

RAID Subsystem

12Gb/s SAS to SAS RAID Sub-system

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-72xx series 8/12/16-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

Contents

1. Introduction	12
1.1 Overview	12
1.2 Technical Specifications.....	14
1.3 Locations of the Subsystem Component	17
1.3.1 RAID Subsystem Front View	17
1.3.2 RAID Subsystem Rear View	19
1.3.2.1 SAS RAID Controller Module Outline	19
1.3.2.2 SAS LED Indicators	20
1.3.2.3 Fan/Power/Controller LED Indicator.....	21
1.4 RAID Subsystem Alarm.....	22
1.5 Expansion Connection.....	23
2. Hardware Installation	24
2.1 Installing an Subsystem into the Rack or Tower (Optional).....	25
2.2 Installing or Removing Drives in the Subsystem	26
2.2.1 Installing Drives in the Subsystem.....	27
2.2.1.1 Installing 2.5-inch Drives into 3.5-inch Drive Tray	27
2.2.1.2 Installing 3.5-inch Drives into 3.5-inch Drive Tray	29
2.2.2 Removing Drives from the Subsystem	30
2.2.3 Adding a Battery/Flash-based Backup Module (Optional)...	30
2.3 Installing and Removing the Power Supply Modules	30
2.3.1 Installing the Power Supply Modules	30
2.3.2 Removing a Power Supply Modules	31
2.4 Removing and Installing the Fan Modules	32
2.5 Connecting the RAID Subsystem	33
2.5.1 Connecting to Host System	33
2.5.2 Connecting Monitor Port	33
2.5.3 Power Up the RAID Subsystem	35
2.6 Configuring RAID Subsystems.....	36
2.6.1 Configuring Method	36
2.6.2 Format, Partition and Mount the SAS RAID Subsystem Vol- umes	37
3. Configuration Methods	38
3.1 Using local front panel touch-control keypad.....	38
3.2 VT100 terminal (Using the controller's serial port)	40
3.2.1 RS-232C Port Pin Assignment.....	40
3.2.2 Start-up VT100 Screen.....	41
3.3 Web browser-based RAID manager.....	44

3.4 Configuration Menu Tree	44
4. LCD Configuration Menu	46
4.1 Starting LCD Configuration Utility	46
4.2 LCD Configuration Utility Main Menu Options.....	47
4.3 Configuring Raid Sets and Volume Sets	47
4.4 Designating Drives as Hot Spares.....	48
4.5 Using Easy RAID Configuration	48
4.6 Using Raid Set and Volume Set Functions	50
4.7 Navigation Map of the LCD	51
4.7.1 Quick Volume And Raid Setup	52
4.7.2 Raid Set Functions.....	52
4.7.2.1 Create A New Raid Set	53
4.7.2.2 Delete Raid Set	53
4.7.2.3 Expand Raid Set.....	54
4.7.2.4 Offline Raid Set	54
4.7.2.5 Activate Incomplete RaidSet.....	55
4.7.2.6 Create Hot Spare Disk.....	55
4.7.2.7 Delete Hot Spare Disk	55
4.7.2.8 Display Raid Set Information	55
4.7.3 Volume Set Functions	56
4.7.3.1 Create Raid Volume Set	56
4.7.3.1.1 Volume Name.....	57
4.7.3.1.2 Raid Level	57
4.7.3.1.3 Stripe Size	57
4.7.3.1.4 Cache Mode	58
4.7.3.1.5 SAS Port/SAS LUN Base/SAS LUN	58
4.7.3.1.6 Tagged Queuing.....	58
4.7.3.1.7 Initialization Mode.....	59
4.7.3.2 Delete Existed Volume Set	59
4.7.3.3 Modify Volume Set Attribute.....	59
4.7.3.3.1 Volume Set Migration	60
4.7.3.4 Check Volume Set Consistency	60
4.7.3.5 Stop Volume Set Consistency Check.....	61
4.7.3.6 Display Volume Set Information.....	61
4.7.4 Physical Drive Functions	61
4.7.4.1 Display Drive Information	63
4.7.4.2 Create Pass Through Disk	63
4.7.4.3 Modify Pass-Through Disk	63
4.7.4.4 Delete Pass-Through Disk	64
4.7.4.5 Identify The Selected Drive	64
4.7.5 Raid System Functions	64

4.7.5.1 Mute The Alert Beeper	66
4.7.5.2 Alert Beeper Setting	66
4.7.5.3 Change Password	66
4.7.5.4 JBOD/RAID Mode Configuration	66
4.7.5.5 Raid Rebuild Priority.....	67
4.7.5.6 SATA NCQ Mode Support	67
4.7.5.7 HDD Read Ahead Cache.....	67
4.7.5.8 Volume Data Read Ahead.....	67
4.7.5.9 Disk Write Cache Mode.....	68
4.7.5.10 Disk Capacity Truncation Mode.....	68
4.7.5.11 Shutdown The Controller.....	68
4.7.5.12 Restart Controller	69
4.7.6 Hdd Power Management.....	69
4.7.6.1 Stagger Power On Control.....	69
4.7.6.2 Time To Hdd Low Power Idle	70
4.7.6.3 Time To Hdd Low RPM Mode.....	70
4.7.6.4 Time To Spin Down Idle HDD	70
4.7.7 Ethernet Configuration	70
4.7.7.1 DHCP	70
4.7.7.2 Local IP Adress.....	71
4.7.7.3 HTTP Port Number	71
4.7.7.4 Telnet Port Number	71
4.7.7.5 SMTP Port Number.....	72
4.7.7.6 Ethernet Address.....	72
4.7.8 Show System Events	72
4.7.9 Clear all Event Buffers.....	72
4.7.10 Hardware Monitor Information.....	72
4.7.11 System Information	73

5. VT-100 Utility Configuration 74

5.1 Configuring Raid Sets/Volume Sets.....	74
5.2 Designating Drives as Hot Spares.....	75
5.3 Using Quick Volume /Raid Setup Configuration	75
5.4 Using Raid Set/Volume Set Function Method	77
5.5 Main Menu	78
5.5.1 Quick Volume/Raid Setup	79
5.5.2 Raid Set Function	83
5.5.2.1 Create Raid Set	83
5.5.2.2 Delete Raid Set	85
5.5.2.3 Expand Raid Set.....	85
5.5.2.4 Offline Raid Set	87
5.5.2.5 Activate Raid Set.....	87

5.5.2.6 Create Hot Spare	88
5.5.2.7 Delete Hot Spare	88
5.5.2.8 Rescue Raid Set	89
5.5.2.9 Raid Set Information	89
5.5.3 Volume Set Function	90
5.5.3.1 Create Volume Set (0/1/10/3/5/6)	91
5.5.3.1.1 Volume Name	92
5.5.3.1.2 Raid Level	93
5.5.3.1.3 Capacity	93
5.5.3.1.4 Stripe Size	95
5.5.3.1.5 SAS Port #	95
5.5.3.1.6 LUN Base	96
5.5.3.1.7 SAS LUN	96
5.5.3.1.8 Cache Mode	97
5.5.3.1.9 Tag Queuing	97
5.5.3.2 Create Raid30/50/60	98
5.5.3.3 Delete Volume Set	99
5.5.3.4 Modify Volume Set	99
5.5.3.4.1 Volume Growth	100
5.5.3.4.2 Volume Set Migration	101
5.5.3.5 Check Volume Set	101
5.5.3.6 Stop Volume Set Check	102
5.5.3.7 Display Volume Info.	102
5.5.4 Physical Drives	103
5.5.4.1 View Drive Information	103
5.5.4.2 Create Pass-Through Disk	104
5.5.4.3 Modify Pass-Through Disk	104
5.5.4.4 Delete Pass-Through Disk	105
5.5.4.5 Identify Selected Drive	105
5.5.4.6 Identify Enclosure	106
5.5.5 Raid System Function	106
5.5.5.1 Mute The Alert Beeper	107
5.5.5.2 Alert Beeper Setting	107
5.5.5.3 Change Password	108
5.5.5.4 JBOD/RAID Function	108
5.5.5.5 Background Task Priority	109
5.5.5.6 SATA NCQ Support	109
5.5.5.7 HDD Read Ahead Cache	110
5.5.5.8 Volume Data Read Ahead	111
5.5.5.9 Hdd Queue Depth Setting	111
5.5.5.10 Disk Write Cache Mode	112
5.5.5.11 Auto Activate Raid Set	112

5.5.5.12 Capacity Truncation	113
5.5.5.13 Update Firmware	114
5.5.5.14 Shutdown Controller.....	114
5.5.5.15 Restart Controller	115
5.5.6 More System Functions	115
5.5.6.1 Smart Option For HDD	116
5.5.6.2 Smart Polling Interval	117
5.5.6.3 Hot Plugged Disk For Rebuilding	117
5.5.6.4 End Device Frame Buffering	118
5.5.7 HDD Power Management	119
5.5.7.1 Stagger Power On.....	120
5.5.7.2 Time to Hdd Low Power Idle (Minutes).....	121
5.5.7.3 Time To Low RPM Mode (Minutes)	121
5.5.7.4 Time To Spin Down Idle Hdd (Minutes)	122
5.5.8 In Band SAS Config	122
5.5.8.1 Inband SAS Function.....	123
5.5.8.2 Inband SAS Port.....	123
5.5.9 Ethernet Configuration	124
5.5.9.1 DHCP Function	125
5.5.9.2 Local IP Address.....	125
5.5.9.3 HTTP Port Number	126
5.5.9.4 Telnet Port Number	127
5.5.9.5 SMTP Port Number.....	127
5.5.9.6 Ethernet Address.....	128
5.5.10 Alert By Mail Configuration	128
5.5.10.1 SMTP Server Configuration.....	128
5.5.10.2 Mail Address Configurations.....	129
5.5.10.3 Event Notification Configurations.....	130
5.5.11 View System Events.....	132
5.5.12 Clear Events Buffer	132
5.5.13 Hardware Monitor Information.....	132
5.5.14 System Information	133

6. Web Browser-based Configuration 134

6.1 Web Browser McRAID Storage Manager.....	134
6.2 Web Browser Start-up Screen	135
6.3 Main Menu	135
6.4 Quick Function.....	136
6.5 Raid Set Functions	137
6.5.1 Create a New Raid Set	137
6.5.2 Delete Raid Set	138
6.5.3 Expand Raid Set.....	138

6.5.4 Offline Raid Set	139
6.5.5 Rename Raid Set.....	140
6.5.6 Activate Incomplete Raid Set	140
6.5.7 Create Hot Spare	141
6.5.8 Delete Hot Spare.....	142
6.5.9 Rescue Raid Set	142
6.6 Volume Set Functions	143
6.6.1 Create Volume Set (0/1/10/3/5/6)	143
6.6.2 Create Raid30/50/60 (Volume Set 30/50/60)	147
6.6.3 Delete Volume Set.....	147
6.6.4 Modify Volume Set.....	148
6.6.4.1 Volume Growth	149
6.6.4.2 Volume Set Migration	149
6.6.5 Check Volume Set	150
6.6.6 Schedule Volume Check	151
6.6.7 Stop Volume Check.....	152
6.7 Security Function	152
6.7.1 Create SED RAID Set	152
6.7.2 Delete SED RAID Set	153
6.7.3 Delete ISE RAID Set	154
6.7.4 Security Key Setup	154
6.7.4.1 SED Key Management-Creation	155
6.7.4.2 SED Key Management-Modification	155
6.7.5 Import Security Key.....	156
6.7.6 Erase Failed Disk	157
6.8 Physical Drive	158
6.8.1 Create Pass-Through Disk.....	158
6.7.7 RevertSP	158
6.8.2 Modify a Pass-Through Disk	159
6.8.3 Delete Pass-Through Disk	160
6.8.4 Clone Disk.....	160
6.8.4.1 Clone And Replace	161
6.8.4.2 Clone Only	161
6.8.5 Abort Cloning.....	161
6.8.6 Set Disk To Be Failed	162
6.8.7 Activate Failed Disk	162
6.8.8 Identify Enclosure	163
6.8.9 Identify Drive	163
6.9 System Controls	164
6.9.1 System Config	164
• System Beeper Setting	164
• Background Task Priority	164

• JBOD/RAID Configuration	164
• SATA NCQ Support	165
• HDD Read Ahead Cache	165
• Volume Data Read Ahead	165
• HDD Queue Depth	165
• Disk Write Cache Mode	166
• Write Same For Initialization	166
• Hot Plugged Disk For Rebuilding	166
• Disk Capacity Truncation Mode	166
6.9.2 Advanced Configuration	168
6.9.3 Hdd Power Management	174
6.9.3.1 Stagger Power On Control	174
6.9.3.2 Time To Hdd Low Power Idle	175
6.9.3.3 Time To Hdd Low RPM Mode	175
6.9.3.4 Time To Spin Down Idle HDD	175
6.9.3.5 Time To Wait HDD Spin Up	175
6.9.3.6 SATA Power Up In Standby	175
6.9.4 Ethernet Configuration	176
6.9.5 Alert By Mail Configuration	177
6.9.6 SNMP Configuration	177
• SNMP Trap Configurations	178
• SNMP System Configurations	178
• SNMP Trap Notification Configurations	178
6.9.7 NTP Configuration	179
• Time Zone	179
• Automatic Daylight Saving	179
6.9.8 View Events/Mute Beeper	180
6.9.9 Generate Test Event	181
6.9.10 Clear Events Buffer	181
6.9.11 Modify Password	182
6.9.12 Upgrade Firmware	182
6.9.13 Shutdown Controller	183
6.9.14 Restart Controller	183
6.10 Information	184
6.10.1 Raid Set Hierarchy	184
6.9.1.1 Hdd Xfer Speed	184
6.10.2 SAS Chip Information	185
6.10.3 System Information	186
6.10.4 Hardware Monitor	186

Appendix A	187
Upgrading Flash ROM Update Process	187

Establishing the Connection for the RS-232.....	187
Upgrade Firmware Through ANSI/VT-100 Terminal Emulation	188
Upgrade Firmware Through Web Browser Manager (LAN Port) ...	191
Appendix B	192
Flash-based Backup Module (ARC-1883-BAT/CAP).....	192
Appendix C	200
Battery Backup Module (ARC-6120BA-T121-7).....	200
Appendix D.....	207
SNMP Operation & Definition	207
Appendix E	209
Event Notification Configurations	209
A. Device Event.....	209
B. Volume Event.....	210
C. RAID Set Event	211
D. Hardware Monitor Event	211
Appendix F	213
RAID Concept	213
RAID Set.....	213
Volume Set.....	213
Easy of Use Features.....	214
• Instant Availability/Background	214
• Online Array Roaming/Offline RAID set.....	214
• Online Capacity Expansion.....	214
• Online RAID Level and Stripe Size Migration	215
High availability.....	216
• Global/Dedicated Hot Spares	216
• Hot-Swap Disk Drive Support.....	216
• Hot-Swap Disk Rebuild.....	217
Understanding RAID	217
• RAID 0	217
• RAID 1	218
• RAID 10(1E).....	219
• RAID 3	219
• RAID 5	220
• RAID 6	220
• RAID x0.....	221
• JBOD.....	222
• Single Disk (Pass-Through Disk).....	222
Summary of RAID Levels	222

INTRODUCTION

1. Introduction

This section presents a brief overview of the ARC-72xx series 8/12/16 bays 12Gb/s SAS to SAS RAID subsystem.

1.1 Overview

The ARC-72xx RAID subsystem is a family of 8/12/16 12.0Gbps SAS hard drive ports depending upon the amount of storage required. The ARC-72xx is designed to provide a truly innovative 12Gb/s SAS host interfaces to address the needs of different cost-effective RAID storage requirements. When properly configured, the RAID subsystem can provide non-stop service with a high degree of fault tolerance through the use of RAID technology and advanced array management features. 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 SAS to 12Gb/s SAS RAID controllers attach directly to SATA/SAS midplanes and increase capacity using one additional HD SFF-8644 external connector.

The ARC-72xx SAS to SAS RAID subsystem provides 12Gb/s SAS host interface link to the host board on the server system. This RAID controller utilizes the same RAID kernel that has been field-proven in existing internal/external SATA/SAS RAID controller products, allowing to bring stable and reliable SAS RAID external subsystem. The ARC-72xx provides 2U/3U rack-mounted external storage chassis capable of accommodating up to 8/12/16 12.0-Gb/s, Serial-Attached SCSI (SAS) drives or 6.0-Gb/s Serial ATA (SATA) drives.

Unparalleled Performance for 12Gb/s SAS

The ARC-72xx 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 12Gb/s SAS technology. The subsystem each includes 2GB DDR3-1866 and 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

INTRODUCTION

controllers will provide maximum read/write performance improvements for the most performancehungry database and IT applications.

Unsurpassed Data Availability

Designed and leveraged with Areca's existing high performance RAID solution, ARC-72xx series subsystems provide 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 down-time. 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 Controllers.

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 several available RAID managers include internet browser, CLI, Telnet, API, SMTP and SNMP via a LAN port. The ArcSAP Quick Manager can scan multiple RAID units in the local and remote side and provide an effective management interface for configuration, and monitoring Areca RAID controllers.

INTRODUCTION

1.2 Technical Specifications

Controller Architecture

- Dual Core RAID-on-Chip (ROC) 1.2 GHz
- On-board 2GB DDR3-1866 ECC SDRAM
- Write-through or write-back cache support
- Redundant flash image for adapter availability
- Battery Backup Module 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)
- 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
- Automatic drive failover/detection and rebuild using multiple Global, Dedicated or Enclosure hot-spare drives
- Configurable stripe size up to 1MB
- Multiple pairs SSD/HDD disk clone function
- SSD automatic monitor clone support
- SED (Self-encrypting drives) function support
- Support native 4K and 512 byte sector devices
- Support HDD firmware update
- Max 256 devices
- Max 128 LUNs (volume set) per controller

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
- Enclosure management ready (SES over in-band SAS)

Drive Interface

- Up to 256 devices using SAS expanders (one external SFF-8644 SAS connector)
- Up to 12Gb/s per port

INTRODUCTION

- 8/12/16 SAS internal hard-drive connectors

Host Interface

- 12Gb/s SAS-to-SAS
2 x SFF-8644 SAS 12Gb/s SAS Ports - 1200MB/sec per PHY link

RAID Management

- Field-upgradeable firmware in flash ROM
- Firmware-embedded manager via RS-232 port
- API library for customer to write its own monitor utility
- Embedded browser-based RAID manager via built-in 10/100 Lan port
- SAP monitor utility easily manage multiple RAID units in the network
- Access terminal menu by telnet via a LAN port

Controller Back-Panel Connectors

Host connectors (per controller board)

- 2 x 12.0Gb/s SAS connectors for connection to the host connector
- 1 x RJ11 connector
- 1 x LAN RJ45 connector

LED Indicators

Hard-drive carrier

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

Controller board

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

Fan / Power supply / Controller LED indicator panel

- 2 x single-color LED status indicators for subsystem, one for power-on and one for subsystem fault status
- 1 x dual-color LED status indicators for the status of "working" and "fault" on each fan LED
- 1 x dual-color LED status indicators for the status of "AC_OK" and "fault" on each power supply LED
- 1 x dual-color LED status indicators for the status of "working"

INTRODUCTION

and “fault” on controller LED

Power Supplies

- Dual 400W hot swap, N+1 redundant with PFC
- Supports 100–240VAC input at 47 and 63Hz frequency

Dimensions

2U 8 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)

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)

Subsystem Net Weight (Without Drives)

- Single 8/12/16 bays 26.4 kg/27 kg/31 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)

1.3 Locations of the Subsystem Component

The main components of the ARC-72xx series RAID subsystem are shown in the below figure.

1.3.1 RAID Subsystem Front View

- 2U-8 bays SAS RAID Subsystem Front View

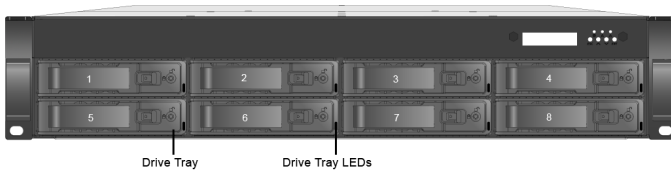


Figure 1-1. 2U-8 bays SAS RAID Subsystem Front View

- 2U-12 bays SAS RAID Subsystem Front View

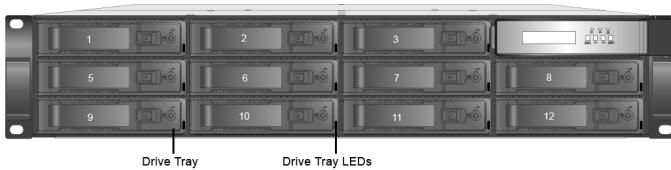


Figure 1-2. 2U-12 bays SAS RAID Subsystem Front View

- 3U-16 bays SAS RAID Subsystem Front View



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

INTRODUCTION

- **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
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.

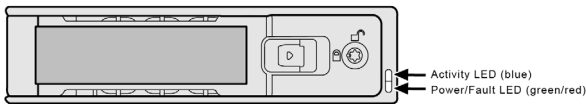


Figure 1-4. 3.5-inch SATA Drive Tray LED

INTRODUCTION

1.3.2 RAID Subsystem Rear View

ARC-72xx series enclosures include a mid-plane, RAID controller, and power supply unit all in one cableless chassis design. Multiple fans and optional power supplies provide redundancy to ensure continued usage during component failure.

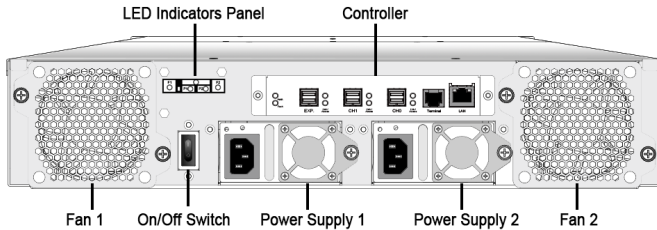


Figure 1-5. 2U-8/2U-12 bays SAS RAID Subsystem Rear View

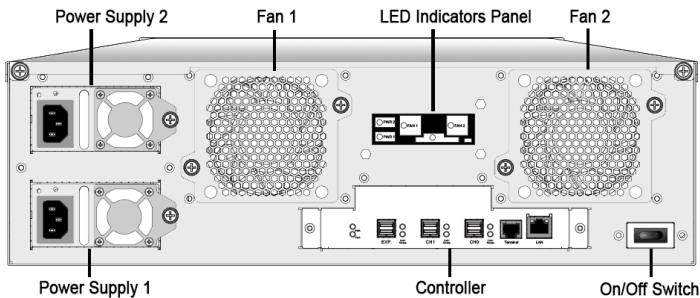


Figure 1-6. 3U-16 bays SAS RAID Subsystem Rear View

1.3.2.1 SAS RAID Controller Module Outline

The ARC-72xx SAS RAID controller can support two 12Gb/s SAS host ports and one 12Gb/s SAS expansion port. This section provides the 12Gb/s SAS expansion RAID controller box outline.

INTRODUCTION

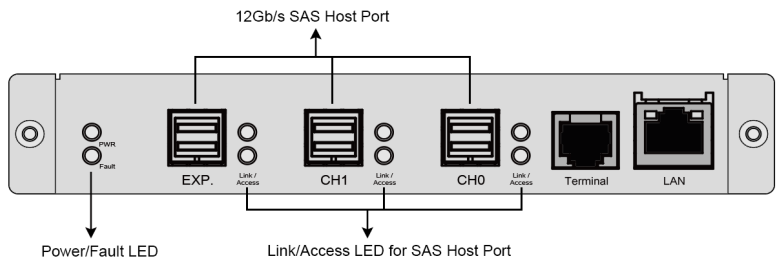


Figure 1-7, Rear View of ARC-72xx RAID Controller

1.3.2.2 SAS LED Indicators

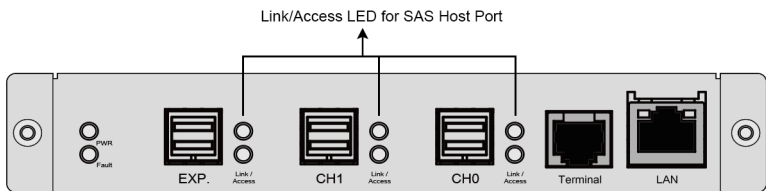


Figure 1-8. SAS LED Indicator

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

SAS Port LED	Status
Link LED (Green light)	When link LED illuminate light that indicates the SAS channel host link has connected.
Activity LED (Blue light)	The SAS channel host accesses to the ARC-72xx RAID subsystem

The following table describes the SAS to SAS RAID subsystem power/fault status LED.

