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

with Workstation Array Manager™

Installation Guide and User Manual

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

Installation Guide and User Manual

Part Number 771961-11
08P3776

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About This Manual

This installation guide covers the steps involved to install and use the client component of Mylex Corporation's Global Array Manager or the Workstation Array Manager with Mylex PCI Disk Array Controllers.

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***.

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

🛑 **WARNING**

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

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Figure 1-1. Global Array Manager Client

Overview

Global Array Manager Client software for Mylex PCI Controllers is used to:

• 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.

Workstation Array Manager functions very similarly to Global Array Manager Client, except for the following:

- Workstation Array Manager (WSAM) is used to monitor, manage, maintain, and configure only Mylex Disk Array Controllers, physical devices, and logical drives *that reside on the individual workstation where WSAM is running*.

- WSAM cannot access remote servers and work with controllers or devices connected to those servers.

- WSAM runs only under Windows 64, Windows 2000 or Windows NT, while GAM Client can run under Windows 64, Windows 2000, Windows NT, Windows 95, or Windows 98.

- Workstation Array Manager has no Global Status View and does not include any of the network-related components available through Global Array Manager Client.

Most functions of GAM Client, however, are available in WSAM, so this manual applies to both products.

Global Array Manager Components

Global Array Manager has three components:

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

- Global Array Manager Client component

- Workstation Array Manager 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 and WSAM components 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 or Workstation Array Manager 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 check (or parity) on arrays that are configured to support redundancy. The Global Array Manager Server executes the management instructions specified by the Global Array Manager Client.

What's New In GAM?

Global Array Manager for PCI Controllers contains new features, enhancements, and modifications not available in earlier versions of Global Array Manager.

- **PCI Controller Only Manual.** This Global Array Manager Client for PCI Controllers Manual only addresses PCI Controllers. For External Controller GAM Client information see the appropriate GAM Client for External Controller's User's Manual.

- **Support for Disk Array Controllers Using PCI Firmware 6.x.** GAM supports Mylex PCI Disk Array Controllers which run Mylex PCI Firmware up to and including Version 6.x.

- **Support for the Windows 64 Operating System.** The Global Array Manager Client for PCI Controllers can now be installed on systems using the Windows 64 operating system.

- **NVRAM Error Log**. A new tab is added to the Error Table dialog box. This error logging feature allows field recovery of controller firmware and hardware error logging information at the time of firmware-detected failures and error recovery process.

- **Patrol Read.** This function checks all sectors sequentially for the entire physical drives, including COD or unused sectors. It works for all RAID levels and applies to standby drives as well. The only requirement is that it is RAID configured. Drives are checked in a pack group by group.

- **Additional Functional and User Interface Enhancements.** GAM also offers several functional and UI enhancements not specifically referred to above, such as a new "PFA Information" button on the Disk Device Information page.

Requirements

GAM

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 Installation Guide and User Manual*.

WSAM

If remote server access is not required, Workstation Array Manager can be installed instead of GAM Client on a Windows 64, Windows 2000 or Windows NT workstation. WSAM requires only that Windows 2000 or NT be running; it does not require installation of GAM Server or GAM Client on any system.

However, WSAM is not recommended unless there is no networking available.

Client and Workstation 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)

- GAM Only: Network interface card connected to a functioning network

- GAM Only: Appropriate network device drivers for the installed network interface card

- GAM Only: 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.
- For GAM component installation and operation: Microsoft Windows 64, Windows 2000, Windows NT 4.0, Windows 95 or Windows 98 installed on a local hard disk
- GAM Only: TCP/IP stack installed
- For WSAM component installation and operation, Microsoft Windows 64, Windows 2000 or Windows NT 4.0 installed on a local hard disk

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 Fax (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.

Installation

Installation Overview

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

- Windows 64

- Windows 2000

- Windows NT 4.0

- Windows 98

- Windows 95

Installation of the Workstation Array Manager component requires the Windows 64, Windows 2000 or Windows NT 4.0 operating system.

> ☛ **Note**
>
> You may install either Global Array Manager Client or Workstation Array Manager during an installation session, but not both at the same time.

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 Installation Guide and User Manual* for GAM Server installation instructions.

Installation of Global Array Manager Client or Workstation Array Manager

File List

Global Array Manager and Workstation Array Manager software are 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, GAM Client, or WSAM.

   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 Mylex 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

☞ **Note**

> GAM and WSAM cannot be installed at the same time.

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

   To select Workstation Array Manager for installation, click the box to check the Workstation Array Manager 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. However, If Workstation Array Manager and GAM Server are installed on the same system and one of them is uninstalled, the other will no longer work because the GAM Driver will be uninstalled.

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

Startup & Navigation

Starting Global Array Manager or Workstation Array Manager

Server Component

☛ **Note**

> Installation and startup of the Global Array Manager
> Server component is covered in the *Global Array
> Manager Server 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

☛ **Note**

> Install and start the GAM Server component *before*
> you attempt to run the GAM Client component.

Under Windows 64, Windows 2000, Windows NT 4.0, or Windows 95/98, you are ready to start the Global Array Manager Client once you have installed the client on your workstation (see the previous chapter).

Start the GAM Client software (**Start->Programs->Mylex Global Array Manager Client**). 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 4-4).

☛ **Note**

> After starting the Global Array Manager Client,
> minimize the utility and let it run in the background at
> all times, unless you're doing a configuration or

setting up a maintenance process. If Global Array Manager detects a logical drive in a critical state, or a physical drive failing, it prompts you with windows describing the location and nature of the problem. Maximize the utility to display more detailed information.

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

Workstation Array Manager Component

Under Windows 64, Windows 2000 or Windows NT 4.0, you are ready to start up the Workstation Array Manager once you have installed this component on your workstation (see the previous chapter).

Start the WSAM software (**Start->Programs->Mylex Workstation Array Manager**).

Navigating Global Array Manager Client or Workstation Array Manager

Button Controls

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

OK	Click this button to apply the settings made in the dialog box.
Cancel	Click this button to cancel the settings made in the dialog box.
Yes	Click this button to confirm the action identified in the dialog box.
No	Click this button to cancel the action identified in the dialog box.
Close	Click this button to close the active dialog box.
Apply	Click this button to apply your configuration changes.

Components of the GAM Client and WSAM Opening Screen

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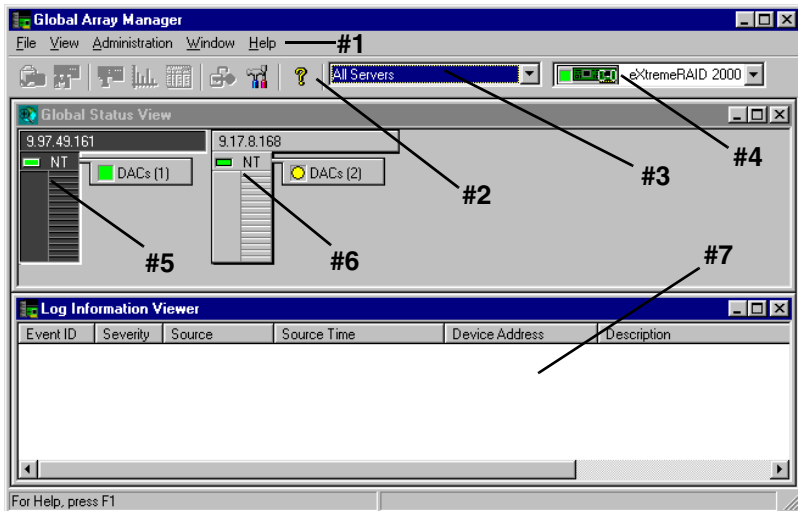

Figure 3-1. Opening GAM Screen

Components of the GAM Client and WSAM Windows

The major components of the GAM Client and WSAM 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 eight 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. 9.17.8.170) or name (e.g. ide40) of the server

   • the network operating system running on the server (e.g. SCO = SCO OpenServer; 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 and WSAM *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.

Menu Bar and Menus

GAM Client and WSAM contain a menubar (Figure 3-2) in the Global Array Manager (or Workstation Array Manager) window.

Figure 3-2. Menu Bar

File Menu

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

- **Open Configuration (Ctrl+O)**: Loads a configuration from disk and saves it to the controller. (See "Loading a Configuration from Disk" on page 4-6.)

- **Save Configuration (Ctrl+S)**: Saves a configuration file to a new filename, disk, and/or directory.

- **Clear Configuration**: Removes configuration information for 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 controller) will be deleted.

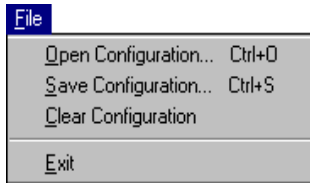- **Exit**: Exits the GAM Client or WSAM.

Figure 3-3. File Menu

View Menu

The View menu (Figure 3-4) contains the following options:

- **Global Status View**: Toggles the Global Status View window (GAM Client only). 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.

- **Statistics View**: Toggles the Statistics View window display 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 or Workstation Array Manager starts.

- **Initialize Status**: Displays the progress (percent complete) of an ongoing full initialization of one or more drives.
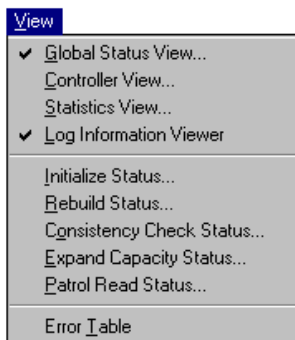

Figure 3-4. View Menu

- **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.

  ### ⚠ *Caution*

  > Once the Expand Array (Expand Capacity) process has begun, you should not attempt to interrupt that process before completion. Data loss will result. You may, however, monitor the progress by choosing the Expand Capacity Status option.

- **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.

Administration Menu

The Administration menu (Figure 3-5) contains the following options:

- **Sign On**: Enables use of GAM's or WSAM's configuration and administration functions to "Administrators" ("gamroot" + password). Enables only monitoring functions to "Users."

- **Define Server Groups**: (GAM Client only) Sets up server groups and individual server names or IP addresses within each group.

- **Select Current Server Group (Ctrl+G)**: (GAM Client only) 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 or Workstation 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.
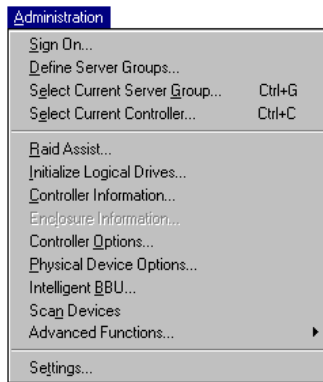
Figure 3-5. Administration Menu

- **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.

- **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/WSAM simply offer 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 or WSAM.

- **Advanced Functions**: Opens a submenu (Figure 3-6) from which you can select the following options:

  - **Performance Analysis**: Allows detailed analysis of disk-level performance along several parameters.
  - **Flash Utility**: Provides the ability to upgrade controller firmware, BIOS, boot block, or BIOS configuration utility as new maintenance releases become available.
  - **Shutdown**: (External Disk Array Controllers Only)

Figure 3-6. 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 3-7) is a standard feature of Windows 95/98, Windows 2000, and Windows NT. It is implemented as such in GAM/ WSAM.
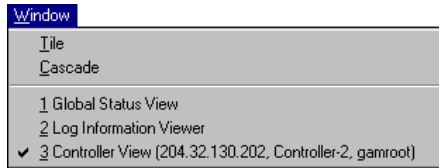
Figure 3-7. Window Menu

Help Menu

The Help menu (Figure 3-8) identifies the on-line help options available within the Global Array Manager Client or Workstation Array Manager.

- **Contents (F1)**: Displays a list of available help topics.

- **About Global Array Manager (or About Workstation Array Manager)**: Displays the Windows standard "About" box.

Figure 3-8. Help Menu

Toolbar and Toolbar Icons

GAM Client and WSAM contain a toolbar (Figure 3-9) in the Global Array Manager or Workstation Array Manager window.

Figure 3-9. 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/WSAM.

Displays Controller Information: Displays key information about the currently-selected RAID Controller or HBA.
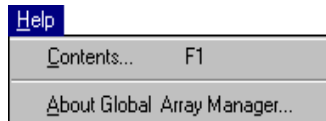
Statistics View: Toggles the Statistics View window for the currently-selected RAID controller or HBA.

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 or Workstation Array Manager

Exiting GAM Client or WSAM

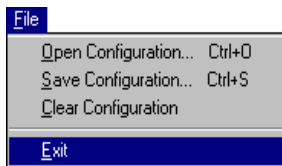Exit Global Array Manager Client or Workstation Array Manager as shown in Figure 3-10:

Figure 3-10. 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

Some operating systems (such as NetWare) allow you to "unload" the GAM Server component while the file server remains running. Other operating systems may require you to "down" the file server in order to exit from or remove the GAM Server component.

⚠ *Caution*

Be aware that downing a file server may result in data loss if I/Os are in progress along the network. Exit the GAM Server component only if necessary.

For More Information...

This concludes the Startup & Navigation chapter. For additional information on Global Array Manager or Workstation 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.

Introduction

Configuration activities involve the following:

- Setting up server groups and servers (GAM Client only)

- Loading a configuration from disk and saving it to the controller

- Setting or modifying user preferences such as alarms, alerts, event message editing, and communications parameters

- 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

Signing On to a Server

Security Access Levels

The ability to perform certain actions within the Global Array Manager Client depends on your security access level.

There are three levels of security access, Guest (no sign-on), User, and Administrator.

Guest

By attaching to a file server through the Global Array Manager Client, a user is automatically assigned Guest (no sign-on) status. Guest users can monitor Global status and the Log Information Viewer. They cannot make changes to any parameters or configurations.

User

A User has ordinary system privileges. A User signs on with his or her username and a password that the administrator of that server assigns. A User can alter parameters of anything that is not controller or drive related, and also monitor the status of any selected controller and RAID subsystem,

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but has no administrative capability. The User cannot set up or modify configurations, rebuild drives, or change their on-line status. In essence, Users can "look," but they can't "touch."

Administrator

Individuals with Administrator security access have the capabilities of Guests and Users plus the ability to manipulate controllers and RAID subsystems. These additional abilities include configuration, drive offline, drive rebuild, and drive state changes. An Administrator initially signs on as "gamroot" and secures his or her access with a password.

Under Windows 64, Windows 2000 and Windows NT, the Global Array Manager uses security features built into the operating system.

Signing On

To gain access capabilities beyond User level, you must sign on to a server. If you double-click a server from the Global Status View window when you are not already signed on, or click on any option that requires Administrator rights, the Sign On dialog box displays automatically (Figure 4-1).
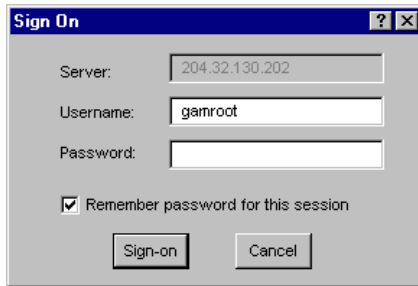
Figure 4-1. Sign On Dialog Box

Or you may open Sign On at any time as shown in Figure 4-2:
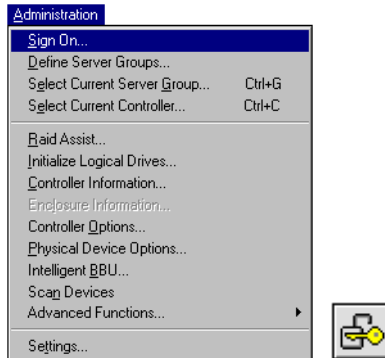
Figure 4-2. Select "Sign On"

Do the following:

1. Type the password previously enabled on the server that corresponds with username "gamroot."

    This should provide Administrator access privileges.

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.

Setting Up Server Groups and Servers

Adding a Server Group to the Server Group List

Open Define Server Groups as shown in Figure 4-3. (This is not necessary if you are starting GAM and no Server Groups are defined. The Define Server Groups dialog box will display automatically.)

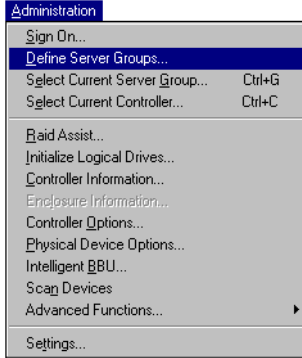**Figure 4-3. Select "Define Server Groups"**

In the Define Server Groups dialog box (Figure 4-4), do the following:

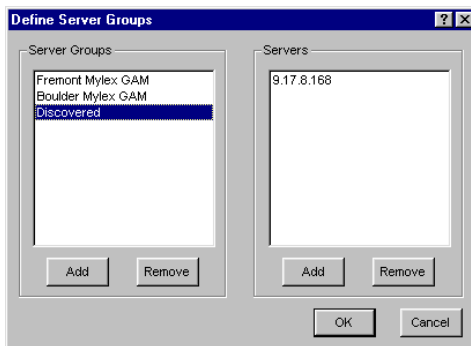1. Click the Add button under the Server Groups section of the dialog box.

Figure 4-4. Define Server Groups Dialog Box

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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 4-4), 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 2000 or Windows NT, 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.

Loading a Configuration from Disk

Load a previously-saved configuration from disk as shown in Figure 4-5.
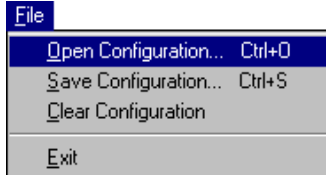
Figure 4-5. Select "Open Configuration"

1. In the Open Configuration dialog box (Figure 4-6), select the configuration file you wish to open to save to the controller.

