Areas Covered

Before Reading This Manual
This section explains the notes for your safety and conventions used in this manual.

Chapter 1 Overview
This chapter provides an overview and precautions for the disk array and its features configured with this array controller.

Chapter 2 Using the BIOS Utility
This chapter explains the BIOS Utility setup procedure. BIOS Utility is a basic utility to set up and manage the array controller.

Chapter 3 Updating the Device Drivers
This chapter explains how to update the device drivers and how to apply a hotfix.

Chapter 4 Overview and Installation of Global Array Manager (GAM)
This chapter contains an overview of and product requirements for Global Array Manager (GAM), and describes how to install the program.

Chapter 5 Using GAM
This chapter explains how to manage the disk array with GAM.

Chapter 6 Replacing a Hard Disk Drive
This chapter explains maintenance related issues, such as hard disk drive replacement.

Appendix
This section explains the GAM error codes.
Before Reading This Manual

Remarks

■ Symbols
Symbols used in this manual have the following meanings:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>!important</td>
<td>These sections explain prohibited actions and points to note when using this software. Make sure to read these sections.</td>
</tr>
<tr>
<td>point</td>
<td>These sections explain information needed to operate the hardware and software properly. Make sure to read these sections.</td>
</tr>
<tr>
<td>➔</td>
<td>This mark indicates reference pages or manuals.</td>
</tr>
</tbody>
</table>

■ Key Descriptions / Operations
Keys are represented throughout this manual in the following manner:
E.g.: [Ctrl] key, [Enter] key, [→] key, etc.
The following indicate the pressing of several keys at once:
E.g.: [Ctrl] + [F3] key, [Shift] + [↑] key, etc.

■ Entering Commands (Keys)
Command entries are written in the following way:

```
diskcopy a: a: ↑ ↑
```
• In the spaces indicated with the “↑” mark, press the [Space] key once.
• In the example above, the command entry is written in lower case, but upper case is also allowed.
• CD-ROM drive names are shown as [CD-ROM drive]. Enter your drive name according to your environment.
  [CD-ROM drive]:\setup.exe

■ Screen Shots and Figures
Screen shots and figures are used as visual aids throughout this manual. Windows, screens, and file names may vary depending on the OS, software, or configuration of the server used. Figures in this manual may not show cables that are actually connected for convenience of explanation.

■ Consecutive Operations
Consecutive operations are described by connecting them with arrows (➔).
Example: For the operation to click the [Start] button, point to [Programs], and click [Accessories]

↓
Click the [Start] button ➔ [Programs] ➔ [Accessories].
■ Abbreviations

The following expressions and abbreviations are used throughout this manual.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Expressions and abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated Mirroring SAS</td>
<td>the array controller, this array controller</td>
</tr>
<tr>
<td>Microsoft® Windows Server™ 2003, Enterprise Edition</td>
<td></td>
</tr>
<tr>
<td>Microsoft® Windows Server™ 2003 R2, Standard Edition</td>
<td></td>
</tr>
<tr>
<td>Microsoft® Windows Server™ 2003 R2, Enterprise Edition</td>
<td></td>
</tr>
<tr>
<td>Microsoft® Windows Server™ 2003, Standard x64 Edition</td>
<td>Windows Server 2003 x64 [*1]</td>
</tr>
<tr>
<td>Microsoft® Windows Server™ 2003, Enterprise x64 Edition</td>
<td></td>
</tr>
<tr>
<td>Microsoft® Windows Server™ 2003 R2, Standard x64 Edition</td>
<td></td>
</tr>
<tr>
<td>Microsoft® Windows Server™ 2003 R2, Enterprise x64 Edition</td>
<td></td>
</tr>
<tr>
<td>Microsoft® Windows® 2000 Server</td>
<td>Windows 2000 Server</td>
</tr>
<tr>
<td>Microsoft® Windows® 2000 Advanced Server</td>
<td></td>
</tr>
<tr>
<td>Microsoft® Windows® XP Professional</td>
<td>Windows XP</td>
</tr>
<tr>
<td>Microsoft® Windows® 2000 Professional</td>
<td>Windows 2000 Professional</td>
</tr>
<tr>
<td>Microsoft® Windows NT® Workstation Operating System 4.0</td>
<td>Windows NT Workstation 4.0</td>
</tr>
<tr>
<td>Red Hat Enterprise Linux AS (v.4 for x86)</td>
<td>Red Hat Linux</td>
</tr>
<tr>
<td>Red Hat Enterprise Linux AS (v.4 for EM64T)</td>
<td>RHEL-AS4(EM64T)</td>
</tr>
<tr>
<td>Red Hat Enterprise Linux AS (v.3 for x86)</td>
<td>RHEL-AS3(x86)</td>
</tr>
<tr>
<td>Red Hat Enterprise Linux ES (v.3 for x86)</td>
<td>RHEL-ES3(x86)</td>
</tr>
<tr>
<td>Red Hat Enterprise Linux ES (v.4 for x86)</td>
<td>RHEL-ES4(x86)</td>
</tr>
<tr>
<td>Red Hat Enterprise Linux ES (v.4 for EM64T)</td>
<td>RHEL-ES4(EM64T)</td>
</tr>
<tr>
<td>SUSE™ Linux® Enterprise Server 9</td>
<td>SLES9 or SUSE Linux</td>
</tr>
</tbody>
</table>

*1: Unless otherwise noted, Windows Server 2003 can also mean Windows Server 2003 x64.

Reference Information

■ Latest Information about PRIMERGY

For the latest information on PRIMERGY, update modules, drivers and the software, refer to the Fujitsu PRIMERGY website (http://primergy.fujitsu.com).
Trademarks

Microsoft, Windows, and Windows Server are trademarks or registered trademarks of Microsoft Corporation in the USA and other countries.
Linux is a trademark or registered trademark of Linus Torvalds in the USA and other countries.
Red Hat and all Red Hat-based trademarks and logos are trademarks or registered trademarks of Red Hat, Inc. in the USA and other countries.
SUSE is a trademark of Novell, Inc. in the United States and other countries.
LSI Logic, Global Array Manager (GAM), and Integrated Mirroring are trademarks or registered trademarks of LSI Logic Corp.
All other hardware and software names used are trademarks or registered trademarks of their respective manufacturers.
Other product names are copyrights of their respective manufacturers.

All Rights Reserved, Copyright© FUJITSU LIMITED 2006

Screen shot(s) reprinted with permission from Microsoft Corporation.
## Contents

### Chapter 1 Overview

1. **Overview of the Disk Array Configuration** ................................................. 10
   1.1.1 Array Controller Specifications ....................................................... 10
   1.1.2 What is a Disk Array? ................................................................. 10
   1.1.3 RAID Levels ............................................................................. 11
   1.1.4 Logical Drives ........................................................................ 12
   1.1.5 Checking the Hard Disk Status .................................................... 13

2. **Disk Array Configuration Features** ............................................................ 14
   2.1.1 Write Policy ........................................................................... 14
   2.1.2 Rebuild .................................................................................. 14
   2.1.3 Media Verification .................................................................... 15
   2.1.4 The Hard Disk Failure Prediction Function (PFA / S.M.A.R.T.) ....... 15

3. **Notes before Configuring a Disk Array** ...................................................... 16
   3.1.1 Notes on Hard Disk Drives to Be Used ......................................... 16
   3.1.2 Setup Flow of This Product ......................................................... 17

4. **Notes on Operation** .................................................................................. 18
   4.1.1 Notes for Using Array Controllers ............................................. 18
   4.1.2 Error Messages from Global Array Manager ............................ 18

### Chapter 2 Using the BIOS Utility

5. **Starting and Exiting the BIOS Utility** ....................................................... 22
   2.1.1 Starting the BIOS Utility ........................................................... 22
   2.1.2 Exiting the BIOS Utility ............................................................ 24

6. **The BIOS Utility Screen Layout** ................................................................. 25

7. **Viewing Information** ................................................................................ 26
   2.3.1 Viewing Information on Array Controller ................................. 26
   2.3.2 Viewing Information on the Logical Drive and the Hard Disk Drives .. 29

8. **Creating and Deleting a Logical Drive** ....................................................... 33
   2.4.1 Creating and Initializing a Logical Drive ..................................... 33
   2.4.2 Deleting the Logical Drive ........................................................ 40

9. **Low Level Formatting of Hard Disk Drives** ............................................... 43

### Chapter 3 Updating the Device Drivers

10. **Updating the Device Drivers** ................................................................. 48
    3.1.1 Creating Driver Disks ............................................................... 48
    3.1.2 Updating the Drivers (Windows Server 2003) .......................... 49
    3.1.3 Updating the Drivers (Windows 2000 Server) .......................... 50

11. **Applying the Hotfix** .................................................................................. 51
Chapter 4 Overview and Installation of Global Array Manager (GAM)

4.1 Overview of and Product Requirements for GAM .......... 54
    4.1.1 GAM Overview .................................................. 54
    4.1.2 Requirements for GAM ........................................ 55
    4.1.3 Access Privileges to GAM .................................... 56

4.2 Using GAM in a Linux Environment ......................... 57

4.3 Using GAM in a Multiple Server Environment .......... 58
    4.3.1 Interaction between ServerView and AlarmService ....... 59

4.4 Installing GAM (Windows) ................................. 60
    4.4.1 How to Install GAM ........................................... 60
    4.4.2 Local Logon Settings on a Domain Controller .......... 63
    4.4.3 Uninstalling GAM .............................................. 64

Chapter 5 Using GAM

5.1 Starting and Exiting GAM ................................. 68
    5.1.1 Starting GAM .................................................. 68
    5.1.2 Signing On .................................................... 68
    5.1.3 Exiting GAM .................................................. 69

5.2 GAM Window Layout ............................................. 70
    5.2.1 Startup Window Layout and Functions .................... 70
    5.2.2 Menu Layout and Functions ................................. 72
    5.2.3 Toolbar Icons ................................................ 74
    5.2.4 Starting Controller View and the Window Layout ....... 75

5.3 Server Group and Server Settings ............................ 77

5.4 Viewing Information ........................................... 78
    5.4.1 Events ......................................................... 78
    5.4.2 Viewing Array Controller Information .................. 80
    5.4.3 Viewing Hard Disk Drive Information ................. 82
    5.4.4 Viewing Logical Drive Information ..................... 84

5.5 Rebuild ........................................................... 86

Chapter 6 Replacing a Hard Disk Drive

6.1 Checking the Hard Disk Drive to Replace ............... 90
6.2 Replacing a Failed Hard Disk Drive ..................... 92
6.3 Preventive Replacement of a Hard Disk Drive ........... 94
    6.3.1 Checking Availability of Redundancy .................... 94
    6.3.2 When Operating in a Redundant Configuration (RAID 1) 96
    6.3.3 When Operating in a Non-Redundant Configuration .... 99
This chapter provides an overview and precautions for the disk array and its features configured with this array controller.
Chapter 1  Overview

1.1 Overview of the Disk Array Configuration

This section contains an overview (RAID levels, disk groups, and logical drives) and a functional description of the disk array.

1.1.1 Array Controller Specifications

The specifications of the array controller described in this manual are as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>SAS (Serial Attached SCSI)</td>
</tr>
<tr>
<td>Number of ports</td>
<td>2</td>
</tr>
<tr>
<td>Cache memory</td>
<td>No</td>
</tr>
<tr>
<td>Management Tools</td>
<td>• BIOS Utility</td>
</tr>
<tr>
<td></td>
<td>The BIOS utility in this array controller.</td>
</tr>
<tr>
<td></td>
<td>• Global Array Manager (GAM)</td>
</tr>
<tr>
<td></td>
<td>Software running on the OS to monitor and manage this array controller.</td>
</tr>
</tbody>
</table>

**IMPORTANT**

- Be sure to install the Global Array Manager (GAM) and ServerView and apply the latest service pack before using this array controller.
- When using this array controller in a non-redundant configuration, Global Array Manager does not need to be installed.

**POINT**

**Supported OSs**

- Refer to the information about the supported OSs for the server on which this array controller is installed.
- TCP/IP is required for any OS.

1.1.2 What is a Disk Array?

A disk array or RAID (Redundant Array of Independent Disks) is a system that uses an array controller and multiple hard disk drives to achieve better performance and higher reliability than when using a single hard disk drive.

An array controller controls the access to each hard disk drive. The control method depends on the RAID level.

By using a redundant RAID configuration, system operation can be continued without data loss in the event that one of the single hard disk drives should fail.
1.1.3 RAID Levels

There are several types of RAID levels, with different characteristics. This array controller only supports RAID 1.

**RAID 1 - Mirroring**

Mirroring is a function in which identical data is written in two hard disk drives in duplicate. When operating in RAID 1 disk array configuration, the system always writes the same data in two hard disk drives, using the redundancy feature. Operation continues even in a situation where one of the hard disk drives fails (Critical).

RAID 1 always consists of two hard disk drives and the actual available capacity is equal to the capacity of one hard disk drive.

<table>
<thead>
<tr>
<th>Number of hard disk drives</th>
<th>Available total capacity</th>
<th>Redundancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Equal to the capacity of one hard disk drive</td>
<td>Yes</td>
</tr>
</tbody>
</table>

- To prepare for unexpected problems, back up the data as frequently as possible.

- With RAID 1, operation continues even if one of the hard disk drives should fail (Critical). However, data may be lost if both hard disk drives fail. If the status of a logical drive becomes "Critical", replace the failed hard disk drive and perform a rebuild to return to "Online" status as soon as possible.
  - See "Chapter 6 Replacing a Hard Disk Drive" (→pg.89) for information on how to replace a hard disk drive.
  - See "5.5 Rebuild" (→pg.86) for information on how to perform a Rebuild.
1.1.4 Logical Drives

A logical drive is a logical hard disk space that consists of two hard disk drives. It is recognized as a single hard disk drive by the OS.

As shown in the following figure, with RAID 1, two hard disk drives compose one logical drive, but the OS recognizes it as if a single hard disk drive was connected.

![Logical drive 0](image)

- The maximum capacity of one logical drive is 2TB.
- To compose a logical drive, hard disk drives of the same model (with the same capacity and speed) must be used.

**Logical Drive Initialization**

Right after the creation of a logical drive using this array controller, the logical drive does not have redundancy and data is only stored on the primary hard disk drive. To enable a logical drive to operate with redundancy, it needs to be initialized to copy the data on the primary drive to the secondary drive. The initialization can be done with a rebuild. For details about rebuild, see "1.2.2 Rebuild" (→pg.14).

- The logical drive does not have redundancy until the initialization is completed, so if the primary hard disk drive fails, the data will be lost.

**POINT**

- Before the initialization, the secondary hard disk drive cannot be used and its failure LED remains lit. In addition, the logical drive status remains "Critical".
- The initialization is done with a rebuild, which means that the hard disk failure LED of the secondary drive flashes during the initialization.
1.1.5 Checking the Hard Disk Status

Constantly monitor the status of the hard disk drives in the logical drive, and replace any drive that fails or is predicted to fail.

**Logical Drive Status**

A logical drive can be in one of the following states:

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical</td>
<td>A logical drive that had redundancy is operating without redundancy due to a failure of one of the hard disk drives. Replace the failed hard disk drive as soon as possible and perform a rebuild to restore the status to &quot;Online&quot;. See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→pg.92) for information on how to replace the hard disk drive and for rebuild.</td>
</tr>
<tr>
<td>Offline</td>
<td>Indicates that the logical drive is not operating. This status occurs when both hard disk drives in a disk group fail. In this case, the data on the logical drive will be lost.</td>
</tr>
</tbody>
</table>

**Hard Disk Status**

A hard disk drive can be in one of the following states:

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unconfigured</td>
<td>Not included in the disk array, but operating normally.</td>
</tr>
<tr>
<td>Online</td>
<td>Included in the disk array and operating normally.</td>
</tr>
<tr>
<td>Critical</td>
<td>Operating above the PFA (S.M.A.R.T.) threshold. Currently operating normally, but may fail in the near future (failure expected status). See &quot;6.3 Preventive Replacement of a Hard Disk Drive&quot; (→pg.94) and replace the hard disk drive as soon as it is convenient.</td>
</tr>
<tr>
<td>Offline</td>
<td>Data read/write is disabled by the array controller's &quot;Make Offline&quot; function. Perform &quot;5.5 Rebuild&quot; (→pg.86) to use the drive again.</td>
</tr>
<tr>
<td>Failed</td>
<td>The drive is damaged and data read/write is disabled. Replace the hard disk drive and perform a rebuild. See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→pg.92) for information on how to replace a hard disk drive.</td>
</tr>
</tbody>
</table>

**IMPORTANT**

- If a hard disk status is "Failed", it may be in the event of the hard disk failure and operating without redundancy. Replace the hard disk drive promptly. See "6.2 Replacing a Failed Hard Disk Drive" (→pg.92) for information on how to replace a hard disk drive.
- A hard disk with "Critical" status may fail in the near future. See "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.94) and replace the hard disk drive.
1.2 Disk Array Configuration Features

This section explains the features in disk array configuration.

1.2.1 Write Policy

Write Policy or Write Cache is the mode for writing to cache memory. This array controller does not have any cache memory, so it always operates in the Write Through mode. In the Write Through mode, when an instruction to write data is issued from the system to a logical drive, a completion of writing instruction is reported to the system after the data write to the hard disk drive is completed.

1.2.2 Rebuild

Even if one hard disk drive in a logical drive fails, a logical drive with redundancy continues to operate in "Critical" status. However, if the other hard disk drive in the same logical drive also fails, the status of the logical drive becomes "Offline". Rebuild is the operation to restore a logical drive in "Critical" status to "Online" status. You can start a rebuild by selecting [Synchronize] in the BIOS Utility or by selecting [Rebuild] in GAM. Until the failed hard disk drives have been replaced and rebuild is complete, the logical drive continues to operate in "Critical" status.