Status LED	Status
Power LED (Green light)	The green light indicates that the subsystem is in power-on state.
Fault LED (Red light)	The red light indicates that a fault error occurs on the subsystem.

INTRODUCTION

1.3.2.3 Fan/Power/Controller LED Indicator

The following figures describe the LEDs which indicate the status of the SAS RAID subsystem's fans, power supplies and controller.

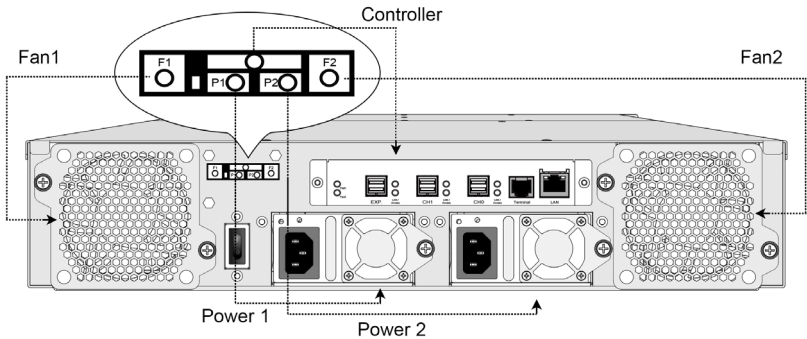


Figure 1-9. Fan/Power/Controller LED Indicator of ARC-7208/7212

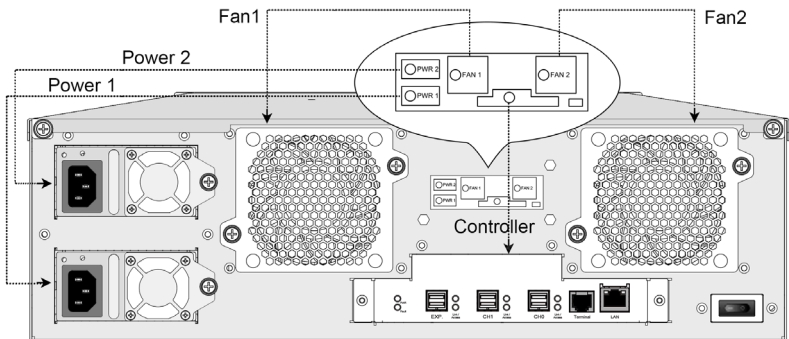


Figure 1-10. Fan/Power/Controller LED Indicator of ARC-7216

INTRODUCTION

The following table describes the Fan1/Fan2 LED status.

Fan LED Status	Indication
Fan_OK (Green light)	The green light indicates that the fan is working functionally.
Fault (Red light)	The red light indicates that a fan fault has occurred.

The following table describes the Power1/Power2 LED status.

Power LED Status	Indication
AC_OK (Green light)	The green light indicates that the AC cord is present and above the minimum AC input voltage threshold.
Fault (Red light)	The red light indicates that a power supply fault has occurred.

The following table describes the Controller LED status.

Controller LED status	Status
Working (Green light)	The green light indicates that the controller is in working state, controller CPU access the subsystem resource.
Fault (Red light)	The red light indicates that a controller reset occurs on a controller.

1.4 RAID Subsystem Alarm

An audible alarm is activated if any of the fault conditions occur, such as Voltage, Temperature, Fan or Power Supply. 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.

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.

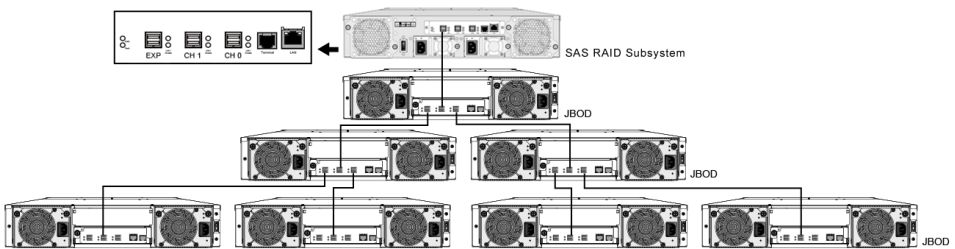


Figure 1-11. Module Daisy-chain

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

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

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
- Fan modules
- 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.)
- 1 x RJ11 to DB9 serial communications null-modem cable
- 2 power cords
- 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-8 or 3U-16 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.

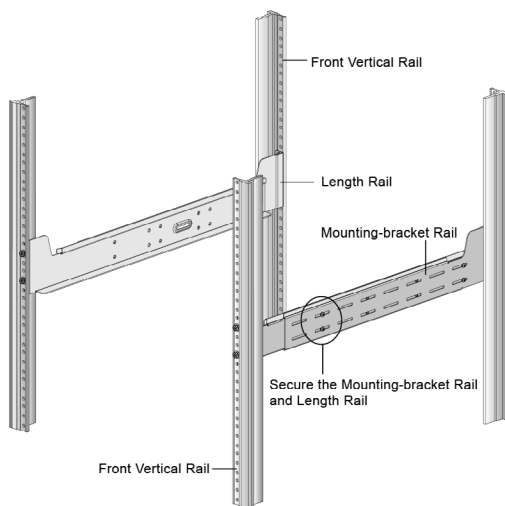


Figure 2-1. Attaching the Mounting Rails to the Cabinet

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

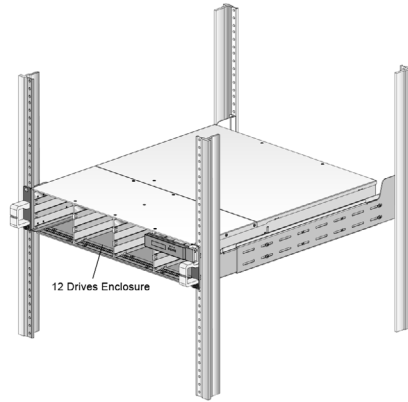


Figure 2-2. Sliding the Subsystem into the Rails

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

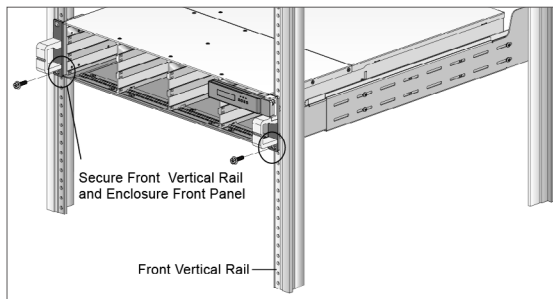


Figure 2-3. Attaching the Front of the Subsystem

2.2 Installing or Removing Drives in the Subsystem

Your subsystem supports up to 8/12/16 3.5-inch disk drives or 8/12/16 2.5-inch 12Gb/s SAS or 6Gb/s SAS/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 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 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.

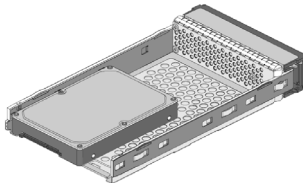


Figure 2-4. Put 2.5-inch Drive into 3.5- inch Disk Tray

- 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 2-5. 2.5-inch Drive Carrier with 3.5-inch 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.

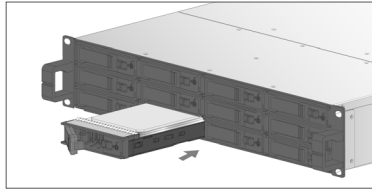


Figure 2-6. Installing 3.5-inch Drive into Enclosure

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.

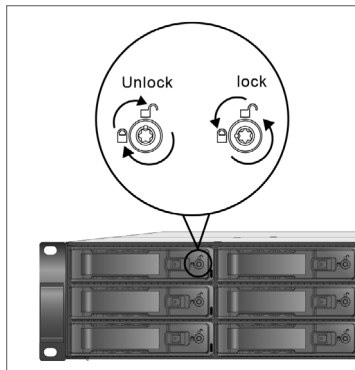


Figure 2-7. Locking Drive Tray

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.

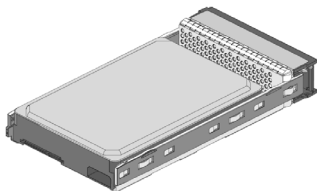


Figure 2-8. Putting Drive into Drive Tray

- 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.

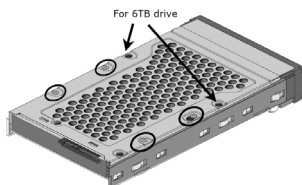


Figure 2-9. Securing Drive

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.

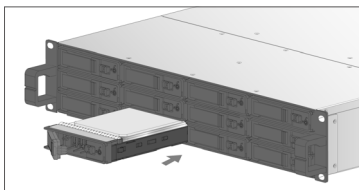


Figure 2-10. Installing Drive into Subsystem

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 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.

2.2.3 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.

2.3 Installing and Removing the Power Supply Modules

The subsystem supports two separate power modules.

2.3.1 Installing the Power Supply Modules

1. Carefully slide the power supply 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 modules.

HARDWARE INSTALLATION

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.

2.3.2 Removing a Power Supply Modules

1. Verify that the power LED is red. See Figure 1-9 and 1-10.
2. Turn off the power supply and unplug the AC power cords.
3. Loosen and remove the retaining screw on the right side of the power module then gently but firmly pull the power supply modules out from the slot.

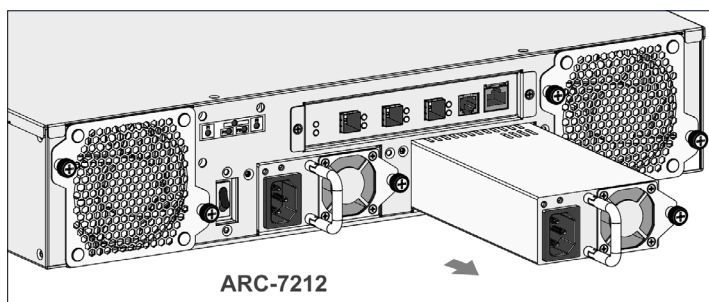


Figure 2-11, Pulling Power Module

Note:

The power supply modules are hot-pluggable. If one power supply module is functioning normally, you can hot-swap the other one while the subsystem is powered on.

HARDWARE INSTALLATION

2.4 Removing and Installing the Fan Modules

The ARC-72xx models have externally mounted fans that you can replace without shutting down the subsystem.

1. Verify that the Fan LED is red. See Figure 1-9 and Figure 1-10.
2. Remove the two fan module mounting screws.
3. Draw the fan module away from the I/O module.
4. Disconnect the fan cable from its connector on the I/O module.
5. Remove the four attaching plastic screws.
6. Place the new fan onto the fan module and install the four attaching plastic screws.
7. Connect the new fan's cable.
8. Push the fan module into the I/O module until it is firmly seated in the backside
9. Install the two mounting screws.

This completes the fan replacement procedure. Please refer to the figure below.

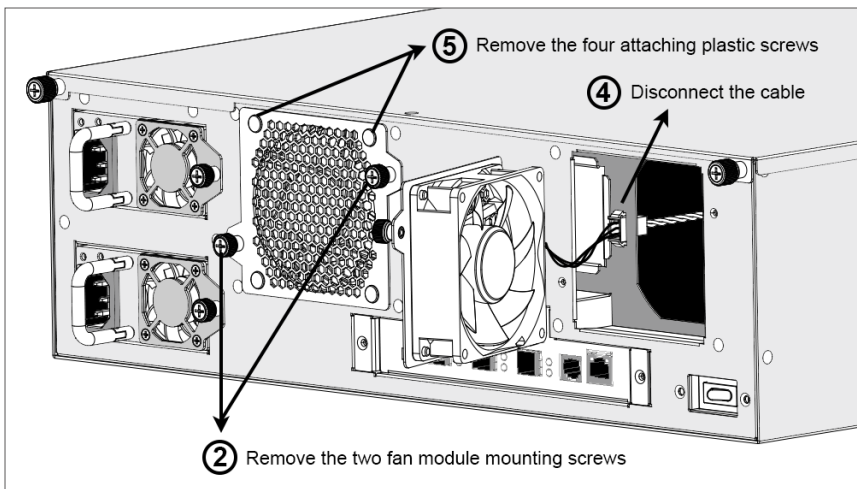


Figure 2-12. Removing and Installing the Fan Module

HARDWARE INSTALLATION

2.5 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.

2.5.1 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. The ARC-72xx RAID controller has two (2) SFF-8644 SAS IN Port connectors and one (1) SFF-8644 SAS Expansion Port connector.

To install host adapter and RAID subsystem:

1. Attach one end of a SAS data cable to the SAS HBA card in the Host system.
2. Attach the other end of the SAS data cable to one of the SAS ports on the ARC-72xx RAID subsystem.

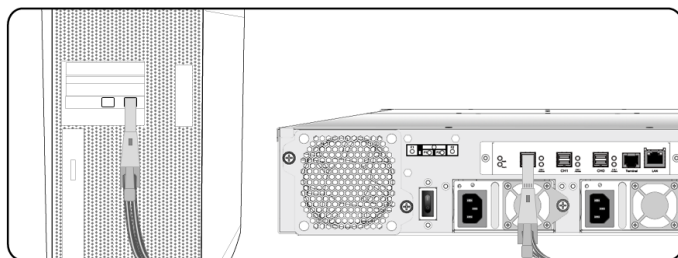


Figure 2-13, Connecting to Host Adapter

2.5.2 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.

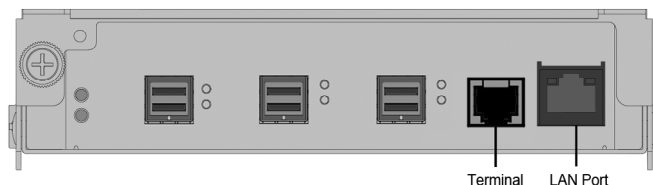


Figure 2-14, Monitor Port Location

HARDWARE INSTALLATION

- Terminal Port Connection

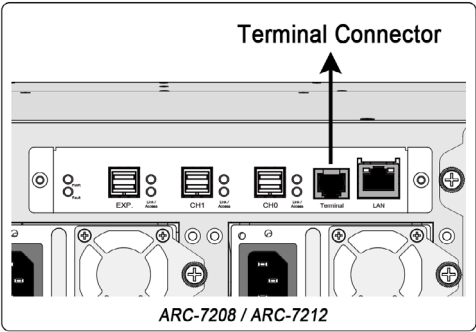


Figure 2-15, Terminal Monitor Port Location

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 "RJ11 Connector" for access to the text-based setup menu.

Please configure the SW1(2-1) settings on the RAID controller to define the Terminal connector function for RAID controller and expander.

SW1-2	SW1-1	Terminal Port Function
OFF	OFF	Expander Terminal
OFF	ON	Expander Debug
ON	OFF	Controller Terminal
ON	ON	Controller Debug

Table 2-1, Terminal Port Function Definition

The SAS RAID subsystem package includes one RJ11-to-DB9 serial data cable. Use the RJ11 serial port on the controller module to establish the serial communication link. You can attach a serial (Character-Based) terminal or server com port to the RAID controller I/O shield for access to the text based Setup Menu, note the following:

HARDWARE INSTALLATION

1. Attach RJ11 end of the serial data cable to the Terminal connector on the SAS RAID subsystem.
2. Attach the DB9 of the serial data cable to a serial port on the host PC or server.

For additional information on using the RS-232 port to configure the RAID controller see the Chapter 5 of VT-100 Utility Configuration in the user manual.

• LAN Port Connection

The SAS RAID subsystem has embedded the TCP/IP & web browser-based RAID manager in the firmware. 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.

2.5.3 Power Up the RAID Subsystem

ARC-72xx series SAS RAID subsystems are equipped with two power supplies for each unit. Using the included power cords, connect each power supply to a suitable AC power source.

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 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.

HARDWARE INSTALLATION

2.6 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.

2.6.1 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:

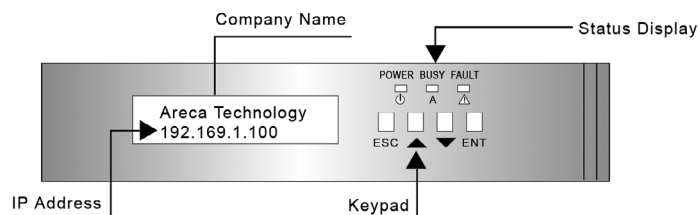


Figure 2-16, LCD Initial Screen

- 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.

HARDWARE INSTALLATION

- 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.

2.6.2 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 (optional)
- 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 in 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

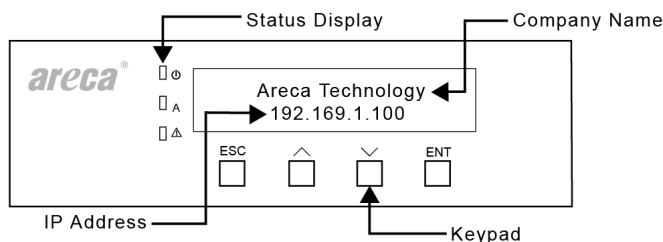
The front panel keypad and liquid crystal display (LCD) is the primary user interface for the SAS RAID subsystem. All configuration and management of the controller and its properly connected disk arrays can be performed from this interface.

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

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 as the following:



Function Key Definitions:

The four function keys at the bottom 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 SAS 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

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

CONFIGURATION METHOD

3.2 VT100 terminal (Using the controller’s serial port)

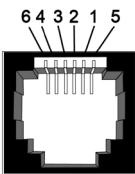
The serial port on the SAS RAID subsystem’s front can be used in VT100 mode. The provided interface cable converts the RS232 signal of the 6-pin RJ11 connector on the RAID subsystem into a 9-pin D-Sub female connector. The firmware-based terminal array management interface can access the array through 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 requirment	
Connection	Null-modem cable
Baud Rate	115,200
Data bits	8
Stop	1
Flow Control	None

The VT-100 port for the SAS RAID configuration, please refer to table 2-1 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.

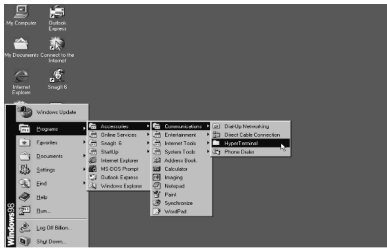
Key	Function
Arrow Key	Move cursor
Enter Key	Submit selection function
ESC Key	Return to previous screen
L Key	Line draw
X Key	Redraw

3.2.2 Start-up VT100 Screen

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

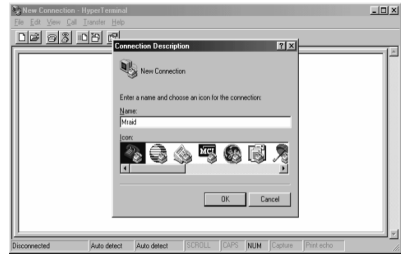
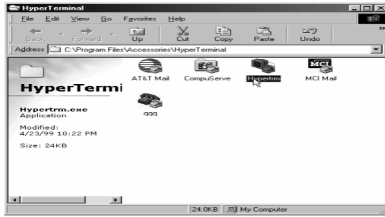
There are a wide variety of Terminal Emulation packages, but for the most part they should be very similar. The following setup procedure is an example Setup VT100 Terminal in Windows system using Hyper Terminal use Version 3.0 or higher.

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).

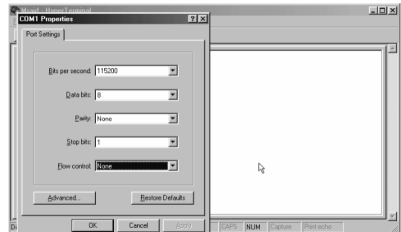
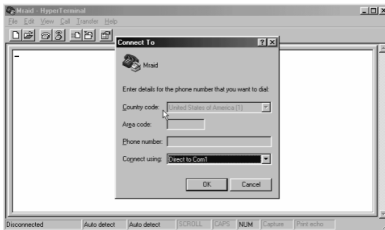


Step 2. Open **HYPERTERM.EXE** and enter a name for your Terminal. Click **OK**.

CONFIGURATION METHOD



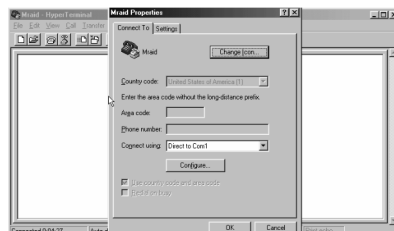
Step 3. Select an appropriate connecting port in your Terminal. Click OK. Configure the port parameter settings. Bits per second: "**115200**", Data bits: "**8**", Parity: "**None**", Stop bits: "**1**", Flow control: "**None**". Click "**OK**".



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

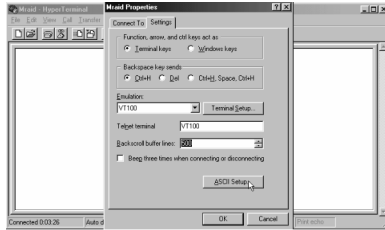


Step 5. Open the Settings Tab.



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 SAS RAID subsystem on a local or remote machine, you need to know its IP Address. The IP address will default be shown in the "LCD" screen, or get from VT-100 System Information or ArcSAP utility. 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 SAS 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 SAS RAID subsystem has embedded the TCP/IP & web browser-based RAID manager in the firmware. User can remote manage the SAS 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 SAS RAID subsystem. Detail procedures please refer to the Chapter 6 "*Web Browser-based Configuration method*".

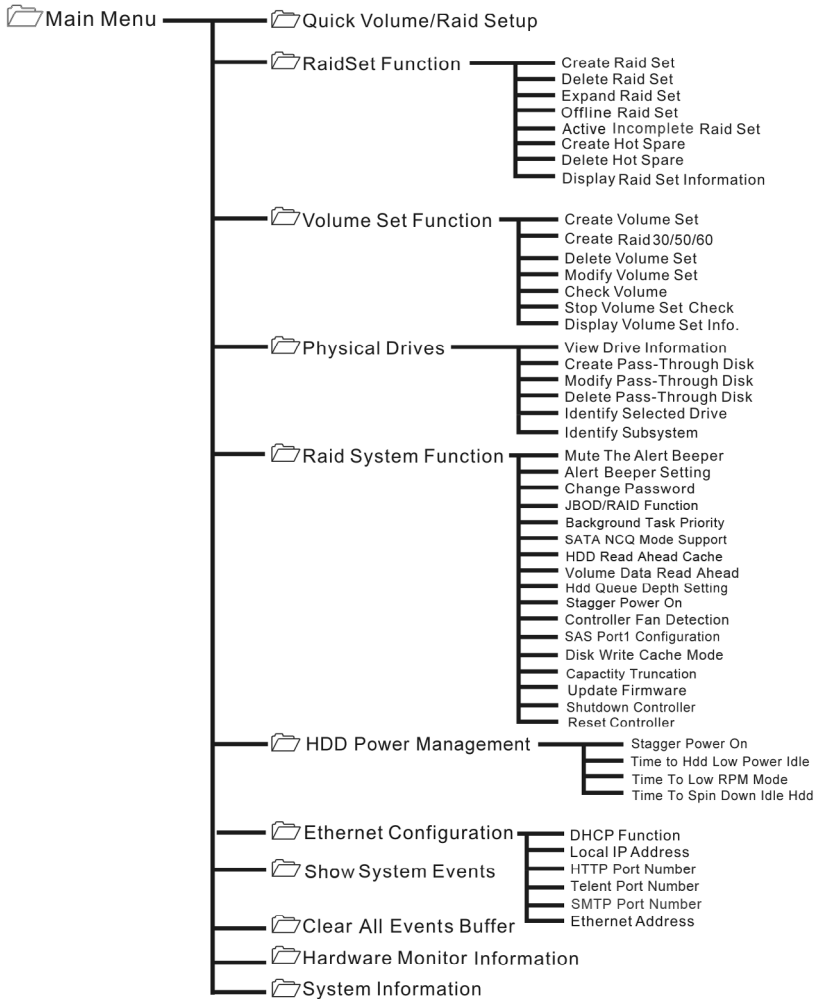
Note:

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 optional LCD module 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 button 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 SAS 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
Hdd Power Management	Setting Hdd power management function
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:

LCD CONFIGURATION MENU

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.
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	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.
4	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.
5	When you finished defining the volume set, press ENT to confirm the "Quick Volume And Raid Set Setup" function.
6	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.
7	Initialize the volume set you have just configured.
8	If you need to add additional volume set, using main menu "Create Volume Set" functions.

