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 configuration precautions for the disk array, and an explanation of the array configuration flow.
Chapter 2 Using WebBIOS	This chapter explains the WebBIOS setup procedures. WebBIOS 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 RAID level and list of GAM error codes.

Before Reading This Manual

Remarks

■ Symbols

Symbols used in this manual have the following meanings:

IMPORTANT	These sections explain prohibited actions and points to note when using this software. Make sure to read these sections.
POINT	These sections explain information needed to operate the hardware and software properly. Make sure to read these sections.
→	This mark indicates reference pages or manuals.

■ 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: Abbreviations of Product Names

Product name	Expressions and abbreviations	
MegaRAID SAS 300-8E ROMB	the array controller, this array controller	
Microsoft® Windows Server™ 2003, Standard Edition Microsoft® Windows Server™ 2003, Enterprise Edition Microsoft® Windows Server™ 2003 R2, Standard Edition Microsoft® Windows Server™ 2003 R2, Enterprise Edition	Windows Server 2003	Windows
Microsoft® Windows Server™ 2003, Standard x64 Edition Microsoft® Windows Server™ 2003, Enterprise x64 Edition Microsoft® Windows Server™ 2003 R2, Standard x64 Edition Microsoft® Windows Server™ 2003 R2, Enterprise x64 Edition	Windows Server 2003 x64 [*1]	
Microsoft® Windows® 2000 Server Microsoft® Windows® 2000 Advanced Server	Windows 2000 Server	
Microsoft® Windows® XP Professional	Windows XP	
Microsoft® Windows® 2000 Professional	Windows 2000 Professional	
Microsoft® Windows NT® Workstation Operating System 4.0	Windows NT Workstation 4.0	
Red Hat Enterprise Linux AS（v.4 for x86）	Red Hat Linux	Linux
	RHEL-AS4(x86)	
Red Hat Enterprise Linux ES（v.4 for x86）	RHEL-ES4(x86)	
Red Hat Enterprise Linux AS（v.4 for EM64T）	RHEL-AS4(EM64T)	
Red Hat Enterprise Linux ES（v.4 for EM64T）	RHEL-ES4(EM64T)	
Red Hat Enterprise Linux AS（v.3 for x86）	RHEL-AS3(x86)	
Red Hat Enterprise Linux ES（v.3 for x86）	RHEL-ES3(x86)	
SUSE™ Linux® Enterprise Server 9	SLES9 or SUSE Linux	

*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).

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Chapter 1

Overview

This chapter provides an overview and configuration precautions for the disk array, and an explanation of the array configuration flow.

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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: Specification of MegaRAID SAS 300-8E ROMB

Item	Contents
Interface	SAS (Serial Attached SCSI)
Number of ports	8
Cache memory	Available (size depends on the server model)
Cache memory battery	Unavailable/Available (depending on the server model)
Management Tools	• WebBIOS BIOS utility in the array controller. • Global Array Manager (GAM) Software running on the OS to monitor and manage the array controller.

IMPORTANT

- Be sure to install the Global Array Manager (GAM) and ServerView and apply the latest service pack before using this array controller.

POINT

Supported operating systems

- Refer to the supported operating systems for the server running this array controller.
  Note that TCP/IP must be installed on all operating systems.

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. The RAID levels supported by this array controller are 0, 1 and 5. Depending on the RAID level, the number of available hard disk drives, available capacity and applicability of redundancy are different.

table: Characteristics of each RAID Level

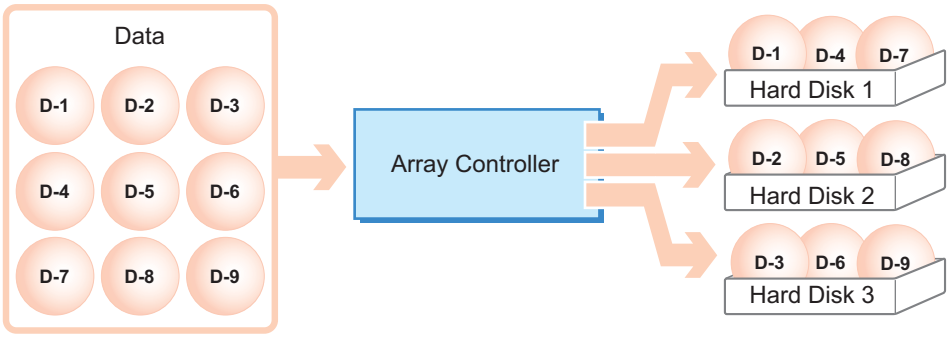
RAID Level	Number of hard disk drives	Available total capacity	Redundancy
RAID 0	1 to 32	Capacity of one hard disk drive x number of hard disk drives	No
RAID 1	2	Capacity of one hard disk drive	Yes
RAID 5	3 to 32	Capacity of one hard disk drive x (number of hard disk drives -1)	Yes

POINT

- Regardless of the applicability of redundancy, data backup should be performed as frequently as possible just in case.

■ RAID 0 (Striping)

Striping refers to the function of dividing data and writing them on multiple hard disk drives. For example, when writing nine blocks of data (D1 to D9), if three hard disk drives are involved, data is written evenly on each hard disk drive as shown in the figure below. Performance is improved by writing data on three different hard disk drives rather than writing all nine data blocks on a single hard disk drive.

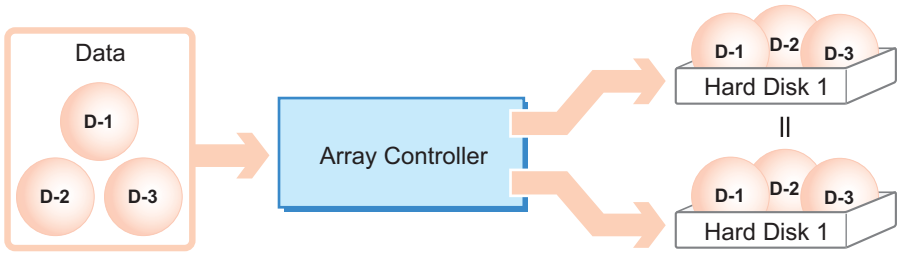


IMPORTANT

- RAID 0 has no redundancy and data may be lost in case of a hard disk failure. System operation will also be interrupted.

■ 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 a single hard disk drive.

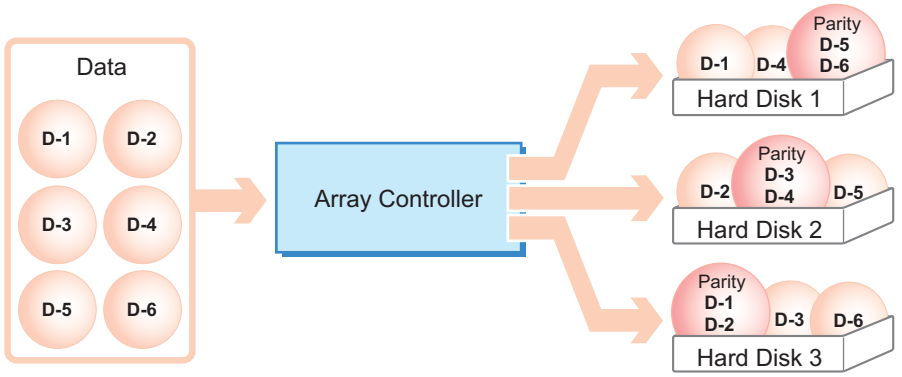


IMPORTANT

- 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 "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) for information on how to replace a hard disk drive.
  - See "5.6.2 Rebuild" (→pg.143) for information on how to perform a Rebuild.

■ RAID 5 (Striping + Parity)

In addition to striping, which divides the data and distributes them over multiple hard disk drives, RAID 5 generates parity data to provide redundancy. Parity data is data obtained through calculations on the data. For example, when writing six blocks of data (D-1 to D-6), if three hard disk drives are used, the data and calculated parity data are written evenly on each hard disk drive.In a RAID 5 configuration, the size of a single disk drive is used for parity data in order to provide redundancy by parity data.



IMPORTANT

- With RAID 5, operation continues even if one of the hard disk drives should fail (Critical). However, data may be lost if two or more 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 "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) for information on how to replace a hard disk drive.
  - See "5.6.2 Rebuild" (→pg.143) for information on how to perform a Rebuild.

■ Reliability and Performance Compararison between RAID Levels

When choosing RAID level, compare reliability and performance between RAID levels to determine the right level. The recommended RAID level is RAID 1. RAID 1 is superior to other RAID levels in data recoverablility. RAID 1 can only be configured with two hard disk drives and the available capacity will be equal to the capacity of a single hard disk drive. If the logical drive capacity is insufficient, you can increase the capacity by configuring multiple RAID 1 logical drives.

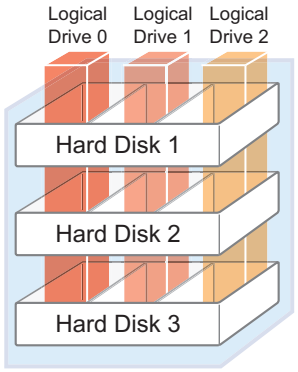
table: Characteristics of each RAID Level

RAID Level	Data Reliability		Performance		Capacity	Remarks
	Redundancy*1	Recoverability*2	Write	Read		
RAID 0	×	×	○	○	◎	The total capacity of all hard disk drives is available. This is not recommended, because no data redundancy is provided.
RAID 1	○	△	○	○	△	Half the capacity of all hard disk drives is available. Highly recommended for its excellent data recoverability.
RAID 5	○	×	△	○	○	The capacity of one hard disk drive is available. The write performance is poorer than for other RAID levels.

*1) Data redundancy for the case when one hard disk drive fails or gets disconnected.
*2) Data recoverability for the case when two or more hard disk drives are disconnected due to the failure of other parts than hard disk drives. For RAID 1, in which data is not striped, other systems may read one of the constituent hard disk drives in the RAID 1 configuration. However, even for RAID 1, data cannot always be recovered.

1.1.4 Disk Groups and Logical Drives

The hard disk drives forming RAID are referred to as a disk group and the logical units configured within a disk group are called logical drives.



Disk group

- **Disk Groups**

A disk group is a group of physical hard disk drives that form a disk array. It is not recognized by the OS.

IMPORTANT

- A disk group can consist of 1 to 32 hard disk drives.
- The maximum capacity of one disk group may not exceed 2TB.
- Generally, hard disk drives of the same model (with the same capacity and speed) should be used within a disk group.

- **Logical Drives**

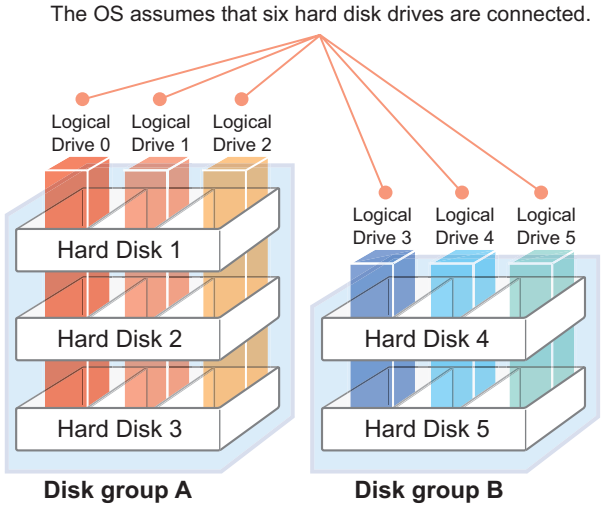
A logical drive is a logical hard disk space within a disk group. It is recognized in the same manner as a single hard disk drive by the OS.

IMPORTANT

- The maximum capacity of one logical drive is 2TB.
- Up to eight logical drives can be configured within a single array controller.
- Only one type of RAID level can be configured for the logical drives within a disk group.

■ Example of Disk Group and Logical Drive Configuration

Assume that two disk groups A and B are created using five hard disk drives and that six logical drives are created on those groups. In this case, the OS will assume that six hard disk drives are connected.



POINT

Configuring conditions

- Disk group A (drives 1 to 3) must consist of hard disk drives of the same type and with the same capacity.
- Disk group B (drives 4 and 5) must consist of hard disk drives of the same type and with the same capacity..
- One type of RAID level can be configured for the logical drives of disk group A.
- One type of RAID level can be configured for the logical drives of disk group B.

■ Status During Hard Disk Failure

In the above example, if, for instance, hard disk drive 1 fails, the status of all the logical drives 0 to 2 in the same disk group becomes "Critical". If another drive (e.g. drive 2 or 3) also fails, the status of the logical drives 0 to 2 becomes "Offline". However, the logical drives 3 to 5 of disk group B will remain "Online" because there is no hard disk problem.

1.1.5 Checking the Hard Disk Status

Constantly monitor the status of the hard disk drives in the disk group and the logical drive, and replace if there is a failure or indication of a failure.

■ Logical Drive Status

A logical drive can be in 3 different states as follows:

table: Logical drive status

Status	Description
Online	The logical drive is operating normally.
Critical	A redundant logical drive (RAID 1 and RAID 5) is operating without redundancy due to a failure of one hard disk drive. Replace the failed hard disk drive as soon as possible and perform a rebuild to restore the status to "Online". See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) for information on how to replace the hard disk drive and for rebuild.
Offline	Indicates that the logical drive is not operating. This status occurs when two or more hard disk drives in a disk group fail. In this case, data in the logical drive will be lost.

■ Hard Disk Status

A hard disk may be in any of the following states.

table: Hard disk status

Status	Description
Unconfigured Good	Not included in the disk array, but operating normally.
Online	Included in the disk array and operating normally.
Critical	Operating above the PFA (S.M.A.R.T.) threshold. Currently operating normally, but may fail in the near future (failure expected status). See "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.150) and replace the hard disk drive as soon as it is convenient.
Offline	Data read/write is disabled by the array controller's "Make Offline" function. Perform "5.6.2 Rebuild" (→pg.143) to use the drive again.
Failed	The drive is damaged and data read/write is disabled. Replace the hard disk drive and perform a rebuild. See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) for information on how to replace a hard disk drive.
Unconfigured Bad	The disk is not included in the disk array and is damaged. Replace the hard disk drive and perform a rebuild. See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) for information on how to replace a hard disk drive.
Hotspare	The hard disk drive is configured as a spare disk drive.

IMPORTANT

- If there is a hard disk drive with "Failed" or "Unconfigured Bad" status, there may be a hard disk failure and the drives may be operating without redundancy. The hard disk drive must be replaced as soon as possible. See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) for information on how to replace a hard disk drive.
- A hard disk drive with "Critical" status may fail in the near future. Perform "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.150).

1.2 Disk Array Configuration Features

This section explains the features in disk array configuration.

1.2.1 Write Policy

The Write Policy or Write Cache is the mode for writing to cache memory and can be configured for each logical drive.
There are three Write Policy modes: Write Through, Write Back, and Bad BBU.

IMPORTANT

- When installing the OS on the logical drive connected to this array controller, set the Write Policy of the logical drive to Write Through before the OS installation.
  If you want to set the Write Policy to Write Back or Bad BBU, change it using WebBIOS or GAM after the OS installation is completed.

■ Write Through

In this 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.

IMPORTANT

- Internal data will be lost if power to the cache memory is lost. If there is no battery for the cache memory and the server power supply is not protected by UPS, Write Through is recommended to prevent data loss in case of a power failure.

■ Write Back

In this 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 at the same time as data is written to cache memory, and the data write to the hard disk drive is performed later. However, Write Back cannot be used unless the cache memory has a battery.

IMPORTANT

- In general, the write performance is better than for Write Through, but the risk of data loss is higher. This is because data that is not written to the hard disk drive may remain in cache memory after the completion of writing instruction.

POINT

- If the cache memory has a battery and the voltage of the cache memory battery becomes low, the Write Policy is changed to Write Through in order to protect the data in the cache memory.

■ Bad BBU

The write method is the same as for Write Back, but Bad BBU maintains the Write Back status regardless of whether the cache memory is equipped with a battery or not. Therefore, the risk of data loss is higher than with Write Back.

IMPORTANT

- Do not perform write using Bad BBU if the server power supply is not protected by UPS. Otherwise, there is a risk of data loss in case of power failure.

1.2.2 Logical Drive Initialization

After configuring a logical drive, it must be initialized in order to make the best use of it. There are three methods to initialize a logical drive as described below.

■ Foreground Initialization

With this method, "0 (zero)" is wrtten in all areas of a logical drive to maintain consistency between the hard disk drives and to initialize them. This requires a certain amount of time because write operations are performed for the entire space of the hard disk drives.

POINT

- Foreground initialization is performed from WebBIOS.
  →"2.5.1 Initializing Logical Drives" (pg.59)
- "Foreground initialization is sometimes referred to simply as "initialization".
  This array controller also supports Background Initialization (→pg.19). If you do not want to perform background initialization, initialize the logical drives beforehand using foreground initialization.
- This function is terminated if the server is rebooted or the power is turned off, but in that case the initialization will not be complete.

● Time Required for Foreground Initialization

The following table shows the estimated initialization time per 10GB of logical drive space.

table: Estimated time for foreground initialization per 10GB

RAID Level	Number of hard disk drives	Execution time per 10GB
RAID 1	2	138 sec.
RAID 5	3	70 sec.
	6	27 sec.

For example, the capacity of a RAID 5 logical drive consisting of three 73GB hard disk drives is 146GB (= 73GB x (3 - 1)), which requires approximately 17 minutes (= approx. 70 sec./10GB x 146GB) to initialize. However, the time may differ from the value in the above table depending on the configuration and the hard disk type.

■ Background Initialization

With this method, initialization of the logical drive is performed in parallel with normal I/O access operations from the host. If foreground initialization is not performed, background initialization is performed automatically. This can save the time of a foreground initialization, but the following points must be noted.

- During background initialization, access to the hard disk drives may occur regardless of normal I/O access.
- Do not perform background initialization on hard disk drives that may contain partition information. If you need to perform background initialization on hard disk drives that contain data, see "2.7 Reusing a Hard Disk Drive" (→pg.68) and erase the data from the hard disk drives before configuring the array.

POINT

- Background initialization starts automatically when the array controller checks redundant logical drives (RAID 1/5) and detects a drive that is not initialized. The array controller checks for uninitialized logical drives every 5 minutes.
- If the server is reset or turned off before completing the background initialization, the background initialization is interrupted.
  Background initialization will be resumed from the interrupted block when the server is restarted.
- Until the background initialization is completed, I/O processing performance may be lower compared to logical drives that have been initialized.
- During background initialization, the access lamps of the hard disk drives that make up the target logical drive remain lit.
- The execution time of this function can be reduced by changing the BGI Rate and giving priority to this function over server I/O, but I/O performance will be reduced accordingly. Normally, use the default settings.

● Time Required for Background Initialization

The following table shows the estimated execution time per 10GB of logical drive space when there is no server I/O.

table: Estimated time for background initialization per 10GB

RAID Level	Number of hard disk drives	Estimated execution time per 10GB
RAID 1	2	143 sec.
RAID 5	3	71 sec.
	6	35 sec.

For example, the capacity of a RAID 5 logical drive consisting of three 73GB hard disk drives is 146GB (= 73GB x (3 - 1)), which requires approximately 18 minutes (= approx. 71 sec./10GB x 146GB) to initialize. However, the time may differ from the value in the above table depending on the configuration and the hard disk type.

POINT

- The above execution time is an estimate for when the BGI Rate is 80 (the default value).

■ Fast Initialization

With fast initialization, "0 (zero)" is written only in the first 50KB of the logical drive. However, even when the fast initialization is complete the entire area of the logical drive is not treated as initialized. Therefore, the entire area of the logical drive is initialized in combination with the subsequent background initialization which starts automatically.
Fast initialization can be performed with WebBIOS. See "2.5.1 Initializing Logical Drives" (→pg.59) for the detailed procedure.

POINT

- This initialization completes in few seconds, but the subsequent background initialization may take some time.
- This function can only be started from WebBIOS.

1.2.3 Rebuild

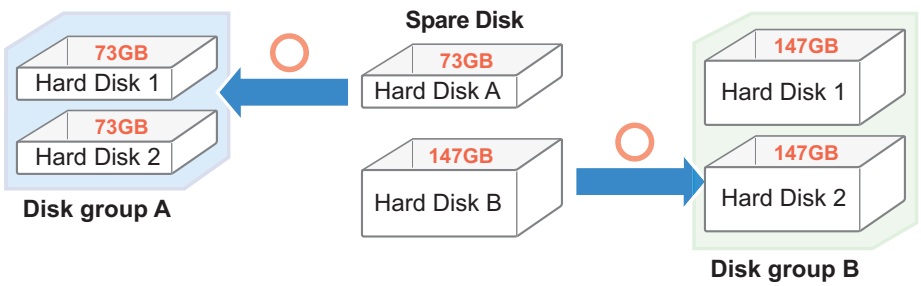
Even if a hard disk drive in a logical drive fails, if there is redundancy (RAID 1 or RAID 5), the logical drive continues to operate in "Critical" status. However, if another hard disk drive in the same logical drive also fails, the status of the logical drive becomes "Offline". Rebuild is the operation to restore a logical drive in "Critical" status to "Online" status. There are two methods for rebuilding as described below.

■ Hot Spare Rebuild

Hot spare rebuild is a rebuild that is performed automatically in the event of a hard disk failure, by having a pre-installed spare hard disk drive. The pre-installed spare hard disk drive is called a spare disk drive. When a hard disk failure occurs, rebuild is immediately performed on the spare disk drive, to quickly recover the "Critical" status and improve the reliability of the disk array.
When the failed hard disk drive is replaced, the newly installed hard disk drive is automatically configured as the spare disk drive.

IMPORTANT

- A spare disk drive is used as a substitute for a failed hard disk drive. Therefore, use a hard disk drive with the same capacity and speed as the hard disk drives connected in the disk group.
- When configuring spare disk drives in an environment with multiple disk groups using different types of hard disk drives, for each disk group, configure at least one spare disk drive with the same capacity and speed as the hard disk drive used in each disk group.



■ Manual Rebuild

Manual rebuild is a rebuild that is performed by replacing a failed hard disk drive with a new hard disk drive. When no spare disk drive is available, the disk array needs to be repaired through manual rebuild. 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 Manual Rebuild

The following table shows the estimated execution time per 10GB of logical drive space when there is no server I/O.

table: Estimated execution time for manual rebuild per 10GB

RAID Level	Number of hard disk drives	Estimated execution time per 10GB
RAID 1	2	152 sec.
RAID 5	3	82 sec.
	6	34 sec.

For example, the capacity of a RAID 5 logical drive consisting of three 73GB hard disk drives is 146GB (= 73GB x (3 - 1)), which requires approximately 20 minutes (= 82 sec./10GB x 146GB) to rebuild. However, the time may differ from the value in the above table depending on the configuration and the hard disk type.

POINT

- The rebuild time can be reduced by setting the [Rebuild Rate] to "100" and giving priority to rebuild over I/O. However, I/O performance will be impacted because rebuild is given priority. Normally, use the default settings. [Rebuild Rate] can be set from [Adapter Properties] (→pg.46) of WebBIOS or from "5.3.2 Setting and Changing Controller Options" (→pg.110) of GAM.
- 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 and the default settings, the I/O performance decreases about 30% at maximum.
- If restart or shutdown is performed during the rebuild, rebuild is resumed from where it was stopped the next time it is started.
- The above execution time is an estimate when the Rebuild Rate is 80 (the default value).

1.2.4 Make Data Consistent

"Make Data Consistent" is a function to maintain consistency between data on redundant logical drives (RAID 1 or RAID 5) and mirrored data or parity data.

IMPORTANT

- If the server is not shutdown properly, consistency of the data among hard disk drives may be lost. In such cases, use this function to make the data consistent.
- The Make Data Consistent function is also used to recover from hard disk media errors (different from inconsistency) because it reads the data on the hard disk drive.

POINT

- Data sent to the server is never changed by performing Make Data Consistent because correction of mirrored data and parity data is performed as necessary.
- The execution time of Making Data Consistent can be reduced by changing the CC Rate and giving priority to this function over system I/O, but then I/O performance is reduced accordingly. Normally, use the default settings.

● Time Required for Make Data Consistent

The following table shows the estimated execution time per 10GB of logical drive space when there is no server I/O.

table: Estimated execution time for Make Data Consistent per 10GB

RAID Level	Number of hard disk drives	Estimated execution time per 10GB
RAID 1	2	155 sec.
RAID 5	3	80 sec.
	6	39 sec.

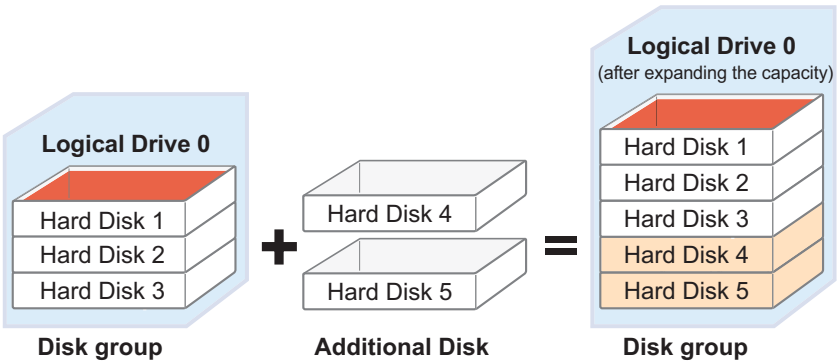
For example, the capacity of a RAID 5 logical drive consisting of three 73GB hard disk drives is 146GB (= 73GB x (3 - 1)), which requires approximately 20 minutes (= 80 sec./10GB x 146GB) for Make Data Consistent. However, the time may differ from the value in the above table depending on the configuration and the hard disk type.

POINT

- The above execution time is an estimate when the CC Rate is 80 (the default value).

1.2.5 Capacity Expansion

Capacity expansion is a function to expand the capacity of a logical drive by adding hard disk drives without destroying existing data. The following figure shows an example of adding two hard disk drives to disk group A, which consists of three hard disk drives. Re-striping is performed for the five hard disk drives without destroying the data on the logical drive, and the capacity of the additional hard disk drives is added to the logical drive.



After performing capacity expansion, the RAID level may change as follow.

table: RAID Level after Capacity Expansion

RAID level before capacity expansion	RAID level after capacity expansion	
	Migration only	Migration with addition
RAID 0	N/A	RAID 0, RAID 1, or RAID 5
RAID 1	RAID 0	RAID 0 or RAID 5
RAID 5	RAID 0	RAID 0 or RAID 5

POINT

- Only the capacity of logical drives is expanded by capacity expansion. The capacity of OS partitions is not expanded.
- The execution time of capacity expansion can be reduced by changing Reconstruction Rate or More Rate and giving priority to this function over system I/O, but then I/O performance is reduced accordingly. Normally, use the default settings.
- If the RAID level of the logical drive after the expansion has data redundancy (that is RAID 1 or RAID 5), background initialization will be performed after the capacity expansion is completed.
- If the capacity is expanded without adding a hard disk drive, the RAID level of the logical drive is converted to RAID 0 and the logical drive loses its redundancy. We recommend that you add a hard disk drive when expanding the capacity.

IMPORTANT

- Capacity expansion is only available when the logical drive is used in a Windows environment and the partition style for the logical drive has been initialized in MBR format. Do not perform capacity expansion if the partition style is in GUID Partition Table (GPT) format under Windows, or if using Linux. The GPT partition style may be available for Windows Server 2003 SP1 or later, or Windows Server 2003 x64.
- If there are multiple logical drives within a disk group, capacity expansion cannot be performed for the logical drives in that disk group.
- Capacity expansion cannot be canceled.
- The load when performing capacity expansion is very high and operation will slow down.
  In addition, since the logical drive loses its redundancy during capacity expansion, all the data on the logical drive will be lost if a hard disk failure occurs.

● Time Required for Capacity Expansion

The following table shows the estimated execution time per 10GB of logical drive space when there is no server I/O.

table: Estimated Time of Capacity Expansion per 10GB

RAID level before capacity expansion	Number of hard disk drives	RAID level after capacity expansion	Execution time per 10GB	
			When adding 1 drive	When adding 3 drives
RAID 0	1	RAID 0	330 sec.	173 sec.
RAID 0	1	RAID 1	362 sec.	-
RAID 0	1	RAID 5	-	201 sec.
RAID 1	2	RAID 0	133 sec.	72 sec.
RAID 1	2	RAID 5	186 sec.	110 sec.
RAID 5	3	RAID 0	183 sec.	119 sec.
RAID 5	3	RAID 5	116 sec.	144 sec.

For example, when expanding capacity of a RAID 5 logical drive consisting of three 73GB hard disk drives is 146GB (= 73GB x (3 - 1)), which requires 28 minutes (= 116 sec./ 10GB x 146GB) by adding one hard disk drive. However, the time may differ from the value in the above table depending on the configuration, the hard disk type and the number of added hard disk drives. Use the table only as a guide.

POINT

- The above execution time is an estimate when the Reconstruction Rate is 80 (the default value).

1.2.6 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.150) for the replacement procedure. The hard disk drive for which failure is predicted can be identified by WebBIOS and GAM.

1.2.7 HDD Check Scheduler

HDD Check Scheduler is a tool to detect or recover media errors on hard disk drives. HDD Check Scheduler performs Make Data Consistent periodically for media which are used. It also tests reading of drive areas that are not accessed in everyday operation.

- **Overview**

Media errors may occur accidentally on a hard disk drive, in particular if the drive is exposed to a severe shock during operation. Since this kind of event is not a hard disk failure, the media error will not be detected until reading the data in the erroneous sector, and if the drive is configured in a RAID level with redundancy, this array controller's usual functions will recover the data using the data on other hard disk drives. If a media error occurs in a file that is rarely accessed, the error will remain unrecovered, and if an additional hard disk drive should also fail, the data in the erroneous sector will be lost. The array controller uses a function to read data on the hard disk drives in the array to realign the data consistency , which makes it possible to read and check the entire hard disk drives.

HDD Check Scheduler performs Make Data Consistent periodically using the standard OS task-scheduling function. It reduces the risk of data loss during a rebuild caused by media errors. When you install HDD Check Scheduler, the check is set to start every day at 12:00 by default.

IMPORTANT

- Make sure to install HDD Check Scheduler. Before installing HDD Check Scheduler, install GAM (→pg.86).
  For details on how to install HDD Check Scheduler, see "4.5 Installing HDD Check Scheduler (Windows)" (→pg.92).
- The HDD checks using HDD Check Scheduler can only be performed on logical drives with redundancy (RAID 1 or RAID 5). The checks cannot be performed on RAID 0 logical drives or spare disk drives.

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**

  All the hard disk drives in a single disk group 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 "2.7.2 Wiping Information from a Hard Disk Drive" (→pg.68) 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 to this device controller.

1.3.2 Disk Array Configuration Flow

Proceed according to the following flowchart when configuring an array using an array controller and newly installing an OS.

1 Configuring the Array Disk Using WebBIOS

→"Chapter 2 Using WebBIOS" (pg.31)

Configure the disk array using WebBIOS before installing the OS and the device drivers.

1. Set up properties for the array controller
2. Create the disk group
3. Create the logical drive
   - Select RAID level
   - Set the Write Policy
   - Set the capacity of the logical drive
   - Initialize the logical drive

2 Installing the OS and the Device Drivers

See "User's Guide" supplied with the server to install the OS and the device drivers.

IMPORTANT

- When installing the OS on the logical drive connected to this array controller, set the Write Policy of the logical drive to Write Through before the OS installation.
  If you want to set the Write Policy to Write Back or Bad BBU, change it using WebBIOS or GAM after the OS installation is completed.

3 Installing Management Tools

→"Chapter 4 Overview and Installation of Global Array Manager (GAM)" (pg.79)

Install ServerView, GAM and HDD Check Scheduler on the server or client PC to monitor and control the disk array.

POINT

- See "ServerView User's Guide" to install and use ServerView.

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.74)

→"3.2 Applying the Hotfix" (pg.77)

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      : msas2k3
Type        : Warning
Event ID    : 129
Description: The description for Event ID (129) in Source (msas2k3)
             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.

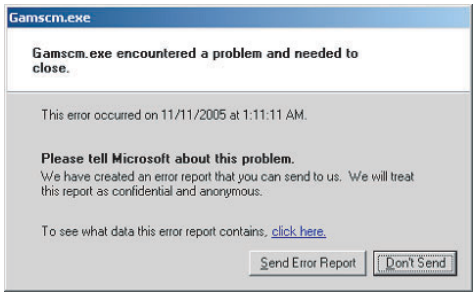
1.4.2 Error Message of Global Array Manager

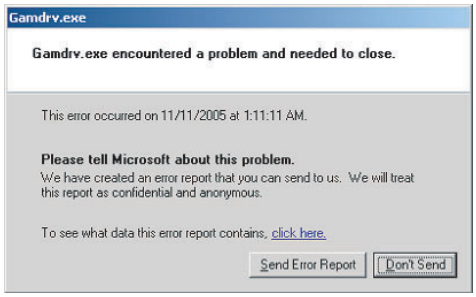
When using Windows where Dlobal Array Manager is installed, the following error may be entered in the application log and pop-up windows may be displayed:

- **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.)
```

- **Pop-up Window**





"Gamdrv" and "Gamscm" are modules included in the service of GAM, and this error occurs when failing in the start of GAM service because of high load to CPU, etc..
Ignore this error because the restart processing of the following two services is automatically performed. Click [Don't Send] or [Close Message] to close the window.

- Mylex Global Array Manager Service
- SNMP Service

POINT

- When the above error occurs, the following logs may be entered in the OS system log. However, these logs can be ignored because the service is restarted normally.