- Time Required for Rebuild

The estimated rebuild execution time per 10GB is approximately 1 hour when there is no server I/O. For example, when a logical drive consists of two 73GB hard disk drives, the rebuild takes about 7 hours (approx. 1 hr./10GB x 73GB). However, the time may differ from this example depending on the configuration and the hard disk type.

- If the server is restarted or shut down during the rebuild, the rebuild will resume from the stage where the process stopped the next time the system starts up.
- During the rebuild, the data is read from the hard disk drives with Online status and written to the newly replaced hard disk drives, decreasing the I/O performance for the logical drive. With this array controller, the I/O performance may decrease up to about 50%. However, the I/O performance during the rebuild may vary depending on the load and access method of the I/O operations, etc.
### 1.2.3 Media Verification

Media verification is a function that detects media errors on a hard disk drive in advance and restores data using the data on the other hard disk drive. This array controller always performs media verification when the logical drive is in "Online" status.

If there is a media error on the remaining hard disk drive during the rebuild, the rebuild cannot restore the data. Media verification reduces the risk of data loss at a rebuild, by correcting media errors in advance.

### 1.2.4 The Hard Disk Failure Prediction Function (PFA / S.M.A.R.T.)

The PFA / S.M.A.R.T. function is a failure prediction function for the hard disk drives which determines the risk of a failure in advance and issues a warning when the risk is high.

Although a hard disk drive will still operate normally even when a risk of a failure is predicted, that hard disk drive may fail in the near future and should be replaced as soon as possible. See "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.94) for the replacement procedure. The hard disk drive for which failure is predicted can be identified by the BIOS Utility and GAM.
1.3 Notes before Configuring a Disk Array

Check the following before configuring a disk array.

1.3.1 Notes on Hard Disk Drives to Be Used

The following notes apply to the hard disk drives to be used. Please check in advance.

● **Usable Hard Disk Drives**

When using two hard disk drives in a redundant configuration (RAID 1), the hard disk drives must be of the same model (with the same capacity and speed). Check that the installed hard disk drives have the same model name. Also, be sure to check that the hard disk drives are installable on the server.

● **When Reusing a Hard Disk Drive**

Hard disk drives containing data may have partition information or array configuration information. Using such drives without taking the proper measures may cause unexpected problems. When using a previously used hard disk drive, erase the data by performing low level format on the system that was using the hard disk drive, before connecting the drive to this array controller.

The same caution applies when using hard disk drives used by this product on another system. See "2.5 Low Level Formatting of Hard Disk Drives" (→pg.43) and completely erase the information on the hard disk drive before using it on another system.

● **Removing an Operating Hard Disk Drive**

Do not remove a working hard disk drive while the server power is on, except when replacing a failed hard disk drive.

● **Notes on Connecting Other Devices**

Do not connect any other devices than hard disk drives under the array controller.
1.3.2 Setup Flow of This Product

Perform the procedure in the following flowchart to newly install an OS to the server on which the array controller is installed.

1. **Configuring the Disk Array Using BIOS Utility**
   
   "Chapter 2 Using the BIOS Utility" (pg.21)
   
   Create the logical drive using BIOS Utility before installing the OS and the device drivers.
   - Create the logical drive
   - Initialize the logical drive

   **POINT**
   - This procedure is not required in a non-redundant configuration.

2. **Installing the OS and the Device Drivers**
   
   See "User's Guide" supplied with the server to install the OS and the device drivers.

3. **Installing Management Tools**
   
   "Chapter 4 Overview and Installation of Global Array Manager (GAM)" (pg.53)
   
   Install ServerView and GAM on the server or client PC to monitor and control the disk array.

   **POINT**
   - GAM is not required in a non-redundant configuration.

4. **Updating the Device Drivers and Applying the Hotfix**
   
   Create the driver disk from the "Array Controller Document & Tool CD" supplied with the server and update the device drivers. And also, apply the Hotfix.

   →"3.1 Updating the Device Drivers" (pg.48)
   →"3.2 Applying the Hotfix" (pg.51)
1.4 Notes on Operation

This section contains notes concerning system operation when using this array controller.

1.4.1 Notes for Using Array Controllers

When using Windows in a disk array configuration, the following event may be entered in the Event Viewer's system log:

```
Source : lsi_sas
Type   : Warning
Event ID : 129
Description: The description for Event ID (129) in Source (lsi_sas) cannot be found.
(The rest is omitted.)
```

This log entry means that an internal reset has been issued in the device driver, but since the event has been restored by an OS retry, you can continue with the operation.

However, if this event occurs repeatedly (about twice in every 10 minutes), there is a possibility of hardware failure. Contact an office listed in the "Contact Information" of "Start Guide" and check the array controller and hard disk drives.

1.4.2 Error Messages from Global Array Manager

In a Windows environment where Global Array Manager (GAM) is installed, the following error may be entered in the application log and a popup window may appear when Windows starts up.

- **Application Log**

```
Source : Application Error
Type   : Error
Event ID : 1000
Description: Faulting application Gamdrv.exe, version 0.0.0.0, faulting module ...  
(The rest is omitted.)
```
"Gamdrv" and "Gamscm" are modules included in the GAM service. This error occurs when the GAM service failed to start up due to a heavy CPU load or some other reason. If this error occurs, the following two services are automatically restarted, so the error can be ignored. Click [Don’t send] or [Close Message] to close the popup window.

- Mylex Global Array Manager Service
- SNMP Service

When this error occurs, the following events may be entered in the OS system log, but the services are restarted normally and there will be no problem.

```
Source : Service Control Manager
Type   : Error
Event ID : 7011
Description: Timeout (30000 milliseconds) waiting for a transaction response from the gamscm service.
```

```
Source : Service Control Manager
Type   : Error
Event ID : 7011
Description: Timeout (30000 milliseconds) waiting for a transaction response from the service.
```
Chapter 2

Using the BIOS Utility

This chapter explains the BIOS Utility setup procedure. BIOS Utility is a basic utility to set up and manage the array controller.

2.1 Starting and Exiting the BIOS Utility .......................... 22
2.2 The BIOS Utility Screen Layout ............................... 25
2.3 Viewing Information ............................................ 26
2.4 Creating and Deleting a Logical Drive .................... 33
2.5 Low Level Formatting of Hard Disk Drives ............... 43
2.1 Starting and Exiting the BIOS Utility

This section explains how to start up and exit the BIOS Utility. The BIOS Utility can be set to start from the BIOS at system startup, regardless of whether the OS has been installed or not on the computer to be used.

- The terms "logical drive" and "array controller" used in this manual are displayed as "Array" and "Adapter" respectively in the BIOS Utility. Read the manual by replacing the terms with those used in the BIOS Utility when necessary.

2.1.1 Starting the BIOS Utility

Perform the following procedure:

1. Turn on the server, and press the [Ctrl]+[C] keys while the following messages are displayed on the screen.

   LSI Logic Corp. MPT SAS BIOS
   MPTBIOS-x.xx.xx.xx (xxxx.xx.xx)
   Copyright xxxx-xxxx LSI Logic Corp.
   \[Press Ctrl C to start LSI Logic Configuration Utility\]

   Press the [Ctrl]+[C] keys while the message "Press Ctrl C to start LSI Logic Configuration Utility" is displayed on the screen.

   The following message appears and the BIOS Utility starts up after the POST of the server is complete.

   Please wait, invoking SAS Configuration Utility.

   - If the following message appears, the hard disk drive may have a failure.

   \[xxxx enter the LSI Logic Configuration Utility to investigate!\]

   In this case, see "Chapter 6 Replacing a Hard Disk Drive" (⇒pg.89) to check the hard disk drive status. If there is a failed hard disk drive, replace the drive and perform rebuild.
The BIOS Utility starts and the [Adapter List] screen appears.

For this array controller, "SAS1068" is displayed for [Adapter] on the above screen.
2.1.2 Exiting the BIOS Utility

Follow the steps below to exit the BIOS Utility.

1 Display the [Adapter List] screen.
   If another screen is displayed, press the [Esc] key several times until the [Adapter list] screen appears.

2 Press the [Esc] key.
   The [Exit] menu appears.

3 Select [Exit the Configuration Utility and Reboot] and press the [Enter] key.
   The BIOS Utility exits and the system restarts.
### 2.2 The BIOS Utility Screen Layout

The BIOS Utility screen consists of three areas. The displayed contents depend on the selected function.

#### Header Area
- The BIOS Utility shifts between screens according to the selected function.
- Pressing the [Esc] key on each screen returns to the previous screen.

#### Main Area
- The main area for each screen. Configurable items and menus are displayed in yellow and can be selected by the cursor.

#### Footer Area
- A help message for the current screen. An explanation of the function keys is displayed.
2.3 Viewing Information

With the BIOS Utility, you can see information about the array controller, the logical drive, and the hard disk drives.
- Viewing Information on Array Controller (→pg.26)
- Viewing Information on the Logical Drive and the Hard Disk Drives (→pg.29)

2.3.1 Viewing Information on Array Controller


■ Adapter Properties

1. Start up the BIOS Utility.
   → "2.1.1 Starting the BIOS Utility" (pg.22)

   POINT
   ‣ If the BIOS Utility is already running and another screen is displayed, press the [Esc] key several times until the [Adapter list] screen appears.

2. Check that the [Adapter List] menu is selected and press the [Enter] key.

   POINT
   ‣ This screen is for selecting an array controller to access, but only one controller is shown. So, just press the [Enter] key.

The [Adapter Properties] screen appears.
Press the [Esc] key to return the [Adapter list] screen. If you have changed some settings, a confirmation screen appears. Select [Discard changes then exit this menu].

### Global Properties

1. Start up the BIOS Utility.

   → "2.1.1 Starting the BIOS Utility" (pg.22)

   ▶ If the BIOS Utility is already running and another screen is displayed, press the [Esc] key several times until the [Adapter list] screen appears.
2 Check that the [Adapter List] menu is selected and press the [Alt]+[N] keys to select the [Global Properties] menu.


- Do not change the items on this screen from the default settings.
  If you have changed them by mistake, select [Restore Defaults] and press the [Enter] key to restore the default values.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pause When Boot Alert</td>
<td>Indicates whether or not to pause operation when a failure is detected during the array controller's Power On Self Test (POST). The default value is &quot;No&quot;.</td>
</tr>
<tr>
<td>Displayed</td>
<td></td>
</tr>
<tr>
<td>Boot Information Display</td>
<td>Displays the scope of the information that is displayed during the array controller's POST (e.g. hard disk drives). The default value is &quot;Display adapter &amp; installed devices&quot;.</td>
</tr>
<tr>
<td>Mode</td>
<td></td>
</tr>
<tr>
<td>Set Interrupt</td>
<td>Indicates whether or not to accept INT 13h interrupts. The default value is &quot;Hook interrupt, the default&quot;.</td>
</tr>
</tbody>
</table>

- Press the [Esc] key to return the [Adapter list] screen. If you have changed some settings, a confirmation screen appears. Select [Discard changes then exit this menu].
2.3.2 Viewing Information on the Logical Drive and the Hard Disk Drives

You can see the information about the logical drive and the hard disk drives on the [View Array] screen.

1 Start up the BIOS Utility.
   → "2.1.1 Starting the BIOS Utility" (pg.22)

   • If the BIOS Utility is already running and another screen is displayed, press the [Esc] key several times until the [Adapter list] screen appears.

2 Check that the [Adapter List] menu is selected and press the [Enter] key.

   • This screen is for selecting an array controller to access, but only one controller is shown. So, just press the [Enter] key.

   The [Adapter Properties] screen appears.

3 Select [RAID Properties] and press the [Enter] key.

   The [Select New Array Type] screen appears.
4 Select [View Existing Array] and press the [Enter] key.
The [View Array] screen appears, which displays the information about the logical drive and the hard disk drives that belong to the logical drive.

![View Array Screen]

When no logical drive exists, [View Existing Array] is not displayed.
You can see the status of the mounted hard disk drives by selecting [Create IM Volume] and opening the [Create New Array] screen. (The status of the logical drive, however, is not displayed.)

See "■ Information about the Logical Drive" (→pg.30) for information about the logical drive, and "■ Information about the Hard Disk Drives" (→pg.31) for detailed information about hard disk drives.

5 Press the [Esc] key to close the screen.
The display returns to the [Adapter Properties] screen.

■ Information about the Logical Drive
This section explains each item in the information about the logical drive.

![Logical Drive Information]

- The information about the logical drive is displayed at the top of the [View Array] screen.

- **Array**
The total number of logical drives existing on the array controller and the number of the logical drive for which information is currently shown are displayed. Usually only one logical drive is created, so the display is normally "1 of 1".

- **Identifier**
Displays the name to identify the logical drive. Usually displayed as "LSILOGIC Logical Volume 3000".
● **Type**
Displays the type of logical drive. Always displayed as "IM ".

● **Scan Order**
Displays the scan order among multiple logical drives. Only one logical drive can be created on this array controller, so this item is always "0".

● **Size (MB)**
Displays the total capacity of the logical drive.

● **Status**
Displays the current status of the logical drive. The meaning of each status is as follows:

<table>
<thead>
<tr>
<th>Status Indication</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal</td>
<td>The logical drive is operating normally.</td>
</tr>
<tr>
<td>Degraded</td>
<td>The logical drive is operating without redundancy because one of the hard disk drives has failed. See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→pg.92) and immediately replace the failed hard disk drive.</td>
</tr>
<tr>
<td>Failed</td>
<td>The logical drive is unavailable because both hard disk drives have failed. See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→pg.92) and immediately replace the failed hard disk drives.</td>
</tr>
<tr>
<td>xx% Syncd</td>
<td>The logical drive is being rebuilt or initialized. The progress is displayed as a percentage.</td>
</tr>
<tr>
<td>Inactive</td>
<td>The logical drive cannot be used because it has been used in another system and the hard disk drives still contain the previous system information. See &quot;2.5 Low Level Formatting of Hard Disk Drives&quot; (→pg.43) to format the hard disk drives, and then configure a new logical drive. Also, when only one connected hard disk drive can be detected, there is a possibility that the detected hard disk drive has a failure in past times and old data is stored. See &quot;Chapter 6 Replacing a Hard Disk Drive&quot; (→pg.89), and if the hard disk drive has a failure, immediately replace the drive.</td>
</tr>
</tbody>
</table>

### Information about the Hard Disk Drives
This section explains each item in the information about the hard disk drives.

#### POINT
- The information about the hard disk drives is displayed at the bottom of the [View Array] screen.

● **Slot Num**
Displays the number of the physical slot in which the hard disk drive is mounted.

● **Device Identifier**
Displays, from left to right, the hard disk vendor name, the model name, and the firmware revision number of the hard disk drive.

● **RAID Disk**
Indicates whether or not the hard disk drive is contained in the logical drive with “Yes” or “No”.
● **Hot Spr**
Indicates whether or not the hard disk drive is assigned as a hot spare drive with "Yes" or "No". This item is always "No", because this array controller does not support the hot spare function.

● **Drive Status**
Displays the current status of the hard disk drive. The meaning of each status is as follows:

**table: Hard disk drive status**

<table>
<thead>
<tr>
<th>Status Indication</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>...........</td>
<td>The hard disk drive is operating normally but does not belong to a logical drive.</td>
</tr>
<tr>
<td>Primary</td>
<td>The hard disk drive is operating normally and is configured as the primary drive of RAID 1.</td>
</tr>
<tr>
<td>Secondary</td>
<td>The hard disk drive is operating normally and is configured as the secondary drive of RAID 1.</td>
</tr>
<tr>
<td>Missing</td>
<td>There is no response from the hard disk drive.</td>
</tr>
<tr>
<td>Failed</td>
<td>The hard disk drive has a failure or cannot be detected. See &quot;Chapter 6 Replacing a Hard Disk Drive&quot; (→pg.89), and if the hard disk drive has a failure, immediately replace the drive.</td>
</tr>
<tr>
<td>Offline</td>
<td>The hard disk drive is operating offline.</td>
</tr>
<tr>
<td>Initing</td>
<td>The hard disk drive is being formatted.</td>
</tr>
<tr>
<td>Inactive</td>
<td>The hard disk drive cannot be used because it contains information for another system. See &quot;2.5 Low Level Formatting of Hard Disk Drives&quot; (→pg.43) and format the hard disk drive before using it. There is also a possibility that the detected hard disk drive has a failure. See &quot;Chapter 6 Replacing a Hard Disk Drive&quot; (→pg.89), and if the hard disk drive has a failure, immediately replace the drive.</td>
</tr>
<tr>
<td>Not Syncd</td>
<td>The hard disk drive has a failure. See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→pg.92) and immediately replace the failed hard disk drive. This status is also displayed during a rebuild or immediately after configuring a logical drive, because the data on the primary drive and the secondary drive are different. This kind of event is not a hard disk drive failure.</td>
</tr>
<tr>
<td>Wrg Type</td>
<td>The hard disk drive cannot be used as a part of logical drive, because the drive is of the wrong type or is not an appropriate product.</td>
</tr>
<tr>
<td>Too Small</td>
<td>The hard disk drive cannot be used as part of logical drive, because its capacity is too small.</td>
</tr>
<tr>
<td>Max Dsks</td>
<td>The number of hard disk drives exceeds the maximum possible number that can be configured in a logical drive.</td>
</tr>
<tr>
<td>No SMART</td>
<td>The hard disk drive cannot be used, because it does not support the S.M.A.R.T. failure prediction function.</td>
</tr>
<tr>
<td>Wrg Intfc</td>
<td>The hard disk drive cannot be used as part of logical drive, because its interface is not SAS.</td>
</tr>
</tbody>
</table>

● **Pred Fail**
Displays whether or not the hard disk drive is operating over the PFA (S.M.A.R.T.) threshold value with "Yes" or "No".

