

Fibre to SATA RAID Subsystem

User Manual

Revision 1.0

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Preface

About this manual

This manual provides information regarding the hardware features, installation and configuration of the **RAID subsystem**. This document also describes how to use the storage management software. Information contained in the manual has been reviewed for accuracy, but not for product warranty because of the various environment/OS/settings. Information and specifications will be changed without further notice.

This manual uses section numbering for every topic being discussed for easy and convenient way of finding information in accordance with the user's needs. The following icons are being used for some details and information to be considered in going through with this manual:



NOTES:

These are notes that contain useful information and tips that the user must give attention to in going through with the subsystem operation.



IMPORTANT!

These are the important information that the user must remember.



WARNING!

These are the warnings that the user must follow to avoid unnecessary errors and bodily injury during hardware and software operation of the subsystem.



CAUTION:

These are the cautions that user must be aware of to prevent damage to the subsystem and/or its components.

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Changes

The material in this document is for information only and is subject to change without notice.

Before You Begin

Before going through with this manual, you should read and focus on the following safety guidelines. Notes about the subsystem's controller configuration and the product packaging and delivery are also included here.

Safety Guidelines

To provide reasonable protection against any harm on the part of the user and to obtain maximum performance, user is advised to be aware of the following safety guidelines particularly in handling hardware components:

Upon receiving of the product:

- ❖ Place the product in its proper location.
- ❖ Do not try to lift it by yourself alone. Two or more persons are needed to remove or lift the product to its packaging. To avoid unnecessary dropping out, make sure that somebody is around for immediate assistance.
- ❖ It should be handled with care to avoid dropping that may cause damage to the product. Always use the correct lifting procedures.

Upon installing of the product:

- ❖ Ambient temperature is very important for the installation site. It must not exceed 30°C. Due to seasonal climate changes; regulate the installation site temperature making it not to exceed the allowed ambient temperature.
- ❖ Before plugging-in any power cords, cables and connectors, make sure that the power switches are turned off. Disconnect first any power connection if the power supply module is being removed from the enclosure.
- ❖ Outlets must be accessible to the equipment.
- ❖ All external connections should be made using shielded cables and as much as possible should not be performed by bare hand. Using anti-static hand gloves is recommended.
- ❖ In installing each component, secure all the mounting screws and locks. Make sure that all screws are fully tightened. Follow correctly all the listed procedures in this manual for reliable performance.

Controller Configurations

This RAID subsystem supports both single controller configurations. The single controller can be configured depending on the user's requirements.

This manual will discuss single controller configuration.

Packaging, Shipment and Delivery

- ❖ Before removing the subsystem from the shipping carton, you should visually inspect the physical condition of the shipping carton.
- ❖ Unpack and verify that the contents of the shipping carton are complete and in good condition.
- ❖ Exterior damage to the shipping carton may indicate that the contents of the carton are damaged.
- ❖ If any damage is found, do not remove the components; contact the dealer where you purchased the subsystem for further instructions.

Unpacking the Shipping Carton

The shipping package contains the following:

	RAID Subsystem Unit
	Three (3) power cords
	Two (2) Fibre optic cables
	One (1) RJ45 Ethernet cable
	One (1) external RS232 cable
	One (1) external UPS cable
	User Manual



NOTE: If any damage is found, contact the dealer or vendor for assistance.

Chapter 1 Product Introduction



The RAID Subsystem

Highest Density Available

- 3U chassis with 16 bays carriers.

Extraordinary fault tolerance

- Advanced Data Guarding technology (RAID ADG) provides the highest level of data protection.
- RAID ADG can tolerate multiple simultaneous drive failures without downtime or data loss.

Exceptional Manageability

- The firmware-embedded Web Browser-based RAID manager allows local or remote management and configuration.
- The firmware-embedded SMTP manager monitors all system events and user notification automatically.
- The firmware-embedded SNMP agent allows remote to monitor events via LAN with no SNMP agent required.
- Menu-driven front panel display.

RAID Management

- Smart-function LCD panel.
- Environmental monitoring unit.
- Real time-drive activity and status indicators.
- Browser-based GUI management utility.

Features

- Supports RAID levels 0, 1, 10(1E), 3, 5, 6, 30, 50, 60 and JBOD
- Supports online Array roaming
- Online RAID level/stripe size migration
- Online capacity expansion and RAID level migration simultaneously
- Online Volume Set Expansion
- Supports multiple array enclosures per host connection
- Supports greater than 2TB per volume set
- Transparent data protection for all popular operating systems
- RAID ADG provides the highest level of data protection
- Instant availability and background initialization
- Supports S.M.A.R.T, NCQ and OOB Staggered Spin-up capable drives
- Local audible event notification alarm
- Supports password protection
- Serial port interface for remote event notification
- Redundant flash image for high availability
- Support spin down drives when not in use to extend service (MAID)
- Supports Bad Blocks auto remapping and schedule volume check
- Supports hot spare and automatic hot rebuild

1.1 Technical Specifications

Form-factor	3U 19-inch rackmount chassis
RAID processor	Intel 64 bit RISC
RAID level	0, 1, 10(1E), 3, 5, 6, 30, 50, 60 and JBOD
Cache memory	512MB~4GB DDRII ECC SDRAM
No. of Channels (host+drive)	2 + 16
Host interface	FC-AL x2 (4Gb/s)
Drive bus interface	SATA II
Data Rate Transfer	Up to 400MB/Sec
Backplane board	SATA II
Hot-swap drive trays	Sixteen (16) 1-inch trays
Hot-swappable power supplies	Three (3) 300W power supplies with PFC
Cooling fans	2 (blower)
Battery backup	Option
R-Link support	Yes
SNMP Protocol Support	Yes
Background RAID Initialization	Yes
Array roaming	Yes
Power Requirements	AC 90V ~ 254V Full Range 12A/6A at 110V/220V, 50Hz ~ 60Hz
Relative Humidity	10% ~ 85% Non-condensing
Operating Temperature	10°C ~ 40°C (50°F ~ 104°F)
Physical Dimension	133(H) x 482 (W) x 609(D) mm
Weight (Without Disk)	20.5kgs / 45.1Lbs



NOTE: If any damage is found, contact the dealer or vendor for assistance.

1.2 RAID Concepts

RAID Fundamentals

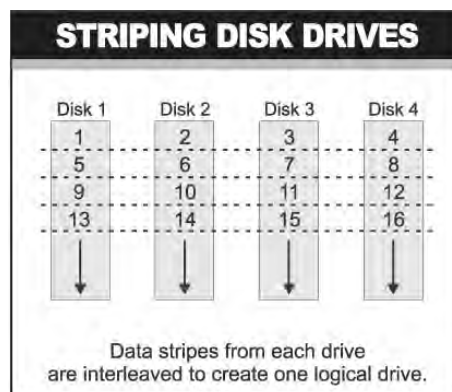
The basic idea of RAID (Redundant Array of Independent Disks) is to combine multiple inexpensive disk drives into an array of disk drives to obtain performance, capacity and reliability that exceeds that of a single large drive. The array of drives appears to the host computer as a single logical drive.

Five types of array architectures, RAID 1 through RAID 5, were originally defined; each provides disk fault-tolerance with different compromises in features and performance. In addition to these five redundant array architectures, it has become popular to refer to a non-redundant array of disk drives as a RAID 0 arrays.

Disk Striping

Fundamental to RAID technology is striping. This is a method of combining multiple drives into one logical storage unit. Striping partitions the storage space of each drive into stripes, which can be as small as one sector (512 bytes) or as large as several megabytes. These stripes are then interleaved in a rotating sequence, so that the combined space is composed alternately of stripes from each drive. The specific type of operating environment determines whether large or small stripes should be used.

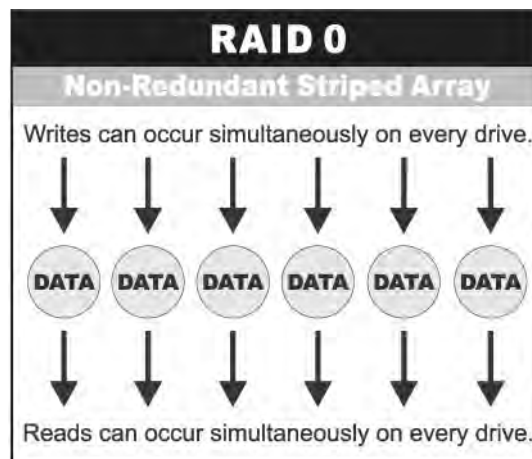
Most operating systems today support concurrent disk I/O operations across multiple drives. However, in order to maximize throughput for the disk subsystem, the I/O load must be balanced across all the drives so that each drive can be kept busy as much as possible. In a multiple drive system without striping, the disk I/O load is never perfectly balanced. Some drives will contain data files that are frequently accessed and some drives will rarely be accessed.



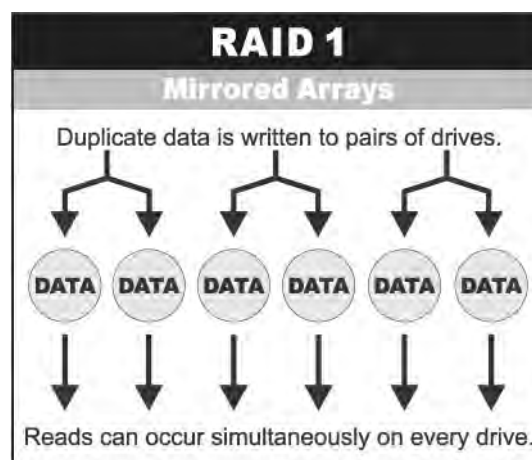
By striping the drives in the array with stripes large enough so that each record falls entirely within one stripe, most records can be evenly distributed across all drives. This keeps all drives in the array busy during heavy load situations. This situation allows all drives to work concurrently on different I/O operations, and thus maximize the number of simultaneous I/O operations that can be performed by the array.

Definition of RAID Levels

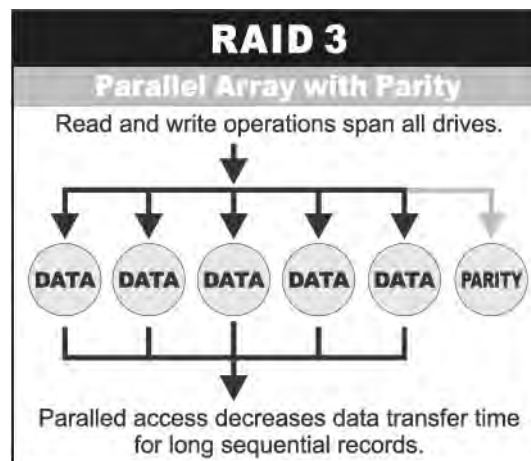
RAID 0 is typically defined as a group of striped disk drives without parity or data redundancy. RAID 0 arrays can be configured with large stripes for multi-user environments or small stripes for single-user systems that access long sequential records. RAID 0 arrays deliver the best data storage efficiency and performance of any array type. The disadvantage is that if one drive in a RAID 0 array fails, the entire array fails.



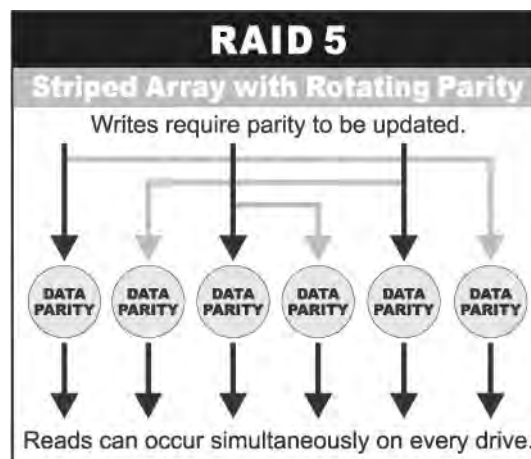
RAID 1, also known as disk mirroring, is simply a pair of disk drives that store duplicate data but appear to the computer as a single drive. Although striping is not used within a single mirrored drive pair, multiple RAID 1 arrays can be striped together to create a single large array consisting of pairs of mirrored drives. All writes must go to both drives of a mirrored pair so that the information on the drives is kept identical. However, each individual drive can perform simultaneous, independent read operations. Mirroring thus doubles the read performance of a single non-mirrored drive and while the write performance is unchanged. RAID 1 delivers the best performance of any redundant array type. In addition, there is less performance degradation during drive failure than in RAID 5 arrays.



RAID 3 sector-stripes data across groups of drives, but one drive in the group is dedicated for storing parity information. RAID 3 relies on the embedded ECC in each sector for error detection. In the case of drive failure, data recovery is accomplished by calculating the exclusive OR (XOR) of the information recorded on the remaining drives. Records typically span all drives, which optimizes the disk transfer rate. Because each I/O request accesses every drive in the array, RAID 3 arrays can satisfy only one I/O request at a time. RAID 3 delivers the best performance for single-user, single-tasking environments with long records. Synchronized-spindle drives are required for RAID 3 arrays in order to avoid performance degradation with short records. RAID 5 arrays with small stripes can yield similar performance to RAID 3 arrays.

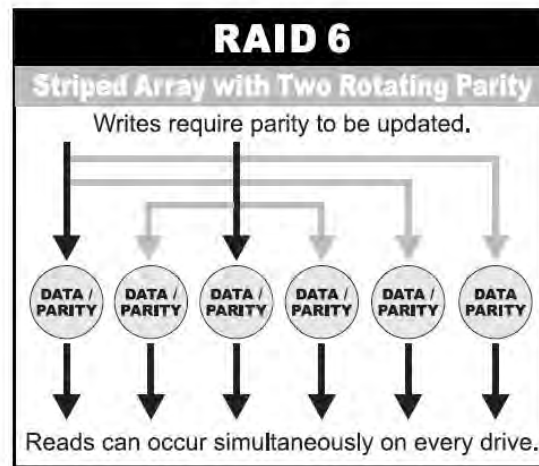


Under **RAID 5** parity information is distributed across all the drives. Since there is no dedicated parity drive, all drives contain data and read operations can be overlapped on every drive in the array. Write operations will typically access one data drive and one parity drive. However, because different records store their parity on different drives, write operations can usually be overlapped.



Dual-level RAID achieves a balance between the increased data availability inherent in RAID 1, RAID 3, RAID 5, or RAID 6 and the increased read performance inherent in disk striping (RAID 0). These arrays are sometimes referred to as RAID 10 (1E), RAID 30, RAID 50 or RAID 60.

RAID 6 is similar to RAID 5 in that data protection is achieved by writing parity information to the physical drives in the array. With RAID 6, however, *two* sets of parity data are used. These two sets are different, and each set occupies a capacity equivalent to that of one of the constituent drives. The main advantage of RAID 6 is High data availability – any two drives can fail without loss of critical data.



In summary:

- RAID 0 is the fastest and most efficient array type but offers no fault-tolerance. RAID 0 requires a minimum of one drive.
- RAID 1 is the best choice for performance-critical, fault-tolerant environments. RAID 1 is the only choice for fault-tolerance if no more than two drives are used.
- RAID 3 can be used to speed up data transfer and provide fault-tolerance in single-user environments that access long sequential records. However, RAID 3 does not allow overlapping of multiple I/O operations and requires synchronized-spindle drives to avoid performance degradation with short records. RAID 5 with a small stripe size offers similar performance.
- RAID 5 combines efficient, fault-tolerant data storage with good performance characteristics. However, write performance and performance during drive failure is slower than with RAID 1. Rebuild operations also require more time than with RAID 1 because parity information is also reconstructed. At least three drives are required for RAID 5 arrays.
- RAID 6 is essentially an extension of RAID level 5 which allows for additional fault tolerance by using a second independent distributed parity scheme (two-dimensional parity). Data is striped on a block level across a set of drives, just like in RAID 5, and a second set of parity is calculated and written across all the drives; RAID 6 provides for an extremely high data fault tolerance and can sustain multiple simultaneous drive failures. It is a perfect solution for mission critical applications.

RAID Management

The subsystem can implement several different levels of RAID technology. RAID levels supported by the subsystem are shown below.

RAID Level	Description	Min. Drives
0	Block striping is provide, which yields higher performance than with individual drives. There is no redundancy.	1
1	Drives are paired and mirrored. All data is 100% duplicated on an equivalent drive. Fully redundant.	2
3	Data is striped across several physical drives. Parity protection is used for data redundancy.	3
5	Data is striped across several physical drives. Parity protection is used for data redundancy.	3
6	Data is striped across several physical drives. Parity protection is used for data redundancy. Requires N+2 drives to implement because of two-dimensional parity scheme.	4
10	Combination of RAID levels 1 and 0. This level provides striping and redundancy through mirroring. RAID 10 requires the use of an <u>even number</u> of disk drives to achieve data protection, while RAID 1E (Enhanced Mirroring) uses an <u>odd number</u> of drives.	4 (3)
30	Combination of RAID levels 0 and 3. This level is best implemented on two RAID 3 disk arrays with data striped across both disk arrays.	6
50	RAID 50 provides the features of both RAID 0 and RAID 5. RAID 50 includes both parity and disk striping across multiple drives. RAID 50 is best implemented on two RAID 5 disk arrays with data striped across both disk arrays.	6
60	RAID 60 combines both RAID 6 and RAID 0 features. Data is striped across disks as in RAID 0, and it uses double distributed parity as in RAID 6. RAID 60 provides data reliability, good overall performance and supports larger volume sizes. RAID 60 also provides very high reliability because data is still available even if multiple disk drives fail (two in each disk array).	8

1.3 Fibre Functions

1.3.1 Overview

Fibre Channel is a set of standards under the auspices of ANSI (American National Standards Institute). Fibre Channel combines the best features from SCSI bus and IP protocols into a single standard interface, including high-performance data transfer (up to 800 MB per second), low error rates, multiple connection topologies, scalability, and more. It retains the SCSI command-set functionality, but uses a Fibre Channel controller instead of a SCSI controller to provide the interface for data transmission. In today's fast-moving computer environments, Fibre Channel is the serial data transfer protocol choice for high-speed transportation of large volume of information between workstation, server, mass storage subsystems, and peripherals. Physically, the Fibre Channel can be an interconnection of multiple communication points, called N_Ports. The port itself only manages the connection between itself and another such end-port which, which could either be part of a switched network, referred to as a Fabric in FC terminology, or a point-to-point link. The fundamental elements of a Fibre Channel Network are Port and Node. So a Node can be a computer system, storage device, or Hub/Switch.

This chapter describes the Fibre-specific functions available in the Fibre Channel RAID controller. Optional functions have been implemented for Fibre Channel operation which is only available in the Web browser-based RAID manager. The LCD and VT-100 can't be used to configure some of the options available for Fibre Channel RAID controller.

1.3.2 Three ways to connect (FC Topologies)

A topology defines the interconnection scheme. It defines the number of devices that can be connected. Fibre Channel supports three different logical or physical arrangements (topologies) for connecting the devices into a network:

- Point-to-Point
- Arbitrated Loop(AL)
- Switched (Fabric)

The physical connection between devices varies from one topology to another. In all of these topologies, a transmitter node in one device sends information to a receiver node in another device. Fibre Channel networks can use any combination of point-to-point, arbitrated loop (FC_AL), and switched fabric topologies to provide a variety of device sharing options.

Point-to-point

A point-to-point topology consists of two and only two devices connected by N- ports of which are connected directly. In this topology, the transmit Fibre of one device connects to the receiver Fibre of the other device and vice versa. The connection is not shared with any other devices. Simplicity and use of the full data transfer rate make this Point-to-point topology an ideal extension to the standard SCSI bus interface. The point-to-point topology extends SCSI connectivity from a server to a peripheral device over longer distances.

Arbitrated Loop

The arbitrated loop (FC-AL) topology provides a relatively simple method of connecting and sharing resources. This topology allows up to 126 devices or nodes in a single, continuous loop or ring. The loop is constructed by daisy-chaining the transmit and receive cables from one device to the next or by using a hub or switch to create a virtual loop. The loop can be self-contained or incorporated as an element in a larger network. Increasing the number of devices on the loop can reduce the overall performance of the loop because the amount of time each device can use the loop is reduced. The ports in an arbitrated loop are referred as L-Ports.

Switched Fabric

A switched fabric a term is used in a Fibre channel to describe the generic switching or routing structure that delivers a frame to a destination based on the destination address in the frame header. It can be used to connect up to 16 million nodes, each of which is identified by a unique, world-wide name (WWN). In a switched fabric, each data frame is transferred over a virtual point-to-point connection. There can be any number of full-bandwidth transfers occurring through the switch. Devices do not have to arbitrate for control of the network; each device can use the full available bandwidth.

A fabric topology contains one or more switches connecting the ports in the FC network. The benefit of this topology is that many devices (approximately 2-24) can be connected. A port on a Fabric switch is called an F-Port (Fabric Port). Fabric switches can function as an alias server, multi-cast server, broadcast server, quality of service facilitator and directory server as well.

1.4 Array Definition

1.4.1 Raid Set

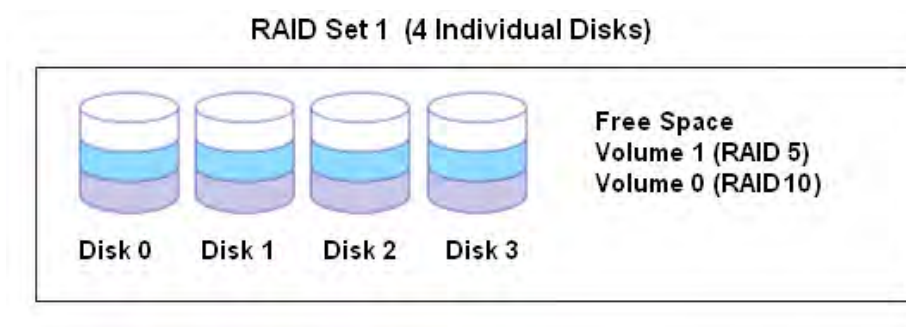
A Raid Set is a group of disk drives containing one or more logical volumes called Volume Sets. It is not possible to have multiple Raid Sets on the same disk drives.

A Volume Set must be created either on an existing Raid Set or on a group of available individual disk drives (disk drives that are not yet a part of a Raid Set). If there are existing Raid Sets with available raw capacity, new Volume Set can be created. New Volume Set can also be created on an existing Raid Set without free raw capacity by expanding the Raid Set using available disk drive(s) which is/are not yet Raid Set member. If disk drives of different capacity are grouped together in a Raid Set, then the capacity of the smallest disk will become the effective capacity of all the disks in the Raid Set.

1.4.2 Volume Set

A Volume Set is seen by the host system as a single logical device. It is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a Volume Set. A Volume Set capacity can consume all or a portion of the raw capacity available in a Raid Set. Multiple Volume Sets can exist on a group of disks in a Raid Set. Additional Volume Sets created in a specified Raid Set will reside on all the physical disks in the Raid Set. Thus each Volume Set on the Raid Set will have its data spread evenly across all the disks in the Raid Set. Volume Sets of different RAID levels may coexist on the same Raid Set.

In the illustration below, Volume 1 can be assigned a RAID 5 level while Volume 0 might be assigned a RAID 10 level.



1.5 High Availability

1.5.1 Creating Hot Spares

A hot spare drive is an unused online available drive, which is ready to replace a failed disk drive. In a RAID level 1, 10, 3, 5, 6, 30, 50 or 60 Raid Set, any unused online available drive installed but not belonging to a Raid Set can be defined as a hot spare drive. Hot spares permit you to replace failed drives without powering down the system. When the RAID subsystem detects a drive failure, the system will do automatic and transparent rebuild using the hot spare drives. The Raid Set will be reconfigured and rebuilt in the background while the RAID subsystem continues to handle system request. During the automatic rebuild process, system activity will continue as normal, however, the system performance and fault tolerance will be affected.



IMPORTANT: The hot spare must have at least the same or more capacity as the drive it replaces.

1.5.2 Hot-Swap Disk Drive Support

The RAID subsystem has built-in protection circuit to support the replacement of SATA II hard disk drives without having to shut down or reboot the system. The removable hard drive tray can deliver “hot swappable” fault-tolerant RAID solution at a price much less than the cost of conventional SCSI hard disk RAID subsystems. This feature is provided in the RAID subsystem for advance fault tolerant RAID protection and “online” drive replacement.

1.5.3 Hot-Swap Disk Rebuild

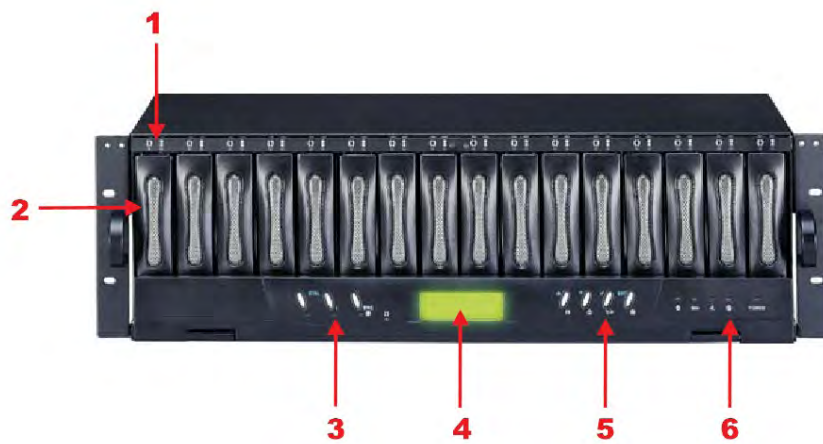
The Hot-Swap feature can be used to rebuild Raid Sets with data redundancy such as RAID level 1, 10, 3, 5, or 6. If a hot spare is not available, the failed disk drive must be replaced with a new disk drive so that the data on the failed drive can be rebuilt. If a hot spare is available, the rebuild starts automatically when a drive fails. The RAID subsystem automatically and transparently rebuilds failed drives in the background with user-definable rebuild rates. The RAID subsystem will automatically continue the rebuild process if the subsystem is shut down or powered off abnormally during a reconstruction process.

Chapter 2 Identifying Parts of the RAID Subsystem

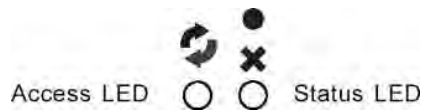
The illustrations below identify the various parts of the system. Familiarize yourself with the parts and terms as you may encounter them later in the later chapters and sections.


2.1 Main Components

2.1.1 Front View



1. HDD Status Indicator



Parts	Function
HDD Status LED 	Green LED indicates power is on and hard drive status is good for this slot. If there is no hard drive, the LED is Red. If hard drive defected in this slot or the hard drive is failure, the LED is blinking amber.
HDD Access LED	This LED will blink blue when the hard drive is being accessed or busy.

2. HDD Trays 1 ~ 16 (From right to left)

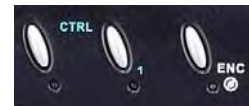
3. Activity LED

The LED will be blinking blue when system is busy or data is being accessed.

4. LCD Display Panel





NOTE: The 3 buttons on the left of the LCD Display Panel are reserved (no function).







5. Smart Function Front Panel

The smart LCD panel is an option to configure the RAID subsystem. If you are configuring the subsystem using the LCD panel, press the Select button to login and configure the RAID subsystem.

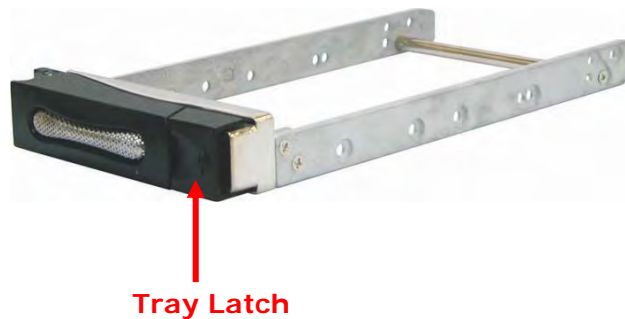
Parts	Function
Up and Down Arrow buttons 	Use the Up or Down arrow keys to go through the information on the LCD screen. This is also used to move between each menu when you configure the subsystem.
Select button 	This is used to enter the option you have selected.
Exit button EXIT	Press this button to return to the previous menu.