Figure 4-6. Open Configuration Dialog Box

2. Click Open to access the configuration file.

   Changing the configuration is data destructive. A warning message appears (Figure 4-7):
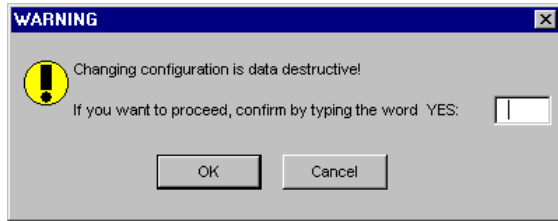
Figure 4-7. Open Configuration Warning Message

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.

Setting and Modifying User Preferences

Open Settings by clicking Administration->Settings on the menu bar or the Preferences icon as shown in Figure 4-8.
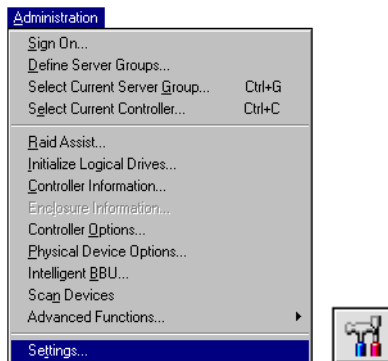
Figure 4-8. Select "Settings"

Alert Preferences
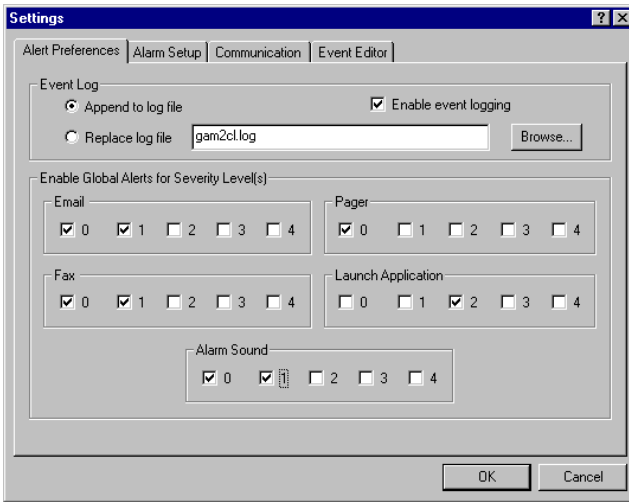
Figure 4-9. Settings Dialog Box: Alert Preferences

In the Settings dialog box, under the Alert Preferences tab (Figure 4-9), 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 4-9, 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 4-10).

☛ **Note**

Email requires MAPI- or SMTP-compliant messaging (e.g. Microsoft Outlook), as well as Microsoft Exchange.
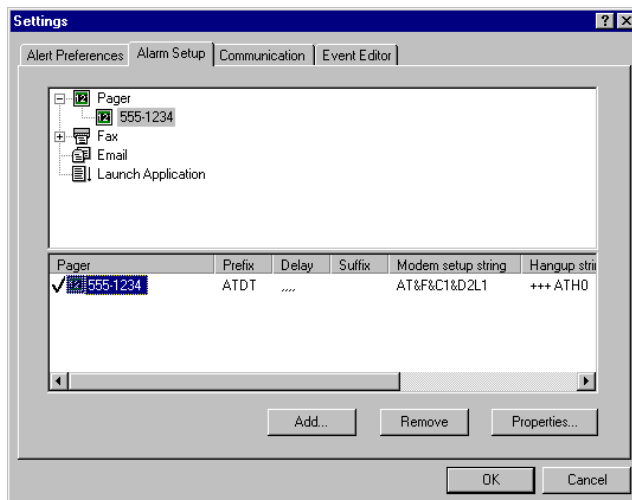
Figure 4-10. Settings Dialog Box: Alarm Setup

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 4-11.
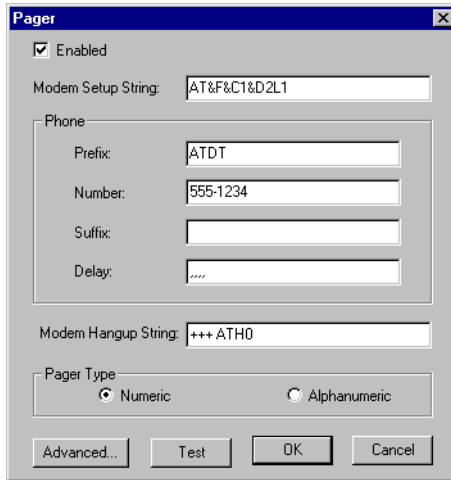
Figure 4-11. Pager Setup Dialog Box

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 Hangup 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 4-10 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 4-12.

Figure 4-12. Remove Pager Entry Message

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

Add a Fax

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 4-13).

Figure 4-13. Fax Alarm Setup

2. Click Add.

The Fax setup box is displayed as shown in Figure 4-14.
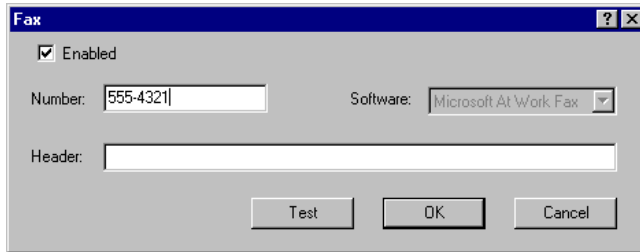
Figure 4-14. Fax Setup Dialog Box

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 4-13 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 Email

1. Select the Email alarm type in the upper window of the Alarm Setup dialog box (Figure 4-15).
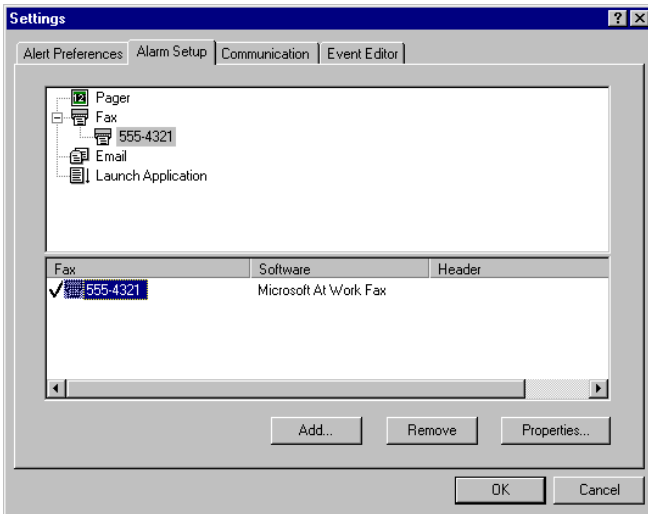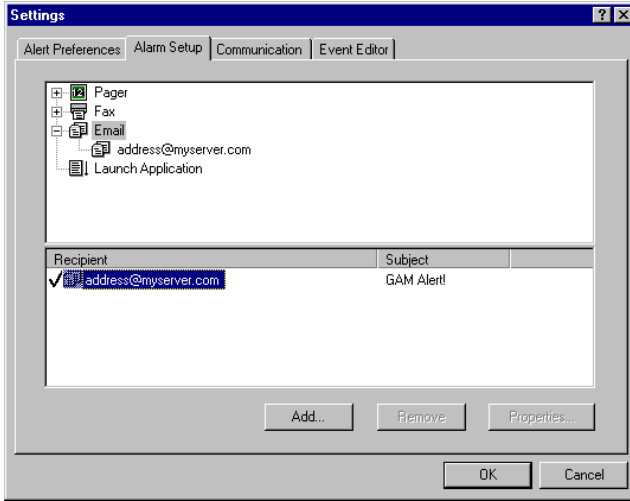

Figure 4-15. Email Alarm Setup

2. Click Add.

   The Email setup box is displayed as shown in Figure 4-16.
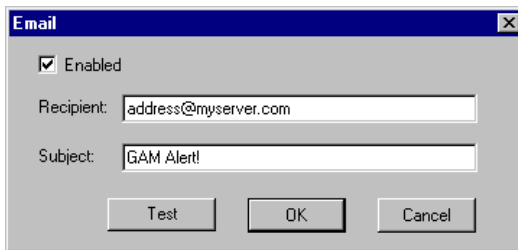
Figure 4-16. Email Setup Dialog Box

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 4-15 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 Application to Launch

1. Select the Launch Application alarm type in the upper window of the Alarm Setup dialog box (Figure 4-17).
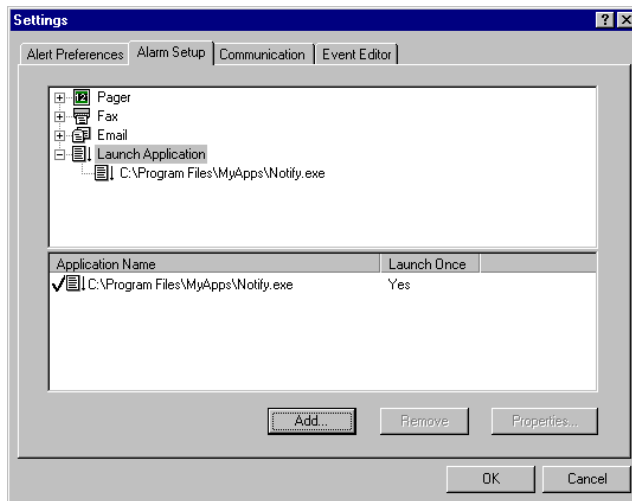
Figure 4-17. Launch Application Alarm Setup

2. Click Add.

The Launch Application setup box is displayed as shown in Figure 4-18.
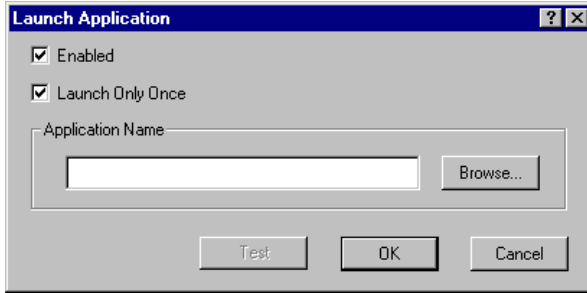
Figure 4-18. Launch Application Setup Dialog Box

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 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 4-17 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 4-19), you have the option to change any of the following:
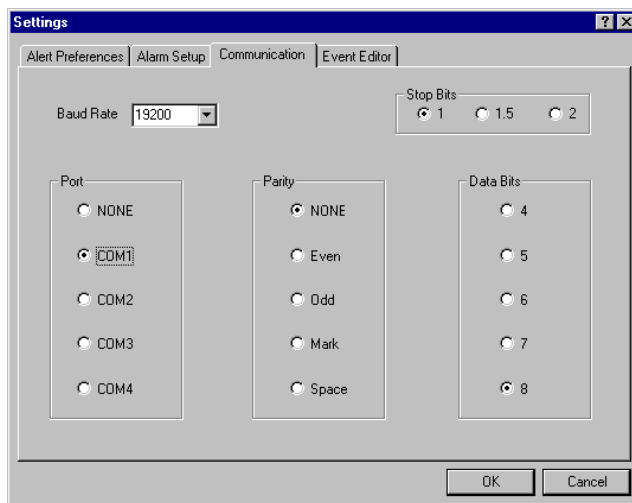
Figure 4-19. Settings Dialog Box: Communication

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
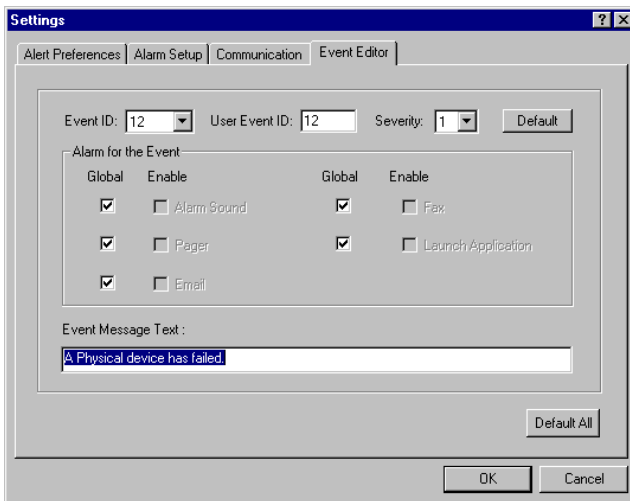
Figure 4-20. Settings Dialog Box–Event Editor

In the Settings dialog box, under the Event Editor tab (Figure 4-20), 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 Mylex).

4. Click the Default button to return all settings for this particular event to their Mylex defaults.

Alarm for the Event

When all Global boxes are checked, you are seeing 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 Mylex).

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 4-21).
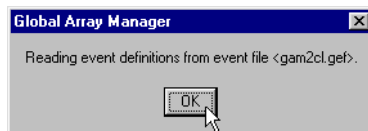
Figure 4-21. gam2cl.gef dialog box

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 Mylex 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.

Setting and Modifying Controller Options

Open Controller Options as shown in Figure 4-22.
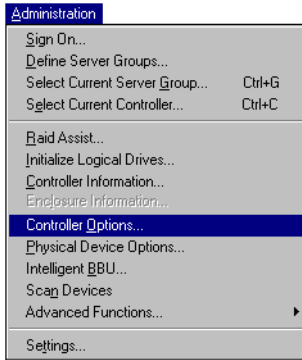
Figure 4-22. Select "Controller Options"

Previous Mylex PCI RAID Controllers[1]

☛ **Note**

You cannot change controller options if the controller is running Mylex PCI firmware version 3.x or below!

In the Controller Options dialog box (Figure 4-23), you have several options:

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1. These controllers include DAC960P Series, AcceleRAID 150/ 200/250, and eXtremeRAID 1100 (DAC1164P).

Figure 4-23. Controller Options Dialog Box for Older PCI DAC

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.

- **Active Negation**. Recommended for cleaner SCSI signal transitions.

- **Read Ahead**. Reads data to the next stripe boundary (based on stripe size) and retains in cache any data beyond the size of the actual read request.

- **Disconnect On First Command**. Allows target to disconnect from initiator.

- **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 Rebuild Rate to less than or equal to 50.

A rate of 50 devotes the maximum allowable resources to a drive rebuild or array expansion, allowing the Rebuild or Expand to proceed at its fastest. Lowering the number devotes more resources to I/Os and consequently slows the Rebuild or Expand Array process.

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.

Change any of the following SCSI Parameters (note that Transfer Speed is read only):

- **Channel** for this controller.
- Whether the controller will handle data at **8-bit** or **16-bit** transfers.
- Maximum data transfer rate of the disk side channels. Speeds are **Asynchronous**, **5 MHz**, **8 MHz**, **10 MHz**, **20 MHz**, and **40 MHz** (Low Voltage Differential only).
- **SCSI Tag Queuing**. Enable in order to queue up commands for the target to execute.

Enable or disable (by checking or unchecking) the following Clustering Parameter:

Clustering. Under 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.

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

New Mylex PCI RAID Controllers[1]

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

Controller Options

To configure Controller Options, follow these steps:

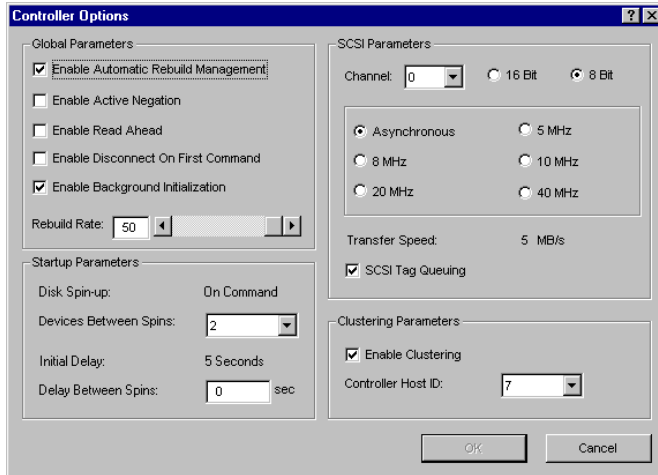1. Select the Controller Options tab (Figure 4-24).

Figure 4-24. 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.

    *   **Background Initialization**. Allows logical drive initialization to take place "behind the scenes" so that the logical drive is

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    1. These controllers include AcceleRAID 160/170/170LP/352 and eXtremeRAID 2000 PCI to Ultra 160 SCSI controllers, and the eXtremeRAID 3000 PCI to Fibre Channel controller.

immediately available for use. If you disable this option, logical drives will need to complete their initialization process before they can be used.

- **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 the default Rebuild Rate to less than or equal to 50.

A rate of 50 devotes the maximum allowable resources to a drive rebuild or array expansion, allowing the Rebuild or Expand to proceed at its fastest. Lowering the number devotes more resources to I/Os and consequently slows the Rebuild or Expand Array process.

Change the Cache Line Size for this controller (if enabled).

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.

Enable or disable (by checking or unchecking) the following Clustering Parameter:

- **Clustering**. Under 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.

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 4-25).

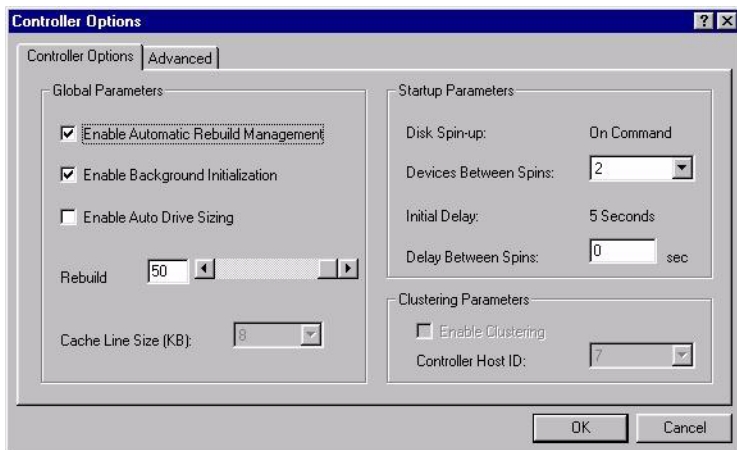**Figure 4-25. Advanced Controller Options Dialog Box for new PCI DAC**

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 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

COD 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.