**IMPORTANT**

- A hard disk drive for which [Pred Fail] is displayed as "Yes" is exceeding the PFA (S.M.A.R.T.) threshold value and may fail in the near future. See "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.94) to replace that hard disk drive as a preventive measure as soon as possible.
2.4 Creating and Deleting a Logical Drive

When using the drives with redundancy (RAID 1), create a logical drive with the BIOS Utility.
When deleting a logical drive, the hard disk drives used in that logical drive can be restored to their original state, not belonging to a logical drive.

POINT

- When you do not use the hard disk drives with redundancy, i.e. when accessing connected hard disk drives stand-alone, you do not need to create a logical drive.

2.4.1 Creating and Initializing a Logical Drive

Use the following procedure to create a logical drive.
After creating the logical drive, initialize it to make it redundant.

1. Start up the BIOS Utility.
   → "2.1.1 Starting the BIOS Utility" (pg.22)

   POINT

   - If the BIOS Utility is already running and another screen is displayed, press the [Esc] key several times until the [Adapter list] screen appears.

2. Check that the [Adapter List] menu is selected and press the [Enter] key.

   POINT

   - This screen is for selecting an array controller to access, but only one controller is shown. So, just press the [Enter] key.

   The [Adapter Properties] screen appears.
3 Select [RAID Properties] and press the [Enter] key.
The [Select New Array Type] screen appears.

4 Select [Create IM Volume] and press the [Enter] key.

POINT

- This array controller does not support the [Create IME Volume] and [Create IS Volume] functions. Do not select these.

The [Create New Array] screen appears.
5  Move the cursor to the [RAID Disk] field of the hard disk drive to be configured as the primary drive and press the [Space] key.

**POINT**
- The drive with [Slot Num] "0" is usually configured as the primary drive.

The methods to make a logical drive are displayed.

6  Press the [M] key to select the method in the upper row.

**IMPORTANT**
- Do not press the [D] key here. This array controller does not support the method selected with the [D] key.

A list of the mounted hard disk drives is displayed. Check that the [Drive Status] of the drive selected in step 4 is displayed as "Primary".
7 Move the cursor to the [RAID Disk] field of the other drive and press the [Space] key.

The [Drive Status] becomes "Secondary".

8 Press the [C] key.

A confirmation screen to create a logical drive appears.

9 Select [Save changes then exit this menu] and press the [Enter] key.

The creation of the logical drive starts. It may take from several seconds to up to a minute to create a logical drive.

When the creation is completed, the [Adapter Properties] screen appears.

- The created logical drive does not have redundancy. Make sure to make it redundant by initializing it.
10 Initialize the logical drive. Select [RAID Properties] and press the [Enter] key. The [Select New Array Type] screen appears.

11 Select [View Existing Array] and press the [Enter] key. The [View Array] screen appears.
12 Select [Manage Array] and press the [Enter] key.

The [Manage Array] screen appears.

13 Select [Synchronize Array] and press the [Enter] key.

**IMPORTANT**

- This array controller does not support the [Manage Hot Spare] function. Do not select it.

The confirmation screen to initialize a logical drive appears.
14 Press the [Y] key.
The [Manage Array] screen appears and the initialization of the logical drive starts. Wait for a while until the initialization is finished.

**IMPORTANT**
- The logical drive does not have redundancy until the completion of the initialization, and if the primary hard disk drive fails, data will be lost.

**POINT**
- During the initialization, you can check the progress in the [Status] field. When the display becomes “Optimal”, the initialization is finished.
- This array controller supports background initialization. If you exit the BIOS Utility and restart the server, initialization is performed in parallel with the OS installation.
- Because the secondary drive cannot be used before the initialization, its hard disk drive failure lamp remains lit. In addition, the status of the logical drive is displayed as “Critical”.
- The initialization of a logical drive is performed by a rebuild, and the hard disk drive failure lamp of the secondary drive flashes during initialization. The BIOS Utility displays the status as “xx% Sync’d”, and GAM displays the status as rebuilding (“Critical” for the logical drive and “Rebuilding” for the hard disk drives).

15 Press the [Esc] key twice to return to the [Adapter Properties] screen.
2.4.2 Deleting the Logical Drive

To delete the logical drive and restore the hard disk drives to their original state (not belonging to a logical drive), perform the following procedure.

- Note that the data on the hard disk drives are deleted when the logical drive is deleted.

1. **Start up the BIOS Utility.**
   
   → “2.1.1 Starting the BIOS Utility” (pg.22)
   
   - If the BIOS Utility is already running and another screen is displayed, press the [Esc] key several times until the [Adapter list] screen appears.

2. **Check that the [Adapter List] menu is selected and press the [Enter] key.**
   
   - This screen is for selecting an array controller to access, but only one controller is shown. So, just press the [Enter] key.

   The [Adapter Properties] screen appears.

3. **Select [RAID Properties] and press the [Enter] key.**

   The [Select New Array Type] screen appears.

![LSI Logic MPT Setup Utility](image)
4. Select [View Existing Array] and press the [Enter] key.
   The [View Array] screen appears.

5. Select [Manage Array] and press the [Enter] key.
   The [Manage Array] screen appears.
6 Select [Delete Array] and press the [Enter] key.
   The confirmation screen to delete the logical drive appears.

   ![Confirmation Screen]

   - **Y**  Delete array and exit to Adapter Properties
   - **N**  Abandon array deletion and exit this menu

7 Press the [Y] key.
   The deletion of the logical drive starts. It may take from several seconds to up to a minute to delete the logical drive.
   When the deletion is finished, the [Adapter Properties] screen appears.
2.5 Low Level Formatting of Hard Disk Drives

This section explains how to perform a low level formatting of hard disk drives in the BIOS Utility.

When you reuse a hard disk drive that was previously used in another system, format it by performing the following procedure.

**IMPORTANT**

- All the data on a hard disk drive are deleted when the drive is formatted.
- Do not turn off or restart the server during formatting. The hard disk drive will fail and become unusable.
- Hard disk drive formatting takes a long time. The time required depends on the type of the hard disk drive, but approximately 1.5 minutes per GB. (For example, it takes about 110 minutes to format a 73GB hard disk drive.)
- Make sure you have enough time before performing formatting, as the formatting cannot be interrupted once it has been started.

**POINT**

- Hard disk drive formatting can only be done for hard disk drives that are not contained in a logical drive.
- To format the hard disk drives contained in a logical drive, delete the logical drive first, referring "2.4.2 Deleting the Logical Drive" (pg.40), and then format the hard disk drive with the following procedure.
- It is not possible to format multiple hard disk drives at the same time.

1. Start up the BIOS Utility.
   → "2.1.1 Starting the BIOS Utility" (pg.22)

   **POINT**

   - If the BIOS Utility is already running and another screen is displayed, press the [Esc] key several times until the [Adapter list] screen appears.

2. Check that the [Adapter List] menu is selected and press the [Enter] key.

   **POINT**

   - This screen is for selecting an array controller to access, but only one controller is shown. So, just press the [Enter] key.

The [Adapter Properties] screen appears.
3 Select [SAS Topology] and press the [Enter] key.
The [SAS Topology] screen appears.

4 Select [Direct Attached Devices] and press the [Enter] key.
A list of the connected hard disk drives is displayed.
5 Select the hard disk drive you wish to format and press the [Alt]+[D] keys. The [Device Properties] screen appears.

![Device Properties Screen]


![Device Format Screen]
7 Press the [F] key.
The hard disk drive formatting starts and a progress bar is displayed at the bottom of the screen. Formatting is complete when the progress bar reaches 100% (the end).

8 Press the [Esc] key three times to return to the [Adapter Properties] screen.
Chapter 3

Updating the Device Drivers

This chapter explains how to update the device drivers and how to apply a hotfix.

3.1 Updating the Device Drivers ......................... 48
3.2 Applying the Hotfix .................................. 51
3.1 Updating the Device Drivers

This section explains how to update the device drivers installed in the server. The driver update operation varies depending on the OS. Before the update, driver disks must be created using the "Array Controller Document & Tool CD".

Even if the OS is newly installed in the server, the drivers need to be updated with those included on the "Array Controller Document & Tool CD".

3.1.1 Creating Driver Disks

Before updating the device drivers, create driver disks from the "Array Controller Document & Tool CD" by performing the following procedure.

1. Prepare formatted floppy disks.
2. Insert the "Array Controller Document & Tool CD" into the CD-ROM drive.
3. Copy the drivers for the OS to use from the following folder on the CD-ROM to the floppy disks.
   Label the floppy disks with the floppy disk names in the following table.

   For the version number of the device drivers, see ReadmeEN.html on the "Array Controller Document & Tool CD" supplied with the server.
3.1.2 Updating the Drivers (Windows Server 2003)

1. Log on to Windows with Administrator privileges.

2. Exit all programs before updating.

3. Select [System] from the [Control Panel].

4. Select the [Hardware] tab and click [Device Manager].

5. Double-click [SCSI and RAID Controller].
The SCSI adapter list appears.

6. Double-click [LSI Logic Adapter, SAS 3000 series, 8-port with 1068-StorPort].
The [Properties] window appears.

7. Select the [Driver] tab and click [Update Driver].
The "Hardware Update Wizard" window appears.

8. Select [No, not this time] and click [Next].

9. Select [Install from a list or specific location] and click [Next].

10. Select [Don't search. I will choose the driver to install.] and click [Next].

11. Insert the following floppy disk in the floppy disk drive and click [Have Disk].
   - For Windows Server 2003
     "Integrated Mirroring SAS Windows Server 2003 Drivers Disk"
   - For Windows Server 2003 x64
     "Integrated Mirroring SAS Windows Server 2003 for x64 Edition Drivers Disk"

12. Enter "A:" in [Copy manufacturer's file from] and click [OK].

13. Select [LSI Logic Adapter, SAS 3000 series, 8-port with 1068-StorPort] in the model field and click [Next].
The files are copied.

14. When file copying is finished, click [Done] and close the [Hardware Update Wizard] window.

15. Click [Close] to close the [Properties] window.

16. Restart the system.
3.1.3 Updating the Drivers (Windows 2000 Server)

1. Log on to Windows with Administrator privileges.
2. Exit all programs before updating.
3. Select [System] from the [Control Panel].
4. Select the [Hardware] tab and click [Device Manager].
5. Double-click [SCSI and RAID Controller].
   The SCSI adapter list appears.
6. Double-click [LSI Adapter, SAS 3000 series, 8-port with 1068].
   The [Properties] window appears.
7. Select the [Driver] tab and click [Update Driver].
   The [Device Driver Upgrade Wizard] window appears.
8. Click [Next].
9. Select [Display known drivers for this device and select a driver from the list.] and click [Next].
10. Click [Have Disk] and insert the "Integrated Mirroring SAS Windows 2000 Drivers Disk" in the floppy disk drive.
11. Enter "A:\" in [Copy manufacturer's file from] and click [OK].
12. Select [LSI Adapter, SAS 3000 series, 8-port with 1068] in the model field and click [Next].
    The device driver installation starts.
13. When the installation is finished, click [Done] and close the [Device Driver Update Wizard] window.
15. Restart the system.

⚠️ If the [Change System Settings] window appears, click [No].
3.2 Applying the Hotfix

In order to use this array controller in a Windows environment, a hotfix needs to be applied.

**IMPORTANT**

For the hotfix, use the "ServerStart Disc 1 CD-ROM" supplied with the server. Make sure to apply the hotfix when using this array controller with a newly installed OS in a Windows environment.

### Application Procedure

1. Log on to Windows with Administrator privileges.
2. Close all applications.
3. Insert the "ServerStart Disc 1 CD-ROM" into the CD-ROM drive.
4. Run the following program to apply the hotfix.
   - For Windows 2000 Server
     
     [CD-ROM drive]:\HOTFIX\W2K\ENU\Windows2000-KB904374-x86-ENU.EXE
   - For Windows Server 2003
     
     [CD-ROM drive]:\HOTFIX\W2K3\WindowsServer2003-KB912944-x86-ENU.exe
   - For Windows Server 2003 x64
     
     [CD-ROM drive]:\HOTFIX\W2K3x64\WindowsServer2003.WindowsXP-KB912944-x64-ENU.exe
Chapter 4

Overview and Installation of Global Array Manager (GAM)

This chapter contains an overview of and product requirements for Global Array Manager (GAM), and describes how to install the program.

4.1 Overview of and Product Requirements for GAM .......... 54
4.2 Using GAM in a Linux Environment .................. 57
4.3 Using GAM in a Multiple Server Environment .......... 58
4.4 Installing GAM (Windows) .............................. 60
4.1 **Overview of and Product Requirements for GAM**

This section explains Global Array Manager (GAM). GAM is used to monitor, manage, maintain, and configure an array controller and the hard disk drive and logical drives that are connected to the array controller.

### 4.1.1 GAM Overview

GAM is an application that allows you to manage a disk array system connected to an array controller (RAID controller). The functions of GAM are accomplished by the interaction between GAM Server and GAM Client.

- **GAM Server (Monitoring function)**
  GAM Server monitors and collects information about the status and resource usage of the disk arrays, and notifies the operator.

- **GAM Client (Management function)**
  GAM Client provides fault management, highly reliable messaging, and excellent OS support. You can manage the maintenance of disk arrays and hard disk drives from the server or from a client PC connected to the network.

---

**IMPORTANT**

- To ensure stable operation of PRIMERGY, install GAM when using RAID. The hard disk status cannot be monitored when the system operates without GAM. For instance, if one hard disk drive should fail and this is not noticed, the system may stop or data may be lost should a second drive also fail. Install GAM to detect the failure as soon as one hard disk drive breaks down.

- Only start GAM Client when management or maintenance of arrays is necessary. From a security point of view, it is not recommended to run GAM Client continuously. While signing on from GAM Client, if the accessed server shuts down, GAM Client cannot communicate with GAM Server and cannot respond, which prevents the user from operating it. In that case, wait for the GAM Server that is to be accessed to start up again, or forcibly exit GAM Client.
4.1.2 Requirements for GAM

An appropriate server environment is required for using GAM Server and GAM Client properly. Use hardware and software that meet the following conditions:

**GAM-Server**

- OS supporting servers with this array controller installed
- Hard disk drive: 64MB or more free space
- TCP/IP, SNMP service, and ServerView must be installed.

**IMPORTANT**

- Apply the latest Service Pack for the OS.
- Make sure to install the device drivers and GAM specified by Fujitsu.
- Make sure to configure the network setting properly. If there is a problem with the network configuration, you may not be able to monitor the status of arrays by ServerView or events may not be notified.

**POINT**

- Disk arrays are monitored by OS event logs that are notified by ServerView (Source: Fujitsu ServerView Services). Because events that are notified from GAM (source: gamevlog) are not supported, you can ignore the events recorded by "gamevlog". If any logs for an array controller are notified by ServerView before or after the event, view the logs. For the list of logs notified by ServerView, see "Appendix A A List of GAM Error Codes" (→pg.102).

**GAM-Client (When Managed from a Client PC)**

When GAM Client is installed on a client PC different from the server, the following environment is required for the client PC.

- Network connection with TCP/IP available
- A mouse or other pointing device
- Processor: Pentium™ or later
- Memory: 256MB or more
- Hard disk drive: 32MB or more free space
- Monitor: 800 x 600 or better resolution (1024 x 768 or more recommended)
4.1.3 Access Privileges to GAM

You need to sign on to GAM to use the GAM functions. User authentication is based on the user accounts registered in the OS. Note that the available functions vary depending on the user account used to sign on. There are three levels of access privileges as shown below:

- **Guest Privileges**
  When using GAM with Guest privileges, it is not necessary to sign on. With Guest privileges, only the RAID status and occurring events can be checked.

- **User Privileges**
  This is mainly used to monitor the status of controllers, hard disk drives, and logical drives. To use User privileges, sign on with any of the user names and passwords registered in the OS. With User privileges, in addition to the functions available with Guest privileges, you can see the detailed status of the selected controllers or of the RAID subsystem. However, drive management, such as rebuild, cannot be performed.

  - **POINT**
    - A rebuild and other operation cannot be performed with User privileges. We recommend that you sign on with User privileges when only monitoring RAID or only checking its status.

- **Administrator Privileges**
  This function is used for management, maintenance, and configuration of controllers, hard disk drives, and logical drives. To use Administrator privileges, sign on as "gamroot". In addition to the monitoring functions available with Guest and User privileges, all other functions are available, including rebuilding drives, checking the consistency of logical drives, and changing the drive status.

  - **IMPORTANT**
    - When using GAM with Administrator privileges, data may be lost in the array controller depending on the operation. Read this Chapter and use GAM very carefully.
    - If GAM information cannot be monitored from ServerView, the network settings may be incorrect. In this case, check the network settings again.
4.2 Using GAM in a Linux Environment

To use GAM in a Linux environment, you need to install device drivers and GAM.

For using Linux, see the PRIMERGY page on the Fujitsu website (http://primergy.fujitsu.com/) and refer to information about Linux.

---

POINT

- GAM Client can only be installed on servers or PCs running Windows. Even when monitoring array controllers on Linux servers using GAM Client, GAM Client cannot be installed on Linux servers. Prepare a Windows server or client PC and install GAM Client on it.

The following figure shows a system configuration in which GAM Client on a Windows server or on a client PC manages a Linux server.

---

POINT

- On Linux servers, you need to install GAM Server and edit the configuration file to set the GAM event recipient and enable storing event logs after the installation. For more details, see the "Installation Guide" for Linux at the above URL.
- If there is an intervening firewall in the environment, you need to configure the network settings so that the port used by the GAM protocol is not blocked.
4.3 Using GAM in a Multiple Server Environment

In a network environment, arrays on multiple servers can be monitored and managed from a Windows client connected to the network. The following figure shows a system configuration in which GAM Client on the other Windows client manages GAM Server.

