

RAID Subsystem

**Fibre/SAS/iSCSI to 12Gb/s SAS
RAID Subsystem**

User's Manual

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FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

Manufacturer's Declaration for CE Certification

We confirm ARC-92xx series 12/16/24-bays 12Gb/s SAS RAID subsystem has been tested and found compliant with the requirements in the council directive relating to the EMC Directive 2004/108/EC. Regarding to the electromagnetic compatibility, the following standards were applied:

EN 55022: 2006, Class B
EN 61000-3-2: 2006
EN 61000-3-3: 1995+A1: 2001+A2: 2005

EN 55024:1998+A1:2001=A2:2003
IEC61000-4-2: 2001
IEC61000-4-3: 2006
IEC61000-4-4: 2004
IEC61000-4-5: 2005
IEC61000-4-6: 2006
IEC61000-4-8: 2001
IEC61000-4-11: 2004

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INTRODUCTION

1. Introduction

This section presents a brief overview of the 12/16/24 bays external Fibre/SAS/iSCSI to 12Gb/s SAS RAID subsystem.

1.1 Overview

The 12Gb/s SAS interface supports both 12Gb/s SAS disk drives for data-intensive applications and 6Gb/s SATA drives for low-cost bulk storage of reference data. The Fibre/SAS/iSCSI to 12Gb/s SAS RAID controllers attach directly to SATA/SAS midplanes with 3 x Z-PACK HM-Zd high speed connectors or increase capacity using one additional Min SAS HD SFF-8644 external connector. When used with 12Gb/s SAS expanders, the controller can provide up to (256) devices through one or more SAS JBODs, making it an ideal solution for enterprise class storage applications that called for maximum configuration flexibility.

The Fibre/SAS/iSCSI to 6Gb/s SAS RAID subsystem provides a 2U/3U/4U rackmount external storage chassis capable of accommodating up to 12/16/24 12.0-Gb/s, Serial-Attached SCSI (SAS) drives or 6.0-Gb/s Serial ATA (SATA) drives. It provides three kinds of host interface link to the host board on the server system. The redundant controller model provides fault-tolerant links across separate host interface, while the single controller model provides a single, straight-through data path.

Unparalleled Performance for 12Gb/s SAS

The 12Gb/s SAS RAID subsystems raise the standard to higher performance levels with several enhancements including new high performance 1.2 GHz dual core ROC processor, a DDR3-1866 memory architecture and high performance PCIe 3.0 interface bus interconnection. The subsystem each includes one 240-pin DIMM socket with default 2GB DDR3-1866, single rank, 1Rx8, upgrade to 8GB or 8GB DDR3-1600, dual rank, 2Rx8, ECC SDRAM. The 12Gb/s SAS is designed for backward compatibility with 6Gb/s and 3Gb/s SAS and SATA hard drives. Regardless of the drive speed, 12Gb/s SAS RAID controllers will provide maximum read/write performance improvements for the most performance-hungry database and IT applica-

tions.

The subsystem includes one 12Gb/s SAS expander that incorporates the latest enhancements in SAS along with new LSI DataBolt bandwidth optimizer technology. This is designed to help facilitate the industry transition to 12Gb/s SAS-enabled systems by allowing users to take advantage of 12Gb/s speeds while utilizing existing 6Gb/s drives and backplanes. Using DataBolt, the subsystem buffers 6Gb/s data and then transfers it out to the host at 12Gb/s speeds in order to match the bandwidth between faster hosts and slower SAS or SATA devices.

Unsurpassed Data Availability

Designed and leveraged with Areca's existing high performance RAID solution, ARC-1883 provides superior levels performance and enterprise level data protection for the most demanding next generation server and storage environments. It supports the hardware RAID 6 engine to allow two HDDs failures without impact the existing data and performance. It allows users to hot swap drive in the event of a drive failure with zero downtime. With innovative new RAID-on-Chip 12Gb/s SAS feature and support for SATA, SAS and SSDs, the SAS RAID subsystems provides small- to mid-sized enterprises with superior levels of RAID performance and scalability for external storage. The optional flash-based backup module provides power to the cache if it contains data not yet written to the drives when power is lost. The subsystem also supports traditional Lithium-ion (Li-ion) battery backup module (BBM) to protect cached data on RAID adapters.

Easy RAID Management

Configuration and monitoring can be managed either through the LCD control panel, RS232 port or LAN port. The firmware also contains an embedded terminal emulation via the RS-232 port. The firmware-embedded web browser-based RAID manager allows local or remote to access it from any standard internet browser via a LAN port. The controller also supports API library for customer to write its own monitor utility. The Single Admin Portal (SAP) monitor utility can support one application to manage multiple RAID units in the network.

INTRODUCTION

1.2 Subsystem Naming Rule

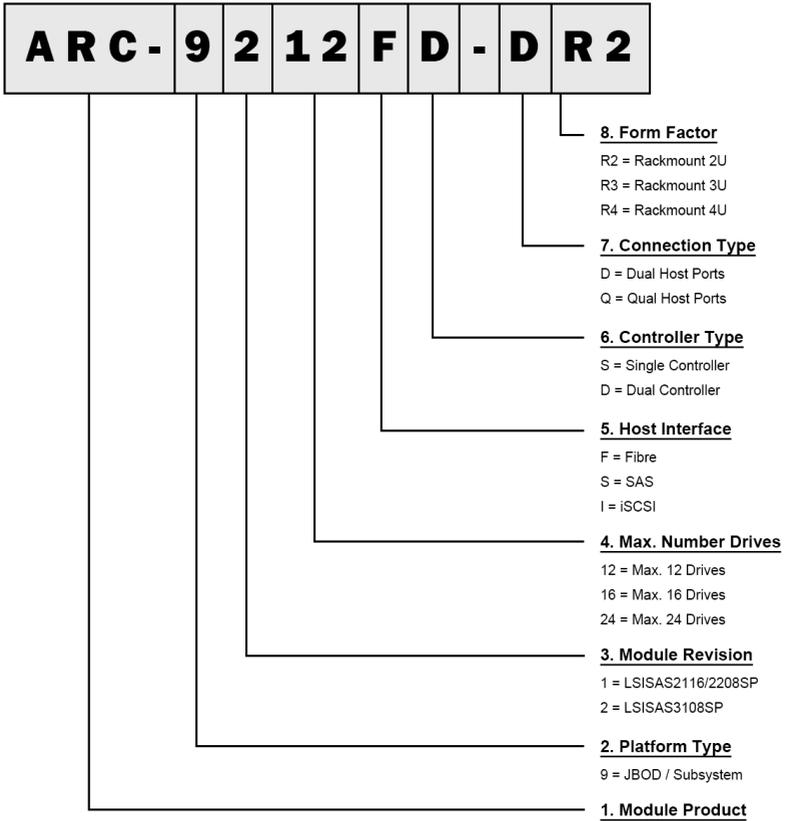


Figure 1-1. Subsystem Naming Rule

HARDWARE INSTALLATION

1.3 Locations of the Subsystem Component

The main components of the Fibre/SAS/iSCSI to 12Gb/s SAS RAID subsystem are shown in the below figure.

1.3.1 RAID Subsystem Front View

- 2U-12 bays SAS RAID Subsystem Front View

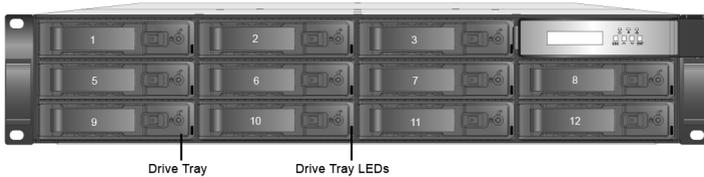


Figure 1-2. 2U-12 bays SAS RAID Subsystem Front View

- 3U-16 bays SAS RAID Subsystem Front View



Figure 1-3. 3U-16 bays SAS RAID Subsystem Front View

- 2U-24 bays SAS RAID Subsystem Front View

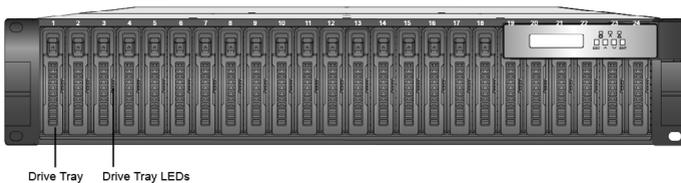


Figure 1-4. 2U-24-bays SAS RAID Subsystem Front View

HARDWARE INSTALLATION

- 4U-24 bays SAS RAID Subsystem Front View

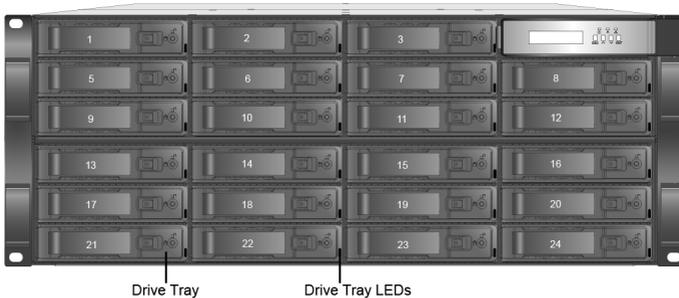


Figure 1-5. 4U-24-bays SAS RAID Subsystem Front View

- **Disk Slot Numbers**

To perform a disk hot-plug procedure, you must know the physical disk slot number for the drive that you want to install or remove. The number on the drive tray shows how RAID subsystem disk slots are numbered. Disk slot number is reflected in the RAID manager interface.

- **Drive Tray LED Indicators**

Each drive tray in your subsystem has two LEDs: an activity LED (blue) and one power/fault (two colors green/red) status LED. The activity LED flashes whenever the drive is accessed. The following table describes the SAS RAID subsystem drive tray LED status.

LED	Normal status	Problem Indication
Blue LED (Activity)	<ol style="list-style-type: none">1. When the activity LED is lit, there is I/O activity on that disk drive.2. When the LED is not lit; there is no activity on that disk drive.	N/A

HARDWARE INSTALLATION

Green/Red LED (Power/Fault)	<ol style="list-style-type: none">1. When the power LED (green) is lit and fault LED (red) is off, that disk is present and status normal.2. When the fault LED is lit there is no disk present.	<ol style="list-style-type: none">1. When the fault LED (red) is slow blinking (2 times/sec), that disk drive has failed and should be hot-swapped immediately.2. When the activity LED (blue) is lit and fault LED (red) is fast blinking (10 times/sec) there is re-building activity on that disk drive.
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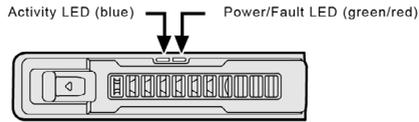


Figure 1-6. 2.5-inch SAS/SATA Drive Tray LED

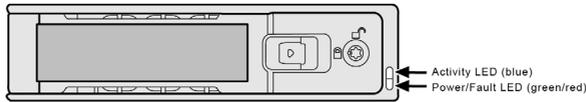


Figure 1-7. 3.5-inch SAS/SATA Drive Tray LED

1.3.2 RAID Subsystem Rear View

- 2U-12 bays SAS RAID Subsystem Rear View

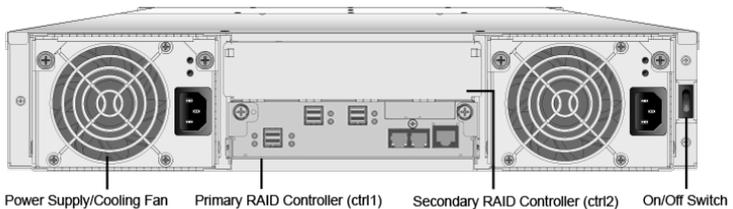


Figure 1-8. 2U-12 bays SAS RAID Subsystem Rear View

HARDWARE INSTALLATION

- 3U-16 bays SAS RAID Subsystem Rear View

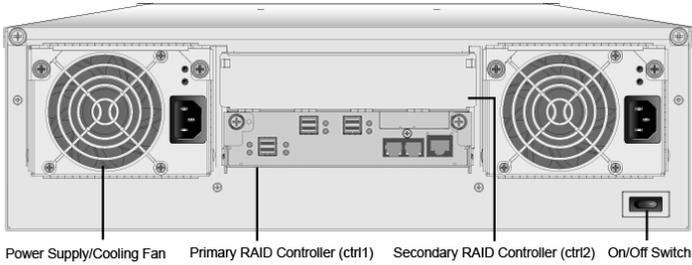


Figure 1-9. 3U-16 bays SAS RAID Subsystem Rear View

- 2U-24 bays SAS RAID Subsystem Rear View

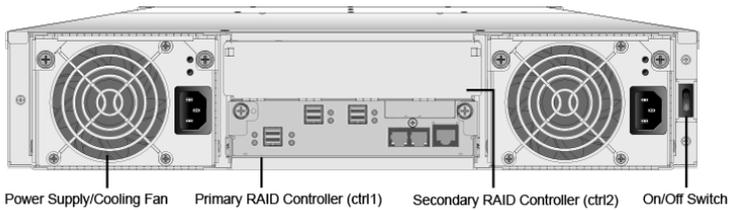


Figure 1-10. 2U-24 bays SAS RAID Subsystem Rear View

- 4U-24 bays SAS RAID Subsystem Rear View

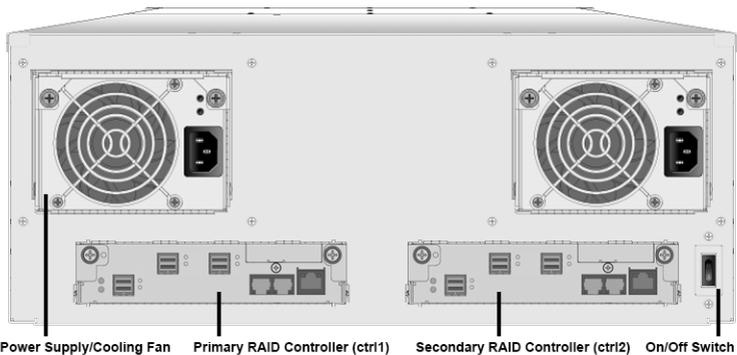


Figure 1-11. 4U-24 bays SAS RAID Subsystem Rear View

HARDWARE INSTALLATION

1.3.2.1 Rear View of Fibre to SAS RAID Controller

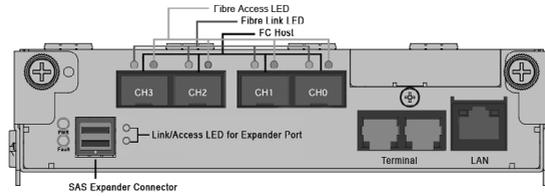


Figure 1-12. Rear View of Fibre to SAS RAID Controller

The following table describes the Fibre to SAS RAID subsystem host channel link/access LED.

Fibre Host Port LED	Status
Link LED (Green/Orange light)	Two LEDs (green/orange) are used to indicate the link speed of the operation of each Fibre Channel port. 1. On (green) when the Fibre Channel 16Gbps link speed is connected and established. 2. On (orange) when the Fibre Channel 8Gbps link speed is connected and established. 3. On (green and orange interactive flash) when the Fibre Channel 4Gbps link speed is connected and established.
Access LED (Blue light)	The Fibre channel host accesses to the Fibre to SAS RAID subsystem.

1.3.2.2 Rear View of SAS to SAS RAID Controller

The following table describes the SAS to SAS RAID subsystem host channel link/access LED.

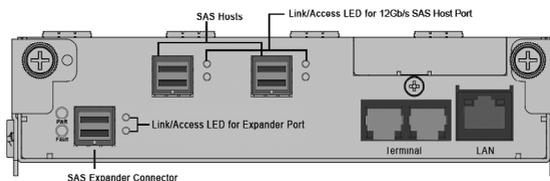


Figure 1-13. Rear View of SAS to SAS RAID Controller

HARDWARE INSTALLATION

SAS Host Port LED	Status
Link LED (Green light)	<ol style="list-style-type: none"> 1. When host port link LED is lit for 1 second and turns off for 3 seconds that indicates the one link has connected. 2. When host port link LED is lit for 2 seconds and turns off for 2 seconds that indicates the two links have connected. 3. When host port link LED is lit for 4 seconds that indicates the four links have connected.
Access LED (Blue light)	When access LED is lit that indicates the SAS host accesses to the SAS to SAS RAID subsystem.

1.3.2.3 Rear View of iSCSI to SAS RAID Controller

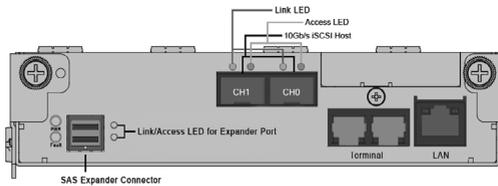


Figure 1-14. Rear View of iSCSI to SAS RAID Controller

The following table describes the iSCSI to SAS RAID subsystem host channel link and access LED.

iSCSI Host Port	Status
Link LED (Green light)	When link LED is lit that indicates the iSCSI host link has connected.
Access LED (Blue light)	When activity LED is flashed that indicates the iSCSI host accesses to the iSCSI RAID subsystem.

1.3.2.4 Expander Output

The following table describes the SAS RAID subsystem expander port link/access LED.

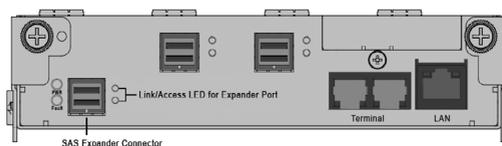


Figure 1-15. Expander Port LED

HARDWARE INSTALLATION

Expander LED	Status
Link LED (Green light)	<ol style="list-style-type: none">1. When link LED is lit for 1 second and turns off for 3 seconds that indicates the one expander link has connected.2. When link LED is lit for 2 seconds and turns off for 2 seconds that indicates the two expander links have connected.3. When link LED is lit for 4 seconds that indicates the four expander links have connected.
Access LED (Blue light)	When access LED is lit that indicates the SAS expander connector accesses to next JBOD.

1.3.2.5 Global Status

On the left side of expander port are two LEDs which indicate the status of the RAID controller working on dual controller mode.

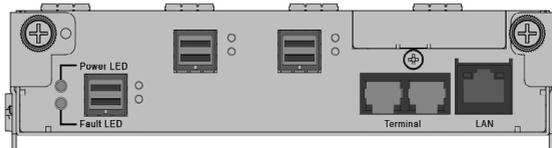


Figure 1-16. Dual Controller Global Status

Subsystem Indicators	Status
Power LED (Heartbeat/ Green light)	When power LED is lit that indicates the subsystem in working state. Flashing power LED indicates controller CPU access the subsystem resource.
Fault LED (Red light)	Flashing fault LED indicates a controller reset occurs on a controller.

1.3.2.6 Power Supply/Cooling Fan LED

The subsystem supports two separate power modules. Each of them contains an integrated power supply and two cooling fans. The LEDs on the RAID subsystem's power supplies indicate status of the power supply: one for AC_OK (green) and other FAULT(red). The following figure is shown LEDs on the power supply module.

HARDWARE INSTALLATION

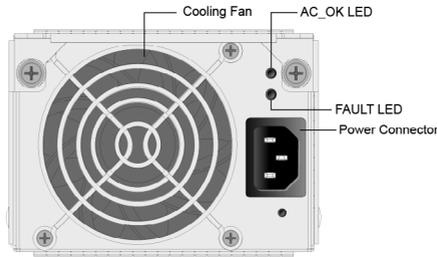


Figure 1-17. Power Supply Front View

The following table describes the power LEDs status.

Power LED Status	Indication
AC_OK (Green LED)	The AC_OK LED indicates that the AC line is present and above the minimum AC input voltage threshold
FAULT (Red LED)	The FAULT LED is driven by the microprocessor and will indicate that a power supply fault has occurred

The power supply cooling shall be provided by the internal tandem fans, powered by the common 12V rail voltage. Fan speed is controlled by PWM input signal. And the power supply firmware shall determine the fan RPM required to provide forced air cooling using data from a thermal sensor in the power supply that reflects the output loading.

The cooling fans included on the power supply run on separate control circuits from the power supply. Therefore, if one power supply fails, the failed power's fan continues to work on the power supplied from the other good power supply.

Note:

A power supply/cooling fan module can be removed from a powered-on subsystem; however, the expander controller may automatically shut down the subsystem if overheating occurs.

HARDWARE INSTALLATION

1.4 RAID Subsystem Alarm

An audible alarm is activated if any of the fault conditions occur, such as Voltage, Temperature, Fan, Power Supply or from SES2. The "Alert Beeper Setting" function on the RAID System Function is used to disable or enable the RAID subsystem alarm tone generator. The "Mute The Alert Beeper" function on the "RAID System Function" is used to control the SAS RAID subsystem beeper. It turns the beeper off temporarily. The beeper will still activate on the next event.

Note:

It is rare for both 12Gb/s SAS RAID controller to fail simultaneously. However, if this occurs, the RAID subsystem can not issue critical or non-critical event alarms for any subsystem component.

1.5 Expansion Connection

The SAS RAID subsystem is a device that contains one expander port. Expander port may support being attached to SAS initiator ports, SAS and/or SATA target ports, and to other expander ports. The SAS RAID subsystem can connect up to 7 expander enclosures to the host system. The maximum drive no. is 256 through this RAID subsystem with 7 expander enclosures. Enclosures installed with SAS disks or SATA disks can be included in the same daisy-chain. The following figure shows how to connect the external Mini SAS HD SFF-8644 cable from the 12Gb/s SAS RAID subsystem to the external SAS RAID subsystem. Daisy-chains longer than the limitation of subsystems are not supported even if it may be workable.

HARDWARE INSTALLATION

- Single Controller Mode

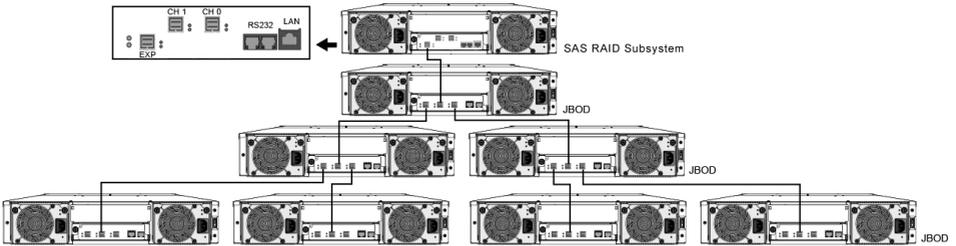


Figure 1-18. Single Module Daisy-chain

- Dual Controller Mode

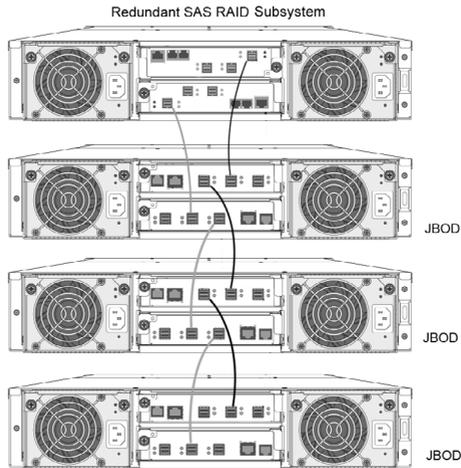


Figure 1-19. Dual Controller Daisy-chain

The following table is the max no. of SAS RAID subsystem supported:

	Disks/Subsystem	Expander	Devices/Controller	Volume
Max No.	128	8	256	128

HARDWARE INSTALLATION

Note:

1. Turn on the SAS RAID subsystem first to make sure the host adapter on the server recognizes the drives in the subsystem.
2. Turn on the JBOD first to make sure the SAS RAID subsystem recognizes the drives in the JBOD.

HARDWARE INSTALLATION

2. Hardware Installation

This chapter explains how to install the following components:

- Rack installation guide
- Drives and drive carriers
- SAS RAID controller boards
- Power supplies

Unpack

Unpack and install the hardware in a static-free environment. The SAS RAID subsystem is packed inside an anti-static bag between two sponge sheets. Remove it and inspect it for damage. If the SAS RAID subsystem appears damaged, or if any items of the contents listed below are missing or damaged, please contact your dealer or distributor immediately.

Checklist

The SAS RAID subsystem kit may have included the following items in the shipping package:

- SAS RAID subsystem
- RAID rack kit
- Mounting hardware (attachment rails, screws, etc.)
- SFF-8644 to SFF-8644 cable (optional)
- Power cords
- RJ11 to DB9 serial communications null-modem cable
- Installation guide (user manual in the production CD)

Installing into a Subsystem Rack

Before you install the rack for your SAS RAID subsystem, please make sure you have these rack kit components:

- One pair of mounting-bracket rail
- One pair of length rail
- 10-32 x 0.5-inch flange-head Phillips screws (8)

HARDWARE INSTALLATION

2.1 Installing an Subsystem into the Rack or Tower (Optional)

The following sections show the 2U-12 bays installation. An installation with the 2U-24, 3U-16 or 4U-24 bays is exactly the same.

1. Using supplied screws to secure the mounting-bracket rail and length rail and then secure them on the front vertical rail and rear vertical rail, as shown below. Make sure that all connections are tightened before continuing.

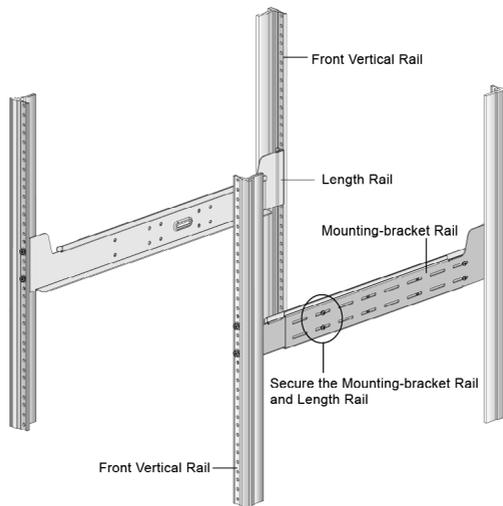


Figure 2-1. Attaching the Mounting Rails to the Cabinet

2. Slide the rear side of subsystem fully onto the rack until the subsystem front panel touched the front vertical rails. Align the mounting holes of the subsystem on the front vertical rail holes. The subsystem is too heavy; it needs some assistance from other people to lift it onto the rack together.

HARDWARE INSTALLATION

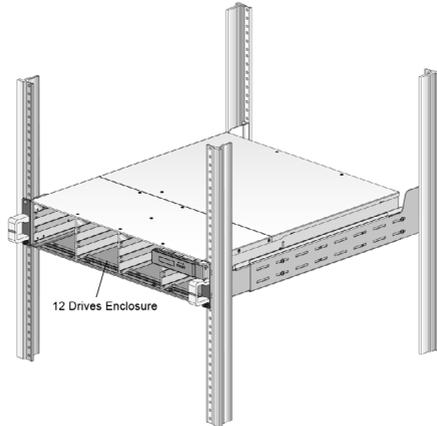


Figure 2-2. Sliding the Subsystem into the Rails

3. Secure the subsystem to the front vertical rail and mounting-bracket rail on both sides.

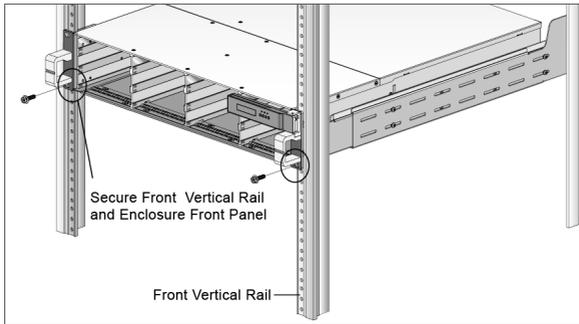


Figure 2-3. Attaching the Front of the Subsystem

2.2 Installing or Removing SAS/SATA Drives in the Subsystem

Your subsystem supports up to 12/16/24 3.5-inch disk drives or 12/16/24 2.5-inch 12Gb/s SAS or 6.0Gb/s SATA drives, each one contained in its individual drive carrier. Each drive is hot-pluggable, allowing you to remove and insert drives without shutting down your subsystem.

This section describes how to install or remove drives in your subsystem.

HARDWARE INSTALLATION

Note:

Be careful when handling and storing the drives. The tray provides some protection, but the drives and tray connectors can be damaged by rough handling. When removing the drives from the subsystem, place them on a padded surface. Do not drop the drives.

2.2.1 Installing SAS/SATA Drives in the Subsystem

Follow the steps below to install the drives into drive tray.

2.2.1.1 Installing 2.5-inch Drives into 2.5-inch or 3.5-inch Drive Tray

- 1-1. Install the drives into the drive tray and make sure the holes of the disk trays align with the holes of the drive.

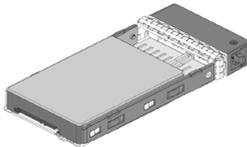


Figure 2-4. Put 2.5-inch SAS/SATA Drive into 2.5-inch Disk Tray

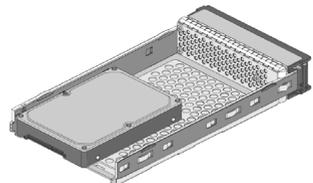


Figure 2-5. Put 2.5-inch SAS/SATA Drive into 3.5-inch Disk Tray

- 1-2. Turn the drive tray upside down and using a screwdriver to secure the drive to the drive tray by four of the mounting screws.



Figure 2-6. 2.5-inch drive Carrier with 2.5-inch SAS/SATA Drive



Figure 2-7. 2.5-inch Drive Carrier with 3.5-inch SAS/SATA Drive

HARDWARE INSTALLATION

2. After installing the drive into the drive tray completely, make sure the drive tray latch is open, then slide the drive tray with the attached drive into the subsystem drive slot.
3. Gently slide the drive tray back of the subsystem drive slot until the bottom of the open carrier handle makes contact with the subsystem face plate.

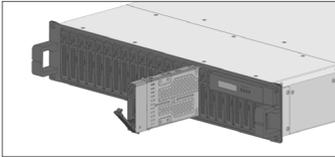


Figure 2-8. Installing 2.5-inch Drive into Enclosure

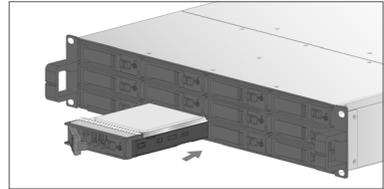


Figure 2-9. Installing 3.5-inch Drive into Enclosure

4. Click the drive tray latch into position, then continuing to slide the other drive tray into the slot.
5. Turn the key-lock to the proper position, using the “Star Wrench L-Handle” in the shipping box. The key-lock is unlock, if the dot on its face is in the unlock orientation.

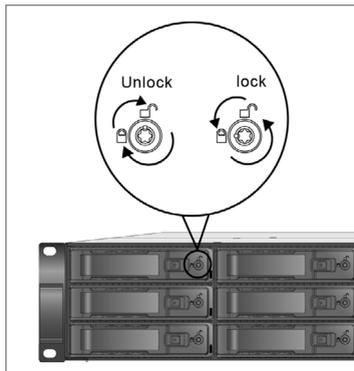


Figure 2-10. Locking Drive Tray

Note:

To ensure proper airflow for subsystem cooling, each slot should contain a drive tray.

HARDWARE INSTALLATION

2.2.1.2 Installing 3.5-inch Drives into 3.5-inch Drive Tray

- 1-1. Install the drives into the drive tray and make sure the holes of the drive trays align with the holes of the drive.

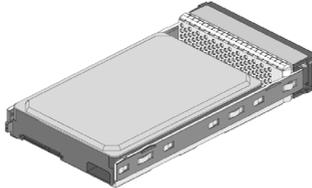


Figure 2-11. Putting Drive into Drive Tray

- 1-2. Turn the drive tray upside down and using a screwdriver to secure the drive to the drive tray by four of the mounting screws.

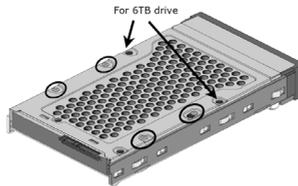


Figure 2-12. Securing Drive

2. After installing the drive into the drive tray completely, make sure the drive tray latch is open, then slide the drive tray with the attached drive into the subsystem drive slot.
3. Gently slide the drive tray back of the subsystem drive slot until the bottom of the open carrier handle makes contact with the subsystem face plate.

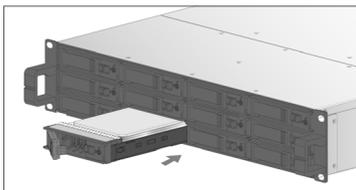


Figure 2-13. Installing Drive into Subsystem

HARDWARE INSTALLATION

4. Click the drive tray latch into position, then continuing to slide the other drive tray into the slot.
5. Turn the key-lock to the proper position, using the "Star Wrench L-Handle" in the shipping box. The key-lock is unlock, if the dot on its face is in the unlock orientation.

2.2.2 Installing SATA Drives with Interposer Board

The interposer board is for usage with SATA drives. It provides dual data path for dual controller. If your subsystem has two SAS expander module and you are installing SATA drives, an interposer board is required so that both expander modules can access the SATA drives. Follow the steps below to install the SATA drive with interposer board into the drive tray.

2.2.2.1 Installing 2.5-inch Drives into 3.5-inch Drive Tray

- 1-1. Prepare the interposer module.

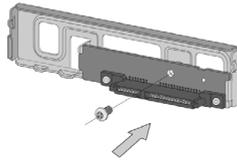


Figure 2-14. Fastening Interposer Board into Mounting Bracket

- 1-2. Clip the interposer board into the drive tray.

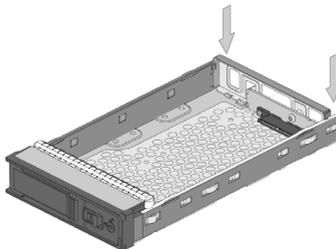


Figure 2-15. Installing Interposer Module

HARDWARE INSTALLATION

- 1-3. Carefully slide the 2.5-inch drive toward the interposer module.

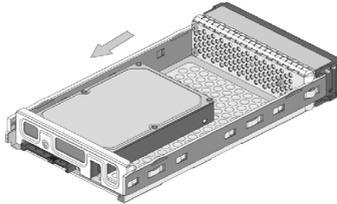


Figure 2-16. Sliding Drive into Drive Tray

- 1-4. Turn the drive tray upside down and using a screwdriver to secure the drive to the drive tray by four of the mounting screws.



Figure 2-17. Securing Drive

2. After installing the drive into the drive tray completely, make sure the drive tray latch is open, then slide the drive tray with the attached drive into the subsystem drive slot.
3. Gently slide the drive tray back of the subsystem drive slot until the bottom of the open carrier handle makes contact with the subsystem face plate.
4. Click the drive tray latch into position, then continuing to slide the other drive tray into the slot.
5. Turn the key-lock to the proper position, using the "Star Wrench L-Handle" in the shipping box. The key-lock is unlock, if the dot on its face is in the unlock orientation.

HARDWARE INSTALLATION

2.2.2.2 Installing 2.5-inch Drives into 2.5-inch Drive Tray

- a. Slide the 2.5-inch drive toward the interposer module.

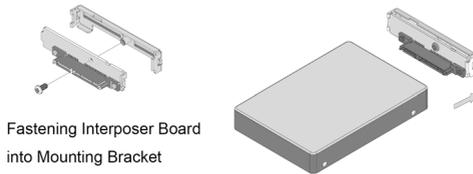


Figure 2-18.
Preparing and
Sliding Interposer
Module

- b. Position interposer module with drive toward the interposer module slot with the latch point in the interposer module aligned with the interposer module slot. Gently press down the module until it snaps into place in the interposer module slot on the tray.

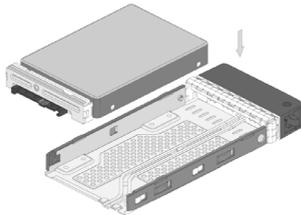


Figure 2-19.
Installing Drive into Drive Tray

- c. Turn the drive tray upside down and using a screwdriver to secure the drive to the drive tray by four of the mounting screws.



Figure 2-20. Securing Drive

1. After installing the drive into the drive tray completely, make sure the drive tray latch is open, then slide the drive tray with the attached drive into the enclosure drive slot.
2. Gently slide the drive tray back of the enclosure drive slot until the bottom of the open carrier handle makes contact with the enclosure face plate.
3. Click the drive tray latch into position, then continuing to slide the other drive tray into the slot.

HARDWARE INSTALLATION

2.2.2.3 Installing 3.5-inch Drives into 3.5-inch Drive Tray

1-1. Slide the 3.5-inch drive toward the interposer module.

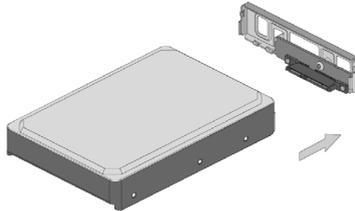


Figure 2-21. Sliding Interposer Module

1-2. Position interposer module with drive toward the interposer module slot with the latch point in the interposer module aligned with the interposer module slot. Gently press down the module until it snaps into place in the interposer module slot on the tray.

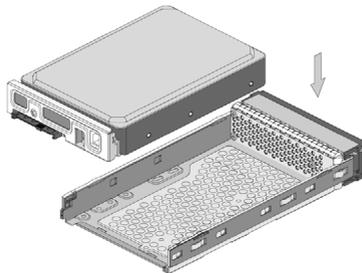


Figure 2-22. Installing Drive into Drive Tray

1-3. Turn the drive tray upside down and using a screwdriver to secure the drive to the drive tray by four of the mounting screws.

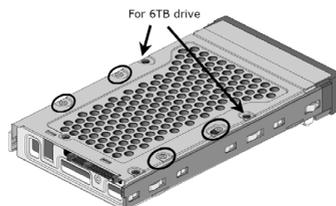


Figure 2-23. Securing Drive

HARDWARE INSTALLATION

2. After installing the drive into the drive tray completely, make sure the drive tray latch is open, then slide the drive tray with the attached drive into the subsystem drive slot.
3. Gently slide the drive tray back of the subsystem drive slot until the bottom of the open carrier handle makes contact with the subsystem face plate.
4. Click the drive tray latch into position, then continuing to slide the other drive tray into the slot.
5. Turn the key-lock to the proper position, using the "Star Wrench L-Handle" in the shipping box. The key-lock is unlock, if the dot on its face is in the unlock orientation.

2.2.3 Removing Drives from the Subsystem

1. Don't power the system off until the LED indicator on the drive tray stop flashing.
2. For 3.5-inch drive tray, turn the key-lock to the unlock position.
3. Open the drive tray latch, then gently but firmly pull the drive tray out from the slot.

2.3 Installing or Removing the RAID Controller in the Subsystem

A RAID subsystem with redundant subsystem management contains two controllers. A RAID subsystem with non-redundant subsystem management only has one controller. If only one controller is installed, it must be in the primary expander bay and a blank module cover must be installed in the secondary expander bay.

2.3.1 Installing the RAID Controller in the Subsystem

Follow the steps below to install the SAS RAID controller in the subsystem:

HARDWARE INSTALLATION

1. Carefully slide the SAS RAID controller into the empty slot.
2. Push the SAS RAID controller caddy back of the slot until it is firmly seated in the backplane connector.
3. Put the lever toward the subsystem and tighten the thumb-screw which located on the left side of lever of the SAS RAID controller caddy.

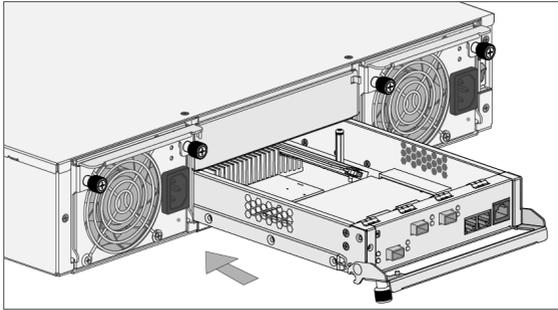


Figure 2-24. Installing Controller Module

Note:

There are two slots for your SAS RAID controller. If you only installed one in your subsystem, the other empty slot must place a cover. To remove the cover, pull out on the thin tabs on each end of the cover and slide the cover out of the slot.

2.3.2 Removing the RAID Controller from the Subsystem

Follow the steps below to remove the RAID controller from the subsystem:

1. Loosen the thumbscrew on left side of the lever, then gently but firmly pull the SAS RAID controller caddy out from the slot.
2. After removed the SAS RAID controller caddy from the enclosure, place the cover in the empty slot.

HARDWARE INSTALLATION

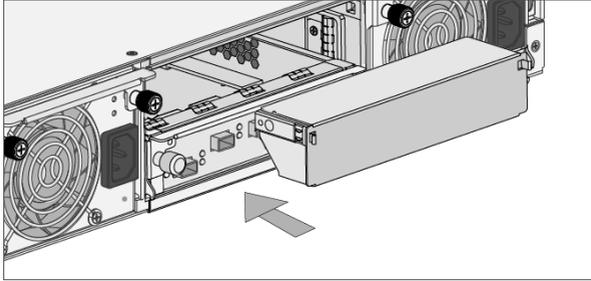


Figure 2-25. Installing the Cover

Note:

At least one SAS RAID controller must be installed in the RAID subsystem. If only one SAS RAID controller is installed, it must be in the primary SAS RAID controller slot and the other one must contain a cover.

2.3.3 Check Controller Memory Module

At least 2GB registered DDR3-1866 cache memory is required in each controller. Make sure the cache memory module is present and seated firmly in the DIMM socket (DDR3-1866) for series SAS RAID subsystems.

2.3.3.1 Installing the DDR-3 SDRAM DIMM

1. Position the DIMM module toward the socket with the notches in the module aligned with the receptive point on the socket.
2. Gently press down the module until it snaps into place in the socket. The release tabs will hold the DIMM in place.
3. Make sure the selected registered DIMM module using x8 or x16 device on the module.

HARDWARE INSTALLATION

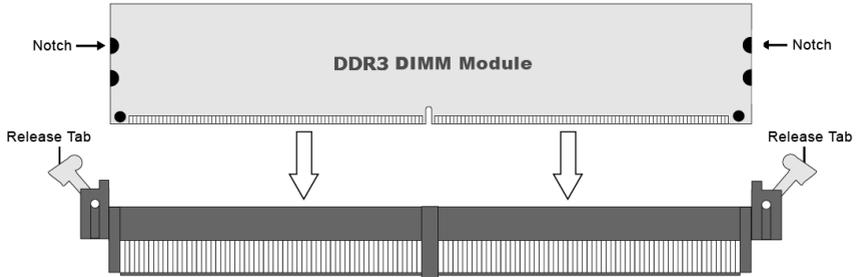


Figure 2-26, Inserting DIMM Module into Socket

2.3.3.2 Removing the DDR-3 SDRAM DIMM

Use your thumbs to gently push the release tabs at both ends of the socket to release it from the socket.

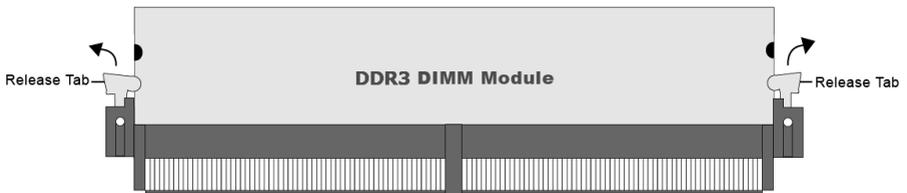


Figure 2-27, Releasing DIMM Module from Socket

2.3.4 Adding a Battery/Flash-based Backup Module (Optional)

Please refer to Appendix B/C for installing the BBM/FBM in your series SAS RAID subsystem.

HARDWARE INSTALLATION

2.4 Installing and Removing the Power Supply/Cooling Fan Modules

The subsystem supports two separate power modules. Each of them contains an integrated power supply and two cooling fans.

2.4.1 Installing the Power Supply/Cooling Fan Modules

1. Carefully slide the power supply/cooling fan modules into the empty slot.
2. Push the module back of the slot until it is firmly seated in the backplane connector.
3. Tighten the two thumbscrews to secure the power supply/cooling fan modules.
4. Connect the AC power cords to a grounded electrical outlet and to the power supply. Turn on the AC power switch from RAID subsystem. (Please refer to section 2.5 Installing the Power Cord Clamp)

Note:

The power supply/cooling fan modules are heavy. Be careful when you lift it up into the slot.

2.4.2 Removing a Power Supply/Cooling Fan Modules

1. Turn off the power supply and unplug the AC power cords.
2. Loosen the thumbscrews on power supply/cooling fan module then gently but firmly pull the power supply/cooling fan modules out from the slot.

HARDWARE INSTALLATION

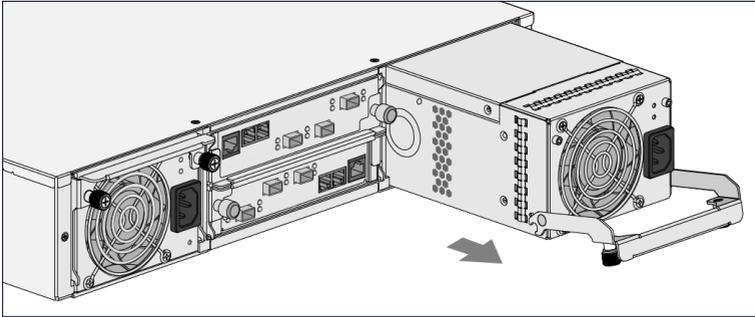


Figure 2-28, Pulling Power Module

Note:

1. The power supply/cooling fan modules are hot-pluggable. If one power supply/cooling fan module is functioning normally, you can hot-swap the other one while the subsystem is powered on.
2. If you remove a power supply/cooling fan module, the fan speed on the existing module will increase significantly to provide adequate cooling. The fan speed will decrease gradually when a new power supply/cooling fan module is inserted into the subsystem.

2.5 Installing the Power Cord Clamp

Using the included power cords, connect each power supply and cooling fan unit to an AC power source. The cable clamp prevents the power cord from being accidentally unplugged.

1. Connect the cable clamp to the cable strap. Opening the release tab then insert the angled end of cable strap through the cable tie frame. Facing up of cable strip smooth side and the other side facing down.

HARDWARE INSTALLATION

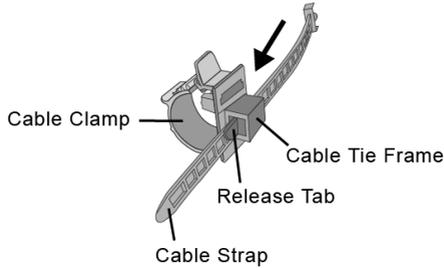


Figure 2-29, Power Cord Clamp

2. Connect the power cord and connect the cable strap with opening cable clamp to the power module. Using the release tab to adjust the cable clamp to the suitable place.

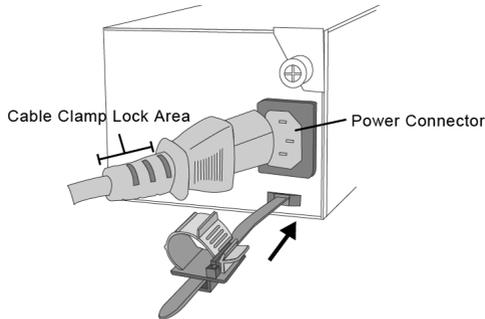


Figure 2-30, Adjusting Power Cord Clamp

3. Using cable clamp wrap the power cord and clip lock it. Repeat step 1 to 3 procedures to install the power cord clamp on the other power side.

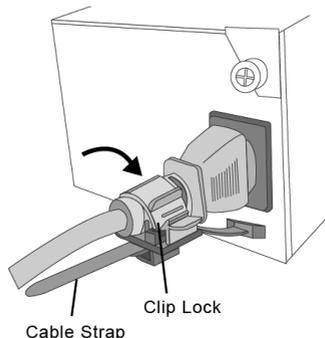


Figure 2-31, Clipping Lock

HARDWARE INSTALLATION

2.6 Connecting the RAID Subsystem

Once the SAS RAID subsystem has finished the installation of hardware components, then you can connect it to a host computer. The SAS RAID subsystem can be connected to a host computer through the SAS, Fibre or iSCSI interface. User can select the right cable connected to the host controller or other SAS RAID subsystem.