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

SCSI Host Bus Adapters

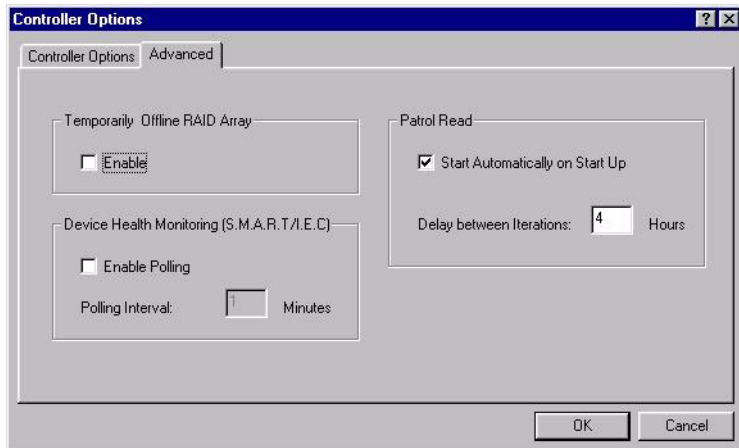In the Controller Options dialog box (Figure 4-26), you have several options.
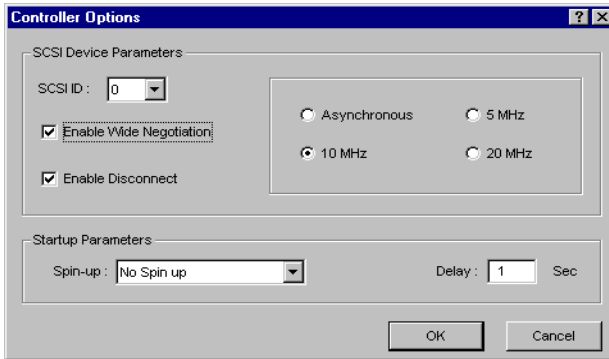
Figure 4-26. Controller Options Dialog Box for SCSI HBA

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, 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 4-27:
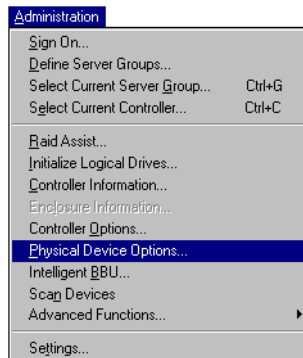
Figure 4-27. Select "Physical Device Options"

The Physical Device Options dialog box (Figure 4-28) displays and allows you to change certain physical device transfer options.
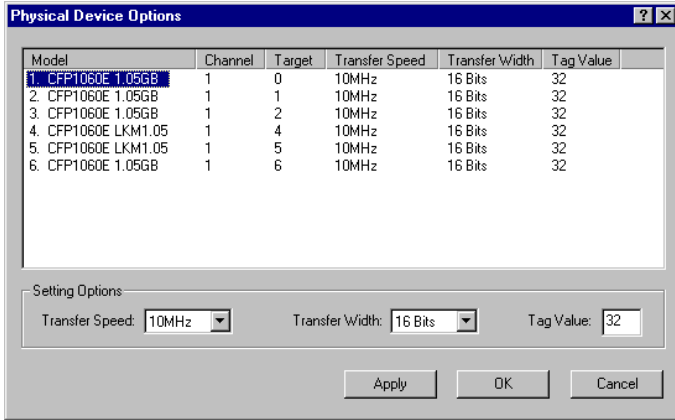
Figure 4-28. Physical Device options Dialog Box

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 4-29.
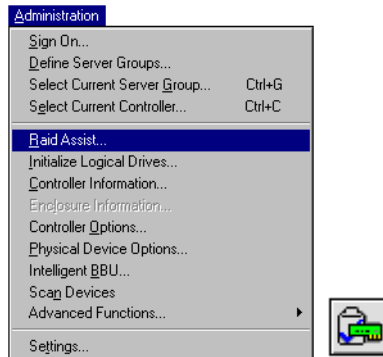
Figure 4-29. Select "RAID Assist"

The RAID Assist "Welcome" dialog box displays Figure 4-30.
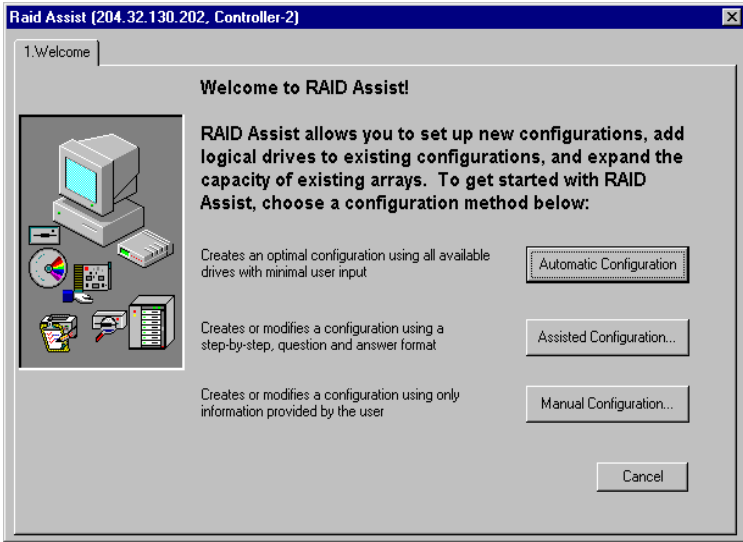
Figure 4-30. RAID Assist "Welcome" Dialog Box

In the RAID Assist "Welcome" dialog box (Figure 4-30), 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 4-31.
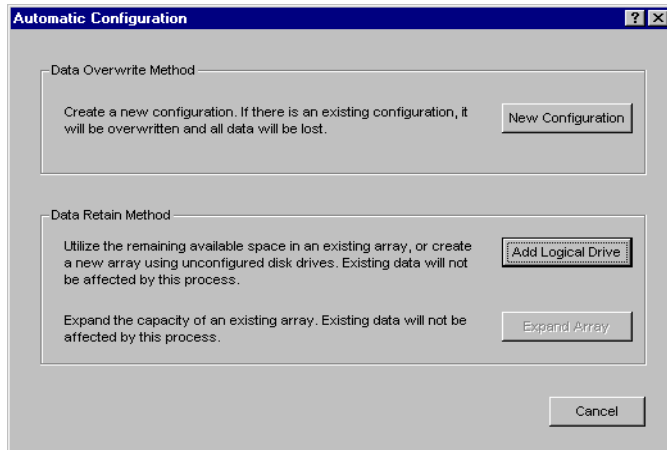
Figure 4-31. Select "New Configuration"

The New Configuration option of the Automatic Configuration feature provides the administrator with the option of customizing the automatic configuration. Global Array Manager Client creates an "autoconfig.dat" file that can edit the administrator. The "autoconfig.dat" file can be opened and edited through notepad or another text editing application. The new configuration created by the "autoconfig.dat" file 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 administrator can edit the following parameters within the "autoconfig.dat" file:

- Total number of physical disk drives available.

- Number of physical disk drives in each logical drive.

- RAID level (RAID 0, RAID 1, RAID 3, RAID 5, RAID 0+1, and JBOD).

- Write cache policy: write-through (WT) or write-back (WB).

- Desired usable logical drive size, in MB.

- Number of hot spare drives.

Multipliers can be added as part of the logical drive configuration to indicate replication of the logical drive definition on the same set of drives.

If the "autoconfig.dat" file is not found, the Global Array Manager will notify the administrator with an error window, and then ask if the administrator would like the Global Array Manger to create an example file. The example file will be the default file created at the time of the client installation.

The Finish screen displays (Figure 4-32).
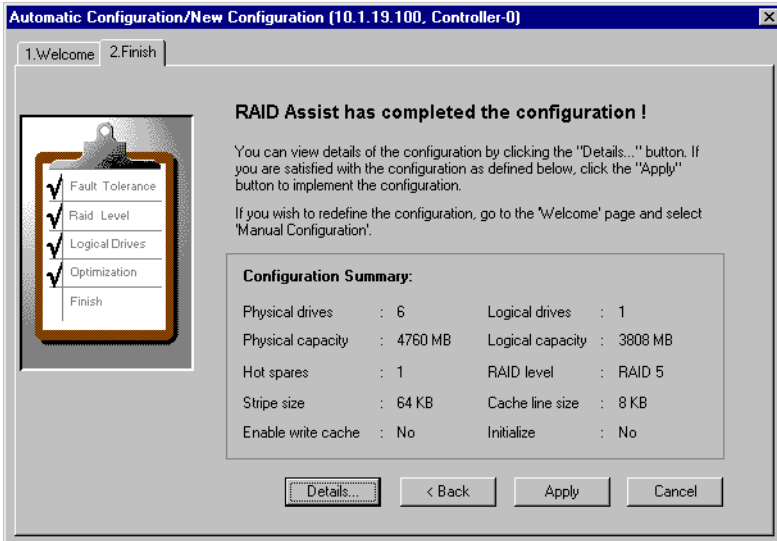
Figure 4-32. Automatic Configuration->New Configuration->Finish

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 4-33.
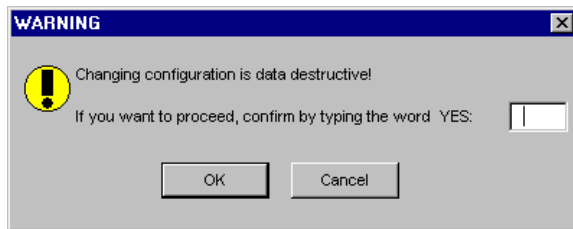
Figure 4-33. WARNING Before Applying the Configuration

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.

   ☛ **Note**

   In Automatic Configuration, Add Logical Drive and Expand Array function very similarly to the New Configuration option, except that they do not use the autoconfig.dat file. In each case RAID Assist prepares an optimal configuration without user input based on characteristics of the available devices.

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 4-34:
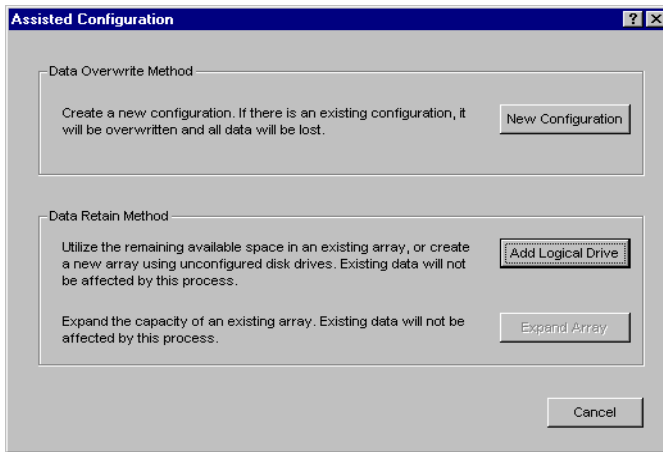
Figure 4-34. Select "New Configuration"

Assisted Configuration walks you step by step through a new configuration (Figure 4-35). 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 4-35) for fault tolerance.

1. Do you want Fault Tolerance? [Yes/No]

2. Do you want a Hot Spare? [Yes/No]
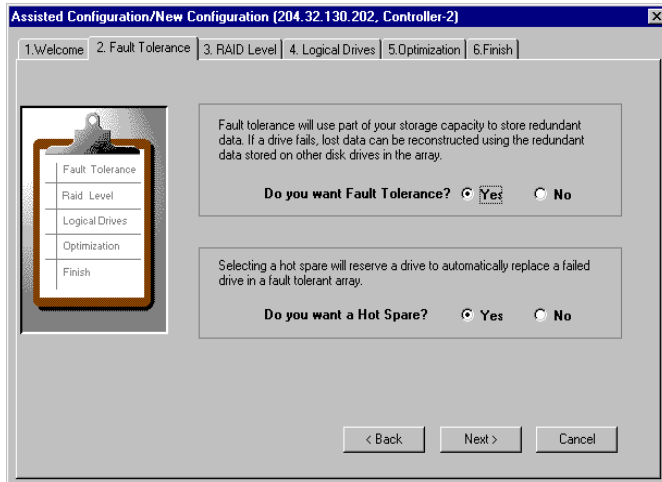
Figure 4-35. Assisted Configuration –Fault Tolerance

RAID Level Tab If Fault Tolerance Was Yes (Figure 4-36), choose between:

- Parity error correction (RAID 5, RAID 3), or
- Fully redundant drives (RAID 1, RAID 0+1)
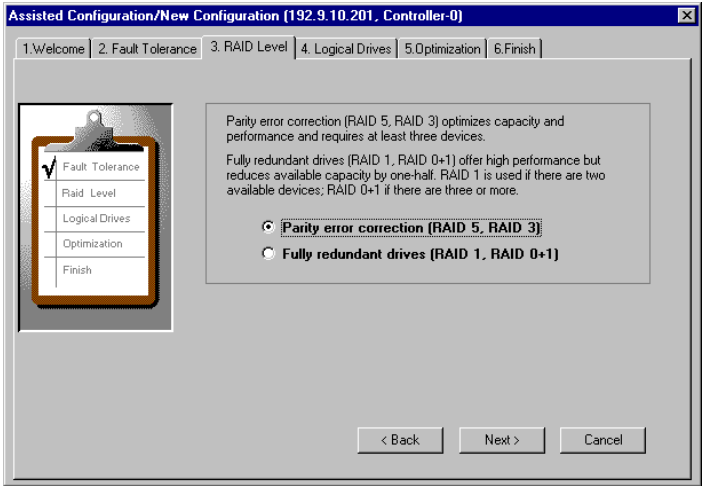
Figure 4-36. Assisted Configuration –RAID Level With Fault Tolerance

RAID Level Tab If Fault Tolerance Was No (Figure 4-37), choose between:

- Striping (RAID 0), or
- Stand-alone drive (JBOD)
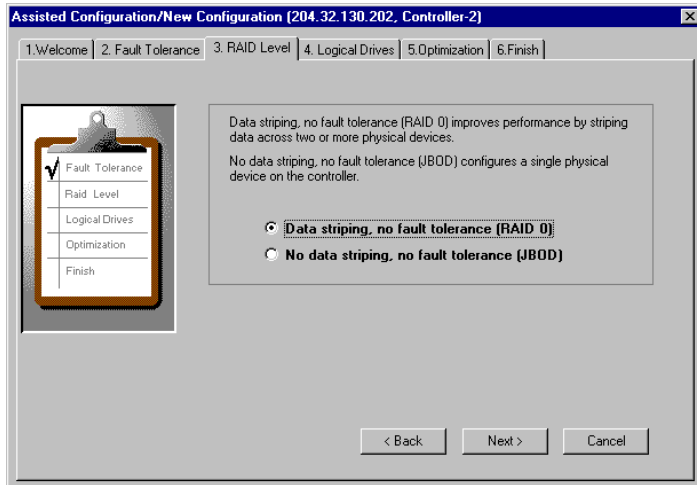
Figure 4-37. Assisted Configuration –RAID Level With No Fault Tolerance

Logical Drives Tab

Configure the following options (Figure 4-38) 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.
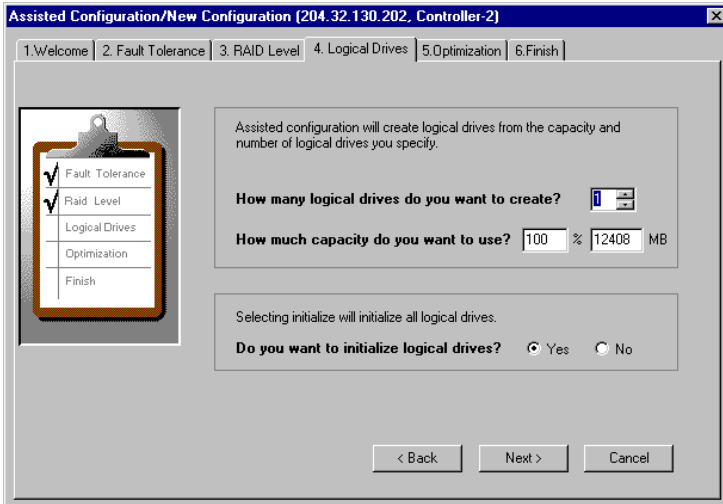
Figure 4-38. Assisted Configuration –Logical Drives

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 4-39):
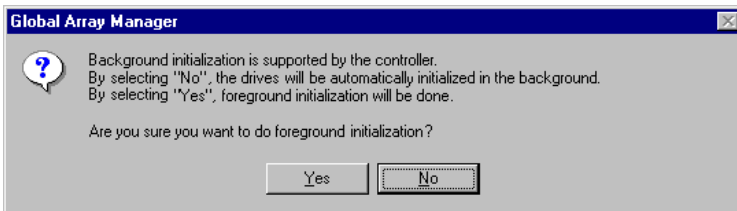
Figure 4-39. Background Initialization is Supported

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 4-40) for optimization.

1. Choose between:

   - Write cache enabled (write back), or

   - Write cache disabled (write through).

