USER'S GUIDE

ADAPTEC CI/O
MANAGEMENT SOFTWARE

Adaptec CI/O Management Software

User's Guide

adaptec®

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1

Getting Started

In This Chapter

This guide explains how to use Adaptec® CI/O™ Management
Software to perform the following operations:

- Install and use CI/O

- View SCSI and UDMA devices

- Create arrays and perform array, spare, and disk operations

- Manage SCSI host adapters

- Replace array members

Supported Disks and Features

You use CI/O to manage SCSI host adapters, SCSI array controllers, and UDMA array controllers. The following chart lists the differences among the types of disks and features supported by these controllers:

Feature	SCSI Host Adapter[1]	SCSI Array Controller	UDMA Array Controller
Hot swapping		✓[2]	
Non-hard disks	✓	✓	
SAF-TE enclosures	✓	✓	
S.M.A.R.T.	✓	✓	
Number and type of disks managed	15 SCSI disks per channel	15 SCSI disks per channel	Maximum of 4 IDE hard disks, 1 per internal connector

[1] SCSI host adapters are discussed mainly in Chapter 6.
[2] ✓ = supported.

Overview of the Adaptec CI/O Management Software

This user's guide explains the most effective ways to use the Adaptec CI/O Management Software. Use the Contents and Index to find instructions for specific software commands.

CI/O Functions

You can use CI/O to perform the following functions:

■ Monitor the status of, and information about, arrays, spares, and other devices on a local system or remote server. The software sends status updates (event notifications) from multiple remote servers. You can simultaneously monitor servers running under different operating systems.

Note: UDMA controllers only support hard disk arrays and spares. Other device types are not supported.

- Schedule regular verification of fault-tolerant arrays and testing of spares. We recommend that you respond immediately to arrays in critical status by promptly replacing a failed hard disk with a spare.

- Use CI/O (either on a local system or on a networked client) to add, delete, or reconfigure arrays on an established system.

- Use the password feature to prevent unauthorized users from changing your array configuration.

- Ensure that arrays are adequately protected with a spare pool (recommended for SCSI arrays) or dedicated spares. You can create and delete spares with CI/O.

Note: You can only create a spare pool on a SCSI array. UDMA arrays do not support spare pools.

Conventions

This document uses the following typographic conventions:

bold
Used for key names (… press the **Enter** key …) and for options you are told to select (… select **Configure SCSI Channels**…).

`Courier`
Used for screen messages (…`Save changes?`…) and for text that must be typed exactly as shown.

Helvetica Italics
Used for program and file names when referenced in the text (… these changes are made to the *config.sys* file…).

This document includes two kinds of advisories:

Note: Notes are reminders, tips, or suggestions that might simplify the procedures included in this document.

Caution: Cautions alert you to actions that might cause damage to your system or your data.

2

Installing and Starting CI/O Software

In This Chapter

This chapter describes how to install CI/O on the following operating systems:

■ Windows® 95/98, 2000®, or NT® client

■ Windows NT server or workstation

■ Novell NetWare server

■ UnixWare server

This chapter also describes how to install the TIRPC Communications Module on NetWare 4.x.

Installing the Adaptec CI/O Management Software on a Server or Workstation (Windows NT or 2000)

To install CI/O on a Windows Server or workstation:

1 Start Windows.

2 Insert the Adaptec CI/O Management Software CD in the CD-ROM drive.

3 Double-click **My Computer**.

4 Double-click the CD-ROM drive icon.

5 Double-click **Cio400**.

6 Double-click **WINDOWS_95_NT.**

7 Double-click **disk 1.**

8 Double-click **Setup.exe**.

The Welcome dialog box appears.

9   Click **Next**.

The Setup Type Selection dialog box appears.
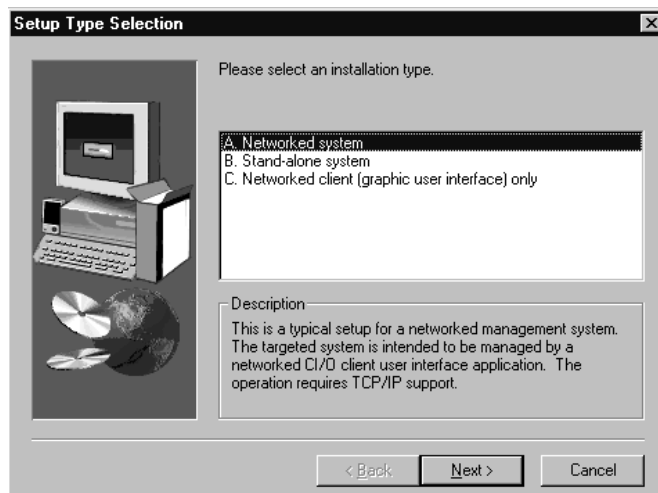
10   If you are setting up a Windows server, select **Networked System**. If you are setting up a stand-alone Windows Workstation, select **Stand-alone system**. Click **Next** to continue.

The Information dialog box appears. We recommend that you read through this information before proceeding.
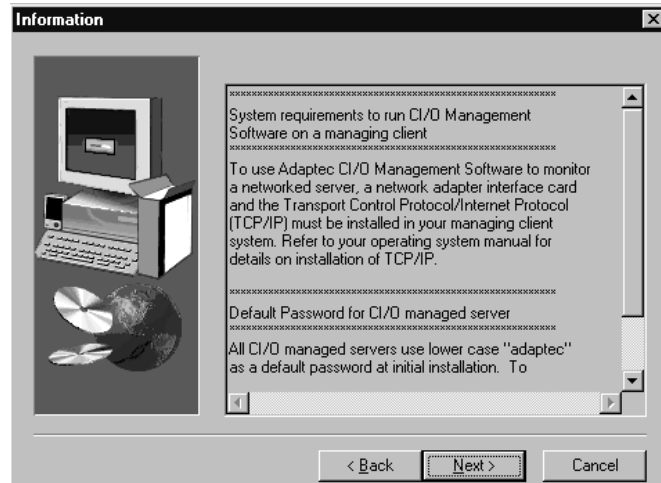
11 Click **Next**.

The Choose Destination Location dialog box appears.

12 To select the default destination folder, click **Next**. To specify a different folder, click **Browse**, select a folder, and click **Next**.

The Select Components dialog box appears.

Note: If you selected Stand-Alone System, the Select Components dialog box does not appear.
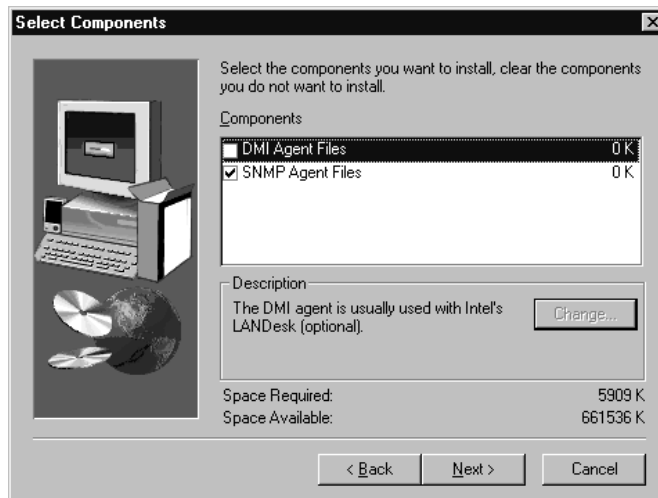
13 Select the components you want to install, deselect the components you want to omit, and click **Next**.

The Select Program Folder dialog box appears.
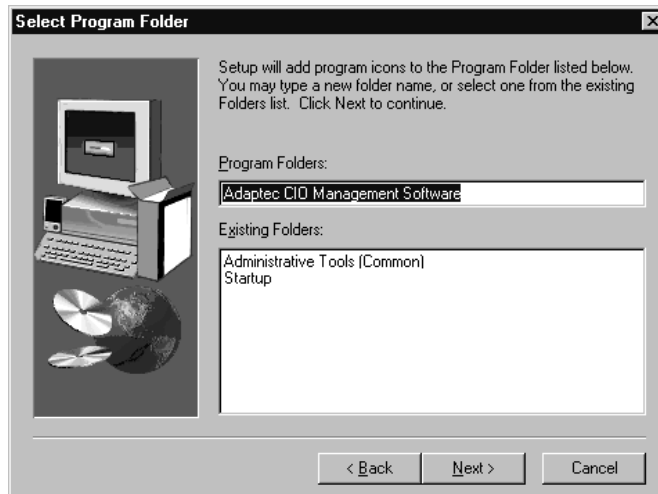
14 Select the program folder from the existing folders list, or type a new folder name. Click **Next**.

The Start Copying Files dialog box appears. If you previously selected Stand-alone system in the Setup Type Selection dialog box, Components Selected shows only IO Manager Service and Console User Interface.
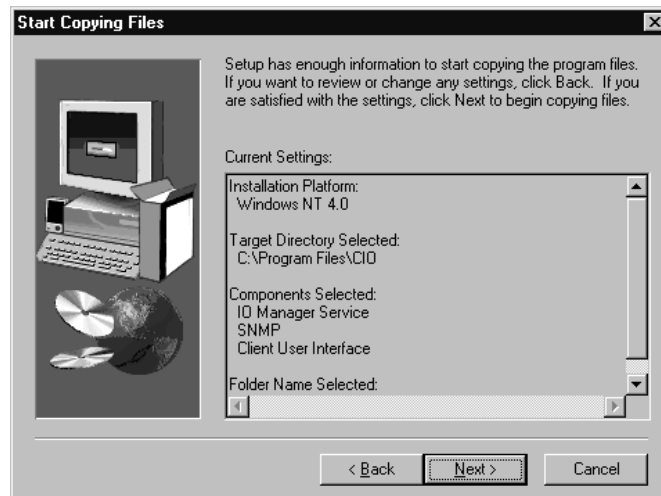
15 Click **Next** to begin copying files.

A progress indicator appears while Setup copies the files.

16 When the files are copied, choose whether or not to view the CI/O Readme file by clicking **Yes** or **No**.

If you click **Yes,** the Readme file opens, and you can view and close it before proceeding to the Setup Complete dialog box. If you click **No,** the Setup Complete dialog box appears immediately.

17 Setup is now complete. Click **Finish**, and reboot the system.

Modifying Automatic Start of the CI/O Management Services

To modify automatic start of the CI/O Management Services:

1 Double-click **My Computer**.

2 Double-click **Control Panel**.

The Control Panel window opens.

3 Locate and double-click the **Services** Control Panel icon.

The Services dialog box appears.
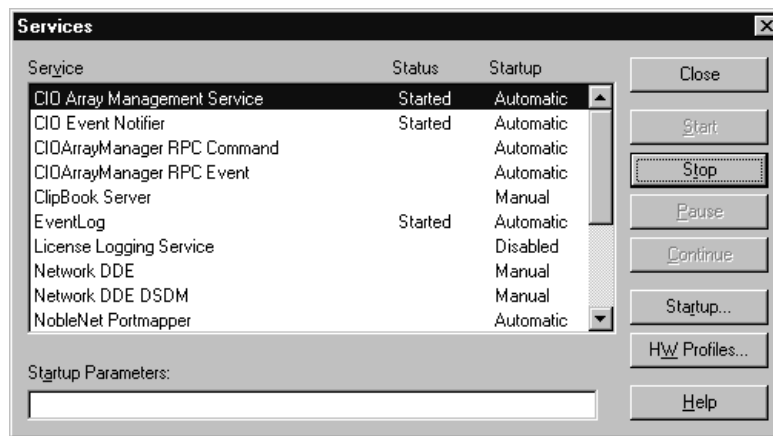
4 Locate and Double-click **CIO Array Management Service**.

The Service dialog box appears.
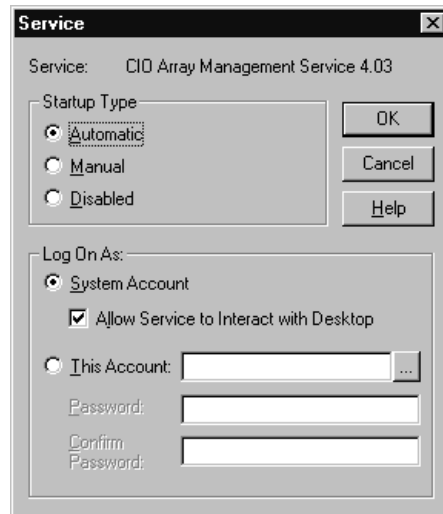
5   Select **Manual**, and click **OK**.

6   Repeat steps 4 and 5 to stop automatic start for the following
    services:

- CIOArrayManagerRPC Command

- CIOArrayManagerRPC Event

- NobleNet Portmapper

Note: NobleNet Portmapper may be in use by other
applications.

Starting the Adaptec CI/O Management Software in Windows NT

This procedure assumes that CI/O is already installed on the system and that communications have been established between the system and the networked clients or other consoles.

> **Note:** *Default Password:* You must have the proper level of password authorization to perform operations using CI/O. The default case-sensitive password is *adaptec*. We recommend that you change the default password as soon as possible to prevent unauthorized access. See Chapter 11, *Setting Security Options*, for more information.

To start CI/O:

1 Click the Windows NT **Start** button.

2 Point to **Programs**.

3 Point to **CI/O Management Software**.

4 Click **CI/O Management Software**.

The CI/O window appears.

> **Note:** You can choose how you want to launch CI/O, either in minimized mode or as a status bar icon. See *Selecting a Program Launch Mode* on page 5-12 for instructions.

Stopping CI/O Management Services in Windows NT

To stop CI/O Management Services in Windows NT:

1 Double-click **My Computer**.

2 Double-click **Control Panel**.

The Control Panel window opens.

3 Double-click **Services**.

The Services dialog box appears.
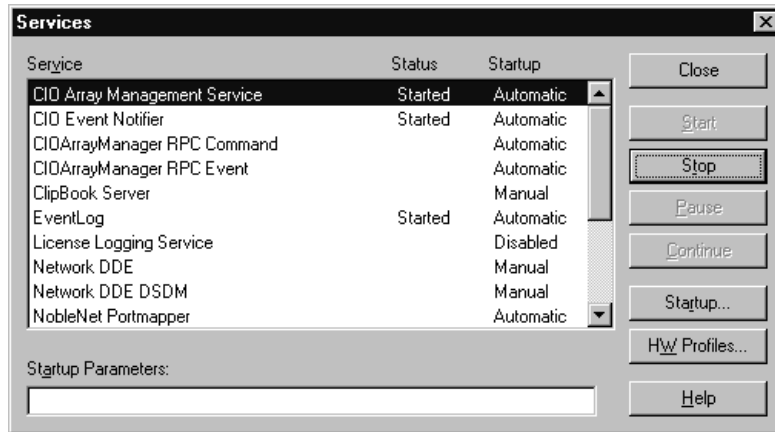
4 Click **CIO Array Management Service**, and then click **Stop**.

The Stopping dialog box appears.
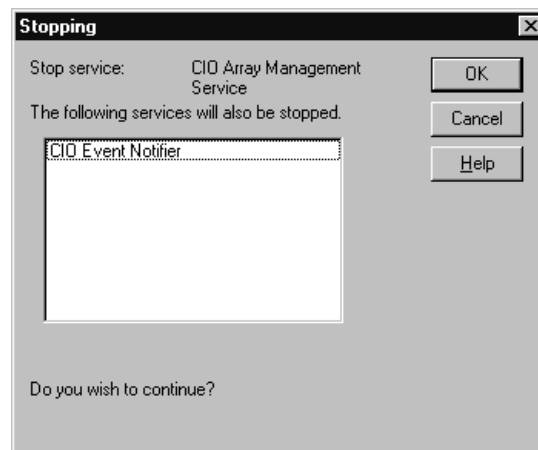
5 Click **OK**.

The Service Control dialog box appears while the Adaptec CI/O Array Management Service and the CI/O Event Notifier are stopping.

6 Repeat steps 4 and 5 to stop NobleNet Portmapper.

Note: Remember that the NobleNet PortMapper may be used by other installed applications besides CI/O.

Uninstalling the Adaptec CI/O Management Software in Windows 95/98, 2000, or NT

To uninstall CI/O in Windows 95, 98, NT, or 2000:

1 Double-click **My Computer**.

2 Double-click **Control Panel**.

The Control Panel window opens.

3 Locate and Double-click **Add/Remove Programs**.

4 Select **Adaptec CI/O Array Management Software**, and click **Add/Remove**.

5 Follow the instructions that appear on the screen.

Installing the Adaptec CI/O Management Software on a Networked Monitoring Client (Windows 95/98, NT, or 2000)

This section explains how to install CI/O on a networked client running under 32-bit Windows (Windows 95/98, 2000, or Windows NT).

If you want to manage your arrays on the server from a remote networked client, first make sure that the required LAN adapter components have been installed both on that server and on the remote client. Then continue with the remainder of this chapter.

If you install a LAN adapter on a stand-alone Windows NT system, then all required components are already in place for you. If you select **Networked System** in the Setup Type Selection dialog box, you do not need to set up the NT client again in order to manage other remote servers.

> **Note:** Before you start CI/O, ensure that communication with the server via the network is already established. As long as communication is established, you do not need to log on to the server to monitor the I/O subsystem via the network. See the documentation provided with the TCP/IP software for instructions on establishing communications.

When installing the TCP/IP software (not provided by Adaptec), follow the installation instructions provided with the TCP/IP software. You will be asked to enter information such as an IP address, host name, and host file. The TCP/IP stack uses the host name from the TCP/IP setup.

To install CI/O on a Windows 95/98, 2000, or Windows NT client:

1 Start Windows 95/98, 2000, or Windows NT.

2 Insert the Adaptec CI/O Management Software CD in the CD-ROM drive.

3 Double-click **My Computer**.

4 Double-click the CD-ROM drive icon.

5 Double-click **Cio400**.

6 Double-click **WINDOWS_95_NT.**

7 Double-click **disk 1**.

8 Double-click **Setup.exe**.

The Welcome dialog box appears.
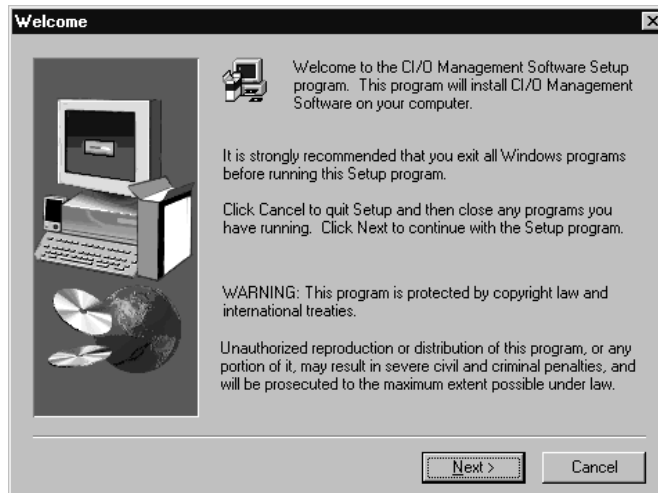
9 Click **Next**.

If you are running under Windows NT, the Setup Type
Selection dialog box appears. This dialog box does not appear
if you are running under Windows 95/98.
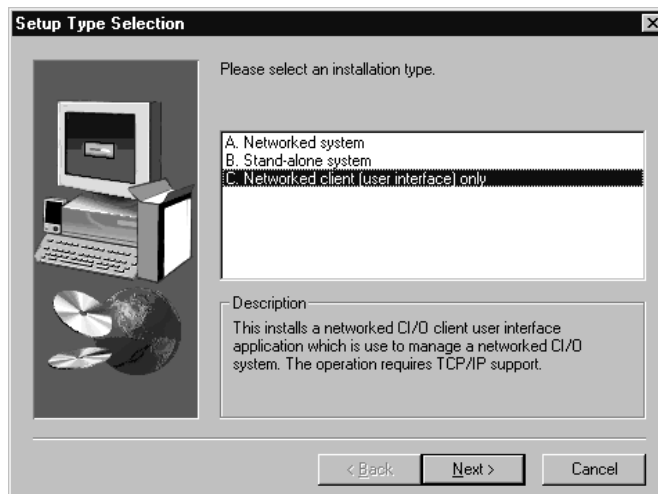
10 Select **Networked client (user interface) only,** and click **Next**.

The Information dialog box appears.

11 Click **Next**.

The Choose Destination Location dialog box appears.

12 To select the default destination folder, click **Next**. To specify a different destination folder, click **Browse**, select a folder, and click **Next**.

The Select Program Folders dialog box appears.
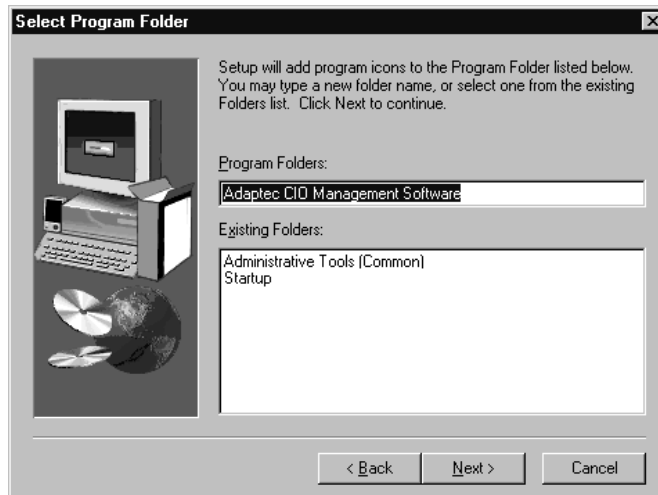
13 Select the program folder from the existing folders list, or type a new folder name, and then click **Next**.

The Start Copying Files dialog box appears.
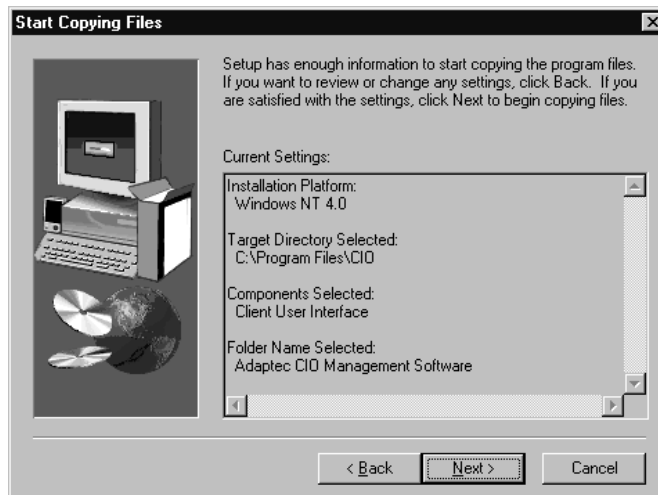
14 Click **Next** to begin copying files.

A progress indicator appears while Setup copies the files.

15 When the files are copied, choose whether or not to view the CI/O Readme file by clicking **Yes** or **No**.

If you click **Yes,** the Readme file opens, and you can view it before proceeding to the Setup Complete dialog box. If you click **No**, the Setup Complete dialog box appears immediately.

16 Setup is now complete. Click **Finish**, and reboot the system.

Installing the TIRPC Communications Module on NetWare Servers v4.x and v.5.x

Note: CI/O does not support Novell Netware 4.10.

To install the TIRPC communication module:

1 Insert the Adaptec CI/O Management Software CD in a DOS-mounted CD-ROM drive.

2 Bring up the server using the following pathname:

```
C:\> cd nwserver
C:\nwserver>server
```

3 From the NetWare System Console prompt (:), type one of the following commands and press **Enter**:

```
load nwconfig  (for NetWare 5.x)
```

or

```
load install (for NetWare 4.x)
```

4 Open the Configurations Options menu and select **Product Options** (for NetWare v5.x) or **Installation Options** (for NetWare v4.x).

5 Open the Other Installation Actions menu and select **Install a Product Not Listed**.

6 Press **F3** to specify the pathname.

7 Enter the DOS pathname to the CD-ROM drive (for example, `d:\`). The CD-ROM drive must be a DOS CD-ROM drive. For more details, refer to the installation and hardware guide for the product.

8   Open the Select An Action menu and select **Continue and access the CD-ROM**.

9   Select **NetWare 4.0 TIRPC Runtime and Configuration Files,** and press **Enter** (TIRPC must be installed in the *sys:\system* directory only).

> **Note:** Use the **NetWare 4.0 TIRPC Runtime and Configuration Files** even if you are using NetWare 5.x.

10   Press **Enter** to accept the default choice of *sys:\system*.

11   From the Start Installation menu, select **Yes**.

12   From the Overwrite Existing Files menu, select **Yes** if you are prompted to overwrite the *rpcnet.cfg* file. Select **No** for other prompts.

13   Press **Esc** twice when you see the message that reads `Installation for Select Files group done.`

14   In the Exit Installation screen, select **Yes**.

15   At the next two screens, press **Esc**.

16   In the Exit Installation screen(for NetWare v4.x) or in the nwconfig (for NetWare v5.x) screen, select **Yes**.

Installing the Adaptec CI/O Management Software on Novell NetWare Servers

> **Note:** Before you start CI/O, be sure the TIRPC communications module is installed (see the following section). Also, ensure that communication with the server via the network is already established. See the documentation provided with the TCP/IP software for instructions on establishing communications.

Complete the following steps to enable TCP/IP communications support:

- The *tcpip.nlm* must be loaded, and the IP protocol must be bound to a valid IP address.

■ The IP protocol generally must be bound to an ethernet frame type, ETHERNET_II, which must be specified when loading the LAN driver. A LAN driver can be loaded multiple times for different ethernet frame types.

To install CI/O from a DOS-mounted CD-ROM drive for Novell NetWare v4.x and Novell NetWare v5.x:

1 Insert the Adaptec CI/O Management Software CD in a DOS-mounted CD-ROM drive. Adaptec CI/O *newsetup* NLM supports installation from either the DOS drive or from a NetWare volume. You need to mount or attach the CD-ROM drive to the system according to the Novell instructions.

2 From the NetWare System Console prompt (:), type the following command (*x* is the CD-ROM drive letter, or CD-ROM volume assigned) and press **Enter**:

```
search add x:\cio400\netware
```

3 Type the following command, and press **Enter**:

```
load nwsetup
```

The *nwsetup* NLM is located at *cio400\netware\nwsetup.nlm* on the CD.

4 From the NWSETUP Select Operation menu, select **Default Installation** or **Custom Installation**. (Press **F1** for Help.)

5 At the Install menu, press **Enter.**

6 If the following message appears, select **overwrite**.

```
File: SYS:SYSTEM\nwaspi.cdm already exists!
```

7 At the end of the installation process, press **Enter** when you are prompted to update the *autoexec.ncf* file. (This adds the appropriate NLM command lines to the file so all software is automatically loaded when the server starts.)

Command lines similar to the following are automatically added to the *autoexec.ncf* file when you run the *nwsetup* utility:

```
#
# NWSETUP: UPDATED ON XX-XX-XX
SYS: SYSTEM\IOMGR.NCF
RPCSTART
SYS:SYSTEM\IOMGRRPC.NCF
```

8   Press **Esc** to exit Install.

9   Reboot the system.

Stopping Adaptec CI/O Management Software in Novell NetWare

To stop CI/O Management Services in Novell NetWare:

1   Stop CI/O using the command `unload iomgr.nlm`

2   The system will prompt you to stop all the dependent *.nlm* modules as well. To do this, follow the directions displayed on the NetWare system console.

Installing Adaptec CI/O Management Software on UnixWare 7.0.x Servers

> **Note:** UDMA array controllers are not supported in UNIXWare.

This section explains how to install CI/O on UnixWare. The installation is a two-part process. First you mount the CD-ROM drive, and then you install CI/O.

> **Note:** Before you install CI/O, you must have the proper level of administrative privileges on the UnixWare server to perform the required operations.

Mount the CD-ROM for UnixWare v7.0.x

To mount the CD-ROM drive for UnixWare v7.0x

1   Log onto UnixWare as a desktop user, and open the SCO Administration Utility.

2   Double-click **File system Manager**.

3   In the Filesystem Manager, select **Mount** -> **Add Mount Configuration** -> **Local.**

4   In the Local Mount Configuration window:

     ■   Select the appropriate file from the Device File list.

■ When the following message appears, insert the Adaptec CI/O Management Software CD in the CD-ROM drive and click **Continue**.

```
Please insert floppy or CD into the
drive. Press continue when ready.
```

The menu displays the file system type as **CDFS**.

■ Enter the mount point pathname in the Mount Point box.

■ Select **Set More Options** from the Advanced Options list.

5 In the Advanced Options window, select **Do Not Convert** from the File Name Conversion list.

6 In the Advanced Options window, select **OK**.

7 In the Local Mount Configuration window, select **OK** to start mounting the file system.

Installing the Adaptec CI/O Management Software on UnixWare v7.0.x

To install CI/O on UnixWare v7.0.x:

1 In the System Administration window, double-click **Software Management**.

2 Double-click **Application Installer**.

3 From the Install From list, select **Other**.

4 Click **Find Folder** to open the View Folder window.

5 Click the correct mount point for the CD-ROM drive.

6 Click the **cio400** directory, and then click **UnixWare**.

7 Use the arrow keys to highlight the **cio400** directory, and then click **Select**.

The **cio400** icon appears in the Application Installer window.

8 Click **Install** to begin the installation process.

9 Next, you need to remove the mount configuration. From the Filesystem Manager window, select the correct mount point pathname for the CD-ROM drive.

10 From the Mount list, select **Remove Mount Configuration** and then click **Yes**.

11 You can now close the Filesystem Manager window and the Application Installer window.

Stopping the Adaptec CI/O Management Software in UnixWare

To stop CI/O Array Management Services in UNIXWare:

1 Change directories to the */ciodata* directory.

2 Run the script named */cio*.

The CI/O start and stop commands are as follows:

```
./cio start
./cio stop
```

The *cio* script is responsible for starting and stopping all the dependent services including IOMGR, RPC, SNMP and DMI services.

