Infortrend

External RAID Controller

Generic Operation Manual

Revision 1.4

Firmware Revision: 3.21

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Table of Contents

Chapter 5 LCD Screen Messages

Chapter 6 Front Panel Operation

Chapter 7 Terminal Screen Messages

Chapter 8 Terminal Operation

Chapter 9 Fibre Operation

Chapter 10 Advanced Configuration

Chapter 11 Record of Settings

Chapter 12 Redundant Controller

Chapter 13 In-band SCSI Text RAID Manager and SNMP Agent Installation

Chapter 14 Fault-Bus

Appendix A LCD Front Panel Navigation Map

Appendix B Firmware Functionality Specifications

Appendix C System Functions: Upgrading Firmware

Appendix D Event Message

Appendix E Differences in Logical Drive Format

Index

List of Tables

List of Figures

Chapter 8

Chapter 9

Chapter 10

Chapter 12

Chapter 14

About This Manual

This manual provides all of the necessary information that a system administrator needs to configure and maintain one of Infortrend's external RAID controllers. For hardware-related information, please refer to the ***Hardware Manual*** that came with your RAID controller. Also available is the ***User's Manual*** for the Java-based GUI RAID manager for remote and concurrent management of multiple RAID systems.

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

The terminal screen displays as well as the LCD messages may appear differently when using controllers running different firmware versions.

Chapter 1 provides a brief description of Infortrend's controller functions.

Chapter 2 introduces basic RAID concepts and configurations, including RAID levels, logical drives, spare drives, and logical volumes. It is recommended that users unfamiliar with RAID technologies should read through the whole chapter before creating a RAID.

Chapter 3 tells the user how to begin with a RAID. At the beginning of this chapter, we raise some basic questions of which the user should know the answers prior to creating a RAID.

Chapter 4 teaches the user how to configure the RS-232C terminal emulation interface and out-of-band connection through a LAN port.

Chapter 5 helps the user to understand the screen messages on the LCD display.

Chapter 6 gives step-by-step instructions on creating a RAID using the LCD panel.

Chapter 7 teaches the user how to interpret the information found on the RS-232 terminal emulation and Text RAID Manager screens.

Chapter 8 gives step-by-step instructions on how to create a RAID via the RS-232 terminal.

Chapter 9 includes all the Fibre-specific functions implemented since the firmware release 3.12.

Chapter 10 provides some of the advanced options for RAID configuration. Some of the new functions from firmware release 3.11 and above are given detailed explanations in this chapter.

Chapter 11 provides recording forms with which a system administrator can make a record of his configuration.

Chapter 12 addresses concerns regarding the redundant controller configuration and the configuration process.

Chapter 13 details how to install the In-band SCSI Text RAID Manager for various operating systems.

Chapter 14 teaches the user how to set up Fault-bus (3101, 3102, and the SentinelRAID 100 / 150 series).

Appendix A outlines the menu structure of the LCD front panel operation.

Appendix B lists important firmware features supported by the external RAID controller, arranged in accordance with the latest firmware version as of press date.

Appendix C teaches the user how to upgrade firmware.

Appendix D lists all the controller event messages for the current firmware version.

Appendix E is a special note on the differences between logical drive format that users may experience when different firmware versions are applied to the same array.

Note on Firmware Version

Infortrend's newest line of controllers (the SentinelRAID and EonRAID series) is powered by a 64-bit PowerPC CPU. Firmware revisions ***3.11*** and above have been upgraded to work with a 64-bit controller architecture. Firmware revision ***2.23*** can work with the 3101 and 3102 external controller series. These two firmware types are not interchangeable; however, basic configurations with these two types of firmware are basically the same. This manual can be applied for reference to work with these firmware revisions. ***The only exception to this is Chapter 9.*** Chapter 9 focuses on the Fibre-specific options available only with the 3.xx line of firmware. Some other minor differences, for example, the status of front panel cooling fans and Fault-Bus, will be specified during the discussion.

Firmware version: 2.23K / 3.21N
Part number for this manual: M0000U0G14
Date: 09 / 15 / 01

Revision History:

Version 1.0:	initial release
Version 1.1:	added redundant controller configuration

Version 1.2:	Added host-side and drive-side SCSI parameters added S.M.A.R.T. with implemented Fault-Prevention functions. added system functions added Fault-bus configuration to be compatible with 3101 and 3102 series added Host-side interface installation details added Event Messages for error message identification added all advanced functions available since 2.23K and 3.11F upward added a functional table of content for quick searching functions moved SCSI/Fibre Cable Specifications to Hardware Manual
Version 1.3:	added Chapter 9 "Fibre Operation" for the new functions available since firmware release 3.12.
Version 1.4:	added firmware features available with firmware revisions 3.14, 3.15, and 3.21 revised details about redundant controllers, host LUN mapping, etc. modified string definitions in Chapter 14 "In-band SCSI Drives and Utilities" section Corrected descriptions of "Controller Unique Identifier" added the configuration process for out-of-band via LAN port

Functional Table of Contents:

This functional table of contents helps you to quickly locate the descriptions of functions included in this manual.

Chapter

1 Introduction

Firmware Specifications:

The Infortrend RAID controllers are specifically designed to provide RAID 0, 1 (0+1), 3, 5, 10, 30, 50, NRAID or JBOD capability to any host system equipped with a SCSI or Fibre interface. It is totally independent of the host computer's operating system. All RAID functions are performed by a PowerPC® RISC CPU (SentinelRAID series and above) coupled with high-speed system memory and firmware in flash memory. In effect, it endows the host system with a high-speed and fault-tolerant disk storage operation using the RAID technology. It is an ideal solution for weaving several hard disks into one contiguous volume.

The controllers have comprehensive drive failure management that allows automatic reassignment of reserved blocks when a bad sector is encountered during a write. Hot-swapping is supported through automatic disconnection of a failed drive and detection of a reserved drive followed with background rebuilding of data. Spare drives can be dedicated to a logical drive or global, which is ready to restore data from any failed drive in the system. What's remarkable is all these failure recovery procedures are transparent to the host system.

Storage capacity can be expanded by adding or replacing disk drives without powering down the system. S.M.A.R.T. is supported with enhanced features. Related parameters can be set to determine controller's reaction when a drive failure is predicted.

The controllers have been designed with ease of integration and maintenance in mind. All major RAID features are described in the following chapter. The controller already includes all the major operational requirements of a RAID subsystem. The overall features of a fully-built RAID subsystem will, however, depend on the actual components used and the creativity of the integrator.

Chapter

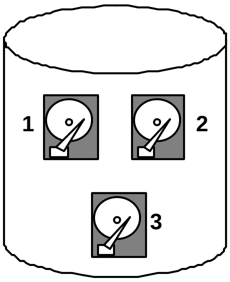
2

Functional Description

Redundant Arrays of Independent Disks, or RAID, offers the following advantages: Availability, Capacity, and Performance. Choosing the right RAID level and drive failure management can increase Capacity and Performance, subsequently increasing Availability. Infortrend's external RAID controllers provide complete RAID functionality and enhanced drive failure management.

2.1 Logical Drive

Figure 2 - 1 Logical Drive



Logical Drive

The advantages mentioned above are achieved by creating "logical drives." A logical drive is simply an array of independent physical drives. The logical drive appears to the host the same as a local hard disk drive does.

The following section describes the different methods by which logical drives are created, such as spanning, mirroring and data parity. These methods are referred to as "RAID levels."

2.2 Logical Volume

What is a logical volume?

The concept of a logical volume is very similar to that of a logical drive. A logical volume is composed of one or several logical drives. The member logical drives can be composed of the same RAID level or each of different RAID levels. The logical volume can be divided into a maximum of 8 partitions. During operation, the host sees a non-partitioned logical volume or a partition of a partitioned logical volume as one single physical drive.

2.3 RAID Levels

RAID stands for Redundant Array of Independent Disks. Using a RAID storage subsystem has the following advantages:

- Provides disk spanning by weaving all connected drives into one single volume.
- Increases disk access speed by breaking data into several blocks when reading/writing to several drives in parallel. With RAID, storage speed increases as more drives are added as the channel bus allows.
- Provides fault-tolerance by mirroring or parity operation.

What are the RAID levels?

Table 2 - 1 RAID Levels

RAID Level	Description	Capacity	Data Availability
NRAID	Non-RAID	N	
RAID 0	Disk Striping	N	==NRAID
RAID 1 (0+1)	Mirroring Plus Striping (if N>1)	N/2	>>NRAID ==RAID 5
RAID 3	Striping with Parity on dedicated disk	N-1	>>NRAID ==RAID 5
RAID 5	Striping with interspersed parity	N-1	>>NRAID ==RAID 5
RAID 10 (Logical Volume)	Striping with RAID 1 logical drives	/	>>NRAID >>RAID 5
RAID 30 (Logical Volume)	Striping with RAID 3 logical drives	/	>>NRAID >>RAID 5
RAID 50 (Logical Volume)	Striping with RAID 5 logical drives	/	>>NRAID >>RAID 5

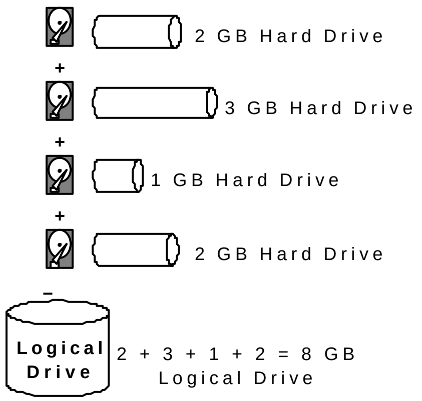
NOTE: Drives on different channels can be included in a logical drive and logical drives of different RAID levels can be used to configure a logical volume. There are more combinations than RAID 10, 30, and 50.

RAID Level	Performance Sequential	Performance Random
NRAID	Drive	Drive
RAID 0	R: Highest W: Highest	R: High W: Highest
RAID 1 (0+1)	R: High W: Medium	R: Medium W: Low
RAID 3	R: High W: Medium	R: Medium W: Low
RAID 5	R: High W: Medium	R: High W: Low

NRAID

Disk Spanning

Figure 2 - 2 NRAID



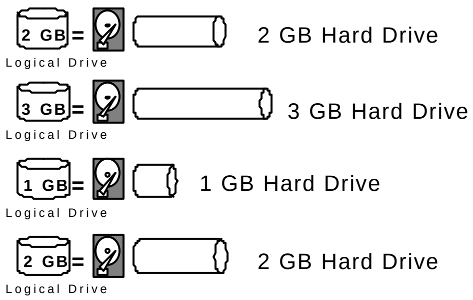
NRAID	
Minimum Disks required	1
Capacity	N
Redundancy	No

NRAID stands for Non-RAID. The capacity of all the drives is combined to become one logical drive (no block striping). In other words, the capacity of the logical drive is the total capacity of the physical drives. NRAID does not provide data redundancy.

JBOD

Single Drive Control

Figure 2 - 3 JBOD



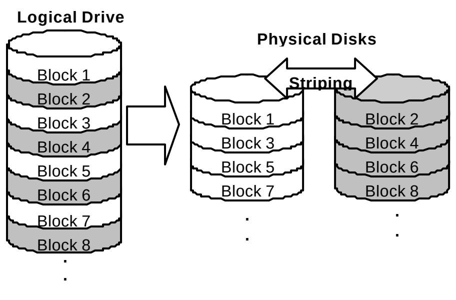
JBOD	
Minimum Disks required	1
Capacity	1
Redundancy	No

JBOD stands for Just a Bunch of Drives. The controller treats each drive as a stand-alone disk, therefore each drive is an independent logical drive. JBOD does not provide data redundancy.

RAID 0

Disk Striping

Figure 2 - 4 RAID 0



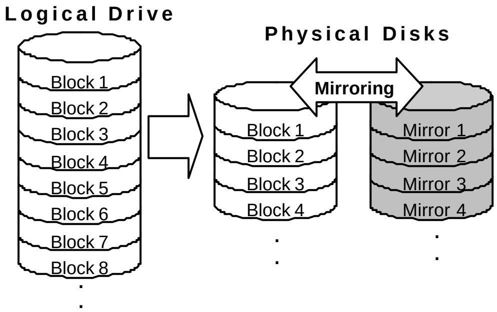
RAID 0	
Minimum Disks required	2
Capacity	N
Redundancy	No

RAID 0 provides the highest performance but no redundancy. Data in the logical drive is striped (distributed) across several physical drives.

RAID 1

Disk Mirroring

Figure 2 - 5 RAID 1



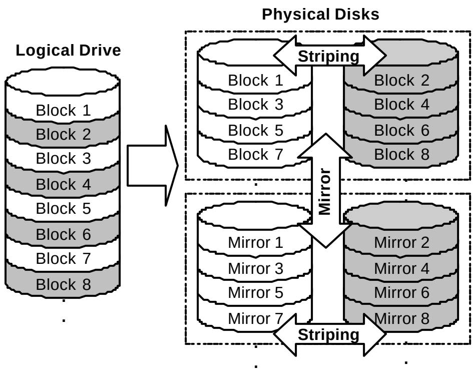
RAID 1	
Disks required	2
Capacity	N/2
Redundancy	Yes

RAID 1 mirrors the data stored in one hard drive to another. RAID 1 can only be performed with two hard drives. If there are more than two hard drives, RAID (0+1) will be performed automatically.

RAID (0+1)

Disk Striping with Mirroring

Figure 2 - 6 RAID (0+1)



RAID (0+1)	
Minimum Disks required	4
Capacity	N/2
Redundancy	Yes

RAID (0+1) combines RAID 0 and RAID 1 - Mirroring and Striping. RAID (0+1) allows multiple drive failure because of the full redundancy of the hard drives. If there are more than two hard drives assigned to perform RAID 1, RAID (0+1) will be performed automatically.

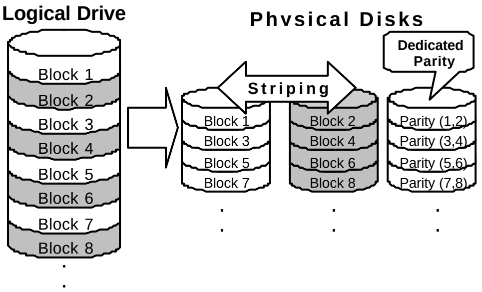
IMPORTANT!

- *"RAID (0+1)" will not appear in the list of RAID levels supported by the controller. If you wish to perform RAID 1, the controller will determine whether to perform RAID 1 or RAID (0+1). This will depend on the number of drives that has been selected for the logical drive.*

RAID 3

Disk Striping with Dedicated Parity Disk

Figure 2 - 7 RAID 3



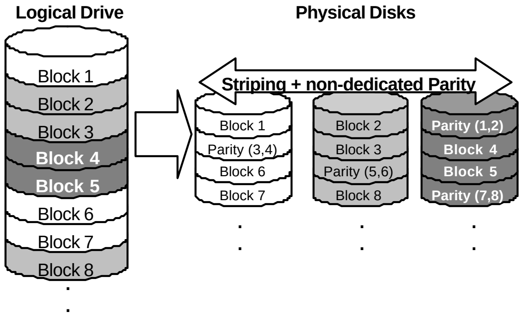
RAID 3	
Minimum Disks required	3
Capacity	N-1
Redundancy	Yes

RAID 3 performs Block Striping with Dedicated Parity. One drive member is dedicated to storing the parity data. When a drive member fails, the controller can recover/regenerate the lost data of the failed drive from the dedicated parity drive.

RAID 5

Striping with Interspersed Parity

Figure 2 - 8 RAID 5



RAID 5	
Minimum Disks required	3
Capacity	N-1
Redundancy	Yes

RAID 5 is similar to RAID 3 but the parity data is not stored in one dedicated hard drive. Parity information is interspersed across the drive array. In the event of a failure, the controller can recover/regenerate the lost data of the failed drive from the other surviving drives.

2.4 Spare Drives

2.4.1 Global and Local Spare Drive

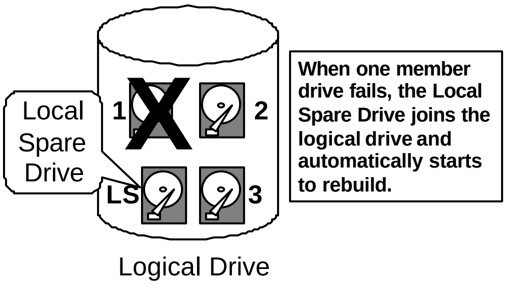


Figure 2 - 9 Local (Dedicated) Spare

Local Spare Drive is a standby drive assigned to serve one specified logical drive. When a member drive of this specified logical drive fails, the Local Spare Drive becomes a member drive and automatically starts to rebuild.

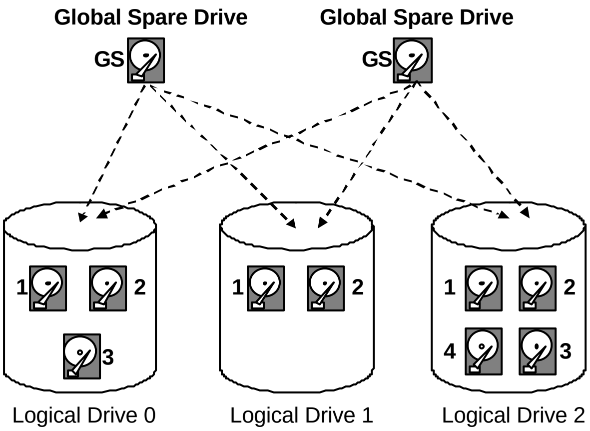
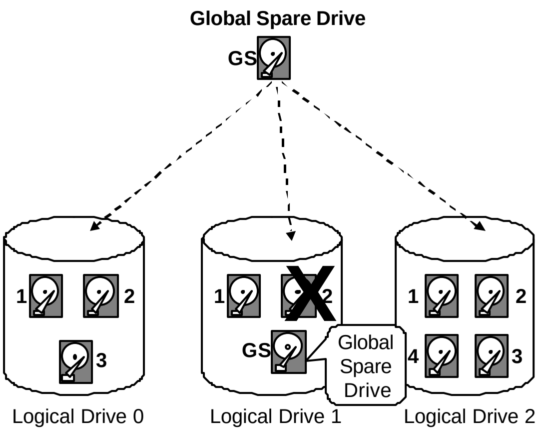


Figure 2 - 10 Global Spare

Global Spare Drive does not only serve one specified logical drive. When a member drive from any of the logical drive fails, the Global Spare Drive will join that logical drive and automatically starts to rebuild.

Global Spare Drives serve any logical

Figure 2 - 11 Global Spare Rebuild

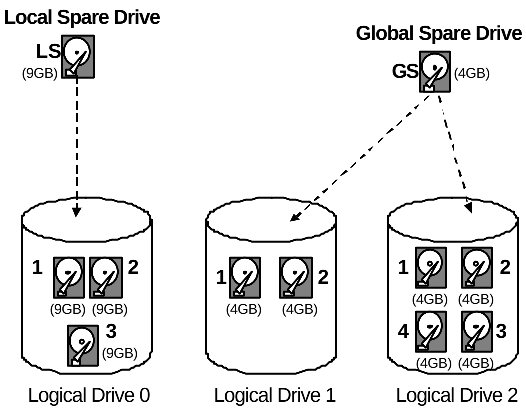


The external RAID controllers provide both Local Spare Drive and Global Spare Drive functions. On certain occasions, applying these two functions together will better fit various needs. Take note though that the **Local Spare Drive always has higher priority than the Global Spare Drive.**

When a member drive from any logical drive fails, the Global Spare Drive joins that logical drive and automatically starts to rebuild.

In the example shown below, the member drives in Logical Drive 0 are 9 GB drives, and the members in Logical Drives 1 and 2 are all 4 GB drives.

Figure 2 - 12 Mixing Local and Global Spares



It is not possible for the 4 GB Global Spare Drive to join Logical Drive 0 because of its insufficient capacity. However using a 9GB drive as the Global Spare drive for a failed drive that comes from Logical Drive 1 or 2 will bring huge amount of excess capacity since these logical drives require 4 GB only. In the diagram below, the 9 GB Local Spare Drive will aid Logical Drive 0 once a drive in this logical drive fails. If the failed drive is in Logical Drive 1 or 2, the 4 GB Global Spare drive will immediately give aid to the failed drive.

Local Spare Drive always has higher priority than Global Spare Drive.

2.4.2 Identifying Drives

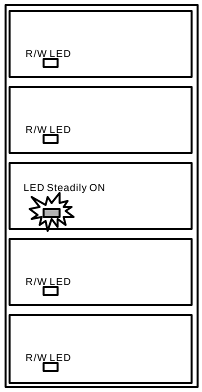
Assuming there is a failed drive in the RAID 5 logical drive, make it a point to replace the failed drive with a new drive to keep the logical drive working.

If, when trying to remove a failed drive you mistakenly remove the wrong drive, you will no longer be able to access the logical drive because you have inadequately failed another drive.

To prevent this from happening, the controller provides an easy way to identify the failed drive. That is, the read / write LED of the failed hard drive will light. This LED will prevent you from removing the wrong drive, and is also helpful when locating a drive.

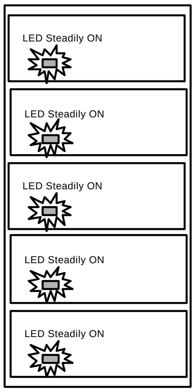
Flash Selected SCSI Drive

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



Flash All SCSI Drives

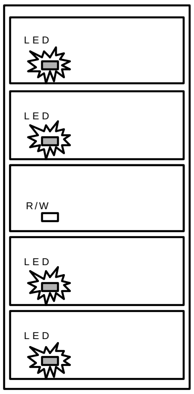
The Read / Write LED of all connected drives will light for a configurable period of time. If the LED of the defective drive did not light on the "Flash Selected SCSI Drive" function, use "Flash All SCSI Drives." The "Flash All SCSI Drives" function will light LED's of all the drives except the defective one.



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 from 1 to 999 seconds. If an administrator can not be sure of the exact location of specific drive, this function will help to indicate where it is. This can prevent removal of the wrong drive when a drive fails.

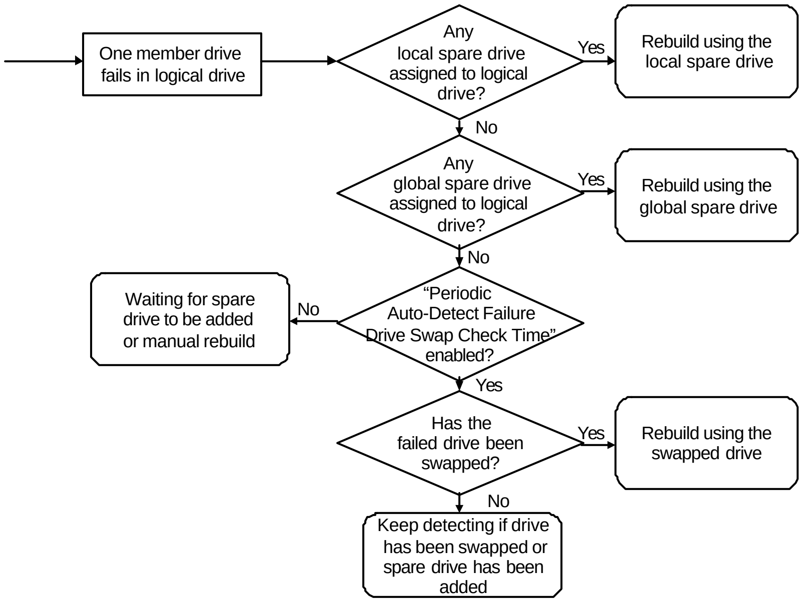
The drive identifying function can be selected from "Main Menu" / "View and Edit SCSI Drives" / "Identify SCSI Drives."



2.4.3 Automatic Rebuild and Manual Rebuild

Automatic Rebuild

Figure 2 - 13 Automatic Rebuild



Rebuild with Spare: When a member drive in a logical drive fails, the controller will first examine whether there is a Local Spare Drive assigned to this logical drive. If yes, it will automatically start to rebuild.

If there is no Local Spare available, the controller will search for a Global Spare. If there is a Global Spare, it will automatically rebuild the logical drive.

Failed Drive Swap Detect: If neither Local Spare Drive nor Global Spare Drive is available, and the "***Periodic Auto-Detect Failure Drive Swap Check Time***" is "Disabled," the controller will not attempt to rebuild unless the user applies a forced-manual rebuild.

When the "***Periodic Auto-Detect Failure Drive Swap Check Time***" is "Enabled" (i.e., a check time interval has been selected), the controller will detect whether or not the failed drive has been swapped (by checking the failed drive's channel/ID). Once the failed drive has been swapped, the rebuild will begin immediately.

If the failed drive is not swapped but a local spare is added to the logical drive, rebuild will begin with the spare.

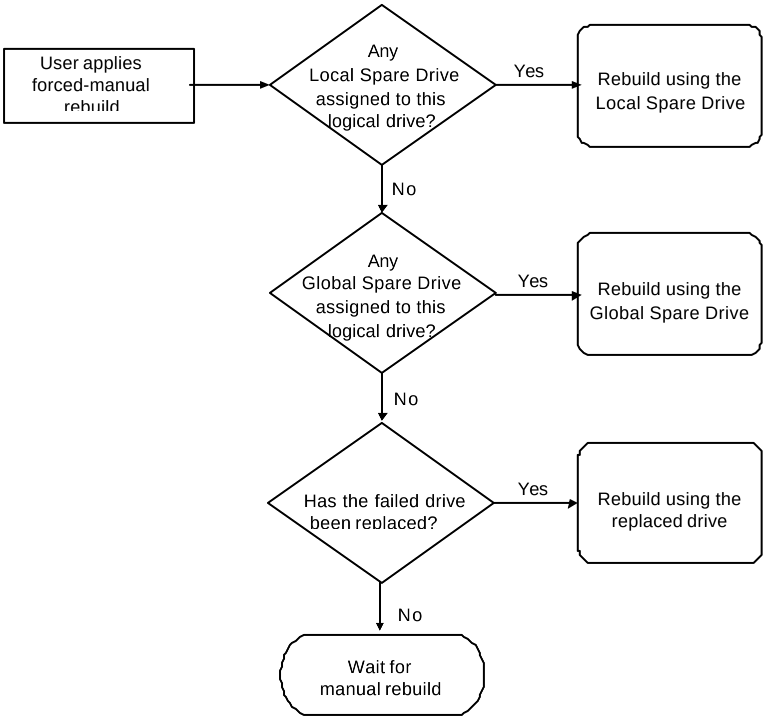
If the S.M.A.R.T. function is enabled on drives and the reaction scheme is selected for securing data on a failing drive, spare will also be used for restoring data. Please refer to Chapter 10, Advanced Functions, for more details.

Manual Rebuild

When a user applies forced-manual rebuild, the controller will first examine whether there is any Local Spare assigned to the logical drive. If yes, it will automatically start to rebuild.

If there is no Local Spare available, the controller will search for a Global Spare. If there is a Global Spare, logical drive rebuild will be automatically conducted.

Figure 2 - 14 Manual Rebuild



If neither Local Spare nor Global Spare is available, the controller will examine the SCSI channel and ID of the failed drive. Once the failed drive has been replaced by a healthy one, it starts to rebuild using the new drive. If there is no available drive for rebuilding, the controller will not attempt to rebuild until the user applies another forced-manual rebuild.

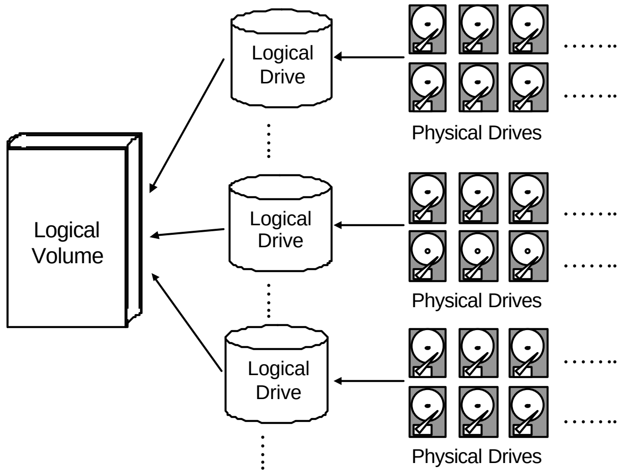
2.4.4 Concurrent Rebuild in RAID (0+1)

RAID (0+1) allows multiple drive failure and concurrent multiple drive rebuild. Drives newly swapped must be scanned and set as Local Spares. These drives will be rebuilt at the same time (you do not need to repeat the rebuilding process for each drive).

2.5 Logical Volume (Multi-Level RAID)

What is a logical volume?

Figure 2 - 15 Logical Volume



A logical volume is a combination of RAID 0 (Striping) and other RAID levels. Data written to a logical volume is first broken into smaller data segments and striped across different logical drives in a logical volume. Each logical drive then distributes data segments to its member drives according to its mirroring, parity, or striping scheme. A logical volume can be divided into a maximum of eight partitions. During normal operation, the host sees a non-partitioned logical volume or a partition of a partitioned logical volume as one single physical drive.

The benefits of using logical volumes include:

1. Expand the MTBF (mean time between failure) by using more redundancy drives.

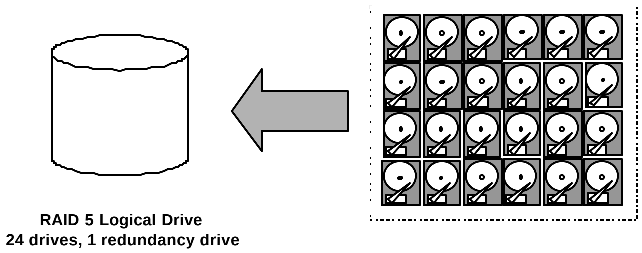
2. Decrease the time to rebuild and reduce the chance of data loss caused by multiple drive failures happening at the same time.

3. Avoid the disastrous loss of data caused by channel bus failure with proper drive deployment.

4. Cost-efficiency.

As diagramed below, a RAID 5 logical drive consists of 24 physical drives, and there is one drive for redundancy. By combining several logical drives into a logical volume, the MTBF can be expanded for that the number of the redundancy drives increases.

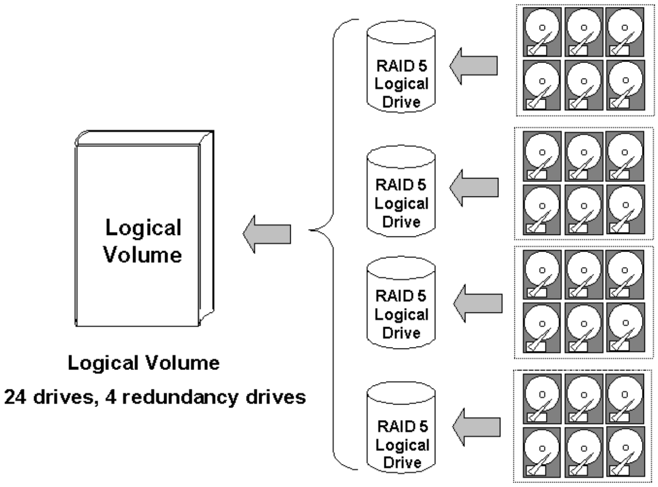
Figure 2 - 16 Logical Drive Composed of 24 Drives



Configuration A - One logical drive with all 24 drives

As illustrated above, Configuration A is a RAID 5 logical drive composed of 24 physical drives. Configuration B is a logical volume composed of four RAID 5 logical drives.

Figure 2 - 17 Logical Volume with 4 Logical Drives



Configuration B - One logical volume with 4 logical drives

Configuration B can help to reduce the chance of encountering points of failure:

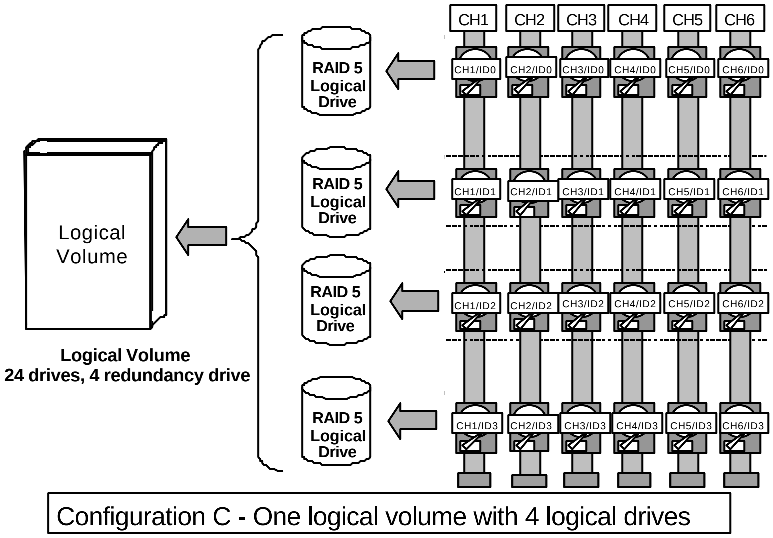
a) Higher Redundancy: Configuration A has one dedicated spare, while Configuration B allows the configuration of four spares. In Configuration B, chance for failing two drives in a logical drive together is significantly reduced than in Configuration A. The total of drive capacity is comparatively smaller for the use of spares.

b) Less Rebuild Time: The time during rebuild is a time of hazard. For example, a RAID 5 logical drive can only withstand single drive failure, if another drive fails during the rebuild process, data will be lost. The time span of rebuild process should be minimized to reduce the possibility of having two drives to fail at the same time.

Configuration A is a large logical drive and takes a long time to rebuild. All of the 24 members will be involved during the rebuild process. In Configuration B, the time span is shorter because only a maximum of 6 drives will participate when rebuilding any of the logical drives.

c) Channel Failure Protection: A channel failure will cause multiple drives to fail at the same time and inevitably lead to a fatal failure. Using a logical volume with drives coming from different drive channels can get around this point of failure. Channel failure may sometimes result from absurd matters like a cable failure.

Figure 2 - 18 Logical Volume with Drives on Different Channels



As illustrated above, should one of the drive channels fail, each logical drive loses one of its members. Logical drives will still be capable of normal operation. Data remains intact and the rebuild can be performed after the failed channel is recovered. No access interruptions to the logical volume will be experienced on the host side.

Spare drives in a logical volume?

A Local Spare can not be assigned to a Logical Volume. If a drive fails, it fails as a member of a logical drive; therefore, the controller allows Local Spare's assignment to logical drives rather than logical volumes.

Limitations:

The logical volume cannot have any logical drive stated as "fatal failed." If there is any failed drive in any of the member logical drives (of a logical volume), controller will start to rebuild that logical drive.

Should any of the member logical drives fail fatally, the logical volume fails fatally and data will not be accessible.

To avoid a logical volume failure:

1. Logical drives as members to a logical volume should be configured in RAID levels that provide redundancy - RAID level 1 (0+1), 3, or 5.
2. Rebuild the logical drive as soon as possible whenever drive failure occurs.
3. A logical drive should be composed of physical drives from different drive channels. Compose the logical drive with drives from different drive channels to avoid the fatal loss of data caused by bus failure.

Partitioning - partitioning the logical drive or partitioning the logical volume?

Once a logical drive has been divided into partitions, the logical drive can no longer be used as a member of a logical volume. The member logical drives of a logical volume should have one partition only with the entire capacity.

If you want to use a partitioned logical drive for a logical volume, delete the other partitions in this logical drive until there remains one partition only with the entire logical drive capacity. Mind that deleting the partition of the logical drive will also destroy all the data. Data should be backed up to somewhere else before making partition configuration.

When a logical drive is used as a member to a logical volume, this logical drive can no longer be partitioned in "View and Edit Logical Drives." Instead, the Logical Volume can be partitioned into 8 in "View and Edit Logical Volume."

The procedure for partitioning a logical volume is the same as that for partitioning a logical drive. After the logical volume has been partitioned, map each partition to a host ID/LUN to allow the host computer to utilize the partitions as individual drives.

RAID expansion with logical volume?

The Logical Volume can also be expanded using the RAID expansion function. The concept of expanding a logical volume is similar to that of expanding a logical drive. To perform RAID expansion on a logical drive, replace each member physical drive with a drive of larger capacity or add a new drive, then perform logical drive expansion to utilize the newly-added capacity. For information about RAID expansion, please refer to Chapter 10 "Advanced Configurations."

To perform RAID expansion on a logical volume, expand each member logical drive, then perform RAID expansion on the logical volume.

Steps to expand a Logical Volume:

1. Expand each member logical drive.
2. Expand the logical volume.
3. Map the newly-added capacity (in the form of a new partition) to a host LUN.

Is there anything changed with logical volume?

Redundant Controller:

Without logical volume - logical drives can be assigned to the primary controller or to the secondary controller. The host I/Os directed to a logical drive will be served by the controller to which this logical drive is assigned. If a controller fails, the host I/Os originally assigned to the failed controller will be taken over by the existing controller. When the controller fails back (failed controller being replaced by a new one), logical drives will be returned to the replacement controller in the original configuration.

With logical volume - logical volumes can also be assigned to different controllers. The only difference is that the Logical volumes will be considered as the base units for shifting the control during a controller failure.

A logical volume with logical drives of different levels?

Multi-level RAID systems

1. **RAID (0+1) -** this is a standard feature of Infortrend RAID controllers. It has the benefits of RAID 1 (high availability) and RAID 0 (enhanced I/O performance through striping). Simply choose multiple drives for a RAID 1 logical drive, the RAID controller will implement RAID (0+1) automatically.

2. **RAID (3+0) -** a logical volume itself is a multi-level RAID implementation. A logical volume is composed of one or several logical drives with data "striping" (RAID 0). A logical volume with several RAID 3 member logical drives can be considered as a RAID (3+0), or RAID 53 as defined in "The *RAID* Book" (from The RAID Advisory Board).

3. **RAID (5+0) -** a logical volume with several RAID 5 member logical drives.

4. **RAID (5+1)** - requires multiple RAID controllers. In a RAID (5+1) system, each layer-1 RAID controller handles one RAID 5 logical drive and a layer-2 RAID controller performs RAID 1 (mirroring) function to the virtual disks controlled by all of the layer-1 RAID controllers.

5. **RAID (5+5)** - requires multiple RAID controllers. In the RAID (5+5) system, each layer-1 RAID controllers handles one to several RAID 5 logical drives and a layer-2 RAID controller performs RAID 5 to the virtual disks provided by all of the layer-1 RAID controllers.

Chapter

3

RAID Planning

3.1 Considerations

After you understand the basic ideas behind a RAID system, you may still be wondering about how to begin. Here are the answers to some questions that may help you through the decision making.

1. How many physical drives do you have?

When initially creating the drive groups, you should know how many drives you have in drive chassis or cabinet.

2. How many drives would you like to appear to the host computer?

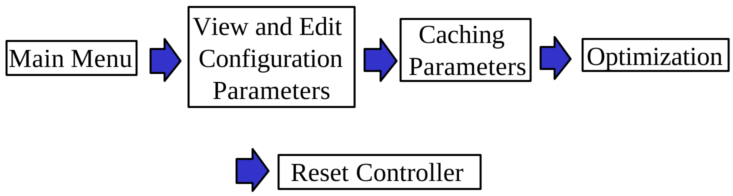
It must be decided what capacity will be included in a logical configuration of drives. A logical configuration of drives will appear to the host as a single capacity volume.

3. What kind of host application?

The frequency of read / write activities can vary from one host application to another. The application can be a SQL server, Oracle server, Informix, or other data base server of a transaction-based nature. Applications like video playback and video post-production editing require read / writes of huge files in a sequential order.

The RAID level setting depends on what is the most important for a given application – capacity, availability, or performance. Before creating your RAID, you need to choose an optimization scheme .and optimize the controller for your application.

Figure 3 - 1 Optimization Process



The controller optimization mode can only be changed when there is no existing logical configurations. Once the controller optimization mode is set, the same mode will be applied to all logical drives. Data stripe size is changed once the optimization method is changed. Therefore, you can not proceed with changing the optimization mode until data is backed-up, all logical drives deleted, and system restarted. Therefore, think twice before choosing an optimization mode for your controller.

The controller factory defaults guarantee the optimal performance for most applications. Consult Table 3-2 for all the controller parameters that are related to system performance and fault- tolerance.

4. How many logical volumes & logical drives and at what RAID level?

Different RAID levels provide varying degrees of performance and fault tolerance.

Table 3 - 1 RAID Levels

RAID Level	Description	Capacity	Data Availability
NRAID	Non-RAID	N	N/A
RAID 0	Disk Striping	N	==NRAID
RAID 1 (0+1)	Mirroring Plus Striping (if N>1)	N/2	>>NRAID ==RAID 5
RAID 3	Striping with Parity on dedicated disk	N-1	>>NRAID ==RAID 5
RAID 5	Striping with interspersed parity	N-1	>>NRAID ==RAID 5
Logical Volume	Striping; Logical Volume containing one or more logical drives of different RAID levels	*	Depends on member logical drive(s)

RAID Level	Performance Sequential	Performance Random
NRAID	Drive	Drive
RAID 0	R: Highest W: Highest	R: High W: Highest
RAID 1 (0+1)	R: High W: Medium	R: Medium W: Low
RAID 3	R: High W: Medium	R: Medium W: Low
RAID 5	R: High W: Medium	R: High W: Low
Logical Volume	Depends on member logical drive(s)	Depends on member logical drive(s)

5. Any spare drives?

(Swap Drive Rebuild / Spare Drive Rebuild)

Spare drives allow for the unattended rebuilding of a failed drive, heightening the degree of fault tolerance. If there is no spare drive, data rebuild has to be performed manually by replacing a failed drive with a healthy one.

6. Limitations?

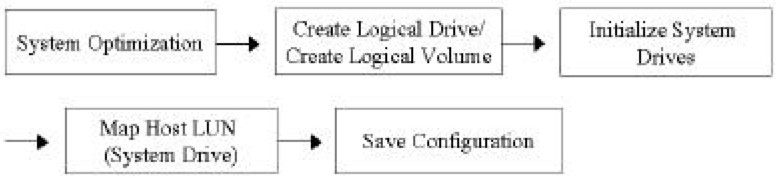
A logical drive or logical volume can not be larger than two terabytes. A total of 16 terabytes drive space can be included in a RAID array.

3.2 Configuring the Array:

3.2.1 Starting a RAID System

The following is a basic flowchart illustrating steps to be taken when configuring a RAID system. Hardware installation should be completed before any configurations takes place.

Figure 3 - 2 Array Configuration Process



Drives must be configured and the controller properly initialized before host computer can access the storage capacity.

1. When power is on, the controller scans all the hard drives that are connected through the drive channels. If a hard drive was connected after the controller completes initialization, use the "Scan SCSI Drive" function to let the controller recognize the newly added hard drive and configure it as a member of a logical drive.

2. Optimize controller's parameters for your applications. Please refer to Table 3-2 for details.

3. Configure a logical drive to contain one or more hard drives based on the desired RAID level, and partition the logical drive into one or several partitions. For the redundancy across different channels, you may also create a logical unit containing drives distributed over different channels. You may then partition the logical unit into one or several partitions.

NOTE:

- *A "Logical Drive" is a set of drives grouped together to operate under a given RAID level and appears as a single contiguous storage volume. The controller is capable of grouping drives to as many as 8 logical drives, each configured on the same or different RAID levels.*
- *A total of 8 "Logical Volumes" can be created each from one or several logical drives. A logical drive or logical volume can be further divided into a maximum of 8 "Partitions." A total of 64 partitions can be created in an array.*

4. The next step is to map each storage partition as one system drive (host ID/LUN). The host SCSI or Fibre adapter will recognize the system drives after re-initializing the host bus.

5. The last step is to save your configuration profile as a file or to the logical drive you created.

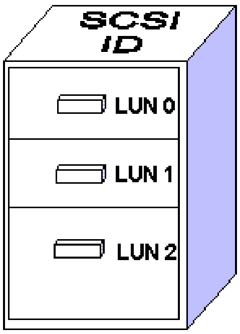
The controller is totally independent from host operating system. Host operating system will not be able to tell whether the attached storage is a physical hard drive or the virtual system drives created by the RAID controller.

3.3 Operation Theory

3.3.1 I/O Channel, SCSI ID, and LUN

A SCSI channel (SCSI bus) can connect up to 15 devices (excluding the controller itself) when the Wide function is enabled (16-bit SCSI). A Fibre channel allows, theoretically, the connectivity of up to 125 devices in a loop. Each device has one unique SCSI ID.

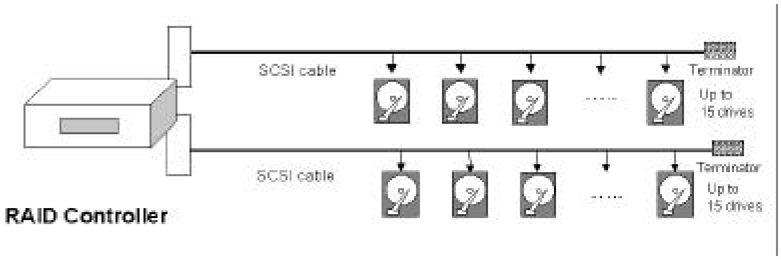
Figure 3 - 3 SCSI ID/LUNs



The figure on the left illustrates the idea of mapping a system drive to host ID/LUN combination. If you are to file document into a cabinet, you must put the document into one of the drawers. Let's apply this metaphor to SCSI: the SCSI ID is like a cabinet, and the drawers are the LUNs (LUN is short for logical unit number). Each cabinet (SCSI ID) can have up to 32 drawers (LUNs). Data can be stored into one of the LUNs of the SCSI ID. Most SCSI host adapters treat a LUN like another SCSI device.

3.3.2 Understanding Step by Step

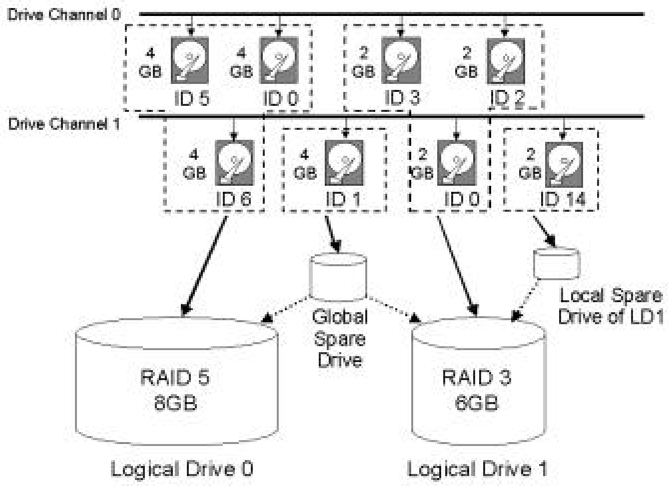
Figure 3 - 4 Connecting Drives



The physical connection of a RAID controller should be similar to the one shown above. Install the controller into an enclosure canister, then connect drives to the controller's SCSI / Fibre channels.

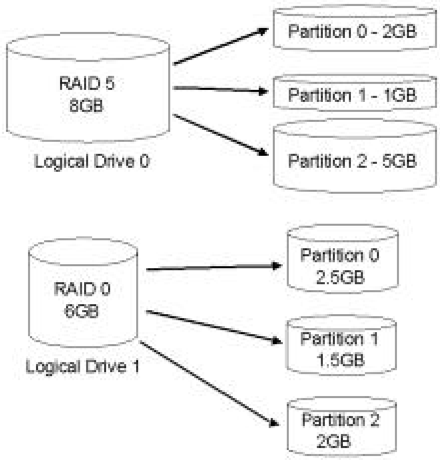
A Logical Drive consists of a group of SCSI drives. Drives in one logical drive do not have to come from the same SCSI channel. Also, each logical drive can be configured a different RAID level.

Figure 3 - 5 Allocations of drives in Logical Configurations



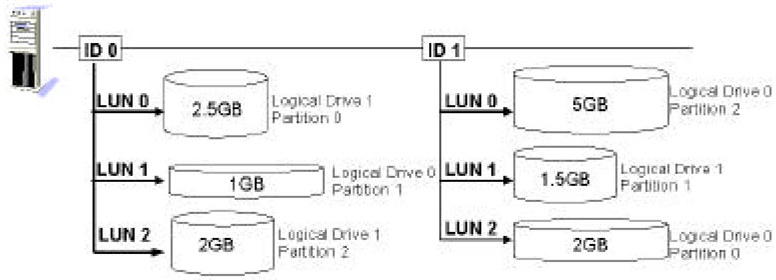
A drive can be assigned as the Local Spare Drive to one specified logical drive, or as a Global Spare Drive. Spares can be conducted to automatic system rebuild. Spare is not available for logical drives that has no data redundancy (NRAID and RAID 0).

Figure 3 - 6 Partitions in Logical Configurations



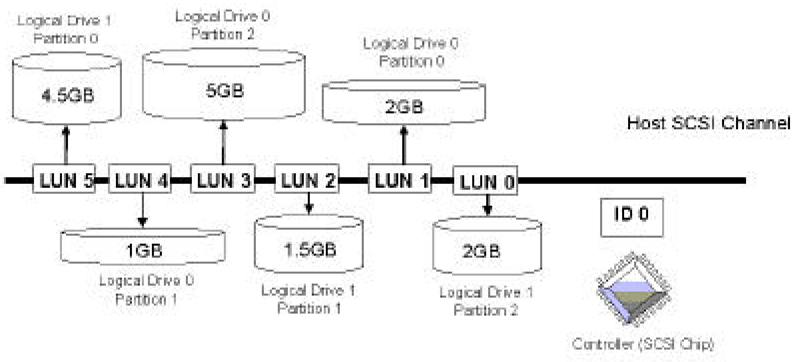
You may divide a logical drive or logical volume into several partitions, or use the entire logical drive as single partition.

Figure 3 - 7 Mapping Partitions to Host ID/LUNs



Map each partition to LUNs under host SCSI IDs or IDs on host channels. Each SCSI ID / LUN will act as one individual hard drive to the host computer virtually. In this way, estimated workload can also be distributed over different data paths for performance optimization.

Figure 3 - 8 Mapping Partitions to LUNs under ID



3.3.3 Preparing the Array

This section provides suggestions for the steps necessary to prepare a disk array system. Each step will be described in greater detail in the following chapters. The configuration process will be demonstrated in LCD mode and terminal mode.

1. Start terminal emulation (please refer to Chapter 4, your enclosure manual and the controller ***Hardware Manual*** that came with your controller). You may also begin with the LCD keypad or RAIDWatch manager.

2. Fine-tune the controller optimization parameters for your host applications. Although the factory defaults guarantee the optimized controller operation, you may refer to the table below to facilitate tuning of your array. Some of the performance and fault-tolerance settings may also be changed later during the preparation process of your disk array.

Table 3 - 2 Controller Parameter Settings

✦	Parameters that should be configured at the initial stage of system configuration
⟐	Parameters that can be changed later
◇	non-critical

User-Defined Parameter	Default	Alternate Settings
Fault Management:		
✦ Automatic Logical Drive Rebuild - Spare Drive	Enabled when Spare Drive is available	RAID 1 + Local Spare RAID 3 + Local Spare RAID 5 + Local Spare Global Spare
✦ S.M.A.R.T.	Disabled	Detect Only Perpetual Clone Clone + Replace
◇ Clone Failing Drive	Manual function	Replace After Clone Perpetual Clone
✦ Rebuild Priority	Low (higher priority requires more system resource)	Low Normal Improved High
✦ Verification on Write	Disabled	On LD Initialization On LD Rebuild On Normal Drive Writes
◇ SDRAM ECC	Disabled	Enabled
✦ Event Notification	Reports to user interface and onboard alarm	Over Dial-out Modem Over SNMP Trap Over Java-Based Management Software
✦ System Events	System default	Upper and Lower event triggering thresholds configurable
Optimization Mode:		
✦ Write-back Cache	Enabled	Disabled
✦ Optimization for	Sequential	Either (default and must be

Random / Sequential		sequential for LD larger than 512MB)
SCSI Parameters:		
✦ Data Transfer Rate	*	Async. to 40.0MHz
✦ Maximum Tag Count	32	1-128
✦ Maximum Queued I/O Count	32	32 to 1024
◈ LUN's per SCSI ID	8	Up to 32
✦ Periodic Drive Check Time	Disabled	Enabled
✦ Periodic SAF-TE and SES Device Check Time	5	Disabled to 60 seconds
✦ Periodic Auto-Detect Failure Drive Swap Check Time	Disabled	5 to 60 seconds
✦ Number of Host-LUN Connection	4	1 to 32
✦ Tag per Host-LUN Connection	32	1 to 256
✦ Wide Transfer	*	Enabled / Disabled
✦ Parity Check	Disabled	Enabled
Spin-Up Parameters:		
✦ Motor Spin-Up	Disabled	Enabled
✦ Reset at Power-UP	Enabled	Disabled
✦ Initial Disk Access Delay	*	None to 75 seconds
Fibre Channel Parameters:		
✦ Fibre Connection Options	*	Loop Only Point-to-Point Only Loop Preferred Point-to-Point Preferred
✦ Fibre Channel Dual-Loop	Enabled	Enabled by cabling
✦ Host ID / WWN name list	*	User configurable
✦ LUN Filtering	*	Host Access Filter Control Configurable - filter type - access right - name
✦ Controller Unique Identifier	N / A	Necessary for redundant controller configuration: 1 to 65535
✦ RCC through Fibre channel	*	Dedicated or sharing drive channel(s)
Others:		
◇ Password	N / A	User-Defined; Password Validation Timeout: 1 to Always Check Configurable
◇ LCD Display Controller Name	N / A	User-Defined

3. Create and configure one or more logical drives or logical volumes. The host and drive channel configuration depends on your application topology. Map the logical units you created to Host IDs/LUN combinations.

4. Save your configuration. The configuration information can be saved to logical drives or as a file in host system disk. When all the RAID configuration is done, use the "Save NVRAM to Disk" function (please refer to Chapter 6 and Chapter 8) to save your configuration data. You may also use the forms in Chapter 11 of this manual to keep a hard record of your configuration.

5. Initialize your system and proceed with installing your operating system.

Chapter

4 Out-of-Band via Serial Port and Ethernet

4.1 By RS-232

The Infortrend controller can be configured via a PC running a VT-100 terminal emulation program, or a VT-100 compatible terminal. In order to transfer configuration commands to your host computer, you need to connect the RAID system to a service computer. RAID enclosures usually provide one or more DB-9 RS-232 ports. Simply use an RS-232 cable to connect between controller RS-232 port and PC terminal port.

Make sure Null Modem is already installed in your enclosure or that a Null Modem can be attached to the host serial port. The Null Modem has serial signals swapped for connecting to a standard PC serial interface.

The following are guidelines on using the serial port:

- The serial port's default is set at 38400 baud, 8 bit, 1 stop bit and no parity. Use the COM1 serial port of the controller.
- In most cases, connecting RD, TD, and SG are enough to establish the communication with a terminal.
- If you are using a PC as a terminal, any VT-100 terminal emulation software will suffice. Microsoft® Windows includes a terminal emulation program as presented with the "(Hyper) Terminal" icon in the Accessories window.
- For other details of connecting serial port, please refer to the *Hardware Manual* that came with your controller.

4.1.1 Configuring RS-232 Connection via Front Panel

Take the following steps to change the baud rate using the front panel:

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Configuration ..", then press **ENT**.

```
View and Edit
Config Parms   ↕
```

Select "Communication Parameters ..", then press **ENT**.

```
Communication
Parameters    ..
```

Select "RS-232 Configuration ..", then press **ENT**.

```
RS-232
Configuration ..
```

Select "COM1 Configuration ..", then press **ENT**.

```
COM1
Configuration ..
```

Select "Baud-rate 38400 ..", then press **ENT**.

```
Baud-rate  38400
              ..
```

If other baud rate is preferred, press ▼ or ▲ to select the baud rate, then press **ENT** for 2 seconds to confirm the selected baud rate. Set identical baud rate to your controller and your host computer.

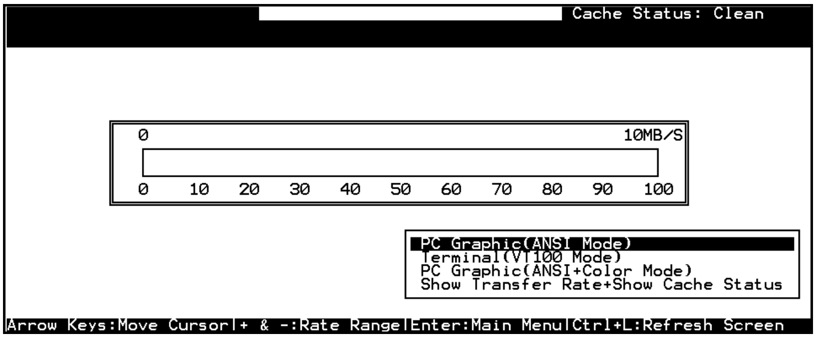
```
Baud-rate 38400
Change to 19200?
```

- The following baud rates are available: 2400, 4800, 9600, 19200 and 38400.

4.1.2 Starting RS-232 Terminal Emulation

The keys used when operating via the terminal are as follows:

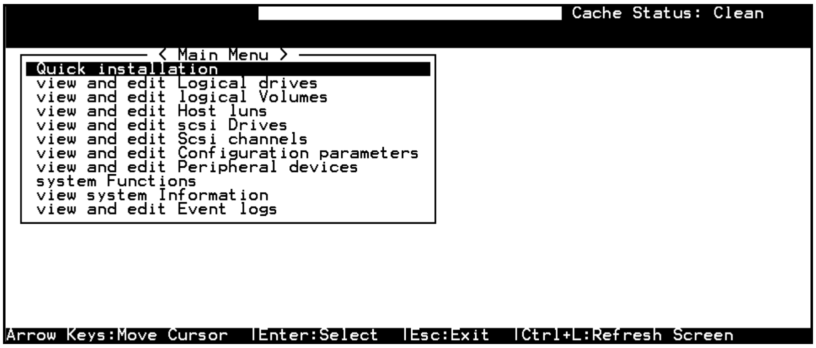
¬ ® - ¯	To select options
[Enter]	To go to a submenu or to execute a selected option
[Esc]	To escape and go back to the previous menu
[Ctrl] [L]	The controller will refresh the screen information



IMPORTANT!

- *If the RS-232 cable is connected while the controller is powered on, press [Ctrl] [L] to refresh the screen information.*

The initial screen appears when the controller is powered-on. Use - ¯ arrow keys to select the desired terminal emulation mode, then press **[ENTER]** to enter the Main Menu.



Choose a functional item from the main menu to begin configuring your RAID.

4.2 Out-of-Band via Ethernet

Newer line of Infortrend controllers are equipped with an Ethernet port for out-of-band management. To simplify software installation process, necessary software agents are already implemented with controller firmware (release 3.21 and above). The main RAIDWatch programs can be transferred to the reserved sectors on the members of a logical drive, allowing users to manage the system from any management station in any place using internet browser.

The event notification (NPC) and Event Monitor modules still need to be installed on a host computer to report system errors.

4.2.1 Requirements

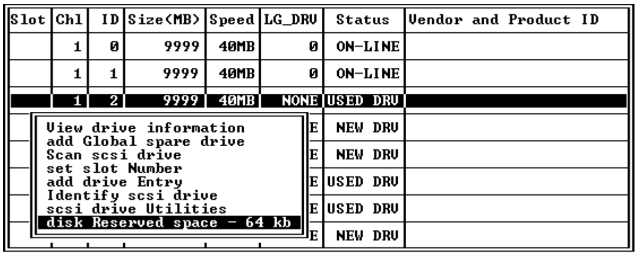
1. Controller with Ethernet connectivity: i.e., SentinelRAID series **PCB version 2.9** and above
2. **Firmware revision 3.21** and above
3. **Management Platform**:
   Pentium or above compatible (or equivalent PC) running Windows NT 4/Windows 2000; Solaris 7 & 8 (SPARC, x86); AIX 4.3; or Red Hat Linux 6.1 (kernel v2.2.xx); Red Hat 7, SUSE 7, WIN95/98, Windows Me
4. Standard web browser. A computer running RAIDWatch manager must support:
   - TCP/IP
   - Java Runtime: a package is bundled with RAIDWatch installer or downloaded from Sun's web site.

4.2.2 Configuration Procedure

Listed below are steps necessary for preparing RAIDWatch programs on a RAID controller system.

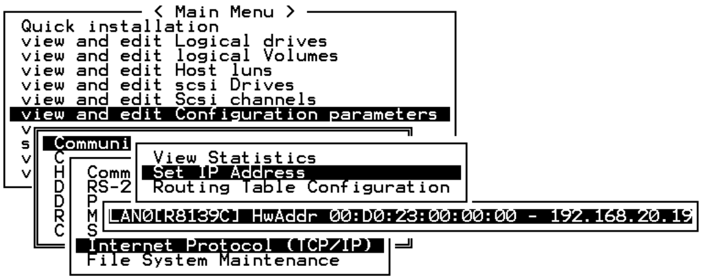
1. Follow the instructions in documentation that came with your controller for details on how to connect Ethernet port. Requirements for a computer running web-based RAIDWatch are the same as those for the clients as described in RAIDWatch's user's manual. Java plug-in is also necessary for a management station.

2. Firmware 3.21 and above will automatically create a reserved space on member drives when a logical array is created. Create a logical group of drives using the LCD keypad or firmware-embedded manager. If logical configurations have been created and then deleted, the preserved space on physical drives should be manually removed before configuring a new array.

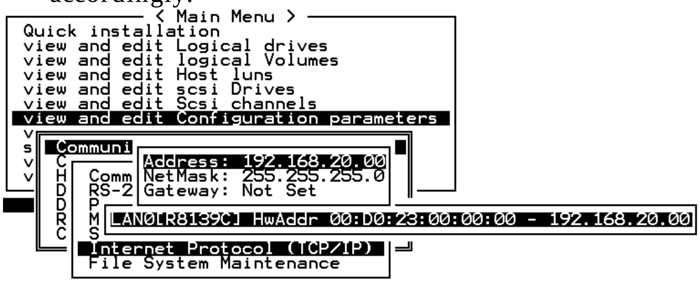


3. Assign an IP address to the controller and specify the Net Mask and gateway values. Reset the controller for the configuration to take effect.

   - Select "View and Edit Configuration Parameters" from the main menu. Select "Communication Parameters" → "Internet Protocol (TCP/IP)" → press **[ENTER]** on chip hardware address → and then select "Set IP Address."



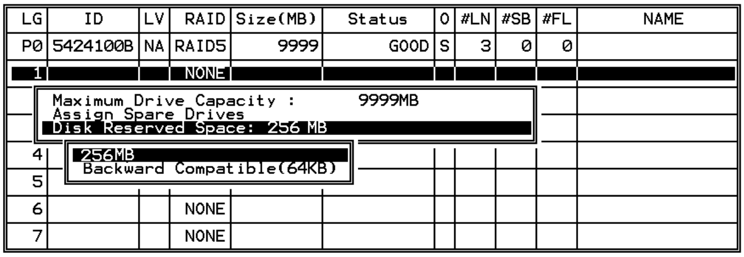
   - Enter the IP address, NetMask, and Gateway values accordingly.



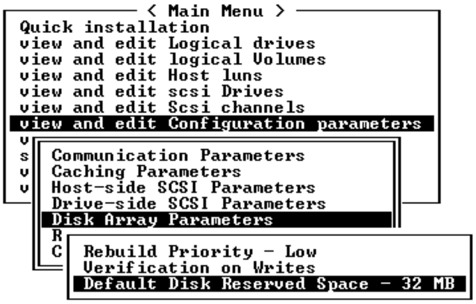
4. The controller will take a while formatting a small storage sector on each physical drive before logical drives can be successfully initialized. When the initialization process is complete, ftp RAIDWatch programs ("grm.htm" and "grm.jar") to the designated controller IP address. You may need to transfer another file, "IFT_bundle" to the controller for OEM definitions to work.

   The RAIDWatch program files are included in the "gui.zip" of the software package.

   - The controller default for the reserved space can be changed.



- One logical drive with reserved space configuration is sufficient for running the manager.



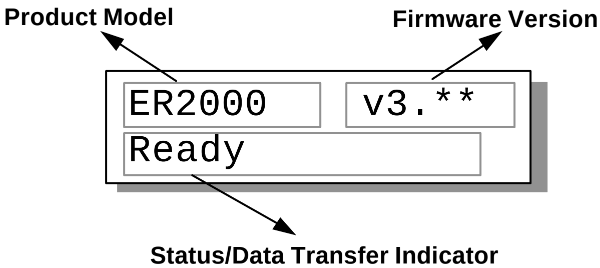
5. For event notification, NPC modules and the Event Monitor should be installed on a host computer.
6. Start your web browser and enter the IP address assigned to the controller followed by grm.htm as your URL (e.g., http://222.212.121.123/grm.htm).
7. A RAID system thus connected can also be accessed by a Primary Agent host in a greater topological scheme involving multiple RAID systems. The RAID system will then be considered as one of the Secondary Agent hosts and managed from where another RAIDWatch manager resides. The RAID system can also be defined as one of the monitored targets where multiple systems are managed by an NPC or Event Monitor.

Chapter

5

LCD Screen Messages

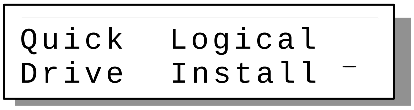
5.1 The Initial Screen



Status/Data Transfer Indicator:

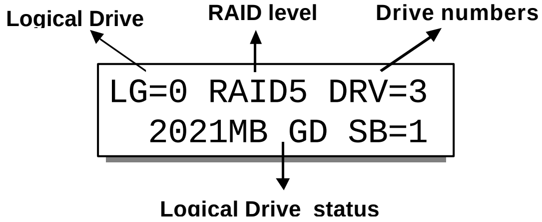
Ready	There is at least one logical drive or logical volume mapped to a LUN.
No Host LUN	No logical drive created or the logical drive has not yet been mapped to any Host LUN.
████████████	Indicates data transfer. Each block indicates 256Kbytes of data throughput.

5.2 Quick Installation Screen



Press **[ENT]** to create a logical drive, the controller will start initialization of one logical drive with all the connected SCSI drives and automatically map the logical drive to LUN 0 of the first host channel. The “Quick Installation” can only be performed when there is no Logical Drive/Logical Volume created.

5.3 Logical Drive Status

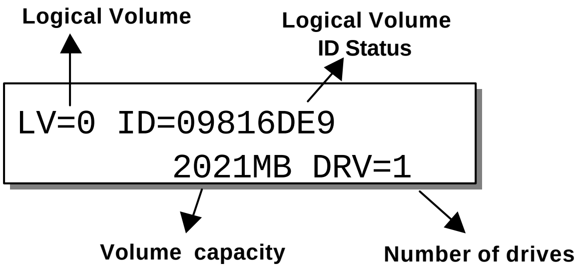


Logical Drive:	The Logical Drive number.
RAID level:	The RAID level used in this logical drive
Drive numbers:	The number of SCSI drives in this logical drive.

Logical Drive status:

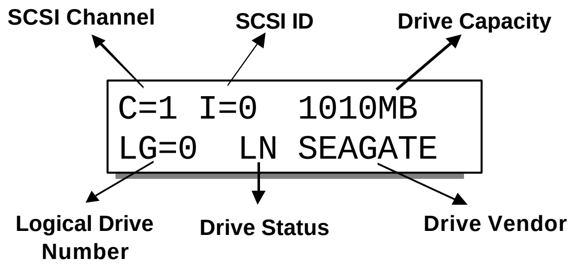
xxxxMB	The capacity of this logical drive.
SB=x	Standby drives available for this logical drive. All the spare drive(s) available for this logical drive will be counted in this field, both Global Spare Drives and Local Spare Drives.
xxxxMB INITING	The logical drive is now initializing.
xxxxMB INVALID	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.”
xxxxMB GD SB=x	The logical drive is in good condition.
xxxxMB FL SB=x	One drive failed in this logical drive.
xxxxMB RB SB=x	Logical Drive is rebuilding.
xxxxMB DRVMISS	One of the drives cannot be detected.
INCOMPLETE ARRAY	Two or more drives failed in this logical drive.

5.4 Logical Volume Status



Logical Volume:	The Logical Volume number.
DRV=x:	The number of logical drive(s) contained in this logical volume.
Logical Volume ID:	The unique ID number of the logical volume (controller random generated).
Logical Volume Status:	
xxxMB	The capacity of this logical volume.
DRV=X:	The number of member logical drive(s) in this logical volume.

5.5 SCSI Drive Status

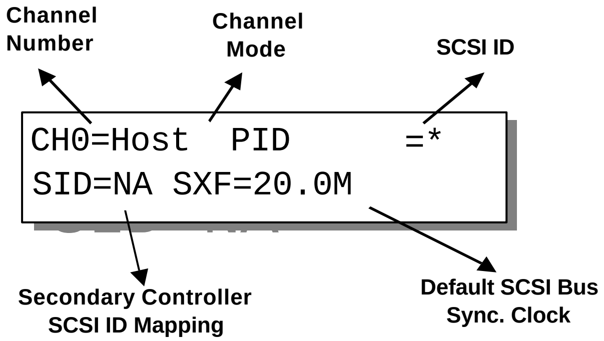


Drive Status:

LG=x IN	Initializing
LG=x LN	On-line
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
MISSING	Drive missing (drive was once there)
SB-MISS	Spare drive missing

5.6 SCSI Channel Status

Channel Mode:



Host	Host Channel mode
Drive	Drive Channel mode

Default SCSI Bus Sync Clock:

40.0M	The default setting of this SCSI channel is 40.0MHz in Synchronous mode
Async	The default setting of this SCSI channel is in Asynchronous mode

Primary Controller SCSI ID Mapping:

*	Multiple SCSI ID's applied (Host Channel mode only)
(ID number)	Primary Controller is using this SCSI ID for host LUN mapping.
NA	No SCSI ID applied (Drive Channel mode only)

Secondary Controller SCSI ID Mapping:

*	Multiple SCSI ID's applied (Host Channel mode only)
(ID number)	Secondary Controller is using this SCSI ID for host LUN mapping.
NA	No SCSI ID applied (Drive Channel mode only)

5.7 Controller Voltage and Temperature

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Peripheral Dev," then press **ENT**.

```
View and Edit
Peripheral Dev ↕
```

Press ▼ or ▲ to select "Temperature and Voltage Config..", then press **ENT**.

```
Temperature and
Voltage Config..
```

Press ▼ or ▲ to choose either "Temperature and Voltage Monitor," or "Temperature and Voltage Parms."

```
Temperature and
Voltage Monitor
```

Press ▼ or ▲ to browse through the various voltage and temperature statuses.

```
Temperature and
Voltage Parms..
```

Select "Temperature and Voltage Monitor" by pressing **Enter**. Press ▼ or ▲ to browse through the various voltage and temperature statuses.

```
[+12V] 12.077V
Operation Normal
```

```
[+5v]    4.938v
Operation Normal
```

```
[+12V] 12.077V
Operation Normal
```

```
[CPU] 43.5°C
in Safe Range
```

```
[+12v]  12.077v
Operation Normal
```

```
[CPU] 43.5°C
in Safe Range
```

```
[Board]46.5°C
 in Safe Range
```

5.8 Cache Dirty Percentage

The LCD panel indicates the cache dirty percentage. The amber-colored "busy" light blinking on front panel also indicates that the cache is being accessed.

5.9 View and Edit Event Logs

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Event Logs," then press **ENT**.

```
View and Edit
Event Logs     ↑
```

Press ▼ or ▲ 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.*

Chapter

6

Front Panel Operation

6.1 Power on 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.

6.2 Caching Parameters

Optimization Modes

Mass storage applications fall into two major categories: database applications and video/imaging applications. The controller supports two embedded optimization modes: Optimization for Random I/O and Optimization for Sequential I/O.

Limitations: There are limitations on the optimization modes. First, one optimization mode must be applied to all logical units in a RAID system. Second, once the optimization mode is selected and data written in logical units, the only way to change the optimization mode is to backup all data to somewhere else, delete all logical configurations of drives, change optimization mode and reboot system.