2.6.1 Connecting to Host System

The external host connector is provided on the back of the SAS RAID subsystem for connecting the array to server host adapter. By installing host port adapter and RAID subsystem using the correct external cables which is included in your SAS RAID subsystem kits. Then connect SAS RAID subsystem and host port adapter as shown below:

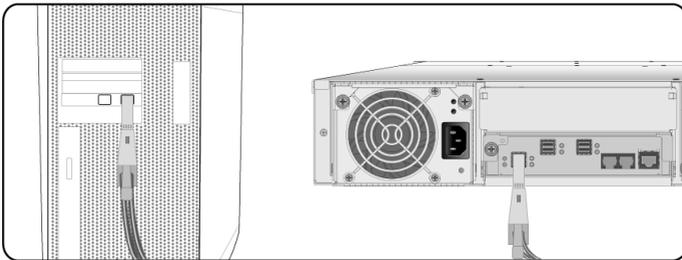


Figure 2-32, Connecting to Host Adapter

2.6.2 Connecting Monitor Port

The SAS RAID subsystem is normally delivered with LCD pre-installed. Your SAS RAID subsystem can be configured by using the LCD with keypad, a serial device (terminal emulation) or LAN port.



Figure 2-33, Monitor Port Location

HARDWARE INSTALLATION

- **RS232C Port Connection**

The SAS RAID subsystem can be configured via a VT-100 compatible terminal or a PC running a VT-100 terminal emulation program. You can attach a serial (Character-Based) terminal or server com port to the SAS RAID subsystem for access to the text-based setup menu. There are two RJ11 connectors that can support multiple functions on each connector. The controller board J3 jumper is used to define each RS 232 port (VT-100 for expander/Debug and VT-100 for controller) function.

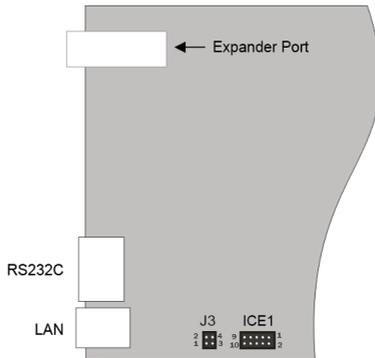


Figure 2-34, Jumper for Setting RS-232C Port

J3 jumper	Left RJ11 (Facing Connector)	Right RJ11 (Facing Connector)
1-2	Controller Debug Port	Expander Port
3-4 (Default)	Controller Debug Port	Controller VT-100 Port
No Cap	Expander Port	Controller VT-100 Port

Table 2-1, RS232C Port Function Definition

- **LAN Port Connection**

The SAS RAID subsystem has embedded the TCP/IP & web browser-based RAID manager in the firmware(method 3). User can remote manage the SAS RAID subsystem without adding any user specific software (platform independent) via standard web browsers directly connected to the RJ45 LAN port. Connect Ethernet port of the SAS RAID subsystem using the included LAN cable and then to a LAN port or LAN switch.

HARDWARE INSTALLATION

2.6.3 Power Up the RAID Subsystem

There is one main power on/off switch located on the rear side of the RAID subsystem. This on/off power switch is used to apply or remove power from the power supply to the RAID subsystem. Turning off subsystem power with this switch removes the main power but keeps standby power supplied to the RAID subsystem. Therefore, you must unplug the power cord before subsystem servicing.

The cooling fan included on the power supply run on separate control circuits from the power supply. Therefore, if one power supply fails, the failed power's fan continues to work on the power supplied from the other good power supply.

The installation is completed. You can use your SAS RAID subsystem.

Note:

A power supply/cooling fan module can be removed from a powered-on subsystem; however, the subsystem should shut down if overheating occurs.

2.7 Configuring RAID Subsystems

There are often multiple ways to accomplish the same configuration and maintenance tasks for your SAS RAID subsystem. The SAS RAID subsystem is normally delivered with LCD preinstalled. Your SAS RAID subsystem can be configured by using the LCD with keypad, a serial device (terminal emulation) or LAN port. Turn to the relative section of RAID configuration in the user manual for information about detail configuring RAID arrays.

HARDWARE INSTALLATION

2.7.1 Configuring Method

- Method 1: LCD Panel with Keypad

You can use LCD front panel and keypad function to simply create the RAID volume. The LCD status panel also informs you of the disk array's current operating status at a glance. For additional information on using the LCD to configure the RAID subsystem see the Chapter 4 of LCD Configuration.

The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays up to two lines at a time of menu items or other information.

The initial screen is shown as below:

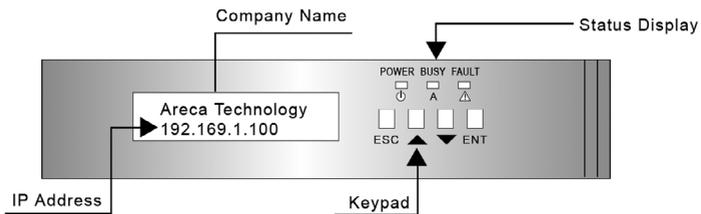


Figure 2-35, LCD Initial Screen

- Method 2: RS-232 Port Connection
For additional information on using the RS-232 port to configure the SAS RAID subsystem see the Chapter 5 of VT-100 Utility Configuration.
- Method 3: LAN Port Connection
For additional information on using the LAN port to configure the RAID subsystem see the Chapter 6 of Web Browser-Based Configuration.

Note:

It's a good ideal to turn on your SAS RAID subsystem before turning on the host computer. This will insure that the host computer recognize the volumes and drivers in the SAS RAID subsystem.

HARDWARE INSTALLATION

2.7.2 Format, Partition and Mount the SAS RAID Subsystem Volumes

Safety checks the installation. Connect all power cords. Turn on the AC power switch at the rear of host computer then press the power button at the front of the host computer.

After you create a unit, it needs to be partitioned, formatted, and mounted by the operating system. There are various steps, that depend on what operating system you are using (Windows, Linux, FreeBSD or Mac, etc.). Detailed steps for each operating system are provided on their disk utility. After that, the SAS RAID subsystem can be fully used.

CONFIGURATION METHOD

3. Configuration Methods

After the hardware installation, the SAS/SATA disk drives connected to the SAS RAID subsystem must be configured and the volume set units initialized before they are ready to use. This can be accomplished by one of the following methods:

- Front panel touch-control keypad.
- VT100 terminal connected through the controller's serial port.
- Web browser-based RAID manager via the controller's 10/100 LAN port.

Those user interfaces can access the built-in configuration and administration utility that resides on the controller's firmware. They provide complete control and management of the controller and disk arrays, eliminating the need for additional hardware or software.

Note:

The SAS RAID subsystem allows only one method to access menus at a time.

3.1 Using Local Front Panel Touch-control Keypad

The front panel keypad and liquid crystal display (LCD) is the primary user interface for the RAID subsystem. All configuration and management of the controller and its properly connected disk arrays can be performed from this interface.

The front panel keypad and LCD are connected to the RAID subsystem to access the built-in configuration and administration utility that resides in the controller's firmware. Complete control and management of the array's physical drives and logical units can be performed from the front panel, requiring no additional hardware or software drivers for that purpose.

CONFIGURATION METHOD

A touch-control keypad and a liquid crystal display (LCD) mounted on the front of the RAID subsystem is the primary operational interface and monitor display for the disk array controller. This user interface controls all configuration and management functions for the RAID subsystem it is properly connected.

The LCD provides a system of screens with areas for information, status indication or menus. The LCD screen displays up to two lines at a time of menu items or other information.

The initial screen is shown as below:

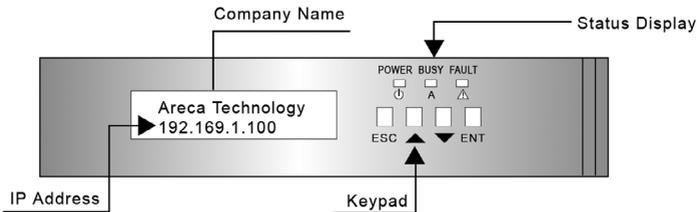


Figure 3-1, LCD Initial Screen

Function Key Definitions:

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

Key	Function
Up Arrow	Use to scroll the cursor Upward/Rightward
Down Arrow	Use to scroll the cursor Downward/Leftward
ENT Key	Submit select ion function (Confirm a selected item)
ESC Key	Return to previous screen (Exit a selection configuration)

There are a variety of failure conditions that cause the RAID subsystem monitoring LED to light. Following table provides a summary of the front panel LED.

Panel LED	Normal Status	Problem Indication
Power LED	Solid green, when power on	Unlit, when power on
Busy LED	Blinking amber during host accesses SAS RAID subsystem	Unlit or never flicker
Fault LED	Unlit	Solid red

CONFIGURATION METHOD

For additional information on using the LCD panel and keypad to configure the SAS RAID subsystem see "LCD Configuration Menu" on Chapter 4.

3.2 VT100 Terminal (Using the Controller's Serial Port)

The serial port on the RAID subsystem's backside can be used in VT100 mode. The provided interface cable converts the RS232 signal of the 6-pin RJ11 connector on the RAID subsystem into a 9-pin D-Sub female connector. The firmware-based terminal array management interface can access the array through this RS-232 port. You can attach a VT-100 compatible terminal or a PC running a VT-100 terminal emulation program to the serial port for accessing the text-based setup menu.

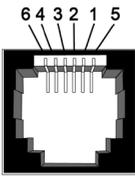
3.2.1 RS-232C Port Pin Assignment

To ensure proper communications between the RAID subsystem and the VT-100 Terminal Emulation, please configure the VT100 terminal emulation settings to the values shown below:

Terminal requirement	
Connection	Null-modem cable
Baud Rate	115,200
Data bits	8
Stop	1
Flow Control	None

The VT-100 port for the RAID configuration, please refer to table 2-2 in chapter 2. The controller VT-100 RJ11 connector pin assignments are defined as below.

Pin Assignment			
Pin	Definition	Pin	Definition
1	RTS (RS232)	4	GND
2	RXD (RS232)	5	GND
3	TXD (RS232)	6	GND



CONFIGURATION METHOD

Keyboard Navigation

The following definition is the VT-100 RAID configuration utility keyboard navigation.

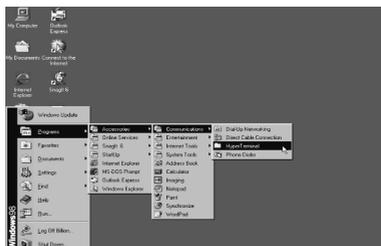
Key	Function
Arrow Key	Move cursor
Enter Key	Submit selection function
ESC Key	Return to previous screen
L Key	Line draw
X Key	Redraw

3.2.2 Start-up VT100 Screen

By connecting a VT100 compatible terminal, or a PC operating in an equivalent terminal emulation mode, all RAID subsystem monitoring, configuration and administration functions can be exercised from the VT100 terminal.

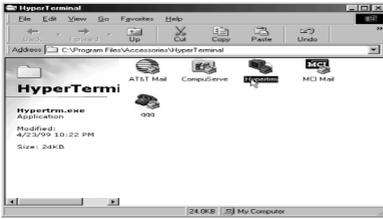
There are a wide variety of Terminal Emulation packages, but for the most part they should be very similar. The following setup procedure is an example setup VT100 Terminal in Windows system using Hyper Terminal use Version 3.0 or higher.

Step 1. From the Desktop open the start menu. Pick Programs, Accessories, Communications and Hyper Terminal. Open Hyper Terminal (requires version 3.0 or higher)

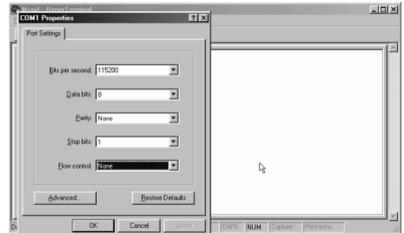


Step 2. Open **HYPERTERM.EXE** and enter a name for your Terminal. Click **OK**.

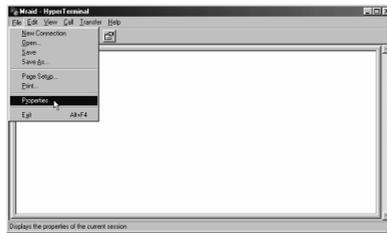
CONFIGURATION METHOD



Step 3. Select an appropriate connecting port in your Terminal. Click OK. Configure the port parameter settings. Bits per second: "**115200**", Data bits: "**8**", Parity: "**None**", Stop bits: "**1**", Flow control: "**None**". Click "**OK**"



Step 4. Open the File menu, and then open Properties.

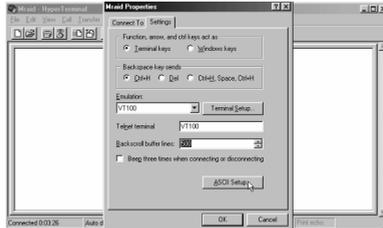


Step 5. Open the Settings Tab.



CONFIGURATION METHOD

Step 6. Open the Settings Tab. Function, arrow and ctrl keys act as: Terminal Keys, Backspace key sends: "**Crtl+H**", Emulation: VT100, Telnet terminal: VT100, Back scroll buffer lines: 500. Click **OK**.



Now, the VT100 is ready to use. After you have finished the VT100 Terminal setup, you may press "**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.

CONFIGURATION METHOD

3.3 Web Browser-based RAID Manager

To configure RAID subsystem on a local or remote machine, you need to know its IP Address. The IP address will default show in the "LCD" screen or "Ethernet Configuration" option on the VT100 utility configuration. Launch your firmware-embedded web browser-based RAID manager by entering `http://[IP Address]` in the web browser.

The provided LAN interface cable connects the RAID subsystem LAN port into a LAN port from your local network. Use only shield cable to avoid radiated emission that may cause interruptions. To ensure proper communications between the RAID subsystem and web browser-based RAID management, please connect the RAID subsystem LAN port to any LAN switch port.

The RAID subsystem has embedded the TCP/IP & web browser-based RAID manager in the firmware. User can remote manage the RAID subsystem without adding any user specific software (platform independent) via standard web browsers directly connected to the 10/100 RJ45 LAN port.

The storage console current configuration screen displays the current configuration of your RAID subsystem. Detail procedures, please refer to the Chapter 6 Web Browser-based Configuration method.

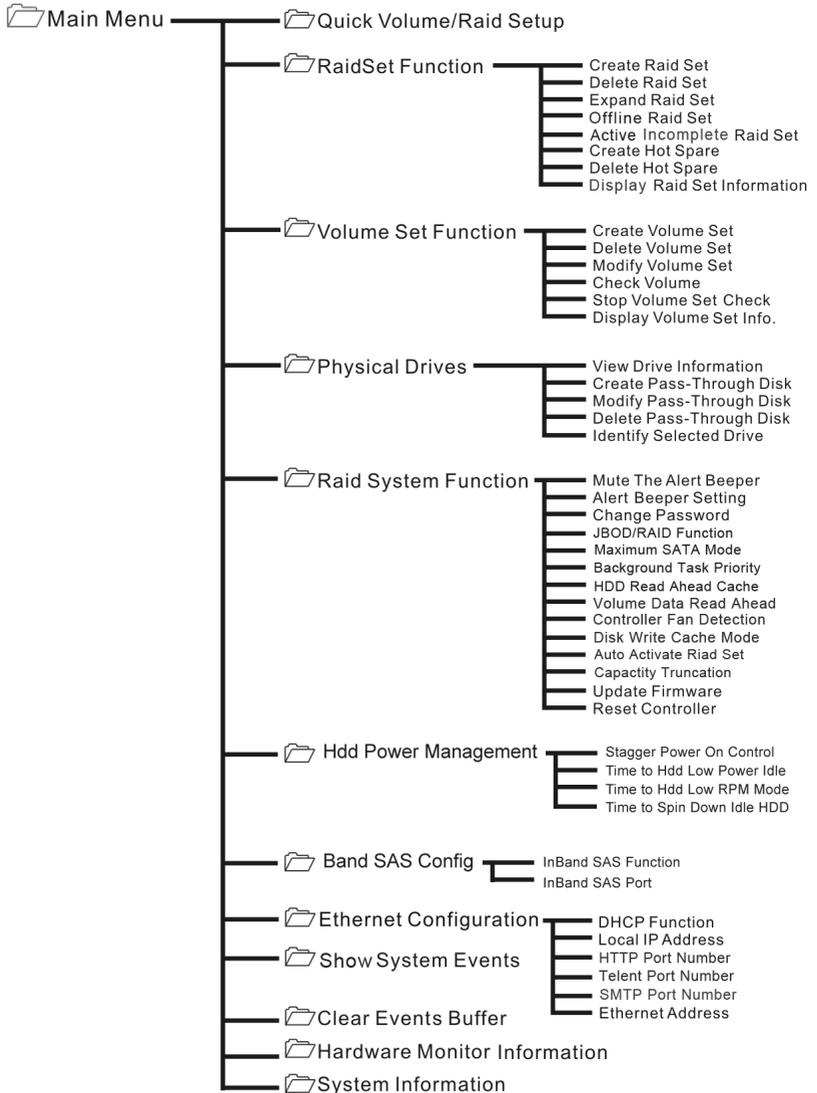
Note:

1. You must be logged in as administrator with local admin rights on the remote machine to remotely configure it.
2. The RAID subsystem default user name is "admin" and the password is "0000".

3.4 Configuration Menu Tree

The following is an expansion of the menus in configuration utility that can be accessed through the LCD panel, RS-232 serial port and LAN port.

CONFIGURATION METHOD



Note:

Ethernet Configuration, Alert By Mail Config, and SNMP Config can only be set in the web-based configuration.

LCD CONFIGURATION MENU

4. LCD Configuration Menu

After the hardware installation, the disk drives connected to the RAID subsystem must be configured and the volume set units initialized before they are ready to use. This can be also accomplished by the front panel touch-control keypad.

The LCD module on the front side can access the built-in configuration and administration utility that resides in the controller's firmware. To complete control and management of the array's physical drives and logical units can be performed from the front panel, requiring no additional hardware or software drivers for that purpose.

The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays up to two lines at a time of menu items or other information.

The LCD display front panel function keys are the primary user interface for the RAID subsystem. Except for the complex function, major of the configurations can be performed through this interface.

Function Key Definitions

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

Key	Function
Up Arrow	Use to scroll the cursor Upward/Rightward
Down Arrow	Use to scroll the cursor Downward/Leftward
ENT Key	Submit select ion function (Confirm a selected item)
ESC Key	Return to previous screen (Exit a selection configuration)

4.1 Starting LCD Configuration Utility

After power on the RAID subsystem, press **ENT** to verify password for entering the main menu from LCD panel. Using the **UP/DOWN** buttons to select the menu item, then press **ENT** to confirm it. Press **ESC** to return to the previous screen.

LCD CONFIGURATION MENU

4.2 LCD Configuration Utility Main Menu Options

Select an option, related information or submenu items to display beneath it. The submenus for each item are explained on the section 4.7.2. The configuration utility main menu options are:

Option	Description
Quick Volume And Raid Set Setup	Create a default configurations which are based on the number of physical disk 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
Ethernet Configuration	LAN port setting
Show System Events	Record all system events in the buffer
Clear All Event Buffers	Clear all event buffer information
Hardware Monitor Information	Show all system environment status
Show System information	View the controller information

4.3 Configuring Raid Sets and Volume Sets

You can use “Quick Volume And Raid Set Setup” or “Raid Set Functions” and “Volume Set Functions” to configure RAID sets and volume sets from LCD panel. Each configuration method requires a different level of user input. The general flow of operations for RAID set and volume set configuration is:

Step	Action
1	Designate hot spares/pass-through (optional)
2	Choose a configuration method
3	Create RAID set using the available physical drives
4	Define volume set using the space in the RAID set
5	Initialize the volume set and use volume set in the host OS

LCD CONFIGURATION MENU

4.4 Designating Drives as Hot Spares

To designate drives as hot spares, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the " RAID Set Functions " option and then press **ENT**. All RAID set functions will be displayed. Press **UP/DOWN** buttons to select the " Create Hot Spare Disk " option and then press **ENT**. The first unused physical device connected to the current RAID subsystem appears. Press **UP/DOWN** buttons to scroll the unused physical devices and select the target disk to assign as a hot spare and press **ENT** to designate it as a hot spare.

4.5 Using Easy RAID Configuration

In " Quick Volume And Raid Setup " configuration, the RAID set you create is associated with exactly one volume set, and you can modify the Raid Level, Stripe Size, and Capacity. Designating drives as hot spares will also combine with RAID level in this setup.

The volume set default settings will be:

Parameter	Setting
Volume Name	Volume Set # 00
SAS Port#/LUN Base/LUN	0/0/0
Cache Mode	Write-Back
Tag Queuing	Yes

The default setting values can be changed after configuration is completed.

Follow the steps below to create RAID set using " Quick Volume And Raid Setup " configuration:

Step	Action
1	Choose " Quick Volume And Raid Setup " from the main menu. The available RAID levels with hot spare for the current volume set drive are displayed.

LCD CONFIGURATION MENU

2	<p>It is recommended to use drives have same capacity in a specific array. If you use drives with different capacities in an array, all drives in the RAID set will select the lowest capacity of the drive in the RAID set.</p> <p>The numbers of physical drives in a specific array determine the RAID levels that can be implemented with the array.</p> <p>RAID 0 requires 1 or more physical drives</p> <p>RAID 1 requires at least 2 physical drives</p> <p>RAID 1+Spare requires at least 3 physical drives</p> <p>RAID 3 requires at least 3 physical drives</p> <p>RAID 5 requires at least 3 physical drives</p> <p>RAID 3 +Spare requires at least 4 physical drives</p> <p>RAID 5 + Spare requires at least 4 physical drives</p> <p>RAID 6 + Spare requires at least 5 physical drives.</p> <p>Using UP/DOWN buttons to select RAID level for the volume set and press ENT to confirm it.</p>
3	<p>Using UP/DOWN buttons to create the current volume set capacity size and press ENT to confirm it. The available stripe sizes for the current volume set are displayed.</p>
4	<p>Using UP/DOWN buttons to select the current volume set stripe size and press ENT key to confirm it. This parameter specifies the size of the stripes written to each disk in a RAID 0, 1, 10(1E), 5 or 6 volume set. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128 KB, 256KB, 512KB or 1024KB. A larger stripe size provides better-read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random read requests more often, choose a small stripe size.</p>
5	<p>When you finished defining the volume set, press ENT to confirm the "Quick Volume And Raid Set Setup" function.</p>
6	<p>Press ENT to define "FGrnd Init (Foreground initialization)" or press ESC to define "BGrnd Init (Background initialization)". When "FGrnd Init", the initialization proceeds must be completed before the volume set ready for system accesses. When "BGrnd Init", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete.</p>
7	<p>Initialize the volume set you have just configured.</p>
8	<p>If you need to add additional volume set, using main menu "Create Volume Set" functions.</p>

LCD CONFIGURATION MENU

4.6 Using Raid Set and Volume Set Functions

In "Raid Set Function", you can use the create RAID set function to generate the new RAID set. In "Volume Set Function", you can use the create volume set function to generate its associated volume set and parameters. If the current RAID subsystem has unused physical devices connected, you can choose the "Create Hot Spare" option in the "Raid Set Function" to define a hot spare.

Select this method to configure new RAID sets and volume sets. This configuration option allows you to associate volume set with partial and full RAID set.

Step	Action
1	To setup the hot spare (option), choose "Raid Set Function" from the main menu. Select the "Create Hot Spare" and press ENT to set the hot spare.
2	Choose "Raid Set Function" from the main menu. Select the "Create Raid Set" and press ENT .
3	Select a drive for RAID set from the SAS/SATA/SSD drive connected to the RAID subsystem.
4	Press UP/DOWN buttons to select specific physical drives. Press the ENT key to associate the selected physical drive with the current RAID set. Recommend use drives has same capacity in a specific RAID set. If you use drives with different capacities in an array, all drives in the RAID set will select the lowest capacity of the drive in the RAID set. The numbers of physical drives in a specific RAID set determine the RAID levels that can be implemented with the RAID set. RAID 0 requires 1 or more physical drives per RAID set. RAID 1 requires at least 2 physical drives per RAID set. RAID 1 + Spare requires at least 3 physical drives per RAID set. RAID 3 requires at least 3 physical drives per RAID set. RAID 5 requires at least 3 physical drives per RAID set. RAID 3 + Spare requires at least 4 physical drives per RAID set. RAID 5 + Spare requires at least 4 physical drives per RAID set. RAID 6 + Spare requires at least 5 physical drives per RAID set.
5	After adding physical drives to the current RAID set as desired, press ENT to confirm the "Create Raid Set" function.
6	An edit the RAID set name screen appears. Enter 1 to 15 alphanumeric characters to define a unique identifier for a RAID set. The default RAID set name will always appear as Raid Set. #. Press ENT to finish the name editing.

LCD CONFIGURATION MENU

7	Press ENT when you are finished creating the current RAID set. To continue defining another RAID set, repeat step 3. To begin volume set configuration, go to step 8.
8	Choose "Volume Set Functions" from the main menu. Select the "Create Volume Set" and press ENT .
9	Choose one RAID set from the screen. Press ENT to confirm it.
10	<p>The volume set attributes screen appears: The volume set attributes screen shows the volume set default configuration value that is currently being configured. The volume set attributes are: Volume Name, Raid Level, Stripe Size, Cache Mode, SAS Port/SAS LUN Base/SAS LUN, Fibre Port/ Fibre LUN Base/Fibre LUN and iSCSI Target Node/iSCSI LUN, Write Protect and Tagged Queuing.</p> <p>All values can be changed by the user. Press the UP/DOWN buttons to select the attributes. Press the ENT to modify each attribute of the default value. Using UP/DOWN buttons to select attribute value and press the ENT to accept the default value.</p>
11	After user completed modifying the attribute, press ESC to enter the select capacity for the volume set. Using the UP/DOWN buttons to set the volume set capacity and press ENT to confirm it.
12	When you finished defining the volume set, press ENT to confirm the creation function.
13	Press ENT to define "FGrnd Init (Foreground initialization)" or press ESC to define "BGrnd Init (Background initialization)"or. The controller will begin to initialize the volume set, you have just configured. If space remains in the RAID set, the next volume set can be configured. Repeat steps 8 to 13 to configure another volume set.

4.7 Navigation Map of the LCD

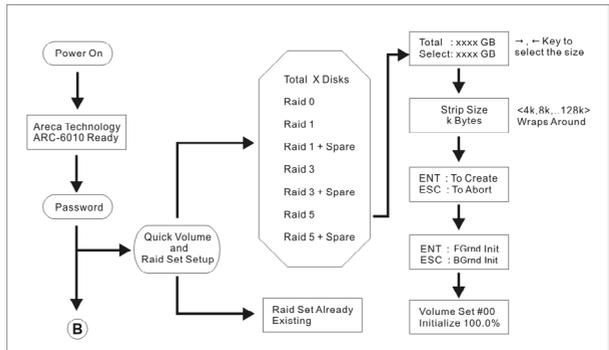
The password option allows user to set or clear the RAID subsystem's password protection feature. Once the password has been set, the user can only monitor and configure the RAID subsystem by providing the correct password. The password is used to protect the RAID subsystem from unauthorized entry. The RAID subsystem 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 five minutes. The RAID subsystem's password is default setting at "**0000**" by the manufacture.

LCD CONFIGURATION MENU

4.7.1 Quick Volume And Raid Setup

“Quick Volume And Raid Setup” is the fastest way to prepare a RAID set and volume set. It only needs a few keystrokes to complete it. Although disk drives of different capacity may be used in the RAID set, it will use the smallest capacity of the disk drive as the capacity of all disk drives in the RAID set. The “Quick Volume And Raid Setup” option creates a RAID set with the following properties:

Figure 4.7.1-1



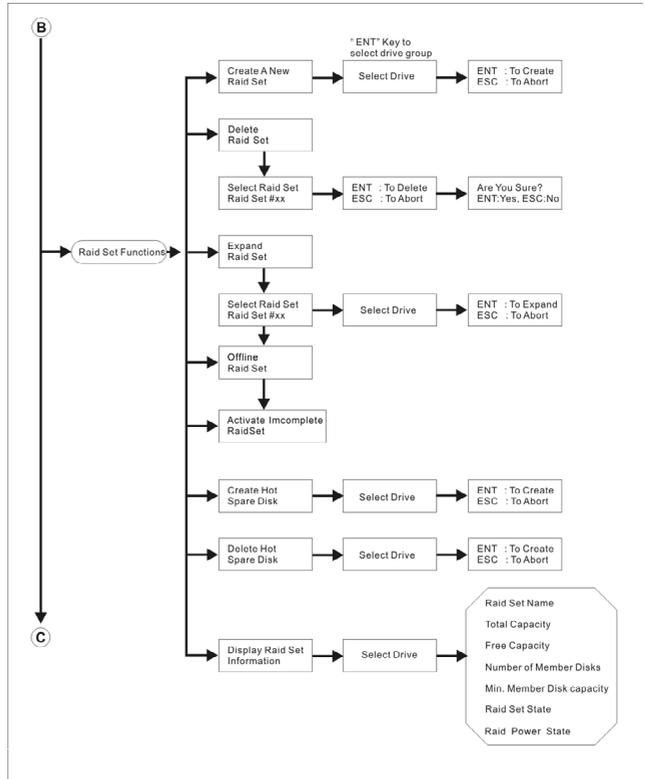
1. All of the physical disk drives are contained in a RAID set.
2. The RAID levels associated with hot spare, capacity, and stripe size are selected during the configuration process.
3. A single volume set is created and consumed all or a portion of the disk capacity available in this RAID set.
4. If you need to add additional volume set, using main menu “Volume Set Functions”. Detailed procedure refer to this chapter section 4.7.3.

4.7.2 Raid Set Functions

User manual configuration can complete control of the RAID set setting, but it will take longer time to complete than the “Quick Volume And Raid Setup” configuration. Select the “Raid Set Functions” to manually configure the RAID set for the first time or deletes existing RAID set and reconfigures the RAID set. To enter a “Raid Set Functions”, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the “Raid Set Functions” option and then press **ENT** to enter further submenus. All RAID set submenus will be displayed.

LCD CONFIGURATION MENU

Figure 4.7.2-1



4.7.2.1 Create A New Raid Set

For detailed procedure please refer to chapter section 4.6.

4.7.2.2 Delete Raid Set

Press **UP/DOWN** buttons to choose the "Delete Raid Set" option. Using **UP/DOWN** buttons to select the RAID set number that user wants to delete and then press **ENT** to accept the RAID set number. The confirmation screen appears, then press **ENT** to accept the delete RAID set function. The double confirmation screen appears, then press **ENT** to make sure of the delete existed RAID set function.

LCD CONFIGURATION MENU

4.7.2.3 Expand Raid Set

Instead of deleting a RAID set and recreating it with additional disk drives, the "Expand Existed Raid Set" function allows the user to add disk drives to the RAID set that was created.

To expand existed RAID set, press **UP/DOWN** buttons to choose the "Expand Raid Set" option. Using **UP/DOWN** buttons to select the RAID set number that user wants to expand and then press **ENT** to accept the RAID set number. If there is an available disk, then the "Select Drive" appears. Using **UP/DOWN** buttons to select the target disk and then press **ENT** to select it. Press **ENT** to start expanding the existed RAID set. The new added capacity can defined one or more volume sets. Follow the instruction presented in the "Volume Set Function" to create the volume sets.

Migrating occurs when a disk is added to a RAID set. Migration status is displayed in the RAID status area of the "Raid Set information" when a disk is added to a RAID set. Migrating status is also displayed in the associated volume status area of the volume set information when a disk is added to a RAID set.

Note:

1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.
2. 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 completes.

4.7.2.4 Offline Raid Set

Press **UP/DOWN** buttons to choose the "Offline Raid Set" option. This function is for customer being able to unmount and remount a multi-disk volume. All hdds of the selected RAID set will be put into offline state, spun down and fault LED will be in fast blinking mode.

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4.7.2.5 Activate Incomplete RaidSet

When one of the disk drive is removed or loosed connection in power off state, the RAID set state will change to "Incomplete State". If user wants to continue to work, when the RAID subsystem is power on. User can use the "Activate Incomplete RaidSet" option to active the RAID set. After user completed the function, the "Raid State" will change to "Degraded Mode".

4.7.2.6 Create Hot Spare Disk

Please refer to this chapter section 4.4. Designating drives as hot spares.

4.7.2.7 Delete Hot Spare Disk

To delete hot spare, press **UP/DOWN** buttons to choose the "Delete Hot Spare Disk" option. Using **UP/DOWN** buttons to select the hot spare number that user wants to delete and then press **ENT** to select it. The confirmation screen appears and press **ENT** to delete the hot spare.

4.7.2.8 Display Raid Set Information

Choose the "Display Raid Set Information" option and press **ENT**. Using **UP/DOWN** buttons to select the RAID set number. Then the RAID set information will be displayed.

Using **UP/DOWN** buttons to see the RAID set information, it will show Raid Set Name, Total Capacity, Free Capacity, Number of Member Disks, Min. Member Disk Capacity, Raid Set State and Raid Power Status.

4.7.3 Volume Set Functions

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 disk capacity available in a RAID set. Multiple volume sets can exist on a group of disks in a RAID set. Addi-

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tional 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.

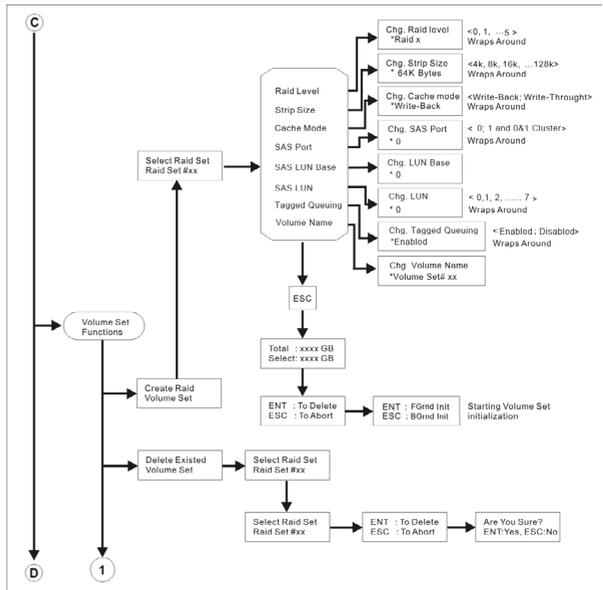
To enter the "Volume Set Functions", press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Volume Set Functions" option and then press **ENT** to enter further submenus. All volume set submenus will be displayed.

4.7.3.1 Create Raid Volume Set

To create a volume set, please refer to this chapter section 4.7, using "Raid Set Functions" and "Volume Set Functions". The volume set attributes screen shows the volume set default configuration values that have currently being configured.

The attributes for RAID subsystem series are Volume Name, Raid Level, Stripe Size, Cache Mode, SAS Port/ SAS LUN Base/ SAS LUN, Fibre Port/Fibre LUN Base/Fibre LUN, iSCSI Target Node/ iSCSI LUN, Write Protect and Tagged Queuing. See Figure 4.7.3.1-1.

Figure 4.7.3.1-1



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All values can be changed by user. Press the **UP/DOWN** buttons to select attributes. Press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press **ENT** to accept the default value. The following is the attributes descriptions. Please refer to this chapter section 4.7 using "Raid Set Functions" and "Volume Set Functions" to complete the create volume set function.

4.7.3.1.1 Volume Name

The default volume name will always appear as volume set#. You can rename the volume set name providing it does not exceed the 15 characters limit.

4.7.3.1.2 Raid Level

The RAID subsystem can only set the RAID level 0, 1, 10(1E), 3, 5 and 6 on the LCD configuration.

4.7.3.1.3 Stripe Size

This parameter sets the size of the segment written to each disk in a RAID 0, 1, 10(1E), 5 or 6 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128KB, 256KB, 512KB or 1024KB. 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.

4.7.3.1.4 Cache Mode

User can set the cache mode as "Write-Through" or "Write-Back".

4.7.3.1.5 Hot Port/Host LUN Base/Host LUN

• SAS Port/SAS LUN Base/SAS LUN

SAS Port - Two 4-PHY links SAS ports can be applied to the RAID subsystem. The RAID subsystem supports Port 0, 1 and 0&1 Cluster option.

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SAS LUN base - Each SAS device attached to the SAS host adapter must be assigned a unique SAS ID number. A SAS port can connect up to 128(16*8) volume sets. The RAID subsystem is as a large SAS device. We should assign a LUN base from a list of SAS LUN Base.

SAS LUN - Each LUN Base can support up to 8 SAS LUNs. Most SAS port host adapter treats each SAS LUN like a SAS disk.

● **Fibre Port/Fibre LUN Base/Fibre LUN**

Fibre Port - Two 16Gps or Four 16Gbps Fibre channel can be applied to the RAID subsystem. Choose the Fibre Host: "0", "1" or "0&1 Cluster" option. A "Select Fibre Channel" appears, select the channel number and press **ENT** key to confirm it.

Fibre LUN Base - Each fibre device attached to the Fibre card, as well as the card itself, must be assigned a unique fibre ID number. A Fibre channel can connect up to 128(16*8) volume sets. The RAID subsystem is as a large Fibre device. We should assign an LUN base from a list of Fibre LUN Base.

Fibre LUN - Each Fibre LUN base can support up to 8 LUNs. Most Fibre channel host adapter treats each LUN like a Fibre disk.

● **iSCSI Target Node/iSCSI LUN**

iSCSI Target Node - A iSCSI RAID subsystem can connect up to 16 target nodes. The iSCSI RAID subsystem is as a large SAS/SATA device. We should assign a Node from a list of Target Node. A iSCSI channel can connect up to 128(16*8) volume sets.

iSCSI LUN - Each Target Node can support up to 8 LUNs. Most iSCSI host adapter treats each LUN like a SAS/SATA disk.

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4.7.3.1.6 Tagged Queuing

This option, when enabled, can enhance overall system performance under multi-tasking operating systems. The Command Tag (Drive Channel) function controls the SAS command tag queuing support for each drive channel. This function should normally remain enabled. Disabled this function only when using older drives that do not support command tag queuing. Tagged Command Queuing (TCQ) is a technology built into SAS hard drives. It allows the RAID controller to send multiple read and write requests to a hard drive. This function should normally remain "Enabled". "Disabled" this function only when using SAS drives that do not support command tag queuing.

4.7.3.1.7 Initialization Mode

Press **ENT** to define "FGrnd Init (Foreground initialization)" or press **ESC** to define "BGrnd Init (Background initialization)". When "FGrnd Init", the initialization proceeds must be completed before the volume set ready for system accesses. When "BGrnd Init", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete.

4.7.3.2 Delete Existed Volume Set

Choose the "Delete Existed Volume Set" option. Using **UP/ DOWN** buttons to select the RAID set number that user wants to delete and press **ENT**. The confirmation screen appears, and then press **ENT** to accept the delete volume set function. The double confirmation screen appears, then press **ENT** to make sure of the delete existed volume set.

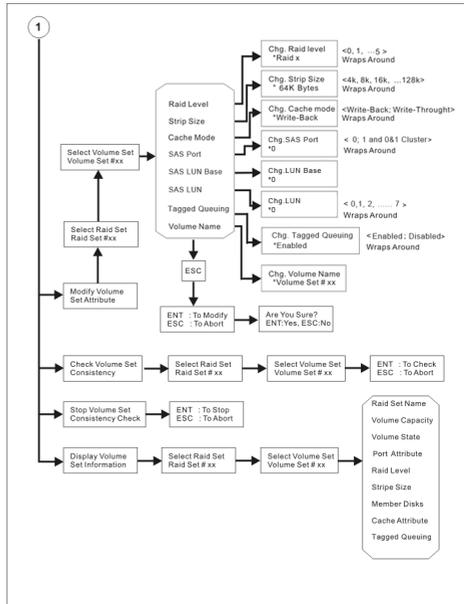
4.7.3.3 Modify Volume Set Attribute

Use this option to modify volume set configuration. To modify volume set attributes from RAID set system function, press **UP/ DOWN** buttons to choose the "Modify Volume Set Attribute" op-

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tion. Using **UP/DOWN** buttons to select the RAID set number that user wants to modify and press **ENT**. Press **ENT** to select the existed volume set attribute. The volume set attributes screen shows the volume set setting configuration attributes that were currently being configured. The attributes are Raid Level, Stripe Size, Cache Mode, SAS Port/SAS LUN Base/SAS LUN, Fibre Port/Fibre LUN Base/Fibre LUN, iSCSI Target Node/ iSCSI LUN, Write Protect, Tagged Queuing and Volume Name (number). All values can be modified by user. Press the **UP/DOWN** buttons to select attribute. Press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press the **ENT** to accept the selection value. Choose this option to display the properties of the selected volume set.

Figure 4.7.3.3-1



4.7.3.3.1 Volume Set Migration

Migrating occurs when a volume set is migrating from one RAID level to another, a volume set strip size changes, or when a disk is added to a RAID set. Migration status is displayed in the volume state area of the "Display Volume Set" Information.

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4.7.3.4 Check Volume Set Consistency

Use this option to check volume set consistency. To check volume set consistency from volume set system function, press **UP/DOWN** buttons to choose the "Check Volume Set Consistency" option. Using **UP/DOWN** button to select the RAID set number that user wants to check and press **ENT**. The confirmation screen appears, press **ENT** to start the check volume set consistency.

4.7.3.5 Stop Volume Set Consistency Check

Use this option to stop volume set consistency check. To stop volume set consistency check from volume set system function, press **UP/DOWN** buttons to choose the "Stop Volume Set Consistency Check" option and then press **ENT** to stop the check volume set consistency.

4.7.3.6 Display Volume Set Information

To display volume set information from volume set function, press **UP/DOWN** buttons to choose the "Display Volume Set Information" option. Using **UP/DOWN** buttons to select the RAID set number that user wants to show and press **ENT**. The volume set information will show Volume Set Name, Raid Set Name, Volume Capacity, Port Attribute, RAID Level, Stripe Size, Member Disks, Cache Attribute and Tagged Queuing. All values can not be modified by this option.

4.7.4 Physical Drive Functions

Choose this option from the main menu to select a physical disk and to perform the operations listed below. To enter a physical drive functions, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Physical Drive Functions" option and then press **ENT** to enter further submenus. All physical drive submenus will be displayed.

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Figure 4.7.4-1

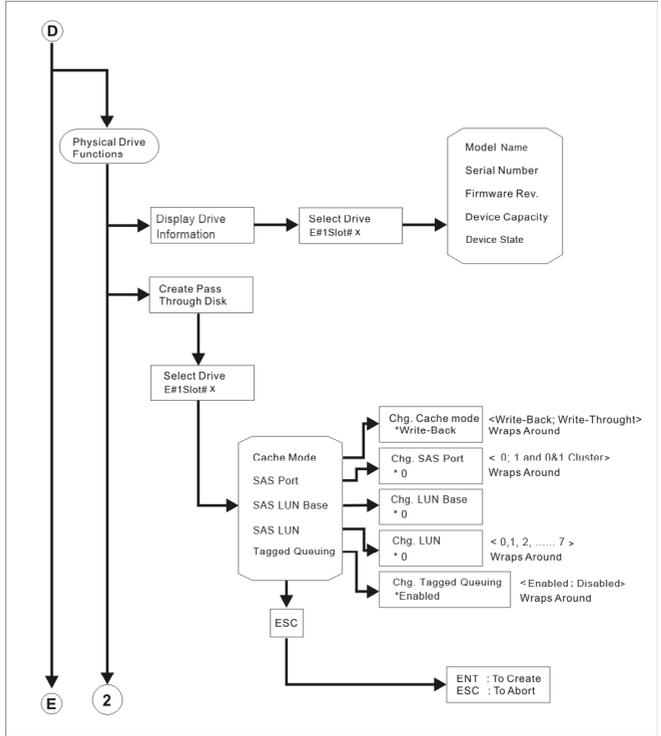
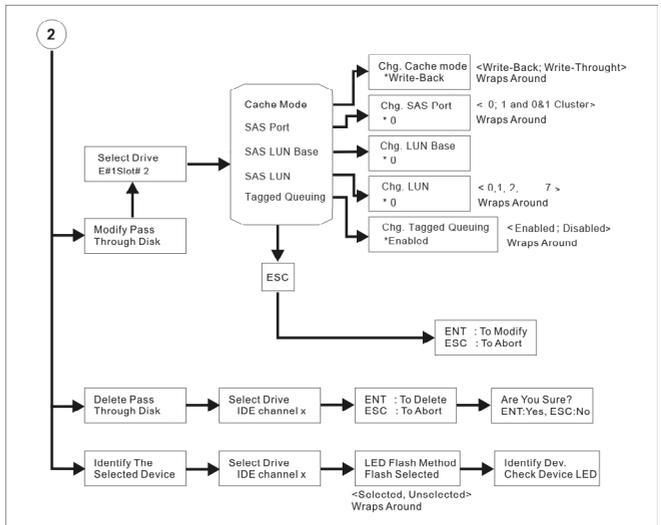


Figure 4.7.4-2



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4.7.4.1 Display Drive Information

Using **UP/DOWN** buttons to choose the "Display Drive Information" option and press **ENT**. Using **UP/DOWN** buttons to select the drive SAS/SATA number that user want to display. The drive information will be displayed. The SATA drive information screen shows the Model Name, Serial Number, Firmware Rev., Device Capacity, Current SATA, Supported SATA, and Device State.

4.7.4.2 Create Pass-Through Disk

Disk is not controlled by the RAID subsystem's firmware and thus can not be a part of a RAID set. The disk is available to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID subsystem's firmware. Using **UP/DOWN** buttons to choose the "Create Pass-Through Disk" option and press **ENT**. Using **UP/DOWN** buttons to select the drive SAS/SATA number that user want to create. The drive attributes will be displayed.

The attributes for pass-through disk show the Volume Cache Mode, SAS Port/ SAS LUN Base/SAS LUN, Fibre Port/Fibre LUN Base/Fibre LUN, iSCSI Target Node/iSCSI LUN, Write Protect and Tagged Queuing. All values can be changed by user. Press the **UP/DOWN** buttons to attribute and then press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press **ENT** to accept the selection value.

4.7.4.3 Modify Pass-Through Disk

To modify pass-through disk attributes from pass-through drive pool, press **UP/DOWN** buttons to choose the "Modify Pass-Through Disk" option, and then press **ENT**. The select drive function menu will show all pass-through disk number items. Using **UP/DOWN** buttons to select the pass-through disk that user wants to modify and press **ENT**. The attributes screen shows the pass through disk setting values that were currently being configured.

The attributes for pass-through disk are the Volume Cache Mode, SAS Port/ SAS LUN Base/SAS LUN, Fibre Port/Fibre LUN

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Base/Fibre LUN, iSCSI Target Node/ iSCSI LUN, Write Protect and Tagged Command Queuing. All values can be modified by user. Using **UP/DOWN** buttons to select attribute. Press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press **ENT** to accept the selection value. After completing the modification, press **ESC** to enter the confirmation screen and then press **ENT** to accept the "Modify Pass-Through Disk" function.

4.7.4.4 Delete Pass-Through Disk

To delete pass through disk from the pass-through drive pool, press **UP/DOWN** buttons to choose the "Delete Pass-Through Disk" option, and then press **ENT**. The "Select Drive Function" menu will show all pass-through disk number items. Using **UP/DOWN** buttons to select the pass-through disk that user wants to delete and press **ENT**. The delete pass-through confirmation screen will appear, press **ENT** to delete it.