2. Select Stripe Size (valid options are in the list).

3. Select Cache line size.

   Valid cache line size values depend on the stripe size setting and are listed appropriately once you have selected a stripe size.
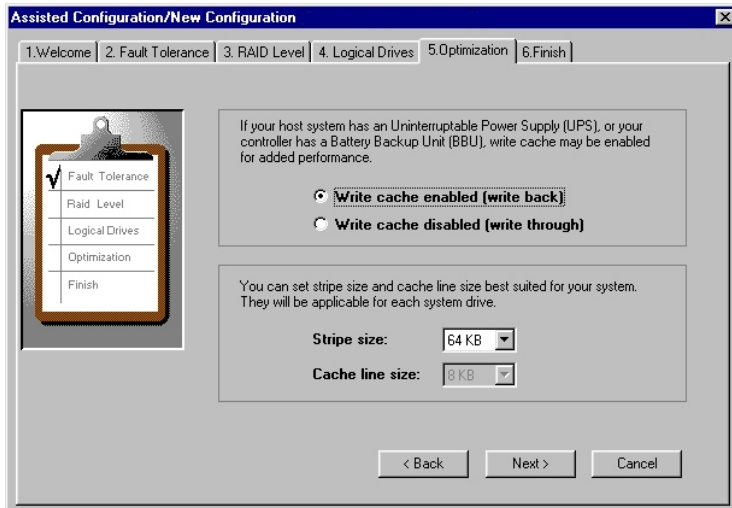
Figure 4-40. Assisted Configuration –Optimization

Finish Tab

When you get to the Finish screen (Figure 4-41), do the following:
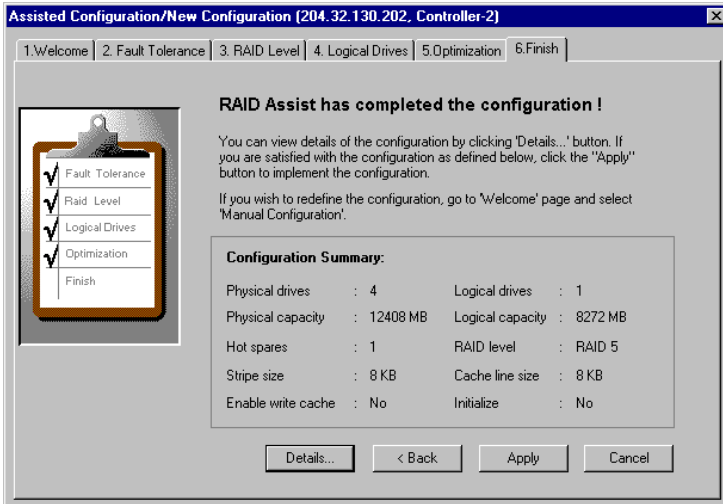
Figure 4-41. Assisted Configuration ->New Configuration ->Finish

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 4-42:
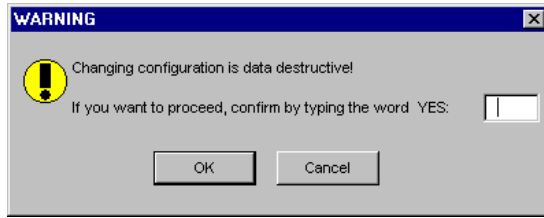
Figure 4-42. WARNING Before Applying the Configuration

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 make any changes that you require.

- **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 4-43.
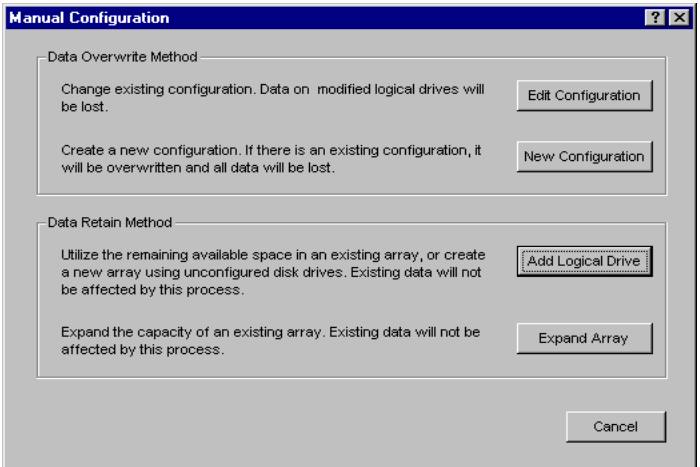
Figure 4-43. Select "New Configuration"

The Disk Arrays tab in Manual Configuration is where you begin to configure your unused disk drives (lower left, Figure 4-44).
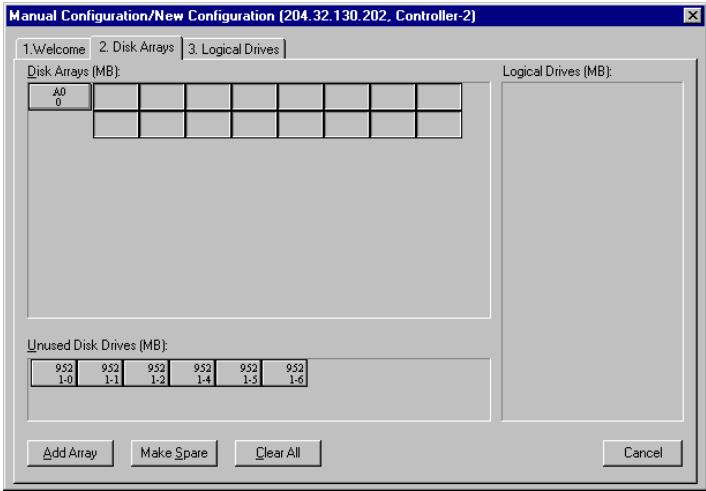
Figure 4-44. Manual Configuration –Disk Arrays

Each disk array is represented by two lines in the Disk Arrays area of the screen (upper left, Figure 4-44). 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 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.

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 4-45).
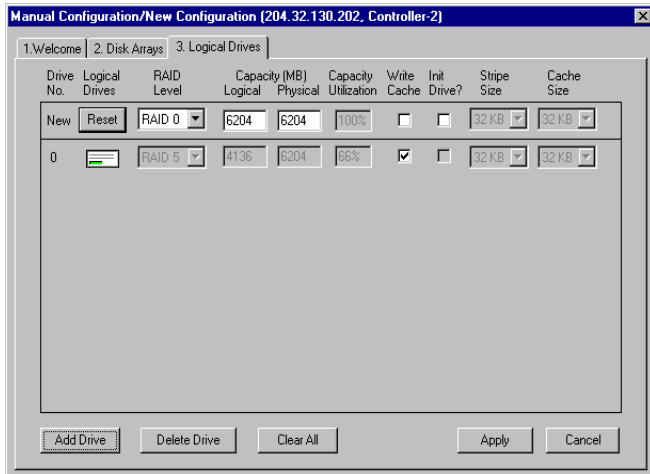
Figure 4-45. Manual Configuration –Logical Drives

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

Do the following:

1. 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.

2. 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.

3. 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.

4. 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.

5. Select a stripe size.

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

7. Click the Add Drive button to register your new logical drive.

8. 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 4-46:
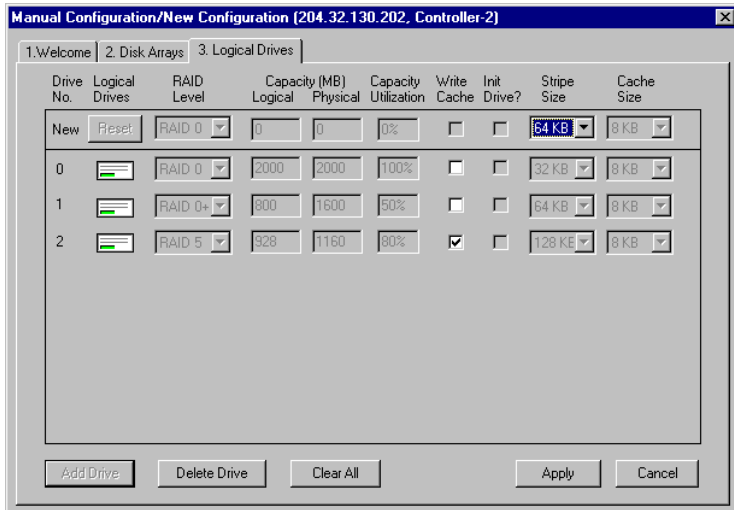
Figure 4-46. Sample Manual Configuration Just Before "Apply"

☞ **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.

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

Global Array Manager Server and the Workstation Array Manager driver subcomponent monitor 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/WSAM.

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 or Workstation Array Manager be kept active continuously as a minimized Windows application.

Opening the Log Information Viewer

The Log Information Viewer is opened when the program is started and one or more controllers are detected as connected to the server(s). 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.

Should you need to open the Log Information Viewer manually, do so as shown in Figure 5-1:
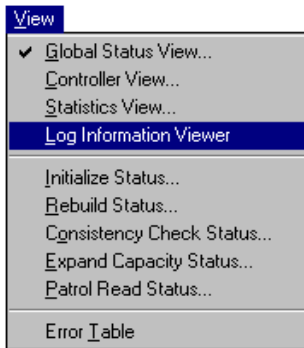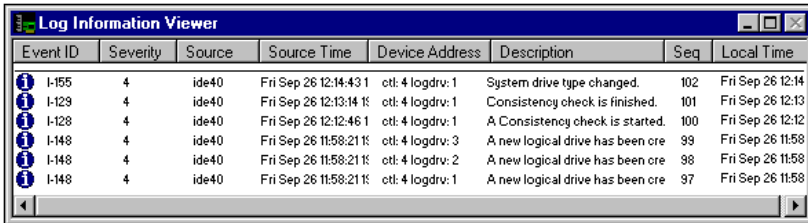
Figure 5-1. Select "Log Information Viewer"

The Log Information Viewer displays (Figure 5-2).

Figure 5-2. Log Information Viewer

The Log Information Viewer displays the following information about events:

- **Event ID**. Displays an icon showing whether the event is informational, cautionary, a warning, or failure, plus the identification number assigned to this event.

- **Severity**. The severity level of this event. Click on the Severity column header to sort the events in ascending or descending order.

- **Source**. The IP address or name of the file server that is the sender (source) of this event (blank for WSAM).

- **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 activity and other data pertaining to why this event posted.

- **Description**. Text of the message describing what occurred.

- **Sequence (Seq)**. Number representing where this event fell in a sequence of possibly related events. Click on the Sequence column header to sort the events in ascending or descending order.

- **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.

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 single 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 5-3:
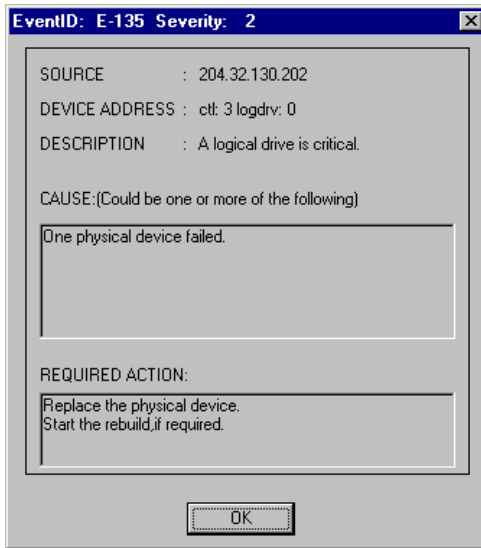
Figure 5-3. Event Information Window

   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

For GAM Client, 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.

For WSAM, Controller View opens for the C-0 controller on the local server at startup.

Opening the Controller View

Open the Controller View by double-clicking any server icon in the Global Status View, or as shown in Figure 5-4:
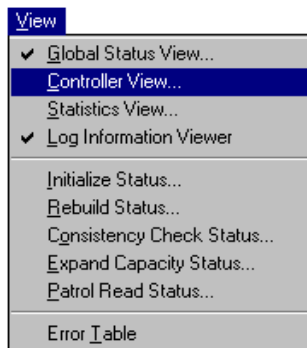
Figure 5-4. Select "Controller View"

For WSAM, you can only access controllers on the local server. Open a controller view from the controller selection box.

All PCI RAID Controllers Except eXtremeRAID 3000

The Controller View window (Figure 5-5), displays the following information about the controller currently selected in the *controller selection box*:

- The number of channels on this controller, each channel depicted as a tower

- The physical devices present on each channel, specifying the target ID, capacity of the device, device type, and device status.

> ☛ **Note**
>
> To check a physical device status, double-click the desired device. See "Physical Device and Logical Drive Monitoring" on page 5-9 for more information.

- The logical drives configured on the controller, specifying the logical drive number, capacity of the logical drive, configured RAID level, and logical drive status
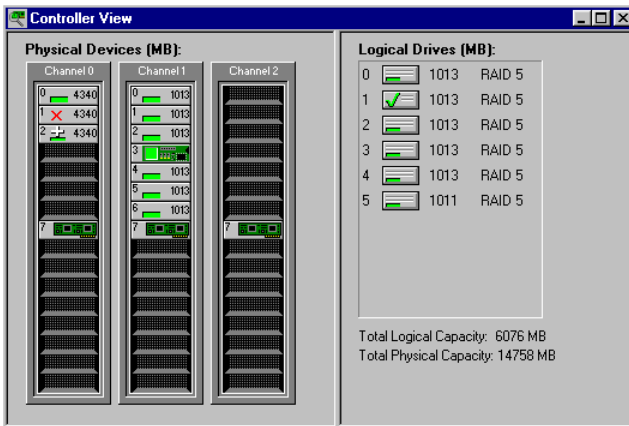
Figure 5-5. Controller View Window –"Non-Fibre" RAID Controller

eXtremeRAID 3000

The Controller View window for the eXtremeRAID 3000 (Figure 5-6), 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.
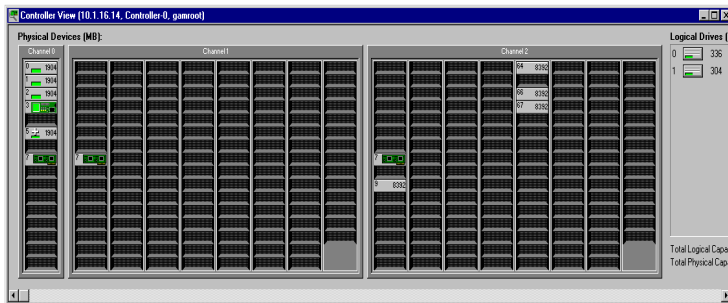
Figure 5-6. Controller View Window – eXtremeRAID 3000 Controller

Displaying Controller Information

Open Controller Information by clicking Administration->Controller Information on the menu bar or the Controller Information icon as shown in Figure 5-7:
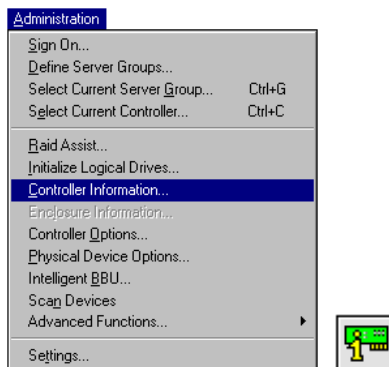
Figure 5-7. Select "Controller Information"

Figure 5-8 shows the Controller Information window for a PCI RAID Controller.
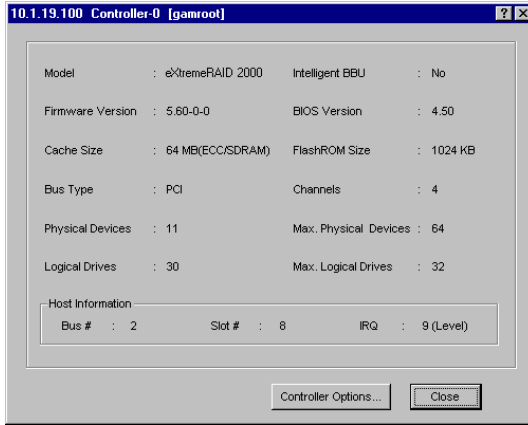
Figure 5-8. Controller Information – PCI Controllers

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 4-20).

Click the Close button to close the Controller Information window.

Physical Device and Logical Drive Monitoring

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 5-9. Host Device Information: RAID Controller
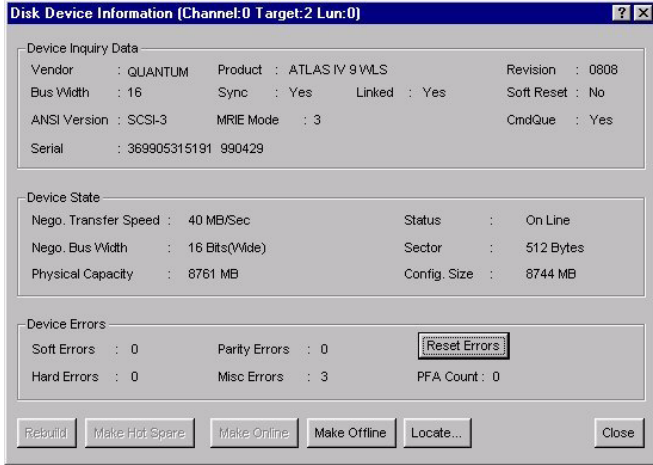
Figure 5-10. Disk Device Information

Device Information (Figure 5-9, Figure 5-10) 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 Hot Spare button may be available to set this device as a hot spare.

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 Mylex 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 device will blink to reveal its location.

Figure 5-11. Locate Device Message. Click OK When Done.

2. Click OK (see Figure 5-12) 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 5-12).

☞ **Note**

The PFA button will not be visible if the PFA count is zero.
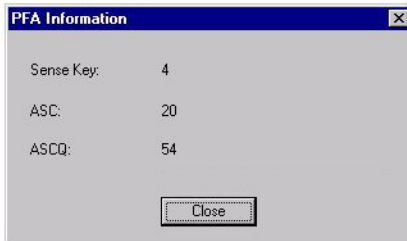
Figure 5-12. PFA Information Window

Click the Close button to close the window.

Viewing the Bad Block Table, 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 5-13.
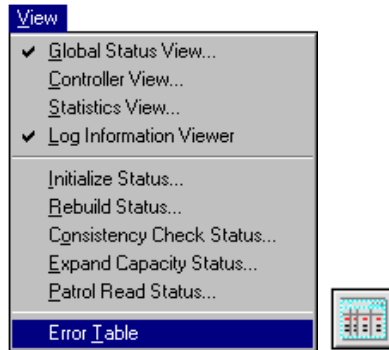
Figure 5-13. Select "Error Table"

A screen of the following type appears (Figure 5-14):

Figure 5-14. Bad Block Table

☛ **Note**

New Mylex PCI controllers (AcceleRAID 160/170/
170LP/352, eXtremeRAID 2000/3000) do not support
the Bad Block Table. In this case, the Bad Block Table
tab will not appear in the Error Table dialog box.