The limitation derives from the consideration with the redundant configuration of controllers. Data inconsistency might occur when a controller pre-configured with optimization mode is used to replace a failed controller with different mode.

Database and Transaction-based Applications: this kind of applications usually include SQL server, Oracle server, Informix, or other data base services. These applications keep each transaction within the minimal size, so that I/O transfers will not be clogged by one large transaction. Due to its transaction-based nature, these applications do not read or write a bunch of data in a sequential order. Instead, access to data occurs randomly. The transaction size ranges from 2K to 4K. Transaction-based performance is usually measured in “I/Os per second” or “IOPS.”

Video Recording/Playback and Imaging Applications: this kind of application usually belongs to video playback, video post-production editing, or other similar applications. These applications read or write large files from and into storage in a sequential order. The size of each I/O can be 128K, 256K, 512K, or up to 1MB. Performance 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 files instead of small and randomly accessed files.

1. Optimization for Random I/O: the logical drive, cache memory, and other controller parameters will be adjusted for the use of database/transaction-processing applications.

2. Optimization for Sequential I/O:
"Optimization for Sequential I/O" provides larger stripe size (block size, also known as Chunk size) than "Optimization for Random I/O." Numerous controller's internal parameters will also be changed to optimize for sequential or random I/O. The change will take effect after the controller resets.

The logical drive, cache memory, and other controller internal parameters will be adjusted for the use of video/imaging applications.

Optimization for Random or Sequential I/O

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 reset.

```
Caching
Parameters     ..
```

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

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

IMPORTANT!

- *Changing the setting to "Optimization for Sequential I/O" or "Optimization for Random I/O" should be performed only when no logical drive exists.*
- *If the logical drive size is larger than 512GB, only the optimization for sequential I/O can be applied.*

Write-Back/Write-Through Cache Enable/Disable

In the submenu of "Caching Parameters," 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
Enable        ..
```

The Write-through cache strategy is considered more secure if a power failure should occur. However, Write-through cache strategy will be slower than write-back.

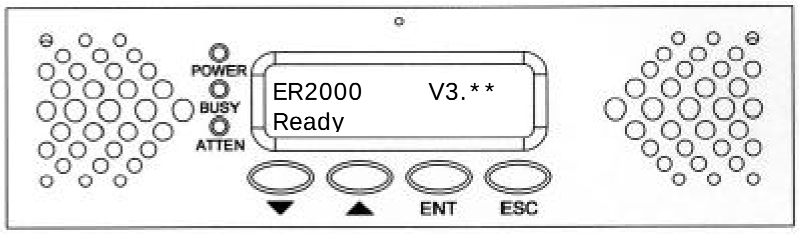
```
Disable Write
-Back Cache    ?
```

IMPORTANT!

- *Every time you change the Caching Parameters, you must reset the controller for the changes to take effect.*
- *When using the Redundant Controller function, write-back will only be available with a synchronized cache channel established between the two controllers.*

6.3 View Connected Drives:

Shown below is the Infortrend controller front panel:



2 x 16 LCD	Displays throughput during normal operation. Displays messages for configuration and management. (2 lines x 16 characters)
POWER	Lighted LED indicates power is on.
BUSY	Unlit indicates no activity Blinking indicates data is being accessed Lighted LED indicates unprocessed cached data is still in the memory.
ATTEN	Lights when an error message appears or service is required…, when a drive fails and needs to be replaced.
▼ ▲ buttons	Scroll through available options
ENT button	Choose or execute an option
ESC button	Return to previous menu or cancel selection.

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

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

```
View and Edit
SCSI Drives
```

Use ▼ or ▲ to scroll down the list of connected drives' information screens.

```
C=2 I=0 1010MB
New DRV SEAGATE
```

Use ▼ or ▲ to navigate through the menus. Choose "View Drive Information," then press **ENT**.

```
View Drive
Information   ..
```

The Revision Number of the selected SCSI drive will be shown on the LCD. Press ▼ to view the other items.

```
Revision Number:
0274
```

Other items include "Serial Number" and "Disk Capacity" (displayed in blocks). Each block size displayed is equal to 512K Bytes.

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 contact your system vendor.

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 a block. If the drive members in one logical drive have different block numbers (capacity), the minimum block number among all the member drives will be chosen as the maximum block number for the RAID configuration. Therefore, use drives of the same capacity.*
- *You may assign a Local/Global Spare Drive to a logical drive whose member drive's block number is equal or smaller to the Local/Global Spare Drive's block number but you may not do the reverse.*

6.4 Creating a Logical Drive

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

```
View and Edit
Logical Drives
```

Press ▼ or ▲ to select a logical drive, then press **ENT** for two seconds to proceed. "LG" refers to Logical Drive.

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

Choosing a RAID Level:

Press ▼ or ▲ to choose the desired RAID level, then press **ENT** for two seconds. "TDRV" (Total Drives) on the LCD refers to the number of available SCSI drives.

```
TDRV=4 Create
LG Level=RAID5 ?
```

Choosing Member Drives:

Press **ENT** for two seconds, a message “RAID X selected To Select drives” will appear. Confirm your selection by pressing **ENT**.

```
RAID X  Selected
To Select drives
```

Press **ENT**, then use ▼ or ▲ to browse through the 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. "C=1 I=0" refers to "Channel 1, SCSI ID 0".

```
C=1 I=0   1010MB
NEW DRV  SEAGATE
```

After all the desired drives have been selected, press **ENT** for two seconds to continue. Press ▼ or ▲ to choose “Create Logical Drive,” then press **ENT** for two seconds to start initializing the logical drive.

```
Create Logical
Drive          ?
```

Logical Drive Preferences:

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

```
Change Logical
Drive Parameter?
```

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 drive.

```
Maximum Drive
Capacity      ..
```

Use ▼ and ▲ to change the maximum size that will be used on each drive.

```
MaxSiz=  1010MB
Set to   1010MB?
```

Spare Drive Assignments:

The Local Spare Drive can also be assigned here. Press ▼ or ▲ to choose "Spare Drive Assignments," then press **ENT**.

```
Spare Drive
Assignments   ..
```

The currently available drives will be listed. Use ▼ or ▲ to browse through the drives, then press **ENT** to choose the drive you wish to serve as the Local Spare Drive. Press **ENT** again for two seconds.

```
C=1 I=15  1010MB
*LG=0 SL SEAGATE
```

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

```
Create Logical
Drive          ?
```

The Controller will start to initialize the parity of the logical drive. Please note that if NRAID or RAID 0 is selected, initialization time is short and completes almost immediately.

```
Init Parity  90%
Please Wait!
```

The LCD will display the logical drive's information after the initialization process is completed.

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

IMPORTANT!

- *The basic read/write unit of a hard drive is a block. If the drive members in one logical drive have different block numbers (capacity), the minimum block number among all the member drives will be chosen as the maximum block number of the RAID configuration.*

6.5 Creating a Logical Volume

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Logical Volume," then press **ENT**.

```
View and Edit
Logical Volume ↕
```

Press ▼ or ▲ to select an undefined logical volume, then press **ENT** for two seconds to proceed. The "LV" means Logical Volume.

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

When a logical volume is selected, proceed to select a logical drive that has not yet been configured. Press **ENT** for two seconds. The "LD" refers to Logical Drive.

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

Use ▼ or ▲ 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
```

```
Create
Logical Volume ?
```

Press ▼ or ▲ to choose "Create Logical Volume," then press **ENT** for two seconds to start initializing the logical volume.

```
Create Logical
Volume Successed
```

The logical volume has been successfully created.

Or, if you have two controllers, you may choose to assign this logical volume to a primary or secondary controller. Use▼ or ▲ to select "Change Logical Volume Params," "Logical Volume Assignment...," and assign the logical volume to the primary or secondary controller.

```
Change Logical
Volume Params?
```

```
Logical Volume
Assignments   ..
```

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

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

6.6 Partitioning a Logical Drive/Logical Volume

Partitioning, as well as the creation of logical volume, are not the requirement for creating a RAID system. Processes necessary 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 ▼ or ▲ to select "View and Edit Logical Volume," then press **ENT**.

```
View and Edit
Logical Volume ↕
```

Press ▼ or ▲ to select a logical volume, then press **ENT**.

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

Press ▼ or ▲ to select “Partition Logical Volume,” then press **ENT**.

```
Partition
Logical Volume..
```

The current partition size of this logical volume will be displayed. Press **ENT** for two seconds to change the partition size of this logical volume.

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

The current partition’s information will be displayed on the LCD. Use ▼ or ▲ 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.

```
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 8 partitions using the same method as described above.

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

Press **ESC** for several times to go back to the main menu.

IMPORTANT!

- *The basic read/write unit of a hard drive is a block. If the drive members in one logical drive have different block numbers (capacity), the minimum block number among all the member drives will be chosen as the maximum block number of the RAID configuration.*

6.7 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. Mapping a logical volume is taken as an example here.

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Host Luns," then press **ENT**.

```
View and Edit
Host Luns      ↕
```

Several details are noticeable here:

1. A logical group of drives (logical drive/logical volume) previously assigned to the primary controller can not be mapped to a secondary ID. Neither can that assigned to the secondary controller be mapped to a primary ID.
2. ID 7 is reserved for the controller itself. If there are two controllers, controllers might occupy ID 6 and ID 7.

Press ▼ or ▲ to select the controller-host Channel ID combination, and then press **ENT** for two seconds to confirm.

```
Map Pri.Ctlr
CH=0 ID=0  ?
```

Press ▼ or ▲ to select the mapping type. Available choices will be "Map to Logical Volume," "Map to Logical Drive," or "Map to Physical Drive." Select one by pressing **ENT.**

```
Map to
Logical Volume ?
```

Press ▼ or ▲ to select a LUN number, then press **ENT** to proceed.

```
CH=0 ID=0 LUN=0
Not Mapped
```

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

```
Map Host LUN   ?
```

Press ▼ or ▲ to browse through all the available partitions in the logical volume. Press **ENT** for two seconds to map the selected partition of the logical volume to this LUN.

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

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

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

```
CH=0 ID0 LUN0
MAP to LV=0 PRT=0?
```

With any of the Host LUN mapped, the “No Host LUN” message in the main menu will change to “Ready.”

If your controller has not been configured with host channel and assigned with SCSI ID, please move on to section 6.11 for more details.

6.8 Assigning Spare Drive and Rebuild Settings

Adding a Local Spare Drive

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Drives," then press **ENT**.

```
View and Edit
SCSI Drives ↕
```

SCSI drive information will be displayed on the LCD. Press ▼ or ▲ to select a drive that is stated as “NEW DRV” or “USED DRV” that has not been assigned to any logical drive, as spare drive or failed drive, then press **ENT** to select it.

```
C=2 I=4   1010MB
NEW DRV  SEAGATE
```

Press ▼ or ▲ to select “Add Local Spare Drive,” then press **ENT**.

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

Press ▼ or ▲ 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
```

Adding a Global Spare Drive

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Drives," then press **ENT**.

```
View and Edit
SCSI Drives ↕
```

SCSI drive information will be displayed on the LCD. Press ▼ or ▲ to select a SCSI drive that has not been assigned to any logical drive yet, then press **ENT**.

```
C=2 I=4   1010MB
NEW DRV  SEAGATE
```

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

Press ▼ or ▲ to select "Add Global Spare Drive," then press **ENT**.

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

```
Add Global Spare
Drive Successful
```

Rebuild Settings

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Config Parms," then press **ENT**.

```
View and Edit
Config Parms   ↕
```

Press ▼ or ▲ to select "Disk Array Parameters," then press **ENT**.

```
Disk   Array
Parameters..
```

Press ▼ or ▲ to select "Rebuild Priority Low," then press **ENT**. "Low" refers to the temporary setting.

```
Rebuild Priority
Low           ..
```

Press **ENT** again and the abbreviation mark ".." will change to question mark "?". Press ▼ or ▲ to select priority Low, Normal, Improved, or High on the LCD.

```
Rebuild Priority
Low            ?
```

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

```
Rebuild Priority
High           ..
```

NOTE:

- *The different levels of rebuild priority will reserve different levels of controller resources to perform logical Drive Rebuild. The default setting of the rebuild priority is "LOW," the Host I/O access will have lower impact during the logical drive rebuilding process, but the time needed to rebuild is longer than the other settings. Changing the rebuild priority to a higher level will result in a shorter rebuilding time, but will certainly increase the Host I/O access response time. The default setting "LOW" is recommended.*

6.9 Viewing and Editing Logical Drives and Drive Members

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Logical Drives..," then press **ENT**.

```
View and Edit
Logical Drives ↕
```

Press ▼ or ▲ to select the logical drive, then press **ENT**.

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

Press ▼ or ▲ to select "View SCSI Drives..," then press **ENT** .

```
View SCSI Drives
              ..
```

Press ▼ or ▲ to scroll through the drives.

```
C=1 I=0   1010MB
 LG=0 LN SEAGATE
```

Deleting a Logical Drive

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Logical Drives," then press **ENT**.

```
View and Edit
Logical Drives ↕
```

Press ▼ or ▲ to select a logical drive, then press **ENT**.

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

Press ▼ or ▲ 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    ?
```

Deleting a Partition of a Logical Drive

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Logical Drives..," then press **ENT**.

```
View and Edit
Logical Drives ↕
```

Press ▼ or ▲ to select a logical drive, then press **ENT**.

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

Press ▼ or ▲ to choose "Partition Logical Drive," then press **ENT**.

```
Partition
Logical Drive ..
```

The current partition's information will be displayed on the LCD. Press ▼ or ▲ to browse through the existing partitions in the logical drive. Select a partition by pressing **ENT** for two seconds.

```
LG=0 Partition=1
   200MB       ?
```

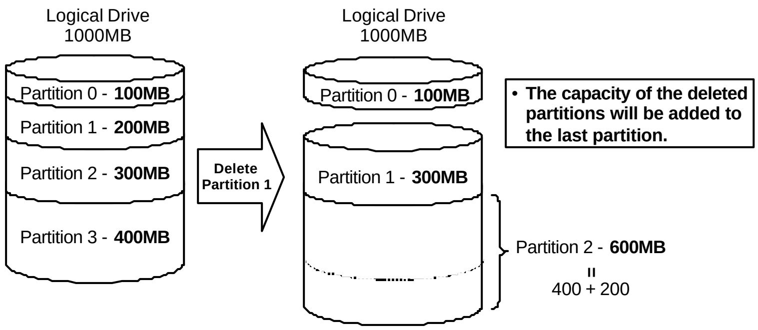
```
LG=0 Partition=1
   300MB       ?
```

Use ▼ or ▲ 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.

The rest of the drive space will be automatically allocated to the last partition.

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

Figure 6 - 1 Drive Space Allocated to the Last Partition



The capacity of the deleted partition will be added to the last partition.

WARNING!

- *Whenever there is a partition change, all host LUN mappings will be removed. Therefore, every time a partition has been changed, it is necessary to re-configure all host LUN mappings.*

Assigning a Logical Drive Name

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Logical Drives..," then press **ENT**.

```
View and Edit
Logical Drives ↕
```

Press ▼ or ▲ to select a logical drive, then press **ENT**.

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

Press ▼ or ▲ to select “Logical Drive Name," then press **ENT**.

```
Logical Drive
Name          ..
```

Press ▼ or ▲ 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 25.

```
Enter LD Name:
_
```

Rebuilding a Logical Drive

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Logical Drives..," then press **ENT**.

```
View and Edit
Logical Drives ↕
```

Press ▼ or ▲ to select the logical drive that has a failed member drive, then press **ENT**.

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

Press ▼ or ▲ 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.

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

When rebuilding has already started or the logical drive is being rebuilt automatically by a Local Spare Drive or Global Spare Drive, choose “Rebuild Progress” to view the rebuilding progress on the LCD.

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

```
Rebuild Progress
              ..
```

IMPORTANT!

- *The Rebuild function will appear only if a logical drive (with RAID level 1, 3 or 5) has a failed member drive.*
- *Use the "Identify Drive" function to check the location of the failed drive. Removing the wrong drive may cause a logical drive to fail and data loss is unrecoverable.*
- *Refer to section "2.4.3 Automatic Rebuild and Manual Rebuild" of this manual for more information on the rebuilding process.*

Regenerating Logical Drive Parity

If no verifying method is applied to data writes, this function can be performed every so often to ensure that parity errors can be repaired.

From the Main Menu, press ▼ or ▲ to select "View and Edit Logical Drives."

```
View and Edit
Logical Drives
```

Your logical drive will be displayed. If you have more than one logical drive, use the ▼ or ▲ 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
```

Press ▼ or ▲ to select "Regenerate Parity" and then press **ENT.**

```
Regenerate
Parity        ..
```

IMPORTANT!

- *If Parity Regenerating process is stopped by a drive failure, the process cannot restart until logical drive rebuild has been completed.*

6.10 Viewing and Editing Host LUNs

Viewing and Deleting LUN Mappings

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit Host Luns," then press **ENT**.

```
View and Edit
Host Luns     ↕
```

Press ▼ or ▲ to select a host channel, then press **ENT** for two seconds.

```
Map Channel=0  ?
```

Press ▼ or ▲ to select a SCSI ID, then press **ENT** for two seconds.

```
Map Channel=0
ID=0 Pri. Ctrl?
```

Press ▼ or ▲ to browse through the LUN number and its LUN mapping information.

```
Ch=0 ID=0 LUN=0
Mapto LG=0 PRT=0
```

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

```
Delete C=0 ID=0
LUN=0 Mapping  ?
```

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

```
CH=0 ID=0 LUN=0
Not Mapped
```

Pass-through SCSI Commands

Pass-through SCSI commands facilitate functions like downloading firmware for drives or devices (not controller firmware), setting SCSI drive mode parameters, or monitoring a SAF-TE/S.E.S. device directly from the host. To perform such a function, the SCSI device must be mapped to a host SCSI ID.

From the Main Menu, press ▼ or ▲ to select "View and Edit Host LUNs."

```
View and Edit
Host Luns
```

If you have primary and secondary controllers, use the ▼ or ▲ to select the controller for the device that you would like to map.

```
Map Channel=0
ID=0 Pri Ctlr ?
```

Press ▼ or ▲ to choose to map a SCSI ID to "Physical Drive" or other device and then press **ENT**.

```
Map to
Physical Drive ?
```

WARNING!

- *Pass-through SCSI Commands are only intended to perform maintenance functions for a drive or device on the drive side. Do not perform any destructive commands to a disk drive (i.e., any commands that write data to a drive media). If a disk drive is a spare drive or a member of a logical drive, such a destructive command may cause a data inconsistency.*
- *When a drive/device is mapped to a host SCSI ID so that Pass-through SCSI Commands can be used, the data on that drive/device will not be protected by the controller. Users who employ Pass-through SCSI Commands to perform any write commands to drive media do so at their own risk.*

6.11 Viewing and Editing SCSI Drives

Scanning New SCSI Drive

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Drives," then press **ENT**.

```
View and Edit
SCSI Drives ↕
```

SCSI drive information will be displayed on the LCD. Press **ENT**. Use ▼ or ▲ to select "Scan New SCSI Drive," then press **ENT** again.

```
Scan new SCSI
Drive          ..
```

Press ▼ or ▲ to select a SCSI channel, then press **ENT** for two seconds.

```
Scan Channel=1 ?
```

Press ▼ or ▲ to select a SCSI ID, then press **ENT** for two seconds.

```
Scan Channel=1
ID= 0          ?
```

The information of the scanned SCSI drive will be displayed on the LCD.

```
C=1 I=0   1010MB
NEW DRV  SEAGATE
```

If the drive was not detected on the selected SCSI channel and ID, the LCD will display "Scan Fail!"

```
Scan Channel=1
ID=1 Scan Fail!
```

An empty drive entry will be added to this channel/SCSI ID for enclosure management. The drive status is "ABSENT."

```
C=1 I=1 ABSENT
```

To clear the empty drive entry, press ▼ or ▲ on the empty drive entry, then

```
Clear Drive
Status         ..
```

press **ENT**. Press ▼ or ▲ to choose "Clear Drive Status," then press **ENT**.

Press **ENT** for two seconds to confirm the drive entry's deletion. The other existing SCSI drive information will be displayed on the LCD.

```
Clear Drive
Status          ?
```

Identifying a Drive

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Drives," then press **ENT**.

```
View and Edit
SCSI Drives ↕
```

SCSI drive information will be displayed on the LCD. Press ▼ or ▲ to select a SCSI drive, then press **ENT.**

```
C=1 I=0   1010MB
GlobalSB SEAGATE
```

Press ▼ or ▲ to select "Identify Drive," then press **ENT** to continue.

```
Identify Drive
               ..
```

Press ▼ or ▲ to select "Flash All SCSI Drives" or "Flash All BUT selected drive." Now press **ENT** for two seconds to flash the read / write LEDs of all the connected drives.

```
Flash All SCSI
Drives          ?
```

Or, press ▼ or ▲ to select "Flash Selected SCSI Drives," then press **ENT** for two seconds to flash the read / write LED of the selected drive. The read / write LED will light for a configurable time period from 1 to 999 seconds.

```
Flash Selected
SCSI Drives     ?
```

```
Flash all But
Selected Drives?
```

Deleting Spare Drive (Global / Local Spare Drive)

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Drives," then press **ENT**.

```
View and Edit
SCSI Drives ↕
```

SCSI drive information will be displayed on the LCD. Press ▼ or ▲ to select the spare drive you wish to delete, then press **ENT.**

```
C=1 I=0   1010MB
GlobalSB SEAGATE
```

Press ▼ or ▲ 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
```

6.12 Viewing and Editing SCSI Channels

Redefining Channel Mode

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Channels," then press **ENT**.

```
View and Edit
SCSI Channels  ↕
```

SCSI Channel information will be displayed on the LCD. Press ▼ or ▲ to browse through the information of every SCSI channel. Press **ENT** on the channel you wish the channel mode changed.

```
CH0=Host  PID=0
SID=NA SXF=20.0M
```

Press ▼ or ▲ to select "Redefine Channel Mode," then press **ENT**.

```
Redefine Channel
Mode           ..
```

Press **ENT** for two seconds to change the channel mode.

```
Redefine? CHL=0
To=Drive Channel
```

The new channel's setting will be displayed on the LCD .

```
CH0=Drive PID=7
SID=NA SXF=20.8M
```

IMPORTANT!

- *Every time you change channel mode, you must reset the controller for the changes to take effect.*

Setting a SCSI Channel's ID / Host Channel

Viewing a SCSI Channel's ID

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Channels," then press **ENT**.

```
View and Edit
SCSI Channels  ↕
```

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

```
CH0=Host  PID=0
SID=NA SXF=20.0M
```

Press ▼ or ▲ to select "Set SCSI Channel ID," then press **ENT**.

```
Set SCSI Channel
ID             ..
```

Press ▼ or ▲ to browse through all the current SCSI ID settings. Press **ENT** to continue.

```
CHL=0 ID=0
Primary Ctrl  ..
```

Adding a SCSI Channel's ID

Press ▼ or ▲ to choose "Add Channel SCSI ID ," then press **ENT**.

```
Add Channel
SCSI ID       ..
```

Press ▼ or ▲ to choose "Primary Controller," then press **ENT** for two seconds.

```
Primary
Controller     ?
```

Press ▼ or ▲ to choose the SCSI ID you wish to add, then press **ENT** for two seconds.

```
Add CHL=0 ID=2
Primary Ctlr   ?
```

IMPORTANT!

- *To change the SCSI ID of the host, delete the current ID before replacing a new one.*

Deleting a SCSI Channel's ID

Press ▼ or ▲ to choose "Delete Channel SCSI ID," then press **ENT**.

```
Delete Channel
SCSI ID       ..
```

Press ▼ or ▲ to choose "Primary Controller," then press **ENT** for two seconds.

```
Primary
Controller     ?
```

Press ▼ or ▲ to choose the SCSI ID you wish to delete, then press **ENT** for two seconds.

```
DeleteCHL=0 ID=2
Primary Ctlr   ?
```

IMPORTANT!

- *Every time you change a channel's SCSI ID, you must reset the controller for the changes to take effect.*
- *The default SCSI ID of the Host channel is 0, the Drive channel is 7.*

- *If only one controller exists, you must set the Secondary Controller's SCSI ID to "NA." If a secondary controller exists, you need to set a SCSI ID.*
- *Multiple SCSI ID's can be applied to the Host channel while the Drive channel has only one SCSI ID or two SCSI IDs (in redundant mode).*
- *At least a controller's SCSI ID has to be present on the SCSI bus.*

Setting a SCSI Channel's Primary ID / Drive Channel

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Channels," then press **ENT**.

```
View and Edit
SCSI Channels  ↕
```

SCSI channel information will be displayed on the LCD. Press **ENT** on the drive channel you wish the SCSI ID changed.

```
CH1=Drive  PID=7
SID=NA SXF=20.0M
```

Press ▼ or ▲ to select "Set SCSI Channel Primary ID," then press **ENT**.

```
Set SCSI Channel
Primary ID    ..
```

The current Primary SCSI ID will be displayed on the LCD. Press ▼ or ▲ to change the current SCSI ID, then press **ENT** for two seconds.

```
Set Pri. Ctlr
ID= 7 to ID: 8 ?
```

Setting a SCSI Channel's Secondary ID / Drive Channel

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Channels," then press **ENT**.

```
View and Edit
SCSI Channels  ↕
```

SCSI channel information will be displayed on the LCD. Press **ENT** on the drive channel you wish the SCSI ID changed.

```
CH1=Drive  PID=7
SID=NA SXF=20.0M
```

Press ▼ or ▲ to select "Set SCSI Channel Secondary ID," then press **ENT**.

```
Set SCSI Channel
Secondary ID
```

The current Secondary SCSI ID will be displayed on the LCD. Press ▼ or ▲ to change the current SCSI ID, then press **ENT** for two seconds to confirm.

```
Set Sec. Ctlr
ID= 7 to ID: 8 ?
```

Setting a SCSI Channel's Terminator

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Channels," then press **ENT**.

```
View and Edit
SCSI Channels  ↕
```

SCSI channel information will be displayed on the LCD. Press ▼ or ▲ to browse through the information of every SCSI channel. Press **ENT** on a channel you wish the terminator mode changed.

```
CH0=Host  PID=0
SID=NA SXF=20.0M
```

Press ▼ or ▲ to select "Set SCSI Channel Terminator," then press **ENT**.

```
Set SCSI Channel
Terminator    ..
```

The status of the SCSI terminator will be displayed on the LCD. Press **ENT** to continue.

```
SCSI Terminator
Enabled       ..
```

Press **ENT** again for two seconds to change the terminator mode to the alternate setting.

```
CHL=0 Disable
Terminator     ?
```

IMPORTANT!

- *For the SentinelRAID series controllers, setting terminator jumpers as terminator enabled requires no firmware configuration change. However, to disable SCSI termination, terminator jumpers associated with specific channel must be left open and firmware setting set to disabled.*

Setting Transfer Speed

Transfer speed refers to the SCSI bus speed in synchronous mode. Asynchronous mode is also available in this option setting. In Ultra / Ultra Wide SCSI, the maximum synchronous speed is 20.8Mhz.

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Channels," then press **ENT**.

```
View and Edit
SCSI Channels  ↕
```

SCSI channel information will be displayed on the LCD. Press ▼ or ▲ to browse through the information of every SCSI channel. Press **ENT** on the channel you wish the transfer speed changed.

```
CH0=Host  PID=0
SID=NA SXF=20.0M
```

```
Set Transfer
Speed          ..
```

Press ▼ or ▲ to select "Set Transfer Speed," then press **ENT**.

The current speed of this SCSI channel will be displayed on the LCD. Press ▼ or ▲ to select the desired speed, then press **ENT** for two seconds.

```
CHL=0 Clk=20.0M
Change to=20.0M?
```

IMPORTANT!

- *Every time you change the Transfer Speed, you must reset the controller for the changes to take effect.*

Setting Transfer Width

The controller supports 8-bit SCSI and 16-bit SCSI. Enable "Wide Transfer" to use the 16-bit SCSI function. Disabling "Wide Transfer" will limit the controller to 8-bit SCSI.

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Channels," then press **ENT**.

```
View and Edit
SCSI Channels  ↕
```

SCSI channel information will be displayed on the LCD. Press ▼ or ▲ to browse through the information of every SCSI channel. Press **ENT** on the channel you wish the transfer width changed.

```
CH0=Host  PID=0
SID=NA SXF=20.0M
```

Press ▼ or ▲ to select “Set Transfer Width," then press **ENT**.

```
Set Transfer
Width          ..
```

The current mode will be displayed on the LCD. Press **ENT** to continue.

```
Wide Transfer
Enabled        ..
```

Press **ENT** again for two seconds.

```
Disable
Wide Transfer  ?
```

IMPORTANT!

- *Every time you change the SCSI Transfer Width, you must reset the controller for the changes to take effect.*

Viewing and Editing SCSI Target / Drive Channel

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Channels," then press **ENT**.

```
View and Edit
SCSI Channels  ↕
```

SCSI channel information will be displayed on the LCD. Press **ENT** on the drive channel you wish the SCSI ID changed.

```
CH1=Drive  PID=7
SID=NA SXF=20.0M
```

Press ▼ or ▲ to select “View and Edit SCSI Target,” then press **ENT**.

```
View and Edit
SCSI Target    ..
```

Press ▼ or ▲ to select a SCSI target, then press **ENT**.

```
SCSI Target
CHL=1 ID=0     ..
```

Slot Number

To set the Slot number of the SCSI target, choose “Slot Assignment," then press **ENT**. The current slot number will be displayed on the LCD.

```
Slot Assignment
Default No Set..
```

Press ▼ or ▲ to change the slot number, then press **ENT** for two seconds. Refer to Chapter 14, Fault-Bus, for more information about the slot number.

```
Slot Assignment
Set to    # 9  ?
```

Maximum Synchronous Transfer Clock

Press ▼ or ▲ to select a SCSI target, then press **ENT**.

```
SCSI Target
CHL=1 ID=0    ..
```

To set the maximum synchronous clock of this SCSI target, choose “Max. Synchronous Xfer Clock," then press **ENT**. The current clock setting will be displayed on the LCD.

```
Max Synchronous
Xfer Clock# 12..
```

Press ▼ or ▲ to change the clock, then press **ENT** for two seconds.

```
Period   Factor
Def= 12 to  --?
```

Maximum Transfer Width

Press ▼ or ▲ to select a SCSI target, then press **ENT**.

```
SCSI Target
CHL=1 ID=0    ..
```

To set the maximum transfer width of this SCSI target, choose “Max. Xfer Narrow Only” or “Max. Xfer Wide Supported,” then press **ENT**. The current clock setting will be displayed on the LCD.

```
Max Xfer Wide
Supported      ..
```

Press **ENT** for two seconds to change the setting.

```
Max Xfer Narrow
Only            ?
```

Parity Check

Press ▼ or ▲ to select a SCSI target, then press **ENT**.

```
SCSI Target
CHL=1 ID=0    ..
```

Choose “Parity Check," then press **ENT**. The current clock setting will be displayed on the LCD.

```
Parity Check
Enabled        ..
```

Press **ENT** for two seconds to change the setting.

```
Disable
Parity Checking?
```

Disconnecting Support

Press ▼ or ▲ to select a SCSI target, then press **ENT**.

```
SCSI Target
CHL=1 ID=0    ..
```

Choose “Disconnect Support," then press **ENT**. The current clock setting will be displayed on the LCD.

```
Disconnect
Support Enabled
```

Press **ENT** for two seconds to change the setting.

```
Disable Support
Disconnect     ?
```

Maximum Tag Count

Press ▼ or ▲ to select a SCSI target, then press **ENT**.

```
SCSI Target
CHL=1 ID=0    ..
```

Choose "Max Tag Count," then press **ENT**. The current clock setting will be displayed on the LCD.

```
Max Tag Count:
Default( 32)  ..
```

Press ▼ or ▲ to change the setting, then press **ENT** for two seconds to change the setting.

```
Tag Cur=32
Set to:Default ?
```

IMPORTANT!

- *Disabling the Maximum Tag Count will disable the internal cache of this SCSI drive.*

Restoring the Default Setting

Press ▼ or ▲ to select a SCSI target, then press **ENT**.

```
SCSI Target
CHL=1 ID=0    ..
```

Choose "Restore to Default Setting," then press **ENT**.

```
Restore to
Default Setting.
```

Press **ENT** again for two seconds to restore the SCSI target's default settings.

```
Restore to
Default Setting?
```

6.13 System Functions

Choose "System Functions" in the main menu, then press ENT. The System Functions menu will appear. Press ▼ or ▲ to select an item, then press **ENT**.

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
              ..
```

Change Password

Use the controller's password to protect the controller from unauthorized entry. Once the controller's password has been 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 is able to verify the password when entering the main menu from the initial screen or making configuration change. If the controller is going to be left unattended, the "Password Validation Timeout" can be set to "Always Check."*
- *The controller password and controller name are sharing a 16-character space. The maximum characters for the controller password is 15. When the controller name occupied 15 characters, there is only one character left for the controller password and vice versa.*

Changing Password

To set or change the controller password, press ▼ or ▲ to select "Change Password," then press ENT.

```
Change Password
              ..
```

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 can not be replaced unless a correct old password is provided.

```
Change Password
              ..
```

```
Old    Password
              ..
```

Press ▼ or ▲ to select a character, then press **ENT** to move to the next space. After entering all the characters, 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
```

Disabling Password

To disable or delete the password, press ENT only 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 screen or making configuration.

Reset Controller

```
Reset This
Controller    ..
```

To reset the controller without powering off the system, Press ▼ or ▲ to “Reset Controller,” then press **ENT**. Press ENT again for two seconds to confirm. The controller will now reset.

```
Reset This
Controller    ?
```

Shutdown Controller

```
Shutdown This
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 ▼ or ▲ to “Shutdown Controller,” then press **ENT**. Press **ENT** again for two seconds to confirm.

```
Shutdown This
Controller    ?
```

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

```
ShutdownComplete
   Reset Ctlr?
```

For Controller Maintenance functions, please refer to Appendix C.

Saving NVRAM to Disks

You can choose to backup your controller-dependent configuration information to disk. We strongly recommend using this function to save configuration information whenever a configuration change is made. The information will be distributed to every member drive of the array. If using the Text-based RAIDMAN manager, you can save configuration data to a specific file.

First, a RAID configuration unit 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. The message will turn into “Save NVRAM to Disks?,” press **ENT** for two seconds to confirm.

```
Controller
Maintenance   ..
```

```
Save NVRAM
 To Disks    ?
```

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

Restore NVRAM from Disks

Once you want to restore your NVRAM information from what you previously saved onto disk, 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    ?
```

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

6.14 Controller Parameters

Controller Name

Select "View and Edit Config Parms" from the main menu. Choose "View and Edit Configuration parameters," "Controller Parameters," then press **ENT**. The current controller name will be displayed. Press **ENT** for two seconds and enter the new controller name by using ▼ or ▲. Press **ENT** to move to another character and then press **ENT** for two seconds to confirm.

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

```
Enter Ctlr Name:
▯
```

LCD Title Display Controller Name

Choose "View and Edit Configuration parameters," "Controller Parameters," then press **ENT**. Use ▼ or ▲ to choose to display the embedded controller logo or any given name on LCD.

```
LCD Title Disp –
Controller Logo?
```

```
LCD Title Disp –
Controller Name?
```

Password Validation Timeout

Choose "View and Edit Configuration parameters," "Controller Parameters," then press **ENT**. Select "Password Validation Timeout," and press **ENT**. Press ▼ or ▲ to choose to enable a validation timeout from one to five minutes to always check. The always check timeout will disable any configuration change without entering the correct password.

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

Controller Unique Identifier

Choose "View and Edit Configuration parameters," "Controller Parameters," then press **ENT**. Press▼ or ▲ to select "Ctlr Unique ID-," then press **ENT**. Enter any number from 1 to 65535 and press **ENT** to proceed. The ID will be generated into a controller-unique WWN node name. In redundant mode, this unique ID will be used to prevent host from mis-addressing the storage system during failback process. ID ***MUST*** be different for each controller.

```
Ctlr Unique
ID-
```

6.15 SCSI Drive Utilities

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

```
View and Edit
SCSI Drives
```

```
C=1 I=1  8683MB
NEW DRV  SEAGATE
```

```
SCSI Drives
  Utilities   ..
```

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

SCSI Drive Low-level Format

Choose "SCSI Drive Low-level Format" and confirm by selecting **Yes**.

```
Drive Low-Level
 Format       ..
```

IMPORTANT!

- *Do not switch the controller's and/or SCSI disk drive's power off during the SCSI Drive Low-level Format. If any power failure occurs during a drive low-level format, the formatting must be performed again when power resumes.*
- *All of the data stored in the SCSI disk drive will be destroyed during a low-level format.*
- *The SCSI disk drive on which a low-level disk format will be performed cannot be a spare drive (local or global) nor a member drive of a logical drive. The "SCSI Drive Low-level Format" option will not appear if the drive is not a "New Drive" or a "Used Drive."*

SCSI Drive Read/Write Test

From the “View and Edit SCSI Drives” menu, select a new or used drive that the utility is to be performed on; then press **ENT**. Select “SCSI Drive Utilities;" then press **ENT**. Choose “Read / Write Test” and press **ENT**. Press▼ or ▲ to select and choose to enable / disable the following options: 1. "Auto Reassign Bad Block; 2. Abort When Error Occurs; 3. Drive Test for - Read Only / Read and Write. When finished with configuration, select "Execute Drive Testing" and press **ENT** to proceed.

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

```
Auto Reassign
Disabled       ..
```

```
Abort When Error
Occur-Enabled
```

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

```
Execute Drive
   Testing     ..
```

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     ..
```

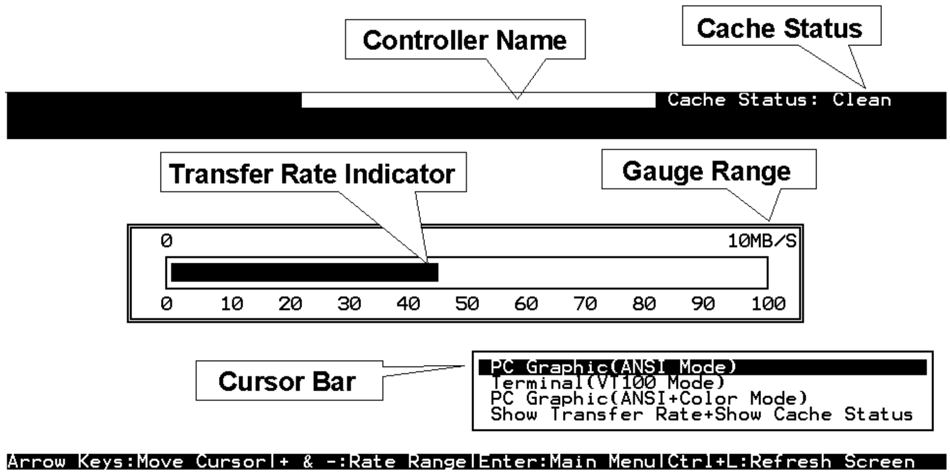
Chapter

7

Terminal Screen Messages

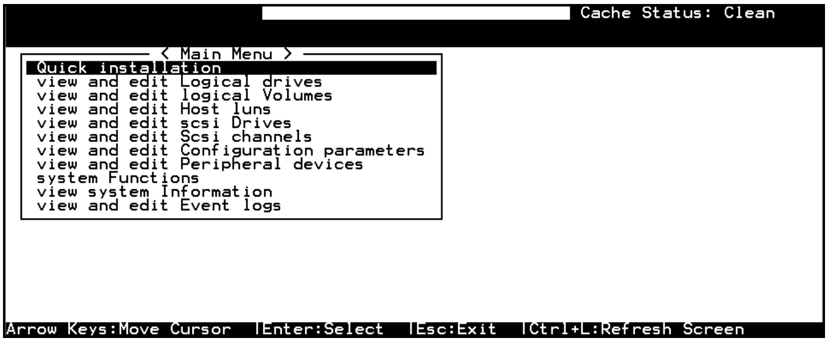
The following guide to the on-screen information applies to both the RS-232 terminal emulation and the in-band SCSI Text-based manager.

7.1 The Initial Screen



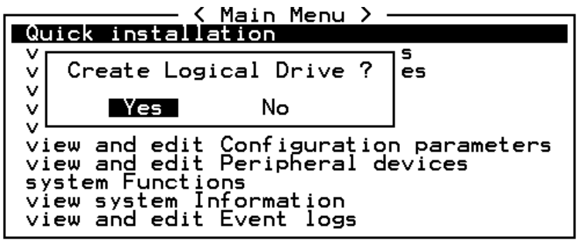
Cursor Bar:	Move the cursor bar to a desired item, then press **[ENTER]** to select.
Controller Name:	Identifies the type of controller.
Transfer Rate Indicator	Indicates the current data transfer rate.
Gauge Range:	Use + or **-** keys to change the gauge range in order to view the transfer rate indicator.
Cache Status:	Indicates the current cache status.
PC Graphic (ANSI Mode):	Enters the Main Menu and operates in ANSI mode
Terminal (VT-100 Mode):	Enters the Main Menu and operates in VT-100 mode.
PC Graphic (ANSI+Color Mode):	Enters the Main Menu and operates in ANSI color mode.
Show Transfer Rate+Show Cache Status:	Press **[ENTER]** on this item to show the cache status and transfer rate.

7.2 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.

7.3 Quick Installation

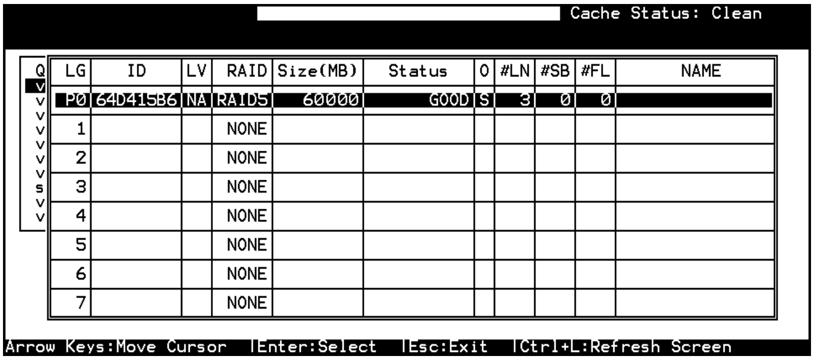


Type **Q** or use the – ¯ keys to select "Quick installation", then press **[ENTER]**. Choose **Yes** to create a logical drive.

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

The controller will start initialization and automatically map the logical drive to LUN 0 of the first host channel.

7.4 Logical Drive Status

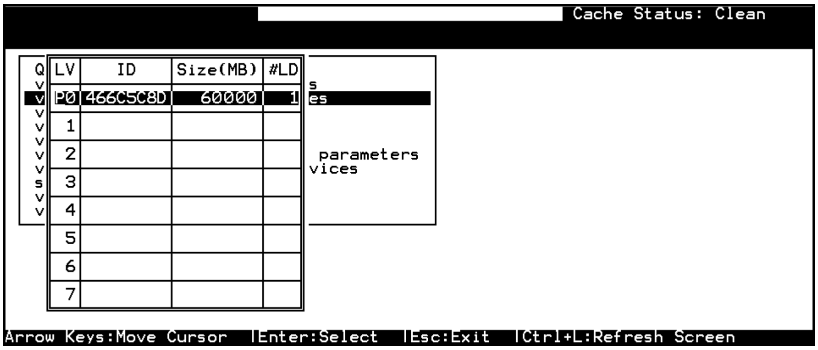


LG	Logical Drive number
	P0: Logical Drive 0 of the Primary Controller
LV	The Logical volume to which this logical drive belongs
ID	Controller-generated unique ID
RAID	RAID level
SIZE (MB)	Capacity of the Logical Drive
RAID	RAID Level
Size(MB)	Capacity of the Logical Drive
Status	Logical Drive Status

INITING	The logical drive is now initializing
INVALID	The logical drive was created with "Optimization for Sequential I/O," but the current setting is "Optimization for Random I/O." Or The logical drive was created with "Optimization for Random I/O," but the current setting is "Optimization for Sequential I/O."
GOOD	The logical drive is in good condition
DRV FAILED	A drive member failed in the logical drive
REBUILDING	Rebuilding the logical drive
DRV ABSENT	One of the drives cannot be detected
INCOMPLETE	Two or more drives failed in the logical drive

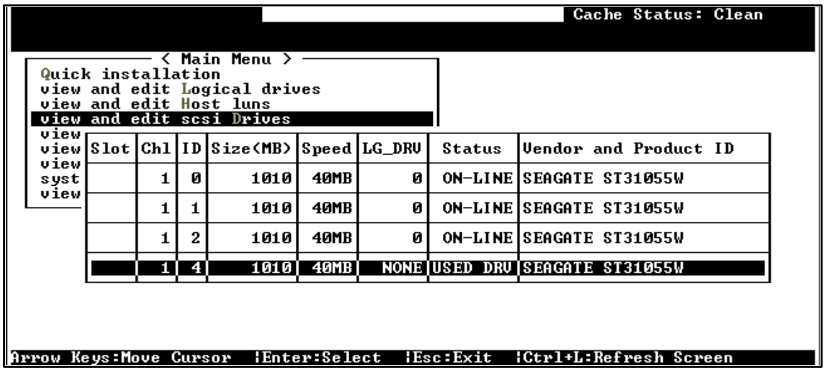
O	**S** Optimization for Sequential I/O
	R Optimization for Random I/O
#LN	Total drive members in the logical drive
#SB	Standby drives available for the logical drive. This includes all the spare drives (local spare, global spare) available for the logical drive
#FL	Number of Failed drive member(s) in the logical drive
Name	Logical drive name (user configurable)

7.5 Logical Volume Status



LV	Logical Volume number. P0: Logical Volume 0 of the Primary Controller S0: Logical Volume 0 of the Secondary Controller
ID	Logical Volume ID number (controller random generated)
Size(MB)	Capacity of the Logical Volume
#LD	The number of Logical Drive(s) included in this Logical Volume

7.6 SCSI Drive's Status



Slot Slot number of the SCSI drive

Chl The SCSI Channel of the connected drive

ID The SCSI ID of the drive

Size (MB) Drive Capacity.

Speed **xxMB** Maximum synchronous transfer rate of this drive.

Async The drive is using asynchronous mode.

LG_DRV **x** The SCSI drive is a drive member of logical drive x.

If the Status column shows "STAND-BY", the SCSI drive is a Local Spare Drive of logical drive *x*.

Status **Global** The SCSI drive is a Global Spare Drive

INITING Processing initialization

ON-LINE The drive is in good condition

REBUILD Processing Rebuild

STAND-BY 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".

NEW DRV The new drive has not been configured to any logical drive or as a spare drive

USED DRV The used drive has not been configured to any logical drive or as a spare drive

BAD Failed drive

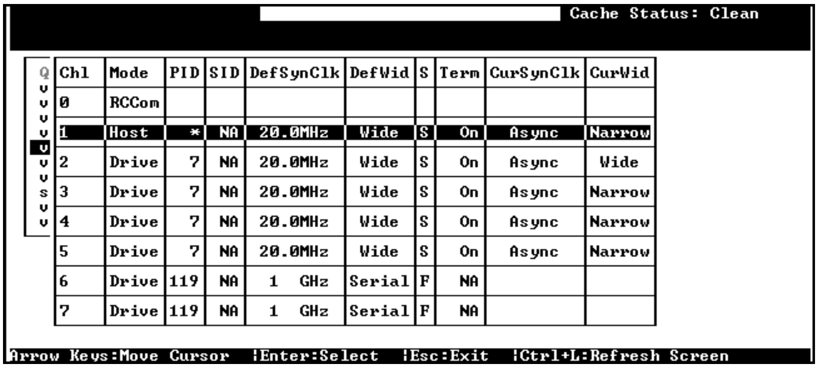
ABSENT Drive does not exist

MISSING Drive once exist, but is missing now

SB-MISS Spare drive missing

Vendor and Product ID The vendor and product model information of the drive

7.7 SCSI Channel's Status


Cache Status: Clean

Chl	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid
0	RCCom								
1	Host	*	NA	20.0MHz	Wide	S	On	Async	Narrow
2	Drive	7	NA	20.0MHz	Wide	S	On	Async	Wide
3	Drive	7	NA	20.0MHz	Wide	S	On	Async	Narrow
4	Drive	7	NA	20.0MHz	Wide	S	On	Async	Narrow
5	Drive	7	NA	20.0MHz	Wide	S	On	Async	Narrow
6	Drive	119	NA	1 GHz	Serial	F	NA		
7	Drive	119	NA	1 GHz	Serial	F	NA		

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

Chl SCSI channel's ID.

Mode Channel mode.

RCCom Redundant controller communication channel

Host Host Channel mode

Drive Drive Channel mode

PID Primary controller's SCSI ID mapping:

* Multiple SCSI IDs were applied (Host Channel mode only).

(ID number) The Primary Controller is using the SCSI ID for host LUN mapping.

NA No SCSI ID applied (Drive Channel mode only).

SID Secondary controller's SCSI ID mapping:

* Multiple SCSI IDs were applied (Host Channel mode only).

(ID number) The Primary Controller is using the SCSI ID for host LUN mapping.

NA No SCSI ID applied

DefSynClk Default SCSI bus synchronous clock:

*??.?*M The default setting of the SCSI channel is 20.0 MHz in Synchronous mode.

Async. The default setting of the SCSI channel is Asynchronous mode.

DefWid Default SCSI Bus Width:

Wide 16-bit SCSI

Narrow 8-bit SCSI

S Signal:

S Single-ended

L LVD

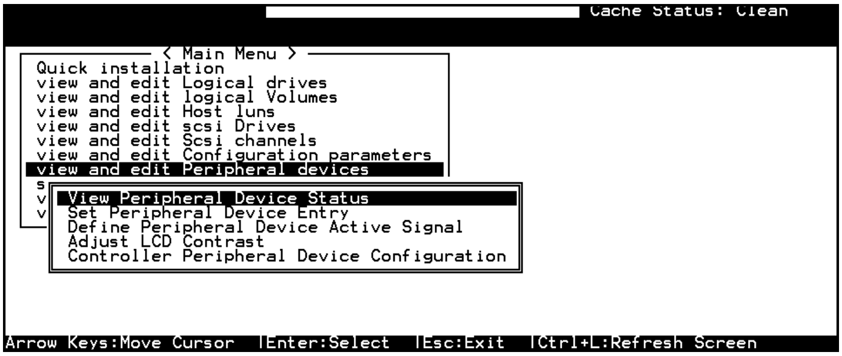
F Fibre

Term Terminator Status:

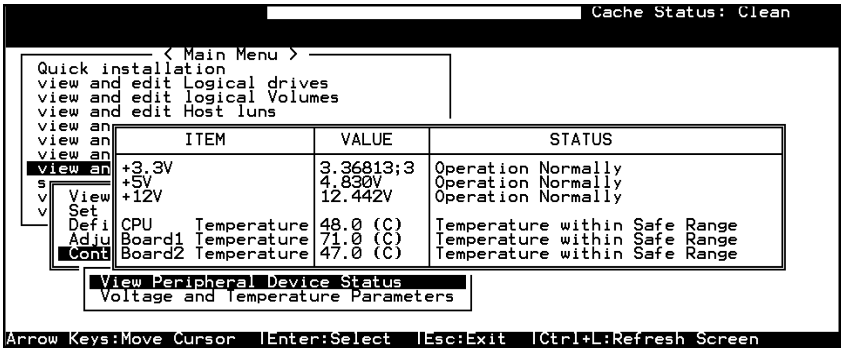
	On	Terminator is enabled.
	Off	Terminator is disabled.
	Diff	The channel is a Differential channel. The terminator can only be installed / removed physically.
CurSynClk	Current SCSI bus synchronous clock:	
	*??.?*M	The default setting of the SCSI channel is 20.0 MHz in Synchronous mode.
	Async.	The default setting of the SCSI channel is Asynchronous mode.
	(empty)	The default SCSI bus synchronous clock has changed. Reset the controller for the changes to take effect.
CurWid	Current SCSI Bus Width:	
	Wide	16-bit SCSI
	Narrow	8-bit SCSI
	(empty)	The default SCSI bus width has changed. Reset the controller for the changes to take effect.

7.8 Controller Voltage and Temperature

Controller voltage and temperature monitoring



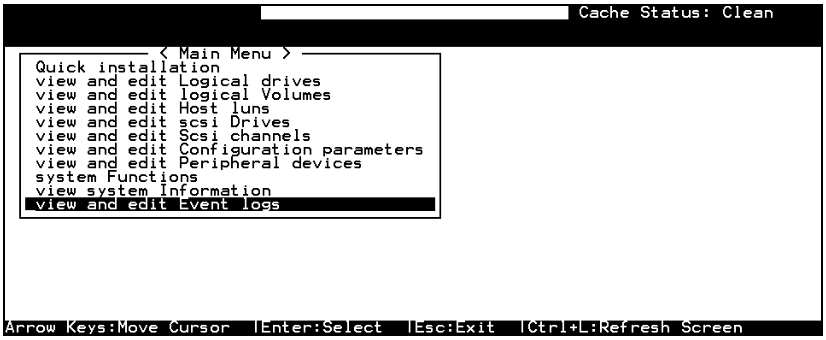
Choose from main menu "View and Edit Peripheral Devices," and press **[ENTER].** From the submenu, choose "Voltage and Temperature Configuration," then press **[ENTER].** Select "Voltage and Temperature Monitor," press **[ENTER]**.



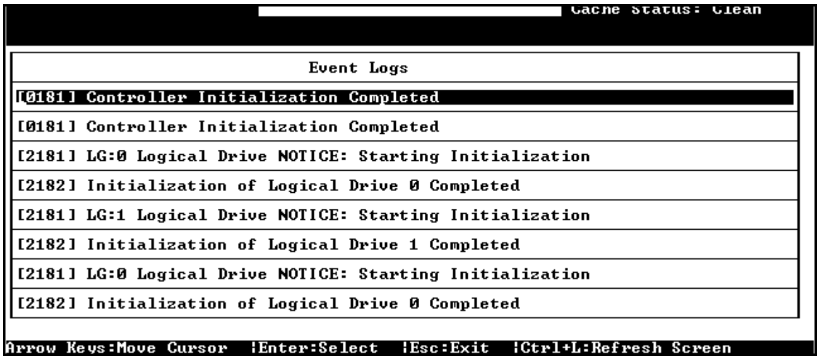
The current specimens of voltage and temperature detected by controller will be displayed on screen and will be defined as normal or out of order.

7.9 Viewing Event Logs on the Screen

There may be a chance when errors occur and you may want to trace down the record to see what has happened to your system. The controller's event log management will record all the events from power on, it can record 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 logs on screen, choose from main menu "view and edit Event logs" by pressing **[ENTER]**.



The controller can store up to 1000 event logs for use in modifying the configuration.



To clear the saved event logs, scroll the cursor down to the last event and press **[ENTER].**

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

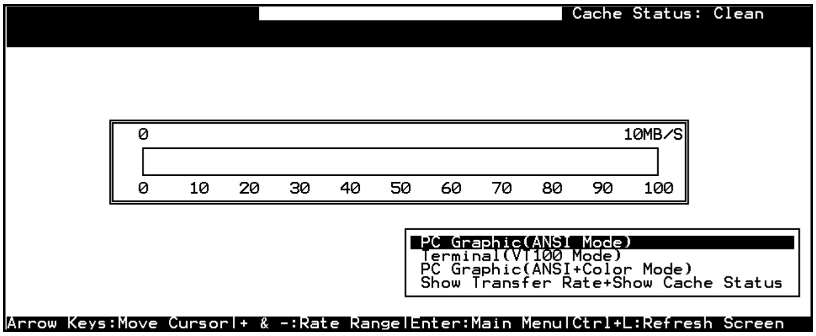
Chapter

8 Terminal Operation

8.1 Power on RAID Enclosure

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

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



8.2 Caching Parameters

Optimization Modes

Mass storage applications fall into two major categories: database applications and video/imaging applications. The controller supports two embedded optimization modes: Optimization for Random I/O and Optimization for Sequential I/O.

Limitations: There are limitations on the optimization modes. First, one optimization mode must be applied to all logical units in a RAID system. Second, once the optimization mode is selected and data written in logical units, the only way to change the optimization mode is to backup all data to somewhere else, delete all logical configurations of drives, and reboot system.

The limitation derives from the consideration with the redundant configuration of controllers. Data inconsistency might occur when a controller pre-configured with optimization mode is used to replace a failed controller with different mode.

Database and Transaction-based Applications: this kind of applications usually include SQL server, Oracle server, Informix, or other data base services. These applications keep each transaction within the minimal size, so that I/O transfers will not be clogged by one large transaction. Due to its transaction-based nature, these applications do not read or write a bunch of data in a sequential order. Instead, access to data occurs randomly. The transaction size ranges from 2K to 4K. Transaction-based performance is usually measured in "I/Os per second" or "IOPS."

Video Recording/Playback and Imaging Applications: this kind of application usually belongs to video playback, video post-production editing, or other similar applications. These applications read or write large files from and into storage in a sequential order. The size of each I/O can be 128K, 256K, 512K, or up to 1MB. Performance is measured in "MB/Sec."

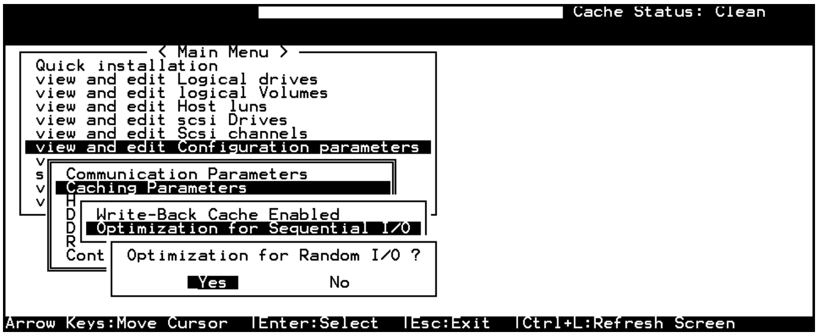
When an array works with applications such as video or image oriented applications, the application reads/writes from the drive as large-block, sequential files instead of small-block and randomly accessed files.

1. Optimization for Random I/O: the logical drive, cache memory, and other controller parameters will be adjusted for the use of database/transaction-processing applications.

2. Optimization for Sequential I/O:
"Optimization for Sequential I/O" provides larger stripe size (block size, also known as Chunk size) than "Optimization for Random I/O." Numerous controller's internal parameters will also be changed to optimize for sequential or random I/O. The change will take effect after the controller resets.

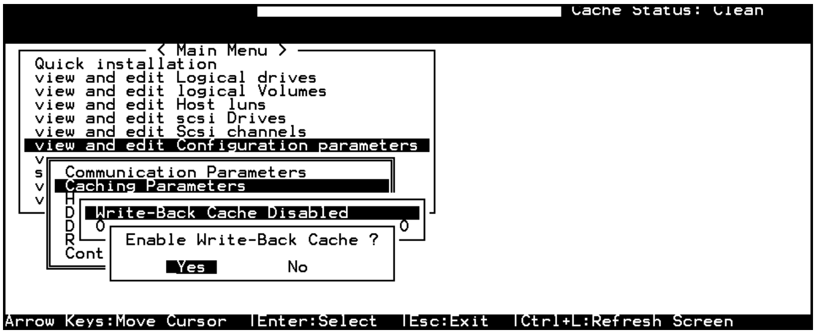
The logical drive, cache memory, and other controller internal parameters will be adjusted for the use of video/imaging applications.

Optimization for Random or Sequential I/O



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.

Write-Back/Write-Through Cache Enable/Disable



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

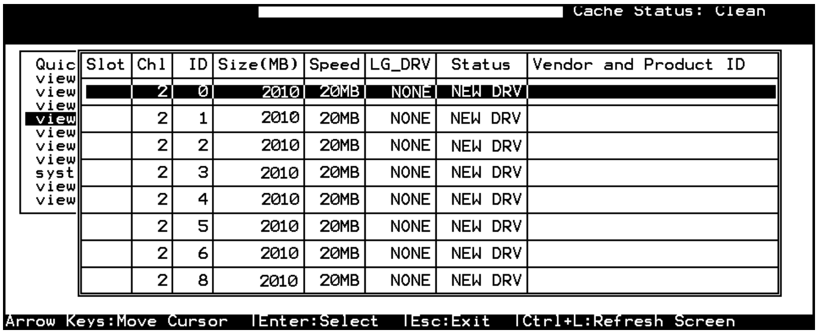
The write-back cache function significantly enhances controller performance. Write-through strategy is considered more secure if power failure should occur. However, if the battery module is installed, power will be supplied to the data cached in memory and the cached writes can be completed when power is restored.

IMPORTANT!

- *The default optimization mode is for "Sequential." Optimization mode for sequential is automatically applied to any logical configuration of drives larger than 512GB.*

8.3 Viewing the Connected Drives

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


Cache Status: Clean

Quic
view
view
view
view
view
view
view
syst
view
view

Slot	Chl	ID	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
	2	0	2010	20MB	NONE	NEW DRV	
	2	1	2010	20MB	NONE	NEW DRV	
	2	2	2010	20MB	NONE	NEW DRV	
	2	3	2010	20MB	NONE	NEW DRV	
	2	4	2010	20MB	NONE	NEW DRV	
	2	5	2010	20MB	NONE	NEW DRV	
	2	6	2010	20MB	NONE	NEW DRV	
	2	8	2010	20MB	NONE	NEW DRV	

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

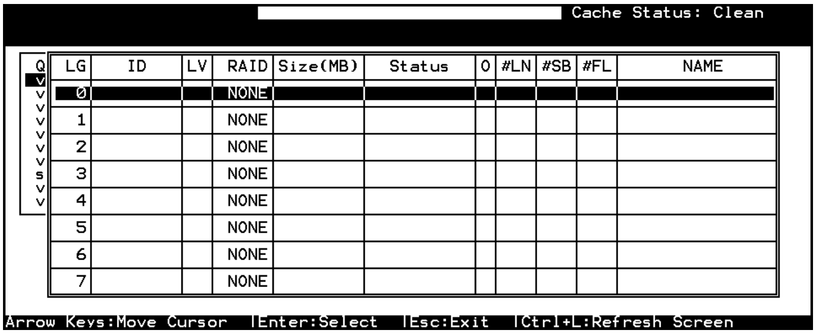
Use arrow keys to scroll down to “View and Edit SCSI Drives.” This will display information of all the physical drives installed.

To learn more about the legends used in each column, please refer to the previous chapter.

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

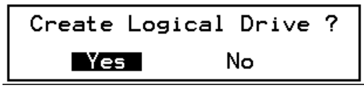
8.4 Creating a Logical Drive

Browse through the main menu and select “View and Edit Logical Drive.”



For the first logical drive on RAID, simply choose LG 0 and press **[ENTER]** to proceed. You may create as many as eight logical drives from drives on any SCSI bus.

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

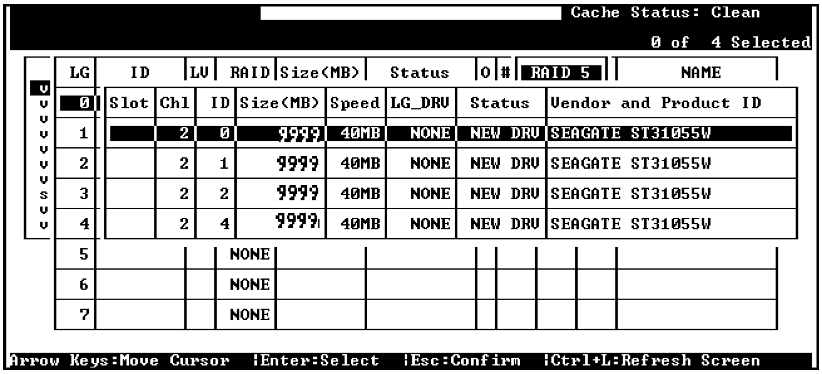


Choosing RAID Level:

A pull-down list of supported RAID levels will appear. In this chapter, RAID 5 will be used to demonstrate the configuration process. Choose a RAID level for this logical drive.

Choosing Member Drives:

Choose your member drive(s) from the list of available physical drives. The drives can be tagged for inclusion by positioning the cursor bar on the 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 – ¯ keys to select more drives.



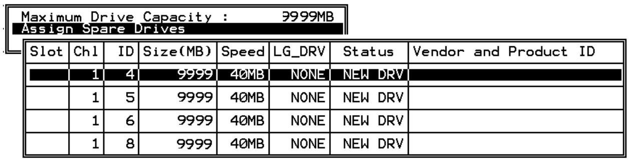
Logical Drive Preferences:

After member drives are selected, a list of selections will appear.

Maximum Drive Capacity:

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

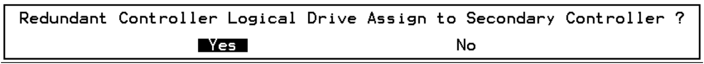
Assign Spare Drives:



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

A logical drive composed in a none-redundancy RAID level (NRAID or RAID 0) does not support spare drive rebuild.

Logical Drive Assignments:



If you use two controllers for the redundant configuration, a logical drive can be assigned to either of the controllers to balance workload. The default is primary controller, press **[ESC]** if change is not preferred. Logical drive assignment can be changed any time later.

Press **[ENTER]** to confirm and then press **[ESC]** to continue when all the preferences have been set.

```
Raid Level                 : RAID 5
Online SCSI Drives         : 4
Maximum Drive Capacity     : 9999 MB
Spare SCSI Drives          : 1
Logical Drive Assignment: Primary Controller

          Create Logical Drive ?

            Yes                  No
```

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

```
Initializing
Notification
[2181] LG:0 Logical Drive NOTICE: Starting Initialization
```

A controller event will prompt to indicate the logical drive initialization has begun. Tap **[ESC]** to cancel the "Notification" prompt and a progress indicator will be displayed on the screen as a percentage bar.

```
Initializing

39% Completed
```

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

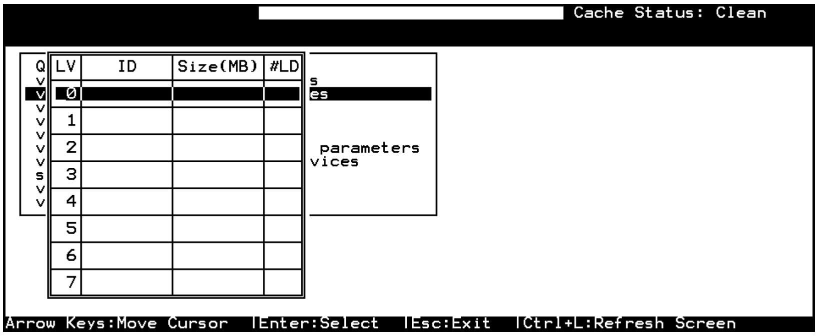
Once the logical drive initialization is completed, use the **[ESC]** key to view the status of the created logical drive.

```
LG  ID        LV  RAID   Size(MB)  Status  O  #LN  #SB  #FL  NAME
P0  69FCE89B  NA  RAID5       597    GOOD  R    4    1    0
    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
 6                NONE
 7                NONE
```

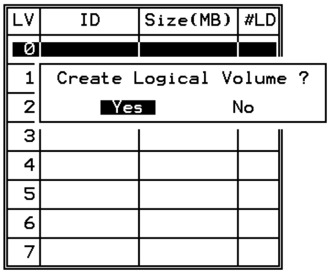
IMPORTANT!

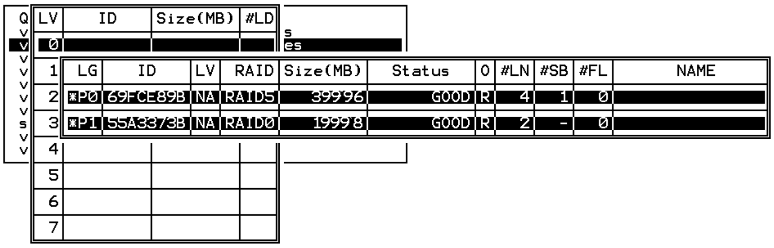
- *Mind that only logical drives with RAID level 1, 3 and 5 will take the time to initialize the logical drive. Logical drives with RAID level 0 and NRAID do not have the necessity to perform logical drive initialization; the drive initialization will be finished immediately.*

8.5 Creating a Logical Volume

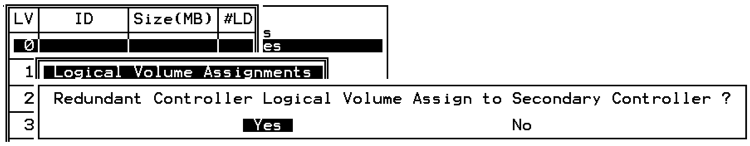


A logical volume consists of one or several logical drives. Choose "View and Edit logical volumes" in the main menu. The current logical volume configuration and status will be displayed on the screen. Choose a logical volume number (0-7) that has not yet been defined, then press **[ENTER]** to proceed.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

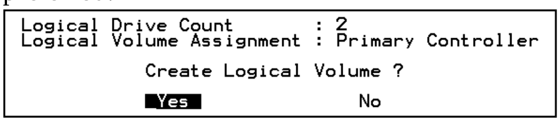




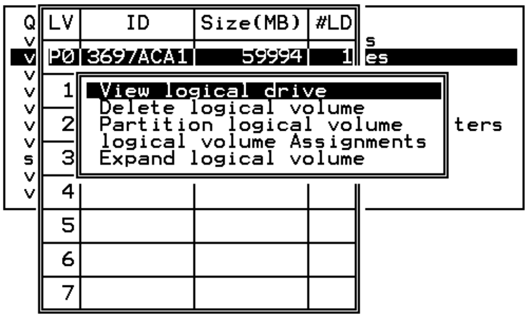
Select one or more logical drive(s) available on the list. The same as creating a logical drive, the logical drive(s) can be tagged for inclusion by positioning the cursor bar on the desired drive and then press **[ENTER]** to select. An asterisk (*) will appear on the selected drive. Press **[ENTER]**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



Logical volumes can also be assigned to different controllers (primary or secondary). Default is primary. Press **[ESC]** if change is not preferred.



As all the member logical drives are selected, press **[ESC]** to continue. The logical volume creation confirm box will appear. Choose **Yes** to create the logical volume.

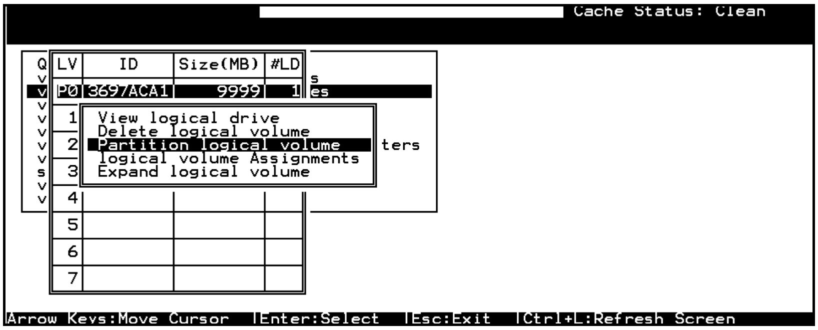


Press **[ENTER]** and the information of the created logical volume will appear.

LV:	Logical Volume number
P0:	Logical Volume 0 belongs to the primary controller
S0:	Logical Volume 0 belongs to the secondary controller
ID:	Controller random generated Logical Volume's unique ID
Size:	The capacity of the Logical Volume
#LD:	Number of the member logical drive(s)

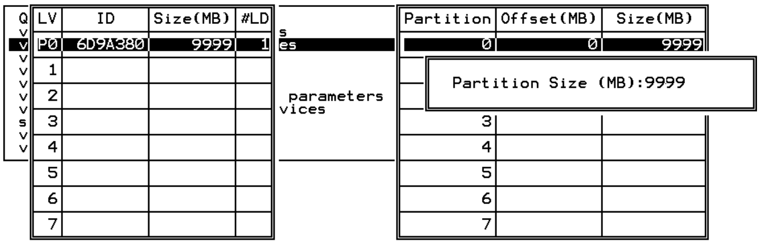
8.6 Partitioning a Logical Drive/Logical Volume

The process of partitioning a logical drive is the same as that of partitioning a logical volume. We take the partitioning of a logical volume for an example in the proceeding discussion. Please note that the partitioning of a logical drive or logical volume is not a must for RAID configuration.



