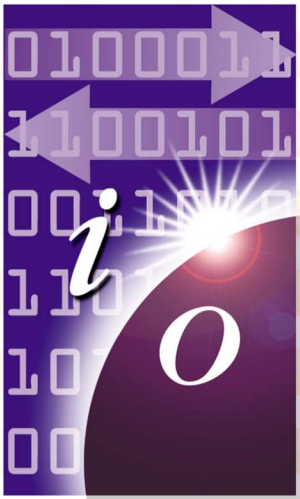
Global Array Manager™ Client Software for Mylex PCI Disk Array Controllers

Installation Guide and User Manual

for Software Kit 5



SA67-0049-01

Global Array Manager™ Client Software for Mylex PCI Disk Array Controllers

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for Software Kit 5

Form Number SA67-0049-01

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About This Manual

This installation guide covers the steps involved to install and use the client component of Mylex's Global Array Manager® with Mylex PCI Disk Array Controllers for Software Kit 5.

For information on installing and running the *server* component of Global Array Manager, consult the *Global Array Manager Server Software Installation Guide and User Manual* for Software Kit 5.

Conventions

Throughout the manual, the following conventions are used to describe user interaction with the product:

`bold`	The user must enter the bold text exactly as shown
↵	Press the Enter key, or
Enter	Press the key labeled "Enter" (or "Delete", etc.)
File->Run	Select the Run option from the pull-down menu activated when the File menu pad is selected

☛ **Note**

Supplementary information that can have an effect on system performance.

⚠ ***Caution***

Notification that a proscribed action has the *potential* to adversely affect equipment operation, system performance, or data integrity.

STOP **WARNING**

Notification that a proscribed action will *definitely* result in equipment damage, data loss, or personal injury.

Contents

Chapter 1
Introduction

Overview

Global Array Manager® (GAM) Client software manages the AcceleRAID and eXtremeRAID families of PCI RAID controllers. This manual provides information on GAM Client for Software Kit 5. Software Kit 5 supports new server features for the following controllers:

- eXtremeRAID 2000/3000
- AcceleRAID 352/170/160

If you are using Mylex controllers that are not listed above, refer to the Global Array Manager Client Installation and User Manual for Software Kit 4.

GAM Client software is used to:

- Monitor and manage virtually unlimited numbers of server and disk array groups:
- Monitor, manage, maintain, and configure Mylex Disk Array Controllers and the physical and logical drives that are connected to these controllers, even across remote servers.
- Monitor and manage SCSI Host Bus Adapters and the physical devices that are connected to these adapters, even across remote servers.

Global Array Manager Components

Global Array Manager has two components:

- Global Array Manager Server component (which is part of the Mylex Disk Array Controller Software Kit 5)
- Global Array Manager Client component

Each component handles specific tasks based upon the selected function.

Configuration Functions

Configuration functions are easily performed using RAID Assist™, an intuitive, wizard-like utility in the GAM Client component that simplifies the process of setting up or reconfiguring a disk array. Just answer a few brief questions, and RAID Assist automatically does the rest. Use Manual Configuration for more control over drive group setup or individual configuration parameters.

Monitoring Functions

The Global Array Manager Server component collects and disseminates information on disk array or HBA subsystem status and resource utilization. The Global Array Manager Client component organizes this information through an intuitive graphical display. Errors and events are recorded in a log file and in the Log Information Viewer window, and if a problem is serious enough to warrant immediate attention, operators can be alerted via popup windows, pagers, fax, or email if so desired.

Maintenance Functions

The Global Array Manager Client manages or performs maintenance on individual disk arrays and drives (with the appropriate authentication), again by means of the graphical user interface. This includes removing physical devices from operation in a functioning disk array (also known as “killing” or off-lining a drive), rebuilding drives, selecting hot spares, and initiating a consistency (or parity) check on arrays that are configured to support redundancy. The Global Array Manager Server executes the management instructions specified by the Global Array Manager Client.

Requirements

Since Global Array Manager is a *client/server* application, the GAM Server software component provided in the Mylex Disk Array Controller Software Kit must be installed in one or more file servers in order for the GAM Client software component to operate. Hardware and software requirements for installation and operation of the GAM Server component are described for each supported network operating system in the *Global Array Manager Server Software Installation Guide and User Manual*.

Client Hardware and Software

- PC-compatible computer with an 80486 or higher class processor and at least 4 MB of system memory (Pentium® processor and 16 MB of system memory are recommended)
- Network interface card connected to a functioning network
- Appropriate network device drivers for the installed network interface card
- For proper client component connectivity, installed and functioning GAM Server software component *on the server*, under any of the supported operating systems
- CD-ROM drive for CD-ROM installation, or 3 1/2-inch disk drive for diskette installation
- Fixed disk with at least 8 MB available free space (16 MB recommended)
- Mouse or other pointing device
- A minimum display screen setting of 800 x 600 is recommended. However, we recommend setting the display at 1024 x 768 for optimum GAM client viewing.
- Component installation and operation: Linux, Microsoft® Windows® XP 32-bit and 64-bit, Windows 2000, Windows NT® 4.0, Windows 95, Windows 98, or Microsoft Me™ installed on a local hard disk
- TCP/IP stack installed

Optional

- Modem or Fax/Modem (Hayes-compatible)
- MAPI- or SMTP-compliant messaging such as Microsoft Outlook™ (Required for Windows)
- Microsoft Exchange®, and Microsoft At Work® (Windows 95) for fax notification of events

Refer to your server documentation and to the Windows documentation for more information on hardware and operating system requirements.

Chapter 2
Installation

Installation Overview

Installation of the Global Array Manager Client component requires one of the following operating systems:

- Windows XP 32-bit or 64-bit
- Linux (using Wine)
- Windows NT 4.0
- Windows 2000
- Windows 98
- Windows Me

This chapter assumes that the network administrator for this site will be performing these installation procedures.

If you are installing GAM Client, you may also choose to install GAM Server and its subcomponents at the same time on the same system. When installing GAM Server, dialog boxes for the server component appear and require a computer restart before launching the GAM Client software. Refer to the *Global Array Manager Server Software Installation Guide and User Manual* for GAM Server installation instructions.

Installation of Global Array Manager Client

Global Array Manager software is shipped on an accompanying distribution CD-ROM. The file list (and path) is as follows (where X: represents the drive letter of your CD-ROM drive):

X:\GAM\WINNT\ (X:\GAM\WIN2K\ or X:\GAM\WIN64\)

```
_INST32I.EX_        DATA.TAG        SETUP.EXE
_ISDEL.EXE          DATA1.CAB       SETUP.INI
_SETUP.DLL          DATA1.HDR       SETUP.INS
_SYS1.CAB           LANG.DAT        SETUP.LID
_SYS1.HDR           LAYOUT.BIN
_USER1.CAB          OS.DAT
_USER1.HDR
```

Installing Global Array Manager Client Software

1. If you intend to install GAM Server with GAM Client, make sure TCP/IP is installed and functioning properly.
2. Insert the distribution CD-ROM into your CD-ROM drive.

   AutoRun will cause the CD-ROM to display the Mylex RAID Management Software Installation menu (Figure 2-1).

Figure 2-1. Mylex RAID Management Software Installation Menu

3. Click the option called “Install Global Array Manager.” This option is used to install GAM Server and GAM Client.

Global Array Manager Setup will load the installation wizard.

4. After a few moments, the Welcome dialog box will display (Figure 2-2). Click Next to proceed with the installation, or click Cancel to end the installation procedure and return to the menu.

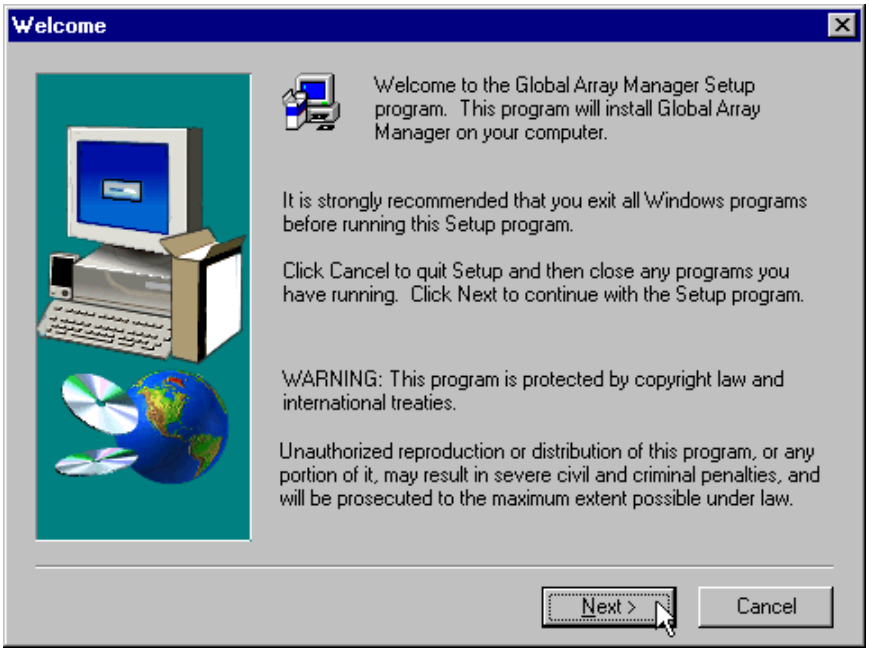


Figure 2-2. Welcome Dialog Box

5. When the IBM Software License Agreement screen displays, click Yes to accept the terms of the agreement and continue.

   If you click No, you will not be allowed to continue GAM Client installation.

The Select Components dialog box is displayed as shown in Figure 2-3. At this point you will select the component(s) you wish to install.

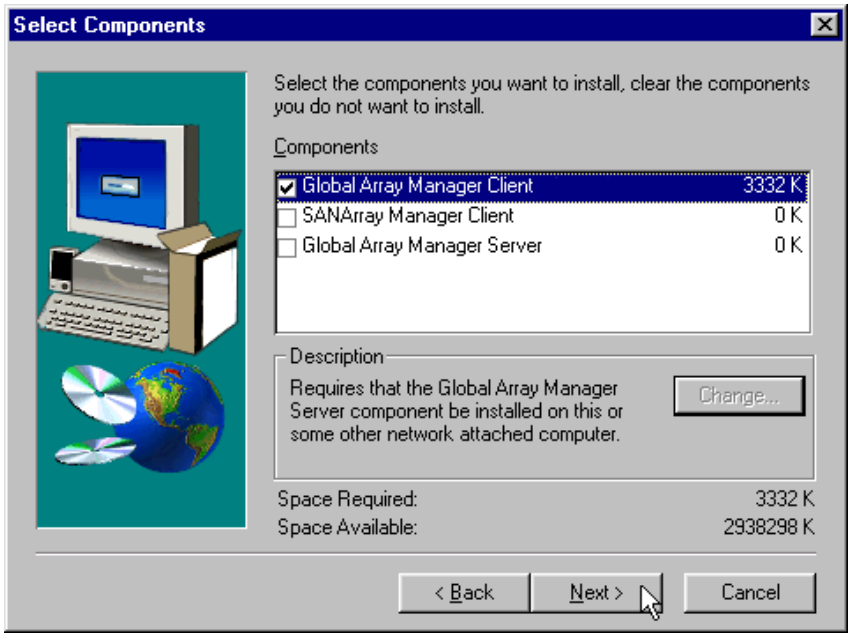


Figure 2-3. Select Components to Install

6. To select Global Array Manager Client for installation, click the box (if necessary) to check the Global Array Manager Client option.

> ☛ **Note**
>
> If installing the Global Array Manager Client, you may also choose to install Global Array Manager Server at this time. Instructions for GAM Server installation are described in the *Global Array Manager Server Software Installation Guide and User Manual*.

7. Click Next and follow the on-screen prompts.

Installing Global Array Manager Client with Linux

Installing the Global Array Manager Client on a Linux operating system requires the use of Wine™. Wine is a program that ports the GAM Client onto Linux. It is highly recommended that you use the Wine version from the specified web site. This version of Wine has been tested with GAM Client and we do not guarantee that our product supports other versions.

Install Wine

Go to the following web site to download Wine:

http://www.rpmfind.net

Refer to the following web sites for further information on Wine.

http://www.winehq.com

http://www.codeweavers.com

Install GAM Client

Global Array Manager software is shipped on an accompanying distribution CD-ROM. The file path is as follows (where x: represents the current version number.):

\GAM\Linux\gam-client-x.xx-xx.i386.rpm

Install GAM Client on Linux:

rpm -ivh gam-5.00-xxxxxxxx.i386.rpm

GAM will be installed under /opt/gam

To run GAM Client see“Starting Global Array Manager” on page 3-1. Further information is available in README.TXT file in the distribution CD-ROM

To Uninstall GAM Client Software

1. Query the installed GAM Client software:

   rpm -qa | grep gam

2. Uninstall GAM Client software:

   rpm -e gam-5.00-xxxxxxxx

Chapter 3
Startup & Navigation

Starting Global Array Manager

Starting the Global Array Manager Client requires both the Server and Client components. It is required that you install and start GAM Server *before* you attempt to run the Global Array Manager Client.

Server Component

Installation and startup of the Global Array Manager Server component is covered in the *Global Array Manager Server Software Installation Guide and User Manual*. The software for GAM Server is provided on the installation CD-ROM.

Refer to the appropriate sections in the above-mentioned manual for instructions on starting the Global Array Manager Server component under any of the supported network operating systems.

Client Component

Under Windows XP 32-bit and 64-bit, Windows Me, Windows 2000, Windows NT 4.0, Windows 98 or Linux, you are ready to start the Global Array Manager Client once you have installed the client on your workstation (see “Installation” on page 2-1).

To start GAM Client:

- Under Windows XP 32-bit and 64-bit, Windows Me, Windows 2000, Windows NT 4.0, or Windows 98, start the GAM Client software by selecting
  Start->Programs->Mylex Global Array Manager Client.
- Under Linux, type **gam**.

If at least one server group and file server are defined, the opening screen appears. If not, the Define Server Groups dialog box appears (see “Setting Up Server Groups and Servers” on page 3-17).

> ☛ **Note**
>
> In order for event notification to occur, the Global Array Manager Server and Global Array Manager Client must be running at all times.

Navigating Global Array Manager Client

This section describes the navigating features and options that GAM provides.

Button Controls

Dialog boxes throughout the Global Array Manager Client have a series of control buttons. Some examples of these include:

Click this button to apply the settings made in the dialog box.

Click this button to cancel the settings made in the dialog box.

Click this button to confirm the action identified in the dialog box.

Click this button to cancel the action identified in the dialog box.

Click this button to close the active dialog box.

Click this button to apply your configuration changes.

Components of the GAM Client Opening Screen

Upon startup (with defined servers), Global Array Manager Client displays the opening screen, consisting of the Global Array Manager window, the Global Status View window, and the Log Information Viewer (Figure 3-1).

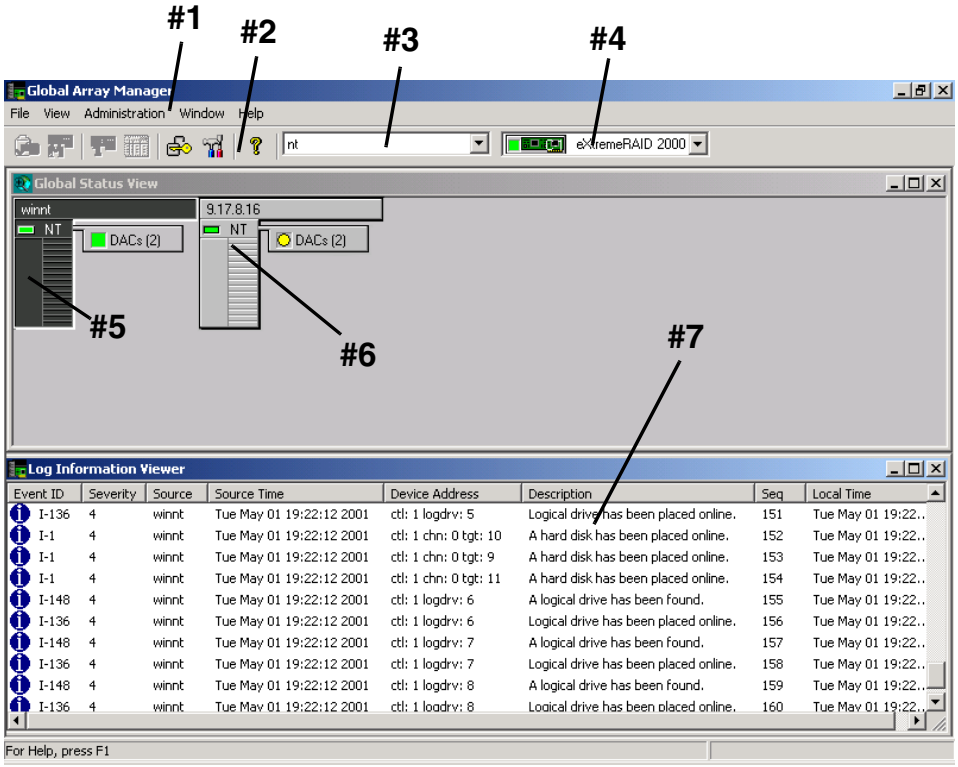


Figure 3-1. Opening GAM Screen

Components of the GAM Client Windows

The major components of the GAM Client windows (Figure 3-1) are described below.

1. Item **#1** is the *menu bar.* There are five menus with several selections each. The contents of the menus and the functionality of several of the most important selections will be described throughout this guide.
2. Item **#2** is the *toolbar.* There are seven toolbar icons representing eight of the most useful functions available in GAM Client. The identity of each toolbar icon and an explanation of the purpose of each will be described in later sections of this chapter.
3. Item **#3** is the *server selection box*. When selected, the box displays the

names of each server group that is in contact with the current client workstation. Each group may consist of multiple servers. You may select a specific server group to view, or select “All Servers” if you want to view all the servers that are connected to this workstation.

4. Item **#4** is the *controller selection box*. When selected, the box displays the controller ID (C-0, C-1, etc.) and controller type (BT-952, eXtremeRAID 2000, etc.) of each SCSI HBA and PCI/SCSI connected to the currently-selected server.

Components of the Global Status View Window

The major components of the Global Status View window (Figure 3-1) are described below:

5. Item **#5** is an icon that represents the *currently-selected file server* running the GAM Server component. The icon identifies:
   - the IP address (e.g. 10.17.3.172) or name (e.g. ide40) of the server
   - the network operating system running on the server (e.g. 2000 = Windows 2000; NT = Windows NT; NW = Novell NetWare, etc.)
   - the operational status of the server (green = functioning, yellow = attempting connection, red ‘X’ = unable to connect)
   - the number of DAC (PCI/SCSI) controllers and/or SCSI HBA controllers connected on the server, with a controller operational status light (green = functioning, yellow = critical, red ‘X’ = down or nonfunctional)
6. Item **#6** is an icon that represents a currently *unselected file server* running the GAM Server component. The icon identifies the same information described above.

Components of the Log Information Viewer

7. Item **#7** in Figure 3-1 is the GAM Client *Log Information Viewer*. Each line in the Log Information Viewer identifies a single *event* (error, status, warning, etc.) which was noted during monitoring by a file server running GAM Server, and was transmitted by that server to this client workstation. Relevant details accompany the event:
   - **Event ID**. Displays an icon showing whether the event is informational, cautionary, a warning, etc., plus the identification number assigned to this event.

- **Severity**. The severity level of this event.
- **Source**. The IP address or name of the file server that is the sender (source) of this event.
- **Source Time**. Day of the week, month, day of the month, time of day, and year at the source file server's location when this event occurred.
- **Device Address**. Relevant channel/target or other data pertaining to the source of this event.
- **Description**. Text of the message describing what occurred.
- **Sequence (Seq)**. Number representing where this event fell in a stream of events from the same source.
- **Local Time**. Day of the week, month, day of the month, time of day, and year at the *local client workstation's location* when this event arrived.

Components of the Controller View Window

Open the Controller View window by double-clicking any server icon in the Global Status View, or as shown in Figure 3-2:

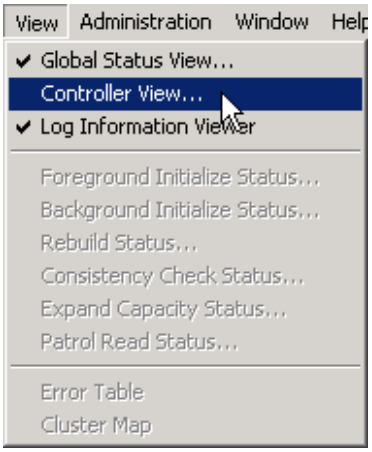


Figure 3-2. Select "Controller View"

The Controller View window (Figure 3-3), displays the following information about the controller currently selected in the *controller selection box*:

- Item **#1:** The number of channels on this controller, each channel depicted as a tower.

- Item **#2:** The physical devices present on each channel, specifying the target ID, capacity of the device, device type, and device status. See “Physical Device and Logical Drive Monitoring” on page 5-6 for more information.
- Item **#3:** The logical drives configured on the controller, specifying the logical drive number, capacity of the logical drive, configured RAID level, and logical drive status.
- Item **#4:** The enclosure device present on each channel, specifying the device inquiry data (vendor, bus width, etc...), and the device state.
- Item **#5:** The host device present on each channel, specifying the device inquiry data (vendor, bus width, etc...), and the device state.

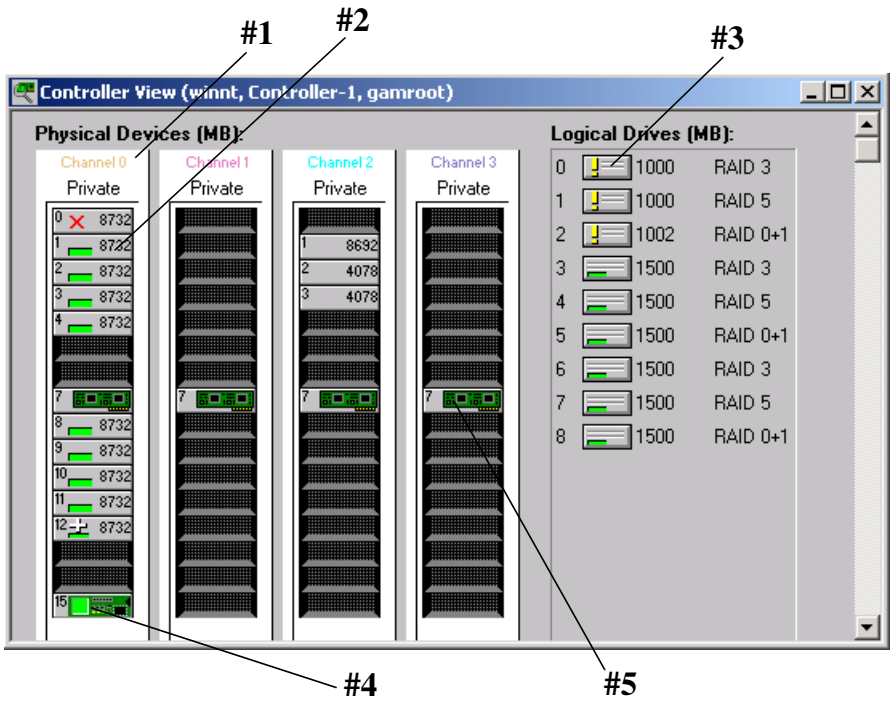


Figure 3-3. Controller View Window – “Non-Fibre” RAID Controller

eXtremeRAID 3000

The Controller View window for the eXtremeRAID 3000 (Figure 3-4), displays the same information as described in the previous section. However, it is organized graphically to allow many more targets to be shown in each of the fibre channels, and the Controller View *is scrollable*.

The number of targets per column can be set in the GAM2CL.INI file.

Channel 0 represents the internal SCSI channel.

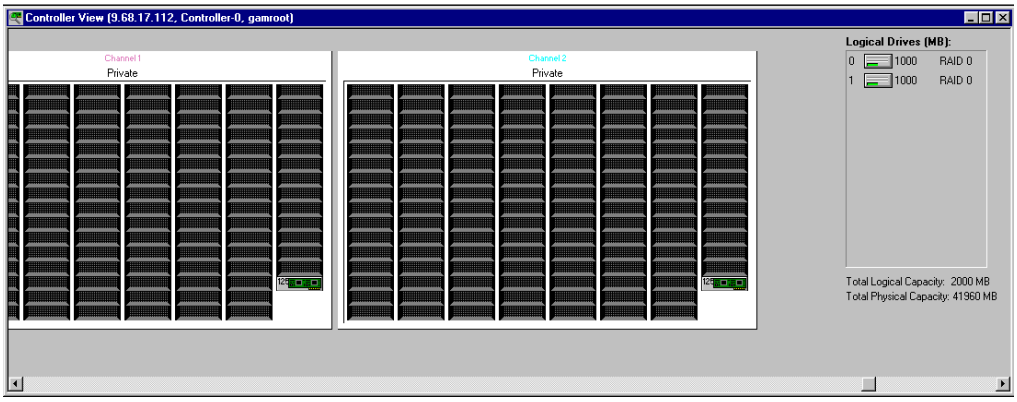


Figure 3-4. Controller View Window – eXtremeRAID 3000 Controller

Status Icons

The following icons display the status of logical and physical devices in the Controller View Window:

Physical Device Offline State

Physical Device Online State (configured)

Physical Device Rebuild State

Physical Device Unconfigured

Spare Physical Device

Logical Drive Critical State


Logical Drive Consistency Check State


Logical Drive Online State (configured)


Logical Drive Offline State

Menu Bar and Menus

GAM Client contains a menubar (Figure 3-5) in the Global Array Manager window.

Figure 3-5. Menu Bar

File Menu

The File menu (Figure 3-6) contains the following options:

- **Open Configuration (Ctrl+O)**: Loads a configuration from disk and saves it to the controller. (See “Setting Up Server Groups and Servers” on page 3-17.)
- **Save Configuration (Ctrl+S)**: Saves a configuration file to a new filename, disk, and/or directory.
- **Clear Configuration**: Removes configuration information from the selected array on the selected controller.

  ⚠ Caution

  Although there are confirmation checkpoints and warnings following selection of this option, remember that all existing configuration and file data (on all drives connected to the array) will be deleted.

- **Exit**: Exits the GAM Client.

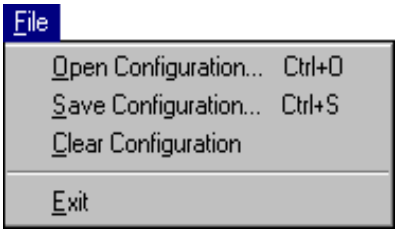


Figure 3-6. File Menu

View Menu

The View menu (Figure 3-7) contains the following options:

- **Global Status View**: Toggles the Global Status View window. The Global Status View window opens by default when Global Array Manager Client starts.
- **Controller View**: Toggles the Controller View window showing channel/ID/target information and physical device/logical drive configurations for the controller selected in the controller selection box.
- **Log Information Viewer**: Toggles the Log Information Viewer, a window showing a log of recent system error and status event messages. The Log Information Viewer opens by default when Global Array Manager Client starts.
- **Foreground Initialization Status**: Displays the progress (percent complete) of an ongoing full foreground initialization of one or more drives.

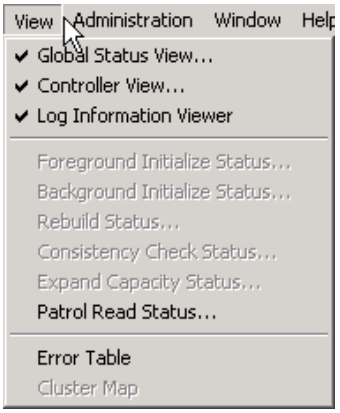


Figure 3-7. View Menu

- **Background Initialization Status**: Displays the progress (percent complete) of an ongoing full background initialization of one or more drives.
- **Rebuild Status**: Displays the progress (percent complete) of an ongoing device rebuild.

- **Consistency Check Status**: Displays the progress (percent complete) of an ongoing logical drive consistency check.
- **Expand Capacity Status**: Displays the progress (percent complete) of an ongoing data restriping process across the target RAID group.
- **Patrol Read Status**: Enables GAM Client to poll every 1 minute to get new status data from the controller.
- **Error Table**: Displays a table of bad block and "request sense" data generated as a result of finding areas of damage or data unavailability on a storage device. Data for all storage devices on the selected controller are presented in the same tables.
- **Cluster Map**: Displays a graphical back end cable connection for the controller selected from the cluster controller list.

Administration Menu

The Administration menu (Figure 3-8) contains the following options:

- **Sign On**: Enables use of GAM's configuration and administration functions to "Administrators" ("gamroot" + password). Enables only monitoring functions to "Users."
- **Define Server Groups**: Sets up server groups and individual server names or IP addresses within each group.
- **Select Current Server Group (Ctrl+G)**: Displays the current contents of the server selection box located in the Global Array Manager window. Functions in the same way as directly selecting the server selection box.
- **Select Current Controller (Ctrl+C)**: Displays the current contents of the controller selection box located in the Global Array Manager window. Functions in the same way as directly selecting the controller selection box.
- **RAID Assist**: Mylex's built-in RAID Controller configuration utility. Facilitates configuration tasks using either one-step "automatic" configuration, a configuration "wizard" assistant, or a manual (advanced level) configuration option allowing more control over configuration parameters.

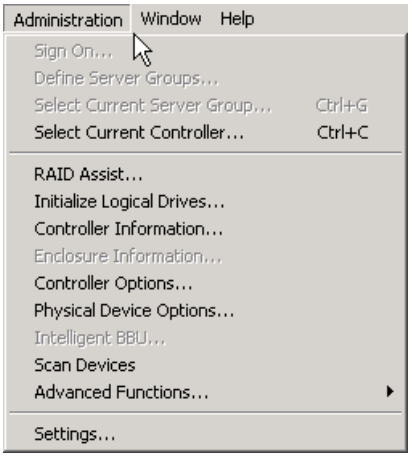


Figure 3-8. Administration Menu

- **Initialize Logical Drives**: Offers the ability to run a full initialization of logical drives at a time of your choice, not just immediately following a new configuration. If it's inconvenient to follow a configuration immediately with a logical drive initialization, you can decline the initialization and use this menu item to start the process at a later time.

  ⚠ ***Caution***

  If you perform an initialization on a logical drive(s) that you are currently using for data storage, you will lose the data stored on the drive(s).

- **Controller Information**: Displays key information about the currently-selected controller.
- **Enclosure Information**: Displays information and status about components in the external disk enclosure.
- **Controller Options**: Sets various parameters for the selected Disk Array Controller or SCSI HBA. Unlike Controller Information, user definable controller parameters are modified in Controller Options.
- **Physical Device Options**: Displays a list of all physical devices connected on the currently-selected controller and allows the user to change transfer speed, transfer width, and/or tag value for individual devices.

- **Intelligent BBU**: *(Only enabled if the selected controller has an Intelligent Battery Backup Unit installed.)* Displays a dialog box from which you can do the following:
  - Monitor the power remaining in the Intelligent BBU.
  - Request reconditioning of the Intelligent BBU (for eXtremeRAID 2000 and eXtremeRAID 3000).
  - Set the low power threshold.

  The Intelligent BBU's features and functionality are described in detail elsewhere. GAM simply offers a way of keeping up-to-date as to the condition and charge in the battery.
- **Scan Devices**: Scans for new devices that have recently been added and which are not currently identified within GAM Client.
- **Advanced Functions**: Opens a submenu (Figure 3-9) from which you can select the following options:
  - **Flash Utility**: Provides the ability to upgrade controller firmware, BIOS, boot block, or BIOS configuration utility as new maintenance releases become available.
  - **PATHpilot**: Starts the PATHpilot Information Control Console (PIC) as a separate application. See "Clustering & Teaming" on page 4-38 for more information.

Figure 3-9. Advanced Functions Submenu

- **Settings**: Opens a tabbed dialog box in which you can specify the Alert/Alarm, Communication, and Event Editor settings that you desire. Examples of such settings include type of alarm, such as pager, fax, email, etc., modem baud rate, COM port, stop bits, data bits, parity, event severity level, event message editing, and so on.

Window Menu

The Window menu (Figure 3-10) is a standard feature of Windows XP 32-bit and 64-bit, Windows Me, Windows 95/98, Windows 2000, and Windows NT. It is implemented as such in GAM.

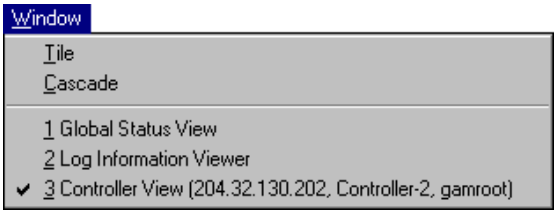


Figure 3-10. Window Menu

Help Menu

The Help menu (Figure 3-11) identifies the on-line help options available within the Global Array Manager Client.

- **Contents (F1)**: Displays a list of available help topics.
- **About Global Array Manager**: Displays the Windows standard "About" box.

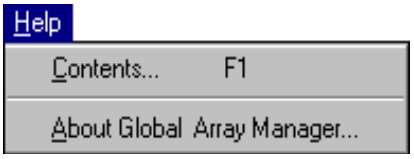


Figure 3-11. Help Menu

Toolbar and Toolbar Icons

GAM Client contains a toolbar (Figure 3-12) in the Global Array Manager window.

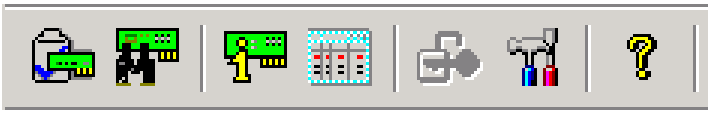


Figure 3-12. Toolbar

Each toolbar button corresponds to a function available from the menu bar.

Disk Configuration Wizard: Brings up the RAID Assist dialog box for RAID controller configuration.

Scan Devices: Scans for new, recently added devices which are not yet identified within GAM.

Displays Controller Information: Displays key information about the currently-selected RAID Controller or HBA.

Error Table: Displays a table of “request sense” data.

Sign-On: Enables configuration and administration functions to Administrators and monitoring functions to “Users.”

Settings for Events: Opens a dialog box for specifying the Alert/Alarm, Communication, and Event Editor settings that you desire.

Help Contents: Displays the on-line help contents page.

Exiting Global Array Manager

Exit Global Array Manager Client as shown in Figure 3-13:

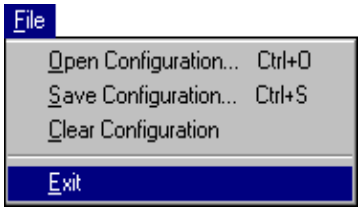


Figure 3-13. Select "Exit"

☛ **Note**

We recommend leaving the GAM Client running as long as there are servers you wish to monitor or configure. If you do exit, you will be unable to receive events from GAM Server and you will not be informed of errors or status unless you restart GAM Client and reconnect to the server(s).

Exiting GAM Server

Refer to the GAM Server manual for Software Kit 5 for details on how to exit GAM Server.

Setting Up Server Groups and Servers

Adding a Server Group to the Server Group List

Open Define Server Groups as shown in Figure 3-14. (This is not necessary if you are starting GAM and no Server Groups are defined. The Define Server Groups dialog box will display automatically.)