The Bad Block Table contains information about bad (unusable) areas on currently-configured logical drives, and the date and time when the errors were discovered. A large number of bad blocks may signal a corrupted or failing disk.

Click Save File to record the bad block information for later inspection.

If you click the Request Sense Data tab, the following type of information appears (Figure 5-15):
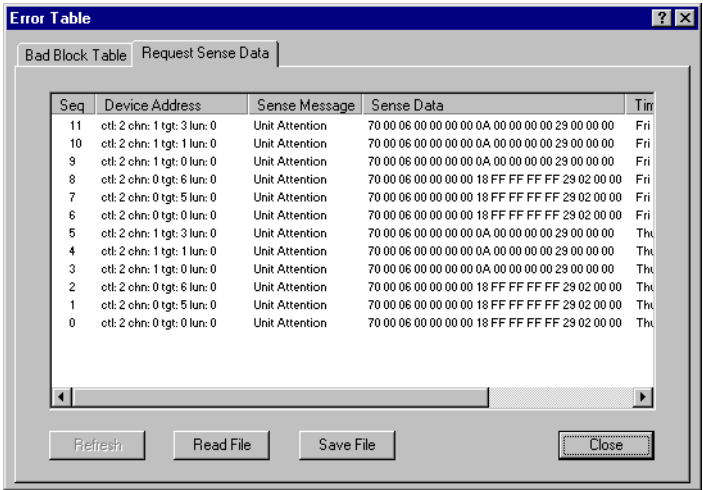
Figure 5-15. Request Sense Data

This information may be useful for troubleshooting or later analysis.

1. Click Save File to record the request sense data for later use.

2. Click Close to close the Error Table.

For new PCI controllers, a tab for NVRAM Error Log will be added (Figure 5-16):
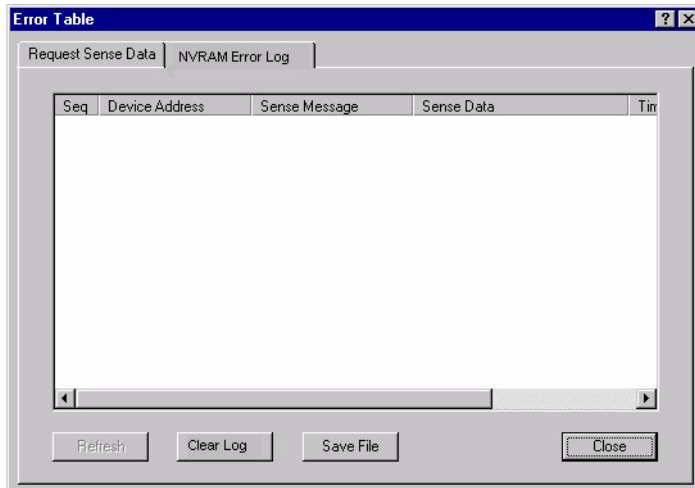
Figure 5-16. NVRAM Error Log

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: This is 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.

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.
- The Refresh button displays when new NVRAM errors are logged. Click the Refresh button to update the NVRAM Error Log with the latest errors from the controller.
- 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 5-17).
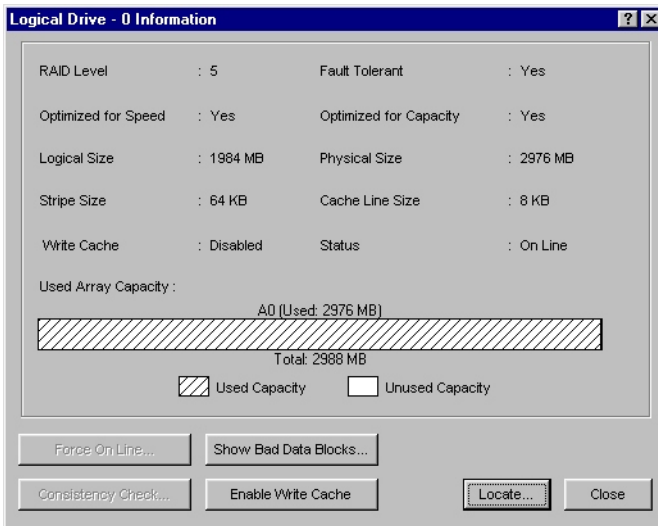
Figure 5-17. Logical Drive Information for a RAID Controller

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 device(s) will blink to reveal their location.
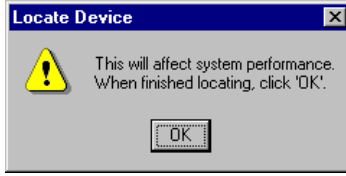
Figure 5-18. Locate Drive Message. Click OK When Done.

2. Click OK (see Figure 5-18) to end the locate operation and return to normal status.

3. Click the Close button to close the dialog box.

Enclosure Monitoring and Management

SCSI Enclosures

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

Double-click the cabinet processor icon to display enclosure information about the cabinet processor (Figure 5-19).
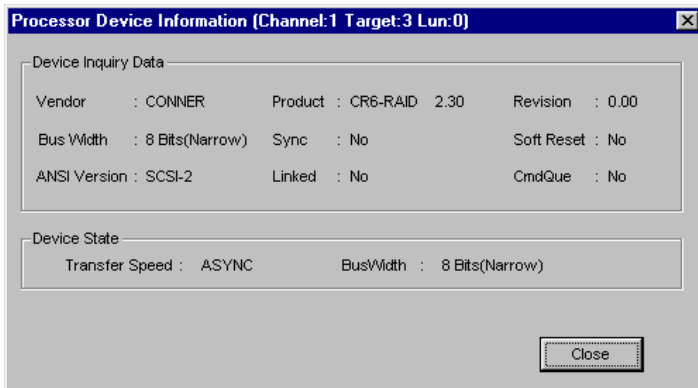
Figure 5-19. Processor Device (Enclosure) Information: SCSI

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.

Performance Monitoring

Performance can be monitored in two ways:

- **Statistics View**. This measures RAID controller performance using operations such as Reads, Writes, % Reads, % Writes, Cache Hits, etc. A flexible settings page lets you choose which controllers, targets, and operations to monitor. Past and present data can be viewed as a line graph, pie graph, or bar graph. Settings can be saved and opened, and statistics data can be captured, saved, and displayed.

- **Performance Analysis**. This focuses on disk-level performance as often used in a TPC-C environment. This system-side tool uses items such as Command Completion Time, Retries, etc., to monitor and analyze performance. A flexible settings page lets you choose which controllers, targets, and operations to monitor. Past and present data can be viewed as a line graph in a History window. Settings can be saved and opened, and performance data can be captured, saved, and displayed.

Statistics View

Open Statistics View by clicking View->Statistics View on the menu bar or the Statistics View icon as shown in Figure 5-20:
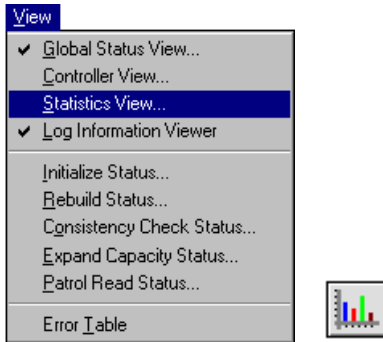
Figure 5-20. Select "Statistics View"

Settings

When you open Statistics View, the Settings page is displayed. Here you will define the controllers, channels, and target physical devices or logical drives to include for statistical analysis. You select an operation to analyze, define a color and line segment to differentiate this analysis from others used for comparison, and optionally save your settings and capture data to a file.

Figure 5-21 shows the Settings page.
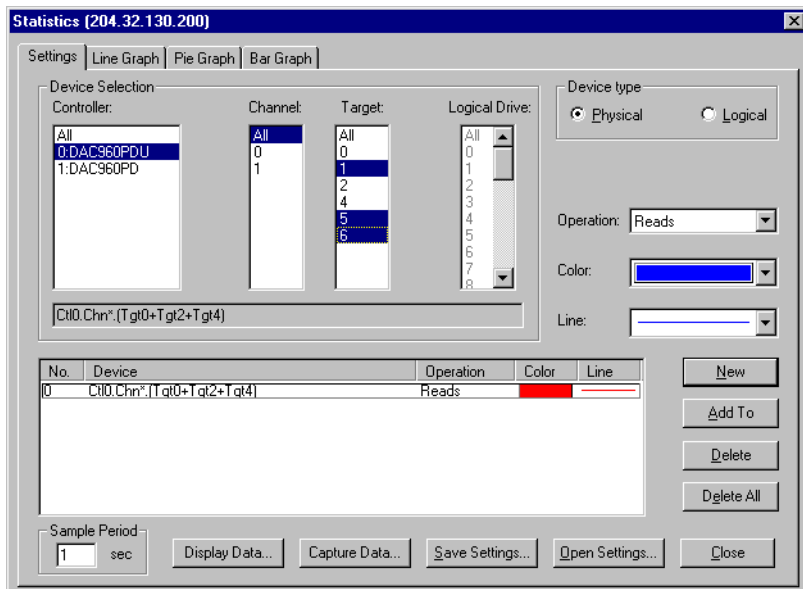
Figure 5-21. Statistics View: Settings

You build a string which defines a line of data on a line graph, a section of a pie graph, or a bar on a bar graph. Each string consists of one or more controllers, channels, and physical devices or logical drives to include in the analysis, an operation to be analyzed, and a color and line style (for line graphs) to represent this string graphically.

To build an analysis string:

1. In Device type, select either physical devices or logical drives for the analysis string you're building.

In Device Selection, do the following:

2. Select one or more controllers to include in the analysis string. Click All for all controllers. For *individual* controllers, make sure All is not highlighted.

3. Select one or more channels to include in the analysis string. Click All for all channels. For *individual* channels, make sure All is not highlighted.

4. If you chose Physical under Device type, select one or more targets to include in the analysis string. Click All for all targets. For *individual* targets, make sure All is not highlighted.

   If you chose Logical under Device type, select one or more logical drives to include in the analysis string. Click All for all logical drives. For *individual* logical drives, make sure All is not highlighted.

At the bottom of the Device Selection box, a field displays the analysis string being constructed. The symbol "*" refers to All.

Next, do the following:

5. In the Operation drop-down list box, select an operation to monitor for this analysis string. Examples of operations include:

   • **Reads** –The number of reads issued by the controller to the physical device or the number of reads issued by the host to the logical device.

   • **ReadKB** –The amount of KiloByte data read by the controller from the physical device or the amount of KiloByte data read by the host from the logical device.

   • **%ReadCacheHit** –The amount of KiloByte data read by the host from the cache or the total amount of KiloByte data read by the host from the logical device.

   • **Writes** –The number of writes issued by the controller to the physical device or the number of writes issued by the host to the logical device.

   • **WritesKB** –The amount of KiloByte data read by the controller from the physical device or the amount of KiloByte data read by the host from the logical device.

   • **%Read** –Reads *100/(Reads and Writes)

   • **%Write** –Writes *100/(Reads and Writes)

- **Read+Write** –Reads and Writes
- **%ReadKB** –ReadKB*100/(ReadKB and WriteKB)
- **%WriteKB** –WriteKB*100/(ReadKB and WriteKB)
- **RKB+WKB** –ReadKB and WriteKB

6. In the Color drop-down list box, select a color to represent this analysis string graphically.

7. In the Line drop-down list box, select a line style to represent this analysis string in a line graph.

8. Your string is built. Click New to add this string to the display box.

9. Repeat steps 1 through 8 to create additional analysis strings if you so desire, OR

   If you want to add to an already-built string, select the string in the display box, select additional devices under Device Selection, and click the Add To button. If you change the Operation, Color, or Line and click Add To, the new selection replaces the previous one.

To delete analysis strings:

Select a string in the display box and click Delete, OR

   Click Delete All to delete all defined analysis strings.

To set the Sample Period:

Type a number of seconds in the Sample Period box. A data point will be created to display each [Sample Period] number of seconds.

To save all your settings to a file for future use:

1. Click Save Settings. A Save As dialog box is displayed (Figure 5-22).
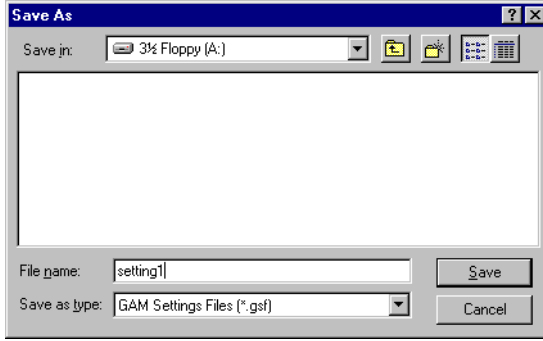
Figure 5-22. Save Settings to a File

2. Enter a destination and filename for your settings file.

3. Click Save.

To use previously saved settings:

1. Click Open Settings. An Open dialog box is displayed (Figure 5-23).
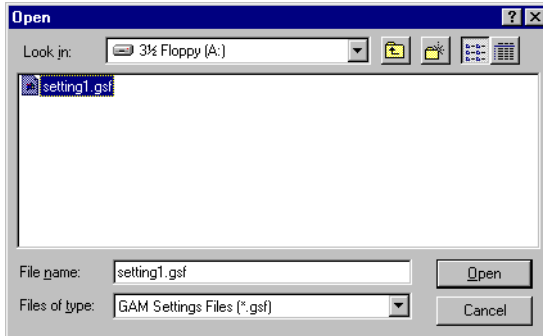
Figure 5-23. Open Previously Saved Settings

2. Enter a destination and select the settings file you wish to open.

3. Click Open.

The data generated by your analysis strings can be captured to a file. This file can be opened later for examination or analysis.

To capture data to a file:

1. Click Capture Data. A Capture Data dialog box is displayed (Figure 5-24).
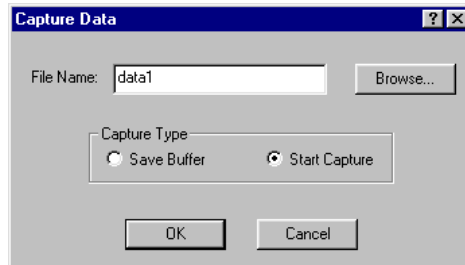
Figure 5-24. Capture Data to a File

2. With Start Capture selected, type a filename for the data file to be saved, or click Browse to find an existing data file and append to it.

3. Click OK.

Data defined by your analysis strings will be generated. You can see the data as a line graph, pie graph, or bar graph. Data will be collected until you click the Stop Capture button.

You may wish to save the contents of the data buffer to a file for later examination.

To save the data buffer to a file:

1. Click Capture Data.

2. Select Save Buffer, and type a filename for the data file to be saved, or click Browse to find an existing data file and append the buffer to it.

3. Click OK.

To display previously saved data:

1. Click Display Data. A Display Data dialog box opens (Figure 5-25).
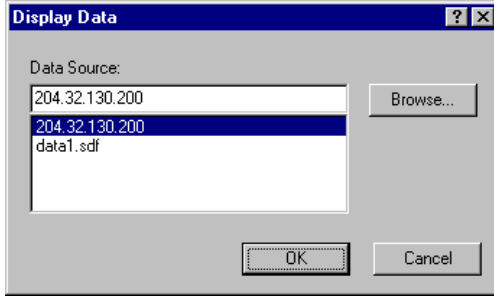
Figure 5-25. Display Data

2. Select a data file to display, or click Browse to locate a data file in a different directory.

   ☛ **Note**

   Selecting the IP Address in the Data source box indicates that you wish to view data currently being generated by that server. Only the currently selected server will be displayed.

3. Click OK to open the data file for display (or the server currently generating data).

   You may view saved data by clicking the Line Graph tab and choosing Past in the Graph Data box.

   You may view current data by clicking the Line Graph tab and choosing Present in the Graph Data box, or by clicking the Pie Graph or Bar Graph tab.

Line Graph

Click the Line Graph tab to open the Line Graph data page (Figure 5-26).
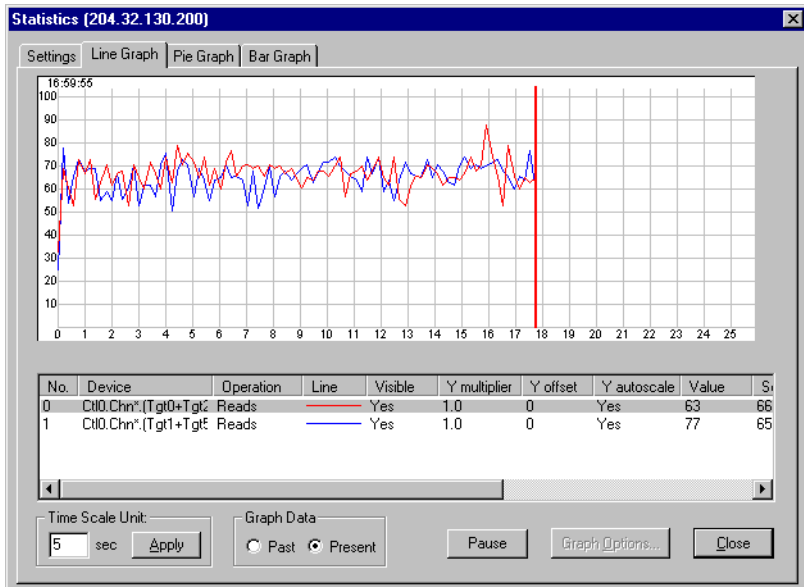
Figure 5-26. Statistics View: Line Graph Display

The Line Graph page displays data for the analysis strings specified in the display window in the form of lines generated on a grid with time units along the horizontal axis and percentage along the vertical axis.