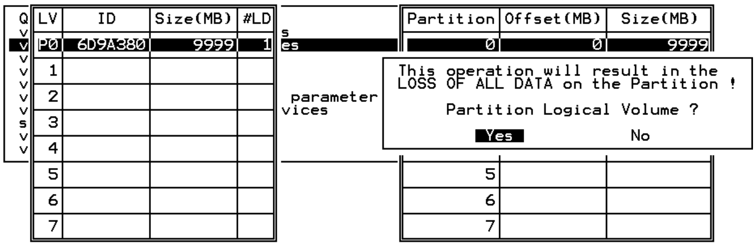
Choose the logical volume you wish to partition, then press **[ENTER]**. Choose "Partition logical volume" from the sub-menu, then press **[ENTER]**. Select from the list of undefined partitions and Press **[ENTER]**.

A list of the partitions for this logical volume will appear. If the logical volume has not yet been partitioned, all the logical volume capacity will list as "partition 0."



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.

Choose **Yes** to confirm when prompted to the "Partition Logical Volume?" message. Press **[ENTER]** to confirm. Follow the same procedure to partition the remaining capacity of your logical volume.



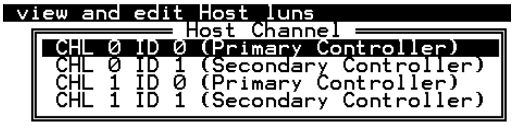
When a partition of logical drive/logical volume is deleted, the capacity of the deleted partition will be added to the last partition.

IMPORTANT!

- *As long as a partition has been changed, it is necessary to re-configure all host LUN mappings. All the host LUN mappings will be removed with any change to partition capacity.*

8.7 Mapping a Logical Volume to Host LUN

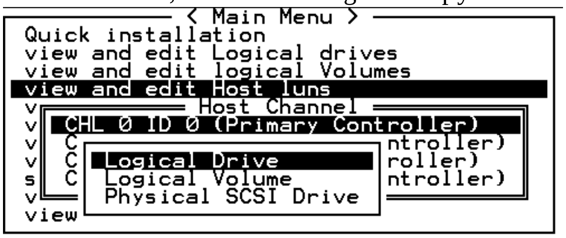
Select “View and Edit Host luns” in the main menu, then press **[ENTER]**.



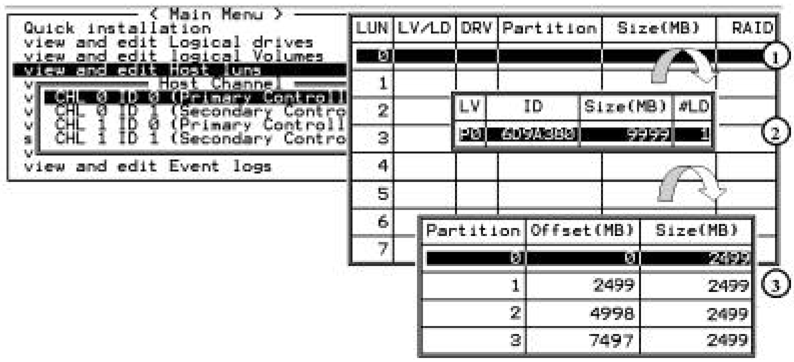
A list of host channel(s)/ID(s) combinations appear on the screen. The diagram above shows two host channels and each is designated with both a primary and a secondary ID. Multiple IDs on host channels are necessary for redundant controller configuration. Details on creating multiple IDs and changing channel mode will be discussed later. Choose a host ID by pressing **[ENTER]**.

Several details are noticeable here:

1. A logical group of drives (logical drive/logical volume) previously assigned to the primary controller can not be mapped to a secondary ID combination. Neither can that assigned to the secondary controller mapped to a primary ID.
2. ID 7 is reserved for the controller itself. If there are two controllers, controllers might occupy ID 6 and ID 7.



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



1. A list of LUNs and their respective mappings will be displayed on the screen. To map a host LUN to a logical volume’s partition,

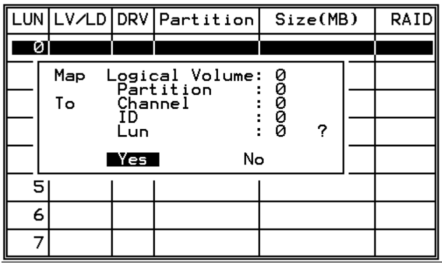
select an available LUN (one not mapped yet) by moving the cursor bar to the LUN, then press **[ENTER]**.

2. A list of available logical volumes will be displayed on the screen. Move the cursor bar to the desired logical unit, then press**[ENTER]**.

3. A list of available partitions within the logical volume will be displayed. Move cursor bar to the desired partition, then press **[ENTER]**. If you have not partitioned the logical volume, it will be displayed as one logical partition.

4. When prompted to “Map Host LUN," press **[ENTER]** to proceed. For access control over Fibre network, find in Chapter 9 details about "Create Host Filter Entry."

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



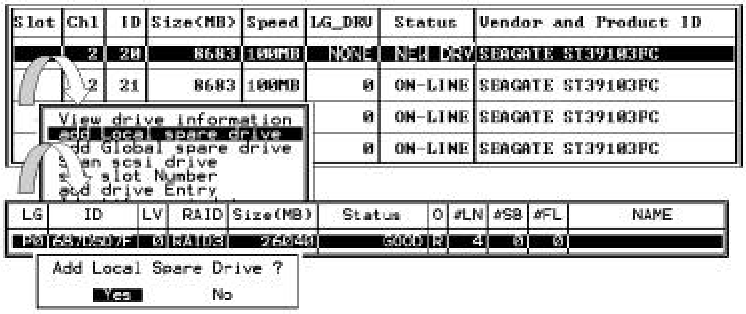
A prompt will display the mapping you wish to create. Choose **Yes** to confirm the LUN mapping you selected. The details in the confirm box read: partition 0 of logical volume 0 will map to LUN 0 of SCSI ID 0 on host channel 0.

If your controller has not been configured with a host channel and assigned with SCSI ID, please move on to section 8.12.

8.8 Assigning Spare Drive, Rebuild Settings

Adding Local Spare Drive

A spare drive is a standby drive automatically initiated by controller firmware to replace and rebuild a failed drive. A spare drive must have an equal or larger capacity than member drives. A local spare should have a capacity equal or larger than the members of the logical drive it is assigned to. A global spare should have a capacity equal or larger than all physical drives used in an array.



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

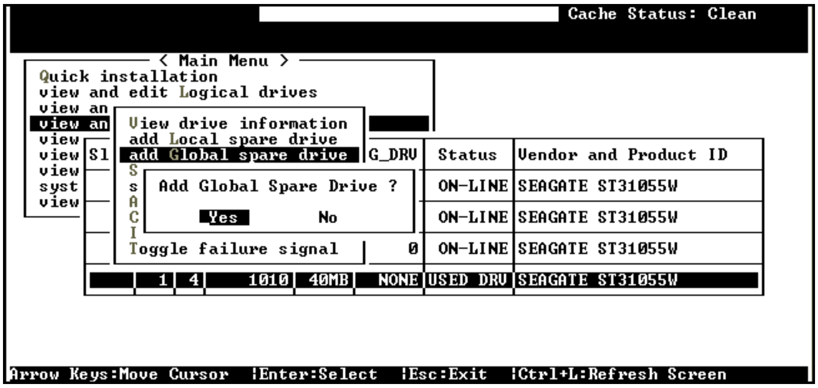
Choose “Add Local Spare Drive” and press **[ENTER]**. A list of available logical drives will be displayed on the screen.

Move the cursor bar to a logical drive, then press **[ENTER]**. The unassigned SCSI drive will be assigned to this logical drive as the Local Spare Drive.

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

Adding a Global Spare Drive

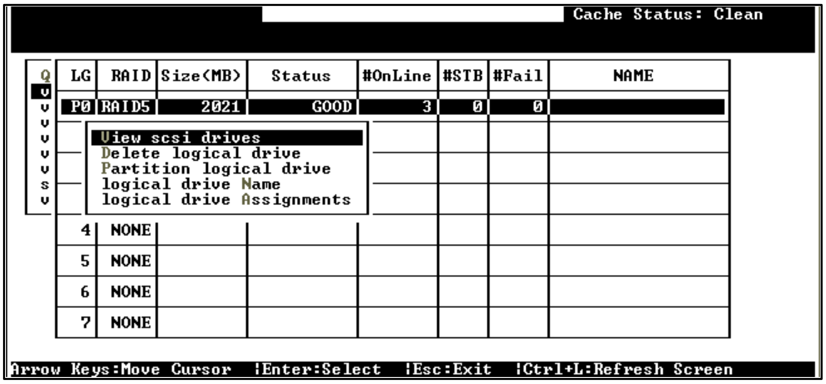
A global spare replaces and is used to rebuild any failed drive in any of the logical drives of a RAID array.



Move cursor bar to the SCSI drive that is not assigned to a logical drive or as a spare drive (usually indicated as a "New Drive"), and then press **[ENTER]**. Choose "Add Global Spare Drive." When prompted to "Add Global Spare Drive?," choose **Yes**.

8.9 Viewing and Editing Logical Drive and Drive Members

Choose "View and Edit Logical Drives" in the main menu. The current logical drive configuration and status will be displayed on the screen. Refer to the previous chapter for more details on the legends used in Logical Drive's Status. To view the SCSI drive members of the logical drive, choose the logical drive by pressing **[ENTER]**.

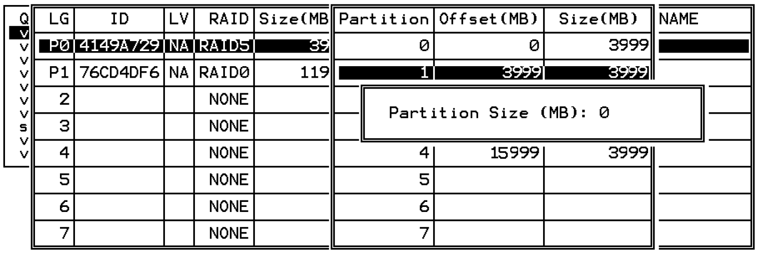


Choose "View SCSI Drives." The member drive information will be displayed on the screen.

Deleting Logical Drive

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

Deleting a Partition of a Logical Drive

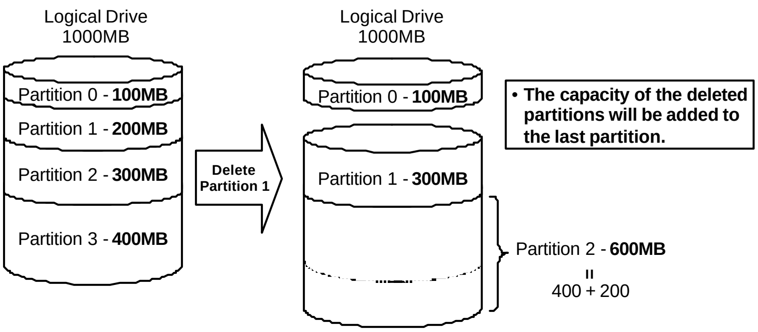


LG	ID	LV	RAID	Size(MB	Partition	Offset(MB)	Size(MB)	NAME
P0	4149A729	NA	RAID5	39	0	0	3999	
P1	76CD4DF6	NA	RAID0	119	1	3999	3999	
2			NONE					
3			NONE					
4			NONE		4	15999	3999	
5			NONE		5			
6			NONE		6			
7			NONE		7			

Partition Size (MB): 0

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 this partition.

Figure 8 - 1 Drive Space Allocated to the Last Partition



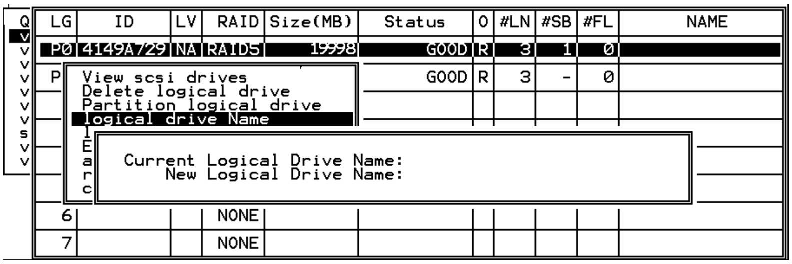
As illustrated above, the capacity of the deleted partition will be added into the last partition.

WARNING!

- *As long as a partition has been changed, it is necessary to reconfigure all host LUN mappings. All the host LUN mappings will be removed with any partition change.*

Assigning Logical Drive Name

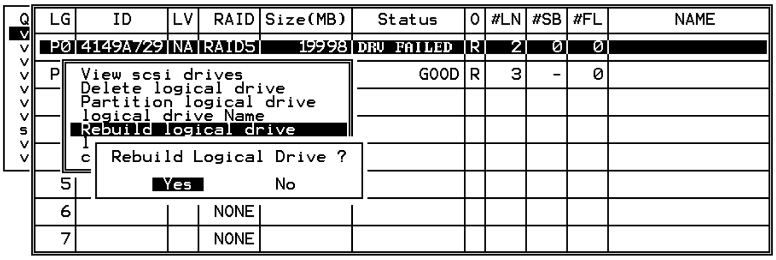
Naming a logical drive can help to identify different logical drives. In the event such as when one or more logical drives have been deleted, the drive indexing is changed after system reboot. The second logical drive might become the first on the list after system reboot.



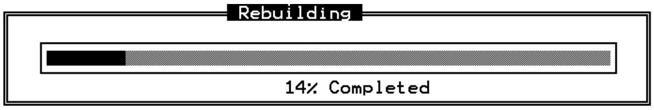
Choose the logical drive you wish to assign a name, then press **[ENTER]**. Choose "logical drive name," then press **[ENTER]** again. The current logical drive name will be displayed on the screen. You may now enter the new logical drive name in this field. Enter the logical drive name, then press **[ENTER]** to save the new name.

Rebuilding Logical Drive

If no spare drive is ready for logical drive rebuild, a failed drive should be replaced immediately by a new drive and the rebuild process should be initiated manually.



Choose the logical drive that has a failed member drive, then press **[ENTER].** Choose "Rebuild logical drive", then press **[ENTER].** When prompted to "Rebuild Logical Drive?," select **Yes**.



The rebuilding progress will be displayed on the screen.

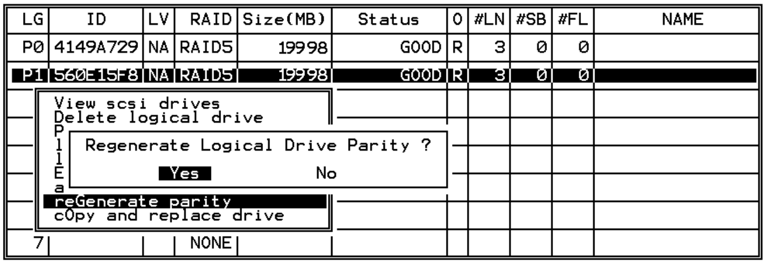
When rebuilding has already started or the logical drive has been automatically rebuilt by a Local Spare Drive or Global Spare Drive, choose "Rebuild progress" to view the rebuilding progress.

IMPORTANT!

- *The Rebuild function will appear only when a logical drive (with RAID level 1, 3 or 5) has a failed drive member. NRAID and RAID 0 configurations provide no data redundancy.*

Regenerating Logical Drive Parity

If no verifying method is applied to data writes, this function can be performed every so often by user to ensure bad sectors will not cause data loss in the event of drive failure. In a RAID unit, data is striped across multiple member drives and this function can regenerate parity and prevent bad blocks on drives.



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**.

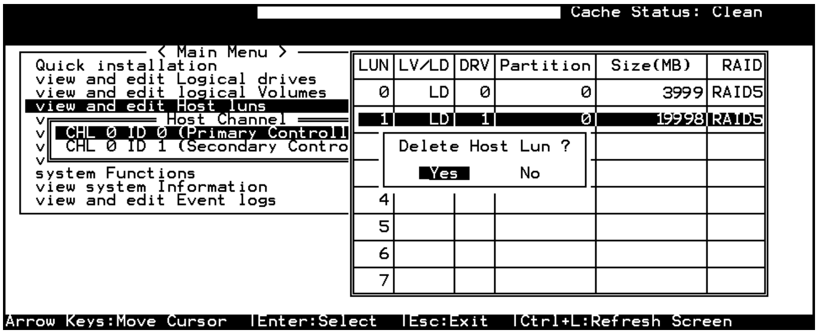
IMPORTANT!

- *If a regenerating process is stopped by a drive failure, the process cannot restart until logical drive rebuild has been completed.*

8.10 Viewing and Editing Host LUNs

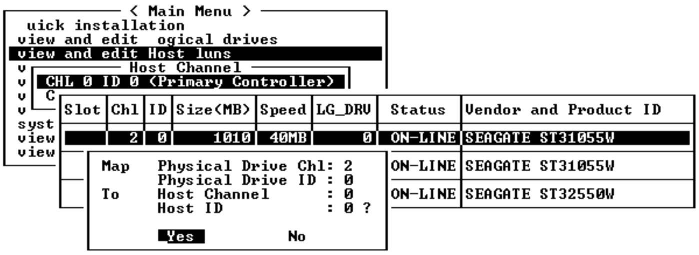
Viewing or Deleting LUN Mappings

Choose the host channel and SCSI ID of the LUN mapping you wish to view or delete.



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.

Pass-through SCSI Commands

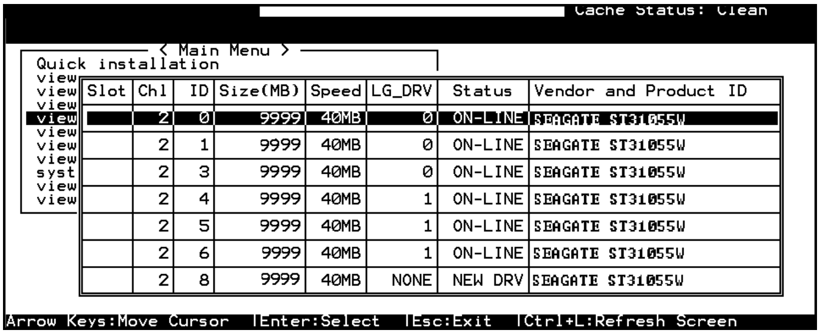


If you have primary and secondary controllers, move the cursor to the controller for the device that you wish to map; then press [**ENTER**]. You will be prompted to map a SCSI ID to a physical drive.

WARNING!

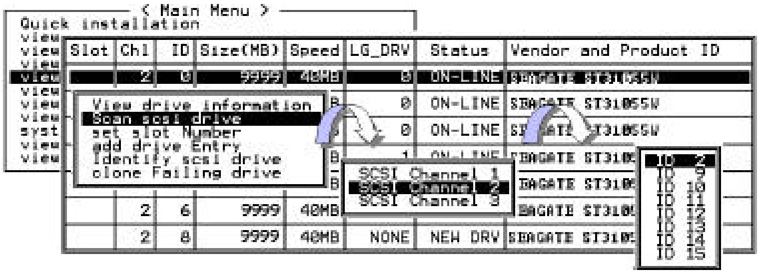
- *Pass-through SCSI Commands are only intended to perform maintenance functions for a drive or device on the drive side.* ***Do not*** *perform any destructive commands to a disk drive (i.e., any commands that write data to a drive media). This will result in inconsistent parity among drives included in a logical configuration of drives. If a disk drive is a spare drive or a member of a logical drive, such a destructive command may cause a data inconsistency.*
- *When a drive/device is mapped to a host SCSI ID so that Pass-through SCSI Commands can be used, the data on that drive/device will not be protected by the controller. Users who employ Pass-through SCSI Commands to perform any write commands to drive media do so at their own risk.*

8.11 Viewing and Editing SCSI Drives



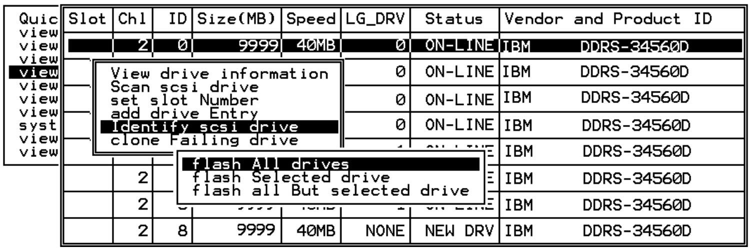
Choose "View and Edit SCSI Drives" in the main menu. All drives attached to the drive channels will be displayed on the screen.

Scanning New Drive

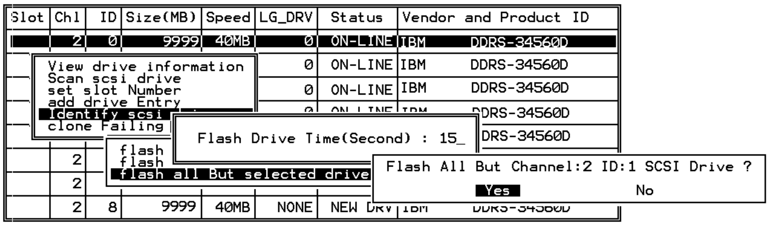


If there is a drive connected after the array is started, choose a drive and press **[ENTER].** Choose "Scan SCSI drive", then press **[ENTER].** The menu may vary according to the drive status. Choose the drive channel and SCSI ID of the drive you wish to scan, then press **[ENTER].**

Identifying Drive



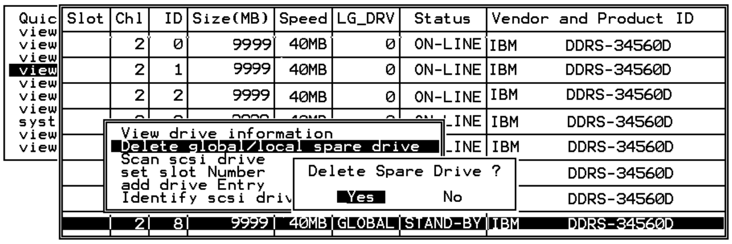
Move the cursor bar to the drive you wish to identify, then press **[ENTER].** Choose "Identify SCSI drive," then choose "flash all drives" to flash the read/write LEDs of all the drives in the drive channel. Choose **Yes**.



You may also choose "**flash selected drive**" or "**flash all But Selected drives**" to flash the read/write LED of the selected drive only, or all the drives except the selected drive. Choose **Yes** and choose an extent of time from 1 to 999 seconds.

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.

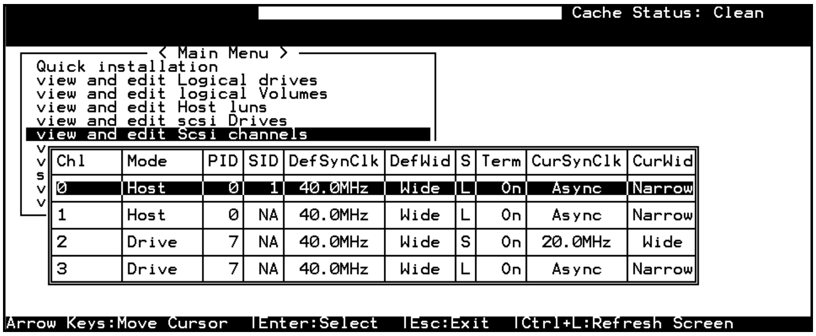


NOTE:

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

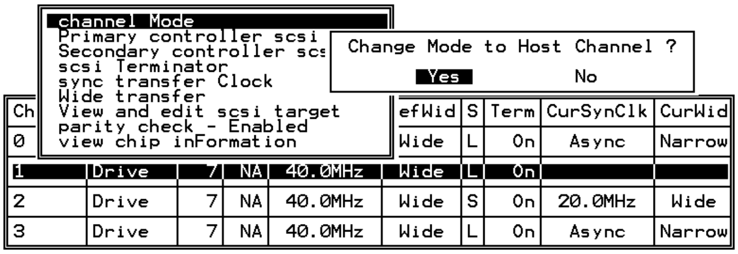
8.12 Viewing and Editing SCSI Channels

Except for those shipped in dual-redundant chassis, the factory default uses channel 0 as the host channel and also the communications path between controllers. If redundant controller configuration is preferred, you may need to assign other channel(s) as host. Flexibility is added for all channels can be configured as host or drive.



Choose "View and Edit SCSI Channels" in the main menu. Channel status will be displayed on the screen.

Redefining Channel Mode



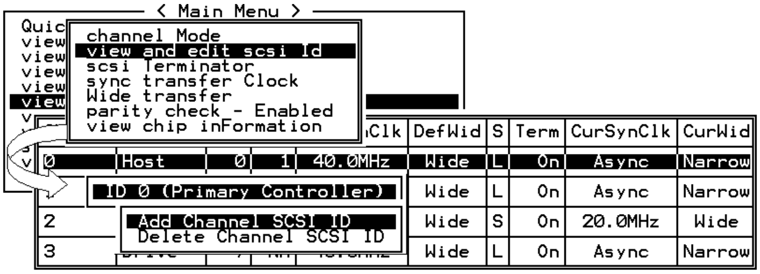
All channels can be changed into host mode or drive mode. Choose the channel you wish to change, then press **[ENTER]**. Choose "Channel Mode," then press **[ENTER]**. A dialog box will appear asking you to confirm the change.

Channel mode is related to the topological scheme. You may consider using data paths in pairs with host software support so that data access will not be interrupted if one data path should fail. More information on topologies is provided in the Hardware Manuals that came with your controller.

IMPORTANT!

- *Every time you change the channel mode, you must reset the controller for the change to take effect.*

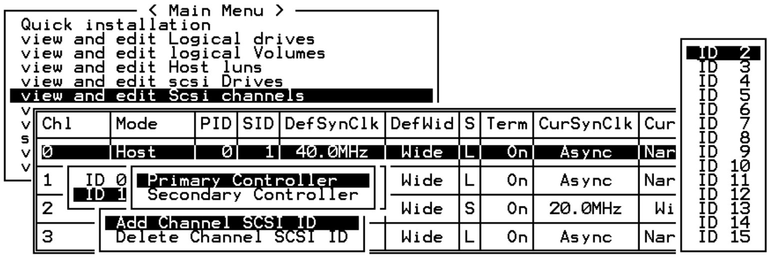
Viewing and Editing SCSI IDs / Host Channel



Choose a host channel, then press **[ENTER]**. Choose “View and Edit SCSI ID.” A list of existing ID(s) will be displayed on the screen.

Viewing and Editing SCSI IDs / Drive Channel

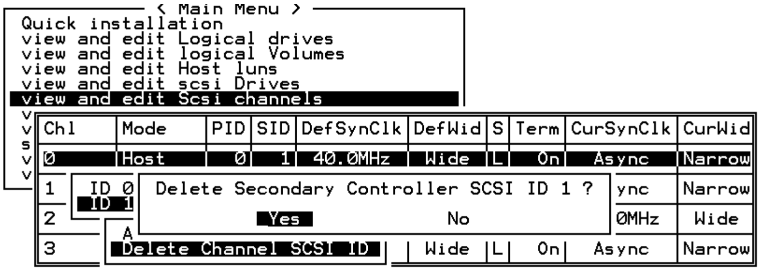
Adding a SCSI ID (Primary/Secondary Controller ID)



Press **[ENTER]** on one of the existing SCSI IDs. Choose “Add Channel SCSI ID,” then choose to assign an ID for either the “Primary Controller” or "Secondary Controller." A list of SCSI IDs will appear. Choose a SCSI ID. **DO NOT** choose a SCSI ID used by another device on the same channel. The defaults are PID=0 and SID=1 (SCSI channel). In redundant mode, logical drives mapped to a primary ID will be managed by the primary controller, and vice versa.

Host channel supports multiple IDs. One exception to this is Fibre channel. For controllers running firmware 3.21, each Fibre channel processor supports two hardware address IDs. For controllers running former firmware versions, two host channels are required for active-to-active configuration. Avail either a primary or a secondary ID on each of the host channels.

Deleting a SCSI ID

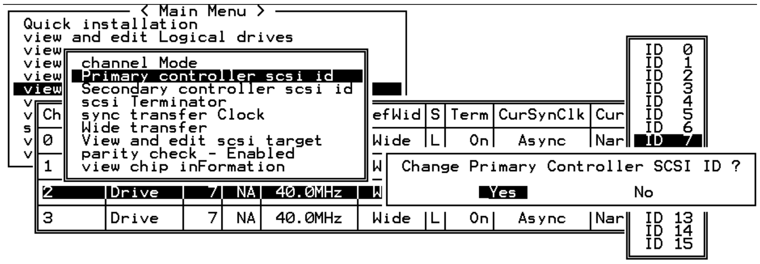


Choose the SCSI ID you wish to delete. Choose "Delete Channel SCSI ID." The dialog box "Delete Primary / Secondary Controller SCSI ID?" will appear. Select **Yes**, then press **[ENTER]** to confirm.

IMPORTANT!

- *Every time you change a channel's SCSI ID, you must reset the controller for the changes to take effect.*
- *The default SCSI ID of the primary controller (single controller configuration) on a host channel is 0, on a Drive channel is 7.*
- *If only one controller exists, you must set the Secondary Controller's SCSI ID to "NA." If a secondary controller exists, you need to set a secondary SCSI ID on host and drive channels.*
- *Multiple SCSI IDs can be applied to the Host and Drive channels.*
- *At least a controller's SCSI ID has to present on the SCSI bus.*

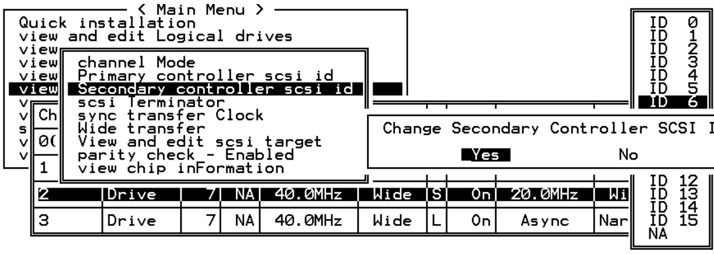
Setting a Primary Controller's SCSI ID / Drive Channel



Choose a drive channel, then press **[ENTER]**. Choose "Primary Controller SCSI ID." A list of SCSI IDs will be displayed on the screen. Now choose a SCSI ID. The dialog box "Change Primary Controller SCSI ID?" will appear. Select **Yes**, then press **[ENTER].**

For more details on ID settings in redundant mode, please refer to Chapter 12.

Setting a Secondary Controller's SCSI ID / Drive Channel

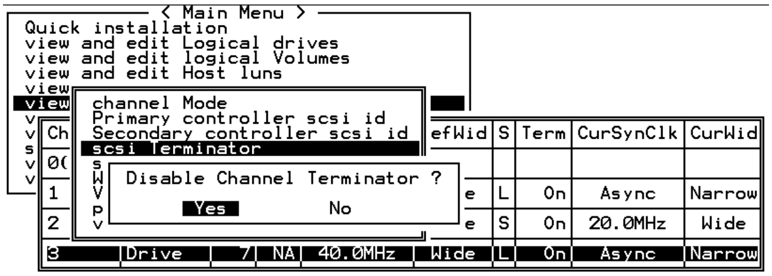


Choose a Drive channel, then press **[ENTER].** Choose "Secondary Controller SCSI ID." A list of SCSI IDs will be displayed on the screen. Assign a SCSI ID to the drive channel of the secondary controller. Choose a SCSI ID. The dialog box "Change Secondary Controller SCSI ID?" will appear. Select **Yes**, then press **[ENTER].**

IMPORTANT!

- *Every time you change a channel's SCSI ID, you must reset the controller for the changes to take effect.*
- *The default SCSI ID of the Host channel is 0, the Drive channel is 7. If there is only one controller, it is presumed by firmware as the primary controller.*
- *If only one controller exists, you must set the Secondary Controller's SCSI ID to "NA." If a secondary controller exists, you need to set a SCSI ID.*
- *Multiple SCSI ID can be applied to the Host channel while the Drive channel has one or two SCSI IDs (in redundant mode).*
- *At least a controller's SCSI ID has to be present on the SCSI bus.*

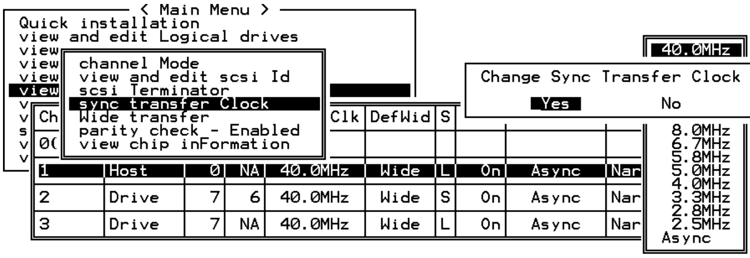
Setting a SCSI Channel's Terminator



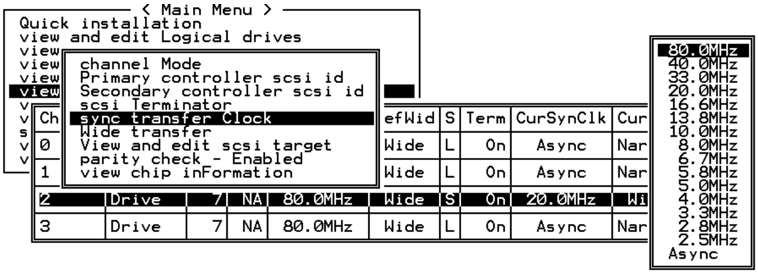
Choose the channel you wish the terminator enabled or disabled, then press **[ENTER].** Choose "SCSI Terminator", then press **[ENTER].** A dialog box will appear. Choose **Yes**, then press **[ENTER].** Terminator can also be enabled by switch jumpers, please refer to the controller hardware manual for more details.

Setting a Transfer Speed

Drive Channel



Host Channel

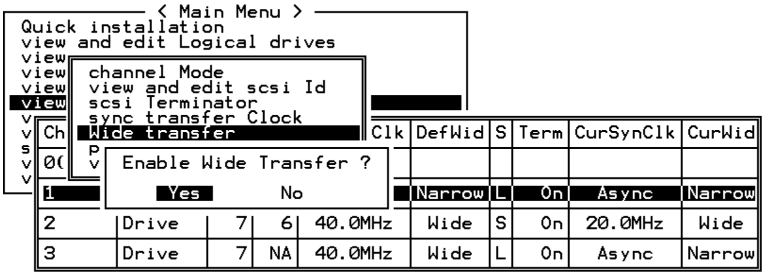


Move the cursor bar to a channel, then press **[ENTER].** Choose “Sync Transfer Clock”, then press **[ENTER].** A list of the clock speed will appear. Move the cursor bar to the desired speed and press **[ENTER]**. A dialog box “Change Sync Transfer Clock?” will appear. Choose **Yes** to confirm.

IMPORTANT!

- *Every time you change the SCSI Transfer Speed, you must reset the controller for the changes to take effect.*

Setting a Transfer Width

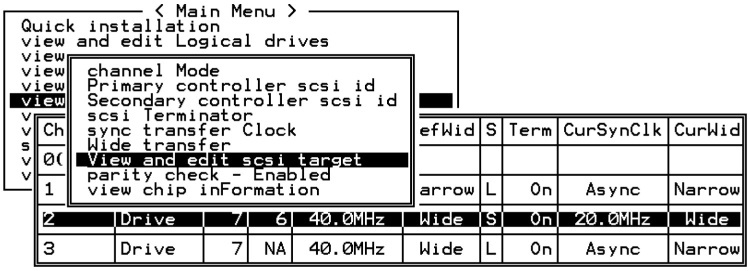


Move the cursor bar to a channel, then press **[ENTER].** Select “Wide Transfer,” then press **[ENTER]**. A dialog box “Disable Wide Transfer?” or “Enable Wide Transfer?” will appear. Choose **Yes** to confirm.

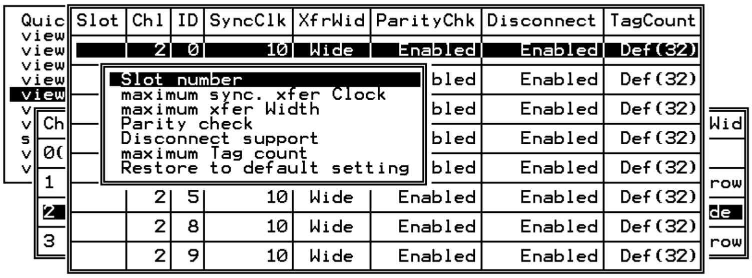
IMPORTANT!

- *Every time you change the SCSI Transfer Width, you must reset the controller for the changes to take effect.*

Viewing and Editing SCSI Target / Drive Channel



Move the cursor bar to a Drive channel, then press **[ENTER].** Select "View and Edit SCSI Target," then press **[ENTER]**.



A list of all the SCSI targets and their current settings will appear. Press **[ENTER]** on a SCSI target and a menu list will appear on the screen.

NOTE:

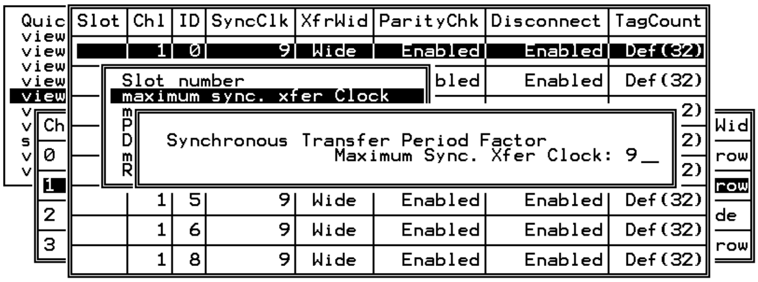
- *It is only recommended to alter the SCSI target settings when adjustments should be made to specific devices on a drive channel. You may change the SCSI parameters for specific drives when mixing different drives or connecting other SCSI device like a CD-ROM on a drive channel. Please note that neither mixing drives nor connecting CD-ROM is recommended for the controller.*

Slot Number

Choose "Slot Number", then press **[ENTER]**. Enter a slot number, then press **[ENTER]** again.

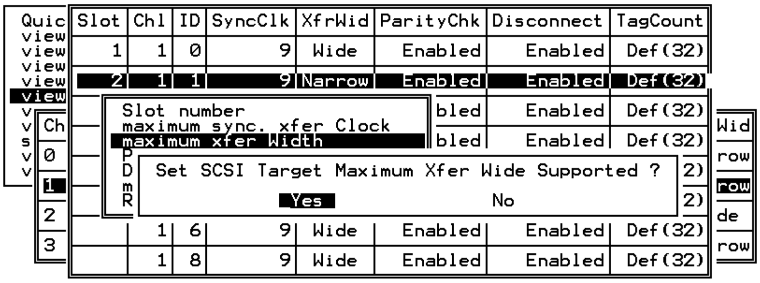
Please refer to Chapter 14, "Fault-Bus," for more information.

Maximum Synchronous Transfer Clock



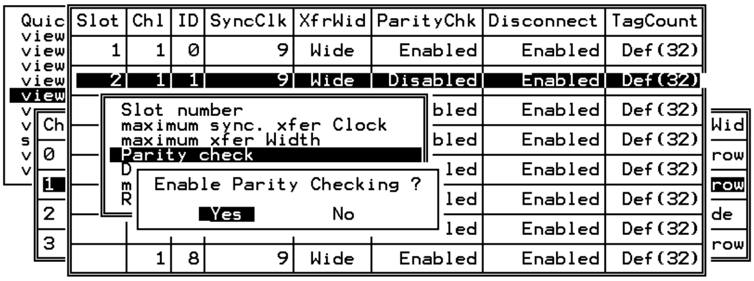
Choose “Maximum Sync. Xfer Clock,” then press **[ENTER].** A dialog box will appear on the screen. Enter the clock, then press **[ENTER]**.

Maximum Transfer Width



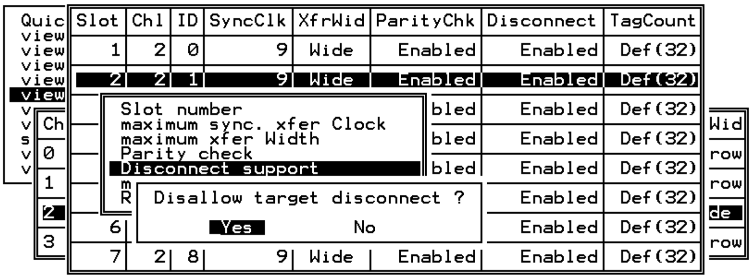
Choose “Maximum Xfer Width”, then press **[ENTER]**. Choose **Yes** in the dialog box to confirm the setting.

Parity Check



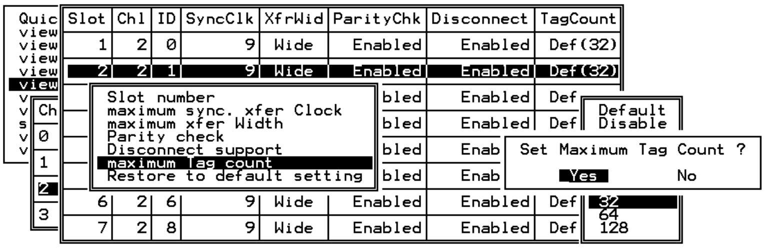
Choose “Parity Check.” Choose **Yes** in the dialog box that follows to confirm the setting.

Disconnecting Support



Choose "Disconnect Support." Choose **Yes** in the dialog box that follows to confirm the setting.

Maximum Tag Count

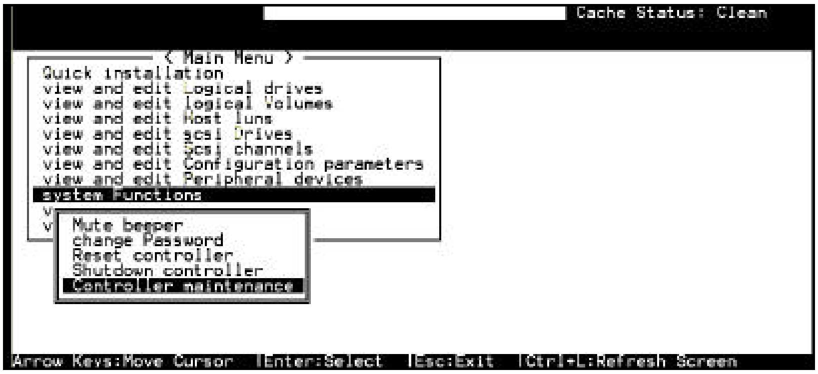


Choose "Maximum Tag Count," then press **[ENTER].** A list of available tag count numbers will appear. Move the cursor bar to a number, then press **[ENTER].** Choose **Yes** in the dialog box that follows to confirm the setting.

IMPORTANT!

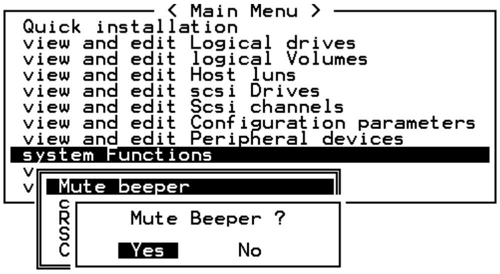
- *Disabling the Maximum Tag Count will disable the internal cache of the SCSI drive.*

8.13 System Functions



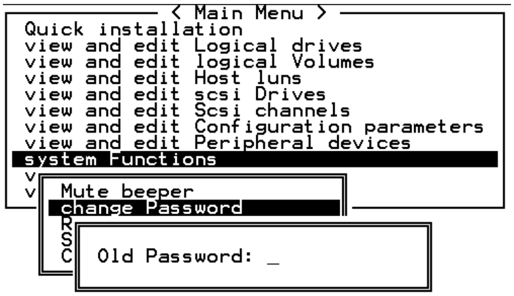
Choose "System Functions" in the main menu, then press **[ENTER].** The System Functions menu will appear. Move the cursor bar to an item, then press **[ENTER].**

Mute Beeper



When the controller's beeper 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 on the next event.

Change Password



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

IMPORTANT!

- *The controller is able to verify the password when entering the main menu from the initial screen or making configuration change. If the controller is going to be left unattended, the "Password Validation Timeout" can be set to "Always Check." Setting validation timeout to "always check" will protect the controller configuration from any unauthorized change.*
- *The controller password and controller name share a 16-character space. The maximum characters for the controller password is 15. When the controller name occupies 15 characters, there is only one character left for the controller password, and vice versa.*

Changing the Password

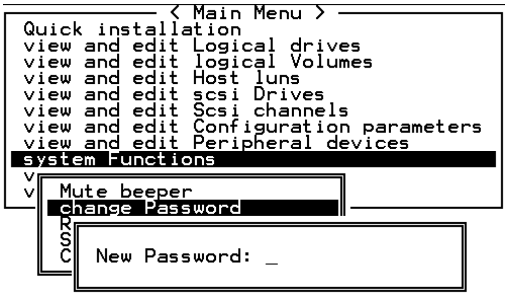
To set or change the controller password, move the cursor bar to "Change Password," then press **[ENTER]**.

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 can not be replaced unless a 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.

Setting a New Password



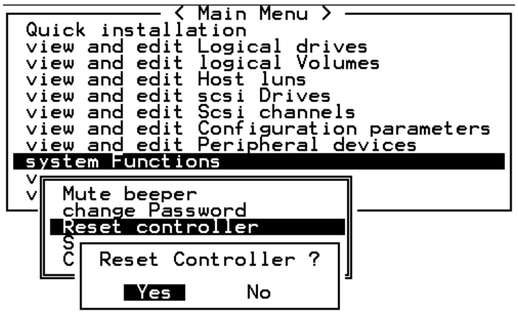
Enter the desired password in the column, then press **[ENTER].** The next dialog box will display "Re-Enter Password". Enter the password again to confirm and press **[ENTER]**.

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.

Disabling the Password

To disable or delete the password, press **[ENTER]** only in the password 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 from the Initial screen.

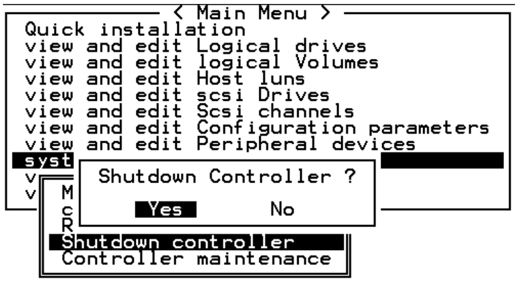
Reset Controller



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.

Shutdown Controller

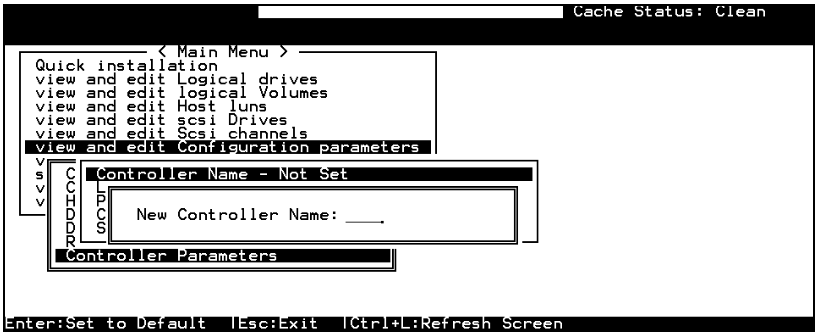
Before powering off the controller, unwritten data may still reside in cache memory. Use the "Shutdown Controller" function to flush the cache content. Move the cursor bar to "Shutdown Controller," then press [**ENTER**]. Choose **Yes** in the dialog box that follows, then press [**ENTER**]. The controller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



For "Controller Maintenance" functions, such as "Download Firmware," please refer to Appendix C.

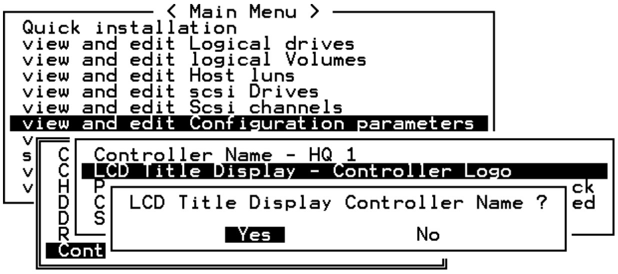
8.14 Controller Parameters

Controller Name



Choose "View and Edit Configuration Parameters," "Controller Parameters," then press **[ENTER]**. The current controller name will be displayed. Press **[ENTER]**. Enter the new controller name in the dialog box that follows, then press **[ENTER]**.

LCD Title Display Controller Name



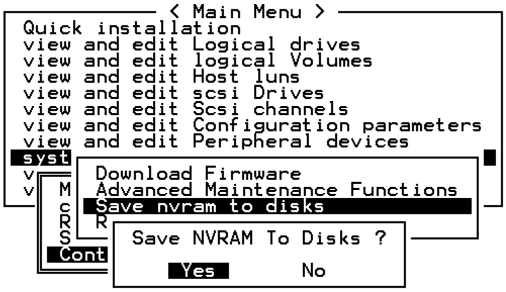
Choose "View and Edit Configuration Parameters," "Controller Parameters," then press **[ENTER]**. Choose to display the embedded controller logo or any given name on LCD. Giving a specific name to controller will help if you choose to configure a multiple number of RAID systems remotely through management software.

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 written to a logical configuration of drives.

First, 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 **[ENTER].**



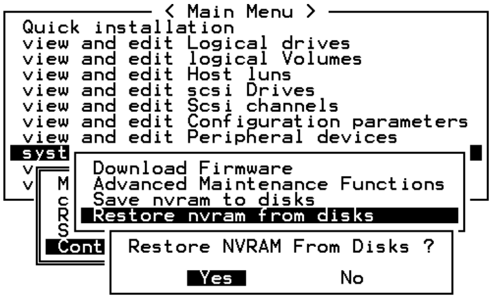
Choose **Yes** to confirm.

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

Restore NVRAM from Disks

When you want to restore your NVRAM information from what you previously saved onto disk, use this function to restore the configuration information.

From the main menu, choose "system functions." Use arrow keys to scroll down and select "controller maintenance," "restore NVRAM from disks," and then press **[ENTER].**

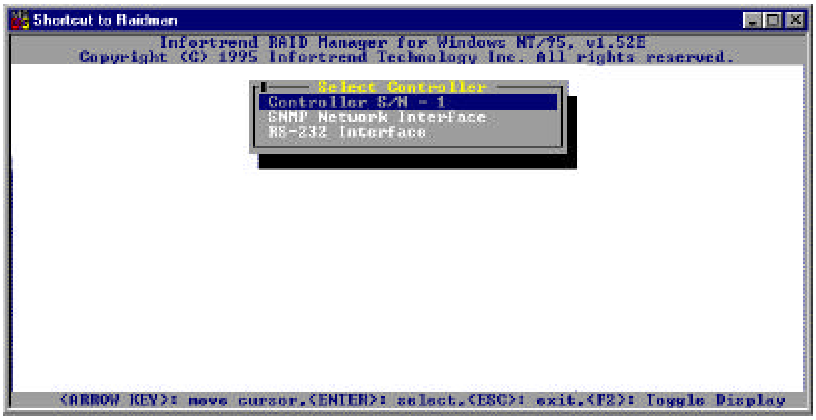


Press **Yes** to confirm.

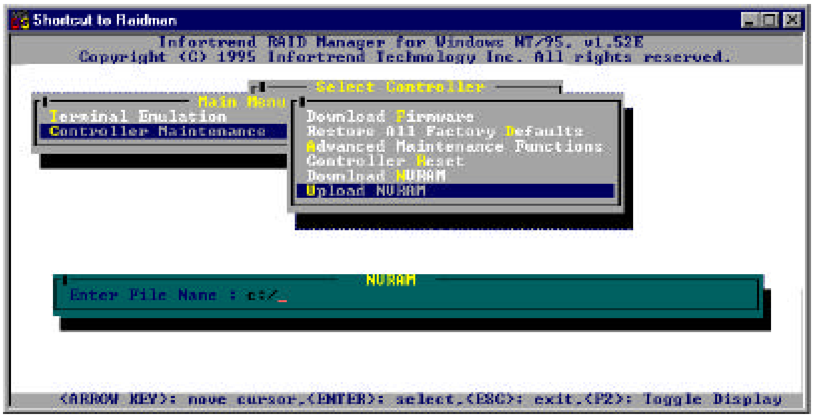
A prompt will notify you that the controller NVRAM data has been successfully restored from disks.

Saving NVRAM to File (via Text RAID Manager)

You can also save controller's configuration data as a file to your host computer. Run Text RAID manager and enable the connection to controller via in-band SCSI.



Execute the Text RAID manager program and select "Controller Maintenance." Press **[ENTER]** to proceed and then select "Upload NVRAM" as a file or "Download NVRAM" from a previously saved file.

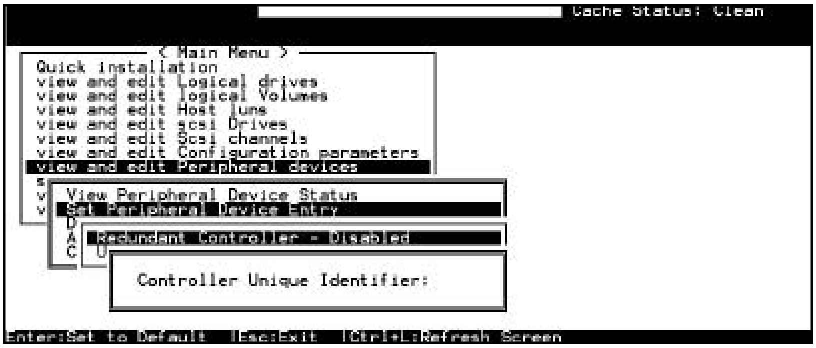


Provide location and file name, then press **[ENTER]** to proceed**.** The uploading or downloading process will be completed almost instantly.

Password Validation Timeout

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 one minute to always check. The always check timeout will disable any configuration change without entering the correct password.

Controller Unique Identifier

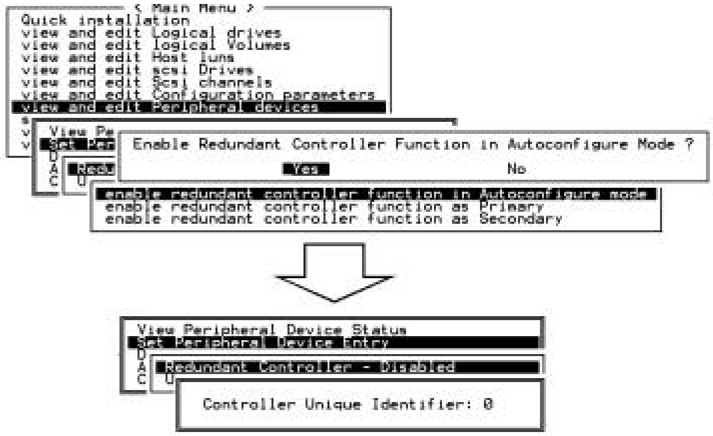


Controller Unique Identifier is ***required*** for operation with the ***Redundant controller configuration***. The controller will automatically notify users to enter a unique identifier when the first logical drive is created in a dual-controller system.

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 as the last two bytes.

In redundant mode, configuration data is synchronized between controllers. Host ports on both controllers appear with the same node name and each with a different port name (WWPN). When a controller fails and a replacement is combined as the Secondary controller, the node name will be passed down to the replacement. The host will not acknowledge any differences so that controller failback is totally transparent.

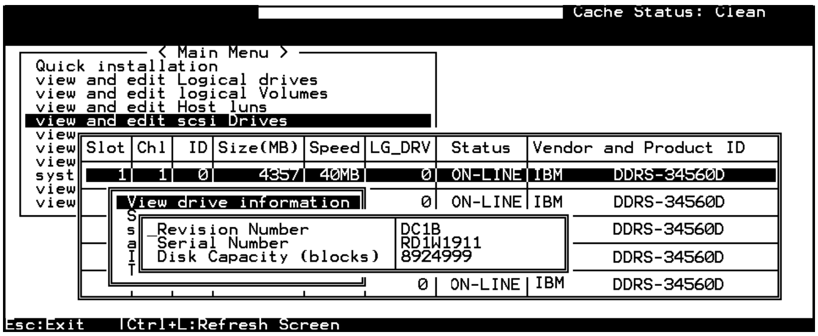
Choose “View and Edit Peripheral Devices,” “Set Peripheral Device Entry," then enable the "Redundant Controller" configuration. You will be requested to enter a value for the “Controller Unique Identifier.” Enter any number from **1** to **65535** and press **[ENTER]**. The identifier selection box will prompt automatically. The value you enter ***MUST*** be different for each controller.



The unique identifier can also be accessed from "View and Edit Configuration Parameters"→ "Controller Parameters"→ "Controller Unique ID."

8.15 SCSI Drive Information

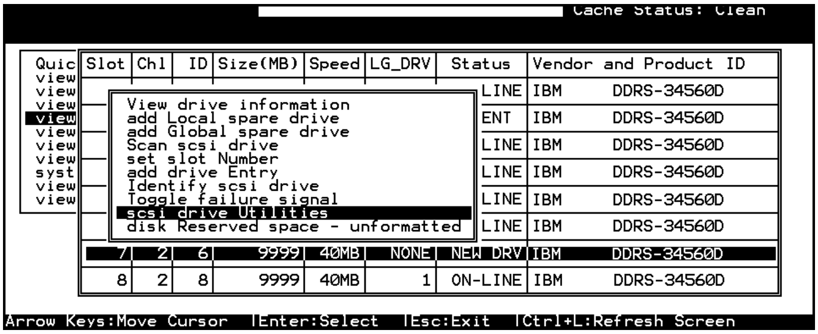
View Drive Information



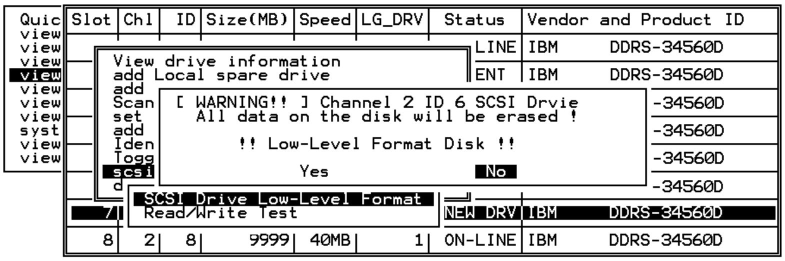
From the “View and Edit SCSI Drives” menu, select the drive that the utility is to performed on, then press **[ENTER]**. Select “View drive information," then press **[ENTER]**.

SCSI Drive Utilities

From the “View and Edit SCSI Drives” menu, select the drive that the utility is to performed on, then press **[ENTER]**. Select “SCSI Drive Utilities, then press **[ENTER]**. Choose either “SCSI Drive Low-level Format” or “Read / Write Test.”



SCSI Drive Low-level Format



Choose “SCSI Drive Low-level Format” and confirm by selecting **Yes**.

IMPORTANT!

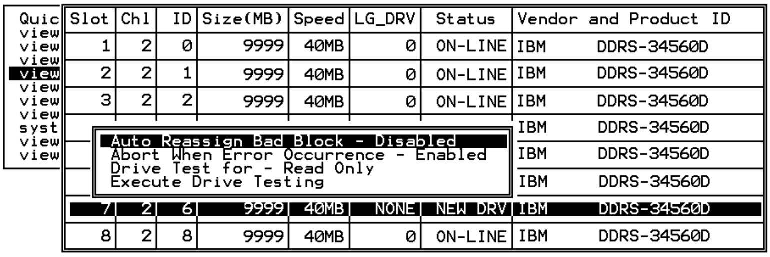
- *Do not switch the controller’s and/or SCSI disk drive’s power off during the SCSI Drive Low-level Format. If any power failure occurs during a drive low-level format, the formatting must be performed again when power resumes.*
- *All data stored in the SCSI disk drive will be destroyed during a low-level format.*
- *The SCSI disk drive on which a low-level disk format will be performed cannot be a spare drive (local or global) nor a member drive of a logical drive. The "SCSI Drive Low-level Format" option will not appear if the drive is not indicated as a "New Drive" or a "Used Drive."*

SCSI Drive Read/Write Test

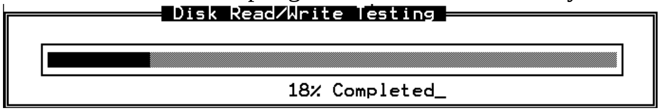
From the "View and Edit SCSI Drives" menu, select a new or used drive that the utility is to perform on; then press [**ENTER**]. Select "SCSI Drive Utilities," then press [**ENTER**]. Choose "Read/Write Test" and press [**ENTER**]. You can choose to enable/disable the following options:

1. Auto Reassign Bad Block;
2. Abort When Error Occurs;
3. Drive Test for - Read Only / Read and Write.

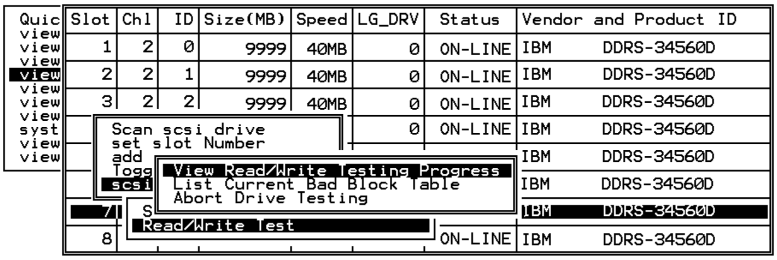
When finished with configuration, select "Execute Drive Testing" and press **[ENTER]** to proceed.

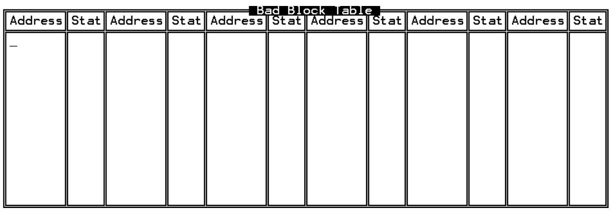


The Read/Write test progress will be indicated by a status bar.



You may press **[ESC]** and select "Read/Write Test" later and choose either 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 **[ENTER]** to proceed.





Chapter

9

Fibre Channel

9.1 Overview

Fibre channel is a device (in term of RAID, a data storage device) protocol capable of high data transfer rates. Fibre channel simplifies data bus sharing and supports not only greater speed, but also more devices on the same bus than SCSI. Fibre channel can be used over both copper wire and optical cable. It can be used for concurrent communications among multiple workstations, servers, storage systems, and other peripherals using SCSI and IP protocols. When a Fibre hub or fabric switch is employed, it provides means of interconnections in flexible topologies.

This chapter describes the Fibre-specific functions available since the firmware release 3.12 and above. Optional functions have been implemented for Fibre channel operation and access control under a multiple-host environment such as the Storage Area Network. Users familiar with Fibre channel configurations, please jump to section 9.4.

Data Availability:

Data availability is one of the major requirements for today's mission-critical applications. Highest availability can be accomplished by the following features as have been implemented in Infortrend's lines of controllers:

1. **Hot-plug capabilities:** controller hot-plug capability. With proper hardware and software configuration in dual controller mode, a failed controller can be replaced online while the existing controller is actively serving I/Os.
2. **Dual loop configurations:** dual loop provides path redundancy and greater throughput. The controller is capable of executing a load-sharing algorithm for a better dual loop performance.
3. **Controller communications over Fibre channel:** Selectable either via dedicated loop(s) or all drive loops. This allows a flexible and extended configuration of redundant controllers.

Scalability:

Fibre channel also brings scalability and upgradability to storage. In term of RAID system, storage expansion can be as easy as cascading another drive JBOD to a configured JBOD without powering down the running system. This also makes backup an easier job.

Different Fibre arrays can be daisy-chained. Up to 125 devices can be configured in a single Fibre loop.

Basic components:

A storage network built on Fibre channel may consist of the following components: Fibre channel HBAs, Hubs, fabric switches, or Fibre-to-SCSI bridges.

Fibre Channel HBAs:

Fibre channel adapters of a host computer, server, or workstation.

Fibre Hubs:

An Arbitrated Loop Hub is a wiring concentrator. "Arbitrated" means that all nodes communicating over this Fibre loop are sharing a 100MBps segment. Whenever more devices are added to a single segment, the bandwidth available to each node is further divided. A loop configuration allows different devices in the loop to be configured in a token ring style. With a Fibre Hub, a Fibre loop can be re-arranged in a star-like configuration for the Hub itself contains port bypass circuitry that forms an internal loop inside. Bypass circuits can automatically reconfigure the loop once a device is removed or added without disrupting the physical connection to other devices.

Fabric Switch:

A Fabric switch functions as a routing engine, which actively directs data transfer from source to destination and arbitrates every connection. Bandwidth per node via a Fabric switch remains constant when more nodes are added, and a node on a switch port uses an up-to-100MBps data path to send or receive data.

9.2 Supported Features

Hardware Features:

Fibre Chip

Fibre loops (1 Gbit FC-AL) comply with (FC-PH) X2.230:1994, (SCSI-FCP) X3.269:1996, (FC-AL-2) Project 1133-D rev.6.5, and (SCSI-2) X3.131-1994, supporting sustained 1 Gigabit/sec (100MB/sec) transfer rates. Each Fibre loop can be independently configured for connection to host or drive.

Loop ID:

Each channel configured as host loop supports two hard loop IDs in the range from 0 to 125.

Supported ways to address a Fibre port include Hard assigned and Soft assigned. The controller supports automatic loop ID assignment on drive channel. Usually, a hard loop address ID can be assigned to disk drives by switching jumpers on enclosure backplane. If the AL_PA configuration on the backplane is set to a neutral status, physical IDs will be assigned to drives automatically.

Firmware Features:

1. Host-Side Connection Mode:

Choosing the right connection mode is necessary for different link services. The selection for host-side connection protocol should comply with your Fibre channel topology. The controller default is "Loop Only." For example, if you combine two EonRAID controllers in a Fibre loop, your Fibre channel topology will necessarily be a private or public loop. You **MUST** select "loop only" in "View and Edit Host-side Parameters."

So far all the Fibre cards (HBA) are using "FC-AL" protocol even when they are used in point-to-point topology. For those supporting point-to-point connectivity, FC-AL is supported to maintain backward compatibility. It is safe to use "loop only" for most of the time and is not necessary to change this option.

The available options are:

- Loop only
- Point-to-point only
- Loop preferred, otherwise point-to-point
- Point-to-point preferred, otherwise loop

2. LUN Filtering: (RAID-Based Mapping)

LUN Filtering is a method used for separating and controlling accesses to data from the RAID controller. One major benefit of Fibre channel is the capability to share a common storage pool with multiple servers or workstations. However, allocation becomes an issue when every server in this network can access the data in a disk array. LUN Filtering provides a means for controlling data access if data is not allowed for every server.

Firmware provides the RAID-based facility and it is embedded with host-LUN mapping process. During the process of mapping a logical unit to host LUN, system integrators can create a **LUN Map** with reference to the WWPN port names that are specific to each host adapter. A **LUN Mask** can then be created as an access filter for including or excluding host adapter(s) from addressing specific storage unit. It is composed of an ID range which is configured to include one or more IDs. Different host adapters can then be identified by its IDs (device-specific port names) as included or excluded from range. The LUN mask is also defined with a Filter type as "read only," "read / write," or "exclude."

3. Redundant Loops:

Host-side and drive-side dual loops. The selection for "drive-side dual-loop" is enabled by default. While two channels are used to connect a group of physical drives, the two channels will automatically assume the same ID address and operate in duplex mode.

Redundant loops not only provide redundant data paths but also double the transfer throughput. The selection can be found in "View & Edit Drive-side Parameters" / "Fibre Channel Dual Loop."

4. Dynamic Load Balancing:

A mechanism is integrated to equally distribute I/O loads to loops configured as a redundant pair.

5. In-band Fibre:

"SCSI Pass-through" commands are supported over host and drive Fibre loops just as they are over SCSI channels. "In-band Fibre" protocol for packaging "External Interface" protocol commands / responses is supported over host Fibre loops (such as the Text RAID Manager). Drive-side S.E.S. device identification, monitoring and control are likewise supported over drive Fibre loops.

9.3 Configurable Options Related to Cabling Topologies

HBAs:

Fibre channel is widely applied to storage configurations with topologies that aim to avoid loss of data by component failure. To avoid single point of failure, the connections between source and target should be configured in redundant pairs. The recommended host side connection should consist of two host adapters. Each host adapter is used to configure a loop between host computer and storage.

In active-to-active redundant controller mode, the primary loop serves the I/O traffic directed to the primary controller, and its pair loop serves that to the secondary controller. The host-side management software directs I/O traffic to its pair loop should one of the redundant loops fail.

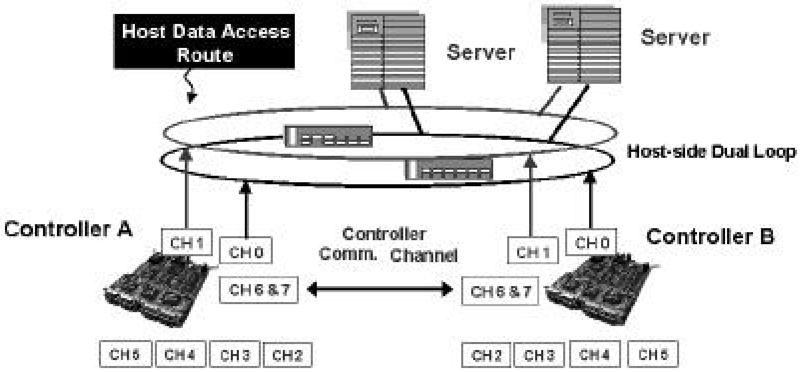
Considerations for Redundant Controller Configuration:

Active to Active Redundant Controller:

Using two HBAs in each server ensures continued operation when a data path fails.

With redundant paths, the connection to each host bus adapter should be considered a data path connecting host to the primary or the secondary controller. Multiple IDs can also be assigned on a single host loop, letting I/Os to be directed to both controllers via the same loop. To avoid single point of failure, one loop should be configured to serve the primary controller, and the other the secondary. Each of the target IDs on host channels should be assigned as either a primary ID or a secondary ID. Should one controller fail, the existing controller can inherit ID settings from its counterpart and activate the once standby channel (chip) to continue host I/Os.

Figure 9 - 1 Host Loop Connection: EonRAID 2000-4 in Redundant Mode



Controller/Host Channel	Status	ID Mapping
A / Fibre channel 0	Active	Primary ID
A / Fibre channel 1	Standby	N / A
B / Fibre channel 0	Standby	N / A
B / Fibre channel 1	Active	Secondary ID

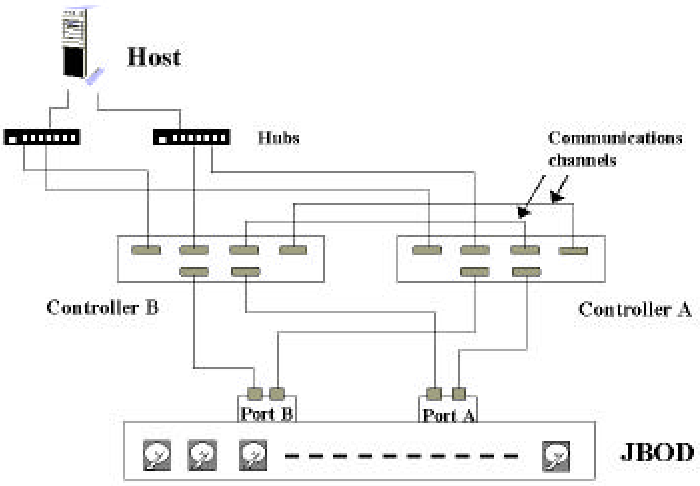
In the unlikely event of controller failure, the standby channels on an existing controller becomes an active route serving the host I/Os originally directed to the active channel on its pair controller. In addition to this, "application failover" software should be running on host computer to control the transfer of I/Os from one HBA to another should either of the data paths fail.