- You need to configure the server receiving GAM events during GAM installation. For details, see Step 12 in "4.4.1 How to Install GAM" (pg.60).
- If there is an intervening firewall in the environment, you need to configure the network settings so that the port used by the GAM protocol is not blocked.
- One GAM Client can manage up to a maximum of 100 GAM Servers.
  When monitoring more than 100 servers, one Windows server or client PC to be used as GAM Client is necessary per 100 servers.
4.3.1 Interaction between ServerView and AlarmService

The following figure shows the interaction between ServerView and AlarmService when GAM Client on the other Windows server (client) manages GAM Server. OS event logs can be stored both on the GAM Server and on the Windows server (client).

**When Storing OS Event Logs on the GAM Client Server/PC**

- **POINT**
  - ServerView must be installed on the GAM Client server/PC as well.

- **IMPORTANT**
  - Make sure to install ServerView on the Server.
This section explains how to install GAM on a Windows server.

**4.4 Installing GAM (Windows)**

GAM cannot be installed by overwriting an existing installation. Make sure to uninstall any existing version of GAM before reinstalling GAM.

Depending on the system configuration, the SNMP service may be stopped after installing or uninstalling GAM. Restart the OS after installing or uninstalling GAM.

During the GAM installation, you may be prompted to enter appropriate information. In such cases, follow the instructions on the screen to proceed.

If Service Pack 1 of Windows Server 2003 has been applied, the following message may pop up when restarting the system just after installing or uninstalling GAM.

> A problem has been detected and Windows has shut down to prevent damage to your computer.
> Name: SNMP Service

There will be no problem with operations. Click [Close] to close the message.

To record events in OS event logs, make sure to install ServerView and configure the event-logging settings. For details, see “ServerView Users Guide”.

**4.4.1 How to Install GAM**

Perform the following procedure to install GAM.

1. Log on to Windows with Administrator privileges.

2. Before installing GAM, complete the following preparation:
   - Check that TCP/IP is installed and working properly.
   - Check that ServerView is installed and working properly.
   - Insert the "Array Controller IME SAS Document & Tool CD" provided with this product into the CD-ROM drive.
   - Exit all applications.

   **IMPORTANT**

   Exit all applications before starting the installation. In particular, if you install the software while Event Viewer or Computer Management is running, the installation may fail.

3. Click [Start] → [Run...]. Enter the following path and click [OK].
   [CD-ROM drive]:\RAIDTOOL\GAM\Windows\install.bat
   The Global Array Manager Setup wizard starts up.

   The [Software License Agreement] screen appears.
5 Click [Yes].
The [Select Components] screen appears.
Make sure the boxes next to [Global Array Manager Server] and [Global Array Manager Client] are checked.

6 Select [Global Array Manager Server] and click [Change].
The [Select Sub-components] screen appears.
Make sure [Program Files] and [SNMP] are checked.

7 Confirm the settings and click [Continue].
The [Select Components] screen appears again.

8 Click [Next].
The [Choose Destination Location] screen appears.

9 Click [Next].
The installation location for GAM is displayed.
If GAM Client is already installed, a warning message will appear to confirm overwriting. After clicking [Cancel] to close the warning message box, click [Cancel] and then [Exit Setup] to quit the GAM setup. If the command prompt is displayed, click the [X] button to close the command prompt. After uninstalling GAM Client, perform the installation again.

10 Confirm the installation location and click [Next].
The files are copied.

11 Specify the client receiving events from GAM Server.
In the text box, enter the name of the computer where GAM Client is being installed and click [Next].

The [Server Event Logging] screen appears.

- If GAM Client is installed on the same computer as GAM Server, enter the name of the server.
- To specify multiple clients receiving events, enter the servers' computer names or IP addresses separated by spaces. You can specify up to 25 clients receiving events at a time.

- If the IP address or computer name of the Client is changed after GAM Server has been installed, events cannot be correctly notified. In this case, GAM Server needs to be first uninstalled and then reinstalled. (If the IP address is automatically obtained from the DHCP server, the IP address may be changed depending on the timing when the system is turned on/off or restarted.)

12 Make sure [Enable event logging on the server machine] is checked and click [Next].

- This option must be enabled.
13 When the full pathname of the configuration file appears, click [OK].
   The [Setup Complete] screen appears.

14 Click [Finish] to exit.
   Following the message displayed at the command prompt, press the [Enter] key to close the
   command prompt.

15 Restart the system.

16 After the restart, create the user account "gamroot" with GAM Administrator
   privileges and a user account with GAM User privileges (e.g. gamuser) as
   Windows user accounts.
   Assign the user account "gamroot" to the Administrators group.

   **IMPORTANT**
   - When creating the account with GAM Administrator privileges, uncheck the [User must
     change password at next logon] checkbox.
   - Also check the [Password never expires] checkbox.
   - If you do not make the above settings, you may be unable to sign on to GAM.

   **POINT**
   - Create each user account as an OS user account.

4.4.2 Local Logon Settings on a Domain Controller

   If Windows Server 2003 or Windows 2000 Server is used as a domain controller, it is necessary to set
   the local logon privileges to the user account you use to sign on to GAM.
   Configure the settings according to the following procedure.

   **POINT**
   - Attempting to sign on to GAM with a user account that does not have local logon privileges will fail
     even if the user name and password are entered correctly.

1 Click [Start] → [Programs] → [Administrative Tools] → [Domain Controller
   Security Policy].

2 Double-click [Security Settings].

3 Double-click [Local Policies].

4 Double-click [User Rights Assignment].

5 Double-click [Log on locally].

6 Click [Add].
7 Click [Browse].
8 Select the user account you will use to sign on to GAM and click [Add].
9 Click [OK].
10 Click [OK].
   The [Add User or Group] window closes.
11 Click [OK].
12 Open [Command Prompt] and run the following command.
   - For Windows Server 2003
     \C:\>gupdate
   - For Windows 2000 Server
     \C:\>secedit /refreshpolicy MACHINE_POLICY

### 4.4.3 Uninstalling GAM

Perform the following procedure to uninstall GAM.

* IMPORTANT

   Normally, do not uninstall GAM Server or GAM Client.

#### Uninstalling GAM Client

1 Log on to Windows with Administrator privileges.

  * POINT
    - Exit all programs before starting the uninstallation.
      If uninstalling the software while Event Viewer or Computer Management is running, the
      uninstallation will fail. Make sure to exit all programs.

2 Click [Start] → [Settings] → [Control Panel].

3 Double-click [Add or Remove Applications] (or [Add or Remove Programs] depending on the OS).

4 Select [Mylex Global Array Manager Client v.n.nn-nn] from the application list
   and click [Change/Remove].
   The message "Are you sure you want to completely remove 'Mylex Global Array Manager Client
   vn.nn-nn' and all of its components?" appears.

5 Click [Yes].
   The uninstallation process starts.
6 When the uninstallation is finished, click [OK].

**Uninstalling GAM Server**

1 Log on to Windows with Administrator privileges.

POINT

- Exit all programs before starting the uninstallation.
- If uninstalling the software while Event Viewer or Computer Management is running, the uninstallation will fail. Make sure to exit all programs.

2 Click [Start] → [Settings] → [Control Panel].

3 Double-click [Add or Remove Applications] (or [Add or Remove Programs] depending on the OS).

4 Select [Mylex Global Array Manager Server v.x.xx-xx] from the application list and click [Change/Remove].
   The message "Are you sure you want to completely remove 'Mylex Global Array Manager Server v.x.xx-xx' and all of its components?" appears.

5 Click [Yes].
   The uninstallation process starts.

6 When the uninstallation is finished, click [OK].

7 Restart the system.
You can manage the disk array with GAM. Read this chapter carefully before use.

5.1 Starting and Exiting GAM ................................. 68
5.2 GAM Window Layout ................................. 70
5.3 Server group and server settings ......................... 77
5.4 Viewing Information ................................. 78
5.5 Rebuild ........................................ 86
5.1 Starting and Exiting GAM

This section explains how to start and exit GAM.

5.1.1 Starting GAM

To start GAM, click [Start] → [Programs] (or [All Programs] in Windows Server 2003) → [Mylex Global Array Manager Client]. If a server group or server is already defined, [Global Status View] appears.

- When GAM is started for the first time after the installation, the [Define Server Groups] window appears. See "5.3 Server group and server settings" (→ pg.77) to make the settings.
- Only start GAM Client when management or maintenance of arrays is necessary. From a security point of view, it is not recommended to run GAM Client continuously. While signing on from GAM Client, if the accessed server shuts down, GAM Client cannot communicate with GAM Server and cannot respond, which prevents the user from operating it. In that case, wait for the GAM Server that is to be accessed to start up again, or forcibly exit GAM Client.

POINT

- GAM starts with Guest privileges. To use User or Administrator privileges, you have to sign on.

5.1.2 Signing On

GAM requires user authentication to limit the availability of functions according to uses. You have to sign on to GAM to obtain User access privileges or higher.

When you double-click the server icon in the [Global Status View] window, or perform operations that require Administrator privileges, the following [Sign On] window is automatically displayed.

POINT

- You can also open the [Sign On] window by selecting [Sign On] from the [Administration] menu.
- If the GAM Client and GAM Server are installed on different servers (for a Linux system, etc.), enter the password for the GAM Server.
Perform the following procedure to sign on.

1 **Enter your user name.**
   - When signing on with User privileges
     Enter a user name in [Username].
   - When signing on with Administrator privileges
     Enter "gamroot" in [Username].

2 **Enter a password in [Password].**
   If [Remember password for this session] is checked, uncheck it.

   > **POINT**
   > Note that if this option is checked, you can automatically sign on to different servers. To avoid automatically accessing servers, it is recommended to keep this option unchecked.

3 **Click [Sign-on].**

   > **POINT**
   > If Windows is used as the domain controller, you have to set the local logon rights to the user accounts used to sign on to GAM. If the local logon rights are not set, you cannot sign on to GAM.
   > See "4.4.2 Local Logon Settings on a Domain Controller" (pg.63).
   > GAM restricts the availability of functions according to access privileges. For access privileges, see "4.1.3 Access Privileges to GAM" (pg.56).

### 5.1.3 Exiting GAM

To exit GAM, click [Exit] from [File] in the GAM menu bar.
Chapter 5 Using GAM

5.2 GAM Window Layout

The following provides a description of the windows, buttons, and menu items displayed when using GAM.

5.2.1 Startup Window Layout and Functions

When GAM is started, a window consisting of [Global Status View] and [Log Information Viewer] appear.

- **Menu Bar**
  Allows you to perform GAM functions such as Controller View and RAID Assist.
  For details on the GAM menus, see "5.2.2 Menu Layout and Functions" (→pg.72).

- **Toolbar**
  Buttons for frequently used GAM functions.
  For details on the toolbar, see "5.2.3 Toolbar Icons" (→pg.74).

- **Server Group Selection Box**
  Allows you to select the server group to be managed. Clicking ▼ displays a box listing the names of the server groups connected to the current client workstation.

- **Controller Selection Box**
  Allows you to select the array controller to be operated. Clicking ▼ displays the onboard array controller connected to the currently selected server, or the controller ID and type (e.g. Integrated Mirroring SAS) of the array card.
Global Status View

Displays the servers in the currently selected server group.

■ Server Icon

Displays the server status.

Server name (e.g. PRIMERGY) or IP address (e.g. 192.168.1.5)
OS (e.g. W2K3: Windows Server 2003, Linux: Linux)
Status of the server

The server status icon is displayed as follows.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Color</th>
<th>Server Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Green Icon" /></td>
<td>Green</td>
<td>Normal.</td>
</tr>
<tr>
<td><img src="image2" alt="Yellow Icon" /></td>
<td>Yellow</td>
<td>Waiting for server connection.</td>
</tr>
<tr>
<td><img src="image3" alt="Red Icon" /></td>
<td>Red</td>
<td>The server is down or disconnected. The following are possible causes. • Network malfunction. • No power on the server. • The server IP or host name has been changed. • GAM Server is not installed or not running on the server.</td>
</tr>
</tbody>
</table>

■ Controller Icons

Indicates the array controller status on the servers. Controller Icons are displayed to the right of the server icons. The numbers in the parentheses show the numbers of connected array controllers. The array controllers have the following statuses.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Color</th>
<th>Array Controller Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Green Icon" /></td>
<td>Green</td>
<td>The array controller and the logical drives under the controller are operating normally.</td>
</tr>
<tr>
<td><img src="image5" alt="Yellow Icon" /></td>
<td>Yellow</td>
<td>The array controller and the logical drives under the controller are in Critical status, or there is trouble with the connected hard disk drives.</td>
</tr>
<tr>
<td><img src="image6" alt="Red Icon" /></td>
<td>Red</td>
<td>The array controller or the logical drive under the controller is not operating properly.</td>
</tr>
</tbody>
</table>
Log Information Viewer
Displays events on the array controller.

<table>
<thead>
<tr>
<th>Events</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event ID</td>
<td>The level of the event to be reported is indicated with an icon that signifies Information, Caution, Warning, or Others. The ID assigned to the event being reported is also displayed.</td>
</tr>
<tr>
<td>Severity</td>
<td>Priority level of the event.</td>
</tr>
<tr>
<td>Source</td>
<td>IP address or name of the server that sent the event.</td>
</tr>
<tr>
<td>Source Time</td>
<td>Time when the event occurred.</td>
</tr>
<tr>
<td>Device Address</td>
<td>Other data regarding the addresses of related devices, operations in question, and the reason why the event was sent.</td>
</tr>
<tr>
<td>Description</td>
<td>Event description.</td>
</tr>
<tr>
<td>Sequence (Seq)</td>
<td>Event sequence number.</td>
</tr>
<tr>
<td>Local Time</td>
<td>Time when the event occurrence was signaled to GAM Client.</td>
</tr>
</tbody>
</table>

**IMPORTANT**

- Log Information Viewer only shows events that occur while the GAM Client is running.
  To see all the events that have occurred on the array controller, refer to the event log for the operating system.

5.2.2 Menu Layout and Functions

This section describes the function of the GAM menu items.

### [File] Menu

<table>
<thead>
<tr>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Configuration</td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td>Save Configuration</td>
<td>Saves the current RAID configuration in a file. This controller does not support this function yet.</td>
</tr>
<tr>
<td>Clear Configuration</td>
<td>Clears all the RAID configurations of the currently selected array controller. This array controller does not support this function.</td>
</tr>
</tbody>
</table>

**IMPORTANT**

- The above menus are only available when you sign on with Administrator privileges to open the [Controller View].

**POINT**

- Executing [Open Configuration] or [Clear Configuration] deletes the existing array configurations and all the data on the logical drives. Do not perform these operations unless directed by your maintenance engineer.
### [View] Menu

<table>
<thead>
<tr>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Status View</td>
<td>Displays the [Global Status View] window. With the default settings, [Global Status View] opens automatically when GAM starts up.</td>
</tr>
<tr>
<td>Controller View</td>
<td>Displays the [Controller View] window. Displays information for each device and the status of hard disk drives or logical drives connected to the controller.</td>
</tr>
<tr>
<td>Log Information Viewer</td>
<td>Displays the [Log Information Viewer] window. This window shows events or errors that occurred in the array controller. [Log Information Viewer] opens automatically when GAM Client starts up.</td>
</tr>
<tr>
<td>Foreground Initialize Status</td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td>Background Initialize Status</td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td>Rebuild Status</td>
<td>Shows the rebuild progress. This can only be selected while a rebuild is in progress.</td>
</tr>
<tr>
<td>Make Data Consistent Status</td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td>Expand Capacity Status</td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td>Patrol Read Status</td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td>Error Table</td>
<td>This function is not supported. Do not use it.</td>
</tr>
</tbody>
</table>

### [Administration] Menu

<table>
<thead>
<tr>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sign On</td>
<td>Allows you to sign on when using GAM's monitoring and setting functions. Signing on with a User account registered on the server enables you to use the monitoring function (available with User privileges). Signing on with &quot;gamroot&quot; enables you to use GAM's setting and management functions (available with Administrator privileges).</td>
</tr>
<tr>
<td>Define Server Groups</td>
<td>Sets a server group and the names or IP addresses of servers in the group.</td>
</tr>
<tr>
<td>Select Current Server Group</td>
<td>Selects a server group. Functions in the same manner as when the [Server Selection] box is operated directly.</td>
</tr>
<tr>
<td>RAID Assist</td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td>Initialize Logical Drives</td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td>Controller Information</td>
<td>Displays the main information for the currently selected array controller.</td>
</tr>
<tr>
<td>Enclosure Information</td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td>Controller Options</td>
<td>This function is not supported. Do not use it.</td>
</tr>
</tbody>
</table>
5.2.3 Toolbar Icons

The toolbar icons at the top of the [GAM] window enable you to start up frequently used functions.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Icon" /></td>
<td>Displays the [RAID Assist] window and starts creating a RAID configuration. Functions in the same manner as when [RAID Assist] is selected from the [Administration] menu.</td>
</tr>
<tr>
<td><img src="image2" alt="Icon" /></td>
<td>Rescans the devices. Functions in the same manner as when [Scan Devices] is executed from the [Administration] menu.</td>
</tr>
<tr>
<td><img src="image3" alt="Icon" /></td>
<td>Displays array controller information. Functions in the same manner as when [Controller Information] is selected from the [Administration] menu.</td>
</tr>
<tr>
<td><img src="image4" alt="Icon" /></td>
<td>This function is not supported. Do not use it.</td>
</tr>
<tr>
<td><img src="image5" alt="Icon" /></td>
<td>Opens the [Sign On] window. Functions in the same manner as when [Sign On] is selected from the [Administration] menu.</td>
</tr>
<tr>
<td><img src="image6" alt="Icon" /></td>
<td>This function is not supported.</td>
</tr>
<tr>
<td><img src="image7" alt="Icon" /></td>
<td>Displays Help.</td>
</tr>
</tbody>
</table>
5.2.4 Startng Controller View and the Window Layout

The [Controller View] window enables you to monitor the status of hard disk drives or logical drives. To open the [Controller View] window, select [Controller View] from the GAM [View] menu (→ pg. 73). If the [Sign On] window opens, sign on referring to "5.1.2 Signing On" (→ pg. 68). The following window appears.