Automatic start and stop scripts are also available. These start or stop CI/O services at the time of server reboot or shutdown. The automatic start and stop scripts are:

/etc/rc2.d/S90cio for automatic start

/etc/rc0.d/K90cio for automatic stop

Uninstalling the Adaptec CI/O Management Software on UnixWare v7.0.x

To uninstall CI/O on UnixWare v7.0.x:

1 In the System Administration window, double-click **Software Management**.

2 Double-click **Application Installer**.

3 In Application Installer window, click the **cio40** directory.

4 Click **Remove** to start the uninstall process.

5 You must manually remove the *ciodata* directory from the system.

3

Viewing the System Configuration

In This Chapter

CI/O enables you to view information about the following:

- Systems (stand-alone systems and servers)

- SCSI host adapters and connected devices

- SCSI array controllers and connected devices

- UDMA array controllers and connected devices

This chapter explains how to interpret the system and device information displayed in the System Monitor and Storage Information windows. It also explains the Rescan command.

Viewing Systems

To view systems currently managed by CI/O:

1 In the Adaptec CI/O Management Software window, click the

button to open the System Monitor window.

2 Look in the upper pane of the window.

Selecting a View

Note: The list in the bottom pane of the System Monitor window is explained in *Viewing a List of Current System Events* on page 4-2.

Icon View

To display only the system icon in the upper pane of the System
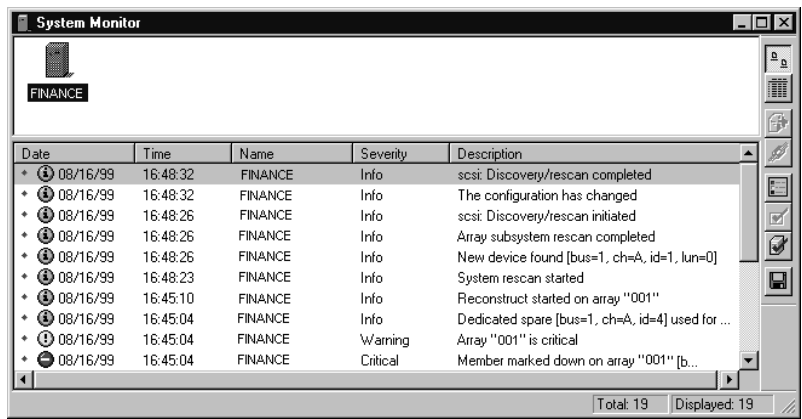
Monitor window, click the button.

Detail View

To display detailed information about the system in the upper pane

of the System Monitor window, click the ▦ button.

```
System Monitor                                                    _ □ ✕
Name              Status        Description    System O/S    CI/O Server Version
📄 FINANCE         Responding                   Windows NT    Unknown                a □
                                                                                     ▦
                                                                                     🗗
Date         Time      Name       Severity   Description                     ▲       ⌨
• ⓘ 08/16/99  16:48:32  FINANCE    Info       scsi: Discovery/rescan completed        ▣
• ⓘ 08/16/99  16:48:32  FINANCE    Info       The configuration has changed           ☑
• ⓘ 08/16/99  16:48:26  FINANCE    Info       scsi: Discovery/rescan initiated        ✔
• ⓘ 08/16/99  16:48:26  FINANCE    Info       Array subsystem rescan completed
• ⓘ 08/16/99  16:48:26  FINANCE    Info       New device found [bus=1, ch=A, id=1, lun=0]  💾
• ⓘ 08/16/99  16:48:23  FINANCE    Info       System rescan started
• ⓘ 08/16/99  16:45:10  FINANCE    Info       Reconstruct started on array "001"
• ⓘ 08/16/99  16:45:04  FINANCE    Info       Dedicated spare [bus=1, ch=A, id=4] used for ...
• ⓘ 08/16/99  16:45:04  FINANCE    Warning    Array "001" is critical
• ⬤ 08/16/99  16:45:04  FINANCE    Critical   Member marked down on array "001" [b...  ▼
◄                                                                         ►
                                                          Total: 19   Displayed: 19
```

Each system is represented by an icon in the upper pane of the
window. The appearance of the icon indicates the system status, as
shown below. The status is also shown in the status bar.

The system is online and available.

The system is unavailable, perhaps due to a busy server or a
network failure. CI/O automatically attempts to reattach to
the server within a user-selectable time. The default is
10 minutes. See *Setting the Ping Interval* on page 5-2 for
instructions on changing the default.

Click the 🖉 button to immediately attempt a reconnect
operation. See *Reconnecting to a Server* on page 3-16 for
complete instructions. If you still cannot reconnect, try
closing CI/O and restarting it.

The system has generated a critical event message.

Guest access to the networked server is disabled. To access system information, double-click the icon and enter the system password when prompted.

The system has generated a warning event message such as an array in critical status.

Viewing SCSI and UDMA Devices

You can view the status of and configuration information about devices connected to one or more SCSI host adapters and SCSI or UDMA array controllers in the Physical Resources pane of the Storage Configuration window.

Viewing Device Status

To view the status of SCSI or UDMA devices connected to SCSI host adapters and SCSI or UDMA array controllers:

1 In the Adaptec CI/O Management Software window, click the

 button to open the Storage Configuration window.
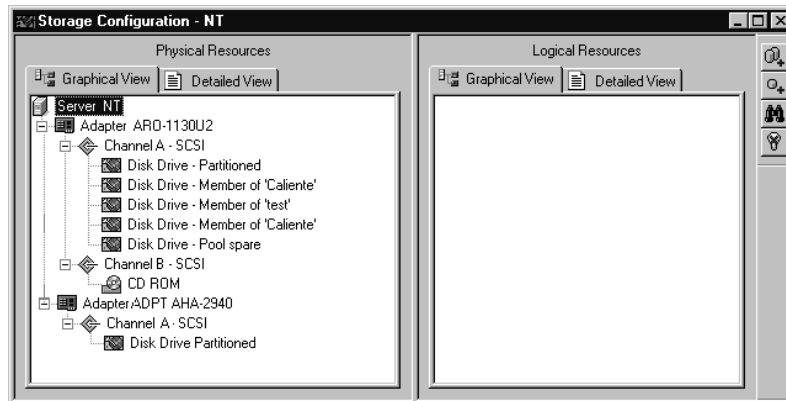
2 Click the **Graphical View** tab to view the status of any adapters, array controllers, or devices in a graphical format
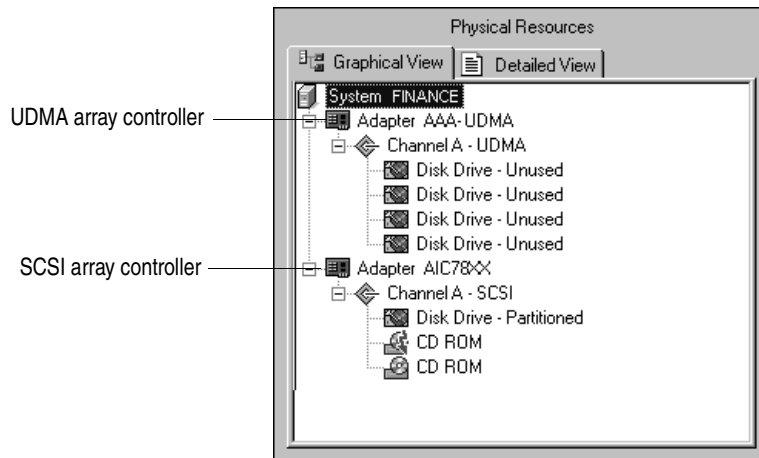
3 Click the **Detailed View** tab to view utilization, status, and capacity information for the devices shown in Graphical View.

Viewing Device Information

To view additional information about SCSI or UDMA devices connected to adapters and array controllers:

1 Click the ⬚ button to open the Storage Configuration window.

2 In the Physical Resources pane, right-click a SCSI device icon.

3 Select **Information** from the shortcut menu. See *Viewing Detailed Device Information* on page 3-7 for more information.

Device Icons

The device icons in the Physical Resources pane correspond to actual physical devices connected to a host adapter or array controller, such as a hard disk or a CD-ROM drive.

> **Note:** UDMA array controllers do not support non-hard disk devices, such as CD-ROMs, or Zip drives.

Device icons are explained below:

SCSI or UDMA array controller or SCSI host adapter

Channel

Hard disk

CD-ROM drive (SCSI only)

Tape drive (SCSI only)

Scanner (SCSI only)
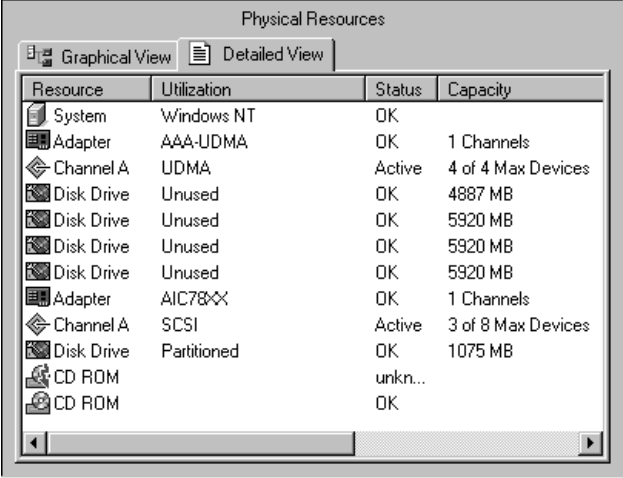
Printer (SCSI only)

Enclosure management processor

■ Click the **Graphical View** tab to view a graphical presentation of the status of an array controller or host adapter and the devices connected to it.

■ Click the **Detailed View** tab to view utilization, status, and capacity information for the devices shown in Graphical View.

Viewing Detailed Device Information

When you right-click a device icon, such as a hard disk, and select **Information** from the shortcut menu, a Device Information dialog box appears. The information provided varies according to the selected device.

To view additional information about devices connected to a SCSI or UDMA array controller:

1 Click the [icon] button to open the Storage Configuration window.

2 In the Physical Resources pane, right-click a device icon.

3 Select **Information** from the shortcut menu. A Device Information dialog box appears, such as the one shown below.
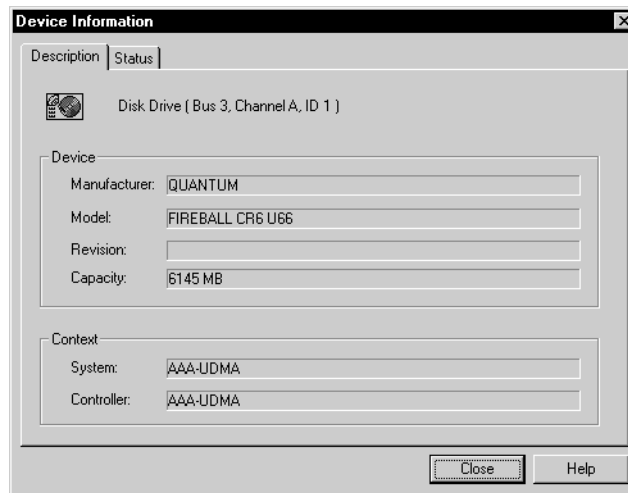
Note: For SCSI devices other than hard disks and CD-ROM drives, the Status tab is not provided.

The Status tab contains the following information about the selected device:

- **Overall**

  The current status of the device (for example, OK, Down, Failed spare, Reconstructing, or Target of Reconstruction)

- **SMART**

  The status of SMART (for example, Enabled, Disabled, or N/A)

Note: SMART is always N/A for UDMA devices; UDMA array controllers do not support SMART notifications.

- **O/S Visibility**

  Describes whether the device is detected by the operating system

■ **RAID Usage**

Describes whether the device is a member of an array, a spare, or neither

4   Click **Close** to close the SCSI Information or the Device Information dialog box

Viewing SCSI Host Adapter and SCSI and UDMA Array Controller Information

To view configuration information for a SCSI host adapter, or SCSI or UDMA array controller:

1   In the Adaptec CI/O Management Software window, click the
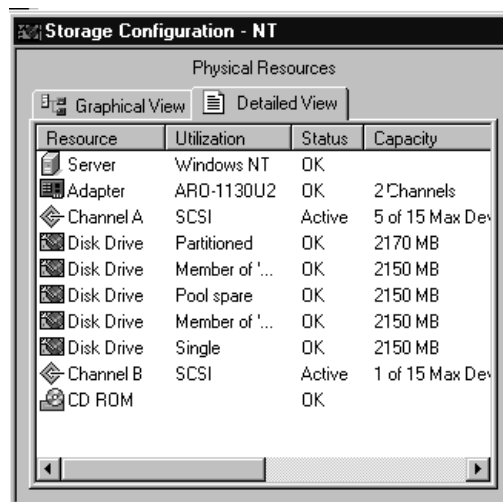
[icon] button to open the Storage Configuration window.
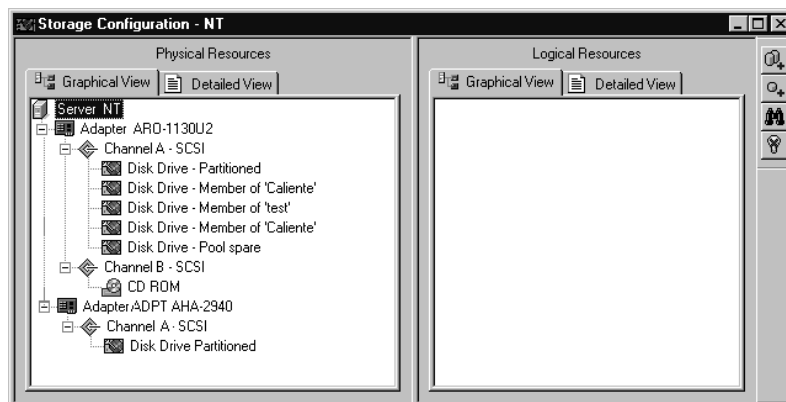
2   In the Physical Resources pane, right-click a SCSI host adapter, SCSI array controller, or UDMA array controller icon [icon].

3 Select **Information** from the shortcut menu.

A Controller Information dialog box appears.

For a host adapter
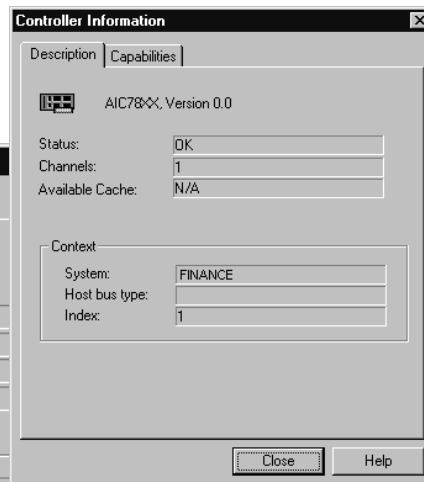
For an array controller
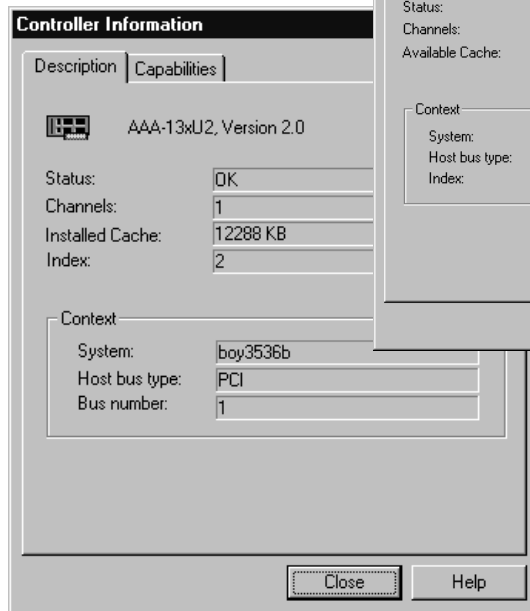
4 Click the **Description** tab.

The Description tab displays the following information:

■ **Status**

The status of the SCSI host adapter or array controller

■ **Channels**

The number of channels on the SCSI host adapter or array controller

■ **Available Cache**

The size of the installed cache on the SCSI host adapter or array controller

■ **Host bus type**

This may be ISA, EISA, or PCI. The bus type is not available for SCSI host adapters

■ **Bus number**

The PCI slot that contains the array controller. The bus number is not available for SCSI host adapters.

■ **Index**

Contains a reference to a particular SCSI host adapter. The index is not available for array controller.

5   Click the **Capabilities** tab for a list of features the selected host adapter or array controller supports. Not all features appear for every product, and the contents of the list may be different for SCSI host adapters and array controllers. This list is for reference only and does not allow you to change capabilities.
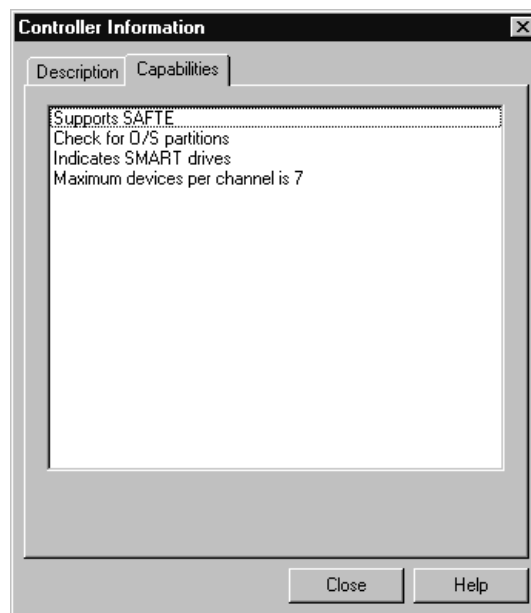
6   Click **Close** to close the Controller Information dialog box.

Viewing SCSI or UDMA Channel Information

To view configuration information for a SCSI or UDMA channel:

1 Right-click a channel icon ◈.

2 Select **Information** from the shortcut menu.
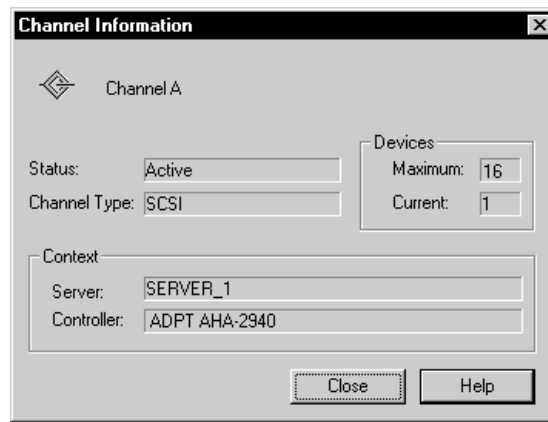
The Channel Information dialog box appears.

The following information appears in the Channel Information dialog box:

■ **Status**

The current operational status of the channel (for example, Active or Inactive)

■ **Channel Type**

The type of channel (for example, SCSI or UDMA)

- **System**

  The name of the system containing the channel

- **Controller**

  The type of controller

- **Devices**

  The number of devices currently connected to the channel (Current) and the maximum number of devices that the channel supports (Maximum)

  - For SCSI channels, you can connect up to 15 devices.

  - For UDMA channels, you can connect up to four devices.

3   Click **Close** to close the Channel Information dialog box.

Rescanning

A rescan operation is done automatically whenever you pause I/O and resume I/O to an array or a device. You do not need to issue a Rescan command to detect a failed array member. CI/O detects the failed member automatically if I/O is present on the array.

You need to issue a Rescan command in the following situations:

- When you connect a new device to the Adaptec Array1000 Family product without using the Pause I/O command

- When you disconnect a device from the Adaptec Array1000 Family product without using the Pause I/O command

- When you need to update the display in the Physical Resources pane of the Storage Configuration window (for example, if CI/O continues to display a device as connected after you removed it from the system)

Note: Pause I/O is not supported on UDMA array controllers.

To rescan the system:

1   In the Adaptec CI/O Management Software window, click the

   button to open the Storage Configuration window.

```
Storage Configuration - NT                                    _ □ ✕
                 Physical Resources              Logical Resources
  Graphical View | Detailed View       Graphical View | Detailed View
 Server NT
 └─ Adapter ARO-1130U2
    └─ Channel A - SCSI
       ├─ Disk Drive - Partitioned
       ├─ Disk Drive - Member of 'Caliente'
       ├─ Disk Drive - Member of 'test'
       ├─ Disk Drive - Member of 'Caliente'
       └─ Disk Drive - Pool spare
    └─ Channel B - SCSI
       └─ CD ROM
 └─ Adapter ADPT AHA-2940
    └─ Channel A - SCSI
       └─ Disk Drive Partitioned
```
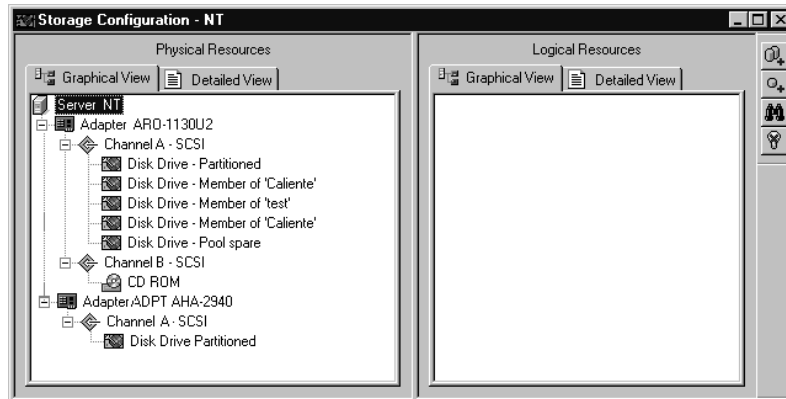
2   Click the   button.

3   In the dialog box that appears, click **Yes** to confirm that you
     want to rescan the system.

     When the rescan operation is complete, changes are reflected
     in the icons in the Storage Configuration window.

✔ **Note:** You cannot use the Rescan command to enable the
operating system to recognize an entire array that was
transferred from another system. CI/O will, however, find
and display the transferred array. You must reboot the
system before the operating system recognizes the
transferred array. If you remove a disk that is an array
member, replace it with another disk, and issue a Rescan
command, CI/O detects that the new disk is not an array
member.

Differences in Rescan Between SCSI Host Adapters and SCSI or UDMA Array Controllers

Rescanning operates somewhat differently on SCSI host adapters compared to SCSI or UDMA array controllers.

In the case of array controllers, Rescanning performs a complete scan of all connected devices to discover any additions or deletions and then updates the screen so that you can continue working.

In the case of SCSI host adapters, devices are scanned in the background and any updates appear onscreen a little later, while you can continue to use CI/O for other operations.

Rescan Details

When *only* SCSI host adapters or *only* SCSI array controllers or *only* UDMA array controllers are being rescanned, an hourglass appears until the rescan is completed and the Storage Configuration window is redrawn with updated information.

If *both* SCSI array controllers *and* SCSI host adapters or *both* SCSI host adapters *and* UDMA array controllers are being rescanned, an hourglass appears until the array-controller rescan is completed, and the Storage Configuration window is redrawn with updated information for the SCSI or UDMA array controllers only. At this time, the host-adapter rescan has not completed, and each SCSI host adapter's icon shows that a rescan is still in progress. When the SCSI rescan operation completes, the Storage Configuration window is again redrawn with updated information.

> **Note:** The software scans the server periodically to detect status changes for any devices attached to installed SCSI host adapters. Changes to SCSI or UDMA array controller status, however, are detected immediately if I/O is present.

Working with Servers

Reconnecting to a Server

If a server has lost connection, you may need to issue a Reconnect Server command to re-establish server communication.

To reconnect to a server:

1   In the Adaptec CI/O Management Software window, click the

   button to open the System Monitor window**.**
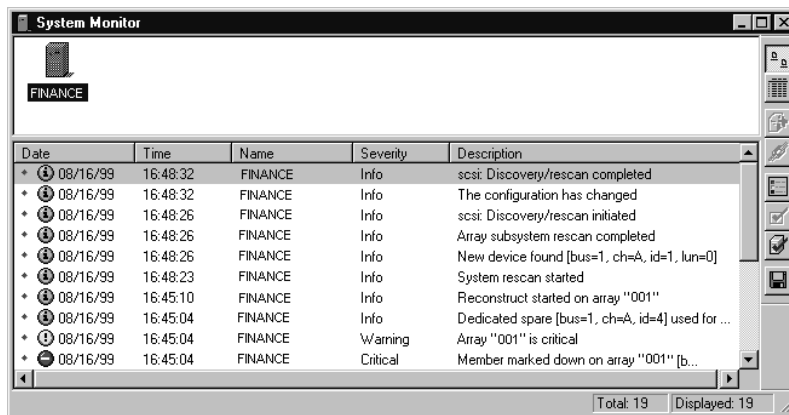
2   Click the icon   of the server to which you need to reconnect.

3   Click the   button.

> **Note:** If you are running CI/O from a networked client and the message Guest Access Disabled appears, the system to which you are trying to connect does not allow remote users to view its configuration information. See *Controlling Guest Access* on page 9-5 for more information.

Adding a New Server Address
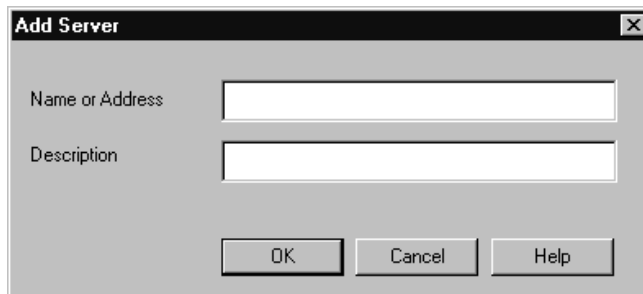
Note: If you are using the user interface from a Windows NT server, the system automatically adds the local system address.

You must enter information about each networked server you want to monitor with CI/O. Once this information is recorded in a configuration file, CI/O automatically finds the server(s) when it starts. The configuration is automatically saved when you exit the program.

To add a new server address:

1 Click the button to open the System Monitor window.

2 Click the button to open the Add Server dialog box.

3 In the Name or Address box, type the server's IP address or name, which can be up to 32 characters. This name appears beneath the server icon in the System Monitor window when you select **Icon View.**

Servers running under Windows NT and NetWare use an IP protocol. You can always enter the server address if you know it. Otherwise, enter the server name. This could be something like `mainserver` or `mainserver.unisystem.com`. Ensure your networked client is set up with either a host file or with the name of a domain resolver. Ask the System Administrator if you are not sure.

The format of a TCP/IP address is *nnn.nnn.nnn.nnn,* where each group of three decimal digits is a number between 0 and 255 (for example, 123.23.45.145).

4 Enter a description of the server—for example, `Application Server` or `Video Server`. This description appears when you select Detail View in the System Monitor window.

5 Click **OK** to add the new server information. If the server name or address is not correct, you will see one of the following error messages:

■ **RPC transport error.**

This means that you entered a server address with the correct IP syntax, but there is no server with this address. Check your typing for errors, and try again.

■ **Transport not present.**

This means that the TCP/IP protocol transport is not present on the system.

■ **Duplicate server exists.**

This means that you entered a server name or address that has already been added for this networked client monitoring list.

Deleting a Server Address

When you delete a server address, the icon for the server no longer appears in the System Monitor window and you can no longer view information about that server or manage it with CI/O.

To delete a server address:

1 Click the ▯ button to open the System Monitor window.

2 Right-click the icon ▯ of the server you want to delete, and select **Delete** from the shortcut menu.

3 In the dialog box that appears, click **Yes** to confirm deletion of the server.

4

Viewing and Responding to System Events

In This Chapter

This chapter describes the Adaptec CI/O Management Software windows that display system events. This chapter also explains how to interpret and respond to system events.

Viewing a List of Current System Events

The System Monitor window enables you to monitor events on all systems to which you are connected. In the System Monitor window, you can sort event notifications according to date, time, name, severity, or description, starting from the time you begin monitoring. You can also view historical event logs for individual systems.

A color-coded circle to the left of each message gives you a quick indicator of its severity. The table on page 4-7 describes the severity levels.

> **Note:** If you minimize the Adaptec CI/O Management Software or launch it as a status bar icon, you can configure the application to flash an icon whenever an important new event notification is received or if there are any unread events. See *Selecting a Program Launch Mode* on page 5-12 for more information.

To use the list of current events in the System Monitor window:

1 In the Adaptec CI/O Management Software window, click the
   button to open the System Monitor window.

   Current event notifications appear in the lower pane of this window.
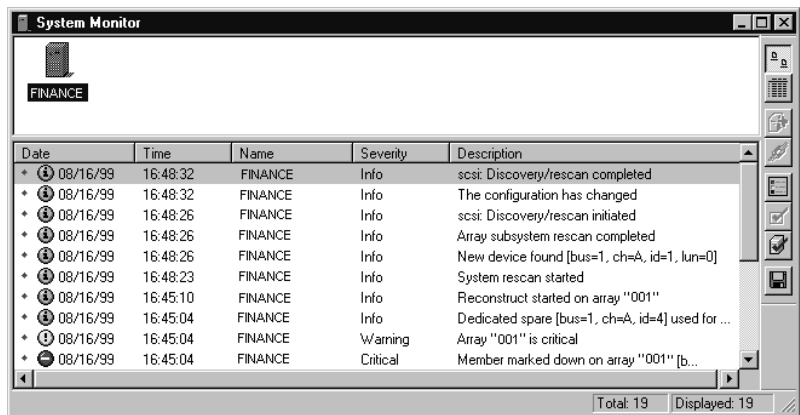
2   View information about all events in order of occurrence (the default):

  ■ New entries appear on the list as the system events occur, and a date and time are listed for each event.

  ■ A green bullet to the left of an event indicates that the event is new and may not yet been viewed.

  See *Interpreting and Responding to System Event Messages* on page 4-7 for more information on how to respond to these messages.