```
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 WebBIOS

This chapter explains the WebBIOS setup procedures. WebBIOS is a basic utility to set up and manage the array controller.

2.1 Starting and Exiting WebBIOS 32
2.2 Checking Each Status [WebBIOS] 37
2.3 Creating/Deleting a Disk Array Configuration 48
2.4 Setting/Releasing a Spare Disk Drive 57
2.5 Operations on Logical Drives 59
2.6 Rebuilding Hard Disk Drives 67
2.7 Reusing a Hard Disk Drive 68

2.1 Starting and Exiting WebBIOS

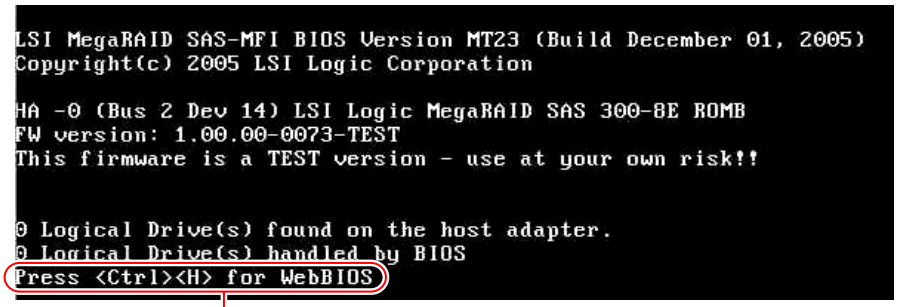
This section explains how to start up and exit WebBIOS. WebBIOS can be set to start from the BIOS at system startup, regardless of whether the OS has been installed or not on the computer to be used.

IMPORTANT

- To use WebBIOS, a mouse needs to be connected. Before starting WebBIOS, make sure that the mouse is connected to the server.
- If both this array controller and the SCSI array controller (MegaRAID SCSI) are installed in the system, the connected USB mouse may not work.
  In this case, start up WebBIOS for this array controller. While the POST screen of this array controller is displayed, press the [Ctrl]+[H] keys to start up WebBIOS.

2.1.1 Starting Up WebBIOS

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



Press the [Ctrl]+[H] keys while the message "Press <CTRL> <H> for WebBIOS" is displayed.

The following message appears and WebBIOS starts up after the system BIOS operations are complete.

```
WebBIOS will be executed after POST completes
```

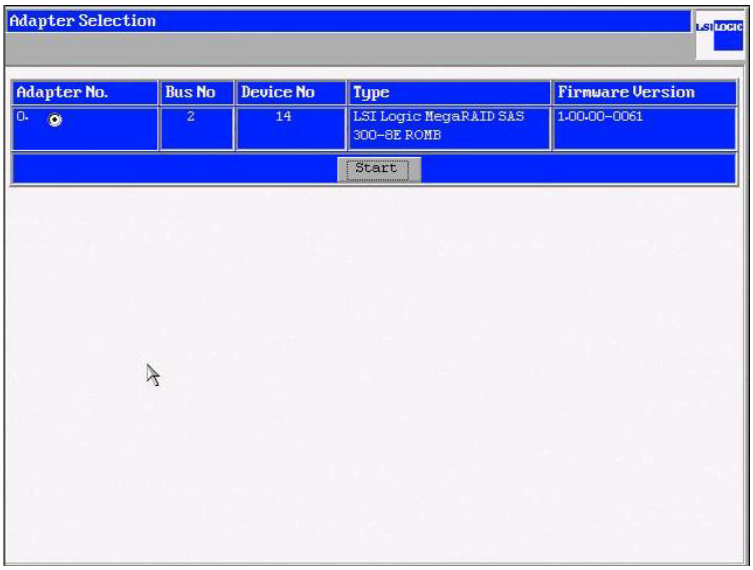
IMPORTANT

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

```
Foreign configuration(s) found on adapter
```

In that case, see "Chapter 6 Replacing a Hard Disk Drive" (→pg.145) to check the hard disk drive condition, replace the hard disk drive, and perform rebuild.

When WebBIOS starts, the [Adapter Selection] window of WebBIOS appears.
If any other array card is mounted at the same time, multiple array controllers are displayed.

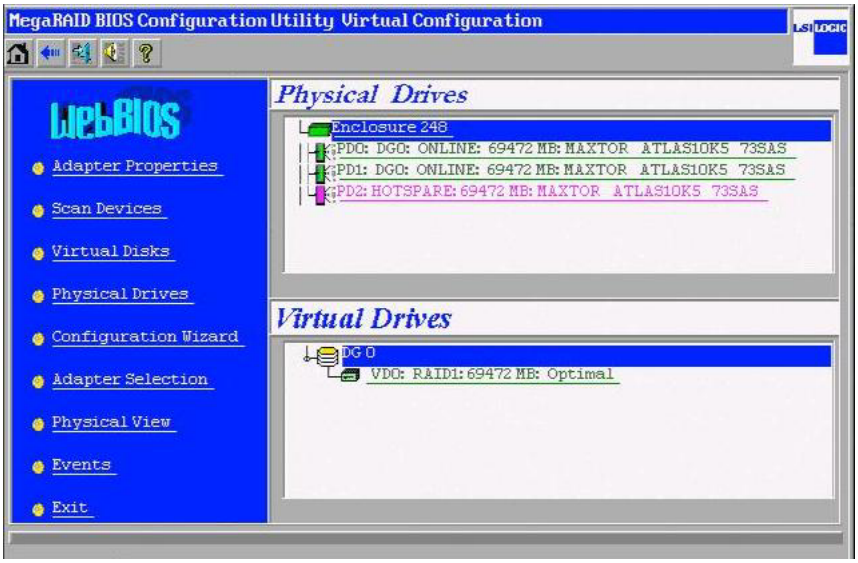


POINT

- For this array controller, the [Type] in the window shown above is displayed as "MegaRAID SAS PCI Express(TM) ROMB".

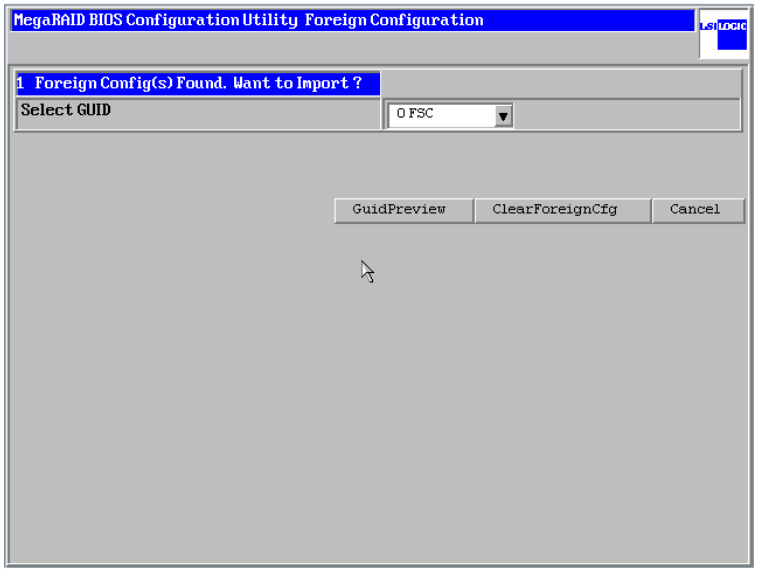
2 Select the array controller to be accessed, and click [Start].

The main window of WebBIOS will appear.



IMPORTANT

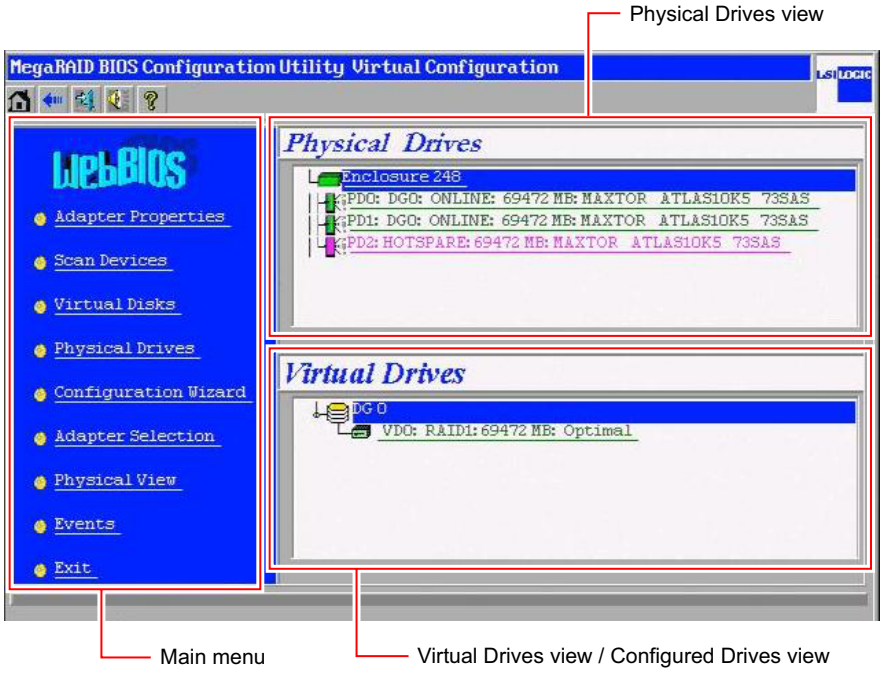
- When the message "Foreign configuration(s) found on adapter" has been displayed at the POST (see IMPORTANT for Step 1 →pg.32), the following screen may appear. Click [Cancel] and continue.



Do not click [GuidPreview] or [ClearForeighCfg].

■ WebBIOS Main Window

The main window of WebBIOS consists of three areas.



Main Menu

WebBIOS has the following menus:

table: WebBIOS Main Menu

Menu name	Description
Adapter Properties	Allows you to view/change the properties settings of the array controller.
Scan Devices	Redetects the hard disk drives connected.
Virtual Drives	Displays a list of the logical drives.
Physical Drives	Displays a list of the hard disk drives. You can also check the state of connected hard disk drives. →"2.2.1 Checking the Hard Disk Status" (pg.37)
Configuration Wizard	Creates and adds/deletes a disk array configuration.
Adapter Selection	Switches array controllers.
Physical View	Displays the [Configured Drives] view, where the disk group can be browsed and manipulated. The menu name switches to the Logical View.
Logical View	Displays the [Virtual Drives] view, where the logical drive can be browsed and manipulated. The menu name switches to the Physical View.
Events	Displays the event log on the array controller. This function is not supported. Do not use it.
Exit	Exits WebBIOS.

POINT

- You can switch between the [Virtual Drives] and [Configured Drives] views by selecting [Logical View] or [Physical View] in the main menu.

[Physical Drives] View

Displays a list of the hard disk drives. The status and the capacity of each hard disk drive are also displayed. For details about the status of hard disk drives, see "2.2.1 Checking the Hard Disk Status" (→pg.37).

[Virtual Drives] View

The [Virtual Drives] view displays the relationship between disk groups and logical drives. The RAID level, capacity and status of logical drives are also displayed. For details about the logical drive status, see "2.2.2 Checking Logical Drive Status" (→pg.40).

[Configured Drives] View

Selecting [Physical View] in the main menu switches the [Virtual Drives] view to the [Configured Drives] view. The [Configured Drives] view allows you to check the relationship between disk groups and the hard disk drives that make up the disk groups. The status and the capacity of each hard disk drive are also displayed.

2.1.2 Exiting WebBIOS

1. Click [Exit] in the main menu.
2. When the message "Exit Application" appears, select [Yes].
   WebBIOS exits.
3. When the message "Please Reboot your System" appears, turn off the server or press the [Ctrl]+[Alt]+[Delete] keys to restart the server.

2.2 Checking Each Status [WebBIOS]

This section explains how to check each status, such as the hard disk status, the logical drive status, and the background task status.

- Checking the Hard Disk Status (→pg.37)
- Checking Logical Drive Status (→pg.40)
- Checking the Progress of a Background Task (→pg.43)
- Confirming Array Controller Information (→pg.45)

2.2.1 Checking the Hard Disk Status

Checks the hard disk status.

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

2 In the [Physical Drives] view, a list of connected hard disk drives and their status are displayed.

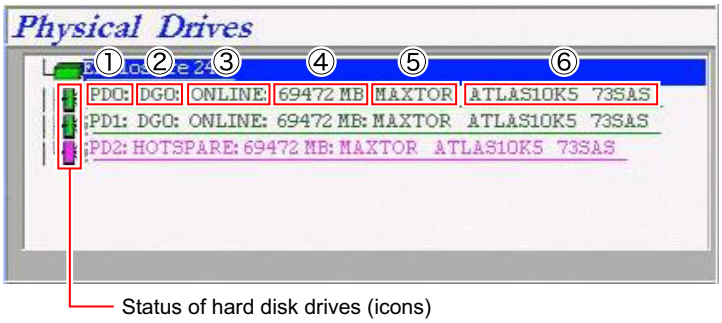


table: Hard disk drive information

	Meaning of Item	Example
1	Hard disk drive ID.	PD0
2	The number of the disk group to which the hard disk drive belongs. Only appears when included in a disk group.	DG0
3	Hard disk status.	ONLINE
4	Hard disk drive capacity.	69472MB
5	Hard disk drive vendor name.	MAXTOR
6	Hard disk drive model name.	ATLAS10K5_SAS

Hard Disk Drive Icons

The hard disk drive status is indicated with an icon, as follows.

table: Indications for Each Hard Disk Status

Color	Message	Status	Description
Blue	UNCONF GOOD	Unconfigured Good	Array is not configured but functions normally
Green	ONLINE	Online	Normal
Brown	REBUILD	Rebuilding	Rebuild in progress
Red	OFFLINE / FAILED	Offline or Failed	Failure
Black	UNCONF BAD	Unconfigured Bad	Array is not configured and has a failure
Pink	HOTSPARE	Hotspare	Spare disk drive

POINT

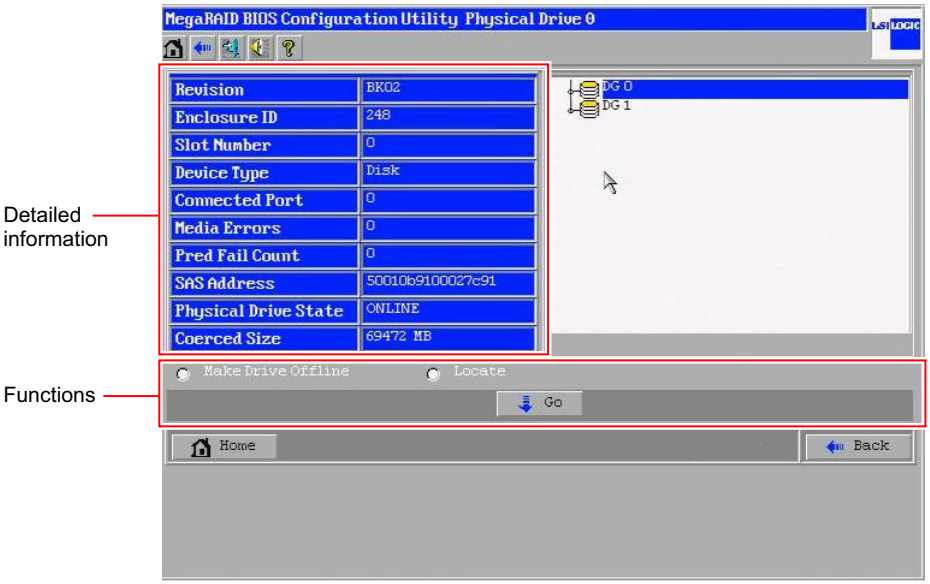
- For hard disk drives displayed in yellow, PFA (S.M.A.R.T.) is detected. Hard disk drives, for which PFA (S.M.A.R.T.) is detected may fail in the near future, and should be replaced as soon as possible. For how to replace hard disk drives, see "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.150).

IMPORTANT

- Depending on the failure condition of the hard disk drive, a "PD Missing from DG x:Slot y" entry may be added and displayed. This entry means that the hard disk drive with ID y in the disk group x is in failure condition. See "Chapter 6 Replacing a Hard Disk Drive" (→pg.145) to replace the hard disk drive with the displayed ID and perform rebuild.

3 Click the icon for the hard disk drive for which you want to check detailed information or that you want to manipulate.

The status and the settings of the selected hard disk drive are displayed.



Detailed information

table: The meaning of the Detailed Information for each item

Item	Description
Revision	Displays the firmware version number.
Enclosure ID	Displays the connected enclosure number.
Slot Number	Displays the installed slot number.
Device Type	Displays the device type.
Connected Port	Displays the connected port number.
Media Errors	Displays the number of medium errors. This function is not supported. Even if counted, no problem occurs because the error is recovered by the firmware.
Pred Fail Count	If PFA (S.M.A.R.T.) is detected, other than zero is displayed. Hard disk drives, for which PFA (S.M.A.R.T.) is detected 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.150) for the replacement procedure.
SAS Address	Displays the SAS address of the hard disk drives.
Physical Drive State	Displays the current state of the hard disk drives. For details about the status of a hard disk drive, see "■ Hard Disk Status" (→pg.16).
Coerced Size	Displays the hard disk drive capacity recognized by the array controller.

Functions

This window allows you to execute functions on the hard disk drives. The executable functions may vary according to the hard disk status.

table: Functions in the Function Executing Area

Item	Description	Executable Status
Locate	Makes the failure LED of the hard disk drive flash for ten seconds to tell the location.	All
Make Global HSP	Sets a spare disk drive. →"2.4.1 Setting a Spare Disk Drive" (pg.57)	Unconfigured Good
Make Dedicated HSP	Creates a special spare disk drive. Disabled. Do not use this.	Unconfigured Good
Make Unconf Bad	Forcibly puts the hard disk drive into Unconfigured Bad status. Disabled. Do not use this.	Unconfigured Good
Prepare for Removal	Stops the motor rotation. Disabled. Do not use this.	Unconfigured Good
Undo Prepare for Removal	Re-starts the stopped motor. Disabled. Do not use this.	Unconfigured Good
Replace Missing PD	Allocates a new hard disk drive instead of the failed drive. Do not execute this function without instructions from us, as the data may be lost.	Unconfigured Good
Make Drive Offline	Forcibly puts the hard disk drive in Offline status. Do not execute this function without instructions from us, as the data may be lost.	Online
Make Online	Forcibly puts the hard disk drive in Online status. Do not execute this function without instructions from us, as the data may be lost.	Offline
Rebuild Drive	Starts a rebuild. →"2.6 Rebuilding Hard Disk Drives" (pg.67)	Offline

table: Functions in the Function Executing Area

Item	Description	Executable Status
Mark as Missing	Forcibly releases the target hard disk drive from the disk array configuration. Do not execute this function without instructions from us, as the data may be lost.	Offline
Make Unconf Good	Forcibly puts the hard disk drive in Unconfigured Good status. Disabled. Do not use this.	Unconfigured Bad
Remove HOTSPARE	Releases a spare disk drive. →"2.4.2 Releasing a Spare Disk Drive" (pg.58)	Hotspare

4 When the check or operation is finished, click [HOME] or to return to the main window.

2.2.2 Checking Logical Drive Status

Checks the logical drive status.

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

2 In the [Virtual Drives] view, the logical drive status is displayed.

If the [Configured Drives] view is shown, select [Virtual View] in the main menu to display the [Virtual Drives] view.

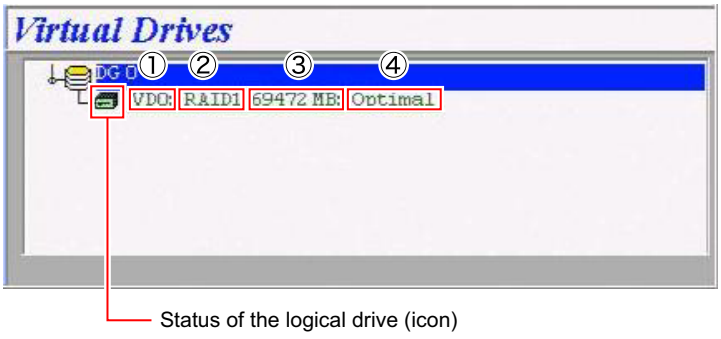


table: Logical drive information

Meaning of Item	Example
1 Logical drive number.	VD0
2 RAID level of the logical drive.	RAID 5
3 Logical drive capacity.	69472MB
4 Logical drive status.	Optimal

Logical Drive Icon

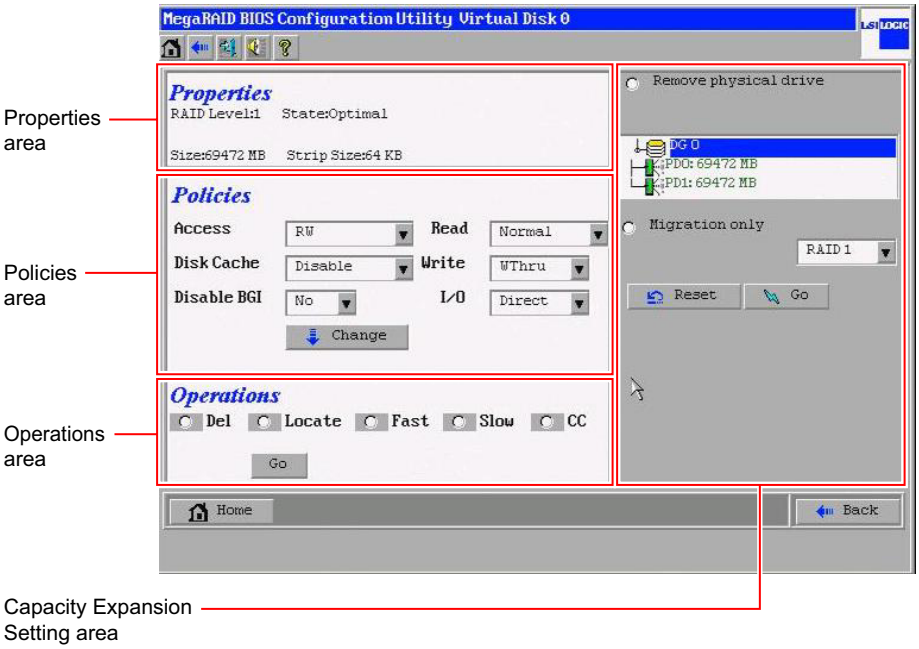
The logical drive icon is displayed in the following color according to the logical drive status.

table: Color of Each Logical Drive Status

Color	Status	Description
Green	Optimal	Normal
Blue	Degraded	Operation with non-redundancy
Red	Offline	Abnormal

3 Click the logical drive for which you want to check details or that you want to manipulate.

The status and the settings of the selected logical drive are displayed.



Properties

table: Properties Information

Item	Description
RAID Level	RAID level of the logical drive.
State	Logical drive status. For details about the logical drive status, see "■ Logical Drive Status" (→pg.16).
Size	Displays the total capacity of the logical drive.
Stripe Size	Displays the configurable stripe sizes of the logical drive.

Policies

table: Policies Information

Item	Description
Access	Sets the I/O access. Do not change this.
Read	Sets the read policy. Do not change this.
Disk Cache	Sets the write cache of the hard disk drive. Do not change this.
Write	Displays and sets the write policy. Specifies WThru (Write Through), WBak (Write Back), and BadBBU respectively. Click [Change] after changing the settings to reflect the new settings. For details about the write policy, see "1.2.1 Write Policy" (→pg.17).
Disable BGI	Sets the BGI. Do not change this.
I/O	Sets the DMA transmission mode. Do not change this.

POINT

- If a background task is in operation, the [Policies] items are only displayed, and cannot be modified.

Operations

Operations can be executed on the logical drives.

To execute, select the target function and click [Go].

table: Information about the Operations Area

Item	Description
Del	Deletes the logical drive. For more details, see "2.5.5 Deleting Logical Drives" (→pg.65).
Locate	Makes the failure LED of the hard disk drive contained in the logical drive flash for ten seconds to tell the location.
Fast	Performs fast initialization of a logical drive. For more details, see "2.5.2 Fast Initialization of Logical Drives" (→pg.60).
Slow	Performs foreground initialization of a logical drive. For more details, see "2.5.1 Initializing Logical Drives" (→pg.59).
CC	Performs Make Data Consistent for a logical drive. For more details, see "2.5.3 Make Data Consistent of Logical Drives" (→pg.61).

Capacity Expansion Setting

The capacity of a logical drive can be expanded. For more details, see "2.5.4 Expanding the Capacity of Logical Drives" (→pg.62).

4 When the capacity expansion check or operation is finished, click [HOME] or to return to the main window.

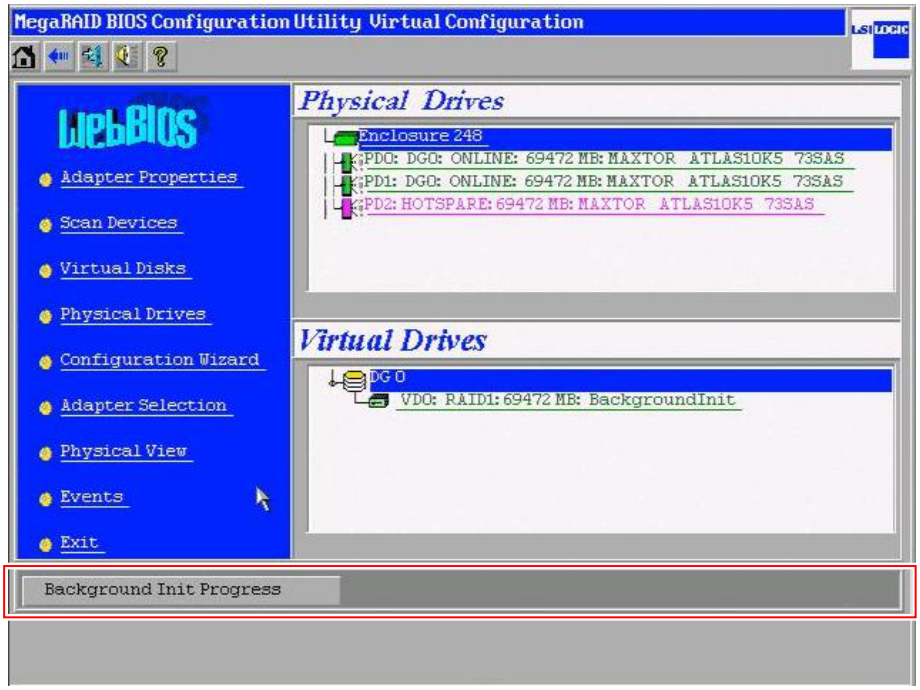
2.2.3 Checking the Progress of a Background Task

Displays the status of a task currently running in the background. This enables to check the progress of various kinds of initialization, Make Data Consistent, rebuild, and capacity expansion for logical drives.

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

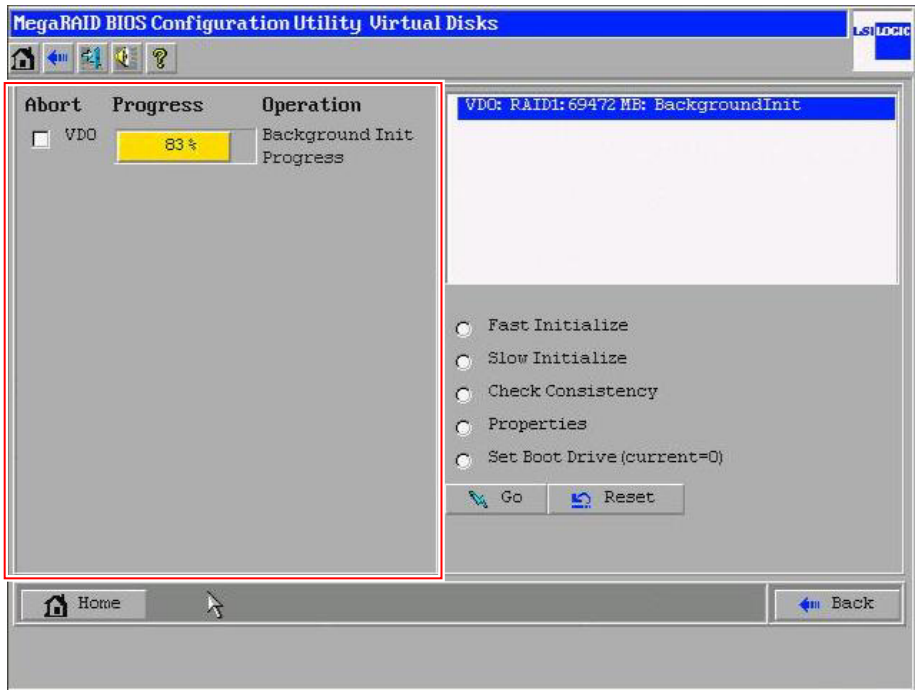
2 Click the button for the task in progress shown at the bottom of the main window.



POINT

- The available tasks and corresponding button names are as follows:
  - Rebuild [Rebuild Progress]
  - Fast Initialization [Initialization Progress]
  - Background Initialization [Background Initialization Progress]
  - Make Data Consistent [Check Consistency Progress]
  - Capacity Expansion [Reconstruction Progress]
- If the button for a task which is supposed to be running in the background is not shown, click [Scan Devices] in the main menu.

The names and status of running tasks are shown in the left area of the window.



IMPORTANT

- If you select [Abort] for a target background task and click [Go] in the lower right of the window, that background task will be aborted. Normally, do not abort.
- Although the options [Fast Initialize], [Check Consistency], [Properties], and [Set Boot Drive] are shown in the right area of the window, these functions are not supported in this window. Do not use them.

3 Confirm the description, then click [HOME] or to return to the main window.

2.2.4 Confirming Array Controller Information

This window displays array controller information. The settings can be changed. Before creating an array configuration, make sure to check the array controller settings.

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

2 Click [Adapter Properties] from the main menu.

The [Adapter Information] window appears.

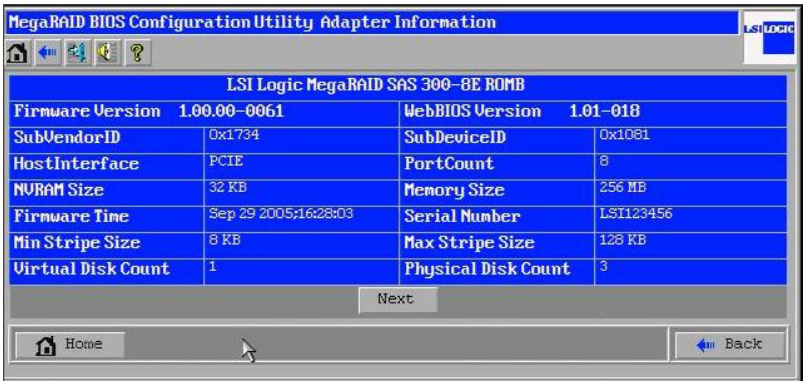
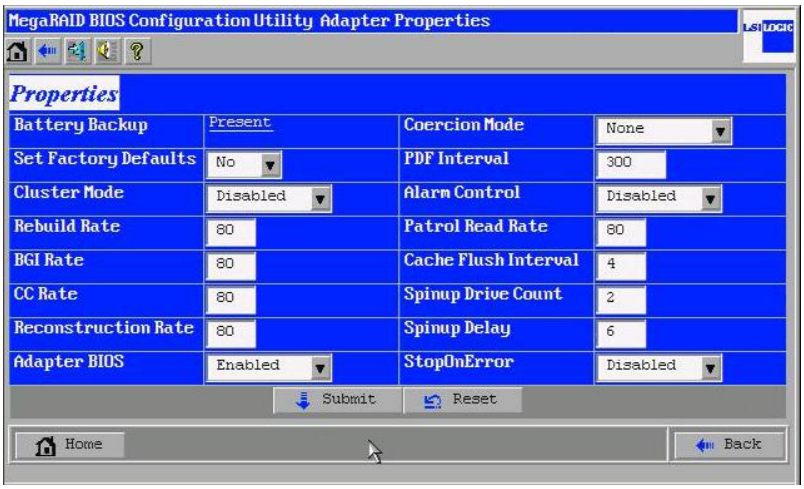


table: Array Controller Information

Item	Description
Firmware Version	Displays the firmware version of the array controller.
WebBIOS Version	Displays the WebBIOS version.
SubVendorID	Displays the Sub Vendor ID.
SubDeviceID	Displays the Sub Device ID.
HostInterface	Displays the interface type between the server and the array controller.
PortCount	Displays the number of SAS ports.
NVRAM Size	Displays the NVRAM size.
Memory Size	Displays the cache memory size.
Firmware Time	Displays the time when the firmware was started up for the first time.
Serial Number	Displays array controller serial number. However, the value displayed here is invalid for the onboard array controllers.
Min Stripe Size	Displays the minimum configurable stripe size of logical drives.
Max Stripe Size	Displays the maximum configurable stripe size of logical drives.
Virtual Disk Count	Displays the number of created logical drives.
Physical Disk Count	Displays the number of hard disk drives connected.