6. Environment Status LEDs

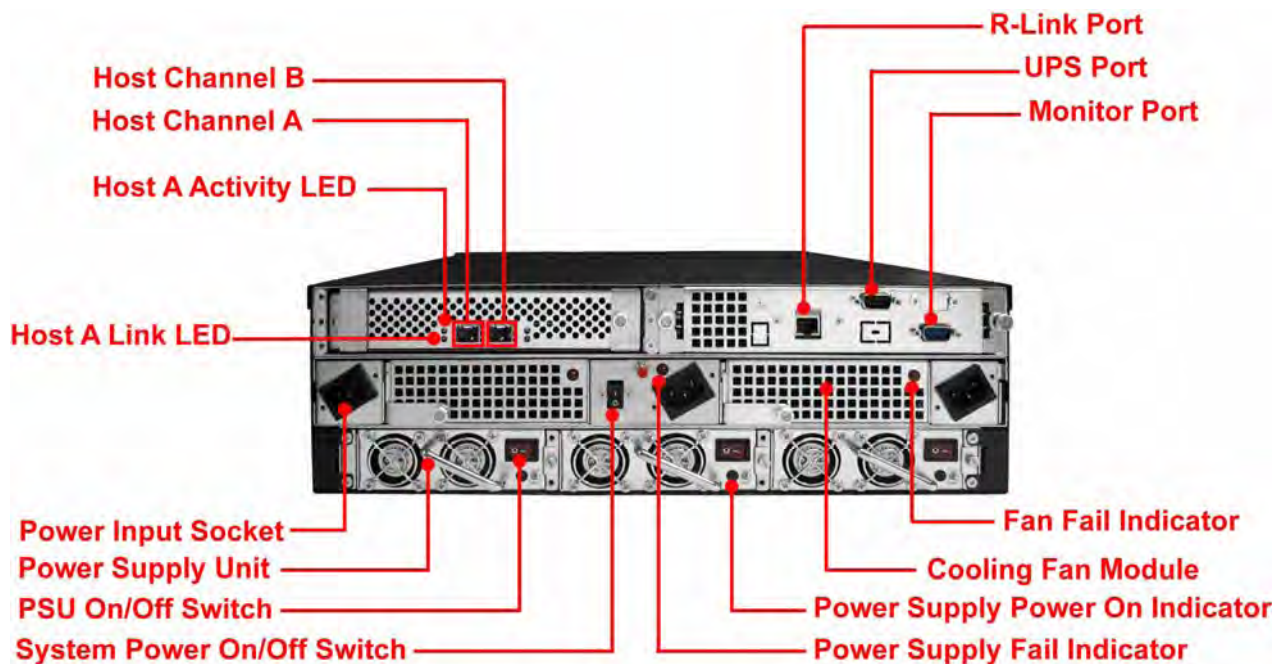
Parts	Function
Power LED	Green LED indicates power is ON.
Power Fail LED 	If a redundant power supply unit fails, this LED will turn to RED and alarm will sound.
Fan Fail LED 	When a fan fails or the fan's rotational speed is below 700RPM, this LED will turn red and an alarm will sound.
Over Temperature LED 	If temperature irregularities in the system occurs (HDD slot temperature over 65°C), this LED will turn RED and alarm will sound.
Voltage Warning LED 	An alarm will sound warning of a voltage abnormality and this LED will turn red.

7. Disk Tray

8. Tray Latch



2.1.2 Rear View



Host Channel B - The subsystem is equipped with 2 host channels (Host channel A and Host channel B). Each host channel with one optical LC Fibre connectors at the rear of the subsystem is use to connect to Fibre Hub/Switch or Server's fibre interface.

Host Channel A - Connect to Host's Fibre adapter.

Host A Activity LED – When there is activity on the Host channel, the LED is blue.

R-Link Port: Remote Link through RJ-45 Ethernet for remote management

The subsystem is equipped with one 10/100 Ethernet RJ45 LAN port. You use web-based browser to management RAID subsystem through Ethernet for remote configuration and monitoring.

Link LED: Green LED indicates Ethernet is linking.

Access LED: The LED will blink orange when the 100Mbps Ethernet is being accessed.

Uninterrupted Power Supply (UPS) Port - The subsystem may come with an optional UPS port allowing you to connect a UPS device. Connect the cable from the UPS device to the UPS port located at the rear of the subsystem. This will automatically allow the subsystem to use the functions and features of the UPS.

Monitor Port - The subsystem is equipped with a serial monitor port allowing you to connect a PC or terminal.

AC power input socket 1 ~ 3 (From left to right)

Power Supply Unit 1 ~ 3 (from left to right) - Three power supplies are located at the rear of the subsystem. Turn on the power of these power supplies to power-on the subsystem. The "power" LED at the front panel will turn green.

If the power supply fails to function or a power supply is not turn on, the Power Fail LED will turn red and an alarm will sound. AN error message will also appear on the LCD screen warning of power failure.

Fan Fail indicator - If fan fails, this LED will turn red.

Cooling Fan Module 1 ~2 (from left to right) - Two blower fans are located at the rear of the subsystem. They provide sufficient airflow and heat dispersion inside the chassis. In case a fan fails to function, the Fan fail LED will turn red and an alarm will sound. You will also see an error message appear in the LCD screen warning you of fan failure.

Chapter 3 Getting Started with the Subsystem

3.1 Disk Drive Installation

This section describes the physical locations of the hard drives supported by the subsystem and give instructions on installing a hard drive. The subsystem supports hot-swapping allowing you to install or replace a hard drive while the subsystem is running.

- a. Pull out an empty disk tray. Press the tray latch downwards to release the tray. Pull the handle outwards to remove the carrier from the enclosure.
- b. Take off the bracket before installing hard drive.



- c. Place the hard drive in the disk tray.
- d. Install the mounting screws on each side to secure the drive in the tray.



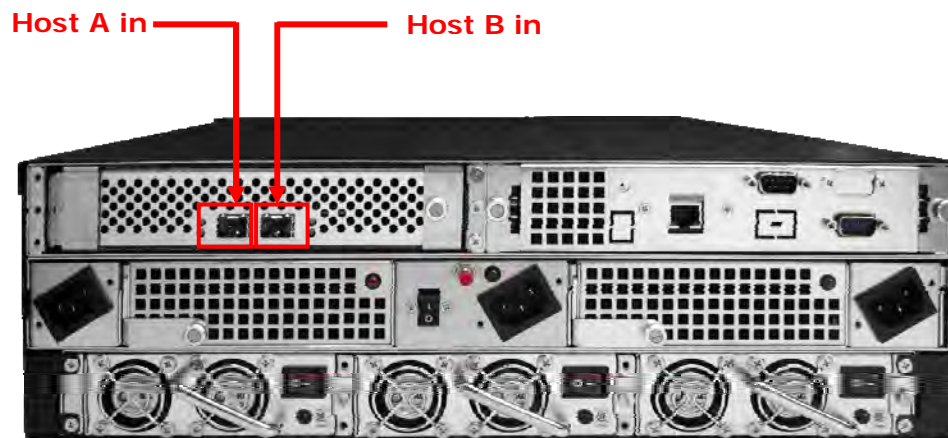
- e. Slide the tray into a slot and close the tray lever until it clicks into place. The HDD status LED will turn green if system is on.
- f. If the HDD power LED did not turn green, check if the hard drive is in good condition. If the hard drive is not being accessed, the HDD access LED will not illuminate.

3.2 Connecting to Fibre HBA

The subsystem supports fibre interface which provides fast 400MB data transfer rate using fibre. This section describes the location of the host channels and instructions on connecting external fibre devices.

1. Configure the Loop ID of subsystem or use dynamic LIP.
2. The package comes with two fibre optical cables. For every pair of host channel fibre connector at the rear of the subsystem, attach one end of the fibre optical cable to one of the fibre connectors and the other end to the host adapter's external fibre connector or to the fibre Hub/Switch.

(The host adapter is installed in your Host subsystem.)



3. Connect the other host system using the other fibre optical cable if you want to configure subsystem into multi-host attachment.



NOTE: For safety reasons, make sure the subsystem and the host computer are turned off when you plug-in the Fibre cable.

3.3 Powering On

When you connect the subsystem to the Host computer, you should press the ON/OFF Power Supply Switch. It will turn the subsystem on and the Self-Test will be started automatically.

1. Plug in all the power cords or power connectors located at the rear of the subsystem.



NOTE: The subsystem is equipped with redundant, full range power supplies with PFC (power factor correction). The system will automatically select voltage.

2. Turn on each Power On/Off Switch to power on the subsystem.
3. The Power LED on the front Panel will turn green.

Chapter 4 RAID Configuration Utility Options

Configuration Methods

There are three methods of configuring the RAID controller:

- a. VT100 terminal connected through the serial Monitor port
- b. Front panel touch-control buttons
- c. Web browser-based remote RAID management via the R-Link Ethernet port
- d. Telnet connection via the R-Link Ethernet port



NOTE: The RAID subsystem allows you to access using only one method at a time. You cannot use more than one method at the same time.

4.1 Configuration through Terminal

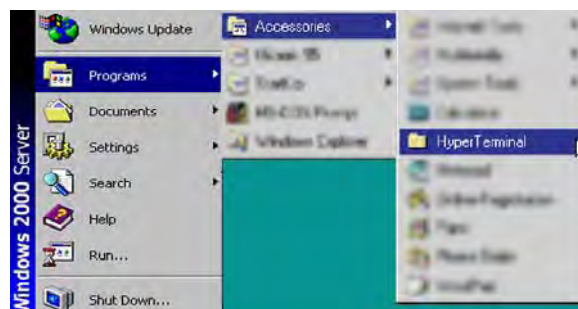
Configuring through a terminal will allow you to use the same configuration options and functions that are available from the LCD panel and via Telnet. To start-up:

1. Connect the Monitor port located at the rear of the system to a PC or a VT100 compatible terminal operating in an equivalent terminal emulation mode using serial cable.



NOTE: You may connect a terminal while the system's power is on.

2. Power-on the terminal.
3. Run the VT100 program or an equivalent terminal program.

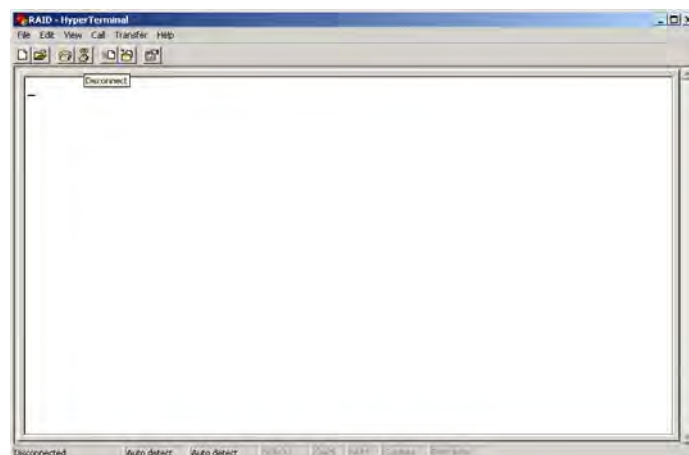




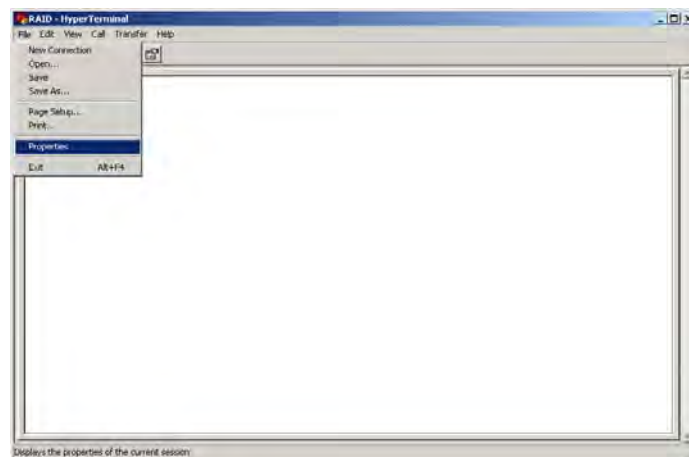
4. The default setting of the monitor port is 115200 baud rate, 8 data bit, non-parity, 1 stop bit and no flow control.



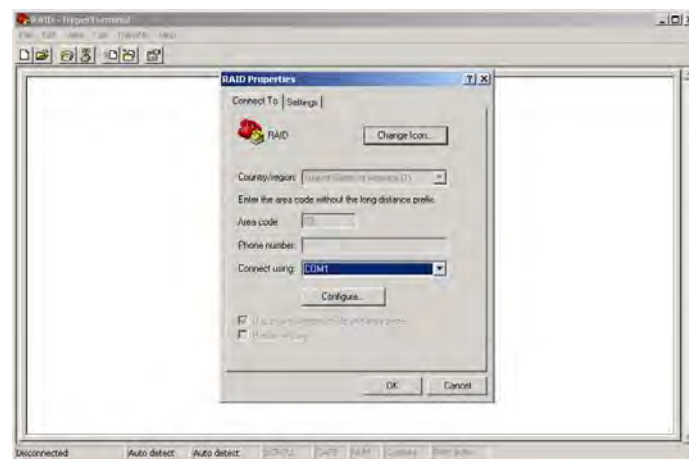
5. Click  disconnect button.



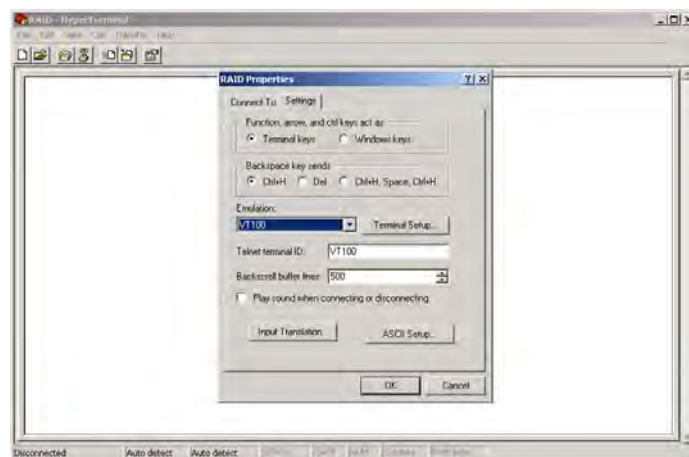
6. Open the File menu, and then open Properties.



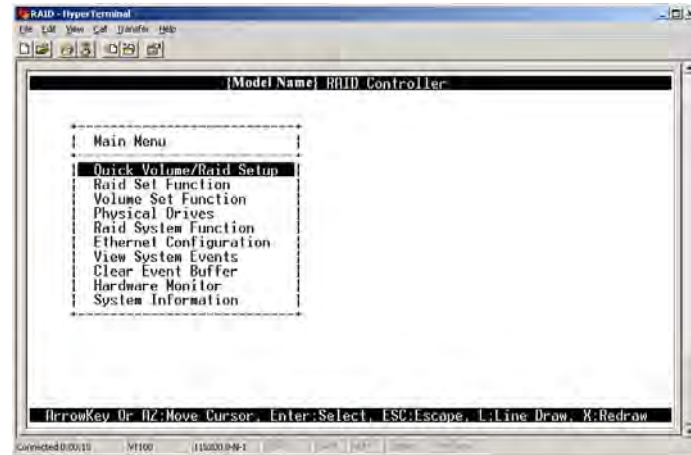
7. Open the Settings Tab.



8. Configure the settings as follows:
 - "Function, arrow and ctrl keys act as": Terminal Keys
 - "Backspace key sends": Ctrl + H
 - "Emulation": VT100
 - "Telnet terminal ID": VT100
 - "Back scroll buffer lines": 500Click OK.



9. Now, the VT100 is ready to use. After you have finished the VT100 Terminal setup, you may press the "X" key (in your Terminal) to link the RAID subsystem and Terminal together. Press "X" key to display the disk array Monitor Utility screen on your VT100 Terminal.
10. The Main Menu will appear.

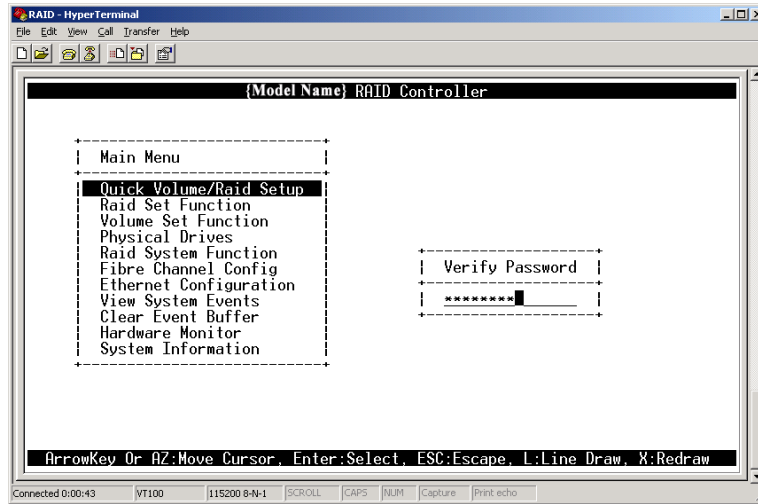


Keyboard Function Key Definitions

- "A" key - to move to the line above
- "Z" key - to move to the next line
- "Enter" key - Submit selection function
- "ESC" key - Return to previous screen
- "L" key - Line draw
- "X" key - Redraw

Main Menu

The main menu shows all function that enables the customer to execute actions by clicking on the appropriate link.



NOTE: The password option allows user to set or clear the RAID subsystem's password protection feature. Once the password has been set, the user can only monitor and configure the RAID subsystem by providing the correct password. The password is used to protect the RAID subsystem from unauthorized access. The controller will check the password only when entering the Main menu from the initial screen. The RAID subsystem will automatically go back to the initial screen when it does not receive any command in twenty seconds. The RAID subsystem's factory default password is set to 00000000.

VT100 Terminal Configuration Utility Main Menu Options

Select an option and the related information or submenu items under it will be displayed. The submenus for each item are shown in Section 4.2.1. The configuration utility main menu options are:

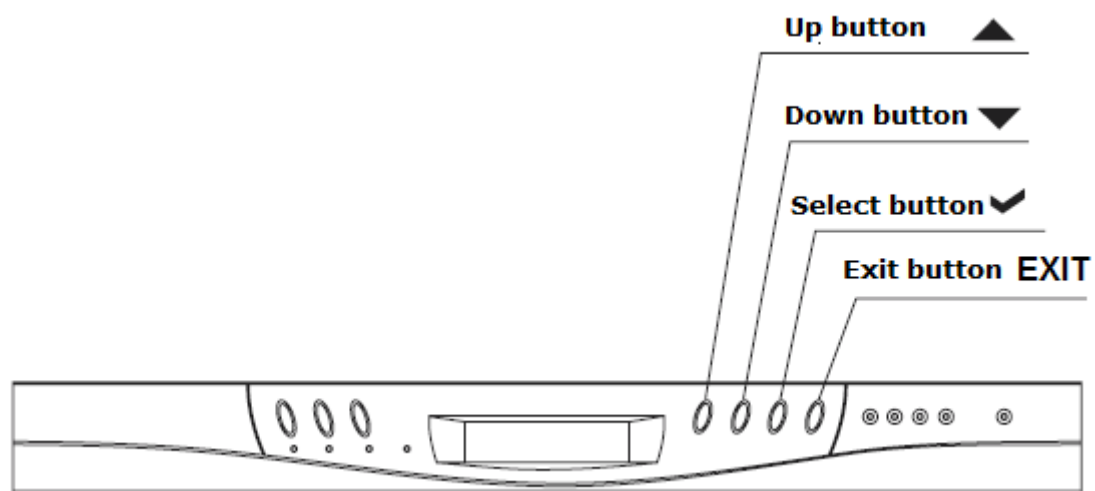
Option	Description
Quick Volume And Raid Set Setup	Create a RAID configuration which consists of all physical disks installed
Raid Set Functions	Create a customized Raid Set
Volume Set Functions	Create a customized Volume Set
Physical Drive Functions	View individual disk information
Raid System Functions	Setting the Raid system configurations
Hdd Power Management	Setting the HDD power management configurations
Fibre Channel Config	Setting the Fibre Channel configurations
Ethernet Configuration	Setting the Ethernet configurations
Views System Events	Record all system events in the buffer
Clear Event Buffer	Clear all event buffer information
Hardware Monitor	Show all system environment status
System Information	View the controller information



4.2 Configuration through the LCD Panel

All configurations can be performed through the LCD Display front panel function keys, except for the "Firmware update". The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays menu items or other information up to two lines at a time. The RAID controller's factory default password is set to **00000000**.

Function Key Definitions

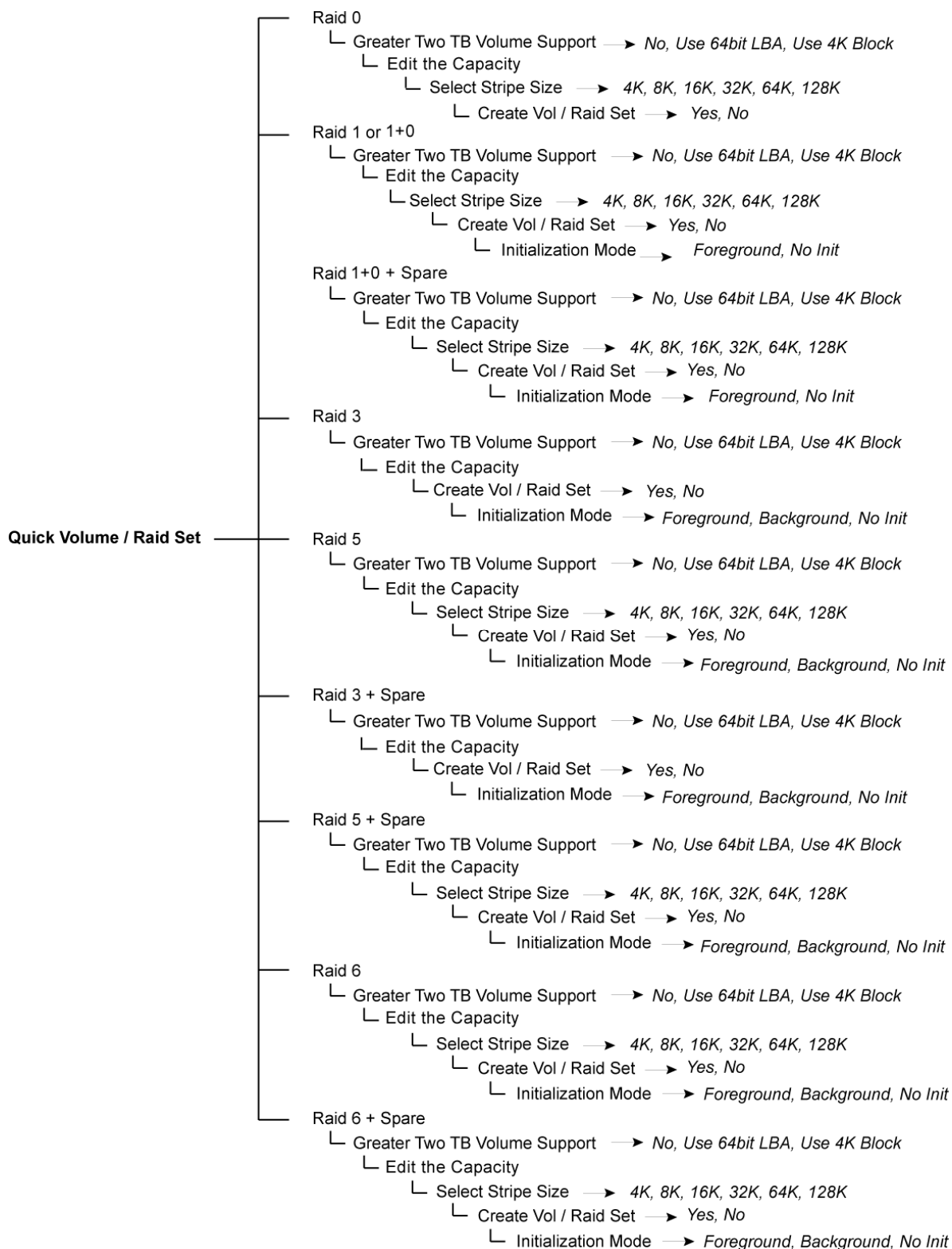
The four function keys at the top of the front panel perform the following functions:

