



# **Fibre to SATA RAID Subsystems**

## **Operation Manual**

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<b>C.8 Controller Events</b> .....	<b>C-33</b>
<i>C.8.1 Critical:</i> .....	<i>C-33</i>
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<i>C.8.3 Notification:</i> .....	<i>C-35</i>

# About This Manual

This manual provides all of the necessary information that a system administrator needs to configure and maintain EonStor Fibre to SATA RAID subsystems.

There are several other manuals that came with your RAID subsystem:

- ***Installation and Hardware Reference Manual:***  
For hardware-related information.
- ***RAIDWatch User's Manual***  
For the Java-based, GUI RAIDWatch manager providing remote and concurrent management of RAID subsystems.
- ***RAID Planning Guide***  
For RAID basic concepts, configurations and subsystem management.

The order of the chapters is arranged in accordance with the steps necessary for creating a RAID array.

The terminal screen displays and the LCD messages may vary when using subsystems running different firmware revisions.

<b>Chapter 1</b>	Helps the user to understand screen messages on the LCD display.
<b>Chapter 2</b>	Gives step-by-step instructions on creating a RAID using the LCD keypad panel.
<b>Chapter 3</b>	Teaches the user how to interpret the information found on the RS-232C terminal emulation.
<b>Chapter 4</b>	Gives step-by-step instructions on how to create a RAID via the RS-232C session.
<b>Chapter 5</b>	Includes all the Fibre Channel-specific functions implemented since the firmware release 3.12.
<b>Chapter 6</b>	Provides the advanced options for the host and drive channel configurations including I/O queuing, number of LUNs, host loop, in-band, and disk access characteristics settings.

<b>Chapter 7</b>	Shows how to supervise system operating and component status.
<b>Chapter 8</b>	Details various methods, either manual or automatic, for maintaining array data integrity.
<b>Chapter 9</b>	Shows how to expand a configured array or logical volume.
<b>Chapter 10</b>	Shows how to use the SMART-related functionality.
<b>Chapter 11</b>	Describes the detail for AV optimization implementation.
<b>Chapter 12</b>	Redundant Controller Function description
<b>Appendix A</b>	Lists the important firmware features supported with the firmware version, arranged in accordance with the latest firmware version as of press date.
<b>Appendix B</b>	Teaches the user how to upgrade firmware and boot record.
<b>Appendix C</b>	Lists all of the controller event messages.

## Revision History

- Initial release

## Who should read this manual?

This manual assumes that its readers are experienced with computer hardware installation and are familiar with storage enclosures.

## Related Documentations

- Installation and Hardware Reference Manual
- RAIDWatch User's Manual

These two documents can be found in the product utility CD included with your subsystem package.

## Conventions

### Naming

From this point on and throughout the rest of this manual, the EonStor series is referred to as simply the “subsystem” or the “system” and EonStor is frequently abbreviated as “ES.”

### Lists

**Bulleted Lists:** Bulleted lists are statements of non-sequential facts. They can be read in any order. Each statement is preceded by a round black dot “•.”

**Numbered Lists:** Numbered lists are used to describe sequential steps you should follow in order.

Important information that users should be aware of is indicated with the following icons:



#### **NOTE:**

*These messages inform the reader of essential but non-critical information. These messages should be read carefully as any directions or instructions contained therein can help you avoid making mistakes.*

---



#### **CAUTION!**

*Cautionary messages should also be heeded to help you reduce the chance of losing data or damaging the system.*

---



#### **IMPORTANT!**

*The Important messages pertain to use the EonStor subsystem introduced in this manual.*

---

---

 **WARNING!**

*Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously.*

---

## Software and Firmware Updates

Please contact your system vendor or visit Infortrend's FTP site (<ftp.infortrend.com.tw>) for the latest software or firmware updates.

Problems that occur during the updating process may cause unrecoverable errors and system down time. Always consult technical personnel before proceeding with any firmware upgrade.



### **NOTE:**

*The firmware version installed on your system should provide the complete functionality listed in the specification sheet/user's manual. We provide special revisions for various application purposes. Therefore, DO NOT upgrade your firmware unless you fully understand what a firmware revision will do.*

---

# LCD Screen Messages

---

## 1.1 The Initial Screen

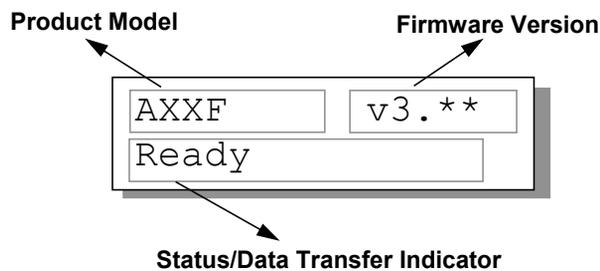


Figure 1 - 1: LCD Initial Screen

### Status/Data Transfer Indicator:

- Ready            There is at least one logical drive or logical volume mapped to a host ID/LUN combination.
- No Host        No logical drive created or the logical drive has not yet been mapped to any host ID/LUN.
- LUN
- Indicates the statistic of internal processing resources, not the host bus throughput. Each block indicates 256Kbytes of data being processed.

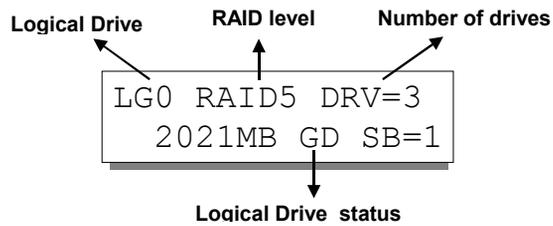
## 1.2 Quick Installation Screen



Figure 1 - 2: Quick Installation Screen

Press [ENT] to create a logical drive. The subsystem/controller will start initialization of one logical drive to include all connected disk drives and automatically map the logical drive to the first ID and LUN number of the first host channel. The “Quick Installation” can only be performed when there is no logical drive.

## 1.3 Logical Drive Status



**Figure 1 - 3: Logical Drive Status Screen**

- Logical Drive:** The Logical Drive number.
- RAID level:** The RAID level applied for this logical drive.
- Number of Drives:** The number of physical drives included in this configuration.

**Logical Drive status:**

XxxxMB	The capacity of this logical drive.
SB=x	Standby drives available to this logical drive. Except the spares dedicated to other logical configurations, all spare drive(s) will be counted in this field, including Global and Local Spares.
xxxxMB INITING	The logical drive is now initializing.
xxxxMB INVALID	For firmware version before 3.31: The logical drive has been created with "Optimization for Sequential I/O", but the current setting is "Optimization for Random I/O." -OR- The logical drive has been created with "Optimization for Random I/O," but the current setting is "Optimization for Sequential I/O."  Firmware versions 3.31 and later have separate settings for array optimization and array stripe size. This message will not appear when the optimization mode is changed.
xxxxMB GD SB=x	The logical drive is in good condition.
xxxxMB FL SB=x	One member drive failed in this logical drive.
xxxxMB RB SB=x	Logical Drive is rebuilding.
xxxxMB DRVMISS	One of the drives is missing.
INCOMPLETE ARRAY	Two or more drives failed in this logical drive.

## 1.4 Logical Volume Status

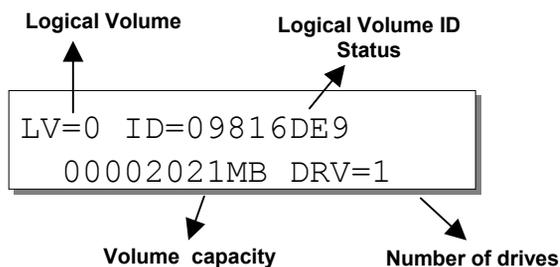


Figure 1 - 4: Logical Volume Status Screen

- Logical Volume:** The Logical Volume number.
- DRV=x:** The number of logical drive(s) contained in this logical volume.
- Logical Volume ID Status:** The unique ID number of the logical volume (randomly generated by firmware).
- Logical Volume Status:**  
**xxxMB** The capacity of this logical volume.

## 1.5 Drive Status

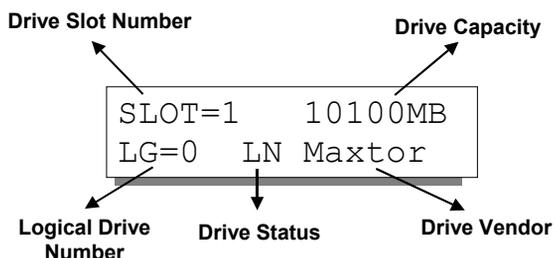
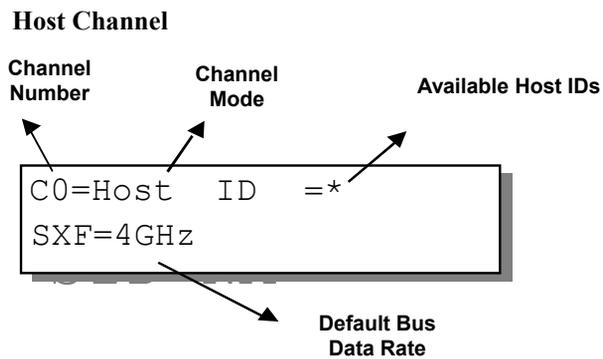


Figure 1 - 5: Drive Status Screen

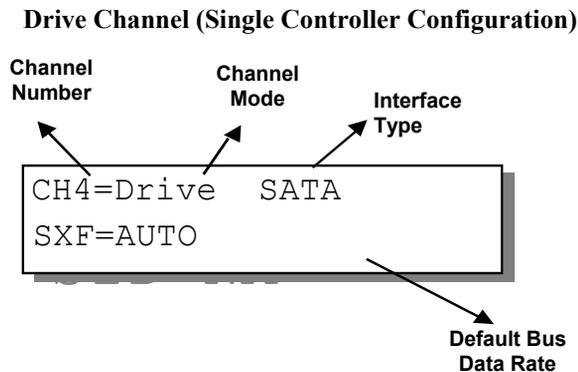
**Drive Status:**

LG=x IN	Initializing
LG=x LN	On-line (already a member of a logical configuration)
LG=x RB	Rebuilding
LG=x SB	Local Spare Drive
GlobalSB	Global Spare Drive
NEW DRV	New drive
BAD DRV	Failed drive
ABSENT	Drive does not exist; an empty drive tray
MISSING	Drive missing (drive was once there)
SB-MISS	Spare drive missing

## 1.6 Channel Status



**Figure 1 - 6: Host Channel Status Screen**



**Figure 1 - 7: Drive Channel Status Screen**

### Channel Mode:

Host	Host channel mode
Drive	Drive channel mode

### Default SCSI Bus Sync Clock:

AUTO	The default setting of this channel is set to the automatic mode
1GHz, 2GHz, 4GHz	Data rate can be manually configured if the need arises

### Available Host IDs:

*	Multiple IDs applied (Host channel mode only)
(ID number)	Primary Controller is using this ID for host LUN mapping.
NA	No ID applied



### IMPORTANT!

*For a single controller configuration, no IDs will be shown for a drive channel status screen. For a dual-active controller configuration, drive channels come with preset IDs.*

## 1.7 Controller Voltage and Temperature

Press ENT for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Peripheral Dev," then press ENT.

Press the up or down arrow keys to select "Ctrl Peripheral Device Config.," press ENT and then choose "View Ctrl Periph Device Status.," then press ENT.

Press the up or down arrow keys to choose either "Voltage Monitor", or "Temperature Monitor".

```
View and Edit  
Peripheral Dev
```

```
Ctrl Peripheral  
Device Config..
```

```
View Ctrl Periph  
Device Status..
```

```
Voltage Monitor  
..
```

```
Temperature  
Monitor ..
```

Select "Temperature and Voltage Monitor" by pressing ENT. Press the up or down arrow keys to browse through the various voltage and temperature statuses.

[+12V] 12.077V  
Operation Normal

[+5v] 4.938v  
Operation Normal

[CPU] 43.5°C  
in Safe Range

[+3.3V] 3.384V  
Operation Normal

[Board1] 46.5°C  
in Safe Range

[CPU] 43.5°C  
in Safe Range

[Board2] 46.5°C  
in Safe Range

[+12v] 12.077v  
Operation Normal

## 1.8 View and Edit Event Logs

Press ENT for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Event Logs," then press ENT.

View and Edit  
Event Logs ↑

Press the up or down arrow keys to browse through the existing event log items.

UPS Power  
Failure Detected

To delete a specified item and all events prior to this event, press ENT for 2 seconds.

Press 2 Seconds  
to Clear Events



### IMPORTANT!

*The event log will be cleared after the controller is powered off or reset.*

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left blank



## LCD Keypad Operation

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A navigation roadmap for the configuration menu options of LCD keypad is separately available as a PDF file. You may check your Product Utility CD or visit Infortrend's FTP site for the latest update.

### 2.1 Power On the RAID Enclosure

Before you start to configure a RAID system, make sure that hardware installation is completed before any configuration takes place. Power on your RAID enclosure.



**NOTE:**

- *If the RAID controller units of the EonStor redundant subsystems come with two modules. Your subsystem's LCD panel provides access to the Secondary controller. However, in the dual-redundant configuration, only the Primary controller responds to user's configuration.*

*Each controller's operating mode is indicated by the flashing digit on the upper right of the LCD screen as "P" or "S." If the LCD displays "S," press the Up and Down arrow keys for one second to switch around the access to different controllers.*

---

## 2.2 Caching Parameters

### 2.2.1 Optimization Modes

Mass storage applications can be divided into two major categories according to its read/write characteristics: database and video/imaging. To optimize a subsystem for these two categories, two embedded optimization modes are available with system behaviors adjusted to different read/write parameters. They are the Optimization for Random I/O and the Optimization for Sequential I/O.

**Limitations:** There are limitations on the use of optimization modes.

1. System default is Optimization for Sequential I/O.
2. You can select the stripe size of each array (logical drive) during the initial configuration. However, changing stripe size is only recommended for experienced engineers who have tested the effects of tuning stripe sizes for different applications.
3. The array stripe size can only be changed during the initial configuration process.
4. Once the controller optimization mode is applied, access to different logical drives in a RAID system will follow the same optimized pattern.

#### **Database and Transaction-based Applications:**

These kinds of applications usually include SQL server, Oracle server, Informix, or other database services. These applications keep the size of each transaction down to the minimum, so that I/Os can be rapidly processed. Due to their transaction-based nature, these applications do not read or write a bunch of data in sequential order - access to data occurs randomly. The transaction size usually ranges from 2K to 4K. Transaction performance is measured in "I/Os per second" or "IOPS."

#### **Video Recording/Playback and Imaging Applications:**

These kinds of applications usually includes video playback, video post-production editing, or other similar applications. These applications have the tendency to read or write large files from and into storage in sequential order. The size of each I/O can be 128K, 256K, 512K, or up to 1MB. The efficiency of these applications is measured in "MB/sec."

When an array works with applications such as video or image oriented applications, the application reads/writes from the drive as large-block, sequential threads instead of small and randomly accessed files.

The controller optimization modes have read-ahead buffer and other R/W characteristics tuned to obtain the best performance for these two major application categories.

## 2.2.2 Optimization Mode and Stripe Size

Each controller optimization mode has preset values for the stripe size of arrays created in different RAID levels. If you want a different setting for a subsystem with configured arrays, you have to backup or move the stored data and re-create the arrays:

1. Stop host I/O access.
2. Move or backup all of your stored data in the subsystem.
3. Change the optimization mode.
4. Reset the controller.
5. Re-create the array(s). Once the array(s) are created, stripe size cannot be changed.

Listed below are the default stripe sizes implemented with different optimization modes and RAID levels. These values should be sufficient for most applications:

**Table 2 - 1 RAID Level, Optimization Modes, and Stripe Sizes**

	Opt. For Sequential I/O	Opt. for Random I/O
RAID0	128KB	32KB
RAID1	128KB	32KB
RAID3	16KB	4KB
RAID5	128KB	32KB
RAID6	128KB	32KB
NRAID	128KB	32KB

## 2.2.3 Optimization for Random or Sequential I/Os

Select from Main Menu “View and Edit Config Parms,” “Caching Parameters,” and press ENT. Choose “Optimization for Random I/O” or “Optimization for Sequential I/O,” then press ENT for two seconds to confirm. Press ESC to leave and the setting will take effect after the controller is restarted.

```
Caching
Parameters ..
```

```
Optimization I/O
Random ..
```

```
Optimization for
Sequential I/O?
```



### IMPORTANT!

*The original 512GB threshold on array optimization mode has been canceled. If the size of an array is larger than 16TB, only the optimization for sequential I/O can be applied. Logical drives of this size may not be practical; therefore, there is actually no limitation on the optimization mode and array capacity.*

## 2.2.4 Write-back Cache Enable/Disable

As one of the submenus in "Caching Parameters," this option controls the cached write function. Press **ENT** to enable or disable "Write-back Cache." Press **ENT** for two seconds to confirm. The current status will be displayed on the LCD.

```
Write-Back Cache
Enabled      ..
```

The Write-through mode is safer if your subsystem is not managed by a controller pair and there is no UPS or battery backup.

```
Disable Write
-Back Cache  ?
```

Write-back caching can dramatically improve write performance by caching the unfinished writes in memory and letting them be committed to drives later in a more efficient manner. In the event of power failure, a battery module can hold cached data for days. In the event of controller failure in a dual-active configuration, data cached in the failed controller has an exact replica on its counterpart controller and therefore remains intact.

## 2.2.5 Periodic Cache Flush

If for a reason Write-Back caching is preferred for better performance and yet data integrity is of the concern, e.g., lack of the battery protection, the system can be configured to flush the cached writes at every preset interval.

Note that the "Continuous Sync" option holds data in cache for as long as necessary to complete a write operation and immediately commits it to hard drives if it does not come in a series of sequential writes.

Select from Main Menu "View and Edit Config Params," "Caching Parameters," and press **ENT**. Use the arrow keys to scroll through the options and select "Periodic CachFlush Time", and then press **ENT** to proceed. The "Set Cache Flush Time - Disable" appears. The default is "Disable." Use your arrow keys to select an option from "ConSync," "1/2min," to "10min." "ConSync" stands for "continuously synchronized." Press **ENT** to select and press **ESC** to leave and the setting will take effect immediately.

```
Period CachFlush
Time - Disable
```

```
Set Cache Flush
Time - Disable
```



## IMPORTANT!

- *Every time you change the caching parameters, you must reset the controller for the changes to take effect.*
- *In the redundant controller configuration, write-back will only be applicable when there is a synchronized cache channel between partner controllers.*

## 2.3 View Connected Drives:

A RAID system consists of many physical drives that can be modified and configured as the members of one or several logical drives.

Press the front panel **ENT** button for two seconds to enter the Main Menu. Use the up or down arrow keys to navigate through the menus. Choose "View and Edit Drives," then press **ENT**.

```
View and Edit
Drives
```

Use the up or down arrow keys to scroll down the list of connected drives' information screens.

```
Slot=* 1010MB
New DRV SEAGATE
```

You may first examine whether there is any drive installed but not shown here. If there is a drive installed but not listed, the drive may be defective or not installed correctly. Please check your enclosure installation and contact your system vendor.

Press **ENT** on a drive. Choose "View Drive Information" by pressing **ENT**. Use the up or down arrow keys to navigate through the screens.

```
View Drive
Information ..
```

The Revision Number of the selected drive will be shown. Press the down arrow key to see other information.

```
Revision Number:
0274
```

Other information screens include "Serial Number" and "Disk Capacity" (displayed in blocks; each block equals 512K Bytes).



## IMPORTANT!

- *Drives of the same brand/model/capacity might not feature the same block number.*
- *The basic read/write unit of a hard drive is a block. If members of a logical drive have different block numbers (capacity), the smallest block number will be taken as the maximum capacity to be used in every drive. Therefore, use drives of the same capacity.*
- *You may assign a Local/Global Spare Drive to a logical drive whose members have a block number equal to or smaller than the Local/Global Spare Drive but you should not do the reverse.*

## 2.4 Creating a Logical Drive

To create a logical drive, press ENT for two seconds to enter the Main Menu. Use the up or down arrow keys to navigate through the menus. Choose "View and Edit Logical Drives," and then press ENT.

```
View and Edit  ↓  
Logical Drives..
```

Press the up or down arrow keys to select a logical drive entry, then press ENT for two seconds to proceed. "LG" is short for Logical Drive.

```
LG=0  
Not Defined   ?
```

### 2.4.1 Choosing a RAID Level

Press the up or down arrow keys to choose the desired RAID level, then press ENT for two seconds. "TDRV" (Total Drives) refers to the number of all available drives.

```
TDRV=24 Create  
LG Level=RAID6 ?
```

### 2.4.2 Choosing Member Drives

Press ENT for two seconds; the message, "RAID X selected To Select drives", will prompt. Confirm your selection by pressing ENT.

```
RAID 6 Selected  
To Select drives
```

Press ENT, then use the up or down arrow keys to browse through the

```
Slot=* 239367MB  
New DRV SEAGATE
```

available drives. Press **ENT** again to select/deselect the drives. An asterisk (\*) mark will appear on the selected drive(s). To deselect a drive, press **ENT** again on the selected drive. The (\*) mark will disappear.

```
SLOT=1 239367MB
*LG=0 SL
```

After all the desired drives have been selected, press **ENT** for two seconds to continue.

### 2.4.3 Logical Drive Preferences

You may also choose “Change Logical Drive Parameter,” then press **ENT** to change related parameters before initializing the logical drive.

```
Change Logical
Drive Parameter?
```

### 2.4.4 Maximum Drive Capacity

Choose “Maximum Drive Capacity,” then press **ENT**. The maximum drive capacity refers to the maximum capacity that will be used in each member drive.

```
Maximum Drive
Capacity ..
```

If necessary, use the up and down arrow keys to change the maximum size that will be used on each drive.

```
MaxSiz= 239367MB
Set to 239367MB?
```

### 2.4.5 Spare Drive Assignments

The Local (Dedicated) Spare Drive can also be assigned here. Press the up or down arrow keys to choose “Spare Drive Assignments,” then press **ENT**.

```
Spare Drive
Assignments ..
```

Available drives will be listed. Use the up or down arrow keys to browse through the drive list, then press **ENT** to select the drive you wish to use as the Local Spare Drive. Press **ENT** again for two seconds.

```
Slot=* 239367MB
New DRV SEAGATE
```

```
Slot=* 239367MB
*LG=0 SL SEAGATE
```

### 2.4.6 Disk Reserved Space

This menu allows you to see the size of disk reserved space. Default is 256MB.

```
Disk Rev. Space
256MB ..
```

### 2.4.7 Logical Drive Assignment (Dual-Active Controllers)

If you have two controllers, you may choose to assign this logical drive to the secondary controller. The assignment can be done during or after the initial configuration.

If the redundant controller function has been enabled, and the secondary controller IDs have been assigned to I/O channels, the assignment menus should appear as listed on the right.

```
Logical Drive
Assignments  ..
```

```
Red Ctlr Assign
to Sec. Ctlr  ?
```

### 2.4.8 Write Policy

This menu allows you to set the caching mode policy for this specific logical drive. "Default" is a neutral value that is coordinated with the subsystem's caching mode setting. Other choices are "Write-back" and "Write-through."

```
Write Policy
Default  ..
```

### 2.4.9 Initialization Mode

This menu allows you to determine if the logical drive is immediately accessible. If the Online method is used, data can be written onto it before the array's initialization is completed. Users may proceed with array configuration, e.g., including this array in a logical volume.

```
Initialization
Mode  Online..
```

Array initialization can take a long time especially for those comprising large capacity. Setting to "Online" means the array is immediately accessible and that the controller will complete the initialization when I/O demands become less intensive.

### 2.4.10 Stripe Size

This menu allows you to change the array stripe size. Setting to an incongruous value can severely drag performance. This item should only be changed when you can be sure of the performance gains it might bring you.

```
Stripe size
Default  ?
```

Listed below are the default values for an array. For each logical drive, the default value for the stripe size is determined by the Optimization Mode and the RAID level chosen.

**Table 2 - 2 RAID Level, Optimization Modes, and Stripe Size**

	Opt. for Sequential I/O	Opt. for Random I/O
<b>RAID0</b>	128KB	32KB
<b>RAID1</b>	128KB	32KB
<b>RAID3</b>	16KB	4KB
<b>RAID5</b>	128KB	32KB
<b>RAID6</b>	128KB	32KB

<b>NRAID</b>	128KB	32KB
--------------	-------	------

When you are done setting logical drive preferences, press **ESC** and use your arrow keys to select "Create Logical Drive?". Press **ENT** for two seconds to proceed.

### 2.4.11 Beginning Initialization

Press **ESC** to return to the previous menu. Use the up or down arrow keys to choose "Create Logical Drive," then press **ENT** for two seconds to start initializing the logical drive.

```
Create Logical
Drive           ?
```

#### The Online Mode:

If the online initialization method is applied, the array will be available for use immediately. The array initialization runs in the background while data can be written onto it and users can continue configuring the RAID system.

```
LG=0 Creation
Completed!
```

#### The Offline Mode:

The controller will start to initialize the array parity if using the "offline" mode. Note that if NRAID or RAID 0 is selected, initialization time is short and completes almost immediately.

```
Initializing090%
Please Wait!
```

```
LG=0 Initializat
ion Completed
```

The logical drive's information displays when the initialization process is completed. If the "online" mode is adopted, array information will be displayed immediately.

```
LG=0 RAID6 DRV=4
478734MB GD SB=0
```



#### NOTE:

*Due to the operation complexity, the RAID Migration option is not available using the LCD keypad panel.*

## 2.5 Creating a Logical Volume

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow

```
View and Edit
Logical Volume
```

keys to select "View and Edit Logical Volume," then press ENT.

Press the up or down arrow keys to select an undefined entry for logical volume, then press ENT for two seconds to proceed. "LV" is short for Logical Volume.

```
LV=0
Not Defined   ?
```

Proceed to select one or more logical drives. Press ENT to proceed. "LD" is short for Logical Drive.

```
LV=0 Selected To
Select LD Drives?
```

Use the up or down arrow keys to browse through the logical drives. Press ENT again to select/deselect the drives. An asterisk (\*) mark will appear when the logical drive is selected. After all the desired logical drive(s) have been selected, press ENT for two seconds to continue.

```
LG0 RAID5 DRV=3
2021MB GD SB=0
```

Two submenus will appear.

### 2.5.1 Initialization Mode

Array initialization can take a long time especially for those comprised of large capacity. Setting to "Online" means the array is immediately accessible and that the controller will complete the initialization when I/O demands become less intensive.

```
Initialization
Mode      Online..
```

```
Write Policy
Default   ..
```

### 2.5.2 Write Policy

This menu allows you to set the caching mode policy for this specific logical volume. "Default" is a neutral value that is coordinated with the controller's caching mode setting. Other choices are "Write-back" and "Write-through."

When you are finished setting the preferences, press ENT for two seconds to display the confirm box. Press ENT for two seconds to start initializing the logical volume.

```
Create
Logical Volume ?
```

```
Lv=0 Creation
Completed
```

The logical volume has been successfully created.

Press ESC to clear the message. Another message will prompt; press ESC to clear it.

```
Lv=0 ID=07548332
0024488MB DRV=2
```

Logical volume information will be displayed below.

```
Create Logical
Volume Succeeded
```

### 2.5.3 Logical Volume Assignment (Dual-Active Controllers)

If you have two controllers, you may choose to assign this logical volume to the secondary controller. The assignment can be done during or after the initial configuration.

```
Change Logical
Volume Params ?
```

```
Logical Volume
Assignments ..
```

If the redundant controller function has been enabled, and the secondary controller IDs have been assigned to I/O channels, the assignment menus should appear as listed on the right.

```
Red Ctlr Assign
to Sec. Ctlr ?
```

If settings related to redundant controllers have not been completed, you may set them after the volume is successfully created.

```
Logical Volume
Assignment ..
```

Press ENT on a configured logical volume. Use arrow keys to select “Logical Volume Assignment..”, and press ENT to proceed. Press ENT for two seconds to confirm.

```
Red Ctlr Assign
to Sec. Ctlr ?
```

Press ESC, and the LCD will display the logical volume’s information when initialization is finished.

```
LV=0 ID=685AE502
2021MB DRV=1
```

## 2.6 Partitioning a Logical Drive/Logical Volume

Partitioning and the creation of a logical volume, are not requirements for creating a RAID system. The configuration processes for partitioning a logical drive are the same as those for partitioning a logical volume.

Press ENT for two seconds to enter the Main Menu. Press the up or down

```
View and Edit
Logical Volume
```

arrow keys to select "View and Edit Logical Volume," then press **ENT**.

Use the up or down arrow keys to select a logical volume, then press **ENT**.

```
LV=0 ID=685AE502
2021MB DRV=1
```

Use the up or down arrow keys to select "Partition Logical Volume," then press **ENT**.

```
Partition
Logical Volume..
```

The total capacity of the logical volume will be displayed as one partition. Press **ENT** for two seconds to change the size of the first partition.

```
LV=0 Prt=1:
2021MB ?
```

Use the up or down arrow keys to change the number of the flashing digit, (see the arrow mark) then press **ENT** to move to the next digit. After changing all the digits, press **ENT** for two seconds to confirm the capacity of this partition. You may also use arrow keys to move down to the next partition to configure more partitions.

```
LV=0 Part=0:
2021MB
```



```
LV=0 Part=0:
700MB ?
```

The rest of the drive space will be automatically allocated as the last partition. You may go on to create up to 16 partitions using the same method described above.

```
LV=0 Partition=1
1321MB ?
```

Press **ESC** several times to go back to the Main Menu.



### **IMPORTANT!**

*If operated with a Unix-based system, reset the subsystem for the configuration to take effect if any changes have been made to partition sizes and partition arrangement.*

---

## 2.7 Mapping a Logical Volume/Logical Drive to Host LUN

The process of mapping a logical drive is identical to that of mapping a logical volume. The process of mapping a logical volume is used as an example.

Press **ENT** for two seconds to enter the Main Menu. Use the up or down arrow keys to select "View and Edit Host Luns," then press **ENT**.

```
View and Edit  ↓
Host Luns     ..
```

Note some details before proceeding:

**Primary/Secondary IDs:** A logical group of drives (logical drive/logical volume) previously assigned to the primary controller cannot be mapped to a secondary ID. Neither can those be assigned to the secondary controller be mapped to a primary ID.

The first available ID on the first host channel appears (usually channel0).

```
CH=0 ID=112
..
```

Press the up or down arrow keys to select a configured host ID, and then press **ENT** for two seconds to confirm.

Press the up or down arrow keys to select the type of logical configuration to be associated with a host ID/LUN. Available choices are "Map to Logical Drive" or "Map to Logical Volume". Confirm your choice by pressing **ENT** for two seconds.

```
Map to
Logical Drive ?
```

```
Map to
Logical Volume ?
```

Press the up or down arrow keys to select a LUN number, then press **ENT** to proceed.

```
CH0 ID112 LUN0
Not Mapped
```

Press **ENT** for two seconds to confirm the selected LUN mapping.

```
Map Host LUN  ?
```

Press the up or down arrow keys to select a logical drive, a logical volume, or a partition of them. Press **ENT** for two seconds to map the selected partition to this LUN. If the logical configuration has not been partitioned, you can map the whole capacity to a host LUN.

```
LV=0 ID=685AE502
478734MB DRV=1
```

```
LV=0 PART=0
700MB ?
```

Press **ENT** for two seconds when prompted by "Map Host LUN" to proceed.

```
Map Host LUN ..
```

Mapping information will be displayed on the subsequent screen. Press **ENT** for two seconds to confirm the LUN mapping.

```
CH0 ID112 LUN0  
MAP to LV0 PRT0?
```

The mapping information will appear for the second time. Press **ENT** or **ESC** to confirm, and the host ID/LUN screen will appear. Use the arrow keys to select another ID or LUN number to continue mapping your logical configurations or press **ESC** for several times to leave the configuration menu.

```
CH0 ID112 LUN0  
MAP to LV0 PRT0
```

```
CH=0 ID=112 ..
```

With any of the host ID/LUN successfully associated with a logical capacity, the "No Host LUN" message in the initial screen will change to "Ready."

If you want to create more host IDs, please move to *Section 2.12 Viewing and Editing Channels* for more details on channel mode and channel IDs setting.

## 2.8 Assigning Spare Drive and Rebuild Settings

### 2.8.1 Adding a Local Spare Drive

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Drives," then press **ENT**.

```
View and Edit  
Drives ●
```

Disk drive information will be displayed on the LCD. Press the up or down arrow keys to select a drive that is stated as "NEW DRV" or "USED DRV" that has not been included in any logical drive, nor specified as a spare drive or failed drive, then press **ENT** to select it.

```
Slot=* 1010MB  
NEW DRV SEAGATE
```

```
Add Local Spare  
Drive ..
```

Press the up or down arrow keys to select "Add Local Spare Drive," then press ENT.

Press the up or down arrow keys to select the logical drive where the Local Spare Drive will be assigned, then press ENT for two seconds to confirm.

```
LG0 RAID5 DRV=3
2012MB GD SB=0
```

The message "Add Local Spare Drive Successful" will be displayed on the LCD.

```
Add Local Spare
Drive Successful
```

## 2.8.2 Adding a Global Spare Drive

Press ENT for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Drives," then press ENT.

```
View and Edit
Drives ●
```

Disk drive information will be displayed on the LCD. Press the up or down arrow keys to select a disk drive that has not been assigned to any logical drive, then press ENT.

```
Slot=* 1010MB
NEW DRV SEAGATE
```

Press the up or down arrow keys to select "Add Global Spare Drive," then press ENT.

```
Add Global Spare
Drive ..
```

Press ENT again for two seconds to add the spare drive. The message, "Add Global Spare Drive Successful," will be displayed on the screen.

```
Add Global Spare
Drive Successful
```

## 2.8.3 Rebuild Settings

Press ENT for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Config Parm," then press ENT.

```
View and Edit
Config Parm
```

Press the up or down arrow keys to select "Disk Array Parameters," then press ENT.

```
Disk Array
Parameters..
```

Press the up or down arrow keys to select "Rebuild Priority Low," then press ENT. "Low" refers to the temporary default setting.

```
Rebuild Priority
Low ..
```

Press **ENT** again and the abbreviation mark “..” will change to a question mark “?”. Press the up or down arrow keys to select priority “Low,” “Normal,” “Improved,” or “High”.

```
Rebuild Priority
Low                ?
```

Press **ENT** to confirm and the question mark “?” will turn into “..”.

```
Rebuild Priority
High              ..
```



### NOTE:

*The rebuild priority determines how much of the system resources are used when rebuilding a logical drive. The default setting of the rebuild priority is “LOW.” Rebuild will have less impact on host I/O access, but will take a longer time to complete. Changing the priority to a higher level will achieve a faster rebuild, but will significantly increase the host I/O response time. The default setting “LOW” is recommended.*

## 2.9 Viewing and Editing Logical Drives and Drive Members

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select “View and Edit Logical Drives..,” then press **ENT**.

```
View and Edit
Logical Drives
```

Press the up or down arrow keys to select the logical drive, then press **ENT**.

```
LG0 RAID5 DRV=3
2012MB GD SB=1
```

Press the up or down arrow keys to select “View Drives..”, then press **ENT**.

```
View Drives
..
```

Press the up or down arrow keys to scroll through the list of member drives.

```
Slot=* 1010MB
LG=0 LN SEAGATE
```

### 2.9.1 Deleting a Logical Drive



#### WARNING!

Deleting a logical drive erases all data stored in it.

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Logical Drives," then press **ENT**.

```
View and Edit
Logical Drives
```

Press the up or down arrow keys to select a logical drive, then press **ENT**.

```
LG0 RAID5 DRV=3
  2012MB GD SB=1
```

Use the up or down arrow keys to select "Delete Logical Drive," then press **ENT**.

```
Delete Logical
Drive ..
```

Press **ENT** for two seconds to delete. The selected logical drive has now been deleted.

```
LG=0
Not Defined ?
```

## 2.9.2 Deleting a Partition of a Logical Drive

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Logical Drives..," then press **ENT**.

```
View and Edit
Logical Drives
```

Press the up or down arrow keys to select a logical drive, then press **ENT**.

```
LG0 RAID5 DRV=3
  2012MB GD SB=1
```

Press the up or down arrow keys to choose "Partition Logical Drive," then press **ENT**.

```
Partition
Logical Drive ..
```

The first partition's information will be shown on the LCD. Press the up or down arrow keys to browse through the existing partitions in the logical drive. Select a partition by pressing **ENT** for two seconds.

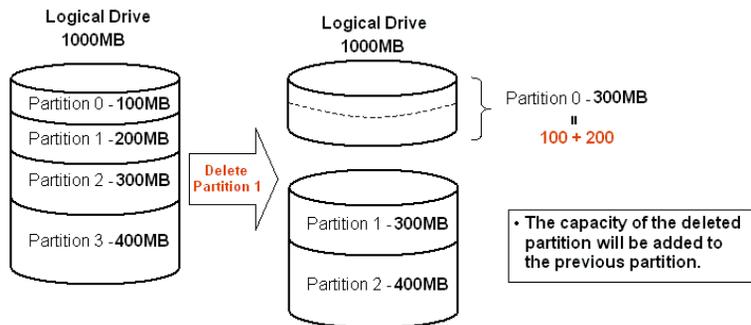
```
LG=0 Prt=0
  200MB ?
```

```
LG=0 Prt=1
  300MB ?
```

Use the up or down arrow keys to change the number of the flashing digit to "0," then press **ENT** to move to the next digit. After changing all the digits, press **ENT** for two seconds.

```
LG=0 Prt=2
  600MB ?
```

The disk space of the deleted partition will be automatically allocated to the previous partition as diagrammed below. If partition 1 is deleted, its disk space will be added to partition 0.



**Figure 2 - 1 Drive Space Allocated to the Previous Partition**



**WARNING!**

*Whenever there is a partition change, data will be erased. Prior to partition change, you have to remove its associated host LUN mappings. After the partition change, you also need to re-arrange the disk volumes from your host system OS.*

### 2.9.3 Assigning a Name to a Logical Drive

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Logical Drives..," then press **ENT**.

```
View and Edit
Logical Drives
```

Press the up or down arrow keys to select a logical drive, then press **ENT**.

```
LG0 RAID5 DRV=3
2012MB GD SB=1
```

Press the up or down arrow keys to select "Logical Drive Name," then press **ENT**.

```
Logical Drive
Name ..
```

Press the up or down arrow keys to change the character of the flashing cursor. Press **ENT** to move the cursor to the next space. The maximum number of characters for a logical drive name is 14.

```
Enter LD Name:
_
```

## 2.9.4 Rebuilding a Logical Drive (Manual Rebuild)

If you want the controller to auto-detect a replacement drive, make sure you have the following options set to enabled:

1. Periodic Drive Check Time
2. Periodic Auto-Detect Failure Drive Swap Check Time

These two configuration options can be found under "View and Edit Configuration Parameters" -> "Drive-Side Parameters".

A manual rebuild takes place after you replace the failed drive with a new drive that is known to be good.

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Logical Drives..", then press **ENT**.

```
View and Edit
Logical Drives
```

Use the up or down arrow keys to select the logical drive that has a failed member, then press **ENT**.

```
LG0 RAID5 DRV=3
2012MB FL SB=0
```

Use the up or down arrow keys to select "Rebuild Logical Drive," then press **ENT**.

```
Rebuild Logical
Drive ..
```

Press **ENT** for two seconds to start rebuilding the logical drive.

```
Rebuild Logical
Drive ?
```

The rebuilding progress will be displayed (as a percentage) on the LCD. When rebuild is already started or the logical drive is being rebuilt by a Local Spare Drive or Global Spare Drive, choose "Rebuild Progress" to see the rebuild progress.

```
LG0 RAID5 DRV=3
2012MB RB SB=0
```

```
Rebuilding 25%
Please Wait!
```

```
Rebuild Progress
..
```



### IMPORTANT!

- *The Rebuild function will appear only if a logical drive (with RAID level 1, 3, 5 or 6) has a failed member.*
- *Carefully verify the physical location of a failed drive before replacement takes place. Removing the wrong drive may cause a logical drive to fail and data loss is unrecoverable.*

## 2.9.5 Regenerating Logical Drive Parity

If no verifying method is applied to data writes, this function can be manually performed to ensure that parity errors can be mended.

From the Main Menu, press the up or down arrow keys to select "View and Edit Logical Drives."

```
View and Edit
Logical Drives
```

If you have more than one logical drive, use the up or down arrow keys to select the logical drive you would like to check the parity for, and then press **ENT**.

```
LG0 RAID5 DRV=3
4095MB GD SB=0
```

```
Regenerate
Parity ..
```

Press the up or down arrow keys to select "Regenerate Parity" and then press **ENT**.

To stop the regeneration process, press **ESC** and enter the submenu to select "Abort Regenerate Parity".

```
Abort Regenerate
Parity ..
```



### **IMPORTANT!**

*If the Parity Regenerating process is stopped by a drive failure, the process cannot restart until the logical drive is rebuilt.*

## 2.9.6 Media Scan

Media Scan is used to examine drives and detect the presence of bad blocks. If any data blocks have not been properly committed, data from those blocks are automatically recalculated, retrieved, rewritten or stored onto undamaged sectors. If bad blocks are encountered on yet another drive during the rebuild process, the block LBA (Logical Block Address) of those bad blocks will be listed. If rebuild is carried out in this situation, rebuild will continue with the unaffected sectors, salvaging a majority of the stored data.

From the Main Menu, press the up or down arrow keys to select "View and Edit Logical Drives".

```
View and Edit
Logical Drives
```

The first logical drive displays. If you have more than one logical drive, use the up or down keys to select the logical drive you want to scan, and then press **ENT**.

```
LG0 RAID5 DRV=3
4095MB GD SB=0
```

Press the up or down arrow keys to select "Media Scan" and then press **ENT**.

```
Media Scan
..
```

Press **ENT** again to display the first configuration option, "Priority." Press **ENT** on it and use arrow keys to select an option. Press **ENT** to confirm the change on priority level.

```
Priority
Normal    ..
```

Use arrow keys to move one level down to another option, "Iteration Count". This option determines how many times the scan is performed on the logical drive. If set to "Continuous," the scan will run in the background continuously until it is stopped by user.

```
Priority
To High   ?
```

```
Iteration Count
Single    ..
```

```
Iteration Count
to
```

If Media Scan continuously runs in the background, considerable system resources will be consumed.

Press **ENT** on your option to confirm.

Press **ENT** for two seconds to display the confirm message, then press **ENT** to start scanning the array.

```
Execute Media
Scanning   ?
```

## 2.9.7 Write Policy

From the Main Menu, use the up or down arrow keys to select "View and Edit Logical Drives".

```
View and Edit
Logical Drives
```

The first logical drive displays. If you have more than one logical drive, use the up or down keys to select the logical drive you want to change the write policy of; and then press **ENT**.

```
LG0 RAID5 DRV=3
4095MB GD SB=0
```

Use arrow keys to select "Write Policy" and then press **ENT**.

```
Write Policy
..
```

The Write-Back cache setting is configurable on a per array basis. Setting to the default value means the array setting is coordinated with the controller's general setting. The controller's general setting option can be found in "View and Edit Config Params" -> "Caching Parameters" -> "Write-Back Cache". Note that cached writes are lost if a power failure occurs unless cached data has been duplicated to a partner controller and a battery is supporting cache memory.

```
Write Policy
Write-Back ?
```

## 2.10 Viewing and Editing Host LUNs

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Host Luns", then press **ENT**.

```
View and Edit
Host Luns
```

Press the up or down arrow keys to select a host ID, then press **ENT** to proceed.

```
CH0 ID112
```

Use the up or down arrow keys to browse through the LUN number and its LUN mapping information.

```
CH0 ID112 LUN0
Mapto LG0 PRT0
```

Press **ENT** on the LUN you wish to delete.

```
Delete CH0 ID112
LUN=00 Mapping ?
```

Press **ENT** for two seconds to confirm deletion. The deleted LUN has now been unmapped.

```
CH0 ID112 LUN0
Not Mapped
```

## 2.11 Viewing and Editing Drives

### Deleting Spare Drive (Global / Local Spare Drive)

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Drives," then press **ENT**.

```
View and Edit
Drives •
```

Drive information will be displayed on the LCD. Press the up or down arrow keys to select the spare drive you wish to delete, then press **ENT**.

```
Slot=* 1010MB
GlobalSB WDC
```

Press the up or down arrow keys to select "Delete Spare Drive," then press **ENT** to continue.

```
Delete Spare
Drive ..
```

Press **ENT** for two seconds to delete the spare drive.

```
Delete Spare
Drive Successful
```

## 2.12 Viewing and Editing Channels

### 2.12.1 Viewing IDs

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Channels," then press **ENT**.

```
View and Edit  
Channels •
```

Channel information will be displayed. Press **ENT** on the host channel you wish the ID changed.

```
CH0=Host ID=112  
SXF=4GHz
```

Press the up or down arrow keys to select "Set Channel ID," then press **ENT**.

```
Set Channel  
ID ..
```

Use the up or down arrow keys to browse through the existing host IDs. Press **ENT** on any ID combination to continue.

```
CHL=0 ID=112  
..
```

### 2.12.2 Adding a Channel ID

Press **ENT** on a host channel, on "Set Channel ID", and then on an existing ID.

Use the up or down arrow keys to choose "Add Channel ID", then press **ENT**.

```
Add Channel ID  
..
```

Use the up or down arrow keys to choose the ID you wish to add, then press **ENT** for two seconds to complete the process.

```
Add CHL=0 ID=113  
?
```

A prompt will remind you to reset the subsystem for the configuration change to take effect. You may press **ENT** to reset the subsystem immediately or you may press **ESC** to continue adding other host IDs and reset the subsystem later.

```
Change Setting  
Do Reset Ctlr ?
```

### 2.12.3 Deleting a Channel ID

Press **ENT** for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Channels," then press **ENT**.

```
View and Edit  
Channels †
```

The first host channel should appear. Press **ENT** to select a host channel.

```
CHL=Host ID=113  
SXF=AUTO ..
```

Press **ENT** on "Set Channel ID.."

```
Set Channel  
ID ..
```

A list of host channel and host ID combinations will appear. Use the up or down arrow keys to select an ID you wish to remove. Press **ENT** to select a channel ID combination.

```
CHL=0 ID=112
..
```

```
CHL=0 ID=113
..
```

You will then be prompted by the “Add Channel ID” option. Press the down arrow key to proceed.

```
Add Channel ID
..
```

The “Delete Channel ID” option will appear. Press **ENT** to display the confirm box. Press **ENT** for two seconds to remove the ID.

```
Delete Channel
ID ..
```

```
Delete ID=113
?
```

A prompt will remind you to reset the subsystem for the configuration change to take effect. You may press **ENT** to reset the subsystem immediately or you may press **ESC** to continue adding other host IDs and reset the subsystem later.

```
Change Setting
Do Reset Ctlr ?
```



## IMPORTANT!

- *Every time you make changes to channel IDs, you must reset the subsystem for the configuration to take effect.*
- *For IDs reserved in different subsystem configurations, please refer to the **Installation and Hardware Reference Manual** that came with your system. For subsystems featuring back-end PCB connection, firmware can detect their board types and automatically apply the preset IDs. There is no need to set IDs for these models.*
- *Multiple target IDs can be applied to host channels while every drive channel has only one or two IDs (in a dual-active controller configuration).*

## 2.12.4 Data Rate

This option is available in the configuration menu of Fibre host channel and the drive channel configuration menus of Fibre-, ATA-, or SATA-based subsystems. Default is "AUTO" and should work fine with most drives. Changing this setting is not recommended unless some particular bus signal issues occur.

The host channel data rate setting allows a 2Gbit Fibre Channel to negotiate with devices communicating over 1GHz link if the link speed configuration is determined externally.

Most SATA/ATA-based systems connect only one drive per SATA/ATA channel (4 for multi-lane with SATA-II). This helps to avoid a single drive failure from affecting other drives. The maximum mechanical performance of today's drives can reach around 30MB/second (sustained read). This is still far below the bandwidth of a drive channel bus. Setting the SATA/ATA bus speed to a lower value can get around some problems, but will not become a bottleneck to system performance.

Note that the SATA/ATA speed is the maximum transfer rate of the SATA/ATA bus in that mode. It does not mean the drive can actually carry out that amount of sustained read/write performance. For the performance of each drive model, please refer to the documentation provided by drive manufacturer.

### Host Channel:

Select from Main Menu, "View and Edit Channels," and then a host channel you wish to change its data rate. Press **ENT** on the channel and use the arrow keys to find the "Data Rate" option. Press **ENT** on the Data Rate option to display "Set Chl=X Data Rate To AUTO?", where "X" stands for the channel number.

```
C0=Host PID=102
SID=NA SXF=AUTO
```

```
Data Rate ..
```

```
Set Chl=X Data
Rate To AUTO ?
```

Use your arrow keys to display a different data rate (1GHz or 2GHz). Press **ENT** to confirm a selection.

### Drive Channel:

Select from Main Menu, "View and Edit Channels," and then a drive channel you wish to change its data rate. Press **ENT** on the channel and use the arrow keys to find the "Data Rate"

```
CHX=Drive PID=7
SID=8 SXF=AUTO
```

```
View Chip
Information ..
```

option. Press **ENT** on the Data Rate option to display “Set Chl=X Data Rate To AUTO?”, where “X” stands for the channel number.

```
Data Rate ..
```

Use your arrow keys to display a data rate value which ranges from 33 to 150MB/s (SATA drive channels). Press **ENT** to confirm a selection.

```
Set Chl=X Data  
Rate to AUTO ?
```

## 2.13 System Functions

Choose “System Functions” in the Main Menu, then press **ENT**. Press the up or down arrow keys to select a submenu, then press **ENT**.

### 2.13.1 Mute Beeper

When the controller’s beeper has been activated, choose “Mute Beeper,” then press **ENT** to turn the beeper off temporarily for the current event. The beeper will still activate on the next event.

```
Mute Beeper ..
```

### 2.13.2 Password

Use the controller’s password to protect the system from unauthorized entry. Once the controller’s password is set, regardless of whether the front panel, the RS-232C terminal interface or the RAIDWatch Manager is used, the user can only configure and monitor the RAID controller by providing the correct password.



#### **IMPORTANT!**

- *The controller requests a password whenever a user is entering the main menu from the initial screen or a configuration change is made. If the controller is going to be left unattended, the “Password Validation Timeout” should be set to “Always Check.”*
- *The controller password and controller name share a 32-character space. The maximum number of characters for a controller password is 32. If 31 characters are used for a controller name, there will be only one character left for the controller password and vice versa. Since 3.42J09, later firmware revisions will support a 32-character space.*

### 2.13.2.1 Change Password

To set or change the controller password, press the up or down arrow keys to select "Change Password," then press ENT.

```
Change Password ..
```

If the password has previously been set, the controller will ask for the old password first. If password has not yet been set, the controller will directly ask for the new password. The password cannot be replaced unless the correct old password is provided.

```
Old Password ..
```

Press the up or down arrow keys to select a character, then press ENT to move to the next space. After entering all the characters (alphabetic or numeric), press ENT for two seconds to confirm. If the password is correct, or there is no preset password, it will ask for the new password. Enter the password again to confirm.

```
Re-Ent Password ..
```

```
Change Password Successful
```

### 2.13.2.2 Disable Password

To disable or delete the password, press ENT on the first flashing digit for two seconds when requested to enter a new password. The existing password will be deleted. No password checking will occur when entering the Main Menu from the initial terminal screen or making configuration changes.

### 2.13.3 Reset Controller

To reset the controller without powering off the system, Press the up or down arrow keys to "Reset Controller," then press ENT. Press ENT again for two seconds to confirm. The controller will now reset.

```
Reset This Controller ..
```

```
Reset This Controller ?
```

### 2.13.4 Shutdown Controller

Before powering off the controller, unwritten data may still reside in cache memory. Use the "Shutdown Controller" function to flush the cache content. Press the up or down arrow keys to "Shutdown Controller," then press ENT. Press ENT again for two seconds to confirm.

```
Shutdown This Controller ?
```

```
Shutdown This Controller ..
```

```
ShutdownComplete  
Reset Ctlr?
```

The controller will now flush the cache memory. Press ENT for two seconds to confirm and to reset or power off the subsystem.

## 2.13.5 Controller Maintenance

For Controller Maintenance functions, please refer to *Appendix C*.

## 2.13.6 Saving NVRAM to Disks

You can choose to backup your controller-dependent configuration information to disks. We strongly recommend using this function to save the configuration profile whenever a configuration change is made. The information will be distributed to every logical drive in the RAID system. If using the RAIDWatch manager, you can save your configuration details as a file to a computer system drive.

A RAID configuration of drives must exist for the controller to write NVRAM content onto it.

From the Main Menu, choose "System Functions." Use arrow keys to scroll down and select "Controller Maintenance," "Save NVRAM to Disks," then press **ENT**. Press **ENT** for two seconds on the message prompt, "Save NVRAM to Disks?".

```
Controller
Maintenance  ..
```

```
Save NVRAM
To Disks    ?
```

A prompt will inform you that NVRAM information has been successfully saved.

## 2.13.7 Restore NVRAM from Disks

If you want to restore your NVRAM information that was previously saved onto the array, use this function to restore the configuration setting.

From the Main Menu, choose "System Functions." Use arrow keys to scroll down and select "Controller Maintenance," "Restore NVRAM from Disks..," and then press **ENT**. Press **ENT** for two seconds to confirm.

```
Restore NVRAM
from Disks    ?
```

In case your previous password (reserved at the time you saved your NVRAM configuration contents) is different from your current password, you are provided with the options whether to restore the password you previously saved with your configuration profile.

```
Restore without
Password    ?
```

```
Restore with
Password    ?
```

A prompt will inform you that the controller NVRAM data has been successfully restored from disks.

## 2.13.8 Adjust LCD Contrast

The controller LCD contrast is set at the factory to a level that should be generally acceptable. The controller is equipped with an LCD contrast adjustment circuit in case the factory-preset level needs to be adjusted either via the RS-232 terminal emulation menus or using the LCD keypad panel.