Table 9 - 1 Supported Configurations with Redundant Controller:

Controller	Host/Drive Connection	Host Side Cabling Topology
SentinelRAID series	Fibre to SCSI	Hub (private or public loop)/ direct host-storage
SentinelRAID R3 series	Fibre to SCSI	Hub/ point-to-point/ Fabric
EonRAID 2000-4 & 2000-6	Fibre to Fibre	Hub (private or public loop)/ direct host-storage
EonRAID 2000 R1 & 2000R2	Fibre to Fibre	Hub/ point-to-point/ Fabric

Controller	Drive Side cabling Topology	Sync. Cache Connection
SentinelRAID series	SCSI	SCSI CH0
SentinelRAID R3 series	SCSI	SCSI CH0
EonRAID 2000-4 & 2000-6	Drive Dual Loop supported	SCSI CH6/7, dedicated loops, or all drive loops
EonRAID 2000 R1 & 2000R2	Drive Dual Loop supported	SCSI CH6/7, dedicated loops, or all drive loops

Figure 9 - 2 Redundant Controller with Redundant Loops: EonRAID 2000-6's in Redundant Mode

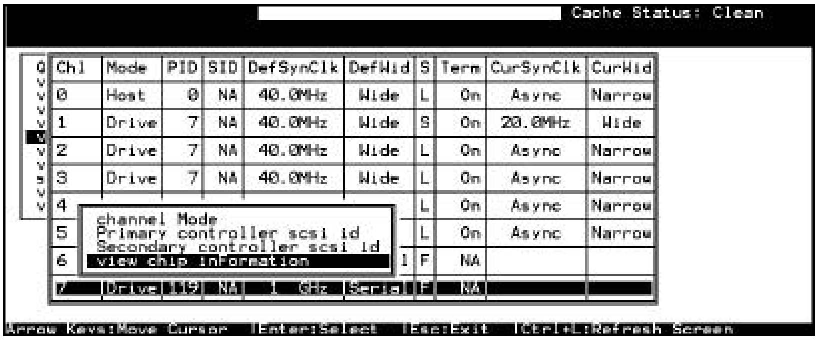


Host Redundant Paths

The controller passively supports redundant Fibre loops on the host side provided that the host has 3rd party software support implemented for this functionality.

9.4 Configuration: Host and Drive Parameters

View and Edit Fibre Channel



Channel Mode:

Every I/O channel can be configured as host or drive by changing its "Channel Mode."

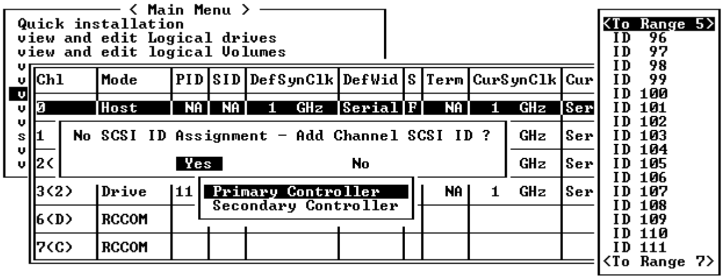
Primary and Secondary Controller IDs:

Select a channel by highlighting its status bar and press **[ENTER]**.

Following are parameters to set in redundant controller mode:

Drive Channel Each drive channel should be assigned with both a "Primary Controller ID" and a "Secondary Controller ID." By default, the primary and secondary IDs on drive channels are 119 and 120.

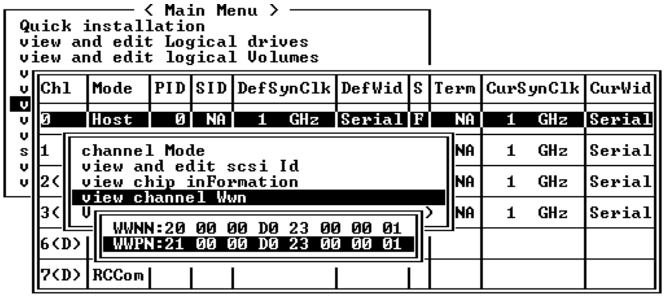
Host Channel Each logical unit (logical drive/logical volume/logical partition) can be mapped to a Primary controller ID or Secondary controller ID independently.



Communications Channel:

A host channel can be selected and converted into a communications channel. To convert a drive channel, change it into host mode and then select "RCCOM." Details can be found in the proceeding discussions.

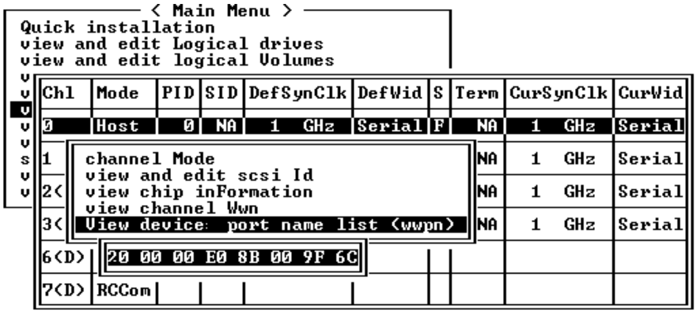
View Channel WWN



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

The controller has multiple channels (I/O paths) and each channel is powered by an I/O processor. This function allows users to inspect the processor's node name and port name. Some management software running on the host side require these names to address storage devices.

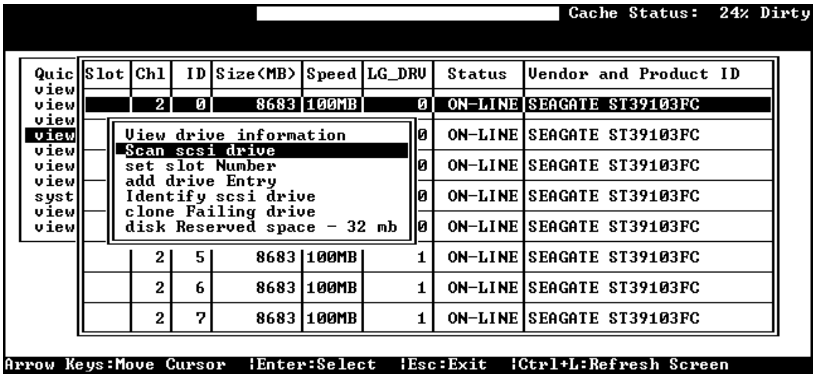
View Device Port Name List (WWPN)



This function displays device port names (host adapter ID) detected on a host loop. Device port names will be listed here except that of the controller's I/O processor itself.

The HBA port names detected can be added to the "**Host-ID WWN name list**" in "View and Edit Host LUN." Adding port names to list can speed the mapping process that follows. Each port name should then be assigned a nick name for ease of identification. This is especially the case when multiple filtering entries must be defined for granting or denying access to a specific storage unit. See the following sections for more details.

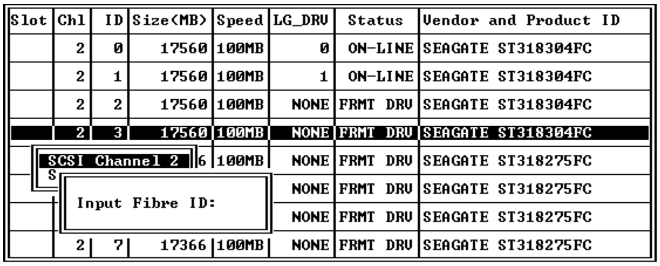
View and Edit Fibre Drive



Choose "View and Edit SCSI Drives" on the main menu and use the arrow keys to move the cursor bar through connected drives. Press **[ENTER]** to choose a drive, or **[ESC]** to return to the previous menu / screen.

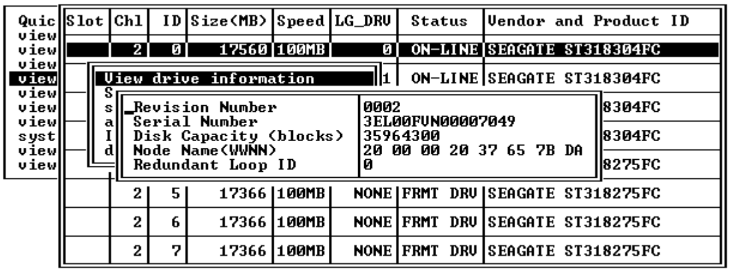
User-Assigned ID (Scan SCSI Drive)

Select "Scan SCSI drive" to assign an ID to drive.



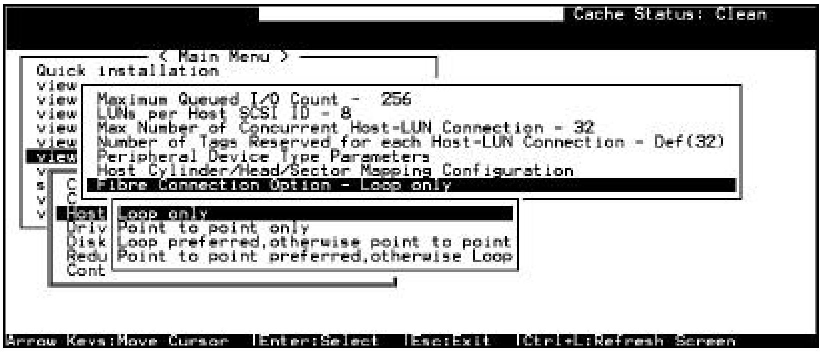
A drive enclosure usually has drive slots pre-assigned with IDs. There are occasions when an ID needs to be assigned manually to a device other than an ID provided otherwise. The "set slot number" and the "add drive entry" functions are reserved for Infortrend's Fault-bus operation.

View Drive Information



If the selected drive belongs to a drive group that is configured in a dual-loop, the "Redundant Loop ID" will be displayed here.

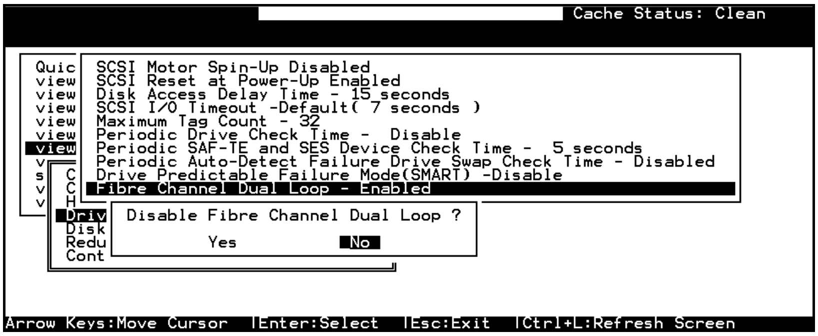
View and Edit Host-Side Parameters



Fibre Connection Options:

Use the - ¯ keys to scroll down to “View and Edit Configuration Parameters,” "Host-side SCSI Parameters," and then "Fibre Connection Option." A prompt will display all the options. Select one appropriate for your Fibre channel topology. If connection to host is through a Fibre hub, choose "Loop only." If connection to host is through a Fibre switch or directly to a server, choose "Point to point only." Proper selection is necessary and will decrease overhead on data transmission.

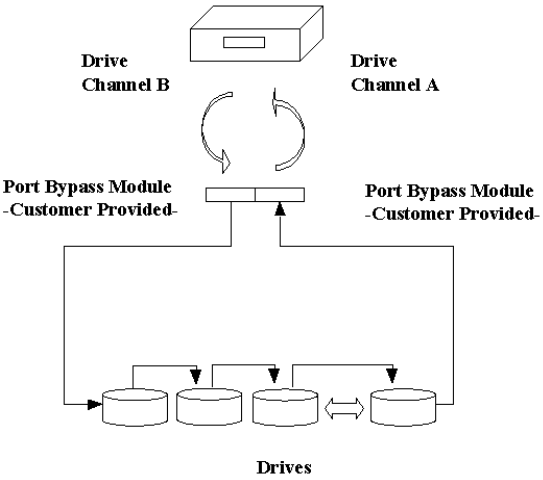
View and Edit Drive-Side Parameters



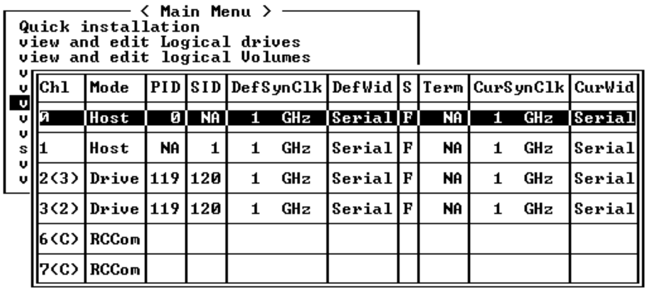
Connecting Drives with Fibre Channel Dual Loop:

Fibre drives are usually configured in a JBOD enclosure. Through the enclosure backplane, these drives form a circuit loop and the external connectors are provided as A port and B port. You may choose to assemble certain number of disk drives into a dual-loop configuration using two controller channels. To configure a dual-loop, you may connect one drive channel to the A port and another to the B port of drive enclosure (JBOD). The dual-loop configuration not only doubles traffic bandwidth by separating the transmitting and receiving paths but also provides path redundancy. Read/Write will be continued should one channel fail.

Figure 9 - 3 Dual Loop Configuration



Controller firmware will automatically examine the node names and port names of all the connected drives once initiated. If devices on two different drive channels appear with the same loop ID and port name, controller will consider these two drive channels as a "dual loop."



Chl	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid
0	Host	0	NA	1 GHz	Serial	F	NA	1 GHz	Serial
1	Host	NA	1	1 GHz	Serial	F	NA	1 GHz	Serial
2<3>	Drive	119	120	1 GHz	Serial	F	NA	1 GHz	Serial
3<2>	Drive	119	120	1 GHz	Serial	F	NA	1 GHz	Serial
6<C>	RCCom								
7<C>	RCCom								

The dual loop configuration will be displayed as "channel <pair channel>." For example, channel numbers are displayed as 2<3> and 3<2> if channel 2 and channel 3 are configured in a dual loop. The data bus will be operating at the bandwidth of up to 200MB/sec.

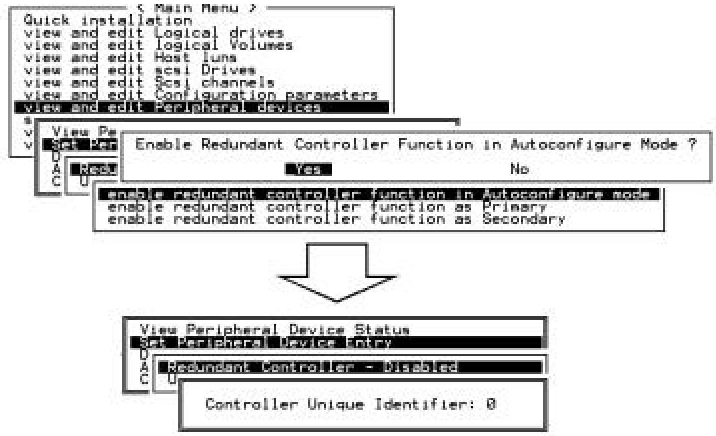
Controller Unique Identifier

A Controller Unique Identifier is ***required*** for operation with the ***Redundant controller configuration***. The controller will automatically notify users to enter a unique identifier when the first logical drive is 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 as the last two bytes.

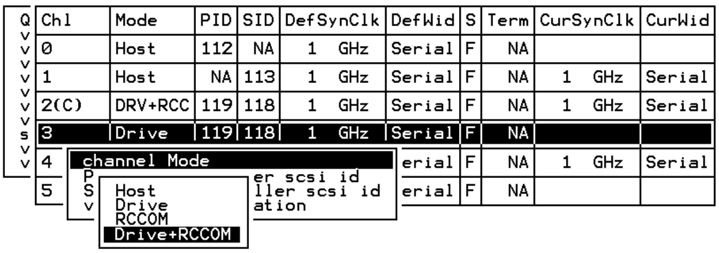
In redundant mode, configuration data is continuously synchronized between controllers. Host ports on both controllers appear with the identical node name and each with a different port name (WWPN). When a controller fails and a replacement is combined, the node name will be passed down to the replacement, making the host unaware of controller replacement so that controller failback is totally transparent.

Choose “View and Edit Peripheral Devices,” “Set Peripheral Device Entry," then enable the "Redundant Controller" configuration. You will be requested to enter a value for the “Controller Unique Identifier.” Enter any number from **1** to **65535** and press **[ENTER]**. The identifier selection box will prompt automatically. The value you enter ***MUST*** be different for each controller.



The unique identifier can also be accessed from "View and Edit Configuration Parameters"→ "Controller Parameters"→ "Controller Unique ID."

Controller Communications Over Fibre Loops



Chl	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid
0	Host	112	NA	1 GHz	Serial	F	NA		
1	Host	NA	113	1 GHz	Serial	F	NA	1 GHz	Serial
2(C)	DRV+RCC	119	118	1 GHz	Serial	F	NA	1 GHz	Serial
3	Drive	119	118	1 GHz	Serial	F	NA		
4					erial	F	NA	1 GHz	Serial
5					erial	F	NA		

With firmware release 3.14 and above, redundant controllers can communicate through Fibre channels. At this stage of development, this feature is supported with the EonRAID series (6-channel). If RCC (Redundant Controller Communications) over Fibre is preferred, some failover signals must be connected externally using the supplied 4-pin RCC cables.

Two schemes are available for controller communications over Fibre loops. Hardware configuration should be completed before firmware setting.

1. **Dedicated Communications loops**: One or two Fibre channels (designated as host channel) can be converted into the dedicated communications path for synchronizing cache and configuration data. Select from the main menu "View and Edit SCSI channels," and configure the selected FC channels into "RCCOM (Redundant Controller Communication)" mode. To guarantee data path redundancy, you may use two channels as the dedicated RCC loops. The dedicated channels should not be attached with any other devices.

2. **Communications traffic distributed over all drive loops**: Select all drive loops and configure them as "Drive+RCCOM (Drive Loops and Redundant Controller Communications)." The communications traffic between the two controllers will be automatically distributed over all drive loops.

Chl	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid
0	Host	112	NA	1 GHz	Serial	F	NA	1 GHz	Serial
1	Host	NA	113	1 GHz	Serial	F	NA	1 GHz	Serial
2(3;C)	DRV+RCC	119	118	1 GHz	Serial	F	NA	1 GHz	Serial
3(2;C)	DRV+RCC	119	118	1 GHz	Serial	F	NA	1 GHz	Serial
4(5;C)	DRV+RCC	119	118	1 GHz	Serial	F	NA	1 GHz	Serial
5(4;C)	DRV+RCC	119	118	1 GHz	Serial	F	NA	1 GHz	Serial

1. As displayed above, channel(s) selected as the communications paths will be displayed as "channel number (C: connected)" or "channel number (D: disconnected)." If channels configured in a dual-loop are selected, channel status will be displayed as "channel number (pair loop; C or D)."

2. If any communications loop should fail, the inter-controller traffic will be automatically shifted to over the remaining RCC loop(s).

Here is an example of Fibre-Fibre RCC configuration:

Controller	EonRAID 2000-6 x 2
Daughterboard Expansion	2 channels with 9282FA
Controller Presence Detect	
Signals connected through 4-pin RCC cables	

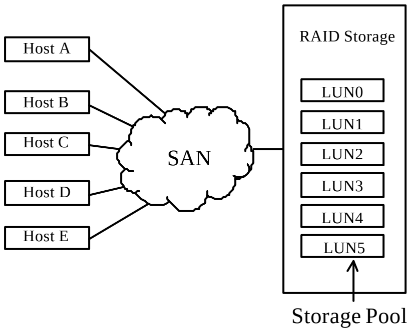
Sync. cache controller-controller communications	Over dedicated or all drive loops (user-configurable)

9.5 RAID-Based Mapping

RAID-based mapping provides access control over a Storage Area Network where:

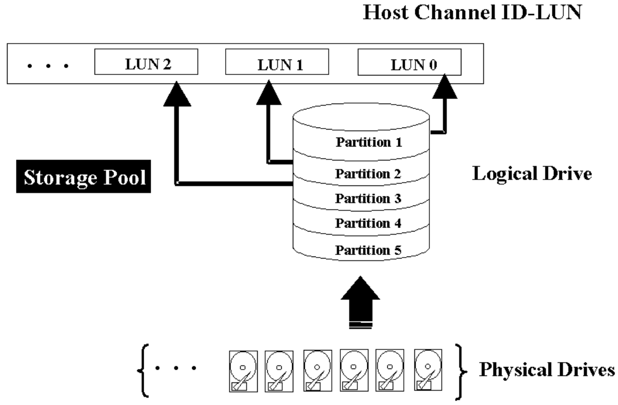
1. Servers share common storage;
2. File integrity becomes an issue and access contentions might occur;
3. File access must be coordinated among multiple servers.

Figure 9 - 4 Storage Pool



RAID-based mapping provides the centralized management for host-storage access. It is derived from the concept that storage can be divided into manageable pieces by mapping storage to different Logical Unit Numbers (LUNs). The storage can then be managed in the context of a LUN map. We then append filtering mask(s) to the LUNs making specific storage unit accessible or inaccessible to one or multiple host adapters.

Figure 9 - 5 Host-LUN Mapping

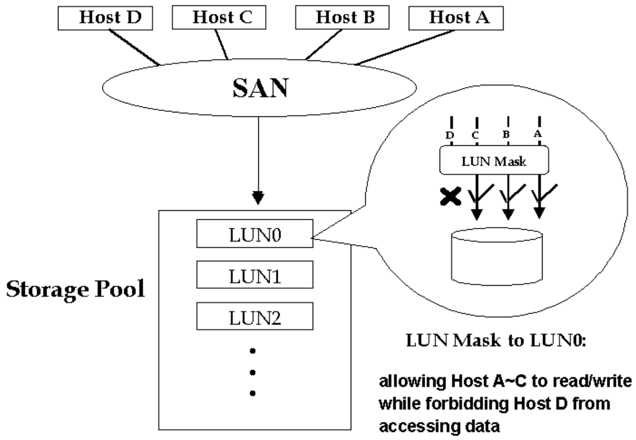


Creating LUN Masks

User can configure the storage subsystem to appear as 32 LUNs per Fibre target ID. Each LUN can be mapped with a storage unit -a partition or the entire logical drive. The configuration of logical units depends on host applications and how many drives and drive channels have been employed in the storage system.

The diagram below shows the idea of the virtual connection and the physical connection between storage and host computers. There are multiple host computers connected across a storage network and a system administrator may want to make each storage unit available for certain host systems while forbidding from some others.

Figure 9 - 6 LUN Mask

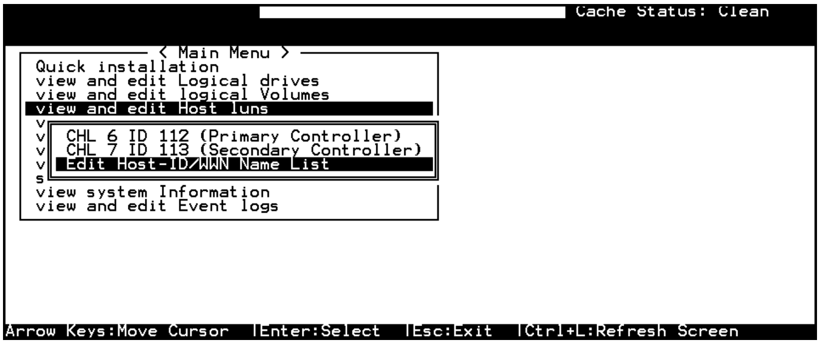


The access control can also be implemented by filter drivers. However, comparing to the control by software, access control based on controller LUN mapping can avoid overheads on server and the additional I/O latency. The LUN map combines **Host ID** (in the Fibre case, a 64-bit "**port name**;" in the SCSI case, the **initiator ID**) with the list of attributes of a LUN map that originally only consisted of the channel, target ID, and the LUN number.

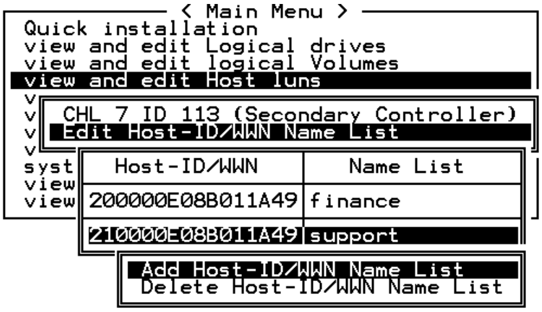
To create LUN masks, select "View and Edit Host LUNs" from Main Menu, then select a host data path (channel-ID combination). In active-to-active mode, selecting a host channel means selecting either the Primary or the Secondary controller I/O path.

WWN Name List

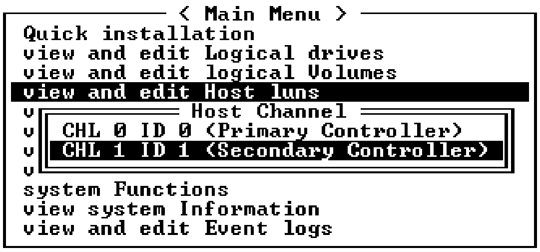
Before mapping host LUNs, you may add host adapter port names to a WWN name list to combine with a nick name given to each adapter. Names will be recorded in controller NVRAM.



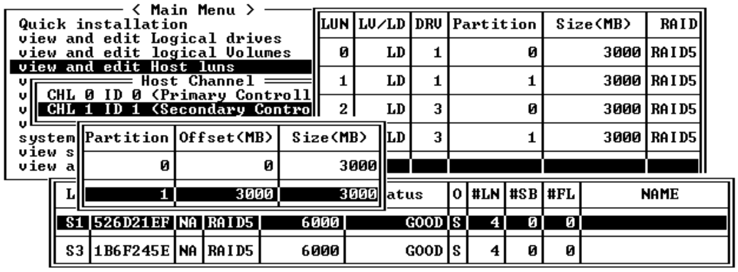
A named adapter (by location or the nature of host applications) can be easily identified and later combined with filtering mask.



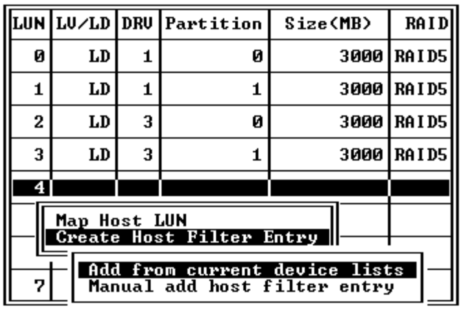
Logical Unit to Host LUN Mapping



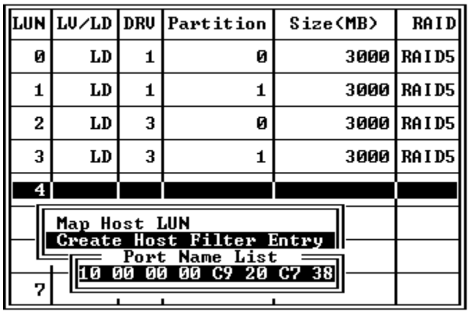
Assign Logical Unit Numbers (LUNs) to logical units (logical drive/logical volume/logical partitions). Select a host channel/ID and then select a LUN number. Select a Host LUN and associate a logical unit with it.



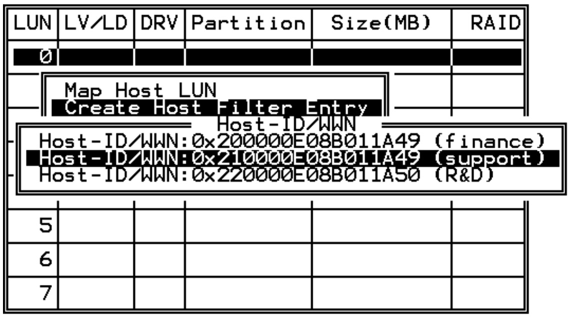
When a logical unit is selected, you may choose to "Map Host LUN" or "Create Host Filter Entry." If you select to map the logical unit directly to a host LUN without LUN masking, the particular logical unit will be accessible for all host computers connected through the network.

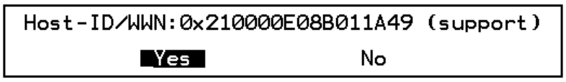


If you want the logical unit to be accessible for some host computers while inaccessible for some others, choose "Create Host Filter Entry." More than one filter entries can be appended to a host LUN to compose a more complex mapping scheme. LUN map is port name-oriented. You can choose to "Add from current device list" or "Manual(ly) add host filter entry."

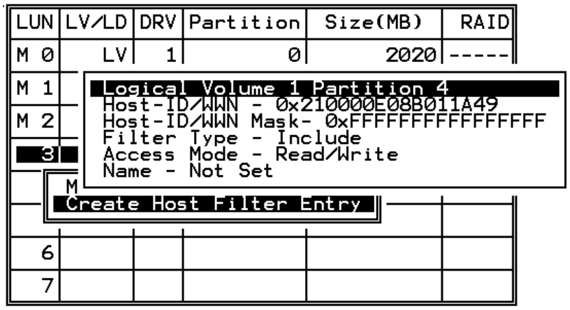


Pressing **[ENTER]** on "Add from current device list" will bring forth a list of port names detected on host loops. If you have a name list pre-configured, port names will appear with its nick names. Select a port name by pressing **[ENTER]**.





Choose Yes to proceed.



The next step is to edit Host ID/WWN Mask. Move cursor bar through the menu items and press ENTER on "Host ID/WWN Mask."

LUN Mask (ID Range) Configuration:

Ranges can be established by combining a basis ID with a mask similar to the way routing table entries are set up on a LAN/WAN. If the port name ID "AND'ed" with the mask equals the basis ID AND'ed with the mask, then the port name ID is considered to fall within the range. If a default value "0xFFFFFFFFFFFFFF" is selected, then the port name ID must match the basis ID for the port name to be considered to fall within the range. "0x" means that all values are presented in hexadecimal. If, for instance, a value "0xFFFFFFFFFFFFF**C**" is selected, and the basic ID is "0x11111111111111," port name IDs ranging from "0x….1110" to "0x….1113" will fall in the ID range.

Usually, a host HBA's port name can be used as the basic ID. If the host adapter's port name is used as the basic ID and the default mask value, "0xFFFFFFFFFFFFFF," is applied, the host will fall exactly within the ID range for the port name ID AND'ed with mask equals the basic ID AND'ed with mask.

Filter Type: Include or Exclude

Filter entry can serve both ends: to include or exclude certain adapters from data access.

Include: If a node's (a workstation or a server) WWN falls in an ID range specified as "Include," the node will be allowed to access the storage capacity mapped to the associated LUN. The access mode can be "read only" or "read / write."

Exclude: If a node's WWN falls in an ID range specified as "Exclude," the node will not be allowed to access the storage capacity mapped with this entry.

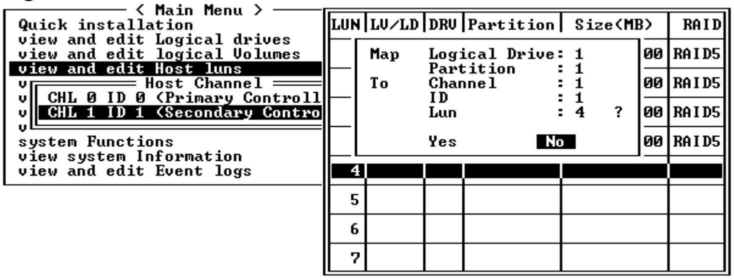
Multiple ranges, or filter entries, can be established for a single channel, target-ID, and LUN combination. Each range can have its own Exclude/Include attributes. The rules for determining whether a particular ID is considered as "included" or "excluded" are listed below:

1. If an ID falls within one or more Include ranges and does not fall in any Exclude range, then it is included.
2. If an ID falls within ANY Exclude range no matter if it also falls in another Include range, then it is excluded.
3. If the ID falls in none of the ranges and there is at least one Include range specified, then the ID should be considered as excluded.
4. If the ID falls in none of the ranges and only Exclude ranges are specified, then the ID is considered as included.

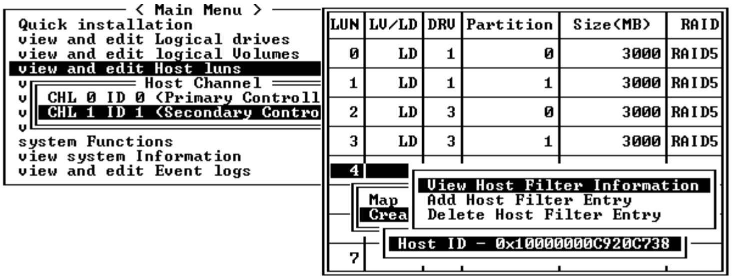
Access Mode: Read Only or Read/Write

A particular extended LUN map can be setup with an attribute of "Read Only" in the event that certain hosts may need to read the data on the media but must not be allowed to change it. In the degenerate case (range only includes a single ID), different hosts can be mapped with completely different logical drives/logical volumes/logical partitions even when they address the same channel, target-ID, and LUN.

When completed with configuring LUN mask, press **[ESC]** to map a logical unit to LUN.



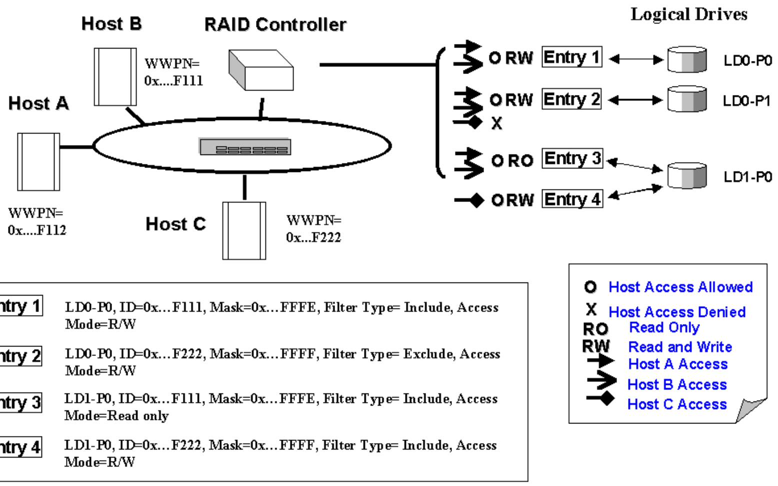
Multiple filter entries can be created for a Host ID/LUN combination, select the Host LUN again to enter the editing menu.



You may add more entries, delete or edit the existing entries.

Sample Configuration:

Figure 9 - 7 LUN Filtering - Configuration Sample



1. Host HBA port name (WWPN) list:
   Host A = 0x…F111
   Host B = 0x…F112
   Host C = 0x…F222

2. Controller Configuration:

   - Logical drives are LD0 and LD1. LD0 is partitioned into two: P0 and P1.
   - Filter Entry (LUN map) list

Configuration Procedure:

1. Create an entry list for the specific logical unit from "View and Edit Host LUN"\Host Channel\Create Host Filter Entry."

2. Select Host Channel ID, and then select a configured logical unit (a logical drive, logical volume, or one of its logical partitions) to create the entry. The entry submenu will appear.

3. Enter and modify the **Host ID**, **Host ID Mask**, **Filter Type**, and **Access Mode**.

The exemplary entry list is shown below. Please refer to the diagram above:

Entry 1: "LD0-P0, ID=0x…F111, Mask=0x…FFFE, Filter Type = Include, Access Mode = Read / Write." It means Host A and B can read / write P0 of LD0.

Entry 2: "LD0-P1, ID=0x…F222, Mask=0x…FFFF, Filter Type = Exclude, Access Mode = Read / Write." It means Host A and B can read / write P1 of LD0, but this partition is inaccessible for Host C.

Entry 3: "LD1-P0, ID=0x…F111, Mask=0x…FFFE, Filter Type = Include, Access Mode = Read Only." It means P0 of LD1 is 'Read Only ' for Host A and B.

Entry 4: "LD1-P0, ID=0x…F222, Mask=0x…FFFF, Filter Type = Include, Access Mode = Read / Write." It means Host C can read / write P0 of LD1.

Chapter

10

Advanced Configurations

This chapter aims to discuss the advanced options for configuring and maintaining a RAID system. Each function will be given a brief explanation as well as a configuration sample. In this chapter, configuration screens will only be demonstrated in terminal mode. Some of the functions require basic knowledge of RAID technology and the practice of them is only recommended for an experienced user.

10.1 RAID Expansion

What is it and how does it work?

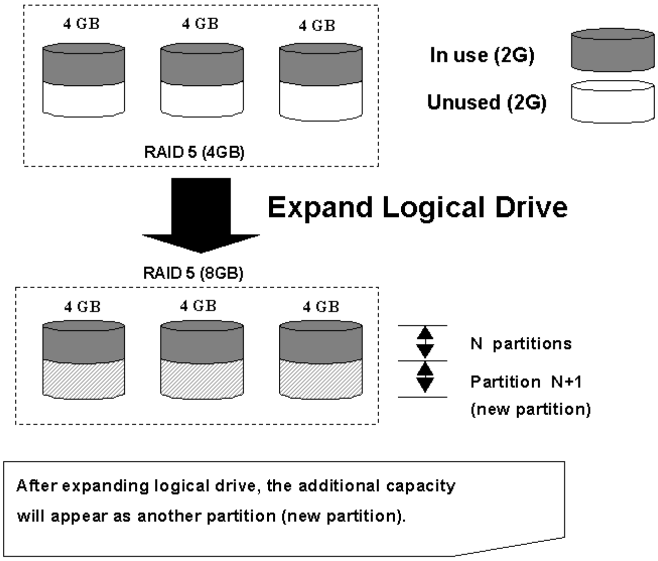
Before the invention of RAID Expansion, increasing the capacity of a RAID system meant backing up all data in the disk array, recreating disk array configuration with new drives, and then restoring data back into system. RAID Expansion allows users to expand a logical drive by adding new drives, or by copying the data from the original member drives to the new ones, and then replacing them without powering down the system.

10.1.1 Logical Drive Expansion

Introduction:

When there is an unused capacity in a logical drive, the user can make use of this unused capacity by expanding the logical drive. An unused capacity is usually created by replacing the original members with drives of larger capacity; or, by adding new drive(s) to a logical drive. After expanding a logical drive, the additional capacity will appear as another partition (a new partition). The diagram below illustrates this idea.

Figure 10 - 1 Logical Drive Expansion



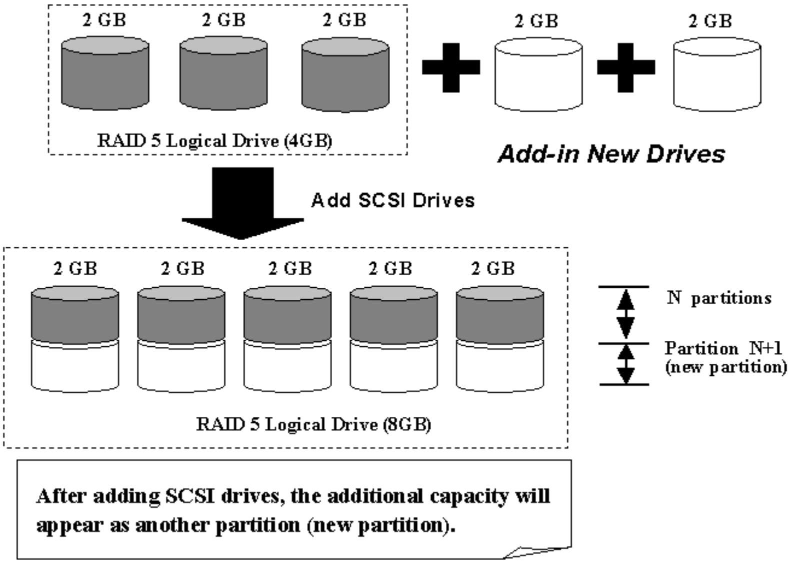
RAID levels supported: RAID 0, 1, 3, and 5

The new partition must be mapped to a host LUN in order for the HBA (host-bus adapter) to recognize its presence. If you want to add the new partition into an existing system drive, operating system support is needed.

10.1.2 Adding Drive to a Logical Drive

Before adding more SCSI drives to a logical drive, make sure your enclosure has empty drive bay(s) ready. You may need to obtain an enclosure with more drive bays. Use new drive of the same capacity. After new drives are added, the capacity of the original logical drive will be the same and the additional capacity will appear as another partition (new partition). When expansion is completed, data will be re-striped across the original and newly added drives. See the diagram below to get a clear idea:

Figure 10 - 2 Expansion by Adding Drive

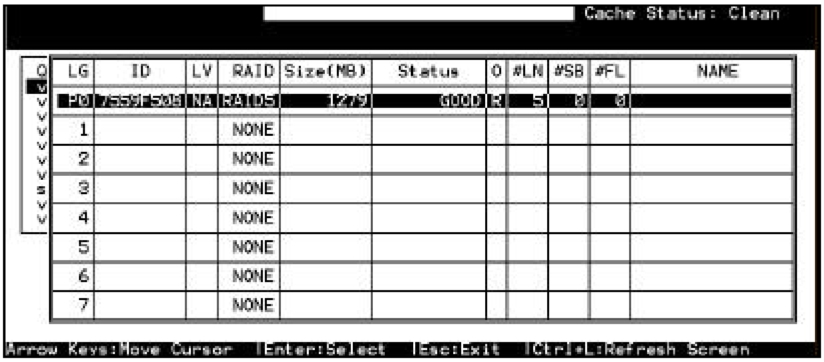


RAID levels supported: RAID 0, 3, and 5.

The new partition must be mapped to a host LUN in order for the HBA (host-bus adapter) to recognize its presence. If you want to add the new partition into an existing partition, operating system support is necessary.

Adding New Drive to a Logical Drive

First select from main menu "View and Edit Logical Drive," and select a logical drive to add a new drive to. The drive selected for adding should have a capacity no less than the original member drive. If possible, use drives of the same capacity because all drives in the array is treated as though they have the capacity of the smallest member drive in the logical array.

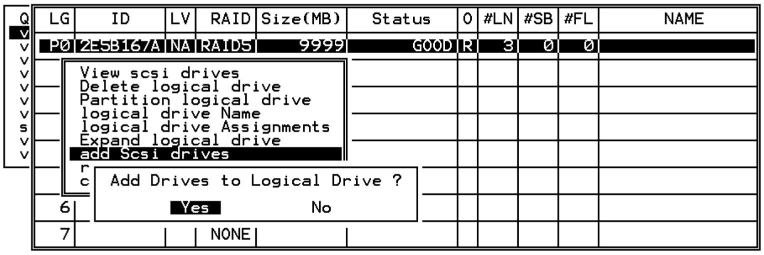


Cache Status: Clean

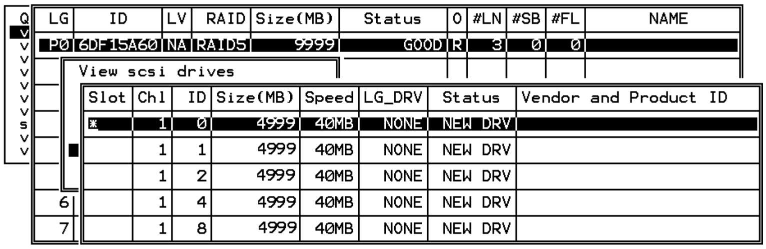
LG	ID	LV	RAID	Size(MB)	Status	O	#LN	#SB	#FL	NAME
P0	7559F508	NA	RAID5	1279	GOOD	R	5	0	0	
1			NONE							
2			NONE							
3			NONE							
4			NONE							
5			NONE							
6			NONE							
7			NONE							

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

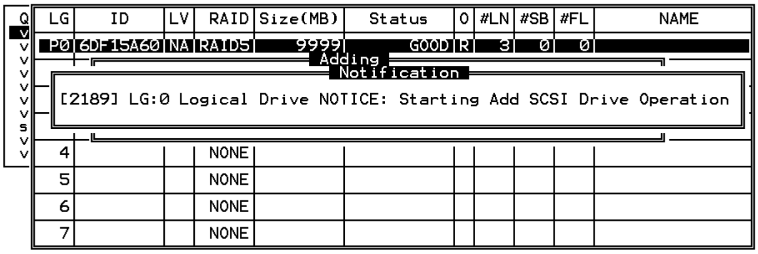
Press **[ENTER]** to select a logical drive and choose "add SCSI drives" from the submenu. Proceed with confirming the selection.



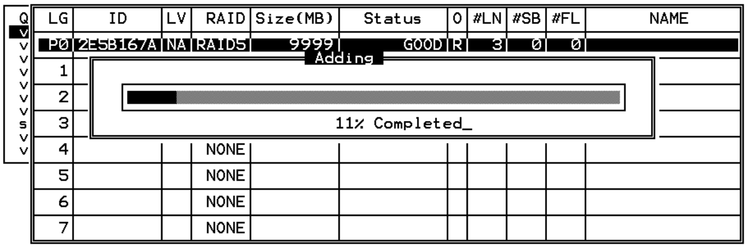
A list of available drives will appear. Select one or more drive(s) to add to the target logical drive by pressing **[ENTER].** The selected drive will be indicated by an asterisk "*" mark.



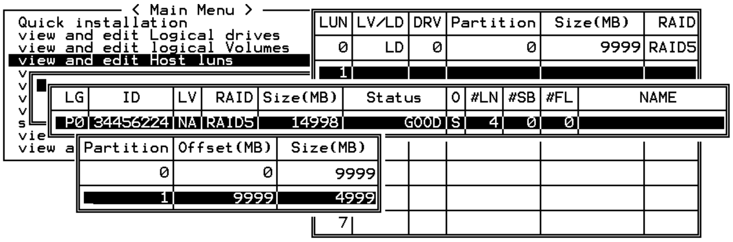
Press **[ESC]** to proceed and the notification will prompt.



Press **[ESC]** again to cancel the notification prompt, a status bar will indicate the percentage of progress.



Upon completion, there will appear a confirming notification. The capacity of the added drive will appear as an unused partition.



The added capacity will be included in the logical drive automatically, meaning that you do not have to perform "expand logical drive" later. However, if the logical drive has already been mapped with a host LUN, you have to 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!

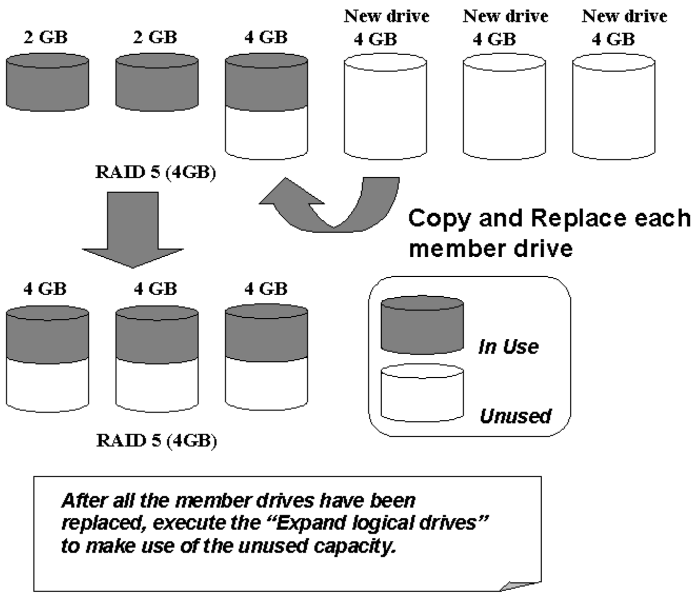
- *Expansion can only be performed on RAID 0, 3 and 5 logical drives. Expansion cannot be performed on an NRAID or RAID 1 logical drive.*
- *Expanding logical drives by adding more SCSI hard disk drives can not be canceled once started. If a power failure occurs, the Expansion will be paused and the controller will NOT automatically continue the expansion when the 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 automatically after logical drive rebuild has been completed.*

10.1.3 Copy and Replace Drives with Drives of Larger Capacity

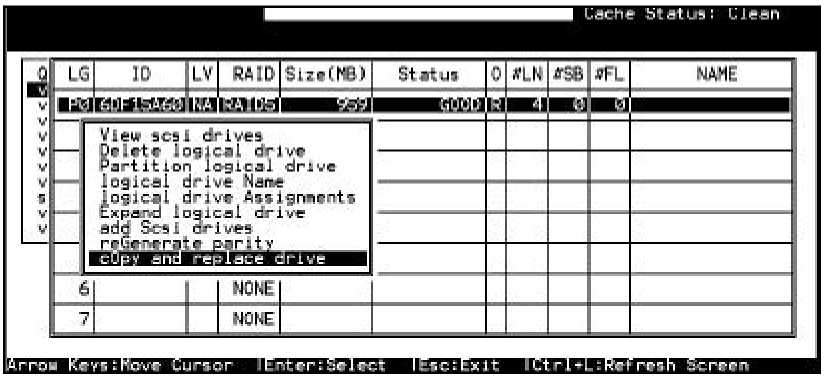
The expansion of logical drive can also be done by copying and replacing all member drives with drives of higher capacity. Please refer to the diagram below for a better understanding. The capacity of member drives are copied and replaced one by one onto drives of larger capacity. When all the member drives have been replaced, execute the "Expand logical drives" function to make use of the unused capacity.

RAID levels supported: RAID 0, 3, and 5

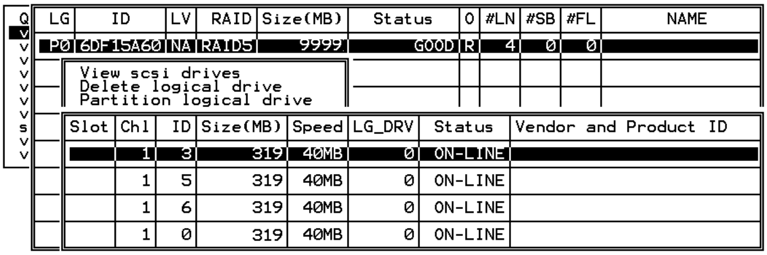
Figure 10 - 3 Expansion by Copy & Replace



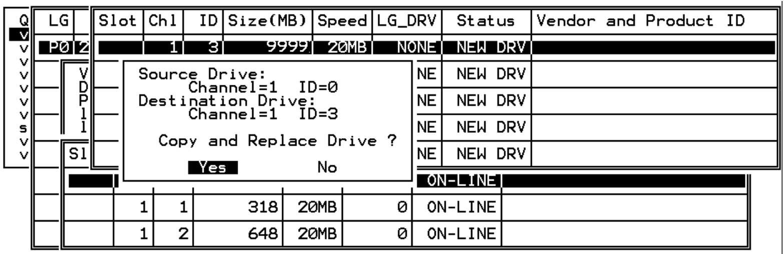
Select from main menu "View and Edit Logical Drives." Select a target logical drive, press **[ENTER]** and scroll down to choose "copy and replace drive." Press **[ENTER]** to proceed.



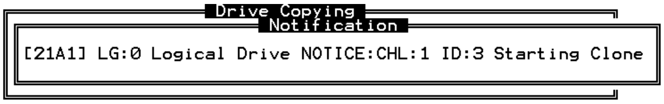
The member drives belonging to the selected logical drive will be listed. Select the member drive (the source drive) which you want to replace with a larger one.



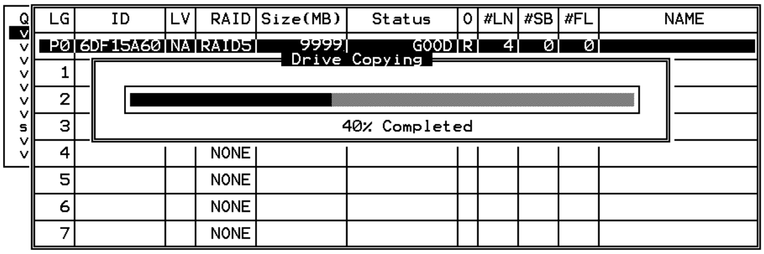
Select one of the member drives as the "**source drive**" (status indicated as ON-LINE) by pressing **[ENTER]**, a table of available SCSI drives will prompt. Select a "**new drive**" to copy the capacity of the source drive. The channel number and ID number of both the "Source Drive" and "the Destination Drive" will be indicated in the confirming box.



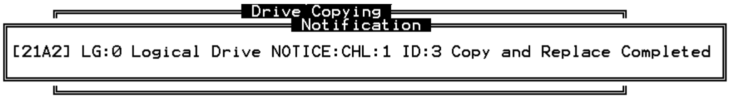
Choose **Yes** to confirm and proceed.



Press **[ESC]** to view the progress.



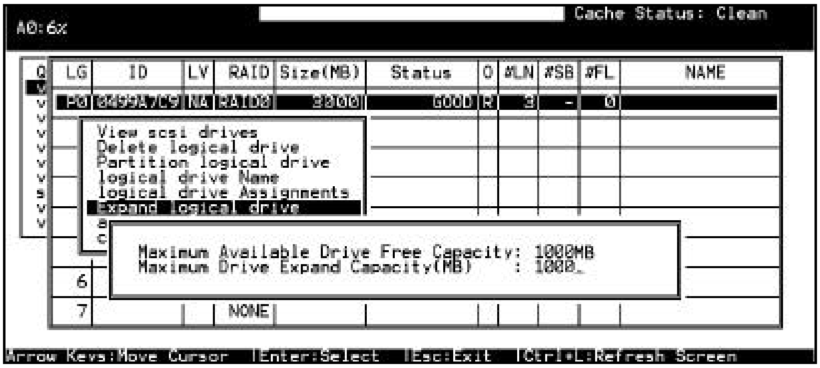
Completion of the Copy and Replace process will be indicated by a notification message. Follow the same method to copy and replace every member drive with drives of higher capacity. You may now perform "Expand Logical Drive" to make use of the capacity brought by the new drives and then map the additional capacity to a Host LUN.



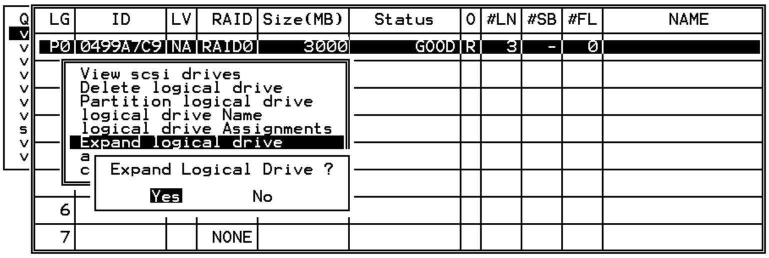
10.1.4 Expand Logical Drive

In the following example, the logical drive is originally composed of three member drives and each member drive has the capacity of 1 Gigabyte. “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 2 Gigabytes. The next step is to perform “Expand Logical Drive” to utilize the additional capacity brought by the new drives.

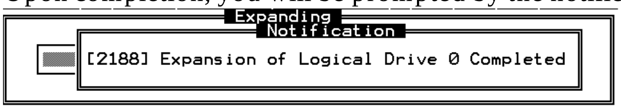
Select “View and Edit Logical Drives” from the main menu and select the logical drive with its members copied and replaced. Select “Expand Logical Drive” in the submenu and press **[ENTER]** to proceed. A confirming box will appear. Proceed by pressing **[ENTER]** or entering any value no larger than the "maximum drive expand capacity" and press **[ENTER]**.



Choose **Yes** to confirm and proceed.

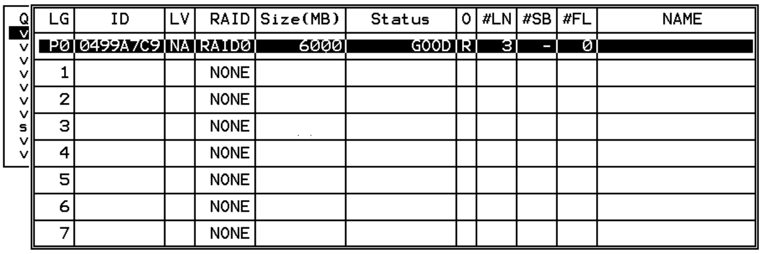


Upon completion, you will be prompted by the notification message.



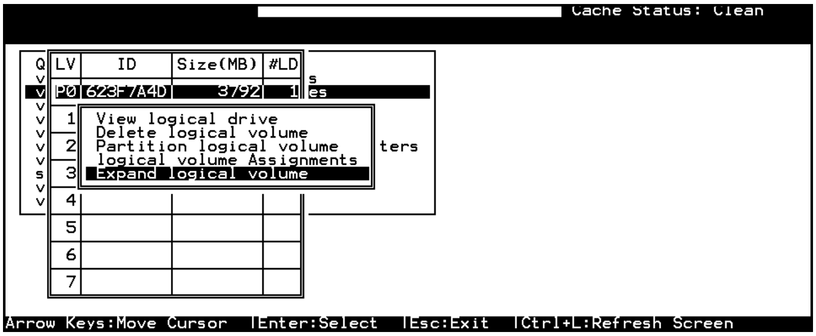
Press **[ESC]** to return to the previous menu screen.

The total capacity of logical drive has been expanded to 6 Gigabytes.



10.1.5 Expand Logical Volume

To expand a logical volume, expand logical drive(s) in the logical volume and then perform “expand logical volume.”



When prompted by "Expand Logical Volume?," Choose **Yes** to confirm and the process will be completed immediately.

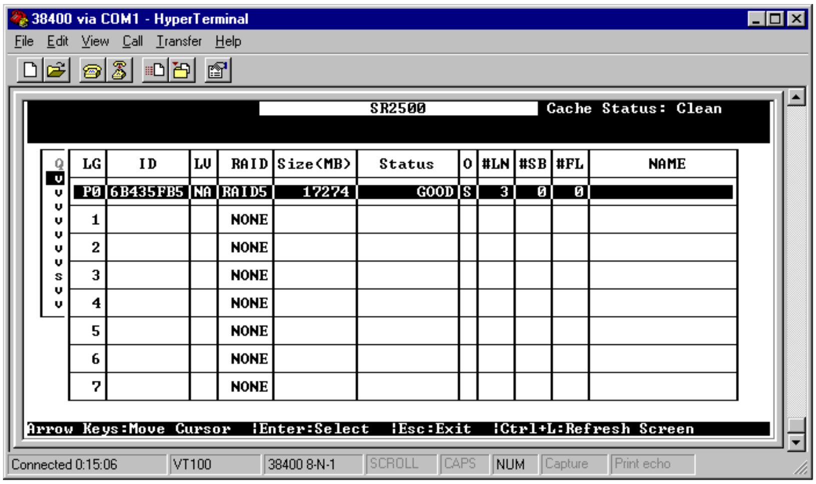
10.1.6 Example: RAID Expansion in Windows NT® Server

Limitations When Using Windows NT 4.0

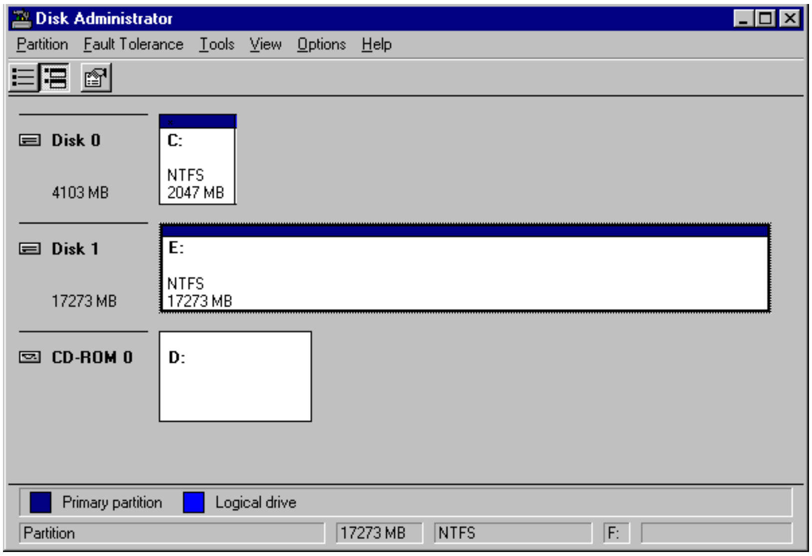
1. Applies only to the Windows NT Server Disk Administrator which includes the Extend Volume Set function; Windows NT Workstation does not support this feature. The volume set expansion formats the new area without affecting existing files on the original volume.
2. The system drive (boot drive) of a Windows NT system can not be expanded.
3. The drive that will be expanded should be using the NTFS file system.

Example:

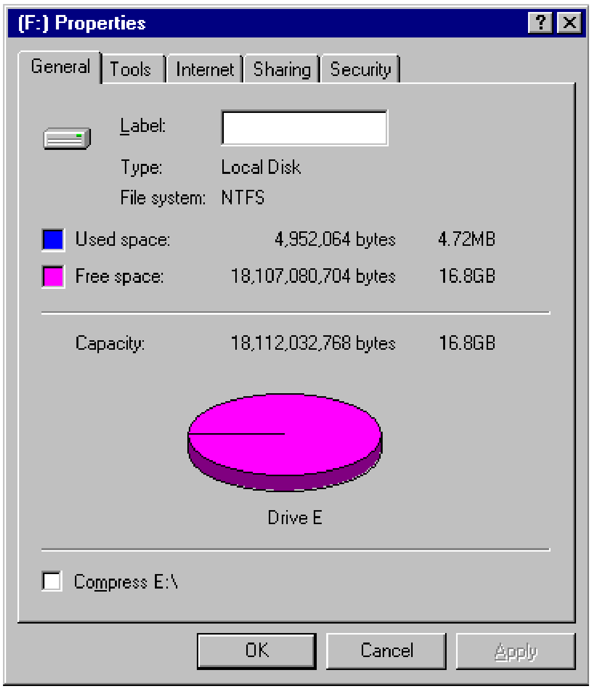
The following example demonstrates the expansion of a 17274MB RAID 5 logical drive. The HyperTerminal emulation software that comes with Windows® 98/Windows NT is used to connect to the RAID controller via RS-232.



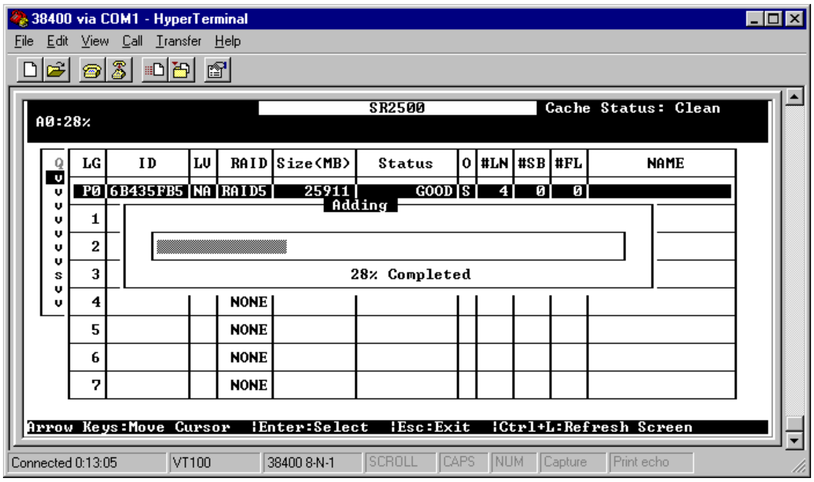
You can view information about this drive in the Windows NT Server's Disk Administrator.



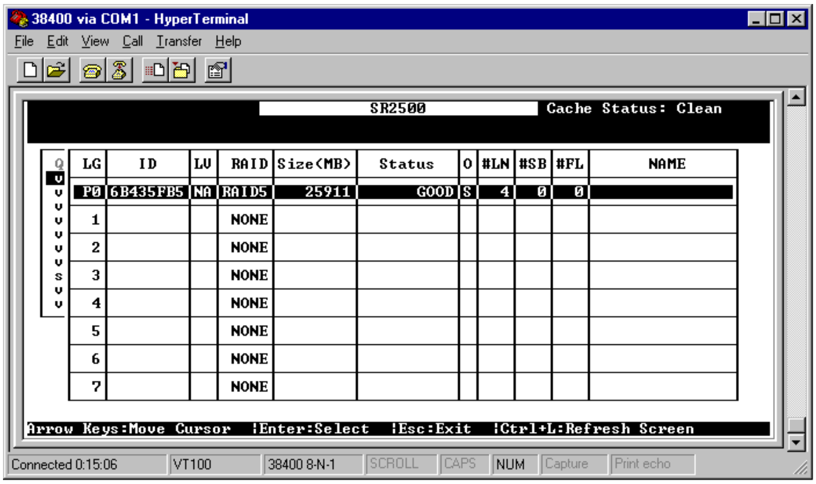
Place the cursor on Disk 1, right-click your mouse, and select "Properties." You will see that the total capacity for the Drive E: is right under 17GB.



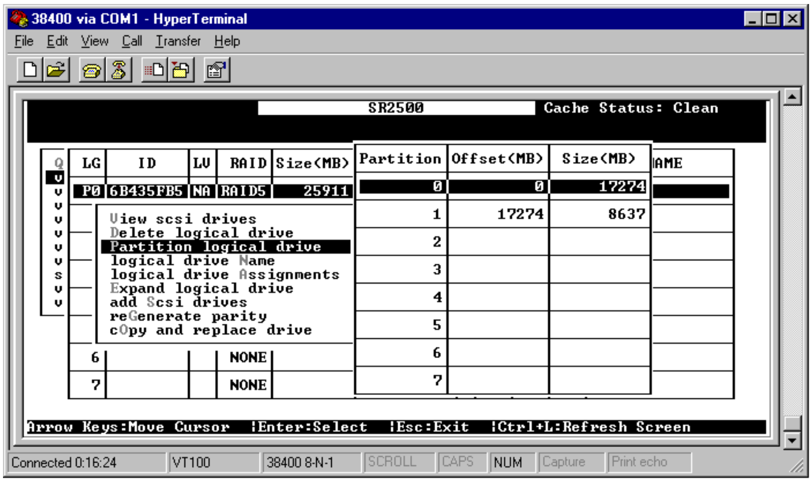
Follow the steps described in the previous section to "add" or "copy & replace" SCSI disk drives and perform Logical Drive Expansion.



The 17GB logical drive has become an 26GB logical drive. Place the cursor on that logical drive, and then press **[ENTER]**.

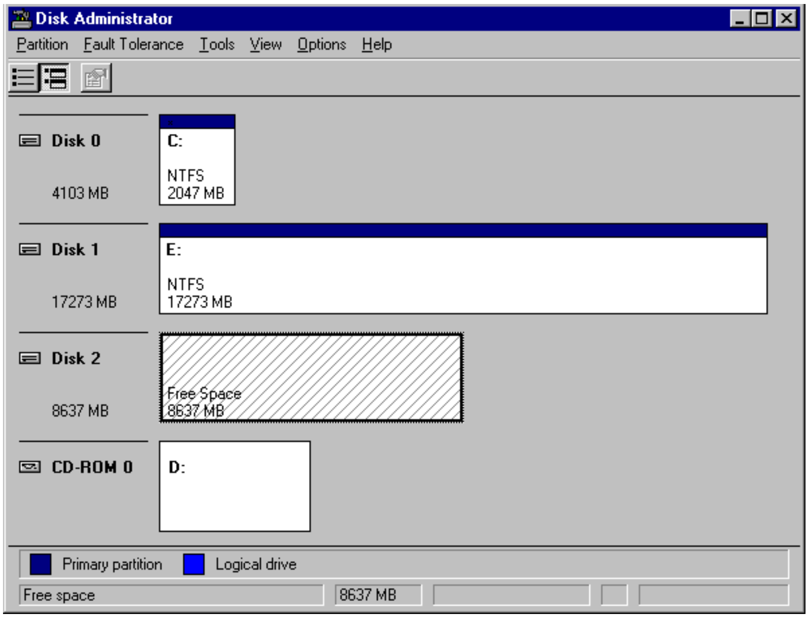


From the menu, select "Partition Logical Drive." You will see that the 26GB logical drive is composed of a 17GB partition and an 8.6GB partition.

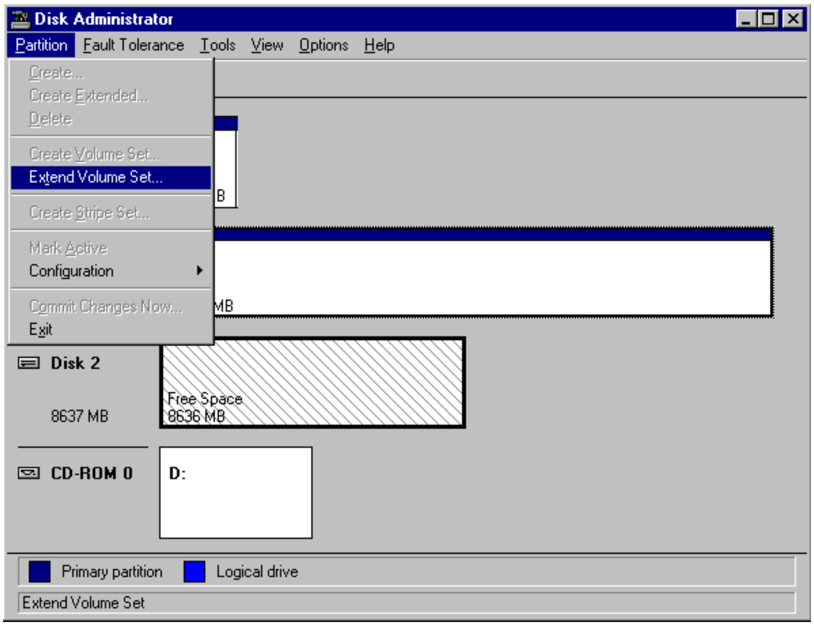


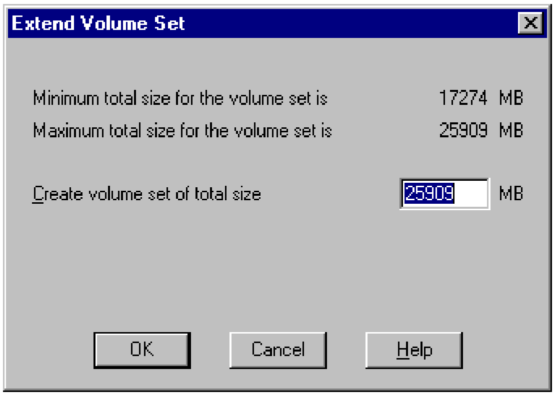
Follow the directions in chapter 6 and chapter 8 to map the new partition to a Host LUN. The new partition must be "**mapped**" to a host LUN in order for the HBA (host-bus adapter) to see it. Once you have mapped the partition, reboot Windows NT. The HBA should be able to detect an additional “disk” during the initialization process.

Return to Windows NT Server’s Disk Administrator. There now exists a Disk 2 with 8.6GB of free space.

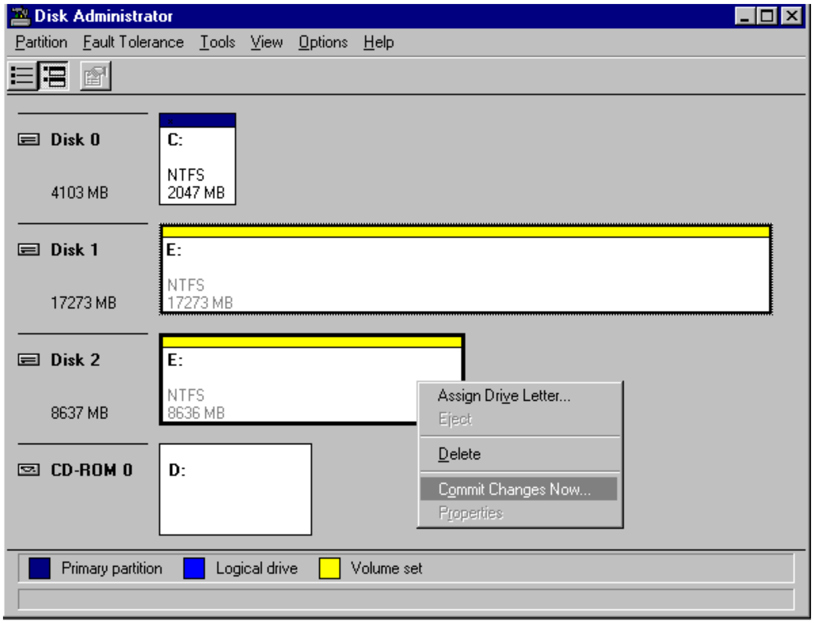


Select an existing volume (Disk1) and then press CTRL while selecting a free space (Disk2). From the "Partition" menu, select "Extend Volume Set."