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 SAS RAID subsystem 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. 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	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, Write Protect and Tagged Queuing. 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.
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)". 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

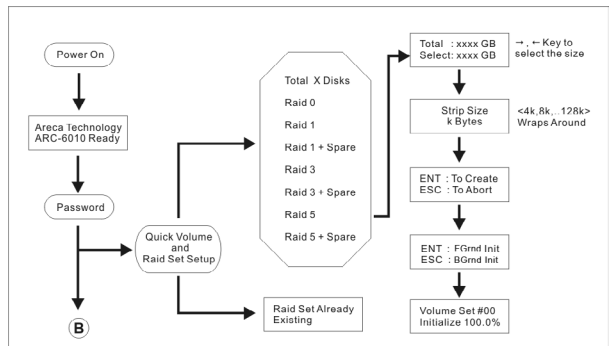
The password option allows user to set or clear the RAID subsystem's password protection feature. Once the password has been set, the user can only monitor and configure the RAID subsystem by providing the correct password. The password is used to protect the RAID subsystem from unauthorized entry. The 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



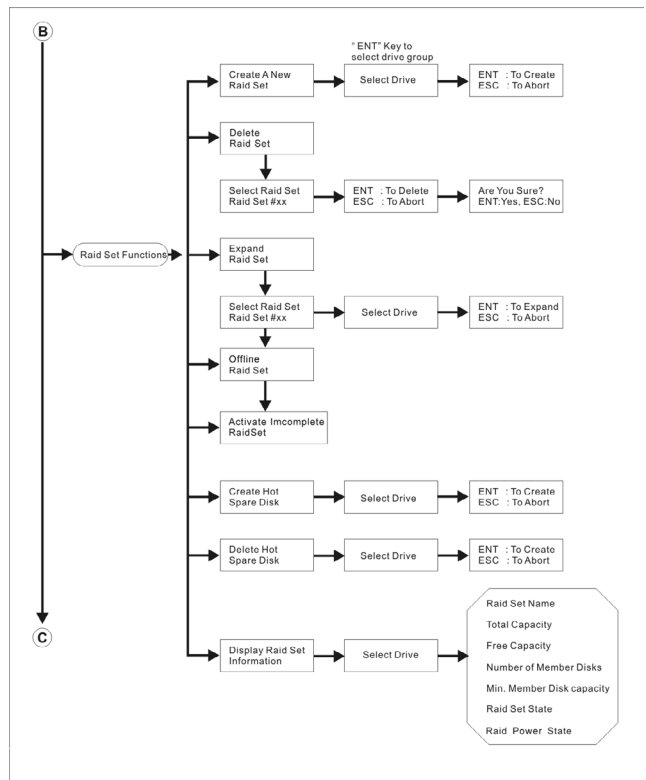
1. All of the physical disk drives are contained in a RAID set.
2. The RAID levels associated with hot spare, capacity, and stripe size are selected during the configuration process.
3. A single volume set is created and consumed all or a portion of the disk capacity available in this RAID set.
4. If 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 want 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 add capacity can define 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.

LCD CONFIGURATION MENU

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 want to delete and then press **ENT** to select it. The confirmation screens appear 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.

LCD CONFIGURATION MENU

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. 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.

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, Write Protect, Tagged Queuing and Initialization Mode, see Figure 4.7.3.1-1.

All values can be changed 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 **ENT** to accept the default value. The following is the attributes descriptions. Please refer to this chapter section 4.7 using "Raid Set Function" and "Volume Set Functions" to complete the create volume set function.

LCD CONFIGURATION MENU

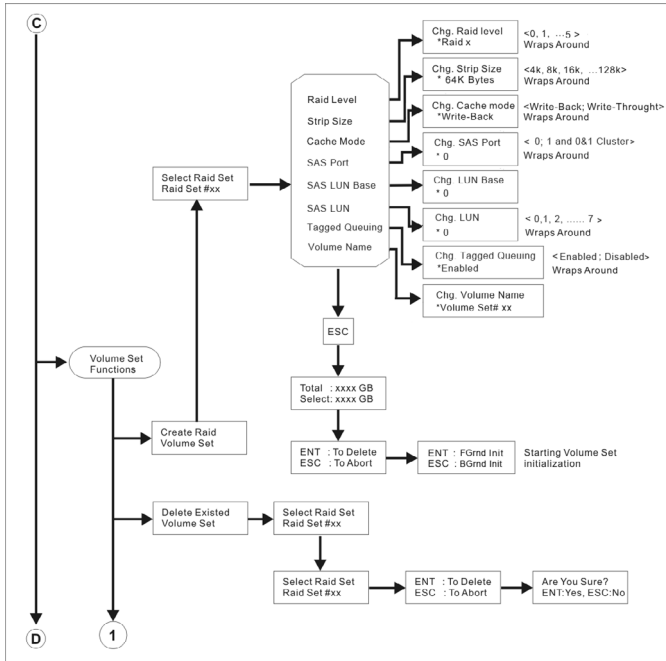


Figure 4.7.3.1-1

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 RAID level 0, 1, 10(1E), 3, 5 and 6 on the LCD configuration menu.

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

LCD CONFIGURATION MENU

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 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.

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.

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.

LCD CONFIGURATION MENU

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" option. 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, 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.

LCD CONFIGURATION MENU

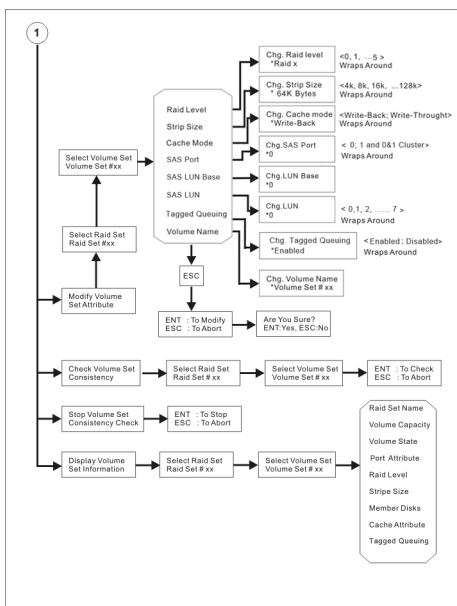


Figure 4.7.3.3-1

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.

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.

LCD CONFIGURATION MENU

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 cannot be modifying 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.

LCD CONFIGURATION MENU

Figure 4.7.4-1

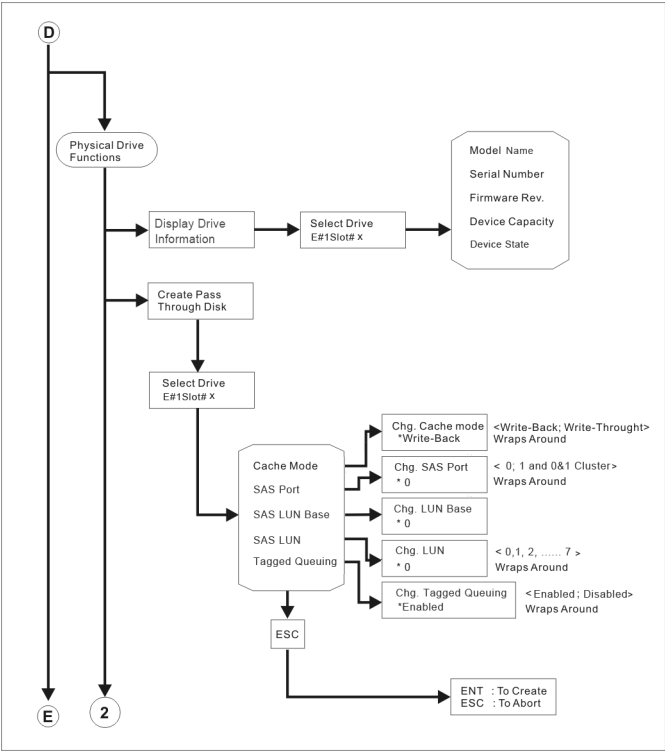
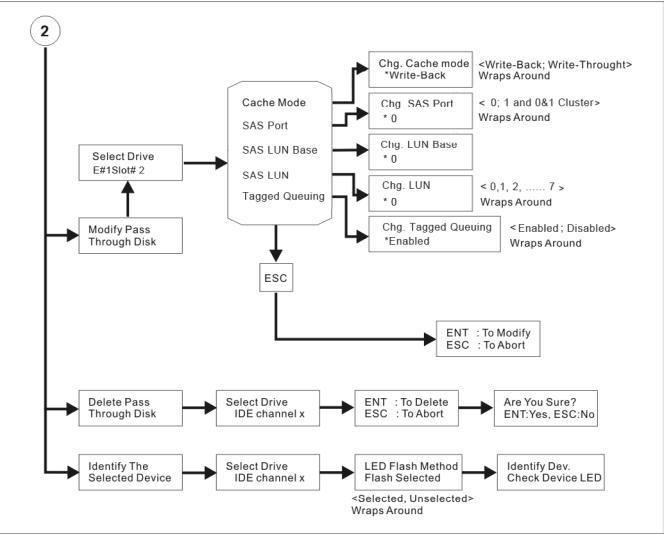


Figure 4.7.4-2



LCD CONFIGURATION MENU

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 no controlled by the RAID subsystem's firmware and thus cannot 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, 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.

LCD CONFIGURATION MENU

The attributes for pass-through disk are the Volume Cache Mode, Tagged Command Queuing and SAS Port/ SAS LUN Base/ SAS LUN, Write Protect and Tagged Command Queuing. All values can be modified by user. **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 want 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

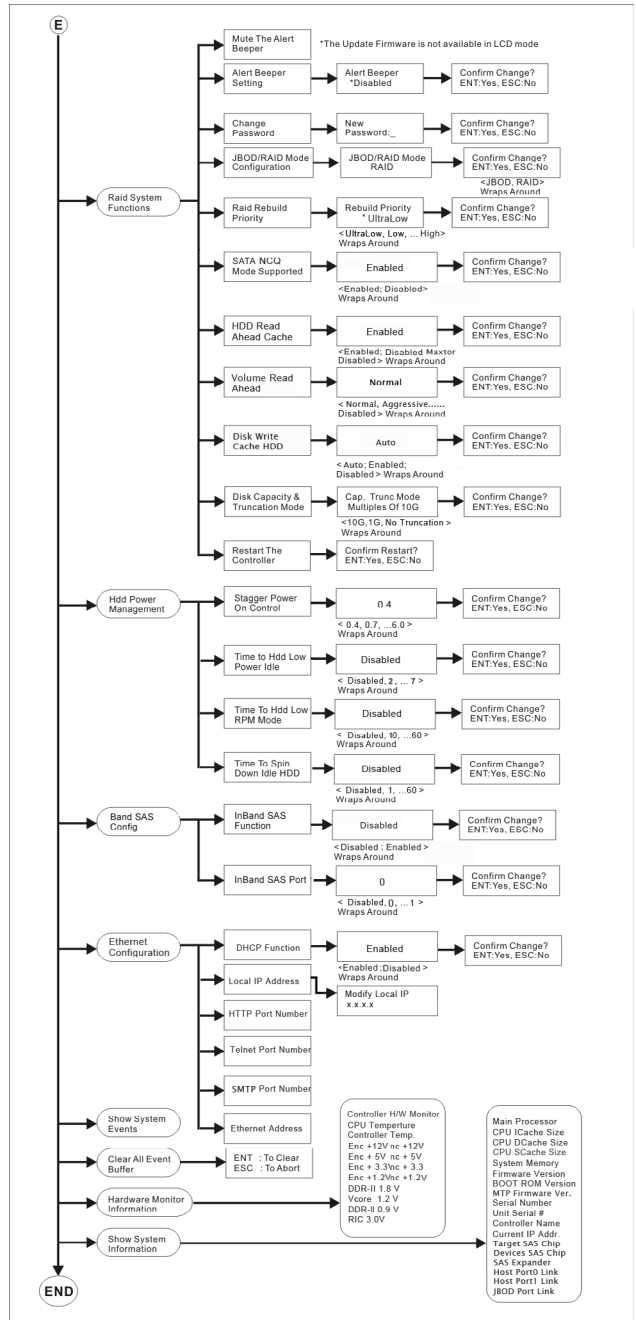
To prevent removing the wrong drive, the selected disk Fault LED indicator will light for physically locating the selected disk when the "Identify The Selected Drive" function is selected. To identify selected drive from the physical drive pool, press **UP/DOWN** buttons to choose the "Identify The Selected 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.

LCD CONFIGURATION MENU

Figure 4.7.5-1



LCD CONFIGURATION MENU

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 user 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.

LCD CONFIGURATION MENU

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

LCD CONFIGURATION MENU

access but it degrades random access.

4.7.5.9 Disk Write Cache Mode

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 use 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 Shutdown The Controller

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

LCD CONFIGURATION MENU

4.7.5.12 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.

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.

LCD CONFIGURATION MENU

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.

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/**

LCD CONFIGURATION MENU

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 other devices on the network.

4.7.7.2 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 RAID subsystem, press the **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select "Local IP Address", 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

LCD CONFIGURATION MENU

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 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 hard-

LCD CONFIGURATION MENU

ware 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.

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

VT-100 UTILITY CONFIGURATION

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	<p>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.</p> <p>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.</p> <p>Highlight the desired RAID level for the volume set and press the Enter key to confirm.</p>
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.

VT-100 UTILITY CONFIGURATION

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.

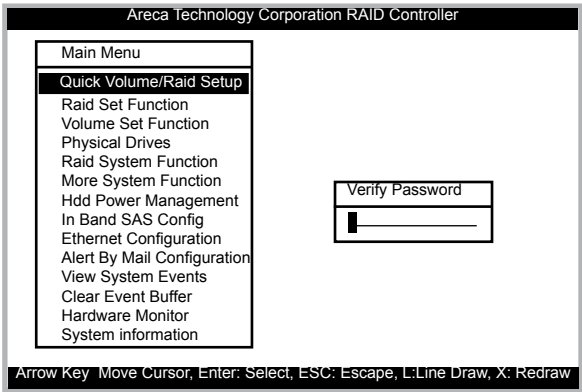
Step	Action
1	To setup the hot spare (option), choose "Raid Set Function" from the main menu. Select the "Create Hot Spare" and press the Enter key to define the hot spare.
2	Choose "RAID Set Function" from the main menu. Select "Create Raid Set" and press the Enter key.
3	The "Select a Drive For Raid Set" window is displayed showing the SAS/SATA drives connected to the RAID subsystem.
4	<p>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.</p> <p>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.</p> <p>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.</p>

VT-100 UTILITY CONFIGURATION

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".

VT-100 UTILITY CONFIGURATION

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
Hdd Power Management	Setting Hdd power management function
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

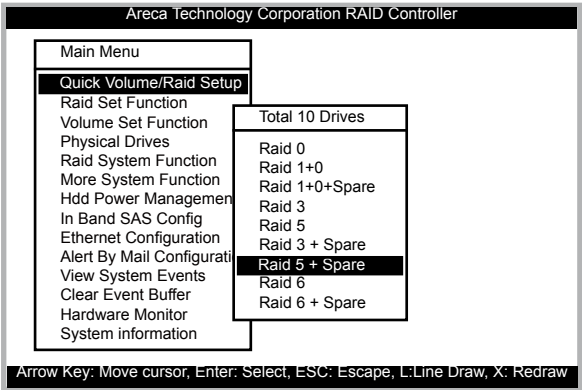
"Quick Volume/RAID Setup" is the fastest way to prepare a RAID set and volume set. It requires only a few keystrokes to complete. Although disk drives of different capacity may be used in the RAID Set, it will use the capacity of the smallest disk drive as the capacity of all disk drives in the RAID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

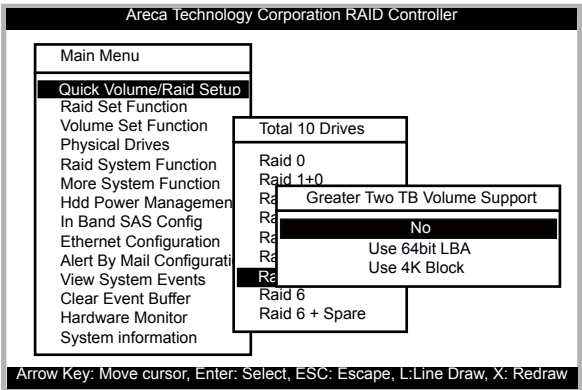
VT-100 UTILITY CONFIGURATION

- 3. When a single volume set is created, it can consume all or a portion of the available disk capacity in this RAID set.
- 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 na-

VT-100 UTILITY CONFIGURATION

tive 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 is 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:

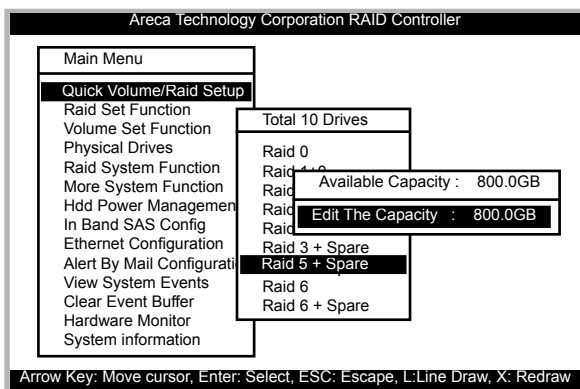
Windows 2003 with SP1 or later

Linux kernel 2.6.x or later

- **Use 4K Block**

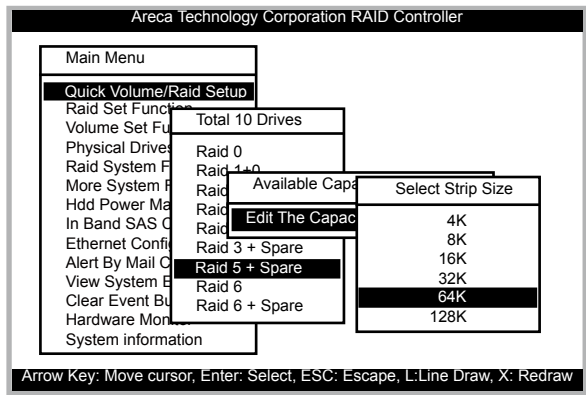
This option uses 16 bytes CDB and changes the sector size from default 512 bytes to 4k bytes. Windows XP only supports maximum volume capacity is up to 16TB.

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.



VT-100 UTILITY CONFIGURATION

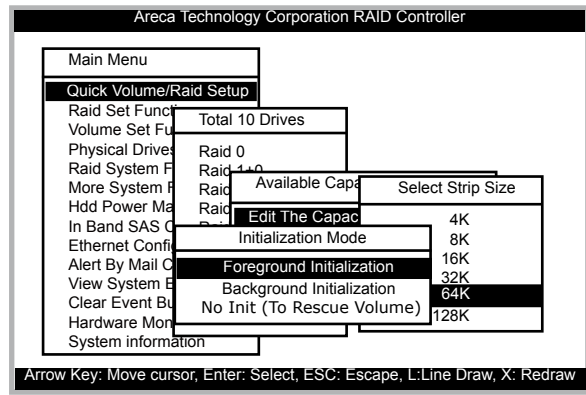
Stripe Size This parameter sets the size of the stripe written to each disk in a RAID 0, 1, 10(1E), 5, or 6 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128KB, 256KB, 512KB or 1024KB.



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

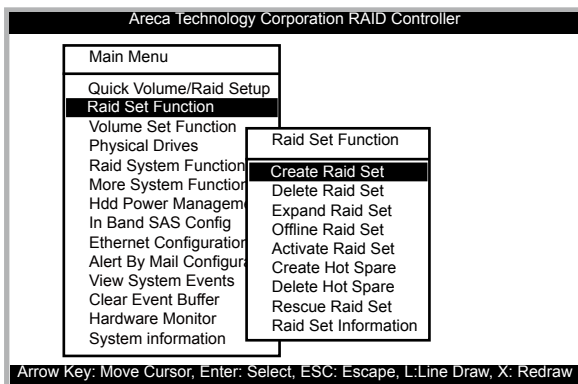
Select "Foreground (Faster Completion)" or "Background (Instant Available)" for initialization and "No Init (To Rescue Volume)" for recovering the missing RAID set configuration.



VT-100 UTILITY CONFIGURATION

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.

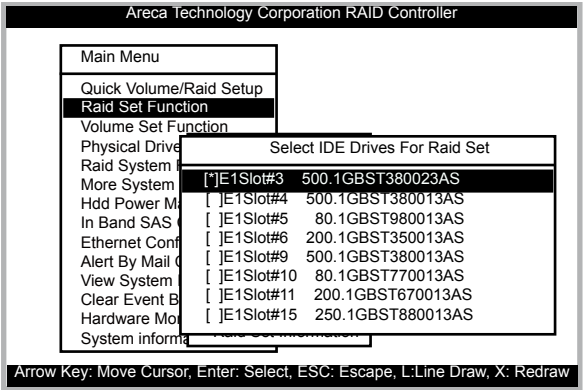
1. Up to 32 disk drives can be included in a single RAID set.
2. Up to 128 RAID sets can be created per controller. RAID level 30, 50 and 60 can support up to eight sub-volumes (RAID set).

To define a RAID set, follow the procedures below:

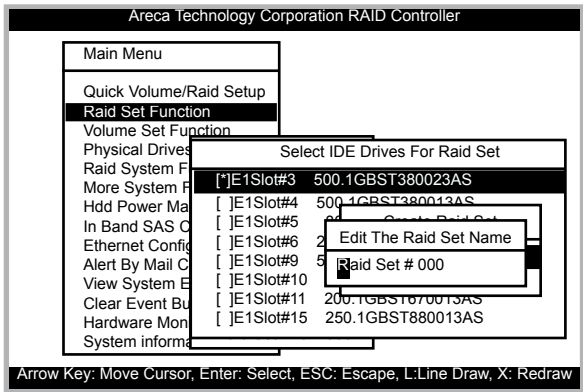
1. Select “Raid Set Function” from the main menu.
2. Select “Create Raid Set” from the “Raid Set Function” dialog box.
3. A “Select IDE Drive For Raid Set” window is displayed showing the SAS/SATA drives connected to the current controller. Press the **UP** and **DOWN** arrow keys to select specific 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.

VT-100 UTILITY CONFIGURATION

4. 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. #.



5. Repeat steps 3 to define another RAID sets.



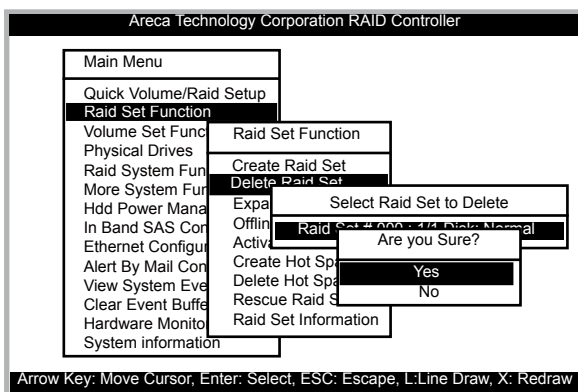
Note:

1. You only can edit the Raid set name in "Create Raid Set".
2. 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 RAID30/50/60.

VT-100 UTILITY CONFIGURATION

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.

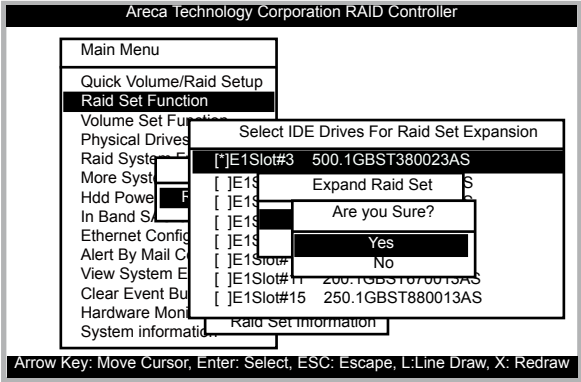


5.5.2.3 Expand Raid Set

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 radio 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.