To set the Time Scale Unit:

1. Enter a number of seconds in the text box.

2. Click Apply.

   Each horizontal grid mark's value (for example, from 0 to 1, 1 to 2, etc.) will equal the number of seconds you've specified.

The Graph Data box allows you to see currently generated data from the selected server (Present) or previously saved data (Past) from the buffer or from a data file selected within the Settings page.

To pause (or resume) the data display:

Click Pause (or Resume, if previously paused).

To change Graph Options for a particular analysis string:

1. Select the analysis string of interest in the display window.

2. Click Graph Options.

   You can change whether this string's data will be visible, whether the data will autoscale along the Y-axis, the Y-axis multiplier, and Y offset.

   ☛ **Note**

   If you want to compare data from different analysis strings, their Y multiplier and Y offset settings should be the same.

To exit:

- Click Close to exit from Statistics View, OR

- Click another Statistics View tab.

Pie Graph

Click the Pie Graph tab to open the Pie Graph data page (Figure 5-27).
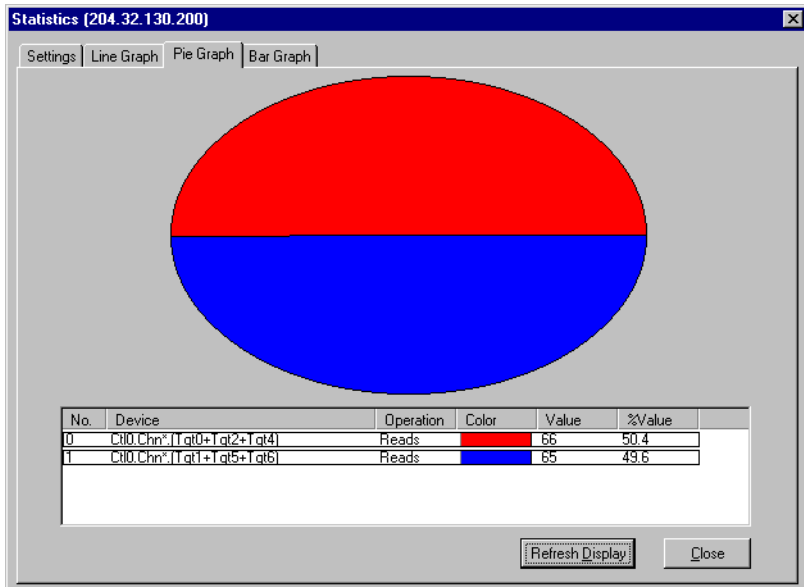
Figure 5-27. Statistics View: Pie Graph Display

The Pie Graph page displays data for the analysis strings specified in the display window in the form of a pie chart.

> ☛ **Note**
>
> Because of the nature of a pie chart, the Operation selected for your analysis strings should be the same. If it is not, the data may or may not be useful.

To update the data in the pie graph to the most current data:

Click Refresh Display.

To exit:

• Click Close to exit from Statistics View, OR

• Click another Statistics View tab.

Bar Graph

Click the Bar Graph tab to open the Bar Graph data page (Figure 5-28).
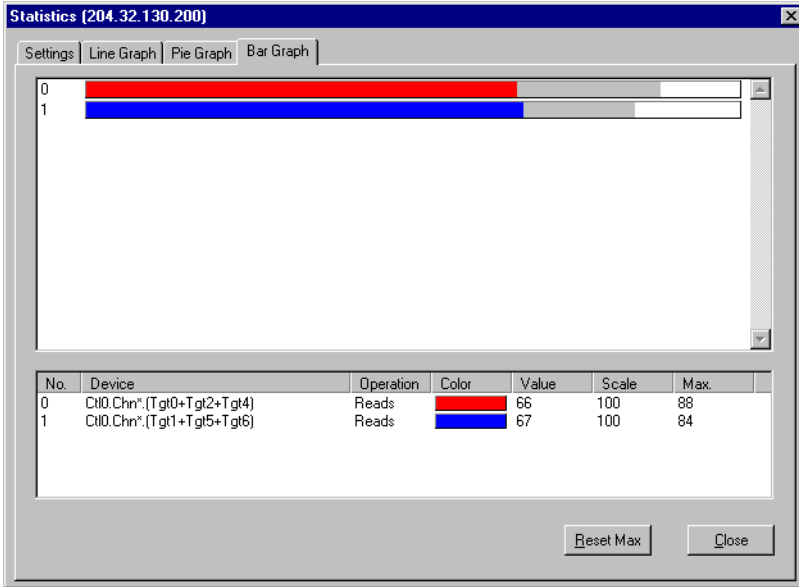
Figure 5-28. Statistics View: Bar Graph Display

The Bar Graph page displays data for each of the analysis strings specified in the display window as a separate bar.

To reset the maximum value if values consistency go off the scale:

Click Reset Max.

The gray portion of the bars displayed in the upper window gives an indication of a maximum value that was hit relative to the current data in the colored bars. In the example in Figure 5-28, both data bars are currently performing under their previous maximum values.

To exit:

• Click Close to exit from Statistics View, OR

• Click another Statistics View tab.

Performance Analysis

Open the Performance Analysis as shown in Figure 5-29:
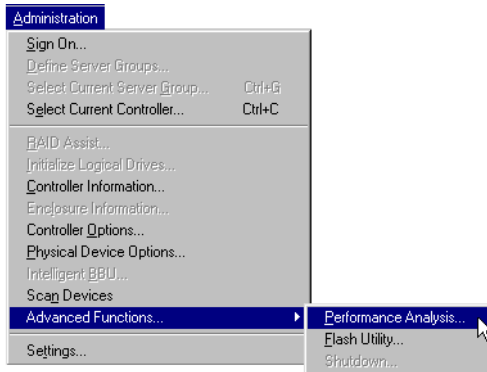
Figure 5-29. Select "Performance Analysis"

Settings

When you open Performance Analysis, the Settings page is displayed. Here you will define the controllers, channels, and target physical devices or logical drives to include for performance analysis. You select an item and operation to analyze, define a color and line segment to differentiate this analysis from others used for comparison, and optionally save your settings and capture data to a file.

Figure 5-30 shows the Settings page.
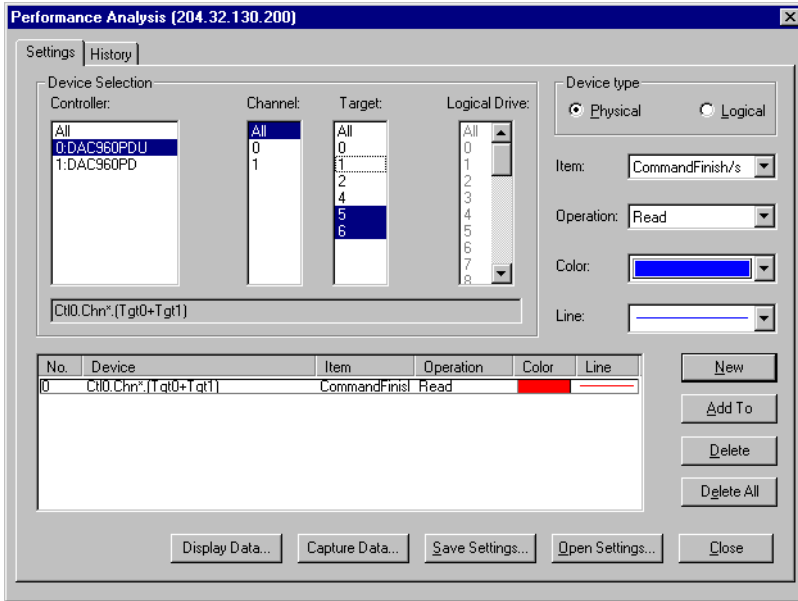
Figure 5-30. Performance Analysis: Settings

You build a string which defines a line of data on a line graph, a section of a pie graph, or a bar on a bar graph. Each string consists of one or more controllers, channels, and physical devices or logical drives to include in the analysis, an item and operation to be analyzed, and a color and line style (for line graphs) to represent this string graphically.

To build an analysis string:

1. In Device type, select either physical devices or logical drives for the analysis string you're building.

In Device Selection, do the following:

2. Select one or more controllers to include in the analysis string. Click All for all controllers. For *individual* controllers, make sure All is not highlighted.

3. Select one or more channels to include in the analysis string. Click All for all channels. For *individual* channels, make sure All is not highlighted.

4. If you chose Physical under Device type, select one or more targets to include in the analysis string. Click All for all targets. For *individual* targets, make sure All is not highlighted.

If you chose Logical under Device type, select one or more logical drives to include in the analysis string. Click All for all logical drives. For *individual* logical drives, make sure All is not highlighted.

At the bottom of the Device Selection box, a field displays the analysis string being constructed. The symbol "*" refers to All.

Next, do the following:

5. In the Item drop-down list box, select an item to monitor for this analysis string. Examples of items include Command Finished, Minimum/Maximum/Average I/O Size, Minimum/Maximum/Average Response Time, Errors, etc.

6. In the Operation drop-down list box, select an operation to monitor for this analysis string. Operations include Read, Write, Read+Write, %Read, and %Write.

7. In the Color drop-down list box, select a color to represent this analysis string graphically.

8. In the Line drop-down list box, select a line style to represent this analysis string in a line graph.

9. Your string is built. Click New to add this string to the display box.

10. Repeat steps 1 through 9 to create additional analysis strings if you so desire, OR

If you want to add to an already-built string, select the string in the display box, select additional devices under Device Selection, and click the Add To button. If you change the Item, Operation, Color, or Line and click Add To, the new selection replaces the previous one.

To delete analysis strings:

- Select a string in the display box and click Delete, OR

- Click Delete All to delete all defined analysis strings.

To save all your settings to a file for future use:

1. Click Save Settings. A Save As dialog box is displayed (Figure 5-31).
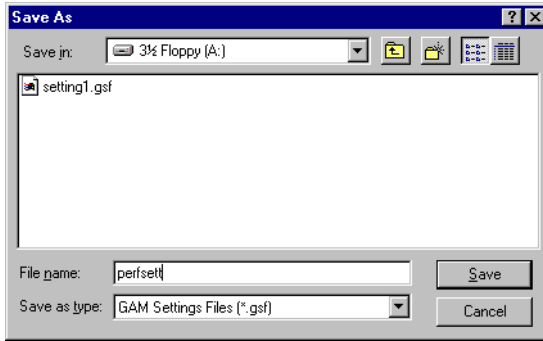
Figure 5-31. Save Settings to a File

2. Enter a destination and filename for your settings file.

3. Click Save.

To use previously saved settings:

1. Click Open Settings. An Open dialog box is displayed (Figure 5-32).
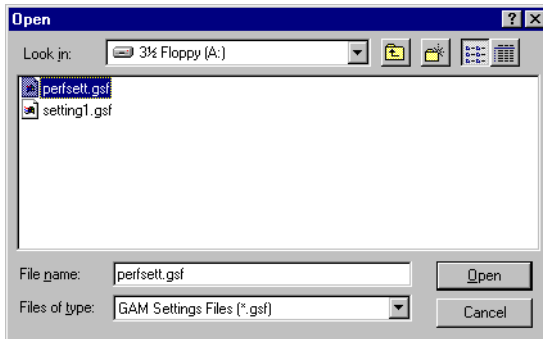
Figure 5-32. Open Previously Saved Settings

2. Enter a destination and select the settings file you wish to open.

3. Click Open.

The data generated by your analysis strings can be captured to a file. This file can be opened later for examination or analysis.

To capture data to a file:

1. Click Capture Data. A Capture Data dialog box is displayed (Figure 5-33).
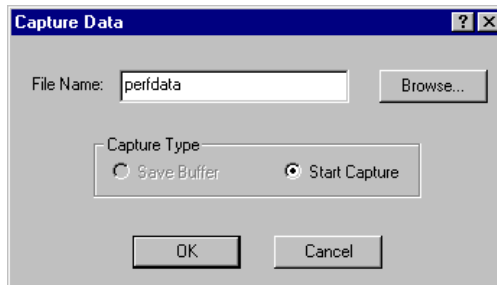
Figure 5-33. Capture Data to a File

2. With Start Capture selected, type a filename for the data file to be saved, or click Browse to find an existing data file and append to it.

3. Click OK.

Data defined by your analysis strings will be generated. You can see the data as a line graph on the History page. Data will be collected until you click the Stop Capture button.

You may wish to save the contents of the data buffer to a file for later examination.

To save the data buffer to a file:

1. Click Capture Data.

2. Select Save Buffer, and type a filename for the data file to be saved, or click Browse to find an existing data file and append the buffer to it.

3. Click OK.

To display previously saved data:

1. Click Display Data. A Display Data dialog box opens (Figure 5-34).
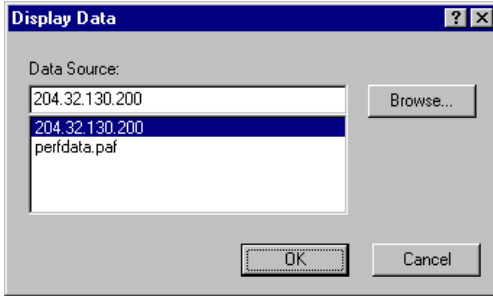
Figure 5-34. Display Data

2. Select a data file to display, or click Browse to locate a data file in a different directory.

   ☞ **Note**

   > Selecting the IP Address in the Data source box indicates that you wish to view data currently being generated by that server. Only the currently selected server will be displayed.

3. Click OK to open the data file for display (or the server currently generating data).

   You may view saved data by clicking the History tab and choosing Past in the Graph Data box.

   You may view current data by clicking the History tab and choosing Present in the Graph Data box.

History

Click the History tab to open the History data page (Figure 5-35).
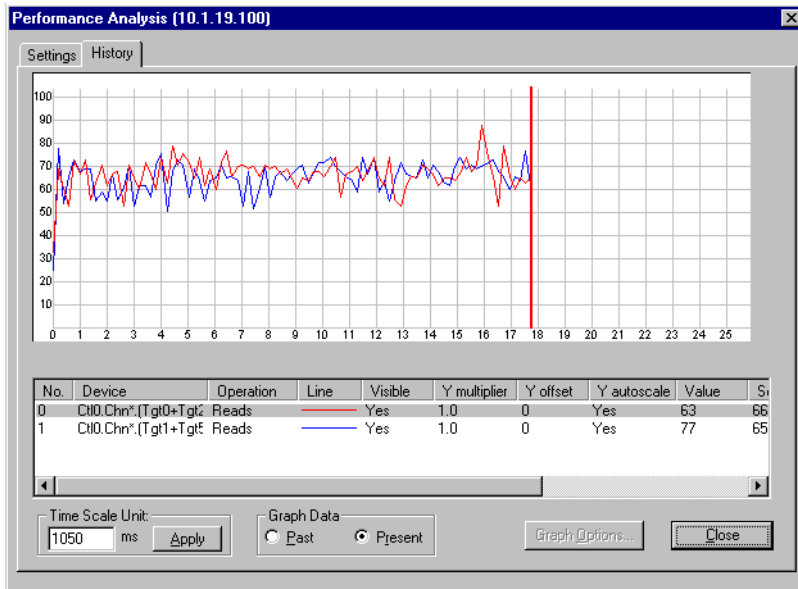
Figure 5-35. Performance Analysis: History Display

The History page displays data for the analysis strings specified in the display window in the form of lines generated on a grid with time units along the horizontal axis and percentage along the vertical axis.

To set the Time Scale Unit:

1. Enter a number of milliseconds in the text box.

2. Click Apply.

   Each horizontal grid mark's value (for example, from 0 to 1, 1 to 2, etc.) will equal the number of milliseconds you've specified.

The Graph Data box allows you to see currently generated data from the selected server (Present) or previously saved data (Past) from the buffer or from a data file selected within the Settings page.

To change Graph Options for a particular analysis string:

1. Select the analysis string of interest in the display window.

2. Click Graph Options.

    You can change whether this string's data will be visible, whether the data will autoscale along the Y-axis, the Y-axis multiplier, and Y offset.

    ☛ **Note**

    If you want to compare data from different analysis strings, the Y multiplier and Y offset settings should be the same.

To exit:

*   Click Close to exit from Statistics View, OR

*   Click the Settings tab.

Process Status Monitoring

Initialization Status

If logical drives are currently being initialized, open the Initialize Status box as shown in Figure 5-36 to monitor the progress of or cancel the process.
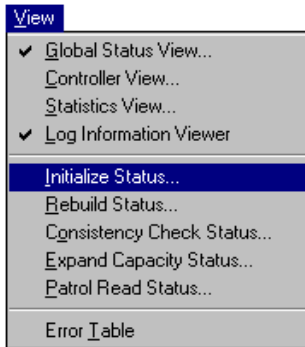
Figure 5-36. Select "Initialize Status"
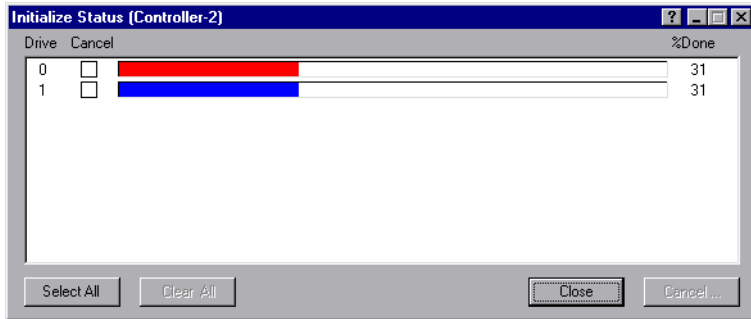
Figure 5-37. Initialization Status Box

The Initialize Status box (Figure 5-37) displays the progress of one or more full logical drive initializations.