From the main menu, choose “View and Edit Peripheral Dev.” Press **ENT** on it, press arrow keys to scroll down, and select “Adjust LCD Contrast,” press **ENT** to proceed, and then use the arrow keys to find an optimal setting. Press **ESC** to return to the previous menu.

```
View and Edit
Peripheral Dev
```

```
Adjust LCD
Contrast ..
```

```
LCD Contrast :
██████-----
```

## 2.14 Controller Parameters

### 2.14.1 Controller Name

Select “View and Edit Config Parm’s” from the Main Menu. Choose “View and Edit Configuration Parameters,” “Controller Parameters,” then press **ENT**. The current name will be displayed. Press **ENT** for two seconds and enter the new controller name by using the up or down arrow keys. Press **ENT** to move to another character and then press **ENT** for two seconds on the last digit of the controller name to complete the process.

```
Controller Name:
_ _ _ _
```

```
Enter Ctlr Name:
□
```

### 2.14.2 LCD Title Display Controller Name

Choose “View and Edit Configuration Parameters,” “Controller Parameters,” then press **ENT**. Use the up or down arrow keys to choose to display the embedded controller logo or any given name on the LCD initial screen.

```
LCD Title Disp -
Controller Logo?
```

```
LCD Title Disp -
Controller Name?
```

### 2.14.3 Password Validation Timeout

Choose "View and Edit Configuration Parameters," "Controller Parameters," then press ENT. Select "Password Validation Timeout," and press ENT. Press the up or down arrow keys to choose to enable a validation timeout from one to five minutes to Always Check. The Always Check timeout will invalidate any configuration change without entering the correct password.

```
PasswdValidation  
Timeout-5 mins..
```

### 2.14.4 Controller Unique Identifier

Choose "View and Edit Configuration Parameters," "Controller Parameters," then press ENT. Press the up or down arrow keys to select "Ctrl Unique ID-," then press ENT. Enter any hex number between "0" and "FFFFF" and press ENT to proceed.

```
Ctrl Unique (Hex)-  
ID-
```

Enter a unique ID for any RAID controller in a single or dual-controller configuration. The unique ID is recognized by the controller as the following:

1. The unique ID is combined to generate a unique WWN node name for controllers or RAID systems using Fibre Channel host ports. The unique node name helps prevent host computers from mis-addressing the storage system during a controller failback/failover process.
2. MAC addresses for the controller's Ethernet port that should be taken over by a surviving controller in the event of controller failure.

### 2.14.5 Controller Date and Time

This submenu is only available for controllers or subsystems that come with a real-time clock on board.

#### Time Zone

Choose "View and Edit Configuration Parameters," "Controller Parameters," then press ENT. Press the up or down arrow keys to scroll down and select "Set Controller Date and Time", then press ENT.

```
View and Edit  
Config Parm
```

```
Controller  
Parameters ..
```

```
Set Controller  
Date and Time ..
```

The controller uses GMT (Greenwich Mean Time), a 24-hours clock. To change the clock to your local time zone, enter the hours later than the Greenwich mean time after a plus (+) sign. For example, enter "+9" for Japanese time zone.

Choose "Time Zone" by pressing **ENT**.

```
Time Zone ..
```

Use the down key to enter the plus sign and the up key to enter numeric representatives.

```
GMT +08:00  
GMT -
```

## Date and Time

Use your arrow keys to scroll down and select "Date and Time" by pressing **ENT**.

```
Date and Time ..
```

Use the arrow keys to select and enter the numeric representatives in the following order: month, day, hour, minute, and the year.

```
[MMDDhhmm[YYYY]]
```

## 2.15 Drive Utilities

From the "View and Edit Drives" menu, select the drive that the utility is to be performed on; then press **ENT**. Select "Drive Utilities"; then press **ENT**. Choose "Read/Write Test".

```
View and Edit  
Drives
```

```
Slot=* 1010MB  
NEW DRV SEAGATE
```

These options are not available for drives already configured in a logical configuration, and can only be performed before a reserved space is created on a drive.

```
Drive  
Utilities ..
```

```
Drive Read/Write  
Test ..
```

## 2.15.1 Drive Read/Write Test

From the "View and Edit Drives" menu, select a new or used drive that the utility is to be performed on; then press ENT. Select "Drive Utilities;" then press ENT. Choose "Read/Write Test" and press ENT.

```
Drive Read/Write
Test ..
```

Press the up or down arrow keys to select and choose to enable/disable the following options:

1. Abort When Error Occurs
2. Drive Test for - Read Only/Read and Write.
3. Execute Drive Testing

```
About When Error
Occur-
Enabled ....
```

```
Drive Test for
Read and Write..
```

```
Execute Drive
Testing ..
```

When finished with configuration, select "Execute Drive Testing" and press ENT to proceed.

The Read/Write test progress will be indicated as a percentage.

```
Drv Testing 23%
Please Wait !
```

You may press ESC and select "Read/Write Test" later and press ● or ● to select to "View Read/Write Testing Progress" or to "List Current Bad Block Table." If you want to stop testing the drive, select "Abort Drive Testing" and press ENT to proceed.

```
View Read/Write
Test Progress ..
```

```
List Current
Bad Block Table.
```

```
Abort Read/Write
Testing ..
```

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# Terminal Screen Messages

## 3.1 The Initial Screen

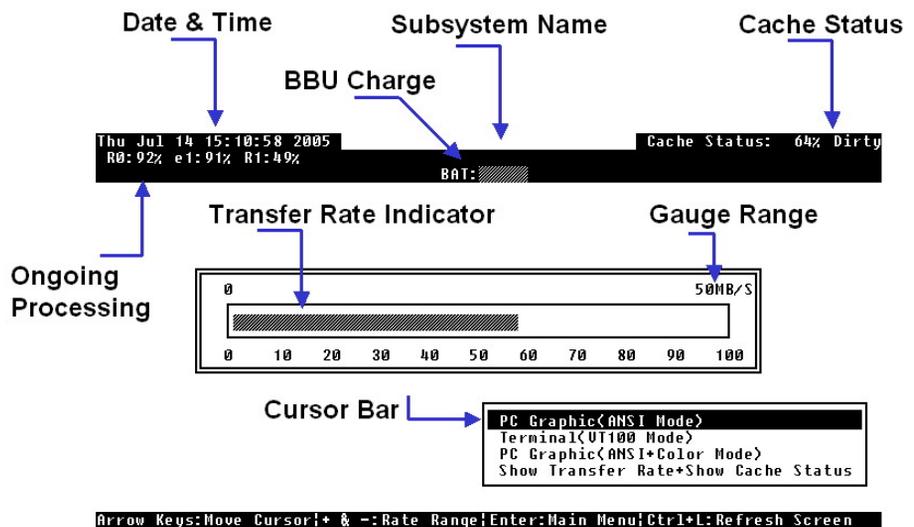


Figure 3 - 1: The RC-232C Initial Screen

<b>Cursor Bar:</b>	Move the cursor bar to a desired item, then press [ENTER] to select
<b>Subsystem Name:</b>	Identifies the type of controller/subsystem or a preset name
<b>Transfer Rate Indicator:</b>	Indicates the current data transfer rate
<b>Gauge Range:</b>	Use + (Shift+""+) or - keys to change the gauge range in order to view the transfer rate indicator
<b>Cache Status:</b>	Indicates current cache status
<b>Write Policy:</b>	Indicates current write-caching policy
<b>Date &amp; Time:</b>	Current system date and time, generated by controller real-time clock
<b>PC Graphic (ANSI Mode):</b>	Enters the Main Menu and operates in ANSI mode
<b>Terminal (VT-100 Mode):</b>	Enters the Main Menu and operates in VT-100 mode
<b>PC Graphic (ANSI+Color Mode):</b>	Enters the Main Menu and operates in ANSI color mode
<b>Show Transfer Rate+Show Cache Status:</b>	Press [ENTER] on this item to show the cache status and transfer rate
<b>Ongoing Processing:</b>	<p><b>e#:</b> logical drive # is being expanded</p> <p><b>i#:</b> logical drive # is being initialized</p> <p><b>R#:</b> logical drive # is being rebuilt</p> <p><b>P#:</b> logical drive # Parity Regeneration completion ratio</p> <p><b>S#:</b> logical drive # Media Scan completion ratio</p> <p><b>For more details, please refer to Section 6.4 Logical Drive Status</b></p>

## 3.2 Main Menu

```
Fri Jul 8 18:03:50 2005 Cache Status: 66% Dirty
i0:45% P2:40%
BAT:+++++
< Main Menu >
Quick installation
view and edit Logical drives
view and edit logical volumes
view and edit Host luns
view and edit Drives
view and edit channels
view and edit Configuration parameters
view and edit Peripheral devices
system Functions
view system Information
view and edit Event logs
Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen
```

Figure 3 - 2: The RC-232C Main Menu

Use the arrow keys to move the cursor bar through the menu items, then press [ENTER] to choose a menu, or [ESC] to return to the previous menu/screen.

In a subsystem or controller head where battery status can be detected, battery status will be displayed at the top center. Status will be stated as Good, Bad, several “+ ” (plus) signs (VT-100 mode), or color blocks (ANSI mode) will be used to indicate battery charge. A battery fully-charged will be indicated by five plus signs or color blocks.

When initializing or scanning an array, the controller displays progress percentage on the upper left corner of the configuration screen. An “i” indicates array initialization. An “s” stands for scanning process. The number(s) next to them indicate the logical drive number (e.g., logical drive 0).

## 3.3 Quick Installation

```
< Main Menu >
Quick installation
v
v Create Logical Drive ? s
v Yes No es
v
v view and edit Configuration parameters
v view and edit Peripheral devices
v system Functions
v view system Information
v view and edit Event logs
```

Figure 3 - 3: Quick Installation Page

Type **Q** or use the  $\uparrow\downarrow$  keys to select "Quick installation", then press **[ENTER]**. Choose **Yes** to create a logical drive.

All possible RAID levels will be displayed. Use the  $\uparrow\downarrow$  keys to select a RAID level, then press **[ENTER]**. The assigned spare drive will be a Local Spare Drive, not a Global Spare Drive.

All available disk drives in the enclosure will be included in one logical drive. The subsystem will start initialization and automatically map the logical drive to LUN 0 of the first host channel available.

### 3.4 Logical Drive Status

Fri Oct 28 17:56:38 2005													Cache Status: Clean	
BAT: +++++														
LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
P0	78DFE33F	NA	RAID6	4000	GOOD				7	B	6	0	0	
S1	449FE016	NA	RAID6	4400	GOOD				7	B	6	0	0	
P2	64745A71	NA	RAID6	5600	GOOD				7	B	6	0	0	
S3	2723A913	NA	RAID6	6400	GOOD				7	B	6	0	0	
4			NONE											
5			NONE											
6			NONE											
7			NONE											

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 3 - 4: Logical Drive Status Screen**



**NOTE:**

- A logical drive in a single-controller subsystem is always managed by one controller, and the "P" or "S" indicator will not appear.

LG	Logical Drive number
	P Primary
	S Secondary
LV	The Logical volume to which this logical drive belongs
ID	Controller-generated unique ID
RAID	RAID level
SIZE (MB)	Capacity of the Logical Drive
Status 1	Logical Drive Status - Column 1

<b>GOOD</b>	The logical drive is in good condition		
<b>DRV FAILED</b>	A drive member failed in the logical drive		
<b>CREATING</b>	Logical drive is being initiated		
<b>DRV ABSENT</b>	An empty drive tray		
<b>INCOMPLETE</b>	Two or more drives failed in the logical drive		
<b>INVALID</b>	The logical drive was created but has not been fully initialized when another version of firmware is being loaded. After the subsystem resets, the array status should return to normal.		
<b>FATAL FAIL</b>	Two member drives failed at the same time, the array is inaccessible		
<b>DRV MISS</b>	A member drive is missing; could result from insecure installation		
<b>REBUILDING</b>	The logical drive is being rebuilt		
<b>Status 2</b>	Logical Drive Status – Column 2		
<b>I</b>	Initializing drives		
<b>A</b>	Adding drive(s)		
<b>E</b>	Expanding logical drive		
<b>H</b>	Add drive operation on hold		
<b>Status 3</b>	Logical Drive Status – Column 3		
<b>R</b>	Rebuilding the logical drive		
<b>P</b>	Regenerating array parity		
<b>Column O</b>	Logical Drive Status – Stripe size		
<b>N/A</b>	Default		
<b>2</b>	4KB	<b>6</b>	64KB
<b>3</b>	8KB	<b>7</b>	128KB
<b>4</b>	16KB	<b>8</b>	256KB
<b>5</b>	32KB	<b>9</b>	512KB
<b>A</b>	1024KB		
<b>Column C</b>	Logical Drive Status – Write Policy setting		
<b>B</b>	Write-back		
<b>T</b>	Write-through		
<b>#LN</b>	Total drive members in the logical drive		
<b>#SB</b>	Standby drives available for the logical drive. This includes all the spare drives (local spare, global spare) available for the specific logical drive		
<b>#FL</b>	Number of Failed member(s) in the logical drive		
<b>Name</b>	Logical drive name (user configurable)		

## 3.5 Logical Volume Status

Cache Status: Clean

Q	LV	ID	Size(MB)	#LD	
v	0	46605C8D	60000	1	s
v	1				es
v	2				
v	3				parameters
v	4				vices
s	5				
v	6				
v	7				

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 3 - 5: Logical Volume Status Screen**



**NOTE:**

- *A logical volume in a single-controller subsystem is always managed by one controller, and the "P" or "S" indicator will not appear.*

<b>LV</b>	Logical Volume number.
<b>ID</b>	Logical Volume ID number (controller randomly generated)
<b>Size(MB)</b>	Capacity of the Logical Volume
<b>#LD</b>	The number of Logical Drive(s) included in this Logical Volume

## 3.6 Drive Status

Thu Oct 6 10:41:01 2005		Cache Status: Clean						
BAT:BAD								
JBOD	Slot	Chl	ID	Size(MB)	Speed	LG_DRU	Status	Vendor and Product ID
	9	5	3	35003	300MB	0	ON-LINE	SEAGATE ST336754SS
	10	5	2	35003	300MB	0	ON-LINE	SEAGATE ST336754SS
	11	5	1	35003	300MB	0	ON-LINE	SEAGATE ST336754SS
	12	5	0	70007	300MB	0	ON-LINE	SEAGATE ST373454SS
9	1	3(4)	0	35003	300MB	0	ON-LINE	SEAGATE ST336754SS
9	2	3(4)	1	35003	300MB	0	ON-LINE	SEAGATE ST336754SS
9	3	3(4)	2	35003	300MB	0	ON-LINE	SEAGATE ST336754SS
9	4	3(4)	3	35003	300MB	0	ON-LINE	SEAGATE ST336754SS

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

**Figure 3 - 6: Drive Status Screen**

<b>JBOD</b>	<b>JBOD ID of the disk drive</b>
<b>Slot</b>	Slot number of the disk drive
<b>Size (MB)</b>	Drive capacity
<b>Speed</b>	<b>XXMB</b> Maximum transfer rate of the drive channel interface
<b>LG_DRV</b>	<b>X</b> The disk drive is a member of logical drive "X." If the Status column shows "STAND-BY", the drive is a Local Spare belonging to logical drive "X."
<b>Status</b>	<b>Global</b> The disk drive is a Global Spare Drive
	<b>INITING</b> Proceeding with array initialization
	<b>ON-LINE</b> The drive is in good condition
	<b>REBUILD</b> Proceeding with array Rebuild process
	<b>STAND-BY</b> Local Spare Drive or Global Spare Drive. The Local Spare Drive's LG_DRV column will show the logical drive number. The Global Spare Drive's LG_DRV column will show "Global".
	<b>NEW DRV</b> A new drive has not been included in any logical drive or configured as a spare drive
	<b>USED DRV</b> An used drive that is not a member of any logical drive or configured as a spare
	<b>FRMT DRV</b> Formatted drive (drive formatted with a reserved section)
	<b>BAD</b> Failed drive

	<b>ABSENT</b>	Drive does not exist
	<b>MISSING</b>	Drive once existed, but is missing now
	<b>SB-MISS</b>	Spare drive missing
<b>Vendor and Product ID</b>		The vendor and product model information of the drive

## 3.7 Channel's Status

Fri Oct 7 11:27:24 2005										Cache Status: Clean	
i0:21%										WT	
BAT:++++											
Q	Ch1	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid	
U	0	Host	102	NA	AUTO	Serial	F	NA	2 GHz	Serial	
U	1	Host	NA	102	AUTO	Serial	F	NA			
U	2	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Serial	
U	3(4)	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Serial	
U	4(3)	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Serial	
U	5	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Serial	
S	6	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SATA	
U	7	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SATA	

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

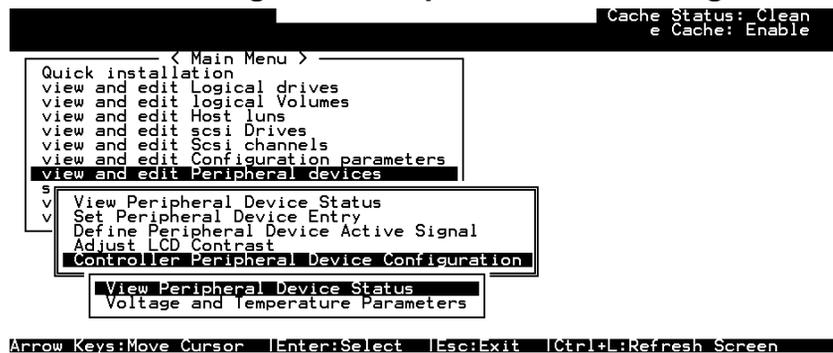
**Figure 3 - 7: Channel Status Screen**

<b>Ch1</b>	Channel number
<b>Mode</b>	Channel mode
	RCCom Redundant controller communication channel
	Host Host Channel mode
	Drive Drive Channel mode
<b>PID</b>	IDs managed by the Primary Controller
	* Multiple IDs were applied (Host Channel mode only)
	(ID Host Channel:
	number) Specific IDs managed by the Primary Controller for host LUN mapping
	Drive Channel:
	Specific ID reserved for the channel processor on the Primary Controller
<b>SID</b>	IDs managed by the Secondary Controller
	* Multiple IDs were applied (Host Channel mode only)
	(ID Host Channel:
	number) Specific IDs managed by the Secondary Controller for host LUN mapping
	Drive Channel:
	Specific ID reserved for the channel processor on the Secondary controller; used in redundant controller mode
	NA No channel ID applied
<b>AUTO</b>	Channel bus data rate set to auto speed negotiation
<b>DefSynClk</b>	Default bus synchronous clock:
	??M The default setting of the channel is ??? MHz in Synchronous mode.
	Async. The default setting of the channel is Asynchronous mode.

<b>DefWid</b>	Default bus width:
	Serial      Serial transfer protocol; Fibre Channel, SAS Channel
<b>S</b>	Signal:
	F    Fibre
	A    SAS
<b>Term</b>	Terminator Status:
	On      Terminator is enabled.
	Off     Terminator is disabled.
	Diff    The channel is a Differential channel. The terminator can only be installed/removed physically.
	N/A     Non-SCSI bus
<b>CurSynClk</b>	Current bus synchronous clock:
	???.?GHz    The default setting of the channel bus is ??? GHz
	Async.    The default setting of the channel bus is Asynchronous mode.
	(empty)    The default bus synchronous clock has changed. Reset the controller for the changes to take effect.
<b>CurWid</b>	Current Bus Width:
	Serial      Serial transfer protocol; Fibre Channel, SAS Channel, SATA Channel.

## 3.8 Controller Voltage and Temperature

### Controller Voltage and Temperature Monitoring



**Figure 3 - 8: Controller Voltage and Temperature Monitoring Page**

Choose from Main Menu “View and Edit Peripheral Devices,” and press [ENTER]. From the submenu, choose “Controller Peripheral Device Configuration,” “View Peripheral Device Status”, then press [ENTER].

```

Cache Status: Clean
e Cache: Enable

< Main Menu >
Quick installation
view and edit logical drives
view and edit logical Volumes
view and edit Host luns
view an
view an
view an
view an
view an
view an
s
v
v
v
v
v
View
Set
Defi
Adju
Cont
View Peripheral Device Status
Voltage and temperature Parameters

ITEM          VALUE          STATUS
+3.3V         3.384V         Operation Normally
+5V           5.260V         Operation Normally
+12V          12.868V         Operation Normally
CPU Temperature 32.0 (C)       Temperature within Safe Range
Board1 Temperature 45.5 (C)       Temperature within Safe Range
Board2 Temperature 43.0 (C)       Temperature within Safe Range

```

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 3 - 9: Controller Voltage and Temperature Status Screen**

The current status of voltage and temperature detected by the controller will be displayed on-screen and will be stated as normal, out of order, within or within the safety range.

### 3.9 Viewing Event Logs on the Screen

When errors occur, you may want to trace the records to see what has happened to your system. The controller’s event log management records all events starting from the time when the system is powered on, recording up to 1,000 events. Powering off or resetting the controller will cause an automatic deletion of all the recorded event logs. To view the events log on-screen, from the Main Menu “View and Edit Event Logs” by pressing [ENTER].

```

Sun Feb 17 23:08:08 2002          Cache Status: Clean
BAT:+++++

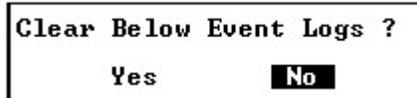
Event Logs
On-Line Initialization of Logical Drive 0 Completed
<Sun Feb 17 22:48:22 2002>
LG:0 Logical Drive NOTICE: Starting on-Line Initialization
<Sun Feb 17 22:47:49 2002>
Creation of Logical Drive 0 Completed
<Sun Feb 17 22:47:49 2002>
LG:0 Logical Drive NOTICE: Starting Creation
<Sun Feb 17 22:47:44 2002>
Controller BBU Not Fully Charged !
<Sun Feb 17 22:33:24 2002>
Controller Initialization Completed
<Sun Feb 17 22:33:27 2002>
Controller NOTICE: NVRAM Factory Defaults Restored
<Sun Feb 17 22:32:22 2002>
Controller Initialization Completed
<Sun Feb 17 22:33:22 2002>

```

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 3 - 10: Event Logs Screen**

To clear the saved event logs, scroll the cursor down to select an event and press [ENTER] to delete the event and the events below.



**Figure 3 - 11: Clear Event Logs Dialogue Box**

Choose **Yes** to clear the recorded event logs.

This page is intentionally  
left blank

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# Terminal Operation

---

## 4.1 Power on RAID Enclosure

Hardware installation should be completed before powering on your RAID enclosure. The subsystem and disk drives must be configured and properly initialized before the host computer can access the storage capacity. The configuration and administration utility resides in the controller's firmware.

Open the initial terminal screen: use the arrow keys to move the cursor bar through the menu items, then press [ENTER] to choose the terminal emulation mode, and [ESC] to return to the previous menu/screen.

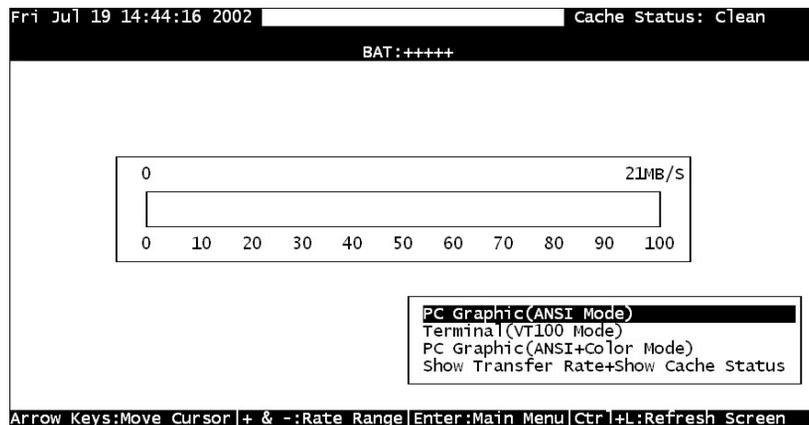


Figure 4 - 1: RS-232C Initial Screen



**NOTE:**

*All figures in this chapter are showing examples using the management hyper terminal screen.*

---

## 4.2 Caching Parameters

### 4.2.1 Optimization Modes

Mass storage applications can be roughly divided into two categories—database and video/imaging—according to their read/write characteristics. To optimize system operation, there are two embedded optimization modes with system behaviors pre-adjusted to different read/write parameters: “Optimization for Random I/O” and the “Optimization for Sequential I/O.”

#### Limitations

The following are the limitations on the use of optimization modes.

1. The system default is Optimization for Sequential I/O.
2. You can select the stripe size of each array (logical drive) during the initial configuration. However, changing stripe size is only recommended for experienced engineers who have tested the effects of tuning stripe sizes for different applications.
3. The array stripe size can only be changed during the initial configuration process.
4. Carefully consider the outcome before choosing an optimization mode. Once the controller optimization mode is applied, access to different arrays in a RAID system will follow the same optimized pattern. **You can only change the optimization mode after recreating the arrays.**

#### Database and Transaction-based Applications

These kinds of applications usually include SQL server, Oracle server, Informix, or other database services that keep the size of each transaction down to a minimum, so that I/Os can be rapidly processed. Due to their transaction-based nature, these applications do not read or write a bunch of data in a sequential order—access to data occurs randomly. The transaction size usually ranges from 2K to 4K. Transaction performance is measured in “I/Os per second” or “IOPS.”

#### Video Recording/Playback and Imaging Applications

These kinds of applications usually include video playback, video post-production editing, or applications of a similar nature that tend to read or write large files to and from storage in a sequential order. The size of each I/O can be 128K, 256K, 512K, or up to 1MB. The efficiency of these applications is measured in MB per second (MBps).

When an array works with applications such as video or image-oriented applications, the application reads/writes from the drive as large-block, sequential threads instead of small and randomly accessed files.

The controller optimization modes have read-ahead buffer and other Read/Write characteristics tuned to obtain the best performance for these two major application categories.

## 4.2.2 Optimization Mode and Stripe Size

Each controller optimization mode has preset values for the stripe size of arrays created in different RAID levels. If you want a different optimization mode for a configured array, you must backup or move the stored data and recreate the arrays following the steps below:

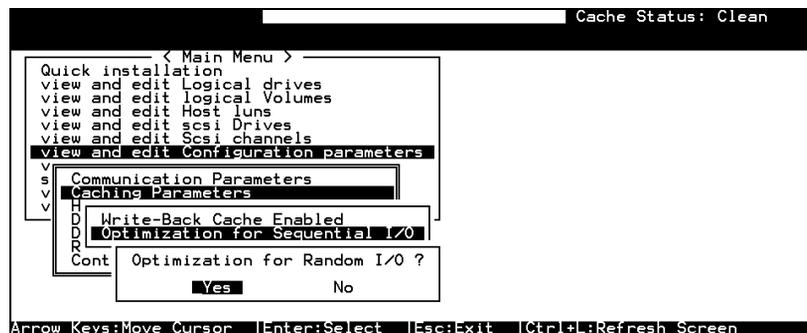
1. Stop host I/O access.
2. Move or backup all of your stored data in the subsystem.
3. Change the optimization mode.
4. Reset the subsystem.
5. Recreate the array(s). Once the array(s) are created, stripe size cannot be changed.

Listed below are the default stripe sizes implemented with different optimization modes and RAID levels. These values should be sufficient for most applications.

	Stripe Size: Opt. for Sequential I/O	Stripe Size: Opt. for Random I/O
RAID0	128KB	32KB
RAID1	128KB	32KB
RAID3	16KB	4KB
RAID5	128KB	32KB
RAID6	128KB	32KB
NRAID	128KB	32KB

**Table 4-1: RAID Levels, Optimization Modes, and Stripe Sizes**

## 4.2.3 Optimization for Random or Sequential I/Os



**Figure 4 – 2: Optimization for Random or Sequential I/Os Page**

Choose “Optimization for Random I/O” or “Optimization for Sequential I/O,” then press [ENTER]. The “Random” or “Sequential” dialog box will appear, depending on the option you have selected. Choose *Yes* in the dialog box that follows to confirm the setting. Press [ESC] to exit and the setting will take effect after the subsystem is restarted.



#### NOTE:

*There is no longer a 512GB threshold for array optimization modes. If an array is larger than 16TB, only the optimization mode for sequential I/Os can be applied. Since logical drives of this size may not be practical, there is actually no limitation on the optimization mode and array capacity.*

### 4.2.4 Write-Back Cache Enable/Disable

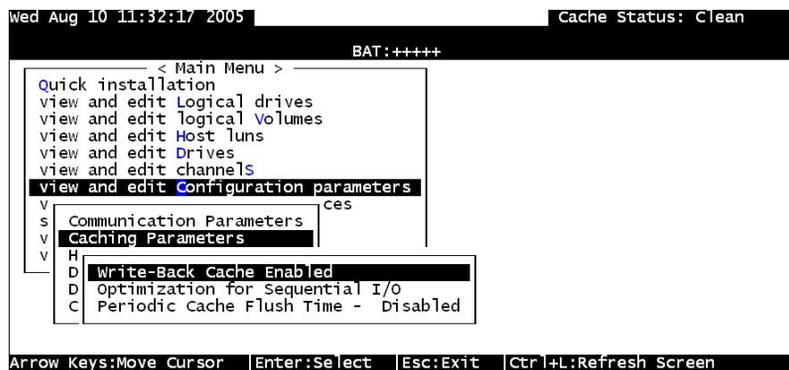


Figure 4 – 3: Write-Back Cache Enable/Disable Page

As one of the submenus in “Caching Parameters,” this option controls the cached write policy.

Choose *Caching Parameters*, then press [ENTER]. Select *Write-Back Cache*, then press [ENTER]. “Enabled” or “Disabled” will display the current setting with Write-back caching. Choose *Yes* in the dialog box that follows to confirm the setting.

The Write-through mode is safer if your controller is not configured in a redundant pair and there is no battery backup or UPS device to protect cached data.

Write-back caching can dramatically improve write performance by caching the unfinished writes in memory and letting them be committed to drives in a more efficient manner. In the event of power failure, a battery backup module can hold cached data for days.

## 4.2.5 Periodic Cache Flush

```
Mon May 10 13:59:44 2004                               Cache Status: Clean
BAT:+++++
< Main Menu >
Quick installation
view and edit Logical drives
view and edit logical Volumes
view and edit Host luns
view and edit Drives
view and edit channels
view and edit Configuration parameters
V
S
V
V
H
D
D
R
C
Communication Parameters
Caching Parameters
Write-Back Cache Enabled           Disabled (Default)
Optimization for Sequential I/O    Continuous Sync
Periodic cache Flush Time - Disabled 1/2 min
                                      1 min
                                      2 min
                                      5 min
                                      10 min
Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen
```

**Figure 4 - 4: Periodic Cache Flush Page**

If Write-back caching is preferred for better performance yet data integrity is also a concern, e.g., no battery protection, the system can be configured to flush the cached writes at preset intervals.

Note that the “Continuous Sync” option holds data in cache for as long as necessary to complete a write operation and immediately commits it to hard drives if it does not come in a series of sequential write requests.



### **IMPORTANT!**

- *If the size of an array is larger than 16TB, only the optimization for sequential I/O can be applied. Since a logical drive of this size may not be practical, there is actually no limitation on the combination of optimization mode and array capacity.*
- *Every time you change the Caching Parameters you must reset the controller for the changes to take effect.*
- *The Adaptive Write Policy is applicable to subsystems working under normal conditions. If, for example, a drive fails in an array, the firmware automatically restores the array’s original write policy.*

## 4.3 Viewing the Connected Drives

Prior to configuring disk drives into a logical drive, it is necessary to understand the status of the physical drives in your enclosure.

Fri Jul 19 15:34:44 2002 Cache Status: Clean

BAT:++++

Quick view	Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
	1	239367	150MB	NONE	NEW DRV	Maxtor 7Y250M0
	2	239367	150MB	NONE	NEW DRV	Maxtor 7Y250M0
	3	239367	150MB	NONE	NEW DRV	Maxtor 7Y250M0
	4	239367	150MB	GLOBAL	STAND-BY	Maxtor 7Y250M0
	5	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
	6	239367	150MB	1	ON-LINE	Maxtor 7Y250M0
	7	239367	150MB	1	ON-LINE	Maxtor 7Y250M0
	8	239367	133MB	0	ON-LINE	Maxtor 7Y250M0

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

**Figure 4 - 6: View and Edit Drives Page**

Use the arrow keys to scroll down to “View and Edit Drives” to display information on all the physical drives installed.

Drives are listed in the “View and Edit Drives” table. Use the arrow keys to scroll the table. First examine whether there is any drive installed but not listed here. If a disk drive is installed but not listed, the drive may be defective or not installed correctly. If so, please contact your RAID supplier.



### NOTE:

The JBOD column will show the ID from the JBOD rotary switch number when you connected to the RAID subsystem.



### IMPORTANT!

- Drives of the same brand/model/capacity might not have the same block number.
- The basic read/write unit of a hard drive is block. If members of a logical drive have different block numbers (capacity), the smallest block number will be taken as the maximum capacity to be used in every drive. Therefore, use drives of the same capacity.
- You may assign a Spare Drive to a logical drive whose members have a block number equal or smaller than the Local/Global Spare Drive, but you should not do the reverse.

## 4.4 Creating a Logical Drive

Browse through the Main Menu and select *View and Edit Logical Drive*.

Thu Jul 21 17:18:22 2005												Cache Status: Clean		
BAT:++++														
LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
0			NONE											
Create Logical Drive ?														
<input checked="" type="radio"/> Yes <input type="radio"/> No														
3			NONE											
4			NONE											
5			NONE											
6			NONE											
7			NONE											

Arrow Keys:Move Cursor    Enter:Select    Esc:Exit    Ctrl+L:Refresh Screen

**Figure 4 - 7: View and Edit Logical Drive Page**

For the first logical drive on the RAID subsystem, simply choose the first logical drive entry, *LG 0*, and press [ENTER] to proceed. You may create as many as 16 logical drives or more using drives in a RAID subsystem or in a cascaded enclosure.

When prompted to “Create Logical Drive?,” select *Yes* and press [ENTER] to proceed.

Create Logical Drive ?	
<input checked="" type="radio"/> Yes	<input type="radio"/> No

### 4.4.1 Choosing a RAID Level

A pull-down list of supported RAID levels will appear. Choose a RAID level for this logical drive. In this chapter, RAID 6 will be used to demonstrate the configuration process.

RAID 5
<b>RAID 6</b>
RAID 3
RAID 1
RAID 0
NRAID



**NOTE:**

*Some specific functions associate with RAID 6 only work with certain product models.*

## 4.4.2 Choosing Member Drives

Choose your member drive(s) from the list of available physical drives. Tag the drives for inclusion by positioning the cursor bar on the drive and then pressing [ENTER]. A star sign "\*" will appear on the selected physical drive(s). To deselect the drive, press [ENTER] again on the selected drive and the "\*" will disappear. Use the same method to select more drives.

Thu Jul 21 17:24:13 2005 Cache Status: Clean

BAT:+++++ 4 of 4 Selected

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	RAID 5	RAID 6	#FL	NAME
0													
1													
2													
3													
4													
5													
6			NONE										
7			NONE										

Slot | Size(MB) | Speed | LG\_DRV | Status | Vendor and Product ID

* 13	239367	150MB	NONE	NEW DRV	HITACHI HDS722525VLSA80
* 14	238469	150MB	NONE	NEW DRV	HITACHI HDS722525VLSA80
* 15	238469	150MB	NONE	NEW DRV	HITACHI HDS722525VLSA80
* 16	238469	100MB	NONE	NEW DRV	HITACHI HDS722525VLSA80

Arrow Keys: Move Cursor | Enter: Select | Esc: Confirm | Ctrl+L: Refresh Screen

**Figure 4 - 8: Choose Member Drives Page**

## 4.4.3 Logical Drive Preferences

Maximum Drive Capacity :	9999MB
Assign Spare Drives	
Disk Reserved Space:	256 MB
Logical Drive Assignments	
Write Policy:	Default (Write-Back)
Initialize Mode:	On-Line
Stripe Size:	Default

**Figure 4 - 9: Logical Drive Preferences Screen**

After all member drives have been selected, press [ESC] to continue with the next option. A list of array options is displayed.

### 4.4.3.1 Maximum Drive Capacity

Maximum Available Drive Capacity(MB):	239112
Maximum Drive Capacity(MB)	: 239112

**Figure 4 - 10: Maximum Drive Capacity Screen**

As a rule, a logical drive should be composed of drives of the same capacity. A logical drive can only use the capacity of each drive up to the maximum capacity of the smallest member selected for the array.

### 4.4.3.2 Assign Spare Drives

Maximum Drive Capacity : 239112MB							
Assign Spare Drives							
Disk	Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID	
Logi	*	5	239367	150MB	NONE	NEW DRV	Maxtor 7Y250M0
Writ		6	239367	150MB	NONE	NEW DRV	Maxtor 7Y250M0
Init							
Stri							

Figure 4 - 11: Assign Spare Drives Page

You can add a spare drive from the list of the unused drives. The spare chosen here is a Local spare and will automatically replace any failed drive. The controller will then rebuild data onto the replacement drive.

A logical drive composed in a non-redundancy RAID level (NRAID or RAID 0) does not support spare drive rebuild.

### 4.4.3.3 Disk Reserved Space

The reserved space is a small section of disk space formatted for storing array configuration and RAIDWatch program data. This item is for display only—you cannot change the size of the reserved space.

### 4.4.3.4 Logical Drive Assignments (Dual-Active Controllers)

Maximum Drive Capacity : 9999MB	
Assign Spare Drives	
Disk Reserved Space: 256 MB	
Logical Drive Assignments	
W	Redundant Controller Logical Drive Assign to Secondary Controller ?
I	<input checked="" type="radio"/> Yes <input type="radio"/> No
S	

If you use two controllers for a dual-active configuration, a logical drive can be assigned to either of the controllers to balance workload. The default is the Primary Controller; press [ESC] if change is not preferred.

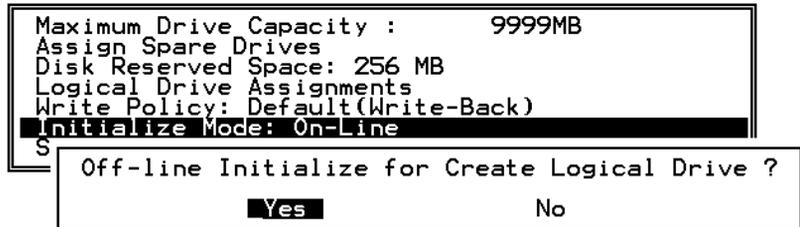
### 4.4.3.5 Write Policy

Maximum Drive Capacity : 9999MB	
Assign Spare Drives	
Disk Reserved Space: 256 MB	
Logical Drive Assignments	
Write Policy: Default(Write-Back)	
W	Change Write Policy ?
I	<input checked="" type="radio"/> Default <input type="radio"/> Write-Back <input type="radio"/> Write-Through
S	

Figure 4 - 12: Write Policy Sub-menu

This sub-menu allows you to set the caching mode for this specific logical drive. “Default” is a neutral value that is coordinated with the subsystem’s general caching mode setting shown in brackets in the Write Policy status.

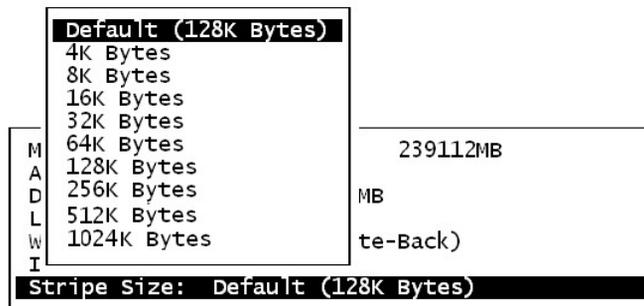
#### 4.4.3.6 Initialization Mode



**Figure 4 - 13: Initialization Mode Sub-menu**

This sub-menu allows you to see if the logical drive is immediately available. If the online (default) mode is used, data can be written onto it immediately and you may continue with array configuration, e.g., including the array into a logical volume, before the array’s initialization process is completed.

#### 4.4.3.7 Stripe Size



**Figure 4 - 14: Stripe Size Option Box**

This option should only be changed by experienced engineers. Setting to an incongruous value can severely drag performance, therefore, this option should only be changed when you can be sure of the performance gains it might bring you.

The default value is determined by the combination of the controller **Optimization Mode** setting and the **RAID level** used for the array.

Press [ESC] to continue when all the preferences have been set.

```

Raid Level           : RAID 6
Online Drives        : 4
Maximum Drive Capacity : 239112 MB
Disk Reserved Space  : 256 MB
Spare Drives         : 1
Logical Drive Assignment: Primary Controller
Write Policy         : Default(write-Back)
Initialize Mode      : On-Line
Stripe Size         : Default (128K Bytes)

Create Logical Drive ?

Yes                No

```

**Figure 4 - 15: Logical Drive Preferences Screen**

A confirm box will appear on the screen. Verify all information in the box before choosing *Yes* to confirm and proceed.

```

Notification
LG:0 Logical Drive NOTICE: Starting Creation

```

If the online initialization mode is applied, the logical drive will first be created and the controller will find an appropriate time to initialize the array.

```

Notification
Creation of Logical Drive 0 Completed

```

The completion of array creation is indicated by the message prompt above.

```

Initializing
Notification
LG:0 Logical Drive NOTICE: Starting Initialization

```

A controller event will then prompt to indicate that the logical drive initialization has begun. Press **[ESC]** to cancel the “Notification” prompt, and a progress indicator will display on the screen as a percentage bar.

While the array initialization runs in the background, you can start using the array or continue configuring your RAID subsystem.

```

Initializing
39% Completed

```

When a fault-tolerant RAID level (RAID 1, 3, 5 or 6) is selected, the subsystem will start initializing parity.

Use the **[ESC]** key to view the status of the created logical drive.

Fri Oct 28 10:11:26 2005 Cache Status: Clean

BAT:+++++

LG	ID	LU	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME	
P0	78DFE33F	NA	RAID6	4000	GOOD						7	B	6	0	0
P	view drives														
	Delete logical drive														
P	Partition logical drive														
	logical drive Name														
P	logical drive assignments														
	Expand logical drive														
	migrate logical drive														
	add drives														
	reGenerate parity														
	copy and replace drive														
	Media scan														
	write policy														

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 4 - 16: Logical Drive Status Screen**



**IMPORTANT!**

*Only logical drives with RAID levels 1, 3, 5, or 6 will take the time to initialize the logical drive. Logical drives with RAID level 0 and NRAID do not perform logical drive initialization; the drive initialization will be finished almost immediately.*

## 4.5 RAID Migration

Currently RAID migration function supports migrate between RAID5 and RAID6.

Before proceeding with RAID migration, make sure you have sufficient free capacity or unused drives in your RAID array. RAID6 arrays require at least four (4) member drives and use additional capacity for the distribution of secondary parity. For example, if you want to migrate a RAID5 array consisting of three (3) drives to RAID6, one additional disk drive must be available.



**NOTE:**

*Some specific functions associate with RAID migration only work with certain product models.*

The different features of RAID5 and RAID6 arrays is summarized as follows:

	<b>RAID5</b>	<b>RAID6</b>
Min. No. of Member Drives	3	4
Raw Capacity	N	N
Usable Capacity	N-1 (parity drive)	N-2 (parity drives); N $\geq$ 2
	<ul style="list-style-type: none"> <li>• If individual disk capacity = 100G,</li> <li>• Capacity of a 4-drive RAID5 = (4-1) x 100G = 300G</li> <li>• Capacity of a 4-drive RAID6 = (4-2) x 100G = 200G</li> </ul>	
Redundancy	1 drive failure	2 drive failures

#### 4.5.1 Requirements for Migrating a RAID5 Array

The preconditions for migrating a RAID5 array is:

**The usable capacity of the RAID6 array should be equal or larger than the usable capacity of the original RAID5 array.**

To obtain the larger capacity, you can:

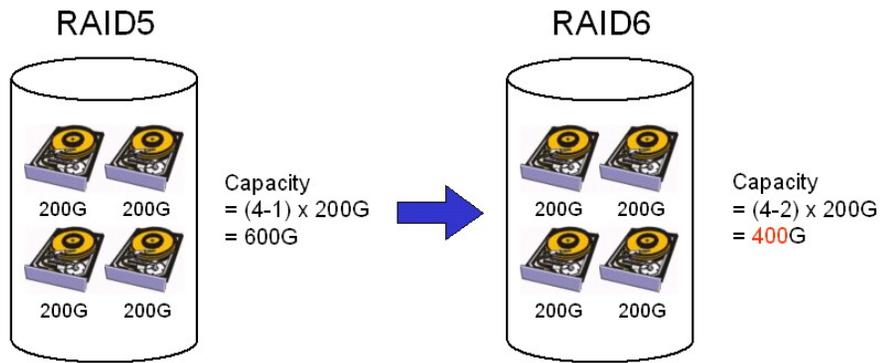
- 1). **Add Drive(s)**: Include one or more disk drives into the array.
- 2). **Copy and Replace**: Use larger disk drives in the array to replace the original members of the RAID5 array.

#### 4.5.2 Migration Methods

The conditions for migrating an array to RAID6 is diagrammed as follows:

1. Fault condition:

The usable capacity of the RAID6 array is smaller than the usable capacity of the original RAID5 array.

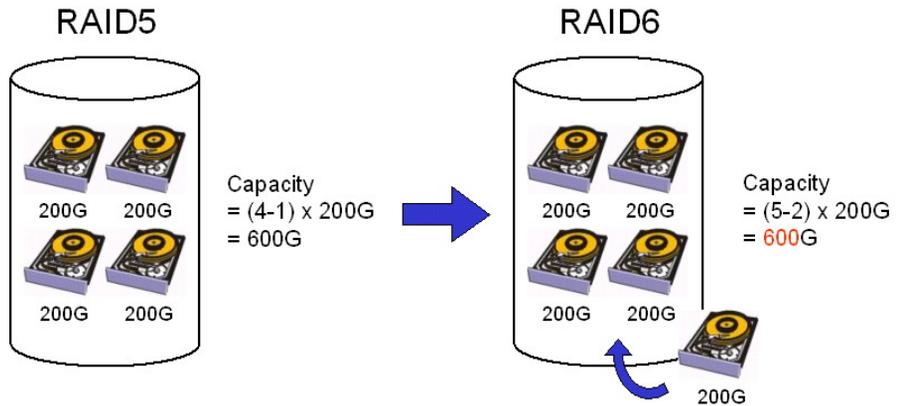


**Migration not allowed!**

**Figure 4 - 17: Migration Not Allowed for Insufficient Capacity**

2. Migration by adding drive(s):

The additional capacity for composing a RAID6 array is acquired by adding a new member drive.

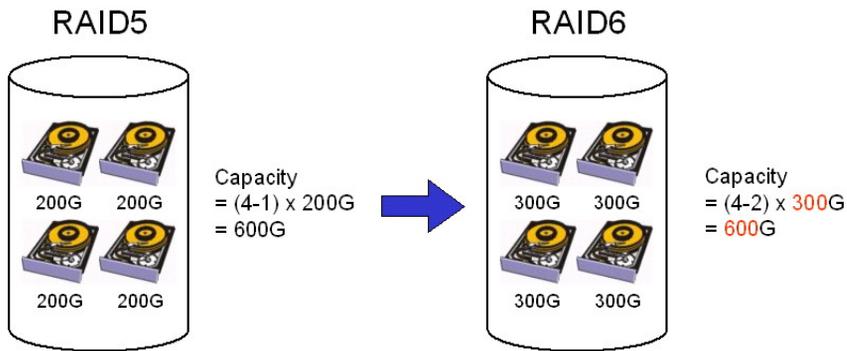


**Migration condition met by adding drive(s)!**

**Figure 4- 18: Migration Condition Met by Adding Drive(s)**

3. Migration by copy and replace:

The additional capacity for composing a RAID6 array is acquired by using larger drives as members of the array.



**Migration condition met by using larger drive(s)!**

**Figure 4 - 19: Migration Condition Met by Using Larger Drives**

### 4.5.3 Migration: Exemplary Procedure

To migrate a RAID5 array to RAID6, follow the steps below:

From the “View and Edit Logical Drives” status screen, select an existing RAID5 array and press [ENTER]. A sub-menu will appear. Move your cursor bar to select *Migrate Logical Drive*.

```
Thu Jul 21 17:41:00 2005 Cache Status: Clean
BAT:+++++
```

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
P0	6E5863A9	NA	RAID5	1800	GOOD					7	B	4	0	0

```

view drives
Delete logical drive
Partition logical drive
logical drive Name
logical drive assignmentS
Expand logical drive
Migrate logical drive
add drives
reGenerate parity
cOpy and replace drive
Media scan
write policy

```

```

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

```

**Figure 4 - 20: Migrate Logical Drive Sub-menu**

A confirm box should appear. Select *Yes* to proceed.

```

view drives
Delete logical drive
Partition logical drive
logical drive Name
logical drive assignmentS
Expand logical drive
Migrate logical drive

```

```

a
r
c
M Migrate this logical drive?
w Yes No

```

### Figure 4 - 21: Confirm Box

A selection box should prompt allowing you to choose a RAID level to migrate to. Press [ENTER] on RAID6.

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	RAID 5	RAID 6	#FL
P0	6E5863A9	NA	RAID5	1800	GOOD				7			0

### Figure 4 - 22: RAID Level Selection Box

A list of member drives and unused disk drives (new or used drives) should prompt. In the case of migrating a 3-drive RAID5 to 4-drive RAID6, you can select the original members of the RAID5 array and select one more disk drive to meet the minimum requirements of RAID6. You may also select different disk drives for composing the new RAID6 array.

ID	LV	RAID	Size(MB)	Status	1	2	3	0	RAID 5	RAID 6	#FL

Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
* 13	239367	150MB	0	ON-LINE	HITACHI HDS722525VLSA80
* 14	238469	150MB	0	ON-LINE	HITACHI HDS722525VLSA80
* 15	238469	150MB	0	ON-LINE	HITACHI HDS722525VLSA80
* 16	238469	150MB	0	ON-LINE	HITACHI HDS722525VLSA80

### Figure 4 - 23: Member Drives and Unused Drives List

Press [ESC] to proceed to the next configuration screen. A sub-menu should prompt.

You may either change the maximum capacity to be included in the new RAID6 array or change the array stripe size.

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
P0	6E5863A9	NA	RAID5	1800	GOOD				7	B	4	0	0	

Maximum Drive Capacity :	238214MB
Stripe Size:	Default (128K Bytes)

### Figure 4 - 24: Drives Configuration Screen

A confirm box should prompt. Check the configuration details and select Yes to start the migration process.

Raid Level	: RAID 6
Online Drives	: 4
Maximum Drive Capacity	: 2000 MB
Disk Reserved Space	: 256 MB
Spare Drives	: 0
Logical Drive Assignment:	Primary Controller
Stripe Size	: Default (128K Bytes)
Migrate Logical Drive ?	
Yes	No

## Figure 4 - 25: Confirm Box

A message should prompt indicating the migration process has started.

```
Off-Line Initializing Notification
lg:0 Logical Drive NOTICE: Starting Add Drive Operation
```

Press [ESC] to clear the message. The initialization progress is shown below.

```
Off-Line Initializing
---
7% Completed
```

Since the migration includes adding a new member drive, the completion of RAID migration is indicated as follows:

```
Notification
lg:0 Logical Drive NOTICE: Add Drive to Logical Drive Completed
```

Once the migration is completed, associate the RAID6 array with the ID/LUN number originally associated with the previous RAID5 array. Please refer to *Section 4.8 Mapping a Logical Volume to Host LUNs* for more information.

## 4.6 Creating a Logical Volume

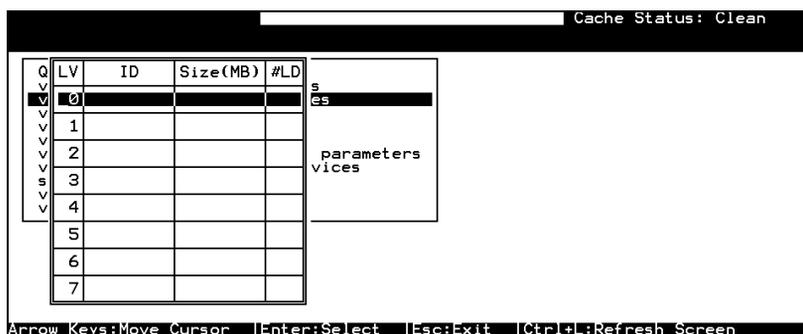
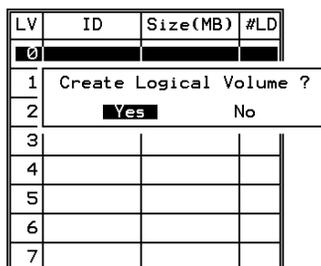


Figure 4 - 26: View and Edit Logical Volumes Screen



A logical volume consists of one or several logical drives. Choose *View and Edit Logical Volumes* in the Main Menu to display the current logical volume configuration and status on the screen. Choose a logical volume number (0-7) that has not yet been defined, then press [ENTER] to proceed. A prompt “Create Logical Volume?” will appear. Select *Yes* and press [ENTER].

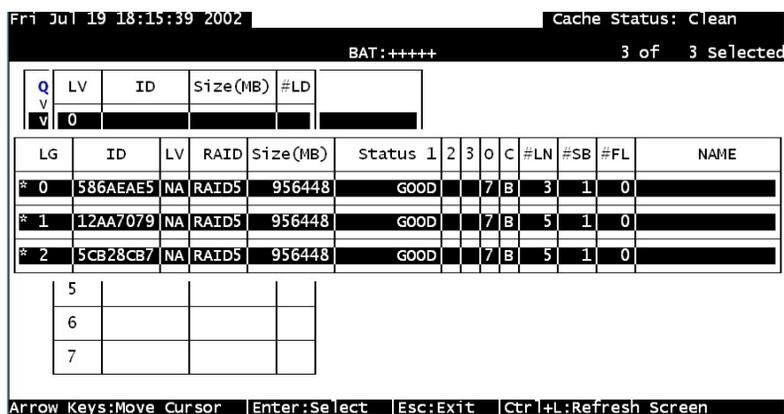


Figure 4 - 27: Select Logical Drive Page

Select one or more logical drive(s) available on the list. The same as creating a logical drive, the logical drive(s) can be tagged for inclusion by positioning the cursor bar on the desired drive and pressing [ENTER] to select. An asterisk (\*) will appear on the selected logical drive. Pressing [ENTER] again will deselect a logical drive.

Q	LV	ID	Size(MB)	#LD	
v	0				
v	1				
v	2				
v	3				
s	4				
v	5				
v	6				
v	7				

1 Initialization Mode - On-Line  
 2 Write Policy - Default  
 Logical Volume Assignment - Primary

**Figure 4 - 28: Selection Sub-menu**

Use the arrow keys to select a sub-menu and change the initialization mode, write policy, or the managing controller.