4.7.4.5 Identify The Selected Drive

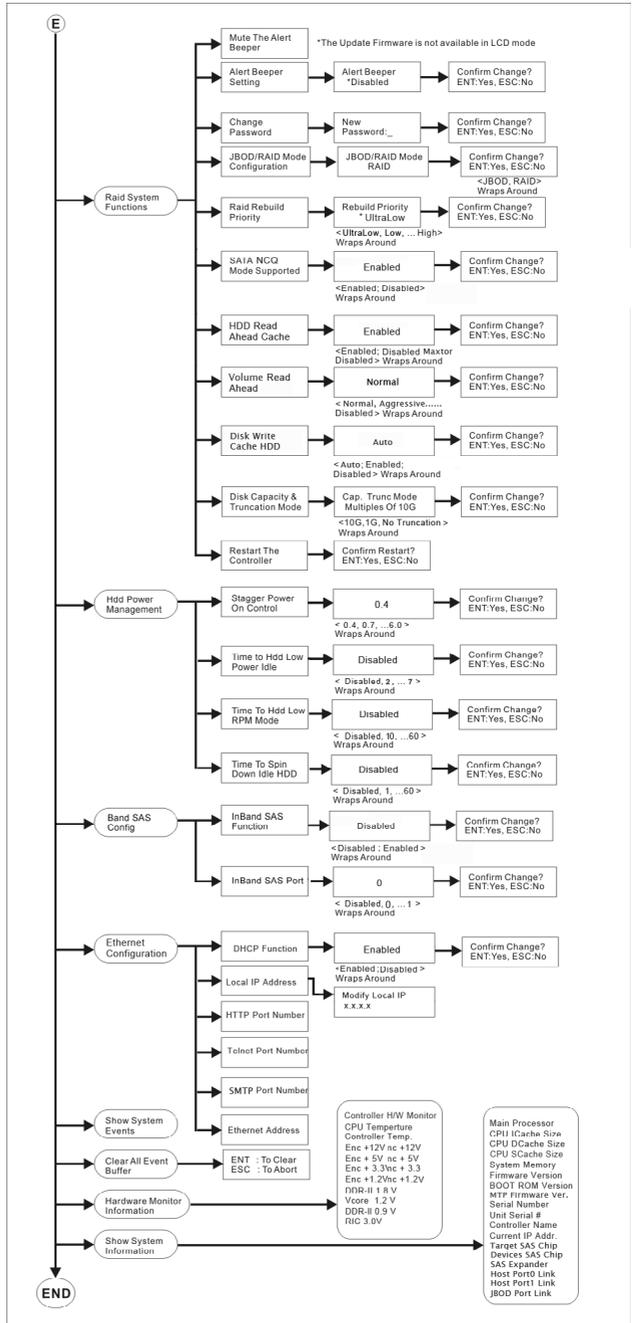
To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the "Identify The Selected Drive" function is selected. To identify selected drive from the physical drive pool, press **UP/DOWN** buttons to choose the "Identify The Selected Drive" option, then press **ENT** key. The "Select Drive function" menu will show all physical drive number items. Using **UP/DOWN** buttons to select the disk that user want to identify and press **ENT**. The selected disk fault LED indicator will flash.

4.7.5 Raid System Functions

To enter a "Raid System Functions", press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Raid System Functions" option and then press **ENT** to enter further submenus. All RAID system submenus will be displayed. Using **UP/DOWN** buttons to select the submenus option and then press **ENT** to enter the selection function.

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Figure 4.7.5-1



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4.7.5.1 Mute The Alert Beeper

The "Mute The Alert Beeper" function item is used to control the RAID subsystem beeper. Select **No** and press **ENT** button to turn the beeper off temporarily. The beeper will still activate on the next event.

4.7.5.2 Alert Beeper Setting

The "Alert Beeper Setting" function item is used to disable or enable the RAID subsystem's alarm tone generator. Using the **UP/DOWN** buttons to select "Alert beeper Setting" and press **ENT** to accept the selection. After completed the selection, the confirmation screen will be displayed and then press **ENT** to accept the function. Select the "Disabled" and press **ENT** key in the dialog box to turn the beeper off.

4.7.5.3 Change Password

To set or change the RAID subsystem's password, press the **UP/DOWN** buttons to select "Change Password" option and then press **ENT** to accept the selection. The "New Password:" screen appears and enter new password that users want to change. Using **UP/DOWN** buttons to set the password value. After completed the modification, the confirmation screen will be displayed and then press **ENT** to accept the function. To disable the password, press **ENT** only in the "New Password:" column. The existing password will be cleared. No password checking will occur when entering the main menu from the starting screen. The RAID subsystem will automatically go back to the initial screen when it does not receive any command in 5 minutes. Do not use spaces when you enter the password, If spaces are used, it will lock out the user.

4.7.5.4 JBOD/RAID Mode Configuration

JBOD is an acronym for "Just a Bunch Of Disk". A group of hard disks in a RAID subsystem are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to change the option from the RAID to the JBOD function.

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4.7.5.5 Raid Rebuild Priority

The "Raid Rebuild Priority" is a relative indication of how much time the controller devotes to a rebuild operation. The RAID subsystem allows user to choose the rebuild priority (UltraLow, Low, ... High) to balance volume set access and rebuild tasks appropriately. To set or change the RAID subsystem's RAID rebuild priority, press the **UP/DOWN** buttons to select "RAID Rebuild Priority" and press **ENT** to accept the selection. The rebuild priority selection screen appears and uses the **UP/DOWN** buttons to set the rebuild value. After completing the modification, the confirmation screen will be displayed and then press **ENT** to accept the function.

4.7.5.6 SATA NCQ Mode Support

The controller supports both SAS and SATA disk drives. The SATA NCQ 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. The RAID subsystem allows the user to select the SATA NCQ support: "Enabled" or "Disabled".

4.7.5.7 HDD Read Ahead Cache

Allow Read Ahead (Default: Enabled)—When "Enabled", the drive's read ahead cache algorithm is used, providing maximum performance under most circumstances.

4.7.5.8 Volume Data Read Ahead

The data read ahead parameter specifies the controller firmware algorithms which process the "Data Read Ahead" blocks from the disk. The read ahead parameter is normal by default. To modify the value, you must know your application behavior. The default "Normal" option satisfies the performance requirements for a typical volume. The "Disabled" value implies no read ahead. The most efficient value for the controllers depends on your application. "Aggressive" read ahead is optimal for sequential

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access but it degrades random access.

4.7.5.9 Disk Write Cache HDD

User can set the "Disk Write Cache Mode" to "Auto", "Enabled", or "Disabled". "Enabled" increases speed, "Disabled" increases reliability.

4.7.5.10 Disk Capacity Truncation Mode

The RAID subsystem uses drive truncation so that drives from differing 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 redundant units. The RAID subsystem provides three truncation modes in the system configuration: Multiples Of 10G, Multiples Of 1G and Disabled.

Multiples Of 10G - If you have 120 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 120 GB. "Multiples Of 10G" truncates the number under tens. This makes the same capacity for both of these drives so that one could replace the other.

Multiples Of 1G - If you have 123 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 123.4 GB. "Multiples Of 1G" truncates the fractional part. This makes the same capacity for both of these drives so that one could replace the other.

Disabled - It does not truncate the capacity.

4.7.5.11 Restart Controller

To restart the RAID controller, press **UP/DOWN** buttons to select "Restart Controller" and then press **ENT** to accept the selection. The confirmation screen will be displayed and then press **ENT** to accept the function.

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Note:

It can only work properly at host and drive without any activity.

4.7.6 Hdd Power Management

Areca has automated the ability to manage HDD power based on usage patterns. The "HDD Power Management" allows you to choose a "Stagger Power On Control", "Low Power Idle", "Low RPM" and completely "Spins Down Idle HDD". It is designed to reduce power consumption and heat generation on idle drives.

4.7.6.1 Stagger Power On Control

In a RAID subsystems with more than two drives, the startup current from spinning up the drives all at once can overload the power supply, causing damage to the power supply, disk drives and other subsystem components. This damage can be avoided by allowing the RAID controller to stagger the spin-up of the drives. The SAS/SATA drives have support stagger spin-up capabilities to boost reliability. Stagger spin-up is a very useful feature for managing multiple disk drives in a storage subsystem. It gives the RAID controller the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. Staggering drive spin-up in a multiple drive environment also avoids the extra cost of a power supply designed to meet short-term startup power demand as well as steady state conditions.

Areca RAID controller has included the option for customer to select the disk drives sequentially stagger power up value. The values can be selected within the range 0.4 to 6 seconds per step which powers up one drive groups.

4.7.6.2 Time to Hdd Low Power Idle

This option delivers lower power consumption by automatically unloading recording heads during the setting idle time. The values can be selected "Disabled" or within the range 2 to 7 minutes.

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4.7.6.3 Time To Hdd Low RPM Mode

This function can automatically spin disks at lower RPM if there have not been used during the setting idle time. The values can be selected "Disabled" or within the range 10 to 60 minutes.

4.7.6.4 Time To Spin Down Idle HDD

This function can automatically spin down the drive if it hasn't been accessed for a certain amount of time. This value is used by the drive to determine how long to wait (with no disk activity, before turning off the spindle motor to save power). The values can be selected "Disabled" or within the range 1 to 60 minutes.

4.7.7 Ethernet Configuration

To configuration Ethernet function, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the option.

4.7.7.1 DHCP

DHCP (Dynamic Host Configuration Protocol) allows network administrators centrally manage and automate the assignment of IP (Internet Protocol) addresses on a computer network. When using the TCP/IP protocol (Internet protocol), it is necessary for a computer to have a unique IP address in order to communicate to other computer systems. Without DHCP, the IP address must be entered manually at each computer system. DHCP lets a network administrator supervise and distribute IP addresses from a central point. The purpose of DHCP is to provide the automatic (dynamic) allocation of IP client configurations for a specific time period (called a lease period) and to minimize the work necessary to administer a large IP network. To manually configure the IP address of the RAID subsystem, press the **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select DHCP, then press **ENT**.

Select the "Disabled" or "Enabled" option to enable or disable the DHCP function. If DHCP is disabled, it will be necessary to manually enter a static IP address that does not conflict with

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other devices on the network.

4.7.7.2 Local IP Adress

If you intend to set up your client computers manually (no DHCP), make sure that the assigned IP address is in the same range as the default router address and that it is unique to your private network. However, it is highly recommend to use DHCP if that option is available on your network. An IP address allocation scheme will reduce the time it takes to set-up client computers and eliminate the possibilities of administrative errors and duplicate addresses. To manually configure the IP address of the RAID subsystem, press the **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select "Local IP Adress", then press **ENT**. It will show the default address setting in the RAID subsystem. You can then reassign the static IP address of the RAID subsystem.

4.7.7.3 HTTP Port Number

To manually configure the "HTTP Port Number" of the RAID subsystem, press **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select "HTTP Port Number", then press **ENT**. It will show the default address setting in the RAID subsystem. Then You can reassign the default "HTTP Port Number" of the controller.

4.7.7.4 Telnet Port Number

To manually configure the "Telnet Port Number" of the RAID subsystem, press the **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select "Telnet Port Number", then press **ENT**. It will show the default address setting in the RAID subsystem. You can then reassign the default "Telnet Port Number" of RAID subsystem.

4.7.7.5 SMTP Port Number

To manually configure the "SMTP Port Number" of the RAID subsystem, press the **UP/DOWN** buttons to select "Ethernet

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Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select "SMTP Port Number", then press **ENT**. It will show the default address setting in the RAID subsystem. You can then reassign the default "SMTP Port Number" of RAID subsystem.

4.7.7.6 Ethernet Address

Each Ethernet port has its unique Mac address, which is also factory assigned. Usually, Ethernet Address is used to uniquely identify a port in the Ethernet network.

4.7.8 Show System Events

To view the RAID subsystem events, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Show System Events" option, and then press **ENT**. The system events will be displayed. Press **UP/DOWN** buttons to browse all the system events.

4.7.9 Clear all Event Buffers

Use this feature to clear the entire events buffer information. To clear all event buffers, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Clear all Event Buffers" option, and then press **ENT**. The confirmation message will be displayed and press **ENT** to clear all event buffers or **ESC** to abort the action.

4.7.10 Hardware Monitor Information

To view the RAID subsystem monitor information, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Hardware Information" option, and then press **ENT**. All hardware monitor information will be displayed. Press **UP/DOWN** buttons to browse all the hardware information. The hardware information provides the CPU temperature, controller temperature, fan speed (chassis fan), battery status and voltage of the RAID subsystem. All items are also unchangeable. The warning messages will indicate through the LCD, LED and alarm buzzer.

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4.7.11 System Information

Choose this option to display Main processor, CPU instruction cache size, CPU data cache size, system memory, firmware version, BOOT ROM version, MTP firmware, serial number, unit serial, controller name, current IP, target SAS chip, devices chip, SAS expander, host port link and JBOD port link. To check the system information, press **ENT** to enter the main menu. Press **UP/DOWN** button to select the "Show System Information" option, and then press **ENT**. All major controller system information will be displayed. Press **UP/DOWN** buttons to browse all the system information.

VT-100 UTILITY CONFIGURATION

5. VT-100 Utility Configuration

The RAID subsystem configuration utility is firmware-based and uses to configure RAID sets and volume sets. Because the utility resides in the RAID subsystem's firmware, its operation is independent of the operating systems on your computer. Use this utility to:

- Create RAID set,
- Expand RAID set,
- Define volume set,
- Add physical drive,
- Modify volume set,
- Modify RAID level/stripe size,
- Define pass-through disk drives,
- Update firmware,
- Modify system function and
- Designate drives as hot spares.

Keyboard Navigation

The following definition is the VT-100 RAID configuration utility keyboard navigation.

Key	Function
Arrow Key	Move Cursor
Enter Key	Submit selection function
ESC Key	Return to previous screen
L Key	Line Draw
X Key	Redraw

5.1 Configuring Raid Sets/Volume Sets

You can configure RAID sets and volume sets with VT-100 utility configuration automatically. Using "Quick Volume/Raid Setup" or manually using "Raid Set/Volume Set Function". Each configuration method requires a different level of user input. The general flow of operations for RAID set and volume set configuration is:

VT-100 UTILITY CONFIGURATION

Step	Action
1	Designate hot spares/pass-through (optional).
2	Choose a configuration method.
3	Create RAID sets using the available physical drives.
4	Define volume sets using the space in the RAID set.
5	Initialize the volume sets (logical drives) and use volume sets in the host OS.

5.2 Designating Drives as Hot Spares

Any unused disk drive that is not part of a RAID set can be designated as a hot spare. The "Quick Volume/Raid Setup" configuration will add the spare disk drive and automatically display the appropriate RAID level from which the user can select. For the "Raid Set Function" configuration option, the user can use the "Create Hot Spare" option to define the hot spare disk drive.

When a hot spare disk drive is being created using the "Create Hot Spare" option (in the "Raid Set Function"), all unused physical devices connected to the current controller appear:

1. Choose the target disk by selecting the appropriate check box.
2. Press **Enter** key to select a disk drive, and press **Yes** in the "Create Hot Spare" to designate it as a hot spare.

5.3 Using Quick Volume/Raid Setup Configuration

"Quick Volume / Raid Setup configuration" collects all available drives and includes them in a RAID set. The RAID set you created is associated with exactly one volume set. You will only be able to modify the default RAID level, stripe size and capacity of the new volume set. Designating drives as hot spares is also possible in the "Raid Level" selection option. The volume set default settings will be:

Parameter	Setting
Volume Name	Volume Set # 00
SAS Port#/LUN Base/LUN	0/0/0
Cache Mode	Write-Back
Tag Queuing	Yes

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The default setting values can be changed after configuration is complete. Follow the steps below to create arrays using "Quick Volume / Raid Setup" configuration:

Step	Action
1	Choose "Quick Volume /Raid Setup" from the main menu. The available RAID levels with hot spare for the current volume set drive are displayed.
2	It is recommended that you use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the RAID set will be set to the capacity of the smallest drive in the RAID set. The numbers of physical drives in a specific array determines which RAID levels that can be implemented in the array. RAID 0 requires 1 or more physical drives. RAID 1 requires at least 2 physical drives. RAID 10(1E) requires at least 3 physical drives. RAID 3 requires at least 3 physical drives. RAID 5 requires at least 3 physical drives. RAID 3 +Spare requires at least 4 physical drives. RAID 5 + Spare requires at least 4 physical drives. RAID 6 requires at least 4 physical drives. RAID 6 + Spare requires at least 5 physical drives. Highlight the desired RAID level for the volume set and press the Enter key to confirm.
3	The capacity for the current volume set is entered after highlighting the desired RAID level and pressing the Enter key. The capacity for the current volume set is displayed. Use the UP and DOWN arrow keys to set the capacity of the volume set and press the Enter key to confirm. The available stripe sizes for the current volume set are then displayed.
4	Use the UP and DOWN arrow keys to select the current volume set stripe size and press the Enter key to confirm. This parameter specifies the size of the stripes written to each disk in a RAID 0, 1, 10(1E), 5 or 6 volume set. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128KB, 256KB, 512KB or 1024KB. A larger stripe size provides better read performance, especially when the computer performs mostly sequential reads. However, if the computer performs random read requests more often, choose a smaller stripe size.
5	When you are finished defining the volume set, press the Yes key to confirm the "Quick Volume And Raid Set Setup" function.
6	Foreground (Fast Completion) Press Enter key to define fast initialization or selected the Background (Instant Available) or No Init (To Rescue Volume). In the "Background Initialization", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete. In "Foreground Initialization", the initialization proceeds must be completed before the volume set ready for system accesses. In "No Init", there is no initialization on this volume.

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7	Initialize the volume set you have just configured
8	If you need to add additional volume set, using main menu "Create Volume Set" function.

5.4 Using Raid Set/Volume Set Function Method

In "Raid Set Function", you can use the "Create Raid Set" function to generate a new RAID set. In "Volume Set Function", you can use the "Create Volume Set" function to generate an associated volume set and configuration parameters.

If the current controller has unused physical devices connected, you can choose the "Create Hot Spare" option in the "Raid Set Function" to define a global hot spare. Select this method to configure new RAID sets and volume sets. The "Raid Set/Volume Set Function" configuration option allows you to associate volume sets with partial and full RAID sets.

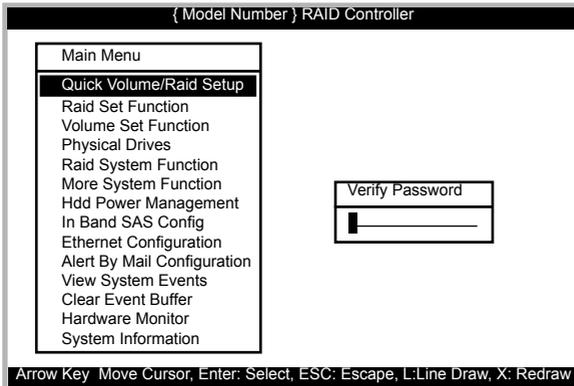
Step	Action
1	To setup the hot spare (option), choose "Raid Set Function" from the main menu. Select the "Create Hot Spare" and press the Enter key to define the hot spare.
2	Choose "RAID Set Function" from the main menu. Select "Create Raid Set" and press the Enter key.
3	The "Select a Drive For Raid Set" window is displayed showing the SAS/SATA drives connected to the RAID subsystem.
4	Press the UP and DOWN arrow keys to select specific physical drives. Press the Enter key to associate the selected physical drive with the current RAID set. It is recommended that you use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the RAID set will be set to the capacity of the smallest drive in the RAID set. The numbers of physical drives in a specific array determines which RAID levels that can be implemented in the array. RAID 0 requires 1 or more physical drives. RAID 1 requires at least 2 physical drives. RAID 10(1E) requires at least 3 physical drives. RAID 3 requires at least 3 physical drives. RAID 5 requires at least 3 physical drives. RAID 6 requires at least 4 physical drives. RAID 30 requires at least 6 physical drives. RAID 50 requires at least 6 physical drives. RAID 60 requires at least 8 physical drives.

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5	After adding the desired physical drives to the current RAID set, press the Enter to confirm the "Create Raid Set" function.
6	An "Edit The Raid Set Name" dialog box appears. Enter 1 to 15 alphanumeric characters to define a unique identifier for this new RAID set. The default RAID set name will always appear as Raid Set. #. Press Enter to finish the name editing.
7	Press the Enter key when you are finished creating the current RAID set. To continue defining another RAID set, repeat step 3. To begin volume set configuration, go to step 8.
8	Choose the "Volume Set Function" from the main menu. Select "Create Volume Set" and press the Enter key.
9	Choose a RAID set from the "Create Volume From Raid Set" window. Press the Yes key to confirm the selection.
10	Choosing Foreground (Fast Completion) Press Enter key to define fast initialization or selected the Background (Instant Available) or No Init (To Rescue Volume). In the "Background Initialization", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete. In "Foreground Initialization", the initialization proceeds must be completed before the volume set ready for system accesses. In "No Init", there is no initialization on this volume.
11	If space remains in the RAID set, the next volume set can be configured. Repeat steps 8 to 10 to configure another volume set.

5.5 Main Menu

The main menu shows all functions that are available for executing actions, which is accomplished by clicking on the appropriate link.



Note:

The manufacture default password is set to 0000, this password can be selected by the "Change Password" in the section of "Raid System Function".

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Option	Description
Quick Volume/Raid Setup	Create a default configuration which based on numbers of physical disk installed
Raid Set Function	Create a customized RAID set
Volume Set Function	Create a customized volume set
Physical Drives	View individual disk information
Raid System Function	Setting the RAID system configuration
In Band SAS Config	In Band management configuration
Ethernet Configuration	LAN port setting
View 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

This 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 internal RAID subsystem from unauthorized entry. The controller will prompt for the password only when entering the main menu from the initial screen. The RAID subsystem will automatically return to the initial screen when it does not receive any command in five minutes.

5.5.1 Quick Volume/Raid Setup

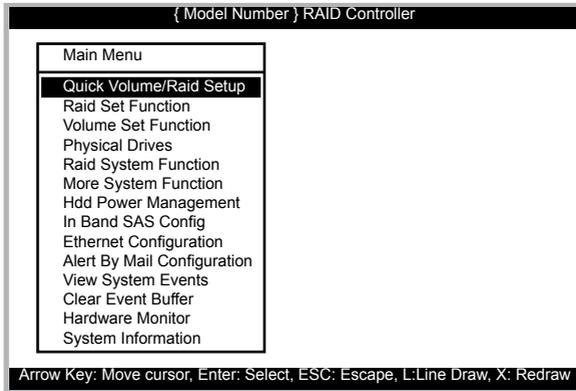
"Quick Volume/RAID Setup" is the fastest way to prepare a RAID set and volume set. It requires only a few keystrokes to complete. Although disk drives of different capacity may be used in the RAID Set, it will use the capacity of the smallest disk drive as the capacity of all disk drives in the RAID Set. The "Quick Volume/RAID Setup" option creates a RAID set with the following properties:

1. All of the physical drives are contained in one RAID set.
2. The RAID level, hot spare, capacity, and stripe size options are selected during the configuration process.
3. When a single volume set is created, it can consume all or a portion of the available disk capacity in this RAID set.

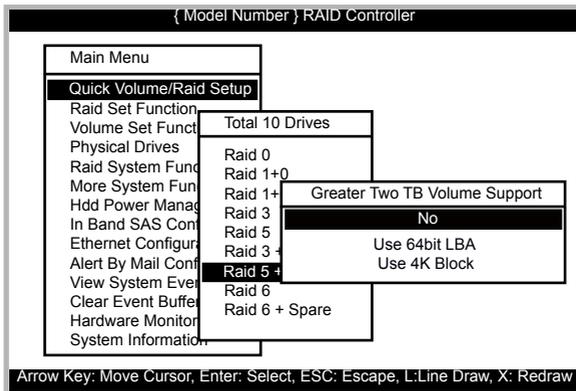
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4. If you need to add an additional volume set, use the main menu "Create Volume Set" function.

The total number of physical drives in a specific RAID set determine the RAID levels that can be implemented within the RAID set. Select "Quick Volume/Raid Setup" from the main menu; all possible RAID level will be displayed on the screen.



If volume capacity will exceed 2TB, controller will show the "Greater Two TB Volume Support" sub-menu.



- No

When this option is enabled, it keeps the volume size with max. 2TB limitation. For any hard disk drives working in the 4K native mode in the Raid set, the volume set directly sets and exposes 4KB sector size to the operating system.

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- 64bit LBA

This option uses 16 bytes CDB instead of 10 bytes. The maximum volume capacity supports up to 512TB. For any hard disk drives working in the 4K native mode in the Raid set, the volume set directly sets and exposes 4KB sector size to the operating system.

This option works on different OS which supports 16 bytes CDB. Such as:

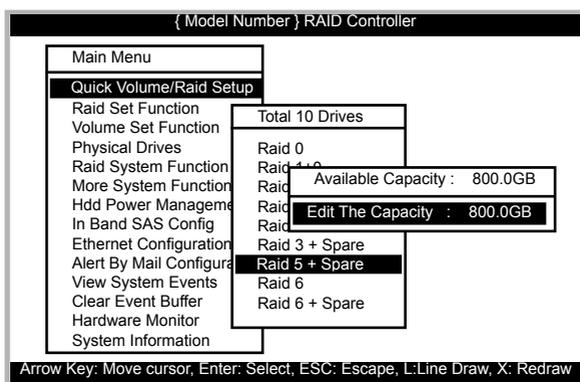
Windows 2003 with SP1 or later

Linux kernel 2.6.x or later

- Use 4K Block

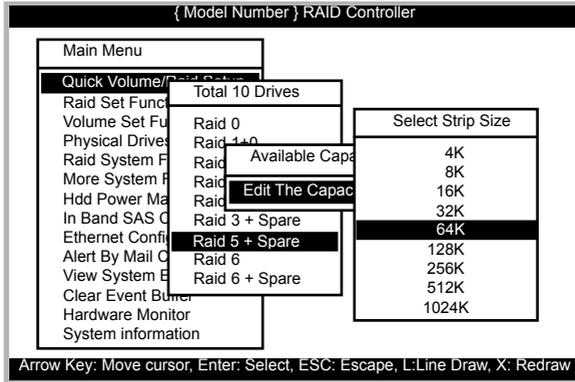
This option uses 16 bytes CDB and changes the sector size from default 512 bytes to 4k bytes. Windows XP only supports maximum volume capacity is up to 16TB.

A single volume set is created and consumes all or a portion of the disk capacity available in this RAID set. Define the capacity of volume set in the "Available Capacity" popup. The default value for the volume set, which is 100% of the available capacity, is displayed in the selected capacity. Use the **UP** and **DOWN** arrow key to set capacity of the volume set and press **Enter** key to accept this value. If the volume set uses only part of the RAID set capacity, you can use the "Create Volume Set" option in the main menu to define additional volume sets.



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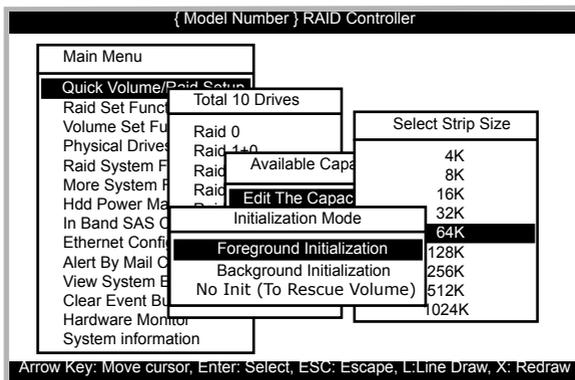
Stripe Size This parameter sets the size of the stripe written to each disk in a RAID 0, 1, 10(1E), 5, or 6 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128KB, 256KB, 512KB or 1024KB.



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

Press **Yes** option in the "Create Vol/Raid Set" dialog box, the RAID set and volume set will start to initialize it.

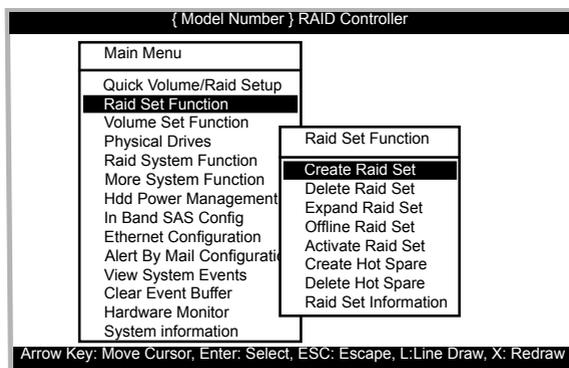
Select "Foreground (Faster Completion)" or "Background (Instant Available)" for initialization or "No Init (To Rescue Volume)" for recovering the missing RAID set configuration.



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5.5.2 Raid Set Function

Manual configuration gives complete control of the RAID set setting, but it will take longer to configure than "Quick Volume/Raid Setup" configuration. Select "Raid Set Function" to manually configure the RAID set for the first time or delete existing RAID sets and reconfigure the RAID set.



5.5.2.1 Create Raid Set

The following is the RAID set features for the RAID subsystem.

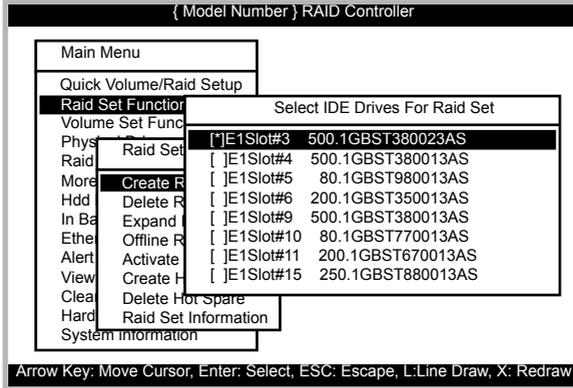
1. Up to 32 disk drives can be included in a single RAID set.
2. Up to 128 RAID sets can be created per controller. RAID level 30, 50 and 60 can support up to eight sub-volumes (RAID set).

To define a RAID set, follow the procedures below:

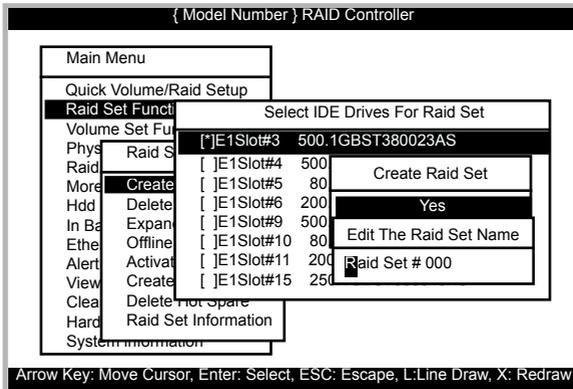
1. Select "Raid Set Function" from the main menu.
2. Select "Create Raid Set" from the "Raid Set Function" dialog box.
3. A "Select IDE Drive For Raid Set" window is displayed showing the SAS/SATA drives connected to the current controller. Press the **UP** and **DOWN** arrow keys to select specific physical drives. Press the **Enter** key to associate the selected physical drive with the current RAID set. Repeat this step; the user can add as many disk drives as are available to a single RAID set. When finished selecting SAS/SATA drives for RAID set, press **Esc** key. A "Create Raid Set Confirmation" screen will appear, select the **Yes** option to confirm it.

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- An "Edit The Raid Set Name" dialog box appears. Enter 1 to 15 alphanumeric characters to define a unique identifier for the RAID set. The default RAID set name will always appear as Raid Set. #.



- Repeat steps 3 and 4 to define another RAID set.



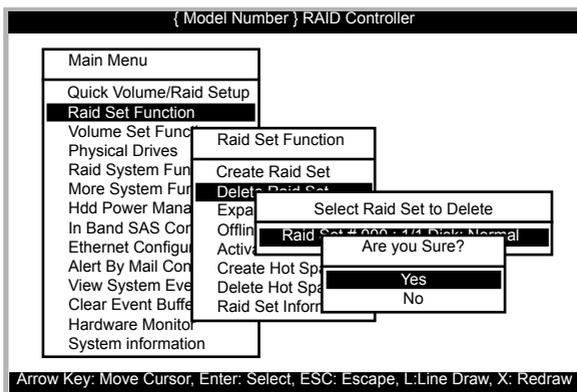
Note:

- You can only edit the Raid set name in "Create Raid Set".
- To create RAID 30/50/60 volume, you need to create multiple RAID sets first with the same disk members on each RAID set. The max no. disk drives per volume set: 32 for RAID 0/1/10(1E)/3/5/6 and 128 for RAID 30/50/60.

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5.5.2.2 Delete Raid Set

To completely erase and reconfigure a RAID set, you must first delete it and re-create the RAID set. To delete a RAID set, select the RAID set number that you want to delete in the "Select Raid Set To Delete" screen. Then "Delete Raid Set" dialog box will appear, press the **Yes** to delete it. Warning, data on RAID set will be lost if this option is used. But for deleting RAID set with the Raid 30/50/60 volume, firstly, you need to delete the volumes belonging those RAID sets.

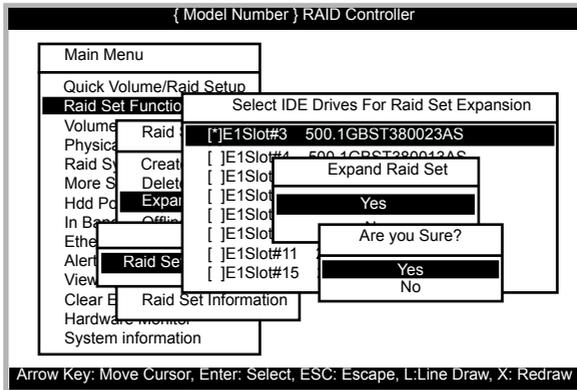


5.5.2.3 Expand Raid Set

Instead of deleting a RAID set and recreating it with additional disk drives, the "Expand Raid Set" function allows the users to add disk drives to the RAID set that have already been created. To expand a RAID set:

1. Select the "Expand Raid Set" option. If there is an available disk, then the "Select SATA Drives For Raid Set Expansion" screen appears.
2. Select the target RAID set by clicking on the appropriate radius button. Select the target disk by clicking on the appropriate check box.
3. Press the **Yes** key to start the expansion on the RAID set. The new additional capacity can be utilized by one or more volume sets. The volume sets associated with this RAID set appear for you to have chance to modify RAID level or stripe size. Follow the instruction presented in the "Modify Volume Set" to modify the volume sets; operation system specific utilities may be required to expand operating system partitions.

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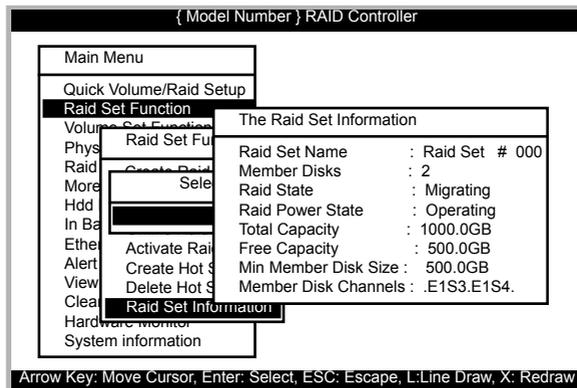


Note:

1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.
2. 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 completes.
3. RAID 30/50/60 doesn't support the "Expand Raid Set".

• Migrating

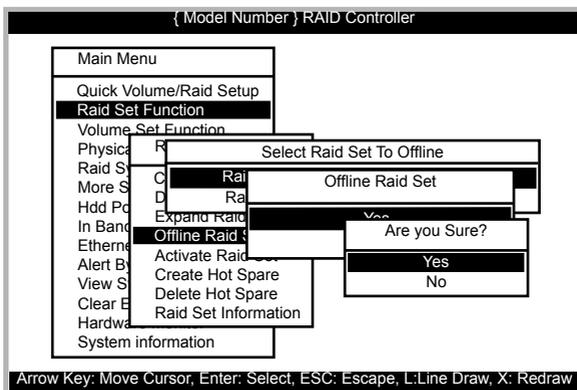
Migration occurs when a disk is added to a RAID set. Migrating state is displayed on the RAID state area of "The Raid Set Information" screen when a disk is being added to a RAID set. Migrating state is also displayed in the associated volume state area of the "Volume Set Information" which belongs this RAID set.



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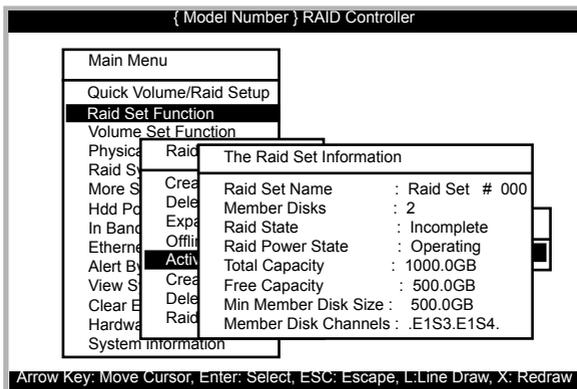
5.5.2.4 Offline Raid Set

This function is for customer being able to unmount and remount a multi-disk volume. All Hdds of the selected RAID set will be put into offline state and spun down and fault LED will be in fast blinking mode.



5.5.2.5 Activate Raid Set

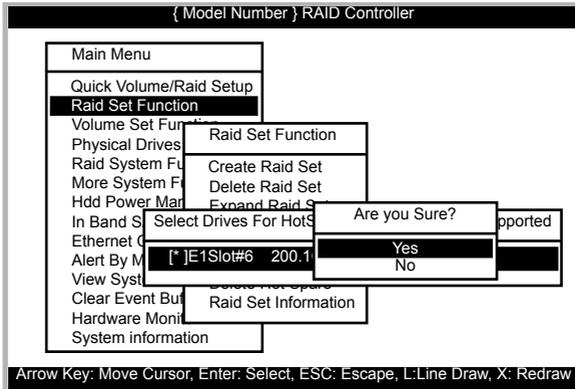
The following screen is used to activate the RAID set after one of its disk drive was removed in the power off state. When one of the disk drives is removed in power off state, the RAID set state will change to "Incomplete State". If user wants to continue to work while the RAID subsystem is powered on, the user can use the "Activate Incomplete Raid Set" option to activate the RAID set. After user selects this function, the RAID state will change to "Degraded Mode" and start to work.



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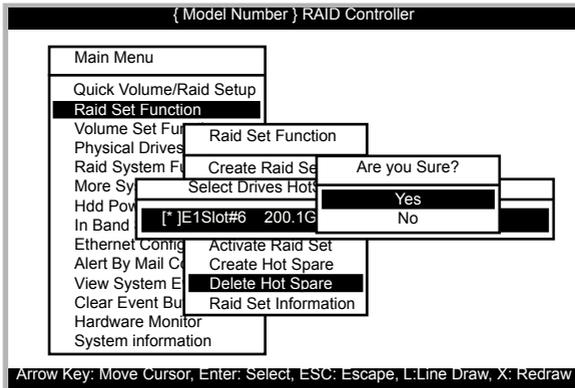
5.5.2.6 Create Hot Spare

When you choose the "Create Hot Spare" option in the "Raid Set Function", all unused physical devices connected to the current controller will result in the screen. Select the target disk by clicking on the appropriate check box. Press the **Enter** key to select a disk drive and press **Yes** in the "Create Hot Spare" to designate it as a hot spare. The "Create Hot Spare" option gives you the ability to define a global hot spare.



5.5.2.7 Delete Hot Spare

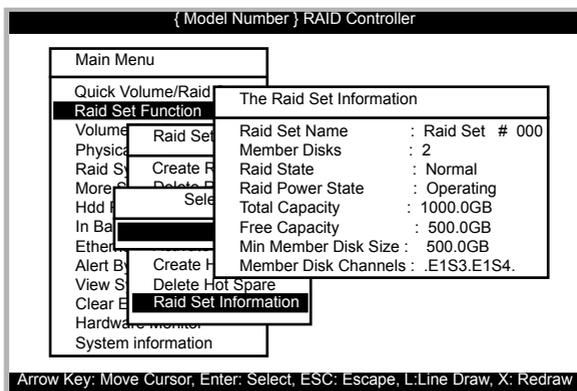
Select the target hot spare disk to delete by clicking on the appropriate check box. Press the **Enter** key to select a hot spare disk drive, and press **Yes** in the "Delete Hot Spare" screen to delete the hot spare.



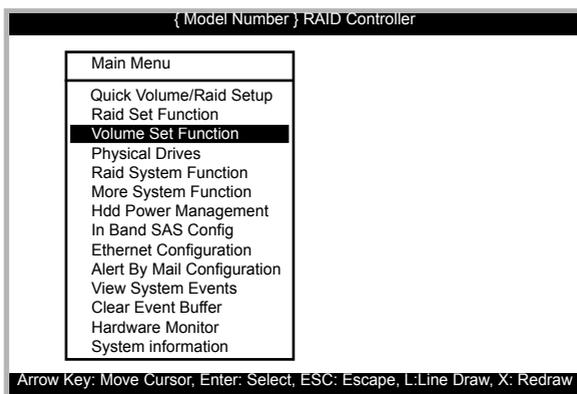
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5.5.2.8 Raid Set Information

To display RAID set information, move the cursor bar to the desired RAID set number, then press the **Enter** key. The "Raid Set Information" will appear. You can only view information for the RAID set in this screen.



5.5.3 Volume Set Function



A volume set is seen by the host system as a single logical device; it is organized in a RAID level within the controller utilizing one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set can consume all of the capacity or a portion of the available disk capacity of a RAID set. Multiple volume sets can exist on a RAID set. If multiple volume sets reside on a specified RAID set, all

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volume sets will reside on all 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 rather than one volume set using some of the available disks and another volume set using other disks.

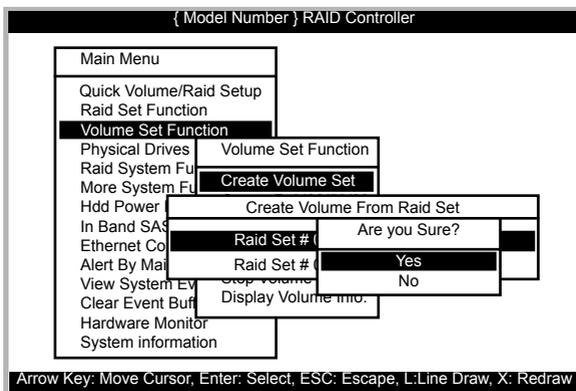
The following is the volume set features for the RAID subsystem.

1. Volume sets of different RAID levels may coexist on the same RAID set.
2. Up to 128 volume sets can be created in a RAID set.
3. The maximum addressable size of a single volume set is not limited to 2TB, because the controller is capable of 64-bit LBA mode. However the operating system itself may not be capable of addressing more than 2TB.

5.5.3.1 Create Volume Set (0/1/10/3/5/6)

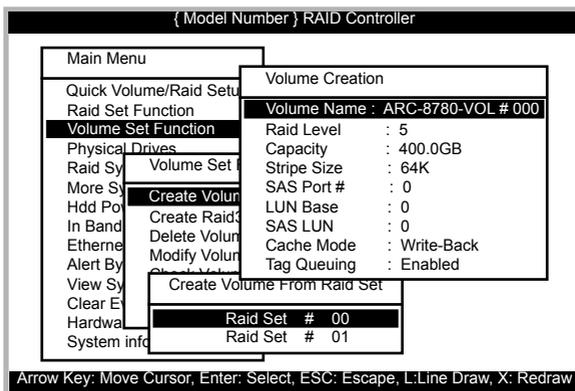
To create a volume set, following the steps:

1. Select the "Volume Set Function" from the main menu.
2. Choose the "Create Volume Set" from "Volume Set Functions" dialog box screen.
3. The "Create Volume From Raid Set" appears. This screen displays the existing arranged RAID sets. Select the RAID set number and press the **Enter** key. The "Volume Creation" dialog is displayed in the screen.

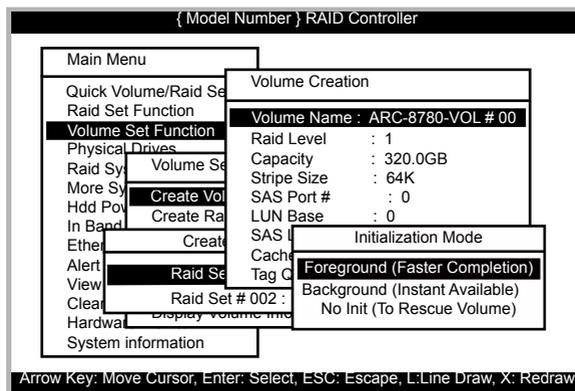


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- The new create volume set attribute allows user to select the Volume Name, Raid level, Capacity, Strip Size, SAS Port#/LUN Base/LUN, Cache Mode, Write Protect, and Tagged Command Queuing .



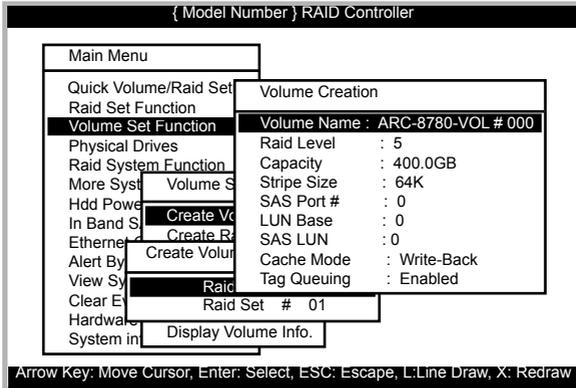
- After completed the modification of the volume set, press the **Esc** key to confirm it. An "Initialization Mode" screen appears.
 - Select "Foreground (Faster Completion)" for faster initialization of the selected volume set.
 - Select "Background (Instant Available)" for normal initialization of the selected volume set.
 - Select "No Init (To Rescue Volume)" for no initialization of the selected volume.
- Repeat steps 3 to 5 to create additional volume sets.
- The initialization percentage of volume set will be displayed at the button line.



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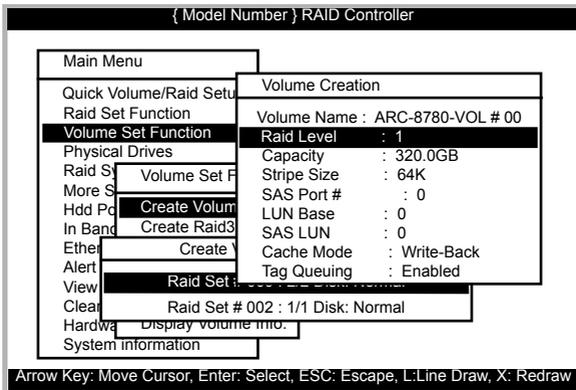
5.5.3.1.1 Volume Name

The default volume name will always appear as ARC-8668-VOL #. You can rename the volume set providing it does not exceed the 15 characters limit.



5.5.3.1.2 Raid Level

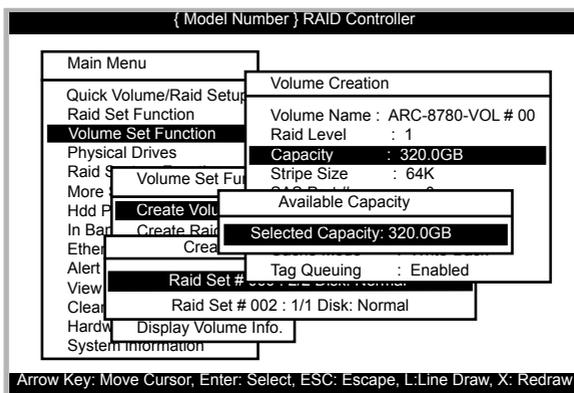
Set the RAID level for the volume set. Highlight "Raid Level" and press the **Enter** key. The available RAID levels for the current volume set are displayed. Select a RAID level and press the **Enter** key to confirm.