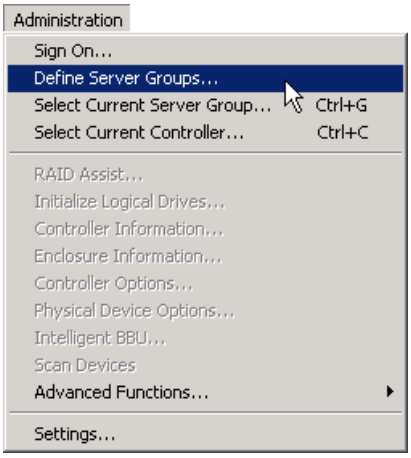


Figure 3-14. Select "Define Server Groups"

In the Define Server Groups dialog box (Figure 3-15), do the following:

1. Click the Add button under the Server Groups section of the dialog box.

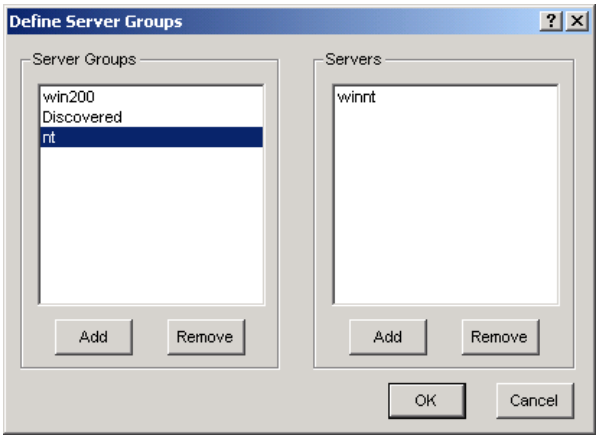


Figure 3-15. Define Server Groups Dialog Box

2. In the Adding Item dialog box, type the name of the server group that you are adding.
3. Click OK. The Define Server Groups dialog box will reappear with the newly-defined server group added.

> ☛ **Note**
>
> The Discovered group contains a list of all server hosts that are sending events to the client.

Adding a Server to the Server Groups List

With the Define Server Groups dialog box open (Figure 3-15), do the following:

1. Click the Add button under the Servers section of the dialog box.
2. In the Adding Item dialog box, type the IP address of the server that you are adding. If you're running GAM Client under Windows XP 32-bit and 64-bit, Windows 2000, Windows NT or Linux, you may instead type the *name* of the server.
3. Click OK. The Define Server Groups dialog box will reappear with the newly-defined server added.
4. To add more servers to the group, repeat steps 1 through 3.
5. Click OK in the Define Server Groups dialog box when you are finished.

After adding servers, Global Array Manager returns to the Global Status window.

> ☛ **Note**
>
> Select "All Servers" to see all servers in the Global Status view.

Signing On to a Server

This section describes the different server access levels and the methods of signing onto the Global Array Manager Client.

Security Access Levels

The ability to perform certain actions within the GAM Client depends on your security access level. There are three levels of security access, Guest (no sign-on), User, and Administrator.

> ☛ **Note**
>
> Do not confuse GAM's Administrator access level with the Windows' log on name "Administrator," they are not the same. The password "gamroot" is required to be established as a user on the server host. It is recommended that the "gamroot" user be established with Windows' "Administrator" privileges or Linux's root privileges. The "gamroot" account must be password protected and the password must be managed in a security conscious manner. GAM relies on the server host's operating system security measures. Therefore, proper handling of the "gamroot" password is critical to the protection of user data on the controller.

Guest

Guest access level is achieved by not signing on to a server host. Guests can monitor the Log Information Viewer and the Global Status View. Guests cannot view or make changes to any controller parameters or configurations.

User

User access level is achieved by signing on to a server host using a username that is not "gamroot," but one that the administrator of that server assigns. Users have all the capabilities of Guests. Users can also view the detailed status of a controller by activating the Controller View, Controller Information and Enclosure Information. Users cannot view or make changes to any controller parameters or configurations.

Administrator

Administrator access level is achieved by signing on to a server host using the username “gamroot”; use of a password is highly recommended. Administrators have the capabilities of Guests and Users plus the full privilege to view and change the status and settings of the selected controller and other internal GAM settings.

Signing On

To gain access to capabilities beyond Guest access level, you must sign on to a server host.

Double-click a host icon in the Global Status View (Controller View must be closed first).

- The Sign On dialog opens if you have never signed on during this session or if you did not check the Sign On dialog’s Remember password box on the previous sign on (see Figure 3-16).
- If you have previously signed on and did check the Remember password box then the previously entered username and password will automatically be used for this new sign on.

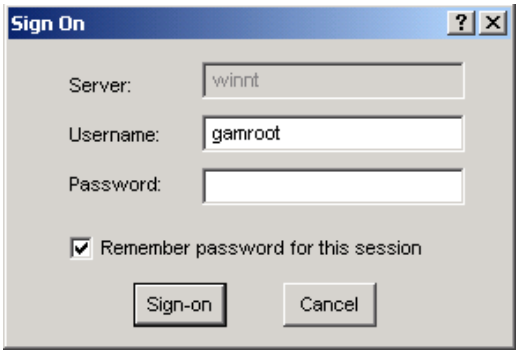


Figure 3-16. Sign On Dialog Box

If the sign on fails, the Sign On dialog will open to allow adjustment of the username and/or password or you may open Sign On at any time as shown in Figure 3-17.

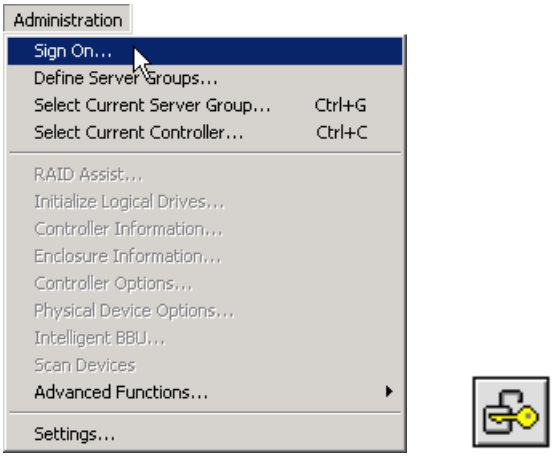


Figure 3-17. Select "Sign On"

GAM's internal operation during Sign On is to:

1. Encrypt the username and password and send them to the GAM Server running on the selected server host.
2. The GAM Server receives and decrypts the username and password and makes an operating system specific call to validate them per the server host's operating system's user accounts.
3. After the username and password are validated by the operating system the username is compared to the string "gamroot". If the username matches, sign on is granted Administrator access level.
4. The GAM Server notifies GAM Client of the success or failure of the sign on attempt and whether or not that sign on attempt has been granted Administrator access level.

Do the following to sign on to a server:

1. Type a username and password of your choice that are previously enabled on the server host.

   This will provide access privileges appropriate for the username.
2. Check the box labeled "Remember password for this session" if you want GAM to refrain from Sign On messages each time you select a server during this session which uses the same password. This amounts to an automatic sign-on to additional servers and should be used with caution.

Uncheck the box if you want to retain the option of signing on to each server you wish to access individually.

3. Click the Sign-On button (see Figure 3-16).

Setting and Modifying User Preferences

Open Settings by clicking **Administration->Settings** on the menu bar or the Preferences icon as shown in Figure 3-18.

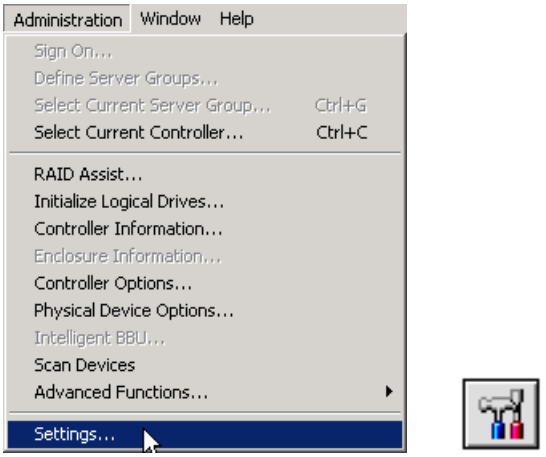


Figure 3-18. Select "Settings"

Alert Preferences

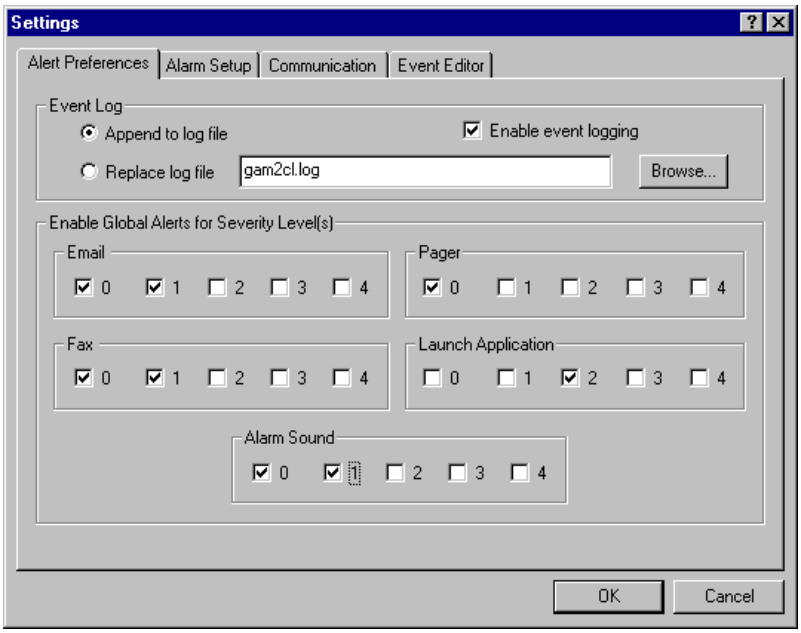


Figure 3-19. Settings Dialog Box – Alert Preferences

In the Settings dialog box, under the Alert Preferences tab (Figure 3-19), you have several options:

Event Log

- Append events to your current log file, or
- Replace the log file (overwrite it)
- Rename the log file
- Enable or disable the event logging function

Enable Global Alerts for Severity Level(s)

- For each type of alarm (Email, Pager, Fax, Launch Application, and Alarm Sound) check the box(es) corresponding to the event severity level(s) for which you would like to enable this type of alarm globally.

  For example, in Figure 3-19, all Level 0 and Level 1 messages/events will result in an alarm sound locally, and email, page (Level 0 only), and fax to those individuals identified in Alarm Setup.

Events are numbered from 0 for most severe to 4 for least severe, and can be edited by the user.

Finish by doing one of the following:

- Click OK to accept the global alert settings and exit the Settings dialog box, or
- Click Cancel to leave original settings unchanged, or
- Click another Settings tab to set additional user preferences.

Alarm Setup

The top half of the Alarm Setup dialog box lists the types of alarms that can be used (Pager, Fax, Email, Launch Application). The lower half of the Alarm Setup dialog box lists the currently defined destinations/recipients/ applications for the alarm type selected in the upper window (Figure 3-20).

Note

Email requires MAPI- or SMTP-compliant messaging (e.g. Microsoft Outlook), as well as Microsoft Exchange.

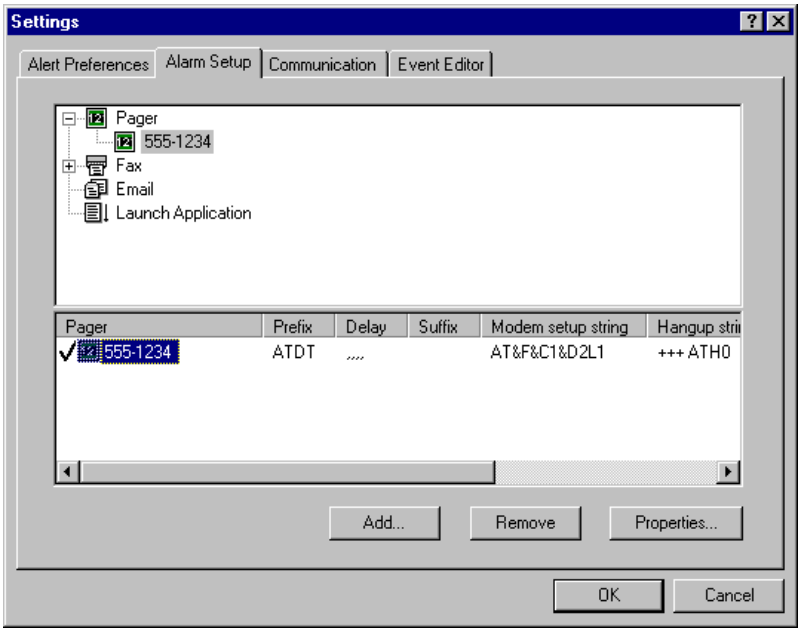


Figure 3-20. Settings Dialog Box – Alarm Setup

Add a Pager

1. Select the Pager alarm type in the upper window.
2. Click Add.

   The Pager setup box is displayed as shown in Figure 3-21.

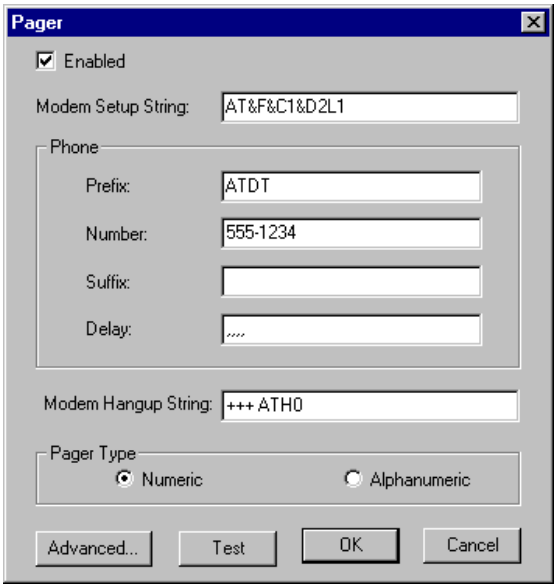


Figure 3-21. Pager Setup Dialog Box

3. In the Pager box:
   - Enable or disable this Pager entry using the Enabled check box.
   - Type the Modem Setup String, or keep the default.
   - Type a Pager Prefix, or keep the default.
   - Type the phone number of someone who will receive a page.
   - Type a Pager Suffix if needed.
   - Type a Pager Delay interval. The value of each comma is 1 second.
   - Type the Modem Hang-up String, or keep the default.

   ☛ **Note**

   Please consult your modem manufacturer or modem documentation for the specific strings which work best with your modem.

- Select the appropriate button for a Numeric or Alphanumeric pager.

4. If you need to enter a Message Prefix, Suffix, or Delay interval, click Advanced. Type the desired information and click OK to return to the Pager setup box.
5. To test the pager using the settings you've input, click Test.
6. When you are satisfied with the Pager you've set up, click OK.

   Your new Pager entry appears in the lower window of the Alarm Setup dialog box. (Refer to Figure 3-20 for an example.)

Remove a Pager

1. Select the Pager alarm type in the upper window of Alarm Setup.
2. Select the Pager entry to remove in the lower window of Alarm Setup.
3. Click Remove.

   A confirmation message is displayed as shown in Figure 3-22.

Figure 3-22. Remove Pager Entry Message

4. Click Yes to remove the Pager entry, or click No to keep the entry.

Add a Fax Using Windows

For fax notification Microsoft Exchange and Microsoft At Work Fax software must be installed on your system. GAM supports only Microsoft At Work Fax under Windows 95. The Software field is not selectable.

The required fax software components should already be available as part of the normal Windows installation.

To add a fax, follow these steps.

1. Select the Fax alarm type in the upper window of the Alarm Setup dialog box (Figure 3-23).

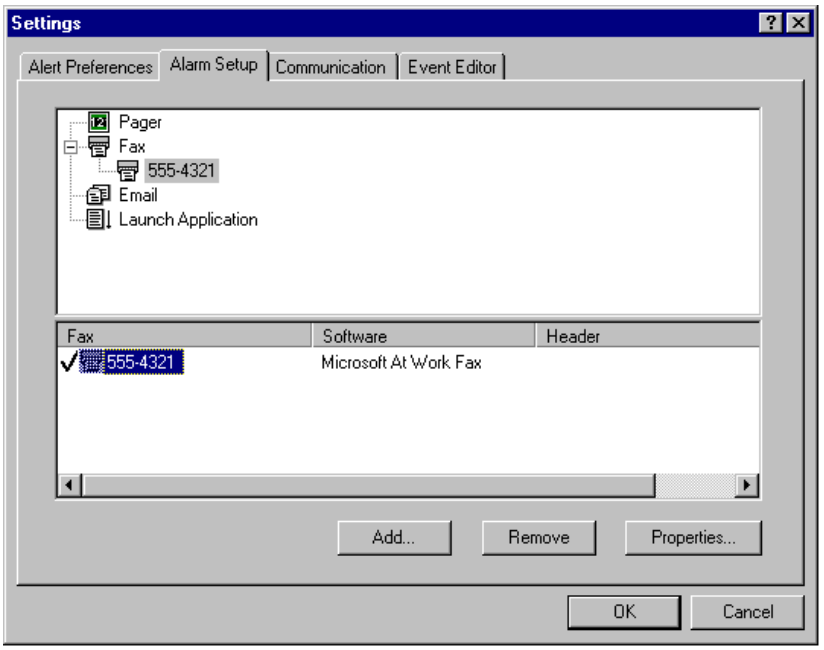


Figure 3-23. Fax Alarm Setup

2. Click Add.

The Fax setup box is displayed as shown in Figure 3-24.

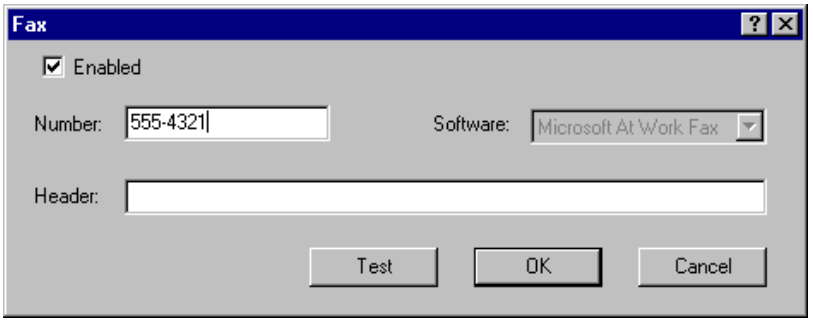


Figure 3-24. Fax Setup Dialog Box

3. In the Fax box:
   - Enable or disable this Fax entry using the Enabled check box.
   - Type the fax phone number of someone who will receive a fax.
   - Type a fax header, if desired.
4. To test the fax using the settings you have input, click Test.
5. When you are satisfied with the Fax you have set up, click OK.

   Your new Fax entry appears in the lower window of the Alarm Setup dialog box. (Refer to Figure 3-23 for an example.)

Remove a Fax

1. Select the Fax alarm type in the upper window of Alarm Setup.
2. Select the Fax entry to remove in the lower window of Alarm Setup.
3. Click Remove.
4. At the confirmation message, click Yes to remove the Fax entry, or click No to keep the entry.

Add a Fax Using Linux

When using Linux, the behavior of the Fax Alert function is defined in gam2cl.ini file as follows, which is located under "~User/.gam/".

> ☛ **Note**
>
> If you are using a fax utility program other than "fax," you may need to modify the FAXUSERSCRIPT accordingly.

[COMM_SECTION]

...

FAXUSERSCRIPT=/usr/bin/fax DEV=ttyS0 NAME=%H send %N %M

...

where,

%H is replaced with header string

%N is replaced with phone number to dial

%M is replaced with message file name

Add an Email Using Windows

1. Select the Email alarm type in the upper window of the Alarm Setup dialog box (Figure 3-25).

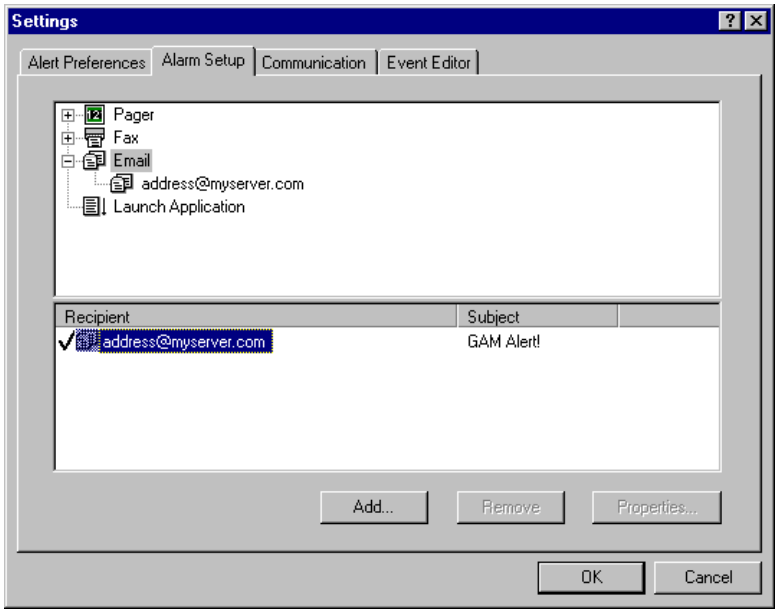


Figure 3-25. Email Alarm Setup

2. Click Add.

   The Email setup box is displayed as shown in Figure 3-26.

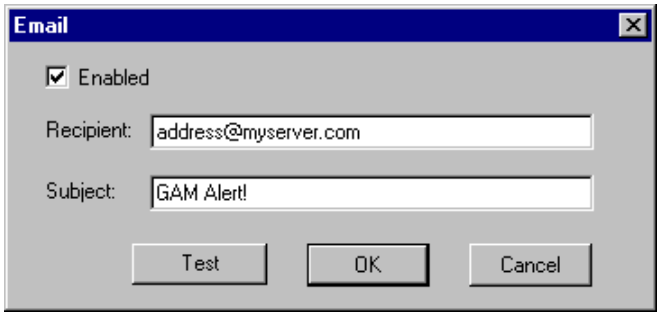


Figure 3-26. Email Setup Dialog Box

3. In the Email box:
   - Enable or disable this Email entry using the Enabled check box.
   - Type the email address of someone who will receive an email.
   - Type the subject of the email.

4. To test the email using the settings you've input, click Test.
5. When you are satisfied with the Email you've set up, click OK.

   Your new Email entry appears in the lower window of the Alarm Setup dialog box. (Refer to Figure 3-25 for an example.)

Remove Email

1. Select the Email alarm type in the upper window of Alarm Setup.
2. Select the Email entry to remove in the lower window of Alarm Setup.
3. Click Remove.
4. At the confirmation message, click Yes to remove the Email entry, or click No to keep the entry.

Add an Email Using Linux

When using Linux, the behavior of the E-mail Alert function is defined in gam2cl.ini file as follows, which is located under "~User/.gam/".

[COMM_SECTION]

...

EMAILUSERSCRIPT=/usr/bin/mail -s "%S" %R < %M

...

where,

%S is replaced with subject string

%R is replaced with recipients

%M is replaced with message file name

Add an Application to Launch

1. Select the Launch Application alarm type in the upper window of the Alarm Setup dialog box (Figure 3-27).

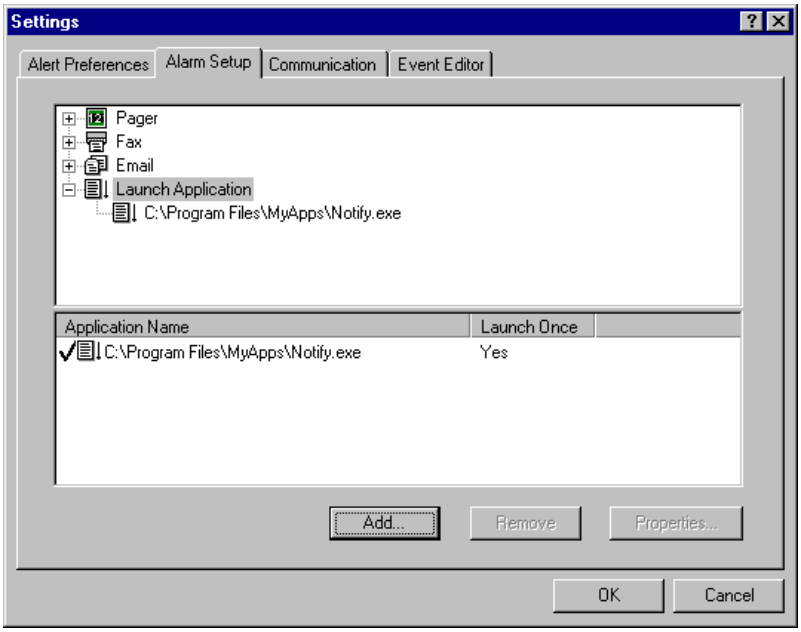


Figure 3-27. Launch Application Alarm Setup

2. Click Add.

   The Launch Application setup box is displayed as shown in Figure 3-28.

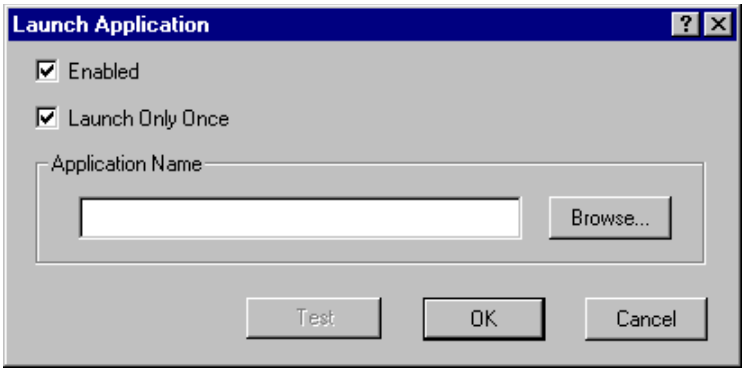


Figure 3-28. Launch Application Setup Dialog Box

3. In the Launch Application box:
   - Enable or disable this Application entry using the Enabled check box.
   - Enable Launch Only Once if you want to prevent the application from launching again if GAM detects that it is already running.
   - Type the name of an application to launch should certain events or messages require it. If you are using Linux, you need to type the full location path beginning with a slash (/).
   - If you don't remember the name or path of the application, click the Browse button.
4. To test the application launch using the settings you've input, click Test.
5. When you are satisfied with the application you've set up, click OK.

   Your new application entry appears in the lower window of the Alarm Setup dialog box (refer back to Figure 3-27 for an example.)

Remove an Application to Launch

1. Select the Launch Application alarm type in the upper window of Alarm Setup.
2. Select the Launch Application entry to remove in the lower window of Alarm Setup.
3. Click Remove.

4. At the confirmation message, click Yes to remove the application entry, or click No to keep the entry.

Properties

For any of the four alarm types (Pager, Fax, Email, Application), you may view a particular entry's settings by selecting an entry in the lower window of Alarm Setup and clicking Properties.

Communication

In the Settings dialog box, under the Communication tab (Figure 3-29), you have the option to change any of the following:

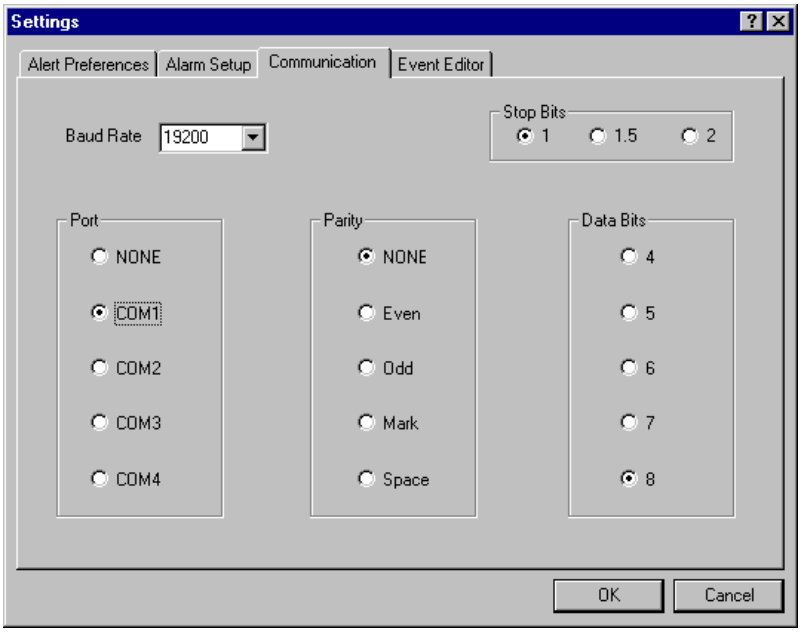


Figure 3-29. Settings Dialog Box – Communication

Baud Rate

Select the baud rate appropriate to your communication hardware.

Port

Select the COM port at which your communication hardware resides.

Parity

Select the type of parity for communication sessions: None, Even, Odd, Mark, Space.

Stop Bits

Select the number of stop bits required for communication sessions: 1, 1.5, 2.

Data Bits

Select the number of data bits required for communication sessions: 4, 5, 6, 7, 8.

Finish by doing one of the following:

- Click OK to accept the communication settings and exit the Settings dialog box, or
- Click Cancel to leave original settings unchanged, or
- Click another Settings tab to set additional user preferences.

Event Editor

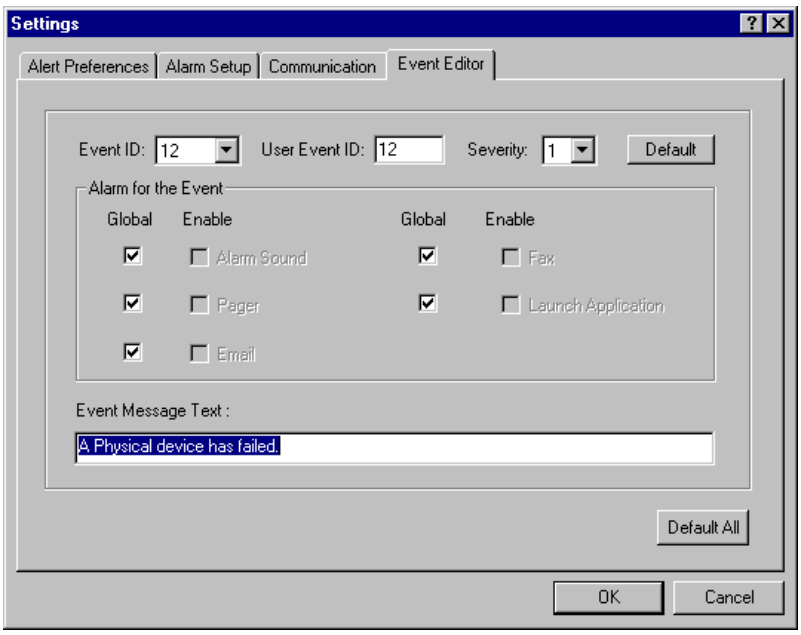


Figure 3-30. Settings Dialog Box – Event Editor

In the Settings dialog box, under the Event Editor tab (Figure 3-30), you have several options.

Event ID/User Event ID/Severity/Default

1. Select an Event ID to edit from the Event ID list box.
2. Type your own number for this event in the User Event ID list box, or keep the default (equal to the Event ID number).
3. Type your own event severity level in the Severity list box, or keep the default (set by IBM).
4. Click the Default button to return all settings for this particular event to their defaults.

Alarm for the Event

When all Global boxes are checked, you can view the alarms that will activate when this particular event occurs (these are based on the settings in Alert Preferences). Check or uncheck specific boxes if you wish to override these defaults and change the alarms for this event.

Event Message Text

Type new text for this event, or keep the default text (set by IBM).

After modifying the event definitions, a data file called “gam2cl.gef” will automatically be generated. This file will then be read at each GAM startup and a dialog box will be displayed (Figure 3-31).

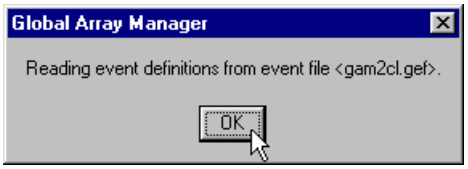


Figure 3-31. gam2cl.gef dialog box

The dialog box message indicates that the file defines all events even for new releases of GAM that may have added new events. However, the new events will not be seen until the gam2cl.gef file is deleted and GAM client is restarted.

Default All

Click the Default All button to reset all events of all severity levels back to their defaults.

Finish by doing one of the following:

- Click OK to accept the event settings and exit the Settings dialog box, or
- Click Cancel to leave original settings unchanged, or
- Click another Settings tab to set additional user preferences.

For More Information...

This concludes the Startup & Navigation chapter. For additional information on Global Array Manager options and functionality, refer to other chapters in this installation guide, and to the context-sensitive online help file available from the Help menu, by pressing **F1**, or by right-mouse-clicking an item on which you require help.

Chapter 4
Configuration

Introduction

Configuration activities involve the following:

- Setting or modifying controller options to suit your application needs
- Modifying physical device options for data transfer or tag value
- Creating, modifying, or deleting Mylex RAID Controller configurations
- Loading a configuration from disk and saving it to the controller

Setting and Modifying Controller Options

Open Controller Options as shown in Figure 4-1.

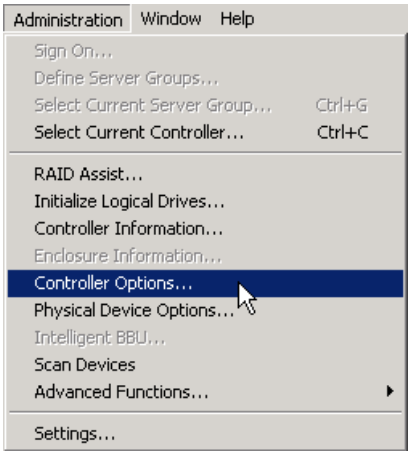


Figure 4-1. Select "Controller Options"

To configure options for a controller, complete the following property pages.

Controller Options

To configure Controller Options, follow these steps:

1. Select the Controller Options tab (Figure 4-2).

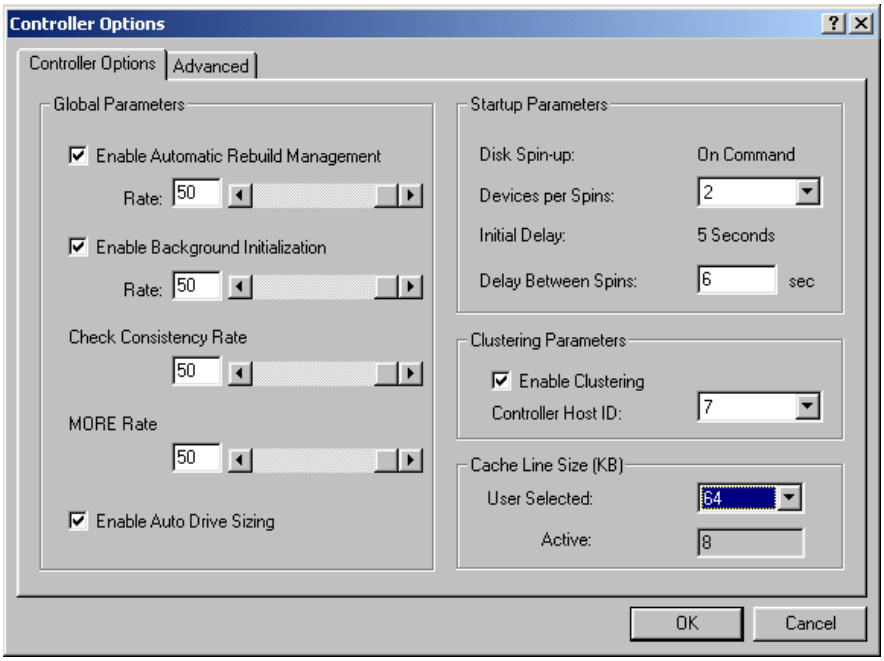


Figure 4-2. Controller Options Dialog Box for new PCI DAC

2. Enable or disable (by checking or unchecking) any of the following global parameters:

   - **Automatic Rebuild Management**. Works in conjunction with SAF-TE disk array enclosures to detect removal of a failed drive and perform an automatic rebuild after installation of a replacement drive. Change the default Rate Controls to less than or equal to 50. Do this by using the slide bar or typing the rate in the edit box. A rate of 50 dedicates the maximum allowable resources to a rebuild allowing it to proceed at its fastest.
   - **Background Initialization**. Allows logical drive initialization to take place “behind the scenes” so that the logical drive is immediately available for use. If you disable this option, logical drives will need to complete their initialization process before they can be used. Change the default Rate Controls to less than or equal to 50. Do this by using the slide bar or typing the rate in the edit box. A rate of 50 dedicates the maximum allowable resources to an initialization allowing it to proceed at its fastest.