To cancel ALL 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 5-38 to monitor the rebuild progress or cancel the process.
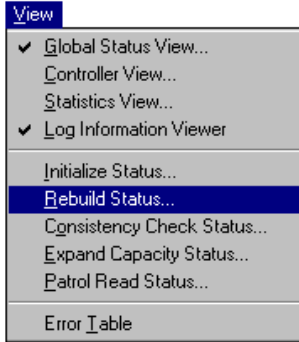
Figure 5-38. Select "Rebuild Status"

The Rebuild Status box (Figure 5-39) displays the progress of a physical drive rebuild. The command rebuilds *all* logical drives that occupy any portion of the targeted physical drive.
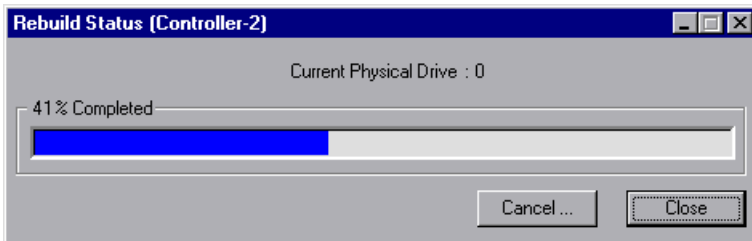
Figure 5-39. Rebuild Status Box

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 5-40 to monitor the consistency check progress or cancel the process.
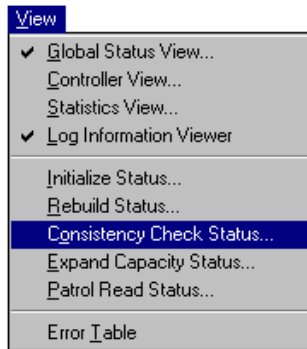
Figure 5-40. Select "Consistency Check Status"

The Consistency Check Status box (Figure 5-41) displays the progress of a logical drive consistency check.
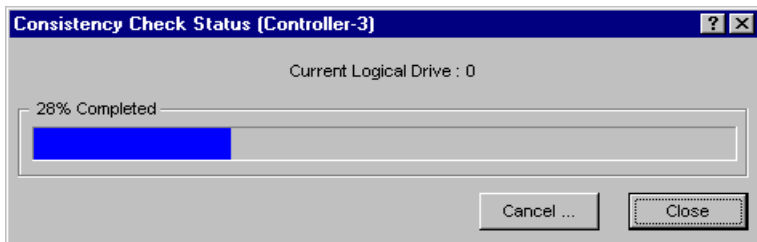
Figure 5-41. Consistency Check Status Box

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 "expand capacity") process is currently underway, open the Expand Capacity Status box as shown in Figure 5-42 to monitor the progress of this process.
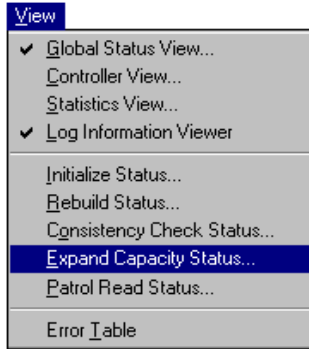
Figure 5-42. Select "Expand Capacity Status"

The Expand Capacity Status box (Figure 5-43) displays the progress of a disk array capacity expansion.
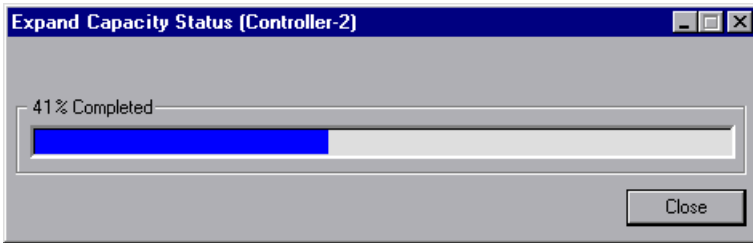
Figure 5-43. Expand Capacity Status Box

🛑 WARNING

You should not attempt to cancel an Expand Array (Expand Capacity) process; data loss will result.

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 5-44.
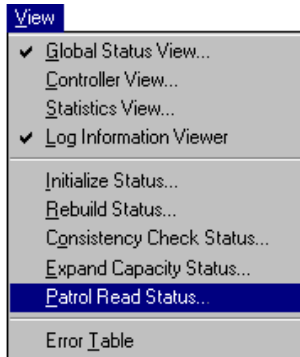
Figure 5-44. Select "Patrol Read Status"

The Patrol Read Status dialog box displays (Figure 5-45). 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 5-45. 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 5-46:
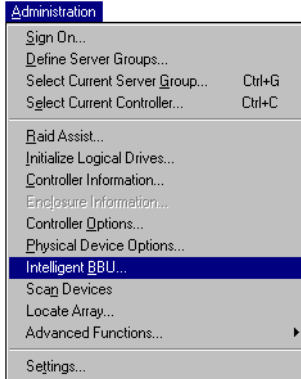
Figure 5-46. Select "Intelligent BBU"

Previous Mylex PCI RAID Controllers

Figure 5-47 shows the Intelligent Battery Backup Unit window for certain older Mylex PCI RAID Controllers.
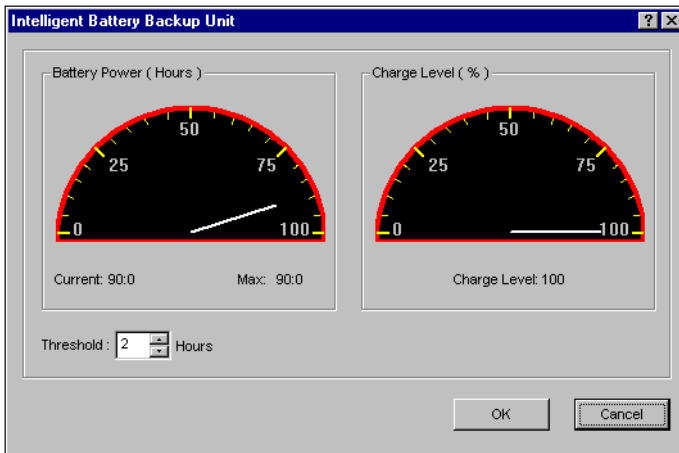
Figure 5-47. Intelligent BBU –Older Mylex PCI Controllers

Older Mylex PCI RAID Controller BBUs can only be monitored through GAM Client or WSAM. BBUs cannot be reconditioned or recharged. The only user interactive setting is low power threshold.

The following information is displayed in the dialog box:

- A gauge and text showing the current battery power remaining (in hours), as well as a maximum value.

- A gauge and text showing the current charge level (in percentage points).

- The low power threshold for the battery (in hours). When battery power sinks below this threshold, an alarm or message will alert the user to a low battery power state.

Click OK if you changed the threshold value. This will accept the change, or

Click Cancel to close the Intelligent Battery Backup Unit window without saving any changes.

New Mylex PCI RAID Controllers

Figure 5-48 shows the Intelligent BBU window for new Mylex PCI RAID Controllers[1].
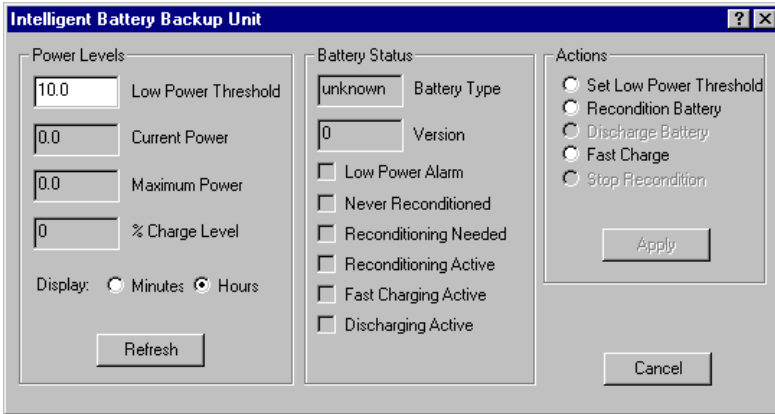
Figure 5-48. Intelligent BBU –New PCI Controllers

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, Mylex recommends that you condition the battery for maximum longevity. See "Conditioning the Battery" on page 5-49.

Power Levels

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

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1. AcceleRAID 160/170/170LP/352, eXtremeRAID 2000, eXtremeRAID 3000

- **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.

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 consistency check on a logical drive to examine (and optionally restore) consistency (parity). Encountered errors may 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.

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 6-1):
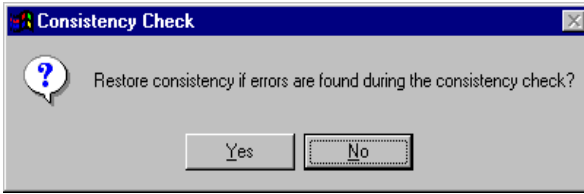
Figure 6-1. Restore Consistency If Errors Are Found?

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 6-2):
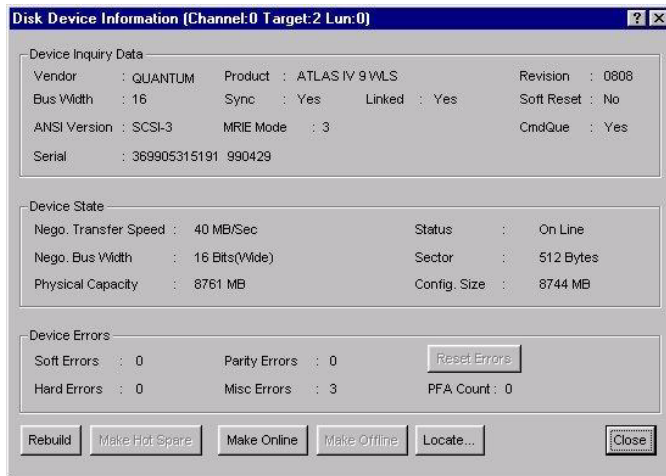
Figure 6-2. Rebuild Button Available for This Disk Device

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 or WSAM.

⚠ *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 6-3:
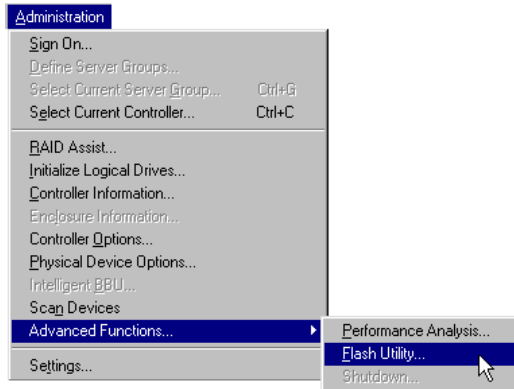
Figure 6-3. Select "Flash Utility"

The Flash Utility dialog box appears as shown in Figure 6-4:
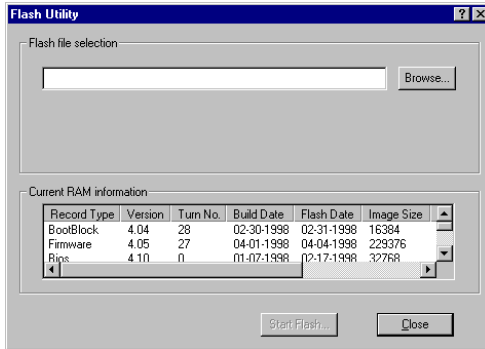
Figure 6-4. Flash Utility Dialog Box

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 do 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 6-5:
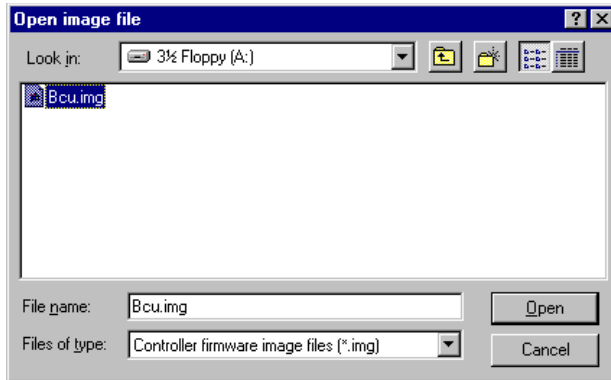
Figure 6-5. Open Image File Dialog Box

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 6-6).
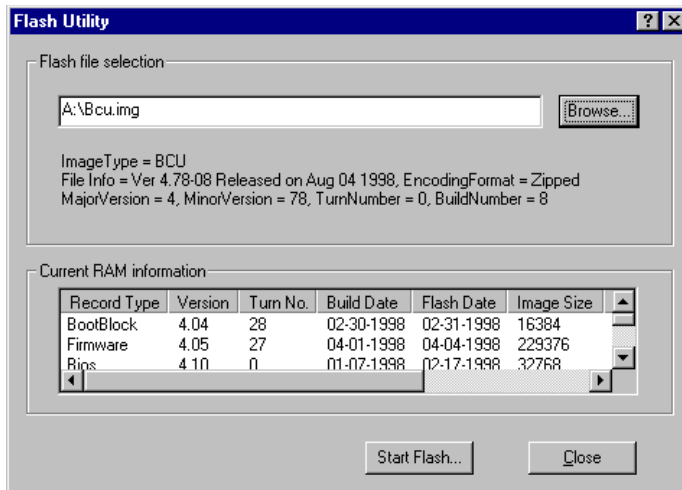
Figure 6-6. Additional Flash File Information

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.

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 hard disk has been placed online.	Rebuild completed. Device was configured. Manual on-line was done.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
2	4	A hard disk 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 device failed.	New physical device failed. New physical device may not be compatible with MDAC hardware/ firmware.	Replace the physical device.

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.	At least one more physical device failed in the array. Bad data table overflow.
12	1	A hard disk has failed.	A physical device failed. A user action caused the physical device to fail.	Replace the physical device.
13	4	A new hard disk has been found.	A physical device has been powered on. A new physical device has been added. Controller was powered on. Controller was added. System has rebooted.	None.
14	4	A hard disk has been removed	User removed an unconfigured physical device. An unconfigured physical device failed. A controller was removed. A controller powered off.	Replace the device if needed.
15	4	A previously configured 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 hard device.	Physical device has been removed. Physical device failed\nCommand time out value is not correct.	None.
20	0	SCSI command abort on hard 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 hard 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. Contact your service representative.
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\nthe SCSI format command.	Try to initialize again.\nContact your service representative.

Table A-2. GAM Events for PCI Controllers

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

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
41	1	A hard disk failed because of busy status or parity error.	The device returned busy status.\nThe SCSI transaction with the device met with parity error.	Replace hard disk and rebuild it.
42	1	A hard disk set to failed state by host.	Command from host set the hard disk to failed state.	Replace hard disk and rebuild it.
43	1	A hard disk failed because access to the device met with a selection time out.	Device disconnected or powered off. Bad device.	Replace hard disk and rebuild it. Check power and cabling.
44	1	A hard disk failed because of a sequence error in the SCSI bus phase handling.	Bad hard disk.	Replace hard disk and rebuild it.
45	1	A hard disk failed because device returned an unknown status.	Bad hard disk or incompatible device.	Replace hard disk or the device and rebuild it.
46	1	A hard disk failed because device is not ready.	Device not spinning, just turned bad. Power to the device failed.	Replace device and rebuild it. Check power and rebuild device.
47	1	A hard 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 hard disk failed because write operation of the 'Configuration On Disk' failed.	Bad hard disk. Device write protected.	Replace hard disk and rebuild it. Check the startup option parameters on the system.
49	1	A hard disk failed because write operation of 'Bad Data Table' failed.	Bad hard disk. Device write protected.	Replace hard disk and rebuild it. Check the startup option parameters on the system.
57	1	Physical drive missing on startup.	Physical drive missing.	Replace the physical drive 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 drive is switching from a channel to the other channel.	Physical drive removed or channel failed	None.
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.
128	4	Consistency check is started.	User started a consistency check. Raidbld started consistency check.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
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 device failure.	A physical device 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.
136	4	Logical drive has been placed online.	Rebuild completed. User set the physical device online. New configuration was added.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
137	4	An automatic rebuild has started on logical drive.	A physical device failed and a spare device was available. A spare physical device 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.
143	2	Rebuild stopped because logical drive failed.	At least one more physical device 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.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
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.
150	4	Expand capacity started.	User started the Online RAID Expansion operation.	None.
151	4	Expand Capacity Completed.	Online RAID Expansion completed.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
152	2	Expand Capacity stopped with error.	Multiple physical devices 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 device 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.
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.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
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 device failed and a spare device was available.	None.
256	1	Fan Failure.	Cable connection broken. Bad Fan.	Replace fan
257	4	Fan has been restored.	Faulty fan has been replaced.Cable is connected properly.	None.
258	2	Fan failure.	Cable connection is broken. Bad fan.	Replace fan.