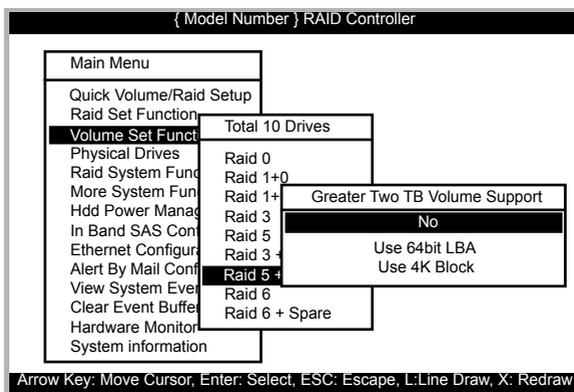
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5.5.3.1.3 Capacity

The maximum available volume size is the default value for the first setting. Enter the appropriate volume size to fit your application. The capacity value can be increased or decreased by the **UP** and **DOWN** arrow keys. The capacity of each volume set must be less than or equal to the total capacity of the RAID set on which it resides.



If volume capacity will exceed 2TB, controller will show the "Greater Two TB Volume Support" sub-menu.



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- No

When this option is enabled, it keeps the volume size with max. 2TB limitation. For any hard disk drives working in the 4K native mode in the Raid set, the volume set directly sets and exposes 4KB sector size to the operating system.

- 64bit LBA

This option uses 16 bytes CDB instead of 10 bytes. The maximum volume capacity supports up to 512TB. For any hard disk drives working in the 4K native mode in the Raid set, the volume set directly sets and exposes 4KB sector size to the operating system.

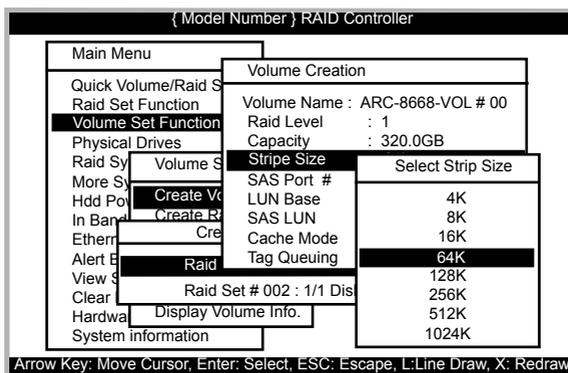
This option works on different OS which supports 16 bytes CDB. Such as:
Windows 2003 with SP1 or later
Linux kernel 2.6.x or later

- Use 4K Block

This option uses 16 bytes CDB and changes the sector size from default 512 bytes to 4k bytes. Windows XP only supports maximum volume capacity is up to 16TB.

5.5.3.1.4 Stripe Size

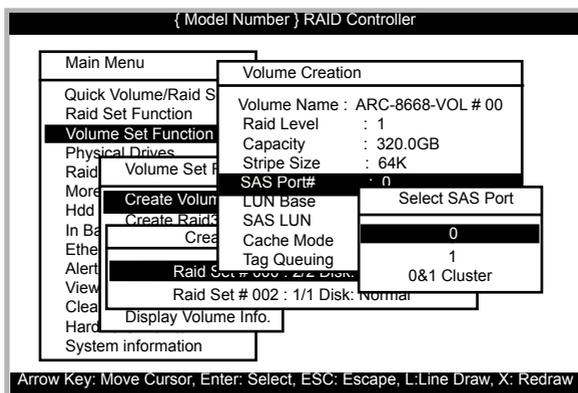
This parameter sets the size of segment written to each disk in a RAID 0, 1, 10(1E), 5, 6, 50 or 60 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128KB, 256KB, 512KB or 1024KB.



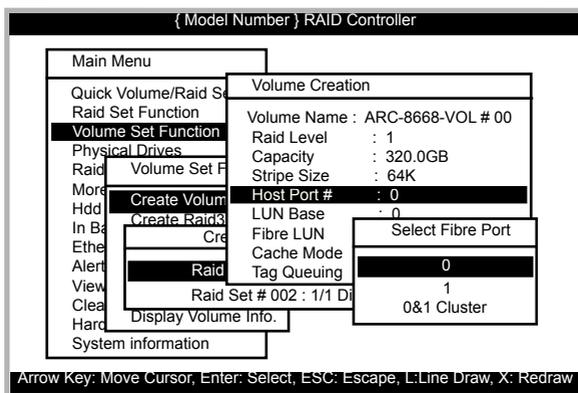
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5.5.3.1.5 SAS Port # / Fibre Host

Two 4-PHY links SAS ports can be applied to the RAID subsystem. Choose the SAS Port# option 0, 1 and 0&1 cluster.

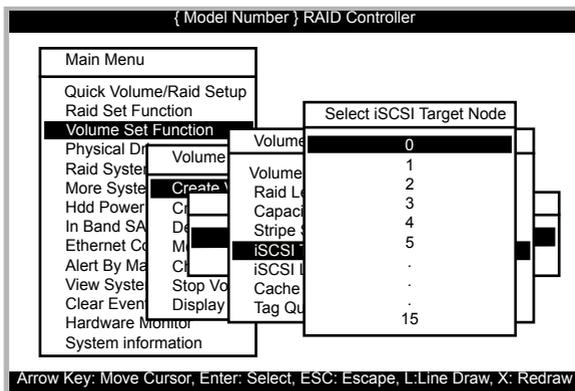


Two 16Gbps or four 16Gbps Fibre channel can be applied to the Fibre to SAS RAID subsystem. Choose the Fibre Host: "0", "1" or "0&1 Cluster" option. A Select Fibre Channel dialog box appears, select the channel number and press **Enter** key to confirm it.



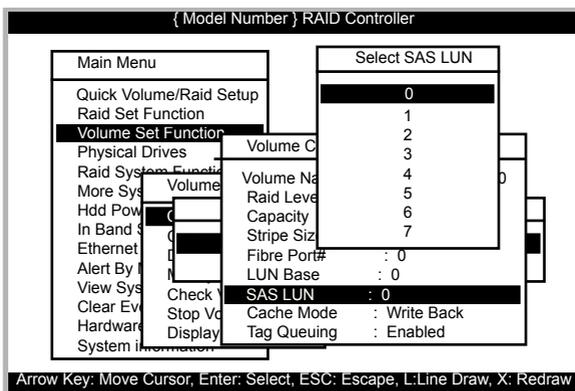
VT-100 UTILITY CONFIGURATION

Target Node - A iSCSI RAID subsystem can connect up to 16 target nodes. The iSCSI RAID subsystem is as a large SAS/SATA device. We should assign a Node from a list of Target Node. A iSCSI controller can connect up to 128 (16*8) volume sets.



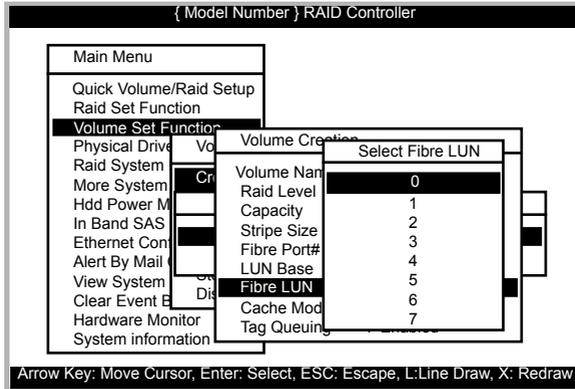
5.5.3.1.7 SAS LUN/Fibre LUN/iSCSI LUN

SAS LUN - Each LUN Base can support up to 8 SAS LUNs. Most SAS port host adapter treats each SAS LUN like a SAS disk.

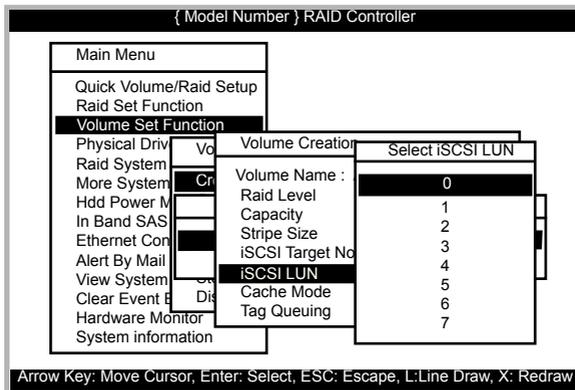


Fibre LUN - Each Fibre LUN base can support up to 8 LUNs. Most Fibre Channel host adapter treats each LUN like a Fibre disk.

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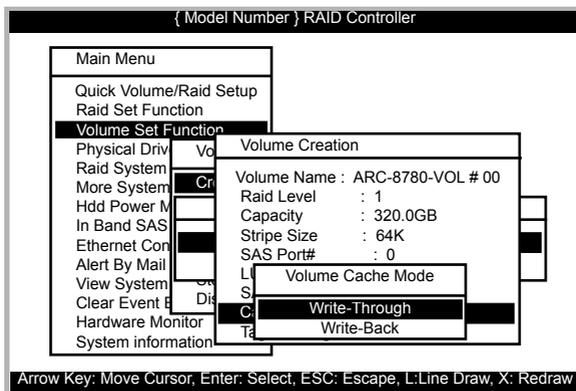
iSCSI LUN - Each Target Node can support up to 8 LUNs. Most iSCSI host adapter treats each LUN like a SAS/SATA disk.



5.5.3.1.8 Cache Mode

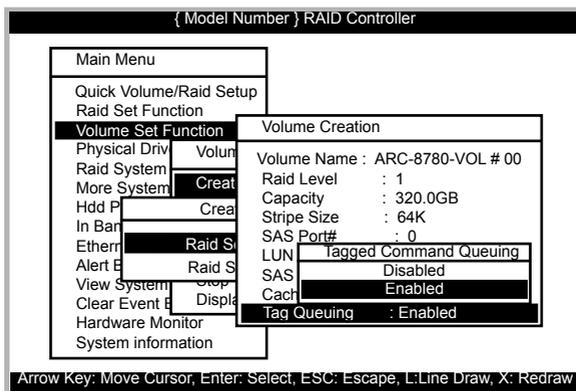
User can set the cache mode to: "Write-Through" or "Write-Back".

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5.5.3.1.9 Tag Queuing

This option, when enabled, can enhance overall system performance under multi-tasking operating systems. The Command Tag (Drive Channel) function controls the SAS command tag queuing support for each drive channel. This function should normally remain enabled. Disabled this function only when using older drives that do not support command tag queuing. Tagged Command Queuing (TCQ) is a technology built into SAS hard drives. It allows the RAID controller to send multiple read and write requests to a hard drive. This function should normally remain "Enabled". "Disabled" this function only when using SAS drives that do not support command tag queuing.

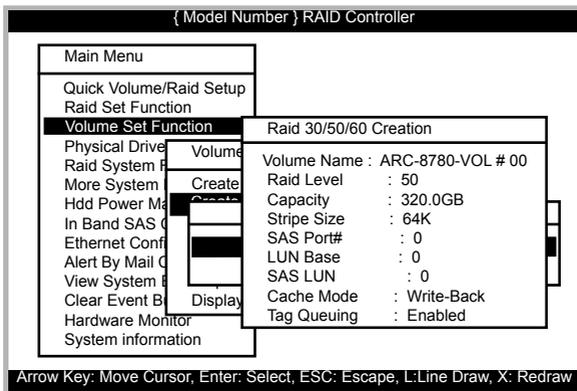


VT-100 UTILITY CONFIGURATION

5.5.3.2 Create Raid30/50/60

To create 30/50/60 volume set from RAID set group, move the cursor bar to the main menu and click on the "Create Raid30/50/60" link. The "Select The Raid Set To Create Volume On It" screen will show all RAID set number. Tick on the RAID set numbers (same disk No per RAID set) that you want to create and then click on it.

The created new volume set attribute option allows users to select the Volume Name, Capacity, Raid Level, Stripe Size, SAS Port#/LUN Base/LUN, Cache Mode, Write Protect and Tagged Command Queuing. The detailed description of those parameters can refer to section 5.5.3.1. User can modify the default values in this screen; the modification procedures are in section 5.5.3.4



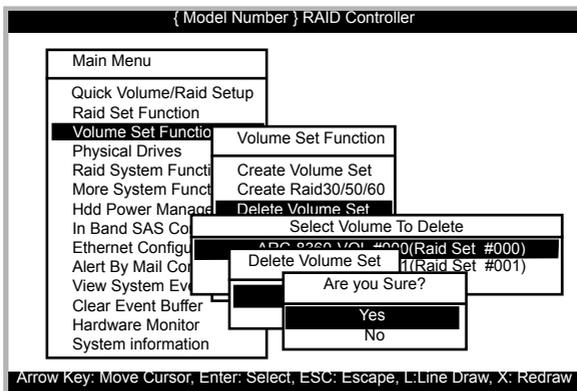
Note:

RAID level 30 50 and 60 can support up to eight RAID set.

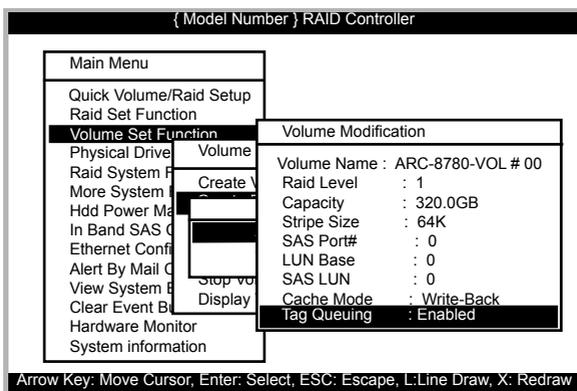
5.5.3.3 Delete Volume Set

To delete volume set from a RAID set, move the cursor bar to the "Volume Set Functions" menu and select the "Delete Volume Set" item, then press the **Enter** key. The "Volume Set Functions" menu will show all Raid Set # items. Move the cursor bar to a RAID set number, then press the **Enter** key to show all volume sets within that RAID set. Move the cursor to the volume set number that is to be deleted and press the **Enter** to delete it.

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5.5.3.4 Modify Volume Set



Use this option to modify volume set configuration. To modify volume set values from RAID set system function, move the cursor bar to the "Modify Volume Set" item, then press the **Enter** key. The "Volume Set Functions" menu will show all RAID set items. Move the cursor bar to a RAID set number item, then press the **Enter** key to show all volume set items. Select the volume set from the list to be changed, press the **Enter** key to modify it.

As shown, volume information can be modified at this screen. Choose this option to display the properties of the selected volume set. But user can only modify the last volume set capacity.

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5.5.3.4.1 Volume Growth

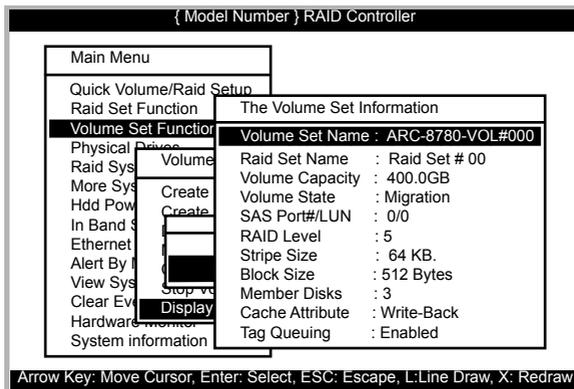
Use "Expand RAID Set" function to add disk to a RAID set. The additional capacity can be used to enlarge the last volume set size or to create another volume set. The "Modify Volume Set" function can support the "Volume Modification" function. To expand the last volume set capacity, move the cursor bar to the "Capacity" item and enter the capacity size. When finished the above action, press the **ESC** key and select the **Yes** option to complete the action. The last volume set starts to expand its capacity.

To expand an existing volume noticed:

- Only the last volume can expand capacity.
- When expanding volume capacity, you can't modify stripe size or modify RAID level simultaneously.
- You can expand volume capacity, but can't shrink volume capacity size.
- After volume expansion, the volume capacity can't be decreased.

For greater 2TB expansion:

- If your system installed in the volume, don't expand the volume capacity greater 2TB, currently OS can't support boot up from a greater than 2TB capacity device.
- Expand over 2TB used LBA64 mode. Please make sure your OS supports LBA64 before expand it.



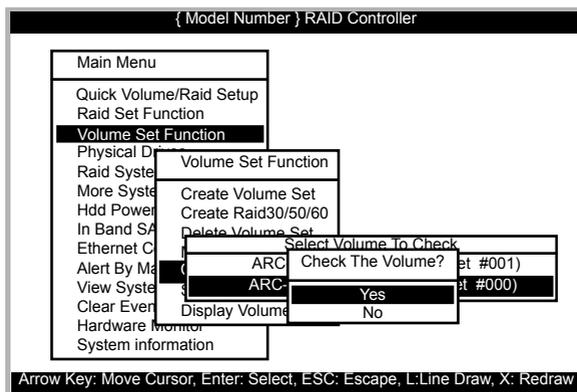
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5.5.3.4.2 Volume Set Migration

Migrating occurs when a volume set is migrating from one RAID level to another, when a volume set strip size changes, or when a disk is added to a RAID set. Migration state is displayed in the volume state area of the "Volume Set Information" screen.

5.5.3.5 Check Volume Set

Use this option to verify the correctness of the redundant data in a volume set. For example, in a system with a dedicated parity disk drive, a volume set check entails computing the parity of the data disk drives and comparing those results to the contents of the dedicated parity disk drive. To check volume set, move the cursor bar to the "Check Volume Set" item, then press the **Enter** key. The "Volume Set Functions" menu will show all RAID set number items. Move the cursor bar to an RAID set number item and then press the **Enter** key to show all volume set items. Select the volume set to be checked from the list and press **Enter** to select it. After completed the selection, the confirmation screen appears, press **Yes** to start the check.



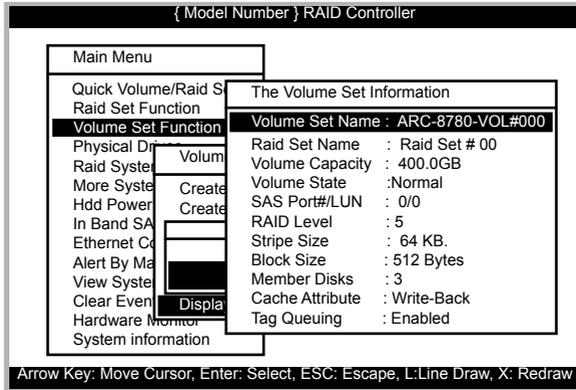
5.5.3.6 Stop Volume Set Check

Use this option to stop all of the "Check Volume Set" operations.

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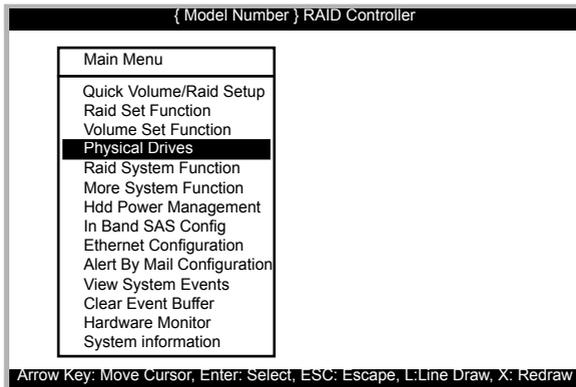
5.5.3.7 Display Volume Set Info.

To display volume set information, move the cursor bar to the desired volume set number and then press the **Enter** key. The "Volume Set Information" screen will be shown. You can only view the information of this volume set in this screen, but can not modify it.



5.5.4 Physical Drives

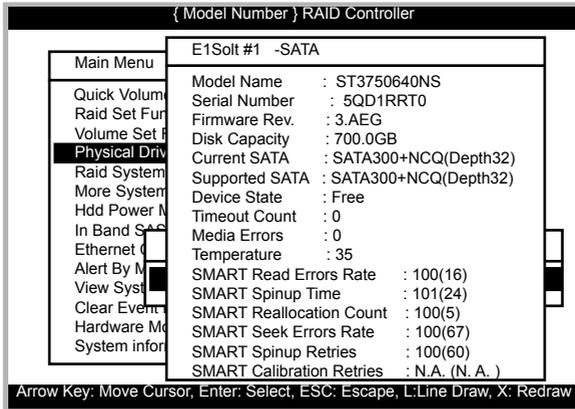
Choose this option from the main menu to select a physical disk and perform the operations listed above. Move the cursor bar to an item, then press **Enter** key to select the desired function.



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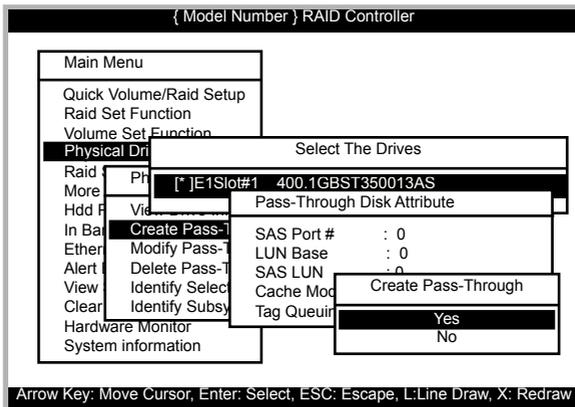
5.5.4.1 View Drive Information

When you choose this option, the physical disks connected to the RAID subsystem are listed. Move the cursor to the desired drive and press **Enter** key to view drive information.



5.5.4.2 Create Pass-Through Disk

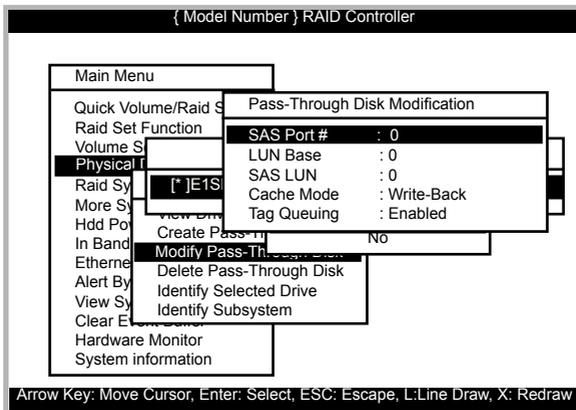
A pass-through disk is not controlled by the RAID subsystem's firmware and thus can not be a part of a volume set. The disk is available directly to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID subsystem's firmware. The SAS Port#/SAS LUN Base/SAS LUN, Cache Mode, Write Protect and Tag Queuing must be specified to create a pass-through disk.



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5.5.4.3 Modify Pass-Through Disk

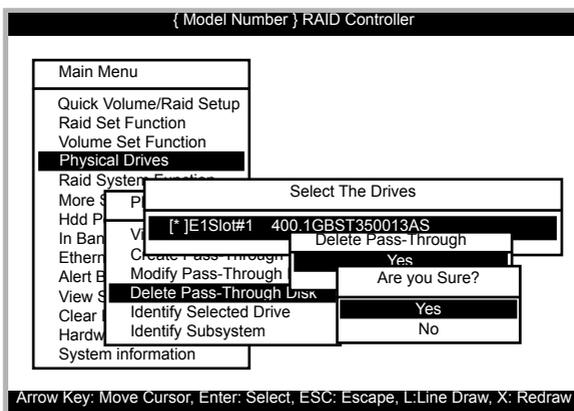
Use this option to modify "Pass-Through Disk Attributes". To select and modify a pass-through disk from the pool of pass-through disks, move the "Modify Pass-Through Drive" option and then press the **Enter** key. The "Physical Drive Function" menu will show all pass-through drive number options. Move the cursor bar to the desired number and then press the **Enter** key to show all pass-through disk attributes. Select the parameter from the list to be changed and then press the **Enter** key to modify it.



5.5.4.4 Delete Pass-Through Disk

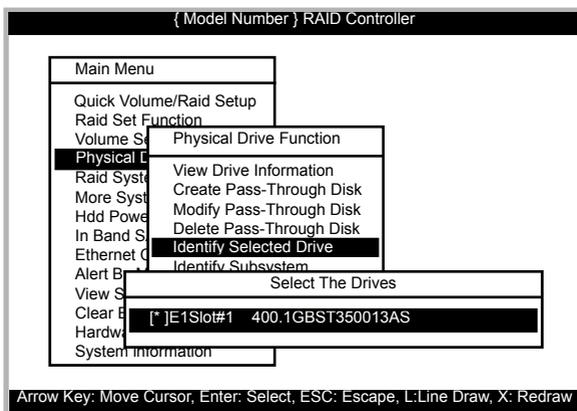
To delete a pass-through drive from the pass-through drive pool, move the cursor bar to the "Delete Pass-Through Drive" item, then press the **Enter** key. The "Delete Pass-Through confirmation" screen will appear; select **Yes** to delete it.

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5.5.4.5 Identify Selected Drive

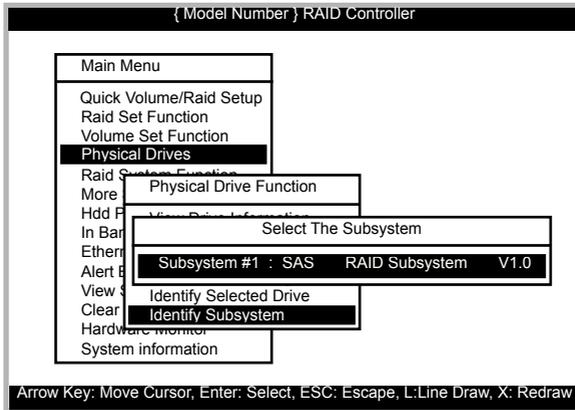
To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the "Identify Selected Device" is selected.



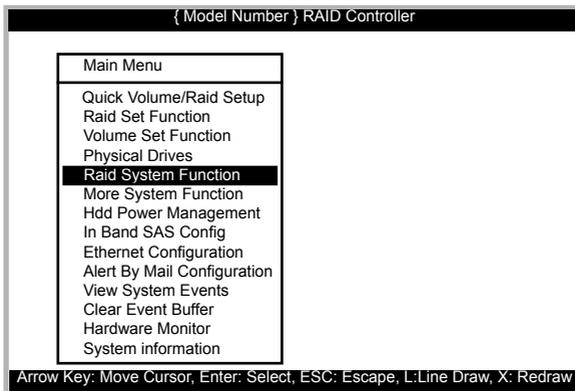
5.5.4.6 Identify Subsystem

To prevent removing the wrong subsystem, the selected Areca expander subsystem all disks fault LED Indicator will light for physically locating the selected subsystem when the "Identify Subsystem" is selected. This function will also light the subsystem LED indicator, if it is existed.

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5.5.5 Raid System Function

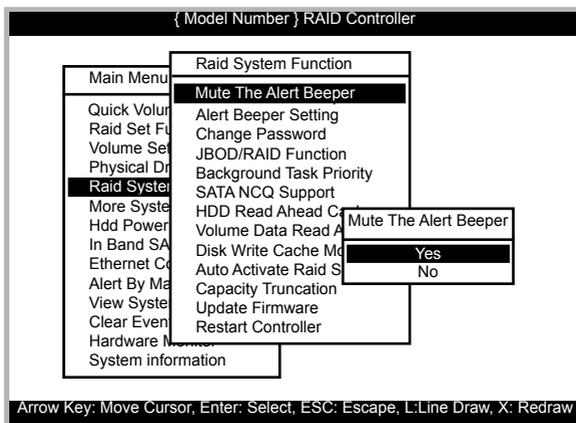


To set the "Raid System Function", move the cursor bar to the main menu and select the "Raid System Function" item and then press **Enter** key. The "Raid System Function" menu will show multiple items. Move the cursor bar to an item, then press **Enter** key to select the desired function.

5.5.5.1 Mute The Alert Beeper

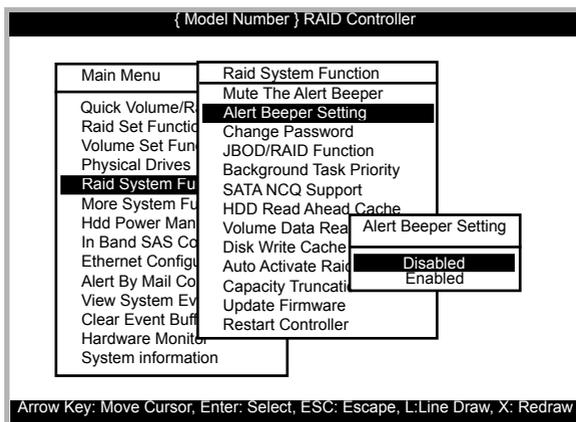
The "Mute The Alert Beeper" function item is used to control the RAID subsystem beeper. Select **Yes** and press the **Enter** key in the dialog box to turn the beeper off temporarily. The beeper will still activate on the next event.

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5.5.5.2 Alert Beeper Setting

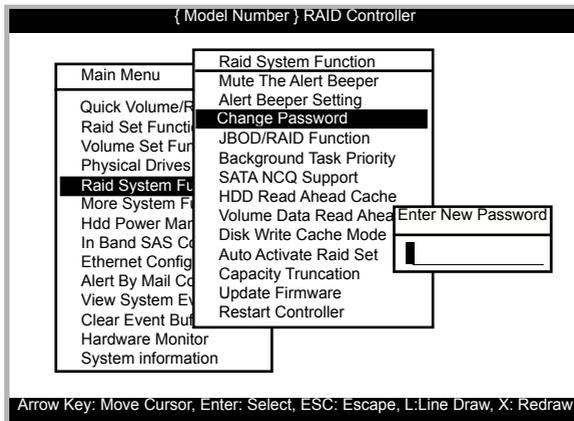
The "Alert Beeper Setting" function item is used to "Disabled" or "Enabled" the RAID subsystem alarm tone generator. Select "Disabled" and press the **Enter** key in the dialog box to turn the beeper off.



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5.5.5.3 Change Password

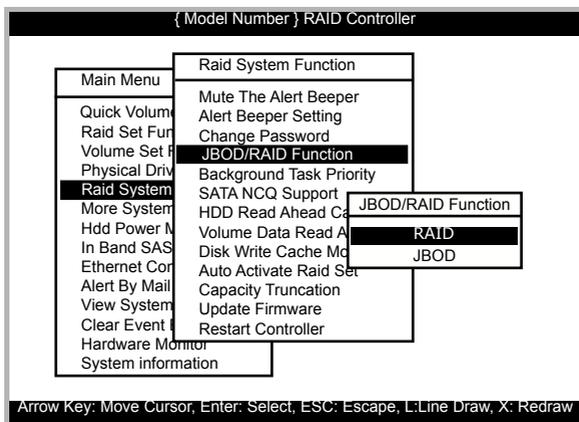
The manufacture default password is set to **0000**. The password option allows user to set or clear the password protection feature. Once the password has been set, the user can monitor and configure the controller only by providing the correct password. This feature is used to protect the internal RAID system from unauthorized access. The controller will check the password only when entering the main menu from the initial screen. The system will automatically go back to the initial screen if it does not receive any command in 5 minutes. To set or change the password, move the cursor to "Raid System Function" screen, press the "Change Password" item. The "Enter New Password" screen will appear. Do not use spaces when you enter the password, If spaces are used, it will lock out the user. To disable the password, only press **Enter** key in both the "Enter New Password" and "Re-Enter New Password" column. The existing password will be cleared. No password checking will occur when entering the main menu.



5.5.5.4 JBOD/RAID Function

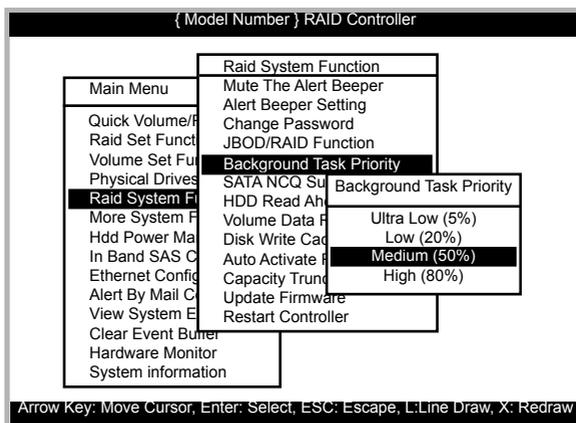
JBOD is an acronym for "Just a Bunch Of Disk". A group of hard disks in a RAID subsystem are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to change the option from the RAID to the JBOD function.

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5.5.5.5 Background Task Priority

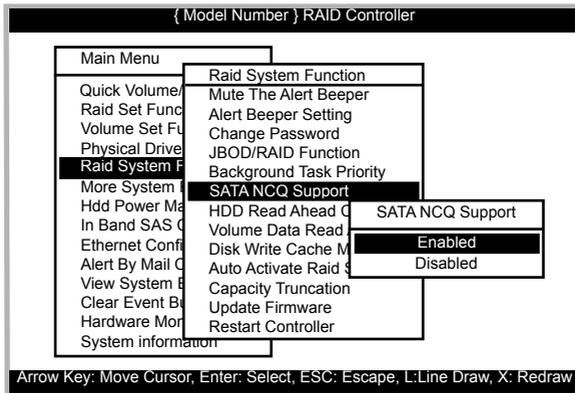
The "Background Task Priority" is a relative indication of how much time the controller devotes to a rebuild operation. The RAID subsystem allows the user to choose the rebuild priority (UltraLow, Low, Normal, High) to balance volume set access and rebuild tasks appropriately.



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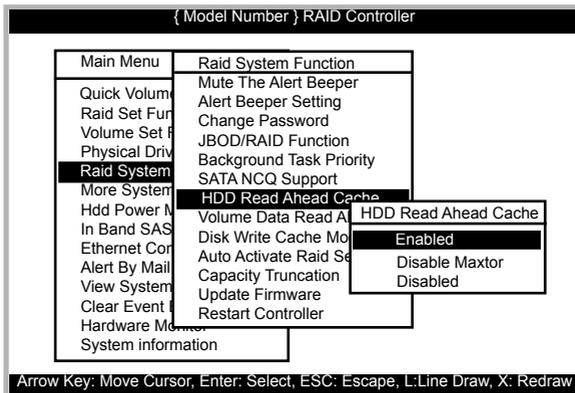
5.5.5.6 SATA NCQ Support

The controller supports both SAS and SATA disk drives. The SATA NCQ 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. The RAID subsystem allows the user to select the SATA NCQ support: "Enabled" or "Disabled".



5.5.5.7 HDD Read Ahead Cache

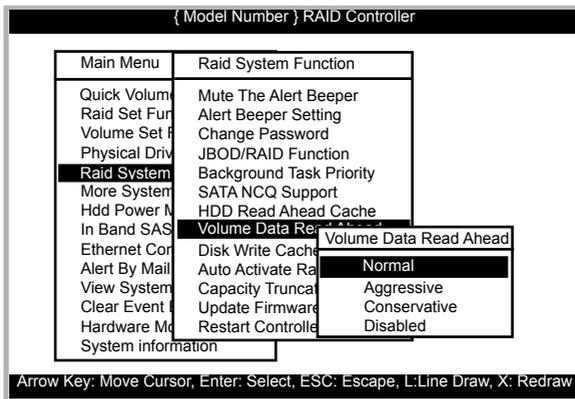
Allow Read Ahead (Default: Enabled)—When "Enabled", the drive's read ahead cache algorithm is used, providing maximum performance under most circumstances.



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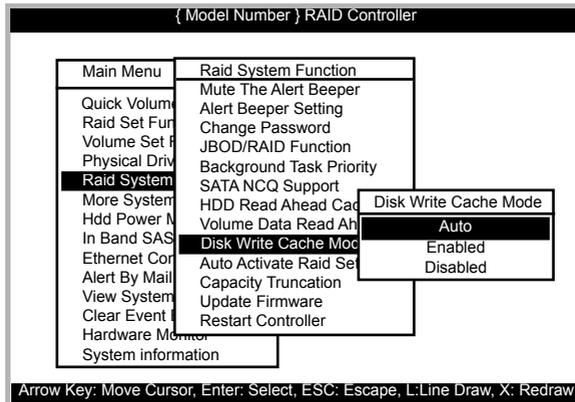
5.5.5.8 Volume Data Read Ahead

The "Data Read Ahead" parameter specifies the controller firmware algorithms which process the read ahead data blocks from the disk. The "Data Read Ahead" parameter is normal by default. To modify the value, you must know the application behavior. The default "Normal" option satisfies the performance requirements for a typical volume. The "Disabled" value implies no read ahead. The most efficient value for the controllers depends on your application. "Aggressive" read ahead is optimal for sequential access but it degrades random access.



5.5.5.9 Disk Write Cache Mode

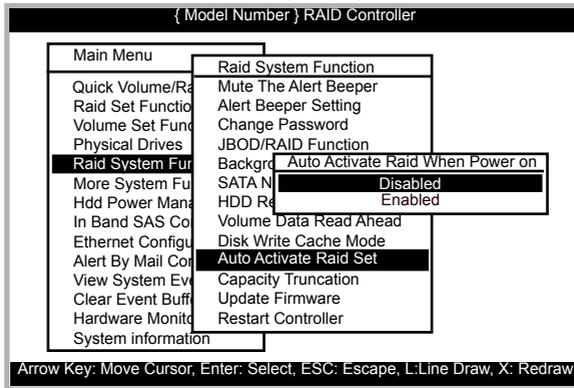
A user can set the "Disk Write Cache Mode": Auto, Enabled, or Disabled.



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5.5.5.10 Auto Activate Raid Set

When some of the disk drives are removed in power off state or boot up stage, the RAID set state will change to "Incomplete State". But if a user wants to automatically continue to work while the RAID subsystem is powered on, then user can set the "Auto Activate Raid Set" option to "Enabled". The RAID state will change to "Degraded Mode" while it powers on.



5.5.5.11 Capacity Truncation

The RAID subsystem uses drive truncation so that drives from different vendors are more likely to be usable as spares for one another. Drive truncation slightly decreases the usable capacity of a drive that is used in redundant units. The controller provides three truncation modes in the system configuration: Multiples Of 10G, Multiples Of 1G and Disabled.

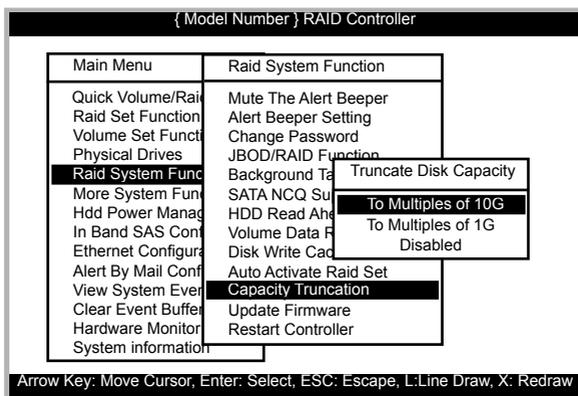
Multiples Of 10G - If you have 120 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 120 GB. "Multiples Of 10G" truncates the number under tens. This makes the same capacity for both of these drives so that one could replace the other.

Multiples Of 1G - If you have 123 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 123.4 GB.

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“Multiples Of 1G” truncates the fractional part. This makes the same capacity for both of these drives so that one could replace the other. Example, one drive might be 123.5 GB, and the other 123.4 GB. “Multiples Of 1G” truncates the fractional part. This makes the same capacity for both of these drives so that one could replace the other.

Disabled - It does not truncate the capacity.



5.5.5.12 Update Firmware

Please refer to the appendix A Upgrading Flash ROM Update Process.

Note:

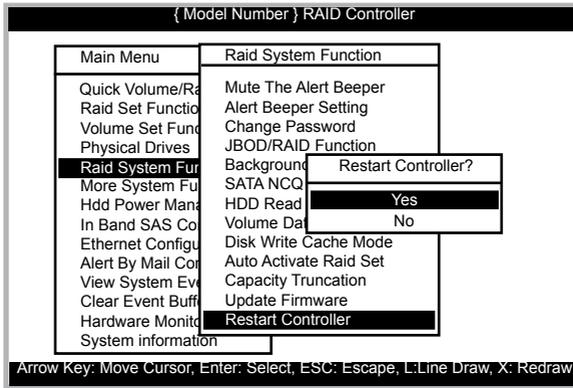
User can only update the firmware through the VT-100 Terminal or web browser-based RAID manager through the controller's LAN port.

5.5.5.13 Restart Controller

Use the “Restart Controller” function to restart the RAID controller, move the cursor bar to the main menu “Raid System Function” item and then press the **Enter** key. The “Raid system Function” menu appears on the screen. Press **Enter** key to se-

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lect "Restart Controller" item. The restart controller confirmation screen appears. Select **Yes** key to restart entire RAID controller.

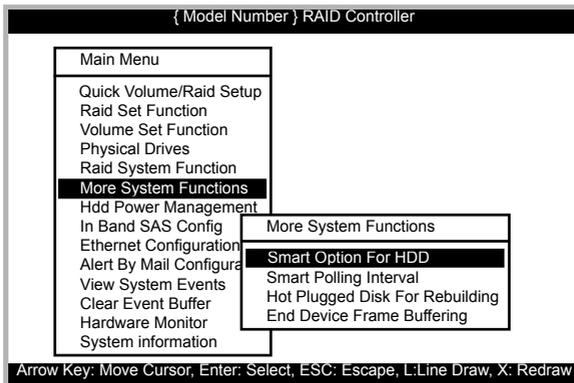


Note:

It can only work properly at Host and Drive without any activity.

5.5.6 More System Functions

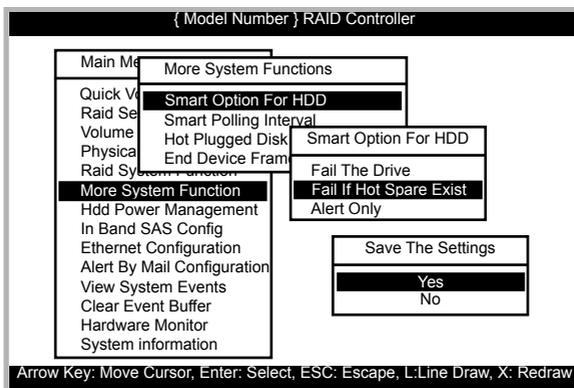
To set the "More System Functions", move the cursor bar to the main menu and select the "More System Functions" item and then press **Enter** key. The "More System Functions" menu will show multiple items. Move the cursor bar to an item, then press **Enter** key to select the desired function.



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5.5.6.1 Smart Option For HDD

This option is used to increase the reliability of SSDs/HDDs by automatically copying data from a drive with potential to fail to a designated hot spare or newly inserted drive. The options are: "Fail The Drive", "Fail If Hot Spare Exist", and "Alert Only". The default is "Alert Only".



"Fail The Drive"- controllers kill off the SMART fail drive immediately.

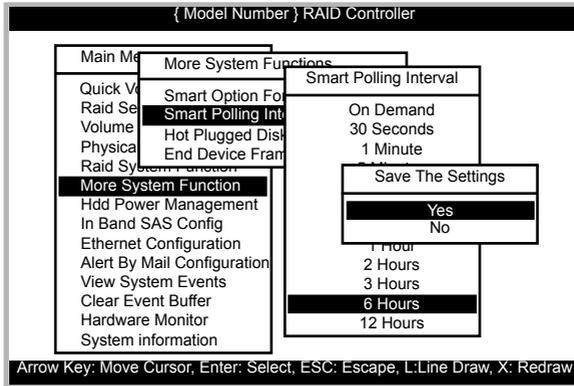
"Fail If Hot Spare Exist" – controllers kill off the SMART fail disk if hot spare drive is existed.

"Alert Only" – it will trigger alert when there happens a SMART failed drive.

5.5.6.2 Smart Polling Interval

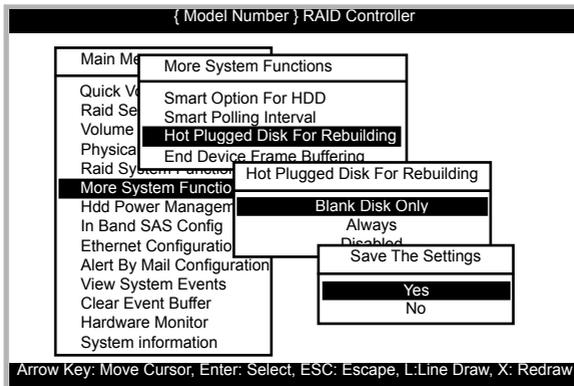
Besides the scheduled volume check, user can define the Smart Pulling Interval to pull the SMART status of each disk. The default is "on demand". User can schedule every certain period of time interval to pull the SMART status of each disk. When SMART pulling is executed, disk activity will be temporally halted until the SMART parameter reading is finished. That is why you don't want to set the Interval too frequent. What to use is up to the users to decide based on their applications and experiment results.

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5.5.6.3 Hot Plugged Disk For Rebuilding

It defines if the RAID array volume should start rebuilding or not when detects a disk is inserted/re-inserted during online. The options are: "Blank Disk Only", "Always", and "Disable". The default is "Blank Disk Only".

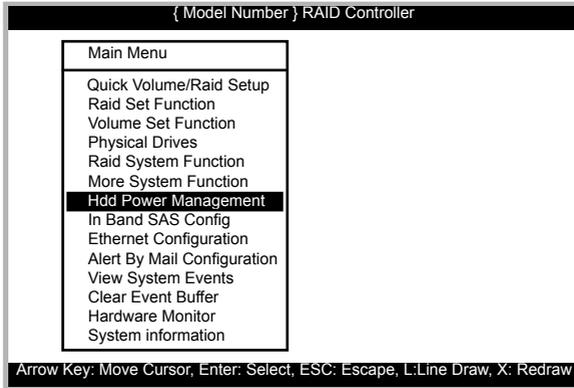


"Blank Disk Only" – it will trigger the rebuilding if and only if the inserted disk has not been in the RAID array before, which has no RAID signature on it. So when a previously removed disk is self re-inserted, it won't trigger the degraded RAID array to rebuild, and so that the administrator has a chance to identify this mis-behaving disk and replaces it.

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5.5.7 Hdd Power Management

Areca has automated the ability to manage HDD power based on usage patterns. The "HDD Power Management" allows you to choose a "Stagger Power On Control", "Low Power Idle", "Low RPM" and completely "Spins Down Idle HDD". It is designed to reduce power consumption and heat generation on idle drives.

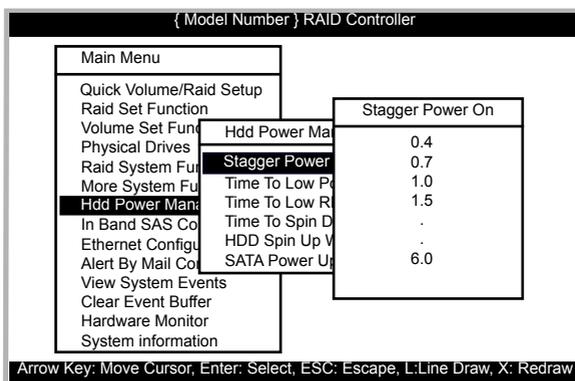


5.5.7.1 Stagger Power On Control

In a RAID subsystems with more than two drives, the startup current from spinning up the drives all at once can overload the power supply, causing damage to the power supply, disk drives and other subsystem components. This damage can be avoided by allowing the RAID controller to stagger the spin-up of the drives. The SAS/SATA drives have support stagger spin-up capabilities to boost reliability. Stagger spin-up is a very useful feature for managing multiple disk drives in a storage subsystem. It gives the RAID controller the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. Staggering drive spin-up in a multiple drive environment also avoids the extra cost of a power supply designed to meet short-term startup power demand as well as steady state conditions.

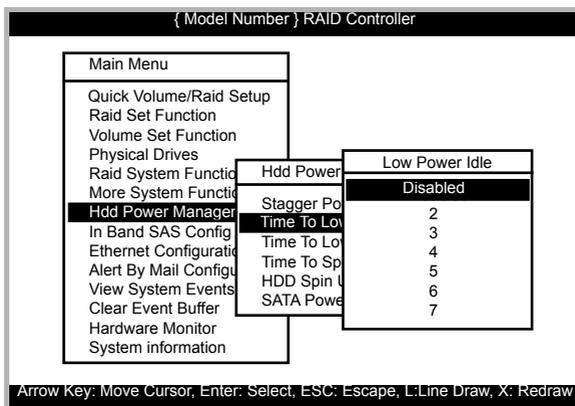
Areca RAID controller has included the option for customer to select the disk drives sequentially stagger power up value. The values can be selected within the range 0.4 to 6 seconds per step which powers up one drive groups.