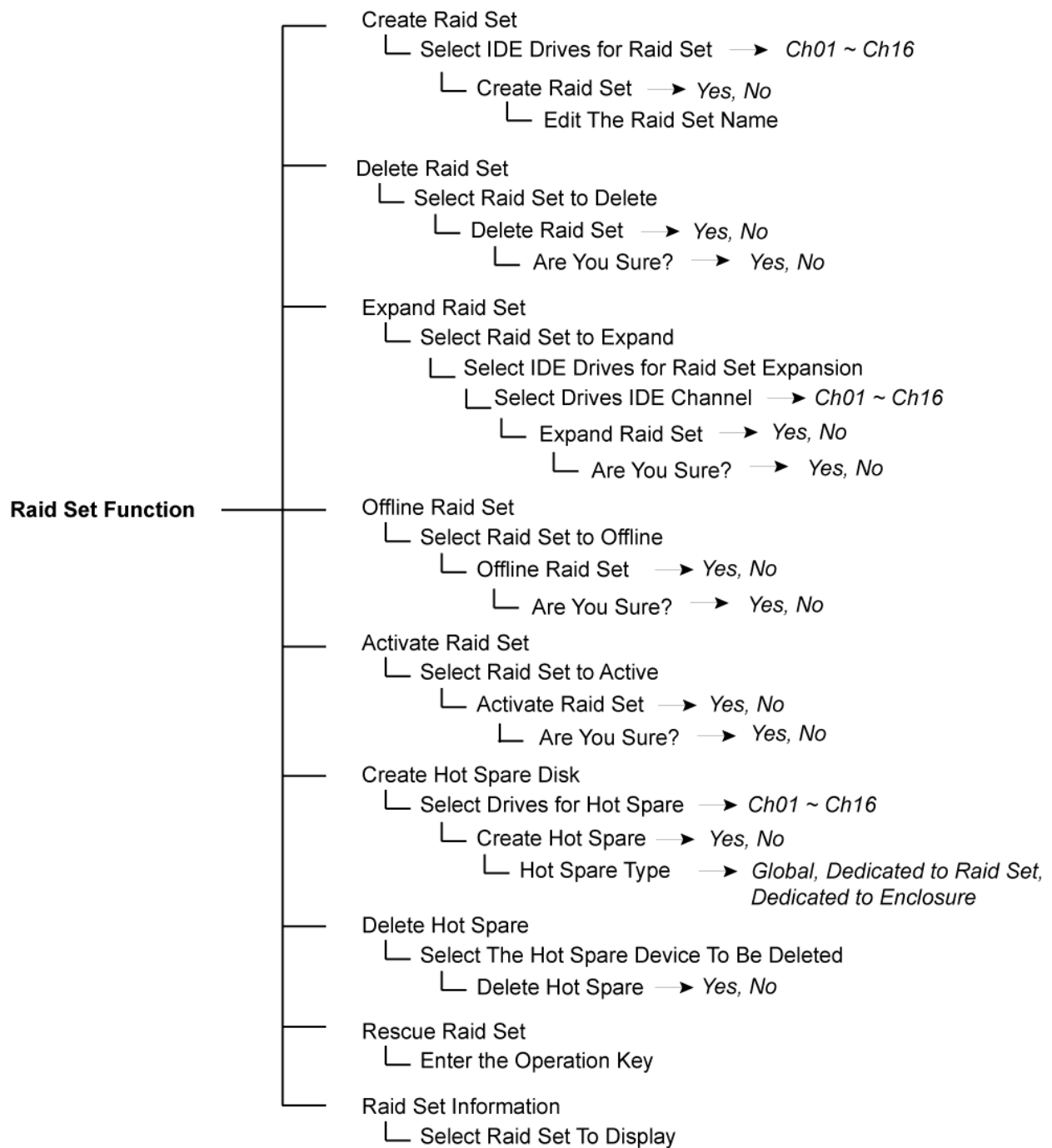


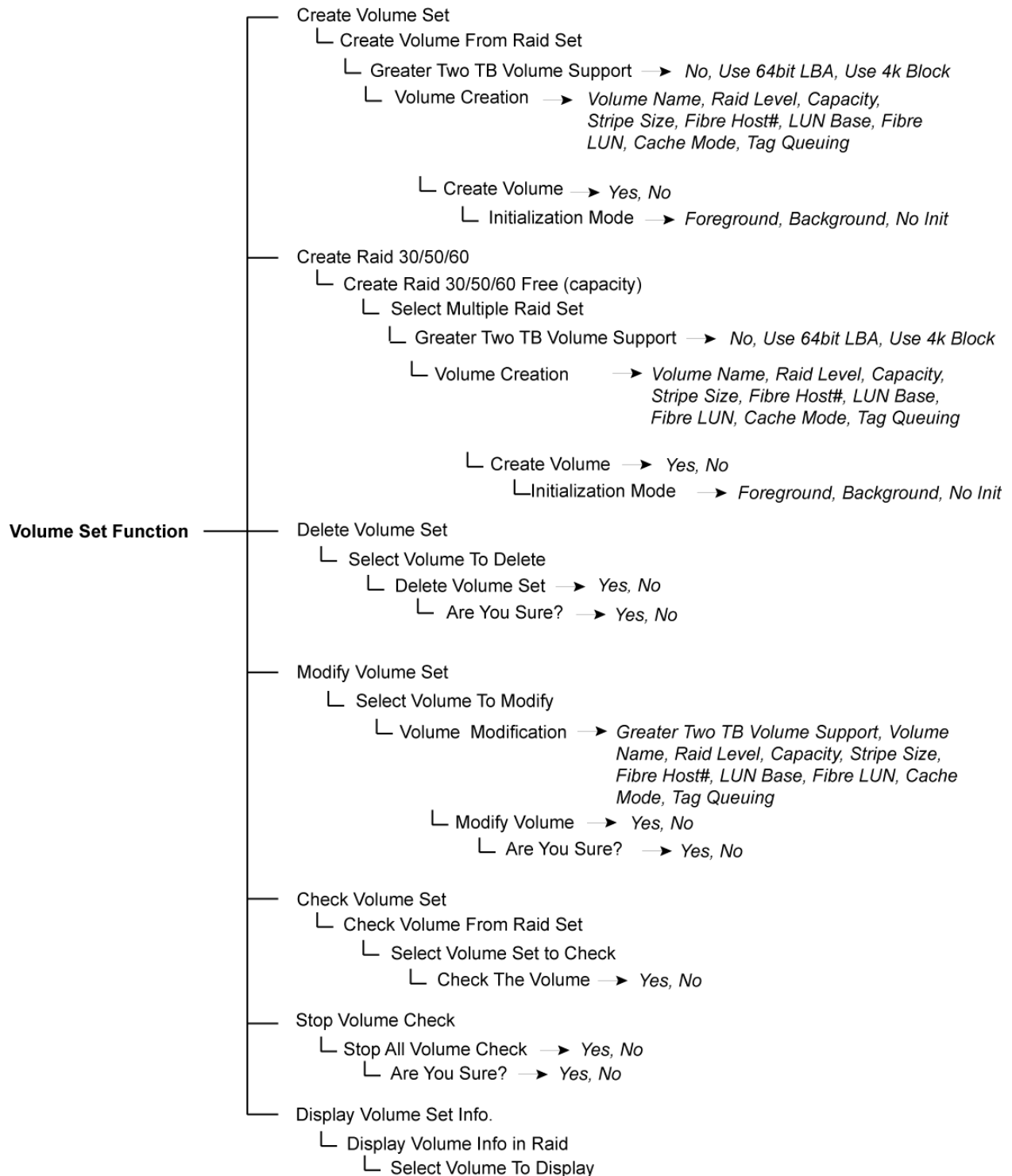
Parts	Function
Up and Down Arrow buttons 	Use the Up or Down arrow keys to go through the information on the LCD screen. This is also used to move between each menu when you configure the RAID.
Select button 	This is used to enter the option you have selected.
Exit button EXIT	Press this button to return to the previous menu.

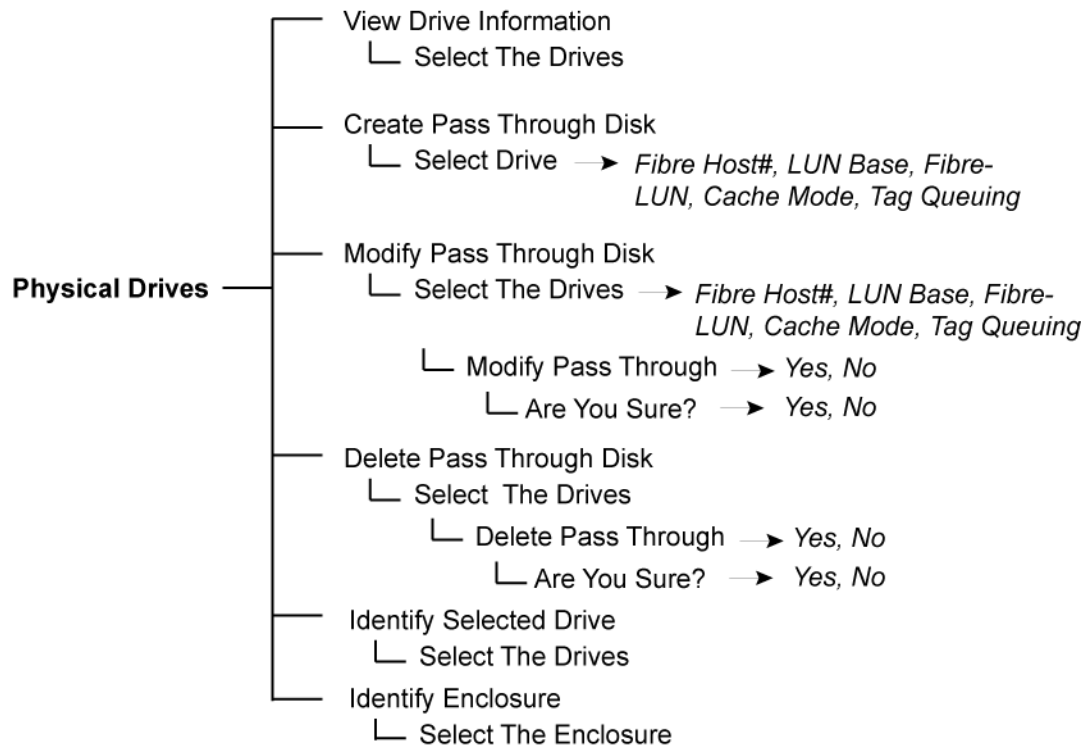
4.2.1 Menu Diagram

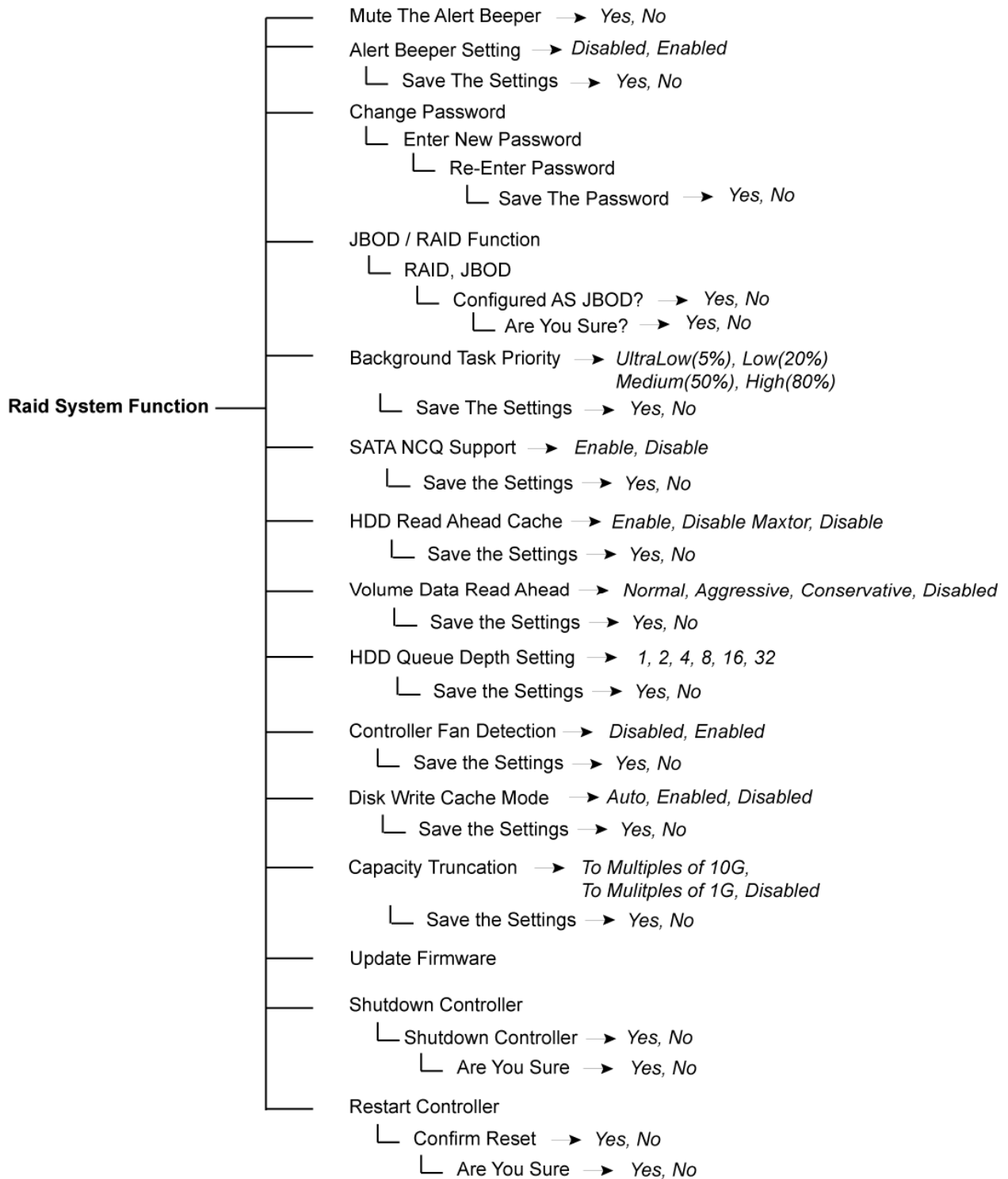
The following menu diagram is a summary of the various configurations and setting functions that can be accessed through terminal.

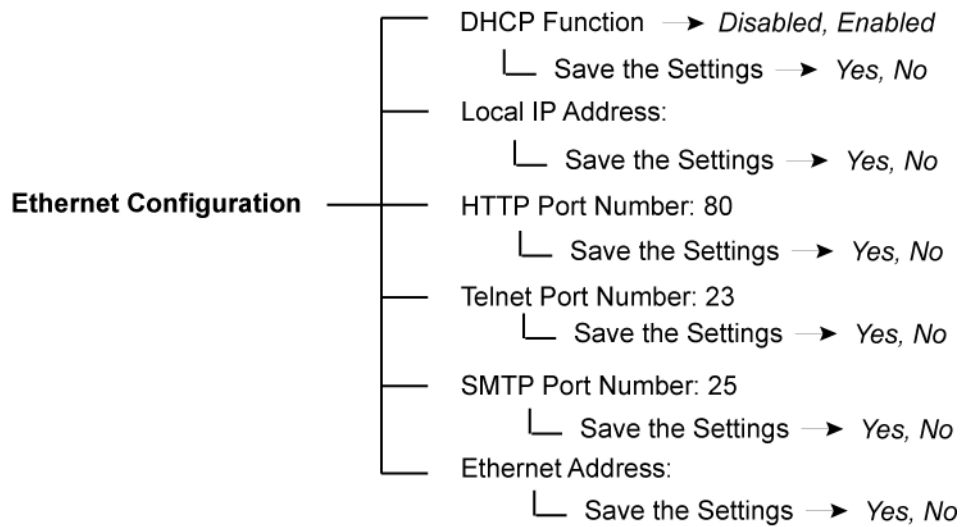
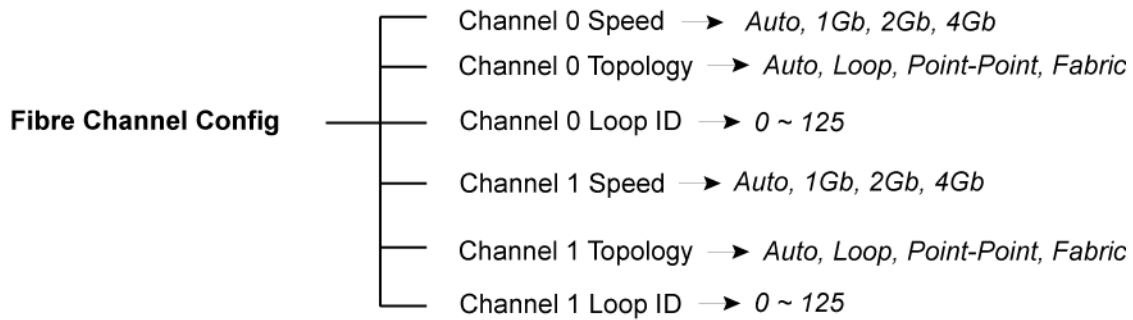
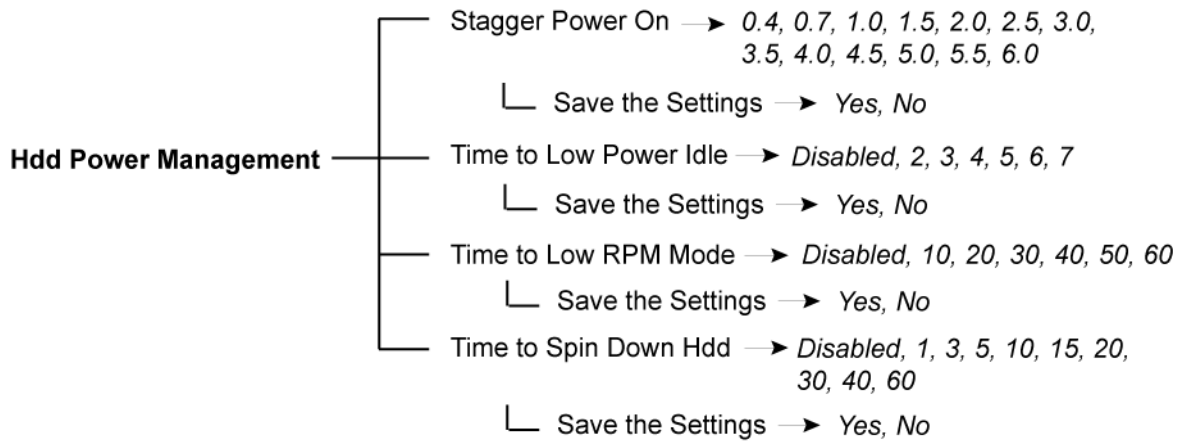












View System Events	—————	Show System Events
Clear Event Buffers	—————	Clear Event Buffer → Yes, No
Hardware Monitor	—————	The Hardware Monitor Information
System Information	—————	The System Information

4.3 Configuration through web browser-based proRAID Manager

The RAID subsystem can be remotely configured via R-Link port with proRAID Manager, a web browser-based application. The proRAID Manager can be used to manage all available functions of the RAID controller.

To configure the RAID subsystem from a remote machine, you need to know its IP Address. Launch your web browser from remote machine and enter in the address bar:
http://[IP-Address].



IMPORTANT! The default IP address of the Controller R-Link Port is 192.168.1.100 and subnet mask is 255.255.255.0. DHCP client function is also enabled by default. You can reconfigure the IP Address or disable the DHCP client function through the LCD front panel or terminal "Ethernet Configuration" menu.



NOTE: If DHCP client function is enabled but a DHCP server is unavailable and the IP address is changed, a Controller Restart is necessary. If the DHCP client function is disabled and the IP address is changed, Controller Restart is not needed.

Note that you may need to be logged in as administrator with local admin rights on the remote machine to remotely configure the RAID subsystem. The RAID subsystem controller default User Name is "admin" and the Password is "00000000".

[open all][close all]				
<ul style="list-style-type: none"> Raid System Console <ul style="list-style-type: none"> Quick Function RAID Set Functions Volume Set Functions Physical Drives System Controls Information <ul style="list-style-type: none"> RAID Set Hierarchy System Information Hardware Monitor 				
■ RAID Set Hierarchy				
RAID Set	Devices	Volume Set(Ch/Lun)	Volume State	Capacity
Raid Set # 000	E#1Slot#1	Volume---VOL#000(0/0)	Normal	2199.0GB
	E#1Slot#2			
	E#1Slot#3			
	E#1Slot#4			
	E#1Slot#5			
	E#1Slot#6			
■ Enclosure#1 : SATA RAID Subsystem V1.0				
Device	Usage	Capacity	Model	
Slot#1(0:3)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0	
Slot#2(0:1)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0	
Slot#3(0:0)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0	
Slot#4(0:2)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0	
Slot#5(0:0)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0	
Slot#6(0:4)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0	
Slot#7(0:5)	Free	1000.2GB	WDC WD1002FBYS-01A6B0	
Slot#8(0:6)	Free	1000.2GB	WDC WD1002FBYS-01A6B0	
Slot#9(0:7)	Free	1000.2GB	Hitachi HDE721010SLA330	
Slot#10(0:8)	Free	1000.2GB	Hitachi HDE721010SLA330	
Slot#11(0:9)	Free	1000.2GB	Hitachi HDE721010SLA330	
Slot#12(0:A)	Free	1000.2GB	Hitachi HDE721010SLA330	

Main Menu

The main menu shows all available function that user can execute by clicking on the appropriate hyperlink.

Individual Category	Description
Quick Function	Create a RAID configuration, which consists of all physical disks installed. The Volume Set Capacity, Raid Level, and Stripe Size can be modified during setup.
Raid Set Functions	Create customized Raid Sets.
Volume Set Functions	Create customized Volume Sets and allow modification of parameters of existing Volume Sets parameter.
Physical Drives	Create pass through disks and allow modification of parameters of existing pass through drives. This also provides a function to identify a disk drive.
System Controls	For setting the RAID system configurations.
Information	To view the controller and hardware monitor information. The Raid Set hierarchy can also be viewed through the Raid Set Hierarchy item.

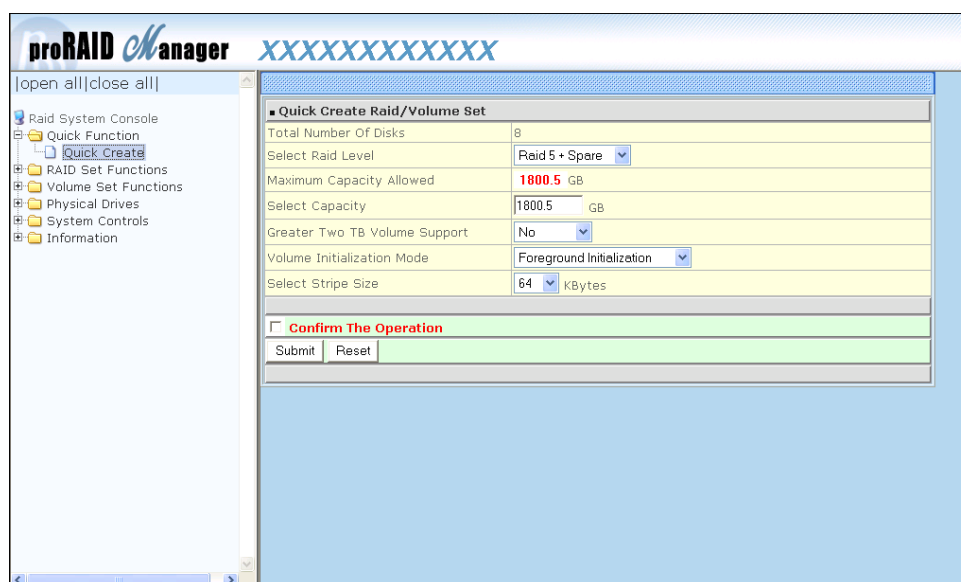
Chapter 5 RAID Management

5.1 Quick Function

5.1.1 Quick Create

The number of physical drives in the RAID subsystem determines the RAID levels that can be implemented with the Raid Set. This feature allows user to create a Raid Set associated with exactly one Volume Set. User can change the Raid Level, Capacity, Volume Initialization Mode and Stripe Size. A hot spare can also be created depending upon the existing configuration.

If the Volume Set size is over 2TB, an option “Greater Two TB Volume Support” will be automatically provided in the screen as shown in the example below. There are three options to select: “No”, “64bit LBA”, and “4K Block”).



Greater Two TB Volume Support:

No: Volume Set capacity is set to maximum 2TB.

64bit LBA: Use this option for UNIX, Linux Kernel 2.6 or later, Windows Server 2003 + SP1 or later versions, Windows x64, and other supported operating systems. The maximum Volume Set size is up to 512TB.

4K Block: Use this option for Windows OS such as Windows 2000, 2003, or XP. The maximum Volume Set size is 16TB. Just use the Volume as “Basic Disk”. Volume can’t be used as “Dynamic Disk”; also can’t be used in 512Bytes block service program.

Tick on the **Confirm The Operation** option and click on the **Submit** button in the Quick Create screen. The Raid Set and Volume Set will start to initialize.

You can use **RaidSet Hierarchy** feature to view the Volume Set information (Refer to Section 5.6.1).



NOTE: In Quick Create, your Raid Set is automatically configured based on the number of disks in your system (maximum 32 disks per Raid Set). Use the Raid Set Function and Volume Set Function if you prefer to create customized Raid Set and Volume Set.

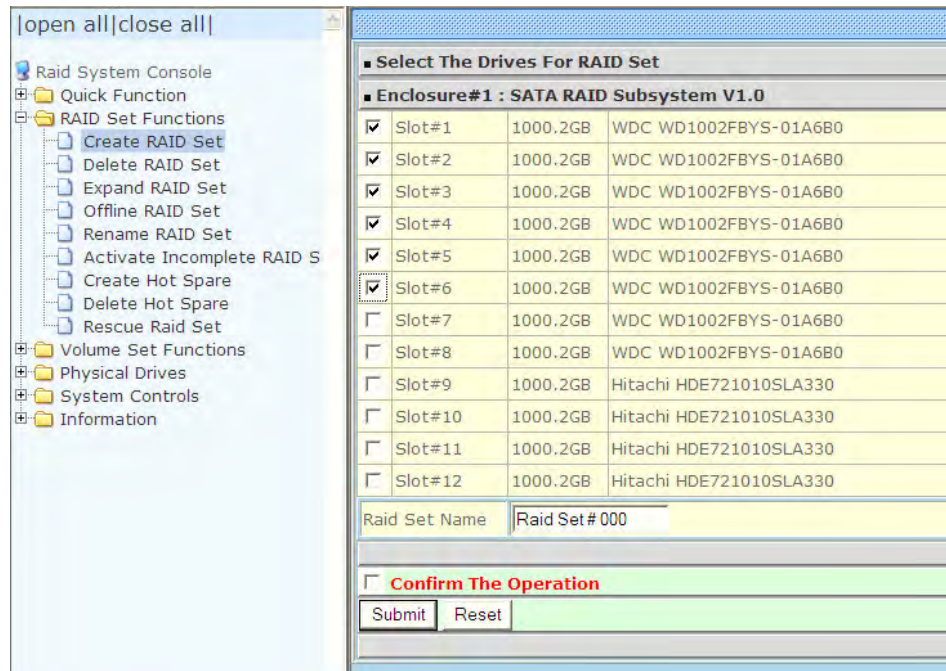


NOTE: In Quick Create, the Raid Level options 30, 50, and 60 are not available. If you need to create Volume Set with Raid Level 30, 50, or 60, use the Create Raid Set function and Create Volume Set function.

5.2 RAID Set Functions

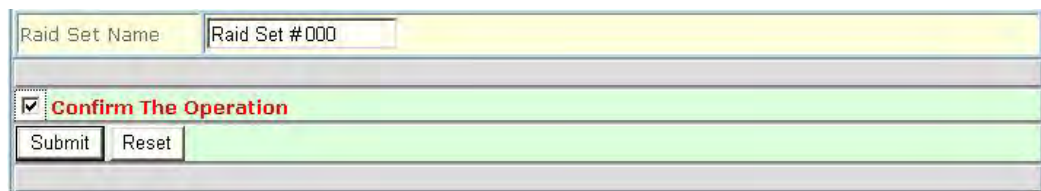
Use the Raid Set Function and Volume Set Function if you prefer to create customized Raid Sets and Volume Sets. User can manually configure and take full control of the Raid Set settings, but it will take a little longer to setup than the Quick Create configuration. Select the Raid Set Function to manually configure the Raid Set for the first time or to delete existing Raid Set and reconfigure a Raid Set.

5.2.1 Create RAID Set



To create a Raid Set, click on the **Create RAID Set** link. A "Select The Drives For RAID Set" screen is displayed showing the disk drives in the system. Tick the box of each disk drive that will be included in Raid Set to be created. Enter the preferred Raid Set Name (1 to 16 alphanumeric characters) to define a unique identifier for the Raid Set. Default Raid Set name always appear as **Raid Set # xxx**.

Tick on the **Confirm The Operation** option and click on the **Submit** button in the screen.



5.2.2 Delete RAID Set

To delete a Raid Set, click on the **Delete RAID Set** link. A “Select The Raid Set To Delete” screen is displayed showing all Raid Sets existing in the system. Select the Raid Set you want to delete in the Select column.

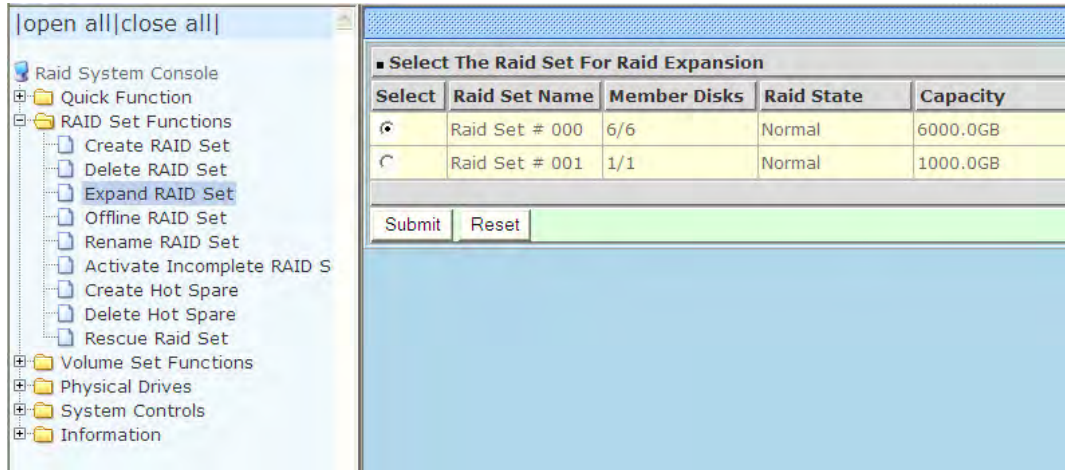
Tick on the **Confirm The Operation** and click on the **Submit** button to process with deletion.



NOTE: You cannot delete a Raid Set containing a Raid 30/50/60 Volume Set. You must delete the Raid 30/50/60 Volume Set first.

5.2.3 Expand RAID Set

Use this option to expand a Raid Set, when one or more disk drives is/are added to the system. This function is active when at least one drive is available.