3   To specify the event order, click the appropriate column heading.

> **Note:** The client sorts events from different systems after adjusting the time stamp for each event to the client's local time. Events are sorted correctly by absolute time of occurrence and are displayed in the remote client's local time.

4   To mark all new event notifications *from all systems* as "read" without actually reading them, click the button. This stops the Adaptec CI/O Management Software icon from flashing when the application is minimized (if so configured).

  To mark as read all new event notifications *from the local system or the currently selected system* without actually reading them, click the button.

5   To filter the event notifications in this window by severity, click the button. For example, you may only want to view critically important events at this time. See *Selecting Notification Settings* on page 5-5 for more information.

6   To save the event list to a file, click the button.

7   Close the System Monitor window when you are finished viewing the events, or leave it open so you are aware of events as they occur.

To view detailed information about an event:

1 Double-click an event entry in the list.

The Event Detail dialog box appears.
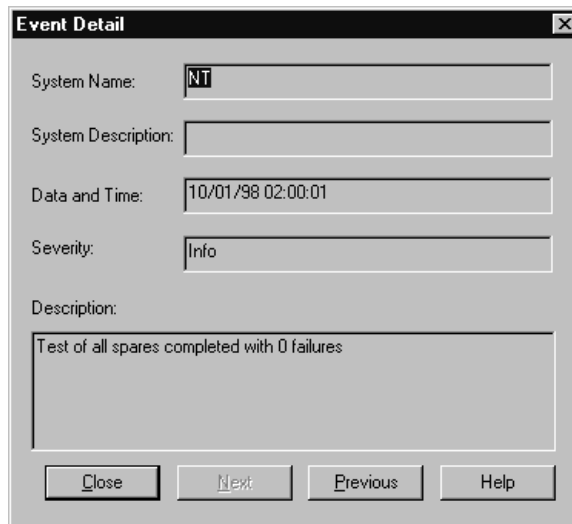
The information displayed in the Event Detail dialog box is similar to the information in the one-line log entry, but the full text description of the event appears. You can click **Next** and **Previous** at the bottom of the Event Detail dialog box to view all events.

2 Click **Close** when you are finished viewing the Event Detail dialog box. When you do this, you automatically notify the Adaptec CI/O Management Software that you have read the event notification.

Viewing a List of Historical System Events
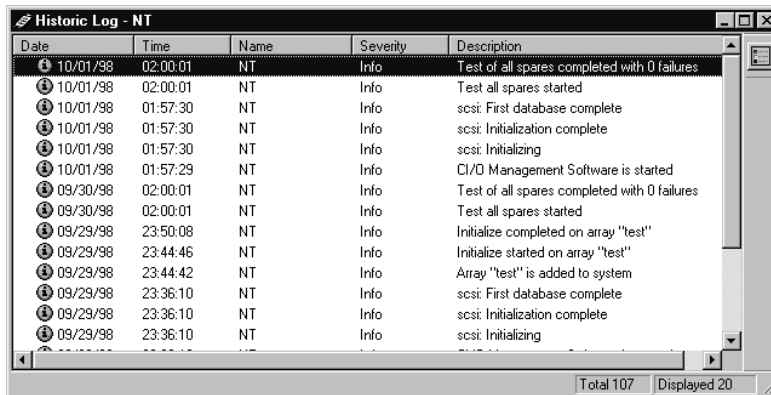
The Historic Event Log window enables you to view historical information for any specific system to which you are connected. If you are running the stand-alone version of the Adaptec CI/O Management Software on a Windows NT system, you can view the log for this one system. If you are running the networked version of CI/O Management Software, you can view the log for any system to

which you are connected after you select its icon in the System Monitor window.

To use the Historic Log window:

1 In the Adaptec CI/O Management Software window, click the

🖉 button to open the Historic Log window for the currently selected system.

Date	Time	Name	Severity	Description
🚯 10/01/98	02:00:01	NT	Info	Test of all spares completed with 0 failures
🚯 10/01/98	02:00:01	NT	Info	Test all spares started
🚯 10/01/98	01:57:30	NT	Info	scsi: First database complete
🚯 10/01/98	01:57:30	NT	Info	scsi: Initialization complete
🚯 10/01/98	01:57:30	NT	Info	scsi: Initializing
🚯 10/01/98	01:57:29	NT	Info	CI/O Management Software is started
🚯 09/30/98	02:00:01	NT	Info	Test of all spares completed with 0 failures
🚯 09/30/98	02:00:01	NT	Info	Test all spares started
🚯 09/29/98	23:50:08	NT	Info	Initialize completed on array "test"
🚯 09/29/98	23:44:46	NT	Info	Initialize started on array "test"
🚯 09/29/98	23:44:42	NT	Info	Array "test" is added to system
🚯 09/29/98	23:36:10	NT	Info	scsi: First database complete
🚯 09/29/98	23:36:10	NT	Info	scsi: Initialization complete
🚯 09/29/98	23:36:10	NT	Info	scsi: Initializing

Total 107   Displayed 20

2 View the historical event information for the system. New entries are added to the top of the list as they occur.

A color-coded circle to the left of each message gives you a quick indicator of its severity. The table on page 4-7 describes the severity levels.

Note: When you open the Historic Log window, only the most recent log entries are initially retrieved from the system. If you scroll down beyond these entries, another group of entries is retrieved. This avoids the delay that might occur if an entire large log file was retrieved from the system at one time. To keep the file from getting too large, specify a maximum size for it in the initialization file See Appendix A, *Configuration Settings*, for more information.

3 To sort the displayed events by date, time, or severity, click the appropriate column heading.

4 Click the ▣ button to change the Filter settings. For example, you may only want to view critically important events at this time. See *Selecting Notification Settings* on page 5-5 for more information.

5 Close the window or minimize it when you are finished viewing log entries.

To view detailed information about an event:

1 Double-click an event entry in the list.

The Event Detail dialog box appears.
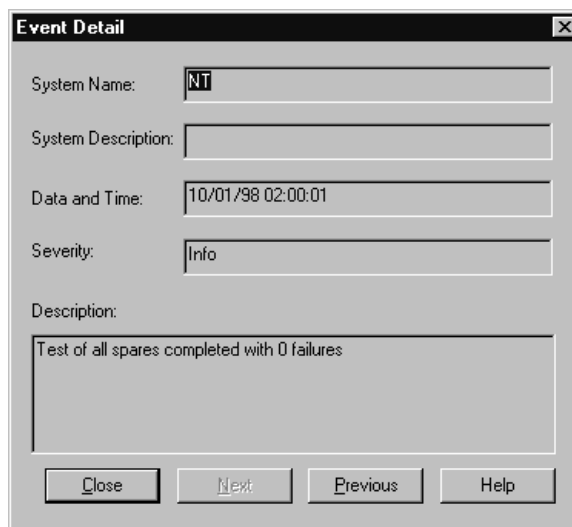
The information displayed in the Event Detail dialog box is similar to the information in the one-line log entry; however, no text appears cut off. You can click **Next** and **Previous** at the bottom of the Event Detail dialog box to view all events.

2 Click **Close** when you are finished viewing the Event Detail dialog box.

Interpreting and Responding to System Event Messages

Server events can have three different severity levels, as described in the following table:

Symbol	Severity Level	Description
 Red icon	Critical	Indicates that an array or system problem requires immediate action, such as an array that goes off-line because two array members have failed. See *Responding to a Critical Array* on page 10-2 for more information.
 Yellow icon	Warning	Indicates that an array or system problem, such as a paused channel or a fault-tolerant array with a failed hard disk, requires attention. If no spare is available to replace the failed hard disk, take action immediately before another hard disk fails. See *Responding to a Critical Array* on page 10-2 for more information.
 Blue icon	Informational	Contains information about a normal operation such as creating a new array, adding a spare, or verifying an array.

5

Setting Preferences

In This Chapter

This chapter provides instructions for setting preferences in the
Adaptec CI/O Management Software Preferences dialog box.

To open the Preferences dialog box, click the ▯ button in the Adaptec CI/O Management Software window.
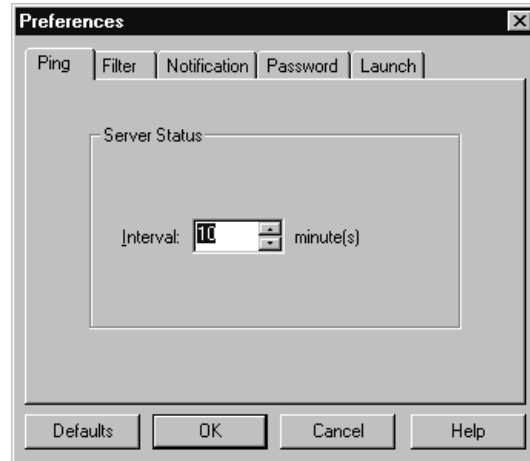
Note: If you are using a stand-alone system, or if you are directly monitoring a system without accessing it through the network, the Ping tab is not provided.

Setting the Ping Interval

To set the ping interval:

1   In the Preferences dialog box, click the Ping tab.

The Ping page appears.
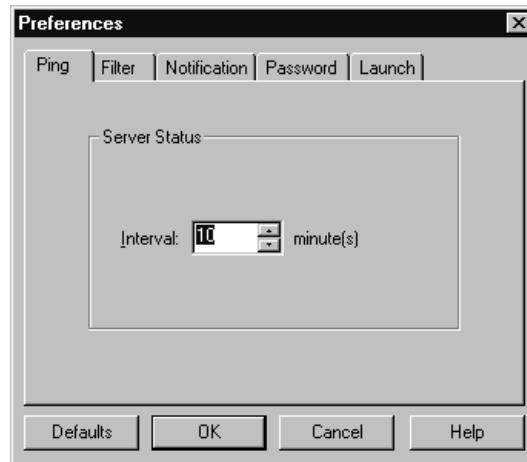
2 In the Interval box, type or choose a ping interval. This is the interval at which the management client verifies continued access to all monitored servers and checks for any missed events. We recommend a value of 10 minutes.

3 Click **OK** to save the changes.

Changing Filter Options

You can control what kinds of event entries are listed in both the System Monitor window and the Historic Log window. See *Viewing a List of Historical System Events* on page 4-4 for more information about the Historic Log window.

To change the filter settings globally:

1 In the Adaptec CI/O Management Software window, click the

 button to open the Preferences dialog box.

2 Click the **Filter** tab.

The Filter page appears.

3 Select or deselect the check boxes to control which kinds of messages appear in the System Monitor window and in the Historic Log window. We recommend that you leave all check boxes selected. If you choose *not* to display some kinds of messages, the following occurs:

■ The Displayed area on the window's status bar shows the number of messages that are actually displayed.

■ The Total area on the window's status bar shows the total number of messages of all types.

4 Click **OK** to save the changes.

To change the filter options for a specific window only:

1 Open the System Monitor window or the Historic Log window.

2 Click the ▣ button.

3 Change the options as described in step 3 above.

4 Click **OK** to save the changes.

The changed settings apply to this window only while it is open; the settings return to the defaults if you close and reopen the window or if you restart CI/O.

Selecting Notification Settings

The notification settings determine how you are notified of events that occur on systems to which CI/O is connected. The text describing these events appears in the list of server events in the System Monitor window and in the Historic Log window.

To select notification settings:

1 In the Preferences dialog box, click the Notification tab.

The Notification page appears.
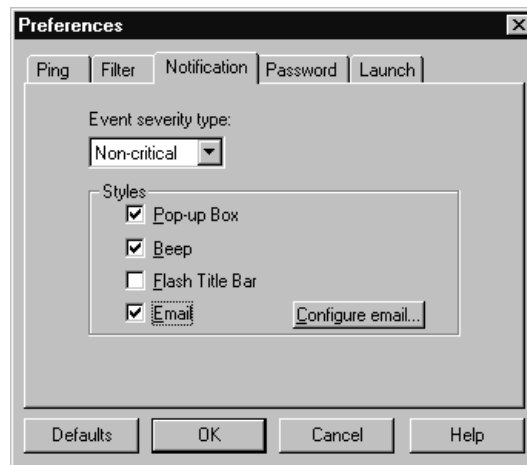
2 Select **Critical Events** or **Non-critical Events** from the Severity Type menu.

3 Select or deselect the check boxes to control how you are notified of events received from all systems to which CI/O is connected. For non-critical events, the flashing occurs only when the application does not have the focus.

Note: Regardless of the options you select, CI/O always notifies you of critical events in a dialog box, with a beep, and via a flashing title bar when the user interface is running.

> **Note:** If you want to save screen space, we recommend launching the software as a status-bar icon. See *Selecting a Program Launch Mode* on page 5-12 for instructions.

4 Click **OK** to save the settings.

Configuring Email

To configure Email notification:
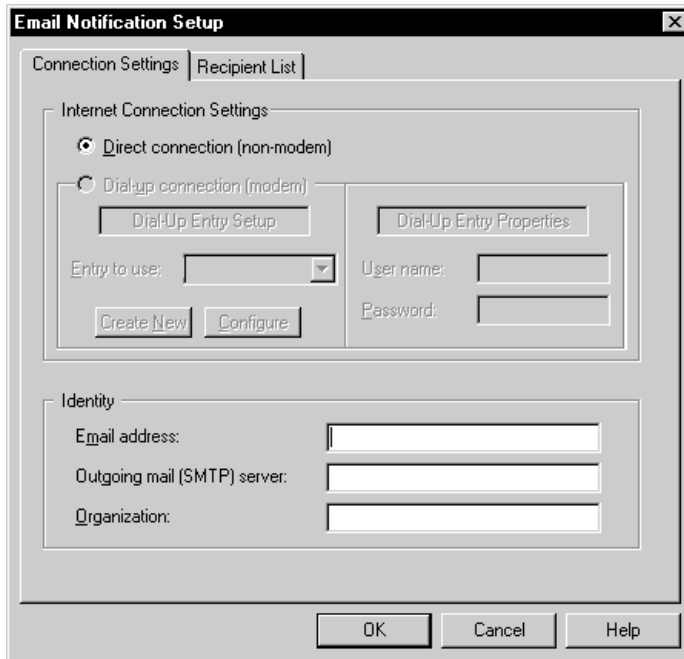
1 In the Preferences dialog box, click the Notification tab.

The Notification page appears.
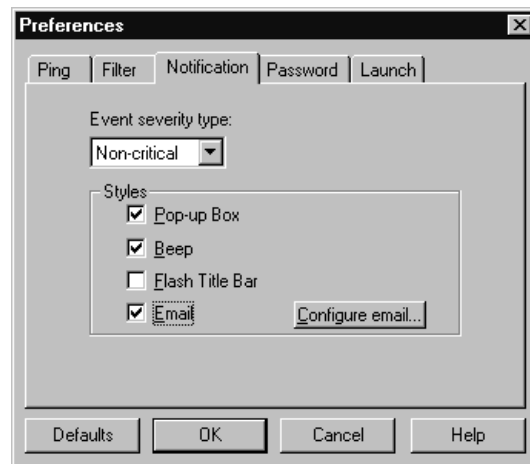
2 Select the **Email** check box, and click **Configure email**.

The Email Notification Setup dialog box appears.

Setting Up Connections

1 Click the Connection Settings tab in the Email Notification
Setup dialog box.

The Connection Settings page appears.

2 Select an option in the Internet Connection Settings area.

If you select **Dial-up connection (modem)**

■ Enter a user name and the correct password in the Dial-Up
Entry Properties area.

■ Select a dial-up entry from the Entry to use list in the
Dial-Up Entry Setup area; click **Create New** if you want to
create a new entry; or if you want to change an existing
entry, click **Configure**.

Note: To enable the dial-up connection, the system must
have Windows Dial-Up Networking (DUN) installed.

3 In the Identity area, type the appropriate information in the Email address, Outgoing mail (SMTP) server, and Organization (optional) boxes.

Adding, Modifying, and Removing Recipients

1 Click the Recipient List tab in the Email Notification Setup dialog box.
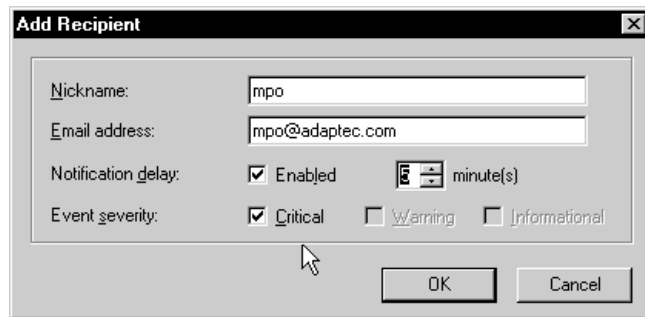
The Recipient List page appears.
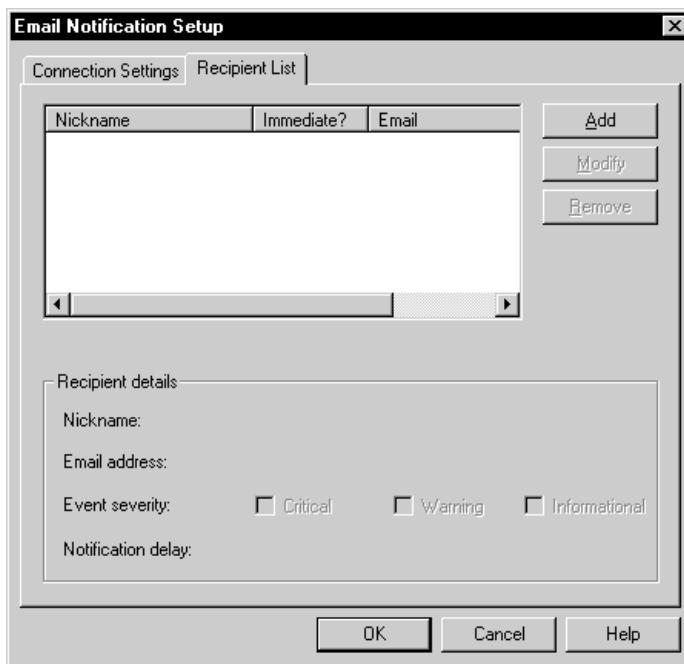
2 To add a recipient:

a Click **Add**.

The Add Recipient dialog box appears.

b Type or select the following information:

- **Nickname:**

    An alias for the email recipient.

- **Email address:**

    The recipient's email address.

- **Notification delay:**

    If you select **Enabled**, the event notification is not sent for the period of time you specify in the minute(s) box, and the Critical Event severity check box is automatically selected. Use this option to register recipients that you want to notify in case there is no response within the notification delay time.

- **Event severity:**

    Select the type of event(s) you want to receive. See *Interpreting and Responding to System Event Messages* on page 4-7 for additional information.

> **Note:** In order for recipients to receive event severity notices, you must check the Email check box in the Preferences Event Notification dialog box. The Email check box must be checked for both non-critical and critical event severity types.

3 To modify a recipient, click the **Modify** button and edit as needed.

4 To remove a recipient, click the **Remove** button.

5 Click **OK** to save the changes.

Setting the Level of Password Protection

1 In the Preferences dialog box, click the Password tab.

The Password page appears.
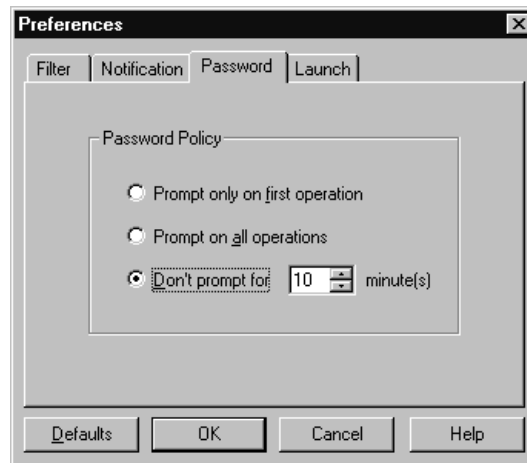
2 Select an option to set the level of password protection for this workstation or server. See *Setting the Password Policy* on page 11-3 for more information.

3 Click **OK** to save the changes.

Selecting a Program Launch Mode

1 In the Preferences dialog box, click the Launch tab.

The Launch page appears.

2 Select the way you want to initially view CI/O. You can start the program in maximized mode, or you can set it up to start as a status-bar icon.

3 Click **OK** to save the changes.

> **Note:** We recommend configuring the system to automatically start CI/O as a status bar icon after each reboot. This ensures that you are notified of any problems the RAID or SCSI subsystem encounters.

6

Managing SCSI Host Adapters

In This Chapter

Note: This chapter only applies to SCSI host adapters. It does not apply to SCSI or UDMA array controllers.

This chapter explains the three distinct tasks that CI/O performs for SCSI host adapters:

■ Discovery

■ Poll

■ Statistics

Discovery and poll cycles respond individually to system changes, which means that the length of time it takes for CI/O to respond to system changes may vary. Devices that are new or recovered are detected at the next discovery cycle, whereas devices that have failed are detected at either the next poll or discovery cycle, whichever occurs first.

Discovery Phase

During the discovery phase, CI/O analyzes the current configuration and compares it with the previous configuration. This phase requires that SCSI commands time out for every SCSI adapter that has no device present. Therefore, the discovery phase can be lengthy.

By default, the software runs the discovery phase every 30 minutes. You can modify this setting in the *iomgr.ini* file. For information about modifying the *iomgr.ini* file, refer to the section titled *I/O Manager* on page A-2.

CI/O performs the following steps during the discovery phase:

1 Performs a host adapter inquiry on each installed adapter to determine the characteristics and health of that adapter.

2 For each SCSI host adapter, the application performs a SCSI inquiry to every possible target device to determine the presence, health, and characteristics of all devices.

3 Determines the number of SCSI host adapters installed.

CI/O records all information discovered about SCSI host adapters and devices in an internal table. If an internal table already exists, discrepancies between the current system configuration and the internally recorded configuration are checked, tables are updated, and the display is updated. The user is informed of each change through logged events, which may be viewed in the historic log for that system, in the System Monitor window.

Poll Phase

During the poll phase, CI/O validates discovery information. The software attempts to contact devices that are previously known to be present and working properly. By default, CI/O runs the poll phase every 3 minutes. You can modify this setting in the *iomgr.ini* file.

CI/O performs the following steps during the poll phase:

1 Verifies that the number of SCSI host adapters is the same as in the discovery phase.

2 Performs a host adapter inquiry on each SCSI host adapter that already appears in the internal tables to ensure the adapter is still responding.

3 Performs a device inquiry on each device in the internal tables to ensure the device is still responding.

4 Verifies that the information obtained from the device matches previous information.

Statistics Phase

Note: This data is currently only available from SNMP or DMI interfaces.

During the statistics phase, CI/O collects I/O statistics. The software collects read and write statistics from applicable devices. By default, CI/O runs the statistics phase every 10 seconds. You can modify this setting in the *iomgr.ini* file.

CI/O performs the following steps during the statistics phase:

1 Iterates through all SCSI host adapters and devices.

2 Gathers statistics for each SCSI host adapter or device.

7

Configuring Arrays and Spares

In This Chapter

This chapter explains how to create (after choosing a RAID level), initialize, optimize performance for, and delete arrays with the Adaptec CI/O Management Software. This chapter also tells you how to create and delete spares. You must know the CI/O password to create and delete arrays and spares. See *Chapter 11, Setting Security Options*, for more information.

Choosing a RAID Level for an Array

Before you create an array, you must choose a RAID level that is based on your needs for data reliability, read/write performance, and storage capacity. The information in this section is provided to help you make this choice. This section explains RAID concepts; describes four RAID levels; and presents the advantages, disadvantages, and requirements of each RAID level.

The term *RAID* means Redundant Array of Independent Disks. An array is a grouping of hard disks that, by means of array management software, appears to the computer's operating system as one large disk. Part of the storage capacity of most kinds of arrays contains redundant information about the user data on the array[1]. If a hard disk in an array fails, the contents of the disk can be regenerated on a new hard disk from the redundant information on the other hard disks in the array.

> **Note:** We strongly recommended that you consistently and regularly back up array disks to archive media so that you can recover in the event of data loss caused by problems other than hard disk failure.

Compared with single hard disks, arrays can provide one or more of these desirable properties:

■ Improved read and write performance by striping data across the hard disks in the array. This allows data to be read from or written to two or more disks simultaneously.

■ Improved data reliability by storing redundant data to regenerate a failed hard disk in an array, as described above. This is especially important for servers, where arrays are most often used to store large amounts of mission-critical data.

■ Improved capacity utilization by managing a large number of hard disks as if they were one large disk. This makes it easier to back up data, create directories, and perform other disk management tasks.

---

[1] RAID 0 arrays, which do not store redundant data, are an exception to this definition.

All disks in an array (including spares) must be connected to the same Adaptec Array1000 Family product, although they can be connected to different channels. You can create dedicated spare disks for each RAID 1, RAID 5, and RAID 0/1 array. You can also create a pool of spares that can be used by any RAID 1, RAID 5, or RAID 0/1 array on the Adaptec Array1000 Family product.[1]

The array management software and firmware support RAID 0, RAID 1, RAID 5, and RAID 0/1 arrays. The remainder of this section explains the advantages, disadvantages, and requirements of these RAID levels.

RAID 0

SCSI array controller

> Maximum disks allowed: 15 (or as allowed by the controller)
> Minimum disks allowed: 1

UDMA array controller

> Maximum disks allowed: 4
> Minimum disks allowed: 1

In a RAID 0 array consisting of more than one disk, data is distributed, or striped, across the hard disks in the array. The capacity of the array is approximately equal to the combined capacity of the physical disks. The I/O performance of a RAID 0 array is much better than that of a single physical disk because multiple reads and writes can be handled in parallel and because when large files are accessed, the striped data is retrieved simultaneously from several hard disks.

One-disk RAID 0 arrays are used to control the virtual device order of single hard disks, or to enable single drives to be cached on controllers that support this.

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

---

[1] A hard disk in a spare pool can only replace a failed hard disk in an array if it is at least as large as the smallest disk in the array.

RAID 1

SCSI and UDMA array controllers

> Maximum disks allowed: 2
> Minimum disks allowed: 2

RAID 1 arrays use a single pair of hard disks. They are called *mirrored disks* because both hard disks in the pair contain the same data. When data is written to a RAID 1 array, it is written to each hard disk in the pair.

The read performance of a RAID 1 array can be much better than that of a single hard disk, while the write performance is slightly worse. Mirrored arrays are highly reliable because the data is still safe if one hard disk in the pair fails. Mirrored arrays are more costly, however, because a pair of hard disks yields only one hard disk of actual storage capacity.

RAID 5

SCSI array controller

> Maximum disks allowed: 16^1 (or as allowed by the controller)
> Minimum disks allowed: 3

UDMA array controller

> Maximum disks allowed: 4
> Minimum disks allowed: 3

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

The read performance of a RAID 5 array is excellent and is comparable to that of a RAID 0 array. Write performance is slower than that of a RAID 0 array because new parity data must also be calculated and written when user data is written.

---

[1] The maximum is 15 disks if the system has a single SCSI channel.

RAID 0/1

SCSI array controller

> Maximum disks allowed: 16^1 (or as allowed by the controller; must be an even number)
> Minimum disks allowed: 4

UDMA array controller

> Maximum disks allowed: 4
> Minimum disks allowed: 4

RAID 0/1 disks use from two to eight pairs of disks. They are called mirrored arrays because both disks in each pair contain the same data.

The read and write performance of a RAID 0/1 array is much better than that of a single physical disk. RAID 0/1 arrays are highly reliable; the array data remains safe as long as at least one disk of each mirrored pair is good. Thus, in a 12-disk RAID 0/1 array, the array continues working with up to six failed disks if one disk in each pair is still good. Because of the mirrored arrangement, RAID 0/1 arrays require twice as many disks as the actual amount of storage space.

Creating an Array

This section tells you how to create an array with CI/O.

> **Note:** When you create an array using disks of different capacities, the software assumes that all array members are the same size as the smallest disk used. Mixing disk capacities can therefore limit the amount of usable disk space in an array.

---

[1] The maximum is 14 disks if the system has a single SCSI channel.

1 In the Adaptec CI/O Management Software window, click the

[icon] button to open the Storage Configuration window. All
array and spare configuration tasks are done in this window in
either Graphical View or Detailed View.
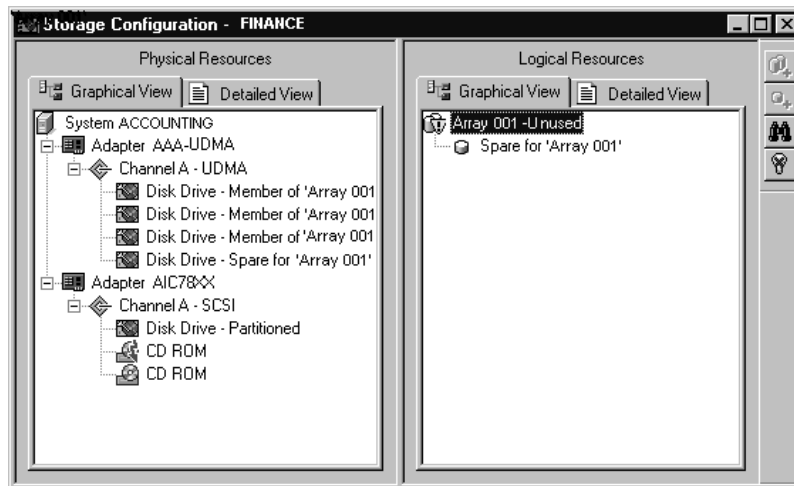
The icons in the left pane of the Storage Configuration window
represent the server's *physical resources*—the array controller
products, channels, and devices installed in the system. The
icons in the right pane represent the system's *logical resources*—
the arrays and spares you define.

2 Before you define a new array, see *Choosing a RAID Level for an
Array* on page 7-2 for more information, and do the following:

- Decide what *RAID level* you want to use.