3 Click [Next].

The [Adapter Properties] window appears.



To Change Properties

To change the property settings of the array controller, edit or select the item to change, and then click [Submit] to confirm the change.

IMPORTANT

- Before changing the properties, check the changeable and fixed items in "Array Controller Settings" (→ P.46).

4 Confirm the description, then click [HOME] or to return to the main window.

■ Array Controller Settings

The factory setting for each property item of the array controller is as follows:

table: Array Controller Property Default Settings

Item	Setting	Description
Battery Backup	Present or None	Specifies whether a battery is installed or not. "Present" (detected) or "None" (not detected) will appear depending on whether a battery is detected or not.
Set Factory Defaults	No	Selecting [Yes] and saving the settings allows you to reset each setting of the array controller to the factory defaults.
Cluster Mode	Disabled (Fixed parameter)	This is an optional setting for supporting multi-initiator environments. For this product, this item is set to "Disabled" and must not be changed.
Rebuild Rate	80	Sets the priority when performing rebuild. The higher this number, the higher priority the rebuild has over I/Os from the server.
BGI Rate	80	Sets the priority when running a background initialization. The higher this number, the higher priority the background initialization has over I/Os from the server.
CC Rate	80	Sets the priority when performing Make Data Consistent. The higher this number, the higher priority Make Data Consistent has over I/Os from the server.

table: Array Controller Property Default Settings

Item	Setting	Description
Reconstruction Rate	80	Sets the priority when performing capacity expansion. The higher this number, the higher priority the capacity expansion has over I/Os from the server.
Adapter BIOS	Enabled (Fixed parameter)	Enables or disables the array controller BIOS. For this product, this item is set to "Enabled" and must not be changed.
Coercion Mode	None (Fixed parameter)	Sets the capacity rounding function for unifying hard disk drive capacities. For this product, this item is set to "None" and must not be changed.
PDF Interval	300 (Fixed parameter)	Sets the PFA (=S.M.A.R.T.) tracking interval for the hard disk drive. For this product, this item is set to "300" and must not be changed.
Alarm Control	Disabled (Fixed parameter)	If a buzzer for notifying errors is installed in the array controller, this enables or disables the buzzer. For this product, this item is set to "Disabled" and must not be changed.
Patrol Read Rate	80	Sets the priority when running Patrol Read. The higher this number, the higher priority the Patrol Read has over I/Os from the server.
Cache Flush Interval	4 (Fixed parameter)	Sets the data write interval from the cache memory to the hard disk drive when running in write back mode. For this product, this item is set to "4" and must not be changed.
Spinup Drive Count	2 (Fixed parameter)	Sets the number of hard disk drives that start rotating at the same time. For this product, this item is set to "2" and must not be changed.
Spinup Delay	6 (Fixed parameter)	Sets the interval to the next start after starting the hard disk drive rotation for the first time. For this product, this item is set to "6" and must not be changed.
StopOnError	Disabled (Fixed parameter)	During POST, sets whether to stop the POST as soon as a specific message appears. For this product, this item is set to "Disabled" and must not be changed.

2.3 Creating/Deleting a Disk Array Configuration

This section explains how to configure a newly created disk array.

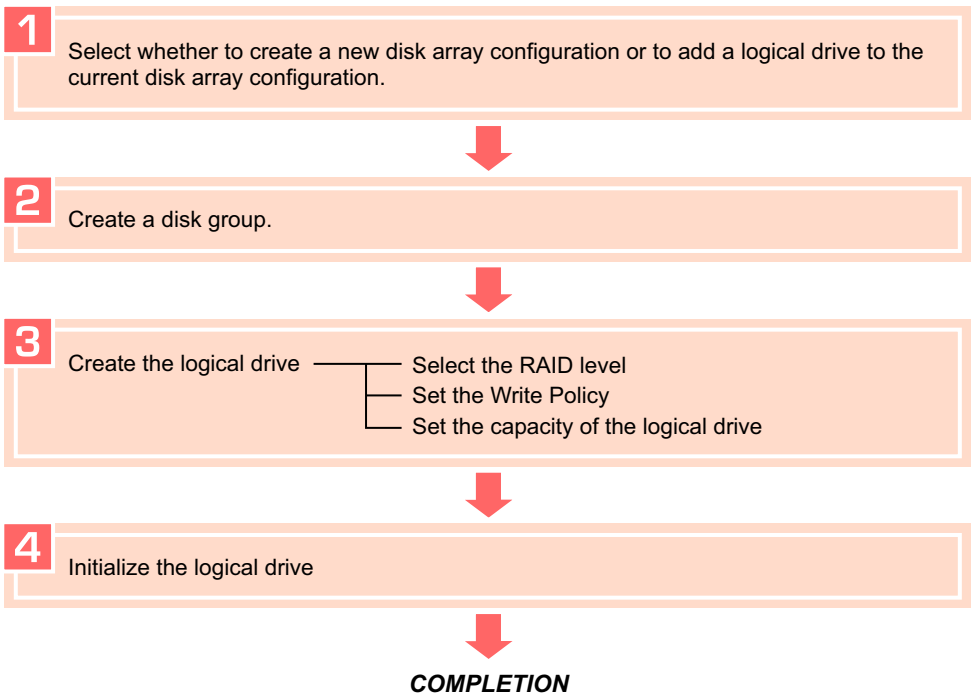
2.3.1 Creating a Disk Array Configuration

■ Overview of the Array Configuration Procedure

The disk array is configured by performing the following steps:

POINT

- Before starting the disk array configuration, see "2.2.4 Confirming Array Controller Information" (→pg.45) and check the array controller properties.



■ How to Create a Disk Array Configuration

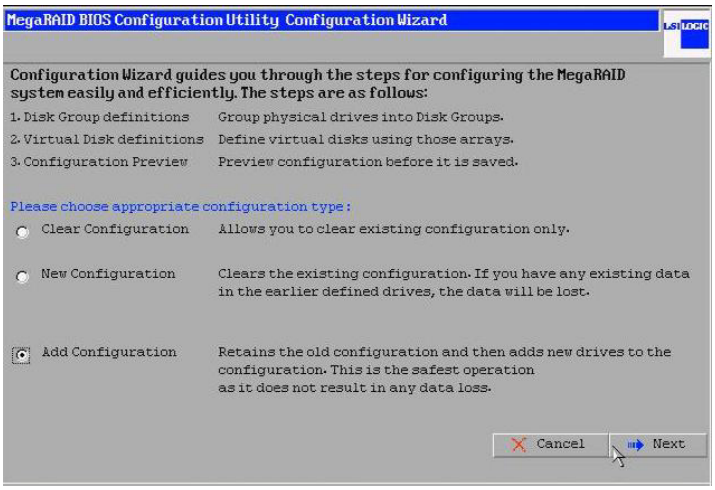
Perform the following procedure to set a disk array configuration.

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

2 Click [Configuration Wizard] from the main menu.

The [Configuration Wizard] window appears.



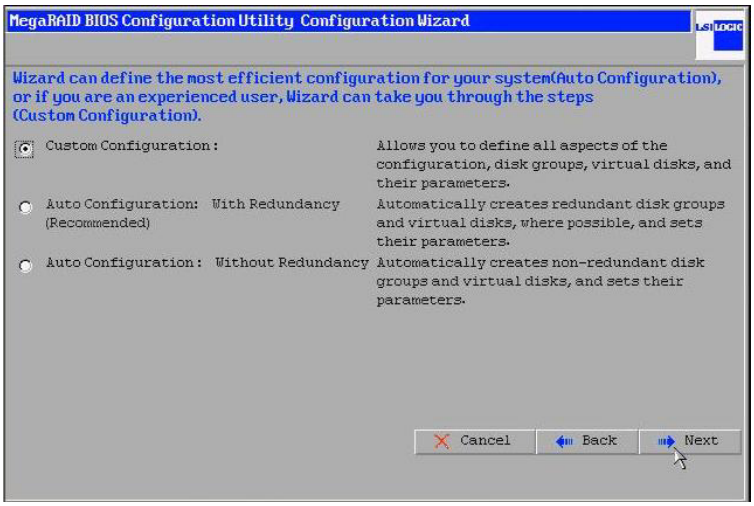
3 Select [New Configuration] to create a new disk array configuration, or [Add Configuration] to add a logical drive to the current disk array configuration. Then click [Next].

IMPORTANT

- If you select [New Configuration] when a disk array configuration already exists, a warning appears because the existing configuration will be deleted.

If you want to delete the current configuration, click [Yes] to proceed.
To add a new logical drive while keeping the existing logical drive, click [No] to perform [Add Configuration].

The following window appears.

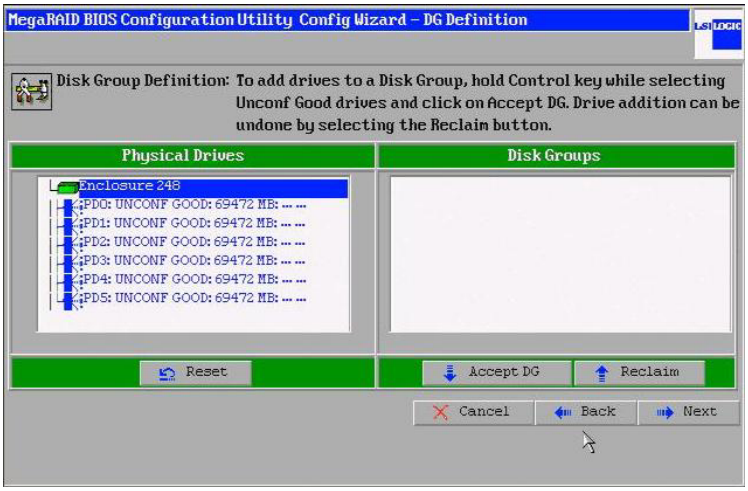


IMPORTANT

- [Auto Configuration With Redundancy (Recommended)] and [Auto Configuration Without Redundancy] are not supported. Do not select these.

4 Select [Custom Configuration] and click [Next].

The [DG Definition] window appears.



5 Create a disk group.

Perform the following procedures:

1. Select the hard disk drive to be added to the disk group from the "Physical Drives" area while pressing the [Ctrl] key.
   The selectable hard disk drives are indicated with "UNCONF GOOD" in blue.
2. Click [Accept DG].
   The disk group is confirmed and displayed in the [Arrays] area.
3. Repeat the above procedure to set the required number of disk groups.
   Add the required number of hard disk drives for creating the array configuration.

table: Number of Hard Disk Drives Needed for Each RAID Level

RAID Level	Necessary Number of Hard Disk Drives
RAID 0	1 or more
RAID 1	2
RAID 5	3 or more

IMPORTANT

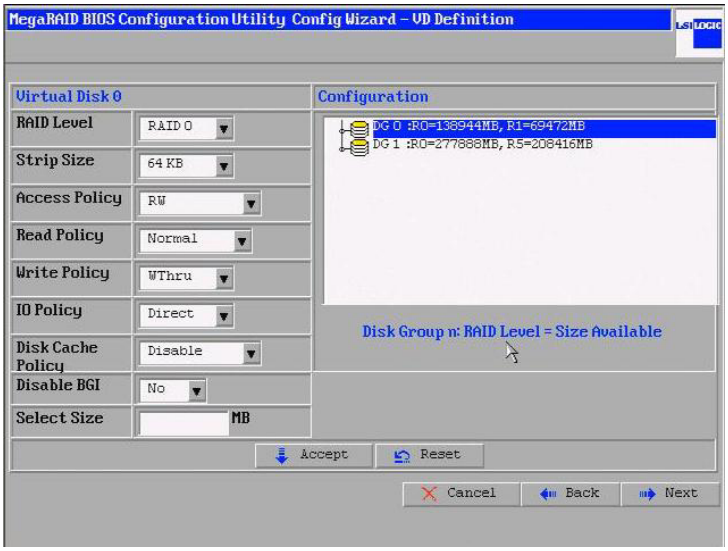
- In general, the hard disk drives in a single disk group should be of the same model (with the same capacity and speed).

POINT

- Hard disk drives that are already included in a disk group are displayed as "Online" in green letters.
- If an incorrect disk group is set by mistake, click [Back] and redo the procedure from Step 3.

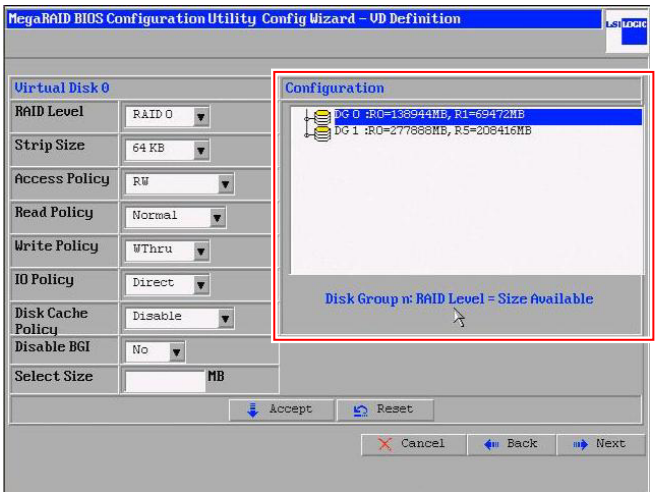
6 When the disk group creation is finished, click [Next].

The [VD Definition] window appears.



7 Create the logical drive.

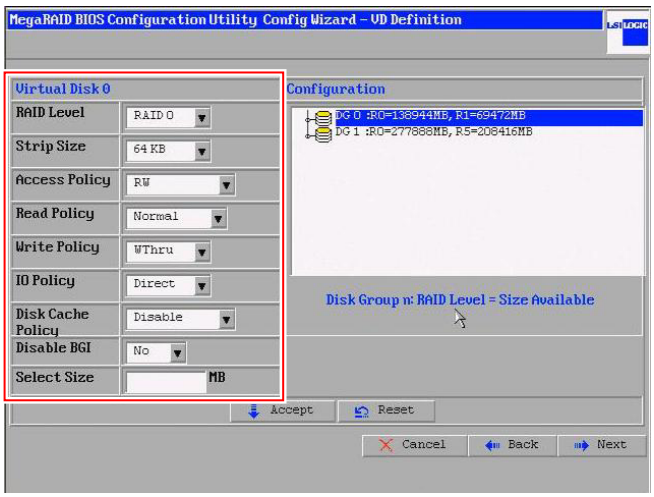
1. Select disk groups for the logical drive from the right area.



IMPORTANT

- To create a logical drive, begin from the disk group with the lowest number.
  For example, if there are disk groups named "DG 0" and "DG 1", start creating the logical drive from the disk group "DG 0".
- Do not create a logical drive for the next disk group while free space remains in the previous disk group. Wait until no free space remains in the previous disk group before creating a logical drive for the next disk group.

2. Enter settings for the logical drive.



The setting items and their defaults for the logical drive are as follows:

table: Logical Drive Settings

Item	Default value	Remarks
RAID Level	RAID 0	Sets the RAID level.
Stripe Size	64KB	Do not change this.
Access Policy	RW	Do not change this.
Read Policy	Normal	Do not change this.

table: Logical Drive Settings

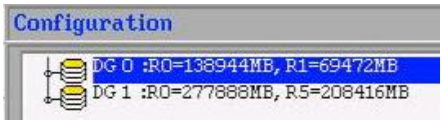
Item	Default value	Remarks
Write Policy	WThru	The possible values are WThru (Write Through), WBak (Write Back), or BadBBU.
IO Policy	Direct	Do not change this.
Disk Cache Policy	Disable	Do not change this.
Disable BGI	No	Do not change this.
Select Size	(Blank)	Sets the capacity of the logical drive in MB.

IMPORTANT

- Only one RAID level can be configured in a disk group.
- Always refer to "1.2.1 Write Policy" (→pg.17) before changing the write policy default setting.

POINT

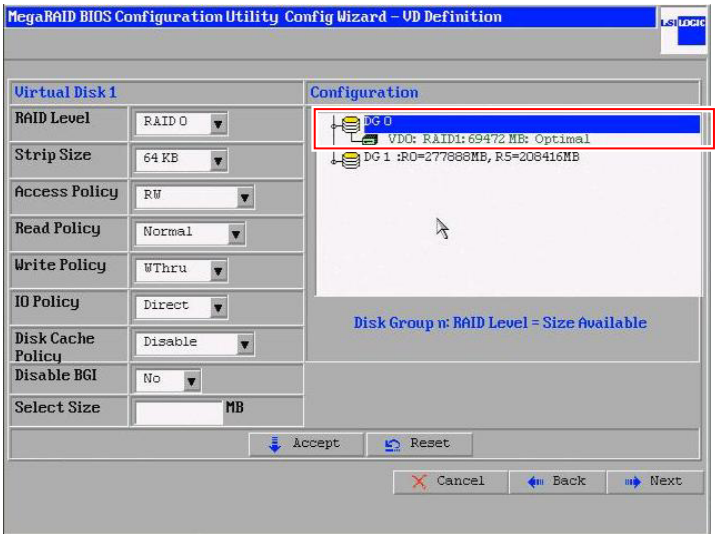
- The capacity of the logical drive is displayed in the "RAID level = maximum value" format above the disk groups to the right. Do not set a higher value than the maximum value.
  For example, in the figure below, if "DG 0:R0=138944MB, R1=69472MB" is displayed, the maximum configurable RAID 0 capacity for disk group 0 is 138,944 MB, and the maximum configurable RAID 1 capacity is 69,472 MB.



- Setting the logical drive capacity to a lower value than the maximum capacity allows you to create multiple logical drives.

8 When the creation of the logical drive is finished, click [Accept].

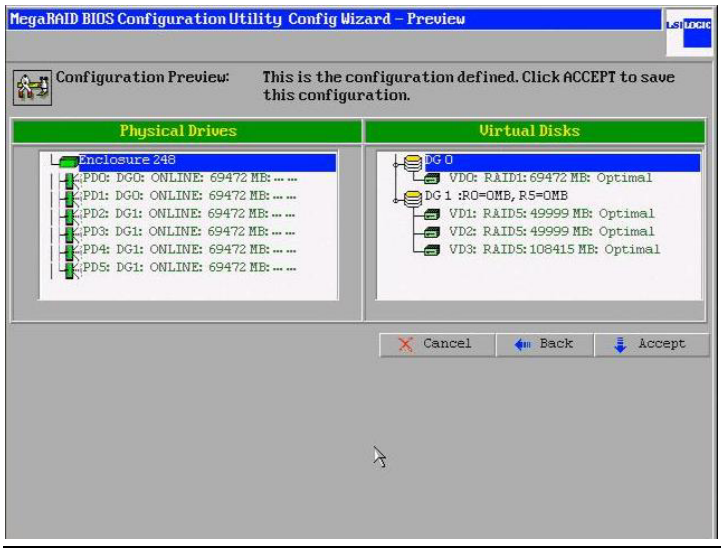
The logical drive is added under the disk groups in the [Configuration] area.



IMPORTANT

- If capacity remains to set other logical drives, or if there is a disk group for which no logical drive has been set, the [VD Definition] window appears again.
  Return to Step 7, and create logical drives until no free space remains in the disk group.
  When there is no more free space in the disk group, the [Preview] window appears.

When the disk group settings are finished, the [Preview] window appears.



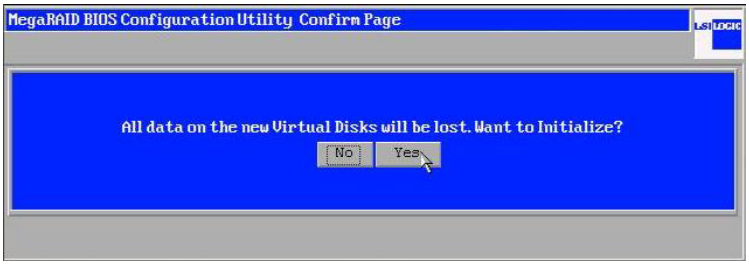
POINT

- If you create an incorrect logical drive by mistake, click [Back] and start again from the [DG Definition] window.

9 If the description in the [Preview] window is correct, click [Accept].

10 When the message "Save this Configuration?" appears, click [Yes].

The modified settings are written, and the [Confirm Page] window appears.



11 To initialize the logical drive now, click [Yes]. To initialize it later, click [No].

POINT

- Clicking [Yes] at this point will start a fast initialization. After a short while, background initialization will automatically be started.
  If you click [No] (i.e. if you do not want to perform background initialization), perform foreground initialization, referring to "2.5.1 Initializing Logical Drives" (→pg.59).

12 When the initialization is finished, click [HOME] or to return to the main window.

2.3.2 Deleting the Disk Array Configuration

To delete the entire current disk array configuration, use the [Clear Configuration] function in the [Configuration Wizard].
When the disk array configuration is deleted, the data on the hard disk drive can no longer be accessed. The configuration information for the disk array is completely deleted, and all hard disk drives are restored to the "Unconfigured Good" state.

IMPORTANT

- Normally, this function should not be used. If this function is used, the current settings on the array controller are deleted and all the data on the hard disk drives connected to the array controller is also deleted. If using this function, make a plan beforehand and proceed carefully.

1 Start up WebBIOS.

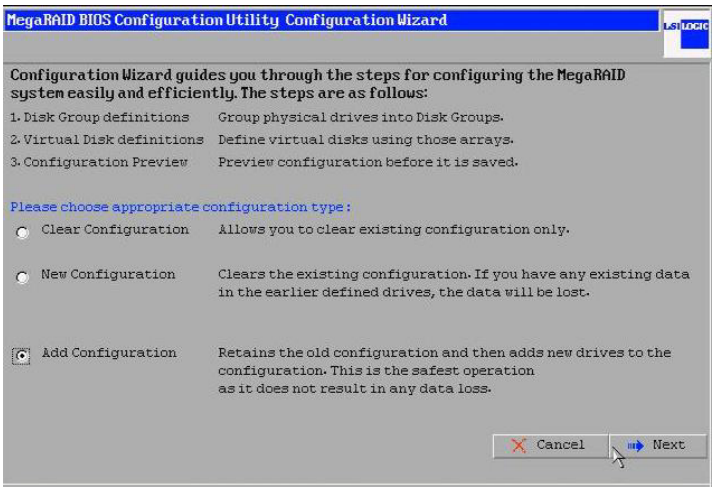
→"2.1.1 Starting Up WebBIOS" (pg.32)

POINT

- When multiple array controllers are installed, select the controller for which the disk array is to be deleted in the controller selection window.

2 Click [Configuration Wizard] from the main menu.

The [Configuration Wizard] window appears.



3 Select [Clear Configuration] and click [Next].

When the following warning message appears, click [Yes].

4 If the [Configuration Preview] window is displayed, click [Accept].

When the message "Save this Configuration?" appears, click [Yes]. Allocation of all logical drives is deleted, and the status of all hard disk drives connected to the array controller becomes "Unconfigured Good".

IMPORTANT

- If a hard disk drive is in the "Unconfigured Bad" state after clicking [Yes], it means that that hard disk drive is defective. That hard disk drive cannot be used. See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the defective hard disk drive.

5 Click [HOME] or to return to the main window.

2.4 Setting/Releasing a Spare Disk Drive

This section explains how to set a hard disk drive in "Unconfigured Good" state as a spare disk drive and how to release an existing spare disk drive.

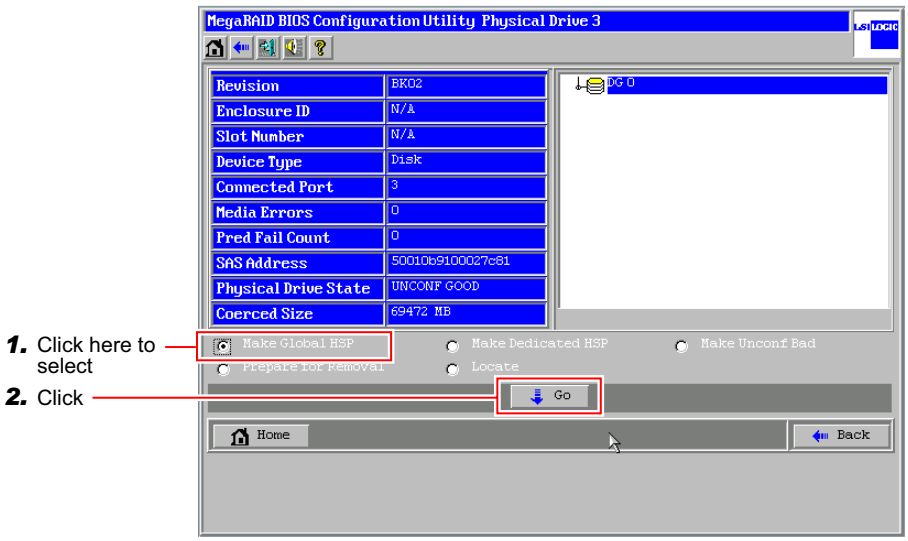
2.4.1 Setting a Spare Disk Drive

This procedure is used to set a hard disk drive in "Unconfigured Good" state as a spare disk drive.

1. Start up WebBIOS.
   →"2.1.1 Starting Up WebBIOS" (pg.32)

2. Select a hard disk drive in "Unconfigured Good" state to set as a spare disk drive from the [Physical Drives] view in the main window.

3. Select [Make Global HOTSPARE] at the bottom of the window, and click [Go].



Make sure that the hard disk drive has been set as a spare disk drive and that the "Physical Drive State" is indicated as "HOTSPARE".

4. Confirm the settings and click [HOME] or to return to the main window.

2.4.2 Releasing a Spare Disk Drive

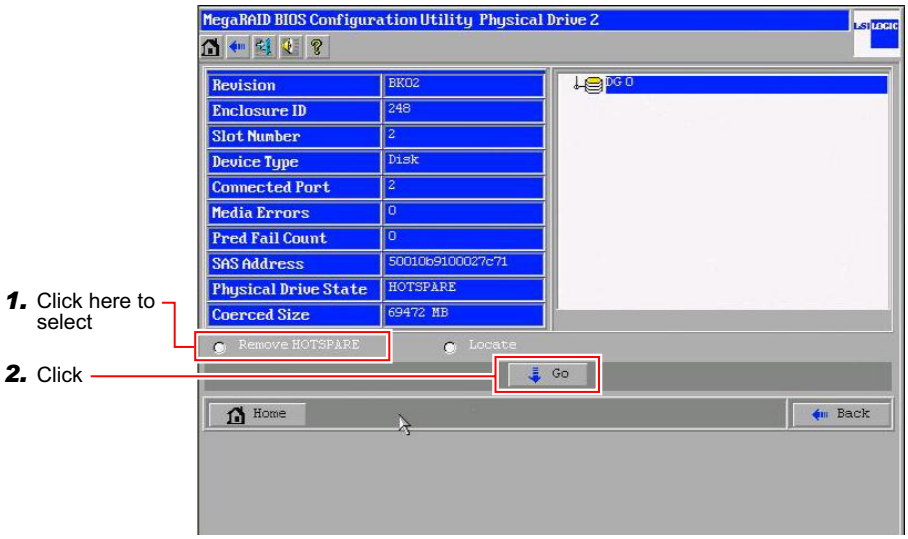
Restores a hard disk drive in "HOTSPARE" state to "Unconfigured Good" state.

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

2 Select the hard disk drive in the "HOTSPARE" state to restore to "Unconfigured Good" state from the [Physical Drives] view of the main window.

3 Select [Remove HOTSPARE] at the bottom of the window, and click [Go].



Make sure that the spare disk drive has been released and that the "Physical Drive State" is indicated as "UNCONF GOOD".

4 Confirm the settings and click [HOME] or to return to the main window.

2.5 Operations on Logical Drives

This section explains the following operations on logical drives:

- Initializing Logical Drives→pg.59
- Fast Initialization of Logical Drives→pg.60
- Make Data Consistent for Logical Drives→pg.61
- Expanding Capacity of Logical Drives→pg.62

2.5.1 Initializing Logical Drives

To initialize a logical drive in the foreground, perform the following procedure.

IMPORTANT

- Note that initialization of a logical drive will delete all the data on the target logical drive.

POINT

- For an overview of the initialization functions, see "1.2.2 Logical Drive Initialization" (→pg.18).
- This array controller supports background initialization. If you do not want to initialize the logical drive in the background, perform this function beforehand to initialize the logical drive.

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

2 Click the logical drive to initialize in the [Virtual Drives] view in the main window.

3 Select "Slow" in "Operations" and click [Go].

A confirmation window appears.

4 Click [Yes].

The initialization of the logical drive starts.

POINT

- Clicking [No] allows you to return to the previous window.
- During initialization, you to check the progress by clicking [Initialization Progress] in the lower part of the window. For more details, see "2.2.3 Checking the Progress of a Background Task" (→pg.43).

5 When the initialization is finished, click [HOME] or to return to the main window.

2.5.2 Fast Initialization of Logical Drives

To fast initialize logical drives, perform the following procedure:

POINT

- For an overview of the fast initialization function, see "■ Fast Initialization" (→pg.20).
- Normally, the logical drive is initialized when the disk array is configured, so that fast initialization after creating the logical drive is not required.
- When a background initialization is in progress, fast initialization cannot be performed.

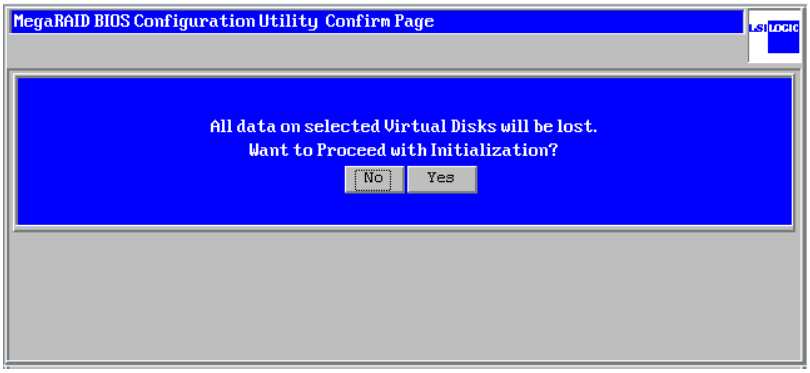
1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

2 Click the logical drive to fast initialize in the [Virtual Drives] view in the main window.

3 Select "Fast" in "Operations" and click [Go].

A final confirmation window appears.



4 Click [Yes].

The fast initialization of the logical drive starts.

POINT

- Clicking [No] allows you to return to the previous window.

5 When the initialization is finished, click [HOME] or to return to the main window.

2.5.3 Make Data Consistent of Logical Drives

To make data consistency of a logical drive, perform the following procedure:

POINT

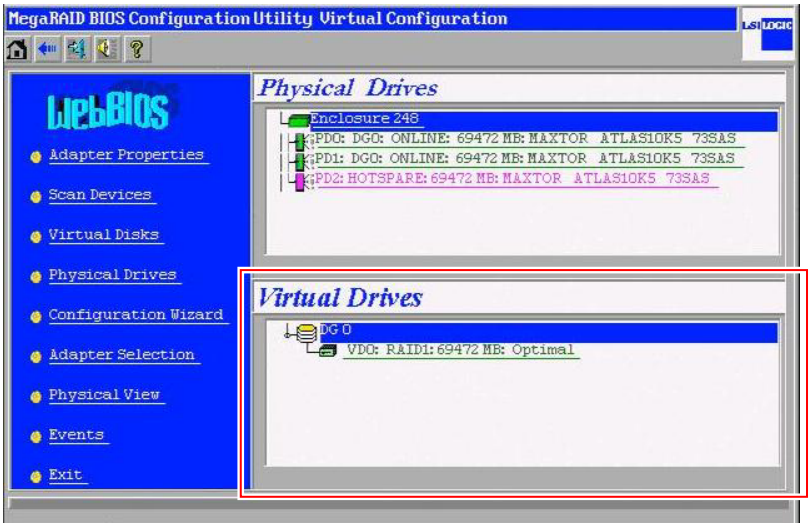
- For an overview of the Make Data Consistent function, see "1.2.4 Make Data Consistent" (→pg.22).

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

2 Make sure that the [Virtual Drives] view is shown.

If the [Configured Drives] view is shown, select [Virtual View] in the main menu to switch to the [Virtual Drives] view.



3 Click the logical drive whose consistency is to be checked in the [Virtual Drives] view.

4 Select "CC" in "Operations" and click [GO].

5 Click [Yes] when a confirmation window appears.

The Make Data Consistent for the logical drive starts.