To expand a Raid Set, click on the **Expand RAID Set** link. Select the Raid Set which you want to expand.

Tick on the available disk(s) and check **Confirm The Operation**. Click on the **Submit** button to add the selected disk(s) to the Raid Set.



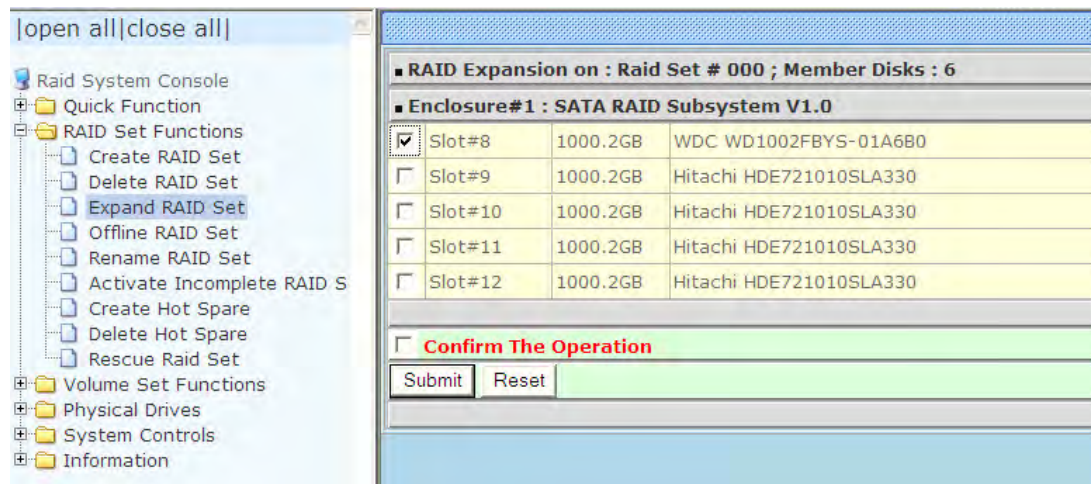
NOTE: Once the Expand Raid Set process has started, user cannot stop it. The process must be completed.



NOTE: If a disk drive fails during Raid Set expansion and a hot spare is available, an auto rebuild operation will occur after the Raid Set expansion is completed.



NOTE: A Raid Set cannot be expanded if it contains a Raid 30/50/60 Volume Set.



Migration occurs when a disk is added to a Raid Set. Migrating status is displayed in the Raid Set status area of the Raid Set information. Migrating status is also displayed in the Volume Set status area of the Volume Set Information for all Volume Sets under the Raid Set which is migrating.

open allclose all

Raid System Console

Quick Function

RAID Set Functions

Create RAID Set

Delete RAID Set

Expand RAID Set

Offline RAID Set

Rename RAID Set

Activate Incomplete RAID S

Create Hot Spare

Delete Hot Spare

Rescue Raid Set

Volume Set Functions

Physical Drives

System Controls

Information

RAID Set Hierarchy

Hardware Monitor

Stop Auto Refresh

RAIDSet Hierarchy

RAID Set	Devices	Volume Set(Ch/Lun)	Volume State	Capacity
Raid Set # 000	E#1Slot#1	Volume---VOL#000(0/0)	Migrating(0.6%)	2199.0GB
	E#1Slot#2			
	E#1Slot#3			
	E#1Slot#4			
	E#1Slot#5			
	E#1Slot#6			
	E#1Slot#8			
Raid Set # 001	E#1Slot#7			

Enclosure#1 : SATA RAID Subsystem V1.0

Device	Usage	Capacity	Model
Slot#1(0:3)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#2(0:1)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#3(0:0)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#4(0:2)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#5(0:0)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#6(0:4)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#7(0:5)	Raid Set # 001	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#8(0:6)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#9(0:7)	Free	1000.2GB	Hitachi HDE721010SLA330



NOTE: Cannot expand Raid Set when contains Raid30/50/60 volume.

open allclose all

Raid System Console

Quick Function

RAID Set Functions

Create RAID Set

Delete RAID Set

Expand RAID Set

Offline RAID Set

Rename RAID Set

Activate Incomplete RAID S

Create Hot Spare

Delete Hot Spare

Rescue Raid Set

Volume Set Functions

Physical Drives

System Controls

Information

Controller Response

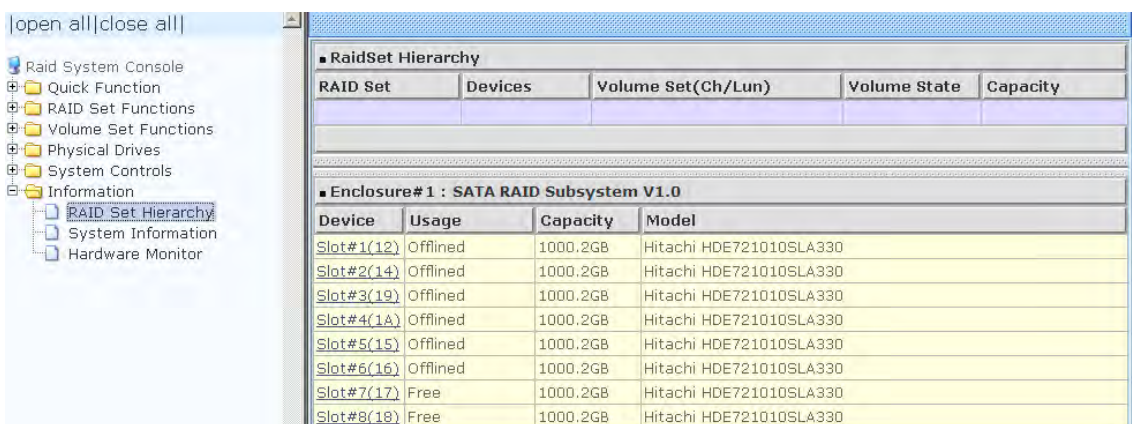
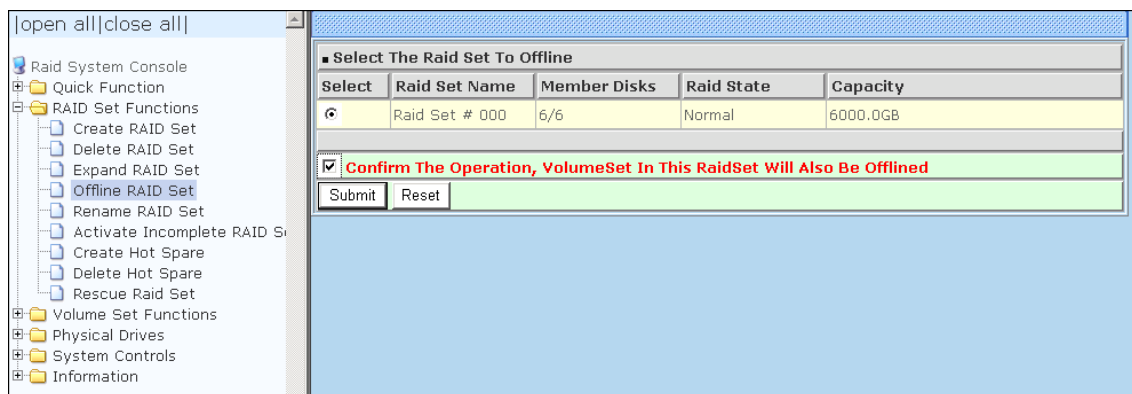
Cannot Expand RaidSet Contains Raid30/50/60 Volume

5.2.4 Offline RAID Set

If user wants to offline (and move) a Raid Set while the system is powered on, use the Offline Raid Set function. After completing the function, the HDD state will change to “Offlined” Mode and the HDD Status LEDs will be blinking RED.

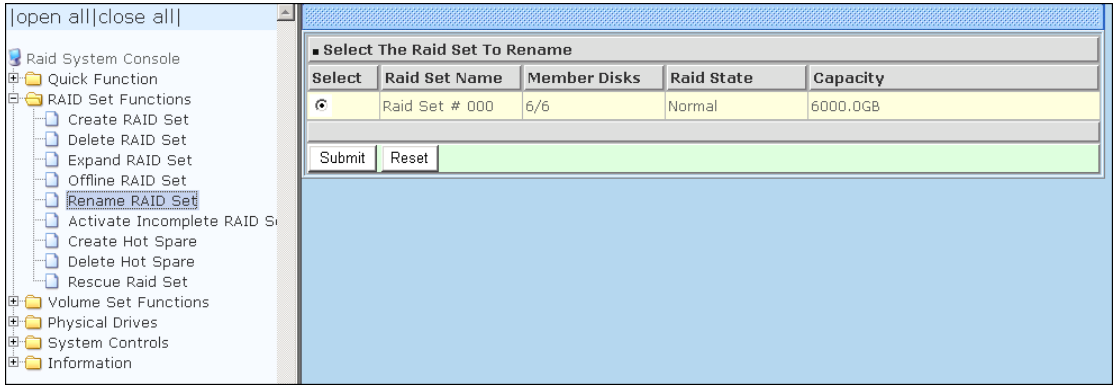
To offline a Raid Set, click on the **Offline RAID Set** link. A “Select The RAID SET To Offline” screen is displayed showing all existing Raid Sets in the subsystem. Select the Raid Set which you want to offline in the Select column.

Tick on the **Confirm The Operation**, and then click on the **Submit** button to offline the selected Raid Set.

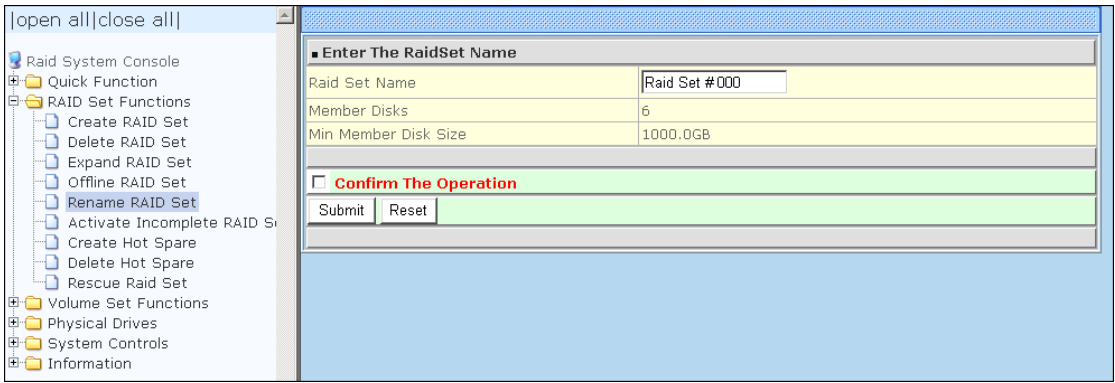


5.2.5 Rename RAID Set

Use this function to rename a RAID Set. Select the **"Rename RAID Set"** under the RAID Set Functions, and then select the Select the RAID Set to rename and click **"Submit"**.



Enter the new name for the RAID Set. Tick the **"Confirm The Operation"** and click **"Submit"**.



5.2.6 Activate Incomplete RAID Set

When Raid Set State is **“Normal”**, this means there is no failed disk drive.

■ Raid Set Information	
Raid Set Name	Raid Set # 000
Member Disks	10
Total Raw Capacity	3200.0GB
Free Raw Capacity	756.7GB
Min Member Disk Size	320.0GB
Raid Set Power State	Operating
Raid Set State	Normal

When does a Raid Set State becomes “Incomplete”?

If the RAID subsystem is powered off and one disk drive is removed or has failed in power off state, and when the subsystem is powered on, the Raid Set State will change to **“Incomplete”**.

■ Raid Set Information	
Raid Set Name	Raid Set # 000
Member Disks	10
Total Raw Capacity	3200.0GB
Free Raw Capacity	3200.0GB
Min Member Disk Size	320.0GB
Raid Set Power State	Operating
Raid Set State	Incomplete

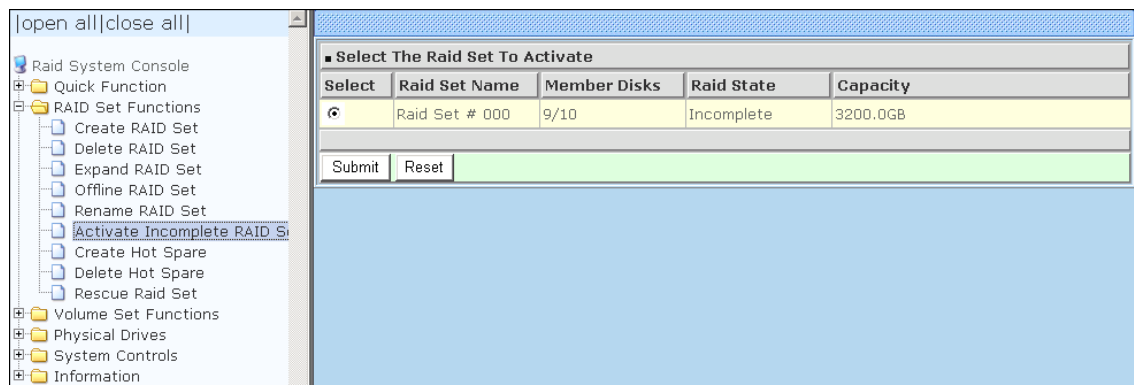
The Volume Set(s) associated with the Raid Set will not be visible and the failed or removed disk will be shown as **“Missing”**. At the same time, the subsystem will not detect the Volume Set(s); hence the volume(s) is/are not accessible.

■ RaidSet Hierarchy				
RAID Set	Devices	Volume Set(Ch/Lun)	Volume State	Capacity
Raid Set # 000	E#1SLOT 01			
	E#1SLOT 02			
	Missing			
	E#1SLOT 04			
	E#1SLOT 05			
	E#1SLOT 06			
	E#1SLOT 07			
	E#1SLOT 08			
	E#1SLOT 09			
	E#1SLOT 10			

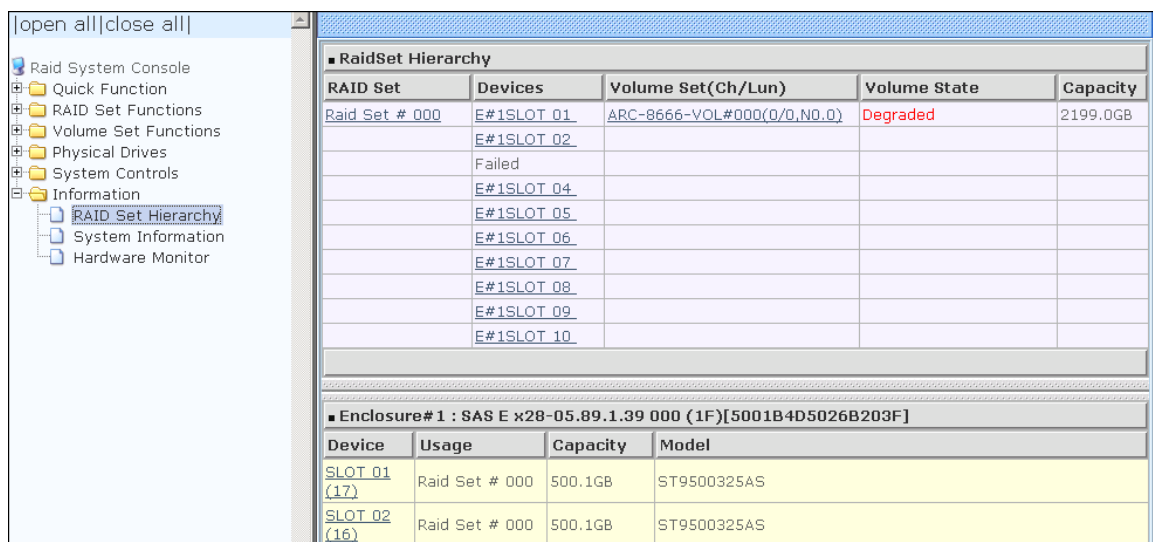
When can the “Activate Incomplete Raid Set” function be used?

In order to access the Volume Set(s) and corresponding data, use the **Activate Incomplete RAID Set** function to active the Raid Set. After selecting this function, the Raid State will change to “**Degraded**” state.

To activate the incomplete the Raid Set, click on the **Activate Incomplete RAID Set** link. A “Select The Raid Set To Activate” screen is displayed showing all existing Raid Sets in the subsystem. Select the Raid Set with “**Incomplete**” state which you want to activate in the Select column.



Click on the **Submit** button to activate the Raid Set. The Volume Set(s) associated with the Raid Set will become accessible in “**Degraded**” mode.

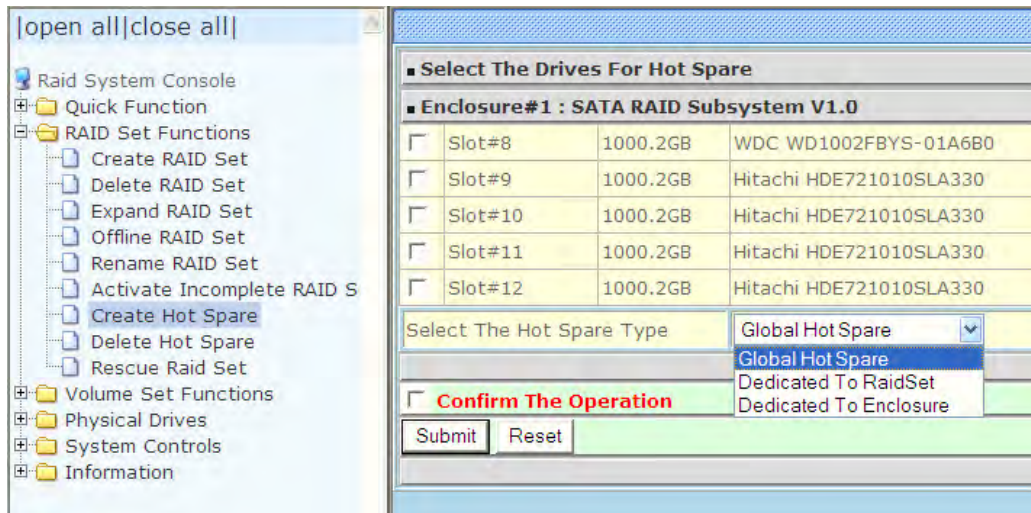


NOTE: The “Activate Incomplete Raid Set” function is only used when Raid Set State is “Incomplete”. It cannot be used when Raid Set configuration is lost. If in case the RAID Set configuration is lost, please contact your vendor’s support engineer.

5.2.7 Create Hot Spare

The Create Hot Spare option gives you the ability to define a global hot spare.

When you choose the **Create Hot Spare** option in the Raid Set Function, all unused (non Raid Set member) disk drives in the subsystem appear. Select the target disk drive by clicking on the appropriate check box. Tick on the **Confirm The Operation** and click on the **Submit** button to create hot spare drive(s).



Hot Spare Type	Description
Global Hot Spare	The Hot Spare disk is a hot spare on all enclosures connected in daisy chain. It can replace any failed disk in any enclosure.
Dedicated to RaidSet	The Hot Spare disk is a hot spare dedicated only to the RaidSet where it is assigned. It can replace any failed disk in the RaidSet where it is assigned.
Dedicated to Enclosure	The Hot Spare disk is a hot spare dedicated only to the enclosure where it is located. It can replace any failed disk on the enclosure where it is located.



NOTE: The capacity of the hot spare disk(s) must be equal to or greater than the smallest hard disk size in the subsystem so that it/they can replace any failed disk drive.

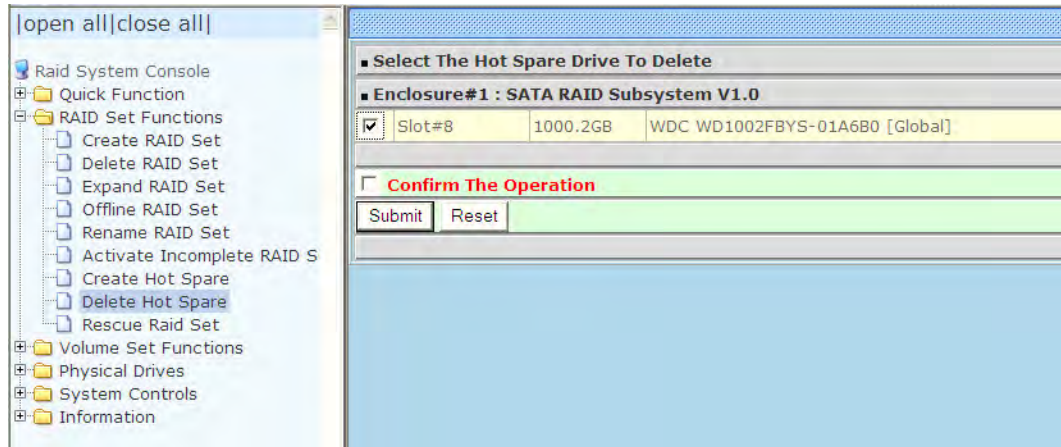


NOTE: The Hot Spare Type can also be viewed by clicking on Raid Set Hierarchy in the Information menu.

5.2.8 Delete Hot Spare

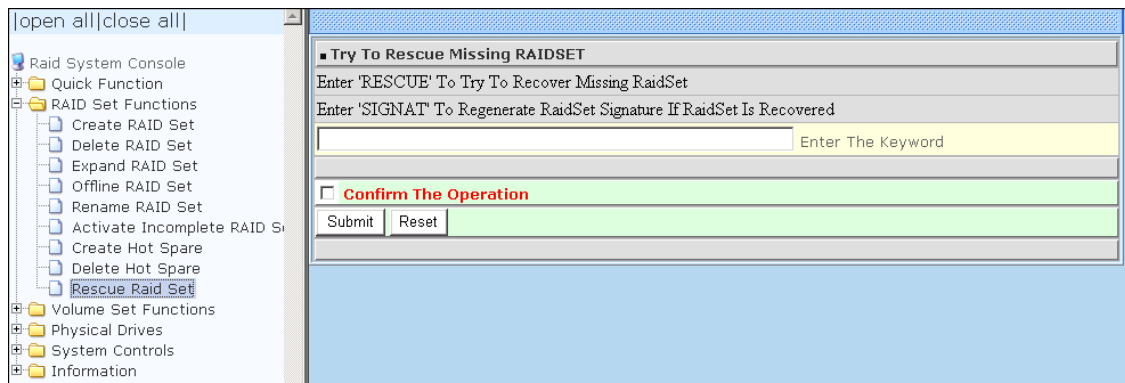
Select the target Hot Spare disk(s) to delete by clicking on the appropriate check box.

Tick on the **Confirm The Operation**, and click on the **Submit** button in the screen to delete the hot spare(s).



5.2.9 Rescue Raid Set

If you need to recover a missing Raid Set using the "Rescue Raid Set" function, please contact your vendor's support engineer for assistance.



5.3 Volume Set Function

Volume Set is seen by the host system as a single logical device. It is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a Volume Set. A Volume Set capacity can consume all or a portion of the raw capacity available in a Raid Set.

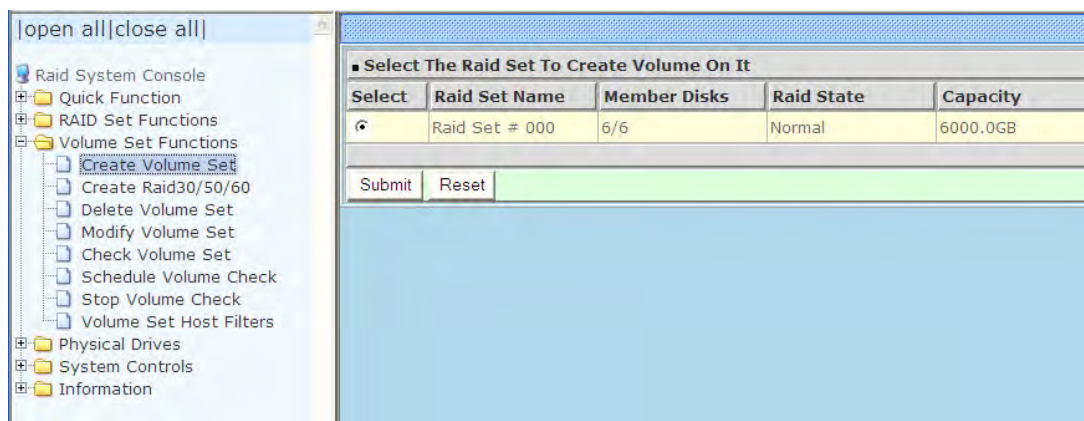
Multiple Volume Sets can exist on a group of disks in a Raid Set. Additional Volume Sets created in a specified Raid Set will reside on all the physical disks in the Raid Set. Thus each Volume Set on the Raid Set will have its data spread evenly across all the disks in the Raid Set.

5.3.1 Create Volume Set

The following are the Volume Set features:

1. Volume sets of different RAID levels may coexist on the same Raid Set.
2. Up to 128 Volume Sets in a Raid Set can be created in the RAID subsystem.

To create Volume Set from a Raid Set, expand the Volume Set Functions in the main menu and click on the **Create Volume Set** link. The **Select The Raid Set To Create Volume On It** screen will show all existing Raid Sets. Tick on the Raid Set where you want to create the Volume Set and then click on the **Submit** button.



The Volume Set setup screen allows user to configure the Volume Name, Capacity, RAID level, Initialization Mode, Stripe Size, Cache Mode, Tagged Command Queuing, Fibre Channel/LUN Base/LUN, and Volume To Be Created.

The screenshot shows the RAID System Console interface. On the left is a tree view with categories like 'Quick Function', 'RAID Set Functions', 'Volume Set Functions', 'Physical Drives', 'System Controls', and 'Information'. The 'Volume Set Functions' category is expanded, showing options like 'Create Volume Set', 'Create Raid30/50/60', 'Delete Volume Set', 'Modify Volume Set', 'Check Volume Set', 'Schedule Volume Check', 'Stop Volume Check', and 'Volume Set Host Filters'. The main area displays the 'Enter The Volume Attribute' configuration window. This window contains the following fields and values:

Volume Name	Volume---VOL#000
Member Disks	6
Volume Raid Level	Raid 5
Max Capacity Allowed	5000 GB
Select Volume Capacity	5000 GB
Greater Two TB Volume Support	No
Volume Initialization Mode	Foreground Initialization
Volume Stripe Size	64 KBytes
Volume Cache Mode	Write Back
Tagged Command Queuing	Enabled
Fibre Channel: LUN Base: LUN	0 : 0 : 0
Volumes To Be Created	1

At the bottom of the configuration window is a green bar with the text 'Confirm The Operation' and two buttons: 'Submit' and 'Reset'.

Volume Name:

The default Volume Set name will appear as "Volume---VOL#XXX". You can rename the Volume Set name provided it does not exceed the 16 characters limit.

Volume Raid Level:

Set the RAID level for the Volume Set. Click the down-arrow in the drop-down list. The available RAID levels for the current Volume Set are displayed. Select the preferred RAID level.

Select Volume Capacity:

The maximum Volume Set size is displayed by default. If necessary, change the Volume Set size appropriate for your application.

Greater Two TB Volume Support:

If the Volume Set size is over 2TB, an option "Greater Two TB Volume Support" will be automatically provided in the screen as shown in the example above. There are three options to select: "No", "64bit LBA", and "4K Block").

No: Volume Set size is set to maximum 2TB limitation.

64bit LBA: Use this option for UNIX, Linux Kernel 2.6 or later, Windows Server 2003 + SP1 or later versions, Windows x64, and other supported operating systems. The maximum Volume Set size is up to 512TB.

4K Block: Use this option for Windows OS such as Windows 2000, 2003, or XP. The maximum Volume Set size is 16TB. Just use the Volume as "Basic Disk". Volume can't be used as "Dynamic Disk"; also can't be used in 512Bytes block service program.

Initialization Mode:

Set the Initialization Mode for the Volume Set. Initialization in Foreground mode is completed faster but must be completed before Volume Set becomes accessible.

