

User's Guide

AEC-4412B/7412B External RAID Controller

AEC-4412B/7412B	Page: Front Cover
Stock Number: 511640-00 Rev B	
Print Spec Number: 497358-00	
Current Date: 3/19/98	ECN Date: 3/20/98

Adaptec, Inc.
691 South Milpitas Boulevard
Milpitas, CA 95035

© 1998 Adaptec, Inc.
All rights reserved. Adaptec, the Adaptec logo, is a
trademark of Adaptec, Inc. which may be registered in
some jurisdictions.

Printed in Singapore
STOCK NO.: 511640-00 Rev. B RF 3/98

AEC-4412B/7412B	
Stock Number: 511640-00 Rev. B	Page: Back Cover
Print Spec Number: 497358-00	
Current Date: 3/19/98	ECN Date: 3/20/98

AEC-4412B/7412B

External RAID Controller

User's Guide



AEC-4412B/7412B User's Guide

Stock Number: 511640-00 Rev. B

Print Spec Number: 497358-00

Current Date: 3/19/98

Page: i

ECN Date: 3/20/98

Copyright

©1998 Adaptec, Inc. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written consent of Adaptec, Inc., 691 South Milpitas Blvd., Milpitas, CA 95035.

Trademarks

Adaptec, the Adaptec logo, AHA, MultiChannel, and SCSI*Select* are trademarks of Adaptec, Inc. which may be registered in some jurisdictions.

All other trademarks are owned by their respective owners.

Changes

The material in this document is for information only and is subject to change without notice. While reasonable efforts have been made in the preparation of this document to assure its accuracy, Adaptec, Inc. assumes no liability resulting from errors or omissions in this document, or from the use of the information contained herein.

Adaptec reserves the right to make changes in the product design without reservation and without notification to its users.

Adaptec Technical Support and Services

If you have questions about installing or using your Adaptec product, check this user's guide first—you will find answers to most of your questions here. If you need further assistance, please contact us. We offer the following support and information services:

Electronic Support

Technical information, including product literature, answers to commonly asked questions, information on software upgrades and other topics is available electronically through the following:

- Adaptec World Wide Web (WWW) site at <http://www.adaptec.com>.
- File Transfer Protocol (FTP) server at <ftp.adaptec.com>.
- Adaptec USA Bulletin Board Service (BBS) at 408-945-7272; supports up to 28,800 bps (bits per second), 8 data bits, 1 stop bit, no parity. No product literature is available on the Adaptec BBS.
- Interactive Fax System at 303-684-3400; available 23 hours a day, 7 days a week. The fax system is out of service 1 hour each day.

Technical and Product Support

- For technical support and information about many of Adaptec's electronic support services, call 800-959-7274 or 408-945-2550, 24 hours a day, 7 days a week.
- To use the Adaptec Interactive Support System, call 800-959-7274 or 408-945-2550, 24 hours a day, 7 days a week. The system prompts you with questions regarding your problem and then provides step-by-step troubleshooting instructions.
- To speak with a product support representative, call 408-934-7274, M-F, 6:00 A.M. to 5:00 P.M., Pacific Time. After hours, on weekends, and on holidays, product support is also available for a fee at 800-416-8066.

Sales and Ordering Information

- For sales information, call 800-959-7274 or 408-945-2550, M-F, 6:00 A.M. to 5:00 P.M., Pacific Time.
- To order Adaptec software and SCSI cables, call 800-442-7274 or 408-957- 7274, M-F, 6:00 A.M. to 5:00 P.M., Pacific Time.
- To request additional documentation for Adaptec products, call 800-934-2766 or 510-732-3829, M-F, 6:00 A.M. to 5:00 P.M., Pacific Time.

Federal Communications Commission Radio Frequency Interference Statement

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canadian Compliance Statement

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

AEC-4412B/7412B User's Guide

Stock Number: 511640-00 Rev B

Print Spec Number: 497358-00

Current Date: 3/19/98

Page: iv

ECN Date: 3/20/98

Contents

1 Introduction

- Product Features 1-2
 - Mother Board 1-2
 - Daughter Boards 1-3
 - Canister Front and Back Panel Interface 1-3
 - Integrated Battery Backup 1-5
- Specifications 1-5
 - Physical 1-5
 - Electrical 1-6
 - Environmental 1-6
 - Battery 1-7
- Upgrade Options 1-7
 - How to Order Upgrades 1-8
- Reference Documents 1-8
 - External Documents 1-8
 - Adaptec Documents 1-8

2 Hardware Installation

- AEC-4412B Canister Installation Steps 2-1
- AEC-7412B Canister Installation Steps 2-5

3 Software Configuration

- Configuration Overview 3-1
- Switching Between the Administrator Utility and the Front Panel
 - Display Menus 3-2
 - Running the Administrator Utility 3-2
 - Running the Front Panel Display 3-2
- Configuration Quick Start Steps 3-3
- Using the Administrator Utility 3-4
 - Selecting Menu Options 3-7

v

AEC-4412B/7412B User's Guide

- About the System Menu 3-8
- Configuration Step-by-Step Instructions 3-9
 - Adding an Array 3-10
 - Deleting an Array 3-13
 - Configuration Menu 3-14
 - Utilities Menu 3-17
 - Array Menu 3-19
- Using the Front Panel Display 3-27
 - LED Status Lights 3-28
 - Using the Front Panel Buttons 3-29
 - Accessing the Front Panel Display Main Menu 3-29
 - Accessing the System Menu 3-30
 - Front Panel Display Menu Options 3-30
 - Using the Bridge Flash Loader Utility (BFLU) 3-32
 - Accessing the BFLU Using a VT-100/ANSI Terminal 3-32
 - Accessing the BFLU Using the Front Panel Display 3-33

4 SCSI Implementation

- SCSI Commands 4-2
 - Format Unit 4-2
 - Inquiry 4-3
 - Mode Select 6 4-7
 - Mode Sense 6 4-7
 - Read 6 and Read 10 4-8
 - Read Capacity 4-9
 - Release 4-10
 - Request Sense 4-10
 - Reserve 4-12
 - Rezero Unit 4-12
 - Seek 6 and Seek 10 4-13
 - Send Diagnostic 4-13
 - Start Stop Unit 4-14
 - Synchronize Cache 4-14
 - Test Unit Ready 4-15
 - Verify 4-16
 - Write and Verify 4-17

Contents

Write 6 and Write 10 4-17
SCSI Messages 4-19

5 Fibre Channel Implementation

Link Services 5-2
Basic Link Service Commands 5-2
Extended Link Service Commands 5-3
FCP-SCSI Implementation 5-10

6 Troubleshooting

Terminal Emulator and COM Port Problems 6-1
Host SCSI Channel Problems 6-2
Device SCSI Channel Problems 6-4

A Array Basics

Array Types A-1
RAID 0 (Striped Disks) A-2
RAID 1, RAID 1/0 (Mirrored Disks) A-2
RAID 3 A-2
RAID 4 A-3
RAID 5 A-3
Comparing RAID Levels A-4
Mixing Disks from Different Manufacturers or with Different
Capacities A-5
Mixing Disks on Different RAID Controller Channels A-6

B Diagnostic Error Codes

Reading LCD Panel Error Codes B-1
Viewing Additional Error Information B-2
Battery Error Messages B-2
Error Code Descriptions B-4

Index



AEC-4412B/7412B User's Guide

Stock Number: 511640-00 Rev B

Print Spec Number: 497358-00

Current Date: 3/19/98

Page: viii

ECN Date: 3/20/98

1

Introduction

This *User's Guide* explains how to install and use the Adaptec® AEC™-4412B and AEC-7412B External RAID Controllers, which are designed to be installed in a RAID enclosure and used with a host system to provide a powerful disk subsystem. The canister is designed to fit in a 5.25-inch half-height disk bay. The AEC-4412B controller supports single-ended or differential host UltraSCSI buses. The AEC-7412B supports Fibre Channel-to-UltraSCSI, single loop.

The AEC-4412B RAID controller is a fault-tolerant SCSI-to-SCSI RAID controller that bridges the SCSI interface between the host system and the SCSI hard drive peripherals.

The AEC-4412B has one UltraSCSI input channel and two UltraSCSI output channels. Each output channel is a separate SCSI bus.

The AEC-7412B has one fibre channel (FC) input and two UltraSCSI output channels. Each output channel is a separate SCSI bus.

Administrative software is embedded in firmware; thus, the AEC-4412B/7412B requires no specific software drivers for the host operating system.

Product Features

The following sections describe the features of the AEC-4412B/7412B RAID controller.

Mother Board

The mother board comes installed in the canister and includes the following features:

- Am5_x86-133 MHz processor with internal 16 KByte L1 unified code and data cache
- L2 unified code and data cache, supporting writeback, cache size = 128K byte, SRAM
- Onboard CPU parity-based local DRAM memory, 4-MByte extended-data-out (EDO)
- ALI "Finale" 486 PCI chip-set (two chip integrated CPU, DRAM, PCI, IO solution)
- PCI-to-PCI Bridge providing full CPU and PCI bus concurrency
- AIC-7895 PCI-dual SCSI interface controller (SCSI disk channels)
- Onboard programmable single-ended host and disk SCSI termination
- All SCSI channels support ultra-wide SCSI (40 MBytes/sec)
- Dual AIC-7810 PCI-XOR memory controllers (disk data/parity cache memory configuration)
- Up to 32-MByte total fast-page-mode (FPM) DRAM for disk cache using two standard single bank 72-pin SIMMs
- Battery backup disk cache DRAM memory interface
- Nickel Metal Hydride (NiMH) battery charger and power sharing regulator
- Shared onboard SCB (SCSI Command Block) SRAM 32Kx9 (byte wide + parity bit)
- Non-volatile sectored Flash code store memory (1MByte), with hardware erase/write protection

- Dual RS-232 serial ports and I²C serial port
- Analog-to-Digital Converter for power/battery/temperature monitoring
- Onboard standard PC-type lithium disk battery for continuous Real Time Clock (RTC) power when the unit is shut down

Daughter Boards

The AEC-4412B/7412B main board supports three different daughter board options depending on your needs. They include:

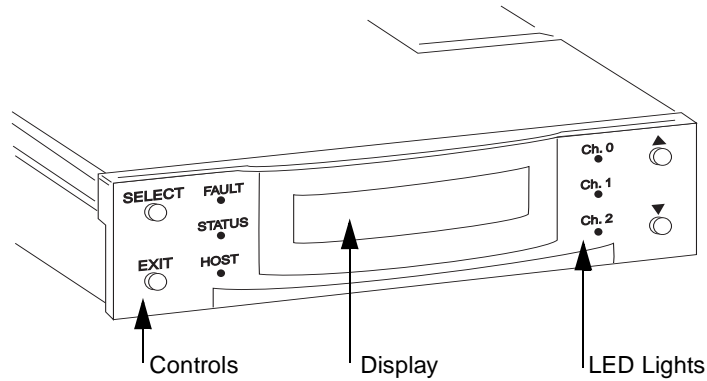
- Single-ended UltraSCSI host
- Differential UltraSCSI host
- Single loop Fibre Channel host

See *How to Order Upgrades* on page 1-8.

Canister Front and Back Panel Interface

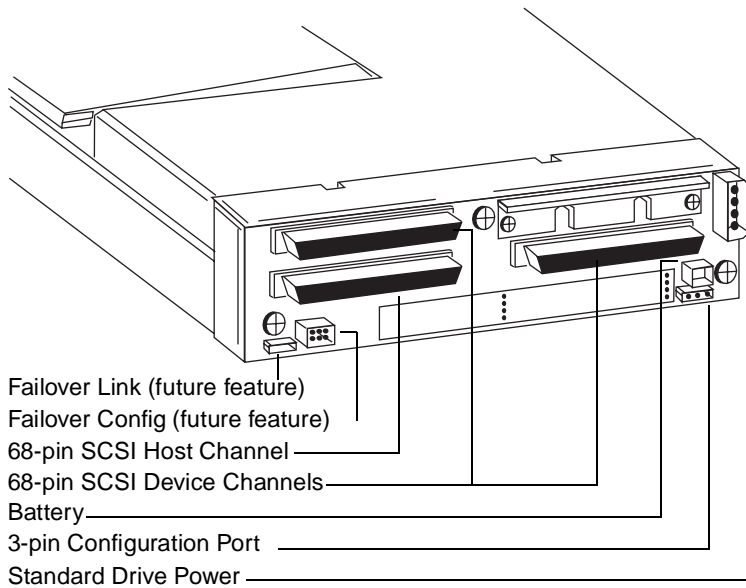
- In-system speaker alarm
- LCD control panel display
- Front panel push button controls for the LCD display

- Front panel LED lights for channel activity and controller status



Note: See *Using the Front Panel Display* on page 3-27 for information on how to use the front panel push button controls and the meaning of the LEDs.

- Back panel I/O connectors:



Integrated Battery Backup

- Battery interface: battery pack/cells located inside the canister lid and connected to the mother board using an integrated, 3-pin cable
- Battery cell capacity and mechanical form factor flexible for different platforms
- Software controlled battery charger and diagnostics

Specifications

The following sections describe the physical, electrical, environmental, and battery specifications of the AEC-4412B/7412B.

Physical

The following table shows the physical specifications of the main board, the daughter boards and the canister:

Mother Board	Form factor: 4.95 x 7.30 inch mother board PCB, 1.25 inch max Z-axis height AMP Z-Pack backplane mating receptacle, 235-pin connector with combined SCSI, Fibre Channel, RS-232 serial port, I ² C, general purpose IO (GPIO), and power
Daughter Boards	Form factor: 4.0 x 3.88 inch PCB board, 0.54 inch typical Z-axis height above top surface of mother board PCB, 0.96 inch max Z-axis height (dual stacked daughter board configuration) 100-pin surface mount connectors with 0.8-mm pin pitch, 7mm connector stack height
Canister	Form factor: 1.61 inch height, 5.75 inch width, 8.625 inch length Weight: 3.0 lbs

Electrical

The following table shows the mother and daughter board electrical specifications of the AEC-4412B/7412B:

Mother Board	5.0VDC \pm 5% @ 2.5 amps max 12.0VDC \pm 10.0% @ 0.6 amps max (battery charging), 0.3amps max (battery charged)
Daughter Boards	5.0VDC \pm 5% @ 0.5 amps SCSI Single-ended, 1.0 amps SCSI Differential, 1.5 amps Fibre Channel

Environmental

The following table shows the environmental specifications of the AEC-4412B/7412B:

Reliability	Calculated MTBF: 114,223 AEC-4412BD 117,796 AEC-4412BS MTTR (Mean Time To Repair): 20 minutes
Temperature	Operating: Front bezel intake ambient 5° C to 35° C Internal storage enclosure ambient operating: 5° C to 45° C (but external to the AEC-4412/7412B) Non-operating: -40° C to +70° C with battery <i>not</i> installed; -20° C to +40° C with battery installed Non-condensing (non-operating) 5% to 90%
Humidity	Operating: 10% to 85% non-condensing Non-operating: 5% to 90% non-condensing
Air flow	Canister application = zero with unobstructed intake and fan exhaust
Vibration	Operating: 5Hz @ 2.0×10^{-7} PSD, 17-500Hz @ 2.2×10^{-5} PSD (PSD = power spectral density g^2 /Hz) per IBM C-S 1-9711- 002
Shock	Vertical: 30.0g @ 3.0 msec pulse width Horizontal: 15.0 g @ 3.0 msec pulse width per IBM C-S 1-9711-007

Battery

The following table shows the battery specifications of the AEC-4412B/7412B:

Charge time	4 hours maximum
Operating range	5° C to +40° C = 3 year life; >40° C = 1 year life
Storage temperature	-20° C to +40° C
Storage humidity	65% ± 20%



Note: A fully charged battery can provide a minimum of 72 hours backup time.

Upgrade Options

The design of the AEC-4412B and the AEC-7412B RAID controllers includes daughter boards that can be upgraded to reconfigure the controller. Adaptec offers the following three daughter board options:

- Single-ended UltraSCSI
- Differential UltraSCSI
- Single Loop Fibre Channel

By exchanging the daughter board installed in your controller with one listed above, you can reconfigure the controller to meet your changing needs. For example, you can change your single-ended configuration to differential UltraSCSI. Likewise, you can upgrade to fibre channel as the need arises.

How to Order Upgrades

To order an upgrade, contact the place where you purchased the controller or contact Adaptec Inside Sales at:

- Phone: 1-800-442-7274
- Email: Sales@Adaptec.com

For more information about the upgrade options and other Adaptec RAID products, visit our World Wide Web (WWW) site at:
<http://www.adaptec.com/raid/>.