The [Controller View] window shows the information below regarding the controller currently selected in the [Controller Selection] box.
● Hard disk drive
Displays information about each hard disk drive.

The hard disk status icon is displayed as follows.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Color</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Green Icon" /></td>
<td>Green</td>
<td>Normal. (Online)</td>
</tr>
<tr>
<td><img src="image" alt="Red Icon" /></td>
<td>Red</td>
<td>The hard disk drive has a failure or is unrecognized. (Dead / Offline)</td>
</tr>
<tr>
<td><img src="image" alt="Yellow Icon" /></td>
<td>Yellow</td>
<td>Rebuild in progress. (Rebuilding)</td>
</tr>
<tr>
<td><img src="image" alt="Yellow Icon" /></td>
<td>Yellow</td>
<td>Failure expected. (Critical) State of PFA Count not 0.</td>
</tr>
<tr>
<td><img src="image" alt="Not Applied Icon" /></td>
<td>Not applied</td>
<td>Unused or available. (Unconfigured)</td>
</tr>
</tbody>
</table>

POINT

- Double-click the icon for each hard disk drive to see more detailed information. For more details, see "5.4.3 Viewing Hard Disk Drive Information" (→pg.82).
- If a hard disk drive is in a unrecognizable state, detailed information may not be displayed even when double-clicking its hard disk drive icon.

● Logical Drives
Displays information about each logical drive.

The logical drive status icon is displayed as follows.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Color</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Green Icon" /></td>
<td>Green</td>
<td>Normal. (Online)</td>
</tr>
<tr>
<td><img src="image" alt="Yellow Icon" /></td>
<td>Yellow</td>
<td>Operating without redundancy. (Critical)</td>
</tr>
<tr>
<td><img src="image" alt="Red Icon" /></td>
<td>Red</td>
<td>Not available. (Offline)</td>
</tr>
<tr>
<td><img src="image" alt="Green Icon" /></td>
<td>Green</td>
<td>Regenerating redundant data on the logical drive.</td>
</tr>
</tbody>
</table>

POINT

- Double-click the icon of each logical drive to see more detailed information. For more details, see "5.4.4 Viewing Logical Drive Information" (→pg.84).
5.3 Server group and server settings

The [Server Group Setting] window automatically opens when the GAM Client is started for the first time. Add a server group and servers according to the following procedures:

1. Click the [Add] button below the [Server Groups] area.
2. Enter a name for the server group to be added using the [Adding Item] window.
3. Click [OK].
   The added server group name is displayed in the [Server Groups] area.
4. Select the added server group and click the [Add] button below the [Servers] area.
   The [Adding Item] window is displayed.
5. Enter the name or the IP address of the server computer that you want to monitor in the [Adding Item] window.
   - Do not specify "localhost" or the loopback address "127.0.0.1" as the computer name or the IP address of the server to be monitored.
6. Click [OK].
   The entered server name is added in the [Server] area.
7. Click [OK] to close the [Define Server Groups] window.
   Confirm that the registered server appears in [Global Status View].
   - You can also set a server group by selecting [Define Server Groups] from the [Administration] menu (→pg.73).
Chapter 5 Using GAM

5.4 Viewing Information

The following information can be viewed using GAM.

- Information about events or errors that have occurred: "Appendix A A List of GAM Error Codes" (→ pg.102)
- Array configuration or controller information: "5.4.2 Viewing Array Controller Information" (→ pg.80)
- Hard disk drive information: "5.4.3 Viewing Hard Disk Drive Information" (→ pg.82)
- Logical drive information: "5.4.4 Viewing Logical Drive Information" (→ pg.84)

5.4.1 Events

GAM monitors the operation of array controllers and hard disk drives connected to the controllers. If a behavior that should be treated as an event (a serious event such as a hard disk drive failure) is found, GAM is notified of that event.

Events such as disk array system errors, information, or management tasks are displayed in the [Log Information Viewer].

- For monitoring array controllers, use the OS event log (the application log; Source: Fujitsu ServerView Services). However, if the GAM Client has not been started, or if the network has a failure, [Log Information Viewer] cannot monitor the log for events that occur in the array controller.

- To enter events or errors into the event logs of the operating system, it is necessary to install ServerView. See the "User's Guide" in the "PRIMERGY Document & Tool CD" supplied with the server to install and configure ServerView.

  The GAM Server records detailed information about events that occur in the file "GAMEVLOG.LOG". This file may be used when investigation is necessary. The path where "GAMEVLOG.LOG" is stored is as follows, depending on the OS:
  - For Windows Server 2003 / Windows 2000 Server:
    [%SystemRoot%\System32\Gamserv\GAMEVLOG.LOG]
  - For Windows Server 2003 x64:
    [%SystemRoot%\Syswow64\Gamserv\GAMEVLOG.LOG]
  - For Linux:
    [var/log/gamevlog.log]

  While GAM Client is running, if the IP address of the server to be monitored is changed or the LAN connection is disconnected, the "Lost connection to server, or server is down" message will be recorded every 10 minutes. In such cases, confirm the network status and that the GAM Server is working properly, and then restart the GAM Client.

  If the IP address or computer name of the Client is changed after the installation of the GAM Server, events cannot be correctly notified. In this case, GAM Server needs to be first uninstalled and then reinstalled. (If the IP address is automatically obtained from the DHCP server, the IP address may be changed depending on the timing when the system is turned on/off or restarted.)
Log Information Viewer

Log Information Viewer is automatically displayed when the GAM Client is started and an array controller is detected.

POINT

- The event histories displayed in the Log Information Viewer are stored in the file GAM2CL.LOG. This file may be used when investigation is necessary. (Viewing or monitoring of this log file is not supported.)

To manually open the Log Information Viewer, select [Log Information Viewer] from the [View] menu. For the meaning of each item displayed in the Log Information Viewer, see "5.2.1 Startup Window Layout and Functions" (+pg.70).

Displaying Detailed Information about Each Event

When detailed information about an event displayed in Log Information Viewer is needed, open the [Event Information] window.

To open the [Event Information] window, double-click the event in the Log Information Viewer.

Detailed information about the selected event is displayed.

POINT

- Click [OK] to close the window.
5.4.2 Viewing Array Controller Information

■ Using Controller View

Using Controller View, you can view the status of the array controller and the hard disk drives or logical drives connected to the controller. For how to start Controller View, and for details about its icons, see "5.2.4 Starting Controller View and the Window Layout" (pg.75).

■ Displaying Detailed Information about the Array Controller

1. Start up GAM and sign on.
   \rightarrow "5.1 Starting and Exiting GAM" (pg.68)

2. Select [Controller Information] from the [Administration] menu.
   The [Controller Information] window appears.

   ![Controller Information Window]

   - Click [Close] to close the window.

POINT

- Click [Close] to close the window.
## Detailed Information about Array Controllers

The following information is displayed.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>The model name of the array controller.</td>
</tr>
<tr>
<td>Firmware Version</td>
<td>The version of the array controller's firmware.</td>
</tr>
<tr>
<td>Intelligent BBU</td>
<td>Indicates whether there is a battery backup unit for the array controller. For this array controller, the value is always displayed as &quot;No&quot;.</td>
</tr>
<tr>
<td>Package Version</td>
<td>This item is not supported.</td>
</tr>
<tr>
<td>BIOS Version</td>
<td>The version of the array controller's BIOS.</td>
</tr>
<tr>
<td>Cache Size</td>
<td>The cache size of the array controller.</td>
</tr>
<tr>
<td>FlashROM Size</td>
<td>The size of the array controller's FlashROM.</td>
</tr>
<tr>
<td>Bus Type</td>
<td>The type of the host-side bus.</td>
</tr>
<tr>
<td>Channels</td>
<td>This item is not supported.</td>
</tr>
<tr>
<td>Physical Devices</td>
<td>The number of hard disk drives connected to the array controller.</td>
</tr>
<tr>
<td>Max. Physical Devices</td>
<td>This item is not supported.</td>
</tr>
<tr>
<td>Logical Drives</td>
<td>The number of logical drives.</td>
</tr>
<tr>
<td>Max. Logical Drives</td>
<td>This item is not supported.</td>
</tr>
<tr>
<td>Bus</td>
<td>The bus number for the array controller.</td>
</tr>
<tr>
<td>Device #</td>
<td>The device number for the array controller.</td>
</tr>
<tr>
<td>IRQ</td>
<td>The IRQ number.</td>
</tr>
</tbody>
</table>
5.4.3 Viewing Hard Disk Drive Information

Using Controller View, you can view detailed information about the hard disk drives connected to the controller channels.

1  Start up GAM and sign on.
   ⇒ "5.1 Starting and Exiting GAM" (pg.68)

2  Select [Controller View] from the [View] menu.
   ⇒ "5.2.4 Starting Controller View and the Window Layout" (pg.75)

3  Double-click the icon for the hard disk drive to see the information about it.
   Detailed information about the selected hard disk drive is displayed.

![Disk Device Information](image)

POINT
- The channel, target and LUN information displayed in the title bar is not supported.
- Click [Close] to close the window.

### Detailed Information about Hard Disk Drives
The following information is displayed.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendor</td>
<td>Information about the hard disk drive vendor.</td>
</tr>
<tr>
<td>Product</td>
<td>The part number of the hard disk drive.</td>
</tr>
<tr>
<td>Revision</td>
<td>The revision number of the hard disk drive's firmware.</td>
</tr>
<tr>
<td>Bus Width</td>
<td>This information is not supported. (Always displayed as &quot;0 bits&quot;).</td>
</tr>
<tr>
<td>Sync</td>
<td>This information is not supported. (Always displayed as &quot;No&quot;).</td>
</tr>
</tbody>
</table>
### Function Buttons

You can perform the following operations using the buttons.

- **[Rebuild]** button
  This button is only enabled when the status of the hard disk drive is "Offline". Click this button to perform a rebuild of the hard disk drive.
  →"5.5 Rebuild" (pg.86)
- **[Make Online]** button
  This array controller does not support this function. Do not select this.
- **[Make Ready]** button
  This array controller does not support this function. Do not select this.
- **[Make Offline]** button
  Forces a change of the hard disk drive status to "Offline".
  > Do not use the [Make Offline] button unless you are instructed to do so by your maintenance engineer.
- **[Locate]** button
  Makes the failure lamp of the hard disk drive flash to indicate the drive's location.
- **[Close]** button
  Closes the detailed hard disk drive information window.

### Table: Detailed Information about Hard Disk Drives

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linked</td>
<td>This information is not supported. (Always displayed as &quot;Yes&quot;.)</td>
</tr>
<tr>
<td>Soft Reset</td>
<td>This information is not supported. (Always displayed as &quot;No&quot;.)</td>
</tr>
<tr>
<td>ANSI Version</td>
<td>This information is not supported. (Always displayed as &quot;SCSI-3&quot;.)</td>
</tr>
<tr>
<td>CmdQue</td>
<td>This information is not supported. (Always displayed as &quot;Yes&quot;.)</td>
</tr>
<tr>
<td>Serial</td>
<td>The serial number of the hard disk drive.</td>
</tr>
<tr>
<td>Nego. Transfer Speed</td>
<td>This information is not supported. (Always displayed as &quot;0 MB/Sec&quot;.)</td>
</tr>
<tr>
<td>Nego. Bus Width</td>
<td>This information is not supported. (Always displayed as &quot;0 bits&quot;.)</td>
</tr>
<tr>
<td>Sector Size</td>
<td>The sector size.</td>
</tr>
<tr>
<td>Physical Capacity</td>
<td>The physical capacity of the hard disk drive.</td>
</tr>
<tr>
<td>Config. Size</td>
<td>The hard disk drive's available capacity when connected to this controller.</td>
</tr>
</tbody>
</table>
| Status | The current status of the hard disk drive.  
For details about the status, see "Hard Disk Status" (➔pg.13). |
| Soft Errors / Parity Errors / Hard Errors / Misc Errors | These items are not supported. (Not displayed.) |
| PFA Count | The counter for the S.M.A.R.T. failure predictions for the hard disk drive. |
### 5.4.4 Viewing Logical Drive Information

Using Controller View, you can view detailed information about the defined logical drives. The logical drives are displayed to the right in the [Controller View] window. Each icon represents one logical drive (also called Logical Unit or System Drive).

1. **Start up GAM and sign on.**
   → "5.1 Starting and Exiting GAM" (pg. 68)

2. **Select [Controller View] from the [View] menu.**
   → "5.2.4 Starting Controller View and the Window Layout" (pg. 75)

3. **Double-click the icon of a logical drive to see the information about it.**
   Detailed information about the selected logical drive is displayed.

![Logical Drive Information](image)

- The logical drive number is displayed on the title bar.
- This array controller does not support above function buttons. Do not select these buttons.
- Click [Close] to close the window.
# Detailed Information about Logical Drives

The following information is displayed.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID Level</td>
<td>The RAID level set for the logical drive. (Always displayed as &quot;1&quot;).</td>
</tr>
<tr>
<td>Fault Tolerant</td>
<td>Indicates whether or not the logical drive has redundancy. (Always displayed as &quot;Yes&quot;).</td>
</tr>
<tr>
<td>Optimized for Speed</td>
<td>Indicates whether or not the logical drive's priority is placed on speed. (Always displayed as &quot;No&quot;).</td>
</tr>
<tr>
<td>Optimized for Capacity</td>
<td>Indicates whether or not the logical drive's priority is placed on capacity. (Always displayed as &quot;No&quot;).</td>
</tr>
<tr>
<td>Logical Size</td>
<td>The logical size of the logical drive.</td>
</tr>
<tr>
<td>Physical Size</td>
<td>The physical size of the logical drive.</td>
</tr>
<tr>
<td>Stripe Size</td>
<td>The striping size used by the logical drive.</td>
</tr>
<tr>
<td>Status</td>
<td>The current status of the logical drive. For details about the status, see &quot;Logical Drive Status&quot; (pg.13).</td>
</tr>
<tr>
<td>Write Cache</td>
<td>The current write policy set for the logical drive.</td>
</tr>
<tr>
<td>Used Array Capacity</td>
<td>Displays the ratio of the logical drive's capacity to the disk group's total capacity.</td>
</tr>
</tbody>
</table>
5.5 Rebuild

To execute a manual rebuild, perform the following procedure.

1 Start up GAM and sign on.
   ⇒ "5.1 Starting and Exiting GAM" (pg.68)

2 Select [Controller View] from the [View] menu.
   ⇒ "5.2.4 Starting Controller View and the Window Layout" (pg.75)

3 Double-click the icon of a hard disk drive with "Dead" status (Dead) in the [Controller View] window.
   The detailed information about the hard drive is displayed in the [Disk Device Information] window.

4 Click [Rebuild].
   Rebuild starts.
   When the rebuild is finished, the following window appears and the hard disk drive and the related logical drives are restored to Online status.

5 Click [OK] to exit.
Rebuild Status

When a rebuild is in progress, you can check its progress by selecting [Rebuild Status] from the [View] menu.

Click [Close] to close the [Rebuild Status] window.

Do not cancel the rebuild.

Calculating the Approximate Time Needed for a Rebuild

Referring to the progress bar in the [Rebuild Status] window, you can figure out approximately how long the task will take from start to finish.

1 Measure the period of time required for the progress bar to advance 1%.

2 Calculate the approximate time that the rebuild takes from start to finish, using the following formula.
   \[(\text{Period measured in step 1}) \times 100\]

Use the calculated time only as a guideline. The actual time may be different from the calculated time depending on the system load and other factors.
Chapter 6
Replacing a Hard Disk Drive

This chapter explains maintenance related issues, such as hard disk drive replacement.

6.1 Checking the Hard Disk Drive to Replace ................. 90
6.2 Replacing a Failed Hard Disk Drive ...................... 92
6.3 Preventive Replacement of a Hard Disk Drive .......... 94
6.1 Checking the Hard Disk Drive to Replace

Confirm the slot ID of the target hard disk drive before replacing the hard disk drive.

- This section only explains the procedure for confirming the slot ID when an array is configured with redundancy (RAID 1). When the hard disk drive is used without redundancy (used as stand-alone), determine the slot ID by referring to the OS event log, etc. Normally, slot ID 0 is assigned to the system boot drive.

1 Start up GAM and sign on.
   → "5.1 Starting and Exiting GAM" (pg.68)

2 Select [Controller View] from the [View] menu.
   → "5.2.4 Starting Controller View and the Window Layout" (pg.75)

3 Check the displayed icon for the hard disk drive.

   A failed hard disk drive is indicated with the icon.

   A hard disk drive that has been predicted to fail is indicated with the icon.

   The slot ID can be confirmed at the following location on the hard disk drive icon.

   Slot ID
   In this case, the Slot ID is "1".

- If there are any hard disk drives being rebuilt (indicated with ), wait until the rebuild is finished. After the rebuild has finished, check the hard disk drive status again.

4 Double-click the hard disk drive icon to confirm detailed information.

   Detailed information about the selected hard disk drive is displayed.

   If the [PFA Count] in the [Device Errors] field is displayed as [Found], a failure prediction warning (S.M.A.R.T.) has been detected.

   - The detailed information may not be displayable depending on the failure condition of the hard disk drive.
5 If there is a failed hard disk drive or a hard disk drive that is predicted to fail, replace it using the following procedures.

If there is a failed hard disk drive
See “6.2 Replacing a Failed Hard Disk Drive” (p.92) to replace the hard disk drive.

If there is a hard disk drive that is predicted to fail
See “6.3 Preventive Replacement of a Hard Disk Drive” (p.94) to replace the hard disk drive with the failure prediction warning.