- **Consistency Check Rate**. Change the default Rate Controls to less than or equal to 50. Do this by using the slide bar or typing the rate in the edit box. A rate of 50 dedicates the maximum allowable resources to a Consistency Check allowing it to proceed at its fastest. Lowering the number devotes more resources to I/Os and consequently slows the Consistency Check process.
- **MORE Rate**. Change the default Rate Controls to less than or equal to 50. Do this by using the slide bar or typing the rate in the edit box. A rate of 50 dedicates the maximum allowable resources to an array expansion or other MORE operation allowing it to proceed at its fastest. Lowering the number devotes more resources to I/Os and consequently slows any MORE process.
- **Auto Drive Sizing**. Allows the software to set similar drive sizes (e.g. 4.0 GB, 4.1 GB, 4.2 GB) to a common size automatically without the need to edit the mylexdrv.siz file. This leads to smoother operation by allowing drives of similar sizes to be treated as identical sizes for hot spares, replacement drives, and within arrays. If you disable this option, the software will read and use the current contents of mylexdrv.siz.

Change some of the following Startup Parameters:

- **Disk Spin-up**. On Command drive spin-up only.
- **Devices Between Spins**. Number of devices to spin up at one time. A low number lessens the likelihood of a power drain.
- **Initial Delay**. Number of seconds between physical device start-ups.
- **Delay Between Spins**. Number of seconds between consecutive device spin-up cycles.

Clustering. Under Windows XP 32-bit and 64-bit, Windows 2000 or Windows NT 4.0, allows redundancy among controllers in various servers. If a controller or server fails, another controller can take over the disk drives and disk arrays that were formerly handled by the failed controller. This mechanism imparts a “fault tolerance” among controllers and servers.

Change the following Clustering Parameter:

Controller Host ID. Change if you want to set this controller’s target ID to something other than 7.

Cache Line Size. The cache line size represents the size of the data in controller memory that will be read or written at one time.

Change the following cache line size parameters:

- **User Selected**. Select the 64KB cache line size if all of your logical drives have a stripe size greater than 64KB. If not, select the 8KB cache line size. If you try and select a 64KB cache line size and GAM detects one or more logical drives with a stripe size less than 64KB, a message box will open with the message "*64KB Cache Line Size will be used only when all logical drives use 64KB or greater Stripe Size*."
- **Active**. Displays the cache line size that the controller is currently using. Read-Only field.

Click the OK button to accept the changes, or the Cancel button to discard them.

Advanced Controller Options

To configure Advanced Controller Options, follow these steps:

1. Select the Advanced Controller Options tab (Figure 4-3).

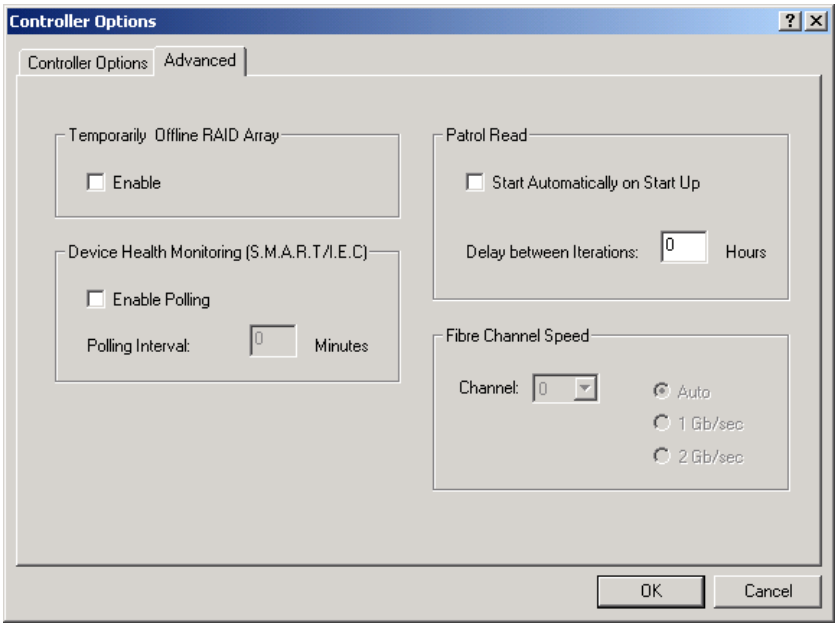


Figure 4-3. Advanced Controller Options Dialog Box for new PCI DAC

Enable or disable (by checking or unchecking) the following parameters:

- **Temporarily Offline RAID Array**. Prevents a second physical drive associated with a currently critical system drive from being permanently marked offline. The disk drive is marked temporarily unavailable or dead.
- **Device Health Monitoring (S.M.A.R.T)**. S.M.A.R.T. (Self-Monitoring Analysis and Reporting Technology) will monitor the condition of drives and global and dedicated hot spare drives that are part of a RAID configuration group.

  You can set the Polling Interval from 0–255 minutes, where 0 means that S.M.A.R.T. mode 6 is disabled.
- **Patrol Read**. Starts the Patrol Read operation automatically on power up. Patrol Read will periodically verify all sectors, including system reserved area in the RAID configured drives. It works for all RAID levels and standby drives. The patrol read is initiated only when the controller is idle for a defined period and has no other background activities.

  Once enabled, Patrol Read assumes that all configured system drives will undergo patrol read sequentially. When all configured drives are "patrolled," it will repeat the operation over and over again.

  You can set the Patrol Read Iterations from four hours to 1016 hours in multiples of four hours.
- **Fibre Channel Speed**. Manages three speeds of the fibre channel.
  Auto - Sets an Auto Negotiate speed for the host port(s) selected.
  1 Gb - Sets a 1 Gigabits/second speed for the host port(s) selected.
  2 Gb - Sets a 2 Gigabits/second speed for the host port(s) selected.

Click the OK button to accept the changes, or the Cancel button to discard them.

SCSI Host Bus Adapters

In the Controller Options dialog box (Figure 4-4), you have several options.

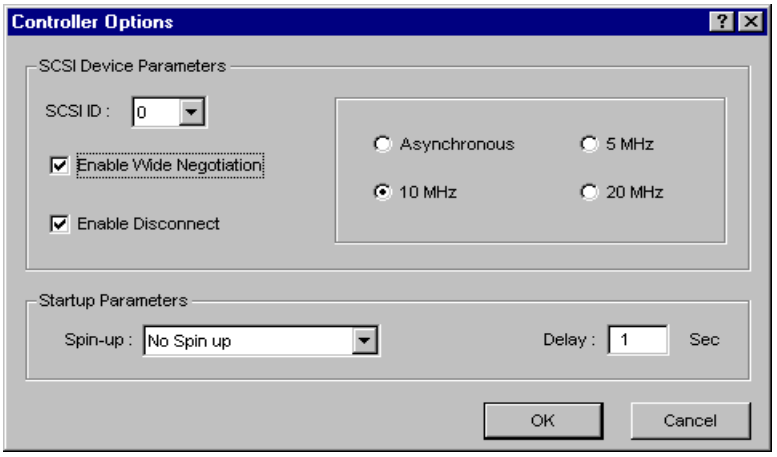


Figure 4-4. Controller Options Dialog Box for SCSI HBA

Enable or disable (by checking or unchecking) the following SCSI Device Parameters:

- **Wide Negotiation**. Allows the controller to negotiate at wide data transfer rates.
- **Disconnect**. Allows the target to disconnect from the initiator.

Change the **SCSI ID** of this HBA.

Change either of the following Startup Parameters:

- **Spin-up**. No Spin up or Controller spin up.
- **Delay**. Number of seconds before physical device startup.

Change the following SCSI Device Parameter:

- Maximum data transfer rate of the disk side channels. Speeds are **Asynchronous**, **5 MHz**, **10 MHz**, and **20 MHz**.

Click the OK button to accept the changes or the Cancel button to discard them.

Modifying Physical Device Options

Open Physical Device Options as shown in Figure 4-5:

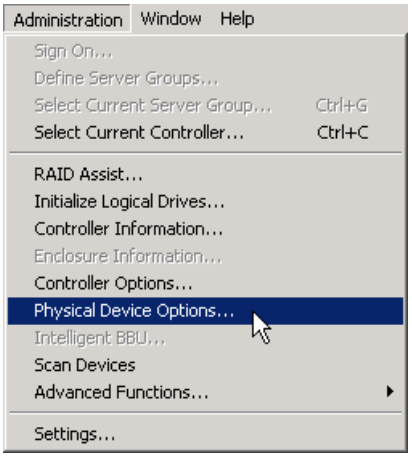


Figure 4-5. Select "Physical Device Options"

The Physical Device Options dialog box (Figure 4-6) displays and allows you to change certain physical device transfer options.

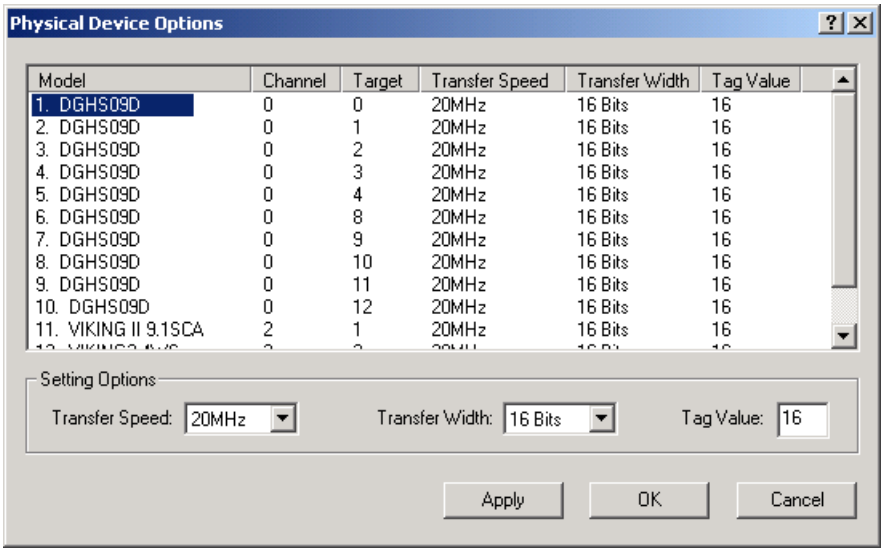


Figure 4-6. Physical Device options Dialog Box

A list of physical devices connected to the currently-selected controller is displayed with the following information about each device:

- **Model** number of the physical device (often includes drive size)
- **Channel** number and **Target ID** where this device resides on the controller
- The current **Transfer Speed** (in MHz) for the device
- The **Transfer Width** (8 bits or 16 bits) for the device
- The **Tag Value**

You may change the Transfer Speed, Transfer Width, and/or Tag Value for a single or for multiple physical device(s) as follows:

1. Select the physical device(s) in the window by clicking under **Model**.

   Current settings are displayed under **Setting Options**.
2. Change the **Transfer Speed** and/or **Transfer Width**, if desired, by selecting an available option in the drop down list box.
3. Change the **Tag Value**, if desired, by typing a new value in the Tag Value field.

If you selected multiple devices together, all selected devices will be changed to the values you've specified.

Running RAID Assist

RAID Assist is the Global Array Manager Client's "wizard" for the setup and configuration of new logical drives and disk arrays.

In its simplest form, RAID Assist provides an *Auto Configuration* option which immediately configures all available drives into an optimal, RAID 5 configuration. RAID Assist's *Assisted Configuration* sets up a new array according to predefined parameters, and asks the user questions to gather the key information necessary to build the array.

If configuration needs go beyond what Auto or Assisted Configuration offers, the *Manual Configuration* option allows additional control over logical drive setup parameters.

Entering RAID Assist

Open RAID Assist by clicking **Administration->RAID Assist** on the menu bar or the RAID Assist icon as shown in Figure 4-7.

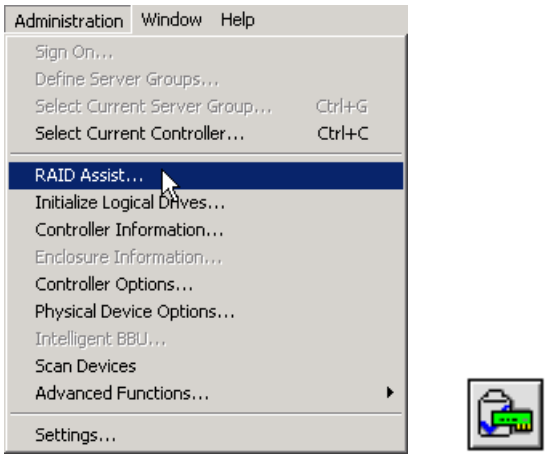


Figure 4-7. Select "RAID Assist"

The RAID Assist "Welcome" dialog box displays (Figure 4-8).

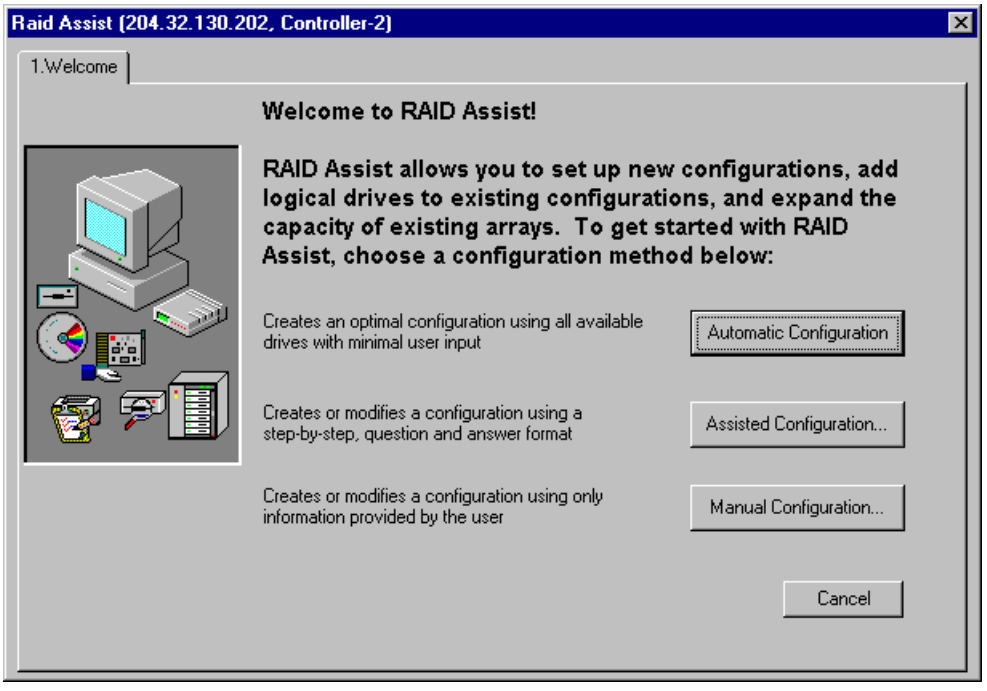


Figure 4-8. RAID Assist "Welcome" Dialog Box

In the RAID Assist "Welcome" dialog box (Figure 4-8), do one of the following:

- Click the *Automatic Configuration* button if you want to provide only

minimal input and allow RAID Assist to set up an optimal configuration automatically, or

- Click the *Assisted Configuration* button if you want RAID Assist to lead you step-by-step through the configuration, or
- Click the *Manual Configuration* button if you want full control over your configuration setup, or
- Click Cancel if you want to exit RAID Assist without any changes.

Automatic Configuration

Automatic Configuration provides three options:

- **New Configuration**. Sets up a new configuration on the controller, deleting the previous configuration and data (if any).
- **Add Logical Drive**. Sets up additional arrays (logical drives) leaving the existing array(s) intact. At least one array must be configured on this controller, and unconfigured drive space must remain.
- **Expand Array**. Restripes data in your array across additional, unconfigured drives to expand the capacity of the array.

For example, open New Configuration as shown in Figure 4-9.

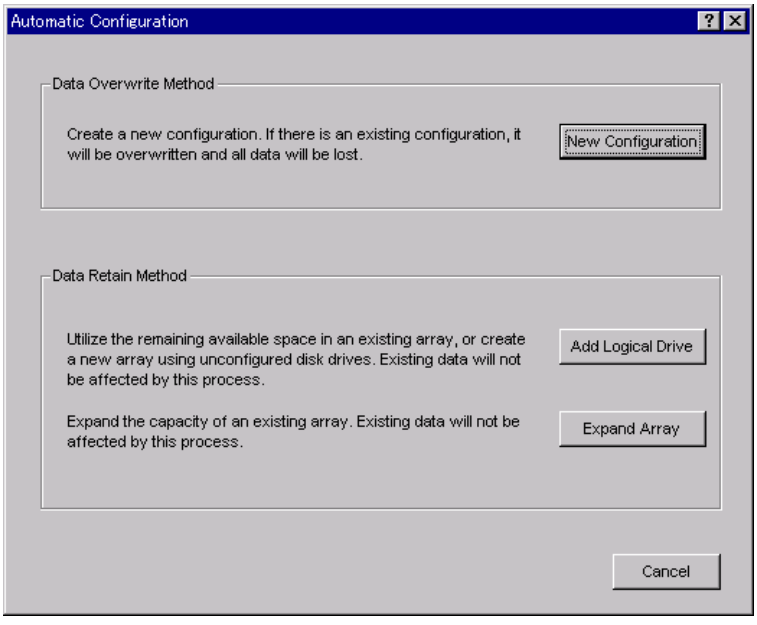


Figure 4-9. Select "New Configuration"

The new configuration created is based on the total number of drives discovered by the Global Array Manager. The automatic configuration feature uses the maximum number of drives, provides a fault tolerant RAID level when able, and creates a hot spare drive for drive failure protection. The number of logical drives created is dependent on the total number of physical drives discovered.

The Finish screen displays (Figure 4-10).

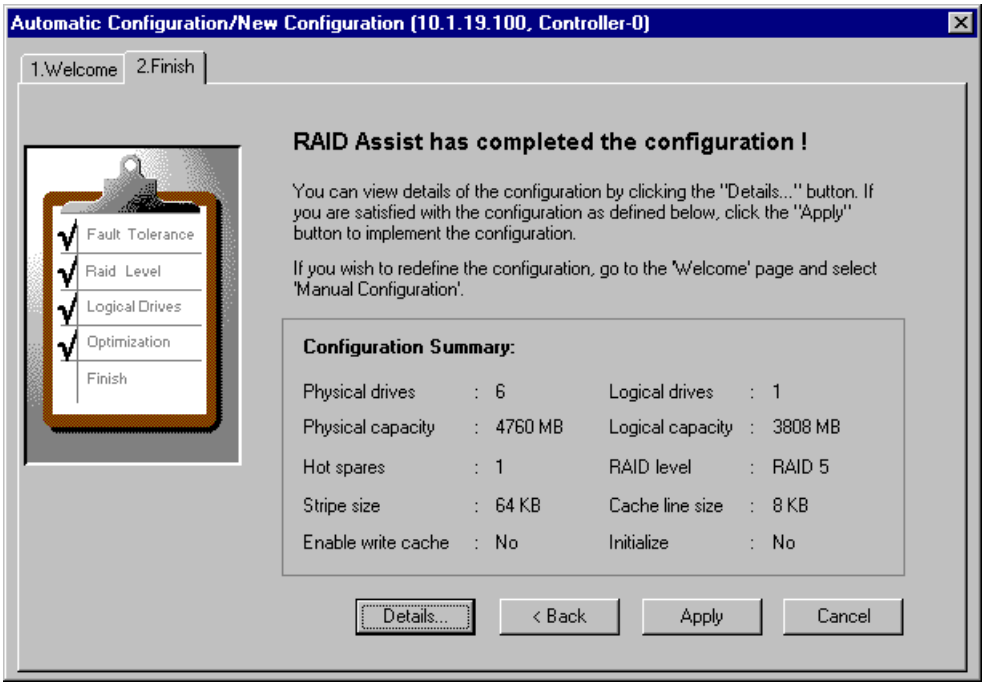


Figure 4-10. Automatic Configuration->New Configuration->Finish

Do the following:

1. Examine the Configuration Summary for details about the configuration that RAID Assist will set up.
2. If you want to start over, click the Back or Cancel button, or the Welcome tab, OR

   If you want to view the configuration before it is applied to the controller, click the Details button. You will be taken to an equivalent of the Disk Arrays page as shown in Manual Configuration, except that you can only view and close the details window.
3. If you accept the configuration as presented, click the Apply button at the Finish page to apply the new configuration to the controller.

   A warning confirmation box appears as shown in Figure 4-11.

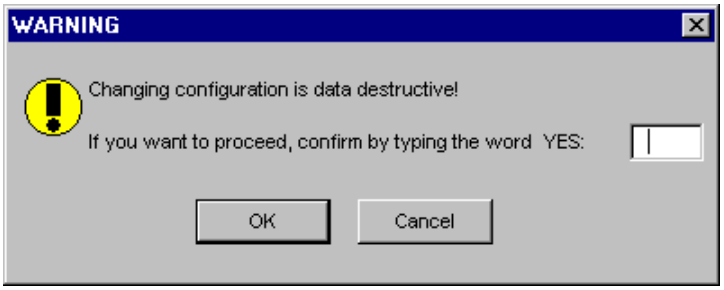


Figure 4-11. WARNING Before Applying the Configuration

4. Type YES and click OK if you are sure you want to apply the new configuration and overwrite the old. If you're not sure, click Cancel.

Assisted Configuration

Assisted Configuration provides three options:

- **New Configuration**. Sets up a new configuration on the controller, deleting the previous configuration and data (if any).
- **Add Logical Drive**. Sets up additional arrays (logical drives) leaving the existing array(s) intact. At least one array must be configured on this controller, and unconfigured drive space must remain.
- **Expand Array**. Restripes data in your array across additional, unconfigured drives to expand the capacity of the array.

For example, open New Configuration as shown in Figure 4-12:

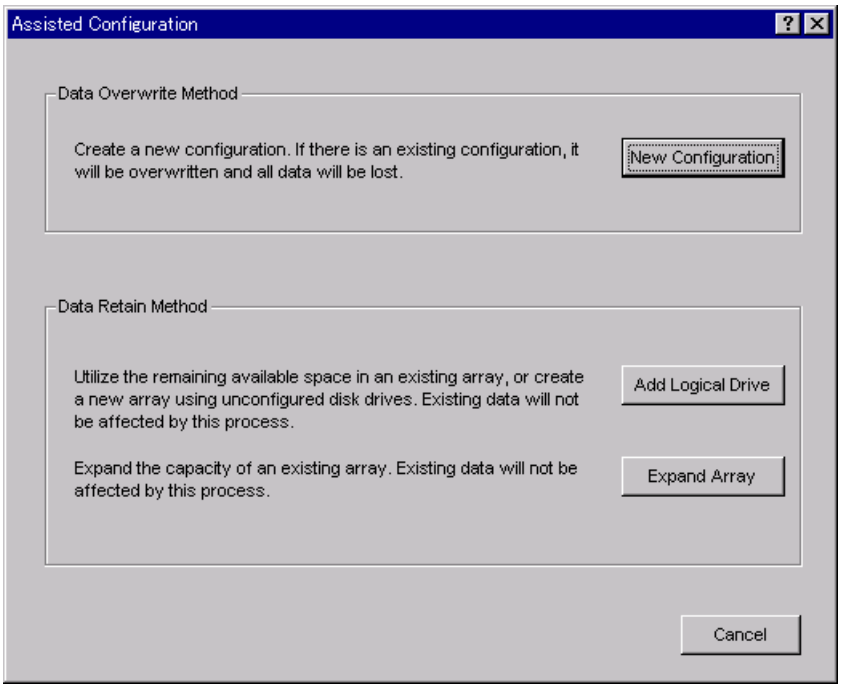


Figure 4-12. Select "New Configuration"

Assisted Configuration walks you step by step through a new configuration (Figure 4-13). Each "tab" in the Assisted Configuration dialog box collects information about an important aspect of the configuration you wish to set up. During this process, you provide answers to several questions.

Fault Tolerance Tab

Configure the following options (Figure 4-13) for fault tolerance.

1. Do you want Fault Tolerance? [Yes/No]
2. Do you want a Hot Spare? [Yes/No]

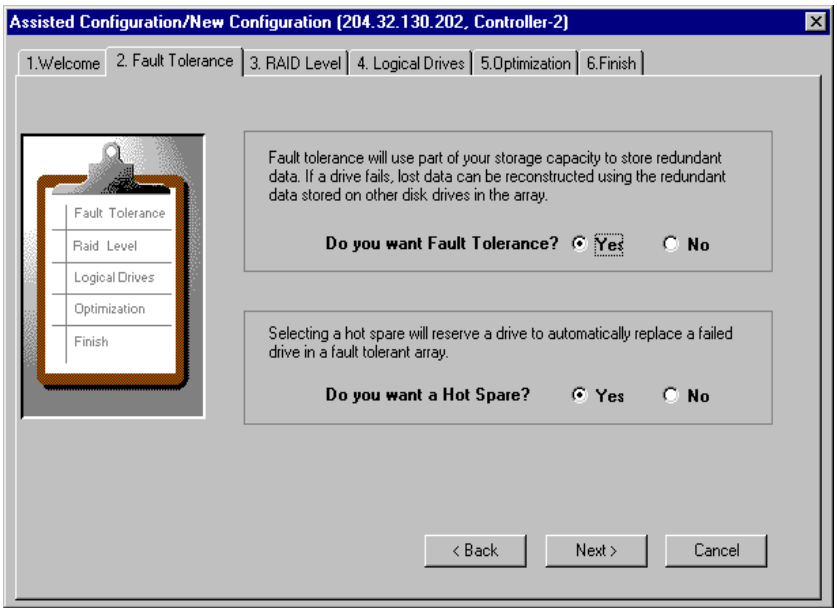


Figure 4-13. Assisted Configuration – Fault Tolerance

RAID Level Tab If Fault Tolerance Was Yes (Figure 4-14), choose between:

- Parity error correction (RAID 5, RAID 3), or
- Fully redundant drives (RAID 1, RAID 0+1)

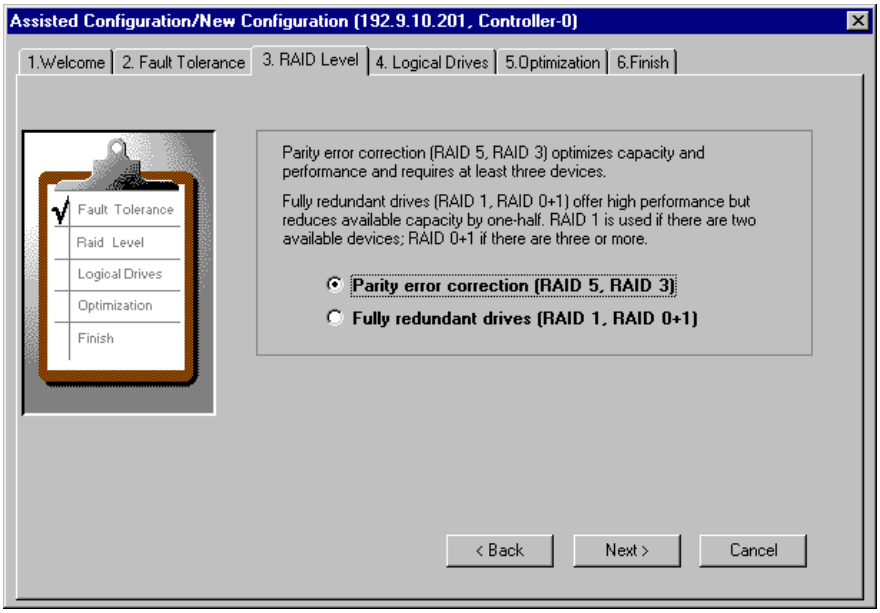


Figure 4-14. Assisted Configuration – RAID Level With Fault Tolerance

RAID Level Tab If Fault Tolerance Was No (Figure 4-15), choose between:

- Striping (RAID 0), or
- Stand-alone drive (JBOD)

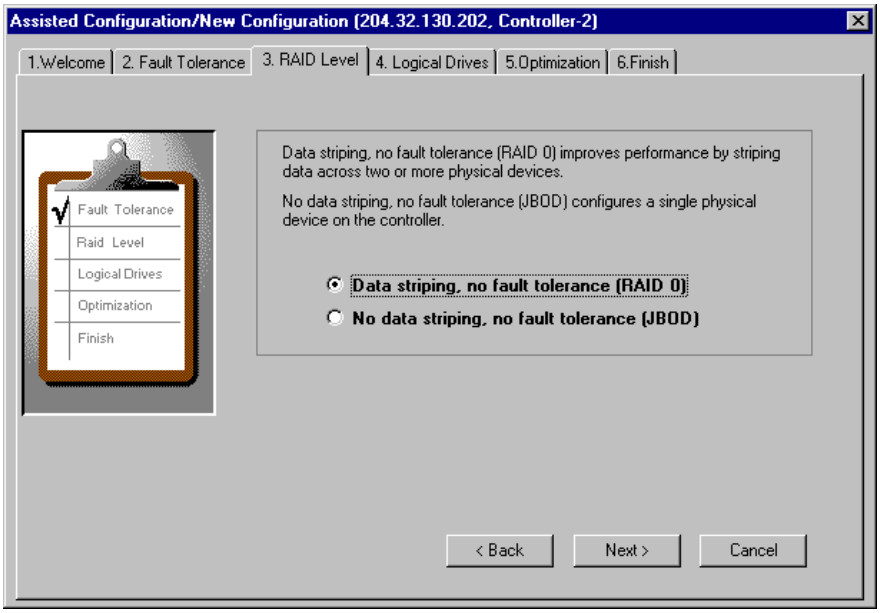


Figure 4-15. Assisted Configuration – RAID Level With No Fault Tolerance

Logical Drives Tab

Configure the following options (Figure 4-16) for a logical drive.

1. How many logical drives do you want to create? [1–32]
2. How much capacity do you want to use? [default=100% available space, or equivalent in MB]
3. Do you want to initialize logical drives? [Yes/No]

   This is done after the configuration has been applied.

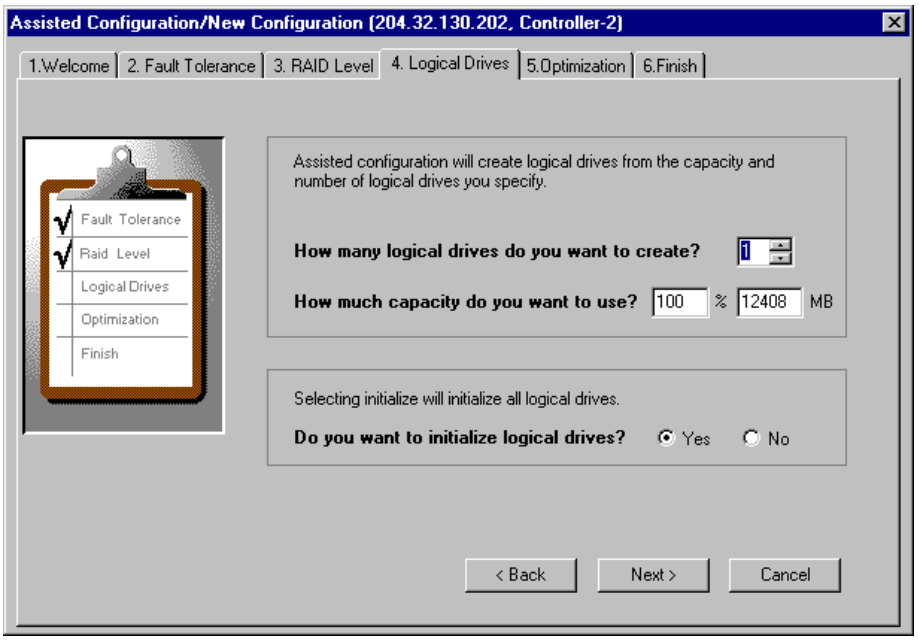


Figure 4-16. Assisted Configuration –Logical Drives

Certain Mylex PCI RAID Controllers allow Immediate RAID Availability of logical drives after configuration. For these controllers, initialization can take place in the background without the need to wait for full foreground initialization. If you selected Yes to the question above and the controller supports background initialization, the following screen will display (Figure 4-17):

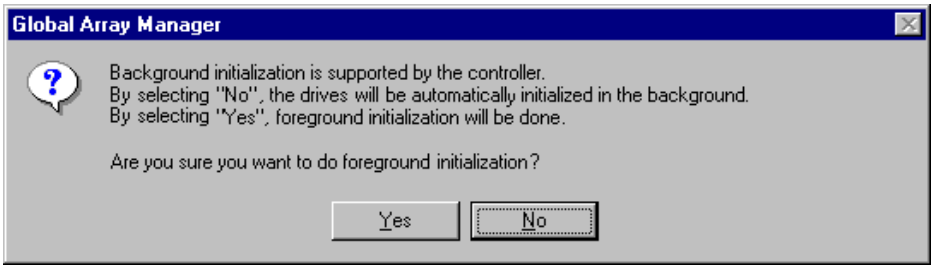


Figure 4-17. Background Initialization is Supported

4. If this message appears, click Yes to request a full foreground initialization of logical drives once the new configuration is applied,

   OR

   Click No to take advantage of the background initialization support. Once you've applied your configuration, your logical drives will be available for immediate use.

Optimization Tab

Configure the following options (Figure 4-18) for optimization.

1. Choose between:
   - Write cache enabled (write back)
   - Write cache disabled (write through)
2. Select a Stripe Size from the valid drop-down list.
3. Select Cache line size.