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Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
259	4	Storage cabinet fan is not present.	Enclosure Management Connection is broken. Management hardware is bad. Fan is not present.	Follow enclosure management vendor's diagnostics and repair procedures.
272	1	Power supply failure.	Cable connection is broken. Bad power supply.	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. Bad power supply.	Replace power supply.
275	4	Storage cabinet power supply is not present.	Management connection is broken. Management hardware is bad. Power supply is not present.	Follow enclosure management vendor's diagnostics and repair procedures.
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.	Temperature is above 50 degrees Celsius.	Replace fan. Turn off the system. Adjust the room temperature. pager=0

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
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. Bad fan.	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.	Follow enclosure management vendor's diagnostics and repair procedures.
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.
306	4	Storage Works enclosure reported normal state.	Problem has been rectified.	None.
320	1	Fan failure.	Cable connection broken. Bad Fan.	Replace fan.
321	4	Fan has been restored.	Faulty fan has been replaced. Cable is connected properly.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
322	4	Fan is not present.	Enclosure Management Connection is broken. Management hardware is bad. Fan is not present.	Follow enclosure management vendor's diagnostics and repair procedures.
323	1	Power supply failure.	Cable connection is broken. Bad power supply.	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.	Follow enclosure management vendor's diagnostics and repair procedures.
326	2	Temperature is over safe limit. Failure imminent.	Room temperature is too high. Bad fan. Bad sensor.	Turn off the system and allow it to cool down. Adjust the room temperature.
327	3	Temperature is above working limit.	Room temperature is high. Bad fan	Replace fan. Turn off the system. Adjust the room temperature.
328	4	Normal temperature has been restored.	Faulty fan has been replaced. Room temperature was reduced.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
329	4	Temperature sensor is not present.	Enclosure management connection is broken. Management hardware is bad. Sensor is not present.	Follow enclosure management vendor's diagnostics and repair procedures.
330	3	Enclosure access critical.	Enclosure management connection is broken. Management hardware is bad.	Follow enclosure management vendor's diagnostics and repair procedures.
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 is bad.	Follow enclosure management vendor's diagnostics and repair procedures.
384	4	Array management server software started successfully.	c	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.
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.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
388	0	Controller is dead. System is disconnecting from this controller.	" "	Contact your service representative.
389	3	Controller has been reset.	Controller failed. Controller was removed from the system. Controller has been powered off.	None.
390	4	Controller is found.	Driver has reset the controller to recover from an error. Driver has reset the controller to activate new firmware.	None.
391	0	Controller is gone. System is disconnecting from this controller.	New controller has been installed. Controller has been powered on. System has rebooted.	None.
392	4	BBU Present	Controller is dead. Controller has been removed. Controller has been powered off.	None.
393	3	BBU Power Low.	A BBU unit was found on the controller.	If this message occurs without power failure, replace the BBU.
394	4	BBU Power OK.	BBU does not have enough power to enable the write data cache.	None.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
395	0	Controller is gone. System is disconnecting from this controller.	BBU has enough power to enable the write data cache.	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.	" "	Installation aborted.
404	1	Controller firmware mismatch	Replacement controller with downlevel firmware installed.	Reload controller firmware.
405	3	BBU Removed.	BBU physically removed.	Reinstall BBU.
406	1	WARM BOOT failed.	Memory error detected during WARM boot scan. Possible data loss	Restore data from a back up.
414	3	Soft ECC error Corrected.	Faulty Memory Module.	Replace Memory Module.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
415	3	Hard 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 could have failed.	Run consistency check and restore consistency.
428	0	Mirror Race on critical drive.	Logical device is critical.	Replace dead drive and rebuild.
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 device size information is defined.	Remove unused device information for 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.

Table A-2. GAM Events for PCI Controllers

ID	Severity	Description	Details	Actions
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
897	2	Internal Controller has encountered a Firmware breakpoint.	Internal Controller has encountered a Firmware breakpoint.	Controller has to be powered off and on
912	2	Internal Controller has encountered i960 processor specific error.	Internal Controller has encountered i960 processor specific error.	Controller has to be powered off and on.
928	2	Internal Controller has encountered Strong-ARM processor specific error.	Internal Controller has encountered Strong-ARM processor specific error.	Controller has to be powered off and on.

Glossary

AcceleRAID™

The AcceleRAID family features high performance, cost effective Ultra SCSI/Ultra2 SCSI LVD and Ultra 160 SCSI to PCI RAID controllers and adapters for high-end desktops, workstations, and entry level and mid range servers. AcceleRAID controllers support PCI-based motherboards with embedded SCSI chips and systems that have a PCI expansion slot designated for add-in RAID controllers. The AcceleRAID family consists of the 150, 200, 250, 352, 160, 170, and 170LP controllers. The 150, 200, and 250 products can utilize the on-board SCSI chips of servers and use SCSI interrupt steering logic (*"SISL"*). In addition, the 150 and 250 products can work in any PC or server with a PCI slot whether or not they have SCSI interrupt steering logic. The 150 and 250 have one Ultra2 SCSI LVD channel.

Active/Active

A synonym for *"Dual Active"* controllers. Under normal operating conditions, both controllers in a dual active controller configuration are actively processing I/O.

Active/Passive

A synonym for *"Hot Standby"* .

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).

Application Program

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

Application Server

A centralized computer that holds and distributes application programs to users.

ircuit, a chip created for a specific application.

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.

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."* .

BBU

Battery Backup Unit, provides a battery backup for data currently stored in the on-board cache memory during intermittent power loss to the controller. In the event of a power failure, the BBU can hold data in the cache for a certain amount of time. Once power is restored the data can be saved to a disk.

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.

Burst Data Rate

The speed at which a specific amount of data is sent or received in intermittent operations (compare to *"Sustained Data Transfer Rate"*).

Bus

A set of conductors that connect the functional units in a computer and are the channels through which data is transferred. There are several types of bus channels, including serial, parallel, PCI, ISA, EISA, and MCA. See also *"I/O Bus."*

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^{TM}, 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.

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."*

CD-ROM

Compact Disk-Read Only Memory, a removable read-only storage device, similar to an audio compact laser disk, holding up to 640MB of data.

Channel

Any path used for the transfer of data and control of information between storage devices and a storage controller or I/O adapter. Also refers to one SCSI bus on a disk array controller. Each disk array controller provides at least one channel.

Cold Swap

The physical exchange of a replacement unit in a storage system for a defective one. The exchange requires human intervention and power must be removed from the storage system in order to perform the exchange.

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^{TM} (GAM) or RAID EzAssist^{TM} give the user the ability to have a discrepancy reported and corrected. See also *"Parity Check."*

Controller

An adapter card, RAID controller, or other module that interprets and controls signals between a host and a peripheral device.

CPU

Central Processing Unit, the circuitry that performs the basic instructions that drive the computer.

Critical

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.

Cylinder

The tracks of a disk storage device that can be accessed without repositioning the access mechanism.

DACCF

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

DAC960 Series

Disk Array Controller 960 Series, a family of RAID controllers from Mylex Corporation. The DAC960 series includes both internal PCI-based RAID controllers and external RAID controllers. The DAC960 series controllers use Intel's® i960 microprocessor.

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.

DIMM

Dual In-line Memory Module, a circuit board that has memory chips. Instead of installing two SIMMs for the 64-bit memory path on a Pentium processor, one DIMM can be installed.

Disk

A non-volatile, randomly addressable, re-writable data storage device, including rotating magnetic and optical disks as well as solid-state disks or other electronic storage elements.

Disk Array

A collection of disks from one or more commonly accessible disk systems. Disk arrays, also known as RAID, allow disk drives to be used together to improve fault tolerance, performance, or both. Disk arrays are commonly

used on servers and are becoming more popular on desktops and workstations. See also *"Array."*

Disk Drive

A device for the electronic digital storage of information.

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, and writes the data out to a new location on the disk. Since the problem has been resolved, no error is reported to the system.

Disk System

A storage system capable of supporting only disks.

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.

Dual Active

A pair of components, such as storage controllers in a failure tolerant storage system, that share a task or set of tasks when both are functioning normally. When one component of the pair fails, the other takes the entire load. Dual active controllers (also called *"Active/Active"* controllers) are connected to the same set of devices and provide a combination of higher I/O performance and greater failure tolerance than a single controller.

ECC

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

EDO

Extended Data Output, a type of random access memory (*"RAM"*) chip designed to improve the time to read from memory on faster

microprocessors such as the Intel® Pentium.

Embedded Storage Controller

An intelligent storage controller that mounts in a host computer's housing and attaches directly to a host's memory bus with no intervening I/O adapter or I/O bus.

eXtremeRAID

A family of Mylex RAID controllers which offer uncompromising fault tolerance, data availability, superior configuration, and management flexibility. The eXtremeRAID family incorporates the latest performance

technology by using the fastest processor on a PCI based RAID solution, a 233 MHz RISC processor, up to four 160MB/sec *"Warm Swap"* channels, and a 64-bit PCI interface to provide eXtreme performance for servers. The eXtremeRAID controllers use driver technology with which Mylex has won tpm-C benchmarks worldwide. With this technology, the eXtremeRAID 1100, 2000, and 3000 provide the highest performance and most flexible RAID solution available today.

Failback

Restoring a failed system component's share of a load to a replacement component.

Failover

A mode of operation for failure tolerant systems in which a component has failed and a redundant component has assumed its functions.

Failure

A detectable physical change in hardware, requiring replacement of the component.

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.

FlashPoint

A family of Mylex SCSI host bus adapters.

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.

Hard Disk

A magnetically coated disk substrate that spins inside a disk drive and is used as the storage medium for digital data.

Hard Disk Drive (HDD)

The main data storage unit of a computer.

HDM

Hardware Driver Module, a driver set required for SCSI adapters for use in an I_2O environment.

Host

Any computer system to which disks are attached and accessible for data storage and I/O.

Host Bus Adapter (HBA)

An I/O adapter that connects a host I/O bus to the host's storage memory system.

Host I/O Bus

An I/O bus used to connect a host computer to storage systems or storage devices.

Hot Plug

The process of adding or removing a device from a bus while transactions involving other devices are occurring over the bus. See also *"PCI Hot Plug."*

Hot Replacement of Disks

The design of all Mylex controllers allows for the replacement of failed hard disk drives without interruption of system service. In the event of a SCSI drive failure on a properly configured system (where the data redundancy features of the controller are used), the system generates a message to alert the system operator.

When a replacement drive becomes available, the system operator can remove the failed disk drive, install a new disk drive, and instruct the controller to "rebuild" the data on the new drive, all without interrupting system operations. Once the rebuild is complete, the controller will be brought back into a fault tolerant state. See also *"Hot Swap."*

Hot Spare

A physical disk drive not part of a system drive that the controller can use to automatically rebuild a critical system drive. The hot spare drive must have at least as much capacity as the largest disk drive in the array or the rebuild may not start. See also *"Hot Standby"* and *"Standby Replacement of Disks."*

Hot Standby

A redundant component in a fault tolerant storage system that has power applied and is ready to operate, but which does not perform its task as long as the primary component for which it is standing by is functioning properly. See also *"Hot Replacement of Disks"* and *"Hot Spare."*

Hot Swap

The exchange of a replacement unit in a storage system for a defective unit. The exchange requires human intervention, but the system can continue to perform its normal functions.

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 (also known as IDE) and SCSI.

Internal RAID Controller

A controller circuit board that resides inside a computer or server. An internal RAID controller resides on a bus, such as the PCI bus. Examples of internal RAID controllers include the Mylex AcceleRAID and eXtremeRAID families.

I/O

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

I/O Bus

Any path used for the transfer of data and control information between I/O adapters and storage controllers or storage devices. See also *"Bus."*

ISA

Industry Standard Architecture, a standard bus (computer interconnection) architecture associated with the IBM AT motherboard. It allows 16 bits at a time to flow between the motherboard circuitry and an expansion slot card and its associated device(s).

JBOD

Just A Bunch of Disks (Drives), a number of disk drives, usually in an enclosure. JBOD implies that the disks do not use RAID technology and function independently. All Mylex RAID controllers support JBOD mode.

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.

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 make 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)* 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 devices. 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 devices in order to take advantage of the LVD signaling. Mylex AcceleRAID, eXtremeRAID, and DAC FL controllers are LVD controllers.

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.

Mirrored Hard Drive

Two hard drives the computer sees as one unit. Information is stored simultaneously on each drive. If one hard disk drive fails, the other contains all of the cached data and the system can continue operating.

Mirroring

Refers to 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.

MTBF

Mean Time Between Failures, the average time from start of use to failure in a large population of identical systems, computers, or devices.

MTDL

Mean Time until Data Loss, the average time from startup until a component failure causes a permanent loss of user data in a large population of disk arrays.

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.

Online

A *"Logical Drive"* is in an "online" state if all of its participating SCSI drives have power and are operational.

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.

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

When 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.

PCI

Peripheral Component Interconnect, a standardized architecture that provides a high-speed data path between peripherals and the CPU. PCI is a

high-performance, backplane interface, expansion slot architecture found on PCs, Macintoshes, and UNIX workstations. PCI cards are portable across hardware platforms with the help of various software drivers.

PCI Hot Plug

A feature that allows for the printed circuit board (*PCB*) to be replaced without powering down the entire system—an essential feature in newer PCI-based PCs. Mylex DAC960PG, DAC960PJ, AcceleRAID, and eXtremeRAID products are all PCI Hot Plug compatible.

Physical Device

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

Physical Disk Drive

A single hard disk drive. Each physical disk drive is assigned a unique identification address.

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. DAC960 controllers implement this technology to connect up to 15 SCSI devices per channel. The different forms of RAID implementation are known as "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 Adapters

See *"RAID Controller."*

RAID Controller

Low cost RAID controllers that use SCSI channels on the motherboard.

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.

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.

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).

RISC

Reduced Instruction Set Computing, architecture for an application-specific processor.

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, the data in ROM is not lost when the computer power is turned off; a small long-life battery in your computer sustains the ROM.

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.

SCSI

Small Computer System Interface, a technological standard that defines connections between computers and peripheral devices.

SCSI Adapters

Storage controllers for managing SCSI devices.

SCSI Drive

A disk drive equipped with a SCSI interface (sometimes referred to as a SCSI Disk). Each disk drive will be assigned a SCSI address (or SCSI ID), which is a number from 0 to 7 (0 to 15 under wide or Ultra SCSI). The SCSI address uniquely identifies the drive on the SCSI bus or channel.

SCSI Drive States

Refers to a SCSI drive's current operational status. At any given time, a SCSI drive can be in one of five states: *Ready*, *Online*, *Standby*, *Dead*, or *Rebuild*.

The controller stores the state of the attached SCSI drives in its non-volatile memory. This information is retained even after power-off. Hence, if a SCSI disk is labeled "dead" in one session, it will stay in the "dead" state until a change is made either by using a system level utility or after a rebuild. Each state is described below:

Ready: A SCSI disk drive is in a "ready" state if it is powered on and is available to be configured during the current session but remains unconfigured.

Online: A SCSI disk drive is in an "online" state if is powered on, has been defined as a member of a drive group, and is operating properly.

Standby: A SCSI disk drive is in a "standby" state if it is powered on, is able to operate properly, and was NOT defined as part of any drive group.

Dead: A SCSI disk drive is in a "dead" state if it is not present, if it is present but not powered on, or if it failed to operate properly and was "killed" by the controller. When the controller detects a failure on a disk, it "kills" that disk by changing its state to "dead." A "dead" SCSI drive can also be present and powered on, but a SCSI drive in a "dead" state does not participate in any I/O activity; no commands are issued to dead drives.

Rebuild: A SCSI disk drive is in a "rebuild" state while it is in the process of being rebuilt. During this process, data is regenerated and written to the disk drive. This state is also referred to as "Write-Only" (WRO).

SCSI Interrupt Steering Logic (SISL)

Architecture that allows a RAID controller, such as AcceleRAID 150, 200 or 250, to implement RAID on a system board-embedded SCSI bus or a set of SCSI busses.

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 in is also frequently referred to as a server.

SES

SCSI Enclosure Services, a standard for SCSI access to services within an enclosure containing one or more SCSI devices. For disk drives, power supplies, cooling elements, and temperature sensors, the actions performed are the same as for SAF-TE monitoring. If a UPS is connected to any SES-monitored enclosures, and an AC failure or two minute warning is reported, conservative cache is enabled and all system drives are switched to write-through cache. Primarily used in fibre enclosures.

Session

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

SISL

See *"SCSI Interrupt Steering Logic (SISL)."*

SMART

Self-Monitoring Analysis and Reporting Technology, the industry standard reliability prediction indicator for both the ATA/IDE 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.

Standard Disk Drive

This term refers to a hard disk drive with SCSI, IDE, or other interface, attached to the host system through a standard disk controller.

Standby Replacement of Disks

One of the most important features the RAID controller provides to achieve automatic, non-stop service with a high degree of fault-tolerance. The controller automatically carries out the rebuild operation when a SCSI disk drive fails and both of the following conditions are true:

A "standby" SCSI disk drive of identical size is found attached to the same controller;

All of the system drives that are dependent on the failed disk are redundant system drives, e.g., RAID 1, RAID 3, RAID 5, and RAID 0+1.

☛ **Note**

> The standby rebuild will only happen on the SAME DAC960 controller, never across DAC960 controllers.

During the automatic rebuild process, system activity continues as normal. System performance may degrade slightly during the rebuild process.

To use the standby rebuild feature, you should always maintain a standby SCSI disk in your system. When a disk fails, the standby disk will automatically replace the failed drive and the data will be rebuilt. The system administrator can disconnect and remove the bad disk and replace it with a new disk. The administrator can then make this new disk a standby.

The standby replacement table has a limit of 8 automatic replacements in any session (from power-on/reset to the next power-off/reset). When the limit of

8 is reached and a disk failure occurs, the standby replacement will occur but will not be recorded in the replacement table.

To clear the "standby replacement" table, reboot the system from a DOS bootable floppy, run the configuration utility and select the option 'view/ update configuration' from the main menu. A red box labeled 'Drive Remap List' will be displayed. Selecting the box will allow you to continue. You should save the configuration without making any changes, and exit the configuration utility. This will clear the replacement table. You may now proceed to boot your system and continue normal operations.

In normal use, the replacement table limit of 8 should not cause any problems. Assuming that a disk fails about once a year (drives we support generally come with a 5-year warranty), the system would run continuously for a minimum of 8 years before the table would need to be cleared. See also *"Hot Spare."*

Storage Device

A collective term for disks, tape transports, and other mechanisms capable of non-volatile data storage.

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 and 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.

Sub-System Storage

A collection of disks providing data storage space to a system user.

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).

System Disk

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

System Drives

See *"Logical Drive."*

Target ID

The SCSI ID of a device attached to a controller. Each SCSI channel can have up to 15 attached SCSI devices (target ID from 0 to 6 and 8 to 15).

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.

Terminator

A part used to end a SCSI bus.

Termination

A method of matching transmission impedance of a bus to eliminate signal reflections from the physical ends of the bus.

Thin File Server

A small server maximized for the sole purpose of serving files, as opposed to computing.

Throughput

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

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.

Warm Swap

The exchange of a defective disk with a working disk while power is maintained to the system, but I/O operations have ceased.

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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