VT-100 UTILITY CONFIGURATION

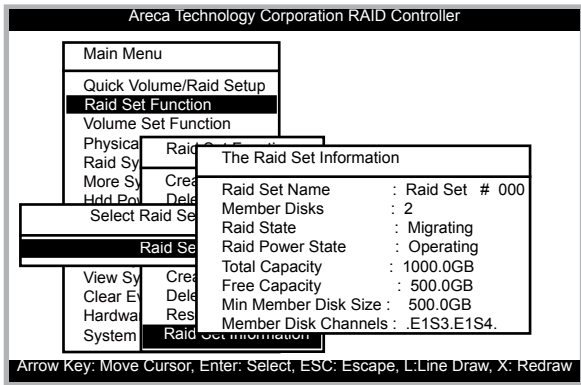


Note:

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

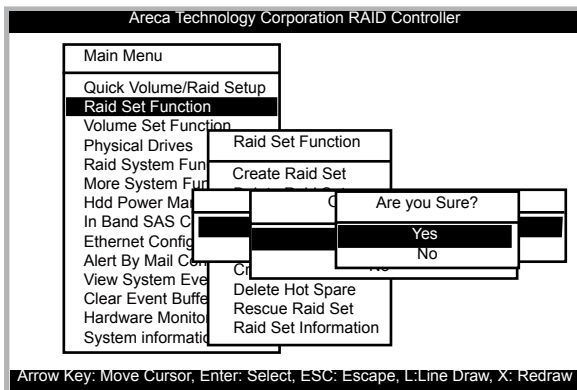
Migration occurs when a disk is added to a RAID set. Migrating state is displayed in the RAID state area of "The Raid Set Information" screen when a disk is being added to a RAID set. Migrating state is also displayed in the associated volume state area of the "Volume Set Information" which belongs this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



VT-100 UTILITY CONFIGURATION

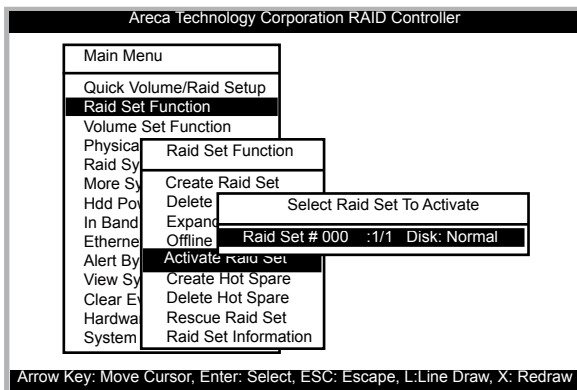
5.5.2.4 Offline Raid Set

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

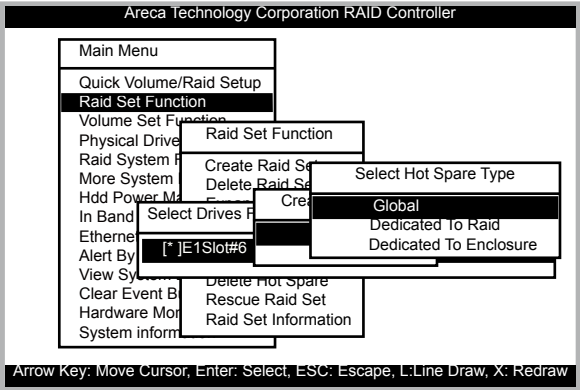
The following screen is used to activate the RAID set after one of its disk drive was removed in the power off state. When one of the disk drives is removed in power off state, the RAID set state will change to "Incomplete State". If user wants to continue to work while the RAID subsystem is powered 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.



VT-100 UTILITY CONFIGURATION

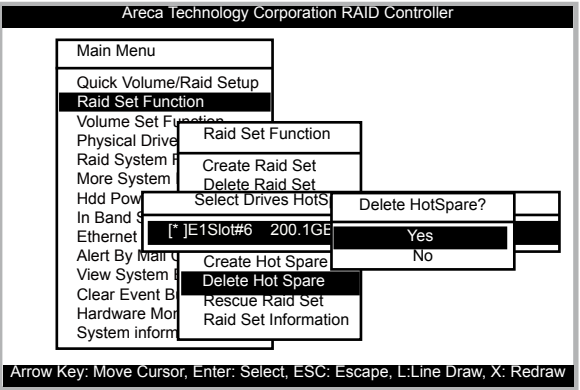
5.5.2.6 Create Hot Spare

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” gives you the ability to define a global or dedicated hot spare.



5.5.2.7 Delete Hot Spare

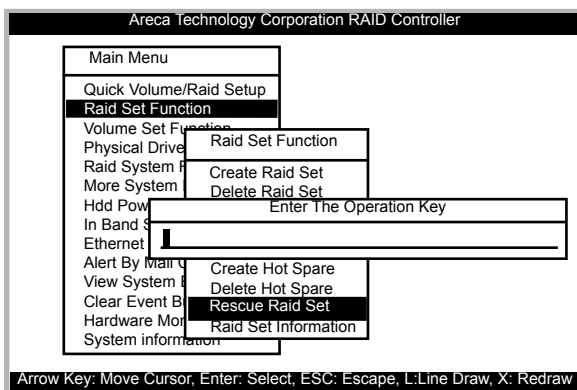
Select the target hot spare disk to delete by clicking on the appropriate check box. Press the **Enter** key to select a hot spare disk drive, and press **Yes** in the “Delete Hot Spare” screen to delete the hot spare.



VT-100 UTILITY CONFIGURATION

5.5.2.8 Rescue Raid Set

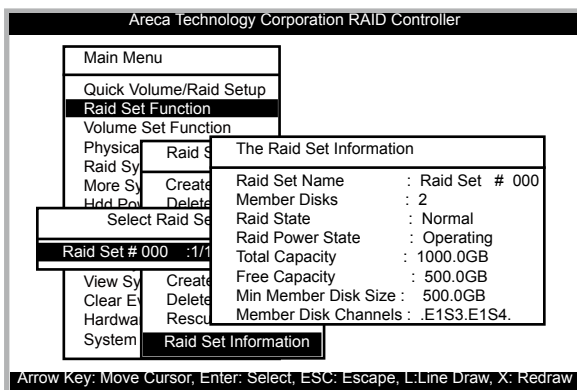
When the system is powered off in the RAID set update/creation period, it possibly could disappear due to this abnormal condition. The "RESCUE" function can recover the missing RAID set information. The RAID controller uses the time as the RAID set signature. The RAID set may have different time after the RAID set is recovered. The "SIGANT" function can regenerate the signature for the RAID set.



5.5.2.9 Raid Set Information

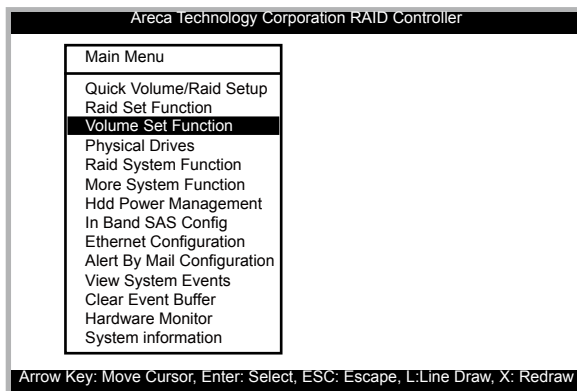
To display RAID set information, move the cursor bar to the desired RAID set number, then press the **Enter** key. The "Raid Set Information" will appear.

You can only view information for the RAID set in this screen.



VT-100 UTILITY CONFIGURATION

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 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.

VT-100 UTILITY CONFIGURATION

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.

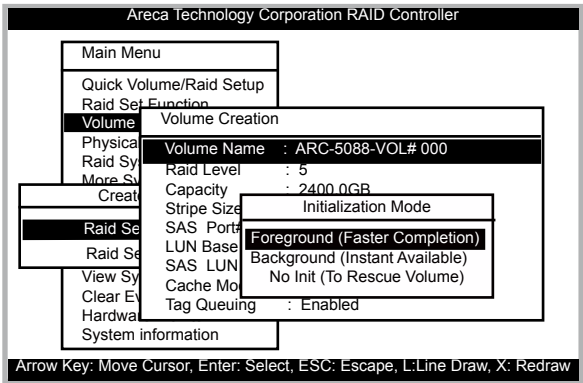
The screenshot displays the 'Areca Technology Corporation RAID Controller' utility. On the left is a 'Main Menu' with options: Quick Volume/Raid Setup, Raid Set Function, Volume Set Function, Physical, Raid System, More System, HDD Power, In-Band, Ethernet, Alert By, View System, Clear Event, Hardware, and System Information. The 'Volume Set Function' option is selected. A 'Volume Creation' dialog box is open, showing the following fields: Volume Name (ARC-5088-VOL# 000), Raid Level (5), Capacity (2400.0GB), Stripe Size (64K), SAS Port# (0), LUN Base (0), SAS LUN (0), Cache Mode (Write Back), and Tag Queuing (Enabled). A 'Create Volume?' prompt is shown with 'Yes' and 'No' buttons. At the bottom, a legend states: 'Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L: Line Draw, X: Redraw'.

4. 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, Tagged Command Queuing.

This screenshot is similar to the previous one, showing the 'Areca Technology Corporation RAID Controller' utility. The 'Volume Set Function' option is selected in the 'Main Menu'. The 'Volume Creation' dialog box is open, displaying the same fields as before. The 'Create Volume' option is now selected in the 'Main Menu'. The 'Volume Creation' dialog box shows the same fields: Volume Name (ARC-5088-VOL# 000), Raid Level (5), Capacity (2400.0GB), Stripe Size (64K), SAS Port# (0), LUN Base (0), SAS LUN (0), Cache Mode (Write Back), and Tag Queuing (Enabled). The 'Create Volume?' prompt is shown with 'Yes' and 'No' buttons. At the bottom, a legend states: 'Arrow Key: Move Cursor, Enter: Select, ESC: Escape, L: Line Draw, X: Redraw'.

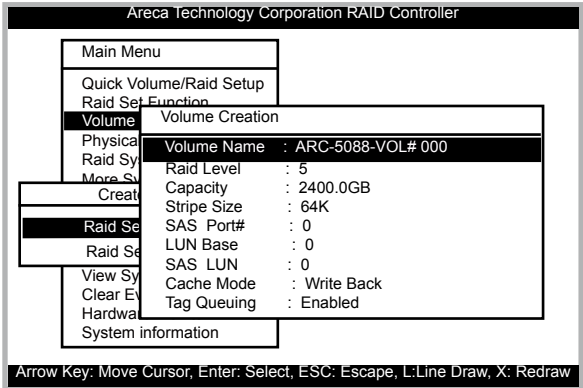
VT-100 UTILITY CONFIGURATION

5. 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.
6. Repeat steps 3 to 5 to create additional volume sets.
7. The initialization percentage of volume set will be displayed at the button line.



5.5.3.1.1 Volume Name

The default volume name will always appear as ARC-5088-VOL #. You can rename the volume set providing it does not exceed the 15 characters limit.



VT-100 UTILITY CONFIGURATION

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.

Areca Technology Corporation RAID Controller	
Main Menu	
Quick Volume/Raid Setup	
Raid Set Function	
Volume	Volume Creation
Physical	Volume Name : ARC-5088-VOL# 000
Raid System	Raid Level : 5
More Settings	Capacity : 2400.0GB
Create	Stripe Size : 64K
	SAS Port# : 0
Raid Set	LUN Base : 0
Raid Set	SAS LUN : 0
View System	Cache Mode : Write Back
Clear Event	Tag Queuing : Enabled
Hardware	
System information	

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

5.5.3.1.3 Capacity

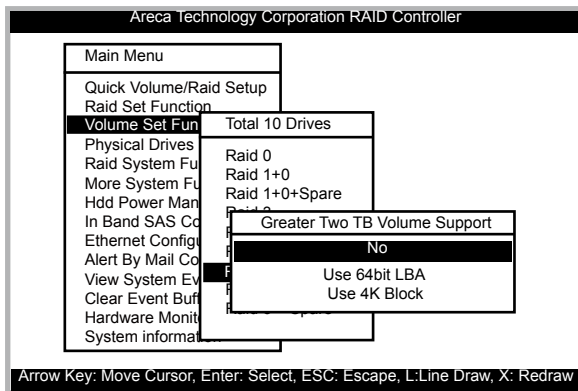
The maximum available volume size is the default value for the first setting. Enter the appropriate volume size to fit your application. The capacity value can be increased or decreased by the **UP** and **DOWN** arrow keys. The capacity of each volume set must be less than or equal to the total capacity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

Areca Technology Corporation RAID Controller	
Main Menu	
Quick Volume/Raid Setup	
Raid Set Function	
Volume	Volume Creation
Physical	Volume Name : ARC-5088-VOL# 000
Raid System	Raid Level : 5
More Settings	Capacity : 2400.0GB
Create	Stripe Size : Available Capacity
	SAS Port# : Selected Capacity: 2400.0GB
Raid Set	LUN Base : 0
Raid Set	SAS LUN : 0
View System	Cache Mode : Write Back
Clear Event	Tag Queuing : Enabled
Hardware	
System information	

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

VT-100 UTILITY CONFIGURATION

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.

- **64bit LBA**

This option uses 16 bytes CDB instead of 10 bytes. The maximum volume capacity is 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

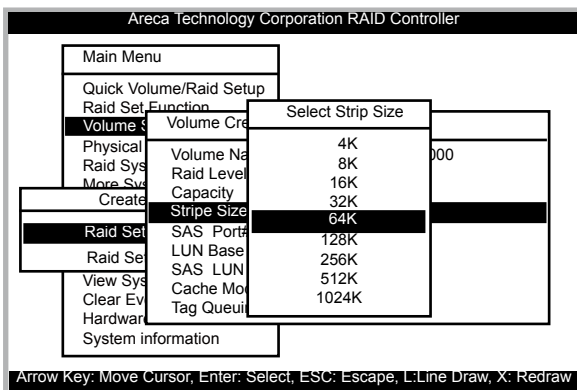
- **Use 4K Block**

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.

VT-100 UTILITY CONFIGURATION

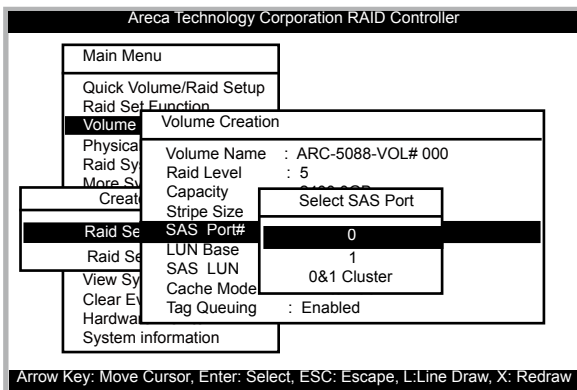
5.5.3.1.4 Stripe Size

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, or 128 KB, 256KB, 512KB or 1024KB.



5.5.3.1.5 SAS Port

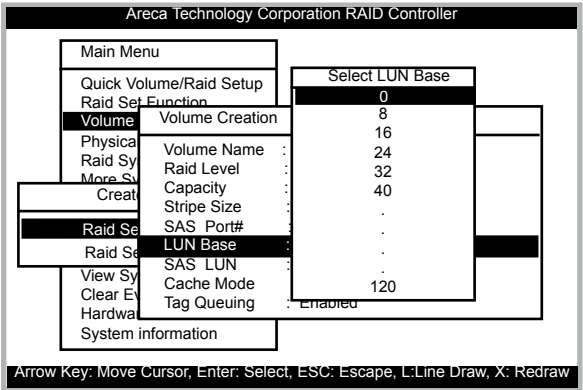
Two 4-lanes SAS ports can be applied to the RAID subsystem. Choose the SAS Port# option 0, 1 and 0&1 Cluster. If you configure the Host/JBOD port as a JBOD function on the "Raid System Function", then there will be no function on the selection of '1' and "0&1 Cluster" option.



VT-100 UTILITY CONFIGURATION

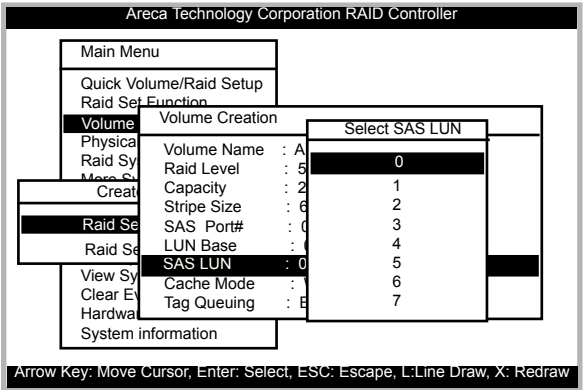
5.5.3.1.6 LUN Base

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



5.5.3.1.7 SAS LUN

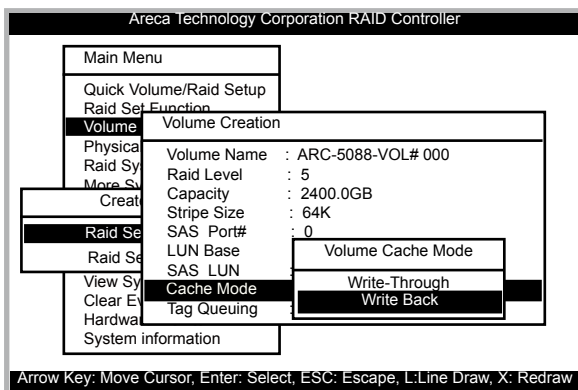
Each LUN Base can support up to 8 SAS LUNs. Most SAS port host adapter treats each SAS LUN like a SAS disk.



VT-100 UTILITY CONFIGURATION

5.5.3.1.8 Cache Mode

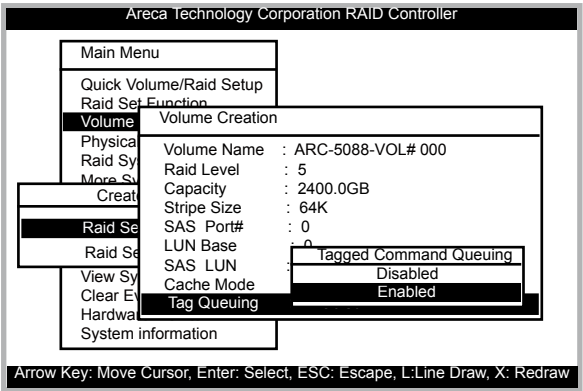
User can set the cache mode to: "Write-Through" or "Write-Back".



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.

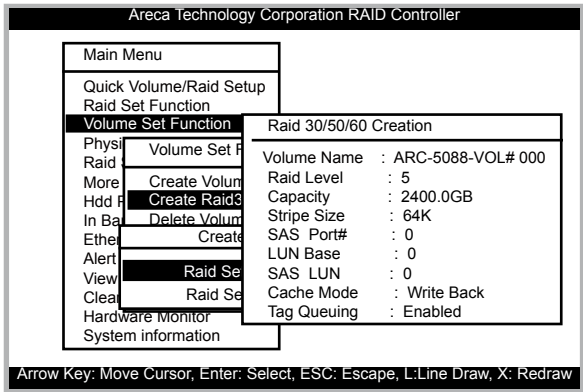
VT-100 UTILITY CONFIGURATION



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 Raid 30/50/60" 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.

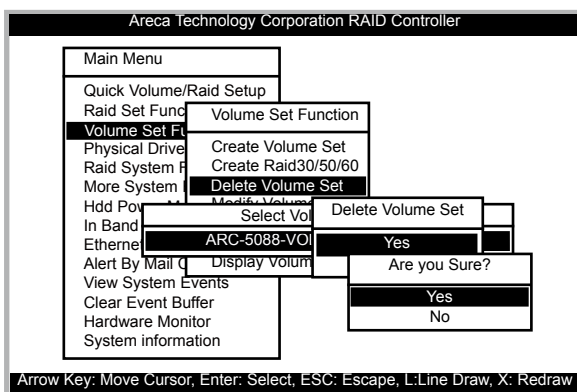
The created new volume set attribute option allows users to select the Volume Name, Capacity, Raid Level, Strip Size, SAS Port#/LUN Base/LUN, Cache Mode, Write Protect and Tagged Command Queuing. The detailed description of those parameters can refer to section 5.5.3.1. User can modify the default values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



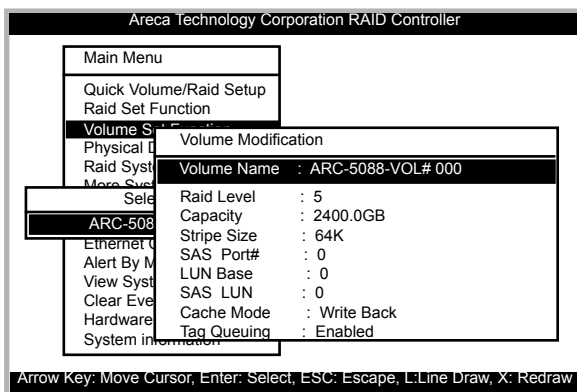
VT-100 UTILITY CONFIGURATION

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.



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

VT-100 UTILITY CONFIGURATION

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.

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 entry 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.

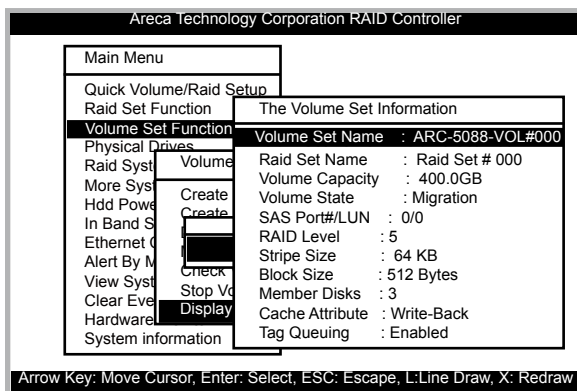
To expand an existing volume noticed:

- Only the last volume can expand capacity.
- When expand 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 2TB capacity device.
- Expand over 2TB used LBA64 mode. Please make sure your OS supports LBA64 before expand it.

VT-100 UTILITY CONFIGURATION



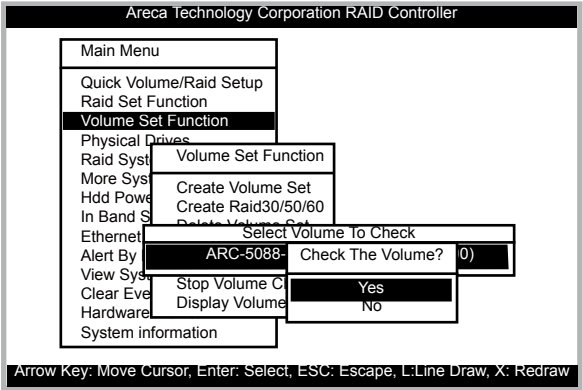
5.5.3.4.2 Volume Set Migration

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.

VT-100 UTILITY CONFIGURATION

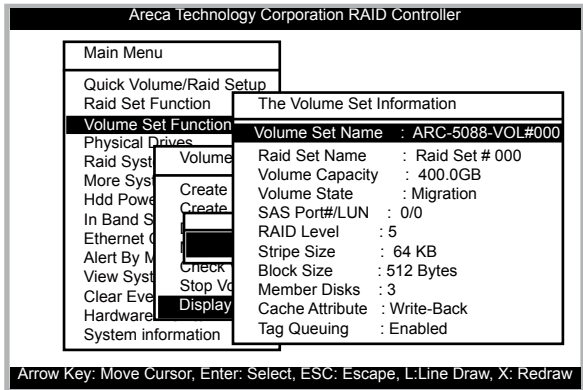


5.5.3.6 Stop Volume Set Check

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

5.5.3.7 Display Volume Info.

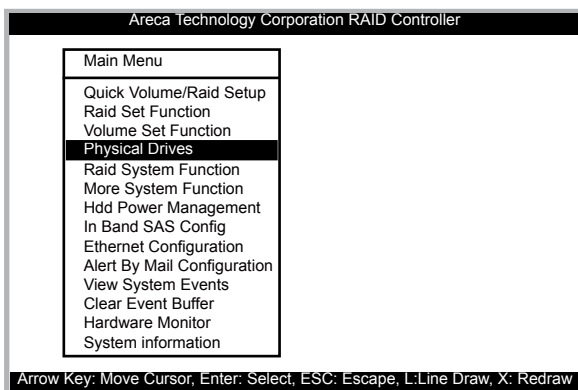
To display volume set information, move the cursor bar to the desired volume set number and then press the **Enter** key. The "Volume Set Information" screen will be shown. You can only view the information of this volume set in this screen, but can not modify it.