   Valid cache line size values depend on the stripe size settings. If the cache line size of 64KB is currently being used by the controller and you choose a stripe size that is lower than 64KB, a Warning dialog box will open with the following message, "*Due to your selection of Stripe Size less than 64KB, 8KB Cache Line Size will be used.*"

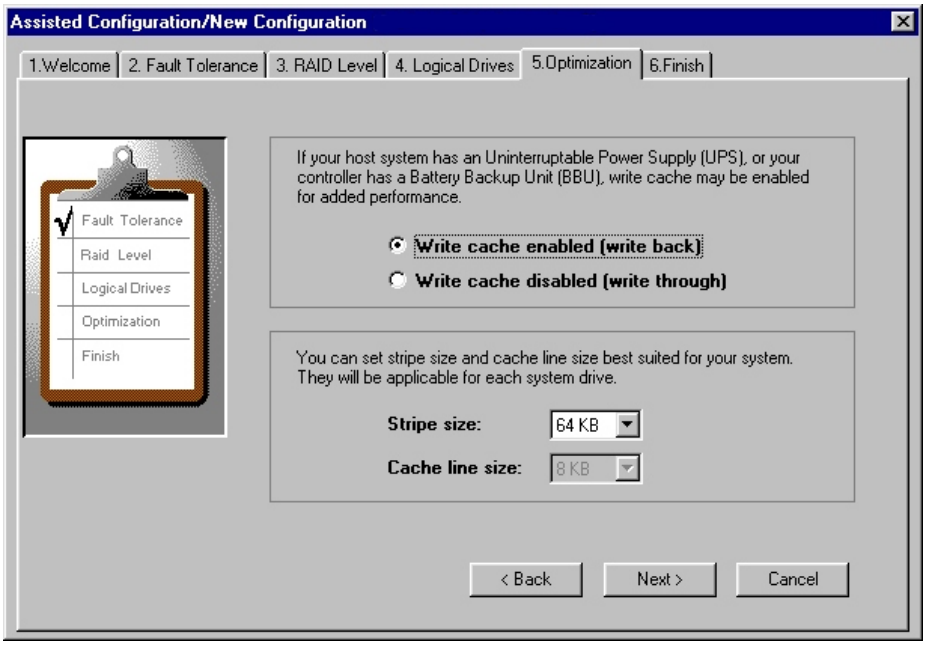


Figure 4-18. Assisted Configuration – Optimization

Finish Tab

When you get to the Finish screen (Figure 4-19), do the following:

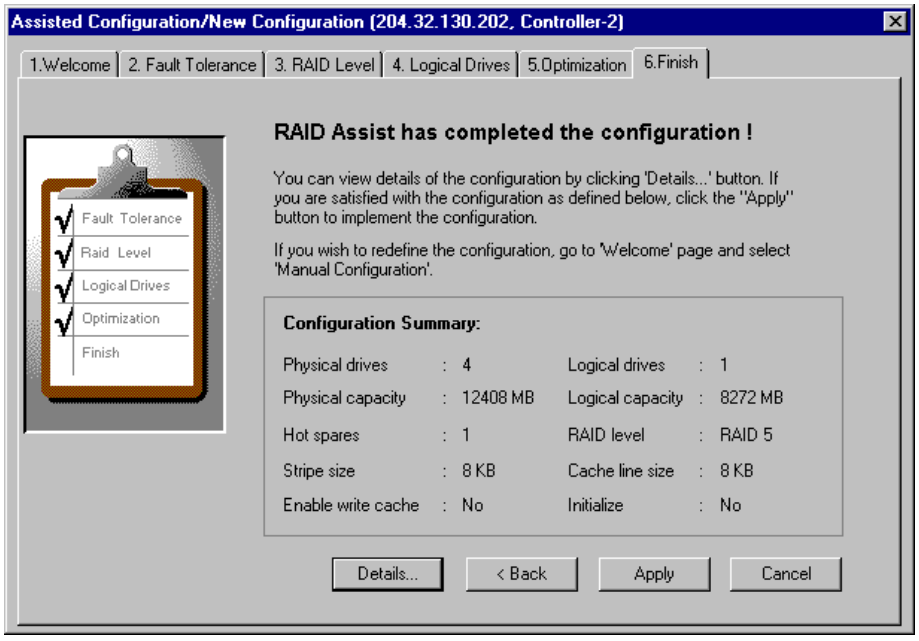


Figure 4-19. Assisted Configuration ->New Configuration ->Finish

1. Examine the Configuration Summary for details about the configuration that RAID Assist will set up.
2. If you want to start over, click the Welcome tab or Cancel button, OR

   If you want to change your answers to any of the questions you were asked, click the appropriate tab to return to that screen, OR

   If you want to view the configuration before it is applied to the controller, click the Details button. You will be taken to an equivalent of the Disk Arrays page as shown in Manual Configuration, except that you can only view and close the details window.
3. If you accept the configuration as presented, click the Apply button at the Finish page to apply the new configuration to the controller.

   A warning confirmation box appears as shown in Figure 4-20:

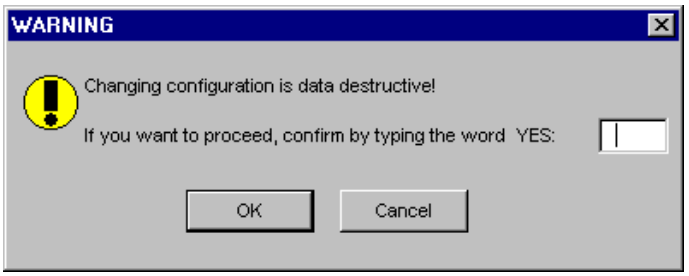


Figure 4-20. WARNING Before Applying the Configuration

4. Type YES and click OK if you are sure you want to apply the new configuration and overwrite the old. If you are not sure, click Cancel.

> ☛ **Note**
>
> In Assisted Configuration, Add Logical Drive and Expand Array function very similarly to the New Configuration option. In each case RAID Assist leads you step-by-step through the relevant questions for the task.

Manual Configuration

Manual Configuration provides four options:

- **Edit Configuration**. Displays the current configuration (disk arrays and logical drives) and allows you to add or delete a logical drive(s) randomly. This operation is called Random Add or Delete a Logical Drive(s) and does not affect any other existing logical drive data, but it may cause an available space to be segmented. After the edit is applied, if deleting a logical drive, data on the edited logical drive(s) will be lost.
- **New Configuration**. Sets up a new configuration on the controller, deleting the previous configuration and data (if any).
- **Add Logical Drive**. Sets up additional arrays (logical drives) randomly leaving the existing array(s) intact. At least one array must be configured on this controller, and unconfigured drive space must remain.
- **Expand Array**. Restripes data in your array across additional, unconfigured drives to expand the capacity of the array. M.O.R.E.2 and RAID Level Migration functions are available here.

- **Defragment Array**. Defragments unused spaces in an existing array.

For example open New Configuration as shown in Figure 4-21.

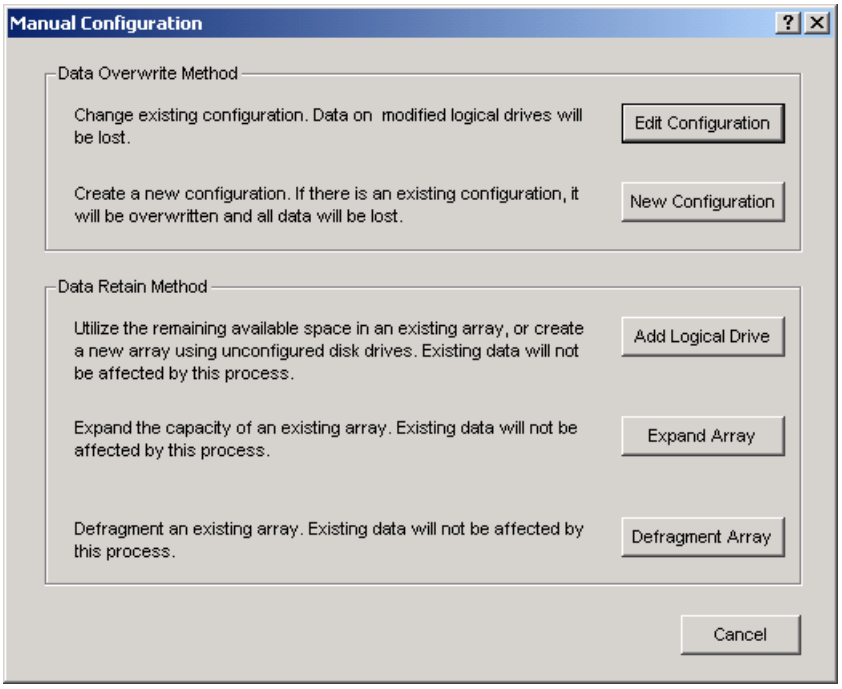


Figure 4-21. Select "New Configuration"

The Disk Arrays tab in Manual Configuration is where you begin to configure your unused disk drives (lower left, Figure 4-22).

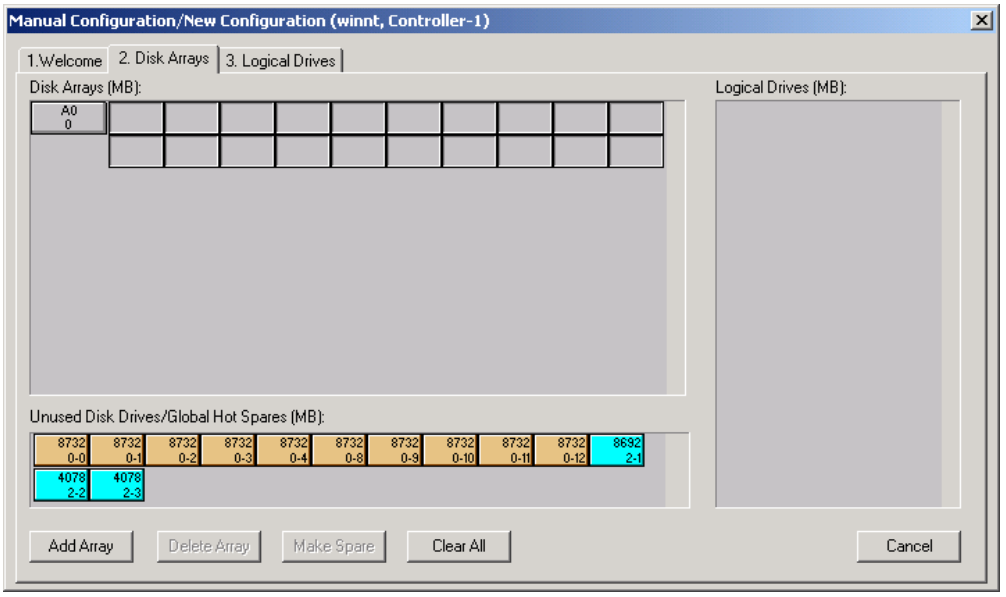


Figure 4-22. Manual Configuration – Disk Arrays

Each disk array is represented by two lines in the Disk Arrays area of the screen (upper left, Figure 4-22). Logical drives (if any have already been configured) display on the right side.

Do the following:

1. Select an unused drive and drag it to the Disk Array A0 section. The drive will be part of a disk array referred to as "A0."
2. Select other unused drives and drag them to Disk Array A0, or click the Add Array button to create a row for Disk Array A1 (then A2, A3, etc.), then drag unused drives to A1 (or A2, A3, etc.) if you so desire.

> ☛ **Note**
>
> Multiple drives can be added by holding down Ctrl while clicking drives, then dragging the selected set to a Disk Array section.

3. If you want to manually configure a hot spare, click an unused drive, then click the Make Spare button. If you want a dedicated hot spare, drag and drop the hot spare to the desired disk array.
4. If you want to start over, click the Clear All button and start again.

5. Once you have assembled the disk array groups, click the Logical Drives tab to continue on to logical drive setup (Figure 4-23).

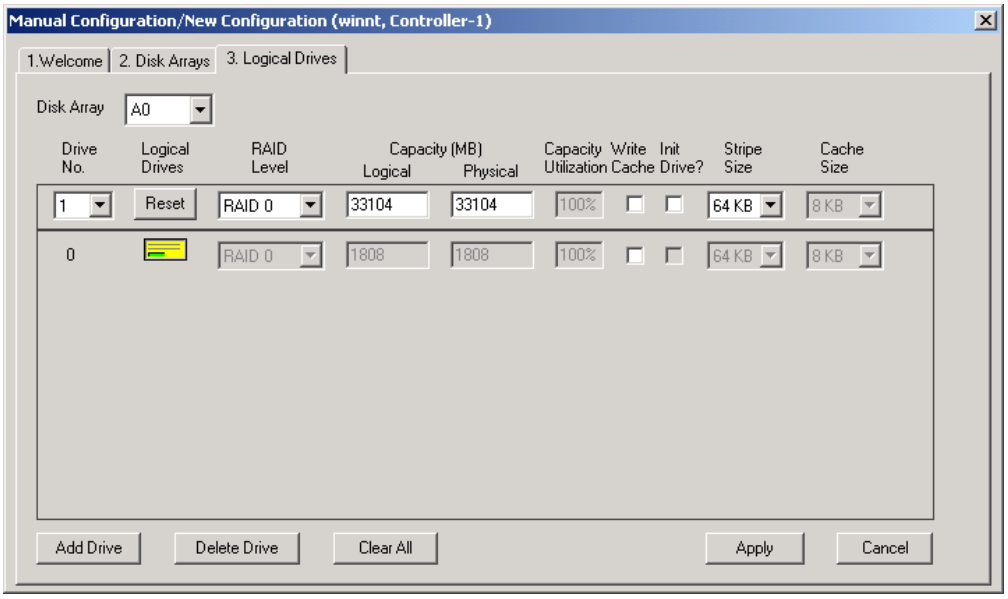


Figure 4-23. Manual Configuration – Logical Drives

The Logical Drives tab in Manual Configuration is where you configure your disk arrays into logical drives.

Do the following:

1. If you want to randomly create a logical drive, select the desired disk array from the Disk Array drop down menu.
2. Select a RAID level for your first logical drive. Supported RAID levels are RAID 0, RAID 1, RAID 3, RAID 5, RAID 0+1, and stand-alone drive (JBOD). Only RAID levels compatible with the current configuration will be available in the list.
3. Type the amount of available logical or physical capacity for this logical drive. If your total configuration will have only one logical drive which uses all available capacity, the default sizes should not be changed. If you intend to create additional logical drives now or later, type a smaller number to reserve the desired amount of capacity.

☛ **Note**

When creating a random logical drive, if there are a

few existing segmented spaces, the largest space is used to create the logical drive.

4. Check the Write Cache box if you want this logical drive to use Write Back caching. This improves performance but puts data at risk. You should have a battery backup unit or uninterruptable power supply if selecting this feature.
5. Check the Init Drive box if you want this logical drive to be fully initialized at the conclusion of the configuration. It is recommended that you check this option (if available), unless the controller is capable of background initialization. If so, and you check the box, you'll see a message when you apply the configuration indicating that you can make use of the background initialization support.
6. Select a stripe size. The stripe size is defined as the size, in kilobytes (1024 bytes), of a single I/O operation. A stripe of data (data residing in actual physical disk sectors, which are logically ordered first to last) is divided over all disks in the drive group.

   When selecting a stripe size of less than 64KB, the active cache line size will change from 64KB to 8KB. A Warning message box will open when you click the Apply button to complete your configuration (see Figure 4-24).

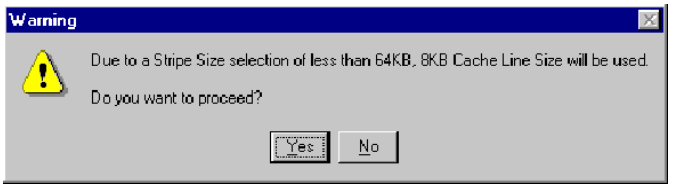


Figure 4-24. Stripe Size Selection Warning

   If you select **Yes**, the new configuration will be applied and an 8KB cache line size will be active.

   If you select **No**, the Logical Drives page of the Manual Configuration Wizard will open. You can change the stripe size in order to obtain the desired cache line size.

7. Select a cache line size, if enabled. Available settings will depend on the selected stripe size.

8. Click the Add Drive button to register your new logical drive.
9. Click Apply to save the configuration if you are finished setting up logical drives, OR

   Repeat the process above to set up additional logical drives, then click Apply when you're done.

An example of a completed Manual configuration is shown in Figure 4-25:

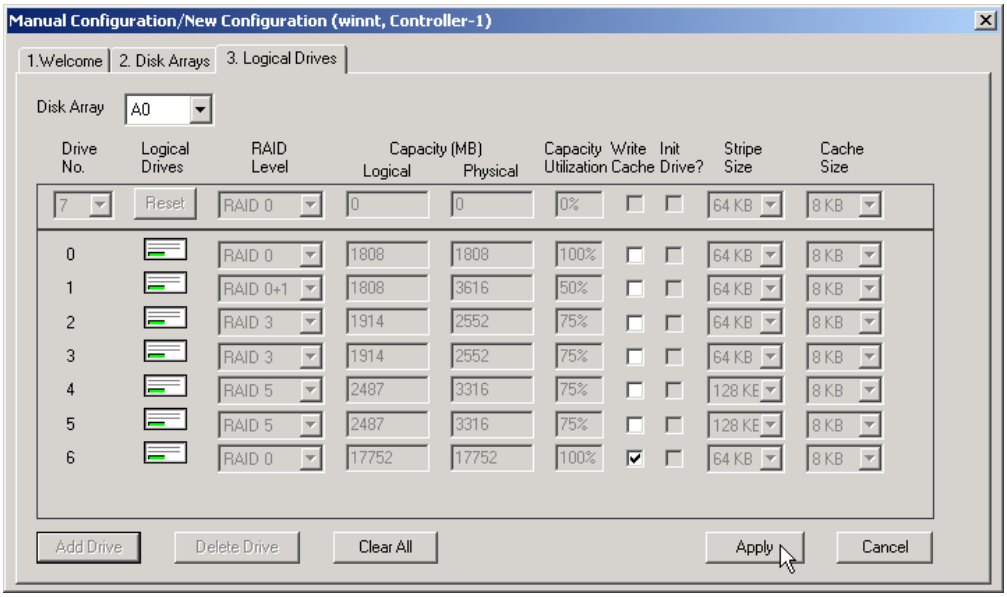


Figure 4-25. Sample Manual Configuration Just Before "Apply"

☛ Note

In Manual Configuration, Add Logical Drive and Expand Array function very similarly to what was shown above. In each of these two cases, however, RAID Assist shows you the disk arrays and logical drives and allows you to add to the configuration without risking existing data.

Global Hot Spares vs. Dedicated Hot Spares

A hot spare is classified as two types: 1) a Dedicated Hot Spare and 2) a Global Hot Spare. Dedicated Hot Spares belong to a single disk array or spanned disk array. Global Hot Spares do not belong to specific disk arrays, but are available for all disk arrays within Private or Shared channel boundaries.

To create a Global Hot spare, use the following procedure:

1. Open RAID Assist by clicking **Administration->RAID Assist** on the menu bar or the RAID Assist icon as shown in Figure 4-7.
2. The RAID Assist “Welcome” dialog box displays (Figure 4-8).
3. Click the Manual Configuration button.
4. Click the Edit Configuration button.
5. Click the Disk Array tab.
6. Select a physical drive in Unused Disk Drives/Global Hot Spares pane.
7. Click the Make Spare button.

   A Global Hot Spare is created, and a white plus sign indicates the physical disk drive has changed to a Global Hot Spare (see Figure 4-26).

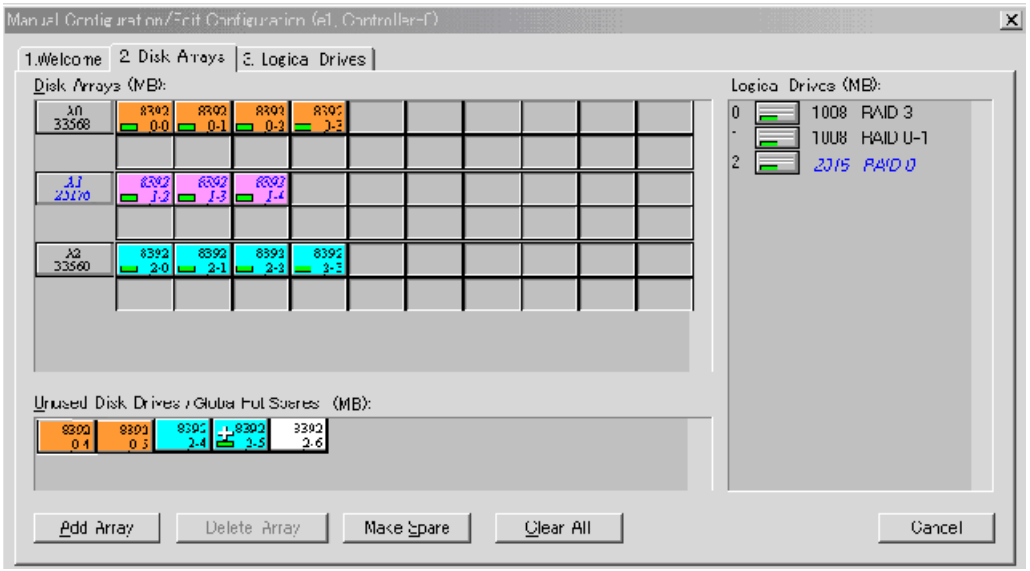


Figure 4-26. Creating a Global Hot Spare

8. If you want the Global Hot Spare to be a Dedicated Hot Spare drag and drop it to the disk array that the Global Hot Spare belongs (see Figure 4-27).

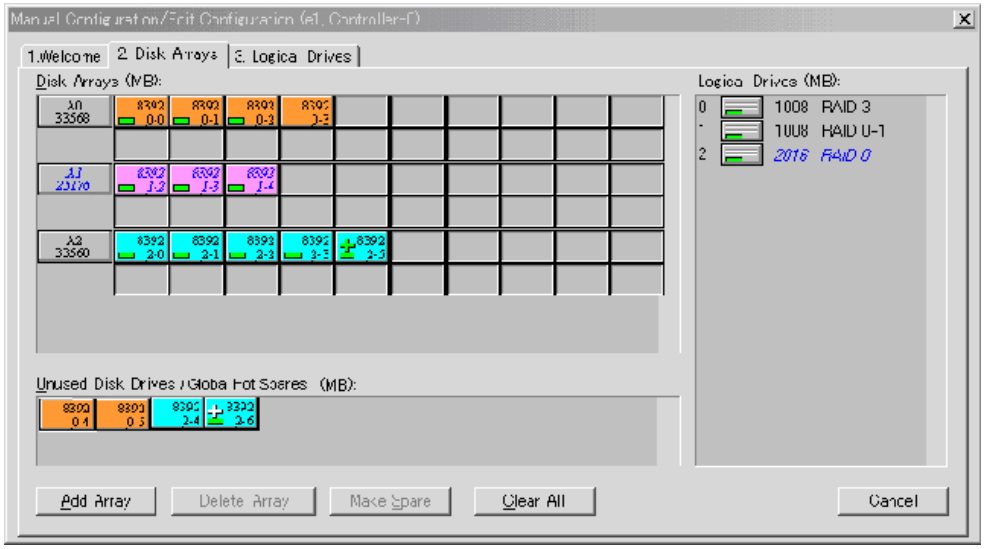


Figure 4-27. Creating a Dedicated Hot Spare

A Dedicated Hot Spare is created, and a green plus sign indicates the physical disk drive has changed to a Dedicated Hot Spare (see Figure 4-27).

Expand Capacity

GAM provides an advanced configuration mode known as MORE2 (Mylex Online RAID Expansion 2) which provides two features, Online Capacity Expansion and Extension (OCE), and RAID Level Management (RLM). These features allow you to increase the capacity of a RAID array in a variety of ways. All of the following operations are available while the controller is online. The operations are performed in the background while normal data operations occur.

- Add a physical drive or drives to the system
- Add a logical drive to the system
- Increase the size of a logical drive or drives in the system
- Change RAID level on a logical drive or drives

MORE2 operations have the following restrictions:

- no channel swapping during more operation
- no operation on a spanned array
- result configuration group may not exceed 16 physical disks

> ☛ **Note**
>
> Although OCE and RLM operations are explained separately in the following sections, these operations may be combined.

Expanding a Logical Drive

Online Capacity Expansion is the ability to increase the size of a logical system drive while normal reads and writes occur. The expansion can be obtained by adding one or more physical drives to the system, changing the RAID level and/or increasing the amount of space on the physical drives allocated to the logical drive.Only one logical drive can be created per the Expand operation. When performing this operation, you cannot change the write cache, init drive, or strip size of an existing logical drive.

Added capacity amounts are rounded up to the next whole megabyte on the physical drives. This means that the space is allocated on the physical drives with one megabyte granularity.

To expand a logical drive, follow these steps:

> ⚠ ***Caution***
>
> It is highly recommended that you backup your current configuration before making modifications.

1. Select **Administration->RAID Assist** on the menu bar or the RAID Assist icon (see Figure 4-7).
2. Click the Manual Configuration button.
3. Click the Logical Drives tab, this is where you can add capacity.

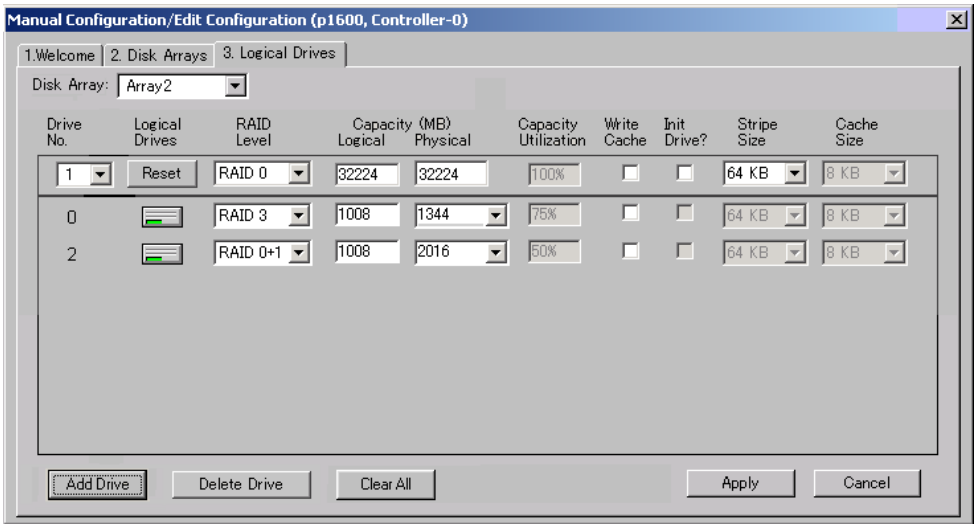


Figure 4-28. Expand Capacity – Logical Drives Tab

4. Click on the Add Drive button to add a logical drive(s). If there are a few available segmented spaces, the largest space is used for the creation of a new logical drive.

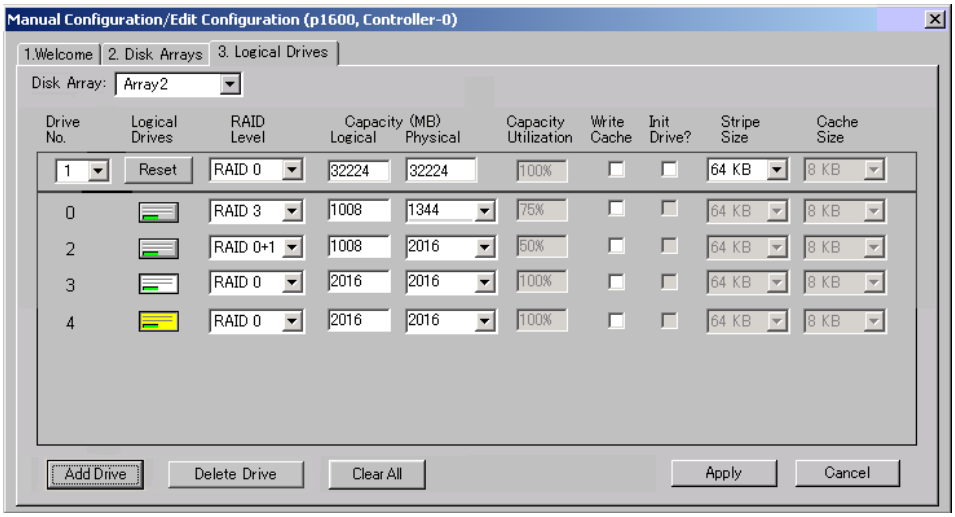


Figure 4-29. Expand Capacity – Add Logical Drive(s)

5. Select a RAID level for your new logical drive.
6. Type the desired amount of available logical or physical capacity for this logical drive.
7. Check the Write Cache box if you want this logical drive to use Write Back caching. This improves performance but puts data at risk. You should have a battery backup unit or uninterruptable power supply if selecting this feature.
8. Check the Init Drive box if you want this logical drive to be fully initialized at the conclusion of the configuration.
9. Select a stripe size.
10. Select a cache line size, if enabled. Available settings will depend on the selected stripe size.

☛ **Note**

Only a newly created logical drive can be deleted. Select the logical drive by a right mouse click, then click the Delete Drive button.

11. Click the Apply button to save your new configuration.

    A message box appears as shown in Figure 4-30,

    click Yes to proceed:

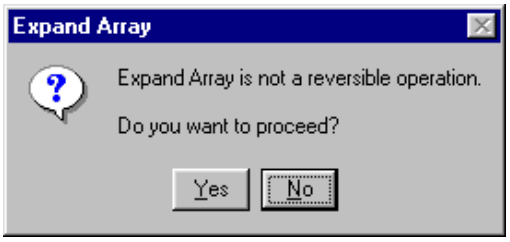


Figure 4-30. Message Before Applying the Configuration

A warning confirmation box appears as shown in Figure 4-31

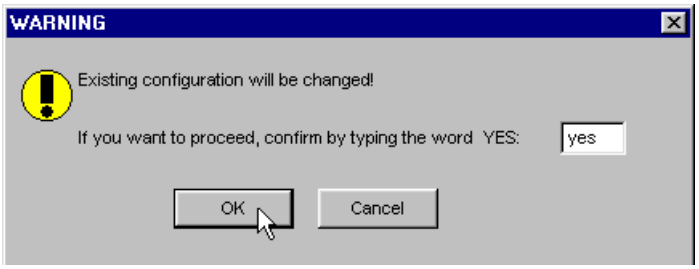


Figure 4-31. WARNING Before Applying the Configuration

12. Type YES and click OK if you are sure you want to apply the new configuration and overwrite the old.

    WARNING

    Expand Capacity cannot be cancelled.

    The Expand Capacity Status box (Figure 4-32) opens and displays the progress of a disk array capacity expansion.

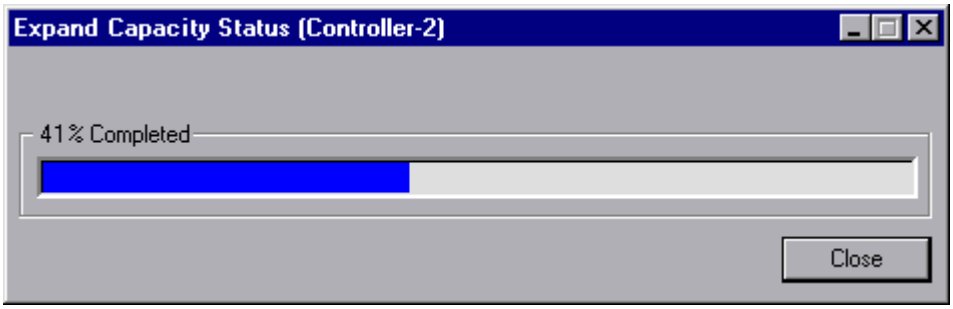


Figure 4-32. Expand Capacity Status Box

Click Close to close the Expand Capacity Status box at any time. Click **View-> Expand Capacity Status** to open the status box at any time.

Migrating a RAID Level

RAID Level Migration is the ability to change the RAID level on one or more system drives. This may require more or less space on the physical drives. Any other logical drives are moved to make room for the size change. This includes moving system drives to remove gaps between the system drives that either exist before migration or those that would be a result of the migration.

The following table (Table 4-1) describes the allowed migrations.

Table 4-1. RAID Level Migration Options

Starting RAID level	Destination RAID level
0	0, 3, 5, 0+1
1	1, 3, 5, 0+1
3	3, 5, 0+1
5	3, 5, 0+1
0+1	3, 5, 0+1
JBOD	0, 1, 3, 5, 0+1

To migrate a RAID level, follow these steps:

1. Select **Administration->RAID Assist** on the menu bar or the RAID Assist icon (see Figure 4-7).
2. Click the Manual Configuration button.
3. Click the Logical Drives tab, this is where you can edit a RAID level.
4. Follow Step 5 through Step 12 of “Expand Capacity” on page 4-30.

Transporting a Disk Array

You can transport a disk array group between any single controller to any dual controllers and vice versa. However, it may not be easy for you to know which disk drives in an enclosure belongs to which specific disk array. To help you, the locate function is expanded to indicate visually all disk drives (dedicated hot spares and global hot spares are not included) that belong to a specific disk array by using LEDs.

To locate a disk array for transportability, use the following procedure:

1. In the Controller View Window, double click a logical drive.
2. The Logical Drive Information Window opens (see Figure 4-33).

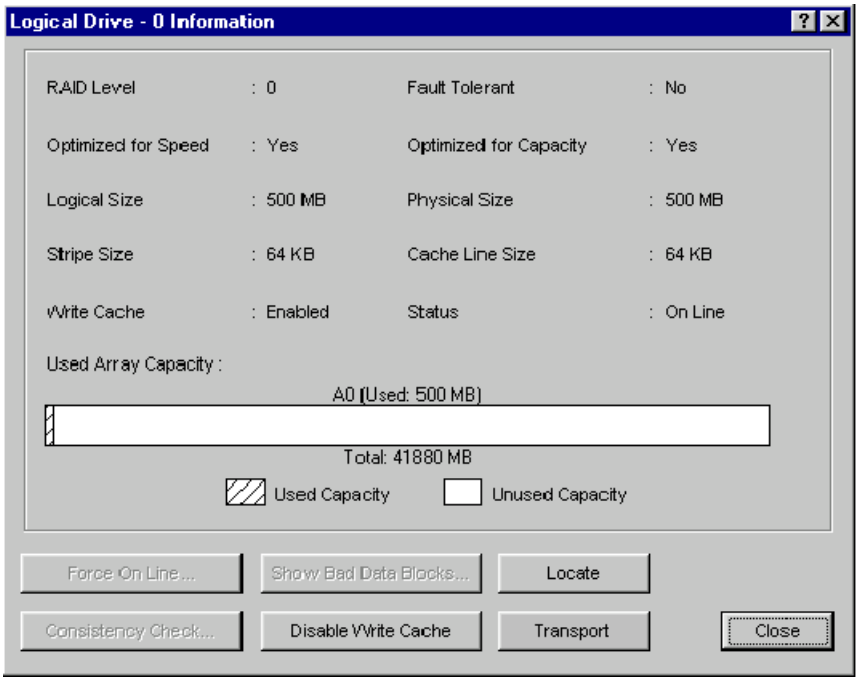


Figure 4-33. Logical Drive Information Window – Transport Button

> **Note**
>
> Clicking the Locate button in the Logical Drive Information window (Figure 4-33) turns on LEDs on all of the physical drives belonging to the disk array excluding the global or dedicated hot spares.

3. Click the Transport Button, the Disk Array Transport Information Window opens (Figure 4-34).

Figure 4-34. Disk Array Transport Information Window

All of the physical drives including the global and dedicated spares associated with the selected logical drive and all of the logical drives that belong to the same disk array are displayed.

Click the Locate Transport button to turn on LEDs on all of the physical drives including the global hot and dedicated hot spares that belong to the disk array for visual indication.

You are now ready to transport your physical drives.

Clustering & Teaming

In a clustered RAID environment, multiple controllers share the same back end SCSI disk drives through a SCSI or Fibre channel cable(s). If the controllers reside on different systems respectively, it is called clustering. A clustering software manages the clustering configuration. If controllers reside on the same system, it is called teaming. PATHpilot Pro manages the task of teaming by allowing monitoring and manipulation of paths. GAM provides the following information:

- Servers participating in the cluster configuration
- Controllers that are part of the cluster configuration
- Channels on each cluster that share backend disk drives

Select **View->Cluster Map** to open the Cluster Map Window (Figure 4-35).