Background mode makes the Volume Set instantly available but the initialization process takes longer. No Init (To Rescue Volume) is used to create a Volume Set without initialization; normally used to recreate Volume Set configuration to recover data.

Stripe Size:

This parameter sets the size of the stripe written to each disk in a RAID 0, 1, 10, 5 or 6 Volume Set. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB.

A larger stripe size produces better-read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random reads more often, select a small stripe size.



NOTE: Stripe Size in RAID level 3 can't be modified.

Cache Mode:

The RAID subsystem supports two types of write caching: Write-Through and Write-Back.

Write-Through: data are both written to the cache and the disk(s) before the write I/O is acknowledged as complete.

Write-Back: when data is written to cache, the I/O is acknowledged as complete, and some time later, the cached data is written or flushed to the disk(s). This provides better performance but requires a battery module support for the cache memory, or a UPS for the subsystem.

Tagged Command Queuing:

When this option is enabled, it enhances the overall system performance under multi-tasking operating systems by reordering tasks or requests in the command queue of the RAID system. This function should normally remain enabled.

Fibre Channel/LUN Base/ LUN

Fibre Channel: Each RAID controller has two 4Gbps Fibre Host Channels (ports).

Select the Fibre port where to map the LUN (Volume Set). Options are: **0**, **1** and

0&1 Cluster. "0&1 Cluster" will make the LUN visible on both Fibre ports.

LUN Base: The base LUN number. Each LUN Base supports 8 LUNs.

LUN: Each Volume Set must be assigned a unique LUN ID number. A Fibre Port can connect up to 128 devices (LUN ID: 0 to 127). Select the LUN ID for the Volume Set.

Volumes To Be Created:

Use this option to create several Volume Sets with the same Volume Set attributes. Up to 128 Volume Sets can be created.

5.3.2 Create Raid 30/50/60

To create a Raid30/50/60 Volume Set, move the mouse cursor to the main menu and click on the **Create Raid30/50/60** link. The **Select Multiple RaidSet For Raid30/50/60** screen will show all Raid Sets. Tick on the Raid Sets that you want to include in the creation and then click on the **Submit** button.



NOTE: When creating Raid 30/50/60 Volume set, you need to create first the Raid Sets. Up to 8 Raid Sets maximum is supported in Raid 30/50/60. All Raid Sets must contain the same number of disk drives.

Select Multiple RaidSet For Raid30/50/60 (Max 8 RaidSet Supported)				
<input checked="" type="checkbox"/>	Raid Set # 000	6	3361.2GB	6000.0GB
<input checked="" type="checkbox"/>	Raid Set # 001	6	6000.0GB	6000.0GB

Submit Reset

Configure the Volume Set attributes (refer to previous section for the Volume Set attributes). When done, tick **Confirm The Operation** and click on **Submit** button.

Enter The Volume Attribute	
Volume Name	Volume---VOL#001
Member Disks	2x6
Volume Raid Level	50
Max Capacity Allowed	5602.0 GB
Select Volume Capacity	5602.0 GB
Greater Two TB Volume Support	No
Volume Initialization Mode	Foreground Initialization
Volume Stripe Size	64 KBytes
Volume Cache Mode	Write Back
Tagged Command Queuing	Enabled
Fibre Channel:LUN Base:LUN	0 : 0 : 1
Volumes To Be Created	1

☐ Confirm The Operation

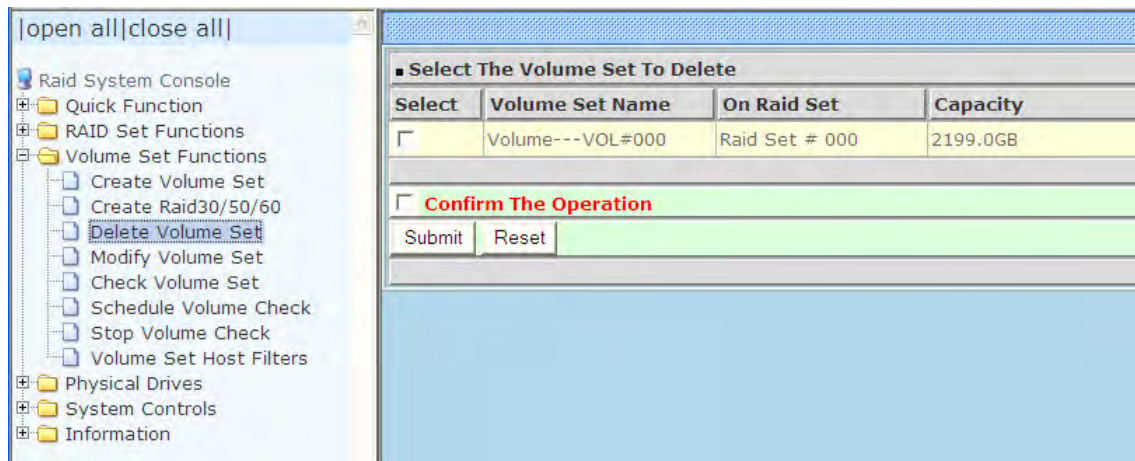
Submit Reset



NOTE: Refer to Section 5.3.1 Create Volume Set for detailed information about the Volume Set settings.

5.3.3 Delete Volume Set

To delete a Volume Set, select the Volume Set Functions in the main menu and click on the **Delete Volume Set** link. The **Select The Volume Set To Delete** screen will show all available Raid Sets. Tick on a Raid Set and check the **Confirm The Operation** option and then click on the **Submit** button to show all Volume Sets in the selected Raid Set. Tick on a Volume Set and check the **Confirm The Operation** option. Click on the **Submit** button to delete the Volume Set.

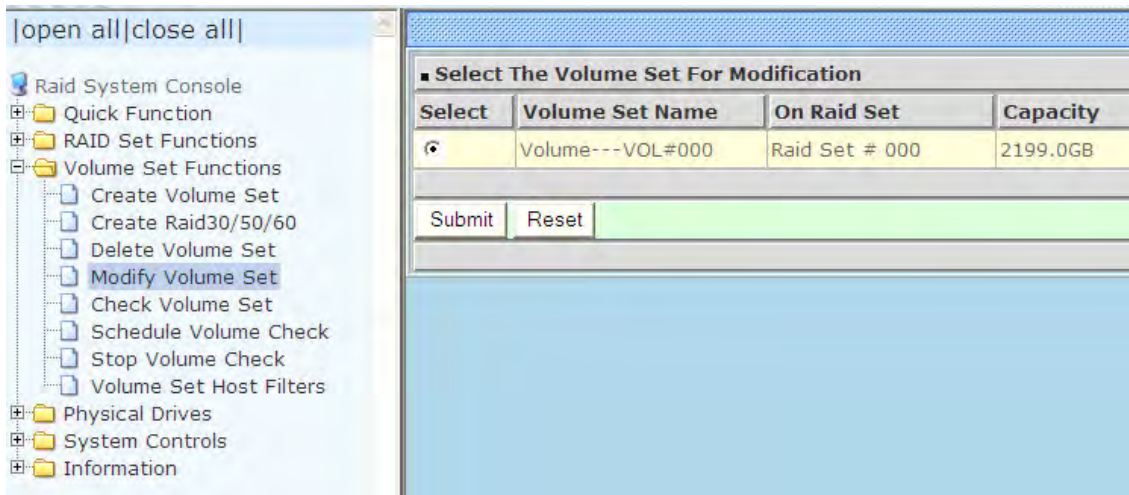


5.3.4 Modify Volume Set

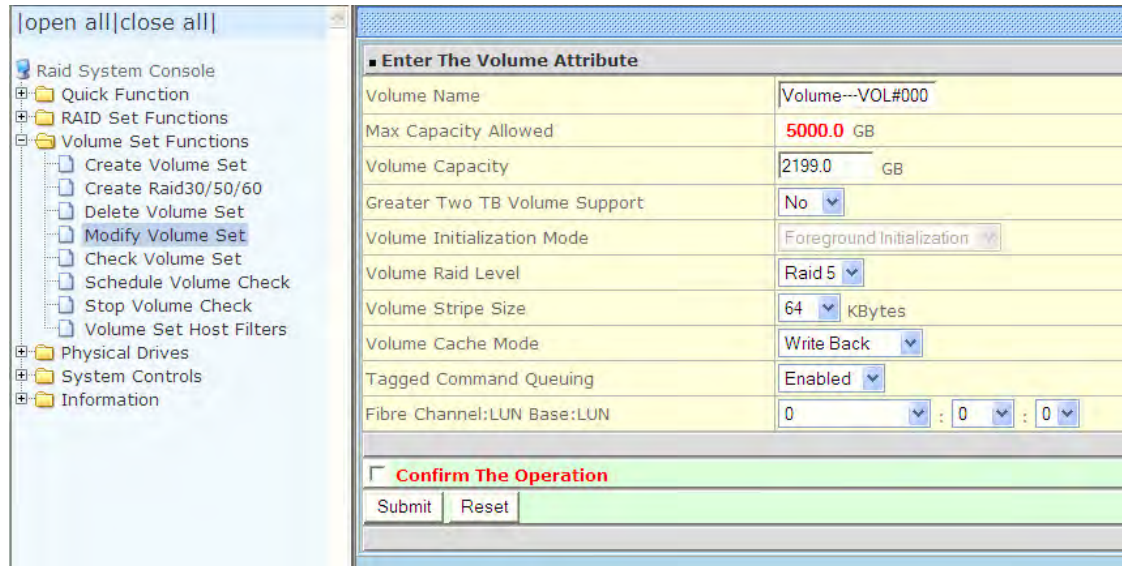
Use this function to modify Volume Set configuration.

To modify the attributes of a Volume Set:

1. Click on the **Modify Volume Set** link.
2. Tick from the list the Volume Set you want to modify. Click on the **Submit** button.



The following screen appears.



To modify Volume Set attribute values, select an attribute item and click on the attribute value. After completing the modification, tick on the **Confirm The Operation** option and click on the **Submit** button to save the changes.

5.3.4.1 Volume Set Expansion

Volume Capacity (Logical Volume Concatenation Plus Re-stripe)

Use the Expand Raid Set function to expand a Raid Set when a disk is added to your subsystem. (Refer to Section 5.2.3)

The expanded capacity can be used to enlarge the Volume Set size or create another Volume Set. Use the Modify Volume Set function to expand the Volume Set capacity. Select the Volume Set and move the cursor to the **Volume Set Capacity** item and enter the capacity size.

Tick on the **Confirm The Operation** and click on the **Submit** button to complete the action. The Volume Set starts to expand.

The screenshot shows the RAID System Console interface. On the left is a tree view with categories: Raid System Console, Quick Function, RAID Set Functions, Volume Set Functions, Physical Drives, System Controls, and Information. Under 'Volume Set Functions', 'Modify Volume Set' is selected. The main panel displays the 'Enter The Volume Attribute' dialog box. It has the following fields: Volume Name (Volume---VOL#000), Max Capacity Allowed (5000.0 GB), Volume Capacity (2199.0 GB), Greater Two TB Volume Support (No), Volume Initialization Mode (Foreground Initialization), Volume Raid Level (Raid 5), Volume Stripe Size (64 KBytes), Volume Cache Mode (Write Back), Tagged Command Queuing (Enabled), and Fibre Channel:LUN Base:LUN (0 : 0 : 0). At the bottom, there is a 'Confirm The Operation' checkbox which is checked, and 'Submit' and 'Reset' buttons.



NOTE: The Volume Set capacity of Raid30/50/60 cannot be expanded.

NOTE: The Stripe Size of a Raid30/50/60 Volume Set cannot be modified.

The screenshot shows the RAID System Console interface. On the left is the same tree view as before. The main panel displays the 'Controller Response' dialog box. It has a title bar 'Controller Response' and a yellow message box with the text: 'Cannot Expand RaidSet Contains Raid30/50/60 Volume'.

5.3.4.2 Volume Set Migration

Migration occurs when a Volume Set migrates from one RAID level to another, a Volume Set stripe size changes, or when a disk is added to a Raid Set.

Migrating status is displayed in the Volume Set status area of the RaidSet Hierarchy screen during migration.

[open all][close all]

Raid System Console

- Quick Function
 - RAID Set Functions
 - Create RAID Set
 - Delete RAID Set
 - Expand RAID Set
 - Offline RAID Set
 - Rename RAID Set
 - Activate Incomplete RAID S
 - Create Hot Spare
 - Delete Hot Spare
 - Rescue Raid Set
 - Volume Set Functions
 - Physical Drives
 - System Controls
 - Information
 - RAID Set Hierarchy**
 - System Information
 - Hardware Monitor

Stop Auto Refresh

■ RAID Set Hierarchy

RAID Set	Devices	Volume Set(Ch/Lun)	Volume State	Capacity
Raid Set # 000	E#1Slot#1	Volume---VOL#000(0/0)	Migrating(0.6%)	2199.0GB
	E#1Slot#2			
	E#1Slot#3			
	E#1Slot#4			
	E#1Slot#5			
	E#1Slot#6			
	E#1Slot#8			
Raid Set # 001	E#1Slot#7			

■ Enclosure#1 : SATA RAID Subsystem V1.0

Device	Usage	Capacity	Model
Slot#1(0:3)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#2(0:1)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#3(0:0)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#4(0:2)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#5(0:D)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#6(0:4)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#7(0:5)	Raid Set # 001	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#8(0:6)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#9(0:7)	Free	1000.2GB	Hitachi HDE721010SLA330

5.3.5 Check Volume Set

Use this function to perform Volume Set consistency check, which verifies the correctness of redundant data (data blocks and parity blocks) in a Volume Set. This basically means computing the parity from the data blocks and comparing the results to the contents of the parity blocks, or computing the data from the parity blocks and comparing the results to the contents of the data blocks.



NOTE: The Volume Set state must be Normal in order to perform Check Volume Set. Only RAID levels with parity (redundant data) such as RAID Levels 3, 5, 6, 30, 50, and 60 support this function.

To perform Check Volume Set function:

1. Click on the **Check Volume Set** link.
2. Tick from the list the Volume Set you want to check. Select the Check Volume Set options.

open all | close all

- Raid System Console
 - Quick Function
 - RAID Set Functions
 - Volume Set Functions
 - Create Volume Set
 - Create Raid30/50/60
 - Delete Volume Set
 - Modify Volume Set
 - Check Volume Set**
 - Schedule Volume Check
 - Stop Volume Check
 - Volume Set Host Filters
 - Physical Drives
 - System Controls
 - Information

Select The Volume Set To Be Checked

Select	Volume Set Name	On Raid Set	Capacity
<input type="checkbox"/>	Volume---VOL#000	Raid Set # 000	2199.0GB

☒ **Scrub Bad Block If Bad Block Is Found, Assume Parity Data Is Good.**
☒ **Re-compute Parity If Parity Error Is Found, Assume Data Is Good.**

☐ **Confirm The Operation**

Submit Reset

Check Volume Set Options:

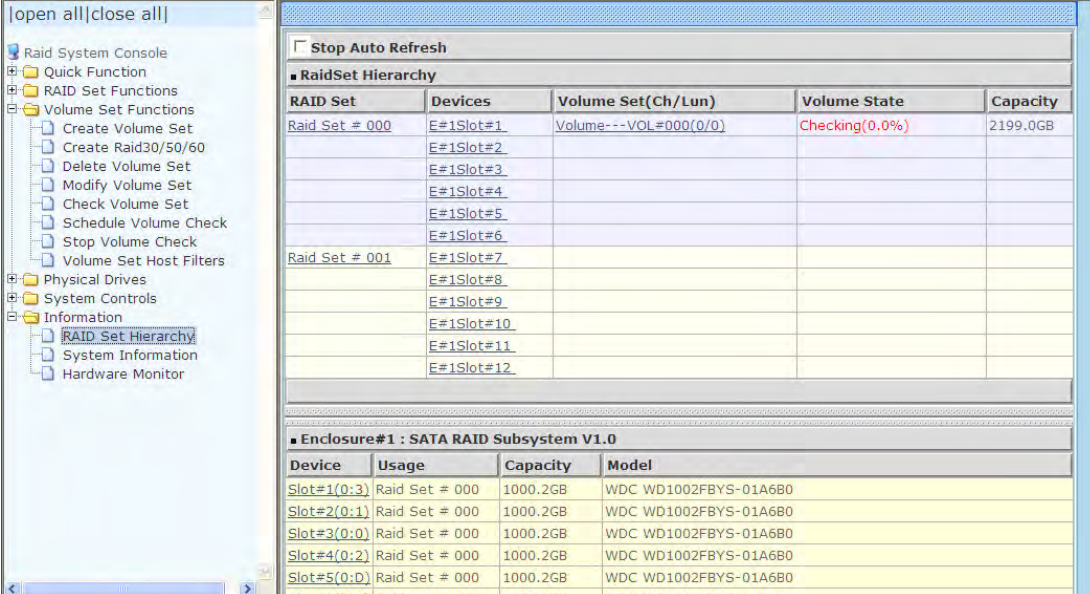
- **Scrub Bad Block If Bad Block Found, Assume Parity Data is Good**
- **Re-compute Parity if Parity Error, Assume Data is Good**



NOTE: When the 2 options are not selected, it will only check for errors. It is recommended to perform Check Volume Set with the 2 options unselected at first. If the result shows errors, the data must be backed up to a safe storage. Then the two options can be selected and redo Check Volume Set to correct the errors.

3. Tick on **Confirm The Operation** and click on the **Submit** button. The Checking process will be started.

The checking percentage can also be viewed by clicking on RaidSet Hierarchy in the Information menu.



The screenshot shows the RAID System Console interface. On the left is a tree view with the following structure:

- Raid System Console
 - Quick Function
 - RAID Set Functions
 - Volume Set Functions
 - Create Volume Set
 - Create Raid30/50/60
 - Delete Volume Set
 - Modify Volume Set
 - Check Volume Set
 - Schedule Volume Check
 - Stop Volume Check
 - Volume Set Host Filters
 - Physical Drives
 - System Controls
 - Information
 - RAID Set Hierarchy** (selected)
 - System Information
 - Hardware Monitor

The main area displays the RAID Set Hierarchy table:

RAID Set	Devices	Volume Set(Ch/Lun)	Volume State	Capacity
Raid Set # 000	E#1Slot#1	Volume---VOL#000(0/0)	Checking(0.0%)	2199.0GB
	E#1Slot#2			
	E#1Slot#3			
	E#1Slot#4			
	E#1Slot#5			
	E#1Slot#6			
Raid Set # 001	E#1Slot#7			
	E#1Slot#8			
	E#1Slot#9			
	E#1Slot#10			
	E#1Slot#11			
	E#1Slot#12			

Below the RAID Set Hierarchy table is the Enclosure#1: SATA RAID Subsystem V1.0 table:

Device	Usage	Capacity	Model
Slot#1(0:3)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#2(0:1)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#3(0:0)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#4(0:2)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#5(0:0)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#6(0:4)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0



NOTE: The result of Check Volume Set function is shown in System Events Information and Volume Set Information. In System Events Information, it is shown in the Errors column. In Volume Set Information, it is shown in Errors Found field.

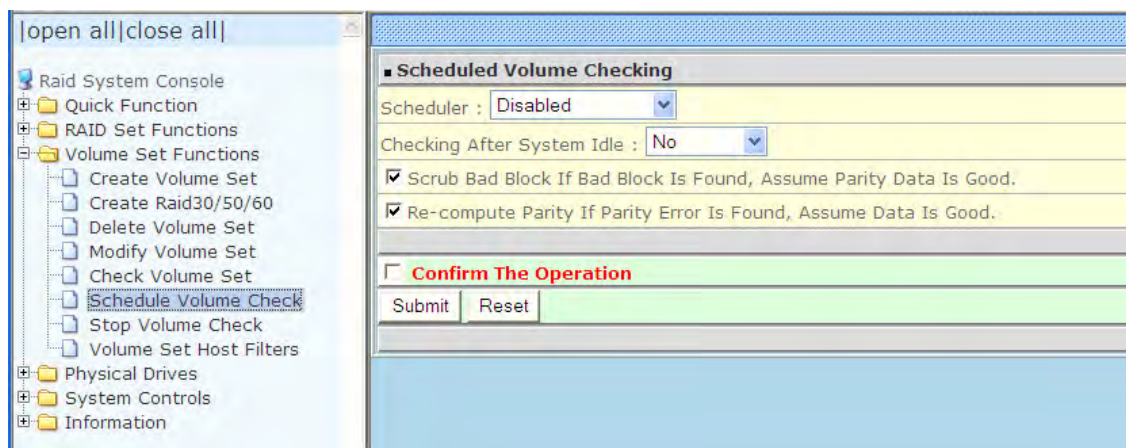
5.3.6 Schedule Volume Check

To perform Check Volume Set by schedule, follow these steps:

1. Click on the **Schedule Volume Check** link.
2. Select the desired schedule that you wish the Check Volume Set function to run. Tick on **Confirm The Operation** and click on the **Submit** button.

Scheduler: Disabled, 1Day (For Testing), 1Week, 2Weeks, 3Weeks, 4Weeks, 8Weeks, 12Weeks, 16Weeks, 20Weeks and 24Weeks.

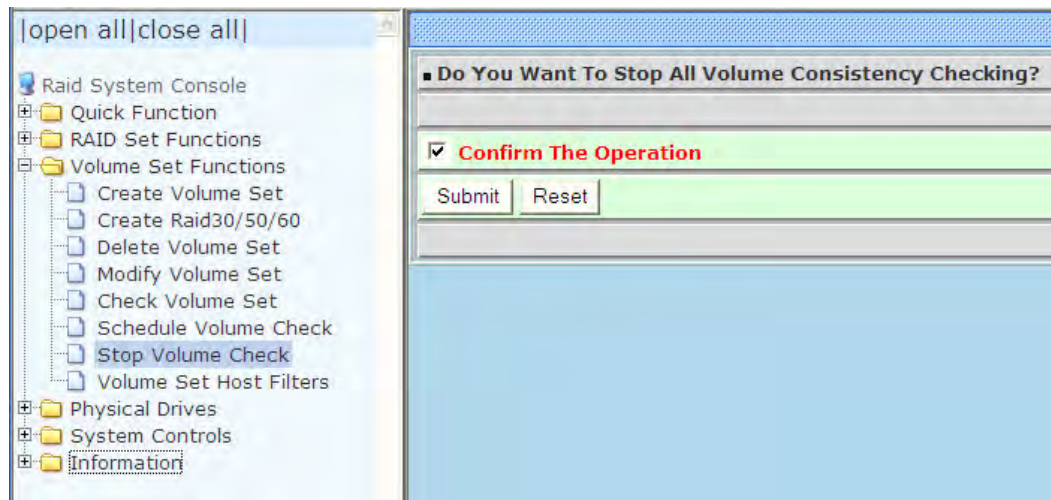
Check After System Idle: No, 1 Minute, 3 Minutes, 5 Minutes, 10 Minutes, 15 Minutes, 20 Minutes, 30 Minutes, 45 Minutes and 60 Minutes.



NOTE: To verify the Volume Check schedule, go to **Information -> RAID Set Hierarchy -> select the Volume Set -> the Volume Set Information** will be displayed.

5.3.7 Stop Volume Check

Use this option to stop all Volume Set consistency checking process/processes.



5.4 Physical Drive

Choose this option from the Main Menu to select a disk drive and to perform the functions listed below.

5.4.1 Create Pass-Through Disk

A Pass-Through Disk is a disk drive not controlled by the internal RAID subsystem firmware and thus cannot be a part of a Volume Set. A Pass-Through disk is a separate and individual Raid Set. The disk is available to the host as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID firmware.

To create pass-through disk, click on the **Create Pass-Through** link under the Physical Drives main menu. The setting function screen appears.

Select the disk drive to be made as Pass-Through Disk and configure the Pass-Through Disk attributes, such as the Cache Mode, Tagged Command Queuing, and Fibre Channel/LUN Base/LUN for this volume.

open all | close all

- Raid System Console
 - Quick Function
 - RAID Set Functions
 - Volume Set Functions
 - Physical Drives
 - Create Pass-Through Disk
 - Modify a Pass-Through Disk
 - Delete Pass-Through Disk
 - Identify Enclosure
 - Identify Drive
 - System Controls
 - Information

Select the IDE drive For Pass Through

Enclosure#1 : SATA RAID Subsystem V1.0

Slot	Capacity	Model
Slot#1	1000.2GB	WDC WD1002FBYS-01A680
Slot#2	1000.2GB	WDC WD1002FBYS-01A680
Slot#3	1000.2GB	WDC WD1002FBYS-01A680
Slot#4	1000.2GB	WDC WD1002FBYS-01A680
Slot#5	1000.2GB	WDC WD1002FBYS-01A680
Slot#6	1000.2GB	WDC WD1002FBYS-01A680
Slot#7	1000.2GB	WDC WD1002FBYS-01A680
Slot#8	1000.2GB	WDC WD1002FBYS-01A680
Slot#9	1000.2GB	Hitachi HDE721010SLA330
Slot#10	1000.2GB	Hitachi HDE721010SLA330
Slot#11	1000.2GB	Hitachi HDE721010SLA330
Slot#12	1000.2GB	Hitachi HDE721010SLA330

Enter Pass Through Disk Attribute

Volume Cache Mode: Write Back

Tagged Command Queuing: Enabled

Fibre Channel:LUN Base:LUN: 0 : 0 : 0

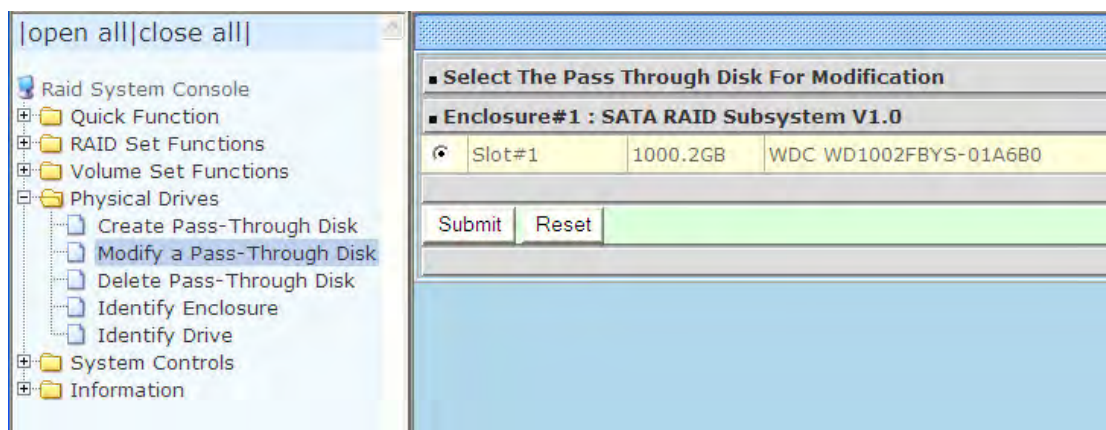
Confirm The Operation

Submit Reset

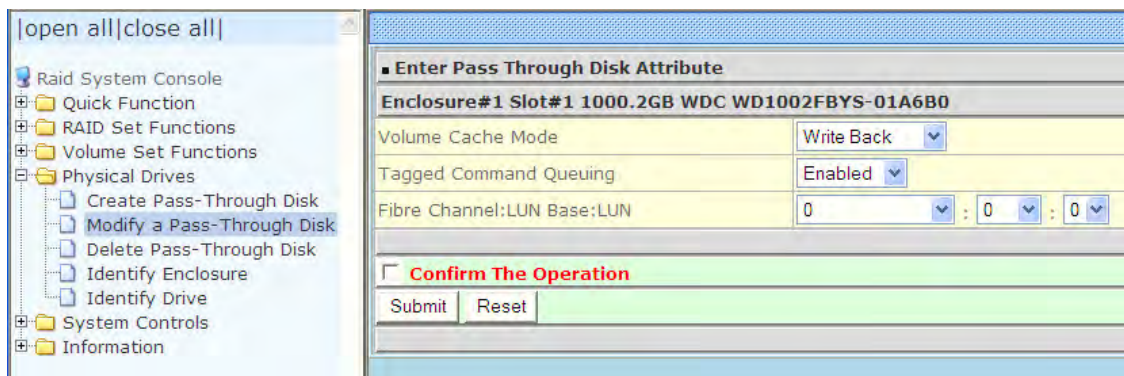
5.4.2 Modify a Pass-Through Disk

Use this option to modify the attribute of a Pass-Through Disk. User can modify the Cache Mode, Tagged Command Queuing, and Fibre Channel/LUN Base/LUN on an existing Pass-Through Disk.