Logical volumes can be assigned to different controllers (primary or secondary). The default is primary.

Logical Drive Count	: 2
Logical Volume Assignment	: Primary Controller
Write Policy	: Write-Through
Initial Mode	: On-Line
Create Logical Volume ?	
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No

**Figure 4 - 29: Confirm Box**

Note that if a logical volume is manually assigned to a specific controller, all its members' assignments will also be shifted to that controller.

When all the member logical drives have been selected, press [ESC] to continue. The confirm box displays. Choose *Yes* to create the logical volume.

Q	LV	ID	Size(MB)	#LD	
v	0	2D99C36B	59956	2	
v	1				
v	2				
v	3				
s	4				
v	5				
v	6				
v	7				

1 View logical drive  
 2 Delete logical volume  
 3 Partition logical volume  
 Logical volume Assignments  
 4 Expand logical volume  
 Write Policy  
 add Logical drive

**Figure 4 - 30: View Logical Drive Selection Box**

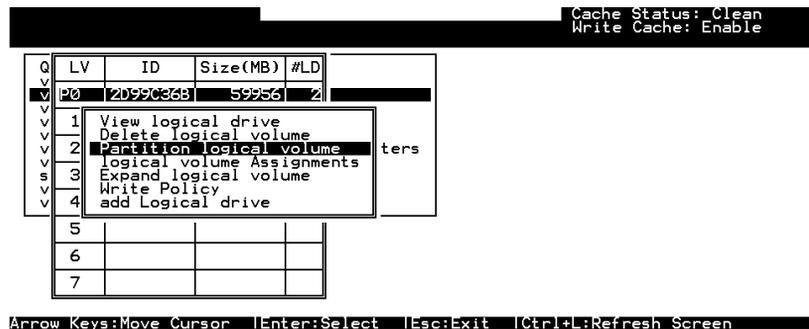
Press [ENTER] on a configured volume, and the information of the created logical volume displays.

- LV:** Logical Volume ID
- ID:** Unique ID for the logical volume, randomly generated by the RAID controller firmware
- Size:** Capacity of this volume
- #LD:** Number of the included members

## 4.7 Partitioning a Logical Drive/Logical Volume

The process of partitioning a logical drive is the same as that of partitioning a logical volume. The partitioning of a logical volume is used as an example in the preceding discussion.

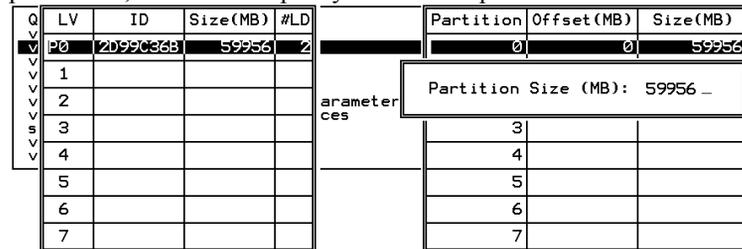
Note that partitioning can be very useful when dealing with a very large capacity; however, partitioning a logical drive or logical volume is not a requirement for RAID configuration.



**Figure 4 - 31: Partition Logical Volume Page**

Choose the logical volume you wish to partition, then press [ENTER]. Choose *Partition logical volume*, then press [ENTER]. Select from the list of undefined partitions and press [ENTER].

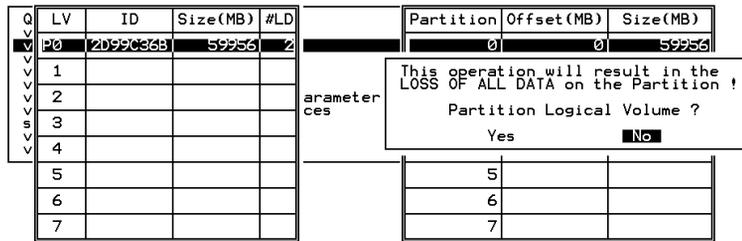
A list of partitions displays. If the logical volume has not yet been partitioned, all volume capacity will list as “partition 0.”



**Figure 4 - 32: Partition List**

Press [ENTER] and type the desired size for the selected partition, and then press [ENTER] to proceed. The remaining size will be automatically allotted to the next partition.

When prompted by the “Partition Logical Volume?” message, choose *Yes* to confirm then press [ENTER]. Follow the same procedure to partition the remaining capacity of your logical volume.



**Figure 4 - 33: Confirm Box**

When a partition of a logical drive/logical volume is deleted, the capacity of the deleted partition will be added to the previous partition.

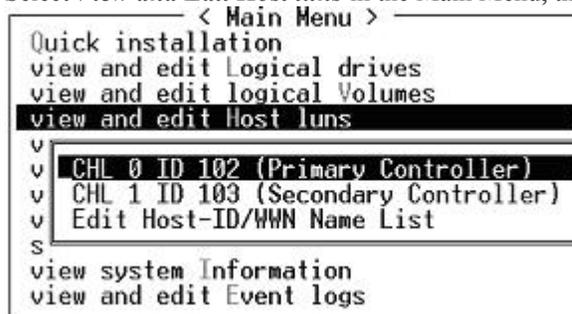


**WARNING!**

- *Whenever a partition is changed, it is necessary to reconfigure all host LUN mappings. All data in it will be lost and all host LUN mappings will be removed when there is any change to the partition capacity.*
- *If operating in a Unix-based system, reset the subsystem for the configuration changes to take effect if any changes were made to partition sizes and partition arrangement.*

## 4.8 Mapping a Logical Volume to Host LUNs

Select *View and Edit Host luns* in the Main Menu, then press [ENTER].

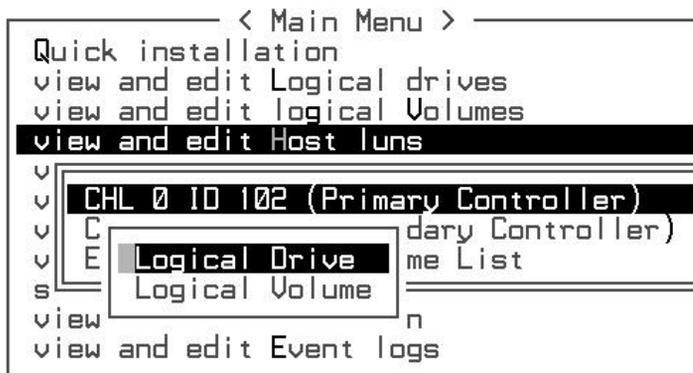


**Figure 4 - 34: View and Edit Host LUNs Screen**

A list of host channel/ID combinations appears on the screen. The diagram above shows two host channels and each is designated with a default ID. More can be added on each channel.

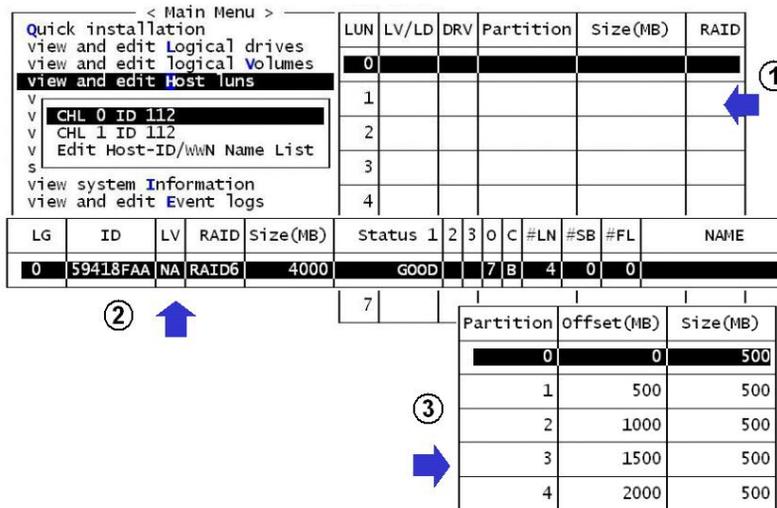
Multiple IDs on host channels are necessary for redundant controller configuration (refer to Chapter. 15 redundant Controller Configuration).

Details on creating multiple IDs and changing channel modes will be discussed later. Choose a host ID by pressing [ENTER].



**Figure 4 - 35: Host Channel/ID List**

Choose the channel-ID combination you wish to map, then press [ENTER] to proceed. Choose mapping a *Logical Drive* or a *Logical Volume* on the drop box.



**Figure 4 - 36: Mapping Result Page**

1. A list of LUN entries and their respective mappings will display. To map a host LUN to a logical volume's partition, select an available LUN entry (one not mapped yet) by moving the cursor bar to the LUN, then press [ENTER].
2. A list of available logical volumes displays. Move the cursor bar to the desired logical unit, then press [ENTER].
3. A list of available partitions will prompt. Move the cursor bar to the desired partition, then press [ENTER]. If you have not partitioned the logical volume, the whole capacity will be displayed as one logical partition.

- When prompted to "Map Host LUN," press [ENTER] to proceed.



- When prompted to "Map Logical Volume?," select *Yes* to continue.

A prompt will display the mapping you wish to create. Choose *Yes* to confirm the LUN mapping you selected.

LUN	LV/LD	DRV	Partition	Size(MB)	RAID
0					
Map Logical Volume: 0 To Partition : 0 Channel : 0 ID : 0 Lun : 0 ? <input checked="" type="checkbox"/> Yes      No					
5					
6					
7					

The detail in the confirm box reads: partition 0 of logical volume 0 will map to LUN 0 of ID 0 on host channel 0.

Continue to map other partitions to host LUNs.

Once any host ID/LUN is successfully associated with a logical capacity, the "No Host LUN" message in the LCD screen will change to "Ready."

If your controller has not been configured with a host channel and assigned an ID.

Please proceed to *Section 4.13* .

## 4.9 Assigning a Spare Drive and Rebuild Settings

### 4.9.1 Adding Local Spare Drive

A spare drive is a standby drive automatically initiated by controller firmware to replace a failed drive. A spare drive must have an equal or larger capacity than the array members. A Local Spare should have a capacity equal to or larger than the members of the logical drive it is assigned to. A Global Spare should have a capacity equal to or larger than all physical drives in a RAID subsystem.

Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
3	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
4	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
View drive information add local spare drive add Global spare drive drive Utilities disk Reserved space - unformatted					tor 7Y250M0
8	239367	150MB	NONE	NEW DRV	Maxtor 7Y250M0
9	239367	150MB	1	ON-LINE	Maxtor 7Y250M0
10	239367	150MB	1	ON-LINE	Maxtor 7Y250M0

### Figure 4 - 37: Add Local Spare Drive Page

Choose *View and Edit Drives* on the Main Menu, then press [ENTER]. Move the cursor bar to a drive that is not assigned to a logical drive or as a spare drive (usually indicated as a "New Drive"), and then press [ENTER].

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
P0	586AEAE5	NA	RAID5	956448	GOOD				7	B	5	1	0	
P1	12AA7079	NA	RAID5	956448	GOOD				7	B	5	1	0	
P2	5CB28CB7	NA	RAID5	956448	GOOD				7	B	5	1	0	

### Figure 4 - 38: Logical Drives List

Choose *Add Local Spare Drive* and press [ENTER]. A list of logical drives displays.

Move the cursor bar to a logical drive, then press [ENTER]. The unassigned disk drive will be associated with this logical drive as a Local Spare.

Add Local Spare Drive ?	
<b>Yes</b>	No

### Figure 4 - 39: Confirming Adding Local Spare Drive

When prompted to “Add Local Spare Drive?,” choose *Yes* to confirm.

## 4.9.2 Adding a Global Spare Drive

A Global Spare replaces the failed drive in any logical drive of a RAID subsystem.

Quic	Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
view	3	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
view	4	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
view	View drive information					tor 7Y250M0
view	add Local spare drive					tor 7Y250M0
view	add Global spare drive					tor 7Y250M0
view	Add Global Spare Drive ?					tted tor 7Y250M0
view	8	Yes			No	RV Maxtor 7Y250M0
	9	239367	150MB	1	ON-LINE	Maxtor 7Y250M0
	10	239367	150MB	1	ON-LINE	Maxtor 7Y250M0

### Figure 4 - 40: Add Global Spare Drive Page

Move the cursor bar to the drive that is not a member drive or a spare (usually indicated as a "New Drive"), and then press [ENTER]. Choose

*Add Global Spare Drive.* When prompted to “Add Global Spare Drive?,” choose *Yes*.

## 4.10 Viewing and Editing Logical Drives and Drive Members

Choose *View and Edit Logical Drives* in the Main Menu to display the array status. Refer to the previous chapter for more details on the legends used in the Logical Drive’s status. To see the drive member information, choose the logical drive by pressing [ENTER].

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
0	12E37A22	NA	RAID6	476428	GOOD				7	B	4	0	0	
				428	GOOD				7	B	4	0	0	
				642	GOOD				7	B	4	0	0	
7			NONE											

Arrow Keys: Move Cursor |Enter: Select |Esc: Exit |Ctrl+L: Refresh Screen

**Figure 4 - 41: View and Edit Logical Drives Page**

The disk drive-related functions include:

Selections	Function
1. View Drive	Display drive member information
2. Delete Logical Drive	To delete a logical drive
3. Partition Logical Drive	To delete a partition of a logical drive
4. Logical Drive Name	Assign a name to a logical drive
5. Logical Drive Assignments	Assign LD to Primary or Secondary controller
6. Rebuild Logical Drive	Rebuild a logical drive when a drive failed
7. Expand Logical Drive	To expand the size of a logical drive
8. Migrate Logical Drive	To migrate a logical drive to different RAID level
9. Add Drives	Add physical drive to a logical drive
10. Regenerate Parity	Regenerate logical drive parity
11. Copy and Replace Drive	Copy or replace a logical drive

12. Media Scan	Set media scan priority, iteration count and task schedules
13. Write Policy	Choose an appropriate write policy

### 4.10.1 Deleting a Logical Drive

Choose the logical drive you wish to delete, then press [ENTER]. Choose *Delete logical drive*, then choose **Yes** when prompted to confirm.

Wed Aug 10 13:49:24 2005 Cache Status: Clean

BAT:++++

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME	
0	59418FAA	NA	RAID6	478734	GOOD						7	B	4	0	0

view drives

Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
1	239367	133MB	0	ON-LINE	Maxtor 7Y250M0
2	239367	133MB	0	ON-LINE	Maxtor 7Y250M0
3	239367	133MB	0	ON-LINE	Seagate ST380023AS
4	239367	150MB	0	ON-LINE	WDC WD2500JD-00FYB0
7			NONE		

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

Figure 4 - 42: Delete Logical Drive Page

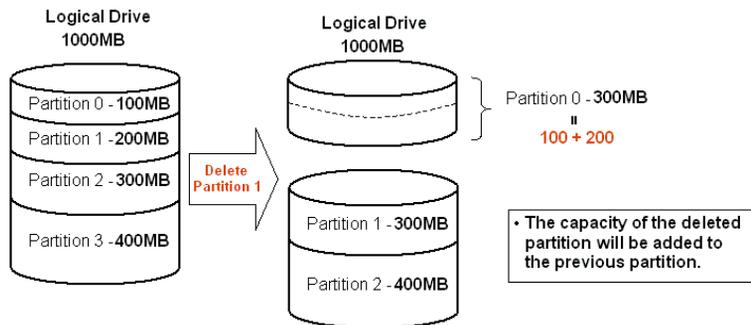
### 4.10.2 Deleting a Partition of a Logical Drive

Q	LG	ID	LV	RAID	Size(MB)	Partition	Offset(MB)	Size(MB)	NAME
Q	P0	4149A729	NA	RAID5	39	0	0	3999	
v	P1	76CD4DF6	NA	RAID0	119	1	3999	3999	
v	2			NONE					
v	3			NONE					
v	4			NONE		4	15999	3999	
v	5			NONE		5			
v	6			NONE		6			
v	7			NONE		7			

Partition Size (MB): 0

Figure 4 - 43: Delete Partition Page

Choose the logical drive which has a partition you wish to delete, then press [ENTER]. Choose *Partition logical drive*. Partitions of the logical drive will be displayed in tabulated form. Move the cursor bar to the partition you wish to delete, then press [ENTER]. Enter "0" on the partition size to delete the partition.



**Figure 4-44: Drive Space Allocated to the Previous Partition**

As illustrated above, the capacity of the deleted partition will be added to the previous partition.



**WARNING!**

*Whenever a partition is changed, it is necessary to reconfigure all host LUN mappings. All data kept in the partition and the host LUN mappings will be removed with any partition change.*

### 4.10.3 Assigning a Name to a Logical Drive

Naming can help identify different arrays in a multi-array configuration. This function is also useful in special situations. For example, when one or more logical drives have been deleted, the array indexing is changed after system reboot. The second logical drive might become the first on the list.

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
P0	477F9A83	0	RAIDS	9999	GOOD					S	3	0	0	
P	View scsi drives			999	GOOD					S	2	-	0	
P	Delete logical drive			999	GOOD					S	2	-	0	
	Partition logical drive													
	Logical drive Name													
	<div style="border: 1px solid black; padding: 5px;">           Current Logical Drive Name: _____            New Logical Drive Name: _         </div>													
7			NONE											

**Figure 4 - 45: Name a Logical Drive Page**

Choose the logical drive for which you wish to assign a name, then press [ENTER]. Choose *logical drive name*, then press [ENTER] again. The current name will be displayed. You may now enter a new name in this field. Enter a name, then press [ENTER] to save the configuration. The maximum number of characters for a logical drive name is 14.

### 4.10.4 Rebuilding a Logical Drive

If there is no spare drive in the system, a failed drive should be immediately replaced by a drive known to be good. Once the failed drive is replaced, the rebuild process can be manually initiated.





Wed Sep 7 15:13:06 2005											Cache Status: Clean			
BAT: NONE											0 of 4 Selected			
LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
0	12E37A22	NA	RAID6	476428	DRV FAILED					7 B	3	1	1	
1	281DFB99	NA	RAID6	476428	GOOD					7 B	4	1	0	
view drives				642	GOOD					7 B	4	1	0	
Dele				Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID					
Part				3	238469	150MB	NONE	USED DRV	WDC WD2500SD-01KCB0					
logi				14	238469	150MB	NONE	NEW DRV	WDC WD2500SD-01KCB0					
Expa				15	238469	150MB	NONE	NEW DRV	WDC WD2500SD-01KCC0					
migr				16	238469	150MB	NONE	NEW DRV	WDC WD2500SD-01KCB0					
add														
reGe														
cOpy														
Medi														
writ														

Figure 4 - 48: Add Drive Screen

### 4.10.8 Regenerating Logical Drive Parity

(Applies to RAID Levels 1, 3, 5, and 6)

If no verifying method is applied to data writes, this function can often be performed to verify parity blocks of a selected array. This function compares and recalculates parity data to correct parity errors.

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
P0	4295529B	NA	RAID5	476000	GOOD					4 B	3	0	0	
Execute Regenerate Logical Drive Parity														
Overwrite Inconsistent Parity - Enabled														
Generate Check Parity Error Event - Enabled														
3			NONE											
4			NONE											
5			NONE											
6			NONE											
7			NONE											

Figure 4 - 49: Confirm Box

Choose the logical drive that you want to regenerate the parity for, and then press [ENTER]. Choose **Regenerate Parity**, then press [ENTER]. When prompted to “Regenerate Parity?,” select **Yes**.

Please refer to *Chapter 11 Data Integrity* for more information on parity regeneration.

### 4.10.9 Media Scan

Media Scan examines drives and detects the presence of bad blocks. If any data blocks have not been properly committed and are found during the scanning process, data from those blocks are automatically recalculated, retrieved and stored onto undamaged sectors. If bad blocks are encountered on yet another drive during the rebuild process, the block LBA (Logical Block Address) of those bad blocks will be shown. If rebuild is carried out

under this situation, rebuild will continue with the unaffected sectors, salvaging the majority of the stored data.

Thu Jun 16 18:31:36 2005											Cache Status: Clean										
BAT:++++																					
LG	ID	LU	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME							
P0	6E448ADE	NA	NRAID	238214	GOOD						7	B	1	-	0						
Media Scan Priority - Normal																					
Iteration Count - Single Time																					
Task Scheduler																					
3			NONE																		
4			NONE																		
5			NONE																		
6			NONE																		
7			NONE																		

Arrow Keys:Move Cursor !Enter:Select !Esc:Exit !Ctrl+L:Refresh Screen

**Figure 4 - 50: Media Scan Screen**

There are two options with performing the Media Scan:

1. **Media Scan Priority:** determines how much of the system resources will be used for the drive scanning and recalculating process.
2. **Iteration Count:** determines how many times the scan is performed. If set to “continuous,” the scan will run in the background continuously until it is stopped by a user.

Media Scan Priority - Normal
Iteration Count - Single Time
Set Media Scan Iteration Count to Continuous Scan ?
<input checked="" type="radio"/> Yes <input type="radio"/> No

The system can automatically perform a Media Scan according to a preset task schedule. For more details, please refer to *Chapter 11 Data Integrity*.

#### 4.10.10 Write Policy

```

view drives
Delete logical drive
Partition logical drive
logical drive Name
Expand logical drive
M
a
r
c
M
write policy

```

Change Write Policy ?		
<input checked="" type="radio"/> Default	<input type="radio"/> Write-Back	<input type="radio"/> Write-Through

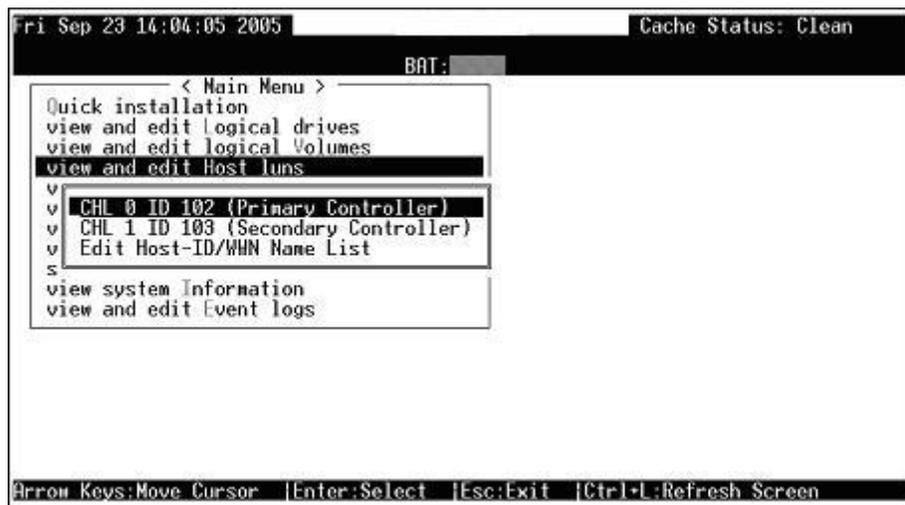
**Figure 4 - 51: Write Policy Screen**

The Write-back cache setting can be configured differently on each array. Setting to the default value means the array setting is coordinated with the controller’s general setting. The controller’s general setting option can be found in “View and Edit Configuration Parameters” -> “Caching Parameters” -> “Write-Back Cache.” Note that cached writes are lost if a power failure occurs.

## 4.11 Viewing and Editing Host LUNs

### 4.11.1 Viewing or Deleting LUN Mappings

Choose the host channel and host ID combination you wish to view or delete.



**Figure 4 - 52: View and Edit Host Luns Page**

A list of the current LUN mapping will be displayed on the screen. Move the cursor bar to the LUN mapping you wish to delete, then press [ENTER]. Select *Yes* to delete the LUN mapping, or *No* to cancel.

### 4.11.2 Edit Host ID/WWN Name List

This is a specific item used for systems communicating over Fibre host loops. Please refer to *Chapter 8 Fibre Operation* for more details.

## 4.12 Viewing and Editing Drives

Sat Jul 20 12:42:35 2002 Cache Status: Clean

BAT:++++

Quic view view view view view view syst view view	Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
	1	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
	2	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
	3	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
	4	239367	150MB	GLOBAL	STAND-BY	Maxtor 7Y250M0
	5	239367	150MB	NONE	FRMT DRV	Maxtor 7Y250M0
	6	239367	150MB	1	ON-LINE	Maxtor 7Y250M0
	7	239367	150MB	1	ON-LINE	Maxtor 7Y250M0
	8	239367	150MB	NONE	NEW DRV	Maxtor 7Y250M0

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 4 - 53: View and Edit Drives Main Menu**

Choose *View and Edit Drives* in the Main Menu. All drives attached to the drive channels will be displayed on the screen.

Press [ENTER] on a selected drive to view a sub-menu featuring functions related to the individual hard drive.

Thu Sep 8 08:31:10 2005 Cache Status: Clean

BAT:NONE

Quic view view view view view view syst view view	Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
	1	238469	150MB	1	ON-LINE	WDC WD2500SD-01KCB0
	View drive information					WDC WD2500SD-01KCB0
	Identify drive					WDC WD2500SD-01KCB0
	clone Failing drive					WDC WD2500SD-01KCB0
	disk Reserved space - 256 mb					WDC WD2500SD-01KCB0
	media error reAssign count - 0					WDC WD2500SD-01KCB0
	5	238469	150MB	1	ON-LINE	WDC WD2500SD-01KCB0
	6	238469	150MB	1	ON-LINE	WDC WD2500SD-01KCB0
	7	238469	150MB	NONE	FRMT DRV	WDC WD2500SD-01KCC0
	8	238469	150MB	NONE	FRMT DRV	WDC WD2500SD-01KCB0

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 4 - 54: View Drive Information Sub-menu**

The disk drive-related functions include:

Function	Availability
1. View Drive Information	Every drive type
2. Identify Drives	Every drive type

3. Clone Failing Drive	Members of logical drives
4. Delete Global/Local Spare Drive	Global/Local Spare drive
5. Add Global/Local Spare Drive	Non-configured drives
6. Media Scan	Non-configured drives; Media Scan on drive members can be found in View and Edit Logical Drives
7. Drive Utilities: Read/Write Test	New drives
8. Disk Reserved Space	View only on member drives, reserved space removable on the used or formatted drives
9. Media Error Reassign Count	View the number of media error encountered on each drive

Using Media Scan is described in the previous *Section 7.10*. Details on the use of Clone Failing Drive can be found in *Chapter 13*. The Drive Utilities function is discussed in the last section of this chapter.

### 4.12.1 Deleting Spare Drive (Global / Local Spare Drive)

Move the cursor to a Local Spare Drive or Global Spare Drive, then press [ENTER]. Choose *Delete Global/Local Spare Drive*, then press [ENTER] again. Choose *Yes* to confirm.

Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
1	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
2	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
3	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
4	239367	150MB	GLOBAL	STAND-BY	Maxtor 7Y250M0
					xtor 7Y250M0
					xtor 7Y250M0
					xtor 7Y250M0
8				EW DRV	Maxtor 7Y250M0

View drive information	
Delete global/local spare drive	
Delete Spare Drive ?	mb
Yes	<b>NO</b>

**Figure 4 - 55: Delete Global/Local Spare Drive Page**



**NOTE:**

*The spare drive you deleted or any drive you replaced from a logical unit will be indicated as a "used drive."*

### 4.12.2 Disk Reserved Space

The 256MB of reserved space can be removed from a drive once the drive is excluded from a logical drive. The reserved space, a space formatted

with a micro-file system, can also be manually created from a new disk drive.

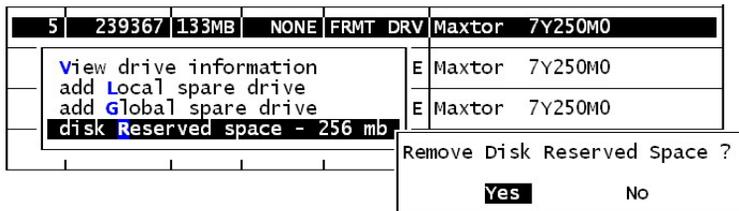


Figure 4 - 56: Remove Disk Reserved Space Screen

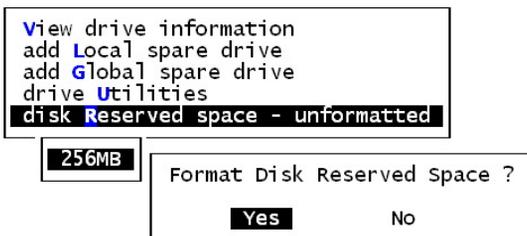


Figure 4 - 57: Format Disk Reserved Space Screen

### 4.12.3 Identifying Drives

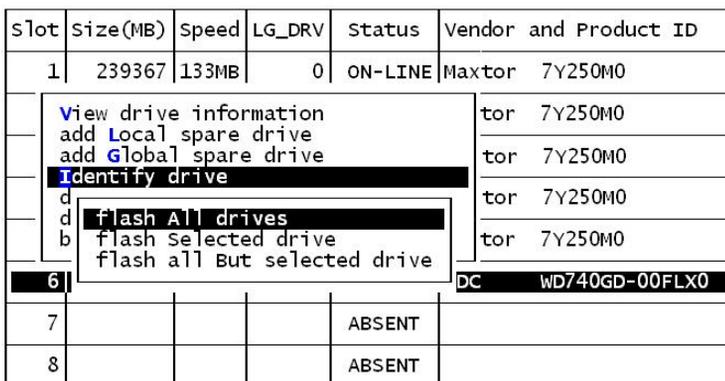


Figure 4 - 58: Identify Drive Page

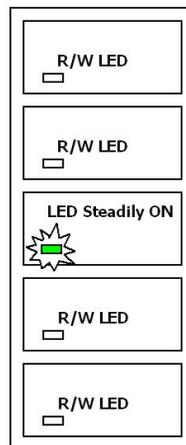
Whenever there is a failed drive in a logical drive, make it a point to replace the failed drive with a new, healthy drive to keep the logical drive working.

If you replaced the wrong drive when trying to replace a failed drive you will no longer be able to access the logical drive because you have inadvertently failed another drive.

To prevent this from happening, the controller provides an easy way to identify the faulty drive. By forcing certain drive LEDs to light for a configurable period of time, the faulty drive can be identified, and thus reduce the chance of removing the wrong drive. This function can be especially helpful in an installation site operating with hundreds of drives.

#### 4.12.3.1 Flash Selected Drive

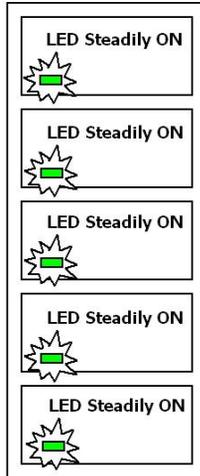
The Read/Write LED of the drive you selected will light steadily for a configurable period of time, from 1 to 999 seconds.



**Figure 4 – 59: Flash Selected Drive**

#### 4.12.3.2 Flash All Drives

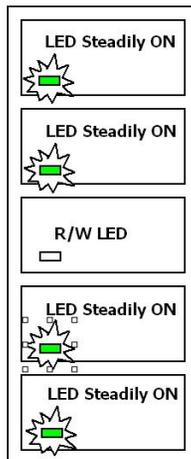
The Read/Write LEDs of all connected drives will light for a configurable period of time. If the LED of the defective drive did not light on the “Flash Selected Drive” function, use “Flash All Drives” to verify the fault. If the “Flash All Drives” function is executed, and the defective drive’s LED still does not respond, it can be a drive tray problem or the drive is dead.



**Figure 4 – 60: Flash All Drives**

#### 4.12.3.3 Flash All but Selected Drives

Except the selected drive, the Read/Write LEDs of all connected drives will light for a configurable period of time ranging from 1 to 999 seconds. If an administrator cannot be sure of the exact location of a specific drive, this function will help to indicate where it is. This can prevent removal of the wrong drive when a drive fails and is about to be replaced.



**Figure 4 – 61: Flash All but Selected Drives**

The drive-identifying function can be selected from “Main Menu”/“View and Edit Drives”/“Identify Drives.”

## 4.13 System Functions

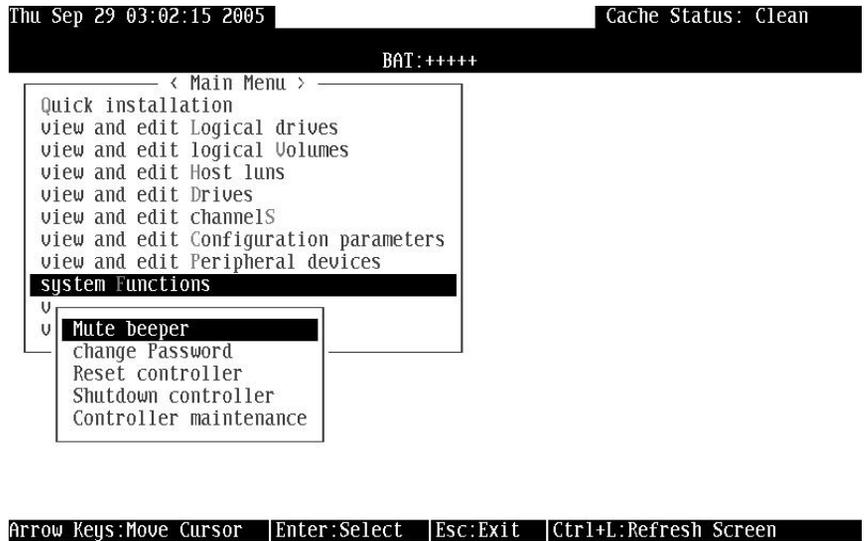


Figure 4 - 62: System Functions Page

Choose *System Functions* in the Main Menu, then press [ENTER] to display the System Functions menu. Move the cursor bar to an item, then press [ENTER].

### 4.13.1 Mute Beeper

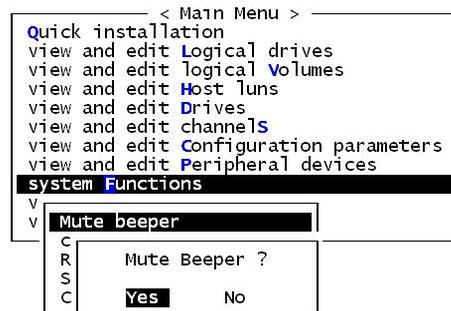


Figure 4 - 63: Mute Beeper Screen

When the subsystem’s beeper (onboard alarm) has been activated, choose *Mute Beeper,*” then press [ENTER]. Choose *Yes* and press [ENTER] in the next dialog box to turn the beeper off temporarily for the current event. The beeper will still be activated by the next event.

## 7.13.2 Change Password

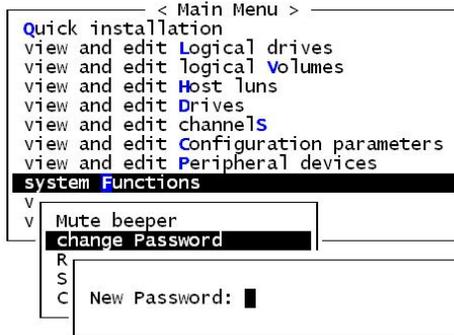


Figure 4 - 64: Change Password Screen

Use the subsystem's password to protect the array from unauthorized entry. Once the subsystem password has been set, regardless of whether the front panel, the RS-232C terminal interface or RAIDWatch Manager is used, you can only access the subsystem by providing the correct password.



### IMPORTANT!

- *The controller verifies the password when entering the Main Menu from the initial screen or when making a configuration change. If the controller is going to be left unattended, the "Password Validation Timeout" can be set to "Always Check." Setting the validation timeout to "Always Check" will protect the controller configuration from any unauthorized access.*
- *The controller password and controller name share a 16-character space. The maximum numbers of characters for the controller password is 32. If the controller name occupies 32 characters, there is only one character left for the controller password, and vice versa.*

## 4.13.3 Changing the Password

To set or change the controller password, move the cursor bar to **Change Password**, then press [ENTER].

If a password has previously been set, the controller will ask for the old password first. If the password has not yet been set, the controller will directly ask for the new password. The password cannot be replaced unless the correct old password is provided.

Key-in the old password, then press [ENTER]. If the password is incorrect, it will not allow you to change the password. Instead, it will display the message "Password incorrect!," then go back to the previous menu.

If the password is correct, or there is no preset password, it will ask for the new password.

#### 4.13.4 Setting a New Password

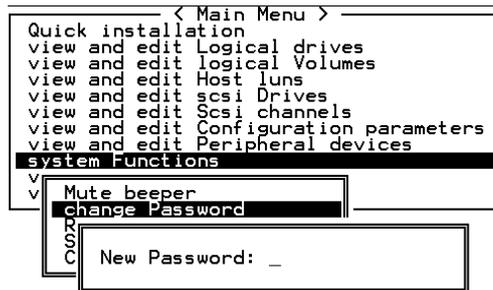


Figure 4 - 65: Set New Password Screen

Enter the desired password in the column, then press [ENTER]. The next dialog box will display “Re-Enter Password.” Enter the password again to confirm and press [ENTER].

The new password will now become the controller’s password. Providing the correct password is necessary when entering the Main Menu from the initial screen.

#### 4.13.5 Disabling the Password

To disable or delete the password, press [ENTER] in the empty column that is used for entering a new password. The existing password will be deleted. No password checking will occur when entering the Main Menu or when making a configuration change.

#### 4.13.6 Reset Controller

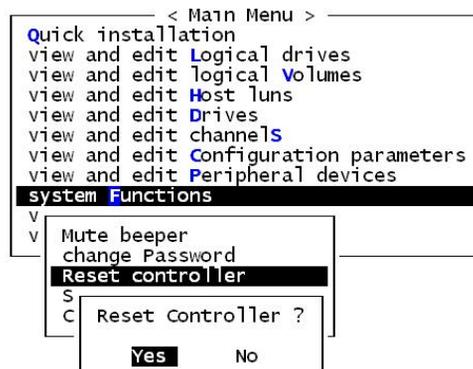


Figure 4 - 66: Reset Controller Screen

To reset the controller without powering off the system, move the cursor bar to **Reset Controller**, then press [ENTER]. Choose **Yes** in the dialog box that follows, then press [ENTER]. The controller will now reset as well as power off or re-power on.

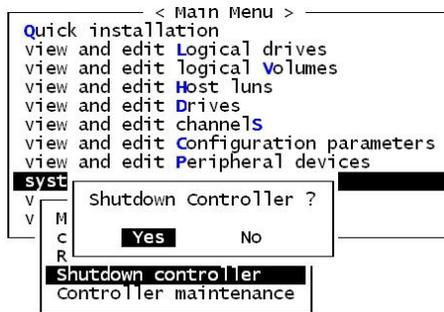


## NOTE:

*Before reset the controller you have to do the shutdown function to flush the cache contents in the memory*

### 4.13.7 Shutdown Controller

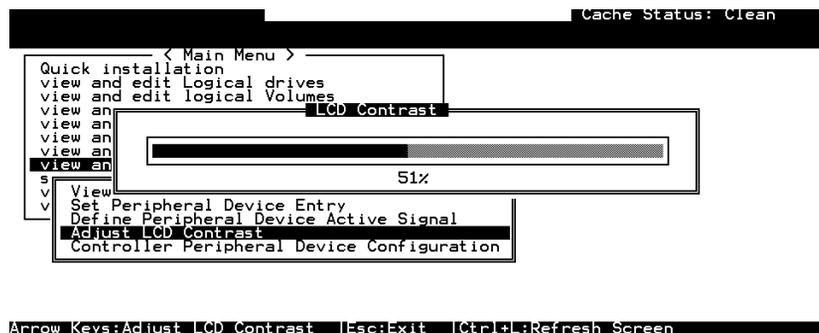
Before powering off the controller, unwritten data may still reside in cache memory. Use the “Shutdown Controller” function to flush the cache content. Move the cursor bar to **Shutdown Controller**, then press [ENTER]. Choose **Yes** in the dialog box that follows, then press [ENTER]. The controller will now flush the cache memory.



**Figure 4 - 67: Shutdown Controller Screen**

For Controller Maintenance functions, such as Download Firmware, please refer to *Appendix B*.

### 4.13.8 Adjust LCD Contrast

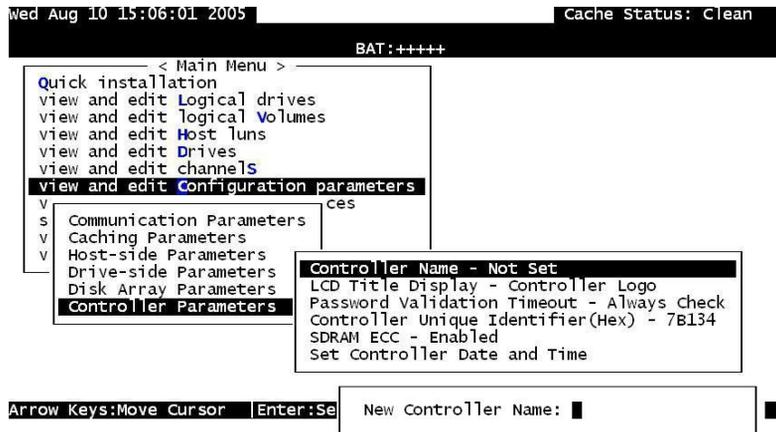


**Figure 4 - 68: Adjust LCD Contrast Page**

The controller LCD contrast is set at the factory to a level that should be generally acceptable. If changes are required, the controller is equipped with an LCD contrast adjustment circuit, allowing the contrast to be adjusted either via the RS-232 Terminal Emulation Menus or by the LCD User Interface.

## 4.14 Controller Parameters

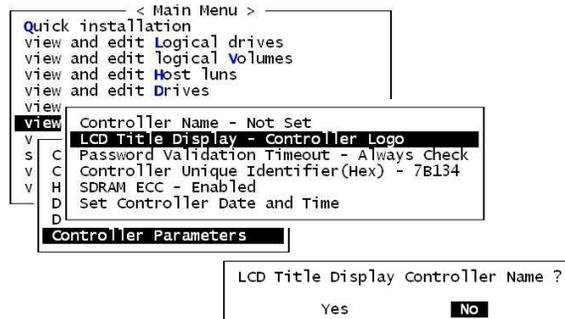
### 4.14.1 Controller Name



**Figure 4 - 69: View and Edit Configuration Parameters Page**

Choose *View and Edit Configuration Parameters, Controller Parameters*, then press [ENTER]. The current name displays. Press [ENTER]. Enter a name in the dialog box that prompts, then press [ENTER].

### 4.14.2 LCD Title Display - Controller Name



**Figure 4 - 70: Controller Parameters Screen**

Choose *View and Edit Configuration Parameters, Controller Parameters*, then press [ENTER]. Choose to display the embedded controller logo or any given name on the LCD. Giving a specific name to each controller will make them easier to identify if you have multiple RAID systems remotely monitored.

### 4.14.3 Saving NVRAM to Disks

You can choose to backup your controller-dependent configuration information to disks. We recommend using this function to save configuration information whenever a configuration change is made. The information will be duplicated and distributed to all logical configurations of drives.

At least a RAID configuration must exist for the controller to write your configuration data onto it.

From the Main Menu, choose *System Functions*. Use the arrow keys to scroll down and select *Controller Maintenance, Save NVRAM to Disks*, then press [ENTER].

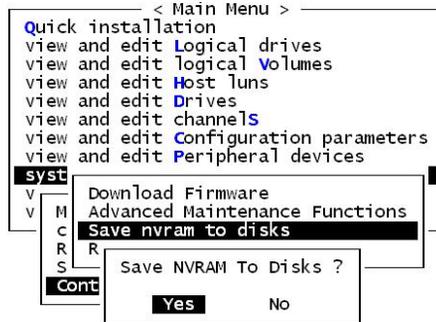


Figure 4 - 71: Save NVRAM to Disk Screen

Choose *Yes* to confirm.

A prompt will inform you that NVRAM information was successfully saved.

### 4.14.4 Restore NVRAM from Disks

Use this function to restore your NVRAM information that you previously saved onto disk.

From the Main Menu, choose *System Functions*. Use the arrow keys to scroll down and select *Controller Maintenance, Restore NVRAM from disks*, and then press [ENTER].

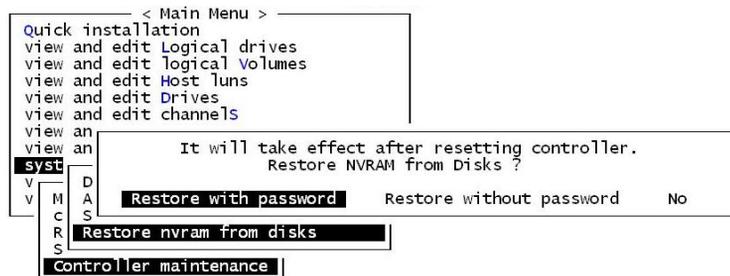


Figure 4 - 72: Restore NVRAM from Disks Screen

Press [ENTER] on one of the selections to confirm.

A prompt will notify you that the controller NVRAM data was successfully restored from disks.

#### 4.14.5 Password Validation Timeout



Figure 4 - 73: Password Validation Timeout Page

Choose *View and Edit Configuration Parameters, Controller Parameters*, then press [ENTER]. Select *Password Validation Timeout*, and press [ENTER]. Choose to enable a validation timeout from “1 minute” to “Always Check.” The Always Check timeout will disable any configuration change made without entering the correct password.

#### 4.14.6 Controller Unique Identifier



Figure 4 - 74: View and Edit Controller Unique Identifier

Enter any hex number between “0” and “FFFFF” for the unique identifier. The value you enter *MUST* be different for each controller.

Every EonStor subsystem comes with a default ID. This ID should be sufficient for avoiding WWNN and WWPN conflict.

Enter a unique ID for every RAID subsystem whether it is configured in a single or dual-controller configuration. The unique ID is necessary for the following:

1. A specific identifier helps RAID controllers to identify their counterpart in a dual-active configuration.
2. The unique ID is generated into a Fibre Channel WWN node name for RAID controllers or RAID subsystems using Fibre Channel host ports. The node name prevents host computers from misaddressing the storage system during the controller failover/failback process in the event of single controller failure.
3. MAC addresses for the controller's Ethernet port that will be taken over by a surviving controller in the event of single RAID controller failure.

When a controller fails and a replacement is combined as the secondary controller, the FC port node names and port names will be passed down to the replacement controller. The host will not acknowledge any differences so that controller failback is totally transparent.

The unique identifier setting can be accessed from "View and Edit Configuration Parameters" -> "Controller Parameters" -> "Controller Unique ID."

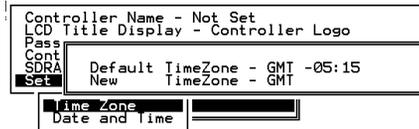
#### 4.14.7 Set Controller Date and Time

This sub-menu only appears when the controller is equipped with a real-time clock.

##### Time Zone

```
Thu Sep 29 01:18:01 2005                               Cache Status: Clean
                                                         BAT:+++++
< Main Menu >
Quick installation
view and edit Logical drives
view and edit logical Volumes
view and edit Host luns
view and edit Drives
view and edit channels
view
  v C Controller Name - Not Set
  s C LCD Title Display - Controller Logo
  v C Password Validation Timeout - Always Check
  v H Controller Unique Identifier(Hex) - 143
  D SDRAM ECC - Enabled
  D Set Controller Date and Time
  R
  Cont Time Zone
      Date and Time

Arrow Keys:Move Cursor  Enter:Select  Esc:Exit  Ctrl+L:Refresh Screen
```



**Figure 4 - 75: Set Controller Date and Time Page**

The controller uses GMT (Greenwich Mean Time), a 24-hour clock. To change the clock to your local time zone, enter the numbers of hours later than the Greenwich Mean Time after a plus (+) sign. For example, enter “+9” for Japan’s time zone.

### Date and Time



**Figure 4 - 76: Enter Date and Time Screen**

Enter time and date in its numeric representatives in the following order: month, day, hour, minute, and the year.

## 4.15 View Drive Information

Sat Jul 20 17:26:58 2002 Cache Status: Clean

BAT:++++

Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
1	239367	150MB	0	ON-LINE	Maxtor 7Y250M0
<b>View drive information</b>					
Revision Number					YAR511w0
Serial Number					Y65678ZE
Disk Capacity (blocks)					490225663
5	239367	150MB	NONE	NEW DRV	Maxtor 7Y250M0
6	239367	150MB	1	ON-LINE	Maxtor 7Y250M0
7	239367	150MB	1	ON-LINE	Maxtor 7Y250M0
8	239367	150MB	NONE	NEW DRV	Maxtor 7Y250M0

Esc:Exit | Ctrl+L:Refresh Screen

**Figure 4 - 77: View Drive Information Page**

From the “View and Edit Drives” menu, select the drive that the utility is to be performed on, then press [ENTER]. Select *View drive information*, then press [ENTER].

## 4.16 Drive Utilities

### 4.16.1 Drive Read/Write Test

From the “View and Edit Drives” menu, select a new or used drive that the utility is to be performed on, then press [ENTER]. Select **Drive Utilities**, then press [ENTER]. Choose **Read/Write Test** and press [ENTER]. You can choose to enable/disable the following options:

1. Execute Drive Testing
2. Abort When Error Occurs
3. Drive Test for - Read Only/Read and Write

Wed Aug 10 15:16:31 2005 Cache Status: Clean

BAT:++++

Quick view	Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
view		View drive information				tor 7Y250M0
view		add Local spare drive				tor 7Y250M0
view		add Global spare drive				tor 7Y250M0
view		Identify drive				gate ST380023AS
view		drive Utilities				gate ST380023AS
view		Read/Write Test				WD2500JD-00FYB0
sys	5	239367	133		Abort When Error Occurrence - Enabled	
view	6	239367	133		Drive Test for - Read Only	
view	7	239367	133MB	0	Execute Drive Testing	
view	8	239367	133MB	0	ON-LINE	Maxtor 7Y250M0

Figure 4 - 78: Drive Read/Write Test Page

When finished with the configuration, select **Execute Drive Testing** and press [ENTER] to proceed.

The Read/Write test progress will be indicated by a status bar.

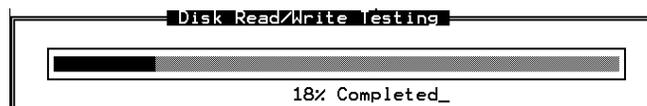


Figure 4 - 79: Disk Read/Write Testing Completion Percentage

You may press [ESC] and select "Read/Write Test" later and choose to "View Read/Write Testing Progress." If you want to stop testing the drive, select **Abort Drive Testing** and press [ENTER] to proceed.

	View Read/Write Testing Progress				
	Abort Drive Testing				
8	Read/Write Test	NE R/W TEST	Maxtor	7Y250M0	

Figure 4 - 80: View Read/Write Testing Progress Screen



## **IMPORTANT!**

*The disk drive on which a read/write test will be performed cannot be a spare drive (local or global) or a member of a logical drive. The "Read/Write Test" option will not appear if the drive is not indicated as a "New Drive" or a "Used Drive." Also, a drive formatted with a 256MB reserved space is also excluded from selection.*

---

# 4

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# **Fibre Host Channel Operation**

---

## **5.1 Overview**

This chapter describes the Fibre-specific functions available since firmware release 3.21 and above. Optional functions have been implemented for operations using Fibre Channel and access control under multiple-host environments such as Storage Area Network.



**NOTE:**

*All figures in this chapter are showing examples using the management hyper terminal screen.*

---

## **5.2 Fibre Channel Configuration: Host Parameters**

### **5.2.1 View and Edit Channels**

EonStor subsystems come with preset data paths and there is no need to modify channel configurations, e.g., channel mode.

Choose *View and Edit Channels* in the Main Menu to display channel status.

Fri Oct 7 11:27:24 2005 Cache Status: Clean  
i0:21% BAT:+++++ WT

Q	Ch1	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid
U	0	Host	102	NA	AUTO	Serial	F	NA	2 GHz	Serial
U	1	Host	NA	102	AUTO	Serial	F	NA		
U	2	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Serial
U	3(4)	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Serial
U	4(3)	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Serial
U	5	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Serial
U	6	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SATA
U	7	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SATA

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

Figure 5 - 1: View and Edit Channels Page



**IMPORTANT!**

*Most EonStor subsystems have preset host, drive, and RCC channels that cannot be changed. Therefore the channel mode option is not available.*

**5.2.2 View and Edit IDs - Host Channel**

Fri Oct 7 11:42:12 2005 Cache Status: Clean  
i0:91% BAT:+++++ WT

Q	Ch1	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid	ID
U	0	Host	102	NA	AUTO	Serial	F	NA	2 GHz	Ser	96
U	1	ID 102 (Primary Controller)				Serial	F	NA			97
U	2	Add Channel SCSI ID Delete Channel SCSI ID				Serial	A	NA	3 GHz	Ser	98
U	3(4)					Serial	A	NA	3 GHz	Ser	99
U	4(3)	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Ser	100
U	5	Drive	AUT	AUT	3 GHz	Serial	A	NA	3 GHz	Ser	101
U	6	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SA	102
U	7	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SA	103
											104
											105
											106
											107
											108
											109
											110
											111

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

Figure 5 - 2: Existing ID List

Choose a host channel, then press [ENTER]. Choose *View and Edit ID*. A list of existing ID(s) will be displayed on the screen. Select one of the existing IDs and press [ENTER]. You may then choose to add or delete an existing ID.

## Limitation:

If host connection is made in FC-AL mode, there can be a total of "16" host IDs.

### 5.2.2.1 Add an ID

Fri Oct 7 11:45:37 2005 Cache Status: Clean

BAT:BAD WT

Q	Ch1	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid	
U	0	Host	102	NA	AUTO	Serial	F	NA	2 GHz	Ser	ID 96
U	1	Host	NA	102	AUTO	Serial	F	NA			ID 97
U	2	ID 102 (Secondary Controller)				ria					ID 98
U	3(4)	Add Channel SCSI ID				Serial					ID 99
U	4(3)	Primary Controller				Serial					
U	5	Secondary Controller				Serial	A	NA	3 GHz	Ser	ID 106
S	6	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SA	ID 107
S	7	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SA	ID 108
S											ID 109
S											ID 110
S											ID 111

Add Primary Controller SCSI ID ?  
 Yes  No

Arrow Keys:Move Cursor | Enter :Select | Esc:Exit | Ctrl+L:Refresh Screen

**Figure 5 - 3: Add ID List**

In single controller mode, you should set the secondary controller's ID to "NA" (usually unavailable in a single-controller subsystem). In dual-controller mode, you may need to set an ID for the secondary controller on each of your drive channels.