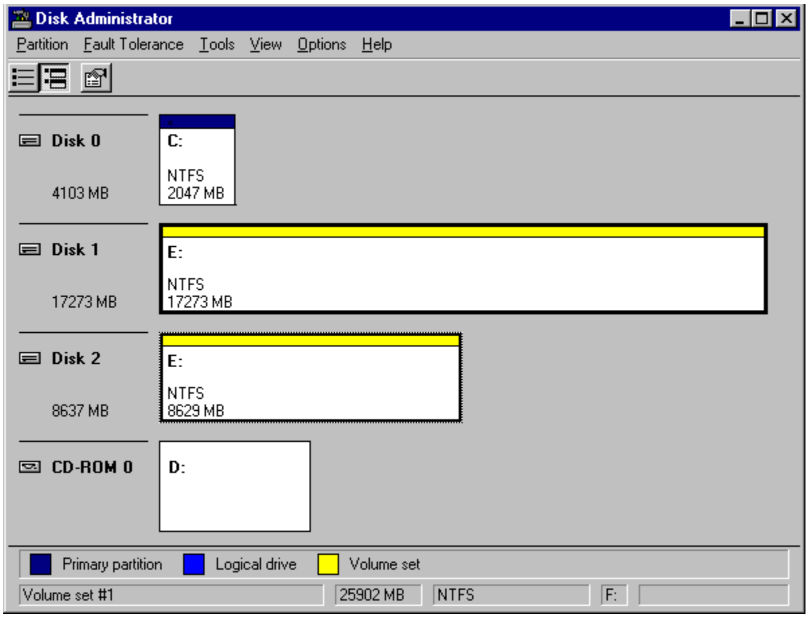




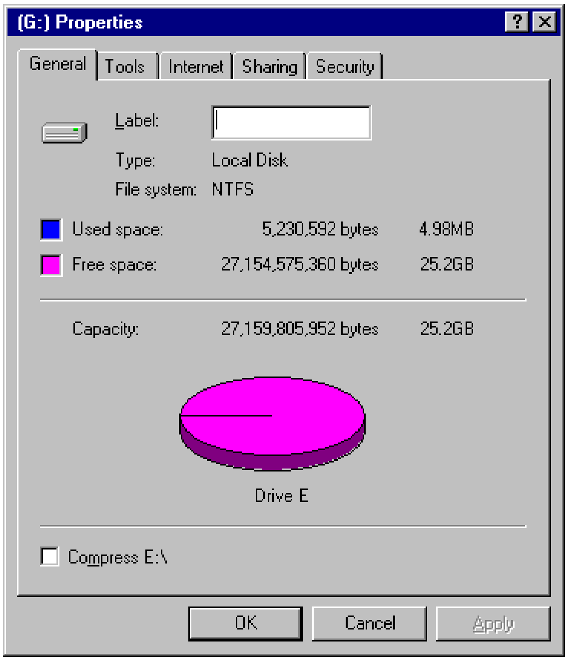
The screen will display that volume set of Drive E: has been extended by the 8.6GB in Disk2. Move the cursor to "Commit Changes Now" to confirm that you want the free space to become a part of the same logical drive.



Logical Drive E: is now composed of two partitions with a total volume of 1800MB. 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 right above 25GB.



10.2 Fault Prevention

With the maturity of technologies like S.M.A.R.T., drive failures can be predictable to a certain degree. Encountering drive bad block reassignments may be the most common omen when a drive is about to fail. In addition to the S.M.A.R.T.-related functions as will be discussed later in this section, a system administrator can also choose to manually perform "Clone Failing Drive" to a drive which is about to fail. System administrators can decide when to replace a drive showing symptoms of defects by a healthy drive. A system administrator may also replace any drive at will even when a source drive is healthy.

Usually, the "Clone Failing Drive" can be performed under the following conditions:

1. Replacing drives about to fail either detected by S.M.A.R.T. or notified by controller.
2. Manually replacing and cloning drive data on any drive to a new drive.

10.2.1 Clone Failing Drive:

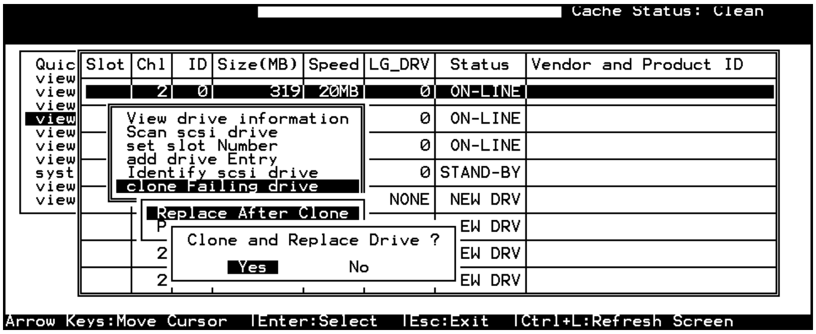
Unlike the similar functions combined with the S.M.A.R.T. setting, the "Clone Failing Drive" is a manual function. There are two options for cloning a failing drive: "Replace after Clone" and "Perpetual Clone."

Replace after Clone:

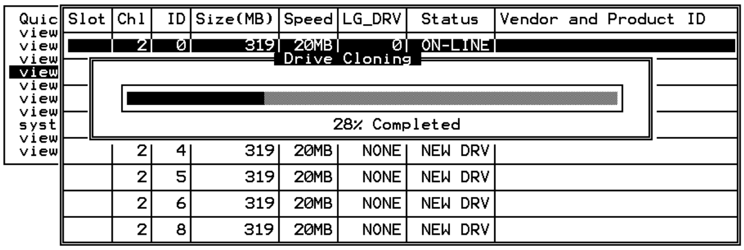
Data on the source drive, the drive with predicted error (or any selected member drive), will be cloned to a standby spare and replaced later by the spare. The status of the replaced drive, the original member drive with predicted error, will be redefined as an "used drive." System administrators may replace the used drive with a new one, and then configure the new drive as a spare drive.

Locate the logical drive to which the specific member drive with predictable error belongs. Select the "clone failing drive" function.

Select "Replace After Clone." The controller will automatically start the cloning process using the existing "stand-by" (dedicated/global spare drive) to clone the source drive (the target member drive with predicted error). If there is no standby drive (local/global spare drive), you need to add a new drive and configure it as a standby drive.

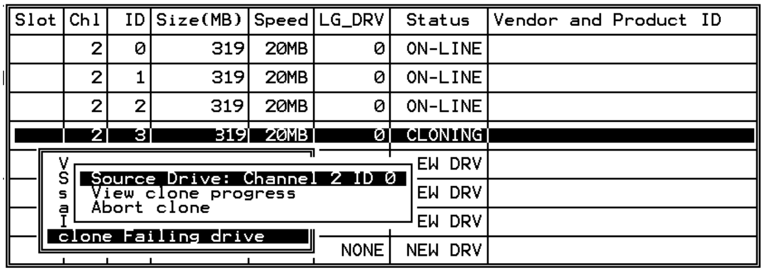


The cloning process will begin with a notification message. Press **[ESC]** to proceed.



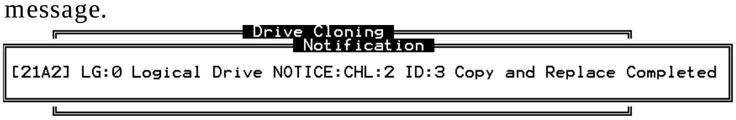
The cloning process will be indicated by a status bar.

You may also 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]**.



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.

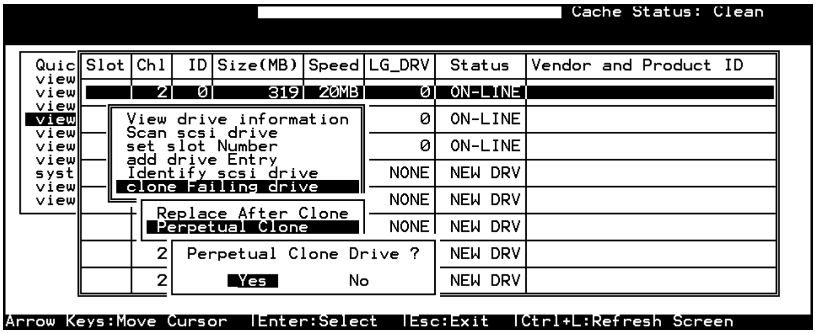
When the process is completed, users will be notified by the following message.



Perpetual Clone:

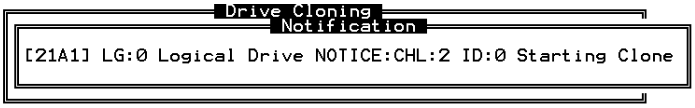
The standby spare drive will clone the source drive, member drive with predicted error or any selected drive, without substituting it. The status of the spare drive will be displayed as "clone drive" after the cloning process. The source drive will remain as a member of the logical drive.

In "View and Edit SCSI drives," locate the member drive with predicted error. Select "clone Failing drive," and choose "Perpetual Clone."

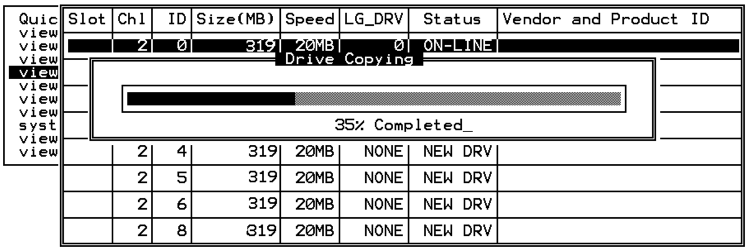


The controller will automatically start the cloning process by using the existing "stand-by" (local / global spare drive) to clone the source drive (the target member drive with predicted error).

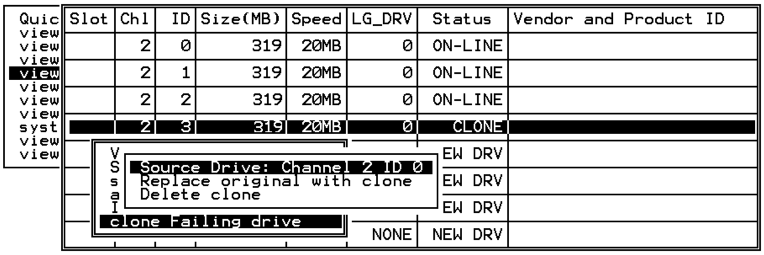
The cloning process will begin with a notification message:



Press **[ESC]** to view the current progress:



You may also quit viewing the status bar by pressing **[ESC]** to return to the previous menu screen. Select the drive indicated as "CLONING" by pressing **[ENTER]**. Select "Clone Failing Drive" again to view the progress. You may identify the source drive and choose to "View clone progress" or "Abort clone" if you happen to have selected the wrong drive.



The cloning progress will be completed by a notification message as displayed below:

```
Notification
[21A2] LG:0 Logical Drive NOTICE:CHL:2 ID:0 Clone Completed
```

You may press **[ESC]** to clear the notification message to see the SCSI drives' status after the cloning process. The source drive (Channel 1 ID 5) remains as a member of logical drive "0," and the "stand-by" drive (Channel 1 ID 2, the dedicated / global spare drive) has become a "CLONE" drive.

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	CLONE	
	2	4	319	20MB	NONE	NEW DRV	
	2	5	319	20MB	NONE	NEW DRV	
	2	6	319	20MB	NONE	NEW DRV	
	2	8	319	20MB	NONE	NEW DRV	

10.2.2 S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology)

This section provides a brief introduction to S.M.A.R.T. as one way to predict drive failure and Infortrend's implementations for preventing data loss caused by drive failure.

A. Introduction

Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.) is an emerging technology that provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive 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 back up data on the failing drive. However, not all failures can be predicted. S.M.A.R.T. predictability is limited to the attributes the drive can monitor which are selected by the device manufacturer based on the attribute's ability to contribute to the prediction of 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

SCSI drives with reliability prediction capability only communicate a reliability condition as either good or failing. In a SCSI environment, the failure decision occurs at 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 to S.M.A.R.T.

Infortrend is using ANSI-SCSI Informational Exception Control (IEC) document X3T10/94-190 standard.

There are four manual selections related to S.M.A.R.T. function in firmware:

Disable:

S.M.A.R.T. function not activated

Detect Only:

S.M.A.R.T. function enabled, controller will send command to enable all the drives' S.M.A.R.T. function, if a drive predicts problem, controller will report the predicted problem in the form of an event log.

Perpetual Clone:

If the S.M.A.R.T. function is enabled, the controller will send command to enable all drives' S.M.A.R.T. function. If a drive predicts problem, controller will report in the form of an event log. Controller will clone the drive if there is a Dedicated/Global spare drive available. “The predict failure drive” will not be taken off-line, and the clone drive will still behave as a standby drive.

If “the predict failure drive” fails, the clone drive will take over immediately. Under the circumstance that “the predict failure drive“ is still working and another drive in the same logical drive should fail, the clone drive will perform as a standby spare drive and start to rebuild the failed drive immediately. This is to prevent a fatal drive error if yet another drive should fail.

Clone + Replace:

Controller will enable all drives' S.M.A.R.T. function. If a drive predicts problem, controller will report in the form of event log. Controller will then clone the drive with predictable failure to a standby spare drive and take “the predict failure drive” off-line as soon as the cloning process is completed.

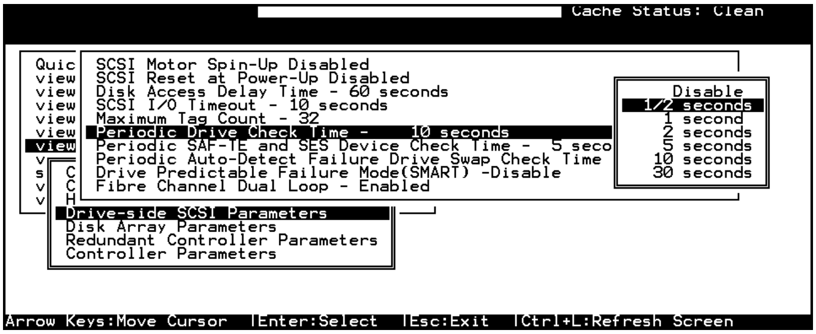
NOTE:

- *If your system is using drives of different brand under the control of the same controller, as long as they are ANSI-SCSI Informational Exception Control (IEC) document X3T10/94-190 compatible, it should not be an issue working with the controller.*

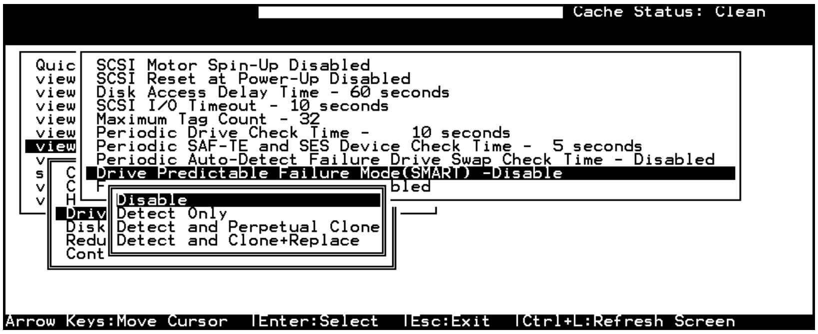
Enabling the S.M.A.R.T. Feature

Follow the procedure listed below to enable S.M.A.R.T. on all drives.

1. First, enable the “Periodic Drive Check Time” function. In \View and Edit Configuration Parameters\Drive-side SCSI Parameters\Periodic Drive Check Time, choose a time interval.



2. In \View and Edit Configuration Parameters\Drive-side SCSI Parameters\Drive Predictable Failure Mode <SMART>, choose one from “Detect Only,” “Detect, Perpetual Clone” and “Detect, Clone+Replace.”



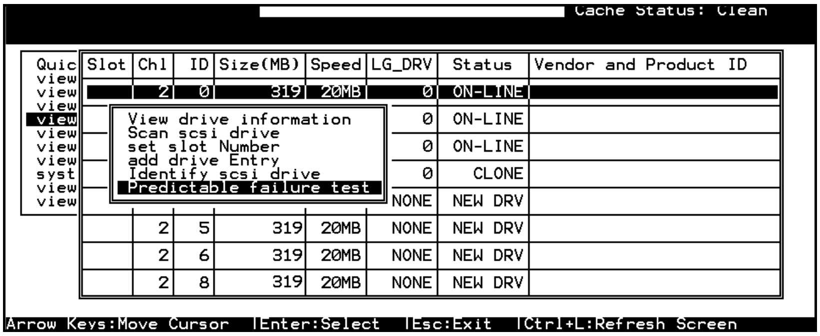
Examining Whether Your Drives Support S.M.A.R.T.

To see if your drive supports S.M.A.R.T., follow the steps below:

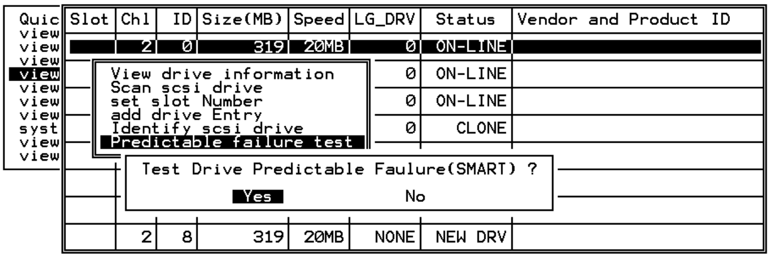
3. Enable "S.M.A.R.T." on the RAID controller.

4. In "View and Edit SCSI Drives," choose one drive to test to. Press **[ENTER]** on the drive, a sub-menu will appear.

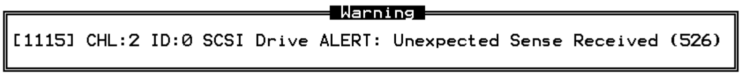
5. Notice that a new item "Predictable Failure Test" appears in the sub-menu. If the SMART" feature is not enabled properly, this item will not appear in this sub-menu.



6. Choose "Predictable Failure Test," the controller will force the drive to simulate the predictable drive error.



7. Press **[ENTER],** and after a while (the next time the controller performs "Periodic Drive Check"), the controller will detect the error simulated by the drive. An error message will be displayed: "[1142] SMART-CH:? ID:? Predictable Failure Detected (TEST)." If this error message appears, it means the selected drive supports S.M.A.R.T. feature. If this error message does not appear, it means that this drive does not support S.M.A.R.T..



8. Otherwise, you may simply contact the drive manufacturer for information about whether the drive model and drive firmware revision support S.M.A.R.T. feature.

How to Utilize the S.M.A.R.T. Functions on the RAID Controller?

1. Enable “SMART” on the RAID controller.

2. Make sure that your drives do support S.M.A.R.T. so that your system will work fitly.

3. The “Detect Only” Function:

3a. In \View and Edit Configuration Parameters\Drive-side SCSI Parameters\Drive Predictable Failure Mode <SMART>, choose “Detect Only.”

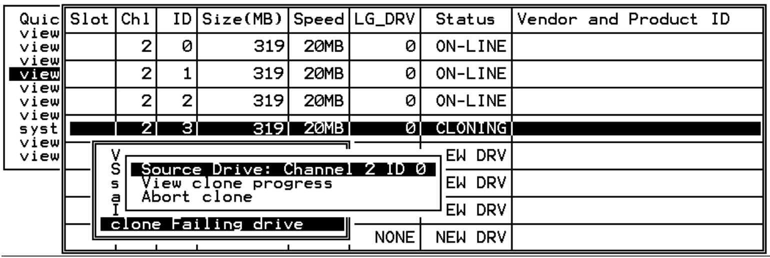
3b. Whenever a drive predicts symptoms of predictable drive failure, controller will issue an error message.

4. The “Detect, Perpetual Clone” Function:

4a. In \View and Edit Configuration Parameters\Drive-side SCSI Parameters\Drive Predictable Failure Mode <SMART>, choose “Detect, Perpetual Clone.”

4b. Assign at least one spare drive to the logical drive (either Local Spare Drive or Global Spare Drive).

4c. When a drive (logical drive member) detects the predictable drive failure, the controller will “clone” the drive with a spare drive. You may enter the "View and Edit SCSI Drive" menu and click on the spare drive (either a local or a global one). Choose from the menu items if you want to know about the status of the source drive, the cloning progress, or abort cloning.



NOTE:

- *With the precaution of untimely drive failure of yet another drive, when configured as "perpetual clone," the spare drive will stay only mirrored to the source drive (the drive with predictable drive failure) but not replacing it until the source drive fails.*

4d. When the spare drive is mirroring the source drive, any occurrence of drive failure (when there is no other spare drives) will force the spare drive to give up the mirrored data and resumed its original role – it will become a spare drive and start rebuilding the failed drive.

5. The "Detect, Clone+Replace" Function:

5a. In \View and Edit Configuration Parameters\Drive-side SCSI Parameters\Drive Predictable Failure Mode <SMART>, choose "Detect, Clone+Replace."

5b. Assign at least one spare drive to the logical drive. (Either Local Spare Drive or Global Spare Drive)

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 finished, it will replace the source drive (the drive which detects the predictable drive failure) immediately. The source drive will become a used drive and you may replace this drive with a new one.

If you want to see the progress of cloning, press **[ESC]** to clear the notification message and see the status bar.

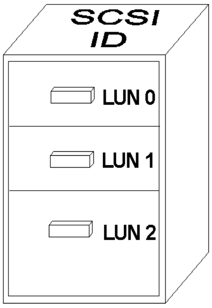
The source drive's status will be re-defined as an "Used drive" and will be immediately replaced and pulled off-line. This drive should be replaced with a new drive as soon as possible.

10.3 Host-side and Drive-side SCSI Parameters

Foreword: SCSI Channel, SCSI ID and LUN

A SCSI channel (SCSI bus) can connect up to 15 devices (not including the SCSI controller itself) when the Wide function is enabled (16-bit SCSI). It can connect up to 7 devices (not including the controller itself) when the Wide function is disabled (8-bit SCSI). Each device has one unique SCSI ID. Two devices owning the same SCSI ID is not allowed.

Figure 10 - 4 SCSI ID/LUNs

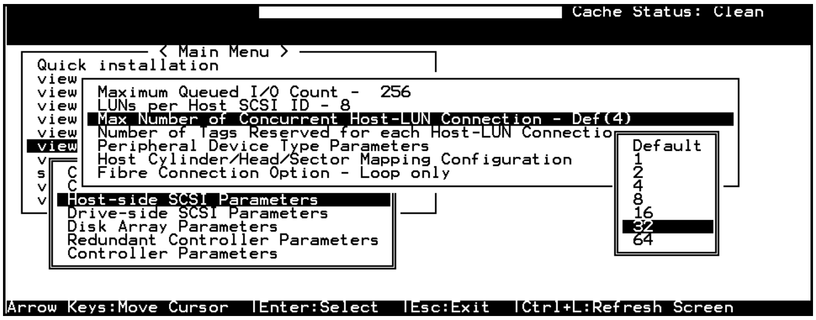


The figure on the left is a very good example. If you are to file document into a cabinet, you must put the document into one of the drawers. From a SCSI's point of view, a SCSI ID is like a cabinet, and the drawers are the LUNs. Each SCSI ID can have up to 32 LUNs (Logical Unit). Data can be stored into one of the LUNs of the SCSI ID. Most SCSI host adapters treat a LUN like another SCSI device.

10.3.1 Host-side SCSI Parameters

Maximum concurrent host LUN connection ("nexus" in SCSI):

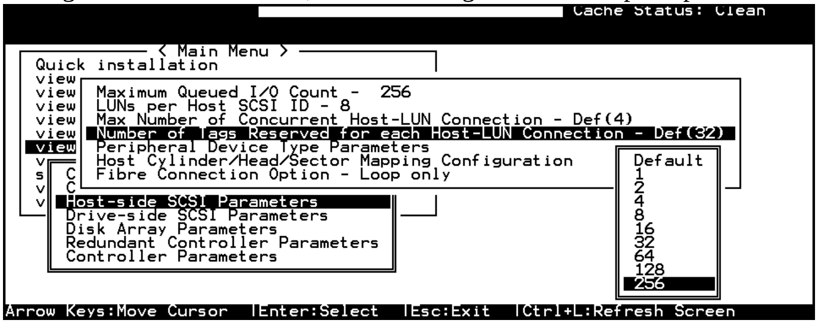
It is the arrangement of the controller internal resources for use with a number of the current host nexus. If there are four hosts (A, B, C, and D) and four host IDs/LUNs (ID 0, 1, 2 and 3) in this configuration, host A accesses ID 0 (one nexus), host B accesses ID 1 (one nexus), host C accesses ID 2 (one nexus) and host D accesses ID 3 (one nexus) - all queued in the cache - that is called 4 nexus. If there are I/Os in the cache with 4 different nexus, and another host I/O comes with a nexus different than the four in the cache (for example, host A access ID 3), controller will return "busy." Mind 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.



From the main menu, select "View and Edit Configuration Parameters," "Host-side SCSI Parameters," then press **[ENTER]**. Choose "Max Number of Concurrent 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. The default setting is 4.

Number of Tags Reserved for each Host-LUN Connection:

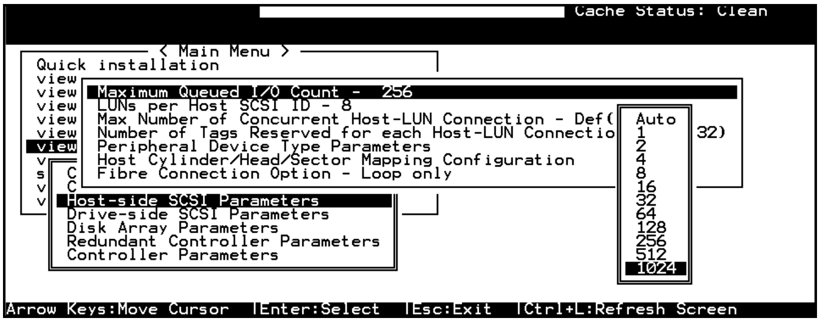
Each "nexus" has "32" (the default setting) tags reserved. When the host computer is sending 8 of I/O tags to the controller, and the controller is too busy to process all, the host might start to send less than 8 tags during every certain period of time since then. This setting ensures that the controller 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 internal resources, at least 32 tags can be accepted per nexus.



Choose "Host-side SCSI 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.

Maximum Queued I/O Count:

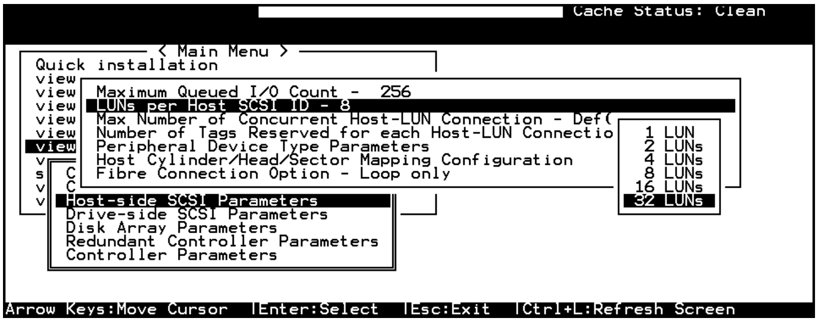
This function allows you to configure the maximum number of I/O queue the controller can accept from the host computer.



Choose "Host-side SCSI 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.

This controller supports the following Host-side SCSI configurations: “Maximum Queued I/O Count,” “LUNs per Host SCSI ID,” “Num of Host-LUN Connect,” “Tag per Host-LUN Connect,” “Peripheral Dev Type Parameters,” and “Cyl/Head/Sector Mapping Config.”

LUNs per Host SCSI ID



Choose “LUNs per Host SCSI 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.

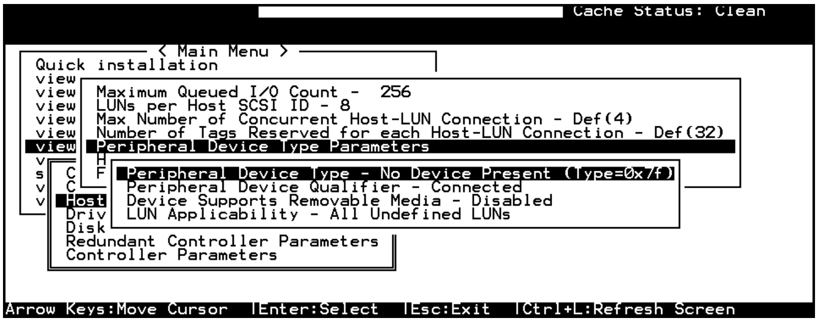
LUN Applicability:

If no logical drive has been created and mapped to a host LUN, and the RAID controller is the only device connecting to the host SCSI card, usually the operating system will not load the driver of the host SCSI adapter. If the driver is not loaded, the host computer will not be able to use the in-band SCSI 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 the table of peripheral device setting for details concerning various operating systems.

Peripheral Device Type:

For connection without a preset logical RAID unit to a host, the in-band SCSI protocol can be used for the host to “see” the RAID controller. Please refer to the reference table below. You will need to make adjustments in the following submenu: Peripheral Device Type, Peripheral Device Qualifier, Device Support for Removable Media, and LUN Application.



In-band SCSI:

What is In-band SCSI?

External devices require communication with the host computer for device monitoring and administration. Except for the regular RS-232, in-band SCSI can serve as an alternative means of management communication. The in-band SCSI technology translates the original commands into standard SCSI commands. These SCSI commands are then sent to and received by the controller using a SCSI cable.

Peripheral Device Type Parameters for Various Operating Systems:

A host can not "see" the controller **UNLESS** a logical unit has been created and mapped to host LUN via the RS-232/front panel interface; or that the "in-band SCSI" connection with the host is established. If users want to start configuring a RAID system from the host before any RAID configuration is made, the host will not be able to "see" the RAID controller. For instance, if user install the Java-based RAID manager on host computer, the in-band SCSI protocol should be applied to communicate between host and controller. In order for a host to "see" the controller, it will be necessary to define the controller as a peripheral device first.

Different host operating systems require different adjustments. Look at the table 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.

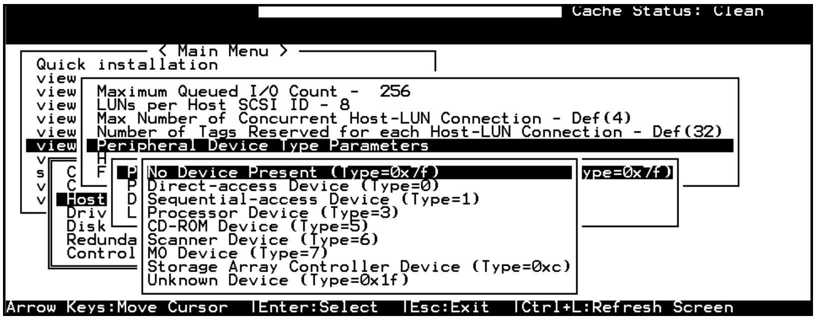


Table 10 - 1 Peripheral Device Type Parameters

Operating System	Peripheral Device Type	Peripheral Device Qualifier	Device Support for Removable Media	LUN Applicability
Windows NT® 4.0	0x1f	connected	disabled	All Undefined LUNs
NetWare® 4.x/Windows 2000	0x03	connected	disabled	All Undefined LUNs
SCO OpenServer 5.0x	0x7f	connected	either is okay	All Undefined LUNs
SCO UnixWare 2.1x, UnixWare 7	0x03	connected	either is okay	All Undefined LUNs
Solaris™ 2.5.x/2.6 (x86 and SPARC)	0x7f	connected	either is okay	All Undefined LUNs
Linux	0x03	connected	enabled	All Undefined LUNs

Table 10 - 2 Peripheral Device Type Settings:

Device Type	Setting
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

Cylinder/Head/Sector Mapping:

In the world of SCSI, the drive capacity is decided by the number of blocks. For some of the operating systems (Sun Solaris...etc.) the OS will read the capacity based on the cylinder / head / sector count of the drive. For Sun Solaris, the cylinder cannot exceed 65535, so user can choose "cylinder<65535," the controller will automatically adjust the head / sector count, then the OS can read the correct drive capacity. Please refer to Appendix B "Advanced Features" and also to the related documents provided with your operating system.

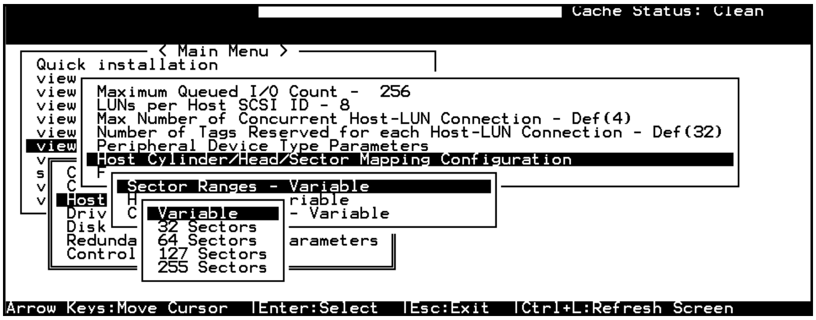
Cylinder, Head, Sector counts are selectable from menu. For difficulties with Sun Solaris configuration the recommended values are listed in the table below.

Table 10 - 3 Cylinder/Head/Sector Mapping under Sun Solaris

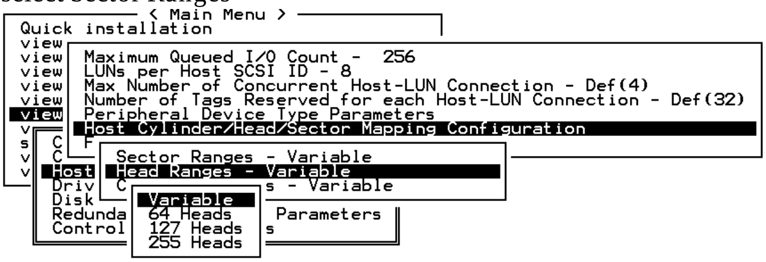
Capacity	Cylinder	Head	Sector
< 64 GB	?	64	32
64 - 128 GB	?	64	64
128 - 256 GB	?	127	64
256 - 512 GB	?	127	127
512 GB - 1 TB	?	255	127

Currently, Solaris does not support drive capacity larger than 1 terabyte.

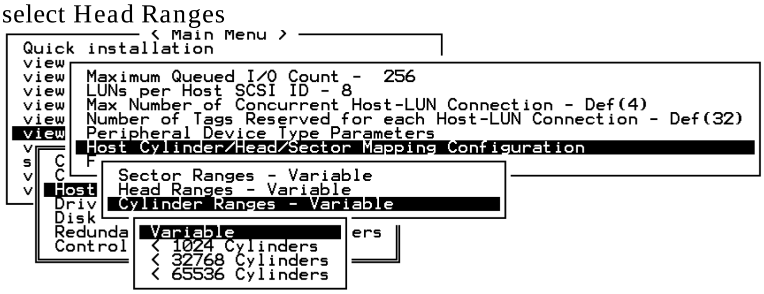
Configuring Sector Ranges / Head Ranges / Cylinder Ranges:



select Sector Ranges

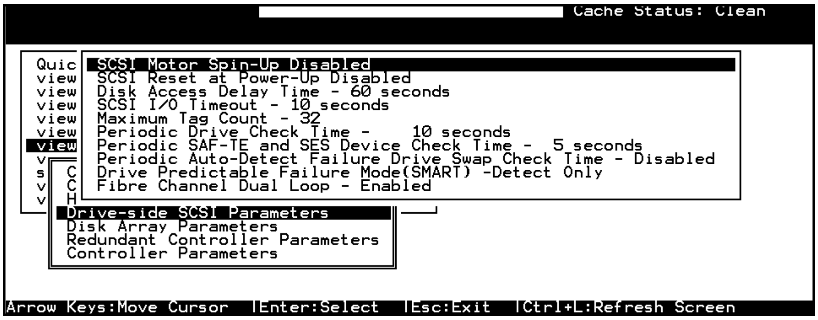


select Head Ranges



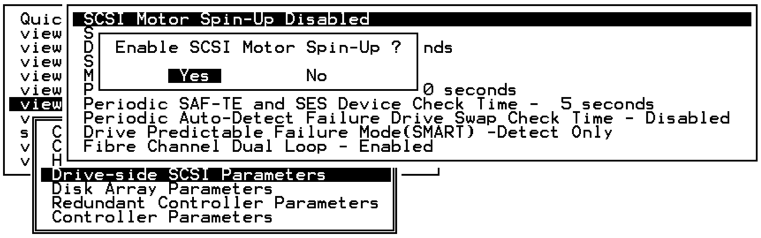
select Cylinder Ranges

10.3.2 Drive-side Parameters:



Choose "Drive-side SCSI Parameters," then press **[ENTER]**. The Drive-side SCSI parameters menu will appear.

SCSI Motor Spin-Up



The SCSI "spin-up" decides how the SCSI drives in a Disk Array are started. When the power supply is unable to provide sufficient current for all the hard drives and controllers that are powered-up at the same time, spinning-up the hard drives serially is one of the best ways of consuming lower power-up current.

By default, all hard drives will spin-up when powered-on. These hard drives can be configured so that all of them will not spin-up at the same time when powered-on. There are 3 methods for spinning-up the hard drive's motor: Spin-up at power-on, Spin-up serially at random sequence or Spin-up by SCSI command. Please refer to the hard drive's user manual for instructions on configuring the hard drive using the "Spin-up by SCSI Command." The procedure for each brand / model of hard drive should vary.

Configure all the hard drives (usually by switching jumpers on hard disk). Choose "SCSI Motor Spin-Up," then press **[ENTER]**. Choose **Yes** in the dialog box that follows to confirm the setting.

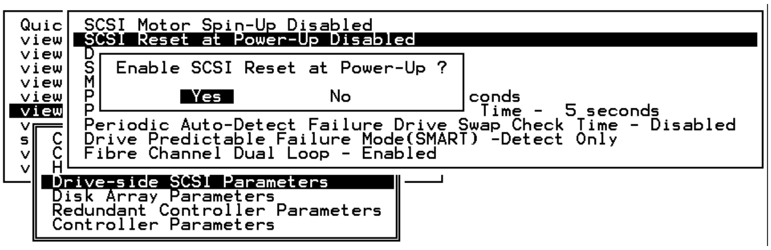
IMPORTANT!

- *If the drives are configured as "Delay Motor Spin-up" or "Motor Spin-up in Random Sequence," some of these drives may not be ready yet for the controller to access when the system powers up. Increase the disk access delay time so that the controller will wait a longer time for the drive to be ready.*

SCSI Reset at Power-Up

By default, when the controller is powered up, it will send a SCSI bus reset command to the SCSI bus. When disabled, it will not send a SCSI bus reset command on the next power-up.

When connecting dual host computers to the same SCSI bus, the SCSI bus reset will interrupt all the read/write requests that are being performed. This may cause some operating systems or host computers to act abnormally. Disable the "SCSI Reset at Power-up" to avoid this situation.

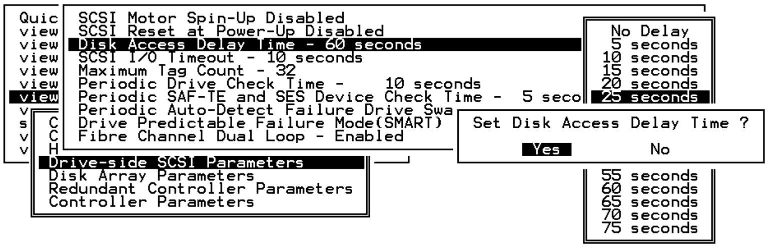


Choose "SCSI Reset at Power-Up", then press **[ENTER]**. Choose **Yes** in the dialog box that follows to confirm the setting.

Power off all hard drives and controller, and power them on again. All the hard drives will not spin-up at this time. The controller will then spin-up the hard drives one by one at the interval of four seconds.

Disk Access Delay Time

Sets the delay time before the controller tries to access the hard drives after power-on. The default is 15 seconds.



Choose "Disk Access Delay Time," then press **[ENTER]**. A list of selections will appear. Move the cursor bar on a selection, then press **[ENTER]**. Choose **Yes** in the dialog box that follows to confirm the setting.

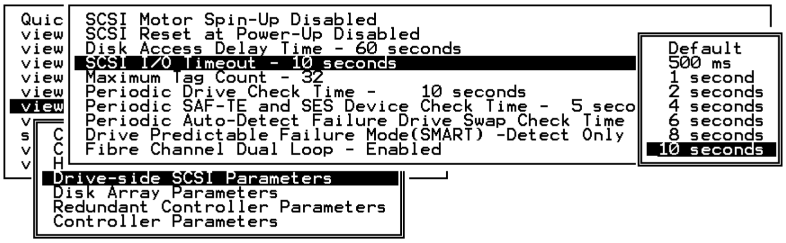
SCSI I/O Timeout

The "SCSI 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 SCSI 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 will retry the previous reading or recalibrate the head. When the drive has encountered a bad block on the media, it has to reassign the bad block to another spare block. However, all of this takes time. The time to perform these operations can vary between different brands and models of drives.

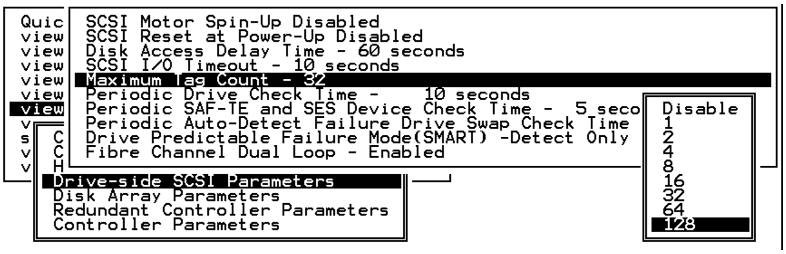
During SCSI bus arbitration, a device with higher priority can utilize the bus first. A device with lower priority will sometimes receive a SCSI I/O timeout when devices of higher priority devices keep utilizing the bus.

The default setting for “SCSI 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.



Choose “SCSI I/O Timeout –Default (7 seconds),” then press **[ENTER]**. A list of selections will appear. Move the cursor bar on a selection, then press **[ENTER]**. Choose **Yes** in the dialog box that follows to confirm the setting.

Maximum Tag Count (Tag Command Queuing)

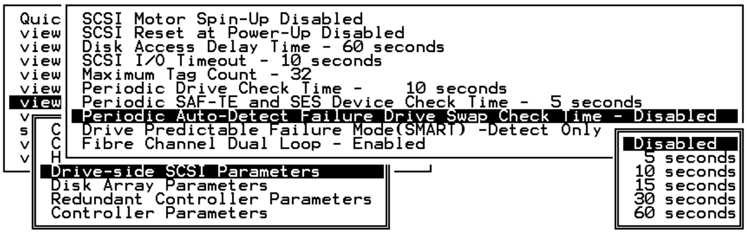


The controller supports tag command queuing with an adjustable maximum tag count from 1 to 128. The default setting is “Enabled” with a maximum tag count of 32. This setting can be changed or tag command queuing can be disabled. Choose “Maximum Tag Count”, then press **[ENTER]**. A list of available tag count numbers will appear. Move the cursor bar to a number, then press **[ENTER]**. Choose **Yes** in the dialog box that follows to confirm the setting.

IMPORTANT!

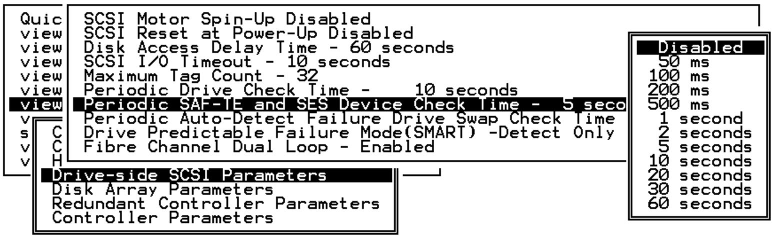
- *Every time you change this setting, you must reset the controller for the changes to take effect.*
- *Disabling Tag Command Queuing will disable the Write- Back cache built in the hard drive.*

Detection of Drive Hot Swap Followed by Auto Rebuild



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.

SAF-TE and S.E.S. Enclosure Monitoring

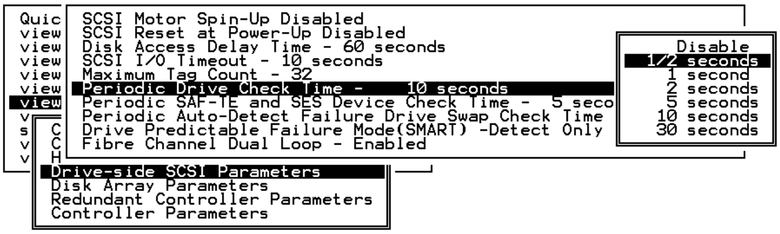


If there are remote devices within your RAID enclosure monitored via SAF-TE/S.E.S., use this function to decide at what interval the controller will check the status of these devices. Choose "Periodic SAF-TE and SES Device Check Time"; then press **[ENTER]**. Move the cursor to the desired interval; then press **[ENTER]**. Choose **Yes** in the dialog box that follows to confirm the setting.

Periodic Drive Check Time

The "Periodic Drive Check Time" is an interval for the controller to check all of the drives that were on the SCSI bus at controller startup (a list of all the drives that were detected can be seen under "View and Edit SCSI Drives"). The default value is "Disabled." "Disabled" means that if a drive is removed from the bus, the controller 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 interval – all of the drives that are listed under "View and

Edit SCSI Drives.” If any drive is then removed, the controller will be able to know – even if no host accesses that drive.

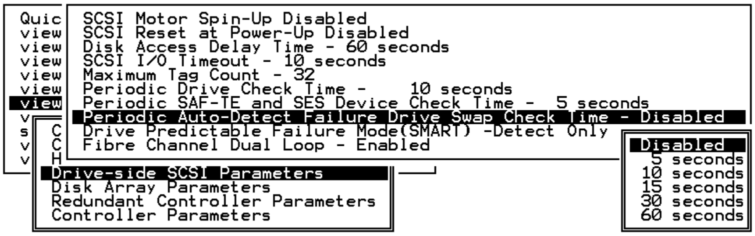


Idle Drive Failure Detection

Periodic Auto-Detect Failure Drive Swap Check Time

The “Drive-Swap Check Time” is the interval at which the controller checks to see whether 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 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.

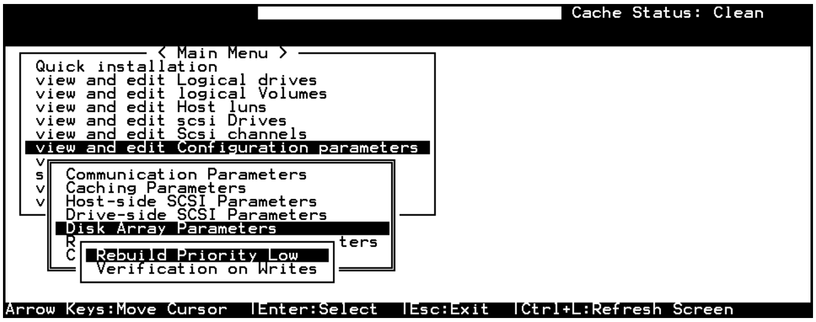


Choose “Periodic Drive Check Time;” then press **[ENTER]**. Move the cursor to the desired interval; then press **[ENTER]**. Choose **Yes** in the dialog box that follows to confirm the setting.

IMPORTANT!

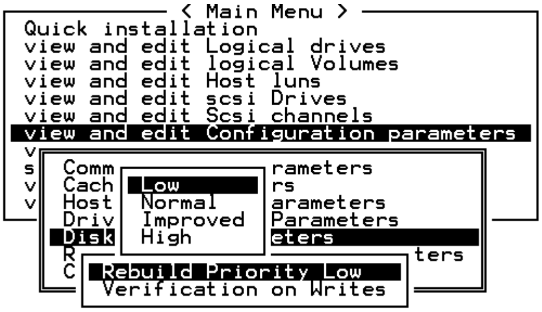
- *By choosing a time value to enable the "Periodic Drive Check Time," the controller will poll all of the connected drives in the controller’s drive channels at the assigned interval. Drive removal will be detected even if a host does not attempt to access data on the drive.*
- *If the "Periodic Drive 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 has been powered on. The controller will only be able to detect drive removal when a host attempts to access the data on the drive.*

10.4 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.

Rebuild Priority



Choose "Rebuild Priority," then press **[ENTER]**. A list of the priority selections (Low, Normal, Improved, or High) will appear. Move the cursor bar to a selection, then press **[ENTER]**.

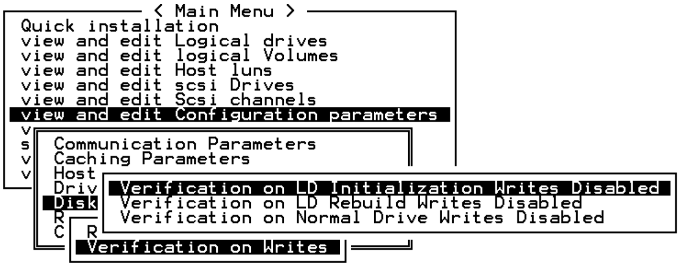
Verification on Writes

Normally, errors may occur when a hard drive writes data. In order to avoid the write error, the controller can force the hard drives to verify the written data. There are three selectable methods:

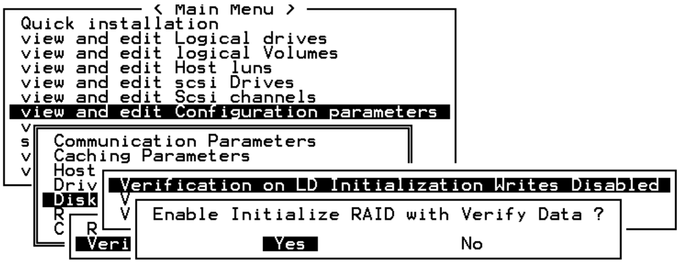
- Verification on LD Initialization Writes
  Performs Verify-after-Write while initializing the logical drive.
- Verification on LD Rebuild Writes
  Performs Verify-after-Write during the rebuilding process.
- Verification on LD Normal Drive Writes
  Performs Verify-after-Write during normal I/O requests.

Each method can be enabled or disabled individually. Hard drives will perform Verify-after-Write according to the selected method.

To decide under what condition the Verification on Writes will work, press **[ENTER]** on the “Verification on Writes” in the “Disk Array Parameters” menu. The items for selection will appear on screen.



Move the cursor bar to the desired item, then press **[ENTER]**.



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 during normal use.*

Chapter

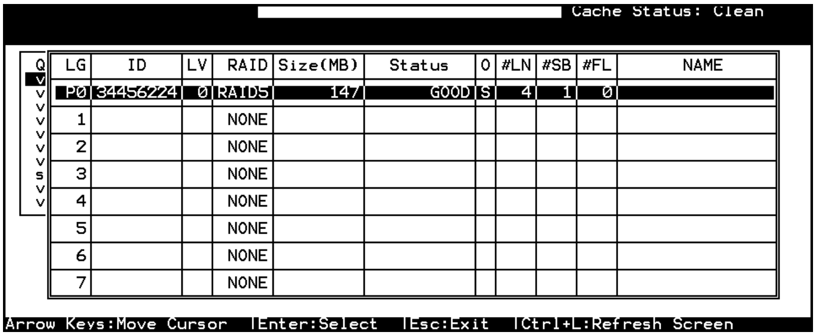
11 Record of Settings

In addition to saving the configuration data in NVRAM to disk, keeping a hard copy of the controller configuration is also recommended. This will speed the recreation of the RAID in the event of a disaster.

The following tables are provided as a model for recording configuration data.

As a general rule, the configuration data in the NVRAM should be *saved to disk or file (using TextRAID Manager)* whenever a configuration change is made (see section 8.14).

11.1 View and Edit Logical Drives



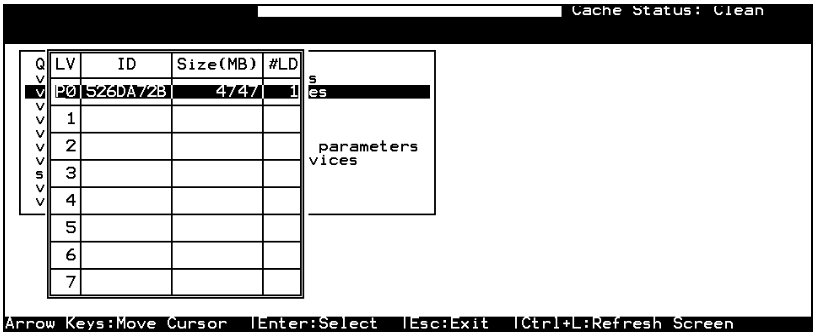
Logical Drive Information

LG	ID	LV	RAID Level	size (MB)	Status	O	#LN	#SB	#FL	NAME	Disk reserved space

Partition Information

LG	Partition	Size (MB)	LG	Partition	Size (MB)

11.2 View and Edit Logical Volumes



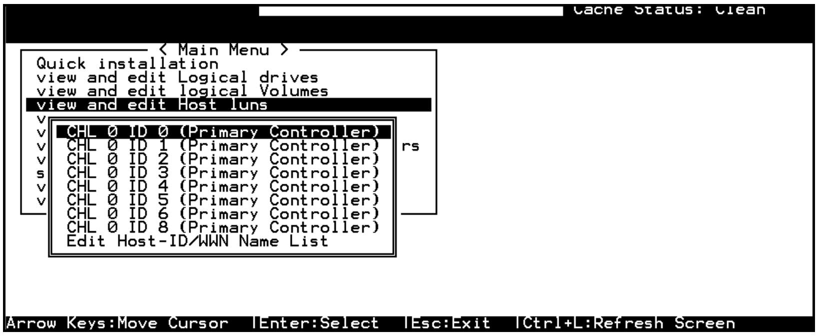
Logical Volume Information

LV	ID	Size	#LD	Stripe size

Partition Information

LV	Partition	Size (MB)	LV	Partition	Size (MB)

11.3 View and Edit Host LUN's

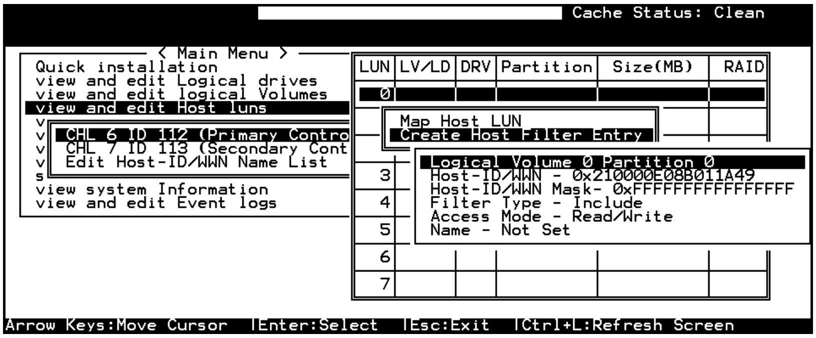


LUN Mappings

Host Channel	Pri. / Sec. Controller	SCSI ID	LUN	Logical Drive / Logical Volume	Partition	Size

Host-ID / WWN Name List

Host-ID/WWN	Name List

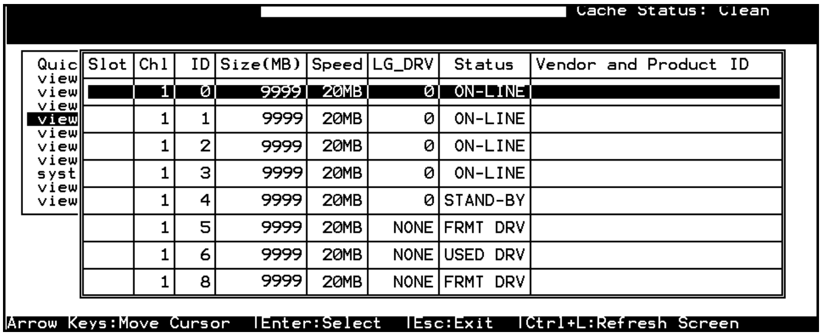


Host Filter Entries

LUN	LV/LD	DRV	Partition	Size (MB)	RAID

LV/LD? Partition ?	Host-ID/WWN	Host-ID/WWN Mask	Filter Type	Access Mode	Name

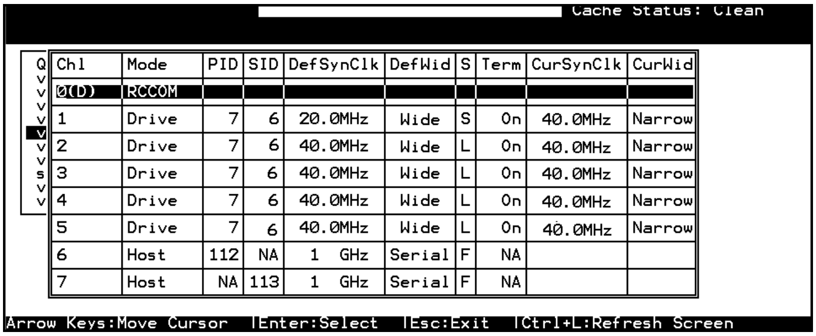
11.4 View and Edit SCSI Drives



Slot	Chl	ID	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID
	1	0	9999	20MB	0	ON-LINE	
	1	1	9999	20MB	0	ON-LINE	
	1	2	9999	20MB	0	ON-LINE	
	1	3	9999	20MB	0	ON-LINE	
	1	4	9999	20MB	0	STAND-BY	
	1	5	9999	20MB	NONE	FRMT DRV	
	1	6	9999	20MB	NONE	USED DRV	
	1	8	9999	20MB	NONE	FRMT DRV	

Slot	Chl	ID	Size (MB)	Speed	LG DRV? Global Spare? Local Spare?		Vendor & Product ID
					LG		
					LG		
					LG		
					LG		
					LG		
					LG		
					LG		
					LG		
					LG		
					LG		
					LG		
					LG		
					LG		
					LG		

11.5 View and Edit SCSI Channels

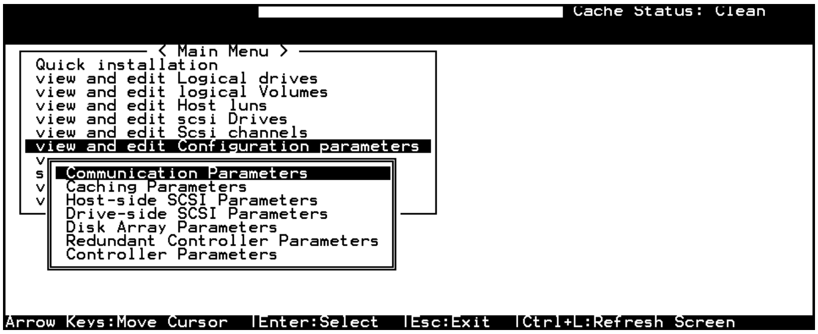


Chl	Mode	PID	SID	DefSynClk	DefWid	S	Term	CurSynClk	CurWid
0(D)	RCCOM								
1	Drive	7	6	20.0MHz	Wide	S	On	40.0MHz	Narrow
2	Drive	7	6	40.0MHz	Wide	L	On	40.0MHz	Narrow
3	Drive	7	6	40.0MHz	Wide	L	On	40.0MHz	Narrow
4	Drive	7	6	40.0MHz	Wide	L	On	40.0MHz	Narrow
5	Drive	7	6	40.0MHz	Wide	L	On	40.0MHz	Narrow
6	Host	112	NA	1 GHz	Serial	F	NA		
7	Host	NA	113	1 GHz	Serial	F	NA		

Chl	Mode (Host / Drive)	Primary Controller SCSI ID(s)	Secondary Controller SCSI ID(s)	Default Sync Clock	Default Wide	Terminator Diff/Enable/Disable/	Current Sync Clock	Current Width

Parity Check	View channel host-ID/WWN	View device port name list (WWPN)

11.6 View and Edit Configuration Parameters



Communication Parameters

RS-232 Port Configuration

COM 1 (RS-232 Port)

Baud Rate	☐ 2400 ☐ 4800 ☐ 9600 ☐ 19200 ☐ 38400
Data Routing	☐ Direct to Port ☐ Through Network
Terminal Emulation	☐ Enabled ☐ Disabled

COM 2 (Redundant Controller Port)

Baud Rate	☐ 2400 ☐ 4800 ☐ 9600 ☐ 19200 ☐ 38400
Data Routing	☐ Direct to Port ☐ Through Network
Terminal Emulation	☐ Enabled ☐ Disabled

PPP Configuration

PPP Access Name	__________
PPP Access Password	__________

Modem Operation → Modem Setup

Configure Modem Port	☐ Modem Port Not Configured ☐ COM1 ☐ COM2
Modem Operation Mode	☐ None (Default Used) ☐ Replace Default ☐ Append to Default
Modem Initialization - Custom Init. Command	AT
Dial-out Command	AT
Auto Dial-out on Initialization	☐ Enabled ☐ Disabled
Dial-out Timeout	________ Seconds
Dial-out Retry Count	Retry ________ times
Dial-out Retry Interval	________ Minutes
Dial-out on Event Condition	☐ Disabled ☐ Critical Events Only

	☐ Critical Events and Warnings ☐ All Events, Warnings and Notifications

Caching Parameters

Write-back Cache	☐ Enabled ☐ Disabled
Optimization for	☐ Random I/O ☐ Sequential I/O

Host Side SCSI Parameters

Maximum Queued I/O Count	☐ Auto __________
LUNs per Host SCSI ID	☐ 1 LUN ☐ 2 LUNs ☐ 4 LUNs ☐ 8 LUNs
Number of Tags Reserved for each Host-LUN connection	__________
Peripheral Device Type Parameters	Peripheral Device Type - Device Qualifier - Removable media - LUN applicability -
Host Cylinder/Head/Sector Mapping configuration	Cylinder - Head - Sector -
Fibre Connection Options	__________

Drive Side SCSI Parameters

SCSI Motor Spin-up	☐ Enabled ☐ Disabled
SCSI Reset at Power Up	☐ Enabled ☐ Disabled
Disk Access Delay Time	☐ No Delay _______ Seconds
SCSI I/O Timeout	☐ Default _______
Maximum Tag Count	☐ Disabled _______
Periodic Drive Check Time	☐ Disabled _______
Periodic SAF-TE and SES Device Check Time	☐ Disabled _______
Periodic Auto-Detect Failure Drive Swap Check Time	☐ Disabled _______
Drive Predictable Failure Mode	☐ Disabled ☐ Detect only ☐ Detect and Perpetual Clone ☐ Detect and Clone + Replace
Fibre Channel Dual Loop	☐ Enabled ☐ Disabled

Disk Array Parameters

Rebuild Priority	☐ Low ☐ Normal ☐ Improved ☐ High
Verifications on Writes	
Verifications on LD Initialization Writes	☐ Enabled ☐ Disabled
Verifications on LD Rebuild Writes	☐ Enabled ☐ Disabled
Verifications on Normal Drive Writes	☐ Enabled ☐ Disabled

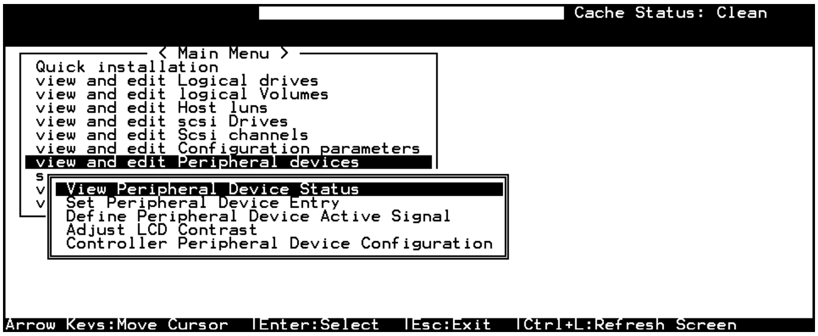
Redundant Controller Parameters

Redundant Controller Communication Channel	__________

Controller Parameters

Controller Name	☐ Not Set __________
LCD Tile Display	☐ Controller Logo ☐ Controller Name
Password Validation Timeout	☐ Disabled ☐ 1 minute ☐ 2 minutes ☐ 5 minutes Logo ☐ Always Check
Controller Unique Identifier	__________
SDRAM ECC	☐ Enabled ☐ Disabled

11.7 View and Edit Peripheral Devices



Set Peripheral Device Entry

Redundant Controller	☐ Enabled ☐ Disabled
Power Supply Status	☐ Enabled ☐ Disabled
Fan Status	☐ Enabled ☐ Disabled
Temperature Status	☐ Enabled ☐ Disabled
UPS Status	☐ Enabled ☐ Disabled

Define Peripheral Device Active Signal

Power Supply Fail Signal	☐ Active High ☐ Active Low
Fan Fail Signal	☐ Active High ☐ Active Low
Temperature Alert Signal	☐ Active High ☐ Active Low
UPS Power Fail Signal	☐ Active High ☐ Active Low
Drive Failure Outputs	☐ Active High ☐ Active Low

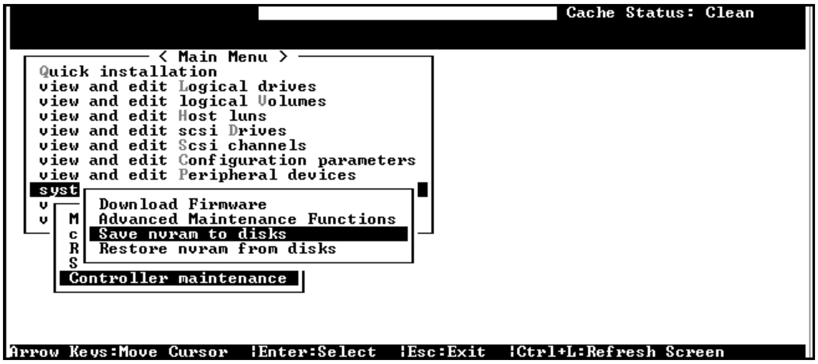
View System Information

Total Cache Size	☐ EDO DRAM ☐ Normal DRAM ________ MB
Firmware Version	
Bootrecord Version	
Serial Number	
Battery Backup	☐ On ☐ Off

Event Threshold Parameters

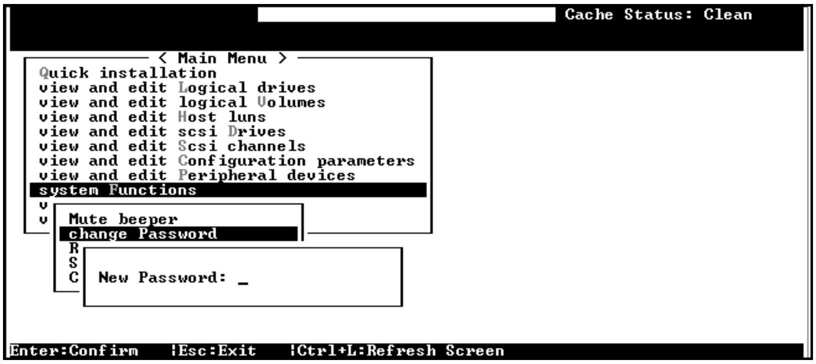
Thresholds for +3.3V	Upper ________ Lower ________
Thresholds for +5V	Upper ________ Lower ________
Thresholds for +12V	Upper ________ Lower ________
Thresholds for CPU temperature	Upper ________ Lower ________
Thresholds for Board Temperature	Upper ________ Lower ________

11.8 Save NVRAM to Disk, Restore from Disk



Update Firmware	Date	Save NVRAM to Disk or File	Date/Location	Restore NVRAM from Disk	Date

11.9 RAID Security: Password



RAID Security

Controller Name	Password __________

Chapter

12

Redundant Controller

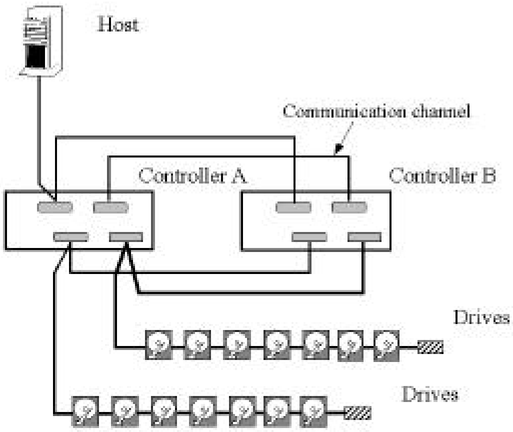
12.1 Operation Theory

12.1.1 Physical Connection

Details in the topological configurations of redundant controllers can be found in the *Hardware Manual* that came with your controller. The proceeding discussions will focus on the theories and the configuration process of a redundant controller system. Users who are familiar with the practice of redundant controller configuration, please jump to section "12.3 Configuration."

SCSI Interface

Figure 12 - 1 Redundant Configuration Using SCSI Controllers

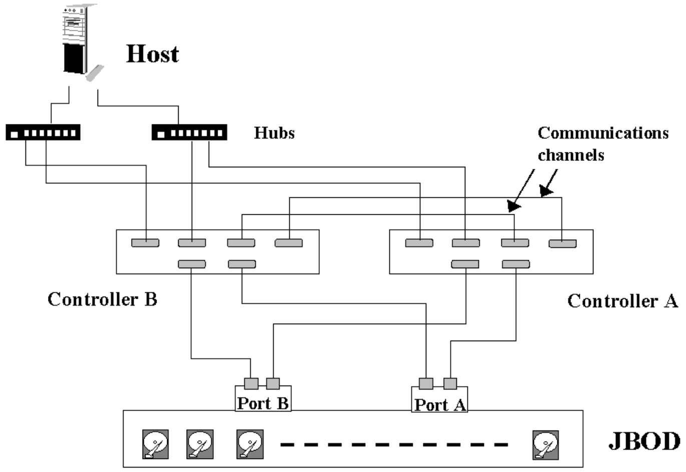


The physical connection between controllers should be similar to the one shown above. All channels should be connected to both controllers. The path default for controller communications (SCSI) is channel 0. Channel 0 is also the default for host interface; therefore, avail other channel for host connection by changing its channel mode.

Fibre Interface

The controller communication is more flexible with the Fibre controllers. Integrators may choose SCSI channels 6 and 7 or Fibre channel(s) as illustrated below for inter-communications. Cache synchronization over two SCSI channels - channel 6 and 7 - is supported by firmware release 3.12 and above.

Figure 12 - 2 Redundant Configuration Using Fibre Controllers



With Fibre-to-Fibre controllers, there are basically three choices with inter-communications:

1. **SCSI Path** - The first is using SCSI channels (implemented as channels 6 and 7) as the communications paths. The only exception is that the 6-channel EonRAID does not support SCSI interface on its back panel.

2. **Dedicated Fibre Loops** - The second is choosing one or two Fibre channels as the dedicated communications paths. Two for communications is recommended for the redundancy it provides. It allows one path to fail without affecting system operation. The controllers will shift communications to the existing path. Dual-channel configuration offers a greater throughput as well as enhanced performance.

3. **Communications over Drive Loops** - The third is choosing all drive loops together. The controllers will distribute the communications traffic to all drive loops. Workflow will be balanced among loops saving channels for drive connection. With the EonRAID 2000-6, for instance, there can be as many as two host and four drive channels forming the drive connectivity in two dual-loop configurations while still benefited from controller communications.