To modify the Pass-Through drive attribute from the Pass-Through drive pool, click on the **Modify a Pass-Through Disk** link. The “Select The Pass-Through Disk For Modification” screen appears. Tick on the Pass-Through Disk from the Pass-Through drive pool and click on the **Submit** button to select the drive.

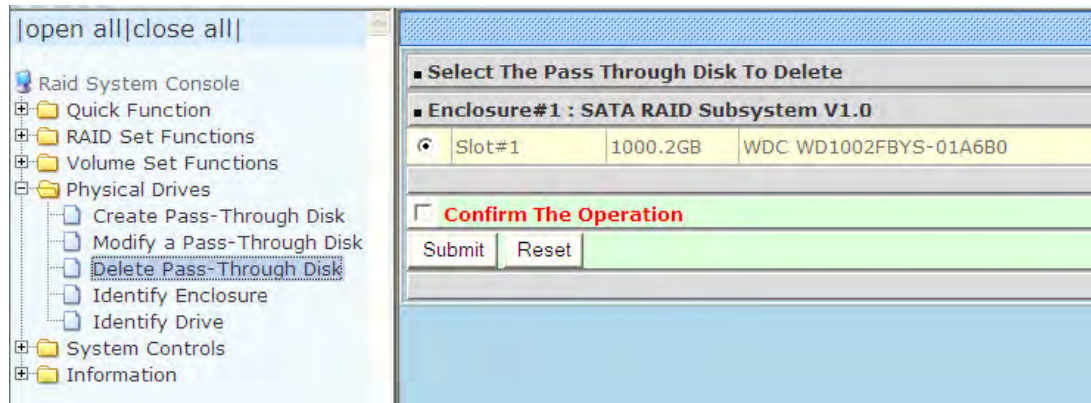


The Enter Pass-Through Disk Attribute screen appears. Modify the drive attribute values as you want.



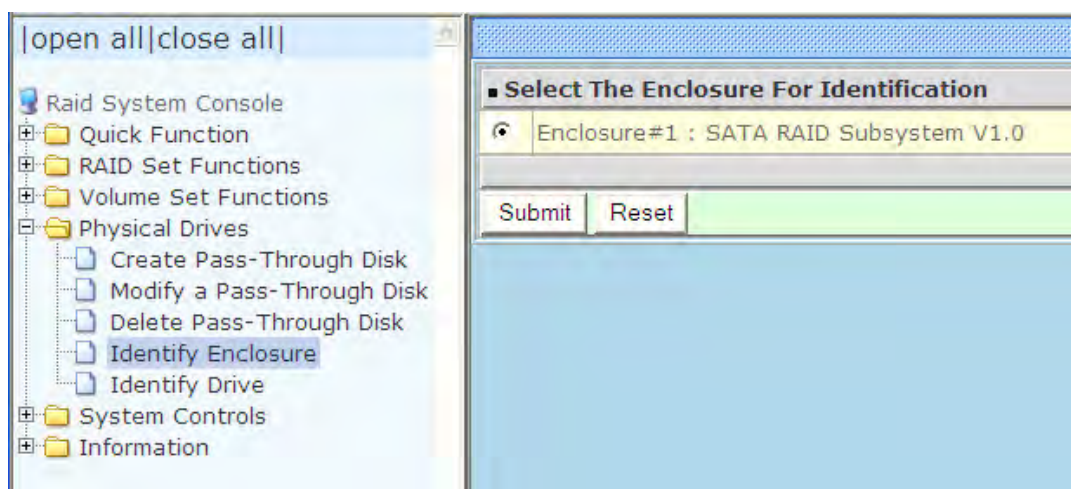
5.4.3 Delete Pass-Through Disk

To delete Pass-Through Disk from the Pass-Through drive pool, click on **Delete Pass-Through** link. Select a Pass-Through Disk, tick on the **Confirm The Operation** and click the **Submit** button to complete the delete action.



5.4.4 Identify Enclosure

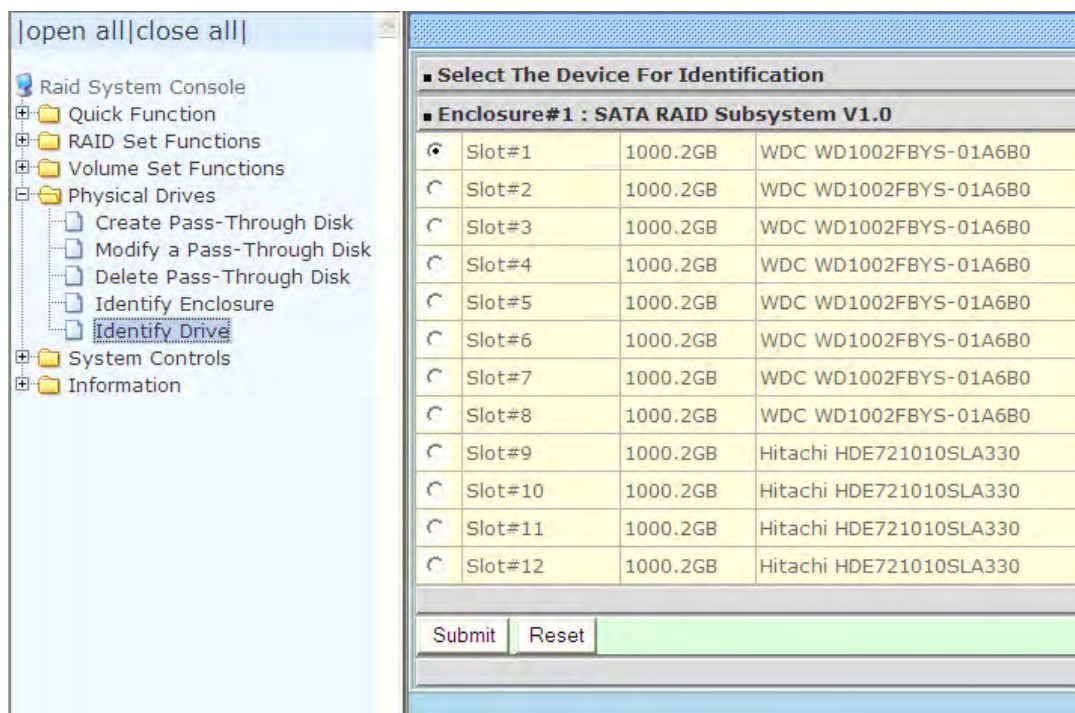
To identify an Enclosure, move the mouse cursor and click on **Identify Enclosure** link. The **Select The Enclosure For Identification** screen appears. Tick on the enclosure from the list of enclosures, then click on the **Submit** button to identify the selected enclosure. All disk drives' LEDs in an enclosure will flash when a particular enclosure is selected.



5.4.5 Identify Selected Drive

Use this option to physically locate a selected drive to prevent removing the wrong drive. When a disk drive is selected using the **Identify Drive** function, the Status LED of the selected disk drive will be blinking.

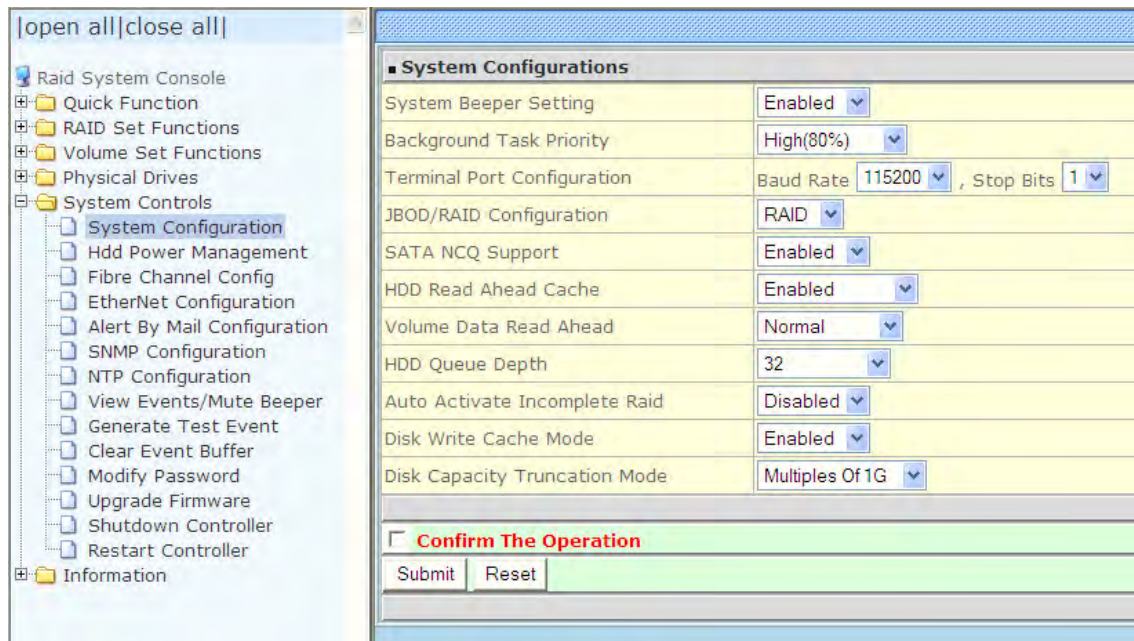
To identify a selected drive from the drives pool, click on the **Identify Drive** link. The "Select The IDE Device For identification" screen appears. Tick on the IDE device from the drives list. After completing the selection, click on the **Submit** button to identify selected drive.



5.5 System Controls

5.5.1 System Configuration

To set the RAID subsystem system configuration options, click the **System Configuration** link under the **System Controls** menu. The System Configurations screen will be shown. Set the desired system option as needed.



System Beeper Setting:

This option is used to Disable or Enable the system's RAID controller alarm beeper.

Background Task Priority:

The Background Task Priority indicates how much time and system resource the RAID controller devotes to a background task, such as a rebuild operation. The RAID subsystem allows user to choose the background task priority (High 80%, Medium 50%, Low 25%, and Ultra Low 5%) to balance between background task process and Volume Set access. For high RAID subsystem performance, specify a low value.

JBOD/RAID Configuration:

The RAID subsystem supports JBOD and RAID configuration.

SATA NCQ Support:

NCQ is a command protocol in Serial ATA that can only be implemented on native Serial ATA hard drives. It allows multiple commands to be outstanding within a drive at the same time. Drives that support NCQ have an internal queue where outstanding commands can be dynamically rescheduled or re-ordered, along with the necessary tracking mechanisms for outstanding and completed portions of the workload. Disabled or Enable the SATA NCQ function.

HDD Read Ahead Cache:

This option allows the users to disable the cache of the HDDs on the RAID subsystem. In some HDD models, disabling the cache in the HDD is necessary to prove the RAID subsystem functions correctly.

Volume Data Read Ahead:

This option allows the users to set the Volume Data Read Ahead function. Options are: Normal, Aggressive, Conservative, and Disabled.

HDD Queue Depth:

The queue depth is the number of I/O operations that can be run in parallel on a disk drive. HDD Queue Depth options are 1, 2, 4, 8, 16, and 32.

Disk Write Cache Mode:

The RAID subsystem supports Disk Write Cache Mode options: Auto, Enabled, and Disabled. If the RAID subsystem has BBM (battery backup module), selecting the Auto option will automatically enable Disk Write Cache. On the other hand, if there is no BBM, the Auto option will disable Disk Write Cache.

Disk Capacity Truncation Mode:

The RAID subsystem use drive truncation so that drives from different vendors are more likely to be able to be used as spares for each other. Drive truncation slightly decreases the usable capacity of a drive that is used in the subsystem. Options are:

Multiples Of 10G: If you have several 120GB drives from different vendors, chances are that the capacity varies slightly. For example, one drive might be 121.1 GB, and the other 120.4 GB. This drive truncation mode makes the 121.1 GB and 120.4 GB drives same capacity as 120 GB so that one could replace the other.

Multiples Of 1G: If you have 120 GB drives from different vendors, chances are that the capacity varies slightly. For example, one drive might be 121.1 GB, and the other 121.4 GB. This drive truncation mode makes the 121.1 GB and 121.4 GB drives same capacity 121 GB so that one could replace the other.

No Truncation: The capacity of the disk drive is not truncated.

5.5.2 HDD Power Management

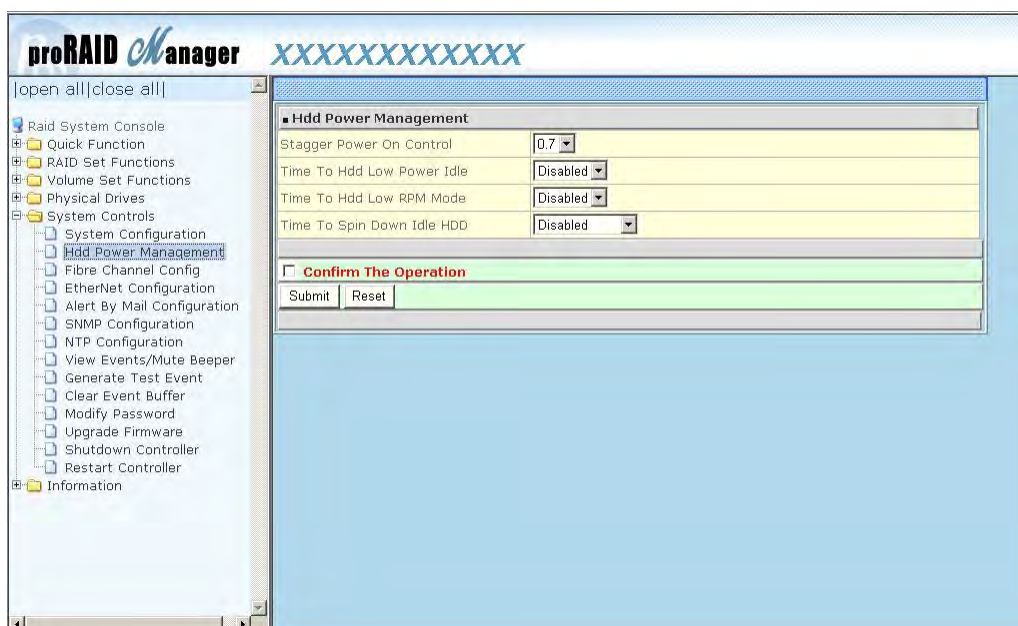
MAID (**M**assive **A**rray of **I**dle **D**isks) is a storage technology that employs a large group of disk drives in which only those drives in active use are spinning at any given time.

This reduces power consumption and prolongs the lives of the drives.

MAID is designed for Write Once, Read Occasionally (WORO) applications such as Data Backup, Document, Mail server, and so on.

MAID technology focuses on "Green Storage Concept" to save power consumption and enhance disk drives effective usage, i.e., "disk drives are spun down when there is no activity or I/O on the drives".

In the RAID subsystem, MAID is implemented in the **HDD Power Management** menu. Using the **Advanced Power Management (APM)** function of disk drives, HDD Power Management has three options (MAID Levels): (Level 1) Place idle drives in Lower Power Mode, where the drives' heads are unloaded; (Level 2) Place idle drives in Low RPM Mode, where drives' heads are unloaded and slows down to around 4000 RPM; and (Level 3) Spin down idle drives, where drives stop spinning and goes into sleep mode.



Stagger Power On Control:

This option allows the RAID subsystem's power supply to power up in succession each HDD in the RAID subsystem. In the past, all the HDDs on the RAID subsystem are powered up altogether at the same time. This function allows the power transfer time (lag time) from the last HDD to the next one be set within the range of 0.4 to 6.0 seconds. Default is 0.7 seconds.

Time to HDD Low Power Idle: (MAID Level 1)

This option enables the RAID subsystem to place idle HDDs of a Raid Set in Low Power Mode, where drives' heads are unloaded. The power consumption of the Idle HDD saving is around 15% to 20%. Recovery time is under a second.

Options are: Disabled, 2, 3, 4, 5, 6, and 7 (Minutes).

Time to HDD Low RPM Mode: (MAID Level 2)

This option enables the RAID subsystem to place idle HDDs of a Raid Set in Low RPM Mode, where drives' heads are unloaded and drive platters speed is reduced to around 4000 RPM. The power consumption of the Idle HDD saving is from 35% to 45%. Recovery time is 15 seconds.

Options are: Disabled, 10, 20, 30, 40, 50, and 60 (Minutes).

Time to Spin Down Idle HDD: (MAID Level 3)

This option enables the Raid subsystem to spin down HDDs of a Raid Set after they become idle after a preset period of time. In this level, the drives stop spinning and go into sleep mode. The power consumption of the Idle HDD saving is from 60% to 70%. Recovery time is 30 to 45 seconds.

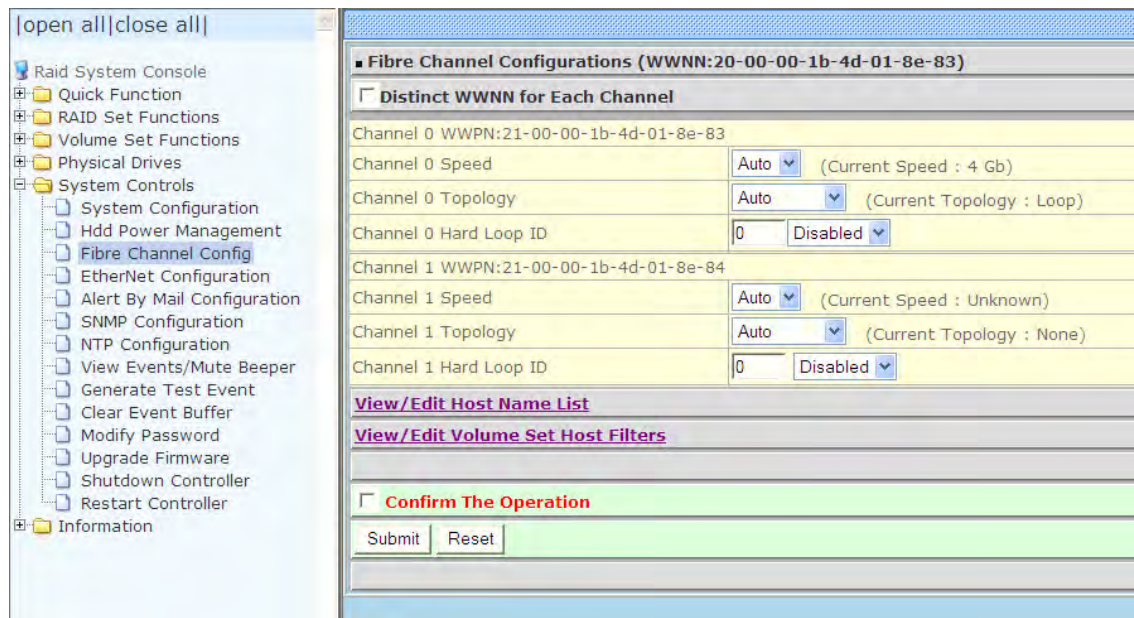
Options are: Disabled, 1 (For Test), 3, 5, 10, 15, 20, 30, 40, and 60 (Minutes).



NOTE: To verify if the disk drive you use supports MAID or APM, select **"RaidSet Hierarchy"** and click the **disk drive (E# Slot#)** link. Check in the **Device Information** screen if the **Disk APM Support** shows **"Yes"**.

5.5.3 Fibre Channel Config

To set the Fibre Channel Configuration function, move the mouse cursor to the main menu and click on the **Fibre Channel Config**. The Fibre Channel Configuration screen will be shown. Configure the desired function.



WWNN (World Wide Node Name)

The WWNN of the FC RAID system is shown at top of the configuration screen. This is an eight-byte unique address factory assigned to the FC RAID, common to both FC ports.

WWPN (World Wide Port Name)

Each FC port has its unique WWPN, which is also factory assigned. Usually, the WWNN:WWPN tuple is used to uniquely identify a port in the Fabric.

Channel Speed

Each FC port speed can be configured either as 1Gbps, 2Gbps, or 4Gbps channel. Another option is to use "Auto" for auto speed negotiation between 1Gbps/2Gbps/4Gbps. The RAID system's default setting is "Auto", which should be adequate under most conditions. The Channel Speed setting takes effect during the next connection. That means a link down / link up should be applied for the change to take effect. The current connection speed is shown at end of the row. You have to click the "Fibre Channel Config" link again from the menu frame to refresh the current speed information.

Channel Topology

Each Fibre Channel can be configured to the following Topology options: Fabric, Point-to-Point, Loop, or Auto. The default Topology is set to "Auto", which takes precedence of Loop Topology. Restarting the RAID controller is needed for any topology change to take effect. The current connection topology is shown at end of the row. You have to click the "Fibre Channel Config" link again from the menu frame to refresh the current topology information. Note that current topology is shown as "None" when no successful connection is made for the channel.

Hard Loop ID

This setting is effective only under Loop topology. When enabled, you can manually set the Loop ID in the range from 0 to 125. Make sure this hard assigned ID does not conflict with other devices on the same loop, otherwise the channel will be disabled. It is a good practice to disable the hard loop ID and let the loop itself auto-arrange the Loop ID.



NOTE: For reliable operation of the RAID subsystem and depending on how the subsystem is connected, it is recommended to setup Channel Speed and Channel Topology as follows:

RAID subsystem is connected to:	Channel Speed setting:	Channel Topology setting:
4Gb FC switch	4Gb	Fabric
2Gb FC switch	2Gb	Fabric
4Gb FC HBA (no switch)	4Gb	Loop
2Gb FC HBA (no switch)	2Gb	Loop

"Fabric" topology is used when there is switch.

"Loop" topology is used when there is no switch.

The Speed setting follows the FC switch speed if there is switch. If there is no FC switch, the Speed setting follows the FC HBA speed.

5.5.3.1 View/Edit Host Name List

To set up LUN masking for each volume, a host list should be established first. This is done by clicking “View/Edit Host Name List” link at bottom of “Fibre Channel Config” page. Only hosts that will be used as include/exclude filters are necessary to be added.

The subsystem provides two ways to add a host to the list:

1. Selecting WWN from Detected Host.
2. Keying in. First, enter the WWPN (exact 16 hex digits) of the host in the “Host WWN” text field. Optional host nick name (up to 23 ASCII characters) can be given for descriptive purpose.

Choose “Add” operation, then Confirm/Submit to complete the add operation.

The added host will be shown in the upper half of the Config Frame. Up to 20 hosts can be added.

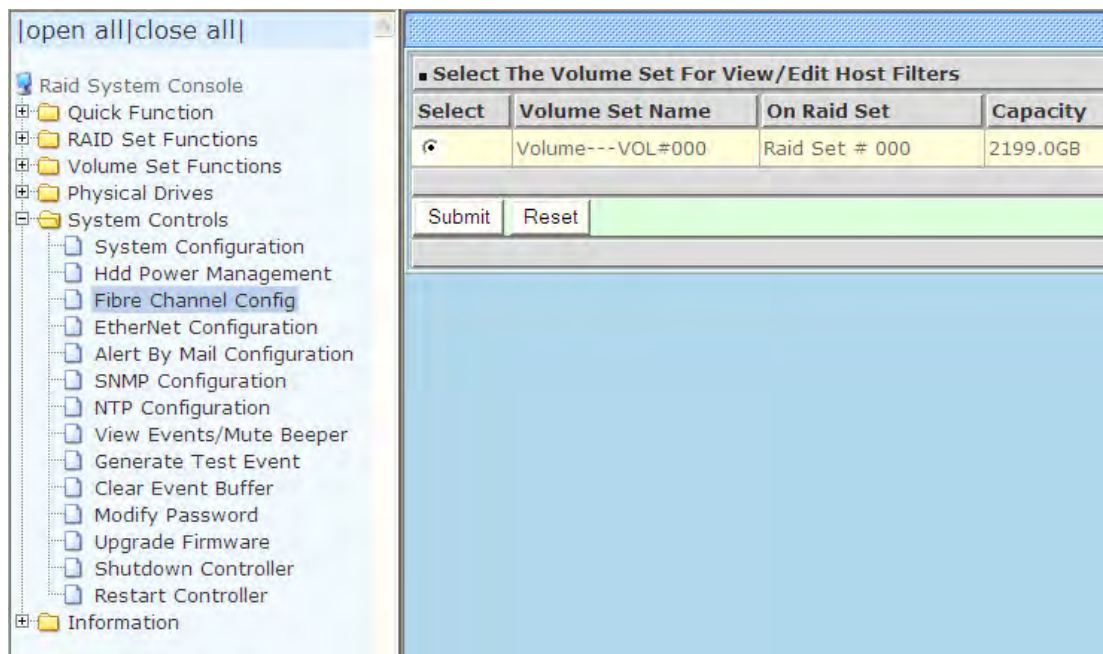
To delete a host from the list, select the radio button before the host name in the host list. Choose “Delete” operation, and then Confirm/Submit to complete the delete operation.

Once volumes are created and the host name list is established, Volume Set Host Filters can be specified by clicking “View/Edit Volume Set Host Filters” link at bottom of “Fibre Channel Configuration” page.

The screenshot displays the 'Fibre Channel Host Name List' configuration window. On the left, a navigation tree includes 'Raid System Console', 'Quick Function', 'RAID Set Functions', 'Volume Set Functions', 'Physical Drives', 'System Controls' (with sub-items like 'System Configuration', 'Hdd Power Management', 'Fibre Channel Config', etc.), and 'Information'. The 'Fibre Channel Config' option is highlighted. The main configuration area on the right features a title bar, a 'None' button, and a section titled 'Add or Delete Selected Host Name Entry'. Within this section, the 'Select WWN From Detected Host' checkbox is checked. Below it, the 'Type' field has radio buttons for 'WWNN' and 'WWPN'. The 'From' field has checkboxes for 'Channel 0' and 'Channel 1'. The 'Host WWN' field contains the value '210000244f0a0243' with a dropdown arrow. The 'Nick Name' field is empty. The 'Operation' dropdown is set to 'Add'. At the bottom, a green bar contains the text 'Confirm The Operation' and two buttons: 'Submit' and 'Reset'.

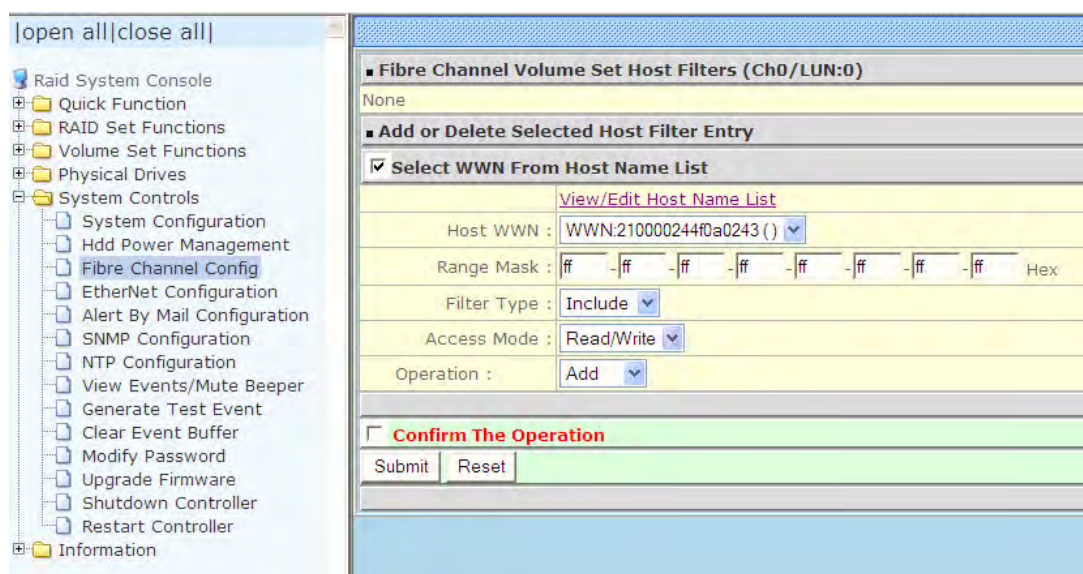
5.5.3.2 Volume Set Host Filters

Volume Set Host Filters can be specified by clicking “View/Edit Volume Set Host Filters” link at bottom of “Fibre Channel Config” page. Then select the Volume Set name and click Submit.