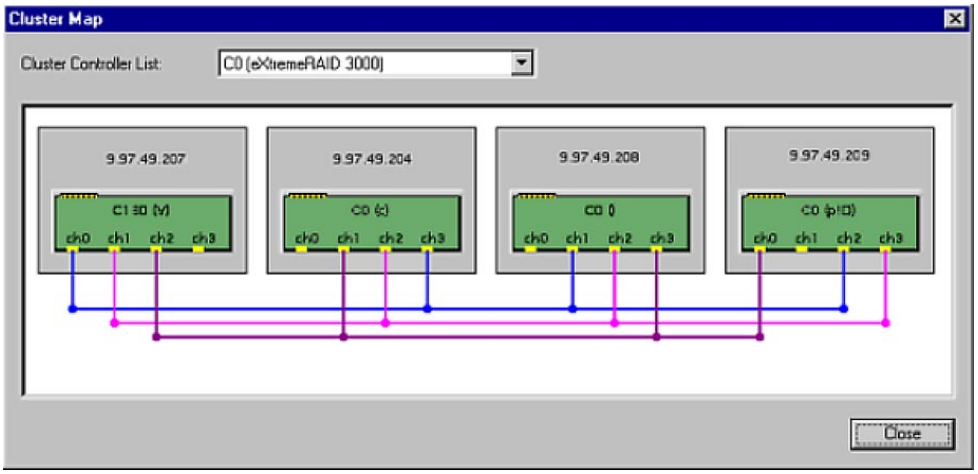


Figure 4-35. Cluster Map

The Cluster Map dialog box displays a graphical backend cable connection for the controller selected from the Cluster Controller list. Channels on the cluster controllers connected by a colored line are shared channels where disk drives are shared. Private channels are shown without any connection. In Figure 4-35, four controllers are connected by three shared cables. If these four controllers reside on different controllers respectively, it is called four nodes clustering. To show a server or IP address for each node, the four servers should be

registered as a single server group through the **Administration->Define Server Groups** dialog box (see “Setting Up Server Groups and Servers” on page 3-17). The colors of the lines have no relation to other color indications (e.g. channel colors).

To launch PATHpilot, click **Administration->Advanced Functions ->PATHpilot**. The PATHpilot Information Control Console (PIC) will start as a separate application. (The information in Figure 4-36 is for demonstration purposes.)

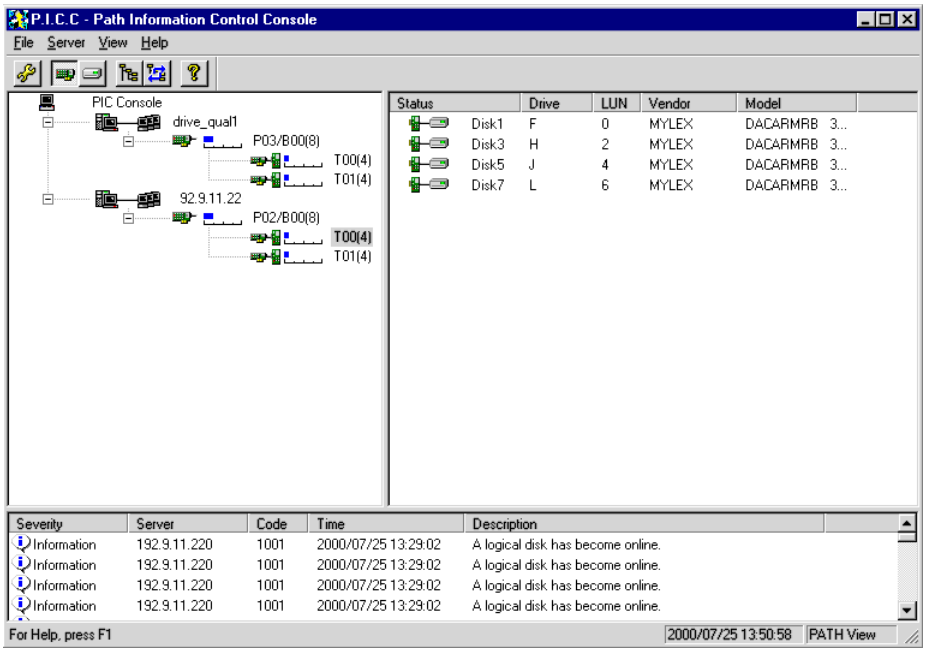


Figure 4-36. PATHpilot Information Control Console (PIC)

The PIC screen consists of a multi-frame viewer, menu bar, tool bar, and status bar. Refer to the PATHpilot Online Help for complete descriptions of Navigation tools and Configuration settings.

Managing Channels

To avoid future “Boot Failure” as result of disk array creation across channels after performing a clustering configuration, a channel that a physical disk belongs will be specifically indicated. The following colors combinations will be used per channel:

- **Channel 0**: Orange
- **Channel 1**: Violet
- **Channel 2**: Cyan
- **Channel 3**: Lavender

> ☛ **Note**
>
> The use of color combinations is being researched. The channel colors listed are subject to change.

A channel that is not shared with any other controller is called a Private channel. A channel that is shared with cluster nodes is called a Shared Channel. To indicate the type of channel, the following colors of text are used:

- **Private Channel**: black text in normal font
- **Shared Channel**: blue text in italic font

For example, Figure 4-37 shows the Disk Array tab where a controller has four channels. Channel 1 is a shared channel and other three channels are Private channels. Because Channel 1 is a shared channel, all text associated with the channel are blue and italicized (physical disk numbers, an array number, and a logical number).

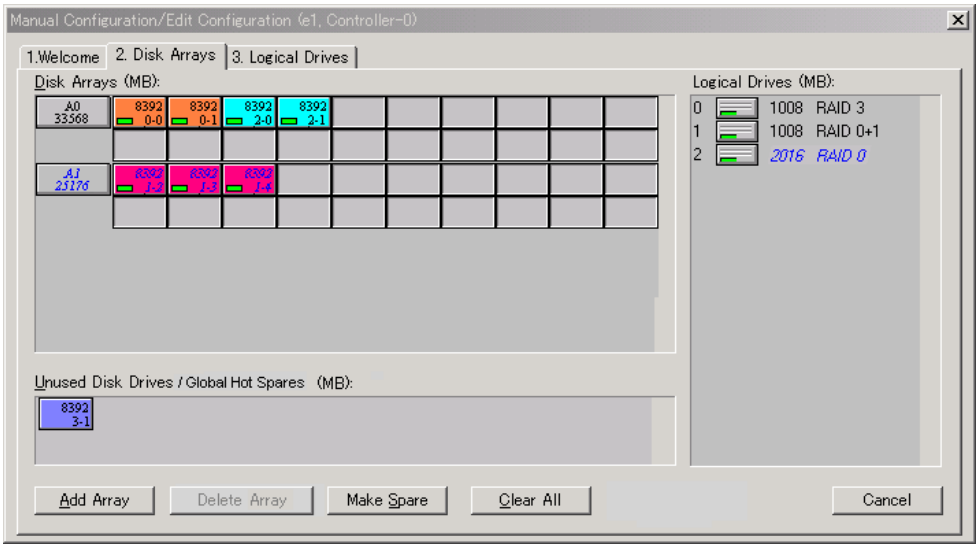


Figure 4-37. Disk Array Tab – Four Channels Displayed

Figure 4-38 shows the Controller View window displaying four channels.

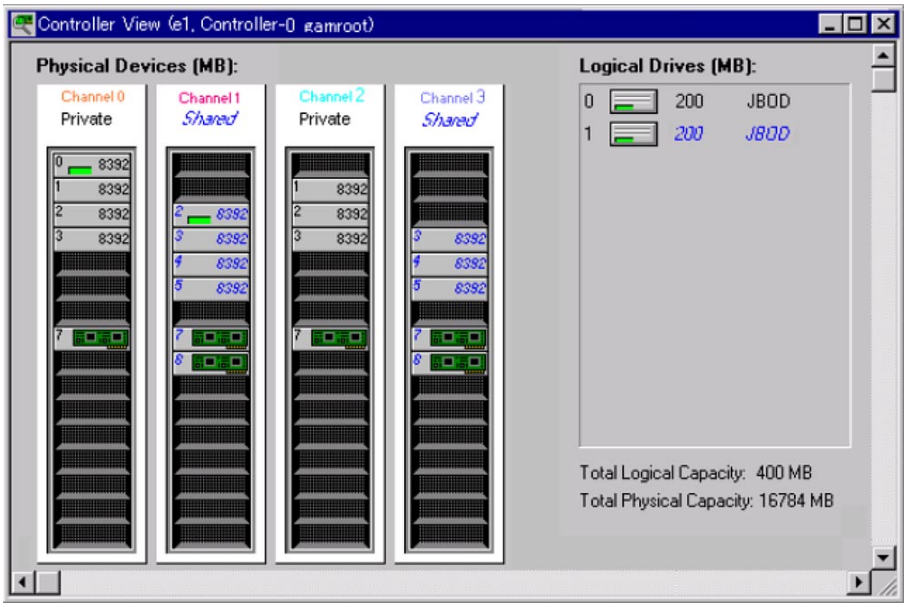


Figure 4-38. Controller View – Four Channels Displayed

When an attempt is made to create a disk array across channels, the caution message in Figure 4-39 opens. The message does not inhibit this operation, click the OK button to continue or click Cancel to end the operation. When

GAM Client is running, this message will display once at the first attempt.

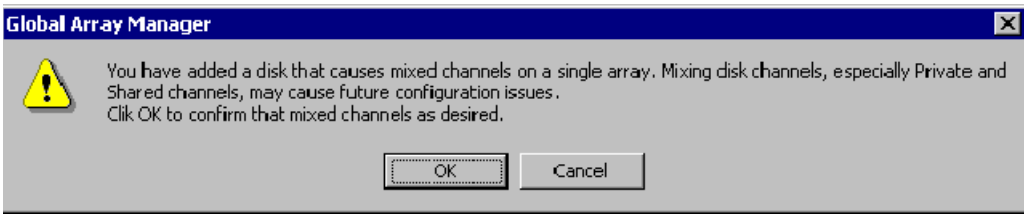


Figure 4-39. Caution – Mixing Channels

If intermixing between Private and Shared channel happens during configuring, the operation is inhibited and a warning message (Figure 4-40) is displayed.

Figure 4-40. Warning – Mixing Channels

Spanning in Global Array Manager

Spanning allows you to configure multiple drive packs or parts of multiple drive packs as one system drive. This means that space is used from the first array to the last identical array.

A drive pack is a group of individual disk drives (preferably identical) that are logically tied to each other and are addressed as a single unit. In some cases this may be called a drive “pack” when referring to just the physical devices.

All physical devices in a drive group should be the same size; otherwise, each of the disks in the group will have the capacity of the smallest member. The total size of the drive group will be the size of the smallest disk in the group multiplied by the number of disks in the group. For example, if you have four disks of 400MB each and one disk of 200MB in a pack, the effective capacity available for use is only 1000MB (5x200), not 1800MB.

Drive packs or groups have the following properties.

- From one to sixteen disk drives included in an individual drive pack or group.
- The drive pack can include physical disk drives located on different drive channels.
- The number of disk drives in a drive pack determines the possible RAID level. To create a JBOD or RAID 0, RAID 1, RAID 3, RAID 5, RAID 0+1 use the following table (Table 4-2):

Table 4-2. Configuring a Spanned Array

RAID Level	Minimum number of Drives	Maximum number of drives	Maximum number of drives with Spanning enabled	Theoretical Maximum number of drives
1	2	16	112	256
2	2	2	32	32
3	3	16	112	256
4	3	16	112	256
5	3	16	112	256
0+1	1	1	16	16

After physical disk drive packs are defined, one or more system drives may be created from drive packs. System drives have the following properties:

- In GAM more than one system drive can be defined on a single drive pack; a system drive can also span 16 packs.
- The minimum size of a system drive is 8MB. The maximum is 2 TB.
- Up to 32 system drives can be created. Each system drive has its own write policy (write-back or write-through).

Enable Spanning in GAM

1. Using a text editor application (such as Notepad), open the gam2cl.ini file.
2. Scroll to the Enable_System_Drive_Span=0 parameter and set the parameter to 1 (default value =0).
3. Save and close the gam2cl.ini file.

Configuring a Spanned Disk Array

1. Open RAID Assist by clicking **Administration->RAID Assist** on the menu bar or the RAID Assist icon as shown in Figure 4-7.
2. The RAID Assist “Welcome” dialog box displays (Figure 4-8).
3. Click the Manual Configuration button.
4. Click the Edit Configuration button.

   ☛ **Note**

   Automatic and Assisted configuration options do not allow spanning.

5. To create a JBOD or RAID0 connect at least four drives of the same size to a controller. To create a RAID 1, RAID 3, RAID 5, or RAID 0+1, connect at least six drives of the same size to a controller.

   Select physical drives from the drive packs to create a spanned array. Remember to use the same number of devices in each Array or spanning will not be utilized. Figure 4-41 shows the creation of two arrays each having three equal sized disk drives.

Creating a Spanned Disk Array

> ☛ **Note**
>
> Spanned disk arrays cannot be created across a Private and Shared channel.

1. Click on the Disk Arrays tab.
2. Click on the Add Array button to add the desired number of arrays. Each time you click the Add Array button, an array will be added to your configuration (A1, A2, A3, etc...). For this example, assume that A0 has been configured before adding new arrays.

> ☛ **Note**
>
> Multiple drives can be added by holding down Ctrl while clicking drives, then dragging the selected set to a Disk Array section.

3. In the Unused Disk Drives/Global Hot Spares (MB) pane, drag and drop the available disk drives to the appropriate disk array (A0, A1, etc...). See Figure 4-41.

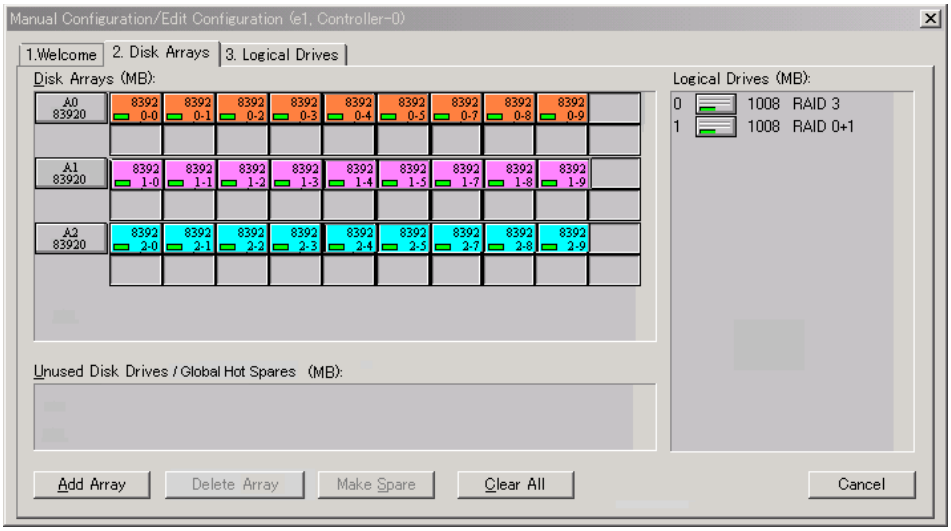


Figure 4-41. Creating a Spanned Array

You can now configure the desired amount of logical drives.

Select the Logical Drives tab to configure your disk arrays into logical drives. It works the same as Manual/New (see “Manual Configuration” on page 4-22). Note that the only logical drives that will be spanned are those whose capacity is taken from more than 1 array.

Loading a Configuration from Disk

Load a previously-saved configuration from disk as shown in Figure 4-42.

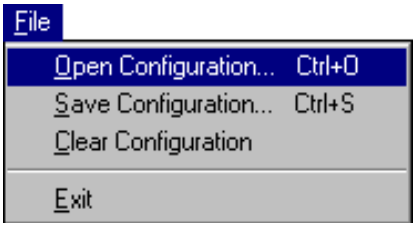


Figure 4-42. Select "Open Configuration"

1. In the Open Configuration dialog box (Figure 4-43), select the configuration file you wish to open to save to the controller.

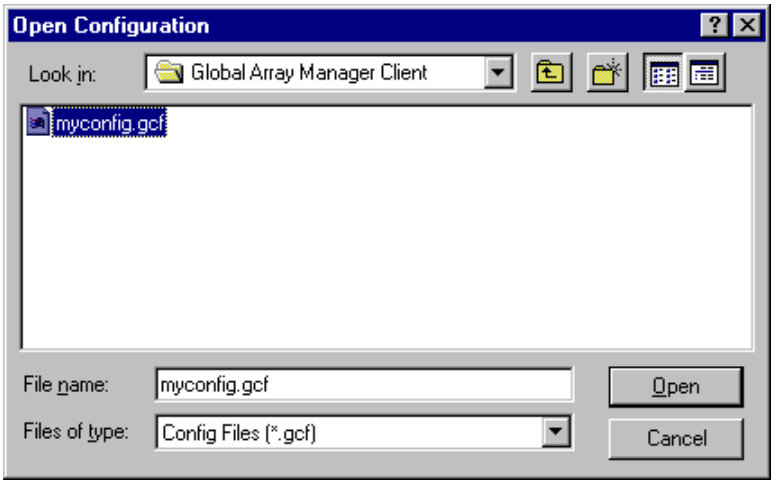


Figure 4-43. Open Configuration Dialog Box

2. Click Open to access the configuration file.

   Changing the configuration is data destructive. A warning message appears (Figure 4-44):

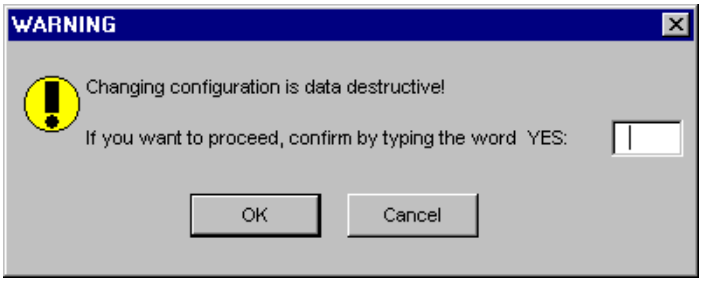


Figure 4-44. Open Configuration Warning Message

3. To confirm your decision to overwrite the existing configuration, type YES then click OK, or

   Click Cancel to stop without applying the saved configuration.

Saving a Configuration to Disk

Saves a configuration file to a new filename, disk, and/or directory.

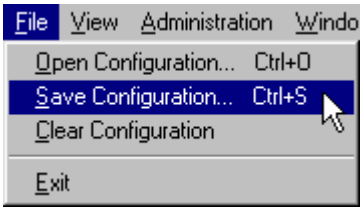


Figure 4-45. Select "Save Configuration"

1. In the Save Configuration dialog box (Figure 4-43), type a name for the configuration file you wish to save.

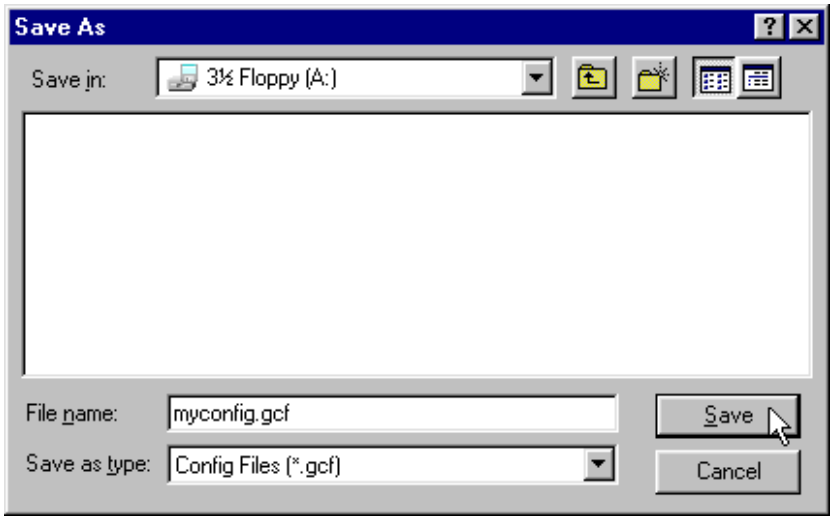


Figure 4-46. Save Configuration Dialog Box

2. Click Save to save the configuration file.

   The configuration file (.gcf) will be saved.

Chapter 5
Monitoring

Introduction

Monitoring activities involve the following:

- Monitoring events (messages) sent by various servers to the client workstation(s).
- Monitoring controller activity; reviewing controller configuration and other information.
- Reviewing physical device and logical drive information.
- Viewing Bad Block Data, Request Sense Data, and NVRAM Log Data.
- Monitoring and managing SCSI and Fibre enclosure information.
- Monitoring the performance of drives and controllers; reviewing historical performance data (Statistics View and Performance Analysis).
- Monitoring the status of ongoing processes, such as initialization, rebuild, consistency check, expanding capacity of an array, and Patrol Status.
- Monitoring the status of an Intelligent Battery Backup Unit (BBU), and recharging/reconditioning the battery if needed (new PCI controllers only).

Event Monitoring

The Global Array Manager Server driver subcomponent monitors activity and performance of all devices and controllers attached to the server. When an identified activity occurs which results in an “event” (whether severe, such as a hard disk failure, or informational, such as assignment of a drive to hot spare status), the event is sent to selected workstations running GAM Client.

Events are displayed in the Log Information Viewer. An “event” can be any of the following:

- Server attach and detach (Guest, User, and Administrator)
- Error or warning condition in a RAID subsystem (such as a power, fan, or drive failure)
- Any administrative activity (taking a drive off-line, killing, or rebuilding a drive)

> ☛ **Note**
>
> It is recommended that the Global Array Manager Client be kept active.

Opening the Log Information Viewer

The Log Information Viewer is opened when the program is started and one or more controllers are detected (see “Components of the Log Information Viewer” on page 3-4). The viewer displays the contents of gam2cl.log, an ASCII text file. This file contains a chronological log of all the events that occur while this session of the program is executing. By default, the log file is named gam2cl.log. The log file name and location can be changed on the Alert Preferences page or in the gam2cl.ini file.

Opening an Event Information Window

If you wish to obtain additional information about any event displayed in the Log Information Viewer, the program allows you to open an event information window. Appendix A documents the entire list of event descriptions, causes (details), and actions.

To open the event information window for a particular event:

1. Check that the Log Information Viewer is displayed.
2. Determine which event you would like more information about (scroll the Log Information Viewer if necessary), and double-click anywhere along the event line (or double-click in the Event ID field).

   An event information window for your selected event is displayed. An example is shown in Figure 5-1:

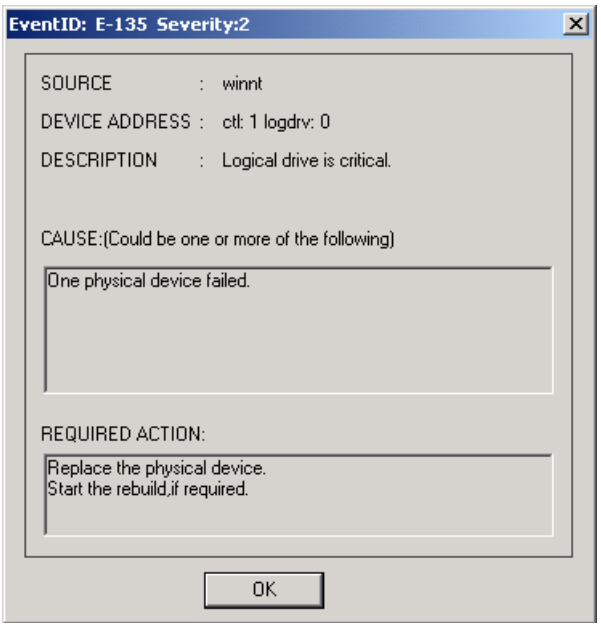


Figure 5-1. Event Information Window

   A variety of information about the event is displayed to aid in troubleshooting. The Event ID and Severity Level are displayed in the window's titlebar. SOURCE, DEVICE ADDRESS, and DESCRIPTION redisplay information from the original event line.

   The most useful fields are:

   - **CAUSE**. Possible reasons that the event occurred, and
   - **REQUIRED ACTION**. What you should do in response to this message. Informational messages will most likely have no required actions. Critical, Serious, Error, and Warning messages may specify useful required actions.

3. Click OK to close the event information window.

Controller Monitoring

After a client and server connection is made through sign-on, the GAM Client opens a window for each RAID controller, SCSI HBA, and their drives operating in that file server. These controller windows are the Global Array Manager Client's Controller View (see "Components of the Controller View Window" on page 3-5 for a detailed description).

Displaying Controller Information

Open Controller Information by clicking **Administration->Controller Information** on the menu bar or the Controller Information icon as shown in Figure 5-2:

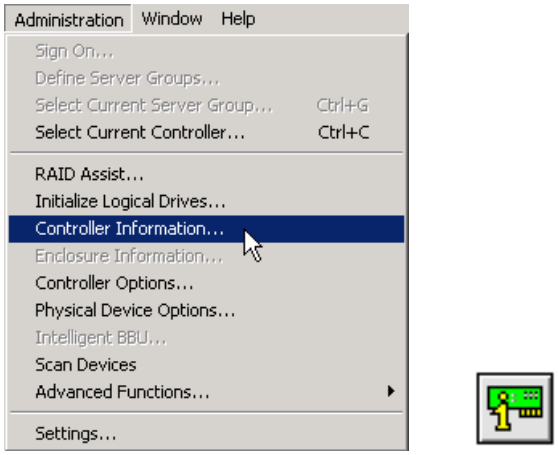


Figure 5-2. Select "Controller Information"

Figure 5-3 shows the Controller Information window for a PCI RAID Controller.

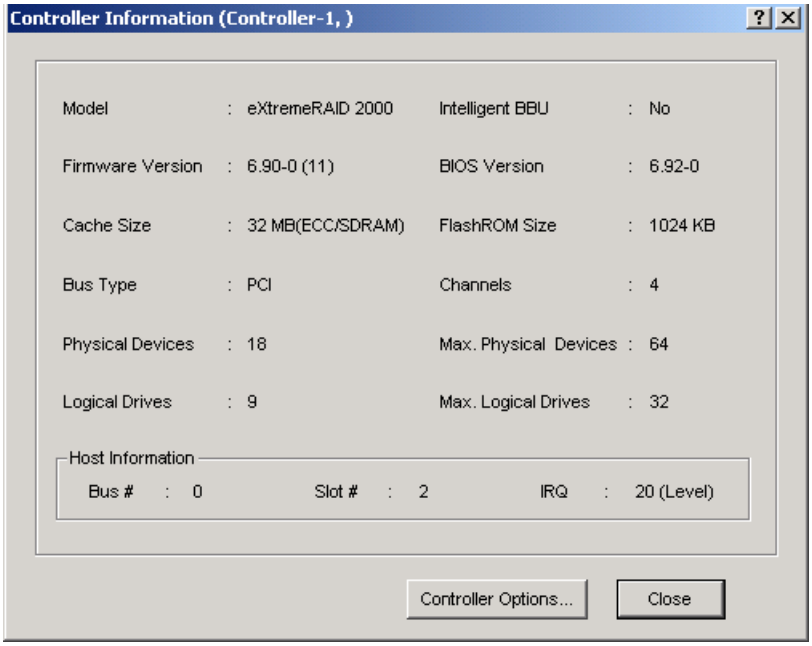


Figure 5-3. Controller Information

The following information is displayed:

- The controller model
- Whether an Intelligent Battery Backup Unit is installed (N/A for not supported on the current controller)
- The firmware and BIOS versions residing on the controller
- The cache size and FlashROM size
- The bus type and number of channels on the controller
- The number of physical devices detected, and the maximum number of physical devices that this controller can hold
- The number of logical drives configured on this controller, and the maximum number of logical drives that can be configured
- Host information: bus number, slot number, and IRQ

Click the Controller Options button to view a dialog box of user-definable controller parameters (see “Setting and Modifying Controller Options” on page 4-2).

Click the Close button to close the Controller Information window.

Physical Device and Logical Drive Monitoring

This section describes how the Global Array Manager Client monitors physical devices and logical drives.

Displaying Device Information

The Controller View window details which *physical* devices are associated with each controller channel. Each stack of drives represents the physical drives connected to a single channel on the controller.

A physical device can be a host controller, a CD-ROM drive, disk drive, tape drive, etc. Double-click a physical device icon to display information about a particular physical device.

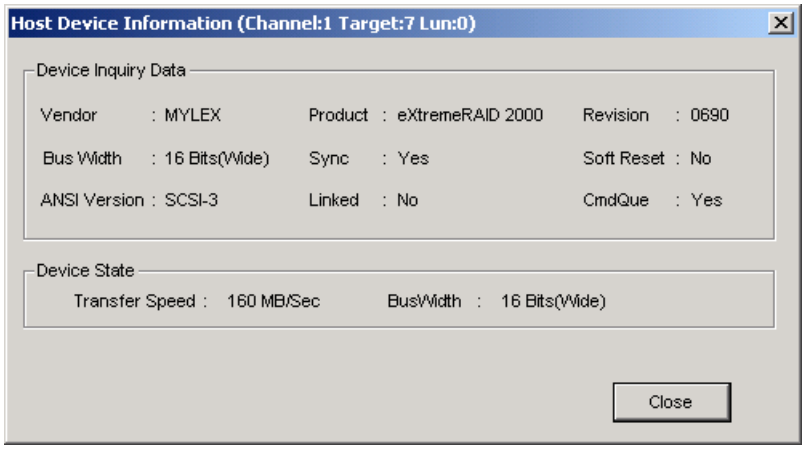


Figure 5-4. Host Device Information – RAID Controller

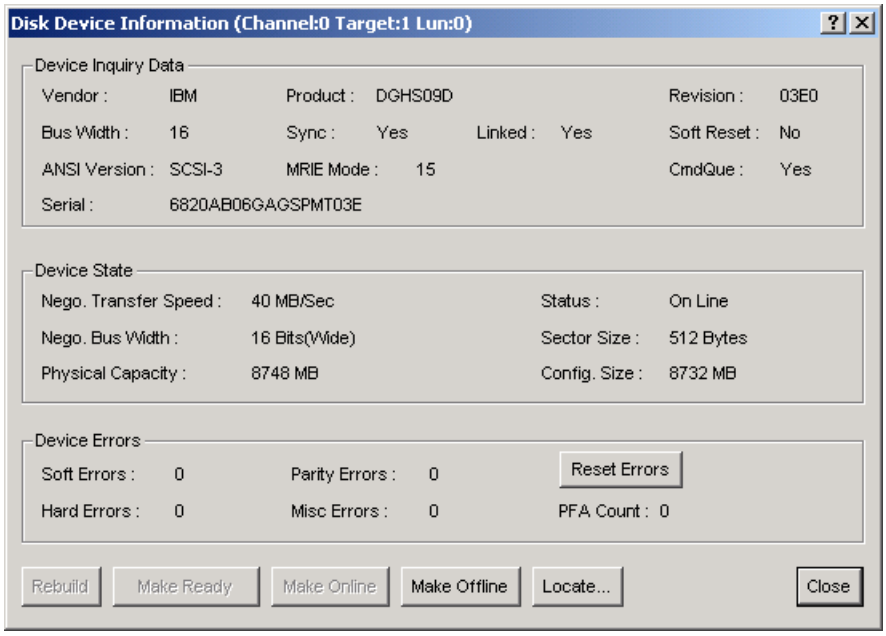


Figure 5-5. Disk Device Information

Device Information (Figure 5-4, Figure 5-5) displays the following about the currently-selected physical device.

Device Information: RAID Controller

- The vendor or source of the controller
- The controller's product identification
- The revision level of the hardware
- The back-end bus width (in bits)
- Whether the following parameters are set to Yes or No: Sync, Soft Reset, Command Queuing
- ANSI Version supported
- Back-end transfer speed and bus width (device state)

Device Information: Disk Drive

- The vendor or source of the drive
- The drive's product identification (such as ATLASIV9WLS)

- The revision level of the firmware in the drive
- The back-end bus width (in bits)
- Whether the following parameters are set to Yes or No: Sync, Soft Reset, Linked, Command Queuing
- ANSI Version supported
- MRIE Mode
- Disk drive serial number
- The physical capacity of the disk device in MB
- The back-end negotiated transfer speed (MB/sec) and back-end negotiated bus width
- The "configured" size of the disk device in MB
- Sector size (usually 512 bytes)
- The current status of the disk (online, offline, etc.) and a failure indicator if the disk drive has failed (refer to Appendix A for a list of error codes)
- The number of soft, hard, parity, and miscellaneous errors registered

In the disk drive Device Information dialog box...

Click the Reset Errors button to return all error tallies to 0.

If the disk drive's status is Rebuild, the Rebuild button may be available so that you can initiate a physical device rebuild.

If the physical device is unconfigured, the Make Ready button may be available to make this device disk available for configuration. You will then need to go to RAID Assist to configure the device disk (see "Running RAID Assist" on page 4-9).

If the disk drive's status is dead, you will see a failure indicator display on the Device Information page in the Device State section.

Make Online and Make Offline buttons should be used with great caution. Refer to the online help file, or call IBM for support on these options.

The Locate button allows you to locate this physical device visually (only for new Mylex PCI controllers):

1. Click the Locate button.

   The LED of the physical disk will blink to reveal its location.

☛ **Note**

LEDs associated with global or dedicated spares will not blink.

Figure 5-6. Locate Device Message

2. Click OK (see Figure 5-6) to end the locate operation and return to normal status.

The PFA Count shows the amount of device errors registered. Click the PFA Information button to display the PFA sense code details (Figure 5-7).

☛ **Note**

The PFA button will not be visible if the PFA count is zero.

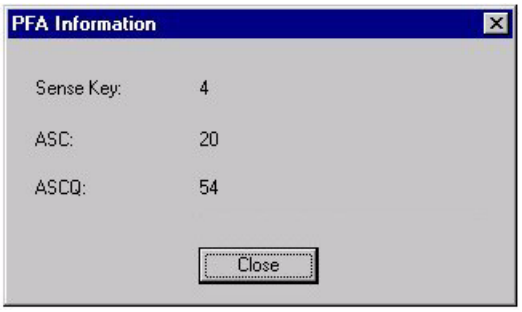


Figure 5-7. PFA Information Window

Click the Close button to close the window.

Viewing the Request Sense Data and NVRAM Error Log

Open the Error Table by clicking **View->Error Table** on the menu bar or the Error Table icon as shown in Figure 5-8.

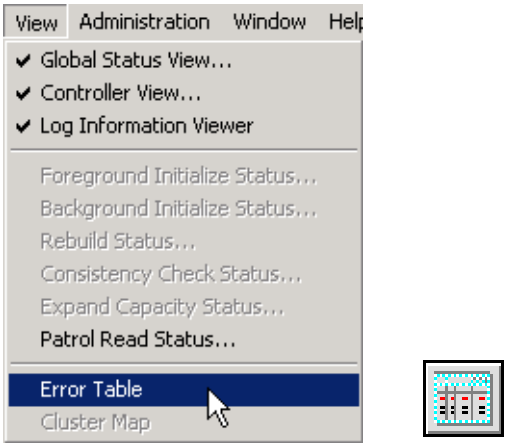


Figure 5-8. Select "Error Table"

If you click the Request Sense Data tab, the following type of information appears (Figure 5-9):

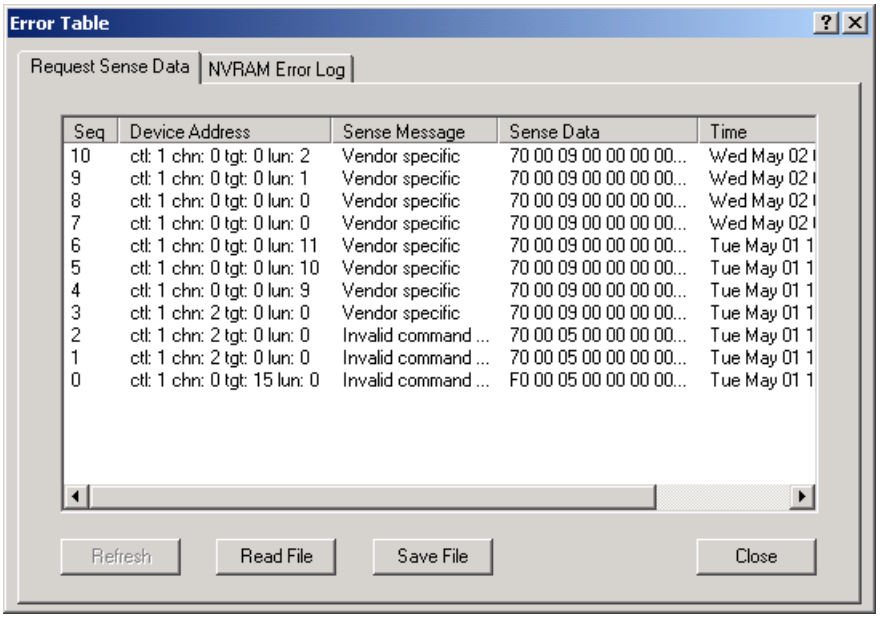


Figure 5-9. Request Sense Data

This information may be useful for troubleshooting or later analysis.