- Determine how many hard disks you want in the array.

- Decide whether you want to define *dedicated spares* (spares
  that can be used only by this array). See *Creating Dedicated
  Spares or a Spare Pool* on page 7-27.

3 Determine if any hard disks you are using for the array have
recognized partitions.

You cannot use hard disks with recognized partitions for the
array. This prevents you from accidentally erasing the server's
boot disk or deleting data from a disk. To determine if a hard

disk has a partition, right-click its icon in the Storage
Configuration window and select **Check Partition** from the
shortcut menu. A dialog box indicates whether the selected
hard disk has a partition and whether the partition is visible to
the operating system.

To use a hard disk with a recognized partition in the array, exit,
back up any data you want to keep, and delete the partition
from the hard disk. Then either rescan or check the partition.

Caution: *All data on a hard disk is deleted when it becomes a
member of an array!* Back up any data you want to keep
before selecting a hard disk as an array member.

4 Click the button.

The Create Array - Members dialog box appears.

Create Array - Members
Select a Controller: AAA–UDMA
Member count: 3
Member size: 4887 MB
Available drives: Channel A, SCSI ID 4   5920 MB
New member drives: Channel A, SCSI ID 1   4887 MB Channel A, SCSI ID 2   5920 MB Channel A, SCSI ID 3   5920 MB
Add →
← Remove
Allowable RAID types: RAID 0 RAID 5
< Back   Next >   Cancel   Help
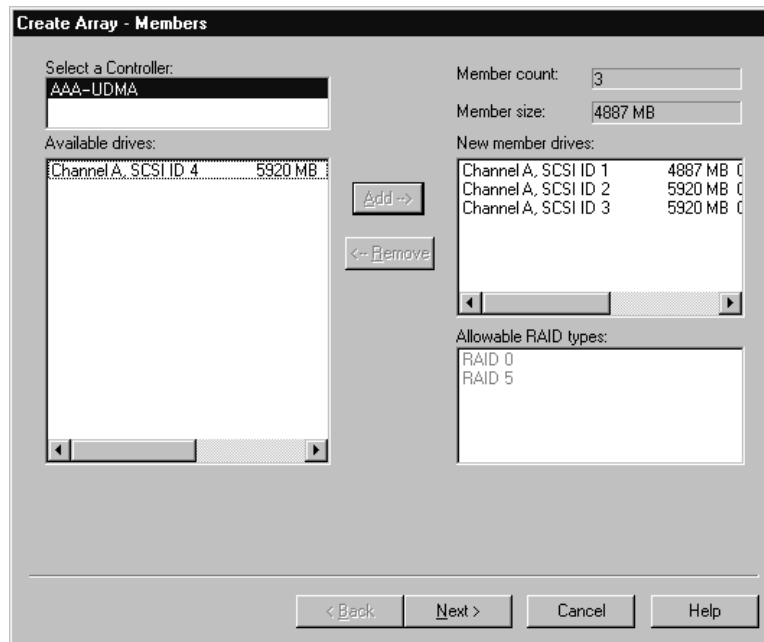
> **Note:** When you create the first array, the driver reserves a portion of cache memory for system use. This may affect the amount of cache memory assigned to subsequent arrays if the cache value you select is larger than the actual memory remaining.

5 Select an array controller from the Select a Controller list. All array disks must be connected to the same Adaptec Array1000 Family product.

> **Note:** Only devices attached to array controllers can be used for arrays and spares. You *cannot* use devices attached to SCSI host adapters as array members or spares.

6 Select hard disks for the new array by clicking the hard disk in the Available drives list and then clicking **Add**.

Each hard disk moves to the New member drives list, and the Allowable RAID types list changes to reflect allowable RAID levels given the current number of hard disks selected.

Do not include hard disks that you want to use as dedicated spares.

To remove a hard disk from the New member drives list, click the disk and then click **Remove**.

Note: Only hard disks available for creation of an array appear in the Create Array - Members dialog box. Any hard disks with partitions or hard disks used in other arrays or as spares *are not* displayed.

7 When you have selected all hard disks for the new array, click
Next.

The Create Array - Name and Type dialog box appears.
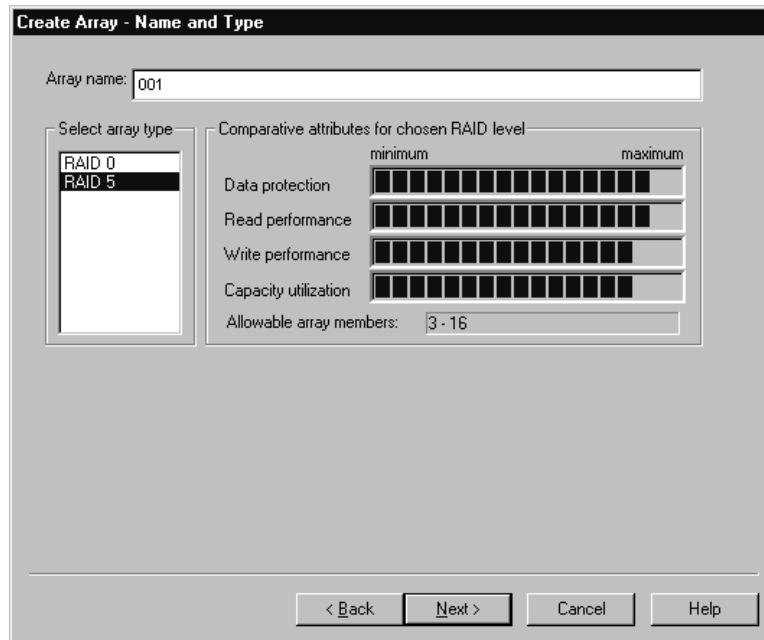
8 Type a name for the new array. The name can be up to 15
characters, including spaces and any other printable
characters.

9 Select a RAID type for the array from the Select array type list.
The bar graphs on the right show the relative levels of data
protection, read performance, write performance, and capacity
utilization for each RAID type.

> **Note:** Only valid RAID configurations that are possible
> using the specified number of hard disks in the new array
> are displayed.

10 Click **Next**.

The Create Array - Advanced dialog box appears.

11 If you decided to assign dedicated spares to the array, select up to two hard disks from the Select dedicated spares (up to 2) list. The hard disks in this list are the available hard disks you did not select as members of the array. The spare(s) you select should be at least as large as the smallest array member., otherwise the usable capacity of each member of the array is reduced to the capacity of the spare.

Note: When setting up more than one array, we recommend using a *spare pool* instead of dedicated spares. See *Creating Dedicated Spares or a Spare Pool* on page 7-27 for more information. Spares in a spare pool can be used by any suitable array on the controller.

12 Select **Cache Enabled** to enable cache for the array, if you are using software and a controller that supports this. If the Cache Enabled check box appears dimmed, no cache is available. If

caching is available but you *do not* want to assign any, deselect the Cache Enabled check box.

13   If you want to distribute cache among arrays, type the number of cache blocks you want to assign to the array in the Assigned box. This number must be less than the total available cache blocks indicated to the right of the Assigned box.

14   Select an optimization option from the Optimize Performance for list. Refer to *Optimizing Array Performance* on page 10-9 for more details.

15   To create the array now, but initialize it at a later time, deselect **auto-initialize**. This option allows you to define several arrays and then initialize them all at the same time.

> ⚠ **Caution:** All arrays except RAID 0 *must be* initialized before you can write data to them. We recommend that you zero-initialize RAID 0 arrays as well.

16   For RAID 0, RAID 5, and RAID 0/1 arrays, select a stripe size from the Stripe Size list.

17   Click **Finish.**

CI/O initializes the array unless you deselected **auto-initialize**. If you deselected **auto-initialize**, go to step 19.

An event notification is generated when the initialization process starts. An icon ⬜ for the new array appears in the Logical Resources pane of the Storage Configuration window. Another event notification is generated when the initialization process finishes.

18   To abort the initialization process (*not recommended*), click the ⬛ button in the Adaptec CI/O Management Software window to open the Activity View window, select the icon ⬛ for the array, and click the ✖ button. Click **Yes** in the dialog box that appears to confirm the abort.

> **Note:** Event notifications may appear in dialog boxes and/or as entries in the Historic Log and System Monitor windows, depending on the options you selected in the Notification page of the Preferences dialog box. See *Selecting Notification Settings* on page 5-5 for more information.

19 When initialization is complete, exit CI/O and reboot the system. After you reboot, you must partition the new array just as you would partition a new stand-alone hard disk.

> **Note:** You cannot use the new array until you reboot the system.

Making an Array the First Virtual Device

Follow the instructions in this section if you want the system to boot the operating system from a SCSI or UDMA array instead of from a stand-alone hard disk.

To use a stand-alone SCSI hard disk as the boot device, we recommend that you assign SCSI ID 0 to this device and that you connect it to Channel A of the Adaptec Array1000 Family product.

You make an array bootable by assigning it *virtual device order* number 0. The virtual device order is the sequence in which the system's operating system detects the arrays, single hard disks, and other devices connected to the Adaptec Array1000 Family product when the system boots.

You may also need to move the Adaptec Array1000 Family product to a different PCI slot. See the Adaptec Array1000 Family product's installation and hardware guide for more information.

> **Caution:** When you make an array bootable, the drive letters assigned to other hard disks and arrays on the system may change. This can cause data access problems on the system.

To create a bootable array:

1 Click the [icon] button to open the Storage Configuration window.

2 In the Logical Resources pane, right-click the icon [icon] of the array you want to make bootable.

3 Select **Make first virtual device** from the shortcut menu.

4 In the dialog box that appears, click **Yes** to confirm that you want to make the array the boot device.

5 Close all applications on the system that contains the array. If the selected array does not already have a bootable partition on it, reboot the system to a floppy disk.
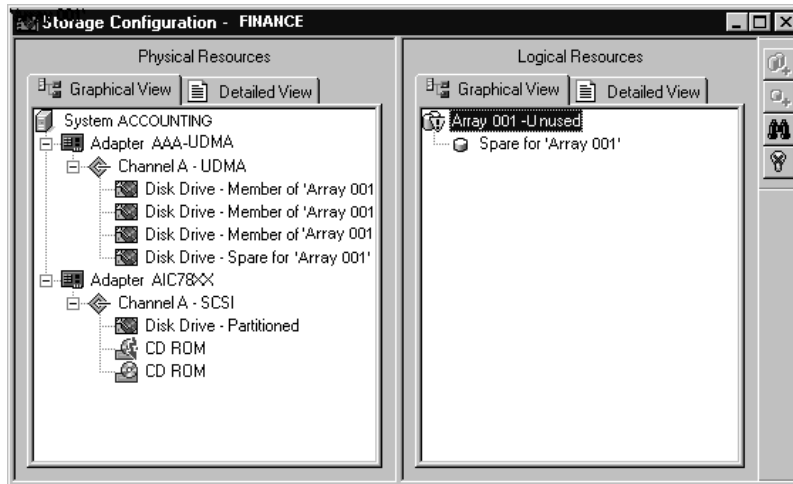
6 Install the operating system on the array. See the Adaptec Array1000 Family product's installation and hardware guide for information.

7 Make sure you restart CI/O after you reboot the system.

The next time you boot the system, it will attempt to use this array as the boot device.

Initializing an Array

When you create a new array, it is initialized immediately by default unless you deselect **auto-initialize** in the Create Array - Advanced dialog box. See step 15 on page 7-12 in the *Creating an Array* section.

> **Note:** Some array controllers *do not* allow deselection of **auto-initialize**.

If you deselected **auto-initialize**, you can initialize the array by following the instructions in this section. You can also reinitialize an array that was previously zero-initialized or low-level formatted.

> **Caution:** All arrays except RAID 0 arrays *must be* initialized or formatted before you can write data to them. We recommend that you zero-initialize RAID 0 arrays as well. *All data on the hard disks is overwritten when you initialize an array!*

To initialize either an array that contains data or a new array that has been defined but not initialized:

1 Click the [ ] button to open the Storage Configuration window.
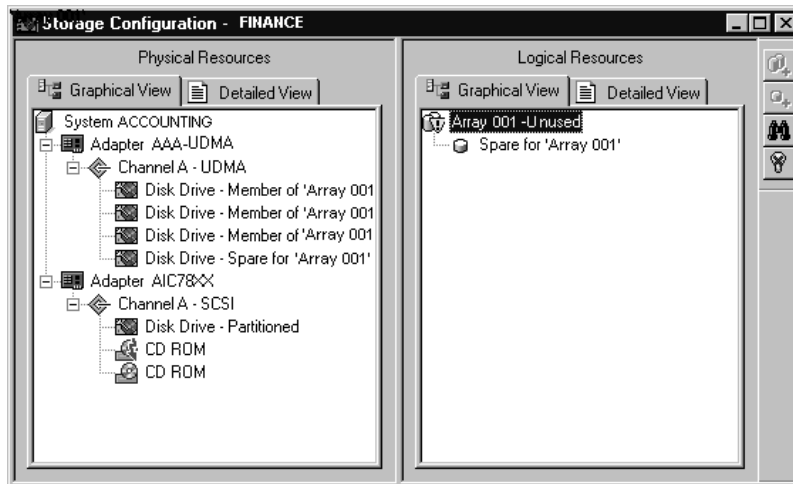
2 In the Logical Resources pane, right-click the icon [ ] of the array you want to initialize.

3 Select **Initialize** from the shortcut menu.

A warning appears if the array has a partition.

■ If the partition is recognized by the operating system, you *cannot* initialize the array.

■ If the partition *is not* recognized by the operating system, you *can* initialize the array.

You are prevented from initalizing an array with a recognized partition. This prevents you from accidentally deleting useful data from an array. To find out if an array has a partition, right-click its icon [ ] and select **Check Partition** from the shortcut menu. A dialog box indicates whether the array has a partition and whether the partition is visible to the operating system.

To initialize an array with a recognized partition, close CI/O, back up any data you want to keep, and delete the partition from the array. Then restart CI/O, and initialize the array.

4 In the dialog box that appears, click **Yes** to confirm that you want to initialize the array.

5 To abort the initialization process (*not recommended*), click the

button in the Adaptec CI/O Management Software

window to open the Activity View window, select the icon

for the array, and click the button. Click **Yes** in the dialog box that appears to confirm the abort.

Note: Depending on the capacity of the array, it may take a long time to initialize an array, especially a very large RAID 5 array with many hard disks.

Adaptec CI/O Management Software User's Guide

Optimizing Array Performance

The SCSI or UDMA array controller may have a built-in onboard
read/write caching feature that allows faster data I/O to arrays
controlled by the array controller. CI/O allows you to allocate cache
to an array and to optimize the performance of a specific
application, if your controller supports this and has enough RAM.
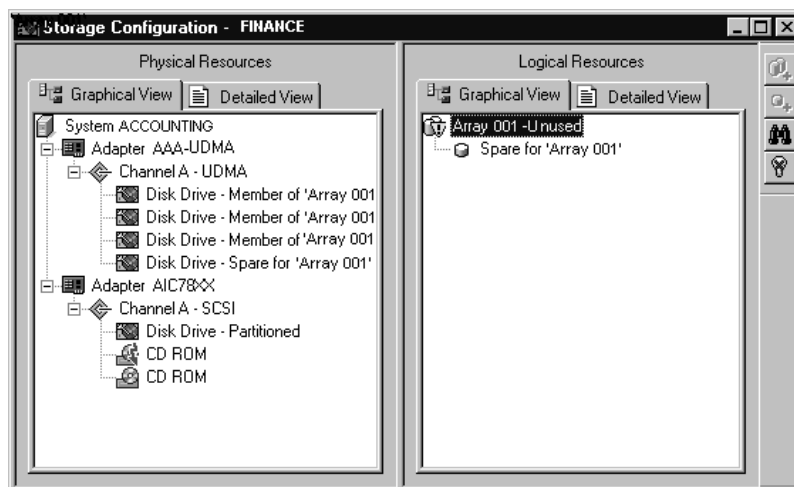
Allocating Cache to an Array

To allocate cache to an array:

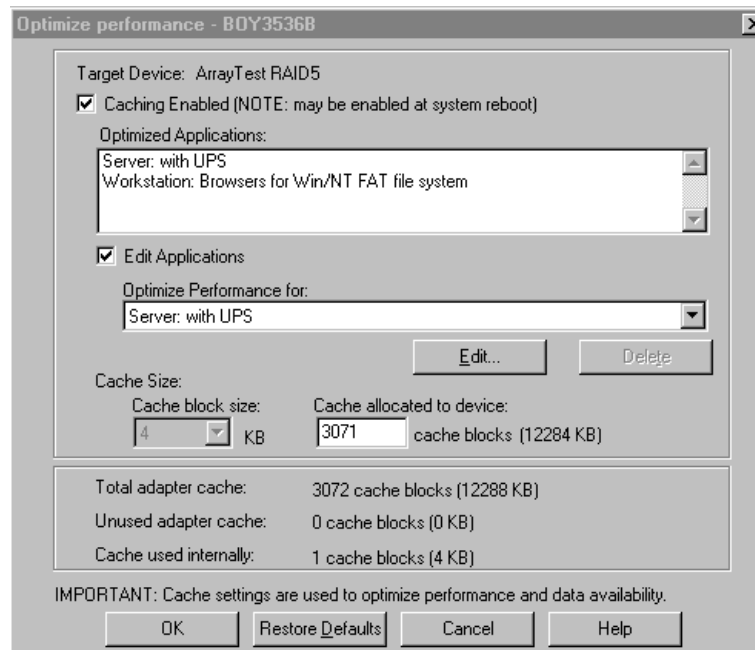**1**   In the Adaptec CI/O Management Software window, click the

[icon] button to open the Storage Configuration window.

_7-18_

2 Right-click the icon ▯ of the array to which you want to
allocate cache, and select **Optimize Performance** from the
shortcut menu.

The Optimize performance dialog box appears.

```
Optimize performance - BOY3536B                                    ✕

  Target Device:  ArrayTest RAID5
  ☑ Caching Enabled (NOTE: may be enabled at system reboot)
     Optimized Applications:
     Server: with UPS                                           ▲
     Workstation: Browsers for Win/NT FAT file system
                                                                ▼

     ☑ Edit Applications
        Optimize Performance for:
        Server: with UPS                                        ▼
                                           Edit...     Delete
     Cache Size:
        Cache block size:     Cache allocated to device:
        4     ▼  KB          3071      cache blocks (12284 KB)

     Total adapter cache:     3072 cache blocks (12288 KB)
     Unused adapter cache:    0 cache blocks (0 KB)
     Cache used internally:   1 cache blocks (4 KB)

  IMPORTANT: Cache settings are used to optimize performance and data availability.
       OK       Restore Defaults     Cancel        Help
```

3 Select the Caching Enabled check box.

The Cache allocated to device box and the Restore Defaults
button become available.

CI/O assigns default values to the read and write cache.

4 Type the number of cache blocks you want to allocate to the
array in the Cache allocated to device box.

Each cache block is 4 KB in size. The number in parentheses
next to this box translates the number of cache blocks into the
overall size of the cache.

5 Click **OK.**

Optimizing Performance for a Specific Application

To optimize performance of a particular application:

1 In the Adaptec CI/O Management Software window, click the

 button to open the Storage Configuration window.

2 Right-click the icon of the array for whose application(s) you want to optimize performance, and select **Optimize Performance** from the shortcut menu.

The Optimize performance dialog box appears.
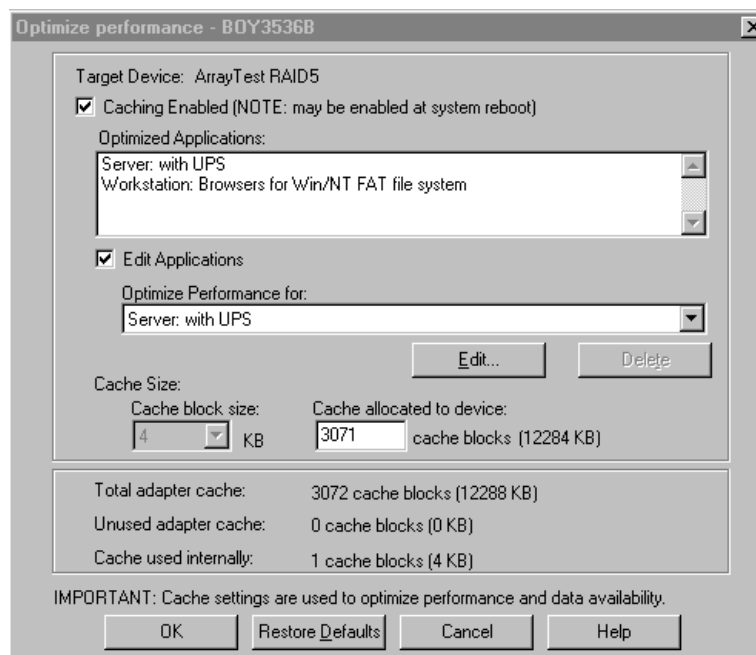
3 Select the **Edit Applications** check box.

The Edit and Delete buttons become available, along with a list of environments that contain the applications.

4   Select an environment from the Optimize Performance for list.

The applications for the environment appear in the Optimized Application list. Each entry is prefaced by the word Workstation or Server, depending on its intended use.

5   Click **Edit**.

The Performance setting dialog box appears.

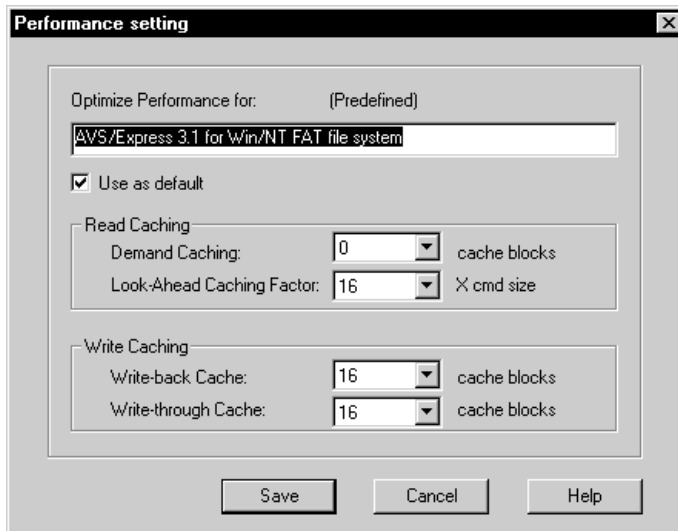**6**   Select the Use as default check box if you want to use this setting as the default when you create a new array.

7   To change the read and write cache settings, select or type a number in the appropriate box(es) under Read Caching and Write Caching. For detailed information, see *Understanding Read and Write Caching* on page 7-22.

To change the read and write cache settings for a read-only performance setting:

a   Type a new name for the performance setting in the Optimize Performance for box.

b   Select or type a number in the appropriate box(es) under Read Caching and Write Caching. For detailed information, see *Understanding Read and Write Caching* on page 7-22.

8   Click **Save**.

The changes are not written to the hard disk until you exit CI/O.

If a new performance setting has been successfully created, it appears in the Optimize Performance for list.

9   In the Optimize performance dialog box, click **OK.**

Understanding Read and Write Caching

There are two types of read caching—*demand caching* and *look-ahead caching*—and there are two types of write caching—*write-back caching* and *write-through caching*. You can set separate values for these caching types for each array.

Demand Caching

Demand caching defines the maximum Read command size (stated as a number of data blocks) that will be cached. Demand caching can greatly improve I/O performance if the application typically reads data and then reads it again soon afterwards.

For example, if demand caching is set to four blocks and the operating system issues a Read command for four blocks of data, all the demand data is cached. However, if the operating system issues a Read command for five or more blocks of data, none of the demand data is cached.

Look-ahead Caching Factor

The look-ahead caching factor determines the maximum number of data blocks that will be stored in the look-ahead cache. Look-ahead caching can greatly improve I/O performance if the application typically reads data in sequential blocks.

For example, if the look-ahead caching factor is set to 16 and the operating system issues a Read command, the demand data is cached if the command is less than or equal to 4 blocks and the next (sequential) 16 x 4 blocks of data is stored in the look-ahead cache.

Write-back Caching

Write-back caching defines the maximum Write command size (stated as a number of data blocks) that will be cached in the write-back cache. When the Write command is issued, the data is quickly written to the cache and a write-completed status is sent to the host system. When the buffer is needed or when there is free time on the bus, the data is written from the cache to the hard disk.

For example, if write-back caching is set to four blocks and the operating system issues a command to write up to four blocks of data, the data is stored in the write-back cache until it can be written to the hard disk. However, if the operating system issues a Write command for five or more blocks of data, nothing is stored in the write-back cache and the data is instead written immediately to the hard disk.

> **Caution:** It is possible for data to be lost if power to the system is interrupted while the data is in the write-back cache, before it is written to the hard disk. To avoid this risk, set write-back caching to zero. If you set write-back caching to a number greater than zero, we recommend that you back up the system data regularly and, if possible, use an uninterruptible power supply.

Write-through Caching

Write-through caching is the same as write-back caching except the data is transferred immediately from the cache to the hard disk before sending the status to the host system.

The write-through caching setting defines the maximum Write command size beyond which the write data is not cached at all, but is written immediately to the hard disk instead. With write-through caching, the data is written to the hard disk and also stored in the cache. This enables faster I/O performance if an application needs to read the data that was recently written. The write-through caching setting must always be greater than the write-back caching setting.

Using Other Means to Improve Array Performance

Besides allocating cache to an array and optimizing the performance of applications, there are other ways to improve array performance:

■ If the Adaptec Array1000 Family product has multiple channels, you may be able to achieve better sequential data access when creating large arrays on powerful, high-end servers if some array disks are connected to each channel.

■ CI/O allows you to use hard disks of various sizes and from various manufacturers in the same array. To achieve the best performance, however, we recommend that you use hard disks of the same capacity and same model. If you use hard disks of different sizes, the amount of capacity actually used on each hard disk is equivalent to that of the smallest hard disk in the array. For example, if you use five 1-GB hard disks and one 500-MB hard disk, only 500 MB on each hard disk is used.

■ You can also optimize array performance by selecting a RAID level for the array that best meets your needs for data reliability, read/write performance, and capacity use. See *Choosing a RAID Level for an Array* on page 7-2 for more information.

Deleting an Array

⚠️ **Caution:** Back up the data on an array before you delete it. *All data on the array hard disks is lost when you delete the array!*
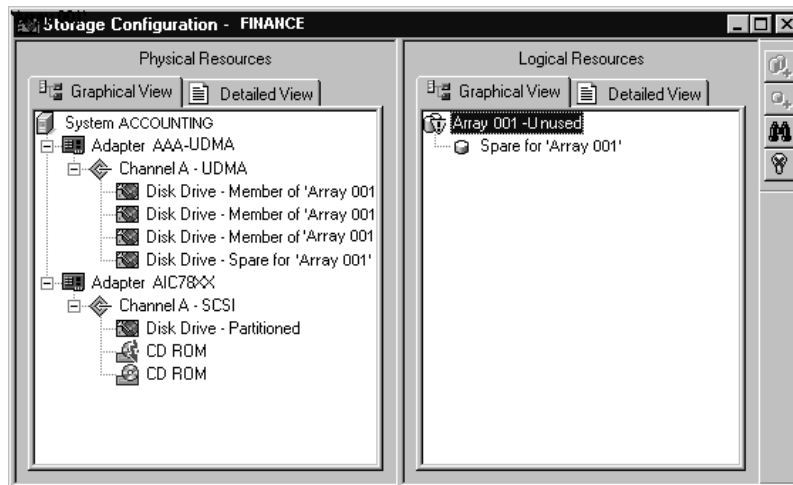
If you delete an array, all the hard disks that were part of the array become single stand-alone hard disks. You can then use the hard disks as spares or as members of a new array.

To delete an array:

1 In the Adaptec CI/O Management Software window, click the

button to open the Storage Configuration window.

2 In the Logical Resources pane, right-click the icon of the array you want to delete.

3 Select **Delete** from the shortcut menu.

A warning message appears if the array has a partition.

■ If the partition is recognized by the operating system, you *cannot* delete the array.

■ If the partition *is not* recognized by the operating system, you *can* delete the array.

You cannot delete an array with a recognized partition. This prevents you from accidentally deleting useful data.

To find out if an array has a partition, right-click its icon and select **Check Partition** from the shortcut menu. A dialog box indicates whether the array has a partition and whether the partition is visible to the operating system. To delete an array with a recognized partition, close CI/O, back up any data you want to keep, and delete the partition from the array. Then restart CI/O and delete the array.

4 In the dialog box that appears, click **Yes** to confirm that you want to delete the array.

Note: After you delete an array, you can immediately use the hard disks that formerly belonged to the array to create spares or a new array without rebooting the server. However, you must reboot the server before you can use the hard disks as single hard disks that are not members of an array. Deleting an array may change the boot order and the drive letter assignment.

Creating Dedicated Spares or a Spare Pool

Each RAID 1, 5, or 0/1 array can have *dedicated spares* that automatically replace failed hard disks *only* for that array. You can create dedicated spares when you create the array, or you can add them to the array at a later time.

Each Adaptec Array1000 Family product, except UDMA array controllers, can have a *spare pool* of multiple hard disks that automatically replace a failed hard disk on *any* array on the controller.

For Adaptec Array1000 Family products other than UDMA controllers, we recommend using a spare pool instead of dedicated spares if you have two or more arrays on a controller. Pool spares give you more flexibility and provide good data protection with fewer hard disks than is required for dedicated spares.

Pool spares must be at least as large as the array's smallest member size. Some physical hard disks may be larger than the member size.

> **Note:** CI/O is automatically configured to test all spares on the system once a day to assure they are always available to replace failed hard disks in arrays. We recommend that you leave this default setting. See *Testing All Spares* on page 9-18 for information.