**IMPORTANT**

If there are both a failed hard disk drive and a drive that is predicted to fail
- First, replace the failed hard disk drive and perform a rebuild. After that, confirm that the status of the replaced hard disk drive shows no failure, and then perform a preventive replacement of the failure-predicted hard disk drive.
- If the hard disk drive that is predicted to fail is replaced before the failed hard disk drive, rebuild cannot be performed and data will be lost.

**POINT**

- It is also possible to check failed hard disk drives from the BIOS Utility. Start up the BIOS Utility and check the status on the [View Array] screen. For more details, see “2.3.2 Viewing Information on the Logical Drive and the Hard Disk Drives” (p.29).
6.2 Replacing a Failed Hard Disk Drive

If a hard disk drive fails, it must be replaced with a new one as soon as possible.

**POINT**

- For how to remove and install hard disk drives, see the "User's Guide" on the "Document & Tool CD" supplied with the server.

**IMPORTANT**

- This section explains only the procedure for replacing hard disk drives configured with redundancy (RAID 1). When replacing hard disk drives without redundancy (used as stand-alone), perform the following procedure:
  1. If possible, back up all the data on the hard disk drive that is to be replaced.
  2. Turn off the server and replace the hard disk drive.
  3. Restore any backup data, such as those backed up in step 1.
- Replace the failed hard disk drive with a new one of the same model (with the same capacity and speed).
- When connecting a hard disk drive that has previously been used in a disk array configuration on a general host adapter, perform a low level format of the hard disk drive on the host adapter in advance.
- Never remove any hard disk drives while the server is turned on, except to replace a failed drive.

1. Confirm the slot ID of the failed hard disk drive and locate the drive.
   See Steps 1 to 3 in → "6.1 Checking the Hard Disk Drive to Replace" (pg.90).

2. Confirm that the hard disk drive failure lamp is lit for the bay corresponding to the failed hard disk drive on the server.

3. Pull out the hard disk drive identified in step 2 about an inch (1 to 3 cm) to disconnect it from the connector.
   For how to remove hard disk drives, see the "User's Guide" on the "PRIMERGY Document & Tool CD" supplied with the server.
   - Do not pull out the hard disk drive completely from the server at this point.

4. Wait at least one minute until the hard disk drive motor has stopped spinnings.

5. Pull out the failed hard disk drive completely from the hard disk drive bay.
6 Install a new hard disk drive in the hard disk drive bay where the failed hard disk drive was previously installed.
Shortly after the installation, the new hard disk drive is recognized and displayed in the [Controller View].

POINT

- If the new hard disk drive is not displayed in the [Controller View], execute [Scan Devices] from the [Administration] menu.

7 Double-click the icon of the newly installed hard disk drive in the [Controller View] window.
The detailed information about the hard disk drive is displayed in the [Disk Device Information] window.

8 Click [Rebuild] to perform a rebuild.
When the rebuild is started, the hard disk drive's failure lamp that was lit starts flashing, and then turns off when the rebuild is completed.
After the rebuild is finished, double-click the icon of the newly installed hard disk drive in the [Controller View] window to confirm that the status has changed from "Dead" to "Online".

POINT

- On this array controller, rebuild does not start automatically.
- When the following event is recorded in the OS event log, or in the Log Information Viewer of the GAM Client, the rebuild is completed.
  - For Log Information Viewer
    
    I-7  ctl:x chn:x tgt:x  Rebuild is over.
  - For OS Event Log

    Source : Fujitsu ServerView Service
    Type : Information
    Event ID : 1
    Description: [ctl:x chn:x tgt:x] Rebuild is over.

To confirm the completion of rebuild in GAM Client, do not close GAM Client until the rebuild is completed.

- For the approximate time to complete the rebuild, see "Time Required for Rebuild" (pg.14) or "Calculating the Approximate Time Needed for a Rebuild" (pg.87).
- If the server is restarted or shut down during the rebuild, the rebuild will resume from the stage where the process stopped the next time the system starts up.
- The rebuild may not start even if [Rebuild] is clicked. In this case, perform [Scan Devices] that can be selected from the [Administration] menu, and perform the rebuild again.
- If the replacement hard disk drive is recognized as good, data is written to it even before the rebuild. In this case, the hard disk drive access lamp on the server flashes, but there is no problem.
6.3 Preventive Replacement of a Hard Disk Drive

When the hard disk drive failure prediction function (PFA/S.M.A.R.T.) reports a hard disk drive as "Critical", it means that the drive may fail in the near future. If the hard disk drive status becomes "Critical", replace that drive as a preventive measure.

For how to remove and install hard disk drives, see the "User's Guide" on the "Document & Tool CD" supplied with the server.

Replace the hard disk drive that is predicted to fail with a new one of the same model (with the same capacity and speed).

We recommend that you back up the data before performing preventive replacement of a hard disk drive.

When both hard disk drives are predicted to fail, replace one drive at a time.

When one of the hard disk drives has failed, replace that drive first, referring to "6.2 Replacing a Failed Hard Disk Drive" (pg.92). If any hard disk drive is being rebuilt, wait until the rebuild process is finished.

6.3.1 Checking Availability of Redundancy

The preventive replacement procedure of a hard disk drive is different depending on whether it is operating in redundant configuration or not.

- When operating in a redundant configuration (RAID 1)
  - "6.3.2 When Operating in a Redundant Configuration (RAID 1)" (pg.96)
- When operating in a non-redundant configuration
  - "6.3.3 When Operating in a Non-Redundant Configuration" (pg.99)

Perform one of the following procedures if you do not know whether the logical drive has redundancy or not.

### Checking the Redundancy with GAM

If GAM is installed, start GAM to check the redundancy.

1. Start up GAM and sign on.
   - "5.1 Starting and Exiting GAM" (pg.68)

2. Select [Controller View] from the [View] menu.
   - "5.2.4 Starting Controller View and the Window Layout" (pg.75)
3 Check if the logical drive icon is displayed in the [Logical Drives] field in the [Controller View] window.
If the logical drive icon is displayed, the drive is operating in a redundant configuration.
If the logical drive icon is not displayed, the drive is operating in a non-redundant configuration.

Checking the Redundancy with the BIOS Utility
If GAM is not installed, start the BIOS Utility to check the redundancy.

1 Start up the BIOS Utility.
   →"2.1.1 Starting the BIOS Utility" (pg.22)

2 Check that the [Adapter List] menu is selected and press the [Enter] key.

POINT

This screen is for selecting an array controller to access, but only one controller is shown. So, just press the [Enter] key.

The [Adapter Properties] screen appears.
3 Select [RAID Properties] and press the [Enter] key. The [Select New Array Type] screen appears.

4 Confirm if the [View Existing Array] function is displayed.
If the function is displayed, the drive is operating in a redundant configuration.
If the function is not displayed, the drive is operating in a non-redundant configuration.

6.3.2 When Operating in a Redundant Configuration (RAID 1)

If the hard disk drive to be replaced operates in a redundant configuration (RAID 1), perform the following procedure for the preventive replacement:

- If the drive is operating without redundancy, do not replace a drive using this procedure. See "6.3.3 When Operating in a Non-Redundant Configuration" (pg.99) for the replacement procedure.
- Replace the hard disk drive that is predicted to fail with a new one of the same model (with the same capacity and speed).
- When both hard disk drives are predicted to fail, replace one drive at a time.
- We recommend that you back up the data before executing preventive replacement of a hard disk.

1 Using GAM, check the slot ID of the hard disk drive with a failure prediction warning ( ) and locate the drive.
See Steps 1 to 3 in "6.1 Checking the Hard Disk Drive to Replace" (pg.90).

- If there is a failed hard disk drive at this point, replace that drive first, referring to "6.2 Replacing a Failed Hard Disk Drive" (pg.92). If any hard disk drive is being rebuilt, wait until the rebuild process is finished.
Replacing a Hard Disk

2 Double-click the icon of the hard disk drive with the failure prediction warning. Detailed information about the selected hard disk drive is displayed. Make sure that its [Status] is indicated as "Critical".

![Disk Device Information](image)

3 Click [Locate] and check the location of the target hard disk drive on the server. The hard disk drive failure lamp corresponding to the hard disk drive starts to flash.

**POINT**

- The hard disk drive confirmed here has received a failure prediction warning (the target hard disk drive for preventive replacement). We recommend that you put some kind of mark on this drive to identify it.

4 Confirm the location and click [OK]. The failure lamp turns off.

5 Click the [Make Offline] button.

6 When the [WARNING] window appears, enter [YES] and click [OK].

7 Confirm that the following log entry is displayed in the GAM Log Information Viewer.

```
Event ID : E-50
Description: Physical disk status changed to offline
```

**POINT**

- The hard disk drive failure lamp of the target hard disk drive remains lit.
8 Pull out the hard disk drive identified in step 3 about an inch (1 to 3 cm) to disconnect it from the connector.
For how to remove hard disk drives, see the "User's Guide" on the "PRIMERGY Document & Tool CD" supplied with the server.

- Do not remove a hard disk drive that is in good condition. Doing so may cause loss of data.
- Do not pull out the hard disk drive completely from the server at this point.

9 Wait at least one minute until the hard disk drive motor has stopped spinnings.

10 Pull out the hard disk drive that is predicted to fail completely from the hard disk drive bay.

11 Install a new hard disk drive in the hard disk drive bay where the failed hard disk drive was previously installed.
Shortly after the installation, the new hard disk drive is recognized and displayed in the [Controller View].

- If the new hard disk drive is not displayed in the [Controller View], execute [Scan Devices] from the [Administration] menu.

12 Double-click the icon of the newly installed hard disk drive in the [Controller View] window.
The detailed information about the hard disk drive is displayed in the [Disk Device Information] window.

13 Click [Rebuild] to perform a rebuild.
When the rebuild is started, the hard disk drive's failure lamp that was lit starts flashing, and then turns off when the rebuild is completed.
After the rebuild is finished, double-click the icon of the newly installed hard disk drive in the [Controller View] window to confirm that the status has changed from "Dead" to "Online".
Replacing a Hard Disk

- On this array controller, rebuild does not start automatically.
- When the following event is recorded in the OS event log, or in the Log Information Viewer of the GAM Client, the rebuild is completed.
  - For Log Information Viewer
    ```
    I-7  ctl:x chn:x tgt:x  Rebuild is over.
    ```
  - For OS Event Log
    ```
    Source : Fujitsu ServerView Service
    Type   : Information
    Event ID : 1
    Description: [ctl:x chn:x tgt:x] Rebuild is over.
    ```

To confirm the completion of rebuild in GAM Client, do not close GAM Client until the rebuild is completed.

- For the approximate time to complete the rebuild, see "Time Required for Rebuild" (pg.14) or "Calculating the Approximate Time Needed for a Rebuild" (pg.87).
- If the server is restarted or shut down during the rebuild, the rebuild will resume from the stage where the process stopped the next time the system starts up.
- The rebuild may not start even if [Rebuild] is clicked. In this case, perform [Scan Devices] that can be selected from the [Administration] menu, and perform the rebuild again.
- If the replacement hard disk drive is recognized as good, data is written to it even before the rebuild. In this case, the hard disk drive access lamp on the server flashes, but there is no problem.

6.3.3 When Operating in a Non-Redundant Configuration

If the drive is operating without redundancy, data needs to be backed up and then restored. Replace the hard disk drive using the following procedure.

- Replace the hard disk drive that is predicted to fail with a new one of the same model (with the same capacity and speed).

1. Restart the system of the server.

2. Use the BIOS Utility to check the slot ID of the hard disk drive that is predicted to fail, and then locate the drive.
   →"2.3.2 Viewing Information on the Logical Drive and the Hard Disk Drives" (pg.29)

3. Back up the data on all hard disk drives that are predicted to fail.

4. Turn off the server.

5. Replace all the hard disk drives that are predicted to fail with new ones.
   For how to replace hard disk drives, see the "User's Guide" on the "PRIMERGY Document & Tool CD" supplied with the server.

6. Restore the backup data.
Appendix

This section explains the GAM error codes.

A A List of GAM Error Codes .......................... 102
A  A List of GAM Error Codes

By installing ServerView, errors that occur can be logged in Event Viewer. The following is a list of logs written to the application log of Windows Event Viewer as events from the source "Fujitsu ServerView Service". The device address is filled in at the beginning of the event log (the bracketed part). The device address indicates where the event occurred.

<table>
<thead>
<tr>
<th>Character String</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ctl:</td>
<td>Not used by this array controller. Displayed information is indefinite.</td>
</tr>
<tr>
<td>chn:</td>
<td>Slot number of hard disk drive</td>
</tr>
<tr>
<td>tgt:</td>
<td>Not used by this array controller. Displayed information is indefinite.</td>
</tr>
<tr>
<td>logdrv:</td>
<td>Logical drive number</td>
</tr>
</tbody>
</table>

```
Unless ServerView is installed, event logging to Event Viewer will not occur. See the "User's Guide" on the "PRIMERGY Documents & Tools CD" supplied with the server to install and configure ServerView.
```

The correspondence between Severity for GAM events (SNMP TRAP), Severity for GAM Client, and the event log type is shown in the table below.

<table>
<thead>
<tr>
<th>Severity</th>
<th>Description</th>
<th>Severity in GAM Client</th>
<th>OS event log type</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRITICAL</td>
<td>Severe error</td>
<td>1</td>
<td>Error</td>
</tr>
<tr>
<td>MAJOR</td>
<td>Error</td>
<td>2</td>
<td>Error</td>
</tr>
<tr>
<td>MINOR</td>
<td>Warning</td>
<td>3</td>
<td>Warning</td>
</tr>
<tr>
<td>INFORMATIONAL</td>
<td>Information (No action required)</td>
<td>4</td>
<td>Information</td>
</tr>
</tbody>
</table>
The number within the parentheses of the GAM ID is displayed in hexadecimal format.

<table>
<thead>
<tr>
<th>GAM ID</th>
<th>Severity</th>
<th>Description</th>
<th>Details</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (0x001)</td>
<td>Info/1</td>
<td>A physical disk has been placed online.</td>
<td>A hard disk drive has become &quot;Online&quot;.</td>
<td>None.</td>
</tr>
<tr>
<td>2 (0x002)</td>
<td>Info/1</td>
<td>Physical disk added as hot spare.</td>
<td>A hard disk drive has been set as a hot spare.</td>
<td>None.</td>
</tr>
</tbody>
</table>
| 3 (0x003) | Error/3 | Physical disk error found. | • A bad sector was found on the media.  
• A mechanical failure of the device.  
• The host device detected an invalid sequence.  
• The target device is missing. | Check the state of the target hard disk drive. If it has a failure, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.92) to replace it and perform a rebuild. If the error occurred only temporarily and does not occur again, the hard disk drive is recovered and no action is required. However, if this error occurs frequently, we recommend that you replace the drive as a precautionary measure, referring to "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.94). |
| 4 (0x004) | Error/3 | Physical disk PFA condition found; this disk may fail soon. | A failure has been predicted for the hard disk drive. | See "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.94) and replace the hard disk drive as a preventive measure. |
| 5 (0x005) | Info/1 | An automatic rebuild has started. | Rebuild started automatically. | None. |
| 6 (0x006) | Info/1 | A rebuild has started. | Rebuild started via a command. | None. |
| 7 (0x007) | Info/1 | Rebuild is over. | Rebuild has been completed. | None. |
| 8 (0x008) | Info/1 | Rebuild is cancelled. | Rebuild was canceled. | Perform the rebuild again. |
| 9 (0x009) | Error/3 | Rebuild stopped with error. | Rebuild terminated abnormally. (When abnormality occurs in the SAS interface, this may be notified not during rebuild processing.) | See "5.4.4 Viewing Logical Drive Information" (→pg.84) to check the current status of the logical drive.  
• For Critical state:  
See "6.2 Replacing a Failed Hard Disk Drive" (→pg.92) to replace the hard disk drive and perform the rebuild again.  
• For Offline state:  
Contact an office listed in the "Contact Information" of "Start Guide". |
| 10 (0x00A) | Error/3 | Rebuild stopped with error. New device failed. | Rebuild terminated abnormally due to a failure found on the target hard disk drive for the rebuild. | See "6.2 Replacing a Failed Hard Disk Drive" (→pg.92) to replace the hard disk drive and perform a rebuild. |
| 11 (0x00B) | Error/3 | Rebuild stopped because logical drive failed. | Rebuild terminated abnormally due to failures in multiple hard disk drives. | Contact an office listed in the "Contact Information" of "Start Guide". |
### List of event log