1. Click Save File to record the request sense data for later use. The .rsd file can be saved to a floppy disk or your hard drive.
2. Click Read File to open and view a .rsd file that was previously saved.
3. Click Close to close the Error Table.

For new PCI controllers, a tab for NVRAM Error Log will be added (Figure 5-10):

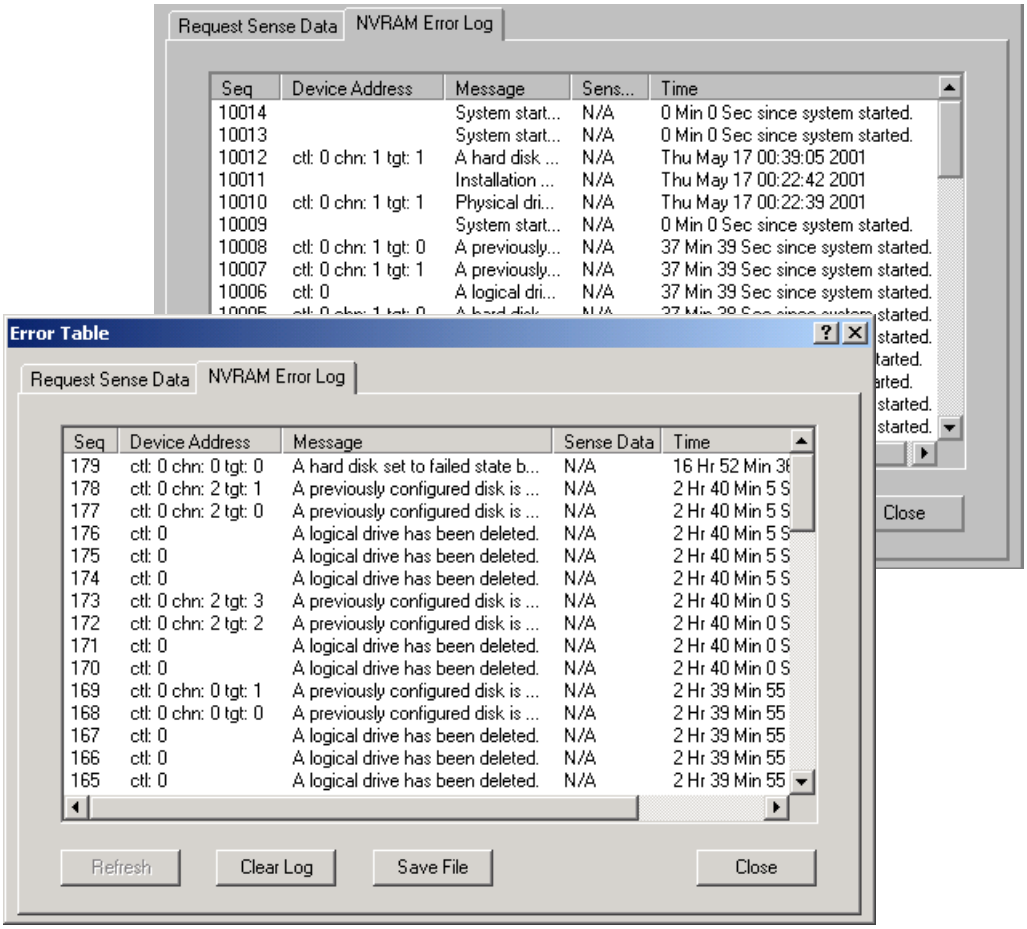


Figure 5-10. NVRAM Error Log

Similar to the event log in the controller memory, the error event logged in the NVRAM has the following types:

- Generic event: it records all activity changes, i.e. disk drive offline, logical created/deleted, etc.

- Request Sense: Also referred to as 'Error Events', this records only error activity in the form of vendor unique SCSI request sense format for Mylex errors or actual SCSI request sense from physical device, i.e. rebuild failed, consistency check failed, deferred write error, etc.
- Additional events that normally output through serial debugging port but are critical for failure analysis will be logged too. For example, power cycling, PCI bus error, abnormal SCSI bus behaviors etc.

> ☛ **Note**
>
> The controller does not have Real Time Clock (RTC) data, therefore, events logged by the controller before you start Windows 2000 will display a relative time stamp.This is a time value that is set when the controller is powered on. See Figure 5-10.
>
> Events logged by the controller after you start Windows 2000 will display an absolute time stamp (date and time). This is a time value that the controller driver sets when Windows 2000 is started.

The following describes the button functions for the NVRAM Error Log:

- To save data for failure analysis that can be used for troubleshooting, click the Save File button to record the NVRAM Error data for later use.
- To clear the NVRAM Error Log, click the Clear Log button.
- When new NVRAM errors are logged, click the Refresh button.
- To update the NVRAM Error Log with the latest errors from the controller, click the Refresh button.
- Click Close to close the Error Table.

Displaying Logical Drive Information

The icons on the right side of the Controller View window represent the *logical drives* (also known as logical units or system drives) created by the controller out of the available physical drives.

Double-click a logical drive icon to display information about a particular logical drive (Figure 5-11).

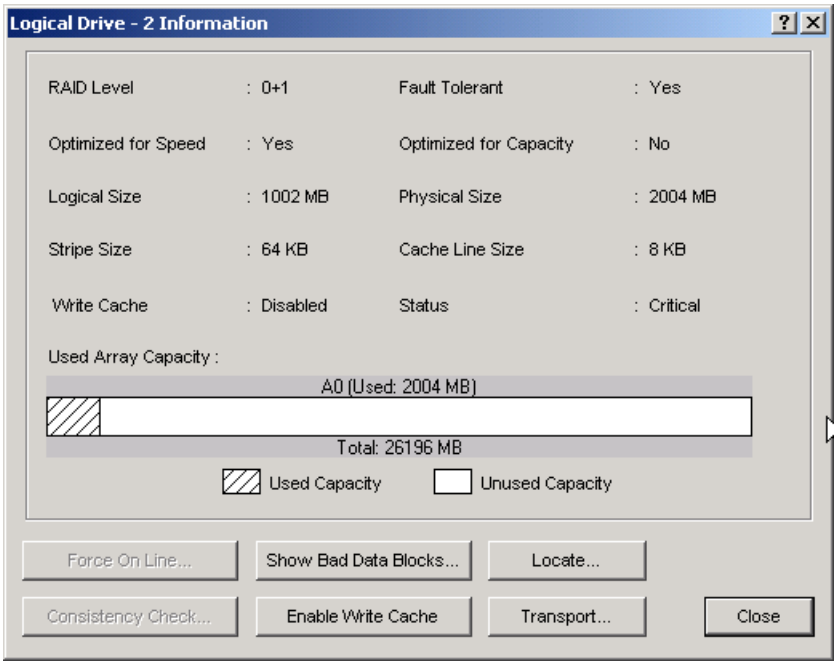


Figure 5-11. Logical Drive Information for a RAID Controller

Logical Drive Information displays the following about the currently-selected logical drive:

- The logical drive number (in the window's titlebar)
- The RAID level at which the logical drive is configured
- Whether the logical drive's configuration is optimized for speed, optimized for capacity, and fault tolerant [Yes/No]
- The logical and physical size of the logical drive
- The stripe size and cache line size in use by the logical drive
- Whether write back cache is enabled or disabled
- The operational status of the logical drive

- Out of the total amount of capacity configured on the controller, the amount of capacity held by this logical drive (shown in a bar graph)

If write back cache is disabled, click the Enable Write Cache button to enable the cache.

If write back cache is enabled, click the Disable Write Cache button to disable the cache (and use write through caching).

If the Consistency Check button is enabled, you may manually run a consistency check on this logical drive (as discussed in the next chapter).

Click Show Bad Data Blocks to display a window of all bad data blocks found on this logical drive.

If the logical drive has been placed offline due to some external cause such as a power failure, click Force On Line to return the logical drive to an active state. A warning window appears asking for confirmation of the force online procedure.

> ⚠ ***Caution***
>
> Forcing a logical drive online should only be done in a power failure recovery situation. Doing so at any other time may result in data loss.

The Locate button allows you to locate the physical devices visually that comprise this logical drive (only for new Mylex PCI controllers).

1. Click the Locate button.

   The LED(s) of the physical disk(s) will blink to reveal their location.

> ☛ **Note**
>
> LEDs associated with global or dedicated spares will not blink

.

Figure 5-12. Locate Device Message

2. Click OK (see Figure 5-12) to end the locate operation and return to normal status.
3. Click the Close button to close the dialog box.

The Transport button opens the Disk Array Transport Information window that shows all of the physical drives, including the spares associated with the selected logical drive, and all of the logical drives that belong to the same disk array. See “Transporting a Disk Array” on page 4-36 for details.

Enclosure Monitoring and Management

The Controller View window contains an Enclosure button with a status light. The Green square indicates OK, the Yellow circle indicates Critical status, and a Red X indicates failed status. You can monitor information, status, and additional details about enclosures by clicking the Enclosure button in Controller View. Alternatively, you can select Enclosure Information from the Administration menu as shown in Figure 5-13.

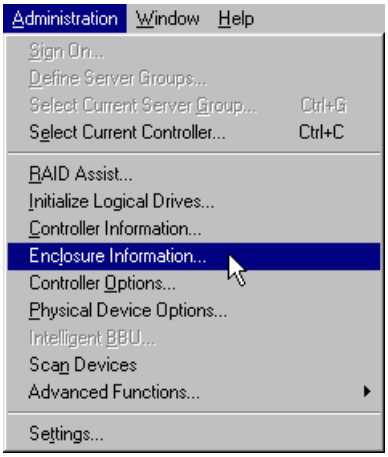


Figure 5-13. Select "Enclosure Information"

The Enclosure Information dialog box is displayed with the Information page active (Figure 5-14).

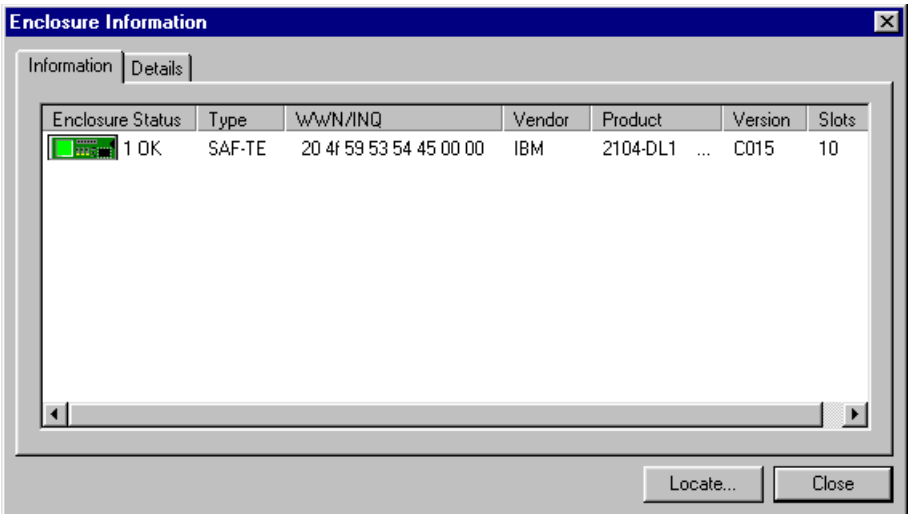


Figure 5-14. SES Enclosure Information – Information Page

Information Page

Enclosure Information displays the following about the currently-available enclosures:

- The status of each enclosure, identified by an icon and an enclosure number (1–32)[1], as well as one of the following expressed in text:
  - OK – All components are optimal.
  - Critical – Some component has failed; one more failure may result in data loss.
  - Failed – A failure has occurred that may result in data loss.
- The enclosure type (SES, SAF-TE).
- The World Wide Name or Inquiry (WWN/INQ) for the enclosure:
  - For SES – The World Wide Name as 8 hex bytes.
  - For SAF-TE – The first 8 bytes of the Inquiry command's data.
- The vendor identification.

1. An undetermined enclosure shows as a zero (0). In this case, all information is presented as if there is a single enclosure with all the fans, power supplies, etc.

- The product identification.
- The product revision level.
- The number of drive slots in the enclosure cabinet.

Highlight an enclosure and the Locate button will become available. Click the Locate button to “blink” the LEDs of all of the physical drives in the enclosure to reveal its location. A locate enclosure dialog box will open, click OK or press the Enter key to end the locate operation.

Click the Close button or press the Enter key to close the dialog box.

Details Page

Select the Details Tab to display Enclosure Information Details (Figure 5-15).

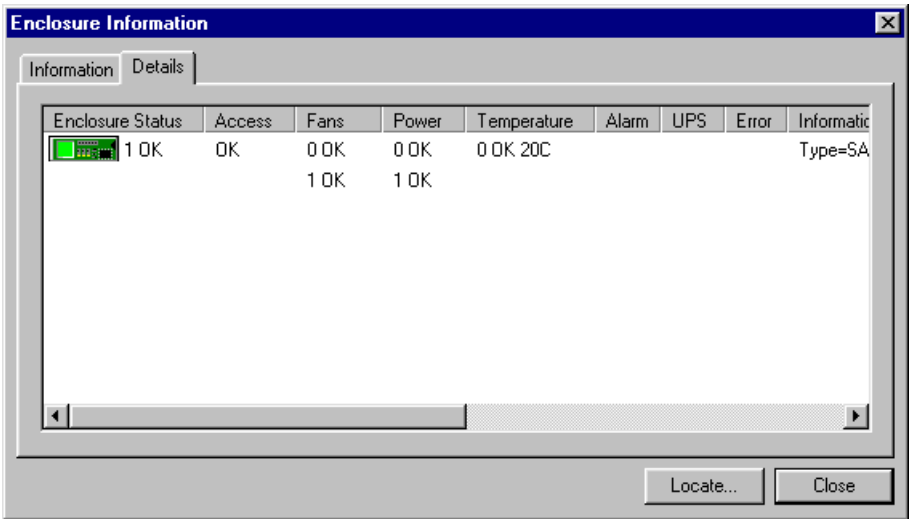


Figure 5-15. SES Enclosure Information – Details Page

Enclosure Information Details page displays the following about the currently-available Fibre enclosures:

The status of each enclosure, identified by an icon and an enclosure number, as well as one of the following expressed in text:

- OK – All components are optimal.
- Critical – Some component has failed; one more failure may result in data loss.
- Failed – A failure has occurred that may result in data loss.

The access status of each enclosure, which indicates the controller's ability to communicate with the enclosure. The status values are:

- OK – Access is optimal.
- Critical – Only one access path remains of the several that were detected previously. If the last access path is lost, the controller will take steps to protect the data.
- Lost – The enclosure is unreachable by the controller. Any failures in the enclosure while this state exists will not be sensed by the controller.

The speed of the fans in the enclosure. Each fan is designated with a number, the values are:

- Absent – The fan is not installed, or has failed in an undetectable way.
- OK – The fan is optimal. Fan speed is shown as either Stopped, Low, or High. (Speed is not shown for SAF-TE enclosures.)
- Failed – The fan is installed, but has failed.

The status of the power supplies in the enclosure. Each power supply is designated with a number. The status values are:

- Absent – The power supply is not installed, or has failed in an undetectable way.
- OK – The power supply is optimal.
- Failed – The power supply is installed, but has failed.

The status of the temperature sensors in the enclosure. Each temperature sensor is designated with a number. The status values are:

- Absent – The temperature sensor is not installed, or has failed in an undetectable way.
- OK – The temperature sensor is optimal. Two additional items are displayed with this state: Celsius Temperature (range for SES is -19º to +235º; range for SAF-TE is -10º to +245º); Over Temperature Warning (OT).
- Failed – The temperature sensor is installed, but has failed.

The status of the alarms in the enclosure. Each alarm is designated with a number, the status values are:

- Absent – The alarm is not installed, or has failed in an undetectable way.
- OK – The alarm is optimal. One additional item is displayed with this state: ON – the alarm is currently on or sounding.
- Failed – The alarm is installed, but has failed.

The status of the enclosure's connection to one or more Uninterruptable Power Supplies (UPS). Each UPS is designated with a number. The status values are:

- Absent – The UPS is not installed, or has failed in an undetectable way.
- OK – The UPS is optimal. Three additional items are displayed with this state: AC Pwr – the UPS is reporting an AC power failure; DC Pwr – the UPS is reporting a DC power failure; Low Bat – the UPS can power the system for only 2 to 5 more minutes.
- Failed – The UPS is installed, but has failed.

Error status for troubleshooting purposes. Error status for an enclosure is reported in a format similar to the following example:

```
0 Addressing 25 02:03 04:05
```

- *0* is the error number.
- *Addressing* is the error type.
- *25* is the ALPA (Arbitrated Loop/Port Address) of the drive in question.
- *02:03* is the first known channel and target to which the ALPA is mapped.
- *04:05* is the second known channel and target to which the ALPA is mapped.

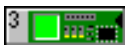
An information field which contains most of the items listed on the Information page for easier cross-reference.

Highlight an enclosure and the Locate button will become available. Click the Locate button to "blink" the LEDs of all of the physical drives in the enclosure to reveal its location. A locate enclosure dialog box will open, click OK or press the Enter key to end the locate operation and return to normal status.

Click the Close button or press the Enter key to close the dialog box.

SCSI Enclosures

Among the stack of drives displayed in a channel tower of the Controller View window, you will find an enclosure depicted. Its icon looks something like this:



Double-click the enclosure icon to display enclosure information about the enclosure icon (Figure 5-16).

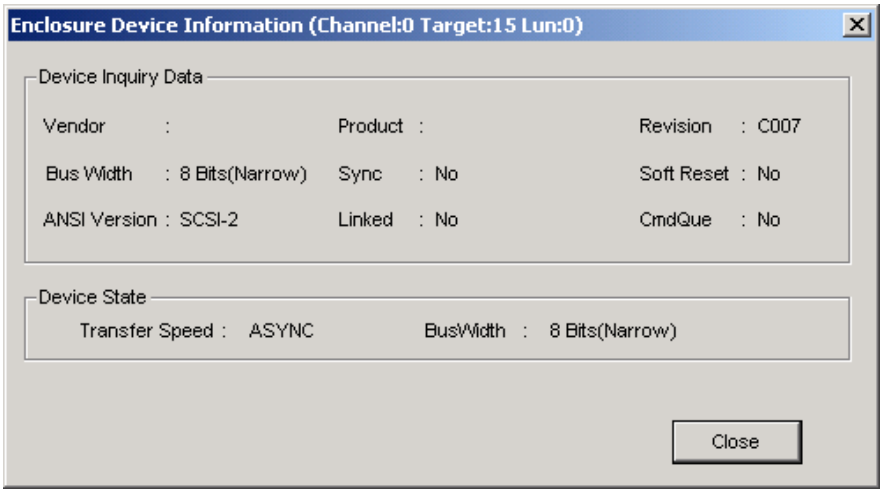


Figure 5-16. Processor Device (Enclosure) Information: SCSI

Processor Device Information displays the following about the currently-selected enclosure/processor:

Processor/Enclosure Information: SCSI

- Device Inquiry Data information, such as vendor, product, product revision, bus width, etc.
- Device State information, such as transfer speed and bus width

Click the Close button to close the dialog box.

Process Status Monitoring

This section describes the various ways to monitor long operation tasks.

Background and Foreground Initialization Status

While background or foreground initialization is performed, open the Background or Foreground Initialization Status box as shown in Figure 5-17 to monitor the progress of or cancel the process.

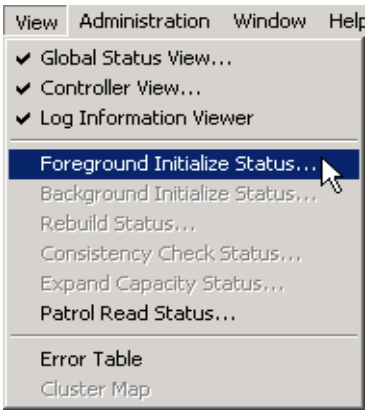


Figure 5-17. Foreground Initialization Status Shown

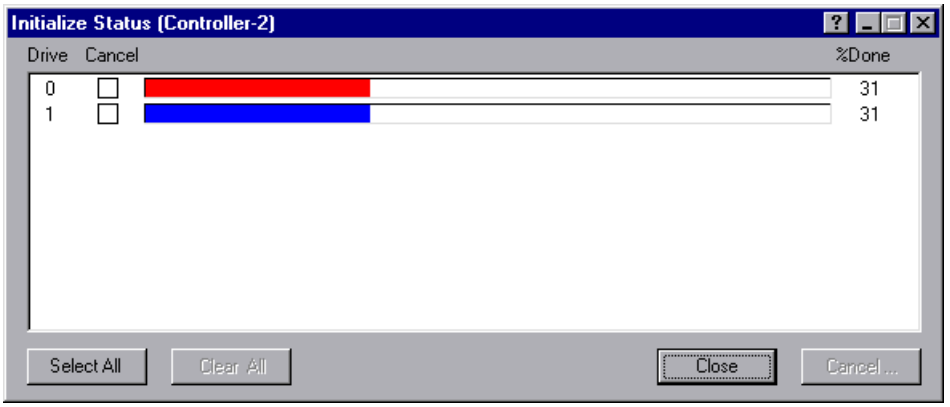


Figure 5-18. Foreground Initialization Status Box Shown

The Initialize Status box (Figure 5-18) displays the progress of one or more full logical drive initializations.

To cancel ALL Foreground drive initializations at the same time...

Click the Select All button, which selects all drives for cancellation, then click Cancel to stop all the initializations.

To cancel individual drive initializations...

Check the box(es) of the drive(s) to cancel, then click Cancel to stop only those initializations.

If all drives are selected for cancellation and you wish to reverse that...

1. Click the Clear All button, which deselects all drives for cancellation.
2. Click Close to close the Initialize Status box at any time.

Rebuild Status

If a rebuild process is currently underway, open the Rebuild Status box as shown in Figure 5-19 to monitor the rebuild progress or cancel the process.

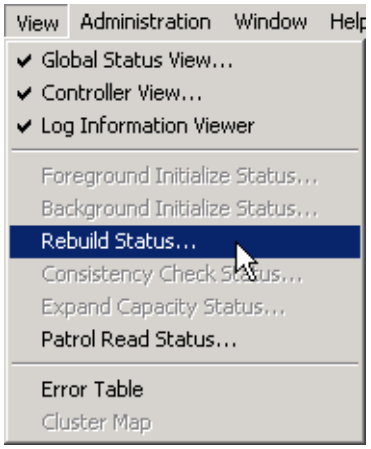


Figure 5-19. Select "Rebuild Status"

The Rebuild Status box (Figure 5-20) displays the progress of a physical drive rebuild. The command rebuilds *all* logical drives that occupy any portion of the targeted physical drive.

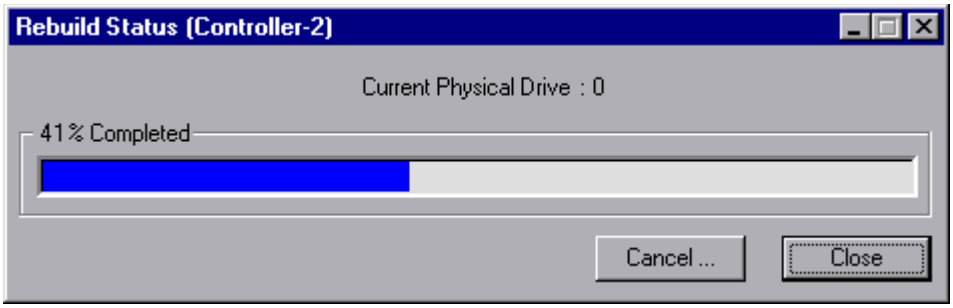


Figure 5-20. Rebuild Status Box

Click Cancel to stop the rebuild. You may need to check the Views menu to see if Rebuild Status is still enabled. If so, you may need to cancel other rebuilds as well.

Click Close to close the Rebuild Status box at any time.

Consistency Check Status

If a consistency check process is currently underway, open the Consistency Check Status box as shown in Figure 5-21 to monitor the consistency check progress or cancel the process.

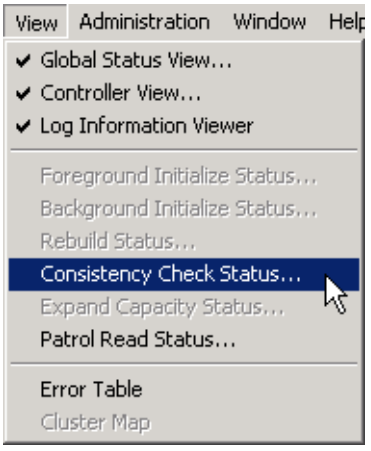


Figure 5-21. Select "Consistency Check Status"

The Consistency Check Status box (Figure 5-22) displays the progress of a logical drive consistency check.

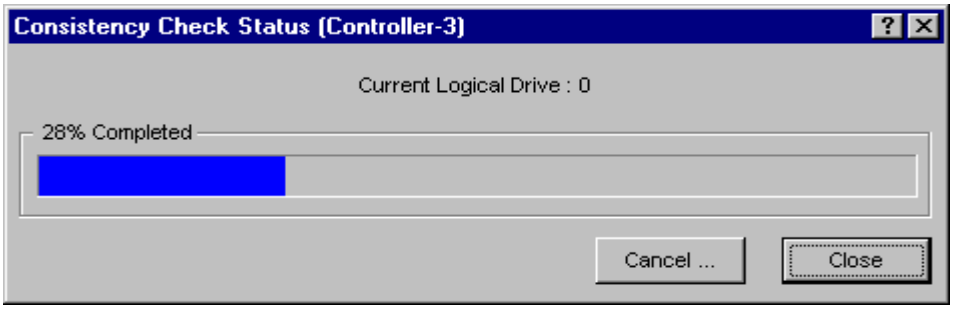


Figure 5-22. Consistency Check Status Box

Click Cancel to stop the consistency check. You may need to check the Views menu to see if Consistency Check Status is still enabled. If so, you may need to cancel other consistency checks as well.

Click Close to close the Consistency Check Status box at any time.

Expand Capacity Status

If an expand array (also called "MORE2") process is currently underway, open the Expand Capacity Status box as shown in Figure 5-23 to monitor the progress of this process. This status box is also used to monitor a defragmentation.

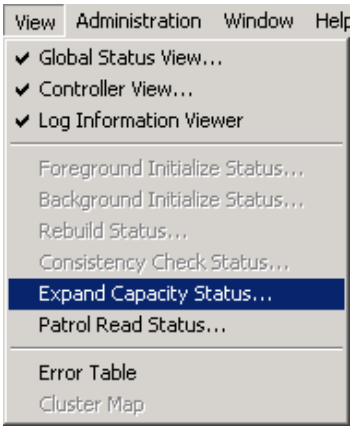


Figure 5-23. Select "Expand Capacity Status"

The Expand Capacity Status box (Figure 5-24) displays the progress of a disk array capacity expansion or defragmentation.

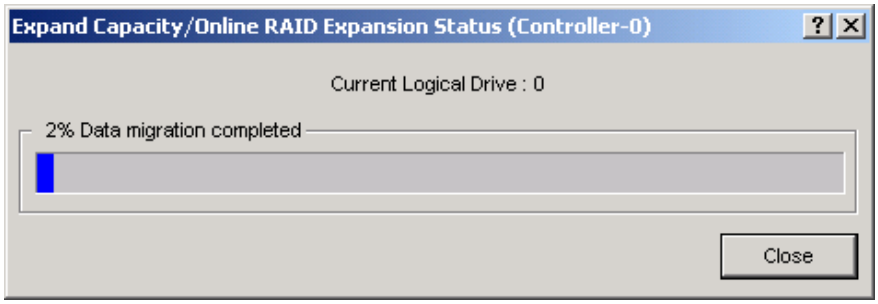


Figure 5-24. Expand Capacity Status Box

WARNING

Expand Capacity cannot be canceled.

Click Close to close the Expand Capacity Status box at any time.

Patrol Status

To monitor the Patrol Read Status, open the Patrol Status box as shown in Figure 5-25.

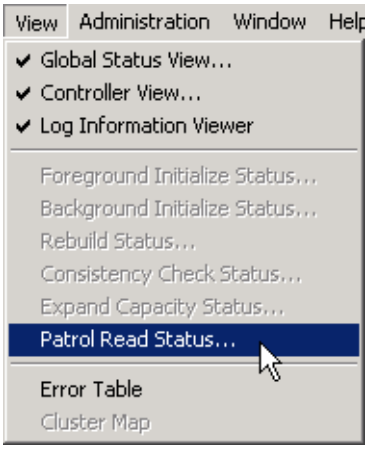


Figure 5-25. Select "Patrol Read Status"

The Patrol Read Status dialog box displays (Figure 5-26). You can start the Patrol Read operation from the point it was stopped. If it was never enabled, the Patrol Read operation will start from the beginning. This feature will enable the GAM Client to poll every 1 minute to get new status data from the controller.

Once you click on the Start button to begin the Patrol Read operation, the Start button will change to Stop. Click the Stop button to end Patrol Reading.

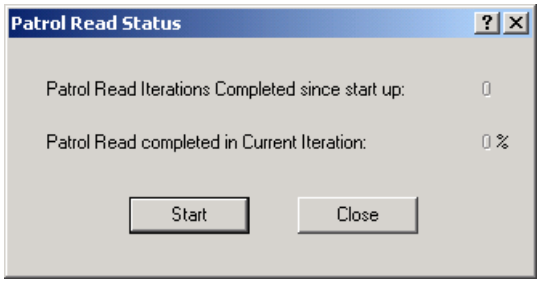


Figure 5-26. Patrol Read Status Dialog Box

Battery Backup Unit Monitoring and Maintenance

If your controller is equipped with an Intelligent Battery Backup Unit (BBU), you will be able to open the BBU dialog box as shown in Figure 5-27:

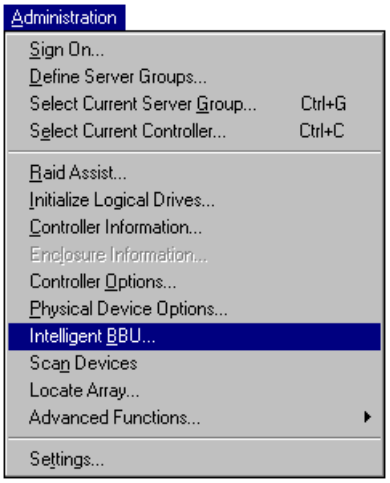


Figure 5-27. Select "Intelligent BBU"

Figure 5-28 shows the Intelligent BBU window for new Mylex PCI RAID Controllers.

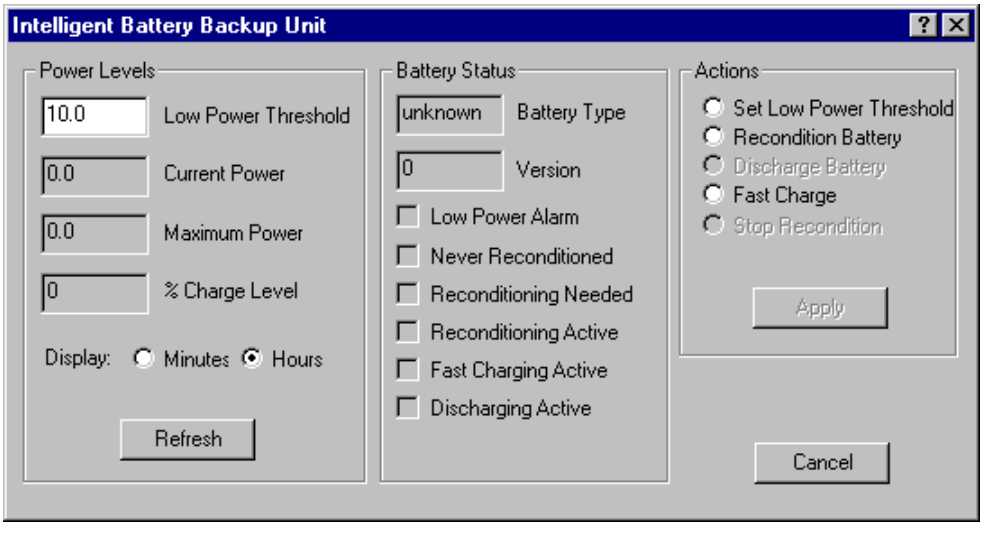


Figure 5-28. Intelligent BBU – New PCI Controllers

The Intelligent Battery Backup Unit (BBU) dialog box is used to monitor and charge or recharge the backup battery pack on the controller. This

battery pack maintains the controller's data in RAM in case AC power is lost to the disk storage system. When a new battery is needed, the BBU dialog indicates this by showing the battery can no longer take or hold a charge. This dialog box is also used after an old battery pack is replaced with a new one. The new battery must be fully discharged before it can be charged up.

Prior to beginning normal operations, IBM recommends that you condition the battery for maximum longevity. See “Conditioning the Battery” on page 5-31.

Power Levels

The Power Levels area of the Intelligent Battery Backup Unit dialog box contains the following:

- **Low Power Threshold**. A preset or modifiable power level, expressed as hours or minutes of charge, used to trigger an alarm when the battery power level drops below the set value. Set a threshold, select “Set Low Power Threshold” under Actions, then click Apply to set the new value.
- **Current Power**. The current power level of the battery expressed as hours or minutes of charge. This value will change as the battery is discharged or charged.
- **Maximum Power**. The highest level the battery has been charged up to expressed as hours or minutes of charge. This value will change as the battery ages and is reconditioned. The older the battery gets, the less charge it can contain.
- **% Charge Level**. The battery's charge level, where 100% means the battery has been charged up to its maximum level.
- **Display: Minutes**. Displays power values in minutes.
- **Display: Hours**. Displays power values in hours and tenths of hours.
- **Refresh**. Updates the Power Levels and Battery Status groups. It is useful during a lengthy operation such as a recondition to update the dialog without leaving it and re-entering.

Battery Status

The Battery Status area of the Intelligent Battery Backup Unit dialog box contains the following:

- **Battery Type**. The battery pack type. Available options are Ni-Cad or Unknown.
- **Version**. Version number for the controller. Version selection numbers are from 0 to 255. The version number used for the first release is 1 for the controller production release.