Creating or Adding a Dedicated Spare
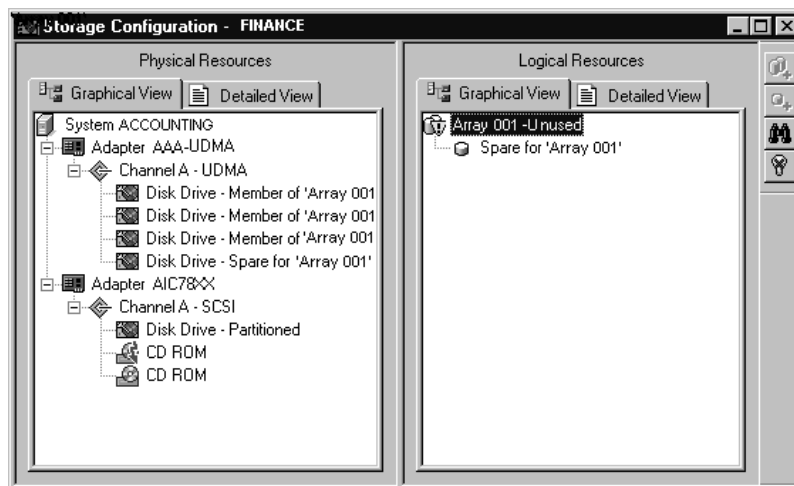
To create or add a dedicated spare:

> ⚠ **Caution:** Before designating a hard disk as a spare, back up all data on the hard disk. *All contents of the disk will be lost!*

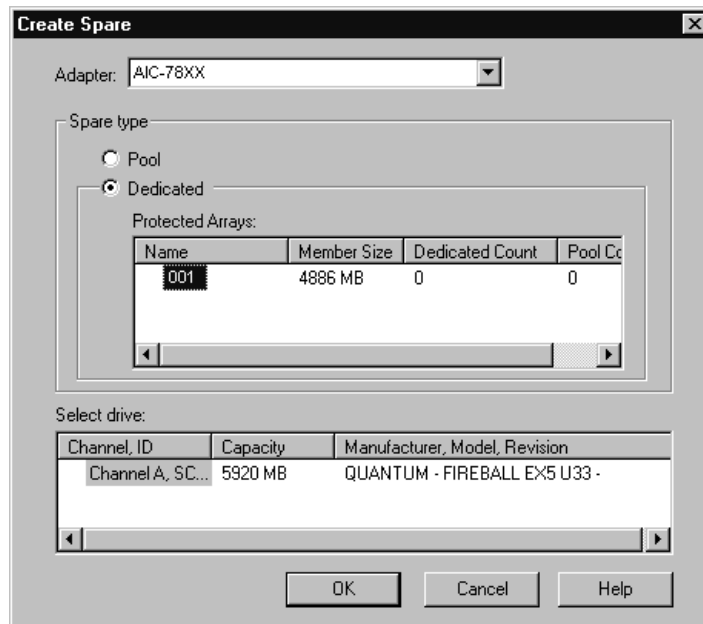**1** In the Adaptec CI/O Management Software window, click the

⬚ button to open the Storage Configuration window.

2 Click the ⟨image⟩ button to display the Create Spare dialog box.

3 Select an array controller from the Adapter list.

4 Select **Dedicated** under Spare type.

5 Select the array you want to dedicate the spare to in the Protected Arrays list.

6 Select the hard disk you want to use as a spare from the Select Drive list.

Hard disks with recognized partitions do not appear in the Select Drive list. This prevents you from accidentally erasing any useful information from a hard disk.

To determine if a hard disk has a partition, right-click its icon

in the Storage Configuration window and select **Check Partitions** from the shortcut menu. A dialog box indicates whether the selected hard disk has a partition and whether the partition is visible to the operating system.

To use a hard disk with a recognized partition as a spare, exit CI/O, back up any data you want to keep, and delete the partition from the hard disk. Then restart CI/O.

7 In the dialog box that appears, click **Yes** to confirm creation of the spare.

Newly-created spares are immediately available for use, without rebooting the system. If an array is in critical status and the spare is large enough, the array is reconstructed as soon as you have created the spare (unless the spare is dedicated to another array).

8 Click **OK** to save the changes.

Creating or Adding a Spare Pool

Note: This section does not apply to UDMA array controllers.

You can add a hard disk of any size to the spare pool, even if the hard disk is too small to protect the existing arrays. For example, if you have created two arrays with 1 GB hard disks, you can add a 500-MB hard disk to the spare pool, even though this disk is too small to replace any one failed array member. This allows you to create a third array later with 500 MB hard disks.
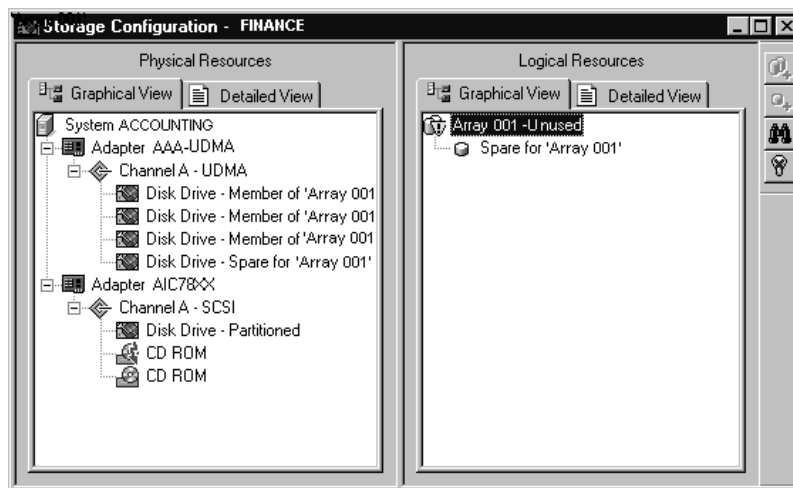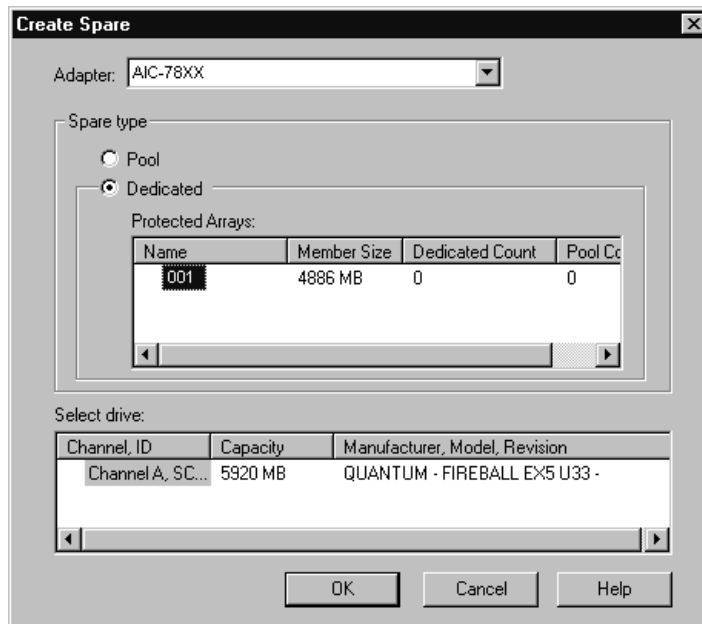
To add a hard disk to a spare pool:

⚠ **Caution:** Before designating a hard disk as a spare, back up all data on the hard disk. *All contents of the hard disk will be lost!*

1 Click the ▨ button to open the Storage Configuration window.

2 Click the ⊙₊ button to display the Create Spare dialog box.

3 Select an array controller from the Adapter list.

4 Select **Pool** under Spare Type.

5 Select the array(s) to which you want to assign the spare from the Protected Arrays list.

6 In the dialog box that appears, click **Yes** to confirm creation of the spare.

Newly-created spares are immediately available for use, without rebooting the system. If an array is in critical status and the spare is large enough, the array is reconstructed as soon as you have created the spare (unless the spare is dedicated to another array).

7 Select the hard disk you want to use as a spare from the Select Drive list.

Hard disks with recognized partitions do not appear in the Select Drive list. This prevents you from accidentally erasing any useful information from a hard disk.

To determine if a hard disk has a partition, right-click its icon

 in the Storage Configuration window and select **Check Partitions** from the shortcut menu. A dialog box indicates whether the selected hard disk has a partition and whether the partition is visible to the operating system.
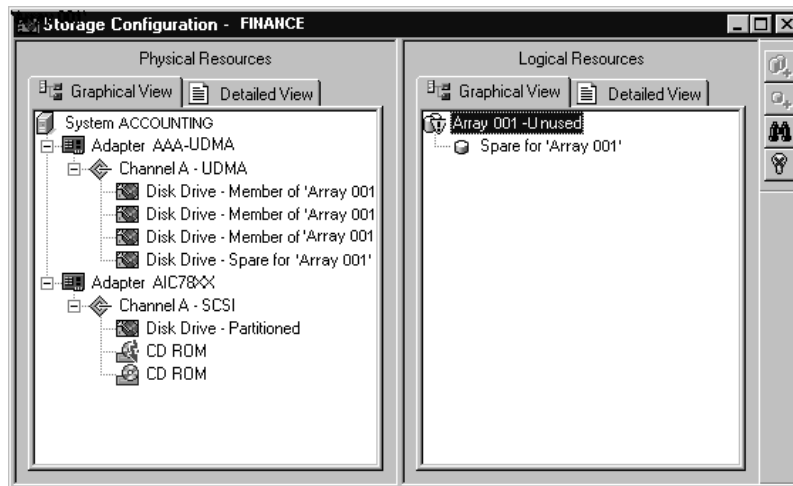
To use a hard disk with a recognized partition as a spare, exit CI/O, back up any data you want to keep, and delete the partition from the hard disk. Then restart CI/O.

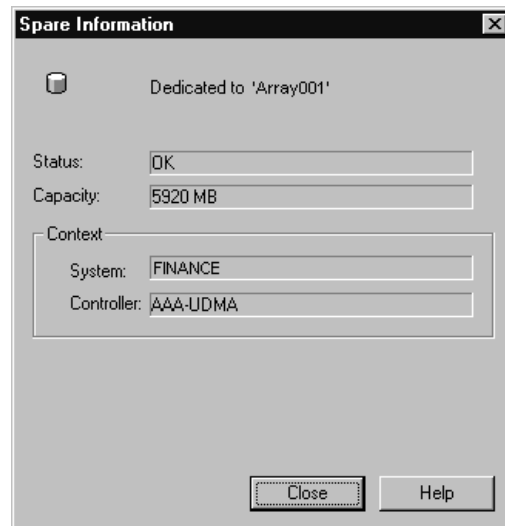**8** Click **OK** to save the changes.

Validating Protection by a Spare

To see which arrays are protected by an existing spare:

1 Click the button to open the Storage Configuration window.

2 Right-click the icon ▯ of the spare you want to validate and
select **Information** from the shortcut menu to display the
Spare Information dialog box.

```
┌─────────────────────────────────────────────────┐
│ Spare Information                            ☒  │
│                                                  │
│    ▯        Dedicated to 'Array001'              │
│                                                  │
│                                                  │
│  Status:      ┌──────────────────────────────┐  │
│               │OK                            │  │
│  Capacity:    ┌──────────────────────────────┐  │
│               │5920 MB                       │  │
│  ┌ Context ─────────────────────────────────┐  │
│  │                                           │  │
│  │  System:    ┌─────────────────────────┐   │  │
│  │             │FINANCE                  │   │  │
│  │  Controller:┌─────────────────────────┐   │  │
│  │             │AAA-UDMA                 │   │  │
│  │                                           │  │
│  └───────────────────────────────────────────┘  │
│                                                  │
│                      ┌──────────┐  ┌──────────┐  │
│                      │  Close   │  │   Help   │  │
│                      └──────────┘  └──────────┘  │
└─────────────────────────────────────────────────┘
```

The dialog box indicates which array the spare protects. If you
have selected a pool spare, a list of protected arrays appears.

Deleting a Spare

After you delete an existing spare and before you reboot the system,
you can use a former spare to create a new array or spare. However,
this hard disk does not become visible to the system's operating
system as a single hard disk until after you reboot the system.

To delete a spare:

1 Click the [icon] button to open the Storage Configuration window.
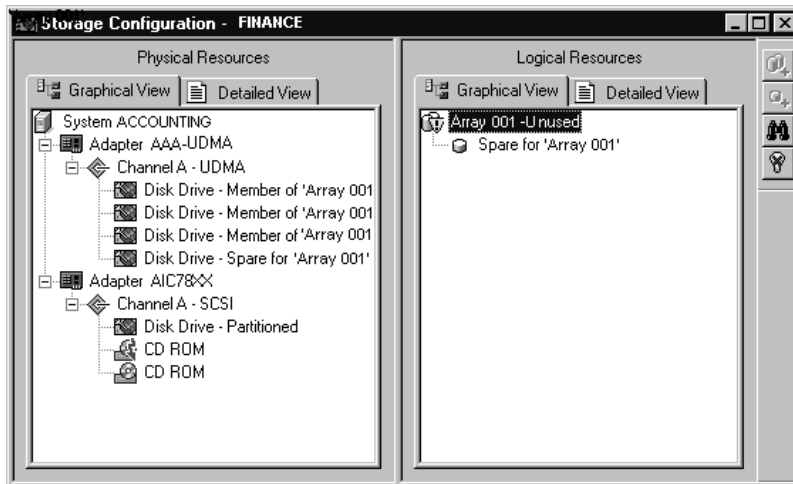
2 Right-click the icon [icon] of the spare you want to delete, and select **Delete** from the shortcut menu.

3 In the dialog box that appears, click **Yes** to confirm deletion of the spare.

8

Viewing Array and Device Information

In This Chapter

The Adaptec CI/O Management Software allows you to view information about arrays, spares, and physical devices on any system to which you have access. You view this information in the Storage Configuration window.

Viewing Physical Devices

You can view the arrangement and status of physical devices connected to one or more SCSI or UDMA array controllers in the Physical Resources pane of the Storage Configuration window in either Graphical View or Detailed View. See *Viewing Systems* on page 3-2 for more information.

✓ **Note:** This section covers only physical devices that are part of a SCSI or UDMA array configuration. *Viewing SCSI and UDMA Devices* on page 3-4 discusses physical devices that are not part of an array.

The device icons in the Physical Resources pane correspond to actual physical devices connected to SCSI or UDMA array controllers.

The following icons represent physical devices:

SCSI or UDMA array controller

Channel

Hard disk

Enclosure management processor (not supported by UDMA array controllers)

Viewing Logical Devices

You can view the status of logical devices that appear in the Logical Resources pane of the Storage Configuration window in either Graphical View or Detailed View. See *Viewing Systems* on page 3-2 for more information.

The device icons in the Logical Resources pane correspond to arrays and spares that are defined by the operator for use on that system. These arrays and spares don't exist until you configure them on the system.

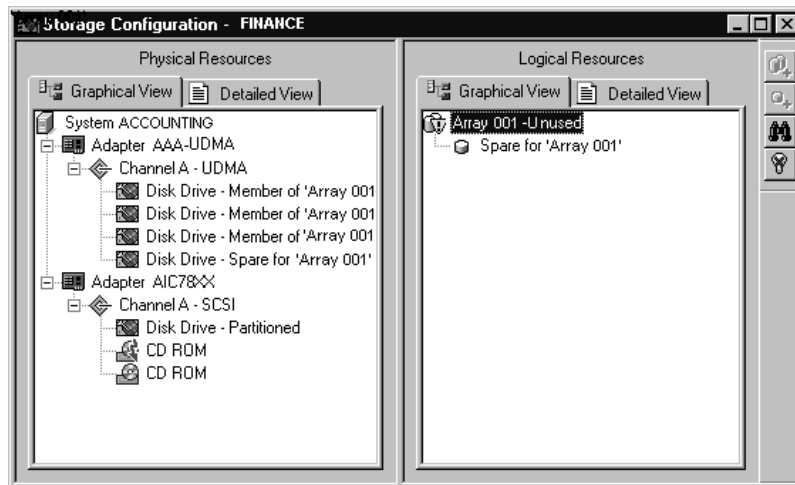Icons that represent logical devices are identified below:

 Array

 Spare

Viewing Configuration Information

To view configuration information about SCSI or UDMA devices that are part of an array configuration:

1 In the Adaptec CI/O Management Software window, click the

 button to open the Storage Configuration window.

2 In the Physical Resources pane, right-click a device icon.

3 Select **Information** from the shortcut menu. See *Viewing SCSI and UDMA Devices* on page 3-4 for more information.

The dialog boxes contained in this section are examples of information dialog boxes for different types of SCSI and UDMA devices that are part of an array configuration.

Viewing SCSI or UDMA Channel Information

To view configuration information for a SCSI or UDMA channel:

1 Right-click a channel icon ⬦, and select **Information** from the shortcut menu.

The Channel Information dialog box appears.

The following information appears in the Channel Information dialog box:

■ **Status**

The current operational status of the channel (for example, Active or Inactive).

■ **Channel Type**

The type of channel (for example, SCSI or UDMA).

■ **System**

The name of the system containing the channel.

■ **Controller**

The type of controller.

■ **Devices**

The number of devices currently connected to the channel (Current) and the maximum number of devices that the channel supports (Maximum).

■ For SCSI channels, the channel itself is counted in this maximum number. For example, if the number is 16, you can connect up to 15 devices.

■ For UDMA channels, the maximum number is always 4, indicating support for four UDMA devices.

2   Click **Close** to close the Channel Information dialog box.

Viewing Array Information

To view information about an array:

1 Right-click an array icon in the Logical Resources pane ,
and select **Information** from the shortcut menu.

The Description page of the Array Information dialog box
appears.
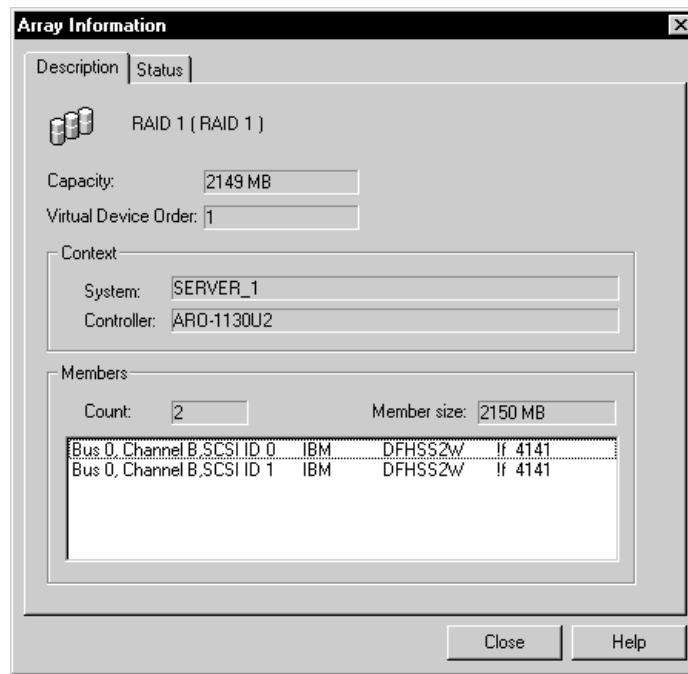
The following information appears in the Description page:

■ **Capacity**

The total usable disk space available in the array, in MB.

■ **Virtual Device Order**

The sequence in which the system's operating system
detects this array when it boots. If the array's virtual device
order is 0 and this is the first storage controller found in the
system, then this array is the device from which the
operating system boots.

■ **System**

The name of the system the array is on.

■ **Controller**

The model name of the Adaptec Array1000 Family product to which the array disks are connected.

■ **Count**

The number of hard disks in the array.

■ **Member size**

The usable size of the array members.

2   Click the **Status** tab to display the Status page.

The following information appears in the Status page:

■ **Dedicated Spares**

The number of spare disks dedicated to this array.

■ **Pool Spares**

The number of pool spares available to protect this array.

■ **O/S Visibility**

Indicates that the array is recognized by the operating system and can be used by the operating system.

■ **Partitions**

Indicates whether or not the hard disk is partitioned.

■ **Caching**

Indicates whether caching is enabled or disabled.

■ **Target Application**

The application that is selected for performance optimization.

■ **Creation**

The date on which the array was created.

■ **Last Verify**

The date on which the array was last verified. See *Verifying Array Integrity* on page 9-9 for information on how to verify an array.

■ **Last Reconstruct**

The date on which the array was last reconstructed. See *Reconstructing an Array* on page 9-2 for information on how to reconstruct an array.
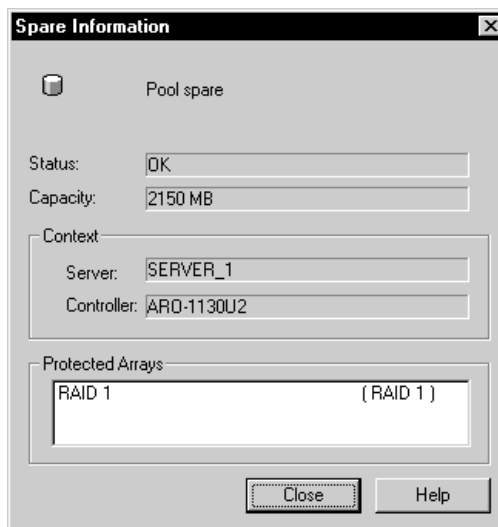
3 Click **Close** to close the Array Information dialog box.

Viewing Spare Information

To view information about a spare:

1 Right-click a spare icon 🗐, and select **Information** from the shortcut menu.

The Spare Information dialog box appears.

The Spare Information dialog box displays the following information:

■ **Status**

The status of the spare.

This can be either OK or Down. If the status is Down, the drive on which the spare is set up is not available for read/write access. This might be caused by a loose cable, a powered-down drive, or a drive failure.

■ **Capacity**

The size of the spare

■ **Server**

The host name of the server to which the spare is connected

- **Controller**

  The model name of the array controller to which the spare is connected

- **Protected Arrays**

  The arrays for which the spare provides protection

2 Click **Close** to close the Spare Information dialog box.

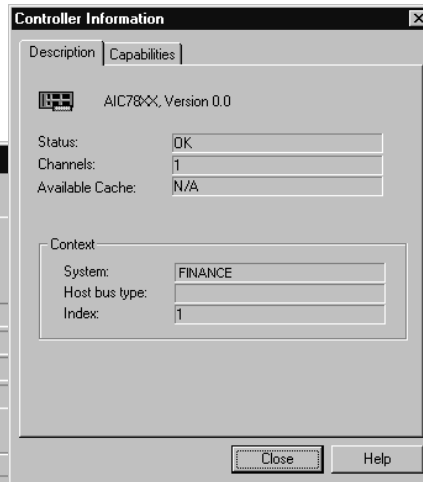## Viewing SCSI or UDMA Controller or Adapter Information

To view configuration information for a SCSI or UDMA array controller or SCSI host adapter:

1 Right-click the SCSI or UDMA array controller icon or SCSI host adapter icon, and select **Information** from the shortcut menu.
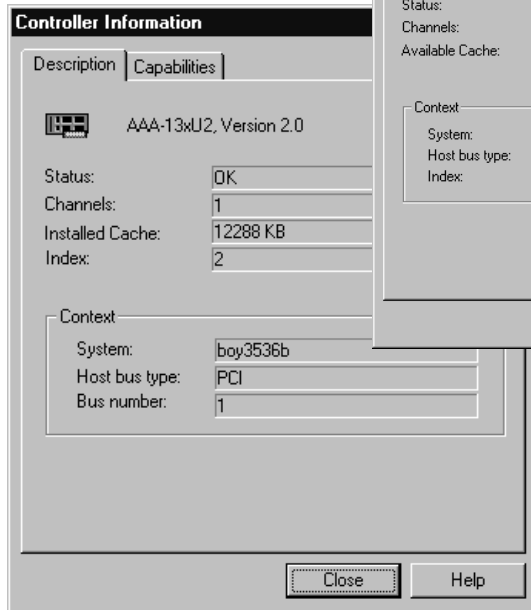
The Controller Information dialog box appears.

For a SCSI host adapter

For a SCSI or a UDMA array controller

The Description tab displays the following information:

■ **Status**

  The status of the SCSI host adapter or array controller

■ **Channels**

  The number of channels on the SCSI host adapter or array controller

■ **Available Cache**

  The size of the installed cache on the SCSI host adapter or array controller

■ **System**

The name of the computer to which the controller is connected

■ **Host bus type**

The type of bus on the server (not available for SCSI host adapters)

This is usually PCI, but it can be ISA, EISA, or MCA.

■ **Bus number**

The PCI slot that contains the array controller. You may need this information to configure the system to boot from an array This information is not available for SCSI host adapters.

■ **Index**

The index is a unique identifier for each adapter or array controller, based on the order in which the adapters or array controllers become visible to the operating system at boot time. The index numbers remain constant unless adapters or array controllers are moved to different PCI slots.

2 Click the **Capabilities** tab for a list of features the selected SCSI or UDMA array controller or SCSI host adapter supports. Not all features appear for every array controller or host adapter.

You cannot change the capabilities in this list; it is for reference only.
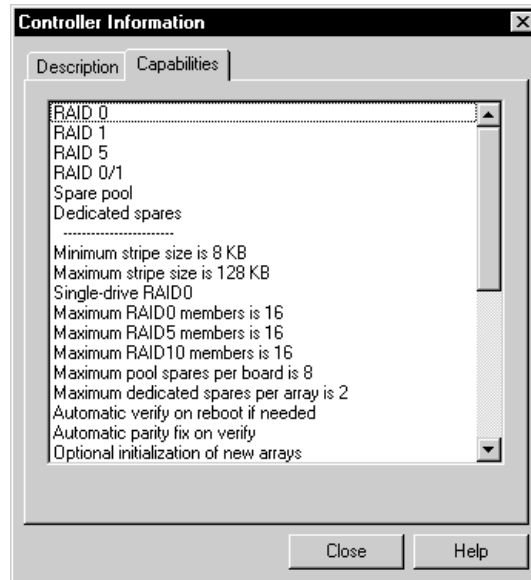
The following items are controller capabilities that may appear on the list:

■ **Supported RAID levels**

Lists the RAID levels that the array controller supports

■ **Spare pool**

Indicates that the array controller supports using spares from a spare pool

■ **Dedicated spares**

Any dedicated spares connected to this controller

■ **Maximum/minimum stripe size**

Lists the range of data stripe and parity stripe sizes that the array controller supports

■ **Single-drive RAID 0**

A single drive supported as a RAID 0 array.

■ **Maximum number of drives for a single array**

Lists the maximum number of hard disks the array controller supports for a single array. This information depends on the RAID level selected for the array.

■ **Maximum number of pool spares**

Lists the maximum number of pool spares per array that the array controller supports

■ **Maximum number of dedicated spares**

Lists the maximum number of dedicated spares per array that the array controller supports

■ **Auto verify**

Automatically verify on reboot if needed (does not apply to UDMA controllers)

■ **Auto fix**

Indicates that the array controller automatically corrects data and RAID parity miscompares

■ **Optional initialization of new arrays**

Indicates that the array controller can initialize new arrays

3 Click **Close** to close the Controller Information dialog box.

9

Performing Array, Spare, and Disk Operations

In This Chapter

The Adaptec CI/O Management Software allows you to perform a number of operations on arrays, spares, and stand-alone hard disks. You can perform some operations immediately, or schedule them to occur at a later time or periodically. See Chapter 10, *Scheduling and Monitoring Array Operations*, for more information.
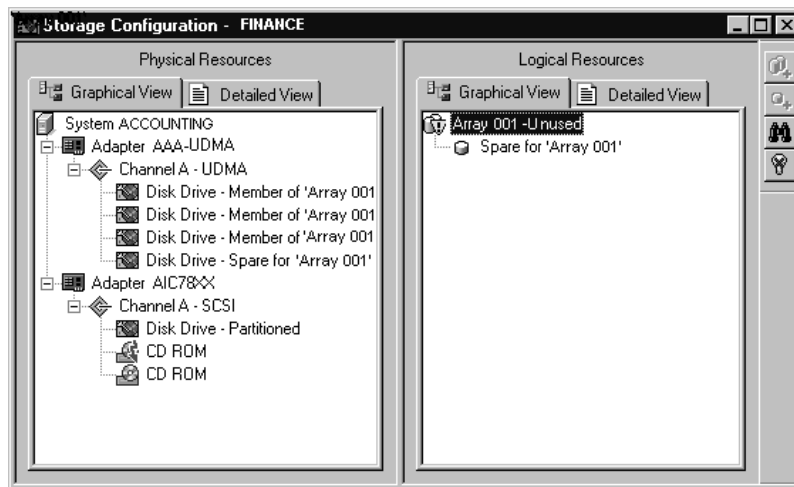
Performing Array Operations

To perform array operations:

1 In the Adaptec CI/O Management Software window, click the

🔲 button to open the Storage Configuration window.

2 In the Logical Resources pane, right-click the icon 🔲 that represents the array you want to work with.

3 Select the operation you want to perform from the shortcut menu that appears. See the appropriate section of this chapter for a description of the operations.

Reconstructing an Array

If a suitable spare is available when a hard disk in an array fails, the array is automatically reconstructed and you do not need to issue the Reconstruct command. However, if a hard disk in an array goes down for some reason other than physical failure and no suitable spare is available to replace it, you receive an event notification that the array is critical. You can then reconstruct the array with the Reconstruct command, after creating a suitable spare.

An array disk can change to a down status for several reasons:

- The array disk physically fails

- The user downs the array disk with the Down a Drive command

- The array disk is removed by mistake

- The cable to the array disk is accidentally disconnected

As long as the array disk is physically functional, you can reconstruct it with the Reconstruct command. You can reconstruct the array immediately, or you can schedule reconstruction to occur at a later time. Since reconstruction may take a long time, you may want to schedule it for a time when there is less activity on the system.

Note: Reconstruction can take up to several hours for a large array.