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5.5.7.2 Time to Hdd Low Power Idle

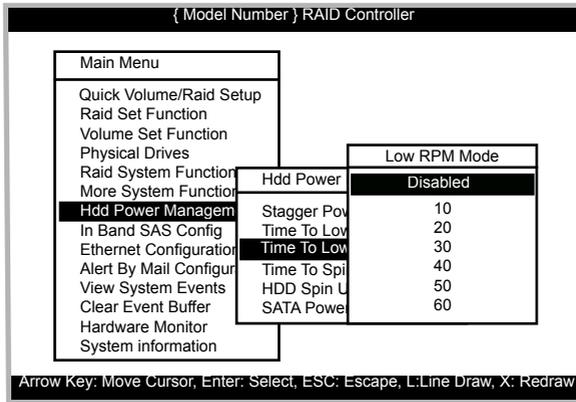
This option delivers lower power consumption by automatically unloading recording heads during the setting idle time. The values can be selected "Disabled" or within the range 2 to 7 minutes.



5.5.7.3 Time To Hdd Low RPM Mode

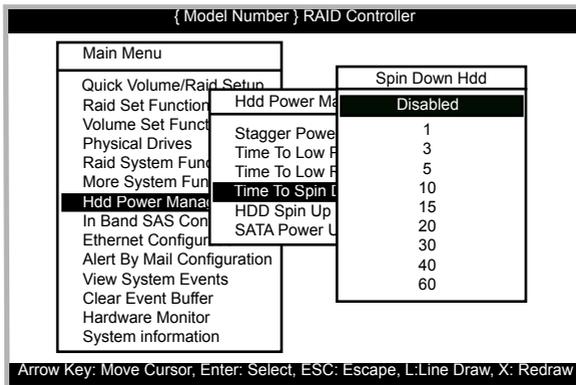
This function can automatically spin disks at lower RPM if there have not been used during the setting idle time. The values can be selected "Disabled" or within the range 10 to 60 minutes.

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5.5.7.4 Time To Spin Down Idle HDD

This function can automatically spin down the drive if it hasn't been accessed for a certain amount of time. This value is used by the drive to determine how long to wait (with no disk activity, before turning off the spindle motor to save power). The values can be selected "Disabled" or within the range 1 to 60 minutes.

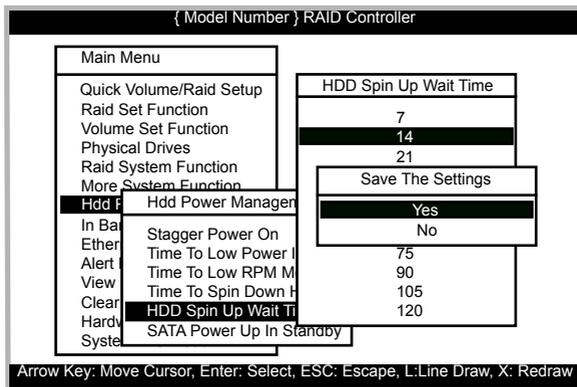


5.5.7.5 HDD Spin Up Wait Time

To conserve energy, hard disk is designed to spin-down in Standby mode after a specific period of inactivity. It is awaiting a read or write instruction at which time the drive will spin-up its platters – wake up and enter Active mode – to perform the

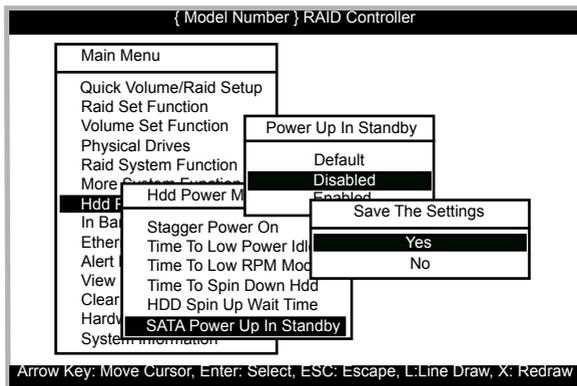
VT-100 UTILITY CONFIGURATION

operation. This value is used by the controller to determine how long to wait (Spin up and switch from Standby to Active mode) when there has any Dynamic disk existed in the controller. The values can be selected within the range 7 to 120 minutes.



5.5.7.6 SATA Power Up In Standby

SATA Power Up In Standby (power management 2 mode, PM2) is a SATA disk drive configuration which prevents the drive from automatic spinup when power is applied. "Enabled" option allows the drive to be powered-up into the standby power management state to minimize inrush current at power-up and to allow the controller to sequence the spinup of devices. It is mainly for server/workstation environments operating in multiple-drive configurations.

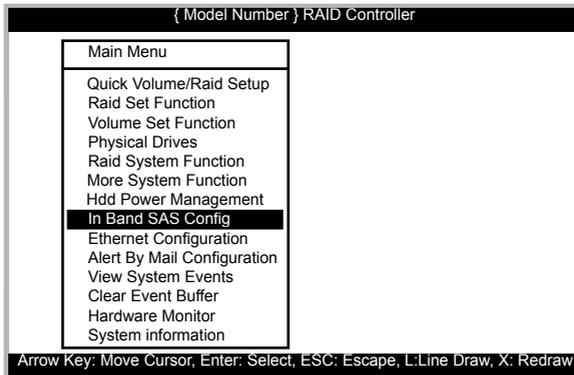


VT-100 UTILITY CONFIGURATION

5.5.8 In Band SAS Config

The RAID manager supports both in-band and out-of-band management to control the disk array subsystem. In-band management refers to management of the SAS disk array from a SAS host management transactions traverse the SAS bus. Out-of-band management refers to management of the disk array from a remote station connected to the controller either via a RS-232 or through a LAN port. In-band management is simpler than out-of-band management for it requires less hardware in its configuration.

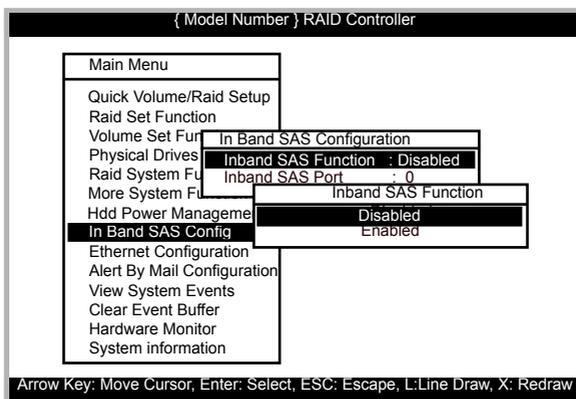
Since the host adapter is already installed in the host system, no extra connection is necessary. Just load the necessary in-band driver for the controller and then combine the API with user's RAID manager from the local host to start management of the disk array system.



5.5.8.1 InBand SAS Function

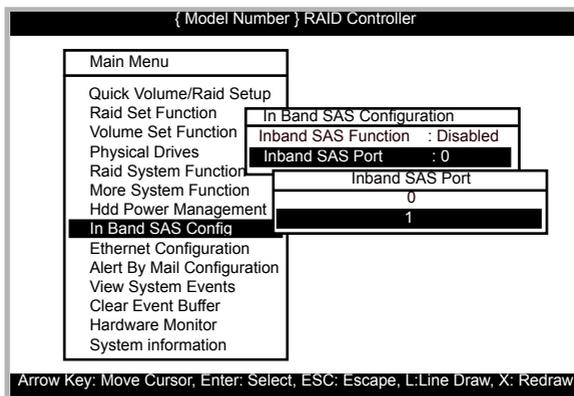
The RAID subsystem reserves one LUN for In-band management transactions. This option is for user to release the LUN when In-band management is not enabled.

VT-100 UTILITY CONFIGURATION



5.5.8.2 InBand SAS Port

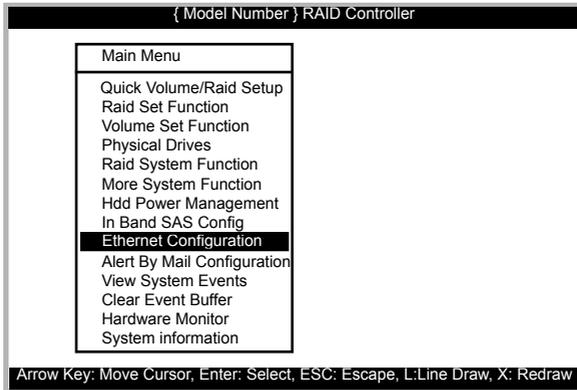
Since the SAS RAID controller supports two SAS host ports, the In-band can through either SAS port 0 or port 1.



5.5.9 Ethernet Configuration

Use this feature to set the controller Ethernet port configuration. It is not necessary to create reserved disk space on any hard disk for the Ethernet port and HTTP service to function; these functions are built into the controller firmware. move the cursor bar to the main menu "Ethernet Configuration Function" item and then press the **Enter** key. The "Ethernet Configuration" menu appears on the screen. Move the cursor bar to an item, then press **Enter** key to select the desired function.

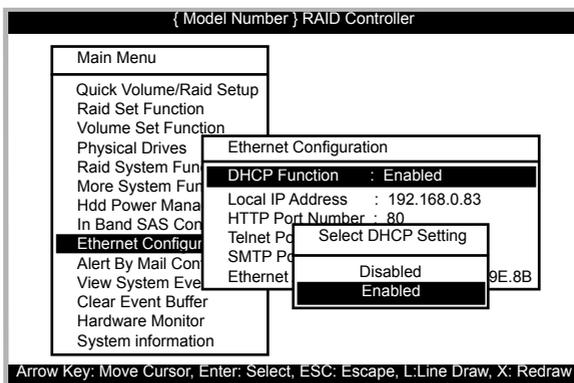
VT-100 UTILITY CONFIGURATION



5.5.9.1 DHCP Function

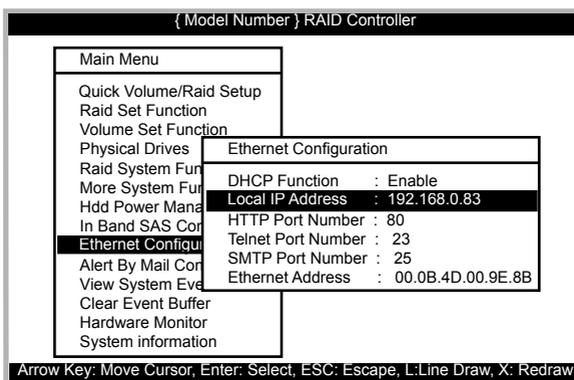
DHCP (Dynamic Host Configuration Protocol) allows network administrators centrally manage and automate the assignment of IP (Internet Protocol) addresses on a computer network. When using the TCP/IP protocol (Internet protocol), it is necessary for a computer to have a unique IP address in order to communicate to other computer systems. Without DHCP, the IP address must be entered manually at each computer system. DHCP lets a network administrator supervise and distribute IP addresses from a central point. The purpose of DHCP is to provide the automatic (dynamic) allocation of IP client configurations for a specific time period (called a lease period) and to minimize the work necessary to administer a large IP network. To manually configure the IP address of the controller, move the cursor bar to DHCP Function item, then press **Enter** key to show the DHCP setting. Select the "Disabled" or "Enabled" option to enable or disable the DHCP function. If DHCP is disabled, it will be necessary to manually enter a static IP address that does not conflict with other devices on the network.

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5.5.9.2 Local IP Address

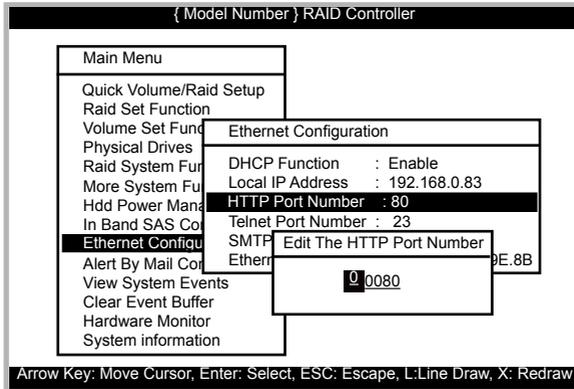
If you intend to set up your client computers manually (no DHCP), make sure that the assigned IP address is in the same range as the default router address and that it is unique to your private network. However, it is highly recommend to use DHCP if that option is available on your network. An IP address allocation scheme will reduce the time it takes to set-up client computers and eliminate the possibilities of administrative errors and duplicate addresses. To manually configure the IP address of the controller, move the cursor bar to Local IP address item, then press the **Enter** key to show the default address setting in the RAID subsystem. You can then reassign the static IP address of the controller.



VT-100 UTILITY CONFIGURATION

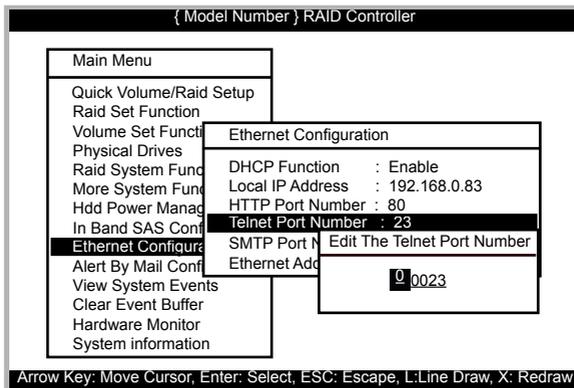
5.5.9.3 HTTP Port Number

To manually configure the “HTTP Port Number” of the controller, move the cursor bar to “HTTP Port Number” item, then press the **Enter** key to show the default address setting in the RAID subsystem. Then You can reassign the default “HTTP Port Number” of the controller.



5.5.9.4 Telnet Port Number

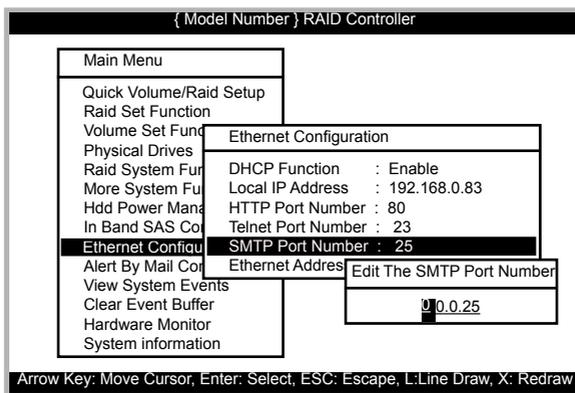
To manually configure the “Telnet Port Number” of the controller, move the cursor bar to “Telnet Port Number” item, then press the **Enter** key to show the default address setting in the RAID subsystem. You can then reassign the default “Telnet Port Number” of the controller.



VT-100 UTILITY CONFIGURATION

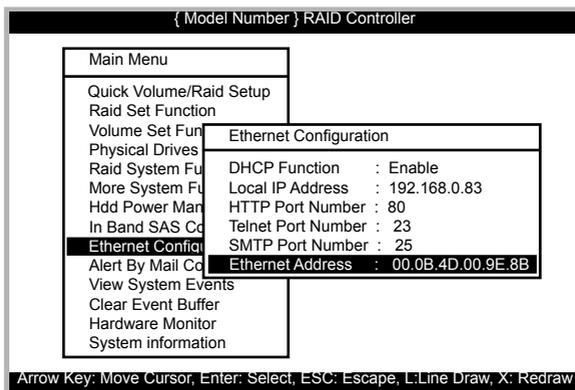
5.5.9.5 SMTP Port Number

To manually configure the "SMTP Port Number" of the controller, move the cursor bar to the main menu "Ethernet Configuration" function item and then press **Enter** key. The "Ethernet Configuration" menu appears on the screen. Move the cursor bar to "SMTP Port Number" item, then press **Enter** key to show the default address setting in the RAID subsystem. You can then reassign the default "SMTP Port Number" of the controller.



5.5.9.6 Ethernet Address

Each Ethernet port has its unique Mac address, which is also factory assigned. Usually, Ethernet address is used to uniquely identify a port in the Ethernet network.



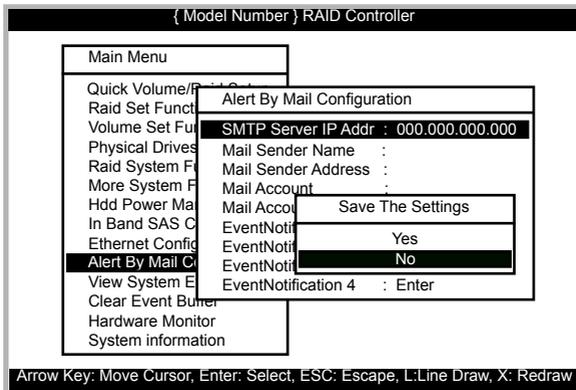
VT-100 UTILITY CONFIGURATION

5.5.10 Alert By Mail Configuration

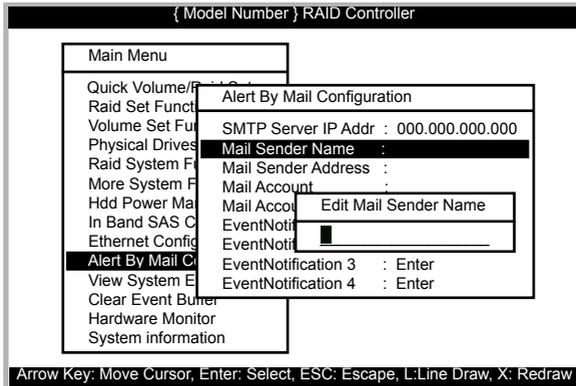
Many users require that email notifications be sent to the appropriate administrators when an alert is detected. To set up your mail servers, move the cursor bar to the main menu "Alert By Mail Configuration" function item and then press **Enter** key. The "Alert By Mail Configuration" menu appears on the screen.

5.5.10.1 SMTP Server Configuration

Move the cursor bar to "SMTP Server IP Addr" item, then press **Enter** key to show the default address setting in the RAID subsystem, then you can reset the SMTP server IP address.



5.5.10.2 Mail Address Configurations



VT-100 UTILITY CONFIGURATION

- **Mail Sender Name**

Enter the sender name that will be shown in the outgoing mail.

- **Mail Sender address**

Enter the sender email that will be shown in the outgoing mail, but don't type IP to replace domain name.

- **Mail Account**

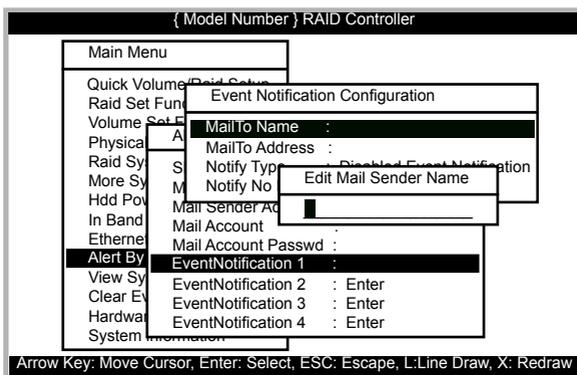
Enter the valid account if your SMTP mail server requires authentication.

- **Mail Account Password**

Enter the valid password if your SMTP mail server requires authentication.

5.5.10.3 Event Notification Configurations

The function of "EventNotification" item is to set up notification rules. Notification rules instruct RAID controller on the notifications that should be sent when certain types of alerts are detected.



- **MailTo Name**

Enter the alert receiver name that will be shown in the outgoing mail.

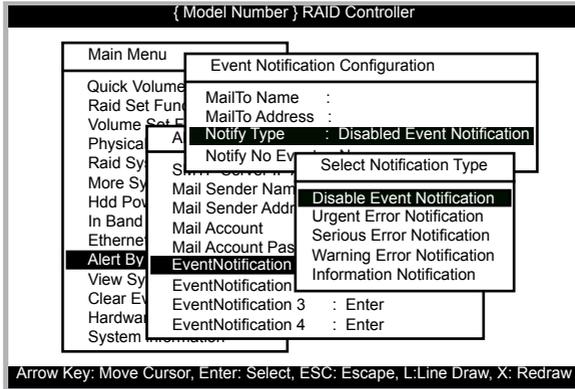
- **MailTo Address**

Enter the receiver's e-mail address. This is the address you want the e-mail alerts sent to.

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• Notify Type

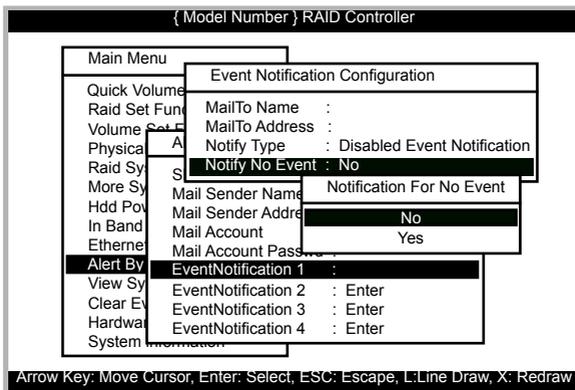
According to your requirement, set the corresponding event level:



- Disable Event Notification: No event notification will be sent.
- Urgent Error Notification: Send only urgent events.
- Serious Error Notification: Send urgent and serious events.
- Warning Error Notification: Send urgent, serious and warning events.
- Information Notification: Send all events.

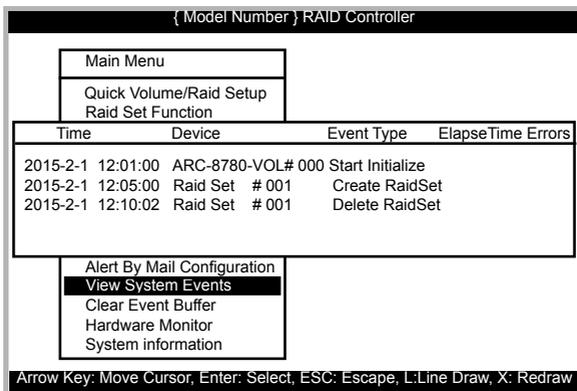
• Notify No Event

Notify user if no event occurs within 24 hours.



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5.5.11 View System Events



{ Model Number } RAID Controller

Main Menu

Quick Volume/Raid Setup

Raid Set Function

Time	Device	Event Type	ElapseTime	Errors
2015-2-1 12:01:00	ARC-8780-VOL# 000	Start Initialize		
2015-2-1 12:05:00	Raid Set # 001	Create RaidSet		
2015-2-1 12:10:02	Raid Set # 001	Delete RaidSet		

Alert By Mail Configuration

View System Events

Clear Event Buffer

Hardware Monitor

System information

Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L:Line Draw, X: Redraw

To view the RAID subsystem's system events information, move the cursor bar to the main menu and select the "View System Events" link, then press the **Enter** key. The RAID subsystem's events screen appear.

Choose this option to view the system events information: Timer, Device, Event type, Elapsed Time, and Errors. The RAID system does not have a build-in real time clock. The time information is the relative time from the RAID subsystem powered on.

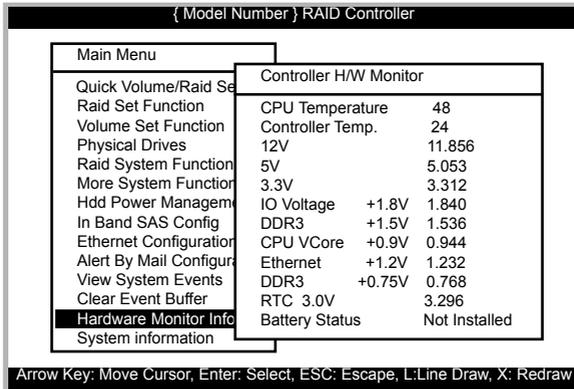
5.5.12 Clear Events Buffer

Use this feature to clear the entire events buffer.

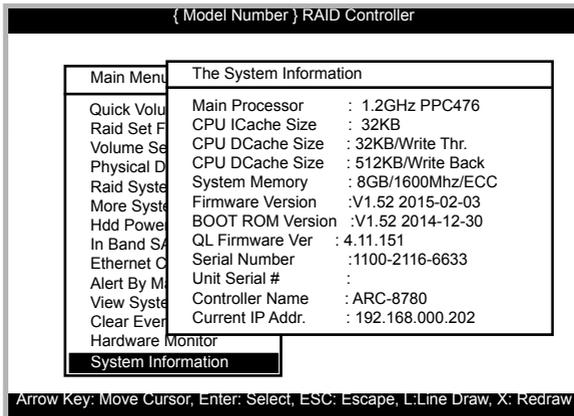
5.5.13 Hardware Monitor Information

To view the RAID subsystem's hardware monitor information, move the cursor bar to the main menu and click the "Hardware Monitor" link. The "Controller H/W Monitor" screen appears. The "Controller H/W Monitor" provides the CPU temperature, controller temperature, voltage and battery status of the RAID subsystem.

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5.5.14 System Information



Choose this option to display the controller's hardware firmware information. The controller provides two four-link Min SAS HD SFF-8644 connector for the host and one four-link Min SAS HD SFF-8644 connector for JBOD. It may have problem between the host/JBOD and controller. The "Host Port# Link" provides current working port link status. The option for port link is defined below. Not Linked → Fail or no link to host/JBOD

1x1200 → Single-link for use

2x1200 → Two-link for use

4x1200 → Four-link for use

6. Web Browser-based Configuration

The RAID subsystem web browser-based configuration utility is firm-ware-based and uses to configure RAID sets and volume sets. Use this utility to:

- Create RAID set,
- Expand RAID set,
- Define volume set,
- Add physical drive,
- Modify volume set,
- Modify RAID level/stripe size,
- Define pass-through disk drives,
- Modify system function,
- Update firmware and,
- Designate drives as hot spares.

If you need to boot the operating system from a RAID subsystem, you must first create a RAID volume by using LCD panel, RS232 or LAN port.

6.1 Web Browser McRAID Storage Manager

To ensure proper communications between the RAID subsystem and web browser-based RAID management, Please connect the RAID system LAN port to any LAN switch port.

The RAID subsystem has embedded the TCP/IP & web browser-based RAID manager in the firmware. User can remote manage the RAID subsystem without adding any user specific software (platform independent) via standard web browsers directly connected to the 10/100 RJ45 LAN port.

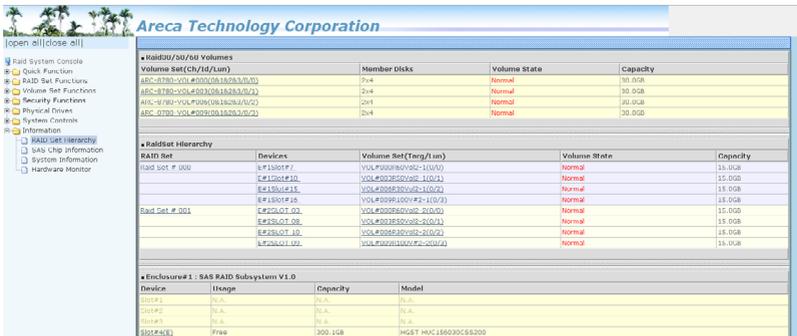
To configure RAID subsystem on a local or remote machine, you need to know its IP Address. The IP address will default show in the LCD screen. Launch your firmware-embedded TCP/IP & Web Browser-based RAID manager by entering `http://[IP Address]` in the web browser.

WEB BROWSER-BASED CONFIGURATION

You must be logged in as administrator with local admin rights on the remote machine to remotely configure it. The RAID subsystem default User Name is "admin" and the Password is "0000".

6.2 Web Browser Start-up Screen

The web browser start-up screen will display the current configuration of your RAID subsystem. It displays the Raid Set List, Volume Set List and Physical Disk List. The RAID set information, volume set information and drive information can also be viewed by clicking on the "RaidSet Hierarchy" screen. The current configuration can also be viewed by clicking on "RaidSet Hierarchy" in the menu.



- To display RAID set information, move the mouse cursor to the desired RAID set number, then click it. The RAID set information will show in the screen.
- To display volume set information, move the mouse cursor to the desired volume set number, then click it. The volume set information will show in the screen.
- To display drive information, move the mouse cursor to the desired physical drive number, then click it. The drive information will show in the screen.

6.3 Main Menu

The main menu shows all available functions, accessible by clicking on the appropriate link.

WEB BROWSER-BASED CONFIGURATION

Individual Category	Description
Quick Function	Create a default configuration, which is based on the number of physical disks installed; it can modify the volume set Capacity, Raid Level, and Stripe Size.
Raid Set Functions	Create a customized RAID set.
Volume Set Functions	Create customized volume sets and modify the existed volume sets parameter.
Physical Drives	Create pass through disks and modify the existing pass through drives parameters. Also provides the function to identify disk drives (blinking fault LED).
System Controls	Setting the RAID system configuration.
Information	Viewing the controller information. The Raid Set Hierarchy can be viewed through the "Raid Set Hierarchy" item.

6.4 Quick Function

The screenshot shows the 'Quick Create Raid/Volume Set' configuration page. The interface includes a navigation menu on the left with options like 'Raid System Console', 'Quick Function', 'Quick Create', 'Raid Set Functions', 'Volume Set Functions', 'Security Functions', 'Physical Drives', 'System Controls', and 'Information'. The main content area is titled 'Quick Create Raid/Volume Set' and contains the following fields:

- Total Number Of Disks: 12
- Select Raid Level: Raid 5 + Spare
- Maximum Capacity Allowed: 800 GB
- Select Capacity: 800 GB
- Volume Initialization Mode: Foreground Initialization
- Select Stripe Size: 64 KBytes

At the bottom of the form, there is a 'Confirm The Operation' checkbox (checked) and two buttons: 'Submit' and 'Reset'.

The number of physical drives in the RAID subsystem determines the RAID levels that can be implemented with the RAID set. You can create a RAID set associated with exactly one volume set. The user can change the Raid Level, Capacity, Initialization Mode and Stripe Size. A hot spare option is also created, depending on the exist configuration. Click the "Confirm The Operation" check box and click on the "Submit" button in the "Quick Create" screen, the RAID set and volume set will start to initialize.

Note:

In "Quick Create", your volume set is automatically configured based on the number of disks in your system. Use the "Raid Set Functions" and "Volume Set Functions" if you prefer to customize your volume set, or RAID 30/50/60 volume set.

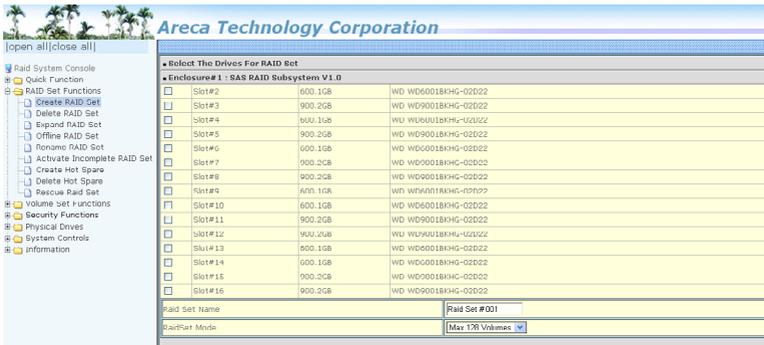
WEB BROWSER-BASED CONFIGURATION

6.5 Raid Set Functions

Use the "Raid Set Function" and "Volume Set Function" if you prefer to customize your volume set. Manual configuration can provide full control of the RAID set settings, but it will take longer to complete than the "Quick Volume/Raid Setup" configuration. Select the "Raid Set Function" to manually configure the RAID set for the first time or delete and reconfigure existing RAID sets. (A RAID set is a group of disks containing one or more volume sets.)

6.5.1 Create a New Raid Set

To create a RAID set, click on the "Create Raid Set" link. A "Select The Drive For RAID Set" screen is displayed showing the drive(s) connected to the current controller and subsystems. Click on the selected physical drives within the current RAID set. Enter 1 to 15 alphanumeric characters to define a unique identifier for a RAID set. The default RAID set name will always appear as "Raid Set #". Click the "Confirm The Operation" check box and click on the "Submit" button on the screen; the RAID set will start to initialize. If you have available disk member, you can repeat above procedures to define another RAID sets.



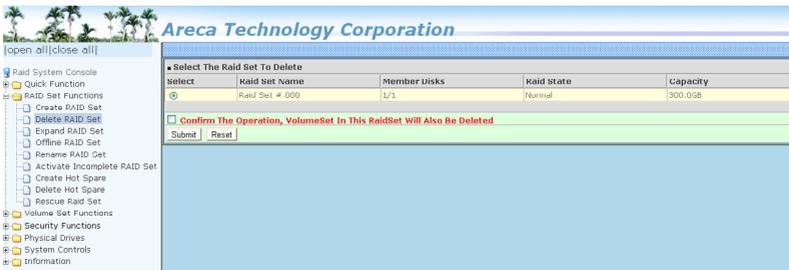
Note:

To create RAID 30/50/60 volume, you need create multiple RAID sets first with the same disk members on each RAID set. The max no. disk drives per volume set:
32 for RAID 0/1/10(1E)/3/5/6 and 128 for RAID 30/50/60.

WEB BROWSER-BASED CONFIGURATION

6.5.2 Delete Raid Set

To delete a RAID set, click on the “Deleted Raid Set” link. A “Select The RAID Set To Delete” screen is displayed showing all exist RAID sets in the current controller. Click the RAID set number which you want to delete in the select column on the delete screen. Then, click the “Confirm The Operation” check box and click on the “Submit” button in the screen to delete it. The volume sets included in the “Delete RAID Set” will be deleted by this action. But for the Raid 30/50/60, you need to delete the volumes belonging to those RAID sets.



6.5.3 Expand Raid Set

Instead of deleting a RAID set and recreating it with additional disk drives, the “Expand Raid Set” function allows the users to add disk drives to the RAID set that have already been created. To expand a RAID set:

1. Select the “Expand Raid Set” option. If there is an available disk, then the “Select SATA Drives For Raid Set Expansion” screen appears.
2. Select the target RAID set by clicking on the appropriate radio button. Select the target disk by clicking on the appropriate check box.



WEB BROWSER-BASED CONFIGURATION

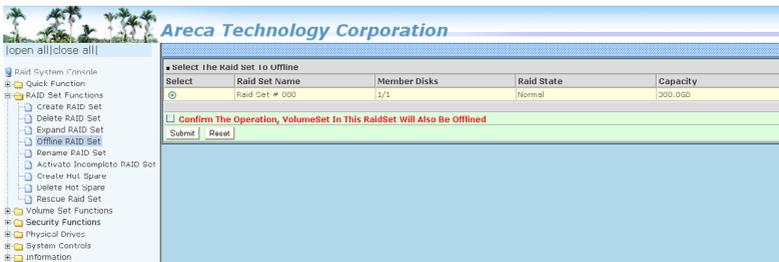
3. Press the **Yes** to start the expansion on the RAID set.
The new additional capacity can be utilized by one or more volume sets. The volume sets associated with this RAID set appear for you to have chance to modify RAID level or stripe size. Follow the instruction presented in the "Modify Volume Set" to modify the volume sets; operation system specific utilities may be required to expand operating system partitions.

Note:

1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.
2. 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 completes.
3. RAID 30/50/60 does not support the "Expand Raid set".

6.5.4 Offline Raid Set

This function is for customer being able to unmount and remount a multi-disk volume. All Hdds of the selected RAID set will be put into offline state, spun down and fault LED in fast blinking mode. User can remove those Hdds and insert new Hdds on those empty slots without needing power down the controller.



6.5.5 Rename Raid Set

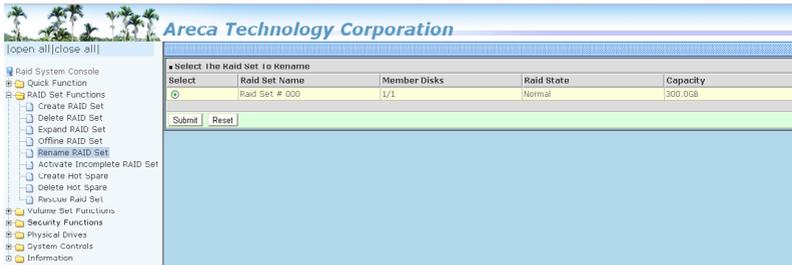
The default RAID set name will always appear as "Raid Set #" when it is firstly created by the controller. The "Rename Raid Set" function is for customer to rename the default RAID set name.

To rename a RAID set from a group of RAID sets:

1. Click on the "Rename Raid Set" link.

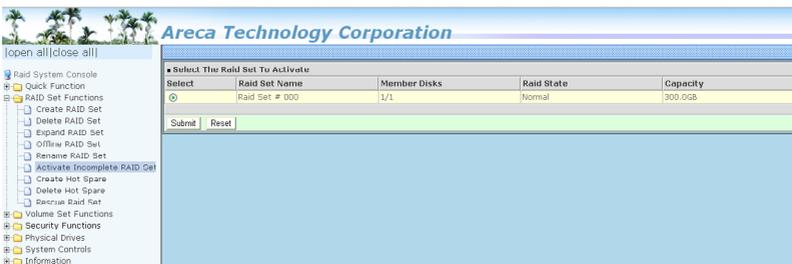
WEB BROWSER-BASED CONFIGURATION

2. Click the RAID set check box from the list that you wish to rename. Click the “Submit” button. The following screen appears. Use this option to rename the RAID set name.



6.5.6 Activate Incomplete Raid Set

If one of the disk drives is removed in power off state, the RAID set state will change to “Incomplete State”. If the user wants to continue to operate the controller without power-off the RAID subsystem, the user can use the “Activate Incomplete Raid Set” option to active the RAID set. After the user completes this function, the Raid State will change to “Degraded Mode” and start to work.

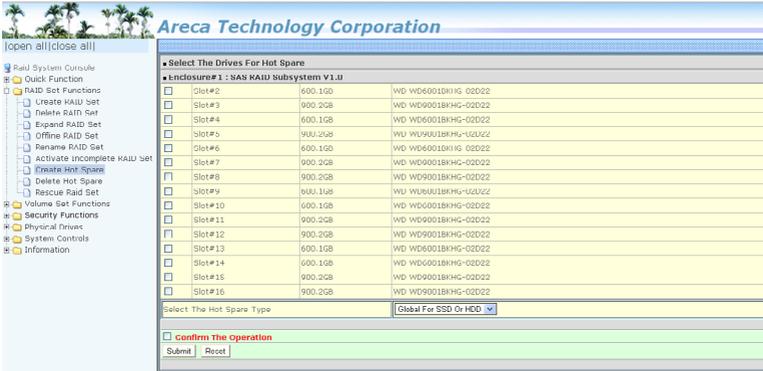


To activate the incomplete the RAID set, click on the “Activate Raid Set” link. A “Select The RAID Set To Activate” screen is displayed showing all RAID sets existing on the current controller. Click the RAID set number to activate in the select column. Click on the “Submit” button on the screen to activate the RAID set that had a disk removed (or failed) in the power off state. The RAID subsystem will continue to work in degraded mode.

WEB BROWSER-BASED CONFIGURATION

6.5.7 Create Hot Spare

When you choose the “Create Hot Spare” option in the “Raid Set Function”, all unused physical devices connected to the current controller appear. Select the target disk by clicking on the appropriate check box. Click the “Confirm The Operation” check box and click the “Submit” button in the screen to create the hot spares. The “Create Hot Spare” option gives you the ability to define a global hot spare.



6.5.8 Delete Hot Spare

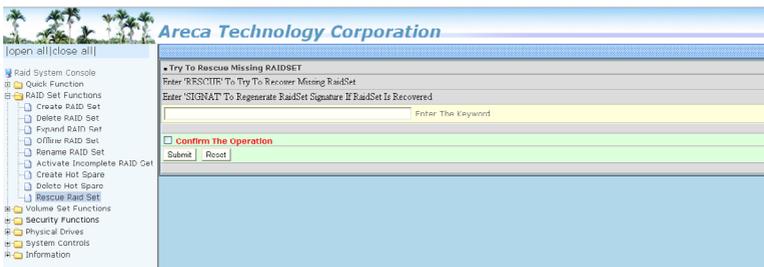
Select the target hot spare disk to delete by clicking on the appropriate check box. Click the “Confirm The Operation” check box and click the “Submit” button on the screen to delete the hot spares.



WEB BROWSER-BASED CONFIGURATION

6.5.9 Rescue Raid Set

When the system is powered off in the RAID set update/creation period, the configuration possibly could disappear due to this abnormal condition. The "RESCUE" function can recover the missing RAID set information. The RAID subsystem uses the time as the RAID set signature. The RAID set may have different time after the RAID set is recovered. The "SIGANT" function can regenerate the signature for the RAID set. Please contact with manufacture's technical support before you use this configuration.



6.6 Volume Set Functions

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 disk 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.

The following is the volume set features for the RAID subsystem.

1. Volume sets of different RAID levels may coexist on the same RAID set.
2. Up to 128 volume sets can be created in a RAID set.
3. The maximum addressable size of a single volume set is not limited to 2TB, because the controller is capable of 64-bit LBA mode. However the operating system itself may not be capable of addressing more than 2TB.

WEB BROWSER-BASED CONFIGURATION

6.6.1 Create Volume Set (0/1/10/3/5/6)

To create volume set from RAID set system, move the cursor bar to the main menu and click on the "Create Volume Set" link. The "Select The Raid Set To Create On It" screen will show all RAID set number. Tick on a RAID set number that you want to create and then click on the "Submit" button. The new create volume set attribute allows user to select the Volume Name, RAID Level, Capacity, Greater Two TB Volume Support, Initialization Mode, Strip Size, Cache Mode, Write Protec Tagged Command Queuing, SAS Port/LUN Base/LUN and Volumes To Be Created.

The screenshot shows the "Areca Technology Corporation" web interface. The main content area is titled "ENTER The Volume Attribute" and contains the following fields:

Volume Name	ARC 0608-VOL4000
Member Disk	1
Volume Raid Level	Fixed0
Max Capacity allowed	300 GB
Select Volume Capacity	500 GB
Greater Two TB Volume Support	No
Volume Initialization Mode	No Initialization
Volume Stripe size	64 bytes
Volume Cache Mode	Write Back
Support command queuing	Disable
Controller#1 Fibre Port Mapping	Port0 Port1
Controller#2 Fibre Port Mapping	Port2 Port3
Fibre Channel LUN Base/MINID LUN	0 0
Volumes to be created	1

At the bottom of the form, there is a "Confirm The Operation" section with "Submit" and "Reset" buttons.

- **Volume Name**

The default volume name will always appear as "ARC-1680-VOL". You can rename the volume set providing it does not exceed the 15 characters limit.

- **Volume Raid Level**

Set the RAID level for the volume set. Highlight the desired RAID Level and press **Enter** key. The available RAID levels for the current volume set are displayed. Select a RAID level and press **Enter** key to confirm.

- **Capacity**

The maximum volume size is the default initial setting. Enter the appropriate volume size to fit your application.

- **Greater Two TB Volume Support**

If volume capacity will exceed Two TB, controller will show the "Greater Two TB Volume Support" sub-menu. Greater Two TB Volume Support option: No and Yes.

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- No

When this option is enabled, it keeps the volume size with max. 2TB limitation. For any hard disk drives working in the 4K native mode in the Raid set, the volume set directly sets and exposes 4KB sector size to the operating system.

- 64bit LBA

This option uses 16 bytes CDB instead of 10 bytes. The maximum volume capacity supports up to 512TB. For any hard disk drives working in the 4K native mode in the Raid set, the volume set directly sets and exposes 4KB sector size to the operating system.

This option works on different OS which supports 16 bytes CDB. Such as:

Windows 2003 with SP1 or later

Linux kernel 2.6.x or later

- Use 4K Block

This option uses 16 bytes CDB and changes the sector size from default 512 bytes to 4k bytes. Windows XP only supports maximum volume capacity is up to 16TB.

● Initialization Mode

This parameter is used to define "Background Initialization", "Foreground Initialization" or "No Init (To Rescue Volume)". When "Background Initialization", the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete. When "Foreground Initialization", the initialization proceeds must be completed before the volume set ready for system accesses. There is no initialization happened when you select "No Init" option. "No Init" is for customer to rescue volume without losing data in the disk.

● Stripe Size

This parameter sets the size of the stripe written to each disk in a RAID 0, 1, 10(1E), 5, 6, 50 or 60 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128KB,

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256KB, 512KB or 1024KB. 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 smaller stripe size.

Note:

RAID level 3 can't modify the cache stripe size.

- **Cache Mode**

The RAID subsystem supports "Write-Through" and "Write-Back" cache.

- **Tagged Command Queuing**

The "Enabled" option is useful for enhancing overall system performance under multi-tasking operating systems. The Command Tag (Drive Channel) function controls the SAS command tag queuing support for each drive channel. This function should normally remain "Enabled". "Disabled" this function only when using SAS drives that do not support command tag queuing. Tagged Command Queuing (TCQ) is a technology built into SAS hard drives. It allows the RAID controller to send multiple read and write requests to a hard drive. This function should normally remain "Enabled". "Disabled" this function only when using SAS drives that do not support command tag queuing.

- **SAS Port/LUN Base/LUN**

SAS Port - Two 4-PHY links SAS ports can be applied to the RAID subsystem. The RAID subsystem supports Port 0,1 and 0&1 cluster option.

LUN base - Each SAS device attached to the SAS host adapter must be assigned a unique SAS ID number. A SAS port can connect up to 128 (16*8) volume sets. The RAID subsystem is as a large SAS device. We should assign a LUN base from a list of SAS LUNs.

SAS LUN - Each LUN Base can support up to 8 SAS LUNs. Most SAS port host adapter treats each SAS LUN like a SAS disk.

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- **Fibre Port/LUN Base/LUN**

Fibre Port - Two 16Gbps or four 16Gbps Fibre channel can be applied to the internal RAID subsystem. Choose the Fibre Host#. A "Select Fibre Channel" dialog box appears, select the channel number.

LUN Base - Each fibre device attached to the Fibre card, as well as the card itself, must be assigned a unique fibre ID number. A Fibre channel can connect up to 128(16*8) volume sets. The RAID subsystem is as a large Fibre device. We should assign a LUN base from a list of Fibre LUN Base.

Fibre LUN - Each Fibre LUN base can support up to 8 LUNs. Most Fibre Channel host adapter treats each LUN like a Fibre disk.

- **iSCSI Target Node/LUN**

Target Node - A iSCSI RAID subsystem can connect up to 16 target nodes. The iSCSI RAID subsystem is as a large SAS/SATA device. We should assign a Node from a list of Target Node. A iSCSI channel can connect up to 128(16*8) volume sets.

iSCSI LUN - Each Target Node can support up to 8 LUNs. Most iSCSI host adapter treats each LUN like a SAS/SATA disk.

- **Volume To Be Created**

The RAID subsystem can support up to 128 volume sets. This option is defined volume number using the same volume set attribute here.

WEB BROWSER-BASED CONFIGURATION

6.6.2 Create Raid30/50/60 (Volume Set 30/50/60)

The screenshot shows the 'Enter The Volume Attribute' configuration page. On the left is a navigation tree with 'Create Raid30/50/60' selected. The main area contains the following fields:

Enter The Volume Attribute	
Volume Name	ARC-8668-VOL000
Member Disks	2x3
Volume Raid Level	50
Max Capacity Allowed	1600.0 GB
Select Volume Capacity	1600.0 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
SAS Port/LUN Base/LUN	0 : 0 : 0
Volumes To Be Created	1

At the bottom, there is a 'Confirm The Operation' checkbox and 'Submit' and 'Reset' buttons.