Reference Documents

External Documents

- SCSI-2 and SCSI-3 Specification - ANSI Standard documents

Adaptec Documents

- AEC-4312B/7312B External RAID Controller Design-In Guide
- AIC-7880, PCI Bus Master Single-chip SCSI Host Adapter Data Book
- AIC-7895, PCI Bus Master Single-chip SCSI Host Adapter Data Book



2

Hardware Installation

This chapter covers the hardware installation of the AEC-4412B/
7412B External RAID Controller.

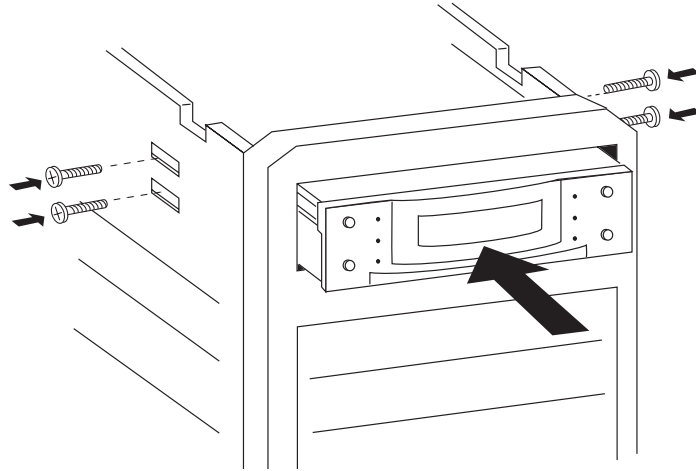
AEC-4412B Canister Installation Steps

- 1 Prepare the host system by using a SCSI host adapter such as the AHA-2940UW for the host connection.
- 2 Enable external termination for the host channel on the I/O board (for differential SCSI *only*).



Note: Termination is automatically set for single-ended SCSI *only*.

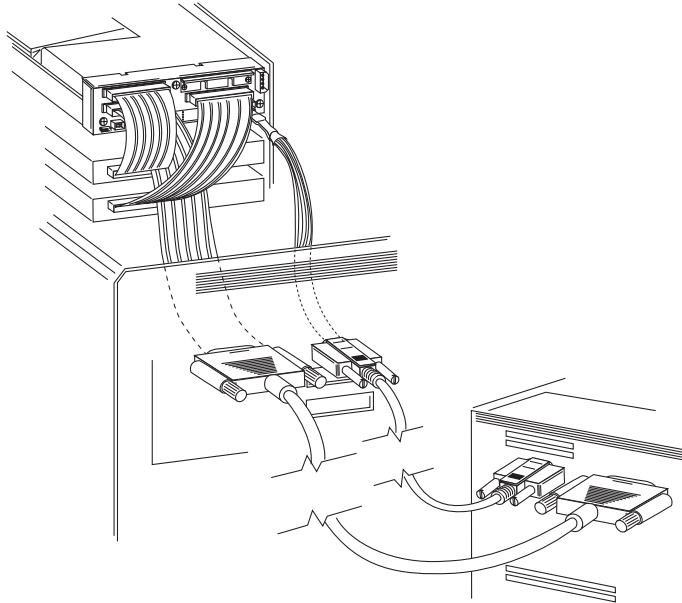
- 3 Insert the AEC-4412B into an available 5.25-inch half-height disk bay and secure it in place by screwing it to the mounting brackets.



Note: Use a minimum of four, size 6-32 screws with a maximum length of 3/8 of an inch.

- 4 Connect the host SCSI output to the SCSI CHANNEL 2/HOST connector on the back of the canister. Use a standard host SCSI cable.
- 5 Connect the external SCSI drive array(s) to the drive CHANNEL 1 SCSI and/or drive CHANNEL 0 SCSI connectors on the back of the Canister. With additional cables, up to fifteen drives can be connected to each SCSI output channel. Use

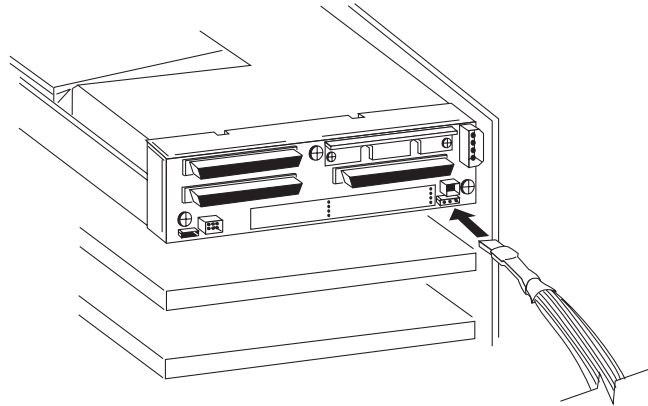
standard SCSI device cables that meet SCSI 2 specifications (for example, cable length should not exceed 3 meters).



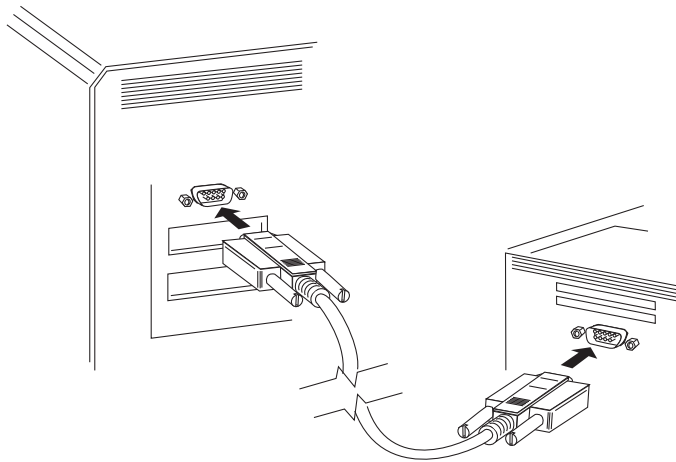
Note: You will need at least three drives to create a RAID 5 array and an additional drive if you want a spare. If convenient, put at least one drive on each drive channel.

- 6 Connect the drives with a SCSI cable.
- 7 Terminate the end of each cable. An external terminator is recommended so that the bus remains terminated if the last drive is removed. Refer to the enclosure's documentation regarding proper termination.
- 8 Assign a unique SCSI ID to each drive on the same channel.

- 9 Connect the RS-232 adapter from the 3-pin RS-232 connector (also known as the CONFIG port) on the back of the Canister to one end of the serial RS-232 DB9 cable. The RS-232 adapter cable is provided.



- 10 Connect the other end of the serial RS-232 DB9 cable to an available COM port at the back of a standard PC or ASCII terminal (optional step).



Note: The 3-pin RS-232 adapter cable is configured as a null modem. Use a direct connect external RS-232 cable if you are connecting the controller to a standard PC COM port.

- 11 Connect a power supply, providing +12 VDC and +5 VDC, to the VCC/+12V connector on the back of the canister. This is a standard drive power connector.

You have completed the AEC-4412B hardware installation steps. See *Configuration Quick Start Steps* on page 3-3 to complete the configuration.

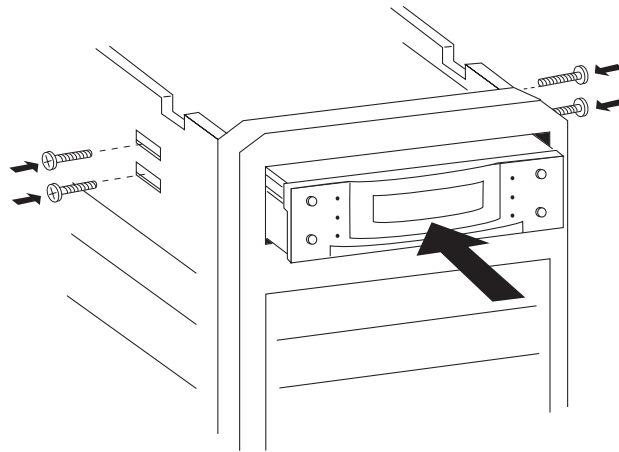
AEC-7412B Canister Installation Steps

- 1 Prepare the host system by using a Fibre channel host adapter such as the AHA-F940 for the host connection.



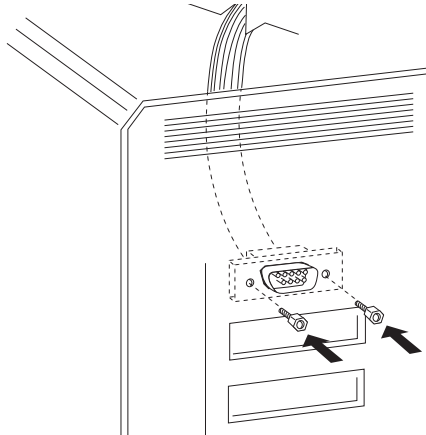
Note: Refer to the Fibre channel host adapter documentation.

- 2 Insert the AEC-7412B into an available 5.25-inch half-height disk bay and secure it in place by screwing it to the mounting brackets.



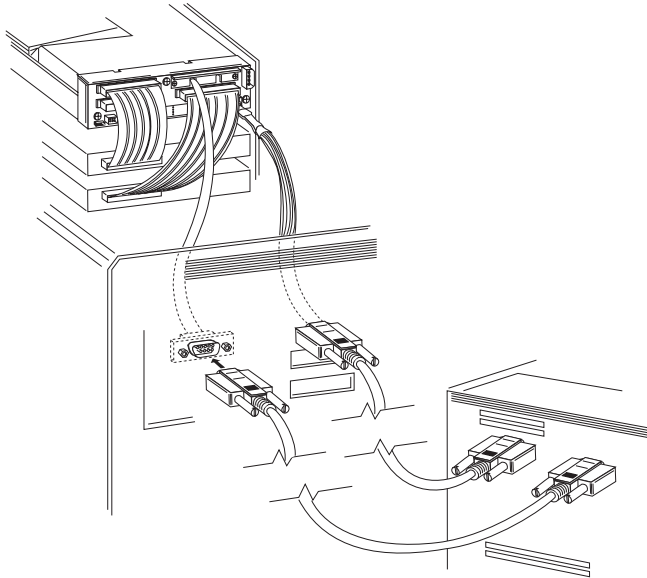
Note: Use a minimum of four, size 6-32 screws with a maximum length of 3/8 of an inch (provided in the kit).

- 3 On the Fibre channel cable attached to the back of the canister, remove the two jack screws from the Fibre channel DB9 receptacle.
- 4 Screw the Fibre channel DB9 receptacle into the DB9 connector punch-out located on the enclosure chassis.



- 5 Connect the external Fibre channel cable to the host adapter and to the Fibre channel DB9 receptacle on the back of the storage enclosure.
- 6 Connect the external SCSI drive array(s) to the drive CHANNEL 1 SCSI and/or drive CHANNEL 0 SCSI connectors on the

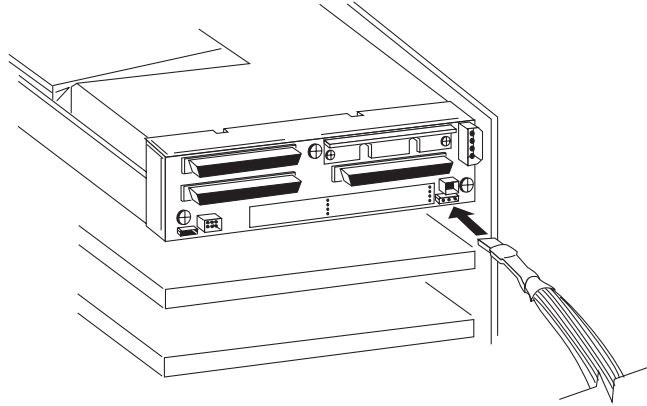
back of the canister. Up to fifteen drives can be connected to each SCSI output channel. Use standard SCSI device cables.



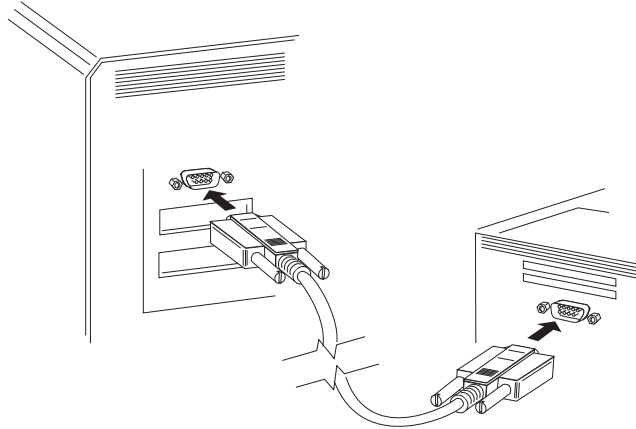
Note: You will need at least three drives to create a RAID 5 array and an additional drive if you want a spare. If convenient, put at least one drive on each drive channel.

- 7 Connect the drives with a SCSI cable.
- 8 Terminate the end of each cable. An external terminator is recommended so that the bus remains terminated if the last drive is removed.
- 9 Assign a unique SCSI ID to each drive on the same channel.

- 10 Connect the RS-232 adapter from the 3-pin RS-232 connector (also known as the CONFIG port) on the back of the Canister to one end of the serial RS-232 DB9 cable.



- 11 Connect the other end of the serial RS-232 DB9 cable to the COM port at the back of a standard PC or ASCII terminal (optional step).



- 12 Connect a power supply, providing +12 VDC and +5 VDC, to the VCC/+12V connector on the back of the Canister. This is a standard drive power connector.

You have completed the AEC-7412B hardware installation steps. See *Configuration Quick Start Steps* on page 3-3 to complete the configuration.



3

Software Configuration

Configuration Overview

To configure the AEC-4412B/7412B, you can use either the Administrator Utility running through a computer serial port or the front panel display. The front panel display offers the ability to configure your system without having to connect the RAID controller to a VT100 or ANSI terminal through a serial RS-232 interface. The Administrator Utility provides additional information that cannot be displayed through the front panel display.

Using either the front panel display or the AEC-4412B/7412B Administrator Utility you can:

- Create arrays
- Delete arrays
- Monitor array statistics
- Verify array integrity
- Change array configurations
- Monitor drive failures and use spare drives

See *Configuration Step-by-Step Instructions* on page 3-9. The instructions in this section describe using the Administrator Utility. However, you can use the front panel display menu options instead which mostly parallel the menu options found in the Administrator Utility. To use the front panel display, follow the instructions in *Configuration Step-by-Step Instructions* on page 3-9 and see the chart in *Accessing the System Menu* on page 3-30 for a summary of the front panel display menu options.

See *Using the Administrator Utility* on page 3-4 or *Using the Front Panel Display* on page 3-27 depending on which mode you want to use to configure the AEC-4412B/7412B.

See *LED Status Lights* on page 3-28 for information on the front panel LEDs.

Switching Between the Administrator Utility and the Front Panel Display Menus

The AEC-4412B/7412B is initially set to use the front panel display to configure the controller. You can switch back and forth if you want. The following sections describe how to change between the two different modes.

Running the Administrator Utility

To switch from the front panel display to the Administrator Utility, follow these steps:

- 1 Make sure the controller is connected to a VT100 or ANSI terminal through a serial RS-232 interface.
- 2 Reboot the controller and hold down the spacebar on the terminal.
The BFLU menu appears.
- 3 Select **Run Bridge** from the menu options.

The Administrator Utility appears on the terminal.

Running the Front Panel Display

By default, the AEC-4412B/7412B is initially set to use the front panel display. If you switched to running the Administrator Utility, you can switch back to using the front panel display by following these steps:

- 1 Reboot the controller and hold down the **Select** button on the front panel.
The BFLU menu appears in the front panel display.
- 2 Use the ↑ or ↓ buttons until you see the **Run Bridge** menu option.

- 3 Press the **Select** button.

You can now use the front panel display to configure the RAID controller.

Configuration Quick Start Steps

- 1 Verify communications between the terminal and the Administrator Utility Program. See *Using the Administrator Utility* on page 3-4.
- 2 Verify that physical drives can be seen and are at the expected IDs by starting to Add an Array and selecting RAID 0 (for a quick initialize). See *Adding an Array* on page 3-10.
- 3 If you selected a RAID level other than RAID 0, continue with adding an array, including a spare drive if you have a sufficient number of drives.
- 4 Reboot the system so that the host recognizes the new array. See *Adding an Array* on page 3-10. The array should appear to the host as a single drive. If you created multiple arrays, the host will have to enable LUN support to see more than the first array.
- 5 Install the operating system on the array or create an OS partition and/or volume if the OS is already installed on the host system.
- 6 Monitor the array status and statistics with the Administrator Utility Program. See *Display Statistics* on page 3-20.

See *LED Status Lights* on page 3-28 for information on the front panel LEDs.