Reconstructing a SCSI Array

To reconstruct a SCSI array when a hard disk fails:

1 Determine which array is in critical status and which hard disk in the array has failed.

It is possible that a RAID 0/1 array in critical status may have more than one failed hard disk. The array can still be reconstructed without data loss as long as at least one hard disk of each mirrored pair is still good.

2 If the array is in an enclosure that does not support hot swapping[1] or if the array is not in an enclosure, pause I/O to the array before you continue, using the instructions in *Pausing I/O on an Array* on page 9-8. You don't need to pause I/O if the array enclosure supports hot swapping.

---

[1] Hot swapping support means that, to prevent data corruption, the array enclosure electrically isolates the bad hard disk's SCSI connector from the SCSI bus while the hard disk is being swapped. Data can still be transferred to and from the remaining good hard disks while the bad hard disk is replaced. UDMA array controllers do not support hot swapping.

3 Remove the failed hard disk, and, if you paused I/O, allow I/O to resume.

4 Insert a good hard disk of at least the same storage capacity. Be sure that the SCSI ID of the new hard disk is different from the SCSI ID of other installed devices. Or, if a hard disk in the array was accidentally disconnected, reconnect it.

5 Click the [icon] button to open the Storage Configuration window.

6 Click the [icon] button to detect the new hard disk.

7 If you installed a new hard disk (or disks), make the hard disk into a spare before beginning reconstruction by following the directions in *Creating Dedicated Spares or a Spare Pool* on page 7-27. Ensure the new spare hard disk is at least as large as the smallest array disk.

When the spare is created, CI/O should automatically start reconstructing the array. If reconstruction *does not* begin automatically, you must perform reconstruction manually.

To manually reconstruct an array:

1 In the Logical Resources pane, right-click the icon [icon] of the array you want to reconstruct, and select **Reconstruct** from the shortcut menu.

■ If the array has one failed hard disk, the Scheduler dialog box appears.
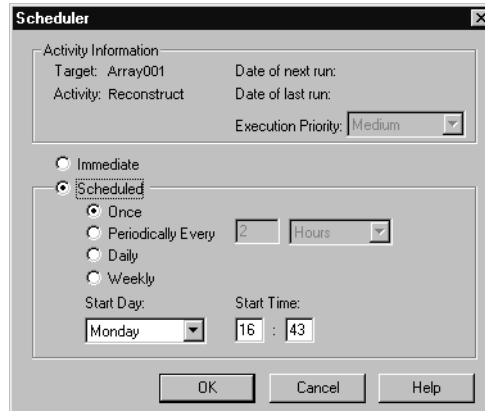
■ If the array is a RAID 0/1, two or more failed hard disks, and at least one hard disk of each mirrored pair is still good, a dialog box appears with a list of the failed hard disks.

You must reconstruct the failed hard disks one at a time, beginning with this step. Select one hard disk on the list, and click **OK**.

If you have already physically replaced all failed hard disks with good hard disks, the Scheduler dialog box appears.

2 Select **Immediate** to reconstruct the hard disk immediately, or select **Scheduled** to schedule reconstruction for a later time. If you select **Scheduled**, select the appropriate options in the Scheduled area. See *Setting Scheduling Options* on page 10-2 for more information.

3 Select an Execution Priority—**High**, **Medium**, or **Low**.

4 Click **OK** to start reconstruction (if you selected Immediate) or to enter the operation on the list of scheduled activities in the Activity View window.

5 In the dialog box that appears, click **Yes** to confirm that you want to reconstruct the array.

6   Read the event notifications that appear in the System Monitor and Historic Log windows (they may also appear in dialog boxes) to determine when reconstruction is complete. You can also watch the animated icon in the Activity View while the reconstruction is in progress. This icon stops moving once the reconstruction is complete.

Reconstructing a UDMA Array

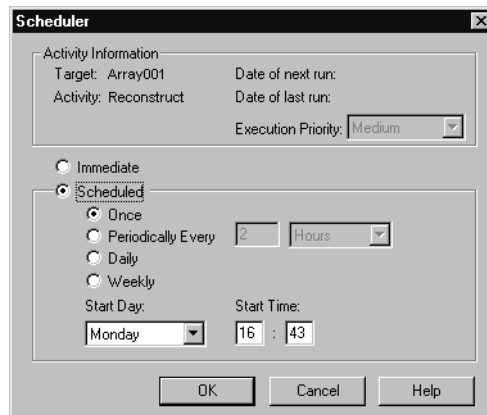To reconstruct a UDMA array when a hard disk fails:

1   Determine which array is in critical status and which hard disk in the array has failed.

2   Shut down the system.

3   Remove the failed hard disk.

4   Insert a good hard disk of at least the same storage capacity. Or, if an array disk was accidentally disconnected, reconnect it.

5   Reboot the system, and run CI/O.

6   Click the [ ] button to open the Storage Configuration window.

7   Click the [ ] button to detect the new hard disk.

8   If you installed a new hard disk, make the disk a dedicated spare before beginning reconstruction by following the directions in *Creating Dedicated Spares or a Spare Pool* on page 7-27. Be sure the new spare hard disk is at least as large as the smallest array disk.

When the spare is created, CI/O should automatically start reconstructing the array. If reconstruction *does not* begin automatically, you must perform reconstruction manually.

To manually reconstruct an array:

1   In the Logical Resources pane, right-click the icon [ ] of the array you want to reconstruct, and select **Reconstruct** from the shortcut menu.

The Scheduler dialog box appears.

2   Select **Immediate** to reconstruct the hard disk immediately, or select **Scheduled** to schedule reconstruction for a later time. If you select **Scheduled**, see *Setting Scheduling Options* on page 10-2 for instructions for selecting the options in the **Scheduled** area.

3   Select an Execution Priority—**High**, **Medium**, or **Low**.

4   Click **OK** to start reconstruction (if you selected Immediate) or to enter the operation on the list of scheduled activities in the Activity View window.

5   In the dialog box that appears, click **Yes** to confirm that you want to reconstruct the array.

6   Read the event notifications that appear in the System Monitor and the Historic Log windows (they may also appear in dialog boxes) to determine when reconstruction is complete, or observe the animated icon in the Activity View.

Pausing I/O on an Array

Use the pause I/O operation to pause data I/O to an array while you perform tasks such as replacing a hard disk and reconnecting a loose connection. Pausing I/O is intended for array disks that are not in enclosures and for array enclosures that do not support hot swapping. See the documentation supplied with the array enclosure for more information.

> **Note:** You should only perform a single action such as removing *or* inserting a hard disk (but not both) with each use of Pause I/O.

When you pause I/O to an array, all other devices on all channels on the Adaptec Array1000 Family product are also paused. I/O is automatically resumed after the pause interval you specify in the Pause I/O dialog box.
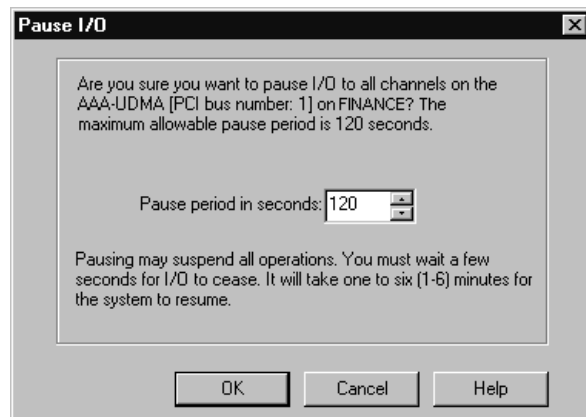
> **Caution:** *Do not* replace a non-downed hard disk in a paused array. The proper procedure is to down the hard disk and then replace it. Failure to do so may lead to data corruption. See *Downing a Hard Disk Drive* on page 9-22 for more information.

To pause and resume I/O to an array:

1 Click the button to open the Storage Configuration window.

2 In the Logical Resources pane, right-click the icon of the array to which you want to pause I/O, and select Pause I/O from the shortcut menu.

The Pause I/O dialog box appears.

```
Pause I/O                                                    [X]

  Are you sure you want to pause I/O to all channels on the
  AAA-UDMA [PCI bus number: 1] on FINANCE? The
  maximum allowable pause period is 120 seconds.


              Pause period in seconds: [120]  [▲▼]


  Pausing may suspend all operations. You must wait a few
  seconds for I/O to cease. It will take one to six (1-6) minutes for
  the system to resume.


                 [  OK  ]    [ Cancel ]    [  Help  ]
```

Note: The Pause I/O command is disabled if a verify, reconstruct, or initialize operation is running.

3 Type or choose a pause period from 5 to 120 seconds.

4 Click **OK** to pause I/O to the array, and then wait a few seconds until data I/O stops.

5 Complete your work with the hard disks in the array.

Data I/O resumes automatically at the end of the pause period.

Verifying Array Integrity

Use the verify operation to verify the integrity of redundant data stored on fault-tolerant arrays (RAID 1, RAID 5, and RAID 0/1). When you issue the Verify command, CI/O checks the array for *miscompares* and corrects parity errors automatically. A miscompare occurs when the parity information on a RAID 5 array does not match the user data or when some part of the data on a mirrored disk pair in a RAID 1 or RAID 0/1 array does not match.

CI/O allows you to schedule the verify operation to run later or to schedule the operation to run at a regularly occurring intervals. We recommend that you schedule a verification of all arrays at least once a week. See *Setting Scheduling Options* on page 10-2 for more information.
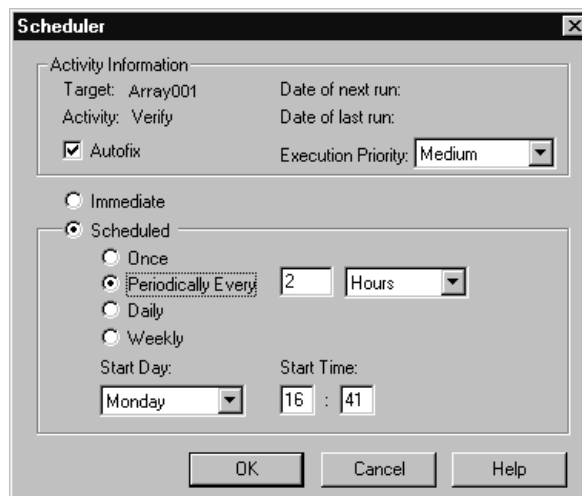
Note: The verify operation runs automatically on all fault-tolerant arrays when you boot up the system following a *disorderly* system shutdown. Disorderly means that the system shuts down in an irregular manner (for example, a power failure or a system lock-up).

To verify the integrity of redundant array data:

1 Click the button to open the Storage Configuration window.

2 In the Logical Resources pane, right-click the icon of the array whose redundant data you want to verify, and select **Verify** from the shortcut menu.

The Scheduler dialog box appears.S

3   Leave the Autofix check box selected so that any data parity or mirroring mismatches will be corrected automatically.

4   Select **Immediate** to run the verify operation immediately, or select **Scheduled** to schedule the operation for a later time. If you select **Scheduled**, see *Setting Scheduling Options* on page 10-2 for instructions for selecting the options in the Scheduled area.

5   Select an Execution Priority—**High**, **Medium**, or **Low**.

This option sets the system resources devoted to the operation. A high priority for the verify operation requires many system resources, which may slow down other system activity.

6   Click **OK** to start the verify operation (if you selected Immediate) or to enter the operation on the list of scheduled activities in the Activity View window.

7   In the dialog box that appears, click **Yes** to confirm that you want to verify the array.

> **Note:** The verify operation can take up to several hours for a large array.

Blinking the Drive Lights in an Array

You can issue a command to blink the drive lights of all the hard disks in a selected array. This allows you to see which physical hard disks actually form the array.

> **Note:** CI/O does not support blinking drive lights on CD-ROM drives or most other non-hard disks.

To blink the drive lights of the hard disks in an array:

1 Click the [button] button to open the Storage Configuration window.

2 In the Logical Resources pane, right-click the icon [icon] of the array in which you want to blink the drive lights, and select **Blink** from the shortcut menu.

The following dialog box appears.

3 Look at the array disks or the array enclosure (if the array disks are housed in an enclosure) to see which hard disks are members of the array.

4 Click **OK** in the dialog box to stop the drive lights in the array from blinking. Click the [button] button to stop blinking that was started from a different managing client location.

Reactivating an Off-line Array

An array may go off-line because a cable is disconnected or because you mistakenly remove the wrong hard disk while trying to replace a failed hard disk. See *Responding to an Off-line Array* on page 12-4 for more examples. In these situations, the array shuts down temporarily. Depending on the reason the array went off-line, it is possible to reactivate it and resume I/O without data loss.

You should only issue the Reactivate command if the system detects the absence of a hard disk in an already critical array and places the array in off-line status.

The system detects the absence of a hard disk in the following three ways:

- Attempts to perform I/O to the hard disk

- Blinks the drive light from CI/O

- Performs a rescan operation on the system from within CI/O

If the system becomes aware of a hard disk absence by attempting to perform normal I/O to the hard disk, the data on the hard disk has probably been corrupted; therefore, the reactivate operation will not restore the data.

> **Caution:** *Do not* issue the Reactivate command unless you are certain the data on the hard disk has not been corrupted.

If you are sure the data on the hard disk has not been corrupted, you must reconnect or reinsert the mistakenly removed hard disk and blink the drive or issue the Rescan command before you issue the Reactivate command.

If you reconnected or reinserted the mistakenly removed hard disk and then rebooted the system, you do not need to issue the Reactivate command because the system recognizes the drive and the array appears in the critical state.

In either case, whether you reboot or not, you must reconstruct the array to return it to fault-tolerant status.

To reactivate an off-line array:

1 Correct any hardware problems.

2 Click the [icon] button to open the Storage Configuration window.

3 In the Logical Resources pane, right-click the off-line array you want to reactivate, and select **Reactivate** from the shortcut menu.

> **Note:** Before you perform the next step, ensure you have corrected any hardware problems.

4   In the dialog box that appears, click **Yes** to confirm that you
   want to reactivate the array.

Changing the Name of an Array

When you create an array, you assign it a name. This name appears
beneath the array icon and in many of the windows and dialog
boxes of CI/O. The array name is also used to identify the source of
event notifications.

To change the name of an existing array:

1   Click the 🖼️ button to open the Storage Configuration
       window.

2   In the Logical Resources pane, right-click the array whose
       name you want to change, and select **Rename** from the
       shortcut menu.

       The Change name dialog box appears.
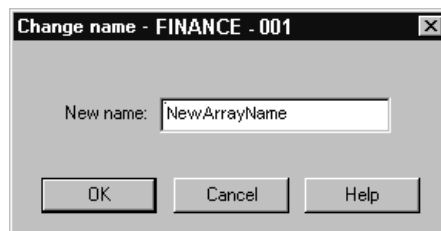
3   Type a new name for the array in the New name box.

4   Click **OK**.

5   In the dialog box that appears, click **Yes** to confirm that you
       want to change the name of the array.

       The change appears immediately in the Storage Configuration
       window.

Checking for Partitions

If you add or delete a File System partition while CI/O is running,
the program does not automatically detect the change. To update
information for an array, issue the Check Partition command. To

update partition information for all hard disks and arrays on a system, issue a Rescan command. See *Rescanning* on page 3-13 for more information.

To check for partitions on an array:

1   Click the [image] button to open the Storage Configuration window.

2   In the Logical Resources pane, right-click the icon [image] of the array whose partitions you want to check, and select **Check Partition** from the shortcut menu.

A dialog box appears telling you if partitions exist on the array.

3   Click **OK**.

Forcing a Spare

Forcing a spare means issuing a command for a spare hard disk to replace a specific hard disk in an array. You can force a spare if the hard disk in the array is not performing well or if it is giving some indication that an array disk may fail soon (for example, if a SMART[1] predictive failure notification is received for a SCSI drive). If an array disk actually fails, a spare replaces it automatically without requiring you to force a spare.

---

[1] SMART stands for Self-Monitoring Analysis and Reporting Technology. Hard disks that support it continually analyze their performance and generate an alert if they determine that the hard disk is likely to fail in the next few hours. CI/O generates an event notification if it receives this alert, allowing you to replace the hard disk before it actually fails. SMART is not supported by UDMA array controllers.

To force a spare:

1 Click the ▨ button to open the Storage Configuration
window.

2 Be sure that one or more spares are available for the array.
These spares can be either dedicated spares for the array or
spares from a spare pool. See *Creating Dedicated Spares or a
Spare Pool* on page 7-27 for more information on configuring
spares.

3 In the Logical Resources pane, right-click the icon ▯ of the
array with the suspect hard disk, and select **Force a Spare** from
the shortcut menu. (This menu option appears dimmed if no
spares are available.)

The Force a Spare dialog box appears if spares are available.
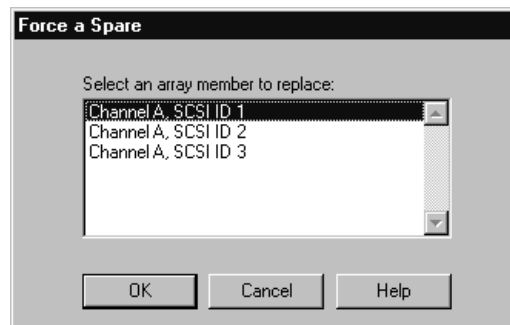
4 Select the hard disk you want to replace from the list.

5 Click **OK**.

6   In the dialog box that appears, click **Yes** to confirm that you want to replace the hard disk with a spare.

Data I/O is paused to the hard disk, and the spare is automatically activated to replace it.

If there is a pool of available spares, you cannot control which hard disk from the pool is activated when you force a spare. If both dedicated spares and pool spares are available, the dedicated spares are used first. If an error message indicates that the pool spare is not at least as large as the smallest hard disk in the array, add a larger spare. See *Creating or Adding a Spare Pool* on page 7-30 for instructions.

Performing Spare Operations

Note: All spare operations apply only to the spares on *the currently selected array controller*.

To perform spare operations:

1   In the Adaptec CI/O Management Software window, click the

button to open the Storage Configuration window.
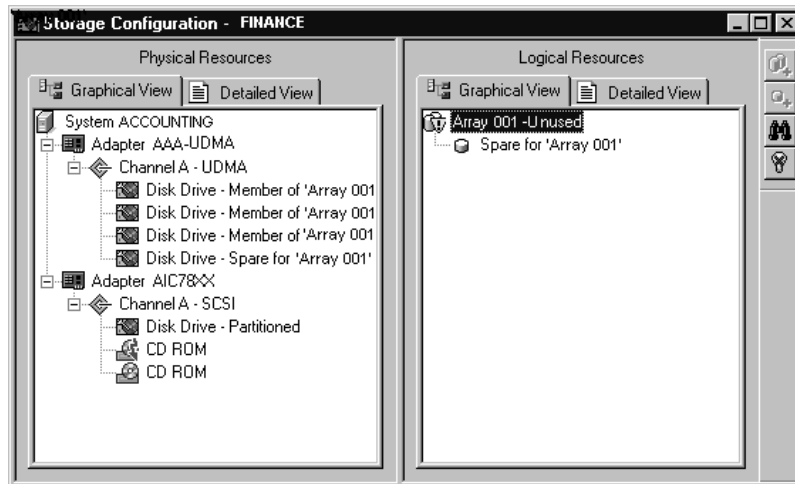
2 In the Logical Resources pane, right-click the icon ▢ that represents the spare you want to work with.

Testing All Spares

Reliable spares must be available to immediately, and automatically, replace any array disk that fails. Spares should be tested regularly to assure that they are working properly. We recommend that you test all spares daily. You can run the test-all-spares operation immediately by issuing the Test All Spares command, or you can set up a recurring check of all the spares at a time when few, if any, users are logged on to the system.

> ✔ **Note:** CI/O automatically sets up a daily test-all-spares operation on the server. We recommend that you leave this default setting. See *Setting Scheduling Options* on page 10-2 for more information.

To test all spares:

1 Click the ▣ button to open the Storage Configuration window.

2 In the Logical Resource**s** pane, right-click the icon ▢ of any spare, and select **Test All Spares** from the shortcut menu.

The Scheduler dialog box appears.
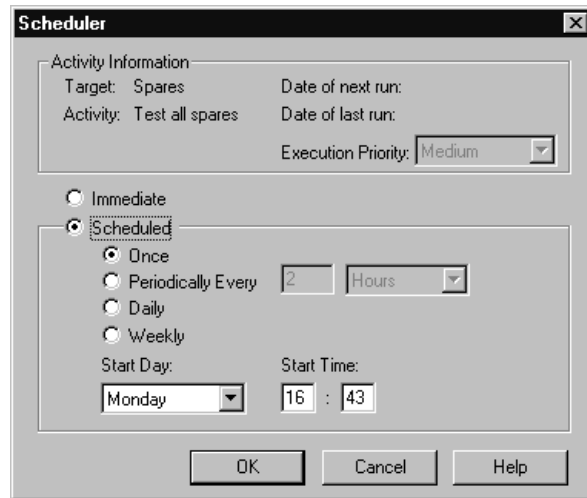
3 Select **Immediate** to test all spares immediately, or select **Scheduled** to schedule the operation for a later time. If you select **Scheduled**, select the appropriate options in the Scheduled area. See *Setting Scheduling Options* on page 10-2 for more information.

4 Select an Execution Priority—**High**, **Medium**, or **Low**.

5 Click **OK** to start the test-all-spares operation (if you selected Immediate) or to enter the operation on the list of scheduled activities in the Activity View window.

6 In the dialog box that appears, click **Yes** to confirm that you want to test all spares.

7 Read the event notifications that appear in the System Monitor and Historic Log windows to determine when the test-all-

spares operation is complete. Look for the icon of a failed spare (or any failed hard disk) in the Physical Resources pane of the Storage Configuration window.

8 Replace the failed hard disk immediately with a good disk of at least the same capacity.

Blinking the Drive Light of a Spare

You can issue the Blink command to blink the drive light of a spare you select in the Logical Resources pane so you can see which physical hard disk corresponds to the spare icon.

To blink the drive light of a spare:

1 Click the [icon] button to open the Storage Configuration window.

2 In the Logical Resources pane, right-click the icon [icon] of the spare whose drive light you want to blink, and select **Blink** from the shortcut menu.

The following dialog box appears.

3 Look at the array or the array enclosure (if the array is housed in an enclosure) to see which hard disk is blinking.

4 Click **OK** in the dialog box to stop the drive lights in the array from blinking. Click the [icon] button to stop blinking that was started from a different managing client location.

Performing Disk Operations

To perform disk operations:

1 In the Adaptec CI/O Management Software window, click the

   ![button icon] button to open the Storage Configuration window.
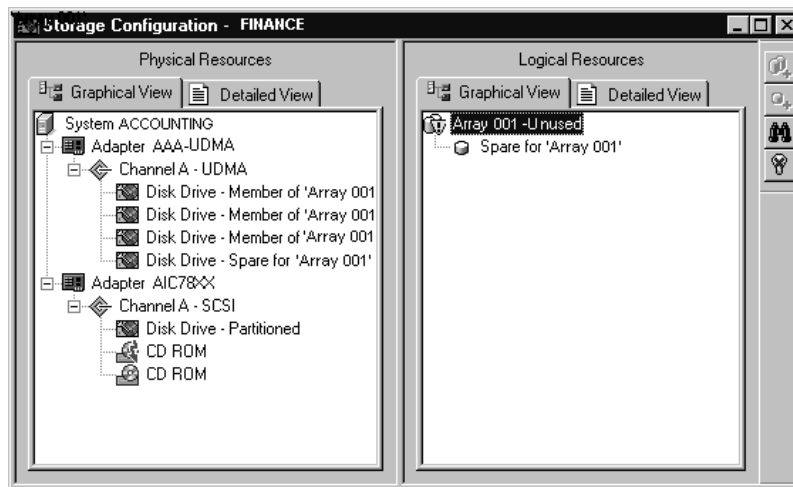
2 In the Physical Resources pane, right-click the icon ![disk icon] that represents the hard disk you want to work with.

Blinking the Drive Light

You can issue the Blink command to blink the drive light of a hard disk so you can see which physical hard disk corresponds to which hard disk icon.

> **Note:** CI/O does not support blinking of the drive light on CD-ROM drives.

To blink a drive light:

1   Click the button to open the Storage Configuration window.

2   In the Physical Resources pane, right-click the icon of the hard disk whose light you want to blink, and select **Blink** from the shortcut menu.

The following dialog box appears.

3   Look at the array or the array enclosure (if the array is housed in an enclosure) to see which hard disks are blinking.

4   Click **OK** in the dialog box to stop the drive lights in the array from blinking. Click the button to stop blinking that was started from a different managing client location.

Downing a Hard Disk Drive

The down-a-drive operation stops all data I/O to an array disk and removes the disk from the array.

You may need to issue the Down a Drive command if the hard disk generates a SMART alert indicating that the hard disk is about to fail. When you down a drive (hard disk), a spare is immediately activated (if available) to replace it, and a Reconstruct operation begins.

> **Note:** The Down a Drive command can be used only for hard disks that are members of an array, not for spares or single hard disks.

To down a hard disk:

1 Click the [button icon] button to open the Storage Configuration window.

2 In the Physical Resources pane, right-click the icon [disk icon] of the hard disk you want to down, and select **Down a Drive** from the shortcut menu.

A dialog box similar to the following appears.
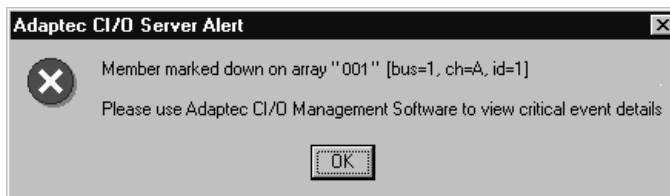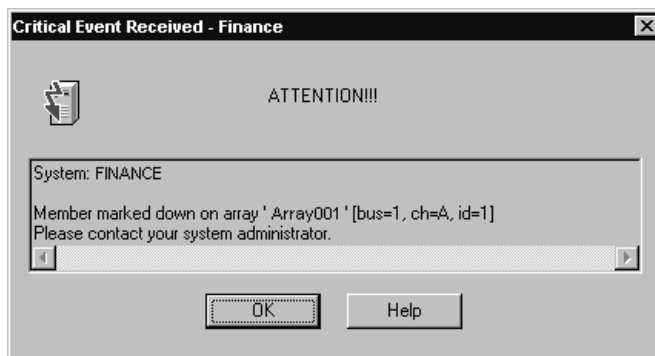
If a spare is available, it is activated immediately to replace the downed hard disk, and the reconstruction operation is started.

3 Wait until the reconstruct operation is complete before you continue working with CI/O.

Checking for Partitions

If you add or delete a File System partition while CI/O is running, the program does not automatically detect the change. To update information for a hard disk, you must issue the Check Partition command. To update partition information for all hard disks and arrays on a system, you can issue the Rescan command. See *Rescanning* on page 3-13 for more information.

To check for partitions on a hard disk:

1 Click the button to open the Storage Configuration window.

2 In the Physical Resources pane, right-click the icon of the hard disk whose partitions you want to check, and select **Check Partition** from the shortcut menu.

A dialog box appears telling you if any partitions exist on the hard disk.
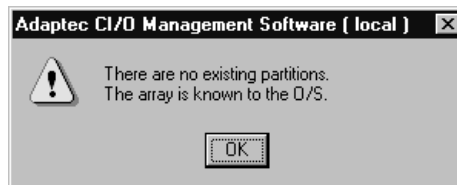
3 Click **OK**.

Pausing I/O to a Hard Disk in an Array Connected to a SCSI Array Controller

Note: UDMA array controllers do not support Pause I/O.

Use the Pause I/O operation to pause data I/O to an array while you perform tasks such as replacing a hard disk and reconnecting a loose connection. Pause I/O is intended for array disks that are not in enclosures and for array enclosures that do not support hot swapping. See the documentation that came with your array enclosure for more information.

Note: Pause I/O cannot assure the same level of protection from electrical noise that you have when you replace a hard disk in a SCSI enclosure that supports hot swapping. Every time you perform a pause I/O operation, you should perform one action only—either removing *or* inserting a hard disk—but not both.

When you pause I/O to a single hard disk, *all* other devices connected to the controller or host adapter are paused as well. I/O resumes automatically after the pause interval you specify in the Pause I/O dialog box.

Caution: *Do not* replace a non-downed hard disk in a paused array. The proper procedure is to down the hard disk and then replace it. Failure to do so may lead to data corruption. See *Downing a Hard Disk Drive* on page 9-22 for more information.

To pause and resume I/O to a hard disk in an array that is connected to a SCSI array controller:

1 Click the ▨ button to open the Storage Configuration window.

2 In the Physical Resources pane, right-click the icon of the hard disk to which you want to pause I/O, and select **Pause I/O** from the shortcut menu.

The Pause I/O dialog box appears.
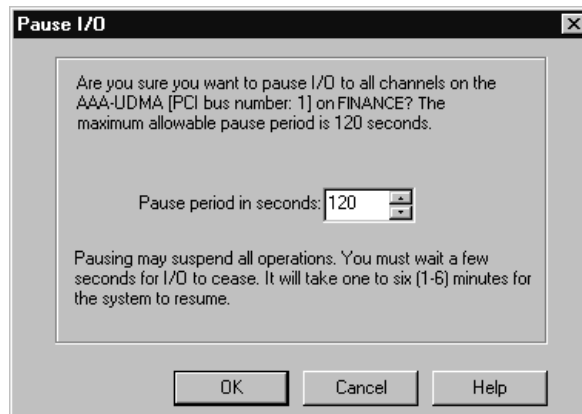
> **Note:** The Pause I/O command is disabled if a verify, reconstruct, or initialize operation is running.

3 Type or choose a pause period from 5 to 120 seconds.

4 Click **OK** to pause I/O to the hard disk, and then wait a few seconds until data I/O stops.

Data I/O resumes automatically at the end of the pause period.