Press [ENTER] on one of the existing IDs. Choose "Add Channel SCSI ID," then choose to assign an ID for either the "Primary Controller" or "Secondary Controller." A list of channel IDs will appear. Choose a ID. In redundant mode, logical drives associated with a primary ID will be managed by the primary controller; a logical drive associated with a secondary ID the secondary controller.

## 5.2.2.2 Delete an ID

Fri Oct 7 11:47:30 2005 Cache Status: Clean

BAT:BAD

Q	Ch1	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid	
U	0	Host	102	NA	AUTO	Serial	F	NA	2 GHz	Serial	
U	1	ID 102 (Primary Controller)				Serial	F	NA			
U	2	Add Channel SCSI ID				Serial	A	NA	3 GHz	Serial	
U	3(4)	Delete Channel SCSI ID							GHz	Serial	
U	4(3)	D	Delete Primary Controller SCSI ID 102 ?							GHz	Serial
U	5	D	Yes <input type="radio"/> No <input checked="" type="radio"/>							GHz	Serial
	6	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SATA	
	7	RCCOM	NA	NA	3.0GHZ	SATA			3.0GHZ	SATA	

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

**Figure 5 - 4: Delete ID Screen**

Choose the host bus ID you wish to delete. Choose **Delete Channel ID**. The dialog box “Delete ID#?” will appear. Select **Yes**, then press **[ENTER]** to confirm.



### IMPORTANT!

- Every time you change a channel ID, you must reset the subsystem/controller for the changes to take effect.
- Multiple target IDs can be applied to a host channels while each drive channel has only one ID.
- At least one controller’s ID has to be present on each channel bus.

### 5.2.3 View Chip Information

Q	Ch1	Mode	ID	DefSynCk	Defwid	S	Term	CurSynCk	Curwid	
V	0	Host	112	AUTO	Serial	F	NA			
V	1	view and edit Id					1	NA		
V	2	view chip inFormation					1	NA		
V	3	Chip Type	Tachyon DX4 (n)					1.33GHZ	SATA	
S	3	Chip Rev. ID	5					1.33GHZ	SATA	
V	4	Chip Fw Rev. ID	N/A					1.33GHZ	SATA	
	5	Drive		AUTO	SATA			1.5GHZ	SATA	
	6	Drive		AUTO	SATA			1.33GHZ	SATA	
	7	Drive		AUTO	SATA			1.5GHZ	SATA	

**Figure 5 - 5: View Chip Information**

This is a view only option showing basic information about the Fibre Channel chip processor.

### 5.2.4 View Channel Host ID/WWN

Q	Ch1	Mode	PID	SID	DefSynCk	Defwid	S	Term	CurSynCk	Curwid	
V	0	Host	102	NA	AUTO	Serial	F	NA	2 GHz	Serial	
V	1	view and edit Id					1	F	NA		
V	2	view chip inFormation					1	F	NA		
V	2	view channel host-id/wwn					1	F	NA		
ID: 102 WWNN: 0x200000D023608231 WWPN: 0x210000D023608231											
V	4	Drive	7	8	AUTO	SATA				SATA	
	5	Drive	7	8	AUTO	SATA				SATA	
	6	Drive	7	8	AUTO	SATA				SATA	
	7	Drive	7	8	AUTO	SATA				SATA	

**Figure 5 - 6: View Host channel Information**

Port name is a unique eight-byte address assigned to an FC device port.

The subsystem has multiple channels (I/O paths) and each channel is managed by an I/O processor. This function allows users to inspect the node name and port name assigned to these chip processors. Some management software running on host computers needs these names to properly address a storage subsystem.

## 5.2.5 View Device Port Name List (WWPN)

Q	Ch1	Mode	PID	SID	DefSynClk	Defwid	S	Term	CurSynClk	Curwid	
V	0	Host	102	NA	AUTO	Serial	F	NA	2 GHz	Serial	
V	1	view and edit Id					1	F	NA		
V	2	view chip inFormation					1	F	NA		
V	3	view channel host-id/wwn					1	F	NA		
S	3	View device port name list(wwpn)					1	F	NA	2 GHz	Serial
V	4	Drive	7	8	WWPN: 0x210100E08B2AB0FD						SATA
V	5	Drive	7	8	AUTO	SATA				SATA	
V	6	Drive	7	8	AUTO	SATA				SATA	
V	7	Drive	7	8	AUTO	SATA				SATA	

**Figure 5 - 7: View Device Port Name**

This function displays the device port names (host adapter ID) detected on a host loop or through fabric host connection.

The HBA port names detected can be added to the "Host-ID WWN name list" in "View and Edit Host LUN" menu. Adding port names to the list can speed the mapping process that follows.

Each port name should then be assigned a nickname for ease of identification.

### 5.2.5.1 Add Host – ID/WWN Label Declaration

A nickname can be added to any host adapter ID for ease of identification in environments, e.g., SAN, where multiple servers are connected.

Ch1	Mode	PID	SID	DefSynClk	Defwid	S	Term	CurSynClk	Curwid
0	Host	102	103	AUTO	Serial	F	NA	2 GHz	Serial
1	WWPN: 0x210000E08B083F00			0	Serial	F	NA		
2	Add Host-ID/WWN Label Declaration ?						NA		
3	Yes						NA	2 GHz	Serial
4	Drive	Host-ID/WWN : 0x210000E08B083F00							
5	Drive	Name :							
6	Drive								
7	Drive								

**Figure 5 - 8: Add Host Nickname**

Press Enter on a displayed adapter WWPN and you will be prompted with a confirm box as shown above. Choose Yes and enter a name for the host adapter.

## 5.2.6 Data Rate

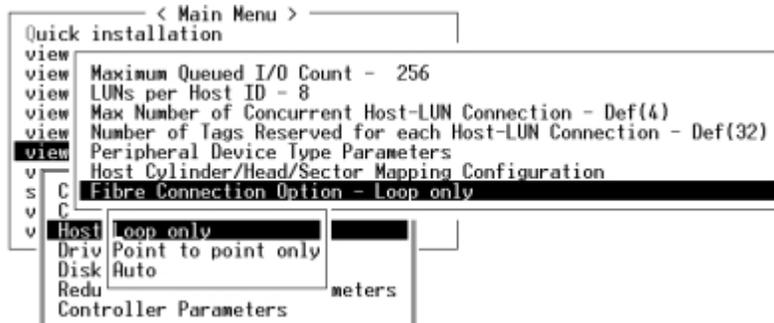
Q	Ch1	Mode	ID	DefsyncClk	Defwid	S	Term	CursyncClk	curwid	
V	0	Host	112	AUTO	Serial	F	NA			
V	1	view and edit Id view chip inFormation view channel host-id/wwn view device port name list(wwpn)						NA		
V	2							1.33GHZ	SATA	
V	3							1.33GHZ	SATA	
S	4	Auto 1 GHZ 2 GHZ 4 GHZ		AUTO	SATA			1.33GHZ	SATA	
V	5			AUTO	SATA			1.5GHZ	SATA	
V	6			AUTO	SATA			1.33GHZ	SATA	
V	7	Drive		AUTO	SATA			1.5GHZ	SATA	

**Figure 5 - 9: Changing Data Rate**

Default is "AUTO" and should work fine with most configurations. Changing this setting is not recommended unless some particular bus signal issues occur.

Transfer rate auto-negotiation is supported. The host channel data rate setting allows a 4GHz or 2GHz Fibre Channel to negotiate with devices communicating over 2GHz or 1GHz link if the link speed configuration is determined externally.

## 5.3 View and Edit Host-side Parameters



**Figure 5 - 10: Edit Fibre Connection**

### 5.3.1 Fibre Channel Connection Option:

Use the ↑ ↓ keys to scroll down to "View and Edit Configuration Parameters," "Host-side Parameters," and then "Fibre Connection Option." A prompt will display all the options. Select one appropriate for your Fibre Channel topology. If the connection to

the host is through % a Fibre hub, or a switch port defined as NL\_Port, choose "Loop only."

If connection to the host is through a Fibre switch N\_Port or directly to a server, choose "Point to point only." Proper selection is necessary and will decrease overhead on data transmission.

For a switched fabric configuration, a redundant controller system can be connected to the NL\_ports on an FC switch and then the host computers connect to its N\_ports.



## IMPORTANT!

- Note that the host ports between redundant controllers can be connected via switched fabric. However, switch ports connecting the controllers should be operating as FL\_Ports. If they are configured as F\_Ports, the controller host ports will not support multiple target IDs, especially when IDs on a failed controller's host ports need to be taken over by the surviving controller.

### 5.3.2 Controller Unique Identifier

```
Fri Mar 5 11:13:11 2004 Cache Status: Clean
< Main Menu >
Quick installation
view and edit Logical drives
view and edit Logical Volumes
view and edit Host luns
view and edit scsi Drives
view
view Controller Name - Not Set
v Set Telnet Inactivity Timeout Time - Disabled (Default)
s C LCD Title Display - Controller Name
v C Password Validation Timeout - Always Check
v H Controller Unique Identifier(Hex) - FFF
D S
D S Controller Unique Identifier(Hex): FFF
R
Cont
```

Enter:Set to Default |Esc:Exit |Ctrl+L:Refresh Screen

Figure 5 - 11: Viewing Controller ID

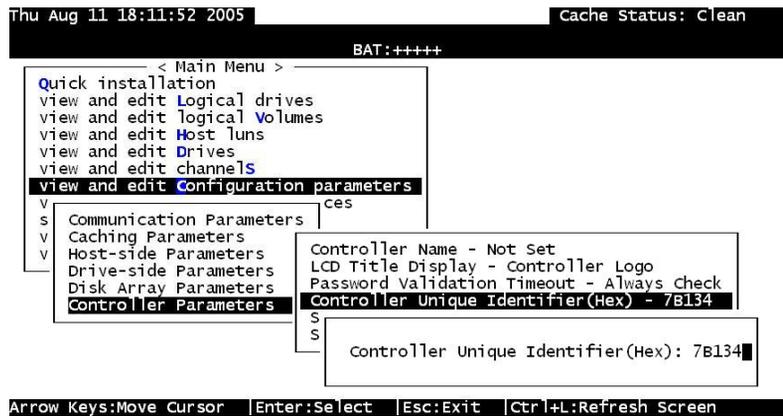
A Controller Unique Identifier is *required* for operation with the *Redundant Controller Configuration*. The controller will automatically notify users a unique identifier when the first logical drive is being created in a dual-controller system.

The unique identifier will be used to generate a Fibre Channel "node name" (WWNN). The node name is device-unique and comprised of information such as the IEEE company ID and this user-configurable identifier in the last two bytes.

In redundant mode, the controller configuration data is continuously synchronized between controllers. Host ports on both

controllers appear with the identical node names and each with a different port name (WWPN). When a controller fails and a replacement is combined, the node name will be passed down to the replacement, making the host unaware of controller replacement so that controller failback is totally transparent.

All EonStor subsystems come with a default identifier. This identifier guarantees your FC ports' port names and node names are unique over a Fibre Channel network. Making changes to the default value is only necessary if the port name conflicts should occur.



**Figure 5 - 12: Changing Controller ID**

The unique identifier can also be accessed from "View and Edit Configuration Parameters" -> "Controller Parameters" -> "Controller Unique Identifier (Hex)."

5.1	Overview.....	1
5.2	<b>Fibre Channel Configuration: Host Parameters</b> .....	1
5.2.1	View and Edit Channels.....	1
5.2.2	View and Edit IDs - Host Channel.....	2
5.2.2.1	Add an ID.....	3
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FL_ports.....		8
ID		
SCSI, deleting.....		4
<i>Multiple target IDs</i> .....		4
node name.....		8
port name.....		9
SCSI		
channels, viewing and editing.....		1
SCSI ID, deleting.....		4
View Channel WWN.....		5
View Device Port Name List.....		6
viewing and editing SCSI channels.....		1
Viewing and Editing SCSI Channels		
terminal.....		1
viewing and editing SCSI ID/host channel2		
Viewing and Editing SCSI IDs terminal....		2

## **Host-side and Drive-side Parameters**

---

This chapter discusses the advanced options for configuring and maintaining a RAID system. Each function is given a brief explanation as well as a configuration sample. Terminal screens are used in the configuration samples. Some of the operations require basic knowledge of RAID technology and are only recommended for an experienced user.



**NOTE:**

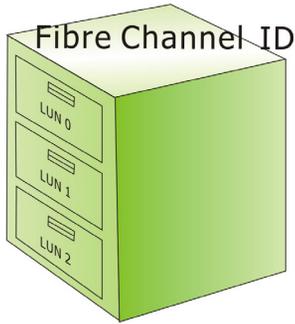
*All figures in this chapter are showing examples using the management hyper terminal screen.*

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### **6.1 Host-side Parameters**

The highly scalable Fibre channel technology can address up to 126 devices per loop. Each device has one unique ID.

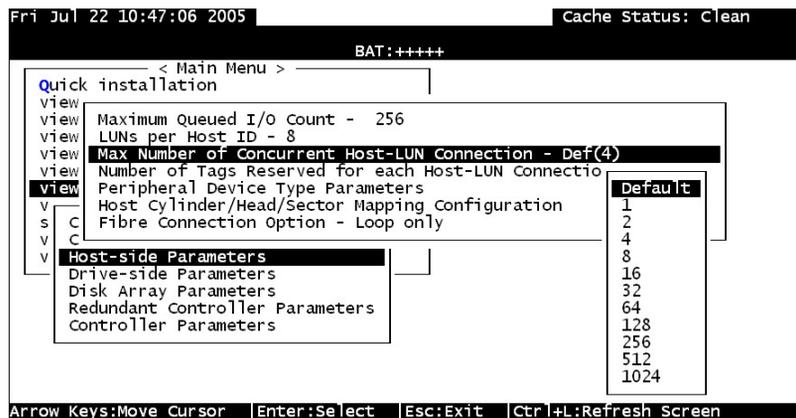
If you file a document into a cabinet, you must put the document into one of the drawers. From a Fibre's point of view, a Fibre channel ID is like a cabinet, and the drawers are the LUNs (Logical units). Each Fibre channel ID enables up to 32 LUNs and up to 1024 LUNs are configurable per controller. Data can be stored into one of the LUNs of the Fibre channel ID. Most Fibre host adapters treats a LUN like another Fibre device.



**Figure 6 - 1: Fibre Channel ID/LUNs**

### 6.1.1 Maximum Concurrent Host LUN Connection (“Nexus” in SCSI)

The configuration option adjusts the internal resources for use with a number of current host nexus. If there are four host computers (A, B, C, and D) accessing the array through four host IDs/LUNs (ID 0, 1, 2 and 3), host A through ID 0 (one nexus), host B through ID 1 (one nexus), host C through ID 2 (one nexus) and host D through ID 3 (one nexus) - all queued in the cache - that is called 4 nexus. If there are I/Os in the cache through four different nexus, and another host I/O comes down with a nexus different than the four in the cache (for example, host A access ID 3), the controller will return "busy." Note that it is "concurrent" nexus; if the cache is cleared up, it will accept four different nexus again. Many I/Os can be accessed via the same nexus.



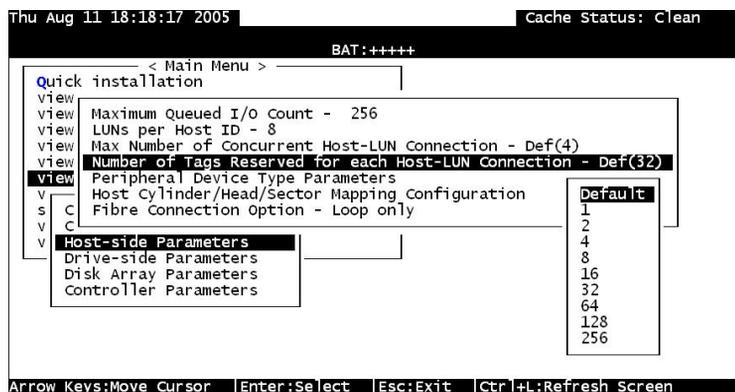
**Figure 6 - 2: Maximum Concurrent Host LUN Connection**

From the Main Menu, select “View and Edit Configuration Parameters,” “Host-side Parameters,” then press [ENTER]. Choose “Max Number of Concurrent Host-LUN Connection,” then press [ENTER]. A list of available selections will appear. Move cursor bar

to an item, then press [ENTER]. Choose **Yes** in the dialog box that follows to confirm your setting. The default is “4.”

## 6.1.2 Number of Tags Reserved for Each Host-LUN Connection

Each nexus has 32 (the default setting) tags reserved. When the host computer sends 8 I/O tags to the controller, and the controller is too busy to process them all, the host might start to send less than 8 tags during every certain period of time since then. This setting ensures that the controller will accept at least 32 tags per nexus. The controller will be able to accept more than that as long as the controller internal resources allow - if the controller does not have enough resources, at least 32 tags can be accepted per nexus.

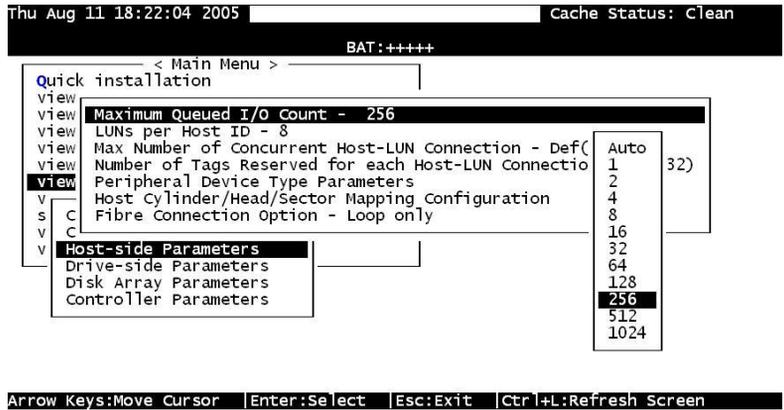


**Figure 6 - 3: Number of Tags Reserved for Each Host-LUN Connection**

Choose “Host-side Parameters,” then press [ENTER]. Choose “Number of Tags Reserved for each Host-LUN Connection,” then press [ENTER]. A list of available selections will appear. Move the cursor bar to an item, then press [ENTER]. Choose **Yes** in the dialog box that follows to confirm the setting.

## 6.1.3 Maximum Queued I/O Count

This function allows you to configure the maximum queued I/O count the controller can receive from the host computer.

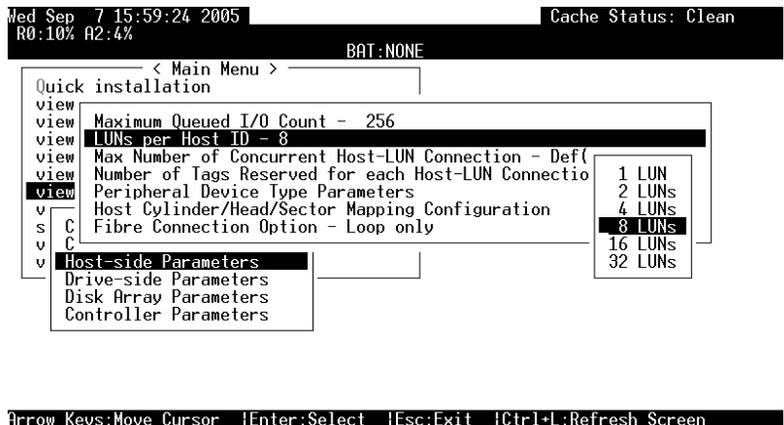


**Figure 6 - 4: Maximum Queued I/O Count**

Choose “Host-side Parameters,” then press [ENTER]. Choose “Maximum Queued I/O Count,” then press [ENTER]. A list of available selections will appear. Move the cursor bar to an item, then press [ENTER]. Choose **Yes** in the dialog box that follows to confirm the setting.

The controller supports the following Host-side configurations: “Maximum Queued I/O Count,” “LUNs per Host ID,” “Num of Host-LUN Connect,” “Tag per Host-LUN Connect,” “Peripheral Dev Type Parameters,” and “Cyl/Head/Sector Mapping Config.”

### 6.1.4 LUNs per Host ID



**Figure 6 - 5: LUNs per Host ID**

Choose “LUNs per Host ID,” then press [ENTER]. A list of selections will appear. Move the cursor bar to an item, then press [ENTER]. Choose **Yes** in the dialog box that follows to confirm the setting.

## 6.1.5 LUN Applicability

If no logical drive has been created and mapped to a host LUN, and the RAID controller is the only device connected to the host SCSI card, usually the operating system will not load the driver for the host adapter. If the driver is not loaded, the host computer will not be able to use the in-band utility to communicate with the RAID controller. This is often the case when users want to start configuring a RAID using management software from the host. It will be necessary to configure the "Peripheral Device Type" setting for the host to communicate with the controller. If the "LUN-0's only" is selected, only LUN-0 of the host ID will appear as a device with the user-defined peripheral device type. If "all undefined LUNs" is selected, each LUN in that host ID will appear as a device with the user-defined peripheral device type.

Different "LUN applicability" selections are available: "Device Type" selection, "Device Qualifier Support," "Support Removable media," "LUN-0's only," and "All undefined LUNs." Please refer to **6.1.8 Peripheral Device Type Parameters for Various Operating Systems** for details concerning various operating systems.

## 6.1.6 Peripheral Device Type

For connection without a pre-configured logical unit and Ethernet link to a host, the in-band SCSI protocol can be used in order for the host to "see" the RAID subsystem. Please refer to the reference table below. You will need to make adjustments in the following submenus: Peripheral Device Type, Peripheral Device Qualifier, Device Support for Removable Media, and LUN Application.

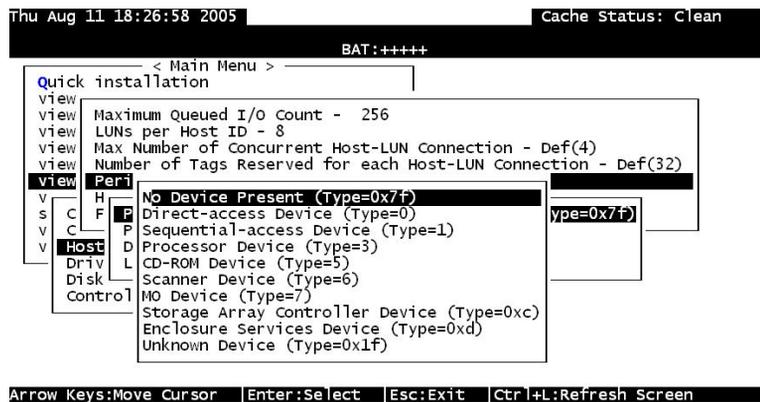


Figure 6 - 6: Peripheral Device Type

## 6.1.7 In-band (SCSI or Fibre)

External devices (including a RAID subsystem; from the view of operation on an application server or management PC) require communication links with a management computer for device

monitoring and administration. In addition to the regular RS-232C or Ethernet connection, in-band SCSI can serve as an alternative means of management communications. In-band SCSI translates the original configuration commands into standard SCSI commands. These SCSI commands are then sent to and received by the controller over the existing host links, either SCSI or Fibre.

### 6.1.8 Peripheral Device Type Parameters for Various Operating Systems

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#### **IMPORTANT!**

*There is no need to configure the Peripheral Device setting if you are trying to manage a RAID subsystem from a RAIDWatch station through an Ethernet connection (to the EonStor subsystem's Ethernet port). An Ethernet connection to RAID uses TCP/IP as the communication protocol.*

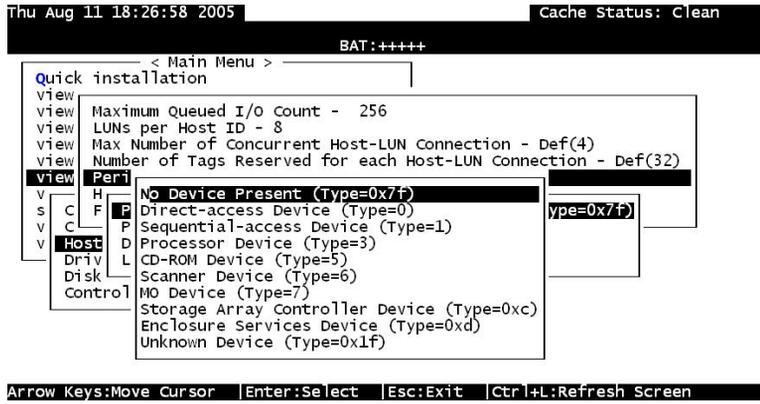
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With an in-band connection, a host computer cannot “see” a RAID controller **UNLESS** the following have been configured:

1. (a) A logical unit has been created.
  - (b) At least one logical unit is mapped to a host ID or LUN via the RS-232/LCD keypad interface.
2. (a) Host bus connection is established.
  - (b) The RAID subsystem/controller is configured to appear as a peripheral device on the channel bus connected to a host computer.

With a brand new array, there is no association between disk drive configurations and the logical ID/LUN presentations on the host bus. If users want to start configuring a RAID system from an application server before any RAID configuration is made, the host will not be able to “see” the RAID subsystem. In order for a host to “see” the subsystem, it will be necessary to define the controller as a peripheral device.

Different host operating systems require different adjustments. See the tables below to find the proper settings for your host operating system. References to “Peripheral Device Qualifier” and “Device Support for Removable Media” are also included.



**Figure 6 - 7: Peripheral Device Type Parameters**

Operating System	Peripheral Device Type	Peripheral Device Qualifier	Device Support for Removable Media	LUN Applicability
Windows 2000/2003	0xd	Connected	Either is okay	LUN-0's
Solaris™ 8/9 (x86 and SPARC)	0xd	Connected	Either is okay	LUN-0's
Linux RedHat 8/9; SuSE 8/9	0xd	Connected	Either is okay	LUN-0's

**Table 6 - 1: Peripheral Device Type Parameters**

Device Type	Setting
Enclosure Service Device	0xd
No Device Present	0x7f
Direct-access Device	0
Sequential-access Device	1
Processor Type	3
CD-ROM Device	5
Scanner Device	6
MO Device	7
Storage Array Controller Device	0xc
Unknown Device	0x1f

**Table 6 - 2: Peripheral Device Type Settings**

## 6.1.9 Cylinder/Head/Sector Mapping

Drive capacity is decided by the number of blocks. For some operating systems (Sun Solaris, for example) the capacity of a drive is determined by the cylinder/head/sector count. For Sun Solaris, the cylinder cannot exceed 65535; choose "cylinder<65535," then the controller will automatically adjust the head/sector count for your OS to read the correct drive capacity. Please refer to the related documents provided with your operating system for more information.

Cylinder, Head, and Sector counts are selectable from the configuration menus shown below. To avoid any difficulties with a Sun Solaris configuration, the values listed below can be applied.

Capacity	Cylinder	Head	Sector
< 64 GB	variable	64	32
64 - 128 GB	variable	64	64
128 – 256 GB	variable	127	64
256 – 512 GB	variable	127	127
512 GB - 1 TB	variable	255	127

**Table 6 - 3: Cylinder/Head/Sector Mapping under Sun Solaris**

Older Solaris versions do not support drive capacities larger than 1 terabyte.

*Solaris 10* now supports array capacity larger than 1TB. Set the values to the values listed in the table below:

Capacity	Cylinder	Head	Sector
>1TB	<65536	255	variable
		variable	255

**Table 6 - 4 Cylinder/Head/Sector Mapping under Sun Solaris 10**

## Configuring Sector Ranges/Head Ranges/Cylinder Ranges:

### Selecting Sector Ranges

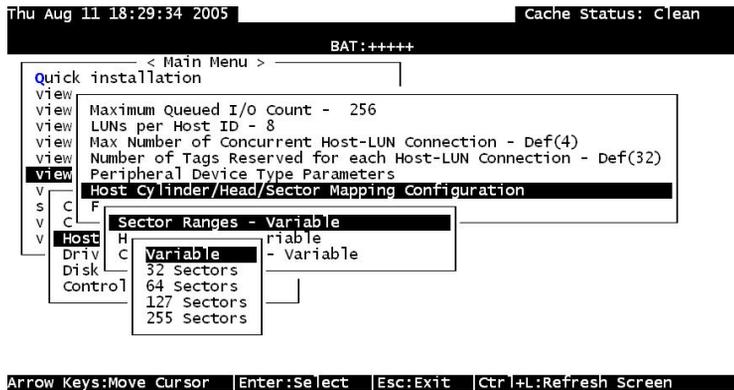


Figure 6 - 8: Selecting Sector Ranges

### Selecting Head Ranges

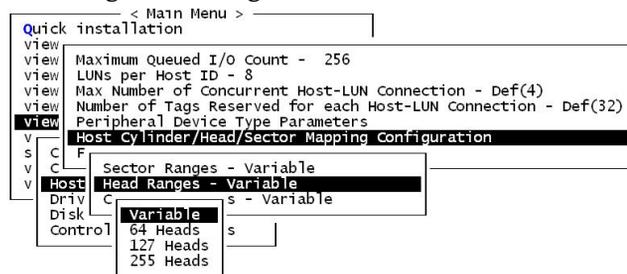


Figure 6 - 9: Selecting Head Ranges

### Selecting Cylinder Ranges

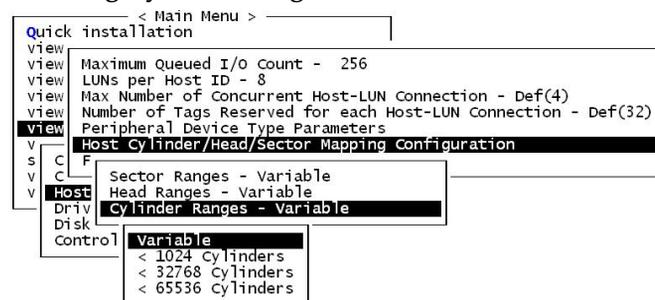


Figure 6 - 10: Selecting Cylinder Ranges

## 6.2 Drive-side Parameters:



Figure 6 - 11: Drive Side Parameters Screen

Choose “Drive-side SCSI Parameters,” then press [ENTER]. The Drive-side SCSI parameters menu displays.

### 6.2.1 Disk Access Delay Time

This feature sets the delay time before the subsystem tries to access the hard drives after power-on. Default may vary 15 seconds to 30 seconds, and from one model to another. This parameter can be adjusted to fit the spin-up speed of different models of disk drives installed in your subsystem.

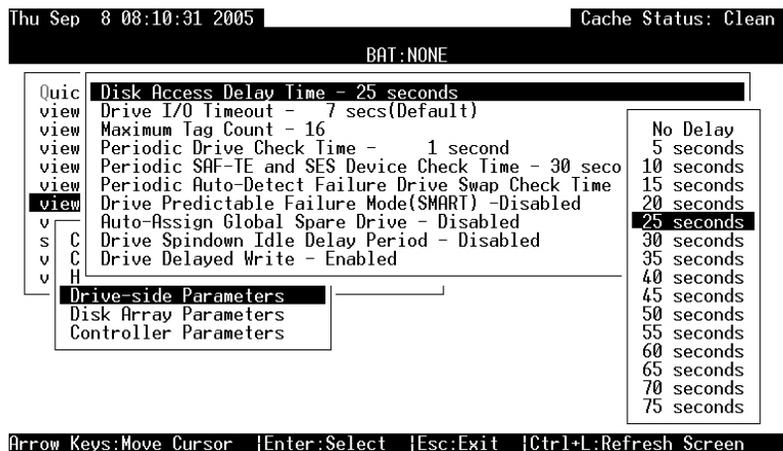


Figure 6 - 12: Selecting Disk Access Delay Time

Choose “Disk Access Delay Time,” then press [ENTER]. A list of selections displays. Move the cursor bar to a selection, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

## 6.2.2 Drive I/O Timeout

The “Drive I/O Timeout” is the time interval for the controller to wait for a drive to respond. If the controller attempts to read data from or write data to a drive but the drive does not respond within the Drive I/O Timeout value, the drive will be considered as a failed drive.

When the drive itself detects a media error while reading from the drive platter, it usually retries the previous reading or re-calibrates the head. When the drive encounters a bad block on the media, it reassigns the bad block onto a spare block. However, it takes time to perform the above actions. The time to perform these operations can vary between different brands and different models.

During channel bus arbitration, a device with higher priority can utilize the bus first. A device with lower priority will sometimes receive an I/O timeout when devices of higher priority keep utilizing the bus.

The default setting for “Drive I/O Timeout” is 7 seconds. It is highly recommended not to change this setting. Setting the timeout to a lower value will cause the controller to judge a drive as failed while a drive is still retrying, or while a drive is unable to arbitrate the SCSI bus. Setting the timeout to a greater value will cause the controller to keep waiting for a drive, and it may sometimes cause a host timeout.

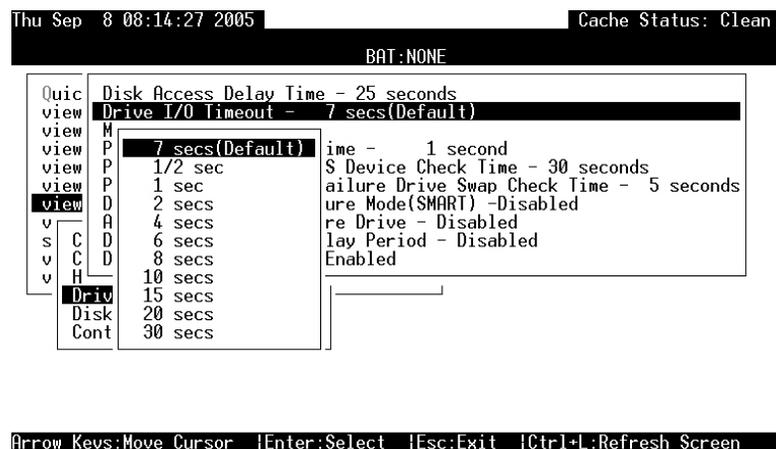


Figure 6 - 13: Selecting Drive I/O Timeout

Choose “Drive I/O Timeout –Default (7 seconds),” then press [ENTER]. A list of selections will appear. Move the cursor bar to a selection, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

### 6.2.3 Maximum Tag Count: Tag Command Queuing (TCQ) and Native Command Queuing (NCQ) Support



**Figure 6 - 14: Selecting Maximum Tag Count**

This sub-menu facilitates the support for both Tagged Command Queuing (TCQ) and Native Command Queuing (NCQ). TCQ is a traditional feature on SCSI or Fibre disk drives, while NCQ is recently implemented with SATA disk drives. The queuing feature requires the support of both host adapters and hard disk drives. Command queuing can intelligently reorder host requests to streamline random accesses for IOPS/multi-user environments.

Infortrend’s subsystems support tag command queuing with an adjustable maximum tag count from 1 to 128. The default setting is “Enabled” with a maximum tag count of 32 (SCSI or Fibre drives) or 16 (default for SATA drives). Choose “Maximum Tag Count”, then press [ENTER]. A list of available tag count numbers displays. Move the cursor bar to a number, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.



## IMPORTANT!

- Every time you change this setting, you must reset the controller for the changes to take effect.
- Disabling Tag Command Queuing will disable the hard drives' built-in cache for Write-Back operation.



## NOTE:

The following options are categorized as related to array maintenance and data integrity:

- Periodic Drive Check Time
- Periodic SAF-TE and SES Device Check Time
- Periodic Auto-Detect Failure Drive Swap Check Time
- Auto-Assign Global Spare Drive

Details of these options can be found in **Chapter 11**.

Another option is associated with disk drive SMART support and details can be found in **Chapter 15**:

- Drive Predictable Failure Mode (SMART)

## 6.2.4 Drive Spindown Idle Delay Period

```

Thu Sep  8 08:17:22 2005                               Cache Status: Clean
                                     BAT: NONE
Quick view Disk Access Delay Time - 25 seconds
view       Drive I/O Timeout - 7 secs(Default)
view       Maximum Tag Count - 16
view       Periodic Drive Check Time - 1 second
view       Periodic SAF-TE and SES Device Check Time - 30 seconds
view       Periodic Auto-Detect Failure Drive Swap Check Time - 5 seconds
view       Drive Predictable Failure Mode(SMART) -Disabled
view       Auto-Assign Global Spare Drive - Disabled
v          C Drive Spindown Idle Delay Period - Disabled
s          C Drive Write - Enabled
v          H Disabled
v          Driv 60 secs ers
           Disk 300 secs ers
           Cont 600 secs ers
  
```

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 6 - 15: Selecting Drive Spindown Idle Delay Period**

This is power saving feature which allows hard drive motor to spin down after a configurable period of time with no I/O requests directed to the hard drives.

The drive spin down command is designed for usage on disk-to-disk (D2D) backup system. In normal case, the RAID system serves as I/O interface between hosts and drives. On disk-to-disk (D2D) backup system, the I/Os only occur when the backup command is valid. Without backup requirements, the spin down command can make drives enter an idle state hence reduce the power consumption of drives.

User can setup an idle period for the drives. Drives will automatically spin down while there is no read/write command to drives within the idle period. Then if any I/O command is issued, such as disk backup, the drives will wake up and serve the I/O requirement.

Choose "Drive Spindown Idle Delay Period," then press [ENTER]. A list of selections will appear. Move the cursor bar to a selection, then press [ENTER]. Choose **Yes** in the dialog box that follows to confirm the setting.

## 6.2.5 Drive Delayed Write



**Figure 6 - 16: Enabling/Disabling Delayed Write**

This option allows to utilize the cache buffer embedded with disk drives. Note that if power outage or hard drive failure occur with data still kept within the disk buffer, data inconsistency might occur.



**NOTE:**

*The default setting on the redundant subsystem is "Disable".*

---

<b>6.1</b>	<b>HOST-SIDE PARAMETERS.....</b>	<b>1</b>
6.1.1	Maximum Concurrent Host LUN Connection (“Nexus” in SCSI).....	2
6.1.2	Number of Tags Reserved for Each Host-LUN Connection .....	3
6.1.3	Maximum Queued I/O Count .....	3
6.1.4	LUNs per Host ID.....	4
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6.1.6	Peripheral Device Type.....	5
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6.1.8	Peripheral Device Type Parameters for Various Operating Systems.....	6
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<b>6.2</b>	<b>DRIVE-SIDE PARAMETERS: .....</b>	<b>10</b>
6.2.1	Disk Access Delay Time.....	10
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6.2.5	Drive Delayed Write .....	14

# Enclosure Management

This chapter discusses the configuration options related to enclosure monitoring. Each function is given a brief explanation as well as a configuration sample. Terminal screens will be used in the configuration samples. Some of the operations require basic knowledge of RAID technology and are only recommended for an experienced user.



**NOTE:**

*All figures in this chapter are showing examples using the management hyper terminal screen.*

## 7.1 Enclosure Monitoring

### 7.1.1 Enclosure Devices

#### 7.1.1.1 Event Triggered Operations

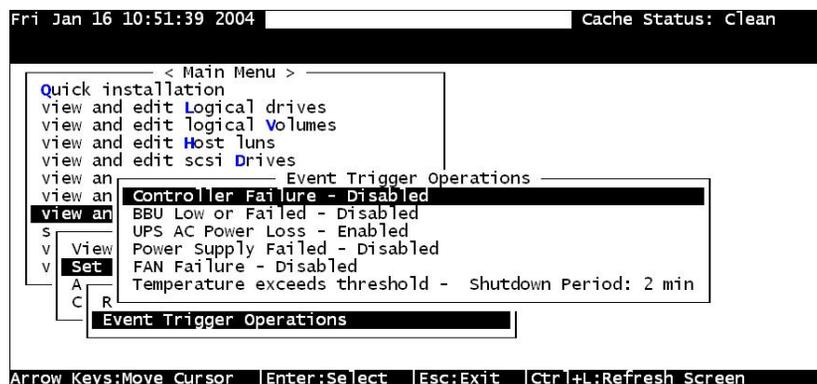


Figure 7 - 1: Event Triggered Operations

Select "View and Edit Peripheral Devices" on the Main Menu and press [ENTER]. Choose "Set Peripheral Device Entry", press [ENTER], then select "Event Trigger Operations" by pressing [ENTER]. The event trigger menu displays.

## The Operations

To reduce the chance of data loss, the controller/subsystem automatically commences the following actions to prevent loss of data:

- 1). Switches its caching mode from write-back to write-through
- 2). Flushes all cached data

## The Trigger

The mode switching and cache flush operations can be triggered by the detection of the following conditions:

- 1. Controller failure (Redundant Model Use Only)**

If a controller fails in a dual-redundant controller configuration, the surviving controller no longer has the protection of cached data by storing the replica of unfinished writes to its partner.

- 2. BBU low or failed:**

If battery fails or is under-charge, the unfinished writes cannot be supported if power outage occurs.

- 3. UPS AC power loss:**

Even with the buffer provided by the UPS, if the mains power fails, cached data should be immediately distributed to hard drives.

- 4. Power supply failure**

- 5. Fan failure**

- 6. Temperature exceeds threshold**

If critical conditions occur, such as the enclosure component failure, chance of system downtime will increase and it is best to temporarily disable write-back caching.

When enabled, each of the above conditions forces the controller/subsystem to adopt the write-through caching mode. When the fault condition is corrected, the controller/subsystem automatically restores the previous caching mode.



**Figure 7 - 2: Controller Write-Through Alert**

Note that the temperature thresholds refer to those set for both sensors on the RAID controller boards and those placed within the subsystem enclosure. In terms of the controller temperature, board 1 refers to the main circuit board and board 2 refers to the second-level I/O board or the daughter card. If any of the threshold values set for any sensor is exceeded, the trigger automatically applies.



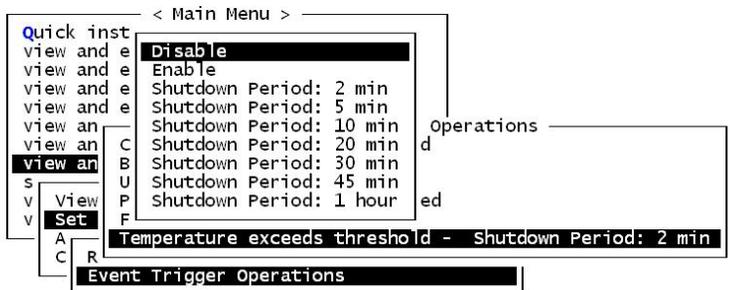
**NOTE:**

*If a battery is not installed in your RAID subsystem, the “BBU Low or Failed” option should be disabled.*

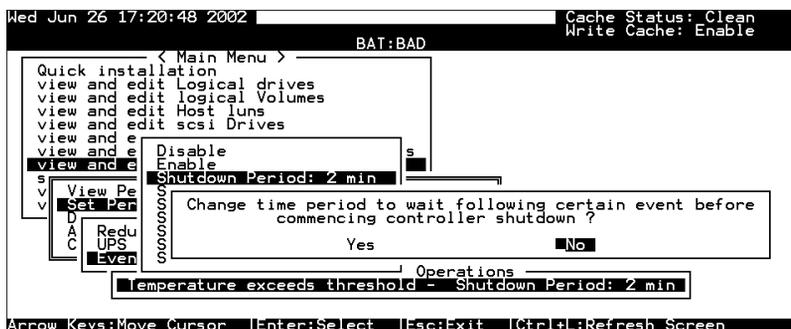
### 7.1.2 Auto Shutdown: Elevated Temperature

System components can be damaged if operated under elevated temperature. You can configure the time periods between the detection of exceeded thresholds and the controller’s commencing an automatic shutdown.

The shutdown does not electrically disconnect the subsystem. When shutdown is commenced, the subsystem stops responding to I/O requests and flushes all cached writes in its memory. During that time, system administrators should have been notified of the condition and have begun restoring proper cooling of the subsystem.



**Figure 7 - 3: Set Auto-Shutdown Period Time**



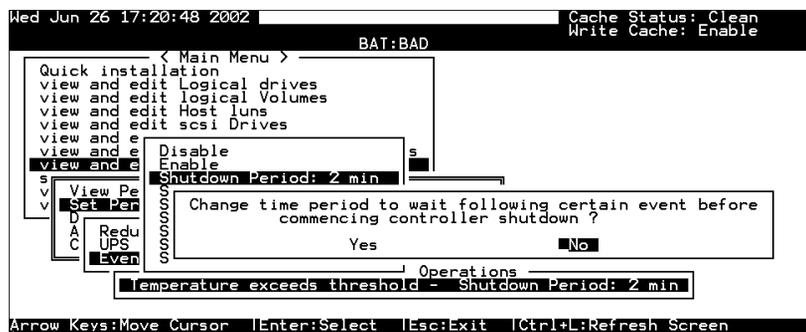
**Figure 7 - 4: Message of Auto-Shutdown Period Time**

Select “View and Edit Peripheral Devices” on the Main Menu and press [ENTER]. Choose “Set Peripheral Device Entry” and “Event Trigger Option” by pressing [ENTER]. The auto-shutdown options display.

Select a configurable time span between the detection of exceeded temperature and the controller’s commencing an automatic shutdown. Extended operation under critical conditions like elevated temperature greatly reduces system efficiency and will eventually cause component failure.

### 7.1.2.1 Dynamic Caching Mode Switch

#### Controller Auto-Shutdown - Event Triggered Operations



**Figure 7 - 4: Change Controller Shutdown Period**

Select “View and Edit Peripheral Devices” on the Main Menu and press [ENTER]. Choose “Set Peripheral Device Entry” and “Event Trigger Option” by pressing [ENTER]. The auto-shutdown option displays.

Select a configurable time span between the detection of exceeded temperature and the controller’s commencing an automatic shutdown. Extended operation under critical conditions like elevated temperature greatly reduces system efficiency and may cause component failure.

### 7.1.3 RAID Controller Self-monitoring

Open your PC Terminal Emulation screen. Enter the Main Menu and select “View and Edit Peripheral Devices.” Use the arrow keys





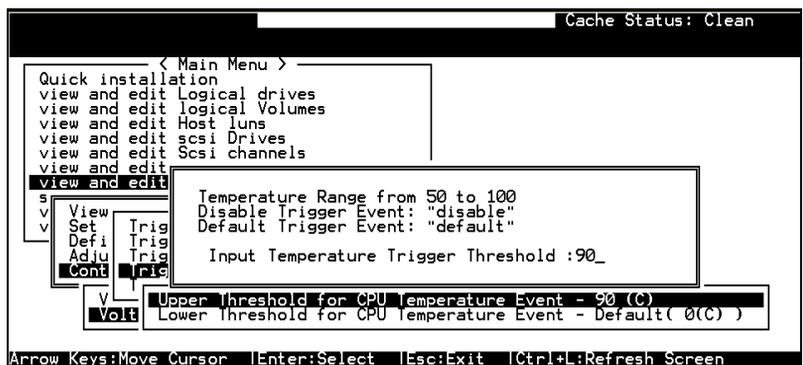
**Figure 7 - 6: Set Trigger Thresholds**

Scroll down and select an item to configure.



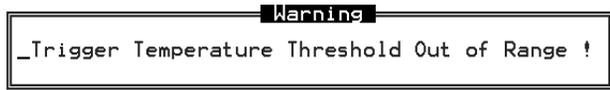
**Figure 7 - 7: Change Threshold for CPU Temperature**

Select an item, such as “Trigger Thresholds for CPU Temperature Events.” Press [ENTER] and a list of selections will appear. You can change the upper or lower threshold values. Press [ENTER] to confirm.



**Figure 7 - 8: Enter Trigger Threshold Value**

A configuration window will prompt. Enter any value within the safety range. Values exceeding the safety range will be rejected by controller firmware.



**Figure 7 - 9: Warning Message for Out of Range**

Follow the same method to modify other threshold parameters.

## 7.2 UPS Support

UPS status monitoring is available from firmware release 3.34 onward. This feature enables the RAID subsystem to observe and respond to the status of the UPS (battery charge or AC power) by dynamically switching the write policy.

### Requirements for UPS Status Monitoring:

1. Connect the UPS device to the controller/subsystem's COM2 serial port.
2. Set the same Baud Rate to the system COM2 and the UPS serial port. Please refer to *Chapter 3, RS-232C Serial Port Settings*.
3. Set the UPS option in the *7.1.1.1* to "Enabled."

### Condition Reports and Reactions:

1. When mains power is lost or when the UPS charge is low, an event is issued; the subsystem commences an auto cache-flush and is forced to adopt the Write-Through mode.
2. When the serial port connection is lost or when the UPS is removed, an event is issued to notify the system manager that the external UPS is absent.
3. When the UPS battery charge or mains power is restored to a safe functioning level, the subsystem automatically restores the original write policy.

## 7.3 SAF-TE and SES Enclosure Monitoring

(Periodic SAF-TE and SES Device Check Time)

```

Fri Jul 22 13:05:41 2005                               Cache Status: Clean
                                                         BAT:+++++
< Main Menu >
Quick installation
view and edit Logical drives
view and edit logical Volumes
view
view
view Drive Motor Spin-Up - Disabled
view Disk Access Delay Time - 30 seconds
view Drive I/O Timeout - 7 secs(Default)
view Maximum Tag Count - 16
view Periodic Drive Check Time - 1 second
view Periodic SAF-TE and SES Device Check Time - 30 seconds
view Periodic Auto-Detect Failure Drive Swap Check Time - 10 seconds
view Drive Predictable Failure Mode(SMART) - Disabled
view Auto-Assign Global Spare Drive - Disabled
view Drive Spindown Idle Delay Period - 60 secs
view Bad Block Reassign warning Threshold - 0
view Force Reassign On Media Error -Disabled
view Drive Delayed write - Disabled
Disabled
50 ms
100 ms
200 ms
500 ms
1 second
2 seconds
5 seconds
10 seconds
20 seconds
30 seconds
60 seconds
Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

```

**Figure 7 - 10: Set SAF-TE and SES Check Time**

If there are remote components in your RAID enclosure being controlled via SAF-TE/S.E.S. devices, use this function to select how often the controller will check the status of these devices. Choose “Periodic SAF-TE and SES Device Check Time”; then press [ENTER]. Move the cursor to the desired interval, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

Unless there is an I<sup>2</sup>C link between enclosures, there must be a valid check time when multiple enclosures are cascaded together; e.g., an EonStor A16F-R RAID subsystem connected to expansion JBOD enclosures using Fibre links. Infortrend’s Fibre-to-SATA JBODs simulate a Fibre Channel device ID and appears as a device on the FC links.

### 7.3.1 Enclosure Devices Status: View Peripheral Device Status

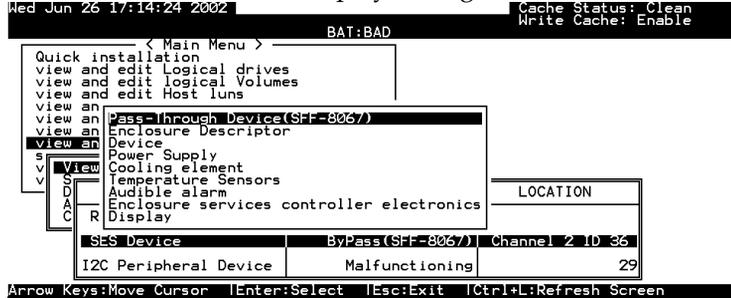
Select “View and edit Peripheral Devices” on the Main Menu and press [ENTER]. Choose “View Peripheral Device Status,” then press [ENTER] again. The device list displays.

Below is a list of peripheral devices (enclosure modules) supported by enclosure monitoring. Monitoring of device status depends on enclosure implementation and is accessed through different interfaces, e.g., SAF-TE, S.E.S., or I<sup>2</sup>C serial bus.

1. Device type
2. Enclosure descriptor
3. Power supply

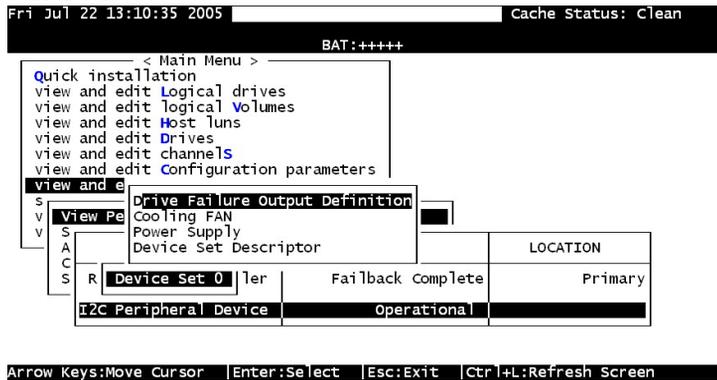
4. Cooling element
5. Temperature Sensors
6. Audible alarm
7. Enclosure services controller electronics

Shown below is a screen display through SES interface:



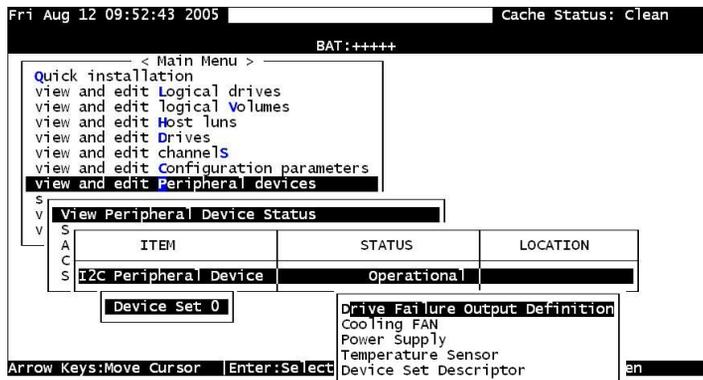
**Figure 7 - 11: SES Device Information**

Below is a screen display showing enclosure devices through an I<sup>2</sup>C serial bus:



**Figure 7 - 12: I<sup>2</sup>C Device Information**

Select the device interface and then press [ENTER] on a connected module to examine its operating status as shown below.



**Figure 7 - 12: Display I<sup>2</sup>C Device Information**

<b>7.1</b>	<b>ENCLOSURE MONITORING .....</b>	<b>1</b>
7.1.1	ENCLOSURE DEVICES.....	1
	<i>The Operations.....</i>	<i>2</i>
	<i>The Trigger .....</i>	<i>2</i>
7.1.2	AUTO SHUTDOWN: ELEVATED TEMPERATURE .....	3
	<i>7.1.2.1 Dynamic Caching Mode Switch.....</i>	<i>4</i>
	<i>Controller Auto-Shutdown - Event Triggered Operations.....</i>	<i>4</i>
7.1.3	RAID CONTROLLER SELF-MONITORING .....	4
	<i>7.1.3.1 Changing Monitoring Thresholds.....</i>	<i>5</i>
<b>7.2</b>	<b>UPS SUPPORT .....</b>	<b>7</b>
<b>7.3</b>	<b>SAF-TE AND SES ENCLOSURE MONITORING .....</b>	<b>7</b>
	<i>(Periodic SAF-TE and SES Device Check Time).....</i>	<i>7</i>
7.3.1	ENCLOSURE DEVICES STATUS: VIEW PERIPHERAL DEVICE STATUS .....	8

## Data Integrity

---

- This chapter discusses various firmware mechanisms that help to secure the integrity of array data.