POINT

- Clicking [No] allows you to return to the previous window.
- During the Make Data Consistent, you to check the progress by clicking [Check Consistency Progress] in the lower part of the window. For more details, see "2.2.3 Checking the Progress of a Background Task" (→pg.43).

6 When the Make Data Consistent is finished, click [HOME] or to return to the main window.

2.5.4 Expanding the Capacity of Logical Drives

Perform this procedure to expand the capacity and change the RAID level for an existing logical drive.

IMPORTANT

- There are certain conditions to note and precautions to take for capacity expansion. Read "1.2.5 Capacity Expansion" (→pg.23) carefully before expanding the capacity.

■ Operations before Capacity Expansion

Before expanding the capacity, perform the following preparatory procedures:

1. Back up the data to prepare for unexpected problems.
2. Perform a Make Data Consistent (→pg.61) on the logical drive where the capacity is to be expanded and make sure that the check terminates normally.

   IMPORTANT

   - If the Make Data Consistent is not completed successfully, do not expand the capacity of the logical drive.
3. Install the hard disk drive to be added to the server.

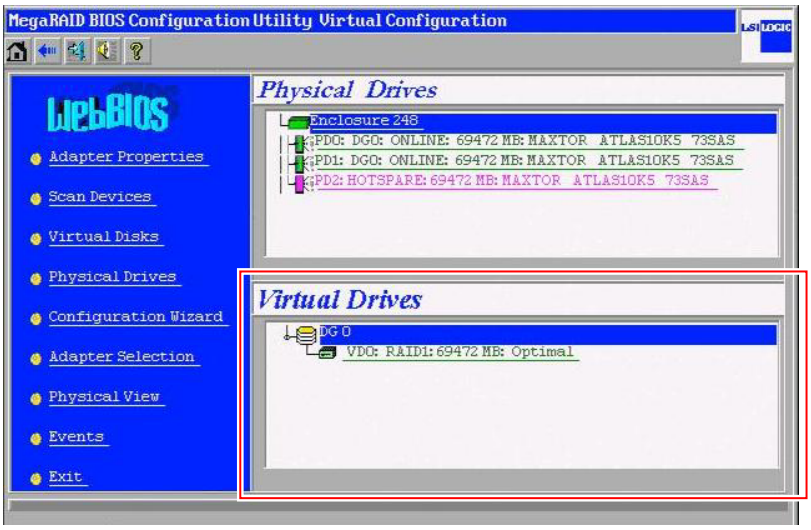
   Install it as a hard disk drive under this array controller.

■ Procedures to Expand Capacity

1. Start up WebBIOS.

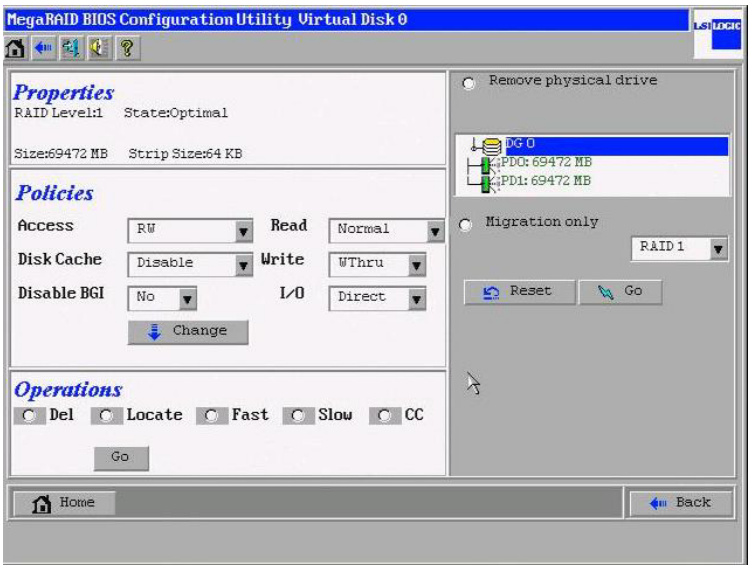
   →"2.1.1 Starting Up WebBIOS" (pg.32)
2. Make sure that the [Virtual Drives] view is shown.

   If the [Configured Drives] view is shown, select [Virtual View] in the main menu to switch to the [Virtual Drives] view.

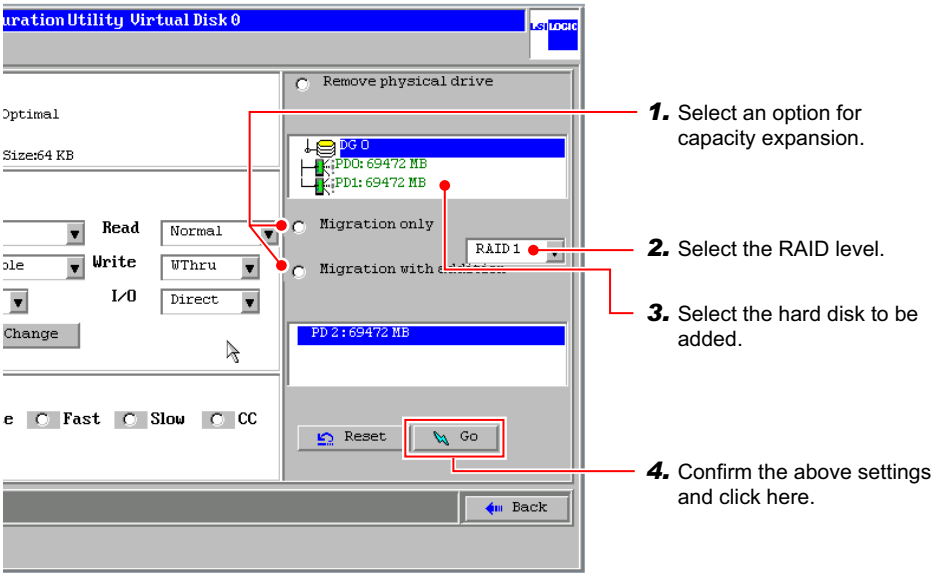


3 Click the logical drive whose capacity is to be expanded in the [Virtual Drives] view.

The logical drive details window appears.



4 Configure the settings for capacity expansion:



1. Select the options for capacity expansion.

   To change the RAID level only, select [Migration only]. To expand capacity by changing the RAID level and adding a hard disk drive, select [Migration with addition].

IMPORTANT

- Do not select [Remove physical drive].

2. Select the RAID level after capacity expansion.

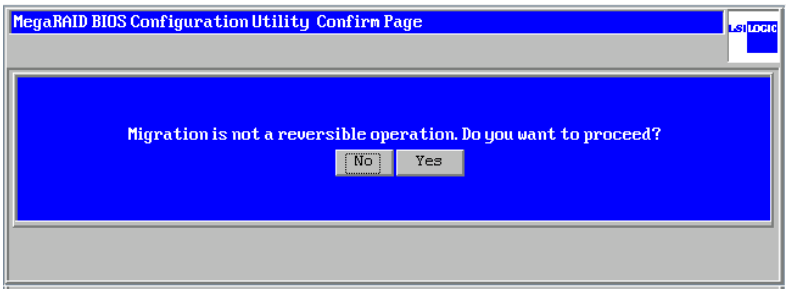
3. Select the hard disk drive to add for capacity expansion.
   If [Migration only] is selected for the capacity expansion option, this operation is not needed.

POINT

- Multiple hard disk drives can be selected at a time by holding down the [Ctrl] key.
- Depending on the number of additional hard disk drives and the RAID level after capacity expansion, only the RAID level may be changed without expanding the capacity. For example, when converting a RAID 0 logical drive into a RAID 5 logical drive by adding a hard disk drive, the capacity will not be expanded, because the added capacity of one drive is used for the RAID 5 parity data capacity.

5 Click [GO].

A confirmation window appears.



6 Click [Yes].

[Reconstruction Progress] appears and the capacity expansion process starts.
Wait for a while until the process is finished.

POINT

- During capacity expansion, you can check the progress by clicking [Reconstruction Progress] in the lower part of the window. For details, see "2.2.3 Checking the Progress of a Background Task" (→pg.43).
- If the message "Unacceptable Reconstruction parameter" is displayed, the combination of the RAID level after capacity expansion and the added hard disk drive may be inappropriate.
- If the message "Failed to start operation on Logical Drive" is displayed, a background task may be under execution. Wait until the background task operations are finished before performing the capacity expansion.
- If the RAID level of the logical drive after the expansion has data redundancy (that is RAID 1 or RAID 5), background initialization will be performed after the capacity expansion is completed.

IMPORTANT

- While capacity expansion is in progress, do not turn off, reset or restart the server. Doing so may cause loss of data on the target logical drive.
- If the server is turned off during the capacity expansion process, access to the hard disk drive resumes automatically after the server has restarted. In this case, wait until the access lamp on the hard disk drive turns off, ensure that no access is made to the hard disk drive, create an array configuration again and then restore the data backed up before the task.

7 When completed, click [HOME] or to return to the main window.

2.5.5 Deleting Logical Drives

When all the logical drives in a disk group are deleted, the hard disk drives in that disk group are restored to "Unconfigured Good" state.

IMPORTANT

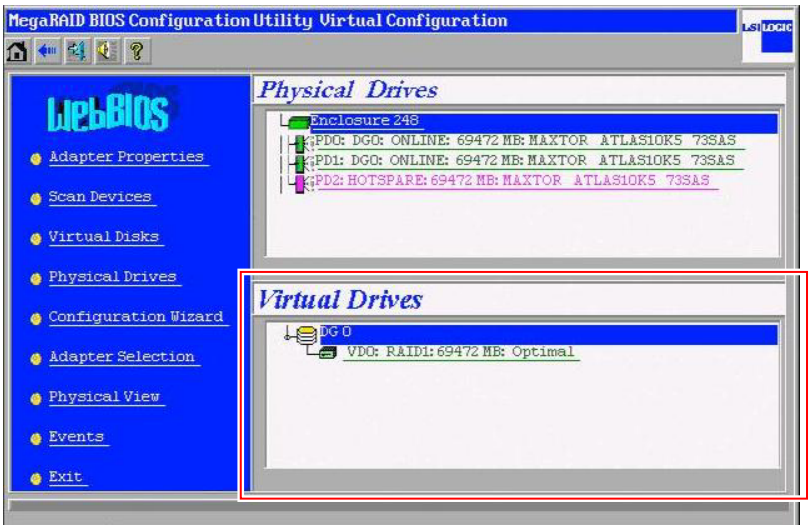
- Delete logical drives in descending logical drive ID order.

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

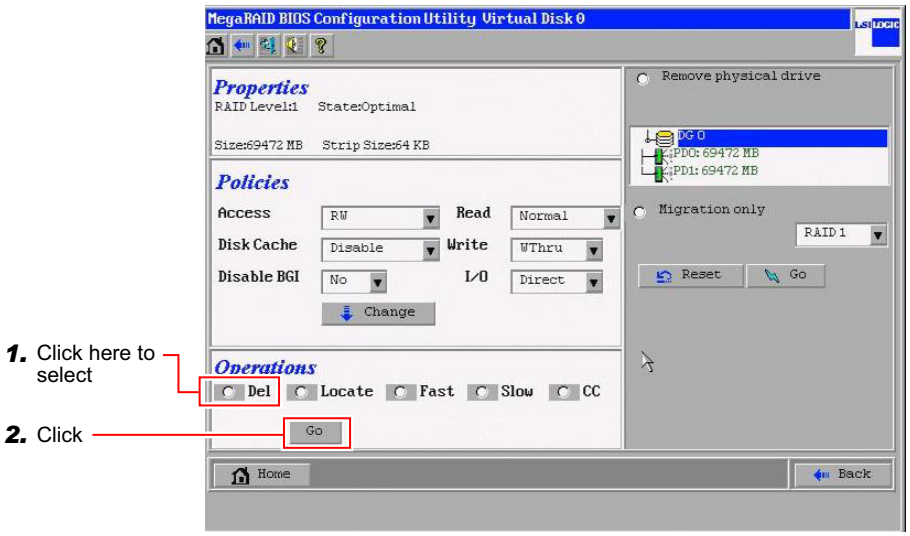
2 Make sure that the [Virtual Drives] view is shown.

If the [Configured Drives] view is displayed, select [Logical View] in the main menu to switch to the [Virtual Drives] view.

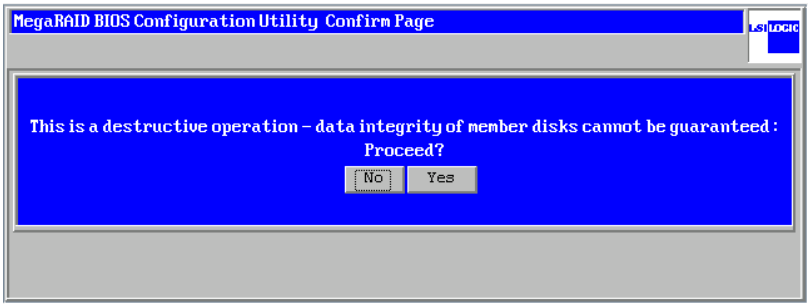


3 Click the last logical drive (at the bottom) in the [Virtual Drives] view.

4 Select "Del" in "Operations" and click [Go].



A confirmation window appears.



5 Click [Yes].

The logical drive is deleted.

6 Click [HOME] or to return to the main window.

POINT

- When all the logical drives in a disk group are deleted, the hard disk drives in that disk group are restored to "Unconfigured Good" state.

2.6 Rebuilding Hard Disk Drives

To execute a manual rebuild, perform the following procedure.

POINT

- Usually, rebuild is executed automatically after replacing a hard disk drive. For details on hard disk drive replacement and automatic rebuild, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148).

1 Start up WebBIOS.

→"2.1.1 Starting Up WebBIOS" (pg.32)

2 Select the hard disk drive to rebuild (in "Failed" or "Offline" status) in the [Physical Drives] view of the main window.

The detailed information window for the selected hard disk drive is displayed.
Regarding the detailed information window for hard disk drives, see "2.2.1 Checking the Hard Disk Status" (→pg.37).

3 Select [Rebuild Drive] in the function area at the bottom of the window, and click [Go].

The hard disk drive status changes to "REBUILD" and the rebuild starts.
Wait for a while until the rebuild is completed.

POINT

- The rebulid is completed when the progress bar for the rebuild reaches its end and the hard disk drive status changes to "ONLINE".

4 When the rebuild is completed, click [HOME] or to return to the main window.

2.7 Reusing a Hard Disk Drive

This section explains how to reuse a hard disk drive that has been connected to this array controller in another system.

2.7.1 Cautions When Reusing a Hard Disk Drive

Before you can reuse a hard disk drive that has been connected to this array controller in another system, the following information must be deleted from the hard disk drive.

- Disk Array Configuration Information
- OS Partition Table

If a hard disk drive with this information remaining is used in another system, it may cause unexpected behavior in the system and problems such as loss of existing data.
Delete the configuration information, etc. completely from the hard disk drive before reusing the hard disk drive.

2.7.2 Wiping Information from a Hard Disk Drive

To reuse a hard disk drive, perform the following procedure to delete all the information from the hard disk drive.

IMPORTANT

- This procedure should be performed in the old system before connecting the hard disk drive to the new system.
- This procedure deletes the entire disk array configuration in the actual array controller.

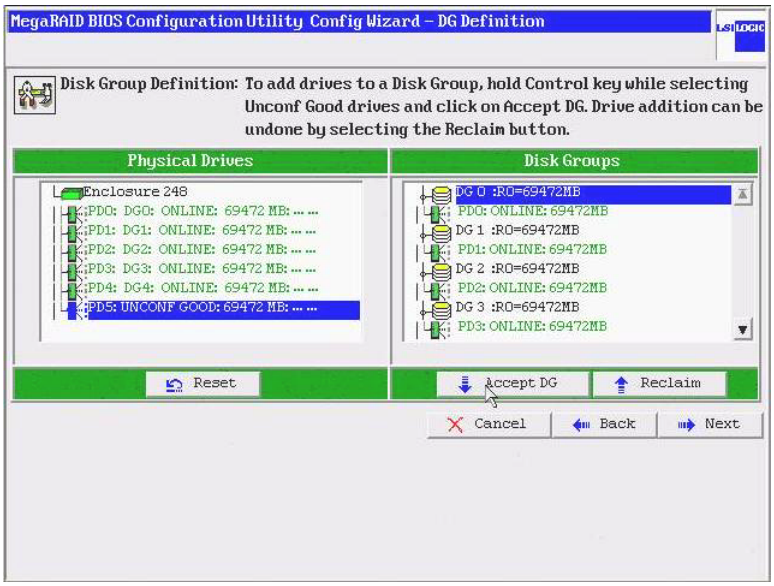
1 If there is a disk array configuration on the hard disk drive, delete the disk array configuration, referring to "2.3.2 Deleting the Disk Array Configuration" (→pg.55).

After the disk array configuration is deleted, all the hard disk drives are displayed as being in "Unconfigured Good" state. If there is a hard disk drive in "Unconfigured Bad" state, it means that that hard disk drive is defective and cannot be used.

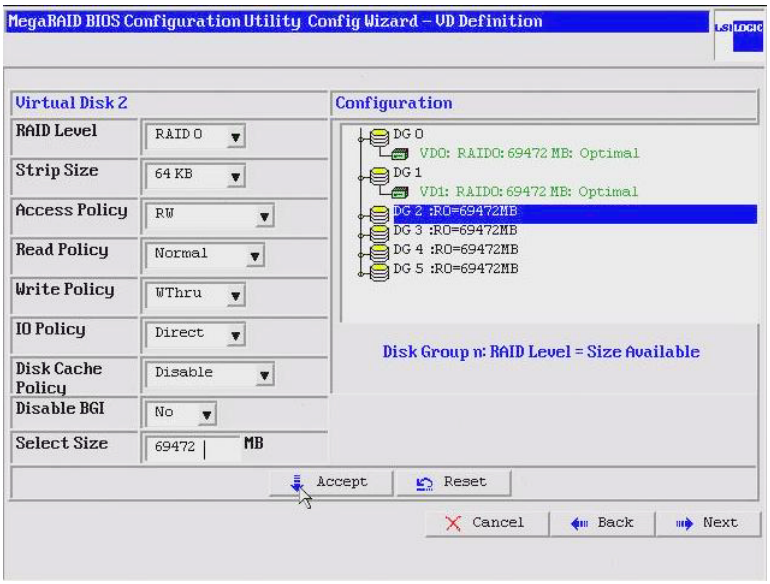
2 Initialize each hard disk drive by creating RAID 0.

1. Click [Configuration Wizard] from the main menu.
   The [Configuration Wizard] window appears.
2. Select [New Configuration] and click [Next].
3. Select [Custom Configuration] and click [Next].
   The [DG Definition] window appears.

4. From the [Physical Drives] area, select a single hard disk drive and click [Accept DG].
   Repeat this for each hard disk drive in "Unconfigured Good" state.



5. If the hard disk drive is displayed as being "Online", click [Next].
   The [VD Definition] window appears.

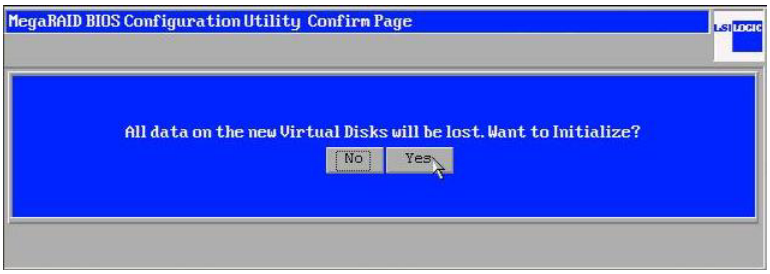


6. Select a disk group from the [Configuration] area, and create a logical drive with the following settings:

table: Logical Drive Settings When Deleting a Hard Disk Drive

Item	Default value	Remarks
RAID Level	RAID 0	Same as the default value
Stripe Size	64KB	Same as the default value
Access Policy	RW	Same as the default value
Write Policy	WThru	Same as the default value
IO Policy	Direct	Same as the default value
Disk Cache Policy	Disable	Same as the default value
Disable BGI	No	Same as the default value
Select Size	Maximum	Specifies the maximum capacity of the logical drive.

7. Perform Step 6 for each disk group.
   When the settings for all logical drives are complete, the [Preview] window appears.
8. Click [Accept].
   The "Save this Configuration?" message window appears.
9. Click [Yes].
   The message window "All data on the new Virtual Disks will be lost. Want to Initialize?" appears.



10. Click [No].

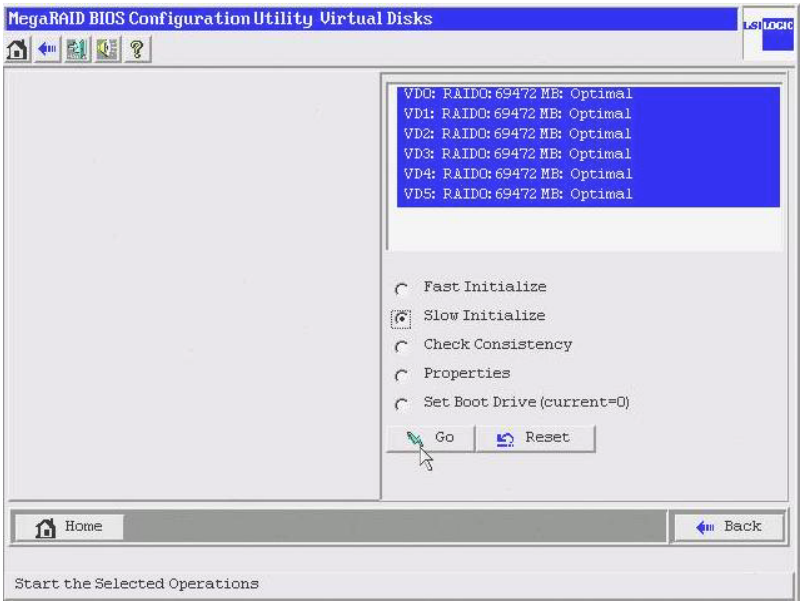
IMPORTANT

- Be sure to click [No] here. Clicking [Yes] will start fast initialization.

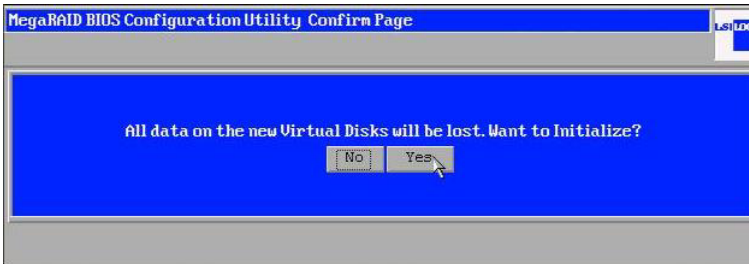
11. Click [HOME] or to return to the main window.

3 Initialize all the created logical drives.

1. Select [Virtual Disks] in the main window.
   The [Virtual Disks] window appears.
2. Select all the displayed logical drives while pressing the [Ctrl] key.



3. Select [Slow Initialize] and click [Go].
4. When the following confirmation window appears, click [Yes].



   The initialization of the logical drive starts. Wait for a while.
5. When the initialization is finished, click [HOME] or to return to the main window.

4 Delete the disk array configuration created in step 2.

→"2.3.2 Deleting the Disk Array Configuration" (pg.55)

This completes the procedure for wiping the data from the hard disk drive. The hard disk drive can now be reused in other systems.

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 74
3.2 Applying the Hotfix 77

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".

IMPORTANT

- 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.

table: Driver Disks

OS	Folder Name	Floppy Disk Name
Windows 2000 Server	\Drivers\Mega-SAS\W2K	MegaRAID SAS Windows 2000 Drivers Disk
Windows Server 2003	\Drivers\Mega-SAS\W2K3	MegaRAID SAS Windows Server 2003 Drivers Disk
Windows Server 2003 x64	\Drivers\Mega-SAS\W2K3x64	MegaRAID SAS Windows Server 2003 for x64 Edition Drivers Disk

POINT

- 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 MegaRAID SAS PCI Express ROMB].
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
  "MegaRAID SAS Windows Server 2003 Drivers Disk"
- For Windows Server 2003 x64
  "MegaRAID 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 MegaRAID SAS PCI Express ROMB] 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.

POINT

- If the [Change System Settings] window appears, click [No].

16 If multiple array controllers are installed, update all of the device drivers. Repeat steps 6 to 15 until all device drivers are updated.

17 Restart the system when all device drivers have been updated.

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 Logic MegaRAID SAS PCI Express ROMB].
   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 "MegaRAID 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 Logic MegaRAID SAS PCI Express ROMB] 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.
14. Click [Close] to close the [Properties] window.

    POINT

    - If the [Change System Settings] window appears, click [No].

15. If multiple array controllers are installed, update all of the device drivers. Repeat steps 6 to 14 until all device drivers are updated.
16. Restart the system when all device drivers have been updated.

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 80
4.2 Using GAM in a Linux Environment 83
4.3 Using GAM in a Multiple Server Environment 84
4.4 Installing GAM (Windows) 86
4.5 Installing HDD Check Scheduler (Windows) 92

4.1 Overview of and Product Requirements for GAM

This section explains GAM (Global Array Manager).
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.158).

■ 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)
- OS: Windows Server 2003 / Windows XP Professional / Windows 2000 Service Pack 4 or later / Windows 2000 Professional Service Pack 4 or later

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. It is not possible to set or change parameters.

■ 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 using the functions made available with Guest privileges, several parameters can be changed. It is also possible to view the detailed status of the selected controller and RAID subsystem. Note that it is not possible to perform management operations such as changing disk array configurations, rebuilding drives, and changing parameters related to controllers and drivers.

POINT

- RAID cannot be configured 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 made available with Guest or User privileges, it is possible to use all other functions including creating/changing a RAID configuration, rebuilding drives, making data 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

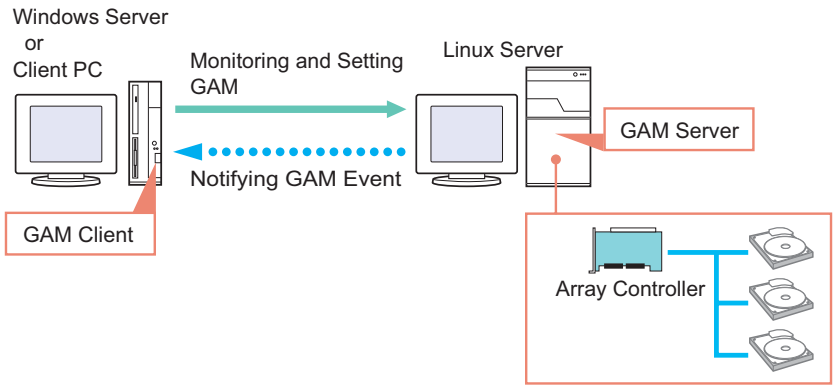
To use GAM in a Linux environment, you need to install device drivers and GAM.

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.

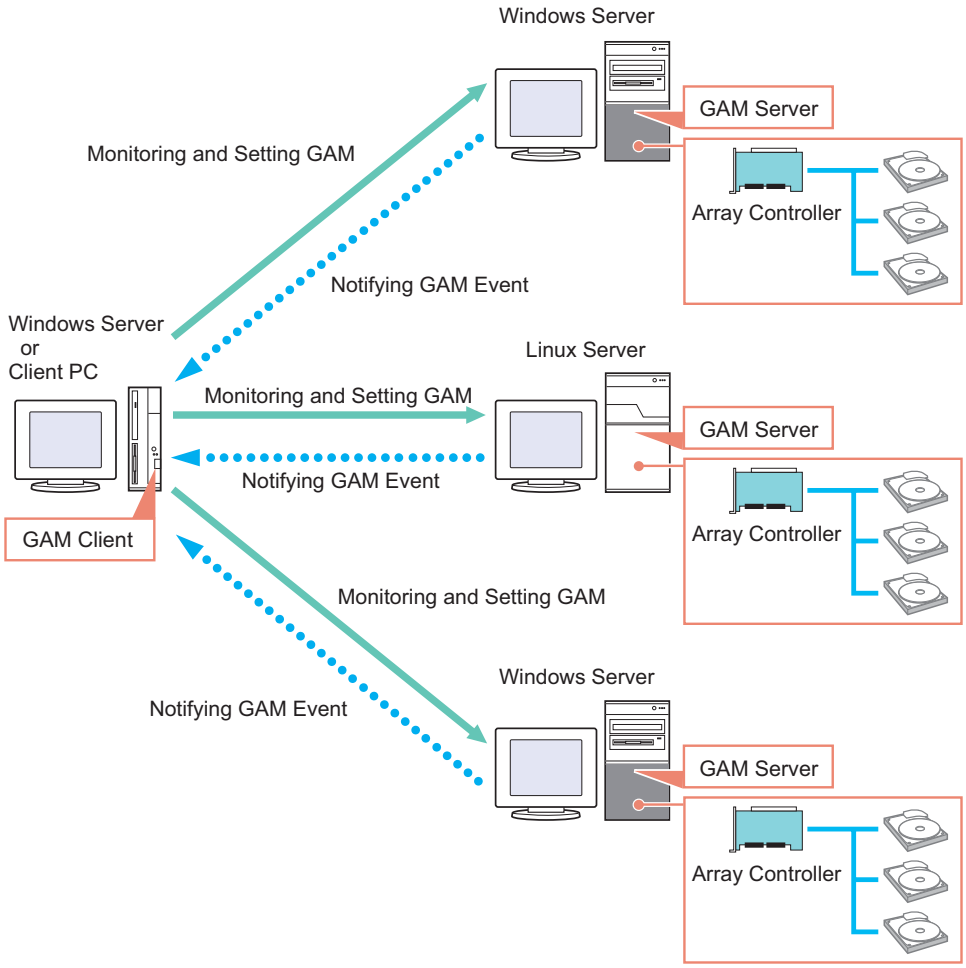


POINT

- 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.



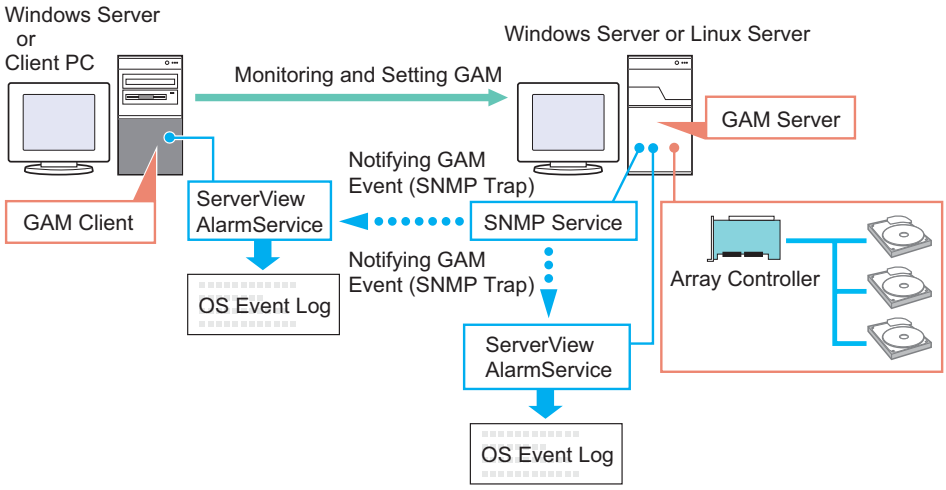
POINT

- 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.86).
- 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.

4.4 Installing GAM (Windows)

This section explains how to install GAM on a Windows server.

IMPORTANT

- 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 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

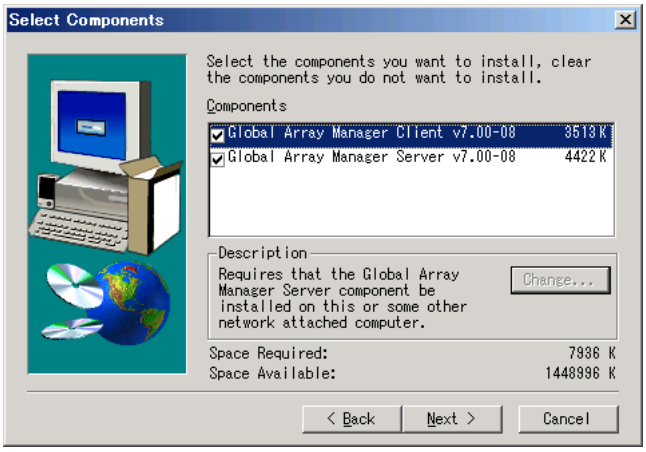
The Global Array Manager Setup wizard starts up.

4 On the [Welcome] screen, click [Next].

The [Software License Agreement] screen appears.