10

Scheduling and Monitoring Array Operations

In This Chapter

The Adaptec CI/O Management Software enables you to schedule certain operations to run at designated times or to run at regularly recurring intervals. You create a schedule when you run the operation, as described in *Reconstructing an Array* on page 9-2, *Verifying Array Integrity* on page 9-9, and *Testing All Spares* on page 9-18.

Setting Scheduling Options

You schedule the reconstruct, verify, and test-all-spares operations in the Scheduler dialog box. You can schedule the reconstruct operation as a one-time event for which you can enter a date and time. You can schedule the verify and test-all-spares operations as hourly, daily, or weekly recurring events.

> **Caution:** All scheduled operations must be deleted and rescheduled if you change the system time. Otherwise, the scheduled operations may not run at the specified time. *Do not* change the system time while the CI/O is running. Instead, stop all CI/O components and RPC modules, change the system time, and then restart CI/O. For more information about stopping CI/O processes, see *Stopping the Adaptec CI/O Management Software in UnixWare* on page 2-21.

To schedule a newly-added operation:

1 In the Adaptec CI/O Management Software window, click the

button to open the Storage Configuration window.

2 In the Logical Resour**es** pane, right-click the icon— for

verify and for reconstruct—of the array you want to schedule a new operation for, and select **Verify** or **Reconstruct** from the shortcut menu.

Alternatively, in the Logical Resources pane, right-click the

icon of the spare you want to schedule a new test-all-spares operation for, and select **Test All Spares** from the shortcut menu.

The Scheduler dialog box appears when you select **Verify**, **Reconstruct** (if the array has only one failed hard disk), or **Test All Spares**. The following example appears when you select **Verify** from the shortcut menu.
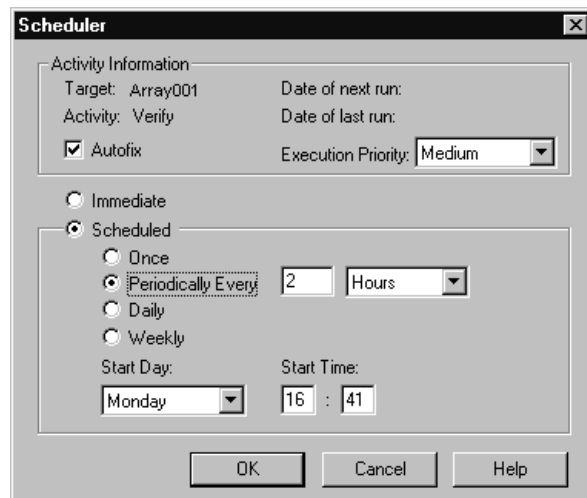
If the array is a RAID 0/1with two or more failed hard disks and at least one disk of each mirrored pair is still good, a dialog box appears with a list of the failed hard disks.

You must reconstruct the failed hard disks one at a time, beginning with this step. Select one hard disk on the list, and click **OK**.

The Scheduler dialog box appears. This assumes that you have already physically replaced all failed hard disks with good hard disks.

3 For the verify operation, leave the Autofix check box selected so any data parity or mirroring mismatches are corrected automatically.

4 Select **Immediate** to run the operation immediately.

Alternatively, select **Scheduled** to schedule the operation for a later time. If you select Scheduled, select **Once**, **Periodically**, **Daily**, or **Weekly**. Type or select other information such as day of the week or start time as required.

> **Note:** If you are scheduling a reconstruct operation, you can only select **Once**. If you schedule an operation from a remote client to occur on a server in a different time zone, the operation occurs at the stated time relative to the server's time zone. For example, suppose you schedule an operation to occur at 11:00 P.M. on a server in a time zone that is 3 hours later than the remote client's time zone. The operation will occur at 11:00 P.M. in the server's time zone, which is 8:00 P.M. in the remote client's time zone.

5 Select an Execution Priority—**High**, **Medium**, or **Low**.

6 Click **OK**.

7 In the dialog box that appears, click **Yes** to confirm that you want CI/O to perform the operation.

Viewing and Managing Scheduled Activities

When you schedule operations, they become *activities*. In the Activity View window, you can view information about scheduled and currently running activities, abort currently running activities, and delete scheduled activities. The Activity View window shows scheduled activities for the currently selected system only. To view activities on another system, select the system's icon in the System Monitor window, and open a new Activity View window.

> **Note:** CI/O automatically sets up a daily test-all-spares activity on the system. If you want to schedule this activity for a different time, first delete the automatically-entered activity, and then create a new schedule.
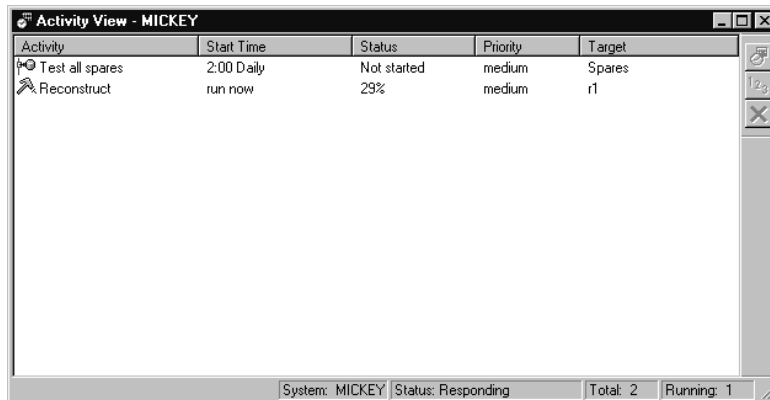
To view and manage scheduled activities:

1 In the Adaptec CI/O Management Software window, click the

🕰 button to open the Activity View window.

Information about each activity appears in the following columns:

■ **Activity**

Shows the name of the scheduled activity and the unique icon assigned to it. If the activity is running, the icon will be animated.

■ **Start Time**

Indicates whether the activity is currently running or if it is scheduled for a later time (one time only or recurring).

■ **Status**

Displays Not started or the percent of completion of the activity.

■ **Priority**

Shows the priority you set in the Scheduler dialog box.

■ **Target**

Shows which array or spare the activity applies to.

2 To view more detailed information about the activity:

    a Right-click its icon, and select **Properties** from the shortcut menu.

    The appropriate Schedule**r** dialog box appears.

    b Click **Cancel** to close the dialog box.

To change the priority of a currently running verify or reconstruct activity (as indicated by a moving icon):

1 Right-click its icon, and select **Change Priority** from the shortcut menu.

2 Select an Execution Priority—**High**, **Medium**, or **Low**.

3 Click **OK**.

> **Note:** The priority change applies only while the activity is running this time. If it is a regularly scheduled activity, the next time it runs, the activity will have the priority originally assigned to it. You cannot change the priority of an initialize or test all spares operation that is currently running.

To delete an activity that *is not* currently running:

1 Right-click its icon, and select **Delete** from the shortcut menu.

2 Click **Yes** in the dialog box that appears.

    When you click Yes, the activity is deleted from the list.

To abort a currently-running activity:

1 Select its icon, and click the ✕ button.

2 Click **Yes** in the dialog box that appears.

    When you click Yes, the activity stops running immediately.

    If this is a regularly recurring activity, such as a nightly test of all spares, it will run at the next scheduled time.

To prevent an activity from running again:

1 Select its icon and click the ![X] button.

When you click Yes, the activity stops running immediately.

2 Right-click its icon, and select **Delete** from the shortcut menu.

11

Setting Security Options

In This Chapter

The Adaptec CI/O Management Software provides effective password protection to prevent unauthorized changes to array configuration. Users who know the password can view server information *and* issue commands to make changes to array configurations. Users who *do not* know the password can view server information, but *cannot* change array configuration. The system administrator can disable Guest Access (see page 11-5) for each server to prevent users who *do not* know the password from viewing server information, although they can still receive event notifications.

When you install CI/O, the initial password is `adaptec`. The password is case-sensitive, so *do not* use capital letters.

The system administrator can change the CI/O password for each server. The system administrator also controls all users' access to passwords.
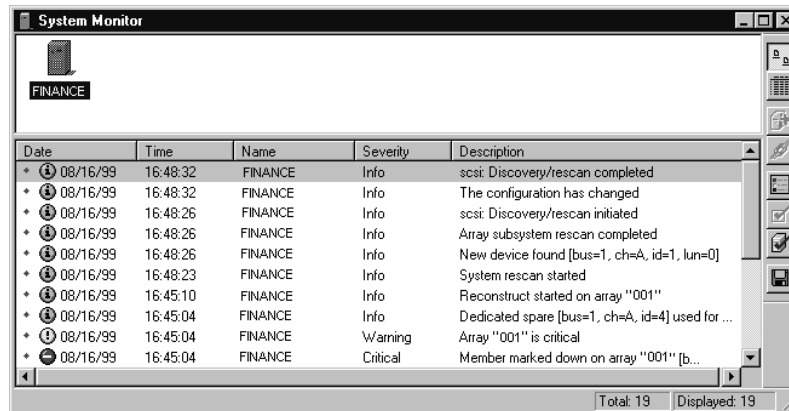
Changing the Password

You can change passwords from any client on the network.

To change the CI/O password:

1 In the Adaptec CI/O Management Software window, click the
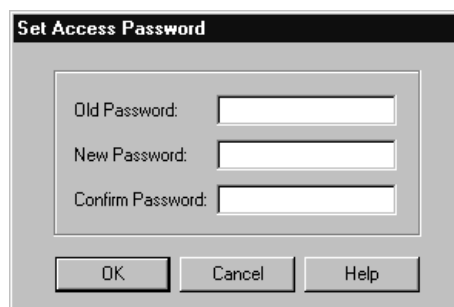
  [ ] button to open the System Monitor window.

2 Right-click the icon [ ] of the server whose password you
  want to change, and select **Change Password** from the shortcut
  menu.

  The Set Access Password dialog box appears.

If you are setting a password for the first time, type the default password, `adaptec`, in the Old Password box. The password is case-sensitive, so *do not* use any capital letters.

> **Note:** We recommend changing the password from the default as soon as possible to prevent unauthorized users from entering CI/O.

3 Type the new password in the New Password box.

Passwords are case-sensitive and can be up to 16 characters long, including the characters A through Z, a through z, and 0 through 9. Spaces are not allowed. Long passwords with a mixture of numerals and letters provide better security. *Do not* use obvious passwords such as your name, the name of a family member, your birthday, or your social security number.

4 Type the new password again in the Confirm Password box.

5 Click **OK**.

Setting the Password Policy

The password policy establishes a system's level of password protection. The password policy setting allows you to control the way in which users are prompted to enter a password when they issue commands to change a system's array configuration. On networked servers that are managed from client workstations, each client has its own password policy, but the passwords are unique to each server.

To change the password policy:

1 In the Adaptec CI/O Management Software window, click the

button to open the System Monitor window.

2 Click the icon of the server whose password policy you want to set.

3 Click the button to open the Preferences dialog box.

4 Click the **Password** tab.
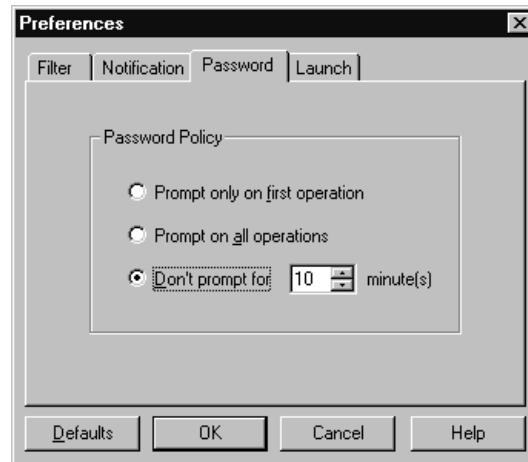
5 Select one of the following options to set the password policy for each selected server:

■ **Prompt only on first operation**

Requires users to enter the password the *first time* only (during each session) that they issue a command to change array configuration. This option provides somewhat less security than the others: if users leave their client or managed system unattended after entering the password, another user can issue commands from the client without being prompted for the password.

■ **Prompt on all operations**

Requires users to re-enter the password *every time* they issue a command to change array configuration.

■ **Don't prompt for** *nn* **minutes**

Requires users to re-enter the password at the interval shown in the box whenever they issue a command to change the array configuration. For example, suppose the interval is 10 minutes. A user starts CI/O at 9:00 and issues a command to create a new array on a system. The user is prompted to enter the password before the command is accepted. After entering the password, the user issues a command at 9:05 to add spares to the spare pool; no password is required. At 9:16, the user issues a command to delete an array. Since the time is beyond the 10-minute interval, the user is prompted again to enter the password before the command is executed.

6 Click **OK**.

Note: You must enter the password at least once for each server after the application has started or when the password setting has changed.

Controlling Guest Access

Guest Access lets the network administrator control who can view information about the server configuration. Guest Access is enabled or disabled for individual servers. The Guest Access setting affects all users who try to view server information from networked clients.

Guest Access works as follows:

When Guest Access is set to Enabled on a server (the default setting), users who do not know the password can view server information from a networked client connected to that server but *cannot* issue commands to change the server configuration.

When Guest Access is set to Disabled on a server, as indicated by the

 icon, users who *do not* know the password *cannot* view server information from a networked client or issue commands to change the server configuration. However, users can still view event notifications generated by servers that are on the client's server list.

If Guest Access has been disabled for a server, you can upgrade access privileges for a particular client to monitor or manage that server as follows:

1 In the Adaptec CI/O Management Software window, click the

 button to open the System Monitor window.

2 Click the icon of the server whose access privileges you want to upgrade.

3 Click the button.

4 Enter the password when prompted.

Although you regained Guest Access privileges for that client, access privileges remain disabled for all other clients monitoring the server. At this point, if you power off and restart that particular client, access privileges revert to Disabled.

> **Note:** If you *do* know the server's password, you can perform array operations such as creating and deleting arrays whether Guest Access is enabled or disabled.

To enable or disable Guest Access:

1 In the Adaptec CI/O Management Software window, click the

 button to open the System Monitor window.

2 Right-click the icon of the server whose guest access setting you want to change, and select **Guest Access** from the shortcut menu.

The Enable/Disable Guest Access dialog box appears.

3 Select or deselect the **Enable Guest Access** check box.

4 Click **OK.**

5 Enter the password when you are prompted to do so.

The Guest Access setting is changed on the server.

12

Array Maintenance

In This Chapter

This chapter explains how to respond to critical and off-line arrays and how to replace spares and active array members. This chapter also provides general information on replacing hard disks.

Returning a Critical Array to Fault-Tolerant Status

You should monitor the status of arrays at all times with the Adaptec CI/O Management Software to detect arrays whose status is critical. You can monitor arrays most effectively by enabling Event Notification using the Preferences dialog box, so that a message appears on the screen whenever an array enters critical status. See *Selecting Notification Settings* on page 5-5.

> **Note:** We recommend that you configure the system to automatically launch CI/O as a status bar icon after each system reboot. This ensures that you will be notified of any important event. See *Selecting a Program Launch Mode* on page 5-12 for instructions.

A fault-tolerant array (RAID 1, RAID 5, or RAID 0/1) enters critical status if one hard disk in the array fails. The array continues to operate normally, but you may lose data if a second hard disk in the array fails before the array is reconstructed. RAID 0/1 arrays can continue operating in critical status even if two or more hard disks fail as long as at least one hard disk in each mirrored pair remains operational.

If a spare is available, CI/O reconstructs the critical array automatically. When the reconstruct operation is complete, the array returns to fault-tolerant status. If no spare is available, you should respond immediately to return the critical array to fault-tolerance and minimize the possibility of data loss. The most effective strategy is prevention: be sure that arrays are always protected by a spare pool or by dedicated spares!

To return a critical array to fault-tolerant status:

1 In the Adaptec CI/O Management Software window, click the

button to open the System Monitor window.

2 Right-click the icon of the critical array, and observe the hard disk icons of the array members on the Physical Resources pane.

3   Right-click the icon of the failed disk, and select **Blink** from the shortcut menu.

4   The hard disk whose drive light is blinking is the one you need to replace.

If no lights are blinking, this could mean one of the following:

■ The hard disk is still connected, but has failed so badly that it cannot respond to the Blink command. Try blinking the drive lights of the hard disks in the array that have not failed. You may be able to determine by the process of elimination which hard disk has failed.

■ The hard disk has been removed or its power cord or cable has been disconnected.

If a hard disk in an array has been disconnected or removed, but the server has not been rebooted, the icon for this hard disk still appears in the Physical Resources pane of the Storage Configuration window. If you know that the hard disk was accidentally disconnected and has not actually

failed, reconnect the hard disk and click the button. Then reconstruct the array by issuing the Reconstruct command.

If the system has been rebooted since the hard disk was disconnected, the hard disk will not appear. To determine if a hard disk is missing from an array, right-click the array icon, select **Information** from the shortcut menu, and click the **Status** tab in the Array Information dialog box. If the list of array members contains a Missing member entry, a hard disk is missing from the array.

■ The hard disk does not have an LED that indicates I/O activity.

5   Replace the failed hard disk, reconstruct the array, and create dedicated spares or a spare pool, as explained in *Reconstructing an Array* on page 9-2.

Responding to an Off-line Array

To determine if a hard disk is in off-line status, right-click the array icon, select **Information** from the shortcut menu, and click the **Status** tab in the Array Information dialog box. If the list of array members contains OFFLINE, the array is in off-line status. An off-

line array can also be identified by the following icon: .

The following is a list of reasons an array can go off-line and the appropriate responses:

> **Caution:** Responses 2, 3, and 6 tell you to issue the Reactivate command. You should only do this if you are sure that no data on the array disks has been corrupted. See *Reactivating an Off-line Array* on page 9-12 for more information.

Reason 1

A hard disk in a RAID 0 array has failed, a second hard disk in a critical RAID 5 array has failed, or both hard disks in a mirrored pair in a RAID 1 or RAID 0/1 array have failed.

Response 1

   1 Delete the off-line array. See *Deleting an Array* on page 7-25.

   2 Create a new array. See *Choosing a RAID Level for an Array* on page 7-2.

   3 Restore the data from the most recent backup.

> **Note:** You *cannot* recover the array data if an array went off-line due to hard disk failure.

Reason 2

You are trying to replace a failed hard disk in a critical RAID 5 or RAID 0/1 array, but you mistakenly remove the wrong hard disk.

Response 2

1   Reinsert the hard disk you mistakenly removed.

2   Issue the Rescan command. See *Rescanning* on page 3-13.

3   Issue the Reactivate command. See *Reactivating an Off-line Array* on page 9-12.

   This will return the array to critical status.

4   Remove the failed hard disk, and replace it with a good hard disk.

5   Reconstruct the array. See *Reconstructing an Array* on page 9-2.

Reason 3

You accidentally disconnect the cable to a good hard disk in a RAID 5 array that already has one failed hard disk, or you accidentally disconnect the cable to a good hard disk in a RAID 0/1 array where the other hard disk of the mirrored pair has already failed.

Response 3

1   Reconnect the cable.

2   Issue the Rescan command. See *Rescanning* on page 3-13.

3   Issue the Reactivate command to return the array to critical status. See *Reactivating an Off-line Array* on page 9-12.

4   Remove the failed hard disk, and replace it with a good hard disk.

5   Reconstruct the array. See *Reconstructing an Array* on page 9-2.

Reason 4

You are trying to replace a failed hard disk in a critical RAID 1 array, but you mistakenly remove the wrong hard disk.

Response 4

 1 Reinsert the hard disk you mistakenly removed.

 2 Replace the failed hard disk.

 3 Shut down the system, and reboot.

 4 Reconstruct the array. See *Reconstructing an Array* on page 9-2.

Reason 5

You accidentally disconnect the cable to a good hard disk in a RAID 1 array that already has one failed hard disk.

Response 5

 1 Shut down the system.

 2 Reconnect the cable.

 3 Replace the failed hard disk.

 4 Reboot the system.

 5 Reconstruct the array. See *Reconstructing an Array* on page 9-2.

Reason 6

You mistakenly remove a hard disk from a RAID 0 array, or you accidentally disconnect the cable to a good hard disk in a RAID 0 array.

Response 6

 1 Reinsert the hard disk you mistakenly removed, or reconnect the cable.

 2 Issue the Rescan command. See *Rescanning* on page 3-13.

 3 Issue the Reactivate command to return the array to OK status. See *Reactivating an Off-line Array* on page 9-12.

Replacing a Spare

This section contains instructions for replacing a spare that CI/O:

- Recognizes as good

- Has marked as down. (This rarely occurs. Usually, if a spare fails a regular test of spares, the software automatically deletes the spare.)

Replacing a Spare in a SCSI Array

To replace a spare that is recognized as good:

1 Delete the spare. See *Deleting a Spare* on page 7-34.

2 If the array is in a SAF-TE enclosure that does not support hot swapping[1] or if the array is not in a SAF-TE enclosure, pause I/O to the array before you continue. See *Pausing I/O on an Array* on page 9-8. Skip this step if the array is in a SAF-TE enclosure that supports hot swapping.

3 Remove the spare hard disk, and, if you paused I/O, allow I/O to resume.

4 Insert a good hard disk of at least the same storage capacity. Be sure the SCSI ID of the new hard disk is different from the SCSI ID of other installed devices.

5 Click the button to open the **Storage Configuration** window.

6 Click the button to detect the new hard disk.

---

[1] *Hot swapping* support means that, to prevent data corruption, the SAF-TE enclosure electrically isolates the bad hard disk's SCSI connector from the SCSI bus while the hard disk is being swapped. Data can still be transferred to and from the remaining good hard disks while the bad hard disk is replaced. UDMA array controllers do not support hot swapping.

7 Make the hard disk into a spare by following the directions in
Creating Dedicated Spares or a Spare Pool on page 7-27. Ensure
the new hard disk is at least as large as the smallest array
member.

When the spare is created, CI/O should automatically start a
reconstruct operation on the array if it is in critical status. If the
reconstruct *does not* begin automatically, you must perform the
reconstruct manually. See *Reconstructing a SCSI Array* on
page 9-3 for instructions.

To replace a spare that is marked as down:

1 If the array is in a SAF-TE enclosure that does not support hot
swapping or if the array is not in a SAF-TE enclosure, pause
I/O to the array before you continue. See *Pausing I/O on an
Array* on page 9-8. Skip this step if the array is in a SAF-TE
enclosure that supports hot swapping.

2 Remove the spare hard disk, and, if you paused I/O, allow I/O
to resume.

3 Insert a good hard disk of at least the same storage capacity. Be
sure that the SCSI ID of the new hard disk is different from the
SCSI ID of other installed devices.

4 Click the   button to open the Storage Configuration
window.

5 Click the   button to detect the new hard disk.

6 Make the hard disk into a spare by following the directions in
Creating Dedicated Spares or a Spare Pool on page 7-27. Ensure
the new spare hard disk is at least as large as the smallest array
member.

When the spare is created, CI/O should automatically start a
reconstruct operation on the array if it is in critical status. If
reconstruction *does not* begin automatically, you must perform
reconstruction manually. See *Reconstructing a SCSI Array* on
page 9-3 for instructions.

Note: You may try to low-level format the hard disk you just removed to see if you can re-use it.

Replacing a Spare in a UDMA Array

Note: CI/O does not support pausing I/O to UDMA arrays. Devices in UDMA arrays can't be hot swapped.

To replace a spare hard disk that is recognized as good:

1 Delete the spare. See *Deleting a Spare* on page 7-34.

2 Shut down and power off the system.

3 Remove the spare hard disk.

4 Insert a good hard disk of at least the same storage capacity.

5 Reboot the system, and run CI/O.

6 Click the ▦ button to open the Storage Configuration window.

7 Click the 🏁 button to detect the new hard disk.

8 If you installed a new hard disk, make the disk a dedicated spare by following the directions in *Creating or Adding a Dedicated Spare* on page 7-28 before reconstruction. Be sure the new spare hard disk is at least as large as the smallest array member.

When the spare is created, CI/O should automatically start a reconstruct operation on the array. If reconstruction *does not* begin automatically, you must perform reconstruction manually. See *Reconstructing a UDMA Array* on page 9-6 for instructions.

To replace a spare hard disk that is marked as down ⬇ by CI/O:

1 Pause I/O by following the instructions in *Pausing I/O on an Array* on page 9-8.

2 Remove the failed hard disk.

3 Insert a good hard disk of at least the same storage capacity.

4 Reboot the system, and run CI/O.

5 Click the [image] button to open the Storage Configuration window.

6 Click the [image] button to detect the new hard disk.

7 If you installed a new hard disk, make the disk a dedicated spare by following the directions in *Creating or Adding a Dedicated Spare* on page 7-28 before reconstruction. Be sure the new spare hard disk is at least as large as the smallest array member.

When the spare is created, CI/O should automatically start a reconstruct operation on the array. If reconstruction *does not* begin automatically, you must perform reconstruction manually. See *Reconstructing a UDMA Array* on page 9-6 for instructions.

> **Note:** You may try to low-level format the hard disk you just removed to see if you can re-use it.

Replacing an Active Array Member

This section contains instructions for removing and replacing a hard disk that is a member of a RAID 1, RAID 5, or RAID 0/1 array and is still active (has not actually failed). You may want to do this if the hard disk has generated a SMART predictive failure alert.

Replacing an Active Member of a SCSI Array

To replace a hard disk that is an active member of a RAID 1, RAID 5, or RAID 0/1 SCSI array:

1 Perform a down-a-drive operation on the hard disk you want to replace. See *Downing a Hard Disk Drive* on page 9-22.

If a spare hard disk was already available, the reconstruct operation begins automatically when you down the hard disk.

2 If the array is in a SAF-TE enclosure that does not support hot swapping or if the array is not in a SAF-TE enclosure, pause I/O to the array before you continue. See *Pausing I/O on an Array* on page 9-8. Skip this step if the array is in a SAF-TE enclosure that supports hot swapping.

3 Remove the hard disk, and, if you paused I/O, allow I/O to resume.

4 Insert a replacement hard disk of at least the same storage capacity. Be sure that the SCSI ID of the new hard disk is different from the SCSI ID of other installed devices.

5 Click the [button icon] button to open the Storage Configuration window.

6 Click the [button icon] button to detect the replacement hard disk.

7 Make the hard disk into a spare by following the directions in *Creating Dedicated Spares or a Spare Pool* on page 7-27 before reconstruction. Be sure the new spare hard disk is at least as large as the smallest array member.

When the spare is created, CI/O should automatically start a reconstruct operation on the array. If reconstruction *does not* begin automatically, you must perform reconstruction manually. See *Reconstructing a SCSI Array* on page 9-3 for instructions.

Replacing an Active Member of a UDMA Array

To replace a hard disk that is an active member of a RAID 1, RAID 5, or RAID 0/1 UDMA array:

1 Perform a down-a-drive operation on the hard disk you want to replace. See *Downing a Hard Disk Drive* on page 9-22.

If a spare hard disk is available, the reconstruct operation begins automatically when you down the hard disk.

2 Shut down the system if no spare is available.

3 Remove the hard disk.

4 Insert a replacement hard disk of at least the same storage capacity.

5 Reboot the system, and run CI/O.

6 Click the button to open the Storage Configuration window.

7 Click the button to detect the replacement hard disk.

8 If you installed a new hard disk, make the disk a dedicated spare by following the directions in *Creating Dedicated Spares or a Spare Pool* on page 7-27 before reconstruction. Be sure the new spare hard disk is at least as large as the smallest array member.

When the spare is created, CI/O should automatically start a reconstruct operation on the array. If reconstruction *does not* begin automatically, you must perform reconstruction manually. See *Reconstructing a UDMA Array* on page 9-6 for instructions.

Tips for Replacing Hard Disks

This section provides recommendations and tips for replacing hard disks:

■ For SCSI host adapters and SCSI array controllers, if you use hot swapping to replace a hard disk that supports tagged command queuing (TCQ), you should replace the hard disk with a hard disk that also supports TCQ. Otherwise, a rescan may not detect that the hard disks have been swapped.

Also, a system hang may occur if the replaced hard disk does not support TCQ and the system sends commands with tags to it. This problem does not occur if you swap hard disks while I/O is paused, or while the system is down or turned off.

 Note: Because UDMA array controllers do not support hot swapping, you must swap hard disks while the system is down or while it is turned off.

■ To minimize the possibility of data corruption, be sure you replace a hard disk with a hard disk of the same capacity or larger.

■ Remove old or defective hard disks from the system as soon as possible. You may low-level format a removed hard disk to see if you can use it again.

A

Configuration Settings

In This Chapter

This appendix describes the configuration variables that control the
Adaptec CI/O Management Software. The other variables are
defined in the *iomgr.ini* and *cioams.ini* files.

Many of the variables are configured for you once you install the
software or start the program. If you are an advanced user and you
want to customize your settings, you can open *iomgr.ini* in a text
editor and manually make changes.

I/O Manager

The I/O Manager is the portion of CI/O that runs on the target system. The I/O Manager provides the run-time intelligence to detect device failures, locate schedules to be run, and send event notifications to clients.

The behavior of the I/O Manager may be changed using entries in the *iomgr.ini* file.

SCSI Host Adapter Settings

I/O Manager options for management of Adaptec SCSI host adapters are configured by certain entries in the standard I/O Manager initialization file (*iomgr.ini*). The *iomgr.ini* file is located in the directory where you installed CI/O.

[ASPIMODEL]

DisableASPI = [Yes | No]

This option disables all SCSI Manager functions. This option can be used for problem isolation in I/O Manager systems that support multiple product families such as SCSI host adapters and SCSI array controllers.

LoadSavedConfiguration= [Yes| No]

This option determines whether the ASPI Manager retains configuration information across I/O Manager invocations. The default value for backward compatibility is *Yes*. When set to **Yes**, the ASPI Manager loads the last known configuration each time the I/O Manager starts. When set to **No**, the ASPI Manager starts with an empty configuration and rediscovers all host adapters and devices.