No system is completely safe from the threat of hardware faults. For example, although the chance of occurrence is considerably low, the occurrences of bad blocks on two (RAID 5) or three (RAID 6) hard drives can fail a whole data set. When properly configured, the functions below help to minimize the chance of data loss:

1. Event Triggered Operations (refer to Chapter. 10)
2. Failed Drive Detection
3. Scheduled Maintenance
4. Regenerate Logical Drive Parity
5. Rebuild Priority
6. Verification on Writes



### NOTE:

*Some of the configuration options may not be available to all sub-revisions of firmware.*

---



### NOTE:

*All figures in this chapter are showing examples using the management hyper terminal screen.*

---

# 8.1 Failed Drive Detection

## 8.1.1 Periodic Drive Check Time

The “Periodic Drive Check Time” is the time interval for the controller to check all disk drives that were on the drive bus at controller startup (a list of all the drives that were detected can be seen under “View and Edit Drives”).

The default value is “1 second.” If set to “Disabled,” it means that if a drive is removed from the bus, the subsystem will not be able to know – so long as no host accesses that drive. Changing the check time to any other value allows the controller to check – at the selected time interval – all of the drives that are listed under “View and Edit Drives.” If any drive is then removed, the controller will be able to know – even if no host accesses that drive

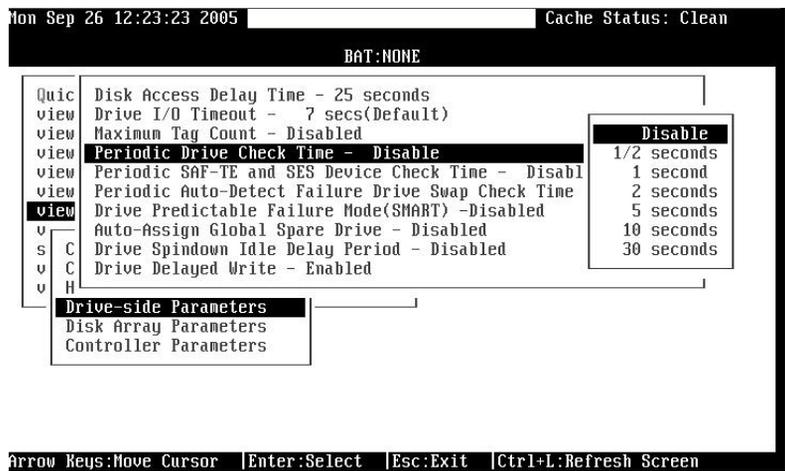


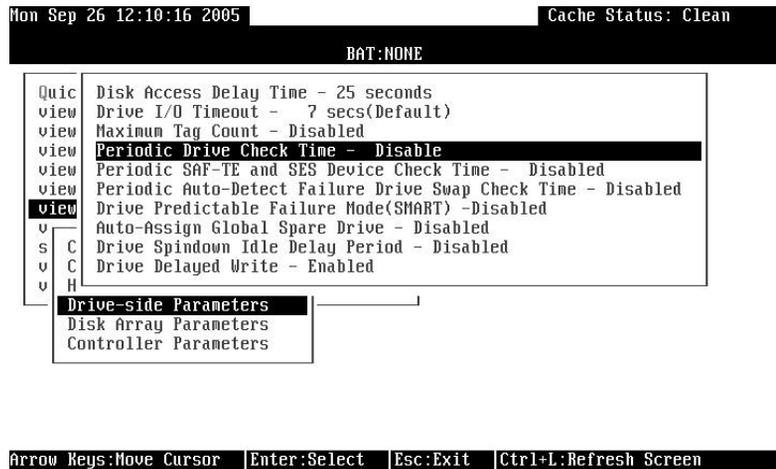
Figure 8 - 1: Set for Periodic Drive Check Time

Choose “Periodic Drive Check Time,” then press [ENTER]. Move the cursor to the desired interval, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

## 8.1.2 Periodic Auto-Detect Failure Drive Swap Check Time

The “Drive-Swap Check Time” is the interval at which the controller checks to see if a failed drive has been swapped. When a logical drive’s member drive fails, the controller will detect the failed drive (at the selected time interval). Once the failed drive has been swapped with a drive that has the adequate capacity to rebuild the logical drive, the rebuild will begin automatically.

The default setting is "Disabled," meaning that the controller will not Auto-Detect the swap of a failed drive. To enable this feature, select a time interval.



**Figure 8 - 2: Set for Auto-Detect Failure Drive Swap Check Time**

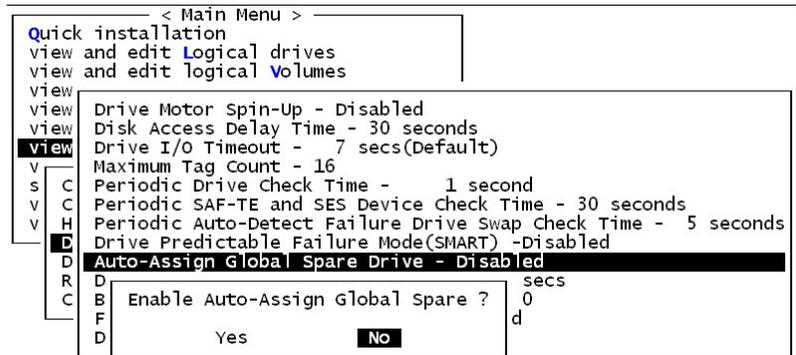
Choose "Periodic Auto-Detect Failure Drive Swap Check Time"; then press [ENTER]. Move the cursor to the desired interval; then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.



### IMPORTANT!

- The "Periodic Drive Check Time" is enabled by choosing a time value. The RAID controller will poll all connected drives through the controller's drive channels at the assigned interval. Drive removal will be detected even if a host does not attempt to access data on that specific drive.
- If the "Periodic Drive Check Time" is set to "Disabled" (the default setting is "Disabled"), the controller will not be able to detect any drive removal that occurs after the controller initialization process. The controller will only be able to detect drive removal when host access is directed to the drive side.

## 8.1.3 Auto-Assign Global Spare Drive



**Figure 8 - 3: Enable Auto-Assign Global Spare Drive**

The “Auto-Assign” function automatically assigns any “new” drives that are not included in logical configurations as Global Spares.

### The Fault Scenario:

Spare drives accelerate rebuild of a logical drive. In the example as described below, multiple faults can occur at the same time making the array exposed to the risk of data loss:

- ◆ There is only one Global Spare in a RAID subsystem.
- ◆ That Global Spare has been used to rebuild a logical drive.
- ◆ The failed drive is swapped out and replaced by a new one.
- ◆ Chances are system administrators forgot to configure the replacement drive as a spare.
- ◆ A member of another logical drive fails.
- ◆ The subsystem has no spare left. Performance decreases for a considerable portion of system resources has to be conducted to generate data from the remaining members of the logical drive. If yet another member fails in the logical drive, data is lost.

The chance of failing two drives increases when a failed drive in the array cannot be replaced immediately for the lack of spare drives.

### The Function:

If a drive has a capacity smaller or apparently larger than the members of configured arrays, the controller may avoid using it as a global spare.

Enable the function and reset the controller for the configuration to take effect.

## 8.2 Scheduled Maintenance

### 8.2.1 Task Scheduler

The Task Scheduler functionality allows Media Scans to be scheduled beginning at a specified start time and repeating at regular intervals defined by a configurable interval period. Each such schedule can be defined to operate on individual drives, all drives of a certain class, all member drives of a specified logical drive, or all member drives of all logical drives. UIs supported are RS232C terminal menus and RAIDWatch GUI manager.

Fri May 7 13:44:51 2004 Cache Status: Clean

BAT: NONE

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME	
0	ECC3E8E	NA	RAIDS	1673784	SHUTDOWN					7	B	8	1	0	
				112	GOOD					7	B	2	1	0	
				000	GOOD					7	B	2	1	0	
				000	GOOD					7	B	3	1	0	
7			NONE												

View drives  
Delete logical drive  
Partition logical drive  
Logical drive Name  
Expand logical drive  
add driveS  
reGenerate parity  
cOpy and replace drive  
Media scan  
Write policy

Arrow Keys: Move Cursor | Enter: Select | Esc: Exit | Ctr | L: Refresh Screen

**Figure 8 - 4: Media Scan Function**

The scheduler is accessed through the “View and Edit Logical Drives” menu by selecting a configured array to display the list of array-related functions. Select “Media Scan” by pressing [ENTER].

```
Media Scan Priority - Normal
Iteration Count - Single Time
Task Scheduler
```

**Figure 8 - 5: Task Scheduler Function**

Select “Task Scheduler” by pressing [ENTER].

## Creating a New Schedule

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	
0	ECC3E8E	NA	RAID5	1673784					7	B	8	1	0	
Media Scan Priority - Normal										7	B	2	1	0
Iteration Count - Single Time										7	B	2	1	0
Task Scheduler										7	B	2	1	0
3	No Media Scan Task Schedule - Add a New Task Schedule ?													
4	Yes						No							

Figure 8 - 6: Enable Task Scheduler

If there is no preset schedule, a confirm box as shown above will prompt.

## Adding or Deleting a Schedule

Media Scan Priority - Normal										7	B	2	1	0	
Iteration Count - Single Time										7	B	2	1	0	
Task Scheduler										7	B	2	1	0	
3	Idx	Start Time and Date			Period		Exec on Init								
4	0	Fri May 7 14:09:00 2004			10 hours		Priority								
5	View Schedule Information														
6	Add New Schedule														
	Delete Schedule														

Figure 8 - 7: Adding or Deleting Task Scheduler

Press [ENTER] on an existing schedule to display the configuration options. You may choose to check information of a task schedule, to create a new schedule, or to remove a configured schedule.

### 8.2.2 Task Scheduler Options

To configure a task schedule, you have the option to do any of the following:

Set the following values/intervals:

#### Execute on Controller Initialization

Media Scan Priority - Normal									
Iteration Count - Single Time									
Task Scheduler									
Execute on Controller Initialization - YES									
Start time and date - Not Set									
Execution Period - Not Set									
Media Scan Mode - Concurrence									
Media Scan Priority - Normal									
Select logical drives									

Figure 8 - 8: Set for Task Scheduler Function

This option determines whether Media Scan is automatically conducted whenever the RAID system is reset or powered on.

### Start Time and Date

Execute on Controller Initialization - YES		1	0
Start time and date - Fri May 7 14:09:00 2004			
E	Set Start Time and Date [MMDDhhmmYYYY] : █		
M			
M			
S			

**Figure 8 - 9: Set for Date on Task Scheduler Function**

Enter time and date in its numeric representatives in the following order: month, day, hour, minute, and the year.

### Execution Period

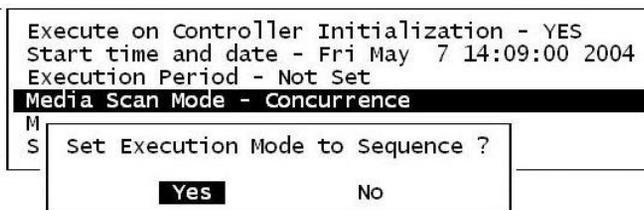
Execute on Controller Initialization - YES	Schedule Period - YES	9:00 2004
Start time and date	Execution Once	
Execution Period -	1 secs	
Media Scan Mode - C	2 secs	
Media Scan Priority	3 secs	
Select logical drive	⋮	
	10 days	
	11 days	
	12 days	
	13 days	
	2 weeks	
	3 weeks	

**Figure 8 - 10: Set for Time on Task Scheduler Function**

The scheduler memorizes the date and the time the actions are to be executed. Select one of the following:

- If the action is intended to be executed for one time only, select "Execution Once."
- In the case of a periodic action, the action is executed at the specified "start time," and then re-enacted at the time interval indicated in the execution period so as to be executed again later. The selectable interval ranges from one second to several weeks.

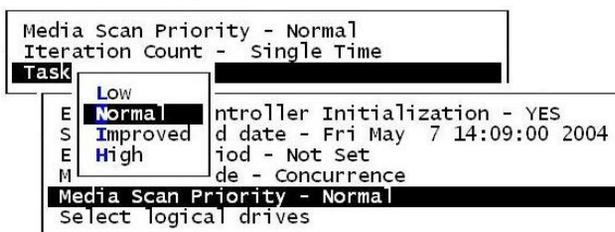
## Media Scan Mode



**Figure 8 - 11: Set for Media Scan Mode**

If the maintenance schedule includes more than one logical drive, the scan can be performed simultaneously or separately on one disk at a time in a sequential order.

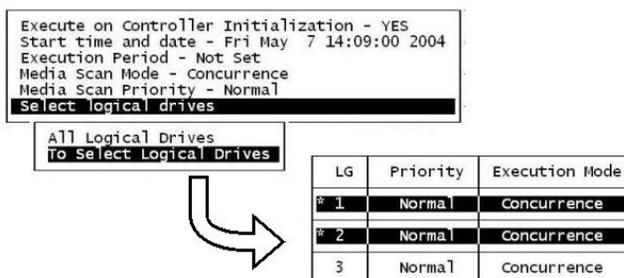
## Media Scan Priority



**Figure 8 - 12: Set for Media Scan Priority**

The scan priority determines how much of the system's resources will be consumed to perform the scheduled task. Select "Low" for better array performance and longer time to complete the media scan. Higher priority allows higher scan performance at the cost of reduced array performance.

## Select Logical Drives



**Figure 8 - 13: Set for Logical Drive**

Press [ENTER] on "Select Logical Drives" to bring out a sub-menu. From there you may include all configured arrays or press [ENTER]

on "To Select Logical Drives" to select one or more specific logical drive(s).

Logical drives can be tagged for inclusion by positioning the cursor bar on the logical drive and then pressing [ENTER]. An asterisk (\*) mark will appear on the selected physical drive(s). To deselect the drive, press [ENTER] again on the selected drive. The "\*" mark will disappear. Use the same method to select more logical drives if required.

When selection is done, press [ESC] to continue.

### 8.2.3 Confirming the Creation of a Task Schedule

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#
0	ECC3E8E	NA	RAID5	1673784	SHUTDOWN				7	B	8	1	
Media Scan Priority - Normal										7	B	2	1
Iteration Count - Single Time										7	B	2	1
Task Scheduler													
3	Start Time and Date : Fri May 7 14:09:00 2004											1	
4	Schedule Period : 10 hours												
5	Execution Mode : Sequence												
6	Priority : LOW												
7	Logical Drive Count : 1												
6	Create Task Schedule ?												
7	Yes											No	

Figure 8 - 14: Enable Task Scheduler Function

When finished with setting the scheduler options, press [ESC] to display a confirm box.

Verify all information in the box before choosing "Yes" to confirm and to complete the configuration process.

## 8.3 Regenerating Logical Drive Parity

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
P0	4295529B	NA	RAID5	476000	GOOD				4	B	3	0	0	
Execute Regenerate Logical Drive Parity														
Overwrite Inconsistent Parity - Enabled														
Generate Check Parity Error Event - Enabled														
3			NONE											
4			NONE											
5			NONE											
6			NONE											
7			NONE											

Figure 8 - 15: Regenerate Logical Drive Parity

Parity regeneration is a function manually performed onto RAID-1/3/5/6 arrays to determine whether inconsistency has occurred with data parity.

You may perform the parity check directly without changing the two options below, or set preferred options and then press [ENTER] on “Execute Regenerate Logical Drive Parity” to begin the operation.

### 8.3.1 Overwrite Inconsistent Parity

Default is “enabled.”

If an array’s data parity is seriously damaged, restoring parity data by regenerating and overwriting the original data may cause data loss. Disable this option if you suspect parity data has been seriously corrupted.

### 8.3.2 Generate Check Parity Error Event

Default is “enabled.”

When enabled, parity inconsistency will be reported as system events.



#### IMPORTANT!

*If a regenerating process is stopped by a drive failure, the process cannot be restarted until the logical drive is successfully rebuilt by having its failed member replaced.*

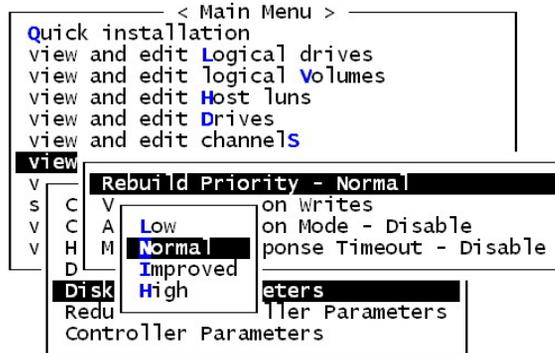
## 8.4 Disk Array Parameters

```
Fri Jul 22 13:48:08 2005 Cache Status: Clean
BAT:++++
< Main Menu >
Quick installation
view and edit Logical drives
view and edit logical Volumes
view and edit Host luns
view and edit Drives
view and edit channels
View
V Rebuild Priority - Normal
S C Verification on writes
V C AV Optimization Mode - Disable
V H Max Drive Response Timeout - Disable
D
Disk Array Parameters
Redundant Controller Parameters
Controller Parameters
Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen
```

Figure 8 - 16: Set for Disk Array Parameters

Select “View and Edit Configuration Parameters” on the Main Menu and press [ENTER]. Choose “Disk Array Parameters,” then press [ENTER] again. The Disk Array Parameters menu will appear.

### 8.4.1 Rebuild Priority



**Figure 8 - 17: Change Rebuild Priority**

Choose “Rebuild Priority,” then press [ENTER]. A list of the priority selections (Low, Normal, Improved, or High) displays. Move the cursor bar to a selection, then press [ENTER].

### 8.4.2 Verification on Writes

Errors may occur when a hard drive writes data. To avoid the write error, the controller can force hard drives to verify written data. There are three selectable methods:

- Verification on LD Initialization Writes  
Performs Verify-after-Write when initializing a logical drive
- Verification on LD Rebuild Writes  
Performs Verify-after-Write during the rebuild process
- Verification on LD Normal Drive Writes  
Performs Verify-after-Write during normal I/Os

Each method can be enabled or disabled individually. Hard drives will perform Verify-after-Write according to the selected method.

```

< Main Menu >
Quick installation
view and edit Logical drives
view and edit logical Volumes
view and edit Host luns
view and edit Drives
view and edit channels
view and edit Configuration parameters
v
s Communication Parameters
v Caching Parameters
v Host
Driv Verification on LD Initialization Writes Disabled
Disk Verification on LD Rebuild Writes Disabled
R Verification on Normal Drive Writes Disabled
C
R
Veri Verification on Writes
Max Max Drive Response Timeout - Disable

```

**Figure 8 - 18: Configure Verification on Write**

Move the cursor bar to the desired item, then press [ENTER].

```

< Main Menu >
Quick installation
view and edit Logical drives
view and edit logical Volumes
view and edit Host luns
view and edit Drives
view and edit channels
view and edit Configuration parameters
v
s Communication Parameters
v Caching Parameters
v Host
Driv Verification on LD Initialization Writes Disabled
Disk V Enable Initialize RAID with Verify Data ?
R V
C R
Veri Yes No
Max

```

**Figure 8 - 19: Enable Verification on LD Initialization Writes**

Choose **Yes** in the confirm box to enable or disable the function. Follow the same procedure to enable or disable each method.



**IMPORTANT!**

*The “verification on Normal Drive Writes” method will affect the “write” performance of your RAID system.*

<b>8.1 FAILED DRIVE DETECTION .....</b>	<b>2</b>
<b>8.1.1 Periodic Drive Check Time.....</b>	<b>2</b>
<b>FIGURE 8 - 1: SET FOR PERIODIC DRIVE CHECK TIME .....</b>	<b>2</b>
<b>8.1.3 Auto-Assign Global Spare Drive .....</b>	<b>3</b>
<b>8.2 SCHEDULED MAINTENANCE .....</b>	<b>5</b>
<b>8.2.1 Task Scheduler.....</b>	<b>5</b>
<i>Creating a New Schedule.....</i>	<i>6</i>
<i>Adding or Deleting a Schedule.....</i>	<i>6</i>
<b>8.2.2 Task Scheduler Options.....</b>	<b>6</b>
<i>Execute on Controller Initialization .....</i>	<i>6</i>
<i>Start Time and Date.....</i>	<i>7</i>
<i>Execution Period .....</i>	<i>7</i>
<i>Media Scan Mode .....</i>	<i>8</i>
<i>Media Scan Priority.....</i>	<i>8</i>
<i>Select Logical Drives.....</i>	<i>8</i>
<b>8.2.3 Confirming the Creation of a Task Schedule .....</b>	<b>9</b>
<b>8.3 REGENERATING LOGICAL DRIVE PARITY .....</b>	<b>9</b>
<b>8.3.1 Overwrite Inconsistent Parity.....</b>	<b>10</b>
<b>8.3.2 Generate Check Parity Error Event.....</b>	<b>10</b>
<b>8.4 DISK ARRAY PARAMETERS.....</b>	<b>10</b>
<b>8.4.1 Rebuild Priority.....</b>	<b>11</b>
<b>8.4.2 Verification on Writes.....</b>	<b>11</b>

# **Array Expansion**

---

The array expansion functions allow you to expand storage capacity without the cost of buying new equipment. Expansion can be completed on-line while the system is serving host I/Os.

## **9.1 Overview**

---

### **What is RAID Expansion and how does it work?**

---

Before the invention of RAID Expansion, increasing the capacity of a RAID system meant backing up all data in the disk array, re-creating the disk array configuration with new drives, and then restoring data back into system.

Infortrend's RAID Expansion technology allows users to expand a logical drive by adding new drives, or replacing drive members with drives of larger capacity. Replacing is done by copying data from the original members onto larger drives; the smaller drives can then be replaced without powering down the system.

## **9.2 Notes on Expansion**

### **1. Added Capacity:**

When a new drive is added to an existing logical drive, the capacity brought by the new drive appears as a new partition. For example, if you have 4 physical drives (36GB each) in a logical drive, and each drive's maximum capacity is used, the capacity of the logical drive will be 108GB. (One drive's capacity is used for parity, e.g., RAID 3). When a new 36GB drive is

added, the capacity will be increased to 144GB in two separate partitions (one is 108GB and the other 36GB).

## 2. Size of the New Drive:

A drive used for adding capacity should have the same or more capacity as other drives in the array.

## 3. Applicable Arrays:

Expansion can only be performed on RAID 0, 1, 3, 5, and 6 logical drives. Expansion cannot be performed on logical configurations that do not have parity, e.g., NRAID or RAID 1.



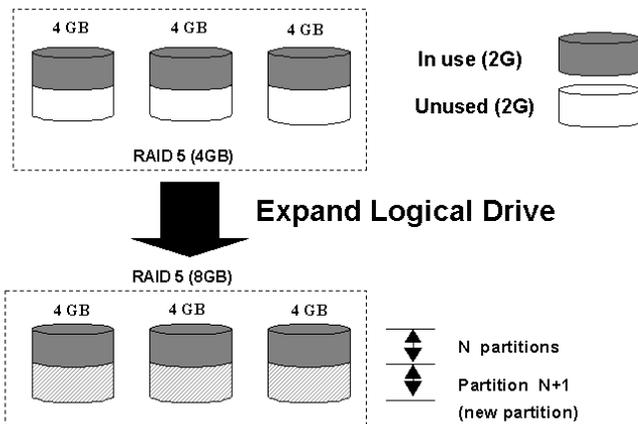
### NOTE:

*Expansion on RAID0 is not recommended, because the RAID0 array has no redundancy. Interruptions during the expansion process may cause unrecoverable data loss.*

## 4. Interruption to the Process:

Expansion should not be canceled or interrupted once begun. A manual restart should be conducted after the occurrence of a power failure or interruption of any kind.

## Expand Logical Drive: Re-striping



After expanding logical drive, the additional capacity will appear as another partition (new partition).

**Figure 9 - 1: Logical Drive Expansion**

RAID levels supported: RAID 0, 1, 3, 5 and 6

Expansion can be performed on logical drives or logical volumes under the following conditions:

1. There is unused capacity in a logical unit
2. Capacity is increased by using member drives of larger capacity (see Copy and Replace in the discussion below)

Data is recalculated and distributed to drive members or members of a logical volume. Upon the completion of the process, the added or the previously unused capacity will become a new partition. The new partition must be made available through host LUN mapping in order for a host adapter to recognize its presence.

### 9.3 Mode 1 Expansion: Adding Drives to a Logical Drive

Use drives with the same capacity as the original drive members. Once completed, the added capacity will appear as another partition (new partition). Data is automatically re-stripped across the new and old members during the add-drive process. See the diagram below to get a clear idea:

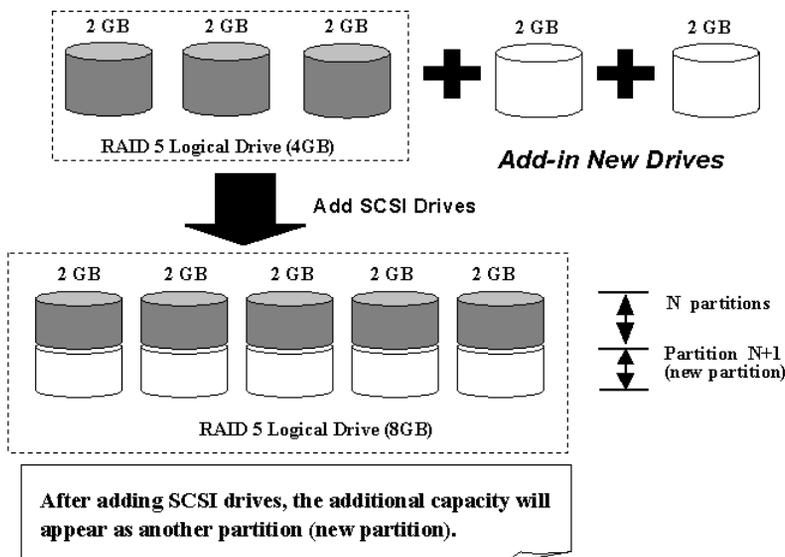


Figure 9 - 2: Expansion by Adding Drive



Available drives will be listed. Select one or more drive(s) to add to the target logical drive by pressing [ENTER]. The selected drive will be indicated by an asterisk "\*" mark.

LG	Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
0	2A	8	238469	150MB	NONE	FRMT DRV
1	12	9	238469	150MB	NONE	FRMT DRV
	view	10	238469	150MB	NONE	FRMT DRV
	Dele	11	238469	150MB	NONE	FRMT DRV
	Part					

**Figure 9 – 5: Select Drives**

Press [ESC] to proceed and the notification will prompt.

Q	LG	ID	LV	RAID	Size(MB)	Status	0	#LN	#SB	#FL	NAME	
	P0	2	SB16	A	INA	RAID5	9999	GOOD	R	3	0	0
	Adding Notification											
	LG:0 Logical Drive NOTICE: Starting Add Drive Operation											
	4			NONE								
	5			NONE								
	6			NONE								
	7			NONE								

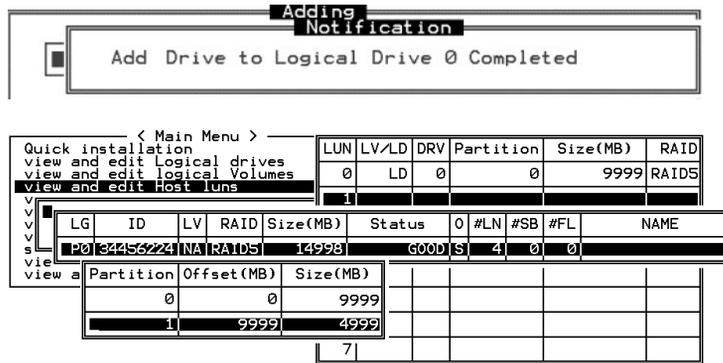
**Figure 9 – 6: Notice Starting Add Drive Operation**

Press [ESC] again to cancel the notification prompt; a status bar will indicate the percentage of progress.

Q	LG	ID	LV	RAID	Size(MB)	Status	0	#LN	#SB	#FL	NAME	
	P0	2	SB16	A	INA	RAID5	9999	GOOD	R	3	0	0
	Adding											
	1											
	2											
	3											
	11% Completed_											
	4			NONE								
	5			NONE								
	6			NONE								
	7			NONE								

**Figure 9 – 7: View the Percentage of Progress**

Upon completion, there will appear a confirming notification. The capacity of the added drive will appear as an unused partition.



**Figure 9 – 8: Completion of Add Drive Function**

The added capacity will be automatically included, meaning that you do not have to "expand logical drive" later. Map the added capacity to another host ID/LUN to make use of it.

As diagrammed above, in "View and Edit Host LUN," the original capacity is 9999MB, its host LUN mapping remains unchanged, and the added capacity appears as the second partition.



**IMPORTANT!**

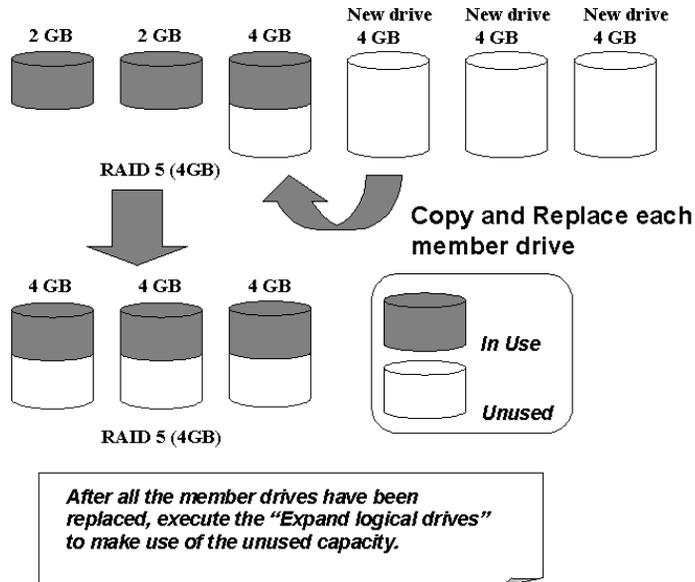
- Expansion by adding drives can not be canceled once started. If power failure occurs, the expansion will be paused and the controller will NOT restart the expansion when power comes back on. Resumption of the RAID expansion must be performed manually.
- If a member drive of the logical drive fails during RAID expansion, the expansion will be paused. The expansion will resume after the logical drive rebuild is completed.

## 9.4 Mode 2 Expansion:

### Copy and Replace Drives with Drives of Larger Capacity

You may also expand your logical drives by copying and replacing all member drives with drives of higher capacity. Please refer to the diagram below for a better understanding. The existing data in the array is copied onto the new drives, and then the original members can be removed.

When all the member drives have been replaced, execute the “Expand Logical Drives” function to make use of the added capacity.



RAID levels supported: RAID 0, 1, 3, 5 and 6

**Figure 9 – 9: Expansion by Copy & Replace**

### Copy and Replace Procedure

Select from Main Menu “View and Edit Logical Drives.” Select a target array, press [ENTER] and scroll down to choose “Copy and Replace Drive.” Press [ENTER] to proceed.

Q	LG	ID	LV	RAID	Size(MB)	Status	0	#LN	#SB	#FL	NAME
V	P0	60F15A60	NA	RAID5	959	GOOD	R	4	0	0	
V											
V											
V											
S											
V											
	6			NONE							
	7			NONE							

View scsi drives  
 Delete logical drive  
 Partition logical drive  
 logical drive Name  
 logical drive Assignments  
 Expand logical drive  
 add Scsi drives  
 reGenerate parity  
**copy and replace drive**

Cache Status: Clean

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 9 – 10: Choose Copy & Replace**

The array members will be listed. Select the member drive (the source drive) you want to replace with a larger one.

LG	Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
0	2A	8	238469	150MB	NONE FRMT DRV	
1	12	9	238469	150MB	NONE FRMT DRV	
	view	10	238469	150MB	NONE FRMT DRV	
	Dele	11	238469	150MB	NONE FRMT DRV	
	Part					

**Figure 9 – 11: Select Source Drive**

Select one of the members as the "source drive" (status indicated as ON-LINE) by pressing [ENTER]; a table of available drives will prompt. Select a "new drive" to copy the capacity of the source drive onto. The channel number and ID number of both the "Source Drive" and the "Destination Drive" will be indicated in the confirming box.

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME	
0	5dc80200	0	RAID6	4000	GOOD						7	8	4	0	

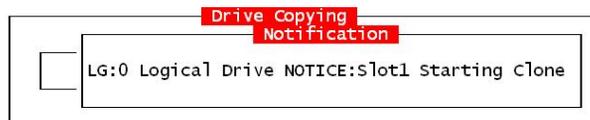
view dri	Source Drive:		Vendor and Product ID	
Delete 1	SLOT=1		Maxtor 7Y250M0	
Partitio	Destination Drive:		us Vendor and Product ID	
lo	SLOT=5		Maxtor 7Y250M0	
Ex	Slot			
ad	1			
re				
Mi	Copy and Replace Drive ?			
ad	Yes	No		
re				
Me				
Me				
wr				

LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
7														
	5	239367	133MB	NONE	NEW DRV									Maxtor 7Y250M0
	6	70906	150MB	NONE	NEW DRV	WDC								WD740GD-00FLX0

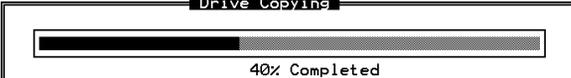
**Figure 9 – 12: Confirm Copy and Replace Drive**

Choose Yes to confirm and proceed.



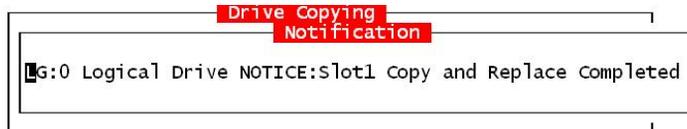
**Figure 9 – 13: Notice Starting Clone**

Press [ESC] to view the progress.

Q	LG	ID	LV	RAID	Size(MB)	Status	O	#LN	#SB	#FL	NAME
V	P0	60-15A60	NA	RAID5	9999	GOOD	R	4	0	0	
V	1	Drive Copying									
V	2										
V	3	40% Completed									
V	4		NONE								
V	5		NONE								
V	6		NONE								
V	7		NONE								

**Figure 9 – 14: View Copy and Replace Progress**

Completion of the Copy and Replace process will be indicated by a notification message. Follow the same method to copy and replace every member drive. You may now perform “Expand Logical Drive” to make use of the added capacity, and then map the additional capacity to a host LUN.

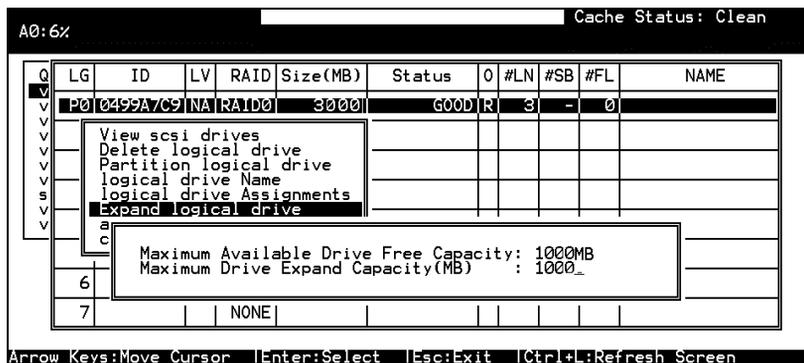


**Figure 9 – 15: Completed Copy and Replace**

## 9.5 Making Use of the Added Capacity: Expand Logical Drive

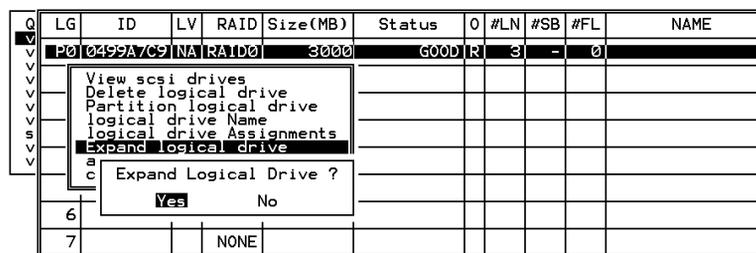
In the following example, the logical drive is originally composed of three member drives and each member drive has the capacity of 1GB. “Copy and Replace” has been performed on the logical drive and each of its member drives has been replaced by a new drive with the capacity of 2GB. The next step is to perform “Expand Logical Drive” to utilize the additional capacity brought by the new drives.

1. Select “View and Edit Logical Drives” from the Main Menu and select the logical drive with its members copied and replaced.
2. Select “Expand Logical Drive” in the sub-menu and press [ENTER] to proceed. A confirming box will appear.
3. Proceed by pressing [ENTER] or entering any value no larger than the "maximum drive expand capacity" and press [ENTER].



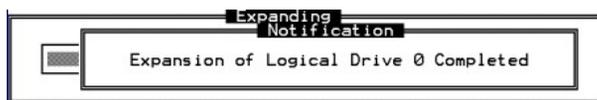
**Figure 9 – 16: Expand Logical Drive**

Choose Yes to confirm and proceed.



**Figure 9 – 17: Choose Expand Logical Drive**

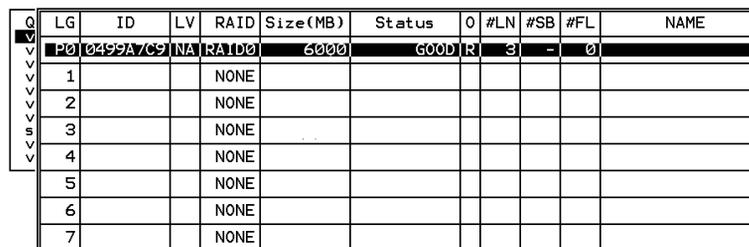
Upon completion, you will be prompted by the notification message.



**Figure 9 – 18: Completed Expand Logical Drive**

Press [ESC] to return to the previous menu screen.

The total capacity of logical drive has been expanded to 6GB.



**Figure 9 – 19: View Logical Drive Information**

## 9.6 Expand Logical Volume

To expand a logical volume, expand its logical drive member(s) and then perform "expand logical volume."

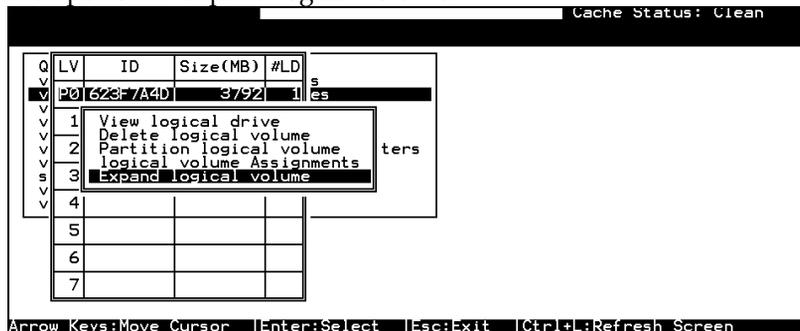


Figure 9 – 20: Expand Logical Volume

When prompted by "Expand Logical Volume?", choose **Yes** to confirm and the process will be completed immediately.

## 9.7 Configuration Example: Volume Extension in Windows 2000®

### Limitations When Using Windows 2000

1. This limitations apply only to the Windows NT Server or Windows 2000 Server Disk Management which includes the Extend Volume Set function; Windows NT Workstation does not support this feature. The Volume Set Expansion formats the new area without affecting existing files on the original volume.
2. The system drive (boot drive) of a Windows NT/2000 system cannot be expanded.
3. The drive to be expanded should be using the NTFS file system.

## Example

The following example demonstrates the expansion of a 16988MB RAID 5 logical drive. The HyperTerminal emulation software that comes with Windows Server is used to connect to the RAID controller via RS-232C.

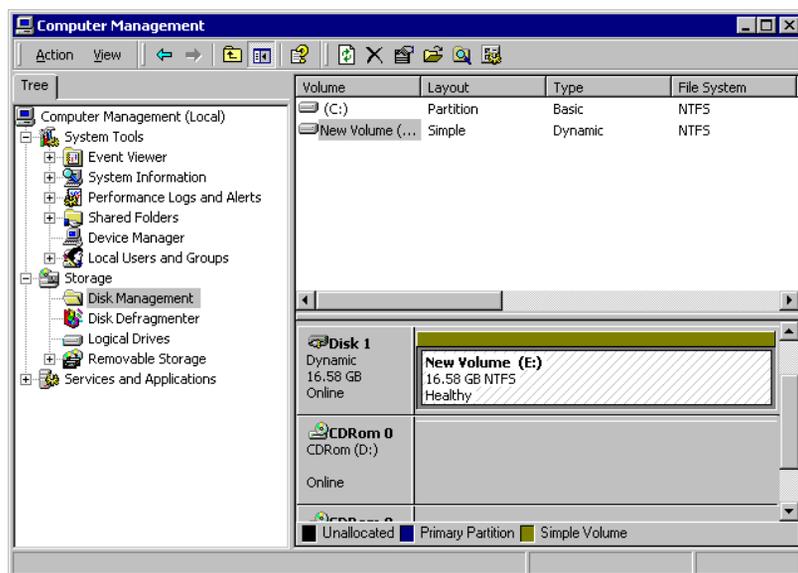
Mon Jan 20 18:30:48 2003 Cache Status: Clean  
A0:92%

LG	ID	LU	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME	
P0	2092804D	NA	RAID5	16988	GOOD						7	B	3	0	0
1			NONE												
2			NONE												
3			NONE												
4			NONE												
5			NONE												
6			NONE												
7			NONE												

Arrow Keys:Move Cursor !Enter:Select !Esc:Exit !Ctrl+L:Refresh Screen

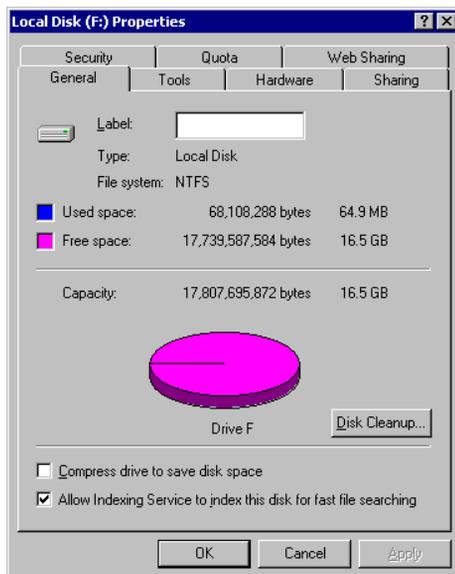
**Figure 9 – 21: View Logical Drive**

You can view information about this drive in the Windows 2000 Server's Computer Management -> Storage -> Disk Management.



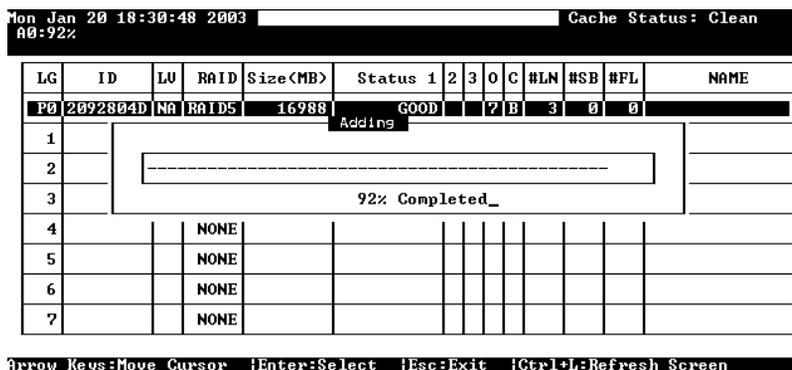
**Figure 9 – 22: View Disk Management on Windows**

Place the cursor on Disk 1, right-click your mouse, and select "Properties." You will see that the total capacity for the Drive E: is about 16.5GB.



**Figure 9 – 23: View Disk Information**

Follow the steps described in the previous section to "add" or "copy & replace" disk drives and perform "Logical Drive Expansion."



**Figure 9 – 24: View Logical Drive Expansion of progress**

The 16.5GB logical drive has become a 25GB logical drive. Place the cursor on that logical drive, and then press [ENTER].

Mon Jan 20 18:32:34 2003 Cache Status: Clean

LG	ID	LU	RAID	Size<MB>	Status	1	2	3	0	C	#LN	#SB	#FL	NAME
P0	2092804D	NA	RAID5	25482	GOOD				7	B	4	0	0	
1			NONE											
2			NONE											
3			NONE											
4			NONE											
5			NONE											
6			NONE											
7			NONE											

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 9 – 25: Choose Logical Drive**

From the menu, select "Partition Logical Drive." You will see that the 25GB logical drive is composed of a 17GB partition and an 8.4GB partition.

Mon Jan 20 18:33:39 2003 Cache Status: Clean

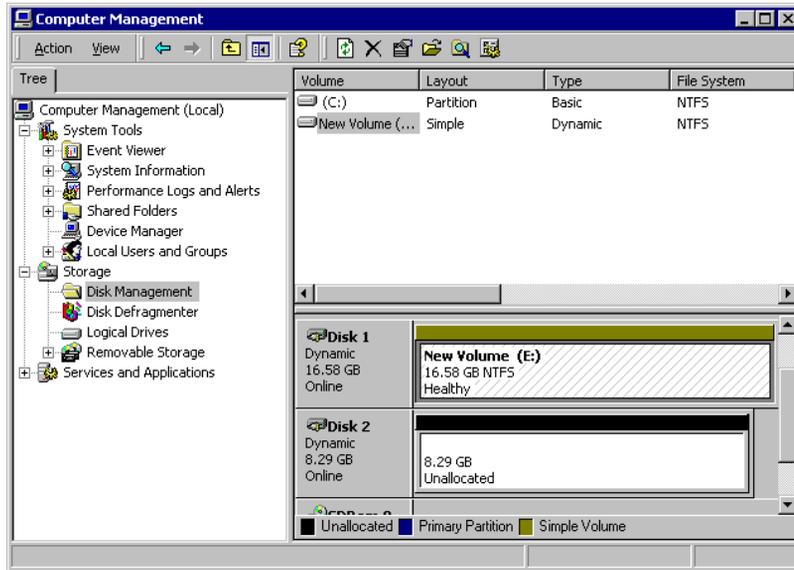
LG	ID	LU	RAID	Size<MB>	Partition	Offset<MB>	Size<MB>	NAME
P0	2092804D	NA	RAID5	25482	0	0	16988	
1			NONE		1	16988	8494	
2			NONE		2			
3			NONE		3			
4			NONE		4			
5			NONE		5			
6			NONE		6			
7			NONE		7			

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

**Figure 9 – 26: View Partition of Logical Drive**

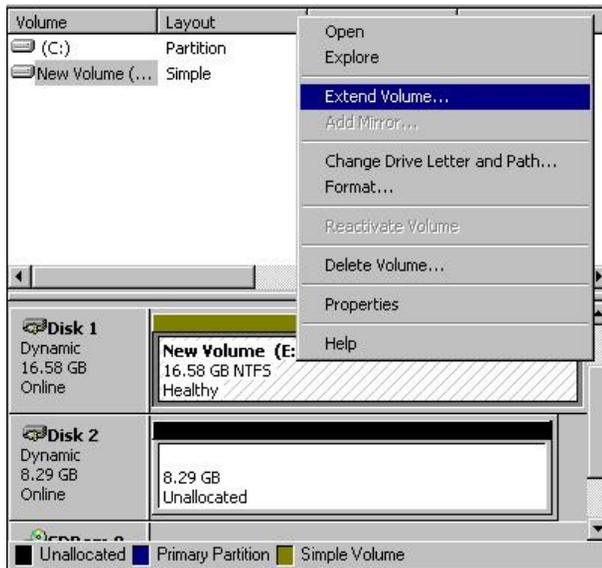
Follow the directions in *Chapter 5* and *Chapter 7* to map the new partition to a host LUN. The new partition must be "mapped" to a host LUN in order for the HBA (host-bus adapter) to see it. Once you have mapped the partition, reboot your Windows server. The HBA should be able to detect an additional disk during the initialization process.

Return to Windows 2000 Server's Disk Management. There now exists a Disk 2 with 8.3GB of free space. You may use the "rescan disks" command to bring up the new drive.



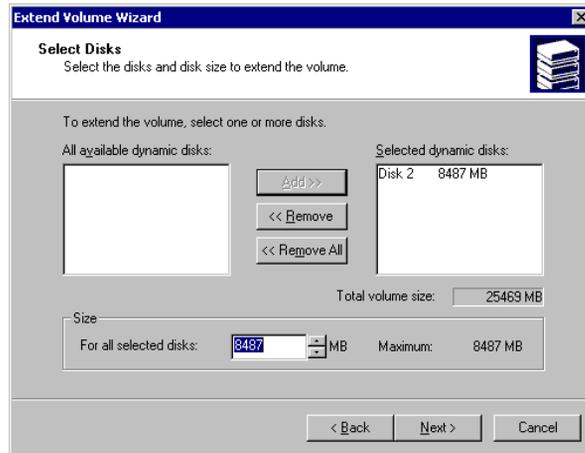
**Figure 9 – 27: View Disk information on Windows**

Select an existing volume (Disk1) and then right-click on the disk column. Select “Extend Volume” to proceed.



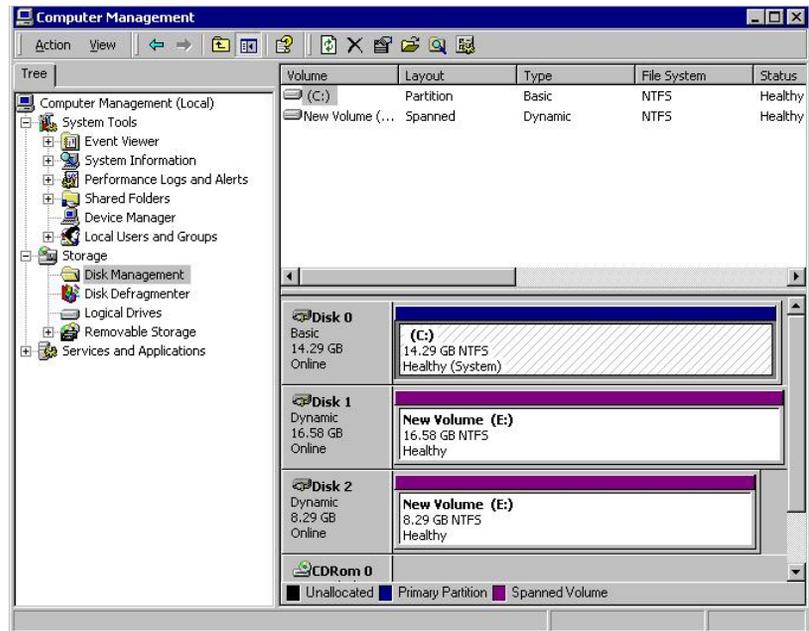
**Figure 9 – 28: Extend the Disk Volume on Windows**

The Extend Volume Wizard will guide you through the rest of the process.



**Figure 9 – 29: Configure Disk Volume**

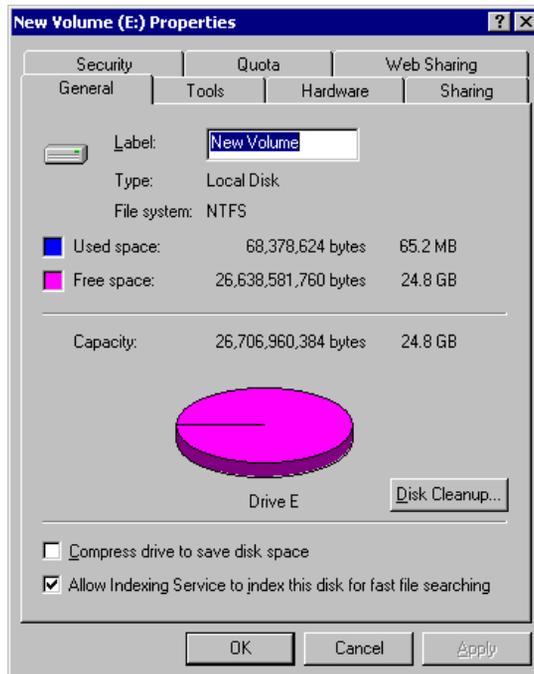
The screen will display that the volume set of Drive E: has been extended into a spanned volume by the 8.3GB in Disk2.



**Figure 9 – 30: View Disk Management on Windows**

Logical Drive E: is now composed of two partitions with a total volume of 2500MB. To see this, hold down on the <Ctrl> key and select both Disk 1 and Disk2; then right-click your mouse and select "Properties."

Drive E: now has a capacity of about 25GB.



**Figure 9 – 31: View Disk Information**

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9.1	Overview .....	1
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9.3	Mode 1 Expansion: .....	3
	Adding Drives to a Logical Drive .....	3
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## 10.1 Overview

### S.M.A.R.T.

With the maturity of technologies like S.M.A.R.T., drive failures can be predicted to certain degree. Before S.M.A.R.T., receiving notifications of drive bad block reassignments may be the most common omen that a drive is about to fail. In addition to the S.M.A.R.T.-related functions as will be discussed later, a system administrator can also choose to manually perform “Clone Failing Drive” on a drive which is about to fail.

This function provides system administrators a choice on when and how to preserve data from a failing drive. Although not necessary under normal conditions, you may also replace any drive at-will even when the source drive is healthy.

The “Clone Failing Drive” can be performed under the following conditions:

1. Replacing a failing drive either detected by S.M.A.R.T. or notified by the controller.
2. Manually replacing and cloning any drive with a new drive.

## 10.2 Clone Failing Drive

Unlike the similar functions combined with S.M.A.R.T., the “Clone Failing Drive” is a manual function. There are two options for cloning a failing drive: “Replace after Clone” and “Perpetual Clone.”



The cloning process will be indicated by a status bar.

You may quit the status bar by pressing [ESC] to return to the table of the connected drives. Select the drive indicated as "CLONING" by pressing [ENTER].