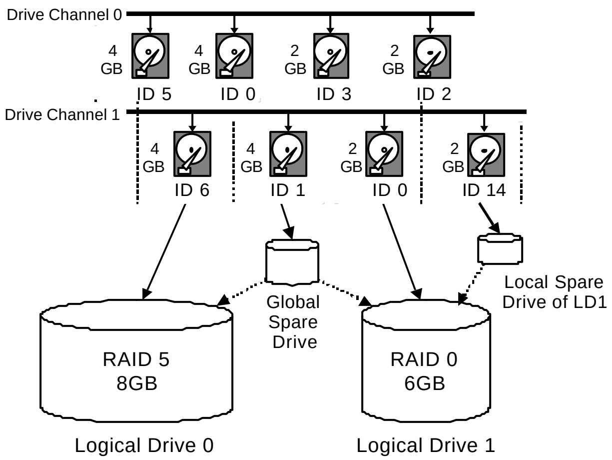
Other Interfaces

Other interfaces need to be connected to both controllers. For example, in the event of single controller failure, terminal emulation through the IFT-9535 cable will be continued by an existing controller without user's intervention.

12.1.2 Grouping Hard Drives and System Drive Mapping

A Logical Drive (logical configuration of drives) consists of a group of SCSI drives. Drives in one logical drive do not have to come from the same SCSI channel. Each logical drive can be configured a different RAID level and several logical drives can be used to compose a larger logical volume.

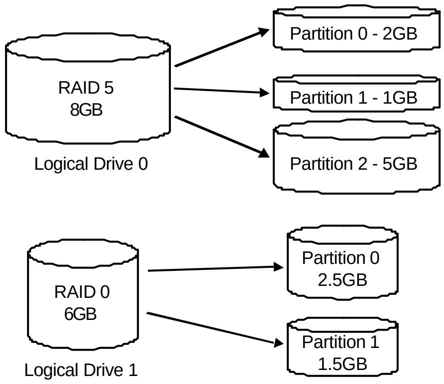
Figure 12 - 3 Grouping Hard Drives



While grouping physical drives together, another drive can be assigned as the **Local Spare Drive** to one specified logical drive, or as the **Global Spare Drive**. A Local Spare is taken to rebuild one logical drive while a Global Spare participates in the rebuild of any logical drive in a RAID system.

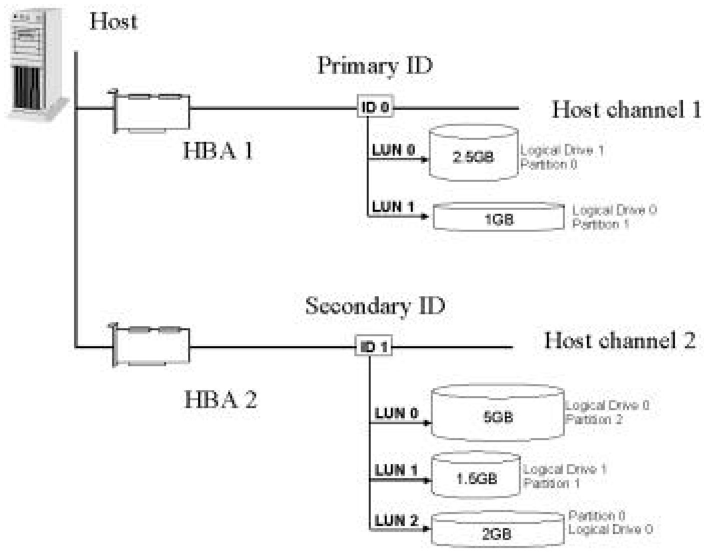
You may divide a logical drive into several partitions as diagrammed below, or use the entire logical drive as one single partition.

Figure 12 - 4 Partitioning Logical Units



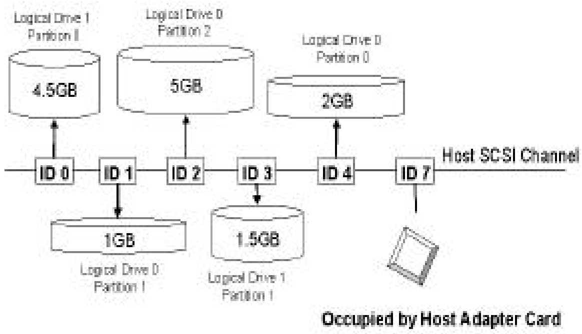
Map each partition to a host SCSI ID (Primary or Secondary ID). You may have to create Primary and Secondary IDs separately on host and drive channels if these IDs are not available. The configuration procedure will be discussed in section "12.3." Partitions mapped to a Primary ID (meaning that the partition has been assigned to the Primary controller) will be managed by the Primary controller, and those mapped to a Secondary ID the Secondary controller. Each SCSI ID (or LUN under ID) will act as one individual hard drive to the host computer virtually.

Figure 12 - 5 Mapping System Drives (LUNs)



configuration of drives to LUNs under either ID and thus divide or distribute the workload specifically to different controllers.

Figure 12 - 6 Mapping System Drives (IDs)



Some operating systems do not read multiple LUNs under single SCSI ID. As diagrammed above, you may create multiple IDs on the host channel and map logical configurations to these IDs. Each of these IDs can be designated as Primary or Secondary. Units mapped to Primary IDs will be managed by the Primary controller, and those mapped to Secondary IDs Secondary controller. As a rule, each unit will be mapped to LUN0 under each SCSI ID.

12.1.3 Fault-Tolerance

Hardware failures can occur. A simple parity error may sometimes cause a RAID system to completely hang up. However, system down time is not allowed for today's mission-critical environment. Having two controllers working together will guarantee that at least one controller will survive the catastrophes and keep the system working. This is the logic behind having redundant controllers – to minimize the best we could the chance of down time for a storage system.

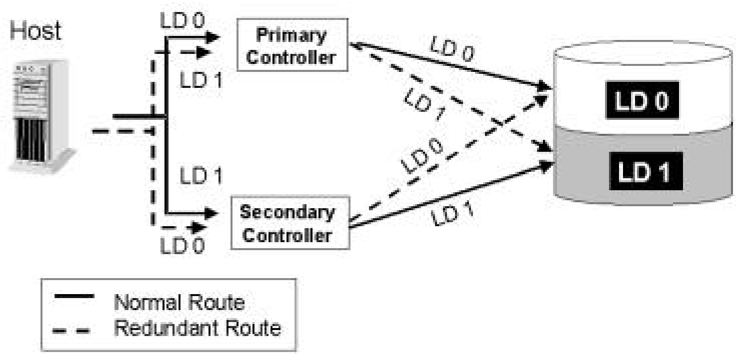
Redundant controller means using two controllers in a RAID system. The redundant controller configuration requires two controllers and both must be working normally. During normal operation, each controller serves its own I/O requests from the host. If one controller in this configuration should fail, the existing controller will temporarily take over for the failed controller until it is replaced. The failover and failback processes are totally transparent to host and require only physical disconnect and reconnect efforts. Controllers are hot-replaceable and replacing a failed unit takes only a few minutes.

Controller Failover and Failback

A. Channel Bus

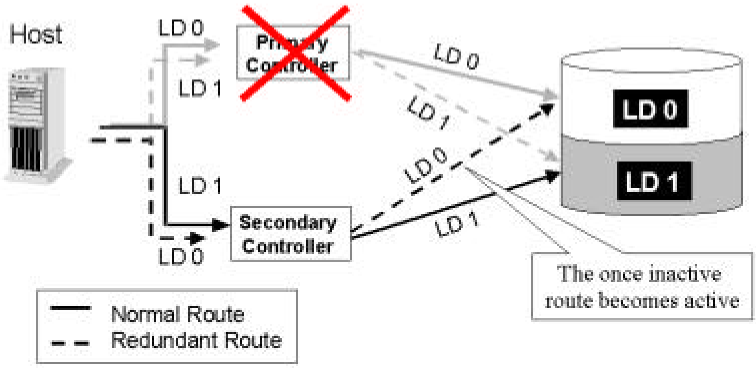
Here is a sample illustration of the redundant controller operation:

Figure 12 - 7 Redundant Controller Channel Bus



The host computer is connected to both the Primary and Secondary controllers. Each controller has one of its SCSI/Fibre channels assigned as the host channel, with the other SCSI/Fibre channels assigned as the drive channels. There are two logical drives. Logical drive 0 is assigned to the Primary controller; and logical drive 1 assigned to the Secondary controller. Should one controller fail, the existing controller will be able to access the logical drive belonging to the failed controller via the previously assigned ID.

Figure 12 - 8 Controller Failover



For every channel that is actively serving I/Os, there is another on the alternate controller that stays idle and will inherit the task should its counterpart fail.

B. Controller Failover and Failback

In an unlikely event of controller failure, the existing controller will acknowledge the situation and disconnect with the failed controller. The existing controller will then behave as both controllers and serve all the host I/O requests. 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 the same version of firmware installed. However, it is inevitable a replacement controller is usually running later version of firmware. To solve this problem, **firmware synchronization** is supported since firmware version 3.21. When the replacement is combined with a redundant controller system, the existing controller will take over and both controllers will be running the same version of firmware.

Your system vendor should be able to provide an appropriate 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 will automatically combine with the replacement controller (IFT-3102U2G and above). When the initialization process is completed, the replacement controller will perform as the Secondary controller. Then both controllers will be restored to the original configuration that was preserved before controller failure. If the existing 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.

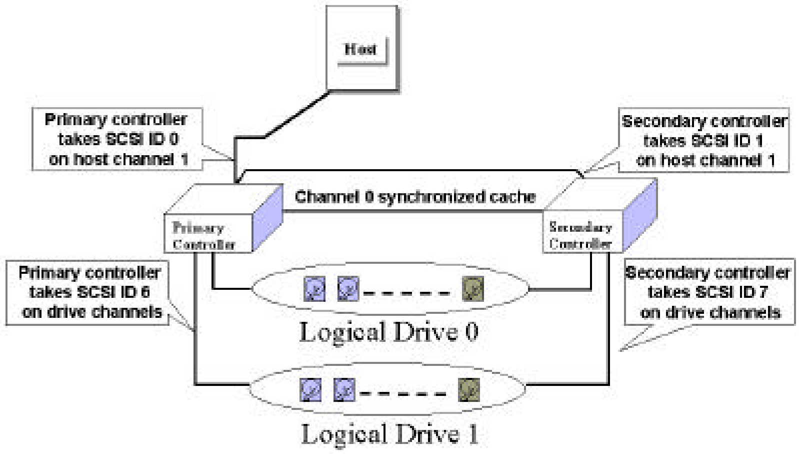
C. Active-to-Active Configuration:

Active-to-active configuration conducts all system resources to performance. Logical units (a logical drive, logical volume, or one of its logical partitions) can be mapped to either the Primary ID or the Secondary ID on host channel. This allows a flexible assignment of different logical units to different controllers. Each controller serves the logical unit(s) mapped to its host ID/LUN during normal operation. Workload can then be manually distributed between controllers.

D. Traffic Distribution and Failover Process

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 are created to facilitate active-active operation. Each controller occupies either a Primary ID or a Secondary ID on drive channels. One logical unit 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 unit and continue I/Os.

Figure 12 - 9 Traffic Distribution



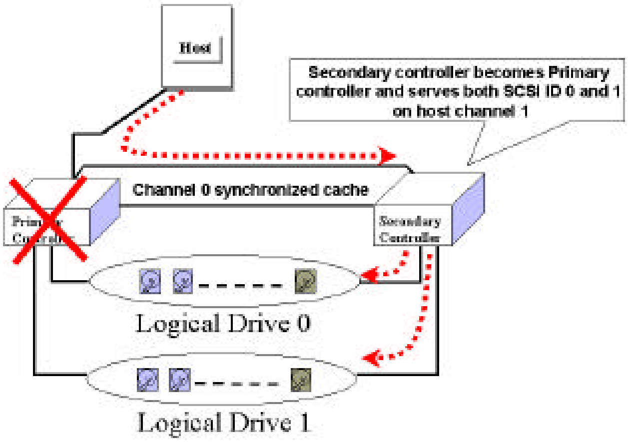
	Logical Drive 0	Logical Drive 1
Host LUN Mapping	ID0 / LUN*	ID1 / LUN*
Logical Drive Assignment	Primary	Secondary
Drive Channel	2	3

When configuring a logical unit, users should assign the logical unit to the Primary or the Secondary controller. Once the assignment is done, logical unit(s) assigned to the Primary controller can only be mapped to the Primary ID on host channel; Logical unit(s) assigned to the Secondary controller can only be mapped to the Secondary ID on host channel.

The channel ID (Primary/Secondary) assignment for a SCSI controller may look like this:

	Primary Controller ID	Secondary Controller ID
Host Chl SCSI ID	PID = 0	SID = 1
Drive Chl SCSI ID	7 (or 8 for the dual redundant chassis)	6 suggested (or 9 for the dual redundant chassis)

Figure 12 - 10 Controller Failover



E. Controller Failure

Controller failure is managed by the existing controller. The existing controller disables and disconnects from its counterpart while gaining access to all the signal paths. The existing controller then manages the ensuing event notifications and take-over process. The existing controller is always the Primary controller regardless of its original status and any replacement recombined afterwards will assume the role of the Secondary.

Symptoms

- LCD on the failed controller is off. LCD on the existing controller displays controller failure message.
- The existing controller sounds alarm
- The "ATTEN" LED flashing on the existing controller
- The existing controller sends event messages notifying controller failure

F. Considerations with Redundant Controllers

- **SCSI Termination:**

For the SentinelRAID series in redundant mode, the on-board terminators should be hardware-enabled by jumper switches. Integrators may apply external terminators at both ends of a SCSI bus or choose to enable the on-board terminators on the controller I/O backplane. The precaution is that, terminators must be "hardware-enabled" via jumper switches rather than "firmware-enabled." Although terminators can be activated via firmware settings, firmware control is lost when a controller fails. Settings via firmware will result in SCSI bus failure because every channel is connected between controllers.

For the 3101 and 3102 series, external terminators should be applied instead. Please refer to the *Hardware Manual* for details.

- **Connection:**

The channels of the two controllers that are connected together must be the same. For example, if controller 1 uses channel 2 to connect a group of drives, controller 2 must also use channel 2 to connect to the drive group.

12.2 Preparing Controllers

12.2.1 Requirements:

To set up the redundant function, you must perform some basic steps. These steps will be discussed in the following section.

Cabling Requirements:

Communications Channels:

- Controller Communications (Cache Synchronizing) Paths:

Controller	RCC cable
3101 & 3102 series	IFT-9013 and IFT-9016 + SCSI CH0
SentinelRAID	A SCSI cable (CH 0)
EonRAID 2000-4	Two SCSI cables (CH 6&7)
EonRAID 2000-6	Two RCC cables (IFT-9536) Fibre cables: Communications over two of the dedicated I/O channels or using all drive loops to distribute comm. traffic

- Using one or two I/O channels for controller communications (as listed above) is necessary especially when write-back caching is preferred. If controllers are running in write-back mode, a battery module is recommended for each controller.
- Use the default channel (CH 0) for the SentinelRAIDs. For the EonRAID users, if the communications over Fibre is preferred, the RCC cables (IFT-9536) should be connected to provide the connection between controller detect signals.

Out-of-band Configuration

- RS-232C cable (for Terminal Interface Operation) connection. Configuring two independent controllers into the redundant mode requires the IFT-9535.
- Ethernet connection: If management through Ethernet is preferred, connect the Ethernet interface from both controllers to ports on a hub. The IP address assigned to one controller will be inherited by another should controller failover occur.

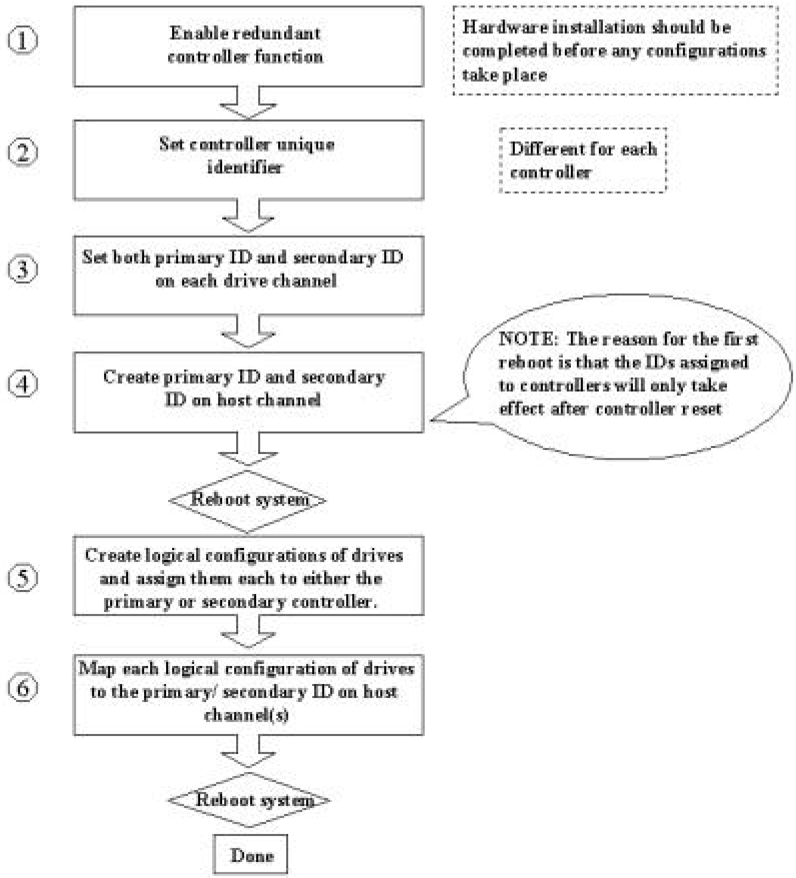
Host and Drive Connection

- All channels must be connected between controllers

Controller Settings:

Redundant Controller Setup: A *Quick Access* to the Configuration Process

Figure 12 - 11 Redundant Controller Configuration Process



1. ***Enable Redundant Controller***:

   "Main Menu"→ "View and Edit Peripheral Devices"→ "Set Peripheral Device Entry"→ "Redundant Controller Enable / Disable"

2. ***Controller Unique Identifier:***

   Set unique identifier to each controller. "View & Edit Peripheral Devices"→ "Set Peripheral Device Entry"→ "Controller Unique Identifier." Enter different value for each controller from 1 to 65535.

3. ***Create Primary and Secondary IDs on Drive Channels:***

   "View and Edit SCSI Channels"→ Choose a Drive Channel→ "Primary / Secondary Controller SCSI ID."

4. ***Create Primary and Secondary IDs on Host Channels:***

   "View and Edit SCSI Channels"→ Choose a host channel→ "View and Edit SCSI ID"→ Choose a SCSI ID→ "Add / Delete Channel SCSI ID"→ "Primary / Secondary Controller"→ Add SCSI ID from the list. Reset the controller for the configuration to take effect.

5. ***Create Logical Configurations of Drives and assign each of them to either the Primary or the Secondary Controller:***

   "View and Edit Logical Drives"→ Select a RAID level→ Select member drives→ "Logical Drive Assignments"→ Create Logical Drive.

6. ***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 / Physical SCSI Drive→ Map to Host LUN (Create Host LUN Entry).

NOTE:

- *The redundant function of the controllers can be enabled via the front keypad or a terminal emulation program. Section 12.3 describes the procedures for using the terminal emulation and LCD front panel. The same result can be achieved regardless of the interface used.*

12.2.2 Limitations

- Both controllers must be exactly the same. Namely, they must operate with the same firmware version, the same size of memory, the same number of host and drive channels, etc. If battery backup is preferred, both should be installed with a battery module.
- The takeover process will take less than one second (using SCSI or Fibre for controller communications) to complete.
- In redundant mode, the maximum number of disk drives on a SCSI drive channel is 14.
- Connection through Fibre hubs or switches is necessary for joining host (Fibre) interfaces between controllers.
- The controller defaults for ID settings are listed below:

Host interface	Host channel (Primary / Secondary)	Drive channel (Primary / Secondary)
SCSI	0 / 1…	7 / 6
Fibre	112 / 113…	119 / 120

- SCSI IDs 8 (PID) and 9 (SID) are the recommended defaults to the drive channels of the dual redundant chassis using an integrated backplane.

12.2.3 Configurable Parameters

Primary Controller or Secondary Controller

If necessary, users can specify a particular controller as Primary or Secondary. By setting each controller to "Autocfg" mode, the controllers will decide between themselves which is the Primary and which is the Secondary.

The controller firmware recognizes the two controllers used in a redundant configuration as Primary and Secondary. Two controllers behave as one Primary controller. Once the redundant configuration takes effect, user's configurations and settings can only be done on the Primary controller. The Secondary controller then synchronizes with the configuration of the Primary controller, making the configurations of two controllers exactly the same.

The two controllers continuously monitor each other. When a controller detects that the other controller is not responding, the working controller will immediately take over and disable the failed controller. However, it is not predictable which one of the controllers should fail. It is necessary to connect all other interfaces to both controllers so that the surviving controller can readily continue all the services provided for the RAID system.

Active-to-Active Configuration

Users can freely assign any logical configuration of drives to both or either of the controllers, then map the logical configurations to 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 grouped into several logical configurations and equally assigned to both controllers allowing both to share the workload.

The active-to-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-to-Standby Configuration

By assigning 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

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 existing controller attempts to complete the writes.

Data inconsistency can be avoided using one or two of the I/O channels as the communications path between the controllers. The controllers communicating over the path are constantly synchronizing the cached data 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 existing controller.

For the IFT-3102 or 3101 series, RS-232C cable can be used for redundant controller configuration, but the connection does not support the heavy traffic load for synchronizing cached data. It is recommended to apply write-through caching instead.

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

Listed below are steps necessary for configuring a redundant controller system:

1. Configure, separately, each controller in "Autoconfig" mode. When two controllers are powered on later, firmware will determine which is the Primary.

2. If SCSI channel 0 is used as the communications channel, firmware will display channel status as "RCCOM (Redundant Controller Communications)." This channel will then be excluded from the use of host / drive connection.

3. When powering on both controllers together, LCD will display "RC connecting." After the controller negotiation is completed, the communications between controllers will be established.

4. Configure your SCSI / Fibre channels as host or drive. The default configuration for SCSI channel termination is "enabled." Please refer to Appendix D of your controller *Hardware Manual* and examine whether the termination jumpers on controller backplane are shunted. If the associated jumpers are shunted, SCSI channels will be terminated on the controller side no matter firmware setting is "enabled" or "disabled."

5. Create a "Primary ID" and a "Secondary ID" on every drive channel.

6. Reset controller for the configuration to take effect.

7. Create Logical drives / logical volumes and assign each logical unit to the Primary or to the Secondary controller.

8. Proceed with Host LUN mapping. After mapping each logical unit to a Primary or Secondary ID on host channel(s), the redundant controller configuration is complete.

12.3.1 Via Front Panel Keypad

Redundant Configuration Using Automatic Setting

Power-on Controller 1. Make sure Controller 2 is powered-off.

Press **[ENT]** for two seconds on the front panel of controller 1 to enter the main menu. Use ▼ or ▲ to navigate through the menus. Choose "View and Edit Peripheral Dev.. (View and Edit Peripheral Devices)," then press **[ENT]**.

```
View and Edit
Peripheral Dev
```

Choose "Set Peripheral Devices Entry," then press **[ENT]**.

```
Set Peripheral
Devices Entry
```

Choose "Redundant Ctlr Function__", and then press **[ENT]**. (Note: The current setting will be displayed on the LCD. If this controller has never been set as a redundant controller before, the default setting of the redundant controller function is "disabled." The message "Redundant Ctlr Function Disable" will be displayed on the LCD. Press **[ENT]** to proceed.

```
Redundant Ctlr
Function Disable
```

The message "Enable Redundant Ctlr: **Autocfg**?" will appear. Use ▼ or ▲ to scroll through the available options ("**Primary,**" "**Secondary**," or "**Autocfg**"), then press **[ENT]** for two seconds to select "Autocfg."

```
Enable Redundant
Ctlr: Autocfg  ?
```

The message “Ctlr Unique ID- ?” will appear. This value will be used to generate a controller-unique WWN node name which is necessary during the controller failback process. Enter any number from 1 to 65535 and press **[ENTER]**. The value you enter should be different for each controller.

```
Ctlr  Unique
ID-      1     ?
```

The message "Redundant Ctlr Autocfg Inactive" will appear. “

```
Redundant Ctlr:
Autocfg Inactive
```

Power-off controller 1, and then power on controller 2. Set controller 2 to "**Autocfg**" as described in the previous discussion. Power off controller 2.

When the redundant controller function is set to the "Autocfg" setting, the controllers will decide between themselves which will be the Primary controller. If you need to specify a particular controller as Primary or Secondary, do not set it as "autocfg;" choose "Primary" or "Secondary" instead. Please refer to the following section for more detail.

Redundant Configuration Using Manual Setting

Power on controller 1. Make sure controller 2 is powered-off.

Press **[ENT]** for two seconds on the front panel of controller 1 to enter the main menu. Use ▼ or ▲ to navigate through the menus. Choose "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__," and then press **[ENT]**. (Note: The current setting will be displayed on the LCD. If this controller has never been set as a redundant controller before, the default setting of the redundant controller function is "disabled." The message "Redundant Ctlr Function Disable" will be displayed on the LCD screen. Press **[ENT]** to proceed.)

```
Redundant Ctlr
Function Disable
```

The message "Enable Redundant Ctlr: Autocfg?" will appear. Use ▼ or ▲ to scroll through the available options ("**Primary**," "**Secondary**," or "**Autocfg**"). Press **[ENT]** for two seconds on "Primary."

```
Enable Redundant
Ctlr: Autocfg  ?
```

You must enter a number from 1 to 65535 and press **[ENT]**. The value you enter here will be generated into a controller unique WWN node name. This value must be different for each controller.

```
Ctlr  Unique
ID-      1     ?
```

The message "Redundant Ctlr Primary Inactive" will appear.

```
Redundant Ctlr
Secndry Inactive
```

Power off controller 1, then power on controller 2. Set controller 2 to "Secondary" as described above.

Power off controller 2.

Starting the Redundant Controllers

```
RC connecting...
<ENT> to cancel
```

Power on all hard drives and the two controllers. 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. A few seconds later, the LCD display on the Secondary controller will be similar to the LCD display on the Primary controller. The upper right corner of LCD will then be displaying 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 an unlikely event of a controller failure.

The Primary and Secondary controllers synchronize each other’s configurations at frequent intervals through the communications channel(s). Write-back caching will be disabled on the 3102 series if the connection between controllers is made by a redundant controller cable without using channel 0 as the synchronized cache channel.

Creating Primary and Secondary ID

```
View and Edit
SCSI Channels ↕
```

Enter "View and Edit SCSI Channels." Press **[ENT]** and use ▼ or ▲ to select the host or drive channel on which you wish to create Primary / Secondary ID.

```
CH1=Drive PID=7
SID=NA SXF=40.0M
```

Press **[ENT]** to proceed.

```
Set SCSI Channel
Sec. Ctlr ID ..
```

Use ▼ or ▲ to select "Set SCSI Channel Pri. Ctlr ID .." or " "Set SCSI Channel Sec. Ctlr ID …" Press **[ENT]** to proceed.

```
Set Sec. Ctlr
ID:NA to ID: 6?
```

Use ▼ or ▲ to select a SCSI ID and press **[ENT]** to confirm. The configuration change will take effect only after controller reset.

The process of creating Primary and Secondary IDs on host channel is basically the same.

Assigning a Logical Drive/Logical Volume to the Secondary Controller

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. The logical drive will ***not*** be able to be accessed by the Secondary controller if this logical drive has not been assigned to the Secondary controller.

Press **[ENT]** for two seconds on the front panel of the Primary controller to enter the Main Menu.

Use ▼ or ▲ 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" SCSI ID created (Create the Secondary controller's SCSI ID on host channel or add a SCSI ID to drive channel in "View and Edit SCSI 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 ▼ or ▲ to navigate through the created IDs and press **[ENT]** to confirm. 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= 0    ?
```

Use ▼ or ▲ to choose mapping "Logical Drive," "Logical Volume," or "Physical Drive" to host LUN. If the logical unit has been partitioned, map each partition to different ID/LUNs.

```
Map to
Logical Drive ?
```

Use ▼ or ▲ to choose a LUN number and press **[ENT]** to confirm.

```
CH0 ID0 LUN0
No Mapped
```

Press **[ENT]** again to confirm.

```
Map Host LUN   ?
```

Choose a logical drive/logical volume if there are many.

```
LG0 RAID5 DRV=3
  9999MB GD SB=0
```

Choose a partition if the logical unit has been partitioned.

```
LG=0 PART=0
     999MB   ?
```

Press **[ENT]** again to confirm or scroll down to "Edit Host Filter Parameter ..." You may refer to Chapter 9 for more details.

```
Map Host LUN   ?
```

Press **[ENT]** to confirm the mapping.

```
CH0 ID9 LUN0 Map
to LG0 PRT0?
```

Press **[ENT]** to re-ensure.

```
Map Sec. Ctlr
CH=0 ID= 0   ?
```

This message indicates that the logical unit has been successfully mapped to the ID/LUN combination. Use ▼ or ▲ to continue mapping other logical units or press **[ENT]** to delete the mapped LUN.

```
CH0 ID9 LUN0
Mapto LG0 PRT0
```

Repeat the process to map all the logical units to host ID/LUNs.

Front Panel View of Controller Failure

What will happen when one of the controllers fails?

Should one of the controllers fail, 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 existing 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 the appropriate replacement unit.*
- *Some operating systems (SCO, UnixWare, and OpenServer, for example) will not 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 a controller with hot-plug capability, all you have to do is to remove front panel and pull out the eject levers to remove the failed controller.

The new controller has to be pre-configured as the "*Secondary Controller.*" (The replacement controller provided by your supplier should have been configured as the Secondary controller. It is recommended to safety check the status of the replacement controller before installing it to your redundant system. Simply attach power to the replacement and configure it as "Secondary." When safety check is done, remove the failed controller and install the replacement controller into its place.)

When the replacement is connected, the "Auto-Failback" will start automatically (IFT-3102U2G and above). If the replacement controller does not initialize, execute the following steps for the new controller to function. Press **[ENT]** for 2 seconds on the existing controller to enter the main menu.

Use ▼ or ▲ to choose "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 Autocfg Degraded" will appear on the LCD.

```
Redundant Ctlr
Autocfg 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
Scanning
```

The new controller will then start to initialize.

```
Initializing...
  Please Wait...
```

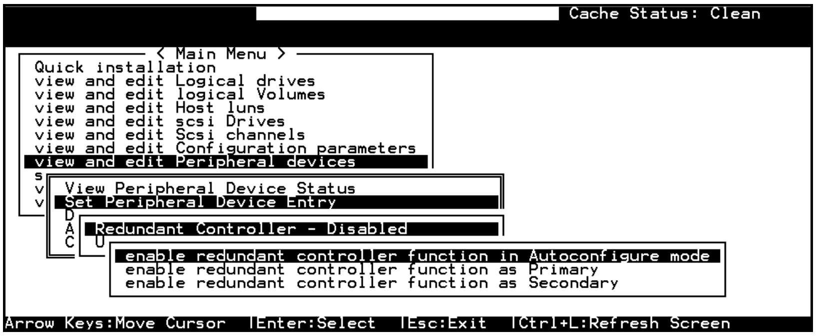
Once initialized, it will act as the Secondary controller.

```
SR2000    v3.**
██████
```

12.3.2 Via Terminal Emulation

Redundant Configuration Using Automatic Setting

Power on Controller 1. Make sure Controller 2 is powered-off.

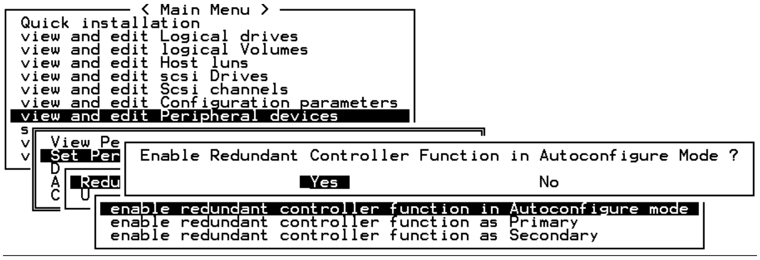


Enter the Main Menu.

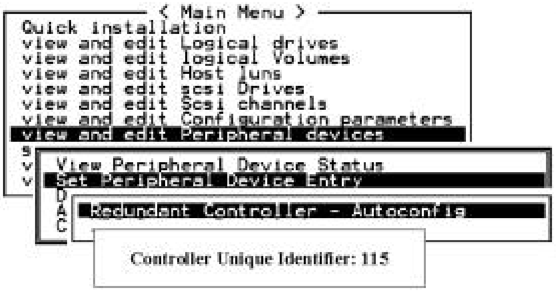
Use the arrow keys to navigate through the menus. Choose "View and Edit Peripheral Devices," then press **[ENTER]**.

Choose "Set Peripheral Devices Entry," then press **[ENTER]**. Choose "Redundant Controller [Function]," and then press **[ENTER]**. (Note: The current setting will be displayed on the screen. If this controller has never been set as a redundant controller before, the default setting of the redundant controller function is "Disabled." The message "Redundant Controller - Disabled" will be displayed on the screen. Press **[ENTER]** to proceed.)

The message "Enable Redundant Controller in **Autoconfigure** Mode" will appear.



Use the arrow keys to scroll through the available options ("Primary," "Secondary," or "Autoconfigure"), then press **[ENTER]** to select "**Autoconfigure**." When prompted by “enable redundant controller function in Autoconfigure mode?,” choose **Yes.**



A “Controller Unique Identifier” box will appear. Enter any value from 1 to 65535, then press **[ENTER]** to proceed. The value you enter for controller unique ID should be different for each controller.

Power off controller 1, and then power on controller 2. Set controller 2 to "Autoconfigure" as described in the steps mentioned above. Power off controller 2.

When the redundant controller function is set to the "Automatic" setting, the controllers will decide between themselves which will be the Primary controller. If you need to specify a particular controller as Primary or Secondary, do not set it as "autocfg;" choose "Primary" or "Secondary" instead.

Redundant Configuration Using Manual Setting

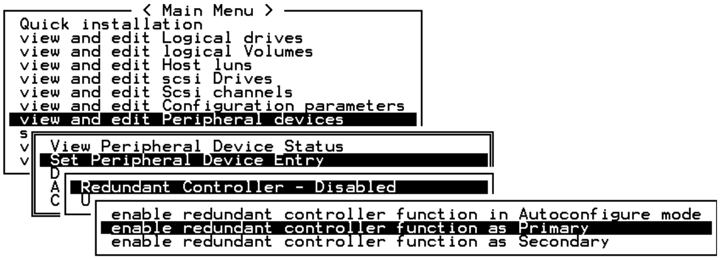
Power on controller 1. Make sure controller 2 is powered-off.

Enter the main menu. Use the arrow keys to navigate through the menus. Choose "View and Edit Peripheral Devices," then press **[ENTER]**.

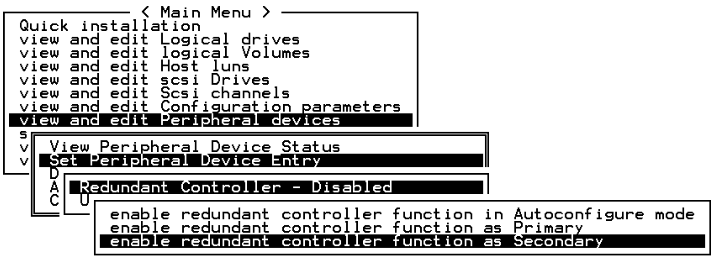
Choose "Set Peripheral Device Entry," then press **[ENTER]**.

Choose "Redundant Controller [Function]," and then press **[ENTER]**. (Note: The current setting will be displayed on the screen. If this controller has never been set as a redundant controller before, the default setting is "Disabled". The message "Redundant Controller - Disabled" will be displayed on the screen. Press **[ENTER]** to proceed.)

The message "Enable Redundant Controller in Autoconfigure Mode" will appear. Use the arrow keys to scroll through the available options ("Primary," "Secondary," or "Autoconfigure"). Press **[ENTER]** on "Primary."



- Power off controller 1, then power on controller 2. Set controller 2 to "Secondary" as described in the above steps.



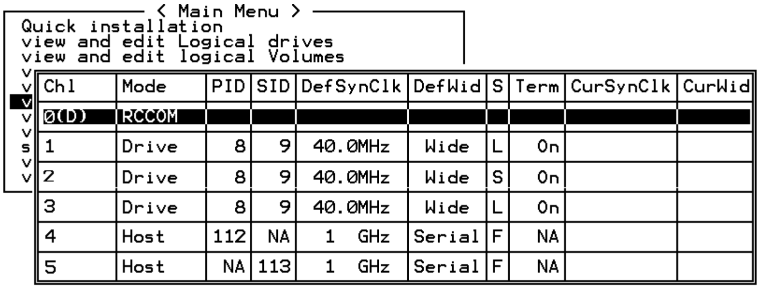
- Power off controller 2.

- Power on both controllers, drives, and host computer for the settings to take effect.

- During normal operation, the controllers continuously monitor each other. Each controller is always ready to take over for the other controller in an unlikely event of a controller failure.

- The Primary and Secondary controllers synchronize each other’s configurations at frequent intervals through the established communications path(s). Write-back cache will be disabled if no sync. cache path exists.

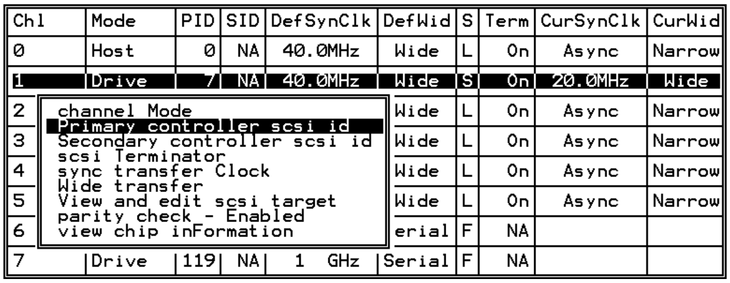
- Select "View and Edit SCSI Channels" from the Main Menu, the communications path will be displayed as "RCCOM (Redundant Controller Communications)."



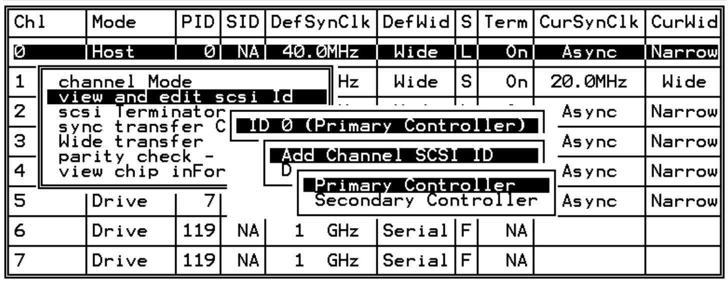
Creating Primary and Secondary ID

Enter "View and Edit SCSI Channels." Press **[ENTER]** and select the host or drive channel on which you wish to create Primary/Secondary ID.

Drive Channel



Host Channel

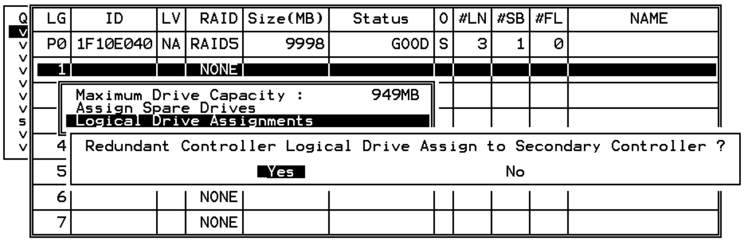


The configuration change will take effect only after controller reset.

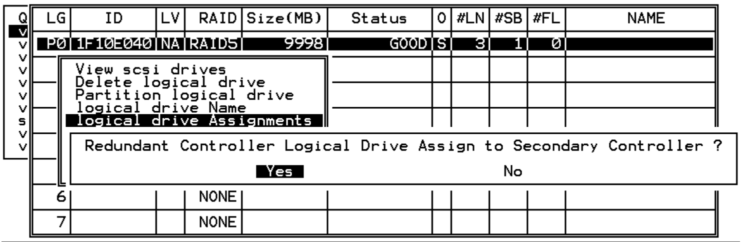
Assigning Logical Drives to the Secondary Controller

A logical drive can be assigned to the Primary or Secondary controller. By default, logical drives will be 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.

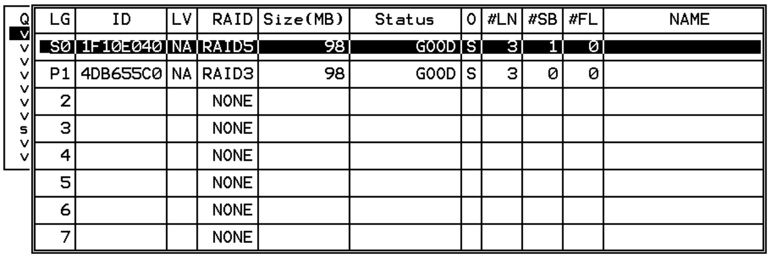
Access "View and Edit Logical Drives" from main menu. Create a logical drive by selecting members and then a selection box will appear on the screen. Move cursor bar to "Logical Drive Assignments" and press **[ENTER]** if you want to assign logical drive to the Secondary controller.



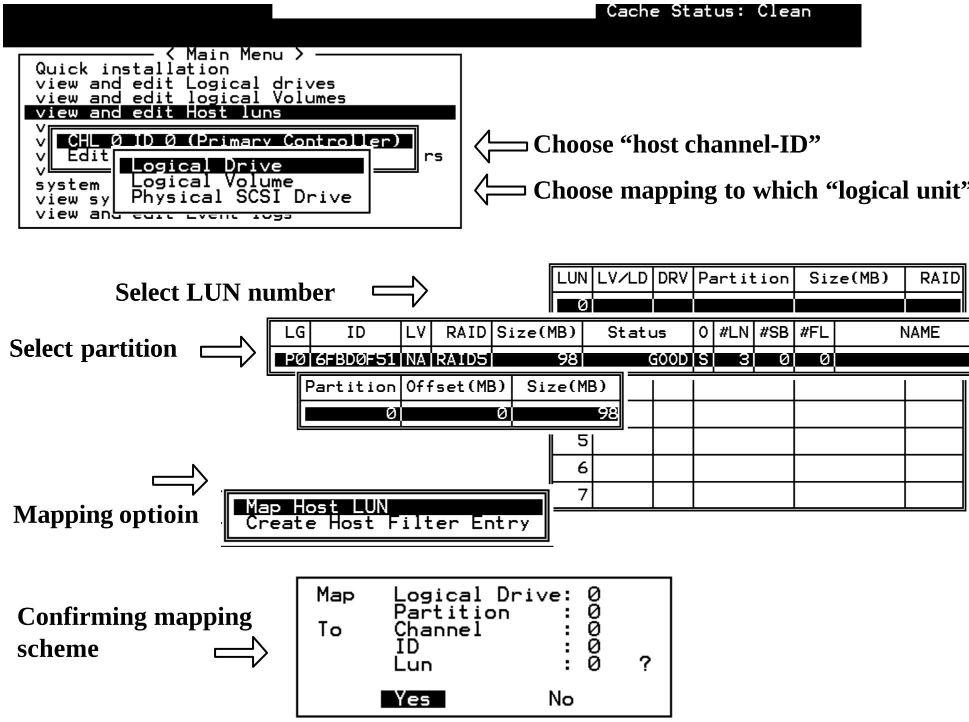
Logical drive assignment can also be changed after a logical drive is created. Create a logical drive or choose an existing logical drive, then press **[ENTER]** to see the logical drive menu. Choose "Logical Drive Assignments," then press **[ENTER]**. Choose **Yes** and press **[ENTER]** to confirm reassignment to the Secondary Controller.



The reassignment is evident from the "View and Edit Logical Drives" screen. "S0" indicates that the logical drive is logical drive 0 assigned to the Secondary Controller.



Mapping a Logical Drive/Logical Volume to the Host LUNs



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.

A warning will be displayed that a "SCSI Bus Reset Issued" for each of the SCSI channels.

In addition, 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 it was the Primary controller that failed, the Secondary controller becomes the Primary controller. If the failed controller is replaced by a new one later, the new controller will behave as the Secondary controller.

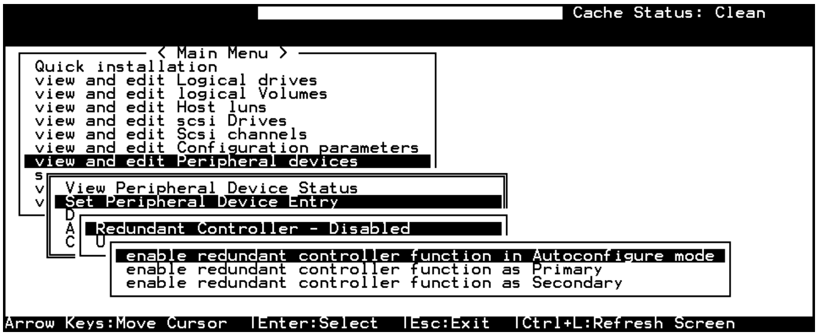
NOTE:

- *Some operating systems (SCO, UnixWare, and OpenServer, for example) will not retry accessing the hard disk drives while the controller is taking over.*

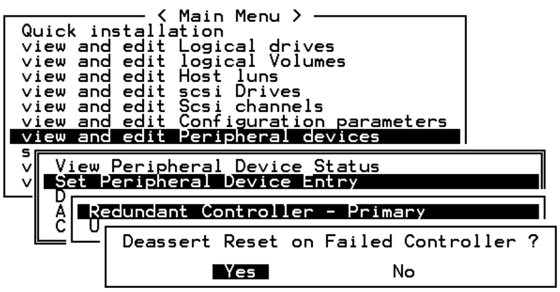
12.3.3 When and How Is the Failed Controller Replaced?

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 front panel and pull out the eject levers to remove the failed controller.

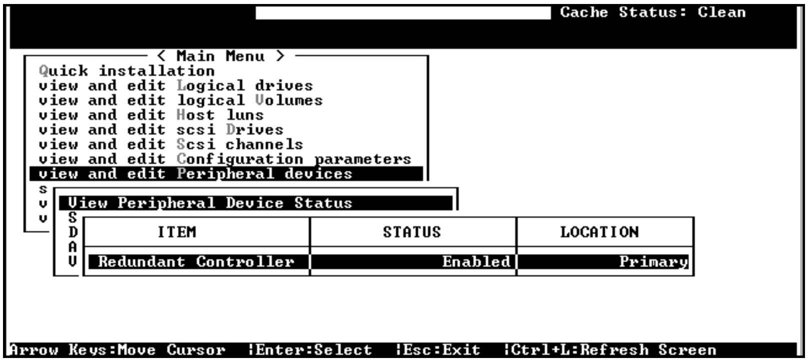
The new controller has to be pre-configured as the "*Secondary Controller.*" (The replacement controller provided by your supplier should have been configured as the Secondary controller. It is recommended to safety check the status of the replacement controller before installing it to your redundant system. Simply attach power to the new controller and configure it as "Secondary." When safety check is done, remove the failed controller and install the replacement controller into its place.)



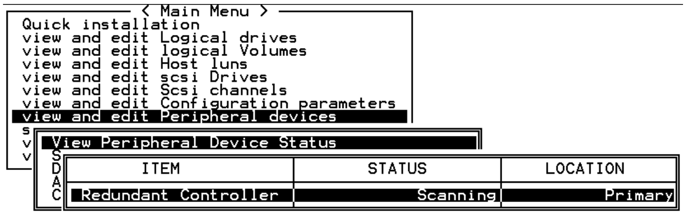
When the new controller is connected, the existing controller will automatically start initializing the replacement controller (IFT-3102U2G and above). If the existing controller does not initialize the replacement controller, execute the "Deassert Reset on Failed Controller" function.



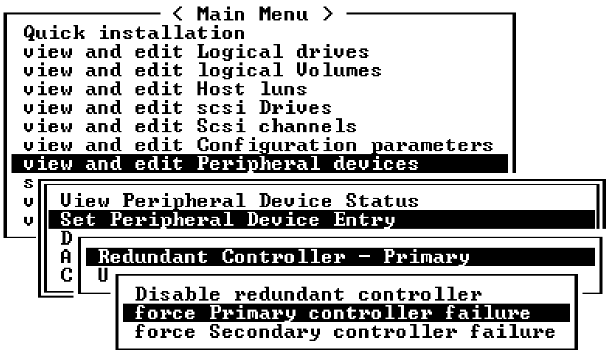
If the replacement has been initialized normally, you may proceed to examine the system status. From the main menu, select "View and Edit Peripheral Devices" and then "View Peripheral Device Status" to see that the new controller is being scanned.



When the scanning has completed, the status will change to "Enabled."



Forcing Controller Failover for Testing



This function is reserved for test only.

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 accompanied by system alarm. The existing controller takes over the work load within a second. Clear all errors by pressing the **ESC** key. You may now push in the controller once removed after activity has been taken over by the existing controller. The controller may take a couple of seconds before the controllers finish initializing and assume their load.

2. Failover by "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 drives. Although the controller is designed to be hot-swappable, unpredictable failures may occur during the process, i.e. improper handling of PCB boards while replacing controllers.*

Chapter

13

In-band SCSI Text RAID Manager and SNMP Agent Installation

13.1 In-band SCSI Text RAID Manager

The Text RAID Manager software offers the same functionality as the VT-100 terminal emulation. Instead of communicating via an RS-232C connection, the program communicates with the RAID controller over the SCSI bus. This is especially useful when you want to ready a RAID system before using the Java-based RAID manager.

In-band SCSI technology translates the original commands into standard SCSI commands. These SCSI commands are then sent to and received from the SCSI RAID controller. The Text RAID Manager is thus able to administrate the RAID controller.

The Text RAID Manager supports both local and remote management of Infortrend external disk array controllers. Local management refers to management of the disk array from a local host – management transactions traverse the SCSI bus connected between the controller and the host's SCSI adapter. Remote management refers to management of the disk array from a remote station connected to the controller through a network cable.

Typically, management will be done locally. A local host runs the Text RAID Manager to configure and monitor the connected controller. Local management is simpler than remote management in that it requires less hardware in its configuration. Remote management is more complicated than local management but provides the following benefit:

- Arrays can be managed from distant and remote locations. Since remote management utilizes network cable or the telephone line, management from anywhere around the globe is possible. All that is needed is a simple attachment to an existing network where the disk array's host exists.

Depending on your specific needs and configuration requirements, you may perform management either from a local host or from a remote station. The following sections describe how to set up your hardware for local and remote management.

13.1.1 Local Management via In-band SCSI

For local management, the RAID controller is connected to the host via a SCSI cable attached to the host computer's SCSI adapter.

13.1.2 Remote Management via SNMP

Network setup utilizes the network bandwidth of 10 Mbps (million bits per second) for Ethernet, 100 Mbps for Fast Ethernet. And you can manage the disk array system from another Text RAID Manager station on the network.

Network setup requires running the Text RAID Manager on the target manager station(s), and enabling the SNMP service on the local host.

The In-band SCSI Text RAID Manager is a text-based, menu-driven utility for configuring and monitoring the RAID controller. Operation is quite similar to the age-old Internet utility TELNET. Because of its nature, it is not suited to remote operation for keystrokes and screen displays would then be handled remotely and would result in very poor responsiveness. As a result, operation is restricted to a local host. Remote operation over a LAN/WAN through a locally-installed SNMP subagent is not supported. The Text RAID Manager is available for the following operating systems:

◊ MS-DOS
◊ Windows 95/98
◊ Windows NT/2000 (x86 and Alpha)
◊ NetWare
◊ SCO OpenServer
◊ SCO UnixWare
◊ Solaris (x86 and SPARC)
◊ Linux

13.2 Windows NT for DEC Alpha

Introduction:

The Driver/Utility package for Windows NT for DEC Alpha is in the "\3102\DISK\ALPHANT" directory on the installation CD-ROM:

- RAID Communications Interface DLL ("RAIDCOMM.DLL") to interface with the Text RAID Management Utility and/or RAID SNMP extension agent to communicate with a standalone RAID controller over the host SCSI bus.
- INI file for RAIDCOMM ("RAIDCOMM.INI")
- In-band SCSI Text RAID Manager for Windows NT ("RAIDMAN.EXE").
- RAID SNMP extension agent ("RAIDSNMP.DLL") to interface with a remote RAID subsystem configuration/monitoring utility.
- SNMP MIB file ("RAIDSNMP.MIB").

13.2.1 Before Using In-band SCSI Text RAID Manager

- In order to let the In-band SCSI utilities (Text RAID Manager or GUI RAID Manager) communicate with the RAID controller correctly, it is a must to set the corresponded Peripheral Device Type if there is no logical drive map to the host channel SCSI ID/LUN.

- Please refer to the README.TXT in "\3102\DISK" of this CD disc, or refer to the Instruction Manual for more detail information about "Peripheral Device Type" setting.

13.2.2 Use In-band SCSI Text RAID Manager to Configure RAID

1. In a Windows NT system with Infortrend RAID controller properly connected to the Host Bus Adapter (SCSI interface or Fibre interface) of the system, insert this CD disc into CD-ROM drive. Use "Windows Explorer" or open a "Command Prompt" to execute the "RAIDMAN.EXE" located in "\3102\disk\winnt\raidman.exe" of this CD.

2. The In-band SCSI Text RAID Manager provides a similar user interface to RS-232 Terminal. Please refer to Chapter 8 of the Instruction manual for the detail operation of the Terminal Emulation of Text RAID Manager.

13.2.3 Install SNMP Agent for Windows NT

The SNMP agent for Infortrend RAID controllers can be installed by the "Infortrend GUI RAID Manager" installation. To install the SNMP agent manually, please follow the following procedures:

1. Install SNMP service and TCP/IP network protocol to Windows NT.

2. Copy RAIDCOMM.DLL and RAIDSNMP.DLL in this directory to SystemRoot \system32. (where "SystemRoot" is the system root directory of Windows NT). For Example:

```
COPY RAIDCOMM.DLL C:\WINNT\SYSTEM32
COPY RAIDSNMP.DLL C:\WINNT\SYSTEM32
```

3. At the DOS command prompt, type REGEDT32 and press <ENTER>.

4. In the registry editor, walk down:

```
\HKEY_LOCAL_MACHINE
\SYSTEM
\CurrentControlSet
\Services
\SNMP
\Parameters
\ExtensionAgents
```

   Add the following entry for the Infortrend RAID SNMP Extension Agent:

```
n:REG_SZ:SOFTWARE\Infortrend\RAIDAgent\CurrentVersion
```

   (where "n" is the index of the extension agent of system; it may be 3.)

5. Click on "ExtensionAgents" registry, select "Edit" option and then select "Add Value". Type a proper value for value name (it may be 3), and set data type to REG_SZ, then click on "OK" button.

6. Type "SOFTWARE\Infortrend\RAIDAgent\CurrentVersion" for string, then click on "OK" button.

7. Go to HKEY_LOCAL_MACHINE\SOFTWARE, click on "SOFTWARE", select "Edit" option and then select "Add Key".

8. Type "Infortrend" for key name, then click on "OK" button. Click on "Infortrend", select "Edit" option and select "Add Key".

9. Type "RAIDAgent" for key name, then click on "OK" button. Click on "RAIDAgent", select "Edit" option and select "Add Key".

10. Type "CurrentVersion" for key name, then click on "OK" button. Click on "CurrentVersion", select "Edit" option and select "Add value".

11. Type "Pathname" for value name, and set data type to REG_EXPAND_SZ, then click on "OK" button.

12. Type "%SystemRoot%\System32\RAIDSNMP.DLL" for string, then click on "OK" button.

13. Close REGEDT32, then the SNMP Agent is ready for Infortrend RAID Manager.

14. Restart the SNMP service or restart your system.

NOTE:

- *The names and values in the NT registry are case sensitive.*

13.2.4 How to Configure the SNMP Trap

1. In order to let the SNMP trap working properly, the "RAIDCOMM.INI" file must be copied in the system root directory (\WINNT).

2. The Descriptions of Contents of the "RAIDCOMM.INI"

Examples:

```
[TRAP]
PERIOD=30
SEVERITY=0
```

Comments:

A There should be a section of "trap". The values of “PERIOD” specify the minimum interval of sequential traps. It is in seconds. For example, as above, it is 30 seconds.

B The value of "Severity " is a filter to mask the traps that is less than its value. The value of "Severity" is considered when the value of "PERIOD" is positive.

C The SNMP agent communicates to the RAID controller through in-band SCSI by default. To change the communication route to RS-232C, please refer to the next paragraph.

D While the Text RAID Manager is running and communicates to the RAID controller through the in-band SCSI, the SNMP traps will not be able to send. It is a must to exit the Text RAID Manager in order to send the SNMP trap properly.

E While the Text RAID Manager is running locally, the remote SNMP connection (GUI via SNMP) cannot be established. It is a must to exit the local Text RAID Manager in order to perform remote administration via SNMP.

3. The SNMP agent communicates to the RAID controller through in-band SCSI by default. To change the communication route to RS-232C, please add:

```
[RAID0]
CONNECT=COM1
BAUDRATE=9600
```

Comments:

A Without this section, the SNMP agent will try to communicate with the RAID controller by the default route - in-band SCSI.

B The "[RAID0]" refers to the first RAID controller connected. If more than one controller are connected, the second RAID controller should have another section titled "[RAID1]".

C The "COM1" refers to the RS-232 port of the host computer connecting to the RAID controller.

D The "BAUDRATE" refers to the baud rate setting on the RAID controller.

Example: Two RAID controllers using RS-232C

```
[RAID0]
CONNECT=COM1
BAUDRATE=9600

[RAID1]
CONNECT=COM2
BAUDRATE=9600
```

13.3 MS-DOS

Introduction:

The Driver / Utility package for MS-DOS is in the "\3102\DISK\DOS" directory on the installation CD-ROM:

- In-band SCSI Text RAID Manager for MS-DOS ("RAIDMAN.EXE").

13.3.1 Before Using In-band SCSI Text RAID Manager for DOS

1. The "In-band SCSI Text RAID Manager for DOS" does not require any setting to the Peripheral Device Type on the RAID controller.
2. It is a must to load the ASPI manager of the Host Bus Adapter (SCSI card or Fibre card) for DOS. The ASPI Manager for DOS is usually loaded by CONFIG.SYS. The manager should be found in the driver diskettes bundled with that SCSI / Fibre adapter.

   For example, if you are using the "2940U2W" SCSI card to connect to the Infortrend RAID controller, the following line should be added to the CONFIG.SYS file:

   ```
   DEVICE=ASPI8U2.SYS
   ```

   (where the "ASPI8U2.SYS" is the filename of the ASPI Manager to that SCSI adapter.)

13.3.2 To configure RAID under DOS - Text RAID Manager for DOS:

To run the text RAID Manager for DOS, boot up the DOS and wait for the command prompt (the ASPI manager should be loaded), run the "raidman.exe" in this directory.

```
C:\> D:
D:\> CD \3102\disk\DOS
D:\3102\disk\DOS> RAIDMAN
```

(where "D:" refers to the drive letter of the CD-ROM drive.)

13.4 Linux (Red Hat and SlackWare)

Introduction:

The Driver/Utility package for Linux is in the "\3102\DISK\LINUX" directory on the installation CD-ROM:

- Disk image files for the In-band SCSI Text RAID Manager and SNMP extension agent for Linux ("IAAL111H" and "IAAL111H.Z")

13.4.1 Supported Operating Systems

This Drivers and Utilities diskette can be applied to the following operating systems:

```
Red Hat Linux 5.1 (2.00.34)
Red Hat Linux 5.1 (2.00.35)
SlackWare Linux 3.5 (2.00.34)
```

Other Linux versions have not been tested yet.

13.4.2 How to Make the Installation Diskette from the Disk Image File

You may find some of the files in this directory have the same filename but with different filename extension. They are the same disk image but one of them is compressed for easy file transferring:

1. With no filename extension:

   This is the disk image made of UNIX "dd" command. To restore this disk image onto a floppy diskette, use "dd" command:

   ```
   # dd if=filename of=/dev/fd0 bs=1440k
   ```

   (where "filename" is the filename of the uncompressed disk image, "/dev/fd0" refers to the device name of the floppy drive.)

2. With filename extension ".Z":

   This is the disk image made of UNIX "dd" command, then compressed by UNIX "compress" command.

To uncompress the compressed file, use the UNIX "uncompress" command:

```
# uncompress filename.Z
```

(where "filename.Z" is the filename of the compressed disk image. After the file has been uncompressed, the filename extension will be removed. The "filename.Z" will become "filename".)

The compressed file - "filename.Z" will become uncompressed – "filename". To restore this disk image onto a floppy diskette, use "dd" command:

```
# dd if=filename of=/dev/fd0 bs=1440k
```

(where "filename" is the filename of the uncompressed disk image, "/dev/fd0" refers to the device name of the floppy drive.)

The disk image files require a floppy drive equipped UNIX system to restore to a floppy diskette. Some UNIX systems might not have the CD-ROM drive, we provide both compressed and uncompressed disk image files for easy file transfer between two systems.

13.4.3 Label the Installation Diskette(s)

1. Please refer to "How to Make the Installation Diskette from the Disk Image File" section above to create the floppy diskettes for installation.

2. Please label the diskette made of "IAAL111H" as:

```
+---------------------------------------+
| Infortrend RAID Controllers           |
|                                       |
| In-band SCSI Drivers and Utilities    |
|    for Linux                          |
|                                       |
| Version 1.11H                         |
| (Code: IAAL111H)                      |
+---------------------------------------+
```

13.4.4 Before Using In-band SCSI for Linux

1. Make sure the "generic SCSI" exists when building Linux.

2. Set proper "Peripheral Device Type" to the controller if there is no logical drive mapping to the host channel. Please refer to README.TXT in "\3102\DISK" for how to set the Peripheral Device Type to the RAID controller.

3. No extra driver software is required to be loaded.

13.4.5 To run Text RAID Manager for Linux:

1. Insert the diskette into the floppy drive and mount it.

```
# mount -r /dev/fd0 /mnt
```

2. Execute the Raidman in /tools directory.

```
# cd /mnt/tools
# ./raidman
```

13.5 NetWare

Introduction:

The Driver/Utility package for NetWare is in the "\3102\DISK\NETWARE" directory on the installation CD-ROM:

- In-band SCSI driver for NetWare ("ASPICOMM.NLM")
- RAID Asynchronous I/O NLM ("RAIDAIO.NLM")
- ("RAIDCOMM.IN_")
- In-band SCSI Text RAID Manager for NetWare ("RAIDMAN.NLM")
- Sample MIB file ("RAIDSNMP.MIB")
- SNMP extension agent for NetWare ("SNMPCOM.NLM")

13.5.1 Before Using In-band SCSI Text RAID Manager for NetWare

1. Copy all the files in this directory into the NetWare directory.

```
C:\> copy d:\3102\ndisk\netware\*.* c:\nwserver
```

(where "d:" refers to the driver letter of the CD-ROM drive, and "c:\nwserver" refers to the NetWare directory.)

13.5.2 Use Text RAID Manager to Configure RAID

1. Boot up the NetWare server. Make sure the driver and ASPI manager of the SCSI adapter (or Fibre adapter) are both properly loaded.

   Example of using the "2940U2W" SCSI card:

```
ServerName: load aic78u2  (the SCSI adapter driver)
ServerName: load nwaspi   (the ASPI Manager)
```

   (For NetWare 5 users: the "nwaspi" is located in "\nwserver \drivers", use "load c:\nwserver\drivers\nwaspi" to load the ASPI manager under NetWare 5.)

   Example of using the "2940UW" SCSI card:

```
ServerName: load aic7870  (the SCSI adapter driver)
ServerName: load aspitran (the ASPI Manager)
```

   (For NetWare 5 users: use ".HAM" driver for the "2940UW" card, type "load aha2940" and "load c:\nwserver\drivers\nwaspi" to load the .HAM driver and ASPI Manager under NetWare 5.)

2. Load "ASPICOMM" for driver of Infortrend RAID controller.

```
ServerName: load c:aspicomm
```

3. Load "RAIDMAN" for the In-band SCSI Text RAID Manager.

```
ServerName: load c:raidman
```

13.5.3 Install SNMP Extension Agent for NetWare

1. Copy all the files in this directory into the NetWare DOS directory.
2. If the SNMP trap is going to be used, rename the "RAIDCOMM.IN_" to "RAIDCOMM.INI".

   ```
   C:\NWSERVER> ren raidcom.in_ raidcomm.ini
   ```

3. Use "load" command to load the SNMP extension agent:

   ```
   ServerName: load snmpcom
   ```

4. The "RAIDSNMP.MIB" is the MIB file for SNMP.

13.5.4 How to Configure the SNMP Trap

1. In order to let the SNMP trap working properly, the "RAIDCOMM.INI" file must be copied in the system root directory (\NWSERVER).
2. The Descriptions of Contents of the "RAIDCOMM.INI" Examples:

   ```
   [TRAP]
   PERIOD=30
   SEVERITY=0
   ```

   Comments:

   A There should be a section of "trap". The value of "PERIOD" specify the minimum interval of sequential traps. It is in seconds. For example, as above, it is 30 seconds.

   B The value of "Severity " is a filter to mask the traps that is less than its value. The value of "Severity" is considered when the value of "PERIOD" is positive.

   C The SNMP agent communicates to the RAID controller through in-band SCSI by default. To change the communication route to RS-232C, please refer to the next paragraph.

   D While the Text RAID Manager is running and communicates to the RAID controller through the in-band SCSI, the SNMP traps will not be able to send. It is a must to exit the Text RAID Manager in order to send the SNMP trap properly.

   E While the Text RAID Manager is running locally, the remote SNMP connection (GUI via SNMP) cannot be established. It is a must to exit the local Text RAID Manager in order to perform remote administration via SNMP.

3. The SNMP agent communicates to the RAID controller through in-band SCSI by default. To change the communication route to RS-232C, please add:

   ```
    [RAID0]
   CONNECT=COM1
   BAUDRATE=9600
   ```

   Comments:

   A Without this section, the SNMP agent will try to communicate with the RAID controller by the default route - in-band SCSI.

B The "[RAID0]" refers to the first RAID controller connected. If more than one controller are connected, the second RAID controller should have another section titled "[RAID1]".

C The "COM1" refers to the RS-232 port of the host computer connecting to the RAID controller.

D The "BAUDRATE" refers to the baud rate setting on the RAID controller.

Example: Two RAID controllers using RS-232C

```
 [RAID0]
CONNECT=COM1
BAUDRATE=9600

 [RAID1]
CONNECT=COM2
BAUDRATE=9600
```

13.6 SCO OpenServer 5.0.x

Introduction:

The Driver/Utility package for SCO OpenServer 5.0.x is in the "\3102\DISK\SCOOS5" directory on the installation CD-ROM:

- Drivers and utilities diskette image for SCO OpenServer 5.0.x ("IAAJ117F" and "IAAJ117.Z")

13.6.1 Supported Operating Systems

This Drivers and Utilities diskette can be applied to the following operating systems:

SCO OpenServer 5.0.0
SCO OpenServer 5.0.2
SCO OpenServer 5.0.4
SCO OpenServer 5.0.5

13.6.2 How to Make the Installation Diskette from the Disk Image File

You may find some of the files in this directory have the same filename but with different filename extension. They are the same disk image but one of them is compressed for easy file transferring:

1. With no filename extension:

This is the disk image made of UNIX "dd" command. To restore this disk image onto a floppy diskette, use "dd" command:

```
# dd if=filename of=/dev/fd0 bs=1440k
```

("Filename" is the filename of the uncompressed disk image, "/dev/fd0" refers to the device name of the floppy drive.)

2. With filename extension ".Z":

This is the disk image made of UNIX "dd" command, then compressed by UNIX "compress" command.

To uncompress the compressed file, use the UNIX "uncompress" command:

```
# uncompress filename.Z
```

(where "filename.Z" is the filename of the compressed disk image. After the file has been uncompressed, the filename extension will be removed. The "filename.Z" will become "filename".)

The compressed file - "filename.Z" will become uncompressed – "filename". To restore this disk image onto a floppy diskette, use "dd" command:

```
# dd if=filename of=/dev/fd0 bs=1440k
```

(where "filename" is the filename of the uncompressed disk image, "/dev/fd0" refers to the device name of the floppy drive.)

The disk image files require a floppy drive equipped UNIX system to restore to a floppy diskette. Some UNIX systems might not have the CD-ROM drive; we provide both compressed and uncompressed disk image files for easy file transfer between two systems.

13.6.3 Label the Installation Diskette(s)

1. Please refer to "How to Make the Installation Diskette from the Disk Image File" section above to create the floppy diskettes for installation.
2. Please label the diskette made of "IAAJ117F" as:

```
+---------------------------------------+
| Infortrend RAID Controllers           |
|                                       |
| In-band SCSI Drivers and Utilities    |
|    for SCO OpenServer 5 and           |
|        SCO UnixWare 2.1.x/UnixWare 7  |
|                                       |
| Version 1.17F                         |
| (Code:IAAJ117F)                       |
+---------------------------------------+
```

13.6.4 Install the In-band SCSI Driver in SCO OpenServer 5

1. Boot the SCO OpenServer 5. Insert the driver diskette into the floppy drive and mount it.

   ```
   # mount -r /dev/fd0 /mnt
   ```

   (where "/dev/fd0" refers to the floppy drive, "/mnt" is the directory where the floppy mounted to.)

2. Use "btldinstall" to install from the floppy diskette, and enter "dasc" as the package name to install.

   ```
   # btldinstall /mnt
   ```

   The following packages are on this disk:

   ```
   NAME   DESCRIPTION
   ```

```
dasc   Infortrend RAID IN-BAND SCSI Driver for SCO
OpenServer 5,0,x /v1.11e

Please enter the names of the packages you
wish to install, or q to quit: dasc
```

3. After the installation has completed, it is a must to re-link the kernel.

```
# cd /etc/conf/cf.d
# link_unix
```

13.6.5 Before Using In-band SCSI Text RAID Manager

- In order to let the In-band SCSI utilities (Text RAID Manager or GUI RAID Manager) communicate with the RAID controller correctly, it is a must to set the corresponded Peripheral Device Type if there is no logical drive mapped to the host channel SCSI ID/LUN.
- Please refer to the README.TXT in "\3102\DISK" of this CD disc, or refer to the instruction manuals for more detail information about "Peripheral Device Type" setting.

13.6.6 Using Text RAID Manager to Configure RAID

1. Insert the driver diskette into the floppy drive and mount it.

```
# mount -r /dev/fd0 /mnt
```

(where "/dev/fd0" refers to the floppy drive, "/mnt" is the directory where the floppy mounted to.)

2. Use "pkgadd" to begin the installation, choose "2" to install the Text RAID Manager for SCO OpenServer.

```
# pkgadd -d /mnt
```

The following packages are available:

```
1  CfgTool        RAID Configuration Tool For Unixware
                  (i386)
2  CfgToolUx      RAID Configuration Tool For SCO OpenServer
                  (i386)
3  sr01  RAID TARGET DRIVER
                  (i386) 1.11b

Select package(s) you wish to process (or 'all' to process
all packages). (Default: all) [?,??,?]:2
```

3. After the installation process completed, use "mkdev hd" to make add a SCSI drive to the system.

```
# mkdev hd
```

Add a SCSI drive with corresponded host ID/LUN to the controller setting. If the host channel ID of the controller is ID 0, add a SCSI drive with SCSI ID 0 / LUN 0.

4. Relink the kernel after add SCSI drive to the system.