<table>
<thead>
<tr>
<th>GAM ID</th>
<th>Severity</th>
<th>Description</th>
<th>Details</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Error/3</td>
<td>Physical disk has failed.</td>
<td>A hard disk drive has failed.</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
<tr>
<td>13</td>
<td>Info/1</td>
<td>A new physical disk has been found.</td>
<td>A new hard disk drive was detected.</td>
<td>None.</td>
</tr>
<tr>
<td>14</td>
<td>Info/1</td>
<td>A physical disk has been removed.</td>
<td>A hard disk drive was removed. A hard disk drive has become undetectable.</td>
<td>None.</td>
</tr>
<tr>
<td>15</td>
<td>Info/1</td>
<td>A previously configured disk is now available.</td>
<td>A hard disk drive is now in Unconfigured state.</td>
<td>None.</td>
</tr>
<tr>
<td>19</td>
<td>Error/3</td>
<td>SCSI command timeout on hard device.</td>
<td>A command timeout was detected.</td>
<td>Because the controller is performing a recovery, there is no problem as long as there are no failed hard disk drives.</td>
</tr>
<tr>
<td>20</td>
<td>Error/3</td>
<td>SCSI command abort on hard disk.</td>
<td>A SCSI command was aborted.</td>
<td>Because the controller is performing a recovery, there is no problem as long as there are no failed hard disk drives.</td>
</tr>
<tr>
<td>21</td>
<td>Warning/2</td>
<td>SCSI command retried on hard disk.</td>
<td>A SCSI command was retried.</td>
<td>Because the controller is performing a recovery, there is no problem as long as there are no failed hard disk drives.</td>
</tr>
<tr>
<td>23</td>
<td>Warning/2</td>
<td>Soft error found.</td>
<td>An error was detected on a hard disk drive, but it was resolved.</td>
<td>Because the controller is performing a recovery, no action is required. If this error occurs frequently, see &quot;6.3 Preventive Replacement of a Hard Disk Drive&quot; (pg.94) to replace the hard disk drive as a precautionary measure.</td>
</tr>
<tr>
<td>24</td>
<td>Warning/2</td>
<td>Misc error found.</td>
<td>An error was detected on a hard disk drive, but it was resolved.</td>
<td>Because the controller is performing a recovery, no action is required. If this error occurs frequently, see &quot;6.3 Preventive Replacement of a Hard Disk Drive&quot; (pg.94) to replace the hard disk drive as a precautionary measure.</td>
</tr>
<tr>
<td>25</td>
<td>Info/1</td>
<td>SCSI device reset.</td>
<td>The firmware issued a device reset.</td>
<td>None.</td>
</tr>
<tr>
<td>28</td>
<td>Error/3</td>
<td>Request Sense Data available.</td>
<td>A hard disk drive reported sense information.</td>
<td>Because the controller is performing a recovery, no action is required as long as the corresponding disk is Online.</td>
</tr>
<tr>
<td>29</td>
<td>Info/1</td>
<td>Initialization started.</td>
<td>A hard disk drive formatting has started.</td>
<td>Wait until the format is completed.</td>
</tr>
<tr>
<td>30</td>
<td>Info/1</td>
<td>Initialization completed.</td>
<td>The hard disk drive format has been completed.</td>
<td>None.</td>
</tr>
</tbody>
</table>
### List of event log

<table>
<thead>
<tr>
<th>GAM ID</th>
<th>Severity</th>
<th>Description</th>
<th>Details</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Error/3</td>
<td>Initialization failed.</td>
<td>The hard disk drive format</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive.</td>
</tr>
<tr>
<td>32</td>
<td>Error/3</td>
<td>Initialization canceled.</td>
<td>The hard disk drive format</td>
<td>Format the hard disk drive again.</td>
</tr>
<tr>
<td>33 - 41</td>
<td>Error/3</td>
<td>A physical disk failed because ***</td>
<td>A hard disk drive has</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>failed.</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Error/3</td>
<td>A physical disk set to failed state by host.</td>
<td>A Make Offline has been</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
<tr>
<td>43 - 49</td>
<td>Error/3</td>
<td>A physical disk failed because ***</td>
<td>A hard disk drive has</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>failed.</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Error/3</td>
<td>Physical disk status changed to offline.</td>
<td>A hard disk drive has</td>
<td>None.</td>
</tr>
<tr>
<td>52</td>
<td>Error/3</td>
<td>Physical disk status changed to rebuild.</td>
<td>The hard disk drive status</td>
<td>None.</td>
</tr>
<tr>
<td>53</td>
<td>Warning/2</td>
<td>Physical device ID did not match.</td>
<td>The hard disk drive ID does</td>
<td>Check the logs surrounding the process and perform necessary actions.</td>
</tr>
<tr>
<td>54</td>
<td>Error/3</td>
<td>Physical disk failed to start.</td>
<td>A hard disk drive failed to</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Warning/2</td>
<td>Physical disk negotiated different offset than config.</td>
<td>A hard disk drive has negotiated an offset different from the configuration.</td>
<td>Check that the hard disk drive is connected properly. If the hard disk drive has failed, see &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
<tr>
<td>56</td>
<td>Warning/2</td>
<td>Physical disk negotiated different bus width than config.</td>
<td>A hard disk drive has negotiated a bus width different from the configuration.</td>
<td>Check that the hard disk drive is connected properly. If the hard disk drive has failed, see &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
</tbody>
</table>
### List of event log

<table>
<thead>
<tr>
<th>GAM ID</th>
<th>Severity</th>
<th>Description</th>
<th>Details</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>Error/3</td>
<td>Physical drive missing on startup.</td>
<td>No hard disk drive was detected during startup.</td>
<td>Check that the hard disk drive is connected properly. If the hard disk drive has failed, see &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
<tr>
<td>58</td>
<td>Error/3</td>
<td>Rebuild startup failed due to lower disk capacity.</td>
<td>Insufficient hard disk space to perform the rebuild.</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive with a drive of the same model (with the same capacity and speed) as the other drives, and then perform a rebuild.</td>
</tr>
<tr>
<td>67</td>
<td>Error/3</td>
<td>Physical Disk found on only one disk channel.</td>
<td>A hard disk drive is connected to only one disk channel.</td>
<td>Check that the hard disk drive is connected properly. If the hard disk drive has failed, see &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
<tr>
<td>68</td>
<td>Info/1</td>
<td>Physical disk type is not approved by vendor.</td>
<td>An installed hard disk drive is not vendor approved.</td>
<td>Use a vendor supported hard disk drive.</td>
</tr>
<tr>
<td>69</td>
<td>Error/3</td>
<td>Physical disk has acquired an inappropriate loop ID. Enclosure disk-slot operations are disabled while this condition persists.</td>
<td>A hard disk drive has acquired an inappropriate loop ID.</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild. If this error occurs again, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>70</td>
<td>Error/3</td>
<td>Physical disk port has failed or cannot operate at the configured channel speed.</td>
<td>• A hard disk drive has failed. • The hard disk drive is not compatible with the system. • The enclosure slot hardware failed.</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild. If this error occurs again, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>72</td>
<td>Error/3</td>
<td>Controller parameters checksum verification failed - restored default.</td>
<td>A mistake was found in the checksum of the controller parameters.</td>
<td>Check and correct the parameters in the [Adapter Properties] (pg.26) of WebBIOS. If the message still appears, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>73</td>
<td>Info/1</td>
<td>Online controller firmware upgrade has started.</td>
<td>An online controller firmware upgrade has started.</td>
<td>None.</td>
</tr>
<tr>
<td>74</td>
<td>Info/1</td>
<td>Online firmware upgrade has completed successfully.</td>
<td>An online firmware upgrade has been completed successfully.</td>
<td>None.</td>
</tr>
</tbody>
</table>
## List of event log

<table>
<thead>
<tr>
<th>GAM ID</th>
<th>Severity</th>
<th>Description</th>
<th>Details</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 (0x04B)</td>
<td>Error/3</td>
<td>Online firmware upgrade has failed.</td>
<td>An online firmware upgrade has failed.</td>
<td>Perform the online controller firmware upgrade again. If the message still appears, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>76 (0x04C)</td>
<td>Info/1</td>
<td>A Configuration On Disk (COD) with unsupported features has been detected.</td>
<td>The array configuration information of the hard disk drive contains features that are not supported. An array configuration information created by another system was detected.</td>
<td>Connect a compatible hard disk drive.</td>
</tr>
<tr>
<td>80 (0x050)</td>
<td>Error/3</td>
<td>Firmware entered unexpected state at run-time.</td>
<td>The firmware entered unexpected state at run-time.</td>
<td>Check the installation of the cache memory or battery backup unit. If the message still appears, replace the cache memory or the battery backup unit.</td>
</tr>
<tr>
<td>85 (0x055)</td>
<td>Info/1</td>
<td>Unable to recover medium error during patrol read.</td>
<td>Recovery of a medium error failed during the Patrol Read operation.</td>
<td>If a corrupted file is found, restore it from the backup.</td>
</tr>
<tr>
<td>86 (0x056)</td>
<td>Info/1</td>
<td>Rebuild resumed.</td>
<td>Rebuild restarted.</td>
<td>None.</td>
</tr>
<tr>
<td>89 (0x059)</td>
<td>Info/1</td>
<td>Physical disk transfer speed changed.</td>
<td>The transfer speed of the hard disk drive has changed due to an unknown error.</td>
<td>Check the previous logs and perform necessary steps.</td>
</tr>
<tr>
<td>90 (0x05A)</td>
<td>Error/3</td>
<td>Channel is suspended due to some faults.</td>
<td>An abnormal state was found in the channel.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>95 (0x05F)</td>
<td>Info/1</td>
<td>Configured physical disk replaced by user by a smaller capacity disk.</td>
<td>A hard disk drive has been replaced with a smaller capacity drive than configured.</td>
<td>Reconnect a proper hard disk drive.</td>
</tr>
<tr>
<td>101 (0x065)</td>
<td>Error/3</td>
<td>Error.</td>
<td>An unknown error was detected.</td>
<td>If the hard disk drive has failed, see &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild. If the message still appears, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>104 (0x068)</td>
<td>Error/3</td>
<td>Reassign write operation failed.</td>
<td>A Reassign operation failed.</td>
<td>If the hard disk drive has failed, see &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
<tr>
<td>105 (0x069)</td>
<td>Error/3</td>
<td>Unrecoverable medium error during rebuild.</td>
<td>An unrecoverable medium error was detected during the rebuild process.</td>
<td>If a corrupted file is found, restore it from the backup.</td>
</tr>
<tr>
<td>GAM ID</td>
<td>Severity</td>
<td>Description</td>
<td>Details</td>
<td>Corrective action</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
<td>-------------</td>
<td>---------</td>
<td>-------------------</td>
</tr>
<tr>
<td>106 (0x06A)</td>
<td>Info/1</td>
<td>Corrected medium error during recovery.</td>
<td>A medium error was corrected.</td>
<td>None.</td>
</tr>
<tr>
<td>107 (0x06B)</td>
<td>Error/3</td>
<td>Unrecoverable medium error during recovery.</td>
<td>An unrecoverable medium error was detected.</td>
<td>If a corrupted file is found, restore it from the backup.</td>
</tr>
<tr>
<td>119 (0x077)</td>
<td>Warning/2</td>
<td>PD too small to be used for auto-rebuild.</td>
<td>The rebuild could not be started because the capacity of the hard disk drive is smaller than the other hard disk drive.</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→ pg.92) to replace the hard disk drive with a drive of the same model (with the same capacity and speed) as the other drives, and then perform a rebuild.</td>
</tr>
<tr>
<td>120 (0x078)</td>
<td>Warning/2</td>
<td>Bad block table on PD is 80% full.</td>
<td>The Bad Block Table usage rate has exceeded 80%.</td>
<td>See &quot;6.3 Preventive Replacement of a Hard Disk Drive&quot; (→ pg.94) and replace the hard disk drive as a preventive measure.</td>
</tr>
<tr>
<td>121 (0x079)</td>
<td>Error/3</td>
<td>Bad block table on PD is full; unable to log blocks.</td>
<td>The Bad Block Table is full.</td>
<td>See &quot;6.3 Preventive Replacement of a Hard Disk Drive&quot; (→ pg.94) and replace the hard disk drive as a preventive measure.</td>
</tr>
<tr>
<td>126 (0x07E)</td>
<td>Info/1</td>
<td>Firmware corrected the 'Read' error.</td>
<td>The media error was corrected.</td>
<td>None.</td>
</tr>
<tr>
<td>134 (0x086)</td>
<td>Error/3</td>
<td>Logical drive has been made offline.</td>
<td>The logical drive has been made Offline.</td>
<td>The logical drive(s) cannot continue running in this state. Recreate the array configuration and restore the data from backup.</td>
</tr>
<tr>
<td>135 (0x087)</td>
<td>Error/3</td>
<td>Logical drive is critical.</td>
<td>The logical drive is in Critical state due to a hard disk drive failure.</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→ pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
<tr>
<td>136 (0x088)</td>
<td>Info/1</td>
<td>Logical drive has been placed online.</td>
<td>The logical drive has been placed online.</td>
<td>None.</td>
</tr>
<tr>
<td>137 (0x089)</td>
<td>Info/1</td>
<td>An automatic rebuild has started on logical drive.</td>
<td>Rebuild started automatically.</td>
<td>None.</td>
</tr>
<tr>
<td>138 (0x08A)</td>
<td>Info/1</td>
<td>A manual rebuild has started on logical drive.</td>
<td>Rebuild started manually.</td>
<td>None.</td>
</tr>
<tr>
<td>139 (0x08B)</td>
<td>Info/1</td>
<td>Rebuild on logical drive is over.</td>
<td>Rebuild has been completed.</td>
<td>None.</td>
</tr>
<tr>
<td>140 (0x08C)</td>
<td>Error/3</td>
<td>Rebuild on logical drive is cancelled.</td>
<td>Rebuild was canceled.</td>
<td>Perform the rebuild again.</td>
</tr>
<tr>
<td>141 (0x08D)</td>
<td>Error/3</td>
<td>Rebuild stopped with error.</td>
<td>Rebuild terminated abnormally.</td>
<td>Check the logs surrounding the process and perform necessary actions.</td>
</tr>
<tr>
<td>142 (0x08E)</td>
<td>Error/3</td>
<td>Rebuild stopped with error. New physical disk failed.</td>
<td>Rebuild terminated abnormally due to a failure on the target hard disk drive.</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→ pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
</tbody>
</table>
### List of Event Log

<table>
<thead>
<tr>
<th>GAM ID</th>
<th>Severity</th>
<th>Description</th>
<th>Details</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>143 (0x08F)</td>
<td>Error/3</td>
<td>Rebuild stopped because logical drive failed.</td>
<td>The source disk of the rebuild failed.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>144 (0x090)</td>
<td>Info/1</td>
<td>Logical drive initialization started.</td>
<td>An initialization of a logical drive has started.</td>
<td>None.</td>
</tr>
<tr>
<td>145 (0x091)</td>
<td>Info/1</td>
<td>Logical drive initialization done.</td>
<td>The initialization of the logical drive has been completed.</td>
<td>None.</td>
</tr>
<tr>
<td>146 (0x092)</td>
<td>Error/3</td>
<td>Logical drive initialization cancelled.</td>
<td>The initialization of the logical drive was canceled.</td>
<td>Perform the initialization process again.</td>
</tr>
<tr>
<td>147 (0x093)</td>
<td>Error/3</td>
<td>Logical drive initialization failed.</td>
<td>The initialization terminated abnormally. The logical drive is now in Offline state.</td>
<td>Backup all the data on the logical drive and see &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive. Recreate the array configuration. Then restore the data from backup.</td>
</tr>
<tr>
<td>148 (0x094)</td>
<td>Info/1</td>
<td>A logical drive has been found.</td>
<td>A new logical drive has been detected.</td>
<td>None.</td>
</tr>
<tr>
<td>149 (0x095)</td>
<td>Info/1</td>
<td>A logical drive has been deleted.</td>
<td>A logical drive was deleted.</td>
<td>None.</td>
</tr>
<tr>
<td>153 (0x099)</td>
<td>Error/3</td>
<td>Bad Blocks found.</td>
<td>A bad block was detected during the Make Data Consistent, rebuild, or capacity expansion process.</td>
<td>• During Make Data Consistent/capacity expansion: The bad block will be repaired, so there is no problem. • During rebuild: If a corrupted file is found, restore it from the backup.</td>
</tr>
<tr>
<td>155 (0x09B)</td>
<td>Info/1</td>
<td>System drive type changed.</td>
<td>• A new configuration was added.</td>
<td>None.</td>
</tr>
<tr>
<td>156 (0x09C)</td>
<td>Error/3</td>
<td>Bad data blocks found. Possible data loss.</td>
<td>Bad blocks were found on multiple hard disk drives at the same location.</td>
<td>If a corrupted file is found, restore it from the backup.</td>
</tr>
<tr>
<td>157 (0x09D)</td>
<td>Info/1</td>
<td>Logical drive LUN mapping has been written to config.</td>
<td>Logical drive LUN mapping has been written to config.</td>
<td>None.</td>
</tr>
<tr>
<td>158 (0x09E)</td>
<td>Error/3</td>
<td>Attempt to read data from block that is marked in Bad Data Table.</td>
<td>An attempt has been made to read data logged in the BDT table.</td>
<td>If a corrupted file is found, restore it from the backup.</td>
</tr>
<tr>
<td>159 (0x09F)</td>
<td>Error/3</td>
<td>Data for Disk Block has been lost due to Logical Drive problem.</td>
<td>Due to a problem with the logical drive, cache data could not be written to the hard disk drive.</td>
<td>Check the logs surrounding the process and perform necessary actions.</td>
</tr>
<tr>
<td>163 (0x0A3)</td>
<td>Error/3</td>
<td>Reconstruct detected uncorrectable double medium errors.</td>
<td>Due to media errors detected in the same position on multiple hard disk drives, data cannot be recovered.</td>
<td>If a corrupted file is found, restore it from the backup.</td>
</tr>
</tbody>
</table>
### List of event log