Slot	Chl	ID	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
	2	0	319	20MB	0	ON-LINE	
	2	1	319	20MB	0	ON-LINE	
	2	2	319	20MB	0	ON-LINE	
	2	3	319	20MB	0	CLONING	

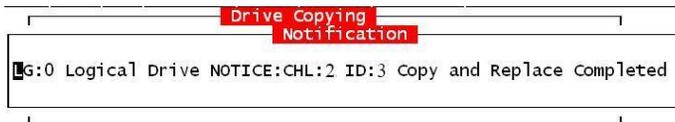
  

V S s a I	Source Drive: Channel 2 ID 0	EW DRV
	View clone progress	EW DRV
	Abort clone	EW DRV
	clone failing drive	NONE NEW DRV

**Figure 13 – 4: Cloning Status**

Select "Clone Failing Drive" again to view the current status. You may identify the source drive and choose to "View Clone Progress," or "Abort Clone" if you happen to have selected the wrong drive.

When the process is completed, you will be notified by the following message.



**Figure 10 – 5: Cloning Drive Completed**

## Perpetual Clone:

The standby spare will clone the source drive, the member drive with predicted errors or any selected drive, without substituting it. The status of the spare drive will be displayed as "clone drive" after the cloning process. The source drive will remain a member of the logical drive. If the source drive fails, the clone drive can readily take its place in the array.

In "View and Edit Drives," locate the member drive that shows predicted errors. Select "Clone Failing Drive," and choose "Perpetual Clone."





predetermined disk drives attributes that are susceptible to degradation over time.

If a failure is likely to occur, S.M.A.R.T. makes a status report available so that the host can prompt the user to backup data from the failing drive. However, not all failures can be predicted. S.M.A.R.T. predictions are limited to the attributes the drive can monitor which are selected by the device manufacturer based on the attribute's ability to contribute to predict degrading or fault conditions.

Although attributes are drive specific, a variety of typical characteristics can be identified:

- Head flying height
- Data throughput performance
- Spin-up time
- Re-allocated sector count
- Seek error rate
- Seek time performance
- Spin try recount
- Drive calibration retry count

Drives with reliability prediction capability only indicate whether the drive is "good" or "failing." In a SCSI environment, the failure decision occurs on the disk drive and the host notifies the user for action. The SCSI specification provides a sense bit to be flagged if the disk drive determines that a reliability issue exists. The system then alerts the user/system administrator.

## **B. Infortrend's Implementations with S.M.A.R.T.**

Infortrend uses the ANSI-SCSI Informational Exception Control (IEC) document X3T10/94-190 standard.

There are four selections related to the S.M.A.R.T. functions in firmware:

---

### **Disabled**

---

Disables S.M.A.R.T.-related functions

---

### **Detect Only:**

---

When the S.M.A.R.T. function is enabled, the controller will send a command to enable all drives' S.M.A.R.T. function, if a drive predicts a problem, the controller will report the problem in an event log.

---

### **Detect and Perpetual Clone**

---

When the S.M.A.R.T. function is enabled, the controller will send a command to enable all drives' S.M.A.R.T. function. If a drive predicts a problem, the controller will report the problem in an event log. The controller will clone the drive if a Dedicated/Global spare is available. The drive with predicted errors will not be taken off-line, and the clone drive will still act as a standby drive.

If the drive with predicted errors fails, the clone drive will take over immediately. If the problematic drive is still working and another drive in the same logical drive fails, the clone drive will resume the role of a standby spare and start to rebuild the failed drive immediately. This prevents a fatal drive error if yet another drive should fail.

---

### **Detect and Clone + Replace**

---

The controller will enable all drives' S.M.A.R.T. function. If a drive predicts a problem, the controller will report the problem in the form of an event log. The controller will then clone the problematic drive to a standby spare and take the problematic drive offline as soon as the cloning process is completed.



#### **NOTE:**

- *If you are using drives of different brands in your RAID system, as long as they are ANSI-SCSI Informational Exception Control (IEC) document X3T10/94-190-compatible, there should not be any problems working with the controller/subsystem.*
- 

## **10.4 Configuration Procedure**

---

### **Enabling the S.M.A.R.T. Feature**

---

Follow the procedure below to enable S.M.A.R.T. on all drives.



- Step 1. First, enable the "Periodic Drive Check Time" function. In \View and Edit Configuration Parameters\Drive-side Parameters\Periodic Drive Check Time, choose a time interval.

```

Fri Sep 12 01:32:42 2003                               Cache Status: Clean
                                                         BAT:+++++
      < Main Menu >
Quick installation
view  Disk Access Delay Time - 30 seconds
view  Drive I/O Timeout - 7 secs(Default)
view  Maximum Tag Count - 16
view  Periodic Drive Check Time - 1 second
view  Periodic SAF-TE and SES Device Check Time - 30 seconds
view  Periodic Auto-Detect Failure Drive Swap Check Time
      Drive Predictable Failure Mode(SMART) -Disabled
      Auto-Assign Global Spare Drive - Disabled
      Drive-side Parameters
      Disk Array Parameters
      Controller Parameters

```

Disable
1/2 seconds
1 second
2 seconds
5 seconds
10 seconds
30 seconds

```

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

```

**Figure 10 – 12: Select Drive Check Time**



Step 2. In \View and Edit Configuration Parameters\Drive-side Parameters\Drive Predictable Failure Mode <SMART>, choose one from “Detect Only,” “Detect, Perpetual Clone” and “Detect, Clone+Replace.”

```

Mon May 12 07:10:01 2003                               Cache Status: Clean
                                                         BAT:+++++
      < Main Menu >
Quick installation
view  Drive Motor Spin-Up - Disabled
view  Disk Access Delay Time - 15 seconds
view  Drive I/O Timeout - 7 secs(Default)
view  Maximum Tag Count - 16
view  Periodic Drive Check Time - Disable
view  Periodic SAF-TE and SES Device Check Time - 30 seconds
view  Periodic Auto-Detect Failure Drive Swap Check Time - Disabled
      Drive Predictable Failure Mode(SMART) -Disabled
      Auto-Assign Global Spare Drive - Disabled
      Disabled
      Detect Only
      Detect and Perpetual Clone
      Detect and Clone+Replace

```

```

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

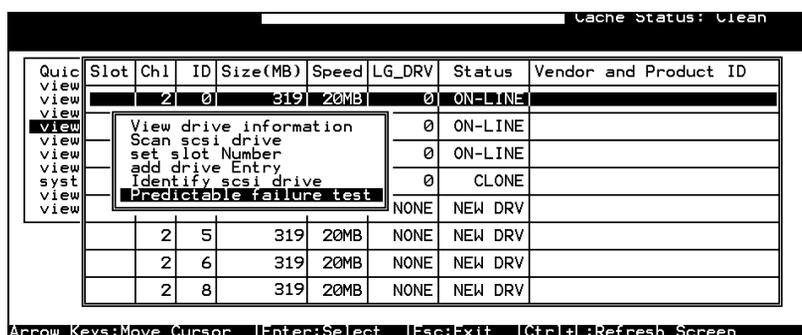
```

**Figure 10 – 13: Select Drive Failure Mode**

## Examining Whether Your Drives Support S.M.A.R.T.

To see if your drive supports S.M.A.R.T., follow the steps below:

-  Step 1. Enable “S.M.A.R.T.” for your drives in the RAID system.
-  Step 2. In “View and Edit Drives,” choose one drive to test to. Press [ENTER] on the drive; a sub-menu will appear.
-  Step 3. Note that a new item “Predictable Failure Test” appears in the sub-menu. If the S.M.A.R.T.” feature is not properly enabled, this item will not appear in the sub-menu.



Cache Status: Clean

Slot	Chl	ID	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
2	0	0	319	20MB	0	ON-LINE	
2	5	5	319	20MB	NONE	NEW DRV	
2	6	6	319	20MB	NONE	NEW DRV	
2	8	8	319	20MB	NONE	NEW DRV	

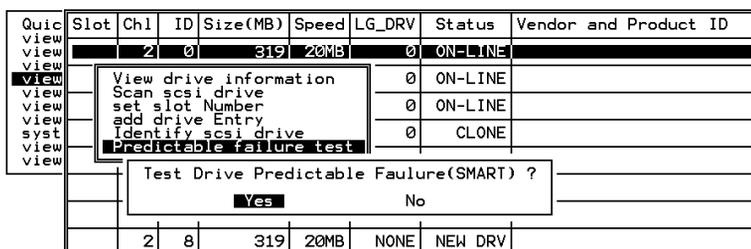
  

View drive information	0	ON-LINE
Scan scsi drive	0	ON-LINE
set slot Number	0	CLONE
add drive Entry	0	CLONE
Identify scsi drive	0	CLONE
<b>Predictable failure test</b>	NONE	NEW DRV

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

Figure 10 – 14: Predictable Failure Test

-  Step 4. Choose “Predictable Failure Test,.” The controller will force the drive to simulate predictable drive errors.



Slot	Chl	ID	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
2	0	0	319	20MB	0	ON-LINE	
2	8	8	319	20MB	NONE	NEW DRV	

View drive information	0	ON-LINE
Scan scsi drive	0	ON-LINE
set slot Number	0	CLONE
add drive Entry	0	CLONE
Identify scsi drive	0	CLONE
<b>Predictable failure test</b>	NONE	NEW DRV

Test Drive Predictable Failure(SMART) ?	
<b>Yes</b>	No

Figure 10 – 15: Choose Predictable Failure Testing

-  Step 5. Press [ENTER], and after a while (the next time the controller performs “Periodic Drive Check”), the controller will detect the errors simulated by the drive. An error message displays like this: “SMART-CH:? ID:? Predictable Failure Detected (TEST).” If this error





- 5c. When a drive (a logical drive member) detects the predictable drive failure, the controller will “clone” the drive with a spare drive. After the “clone” process is completed, it will replace the source drive immediately. The source drive will be identified as a “used drive.”

If you want to see the progress of cloning, press [ESC] to clear the notification message and see the status bar.

The source drive’s status will be defined as a “used drive” and will be immediately replaced and pulled offline. This drive should be replaced with a new one as soon as possible.

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S.M.A.R.T. ....	0-1
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# Implementations for AV Applications

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This chapter introduces some new firmware functions for AV applications. More options will be available for AV applications with future firmware releases.



**NOTE:**

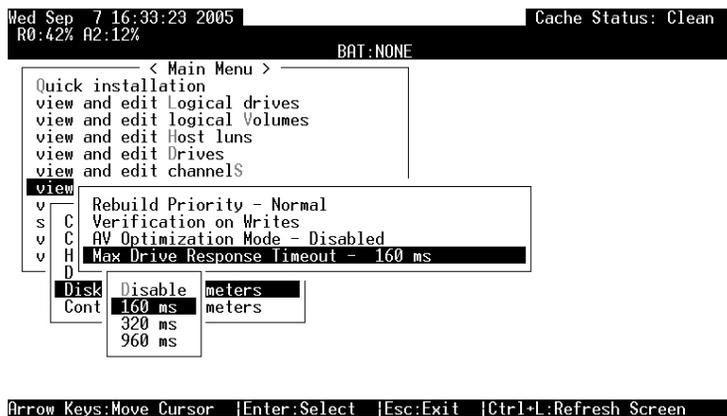
*All figures in this chapter are showing examples using the management hyper terminal screen.*

---

## 11.1 Maximum Drive Response Time

In situations such as drive failure or the occurrence of media error, a read or write action returned after several hundreds milliseconds would prove too long and cause choppy audio or dropped video frames.

The maximum response time option, as displayed below, provides a timeout value for processing read/write requests. If timeout is reported on a specific member of an array, the subsystem immediately retrieves data from the parity data and other members of the array. In this way, causes of delay can be eliminated.



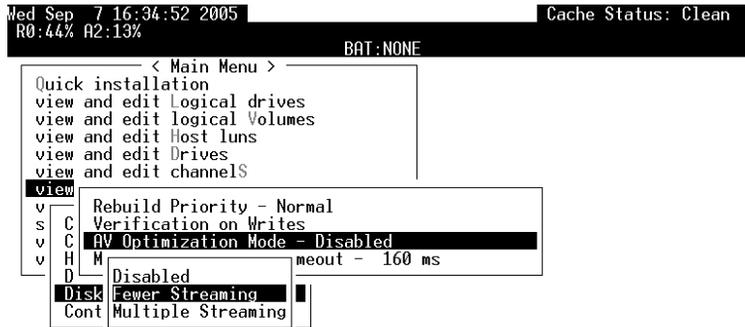
**Figure 11 - 1: Selecting Maximum Drive Response Timeout Value**

To prepare the array for read-intensive applications, the following are recommended:

1. Performance using the write-through caching mode is better than that using the write-back mode on subsystems equipped with redundant RAID controllers.
2. Arrays should not be partitioned.
3. The priorities for Rebuild or Add-drive operations should be set to “low.”
4. Another timeout value, the “Drive I/O Timeout” which determines whether a drive has eventually failed to respond to I/O requests, is required as the first-level timeout.

## 11.2 AV Optimization Mode

The AV optimization is applied for the emerging streaming Audio/Video applications. This option prepares the array for applications requiring continuous reading such as video streaming.



Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

## Figure 14 - 2: Selecting An AV Optimization Mode

The applicable number of streaming for fewer/multiple streaming will depend on the field applications.



### NOTE:

*No matter what user configures for the Maximum Drive Response Timeout, once the AV optimization is set, the Maximum Drive Response Timeout is fixed at its predefined value.*

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14.1 MAXIMUM DRIVE RESPONSE TIME..... 1  
14.2 AV OPTIMIZATION MODE ..... 2

# Redundant Controller

---

## 12.1 Operation Theory

Sample topologies using redundant controllers can be found in the *Installation and Hardware Reference Guide* that came with your RAID subsystems. The proceeding discussions will focus on the theories behind and the configuration procedures for readying a redundant controller system.

Today's high-speed I/O interfaces pose increasing demands on signal quality. We assume that reliable inter-connections have already been made by combining controllers' I/O channels either through a common backplane or cabling connections. Depending on the enclosure design, signal paths for communications should have been strung between controllers over a common backplane. Your RAID subsystems, such as Infortrend's EonStor series, may come with preset IDs and channel mode settings, and require no further configurations.

Users who are familiar with the theories behind dual-controller configurations, please move ahead to *Section 112.3 Configuration*.

This chapter covers the following topics:

### Operation Theory

▪ 12.1.1 Grouping Hard Drives and LUN Mapping
▪ 12.1.2 Fault Tolerance

### Preparing Controllers

▪ 1512.2.1 Requirements
▪ 12.2.2 Limitations
▪ 12.2.3 Configurable Parameters

### Configuration Procedures

▪ 12.3 Configuration
▪ Redundant Configuration Using Manual Setting

▪ Controller Unique ID
▪ Creating Primary and Secondary ID
▪ Logical Drive/Logical Volume
▪ Mapping a Logical Drive/Logical Volume to the Host LUNs
▪ Terminal Interface View of Controller Failure
▪ Forcing Controller Failover for Testing
▪ 12.3.3 When and How Is the Failed Controller Replaced?
▪ 12.4 Redundant controller Parameters

## 12.1.1 Grouping Hard Drives and LUN Mapping

Listed below are the array setting options that need to be considered when planning a dual-controller RAID subsystem:

1. **H**ow many logical drives, logical volumes, or logical partitions, and each of what sizes?
2. **S**ystem drive mapping (Primary/Secondary controller IDs): how many storage volumes will appear to which host ports, and managed by which controller?
3. **W**ill those storage volumes be accessed in a multi-host or multi-path configuration? Will they be used as shared as volumes?
4. **F**ault Tolerance: Configure the RAID controllers so that they can failover and fallback in the event of single controller failure. See *12.1.2 Fault Tolerance* for more details.

## Different Controller Configuration Rules

With subsystems built on the new ASIC266 chipset, a slot A-slot B controller position principle is applied. The new position principle helps to ensure the location of a dominating Primary controller. Array management, ID/LUN mapping and array operation remain basically unchanged using these two principles.

The old principle applies to all controller/subsystems built on the previous ASIC models. The old principle places no significant regulations on the locations of a Primary or Secondary controller.

The new principle defines the RAID controller installed in Slot A, usually the upper controller slot, as the Primary controller. The factory defaults ensures the Slot A controller behaves as a Primary controller. In normal operating conditions, the Slot A controller should always be the Primary controller. In the conditions described below, a slot A controller might temporarily serve as a Secondary controller.

1. If the controller in slot A fails, the original Secondary controller takes over and becomes the Primary controller.
2. If the slot A controller is replaced by a new controller, the slot A controller temporarily serves as the Secondary controller.
3. Once the subsystem is reset, the slot A controller resumes the role of the Primary.

## Logical Drives, Logical Volumes, and Logical Partitions

Listed below are the basics about configuring a logical drive for a dual-controller subsystem:

- All configuration options are accessed through the Primary RAID controller. With the new ASIC 266 subsystem models, the RAID controller installed in the upper controller slot, Slot A, is the Primary controller.

With the older models, a controller showing a flashing <P> digit on the upper right corner of its LCD screen is the Primary. In redundant mode, two controllers behave as one, and there is no need to repeat the configuration on another controller.

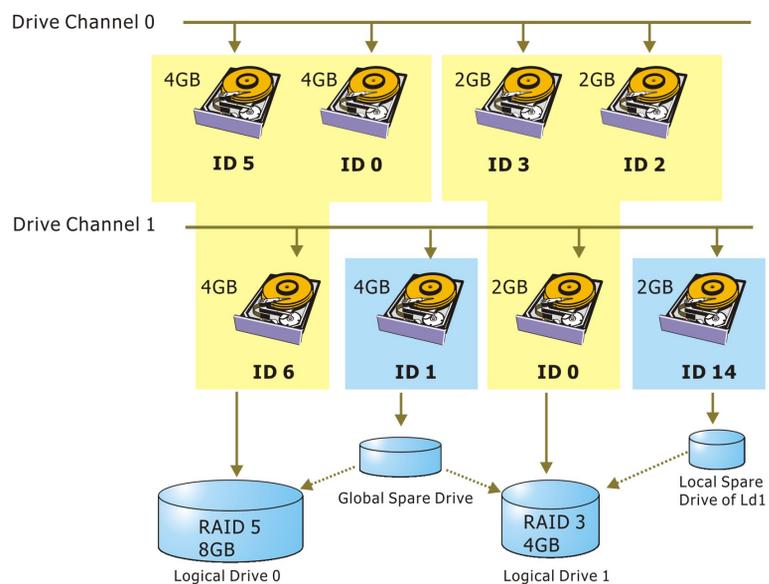
- Disk drive and array configuration processes are the same for subsystems using single or dual-active controllers.
- Using logical drives as the base units, system workload can be distributed to different RAID controllers. Logical units can be manually assigned to different (Primary or Secondary) controllers to facilitate the active-active configuration.

Users can designate a host ID either as a Primary or as a Secondary ID. The Primary and Secondary IDs differentiate the workload assigned to different RAID controllers.

- There is no limitation on drive allocations. The members of a logical drive do not have to come from the same drive channel.

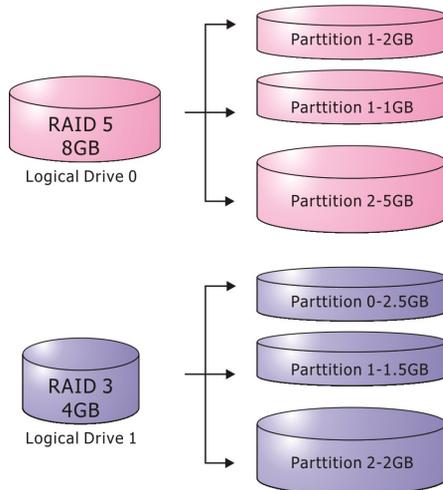
Grouping drives from different drive channels helps reduce the chance of downtime caused by a channel bus or cable failure.

- Each logical drive can be configured in a different RAID level and several logical drives can be striped together to compose a larger logical volume.
- Each of the logical units (a logical drive, logical volume, or one of their partitions) can be made available on one or more host ports using the host LUN mapping options. Each of them can be “**associated**” with one or more host ID/LUNs. Each of these associated host ID/LUNs appears to the host operating system as a virtual hard drive.



**Figure 12 - 1 Grouping Hard Drives**

- As diagrammed above, array composition can be very flexible. You may divide a logical drive or logical volume into several partitions as diagrammed below, or use the entire logical drive as a single partition, with or without the support of one or several spare drives.



**Figure 12 - 2 Partitioning of Logical Units**

- Each logical unit can be associated (mapped) with one or more host IDs (pre-configured as a Primary or Secondary controller ID) or the LUN numbers under these host IDs.

## System Drive Mapping

### Primary and Secondary IDs

- **Host Channel**

When controllers are successfully combined, the array capacity is available through host port IDs, and these IDs are available as “Primary” or “Secondary” IDs. In addition to the default IDs, more IDs can be added through the “Primary ID” or “Secondary ID” pull-down menus from the user interface.

- **Relationship between Controllers**

- New Configuration Rule:

The controllers’ identification is determined by the controller slots into which they are installed. A new and normally functioning subsystem is managed by the controller installed in Slot A, the Primary controller. If the Primary controller fails, the Secondary controller takes over. The RAID controller in slot B becomes the Primary. The slot B controller returns the control when the failed controller in Slot A is replaced and the subsystem is reset.

- Old Configuration Rule:

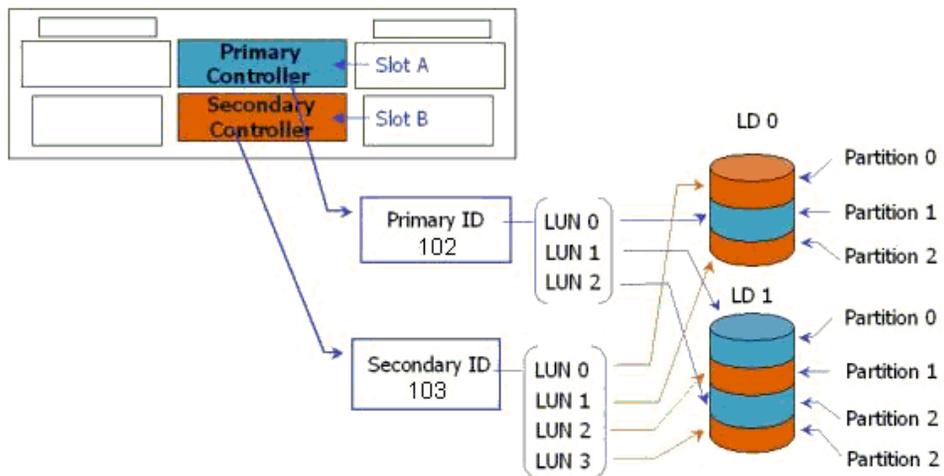
There are no specific regulations on the locations of the Primary/Secondary controllers, before or after a controller failure. They are indicated by the flashing digit showing <P> or <S> on the upper right corner of the LCD screen.

- **Create IDs**

You may have to create Primary and Secondary controller IDs separately on the host, if these IDs are not available. The configuration procedure will be discussed in *Section 12.3 Configuration*.

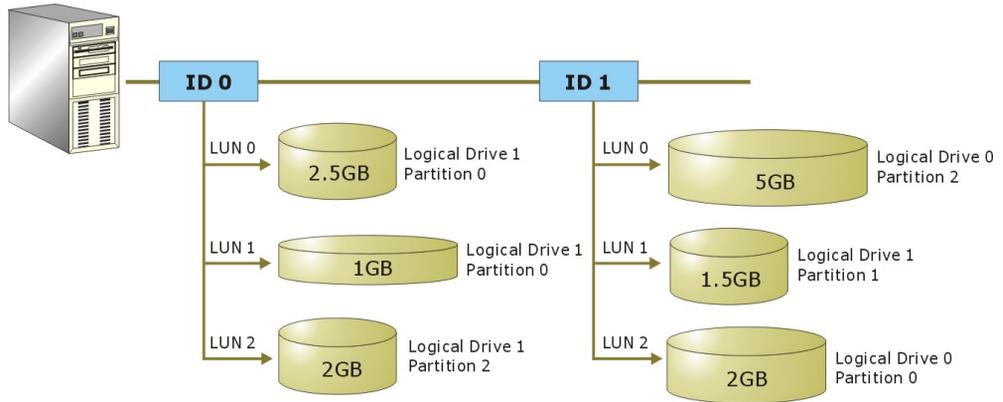
## Mapping

- A logical unit made available through a Primary controller ID will be managed by the Primary controller, and that through a Secondary controller ID by the Secondary controller.



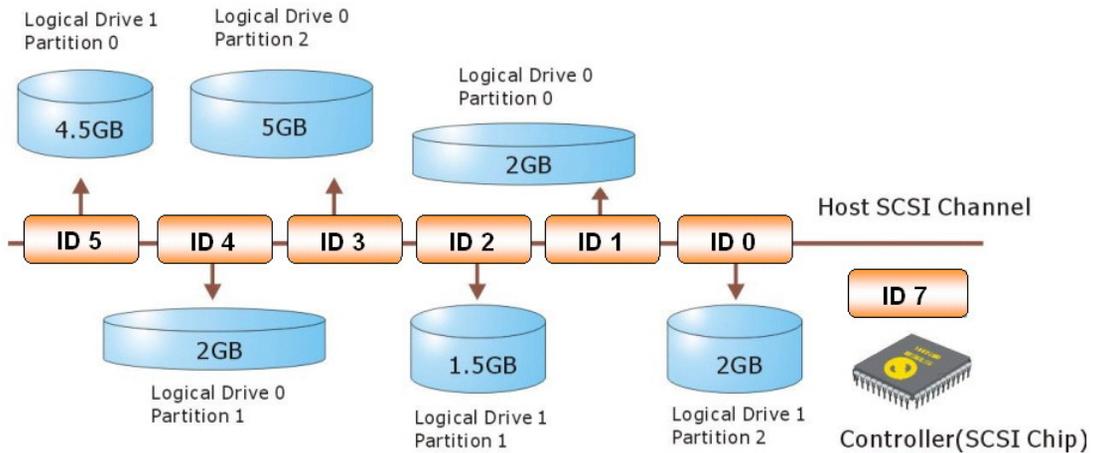
**Figure 12 - 3 Mapping Array Volumes to Different Controllers**

- Each channel ID (or an LUN under target ID) will appear as one virtual storage volume to the host operating system.



**Figure 12 - 4 Mapping System Drives (Mapping to LUNs)**

- The diagram above displays a single host computer equipped with two HBA cards allowing the connection of dual I/O paths. A host port ID is presented on each host port as either a Primary ID or a Secondary ID. Users may then map (associate) any logical configuration of drives equally to these IDs or LUN numbers. Workload can thus be distributed across two host ports and managed by both controllers.



**Figure 12 - 5 Mapping System Drives (an Example on a SCSI bus)**

- Some older operating systems do not read multiple LUNs under a target ID. As diagrammed above, you may have the host channel to present several IDs and map logical configurations to these IDs. Each of these IDs can be identified as "Primary ID" or "Secondary ID." As a rule for most operating systems, each configuration unit will be mapped to LUN 0 under each ID.

## 12.1.2 Fault Tolerance

### What Is a Redundant Controller Configuration?

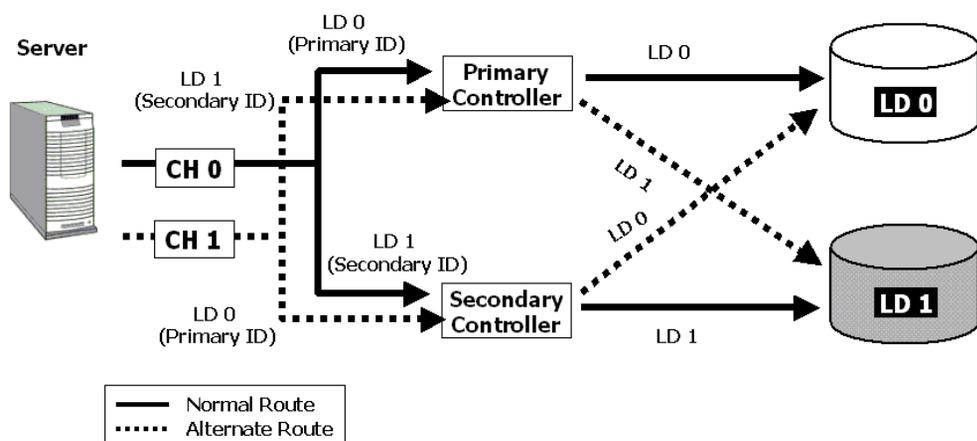
1. Hardware failures can occur. A simple parity error can sometimes cause a RAID system to completely hang up.
2. Having two controllers working together will guarantee that at least one controller will survive catastrophes and keep the system working.
3. This is the logic behind having redundant controllers - to minimize the chance of down time for a storage subsystem.

A redundant controller system uses two controller modules to manage the storage arrays. It requires two identical controllers to work together and both must be working normally. During normal operation, each controller serves its I/O requests. If one controller fails, the existing controller will temporarily take over for the failed controller. The failover and failback processes are completely transparent to the host and require only minimum efforts to restore the original configuration.

### How Does Failover and Failback Work?

#### A. Channel Bus

Below is a sample illustration of the redundant controller operation:



**Figure 12 - 6 Redundant Controller Channel Bus**

The host computer is connected to both the Primary and the Secondary controllers. Each controller has two of its I/O channels

assigned as the host ports, and the rest of I/O channels assigned to drive connection.

There are two logical drives. Logical drive 0 is assigned to the Primary controller (associated with the Primary ID), and logical drive 1 assigned to the Secondary controller (associated with the Secondary ID). If one controller fails, the surviving controller will manage the logical drive that was previously managed by the failed controller via the once inactive ID (the standby ID, see the IDs beside the dash lines).

ID mapping is synchronized between the controllers. If one controller fails, the surviving controller keeps a replica of all configuration data. The related ID mapping on the controllers looks like the tables below:

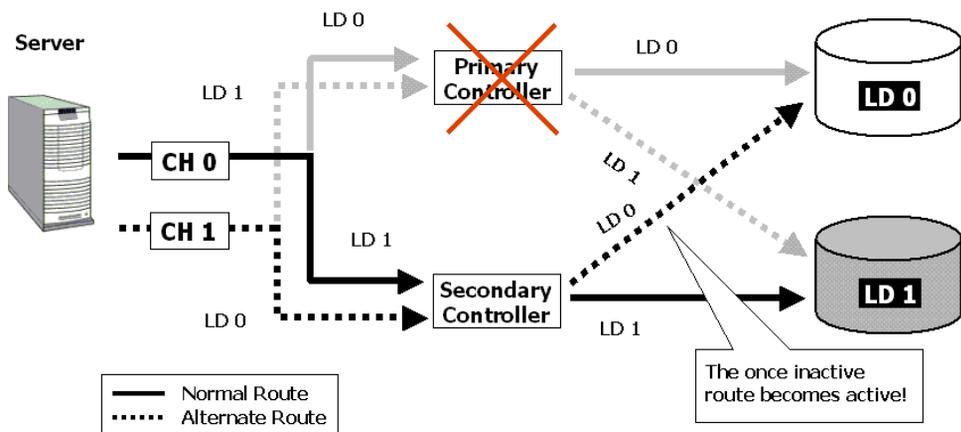
**Table 12 - 1 ID Mapping Status (Normal Operation)**

Channel	ID	Status	Target Chip
0	0 (Primary ID)	Active	Primary Controller channel 0
	1 (Secondary ID)	Standby	Secondary Controller channel 0
1	1 (Secondary ID)	Active	Secondary Controller channel 1
	0 (Primary ID)	Standby	Primary Controller channel 1

In the event of controller failure (say, the Primary controller fails), the once inactive IDs (chip) become active:

**Table 12 - 2 ID Mapping Status (Single Controller Failure)**

Channel	ID	Status	Target Chip
0	0 (Primary ID)	<del>Active</del>	<del>Primary Controller channel 0 - Failed!</del>
	1 (Secondary ID)	Standby- becomes <b>Active!</b>	Secondary Controller channel 0
1	1 (Secondary ID)	Active	Secondary Controller channel 1
	0 (Primary ID)	<del>Standby</del>	<del>Primary Controller channel 1 - Failed!</del>



**Figure 12 - 7 Controller Failover**

For every channel that is actively serving I/Os, there is another channel on the alternate controller that stays idle and will inherit the task should its counterpart fail.

As long as I/O bus bandwidth is not a concern, many active IDs can co-exist on single or multiple host channels. Standby chips may not be necessary.

## **B. Controller Failover and Failback**

In an unlikely event of controller failure, the surviving controller will acknowledge the situation and disconnect from the failed controller. The surviving controller will then act as both controllers and serve all the I/O requests from host.

System failover is transparent to host. System vendors should be contacted for an immediate replacement of the failed unit.

### **Replacing a Failed Unit:**

The replacement controller should have the same amount of memory and run the same version of firmware. However, it is inevitable a replacement controller will be running later revisions of firmware. To solve this problem, **you should manually downgrade the replacement's firmware.**

Your system vendor should be able to provide an appropriate version of firmware and replacement controller.

### **Auto-Failback**

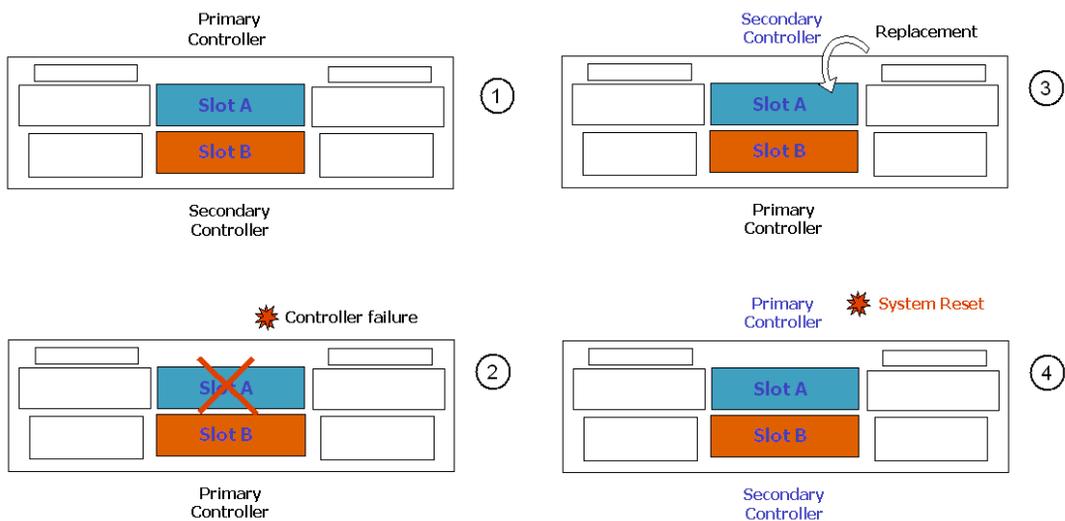
Once the failed controller is removed and a replacement controller is installed, the existing controller will acknowledge the situation. The existing controller should automatically attempt to combine with the replacement controller.

When the initialization process of the replacement controller is completed, the replacement controller should always inherit the status of the Secondary controller.



### IMPORTANT!

*For a subsystem powered by the ASIC266 chipset, reset the subsystem if the replaced controller resides in slot A. If the replacement controller in slot A is successfully combined, a system reset should restore its status as the Primary controller.*



**Figure 12 - 8 Controller Primary-Secondary Relative Positions**

A typical controller failover and failback process is diagrammed above.

- Status 1: Subsystem operating normally. Slot A controller is the Primary controller by factory default.
- Status 2: Slot A controller fails. Slot B controller inherits the Primary role.
- Status 3: The failed controller in Slot A is replaced by a healthy one. The replacement controller becomes the Secondary controller temporarily.

Status 4: If the subsystem resets later, the Slot B controller returns the Primary role to the Slot A controller.

If the subsystem is reset later, the controller installed in the Slot A position will obtain the Primary controller status. The Slot B controller then resumes the Secondary role. The replacement controller will obtain all related configuration parameters from the surviving controller. If the surviving controller fails to re-establish this connection, you can also choose to "de-assert" the replacement controller through the existing controller so that both will serve the original system drive mapping.

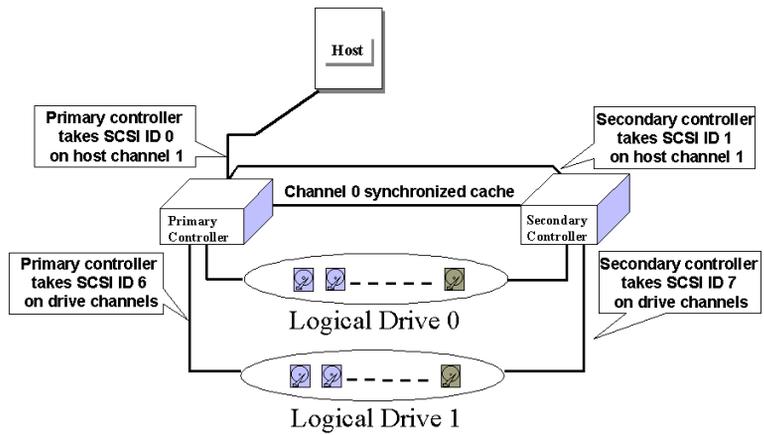
### **C. Active-to-Active Configuration:**

Active-to-active configuration conducts all system resources to performance. Storage volumes can be equally assigned to both controllers so that both controllers are actively serving I/Os. This allows a flexible association between logical units and host ID/LUNs. Workload can then be manually distributed to different controllers.

### **D. Traffic Distribution**

The diagram below illustrates a four-channel configuration using channel 0 as the communications path. Channel 1 serves as the host interface and multiple IDs have been created to facilitate active-active operation. Each controller occupies either a Primary ID or a Secondary ID on drive channels. There are two logical drives. One logical drive is assigned to the Primary Controller and the other the Secondary Controller.

In the event when one controller fails, the existing controller will inherit IDs from the failed controller and continue I/Os.



**Figure 15 - 9 Traffic Distributions**

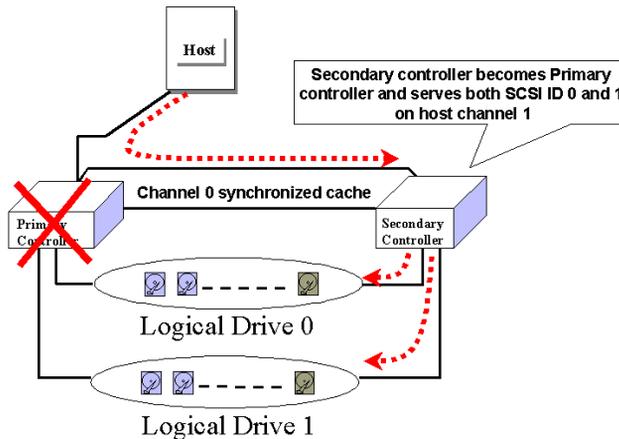
	Logical Drive 0	Logical Drive 1
Host LUN Mapping	ID0 / LUN* (PID)	ID1 / LUN* (SID)
Logical Drive Assignment	Primary	Secondary
Drive Channel	2	3

Users can assign a logical unit either to the Primary or to the Secondary Controller. Once the assignment is done, logical unit(s) assigned to the Primary Controller can only be mapped to the Primary IDs on the host channel; Logical unit(s) assigned to the Secondary Controller can only be mapped to the Secondary IDs on the host channel.

The channel ID (Primary/Secondary) assignment for a SCSI-based controller should look like this:

	Primary Controller ID	Secondary Controller ID
Host Chl SCSI ID	PID = 0	SID = 1
Drive Chl SCSI ID	7	6 suggested

NOTE: The EonStor series has preset drive-side IDs. No configuration change is required.



**Figure 12 - 10 Controller Failover**

## E. Controller Failure

Controller failure is managed by the surviving controller (regardless of its original role as Primary or Secondary). The surviving controller disables and disconnects from its counterpart while gaining access to all signal paths. The existing controller then proceeds with the ensuing event notifications and take-over process.

### Symptoms

- The LCD on the failed controller is off. The LCD on the surviving controller displays controller failure message.
- The surviving controller sounds an alarm.
- The "ATTEN" LED is flashing on the existing controller.
- The surviving controller sends event messages to notify of controller failure (indicating its partner has failed).

## Connection

The channels of the two controllers that are connected together must be the same. For example, if controller A uses channel 2 to connect a group of drives, controller B must also use channel 2 to connect to the same group of drives.

## 12.2 Preparing Controllers

### 12.2.1 Requirements

#### Communications Channels (Redundant Model Use Only)

- Controller Communications (Cache Synchronization) Paths:

<b>Controller</b>	<b>RCC</b>
EonStor	Pre-configured RCC routes over the system backplane; may be SCSI, Fibre, or SATA data paths. These data paths cannot be changed!

- With dual-active controller configuration, write-back cache will be disabled if no RCC path can be found.
- If controllers are running in write-back mode, a battery module is recommended for each controller.

#### Out-of-Band Configuration

- RS-232C cable (for terminal interface operation) connection. Normally a Y-cable will be included with dual-controller subsystems.
- Ethernet connection: If management through Ethernet is preferred, connect the Ethernet interface from both controllers to ports on an Ethernet hub. In the event of controller failure, the IP address assigned to the Primary Controller will be inherited by the surviving controller. The Ethernet port connection (management session) will be continued. An operator may have to re-enter the IP address to re-connect the controller/subsystem.

## General Procedure for Controller Settings

### 1. Controller Unique Identifier

Find a unique identifier for each controller. "View & Edit Peripheral Devices"→ "Controller Parameters"→ "Controller Unique Identifier."

### 2. Creating Primary and Secondary IDs on Host Channels

"View and Edit Channels"→ Choose a host channel→ "View and Edit Fibre ID"→ Choose a ID→ "Add/Delete Channel ID"→ "Primary/Secondary Controller"→ Add ID from the list. Reset the controller for the configuration to take effect.

### 3. Creating Logical Configurations of Drives and Assigning Each of Them Either to the Primary or the Secondary Controller

"View and Edit Logical Drives"→ Select a RAID level→ Select member drives→ "Logical Drive Assignments"→ Create Logical Drive.

### 4. Map Each Logical Configuration of Drives to the Primary/ Secondary ID on host channel(s)

"View and Edit Host LUN"→ Choose a "Host Channel-ID-Controller" Combination→ Choose Logical Drive/Logical Volume/Logical Partition→ Map to Host ID/LUN (Create Host LUN Entry).

## 12.2.2 Limitations

- Both controllers must be exactly the same. Namely, they must operate with the same firmware version, the same size of cache memory, the same number/configuration of host and drive channels, etc. If battery backup is preferred, both should be installed with a battery module.
- Connection through Fibre switches can be necessary for joining host (Fibre) interfaces between controllers.
- The controller defaults for ID settings are listed below:

Host interface	Host channel (Primary/Secondary)
Fibre	102 / 103...

## 12.2.3 Configurable Parameters

### Active-to-Active Configuration

Users can freely map any logical configuration to the host channel IDs/LUNs. I/O requests from host computer will then be directed to the Primary or the Secondary Controller accordingly. The total drive capacity can be divided and equally serviced by both controllers.

The dual-active configuration engages all system resources to performance. Users may also assign all logical configurations to one controller and let the other act as a standby (active-standby).

### Active-to-Standby Configuration

By mapping all the logical configurations of drives to one controller, the other controller will stay idle and becomes active only when its counterpart fails.

### Cache Synchronization

The Write-back caching significantly enhances controller performance. However, if one controller fails in the redundant controller configuration, data cached in its memory will be lost and data inconsistency might occur when the surviving controller takes over and attempts to complete the writes.

Data inconsistency can be avoided using one or several of the I/O channels as the communications paths between the controllers. The cached data is always synchronized in each other's memory. Each controller saves an exact replica of the cache content on its counterpart. In the event of controller or power failure, the unfinished writes will be completed by the surviving controller.

### Battery Support

Unfinished writes will be cached in memory in write-back mode. If power to the system is discontinued, data stored in the cache memory will be lost. Battery modules can support cache memory for a period of several days allowing the controller to keep the cached data. When two controllers are operating in write-back mode, it is recommended to install a battery module to each controller.

## 12.3 Configuration

### General Configuration Steps:

Listed below are the steps necessary to configure a redundant controller subsystem:

1. The partner controllers have no preset roles. When the two controllers are powered on later, the firmware will negotiate and determine which of them is the Primary controller.
2. When powering on both controllers together, the LCD will display "**RC connecting.**" After the controller negotiation is completed, the communications between controllers should be established.
3. Create both a "Primary ID" and a "Secondary ID" on every Host channel. If the controller comes with defaults, it is recommended to use them.
4. Reset the controller for the configuration to take effect.
5. Create Logical drives/logical volumes and assign each logical unit to the Primary or to the Secondary controller.
6. Proceed with host LUN mapping. After mapping each logical unit to one or more Primary or Secondary ID/LUN on the host channel(s), the redundant controller configuration is complete.

## 12.3.1 Via Front Panel Keypad

### Redundant Configuration Using Manual Setting

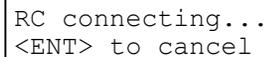
#### 1. Controller Unique ID

Enter "View and Edit Config Parm"-> "Controller Parameters". Use the up or down arrow keys to find "Ctrl Unique ID- xxxxx".

This value will be used to generate a controller-unique WWN node name and port names and to identify the controller during the failover process. Enter a hex number from 0 to FFFFF and press [ENTER]. The value you enter should be different for each controller. If the controller comes with defaults, it is recommended to use them.

#### Starting the Redundant Controllers

Power on all hard drives and the two controllers. If drives are installed in a drive enclosure, wait for the drives to be ready, then power on the enclosure where the RAID controllers are installed.



RC connecting...  
<ENT> to cancel

The message "RC (redundant controller) connecting... <ENT> to cancel" will appear on the LCD display of the two controllers. After a few seconds, the Primary Controller will startup with the model number and firmware version displayed on the LCD, while the Secondary Controller will display the message "RC Standing By.. <ENT> to Cancel" on its LCD.

The upper right corner of LCD will then display a "P" or "S," meaning "Primary" or "Secondary" respectively.

During normal operation, the controllers continuously monitor each other. Each controller is always ready to take over for the other controller in the unlikely event of a controller failure.

The Primary and Secondary Controllers synchronize each other's configurations at frequent intervals through the communications channel(s).

#### Creating Primary and Secondary ID

## Host Channel

The process of creating Primary and Secondary IDs on host channels is basically the same.

```
CHL=0 ID=0
Primary Ctlr ..
```

In "View and Edit Channels", press [ENT] to select a host channel. Use the up or down arrow keys to select "Set Channel ID". A pre-configured ID will appear, press [ENT] to proceed. Use the up or down arrow keys to select "Add Channel ID" and then press [ENT] for two seconds on the "Primary Controller" or "Secondary Controller?" to proceed.

```
Add Channel
ID ..
```

```
Primary
Controller ?
```

When prompted by this message, use the up or down arrow keys to select an ID. Press [ENT] to confirm.

```
Add CHL=0 ID=2
Primary Ctlr ?
```

A message will prompt to remind you to reset the controller. Press [ENT] to reset the controller or press [ESC] to move back to the previous menu. The change of ID will only take effect after the controller has been reset.

```
Change Setting
Do Reset Ctlr ?
```

## Logical Drive/Logical Volume Assignments (Dual-Active Controllers)

A logical drive, logical volume, or any of its logical partitions can be assigned to the Primary or Secondary Controller. By default, a logical drive is automatically assigned to the Primary Controller. It can be assigned to the Secondary Controller if the host computer is also connected to the Secondary Controller.

Note that the partitions of a logical drive that has previously been assigned to the Secondary controller will automatically be assigned to the Secondary Controller.

Press [ENT] for two seconds on the front panel of the Primary controller to enter the Main Menu.

Use the up or down arrow keys to navigate through the menus. Choose "View and Edit Logical Drives", then press [ENT].

```
View and Edit
Logical Drives
```

Create a logical drive or choose an existing logical drive, then press [ENT] to see the logical drive menu.

Choose "Logical Drive Assignment..," then press [ENT].

```
Logical Drive
Assignment..
```

The message "Redud Ctlr LG Assign Sec Ctlr?" will appear. Press [ENT] for two seconds to confirm. The logical drive has now been assigned to the Secondary Controller.

```
Redud Ctlr LG
Assign Sec Ctlr?
```

Map the logical drive (or any logical unit) to a host ID or LUN number under the designated Secondary controller ID. The host channel must have a "Secondary" ID created. (Create the Secondary controller's ID on host channel and add a channel ID to every drive channel in "View and Edit Channels").

## Mapping a Logical Drive/Logical Volume to the Host LUNs

Choose "View and Edit Host Luns" from Main Menu and press [ENT] to proceed.

```
View and Edit
Host Luns      •
```

Use the up or down arrow keys to navigate through the created IDs and press [ENT] to select one of them. Note that a logical unit previously assigned to a Primary Controller can only be mapped a Primary ID, and vice versa.

```
Map Sec Ctlr
CH=0 ID= 000  ?
```

Use the up or down arrow keys to choose mapping "Logical Drive" or "Logical Volume" to host LUNs. If the logical unit has been partitioned, map each partition to different ID/LUNs.

```
Map to
Logical Drive ?
```

Use the up or down arrow keys to choose a LUN number and press [ENT] to confirm.

```
CH0 ID0 LUN0
No Mapped
```

Press [ENT] again to confirm.

```
Map Host LUN  ?
```

Use the up or down arrow keys to select a logical drive/logical volume if there are many.

```
LG0 RAID5 DRV=3
9999MB GD SB=0
```

Press [ENT] and choose a partition if the logical unit has been partitioned.

```
LG=0 PART=0
999MB      ?
```

Press [ENT] again to confirm  
Press [ENT] to confirm the mapping.  
Press [ENT] to re-ensure.

```
CH0 ID9 LUN0 Map
to LG0 PRT0?
```

This message indicates that the logical unit has been successfully mapped to the ID/LUN combination. Use the up or down arrow keys to continue mapping other logical units or press [ENT] to delete the mapped LUN.

```
Map Host LUN  ?
```

```
Map Sec. Ctlr
CH=0 ID= 0    ?
```

Repeat the process to map all the logical units to host ID/LUNs.

```
CH0 ID9 LUN0
Mapto LG0 PRT0
```

## Front Panel View of Controller Failure

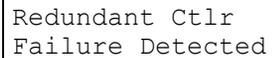
---

### What will happen when one of the controllers fails?

---

If one of the controllers fails, the existing controller will automatically take over within a few seconds.

The red ATTEN LED will light up, and the message "Redundant Ctlr Failure Detected" will appear on the LCD. Users will be notified by audible alarm.



```
Redundant Ctlr  
Failure Detected
```



### NOTE:

- *Although the surviving controller will keep the system working, you should contact your system vendor for a replacement controller as soon as possible. Your vendor should be able to provide an appropriate replacement unit.*
- *Some operating systems (SCO, UnixWare, and OpenServer, for example) will not attempt to retry accessing the hard disk drives while controller is taking over.*

---

### When and how is the failed controller replaced?

---

Remove the failed controller **after** the "working" controller has taken over. For the ventilation concern in most enclosures, it is better to leave a failed controller in place before a replacement arrives. For a controller with hot-plug capability, all you have to do is to remove the failed controller.

**Redundant controller subsystems are designed to withstand a single controller failure. To restore a dual-active operation, do the following:**

1. Combine the controllers while the surviving controller is working.



### NOTE:

- If you power down the surviving controller and power up both controller together, problems might occur for they might contend for the role of the Primary controller.

---

When the replacement is connected, the "Auto-Failback" process will start automatically. If the replacement controller does not initialize, you may execute the following steps to bring the new controller online. Press [ENT] for two seconds on the existing controller to enter the Main Menu.

Use the up or down arrow keys to select "View and Edit Peripheral Dev..," then press [ENT].

```
View and Edit  
Peripheral Dev
```

Choose "Set Peripheral Device Entry..," then press [ENT].

```
Set Peripheral  
Devices Entry ..
```

Choose "Redundant Ctlr Function\_\_," then press [ENT].

```
Redundant Ctlr  
Function__
```

The message "Redundant Ctlr Primary/Secondary Degraded" will appear on the LCD.

```
Redundant Ctlr  
Primary Degraded
```

Press [ENT] and the message "Deassert Reset on Failed Ctlr?" will appear.

```
Deassert Reset  
on Failed Ctlr?
```

Press [ENT] for two seconds and the controller will start to scan for the new controller and bring it online.

```
Redundant Ctlr  
Primary Scanning
```

The new controller will then start to initialize.

```
Initializing...  
Please Wait...
```

Once initialized, it will assume the role of the Secondary Controller.

```
■■■■■■■■■■ v3.**
```

## 12.3.2 Via Terminal Emulation

### Redundant Configuration Using Manual Setting

Power on all hard drives and the two controllers. If drives are installed in a drive enclosure, wait for the drives to be ready, then power on the enclosure where the RAID controllers are installed.

### Creating Primary and Secondary ID

Enter "View and Edit Channels." Press [ENTER] and select the host channel on which you wish to create Primary/Secondary ID.

## Host Channel

Thu Sep 22 09:59:05 2005										A16F-R2422		Cache Status: Clean	
BAT: █████													
Chl	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid				
0	Host	102	103	AUTO	Serial	F	NA	2 GHz	Serial				
1	ID 102 (Primary Controller)				Serial	F	NA	2 GHz	Serial				
2	Add Channel SCSI ID				ATA			1.5GHZ	SATA				
3	Primary Controller				SATA			1.5GHZ	SATA				
4	Secondary Controller				SATA			1.5GHZ	SATA				
5	Drive	7	8	AUTO	SATA			1.5GHZ	SATA				
6	Drive	7	8	AUTO	SATA			1.33GHZ	SATA				
7	Drive	7	8	AUTO	SATA			1.33GHZ	SATA				

Arrow Keys: Move Cursor | Enter: Select | Esc: Exit | Ctrl+L: Refresh Screen

**Figure 12 – 11 Creating PID and SID**

The configuration change will only take effect after the controller has been reset.

## Creating Logical Drives to Controller

A logical drive can be assigned to the Primary or Secondary controller.

Access "View and Edit Logical Drives" from the Main Menu. Create a logical drive by selecting members and then a selection box will appear on the screen.

Browse through the Main Menu and select *View and Edit Logical Drive*.