Using the Administrator Utility

The Administrator Utility is implemented with a VT100 or ANSI terminal connected through a serial RS-232 interface. The Administrator Utility is embedded in firmware; thus, software loading is not required unless it is for an upgrade. See *Using the Bridge Flash Loader Utility (BFLU)* on page 3-32.



Note: Windows® 3.x and Windows NT™ 3.5x include a program called Terminal which does not support ANSI color. In this case select VT-100 for your terminal emulation or use a third party software program such as Procomm® for Windows.



Note: The AEC-4412B/7412B can auto-detect common baud rates between 9600 and 115,200. See *Using the Bridge Flash Loader Utility (BFLU)* on page 3-32.

Use the terminal program to set preferences as follows:

Setting	Value
Terminal Emulation	VT-100 or ANSI (for color support)
Font	Terminal
Translations	None
Columns	80

Set the communications parameters with the terminal program as follows:

Setting	Value
Baud rate	115,200
Data bits	8
Stop bits	1
Parity	None
Flow Control	Software (XON/XOFF)
Connector	COM1 (typically)



Note: The AEC-4412B/7412B configuration utility supports baud rates up to 115,200. If the rate has been set higher than will correctly run, set the terminal back to 9600 bps and invoke the Flash Loader utility described in *Using the Bridge Flash Loader Utility (BFLU)* on page 3-32, using option 5. This will reset the AEC-4412B/7412B back to 9600 bps.

When you boot the AEC-4412B/7412B, a screen similar to Figure 3-1 is displayed.

```

Adaptec AEC-4412B v1.00
(c) 1997 Adaptec, Inc. All Rights Reserved.

PCI Configuration - Single ended host SCSI daughter board detected.
Default hardware register check passed.
Default chip set register check passed.
Analog to digital converter test passed.
Local DRAM memory test passed.
PCI configuration verification test passed.
SCSI device SGE 2866 test passed.
SCSI device scratch RAM check passed.
4 Megabyte data cache memory detected.
4 Megabyte parity cache memory detected.
Cache memory test passed.
Programmable interval timer test passed.
Real time clock chip tests passed.
I2C chip test passed.
Sch lock door test passed.

All diagnostic tests passed.
Scanning for devices...
Ch 1, SCSI ID 004 - EMDATE ST31855M
Ch 1, SCSI ID 005 - EMDATE ST31855M
Ch 1, SCSI ID 006 - EMDATE ST31855M
    
```

Figure 3-1. AEC-4412B/7412B Bootup Screen

AEC-4412B/7412B User's Guide

The first time you boot the AEC-4412B/7412B, Figure 3-2 is displayed. If your terminal does not support line draw characters, answer Y to the prompt in Figure 3-2.

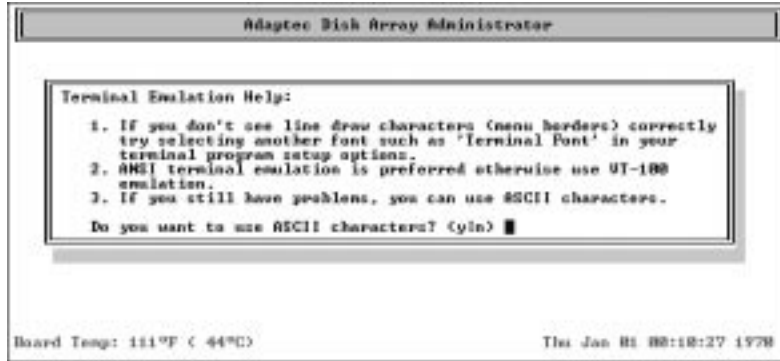


Figure 3-2. AEC-4412B/7412B Terminal Emulation Help Screen

If you do not see colors, try to set your terminal emulation program to ANSI emulation. If no colors are seen in this mode, select "N" at the prompt in Figure 3-3 and the AEC-4412B/7412B will operate in monochrome mode. You can toggle to monochrome mode using **Ctrl-B** from the System or Array menu and change the default in Configuration Menu. If you run the program in color mode with a non-ANSI terminal you may not see the menu selection bar (see Figure 3-3).



Figure 3-3. AEC-4412B/7412B Terminal Color Prompt Screen

If you want to be prompted every boot, select “Y” in the menu shown in Figure 3-4. You will also be prompted for time and date on the first boot.

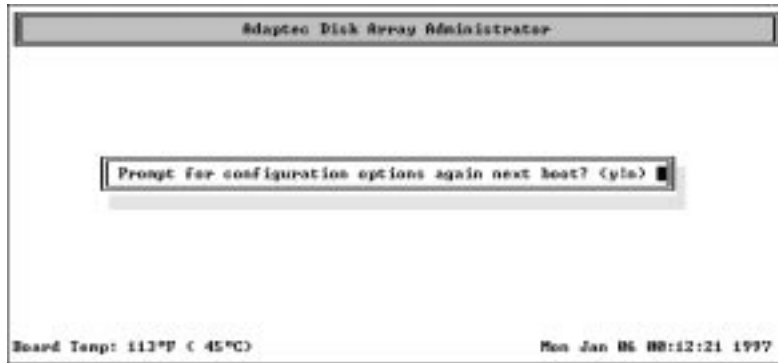


Figure 3-4. Emulation Help Screen

The following conventions must be observed:

- **CTRL-Z** - Backup one menu (or press the Esc key)
- **CTRL-R** - Refresh screen

Selecting Menu Options

Option names in most menus include a *hot key*—a green character in color monitors, and an underlined character in monochrome monitors. To select one of these options, just type the hot key. In the System Menu in Figure 3-5, for example, the Display Status option has the hot key S; to select this option, type s. In this document, hot keys are indicated by an underlined character in the option name.

You can also select a menu option by pressing the ↑ and ↓ keys to highlight the option and then pressing **Enter**.



Note: If you have a monochrome monitor and the highlight bar is not visible, press **Ctrl-B** to change to monochrome mode.

Grayed Menu Options

Grayed menu options are not selectable, usually because they do not apply to the chosen array. If an array has no failed drives, for example, the Reconstruct Functions option on the Array Menu is grayed, because no drives need to be reconstructed.

Getting Help

You can display Help windows for most menus by pressing **Ctrl-H**. As you highlight menu options, the Help window automatically changes to provide information about the highlighted option. To close the Help windows, press **Ctrl-H** again.

About the System Menu

The Administrator utility has two primary menus: the System Menu and the Array Menu. The System Menu, shown in Figure 3-5, appears when you start the Administrator utility. The System Menu shown in Figure 3-6 appears if you have more than one array. You can add and delete arrays (a total of four arrays is possible), display the status of arrays, or go to the Array Menu if you have already added an array. You can also access options for setting up the configuration of the AEC-4412B/7412B using the Configuration menu.

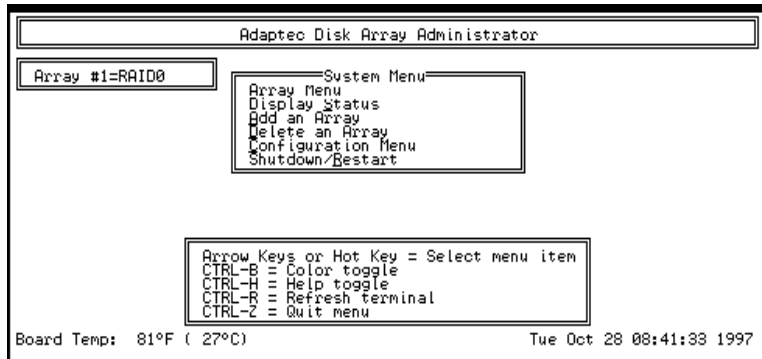


Figure 3-5. System Menu Screen



Figure 3-6. System Menu Screen for Multiple Arrays

The System Menu options are described in the following sections.

Configuration Step-by-Step Instructions

The following sections describe the steps needed to configure the AEC-4412B/7412B RAID controller using the Administrator Utility. If you are configuring your system using the front panel display, follow these steps but use the chart in *Front Panel Display Menu Options* on page 3-30 for a list of available menu options.

Adding an Array

To add a new array, follow these steps:

- 1 From the System Menu select **Add an Array**. The menu shown in Figure 3-7 appears.

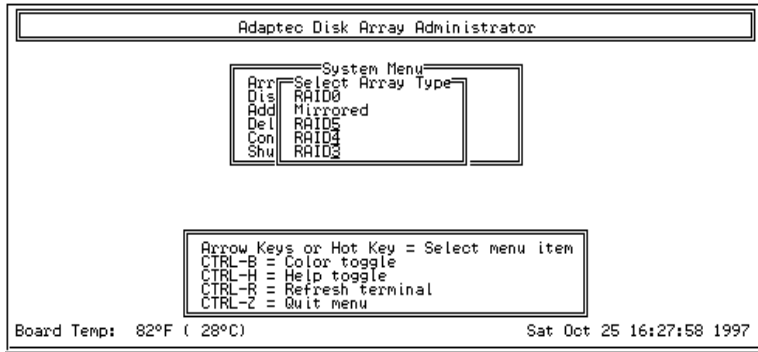


Figure 3-7. Add an Array Screen

- 2 Select the array type: **RAID0, MIRRORRED, RAID5, RAID4** or **RAID3**. The RAID Boards Menu appears. The following table describes the RAID levels and the drive requirements for each level.

RAID Level	Minimum No. of Drives	Maximum No. of Drives
0	2	8
Mirrored	2	16
3	3	8
4	3	8
5	3	8



Note: A RAID 10 is when there are more than two drives in a mirrored array.

See *Comparing RAID Levels* on page A-4 for more information.

- 3 Type in the LUN number for the array or press the Enter key to use the suggested default LUN assignment when prompted.
- 4 A prompt appears, asking how many drives the array will contain, *excluding* spares (see Figure 3-8). Type the number of

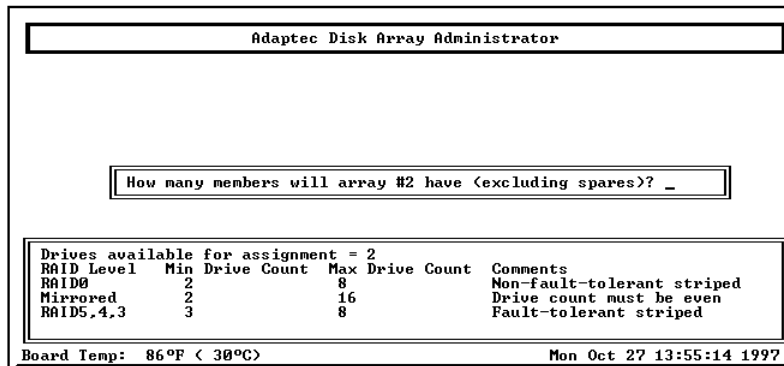


Figure 3-8. Number of Drives in Array Select Screen

drives (excluding spares) you want in the array, and press **Enter**. The utility scans the RAID controller for drives. Press **Tab** to highlight a channel you want to use for the array. Select each drive for the array by pressing the **↑** and **↓** keys until the drive name is highlighted, and then pressing **Enter**. The names of selected drives appear to the right, in the Adaptec Array # box (see Figure 3-9).

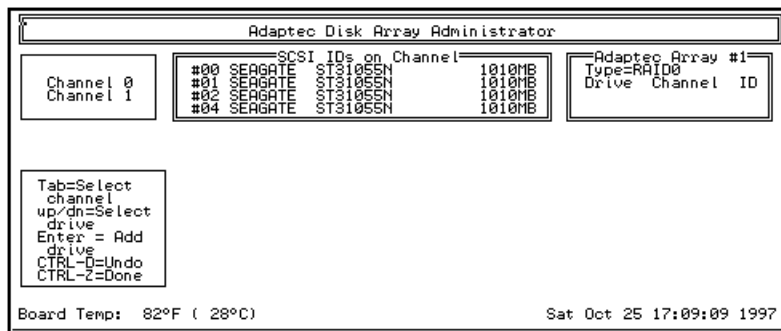


Figure 3-9. Drive Select Screen

To select drives on a different channel, press **Tab** to select another channel and then select the drives from the SCSI IDs on Channel Menu. To deselect a drive, press the **Ctrl-D** key until the drive name no longer appears in the Adaptec Array # box. When you have selected the number of drives you specified in step 3, the next screen appears automatically.

- 5 If the array is mirrored or RAID 5 *and* you have one or more drives left, a prompt appears, asking whether you want to choose a spare drive.

If you do not want a spare: Type n and continue with step 5.



Note: Spare drives are dedicated to a specific array. A spare is not available for use in a second array unless it is *explicitly* reassigned as a spare to that array.

To select a spare: Follow these steps:

- a At the prompt, type y.
 - b If more than one drive is available, a second prompt appears, asking how many spares the array will have. Type the number (1 or 2), and press **Enter**. You can have a maximum of 2 spares for each array.
 - c To select each spare, follow the directions given in step 3. When you have selected the specified number of spares, the Selection List Menu reappears automatically.
- 6 When the next menu appears, select **A**cept Configuration to accept the array you have defined.
 - 7 You can also select **C**ancel Setup to cancel the array definition.
 - 8 Read the message that appears, then press any key to continue.
 - 9 Read the confirmation message, and type y to confirm the array type.
 - 10 Select a data block size for the array. The recommended size is 16 KBytes.
 - 11 Select an initialization method—either **I**nitialize Array to **Z**ero (recommended) or **L**ow-Level Format. Respond to the prompts to confirm that you want to initialize the array(s).

The Administrator utility begins initializing the array. The Status screen for the array appears. The Utility Running field indicates which initialization method is being used. A number on the second line indicates the percentage of initialization that is complete (see Figure 3-10).

```

Configuration for Array #2
Array Type = Mirrored      Drives = 2      Utility Running=Initializing
Utility is 1% complete
Member  SCSI ID  Channel  Status  Capacity  Side  Mirror
0       4       0       Initializing  1010MB  Primary  #1
1       2       0       Initializing  1010MB  Secondary #0

Press any key to continue.
Board Temp: 82°F ( 28°C)                               Sat Oct 25 17:56:56 1997
    
```

Figure 3-10. Initialization Percent Complete Screen

- 12 When initialization of the array is complete, press any key to continue. The status line displays a percentage complete number while the array is being initialized.
- 13 Most operating systems, such as NT 4.0, require the system to be rebooted in order to see the new array. Netware v3.12 and 4.1x can recognize new devices by typing the command **SCAN FOR NEW DEVICES** at the console prompt.

Deleting an Array



Note: If the array your are deleting contains a spare, you must first delete the spare before deleting the array.

To delete an array, follow these steps:

- 1 From the System Menu, select **Delete an Array**.
A menu of arrays appears, if more than one array is defined.
- 2 Select the array you want to delete.
- 3 Type y to delete the array, or n to cancel the operation.

Configuration Menu

The Configuration menu allows you to configure the following AEC-4412B/7412B controller parameters:

- System time/date
- Select color or monochrome display
- Line draw characters
- Clock/temp display
- Serial port flow control
- Communications port baud rate
- Rescan backend SCSI buses for changes
- Hot swap pause
- Error message repeat rate
- Backoff Percent
- Channel termination
- Target SCSI ID
- Backend SCSI channel configuration
- Set SEP options
- Display or clear the event log
- Display hardware information
- Restore default configuration settings

Figure 3-11 shows the Configuration Screen.



Figure 3-11. Configuration Screen

Channel Configuration

With the Channel configuration function you can configure individual channels in the controller. Select **Channel Configuration** from the Configuration Menu then select the channel you want to configure. The screen shown in Figure 3-12 appears.

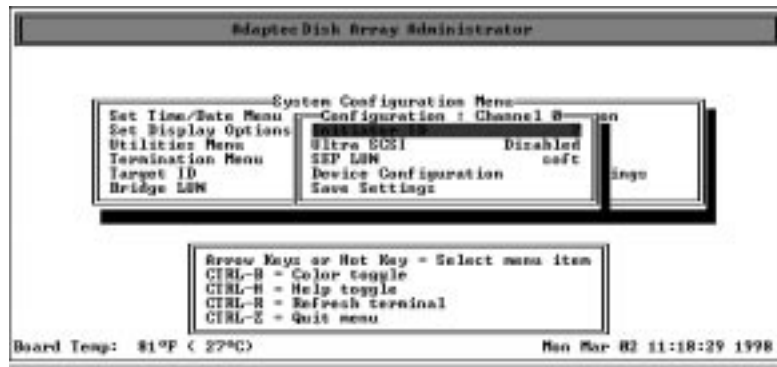


Figure 3-12. Channel Configuration Menu



Note: UltraSCSI is disabled by default. If your devices and cabling conform to the UltraSCSI specification, you can enable UltraSCSI for improved performance. This UltraSCSI setting only affects the device channel. Host SCSI channel rates are controlled by setting the host adapter.