The following are read-only checkbox items which indicate the battery status:

- **Low Power Alarm**. A low power condition exists as defined when the Current Power value drops below the Low Power Threshold value.
- **Never Reconditioned**. Battery has not been fully discharged before it was charged up. A new battery will have this checked until it has been fully discharged and then charged by the Recondition Battery selection under Actions.
- **Reconditioning Needed**. Battery has not been reconditioned within 30 discharge/charge cycles. Select “Recondition Battery” under Actions, then click Apply.
- **Reconditioning Active**. Process of discharging/recharging the battery is underway. Allow the process to complete or it will have to be repeated. If you do need to interrupt reconditioning, select “Stop Recondition” under Actions, then click Apply.
- **Fast Charging Active**. Battery is being charged. A fast charge also occurs when the controller is powered on.
- **Discharging Active**. Battery is currently discharging, which is the first stage of a Recondition Battery action.

Actions

The Actions area of the Intelligent Battery Backup Unit dialog box contains the following:

- **Set Low Power Threshold**. Edit the Low Power Threshold field under Power Levels. To change the threshold to this new setting, select Set Low Power Threshold, then click Apply.
- **Recondition Battery**. To initiate a battery recondition sequence, select Recondition Battery, then click Apply. The controller cache is placed in conservative cache mode (Write Through) while the battery’s capacity remains below the determined threshold.

- **Discharge Battery**. Currently inactive. Reserved for future use.
- **Fast Charge**. To initiate a fast charge on the battery, select Fast Charge, then click Apply. A fast charge also occurs when the controller is powered on.
- **Stop Recondition**. Only enabled when a recondition process is underway. To stop the recondition process, select Stop Recondition, then click Apply.
- **Apply**. Applies and saves the changes made in the BBU dialog box.
- **Cancel**. Exits the dialog box but does not stop the current action.

Conditioning the Battery

A full battery condition cycle consists of discharging and recharging the battery. The condition cycle must start with a fully charged battery. Normally the battery is automatically recharged, but in a new system or a system that has been subjected to a power outage, recharging may be necessary and may take several hours.

> ☛ **Note**
>
> Do not interrupt the reconditioning process.

The system administrator must initiate the condition cycle manually. The condition cycle must complete without an interruption of power. In addition, the operator must not interrupt the cycle by initiating a fast charge or another condition cycle. If the cycle is interrupted for any reason, the batteries must be recharged and the recondition process must be restarted.

> ☛ **Note**
>
> During the reconditioning, write back cache mode will be disabled. This may slow normal operations. Therefore, schedule this operation accordingly.

To ensure that the battery is fully charged and properly conditioned:

1. Choose Intelligent BBU from the Administration menu if the BBU dialog box is not currently displayed.
2. Make sure the “% Charge Level” is 100. If the battery is currently charging, Do Not continue until the Charge Level is 100.
3. Under Actions, select Recondition Battery, then click Apply.

Chapter 6
Maintenance Processes

Introduction

Maintenance processes include the following activities which you may need to perform from time to time on arrays that use redundancy and/or fault tolerance, or to maintain the most up-to-date firmware maintenance releases:

- Running a logical drive initialization.
- Running a consistency check on a logical drive to examine (and optionally restore) consistency (parity). Encountered errors will be written to the Error Table.
- Running a data rebuild on a physical drive that replaces a drive that went dead or offline.
- Upgrading Mylex PCI Controller firmware, BIOS, boot block, or BIOS Configuration Utility.
- Defragmenting an Array.
- Clearing a configuration.

Running a Logical Drive Initialization

Logical drive initialization offers the ability to run a full initialization of logical drives at a time of your choice, not just immediately following a new configuration. If it's inconvenient to follow a configuration immediately with a logical drive initialization, you can decline the initialization and use this menu item to start the process at a later time.

To open Initialize Logical Drives click **Administration->Initialize Logical Drives** on the menu bar as shown in Figure 6-1.

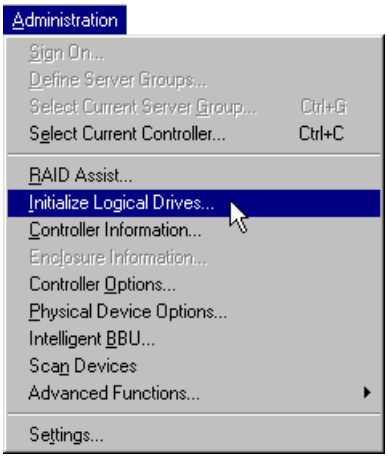


Figure 6-1. Select "Initialize Logical Drives"

An Initialize Logical Drives dialog box opens (Figure 6-2).

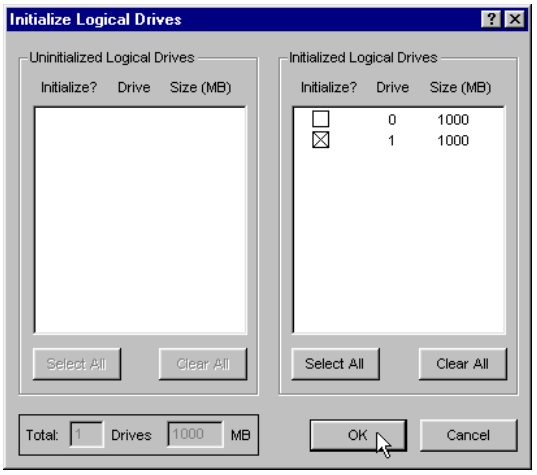


Figure 6-2. Initialize Logical Drives Dialog Box

To select logical drives to initialize, check the desired checkboxes next to the appropriate logical drive. Click The OK button or press the Enter key to begin the initialization. A Warning message dialog box will open for confirmation.

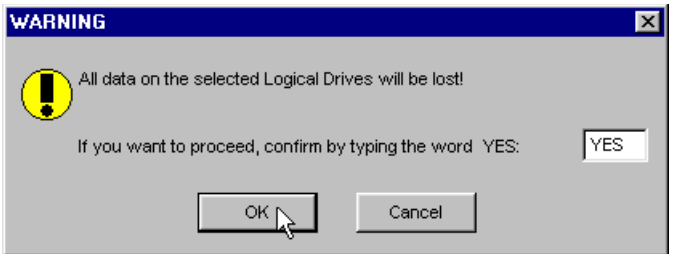


Figure 6-3. Initialization Confirmation Dialog Box

Type YES to confirm the initialization and click the OK button or press the Enter key. The Initialize Status Dialog box opens (Figure 6-4).

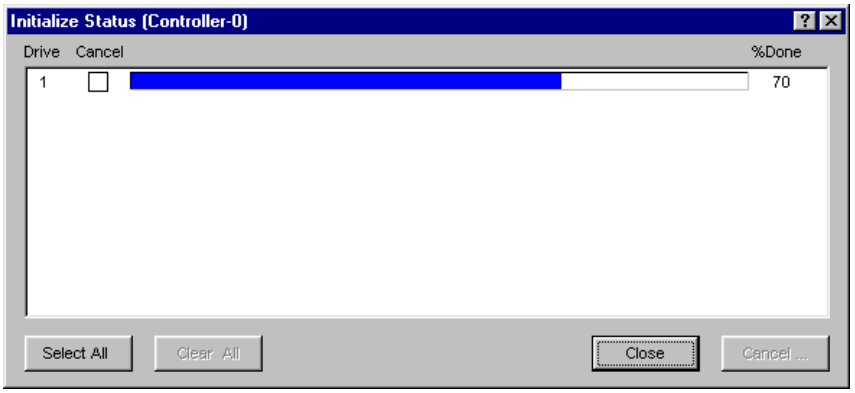


Figure 6-4. Initialize Status Dialog Box

This dialog box is used to monitor and/or cancel initialization. See “Process Status Monitoring” on page 5-22 for more information.

Running a Logical Drive Consistency Check

From time to time run a consistency check on each of your fault tolerant logical drives. This check scans the logical drive to determine whether consistency data has become corrupted and needs to be restored. If you have reason to believe that logical drive consistency data is corrupted, or if you wish to run a consistency check for maintenance reasons, perform the following procedure:

1. Double-click a logical drive in Controller View (right side of a Controller View window).
2. Click the Consistency Check button in the Logical Drive Information dialog box to begin.

A message is displayed asking if you would like consistency to be restored in the event of errors (Figure 6-5):

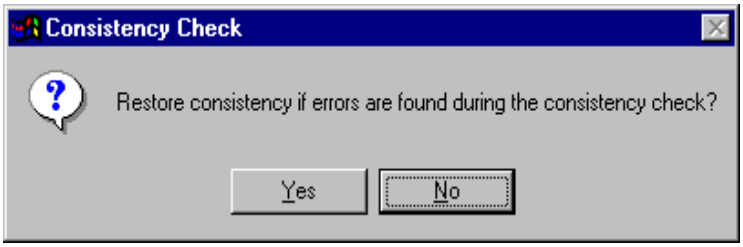


Figure 6-5. Restore Consistency If Errors Are Found?

3. Click Yes to restore consistency during the process.

   ⚠ ***Caution***

   If consistency data is badly corrupted on a logical drive, attempting to restore consistency may result in corrupted real data. Use the Yes option with caution.

   Click No if you just want to carry out the consistency check. There is no risk of data loss. Errors will still be reported to the Error Table but no attempt will be made to correct them.

Consistency Check runs and the Consistency Check Status box appears (see the previous chapter). Close the box and continue or leave the box open until Consistency Check has completed.

Running a Device Rebuild

If a single device in a fault tolerant system fails, the system is spared data loss by virtue of the striping with parity present across the logical drive (RAID 3, RAID 5) or the total redundancy of data (RAID 1, RAID 0+1). The failed drive needs to be replaced, and the failed drive's data must be rebuilt on a new drive to restore the system to fault tolerance once again.

The device rebuild function performs this task. A failed drive's data can be rebuilt to:

- The original drive if this drive happens to be still functional,
- A hot spare (standby) drive present for just this purpose, or
- A drive inserted in place of the failed drive.

If you need to carry out a device rebuild, perform the following procedure:

1. Reinsert the removed drive that caused the failure (if it is still a good drive), or replace the failed drive with a new drive of equal or greater capacity.
2. Double-click the relevant physical device in the Controller View window.

   The Disk Device Information dialog box will open, and the Rebuild button should be available (Figure 6-6).

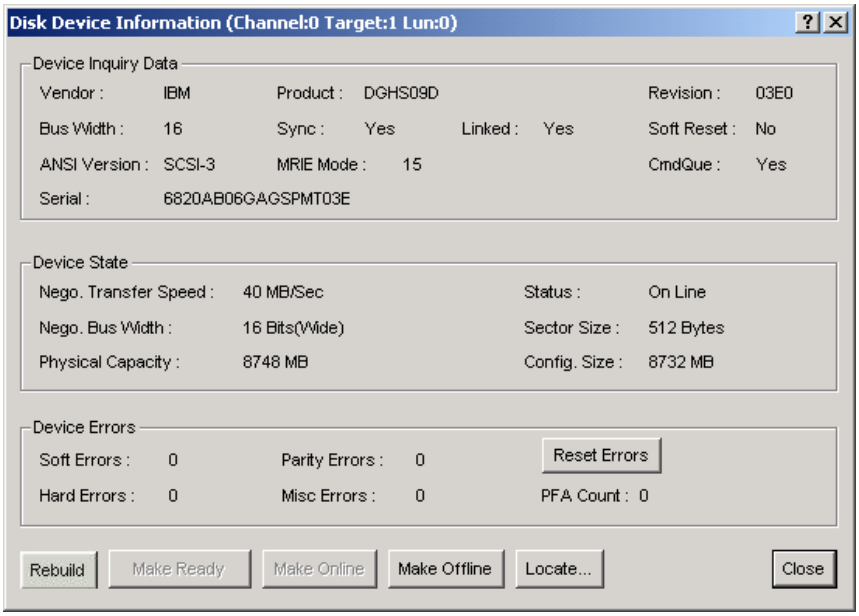


Figure 6-6. Rebuild Button Available for This Disk Device

3. Click the Rebuild button in the Disk Device Information dialog box.

Rebuild runs and the Rebuild Status box appears (see the previous chapter). Close the box and continue or leave the box open until Rebuild has completed.

When rebuild has completed, the selected physical device AND the logical drive(s) of which it is a part are returned to operational status. If you cancel rebuild, the device returns to its offline (dead) status (red X), and the logical drives that occupy this physical device all go to critical status (yellow exclamation point). You must complete a future rebuild to return the physical device and logical drive(s) to operational status.

Using the Flash Utility

The Flash Utility is used to upgrade firmware, BIOS, boot block, and BIOS Configuration Utility software by “flashing” the new code stored in an identified .IMG file to the on-board BIOS of the Mylex PCI Disk Array Controller. As maintenance releases of this code become available, this utility allows you to keep your controller current using GAM.

> ⚠ ***Caution***
>
> If Expand Array (Expand Capacity) is running or was stopped, you must allow the process to run to completion BEFORE replacing controllers and flashing new firmware. Otherwise, data corruption may result!

Open the Flash Utility as shown in Figure 6-7:

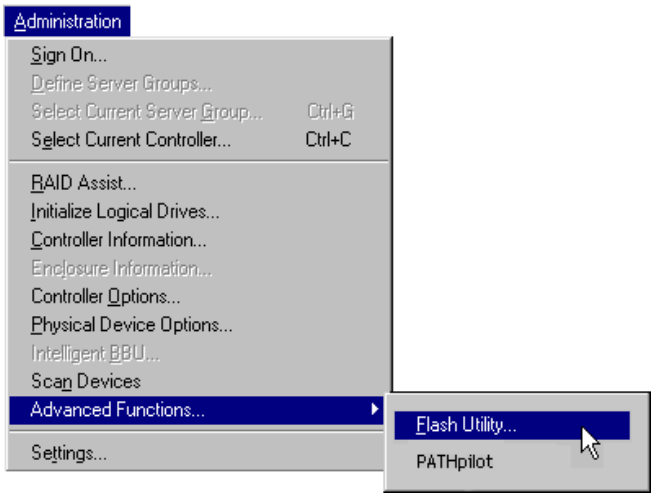


Figure 6-7. Select “Flash Utility”

The Flash Utility dialog box appears as shown in Figure 6-8:

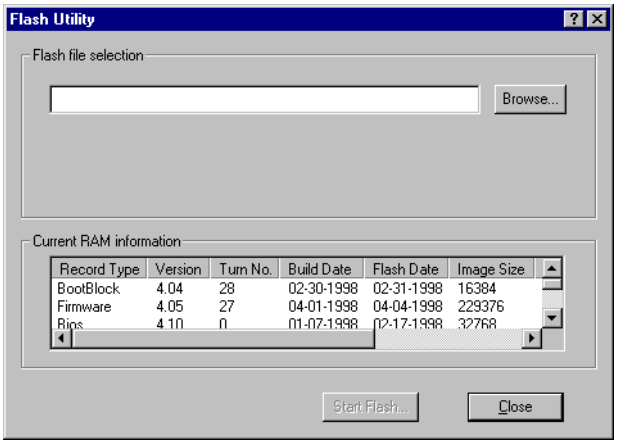


Figure 6-8. Flash Utility Dialog Box

Under Current RAM Information, you see displayed the key information regarding the code that is currently stored in the BIOS of your selected controller. This information is helpful for diagnostic and troubleshooting purposes as well as to determine whether you need to upgrade some aspect of the firmware, BIOS, etc.

To perform a flash upgrade:

1. Type the name of the appropriate image file (.IMG) in the Flash file selection box, or click the Browse button to locate the file.

   If you select Browse, the Open Image file dialog box is displayed as shown in Figure 6-9:

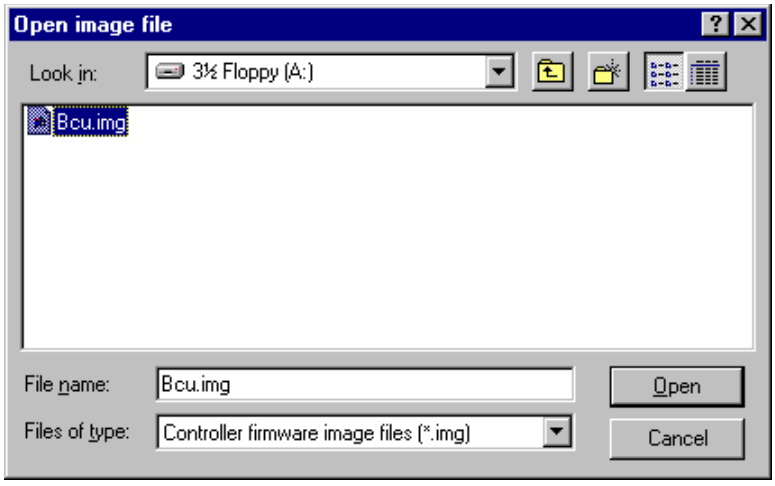


Figure 6-9. Open Image File Dialog Box

2. Select the image filename using the file selection dialog box.
3. Click Open.

   Once you've specified an appropriate image file, the Start Flash button becomes available in the Flash Utility dialog box, and the Flash file selection area displays details regarding the .IMG file (Figure 6-10).

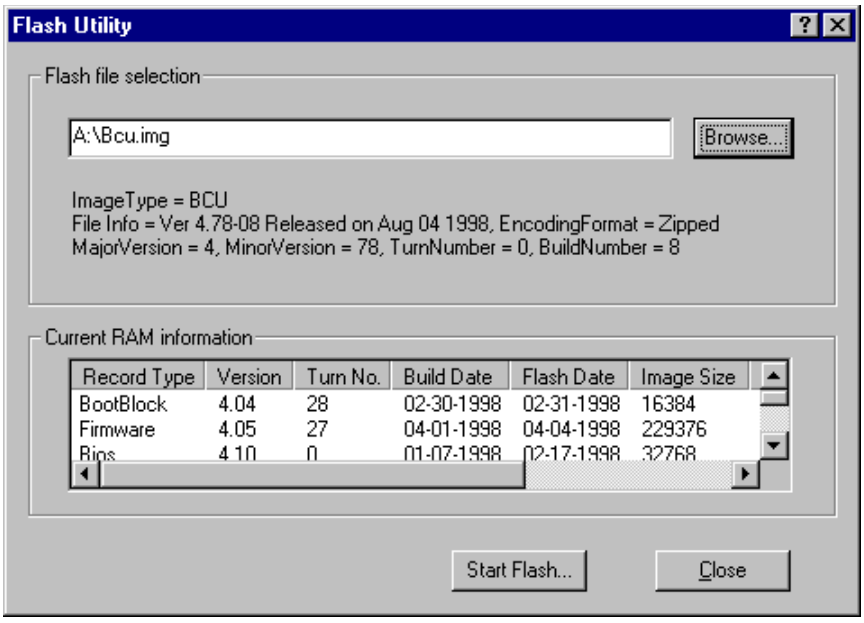


Figure 6-10. Additional Flash File Information

4. Compare the information for the new .IMG with the current information to confirm that a flash is warranted (for example, that the .IMG contains a newer version of code).
5. Click Start Flash.

Because flashing new code to the controller erases what was there previously, two levels of confirmation are required to proceed with the flash.

6. Click OK at the first confirmation message.
7. Type YES, then click OK at the second confirmation message.

   The controller will be updated with the new code contained in the .IMG file.

Defragmenting an Array

Randomly deleting a logical drive(s) will result in unused spaces in an array. Use this feature to unify space. You will need the following information before beginning a defragmentation:

- The location of unused space for the creation of a new logical drive.
- Capacity expansion through MORE2 with an unused physical disk(s).
- A transportation model or other logical drives in the array where the new logical drive is to be created.

To defragment an array:

1. Select **Administration->RAID Assist** on the menu bar or the RAID Assist icon (see Figure 4-7).
2. Click the Manual Configuration button.
3. Click the Defragment Array button, and a Manual Configuration/ Defragment Array Window opens.

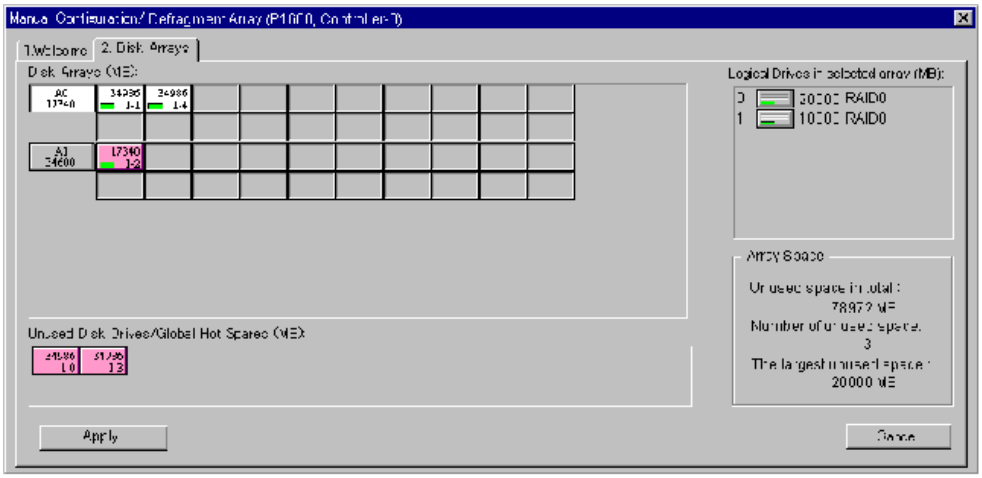


Figure 6-11. Manual Configuration/Defragment Array

This window displays all arrays under the selected controller. The array at the top of the list is selected by default. If the selected array has two or more unused spaces, the Apply button becomes enabled.

The Logical Drives in the selected array pane shows the RAID level and size of the logical drives.

The Array Space pane shows the following information:

- unused disk space
- total number of unused space (MB) in the array
- the largest unused space (MB) in the array

Click the Apply button to begin defragmenting. A warning message box opens (Figure 6-12):

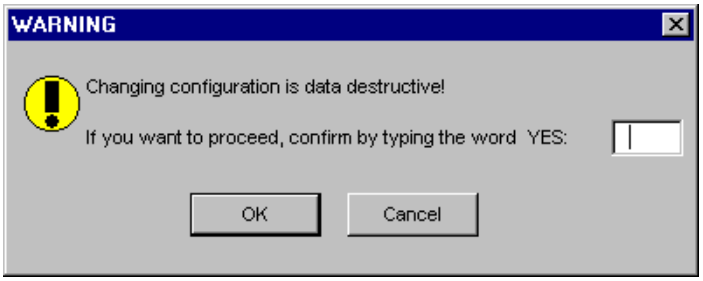


Figure 6-12. Defragmentation Warning Message

4. To confirm your decision to defragment, type YES then click OK, or click Cancel to stop.
5. The Status of the defragmentation can be monitored on the Expand Capacity Status Window, see “Expand Capacity Status” on page 5-25.

Clearing a Configuration

Use the following procedure to clear a configuration.

1. Open the Clear Configuration dialog box, select **File>Clear Configuration.**

   The Clear Configuration Dialog box opens (see Figure 6-13).

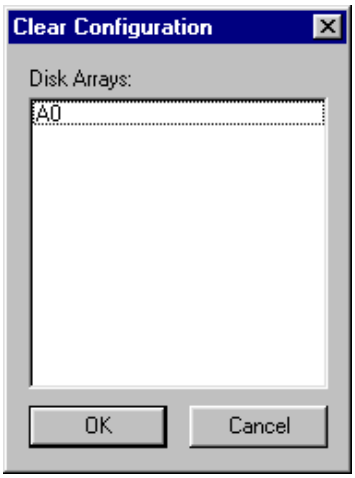


Figure 6-13. Clear Configuration Dialog Box

2. Select the disk array(s) that you want to delete.
3. Click OK to clear the configuration. A caution message box will open (see Figure 6-14).

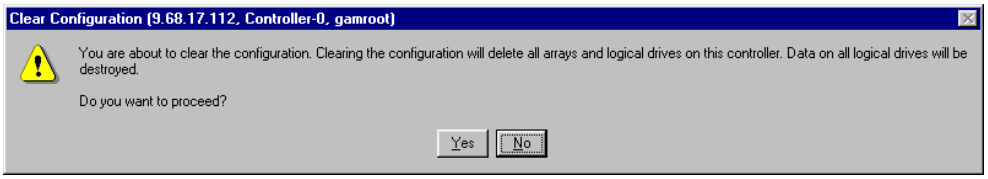


Figure 6-14. Clear Configuration Caution Message

4. Click the Yes button to continue.

   A warning message box will open (see Figure 6-15).

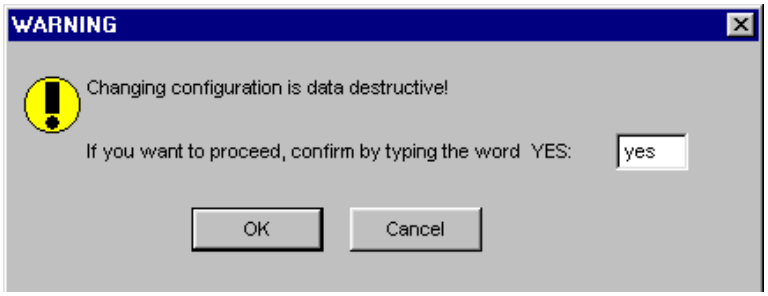


Figure 6-15. Clear Configuration Warning Message

5. To confirm your decision to clear the selected configuration, type YES then click OK, or click Cancel to stop.

Appendix A
Event Information

Overview

Global Array Manager provides information about drive and controller failures, as well as maintaining an event log. Global Array Manager classifies the events it records into five severity levels described in Table A-1. All event information can also be found in the text file EventDef.txt in the GAMFiles folder of the GAM directory.