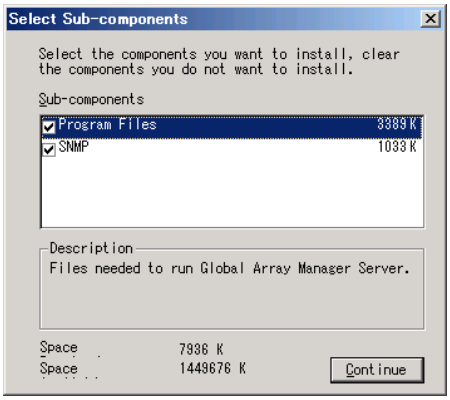
5 Click [Yes].

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.

POINT

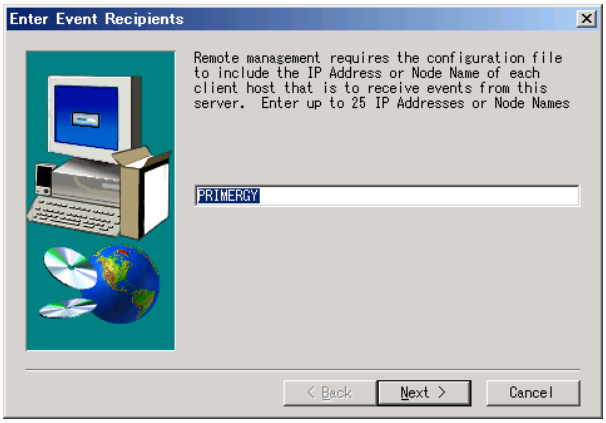
- If GAM Client is already installed, a warning message will appear to confirm overwriting. After clicking [Cancel] to close the warning message box, click [Cancel] and then [Exit Setup] to quit the GAM setup. If the command prompt is displayed, click the [X] button to close the command prompt. After 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.

POINT

- 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.

IMPORTANT

- 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].

IMPORTANT

- 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].

The [Domain Controller Security Policy] window appears.

2 Double-click [Security Settings].

3 Double-click [Local Policies].

4 Double-click [User Rights Assignment].

5 Double-click [Log on locally].

The [Security Policy Setting] window appears.

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].

The [Security Policy Setting] window closes.

12 Open [Command Prompt] and run the following command.

- For Windows Server 2003

```
C:\>gpupdate
```

- 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.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 Client vx.xx-xx' 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 vx.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.

4.5 Installing HDD Check Scheduler (Windows)

HDD Check Scheduler is a tool to detect or recover media errors on hard disk drives, by periodically performing a Make Data Consistent of the media.
This section explains how to install HDD Check Scheduler on a Windows server.

IMPORTANT

- Make sure to install HDD Check Scheduler. Make sure to install GAM before installing HDD Check Scheduler.
- If you update GAM, or uninstall and then reinstall it, be sure also to reinstall HDD Check Scheduler afterwards.
- During the HDD check, the I/O performance for the logical drives decreases to some extent (up to about 30%). After the installation, set the start time so that the check is performed during non-business hours, or low-business hours, referring to "4.5.2 Modifying the HDD Check Start Time" (→pg.93). When you install HDD Check Scheduler, the check is set to start every day at 12:00 by default.

POINT

- For an overview of the HDD Scheduler functions, see "1.2.7 HDD Check Scheduler" (→pg.25).
- HDD Check Scheduler performs Make Data Consistent periodically using the standard OS scheduling function (AT command for Windows, or Cron for Linux).
- We recommend that you perform the HDD check, at least once a week.

4.5.1 Installation Procedure for HDD Check Scheduler

Perform the following procedure to install HDD Check Scheduler.

1 Log on to Windows with Administrator privileges.

2 Before installing HDD Check Scheduler, complete the following preparations:

- Check that GAM is installed.
- Check that ServerView is installed and working properly.
- Insert the "Array Controller 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 file name and click [OK].

[CD-ROM drive]:\RAIDTOOL\HDDCS\Windows\install.bat

The message "Installing HDD Check Scheduler." is displayed at the command prompt.

4 When the message "Installation of HDD Check Scheduler has finished." appears, press the [Enter] key to close the command prompt.

POINT

- When you install HDD Check Scheduler for the first time, the HDD check is set to start every day at 12:00 by default.
- If you reinstall and overwrite HDD Check Scheduler, the previously set start time setting will be kept.

4.5.2 Modifying the HDD Check Start Time

The start time for the HDD check can be modified using the AT command of the operating system. To modify the start time, perform the following procedure.

POINT

- We recommend that you perform the HDD check regularly, at least once a week.

1 Log on to Windows with Administrator privileges.

2 Click [Start] → [All Programs] → [Accessories] → [Command Prompt] to open the command prompt.

3 Type "AT" and press the [Enter] key.

4 Write down the [ID] value for the row with the following value in the [Command Line] column:

For Windows 2000 Server

C:\WINNT\system32\GAMSERV\HDDchk.bat

For Windows Server 2003

C:\WINDOWS\system32\GAMSERV\HDDchk.bat

For Windows Server 2003 x64

C:\WINDOWS\SysWOW64\GAMSERV\HDDchk.bat

Example: If the AT command output is as follows, the ID is 11.

```
C:\Documents and Settings\Administrator>at
Status ID   Day                     Time          Command Line
-------------------------------------------------------------------------
        1   Each M F                10:00 AM      "C:\ProgramFiles\
Fujitsu\F5FBFE01\ServerView Services\WebServer\ClearMyLogs.exe"
       11   Each M T W Th F         12:00 PM      C:\WINDOWS\system32\
GAMSERV\HDDchk.bat
```

5 Delete the currently registered HDD check schedule.

Execute the following command:

```
AT <ID in Step 4> /delete
Example: AT 11 /delete
```

6 Register a new schedule. Using the AT command, register the following command line together with the time of execution.

For Windows 2000 Server

%SystemRoot%\system32\GAMSERV\HDDchk.bat

For Windows Server 2003

%SystemRoot%\system32\GAMSERV\HDDchk.bat

For Windows Server 2003 x64

%SystemRoot%\SysWOW64\GAMSERV\HDDchk.bat

To specify the scheduled execution, enter the following AT command.

```
AT <Start Time> /every:<Day of Week> "Command Line"
```

- To execute the HDD check every Friday at 6 pm, on Windows Server 2003 (except for Windows Server 2003 x64):

```
at 18:00 /every:F "C:\Windows\system32\GAMSERV\HDDchk.bat"
```

- To execute the HDD check every day at 9 pm, on Windows 2000 Server

```
at 21:00 /every:M,T,W,Th,F,S,Su "C:\WINNT\system32\GAMSERV\
HDDchk.bat"
```

POINT

- To specify days of week, use the abbreviations, M, T, W, Th, F, S, and Su, for Monday to Sunday.
- For details on how to use the AT command, see Windows Help.
- To see whether the HDD check is properly executed at the specified time, check that a log entry is recorded in the OS application log at the specified time. If no log entries are recorded at the specified time, review the settings.

```
Source      : Fujitsu ServerView Service
Type        : InformationEvent ID : 1
Description: Consistency check / Make Data Consistent is
started.
```

4.5.3 Uninstallation Procedure for HDD Check Scheduler

Perform the following procedure to uninstall HDD Check Scheduler:

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] → [All Programs] → [Accessories] → [Command Prompt].

A command prompt window opens.

3 Type "AT" and press the [Enter] key.

4 Write down the [ID] value for the row with the following value in the [Command Line] column:

For Windows 2000 Server

C:\WINNT\system32\GAMSERV\HDDchk.bat

For Windows Server 2003

C:\WINDOWS\system32\GAMSERV\HDDchk.bat

For Windows Server 2003 x64

C:\WINDOWS\SysWOW64\GAMSERV\HDDchk.bat

Example: If the AT command output is as follows, the ID is 11.

```
C:\Documents and Settings\Administrator>at
Status ID   Day                     Time          Command Line
-------------------------------------------------------------------------
        1   Each M F                10:00 AM      "C:\Program Files\
Fujitsu\F5FBFE01\ServerView Services\WebServer\ClearMyLogs.exe"
       11   Each M T W Th F         12:00 PM      C:\WINDOWS\system32\
GAMSERV\HDDchk.bat
```

5 Delete the currently registered HDD check schedule.

Execute the following command:

```
AT <ID in Step 4> /delete
Example: AT 11 /delete
```

Chapter 5

Using GAM

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

5.1 Starting and Exiting GAM 98
5.2 GAM Window Layout 100
5.3 Settings 109
5.4 Operating a RAID Configuration 113
5.5 Viewing Information 130
5.6 Maintenance Functions 142

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.

IMPORTANT

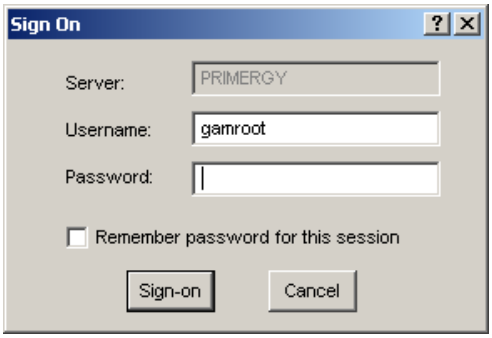
- When GAM is started for the first time after the installation, the [Define Server Groups] window appears. See "5.3.1 Server group and server settings" (→pg.109) to make the settings.
- Only start GAM Client when management or maintenance of arrays is necessary. From a security point of view, it is 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.89).
- GAM restricts the availability of functions according to access privileges. For access privileges, see "4.1.3 Access Privileges to GAM" (→pg.82).

5.1.3 Exiting GAM

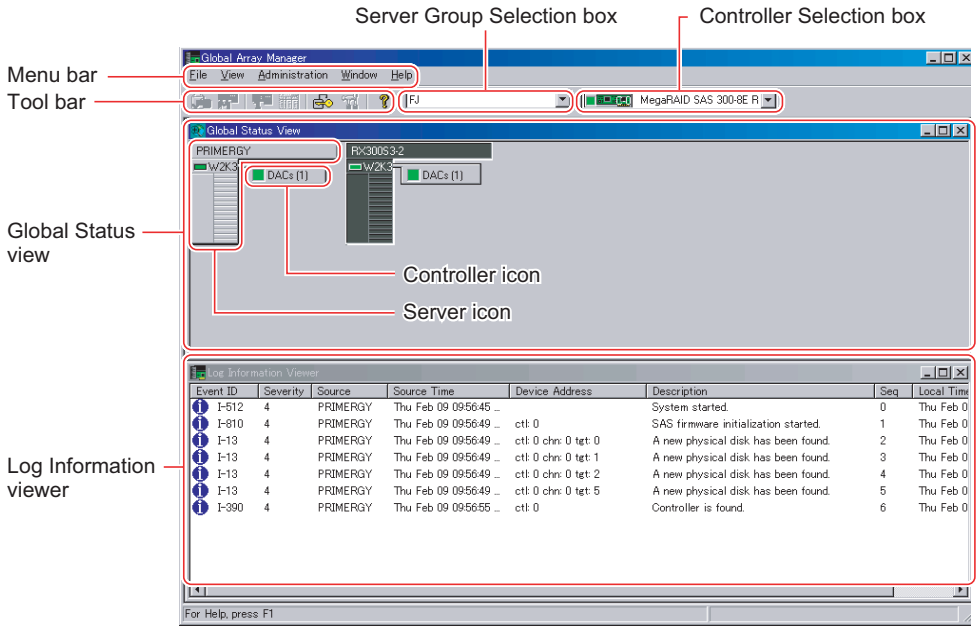
To exit GAM, click [Exit] from [File] in the GAM menu bar.

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.102).

■ Toolbar

Buttons for frequently used GAM functions.
For details on the toolbar, see "5.2.3 Toolbar Icons" (→pg.105).

■ 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 GAM Client.

■ Controller Selection Box

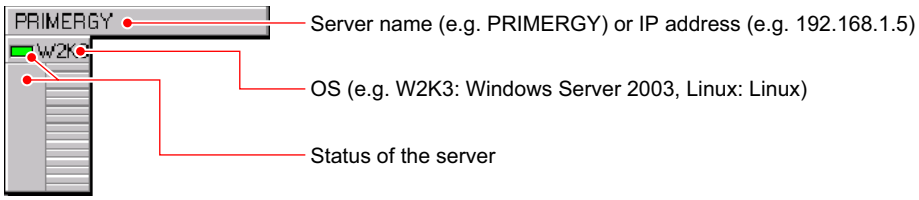
Allows you to select the array controller to be operated. Clicking ▼ displays the onboard array controller connected to the currently selected server, or the controller ID and type (e.g. MegaRAID SAS 300-8E ROMB) of the array card.

■ Global Status View

Displays the servers in the currently selected server group.

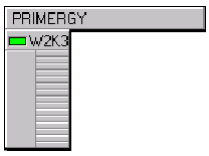
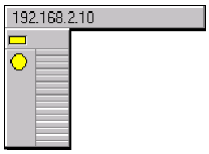
● Server Icon

Displays the server status.



The server status icon is displayed as follows.

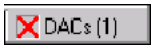
table: Server Status

Icon	Color	Server Status
	Green	Normal
	Yellow	Waiting for server connection.
	Red	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

● 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: Array Controller Status

Icon	Color	Array Controller Status
	Green	The array controller and the logical drives under the controller are operating normally.
	Yellow	The array controller and the logical drives under the controller are in Critical status, or there is trouble with the connected hard disk drives.
	Red	The array controller or the logical drive under the controller is not operating properly.

■ Log Information Viewer

Displays events on the array controller.

table: Log Information Viewer

Events	Details
Event ID	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.
Severity	Priority level of the event.
Source	IP address or name of the server that sent the event.
Source Time	Time when the event occurred.
Device Address	Other data regarding the addresses of related devices, operations in question, and the reason why the event was sent.
Description	Event description
Sequence (Seq)	Event sequence number
Local Time	Time when the event occurrence was signaled to GAM Client.

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: [File] Menu

Menu	Function
Open Configuration	This function is not supported. Do not use it.
Save Configuration	Saves the current RAID configuration in a file. For more details, see "Saving Disk Array Configuration Information" (→ P.128).
Clear Configuration	Clears all the RAID configurations of the currently selected array controller. For more details, see "Deleting Disk Array Configuration Information" (→ P.129).

POINT

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

IMPORTANT

- 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: [View] Menu

Menu	Function
Global Status View	Displays the [Global Status View] window. With the default settings, [Global Status View] opens automatically when GAM starts up.
Controller View	Displays the [Controller View] window. Displays information for each device and the status of hard disk drives or logical drives connected to the controller.
Log Information Viewer	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.
Foreground Initialize Status	Shows the progress of foreground initialization on a logical drive. This can only be selected while foreground initialization is in progress. This function is not supported.
Background Initialize Status	Shows the progress of background initialization on a logical drive. This can only be selected while background initialization is in progress.
Rebuild Status	Shows the rebuild progress. This can only be selected while a rebuild is in progress.
Make Data Consistent Status	Shows the Make Data Consistent progress. This can only be selected while Make Data Consistent is in progress.
Expand Capacity Status	Shows the capacity expansion process progress. This can only be selected while a capacity expansion process is in progress. **Note:** ▸ Do not restart or shut down the system while a capacity expansion process is in progress. Doing so may cause loss of data.
Patrol Read Status	This function is not supported. Do not use it.
Error Table	This function is not supported. Do not use it.

■ [Administration] Menu

table: [Administration] Menu

Menu	Function
Sign On	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 "gamroot" enables you to use GAM's setting and management functions (available with Administrator privileges).
Define Server Groups	Sets a server group and the names or IP addresses of servers in the group.
Select Current Server Group	Selects a server group. Functions in the same manner as when the [Server Selection] box is operated directly. **Note:** ▸ Make sure to select a server group registered with [Define Server Group].
Select Current Controller	Selects a controller to be managed. Functions in the same manner as when the [Controller Selection] box is operated directly.
RAID Assist	Sets a disk array configuration. This function enables you to define disk groups and logical drives. For details, see "5.4.1 Starting the RAID Assist Function" (→pg.113). **Note:** ▸ Automatic Configuration and Assisted Configuration are not supported. Be sure to use Manual Configuration.

table: [Administration] Menu

Menu	Function
Initialize Logical Drives	This function is not supported. Do not use it. **Note:** ▸ This function may cause data loss on logical drives.
Controller Information	Displays the main information for the currently selected array controller.
Enclosure Information	Displays SES and SAF-TE Enclosure Management information. **Note:** ▸ The Enclosure Information function is not supported. Hard disk cabinets cannot be monitored with this function.
Controller Options	Sets parameters for the currently selected array controller. For details, see "5.3.2 Setting and Changing Controller Options" (→pg.110).
Physical Device Options	This function is not supported. Do not use it.
Intelligent BBU	When the RAID has a battery backup unit, its status is displayed.
Scan Devices	Redetects the hard disk drives connected.
Advanced Functions	Other functions. Selecting this opens a submenu. • Flash Utility Updates the firmware on the array controller. **Note:** ▸ Update the firmware only to versions designated by us. Follow our instructions when performing the firmware update.
Settings	This function is not supported. Do not use it.
Alarm Sound	This function is not supported. Do not use it.
Consistency Check with Restoration	This function is not supported. Do not use it.

5.2.3 Toolbar Icons

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

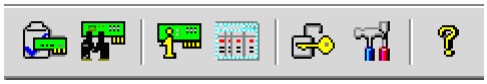
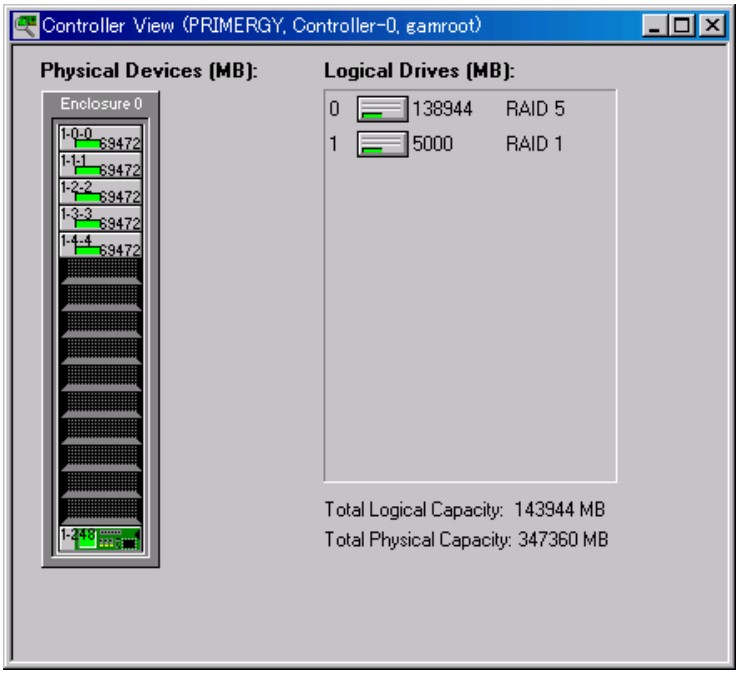


table: Toolbar Icons

Icon	Function
	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.
	Rescans the devices. Functions in the same manner as when [Scan Devices] is executed from the [Administration] menu.
	Displays array controller information. Functions in the same manner as when [Controller Information] is selected from the [Administration] menu.
	This function is not supported. Do not use it.
	Opens the [Sign On] window. Functions in the same manner as when [Sign On] is selected from the [Administration] menu.
	This function is not supported.
	Displays Help.

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.103). If the [Sign On] window opens, sign on referring to "5.1.2 Signing On" (→pg.98).
The following window appears.



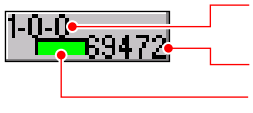
The [Controller View] window shows the information below regarding the controller currently selected in the [Controller Selection] box.

- **The number of enclosures connected to the controller.**

  Each enclosure is displayed as a tower on the left.

Hard disk drive

Displays information about each hard disk drive.



Target ID ("Enclosure ID" and "Hard Disk ID" are not supported for this array controller. Indefinite values are displayed.)

Capacity of hard disk.

Type and status of hard disk.

The hard disk status icon is displayed as follows.

table: Hard disk drive status icon

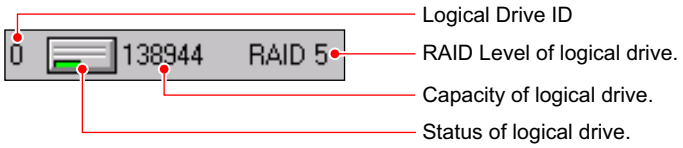
Icon	Color	Status
	Green	Normal (Online)
	Red	The hard disk drive has a failure or is unrecognized. (Dead / Offline / Unconfigured Bad)
	Yellow	Rebuild in progress (Rebuilding)
	Green + white	Spare disk drive (Hot Spare)
	Yellow	Failure expected (Critical) State of PFA Count not 0
	Not applied	Unused or available (Unconfigured)

POINT

- Double-click the icon for each hard disk drive to see more detailed information. For more details, see "5.5.3 Viewing Hard Disk Drive Information" (→pg.134).
- 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: Logical drive status icon

Icon	Color	Status
	Green	Normal (Online)
	Yellow	Operating without redundancy (Critical)
	Red	Not available (Offline)
	Green	Performing a Make Data Consistent for the logical drive.

POINT

- Double-click the icon of each logical drive to see more detailed information. For more details, see "5.5.4 Viewing Logical Drive Information" (→pg.137).

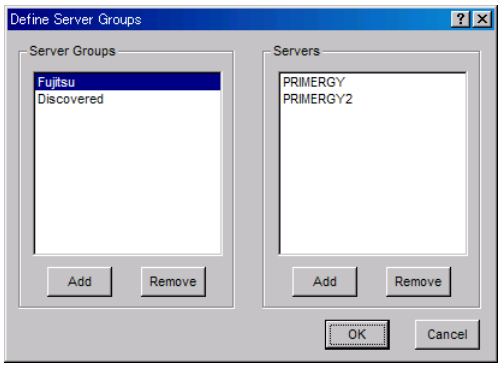
5.3 Settings

This section explains how to set parameters.
The following two items are available:

- Server group and server settings
- Controller option settings

5.3.1 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.

   POINT

   - 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].

POINT

- You can also set a server group by selecting [Define Server Groups] from the [Administration] menu (→pg.103).

5.3.2 Setting and Changing Controller Options

You can check and change array controller options from [Controller Options] in the [Administration] menu.

IMPORTANT

- The controller options must be set within the ranges shown in the following table. You may change only options specified as default in the table. If the settings are outside of the specified ranges, correct operation may not be ensured.

■ Controller Options Tab

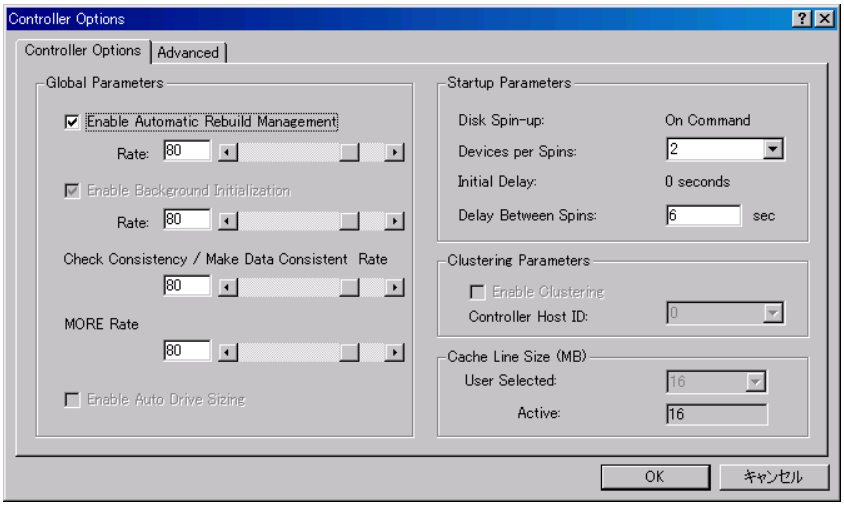


table: Array Controller Properties (Set with Controller Options Tab)

Options	Parameter	Setting		Description
Global Parameters	Enable Automatic Rebuild Management	Enable	Cannot be changed	Enables automatic rebuild after hard disk drive replacement.
	Rate	80	Default	Sets the rebuild priority for normal I/O.
	Enable Background Initialization	Enable	Fixed	Enables the background initialization function.
	Rate	80	Default	Sets the background initialization priority for normal I/O.
	Check Consistency / Make Data Consistent Rate	80	Default	Sets the Make Data Consistent priority for normal I/O.
	MORE Rate	80	Default	Sets the Expand Capacity priority for normal I/O.
	Enable Auto Drive Sizing	Disable	Fixed	Enables rounding of the hard disk drive capacity.
Startup Parameters	Disk Spin-up	On Command	Fixed	Not supported
	Devices per Spins	2	Cannot be changed	Sets the number of hard disk drives that start rotating at the same time.
	Initial Delay	0	Fixed	Not supported
	Delay Between Spins	6	Cannot be changed	Specifies the rotation start interval between hard disk drives.
Clustering Parameters	Enable Clustering	Disable	Fixed	Not supported
	Controller Host ID	0	Fixed	Not supported
Cache Line Size (MB)	User Selected	16	Fixed	Not supported
	Active	16	Fixed	Not supported

■ Advanced Tab

Selecting the [Advanced] tab enables you to set [Advanced] options.

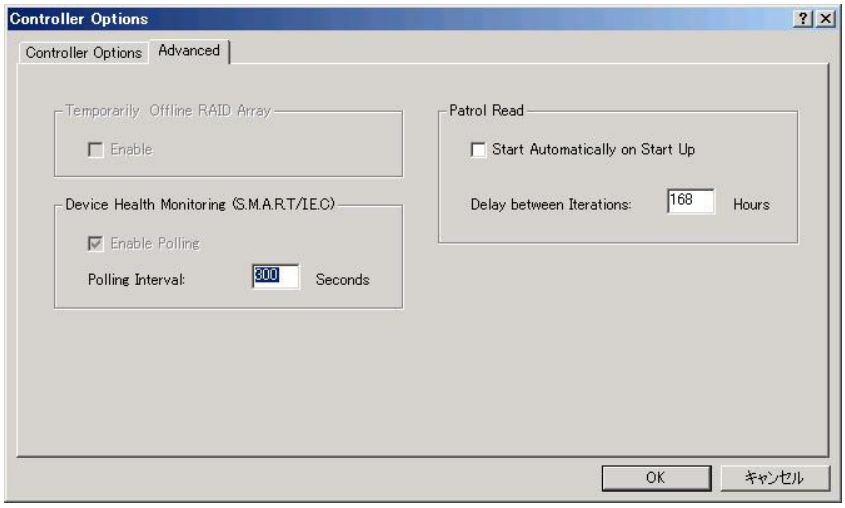


table: Array controller properties (set with the [Advanced] tab)

Options	Parameter	Setting		Description
Temporarily Offline RAID Array	Enable	Disable	Fixed	Not supported
Device Health Monitoring (S.M.A.R.T/ I.E.C)	Enable Polling	Enable	Fixed	Enables the hard disk failure prediction (S.M.A.R.T.) function.
	Polling Interval	300	Cannot be changed	Specifies a polling interval for S.M.A.R.T detection.
Patrol Read	Start Automatically on Start Up	Disable	Cannot be changed	Not supported
	Delay between Iterations	168	Default	Not supported

IMPORTANT

- Apart from the controller options, you may be required to make various settings on the server itself. See the "User's Guide" on the "PRIMERGY Document & Tool CD" provided with the server on how to set up the server.
- While increasing the values for Rebuild Rate, Background Initialization Rate, Make Data Consistent Rate and More Rate increases background task performance, it may also decrease the rate of normal I/O.

5.4 Operating a RAID Configuration

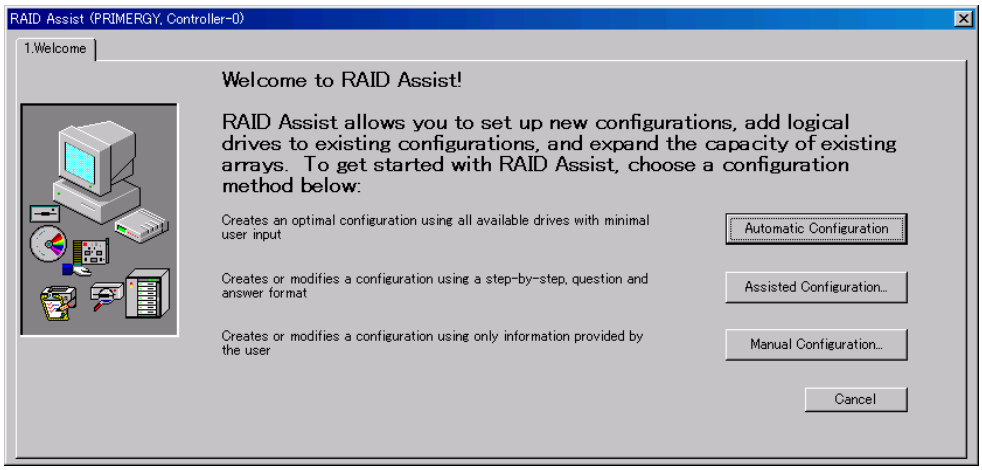
To create a new disk group or logical drive with GAM, use the RAID Assist function. RAID Assist enables you to create or add an array configuration, expand the capacity and set hot spares.

IMPORTANT

- Disk array operations require signing on with Administrator privileges.

5.4.1 Starting the RAID Assist Function

You can start RAID Assist by selecting [RAID Assist] from the [Administration] menu.
The following window appears.

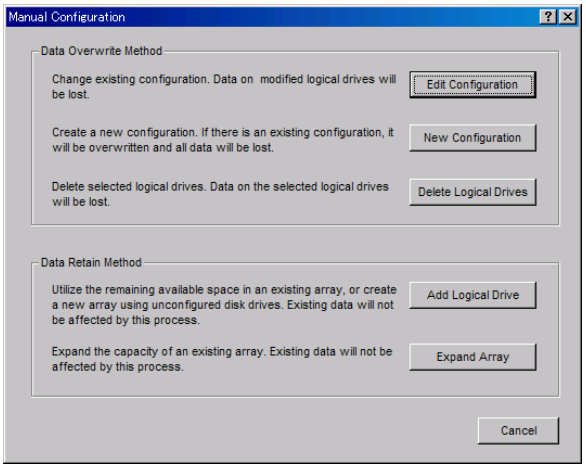


IMPORTANT

- You cannot use the RAID Assist function while rebuilding, expanding the capacity, or running a Make Data Consistent.
- Operating RAID Assist may cause loss of the disk array configuration or data files. Read the manual carefully before use.
- Automatic Configuration and Assisted Configuration are not supported. Do not use them. Use Manual Configuration to create a RAID configuration.

■ Manual Configuration

To start setting the array configuration, click [Manual Configuration].
The following window appears.



● Edit Configuration

Used for setting/releasing a hot spare disk drive or for deleting a logical drive.

IMPORTANT

- Do not use Edit Configuration for any other purposes than to delete a logical drive or to set/release a hot spare.

● New Configuration

Deletes the old array configuration and data (if any) and applies a new array configuration to the array controller. This function is used when no array configuration exists on the array controller, or when creating a new array configuration after deleting the existing array configuration completely.

IMPORTANT

- Executing New Configuration deletes the existing configuration information. Use this function with caution since it will delete all the existing logical drives and the data inside.

● Delete Logical Drives

Not supported. Do not use it. Use [Edit Configuration] to delete logical drives.

● Add Logical Drive

Used for setting up an additional logical drive while keeping the existing array configuration as is. One or more logical drives must be set for the selected array controller, and there must be free space on an unused (Unconfigured) hard disk drive or in a disk group.

- **Expand Array**

  To expand the logical drive's capacity, an unused (Unconfigured) hard disk drive is added to an existing disk group and data on the drive are reconfigured. The data on the logical drive to be expanded will not be destroyed.

5.4.2 Creating a New Disk Array Configuration (New Configuration)

To create a new array configuration, or to create a new array configuration after completely deleting the existing array configuration, perform the following procedure:

1 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [RAID Assist] from the [Administration] menu.

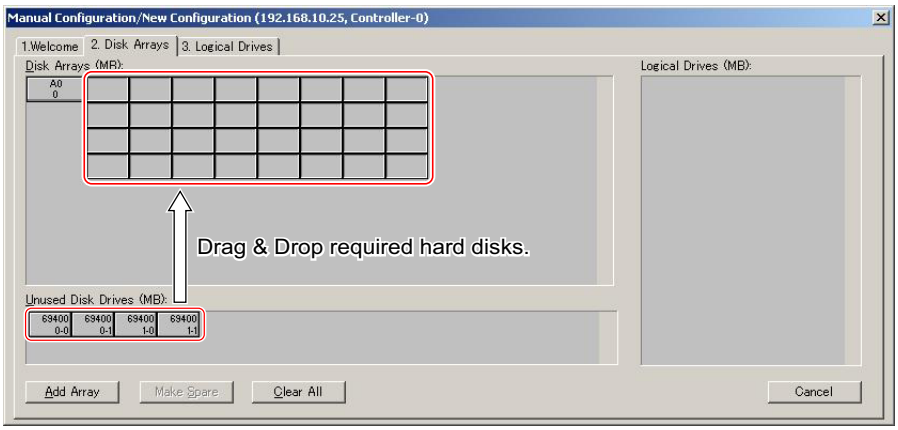
The [RAID Assist] window appears.