SEP Configuration Menu

A SEP (SAF-TE processor) is a SCSI device from which the RAID controller can inquire about environmental conditions such as temperature, power supply and fan status, and the presence or absence of disk drives. The RAID controller can also tell the SEP of RAID activities such as drive rebuilds and failed disk drives.

SAF-TE configuration settings are automatically enabled when the AEC-4412B/7412B is installed in an enclosure that contains an SEP. No changes are required to the default configuration settings to support SAF-TE. There are four SEP configuration settings that can be modified so you can customize the configuration for your environ-

ment. Figure 3-13 shows the options available from the SEP Configuration Menu.



Figure 3-13. SEP Configuration Menu

The following are descriptions of the SEP configuration settings:

- Polling Interval—specifies the interval, in seconds, the RAID controller polls the enclosure's SEPs for status changes. The default setting is 5 seconds.
- Add Temperature—allows the controller's on-board temperature sensor to provide temperature information to the host along with the enclosure's temperature detected by the SEP. The default setting is No (disabled).
- Set SEP Slot Flags—specifies the controller to send commands to the SEP to update the status of each disk drive slot. The default setting is Yes.
- Set SEP Global Flags—specifies the controller to send commands to the SEP to update the overall status of the enclosure. The default setting is No.

Utilities Menu

Figure 3-14 shows the options available from the Utilities Menu.



Figure 3-14. Utilities Menu

Hot Swap Pause

Some drive enclosures allow you to remove and replace drives while SCSI bus activity continues; others do not.



Note: Always use the Hot Swap Pause option before you remove or replace any drives in an array to ensure data integrity.

Hot Swap Pause suspends activity on all device channels used in the array, thereby assuring data integrity on the connected drives and arrays. The Hot Swap Pause feature is shown in Figure 3-15.

- 1 From the Utilities Menu select **Hot Swap Pause**. The screen shown in Figure 3-15 appears.



Figure 3-15. Hot Swap Pause Screen

- 2 To continue, type y. Otherwise, type n.

While SCSI bus activity is paused, the server or terminal beeps to remind you to replace the drive and resume activity. When you have replaced the drive, resume SCSI bus activity by pressing any key at the Administrator utility screen.



WARNING: Do not stay in the Hot Swap Pause mode for too long; otherwise, an operating system time-out may occur.

Display Options

Figure 3-16 shows the Display Options Menu.

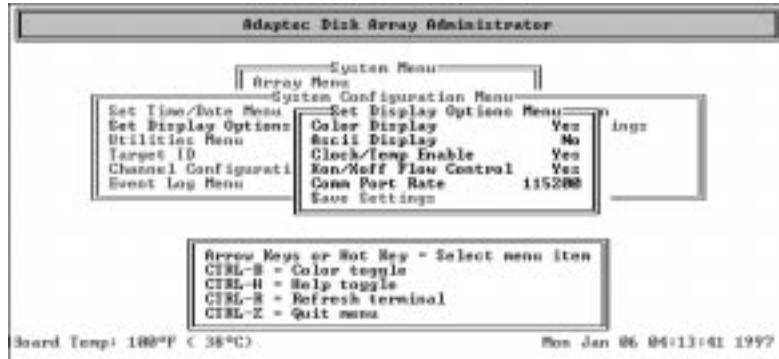


Figure 3-16. Display Options Menu

Array Menu

If more than one array exists (four arrays maximum), a list of arrays will be displayed and you will be prompted to select a specific array. The Array Menu, shown in Figure 3-17, has options for display status of this array only. These options include:

- I/O statistics
- Verifying and auto-correcting Mirrored, RAID 3, RAID 4, and RAID 5 arrays
- Reconstructing failed RAID 3, RAID 4, and RAID 5 drives and mirrored arrays
- Adding and deleting spare drives for appropriate RAID levels
- Drive light blink utility for locating drives in an array
- Changing the LUN assignment for this array



Figure 3-17. Array Menu

Display Statistics

Displays read/write statistics for an array or for a specific drive.

Temporary Array Statistics: To display for the entire array the number of read requests and write requests (see Figure 3-18).

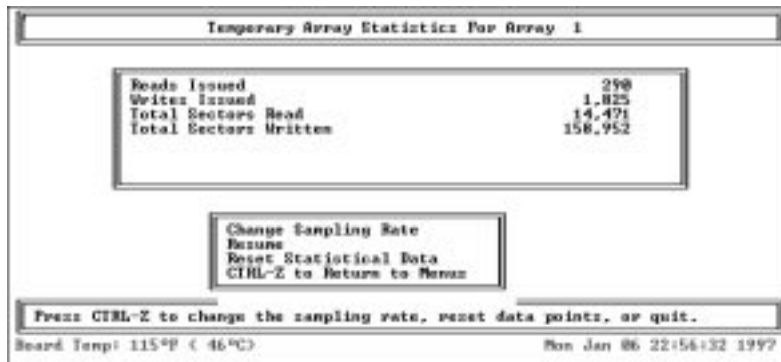


Figure 3-18. Temporary Array Statistics Screen

Temporary Drive Statistics: To display for each drive the number of reads, the number of writes, and the total sectors read from and written to (see Figure 3-19).

Temporary Drive Statistics For Array 01				
Drive	# Reads Issued	# Writes Issued	# Sectors Read	# Sectors Written
0	41	11,733	1,300	375,444
1	45	11,733	1,311	375,444
2	42	11,731	1,336	375,374
3	41	11,732	1,263	375,406

Press CTRL-Z to change the sampling rate, reset data points, or quit.

Board Temp: 115°F < 46°C Mon Jan 06 02:12:49 1997

Figure 3-19. Temporary Drive Statistics Screen

The totals for the statistics are reset to zero when you format an array. You can rezero the temporary statistics at any other time through either of the following procedures:

- 1 Display the Statistics Menu for the array and select **Reset Temporary Statistics**.
- 2 At any screen displaying statistics, press **Ctrl-Z**. From the pop-up menu, select **Reset Statistical Data**. When prompted to confirm, type **y** to reset the statistics. Like the first method, this method rezeros all temporary statistics (not just those displayed onscreen).

To develop the performance statistics, the arrays and drives are sampled once per second. If this slows performance, you can increase the sampling rate through either of the following methods:

- Display the Statistics Menu for the array and select **Set Sampling Rate**. At the prompt, type the new sampling interval (in seconds) and press **Enter**.
- At any screen displaying the statistics, press **Ctrl-Z**. From the pop-up menu, select **Change Sampling Rate**. At the prompt, type the new sampling interval (in seconds) and press **Enter**.

Display Status

Displays information on the selected array and on drives included in the array (see Figure 3-20).

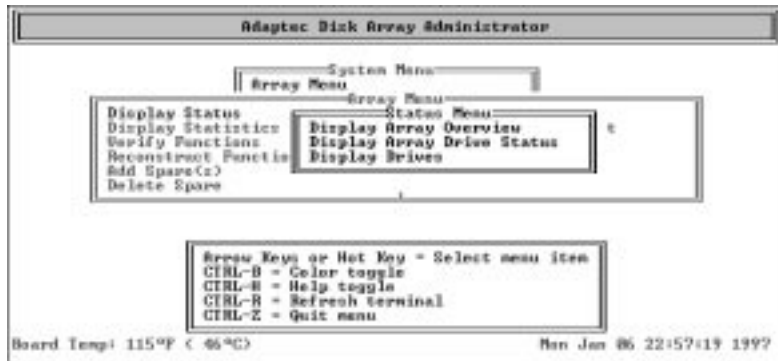


Figure 3-20. Display Array Status Screen

Display Array Overview

Displays an overview of the array including creation date, array type, capacity, status, number of drives, data block size, and the LUN number that the array is mapped to (see Figure 3-21).



Figure 3-21. Display Array Overview Screen

Display Array Drive Status

The Display Array Drive Status screen, shown in Figure 3-22, displays the status of drives within an array including capacity, status (up or down), array type, drives, array member number, SCSI ID, and channel. It also shows the progress of any running utility such as initialize, reconstruct, or verify.

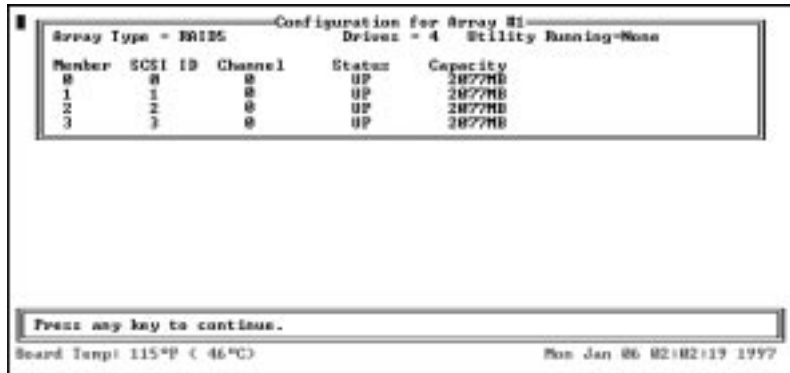


Figure 3-22. Display Array Drive Status Screen

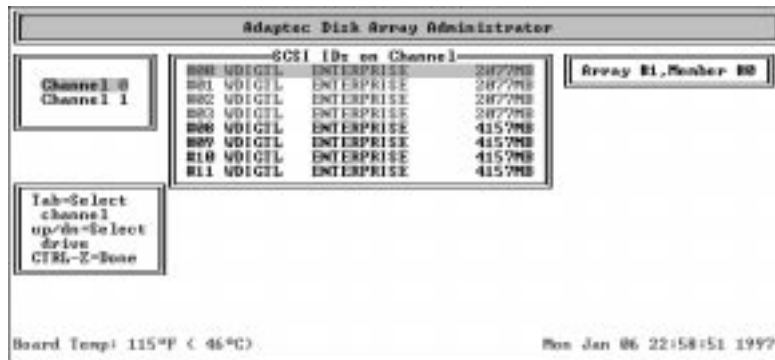


Figure 3-23. Display Drives Menu

Blink Drive Lights

From the Array Menu select **Blink Drive Lights**. The Configuration screen as shown in Figure 3-24 appears.

Member	ECS ID	Channel	Status	Capacity
0	0	1	UP	2877MB
1	1	1	UP	2877MB
2	2	1	UP	2877MB
3	3	1	UP	2877MB

Use Up/Down Arrow to select drive; Enter to toggle drive light illumination.

Board Temp: 115°F < 46°C Mon Jan 06 02:14:43 1997

Figure 3-24. Blink Drive Light Screen

- 1 Use the ↑ and ↓ keys to select the drive you want to identify. The selected drive is denoted by an arrow to the left of the drive number (the first column on the screen).
- 2 To blink the drive light for the selected drive, press **Enter**. A blinking icon appears to the right of the drive number, and the drive light itself starts blinking.
- 3 To stop blinking the drive light, press **Enter** again.

Verify Functions

Verifies the data on the specified array (RAID 5 and mirrored arrays only).

- RAID 3, RAID 4, RAID 5 - Verifies all parity blocks in the selected array and corrects any bad parity.
- Mirrored - Compares the primary and secondary drives. If a mismatch occurs, the primary is copied to the secondary.

To verify an array, follow these steps:

- 1 Select **Start Verify**. At the bottom of the screen, a prompt appears asking you to enter the background priority.
- 2 Indicate the priority by typing a number from 0 through 9 (0 assigns it the lowest priority; 9, the highest).

Verification begins, and the Configuration screen for the array appears. In that screen, the Utility Running field indicates that the verification is under way. A message on the second line indicates the percentage of verification that is complete.

Reconstruct Functions

The Reconstruct functions allow you to re-create data on a replacement drive. If you replace a failed drive in a mirrored, RAID 3, RAID 4, or RAID 5 array, use the Reconstruct functions to reconstruct the data on the replacement drive (you cannot reconstruct data in a RAID 0 array). RAID 3, RAID 4, and RAID 5 data is reconstructed from the user and parity data on the good drives. Mirrored data is copied from the other drive in the mirrored pair. Data is reconstructed in the background, allowing you to continue working.

To reconstruct the data, follow these steps:

- 1 From the Array Menu, select **Reconstruct Functions**. The Reconstruct Menu for that array appears (see Figure 3-25). Menu options that do not apply to that array type are gray, indicating you cannot select them. If the array is mirrored, for example, you can select only Re-mirror Single Drive or Re-mirror all DOWN Drives.



Figure 3-25. Reconstruct Menu

- 2 Select the option you want. The screen shown in Figure 3-26 appears, displaying the current drive status for that array. At the bottom of the screen, a prompt asks you to assign a priority to the operation.



Figure 3-26. Reconstruct Start Screen

- 3 Indicate the priority by typing a number from 0 through 9, where 0 indicates the lowest priority.
- 4 Type y to continue, or n to cancel the operation.

As reconstruction begins, the Configuration screen for the array, as shown in Figure 3-27, appears. A message on the second line indicates the percentage of reconstruction complete.



Figure 3-27. Reconstruct In Progress Screen

Adding a Spare Drive(s)

If you create a mirrored, RAID 3, RAID 4, or RAID 5 array without spare drives (RAID 0 arrays never have spares), you can add up to two spare drives later. Spare drives are activated automatically if a drive in the array fails.

Follow these steps to add a spare drive to an array:

- 1 From the Array Menu, select **Add Spare Drives**.
- 2 If you can add more than one spare, you are prompted to enter the number of spares you want to add. Type the number (1 or 2) and press **Enter**.
- 3 Press **Tab** to highlight the channel with the spare drive(s). Select each spare drive by pressing the **↑** and **↓** keys until the drive name is highlighted, and then pressing the **Enter** key. The names of selected drives appear to the right, in the Adaptec Array # box.
- 4 Type **y** to confirm your choice or **n** to cancel it.

When the confirmation message appears, press any key to return to the Configuration menu.

Deleting a Spare Drive

To delete a spare drive from an array, select the **Delete Spare** command from the Array Menu. If the array has two spares, first select the spare you want to delete. A message appears to confirm the deletion of the spare drive.

You do not need to reinitialize the array when you delete a spare drive.

Using the Front Panel Display

The front panel display menu options work much the same way as the Administrator Utility menu options. See *Configuration Step-by-Step Instructions* on page 3-9 for instructions on configuring your setup and use the tables in *Front Panel Display Menu Options* on page 3-30.

The following sections describe meaning of the LED status lights, how to use the front panel buttons to make your selections, and how to access the front panel display menu.

LED Status Lights

The following table describes the meaning of the LED status lights located on the front panel of the canister:

LED Label	Description	Color	Function
Fault	Controller fault	Red	Solid ON when controller is powered-up and fails any internal diagnostic, detects a critical error, or detects a down array
STATUS	Controller Status	Yellow	Solid ON when controller is powered-up and passes all internal diagnostics
		Yellow	Flashing when controller either <ul style="list-style-type: none"> — detects a warning/degraded mode — assumes failover responsibility, or — fails to boot
HOST	Host SCSI activity	Green	SCSI <ul style="list-style-type: none"> — Solid ON when bus is active or busy
			Fibre Channel <ul style="list-style-type: none"> — Solid ON when FC loop is connected — Solid OFF when FC loop is disconnected
CH 0	Disk channel 0 activity	Green	Solid ON when bus is active or busy
CH 1	Disk channel 1 activity	Green	Solid ON when bus is active or busy
CH 2	Disk channel 2 activity	Green	Solid ON when bus is active or busy (future option)



WARNING: If you turn the controller OFF and the LED status light continues to flash on and off, it means the battery is backing up the data cache memory which contains valid data that has not been written to the array(s). When this occurs, you must turn the system on with the array(s) attached to allow the valid data to flush to the disks. Failure to do so will result in loss of data. A fully charged battery can provide a minimum of 72 hours backup time.

Using the Front Panel Buttons

The following table describes the controls of the front panel buttons on the AEC-4412B/7412B canister:

Button	Function
SELECT	Press the SELECT button when you want to select the displayed option.
EXIT	Press the EXIT button when you want to exit the configuration mode or if the displayed message instructs you to do so.
Up Arrow	Press the up arrow button when you want to scroll up through the list of menu options.
Down Arrow	Press the down arrow button when you want to scroll down through the list of menu options

For information on the front panel LED lights, see *LED Status Lights* on page 3-28.

Accessing the Front Panel Display Main Menu

By default, the AEC-4412B/7412B is initially set to use the front panel display when you power-on the controller. If you switched to running the Administrator Utility, you can switch back to using the front panel display by following these steps:

- 1 Reboot the controller and hold down the **Select** button on the front panel.
The BFLU menu appears in the front panel display.
- 2 Use the ↑ or ↓ buttons until you see the **Run Bridge** menu option.
- 3 Press the **Select** button.