DiscoveryInterval = n

This option configures the frequency (in seconds) that the discovery phase is run. The default value is *1800* (30 minutes). System design prevents a poll phase or a statistics phase from being active when a discovery phase is activated.

PollInterval = n

This option configures the frequency (in seconds) that the poll phase is run. The default value is *180* (3 minutes). If a poll phase is activated when a discovery phase is active, the poll phase is delayed

until the discovery phase completes. System design prevents a statistics phase from being active when a poll phase is activated.

StatisticsInterval = n

This option configures the frequency (in seconds) that the statistics phase is run. The default value is *10* (10 seconds). If a statistics phase is activated when a discovery phase is active, the statistics phase is delayed until the discovery phase completes. System design prevents a poll phase from being active when a statistics phase is activated. Data collected by the statistics phase is only available from the DMI and SNMP interfaces.

TapeBusyTolerationTime = n

A tape drive may be legitimately busy for extended periods of time (for example, during a retension operation). On some operating systems, the SCSI Manager cannot tell the difference between a tape drive device failure and the legitimate temporary unavailability of a busy tape drive. This option configures the time (in seconds) that a tape drive may be considered legitimately busy. If a tape drive fails to respond for a period of time longer than the TapeBusyTolerationTime, then a device failed trap is generated. The default value is *180* (3 minutes). Setting this parameter to 0 eliminates special handling for tape drives.

Lun0Required = [Yes | No]

This option tells the SCSI Manager whether LUN 0 must be present before LUNs other than 0 will be checked. A setting of Yes requires that LUN 0 be present before non-zero LUNs will be checked. The default value is *No*.

Lun0Only = [Yes | No]

This option tells the SCSI Manager whether or not to check LUNs other than 0. A setting of Yes disables non-zero LUNs. The default value is *No.*

ErrorInstrumentation = [Yes | No]

This option, if Yes, enables the SCSI Manager to collect error-related instrumentation from instrumentation-capable drivers. The default value is *No.* If both this option and the IOInstrumentation option are set to **No**, then the SCSI Manager does not check for instrumentation-capable drivers.

IOInstrumentation = [Yes | No]

This option, if Yes, enables the SCSI Manager to collect I/O-related instrumentation from instrumentation-capable drivers. The default value is *No*. If both this option and the ErrorInstrumentation option are set to **No**, then the SCSI Manager does not check for instrumentation-capable drivers.

ResetInstrumentationOnPowerup = [Yes | No]

This option tells the SCSI Manager whether or not to issue an Instrumentation reset to each instrumentation-capable driver when the SCSI Manager initializes. The default value is *Yes,* which enables instrumentation resets. If both the ErrorInstrumentation and the IOInstrumentation options are set to **No,** this option has no effect.

ResetInstrumentationOnDiscovery = [Yes | No]

This option tells the SCSI Manager whether or not to issue an instrumentation reset to each instrumentation capable driver when that driver is newly discovered. The default value is *Yes*, which enables Instrumentation Resets. If both the ErrorInstrumentation and the IOInstrumentation options are set to **No**, this option has no effect.

SMARTPolling = [Yes | No]

This option tells the SCSI Manager whether or not to verify that SCSI devices support SMART (Self Monitoring, Analysis, and Reporting Technology) and if so, to monitor them for SMART events. The default value is *Yes*, which enables SMART support.

SMARTTest = [Yes | No | testcount]

This option tells the SCSI Manager whether or not to enable the SMART test mode. For debugging purposes, SMART capable devices internally have a test bit which allow them to generate SMART events even when the hardware is not having a problem. The default value is *No***,** which does not enable any SMART debug events. Choosing **Yes** turns the SMART debug bit on for all SMART capable devices and leaves it on. Providing a count instead of *Yes* turns the SMART debug bit on until the number of test count debug events are seen; then the SMART debug bit is turned back off. More than the requested count of debug events may be generated before the software can turn all debug events off. This option has no effect if SMART is set to **No.**

ForceHAWide16 = [Yes | No]
ForceHAWide32 = [Yes | No]

These two options are used to override the information obtained from the operating system driver about whether host adapters support Wide SCSI. These switches are especially useful with older drivers that do not report to SCSI Manager whether a host adapter supports Wide SCSI. The default value for both switches is *No*, which forces SCSI to rely on operating system driver information. If ForceHAWide16 is set to **Yes, t**hen all host adapters are assumed to support at least 16-bit Wide SCSI. If ForceHAWide32 is set to **Yes,** then all host adapters are assumed to support at least 32-bit Wide SCSI.

If an operating system driver reports that a host adapter supports 32-bit Wide SCSI when ForceHAWide16 is set to **Yes,** then that host adapter is still treated as a 32-bit Wide SCSI device. In other words, these switches may *widen* a host adapter, but they never make it narrower than what the operating system driver reports.

The switch values are only applied when a host adapter is discovered; if a host adapter already exists in the device database, then these switches have no effect on that host adapter or on subsequently added devices. Therefore, the device database should usually be cleared after changing these switches.

> ⚠ **Caution:** Use these switches with care! If they are set incorrectly, and the host adapter is forced wider than it actually is, the system may attempt I/O to a SCSI ID that cannot exist. The results of doing so are unpredictable.

AccessibleDrivers = [* | comma delimited list of driver names]

This option controls which operating system drivers (and therefore which host adapters) are managed by the SCSI Manager. The drivers are identified by the driver name returned when the SCSI Manager performs a host adapter inquiry. The names specified are inclusive, that is, if a driver name does not appear in the list, then the SCSI Manager ignores all host adapters that are accessed through that driver.

The AccessibleDrivers option is especially useful when the I/O Manager includes multiple manager support, for example, simultaneous SCSI host adapters and array controllers. The SCSI Manager can be informed through this option to leave the management of the array controllers to the RAID Manager component of CI/O. The option can also be used to inform the SCSI Manager to ignore any drivers that may cause problems, such as third party device drivers.

The * syntax is used to specify that all host adapters are accessible. If the following line appears in the *.ini* file, then the SCSI Manager will manage all host adapters it discovers:

```
AccessibleDrivers = *
```

The comma-delimited list of driver names specifies, by name, which drivers are managed by the SCSI Manager. The names are treated as prefixes. For example, specifying a name of AIC allows the SCSI Manager to manage all host adapters whose driver names begin with the three-character sequence AIC. Users may specify the name in as many characters as they wish, so the list may specify either a family of drivers or a specific driver. The names specified are not case-sensitive.

The default is to manage all drivers beginning with AIC and AHA (although the driver names vary somewhat from system to system). The default allows popular Adaptec host adapters, such as the AHA-1540 and AHA-2940, to be managed by the SCSI Manager. The default policies equivalent to the *.ini* specification:

```
AccessibleDrivers = AIC, AHA, ADP, ADAPTEC AIC,
ADAPTEC PCI, ADAPTEC AHA, ADPT AIC, ADPT AHA
```

Note that putting an asterisk anywhere in the names makes all the other names meaningless. The following specification causes all drivers to be accessible, not just AIC drivers:

```
AccessibleDrivers = AIC, *
```

Up to 100 drivers may be specified, and the maximum length of the string of driver names is 255 characters. The names specified in the AccessibleDrivers statement may differ on different operating system platforms.

SCSI Array Controller and UDMA Array Controller Settings

I/O Manager options for management of SCSI array controllers and UDMA controllers are configured by certain entries in the standard I/O Manager initialization file (*iomgr.ini*). The *iomgr.ini* file is located in the directory where you installed CI/O.

[ARRAYOPERATIONS]

RecreatePriority=

This variable specifies the priority of the automatic re-create operation. Valid values are *Low, Medium,* or *High*. The default is *Medium*.

VerifyIfDirty=

This variable specifies whether you want to start the verify operation if the array is dirty (meaning that the array was not shut down properly). Valid values are *Yes* or *No*. The default value is *Yes*.

[SYSTEM]

PauseEnabled=

This setting is not supported on UDMA controllers. This variable specifies whether the Pause I/O capability is enabled or disabled. Valid values are *Yes* and *No*. The default value is *Yes*.

ServerLogSizeInMegabytes=

This variable is used to limit the size of the server log database file. The server log database is truncated if it grows beyond the size specified by the parameter. The size can be specified in increments of 1 MB, to a maximum of 10 MB.

StatisticsCollectionInterval=

This setting is not supported on UDMA controllers. This variable specifies the interval at which system statistics are collected, assuming that the driver supports statistics collection. Values must be entered as whole numbers. The default value is *1*.

WarnAfterFirstPFAEvent=

This setting is not supported on UDMA controllers. If set to **Yes**, this variable specifies that if SMART events (PFA) are received from any drive, the first event is reported as a critical event and all events after that are reported as warning events. If set to **No**, all SMART events are reported as critical. The default is *Yes*.

[TASKS]

TestAllSpares=

This variable schedules the test all spares operation. These jobs are not written to the Scheduler Database and are scheduled every time *iomgr.nlm* (NetWare) or *iomgr.exe* (Windows NT) is started.

Valid values are as follows:

■ *Yes,H*

   Starts test every hour on the hour. For example, TestAllSpares=Yes,H

■ *Yes,D,Time*

   Starts test daily at a specified time (military time format). For example, TestAllSpares=Yes,D,11:34. (The default value is to test all spares daily at 2:00 A.M.)

■ *Yes,W,Day of the week,Time*

   Starts test weekly at a specified day and time. Values for the day of the week are: 0=Sun, 1=Mon, 2=Tues., and so on.). For example, TestAllSpares=Yes,W,2,11:34 (starts every week on Tuesday at 11:34 a.m.).

■ *No*

   No tests are scheduled. For example, TestAllSpares=No.

[CAPABILITIES]

EnableRAID5=

This variable enables or disables the option of creating RAID 5 arrays. If it is set to **No**, users cannot create RAID 5 arrays. Valid values are *Yes* and *No*. The default is *Yes*.

EnableRAID10=

This variable enables or disables the option of creating RAID 0/1 arrays. If it is set to **No,** users cannot create RAID 0/1 arrays. Valid values are *Yes* and *No*. The default is *Yes*.

[ENCLOSUREMANAGER]

EnabledEnclosureInterfaces=SAF-TE

This setting is not supported on UDMA controllers. This variable specifies the enclosure management interfaces which are supported by CI/O. Currently only SAF-TE is supported.

SAF-TEPollingPeriodInSeconds=5

This is the polling frequency for SAF-TE in seconds. It is the interval at which the SAF-TE enclosure is polled to check for status of all elements of the enclosure like power supplies, fans, and so on.

B

Managing SAF-TE Enclosures

In This Chapter

Note: SAF-TE enclosures are not supported by UDMA array controllers.

The Adaptec CI/O Management Software provides easy management of SAF-TE enabled enclosures. Enclosures that support SAF-TE provide a standard, non-proprietary way for third-party SCSI host adapters and SCSI array controllers to fully integrate with peripheral packaging that supports status signals such as LEDs, audible alarms, LCDs, hot swapping of hard disks, and monitoring of enclosure components.

The Adaptec CI/O Management Software periodically checks the status of all elements of all SAF-TE enclosures that are connected to SCSI host adapters as well as to SCSI array controllers and generates associated events. These events are listed in the Historic Log window and are reflected in the Adaptec CI/O Management Software GUI.

CI/O also takes the following actions:

■ Reflects the status on the enclosure.

CI/O takes the appropriate action such as changing the state of the LEDs on the enclosure and setting alarms when it detects status conditions such as power supply failure or temperature out of range.

■ Automatically performs rescan or reconstruct operations upon insertion/removal of devices.

Insertion and removal of hard disks from the enclosure is detected. If the removed hard disk is a single hard disk, CI/O automatically starts the rescan operation. If the removed hard disk is an array member, CI/O automatically starts the array reconstruct operation, if applicable, provided there is at least one dedicated spare or pool spare.

Viewing Enclosure Information

To view information about an enclosure

1 In the Adaptec CI/O Management Software window, click the

button to open the Storage Configuration window.

2 Right-click the icon of the enclosure you want to view and select **Information** from the shortcut menu.

The Information dialog box appears.
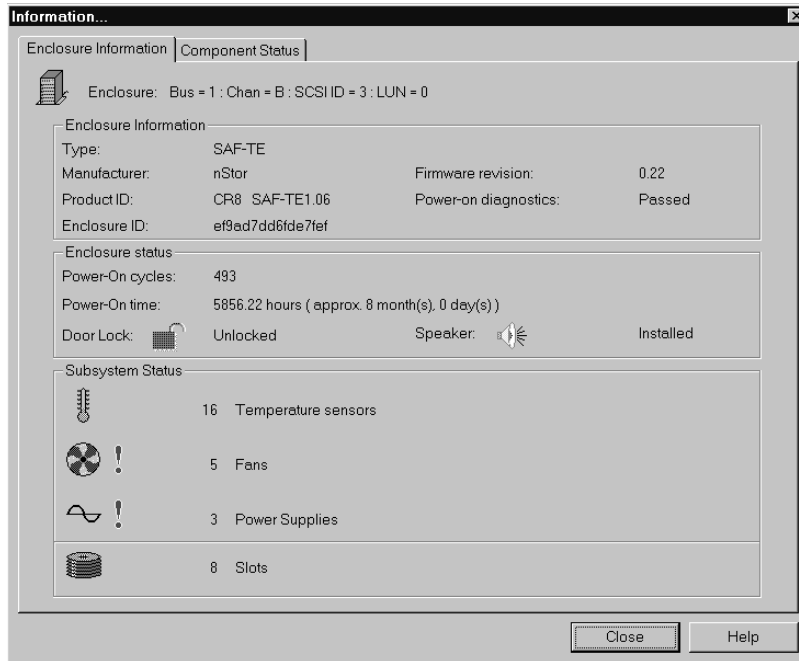
3 Click the Enclosure Information tab.

The following information is displayed within the dialog box. (If an enclosure subsystem component has a problem, the symbol (a red exclamation mark) appears next to the icon of that component.)

- ■ **Enclosure**

  Displays the channel, SCSI ID, and LUN associated with the enclosure.

- ■ **Enclosure Information**

  Displays the type, manufacturer, Product ID, and Enclosure ID of the enclosure.

■ **Enclosure Status**

Displays the following information specific to the selected enclosure:

■ **Power-on Cycles**

Displays the number of times and total cumulative time the enclosure has been powered on.

■ **Power-on Time**

Displays the power-on time in hours, months, and days.

■ **Door Lock**

Displays the door lock status as follows:

 Locked

 Unlocked

 Not installed

 Unknown

■ **Speaker**

Displays the speaker status as off or on.

■ **Alarm**

Displays the alarm status as off or on.

■ **Subsystem Status**

Displays the following information:

■ **Temperature Sensors**

Displays the number of temperature threshold sensors that can report an actual temperature reading and temperature threshold.

■ **Fan**

Displays the number of fans reported by the enclosure.

■ **Power Supplies**

Displays the number of power supplies reported by the enclosure.

■ **Slots**

Displays the number of slots reported by the enclosure.

Viewing Subsystem Status Details

To view detailed information on temperature sensors, fans, or power supplies, click the Component Status tab in the Information dialog box.
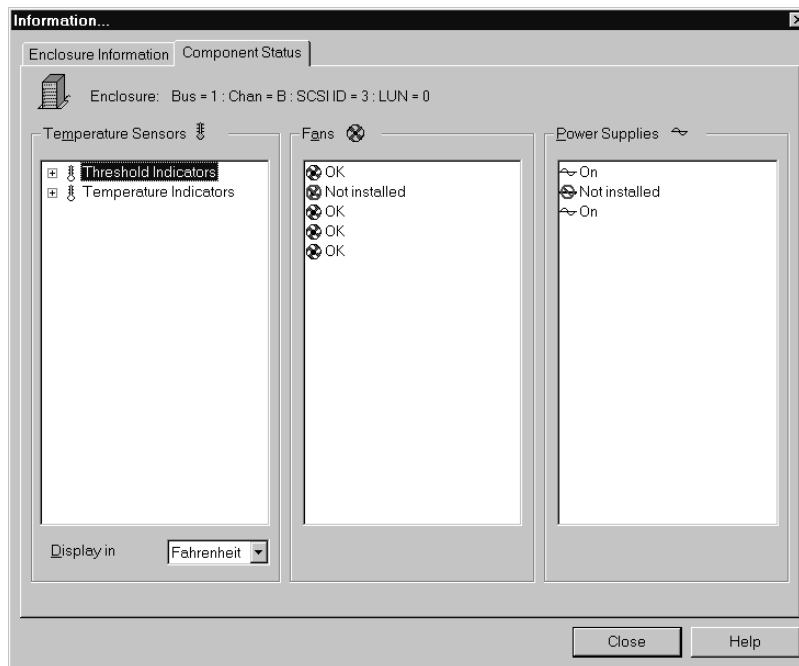
Temperature Sensors

The status of the temperature sensors in the enclosure appears in the Temperature Sensor**s** list. The Adaptec CI/O Management Software supports both threshold indicators and temperature indicators. If the enclosure contains at least one temperature indicator, the actual temperature appears. If the enclosure contains a threshold indicator, Within Range or Out of Range appears for each indicator present. If the temperature is out of normal range, the temperature indicator icon has the ❗ symbol (a red exclamation mark) next to it.

> **Note:** Not all enclosure temperature sensors are supported by Adaptec CI/O Management Software.

Fans

The status of the fans in the enclosure appears in the Fans list as follows:

OK

Malfunctioning

Not installed

Unknown

Power Supplies

The status of the power supplies in the enclosure appears in the Power Supplies list as follows:

On (black icon)

Off (black icon)

Bad state on (red icon)

Bad state off (red icon)

Installed (status not reported)

Not installed

Identification of Events

The Adaptec CI/O Management Software identifies events related to each SAF-TE enclosure. Each enclosure is identified by a unique address (bus/host adapter, channel, SCSI ID, and LUN). This address is specified for all events logged for that particular enclosure to allow easy identification of the enclosure.

Events for SAF-TE Enclosures

The following is a list of events that may be generated for SAF-TE enclosures:

1 Enclosure found [SAF-TE : unique address]

Posted for each found and successfully initialized SAF-TE enclosure, an event identifying the unique address is generated.

2 Enclosure not responding [SAF-TE : unique address]

Posted for each unrecoverable error that occurred when communicating with a SAF-TE enclosure. The Adaptec CI/O Management Software stops polling this device until communication is recovered. On recovery, monitoring of this device starts automatically.

3 Enclosure removed from bus [SAF-TE : unique address]

Posted when an enclosure device is removed from the bus (for example, it was physically removed or power was switched off).

4 Device id=SCSI_ID slot#=slot_ number inserted [SAF-TE : unique address]

Posted when a device is inserted into a SAF-TE enclosure slot. The Adaptec CI/O Management Software automatically performs a rescan on the controller to which the SAF-TE enclosure is attached.

5 Device id=SCSI_ID slot#=slot_number removed [SAF-TE : unique address]

Posted when a device is removed from a SAF-TE enclosure slot. If the removed hard disk is SINGLE, the Adaptec CI/O Management Software automatically performs a rescan. If the removed hard disk is an array member, the Adaptec CI/O Management Software automatically starts a reconstruct, provided there is at least one dedicated or pool spare.

6 For each change in the status of a cooling fan or temperature, the following events indicating the new status may be posted:

■ **Fan #fan_number is malfunctioning [SAF-TE : unique address]**

■ **Fan #fan_number is removed [SAF-TE : unique address]**

■ **Fan #fan_number is in an unknown state [SAF-TE : unique address]**

■ **Temperature is out of normal range, sensor #sensor_number [SAF-TE : unique address]**

■ **Overall Temperature is out of normal range [SAF-TE : unique address]**

The Adaptec CI/O Management Software attempts to spin up all other fans to maximum capacity to avoid possible overheating. As a result of this action, the following two events may be posted:

■ Fans are running at maximum capacity [SAF-TE : unique address]

■ Fan speed increase to maximum capacity has failed [SAF-TE : unique address]

This notification may sometimes be followed by a SCSI error event containing SCSI-specific information. The SCSI error event is posted because the SAF-TE enclosure does not support some of the SAF-TE-interface commands. This situation does not require any intervention by the user.

■ **Fan #fan_number is operational [SAF-TE : unique address]**

■ **Overall temperature is in normal range [SAF-TE : unique address]**

CI/O attempts to slow down cooling fans. As a result of this action, the following two events may be posted:

■ **Fans are running at half capacity [SAF-TE : unique address]**

■ **Fan speed decrease to half capacity has failed [SAF-TE : unique address]**

This notification may sometimes be followed by a SCSI error event containing SCSI-specific information. The SCSI error event is posted because the SAF-TE enclosure does not support some of the SAF-TE-interface commands. This situation does not require any intervention by the user.

7 For each change in the status of the power supplies connected to the enclosure, the following events indicating the new status may be posted:

■ **PowerSupply #power_supply is operational and OFF [SAF-TE unique address]**

■ **PowerSupply #power_supply is operational and ON [SAF-TE unique address]**

■ **PowerSupply #power_supply is malfunctioning and OFF [SAF-TE unique address]**

■ **PowerSupply #power_supply is malfunctioning but ON [SAF-TE unique address]**

■ **PowerSupply #power_supply is present [SAF-TE unique address]**

■ **PowerSupply #power_supply is not present[SAF-TE unique address]**

■ **PowerSupply #power_supply is in unknown state[SAF-TE unique address]**

8 For each change in the status of the door lock of the enclosure, the following events indicating the new status may be posted:

■ **Door is locked [SAF-TE unique address]**

■ **Door is unlocked [SAF-TE unique address]**

■ **Speaker is present [SAF-TE unique address]**

■ **Speaker is not present [SAF-TE unique address]**

9 CI/O sets LED states of devices located inside enclosures in the following cases:

■ **Drive failed**

The failed hard disk is identified.

■ **Predicted fault**

Identifies the hard disk for which a PDF event was received.

■ **Unconfigured drive**

Identifies an unconfigured hard disk.

Events for Devices Connected to Array Controllers

The following events are for devices connected to array controllers only. This information is optional, depending on the enclosure implementation:

1 **Array rebuilding**

All members of an array that is being rebuilt are identified.

2 **Array off-line**

All members of an off-line array are identified.

3 **Critical array**

All members of a critical array are identified.

4 **Array is being verified**

All members of an array that is being verified are identified.

5 **Rebuild failed**

All members of an array for which a rebuild operation failed are identified.

Glossary

A

activity
A scheduled CI/O operation such as reconstruct, verify, or test all spares. Activities appear in the Activity View window.

array
Two or more disks configured to appear as a single disk to the host system.

array controller
The electronic circuitry used to support RAID functionality.

array disk
A hard disk that is a member of an array.

array member
A single hard disk used in an array.

auto-initialize
A command that allows you to create an array and then initialize it immediately or at a later time.

B

blink
A command that blinks the drive lights of all hard disks in a selected array or of a single selected hard disk.

bootable array
An array configured as the boot device.

bus
A set of conductors that connect the functional units in a computer.

C

cache
An intermediate storage area providing faster access for some portion of data.

capacity
The total usable disk space available in an array, in megabytes.

channel
Any path used for the transfer of data and control information between storage devices and a storage controller or I/O adapter.

CI/O

Stands for Comprehensive Input/Output. Refers to the Adaptec CI/O Management Software.

critical array
An array that is still operational, but is no longer maintaining redundant data.

D

dedicated spare
A spare hard disk that automatically replaces a failed hard disk *only* for the array to which it is dedicated.

discovery
The process by which information about a system or subsystem is obtained.

disk
See hard disk.

disk ID
Consists of the bus number, SCSI ID, and LUN, for example, 1:04:0. See also **bus;** LUN; SCSI ID.

drive light
An indicator light on a disk that illuminates during read or write operations.

E

enclosure

A physical housing for hard disks, which can be connected internally or externally to a computer. An enclosure usually contains one or more power supplies, fans, and temperature sensors.

enclosure ID

Consists of the bus number, SCSI ID, and LUN, for example, 1:04:0. See also **bus**; LUN; SCSI ID**.**

enclosure management device

See enclosure.

event

A notification or alert from the system indicating that a change has occurred.

event log

A file used to maintain information about prior controller activities or errors.

event notification

The means used by the system to communicate information about event occurrence.

F

fault tolerance

The ability of a system to keep working in the event of hardware or software faults. Fault tolerance is usually achieved by duplicating key components of the system.

fault-tolerant arrays

Arrays that have duplicate components (RAID 1, RAID 5, and RAID 0/ 1).

first virtual device

A device with virtual device order number 0. This device is the boot device of the system. See also virtual device order.

Force a Spare

A command that forces a spare to replace a specific hard disk in an array.

H

hard disk
A physical hard disk on a SCSI bus.

host adapter
Electronic circuitry that supports I/O to storage devices, but which does not support RAID.

hot-swap
To remove a component from a system and install a new component while the power is on and the system is running.

I

initialized array
An array that is ready for data reads and writes.

L

logical device
A read/write resource, such as an array or spare, that does not exist until configured by CI/O.

Logical Unit Number
See LUN.

look-ahead caching
A type of read caching that involves storing data in memory ahead of that requested in a Read command. This improves performance in application that typically read data in sequential blocks.

low-level format
A low-level format completely cleans any data off the hard disk.

LUN
Stands for Logical Unit Number. The number assigned to a subdevice (logical unit) of a SCSI target. Each SCSI target can contain up to eight subdevices numbered 0 through 7; however, most SCSI devices contain only one subdevice (LUN 0).

M

mirroring; mirrored array
Synonym for RAID 1. Full redundancy is obtained by maintaining identical copies of data on two or more hard disks. Mirroring provides fault tolerance with a minor performance penalty.

monitoring
The process of receiving, displaying, and logging system events.

O

off-line array
An array that is not responding.

P

parity
In RAID, a form of redundancy used to recreate the data of a failed hard disk in a disk array. Used in RAID levels 2, 3, 4 and 5.

password time-out options
Options that allow you to control the way in which users are prompted to enter the system's CI/O password when they issue commands to change a server's array configuration.

pause I/O
The temporary suspension of input/output on a channel.

physical resources
The AAC Family Adapter products, channels, and SCSI and UDMA devices installed in the server.

physical view
A view showing physical devices such as hard disks, CD-ROM drives, and array enclosures.

poll
A validation of discovery information.

pool of spares
See spare pool.

R

RAID

Acronym for Redundant Array of Independent (Inexpensive) Disks. Coined in 1987 by researchers at the University of California at Berkeley to describe a set of disk array architectures that provide fault tolerance and improved performance.

RAID 0

An array where data is distributed, or striped, across the disks in the array.

RAID 0/1 (mirrored)

An array that uses from two to eight pairs of disks. Both disks in each pair contain the same data.

RAID 1 (mirrored)

An array that uses a single pair of disks. Both disks in the pair contain the same data.

RAID 5

An array that contains redundant information in the form of parity data. The parity data is distributed across all the disks in the array and occupies the equivalent capacity of about one disk. User data is interspersed with this parity data.

reconstruction

The regeneration and writing onto one or more replacement hard disks of all the data from a failed hard disk in a redundant RAID array. Reconstruction is usually performed in the background while applications are accessing data in the array.

redundancy

Maintaining duplicates for any given component in a system so the system can automatically replace a failed component with a working substitute. A parity RAID array's members are redundant since surviving members may collectively replace the data from a failed hard disk.

Rescan

The process of updating the current screen to show all resources.

S

SAF-TE

Stands for SCSI Accessed Fault-Tolerant Enclosure. See enclosure.

SCSI
Stands for Small Computer System Interface. A parallel interface standard used to connect various types of peripheral device (such as disk drives) to computers. Although SCSI is an ANSI standard, it exists in several variations.

SCSI array
A group of hard disks connected to the same SCSI array controller and accessed as a single storage unit. It is not apparent to users that an array is actually more than one disk drive.

SCSI array controller
The electronic circuitry used to control a SCSI array.

SCSI Device ID
See SCSI ID.

SCSI ID
The number assigned to each SCSI device attached to a SCSI bus. *See also* bus; disk ID.

server
A computer set up to provide services used by other computers in a network environment. Typical servers handle disk storage, e-mail, or database functions.

SMART
Stands for Self-Monitoring Analysis and Reporting Technology. Hard disks that support this technology continually analyze their performance and generate an alert if they determine that the hard disk is likely to fail in the next few hours.

spare
A disk drive that is assigned to one or more arrays and kept in reserve in case of drive failure. A spare automatically replaces a failed drive in an array.

spare pool
A pool of multiple hard disks that automatically replace failed hard disks on *any* suitable array on the controller.

stand-alone hard disk
A hard disk that is *not* part of an array.

stripe size
The size that is used to stripe data or parity information across the disks in the array.

striping, disk; striped array
Spreading data over multiple disks to enhance performance. Often referred to as RAID 0, simple data striping provides no redundancy scheme and is not technically a standardized RAID level.

subsystem
The collection of software and hardware that controls storage to be managed and monitored.

system
Used generically to refer to a server, a networked client, or a stand-alone workstation.

T

target ID
See SCSI ID; UDMA ID.

U

UDMA
Stands for Ultra Direct Memory Access. The protocol for the interface between a hard disk and the computer that allows the hard disk to bypass the CPU and directly access the system memory. Also known as ATA/ATAPI-4, Ultra-ATA, and Ultra-DMA/32.

UDMA array
A group of hard disks connected to the same UDMA controller and accessed as a single storage unit. It is not apparent to users that an array is actually more than one disk drive.

UDMA array controller
The electronic circuitry used to control a UDMA array.

UDMA ID

An identifying number assigned to each drive connected to a UDMA controller.

V

verify
The process of checking the integrity of redundant data stored on fault-tolerant arrays.

virtual device
Arrays and spares that do not exist until they are configured on the server with CI/O.

virtual device order
The sequence in which the server's operating system detects the arrays, single hard disks, and other devices connected to the AAC controller when the server boots.

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