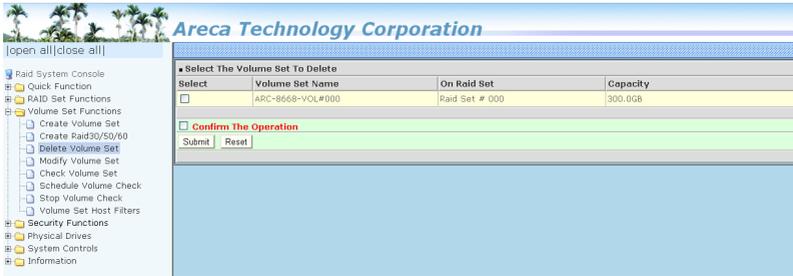
To create 30/50/60 volume set from RAID set group, move the cursor bar to the main menu and click on the "Create Raid30/50/60" link. The "Select The Raid Set To Create Volume On It" screen will show all RAID set number. Tick on the RAID set numbers (same disk No per RAID set) that you want to create and then click on the "Submit" button.

The new create volume set attribute allows user to select the Volume Name, RAID Level, Capacity, Greater Two TB Volume Support, Initialization Mode, Stripe Size, Cache Mode, Write Protect, Tagged Command Queuing, SAS Port/LUN Base/LUN and Volumes To Be Created. Please refer to above section for details description of each item.

6.6.3 Delete Volume Set

To delete a volume from RAID set, move the cursor bar to the main menu and click on the "Delete Volume Set" link. The "Select The Raid Set To Delete" screen will show all RAID set numbers. Click a RAID set number and the "Confirm The Operation" check box and then click the "Submit" button to show all volume set items in the selected RAID set. Click a volume set number and the "Confirm The Operation" check box and then click the "Submit" button to delete the volume set.

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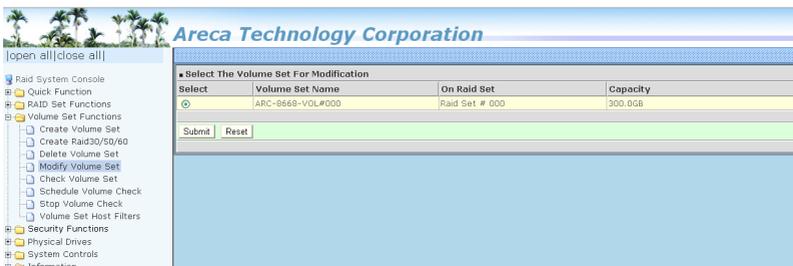


6.6.4 Modify Volume Set

To modify a volume set from a RAID set:

1. Click on the "Modify Volume Set" link.
2. Click the volume set check box from the list that you wish to modify. Click the "Submit" button.

The following screen appears. Use this option to modify the volume set configuration. To modify volume set attributes, move the cursor bar to the volume set attribute menu and click it. The "Enter The Volume Attribute" screen appears. Move the cursor to an attribute item and then click the attribute to modify the value. After you complete the modification, click the "Confirm The Operation" check box and click the "Submit" button to complete the action. The user can only modify the last volume set capacity.



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6.6.4.1 Volume Growth

Use "Expand RAID Set" function to add disk to a RAID set. The additional capacity can be used to enlarge the last volume set size or to create another volume set. The "Modify Volume Set" function can support the "Volume Modification" function. To expand the last volume set capacity, move the cursor bar to the "Capacity" item and enter the capacity size. When finished the above action,click the "Confirm The Operation" check box and click the "Submit" button to complete the action. The last volume set starts to expand its capacity.

To expand an existing volume noticed:

- Only the last volume can expand capacity.
- When expanding volume capacity, you can't modify stripe size or modify RAID level simultaneously.
- You can expand volume capacity, but can't shrink volume capacity size.
- After volume expansion, the volume capacity can't be decreased.

For greater 2TB expansion:

- If your system installed in the volume, don't expand the volume capacity greater than 2TB, currently OS can't support boot up from a greater than 2TB capacity device.
- Expand over 2TB used LBA64 mode. Please make sure your OS supports LBA64 before expand it.

6.6.4.2 Volume Set Migration

Migrating occurs when a volume set is migrating from one RAID level to another, when a volume set strip size changes, or when a disk is added to a RAID set. Migration state is displayed in the volume state area of the "Volume Set Information" screen.

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The screenshot shows the 'RAID Set Hierarchy' section of the Areca Technology Corporation web interface. It displays a tree view on the left and a table of RAID sets on the right. The RAID sets are organized into two main categories: RAID30/50/60 Volumes and RAID Set Hierarchy. The RAID30/50/60 Volumes table lists three RAID sets, each with a Member Disks column showing '2x4', a Volume State of 'Normal', and a Capacity of '30.0GB'. The RAID Set Hierarchy table lists two RAID sets, each with a Volume Set (Larg/Lsm) column showing 'VOL_4500P100(VP-10(G))' and 'VOL_4500P100(VP-10(G))', a Volume State of 'Normal', and a Capacity of '15.0GB'.

• RAID30/50/60 Volumes			
Volume Set(Cy/Larg/Lsm)	Member Disks	Volume State	Capacity
(FC-8780-VOL_4500(C818333/G))	2x4	Normal	30.0GB
(FC-8780-VOL_4500(C818333/G))	2x4	Normal	30.0GB
(FC-8780-VOL_4500(C818333/G))	2x4	Normal	30.0GB

• RAID Set Hierarchy				
Raid Set	Devices	Volume Set (Larg/Lsm)	Volume State	Capacity
Raid Set # 000	(E180)47	VOL_4500P100(VP-10(G))	Normal	15.0GB
	(E180)48	VOL_4500P100(VP-10(G))	Normal	15.0GB
	(E180)49	VOL_4500P100(VP-10(G))	Normal	15.0GB
	(E180)50	VOL_4500P100(VP-10(G))	Normal	15.0GB
Raid Set # 001	(E280)03	VOL_4500P100(VP-10(G))	Normal	15.0GB
	(E280)04	VOL_4500P100(VP-10(G))	Normal	15.0GB
	(E280)05	VOL_4500P100(VP-10(G))	Normal	15.0GB
	(E280)06	VOL_4500P100(VP-10(G))	Normal	15.0GB

Note:

1. If the volume is RAID level 30, 50, or 60, you can not change the volume to another RAID level. If the volume is RAID level 0, 1, 10(1E), 3, 5, or 6, you can not change the volume to RAID level 30, 50, or 60.
2. RAID level 30 50 and 60 can support up to eight sub-volumes, but it can not support expansion and migration.

6.6.5 Check Volume Set

To check a volume set from a RAID set:

1. Click on the "Check Volume Set" link.
2. Click on the volume set from the list that you wish to check.

Tick on "Confirm The Operation" and click on the "Submit" button. Use this option to verify the correctness of the redundant data in a volume set. For example, in a system with dedicated parity, volume set check means computing the parity of the data disk drives and comparing the results to the contents of the dedicated parity disk drive. The checking percentage can also be viewed by clicking on "Raid Set Hierarchy" in the main menu.

6.6.6 Schedule Volume Check

The screenshot shows the 'Scheduled Volume Checking' section of the Areca Technology Corporation web interface. It features a scheduler dropdown set to 'Disabled', a 'checking after system idle' dropdown set to 'No', and two checkboxes: 'scrub bad block (if bad block is found, Assume Parity Data is good)' and 'Re compute Parity If Parity Error Is Found, Assume Data Is Good'. Below these are 'Confirm The Operation' checkboxes and 'Submit' and 'Reset' buttons.

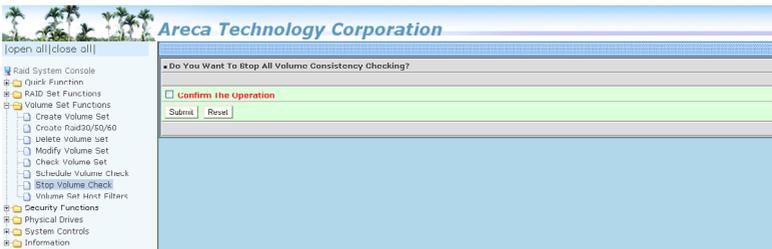
• Scheduled Volume Checking	
Scheduler :	Disabled
checking after system idle :	No
<input type="checkbox"/>	scrub bad block (if bad block is found, Assume Parity Data is good).
<input type="checkbox"/>	Re compute Parity If Parity Error Is Found, Assume Data Is Good.
<input type="checkbox"/> Confirm The Operation	
Submit Reset	

WEB BROWSER-BASED CONFIGURATION

This function can setup a schedule so consistency checks are run automatically at regularly scheduled intervals. If there is a discrepancy found, it will log the error on the system event log. The controller will base on the user selection scrub bad block or re-compute parity to recovery the data. The recommended interval for checking consistency in RAID drives can set on "Scheduler" option. User can specify parameters to "Scheduler" to change the scheduled run time. The "Checking After System Idle" is defined the default time to start the automated consistency check scheduling.

6.6.7 Stop Volume Check

Use this option to stop the "Check Volume Set" function.

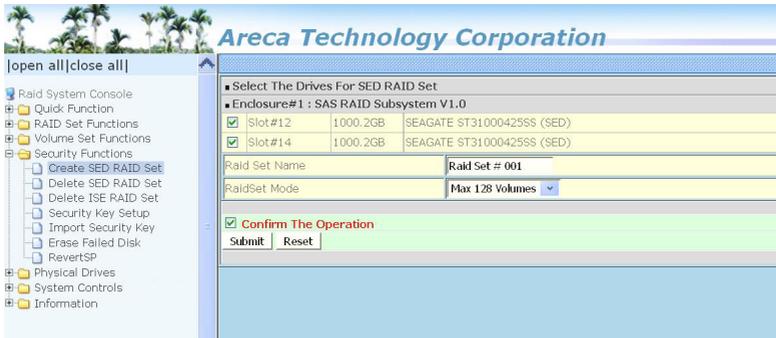


6.7 Security Function

The "Security Function" on the new firmware supports Self-Encrypting Disks (SED) for protection of data against loss or theft of SEDs. Protection is achieved by the use of encryption technology on the drives. The McRAID storage management allows SED keys to be created and managed as well as create/delete RAID sets. The following section provides the "Security Function" instructions to perform the custom configuration tasks. All SED functions are integrated into the intuitive and user friendly McRAID manager interface for easy access. Choose this option from the main menu and then perform the operations listed below.

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6.7.1 Create SED RAID Set



To create a SED RAID set, click on the "Create SED Raid Set" link. A "Select The Drive For SED RAID Set" screen is displayed showing the SED drive(s) connected to the current controller and enclosures. Click on the selected physical drives within the current RAID set. Enter 1 to 15 alphanumeric characters to define a unique identifier for a SED RAID set. The default RAID set name will always appear as "Raid Set #". Tick on the "Confirm The Operation" check box and click on the "Submit" button on the screen; the RAID set will start to initialize. If you have available disk member, you can repeat above procedures to define another RAID sets. The Max 128 Volumes is the default mode for RAID controller.

6.7.2 Delete SED RAID Set



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A SED RAID Set is a RAID Set that has been locked on a controller that holds a security key. When you delete existing SED RAID sets, there has one option available to perform an Instant Secure Erase. The "Secure Erase The Member Disks" function is the process of permanently erasing all data on the SED disks and resetting the security attributes. The data on the SED disk is lost.

To delete a SED RAID set, click on the "Deleted Raid Set" link; a "Select The SED RAID Set To Delete" screen is displayed showing all exist SED RAID sets in the current controller. Click on the SED RAID set num-ber which you want to delete in the select column on the delete screen. Then, tick on the "Confirm The Operation" check box and click on the "Submit" button in the screen to delete it. The volume sets included in the "Delete SED RAID Set". It will be deleted by this action. But for the Raid 30/50/60, you need to delete the volumes belonging to those SED RAID sets.

6.7.3 Delete ISE RAID Set



Instant Secure Erase (ISE) or Crypto Erase allows a drive to be instantly erased using industry-standard commands and options. An ISE RAID Set is a RAID Set that has been created by a group of ISE only SAS hard disks on a controller. When you delete existing SED RAID sets, there has one option available to perform an Instant Secure Erase. The "Secure Erase The Member Disks" function is the process of permanently erasing all data on the ISE disks and resetting the security attributes. The data on the ISE disk is lost.

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To delete an ISE RAID set, click on the "Deleted ISE Raid Set" link. A "Select The ISE RAID Set To Delete" screen is displayed showing all exist ISE RAID sets in the current controller. Click on the RAID set num-ber which you want to delete in the select column on the delete screen. Then, tick on the "Confirm The Operation" check box and click on the "Submit" button in the screen to delete it. The volume sets included in the "Delete ISE RAID Set". It will be deleted by this action. But for the Raid 30/50/60, you need to delete the volumes belonging to those ISE RAID sets.

6.7.4 Security Key Setup

The Areca RAID controllers support Self-Encrypting Disks (SED) for protection of data against loss or theft of SEDs. Protection is achieved by the SED hard drive that automatically and continuously encrypts the data on the drive without any user interaction. There is one SED key per controller. You can manage the SED key under McRAID manager. Local SED key management in the controller firmware is designed to protect data from security breaches with minimal cost and complexity. The key can be escrowed in to a file using McRAID manager. Creating and managing SED key is an important part of the cryptographic process. The key must be kept secret from anyone who should not decrypt your data. This section describes how to generate and manage keys.

6.7.4.1 SED Key Management-Creation

There is one SED key per controller which stores in the controller flash memory. Areca provides both automatically or password methods to generate a key.

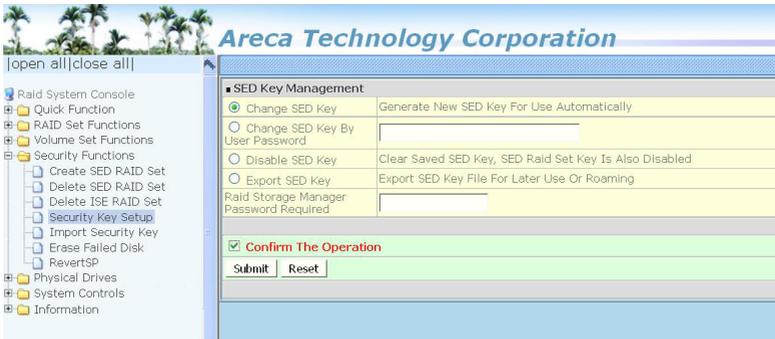
1. SED Key is generated automatically by internal random number for a SED RAID set use without needing a password input.
2. SED Key is generated by user supplied password for a SED RAID set use.

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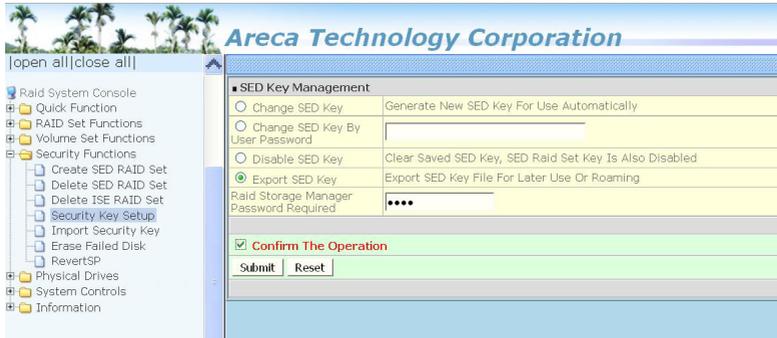
6.7.4.2 SED Key Management-Modification

If you have evidence that the SED key is known to unauthorized users, you can change the SED key again. The 'Disable SED Key' function is used to clear SED key on controller and RAID set members.



In some cases, you may want to export a SED key to store on removable media or to use on a different computer. If you want to create a backup copy of the SED key or use it on another computer, you must first export the SED key. Exporting the SED key puts it in a file (filename.bin) that you can then transfer to another computer or put in a safe place.

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6.7.5 Import Security Key

SED RaidSet created on an Areca RAID adapters can be migrated to another RAID adapter. If you are importing a RaidSet originally secured with a SED key, you need to import the foreign SED key files to secure or unlock that RaidSet. The "Import Security Key" file is for Raidset Roaming or Change SED Key function. If you roam a RaidSet from old controller to another new (with Security Functions support), the foreign SED key file must be imported before it can be used.

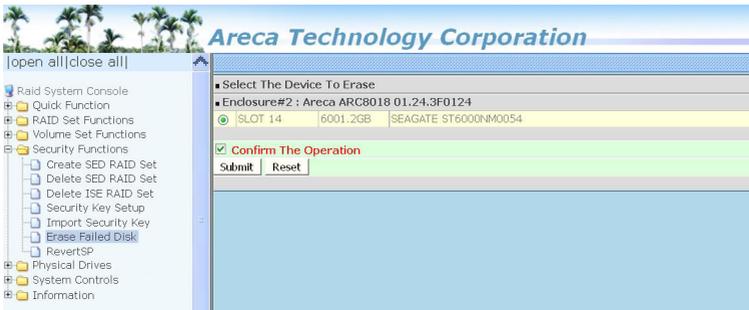
1. Select the "RaidSet Roaming" option to unlock the locked disk and personalize to new controller's SED key. If there is an existing SED key on new controller, RaidSet is updated with the new security key. If there is not an existing SED key on new controller, RaidSet is updated to unlock RaidSet.
2. Select the "Change SED Key" option to unlock the locked disk and change to foreign SED key.



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6.7.6 Erase Failed Disk

To erase the failed encryption-capable physical disk, move the cursor bar to the main menu and click on the "Erase Failed Disk" link. The "Select The Device To Erase" screen will show all failed encryption-capable physical disks. Tick on the failed disk that you want to erase and then click on the "Submit" button. In case controller successfully performs an Instant Secure Erase, it will erase all data on the encryption-capable physical disk disks and reset the security attributes. The data on the encryption-capable physical disk is lost.



6.7.7 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label.



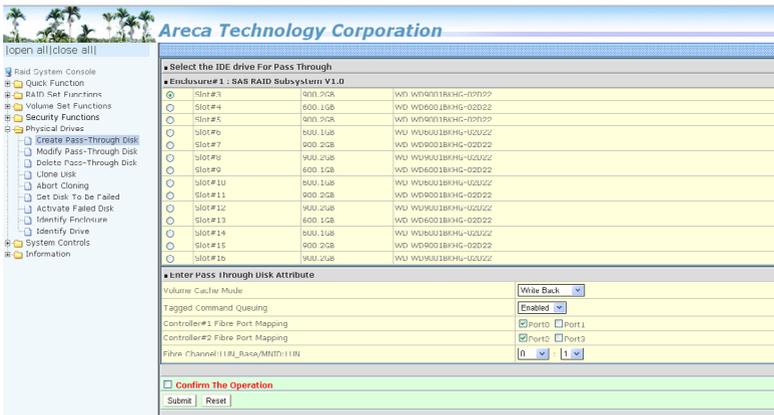
WEB BROWSER-BASED CONFIGURATION

6.8 Physical Drive

Choose this option to select a physical disk from the main menu and then perform the operations listed below.

6.8.1 Create Pass-Through Disk

To create pass-through disk, move the mouse cursor to the main menu and click on the "Create Pass-Through" link. The relative setting function screen appears. A pass-through disk is not controlled by the RAID subsystem firmware, it can not be a part of a volume set. The disk is available to the operating system 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. The user can also select the Cache Mode, Write Protect, Tagged Command Queuing, SAS Port/LUN Base/LUN for this pass-through disk.



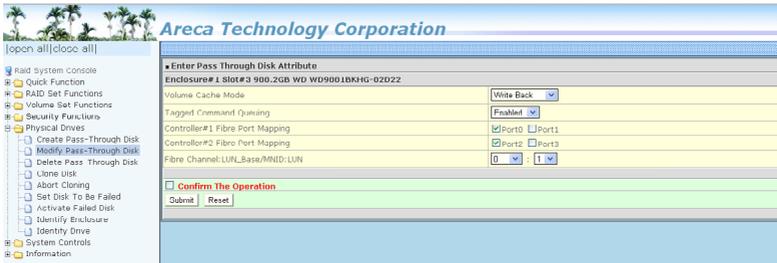
6.8.2 Modify a Pass-Through Disk

Use this option to modify the pass-through disk attribute. The user can modify the Cache Mode, Write protect, Tagged Command Queuing, and SAS Port/LUN Base/LUN on an existing passthrough disk.

To modify the pass-through drive attribute from the pass-through drive pool, move the mouse cursor bar and click on the "Modify a Pass-Through" link. The "Select The Pass Through Disk For Modifi-

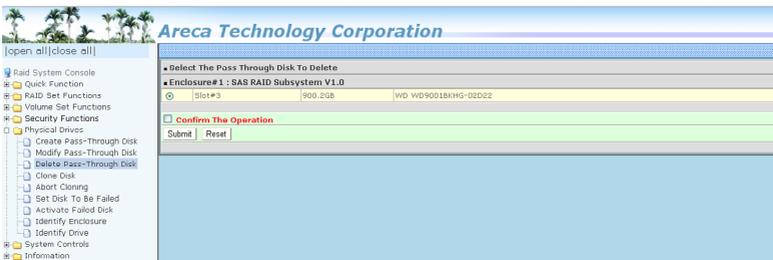
WEB BROWSER-BASED CONFIGURATION

ation” screen appears. Mark the check box for the pass-through disk from the pass-through drive pool and click on the “Submit” button to select the drive. When the “Enter Pass-Through Disk Attribute” screen appears, modify the drive attribute values, as you want. After you complete the selection, mark the check box for “Confirm The Operation” and click on the “Submit” button to complete the selection action.



6.8.3 Delete Pass-Through Disk

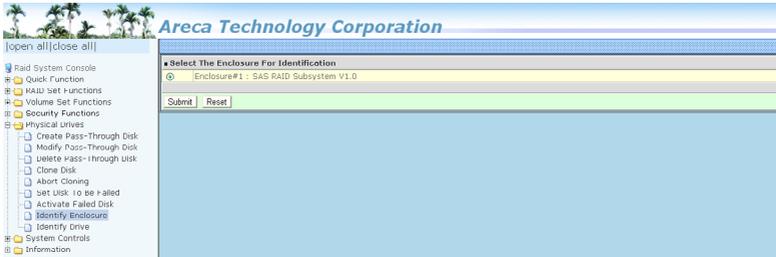
To delete a pass-through drive from the pass-through drive pool, move the mouse cursor bar to the main menus and click the “Delete Pass Through” link. After you complete the selection, mark the check box for “Confirm The Operation” and click the “Submit” button to complete the delete action.



6.8.4 Identify Enclosure

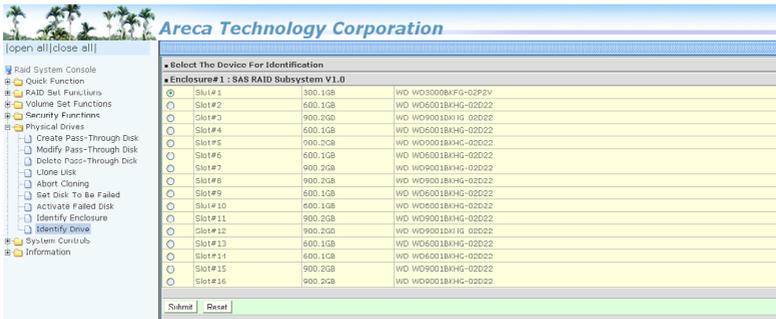
To prevent removing the wrong subsystem, the selected JBOD expander enclosure all disks fault LED indicator will light for physically locating the selected subsystem when the “Identify Subsystem” is selected. This function will also light the subsystem LED indicator, if it is existed.

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6.8.5 Identify Drive

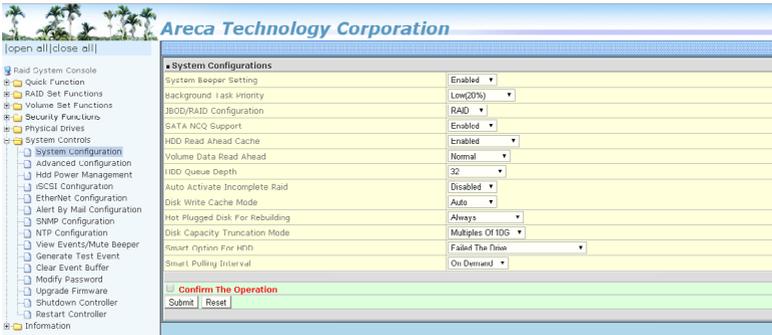
To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the "Identify Selected Device" is selected.



6.9 System Controls

6.9.1 System Config

To set the RAID system function, move the cursor to the main menu and click the "System Controls" link. The "Raid System Function" menu will show all items, then select the desired function.



- **System Beeper Setting**

The "System Beeper Setting" function is used to "Disabled" or "Enabled" the RAID subsystem alarm tone generator.

- **Background Task Priority**

The "Background Task Priority" is a relative indication of how much time the controller devotes to a rebuild operation. The RAID subsystem allows the user to choose the rebuild priority (UltraLow, Low, Normal and High) to balance volume set access and rebuild tasks appropriately. For high array performance, specify a "Low" value.

- **JBOD/RAID Configuration**

JBOD is an acronym for "Just a Bunch Of Disk". A group of hard disks in a RAID subsystem are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to change the option from the RAID to the JBOD function.

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- **SATA NCQ Support**

The controller supports both SAS and SATA disk drives. The SATA NCQ 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. The RAID subsystem allows the user to select the SATA NCQ support: "Enabled" or "Disabled".

- **HDD Read Ahead Cache**

Allow Read Ahead (Default: Enabled)—When "Enabled", the drive's read ahead cache algorithm is used, providing maximum performance under most circumstances.

- **Volume Data Read Ahead**

The "Data Read Ahead" parameter specifies the controller firmware algorithms which process the read ahead data blocks from the disk. The "Data Read Ahead" parameter is normal by default. To modify the value, you must set it from the command line using the "Data Read Ahead" option. The default "Normal" option satisfies the performance requirements for a typical volume. The "Disabled" value implies no data read ahead. The most efficient value for the controllers depends on your application. "Aggressive" read ahead is optimal for sequential access but it degrades random access.

- **HDD Queue Depth**

This parameter is adjusted the queue depth capacity of NCQ (SATA HDD) or Tagged Command Queuing (SAS) which transmits multiple commands to a single target without waiting for the initial command to complete.

- **Auto Activate Incomplete Raid**

When some of the disk drives are removed in power off state or boot up stage, the RAID set state will change to "Incomplete State". But if a user wants to automatically continue to work while the SAS RAID controller is powered on, the user can set the "Auto Activate Incomplete Raid" option to enable. The RAID state will change to "Degraded Mode" while it powers on.

WEB BROWSER-BASED CONFIGURATION

- **Disk Write Cache Mode**

A user can set the "Disk Write Cache Mode": Auto, Enabled, or Disabled.

- **Hot Plugged Disk For Rebuilding**

It defines if the RAID array volume should start rebuilding or not when detects a disk is inserted/re-inserted during online. The options are: "Blank Disk Only", "Always", and "Disable". The default is "Blank Disk Only".

"Blank Disk Only" – it will trigger the rebuilding if and only if the inserted disk has not been in the RAID array before, which has no RAID signature on it. So when a previously removed disk is self re-inserted, it won't trigger the degraded RAID array to rebuild, and so that the administrator has a chance to identify this mis-behaving disk and replaces it.

"Always" – it is what it was before. Whenever a disk is inserted/re-inserted whether new or previously existed, it always trigger a rebuilding for the Degraded RAID set/Volume.

"Disable" – it will not trigger rebuilding regardless what sort of disk plugging in.

When "Disable" and/or "Blank Disk Only" is selected, the re-inserted/previously removed disk will be identified as a disk in a separate RAID set with duplicated RAID set# and with all the rest of RAID members missing.

- **Disk Capacity Truncation Mode**

The RAID subsystem uses drive truncation so that drives from differing 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 redundant units. The controller provides three truncation modes in the system configuration: Multiples Of 10G, Multiples Of 1G, and Disabled.

Multiples Of 10G - If you have 120 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 120 GB. Multiples Of 10G truncates the number under tens. This

WEB BROWSER-BASED CONFIGURATION

makes same capacity for both of these drives so that one could replace the other.

Multiples Of 1G - If you have 123 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 123.4 GB. Multiples Of 1G truncates the fractional part. This makes capacity for both of these drives so that one could replace the other.

Disabled - It does not truncate the capacity.

- **Smart Option For HDD**

This option is used to increase the reliability of SSDs/HDDs by automatically copying data from a drive with potential to fail to a designated hot spare or newly inserted drive. The options are: "Failed The Drive", "Failed The Drive If Hot Spare Exist", and "Alert Only". The default is "Alert Only".

"Failed The Drive"- controllers kill off the SMART fail drive immediately.

"Failed The Drive If Hot Spare Exist" – controllers kill off the SMART fail disk if hot spare drive is existed.

"Alert Only" – it will trigger alert when there happens a SMART failed drive.

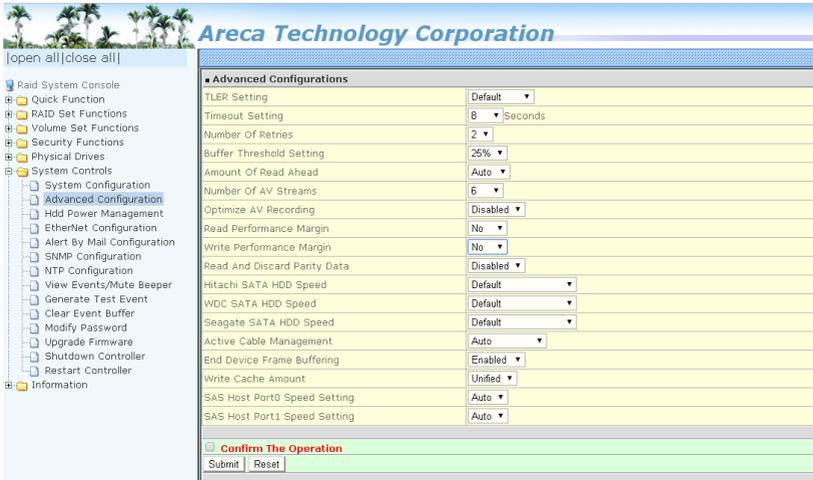
- **Smart Polling Interval**

Besides the scheduled volume check, user can define the Smart Pulling Interval to pull the SMART status of each disk. The default is "on demand". User can schedule every certain period of time interval to pull the SMART status of each disk. When SMART pulling is executed, disk activity will be temporarily halted until the SMART parameter reading is finished. That is why you don't want to set the Interval too frequent. What to use is up to the users to decide based on their applications and experiment results.

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6.9.2 Advanced Configuration

To set the RAID system function, move the cursor to the main menu and click on the "Advanced Configuration" link. The "Advanced Configuration" menu will show all items, then select the desired function.



- **TLER Setting**

TLER (time-limited error recovery) functions provide support for WD Caviar RE (RAID) series disks. This is a new option from WD to support RAID features that were traditionally missing from standard desktop drives. TLER is a method of signaling the system RAID controller in the event that an error recovery process is taking longer than time-out specifications allow. This prevents the RAID controller from dropping the drive from the array during this period. Default value is manufacture setting. You can select between 5, 6 and 7 second. This feature is to setup the HDD internal timeout value.

- **Timeout Setting**

Disk time-out is a registry setting that defines the time that RAID controller will wait for a hard disk to respond to a command. You can modify the retry value by entering a new value in the edit box beside this button and then selecting the button. Normally you should not need to modify this value. Default value is 8 seconds: You can select between 3~8 second.

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- **Number of Retries**

This setting determines the number of access that will be attempted before the current command from the RAID controller to the disk drive is aborted. You can modify the retry value by entering a new value in the edit box beside this button and then selecting the button. Normally you should not need to modify this value. There are two selections, either 2 retry or 3 retry.

- **Buffer Threshold Setting**

This new feature there are 3 options; 25%, 50%, 75%. The percentage represents how much data should be kept in resident cache memory (how full cache should get) before controller starts to flush data onto the hard drives. If the buffer is set for 25%, then all 25% will be cached and is used for writing data. The remaining cache memory will be used for reading and other system overhead. Write buffer threshold for 5% is added for video recording. This option will push data to disk early.

This feature gives controller extra buffer time in case of slow response from the hard drives within a given time. Consequently, this can prevent a pause in data flow and there will be continues data access and stream. This feature is very useful for the video streaming applications where there is high demand for constant non-stop data flow with no interruption due to lower performance of specific hardware.

- **Amount of Read Ahead**

Read-Ahead data is buffered in the RAID controller cache, however, thereby cutting down on the amount of I/O traffic to the disk. The Amount of Read Ahead defines how many data of reading at a time, making more efficient use of the RAID sub system. This makes it possible to locate and re-issue the data without repetitive hard parsing activities. The Amount of Read Ahead parameter is used to allocate an amount of memory in the cache memory the frequently executed queries and return the result set back to the host without real disk read execution. Default value is Auto: Controller will base on the HDD number to set the amount of Read Ahead value. You can select between 512KB ~ 16MB.

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- **Number of AV Stream**

RAID controllers are required to have not only the function of processing ordinary data but also the function of dealing with AV (audio/video) stream data needing real-time processing. Since the bus cycle used in RAID controller was designed to transfer the computer data exactly, it was unsuitable for the transfer of AV stream needing great band widths. They are required to do some setting for the handshaking during the processing of stream data. This setting is an object of transferring stream data efficiently on an existing RAID controller. Normally you should not need to modify this value. Default value is 6. You can select between 6~256.

To decide how to set AV stream playout parameter, you need to check the Number of Stream, Amount of Read Ahead, and Total Cache Memory during runtime. You can try to adjust the three numbers to get the best performance as your requirement. Number of Stream shows the number of stream added to the system, Amount of Read Ahead shows the amount of Read Ahead data taken from the cache without real disk execution, and total cache memory shows the total available memory being installed in the RAID controller.

- **Optimize AV Recording**

AV recording option is for video recording (no time limit), but if used in normal operation, performance may be degraded. This new feature there are 4 options; Disabled, Mode1, Mode2 and Mode 3. Default value is Disabled. Our controller cache uses LRU method, there have no special memory capacity reserved for read or write. The Mode 1, 2 and 3 are used to define the command sorting method. The default sorting method is helpful for normal applications, but not useful for AV applications, so we have defined three different sorting methods for these special applications. To decide how to optimize AV stream recording parameter, you need to adjust the Optimize AV Recording, and Write Buffer Threshold during runtime.

- **Read Performance Margin**

The "Read Performance Margin" is for controller to reserve n% read margin during AV stream recording.

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- **Write Performance Margin**

The "Write Performance Margin" is for controller to reserve n% write margin AV stream recording.

Subsystem AJA Mode Usage:

1. Controller needs to reboot when you adjust the following settings.
 - (1). Optimize For AV Recording: change any setting
 - (2). Read Performance Margin : No <-> X%
 - (3). Write Performance Margin : No <-> X%
2. The following setting is changed for AJA mode, and reboot is required for the setting to take effect.

Setting and Usage			
Optimize AV	Read Margin	Write margin	Description
Mode 3	Any	Any	R/W AJA mode with throttling, no sorting
Mode Disabled/1/2	X%	X%	R/W AJA mode with throttling and sorting
Mode Disabled/1/2	X%	No	Read AJA mode with throttling and sorting
Mode Disabled/1/2	No	X%	Write AJA mode with throttling and sorting

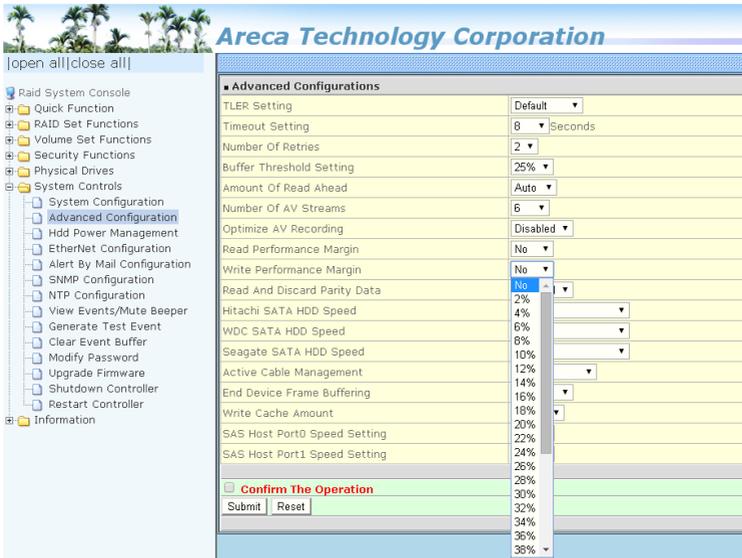
- <a>. Under Optimize For AV Recording mode: 3
Read Performance Margin and Write Performance Margin are enabled with "No" setting is 0%, reboot is not required to change Read Performance Margin and Write Performance Margin
- . If Read Performance Margin or Write Performance Margin are changed to X%, reboot is not required to change X% to Y%.
- <c>. For NON-VIDEO application, the following setting is recommended
Buffer Threshold Setting: 25%
Optimize AV Recording: disabled

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Example:

- (1). Only write throttling is required
 - (a). Buffer Threshold Setting: 5%
 - (b). Optimize For AV Recording Mode left unchanged (Disabled)
 - (c). Read Performance Margin left unchanged (No)
 - (d). Write Performance Margin set to X%
 - (e). Reboot
 - (f). Adjust Write Performance Margin to fine tune the result (no reboot required)

- (2). Read/Write Throttling is required and sorting is to be disabled
 - (1). Buffer Threshold Setting: 5%
 - (2). Optimize For AV Recording Mode set to 3
 - (3). Reboot
 - (4). Adjust Read/Write Performance Margin to fine tune the result (no reboot required)



- **Read And Discard Parity Data**

This function is used to determine if parity data is to be read and discarded.

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- **Hitachi/WDC/Seagate SATA HDD Speed**

The purpose of this setting is to provide alternative method to change the interface speed of a SATA HDD speed so that it can be successfully utilized in some compatible condition. Reboot is required for this setting to take effect.

- **System Fan Control**

There are two fans in each power supply. The speed of the fans must be adjusted according to temperature inside the power supply and HDD inside the enclosure. *Quiet Mode* options slow down the enclosure fan speed for application requiring relatively quiet environment. *Speed Up Mode* options increase the enclosure fan speed to cool down the CPU, controller and HDD temperature. You can choose the safety one option based on your environment temperature. The default is "Standard Mode".

- **End Device Frame Buffering**

Using the 12Gb/s SAS technology, including End Device Frame Buffering (EDFB) technology, the ROC and expander are designed to help ease the industry's transition to 12Gb/s SAS enabled systems by enabling customers to take advantage of 12Gb/s speeds while using existing 6Gb/s drives and backplane infrastructure. This technology allows the expander to perform aggregation, essentially allowing two devices to share one port on the expander.

- **Write Cache Amount**

The "Write Cache Amount" is for controller to configure how much cache SDRAM dedicated for read, and how much for write. By default (Unified), the size of read or write cache is automatically assigned by the controller firmware. If your server application has significantly more reads than writes or more writes than reads, you might need to change this setting to adjust the read/write cache ratio for improving performance. Reboot is required for the setting to take effect. The optimal ratio setting is application-dependent

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6.9.3 Hdd Power Management

Areca has automated the ability to manage HDD power based on usage patterns. The “HDD Power Management” allows you to choose a “Stagger Power On Control”, “Low Power Idle”, “Low RPM” and completely “Spins Down Idle HDD”. It is designed to reduce power consumption and heat generation on idle drives.



6.9.3.1 Stagger Power On Control

In a RAID subsystems with more than two drives, the startup current from spinning up the drives all at once can overload the power supply, causing damage to the power supply, disk drives and other subsystem components. This damage can be avoided by allowing the RAID controller to stagger the spin-up of the drives. The SAS/SATA drives have support stagger spin-up capabilities to boost reliability. Stagger spin-up is a very useful feature for managing multiple disk drives in a storage subsystem.

This option gives the RAID controller the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. Staggering drive spin-up in a multiple drive environment also avoids the extra cost of a power supply designed to meet short-term startup power demand as well as steady state conditions. The values can be selected within the range 0.4 to 6 seconds per step which powers up one drive groups.

6.9.3.2 Time to Hdd Low Power Idle

This option delivers lower power consumption by automatically

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unloading recording heads during the setting idle time. The values can be selected "Disabled" or within the range 2 to 7 minutes.

6.9.3.3 Time To Hdd Low RPM Mode

This function can automatically spin disks at lower RPM if there have not been used during the setting idle time. The values can be selected "Disabled" or within the range 10 to 60 minutes.

6.9.3.4 Time To Spin Down Idle HDD

This function can automatically spin down the drive if it hasn't been accessed for a certain amount of time. This value is used by the drive to determine how long to wait (with no disk activity, before turning off the spindle motor to save power). The values can be selected "Disabled" or within the range 1 to 60 minutes.

6.9.3.5 Time To Wait HDD Spin Up

To conserve energy, hard disk is designed to spin-down in Standby mode after a specific period of inactivity. It is awaiting a read or write instruction at which time the drive will spin-up its platters — wake up and enter Active mode — to perform the operation. This value is used by the controller to determine how long to wait (Spin up and switch from Standby to Active mode) when there has any Dynamic disk existed in the controller. The values can be selected within the range 7 to 60 minutes.

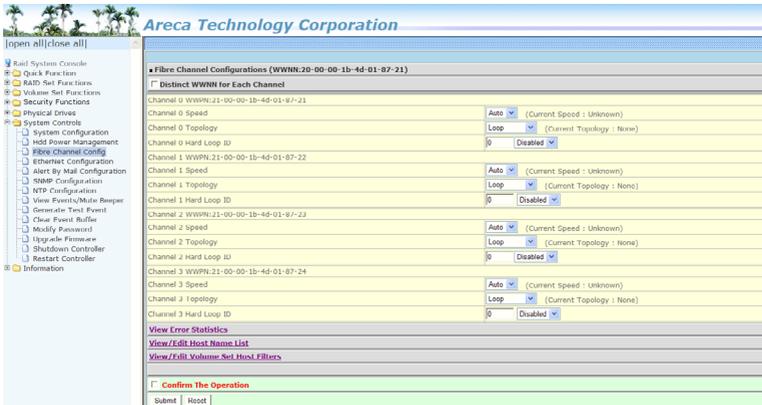
6.9.3.6 SATA Power Up In Standby

SATA Power Up In Standby (power management 2 mode, PM2) is a SATA disk drive configuration which prevents the drive from automatic spinup when power is applied. "Enabled" option allows the drive to be powered-up into the Standby power management state to minimize inrush current at power-up and to allow the controller to sequence the spinup of devices. It is mainly for server/workstation environments operating in multiple-drive configurations.

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6.9.4 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.



● Channel Speed

Fibre Channel is a high-speed robust protocol for managing the transfer of information in storage area networks (SANs). Each channel supports data rates either as 4 Gbps, 8 Gbps, or 16 Gbps. The “Auto” default option is for auto speed negotiation between 4 Gbps/8 Gbps/16 Gbps.

The new Channel Speed setting will take effect during the link down/link of the channel. The current channel speed is shown at end of the row. You can click the “Fibre Channel Config” link again from the menu frame to refresh current channel speed negotiation.

● Channel Topology

Each Fibre Channel interconnect node uses three physical topologies: Loop (Arbitrated loop), Point--Point or NPIV/ MNID. The default Channel Topology is set to “Auto”, which takes precedence of Loop Topology. Loop configuration is a

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ring topology that shares the Fibre Channel bandwidth among multiple endpoints. A point-Point configuration is a direct connection between two endpoints. NPIV (MNID) or N_port ID Virtualization is a Fibre Channel feature whereby multiple multiple virtual N_Port IDs can map to a single physical Fibre Channel N_Port. The new Channel Topology setting will take effect after your controller power cycle again. The current connection topology is shown at end of the row. You can click the "Fibre Channel Config" link again from the menu frame to refresh the current "ChannelTopology" information.

Note:

The current topology is shown as "None" when no successful connection is link for the channel.

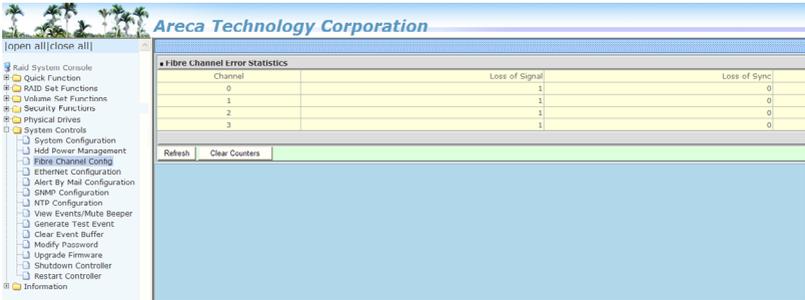
● **Hard Loop ID**

This setting is useful for channel "Loop" topology. When enabled, you can manually set the "Hard Loop ID" from 0 to 125 into a logical loop. Make sure this hard assigned ID does not conflict with other devices on the same logical loop; otherwise the channel will be automatically disabled. The "Disable" option is for controller to dynamic configure "the Hard Loop ID" value.

6.9.4.1 View Error Statistics

You can also view error statistics for each of the ports. Choose "View Error Statistics" to see a summary of the errors since the last fibre channel reboot. This dialog enumerates the various types of errors detected on a fibre channel port. The numbers indicate the error statistics collected by the fibre channel controller since the last reboot. After selecting "View Error Statistics", use the "Refresh" button to update the display.

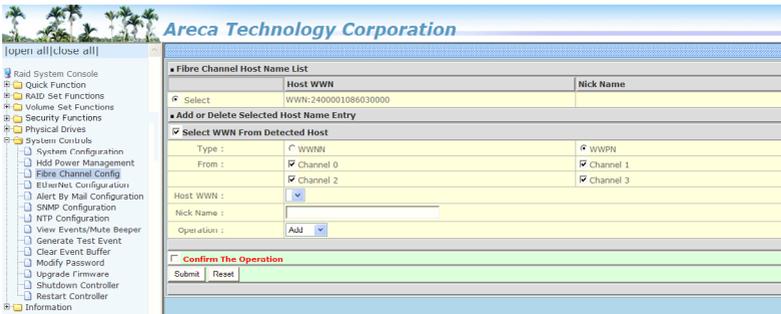
WEB BROWSER-BASED CONFIGURATION



6.9.4.2 View/Edit Host Name List

WWN (World Wide Name) is assigned to a port in a Fibre Channel fabric. It uses on SAN, and performs a function equivalent to the MAC address in Ethernet protocol, as it is supposed to be a unique identifier in the network.

To set WWN (World Wide Name) parameter, move the mouse to click on the "View/Edit Host Name List" function of the "Fibre Channel Config". The "Fibre Channel Host Name List" configuration screen will be shown. Using the "Add or Delete Selected Host Name Entry" add or delete the WWNN and WWPN.



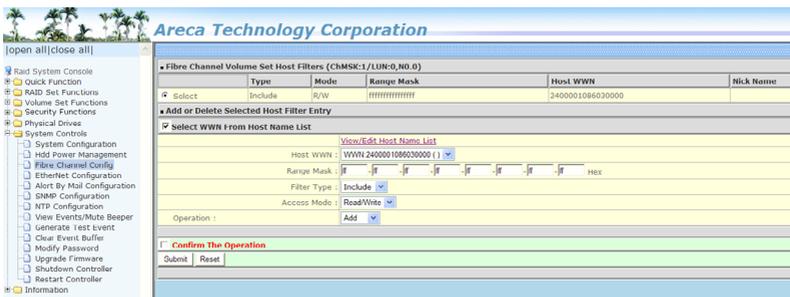
- **WWPN (World Wide Port Name)**
The fibre channel RAID WWPN uniquely identifies each target port on the subsystem. The host operating system uses the combination of the WWNN and WWPN to uniquely identify a port in the Fabric.

WEB BROWSER-BASED CONFIGURATION

World Wide Node Name (WWNN), a WWN assigned to a node/device on a Fibre Channel fabric. It is shown at top of the fibre channel RAID subsystem configuration screen. Worldwide Names consist of 16 hexadecimal digits grouped as 8 pairs unique address factory assigned to the FC RAID. It is valid for the same WWNN to be seen on the four ports.