You can now use the front panel display to configure the RAID controller.

See *Running the Administrator Utility* on page 3-2 if you want to switch to using the Administrator Utility using a serial RS-232 interface.

The AEC-4412B/7412B runs the diagnostic tests, scans the SCSI channels, and initializes the controller. When complete, the following messages appear:

```
Adaptec  
AEC-4412B  
  
Array #  
State  
  
Date, Time,  
Temperature
```

Accessing the System Menu

To access the System menu, press the up or down arrow buttons. The top line of the front panel display is the name of the current menu. The bottom line displays the menu's options.

Front Panel Display Menu Options

Figure 3-28 lists the menu options available from the front panel display. See *Configuration Step-by-Step Instructions* on page 3-9 for configuration information.

Software Configuration

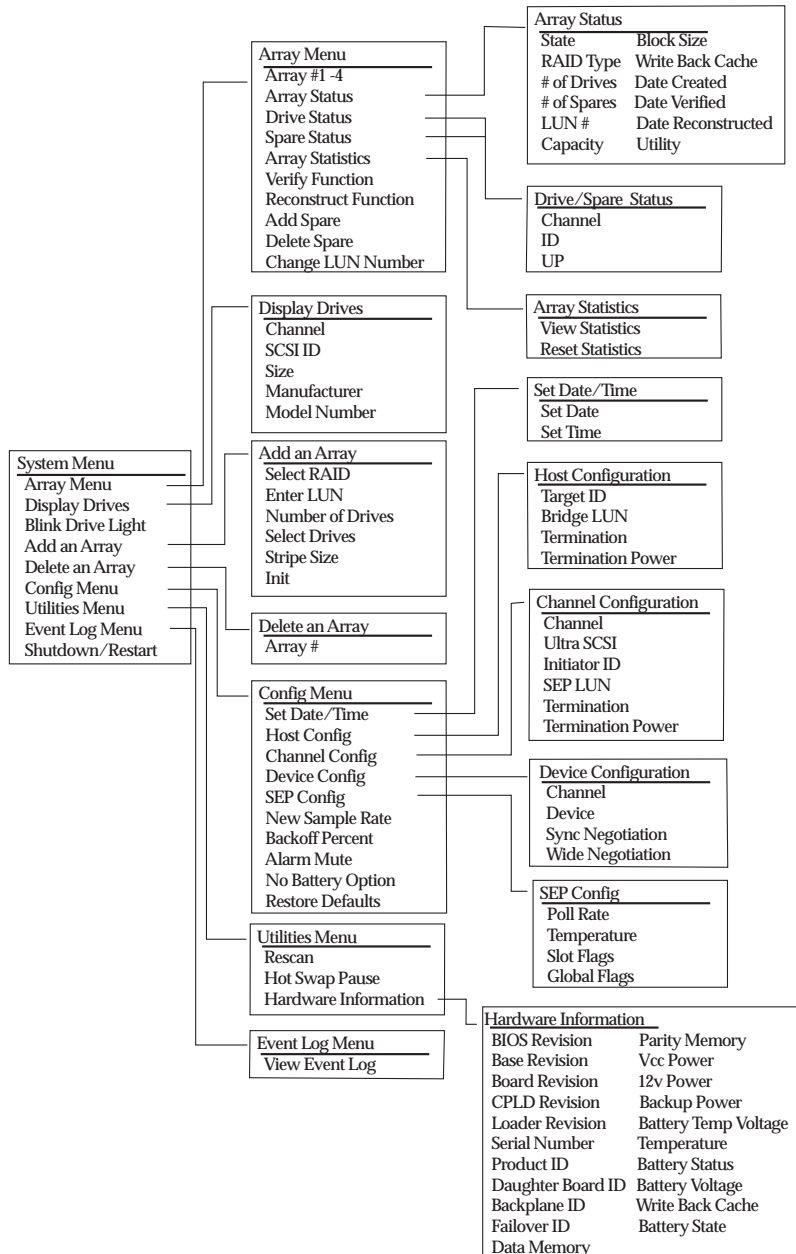


Figure 3-28. Front Panel Display Menu Options

Using the Bridge Flash Loader Utility (BFLU)

The BFLU is resident in the embedded firmware of the AEC-4412B/7412B. It can be used to download a new firmware image, to autodeTECT your VT-100/ANSI terminal baud rate, and to run on-board diagnostics.

The BFLU can be accessed either by using:

- A VT-100/ANSI terminal connected to the AEC-4412B/7412B through a serial RS-232 interface (required for downloading firmware images)

or,

- The front panel display

Follow the instructions below depending on which method you want to use.

Accessing the BFLU Using a VT-100/ANSI Terminal

When accessing the BFLU, the AEC-4412B/7412B will auto-detect your baud rate. Valid baud rates are 9600, 19200, 38400, 57600, and 115,200. To speed the download, 115,200 is recommended.

To access the BFLU, do the following:

- Hold down the space bar on your VT-100/ANSI terminal while powering-on the AEC-4412B/7412B.

The following menu appears:

BFLU

Local Memory Test Passed.
Configuration OKay.

FLASH LOADER v1.004 - Aug 5 1997 14:59:06

Select Protocol

1. FAST BINARY
2. KERMIT
3. XMODEM

4. Run diagnostics
5. Run bridge
- X. Reboot

Downloading New Firmware

To download new firmware (.bfl file), use options 2 through 3 depending on the file transfer protocols supported by your terminal emulator. See the instructions included with the new firmware image for information.



WARNING: When downloading a new firmware image, do *not* interrupt the power.

The AEC-4412B/7412B will automatically reboot when downloading is complete.

Running Onboard Diagnostics

To run onboard diagnostics, select option 4.

Rebooting the AEC-4412B/7412B

To continue to boot the AEC-4412B/7412B to the main banner screen with the newly auto-detected baud rate, select option 5.

Accessing the BFLU Using the Front Panel Display

To access the BFLU using the front panel display, do the following:

- Press and hold the **Select** button on the front panel while powering-on the AEC-4412B/7412B.

The BFLU menu appears. You can press the up or down arrow buttons to scroll through the list of BFLU menu options:

```
Run Bridge
Flash Utilities
Read Bootup Msgs
Reboot
```



AEC-4412B/7412B User's Guide

Stock Number: 511640-00 Rev B

Print Spec Number: 497358-00

Current Date: 3/19/98

Page: 3-34

ECN Date: 3/20/98

4

SCSI Implementation

This chapter describes AEC-4412B/7412B SCSI implementation. The following major SCSI features are supported:

- SCSI-II compliance
- Limited support for SCSI-I initiators (those providing no Identify message)
- Tagged command queuing
- Multiple initiators supported with separate sense data for each
- Up to eight logical unit numbers (LUNs)
- UltraSCSI Data transfer
- Synchronous or Asynchronous data transfer
- Wide (16 bit) and Narrow (8 bit) data transfer
- Hard reset alternative
- SCSI bus parity checking

The following feature is not yet supported

- SCSI Configured Auto Magically (SCAM)

The AEC-4412B/7412B presents a SCSI-2 compliant interface to the host system. However, since several host systems are known to attempt SCSI-1 style connections without sending an identify message during their boot procedure, the AEC-4412B/7412B allows these types of requests. The LUN field in the Command Descriptor Block (CDB) is used when the identify message is not present, and the AEC-4412B/7412B will not disconnect.

SCSI Commands

Since the AEC-4412B/7412B does not support linked commands, the control byte of each CDB must be zero. Also, since the LUN is generally specified by the Identify message, the LUN field in the CDB will be ignored, unless an Identify message is not provided. The AEC-4412B/7412B supports the following SCSI-2 commands:

- Format unit
- Inquiry
- Mode Select 6
- Mode Sense 6
- Read 6 and Read 10
- Read Capacity
- Release
- Request Sense
- Reserve
- Rezero Unit
- Seek
- Send Diagnostic
- Start Stop Unit
- Synchronize cache
- Test Unit Ready
- Verify
- Write and Verify
- Write 6 and Write 10

Table 4-2 through Table 4-26 describe the structure of the SCSI commands.

Format Unit

This command is included for compatibility with host systems. It does not affect the contents of the media.

Table 4-1. Format Unit

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	04h							
1	LUN			FmtD	Cmpl	Defect List Format		
2	Vendor Specific							
3	Interleave							
4								
5	Reserved							

The only defect list format supported is zero. If the FmtD bit is zero, the AEC-4412B/7412B immediately completes this command with a good status. If the FmtD bit is one, the AEC-4412B/7412B transitions to data out phase and receives a four-byte defect list header. The defect list length field must be zero in the defect list header. After receiving the defect list header, the AEC-4412B/7412B returns with a good status without affecting the media contents.

Inquiry

Table 4-2 and Table 4-3 describe the structure of the Inquiry command.

Table 4-2. Inquiry

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	12h							
1	LUN			Reserved			EVPD	
2	Page Code							
3	Reserved							
4	Allocation Length							
5	Reserved							

- EVPD
 - 0= Return standard inquiry data
 - 1=Not supported
- Page Code
 - Must be zero

Table 4-3. Returned Data Format

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Peripheral Qualifier			Peripheral Device Type				
1	RMB	Device Type Qualifier						
2	ISO Version		ECMA Version			ANSI Version		
3	AENC	Trmlop	Reserved		Response Data Format			
4	Additional Length (n-4)							
5	Reserved							
6	Reserved							
7	RelAdr	W32	W16	Sync	Linked	Rsvd	CmdQ	SftRe
8	Vendor							
15	ID							
16	Product							
31	ID							
32	Product							
35	Revision							
36	Adaptec							
43	Reserved							
44	CAPI/ SAF-TE Interface							
49	ID							
50	Adaptec							
55	Reserved							
56	SCSI							
95	Reserved							
96	Bridge							
109	ID							
111	Bridge							
118	Version							
120	Bridge							
130	Serial Number							
131	SEP Vendor							
138	ID							
139	SEP Product							

Table 4-3. Returned Data Format (Continued)

154	ID
155	SEP Product
158	Revision

- Peripheral Qualifier
 - 0=The specified peripheral device type is currently connected to this logical unit.
 - 3=The target is not capable of supporting this logical unit
- Peripheral Device Type
 - 0=Direct access device
 - 1fh=No device type. This is reported when the logical unit is not supported
- RMB
 - 0=Media not removable
- Device Type Qualifier
 - 0=This field is reserved for SCSI 1
- ISO Version
 - 0=No compliance with ISO SCSI specification is claimed
- ECMA Version
 - 0=No compliance with ECMA SCSI specification is claimed
- ANSI
 - 2=The AEC-4412B/7412B is SCSI-2 compliant
- AENC
 - 0=Asynchronous event notification is not supported
- TrmIop
 - 0=Terminate IO process message is not supported
- Response Data Format
 - 2=The Inquiry response data is in SCSI-2 format.
- Additional Length
 - 31 additional bytes (depends on vendor specific return data)

AEC-4412B/7412B User's Guide

- RelAdr
0=Relative addressing is not supported
- W32
0=32 bit wide SCSI is not supported
- W16
1=16 bit wide SCSI is supported
- Sync
1=Synchronous data transfers are supported
- Link
0=Linked commands are not supported
- CmdQue
1=Tagged command queuing is supported
- SftRe
0=The hard reset alternative is supported
- Vendor ID
ADAPTEC
- Product ID
AEC-4412B/7412B
- Product Revision
- CAPI/SAF-TE Interface ID
CAPI or SAF-TE depending on the device
- Bridge ID
Adaptec Bridge
- Bridge Version Number
- Bridge Serial Number
- SEP Vendor ID
- SEP Product ID
- SEP Product Revision

Mode Select 6

The mode select command, as shown in Table 4-4, allows the host to modify, and possibly save, mode pages in the AEC-4412B/7412B. A single set of mode pages is maintained for all initiators.

Table 4-4. Mode Select Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	15h							
1	LUN			PF	Reserved			SP
2	Reserved							
3	Reserved							
4	Parameter List Length							
5	Reserved							

The PF bit must be set to indicate mode pages in SCSI-2 format.

Mode Sense 6

The Mode Sense command, as shown in Table 4-5, allows the host to read mode pages from the AEC-4412B/7412B.

Table 4-5. Mode Sense Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	1ah							
1	LUN			Rsvd	DBD	Reserved		
2	PC	Page Code						
3	Reserved							
4	Allocation Length							
5	Reserved							

The AEC-4412B/7412B will support the following SCSI-2 mode pages:

- Read-write error recovery
- Disconnect-reconnect
- Format device
- Rigid disk geometry
- Verify error recovery

- Caching
- Control mode

These pages are mainly for informational purposes. None of the fields in these pages are changeable except for write cache enable and read cache disable in the caching page. Refer to the SCSI-2 specification for the format of these mode pages. The rigid disk geometry and format device pages are supported to provide certain host operating systems information they need to do high-level formats. The information within them is calculated by the AEC-4412B/7412B based on the current array configuration.

In the caching page the write cache enable (WCE) and read cache disable (RCD) bits apply only to the LUN the mode select command was issued to. For example, write back and read cache may be controlled on a per LUN basis.

Read 6 and Read 10

The AEC-4412B/7412B will support 6 and 10 byte read CDBs. Table 4-6 describes the Read 6 command, Table 4-7 describes the Read 10 command.

Table 4-6. Read 6 Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	08h							
1	LUN			(MSB)				
2	Logical Block Address							
3	(LSB)							
4	Transfer Length							
5	Reserved							

In the six byte Read CDB, a transfer length of zero indicates 256 logical blocks are transferred.

Table 4-7. Read 10 Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	28h							
1	LUN		DPO	FUA	Reserved		Reladr	
2	(MSB)							
3	Logical Block							
4	Address							
5	(LSB)							
6	Reserved							
7	(MSB)				Transfer			
8	Length				(LSB)			
9	Reserved							

In the 10 byte Read CDB, a transfer length of zero indicates no data is to be transferred. This is not considered an error. The DPO, FUA, and Reladr bits are ignored.

Read Capacity

The Read Capacity command, as shown in Table 4-8, allows the host to determine the number of logical blocks on a logical unit.

Table 4-8. Read Capacity

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	25h							
1	LUN		Reserved				Reladr	
2	(MSB)							
3	Logical Block							
4	Address							
5	(LSB)							
6	Reserved							
7	Reserved							
8	Reserved						PMI	
9	Reserved							

The AEC-4412B/7412B will return the LBA and size in bytes of the last LBA on the logical device referenced by the specified LUN. The Reladr bit, PMI bit, and LBA must be zero. The block size is always 200h. Data is returned in the format shown in Table 4-9.

Table 4-9. Return Data Format

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	(MSB)			Returned Logical				
3	Block Address					(LSB)		
4	(MSB)			Block Length				
7	In Bytes			(LSB)				

Release

This command allows the host to release a previously reserved logical unit.

Table 4-10. Release Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	17h							
1	LUN			3rd pty	3rd party device ID		extent	
2	Reservation Identification							
3	Reserved							
4	Reserved							
5	Reserved							

Request Sense

The AEC-4412B/7412B will maintain separate sense data (including sense key, additional sense code and additional sense code qualifier) for each initiator. This data is updated whenever a check condition is returned to the initiator. It will be cleared whenever a command completes successfully to that initiator. Table 4-11 describes the Request Sense command.

Table 4-11. Request Sense Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	03h							
1	LUN			Reserved				
2	Reserved							
3	Reserved							
4	Allocation Length							
5	Reserved							

Table 4-12 describes the Returned Data Format.

Table 4-12. Returned Data Format

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
0	Valid Error Code								
1	Reserved								
2	Rsvd	Rsvd	Rsvd	Rsvd	Sense Key				
3	Information								
6									
7	Additional Sense Length (n-7)								
8	Command Specific Information								
11									
12	Additional Sense Code (ASC)								
13	Additional Sense Code Qualifier								
14	Field Replaceable Unit Code								
15	SKSV							Sense	
17	Key Specific								

- Valid
 - 0=The bytes in the information field are undefined
 - 1=The bytes in the information field contain valid information
- Error Code
 - 70h Normal Errors
 - 71h Deferred Errors
- Information
 - The unsigned LBA associated with the sense key

- Additional Sense Length
6 bytes follow

Reserve

The Reserve command, as shown in Table 4-13, allows the host to reserve a LUN, possibly for another initiator. Extent reservations are not implemented. Although third party reservations are supported as described in the SCSI-2 specification, since the 3rd party device id field is only 3 bits wide, LUNs may only be reserved for SCSI ids 0-7.