VT-100 UTILITY CONFIGURATION

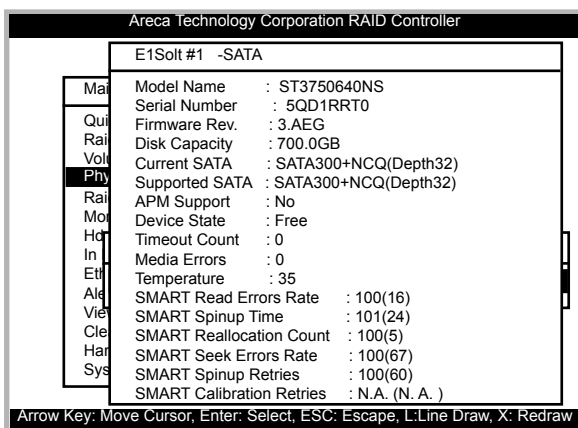
5.5.4 Physical Drives

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.



5.5.4.1 View Drive Information

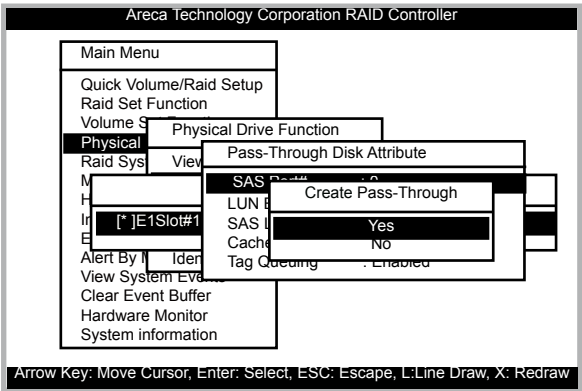
When you choose this option, the physical disks connected to the RAID subsystem are listed. Move the cursor to the desired drive and press **Enter** key to view drive information.



VT-100 UTILITY CONFIGURATION

5.5.4.2 Create Pass-Through Disk

A pass-through disk is not controlled by the RAID subsystem firmware and thus cannot 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 firmware. The SAS Port#/SAS LUN Base/SAS LUN, Cache Mode, and Tag Queuing must be specified to create a pass-through disk.



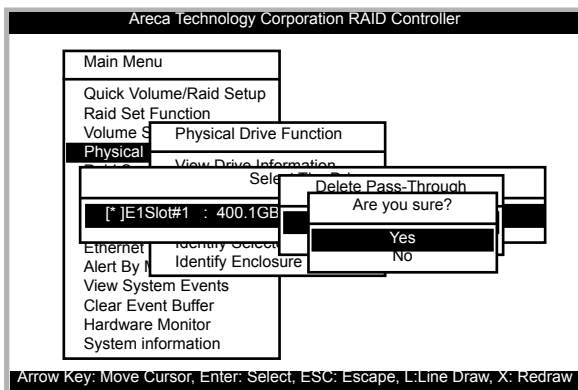
5.5.4.3 Modify Pass-Through Disk

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.

VT-100 UTILITY CONFIGURATION

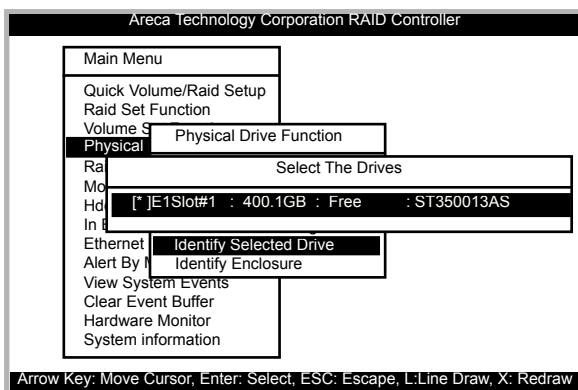
5.5.4.4 Delete Pass-Through Disk

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.



5.5.4.5 Identify Selected Drive

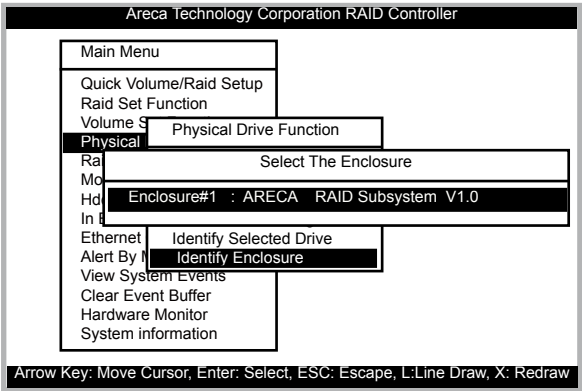
To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the "Identify Selected Device" is selected.



VT-100 UTILITY CONFIGURATION

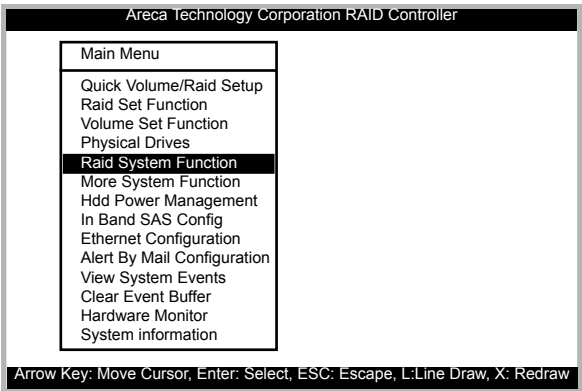
5.5.4.6 Identify Enclosure

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 Enclosure” is selected. This function will also light the subsystem LED indicator, if it is existed.



5.5.5 Raid System Function

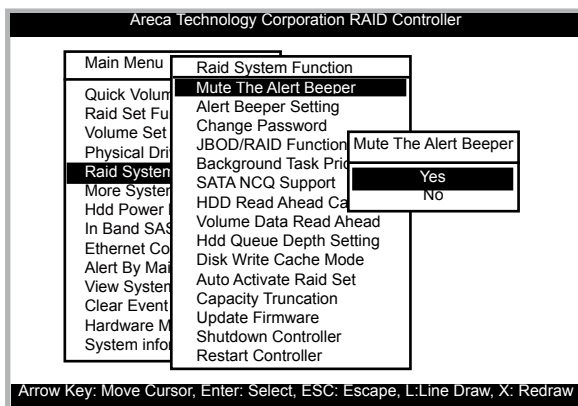
To set the “Raid System Function”, move the cursor bar to the main menu and select the “Raid System Function” item and then press **Enter** key. The “Raid System Function” menu will show multiple items. Move the cursor bar to an item, then press **Enter** key to select the desired function.



VT-100 UTILITY CONFIGURATION

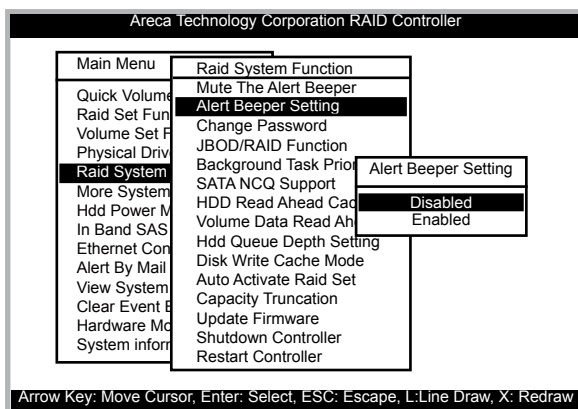
5.5.5.1 Mute The Alert Beeper

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.



5.5.5.2 Alert Beeper Setting

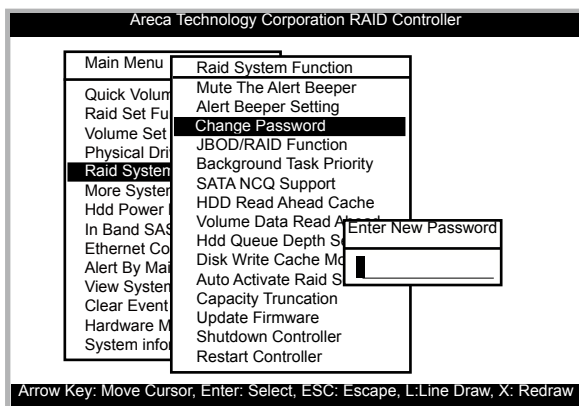
The “Alert Beeper Setting” function item is used to “Disabled” or “Enabled” the RAID subsystem alarm tone generator. Select “Disabled” and press the **Enter** key in the dialog box to turn the beeper off.



VT-100 UTILITY CONFIGURATION

5.5.5.3 Change Password

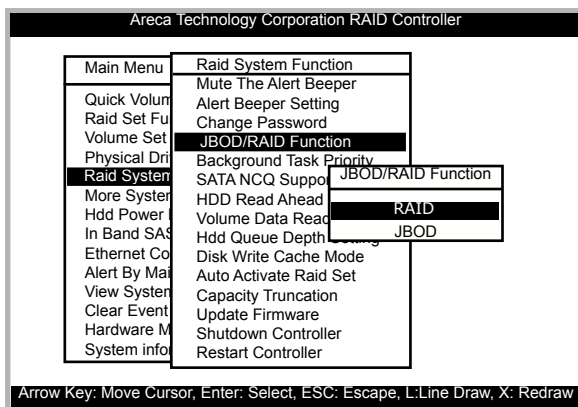
The manufacture default password is set to 0000. The password option allows user to set or clear the password protection feature. Once the password has been set, the user can monitor and configure the controller only by providing the correct password. This feature is used to protect the internal RAID 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

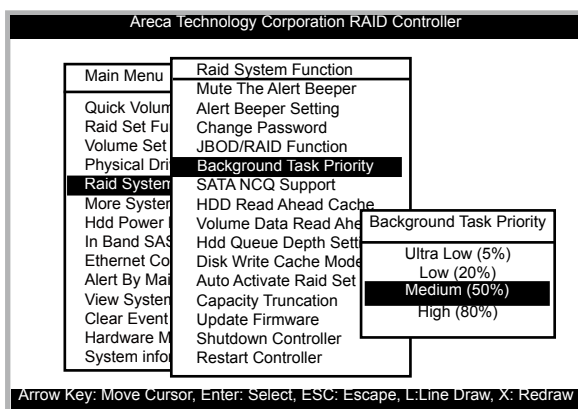
JBOD is an acronym for "Just a Bunch Of Disk". A group of hard disks in a RAID subsystem are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to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

VT-100 UTILITY CONFIGURATION



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.

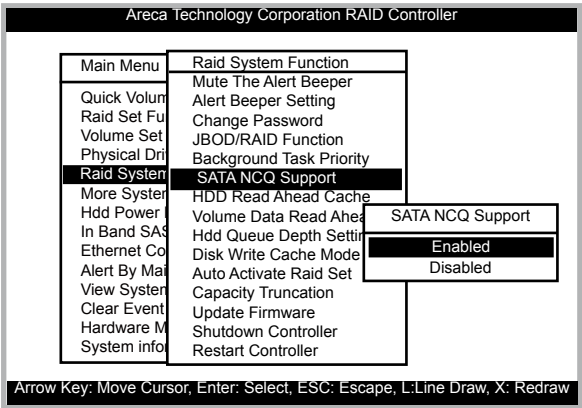


5.5.5.6 SATA NCQ Support

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

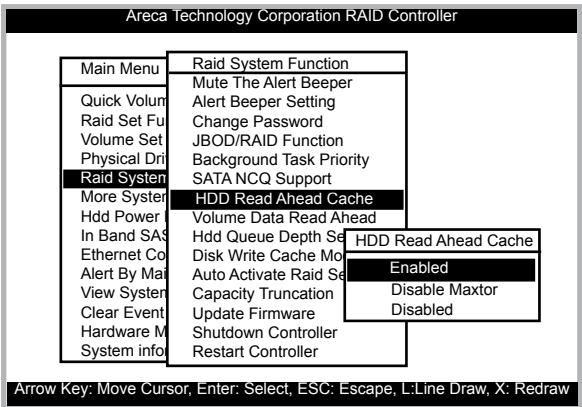
VT-100 UTILITY CONFIGURATION

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

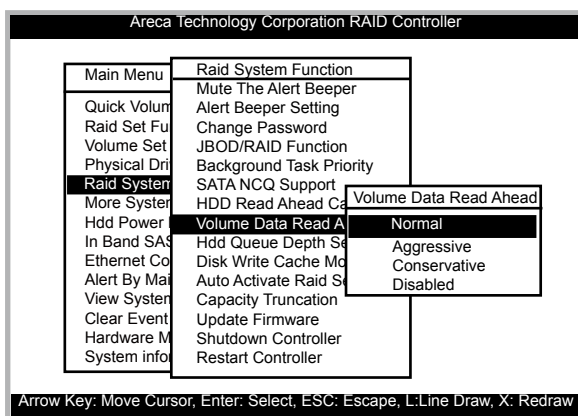
Allow Read Ahead (Default: Enabled)—When Enabled, the drive's read ahead cache algorithm is used, providing maximum performance under most circumstances.



VT-100 UTILITY CONFIGURATION

5.5.5.8 Volume Data Read Ahead

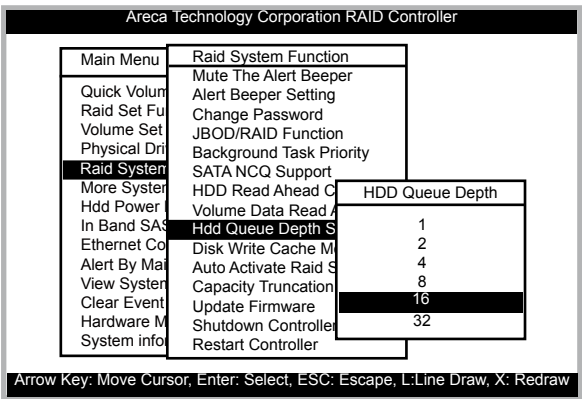
The "Data Read Ahead" parameter specifies the controller firmware algorithms which process the read ahead data blocks from the disk. The "Data Read Ahead" parameter is normal by default. To modify the value, you must know the application behavior. The default "Normal" option satisfies the performance 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 Hdd Queue Depth Setting

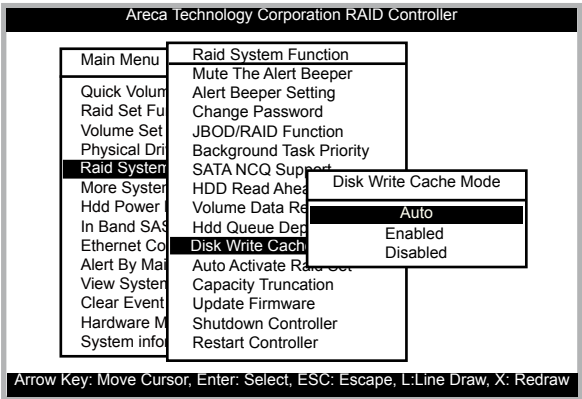
This parameter is adjusted the queue depth capacity of NCQ (SAS HDD) or Tagged Command Queuing (SAS HDD) which transmits multiple commands to a single target without waiting for the initial command to complete.

VT-100 UTILITY CONFIGURATION



5.5.5.10 Disk Write Cache Mode

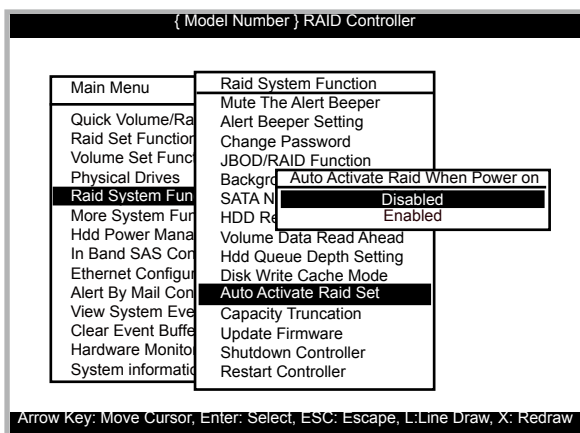
User can set the “Disk Write Cache Mode” to Auto, Enabled, or Disabled. “Enabled” increases speed, “Disabled” increases reliability.



5.5.5.11 Auto Activate Raid Set

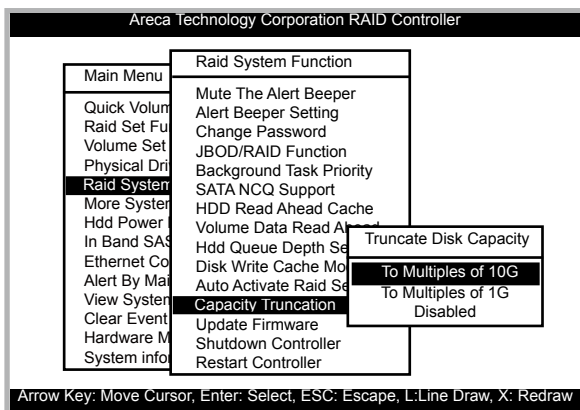
When some of the disk drives are removed in power off state or boot up stage, the RAID set state will change to “Incomplete State”. But if a user wants to automatically continue to work while the RAID subsystem is powered on, then user can set the “Auto Activate Raid Set” option to “Enabled”. The RAID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

VT-100 UTILITY CONFIGURATION



5.5.5.12 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"**.



VT-100 UTILITY CONFIGURATION

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. 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.

5.5.5.13 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 management through the controller's LAN port.

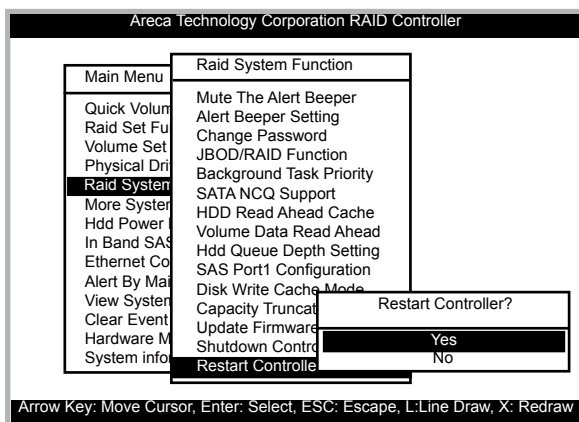
5.5.5.14 Shutdown Controller

Use the "Shutdown Controller" function to flash the cache data to HDD and shutdown the 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 select "Shutdown Controller" item. The shutdown controller confirmation screen appears. Select **Yes** key to flash the cache to HDD and ARC-72xx RAID controller.

VT-100 UTILITY CONFIGURATION

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



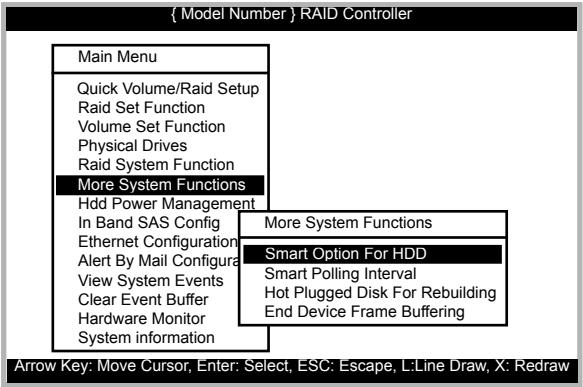
Note:

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

5.5.6 More System Functions

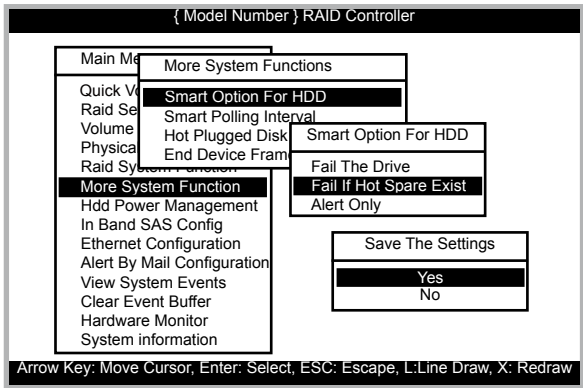
To set the "More System Functions", move the cursor bar to the main menu and select the "More System Functions" item and then press **Enter** key. The "More System Functions" menu will show multiple items. Move the cursor bar to an item, then press **Enter** key to select the desired function.

VT-100 UTILITY CONFIGURATION



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.

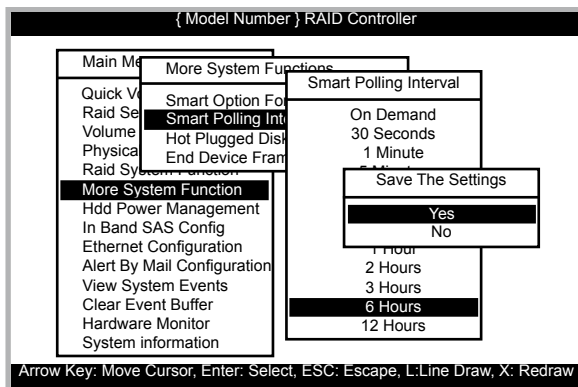
"Fail If Hot Spare Exist" – controllers kill off the SMART fail disk if hot spare drive is existed.

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

VT-100 UTILITY CONFIGURATION

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.



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".

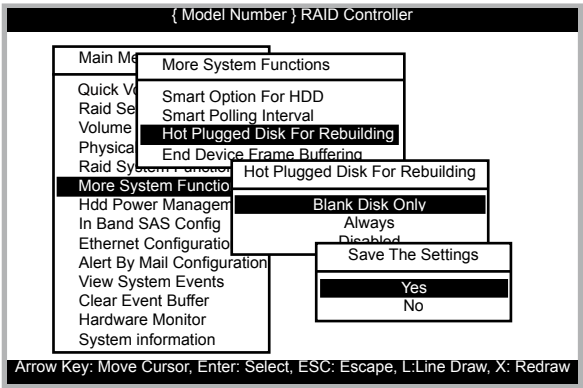
"Blank Disk Only" – it will trigger the rebuilding if and only if the inserted disk has not been in the RAID array before, which has no RAID signature on it. So when a previously removed disk is self re-inserted, it won't trigger the degraded RAID array to rebuild, and so that the administrator has a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

VT-100 UTILITY CONFIGURATION

“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.

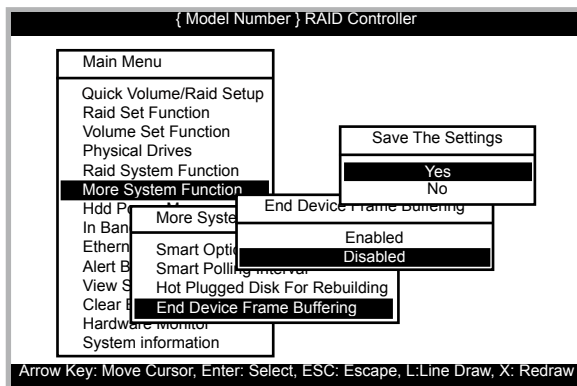
When “Disable” and/or “Blank Disk Only” is selected, the reinserted/previously removed disk will be identified as a disk in a separate RAID set with duplicated RAID set# and with all the rest of RAID members missing.



5.5.6.4 End Device Frame Buffering

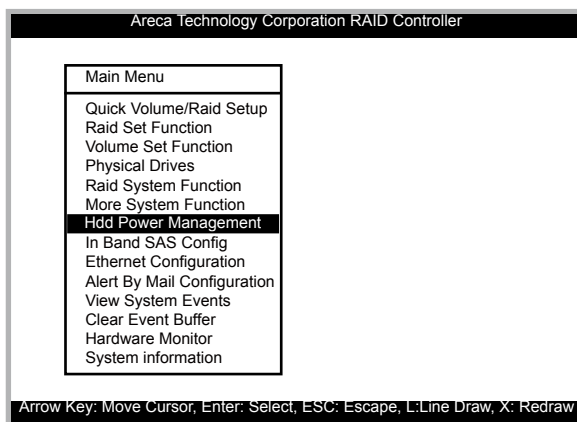
Using the 12Gb/s SAS technology, including End Device Frame Buffering (EDFB) technology, the ROC and expander are designed to help ease the industry’s transition to 12Gb/s SAS-enabled systems by enabling customers to take advantage of 12Gb/s speeds while using existing 6Gb/s drives and backplane infrastructure.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

VT-100 UTILITY CONFIGURATION



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.