Thu Jul 21 17:18:22 2005													Cache Status: Clean			
BAT:+++++																
LG	ID	LV	RAID	Size(MB)	Status	1	2	3	0	C	#LN	#SB	#FL	NAME		
0			NONE													
Create Logical Drive ?																
Yes																
No																
3			NONE													
4			NONE													
5			NONE													
6			NONE													
7			NONE													

Arrow Keys: Move Cursor | Enter: Select | Esc: Exit | Ctrl+L: Refresh Screen

**Figure 12 - 12: View and Edit Logical Drive Page**



## Mapping a Logical Drive/Logical Volume to the Host LUNs.

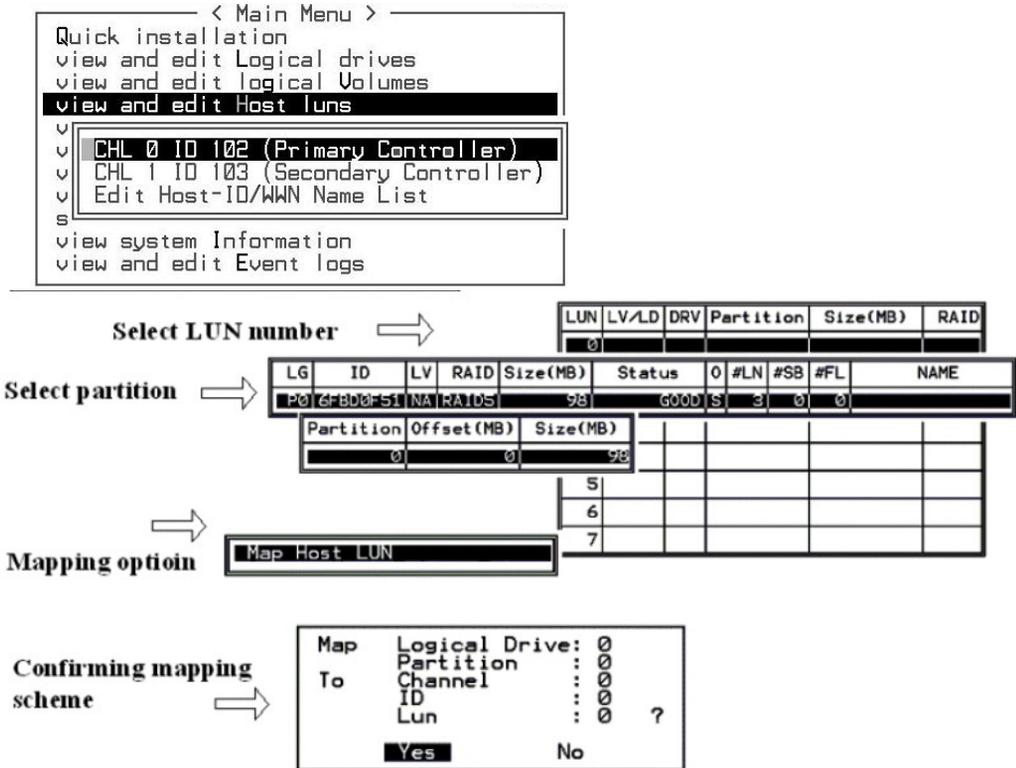


Figure 12 – 15 Mapping LD/LV to Host ID

## Terminal Interface View of Controller Failure

---

### What will happen when one of the controllers fails?

---

When one of the controllers fails, the other controller will take over in a few seconds.

There will be an alert message that reads "Redundant Controller Failure Detected."

Users will be notified by audible alarm.



After a controller takes over, it will act as both controllers. If the Primary Controller failed, the Secondary Controller becomes the Primary Controller. If the failed controller is replaced by a new one later, the new controller will assume the role of the Secondary Controller.



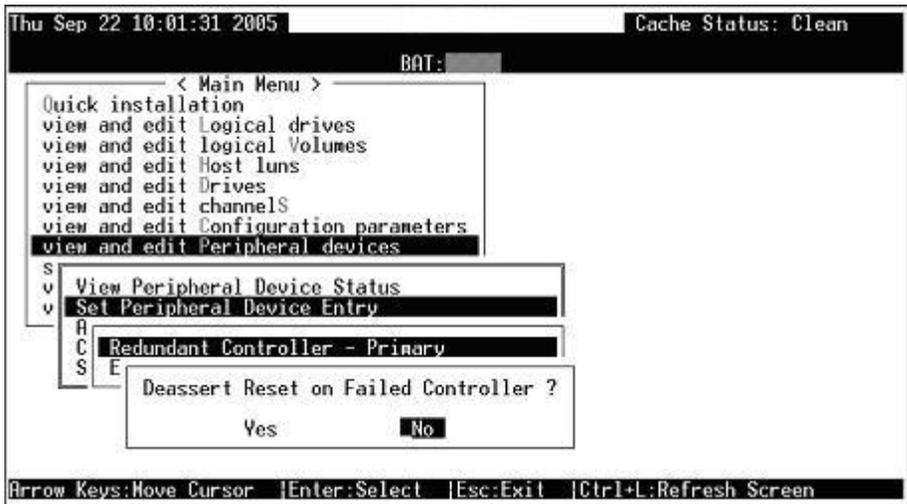
#### NOTE:

- *Some operating systems (SCO, UnixWare, and OpenServer, for example) will not attempt to retry accessing the hard disk drives while the controller is taking over.*
- 

### 12.3.3 When and How Is the Failed Controller Replaced?

Remove the failed controller **after** the take-over of the "working" controller has been completed. For a controller with hot-plug capability, all you have to do is to remove the failed controller. With ventilation considerations, it is recommended to leave a failed controller in most enclosures until the replacement controller arrives.

When the new controller is connected, the existing controller will automatically start initializing the replacement controller. If the existing controller does not initialize the replacement controller, execute the "Deassert Reset on Failed Controller" function.

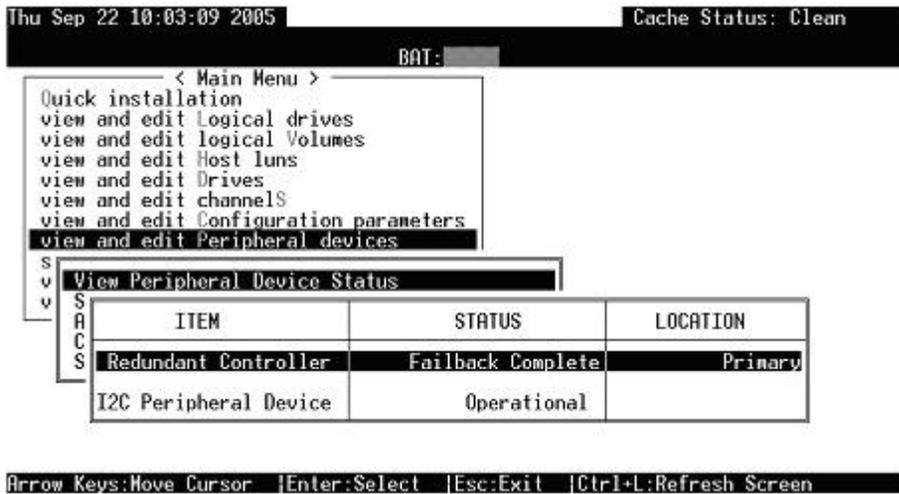


**Figure 12 – 16 Deassert Reset of Failed Controller**

If the replacement has been initialized successfully, you may proceed to examine the system status. From the Main Menu, select "View and Edit Peripheral Devices" and then "View Peripheral Device Status" to see that the new controller is being scanned.



**Figure 12 – 17 View Controller Statuses**



**Figure 12 – 18 Redundant Controller Failback Status**

When the scanning is completed, the status will change to "Failback Complete."

### 12.3.4 Redundant controller Diagnostics

#### Forcing Controller Failover for Testing



**Figure 12 – 19 Redundant Controller testing**

Testing the failover functionality can be performed using the following methods.

- 1. Pulling out one of the controllers to simulate controller failure**

Pull out either the Primary or the Secondary Controller an error

message will display immediately and the alarm will sound. The existing controller takes over the workload within a second. Clear all errors by pressing the **ESC** key. You may re-install the removed controller after all activities have been taken over by the existing controller. It may take a while for the controllers to finish re-initialization and assuming their load.

## 2. "Forcing controller failure"

Select "View and Edit Peripheral Devices," "Set Peripheral Device Entry," and "Redundant Controller Primary/Secondary."

Select "Force Primary/ Secondary Controller Failure." You may now pull out the controller you had just disabled. I/Os should be continued by the existing controller. Continue the aforementioned procedure to complete the test.



### **WARNING!**

- *This function should only be performed for testing the redundant controller functionality before any critical data is committed to the drives. Although the controller is designed to be hot-swappable, unpredictable failures may occur during the process, e.g., improper handling of the module or improper handling of PCB boards while replacing the controller.*
-

## 12.4 Redundant Controller Parameters

### 12.4.1 RCC Status (Redundant Controller Communications Channel)

```
Thu Sep 29 07:53:39 2005                               Cache Status: Clean
                                                         WT
                                                         BAT:++++
      < Main Menu >
Quick installation
view and edit Logical drives
view and edit logical Volumes
view and edit Host luns
view and edit Drives
view and edit channels
view and edit configuration parameters
U
S C Redundant Controller Communication Channel - SATA
C Secondary Controller RS-232 - Disabled
U H Cache Synchronization on Write-Through - Enable
U D Adaptive Write Policy - Disabled
D
Redundant Controller Parameters
Controller Parameters

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen
```

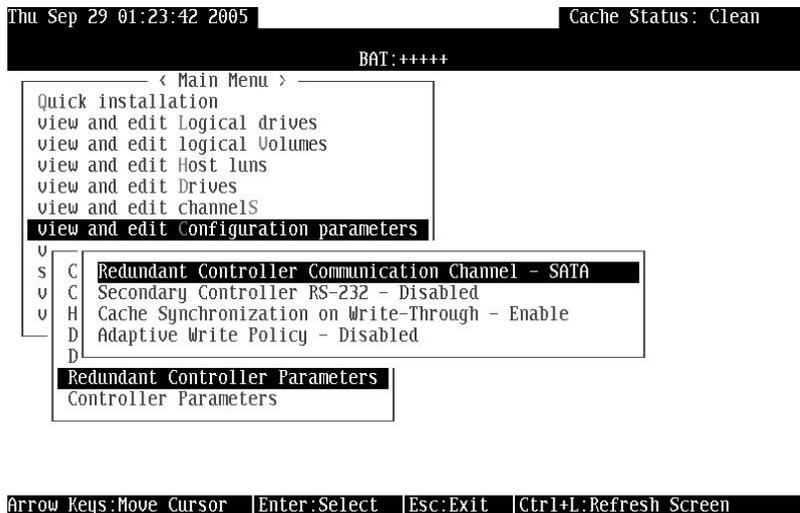
**Figure 12 – 20 Redundant Controller RCC Mode**

This item is for display only, showing the current communications route.

### 12.4.2 Secondary Controller RS-232

This is an option reserved for debugging purposes. When enabled, you can access the Secondary Controller through its serial port. In a redundant controller system, only status display is available through the terminal session with a Secondary Controller. No configuration change can be done through a Secondary Controller.

## 12.4.3 Adaptive Write Policy (Redundant Model Use only)



**Figure 12 - 21: Adaptive Write Policy**

Firmware is embedded with intelligent algorithms to detect and to adapt the array's caching mode to the characteristics of I/O requests. The capability is described as follows:

1. When enabled, the adaptive write policy optimizes array performance for sequential writes.
2. The adaptive policy temporarily disables an array's write-caching algorithm when handling sequential writes. Write-caching can be unnecessary with sequential writes for that write requests can be more efficiently fulfilled by conducting writes onto disk drives following the receiving order.
3. The adaptive policy changes the preset write policy of an array when handling I/Os with heterogeneous characteristics. If firmware determines it is receiving write requests that come in a sequential order, the write-caching algorithm is disabled on the target logical drives.

If the subsequent I/Os are fragmented and are received randomly, firmware automatically restores the original write-cache policy of the target logical drives.

### Adaptation for the Redundant Controller Operation

4. If arrays managed by a redundant-controller configuration are configured to operate with write-back caching, cached data will be constantly synchronized between the partner controllers. Upon

receiving sequential writes, firmware disables write-caching on target arrays and also the synchronized cache operation.



### IMPORTANT!

- *If the size of an array is larger than 16TB, only the optimization for sequential I/O can be applied. A logical drive of this size is not practical; therefore, there is actually no limitation on the combination of optimization mode and array capacity.*
- *Every time you change the Caching Parameters, you must reset the controller for the changes to take effect.*
- *In the redundant controller configuration, write-back will only be applicable when there is a synchronized cache channel strung between partner controllers.*
- *The Adaptive Write Policy is applicable to subsystems working in the normal condition. If, for example, a drive fails in an array, firmware automatically restores the array's original write policy.*

## 12.4.4 Cache Synchronization on Write-Through



Figure 15 – 22 Enable Cache Synchronization on Write-Through

If your redundant controller system is not operating with Write-back caching, you can disable synchronized cache communications. Your system can be spared the effort to mirror and transfer data between partner

controllers. This increases array performance for subsystems that operate without write caching.

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## Appendix

# A

## Firmware Functionality Specifications

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### A.1 Basic RAID Management:

Specification	Feature
RAID levels	0, 1(0+1), 3, 5, 6, 10, 30, 50, 60, JBOD and NRAID. Levels 10, 30, 50, and 60 are the multi-level RAID with the logical volume implementations; logical volumes consist of logical drives of different RAID levels that are striped together.
Maximum number of logical drives	16 as default, up to 32 with a 1GB or above memory size
Maximum logical drive capacity	64TB – when optimization mode is set to Sequential 16TB – when optimization mode is set to Random
RAID level dependency to each logical drive	Independent. Logical drives configured in different RAID levels can co-exist in a logical volume and within a RAID subsystem
Maximum number of logical drive members	128 - 512MB memory size 112 - 256MB memory size
Configurable stripe size	4KB, 16KB, 32KB, 64KB, 128KB, 256KB, 512KB, or 1024KB per logical drive <ul style="list-style-type: none"><li>▪ 128KB is the default for earlier firmware with optimization for Sequential I/Os</li><li>▪ 32KB is the default for earlier firmware with optimization for Random I/Os</li></ul>
Configurable Write Policy (write policy per array)	Write-Back or Write-Through per logical drive. This policy can be modified later.
Logical drive identification	Unique, controller randomly generated logical drive ID; Logical drive name user-configurable for ease of identification in a multiple arrays configuration

<b>Maximum number of partitions for each logical drive</b>	16 as default, up to 64 with a 1GB memory size
<b>Maximum number of logical volumes</b>	8 as default, up to 32 with a 1GB or above memory size
<b>Maximum number of LUNs Mappable</b>	Default is 128, up to 1024 with a 1GB or above memory size
<b>Maximum number of LUNs per host ID</b>	Up to 32, user configurable
<b>Maximum number of Media Scan task schedules</b>	16
<b>Concurrent I/O</b>	Supported
<b>Tag Command Queuing (TCQ)</b>	Supported
<b>Native Command Queuing (NCQ)</b>	Supported
<b>Dedicated spare drive</b>	Supported, hereby defined as the spare drive specifically assigned to a logical drive
<b>Global spare drive</b>	Supported, the spare drive that serves all logical drives (as long as it is equal in size or larger than logical drive members)
<b>Global spare auto-assign</b>	Supported, applies to non-configured drive(s); safeguards the array if a spare has been used in the previous array rebuild and users forget to configure a new drive as a spare.
<b>Co-existing dedicated and global spare drives</b>	Supported
<b>Auto-rebuild onto spare drive</b>	Supported
<b>Auto-scan of replacement drive upon manually initiated rebuild</b>	Supported
<b>One-step rebuild onto a replacement drive</b>	Supported
<b>Immediate logical drive availability</b>	Supported; Logical arrays are immediately ready for Host I/Os. Initialization task is completed in the background except when the logical array is stated as "INCOMPLETE" or "BAD;" e.g., has a failed member right after the creation.
<b>Auto-rebuild onto failed drive replacement</b>	Supported. With no spare drive, the subsystem will auto-scan the failed drive and starts rebuild automatically once the failed drive has been replaced.
<b>Concurrent rebuild / expansion</b>	Multiple logical drives can proceed with a Rebuild/Regenerating Parity, and/or Expansion/Initialization/Add Drive operation at the same time.

	<p><b>NOTE:</b></p> <p>Regenerate Parity and Rebuild cannot take place on a logical drive at the same time.</p> <p>Create, Expand, and Add Drive operations cannot take place on a logical drive at the same time.</p>		
<b>Background firmware download</b>	Firmware can be downloaded during active I/Os.		
<b>Auto recovery from logical drive failure (configuration on drives)</b>	Supported. When user accidentally removed the wrong drive to cause the 2 <sup>nd</sup> drive failure of a one-drive-failed RAID5 / RAID3 logical drive, fatal error may occur. However, you may force the subsystem to reaccept the logical drive by switching off the subsystem, installing the drive back to its original drive slot, and then power on the subsystem. The logical drive will be restored to the one-drive-failed status.		
<p><b>NOTE:</b></p> <p>To ensure smooth operation, sufficient cache memory buffer is required for configurations made up of numerous logical units. An intelligent trigger mechanism is implemented with firmware version 3.47 and later. If a subsystem/controller comes with a DIMM module of the size equal or larger than 1GB, firmware automatically enlarges the maximum numbers of logical units.</p>			
		DIMM size < 1G	DIMM size >= 1G
	Max. no. of LD	16	32
	Max. no. of LV	8	32
	Max. partitions per LD/LV	16	64
	Max. no. of LUN	128	1024

## A.2 Advanced Features:

<b>Media Scan</b>	<p>Supported. Verify written data on drives to avoid bad blocks from causing data inconsistency. If bad blocks are found, data can be reconstructed by comparing and recalculating parity from adjacent drives (RAID1/3/5/6).</p> <p>The “Reconstruction Writes” are followed by “Write Verification” operation.</p>
-------------------	--

<b>Bad Block Handling in degraded mode</b>	<p>A method for handling low quality drives. The operation is performed on both the logical drive in degraded mode or that being rebuilt. If bad blocks should be encountered during Rebuild, Add Drive, Host Write, or Regenerate Parity operation, the controller will first attempt to reconstruct affected data and those unrecoverable bad blocks are stated as bad and passed to host.</p> <p>Users have the option to abandon data on the unrecoverable sectors to continue rebuild in a degraded mode.</p> <p>Low quality drive handling comes with transparent resetting of hung hard drives.</p>
<b>Transparent reset of hung HDDs</b>	Supported
<b>Auto cache flush on critical conditions</b>  <b>(caching mode dynamic switch)</b>	<p>When critical conditions occur, e.g., component failure, or BBU under charge, cached data will be flushed and the write policy will be changed to write-through mode.</p> <p>Configurable “Trigger Events” for Write-through/Write-Back Dynamic Switch. The configuration can also be set with the Oem “lappend” utility.</p>
<b>Drive low-level format</b>	Supported
<b>RAID parity update tracking and recovery</b>	Yes
<b>Host-side Ordered Tag support</b>	Supports write commands with embedded Ordered Tags
<b>Drive identification (flash drive function)</b>	Supported. Force a drive to light on its activity indicator for users to recognize its location
<b>Drive information listing</b>	Supported. Drive vendor name, model number, firmware revision, capacity (blocks), serial number, narrow/wide and current sync. speed
<b>Drive read/write test</b>	Supported
<b>Configuration on disks</b>	Supported. The logical drive information is recorded on drive media. The logical drives can still be accessed if using different Infortrend RAID controllers/subsystems, e.g., drives removed and installed in a different subsystem.
<b>Save/ restore NVRAM to / from disks</b>	Supported. Save all the settings stored in the controller NVRAM to the logical drive members
<b>Save / restore NVRAM to / from a file</b>	Supported. Save all the settings stored in the controller NVRAM to a file (via GUI manager) on user’s computer
<b>Host-side 64-bit LBA support</b>	Supports array configuration (logical drive, logical volume, or a partition of them) of a capacity up to 64TB.

<b>Host LUN geometry: user configurable default geometry (Solaris OSes)</b>	<ol style="list-style-type: none"> <li>1. Capacity &lt;64GB: Head=63, Sector=32, Cylinder=? (depends on capacity)</li> <li>2. 64GB&lt;capacity&lt;128GB: Head=64, Sector=64, Cylinder=? (depends on capacity)</li> <li>3. 128GB&lt;capacity&lt;256GB: Head=127, Sector=64, Cylinder=? (depends on capacity)</li> <li>4. 256GB&lt;capacity&lt;512GB: Head=127, Sector=127, Cylinder=?</li> <li>5. 512GB&lt;capacity&lt;1TB: Head=255, Sector=64, Cylinder=? (depends on capacity)</li> <li>6. 1TB&lt;capacity: Head=225, Sector=225, Cylinder=? (depends on capacity)</li> <li>7. For capacity larger than 1TB, please refer to <b>Chapter 9</b></li> </ol>
<b>User configurable geometry range:</b>	Sector: 32, 64, 127, 255 or Variable Head: 64, 127, 255 or Variable Cylinder: <1024, <32784, <65536 or Variable
<b>Drive motor spin-up</b>	Supported. The controller will send spin-up (start unit) command to each drive at the 4 sec. intervals.
<b>Drive-side tagged command queuing</b>	Supported. User adjustable up to 128 for each drive
<b>Host-side maximum queued I/O count</b>	User adjustable up to 1024
<b>Maximum concurrent host LUN connection</b>	User adjustable up to 64
<b>Number of tags reserved for each Host-LUN connection</b>	User adjustable up to 256
<b>Controller shutdown</b>	Flushes cached contents upon the detection of critical conditions, e.g., a high temperature condition persists for a long time
<b>Drive I/O timeout</b>	User adjustable
<b>I/O channel diagnostics</b>	Supported; please contact your dealer for more details
<b>Maximum Drive Response Time (Guaranteed Latency I/O)</b>	User adjustable from 160 to 960ms. If a disk drive fails to return data on read requests before the timeout value is exceeded, the array immediately generates data from the parity data and the other members of a logical drive.
<b>Drive roaming</b>	Supported; array configuration stored on disk drives

## A.3 Caching Operation:

<b>Write-back cache</b>	Supported.
<b>Write-through cache</b>	Supported.

<b>Supported memory type</b>	SDRAM or DDR memory for enhanced performance Fast Page Memory with Parity for enhanced data security		
<b>Read-ahead operation</b>	Intelligent and dynamic read-ahead operation for processing sequential data requests		
<b>Multi-threaded operation</b>	Yes		
<b>Scatter / Gather</b>	Supported		
<b>I/O sorting</b>	Supported. Optimized I/O sorting for enhanced performance.		
<b>Adaptive Write-back/Write-through switching</b>	For a better performance when handling large sequential writes, firmware temporarily disables write-cache and the synchronized cache operation between partner controllers if operating with dual-active RAID controllers. Firmware automatically restores the write-back mode when later encountering random and small writes.		
<b>Periodic Cache Flush</b>	Firmware can be configured to flush the cached contents in memory at every preset interval: <ol style="list-style-type: none"> <li>1. If data integrity is of the concern, e.g., the lack of a battery backup protection.</li> <li>2. Cache flush on preset intervals to avoid the latency when cache memory is full due to write delays.</li> </ol>		
<b>Variable stripe size</b>		<b>Opt. for Sequential I/Os</b>	<b>Opt. for Random I/Os</b>
	<b>RAID0</b>	128	32
	<b>RAID1</b>	128	32
	<b>RAID3</b>	16	4
	<b>RAID5</b>	128	32
	<b>RAID6</b>	128	32
<b>Caching Optimization</b>	<ul style="list-style-type: none"> <li>• Cache buffer sorting prior to cache flush operation</li> <li>• Gathering of writes during flush operation to minimize the number of I/Os required for parity update</li> <li>• Elevator sorting and gathering of drive I/Os</li> <li>• Multiple concurrent drive I/Os (tagged commands)</li> <li>• Intelligent, predictive multi-threaded read-aheads</li> <li>• Multiple, concurrent host I/O threads (host command queuing)</li> </ul>		

## A.4 RAID Expansion:

<b>On-line RAID expansion</b>	Supported. Capacity brought by array expansion is immediately ready for Host I/Os when its status changes from "EXPAND" to "INITIALIZING." Initialization task is then completed in the background except when the logical array is stated as "INCOMPLETE" or "BAD;" e.g., has a failed member right after creation.
<b>Mode-1 RAID expansion - add drive</b>	Supported. Multiple drives can be added concurrently. Add Drive can even be performed in degraded mode.
<b>Mode-2 RAID expansion – copy and replace drives</b>	Supported. Replace members with drives of larger capacity.
<b>Expand capacity with no extra drive bays required</b>	Supported in Mode 2 RAID expansion, which provides "Copy and Replace Drive" function to replace drives with drives of greater capacity. No need for hardware upgrade, e.g., adding a new enclosure for the extra drives.
<b>Operating system support for RAID expansion</b>	No. No operating system driver required. No software need to be installed for this purpose.

## A.5 S.M.A.R.T. Support:

<b>Copy &amp; replace drive</b>	Supported. User can choose to clone a member drive showing symptoms of defects before it fails.
<b>Drive S.M.A.R.T. support</b>	Supported, with intelligent error handling implementations.
<b>User selectable modes for S.M.A.R.T.</b>	<ol style="list-style-type: none"><li>1. Detect only</li><li>2. Perpetual Clone: using a hot-spare to clone the drive reporting SMART errors; the hot-spare remains a clone drive</li><li>3. Clone + Replace: using a hot-spare to replace the drive reporting SMART errors; the drive reporting errors is pulled offline</li></ol>

## A.6 Redundant Controller:

<b>Active-active redundant controller</b>	Supported
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<b>Synchronized cache</b>	Supported. Through one or multiple, dedicated synchronizing channels on a common backplane or external cabling. Synchronized cache over SCSI channels, Fibre loops, or SATA channels is supported.  Synchronized cache can be disabled when using write-through mode in a redundant controller configuration to prevent performance trade-offs.
<b>Write-back cache enabled in redundant controller mode</b>	Yes, with synchronized cache connection between controllers.
<b>Automatic failover</b>	Yes (user's interaction necessary)
<b>Automatic failback</b>	Yes (user's interaction necessary)
<b>Controller hot-swap</b>	<ul style="list-style-type: none"> <li>▪ No need to shut down the failed controller before replacing the failed controller.</li> <li>▪ Support online hot-swap of the failed controller. There is no need to reset or shutdown the failed controller. One controller can be pulled out during active I/Os to simulate the destructive controller failure. (Customer's design-in hot-swap mechanism necessary)</li> </ul>
<b>Parity synchronization in redundant controller write-back mode to avoid write-hole</b>	Supported.
<b>Redundant controller communication over Fibre loops</b>	Dedicated loops or distribution over drive loops selectable
<b>No single-point-of-failure</b>	Supported.
<b>Automatic engagement of replacement controller</b>	Supported.
<b>Dynamic cache memory allocation</b>	Yes. Cache memory is dynamically allocated, not fixed.
<b>Environment management</b>	Supported. SAF-TE, S.E.S., ISEMS (I <sup>2</sup> C interface); and on-board controller voltage/temp monitor are all supported in both single and redundant controller mode. In the event of controller failure, services can be taken over by the surviving controller.
<b>Cache battery backup</b>	Supported. Battery backup modules support cached data during a power outage in both single controller and redundant controller modes.

<b>Load sharing</b>	Supported. Workload can be flexibly divided between different controllers by assigning logical configurations of drives (LDs/LVs) to different controllers.
<b>User configurable channel mode</b>	Supported. Channel modes configurable (SCSI or Fibre) as HOST or DRIVE on specific models such as the EonRAID 2510FS and EonStor F16F.
<b>Require a special firmware for redundant controller?</b>	No.

## A.7 Data Safety:

<b>Regenerate parity of logical drives</b>	Supported. Can be manually executed to ensure that bad sectors do not cause data loss in the event of drive failure.
<b>Scheduled Media Scan</b>	<p>Revision 3.34 and above allows Media Scan to be scheduled starting at a specified start time and repeated at regularly timed intervals. The start time and time intervals can be selected from drop-down menus. Start time is manually entered using its numeric representatives in the following order [MMDDhhmm[YYYY]], and it reads the date and time set for the controller's real-time clock.</p> <p>The selectable time intervals (the Execution Period) range from one (1) second to seven (7) weeks.</p> <p>Each such schedule can be defined to operate on individual hard drives, all members of a specified logical drive, or members of selected logical drives. Each schedule can include up to five (5) logical drives. The RS-232C terminal interface and RAIDWatch revision 2.0 support this functionality.</p>
<b>Bad block auto-reassignment</b>	Supported. Automatic reassignment of bad block
<b>Battery backup for cache memory</b>	Supported. The battery backup solutions provide long-lasting battery support to the cache memory when power failure occurs. The unwritten data in the cache memory can be committed to drive media when power is restored.
<b>Verification on normal writes</b>	Supported. Performs read-after-write during normal write processes to ensure data is properly written to drives.
<b>Verification on rebuild writes</b>	Supported. Performs read-after-write during rebuild write to ensure data is properly written to

	drives.
<b>Verification on LD initialization writes</b>	Supported. Performs read-after-write during logical drive initialization to ensure data is properly written to drives.
<b>Drive S.M.A.R.T. support</b>	Supported. Drive failure is predictable with reference to the variables detected. Reaction schemes are selectable from Detect only, Perpetual Clone and Copy + Replace. These options help to improve MTBF.
<b>Clone failing drive</b>	Users may choose to clone data from a failing drive to a backup drive manually
<b>Automatic shutdown on over-temperature condition</b>	Controller automatically starts a shutdown sequence (entering an idle state receiving no I/O requests) upon the detection of high-ambient temperature for an extended period of time.

## A.8 System Security:

<b>Password protection</b>	Supported. All settings require the correct password (if set) to ensure system security.
<b>User-configurable password validation timeout</b>	Supported. After certain time in absence of user interaction, the password will be requested again. This helps to avoid unauthorized operation when user is away.
<b>SSL-enabled RAIDWatch Agents</b>	Agents communicate to the controller through limited set of authorization options.

## A.9 Environment Management:

<b>SAF-TE/S.E.S. support</b>	Supported. The SAF-TE/S.E.S. modules can be connected to the drive channels. The RAID controller will detect errors from SAF-TE/S.E.S. devices or notify drive failures via SAF-TE/S.E.S. <ul style="list-style-type: none"> <li>• Both SAF-TE/S.E.S. via drive and device-self-interfaced methods are supported.</li> <li>• Redundant SAF-TE/S.E.S. devices are supported</li> <li>• Multiple S.E.S. devices are supported</li> </ul>
<b>Dynamic on-lining of enclosure services</b>	Once an expansion unit (JBOD) with supported monitoring interface is combined with a RAID system, its status will be automatically polled.
<b>SAF-TE/S.E.S. polling period</b>	User configurable (50ms, 100ms, 200ms, 500ms, 1~60sec)
<b>ISEMS (Infotrend Simple Enclosure Management Service)</b>	Supported.
<b>Multiple SAF-TE/S.E.S. modules on the same channel</b>	Supported.
<b>Multiple SAF-TE /S.E.S. modules on different channels</b>	Supported.
<b>Mapping SAF-TE/S.E.S. device to host channel for use with host-based SAF-TE/S.E.S. monitoring</b>	Supported.
<b>Event Triggered Operation</b>	When any of the following happens, the firmware disables write-back caching to minimize the chance of losing data: <ul style="list-style-type: none"> <li>- Battery, controller, cooling fan, or PSU failure</li> <li>- The upper temperature thresholds are exceeded</li> <li>- Low battery charge</li> <li>- UPS AC loss or low battery charge</li> </ul> The triggering factors are user-configurable
<b>Dual-speed cooling fan control</b>	Yes
<b>Dual-LED drive status indicators</b>	Supported. Both single-LED and dual-LED drive status indicators are supported.
<b>SAF-TE/ S.E.S. temperature value display</b>	Supported. Display the temperature value provided by enclosure SAF-TE module (if available).
<b>On-board controller voltage monitors</b>	Supported. Monitors the 3.3V, 5V, and 12V voltage status. Event triggered thresholds

	user configurable.
<b>On-board controller temperature sensors</b>	Supported. Monitors the CPU and board temperature status. Event trigger threshold user configurable.
<b>Enclosure redundant power supply status monitoring</b>	Supported. SAF-TE/S.E.S./ISEMS
<b>Enclosure fan status monitoring</b>	Supported. SAF-TE/S.E.S./ISEMS
<b>Enclosure UPS status monitoring</b>	Supported. SAF-TE/S.E.S./ISEMS
<b>Enclosure temperature monitoring</b>	Supported. SAF-TE/S.E.S./ISEMS

## A.10 User Interface:

<b>RAIDWatch on-board</b>	Out-of-band configuration and monitoring via Ethernet. Browser accessible configuration options by installing RAIDWatch to reserved space on drive via ftp.
<b>RS-232C terminal</b>	Supports terminal modes: ANSI, VT-100, ANSI Color. Provides menu-driven user-friendly text-based interface.
<b>Graphical user interface (Java-based GUI manager)</b>	Provides user-friendly graphical interface. Communicates with RAID controller via Out-of-band Ethernet, In-band SCSI, In-band Fibre or SNMP (Windows-based GUI).
<b>SSH support</b>	Secure Shell over Telnet supported
<b>External interface API for customized host-based management</b>	Supported.
<b>LCD front panel</b>	Provides easy access for user instinct operation.
<b>Buzzer alarm</b>	Warns users when any failures or critical events occur.

## A.11 High Availability:

<b>Custom inquiry serial number</b>	Custom Inquiry Serial Number (for support of multi-pathing software like Veritas, QLogic, etc)
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# B

## System Functions: Upgrading Firmware

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### B.1 Upgrading Firmware

The RAID controller's firmware resides in flash memory that can be updated through the COM port, LAN port, or via In-band SCSI/Fibre. New releases of firmware are available in the form of a DOS file in the "pub" directory of Infortrend's FTP site or on a 3.5" diskette. The file available at the FTP site is usually a self-extracting file that contains the following:

FW30Dxyz Firmware Binary (where "xyz" refers to the firmware version)  
B30Buvw Boot Record Binary (where "uvw" refers to the boot record version)  
README.TXT Read this file first before upgrading the firmware/boot record. It contains the most up-to-date information which is very important to the firmware upgrade and usage.

These files must be extracted from the compressed file and copied to a directory in boot drive.

#### B.1.1 Background RS-232C Firmware Download: Single Controller

Host I/Os will not be interrupted during the download process. After the download process is completed, user should find a chance to reset the controller for the new firmware to take effect.

### B.1.2 Note for Redundant Controller Firmware Upgrade:

A controller used to replace a failed unit in a dual-controller system is often running a newer release of firmware version. To solve the contention, make sure the firmware on a replacement controller is downgraded to that running on the surviving controller.



#### **IMPORTANT!**

- *Allow the downloading process to finish. Do not reset or turn off the computer or the controller while it is downloading the file. Doing so may result in an unrecoverable error that requires the service of the manufacturer.*
- *When upgrading the firmware, check the boot record version that comes with it. If the boot record version is different from the one installed on the surviving controller previously, the new boot record binary must be installed.*



#### **NOTE:**

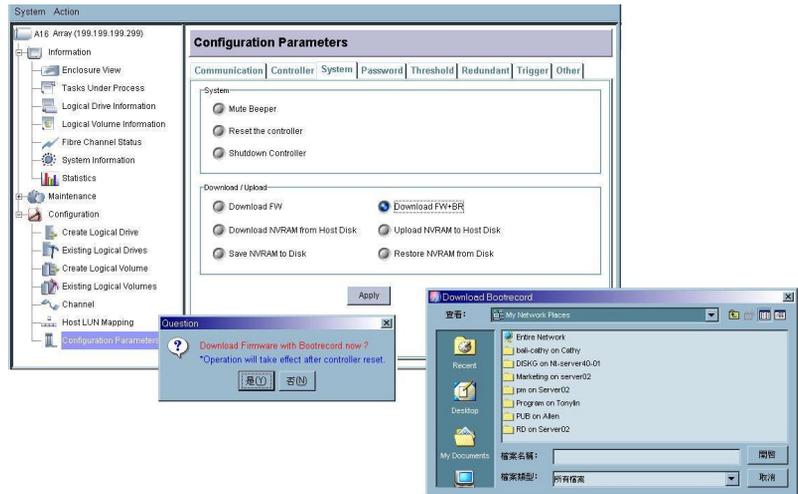
- *The COM 2 serial port cannot be used to download firmware.*
- 

## B.2 Upgrading Firmware Using RAIDWatch Manager

### B.2.1 Establish the In-band SCSI connection in RAIDWatch Manager

Please refer to RAIDWatch *User's Manual* for details on establishing the management session for RAIDWatch Manager.

## B.2.2 Upgrade Both Boot Record and Firmware Binaries



**Figure B - 1: Upgrading Boot Record and Firmware Binaries Using RAIDWatch Program**

1. Connect to the RAID system locally or from a remote computer using RAIDWatch Manager. While connected to the RAID system, there will be icon(s) with IP address specified on the left of the menu screen. Select by double-clicking the icon of the RAID system which firmware is to be upgraded. Select the “Configuration Parameters” icon and then select the “System” tab. Single-click the “Download FW+BR” check circle. Click the Apply button to proceed. A message prompt should display. Click Yes and then a file location prompt will appear.
2. Provide the boot record binary filename, the RAIDWatch Manager will start to download the boot record binary to the controller.
3. After the boot record download is completed, provide the firmware filename to the RAIDWatch Manager. It will start to download the firmware to RAID controller.
4. Shutdown the application server(s) or stop the application(s) which are accessing the RAID, then reset the RAID subsystem/controller in order to use the new downloaded firmware. **With firmware release 3.21 and above**, host I/Os will not be interrupted by the download process. Users may find a chance to stop host I/Os and reset the controller for new firmware to take effect.

## B.2.3 Upgrade the Firmware Binary Only



**Figure B - 2: Upgrading Firmware Binaries Using RAIDWatch Program**

1. Connect to the RAID system locally or from a remote computer using RAIDWatch Manager. While connected to the RAID system, there will be icon(s) with IP address specified on the left of the menu screen. Select by double-clicking the icon of the RAID subsystem which firmware is to be upgraded. Select the "Configuration Parameters" icon and then select the "System" tab. Single-click the "Download FW" check circle. Click the Apply button to proceed. A message prompt should display. Click Yes and then a file location prompt will appear.
2. Provide the firmware filename to the RAIDWatch Manager. It will start to download the firmware to RAID controller.
3. Shutdown the application server(s) or application(s) which are accessing the RAID, then reset the controller in order to use the new downloaded firmware.

## B.3 Upgrading Firmware Using RS-232C Terminal Emulation

The firmware can be downloaded to the RAID controller/subsystem by using an ANSI/VT-100 compatible terminal emulation program. Whichever terminal emulation program is used must support the ZMODEM file transfer protocol. The following example uses the HyperTerminal in Windows NT®. Other terminal emulation programs (e.g., Telix and PROCOMM Plus) can perform the firmware upgrade as well.

### B.3.1 Establishing the connection for the RS-232C Terminal Emulation

Please refer to *Chapter 4*, "Connecting to Terminal Emulation," and also your hardware manual for details on establishing the connection.

### B.3.2 Upgrading Both Boot Record and Firmware Binaries

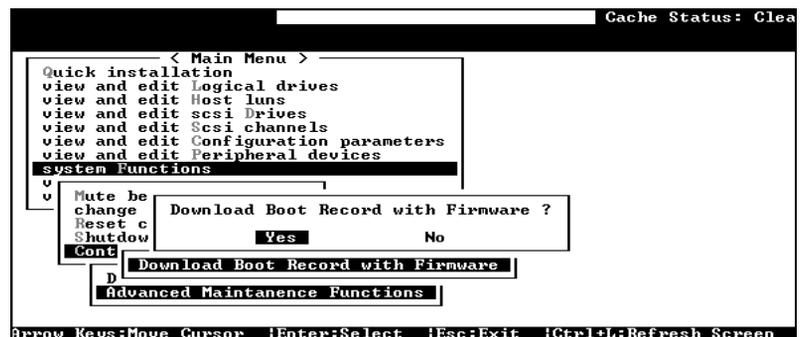


Figure B - 3: Upgrading Boot Record and Firmware Binaries Using Hyper Terminal Screen

1. From the Main Menu, scroll down to "System Functions."
2. Go to "Controller Maintenance."
3. Choose "Advanced Maintenance."
4. Select "Download Boot Record and Firmware."
5. Set ZMODEM as the file transfer protocol of your terminal emulation software.

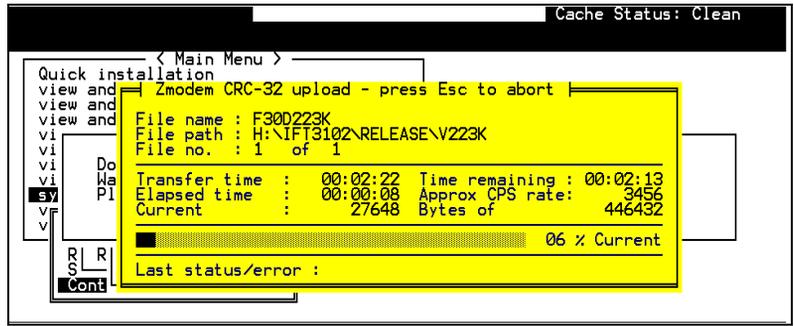
6. Send the Boot Record Binary to the controller. In HyperTerminal, go to the "Transfer" menu and choose "Send file." If you are not using Hyper Terminal, choose "Upload" or "Send" (depending on the software).
7. After the Boot Record has been downloaded, send the Firmware Binary to the controller. In HyperTerminal, go to the "Transfer" menu and choose "Send file." If you are not using Hyper Terminal, choose "Upload" or "Send" (depending on the software).
8. When the Firmware completes downloading, the controller will automatically reset itself. For a newer version of firmware, you need to manually reset the subsystem/controller for the new firmware to take effect.

### B.3.3 Upgrading the Firmware Binary Only



**Figure B - 4: Upgrading Firmware Binaries Using Hyper Terminal Screen**

1. From the Main Menu, scroll down to "System Functions."
2. Go to "Controller Maintenance."
3. Choose "Download Firmware."
4. Set ZMODEM as the file transfer protocol of your terminal emulation software.
5. Send the Firmware Binary to the controller. In Hyper Terminal, select "Send file." If you are not using Hyper Terminal, choose "Upload" or "Send" (depending on the software).



**Figure B - 5: Sending Files**

6. When the Firmware completes downloading, the controller will automatically reset itself. If the subsystem/controller is running firmware later than version 3.21, you need to manually reset the subsystem/controller for the new firmware to take effect.



**Figure B - 6: Receiving Firmware Files**

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## Appendix

# C

## Event Messages

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The controller events can be categorized as follows according to the severity levels:

Critical	Errors that need to attend to immediately
Warning	Errors
Notification	Command processed message sent from Firmware

The RAID subsystem records all system events from power on, it can record up to 1,000 events. To power off or to reset the controller will cause an automatic deletion of all the recorded event logs.

The RAIDWatch manager can be used to record events on multiple subsystems especially when controller reset or power-off is an expected action. The events can also be seen from RAIDWatch's Configuration Client utility. Associated details can be found in the RAIDWatch user's manual and online help.

Descriptions below may contain abbreviations. Abbreviations and Capitalized letters are preserved for the coherency with the event messages shown on LCD screen or terminal.

### C.1 Logical Drive Events

#### C.1.1 Critical:

LG:0 Logical Drive ALERT: CHL:0 ID:132 Drive Missing  
LG:0 Logical Drive ALERT: CHL:0 ID:132 Drive Failure  
LG:0 Logical Drive ALERT: Rebuild Aborted  
LG:0 Logical Drive ALERT: Rebuild Failed  
LG:0 Logical Drive ALERT: Parity Regeneration Aborted  
LG:0 Logical Drive ALERT: Parity Regeneration Failed  
LG:0 Logical Drive ALERT: Creation Aborted  
LG:0 Logical Drive ALERT: Creation Failed  
LG:0 Logical Drive ALERT: Initialization Failed  
LG:0 Logical Drive ALERT: Expansion Aborted  
LG:0 Logical Drive ALERT: Expansion Failed  
ALERT: CHL:0 ID:132 Media Scan Failed  
LG:0 ALERT: CHL:0 ID:132 Media Scan Failed  
LG:0 Logical Drive ALERT:CHL:0 ID:132 Clone Failed  
LG:0 Logical Drive ALERT:CHL:0 ID:132 Clone Aborted  
LG:0 Logical Drive ALERT:CHL:0 ID:132 Clone Failed  
LG:0 Logical Drive ALERT:CHL:0 ID:132 Clone Aborted  
LG:0 Logical Drive ALERT: Logical Drive Bad Block Table FULL  
LG:0 Logical Drive ALERT: Logical Drive Bad Block Table BAD  
LG:0 Logical Drive ALERT: Logical Drive On-Line Init Table BAD  
LG:0 Logical Drive ALERT: Bad Data Block Marked 000000084  
LG:0 Logical Drive ALERT: UNPROTECTED Block Marked 000000084  
LG:0 Logical Drive NOTIFY: Bad Data Block Encountered 000000084  
LG:0 ALERT:Inconsistent Parity Encountered Block 20000000B

#### C.1.2 Notification:

LG:0 Logical Drive NOTICE: Continue Rebuild Operation  
LG:0 Logical Drive NOTICE: Starting Rebuild  
LG:0 Logical Drive NOTICE: Rebuild of Logical Drive Completed  
LG:0 Logical Drive NOTICE: Continue Parity Regeneration Operation  
LG:0 Logical Drive NOTICE: Starting Parity Regeneration  
LG:0 Logical Drive NOTICE: Parity Regeneration of Logical Drive Completed  
LG:0 Logical Drive NOTICE: Starting Creation  
LG:0 Logical Drive NOTICE: Creation of Logical Drive Completed  
LG:0 Logical Drive NOTICE: Starting On-Line Initialization  
LG:0 Logical Drive NOTICE: On-Line Initialization of Logical Drive Completed  
LG:0 Logical Drive NOTICE: Starting Off-Line Initialization  
LG:0 Logical Drive NOTICE: Off-Line Initialization of Logical Drive Completed

LG:0 Logical Drive NOTICE: Starting On-Line Expansion  
LG:0 Logical Drive NOTICE: On-Line Expansion of Logical Drive Completed  
LG:0 Logical Drive NOTICE: Starting Off-Line Expansion  
LG:0 Logical Drive NOTICE: Off-Line Expansion of Logical Drive Completed  
LG:0 Logical Drive NOTICE: Continue Add Drive Operation  
LG:0 Logical Drive NOTICE: Starting Add Drive Operation  
LG:0 Logical Drive NOTICE: Add Drive Operation Paused  
LG:0 Logical Drive NOTICE: Add Drive to Logical Drive Completed  
LG:0 Logical Drive NOTICE: Add Drive Operation Paused  
NOTICE: CHL:0 ID:132 Starting Media Scan  
LG:0 NOTICE: CHL:0 ID:132 Starting Media Scan  
NOTICE: Media Scan of CHL:0 ID:132 Completed  
LG:0 NOTICE: Media Scan of CHL:0 ID:132 Completed  
LG:0 ALERT: CHL:0 ID:132 Media Scan Aborted  
LG:0 Logical Drive NOTICE:CHL:0 ID:132 Continue Clone Operation  
LG:0 Logical Drive NOTICE:CHL:0 ID:132 Starting Clone  
LG:0 Logical Drive NOTICE:CHL:0 ID:132 Copy and Replace Completed  
LG:0 Logical Drive NOTICE:CHL:0 ID:132 Clone Completed  
LG:0 Logical Drive NOTIFY: Bad Data Block Recovered 000000084  
LG:0 Logical Drive NOTIFY: Bad Data Block Recovered 000000084

## C.2 Channel and Individual Drive Events

### C.2.1 Critical:

CHL:0 ID:132 ALERT:Media Error Unrecoverable-0xD8001C7C  
CHL:0 FATAL ERROR(0)

### C.2.2 Warning:

CHL:1 ID:0 Target ALERT: Unexpected Select Timeout  
CHL:1 ID:0 Target ALERT: Unexpected Select Timeout  
CHL:1 Drive Channel ALERT: Unexpected Select Timeout  
CHL:1 RCC Channel ALERT: Gross Phase/Signal Error Detected  
CHL:1 ID:0 Target ALERT: Gross Phase/Signal Error Detected  
CHL:1 ID:0 Target ALERT: Gross Phase/Signal Error Detected  
CHL:1 Drive Channel ALERT: Gross Phase/Signal Error Detected  
CHL:1 RCC Channel ALERT: Unexpected Disconnect Encountered  
CHL:1 ID:0 Target ALERT: Unexpected Disconnect Encountered  
CHL:1 ID:0 Target ALERT: Unexpected Disconnect Encountered  
CHL:1 Drive Channel ALERT: Unexpected Disconnect Encountered  
CHL:1 RCC Channel ALERT: Timeout Waiting for I/O to Complete  
CHL:1 ID:0 Target ALERT: Timeout Waiting for I/O to Complete  
CHL:1 ID:0 Target ALERT: Timeout Waiting for I/O to Complete  
CHL:1 Drive Channel ALERT: Timeout Waiting for I/O to Complete  
CHL:1 RCC Channel ALERT: Parity/CRC Error Detected  
CHL:1 ID:1 Host Channel ALERT: Parity/CRC Error Detected  
CHL:1 Host Channel ALERT: Parity/CRC Error Detected  
CHL:0 ID:0 Drive ALERT: Unexpected Drive Not Ready (00B)  
CHL:0 ID:0 Drive ALERT: Drive HW Error (00B)  
CHL:0 RCC Channel ALERT: Unit Attention Received  
CHL:0 ID:0 Target ALERT: Unit Attention Received (10B)  
CHL:0 ID:0 Target ALERT: Unit Attention Received  
CHL:0 Drive Channel ALERT: Unit Attention Received  
CHL:0 ID:0 Drive ALERT: Aborted Command (00B)  
CHL:0 ID:0 Drive ALERT: Unexpected Sense Received (00B)  
CHL:0 ID:0 Drive NOTIFY: Block Reassignment Failed - 0 (10B)  
CHL:0 ID:0 Drive NOTIFY: Block Reassignment Failed - 0x0  
CHL:0 RCC Channel ALERT: Data Overrun/Underrun Detected  
CHL:0 ID:0 Target ALERT: Data Overrun/Underrun Detected  
CHL:0 ID:0 Target ALERT: Data Overrun/Underrun Detected  
CHL:0 Drive Channel ALERT: Data Overrun/Underrun Detected  
CHL:0 RCC Channel ALERT: Negotiation Error Detected  
CHL:0 ID:0 Target ALERT: Negotiation Error Detected  
CHL:0 ID:0 Target ALERT: Negotiation Error Detected  
CHL:0 Drive Channel ALERT: Negotiation Error Detected  
CHL:0 RCC Channel ALERT: Invalid Status/Sense Data Received  
CHL:0 ID:0 Target ALERT: Invalid Status/Sense Data Received (10B)  
CHL:0 ID:0 Target ALERT: Invalid Status/Sense Data Received  
CHL:0 Drive Channel ALERT: Invalid Status/Sense Data Received  
CHL:0 ALERT: Redundant Loop Connection Error Detected on ID:11

CHL:0 Host Channel ALERT: Channel Failure  
SMART-Slot:-1 Predictable Failure Detected-Clone Failed  
SMART-Slot:-1 Predictable Failure Detected  
SMART-Slot:-1 Predictable Failure Detected-Starting Clone  
SMART-Slot:-1 Predictable Failure Detected(TEST)  
SMART-Slot:-1 Predictable Failure Detected(TEST)  
SMART-Slot:-1 Predictable Failure Detected(TEST)  
SMART-Slot:-1 Predictable Failure Detected(TEST)  
CHL:0 ALERT: Fibre Channel Loop Failure Detected  
CHL:0 ALERT:Redundant Loop for Chl:0 Failure Detected  
CHL:0 ALERT:Redundant Path for Chl:0 ID:0 Expected but Not Found  
CHL:0 ID:0 ALERT:Redundant Path for Chl:0 ID:0 Failure Detected

### **C.2.3 Notification:**

CHL:0 ID:132 NOTICE:Media Error Recovered-0xD8001C7C  
CHL:0 ID:132 NOTICE:Media Error Recovered-0xD8001C7C  
CHL:0 NOTICE:Fibre Channel Loop Connection Restored  
CHL:0 ID:255 NOTICE:Redundant Path for Chl:0 Restored  
CHL:0 NOTICE:Redundant Path for Chl:0 ID:0 Restored  
CHL:0 ID:0 NOTICE:Redundant Path for Chl:0 ID:0 Restored  
CHL:0 ID:0 Drive NOTICE: Drive Recovered Error Reported  
CHL:0 LIP(FF B) Detected  
CHL:0 Host Channel Notification: Bus Reset Issued  
CHL:0 Host Channel ALERT: Bus Reset Issued  
CHL:0 ID:0 Drive NOTICE: Scan Drive Successful  
CHL:0 ID:0 Drive NOTIFY: Block Successfully Reassigned - 0 (10B)  
CHL:0 ID:0 Drive NOTIFY: Block Successfully Reassigned - 0x0

## C.3 General Target Events

### C.3.1 Critical:

SAF-TE Device(0)ALERT: Power Supply Failure Detected(Idx:132)  
Peripheral Set 0 Device ALERT:Power Supply 0 Failure Detected  
Peripheral Set 0 Device ALERT:Power Supply 0 Not Present  
Peripheral Set 0 Device ALERT: Low Voltage Detected(-1073939240.5V)  
SES(C0 I0)Power Supply 0:Device Not Supported !  
SAF-TE Device(0)ALERT: Cooling Fan Not Installed(Idx:2)  
SAF-TE Device(0)ALERT: Cooling Fan Failure Detected(Idx:2)  
Peripheral Set 0 Device ALERT: Cooling fan2 Failure Detected  
Peripheral Set 0 Device ALERT: Cooling fan2 Not Present  
Peripheral Set 0 Device ALERT: Low Speed Detected(-1073870808 RPM)  
SES(C0 I0)Cooling Fan 0:Device Not Supported !  
SAF-TE Device(0)ALERT: Elevated Temperature Alert  
Peripheral Device ALERT: CPU Cold Temperature Detected(0.0(C))  
Peripheral Device ALERT: Elevated Temperature Alert  
Peripheral Device ALERT: Elevated Temperature Alert  
Peripheral Set 0 Device ALERT: Temperature Sensor 0 Failure Detected  
Peripheral Set 0 Device ALERT: Temperature Sensor 0 Not Present  
Peripheral Set 0 Device ALERT: Cold Detected(0(C))  
SES(C0 I0)Temp Sensor 0:Device Not Supported !  
UPS Connection Is Absent  
SAF-TE Device(2)ALERT: UPS Power Failure Detected  
Peripheral Set 2 Device ALERT: UPS 2 AC Power Failure Detected  
Peripheral Set 2 Device ALERT: UPS 2 Battery Failure Detected  
Warning: UPS AC Power-Loss Detected  
Warning: UPS Battery Low - 0%.  
SES(C0 I0)UPS 2:Device Not Supported !