3 Click [Manual Configuration].

The [Manual Configuration] window appears.

4 Click [New Configuration].

The following window appears. At this point, create a disk group.
The disk group is displayed in the [Disk Arrays] area at the top left of the window.



A list of unused hard disk drives is displayed in the [Unused Disk Drives] area at the bottom of the window. Select an unused hard disk drive from the above list and drag it to the [Disk Array A0] area. The dragged-and-dropped hard disk drive will become part of the disk group A0.
A maximum of 32 hard disk drives can be added to one disk group.

POINT

- When selecting unused hard disk drives, you can select multiple hard disk drives at a time by holding down the [Ctrl] key during the selection.
- For RAID 1 arrays, only two hard disk drives can be used in one disk group.

IMPORTANT

- Do not use the [Add Array] at this point. To create multiple disk groups, use [Add Logical Drive] after completing this procedure.
- Use hard disk drives of the same capacity and type in one disk group. If a mixture of different hard disk drives are connected, check them in advance referring to "5.5.3 Viewing Hard Disk Drive Information" (→pg.134).

Removing hard disk drives from the disk group

You can remove hard disk drives from the disk group by dragging them from the [Disk Arrays] area and dropping them into the [Unused Disk Drives] area.

Undoing the configuration

Click [Clear All] if you want to reconfigure a disk group from the beginning. All the settings are cleared.

Setting a Spare Disk Drive

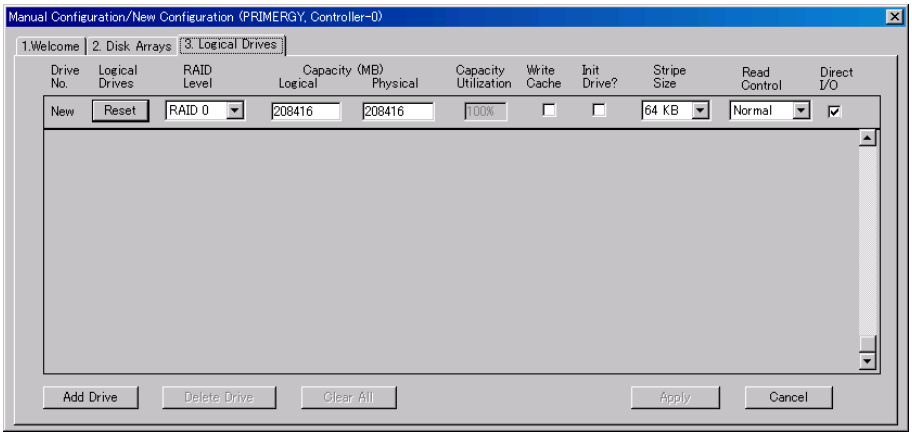
Select an unused hard disk drive and click [Make Spare]. The icon of the unused hard disk drive changes to a spare disk drive icon.

To release a spare disk drive, select a spare disk drive and click [Remove Spare].

IMPORTANT

- Do not drag a hard disk drive assigned as a spare disk drive into the [Disk Arrays] area.
- Use a spare disk drive of the same capacity and type as the hard disk drives in the disk group.
- When there are two or more disk groups that use different hard disk drives, set a spare disk drive for each type of hard disk drive.

5 When the creation of the disk group is completed, click the [Logical Drives] tab to configure the logical drives.



1. Select a RAID level for the logical drive.
   Click ▼ under [RAID Level] and select the RAID level for the logical drive from the displayed list.
2. Enter the capacity of the logical drive to be created in [Capacity-Logical], or enter the physical capacity to be used in [Capacity-Physical].
   When creating only a single logical drive in the disk array, or when creating the last logical drive in the disk group, do not change the default size. When creating multiple logical drives, enter a smaller value than the entire capacity to leave the required capacity for the others.

POINT

- Enter the size in either of the two capacity fields. When a value is entered in one field, the other value is automatically calculated and displayed.

IMPORTANT

- The capacity of the logical drive may be automatically adjusted to match the block size.
- Do not add multiple logical drives at a time. To create multiple logical drives in a single disk group, use the [Add Logical Drive] function (→pg.119) after completing this procedure.
  If multiple logical drives are created in a single disk group, you cannot expand the capacity with the [Expand Capacity] function later.

3. Check the [Write Cache] checkbox to use the logical drive as a write-back drive.

IMPORTANT

- Before using write-back drives, see "■ Write Back" (→pg.17) and make sure you understand the idea.
- If there is no battery backup unit, the logical drive is created in Write Through mode even if [Write Cache] is enabled. To use a logical drive in Write Back mode, see "5.4.7 Changing the Write Policy" (→pg.126) and change the write mode settings after creating the logical drive.

4. Confirm that the other parameters are set to the following values.
   If any difference is found, reset the settings as follows:

table: Parameter Settings

Parameter	Setting
Init Drive?	Disabled
Stripe Size	64 KB
Read Control	Normal
Direct I/O	Enabled

IMPORTANT

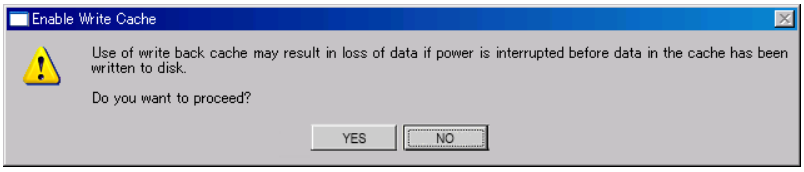
- This array controller does not support the foreground initialization function on the OS side. Logical drives with redundancy are automatically initialized with background initialization.

6 Click [Add Drive] to register the new logical drive.

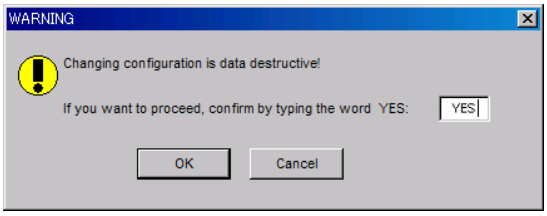
7 Click [Apply] to enable the disk array configuration.

When Write Cache is enabled

When Write Cache is enabled, the following confirmation window appears. Click [Yes].

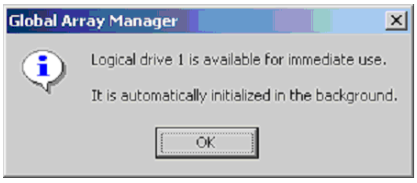


8 A final confirmation window appears. Enter "YES" and click [OK].



A new disk array configuration is created.

9 A message that the logical drive is available appears. Click [OK] to exit.



5.4.3 Adding a Logical Drive to the Existing Disk Array Configuration (Add Logical Drive)

The following explains the procedures for adding a new logical drive to the existing disk array configuration. To add a new logical drive, it is necessary to have either an unused drive or free space in the existing disk group.
Below is the procedure for executing Add Logical Drive.

1 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [RAID Assist] from the [Administration] menu.

The [RAID Assist] window appears.

3 Click [Manual Configuration].

The [Manual Configuration] window appears.

4 Click [Add Logical Drive].

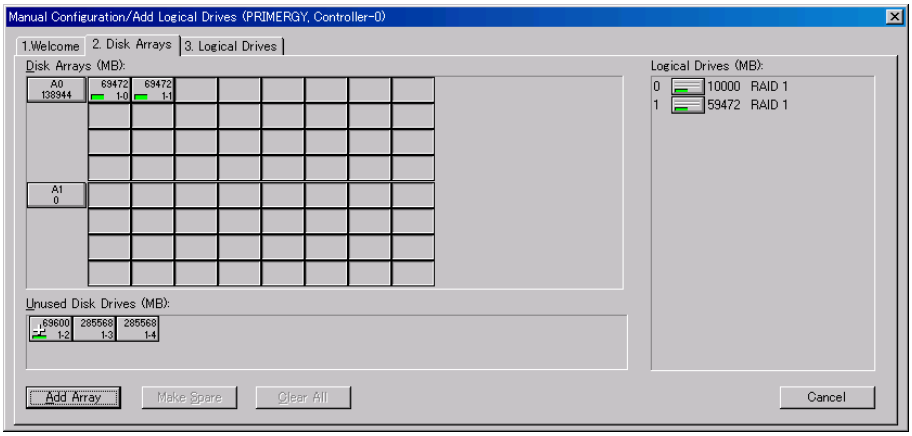
The [Disk Arrays] tab window appears.

POINT

- If there is free space in the defined disk group, the [Logical Drives] tab appears. In this case, see "5.4.2 Creating a New Disk Array Configuration (New Configuration)" (→pg.115) and follow the procedure from Step 5 to assign logical drives.

5 Click [Add Array] to configure a new disk group.

An empty disk group is added in the [Disk Arrays] area.



6 Select an unused hard disk drive from the [Unused Disk Drives] area and drag it to the [Disk Arrays] area.

The dragged hard disk drive will become part of the disk group.
A maximum of 32 hard disk drives can be added to one disk array.

POINT

- When selecting unused hard disk drives, you can select multiple hard disk drives at a time by holding down the [Ctrl] key during the selection.
- For RAID 1 arrays, only two hard disk drives can be used in one disk group.
- To remove hard disk drives from the disk group, drag them from the [Disk Arrays] area and drop them into the [Unused Disk Drives] area.

IMPORTANT

- Do not add multiple disk groups at a time. To create an additional disk group, complete this procedure, apply the configuration, and then perform Add Logical Drive again.
- Use hard disk drives of the same capacity and type in one disk group. If a mixture of different hard disk drives are connected, check them in advance referring to "5.5.3 Viewing Hard Disk Drive Information" (→pg.134).

Setting a Spare Disk Drive

Select an unused hard disk drive and click [Make Spare].

The icon of the unused hard disk drive changes to a spare disk drive icon.

To release a spare disk drive, select the spare disk drive to be released and then click [Remove Spare].

IMPORTANT

- Do not drag a hard disk drive assigned as a spare disk drive into the [Disk Arrays] area.
- Use a spare disk drive of the same capacity and type as the hard disk drives in the disk group.
- When there are two or more disk groups that use different hard disk drives, set a spare disk drive for each type of hard disk drive.

7 When the configuration of the disk group and the spare disk drives are finished, click the [Logical Drives] tab to start configuring logical drives.

The procedure for configuring logical drives is the same as the one for configuring a new disk array. See "5.4.2 Creating a New Disk Array Configuration (New Configuration)" (→pg.115) and follow the procedure from Step 5.

5.4.4 Expanding the Capacity of a Logical Drive (Expand Array)

You can expand the capacity and change the RAID level for existing logical drives.

IMPORTANT

- There are certain conditions to note and precautions to take for capacity expansion. Read "1.2.5 Capacity Expansion" (→pg.23) carefully before the capacity expansion.

1 To prepare for unexpected problems, perform data backup.

2 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

3 Perform a Make Data Consistent (→pg.142) on the logical drive whose capacity is to be expanded and confirm that the check is completed successfully.

IMPORTANT

- If the Make Data Consistent is not completed successfully, do not perform capacity expansion.

4 Select [RAID Assist] from the [Administration] menu.

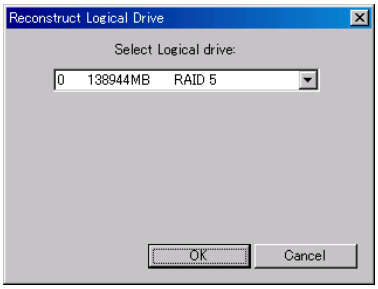
The [RAID Assist] window appears.

5 Click [Manual Configuration].

The [Manual Configuration] window appears.

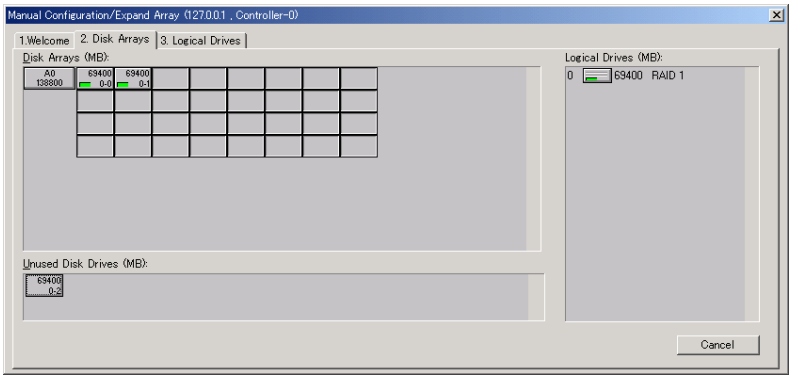
6 Click [Expand Array].

The following window appears.



7 Select the logical drive to be expanded and click [OK].

The [Disk Arrays] tab window appears.



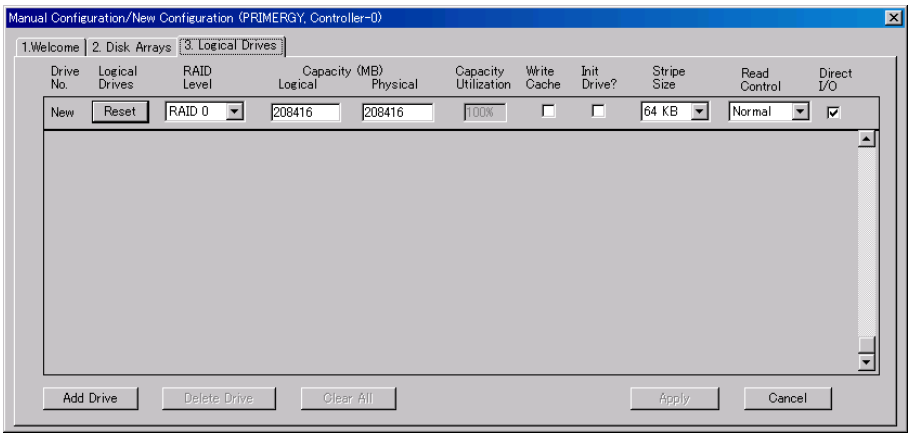
8 Select an unused hard disk drive from the [Unused Disk Drives] area and drag it to the disk group displayed at the top left of the window.

You can add hard disk drives until the total number of drives in the disk group reaches 32.

IMPORTANT

- Make sure that the number of hard disk drives in the disk group does not exceed 32.
- Use additional hard disk drives of the same capacity and type as the existing hard disk drives in the disk group. If a mixture of different hard disk drives are connected, check them in advance referring to "5.5.3 Viewing Hard Disk Drive Information" (→pg.134).

9 When the addition of the hard disk drive to the disk group is finished, click the [Logical Drives] tab to start configuring the logical drive.



10 Select a RAID level for the logical drive.

Click ▼ under [RAID Level] and select the RAID level for the logical drive from the displayed list.

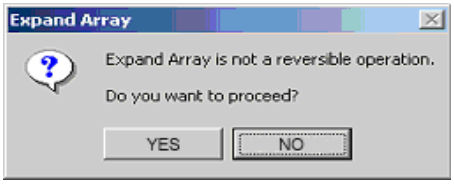
After the expansion, the RAID level of the logical drive will be converted to the RAID level selected here.

IMPORTANT

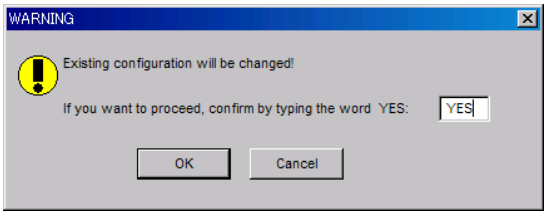
- If you convert a RAID 1 or 5 logical drive to RAID 0, note that the logical drive will lose its redundancy.
- Do not change the Stripe Size.

11 Click [Apply].

When the following confirmation window appears, click [Yes].



12 A final confirmation window appears. Enter "YES" and click [OK].



A window showing the progress of the capacity expansion appears and the expansion process starts. Wait until the process is completed.

IMPORTANT

- Do not turn off, reset or restart the server while capacity expansion is in progress. Doing so may cause loss of data in the target logical drive.
- Should the server be turned off during the capacity expansion process, access to the hard disk drive resumes automatically after the server has restarted. In this case, wait until the access lamp on the hard disk drive turns off to ensure that no access is made to the hard disk drive, redo the array configuration, and then restore the data backed up before the expansion.

POINT

- If the RAID level of the logical drive after the expansion has data redundancy (that is RAID 1 or RAID 5), background initialization will be performed after the capacity expansion is completed.

5.4.5 Deleting an Existing Logical Drive (Edit Configuration)

Use [Edit Configuration] to delete logical drives.

IMPORTANT

- The [Delete Logical Drive] function in [Manual Configuration] is not supported. Do not use it.
- Do not use [Edit Configuration] for operations other than deleting a logical drive or setting/releasing spare disk drives. To create a disk group or logical drives, use [New Configuration] or [Add Logical Drive].
- Make sure to back up data before you delete a logical drive.
- You can only delete the last created logical drive (the drive with the highest number.)
- For how to delete all logical drives (i.e. to clear an array configuration), see "5.4.8 Saving and Deleting Disk Array Configuration Information ." (→pg.128).

1 To prepare for unexpected problems, perform data backup.

2 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

3 Select [RAID Assist] from the [Administration] menu.

The [RAID Assist] window appears.

4 Click [Manual Configuration].

The [Manual Configuration] window appears.

5 Click [Edit Configuration].

When the [Disk Arrays] tab appears, click the [Logical Drives] tab to display a list of the currently defined logical drives.

IMPORTANT

- Do not change the disk group configuration on the [Disk Arrays] tab. If you change the disk group configuration, all the existing logical drives will be deleted. Should the disk group configuration be accidentally changed, click [Cancel] and restart the procedure.

6 Click [Delete Drive].

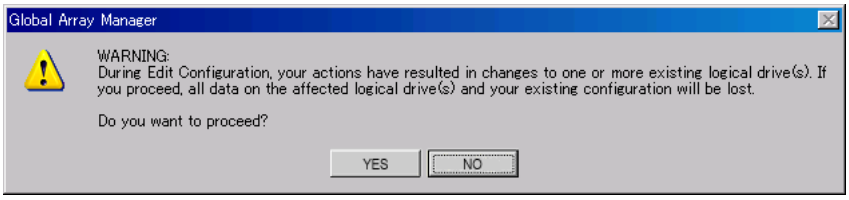
One logical drive will be deleted at a time in descending order from the last in the list.

IMPORTANT

- Do not click [Clear All]. If you click [Clear All], all the logical drives are deleted at once. Should the wrong logical drive be deleted, click [Cancel] and start again from the beginning.

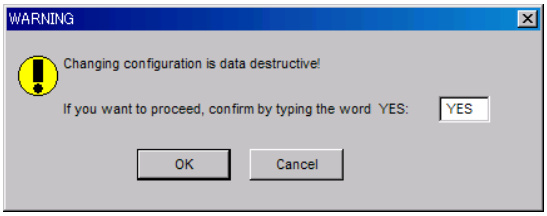
7 When completing deletion of logical drives from the list, reconfirm that you haven't deleted any wrong drives. If everything is OK, click [Apply].

The following warning message appears.



8 Click [Yes].

9 A final confirmation window appears. Enter "YES" and click [OK].



IMPORTANT

- Should you accidentally delete the wrong logical drives, recreate the array configuration, and then restore the data backed up before the deletion.
- If all the logical drives in a disk group are deleted, the disk group will also automatically be deleted, and the hard disk drives that composed that disk group will be marked as unused.

5.4.6 Setting and Releasing Spare Disk Drives (Edit Configuration)

This section explains how to set and release spare disk drives.

IMPORTANT

- Do not use [Edit Configuration] for any other operations than deleting a logical drive or setting/releasing spare disk drives. To create a disk group or logical drives, use [New Configuration] or [Add Logical Drive].

1 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [RAID Assist] from the [Administration] menu.

The [RAID Assist] window appears.

3 Click [Manual Configuration].

The [Manual Configuration] window appears.

4 Click [Edit Configuration].

The [Disk Arrays] tab window appears.

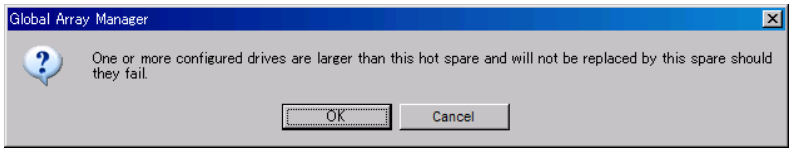
5 Select an unused hard disk drive in the [Unused Disk Drives] area and click [Make Spare].

The icon of the unused hard disk drive changes to a spare disk drive icon.

To release a spare disk drive, select a spare disk drive icon and click [Remove Spare].

POINT

- If a disk group exists that consists of hard disk drives with a capacity larger than that of the hard disk drive to be set as a spare drive, the following message appears when you click [Make Spare]. Click [OK].



IMPORTANT

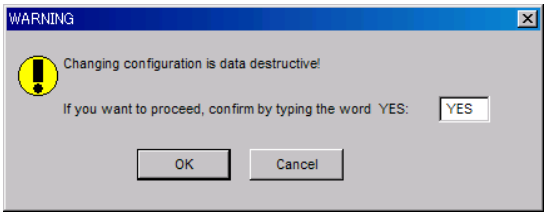
- Do not drag a spare disk drive or an unused hard disk drive into the [Disk Arrays] area.
- Use a spare disk drive of the same capacity and type as the hard disk drives in the disk group.
- When there are two or more disk groups that use different hard disk drives, set a spare disk drive for each type of hard disk drive.

6 When the configuration of the spare disk drive is completed, confirm that the existing logical drives displayed on the right side have not been changed.

If everything is OK, click the [Logical Drives] tab.

7 Click [Apply].

8 A final confirmation window appears. Enter "YES" and click [OK].



5.4.7 Changing the Write Policy

For this array controller, you can configure the write policy for each logical drive.

To change the write policy of a logical drive, perform the following procedure:

IMPORTANT

- Before using write-back drives, see "■ Write Back" (→pg.17) and make sure that you understand the idea.

1 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

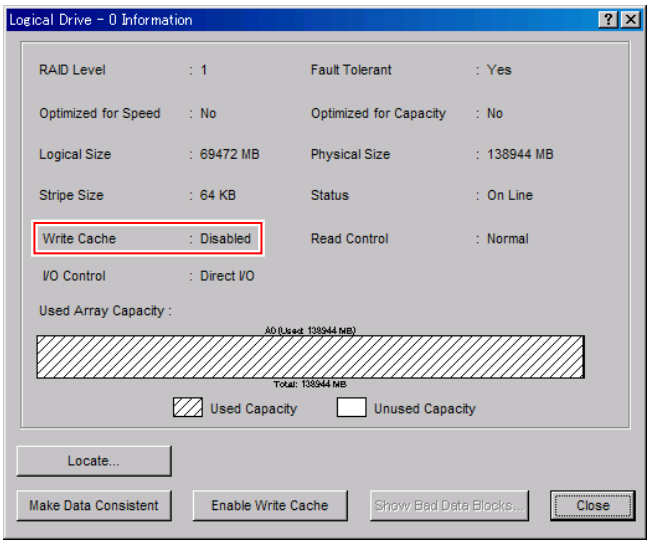
2 Select [Controller View] from the [View] menu.

→"5.2.4 Startng Controller View and the Window Layout" (pg.106)

3 Double-click the icon of the logical drive that you want to change the write policy for in the [Controller View] window.

The [Logical Drive Information] window appears.

4 The current write policy is displayed in the [Write Cache] field of the [Logical Drive Information] window.



- Disabled: Operating in Write Through mode
- Enabled: Operating in Write Back or Bad BBU mode

5 Click the [Enable Write Cache] or [Disable Write Cache] button at the bottom of the window.

The write policy changes to the alternative mode.

POINT

- If you change the write policy to [Enabled] (Write Back mode), the Bad BBU mode is used on WebBIOS. For the Bad BBU mode, see "■ Bad BBU" (→pg.18).

5.4.8 Saving and Deleting Disk Array Configuration Information .

Disk array configuration information refers to the information created when the disk array is configured, such as the disk group or logical drive capacity, RAID level, and which hard disk drive belongs to which disk group.

■ Saving Disk Array Configuration Information

You can save the current disk array configuration information on a floppy disk or a hard disk drive.

1. Start up GAM and sign on.
   →"5.1 Starting and Exiting GAM" (pg.98)
2. Select [Save Configuration] from the [File] menu.
3. Enter a file name and click [Save As].
   The current disk array configuration information is saved as a file.

■ Deleting Disk Array Configuration Information

You can delete disk array configuration information.

IMPORTANT

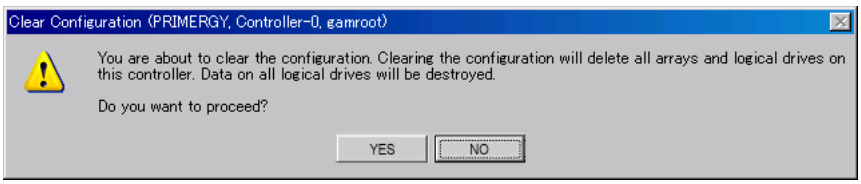
- Do not delete disk array configuration information unless you are instructed to do so by your maintenance engineer. All data on the logical drives will be lost by this operation.

1 Start up GAM and sign on.

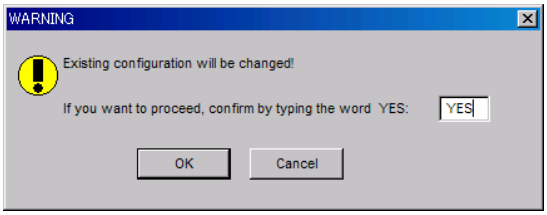
→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [Clear Configuration] from the [File] menu.

When the following confirmation window appears, click [Yes].
If you want to quit deleting the disk array configuration information, click [No].



3 A final confirmation window appears. Enter "YES" and click [OK].



The disk array configuration information is deleted.

5.5 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.158)
- Array configuration or controller information: "5.5.2 Viewing Array Controller Information" (→pg.131)
- Hard disk drive information: "5.5.3 Viewing Hard Disk Drive Information" (→pg.134)
- Logical drive information: "5.5.4 Viewing Logical Drive Information" (→pg.137)
- Information about tasks running in the background: "5.5.5 Checking the Progress of Background Tasks" (→pg.139)

5.5.1 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 failure or an event related to spare disk drive allocation) 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].

IMPORTANT

- 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.

POINT

- 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 occurred events in the file "GAMEVLOG.LOG". This file may be used when investigation is necessary. (Viewing or monitoring of this file is not supported.) 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, you need to uninstall GAM Server and reinstall it again. (If the IP address is automatically obtained from the DHCP server, the IP address may be changed depending on the timing of powering on/off or restarting the system.)

■ Log Information Viewer

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

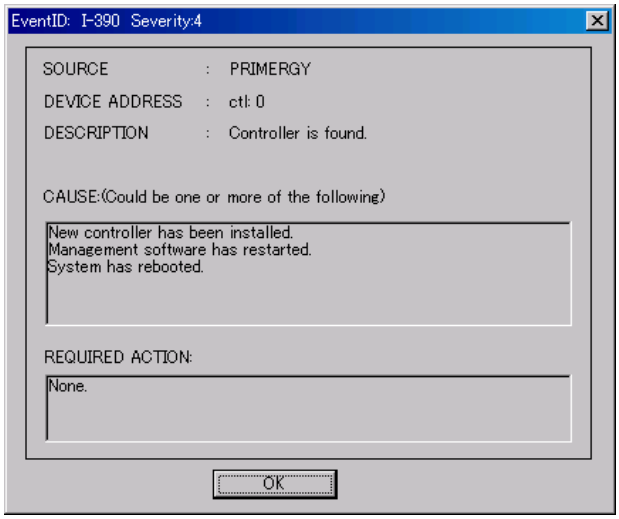
POINT

- 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.100).

■ 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.

5.5.2 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 Startng Controller View and the Window Layout" (→pg.106).

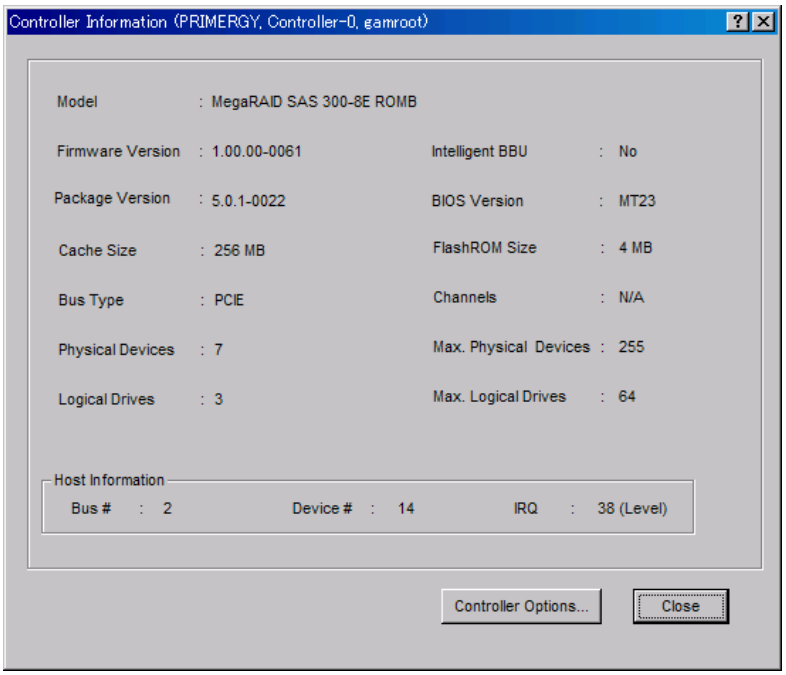
■ Displaying Detailed Information about the Array Controller

1 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [Controller Information] from the [Administration] menu.

The [Controller Information] window appears.



POINT

- You can configure controller options by clicking [Controller Options].
  For details about the controller options, see "5.3.2 Setting and Changing Controller Options" (→pg.110).
- Click [Close] to close the window.

■ Detailed Information about Array Controllers

The following information is displayed.

table: Detailed Information about Array Controllers

Item	Description
Model	The model name of the array controller.
Firmware Version	The version of the array controller's firmware.
Intelligent BBU	Indicates whether there is a battery backup unit for the array controller.
Package Version	The version of the array controller's package.
BIOS Version	The version of the array controller's BIOS.
Cache Size	The cache size of the array controller.
FlashROM Size	The size of the array controller's FlashROM.
Bus Type	The type of the host-side bus.
Channels	This item is not supported.
Physical Devices	The number of hard disk drives connected to the array controller.
Max. Physical Devices	This item is not supported.
Logical Drives	The number of logical drives.
Max. Logical Drives	This item is not supported.
Bus	The bus number for the array controller.
Device #	The device number for the array controller.
IRQ	The IRQ number.

5.5.3 Viewing Hard Disk Drive Information

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

1 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [Controller View] from the [View] menu.

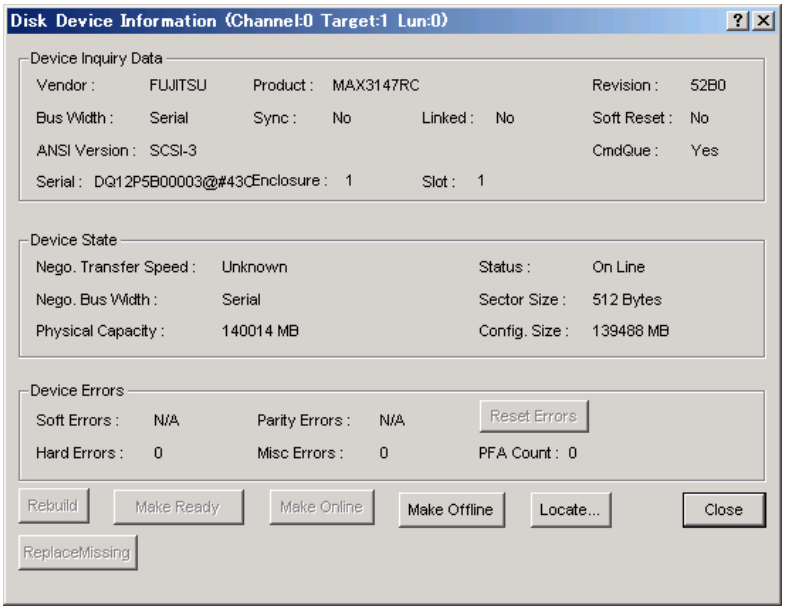
→"5.2.4 Startng Controller View and the Window Layout" (pg.106)

POINT

- Each drive column indicates the hard disk drives connected to each enclosure or to each channel of the controller.

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.