6.9.4.3 View/Edit Volume Set Host Filters

You can define a set of Host Filters for each volume to limit accessibility to certain hosts. When a host logs in to the RAID unit, it's WWN will be compared to these Host Filters and access permission map is updated. The subsequent SCSI commands may be rejected according to the access permission.



To set Volume Set Host Filters parameter, move the mouse to click on the "View/Edit Volume Set Host Filters" function of the Fibre Channel Config. The "Fibre Channel Volume Set Host Filters" configuration screen will be shown. Using the "Add or Delete Selected Host Name Entry" add or delete the "Volume Set Host Filters". Up to 8 entries may be added to the Host Filters with the following operations:

- Specify the Host WWN

This WWN (can be WWNN or WWPN) will be compared with the incoming HBA's WWN for a match. You can select WWN from predefined Host Name List (pull-down menu), or type any WWN directly with "Select WWN From Host Name List" unchecked.

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- Specify the Range Mask
The WWN is 64-bit in length. Only the bit positions with Range Mask set as 1 will be compared in the previous step. This is useful to cover multiple ports of a HBA in one single entry. Normally, just leave the Range Mask as all 1's to specify single WWN comparison.

- Specify the Filter Type (Include or Exclude)
Condition-1, all entries in the Host Filters are specified as "Include" => only the matched WWNs in steps 1&2 can access the corresponding volume. All others will be rejected.

Condition-2, all entries in the Host Filters are specified as "Exclude" => the matched WWNs in steps 1&2 will not be able to access the corresponding volume. All others gain full access.
Condition-3, mixed "Include" & "Exclude" entries => this is basically the same as Condition-1, with "Exclude" entries ignored.

- Specify the Access Mode
Entries with Filter Type specified as "Include" can be further limited as ReadOnly with this option.
- Leave the Operation as "Add". Check "Confirm The Operation" checkbox and then click "Submit" button. An entry is added to this Host Filter set. To delete an entry from the Host Filter, simply select the entry from the listed table, select Operation as "Delete", then check "Confirm The Operation" and click "Submit" button.

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6.9.5 iSCSI Configuration

To setup the iSCSI Channel Configuration function, move the mouse cursor to the main menu and click on the iSCSI Configuration. The iSCSI Channel Configuration screen will be shown. Configure the desired function.

Areca Technology Corporation

open all | close all |

- Raid System Console
 - Quick Function
 - RAID Set Functions
 - Volume Set Functions
 - Security Functions
 - Physical Drives
 - System Controls
 - System Configuration
 - Advanced Configuration
 - Hdd Power Management
 - iSCSI Configuration
 - 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

■ iSCSI Configuration

[Setup TargetNode Parameters](#)

[Setup Initiator CHAP Secret](#)

[Setup Initiator LUN Permission](#)

■ Port 0 (00.04.D9.F1.22.AB) -- Link is Up at 10Gbps Full Duplex

IP Address Assignment DHCP Static

Port IP Address	192	168	176	100
Gateway IP Address	0	0	0	0
Subnet Mask	255	255	255	0
ICSIS Port Number	3260			
MTU	1500			

■ Port 1 (00.04.D9.F1.22.AC) -- Link is Down

IP Address Assignment DHCP Static

Port IP Address	192	168	177	100
Gateway IP Address	0	0	0	0
Subnet Mask	255	255	255	0
ICSIS Port Number	3260			
MTU	1500			

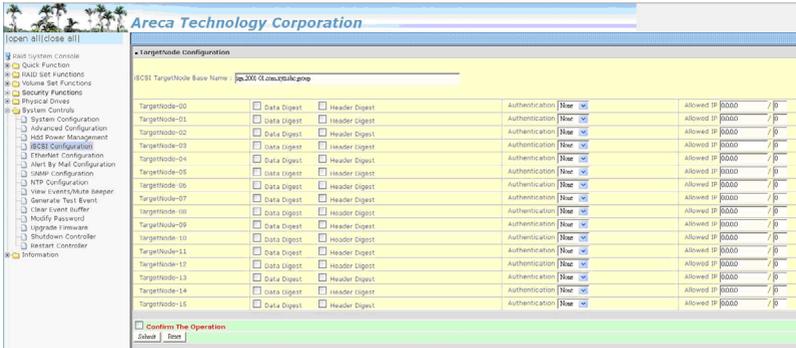
- IP Address Assignment
 - With DHCP (Dynamic Host Configuration Protocol), the IP address is assigned by the DHCP server. Click on the DHCP to show the DHCP lease information.
 - With Static, the IP address must be entered manually for the iSCSI port. For a local environment, it's OK to leave Gateway IP Address as 0.0.0.0.
- iSCSI Port Number: specify the port number to which the iSCSI port attempts to connect to the host adapter. Values within 1024 ~ 65535, excluding the registered ports, could be used. It's a good practice to keep this as 3260.
- Maximum Transmission Unit (MTU): This parameter specifies the payload size of the 10GbE port, rather than the MTU of layer 3 packets. If Jumbo Frame is enabled by setting MTU to 1501 ~ 9000, make sure all the Ethernet switches and nodes are set to the same MTU. If unsure, set the MTU to 1500 for better compatibility.

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Three types of access control can be applied.

1. Per TargetNode IP filtering

To setup volume TargetNode parameter, move the mouse to click on the "Setup TargetNode Parameter" function of the iSCSI Configuration. The "TargetNode Configuration" screen will be shown.

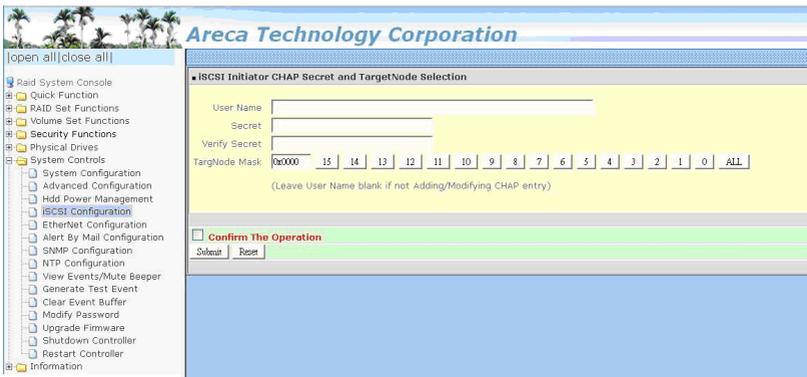


- **Data/Header Digest:** The header/data digest fields are optional values in the iSCSI header to identify, reject and request retransmission of a corrupt PDU.
- **Authentication:** The Challenge Handshake Authentication Protocol (CHAP) is a protocol that is used to authenticate the peer of a connection and is based upon the peers sharing a secret (a security key that is similar to a password).
- **Allowed IP:** Applied with or without CHAP enabled. Only the specified subrange of IP address can access specific TargetNode. The IP subrange notation is similar to CIDR notation as xxx.xxx.xxx.xxx/mm (xxx.xxx.xxx.xxx is the base IP address and mm is # of mask bits). MaskBits is allowed to be 0~32 (instead of 0~30 in CIDR) and specifies bits to be matched from MSB. When mm is set to 0, all IP will match successfully (IP filtering is effectively disabled). When mm is set to 32, only single IP (host) can access the specified TargetNode.

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2. Per Initiator TargetNode Mask

Setup an authentication for your iSCSI devices is optional. In a secure environment, authentication is not required because only trusted initiators can access the target devices. To setup the iSCSI initiator CHAP secret parameter, move the mouse to click on the "Setup iSCSI Initiator CHAP Secret" function of the iSCSI Configuration. The "iSCSI Initiator CHAP Secret and TargetNode Selection" screen will be shown.

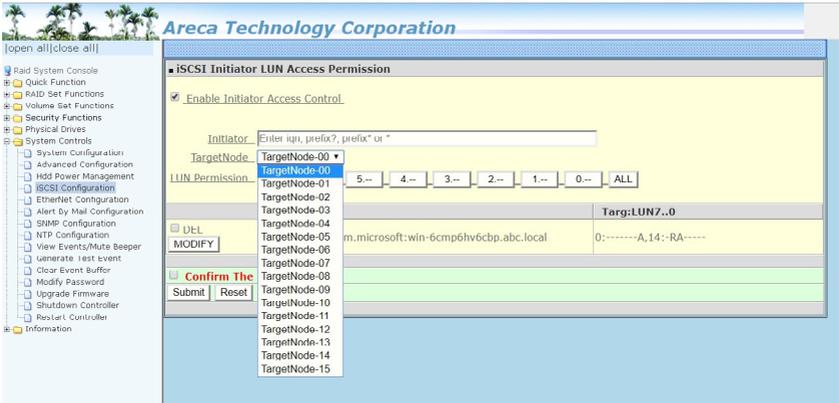


- **User Name:** The initiator CHAP user name can be found using your iSCSI initiator software. The user name alphanumeric character length depends on the host adapter. Leave User Name blank if not Adding/Modifying CHAP entry.
- **Secret:** It is the secret key that the initiator must know to participate in CHAP with the target similar to a password. The initiator CHAP secret alphanumeric character length depends on the host adapter.
- **TargNode Mask:** Initiator accessibility can be limited to specific subset of TargetNodes with this. Click on the TargNode number (0 ~ 15) to exclude accessibility of that TargNode (corresponding mask bit is set to 1).

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3. Per Initiator LUN Permission

This type of access control can be applied to LUN granularity, instead of Target Node granularity like the previous ones. However, it should be combined with CHAP authentication for best security practice since the initiator iqn can be easily faked. To setup the iSCSI initiator LUN permissions, move the mouse to click on the "Setup Initiator LUN Permission" function of the iSCSI Configuration. The "iSCSI Initiator LUN Access Permission" screen will be shown.



- **Enable Initiator Access Control:** This checkbox should be checked to enable LUN access control function.
- **Initiator:** This field specifies the initiator to be added or modified. If the input matches an existing entry, it will be a MODIFY operation and different TargetNodes will be merged into the same entry. In addition to a single iqn, three forms of wildcard can be used. A trailing '?' matches any single character. A trailing '*' matches any substring consisting of zero or more characters. A single '*' matches any initiators.
- **TargetNode:** This is to select one of the 16 target nodes to be added or modified.
- **LUN Permission:** Each TargetNode can have up to 8 LUNs (LUN7..0). By clicking on the LUN button, three permission modes will be circulated, namely "RW" for Read/Write per-

WEB BROWSER-BASED CONFIGURATION

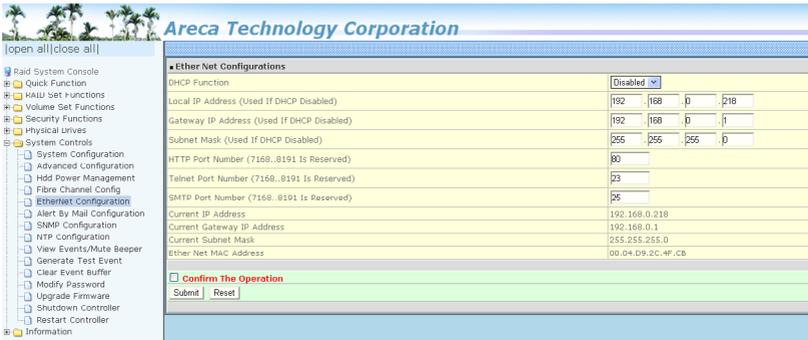
mission, "RO" for Read Only permission and "--" for No Access. Clicking on the "ALL" button will set all LUN permissions to either "RW" or "--". Note that LUN permission will not be changed when LUN to RaidVolume binding is modified.

- DEL checkboxes: To delete LUN permissions for specific initiators, check the checkbox of the rows then Confirm The Operation and Submit.
- MODIFY buttons: To modify LUN permissions, select the TargetNode at first then click on the "MODIFY" button of the desired row. The initiator name will be copied to the "Initiator" field and LUN permissions of the selected TargetNode will be reflected to "LUN Permission" buttons for modification.

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6.9.6 Ethernet Configuration

Use this feature to set the controller Ethernet port configuration. A customer doesn't need to create a reserved space on the arrays before the Ethernet port and HTTP service are working. The firmware-embedded web browser-based RAID manager can access it from any standard internet browser or from any host computer either directly connected or via a LAN or WAN with no software or patches required.



DHCP (Dynamic Host Configuration Protocol) is a protocol that lets network administrators manage centrally and automate the assignment of IP (Internet Protocol) configurations on a computer network. When using the internet's set of protocols (TCP/IP), in order for a computer system to communicate to another computer system, it needs a unique IP address. Without DHCP, the IP address must be entered manually at each computer system. DHCP lets a network administrator supervise and distribute IP addresses from a central point. The purpose of DHCP is to provide the automatic (dynamic) allocation of IP client configurations for a specific time period (called a lease period) and to eliminate the work necessary to administer a large IP network.

To configure the RAID subsystem's Ethernet port, move the cursor bar to the main menu and click on the "System Controls" link. The "System Controls" menu will show all items. Move the cursor bar to the "Ethernet Configuration" item, then press **Enter** key to select the desired function.

WEB BROWSER-BASED CONFIGURATION

6.9.7 Alert By Mail Configuration

To configure the RAID subsystem's e-mail function, move the cursor bar to the main menu and click on the "System Controls" link. The "System Controls" menu will show all items. Move the cursor bar to the "Alert By Mail Configuration" item, then select the desired function. This function can only be set via web-based configuration.

The firmware contains a SMTP manager monitoring all system events. Single or multiple user notifications can be sent via "Plain English" e-mails with no software required.

The screenshot shows the "Alert By Mail Configuration" page in the Areca Technology Corporation web interface. The left sidebar contains a navigation tree with "Alert By Mail Configuration" selected. The main content area is divided into several sections:

- SMTP Server Configuration:** Includes a field for "SMTP Server IP Address" with a value of "0.0.0.0".
- Mail Address Configurations:** Includes fields for "Sender Name", "Account", "Mail Address", and "Password".
- Event Notification Configurations:** A table with four rows, each for a different "MailTo" name. Each row has a "Mail Address" field and a list of notification options with radio buttons:

MailTo Name	Mail Address	Disable Event Notification	Urgent Error Notification	Serious Error Notification	Warning Error Notification	Information Notification	Notification For No Event
MailTo Name1		<input checked="" type="radio"/> No Event Notification Will Be Sent	<input type="radio"/> Send Only Urgent Event	<input type="radio"/> Send Urgent And Serious Event	<input type="radio"/> Send Urgent, Serious And Warning Event	<input type="radio"/> Send All Event	<input type="checkbox"/> Notify User If No Event Occurs Within 24 Hours
MailTo Name2		<input checked="" type="radio"/> No Event Notification Will Be Sent	<input type="radio"/> Send Only Urgent Event	<input type="radio"/> Send Urgent And Serious Event	<input type="radio"/> Send Urgent, Serious And Warning Event	<input type="radio"/> Send All Event	<input type="checkbox"/> Notify User If No Event Occurs Within 24 Hours
MailTo Name3		<input checked="" type="radio"/> No Event Notification Will Be Sent	<input type="radio"/> Send Only Urgent Event	<input type="radio"/> Send Urgent And Serious Event	<input type="radio"/> Send Urgent, Serious And Warning Event	<input type="radio"/> Send All Event	<input type="checkbox"/> Notify User If No Event Occurs Within 24 Hours
MailTo Name4		<input checked="" type="radio"/> No Event Notification Will Be Sent	<input type="radio"/> Send Only Urgent Event	<input type="radio"/> Send Urgent And Serious Event	<input type="radio"/> Send Urgent, Serious And Warning Event	<input type="radio"/> Send All Event	<input type="checkbox"/> Notify User If No Event Occurs Within 24 Hours

At the bottom of the page, there is a "Confirm The Operation" section with "Submit" and "Reset" buttons.

WEB BROWSER-BASED CONFIGURATION

6.9.8 SNMP Configuration

To configure the RAID subsystem's SNMP function, move the cursor bar to the main menu and click on the "System Controls" link. The "System Controls" menu will show all items. Move the cursor bar to the "SNMP Configuration" item, then press **Enter** key to select the desired function. This function can only set by the web-based configuration.

The firmware contains SNMP agent manager monitors all system events and user can use the SNMP function from the web setting with no agent software required. Please refer to Appendix D "SNMP Operation & Definition" for more detail information about the SNMP trap and definition.

The screenshot shows the web-based configuration interface for Areca Technology Corporation. The interface is divided into a left sidebar menu and a main configuration area. The sidebar menu includes options like "System Controls", "SNMP Configuration", and "SNMP Trap Configurations". The main configuration area is titled "SNMP Configuration" and contains several sections:

- SNMP Trap Configurations:** A table with three rows for "SNMP Trap IP Address #1", "SNMP Trap IP Address #2", and "SNMP Trap IP Address #3". Each row has four input fields for IP address octets and a "Port#" field set to "162".
- SNMP System Configurations:** Fields for "Community", "sysContact.O", "sysName.O", and "sysLocation.O".
- SNMP Trap Notification Configurations:** A list of notification types with radio buttons and descriptions:
 - Disable SNMP Trap: No SNMP Trap 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
- Confirm The Operation:** A section with "Submit" and "Reset" buttons.

- **SNMP Trap Configurations**

Enter the SNMP Trap IP Address.

- **SNMP System Configurations**

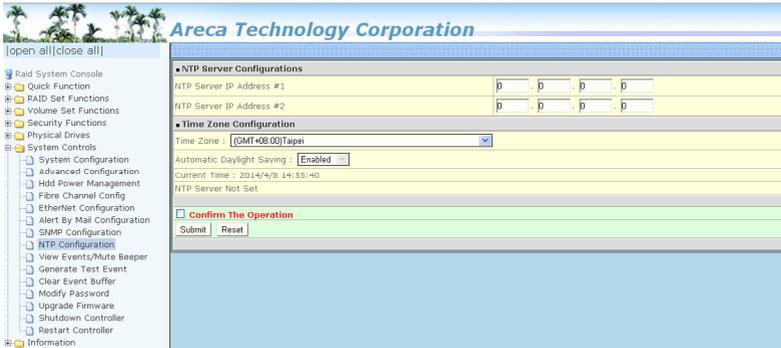
About community, Community name acts as a password to screen accesses to the SNMP agent of a particular network device. Type in the community names of the SNMP agent. Before access is granted to a request station, this station must incorporate a valid community name into its request; otherwise, the SNMP agent will deny access to the system.

Most network devices use "public" as default of their community names. This value is case-sensitive.

- **SNMP Trap Notification Configurations**

Please refer to Appendix F of Event Notification Table.

6.9.9 NTP Configuration



The Network Time Protocol (NTP) is used to synchronize the time of a computer client or server to another server or reference time source, such as a radio or satellite receiver or modem. It provides accuracies typically within a millisecond on LANs and up to a few tens of milliseconds on WANs relative to Coordinated Universal Time (UTC) via a Global Positioning Service (GPS) receiver, for example:

- **NTP Server Address**

The most important factor in providing accurate, reliable time is the selection of NTP servers to be used in the configuration file. Typical NTP configurations utilize multiple redundant servers and diverse network paths in order to achieve high accuracy and reliability. Our NTP configuration supports two existing public NTP synchronization subnets.

- **Time Zone**

Time Zone conveniently runs in the system tray and allows you to easily view the date and time in various locations around the world. You can also quickly and easily add your own personal locations to customize time zone the way you want.

- **Automatic Daylight Saving**

Automatic Daylight Saving will normally attempt to automatically adjust the system clock for daylight saving changes based on the computer time zone. This tweak allows you to disable the automatic adjustment.

WEB BROWSER-BASED CONFIGURATION

Note:

NTP feature works through onboard Ethernet port. So you must make sure that you have connected onboard Ethernet port.

6.9.10 View Events/Mute Beeper

To view the RAID subsystem's event information, click on the "View Event/Mute Beeper" link. The RAID subsystem's "System events Information" screen appears. The mute beeper function automatically enable by clicking on "View Events/Mute Beeper".

Select this option to view the system events information: Timer, Device, Event Type, Elapse Time and Errors. The RAID subsystem does not have a built-in real time clock. The time information is the relative time from the system time setting. The maximum event no. is 256 per controller.

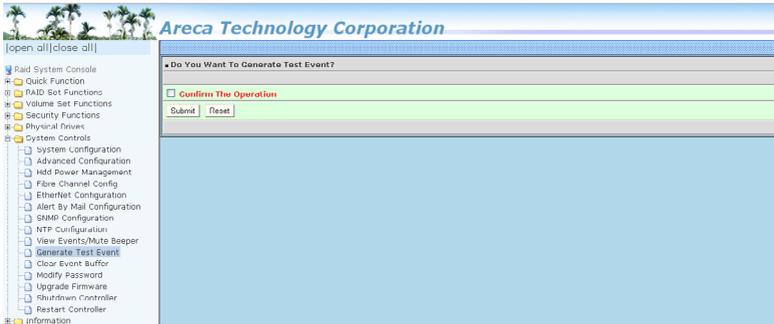
The screenshot shows the Areca Technology Corporation web interface. On the left is a navigation menu with options like "Quick Function", "RAID Set Functions", "Volume Set Functions", "Security Functions", "Physical Drives", "System Controls", "System Configuration", "Advanced Configuration", "Fibre 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", "Hestart Controller", and "Information". The "View Events/Mute Beeper" option is selected. The main content area displays a table titled "System Events Information" with columns for Time, Device, Event Type, and Elapse Time. The table contains 17 rows of event data.

Time	Device	Event Type	Elapse Time
2014-04-08 14:45:26	lenc#1 slot#1	Device Failed	
2014-04-08 14:45:36	ARC-8668-VOL#000	Volume Failed	
2014-04-08 14:41:03	Enc#1 Slot#3	PassThrough Disk Created	
2014-04-08 14:34:15	192.168.0.0.170	HTTP Log In	
2014-04-08 14:31:47	ARC-8668-VOL#000	Create Volume	
2014-04-08 14:08:51	Raid Set # 000	Create RaidSet	
2014-04-08 14:08:45	Raid Set # 003	Delete RaidSet	
2014-04-08 14:08:42	Raid Set # 002	Delete RaidSet	
2014-04-08 14:08:39	Raid Set # 001	Delete RaidSet	
2014-04-08 14:08:29	Raid Set # 000	Delete RaidSet	
2014-04-08 14:08:13	Raid Set # 003	Create RaidSet	
2014-04-08 14:08:02	Raid Set # 002	Create RaidSet	
2014-04-08 14:07:46	Raid Set # 001	Create RaidSet	
2014-04-08 14:01:19	192.168.0.0.170	HTTP Log In	
2014-04-08 14:00:47	192.168.0.0.125	HTTP Log In	
2014-04-08 14:00:45	I/W Monitor	Raid Powered On	
2014-03-28 17:35:25	ARC-8668-VOL#127	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#126	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#125	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#124	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#123	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#122	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#121	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#120	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#119	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#118	Create Volume	
2014-03-28 17:35:25	ARC-8668-VOL#117	Create Volume	

6.9.11 Generate Test Event

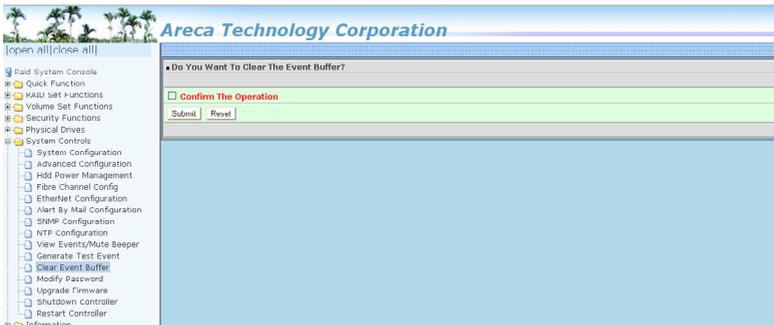
Use this feature to generate events for testing purposes. Such as test mail or SNMP trap settings.

WEB BROWSER-BASED CONFIGURATION



6.9.12 Clear Events Buffer

Use this feature to clear the entire events buffer information.



6.9.13 Modify Password

To set or change the RAID subsystem's password, select "System Controls" from the menu and click on the "Modify Password" link. The "Modify System Password" screen appears.



WEB BROWSER-BASED CONFIGURATION

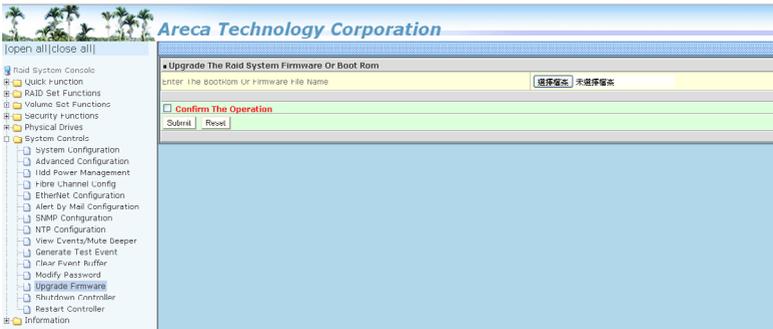
The manufacture default password is set to 0000.

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 entry. 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 5 minutes. Do not use spaces when you enter the password, if spaces are used, it will lock out the user.

To disable the password, leave the fields blank. Once the user confirms the operation and clicks the "Submit" button, the existing password will be cleared. Then, no password checking will occur when entering the main menu from the starting screen.

6.9.14 Update Firmware

Please refer to the Appendix A Upgrading Flash ROM Update Process.



6.9.15 Restart Controller

Use the "Restart Controller" function to restart the RAID controller. Without powering off the subsystem.

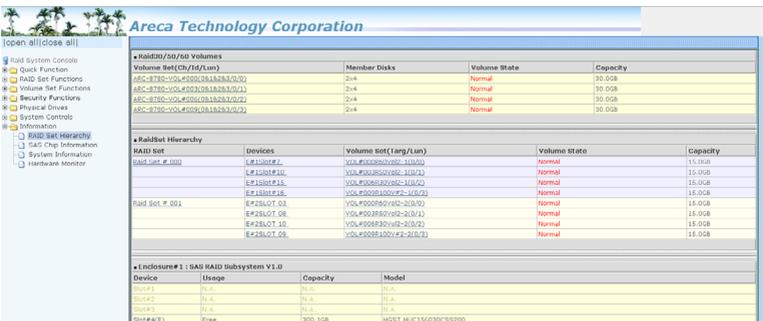
WEB BROWSER-BASED CONFIGURATION



6.10 Information

6.10.1 Raid Set Hierarchy

Use this feature to view the RAID subsystem current RAID set, current volume set and physical disk information. The volume state and capacity are also shown in this screen.



6.10.2 SAS Chip Information

To view the SAS RAID controller's SAS controller and attached expander chip information, move the mouse cursor to the main menu and click on the "SAS Chip Information" link. The SAS RAID controller "SAS Chip Information" screen appears.

WEB BROWSER-BASED CONFIGURATION

The screenshot shows the 'SAS Chip Information' screen. On the left is a navigation menu with options like 'RAID System Console', 'Quick Function', 'RAID Set Functions', 'Volume Set Functions', 'Security Functions', 'Physical Drives', 'System Controls', 'Information', 'RAID Set Hierarchy', 'SAS Chip Information', 'System Information', and 'Hardware Monitor'. The main content area displays details for three components:

- Controller: Areca ARC-8780 1.52**
 - SAS Address: 50004D982ACDD000
 - Enclosure: [Empty]
 - Number Of Phys: 8
 - Attached Expander: Expander#1[[5001B46977D4133F][4x12G]
- Expander#1: Areca ARC8018 B0.00.260000**
 - SAS Address: 5001B46977D4133F
 - Component Vendor: LSI
 - Component ID: Q233
 - Enclosure: ENC#1
 - Number Of Phys: 39
 - Attached Expander: Expander#2[[5001B46905D2433F][4x12G]
 - Attached Expander: Controller[[50004D982ACDD000][8x12G]
- Expander#2: Areca ARC8018 B0.00.260000**
 - SAS Address: 5001B46905D2433F
 - Component Vendor: LSI
 - Component ID: Q235
 - Enclosure: ENC#2
 - Number Of Phys: 31
 - Attached Expander: Expander#1[[5001B46977D4133F][4x12G]

User can click on ROC controller and SAS expander # item on the "SAS Chip Information" screen. It will show statistic page for ports on the ROC controller and SAS expander#. Click on the "Clear Error Log" to refresh the fully statistic page.

6.10.3 System Information

To view the RAID subsystem's system information, move the mouse cursor to the main menu and click on the "System Information" link. The RAID subsystem's "RAID Subsystem Information" screen appears.

Use this feature to view the RAID subsystem's system information. The controller name, controller firmware version, Boot ROM version, SAS firmware version, serial number, main processor, CPU data/instruction cache size, system memory size/speed and current IP address appear in below screen.

The screenshot shows the 'RAID Subsystem Information' screen. The navigation menu is the same as in the previous screenshot. The main content area displays system information for two controllers:

- Controller#2 System Information**
 - Controller Name: ARC-8780
 - Firmware Version: V1.52 2015-02-03
 - BOOT ROM Version: V1.52 2014-12-30
 - QL Firmware Version: 4.1.1.151
 - Serial Number: 1100-2136-6633
 - Unit Serial #: [Empty]
 - Main Processor: 1.2GHz iNt416 iVpU3
 - CPU Cache Size: 32Kbytes
 - CPU DCache Size: 32Kbytes/Write Through
 - QL Cache Size: 512Kbytes/Write Back
 - System Memory: 8192MB/1600MHz/ECC
 - Current IP Address: 192.168.0.203
 - Dual Controller State: Dual Operational
- Controller#1 System Information**
 - Controller Name: ARC-8780
 - Firmware Version: V1.52 2015-02-03
 - BOOT ROM Version: V1.52 2014-12-30
 - QL Firmware Version: 4.1.1.151
 - Serial Number: 1100-2136-6633
 - Unit Serial #: [Empty]
 - Main Processor: 1.3GHz PR476 BwU3
 - CPU Cache Size: 32Kbytes
 - CPU DCache Size: 32Kbytes/Write Through
 - System Memory: 8192MB/1600MHz/ECC
 - Current IP Address: 192.168.0.202
 - Dual Controller State: Dual Operational

WEB BROWSER-BASED CONFIGURATION

The controller provides two four-link Min SAS HD SFF-8644 connector for the host and one four-link SFF-8644 connector for JBOD. It may has problem between the host/JBOD and controller. The "Host Port# Link" provides current working port link status. The option for port link is defined below.

Not Linked → Fail or no link to host/JBOD

1x1200 → Single-link for use

2x1200 → Two-link for use

4x1200 → Four-link for use

6.10.4 Hardware Monitor

The hardware monitor information of the subsystem attached in this controller is also shown on this screen.

The screenshot displays the 'Hardware Monitor' section of the Areca Technology Corporation web interface. It shows real-time monitoring data for three RAID subsystems: Controller#2, Controller#1, and Controller#1 (BAR RAID Subsystem V1.0). The data includes CPU temperature, controller temperature, various voltages (12V, 5V, 3.3V, 1.8V), and battery status.

Controller#2 H/W Monitor	
CPU Temperature	52 °C
Controller Temp.	26 °C
12V	11.855 V
5V	5.053 V
3.3V	3.312 V
IO Voltage +1.0V	1.090 V
DDR3 +1.5V	1.552 V
CPU VCore +0.9V	0.980 V
Ethernet +1.2V	1.215 V
DDR3 +0.75V	0.768 V
BTC 3.0V	3.290 V
Battery Status	Not Installed

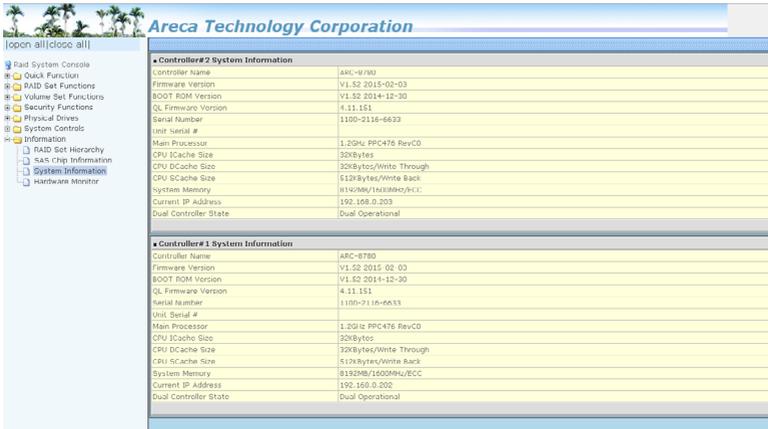
Controller#1 H/W Monitor	
CPU Temperature	58 °C
Controller Temp.	28 °C
12V	11.056 V
5V	5.083 V
3.3V	3.332 V
IO Voltage +1.8V	1.840 V
VRIO +1.5V	1.528 V
CPU VCore +0.9V	0.944 V
Ethernet +1.2V	1.222 V
DDR3 +0.75V	0.768 V
BTC 3.0V	3.298 V
Battery Status	Not Installed

Controller#1 - BAR RAID Subsystem V1.0	
Voltage#1	3.261 V
Voltage#2	4.677 V
Voltage#3	11.498 V
Fan#1	1707 rpm

Assigning Volume to Dual Controllers

7. Assigning Volume to Dual Controllers

The controllers are identified by a Ctrl1 or Ctrl2 designation and, where applicable, a system device name. The Ctrl1 and Ctrl2 are relative names to identify the controllers. All configuration options can be accessed through the Ctrl1 or Ctrl2 RAID controller. The RAID controller installed in the lower controller slot is the Ctrl1 controller. The dual controller's firmware shows both controllers' host channels on the volume port mapping even only one controller existed. The "Dual Controller State" on the "System Information" shows the RAID subsystem working on "Dual Operational" controllers or "Single Operational" controller. The following "System Information" screen shows two controllers on the RAID subsystem.



The following table is shown as the channels assigned by the Ctrl1 and Ctrl2 on the web browser manager.

	Ctrl1	Ctrl2
SAS Host Channel#	0 and 1	2 and 3
Fibre Host Channel#	0, 1, 2 and 3	4, 5, 6 and 7
iSCSI Host Channel#	0, 1, 2 and 3	4, 5, 6 and 7

Assigning Volume to Dual Controllers

7.1 Dual Independent Mode

If your dual controller subsystem is operating with “Dual Independent Mode”, the synchronized cache communication action will be disabled. Your subsystem can be separated the volumes to each individual controllers. This increases array performance for total subsystems that operate one volume groups to one controller and other volume groups to other controller. Using “Dual Independent Mode” operation offers greater throughput and therefore better performance. Your subsystem can be spared the effort to mirror and transfer data between partner controllers. This increases array performance for subsystems that operate without write-caching.

7.1.1 Mapping a Volume to the Host LUNs

When controllers are successfully installed, volume set is created and mapped to either controller channels. Each volume is available through one controller host port LUNs. This kind of volume will work under independent controller mode.

The following volume attribute setting is the volume channel host mapping example for Ctrl1 only on independent mode.



The following volume attribute setting is the volume channel host mapping example for Ctrl2 only on independent mode.



Assigning Volume to Dual Controllers

7.2 Dual Redundant Mode

The redundant controllers communicate with each other via a dedicated high-speed serial bus on the common backplane. This bus is automatically formed when the two controller carriers are joined together. While in "Dual Redundant Mode", a failed controller automatically shifts I/O functions to the counterpart controller. Controller failover and failback are transparent to the host. The controller itself is hot-swappable for full non-stop redundant operation. The dual controller's cache data are always synchronized for maintaining cache coherency. Each controller saves an exact replica of the cache content on its counterpart. In the event of one controller failure, the unfinished writes will be completed by the existing controller.

The backplane holds two separated hot-swap connector for the main controller board. When two controllers are in a redundant configuration and one controller fails, it can be easily hot swapped online without shutting the subsystem down.

7.2.1 Mapping a Volume to the Host LUNs

When controllers are successfully combined, volume set is created and mapped to both controller channels (Ctrl1 & Ctrl2). This kind of volume will work under dual redundant controller mode. Each volume is available through both controller host port LUNs under "Active-to-Active" or "Active-to-Standby" configuration.

The following volume attribute setting is the volume channel host mapping example for dual redundant controller mode.



Assigning Volume to Dual Controllers

When a ARC-8668-VOL#003 is created and mapped to both Ctrl1 and Ctrl2 host channels, this volume will work under "Active-to-Active" or "Active-to-Standby" configuration.

7.2.2 Active-to-Active Configuration

Active-to-Active arrays use two controllers to service read/write requests to the same LUN. The use of two active controllers gives a number of benefits, the primary being the ability to load balance I/O to the array-using host-based software.

7.2.3 Active-to-Standby Configuration

Active-to-Standby configurations will have a LUN "owned" by dual redundant controllers and host ports can sustain the read and write speeds to the controllers. When the controller which owns a LUN fails or the host loses access to that controller, the other (standby) controller takes ownership of the LUN and host IO is then serviced from this new controller.

7.3 Forcing Controller Failover for Testing

There are 2 methods to test/simulate dual redundant controller failure. Those methods are performed for testing the dual redundant controller functionality before any critical data is committed to the drives. Testing the failover functionality can be performed using the following methods.

7.3.1 Pulling out one of the controllers from the carrier

If the one of the active controller is physically removed from the carrier, a switchover will occur and take over the I/Os jobs of the failed controller.

1. Loosen the thumbscrew on either any of the two controller carriers. Pull out the lever slowly and the alert beeper indicates controller failure. The existing controller will then act as both controllers and take over the I/Os jobs.

Assigning Volume to Dual Controllers

2. Unplug all interface cables on the "failed" controller and pull out the controller carrier from the slot.
3. Reinsert the replacement controller.
4. Reconnect all cables and tighten the thumbscrew of the controller carrier.

The existing controller should automatically attempt to form with the replacement controller. When the initialization process of the replacement controller is completed, the alert beeper will be off. Both controllers will be back all the services provided for the RAID subsystem.

7.3.2 Manual switchover request

A user can initiate a manual switchover request from the web browser manager to force one controller failure.

1. Login to the testing emulation failed controller web browser GUI.
2. Under "Raid Set Functions" main menu, select "Rescue Raid Set".
3. In the text box provided, enter the command "HaltCtrl0". Tick "Confirm The Operation" and click "Submit" button.
4. The web browser GUI will show "Controller Will Be Halted In 6 Seconds".
 - a. You may now pull out the controller you had just disabled. I/Os job should be continued by the existing controller. Continue the aforementioned procedure to complete the test.Or
 - b. In the text box provided on the existing controller "Rescue Raid Set" function, enter the command "Restart". Tick "Confirm The Operation" and click "Submit" button. The existing controller should automatically attempt to combine with the emulation failed controller. When the initialization process of the emulation failed controller is completed, the failed con-

troller Fault LED will be off. Both controllers will be back to normal operational mode.

APPENDIX

Appendix A

Upgrading Flash ROM Update Process

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

ARC-NNNNXXXX.BIN Firmware Binary (where NNNN refers to the model name and "XXXX" refers to the function name: BOOT, FIRM and MBR0)

ARC-8780: 2x10G ISCSI

ARC-8380: 2x12G SAS

ARC-8681: 2/4x16G FC

ARC-8x8xBOOT.BIN:→ RAID subsystem hardware initialization.

ARC-8x8xFIRM.BIN:→ RAID kernel program

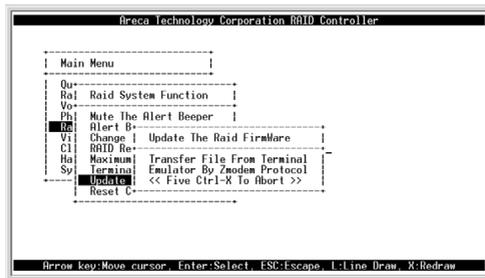
ARC-8x8xMBR0.BIN:→ Master Boot Record for supporting Dual Flash Image in the RAID subsystem.

Release_note.txt file 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 drive A: or C:. The firmware can be downloaded to the RAID subsystem controller by using an ANSI/VT-100 compatible terminal emulation program or HTTP web browser management. You must complete the appropriate installation procedure before proceeding with this firmware upgrade.

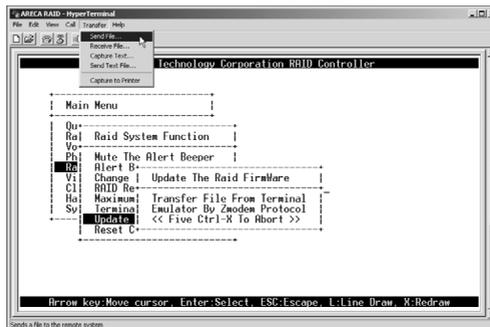
Upgrade Firmware Through ANSI/VT-100 Terminal Emulation

Please refer to chapter 3.2, “VT100 terminal (Using the controller’s serial port)” for details on establishing the connection. Whichever terminal emulation program is used must support the ZMODEM file transfer protocol. Get the new version firmware for your RAID subsystem controller. For example, download the bin file from your OEM’s web site onto the c:

1. From the main menu, scroll down to “Raid System Function”.
2. Choose the “Update Firmware”, The “Update The Raid Firm-ware” dialog box appears.

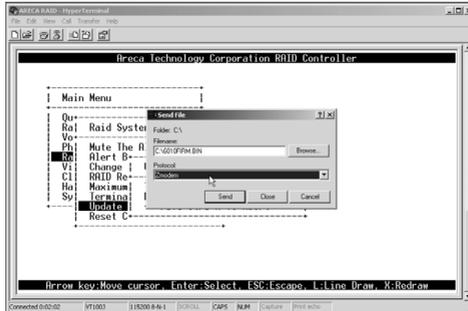


3. Go to the tool bar and select “Transfer”. Open “Send File”.

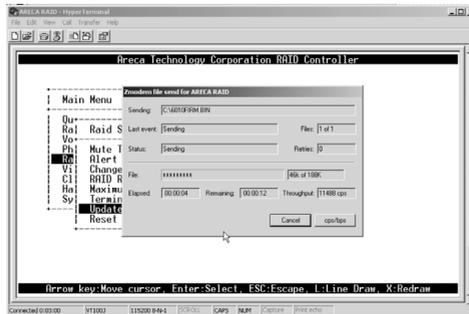


APPENDIX

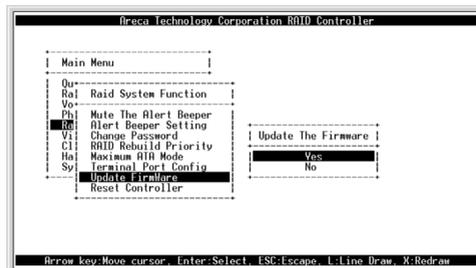
4. Select "ZMODEM modem" under Protocol. ZMODEM as the file transfer protocol of your terminal emulation software.
5. Click "Browse". Look in the location where the firmware upgrade software is located. Select the file name:



6. Click "Send", to send the firmware binary to the controller.



7. When the Firmware completes downloading, the confirmation screen appears. Press **Yes** to start program the flash ROM.



- When the Flash programming starts, a bar indicator will show "Start Updating Firmware. Please Wait".



- The Firmware upgrade will take approximately thirty seconds to complete.
- After the Firmware upgrade is complete, a bar indicator will show "Firmware Has Been Updated Successfully".



Note:

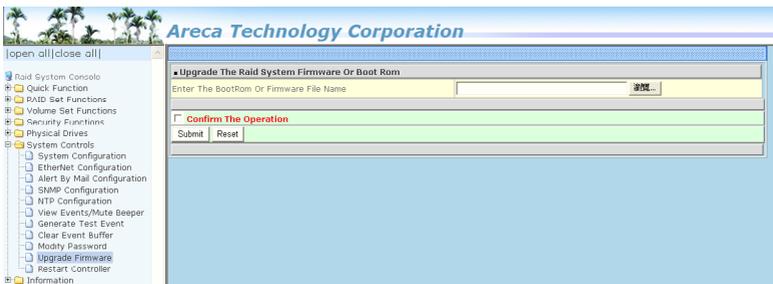
- The user doesn't need to reconfigure all of the settings after the firmware upgrade is complete, because all of the settings will keep the values before upgrade.
- Please update all binary code (BOOT, FIRM and MBR0) before you reboot the RAID subsystem. Otherwise, a mixed firmware package may hang the RAID subsystem.

APPENDIX

Upgrade Firmware Through Web Browser Manager (LAN Port)

Please refer to chapter 3.3, “Web Browser-based RAID Manager” for details on establishing the connection. Get the new version firmware for your RAID subsystem. For example, download the bin file from your OEM’s web site onto the c:

1. To upgrade the RAID subsystem firmware, move the mouse cursor to “Upgrade Firmware” link. The “Upgrade The Raid System Firmware” screen appears.
2. Click “Browse”. Look in the location where the firmware upgrade file is located. Select the file name: “ARC-NNNNXXXX.BIN” and click open.
3. Click the “Confirm The Operation” and press 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 bar indicator will show “Firmware has Been Updated Successfully”

Note:

1. The user doesn’t need to reconfigure all of the settings after the firmware upgrade is complete, because all of the settings will keep us the vaules before upgrade.
2. Please update all binary code (BOOT, FIRM and MBR0) before you reboot the RAID subsystem. Otherwise, a mixed firmware package may hang the RAID subsystem.

Appendix B

Battery Backup Module (ARC8006-2-BBM)

The RAID controller operates using write-caching for optimal performance. The Battery Backup Module (BBM) is an optional item that provides power to the RAID controller write-caching memory in the event of a power failure. The BBM monitors the write back cache on the RAID controller, and provides power to the cache memory if it contains data not yet written to the hard drives when power failure occurs. The BBM is an add-on that can be attached to a RAID controller to supply power to the memory module from an attached battery pack. It is comprised of two pieces: the battery pack module and the BBM control module.

BBM Control Module

This section provides the BBM control module layout and connector for battery pack module.

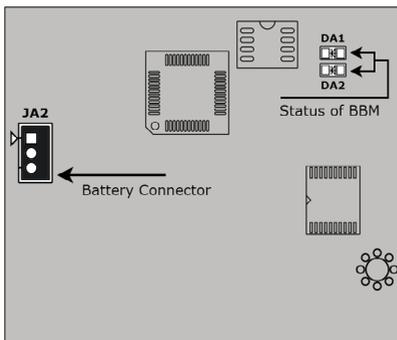


Figure-B-1,
ARC-8006-2 (top view)

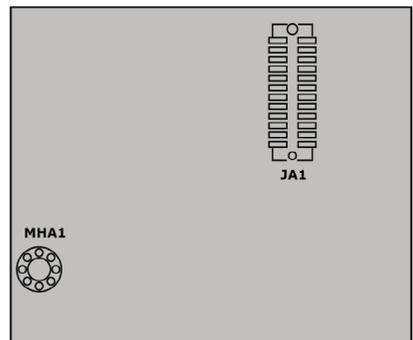


Figure-B-2,
ARC-8006-2 (bottom view)

- DA1 (Green) : light when BBM charged down
- DA2 (Red) : light when BBM charging

APPENDIX

Battery Pack Modules

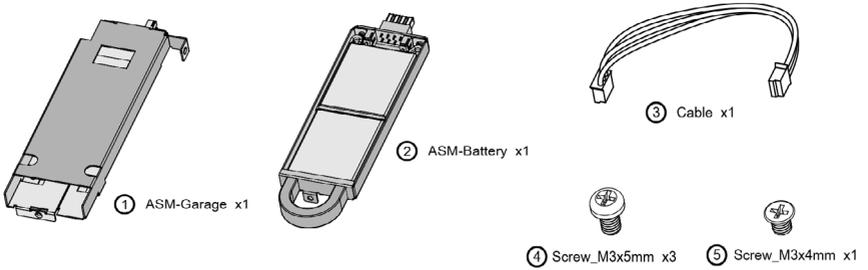


Figure-B-3, ARC-8006-2 Pack Modules

Installing BBM Control Module

1. Make sure all power to the RAID subsystem is disconnected.
2. With the RAID controller on a flat, clean, static-free surface, hold the ARC-8006-2 control board so that the bottom side is facing upward, and the **JA1** board-to-board connector lines up with the **J7** FB connector on the RAID controller. Carefully press the ARC-8006-2 onto the RAID controller, so that the two connectors are firmly joined, as shown in Figure B-4.
3. Use the round-head screw (reference NO.4 in Figure B-3) to secure the ARC-8006-2 control board to the "six eaves copper pillars" on the RAID controller.