To add a host filter entry, first select the host to be include/exclude from Host WWN list.

Adjust Range Mask, Filter Type, Access Mode fields. Choose “Add” operation, then Confirm/Submit to complete the add operation. The added host filter entry will be shown in the upper half of the Config Frame. Up to 8 host filter entries can be added.



To delete a host filter entry from the list, select the radio button before the host name entry. Choose “Delete” operation, and then Confirm/Submit to complete the delete operation.

Range Mark

Sometimes it is convenient to combine some co-related WWNs into one ID range as a single filter entry. This ID range is obtained by “AND’ing” the host WWN and the Range Mask (which are both 64-bit entities). For example, if hosts 0x210000e0_8b03dc84 and 0x210000e0_8b03dc85 have the same access control, they can be combined as a single filter entry (using either WWN as host WWN) with Range Mask setting as 0xFFFFFFFF_FFFFFFFE. Note that under most circumstances, the Range Mask is left as 0xFFFFFFFF_FFFFFFFF, which means that only a single WWN is specified for that filter entry.

Filter Type

Each filter entry can be set to include or exclude certain host(s) from data access.

If a node’s WWN falls in an ID range specified as Exclude, the related Volume Set will be “invisible” to this node and no data access is possible.

If a node’s WWN falls in an ID range specified as Include and does not fall in any ID range specified as Exclude, this node will be allowed to access the data of the related Volume Set.

The access mode can be specified as normal “Read/Write” or restricted “Read Only”.

If a node’s WWN falls in none of the ranges and there is at least one Include-type entry specified, this node is considered as Excluded; otherwise, it is considered as Included.



NOTE: When no Filter Entries are specified for a Volume Set, any node can access the Volume Set as there is no LUN masking.

Access Mode

For certain applications, it is desired to limit the data access as “Read Only” such that the data on the volume won’t be accidentally modified. This can be done by setting the Access Mode of the Included ID range as “Read Only”. However, some Operating Systems (e.g. Linux) may ignore this “Write Protect” attribute and still issue write commands to the protected volumes.

The response to these write commands will then be “Data Protected” error. It is suggested to mount the volumes as “Read Only” for a consistent behavior, if possible.

5.5.4 EtherNet Configuration

To set the Ethernet configuration, click the **EtherNet Configuration** link under the System Controls menu. The RAID subsystem EtherNet Configuration screen will be shown. Set the desired configuration. Once done, tick on the **Confirm The Operation** and click the **Submit** button to save the settings.

proRAID Manager XXXXXXXXXXXXXXXX

[open all][close all]

- Raid System Console
- Quick Function
- RAID Set Functions
- Volume Set Functions
- Physical Drives
- System Controls
 - System Configuration
 - Hdd Power Management
 - Fibre Channel Config
 - EtherNet Configuration**
 - Alert By Mail Configuration
 - SNMP Configuration
 - NTP Configuration
 - View Events/Mute Beeper
 - Generate Test Event
 - Clear Event Buffer
 - Modify Password
 - Upgrade Firmware
 - Shutdown Controller
 - Restart Controller
- Information

■ Ether Net Configurations

DHCP Function	Enabled
Local IP Address (Used If DHCP Disabled)	192 . 168 . 1 . 111
Gateway IP Address (Used If DHCP Disabled)	192 . 168 . 1 . 1
Subnet Mask (Used If DHCP Disabled)	255 . 255 . 255 . 0
HTTP Port Number (7168..8191 Is Reserved)	80
Telnet Port Number (7168..8191 Is Reserved)	23
SMTP Port Number (7168..8191 Is Reserved)	25
Current IP Address	192.168.1.111
Current Gateway IP Address	192.168.1.1
Current Subnet Mask	255.255.255.0
Ether Net MAC Address	00:18:4D:01:04:76

☐ **Confirm The Operation**

Submit Reset



NOTE: If HTTP, Telnet and SMTP Port Number is set to "0", the service is disabled.

5.5.5 Alert By Mail Configuration

To set the Event Notification function, click on the **Alert By Mail Configuration** link under the System Controls menu. The RAID subsystem Event Notification configuration screen will be shown. Set up the desired function and option. When an abnormal condition occurs, an error message will be emailed to the email recipient(s) that a problem has occurred. Events are classified into 4 levels (Urgent, Serious, Warning, and Information).

SMTP Server Configuration

SMTP Server IP Address: 0 . 0 . 0 . 0

Mail Address Configurations

Sender Name : _____ Mail Address : _____

Account : _____ Password : _____

MailTo Name1 : _____ Mail Address : _____

MailTo Name2 : _____ Mail Address : _____

MailTo Name3 : _____ Mail Address : _____

MailTo Name4 : _____ Mail Address : _____

Event Notification Configurations

☒ Disable Event Notification No Event Notification Will Be Sent

☐ Urgent Error Notification Send Only Urgent Event

☐ Serious Error Notification Send Urgent And Serious Event

☐ Warning Error Notification Send Urgent, Serious And Warning Event

☐ Information Notification Send All Event

☐ Notification For No Event Notify User If No Event Occurs Within 24 Hours

☐ **Confirm The Operation**

Submit Reset



NOTE: If Event Notification by email is enabled, every 30 of event log will be sent to the email recipient(s) as one package log.

5.5.6 SNMP Configuration

The SNMP gives users independence from the proprietary network management schemes of some manufacturers and SNMP is supported by many WAN and LAN manufacturers enabling true LAN/ WAN management integration.

To set the SNMP function, move the cursor to the main menu and click on the **SNMP Configuration** link. The RAID subsystem's SNMP Configurations screen will be shown. Select the desired function and set the preferred option.

proRAID Manager XXXXXXXXXXXXXXXX

[open all] [close all]

- Raid System Console
- Quick Function
- RAID Set Functions
- Volume Set Functions
- Physical Drives
- System Controls
 - System Configuration
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 - Fibre Channel Config
 - EtherNet Configuration
 - Alert By Mail Configuration
 - SNMP Configuration**
 - NTP Configuration
 - View Events/Mute Beeper
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 - Modify Password
 - Upgrade Firmware
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 - Restart Controller
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■ SNMP Trap Configurations

SNMP Trap IP Address #1	0 . 0 . 0 . 0	Port#	162
SNMP Trap IP Address #2	0 . 0 . 0 . 0	Port#	162
SNMP Trap IP Address #3	0 . 0 . 0 . 0	Port#	162

■ SNMP System Configurations

Community	
sysContact.0	
sysName.0	
sysLocation.0	

■ SNMP Trap Notification Configurations

<input checked="" type="radio"/> Disable SNMP Trap	No SNMP Trap Will Be Sent
<input type="radio"/> Urgent Error Notification	Send Only Urgent Event
<input type="radio"/> Serious Error Notification	Send Urgent And Serious Event
<input type="radio"/> Warning Error Notification	Send Urgent, Serious And Warning Event
<input type="radio"/> Information Notification	Send All Event

☐ **Confirm The Operation**

SNMP Trap Configurations: Type in the SNMP Trap IP Address box the IP address of the host system where SNMP traps will be sent. The SNMP Port is set to 162 by default.

SNMP System Configuration:

Community: Type the SNMP community. The default is public.

(1) **sysContact.0**, (2) **sysLocation.0**, and (3) **sysName.0**: SNMP parameter (31 bytes max). If these 3 categories are configured and when an event occurs, SNMP will send out a message that includes the 3 categories within the message. This allows user to easily define which RAID unit is having problem.

SNMP Trap Notification Configurations: Select the desired option.

After completing the settings, tick on the **Confirm The Operation** and click on the **Submit** button to save the configuration.

SNMP also works in the same way as Alert By Mail when sending event notifications.

5.5.7 NTP Configuration

NTP stands for **Network Time Protocol**. It is an Internet protocol used to synchronize the clocks of computers to some time reference. Type the NTP Server IP Address to enable the RAID subsystem to synchronize with it.

To set the NTP function, move the cursor to the main menu and click on the **NTP Configuration** link. The RAID subsystem's NTP Configuration screen will be displayed. Select the desired function and configure the necessary option.

After completing the settings, tick on the **Confirm The Operation** and click on the **Submit** button to save the configuration.

proRAID Manager XXXXXXXXXXXXXXXX

[open all][close all]

- Raid System Console
 - Quick Function
 - RAID Set Functions
 - Volume Set Functions
 - Physical Drives
 - System Controls
 - System Configuration
 - Hdd Power Management
 - Fibre Channel Config
 - EtherNet Configuration
 - Alert By Mail Configuration
 - SNMP Configuration
 - NTP Configuration**
 - View Events/Mute Beeper
 - Generate Test Event
 - Clear Event Buffer
 - Modify Password
 - Upgrade Firmware
 - Shutdown Controller
 - Restart Controller
 - Information

■ NTP Server Configurations

NTP Server IP Address #1 [0][0][0][0]

NTP Server IP Address #2 [0][0][0][0]

■ Time Zone Configuration

Time Zone : (GMT+08:00)Taipei

Automatic Daylight Saving : Enabled

Current Time : 2009/4/20 19:33:29

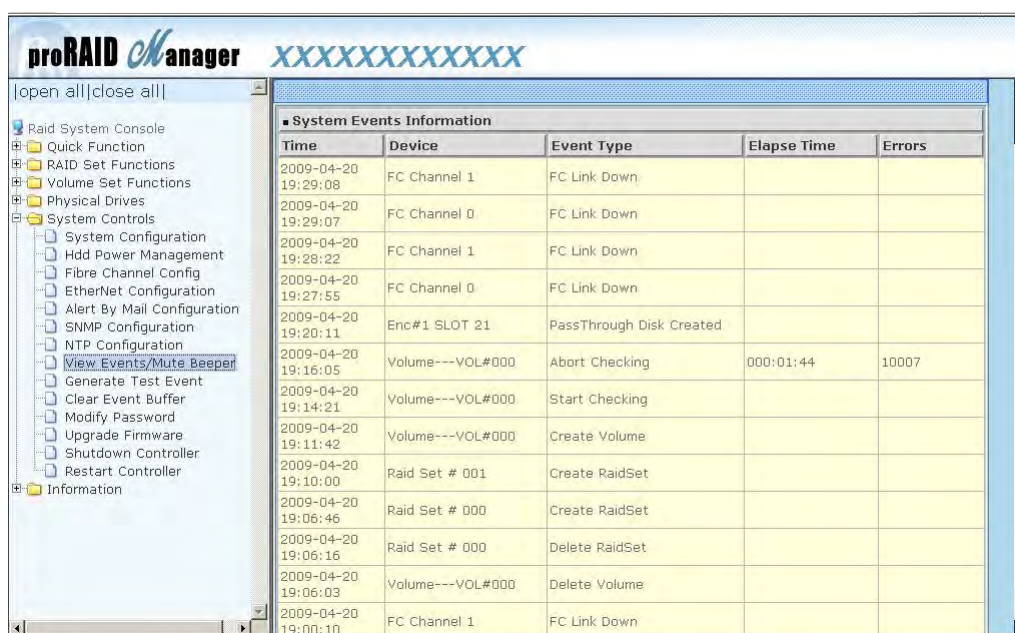
NTP Server Not Set

☐ **Confirm The Operation**

5.5.8 View Events / Mute Beeper

To view the RAID subsystem's event log information, move the mouse cursor to the System Controls menu and click on the **View Events/Mute Beeper** link. The Raid Subsystem's System Events Information screen appears.

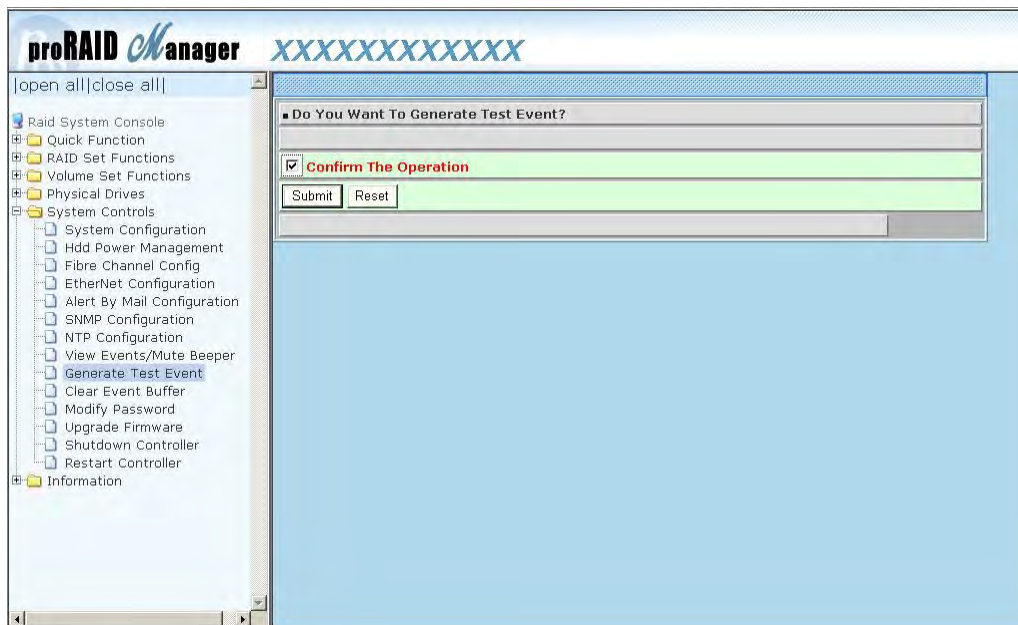
The System Events Information screen will show: Time, Device, Event type, Elapse Time and Errors.



This function is also used to silence the beeper alarm.

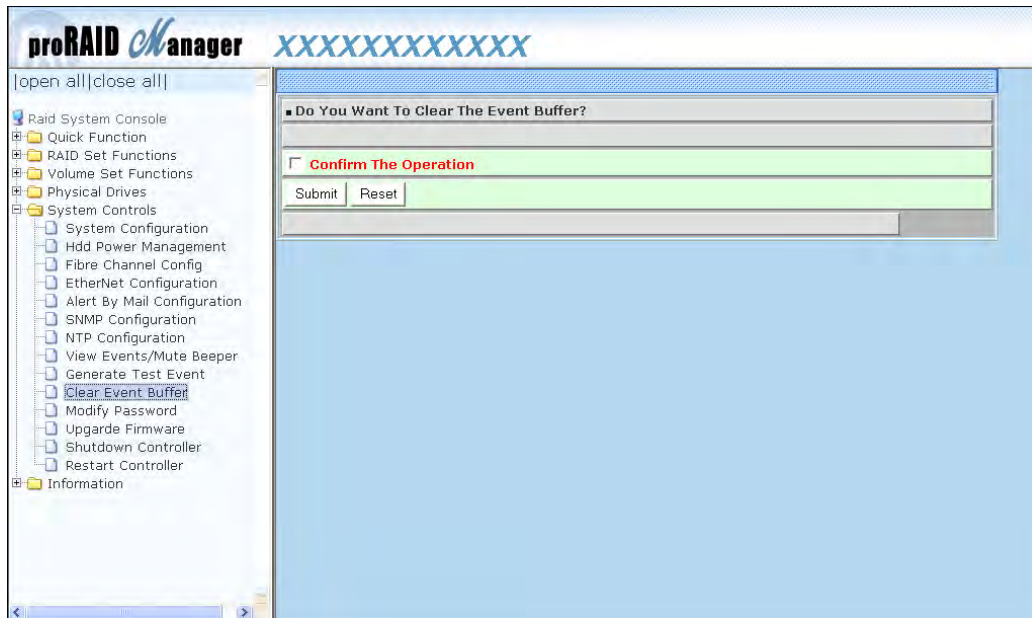
5.5.9 Generate Test Event

If you want to generate test events, move the cursor bar to the main menu and click on the **Generate Test Event** Link. Tick on the **Confirm The Operation** and click on the **Submit** button. Then click on the **View Events/Mute Beeper** to view the test event.



5.5.10 Clear Event Buffer

Use this feature to clear the RAID subsystem's System Events Information buffer.



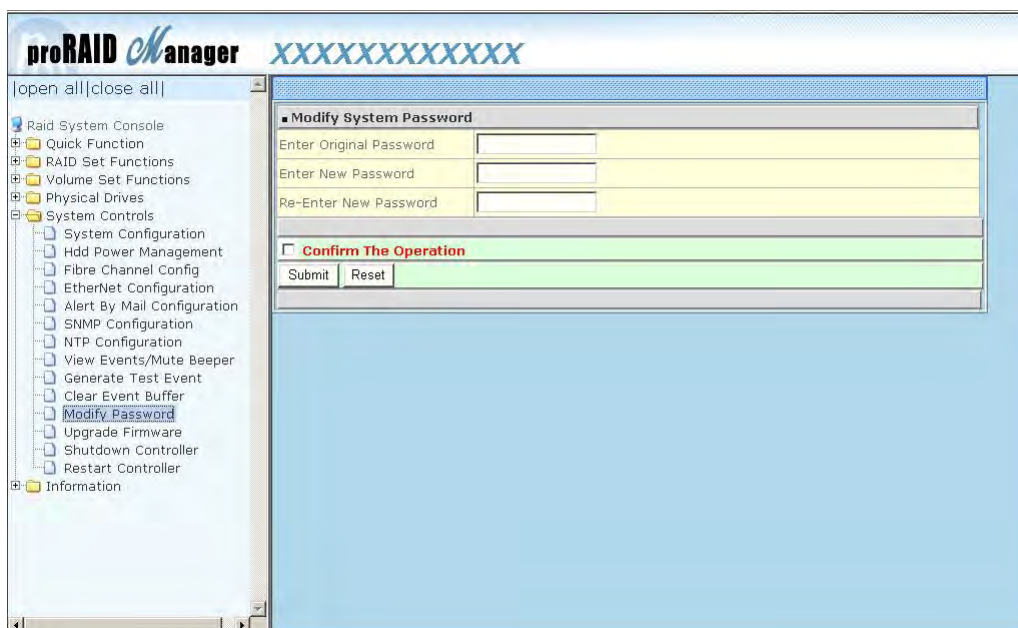
5.5.11 Modify Password

To change or disable the RAID subsystem's admin password, click on the **Modify Password** link under the **System Controls** menu. The Modify System Password screen appears.

The factory-default admin password is set to **00000000**. Once the password has been set, the user or administrator can only monitor and configure the RAID subsystem by providing the correct password.

The password is used to protect the RAID subsystem's configuration from unauthorized access. The RAID controller will check the password only when entering the Main Menu from the initial screen. The RAID subsystem will automatically go back to the initial screen when it does not receive any command after sometime.

To disable the password, enter only the original password in the **Enter Original Password** box, and leave both the **Enter New Password** and **Re-Enter New Password** boxes blank. After selecting the **Confirm The Operation** option and clicking the **Submit** button, the system password checking will be disabled. No password checking will occur when entering the main menu from the starting screen.



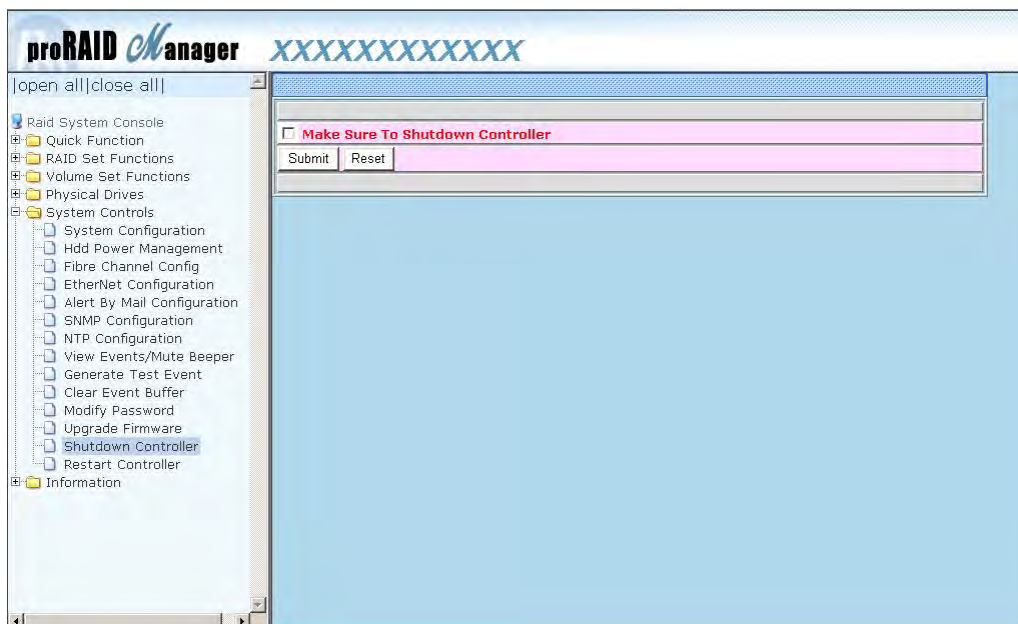
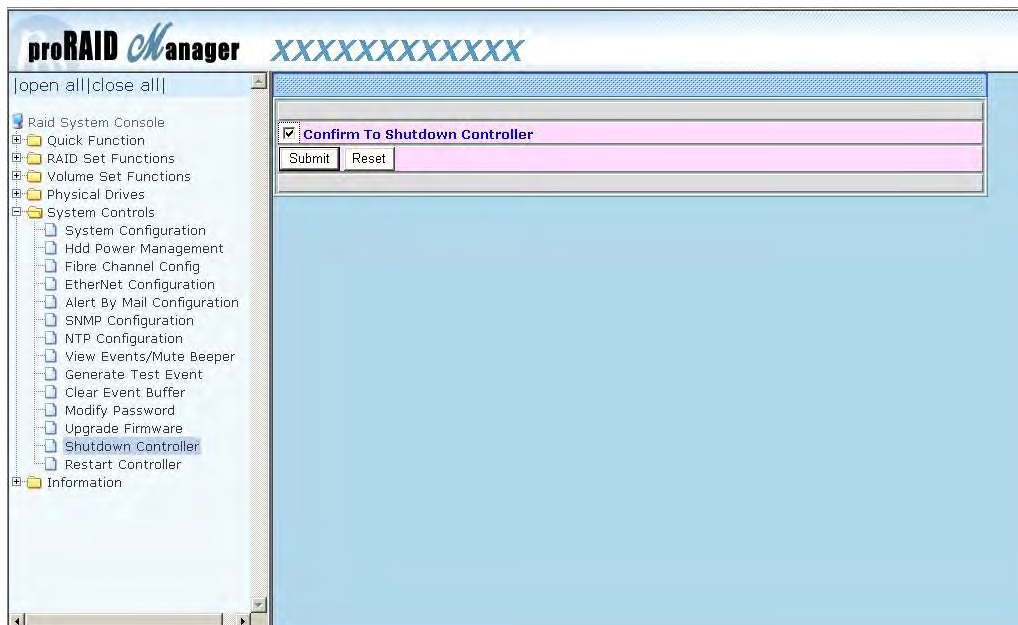
NOTE: The admin Password characters allowed are 'A' – 'Z', 'a' – 'z', and '0' – '9'. The minimum number of Password characters is null/empty (Password is disabled) and maximum number of Password characters is 15.

5.5.12 Upgrade Firmware

Please refer to Section 6.1 for more information.

5.5.13 Shutdown Controller

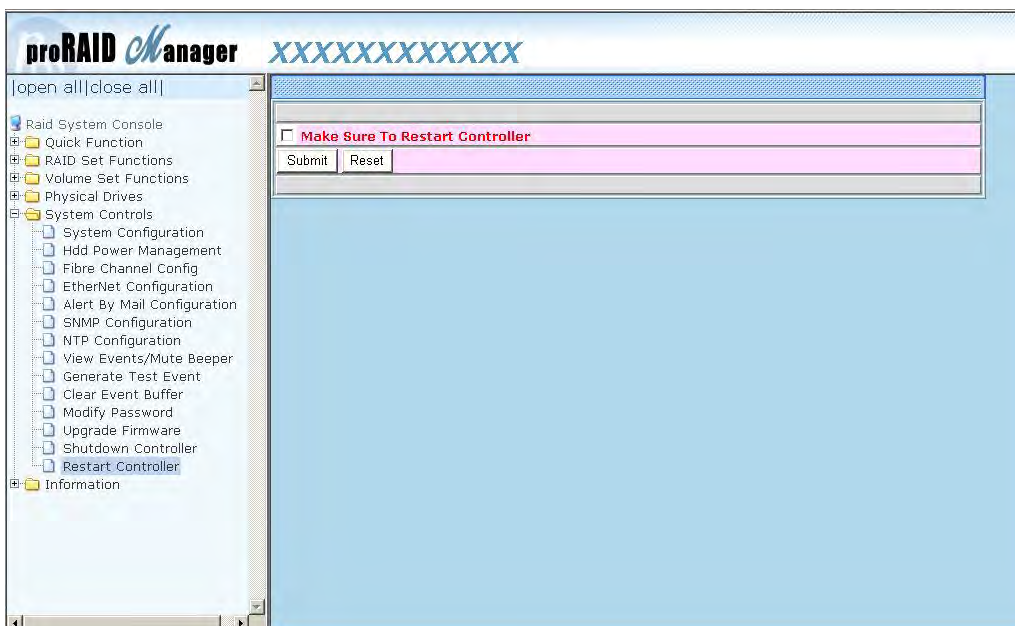
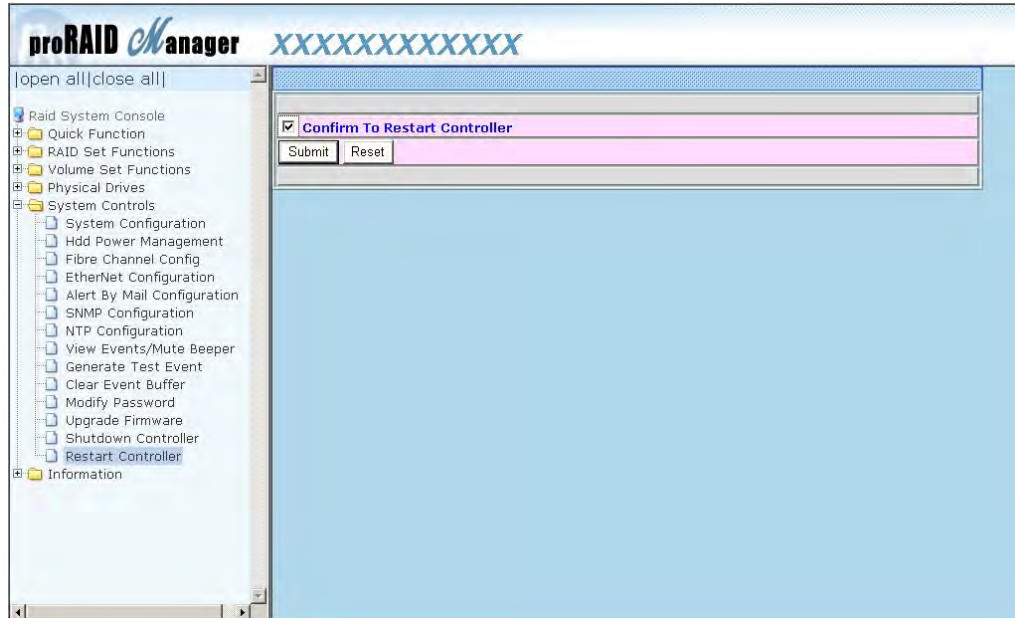
Use this function to shutdown the RAID Controller. This is used to flush the data from the cache memory, and is normally done before powering off the system power switch.