Table 4-13. Reserve Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	16h							
1	LUN			3 rd pty	3 rd party device id			extent
2	Reservation Identification							
3	Extent List							
4	Length							
5	Reserved							

The extent bit must be zero. The reservation identification and extent list length fields are ignored, since they only apply to extent reservations. While a LUN is reserved for one initiator, other initiators may only send Inquiry, Request Sense, and Release commands to that LUN. All other commands are returned with a RESERVATION CONFLICT status.

Rezero Unit

After checking reserved bits, the AEC-4412B/7412B returns good status for the Rezero Unit command, as shown in Table 4-14.

Table 4-14. Rezero Unit Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	01h							
1	LUN			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							

Seek 6 and Seek 10

After checking reserved bits, the AEC-4412B/7412B returns good status for these commands shown in Table 4-15 and Table 4-16.

Table 4-15. Seek 6 Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0bh							
1	LUN			(MSB)				
2	Logical Block Address							
3	(LSB)							
4	Reserved							
5	Reserved							

The logical block address is ignored for both the 6 and 10 byte versions of this command.

Table 4-16. Seek 10 Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	2bh							
1	LUN			Reserved				
2	(MSB)							
3	Logical Block							
4	Address							
5	(LSB)							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							

Send Diagnostic

The Send Diagnostic command, as shown in Table 4-17, allows the host to request an AEC-4412B/7412B self test. Send Diagnostic is only supported when the SelfTest bit is set to one with both the PF bit set and parameter list length set to zero; otherwise, the AEC-4412B/7412B will report CHECK CONDITION, ILLEGAL REQUEST, INVALID FIELD IN CDB.

Table 4-17. Send Diagnostic Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	1dh							
1	LUN		PF	Rsvd	SelfT	DevOf	Uofl	
2	Reserved							
3	(MSB)				Parameter			
4	List Length				(LSB)			
5	Reserved							

Start Stop Unit

After checking reserved bits, the AEC-4412B/7412B returns good status for Start Stop Unit command, as shown in Table 4-18.

Table 4-18. Start Stop Unit Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	1bh							
1	LUN		Reserved				Imm	
2	Reserved							
3	Reserved							
4	Reserved					LoEj	Start	
5	Reserved							

Synchronize Cache

This command causes the AEC-4412B/7412B to commit its write back cache data to the disk media. This ensures that the disk cache matches, or is synchronized with, the copy still in the AEC-4412B/7412B's read cache. The Imm, RelAdr, Logical Block Address, and Number of Blocks fields are all ignored (the command executes as if all these fields were zero). To synchronize all write back data from all LUNs, separate Synchronize Cache commands should be sent to each LUN.

Table 4-19. Synchronize Cache Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	35h							
1	LUN			Reserved			Imm	RelAdr
2	(MSB)							
3	Logical Block							
4	Address							
5	(LSB)							
6	Reserved							
7	(MSB) Number of							
8	Blocks (LSB							
9	Reserved							

Test Unit Ready

The Test Unit Ready command, as shown in Table 4-20, provides a way for the host to determine if the AEC-4412B/7412B is ready to accept media access commands.

Table 4-20. Test Unit Ready Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	00h							
1	LUN			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							

Table 4-21 shows some possible AEC-4412B/7412B states, and test unit ready/request sense responses while in these states.

Table 4-21. Test Unit Ready/Request

AEC-4412B/7412B State	Response to test unit ready	Request Sense Data
Power on Self Test (POST)	Selection timeout	n/a
POST complete, 1 st TUR	Check condition	Unit Attention, power on reset (6h/29h/0h)
POST complete, drives not yet ready, command to any LUN	Check condition	Not Ready, in process of becoming ready (02h/04h/01h)
Drives ready, command to invalid LUN	Check condition	Illegal Request, invalid lun (5h/25h/0h)
Arrays configured and ready	Good	n/a
Array Failure ¹	Check condition	Not ready, manual intervention required

¹ Array Failure is defined as two or more drives failing in a redundant array (RAID 1 or 5), or a single failure in a non-redundant array (RAID 0).

Verify

The Verify command, as shown in Table 4-22, reads the requested blocks from the media, but does not return them to the host. Any errors detected in reading the data are reported to the host.

Table 4-22. Verify Command

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	2fh							
1	LUN		DPO	Rsvd	Rsvd	Bytck	Reladr	
2	(MSB)							
3	Logical Block							
4	Address							
5	(LSB)							
6	Reserved							
7	(MSB)				Verification			
8	Length				(LSB)			
9	Reserved							

The DPO, Bytck, and Reladr bits are ignored. A verification length of zero indicates no data is to be verified. This is not considered an error.

Write and Verify

The Write and Verify command, as shown in Table 4-23, is currently treated the same as a Write command.

Table 4-23. Write and Verify Command

Byte#	Bit 7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	2eh							
1	LUN		DPO	Rsvd	Rsvd	Bytck	Reladr	
2	(MSB)							
3	Logical Block							
4	Address							
5	(LSB)							
6	Reserved							
7	(MSB)				Transfer			
8	Length				(LSB)			
9	Reserved							

A transfer length of zero indicates no data is to be transferred. This is not considered an error. The DPO, Bytck, and Reladr bits are ignored.

Write 6 and Write 10

The AEC-4412B/7412B will support 6 and 10 byte write CDBs. Table 4-24 describes the Write 6 command, Table 4-25 describes the Write 10 command.

Table 4-24. Write 6 Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0ah							
1	LUN			(MSB)				
2	Logical Block Address							
3	(LSB)							
4	Transfer Length							
5	Reserved							

In the 6-byte Write CDB, a transfer length of zero indicates 256 logical blocks shall be transferred.

Table 4-25. Write 10 Command

Byte#	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	2ah							
1	LUN		DPO	FUA	Reserved		Reladr	
2	(MSB)							
3	Logical Block							
4	Address							
5	(LSB)							
6	Reserved							
7	(MSB)				Transfer			
8	Length				(LSB)			
9	Reserved							

In the 10-byte Write CDB, a transfer length of zero indicates no data to be transferred. This is not considered an error. The DPO, FUA, and Reladr bits are ignored.

SCSI Messages

Table 4-26 describes the SCSI messages supported by the AEC-4412B/7412B.

Table 4-26. SCSI Messages

SCSI-2 Message Name	Data Directions Supported
Abort	Out
Abort Tag	Out
Bus Device Reset	Out
Clear Queue	Out
Command Complete	In
Disconnect	In
Identify	In/Out
Ignore Wide Residue	In/Out
Initiator Detected Error	Out
Message Parity Error	Out
Message Reject	In/Out
Head of Queue	Out
Ordered Queue	Out
Simple Queue	In/Out
Restore Pointers	In
Save Data Pointer	In
Synchronous Data Transfer Request	In/Out
Wide Data Transfer Request	In/Out

The AEC-4412B/7412B will not initiate either Synchronous or Wide Data Transfer Request messages, but will respond correctly to initiators that issue these messages.



AEC-4412B/7412B User's Guide

Stock Number: 511640-00 Rev B

Print Spec Number: 497358-00

Current Date: 3/19/98

Page: 4-20

ECN Date: 3/20/98

5

Fibre Channel Implementation

This chapter describes the AEC-7412B Fibre Channel implementation along with the associated FCP (Fibre Channel Protocol - SCSI) supported commands. The chapter also includes Link Service commands supported including basic and extended.

- NL_Port Support
- Supports up to 15 Initiators
- Support for hard and soft ALPA assignment
- Up to 32 concurrent exchanges (32 queued commands)
- Private Loop Disk Attach (PLDA) 1.5 Compliant
- Class 3
- 1.0625 GB/s Interface (100MB/s)
- Copper Direct Media Connection
- Media Interface Adapter (MIA) Support

Link Services

The AEC-7412B supports the complete set of basic and extended link service commands outlined in the PLDA document. Any unsupported commands will be rejected by the controller with a RJT response.

- Abort Sequence (ABTS)
- Basic Accept (BA_ACC)
- Basic Reject (BA_RJT)
- Port Login (PLOGI)
- Port Logout (LOGO)
- Process Login (PRLI)
- Process Logout (PRLO)
- Read Link Error Status Block (RLS)
- Discover Address (ADISC)
- Link Service Reject (LS_RJT)

Basic Link Service Commands

Table 5-1. Basic Accept (BA_ACC)

Byte	7	6	5	4	3	2	1
0					SEQ_ID Valid		
1					Last SEQ_ID		
2					Reserved		
3							
4					OX-ID		
5					Aborted		
6					RX_ID		
7					Aborted		
8					Lowest		
9					SEQ_CNT		
10					Highest		
11					SEQ_CNT		

Table 5-2. Basic Reject (BA_RJT)

Byte	7	6	5	4	3	2	1
0	Reserved						
1	Reason Code						
2	Reason Explanation						
3	Vendor Unique						

Extended Link Service Commands

Table 5-3. Port Login (PLOGI)

Byte	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1	1
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0

Link Service Command Code

4-19	NPort Common Service Parameters
20-27	Port Name
28-35	Node Name
36-51	Class 1 Service Parameters
52-67	Class 2 Service Parameters
68-83	Class 3 Service Parameters
84-99	Reserved
100-115	Vendor Version

Table 5-4. Node/Port Name Format

Byte	7	6	5	4	3	2	1	0
0	0	0	1	0				
	Network Address ID			NPort Identifier				
1								
2								
3			IEEE Company Identifier					
4								
5								
6			Unique Identifier					
7								

Table 5-5. NPort Common Service Parameters

Byte	7	6	5	4	3	2	1	0
0			Highest ANSI FC-PH Version					
1			Lowest ANSI FC-PH Version					
2			Buffer to Buffer					
3			Credit					
4	CIO	RRO	VVV	FP	ACM	RSVD	RSV D	RS VD
5			Reserved					
6	RSVD	RSVD	RSVD	RSVD				
7			Receive Data Field Size					
8			Reserved					
9			Total Concurrent Sequences					
10			Relative Offset					
11			by Info Category					
12								
13			E_D_TOV					
14			(Point to Point)					
15								

Fibre Channel Implementation

Table 5-6. Port Login Accept Payload (PLOGI ACC)

Byte	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
Link Service Command Code								
4-19	NPort Common Service Parameters							
20-27	Port Name							
28-35	Node Name							
36-51	Class 1 Service Parameters							
52-67	Class 2 Service Parameters							
68-83	Class 3 Service Parameters							
84-99	Reserved							
100-115	Vendor Version							

Table 5-7.Process Login (PRLI)

Byte	7	6	5	4	3	2	1	0
0	0	0	1	0	0	0	0	0
Link Service Command Code								
1	0	0	0	1	0	0	0	0
Page Length								
2	0	0	0	0	0	0	0	0
3	0	0	0	1	0	1	0	0
Payload Length								
4	0	0	0	0	1	0	0	0
Type Code								
5	0	0	0	0	1	0	0	0
Type Code Extension								
6	OPAV	RPAV	EIP	RSVD	RSVD	RSVD	RSVD	RSVD
7	Reserved							
8								
9	Originator							
10	Process							
11	Associator							
12								
13	Responder							
14	Process							
15	Associator							
16	Reserved							
17	Reserved							
18	Reserved							
19	RSVD	DOA	IF	TF	C/D	D/R	DRXR	DWXR
Service Parameters								

Fibre Channel Implementation

Table 5-8.Process Login Accept Payload (PRLI ACC)

Byte	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1	0
Link Service Command Code								
1	0	0	0	1	0	0	0	0
Page Length								
2	0	0	0	0	0	0	0	0
3	0	0	0	1	0	1	0	0
Payload Length								
4	0	0	0	0	1	0	0	0
Type Code								
5	0	0	0	0	0	0	0	0
Type Code Extension								
6	OPAV	RPAV	EIP	RSVD	Response Code			
7	Reserved							
8	Reserved							
9	Originator							
10	Process							
11	Associator							
12	Reserved							
13	Responder							
14	Process							
15	Associator							
16	Reserved							
17	Reserved							
18	Reserved							
19	RSVD	DOA	IF	TF	C/D	D/R	DRXR	DWXR
Service Parameters								

Table 5-9. Discover Address (ADISC)

Byte	7	6	5	4	3	2	1	0
0	0	1	0	1	0	0	1	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
Link Service Command Code								
4	Reserved							
5								
6	Hard Address of Originator							
7								
8								
:	Port Name of Originator							
15								
16								
:	Node Name of Originator							
23								
24	Reserved							
25								
26	Nport of Originator							
27								

Fibre Channel Implementation

Table 5-10. Discover Address Accept (ADISC ACC)

Byte	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
	Link Service Command Code							
4	Reserved							
5	Reserved							
6	Hard Address of Responder							
7	Reserved							
8	Reserved							
:	Port Name of Responder							
15	Reserved							
16	Reserved							
:	Node Name of Responder							
23	Reserved							
24	Reserved							
25	Reserved							
26	Nport of Responder							
27	Reserved							

Table 5-11.Link Service Reject (LS_RJT)

Byte	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	1
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
	Link Service Command Code							
4	Reserved							
5	Reason Code							
6	Reason Explanation							
7	Vendor Unique							

FCP-SCSI Implementation

SCSI information is included in the Fibre Channel frame through the use of the Fibre Channel Protocol (FCP). All of the operations start with an FCP command and end with FCP responses. The operations include all task management functions such as reset and queue control. All communication to the AEC-7412B must implement the SCSI-FCP protocol.

Table 5-12.FCP Command Header

Byte	7	6	5	4	3	2	1	0
0	0	0	0	0	0	1	1	0
	R_CTL							
1								
2	Destination ID (D_ID)							
3								
4	Reserved							
5								

Fibre Channel Implementation

Table 5-12.FCP Command Header (Continued)

6	Source ID (S_ID)							
7								
8	0	0	0	0	1	0	0	0
	Type							
9								
10	F_CTL							
11								
12	Sequence ID (SEQ_ID)							
13	0	0	0	0	0	0	0	0
	DF_CTL							
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
	Sequence Count (SEQ_CNT)							
16	Originator ID							
17	(OX_ID)							
18	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1
	Responder ID (RX_ID)							
18	Responder ID							
19	(RX_ID)							
20								
21	Parameter							
22								
23								

Table 5-13.FCP Command Payload

Byte	7	6	5	4	3	2	1	0
0 7	Logical Unit Number							
8	Reserved							
9	Reserved							
10	TT	CACA	TR	Reserved	CTS	ATS	RSVD	
11	Reserved						RDD	WRD
12 27	Command Descriptor Block (CDB)							
28 31	Data Length							

Byte	Bit	Name	Description
7:0		Logical Unit Number	The LUN field is an 8-byte field of which the AEC-7412B only supports single level LUN addressing. Bytes 2 through 7 are not used.
8		Reserved	Must be zero (0).
9	7:3	Reserved	Must be zero (0).
	2:0	Task Attribute	Specifies the type of command queuing for this FCP command: 0 Simple queue Head of queue Ordered queue ACA queue Untagged queue
10	7	Reserved	Must be zero (0).

Fibre Channel Implementation

Table 5-13.FCP Command Payload

6	Clear ACA	Set to clear the auto contingent allegiance condition from the initiator that caused the ACA. Once cleared, normal operation can resume.	
5	Target Reset	When set, all command queues are cleared and unit attention is sent as the next response to any command. NPort and Process Logins are preserved.	
4:3	Reserved	Must be zero (0).	
2	Clear Task Set	When set, clears the queues for all initiators.	
1	Abort Task Set	When set, clears only the queues of the requesting initiator.	
0	Reserved	Must be zero (0).	
11	7:2	Reserved	
	1	Read Data	Set when data is transferred to the initiator.
	0	Write Data	Set when data is transferred from the initiator.
27:12	Command Descriptor Block	16 Byte SCSI Command Descriptor Block.	
31:28	Data Length	Number of data bytes to be transferred.	



AEC-4412B/7412B User's Guide

Stock Number: 511640-00 Rev B

Print Spec Number: 497358-00

Current Date: 3/19/98

Page: 5-14

ECN Date: 3/20/98

6

Troubleshooting

Resolutions to common problems you may encounter are described in the following sections. See Appendix B, *Diagnostic Error Codes* for resolutions to diagnostic errors displayed through a terminal emulator you may encounter when you boot the AEC-4412B/7412B. Descriptions of the error codes displayed through the front panel LCD are also provided.

Terminal Emulator and COM Port Problems

Problem: Screen continuously puts out garbage characters.

The likely cause of this problem is a baud rate mismatch between the terminal emulator and the AEC-4412B/7412B controller. The default baud rate is 115200. Follow these steps if you set your terminal emulator to this rate and still get garbage characters:

- 1 Shut off the power to the enclosure containing the AEC-4412B/7412B.
- 2 Press the space bar of your terminal emulator.
- 3 Turn on the power while continuing to press the space bar. This will allow the AEC-4412B/7412B to auto-detect the baud rate setting.