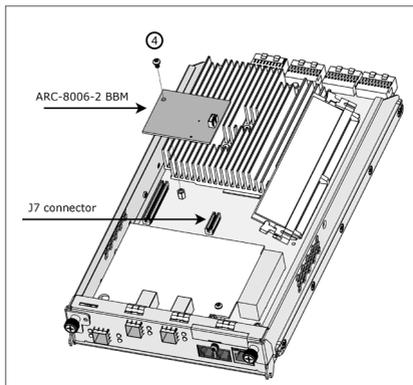


Figure B-4, Securing ARC-8006-2 on Controller

Installing a Battery Pack Module into the RAID Controller

1. Loosen the screw and remove the dummy cover from the rear side of RAID controller caddy, as shown in Figure B-5.

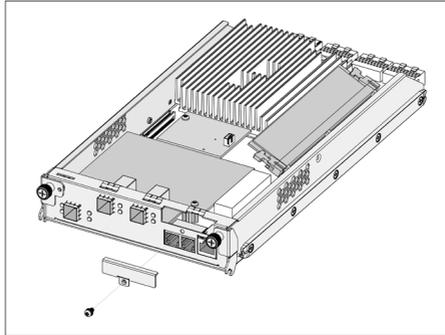


Figure B-5, Loosening the Screw

2. Slide the garage (reference NO.1 in Figure B-3) into the controller caddy as a BBM module slot.
3. Use the two round-head screws and a flat-head screw (reference NO.4 & NO.5 in Figure B-3) that are provided to secure the garage to the controller caddy, as shown in Figure B-6.

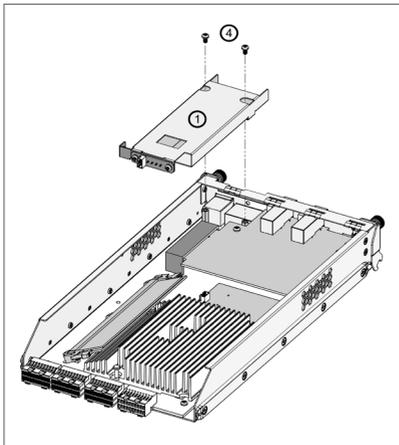


Figure B-6, Sliding the Garage into the Controller Caddy and Securing it

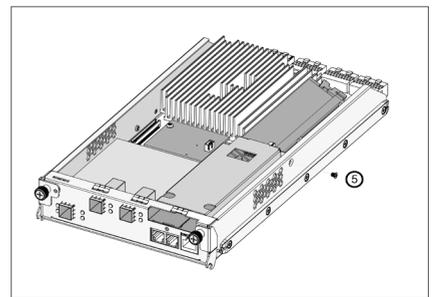


Figure B-7, Securing the Garage on Controller

APPENDIX

4. Use the cable in the BBM package (reference NO.3 in Figure B-3) to connect the **JA2** (3-pin box header battery connector on the ARC-8006-2 control module) to the **JP2** (on the Battery Pack backplane connector back), as shown in Figure B-8.

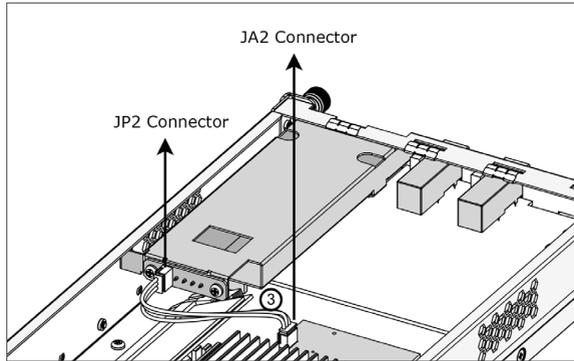


Figure B-8, Connecting to Battery

5. Align the Battery Pack module (reference NO.2 in Figure B-3) to the Battery Pack module slot, gently slide the Battery Pack module until the back of Battery Pack module make contact with the face plat, then secure the Battery Pack module on the RAID controller caddy.

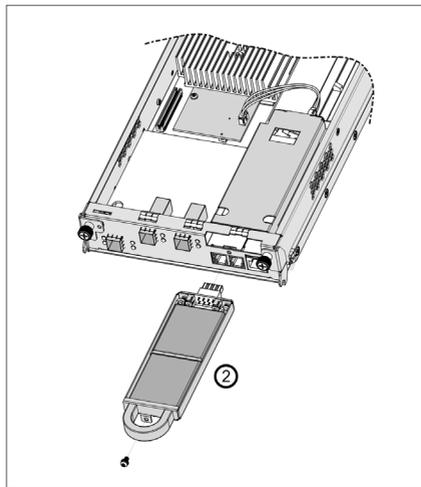


Figure B-9, Securing the Battery Pack Module

APPENDIX

Battery Functionality Test Procedure

1. Write amount of data into controller volume, about 5GB or bigger.
2. Waiting for few seconds, power failed system by remove the power cable.
3. Check the battery status, battery beeps every few seconds.
4. Power on system, and login in the RAID controller.
5. Check the controller event log, make sure the event shows controller boot up with power recovered.

Replacing the Battery Pack Module

At some point, the LI-ION battery will no longer accept a charge properly. LI-ION battery life expectancy is anywhere from approximately 1 to 5 years.

1. Power down the RAID subsystem properly. Make sure that cache memory has been flushed.
2. Loosen the "round head screws" on the rear side of the RAID controller caddy.
3. Pull the old Battery Pack module out from the RAID controller caddy.
4. Align the new Battery Pack module to the Battery Pack module slot, gently slide the Battery Pack module until the back of Battery Pack module make contact with the face plat, then secure the Battery Pack module on the RAID controller caddy.

BBM Specifications

Mechanical

- Module Dimension (W x H x D)
ARC-8006-2: 45 x 7 x 53 mm
Battery Pack: 48.5 x 9 x 146 mm

Environmental

- Operating Temperature
Temperature: 0° C to +40° C
Humidity: 45-85%, non-condensing
- Storage Temperature
Temperature: -40° C to 60° C
Humidity: 45-85%, non-condensing
- Electrical
Input Voltage: +3.8VDC
- On Board Battery Capacity
2200mAH (2*1100mAH)

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Appendix C

Flash_based Backup Module (ARC-8008-FBM)

The ARC-8008-FBM kit includes the Flash-based module (FBM), and one battery pack module. The FBM features NAND flash memory and Lion battery technology that provides cache offload capability to protect cached data in case of system power loss. The module is mounted battery pack that provides power for the backup of your data. When the module detects loss of power, the battery keeps parts of the ARC-8008 RAID controller active long enough to allow cache data to be copied to the flash memory.

FBM Control Module

This section provides the FBM control module layout and connector for battery pack module.

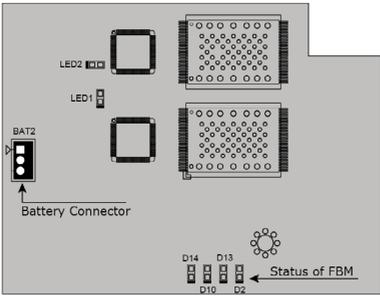


Figure-C-1, ARC-8008-FB (top view)

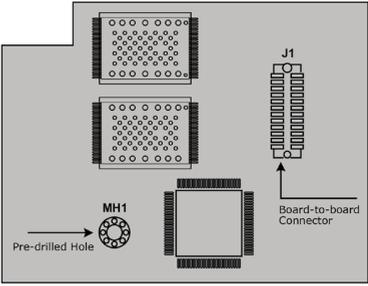


Figure-C-2, ARC-8008-FB (bottom view)

The following table provides the LED status of the FBM.

D2 (Blue)	Status
On	Power On
Off	Power Off

D14 (Blue)	Status
Charge	Slow Flash 1Hz
Charge-Done	On
Discharge	Quick Flash 10Hz

D10 (Green)	Status
Normal	On (SuperCap)
Back-up	Quick Flash 10Hz
Restore	Slow Flash 1Hz
Normal	Off (Battery)

D13 (Red)	Status
Normal	Off
Fail	Quick Flash 10Hz
Calibration	Slow Flash 1Hz
Need Replace	On

Function	LED1 (Green)	LED2 (Green)
NAND Flash R/W	Flash	Flash

Note:

The FBM status will be shown on the web browser of "Hardware Monitor Information" screen.

Battery Pack Modules

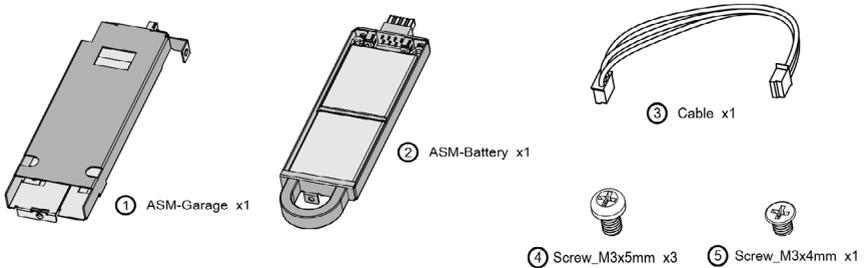


Figure-C-3, ARC-8008-FBM Pack Modules

Installing FBM Control Module

1. Make sure all power to the RAID subsystem is disconnected.
2. With the RAID controller on a flat, clean, static-free surface, hold the ARC-8008-FB control board so that the bottom side is facing upward, and the **J1** board-to-board connector lines up with the **J7** FB connector on the RAID controller. Carefully press the ARC-8008-FB onto the RAID controller, so that the two connectors are firmly joined, as shown in Figure C-4.

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3. Use the round-head screw (reference NO.4 in Figure C-3) to secure the ARC-8008-FB control board to the "six eaves copper pillars" on the RAID controller.

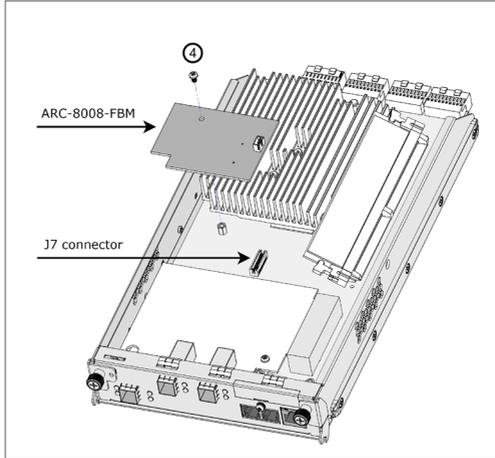


Figure C-4, Securing ARC-8008-FB on Controller

Installing a Battery Pack Module into the RAID Controller

1. Loosen the screw and remove the dummy cover from the rear side of RAID controller caddy, as shown in Figure C-5.

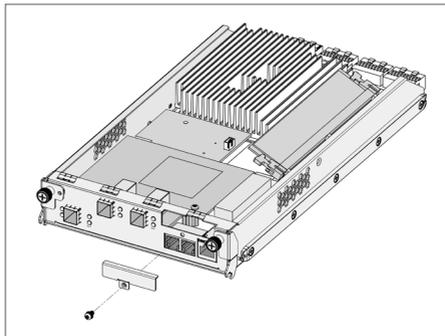


Figure C-5, Loosening the Screw

2. Slide the garage (reference NO.1 in Figure C-3) into the controller caddy as a FBM module slot.
3. Use the two round-head screws and a flat-head screw (reference NO.4 & NO.5 in Figure C-3) that are provided to secure the garage to the controller caddy, as shown in Figure C-6.

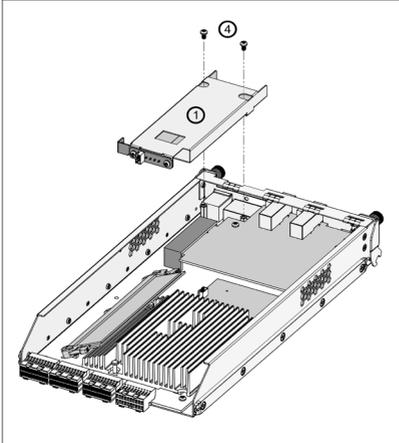


Figure C-6, Sliding the Garage into the Controller Caddy and Securing it

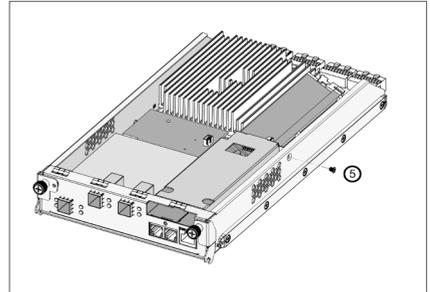


Figure C-7, Securing the Garage on Controller

4. Use the cable in the FBM package (reference NO.3 in Figure C-3) to connect the **BAT2** (3-pin box header battery connector on the ARC-8008-FB control module) to the **JP2** (on the Battery Pack backplane connector back), as shown in Figure C-8.

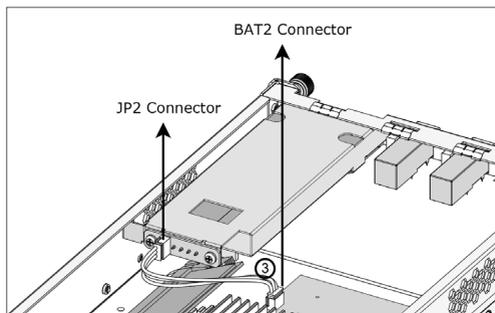


Figure C-8, Connecting to Battery

APPENDIX

- Align the Battery Pack module (reference NO.2 in Figure C-3) to the Battery Pack module slot, gently slide the Battery Pack module until the back of Battery Pack module make contact with the face plat, then secure the Battery Pack module on the RAID controller caddy.

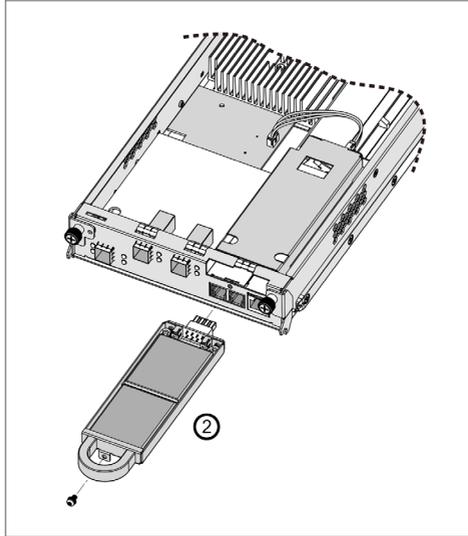
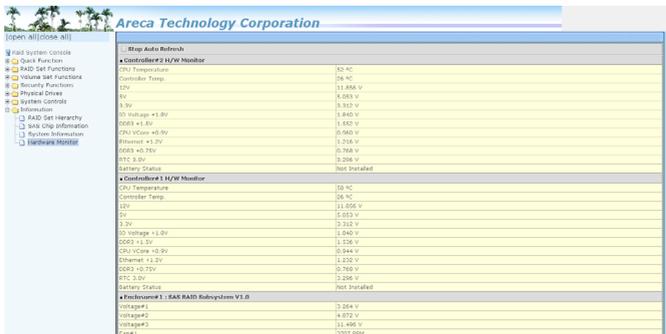


Figure C-9, Securing the Battery Pack Module

Status of FBM

The FBM status will be shown on the web browser of "Hardware Monitor Information" screen.



Areca Technology Corporation

Hardware Monitor Information

■ RAID Array Refresh	
■ Controller#2 H/W Number	
CPU Temperature	52 °C
Controller Temp	26 °C
5V	11.858 V
3.3V	4.203 V
1.8V	3.812 V
5V Voltage +1.0V	1.840 V
DDR3 +1.0V	0.961 V
DDR3 +1.5V	1.582 V
DRAM +0.75V	0.768 V
PTC 2.0V	3.256 V
Battery Status	Not Detailed
■ Controller#1 H/W Number	
CPU Temperature	59 °C
Controller Temp	38 °C
5V	11.556 V
3.3V	5.022 V
1.8V	3.242 V
5V Voltage +1.0V	1.840 V
DDR3 +1.0V	1.558 V
CPU Core +0.9V	0.944 V
DRAM +1.5V	1.252 V
DDR3 +0.75V	0.760 V
PTC 2.0V	3.256 V
Battery Status	Not Detailed
■ Enclosure#1 : 3AK RAID Subsystems V3.0	
Voltage#1	3.284 V
Voltage#2	4.972 V
Voltage#3	11.646 V
Fan#1	3007 RPM

Flash-based Backup Capacity

Flash-based backup capacity is defined as the maximum duration of a power failure for which data in the cache memory can be written into the flash memory on the ARC-8008-FBM. The ARC-8008-FBM can support up to 8GB SDRAM module that installed on the 12Gb/s SAS RAID controller. The flash-based backup capacity varied with the SDRAM module that installed on the RAID controller.

Operation

1. Battery conditioning is automatic. There are no manual procedures for battery conditioning or preconditioning to be performed by the user.
2. In order to make sure of all the capacity is available for your battery cells, allow the battery cell to be fully charged when installed for the first time. The first time charge of a battery cell takes about 24 hours to complete.
3. Set the "Disk Write Cache Mode": Auto, if "Disk Write Cache" option does not set on the "Auto".
4. Set the volume set "Cache Mode": Write-Back Cache.

Flashed-based Backup Functionality Test Procedure

1. Write amount of data into controller volume, about 5GB or bigger.
2. Waiting for few seconds, power failed system by remove the power cable.
3. Check the battery status, battery beeps every few seconds.
4. Power on system, and login in the RAID controller.
5. Check the controller event log, make sure the event shows controller boot up with power recovered.

APPENDIX

Replacing the Battery Pack Module

At some point, the LI-ION battery will no longer accept a charge properly. LI-ION battery life expectancy is anywhere from approximately 1 to 5 years.

1. Power down the RAID subsystem properly. Make sure that cache memory has been flushed.
2. Loosen the “round head screws” on the rear side of the RAID controller caddy.
3. Pull the old Battery Pack module out from the RAID controller caddy.
4. Align the new Battery Pack module to the Battery Pack module slot, gently slide the Battery Pack module until the back of Battery Pack module make contact with the face plat, then secure the Battery Pack module on the RAID controller caddy.

FBM Specifications

Mechanical

- Module Dimension (W x H x D)
FBM Control Module: 45 x 7 x 53 mm
Battery Pack: 48.5 x 9 x 146 mm

Environmental

- Operating Temperature
Temperature: 0° C to +40° C
Humidity: 45-85%, non-condensing
- Storage Temperature
Temperature: -40° C to 60° C
Humidity: 45-85%, non-condensing
- Electrical
Input Voltage: +3.8VDC
- On Board Battery Capacity
2200mAH (2*1100mAH)

Appendix D

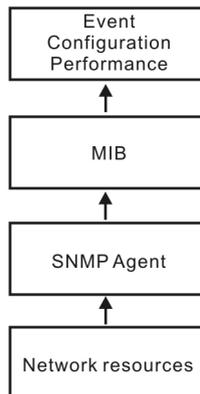
SNMP Operation & Definition

Overview

The external RAID subsystem firmware-embedded Simple Network Management Protocol (SNMP) agent for the connect array. An SNMP-based management application (also known as a SNMP manager) can monitor the disk array. An example of a SNMP management application is Hewlett-Packard's Open View. The firmware-embedded SNMP agent can be used to augment the RAID subsystem if you are already running a SNMP management application at your site.

SNMP Definition

SNMP, an IP-based protocol, has a set of commands for getting the status of target devices. The SNMP management platform is called the SNMP manager, and the managed devices have the SNMP agent loaded. Management data is organized in a hierarchical data structure called the management Information Base (MIB). These MIBs are defined and sanctioned by various industry associations. The objective is for all vendors to create products in compliance with these MIBs so that inter-vendor interoperability can be achieved. If a vendor wishes to include additional device information that is not specified in a standard MIB, then that is usually done through MIB extensions.



APPENDIX

SNMP Installation

The installation of the SNMP manager is accomplished in several phases:

- Installing the SNMP manager software on the client
- Placing a copy of the management information base (MIB) in a directory which is accessible to the management application
- Compiling the MIB description file with the management application

MIB Compilation and Definition File creation

Before the manager application accesses the RAID subsystem, user needs to integrate the MIB into the management application's database of events and status indicator codes. This process is known as compiling the MIB into the application. This process is highly vendor-specific and should be well-covered in the User's Guide of your SNMP application. Ensure the compilation process successfully integrates the contents of the `areca_sas.mib` file into the traps database.

Location for MIB

Depending upon the SNMP management application used, the MIB must be placed in a specific directory on the network management station running the management application. The MIB file must be manually copied to this directory. For example:

SNMP Management Application	MIB Location
HP OpenView	\OV\MIBS
Netware NMS	\NMS\SNMPMIBS\CURRENT

Your management application may have a different target directory. Consult the management application's user manual for the correct location.

Appendix E

Technical Specifications

Controller Architecture

- Dual core RAID-on-Chip (ROC) 1.2GHz processor
- One 240-pin DIMM socket for 2GB (default) up to 8GB DDR3-1866, 1Rx8, ECC module or 8GB, DDR3-1600, 2Rx8, ECC module
- Write-through or write-back cache support
- Supports up to 256 SATA or SAS devices using SAS expanders
- DataBolt™ Bandwidth Optimizer for balance faster host and slower SAS or SATA devices.
- Redundant flash image for controller availability
- Real time clock support
- Support flash-based or battery backup module (FBM/BBM) ready (optional)

RAID Features

- RAID level 0, 1, 10(1E), 3, 5, 6, 30, 50, 60, Single Disk or JBOD
- Multiple RAID 0 and RAID 10(1E) support (RAID 00 and RAID 100)
- Multiple RAID selection
- Configurable stripe size up to 1024KB
- Support HDD firmware update
- Online array roaming
- Online RAID level/stripe size migration
- Online capacity expansion and RAID level migration simultaneously
- Online volume set growth
- Instant availability and background initialization
- Support global and dedicated hot spare
- Automatic drive insertion/removal detection and rebuilding
- Support for native 4K and 512 byte sector SAS and SATA devices
- Multiple pairs SSD/HDD disk clone function
- SSD automatic monitor clone (AMC) support
- Support intelligent power management to save energy and extend service life
- Support NTP protocol to synchronize RAID controller clock over the on-board LAN port
- Redundant controller operation with active/active and failover/

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- failback function
- Dual-active RAID controller with cache mirroring through dedicated high speed bus
- Automatic synchronization of firmware version in the dual-active mode
- Multi-path & load-balancing support (MPIO)
- Max 256 devices
- Max 128 LUNs (volume set) per controller
- Management port seamless take-over
- Redundant controller operation with active/active and failover/failback function

Monitors/Notification

- LCD control panel for setup, alarm mute and configuration
- System status indication through LCD, LED and alarm buzzer
- SMTP support for email notification
- SNMP support for remote manager
- Subsystem management ready

Drive Interface

- Up to 256 devices using SAS expander (one Min SAS HD SFF-8644 connector)
- Up to 12Gb/s per port

Host Interface

- SAS-to-SAS
2 x 12Gb/s SAS Ports
- Fibre-to-SAS
2/4 x 16Gb/s Fibre channels
- iSCSI-to-SAS:
2 x 10Gb/s iSCSI channels

RAID Management

- Field-upgradeable firmware in flash ROM
- Firmware-embedded manager via RS-232 port
- Firmware-embedded web browser-based RAID manager access your RAID subsystem from any standard internet browser via a LAN port
- Access terminal menu by telnet via a LAN port
- API library for customer to write its own monitor utility
- SAP management utility to easily manage multiple RAID units in the network

Software Drivers

- OS Independent

Physical/Electrical

SAS hard drives

- Up to 12/16/24 2.5-inch or 3.5-inch SAS hot-plug hard drives (12Gb/s) at speeds of 10K or 15K rpm

SATA hard drives

- Up to 12/16/24 2.5-inch or 3.5-inch SATA hot-plug hard drives (6Gb/s) at speeds of 7.2K or 10K rpm. Connectivity to the controller system backplane is provided through an interposer assembly for redundant controller.

Subsystem Controller Modules

- Controller board 1 or 2 modules
- Sensors 2 sensor per controller Board

Backplane Board

Connectors

- 12/16/24 x SAS hard-drive connectors
- 2 x power supply/cooling fan module connectors
- 2 sets of controller board connectors (3 connectors each controller board)

Sensors

- 12/16/24 x temperature sensors (one for each slot)

Controller Back-Panel Connectors

Host connectors (per controller board)

- 2 x SAS CH0 and CH1 connector for connection to the host
- 2/4 x Fibre CH0, CH1, CH2 and CH3 connector for connection to the host
- 2 x iSCSI CH0 and CH1 connector for connection to the host

Expander connector (per controller board)

- 1 x SAS "EXP 0" Min SAS HD SFF-8644 connector for expansion to an additional SAS RAID subsystem

Management connector (per controller board)

- 2 x 6-pin UART RJ-11 connector
- 1 x LAN RJ-45 connector

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- 2 x SAS CH0&CH1 connector for SAS to SAS RAID controller

LED Indicators

Hard-drive carrier

- 1 x single-color activity LED status indicator
- 1 x two-color fault/power LED status indicator

Controller board

- 2 x single-color LED status indicators for each SAS expander port, one for link and one for the activity status

Host board

- 2 x single-color LED status indicator per SAS host
- 2 x single-color LED status indicator per Fibre host
- 2 x single-color LED status indicators per iSCSI host

Power supply/cooling fan module

- 2 x single-color LED status indicators for AC_OK and FAULT on each power supply/cooling fan module

Power Supplies

Dual hot swap and redundant with PFC, N+1 design

- Wattage 595 W maximum continuous;
- Voltage 100–240 V rated
- Frequency 50–60 Hz
- Amperage (Max) 6.18A (120 VAC), 3.23A (230 VAC)

Dimensions

2U 12 bays 19-inch rackmount chassis (H x W x D)

- Without handles 88.2 x 445 x 506 mm(3.2 x 17.5 x 19.9 in)
- With handles 88.2 x 482 x 542 mm(3.2 x 22.9 x 21.3 in)

3U 16 bays 19-inch rackmount chassis (H x W x D)

- Without handles 132.6 x 445 x 506 mm(5.2 x 17.5 x 19.9 in)
- With handles 132.6 x 482 x 542 mm(5.2 x 22.9 x 21.3 in)

2U 24 bays 19-inch rackmount chassis (H x W x D)

- Without handles 88.2 x 445 x 470 mm(3.2 x 17.5 x 18.5 in)
- With handles 88.2 x 482 x 506 mm(3.2 x 22.9 x 19.9 in)

Subsystem Net Weight (Without Drives)

- Single 12/16/24 bays 26.5 kg/30.5 kg/27.5kg
- Dual 12/16/24 bays 27 kg/31 kg/28 kg

Environmental

Temperature:

- Operating 0° to 40°C
- Storage -40° to 60°C

Relative humidity:

- Operating 10% to 80% (non-condensing)
- Storage 5% to 95% (non-condensing)

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Appendix F

Event Notification Configurations

The controller classifies disk array events into four levels depending on their severity. These include level 1: Urgent, level 2: Serious, level 3: Warning and level 4: Information. The level 4 covers notification events such as initialization of the controller and initiation of the rebuilding process; Level 2 covers notification events which once have happen; Level 3 includes events which require the issuance of warning messages; Level 1 is the highest level, and covers events the need immediate attention (and action) from the administrator. The following lists sample events for each level:

A. Device Event

Event	Level	Meaning	Action
Device Inserted	Warning	HDD inserted	
Device Removed	Warning	HDD removed	
Reading Error	Warning	HDD reading error	Keep Watching HDD status, may be it caused by noise or HDD unstable.
Writing Error	Warning	HDD writing error	Keep Watching HDD status, may be it caused by noise or HDD unstable.
ATA Ecc Error	Warning	HDD ECC error	Keep Watching HDD status, may be it caused by noise or HDD unstable.
Change ATA Mode	Warning	HDD change ATA mode	Check HDD connection
Time Out Error	Warning	HDD time out	Keep Watching HDD status, may be it caused by noise or HDD unstable.
Device Failed	Urgent	HDD failure	Replace HDD
PCI Parity Error	Serious	PCI parity error	If only happen once, it may be caused by noise. If always happen, please check power supply or contact to us.
Device Failed(SMART)	Urgent	HDD SMART failure	Replace HDD

PassThrough Disk Created	Inform	Pass Through Disk created	
PassThrough Disk Modified	Inform	Pass Through Disk modified	
PassThrough Disk Deleted	Inform	Pass Through Disk deleted	

B. Volume Event

Event	Level	Meaning	Action
Start Initialize	Warning	Volume initialization has started	
Start Rebuilding	Warning	Volume rebuilding has started	
Start Migrating	Warning	Volume migration has started	
Start Checking	Warning	Volume parity checking has started	
Complete Init	Warning	Volume initialization completed	
Complete Rebuild	Warning	Volume rebuilding completed	
Complete Migrate	Warning	Volume migration completed	
Complete Check	Warning	Volume parity checking completed	
Create Volume	Warning	New volume created	
Delete Volume	Warning	Volume deleted	
Modify Volume	Warning	Volume modified	
Volume Degraded	Urgent	Volume degraded	Replace HDD
Volume Failed	Urgent	Volume failure	
Failed Volume Revived	Urgent	Failed volume revived	
Abort Initialization	Warning	Initialization been abort	
Abort Rebuilding	Warning	Rebuilding aborted	
Abort Migration	Warning	Migration aborted	
Abort Checking	Warning	Parity check aborted	
Stop Initialization	Warning	Initialization stopped	
Stop Rebuilding	Warning	Rebuilding stopped	
Stop Migration	Warning	Migration stopped	
Stop Checking	Warning	Parity check stopped	

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C. RAID Set Event

Event	Level	Meaning	Action
Create RaidSet	Warning	New RAID set created	
Delete RaidSet	Warning	Raidset deleted	
Expand RaidSet	Warning	Raidset expanded	
Rebuild RaidSet	Warning	Raidset rebuilding	
RaidSet Degraded	Urgent	Raidset degraded	Replace HDD

D. Hardware Monitor Event

Event	Level	Meaning	Action
DRAM 1-Bit ECC	Urgent	DRAM 1-Bit ECC error	Check DRAM
DRAM Fatal Error	Urgent	DRAM fatal error encountered	Check the DRAM module and replace with new one if required.
Controller Over Temperature	Urgent	Abnormally high temperature detected on controller	Check air flow and cooling fan of the subsystem, and contact us.
Hdd Over Temperature	Urgent	Abnormally high temperature detected on Hdd	Check air flow and cooling fan of the subsystem.
Fan Failed	Urgent	Cooling Fan # failure or speed below 1700RPM	Check cooling fan of the subsystem and replace with a new one if required.
Controller Temp. Recovered	Serious	Controller temperature back to normal level	
Hdd Temp. Recovered	Serious	HDD temperature back to normal level	
Raid Powered On	Warning	RAID power on	
Test Event	Urgent	Test event	
Power On With Battery Backup	Warning	RAID power on with battery backup	
Incomplete RAID Discovered	Serious	Some RAID set member disks missing before power on	Check disk information to find out which channel missing.
HTTP Log In	Serious	a HTTP login detected	

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Telnet Log	Serious	a Telnet login detected	
InVT100 Log In	Serious	a VT100 login detected	
API Log In	Serious	a API login detected	
Lost Rebuilding/ MigrationLBA	Urgent	Some rebuilding/ migration raidset member disks missing before power on.	Reinserted the missing member disk back, controller will continued the incompleted rebuilding/migration.

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Appendix G

RAID Concept

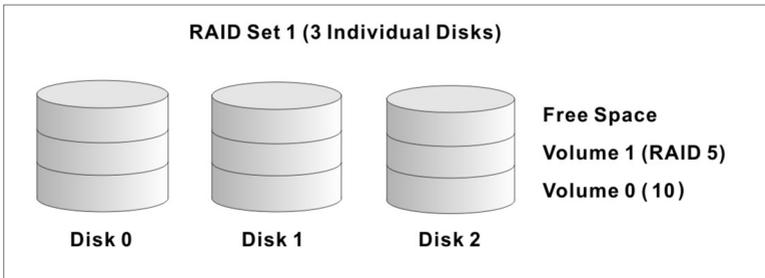
RAID Set

A RAID set is a group of disk containing one or more volume sets. It has the following features in the RAID subsystem. A volume Set must be created either on an existing RAID set or on a group of available individual disks (disks that are not yet a part of an RAID set). If there are pre-existing RAID sets with available capacity and enough disks for specified RAID level desired, then the volume set will be created in the existing RAID set of the user's choice. If physical disk 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.

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 disk capacity available in a RAID set. Multiple volume sets can exist on a group of disks in a RAID set.

In the illustration below, volume 1 can be assigned a RAID 5 level of operation while volume 0 might be assigned a RAID 0+1 level of operation.



Easy of Use Features

- **Instant Availability/Background**

Initialization RAID 0 and RAID 1 volume set can be used immediately after the creation. But the RAID 3 and 5 volume sets must be initialized to generate the parity. In the Normal Initialization, the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete. Furthermore, the RAID volume set is also protected against a single disk failure while initializing. In Fast Initialization, the initialization proceeds must be completed before the volume set ready for system accesses.

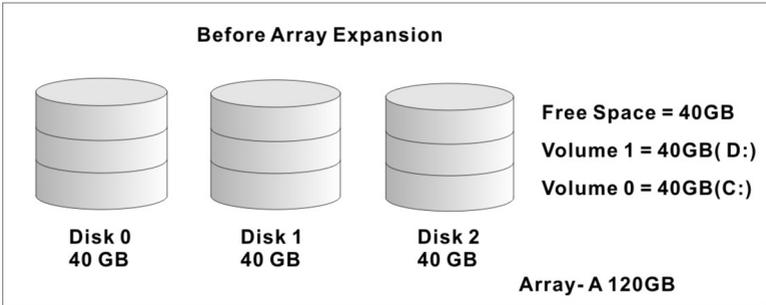
- **Online Array Roaming/Offline RAID set**

The RAID subsystem stores configuration information on the disk drives It can protect the configuration settings in case of a disk drive or controller failure. Array roaming allows the administrators the ability to move a completely RAID set to another system without losing RAID configuration and data on that RAID set. If a server fails to work, the RAID set disk drives can be moved to another server and inserted in any order.

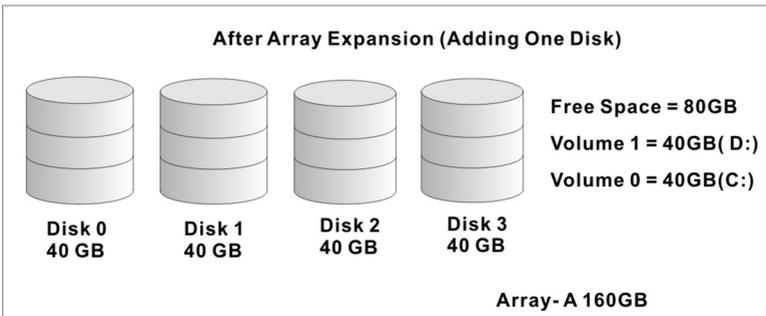
- **Online Capacity Expansion**

Online Capacity Expansion makes it possible to add one or more physical drive to a volume set, while the server is in operation, eliminating the need to store and restore after re-configured the RAID set. When disks are added to a RAID set, unused capacity is added to the end of the RAID set. Data on the existing volume sets residing on that RAID set is redistributed evenly across all the disks. A contiguous block of unused capacity is made available on the RAID set. The unused capacity can create additional volume set. The expansion process is illustrated as following figure.

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The RAID subsystem redistributes the original volume set over the original and newly added disks, using the same fault-tolerance configuration. The unused capacity on the expand RAID set can then be used to create an additional volume sets, with a different fault tolerance setting if user need to change.



● Online RAID Level and Stripe Size Migration

User can migrate both the RAID level and stripe size of an existing volume set, while the server is online and the volume set is in use. Online RAID level/stripe size migration can prove helpful during performance tuning activities as well as in the event that additional physical disks are added to the RAID subsystem. For example, in a system using two drives in RAID level 1, you could add capacity and retain fault tolerance by adding one drive. With the addition of third disk, you have the option of adding this disk to your existing RAID logical drive and migrating from RAID level 1 to 5. The result would be parity fault tolerance and double the available capacity without taking the system off.

High availability

- **Creating Hot Spares**

A hot spare drive is an unused online available drive, which is ready for replacing the failure disk drive. In a RAID level 1, 1E 3, 5, 6 or 10 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 RAID subsystem detects a drive failure, the system will automatically and transparently rebuild using hot spare drives. The raid set will be reconfigured and rebuilt in the background, while the RAID con-troller 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. Basically, the newly installed drive will be reconfigured an online free disk. But, the newest installed drive will be automatically assigned as a hot spare, if any hot spare disk was used to rebuild and without new installed drive replaced it.

Important:

The hot spare must have at least the same capacity as the drive it replaces.

- **Hot-Swap Disk Drive Support**

The RAID subsystem has built the protection circuit to support the replacement of SAS/SATA II hard disk drives without having to shut down or reboot the system. The removable hard drive tray can de-liver "hot swappable," fault-tolerant RAID solutions at prices much less than the cost of conventional SCSI hard disk RAID subsystems. We provide this feature for controllers to provide the advanced fault tolerant RAID protection and "online" drive replacement.

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● Hot-Swap Disk Rebuild

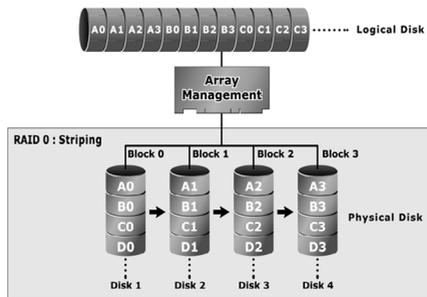
A Hot-Swap function can be used to rebuild disk drives in arrays with data redundancy such as RAID level 1, 10, 3, 5 and 6. If a hot spare is not available, the failed disk drive must be replaced with a new disk drive so that the data on the failed drive can be rebuilt. If a hot spare is available, the 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 restart the system and the rebuild if the system is shut down or powered off abnormally during a reconstruction procedure condition. When a disk is Hot Swap, although the system is functionally operational, the system may no longer be fault tolerant. Fault tolerance will be lost until the removed drive is replaced and the rebuild operation is completed.

Understanding RAID

RAID is an acronym for Redundant Array of Independent Disks. It is an array of multiple independent hard disk drives that provide high performance and fault tolerance. The RAID subsystem implements several levels of the Berkeley RAID technology. An appropriate RAID level is selected when the volume sets are defined or created. This decision is based on disk capacity, data availability (fault tolerance or redundancy), and disk performance. The following is the RAID level, which support in the RAID subsystem. The RAID subsystem makes the RAID implementation and the disks' physical configuration transparent to the host operating system. This means that the host operating system drivers and software utilities are not affected, regardless of the RAID level selected. Correct installation of the disk array and the controller requires a proper understanding of RAID technology and the concepts.

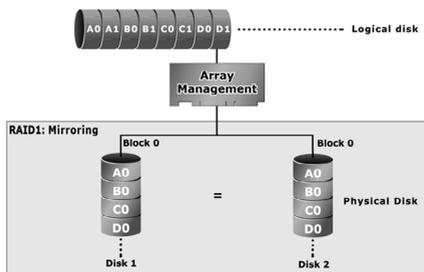
● RAID 0

RAID 0, also referred to as striping, writes stripping of data across multiple disk drives instead of just one disk drive. RAID 0 does not provide any data redundancy, but does offer the best high-speed data throughput. RAID 0 breaks up data into smaller blocks and then writes a block to each drive in the array. Disk striping enhances performance because multiple drives are accessed simultaneously; but the reliability of RAID Level 0 is less than any of its member disk drives due to its lack of redundancy.



● RAID 1

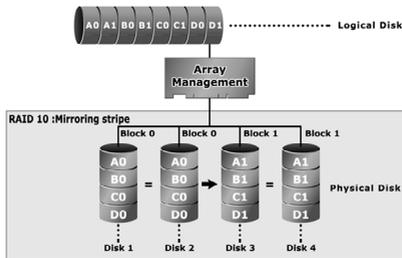
RAID 1 also known as “disk mirroring”, data written to one disk drive is simultaneously written to another disk drive. Read performance may be enhanced if the array controller can parallel accesses both members of a mirrored pair. During writes, there will be a minor performance penalty when compared to writing to a single disk. If one drive fails, all data (and software applications) are preserved on the other drive. RAID 1 offers extremely high data reliability, but at the cost of doubling the required data storage capacity.



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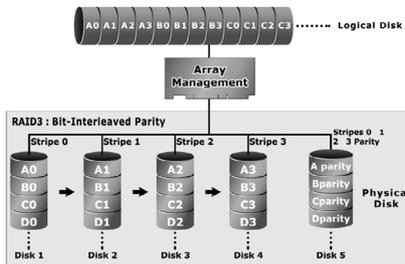
● RAID 10(1E)

RAID 10(1E) is a combination of RAID 0 and RAID 1, combining striping with disk mirroring. RAID Level 10(1E) combines the fast performance of Level 0 with the data redundancy of Level 1. In this configuration, data is distributed across several disk drives, similar to Level 0, which are a stripe across a number of mirrored sets for data protection. RAID 10(1E) provides the highest read/write performance of any of the Hybrid RAID levels, but at the cost of doubling the required data storage capacity.



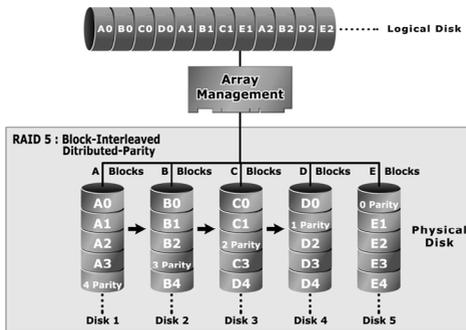
● RAID 3

RAID 3 provides disk striping and complete data redundancy through a dedicated parity drive. RAID 3 breaks up data into smaller blocks, calculates parity by performing an exclusive-or on the blocks, and then writes the blocks to all but one drive in the array. The parity data created during the exclusive-or is then written to the last drive in the array. If a single drive fails, data is still available by computing the exclusive-or of the contents corresponding stripes of the surviving member disk. RAID 3 is best for applications that require very fast data-transfer rates or long data blocks.



● RAID 5

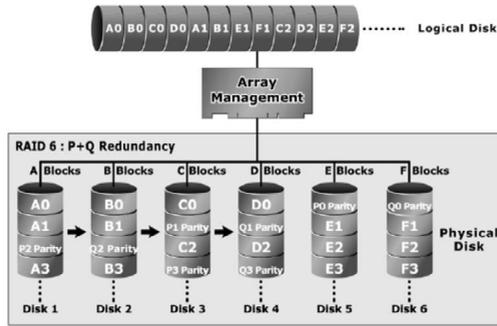
RAID 5 is sometimes called striping with parity at byte level. In RAID 5, the parity information is written to all of the drives in the controllers rather than concentrated on a dedicated parity disk. If one drive in the system fails, the parity information can be used to reconstruct the data from that drive. All drives in the array system can be used to seek operation at the same time, greatly increasing the performance of the RAID system. This relieves the write bottle-neck that characterizes RAID 4, and is the primary reason that RAID 5 is more often implemented in RAID arrays.



● RAID 6

RAID 6 provides highest reliability, but not widely used. Similar to RAID 5, but does two different parity computations or the same computation on overlapping subsets of the data. The RAID 6 can offer fault tolerance greater than RAID 1 or RAID 5 but only consumes the capacity of 2 disk drives for distributed parity data. RAID 6 is an extension of RAID 5 that uses a second independent distributed parity scheme. Data is striped on a block level across a set of drives, and then a second set of parity is calculated and written across all of the drives.

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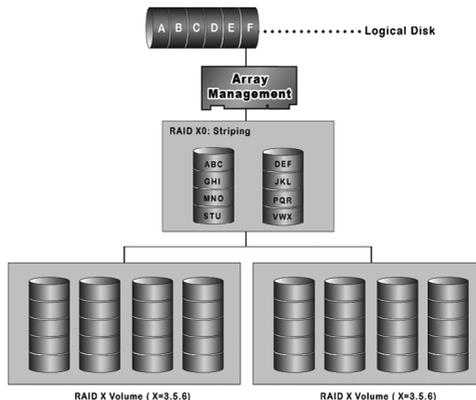


● RAID x0

RAID level-x0 refers to RAID level 30, 50 and 60. RAID x0 is a combination multiple RAID x volume sets with RAID 0 (striping). Striping helps to increase capacity and performance without adding disks to each RAID x array. The operating system uses the spanned volume in the same way as a regular volume. Up to one drive in each sub-volume (RAID 3 or 5) may fail without loss of data. Up to two drives in each sub-volume (RAID 6) may fail without loss of data.

RAID level x0 allows more physical drives in an array. The benefits of doing so are larger volume sets, increased performance, and increased reliability.

The following illustration is an example of a RAID level x0 logical drive.



Important:

RAID level 30, 50 and 60 can support up to eight sub-Volumes (RAID set). If the volume is RAID level 30, 50, or 60, you cannot change the volume to another RAID level. If the volume is RAID level 0, 1, 10, 3, 5, or 6, you cannot change the volume to RAID level 30, 50, or 60.

- **JBOD**

(Just a Bunch Of Disks) A group of hard disks in a RAID subsystem are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy.

- **Single Disk (Pass-Through Disk)**

Pass through disk refers to a drive that is not controlled by the RAID firmware and thus can not be a part of a RAID volume. The drive is available to the operating system as an individual disk.

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Summary of RAID Levels

RAID subsystem supports RAID Level 0, 1, 10(1E), 3, 5, 6, 30, 50 and 60. The following table provides a summary of RAID levels.

RAID Level Comparison			
RAID Level	Description	Disks Requirement (Minimum)	Data Availability
0	Also known as striping. Data distributed across multiple drives in the array. There is no data protection.	1	No data Protection
1	Also known as mirroring. All data replicated on 2 separated disks. N is almost always 2. Due to this is a 100 % duplication, so is a high costly solution.	2	Up to one disk failure
10(1E)	Also known as mirroring and striping. Data is written to two disks simultaneously, and allows an odd number or disk. Read request can be satisfied by data read from either one disk or both disks.	3	Up to one disk failure in each sub-volume
3	Also known Bit-Interleaved Parity. Data and parity information is subdivided and distributed across all data disks. Parity information normally stored on a dedicated parity disk.	3	Up to one disk failure
5	Also known Block-Interleaved Distributed Parity. Data and parity information is subdivided and distributed across all disk. Parity information normally is interspersed with user data.	3	Up to one disk failure
6	RAID 6 provides highest reliability, but not widely used. Similar to RAID 5, but does two different parity computations or the same computation on overlapping subsets of the data. The RAID 6 can offer fault tolerance greater than RAID 1 or RAID 5 but only consumes the capacity of 2 disk drives for distributed parity data.	4	Up to two disk failure
30	RAID 30 is a combination multiple RAID 3 volume sets with RAID 0 (striping)	6	Up to one disk failure in each sub-volume
50	RAID 50 is a combination multiple RAID 5 volume sets with RAID 0 (striping)	6	Up to one disk failure in each sub-volume
60	RAID 60 is a combination multiple RAID 6 volume sets with RAID 0 (striping)	6	Up to two disk failure in each sub-volume