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: Detailed Information about Hard Disk Drives

Item	Description
Vendor	Information about the hard disk drive vendor.
Product	Part number of the hard disk drive.
Revision	The version of the hard disk drive's firmware.
Bus Width	The bus width. The value for this array controller is "Serial".
Sync / Linked / Soft Reset / CmdQue / ANSI Version	These items are not supported.
Serial	Serial number of the hard disk drive.
Enclosure	Enclosure ID that the hard disk drive is connected to.
Slot	The number of the slot where the hard disk drive is mounted.
Nego. Transfer Speed	This item is not supported.
Nego. Bus Width	The current bus width. The value for this array controller is "Serial".
Sector Size	The sector size.
Physical Capacity	The physical capacity of the hard disk drive.
Config. Size	The hard disk drive's available capacity when connected to this array controller.
Status	The current status of the hard disk drive. For details about the status, see "■ Hard Disk Status" (→pg.16).
Soft Errors / Parity Errors / Hard Errors / Misc Errors	These counters are not supported. (The number of recovery attempts made by the array controller for temporary or minor errors. This can be ignored unless the hard disk drive gets a failure status.)
PFA Count	The counter for the S.M.A.R.T. failure predictions for the hard disk drive.

■ 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.
  →"5.6.2 Rebuild" (pg.143)
- [Make Ready] button
  Not supported.

  - Do not use the [Make Ready] button unless you are instructed to do so by your maintenance engineer.

- [Make Online]/[Make Offline] button
  Forcibly changes the status of the hard disk drive to "Online" or "Offline".

  - Do not use the [Make Online] or [Make Offline] button unless you are instructed to do so by your maintenance engineer. In particular, always use the rebuild operation to restore "Online" status of the hard disk drive that has become "Offline". This operation may cause loss of data.

- [Locate] button
  Turns on the access lamp of the hard disk drive to indicate the drive's location.
- [ReplaceMissing] button
  Reassigns a hard disk drive to the disk group.

  - Do not use the [ReplaceMissing] button unless you are instructed to do so by your maintenance engineer.

- [Close] button
  Closes the detailed hard disk drive information window.

5.5.4 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.

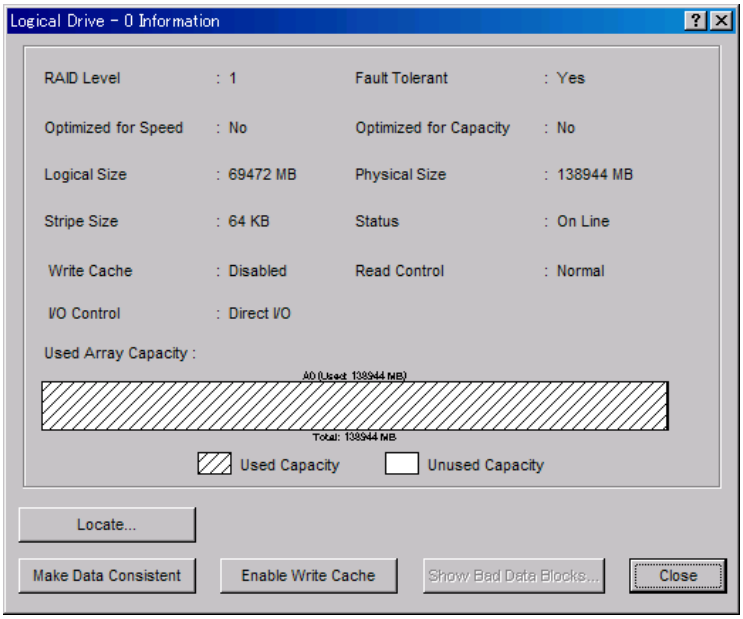
→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [Controller View] from the [View] menu.

→"5.2.4 Startng Controller View and the Window Layout" (pg.106)

3 Double-click the icon of a logical drive to see the information about it.

Detailed information about the selected logical drive is displayed.



POINT

- The logical drive number is displayed on the title bar.
- Click [Close] to close the window.

■ Detailed Information about Logical Drives

The following information is displayed.

table: Detailed Information about Logical Drives

Item	Description
RAID Level	The RAID level set for the logical drive.
Fault Tolerant	Indicates whether the logical drive has a redundancy feature or not.
Optimized for Speed	Indicates whether the logical drive's priority is placed on speed or not.
Optimized for Capacity	Indicates whether the logical drive's priority is placed on capacity or not.
Logical Size	The logical size of the logical drive.
Physical Size	The physical size of the logical drive.
Stripe Size	The striping size used by the logical drive.
Status	The current status of the logical drive. For details about the status, see "■ Logical Drive Status" (→pg.16).
Write Cache	The current write policy set for the logical drive. • Disabled: Write Through mode • Enabled: Write Back or Bad BBU mode **Note:** ▸ On this array controller, the Bad BBU mode is used when this is set to "Enabled". For the Bad BBU mode, see "■ Bad BBU" (→pg.18).
Read Control	This item is not supported.
I/O Control	This item is not supported.
Used Array Capacity	Displays the ratio of the logical drive's capacity to the disk group's total capacity.

■ Function Buttons

You can perform the following operations using the buttons.

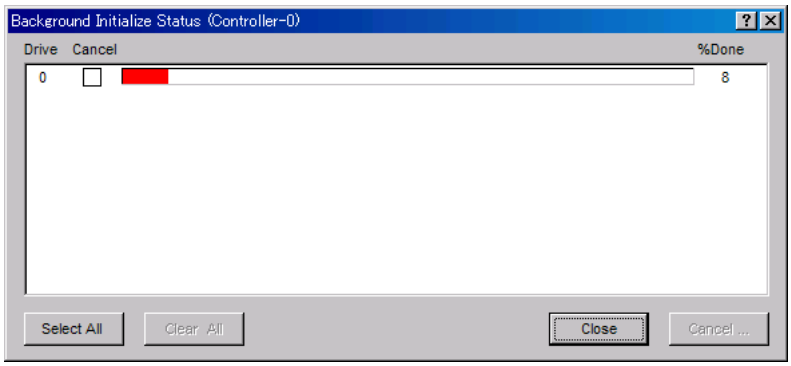
- [Locate] button
  Turns on the access lamps of all the hard disk drives that compose the logical drive to indicate their locations.
- [Make Data Consistent] button
  Starts a Make Data Consistent. For details, see "5.6.1 Make Data Consistent" (→pg.142).
- [Enable Write Cache] / [Disable Write Cache] button
  Changes the write policy of the logical drive. The available button depends on the current write policy. For details, see "5.4.7 Changing the Write Policy" (→pg.126).
- [Show Bad Data Blocks] button
  Not supported.
- [Close] button
  Closes the detailed logical drive information window.

5.5.5 Checking the Progress of Background Tasks

There are four kinds of background tasks: initialization, rebuild, Make Data Consistent and capacity expansion. GAM enables you to check the progress of these tasks with progress bars.
From the pace of the progress bar, you can figure out approximately how long the task will take from start to finish.

■ Background Initialize Status

When the background initialization of a logical drive is in progress, you can check its progress by selecting [Background Initialize Status] from the [View] menu.



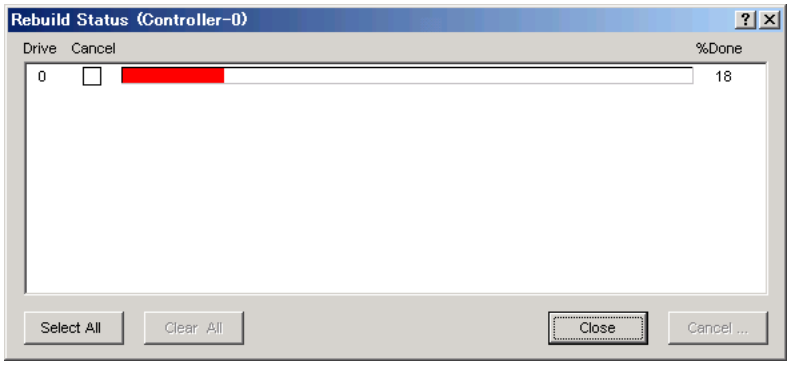
You can cancel the initialization of logical drives by checking the [Cancel] checkbox for each logical drive and clicking [Cancel].
Click [Close] to close the [Background Initialize Status] window.

POINT

- The color of the background task progress bar is different for each logical drive.
- Even if you cancel the background initialization, it is automatically restarted after a certain interval.

■ 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.

POINT

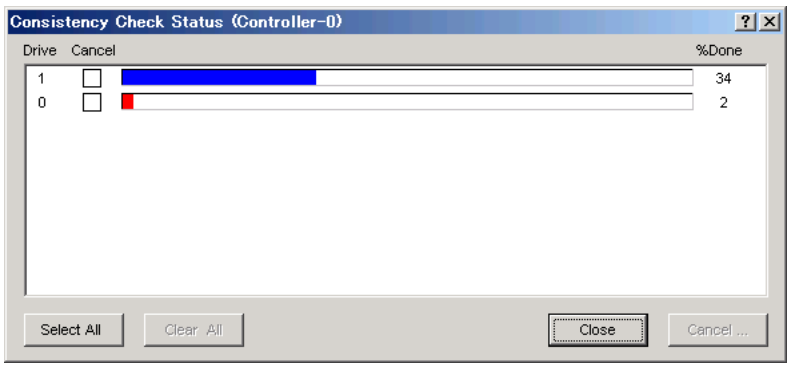
- When there are multiple logical drives assigned to a disk group, the rebuild begins from the logical drive with the lowest number in ascending order. For example, when two logical drives 0 and 1 are assigned to one disk group, after the rebuild of the logical drive 0 is completed 100%, the rebuild of the logical drive 1 starts from 0%.

IMPORTANT

- Do not cancel the rebuild.

■ Make Data Consistent Status

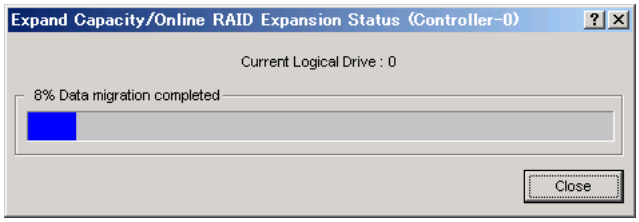
When a Make Data Consistent is in progress, you can check its progress by selecting [Make Data Consistent Status] from the [View] menu.



You can cancel the Make Data Consistent of logical drives by checking the [Cancel] checkbox for each logical drive and clicking [Cancel].
Click [Close] to close the [Consistency Check / Make Data Consistent Status] window.

■ Expand Capacity Status

When a capacity expansion is in progress, you can check its progress by selecting [Expand Capacity Status] from the [View] menu.



Click [Close] to close the [Expand Capacity Status] window.

IMPORTANT

- Do not restart or shut down the system while a capacity expansion process is in progress. Doing so may cause loss of data.
- Do not perform any other GAM operations while a capacity expansion process is in progress.

■ Calculating the Approximate Time Needed for a Background Task

For background initialization, rebuild, Make Data Consistent, and capacity expansion, you can figure out approximate time that the task takes from start to finish from the pace of the progress bar.

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

2. Calculate the approximate time that the task takes from start to finish, using the following formula.

   For background initialization, making data consistency, and capacity expansion:

   (Period measured in Step 1) x 100

   For Rebuild:

   (Period in Step 1) x 100 x (total LD capacity in DG / capacity of LD in rebuild)

   * DG: Disk Group, LD: Logical Drive

POINT

- 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.

5.6 Maintenance Functions

GAM provides the following maintenance functions.

- Making data consistency for logical drive (Make Data Consistent)→pg.142
- Rebuilding offline hard disk drives (Rebuild)→pg.143

5.6.1 Make Data Consistent

Make Data Consistent, also called redundant data regeneration, is a function that regenerates the parity or mirrored data on redundant logical drives and makes the array structure consistent.
When a server failure or a power failure results in a dirty OS shutdown, the array may become inconsistent. When a dirty OS shutdown occurs, perform this function as early as possible.

POINT

- Make Data Consistent can be performed on redundant logical drives, i.e. RAID 1 or RAID 5 logical drives in Online status. Make Data Consistent cannot be performed on logical drives without redundancy, i.e. RAID 0 logical drives or logical drives in Critical/Offline status.
- In addition to keeping the data consistent, the Make Data Consistent also automatically corrects any media errors on the hard disk drives.
- Make Data Consistent can be performed simultaneously for several logical drives.

To make data consistency, perform the following procedure.

1 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [Controller View] from the [View] menu.

→"5.2.4 Startng Controller View and the Window Layout" (pg.106)

3 Double-click the icon of the logical drive for which Make Data Consistent is to be performed from the [Controller View] window.

Detailed information about the logical drive is displayed in the [Logical Drive Information] window.

4 Click [Make Data Consistent] to start the Make Data Consistent.

When the Make Data Consistent is started, the [Make Data Consistent Status] window appears, where the progress of the Make Data Consistent is displayed. When the progress bar reaches 100% and the window closes, the check is completed.

5.6.2 Rebuild

To execute a rebuild manually, perform the following procedure.

IMPORTANT

- Usually, rebuild is automatically executed after replacing the hard disk drive. For how to replace the hard disk drive and how to perform a rebuild, see "Chapter 6 Replacing a Hard Disk Drive" (→pg.145).

1 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [Controller View] from the [View] menu.

→"5.2.4 Startng Controller View and the Window Layout" (pg.106)

3 Double-click the icon of a hard disk drive with "Dead" status ( ) in the [Controller View] window.

The detailed information about the hard disk drive is displayed in the [Disk Device Information] window.

4 Click [Rebuild].

The [Rebuild Status] window appears and a 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.

Chapter 6

Replacing a Hard Disk Drive

6

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

6.1 Checking the Hard Disk Drive to Replace 146
6.2 Replacing a Failed Hard Disk Drive 148
6.3 Preventive Replacement of a Hard Disk Drive 150

6.1 Checking the Hard Disk Drive to Replace

Check the channel and ID of the target hard disk drive before replacing it.

1 Start up GAM and sign on.

→"5.1 Starting and Exiting GAM" (pg.98)

2 Select [Controller View] from the [View] menu.

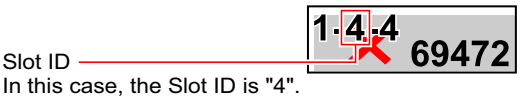
→"5.2.4 Startng Controller View and the Window Layout" (pg.106)

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 number can be confirmed at the following location on the hard disk drive icon.



IMPORTANT

- If there are any hard disk drives being rebuilt (indicated with), wait until the rebuild isfinished. 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.

POINT

- 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" (→pg.148) 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" (→pg.150) 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 failure indication of the replaced hard disk drive has disappeared, i.e. that the logical drive status is "Online", and then replace the hard disk drive that is predicted to fail, as a preventive measure. 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

- Failed hard disk drives can also be confirmed using WebBIOS. Start the WebBIOS and check the [Physical Drives] view. For more details, see "2.2.1 Checking the Hard Disk Status" (→pg.37).

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

- 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 number 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.146).

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

3. Pull out the failed hard disk drive 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.

   IMPORTANT

   - 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 at the same location where the failed hard disk drive was previously installed.

7 Check the following:

The confirmation procedure differs depending on whether a spare disk drive was set before the hard disk drive failure.

If a spare disk drive was set

Shortly after installing a new hard disk drive, it automatically becomes a spare disk drive, and the corresponding hard disk failure LED turns off.

Make sure that the status of the replaced hard disk drive has changed to "Hot Spare" in the [Disk Device Information] window (→pg.134) of GAM.

If no spare disk drive was set

Shortly after installing a new hard disk drive, a rebuild is automatically started for the newly installed hard disk drive. When the rebuild is started, the hard disk drive's failure LED that was lit starts flashing, and then turns off when the rebuild is completed.

When the rebuild is finished, make sure that the status of the replaced hard disk drive has changed to "Online" in the [Disk Device Information] window (→pg.134) of GAM.

POINT

- 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.
  (* [ctl] indicates the controller number and [chn] indicates the slot number of the hard disk drive.)
  - For Log Information Viewer

```
I-7  ctl:x chn:y tgt:z   Rebuild is over.
```

  - For OS Event Log

```
Source      : Fujitsu ServerView Service
Type        : Information
Event ID    : 1
Description: [ctl:x chn:y 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 Manual Rebuild" (→pg.21) or "■ Calculating the Approximate Time Needed for a Background Task" (→pg.141).
- 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.

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.

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

- 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 two or more hard disk drives are predicted to fail, replace one drive at a time.
- 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.148). If any hard disk drive is being rebuilt, wait until the rebuild process is finished.

6.3.1 Checking Availability of Redundancy

The procedure for preventive replacement of a hard disk drive is different depending on the RAID level (availability of redundancy) on the logical drive that the target hard disk drive belongs to.

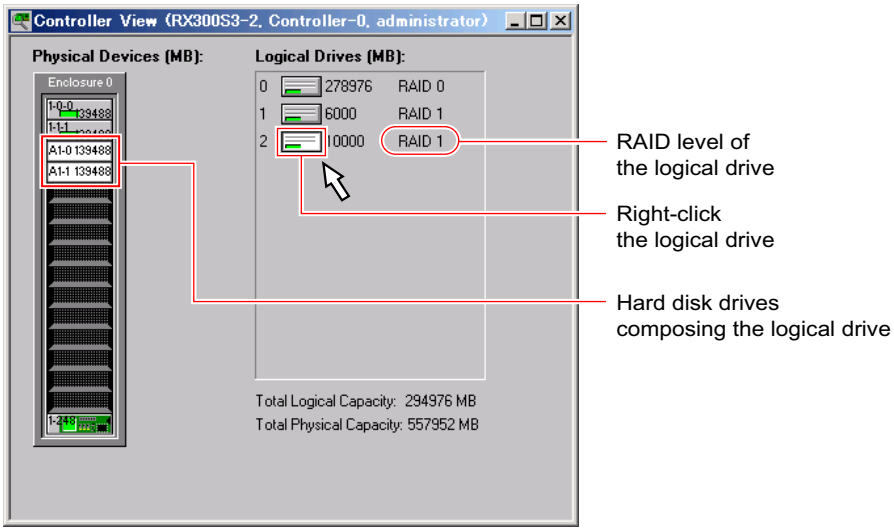
- When the logical drive do not have redundancy (RAID 0)
  →"6.3.2 For a RAID 0 Configuration" (pg.152)
- When the logical drive has redundancy (RAID 1 or RAID 5)
  →"6.3.3 For a RAID 1 or RAID 5 Configuration" (pg.153)

Perform the following procedure if you do not know whether the logical drive has redundancy or not.

1. Start up GAM and sign on.
   →"5.1 Starting and Exiting GAM" (pg.98)
2. Select [Controller View] from the [View] menu.
   →"5.2.4 Startng Controller View and the Window Layout" (pg.106)

3 Right-click and select the logical drive icon displayed in the [Logical Drives] field in the [Controller View] window of GAM.

Check the [Physical Drives] field. The icons for the hard disk drives composing the logical drive appear in white.



POINT

- Right-clicking the logical drive icon again reverts the display to its original status.

4 Check all the hard disk drives included in the disk array configuration, for each logical drive.

5 Determine which logical drive uses the failure-predicted hard disk drive ( ).

6 Confirm the RAID level for the logical drive.

6.3.2 For a RAID 0 Configuration

If the hard disk drive to be replaced belongs to a RAID 0 logical drive, the disk array must be reconfigured and the data must be restored from the backup.
Replace the hard disk drive using the following procedure.

IMPORTANT

- 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 Back up all the data on the hard disk drives connected to this array controller.

2 Using GAM, check the slot number 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.146).

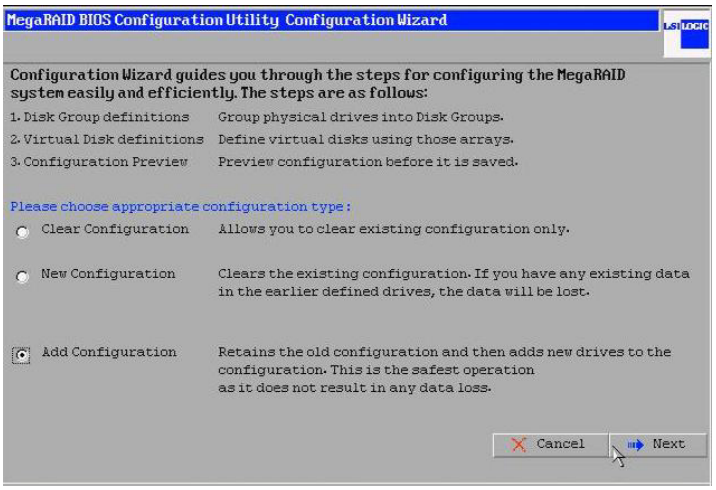
IMPORTANT

- 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.148). If any hard disk drive is being rebuilt, wait until the rebuild process is finished.

3 Restart the server.

4 Start up WebBIOS.
→"2.1.1 Starting Up WebBIOS" (pg.32)

5 Select [Configuration Wizard] from the main menu.
The [Configuration Wizard] window appears.



6 Select [Clear Configuration] and click [Next].

When the following warning message is displayed, click [Yes].

IMPORTANT

- By performing [Clear Configuration], all the data stored on the hard disk drives connected to this array controller is deleted.

7 Close WebBIOS and turn off the server.

→"2.1.2 Exiting WebBIOS" (pg.36)

8 Replace all the hard disk drives that is 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.

9 Turn on the server when the hard disk drive replacement is completed.

10 Create a disk array configuration using WebBIOS.

→"2.3.1 Creating a Disk Array Configuration" (pg.48)

11 Restore the backup data.

6.3.3 For a RAID 1 or RAID 5 Configuration

If the hard disk drive to be replaced belongs to a RAID 1 or RAID 5 logical drive, use the following procedure for the preventive replacement.

IMPORTANT

- If the hard disk drive that is predicted to fail belongs to a RAID 0 array, do not perform this procedure for the preventive replacement. See "6.3.2 For a RAID 0 Configuration" (→pg.152) 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 two or more 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 number 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.146).

IMPORTANT

- 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.148). If any hard disk drive is being rebuilt, wait until the rebuild process is finished.

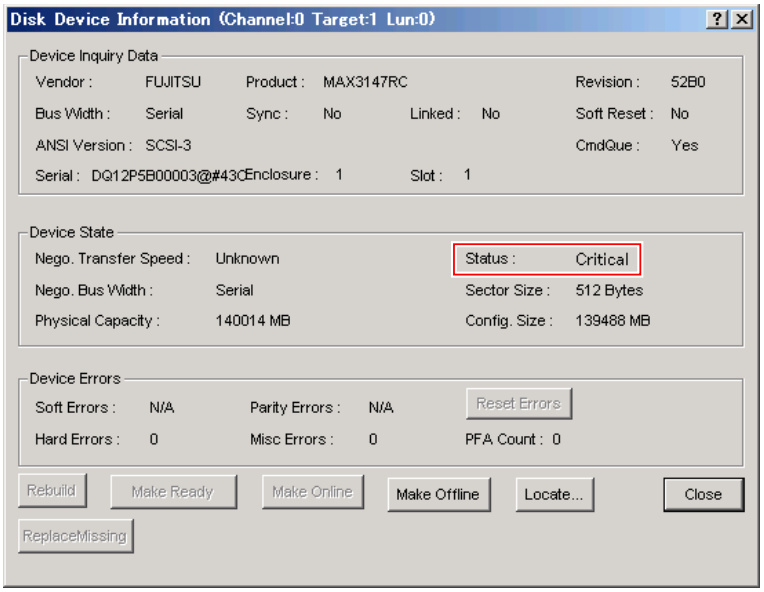
2 Make sure that there are no media errors by performing a Make Data Consistent.

→"5.6.1 Make Data Consistent" (pg.142)

3 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".



4 Click [Locate] and check the location of the target hard disk drive on the server.

The hard disk drive failure LED 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.

5 Click [OK] when the location is confirmed.

The failure LED turns off.

6 Click the [Make Offline] button. When the [WARNING] window appears, enter [YES] and click [OK].

POINT

- If a hot spare disk drive has been set, rebuild is automatically started.

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
```

8 Pull out the hard disk drive identified in Step 4 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.

IMPORTANT

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

POINT

- If no hot spare disk drive was set, the hard disk failure lamp of the drive to replace remains lit.
- If a hot spare disk drive has been set and the hard disk failure lamp is not lit, click [Locate] again to check the location of the drive to replace.
  If the hard disk drive is removed while the [Locate] function is being used, the message "Error returned by firmware." pops up, but there is no particular problem. Click [OK] to close the message.

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 at the same location where the removed hard disk drive was previously installed.

12 Check the following:

If a spare disk drive was set

Shortly after installing a new hard disk drive, it automatically becomes a spare disk drive.
Make sure that the status of the replaced hard disk drive has changed to "Hot Spare" in the [Disk Device Information] window (→pg.134) of GAM.

If no spare disk drive was set

Shortly after installing a new hard disk drive, a rebuild is automatically started for the newly installed hard disk drive. When the rebuild is started, the hard disk drive's failure LED that was lit starts flashing, and then turns off when the rebuild is completed.
When the rebuild is finished, make sure that the status of the replaced hard disk drive has changed to "Online" in the [Disk Device Information] window (→pg.134) of GAM.

POINT

- 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.
- If the [Controller View] didplay is not updated, execute [Scan Devices] from the [Administration] menu.

Appendix

This section explains the GAM error codes.

A A List of GAM Error Codes 158

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: Meaning of Event Log Strings

Character String	Meaning
ctl:	Controller ID
chn:	Slot number of hard disk drive
tgt:	Not used by this array controller.
logdrv:	Logical drive number

IMPORTANT

- Unless ServerView is installed, event logging to Event Viewer will not occur. See the "User's Guide" on the "PRIMERGY Document & Tool 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: Event Log Types and Descriptions

Severity	Description	Severity in GAM Client	OS event log type	
CRITICAL	Severe error	1		Error
MAJOR	Error	2		Error
MINOR	Warning	3		Warning
INFORMATIONAL	Information (No action required)	4		Information

The number within the parentheses of the GAM ID is displayed in hexadecimal format.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
1 (0x001)	Info/1	A physical disk has been placed online.	A hard disk drive has become "Online".	None.
2 (0x002)	Info/1	Physical disk added as hot spare.	A hard disk drive has been set as a hot spare.	None.
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.148) 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.150).
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.150) 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.	See "5.5.4 Viewing Logical Drive Information" (→pg.137) to check the current status of the logical drive. • For Critical state: See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) 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.148) 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".

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
12 (0x00C)	Error/3	Physical disk has failed.	A hard disk drive has failed.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
13 (0x00D)	Info/1	A new physical disk has been found.	A new hard disk drive was detected.	None.
14 (0x00E)	Info/1	A physical disk has been removed.	A hard disk drive was removed. A hard disk drive has become undetectable.	None.
15 (0x00F)	Info/1	A previously configured disk is now available.	A hard disk drive is now in Unconfigured state.	None.
16 (0x010)	Info/1	Expand Capacity Started.	A capacity expansion process has started.	None.
17 (0x011)	Info/1	Expand Capacity Completed.	The capacity expansion has been completed.	None.
18 (0x012)	Error/3	Expand Capacity Stopped with error.	Multiple hard disk drives failed and the capacity expansion process terminated abnormally.	Recreate the array configuration and restore the data from backup.
19 (0x013)	Error/3	SCSI command timeout on hard device.	A command timeout was detected.	Because the controller is performing a recovery, there is no problem as long as there are no failed hard disk drives.
20 (0x014)	Error/3	SCSI command abort on hard disk.	A SCSI command was aborted.	Because the controller is performing a recovery, there is no problem as long as there are no failed hard disk drives.
21 (0x015)	Warning/2	SCSI command retried on hard disk.	A SCSI command was retried.	Because the controller is performing a recovery, there is no problem as long as there are no failed hard disk drives.
23 (0x017)	Warning/2	Soft error found.	An error was detected on a hard disk drive, but it was resolved.	Because the controller is performing a recovery, no action is required. If this error occurs frequently, see "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.150) to replace the hard disk drive as a precautionary measure.
24 (0x018)	Warning/2	Misc error found.	An error was detected on a hard disk drive, but it was resolved.	Because the controller is performing a recovery, no action is required. If this error occurs frequently, see "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.150) to replace the hard disk drive as a precautionary measure.
25 (0x019)	Info/1	SCSI device reset.	The firmware issued a device reset.	None.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
28 (0x01C)	Error/3	Request Sense Data available.	A hard disk drive reported sense information.	Because the controller is performing a recovery, no action is required as long as the corresponding disk is Online.
29 (0x01D)	Info/1	Initialization started.	A hard disk drive formatting has started.	Wait until the format is completed.
30 (0x01E)	Info/1	Initialization completed.	The hard disk drive format has been completed.	None.
31 (0x01F)	Error/3	Initialization failed.	The hard disk drive format failed.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive.
32 (0x020)	Error/3	Initialization canceled.	The hard disk drive format was canceled.	Format the hard disk drive again.
33 - 41 (0x021 - 0x029)	Error/3	A physical disk failed because •••	A hard disk drive has failed.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
42 (0x02A)	Error/3	A physical disk set to failed state by host.	A Make Offline has been executed by the controller.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
43 - 49 (0x02B - 0x031)	Error/3	A physical disk failed because •••	A hard disk drive has failed.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
50 (0x032)	Error/3	Physical disk status changed to offline.	A hard disk drive has become "Offline".	None.
51 (0x033)	Info/1	Physical disk status changed to hot spare.	The hard disk drive status has become "Hot Spare".	None.
52 (0x034)	Error/3	Physical disk status changed to rebuild.	The hard disk drive status has become "Rebuild".	None.
53 (0x035)	Warning/2	Physical device ID did not match.	The hard disk drive ID does not match.	Check the logs surrounding the process and perform necessary actions.
54 (0x036)	Error/3	Physical disk failed to start.	A hard disk drive failed to start.	Check that the hard disk drive is connected properly. If the hard disk drive has failed, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
55 (0x037)	Warning/2	Physical disk negotiated different offset than config.	A hard disk drive has negotiated an offset different from the configuration.	Check that the hard disk drive is connected properly. If the hard disk drive has failed, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
56 (0x038)	Warning/2	Physical disk negotiated different bus width than config.	A hard disk drive has negotiated a bus width different from the configuration.	Check that the hard disk drive is connected properly. If the hard disk drive has failed, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
57 (0x039)	Error/3	Physical drive missing on startup.	No hard disk drive was detected during startup.	Check that the hard disk drive is connected properly. If the hard disk drive has failed, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
58 (0x03A)	Error/3	Rebuild startup failed due to lower disk capacity.	Insufficient hard disk space to perform the rebuild.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) 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.
61 (0x03D)	Info/1	A standby rebuild has started.	Standby rebuild started.	If the hard disk drive has failed, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
62 (0x03E)	Info/1	Hot spare replaced with a smaller capacity physical disk.	A hot spare with a smaller capacity was set.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) 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.
67 (0x043)	Error/3	Physical Disk found on only one disk channel.	A hard disk drive is connected to only one disk channel.	Check that the hard disk drive is connected properly. If the hard disk drive has failed, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
68 (0x044)	Info/1	Physical disk type is not approved by vendor.	An installed hard disk drive is not vendor approved.	Use a vendor supported hard disk drive.
69 (0x045)	Error/3	Physical disk has acquired an inappropriate loop ID. Enclosure disk-slot operations are disabled while this condition persists.	A hard disk drive has acquired an inappropriate loop ID.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild. If this error occurs again, contact an office listed in the "Contact Information" of "Start Guide".
70 (0x046)	Error/3	Physical disk port has failed or cannot operate at the configured channel speed.	• A hard disk drive has failed. • The hard disk drive is not compatible with the system. • The enclosure slot hardware failed.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild. If this error occurs again, contact an office listed in the "Contact Information" of "Start Guide".