### C.3.2 Notification:

SAF-TE Device(2) NOTICE: Fan Back On-Line(Idx:11)  
NOTICE: FAN Module A Back On-Line(FAN0 0RPM)  
NOTICE: Controller FAN 1 Back On-Line(0 RPM)  
Peripheral Device NOTICE: Fan Back On-Line  
Peripheral Set 1 Device NOTICE: FAN 1 Back On-Line  
Peripheral Set 1 Device NOTICE: FAN 1 is Present  
Peripheral Set 1 Device NOTICE: FAN 1 Back On-Line(0 RPM)  
SES(C0 I0)Cooling Fan 1:Fan Back On-Line  
SAF-TE Device(1) NOTICE: Temperature Back To Non-Critical LVs  
Peripheral Set 1 Device NOTICE: Temperature 1 Back To Non-Critical LVs  
Peripheral Set 1 Device NOTICE: Temperature 1 is Present  
Peripheral Set 1 Device NOTICE: Temperature 1 Back To Non-Critical LVs(0(C))  
SES(C0 I0)Temp Sensor 1:Temperature Back To Non-Critical LVs  
SAF-TE Device(1) NOTICE: Power Supply Back On-Line(Idx:4)  
Power Supply 0 Back-Online  
Peripheral Set 2 Device NOTICE: PSU0 +12V Back On-Line  
Peripheral Set 2 Device NOTICE: PSU0 +12V is Present

Peripheral Set 2 Device NOTICE: PSU0 +12V Back On-Line(5.0V)  
SES(C0 I0)Power Supply 2:Power Supply Back On-Line  
UPS Connection Detected  
UPS AC Power Restored  
UPS Battery Restored To Safe Level 0  
SAF-TE Device(2) NOTICE: UPS Power Back On-Line  
Peripheral Set 2 Device NOTICE: UPS 2 AC Power Back On-Line  
Peripheral Set 2 Device NOTICE: UPS 2 Battery Back On-Line  
SES(C0 I0)UPS 2:UPS Power Back On-Line

## C.4 Controller Events

### C.4.1 Critical:

ALERT: +3.3V Low Voltage Detected(205.9V)  
ALERT: Controller FAN 0 Low Speed Detected(0 RPM)  
Controller NOTICE: Redundant Controller Firmware Updated  
Controller ALERT: Redundant Controller Failure Detected  
Controller SDRAM ECC Multi-bits Error Detected  
Controller SDRAM ECC Single-bit Error Detected  
Controller SDRAM Parity Error Detected  
Controller PCI Bus Parity Error Detected  
Controller ALERT: Power Supply Unstable or NVRAM Failed  
BBU Absent or Failed!Correct It and Reset Ctlr to Take Effect  
Controller BBU Absent or Failed! !  
Controller BBU Failure Detected !  
Controller BBU Thermal Shutdown/Enter Sleep-Mode !

### C.4.2 Warning:

Memory Not Sufficient to Fully Support Current Config.

### C.4.3 Notification:

Board1 Cold Temperature Back To Non-Critical LVs(0(C) )  
+12V Upper Voltage Back within Acceptable Limits(0.0V)  
+12V Lower Voltage Back within Acceptable Limits(0.0V)  
Memory is Now Sufficient to Fully Support Current Config.  
Controller NOTICE: NVRAM Factory Defaults Restored  
Controller NOTICE: NVRAM Factory Defaults Restored  
Controller NOTICE: NVRAM Factory Defaults Restored  
Controller BBU is Charging !  
NOTICE: Controller BBU Present !  
NOTICE: Controller BBU Back On-Line !  
NOTICE: Controller BBU Fully Charged !  
Force Controller Write-Through on Trigger Cause

## Event Description

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### C.5 Logical Drive Events

#### C.5.1 Critical:

<b>Message</b>	LG:0 Logical Drive ALERT: CHL:0 ID:132 Drive Missing
<b>What Happens?</b>	The specified hard drive in the specified logical drive has is missing.
<b>What to Do?</b>	The drive could have been accidentally removed or drive connection problems occurred. Check drive connection and related enclosure status.
<b>Message</b>	LG: Logical Drive ALERT: CHL:0 ID:132 Drive Failure
<b>What Happens?</b>	The specified hard drive in the specified logical drive has failed
<b>What to Do?</b>	If a spare is available, the subsystem will automatically start rebuild. If there is no spare, replace the faulty drive and rebuild will be automatically initiated provided that a replacement drive can be recognized by the subsystem. For example, in a SCSI-based subsystem, a manual "Scan Drive" command should be executed. In subsystems using other types of disk drives, drive swap auto-detection should be enabled on the drive channels.
<b>Message</b>	LG:0 Logical Drive ALERT: Rebuild Aborted
<b>What Happens?</b>	Logical drive rebuild aborted. It could result from the one of the following reasons: <ol style="list-style-type: none"><li>1. The rebuild has been manually canceled by a user.</li><li>2. The replacement drive used for a rebuild may have failed during the rebuild or the drive contains immanent defects.</li><li>3. Bad blocks are encountered on another member drive during the rebuild. (RAID 1, 3, and 5 arrays)</li><li>4. System faults occurred.</li></ol>
<b>What to Do?</b>	Carefully identify and replace the faulty drive and perform logical drive rebuild again. It is best to stop host I/Os temporarily to this logical drive.

<b>Message</b>	LG:0 Logical Drive ALERT: Rebuild Failed
<b>What Happens?</b>	Logical drive rebuild failed. It could result from the one of the following reasons: <ol style="list-style-type: none"> <li>1. The rebuild has been manually canceled by a user.</li> <li>2. The replacement drive used for a rebuild may have failed during the rebuild or the drive contains imminent defects.</li> <li>3. Bad blocks are encountered on another member drive during the rebuild. (RAID 1, 3, and 5 arrays)</li> <li>4. System faults occurred.</li> </ol>
<b>What to Do?</b>	Carefully identify and replace the faulty drive and perform logical drive rebuild again. It is best to stop host I/Os temporarily to this logical drive.
<b>Message</b>	LG:0 Logical Drive ALERT: Parity Regeneration Aborted
<b>What Happens?</b>	System faults or integrity problems forced system to abandon the operation. Irrecoverable parity inconsistency may also cause a halt to the operation.
<b>What to Do?</b>	Check proper system working conditions. Contact system vendor for help.
<b>Message</b>	LG:0 Logical Drive ALERT: Parity Regeneration Failed
<b>What Happens?</b>	System faults or integrity problems forced system to abandon the operation. Irrecoverable parity inconsistency may also cause a halt to the operation.
<b>What to Do?</b>	Check proper system working conditions. Contact system vendor for help.
<b>Message</b>	LG:0 Logical Drive ALERT: Creation Aborted
<b>What Happens?</b>	Logical drive creation process manually aborted or that some system integrity problems forced the subsystem to abort logical drive creation process.
<b>What to Do?</b>	Check proper system working conditions.
<b>Message</b>	LG:0 Logical Drive ALERT: Creation Failed
<b>What Happens?</b>	Logical drive creation process failed when one or more drive members failed or have been accidentally removed. Drive abnormality may also be the cause of the problems.
<b>What to Do?</b>	Check proper system working conditions and drive connection. Replace the faulty drives and repeat the creation process.

<b>Message</b>	LG:0 Logical Drive ALERT: Initialization Failed
<b>What Happens?</b>	Logical drive initialization failed. It could result from one of the following reasons: <ol style="list-style-type: none"> <li>1. One of the disk drives used for a logical drive might have failed during rebuild.</li> <li>2. Media errors are encountered on another member drive during the initialization process.</li> <li>3. Drive hardware faults occurred.</li> </ol>
<b>What to Do?</b>	Carefully identify and replace the faulty drive and perform logical drive initialization again.

<b>Message</b>	LG:0 Logical Drive ALERT: Expansion Aborted
<b>What Happens?</b>	Logical drive expansion failed. It could result from one of the following reasons: <ol style="list-style-type: none"> <li>1. The expansion has been canceled by a user.</li> <li>2. The drive used for expansion might have failed during expansion.</li> <li>3. Media errors are encountered on another member drive during the expansion process.</li> <li>4. One member drive has failed.</li> <li>5. Drive hardware faults occurred.</li> </ol>
<b>What to Do?</b>	Carefully identify and replace the faulty drive and perform logical drive expansion again.

<b>Message</b>	LG:0 Logical Drive ALERT: Expansion Failed
<b>What Happens?</b>	Logical drive initialization failed. It could result from one of the following reasons: <ol style="list-style-type: none"> <li>1. The drive(s) used for expansion might have failed during expansion.</li> <li>2. Media errors are encountered on another member drive during the expansion process.</li> <li>3. One member drive has failed.</li> <li>4. Drive hardware faults occurred.</li> </ol>
<b>What to Do?</b>	Carefully identify and replace the faulty drive and perform logical drive expansion again.

<b>Message</b>	LG:0 ALERT: CHL:0 ID:132 Media Scan Failed
<b>What Happens?</b>	Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically failed.
<b>What to Do?</b>	Carefully identify and replace the faulty drive if rebuild is possible.

<b>Message</b>	LG:0 ALERT: CHL:0 ID:132 Media Scan Aborted
<b>What Happens?</b>	Media Scan operation is aborted for certain reasons, e.g., it has been manually canceled.
<b>What to Do?</b>	Check disk drive and system operation status.

<b>Message</b>	LG:0 Logical Drive ALERT: CHL:0 ID:132 Clone Failed
<b>What Happens?</b>	Drive cloning failed. It could result from one of the following reasons: <ol style="list-style-type: none"> <li>1. Cloning has been manually canceled by a user.</li> <li>2. The drive used for cloning might have failed during the cloning process.</li> <li>3. Bad blocks are encountered on another member drive during the cloning process.</li> <li>4. The source drive has failed.</li> <li>5. System faults occurred.</li> </ol>
<b>What to Do?</b>	Carefully identify and replace the faulty drive.
<b>Message</b>	LG:0 Logical Drive ALERT: CHL:0 ID:132 Clone Aborted
<b>What Happens?</b>	Logical drive cloning aborted. It could result from one of the following reasons: <ol style="list-style-type: none"> <li>1. The cloning process has been manually canceled by a user.</li> <li>2. The drive used for cloning might have failed during cloning.</li> <li>3. Media errors are encountered on another member drive during the cloning process.</li> <li>4. The source drive has failed.</li> <li>5. System has been reset or drive hardware faults occurred.</li> </ol>
<b>What to Do?</b>	Carefully identify and replace the faulty drive.
<b>Message</b>	LG:0 Logical Drive ALERT: Logical Drive Bad Block Table FULL
<b>What Happens?</b>	Available bad block table entries full. Media Scan or host access has discovered and marked too many damaged sectors.
<b>What to Do?</b>	The target disk drive may have become physically unreliable. Contact system vendor for help.
<b>Message</b>	LG:0 Logical Drive ALERT: Logical Drive Bad Block Table BAD
<b>What Happens?</b>	System failed to generate a bad block table. Logical drive may have generated serious integrity problems.
<b>What to Do?</b>	The members of a logical drive may have become physically unreliable. Locate, replace, and replace the logical drive if possible. Contact system vendor for help.
<b>Message</b>	LG:0 Logical Drive ALERT: Logical Drive On-Line Init Table Bad
<b>What Happens?</b>	Serious system faults might have occurred, unstable voltage or damaged components, and forced the initialization to halt.
<b>What to Do?</b>	Check proper system working conditions. Contact system vendor for help.

<b>Message</b>	LG:0 Logical Drive ALERT: Bad Data Block Marked 000000084
<b>What Happens?</b>	Media errors caused data inconsistency; e.g., concurrent occurrences of media errors on more than one RAID5 member drive. The affected data blocks # are marked bad. The situation may result from the following: <ol style="list-style-type: none"> <li>1. One member drive failed, and media errors are found on another member drive.</li> <li>2. Media errors occurred consequentially on two member drives.</li> </ol>
<b>What to Do?</b>	The data affected by data blocks failure will be lost. The host computer will return media error messages if host accesses fall within the affected blocks.
<b>Message</b>	LG:0 Logical Drive ALERT: UNPROTECTED Block Marked 000000084
<b>What Happens?</b>	Media errors are found in an unprotected array, e.g., RAID0. The affected data blocks will be marked bad.
<b>What to Do?</b>	The data affected by data blocks failure will be lost. The host computer will return media error messages if host access falls within the affected blocks. Restoring data from a backup source is recommended.
<b>Message</b>	LG:0 Logical Drive NOTIFY: Bad Data Block encountered 000000084
<b>What Happens?</b>	Data blocks previously marked bad are re-encountered during host I/O access or certain operations such as Media Scan.
<b>What to Do?</b>	The data affected by data blocks failure is lost. Restoring data from a backup source is recommended. The host computer will return media error messages if host access falls within the affected blocks.
<b>Message</b>	LG:0 ALERT: Inconsistent Parity Encountered Block 000000084
<b>What Happens?</b>	Parity inconsistency encountered on block address _____
<b>What to Do?</b>	It is recommended to perform the "Regenerate Parity" function to correct the parity faults.

### C.5.2 Notification:

<b>Message</b>	LG:0 Logical Drive NOTICE: Continue Rebuild Operation
<b>What Happens?</b>	The target logical drive has been stored to its previous one-drive-failed status, and the rebuild operation is automatically resumed by firmware. This may occur when the system is powered off or reset during the rebuild process or that media errors have been discovered and corrected during the rebuild.
<b>What to Do?</b>	Press ESC to clear the message.

<b>Message</b>	LG:0 Logical Drive NOTICE: Starting Rebuild
<b>What Happens?</b>	The rebuild process has begun.
<b>What to Do?</b>	This is the message displayed when a stand-by spare is available when a member drive fails or when a faulty drive is physically replaced. The subsystem should automatically detect a drive for rebuild if the hot-swap detection mechanism has been enabled.
<b>Message</b>	LG:0 Logical Drive NOTICE: Rebuild of Logical Drive Completed
<b>What Happens?</b>	The subsystem has successfully rebuilt a logical drive.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Continue Parity Regeneration Operation
<b>What Happens?</b>	Start
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Starting Parity Regeneration
<b>What Happens?</b>	Start regenerating parity of a logical drive.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Parity Regeneration of Logical Drive Completed
<b>What Happens?</b>	The parity regeneration process on logical drive _ is completed.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Starting Creation
<b>What Happens?</b>	Logical drive creation process started. Note that the creation and initialization processes are separated. Creation of a logical drive only takes a second while the initialization may take hours with the arrays containing large capacity drives.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Starting On-Line Initialization
<b>What Happens?</b>	Creation process is completed, initialization process has begun to generate parity sectors and readying member drives. The On-line initialization mode takes a longer time to complete and allows the logical drive to receive host I/Os immediately if appropriate host ID/LUN mapping has been applied.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: On-Line Initialization of Logical Drive Completed
<b>What Happens?</b>	Logical drive on-line initialization completed
<b>What to Do?</b>	Press ESC to clear the message.

<b>Message</b>	LG:0 Logical Drive NOTICE: Starting Off-Line Initialization
<b>What Happens?</b>	Creation process is completed, initialization process has begun to generate parity sectors and readying member drives. The Off-line initialization mode takes place immediately after the creation of a logical drive, and does not allow host I/Os to be distributed to the logical drive at the same time.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Off-Line Initialization of Logical Drive Completed
<b>What Happens?</b>	Logical drive off-line initialization completed. The logical drive is now ready for host ID/LUN mapping, and then receiving host I/Os.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Starting On-Line Expansion
<b>What Happens?</b>	Start expanding the logical drive's added or free capacity (previously not included) when system find appropriate time after selecting to expand its capacity. The On-Line mode allows the added capacity of a logical drive to appear immediately as a usable partition and ready for host I/Os. This partition may require being associated with a separate ID/LUN on the host bus. Response to host I/Os will be slower because the expansion process requires distributing data blocks and parity data across new drive sectors.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: On-Line Expansion of Logical Drive Completed
<b>What Happens?</b>	Logical drive on-line expansion completed. The added capacity will appear as a new partition, and this partition may require being associated with a separate ID/LUN on the host bus. Adjustments should also be made through the host OS volume management utility.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Starting Off-Line Expansion
<b>What Happens?</b>	Start expanding the logical drive's added or free capacity (previously not included) when system find appropriate time after selecting to expand its capacity. The Off-Line mode does not allow the added capacity of a logical drive to be immediately available for host I/Os. This partition can only be associated with a separate ID/LUN on the host bus after the expansion process is completed. Access to the data already stored on the logical drive is not affected.
<b>What to Do?</b>	Press ESC to clear the message.

<b>Message</b>	LG:0 Logical Drive NOTICE: Continue Add Drive Operation
<b>What Happens?</b>	The target logical drive has been restored to its previous status, e.g., power-off or media errors, and the add drive operation can continue.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Starting Add Drive Operation
<b>What Happens?</b>	Add drive expansion process started
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: Add Drive Operation Paused
<b>What Happens?</b>	The add drive expansion process is halted by: <ol style="list-style-type: none"> <li>1. Logical drive expansion is canceled by a user.</li> <li>2. One of the member drives failed during logical drive expansion.</li> <li>3. Media errors are found on one or more of the logical drive members.</li> <li>4. System faults have occurred.</li> </ol>
<b>What to Do?</b>	Carefully identify and replace the faulty drive and correct system faults. The add drive expansion should continue once the faults are corrected.
<b>Message</b>	LG:0 Logical Drive NOTICE: Add Drive to Logical Drive Completed
<b>What Happens?</b>	The add drive expansion process is completed.
<b>What to Do?</b>	Press ESC to clear the message. Please remember to rearrange the added capacity which will appear as a new partition volume.
<b>Message</b>	NOTICE: CHL:0 ID:132 Starting Media Scan
<b>What Happens?</b>	Media Scan is manually or automatically started by the preset Task Schedules on a specific disk drive.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 NOTICE: CHL:0 ID:132 Starting Media Scan
<b>What Happens?</b>	Media Scan is manually or automatically started by the preset Task Schedules on a specific member of Logical Drive 0.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	NOTICE: Media Scan of CHL:0 ID:132 Completed
<b>What Happens?</b>	Media Scan on a specific disk drive is completed.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 NOTICE: Media Scan of CHL:0 ID:132 Completed
<b>What Happens?</b>	Media Scan on a specific member of Logical Drive 0 is completed.
<b>What to Do?</b>	Press ESC to clear the message.

<b>Message</b>	LG:0 Logical Drive NOTICE: CHL:0 ID:132 Continue Clone Operation
<b>What Happens?</b>	The target logical drive has been restored to its previous status, e.g., a failed drive is restored, and the cloning process can continue.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: CHL:0 ID:132 Starting Clone
<b>What Happens?</b>	Cloning process started on one of the members of Logical Drive 0
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: CHL:0 ID:132 Copy and Replace Completed
<b>What Happens?</b>	Copy and replace is completed with a specific member of Logical Drive 0. The original member drive is replaced by another disk drive.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTICE: CHL:0 ID:132 Clone Completed
<b>What Happens?</b>	Cloning is completed with a specific member of Logical Drive 0, whether it is replaced (Copy and Replace) or cloned (Perpetual Clone) to a spare drive.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	LG:0 Logical Drive NOTIFY: Bad Data Block Recovered 000000084
<b>What Happens?</b>	Host writes fall onto the data blocks previously marked bad and overwrite the drive sectors.
<b>What to Do?</b>	Press ESC to clear the message.

## C.6 Channel and Individual Drive Events

### C.6.1 Critical:

<b>Message</b>	CHL:0 ID:132 Target ALERT: Media Error Unrecoverable-0xD8001C7C
<b>What Happens?</b>	Drive surface media errors found and after rewrite the drive sectors are determined as physically damaged and unusable.
<b>What to Do?</b>	Data will be reassigned to other drive sectors. Host writes should continue without problems.
<b>Message</b>	CHL:0 Fatal Error (0)
<b>What Happens?</b>	Channel 0 has fatally failed.
<b>What to Do?</b>	Contact your system vendor for help.

### C.6.2 Warning:

<b>Message</b>	CHL:1 ID:0 Target ALERT: Unexpected Select Timeout
<b>What Happens?</b>	Drive target select timeout. The specified hard drive cannot be selected by the RAID controller/subsystem. Whether the drive has been removed, or the cabling/termination/canister is out of order.
<b>What to Do?</b>	This could occur if a disk drive is not properly installed or accidentally removed, or when cable links become unreliable. Check cabling and drive installation, and contact your RAID system supplier.
<b>Message</b>	CHL:1 Drive Channel ALERT: Unexpected Select Timeout
<b>What Happens?</b>	Drive Channel target select timeout. The specified drive channel cannot be selected by the RAID controller/subsystem. Faults might have occurred with the cabling/termination/internal data paths.
<b>What to Do?</b>	Check cabling and drive installation, and contact your RAID system supplier.
<b>Message</b>	CHL:_ RCC Channel ALERT: Gross Phase/Signal Error Detected
<b>What Happens?</b>	Phase/signal abnormality detected on the specific RCC channel.
<b>What to Do?</b>	Rare occurrence of phase/signal error could be recovered by firmware retry. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Target ALERT: Gross Phase/Signal Error Detected
<b>What Happens?</b>	Phase/signal abnormality detected with a specific target disk drive.
<b>What to Do?</b>	Check proper installation of disk drives and contact your RAID system supplier.

<b>Message</b>	CHL:_ Drive Channel ALERT: Gross Phase/Signal Error Detected
<b>What Happens?</b>	Phase/signal abnormality detected on the specific drive channel.
<b>What to Do?</b>	Contact your RAID system supplier.
<b>Message</b>	CHL:_ RCC Channel ALERT: Unexpected Disconnect Encountered
<b>What Happens?</b>	Unexpected disconnect detected on the specific RCC channel.
<b>What to Do?</b>	Check cabling/termination and canister connections, and contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Target ALERT: Unexpected Disconnect Encountered
<b>What Happens?</b>	Unexpected disconnect detected on the specific target disk drive.
<b>What to Do?</b>	Check cabling/termination and canister installation, and contact your RAID system supplier.
<b>Message</b>	CHL:_ Drive Channel ALERT: Unexpected Disconnect Encountered
<b>What Happens?</b>	Unexpected disconnect detected on the specific drive channel.
<b>What to Do?</b>	Check cabling/termination and canister connections, and contact your RAID system supplier.
<b>Message</b>	CHL:_ RCC Channel ALERT: Timeout Waiting for I/O to Complete
<b>What Happens?</b>	I/O timeout on specific RCC channel.
<b>What to Do?</b>	Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Target ALERT: Timeout Waiting for I/O to Complete
<b>What Happens?</b>	Drive-side target I/O timeout. Possible drive-side cabling/termination and canister connection abnormal or drive malfunctioning.
<b>What to Do?</b>	Check drive-side cabling/termination/canister/disk drive connections and contact your RAID system supplier.
<b>Message</b>	CHL:_ Drive Channel ALERT: Timeout Waiting for I/O to Complete
<b>What Happens?</b>	I/O timeout on specific drive channel.
<b>What to Do?</b>	Contact your RAID system supplier.
<b>Message</b>	CHL:_ RCC Channel ALERT: Parity/CRC Error Detected
<b>What Happens?</b>	RCC channel parity or CRC errors detected.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.

<b>Message</b>	CHL:_ ID:_ Host Channel ALERT: Parity/CRC Error Detected
<b>What Happens?</b>	Parity or CRC errors detected through host ID, CHL:_ ID:_.
<b>What to Do?</b>	Occurrences of these faults usually can be negotiated between RAID subsystems and application servers. If occurrences become frequent, contact your RAID system supplier.
<b>Message</b>	CHL:_ Host Channel ALERT: Parity/CRC Error Detected
<b>What Happens?</b>	Host channel parity or CRC errors detected.
<b>What to Do?</b>	Parity and CRC faults can often be negotiated between application servers and RAID subsystems. Contact your RAID system supplier if this occurs too frequently.
<b>Message</b>	CHL:_ ID:_ Drive ALERT: Unexpected Drive Not Ready (00B)
<b>What Happens?</b>	Unexpected Drive Not Ready returned from a disk drive on CHL:_ ID:_.
<b>What to Do?</b>	Check proper installation of disk drives or cabling connection. This event often occurs when hot-swapping disk drives and may be caused by signal glitches. If the disk drive fails to respond, the subsystem should consider the disk drive as a failed drive when the timeout threshold is reached. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Drive ALERT: Drive HW Error (00B)
<b>What Happens?</b>	Drive hardware error returned from a disk drive on CHL:_ ID:_.
<b>What to Do?</b>	The target disk drive may have failed. Contact your RAID system supplier for a replacement.
<b>Message</b>	CHL:_ RCC Channel ALERT: Unit Attention Received
<b>What Happens?</b>	Unit attention received from RCC channel CHL:_.
<b>What to Do?</b>	Rare occurrences of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Target ALERT: Unit Attention Received (10B)
<b>What Happens?</b>	Drive-side target unit attention receive on a disk drive CHL:_ ID:_.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Target ALERT: Unit Attention Received (10B)
<b>What Happens?</b>	Drive-side target unit attention receive on a disk drive CHL:_ ID:_.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Check disk drive connection and contact your RAID system supplier.

<b>Message</b>	CHL:_ Drive Channel ALERT: Unit Attention Received (10B)
<b>What Happens?</b>	Drive-side target unit attention receive on a drive channel CHL:_ ID:_.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Check proper installation and contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Drive ALERT: Aborted Command (00B)
<b>What Happens?</b>	Aborted command reported from a disk drive CHL:_ ID:_
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Drive ALERT: Unexpected Sense Received (00B)
<b>What Happens?</b>	Drive-side target unexpected sense received on a disk drive CHL:_ ID:_.
<b>What to Do?</b>	Check drive-side cabling/installation/working conditions. This may result from bad signal quality or poor connection. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Drive NOTIFY: Block Reassignment Failed - 0(10B)
<b>What Happens?</b>	Data regeneration and reassignment failed.  The Bad Block Table is full. Too many bad blocks have been found on the disk drive.  The adjacent data blocks on other member drives might have also been damaged.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ RCC Channel ALERT: Data Overrun/Underrun Detected
<b>What Happens?</b>	Data overrun/underrun errors detected on the RCC channel CHL:_.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Target ALERT: Data Overrun/Underrun Detected
<b>What Happens?</b>	Data overrun/underrun errors detected on a disk drive CHL:_ ID:_.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ Drive Channel ALERT: Data Overrun/Underrun Detected
<b>What Happens?</b>	Data overrun/underrun errors detected on the drive channel CHL:_.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.

<b>Message</b>	CHL:_ RCC Channel ALERT: Negotiation Error Detected
<b>What Happens?</b>	Negotiation errors occurred on the RCC channel CHL:._.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Target ALERT: Negotiation Error Detected
<b>What Happens?</b>	Negotiation errors occurred with the communications with a disk drive CHL:_ ID:_. The event could also occur with drive target data bus sync/wide negotiation abnormality.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ Drive Channel ALERT: Negotiation Error Detected
<b>What Happens?</b>	Negotiation errors occurred with the communications with a drive channel CHL:_. The event could also occur with drive target data bus sync/wide negotiation abnormality.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ RCC Channel ALERT: Invalid Status/Sense Data Received
<b>What Happens?</b>	Invalid status/sense data received on the RCC channel CHL:._
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ID:_ Target ALERT: Invalid Status/Sense Data Received (10B)
<b>What Happens?</b>	Invalid status/sense data received by a disk drive CHL:_ ID:_.
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ Drive Channel ALERT: Invalid Status/Sense Data Received
<b>What Happens?</b>	Invalid status/sense data received on the drive channel CHL:._
<b>What to Do?</b>	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ALERT: Redundant Loop Connection Error Detected on ID:._
<b>What Happens?</b>	One of the dual loop members might have failed or been disconnected. Make sure all cabling are properly connected and topological configurations properly set.
<b>What to Do?</b>	Check cabling and channel bus working conditions. If the problem does not result from cabling problems, contact your RAID system supplier.

<b>Message</b>	CHL:_ Host Channel ALERT: Channel Failure
<b>What Happens?</b>	Host channel CHL:_ link failure or disconnection occurred.
<b>What to Do?</b>	Check proper cabling connection and host HBA, link connection devices, etc. Contact your RAID system supplier.
<b>Message</b>	SMART-Slot:_ Predictable Failure Detected-Clone Failed
<b>What Happens?</b>	Hard Drive(s) report SMART-detected defects. A spare drive is commenced to clone or replace the member drive showing defects. The cloning operation failed. The member drive suspected of errors might have failed, or the clone process has been interrupted, e.g., yet another member has failed or the spare drive used for cloning has shown immanent faults.
<b>What to Do?</b>	Carefully check drive status and replace the unstable/failed drive. Contact your RAID system supplier.
<b>Message</b>	SMART-Slot:_ Predictable Failure Detected
<b>What Happens?</b>	Hard drive slot:_ reported SMART-detected errors, e.g., abnormal rotation speed, seek time delay, etc.
<b>What to Do?</b>	Carefully check drive status and replace the unstable/failed drive. Contact your RAID system supplier.
<b>Message</b>	SMART-Slot:_ Predictable Failure Detected-Starting Clone
<b>What Happens?</b>	One or more hard Drive(s) reports SMART-detected defects. Starts using a pre-defined spare drive to clone the member drive suspected of inherent errors. This happens when SMART detection is enabled with the “Copy & Replace” or “Perpetual Clone” reaction schemes.
<b>What to Do?</b>	Press ESC to clear the message. After the cloning process, you may consider replacing the defective drive with a good one and configure it as a spare drive in case drive failure might happen in the future.
<b>Message</b>	SMART-Slot:_ Predictable Failure Detected (TEST)
<b>What Happens?</b>	This results from a manually executed test command. This ensures your disk drive supports SMART detection and report functionality.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	CHL:_ ALERT: Fibre Channel Loop Failure Detected
<b>What Happens?</b>	Fibre Channel loop integrity alert. Lack of bypass or nodes on a loop caused a Fibre loop to fail.
<b>What to Do?</b>	Check host- or drive-side connection. Contact your RAID system supplier.
<b>Message</b>	CHL:_ ALERT: Redundant Loop for CHL:_ Failure Detected
<b>What Happens?</b>	One of the dual loop members may have failed or been disconnected. Make sure all channels are properly connected and topological configurations properly set.
<b>What to Do?</b>	Check cabling and system installation. Contact your supplier if no connection errors could be found.

<b>Message</b>	CHL:_ ALERT: Redundant Path for CHL:_ ID:_ Expected but Not Found
<b>What Happens?</b>	One of the dual loop members may have failed or been disconnected. This event is regenerated in the event when the one of dual loop connections to an expansion enclosure can not be found after power-up. Make sure all channels are properly connected and topological configurations properly set.
<b>What to Do?</b>	Check cabling and system installation. A manual "Issue LIP" command may restore the connection. Contact your supplier if no connection errors could be found.

<b>Message</b>	CHL:_ ID:_ ALERT: Redundant Loop for CHL:_ ID:_ Failure Detected
<b>What Happens?</b>	One of the dual loop members connecting device CHL:_ ID:_ may have failed or been disconnected. Make sure all channels are properly connected and topological configurations properly set.
<b>What to Do?</b>	Check cabling and system installation. Contact your supplier if no connection errors could be found.

### C.6.3 Notification:

<b>Message</b>	CHL:_ ID:_ NOTICE: Media Error Recovered-0xD8001C7C
<b>What Happens?</b>	Data once stored on bad drive sectors has been successfully re-conducted from adjacent data blocks/stripes onto the original drive blocks or distributed onto other healthy sectors.  ** Infortrend firmware translates SATA error codes into SCSI standard sense keys and sense codes. That's the error codes at the end of message.
<b>What to Do?</b>	Press ESC to clear the message.

<b>Message</b>	CHL:_ NOTICE: Fibre Channel Loop Connection Restored
<b>What Happens?</b>	Specific Fibre Channel loop connection restored.
<b>What to Do?</b>	Check proper host- or drive-side activities. Press ESC to clear the message.

<b>Message</b>	CHL:_ ID:_ NOTICE: Redundant Path for CHL:_ Restored
<b>What Happens?</b>	Redundant path, one of the drive-side loop members, for CHL:_ ID:_ is restored.
<b>What to Do?</b>	Check proper host- or drive-side activities. Press ESC to clear the message.

<b>Message</b>	CHL:_ NOTICE: Redundant Path for CHL:_ ID:_ Restored
<b>What Happens?</b>	The redundant path (CHL:_ ) connecting drive (CHL:_ ID:_ ) is restored.
<b>What to Do?</b>	Check proper host- or drive-side activities. Press ESC to clear the message.

<b>Message</b>	CHL:_ ID:_ Drive NOTICE: Drive Recovered Error Reported
<b>What Happens?</b>	Hard drive unrecoverable media error reported. A bad block is encountered in the specified hard drive. The RAID controller will ask the hard drive to retry.
<b>What to Do?</b>	Press [ESC] to clear the message.
<b>Message</b>	CHL:_ LIP(FF B) Detected
<b>What Happens?</b>	A LIP is issued on CHL:_.
<b>What to Do?</b>	Check proper host- or drive-side activities. Press ESC to clear the message.
<b>Message</b>	CHL:_ Host Channel Notification: Bus Reset Issued.
<b>What Happens?</b>	Bus reset on the CHL:_ host channel.
<b>What to Do?</b>	Check proper host- or drive-side activities. Press ESC to clear the message.
<b>Message</b>	CHL:_ ID:_ Drive NOTICE: Scan Drive Successful
<b>What Happens?</b>	A new drive or a replacement drive has been successfully scanned/recognized by the subsystem.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	CHL:_ ID:_ Drive NOTIFY: Block Successfully Reassigned - 0 (10B)
<b>What Happens?</b>	Writes conducted, retried, and media errors were discovered. Writes will then be re-directed to other drive sectors.
<b>What to Do?</b>	Press ESC to clear the message. If this message becomes frequent, the target disk drive might have developed serious media errors.
<b>Message</b>	CHL:_ ID_ Drive #SEV#: Media Error Encountered
<b>What Happens?</b>	Media errors are encountered in a hard drive.
<b>What to Do?</b>	Press ESC to clear the message. If this message becomes frequent, the target disk drive might have developed serious media errors.

## C.7 General Target Events

### C.7.1 Critical:

<b>Message</b>	SAF-TE Device(0) ALERT: Power Supply Failure Detected(Idx:132)
<b>What Happens?</b>	Power supply failure detected through SAF-TE monitoring device.
<b>What to Do?</b>	Contact your RAID supplier for a replacement module.
<b>Message</b>	Peripheral Set 0 Device ALERT: Power Supply 0 Failure Detected
<b>What Happens?</b>	Power supply failure detected through an I2C serial bus.
<b>What to Do?</b>	Contact your RAID supplier for a replacement module.
<b>Message</b>	Peripheral Set 0 Device ALERT: Power Supply 0 Not Present
<b>What Happens?</b>	No power supply module is installed in the expected module slot.
<b>What to Do?</b>	Check proper module installation. If an installed module can not be detected, contact your RAID supplier.
<b>Message</b>	Peripheral Set 0 Device ALERT: Low Voltage Detected (-1073939240.5V)
<b>What Happens?</b>	Low voltage detected from the power supply. Power supply may have become unstable.
<b>What to Do?</b>	Check proper module installation and contact your RAID supplier for a replacement module.
<b>Message</b>	SES(C0 I0)Power Supply 0:Device Not Supported!
<b>What Happens?</b>	Unrecognizable device type. This event may result from an incorrect configuration with the SES remote device monitoring.
<b>What to Do?</b>	Check proper module installation and contact your RAID system supplier.
<b>Message</b>	SAF-TE Device(0) ALERT: Cooling Fan Not Installed(Idx:2)
<b>What Happens?</b>	No cooling fan module is installed in the expected module slot.
<b>What to Do?</b>	Check proper module installation. If an installed module can not be detected, contact your RAID supplier.
<b>Message</b>	SAF-TE Device(0) ALERT: Cooling Fan Failure Detected(Idx:2)
<b>What Happens?</b>	Cooling fan failure detected through SAF-TE monitoring device.
<b>What to Do?</b>	Contact your RAID supplier for a replacement module.
<b>Message</b>	Peripheral Set 0 Device ALERT: Cooling Fan 2 Failure Detected
<b>What Happens?</b>	Cooling fan failure detected through an I2C serial bus.
<b>What to Do?</b>	Contact your RAID supplier for a replacement module.

<b>Message</b>	Peripheral Set 0 Device ALERT: Cooling Fan 2 Note Present
<b>What Happens?</b>	No cooling fan module is installed in the expected module slot.
<b>What to Do?</b>	Check proper module installation or contact your RAID supplier for a replacement module.
<b>Message</b>	Peripheral Set 0 Device ALERT: Low Speed Detected(-1073870808 RPM)
<b>What Happens?</b>	Low rotation speed detected on cooling fan. This is a fault detected through an I2C serial bus.
<b>What to Do?</b>	Check proper module installation or contact your RAID supplier for a replacement module.
<b>Message</b>	SES(C0 I0)Cooling Fan 0:Device Not Supported!
<b>What Happens?</b>	Unrecognizable device type. This event may result from an incorrect configuration with the SES remote device monitoring.
<b>What to Do?</b>	Check proper module installation and contact your RAID system supplier.
<b>Message</b>	SAF-TE Device(0) ALERT: Elevated Temperature Alert
<b>What Happens?</b>	Elevated temperature detected through SAF-TE monitoring device. Improper installation site condition or cooling fan failure might have caused the system temperature to rise.
<b>What to Do?</b>	Check proper cooling and cooling fan working condition. Contact your RAID system supplier.
<b>Message</b>	Peripheral Device ALERT: CPU Cold Temperature Detected(_ _C)
<b>What Happens?</b>	Temperature below the lower CPU threshold detected. Improper installation site condition might have caused the situation.
<b>What to Do?</b>	Correct your installation site condition. Contact your RAID system supplier.
<b>Message</b>	Peripheral Device ALERT: Elevated Temperature Alert
<b>What Happens?</b>	High temperature threshold violated and detected through an I2C serial bus. Improper installation site condition or cooling fan failure might have caused the situation.
<b>What to Do?</b>	Correct your installation site condition and cooling fan failure. Contact your RAID system supplier if a replacement is necessary.
<b>Message</b>	Peripheral Set 0 Device ALERT: Temperature Sensor 0 Failure Detected
<b>What Happens?</b>	Temperature sensor failure reported through an I2C serial bus.
<b>What to Do?</b>	Contact your RAID system supplier.

<b>Message</b>	Peripheral Set 0 Device ALERT: Temperature Sensor 0 Not Present
<b>What Happens?</b>	Temperature sensor failed or serial bus configuration/connection faults occurred.
<b>What to Do?</b>	Contact your RAID system supplier.
<b>Message</b>	Peripheral Set 0 Device ALERT: Cold Detected
<b>What Happens?</b>	Temperature dropped below the lower system threshold detected. Improper installation site condition might have caused the situation.
<b>What to Do?</b>	Correct your installation site condition. Contact your RAID system supplier.
<b>Message</b>	SES(C0 I0)Temp Sensor 0: Device Note Supported!
<b>What Happens?</b>	Unrecognizable device type. This event may result from an incorrect configuration with the SES remote device monitoring.
<b>What to Do?</b>	Check proper module installation and contact your RAID system supplier.
<b>Message</b>	UPS Connection Is Absent
<b>What Happens?</b>	The COM2 link to a UPS device is absent.
<b>What to Do?</b>	Check cabling to the UPS device. If hardware faults occurred, contact your RAID system supplier.
<b>Message</b>	SAF-TE Device(2) ALERT: UPS Power Failure Detected
<b>What Happens?</b>	UPS power failure detected through SAF-TE monitoring device.
<b>What to Do?</b>	Contact your UPS supplier.
<b>Message</b>	Peripheral Set 0 Device ALERT: UPS Power Failure Detected
<b>What Happens?</b>	UPS power failure is detected through an I2C serial bus.
<b>What to Do?</b>	Contact your RAID system supplier.
<b>Message</b>	Peripheral Set 0 Device ALERT: UPS 2 AC Power Failure Detected
<b>What Happens?</b>	AC power source failure reported by UPS and to the subsystem firmware through an I2C serial bus.
<b>What to Do?</b>	Check your power source connection or contact your RAID system supplier.
<b>Message</b>	Peripheral Set 0 Device ALERT: UPS 2 Battery Failure Detected
<b>What Happens?</b>	UPS battery failure reported by UPS and to the subsystem firmware through an I2C serial bus.
<b>What to Do?</b>	Contact your UPS supplier.

<b>Message</b>	Warning: UPS AC Power-Loss Detected
<b>What Happens?</b>	UPS AC power loss reported through the COM2 serial port connection.
<b>What to Do?</b>	Contact your UPS supplier.

<b>Message</b>	Warning: UPS Battery Low - __%
<b>What Happens?</b>	UPS battery charge low, may not be able to support subsystem during a power outage.
<b>What to Do?</b>	Wait for the UPS to recharge or you may use the Event Triggered mechanisms implemented with firmware. These mechanisms use conservative operation modes to reduce the chance of data loss in the event of power outage. Contact your UPS supplier.

<b>Message</b>	SES(C0 I0)UPS 2: Device Not Supported!
<b>What Happens?</b>	Unrecognizable device type. This event may result from an incorrect configuration with the SES remote device monitoring.
<b>What to Do?</b>	Check proper module installation and contact your RAID system supplier.

### C.7.2 Notification:

<b>Message</b>	SAF-TE Device(2) NOTICE: Fan Back On-Line(Idx:11)
<b>What Happens?</b>	A once missing or failed cooling fan is restored. This message is reported through the SAF_TE monitoring device.
<b>What to Do?</b>	Press ESC to clear this message.

<b>Message</b>	NOTICE: Fan Module A Back On-Line(FAN0 _RPM)
<b>What Happens?</b>	A once missing or failed cooling fan is restored. This message is reported through an I2C serial bus with RPM reading.
<b>What to Do?</b>	Press ESC to clear this message.

<b>Message</b>	Peripheral Device NOTICE: Fan Back On-Line
<b>What Happens?</b>	An I2C serial bus message indicating a once missing or failed cooling fan is restored.
<b>What to Do?</b>	Press ESC to clear this message.

<b>Message</b>	Peripheral Set 0 Device NOTICE: FAN 1 Back On-Line
<b>What Happens?</b>	An individual cooling fan once missing or failed is restored.
<b>What to Do?</b>	Press ESC to clear this message.

<b>Message</b>	Peripheral Set 0 Device NOTICE: FAN 1 is Present
<b>What Happens?</b>	An individual cooling fan once missing or failed is restored.
<b>What to Do?</b>	Press ESC to clear this message.

<b>Message</b>	Peripheral Set 0 Device NOTICE: FAN 1 Back On-Line(_RPM)
<b>What Happens?</b>	An individual cooling fan once missing or failed is restored, and the PRM reading displays. This applies to enclosure implementations using cooling fans capable of reporting rotation speed.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	SES(C0 I0) Cooling Fan 1:Fan Back On-Line
<b>What Happens?</b>	A cooling fan once missing or failed is restored. This message is reported through an SES monitoring device.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	Peripheral Set 0 Device NOTICE: FAN 1 Back On-Line
<b>What Happens?</b>	An individual cooling fan once missing or failed is restored.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	SAF-TE Device(1) NOTICE: Temperature Back To Non-Critical LVs
<b>What Happens?</b>	Operating temperature back within normal temperature range.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	Peripheral Set 0 Device NOTICE: Temperature 1 Back To Non-Critical LVs
<b>What Happens?</b>	Temperature sensor 1 reports operating temperature is now within normal temperature range.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	Peripheral Set 0 Device NOTICE: Temperature 1 is Present
<b>What Happens?</b>	Temperature sensor 1 once missing and is now present on the serial bus.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	Peripheral Set 0 Device NOTICE: Temperature 1 Back To Non-Critical LVs (_C)
<b>What Happens?</b>	Temperature sensor 1 reports operating temperature is now within normal temperature range and the Celsius reading displays.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	SES(C0 I0) Temp Sensor 1: Temperature Back to Non Critical LVs
<b>What Happens?</b>	Temperature sensor 1 reports operating temperature is now within normal temperature range.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	SAF-TE Device(1) NOTICE: Power Supply Back On-Line (Idx:4)
<b>What Happens?</b>	A power supply once missing or failed is now restored. This event is reported through the SAF-TE monitoring interface.
<b>What to Do?</b>	Press ESC to clear this message.

<b>Message</b>	Power Supply 0 Back-Online
<b>What Happens?</b>	Power supply module 0 is back online
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	Peripheral Set 0 Device NOTICE: PSU0 +12V Back On-Line
<b>What Happens?</b>	Power supply module 0 restored normal +12V voltage range
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	Peripheral Set 0 Device NOTICE: PSU0 +12V is Present
<b>What Happens?</b>	Power supply module 0 restored normal +12V voltage range
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	SES(C0 I0)Power Supply 2: Power Supply Back On-Line
<b>What Happens?</b>	Power supply module 2 once missing or failed is now restored.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	UPS Connection Detected
<b>What Happens?</b>	The COM2 serial link to UPS device is now valid.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	UPS AC Power Restored
<b>What Happens?</b>	UPS reports AC power source is now restored.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	UPS Battery Restored to Safe Level 0
<b>What Happens?</b>	UPS battery is charged to a safe level, able to protect system operation.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	SAF-TE Device(2) NOTICE: UPS Power Back On-Line
<b>What Happens?</b>	Power supplied by UPS is now restored.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	Peripheral Set 0 Device NOTICE: UPS 2 AC Power Back On-Line
<b>What Happens?</b>	UPS 2 AC power source restored.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	Peripheral Set 0 Device NOTICE: UPS 2 Battery Back On-Line
<b>What Happens?</b>	UPS 2 Battery charge or battery failure restored.
<b>What to Do?</b>	Press ESC to clear this message.
<b>Message</b>	Peripheral Set 0 Device NOTICE: UPS 2 AC Power Back On-Line
<b>What Happens?</b>	UPS 2 AC power source restored.
<b>What to Do?</b>	Press ESC to clear this message.

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<b>Message</b>	SES(C0 I0)UPS 2: UPS Power Back On-Line
<b>What Happens?</b>	UPS 2 connected through SES interface reports power back online.
<b>What to Do?</b>	Press ESC to clear this message.

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## C.8 Controller Events

### C.8.1 Critical:

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<b>Message</b>	ALERT: +3.3V Low Voltage Detected(_._V)
<b>What Happens?</b>	The detected +3.3V voltage source is lower than the preset voltage threshold.
<b>What to Do?</b>	Check power supply working condition, voltage threshold settings, and contact your RAID system supplier if necessary.

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<b>Message</b>	ALERT: Controller FAN 0 Low Speed Detected (_RPM)
<b>What Happens?</b>	This only applies to controller fans in the SentinelRAID series. Low rotation speed detected.
<b>What to Do?</b>	Contact your RAID system supplier for a replacement.

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<b>Message</b>	Controller NOTICE: Redundant Controller Firmware Updated
<b>What Happens?</b>	Firmware updated on a redundant controller RAID subsystem. Resetting the subsystem may be required for the new firmware to take effect.
<b>What to Do?</b>	Updating firmware on a complex system configuration is recommended for experienced engineers only. Unless for bug fixing, updating firmware is not always necessary.

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<b>Message</b>	Controller ALERT: Redundant Controller Failure Detected
<b>What Happens?</b>	One RAID controller in a controller pair failed. This message indicates that its partner has taken the workload and managed the failover operation.
<b>What to Do?</b>	Contact your RAID system supplier for a replacement controller and restore the dual-active configuration.

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<b>Message</b>	Controller SDRAM ECC Multi-bits Errors Detected
<b>What Happens?</b>	Memory multi-bits errors.
<b>What to Do?</b>	Contact your RAID system supplier to return the subsystem/RAID controller for repair.

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<b>Message</b>	Controller SDRAM ECC Single-bit Errors Detected
<b>What Happens?</b>	Memory single-bit errors.
<b>What to Do?</b>	Subsystem firmware should be able to manage the single-bit errors. Contact your RAID system supplier if this message becomes frequent.

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<b>Message</b>	Controller SDRAM Parity Errors Detected
<b>What Happens?</b>	Memory parity errors.
<b>What to Do?</b>	Subsystem firmware should be able to manage the parity errors in memory. Contact your RAID system supplier if this message becomes frequent.

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<b>Message</b>	Controller PCI Bus Parity Errors Detected
<b>What Happens?</b>	Serious system faults have occurred.
<b>What to Do?</b>	Stop host I/Os immediately to prevent further data dis-integrity and contact your RAID system supplier.
<b>Message</b>	Controller ALERT: Power Supply Unstable or NVRAM Failed
<b>What Happens?</b>	Power supply voltage fluctuating or internal system faults have occurred. Different system faults may trigger this event, e.g., memory pins contact problems or incongruent firmware versions, etc.
<b>What to Do?</b>	Check proper system operation conditions and contact your RAID system supplier.
<b>Message</b>	BBU Absent or Failed! Correct It and Reset Ctlr to Take Effect
<b>What Happens?</b>	BBU (battery cell pack) has failed or is accidentally removed. When a new module is installed, reset the subsystem for the configuration to take effect.
<b>What to Do?</b>	Check proper installation of the module or contact your RAID system supplier for a replacement module.
<b>Message</b>	Controller BBU Absent or Failed!
<b>What Happens?</b>	BBU (battery cell pack) has failed or is accidentally removed. When a new module is installed, reset the subsystem for the configuration to take effect.
<b>What to Do?</b>	Check proper installation of the module or contact your RAID system supplier for a replacement module.
<b>Message</b>	Controller BBU Failure Detected!
<b>What Happens?</b>	BBU (battery cell pack) has failed or is accidentally removed. When a new module is installed, reset the subsystem for the configuration to take effect.
<b>What to Do?</b>	Check proper installation of the module or contact your RAID system supplier for a replacement module.

<b>Message</b>	Controller BBU Thermal Shutdown/Enter Sleep-Mode!
<b>What Happens?</b>	The following conditions will cause the charger circuits to enter a low-power and self-protection state: <ol style="list-style-type: none"> <li>1. The temperature sensor on the charger circuit reports elevated temperature reading (<math>\geq 45</math> degree Celsius).</li> <li>2. The BBU (battery cell pack) has been charged for over 7 hours. The BBU charger will enter a timer fault state.</li> </ol>
<b>What to Do?</b>	<ol style="list-style-type: none"> <li>1. Check proper ventilation within the subsystem. You may also check the readings from other sensors within the enclosure. Airflow might have been disrupted by the absence of one or several major modules or the failure of a cooling fan. Once the thermal condition is improved, charging will resume automatically.</li> <li>2. If a new battery module has been charged for over seven (7) hours and this event is issued, you may remove and re-install the battery module. An empty battery module may take more than 7 hours to be fully charge. There is a timer embedded with the charger, doing so can reset the timer. Charging will resume automatically.</li> </ol>

### C.8.2 Warning:

<b>Message</b>	Memory Not Sufficient to Fully Support Current Config.
<b>What Happens?</b>	The installed memory size does not support current configuration. Try using a DIMM module of a larger size.
<b>What to Do?</b>	Check proper installation of the module or contact your RAID system supplier for a certified module.

### C.8.3 Notification:

<b>Message</b>	Board1 Cold Temperature Back to Non-Critical LVs(_C)
<b>What Happens?</b>	Board1 (usually the RAID controller main board) ventilation condition is restored to normal.
<b>What to Do?</b>	Check proper working condition and press ESC to clear the message.

<b>Message</b>	+12V Upper Voltage Back within Acceptable Limits (__V)
<b>What Happens?</b>	+12V voltage dropped back within preset thresholds.
<b>What to Do?</b>	Check proper working condition and press ESC to clear the message.

<b>Message</b>	+12V Lower Voltage Back within Acceptable Limits (._.V)
<b>What Happens?</b>	+12V voltage dropped back within preset thresholds.
<b>What to Do?</b>	Check proper working condition and press ESC to clear the message.
<b>Message</b>	Memory is Now Sufficient to Fully Support Current Config.
<b>What Happens?</b>	Memory of a sufficient capacity is installed and the subsystem should work properly.
<b>What to Do?</b>	Check proper working condition and press ESC to clear the message.
<b>Message</b>	Controller NOTICE: NVRAM Factory Defaults Restored
<b>What Happens?</b>	The factory defaults for configuration profile is restored.
<b>What to Do?</b>	Press ESC to clear the message.
<b>Message</b>	Controller BBU is Charging!
<b>What Happens?</b>	Once a new BBU is installed or BBU charge drops below a preconfigured level, the subsystem will start charging its batteries.
<b>What to Do?</b>	Press ESC to clear the message. All batteries have a limited life expectancy. If this message appears too frequently, the BBU may have gradually lost its ability to hold charge.
<b>Message</b>	+12V Upper Voltage Back within Acceptable Limits (._.V)
<b>What Happens?</b>	+12V voltage dropped back within preset thresholds.
<b>What to Do?</b>	Check proper working condition and press ESC to clear the message.
<b>Message</b>	NOTICE: Controller BBU Present!
<b>What Happens?</b>	A BBU once missing or removed is now electrically connected to the subsystem.
<b>What to Do?</b>	Check proper working condition and press ESC to clear the message.
<b>Message</b>	NOTICE: Controller BBU Back On-Line!
<b>What Happens?</b>	A BBU once missing or removed is now restored to its normal working condition.
<b>What to Do?</b>	Check proper working condition and press ESC to clear the message.
<b>Message</b>	NOTICE: Controller BBU Fully Charged!
<b>What Happens?</b>	A BBU is fully charged.
<b>What to Do?</b>	Check proper working condition and press ESC to clear the message.

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<b>Message</b>	Force Controller Write-Through on Trigger Cause
<b>What Happens?</b>	Preset conditions, e.g., elevated temperature or component failure, has forced the subsystem to adopt a more conservative operating mode by disabling the Write-Back caching.
<b>What to Do?</b>	Check proper working condition and correct system faults. Press ESC to clear the message.

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