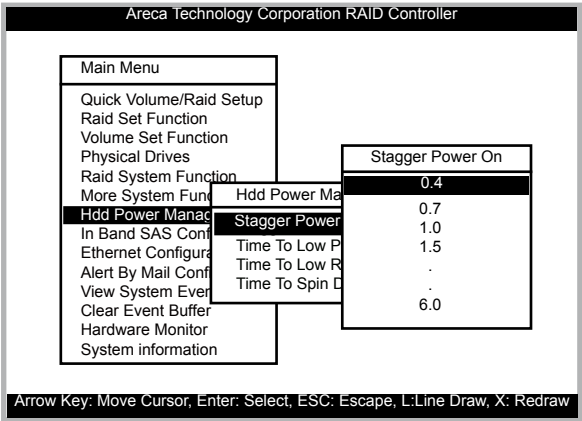


VT-100 UTILITY CONFIGURATION

5.5.7.1 Stagger Power On

In a PC system with only one or two drives, the power can supply enough power to spin up both drives simultaneously. But in systems 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 system components. This damage can be avoided by allowing the host 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 host 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.

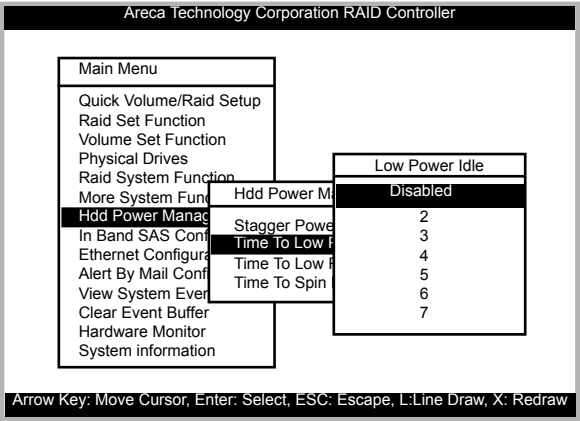
Areca RAID controller has included the option for customer to select the disk drives sequentially stagger power up value. The values can be selected from 0.4s to 6s per step which powers up one group of drives.



VT-100 UTILITY CONFIGURATION

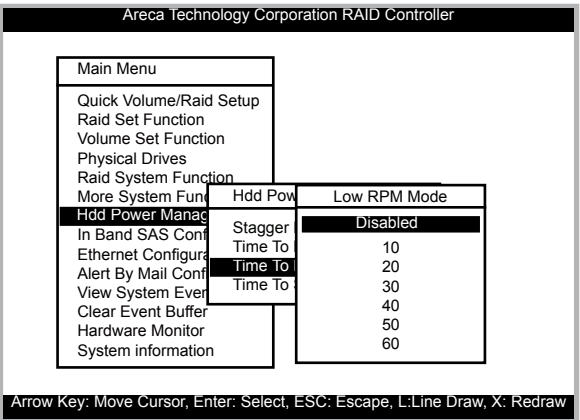
5.5.7.2 Time to Hdd Low Power Idle (Minutes)

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 Low RPM Mode (Minutes)

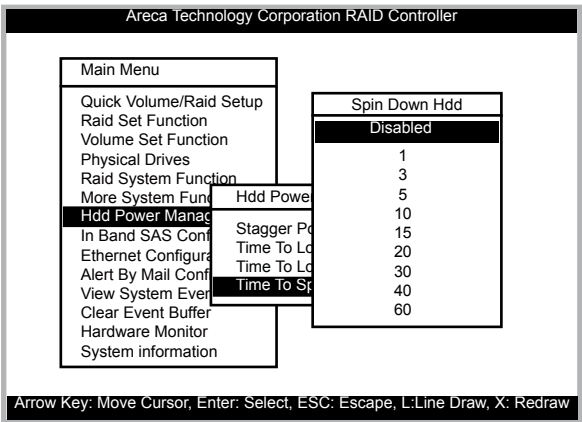
This function can automatically spin disks at lower RPM if there have not been used during the setting idle time. The values can be selected "Disabled" or within the range 10 to 60 minutes.



VT-100 UTILITY CONFIGURATION

5.5.7.4 Time To Spin Down Idle Hdd (Minutes)

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.

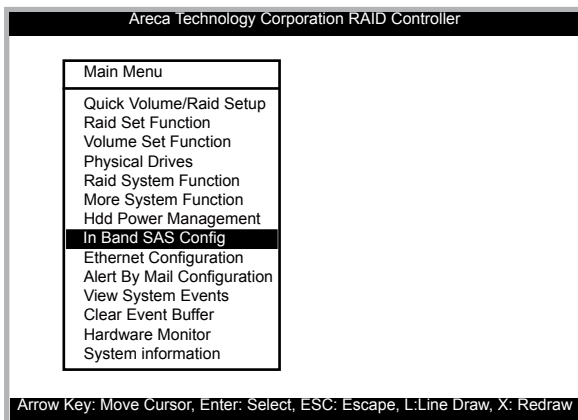


5.5.8 In Band SAS Config

The RAID manager supports both in-band and out-of-band management to control the disk array system. 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 network cable. In-band management is simpler than out-of-band management for it requires less hardware in its configuration.

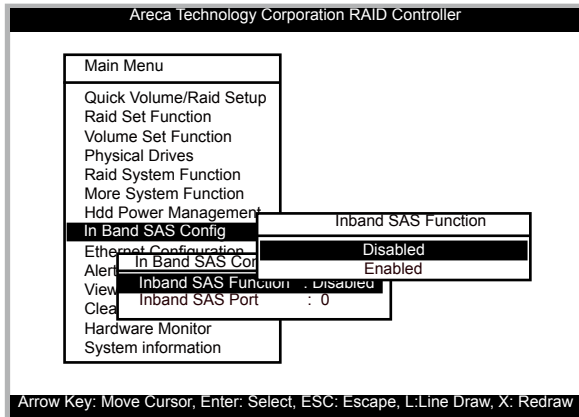
Since the host adapter is already installed in the host system, no extra connection is necessary. Just load the necessary in-band driver for the controller and then combine the API with user's RAID manager from the local host to start management of the disk array system.

VT-100 UTILITY CONFIGURATION



5.5.8.1 Inband SAS Function

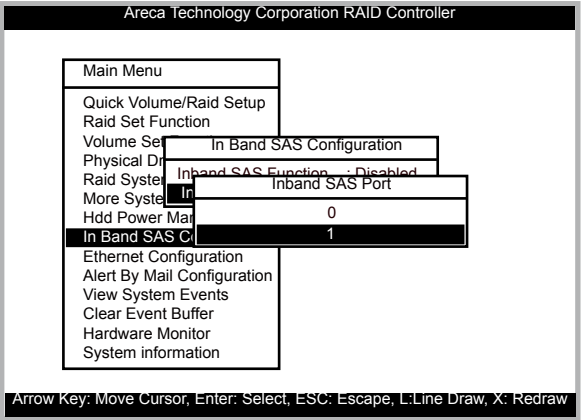
The RAID subsystem reserves one LUN for In-band management transactions. This option is for user to release the LUN when In-band management is not enabled.



5.5.8.2 Inband SAS Port

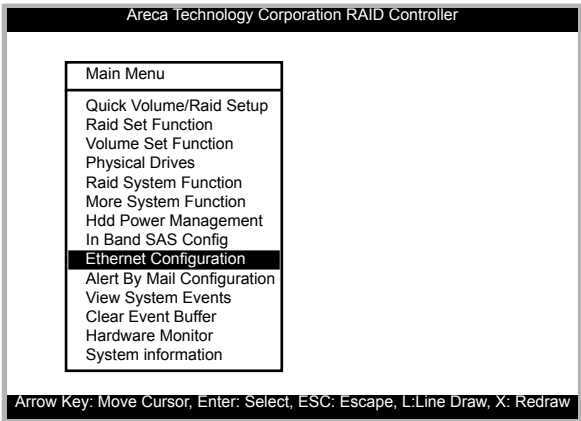
Since the SAS RAID controller supports two SAS host ports, the In-band can through either SAS port 0 or port 1. If you configure the Host/JBOD port as a JBOD function on the "Raid System Function", then there will be no function on the selection of '1' option.

VT-100 UTILITY CONFIGURATION



5.5.9 Ethernet Configuration

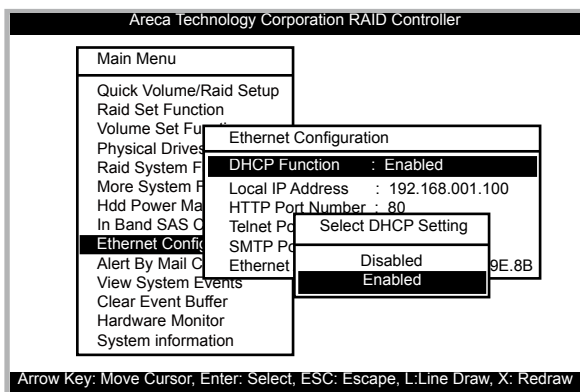
Use this feature to set the controller Ethernet port configuration. It is not necessary to create reserved disk space on any hard disk for the Ethernet port and HTTP service to function; these functions are built into the controller firmware. Move the cursor bar to the main menu "Ethernet Configuration 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.

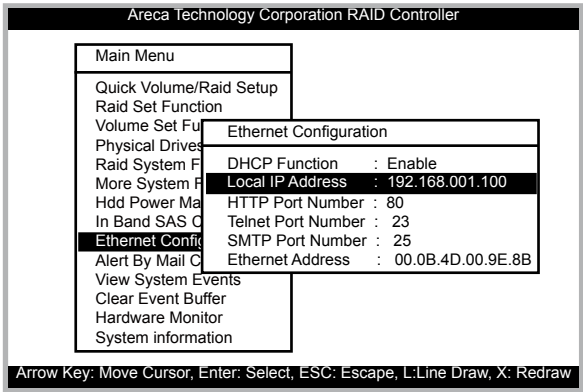


5.5.9.2 Local IP Address

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

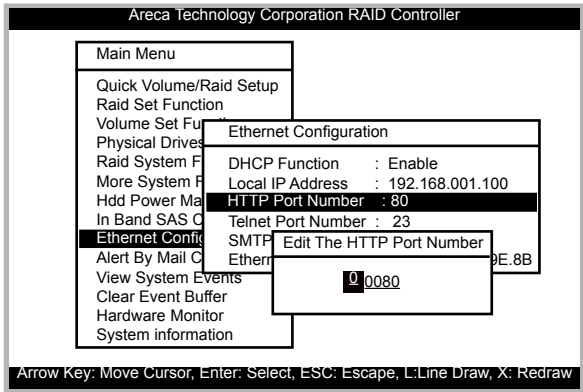
VT-100 UTILITY CONFIGURATION

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.



5.5.9.3 HTTP Port Number

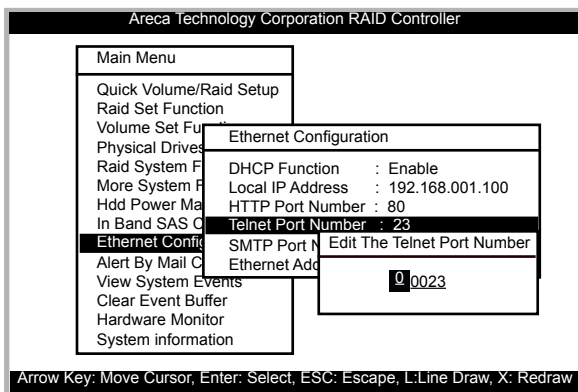
To manually configure the “HTTP Port Number” of the controller, move the cursor bar to “HTTP Port Number” item, then press the **Enter** key to show the default address setting in the RAID subsystem. Then You can reassign the default “HTTP Port Number” of the controller.



VT-100 UTILITY CONFIGURATION

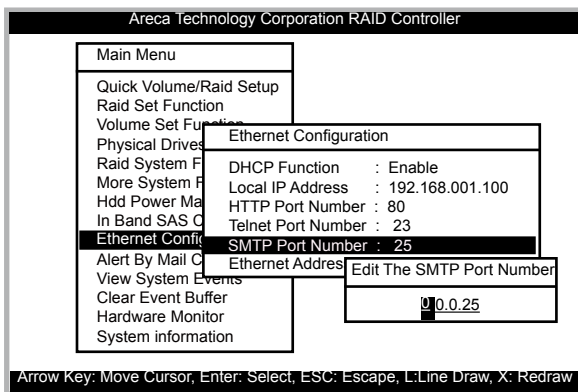
5.5.9.4 Telnet Port Number

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.



5.5.9.5 SMTP Port Number

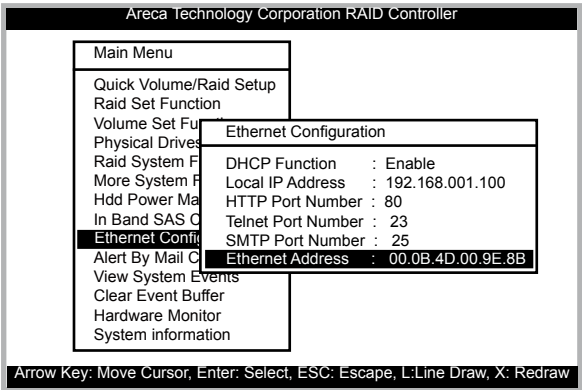
To manually configure the “SMTP Port Number” of the controller, move the cursor bar to the main menu “Ethernet Configuration” function item and then press **Enter** key. The “Ethernet Configuration” menu appears on the screen. Move the cursor bar to “SMTP Port Number” item, then press **Enter** key to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



VT-100 UTILITY CONFIGURATION

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.



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.

VT-100 UTILITY CONFIGURATION

{ Model Number } RAID Controller

Main Menu	
Quick Volume/Format	
Raid Set Function	
Volume Set Function	
Physical Drives	
Raid System Function	
More System Function	
Hdd Power Management	
In Band SAS Configuration	
Ethernet Configuration	
Alert By Mail Configuration	
View System Event Log	
Clear Event Buffer	
Hardware Monitor	
System information	

Alert By Mail Configuration	
SMTP Server IP Addr :	000.000.000.000
Mail Sender Name :	
Mail Sender Address :	
Mail Account :	
Mail Account Password :	
Save The Settings	
EventNotification 1 :	Yes
EventNotification 2 :	No
EventNotification 3 :	
EventNotification 4 :	Enter

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

5.5.10.2 Mail Address Configurations

{ Model Number } RAID Controller

Main Menu	
Quick Volume/Format	
Raid Set Function	
Volume Set Function	
Physical Drives	
Raid System Function	
More System Function	
Hdd Power Management	
In Band SAS Configuration	
Ethernet Configuration	
Alert By Mail Configuration	
View System Event Log	
Clear Event Buffer	
Hardware Monitor	
System information	

Alert By Mail Configuration	
SMTP Server IP Addr :	000.000.000.000
Mail Sender Name :	
Mail Sender Address :	
Mail Account :	
Mail Account Password :	
Edit Mail Sender Name	
EventNotification 1 :	
EventNotification 2 :	
EventNotification 3 :	Enter
EventNotification 4 :	Enter

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

- **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.

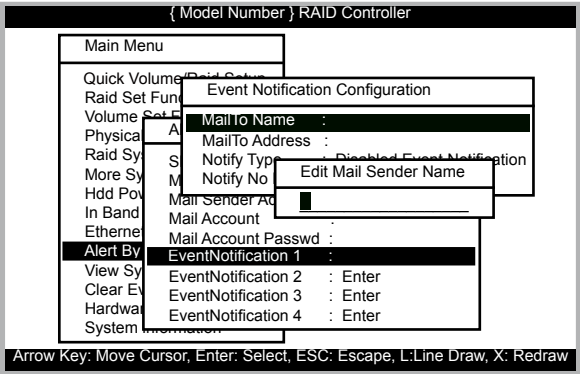
VT-100 UTILITY CONFIGURATION

- **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.

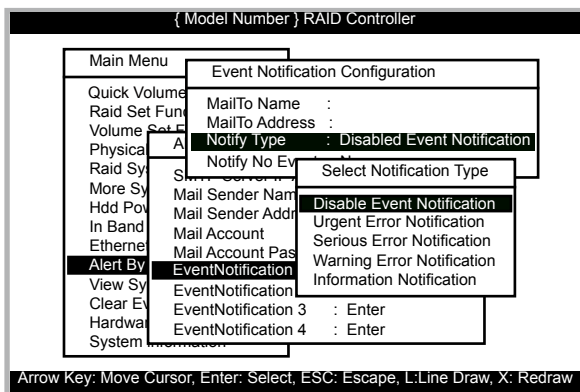
- **MailTo Address**

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

- **Notify Type**

According to your requirement, set the corresponding event level:

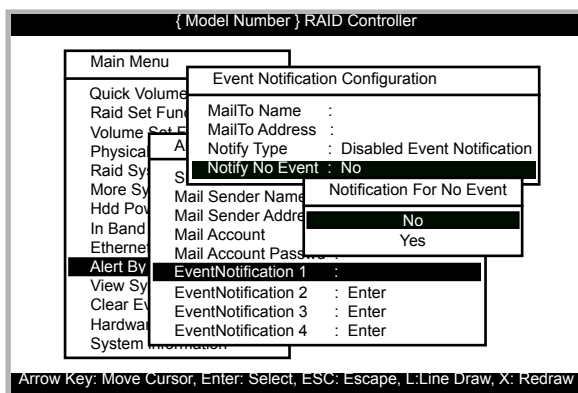
VT-100 UTILITY CONFIGURATION



- 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.

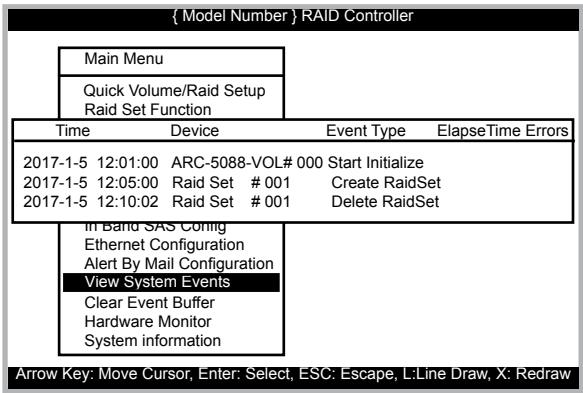
• Notify No Event

Notify user if no event occurs within 24 hours.



VT-100 UTILITY CONFIGURATION

5.5.11 View System Events



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.

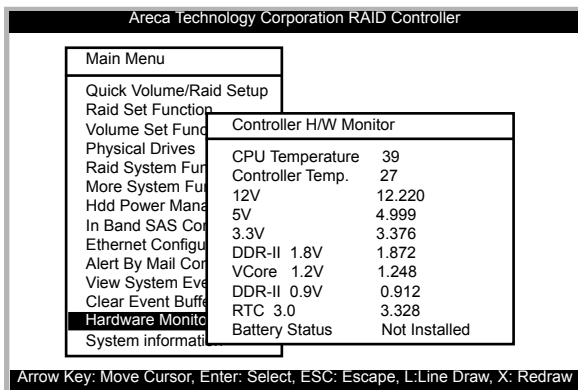
5.5.12 Clear Events Buffer

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.

VT-100 UTILITY CONFIGURATION



5.5.14 System Information

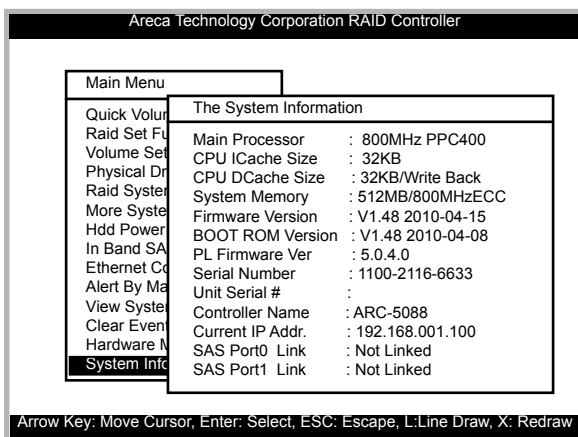
Choose this option to display the controller's hardware firmware information. The controller provides two four-link connector for the Host and one four-link connector for Host or JBOD. It may has problem between the host/JBOD and controller. The port link provides current working port link status. The option for port link is defined below.

Not Linked → Fail or no link to host/JBOD

1x600 → Single-link for use

2x600 → Two-link for use

4x600 → 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 Ethernet 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.

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[open all][close all]

- Raid System Console
- Quick Function
- RAID Set Functions
- Volume Set Functions
- Security Functions
- Physical Drives
- System Controls
- Information
 - RAIDSet Hierarchy
 - SAS Chip Information
 - System Information
 - Hardware Monitor
 - Debug Message

Stop Auto Refresh

RAIDSet Hierarchy

RAID Set	Devices	Volume Set(Port/Lun)	Volume State	Capacity
Raid Set # 000	E#1Slot#1	ABC-S08B-VOL#000(081/0)	Migrating(99.2%)	50.0GB
	E#1Slot#6	ABC-S08B-VOL#001(081/1)	Need Migrate	49.9GB
	E#1Slot#5	ABC-S08B-VOL#000(081/2)	Normal	49.9GB
	E#1Slot#6	ABC-S08B-VOL#003(081/2)	Need Migrate	50.0GB
	E#1Slot#7	ABC-S08B-VOL#004(081/2)	Need Migrate	49.9GB
	E#1Slot#8			
	E#1Slot#9			
	E#1Slot#10			
	E#1Slot#11			
	E#1Slot#12			
	E#1Slot#13			
	E#1Slot#14			
	E#1Slot#15			
	E#1Slot#16			

Enclosure#1: SAS RAID Subsystem V1.0

Device	Usage	Capacity	Model
Slot#1(E)	Raid Set # 000 (0A)	4000.0GB	ST4000NM0033-92M170
Slot#2	N.A.	N.A.	N.A.
Slot#3	N.A.	N.A.	N.A.

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. On the left is a navigation menu with items: Raid System Console, Quick Function (selected), 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 (dropdown)
- Maximum Capacity Allowed: 800 GB
- Select Capacity: 800 GB
- Volume Initialization Mode: Foreground Initialization (dropdown)
- Select Stripe Size: 64 KBytes

At the bottom, there is a 'Confirm The Operation' checkbox 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:

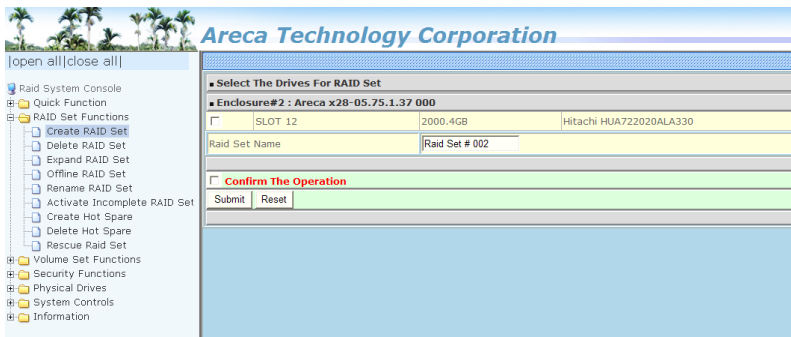
In "Quick Create", your volume set is automatically configured based on the number of disks in your system. Use the "Raid Set Functions" and "Volume Set Functions" if you prefer to customize your volume set, or RAID 30/50/60 volume set.

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)/3/50/60 and 128 for RAID 30/50/60.

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”. It will be deleted by this action. But for the Raid 30/50/60, you need to delete the volumes belonging to those RAID sets.

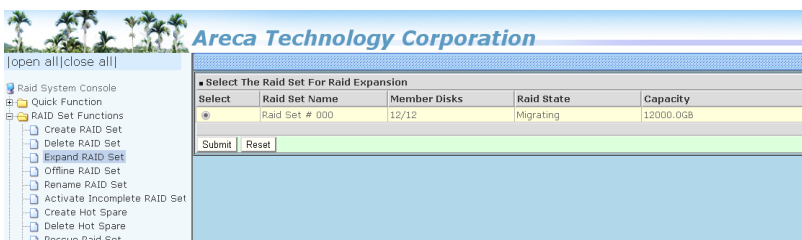


6.5.3 Expand Raid Set

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.
3. Press the Yes to start the expansion on the RAID set.