After shutting down the controller and still want to use the RAID subsystem, you must restart the controller either by Restart Controller function or by Power Supply On/Off switch.

5.5.14 Restart Controller

Use this function to restart the RAID Controller. This is normally done after upgrading the controller's firmware.



5.6 Information Menu

5.6.1 RAID Set Hierarchy

Use this feature to view the RAID subsystem's existing Raid Set(s), Volume Set(s) and disk drive(s) configuration and information. Select the **RAID Set Hierarchy** link from the **Information** menu to display the Raid Set Hierarchy screen.

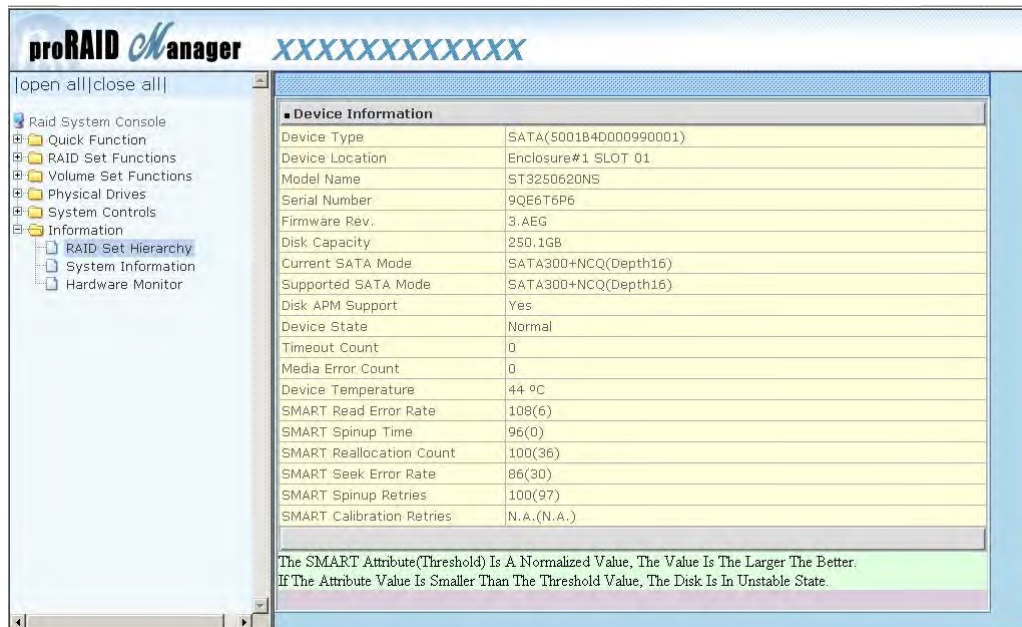
RAID Set	Devices	Volume Set(Ch/Lun)	Volume State	Capacity
Raid Set # 000	E#1Slot#1	Volume---VOL#000(0/0)	Normal	2199.0GB
	E#1Slot#2			
	E#1Slot#3			
	E#1Slot#4			
	E#1Slot#5			
	E#1Slot#6			

Device	Usage	Capacity	Model
Slot#1(0:3)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#2(0:1)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#3(0:0)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#4(0:2)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#5(0:0)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#6(0:4)	Raid Set # 000	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#7(0:5)	Free	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#8(0:6)	Free	1000.2GB	WDC WD1002FBYS-01A6B0
Slot#9(0:7)	Free	1000.2GB	Hitachi HDE721010SLA330
Slot#10(0:8)	Free	1000.2GB	Hitachi HDE721010SLA330
Slot#11(0:9)	Free	1000.2GB	Hitachi HDE721010SLA330
Slot#12(0:A)	Free	1000.2GB	Hitachi HDE721010SLA330

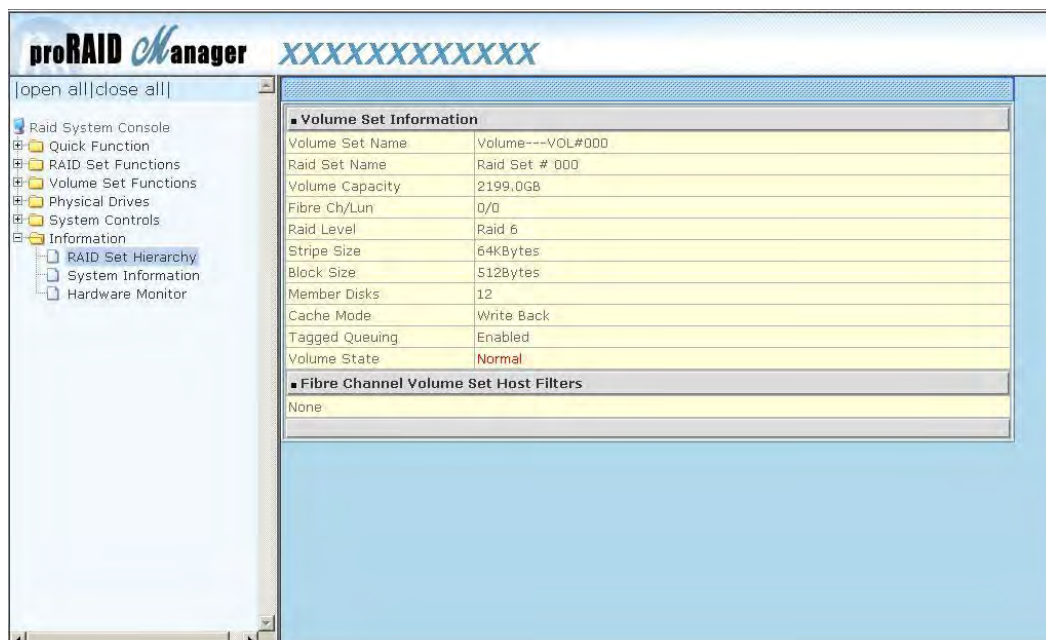
To view the Raid Set information, click the **Raid Set #** link from the Raid Set Hierarchy screen. The Raid Set Information screen appears.

Raid Set Information	
Raid Set Name	Raid Set # 000
Member Disks	12
Total Raw Capacity	5001.2GB
Free Raw Capacity	2557.8GB
Min Member Disk Size	250.1GB
Raid Set Power State	Operating
Raid Set State	Normal

To view the disk drive information, click the **E# Slot#** link from the Raid Set Hierarchy screen. The Device Information screen appears. This screen shows various information such as disk drive model name, serial number, firmware revision, disk capacity, timeout count, media error count, and SMART information.

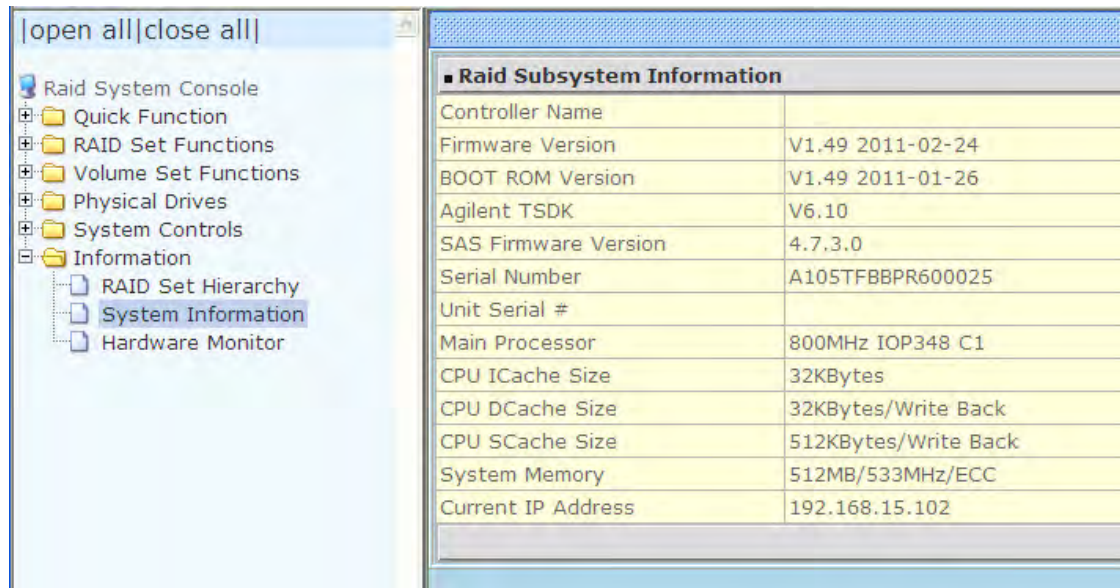


To view the Volume Set information, click the **Volume---VOL#** link from the Raid Set Hierarchy screen. The Volume Set Information screen appears.



5.6.2 System Information

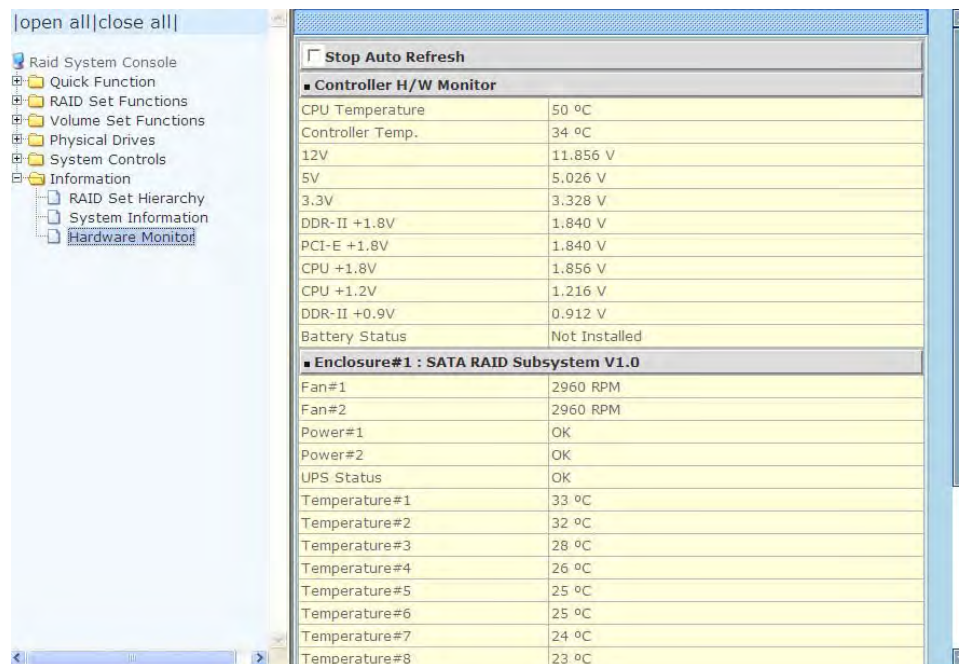
To view the RAID subsystem's controller information, click the **System Information** link from the **Information** menu. The Raid Subsystem Information screen appears.



The Controller Name, Firmware Version, BOOT ROM Version, Agilent TSDK, PL Firmware Version, SAS Firmware Version, Serial Number, Unit Serial #, Main Processor, CPU ICache Size, CPU DCache Size, CPU SCache Size, System Memory, and Current IP Address appear in this screen.

5.6.3 Hardware Monitor

To view the RAID subsystem's hardware information, click the **Hardware Monitor** link from the **Information** menu. The Hardware Monitor Information screen appears.



NOTE: To disable auto refresh of GUI, tick the “Stop Auto Refresh” option.

The Hardware Monitor Information provides information about controller, enclosure 1 such as the temperature, fan speed, power supply status and voltage levels. All items are also unchangeable. When the threshold values are surpassed, warning messages will be indicated through the LCD, LED and alarm buzzer.

Item	Warning Condition
CPU Temperature	> 90 Celsius
Controller Board Temperature	> 70 Celsius
HDD Temperature	> 65 Celsius
Fan Speed	< 1500 RPM
Power Supply +12V	< 10.5V or > 13.5V
Power Supply +5V	< 4.7V or > 5.4V
Power Supply +3.3V	< 3.0V or > 3.6V
DDR Supply Voltage +2.5V	< 2.25V or > 2.75V
CPU Core Voltage +1.3V	< 1.17V or > 1.43V
DDR Termination Power +1.25V	< 1.125V or > 1.375V

Chapter 6 Maintenance

6.1 Upgrading the RAID Controller's Firmware

Upgrading Firmware Using Flash Programming Utility

Since the RAID subsystem's controller features flash firmware, it is not necessary to change the hardware flash chip in order to upgrade the controller firmware. User can simply re-program the old firmware through the RS-232 port. New releases of the firmware are available in the form of binary file at vendor's FTP. The file available at the FTP site is usually a self-extracting file that contains the following:

XXXXVVV.BIN Firmware Binary (where "XXXX" refers to the model name and "VVV" refers to the firmware version)

README.TXT It contains the history information of the firmware change. Read this file first before upgrading the firmware.

These files must be extracted from the compressed file and copied to one directory in the host computer.

Establishing the Connection for the RS-232

The firmware can be downloaded to the RAID subsystem's controller using an ANSI/VT-100 compatible terminal emulation program or web browser-based RAID Manager remote management page.

With terminal emulation program, you must complete the appropriate installation and configuration procedure before proceeding with the firmware upgrade. Whichever terminal emulation program is used must support the ZMODEM file transfer protocol.

Web browser-based RAID Manager can be used to update the firmware. A web browser must have been setup before proceeding with the firmware upgrade.

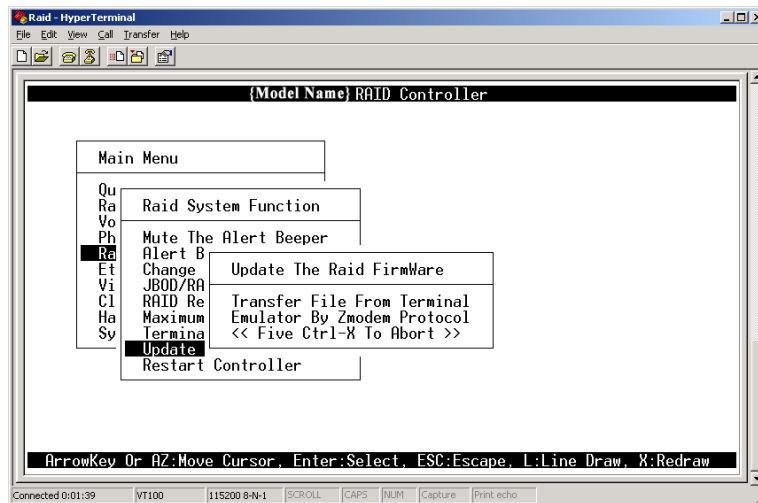
Upgrading Firmware Through ANSI/VT-100 Terminal Emulation

Get the new version firmware for your RAID subsystem controller. For Example, download the bin file from your vendor's web site into the local directory.

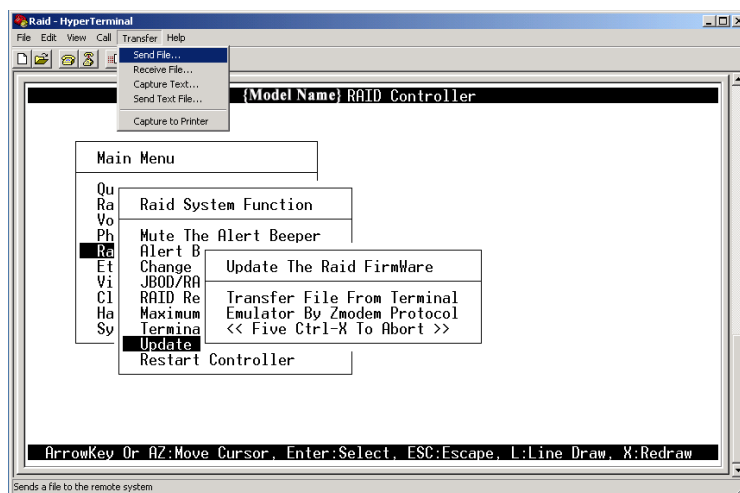


NOTE: When there is new boot ROM firmware that needs to be upgraded, upgrade first the boot ROM firmware. Then repeat the process (steps 1 to 9) to upgrade the firmware code after which a RAID controller restart will be necessary.

1. From the Main Menu, scroll down to "Raid System Function"
2. Choose the "Update Firmware". The **Update The Raid Firmware** dialog box appears.

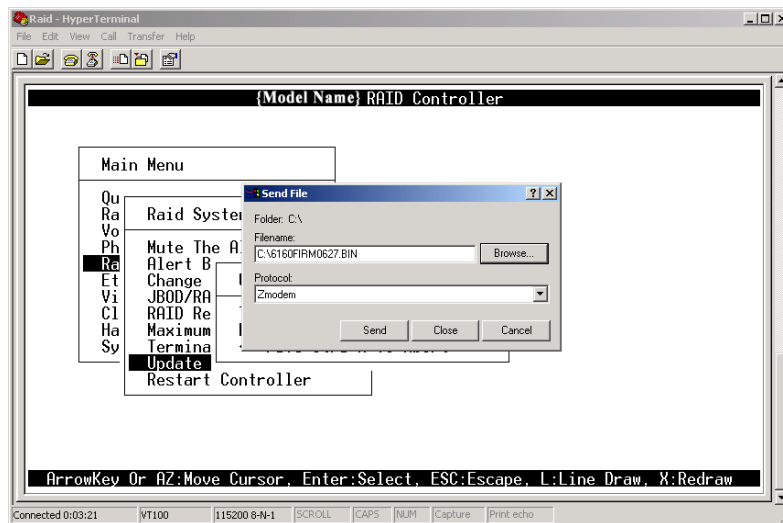


3. Go to the menu bar and click **Transfer**. Select **Send File**.

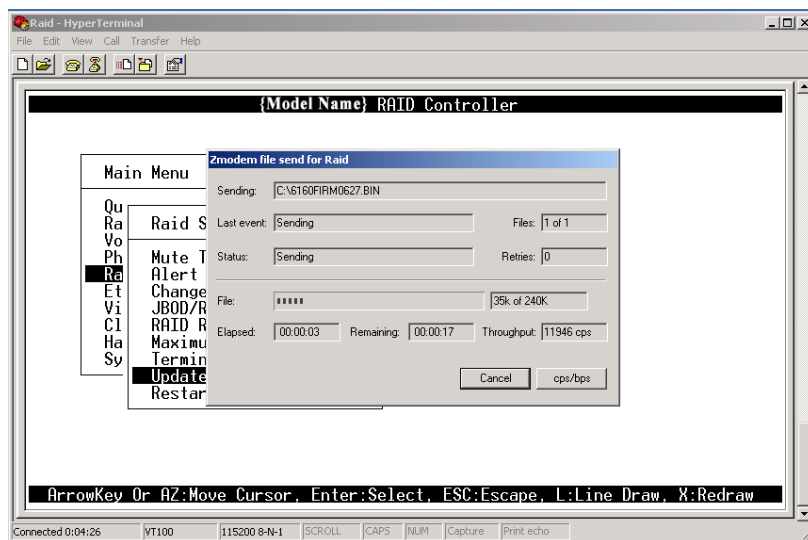


4. Select "ZMODEM modem" under Protocol to set ZMODEM as the file transfer protocol of your terminal emulation software.

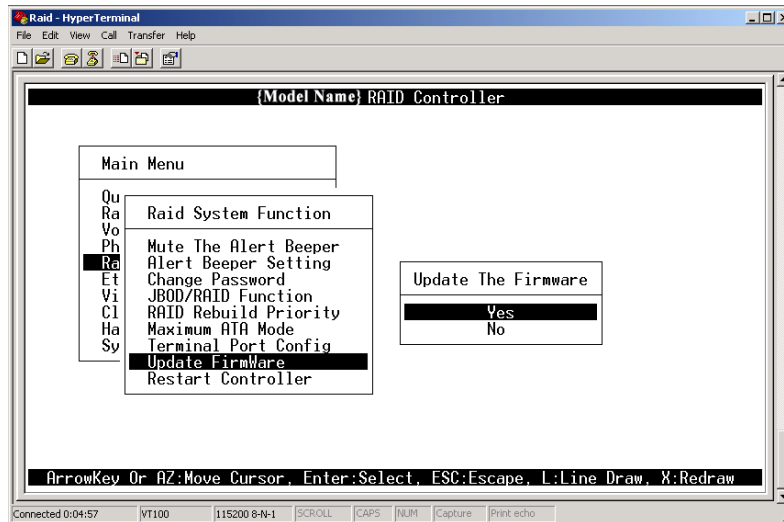
- Click Browse. Look in the location where the firmware file was saved. Select the firmware file name "XXXXXXXX.BIN" and click Open.



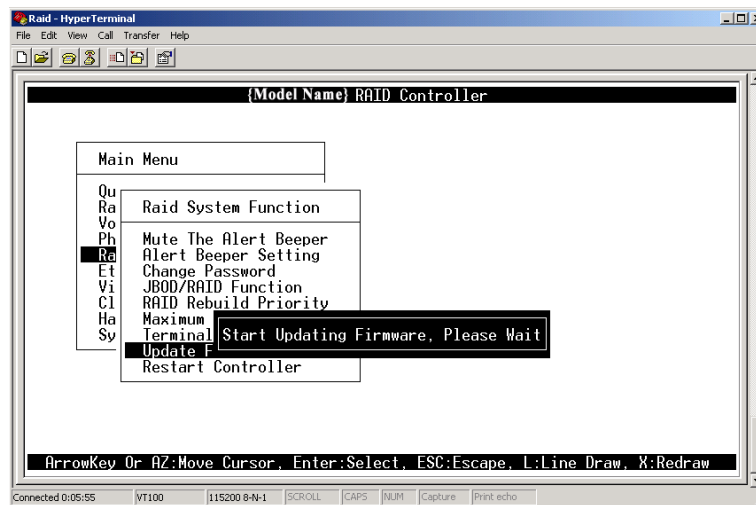
- Click Send to send the firmware binary file to the RAID controller.



7. When the firmware downloading is completed, the confirmation screen appears. Select Yes to start programming the flash ROM.

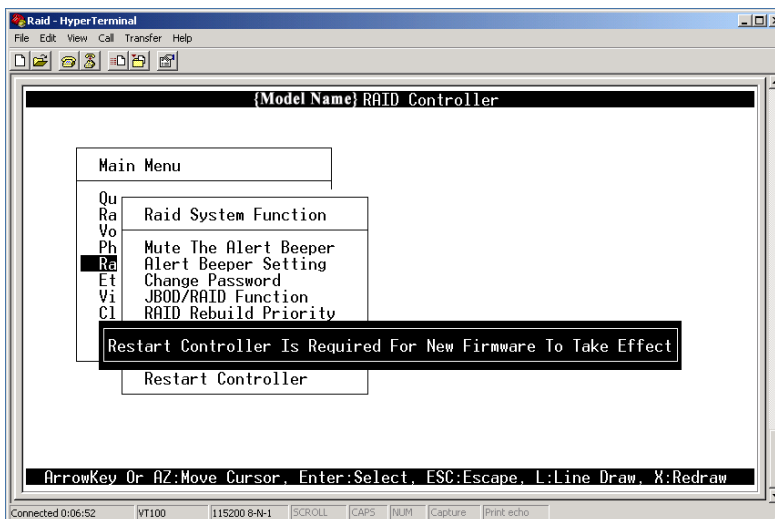
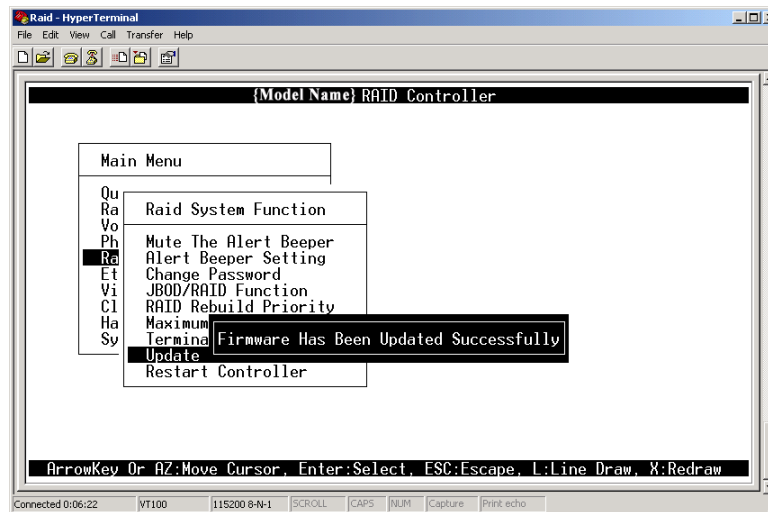


8. When the Flash programming starts, a message will show "Start Updating Firmware. Please Wait".



9. The firmware upgrade will take approximately thirty seconds to complete.

10. After the firmware upgrade is complete, a message will show "Firmware Has Been Updated Successfully". Restarting the RAID controller is required for the new firmware to take effect.



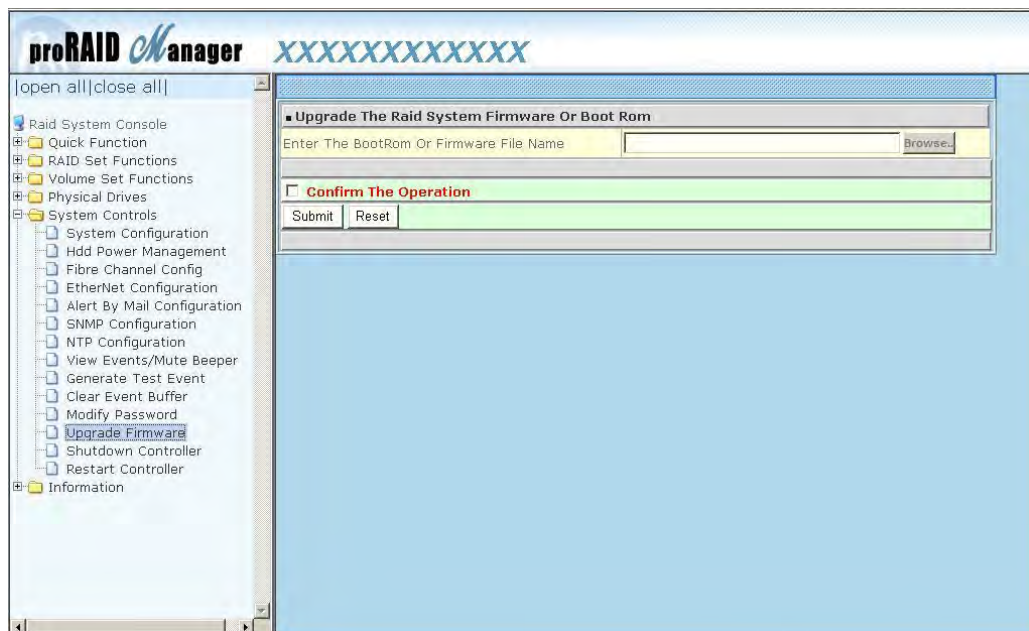
Upgrading Firmware Through Web Browser

Get the new version of firmware for your RAID subsystem controller.



NOTE: When there is new boot ROM firmware that needs to be upgraded, upgrade first the boot ROM firmware. Then repeat the process (steps 1 to 3) to upgrade the firmware code after which a RAID controller restart will be necessary.

1. To upgrade the RAID subsystem firmware, click the **Upgrade Firmware** link under **System Controls** menu. The Upgrade The Raid System Firmware Or Boot Rom screen appears.
2. Click **Browse**. Look in the location where the firmware file was saved. Select the firmware file name "XXXXXXXXX.BIN" and click Open.
3. Select the **Confirm The Operation** option. Click the **Submit** button.



4. The Web Browser begins to download the firmware binary to the controller and start to update the flash ROM.

5. After the firmware upgrade is complete, a message will show "Firmware Has Been Updated Successfully". Restarting the RAID controller is required for the new firmware to take effect.