Table A-1. Severity Level Priorities and Descriptions

Severity	Type	Description
0	Critical	Controller failure.
1	Serious	The failure of a major component within the array enclosure. For example, a power supply, fan or physical drive.
2	Error	A consistency check fails, or a rebuild on a drive stopped because of errors.
3	Warning	Global Array Manager has failed to kill a drive, or failed to start a rebuild.
4	Informational	Messages such as sign-ons and system startups. When a consistency check or a rebuild has finished, for example, or a physical drive has been put on standby.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
1	4	A physical disk has been placed online.	Rebuild completed. Physical disk was configured. Manual on-line was done.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
2	4	A physical disk has been added as hot spare.	Device was configured. Manual hot spare was done. Automatic hot spare was done. 'Raidbld' made it hot spare.	None
5	4	An automatic rebuild has started.	A physical device failed and spare was available. A physical device failed and no spare was available. A spare was added.	None.
6	4	A rebuild has started.	Client started the rebuild on user's request. User replacd the failed device and 'raidbld' started the rebuild.	None.
7	4	Rebuild is over.	Rebuild completed successfully.	None.
8	3	Rebuild is cancelled.	User cancelled the rebuild. Higher priority rebuild started.	Restart the rebuild if required.
9	2	Rebuild stopped with error.	Due to some unknown error on the controller, rebuild failed.	Try rebuild again.
10	2	Rebuild stopped with error. New physical disk failed.	New physical device failed. New physical device may not be compatible with MDAC hardware/ firmware.	Replace the physical disk.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
11	2	Rebuild stopped because logical drive failed.	At least one more physical device failed in the array. Bad data table overflow.	It may not be possible to recover from this error. Contact your service representative.
12	1	A physical disk has failed.	A physical disk failed. A user action caused the physical disk to fail.	Replace the physical disk.
13	4	A new physical disk has been found.	A physical disk has been powered on. A new physical disk has been added. Controller was powered on. Controller was added. System has rebooted.	None.
14	4	A physical disk has been removed	User removed an unconfigured physical disk. An unconfigured physical disk failed. A controller was removed. A controller powered off.	Replace the device if needed.
15	4	A previously configured physical disk is now available.	User set the physical device to unconfigured.	None.
16	4	Expand Capacity Started.	User started the RAID Expansion operation. A suspended RAID Expansion operation was started.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
17	4	Expand Capacity Completed	RAID Expansion finished.	None.
18	2	Expand Capacity Stopped with error.	Multiple physical devices failed.	It may not be possible to recover from this error. Contact your service representative.
19	3	SCSI command timeout on physical device.	Physical device has been removed. Physical device failed. Command time out value is not correct.	Refer to the enclosure manufacturer's service manual.
20	0	SCSI command abort on physical disk.	User may have requested to abort the command. Firmware may have aborted the command to recover from error. The device may have aborted the command.	None.
21	3	SCSI command retried on physical disk.	The command may have timed out. Bus reset may have occured. Device reset may have occured.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
22	3	Parity error found.	A physical device did not generate proper parity. The controller failed, did not check parity properly. Cable failed. Improper cable length. Another physical device interfered. Some outside environment affected the data on the cable (eg.radio frequency signal). Terminator is not connected. Improper termination.	It may not be possible to recover from this error. Refer to the enclosure manufacturer's service manual.
23	3	Soft error found.	An error was detected by physical device and data was recovered.	Run consistency check. If problem occurs frequently, replace the physical device.
24	3	Misc error found.	A physical device reported some error which does not fit in any category. Read/ Write command time out. Data over run. Physical device was busy when host attempted to send command.	If problem occurs frequently, replace the physical device.
25	4	SCSI device reset.	Firmware has done reset to recover from error. User has done a reset.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
26	4	Active spare found.	Device was configured. Manual active spare was done. Automatic active spare was done.	None.
27	4	Warm spare found.	Device was configured. Manual warm spare was done. Automatic warm spare was done.	None.
28	2	Request Sense Data available.	A physical device reported an error. Firmware reported an operational error.	Read the request sense data to understand the root cause.
29	4	Initialization started.	Host started the initialization.	Wait till the initialization is completed. If the system is shutdown prior to this process being completed the physical device can be made useful only by reinitializing it.
30	4	Initialization completed.	Physical device initialization completed successfully.	None
31	3	Initialization failed.	Physical device could have some problems with supporting the SCSI format command.	Try to initialize again. Contact your service representative.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
32	1	Initialization cancelled.	User cancelled the operation.	Physical disk must be initialized again or the Physical disk cannot be used.
33	1	A physical disk failed because write recovery failed.	Write recovery process failed.	Replace physical disk and rebuild it.
34	1	A physical disk failed because SCSI bus reset failed.	SCSI bus reset failed.	Replace physical disk and rebuild it.
35	1	A physical disk failed because double check condition occured.	Double check condition occurred.	Replace physical disk and rebuild it.
36	1	A physical disk failed because device is missing.	Access to the physical disk failed.	Replace physical disk and rebuild it.
37	1	A physical disk failed because of gross error on SCSI processor.	Gross error occurred to the on board SCSI processor.	Replace physical disk and rebuild it.
38	1	A physical disk failed because of bad tag from the device.	The device responded with an invalid tag.	Replace physical disk and rebuild it.
39	1	A physical disk failed because command to the device timed out.	SCSI command timed out on the device.	Replace physical disk and rebuild it.
40	1	A physical disk failed because of the system reset.	System reset occured.	Replace physical disk and rebuild it.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
41	1	A physical disk failed because of busy status or parity error.	The device returned busy status. The SCSI transaction with the device met with parity error.	Replace physical disk and rebuild it.
42	1	A physical disk set to failed state by host.	Command from host set the Physical disk to failed state.	Replace physical disk and rebuild it.
43	1	A physical disk failed because access to the device met with a selection time out.	Device disconnected or powered off. Bad device.	Replace physical disk and rebuild it. Check power and cabling.
44	1	A physical disk failed because of a sequence error in the SCSI bus phase handling.	Physical disk failure.	Replace physical disk and rebuild it.
45	1	A Physical disk failed because device returned an unknown status.	Bad Physical disk or incompatible device.	Replace Physical disk or the device and rebuild it.
46	1	A Physical disk failed because device is not ready.	Device not spinning, just turned bad. Power to the device failed.	Replace Physical disk and rebuild it. Check power and rebuild device.
47	1	A Physical disk failed because device was not found on start up.	Device not connected. Device not responding. Clear configuration suspend mode command was invoked.	Check setup. Check the startup option parameters on the system.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
48	1	A Physical disk failed because write operation of the 'Configuration On Disk' failed.	Bad Physical disk. Device write protected.	Replace Physical disk and rebuild it. Check the startup option parameters on the system.
49	1	A Physical disk failed because write operation of 'Bad Data Table' failed.	Bad Physical disk. Device write protected.	Replace Physical disk and rebuild it. Check the startup option parameters on the system.
57	1	Physical disk missing on startup.	Physical disk missing.	Replace the Physical disk or power-on all enclosures.
58	3	Rebuild startup failed due to lower disk capacity.	Device capacity not sufficient for doing rebuild.	Replace with a disk having sufficient capacity.
59	3	Physical disk is switching from a channel to the other channel.	Physical disk removed or channel failed	Check FC loop; replace physical disk if necessary.
60	2	Temporary-Dead physical drive is automatically made online.	Temporary-Dead state caused because of transient errors	Analyze event log to find out why the drive was marked DEAD.
61	4	A standby rebuild has started.	A physical device failed and spare was available.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
62	4	Hot spare replaced with a smaller capacity physical disk.	The new hot spare may have a smaller physical capacity than the physical disk it replaced. The controller's coercion setting may have reduced the configurable size of the new hot spare.	None.
63	3	A storage access path has come online.	PathPilot reported an access path has become available. Storage previously unavailable has become available again.	None. This indicates that storage access has been restored.
64	3	A storage access path has been lost.	PathPilot is unable to access certain storage on any path. Storage previously available is now unavailable.	Investigate possible causes; e.g., cabling, controller or HBA failure.
65	3	A storage access path has shifted to the alternate path.	PathPilot is unable to access storage on the original path but is able to use the alternate path. A PathPilot failover has occurred.	Investigate possible causes; e.g., cabling, controller or HBA failure.
66	0	A storage access path has shifted to the primary path.	PathPilot is again able to access certain storage on the original path. A PathPilot failback has occurred.	None. This indicates that the primary path has been restored.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
128	4	Consistency check is started.	User started a consistency check. Raidbld started consistency check.	None.
129	4	Consistency check is finished.	Consistency check completed successfully without detecting any errors.	None.
130	3	Consistency check is cancelled.	User cancelled the consistency check.	Restart consistency check, if required.
131	2	Consistency check on logical drive error.	Inconsistent data was found. Bad sectors were found. A physical device reliability problem.	See bad block and request sense table for more information.
132	2	Consistency check on logical drive failed.	A logical device became critical. A logical device failed.	See request sense data for more information.
133	1	Consistency check failed due to physical disk failure.	A physical disk failed.	See request sense data for more information.
134	1	Logical drive has been made offline.	One/multiple physical device(s) failed.	It may not be possible to recover from this error. Contact your service representative.
135	2	Logical drive is critical.	One physical device failed.	Replace the physical device. Start the rebuild, if required.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
136	4	Logical drive has been placed online.	Rebuild completed. User set the physical disk online. New configuration was added.	None.
137	4	An automatic rebuild has started on logical drive.	A physical disk failed and a spare device was available. A spare physical disk was found and replaced the failed device.	None.
138	4	A manual rebuild has started on logical drive.	Client started the rebuild on user's request. User replaced the failed device and 'Raidbld' started the rebuild.	None.
139	4	Rebuild on logical drive is over.	Rebuild completed successfully only for this logical drive.	None.
140	3	Rebuild on logical drive is cancelled.	User cancelled rebuild. Higher priority rebuild started.	Restart the rebuild if required.
141	2	Rebuild stopped with error.	Due to an unknown error on the controller rebuild failed.	Try rebuild again.
142	2	Rebuild stopped with error. New device failed.	New physical device failed. New physical device is not compatible with MDAC hardware/ firmware.	Replace the new device.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
143	2	Rebuild stopped because logical drive failed.	At least one more physical disks failed in the array.	It may not be possible to recover from this error. Contact your service representative.
144	4	Logical drive initialization started.	User started the initialization. Any previous data is lost.	None.
145	4	Logical drive initialization done.	Initialize operation completed successfully.	None.
146	3	Logical drive initialization cancelled.	User cancelled the initialization.	Restart initialization if required.
147	2	Logical drive initialization failed.	One/multiple physical device(s) failed. Controller has been removed. Controller has been powered off.	Refer to the device failure event.
148	4	A logical drive has been found.	A new configuration has been added. MORE completed. A new controller has been plugged in. Controller has been powered on. System has rebooted.	None.
149	4	A logical drive has been deleted.	A new configuration has been added. A new logical device has been deleted. Controller has been removed. Controller has been powered off.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
150	4	Expand capacity started.	User started the Online RAID Expansion operation.	None.
151	4	Expand Capacity Completed.	Online RAID Expansion completed.	None.
152	2	Expand Capacity stopped with error.	Multiple physical disks failed.	It may not be possible to recover from this error. Contact your service representative.
153	0	Bad Blocks found	Bad sector was found on a physical disk during : consistency check/ rebuild/RAID Expansion operation.	Run a Consistency Check with the Restore option. Restore data from a back up.
154	4	System drive size changed.	A new configuration has been added. RAID Expansion has added extra capacity.	None.
155	4	System drive type changed.	A new configuration has been added. RAID migration completed. RAID Expansion completed on RAID 1.	None.
156	1	Bad data blocks found. Possible data loss.	Bad blocks were found on multiple physical devices in same zone.	Restore data from a back up.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
158	1	Attempt to read data from block that is marked in Bad Data Table.	Attempt to read from block that is already marked bad in Bad Data Table. Potential data loss.	Restore data from a back up.
159	2	Data for Disk Block has been lost due to Logical Drive problem.	Data retained in RAID Cache for a Write-back Logical Drive cannot be stored to the physical medium because of Logical Drive problem. The Logical Drive problem could be because of multiple physical medium error or multiple physical devices offline or other reasons.	Insure that all the Physical Drives related to the Logical Drive, disk channel, enclosure or cabling are functional and accessible. Repair or replace them if necessary.
160	2	Temporary-Offline RAID5/RAID3 array is available to the user again with the possibility of data loss in the array.	Temporary-Offline state caused because of transient errors in physical drives.	Verify data from backup.
161	2	Temporary-Offline RAID0+1/RAID1/ RAID0/JBOD array is available to the user again.	Temporary-Offline state caused because of transient errors in physical drives.	No action.
162	4	An standby rebuild has started on logical drive.	A physical disk failed and a spare device was available.	None.
256	1	Fan Failure.	Cable connection is broken. Fan failure.	Replace fan.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
182	2	Low battery charge level. Logical drive may have lost data.	Controller was powered off for duration longer than battery capacity. User connected a new controller. User connected a new BBU.	Run consistency check to verify logical drive consistency. If needed, restore data from backup.
257	4	Fan has been restored.	Faulty fan has been replaced. Cable is connected properly.	None.
258	2	Fan failure.	Cable connection is broken. Fan failure.	Replace fan.
259	4	Storage cabinet fan is not present.	Enclosure Management Connection is broken. Management hardware failure. Fan is not present.	Refer to the enclosure manufacturer's service manual.
272	1	Power supply failure.	Cable connection is broken. Power supply failure.	Reconnect cable or replace the power supply as required.
273	4	Power supply has been restored.	Faulty power supply has been replaced.	None.
274	2	Power supply failure.	Cable connection broken. Power supply failure.	Replace power supply.
275	4	Storage cabinet power supply is not present.	Management connection is broken. Management hardware failure. Power supply is not present.	Refer to the enclosure manufacturer's service manual.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
288	2	Over temperature. Temperature is above 70 degrees Celsius.	Room temperature is too high. Bad fan. Bad sensor.	Turn off the system and allow it to cool down. Adjust the room temperature.
289	3	Temperature is above 50 degrees Celsius.	Room temperature is high. Fan failure.	Replace fan. Turn off the system. Adjust the room temperature.
290	4	Normal temperature has been restored.	Faulty fan has been replaced. Room temperature was reduced.	None.
291	2	Over temperature.	Room temperature is too high. Fan failure.	Turn off the system and allow it to cool down. Adjust the room temperature.
292	4	Storage cabinet temperature sensor is not present.	Enclosure management connection is broken. Management hardware is bad. Sensor is not present.	Refer to the enclosure manufacturer's service manual.
304	2	Storage Works enclosure reported failure state.	Power supply failed. Fan failed. Cabinet is too hot.	Follow enclosure management vendor's diagnostics and repair procedures.
305	3	Storage Works enclosure reported critical state.	Not available.	Not available.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
306	4	Storage Works enclosure reported normal state.	Problem has been rectified.	None.
320	1	Fan failure.	Cable connection broken. Fan failure.	Replace fan.
321	4	Fan has been restored.	Faulty fan has been replaced. Cable is connected properly.	None.
322	4	Fan is not present.	Enclosure Management Connection is broken. Management hardware failure. Fan is not present.	Refer to the enclosure manufacturer's service manual.
323	1	Power supply failure.	Cable connection is broken. Power supply failure.	Replace the power supply.
324	4	Power supply has been restored.	Faulty power supply has been replaced.	None.
325	4	Power supply is not present.	Management connection is broken. Management hardware is bad. Power supply is not present.	Refer to the enclosure manufacturer's service manual.
326	2	Temperature is over safe limit. Failure imminent.	Room temperature is too high. Fan failure. Sensor failure.	Turn off the system and allow it to cool down. Adjust the room temperature.
327	3	Temperature is above working limit.	Room temperature is too high. Fan failure.	Turn off the system. Adjust the room temperature. Replace fan.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
328	4	Normal temperature has been restored.	Faulty fan has been replaced. Room temperature was reduced.	None.
329	4	Temperature sensor is not present.	Enclosure management connection is broken. Management hardware failure. Sensor is not present.	Refer to the enclosure manufacturer's service manual.
330	3	Enclosure access critical.	Enclosure management connection is broken. Management hardware failure.	Refer to the enclosure manufacturer's service manual.
331	4	Enclosure access has been restored.	Enclosure has been fixed or replaced.	None.
332	2	Enclosure access is offline.	Enclosure management connection is broken. Management hardware failure.	Refer to the enclosure manufacturer's service manual.
384	4	Array management server software started successfully.	The server system (or array management utility server) started.	If you did not expect a system reboot, investigate.
385	2	Write back error.	Data cache write failed.	The data may have been lost. Restore the data from a backup.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
386	3	Internal log structures getting full, PLEASE SHUTDOWN AND RESET THE SYSTEM IN THE NEAR FUTURE.	Too many configuration changes occurred since the last boot.	Reboot the system by power cycling when ever convenient.
388	0	Controller is dead. System is disconnecting from this controller.	Hardware failure.	Contact your service representative.
389	3	Controller has been reset.	Controller received a reset command.	If this was an unexpected event, refer to the enclosure manufacturer's service manual.
390	4	Controller is found.	New controller has been installed. Management software has restarted. System has rebooted.	None.
391	0	Controller is gone. System is disconnecting from this controller.	Controller has been powered off or has been reset. Controller has been removed from the system.	None.
392	4	Battery Present	A battery module has been detected and is now operational.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
393	3	Battery Power Low.	Battery power is low.	If this message occurs without power failure, replace the Battery.
394	4	Battery Power OK.	Battery does not have enough power to enable the write data cache.	None.
395	0	Controller is gone. System is disconnecting from this controller.	The connection to the controller has been lost.	None.
396	4	Controller powered on.	Controller was removed from the system. Controller has been powered off.	None.
397	4	Controller is online.	New controller has been installed.	None.
398	0	Controller is gone. System is disconnecting from this controller.	Controller was set online.	None.
399	3	Controller's partner is gone, controller is in failover mode now.	Controller was set offline.	If you did not expect this, investigate.
403	1	Installation aborted.	Equipment improperly arranged while powered off.	Re-establish proper arrangement.
404	1	Controller firmware mismatch.	Replacement controller with downlevel firmware installed.	Reload controller firmware.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
405	3	Battery Removed.	Battery physically removed.	Reinstall the battery.
414	3	Soft ECC error Corrected.	Faulty Memory Module.	Replace Memory Module.
415	3	Physical ECC error Corrected.	Faulty Memory Module.	Replace Memory Module.
418	2	BBU out of service.	BBU will not be able to power the cache if AC power fails. Firmware will switch WriteBack logical drives to WriteThrough.	Replace BBU.
427	2	Mirror Race recovery failed.	Some physical devices may have failed.	Run consistency check and restore consistency.
428	0	Mirror Race on critical logical drive.	Logical device is critical.	Replace failed physical disk and rebuild.
429	4	Controller connected to cluster.	One or more controllers detected during scan and entered nexus with those controllers.	None.
430	4	Controller disconnected from cluster.	All other controllers in cluster are inaccessible due to controller powered off or controller failure or cable failure.	If this was an unexpected event, refer to service manual and correct the failure.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
431	2	Controller improperly shutdown! Data may have been lost.	User improperly shutdown the controller that resulted in inconsistent logical drive and/or data loss.	Run consistency check to verify logical drive consistency. If needed, restore data from backup.
512	4	System started.	The server system (or array management utility server) started.	If you did not expect a system reboot, investigate.
513	4	Size table full.	Too much physical disk size information is defined.	Remove unused size information from this system.
514	4	User logged in.	An array management utility user logged in on the server system.	Not available.
515	4	User logged out.	An array management utility user logged out of the server system.	Not available.
516	4	Server alive.	Reconnected to server. Server rebooted.	None.
517	2	Lost connection to server, or server is down.	Lost network connection to server. Server shutdown.	None.
640	3	Channel Failed.	Cable disconnected.	Plug in cable.
641	3	Channel Online.	Cable reconnected.	None.
896	2	Internal Controller is in the hung state.	Internal Controller is in the hung state.	Controller has to be powered off and on.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
897	2	Internal Controller hung.	Internal controller is in the hung state.	Controller has to be powered off and on.
912	2	Internal Controller i960 processor error.	Internal Controller has encountered i960 processor specific error.	Controller has to be powered off and on.
928	2	Internal Controller Strong-ARM processor error.	Internal Controller has encountered Strong-ARM processor specific error.	Controller has to be powered off and on.

Glossary

ANSI

American National Standards Institute, a standards organization that promotes and facilitates understanding among qualified members for the implementation of agreed upon code and signaling standards and conformity. ANSI represents the U.S. in the ISO (International Standards Organization).

Applet

Small application programs that are usually built into an operating system or a larger application program and designed to run from within another application. The built-in writing and drawing programs that come with Windows are sometimes called “applets.” Applications that run in a web browser are often Java-based applets. See also *Java*.

Application Program

A program designed to perform a specific function directly for the user, or for another application program. Examples of application programs include word processors, database programs, Web browsers, development tools, drawing, paint and image editing programs, and communication programs.

Array

Multiple disk drives configured to behave as a single, independent disk drive. See also *Disk Array.*

Asynchronous Data Transfer

Data transfer not synchronized to a set timing interval. Asynchronous

devices must wait for a signal from the receiving device after each byte of data. Compare with *Synchronous Data Transfer.*

Automatic Rebuild

Mylex controllers provide automatic rebuild capabilities in the event of a physical disk drive failure. The controller performs a rebuild operation automatically when a disk drive fails and both of the following conditions are true:

A standby or hot spare disk drive of identical or larger size is found attached to the same controller;

All system drives that are dependent on the failed disk drive are configured as a redundant array: RAID 1, RAID 3, RAID 5, or RAID 0+1.

During the automatic rebuild process, system activity continues; however, system performance may degrade slightly.

Automatic Switchover

See *Failover*

Background Initialization

Where the initialization process of a disk array takes place in the background, allowing use of a disk array within seconds instead of several hours. Also known as *Immediate RAID Availability.*

Benchmarks

A set of conditions or criteria against which a product or system is measured. Computer trade magazine laboratories frequently test and compare several new computers or computer devices against the same set of application programs, user interactions, and contextual situations. The total context against which all products are measured and compared is referred to as the

benchmark. Programs can be specially designed to provide measurements for a particular operating system or application.

Berkeley RAID Levels

A family of disk array protection and mapping techniques described by Garth Gibson, Randy Katz, and David Patterson in papers written while they were performing research into I/O systems at the University of California at Berkeley. There are six Berkeley RAID levels, usually referred to as RAID Level 0 through RAID Level 5. See also *RAID Levels.*

BIOS

Basic Input/Output System, software that determines what a computer can do without accessing programs. The BIOS contains all the code required to control the keyboard, screen, drives, serial communications, and other functions. Usually the BIOS is built into a ROM chip installed on the motherboard so that the BIOS will always be available and not affected by disk failure. Sometimes the BIOS is recorded on a flash memory chip.

BIOS Config Utility

BIOS-based Configuration Utility, a utility program sequence used, upon powerup, for configuring various hardware elements in a system.

Booting (or Bootstrapping)

Loading operating system code and other basic software from a disk or other storage device to help a computer start.

Cache

A temporary storage area for frequently accessed or recently accessed data.

Cache is used to speed up data transfer to and from a disk. See also *Caching*.

Cache Flush

Refers to an operation where all unwritten blocks in a *Write-Back Cache* are written to the target disk. This operation is necessary before powering down the system.

Cache Line Size

Represents the size of the data "chunk" that will be read or written at one time, and is set in conjunction with stripe size. Under RAID EzAssist™, the cache line size (also known as *Segment Size*) should be based on the stripe size you selected. The default segment size for Mylex RAID controllers is 8K. See also *Stripe Size*.

Caching

Allows data to be stored in a pre-designated area of a disk or RAM. Caching speeds up the operation of RAID systems, disk drives, computers and servers, or other peripheral devices. See also *Cache*.

Conservative Cache

An operating mode in which system drives configured with the *Write-Back Caching* policy are treated as though they were configured for *Write-Through* operation and the cache is flushed.

Consistency Check

A process that verifies the integrity of redundant data. A consistency check on a RAID 1 or RAID 0+1 configuration (mirroring) checks if the data on drives and their mirrored pair are exactly the same. For RAID Level 3 or

RAID Level 5, a consistency check calculates the parity from the data written on the disk and compares it to the written parity. A consistency check from Mylex utilities such as Global Array Manager™ (GAM) or RAID EzAssist™ give the user the ability to have a discrepancy reported and corrected. See also *Parity Check*.

Critical State

A *Logical Drive* is in a "critical" state if it has been configured at RAID level 1, 3, 5, or 0+1, and one (and only one) of its SCSI drives is not "online." A logical drive is considered "critical" because any failure of another of its SCSI drives may result in a loss of data.

Note: I/O operation can only be performed with system drives that are online or critical.

Cyclical Redundancy Check (CRC)

An error detection tool found on *Ultra 160 SCSI (Ultra3 SCSI)*. This tool increases the odds for error free data.

DACCF

Disk Array Controller Configuration File (utility), a diskette-based configuration utility for RAID configuration.

Data Transfer Rate

The amount of data per unit of time moved through a channel or *I/O bus* in the course of execution of an I/O load, usually expressed in MBps.

Degraded Mode

A RAID mode used when a component drive has failed.

Device Driver

A software program that controls a particular type of device attached to a computer, such as a RAID subsystem, printer, display, CD-ROM, disk drive, etc.

Disk Failure Detection

A RAID controller automatically detects SCSI disk failures. A monitoring process running on the controller checks, among other things, elapsed time on all commands issued to disks. A time-out causes the disk to be “reset” and the command to be retried. If the command times out again, the controller could take the disk “offline.” Mylex DAC960 controllers also monitor SCSI bus parity errors and other potential problems. Any disk with too many errors will also be taken “offline.” See also *Offline*.

Disk Media Error Management

Mylex controllers transparently manage disk media errors. Disks are programmed to report errors, even *ECC*-recoverable errors. If ECC RAM is installed, the controller will correct ECC errors. When a disk reports a media error during a read, the controller reads the data from the mirror (RAID 1 or 0+1), or computes the data from the other blocks (RAID 3, RAID 5), and writes the data back to the disk that encountered the error. When a disk reports a media error during a write, the controller issues a “reassign” command to the disk, then writes the data out to a new location on the disk. Since the problem has been resolved, no error is reported to the system.

Drive Groups, Drive Packs

A group of individual disk drives (preferably identical) that are logically tied to each other and are addressed as a single unit. In some cases this may be called a drive “pack” when referring to just the physical devices.

All the physical devices in a drive group should have the same size; otherwise, each of the disks in the group will effectively have the capacity of the smallest member. The total size of the drive group will be the size of the smallest disk in the group multiplied by the number of disks in the group. For example, if you have 4 disks of 400MB each and 1 disk of 200MB in a pack, the effective capacity available for use is only 1000MB (5x200), not 1800MB.

Drivers

A software routine that receives I/O requests from higher levels within the operating system and converts those requests to the protocol required by a specific hardware device.

ECC

Error Correcting Code, a method of generating redundant information which can be used to detect and correct errors in stored or transmitted data.

EEPROM

Electrically Erasable PROM, see *EPROM*.

EPROM

Erasable Programmable Read Only Memory, memory which can be erased and re-used.

eXtremeRAID™

A family of Mylex RAID controllers which offer uncompromising fault tolerance, data availability, superior configuration, and management flexibility. The eXtremeRAID controllers use driver technology, which has won tpm-C benchmarks worldwide. With this technology, eXtremeRAID controllers provide the highest performance and most flexible RAID solution available today.

FAT, FAT 32

File Allocation Table, a distribution table maintained by an operating system on a hard disk that provides a map of the clusters (the basic unit of logical storage on a hard disk) that a file has been stored in. FAT 32 supports 32-bit processors.

Fault Tolerance, Failure Tolerance

The ability of a system to continue to perform its function even when one of its components has failed. A fault tolerant system requires redundancy in disk drives, power supplies, adapters, controllers, and cabling. Mylex RAID controllers offer high levels of fault tolerance.

Flash ROM

Memory on an adapter containing software that can be reprogrammed without removing it from the board.

Format

A pre-established layout for data. Programs accept data as input in a certain format, process it, and provide it as output in the same or another format. All data is stored in some format with the expectation that it will be processed by a program that knows how to handle that format.

Gigabit

10^9 (1,000,000,000) bits. Abbreviated as Gb.

Gigabyte

2^{30} (1,073,741,824) bytes. Abbreviated as G or GB.

Global Array Manager (GAM)™

A Mylex RAID management utility that allows a system administrator to configure, monitor, and manage network RAID storage from anywhere in the world. GAM can communicate critical information via e-mail, fax, pager, SNMP, or the launching of an application. GAM is everything needed to manage Mylex PCI RAID Controllers, SCSI Host Adapters, and External RAID Controllers.

GUI

Graphical User Interface, a software interface that interacts with the user through color graphics and a mouse.

Immediate RAID Availability

See *Background Initialization*

Interface

A hardware or software protocol that manages the exchange of data between the hard disk drive and the computer. The most common interfaces for small computer systems are ATA (advanced technology attachments), also known

as IDE (integrated drive electronics), and SCSI.

Internet

A worldwide system of computers that is a public, cooperative, and self-sustaining facility accessible to tens of millions of users worldwide.

Intranet

A network contained within an enterprise, the main purpose of which is usually to share company information and computing resources among employees. An intranet can also be used to facilitate working in groups and for teleconferences.

I/O

Input/Output, the transmission of information between an external source and the computer.

I/O Intensive

An application whose performance depends strongly on the performance of the I/O system.

I/Os Per Second

Number of I/O transactions per second.

I_2O

Intelligent Input/Output, a driver that uses special I/O processes to eliminate

I/O bottlenecks. The processes deal with interrupt handling, buffering, and data transfer. An I_2O driver also includes an OS-specific module (OSM), which handles higher-level OS details, and a hardware device module (*HDM*), which knows how to communicate with certain devices.

ISM

Integrated Software Module, part of the I_2O package that helps operators insert special functions into the I_2O.

Java

A programming language expressly designed for use in the distributed environment of the *Internet* and enforces a completely object-oriented view of programming. Java can be used to create complete *application programs* that may run on a single computer or be distributed among servers and clients in a network. It can also be used to build small application modules, or *applets*, for use as part of a Web page.

Kilobyte

2^{10} (1,024). Abbreviated as K or KB.

LAN

Local Area Network, a network of interconnected workstations sharing the resources of a single processor or server, typically within the area of a small office building.

Latency

1. The time between the making of an I/O request and completion of the

request's execution. 2. Short for rotational latency, the time between the completion of a seek and the instant of arrival of the first block of data to be transferred at the disk's read/write head.

Logical Drive

The logical devices presented to the operating system. System drives are presented as available disk drives, each with a capacity specified by the Mylex RAID controller. See also *Storage Device*.

Logical Drive States

A logical (system) drive can be *Online*, *Critical*, or *Offline*. Notice that the term "online" is used for both physical and logical drives.

LUN

Logical Unit Number, a SCSI representation of a system drive on a given channel and target ID. This may be a single device or an array of devices configured to behave as a single device.

LUN Mapping

A method whereby a LUN ID is assigned to a system drive, allowing a LUN to be made accessible through specific controllers and ports using system drive affinity.

LVD

Low Voltage Differential, a form of SCSI signaling introduced with *Ultra2 SCSI (Fast 40 SCSI)*. LVD uses data high and data low signal lines to increase transmission distances over those of single-ended (conventional SCSI signaling) lines. LVD allows for cable lengths of up to 12 meters

(approximately 39 feet) with up to 15 drives. LVD also lowers noise, power usage, and amplitude.

LVD differs from conventional differential signaling in that only positive and negative values are distinguished, not voltage levels. Other advantages are that LVD devices consume less power and can sense single-ended devices on the bus and revert to single-ended signaling. Devices need to be Ultra2 SCSI LVD drives in order to take advantage of the LVD signaling. Mylex AcceleRAID, eXtremeRAID, and DAC FL controllers are LVD controllers.

Megabit

A million bits; used as a common unit of measure, relative to time in seconds, as an expression of a transmission technology's bandwidth or data transfer rates (abbreviated as Mb). Megabits per second (Mbps) is a frequent measure of bandwidth on a transmission medium.

Megabyte

2^{20} (1,048,576) bytes. One megabyte can store more than one million characters. Abbreviated as M or MB.

Mirrored Cache

A cache memory that has duplicate data from another controller. In the event of failure of the original controller, the second controller can take the cached data and place it on the disk array.

Mirroring

The complete duplication of data on one disk drive to another disk drive, this duplication occurs simultaneously with each write operation: each disk will be the mirror image of the other (also known as RAID Level 1, see *RAID*

Levels). All Mylex RAID controllers support mirroring.

M.O.R.E.™

Mylex Online RAID Expansion, an advanced configuration mode that allows expansion of any unconfigured or hot spare drive into the expandable drive group while the controller is online with the host. For example, a system using a five-disk-drive RAID set can add another disk drive to create a six-disk-drive RAID set. The M.O.R.E. operation can be performed on all RAID levels except JBOD.

Mylex's Global Array Manager (GAM) supports two M.O.R.E. features:

- Expand Capacity allows logical drive expansion for FFx external controllers only.
- Expand Array allows array expansion for both PCI and FFx external controllers.

During the RAID set expansion process, which includes re-striping data from the old (smaller) RAID set to the new (expanded) RAID set, the controller continues to service host I/O requests.

NFS

Network File System, a client/server application that lets a computer user view and optionally store and update files on a remote computer as though they were on the user's own computer. See also *File Server.*

NOS

Network Operating System, an operating system that has special features for connecting computers and peripheral devices into a *LAN*.

NVRAM

Non-Volatile Random Access Memory, a memory unit equipped with a battery so that the data stays intact even after the main power had been switched off.

Offline

A *Logical Drive* is in an “offline” state if no data can be read from it or written to it. Offline does not apply to physical disk drives. System commands issued to offline logical drives are returned with an error status; no operations can be performed on offline logical drives. See also *Logical Drive States*, *Critical State*, and *Online*

OLTP

Online Transaction Processing, computer processing where the computer responds immediately to user requests.

OS

Operating System, software that manages the system resources and provides the operating environment for application programs.

Parity

A method of providing complete data redundancy while requiring only a fraction of the storage capacity of mirroring. The data and parity blocks are divided between the disk drives in such a way that if any single disk drive is removed or fails, the data on it can be reconstructed using the data on the remaining disk drives. The parity data may exist on only one disk drive or be distributed between all disk drives in a RAID group. See also *Rotated XOR Redundancy.*

Parity Check

A function used to verify the integrity of data on a system drive. It verifies that mirror or parity information matches the stored data on the redundant arrays. If the parity block information is inconsistent with the data blocks, the controller corrects the inconsistencies. See also *Consistency Check*.

Partitioning

Where the full usable storage capacity of a disk or array of disks appears to an operating environment in the form of several virtual disks whose entire capacity approximates that of the underlying disk or array.

Physical Device

Any device connected to some kind of hardware. For example, SCSI disk, fibre disk, network disk, RAM disk, etc.

Platform

An underlying computer system on which application programs can run. A platform consists of an operating system, the computer system's coordinating program, and a microprocessor, the microchip in the computer that performs logic operations and manages data movement in the computer.

Plug and Play

The ability to install peripheral cards or other devices without requiring manual configuration by the user.

PROM

Programmable Read-Only Memory, memory that users with appropriate

instructions can reprogram.

Protocol

A special set of rules for transmitting data between two devices in a telecommunication connection.

Queue

A line of things, commands, or data waiting to be handled, usually in sequential order starting at the beginning or top of the line or sequence.

RAID

Redundant Array of Independent Disks, a collection of two or more disks working together in an array. Mylex RAID controllers implement this technology to connect up to 15 SCSI devices per channel. The different forms of RAID implementation are known as "RAID levels." See also *Berkeley RAID Levels*, *Disk Array,* and *RAID Levels*.

The system manager or integrator selects the appropriate RAID level for a system. This decision will be based on which of the following are to be emphasized:

- Disk Capacity
- Data Availability (redundancy or fault tolerance)
- Disk Performance

RAID Advisory Board (RAB)

An association of companies whose primary intention is to standardize RAID storage systems. IBM is a member of RAB.

RAID EzAssist™

A Mylex RAID management utility for configuration and maintenance of RAID controllers.

RAID Levels

Mylex disk array controllers support four RAID Advisory Board approved (RAID 0, RAID 1, RAID 3, and RAID 5), two special (RAID 0+1, and JBOD), and three spanned (RAID 10, 30, and 50) RAID levels. All DAC960, AcceleRAID, and eXtremeRAID series controllers support these RAID levels. See also *Berkeley RAID Levels*.

Level 0: Provides block "striping" across multiple drives, yielding higher performance than is possible with individual drives. This level does not provide any redundancy.

Level 1: Drives are paired and mirrored. All data is 100 percent duplicated on a drive of equivalent size.

Level 3: Data is "striped" across several physical drives. Maintains parity information which can be used for data recovery.

Level 5: Data is "striped" across several physical drives. For data redundancy, drives are encoded with rotated XOR redundancy.

Level 0+1: Combines RAID 0 striping and RAID 1 mirroring. This level provides redundancy through mirroring.

JBOD: Sometimes referred to as "Just a Bunch of Drives." Each drive is operated independently like a normal disk controller, or drives may be spanned and seen as a single drive. This level does not provide data redundancy.

Level 10: Combines RAID 0 striping and RAID 1 mirroring spanned across multiple drive groups (super drive group). This level provides redundancy through mirroring and better performance than Level 1 alone.

Level 30: Data is "striped" across multiple drive groups (super drive group). Maintains parity information, which can be used for data recovery.

Level 50: Data is "striped" across multiple drive groups (super drive group). For data redundancy, drives are encoded with rotated XOR redundancy.

Note: The host operating system drivers and software utilities remain unchanged regardless of the level of RAID installed. The controller makes the physical configuration and RAID level implementation.

RAID Migration

A feature in RAID subsystems that allows for changing a RAID level to another level without powering down the system.

RAM

Random Access Memory, the “built-in” readable and writable data storage that comes with (or can be added to) a computer.

Read-Ahead Cache

A caching strategy whereby the computer anticipates data and holds it in cache until requested.

Recovery

The process of reconstructing data from a failed disk using data from other drives.

Redundancy

The inclusion of extra components of a given type in a system (beyond those the system requires to carry out its functions).

Replacement Table

A table that contains information regarding which SCSI devices have been

replaced by others through standby replacement.

ROM

Read-Only Memory, built-in computer memory containing data that normally can only be read, not written to. ROM contains the programming that allows a computer to be “booted up” each time you turn it on. Unlike a computer's random access memory (*RAM*), the data in ROM is not lost when the computer power is turned off; the ROM is sustained by a small long-life battery in your computer.

Rotated XOR Redundancy

XOR refers to the Boolean “Exclusive-OR” operator. Also known as *Parity*, a method of providing complete data redundancy while requiring only a fraction of the storage capacity of mirroring. In a system configured under RAID 3 or RAID 5 (which require at least three SCSI drives), all data and parity blocks are divided amongst the drives in such a way that if any single drive is removed (or fails), the data on it can be reconstructed using the data on the remaining drives. In any RAID 3 or RAID 5 array, the capacity allocated to redundancy is the equivalent of one drive.

RTC

Real-Time Clock, a clock that keeps track of the time with its own power supply.

SAF-TE

SCSI Accessed Fault-Tolerant Enclosure, an “open” specification designed to provide a comprehensive standardized method to monitor and report status information on the condition of disk drives, power supplies, and cooling systems used in high availability *LAN* servers and storage subsystems. The specification is independent of hardware I/O cabling,

operating systems, server platforms, and RAID implementation because the enclosure itself is treated as simply another device on the SCSI bus. Many other leading server, storage, and RAID controller manufacturers worldwide have endorsed the SAF-TE specification. Products compliant with the SAF-TE specification will reduce the cost of managing storage enclosures, making it easier for a LAN administrator to obtain base-level fault-tolerant alert notification and status information. All Mylex RAID controllers feature SAF-TE.

SAN

See *Storage Area Network*

SANArray™

Server-independent *External RAID Controllers* that provide fibre channel interface connections to loop or fabric topologies and dual redundant loops for continuous access to large data pools. These controllers are designed for homogeneous and heterogeneous operating system setups in *Storage Area Network* environments.

SANmapping™

A feature of SANArray external controllers, SANmapping manages drive allocation and access, and is similar to the programmable LUN Mapping feature, which is incorporated into this feature. SANmapping is intended for use in configurations in which multiple host computers attach to one or more Mylex controllers or to a *Storage Area Network (SAN)* configuration.

SDRAM

Synchronous Dynamic Random Access Memory, a form of dynamic random access memory (DRAM, a type of memory used in computers) that can be coordinated or synchronized to the clock speed of the computer.

Sector

The unit in which data is physically stored and protected against errors on a fixed-block architecture disk.

Segment Size

See *Cache Line Size*

Sequential I/O

A type of read and write operation where entire blocks of data are accessed one after another in sequence, as opposed to randomly.

Server

A computer program that provides and manages services to other computer programs on the same or other computers. The computer that a server program runs on is also frequently referred to as a server. See also *Application Server.*

Session

The period of time between any two consecutive system shutdowns; system shutdown may be either a power off/on, or a hardware reset.

SMART

Self-Monitoring Analysis and Reporting Technology, the industry standard reliability prediction indicator for both the ATA/IDE (advanced technology attachments/integrated drive electronics) and SCSI hard disk drives. Hard

disk drives with SMART offer early warning of some hard disk failures so critical data can be protected.

SMB

Server Message Block protocol, a method for client applications in a computer to read and write to files on, and to request services from server programs in, a computer network. A client application can read, create, and update files on the remote server. It can also communicate with any server program that is set up to receive an SMB client request.

SNMP

Simple Network Management Protocol, the protocol governing network management: for monitoring network devices and their functions.

Software Driver

Set of utilities and instructions for controllers to work in a specific operating system environment.

Spanning

A process that provides the ability to configure multiple drive packs or parts of multiple drive packs. In effect, spanning allows the volume used for data processing to be larger than a single drive. Spanning increases I/O speeds, however, the probability of drive failure increases as more drives are added to a drive pack. Spanned drive packs use striping for data processing. See also *Striping* and *Drive Groups, Drive Packs*.

Storage Area Network (SAN)

A high-speed, open-standard scalable network of storage devices and servers

providing accelerated data access.

Stripe Order

The order in which SCSI disk drives appear within a drive group. This order must be maintained, and is critical to the controller's ability to "rebuild" failed drives.

Stripe Size

The size, in kilobytes (1024 bytes) of a single I/O operation. A stripe of data (data residing in actual physical disk sectors, which are logically ordered first to last) is divided over all disks in the drive group.

Stripe Width

The number of striped SCSI drives within a drive group.

Striping

The storing of a sequential block of incoming data across multiple SCSI drives in a group. For example, if there are 3 SCSI drives in a group, the data will be separated into blocks. Block 1 of the data will be stored on SCSI drive 1, block 2 on SCSI drive 2, block 3 on SCSI drive 3, block 4 on SCSI drive 1, block 5 on SCSI drive 2, and so on. This storage method increases the disk system throughput by ensuring a balanced load among all drives.

Sustained Data Transfer Rate

A rate of data transfer defined for continuous operation at a maximum speed level.

Synchronous Data Transfer

Data transmission synchronized to a defined time interval, and is faster than asynchronous SCSI because there is no wait for acknowledgment of each byte from the receiving device (up to 20MHz). Compare with *Asynchronous Data Transfer.*

System Disk

The disk on which a system's operating software is stored.

System Drives

See *Logical Drives*

TCP/IP

Transmission Control Protocol/Internet Protocol, the basic communication language or protocol of the Internet. It can also be used as a communications protocol in intranets and extranets. When set up with direct access to the Internet, a computer is provided with a copy of the TCP/IP program just as every other computer that you may send messages to or get information from also has a copy of TCP/IP.

Terabyte

A measure of memory capacity, 2^{40} power; or roughly a thousand billion bytes (that is, a thousand gigabytes).

Throughput

The number of I/O requests satisfied per unit of time (usually per second).

TPC-C, Tpm-C

The Transaction Processing Performance Council (TPC) is a standards organization that measures transaction throughput of systems. One of their benchmarks is Tpm-C, which reflects price and performance metrics. TPC-C reflects new order transaction rate, a benchmark for transaction speed. Mylex products have won consistently high TPC-C results.

Transfer Rate

The rate at which data moves between the host computer and storage, input, or output devices, usually expressed as a number of characters per second.

WAN

Wide Area Network, a geographically broader telecommunication structure as opposed to a local area network (*LAN*) that comprises of two or more LANs. A wide area network may be composed entirely of private structures, but the term also seems to connote the inclusion of public networks and all kinds of transmission media.

Web

A number of computers, servers, or networks linked together in a matrix. See also *Internet* and *Intranet*.

Write-Back Cache

A caching strategy whereby write operations result in a completion signal being sent to the host operating system as soon as the cache (not the disk drive) receives the data to be written. The target disk drive will receive the data at a more appropriate time in order to increase controller performance. An optional cache battery backup can be used to protect against data loss as a result of a power failure or system crash.

Write-Through Cache

A caching strategy whereby data is written to the SCSI drive before a completion status is returned to the host operating system. This caching strategy is considered more secure, since a power failure will be less likely to cause loss of data. However, a write through cache results in a slightly lower performance.

XOR

Exclusive “Or”, a computer language function that generates parity in RAID systems; “this or that but not both.”

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