WEB BROWSER-BASED CONFIGURATION

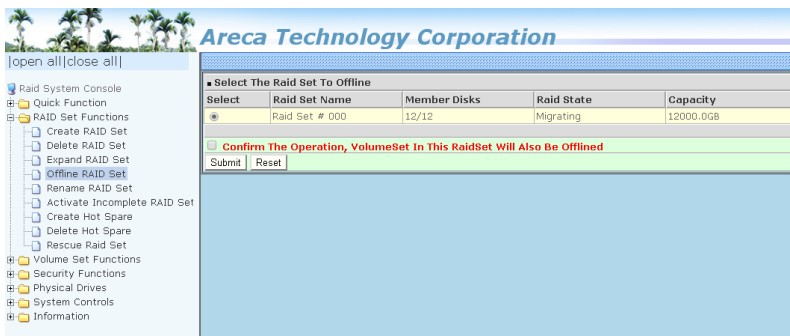
The new additional capacity can be utilized by one or more volume sets. The volume sets associated with this RAID set appear for you to have chance to modify RAID level or stripe size. Follow the instruction presented in the "Modify Volume Set" to modify the volume sets; operation system specific utilities 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

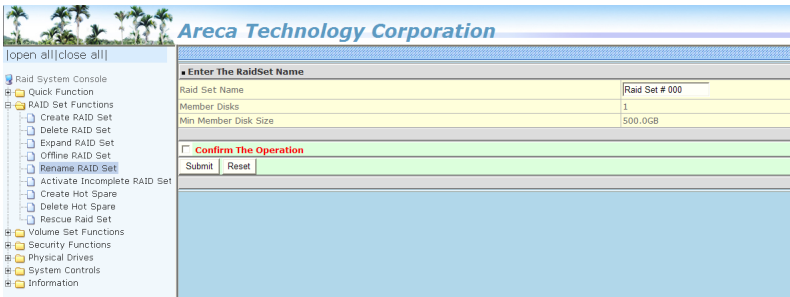
This function is for customer being able to unmount and remount a multi-disk volume. All Hdds of the selected RAID set will be put into offline state, spun down and fault LED in fast blinking mode. User can remove those Hdds and insert new Hdds on those empty slots without needing power down the controller.



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:

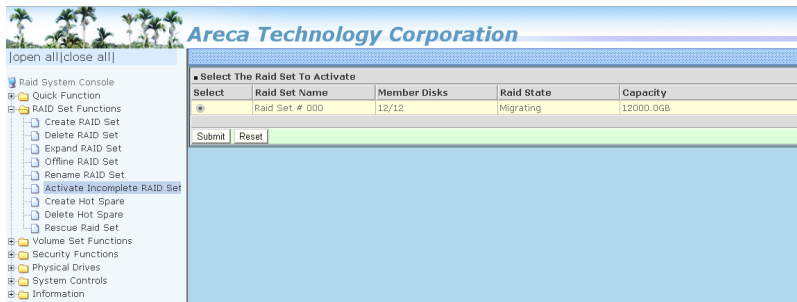
1. Click on the "Rename Raid Set" link.
2. Click the RAID set check box from the list that you wish to rename. Click the "Submit" button. The following screen appears. Use this option to rename the RAID set name.



6.5.6 Activate Incomplete Raid Set

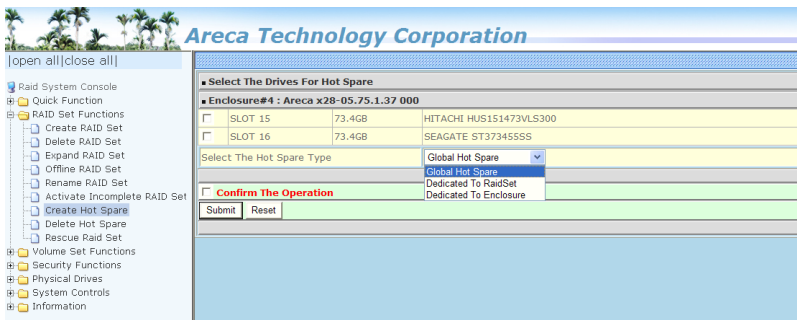
If one of the disk drives is removed in power off state, the RAID set state will change to "Incomplete State". If the user wants to continue to operate the controller without power-off the RAID subsystem, the user can use the "Activate Incomplete Raid Set" option to active the RAID set. After the user 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.



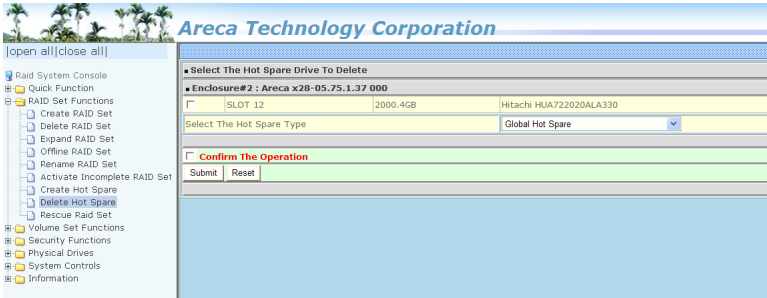
6.5.7 Create Hot Spare

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” gives you the ability to define a global or dedicated hot spare. Unlike “Global Hot Spare” which can be used with any RAID sets, “Dedicated Hot Spare” can only be used with a specific RAID set or Enclosure. When a disk drive fails in the RAID set or enclosure with a dedicated Hot Spare is pre-set, data on the disk drive is rebuild automatically on the dedicated hot spare disk.



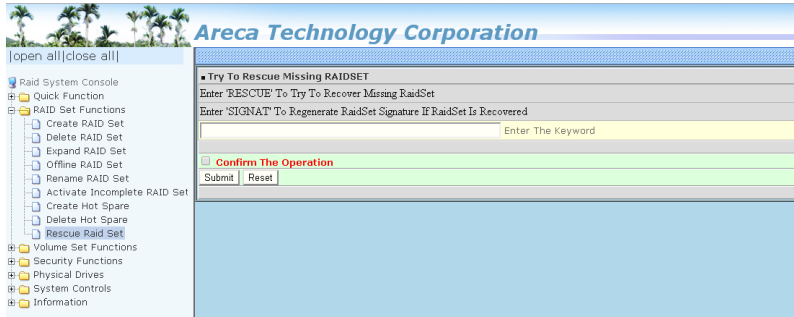
6.5.8 Delete Hot Spare

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.



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 two TB, because the controller is capable of 64-bit LBA mode. However the operating system itself may not be capable of addressing more than 2TB.

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, Tagged Command Queuing, SAS Port/LUN Base/LUN and Volumes To Be Created.

WEB BROWSER-BASED CONFIGURATION

Areca Technology Corporation

[open all] [close all]

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

Enter The Volume Attribute

Volume Name	ARC-5088-VOL005
Member Disks	12
Volume Raid Level	Raid 6
Max Capacity Allowed	9734.3 GB
Select Volume Capacity	9734.3 GB
Greater Two TB Volume Support	64bit LBA
Volume Initialization Mode	Foreground Initialization
Volume Stripe Size	64 KBytes
Volume Cache Mode	Write Back
Volume Write Protection	Disabled
Tagged Command Queuing	Enabled
SAS Port Mapping	<input checked="" type="checkbox"/> Port0 <input type="checkbox"/> Port1
LUN Base: LUN	0 5
Volumes To Be Created	1

Confirm The Operation

Submit Reset

- **Volume Name**

The default volume name will always appear as "ARC-5088-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 from the available levels option.

- **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 2TB, controller will show the "Greater Two TB Volume Support" sub-menu. Greater Two TB Volume Support option: "No", "64bit LBA" and "4K Block".

- **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 is up to 512TB. For any hard disk drives working in the 4K native mode in the Raid set,

WEB BROWSER-BASED CONFIGURATION

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 option 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, 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.

WEB BROWSER-BASED CONFIGURATION

- **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-port 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.

- **Volume To Be Created**

The controller 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)

Areca Technology Corporation

[open all][close all]

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

Enter The Volume Attribute

Volume Name	ARC-5088-VOL#000
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

☐ Confirm The Operation

Submit Reset

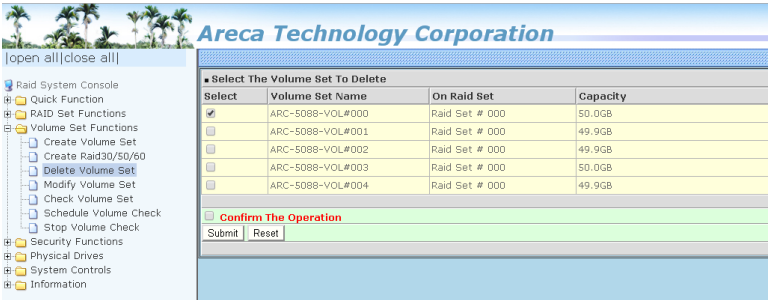
To create 30/50/60 volume set from RAID set group, move the cursor bar to the main menu and click on the "Create Raid30/50/60" link. The "Select The Raid Set To Create Volume On It" screen will show all RAID set number. Tick on the RAID set numbers (same disk No per RAID set) that you want to create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

WEB BROWSER-BASED CONFIGURATION

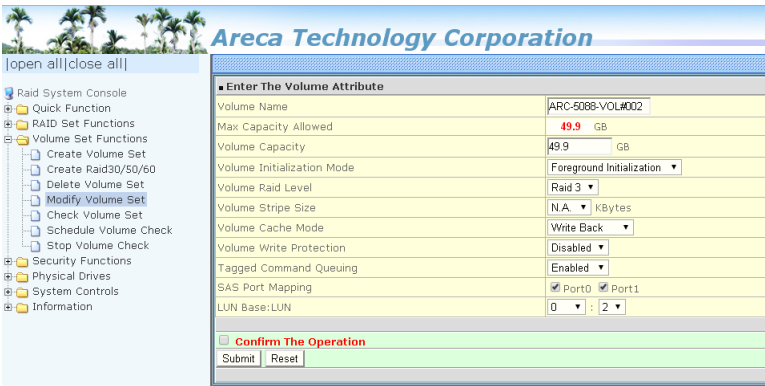


6.6.4 Modify Volume Set

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 on "Enter The Volume Attribute" screen 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.



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 entry 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. If you have free spaces from reserved or delete volumes, you can enlarge the last volume set size before the free spaces.

To expand an existing volume noticed:

- Only the last volume can expand capacity.
- When expand 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.

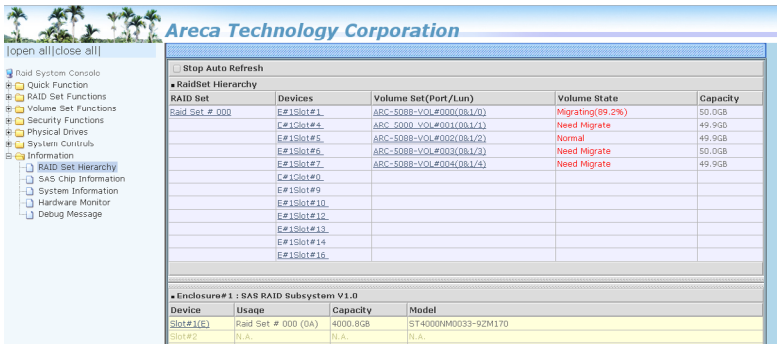
For greater 2TB expansion:

- 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 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.

WEB BROWSER-BASED CONFIGURATION



open all | close all

Areca Technology Corporation

Stop Auto Refresh

RAID Set Hierarchy

RAID Set	Devices	Volume Set (Port/Lun)	Volume State	Capacity
Raid Set # 000	[E]Slot#1	ABC-S08B-VOL#000(OB1/0)	Migrating(99.2%)	50.0GB
	[E]Slot#4	ABC-S000-VOL#000(OB1/1)	Need Migrate	49.9GB
	[E]Slot#5	ABC-S08B-VOL#000(OB1/2)	Normal	49.9GB
	[E]Slot#6	ABC-S08B-VOL#000(OB1/3)	Need Migrate	50.0GB
	[E]Slot#7	ABC-S08B-VOL#000(OB1/4)	Need Migrate	49.9GB
	[E]Slot#8			
	[E]Slot#9			
	[E]Slot#10			
	[E]Slot#12			
	[E]Slot#13			
	[E]Slot#14			
	[E]Slot#16			

Enclosure#1 : SAS RAID Subsystem V1.0

Device	Usage	Capacity	Model
Slot#1(E)	Raid Set # 000 (OA)	4000.0GB	ST4000HM0033-9ZM170
Slot#2	N/A	N/A	N/A

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.

WEB BROWSER-BASED CONFIGURATION

Select	Volume Set Name	On Raid Set	Capacity
<input type="checkbox"/>	ARC-S088-VOL#000	Raid Set # 000	50.0GB
<input type="checkbox"/>	ARC-S088-VOL#001	Raid Set # 000	49.9GB
<input type="checkbox"/>	ARC-S088-VOL#002	Raid Set # 000	49.9GB

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

Confirm The Operation
Submit Reset

6.6.6 Schedule Volume Check

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.

Scheduled Volume Checking
Scheduler : Disabled
Checking After System Idle : No
☐ Scrub Bad Block If Bad Block Is Found, Assume Parity Data Is Good.
☐ Re-compute Parity If Parity Error Is Found, Assume Data Is Good.

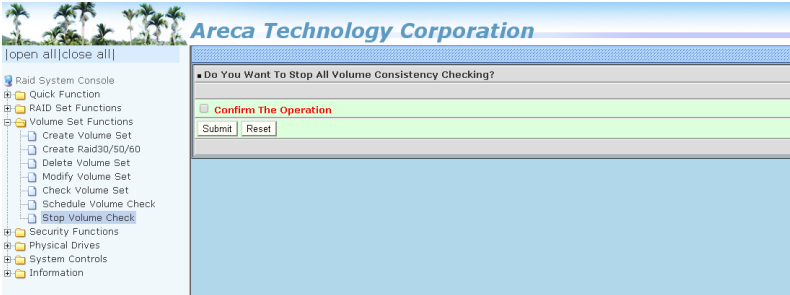
Confirm The Operation
Submit Reset

Note:

Please make sure of the inconsistency source generated by parity error or bad block before you click the recovery method. Otherwise, you will lose the recovery data.

6.6.7 Stop Volume Check

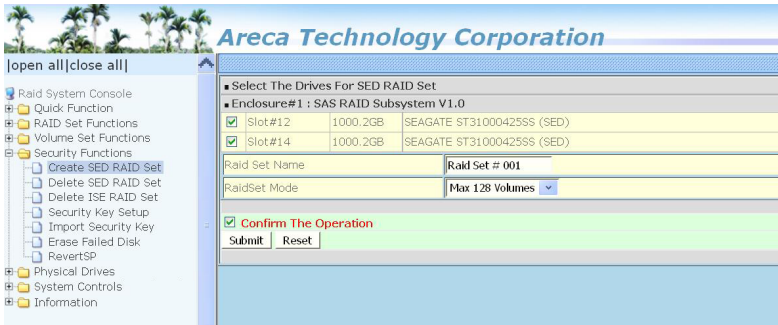
Use this option to stop the “Check Volume Set” function



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.

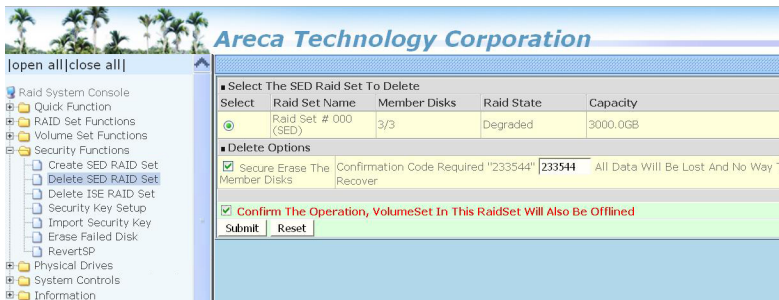
6.7.1 Create SED RAID Set



WEB BROWSER-BASED CONFIGURATION

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



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.

WEB BROWSER-BASED CONFIGURATION

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.

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 con-

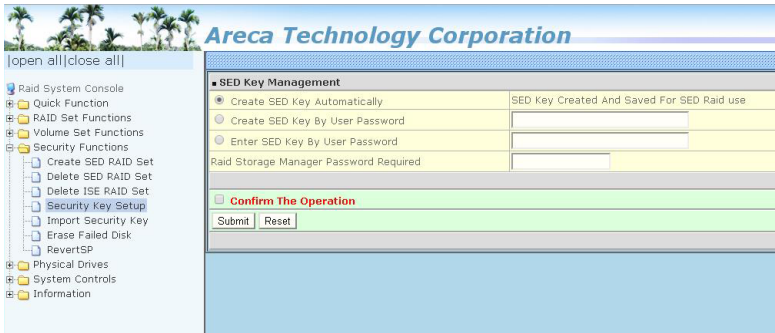
WEB BROWSER-BASED CONFIGURATION

troller 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.



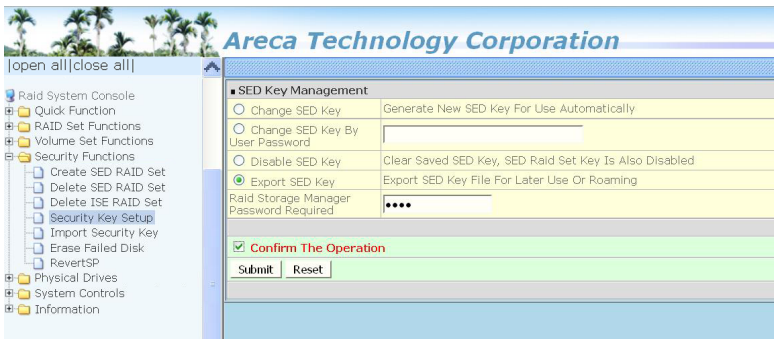
6.7.4.2 SED Key Management-Modification

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.

WEB BROWSER-BASED CONFIGURATION



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.

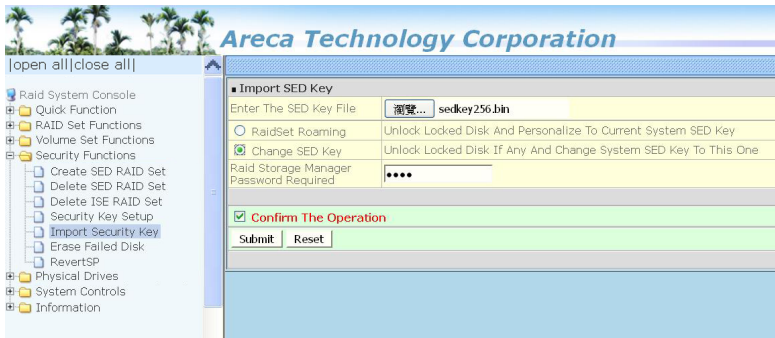


6.7.5 Import Security Key

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.

WEB BROWSER-BASED CONFIGURATION

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.



6.7.6 Erase Failed Disk

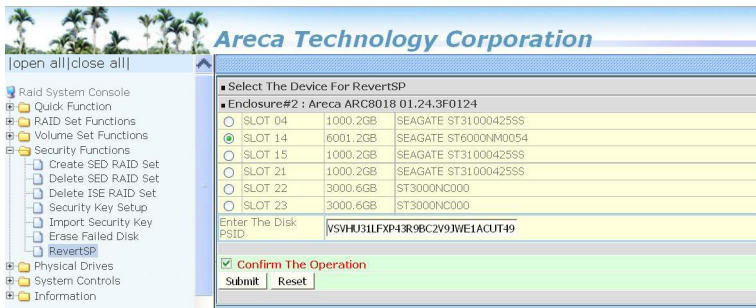
To erase the failed encryption-capable physical disk, move the cursor bar to the main menu and click on the "Erase Failed Disk " link. The "Select The Device To Erase" screen will show all failed encryption-capable physical disks. Tick on the failed disk that you want to erase and then click on the "Submit" 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.



WEB BROWSER-BASED CONFIGURATION

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.



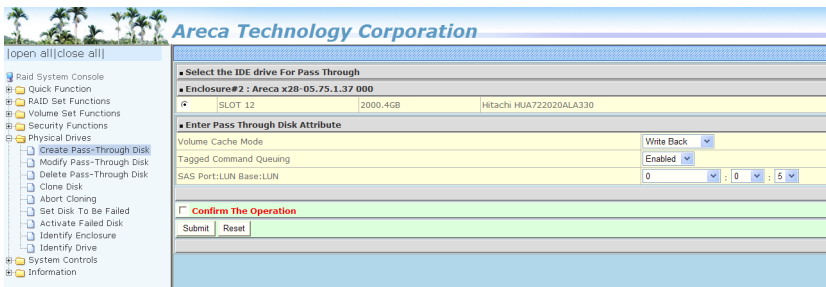
6.8 Physical Drive

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 Volume Cache Mode, Write Protection, Tagged Command Queuing, and SAS Port/LUN Base/LUN for this pass-through disk.

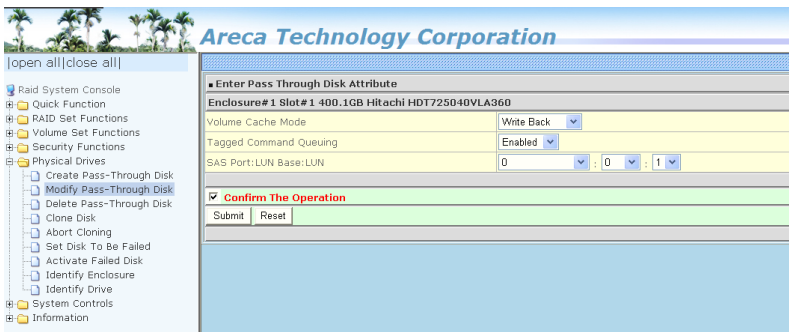
WEB BROWSER-BASED CONFIGURATION



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 pass-through disk.

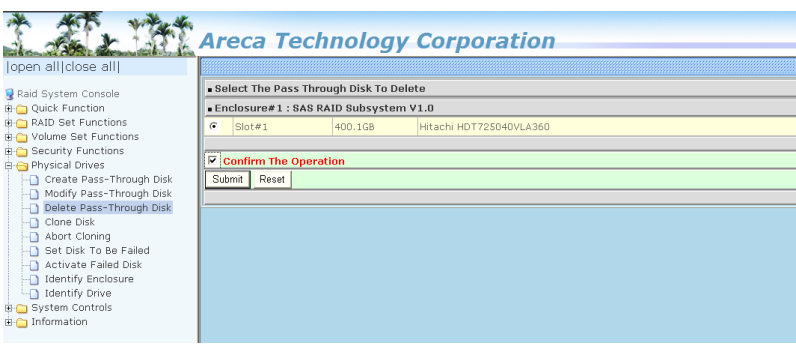
To modify the pass-through drive attribute from the pass-through drive pool, move the mouse cursor bar and click on the "Modify a Pass-Through" link. The "Select The Pass Through Disk For Modification" screen appears mark the check box for the pass-through disk from the pass-through drive pool and click on the "Submit" button to select 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.



WEB BROWSER-BASED CONFIGURATION

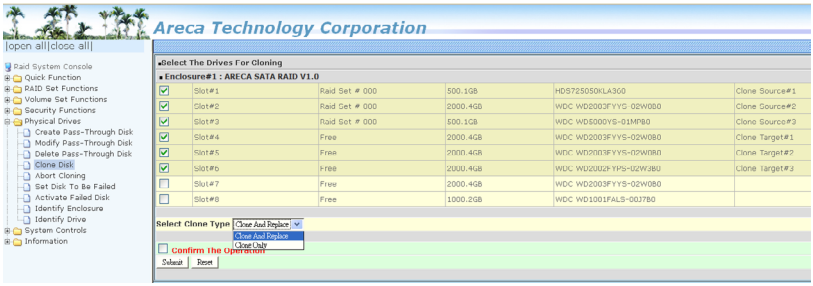
6.8.3 Delete Pass-Through Disk

To delete a pass-through drive from the pass-through drive pool, move the mouse cursor bar to the main menus and click on 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 Clone Disk

Instead of deleting a RAID set and recreating it with larger disk drives, the "Clone Disk" function allows the users to replace larger disk drives to the RAID set that have already been created. Click on the "Clone Disk" option on the "Physical Drives" link to enable the clone function. If there is an available disk, then the "Select The Drives For Cloning" screen appears. There are two "Clone Disk" function options: "Clone And Replace" and "Clone Only."