```
# cd /etc/conf/cf.d
# ./link_unix
```

5. Reboot the system.

6. Run the Text RAID Manager for SCO in "/usr/lib":

```
# cd /usr/lib
# ./raidman
```

Please follow the Instruction manual for the detail operation of the Terminal Emulation or the Text RAID Manager.

13.6.7 SNMP Readme File

1. In the Package

- an mib file(*.defs)
- an executable file, i.e. SMUX Agent
- an initializing file

2. Before Setting Raid SNMP SMUX Agent

- Give it an OID (e.g. enterprises.1714.1.1.10)
- Its password (e.g. mypassword)
- Its priority (e.g. 2). The priority in default is -1.
- Prepare the IP address of the manager

3. Installing

- change directory to /usr/lib/raidsnmp and put the mib file and the agent in the same directory
- add one line to "snmpd.peer" e.g., "raidsnmp," 1.3.6.1.4.1.1714.1.1.9000.1,"nopassword". raidsnmp is the excution file name of the SNMP Agent 1.3.6.1.4.1.1714.1.1.9000.1 is the OID of the SNMP Agent as described previously. nopassword is the password to register its mib for SNMP Agent. (Refer to the system manuals)
- Add one line to snmpd.trap:

  For SCO Open Server, should look like this:

  `public,0.0.0.0,162`

  For SCO UnixWare, it should look like this:

  `ip,public,0.0.0.0.162`

  (Refer to system manuals.)

Comment:
You can find snmpd.peers and snmpd.trap in /etc/ for SCO OpenServer and in /etc/netmgt/ for SCO UnixWare.

4. Running

```
keyin: cd /usr/lib/raidsnmp;./raidsnmp
```

5. Initializing file (/usr/lib/raidsnmp/raidcomm.ini)

The Descriptions of Contents of the "RAIDCOMM.INI"

Examples:

```
[TRAP]
```

```
PERIOD=30
SEVERITY=0
```

Comments:

A There should be a section of "trap". The values of “PERIOD” specify the minimum interval of sequential traps. It is in seconds. For example, as above, it is 30 seconds.

B The value of "Severity " is a filter to mask the traps that is less than its value. The value of "Severity" is considered the value of "PERIOD" is positive.

C The SNMP agent communicates to the RAID controller through in-band SCSI by default. To change the communication route to RS-232C, please refer to the next paragraph.

D While the Text RAID Manager is running and communicates to the RAID controller through the in-band SCSI, the SNMP traps will not be able to send. It is a must to exit the Text RAID Manager in order to send the SNMP trap properly.

E While the Text RAID Manager is running locally, the remote SNMP connection (GUI via SNMP) cannot be established. It is a must to exit the local Text RAID Manager in order to perform remote administration via SNMP.

6. The SNMP agent communicates to the RAID controller through in-band SCSI by default. To change the communication route to RS-232C, please add:

```
 [RAID0]
CONNECT=COM1
BAUDRATE=9600
```

Comments:

A Without this section, the SNMP agent will try to communicate with the RAID controller by the default route - in-band SCSI.

B The "[RAID0]" refers to the first RAID controller connected. If more than one controller are connected, the second RAID controller should have another section titled "[RAID1]".

C The "COM1" refers to the RS-232 port of the host computer connecting to the RAID controller.

D The "BAUDRATE" refers to the baud rate setting on the RAID controller.

Example: Two RAID controllers using RS-232C

```
 [RAID0]
CONNECT=COM1
BAUDRATE=9600

 [RAID1]
CONNECT=COM2
BAUDRATE=9600
```

13.7 Solaris 2.5.x/2.6/7/8 for SPARC

Introduction:

The Driver/Utility package for SPARC Solaris is in the "\3102\DISK\SOLARIS.SPK" directory on the installation CD-ROM:

- In-band SCSI driver for Solaris 2.5.x/2.6 on SPARC platform ("IABR111G" and "IABR111G.Z")

13.7.1 How to Make the Installation Diskette from the Disk Image File

You may find some of the files in this directory have the same filename but with different filename extension. They are the same disk image but one of them is compressed for easy file transferring:

1. With no filename extension:

   This is the disk image made of UNIX "dd" command. To restore this disk image onto a floppy diskette, use "dd" command:

   Example (using Solaris 2.6):

   ```
   Insert a new diskette into the floppy drive.
   # volcheck
   # dd if=filename of=/vol/dev/aliases/floppy0 bs=1440k
   # eject floppy
   # volcheck
   ```

   (where "filename" is the filename of the uncompressed disk image, "/vol/dev/aliases/floppy0" refers to the device name of the floppy drive.)

2. With filename extension ".Z":

   This is the disk image made of UNIX "dd" command, then compressed by UNIX "compress" command.

   To uncompress the compressed file, use the UNIX "uncompress" command:

   ```
   # uncompress filename.Z
   ```

   (where "filename.Z" is the filename of the compressed disk image. After the file has been uncompressed, the filename extension will be removed. The "filename.Z" will become "filename".)

   The compressed file - "filename.Z" will become uncompressed - "filename". To restore this disk image onto a floppy diskette, use "dd" command:

   Example (using Solaris 2.6):

   Insert a new diskette into the floppy drive.

   ```
   # volcheck
   # dd if=filename of=/vol/dev/aliases/floppy0 bs=1440k
   # eject floppy
   # volcheck
   ```

(where "filename" is the filename of the uncompressed disk image, "/vol/dev/aliases/floppy0" refers to the device name of the floppy drive.)

The disk image files require a floppy drive equipped UNIX system to restore to a floppy diskette. Some UNIX systems might not have the CD-ROM drive; we provide both compressed and uncompressed disk image files for easy file transfer between two systems.

13.7.2 Label the Installation Diskette(s)

1. Please refer to "How to Make the Installation Diskette from the Disk Image File" section above to create the floppy diskettes for installation.

2. Please label the diskette made of "IABR111G" as:

```
+---------------------------------------+
| Infortrend RAID Controllers           |
|                                       |
| In-band SCSI Drivers and Utilities    |
|    for Sun Solaris 2.5.x/2.6          |
|    on SPARC platform                  |
|                                       |
| Version 1.11G                         |
| (Code:IABR111G)                       |
+---------------------------------------+
```

13.7.3 Install the In-band SCSI Driver and Text RAID Manager for SUN Solaris 2.5/2.6/7/8

A Installing from the driver diskette created from image file

A1. To install the driver from the driver diskette, type:

```
# pkgadd -d /floppy/floppy0
```

(where "/floppy/floppy0" is the mounted driver diskette.)

Use Solaris Volume Manager and "volcheck" to mount the driver diskette, or mount it manually.

A2. A list of selections will show as below, choose "1" to install the driver for In-band SCSI.

```
 1. dascsparc   RAID In-Band SCSI Driver for Solaris
                (sparc) 1.11c
 2. mgrsprc32   Text RAID Manager for Solaris SPARC
                32-bits (sparc) 1.52e
 3. mgrsprc64   Text RAID Manager for Solaris SPARC
                64-bits (sparc) 1.52h
 4. rhbasprc    PCI-to-SCSI RAID Host Adapter Driver
                for Solaris (sparc) 1.11f
 5. snmpspk32   RAID SNMP SUBAGENT for Solaris SPARC
                32-bits (sparc) 1.15g
 6. snmpspk64   RAID SNMP SUBAGENT for Solaris 64-bits
                (sparc) 1.15h
```

```
Select package(s) you will to process (or 'all' to process
all packages). (default: all) [?,??,q]: 1
```

A3. After the driver installed, the same selections appear again. Choose "2" (for 32-bit OS) or "3" (for 64-bit OS) this time to install the Text RAID Manager for Solaris.

A4. After the driver installed, the same selections appear again. Choose "5" (for 32-bit OS) or "6" (for 64-bit OS) this time to install the RAID SNMP sub-agent for Solaris. This step can be ignored if SNMP remote administration is not going to be used. If TCP/IP protocol and SNMP service have not yet installed on this system, it can be installed later after the system TCP/IP and SNMP installed. The RAID SNMP sub-agent is not a must to be installed.

Install it only when needed.

A5. Choose "q" to quit when the same list of selections appear again.

A6. Reboot the system.

```
# init 6
```

A7. After the system reboot, type "boot -r" in the boot screen to let the Solaris knows to look for new device drivers and incorporate them as part of the boot process.

13.7.4 Using Text RAID Manager to Configure RAID

1. Change the current directory to where the Text RAID Manager is located.

```
# cd /usr/lib/raidsnmp
```

2. Execute the Text RAID Manager under command prompt:

```
# ./raidman
```

13.8 Solaris 2.5.x/2.6/7/8 for x86

Introduction:

The Driver/Utility package for x86 Solaris is in the "\3102\DISK\SOLARIS.X86" directory on the installation CD-ROM:

- In-band SCSI driver for Solaris 2.5.x/2.6 on x86 ("IABS111F" and "IABS111F.Z")

13.8.1 How to Make the Installation Diskette from the Disk Image File

You may find some of the files in this directory have the same filename but with different filename extension. They are the same disk image but one of them is compressed for easy file transferring:

1. With no filename extension:

This is the disk image made of UNIX "dd" command. To restore this disk image onto a floppy diskette, use "dd" command:

Example (using Solaris 2.6):

```
Insert a new diskette into the floppy drive.
# volcheck
# dd if=filename of=/vol/dev/aliases/floppy0 bs=1440k
# eject floppy
# volcheck
```

(where "filename" is the filename of the uncompressed disk image, "/vol/dev/aliases/floppy0" refers to the device name of the floppy drive.)

2. With filename extension ".Z":

This is the disk image made of UNIX "dd" command, then compressed by UNIX "compress" command.

To uncompress the compressed file, use the UNIX "uncompress" command:

```
# uncompress filename.Z
```

(where "filename.Z" is the filename of the compressed disk image. After the file has been uncompressed, the filename extension will be removed. The "filename.Z" will become "filename".)

The compressed file - "filename.Z" will become uncompressed - "filename". To restore this disk image onto a floppy diskette, use "dd" command:

Example (using Solaris 2.6):

```
Insert a new diskette into the floppy drive.
# volcheck
# dd if=filename of=/vol/dev/aliases/floppy0 bs=1440k
# eject floppy
# volcheck
```

(where "filename" is the filename of the uncompressed disk image, "/vol/dev/aliases/floppy0" refers to the device name of the floppy drive.)

The disk image files require a floppy drive equipped UNIX system to restore to a floppy diskette. Some UNIX systems might not have the CD-ROM drive; we provide both compressed and uncompressed disk image files for easy file transfer between two systems.

13.8.2 Label the Installation Diskette(s)

1. Please refer to "How to Make the Installation Diskette from the Disk Image File" section above to create the floppy diskettes for installation.

2. Please label the diskette made of "IABS111F" as:

```
+----------------------------------------+
| Infortrend RAID Controllers            |
|                                        |
| In-band SCSI Drivers and Utilities     |
|    for Sun Solaris 2.5.x/2.6           |
|    on x86 platform                     |
|                                        |
| Version 1.11F                          |
| (Code:IABS111F)                        |
+----------------------------------------+
```

13.8.3 Install the In-band SCSI Driver and Text RAID Manager for SUN Solaris 2.5/2.6/7/8

A Installing from the driver diskette created from image file

A1. To install the driver from the driver diskette, type:

```
# pkgadd -d /floppy/floppy0
```

(where "/floppy/floppy0" is the mounted driver diskette. Use Solaris Volume Manager and "volcheck" to mount the driver diskette, or mount it manually.)

A2. A list of selections will show as below, choose "1" to install the driver for In-band SCSI.

The following packages are available:

```
The following packages are available:
1          RAID In-band SCSI Driver for Solaris 2.5, 2.6
2          Text RAID Management for Solaris 2.5,2.6
3          PCI-SCSI RAID Host Adapter Driver
4          RAID SNMP SUBAGENT for Solaris 2.5,2.6

      Select package(s) you will to process (or 'all' to process
      all packages). (default: all) [?,??,q]: 1
```

A3. After the driver installed, the same selections appear again. Choose "2" this time to install the Text RAID Manager for Solaris.

A4. After the driver installed, the same selections appear again. Choose "4" this time to install the RAID SNMP sub-agent for Solaris. This step can be ignored if SNMP remote administration is not going to be used. If TCP/IP protocol and SNMP service have not yet installed on this system, it can be installed later after the system TCP/IP and SNMP installed. The RAID SNMP sub-agent is not a must to be installed. Install it only when needed.

A5. Choose "q" to quit when the same list of selections appear again.

A6. Reboot the system.

```
# init 6
```

A7. After the system reboot, type "b -r" in the boot screen to let the Solaris knows to look for new device drivers and incorporate them as part of the boot process.

13.8.4 Using Text RAID Manager to Configure RAID

1. Change the current directory to where the Text RAID Manager is located.

```
# cd /usr/lib/raidsnmp
```

2. Execute the Text RAID Manager under command prompt:

```
# ./raidman
```

Please follow the Chapter 8 Instruction manual for the detail operation of the Text RAID Manager.

13.9 SCO UnixWare

Introduction:

The Driver/Utility package for SCO UnixWare 2.1.x/UnixWare 7 is in the "\3102\DISK\UNIXWARE" directory on the installation CD-ROM:

- Drivers and utilities diskette image for SCO UnixWare 2.1.x/7 ("IAAJ118A" and "IAAJ118A.Z")

13.9.1 Supported Operating Systems

This Drivers and Utilities diskette can be applied to the following operating systems:

SCO UnixWare 2.1.x
SCO UnixWare 7

13.9.2 How to Make the Installation Diskette from the Disk Image File

You may find some of the files in this directory have the same filename but with different filename extension. They are the same disk image but one of them is compressed for easy file transferring:

1. With no filename extension:

   This is the disk image made of UNIX "dd" command. To restore this disk image onto a floppy diskette, use "dd" command:

   ```
   # dd if=filename of=/dev/fd0 bs=1440k
   ```

   (where "filename" is the filename of the uncompressed disk image, "/dev/fd0" refers to the device name of the floppy drive.)

2. With filename extension ".Z":

   This is the disk image made of UNIX "dd" command, then compressed by UNIX "compress" command.

   To uncompress the compressed file, use the UNIX "uncompress" command:

   ```
   # uncompress filename.Z
   ```

   (where "filename.Z" is the filename of the compressed disk image. After the file has been uncompressed, the filename extension will be removed. The "filename.Z" will become "filename".)

   The compressed file - "filename.Z" will become uncompressed - "filename". To restore this disk image onto a floppy diskette, use "dd" command:

   ```
   # dd if=filename of=/dev/fd0 bs=1440k
   ```

   (where "filename" is the filename of the uncompressed disk image, "/dev/fd0" refers to the device name of the floppy drive.)

The disk image files require a floppy drive equipped UNIX system to restore to a floppy diskette. Some UNIX systems might not have the CD-ROM drive; we provide both compressed and uncompressed disk image files for easy file transfer between two systems.

13.9.3 Label the Installation Diskette(s)

1. Please refer to "How to Make the Installation Diskette from the Disk Image File" section above to create the floppy diskettes for installation.

2. Please label the diskette made of "IAAJ118A" as:

```
+---------------------------------------+
| Infortrend RAID Controllers           |
|                                       |
| In-band SCSI Drivers and Utilities    |
|    for SCO OpenServer 5 and           |
|        SCO UnixWare 2.1.x/UnixWare 7 |
|                                       |
| Version 1.18A                         |
| (Code:IAAJ118A)                       |
+---------------------------------------+
```

13.9.4 Install In-band SCSI Driver for SCO UnixWare 7

1. Boot the SCO UnixWare 7. Insert the driver diskette into the floppy drive and mount it.

```
# mount -r /dev/fd0 /mnt
```

where "/dev/fd0" refers to the floppy drive, "/mnt" is the directory where the floppy mounted to.

2. Use "pkgadd" to install from the floppy diskette, and choose "3" to install the In-band SCSI driver.

```
# pkgadd -d /mnt
```

The following packages are available:

```
1  CfgTool   RAID Configuration Tool For SCO Unixware
             (i386)
2  CfgToolUx  RAID Configuration Tool For SCO OpenServer
             (i386)
3  sr01      RAID TARGET DRIVER
             (i386) 1.20a

Select package(s) you wish to process (or 'all' to
process
all packages). (Default: all) [?,??,?]: 3
```

13.9.5 Before Using Text RAID Manager to Configure RAID Controller

- In order to let the In-band SCSI utilities (Text RAID Manager) communicate with the RAID controller correctly, it is a must to set the corresponded Peripheral Device Type if there is no logical drive map to the host channel SCSI ID/LUN.

- Please refer to the README.TXT in "\3102\DISK" of this CD disc, or refer to the Instruction Manual for more detail information about "Peripheral Device Type" setting.

13.9.6 Install Text RAID Manager for SCO UnixWare 7

1. Insert the driver diskette into the floppy drive and mount it.

```
# mount -F s5 -r /dev/fd0 /mnt
```

where "/dev/fd0" refers to the floppy drive, "/mnt" is the directory where the floppy mounted to.

2. Use "pkgadd" to begin the installation, choose "1" to install the Text RAID Manager for SCO UnixWare 7.

```
# pkgadd -d /mnt
```

The following packages are available:

```
1  CfgTool   RAID Configuration Tool For SCO Unixware
                   (i386)
2  CfgToolUx RAID Configuration Tool For SCO OpenServer
                   (i386)
3  sr01      RAID TARGET DRIVER
                   (i386) 1.20a

Select package(s) you wish to process (or 'all' to
process all packages). (Default: all) [?,??,?]: 1
```

3. Run the Text RAID Manager for SCO UnixWare 7 in "/usr/lib":

```
# cd /usr/lib
# ./raidman
```

Please follow the Instruction manual for the detail operation of the Terminal Emulation or the Text RAID Manager.

13.10 Windows 95/98

Introduction:

The Driver/Utility package for Windows 95/98 is in the "\3102\DISK\WIN95" directory on the installation CD-ROM:

- RAID interface module file ("RAIDCOMM.DLL")
- Text RAID Manager for Windows 95 ("RAIDMAN.EXE")
- Agent file for RAIDCOMM ("RAIDSNMP.DLL")
- The README file for installation ("README.TXT")

13.10.1 Before Using In-band SCSI Text RAID Manager

- In order to let the In-band SCSI utilities (Text RAID Manager or GUI RAID Manager) communicate with the RAID controller correctly, it is a must to set the corresponded Peripheral Device Type if there is no logical drive map to the host channel SCSI ID/LUN.
- Please refer to the README.TXT in "\3102\DISK" of this CD disc, or refer to the Instruction Manual for more detail information about "Peripheral Device Type" setting.

13.10.2 Use In-band SCSI Text RAID Manager to Configure RAID

1. Copy all the files in this directory into "system32" directory of Windows 95/98.

   ```
   C:\> COPY D:\3102\DISK\WIN95\*.* C:\WINDOWS\SYSTEM32
   ```

   where "D:" refers to the driver letter of the CD-ROM drive, and "C:\WINDOWS" refers to the Windows directory.

2. Open a "MS-DOS Prompt" window, execute "RAIDMAN.EXE".
3. The In-band SCSI Text RAID Manager provides a similar user interface to RS-232 Terminal. Please refer to Chapter 8 of the Instruction manual for the detail operation of the Terminal Emulation of Text RAID Manager.

13.11 Windows NT (x86)

Introduction:

The Driver/Utility package for Windows 95/98 is in the "\3102\DISK\WINNT" directory on the installation CD-ROM:

- RAID interface module file (RAIDCOMM.DLL")
- INI file for RAIDCOMM ("RAIDCOMM.INI")
- Text RAID Manager for Windows NT ("RAIDMAN.EXE").
- SNMP agent for Windows NT ("RAIDSNMP.DLL")

- SNMP MIB file ("RAIDSNMP.MIB")
- The README file for installation ("README.TXT")

Note that the installation procedure for both Windows NT/2000 and Windows 95/98 is the same except for the procedure for installing the system SNMP service.

Driver/Utility Package Installation:

1. Insert package installation diskette into a 3.5" 1.44MB floppy drive.
2. Copy RAIDMAN.EXE and RAIDCOMM.DLL to <SystemRoot>\system32.

   where:

   <SystemRoot> is the path corresponding to the system root directory of Windows NT.

   Example:

   ```
   COPY A:\RAIDMAN\WINNT\RAIDMAN.EXE  C:\WINNT\SYSTEM32
   COPY A:\RAIDMAN\WINNT\RAIDCOMM.DLL C:\WINNT\SYSTEM32
   ```
3. Now, you can run RAIDMAN anywhere to manage Infortrend RAID controllers through RS-232, host bus and SNMP interface. Note: The SNMP service must be installed before using SNMP interface.

Executing the Text RAID Management Utility

To execute the Text RAID Management Utility, simply execute the file "RAIDMAN.EXE".

13.11.1 Before Using In-band SCSI Text RAID Manager

- In order to let the In-band SCSI utilities (Text RAID Manager or GUI RAID Manager) communicate with the RAID controller correctly, it is a must to set the corresponded Peripheral Device Type if there is no logical drive map to the host channel SCSI ID/LUN.
- Please refer to the README.TXT in "\3102\DISK" of this CD disc, or refer to the Instruction Manual for more detail information about "Peripheral Device Type" setting.

13.11.2 Use In-band SCSI Text RAID Manager to Configure RAID

1. In a Windows NT system with Infortrend RAID controller properly connected to the Host Bus Adapter (SCSI interface or Fibre interface) of the system, insert this CD disc into CD-ROM drive. Use "Windows Explorer" or open a "Command Prompt" to execute the "RAIDMAN.EXE" located in "\3102\disk\winnt\raidman.exe" of this CD.

2. The In-band SCSI Text RAID Manager provides a similar user interface to RS-232 Terminal. Please refer to Chapter 8 of the Instruction manual for the detail operation of the Terminal Emulation of Text RAID Manager.

13.11.3 Install the SNMP Agent for Windows NT

The SNMP agent for Infortrend RAID controllers can be installed by the "Infortrend GUI RAID Manager" installation. To install the SNMP agent manually, please follow the following procedures:

1. Install SNMP service and TCP/IP network protocol to Windows NT.

2. Copy RAIDCOMM.DLL and RAIDSNMP.DLL in this directory to SystemRoot \system32. (where "SystemRoot" is the system root directory of Windows NT). For Example:

   ```
   COPY RAIDCOMM.DLL C:\WINNT\SYSTEM32
   COPY RAIDSNMP.DLL C:\WINNT\SYSTEM32
   ```

3. At the DOS command prompt, type REGEDT32 and press <ENTER>.

4. In the registry editor, walk down:

   ```
   \HKEY_LOCAL_MACHINE
          \SYSTEM
                 \CurrentControlSet
                        \Services
                               \SNMP
                                      \Parameters
                                             \ExtensionAgents
   ```

   Add an entry for the Infortrend RAID SNMP Extension Agent, the entry is:

   ```
   n:REG_SZ:SOFTWARE\Infortrend\RAIDAgent\CurrentVersion
   ```

   where "n" is the index of the extension agent of system, for default, it may be 3.

5. Click on "ExtensionAgents" registry, select "Edit" option and then select "Add Value". Type a proper value for value name (it may be 3), and set data type to REG_SZ, then click on "OK" button.

6. Type "SOFTWARE\Infortrend\RAIDAgent\CurrentVersion" for string, then click on "OK" button.

7. Go to HKEY_LOCAL_MACHINE\SOFTWARE, click on "SOFTWARE", select "Edit" option and then select "Add Key".

8. Type "Infortrend" for key name, then click on "OK" button. Click on "Infortrend", select "Edit" option and select "Add Key".

9. Type "RAIDAgent" for key name, then click on "OK" button. Click on "RAIDAgent", select "Edit" option and select "Add Key".

10. Type "CurrentVersion" for key name, then click on "OK" button. Click on "CurrentVersion", select "Edit" option and select "Add value".

11. Type "Pathname" for value name, and set data type to REG_EXPAND_SZ, then click on "OK" button.

12. Type "%SystemRoot%\System32\RAIDSNMP.DLL" for string, then click on "OK" button.

13. Close REGEDT32, then the SNMP Agent is ready for Infortrend RAID Manager.

14. Restart the SNMP service or restart your system.

NOTE:

- *The names and values in the NT registry are case sensitive.*

13.11.4 How to Configure the SNMP Trap

1. In order to let the SNMP trap working properly, the "RAIDCOMM.INI" file must be copied in the system root directory (\WINNT).

2. The Descriptions of Contents of the "RAIDCOMM.INI"

   Examples:

```
 [TRAP]
PERIOD=30
SEVERITY=0
```

   Comments:

   A There should be a section of "trap". The value of "PERIOD" specify the minimum interval of sequential traps. It is in seconds. For example, as above, it is 30 seconds.

   B The value of "Severity " is a filter to mask the traps that is less than its value. The value of "Severity" is considered when the value of "PERIOD" is positive.

   C The SNMP agent communicates to the RAID controller through in-band SCSI by default. To change the communication route to RS-232C, please refer to the next paragraph.

   D While the Text RAID Manager is running and communicates to the RAID controller through the in-band SCSI, the SNMP traps will not be able to send. It is a must to exit the Text RAID Manager in order to send the SNMP trap properly.

   E While the Text RAID Manager is running locally, the remote SNMP connection (GUI via SNMP) cannot be established. It is a must to exit the local Text RAID Manager in order to perform remote administration via SNMP.

3. The SNMP agent communicates to the RAID controller through in-band SCSI by default. To change the communication route to RS-232C, please add:

```
[RAID0]
CONNECT=COM1
BAUDRATE=9600
```

Comments:

- **A** Without this section, the SNMP agent will try to communicate with the RAID controller by the default route - in-band SCSI.
- **B** The "[RAID0]" refers to the first RAID controller connected. If more than one controller are connected, the second RAID controller should have another section titled "[RAID1]".
- **C** The "COM1" refers to the RS-232 port of the host computer connecting to the RAID controller.
- **D** The "BAUDRATE" refers to the baud rate setting on the RAID controller.

Example: Two RAID controllers using RS-232C

```
[RAID0]
CONNECT=COM1
BAUDRATE=9600

[RAID1]
CONNECT=COM2
BAUDRATE=9600
```

Chapter

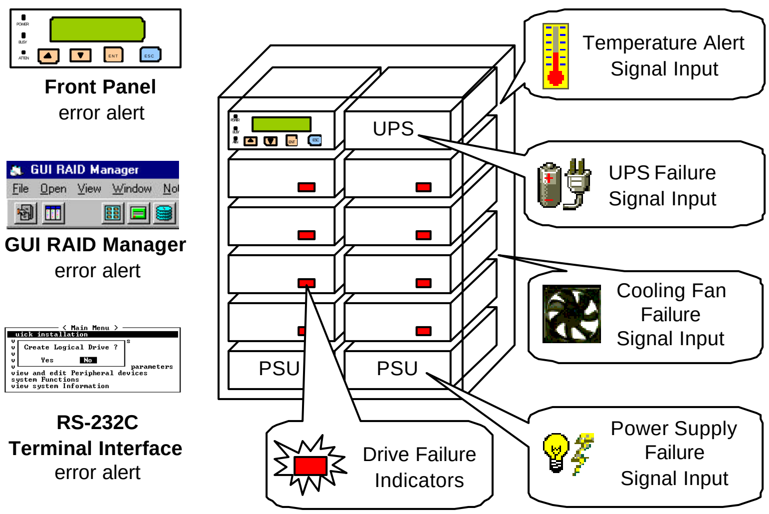
14

Fault-Bus

14.1 What is Fault-Bus? Why the Need for Fault-Bus?

Fault-bus is a proprietary enclosure management interface. It gathers the failure signals from the cooling fans, redundant power supply, enclosure temperature sensor and UPS device. It reports these failure information to the user through the front panel, RS-232C terminal interface and the Java-based RAID manager. The LED of the drive that failed will light showing the location of the drive that needs to be replaced. It warns the user of a dangerous situation happening to the RAID subsystem. Note that Fault-bus is only available with the none hot-swap PowerPC controllers: SentinelRAID 100 and SentinelRAID 150.

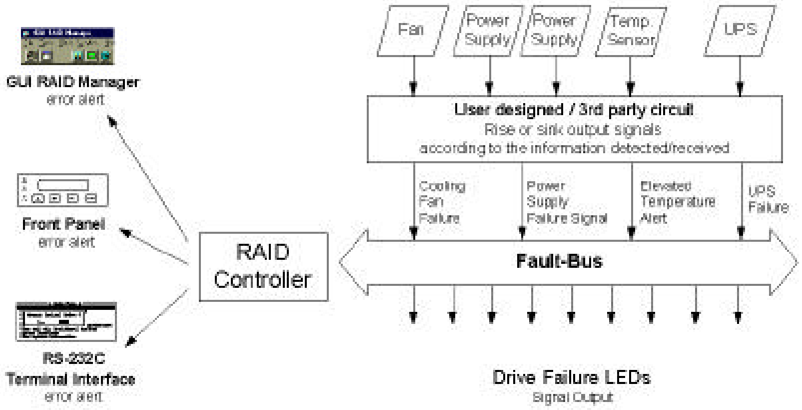
Figure 14 - 1 Fault Bus



Fault-bus is actually a signal bus which contains a group of input and output signals. The Fault-bus design is fully open for easy integration. Simply install, configure and integrate the RAID controller with the enclosure, the RAID controller will be able to provide corresponding alert to the user for an immediate dispose to protect the data stored in the RAID system.

14.2 How Does the Fault-Bus Work?

Figure 14 - 2 Signal Bus



Error Signals Input

Fault-bus only collects the signals, it does not detect the temperature, fan rotation, power supply failure or the UPS power failure. A user designed or a 3rd party circuit is necessary for Fault bus.

The user designed / 3rd party circuit must do the following:

- Detect the fan rotation, and rise up or sink down the "fan" signal of the Fault-bus (pin 26 in the Fault-bus connector) according to the detected information. When the fan fails to rotate, activate the signal. When the fan rotates properly, keep the signal inactive. If more than one fan is supported in this enclosure, detect the fan rotation of each fan and simply combine them into one signal.
- Detect the power supply status, and rise up or sink down the "power" signal of the Fault-bus (pin 23 in the Fault-bus connector) according to the detected information. When a power supply failed, activate the signal. When the power supply is working properly, keep the signal inactive. If the enclosure supports the redundant power supply feature (with more than one power supply), detect the status of each power supply and combine them into one signal.
- Detect the temperature in the enclosure, and rise up or sink down the "temperature" signal of the Fault-bus (pin 24 in the Fault-bus connector) according to the detected information. When the temperature goes too high, activate the signal. When the temperature goes back to normal, keep the signal inactive. If more than one temperature sensor is supported in this enclosure, collect the temperature information from each sensor and combine them into one signal.
- Receive the UPS status from the UPS, and rise up or sink down the "UPS" signal of the Fault-bus (pin 25 in the Fault-bus connector) according to the received information. When UPS reports a power

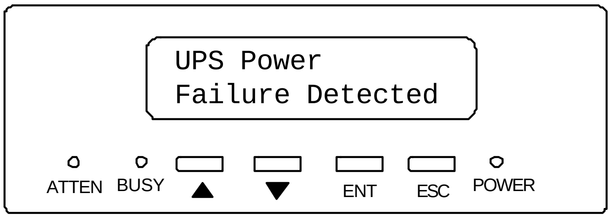
failure, activate the signal. When UPS reports that power failure has recovered, keep the signal inactive.

Drive Failure Signal Outputs

Each SCSI drive can assign a slot number. There are 10 slot signal outputs in the Fault-bus connector. When the RAID controller has detected that a SCSI drive has failed, the corresponding slot number signal will be activated for the failed drive indicated.

The controller will report the Fault-bus error signals to the user through the front panel, RS-232C terminal interface and the RAIDWatch Manager.

14.2.1 Fault-Bus Error Alert



When the Fault-bus function is enabled and a failure signal is detected, an alert message will be shown on the LCD. The ATTEN LED will also light at the same time.

IMPORTANT!

- *The Fault-Bus signals are collected from the enclosure. The controller itself does not detect the temperature, fan rotation or the power supply voltage.*

UPS Power Failure Detected	The input signal from the UPS has been triggered.
Power Supply Failure Detected	The input signal from the power supply has been triggered.
Cooling Fan Failure Detected	The input signal from the cooling fan has been triggered.
Elevated Temperature Alert	The input signal from the temperature sensor in the enclosure has changed.

14.3 How to Setup the Fault-bus?

14.3.1 Hardware

1. Connect all error signal inputs to the 3rd party circuit, then connect the error signals to the Fault-bus. Make sure each signal is active high or active low according to the 3rd party circuit.
2. Connect the LED of the failed drive, located in front of the drive canister, to the Fault-bus. Record the slot number connected to each canister.
3. Make sure the drive failure LED signal required is arranged in accordance with the drive failure LED circuit, active high or active low.

14.3.2 Configuring the Controller through the Front Panel

Assign Each SCSI Drive or Canister a Slot Number

Press **ENT** for two seconds to enter the Main Menu. Press ▼ or ▲ to select "View and Edit SCSI Drives," then press **ENT**.

```
View and Edit
SCSI Drives ↕
```

Assign a Slot Number to an Existing SCSI Drive

The SCSI drive information will be displayed on the LCD. Press ▼ or ▲ to select the desired SCSI drive, then press **ENT**.

```
C=1 I=0   1010MB
LG=0  LN SEAGATE
```

Press ▼ or ▲ to choose "Slot Number Assignments", then press **ENT**.

```
Slot Number
Assignments   ..
```

If currently there is a slot number assigned to this SCSI drive, the current slot number will be displayed. Press ▼ or ▲ to select the desired slot number, then press **ENT**.

```
Slot Def  # 1
Change to # 0  ?
```

The slot number has two characters. The right character will be chosen first, then the left character. Press **ENT** once to switch between the left and right character. Press **ENT** for two seconds.

```
Slot Assignment
Set to    # 0  ?
```

Assign a Slot Number to an Empty Canister

When there is an empty drive canister which currently does not contain any drive, its SCSI channel/ID will not appear in the drive information list. Assign a slot number to this empty canister and add a drive entry in order to use it later when a drive is installed.

Add Drive Entry

Choose "View and Edit SCSI Drives" to enter the Main Menu. The SCSI drive information will be displayed on the LCD. Press ▼ or ▲ to select a SCSI drive, then press **ENT**.

```
C=1 I=0   1010MB
LG=0  LN SEAGATE
```

Press ▼ or ▲ to select "Add Drive Entry," then press **ENT**.

```
Add Drive Entry
              ..
```

Press ▼ or ▲ to select the desired SCSI channel, then press **ENT** for two seconds.

```
Add Channel=1
Drive Entry    ?
```

Press ▼ or ▲ to select the desired SCSI ID, then press **ENT** for two seconds.

```
Add Channel=1
ID= 3 Drv Entry?
```

Delete the Slot Number

Choose "View and Edit SCSI Drives" to enter the Main Menu. The SCSI drive information will be displayed on the LCD. Press ▼ or ▲ to select the desired SCSI drive or empty drive entry, then press **ENT**.

```
C=1 I=0   1010MB
LG=0  LN SEAGATE
```

Press ▼ or ▲ to select "Slot Number Assignment," then press **ENT**.

```
Slot Number
Assignments   ..
```

Press ▼ or ▲ to select "0" for the slot number, then press **ENT**. Press **ENT** for two seconds to set.

```
Slot Def  # 1
Change to #    ?
```

Remove Empty Drive Entry

Before an empty drive entry can be removed, the slot number has to be deleted first. Please refer to the paragraph above on how to delete the slot number.

Choose "View and Edit SCSI Drives" to enter the Main Menu. The SCSI drive information will be displayed on the LCD. Press ▼ or ▲ to select the empty drive entry you desire to remove, then press **ENT**.

```
C=1 I=3 ABSENT
```

```
Clear Drive
Status        ..
```

Press ▼ or ▲ to select "Clear Drive Status", then press **ENT**.

Press **ENT** for two seconds to confirm.

```
Clear Drive
Status        ?
```

Set Each Fault-bus Error Signal Input as Active-high or Active-low

Choose "View and Edit Periph Devices" to enter the Main Menu, then press **ENT**.

```
View and Edit
Periph Parms   ↕
```

Press ▼ or ▲ to select "Define Periph. Active Signal," then press **ENT**.

```
Define Periph.
Active Signal ..
```

Press ▼ or ▲ to select the desired item: Power Supply, Cooling Fan, Temperature Alert, or UPS Power Fail to Drive Failure, then press **ENT** to choose.

```
PowerSupply Fail
Sig. Active Low
```

Press ▼ or ▲ to select an alternative selection. Press **ENT** for two seconds to confirm.

```
Set Power Fail
Sig Active High?
```

Enable Each Fault-bus Error Signal Input

Choose "View and Edit Periph Dev" to enter the Main Menu, then press **ENT**. Press ▼ or ▲ to select "Set Peripheral Devices Entry," then press **ENT**.

```
View and Edit
Periph Dev   ↕
```

```
Set Peripheral
Devices Entry ..
```

Press ▼ or ▲ to select the desired item: Power Supply, Cooling Fan, Temperature Alert or UPS Power Fail, then press ENT to choose.

```
Power Supply
Status Disabled
```

Press ▼ or ▲ to select an alternative selection. Press **ENT** for two seconds to confirm.

```
Enable Power
Supply Status  ?
```

Test Drive Failure LED for Each Drive Canister

Choose "View and Edit SCSI Drives" to enter the Main Menu. The SCSI drive information will be displayed on the LCD. Press ▼ or ▲ to select the desired SCSI drive or empty drive entry, then press **ENT**.

```
C=1 I=0   1010MB
LG=0  LN SEAGATE
```

```
Toggle Failure
Signal        ..
```

Press ▼ or ▲ to select “Toggle Failure Signal,” then press **ENT**.

Press **ENT** for two seconds to toggle the drive failure signal.

```
Toggle Failure
Signal        ?
```

The drive failure LED should light on or off, following the toggle.

Viewing the Status of Each Fault-bus Error Signal Input

Choose “View and Edit Periph Parms” in the Main Menu, then press **ENT**.

```
View and Edit
Periph Parms   ↕
```

Press ▼ or ▲ to select “View Peripheral Devices Status,” then press **ENT**.

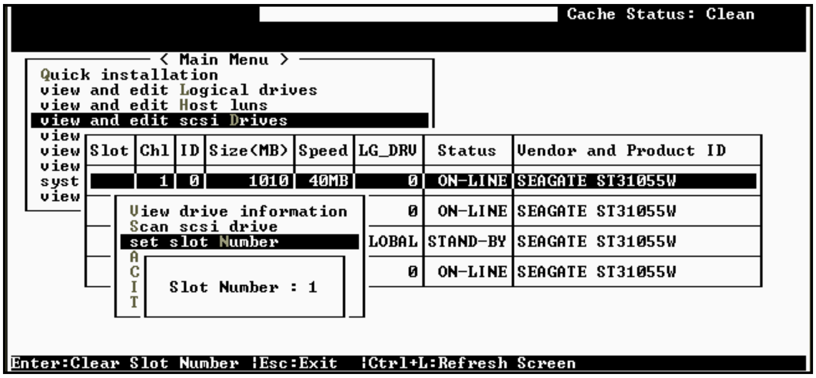
```
View Peripheral
Devices Status..
```

Press ▼ or ▲ to view the desired item: Power Supply, Cooling Fan, Temperature Alert or UPS Power Fail.