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
71 (0x047)	Error/3	Mirror Race recovery failed for logical drive.	Mirror Race recovery failed.	Perform a Make Data Consistent from GAM. For how to perform the Make Data Consistent, see "5.6.1 Make Data Consistent" (→pg.142).
72 (0x048)	Error/3	Controller parameters checksum verification failed - restored default.	A mistake was found in the checksum of the controller parameters.	Check and correct the parameters in the [Adapter Properties] (→pg.45) of WebBIOS. If the message still appears, contact an office listed in the "Contact Information" of "Start Guide".
73 (0x049)	Info/1	Online controller firmware upgrade has started.	An online controller firmware upgrade has started.	None.
74 (0x04A)	Info/1	Online firmware upgrade has completed successfully.	An online firmware upgrade has been completed successfully.	None.
75 (0x04B)	Error/3	Online firmware upgrade has failed.	An online firmware upgrade has failed.	Perform the online controller firmware upgrade again. If the message still appears, contact an office listed in the "Contact Information" of "Start Guide".
76 (0x04C)	Info/1	A Configuration On Disk (COD) with unsupported features has been detected.	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.	Connect a compatible hard disk drive.
77 (0x04D)	Info/1	New battery found.	A new battery was detected.	None.
78 (0x04E)	Error/3	Battery backup unit charger error.	The battery backup unit charger has failed.	Replace the battery backup unit.
79 (0x04F)	Error/3	Battery will not hold a charge.	A battery has failed.	Replace the battery backup unit.
80 (0x050)	Error/3	Firmware entered unexpected state at run-time.	The firmware entered unexpected state at run-time.	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.
85 (0x055)	Info/1	Unable to recover medium error during patrol read.	Recovery of a medium error failed during the Patrol Read operation.	If a corrupted file is found, restore it from the backup.
86 (0x056)	Info/1	Rebuild resumed.	Rebuild restarted.	None.
87 (0x057)	Info/1	Patrol Read operation moved to next available target.	Patrol Read operation started with the next available hard disk drive.	None.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
88 (0x058)	Info/1	Patrol Read operation moved to next available channel.	Patrol Read operation started with the next available channel.	None.
89 (0x059)	Info/1	Physical disk transfer speed changed.	The transfer speed of the hard disk drive has changed due to an unknown error.	Check the previous logs and perform necessary steps.
90 (0x05A)	Error/3	Channel is suspended due to some faults.	An abnormal state was found in the channel.	Contact an office listed in the "Contact Information" of "Start Guide".
95 (0x05F)	Info/1	Configured physical disk replaced by user by a smaller capacity disk.	A hard disk drive has been replaced with a smaller capacity drive than configured.	Reconnect a proper hard disk drive.
97 (0x061)	Info/1	PD Clear aborted.	PD Clear was aborted.	None.
98 (0x062)	Error/3	PD Clear failed.	PD Clear has failed.	Replace the hard disk drive.
99 (0x063)	Info/1	PD Clear started.	PD Clear was started.	None.
100 (0x064)	Info/1	PD Clear completed.	PD Clear has been completed.	None.
101 (0x065)	Error/3	Error.	An unknown error was detected.	If the hard disk drive has failed, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild. If the message still appears, contact an office listed in the "Contact Information" of "Start Guide".
102 (0x066)	Error/3	Hot Spare SMART polling failed.	SMART polling of the Hot Spare failed.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild. Then configure the spare disk drive referring to "2.4 Setting/Releasing a Spare Disk Drive" (→pg.57).
103 (0x067)	Info/1	Patrol Read corrected medium error.	A medium error was corrected by Patrol Read.	None.
104 (0x068)	Error/3	Reassign write operaiton failed.	A Reassign operation failed.	If the hard disk drive has failed, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
105 (0x069)	Error/3	Unrecoverable medium error during rebuild.	An unrecoverable medium error was detected during the rebuild process.	If a corrupted file is found, restore it from the backup.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
106 (0x06A)	Info/1	Corrected medium error during recovery.	A medium error was corrected.	None.
107 (0x06B)	Error/3	Unrecoverable medium error during recovery.	An unrecoverable medium error was detected.	If a corrupted file is found, restore it from the backup.
110 (0x06E)	Info/1	Dedicated Hot Spare no longer useful due to deleted array.	No corresponding disk group exists for the Dedicated spare disk.	The Dedicated spare disk is not supported. Reset the spare disk.
111 (0x06F)	Info/1	Dedicated Hot Spare created.	A Dedicated spare disk was created.	The Dedicated spare disk is not supported. Reset the spare disk.
112 (0x070)	Warning/2	Dedicated Hot Spare disabled.	The Dedicated Hot Spare was removed.	None.
113 (0x071)	Info/1	Dedicated Hot Spare no longer useful for all arrays.	No corresponding disk group exists for the Dedicated spare disk.	The Dedicated spare disk is not supported. Reset the spare disk.
114 (0x072)	Info/1	Global Hot Spare created.	A Global Hot Spare was created.	None.
115 (0x073)	Warning/2	Global Hot Spare disabled.	The Global Hot Spare was disabled.	None.
116 (0x074)	Info/1	Global Hot Spare does not cover all arrays.	The capacity of the spare disk is insufficient, and there is no array targeted for Hot Spare rebuild.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) 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.
119 (0x077)	Warning/2	PD too small to be used for auto-rebuild.	The rebuild could not be started because the capacity of the hard disk drive is smaller then the other hard disk drive.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) 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.
120 (0x078)	Warning/2	Bad block table on PD is 80% full.	The Bad Block Table use rate has exceeded 80%.	See "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.150) and replace the hard disk drive as a preventive measure.
121 (0x079)	Error/3	Bad block table on PD is full; unable to log blocks.	The Bad Block Table is full.	See "6.3 Preventive Replacement of a Hard Disk Drive" (→pg.150) and replace the hard disk drive as a preventive measure.
126 (0x07E)	Info/1	Firmware corrected the 'Read' error.	The media error was corrected.	None.
128 (0x080)	Info/1	Consistency check / Make Data Consistent is started.	A Make Data Consistent has started.	None.
129 (0x081)	Info/1	Consistency check / Make Data Consistent is finished.	The Make Data Consistent has been completed successfully.	None.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
130 (0x082)	Error/3	Consistency check / Make Data Consistent is cancelled.	The Make Data Consistent was canceled.	None.
132 (0x084)	Error/3	Consistency check / Make Data Consistent on logical drive failed.	The Make Data Consistent was aborted, since the logical drive had not been made Online.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild. Then, redo the Make Data Consistent.
134 (0x086)	Error/3	Logical drive has been made offline.	The logical drive has been made Offline.	The logical drive(s) cannot continue running in this state. Recreate the array configuration and restore the data from backup.
135 (0x087)	Error/3	Logical drive is critical.	The logical drive is in Critical state due to a hard disk drive failure.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
136 (0x088)	Info/1	Logical drive has been placed online.	The logical drive has been placed online.	None.
137 (0x089)	Info/1	An automatic rebuild has started on logical drive.	Rebuild started automatically.	None.
138 (0x08A)	Info/1	A manual rebuild has started on logical drive.	Rebuild started manually.	None.
139 (0x08B)	Info/1	Rebuild on logical drive is over.	Rebuild has been completed.	None.
140 (0x08C)	Error/3	Rebuild on logical drive is cancelled.	Rebuild was canceled.	Perform the rebuild again.
141 (0x08D)	Error/3	Rebuild stopped with error.	Rebuild terminated abnormally.	Check the logs surrounding the process and perform necessary actions.
142 (0x08E)	Error/3	Rebuild stopped with error. New physical disk failed.	Rebuild terminated abnormally due to a failure on the target hard disk drive.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
143 (0x08F)	Error/3	Rebuild stopped because logical drive failed.	The source disk of the rebuild failed.	Contact an office listed in the "Contact Information" of "Start Guide".
144 (0x090)	Info/1	Logical drive initialization started.	An initialization of a logical drive has started.	None.
145 (0x091)	Info/1	Logical drive initialization done.	The initialization of the logical drive has been completed.	None.
146 (0x092)	Error/3	Logical drive initialization cancelled.	The initialization of the logical drive was canceled.	Perform the initialization process again.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
147 (0x093)	Error/3	Logical drive initialization failed.	The initialization terminated abnormally. The logical drive is now in Offline state.	Backup all the data on the logical drive and see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive. Recreate the array configuration. Then restore the data from backup.
148 (0x094)	Info/1	A logical drive has been found.	A new logical drive has been detected.	None.
149 (0x095)	Info/1	A logical drive has been deleted.	A logical drive was deleted.	None.
150 (0x096)	Info/1	Expand Capacity Started.	A capacity expansion process has started.	None.
151 (0x097)	Info/1	Expand Capacity Completed.	The capacity expansion has been completed.	None.
152 (0x098)	Error/3	Expand Capacity stopped with error.	The capacity expansion process terminated abnormally due to failures in multiple hard disk drives.	The logical drive(s) cannot continue running in this state. Recreate the array configuration and restore the data from backup.
153 (0x099)	Error/3	Bad Blocks found.	A bad block was detected during the Make Data Consistent, rebuild, or capacity expansion process.	• 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.
154 (0x09A)	Info/1	System drive size changed.	The capacity of the logical drive has changed.	None.
155 (0x09B)	Info/1	System drive type changed.	• A new configuration was added. • The capacity expansion has been completed.	None.
156 (0x09C)	Error/3	Bad data blocks found. Possible data loss.	Bad blocks were found on multiple hard disk drives at the same location.	If a corrupted file is found, restore it from the backup.
157 (0x09D)	Info/1	Logical drive LUN mapping has been written to config.	Logical drive LUN mapping has been written to config.	None.
158 (0x09E)	Error/3	Attempt to read data from block that is marked in Bad Data Table.	An attempt has been made to read data logged in the BDT table.	If a corrupted file is found, restore it from the backup.
159 (0x09F)	Error/3	Data for Disk Block has been lost due to Logical Drive problem.	Due to a problem with the logical drive, cache data could not be written to the hard disk drive.	Check the logs surrounding the process and perform necessary actions.
162 (0x0A2)	Info/1	A standby rebuild has started on a logical drive.	Standby rebuild started.	If the hard disk drive has failed, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
163 (0x0A3)	Error/3	Reconstruct detected uncorrectable double medium errors.	Due to media errors detected in the same position on multiple hard disk drives, data cannot be recovered.	If a corrupted file is found, restore it from the backup.
164 (0x0A4)	Info/1	Reconstuction resumed.	Reconstruction was resumed.	None.
165 (0x0A5)	Error/3	Reconstuction resume failed due to configuraiton mismatch.	Reconstruction resume terminated abnormally due to configuration mismatch.	Recreate the array and restore the backup data.
166 (0x0A6)	Info/1	LD Properties updated.	A parameter has changed on the logical drive.	None.
167 (0x0A7)	Error/3	Marking LD inconsistent due to active writes at shutdown.	The consistency of the logical drive was lost due to shutdown during the writing process.	Perform a Make Data Consistent from GAM. For how to perform the Make Data Consistent, see "5.6.1 Make Data Consistent" (→pg.142).
176 (0x0B0)	Info/1	Logical drive background initialization started.	BGI started.	None.
177 (0x0B1)	Info/1	Logical drive background initialization stopped.	BGI stopped by the user or the firmware.	None.
178 (0x0B2)	Info/1	Logical drive background initialization paused.	BGI was paused for operations with higher priority.	None.
179 (0x0B3)	Info/1	Logical drive background initialization restarted.	BGI resumed after a pause.	None.
180 (0x0B4)	Error/3	Logical drive background initialization failed.	BGI terminated abnormally.	Check the logs surrounding the process and perform necessary actions.
181 (0x0B5)	Info/1	Logical drive background initialization completed.	BGI has been completed.	None.
182 (0x0B6)	Error/3	Low battery charge level. Logical drive may have lost data.	Data may be lost because the power has been off for a long time with data maintained in the cache memory.	Perform a Make Data Consistent (→pg.142) from GAM. If necessary, restore the data from the backup after reconfiguring the array.
185 (0x0B9)	Info/1	Unable to recover medium error during background initialization.	Unrecoverable medium error detected during background initialization.	If a corrupted file is found, restore it from the backup.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
256 (0x100)	Error/3	Fan failure.	A fan failure was detected.	Check the fan with ServerView, and take the necessary measures.
257 (0x101)	Info/1	Fan has been restored.	The fan was restored.	None.
258 (0x102)	Error/3	Fan failure.	A fan failure was detected.	Check the fan with ServerView, and take the necessary measures.
259 (0x103)	Info/1	Storage cabinet fan is not present.	No fan was detected.	None.
272 (0x110)	Error/3	Power supply failure.	The power supply has failed.	Check the power supply status with ServerView, and take the necessary measures.
273 (0x111)	Info/1	Power supply has been restored.	The PSU was restored.	None.
274 (0x112)	Error/3	Power supply failure.	The power supply has failed.	Check the power supply status with ServerView, and take the necessary measures.
275 (0x113)	Info/1	Storage cabinet power supply is not present.	No power supply was detected.	None.
288 (0x120)	Error/3	Over temperature. Temperature is above 70 degrees Celsius.	Abnormal temperature was detected.	Check the fan status with ServerView. In the event of a fan failure, take the necessary measures. If there is no fan failure, adjust the ambient temperature.
289 (0x121)	Warning/2	Temperature is above 50 degrees Celsius.	Abnormal temperature was detected.	Check the fan status with ServerView. In the event of a fan failure, take the necessary measures. If there is no fan failure, adjust the ambient temperature.
290 (0x122)	Info/1	Normal temperature has been restored.	The temperature is now normal.	None.
291 (0x123)	Error/3	Over temperature.	Abnormal temperature was detected.	Check the fan status with ServerView. In the event of a fan failure, take the necessary measures. If there is no fan failure, adjust the ambient temperature.
292 (0x124)	Info/1	Storage cabinet temperature sensor is not present.	No temperature sensor was detected.	None.
320 (0x140)	Error/3	Fan failure.	A fan failure was detected.	Check the fan with ServerView, and take the necessary measures.
321 (0x141)	Info/1	Fan has been restored.	The fan was restored.	None.
322 (0x142)	Info/1	Fan is not present.	No fan was detected.	None.
323 (0x143)	Error/3	Power supply failure.	The power supply has failed.	Check the power supply status with ServerView, and take the necessary measures.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
324 (0x144)	Info/1	Power supply has been restored.	The PSU was restored.	None.
325 (0x145)	Info/1	Power supply is not present.	No power supply was detected.	None.
326 (0x146)	Error/3	Temperature is over safe limit. Failure imminent.	Abnormal temperature was detected.	Check the fan status with ServerView. In the event of a fan failure, take the necessary measures. If there is no fan failure, adjust the ambient temperature.
327 (0x147)	Error/3	Temperature is above working limit.	Abnormal temperature was detected.	Check the fan status with ServerView. In the event of a fan failure, take the necessary measures. If there is no fan failure, adjust the ambient temperature.
328 (0x148)	Info/1	Normal temperature has been restored.	The temperature is now normal.	None.
329 (0x149)	Info/1	Temperature sensor is not present.	No temperature sensor was detected.	None.
330 (0x14A)	Error/3	Enclosure access critical.	An error occurred in the access to the enclosure.	Contact an office listed in the "Contact Information" of "Start Guide".
331 (0x14B)	Info/1	Enclosure access has been restored.	Enclosure access was restored.	None.
332 (0x14C)	Error/3	Enclosure access is offline.	An error occurred in the access to the enclosure.	Contact an office listed in the "Contact Information" of "Start Guide".
334 (0x14E)	Info/1	Enclosure services ready.	Enclosure is ready for service.	None.
335 (0x14F)	Info/1	Access to temperature sensor has been lost.	Access to the temperature sensor was lost.	None.
336 (0x150)	Info/1	Access to power supply status information has been lost.	Access to the power supply status information was lost.	None.
337 (0x151)	Info/1	Access to fan status information has been lost.	Access to the fan status information was lost.	None.
338 (0x152)	Error/3	Physical disks in enclosure being spundown.	Abnormal temperature was detected.	Check the fan status with ServerView. In the event of a fan failure, take the necessary measures. If there is no fan failure, adjust the ambient temperature.
339 (0x153)	Error/3	Temperature is below working limit.	Abnormal temperature was detected.	Check the fan status with ServerView. In the event of a fan failure, take the necessary measures. If there is no fan failure, adjust the ambient temperature.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
340 (0x154)	Error/3	Temperature is under safe limit. Failure imminent.	Abnormal temperature was detected.	Check the fan status with ServerView. In the event of a fan failure, take the necessary measures. If there is no fan failure, adjust the ambient temperature.
346 (0x15A)	Error/3	Enclosure not supported; too many enclosures connected to port.	• Enclosure is not supported. • Too many Enclosures are connected to the port.	Check the condition of the system connections.
347 (0x15B)	Error/3	Enclosure firmware mismatch.	The enclosure firmware does not match.	Contact an office listed in the "Contact Information" of "Start Guide".
348 (0x15C)	Error/3	Sensor bad.	The sensor is abnormal.	Contact an office listed in the "Contact Information" of "Start Guide".
349 (0x15D)	Error/3	Enclosure phy bad.	The Enclosure PHY is abnormal.	Contact an office listed in the "Contact Information" of "Start Guide".
350 (0x15E)	Error/3	SAS/SATA mixing not supported in enclosure; PD disabled.	The hard disk drive cannot be used, because SAS and SATA devices are mixed.	Check if any unsupported hard disk drives are installed. If there is an unsupported hard disk drive installed, replace it with a supported one.
351 (0x15F)	Warning/2	Enclosure (SES) hotplug on was detected, but is not supported.	A Enclosure hotplug was detected, but is not supported.	None.
352 (0x160)	Info/1	Enclosure power supply has been turned off.	The enclosure power supply was turned off.	None.
353 (0x161)	Info/1	Enclosure power supply has been turned on.	The enclosure power supply was turned on.	None.
354 (0x162)	Info/1	Enclosure power supply cable has been removed.	The enclosure power supply cable was removed.	Insert the power supply cable.
355 (0x163)	Info/1	Enclosure power supply cable has been inserted.	The enclosure power supply cable was inserted.	None.
356 (0x164)	Info/1	Enclosure fan returned to normal.	The enclosure fan returned to normal.	None.
357 (0x165)	Info/1	Enclosure temperature difference has been detected.	An enclosure temperature difference was detected.	None.
384 (0x180)	Info/1	Array management server software started successfully.	GAM Server started successfully.	None.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
385 (0x181)	Error/3	Write back error	Failed to write cache.	Check the logs surrounding the process and perform necessary actions.
386 (0x182)	Warning/2	Internal log structures getting full, PLEASE SHUTDOWN AND RESET THE SYSTEM IN THE NEAR FUTURE.	Due to many configuration changes, the configuration change table is full.	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 "Contact Information" of "Start Guide".
388 (0x184)	Error/3	Controller is dead. System is disconnecting from this controller.	The SCSI array controller failed.	Contact an office listed in the "Contact Information" of "Start Guide".
389 (0x185)	Info/1	Controller has been reset.	The controller received a reset command.	Because the firmware is performing a recovery, there is no problem as long as there are no failed hard disk drives.
390 (0x186)	Info/1	Controller is found.	A controller was detected.	None.
391 (0x187)	Error/3	Controller is gone. System is disconnecting from this controller.	• The power to the controller was cut off. • The controller was removed from the system.	Contact an office listed in the "Contact Information" of "Start Guide".
392 (0x188)	Info/1	Battery present.	A battery backup unit was detected.	None.
393 (0x189)	Error/3	Battery is bad.	The battery backup unit has failed.	Replace the battery backup unit.
394 (0x18A)	Info/1	Battery power OK.	The battery is fully charged. (The charge level is above the set threshold.)	None.
395 (0x18B)	Error/3	Controller is gone. System is disconnecting from this controller.	• The power to the controller was cut off. • The controller was removed from the system.	Contact an office listed in the "Contact Information" of "Start Guide".
396 (0x18C)	Info/1	Controller powered on.	A new controller was installed.	None.
397 (0x18D)	Info/1	Controller is online.	A controller came online.	None.
398 (0x18E)	Error/3	Controller is gone. System is disconnecting from this controller.	• The power to the controller was cut off. • The controller was removed from the system.	Contact an office listed in the "Contact Information" of "Start Guide".
399 (0x18F)	Warning/2	Controller's partner is gone, controller is in failover mode now.	The controller went Offline.	None.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
400 (0x190)	Info/1	Battery reconditioning is started.	Reconditioning of the battery has started.	None.
401 (0x191)	Info/1	Battery reconditioning is finished.	Reconditioning of the battery has been completed.	None.
402 (0x192)	Info/1	Battery reconditioning is canceled.	Reconditioning of the battery was canceled.	Perform the battery reconditioning again.
403 (0x193)	Error/3	Installation aborted.	The configuration changed while the system was offline.	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.
404 (0x194)	Error/3	Controller firmware mismatch.	The controller firmware has been replaced with an old version.	Contact an office listed in the "Contact Information" of "Start Guide".
405 (0x195)	Error/3	The Battery Backup Unit is removed.	The battery backup unit was removed.	Check the connection of the battery. If this does not resolve the problem, replace the battery backup unit.
406 (0x196)	Error/3	WARM BOOT failed.	A memory error was detected during the boot process.	Replace the cache memory or the battery backup unit.
407 (0x197)	Info/1	Battery calibration cycle started.	Calibration of the battery was started.	None.
408 (0x198)	Info/1	Battery calibration cycle finished.	Calibration of the battery has been completed.	None.
409 (0x199)	Info/1	Battery calibration cycle was cancelled.	Calibration of the battery was canceled.	Perform the battery reconditioning again.
410 (0x19A)	Error/3	Battery is not present.	No battery was detected.	If a battery backup unit is used, check its connection. If this error occurs again, replace the battery backup unit.
411 (0x19B)	Info/1	Controller entered conservative cache mode.	The SCSI array controller entered Conservative Cache Mode.	None.
412 (0x19C)	Info/1	Controller entered normal cache mode.	The SCSI array controller entered Normal Cache Mode.	None.
413 (0x19D)	Info/1	Controller device start complete.	The controller device started.	None.
414 (0x19E)	Error/3	Soft ECC error Corrected.	An ECC error was detected in the memory.	Replace the memory module or the battery backup unit.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
415 (0x19F)	Error/3	Hard ECC error Corrected.	An ECC error was detected in the memory.	Replace the memory module or the battery backup unit.
416 (0x1A0)	Info/1	Battery recondition suggested.	Reconditioning of the battery is recommended.	Recondition the battery.
418 (0x1A2)	Error/3	BBU out of service.	The battery cannot supply power to the cache memory.	Replace the battery backup unit.
425 (0x1A9)	Error/3	Controller boot ROM image needs to be reloaded.	An inappropriate firmware image was loaded.	Contact an office listed in the "Contact Information" of "Start Guide".
426 (0x1AA)	Error/3	Controller is using default non-unique world-wide name.	The controller's MAC address was lost, or not set.	Contact an office listed in the "Contact Information" of "Start Guide".
427 (0x1AB)	Error/3	Mirror Race recovery failed.	Mirror Race recovery failed.	Perform a Make Data Consistent from GAM. For how to perform the Make Data Consistent, see "5.6.1 Make Data Consistent" (→pg.142).
428 (0x1AC)	Error/3	Mirror Race on critical drive.	The hard disk drive has a failure.	See "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild.
431 (0x1AF)	Error/3	Controller improperly shutdown! Data may have been lost.	The consistency of the logical drive was lost due to an invalid shutdown process.	Perform a Make Data Consistent from GAM. For how to perform the Make Data Consistent, see "5.6.1 Make Data Consistent" (→pg.142).
440 (0x1B8)	Error/3	Error in Mirror Race Table.	An error occurred in the Mirror Race Table.	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.
442 (0x1BA)	Info/1	Patrol Read iteration completed.	Patrol Read has been completed.	None.
443 (0x1BB)	Info/1	Controller entered 'Write Through' cache mode.	The controller entered 'Write Through' cache mode.	None.
444 (0x1BC)	Info/1	Controller entered 'Write Back' cache mode.	The controller entered 'Write Back' cache mode.	None.
446 (0x1BE)	Info/1	Data in Cache flushed during power up.	Data in the cache memory was flushed at the time of system boot.	None.
447 (0x1BF)	Error/3	Data in Cache not flushed during power up.	Data in the cache memory failed to flush at the time of system boot due to an abnormal configuration.	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.

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GAM ID	Severity	Description	Details	Corrective action
448 (0x1C0)	Info/1	Consistency Check rate changed.	The rate of Make Data Consistent has been changed.	None.
449 (0x1C1)	Info/1	Background initialization rate changed.	The background initialization rate has been changed.	None.
450 (0x1C2)	Info/1	Flush rate changed.	The flush rate has been changed.	None.
451 (0x1C3)	Info/1	Patrol Read Rate changed.	The Patrol Read Rate has been changed.	None.
452 (0x1C4)	Info/1	Rebuild rate changed.	The rebuild rate has been changed.	None.
453 (0x1C5)	Info/1	Reconstruction rate changed.	The reconstruction rate has been changed.	None.
455 (0x1C7)	Info/1	Alarm disabled by user.	The user disabled the alarm.	None.
456 (0x1C8)	Info/1	Alarm enabled by user.	The user enabled the alarm.	None.
457 (0x1C9)	Error/3	Unable to recover cache data due to configuration mismatch.	The cache data cannot be recovered due to a configuration mismatch.	If the array configuration is correct, perform a Make Data Consistent (→pg.142). If the array configuration is invalid, reconfigure the array and restore the data from the backup.
458 (0x1CA)	Error/3	Cache data recovered successfully.	The cache data was recovered successfully.	None.
460 (0x1CC)	Info/1	Factory defaults restored.	A factory default was restored.	Reconfigure the controller if necessary.
461 (0x1CD)	Info/1	Hibernate command received from host.	A hibernate command was received from the host.	None.
462 (0x1CE)	Info/1	Event log cleared.	The NVRAM log was cleared.	None.
463 (0x1CF)	Info/1	Event log wrapped.	The NVRAM log was wrapped.	None.
464 (0x1D0)	Error/3	Not enough controller memory.	Insufficient controller memory was detected.	Replace the cache memory or the battery backup unit.
465 (0x1D1)	Info/1	Patrol Read paused.	Patrol Read operation was temporarily paused.	None.
466 (0x1D2)	Info/1	Patrol Read resumed.	Patrol Read operation was resumed.	None.
467 (0x1D3)	Info/1	Patrol Read started.	Patrol Read operation was started.	None.
468 (0x1D4)	Info/1	Shutdown command received from host.	A shutdown command was received from the host.	None.
469 (0x1D5)	Info/1	User entered firmware debugger.	The user entered firmware debug mode.	None.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
470 (0x1D6)	Error/3	Battery temperature is high.	Abnormal temperature was detected.	Check the fan status with ServerView. In the event of a fan failure, take the necessary measures. If there is no fan failure, adjust the ambient temperature. If this error occurs again, replace the battery backup unit.
471 (0x1D7)	Info/1	Battery is charging.	The battery is charging.	None.
472 (0x1D8)	Error/3	Battery is discharging.	The battery is discharging.	None.
473 (0x1D9)	Error/3	Battery needs to be replaced.	Replacement of the battery is required.	Replace the battery backup unit.
474 (0x1DA)	Error/3	Battery relearn timed out.	The battery relearn timed out.	Perform the battery reconditioning again. If this error occurs again, replace the battery backup unit.
475 (0x1DB)	Info/1	Battery relearn pending: Battery is under charge.	The reconditioning of the battery is pending because the battery is being charged.	None.
478 (0x1DE)	Info/1	BBU enabled; changing WT logical drives to WB.	The battery backup unit became enabled and the logical drive was changed from Write Through mode to Write Back mode.	None.
479 (0x1DF)	Warning/2	BBU disabled; changing WB logical drives to WT.	The battery backup unit became disabled and the logical drive was changed from Write Back mode to Write Through mode.	None.
480 (0x1E0)	Info/1	Battery charge complete	The battery charge has been completed.	None.
481 (0x1E1)	Info/1	Battery Relearn request received.	A request to recondition the battery was received.	Perform the battery reconditioning.
482 (0x1E2)	Info/1	Controller Cache discarded by user.	The user discarded the Controller Cache.	None.
483 (0x1E3)	Info/1	Previous configuration is completely missing at boot.	The array configuration was missing at boot time.	• Shut down the system and check the connection to the hard disk drive. • Check that the cabinet is properly connected. • Check the state of the power supply.
512 (0x200)	Info/1	System started.-	The server or GAM Server started.	None.
514 (0x202)	Info/1	User logged in.-	The user logged in to the server.	None.
515 (0x203)	Info/1	User logged out.-	The user logged out from the server.	None.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
516 (0x204)	Info/1	Server alive.	• Reconnected to the server. • The server rebooted.	None.
517 (0x205)	Error/3	Lost connection to server, or server is down.	• The network connection to the server was lost. • The server shut down.	Check the network. Check that GAM Server was properly executed. Check that the server is running.
518 (0x206)	Info/1	Automatic reboot count has changed.	Automatic reboot count has changed.	None.
519 (0x207)	Info/1	Battery test has started.	A battery test started.	None.
520 (0x208)	Info/1	Battery test complete.	The battery test has been completed.	None.
521 (0x209)	Info/1	Battery test canceled.	The battery test was canceled.	None.
522 (0x20A)	Error/3	Battery test failed - battery bad.	Errors were detected during the battery test.	Replace the battery backup unit.
700 (0x2BC)	Info/1	Event log empty.	The content of the event log has become blank.	None.
701 (0x2BD)	Info/1	Event log entries lost.	Event Log entries were lost.	None.
702 (0x2BE)	Info/1	Request Sense.	Sense Information was reported.	Because the firmware is performing a recovery, there is no problem as long as there are no failed hard disk drives.
703 (0x2BF)	Info/1	Set real time clock.	The clock was set.	None.
800 (0x320)	Info/1	New Configuration Received.	A new array configuration was issued.	None.
801 (0x321)	Info/1	Configuration Cleared.	The array configuration was cleared.	None.
802 (0x322)	Warning/2	Configuration Invalid.	The array configuration information is invalid.	Check that the hard disk drive is connected properly. If this does not resolve the problem, recreate the array and recover the backup data.
803 (0x323)	Warning/2	Configuration On Disk Access Error.	The array configuration information could not be read from the hard disk drive.	Check the array configuration. If there is a failed hard disk drive, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace it and perform a rebuild. If the array configuration is invalid, reconfigure the array and restore the data from the backup.
804 (0x324)	Warning/2	Configuration on disk converted.	The array configuration information on the hard disk drive was converted.	None.

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
805 (0x325)	Warning/2	Configuration On Disk Import Failed.	The array configuration information could not be imported.	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.
806 (0x326)	Info/1	A debug dump exists on this system.	A debug dump exists on this system.	None.
807 (0x327)	Info/1	A debug dump exists on this system.	A debug dump exists on this system.	None.
808 (0x328)	Info/1	No valid Configuration On Disk (COD) found.	No valid Configuration On Disk (COD) found.	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.
810 (0x32A)	Info/1	MegaRAID firmware initialization started.	The initialization of the MegaRAID firmware started.	None.
811 (0x32B)	Error/3	Unable to recover cache data from TBBU.	Cache data cannot be recovered from the battery backup unit.	Shut down the system properly, and then restart the system. If this error occurs again, replace the battery backup unit.
812 (0x32C)	Info/1	Cache data recovered from TBBU successfully.	Data was successfully written to the cache memory.	None.
960 (0x3C0)	Error/3	SAS topology error: Loop detected.	Loop detected in the SAS topology.	Check the condition of the system connections. If this error occurs again, even though the connections are correct, contact an office listed in the "Contact Information" of "Start Guide".
961 (0x3C1)	Error/3	SAS topology error: Unaddressable device.	Device is unaddressable in the SAS topology.	Check the condition of the system connections. If the system connections are correct but there is a failed hard disk drive, see "6.2 Replacing a Failed Hard Disk Drive" (→pg.148) to replace the hard disk drive and perform a rebuild. If this error occurs again, contact an office listed in the "Contact Information" of "Start Guide".

table: List of event log

GAM ID	Severity	Description	Details	Corrective action
962 (0x3C2)	Error/3	SAS topology error: Multiple ports to the same SAS address.	Multiple ports were connected to the same SAS address in the SAS topology.	Check the condition of the system connections. If this error occurs again, even though the connections are correct, contact an office listed in the "Contact Information" of "Start Guide".
963 (0x3C3)	Error/3	SAS topology error: Expander error.	An error was detected in the Expander.	Contact an office listed in the "Contact Information" of "Start Guide".
964 (0x3C4)	Error/3	SAS topology error: SMP timeout.	SMP timeout was detected.	Contact an office listed in the "Contact Information" of "Start Guide".
965 (0x3C5)	Error/3	SAS topology error: Out of route entries.	Route entries cannot be found.	Contact an office listed in the "Contact Information" of "Start Guide".
966 (0x3C6)	Error/3	SAS topology error: Index not found.	Index was not found.	Contact an office listed in the "Contact Information" of "Start Guide".
967 (0x3C7)	Error/3	SAS topology error: SMP functoin failed.	An error was detected in an SMP function.	Contact an office listed in the "Contact Information" of "Start Guide".
968 (0x3C8)	Error/3	SAS topology error: SMP CRC error.	A CRC error was detected in SMP.	Contact an office listed in the "Contact Information" of "Start Guide".
969 (0x3C9)	Error/3	SAS topology error: Multiple subtractive.	An error was detected in the SAS topology.	Contact an office listed in the "Contact Information" of "Start Guide".
970 (0x3CA)	Error/3	SAS topology error: Table to table.	An error was detected in the SAS topology.	Contact an office listed in the "Contact Information" of "Start Guide".
971 (0x3CB)	Error/3	SAS topology error: Multiple paths.	Multiple paths exist.	Check the condition of the system connections. If this error occurs again, even though the connections are correct, contact an office listed in the "Contact Information" of "Start Guide".

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