- 4 When the Flash Loader Utility appears, select option 5 to continue to boot the controller.



Note: Some terminal emulators don't immediately change to the new baud rate settings, and you have to exit and restart the emulator to use the new values.

Problem: Nothing is displayed on the terminal emulator.

The probable cause of this problem is a bad RS-232 cable connection or swapped transmit/receive lines. If the cable is properly connected on both ends, try a "null modem" adapter that will reverse the RS-232 transmit and receive signals. The need for a null modem adapter will depend on both your enclosure and the RS-232 cable you are using.

Problem: Screen is updated, but won't respond to keystrokes.

Disable Hardware flow control on the terminal or terminal emulator. The AEC-4412B/7412B supports XON/XOFF flow control and works properly in most cases with no flow control.

Problem: Screen looks correct, but clock is not being updated.

Check to be sure that enclosure containing the AEC-4412B/7412B is still powered on. If you are using XON/XOFF, press the **Ctrl** key and the **Q** key simultaneously.

Problem: Screen is updated and menus appear right, but boxes around menus look incorrect.

Try a different font in your terminal emulator program, such as "Terminal." If you cannot find a font that looks correct, set ASCII Display to **Yes** in the Display options item of the Configuration menu.

Host SCSI Channel Problems

Problem: The AEC-4412B/7412B is not displayed during the host SCSI BIOS scan.

Verify that the AEC-4412B/7412B Administrator Utility is working properly via the RS-232 connection. Check that the SCSI cable to the host is attached to the proper connector of the enclosure. The connector is typically labeled "Host in" or "Host connection." Check that your host interface daughter board type—single-ended or differential—matches the type of your host SCSI connection.

Problem: The host SCSI BIOS scan displays “device name not available.”

The AEC-4412B/7412B is properly connected, but no arrays have been created. Use the Administrator Utility to create an array and reboot the host system.

Problem: The host SCSI BIOS scan hangs

Check that termination is set correctly at the system and the drive enclosure. Check that the device ID set in the Administration utility does not conflict with any other devices on the host SCSI channel. If you have a long SCSI cable, try disabling Ultra on the host SCSI channel.

Problem: Only one array is displayed during host SCSI BIOS scan

Check to assure that LUN support is enabled. Most SCSI host adapters, such as the AHA-2940UW, ship with LUN support disabled by default. Use Display Array Status to check the LUN assignment for each array. If LUN 0 is not assigned to an array, or some other LUN numbers are skipped, use the Change LUN Assignment option for each array until you have LUN numbers starting at 0 with no LUNs skipped. You must reboot the host system to recognize the new LUN assignment.

Problem: All arrays are displayed during host SCSI BIOS scan, but only one array is seen by the operating system.

SCSI drivers for some operating systems require a parameter switch to enable LUN support. For example, the NetWare driver, *aic7870.dsk*, requires the driver parameter LUN_ENABLE=FF (in *startup.ncf*) to scan for all LUN's. Check the driver documentation for your host SCSI channel. You may also need to compact the LUN mapping.

Device SCSI Channel Problems

Problem: Not all drives connected to the AEC-4412B/7412B device channels are displayed during boot, or the AEC-4412B/7412B hangs during display of connected drives and never reaches the Administration Utility screen.

Check your array enclosure documentation to be sure that the enclosure is properly configured for use with a RAID controller. If your enclosure supports removable drives, check the drive shuttles to be sure that the power connectors, SCSI connectors, and ID connectors are properly seated. Check drive termination and ID assignment. If you have enabled UltraSCSI on the device channels 0 and 1, try disabling it.





Array Basics

Adaptec's AEC-4412B/7412B External RAID Controllers let you set up and manage disk arrays. A *disk array* is a group of disks that appears to the system as a single virtual disk. This is accomplished through software resident in the RAID controller. *RAID* (Redundant Array of Independent Disks) refers to disk arrays in which part of the array storage capacity may be used to store redundant information. The redundant information lets you restore user data if a disk in the array fails.

The host system views the AEC-4412B/7412B controllers as a single SCSI disk drive. It is actually an array of physical disks behind a RAID controller. The AEC-4412B/7412B therefore is managed by software to appear as a single very large physical disk. Depending on the array type, the virtual disk has advantages in fault-tolerance, cost, performance, or a combination of these. This chapter explains the different array types and the disk requirements for each type.

Array Types

Array types are defined by their RAID level, a number from 0 through 5 (a higher RAID level does not necessarily indicate a higher level of performance or fault-tolerance). AEC-4412B/7412B RAID controllers let you create the types of arrays that have proven to be the most useful for RAID applications: RAID 0, 1, 1/0 (also known as mirrored), 3, 4, and 5.

RAID 0 (Striped Disks)

In a RAID 0 array, data is distributed, or *striped*, across the disks in the array. The array appears to the server as one large disk with a capacity approximately equal to the combined capacity of the physical disks. Because multiple reads and writes can be handled in parallel, the input/output performance of the array is much better than that of a single physical disk.

RAID 0 arrays do not store redundant data, so they are not true RAID applications. If one disk fails, the entire array fails and all array data is lost. The fault-tolerance of a RAID 0 array, therefore, is less than that of any single disk in the array. The term RAID 0 is widely used for these arrays, however, because they are conceptually similar to true RAID applications.

RAID 1, RAID 1/0 (Mirrored Disks)

In RAID 1 and RAID 1/0 arrays (commonly called *mirrored arrays*) disks are paired, with both disks in a pair containing the same data. When data is written to a mirrored array, it is written twice—once to each disk in the pair. A RAID 1 array has only one set of paired disks. A RAID 1/0 array has multiple pairs, across which data is striped.

The read performance of RAID 1 arrays can be much better than that of a single disk, while the write performance is slightly lower. In RAID 1/0 arrays, both read performance and write performance are better than those of a single disk.

A mirrored array is also highly reliable, because both disks *in a pair* must fail for the array to fail. In an array with five pairs of mirrored disks, for example, the array can maintain its integrity even if five disks fail—as long as each pair is left with one good disk. The main disadvantage of a mirrored array is its cost. Because all disks must have a twin, you must use twice the number of disks that actually contribute to the array capacity. In an eight-disk array, for example, you have only four disks of usable capacity.

RAID 3

RAID 3 arrays contain redundant information in the form of parity data, which is calculated block-by-block for all user data. The user data is distributed across all but one of the disks in the array. The parity data is written exclusively to the *parity disk* (also known as the

check disk). In the event of a disk failure, the data can be reconstructed from corresponding data stripes on the remaining disks in the array.

RAID 3 provides excellent I/O performance for applications that require high data transfer rates such as image processing, video processing, scientific data collection, batch data processing, or sequential reads and writes.

RAID 3 is not well suited for transaction processing or other applications that require simultaneous reads and writes.

RAID 4

RAID 4 is similar to RAID 3 in that the redundant information is achieved in the form of parity data. The user data is distributed across all but one of the disks and uses a single, dedicated parity drive for data protection. The main difference is that RAID 3 usually synchronizes writes to its disks, while RAID 4 can send data to its disk independently.

RAID 4 is best suited for transaction processing application that require high read requests, but not write requests such as inquires rather than updates.

RAID 4 is not recommended for I/O intensive applications that require high data transfer rates.

RAID 5

RAID 5 arrays contain redundant information in the form of parity data, which is calculated block-by-block for all user data. The parity information is distributed across the disks in the array, as in RAID 0 arrays, and occupies the equivalent capacity of about one disk. Data is interspersed with the parity information. If one disk in the array fails, the data on the failed disk can be reconstructed from the parity data and user data on the remaining disks. Two disks must fail before the entire array fails.

The read performance of a RAID 5 array is excellent—comparable to that of a RAID 0 array. Write performance is lower than that of a

RAID 0 array, because write operations involve calculating and writing new parity data as well as writing the new user data.



Note: For more information on RAID levels, see *The RAIDbook: A Source Book for RAID Technology*, published by the RAID Advisory Board (St. Peter, Minnesota: February, 1996).

Comparing RAID Levels

The following table illustrates the differences between the different RAID levels:

RAID Level	Min No of Drives	Description	Strengths	Weaknesses
RAID 0	2	Data striping without redundancy	Highest performance	No data protection— one drive fails, all data is lost
RAID 1	2	Disk mirroring	Very high: <ul style="list-style-type: none"> ■ Performance ■ Data protection ■ Minimal penalty on write performance 	High redundancy cost overhead—because all data is duplicated, twice the storage capacity is required
RAID 2	n/a	No practical use	Previously used for RAM error environments correction (known as Hamming Code) and in disk drives before the use of embedded error correction	No practical use— same performance can be achieved by RAID 3 at lower cost
RAID 3	3	Byte-level data striping with dedicated parity drive	Excellent performance for large, sequential data requests	Not well-suited for transaction-oriented network applications; single parity drive does not support multiple, simultaneous read and write requests

RAID Level	Min No of Drives	Description	Strengths	Weaknesses
RAID 4 (Not widely used)	3	Block-level data striping with dedicated parity drive	Data striping supports multiple simultaneous read requests	Write requests suffer from same single parity-drive bottleneck as RAID 3; RAID 5 offers equal data protection and better performance at same cost
RAID 5	3	Block-level data striping with distributed parity	Best cost/performance for transaction-oriented networks; very high performance and data protection; supports multiple simultaneous reads and writes; can also be optimized for large, sequential requests	Write performance is slower than RAID 0 or RAID 1
RAID 1/0	4	Combination of RAID 0 (data striping) and RAID 1 (mirroring)	Highest performance and data protection (can tolerate multiple drive failures)	High redundancy cost overhead; because all data is duplicated, twice the storage capacity is required; requires minimum of four drives

Mixing Disks from Different Manufacturers or with Different Capacities

An array can contain different models of SCSI disks, even disks with different capacities; for example, an array can include a 4-GByte disk and a 9-GByte disk. If you mix disks with different capacities, however, the smallest disk determines the logical capacity of all other disks in the array, regardless of RAID level. For example, if a RAID 0 array contains one 4-GByte disk and four 9-GByte disks, the capacity of the array is equivalent to about five 4-GByte disks. To maximize disk capacity, use disks of similar size.

Mixing Disks on Different RAID Controller Channels

An AEC-4412B/7412B RAID controller has two device channels: 0 and 1. An array can consist of disks on different channels of the same RAID controller.



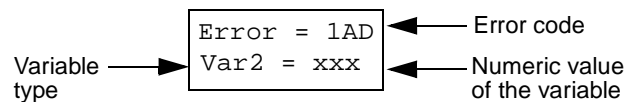
B

Diagnostic Error Codes

Each time you start the AEC-4412B/7412B, the controller performs a set of diagnostic tests to ensure everything is working properly. This section provides instructions on how to read the error codes from the LCD front panel display, descriptions of the error codes, and possible steps to take to resolve an error.

Reading LCD Panel Error Codes

If you receive an error, the front panel LCD shows a message that indicates the type of error received and additional information about the error. The error displayed through the front panel LCD looks similar to the following:



The two or three digit error code represents the error message. Var2 indicates the item being measured and the xxx indicates the numeric value of the variable corresponding to the particular error. Error codes and their corresponding messages and variables can be found in Table B-2, "Error Code Descriptions," on page B-4.

Using the information found in the table and the example listed above, error code 1AD means *The AEC-4412B chip set had a default hardware register error*. The Var2 represents the *Default value* and the xxx would be the actual numeric value of the Default value.

Viewing Additional Error Information

Some error codes do not have variable values associated with the error message, others have more than one. To view additional variable values:

- Press the up ▲ arrow or the down ▼ arrow to scroll through the list of associated variables.

In addition, some error codes return a hexadecimal number to indicate the type of device where the error occurred. Table B- 1 provides the list of hexadecimal numbers and the specific device they represent:

Table B-1. Device Lookup Table

Hex Number	Device
0x80000800	Data Cache
0x80001000	Parity Cache
0x80001800	Disk SCSI Channel 0
0x80001900	Disk SCSI Channel 1
0x80002000	Host SCSI Channel
0x80002800	Host Fibre Channel
0x80003000	PCI Bridge Chip
0x00000000	Invalid Device

Battery Error Messages

When an error occurs due to battery failure, the front panel LCD displays the following message **Battery Failed, Write Back Off**. To view the cause of the error, press the ▼ arrow key. The list of possible battery messages includes the following:

- Good
- Dead
- Fast charge
- Over charge
- Over current
- Charger
- Pack temperature range

B-2

Diagnostic Error Codes

- System temperature range
- Voltage range
- Under voltage
- Over voltage
- Not installed
- Short circuit
- Low
- Unknown failure
- Reset
- Fast charge initiated
- Fast charge active
- Fast charge verify
- Fast charging
- Full charged
- Failed
- Trickle charging
- Unknown state

Error Code Descriptions

The following table provides descriptions of the error codes, the type of variables displayed, and possible steps to resolve.

Table B-2. Error Code Descriptions

Error Code	Description	Steps to resolve
AC	The controller had a default hardware register error. Var 1 = Register Var 2 = Default value Var 3 = Read value	Power OFF the controller and re-try in a few seconds. If that doesn't work, the mother board may be defective. Replace the mother board.
DB	There was a microprocessor triple fault error or an AEC-4312B default hardware register error occurred. Var 1 = Register Var 2 = Default value Var 3 = Read value	Power OFF the controller and re-try in a few seconds. If that doesn't work, the mother board may be defective. Replace the mother board.
D6	The mother board revision is not currently supported. Var 1 = Board revision	Power OFF the controller and re-try in a few seconds. If that doesn't work, the mother board may be defective. Replace the mother board.
1AD	The controller's chip set had a default hardware register error. Var 1 = Register Var 2 = Non-parity default Var 3 = Read value Var 4 = Parity default	The mother board may be defective. Replace the mother board.
1AE	The controller's chip set had a default hardware register error. Var 1 = Register Var 2 = Default values Var 3 = Read value	The mother board may be defective. Replace the mother board.
2AF	An error occurred because the temperature is out of range. Var 1 = Minimum temperature (Celsius) Var 2 = Maximum temperature (Celsius) Var 3 = Current temperature (Celsius) Var 4 = Maximum temperature (Fahrenheit) Var 5 = Current temperature (Fahrenheit) Var 6 = Minimum temperature (Fahrenheit)	Check to make sure the fan is working. If the fan is working, power the controller OFF to let the board cool and retry in 5 to 10 minutes. If that doesn't work, the mother board may be defective. Replace the mother board.

Diagnostic Error Codes

Table B-2. Error Code Descriptions (Continued)

Error Code	Description	Steps to resolve
2B0	Warning. The temperature is out of range. Var 1 = Minimum temperature (Celsius) Var 2 = Maximum temperature (Celsius) Var 3 = Current temperature (Celsius) Var 4 = Maximum temperature (Fahrenheit) Var 5 = Current temperature (Fahrenheit) Var 6 = Minimum temperature (Fahrenheit)	Check to make sure the fan is working. If defective, replace.
2B1	Warning. The voltage level is out of range and displays the affected channel and voltage range. Var 1 = Minimum voltage Var 2 = Channel number Var 3 = Voltage level Var 4 = Reference value Var 5 = Tolerance Var 6 = Maximum Voltage	Check the power source or power supply and replace if defective.
2B2	An error occurred because the voltage level is out of range. Var 1 = Minimum voltage Var 2 = Channel number Var 3 = Voltage level Var 4 = Reference value Var 5 = Tolerance Var 6 = Maximum Voltage	Check the power source or power supply and replace if defective. If that doesn't work, the mother board may be defective. Replace the mother board.
3AB	Local DRAM memory error. Var 1 = Last memory address written Var 2 = Starting memory address written Var 3 = Write date (inverted address) Var 4 = Read data Var 6 = Last memory address inverted	The mother board may be defective. Replace the mother board.
490	Data or parity cache jumper error.	The mother board may be defective. Replace the mother board.
499	Data or parity cache DMCNFG register default error. Var 2 = DMCNFG	The mother board may be defective. Replace the mother board.
49A	Data or parity cache DEVSTAT register default error Var 2 = DEVSTAT	The mother board may be defective. Replace the mother board.