<table>
<thead>
<tr>
<th>GAM ID</th>
<th>Severity</th>
<th>Description</th>
<th>Details</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>164 (0x0A4)</td>
<td>Info/1</td>
<td>Reconstruction resumed.</td>
<td>Reconstruction was resumed.</td>
<td>None.</td>
</tr>
<tr>
<td>165 (0x0A5)</td>
<td>Error/3</td>
<td>Reconstruction resume failed due to configuration mismatch.</td>
<td>Reconstruction resume terminated abnormally due to configuration mismatch.</td>
<td>Recreate the array and restore the backup data.</td>
</tr>
<tr>
<td>166 (0x0A6)</td>
<td>情報 /1</td>
<td>LD Properties updated.</td>
<td>Parameter of the logical drive has been changed.</td>
<td>None.</td>
</tr>
<tr>
<td>350 (0x15E)</td>
<td>Error/3</td>
<td>SAS/SATA mixing not supported in enclosure; PD disabled.</td>
<td>The hard disk drive cannot be used, because SAS and SATA devices are mixed.</td>
<td>Check if any unsupported hard disk drives are installed. If there is an unsupported hard disk drive installed, replace it with a supported one.</td>
</tr>
<tr>
<td>384 (0x180)</td>
<td>Info/1</td>
<td>Array management server software started successfully.</td>
<td>GAM Server started successfully.</td>
<td>None.</td>
</tr>
<tr>
<td>386 (0x182)</td>
<td>Warning/2</td>
<td>Internal log structures getting full, PLEASE SHUTDOWN AND RESET THE SYSTEM IN THE NEAR FUTURE.</td>
<td>Due to many configuration changes, the configuration change table is full.</td>
<td>Shut down the system properly, power off the server and turn it back on. If the same log still appears, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>388 (0x184)</td>
<td>Error/3</td>
<td>Controller is dead. System is disconnecting from this controller.</td>
<td>The SCSI array controller failed.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>389 (0x185)</td>
<td>Info/1</td>
<td>Controller has been reset.</td>
<td>The controller received a reset command.</td>
<td>Because the firmware is performing a recovery, there is no problem as long as there are no failed hard disk drives.</td>
</tr>
<tr>
<td>390 (0x186)</td>
<td>Info/1</td>
<td>Controller is found.</td>
<td>A controller was detected.</td>
<td>None.</td>
</tr>
<tr>
<td>391 (0x187)</td>
<td>Error/3</td>
<td>Controller is gone. System is disconnecting from this controller.</td>
<td>• The power to the controller was cut off. • The controller was removed from the system.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>395 (0x18B)</td>
<td>Error/3</td>
<td>Controller is gone. System is disconnecting from this controller.</td>
<td>• The power to the controller was cut off. • The controller was removed from the system.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>396 (0x18C)</td>
<td>Info/1</td>
<td>Controller powered on.</td>
<td>A new controller was installed.</td>
<td>None.</td>
</tr>
<tr>
<td>397 (0x18D)</td>
<td>Info/1</td>
<td>Controller is online.</td>
<td>A controller came online.</td>
<td>None.</td>
</tr>
<tr>
<td>GAM ID</td>
<td>Severity</td>
<td>Description</td>
<td>Details</td>
<td>Corrective action</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
<td>-------------</td>
<td>---------</td>
<td>-------------------</td>
</tr>
<tr>
<td>398 (0x18E)</td>
<td>Error/3</td>
<td>Controller is gone. System is disconnecting from this controller.</td>
<td>The power to the controller was cut off. The controller was removed from the system.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>399 (0x18F)</td>
<td>Warning/2</td>
<td>Controller's partner is gone, controller is in failover mode now.</td>
<td>The controller went Offline.</td>
<td>None.</td>
</tr>
<tr>
<td>403 (0x193)</td>
<td>Error/3</td>
<td>Installation aborted.</td>
<td>The configuration changed while the system was offline.</td>
<td>Shut down the server and check the hard disk drive connections. Check that the appropriate hard disk drives are installed, and remove any inappropriate hard disk drives. (For example, a hard disk drive for another system may have been installed by mistake.) If this does not resolve the problem, reconfigure the array and restore the backup data.</td>
</tr>
<tr>
<td>404 (0x194)</td>
<td>Error/3</td>
<td>Controller firmware mismatch.</td>
<td>The controller firmware has been replaced with an old version.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>413 (0x19D)</td>
<td>Info/1</td>
<td>Controller device start complete.</td>
<td>The controller device started.</td>
<td>None.</td>
</tr>
<tr>
<td>414 (0x19E)</td>
<td>Error/3</td>
<td>Soft ECC error Corrected.</td>
<td>An ECC error was detected in the memory.</td>
<td>Replace the memory module or the battery backup unit.</td>
</tr>
<tr>
<td>415 (0x19F)</td>
<td>Error/3</td>
<td>Hard ECC error Corrected.</td>
<td>An ECC error was detected in the memory.</td>
<td>Replace the memory module or the battery backup unit.</td>
</tr>
<tr>
<td>425 (0x1A9)</td>
<td>Error/3</td>
<td>Controller boot ROM image needs to be reloaded.</td>
<td>An inappropriate firmware image was loaded.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>426 (0x1AA)</td>
<td>Error/3</td>
<td>Controller is using default non-unique world-wide name.</td>
<td>The controller's MAC address was lost, or not set.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>428 (0x1AC)</td>
<td>Error/3</td>
<td>Mirror Race on critical drive.</td>
<td>The hard disk drive has a failure.</td>
<td>See &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→pg.92) to replace the hard disk drive and perform a rebuild.</td>
</tr>
<tr>
<td>440 (0x1B8)</td>
<td>Error/3</td>
<td>Error in Mirror Race Table.</td>
<td>An error occurred in the Mirror Race Table.</td>
<td>Check the array configuration. If the array configuration is correct, perform a Make Data Consistent. If the array configuration is invalid, reconfigure the array and restore the data from the backup.</td>
</tr>
<tr>
<td>444 (0x1BC)</td>
<td>Info/1</td>
<td>Controller entered 'Write Back' cache mode.</td>
<td>The controller entered 'Write Back' cache mode.</td>
<td>None.</td>
</tr>
<tr>
<td>446 (0x1BE)</td>
<td>Info/1</td>
<td>Data in Cache flushed during power up.</td>
<td>Data in the cache memory was flushed at the time of system boot.</td>
<td>None.</td>
</tr>
</tbody>
</table>
### Table: List of event log

<table>
<thead>
<tr>
<th>GAM ID</th>
<th>Severity</th>
<th>Description</th>
<th>Details</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>447 (0x1BF)</td>
<td>Error/3</td>
<td>Data in Cache not flushed during power up.</td>
<td>Data in the cache memory failed to flush at the time of system boot due to an abnormal configuration.</td>
<td>Check the array configuration. If the array configuration is correct, perform a Make Data Consistent. If the array configuration is invalid, reconfigure the array and restore the data from the backup.</td>
</tr>
<tr>
<td>452 (0x1C4)</td>
<td>Info/1</td>
<td>Rebuild rate changed.</td>
<td>The rebuild rate has been changed.</td>
<td>None.</td>
</tr>
<tr>
<td>460 (0x1CC)</td>
<td>Info/1</td>
<td>Factory defaults restored.</td>
<td>A factory default was restored.</td>
<td>Reconfigure the controller if necessary.</td>
</tr>
<tr>
<td>461 (0x1CD)</td>
<td>Info/1</td>
<td>Hibernate command received from host.</td>
<td>A hibernate command was received from the host.</td>
<td>None.</td>
</tr>
<tr>
<td>462 (0x1CE)</td>
<td>Info/1</td>
<td>Event log cleared.</td>
<td>The NVRAM log was cleared.</td>
<td>None.</td>
</tr>
<tr>
<td>463 (0x1CF)</td>
<td>Info/1</td>
<td>Event log wrapped.</td>
<td>The NVRAM log was wrapped.</td>
<td>None.</td>
</tr>
<tr>
<td>700 (0x2BC)</td>
<td>Info/1</td>
<td>Event log empty.</td>
<td>The content of the event log has become blank.</td>
<td>None.</td>
</tr>
<tr>
<td>701 (0x2BD)</td>
<td>Info/1</td>
<td>Event log entries lost.</td>
<td>Event Log entries were lost.</td>
<td>None.</td>
</tr>
<tr>
<td>702 (0x2BE)</td>
<td>Info/1</td>
<td>Request Sense.</td>
<td>Sense Information was reported.</td>
<td>Because the firmware is performing a recovery, there is no problem as long as there are no failed hard disk drives.</td>
</tr>
<tr>
<td>703 (0x2BF)</td>
<td>Info/1</td>
<td>Set real time clock.</td>
<td>The clock was set.</td>
<td>None.</td>
</tr>
<tr>
<td>800 (0x320)</td>
<td>Info/1</td>
<td>New Configuration Received.</td>
<td>A new array configuration was issued.</td>
<td>None.</td>
</tr>
<tr>
<td>801 (0x321)</td>
<td>Info/1</td>
<td>Configuration Cleared.</td>
<td>The array configuration was cleared.</td>
<td>None.</td>
</tr>
<tr>
<td>802 (0x322)</td>
<td>Warning/2</td>
<td>Configuration Invalid.</td>
<td>The array configuration information is invalid.</td>
<td>Check that the hard disk drive is connected properly. If this does not resolve the problem, recreate the array and recover the backup data.</td>
</tr>
<tr>
<td>803 (0x323)</td>
<td>Warning/2</td>
<td>Configuration On Disk Access Error.</td>
<td>The array configuration information could not be read from the hard disk drive.</td>
<td>Check the array configuration. If there is a failed hard disk drive, see &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (→pg.92) to replace it and perform a rebuild. If the array configuration is invalid, reconfigure the array and restore the data from the backup.</td>
</tr>
<tr>
<td>804 (0x324)</td>
<td>Warning/2</td>
<td>Configuration on disk converted.</td>
<td>The array configuration information on the hard disk drive was converted.</td>
<td>None.</td>
</tr>
<tr>
<td>GAM ID</td>
<td>Severity</td>
<td>Description</td>
<td>Details</td>
<td>Corrective action</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
<td>-------------</td>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>805 (0x325)</td>
<td>Warning/2</td>
<td>Configuration On Disk Import Failed.</td>
<td>The array configuration information could not be imported.</td>
<td>Shut down the server and check the hard disk drive connections. Check that the appropriate hard disk drives are installed, and remove any inappropriate hard disk drives. (For example, a hard disk drive for another system may have been installed by mistake.) If this does not resolve the problem, reconfigure the array and restore the backup data.</td>
</tr>
<tr>
<td>806 (0x326)</td>
<td>Info/1</td>
<td>A debug dump exists on this system.</td>
<td>A debug dump exists on this system.</td>
<td>None.</td>
</tr>
<tr>
<td>807 (0x327)</td>
<td>Info/1</td>
<td>A debug dump exists on this system.</td>
<td>A debug dump exists on this system.</td>
<td>None.</td>
</tr>
<tr>
<td>808 (0x328)</td>
<td>Info/1</td>
<td>No valid Configuration On Disk (COD) found.</td>
<td>No valid Configuration On Disk (COD) found.</td>
<td>Check if the hard disk drive connected was previously used in another system. If a hard disk drive that was previously used in another system is connected, that hard disk drive must be formatted completely before use.</td>
</tr>
<tr>
<td>810 (0x32A)</td>
<td>Info/1</td>
<td>MegaRAID firmware initialization started.</td>
<td>The initialization of the MegaRAID firmware started.</td>
<td>None.</td>
</tr>
<tr>
<td>960 (0x3C0)</td>
<td>Error/3</td>
<td>SAS topology error: Loop detected.</td>
<td>Loop detected in the SAS topology.</td>
<td>Check the condition of the system connections. If this error occurs again, even though the connections are correct, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>961 (0x3C1)</td>
<td>Error/3</td>
<td>SAS topology error: Unaddressable device.</td>
<td>Device is unaddressable in the SAS topology.</td>
<td>Check the condition of the system connections. If the system connections are correct but there is a failed hard disk drive, see &quot;6.2 Replacing a Failed Hard Disk Drive&quot; (pg.92) to replace the hard disk drive and perform a rebuild. If this error occurs again, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>962 (0x3C2)</td>
<td>Error/3</td>
<td>SAS topology error: Multiple ports to the same SAS address.</td>
<td>Multiple ports were connected to the same SAS address in the SAS topology.</td>
<td>Check the condition of the system connections. If this error occurs again, even though the connections are correct, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
</tbody>
</table>
## List of event log

<table>
<thead>
<tr>
<th>GAM ID</th>
<th>Severity</th>
<th>Description</th>
<th>Details</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>963 (0x3C3)</td>
<td>Error/3</td>
<td>SAS topology error: Expander error.</td>
<td>An error was detected in the Expander.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>964 (0x3C4)</td>
<td>Error/3</td>
<td>SAS topology error: SMP timeout.</td>
<td>SMP timeout was detected.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>965 (0x3C5)</td>
<td>Error/3</td>
<td>SAS topology error: Out of route entries.</td>
<td>Route entries cannot be found.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>966 (0x3C6)</td>
<td>Error/3</td>
<td>SAS topology error: Index not found.</td>
<td>Index was not found.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>967 (0x3C7)</td>
<td>Error/3</td>
<td>SAS topology error: SMP function failed.</td>
<td>An error was detected in an SMP function.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>968 (0x3C8)</td>
<td>Error/3</td>
<td>SAS topology error: SMP CRC error.</td>
<td>A CRC error was detected in SMP.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>969 (0x3C9)</td>
<td>Error/3</td>
<td>SAS topology error: Multiple subtractive.</td>
<td>An error was detected in the SAS topology.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>970 (0x3CA)</td>
<td>Error/3</td>
<td>SAS topology error: Table to table.</td>
<td>An error was detected in the SAS topology.</td>
<td>Contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
<tr>
<td>971 (0x3CB)</td>
<td>Error/3</td>
<td>SAS topology error: Multiple paths.</td>
<td>Multiple paths exist.</td>
<td>Check the condition of the system connections. If this error occurs again, even though the connections are correct, contact an office listed in the &quot;Contact Information&quot; of &quot;Start Guide&quot;.</td>
</tr>
</tbody>
</table>
## Index

### A
- Adapter Properties ........................................... 26
- Administration Menu ......................................... 73
- AlarmService .................................................. 59
- Array Controller
  - Controller Icons ........................................... 71
  - Notes ......................................................... 18
  - Specifications ............................................... 10
  - Viewing detailed information using GAM .................. 80
  - Viewing information in the BIOS Utility .................. 26

### B
- BIOS Utility ...................................................... 21
  - Exiting ......................................................... 24
  - Formatting hard disk drives ................................ 43
  - Starting ......................................................... 22
  - Viewing array controller .................................... 26
  - Viewing hard disk drives .................................... 29
  - Viewing logical drive ........................................ 29
  - Window Layout ................................................. 25

### C
- Controller Icons ................................................ 71
- Controller Selection Box ....................................... 70
- Controller View ................................................ 75
  - [Administration] Menu ....................................... 73
  - [File] Menu .................................................... 72
  - [View] Menu .................................................... 73
  - Viewing Hard Disk Drive Information ....................... 82
  - Viewing Logical Drive Information ......................... 84

### D
- Device Drivers
  - Driver Disks .................................................. 48
  - Update (Windows Server 2003) .............................. 49
  - Update (Windows 2000 Server) ............................. 50
- Disk array ....................................................... 10

### E
- Error Codes ..................................................... 102
- Events .......................................................... 78

### G
- GAM ............................................................... 54
  - Access privileges ............................................ 56
  - Error Codes ................................................... 102
  - Error Messages ............................................... 18
  - Exiting ........................................................ 69
  - Installation .................................................... 60
  - Local Logon Settings ......................................... 63
  - Requirements .................................................. 55
  - Sign On ........................................................ 68
  - Starting ......................................................... 68
  - Toolbar ......................................................... 74
  - Uninstallation .................................................. 64
  - Window Layout ................................................ 70
- GAM Client ....................................................... 54
  - Installation .................................................... 60
  - Server group and server settings .......................... 77
  - Uninstallation .................................................. 64
- GAM ID .......................................................... 103
- GAM Server ....................................................... 54
  - Installation .................................................... 60
  - Uninstallation .................................................. 65
- Global Array Manager .......................................... 54
- Global Properties ............................................... 27
- Global Status View .............................................. 71

### H
- Hard disk drive
  - Manual Rebuild .............................................. 86
  - Preventive Replacement ..................................... 94
  - Replacing ...................................................... 92
  - Status Icon .................................................... 76
  - Using Controller View ....................................... 82
- Hard Disk Drives
  - Logical Drives ............................................... 12
  - RAID Level .................................................... 11
- Hard disk drives
  - Low level formatting ........................................ 43
  - Viewing in the BIOS Utility ................................ 29
- Hard disk failure prediction function ....................... 15
- Hotfix ........................................................... 51

### I
- Installation
  - GAM ............................................................ 60
  - GAM Client .................................................... 60
  - GAM Server .................................................... 60
  - Integrated Mirroring SAS ..................................... 10
L
Log Information Viewer ................................ 72, 79
Logical Drive
  Deleting ........................................... 33, 40
  Viewing in the BIOS Utility ...................... 29
Logical drive ............................................ 12
Logical Drives ......................................... 12
  Initialization .................................... 12
  RAID Level ........................................ 11
  Rebuild ............................................ 14
  Status .............................................. 13
  Status Icon ...................................... 76
  Using Controller View ......................... 84

M
Media Verification ...................................... 15
Mirroring .............................................. 11

P
PFA / S.M.A.R.T. ....................................... 15, 94

R
RAID ................................................... 10
RAID Level ............................................ 11
Rebuild ................................................ 14, 86

S
SAS (Serial Attached SCSI) .......................... 10
Server group and server settings .................. 77
Server Icon .......................................... 71
Server Selection Box ............................... 70
ServerView .......................................... 55, 59, 102
Starting
  BIOS Utility ...................................... 22
  Controller View .................................. 75
  GAM ................................................. 68
Status
  Hard disk drive .................................. 13
  Logical Drives .................................. 13
Status Icon
  Hard disk drive .................................. 76
  Logical Drives .................................. 76

U
Uninstallation
  GAM .................................................. 64
  GAM Client ....................................... 64
  GAM Server ....................................... 65

V
View Menu ............................................. 73

W
Write Cache .......................................... 14
Write Policy .......................................... 14
Write policy .......................................... 14
Write Through ....................................... 14
• The contents of this manual may be revised without prior notice.
• Fujitsu assumes no liability for damages to third party copyrights or other rights arising from the use of any information in this manual.
• No part of this manual may be reproduced in any without the prior written permission of Fujitsu.