```
Power Supply
Status Normal
```

14.3.3 Configuring on the Controller through the RS-232C Terminal Interface

Assign Each SCSI Drive or Canister a Slot Number

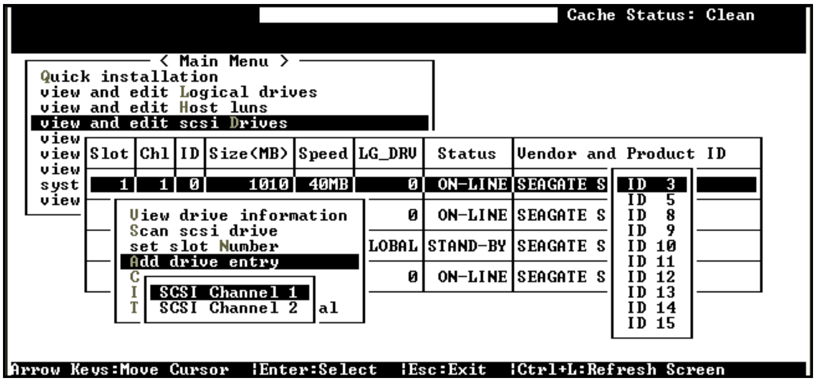


Choose “View and Edit SCSI Drives” in the Main Menu, then press [**ENTER**]. A list of the connected SCSI drives will appear. The “Slot” column indicates the current slot number of each SCSI drive.

Assign a Slot Number to an Existing SCSI Drive

Choose the desired drive to edit the slot number, then press **[ENTER]**. Choose “Set Slot Number” in the menu, then press **[ENTER]**. Enter the corresponding slot number of this SCSI drive, then press **[ENTER]**. The slot number will appear in the slot column of the drive information list.

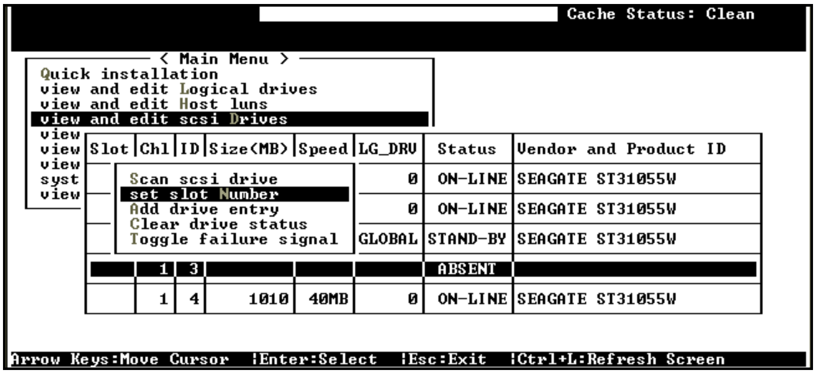
Assign a Slot Number to an Empty Canister



When there is an empty drive canister which currently does not contain any drive, the corresponding SCSI channel/ID will not appear in the drive information list. Assign a slot number to this empty canister and add a drive entry in order to use it later when a drive is installed.

Add Drive Entry

Choose a SCSI drive, then press **[ENTER]**. Choose "Add Drive Entry" in the menu, then press **[ENTER]**. Choose the corresponding SCSI channel/ID for this empty canister, then press **[ENTER]**. An empty drive entry "ABSENT" will appear in the drive information list.

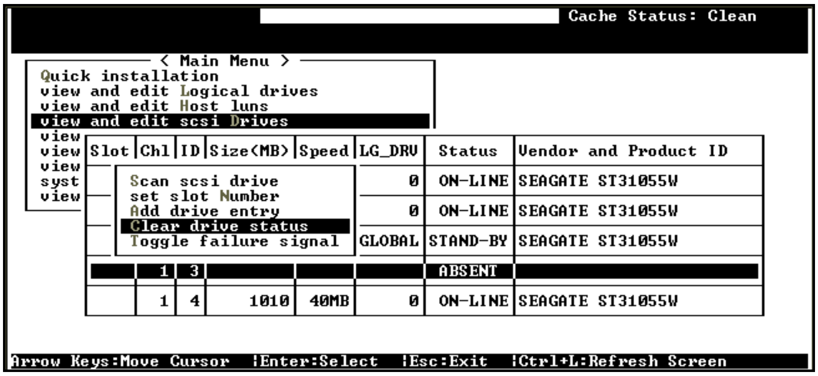


Move the cursor bar on the empty drive entry and press **[ENTER]**. Choose "Set Slot Number" in the menu, then press **[ENTER]**. Enter the slot number of this empty canister so as to use it later when a drive is installed.

Delete the Slot Number of a SCSI Drive or Empty Drive Entry

Choose the desired SCSI drive or empty drive entry to delete its slot number and press **[ENTER]**. Choose "Set Slot Number" in the menu, then press **[ENTER]** on the selected slot number. The slot number can also be cleared by entering "0" at the slot number.

Remove Empty Drive Entry



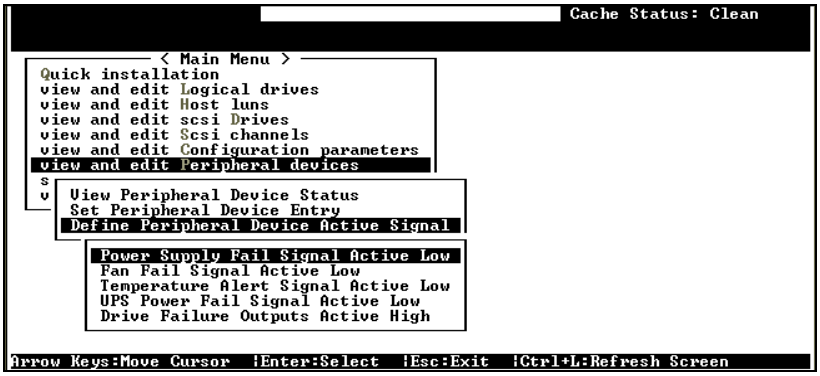
Before an empty drive entry can be removed, the slot number has to be deleted first. Please refer to the above paragraph on how to delete the slot number.

Move the cursor on the empty drive entry, then press **[ENTER].** Choose "Clear Drive Status," then press **[ENTER].** The empty drive entry will now disappear from the drive information list.

IMPORTANT!

- *You will not be able to remove an empty drive entry if it has been assigned a slot number. Delete the slot number before removing the empty drive entry.*

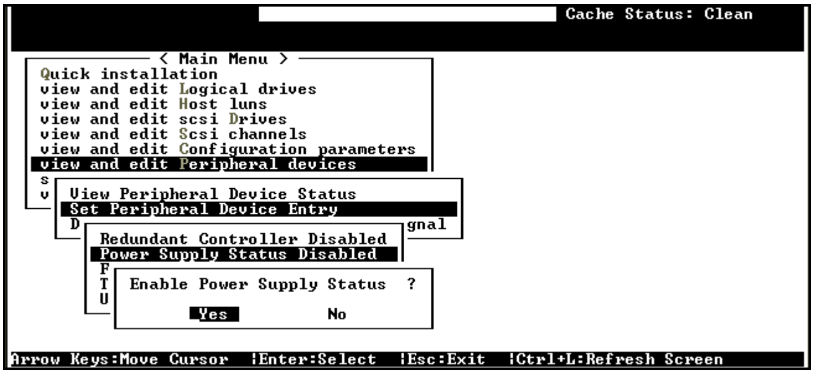
Set Each Fault-bus Error Signal Input as Active-high or Active-low



Choose "View and Edit Peripheral Devices" in the Main Menu, then press **[ENTER]**. Select "Define Peripheral Device Active Signal", then press **[ENTER]**.

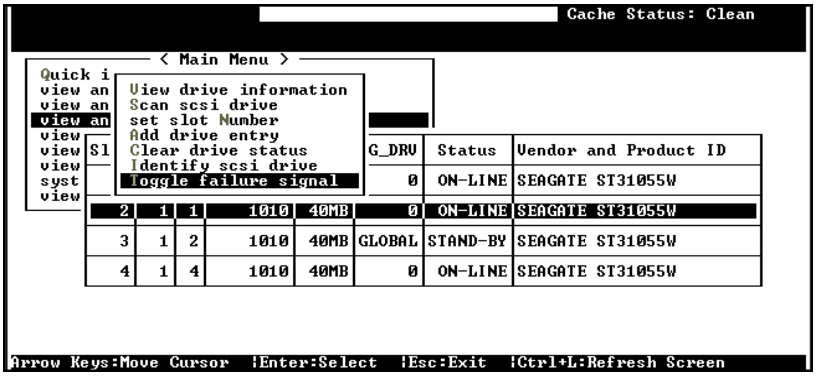
Move the cursor to the item you wish to change, then press **[ENTER]**. Choose "**Yes**" when prompted to confirm, then press **[ENTER]** to set. Each error signal input can be individually set as active high or active low. The drive failure signal output can also be set as active high or active low.

Enable Each Fault-bus Error Signal Input



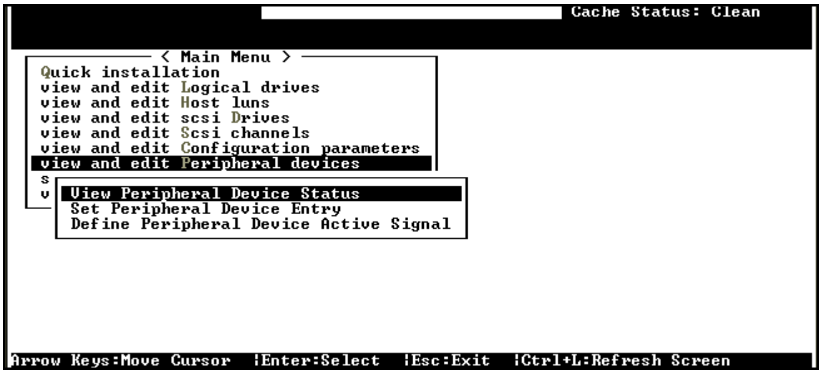
Each item of the error signal input can be individually enabled or disabled. Choose "View and Edit Peripheral Devices" in the Main Menu, then press **[ENTER].** Select "Set Peripheral Device Entry," then press **[ENTER]**. Move the cursor to the desired item to enable or disable, and press **[ENTER]**. Choose "**Yes**" in the following dialog box, then press **[ENTER]** to set.

Test Drive Failure LED for Each Drive Canister



Choose the desired SCSI drive or empty drive entry from the drive information list, and press **[ENTER]**. Choose "Toggle Failure Signal" in the menu, then press **[ENTER]** to toggle the drive failure signal. The drive failure LED should light on or off followed with the toggle.

Viewing the Status of Each Fault-bus Error Signal Input



Choose “View and Edit Peripheral Devices” in the Main Menu and press **[ENTER]**. Select “View Peripheral Device Status” in the menu and press **[ENTER]**.

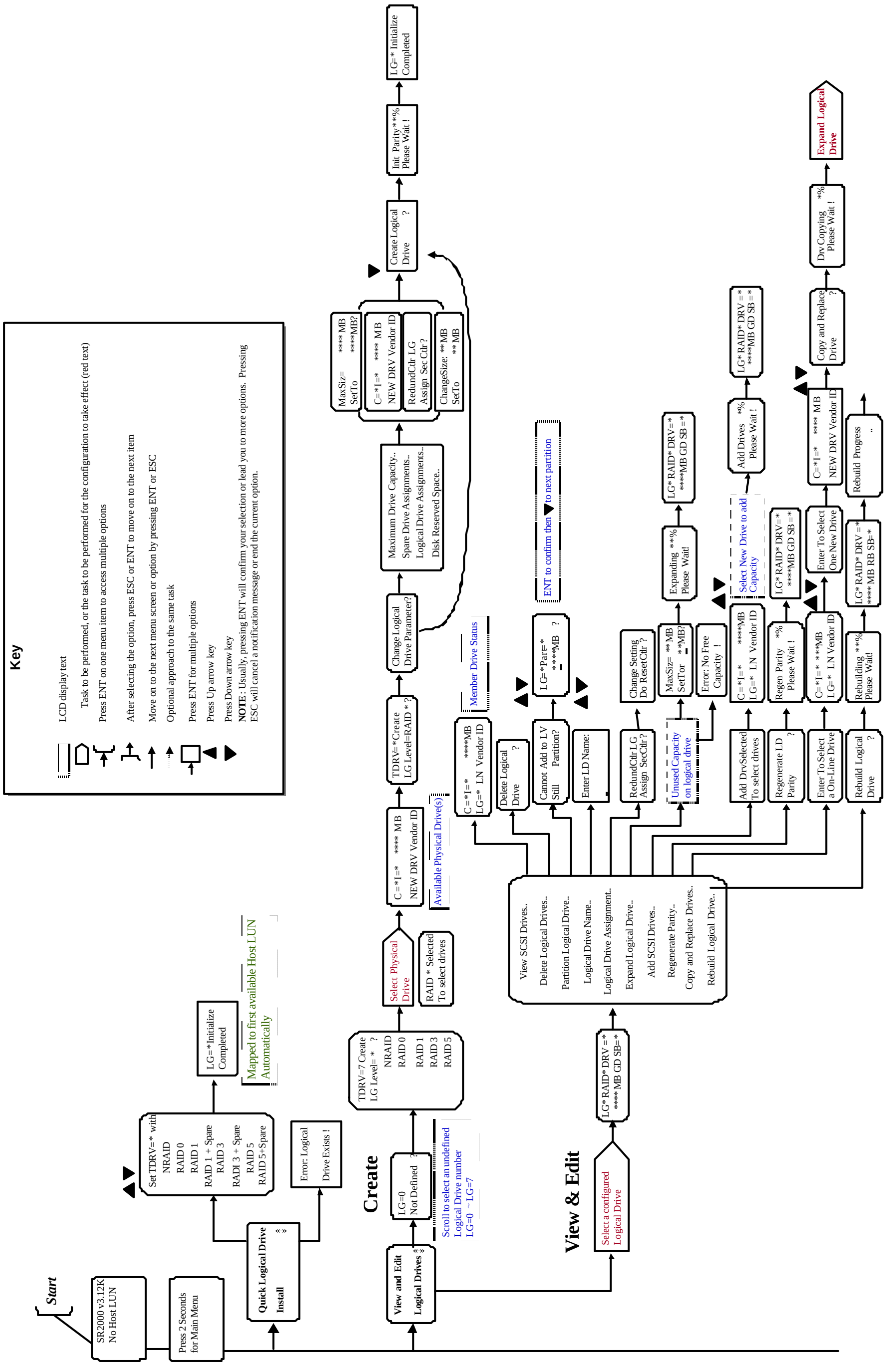
ITEM	STATUS	LOCATION
Redundant Controller	Disabled	
Power Supply Status	Normal	FaultBus
Fan Status	Failed	FaultBus
Temperature Status	Alert	FaultBus
UPS Status	Normal	FaultBus

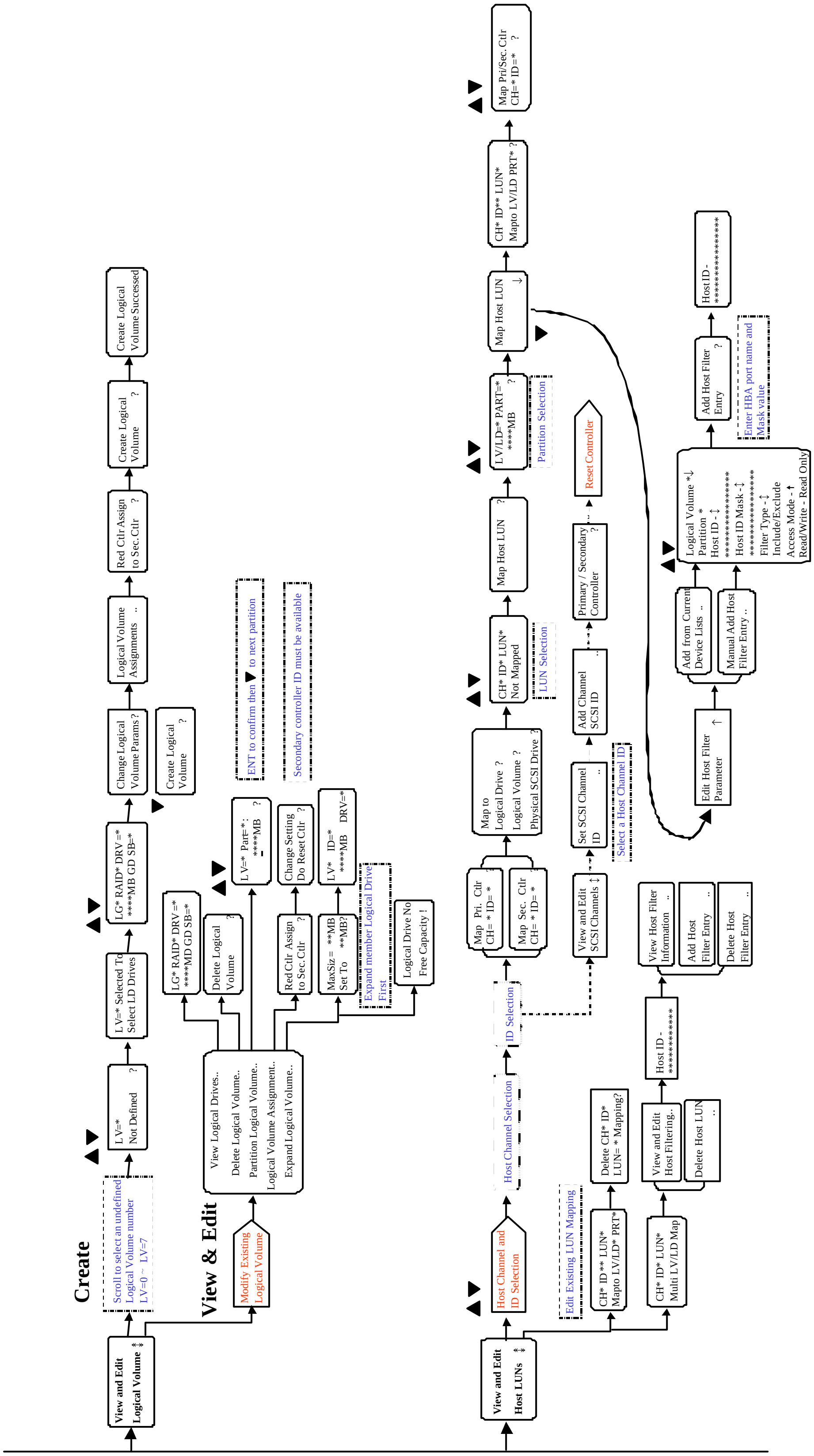
The current status of each enabled Fault-bus error signal input is listed. Try to emulate the errors and view the status of each item as described above.

Appendix

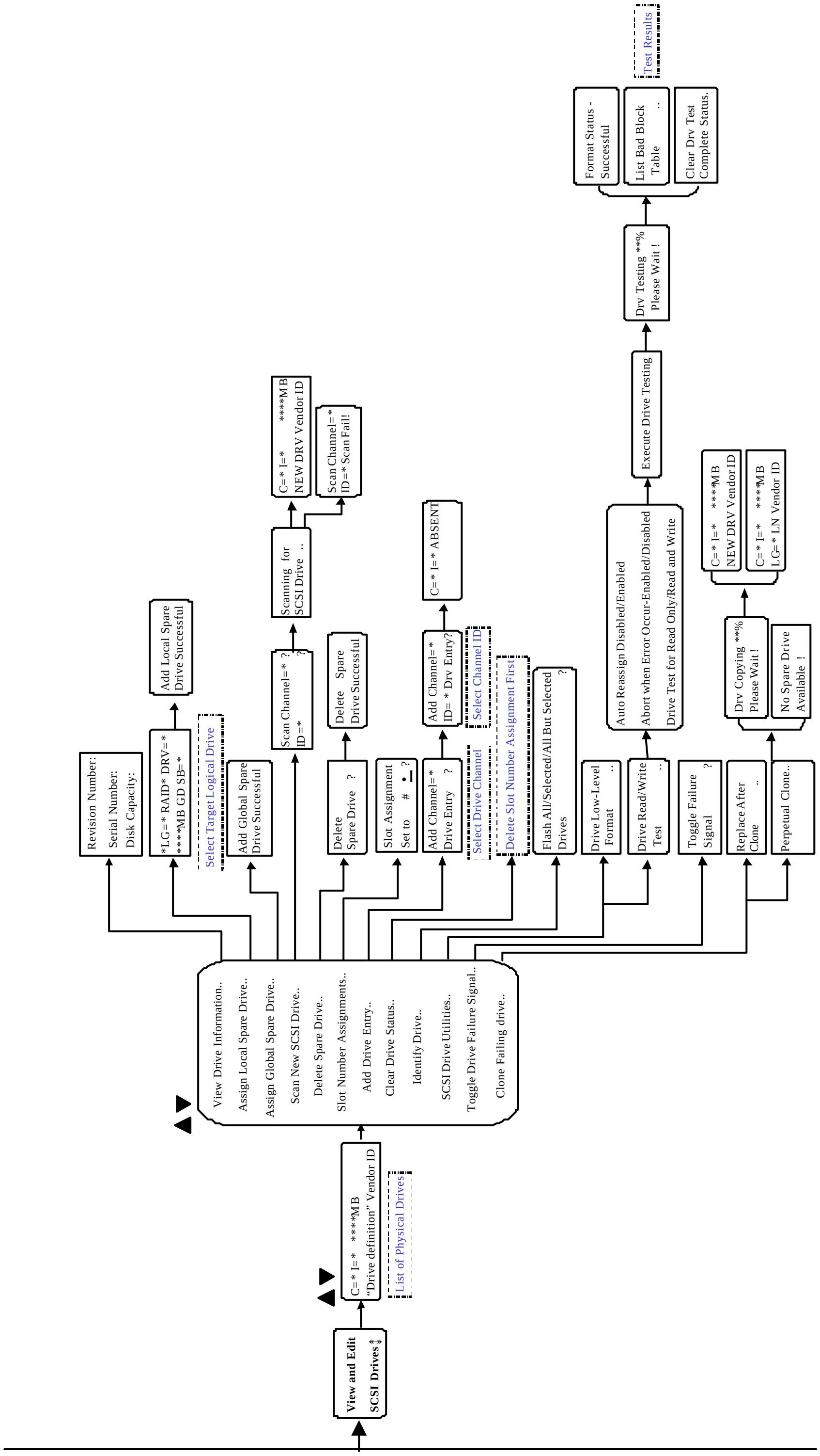
A

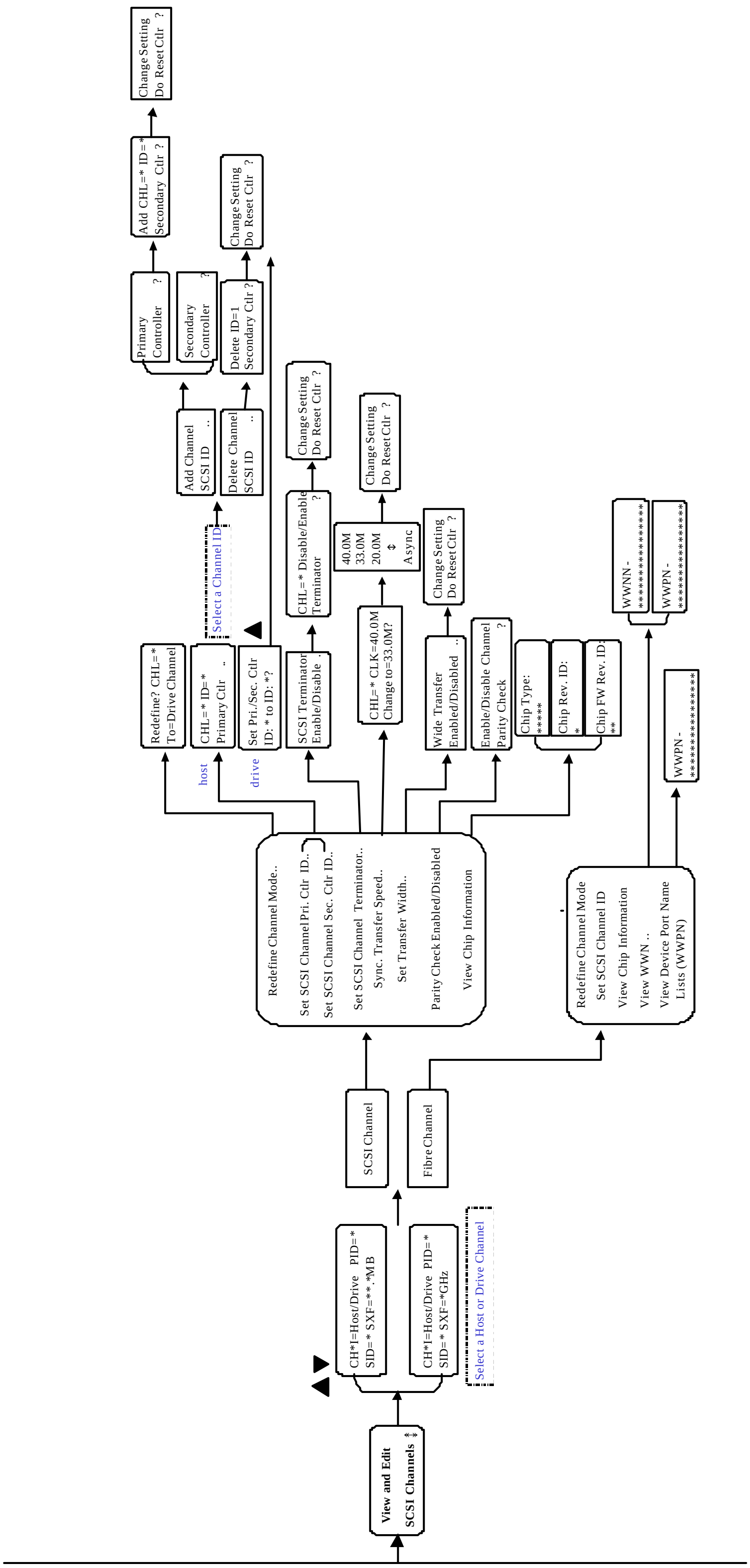
LCD Keypad Navigation Map

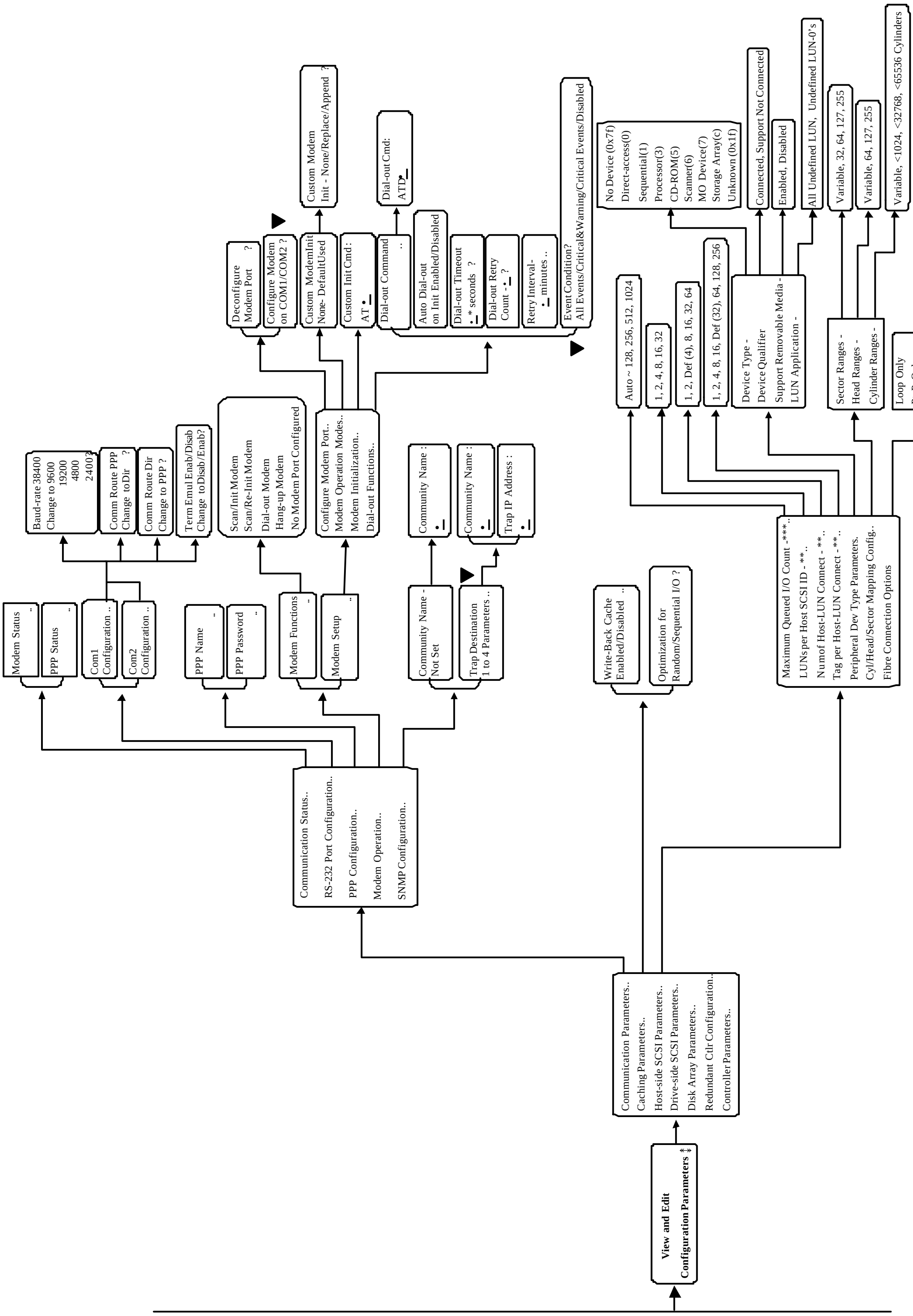




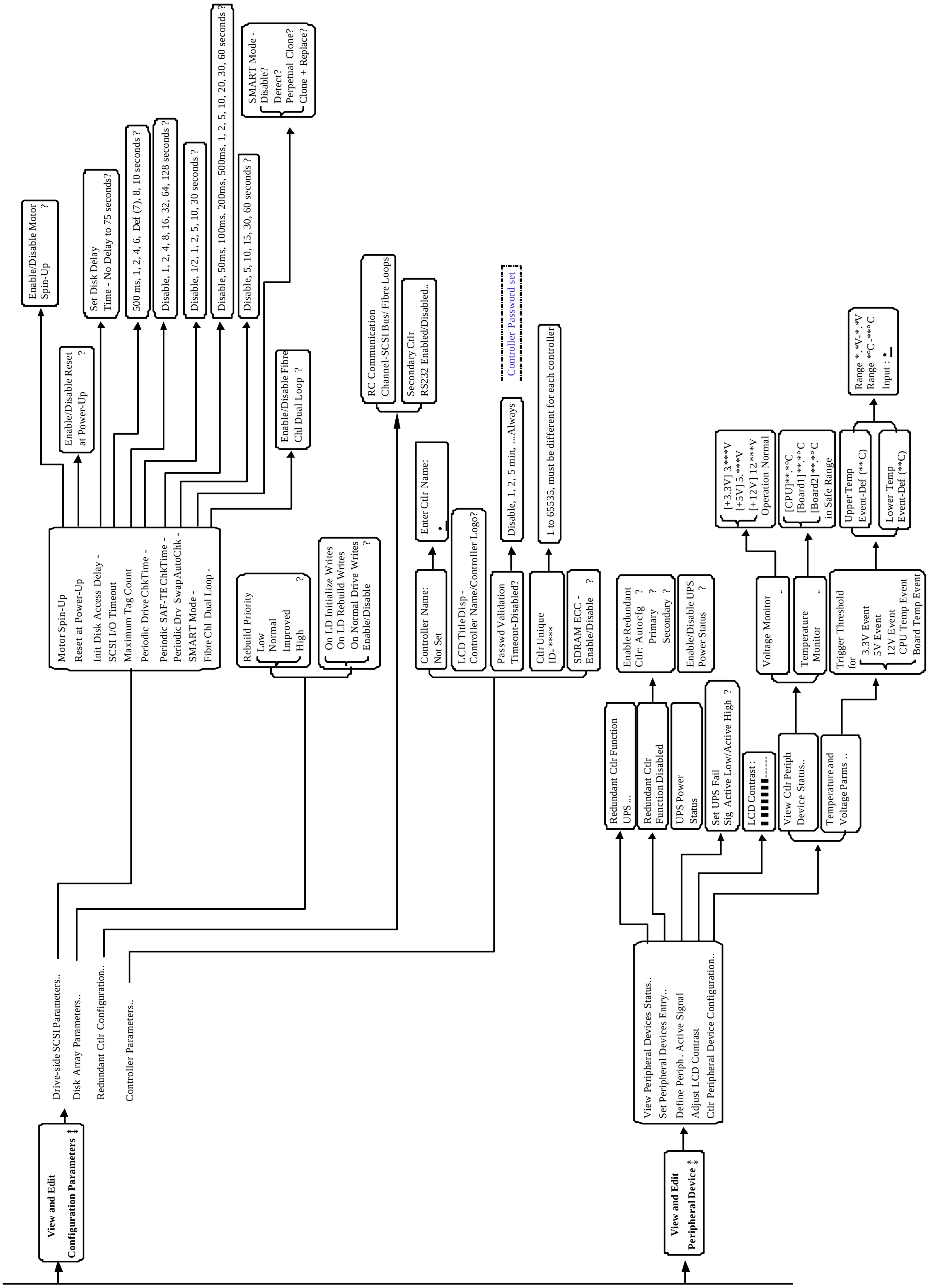
Create
View and Edit Logical Volume
Scroll to select an undefined Logical Volume number LV=0 ~ LV=7
LV=* Not Defined ?
LV=* Selected To Select LD Drives
LG* RAID* DRV=* ****MB GD SB=*
Change Logical Volume Params ?
Create Logical Volume ?
Logical Volume Assignments ..
Red Ctlr Assign to Sec.Ctlr ?
Create Logical Volume ?
Create Logical Volume Successed
View & Edit
Modify Existing Logical Volume
View Logical Drives..
Delete Logical Volume..
Partition Logical Volume..
Logical Volume Assignment..
Expand Logical Volume..
LG* RAID* DRV =* ****MD GD SB=*
Delete Logical Volume ?
LV=* Part=*: ****MB ?
ENT to confirm then ▼ to next partition
Red Ctlr Assign to Sec.Ctlr ?
Change Setting Do Reset Ctlr ?
Secondary controller ID must be available
MaxSiz = **MB Set To **MB?
LV* ID=* ****MB DRV=*
Expand member Logical Drive First
Logical Drive No Free Capacity !
View and Edit Host LUNs
Host Channel and ID Selection
Host Channel Selection
ID Selection
Map Pri. Ctlr CH= * ID= * ?
Map Sec. Ctlr CH= * ID= * ?
Map to Logical Drive ? Logical Volume ? Physical SCSI Drive ?
CH* ID* LUN* Not Mapped
LUN Selection
Map Host LUN ?
LV/LD* PART=* ****MB ?
Partition Selection
Map Host LUN
CH* ID** LUN* Mapto LV/LD PRT* ?
Map Pri/Sec Ctlr CH=* ID=* ?
View and Edit SCSI Channels
Set SCSI Channel ID ..
Select a Host Channel ID
Add Channel SCSI ID ..
Primary / Secondary Controller ?
Reset Controller
Edit Existing LUN Mapping
CH* ID ** LUN* Mapto LV/LD* PRT*
Delete CH* ID* LUN= * Mapping?
CH* ID* LUN* Multi LV/LD Map
View and Edit Host Filtering..
Delete Host LUN ..
Host ID - ************
View Host Filter Information ..
Add Host Filter Entry ..
Delete Host Filter Entry ..
Edit Host Filter Parameter
Add from Current Device Lists ..
Manual Add Host Filter Entry ..
Logical Volume * Partition * Host ID - ************** Host ID Mask - ************** Filter Type - Include/Exclude Access Mode - Read/Write - Read Only
Add Host Filter Entry ?
Enter HBA port name and Mask value
Host ID - ****************

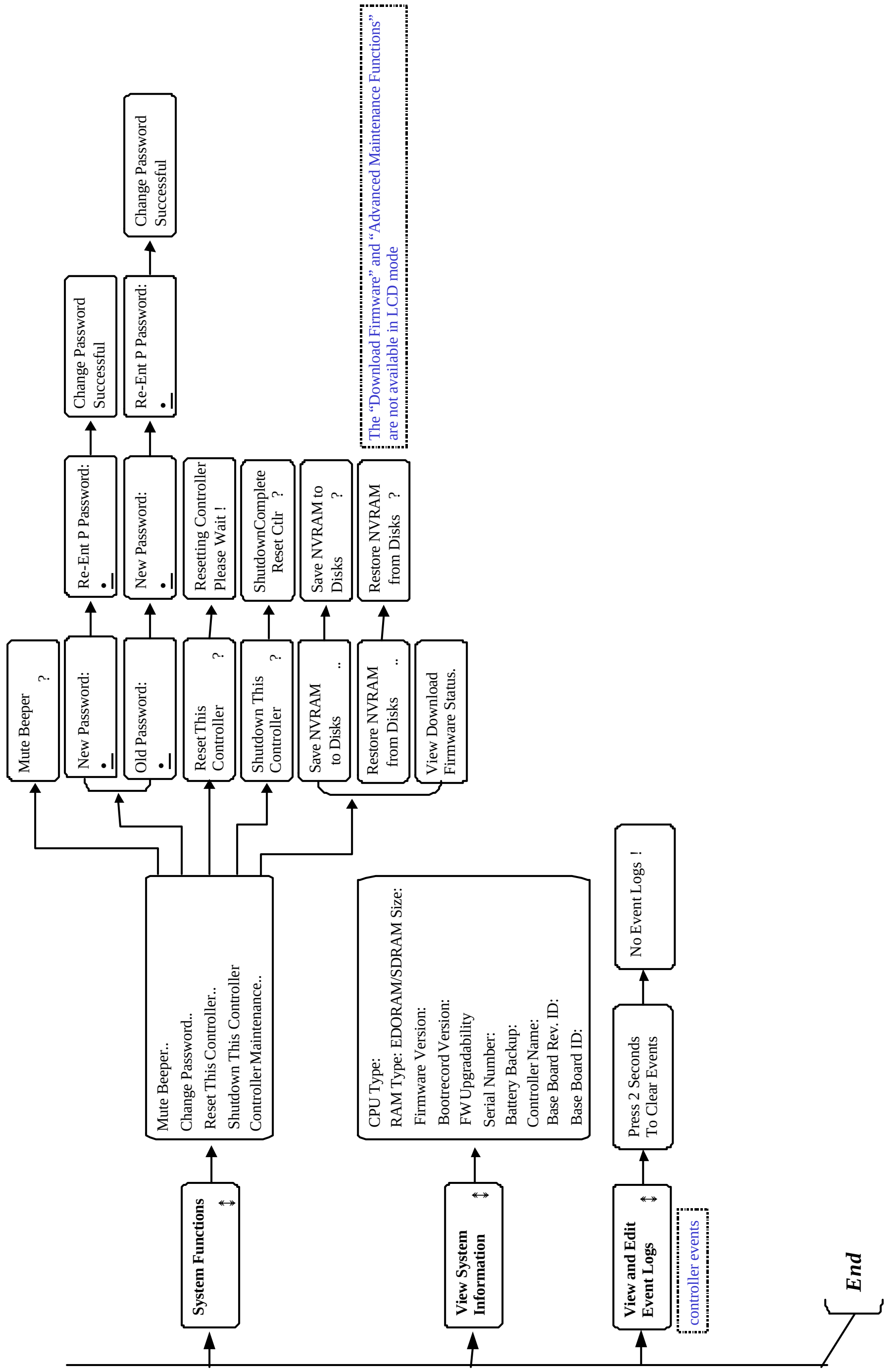

View and Edit SCSI Drives
C=* I=* ****MB "Drive definition" Vendor ID
List of Physical Drives
View Drive Information..
Assign Local Spare Drive..
Assign Global Spare Drive..
Scan New SCSI Drive..
Delete Spare Drive..
Slot Number Assignments..
Add Drive Entry..
Clear Drive Status..
Identify Drive..
SCSI Drive Utilities..
Toggle Drive Failure Signal..
Clone Failing drive..
Revision Number:
Serial Number:
Disk Capacity:
LG= RAID* DRV=* ****MB GD SB=*
Select Target Logical Drive
Add Local Spare Drive Successful
Add Global Spare Drive Successful
Scan Channel=* ? ID=*
Scanning for SCSI Drive ..
C=* I=* ****MB NEW DRV Vendor ID
Scan Channel=* ID=* Scan Fail!
Delete Spare Drive ?
Delete Spare Drive Successful
Slot Assignment Set to # ?
Add Channel=* Drive Entry ?
Select Drive Channel
Add Channel=* ID= * Drv Entry?
Select Channel ID
C=* I=* ABSENT
Delete Slot Number Assignment First
Flash All/Selected/All But Selected Drives ?
Drive Low-Level Format ..
Drive Read/Write Test ..
Auto Reassign Disabled/Enabled
Abort when Error Occur-Enabled/Disabled
Drive Test for Read Only/Read and Write
Execute Drive Testing
Drv Testing **% Please Wait !
Format Status - Successful
List Bad Block Table ..
Clear Drv Test Complete Status.
Test Results
Toggle Failure Signal ?
Replace After Clone ..
Perpetual Clone..
Drv Copying **% Please Wait !
No Spare Drive Available !
C=* I=* ****MB NEW DRV Vendor ID
C=* I=* ****MB LG=* LN Vendor ID


View and Edit SCSI Channels
CH*I=Host/Drive PID=* SID=* SXF=**.*MB
CH*I=Host/Drive PID=* SID=* SXF=*GHz
Select a Host or Drive Channel
SCSI Channel
Fibre Channel
Redefine Channel Mode..
Set SCSI Channel Pri. Ctlr ID..
Set SCSI Channel Sec. Ctlr ID..
Set SCSI Channel Terminator..
Sync. Transfer Speed..
Set Transfer Width..
Parity Check Enabled/Disabled
View Chip Information
Redefine? CHL=* To=Drive Channel
host
CHL=* ID=* Primary Ctlr ..
drive
Set Pri./Sec. Ctlr ID: * to ID: *?
Select a Channel ID
Add Channel SCSI ID ..
Delete Channel SCSI ID ..
Primary Controller ?
Secondary Controller ?
Add CHL=* ID=* Secondary Ctlr ?
Change Setting Do Reset Ctlr ?
Delete ID=1 Secondary Ctlr ?
Change Setting Do Reset Ctlr ?
SCSI Terminator Enable/Disable .
CHL=* Disable/Enable Terminator ?
Change Setting Do Reset Ctlr ?
CHL=* CLK=40.0M Change to=33.0M?
40.0M
33.0M
20.0M
Async
Change Setting Do Reset Ctlr ?
Wide Transfer Enabled/Disabled ..
Change Setting Do Reset Ctlr ?
Enable/Disable Channel Parity Check ?
Chip Type: *****
Chip Rev. ID: *
Chip FW Rev. ID: **
Redefine Channel Mode
Set SCSI Channel ID
View Chip Information
View WWN ..
View Device Port Name Lists (WWPN)
WWNN - ****************
WWPN - ****************
WWPN - ****************



View and Edit
Configuration Parameters
Communication Parameters..
Caching Parameters..
Host-side SCSI Parameters..
Drive-side SCSI Parameters..
Disk Array Parameters..
Redundant Ctlr Configuration..
Controller Parameters..
Communication Status..
RS-232 Port Configuration..
PPP Configuration..
Modem Operation..
SNMP Configuration..
Modem Status
PPP Status
Com1 Configuration ..
Com2 Configuration ..
Baud-rate 38400
Change to 9600
19200
4800
2400 ?
Comm Route PPP
Change to Dir ?
Comm Route Dir
Change to PPP ?
Term Emul Enab/Disab
Change to Disab/Enab?
PPP Name
PPP Password
Modem Functions
Modem Setup
Scan/Init Modem
Scan/Re-Init Modem
Dial-out Modem
Hang-up Modem
No Modem Port Configured
Configure Modem Port..
Modem Operation Modes..
Modem Initialization..
Dial-out Functions..
Deconfigure
Modem Port ?
Configure Modem
on COM1/COM2 ?
Custom ModemInit
None- DefaultUsed
Custom Modem
Init - None/Replace/Append ?
Custom Init Cmd :
AT
Dial-out Command
Dial-out Cmd:
ATD
Auto Dial-out
on Init Enabled/Disabled
Dial-out Timeout
seconds ?
Dial-out Retry
Count - ?
Retry Interval-
minutes ..
Event Condition?
All Events/Critical&Warning/Critical Events/Disabled
Community Name -
Not Set
Trap Destination
1 to 4 Parameters ..
Community Name :
Community Name :
Trap IP Address :
Write-Back Cache
Enabled/Disabled ..
Optimization for
Random/Sequential I/O ?
Maximum Queued I/O Count -***..
LUNs per Host SCSI ID - **..
Numof Host-LUN Connect - **..
Tag per Host-LUN Connect - **..
Peripheral Dev Type Parameters.
Cyl/Head/Sector Mapping Config..
Fibre Connection Options
Auto ~ 128, 256, 512, 1024
1, 2, 4, 8, 16, 32
1, 2, Def (4), 8, 16, 32, 64
1, 2, 4, 8, 16, Def (32), 64, 128, 256
Device Type -
Device Qualifier
Support Removable Media -
LUN Application -
No Device (0x7f)
Direct-access(0)
Sequential(1)
Processor(3)
CD-ROM(5)
Scanner(6)
MO Device(7)
Storage Array(c)
Unknown (0x1f)
Connected, Support Not Connected
Enabled, Disabled
All Undefined LUN, Undefined LUN-0's
Sector Ranges -
Head Ranges -
Cylinder Ranges -
Variable, 32, 64, 127, 255
Variable, 64, 127, 255
Variable, <1024, <32768, <65536 Cylinders
Loop Only
PtoP Only
Loop Preferred
PtoP Preferred


View and Edit
Configuration Parameters
Drive-side SCSI Parameters..
Disk Array Parameters..
Redundant Ctlr Configuration..
Controller Parameters..
Motor Spin-Up
Reset at Power-Up
Init Disk Access Delay -
SCSI I/O Timeout
Maximum Tag Count
Periodic Drive ChkTime -
Periodic SAF-TE ChkTime -
Periodic Drv SwapAutoChk -
SMART Mode -
Fibre Chl Dual Loop -
Enable/Disable Motor Spin-Up ?
Enable/Disable Reset at Power-Up ?
Set Disk Delay Time - No Delay to 75 seconds?
500 ms, 1, 2, 4, 6, Def (7), 8, 10 seconds ?
Disable, 1, 2, 4, 8, 16, 32, 64, 128 seconds ?
Disable, 1/2, 1, 2, 5, 10, 30 seconds ?
Disable, 50ms, 100ms, 200ms, 500ms, 1, 2, 5, 10, 20, 30, 60 seconds ?
Disable, 5, 10, 15, 30, 60 seconds ?
SMART Mode - Disable? Detect? Perpetual Clone? Clone + Replace?
Enable/Disable Fibre Chl Dual Loop ?
Rebuild Priority
Low
Normal
Improved
High ?
On LD Initialize Writes
On LD Rebuild Writes
On Normal Drive Writes
Enable/Disable ?
RC Communication Channel-SCSI Bus/ Fibre Loops
Secondary Ctlr RS232 Enabled/Disabled..
Controller Name: Not Set
LCD Title Disp - Controller Name/Controller Logo?
Passwd Validation Timeout-Disabled?
Ctlr Unique ID- ****
SDRAM ECC - Enable/Disable ?
Enter Ctlr Name:
Disable, 1, 2, 5 min, ...Always
Controller Password set
1 to 65535, must be different for each controller
View and Edit
Peripheral Device
View Peripheral Devices Status..
Set Peripheral Devices Entry..
Define Periph. Active Signal
Adjust LCD Contrast
Ctlr Peripheral Device Configuration..
Redundant Ctlr Function UPS...
Redundant Ctlr Function Disabled
UPS Power Status
Set UPS Fail Sig Active Low/Active High ?
LCD Contrast :
Enable Redundant Ctlr: Autocfg ?
Primary ?
Secondary ?
Enable/Disable UPS Power Status ?
View Ctlr Periph Device Status..
Temperature and Voltage Parms ..
Voltage Monitor ..
Temperature Monitor ..
Trigger Threshold for
3.3V Event
5V Event
12V Event
CPU Temp Event
Board Temp Event
[+3.3V] 3.***V
[+5V] 5.***V
[+12V] 12.***V
Operation Normal
[CPU]**.*°C
[Board1]**.*°C
[Board2]**.*°C
in Safe Range
Upper Temp Event-Def (**C)
Lower Temp Event-Def (**C)
Range *.*V-*.*V
Range **C-**°C
Input : *_


System Functions
Mute Beeper..
Change Password..
Reset This Controller..
Shutdown This Controller
Controller Maintenance..
Mute Beeper ?
New Password:
Re-Ent P Password:
Change Password Successful
Old Password:
New Password:
Re-Ent P Password:
Change Password Successful
Reset This Controller ?
Resetting Controller Please Wait !
Shutdown This Controller ?
ShutdownComplete Reset Ctlr ?
Save NVRAM to Disks ..
Save NVRAM to Disks ?
Restore NVRAM from Disks ..
Restore NVRAM from Disks ?
View Download Firmware Status.
The "Download Firmware" and "Advanced Maintenance Functions" are not available in LCD mode
View System Information
CPU Type:
RAM Type: EDORAM/SDRAM Size:
Firmware Version:
Bootrecord Version:
FW Upgradability
Serial Number:
Battery Backup:
Controller Name:
Base Board Rev. ID:
Base Board ID:
View and Edit Event Logs
controller events
Press 2 Seconds To Clear Events
No Event Logs !
End

Appendix

B

Firmware Functionality Specifications

Basic RAID Management:

Specification	Feature
RAID Levels	0, 1(0+1), 3, 5, 10, 30, and 50. Enhanced RAID Levels supported (with logical volume implementation)
Maximum Number of logical drives	8
RAID level dependency to each logical drive	Independent. Logical drive configured in different RAID levels can co-exist in an array
Maximum drive number of each logical drive	31 (RAID 3 or 5); 45 (RAID 0 or NRAID); 44 (RAID 1)
Logical drive identification	Unique, Controller Randomly generated logical drive ID Logical drive name user-configurable
Maximum partitions of each logical drive	8
Maximum number of logical drives in a logical volume	8
Maximum number of logical volumes	8
Maximum number of LUN per Host ID	Up to 32, user configurable
Concurrent I/O	Supported
Tag Command Queuing	Supported
Dedicated Spare Drive	Supported, hereby defined as the spare drive specifically assigned to a logical drive
Global Spare Drive	Supported, the spare drive serving all logical drives
Co-existing Dedicated and Global Spare Drives	Supported
Auto-rebuild onto spare drive	Supported
▪ **Auto-scan of replacement drive upon manually initiated rebuild** ▪ **One-step rebuild onto replacement drive**	Supported
Auto-rebuild onto failed drive replacement	Supported. With no spare drive assigned, the controller will auto-scan the failed drive and starts rebuild automatically once the failed drive has been

	replaced.
Background firmware download	Firmware can be downloaded during active I/Os. Administrator may find appropriate time to reset controller later.
Auto recovery from logical drive failure	Supported. When user accidentally removed the wrong drive to cause the 2nd drive failure of a one-drive-failed RAID5 / RAID3 logical drive, switch off the controller, put the drive back and power on the controller. The logical drive will be restored to one-drive-failed status.

Advanced Features:

Drive Low-level format	Supported.
Drive Identification	Supported. Force the drive to light on the activity indicator for user to recognize the correct drive.
Drive Information Listing	Supported. Drive vendor name, model number, firmware revision, capacity (blocks), serial number, narrow/wide and current sync. speed.
Drive Read/Write testing	Supported.
Configuration on Disk	Supported. The logical drive information is recorded on drive media. The logical drives can still be accessed if using different Infortrend RAID controllers.
Save/ Restore NVRAM to / from Disks	Supported. Save all the settings stored in the controller NVRAM to the logical drive members
Save / Restore NVRAM to / from file	Supported. Save all the settings stored in the controller NVRAM to a file (via GUI or TextRAID manager) on user's computer.
Host LUN Geometry User Configurable Default Geometry:	1. Capacity <64GB: Head=63, Sector=32, Cylinder=? (depends on capacity) 2. 64GB<capacity<128GB:Head=64, Sector=64, Cylinder=? (depends on capacity) 3. 128GB<capacity<256GB: Head=127, Sector=64, Cylinder=? (depends on capacity) 4. 256GB<capacity<512GB: Head=127, Sector=127, Cylinder=? 5. 512GB<capacity<1TB: Head=255, Sector=64, Cylinder=? (depends on capacity) 6. 1TB<capacity: Head=225, Sector=225, Cylinder=? (depends on capacity)
User Configurable Geometry range:	Sector: 32,64,127,255 or Variable Head: 64,127,255 or Variable Cylinder: <1024, <32784,<65536 or Variable
Drive Motor Spin-up	Supported. The controller will send spin-up (start unit) command to each drive at 4 sec. intervals.
Drive-side Tag Command Queue	Supported. User adjustable up to 128 for each drive
Host-side Maximum Queued I/O count	User adjustable up to 1024

Maximum concurrent Host LUN connection	User adjustable up to 64
Number of Tags Reserved for each Host-LUN connection	User adjustable up to 256
Drive I/O timeout	User adjustable

Caching Operation:

Write-back Cache	Supported.
Write-through Cache	Supported.
Supported Memory type	SDRAM memory for enhanced performance Fast Page Memory with Parity for enhanced data security
Read-ahead Operation	Intelligent Dynamic read-ahead operation for sequential data accessing
Multi-Threaded Operation	Yes
Scatter / Gather	Supported
I/O sorting	Supported. Optimized I/O sorting for enhanced performance
Variable Stripe Size	RAID5: Optimization for Random I/O (32k), optimization for Sequential I/O (128k), user selectable. RAID3: Optimization for Random I/O (4k), optimization for Sequential I/O (16k), user selectable.

RAID Expansion:

On-line RAID Expansion	Supported.
Mode-1 RAID Expansion-add Drive	Supported. Multiple drives can be added concurrently.
Mode-2 RAID Expansion – Copy and Replace drives	Supported. Replace members with drives of larger capacity.
Expand Capacity with no extra drive bays required	Supported in Mode 2 RAID expansion. Provide “Copy and Replace Drive” function to replace drives with drives of greater capacity. No need to add another enclosure for the extra drives.
Operating system support for RAID Expansion	No. No operating system driver required. No software has to be installed for this purpose.

Fibre Channel Support:

Fibre Channel Support	All Firmware supports Fibre Channels
Channel Mode	All channels configurable to Host or Drive mode, user configurable.
Redundant controller	Redundant using FC controllers supported.
Host-side loop failure detection	Supported. The LIPs on the host channels will not be displayed to users.
Drive-side loop failure detection	Supported.
Point-to-point topology	Supported.
Arbitrated loop topology	Supported.
Fabric topology	Supported.
Host Redundant loop / dual-loop topology	Supported. (Also requires the host computer Fibre HBA driver support)
Drive side redundant loop load-sharing	Workloads can be automatically balanced between member loops for performance optimization.
Fibre channel ID	User selectable from ID 0 to 125.
Native Fibre Interface	3-pin Copper: can be converted to optical with a MIA or GBIC HUBs. DB-9 Copper: MIA compliant, a converter or extender is necessary
Point-to-point and FC-AL protocol	User configurable.
LUN Filtering (RAID-Based Mapping)	Host LUN mapping with user-configurable Filter entry and Filter type (access control), up to 128 Filter entries can be appended to Host-ID/LUN combinations. ▪ Host channel HBA WWN browsing: a list of WWNs from detected HBAs on the host channel will be provided for user's convenience when masking LUN Filtering. ▪ Bit-masking: Based on the user provided WWN of the host HBA (user can enter the WWN manually from a list browsed or that provided by the controller). Users can also assign a bit-masking to group a certain group of WWNs to be included in the LUN Filtering. ▪ Read/Write Privilege: Users can choose the following privilege for each LUN Filtering: Read/Write, Read Only, and No Access.
WWN table stored in NVRAM	Each WWN number can be assigned with a nick name for ease of identification
Sync. cache channel over Fibre loops	Supported, no extra cabling between two controllers; communications data can be distributed to one or two dedicated channels or over all drive loops.

S.M.A.R.T. Support:

Copy & Replace Drive	Supported. User can choose to clone a member drive before drive failure.

Drive S.M.A.R.T. Support	Supported, with intelligent error handling implementations.
User selectable modes for S.M.A.R.T.	1. Detect only 2. Perpetual Clone on detection of S.M.A.R.T. condition 3. Clone + Replace

Redundant Controller:

Active-active redundant controller	Supported
Synchronized cache for both controllers	Supported. Through a dedicated synchronizing channel (SCSI, please refer to the previous section for details about Fibre), Synchronized cache over Fibre loops is supported.
Write-back cache enabled in redundant controller mode	Yes; with synchronized cache connection between controllers.

Automatic Failover	Yes for all PowerPC controllers (user's interaction necessary)
Automatic Failback	Yes for all PowerPC controllers (user's interaction necessary)
Fibre channel redundant controller	Supported.
Controller Hot-Swap	▪ No need to shut down the failed controller before replacing the failed controller. (Customer's design-in hot-swap mechanism necessary) ▪ Support on-line 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)
Redundant Controller Communication channel	SentinelRAID: SCSI; RCC Reset signals built-in EonRAID: Fibre channel(s); RCC cable necessary
Redundant Controller Communication over Fibre loops	Dedicated loops or distribution over drive loops selectable
No Single-point-of-failure	Supported.
Automatic engagement of replacement controller	Supported in PowerPC series
Dynamic cache memory allocation	Yes. Cache memory is dynamically allocated, not fixed.
Environment management	Supported. SAF-TE, S.E.S., ISEMS (I^2C interface); and on-board controller voltage/temp monitor are all supported in both single and redundant controller mode. In the event of controller failure, serves can be taken over by the existing controller.
Cache battery backup	Supported. Battery backup solutions for cache memory are supported in both single controller and redundant modes.

Load sharing	Supported. Workload can be flexibly divided between different controllers by assigning logical configurations of drives (LDs/LVs) to different controllers.
User configurable channel mode	Supported. Channel modes configurable (SCSI or Fibre) as HOST or DRIVE in both single controller and redundant controller mode.
Require a special Firmware for redundant controller?	No. All firmware and all Infortrend external RAID controllers support redundant controller function.
Redundant Controller rolling firmware upgrade	Firmware upgrade can be downloaded to the primary controller and then be adopted by both controllers, without interrupting host I/O.

Redundant Controller firmware synchronization	In the event of controller failure, a replacement controller running a different version of firmware can be combined to restore a redundant system with a failed controller. Different firmware versions can be auto-synchronized later.

Data Safety:

Regenerate Parity of logical drives	Supported. Can be performed every so often by user to ensure that bad sectors do not cause data loss in the event of drive failure.
Bad block auto-reassignment	Supported. Automatic reassignment of bad block
Battery backup for cache memory	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.
Verification on Normal Writes	Supported. Performs read-after-write during normal write processes to ensure data is properly written to drives.
Verification on Rebuild Writes	Supported. Performs read-after-write during rebuild write to ensure data is properly written to drives.
Verification on LD initialization writes	Supported. Performs read-after-write during logical drive initialization to ensure data is properly written to drives.
Drive S.M.A.R.T. support	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.
Clone Failing Drive	Users may choose to clone data from a failing drive to a backup drive manually

System Security:

Password protection	Supported. All settings requires the correct password (if set) to ensure system security.
User-configurable Password validation timeout	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.

Environment Management:

SAF-TE/S.E.S. support	Supported. The SAF-TE/S.E.S. modules can be connected to the drive channel, the controller will detect errors from SAF-TE/S.E.S. devices or notify drive failure via SAF-TE/S.E.S.. • Both SAF-TE/S.E.S. via drive and device-self-interfaced are supported. • Redundant SAF-TE/S.E.S. devices are supported • Multiple S.E.S. devices are supported
SAF-TE/S.E.S. polling period	User configurable (50ms, 100ms, 200ms, 500ms, 1~60sec)
ISEMS (Infortrend Simple Enclosure Management Service)	Supported.
Multiple SAF-TE/S.E.S. modules on the same channel	Supported.
Multiple SAF-TE /S.E.S. modules on different channels	Supported.
Mapping SAF-TE/S.E.S. device to host channel for use with Host-based SAF-TE/S.E.S. Monitor	Supported.
Dual-LED drive status indicators	Supported. Both single-LED and dual-LED drive status indicators are supported.
SAF-TE/ S.E.S. Temperature value display	Supported. Display the temperature value provided by enclosure SAF-TE module (if available).
Fault-bus support	Provides the simplest implementation for the enclosure management. All fault-bus input/output signals are active-high/active-low user adjustable.
On-board controller voltage monitors	Supported. Monitors the 3.3V, 5V, and 12V voltage status. Event trigger threshold user configurable.
On-board controller temperature sensors	Supported. Monitors the CPU and board temperature status. Event trigger threshold user configurable.
Enclosure redundant power supply status monitoring	Supported. Fault-Bus/SAF-TE/S.E.S./ISEMS
Enclosure Fan status monitoring	Supported. Fault-Bus/SAF-TE/S.E.S/ISEMS
Enclosure UPS status monitoring	Supported. Fault-Bus/SAF-TE/S.E.S/ISEMS
Enclosure temperature monitoring	Supported. Fault-Bus/SAF-TE/S.E.S/ISEMS

User Interface:

RAIDWatch on-board	Out-of-band configuration via LAN. Browser accessible configuration option by installing RAIDWatch to reserved space on drive via ftp.
RS-232C Terminal	Supports terminal modes: ANSI, VT-100, ANSI Color. Provides menu-driven user-friendly text-based interface.
In-band SCSI/ In-band Fibre Text RAID manager	Provides menu-driven user-friendly text-based interface similar to RS-232C terminal.
Graphical User Interface (Java-based GUI Manager)	Provides user-friendly graphical interface. Communicates with RAID controller via In-band SCSI, In-band Fibre or SNMP (Windows-based GUI). Customers can use Infortrend RAIDWatch or develop their own GUI according to the "External Interface Specification" (contact Infortrend support for this OEM document).
LCD Front Panel	Provides easy access for user instinct operation.
Buzzer alarm	Warns user when any failure or critical event occurs.

Remote Manageability:

Modem Support	The COM 1 port of the controller can be connected to a MODEM for remote manageability.
Auto dial-out	Supported. Can be configured to dial-out to a remote terminal when controller is powered on – for remote administration.
Event dial-out to terminal	Supported. Can be configured to dial-out a remote terminal when an event occurs.
Event dial-out to pager	Supported. Can be configured to dial-out a pager number with message (user configured with AT commands) when an event occurs.
Terminal dial-in	Supported. Can be configured to accept a remote terminal dial-in for remote administration.
Custom Inquiry Serial Number	Custom Inquiry Serial Number (for support of multi-pathing software like Veritas, QLogic, etc)
Remote Redundant Controller Configuration	Supported. Remote redundant controller configuration (support fully automatic failback-user's interaction free)

Appendix

C

System Functions: Upgrading Firmware

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. New releases of the 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.

New Features Supported with Firmware 3.21

Background RS-232 Firmware Download:

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.

Redundant Controller Rolling Firmware Upgrade:

When download is performed on a dual-controller system, firmware is flashed onto both controllers without interrupting host I/Os. After the download process is completed, the Primary controller will reset and let the Secondary take over the service temporarily. When the Primary comes back on-line, the Secondary will hand over the workload and then reset itself for the new firmware to take effect.

The rolling upgrade is automatically performed by controller firmware and user's intervention is not necessary.

Redundant Controller Firmware Sync-version:

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, firmware running on the replacement controller will be 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.*
- *While the firmware is new, the boot record that comes with it may be the same version as the one in the controller. If this is the case, there is no need to upgrade the Boot Record Binary.*

NOTE:

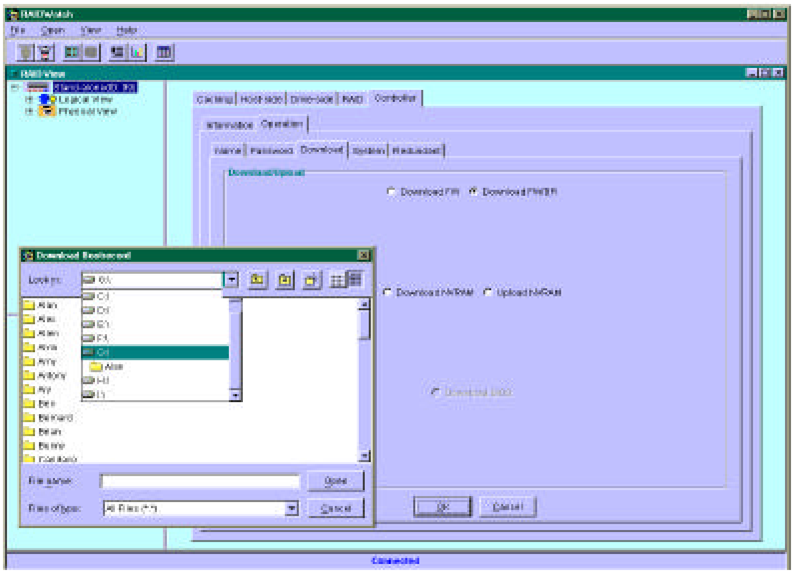
- *Controller serial port COM 2can not be used to download firmware.*

Upgrading Firmware Using In-band SCSI + RAIDWatch Manager

Establish the In-band SCSI connection in RAIDWatch Manager

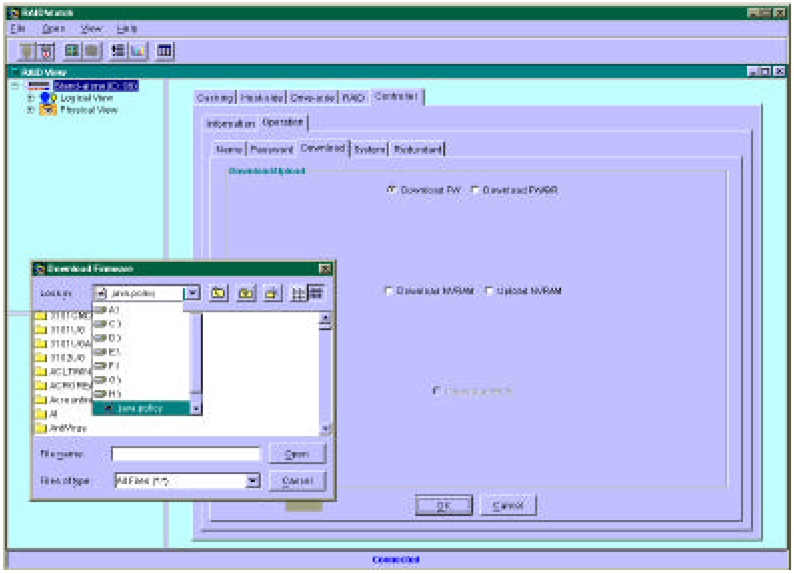
Please refer to RAIDWatch *User's Manual* for details on establishing the In-band SCSI connection for RAIDWatch Manager.

Upgrade Both Boot Record and Firmware Binaries



1. Connect to the RAID system locally or from a remote host 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 controller icon and then select the “RAID system-to-host bus” (usually appears as In-band SCSI). Double-click the RAID-to-host-bus to connect to the desired controller. Choose the “RAID view” icon on the controller panel or the RAID view icon on the control bar. The RAID view window will appear. Choose "Controller" > "Download" -> and click among the selections "Download FW/BR” (Firmware and Boot Record).
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 the controller.
4. Shutdown the system which is accessing the RAID, then reset the 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/O and reset the controller for new firmware to take effect.

Upgrade the Firmware Binary Only



1. Connect to the RAID system locally or from a remote host 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 controller icon and then select the “RAID system-to-host bus” (usually appears as In-band SCSI or PCI bus…). Double-click the RAID-to-host-bus to connect to the desired controller. Choose the “RAID view” icon on the controller panel. The RAID view window will appear. Choose "Controller" > "Download" -> and click among the selections "Download FW” (Firmware). If both boot record and firmware are desired to upgrade, choose "Download Firmware".
2. Provide the firmware filename to the RAIDWatch Manager. It will start to download the firmware to the controller.
3. Shutdown the system which is accessing the RAID, then reset the controller in order to use the new downloaded firmware.

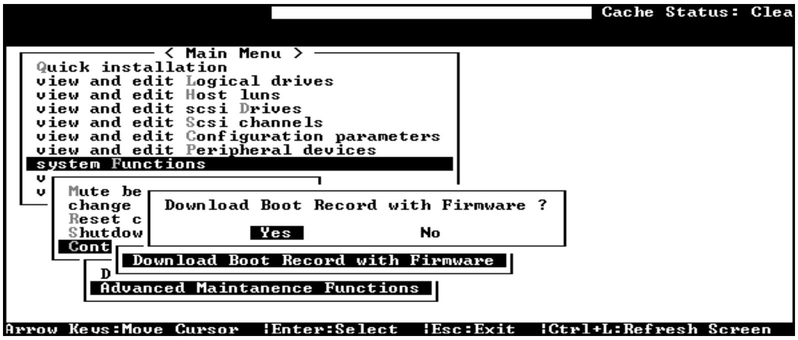
Upgrading Firmware Using RS-232 Terminal Emulation

The firmware can be downloaded to the RAID controller 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.

Establishing the connection for the RS-232 Terminal Emulation

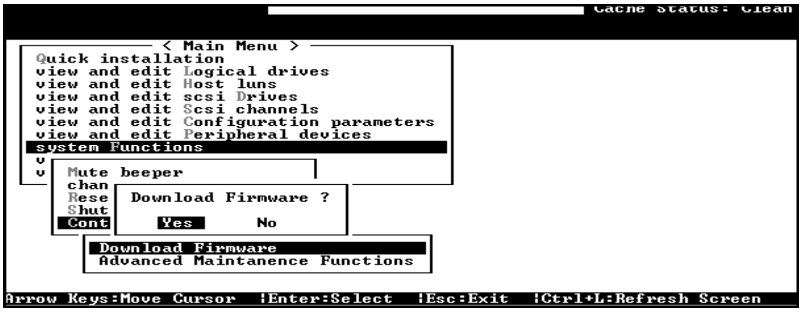
Please refer to chapter 4, “Connecting to Terminal Emulation,” and also your hardware manual for details on establishing the connection.

Upgrading Both Boot Record and Firmware Binaries



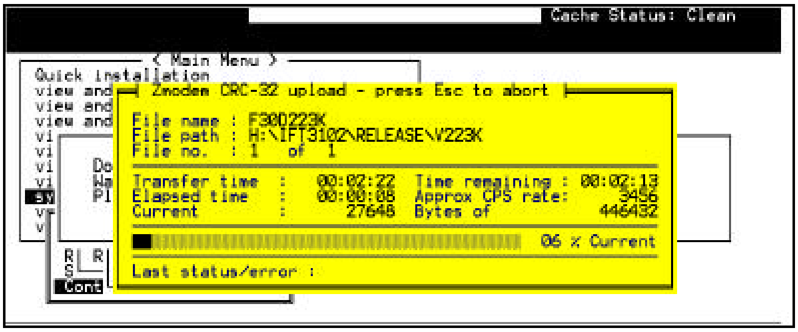
1. From the Main Menu, scroll down to "System Functions."
2. Go to "Controller Maintenance."
3. Choose "Advanced Maintenance."
4. Select "Download Boot Record and Firmware."
5. Set ZMODEM as the file transfer protocol of your terminal emulation software.
6. Send the Boot Record Binary to the controller. 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.

Upgrading the Firmware Binary Only

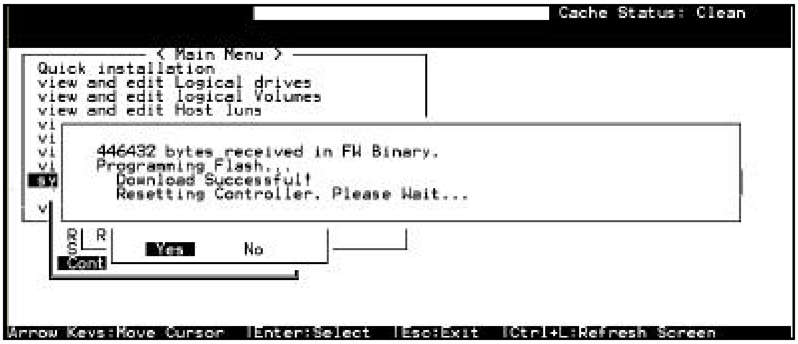


1. From the Main Menu, scroll down to "System Functions."

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 HyperTerminal, choose "Upload" or "Send" (depending on the software).



6. When the Firmware completes downloading, the controller will automatically reset itself.



Appendix

D

Event Messages

The controller events can be categorized as follows:

Critical	Errors that need to attend to immediately
Warning	Errors
Notification	Command processed message sent from Firmware

The controller's event log management will record all the 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.

If there is need to track events recorded before the controller is reset or powered off, Infortrend's Event Monitor can be used.

Descriptions below contain abbreviations. Abbreviations and Capitalized characters are preserved for the coherency with Event Messages as they appear on LCD screen or Terminal.

Event Index

Controller Event

[0104] DRAM Parity Error Detected
[0111] Redundant Controller Failure Detected
[0121] Power Supply Failure Detected
[0122] Fan Failure Detected
[0123] Elevated Temperature Alert
[0123] CPU Hot Temperature Detected
[0123] CPU Cold Temperature Detected
[0123] Board Hot Temperature Detected
[0123] Board Cold Temperature Detected
[0124] UPS Power Failure Detected
[0181] Controller Initialization Completed
[0114] Power Supply Unstable or NVRAM Failed
[01A1] Power Supply Back On-Line
[01A2] Fan Back On-Line
[01A3] Temperature Back To Non-Critical Levels
[01A3] CPU Hot/Cold Temperature Back to Non-Critical Levels
[01A3] Board Hot/Cold Temperature Back to Non-Critical Levels
[01A4] Peripheral Device NOTICE: UPS Power Back On

Drive SCSI Channel/Drive Error

[1101] Unexpected Select Timeout
[1101] Scan Drive Successful
[1102] Gross Phase / Signal Error Detected
[1103] Unexpected Disconnect Encountered
[1104] Negotiation Error Detected
[1105] Timedout Waiting for I / O to Complete
[1106] SCSI Parity Error Detected
[1107] Data Overrun / Underrun Detected
[1108] Invalid Status / Sense Data Received
[110F] SCSI Bus Reset Issued
[1111] Unexpected Drive Not Ready
[1111] Drive Clone Failed
[1112] Drive HW Error
[1113] Bad Block Encountered
[1114] Unit Attention Received
[1115] Unexpected Sense Received
[1116] Block Reassignment Failed - Block_number
[1117] Block Successfully Reassigned - Block_number
[1118] Aborted Command
[113F] SCSI Channel Failure
[113F] Redundant Fibre Channel Loop Failure Detected
[113F] Fibre Channel Loop Connection Restored
[113F] Redundant Path Restored
[113F] Fibre Channel Loop Failure Detected
[113F] Redundant Loop Failure Detected
[113F] Redundant Path Expected But Not Found
[113F] Redundant Path Failed
[1142] Detect Predict Failure
[1187] Mem Not Enough Support Current Configuration
[1187] Mem is Now Enough Support Current Configuration
[1189] NVRAM Factory Default Restored
[1189] NVRAM Restored from Disk
[1189] NVRAM Restored from File

Logical Drive Event

[2101] SCSI Drive Failure
[2102] Initialization Failed
[2103] Rebuild Failed
[2104] Parity Check Failed
[2105] Expansion Failed
[2106] Add SCSI Drive Operation Failed!
[2184] Rebuild Logical Drive Completed
[2182] Initialization Logical Drive Completed
[2185] Starting Parity Check
[2186] Parity Check of Logical Drive Completed
[2187] Starting Expansion
[2188] Expansion of Logical Drive Completed
[2189] Starting Add SCSI Drive Operation
[218A] Add SCSI Drive(s) to Logical Drive Completed
[218B] Add SCSI Drive Operation Paused!

[218C] Add SCSI Drive Operation Continued

Generalized Target Events

[3F21] SAF-TE Device: Power Supply Failure Detected
[3F21] +5V High Voltage Detected
[3F21] +5V High Voltage Detected
[3F21] +5V Low Voltage Detected
[3F21] +3.3V High Voltage Detected
[3F21] +3.3V Low Voltage Detected
[3F21] +12V High Voltage Detected
[3F21] +12V Low Voltage Detected
[3F22] Peripheral Device: Cooling Fan Failure Detected
[3F22] SAF-TE Device: Cooling Fan Failure Detected
[3F23] SAF-TE Device: Elevated Temperature Alert
[3F24] UPS AC Power Loss Detect
[3FA1] SAF-TE Device: Power Back On-Line
[3FA1] +3.3V High / Low Voltage Back within Acceptable Limits
[3FA1] +5V High / Low Voltage Back within Acceptable Limits
[3FA1] +12V High / Low Voltage Back within Acceptable Limits
[3FA2] SAF-TE Device: Fan Back to On-Line
[3FA3] SAF-TE Device: Temperature Back To Non-Critical Levels

Controller Event

2-Line LCD	DRAM Parity Error Detected
Terminal	[0104] Controller ALERT: DRAM Parity Error Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	A DRAM parity error encountered.
What to Do?	Contact the service department of your RAID system supplier. Check the DRAM module(s) and replace with new module(s) if required.

2-Line LCD	Redundant Ctlr Failure Detected
Terminal	[0111] Controller ALERT: Redundant Controller Failure Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	One of the RAID controller has failed to function.
What to Do?	Contact the service department of your RAID system supplier. Replace or check the failed RAID controller.

2-Line LCD	Power Supply Failure Detected
Terminal	[0121] Peripheral Device ALERT: Power Supply Failure Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Power supply failure detected on fault-bus.
What to Do?	Check the power supply and contact the service department of your RAID system supplier.

2-Line LCD	Cooling Fan Failure Detected
Terminal	[0122] Peripheral Device ALERT: Cooling Fan Failure Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Cooling fan failure detected on fault-bus.
What to Do?	Check cooling fan(s) of the RAID enclosure, and contact the service department of your RAID system supplier.

2-Line LCD	Elevated Temperature Alert
Terminal	[0123] Peripheral Device ALERT: Elevated Temperature Alert
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Abnormally high temperature detected on fault-bus.
What to Do?	Contact the service department your RAID system supplier.

2-Line LCD	Hot CPU (_.__°C) Temp Warning
Terminal	[0123] Peripheral Device ALERT: CPU Hot Temperature Detected (*current_temperature*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Abnormally high CPU temperature detected, temperature is higher than the preset threshold.
What to Do?	Check the CPU temperature threshold and contact the service department your RAID system supplier.

2-Line LCD	Cold CPU (_.__°C) Temp Warning
Terminal	[0123] Peripheral Device ALERT: CPU Cold Temperature Detected (*current_temperature*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Abnormally low CPU temperature detected, temperature is lower than the preset threshold.
What to Do?	Check the CPU temperature threshold and contact the service department your RAID system supplier.

2-Line LCD	Hot Board (_.__°C) Temp Warning
Terminal	[0123] Peripheral Device ALERT: Board Hot Temperature Detected (*current_temperature*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Abnormally high board temperature detected, temperature is higher than the preset threshold.
What to Do?	Check the board temperature threshold and contact the service department your RAID system supplier.

2-Line LCD	Cold Board (_.__°C) Temp Warning
Terminal	[0123] Peripheral Device ALERT: Board Cold Temperature Detected (*current_temperature*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Abnormally low board temperature detected, temperature is lower than the preset threshold.
What to Do?	Check the board temperature threshold and contact the service department your RAID system supplier.

2-Line LCD	UPS Power Failure Detected
Terminal	[0124] Peripheral Device ALERT: UPS Power Failure Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	UPS AC power failure detected on fault-bus.
What to Do?	Check AC power status or connection cable between UPS and RAID system.

2-Line LCD	Controller Init Completed
Terminal	[0181] Controller Init Completed
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Controller Initialization completed.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	Power Supply Unstable or NVRAM Failed !
Terminal	[0114]Power Supply Unstable or NVRAM Failed
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The +5V voltage is lower than 4.7V or NVRAM component failure.
What to Do?	Contact the service department of your RAID system supplier. Check the voltage output (+5V) of the power supply.

2-Line LCD	Power Supply Back On-Line
Terminal	[01A1] Peripheral Device NOTICE: Power Supply Back On-Line
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Power supply back to on-line state.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	Fan Back On-Line
Terminal	[01A2] Peripheral Device NOTICE: Fan Back On-Line
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Failed fan back to on-line state.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	Temperature Back To Non-Critical
Terminal	[01A3] Peripheral Device NOTICE: Temperature Back To Non-Critical Levels
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Enclosure temperature back to normal levels.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	CPU Temperature Back Normal (_.__°C)
Terminal	[01A3] CPU Hot / Cold Temperature Back to Non-Critical Levels (*Current_temperature*)
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	CPU temperature back to normal levels.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	Board Temperature Back Normal (_.__°C)
Terminal	[01A3] Board Hot / Cold Temperature Back to Non-Critical Levels (*Current_temperature*)
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Board temperature back to normal levels.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	UPS Power Back On
Terminal	[01A4] Peripheral Device NOTICE: UPS Power Back On
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	UPS AC power back to on-line state.
What to Do?	Press <ESC> to clear the message.

Drive SCSI Channel/Drive Error

2-Line LCD	CHL=_ ID=_ Select Timeout		
Terminal	[1101] CHL:_ ID:_ SCSI Target ALERT: Unexpected Select Timeout		
Event Type	☐Critical	☑Warning	☐Notification
What Happens?	Drive SCSI target select timeout. The specified hard drive cannot be selected by the controller. Whether has been removed, or the cabling / termination / canister is out of order.		
What to Do?	Check drive-side SCSI cable / termination and canister connections.		

2-Line LCD	CHL=_ ID=_ Scan Drive Successful		
Terminal	[1101] CHL:_ ID:_ Scan Drive Successful		
Event Type	☐Critical	☐Warning	☑Notification
What Happens?	Scan SCSI hard drive successful.		
What to Do?	Press <ESC> to clear the message.		

2-Line LCD	C=_ I=_ Gross Signal Error		
Terminal	[1102] CHL:_ ID:_ SCSI Target ALERT: Gross Phase / Signal Error Detected		
Event Type	☐Critical	☑Warning	☐Notification
What Happens?	Drive-side SCSI phase / signal abnormality detected.		
What to Do?	Check cabling / termination and drive canister connections.		

2-Line LCD	C=_ I=_ Disconnect Encountered		
Terminal	[1103] CHL:_ ID:_ SCSI Target ALERT: Unexpected Disconnect Encountered		
Event Type	☐Critical	☑Warning	☐Notification
What Happens?	Drive-side SCSI target unexpected disconnect detected.		
What to Do?	Checking cabling / termination and drive canister connections.		

2-Line LCD	C=_ I=_ Negotiation Error		
Terminal	[1104] CHL:_ ID:_ SCSI Target ALERT: Negotiation Error Detected		
Event Type	☐Critical	☑Warning	☐Notification
What Happens?	Drive-side SCSI target sync / wide negotiation abnormality detected.		
What to Do?			

2-Line LCD	C=_ I=_ Timeout Waiting for I/O
Terminal	[1105] CHL:_ ID:_ SCSI Target ALERT: Timedout Waiting for I/O to Complete
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side SCSI target I/O timeout. Possible drive-side cabling/termination and canister connection abnormal or drive is working abnormally.
What to Do?	Check drive-side cabling/termination/canister connections and hard drive.

2-Line LCD	CHL=_ ID=_ Parity Error
Terminal	[1106] CHL:_ ID:_ SCSI Target ALERT: SCSI Parity Error Detected
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side SCSI channel parity error detected to the specified hard drive.
What to Do?	Check drive-side cable/termination or drive canister connection.

2-Line LCD	C=_ I=_ Data Overrun/Underrun
Terminal	[1107] CHL:_ ID:_ SCSI Target ALERT: Data Overrun/Underrun Detected
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side SCSI target data overrun or underrun detected.
What to Do?	Check drive-side cabling/termination/canister connections and hard drive.

2-Line LCD	C=_ I=_ Invalid Data Received
Terminal	[1108] CHL:_ ID:_ SCSI Target ALERT: Invalid Status/Sense Data Received (*Sense_key Sense_code*)
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side SCSI invalid status/sense data received from target
What to Do?	Check cabling/termination/canister connections.

2-Line LCD	CHL=_ SCSI Bus Reset Issued
Terminal	[110F] CHL:_ SCSI Channel ALERT: SCSI Bus Reset Issued
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side SCSI bus reset issued.
What to Do?	Press [ESC] to clear the error message.

2-Line LCD	C=_ I=_ Drive Not Ready
Terminal	[1111] CHL:_ ID:_ SCSI Drive ALERT: Unexpected Drive Not Ready (*Sense_key /Sense_code*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Drive-side SCSI drive not ready condition reported
What to Do?	Check hard drive and drive-side cabling / termination / canister connections.

2-Line LCD	CHL=_ ID=_ Clone Failed
Terminal	[1111] CHL:_ ID:_ SCSI Drive ALERT: CHL:_ ID:_ Clone Failed
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Clone Drive is failed.
What to Do?	Check hard drive and drive-side cabling / termination / canister connections.

2-Line LCD	CHL=_ ID=_ Drive HW Error
Terminal	[1112] CHL:_ ID:_ SCSI Drive ALERT: Drive HW Error (*Sense_key Sense_code*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Drive-Side SCSI drive unrecoverable hardware error reported
What to Do?	Replace hard drive and rebuild logical drive.

2-Line LCD	C=_ I=_ BadBlock Encountered
Terminal	[1113] CHL:_ ID:_ SCSI Drive ALERT: Bad Block Encountered - *Block_number* (*Sense_key Sense_code*)
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side hard drive unrecoverable media error reported. A bad block encountered in the specified hard drive. The RAID controller will ask the hard drive to retry.
What to Do?	Press [ESC] to clear the message.

2-Line LCD	C=_ I=_ Unit Attention Received
Terminal	[1114] CHL:_ ID:_ SCSI Target ALERT: Unit Attention Received (*Sense_key Sense_code*)
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side SCSI target unit attention received.
What to Do?	Check hard drive and drive-side cabling / termination / canister connections.

2-Line LCD	C=_ I=_ Unexpected Sense Rec.
Terminal	[1115] CHL:_ ID:_ SCSI Drive ALERT: Unexpected Sense Received (*Sense_key Sense_code*)
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side SCSI drive unexpected sense data received.
What to Do?	Checking drive-side cabling / termination / drive canister connections.

2-Line LCD	C=_ I=_ Block Reassign Failed
Terminal	[1116] CHL:_ ID:_ SCSI Drive ALERT: Block Reassignment Failed - *Block_number* (*Sense_key Sense_code*)
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side SCSI drive block reassignment failed. Drive will be considered failed.
What to Do?	Press [ESC] to clear this error message.

2-Line LCD	C=_ I=_ Block Success Reassign
Terminal	[1117] CHL:_ ID:_ SCSI Drive ALERT: Block Successfully Reassigned – *Block_number*
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Drive-side SCSI drive block reassignment completed successfully
What to Do?	Press [ESC] to clear this message.

2-Line LCD	CHL=_ ID=_ Aborted Command
Terminal	[1118] CHL:_ ID:_ SCSI Drive ALERT: Aborted Command (*Sense_key Sense_code*)
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Drive-side SCSI drive aborted command reported
What to Do?	Press [ESC] to clear the error message.

2-Line LCD	CHL=_ SCSI Channel Failure
Terminal	[113F] CHL:_ SCSI Channel ALERT: SCSI Channel Failure
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	SCSI channel failure detected.
What to Do?	Check cabling / termination and drive canister connections.

2-Line LCD	Fibre Chl:_ Loop Failure Detected
Terminal	[113F] Fibre Chl:_ Loop Failure Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Redundant fibre channel loop failure is detected.
What to Do?	Check the redundant fibre channel loop connection is right.

2-Line LCD	Fibre Chl:_ Loop Failure Connect Restored
Terminal	[113F] Fibre Chl:_ Loop Failure Connection Restored
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Fibre channel loop connection is restored.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	C:_ I:_ -Red Path C:_ I:_ Restored
Terminal	[113F] C:_ I:_ -Red Path C:_ I:_ Restored
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Redundant path of fibre channel device is restored.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	C:_ Fibre Chl Loop Failure Detected
Terminal	[113F] C:_ Fibre Chl Loop Failure Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Fibre channel loop failure is detected.
What to Do?	Check if the fibre channel loop connection is right.

2-Line LCD	C:_ Red Loop C:_ Failure Detected
Terminal	[113F] C:_ Red Loop Chl:_ Failure Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Redundant loop drive failure is detected.
What to Do?	Check if the redundant loop connection is right.

2-Line LCD	C:_ Red Path C:_ I:_ Not Found
Terminal	[113F] C:_ Red Path Chl:_ ID:_ Not Found
Event Type	☐Critical ☑Warning ☐Notification
What Happens?	Redundant path is expected but not found
What to Do?	Check if the redundant path of device is connected.

2-Line LCD	C:_ I:_ Red Path C:_ I:__ Failed
Terminal	[113F] C:_ I:_ Red Path C:_ I:__ Failure Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Redundant path failure is detected.
What to Do?	Check the redundant path of device.

2-Line CD	C=_ ID=_ Detect Predict Failure!
Terminal	[1142] CH=_ ID=_ Predict Failures Detected !
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Detect the predict failure of hard drive
What to Do?	Replace a new drive for rebuilding logical drive.

2-Line LCD	Mem Not Enough Support Cur Conf
Terminal	[1187] Mem Not Enough to Support Cur Config
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Memory size is not enough to support current configuration.
What to Do?	Add more memory for the configuration of controller.

2-Line LCD	Mem is Now Enough Support Cur Conf
Terminal	[1187] Mem is Now Enough to Support Cur Config
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Memory size is now enough to support current configuration.
What to Do?	Press <ESC> to clear the message

2-Line CD	NVRAM Factory Default Restored
Terminal	[1189] NVRAM Factory Default Restored
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	NVRAM data is restored by factory defaults
What to Do?	Press <ESC> to clear the message

2-Line LCD	NVRAM Restored From Disk
Terminal	[1189] NVRAM Restored From Disk
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	NVRAM data is restored from disk.
What to Do?	Press <ESC> to clear the message

2-Line CD	NVRAM Restored From File
Terminal	[1189] NVRAM Restored From File
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	NVRAM data is restored from file.
What to Do?	Press <ESC> to clear the message

Logical Drive Event:

2-Line LCD	CHL=_ ID=_ Drive Failure
Terminal	[2101] LG:_ Logical Drive ALERT: CHL:_ ID:_ SCSI Drive Failure
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The specified hard drive in the specified logical drive has failed.
What to Do?	Bringing a new drive or spare drive to rebuild.

2-Line LCD	LG ALERT: Init Failed!
Terminal	[2102] LG:_ Logical Drive ALERT: Initialization Failed
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Logical drive initialization failed. It could be one of the following reason: 1. Logical drive initialization canceled by user. 2. On of the member drives failed during logical drive initialization. 3. One of the member drive encountered bad block.
What to Do?	Replace the failed drive and perform logical drive initialization again.

2-Line LCD	LG=_ Rebuild Failed
Terminal	[2103] LG:_ Logical Drive ALERT: Rebuild Failed
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Logical drive rebuild failed. It could be one of the following reason: 1. The rebuild has been canceled by user. 2. The drive using for rebuild might failed during rebuild. 3. Other member drives encountered bad block during the rebuild.
What to Do?	Using another new drive to perform the rebuild again.

2-Line LCD	LG=_ Check Parity Failed !
Terminal	[2104] LG_ Logical Drive ALERT: Parity Check Failed
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	One member drive of the logical drive has failed.
What to Do?	Rebuild the logical drive first, then perform check parity. Check parity can only be performed on a logical drive with “Good” (GD) status.

2-Line LCD	LG=_ Expansion Completed
Terminal	[2105] LG_ Logical Drive NOTICE: Expansion of Logical Drive _ Completed
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	The “Expand Logical Drive” (mode 2) RAID Expansion has completed.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	LG=_ Expansion Failed !
Terminal	[2105] LG_ Logical Drive ALERT: Expansion Failed
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The “Expand Logical Drive” RAID Expansion has failed.
What to Do?	Replace hard drive and rebuild logical drive.

2-Line LCD	LG=_ Add SCSI Drive Failed
Terminal	[2106] LG_ Logical Drive ALERT: Add SCSI Drive Operation Failed!
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The “Add SCSI Drive” RAID expansion failed. The logical drive has failed. (Fatal failed)
What to Do?	Delete logical drive and recreate logical drive.

2-Line LCD	LG=_ Initialization Completed
Terminal	[2182] Initialization Logical Drive _ Completed
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Logical drive initialization successfully completed.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	LG=_ Rebuild Completed
Terminal	[2184] Rebuild Logical Drive _ Completed
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Logical drive rebuild successfully completed.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	LG=_ Starting Check Parity
Terminal	[2185] LG_ Logical Drive NOTICE: Starting Parity Check
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Logical drive parity checking has started.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	LG=_ Check Parity Completed
Terminal	[2186] LG_ Logical Drive NOTICE: Check Parity Completed of Logical Drive _ Completed
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Logical drive parity checking has completed.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	LG=_ Starting Expansion
Terminal	[2187] LG_ Logical Drive NOTICE: Starting Expansion
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	The “Expand Logical Drive” (mode 2) RAID Expansion has started.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	LG=_ Expansion Completed
Terminal	[2188] LG_ Logical Drive NOTICE: Expansion of Logical Drive_ Completed
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	The “Expand Logical Drive” (mode 2) RAID Expansion has completed.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	LG=_ Starting Add SCSI Drive
Terminal	[2189] Starting Add SCSI Drive Operation
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	“Add SCSI Drive” RAID logical drive expansion (mode 1) has started.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	LG=_ Add SCSI Drive Completed
Terminal	[218A] LG_ Logical Drive NOTICE: Add SCSI Drive(s) to Logical Drive _ Completed
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	The “Add SCSI Drive” RAID expansion has completed.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	LG=_ Add SCSI Drive Paused !
Terminal	[218B] LG_ Logical Drive NOTICE: Add SCSI Drive Operation Paused!
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	The “Add SCSI Drive” RAID logical drive expansion (mode 1) has paused. It could be one of the following reasons: 1. Paused by user. 2. A power failure encountered during RAID expansion. 3. One of the member drives has failed.
What to Do?	1. Resume the RAID expansion. 2. Ensure the power failure has been solved, then perform resume RAID expansion. 3. Rebuild the logical drive, then perform resume RAID expansion.

2-Line LCD	LG=_ Continue Add SCSI Drive
Terminal	[218C] LG_ Logical Drive NOTICE: Add SCSI Drive Operation Continued
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	The paused “Add SCSI drive” RAID expansion has been resumed.
What to Do?	Press <ESC> to clear the message.

Generalized Target Events:

2-Line LCD	SAFTE_: Power (_) Failure Detected
Terminal	[3F21] SAF-TE Device (_) ALERT: Power Supply Failure Detected (_)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Power supply failure detected by SAF-TE enclosure management.
What to Do?	Check the power supply, contact the service department of your RAID system supplier.

2-Line LCD	High +5V Voltage Detected (_.__)
Terminal	[3F21] ALERT: +5V High Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +5V voltage source is now higher than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	Low +5V Voltage Detected (_.__)
Terminal	[3F21] ALERT: +5V Low Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +5V voltage source is now lower than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	High +3.3V Voltage Detected (_.__)
Terminal	[3F21] ALERT: +3.3V High Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +3.3V voltage source is now higher than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	Low +3.3V Voltage Detected (_.__)
Terminal	[3F21] ALERT: +3.3V Low Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +3.3V voltage source is now lower than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	High +12V Voltage Detected (_.__)
Terminal	[3F21] ALERT: +12V High Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +12V voltage source is now higher than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	Low +12V Voltage Detected (_.__)
Terminal	[3F21] ALERT: +12V Low Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +12V voltage source is now lower than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	SAF-TE_: Fan(_) Failure Detected
Terminal	[3F22] SAF-TE Device (_) ALERT: Cooling Fan Failure Detected (_)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Cooling fan failure detected by SAF-TE enclosure management.
What to Do?	Check cooling fan(s) of the RAID enclosure, and contact the service department of your RAID system supplier.

2-Line LCD	SAF-TE_: Elevated Temperature Alert
Terminal	[3F23] SAF-TE Device (_) ALERT: Elevated Temperature Alert
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Abnormally high temperature detected by SAF-TE facility.
What to Do?	Contact the service department your RAID system supplier.

2-Line LCD	SAF-TE_: Power(_) Back To On-Line
Terminal	[3FA1] SAF-TE Device (_) NOTICE: Power Back On-Line (_)
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Power supply back to on-line state.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	+3.3V Back To Safe Range (_._)
Terminal	[3FA1] +3.3V High / Low Voltage Back within Acceptable Limits (*current_voltage*)
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Voltage monitor detects the abnormal voltage has back to the normal range.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	+5V Back To Safe Range (_._)
Terminal	[3FA1] +5V High / Low Voltage Back within Acceptable Limits (*current_voltage*)
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Voltage monitor detects the abnormal voltage has back to the normal range.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	+12V Back To Safe Range (_._)
Terminal	[3FA1] +12V High / Low Voltage Back within Acceptable Limits (*current_voltage*)
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Voltage monitor detects the abnormal voltage has back to the normal range.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	SAF-TE_: Fan(_) Back to On-Line
Terminal	[3FA2] SAF-TE Device (_) NOTICE: Fan Back to On-Line (_)
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Failed fan back to on-line state.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	SAF-TE_: Temp Back Non-Critical
Terminal	[3FA3] SAF-TE Device NOTICE: Temperature Back To Non-Critical Levels
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Enclosure temperature back to normal levels.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	High +5V Voltage Detected (_.__)
Terminal	[0121] ALERT: +5V High Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +5V voltage source is now higher than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	Low +5V Voltage Detected (_.__)
Terminal	[0121] ALERT: +5V Low Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +5V voltage source is now lower than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	High +3.3V Voltage Detected (_.__)
Terminal	[0121] ALERT: +3.3V High Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +3.3V voltage source is now higher than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	Low +3.3V Voltage Detected (_.__)
Terminal	[0121] ALERT: +3.3V Low Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +3.3V voltage source is now lower than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	High +12V Voltage Detected (_.__)
Terminal	[0121] ALERT: +12V High Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +12V voltage source is now higher than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	Low +12V Voltage Detected (_.__)
Terminal	[0121] ALERT: +12V Low Voltage Detected (*current_voltage*)
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	The current +12V voltage source is now lower than the preset voltage threshold.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	SES <C* I*> Power Supply *: Power Supply Back On-Line
Terminal	[01A1] SES Device <C* I*> NOTICE: Power Supply Back On-Line
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Power supply back to on-line state.
What to Do?	Press <ESC> to clear the message.

2-Line LCD	SES <C* I*> Power Supply *: Power Supply Failure Detected
Terminal	[0121] SES Device <C* I*> NOTICE: Power Supply Failure Detected
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Power Supply Failure Detected.
What to Do?	Check the power supply, voltage threshold settings and contact the service department of your RAID system supplier.

2-Line LCD	SES <C* I*> Cooling Fan *: Fan Failure Detected
Terminal	[0122] SES Device <C* I*> ALERT: Cooling Fan Failure Detected
Event Type	☑Critical ☐Warning ☐Notification
What Happens?	Cooling fan failure detected by SES enclosure management.
What to Do?	Check cooling fan(s) of the RAID enclosure, and contact the service department of your RAID system supplier.

2-Line LCD	SES <C* I*> Cooling Fan *: Fan Back On-Line
Terminal	[01A1] SES Device <C* I*> NOTICE: Fan Back On-Line
Event Type	☐Critical ☐Warning ☑Notification
What Happens?	Cooling fan back to on-line state.
What to Do?	Press <ESC> to clear the message.

Appendix

E

Differences in Logical Drive Format

Departure of Firmware Release 3.21 from 3.15 / 3.16

Lines of Firmware:

1. **3.21:** Firmware revision 3.21 is implemented with a sub-function that creates a reserved space on drives for the RAIDWatch programs. This allows users to access the manager programs from a remote station using standard web browser. Chapter 4 has more details on how the function works.

2. **3.15:** Another line of firmware - revisions including 3.15 and 3.16 - will not support RAIDWatch Onboard and will run on controllers that are shipped without the LAN port.

3. Users can apply revision 3.21 on all SentinelRAID and EonRAID series. On the contrary, revisions 3.15 and 3.16 can not be used on the newest line of RAID controllers that support Ethernet connectivity.

Compatibility:

Under some circumstances, i.e., replacing a failed controller, users might accidentally use a controller running earlier firmware for a temporary replacement. In this case, the controller will not be able to access the array originally created by revision 3.21. The best way to ensure compatibility is to always apply a replacement controller installed with the same version of firmware.

Listed below are things to notice about the incompatibility:

1. The size of reserved space on drives is different.

Firmware version	3.15	3.21
Disk reserved space (default)	64KB	256MB

2. Firmware 3.21 can readily accept the logical array created by the earlier firmware revisions. There is no problem with firmware upgrade.

Logical arrays created by revision 3.21 will be stated as "invalid" by controllers installed with earlier revisions.

3. If incompatibility occurs, users will not be able to access the original array unless he switches back to revision 3.21.

4. Backward Compatibility:
Users may create logical drives that can accessed by both lines of firmware in the first place. To create logical drives that are "backward compatible," select a compatible reserved space (64KB) when creating a logical drive. The process is shown in the diagram below:

```
LG | ID       |LV | RAID | Size(MB) | Status | O | #LN | #SB | #FL | NAME
P0 | 5424100B |NA | RAID5|     9999 |   GOOD | S |   3 |   0 |   0 |
 1 |          |   | NONE |
     Maximum Drive Capacity :      9999MB
     Assign Spare Drives
     Disk Reserved Space: 256 MB
 4    256MB
      Backward Compatible(64KB)
 5
 6 |          |   | NONE |
 7 |          |   | NONE |
```

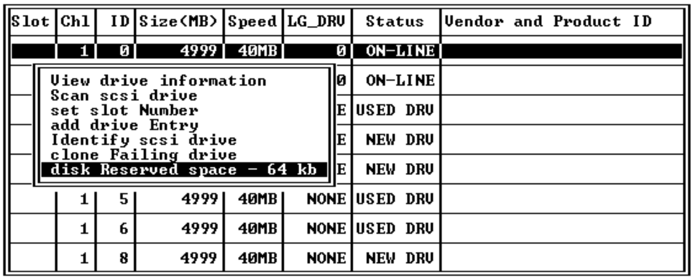
Using Old Drives:
If the controller has recently been upgraded to firmware version 3.21 and drives had been used in a logical drive, controller will ask for a change in the reserved space. Every physical drive that had been included in the logical drive will have a small sector formatted and its status will be displayed as a "FRMT (formatted) DRV."

```
Slot | Chl | ID | Size(MB) | Speed | LG_DRV | Status   | Vendor and Product ID
*    |   1 |  0 |     4999 |  40MB |   NONE | FRMT DRV |
*    |   1 |  1 |     4999 |  40MB |   NONE | FRMT DRV |
*    |   1 |  2 |     4999 |  40MB |   NONE | FRMT DRV |
      Selected drives are backward compatible(64KB),
      want to change reserved space to 256MB?
              Change              No Change
     |   1 |  6 |     4999 |  40MB |   NONE | NEW DRV  |
     |   1 |  8 |     4999 |  40MB |   NONE | NEW DRV  |
```

You will be prompted with the similar options using the Quick Install function. The selection box will not appear when all drives are new or that reserved space has been removed from drives.

```
              < Main Menu >                          RAID 5 + Spare
 Quick installation                                  RAID 5
 view and edit Logical drives
 view and edit logical Volu
 view and edit Host luns     Selected drives are backward compatible(64KB),
 view and edit scsi Drives   want to change reserved space to 256MB?
 view and edit Scsi channel
 view and edit Configuratio        Change              No Change
 view and edit Peripheral d
 system Functions
 view system Information
 view and edit Event logs
```

You may also see the status of reserved space by selecting the drive in "View and Edit SCSI Drives."



Logical Drive Capacity with Reserved Space:

Capacity of a logical drive = Number of member drives X [(drive capacity - reserved space) - parity drive]

Every member physical drive will have a reserved space formatted for storing a copy of RAIDWatch programs; and, in the future, a bad block table for maintaining data integrity. These space will be discounted from logical drive capacity.

Index

A

B

C

D

E

F

G

H

I

J

L

M

N

O

P

Q

R

S

T

U

V

W