Table B-2. Error Code Descriptions (Continued)

Error Code	Description	Steps to resolve
49B	Disk SCSI channel 0 or channel 1 DEV-CONFIG register default error. Var 2 = DEVCONFIG	The mother board may be defective. Replace the mother board.
49C	HOST SCSI channel DEVCONFIG register default error. Var 2 = DEVCONFIG	Remove and then reinstall the daughter board. If that doesn't correct the problem, the daughter or mother board may be defective. Replace either the daughter or mother board.
49D	HOST fibre channel DEVCONFIG register default error. Var 2 = DEVCONFIG	Remove and then reinstall the daughter board. If that doesn't correct the problem, the mother board may be defective. Replace the mother board.
49E	The device displayed in the menu is not responding. The value at PCI configuration offset is incorrect. Var 2 = Default value	The mother board may be defective. Replace the mother board.
49F	There is no daughter board installed in the controller.	If the daughter board is not recognized, remove and then reinstall it. If that doesn't correct the problem, the mother board may be defective. Replace the mother board.
4A0	Both the daughter board and the enclosure have differential bits set.	Turn OFF the differential bits on either the daughter board or the enclosure.
4C6	PCI configuration error.	Power OFF the controller and retry in a few minutes. If that doesn't work, the mother board may be defective. Replace the mother board.
4D7	The wrong software is installed for the daughter board. The Fibre Channel daughter board requires the Fibre Channel code base.	Re-install the software using the Fibre Channel code base or replace the daughter board with a SCSI daughter board.
4D8	The wrong software is installed for the daughter board. The SCSI daughter board requires the SCSI code base.	Re-install the software using the SCSI code base or replace the daughter board with a Fibre Channel daughter board.

Diagnostic Error Codes

Table B-2. Error Code Descriptions (Continued)

Error Code	Description	Steps to resolve
599	Data or parity cache DMCNFIG register error. Var 3 = DMCNFIG	The mother board may be defective. Replace the mother board.
5A1	Configuration space table mismatch. Var 1 = Configuration space address Var 2 = Table data Var 3 = Read data	The mother board may be defective. Replace the mother board.
5A2	Configuration space table register size error. The table register size is not a byte, word, or dword. Var 1 = Configuration space address Var 2 = Table data Var 3 = Read data Var 4 = Table data register size in bytes	The mother board may be defective. Replace the mother board.
5C6	PCI configuration verification test.	Power OFF the controller and re-try in a few minutes. If that doesn't work, the mother board may be defective. Replace the mother board.
6A4	Device SCB SRAM error. Var 1 = Page Var 2 = SCB location Var 3 = Read value Var 4 = Expected value Var 5 = Test loop number	The mother board may be defective. Replace the mother board.
6C6	SCSI device SCB test error.	Power OFF the controller and re-try in a few minutes. If that doesn't work, the mother board may be defective. Replace the mother board.
7A5	Memory test error. Device walking ones error in Scratch Ram. Var 1 = Register Var 2 = Read data Var 3 = Write ones data Var 5 = Word loop Var 6 = Bit loop	The mother board may be defective. Replace the mother board.

Table B-2. Error Code Descriptions (Continued)

Error Code	Description	Steps to resolve
7A6	Memory test error. Device walking zeros error in Scratch Ram. Var 1 = Register Var 2 = Read data Var 3 = Write ones data Var 4 = Write zeros data Var 5 = Word loop Var 6 = Bit loop	The mother board may be defective. Replace the mother board.
7C6	SCSI device scratch RAM test.	Power OFF the controller and re-try in a few minutes. If that doesn't work, the mother board may be defective. Replace the mother board.
891	Data or parity cache error. No DRAM memory installed.	Remove and then reinstall the DRAM memory. If that doesn't correct the problem, replace the memory with the SIMMS that were shipped with the board.
892	Invalid data or parity cache size memory installed. One Mbyte DRAM memory is installed; however, the controller requires 4 MByte or 16 MByte memory SIMMs.	Remove and then reinstall the DRAM memory. If that doesn't correct the problem, replace the memory with the SIMMS that were shipped with the board.
895	Memory test error. Data or parity cache alias error. Unknown DRAM memory size is installed; however, the controller requires 4 MByte or 16 MByte memory SIMMs.	Remove and then reinstall the DRAM memory. If that doesn't correct the problem, replace the memory with the SIMMS that were shipped with the board.
8A7	Memory test error. Data or parity cache walking zeros error in DRAM. Var 1 = Address Var 2 = Read data Var 3 = Write ones data Var 4 = Write zeros data Var 5 = Word loop Var 6 = Bit loop	The mother board may be defective. Replace the mother board.

Diagnostic Error Codes

Table B-2. Error Code Descriptions (Continued)

Error Code	Description	Steps to resolve
8A8	Memory test error. Data or parity cache walking ones error in DRAM. Var 1 = Address Var 2 = Read data Var 3 = Write ones data Var 5 = Word loop Var 6 = Bit loop	Remove and then reinstall the DRAM memory. If that doesn't correct the problem, replace the DRAM memory with new DRAM memory. If the problem persists, the mother board may be defective. Replace the mother board.
8A9	Memory test error. Data or parity cache pattern error in DRAM. Var 1 = Address Var 2 = Read data Var 6 = Write data	Remove and then reinstall the DRAM memory. If that doesn't correct the problem, replace the DRAM memory with new DRAM memory. If the problem persists, the mother board may be defective. Replace the mother board.
9B3	Programmable interval timer interrupt error. The interrupt never occurred.	The mother board may be defective. Replace the mother board.
9B4	Programmable interval timer interrupt error. The interrupt was received later than expected. Var 2 = Loop count remaining Var 3 = Maximum loop count Var 4 = Loop count	The mother board may be defective. Replace the mother board.
AB5	Real time clock periodic timer interrupt error. The periodic interrupt never occurred.	The mother board may be defective. Replace the mother board.
AB6	Real time clock periodic timer interrupt error. The periodic interrupt was received later than expected. Var 2 = Loop count remaining Var 3 = Maximum loop count Var 4 = Loop count	The mother board may be defective. Replace the mother board.
AB7	Real time clock update error. The time did not get updated in the specified amount of time. Var 2 = Initial time specified Var 3 = Time used later Var 4 = Maximum loop count Var 5 = Specified time (in seconds)	The mother board may be defective. Replace the mother board.

Table B-2. Error Code Descriptions (Continued)

Error Code	Description	Steps to resolve
BB8	I2C internal chip error. Cannot talk to register S1 correctly. Var 1 = Read value Var 2 = Default value	The mother board may be defective. Replace the mother board.
BB9	I2C internal chip error. Cannot talk to register S0 prime correctly. Var 1 = Read value Var 2 = Default value	The mother board may be defective. Replace the mother board.
BBA	I2C internal chip error. The board CPU cannot talk to the register S1 correctly. Var 1 = Read value Var 2 = Default value	The mother board may be defective. Replace the mother board.
BBB	I2C internal chip error. The board CPU cannot talk to the register S2 correctly. Var 1 = Read value Var 2 = Default value	The mother board may be defective. Replace the mother board.
BBC	I2C internal chip error. The board CPU cannot talk to the register S3 correctly. Var 1 = Read value Var 2 = Default value	The mother board may be defective. Replace the mother board.
BBD	I2C internal chip error. Register S3 does not come up in 80xx mode. Var 1 = Read value Var 2 = Default value	The mother board may be defective. Replace the mother board.
BBE	I2C internal interrupt error. The interrupt was not received.	The mother board may be defective. Replace the mother board.
CBF	SCB back door memory error. Cannot read the SCB memory correctly. Var 1 = Read value Var 2 = Loop count Var 3 = Write value Var 4 = Memory Address	The mother board may be defective. Replace the mother board.
CC0	SCB back door memory error. The disk SCSI channel cannot read the SCB memory correctly. Var 1 = SCB page Var 2 = SCB location Var 3 = Read value Var 6 = Write value	The mother board may be defective. Replace the mother board.

Diagnostic Error Codes

Table B-2. Error Code Descriptions (Continued)

Error Code	Description	Steps to resolve
CC1	The mother board is not using the SCB back door. Please contact your vendor to upgrade the mother board. Var 1 = Xilinx revision	The mother board may be defective. Upgrade or replace the mother board.
ED5	Non-volatile DRAM bit is unexpectedly set. Var 1 = CMOS value Var 2 = CMOS location This error can occur if the battery is dead.	Follow the steps below depending on if you are using the front panel display or and RS-232 interface. Front Panel Display: 1. Reboot the controller while holding down the Select button. 2. Select Flash Utilities . 3. Select Clear Battery BU . RS-232 Interface: 1. Reboot the controller while holding down the space bar. 2. Select Item 6 from the Flash Utilities menu. 3. Select the Clear Battery Backup option. 4. Reboot the controller.
FD9	SCSI termination error.	Check the termination on the appropriate SCSI bus. Check the SCSI cable.
FDA	SCSI reset error. A device on the SCSI bus (Disk SCSI channel 0, Disk SCSI channel 1, or Host SCSI channel) is holding the bus in reset.	Check the devices on the appropriate SCSI bus. Power off and on the devices. Check the SCSI cable.



AEC-4412B/7412B User's Guide

Stock Number: 511640-00 Rev B

Print Spec Number: 497358-00

Current Date: 3/19/98

Page: B-12

ECN Date: 3/20/98

Index

A

Accessing 3-32
Adaptec
 Inside Sales 1-8
 WWW site 1-8
Add an array 3-10
Adding 3-10
Administrator Utility 3-4
 about 3-4
 backing up one menu 3-7
 boot prompt 3-7
 grayed menu options 3-8
 Help 3-8
 refresh screen 3-7
 RS-232 interface 3-4
 System menu 3-8
AEC-4412B, description 1-1
AEC-4412B/7412B
 product features 1-2
 rebooting 3-33
AEC-7412B, description 1-1
air flow specifications 1-6
ANSI emulation 3-6
array drive status 3-23
array overview displayed 3-22
array types A-1
 reference document A-4
arrays
 data block size 3-12
 deleting 3-13
 mixing disks A-5
 recognizing 3-13
 selecting drives on a different
 channel 3-11

 selecting types 3-10

Arrays, Types
 see Array Types

B

back panel I/O connectors 1-4
basic accept command 5-2
basic reject command 5-3
battery interface 1-5
battery specifications 1-7
baud rates 3-5
BFLU
 using a VT-100/ANSI
 Terminal 3-32
 using the front panel
 display 3-33
blink drive lights 3-24
boot prompt
 Administrator Utility 3-7
bootup screen 3-6
Bridge Flash Loader Utility
 (BFLU) 3-32

C

canister
 back panel I/O connectors 1-4
 physical specifications 1-5
canister interface features 1-3
changing sampling rate 3-21
CHANNEL 0 SCSI connector 2-2,
 2-6
CHANNEL 1 SCSI connector 2-2,
 2-6
channel configuration 3-15
check disk A-3

Index-1

- communications parameters 3-5
- configuration 3-1
 - menu 3-14
 - quick start steps 3-3
- connecting a power supply 2-5, 2-8
- connecting the RS-232 adapter 2-4, 2-8
- controller firmware 3-33
- controller parameters
 - configuring 3-14
- Ctrl-H key 3-8

D

- data block size for array 3-12
- daughter board
 - electrical specifications 1-6
 - options 1-3, 1-7
 - physical specifications 1-5
- deleting arrays 3-13
- device lookup table B-2
- device SCSI channel problems 6-4
- diagnostic tests B-1
- diagnostics
 - running 3-33
- discover address (ADISC) 5-8
- discover address accept (ADISC ACC) 5-9
- disk array A-1
- disks
 - using disks from different manufacturers A-5
 - using disks with different capacities A-5

E

- electrical specifications
 - daughter board 1-6
 - mother board 1-6
- error codes and descriptions B-4

F

- FCP command header 5-10
- FCP command payload 5-12
- fibre channel DB9 connector 2-6
- fibre channel host preparation 2-5
- Fibre Channel Protocol (FCP) 5-10
- Fibre Channel Protocol (FCP) - SCSI commands 5-1
- firmware, downloading 3-33
- format unit SCSI command 4-2
- front panel buttons, using 3-29
- front panel display
 - accessing main menu 3-29
 - reading error codes B-1
 - using 3-27

H

- Help 3-8
- host SCSI BIOS scan
 - problems 6-2, 6-3
- hot key 3-7
- hot swap pause 3-17
- humidity specifications 1-6

I

- initialization method 3-12
- inquiry SCSI command 4-3
- installing the AEC-4412B 2-1
- installing the AEC-7412B 2-5
- in-system speaker alarm 1-3

L

- LCD, using 3-27
- LED status lights 3-28
 - flashing 3-28
- link service commands 5-2

M

- menu options

- Add an Array 3-10
- Add Spare Drives 3-27
- Delete an Array 3-13
- grayed options 3-8
- hot key 3-7
- Hot Swap Pause 3-17
- on the front panel display 3-30
- Reconstruct Functions 3-25
- Reset Temporary Statistics 3-21
- selecting 3-7
- Temporary Array Statistics 3-20
- Temporary Drive Statistics 3-21
- mirrored arrays A-2
- mixing disks on arrays A-5
- mode select 6 SCSI command 4-7
- mode sense 6 SCSI command 4-7
- mother board
 - electrical specifications 1-6
 - features 1-2
 - physical specifications 1-5
- mounting screws 2-2

N

- node/port name format command 5-4
- non-ANSI terminal 3-6
- NPort common service parameters 5-4

O

- order information 1-8
- overview 3-1

P

- parity disk A-2
- performance information
 - temporary statistics 3-20
- performance statistics 3-21
- physical specifications
 - canister 1-5

- daughter board 1-5
 - mother board 1-5
- PLDA 5-2
- polling interval 3-16
- port login accept payload 5-5
- port login command 5-3
- problems with
 - device SCSI channel 6-4
 - host SCSI BIOS scan 6-2, 6-3
 - running configuration utility 3-5
 - terminal screen 6-1, 6-2
- problems with host SCSI BIOS scan 6-3
- process login (PRLI) 5-6
- process login accept payload (PRLI ACC) 5-7

R

- RAID 0 A-2
- RAID 0 defined A-2
- RAID 1 A-2
- RAID 1/0 A-2
- RAID 3 A-2
- RAID 4 A-3
- RAID 5 A-3
- RAID levels
 - compared A-4
 - described A-1
- RAID5 drive requirements 2-3, 2-7
- read 6 and read 10 SCSI command 4-8
- read capacity SCSI command 4-9
- read/write statistics 3-20
- reads 3-21
- reconstruct functions option 3-25
- Reconstruct Menu 3-25
- reconstructing data
 - tracking reconstruction 3-26
- recreating data 3-25
- release SCSI command 4-10
- reliability goals 1-6
- replacement drives 3-25

replacing drives 3-17
request sense SCSI command 4-10
reserve SCSI command 4-12
resuming SCSI bus activity 3-18
rezero unit SCSI command 4-12
RJT response 5-2
RS-232 connector 2-4

S

SAF-TE processor 3-15
scan for new devices command 3-13
SCSI
 messages supported 4-19
SCSI command
 format unit 4-2
 inquiry 4-3
 mode select 6 4-7
 mode sense 6 4-7
 read 6 and read 10 4-8
 read capacity 4-9
 release 4-10
 request sense 4-10
 reserve 4-12
 rezero unit 4-12
 seek 6 and seek 10 4-13
 send diagnostic 4-13
 start stop unit 4-14
 synchronize cache 4-14
 test unit ready 4-15
 verify 4-16
 write 6 and write 10 4-17
 write and verify 4-17
SCSI features 4-1
SCSI IDs
 assigning 2-3, 2-7
SCSI-2 commands 4-2
SCSI-2 compliant interface 4-1
seek 6 and seek 10 SCSI
 command 4-13
selecting array types 3-10
selecting spares 3-12

send diagnostic SCSI
 command 4-13
SEP 3-15
SEP environment status 3-16
SEP global flags 3-16
SEP slot flags 3-16
setting sampling rate 3-21
shock specifications 1-6
single-ended host SCSI bus 1-1
spare drives 3-12
 adding 3-26
 deleting 3-27
 selecting 3-12
start stop unit SCSI command 4-14
starting the BFLU 3-32
striped disks A-2
supported SCSI features 4-1
supported SCSI messages 4-19
synchronize cache SCSI
 command 4-14
System menu 3-8

T

temperature specifications 1-6
temporary statistics
 resetting 3-21
terminal
 screen problems 6-1, 6-2
terminal preferences 3-4
terminal window
 no colors 3-6
termination 2-3, 2-7
test unit ready SCSI command 4-15

U

UltraSCSI
 enabling 3-15
using spare drives 3-12

V

Var2, defined B-1
verify SCSI command 4-16
verifying arrays
 tracking verification 3-25
verifying data 3-24
vibration specifications 1-6

W

Windows Terminal program 3-4
write 6 and write 10 SCSI
 command 4-17
write and verify SCSI
 command 4-17



AEC-4412B/7412B User's Guide

Stock Number: 511640-00 Rev. A

Print Spec Number: 497358-00

Current Date: 3/19/98

Page: Index-6

ECN Date: 3/20/98