WEB BROWSER-BASED CONFIGURATION

Clone Disk Procedure

1. Select one of the members as the "Clone Source" (status indicated as Raid Set #) by clicking on the appropriate check box.
2. Select a "Clone Target" (status indicated as Free or Hot Spare) by clicking on the appropriate check box.
3. If you have available disk member, you can repeat above procedures to define another clone pair.
4. Select clone type.

The pair number for both the "Clone Source" and the "Clone Target" will be indicated in the screen. Tick on the "Confirm The Operation" check box and click on the "Submit" button on the screen; the controller will automatically start the cloning process using the existing "stand-by" (Free or Hot Spare drive) to clone the source drive (the Raid Set member drive). The cloning process percentage will be indicated in the "Volume State" area of the "Volume Set Information" screen. Completion of the Clone function process will be indicated by a notification message on the event log.

6.8.4.1 Clone And Replace

You can enlarge your logical drives by copying and replacing all member drives with drives of higher capacity. The existing data in the logical drives is copied onto the new drives, and then the original members are marked as "Offlined".

6.8.4.2 Clone Only

The stand-by disk will clone the logical drives without substituting it. The status of the stand-by drive will be marked as "Offlined" after the cloning process. The source drive will remain a member of the logical drive.

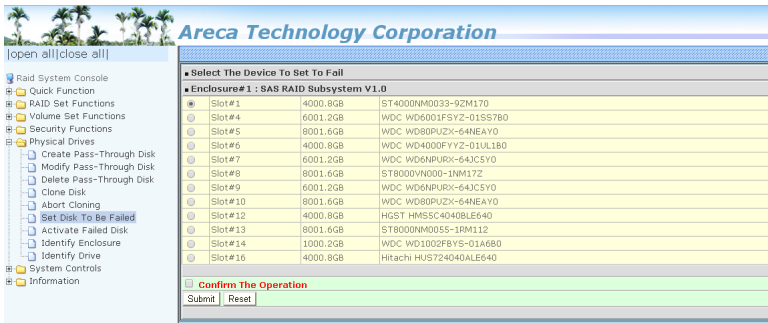
6.8.5 Abort Cloning

Use this function to stop the ongoing clone disk action.

WEB BROWSER-BASED CONFIGURATION

6.8.6 Set Disk To Be Failed

It sets a normal working disk as “failed” so that users can test some of the features and functions.



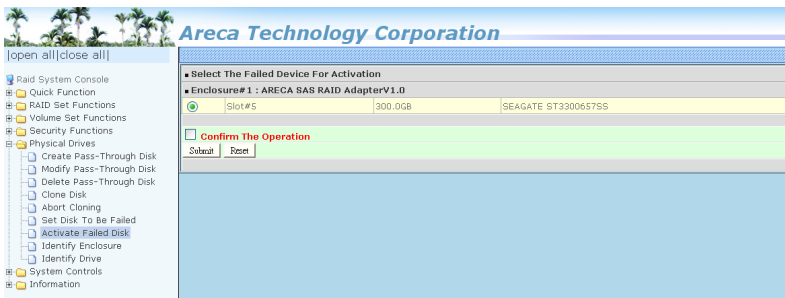
6.8.7 Activate Failed Disk

It forces the current “failed” disk in the system to be back online. “Activate Failed Disk” function has no effect on the removed disks, because a “removed” disk does not give the controller a chance to mark it as “failure”.

Followings are considered as “Removed-Disk”:

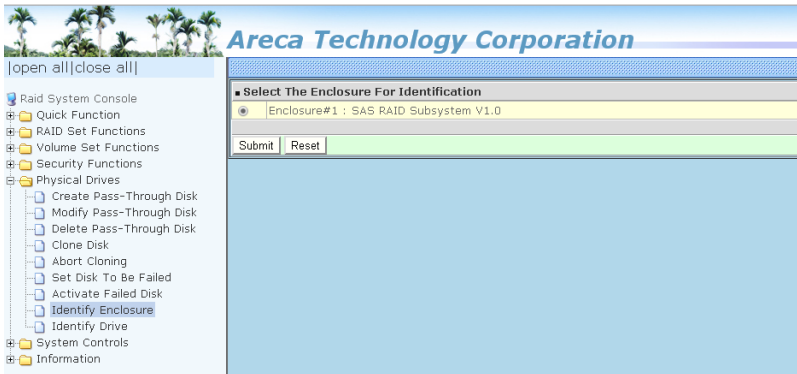
1. Manually removed by user.
2. Losing PHY connection due to bad connector, cable or back-plane.
3. Losing PHY connection due to disk fail.

Basically, in the eyes of the controller, the disk suddenly disappears due to whatever reason.



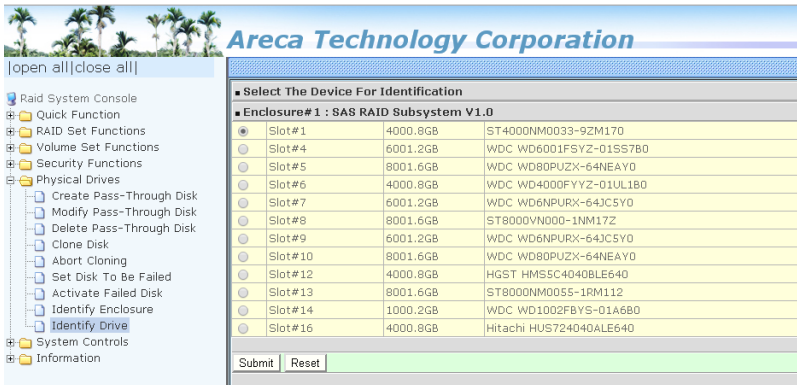
6.8.8 Identify Enclosure

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.



6.8.9 Identify Drive

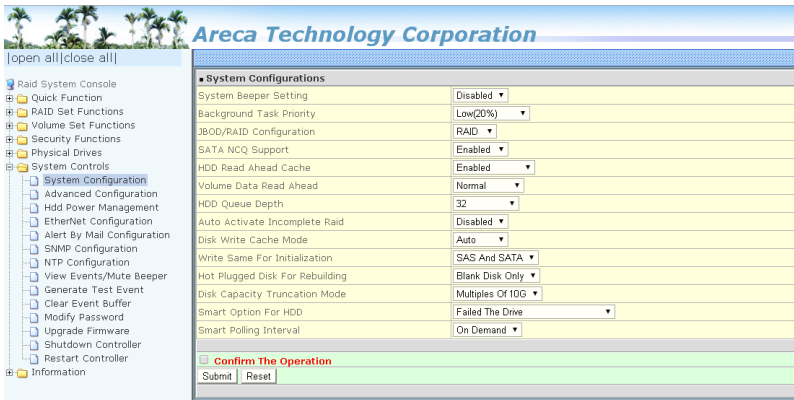
To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the “Identify Selected Device” is selected.



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.

WEB BROWSER-BASED CONFIGURATION

- **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".

- **Write Same For Initialization**

Drives that support the Write Same feature (SCT) can write to multiple drive sectors at once, improving initialization time. To take advantage of this feature, all the drives in the unit must support Write Same. User can set the "SAS And SATA", "SAS Only", "SATA Only" or "Disabled" for the controller initialization.

- **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 reinserted/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.

WEB BROWSER-BASED CONFIGURATION

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 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 tempo-

WEB BROWSER-BASED CONFIGURATION

rally 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.

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.

The screenshot displays the 'Areca Technology Corporation' RAID System Console. On the left is a tree menu with categories like 'Quick Function', 'RAID Set Functions', 'Volume Set Functions', 'Security Functions', 'Physical Drives', 'System Controls', and 'Information'. The 'Advanced Configuration' option under 'System Controls' is selected. The main area shows a table of settings for 'Advanced Configurations'.

■ Advanced Configurations	
TLER Setting	Default ▾
Timeout Setting	8 ▾ Seconds
Number Of Retries	2 ▾
Buffer Threshold Setting	25% ▾
Amount Of Read Ahead	Auto ▾
Number Of AV Streams	6 ▾
Optimize AV Recording	Disabled ▾
Read Performance Margin	No ▾
Write Performance Margin	No ▾
Read And Discard Parity Data	Disabled ▾
Hitachi SATA HDD Speed	Default ▾
WDC SATA HDD Speed	Default ▾
Seagate SATA HDD Speed	Default ▾
System Fan Control	Standard Mode ▾
End Device Frame Buffering	Enabled ▾
Write Cache Amount	Unified ▾

Below the table, there is a checkbox for 'Confirm The Operation' and two buttons: 'Submit' and 'Reset'.

● 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.

WEB BROWSER-BASED CONFIGURATION

- **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.

- **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**

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 AJA mode 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 subsystem. This makes it possible to locate and re-issue the data without repetitive hard parsing activities. The Amount of Read

WEB BROWSER-BASED CONFIGURATION

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.

- **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,

WEB BROWSER-BASED CONFIGURATION

Read/Write Performance Margin, Write cache Amount 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.

● 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%.

WEB BROWSER-BASED CONFIGURATION

<c>. For NON-VIDEO application, the following setting is recommended

Buffer Threshold Setting: 25%

Optimize AV Recording: disabled

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)

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
 - Fibre Channel Config
 - EtherNet Configuration
 - Alert By Mail Configuration
 - SNMP Configuration
 - NTP Configuration
 - View Events/Mute Beeper
 - Generate Test Event
 - Clear Event Buffer
 - Modify Password
 - Upgrade Firmware
 - Shutdown Controller
 - Restart Controller
 - Information

Advanced Configurations

TLER Setting	Default	▼
Timeout Setting	8	Seconds
Number Of Retries	2	▼
Buffer Threshold Setting	25%	▼
Amount Of Read Ahead	Auto	▼
Number Of AV Streams	6	▼
Optimize AV Recording	Disabled	▼
Read Performance Margin	No	▼
Write Performance Margin	No	▼
Read And Discard Parity Data	On	▼
Hitachi SATA HDD Speed	2%	▼
WDC SATA HDD Speed	4%	▼
Seagate SATA HDD Speed	6%	▼
System Fan Control	8%	▼
End Device Frame Buffering	10%	▼
Write Cache Amount	12%	▼
	14%	▼
	16%	▼
	18%	▼
	20%	▼
	22%	▼
	24%	▼
	26%	▼
	28%	▼
	30%	▼
	32%	▼
	34%	▼
	36%	▼
	38%	▼

☐ Confirm The Operation

Submit Reset

WEB BROWSER-BASED CONFIGURATION

- **Read And Discard Parity Data**

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

- **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.

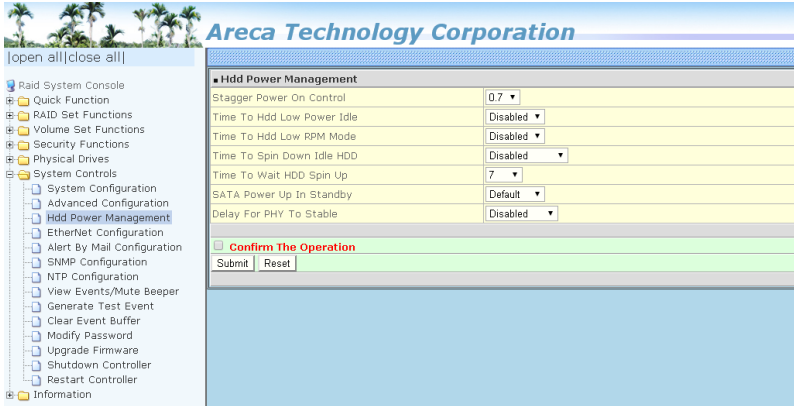
- **Write Cache Amount**

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.

WEB BROWSER-BASED CONFIGURATION

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. 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.

6.9.3.2 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.

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

This function defines the wait time for the drive to spin up. This value is used by the drive to determine how long to wait from a stopped state to an operational speed. The values can be selected within the range 7 to 120 seconds.

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.

WEB BROWSER-BASED CONFIGURATION

6.9.4 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 firm-ware-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.

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
 - EtherNet Configuration**
 - Alert By Mail Configuration
 - SNMP Configuration
 - NTP Configuration
 - View Events/Mute Beeper
 - Generate Test Event
 - Clear Event Buffer
 - Modify Password
 - Upgrade Firmware
 - Shutdown Controller
 - Restart Controller
 - Information

■ Ether Net Configurations

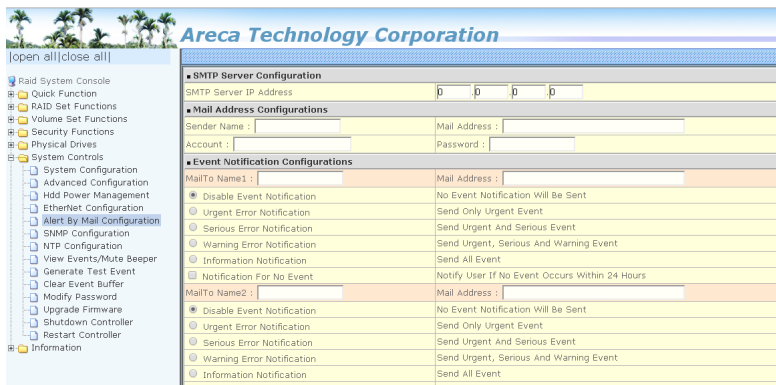
DHCP Function	Enabled ▾			
Local IP Address (Used If DHCP Disabled)	192	168	1	100
Gateway IP Address (Used If DHCP Disabled)	192	168	1	1
Subnet Mask (Used If DHCP Disabled)	255	255	255	0
HTTP Port Number (7168..8191 Is Reserved)	80			
Telnet Port Number (7168..8191 Is Reserved)	23			
SMTP Port Number (7168..8191 Is Reserved)	25			
Current IP Address	192.168.0.61			
Current Gateway IP Address	192.168.0.1			
Current Subnet Mask	255.255.255.0			
Ether Net MAC Address	00.04.D9.5E.0C.4C			

☐ Confirm The Operation

Submit Reset

6.9.5 Alert By Mail 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.



6.9.6 SNMP 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 C SNMP operation & Definition for more detail information about the SNMP trap and definition.

WEB BROWSER-BASED CONFIGURATION

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
 - Hard Power Management
 - 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

SNMP Trap Configurations

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

SNMP System Configurations

Community	
sysContact.0	
sysName.0	
sysLocation.0	

SNMP Trap Notification Configurations

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

Confirm The Operation

Submit Reset

- **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 D of Event Notification Table.

6.9.7 NTP Configuration

The screenshot shows the 'Areca Technology Corporation' web interface. On the left is a navigation tree with categories like 'Raid System Console', 'Quick Function', 'RAID Set Functions', 'Volume Set Functions', 'Security Functions', 'Physical Drives', 'System Controls', and 'System Configuration'. Under 'System Configuration', 'NTP Configuration' is selected. The main content area is titled 'NTP Server Configurations' and contains two sections: 'NTP Server IP Address #1' and 'NTP Server IP Address #2', each with four input fields for IP address digits. Below these is the 'Time Zone Configuration' section, which includes a dropdown menu for 'Time Zone' (set to '(GMT+08:00)Taipei'), a dropdown for 'Automatic Daylight Saving' (set to 'Enabled'), and a text display for 'Current Time' (2017/1/16 13:55:40). A status line indicates 'NTP Server Not Set'. At the bottom of the configuration section is a green bar with the text 'Confirm The Operation' and two buttons: 'Submit' and 'Reset'.

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

WEB BROWSER-BASED CONFIGURATION

on the computer time zone. This tweak allows you to disable the automatic adjustment.


Note:

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

6.9.8 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.



Areca Technology Corporation

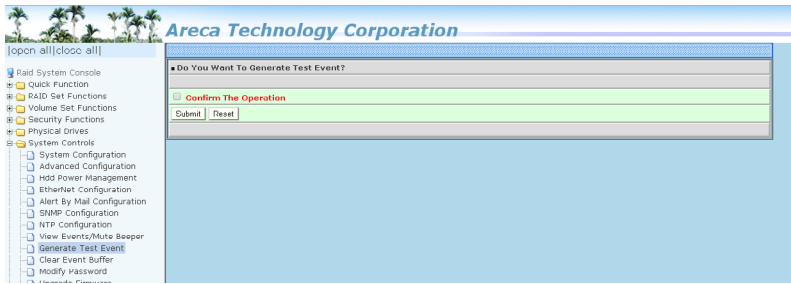
open allclose all

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

System Events Information				
Time	Device	Event Type	Elapse Time	Errors
2017-01-16 13:26:03	ARC-S088-VOL#003	Start Migrating		
2017-01-16 13:26:02	ARC-S088-VOL#001	Complete Migrate	001:04:35	
2017-01-16 12:21:27	ARC-S088-VOL#001	Start Migrating		
2017-01-16 12:21:22	ARC-S088-VOL#000	Complete Migrate	001:11:59	
2017-01-16 11:02:15	ARC-S088-VOL#004	Modify Volume		
2017-01-16 11:02:00	ARC-S088-VOL#003	Modify Volume		
2017-01-16 11:02:00	ARC-S088-VOL#001	Modify Volume		
2017-01-16 11:01:54	ARC-S088-VOL#001	Modify Volume		
2017-01-16 11:01:49	ARC-S088-VOL#000	Start Migrating		
2017-01-16 11:01:46	ARC-S088-VOL#000	Modify Volume		
2017-01-16 10:39:58	ARC-S088-VOL#004	Complete Migrate	000:05:13	
2017-01-16 10:34:45	ARC-S088-VOL#004	Start Migrating		
2017-01-16 10:34:44	ARC-S088-VOL#003	Complete Migrate	000:07:24	
2017-01-16 10:27:20	ARC-S088-VOL#003	Start Migrating		
2017-01-16 10:27:19	ARC-S088-VOL#001	Complete Migrate	000:05:52	
2017-01-16 10:27:19	ARC-S088-VOL#001	Start Migrating		

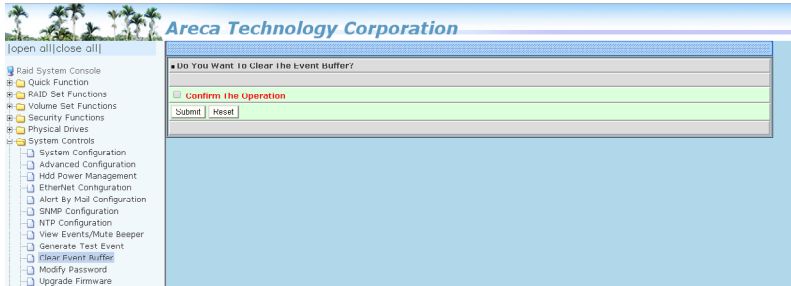
6.9.9 Generate Test Event

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



6.9.10 Clear Events Buffer

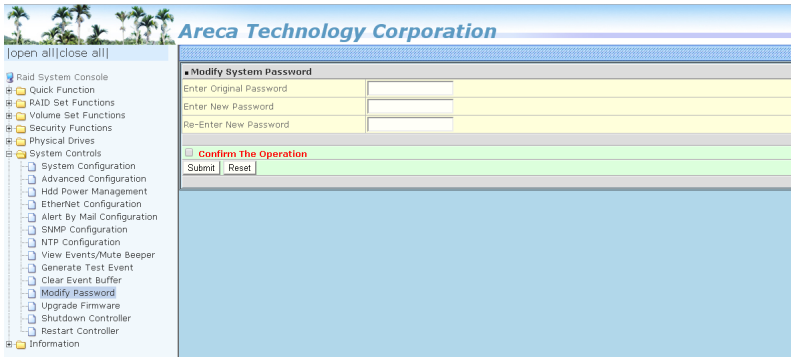
Use this feature to clear the entire events buffer information.



WEB BROWSER-BASED CONFIGURATION

6.9.11 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.



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.

6.9.12 Upgrade Firmware

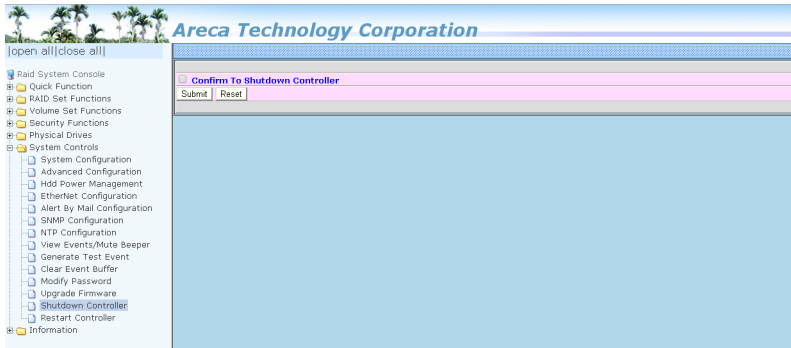
Please refer to the appendix A Upgrading Flash ROM Update Process.

WEB BROWSER-BASED CONFIGURATION



6.9.13 Shutdown Controller

Use the “Shutdown Controller” function to flash the cache data to HDD and shutdown the RAID controller.



6.9.14 Restart Controller

Use the Restart Controller Function to restart the RAID controller.



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.

Areca Technology Corporation

open all | close all

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

Hardware Monitor

Debug Message

Stop Auto Refresh

RAID Set Hierarchy

RAID Set	Devices	Volume Set(Port/Lun)	Volume State	Capa
Raid Set # 000	E#1Slot#1	ABC-S088-VOL#000(081/0)	Migrating(89.2%)	50.0G
	E#1Slot#4	ABC-S088-VOL#001(081/1)	Need Migrate	49.9G
	E#1Slot#5	ABC-S088-VOL#002(081/2)	Normal	49.9G
	E#1Slot#6	ABC-S088-VOL#003(081/3)	Need Migrate	50.0G
	E#1Slot#7	ABC-S088-VOL#004(081/4)	Need Migrate	49.9G
	E#1Slot#8			
	E#1Slot#9			
	E#1Slot#10			
	E#1Slot#12			
	E#1Slot#13			
	E#1Slot#14			
	E#1Slot#16			

Enclosure#1 : SAS RAID Subsystem V1.0

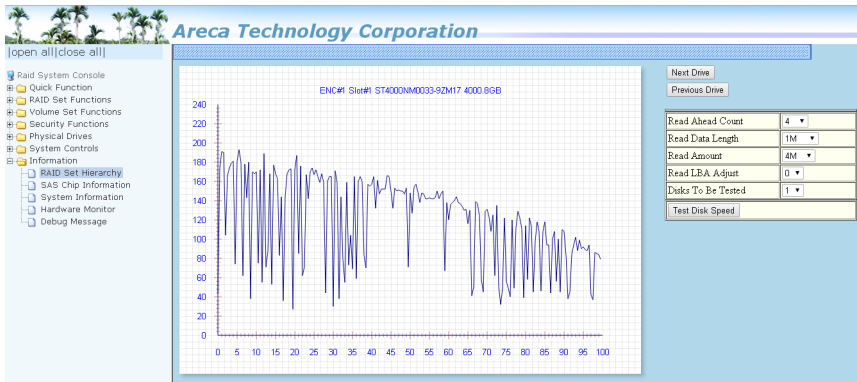
Device	Usage	Capacity	Model
Slot#1(E)	Raid Set # 000 (0A)	4000.8GB	ST4000NM0033-92M170

6.9.1.1 Hdd Xfer Speed

“Hdd Xfer Speed” is a firmware-level hard disk / SSD speed function that is used to measure the drive’s performance. “Hdd Xfer Speed” will perform read tests without overwriting customer data. The read-only palimpsest benchmark of the disk is shown in the device information. If the value drops below the normal curve, something may be wrong with the disk. User can use “Set Disk To Be Failed” function from remote side to set a slow speed disk as “failed” so that volume will be not stuck by the slow speed disk after rebuild.

“Hdd Xfer Speed” result can be accessed by clicking on the “Device” from the “RAID set Hierarchy” you wish to scan, clicking on the “Show Result”. This allows you to set up a scan environment which runs the test by clicking “Test Disk Speed” on the right screen setup option. If more than one drive is checked when you set the ‘Disks To Be Tested’, it will run that test for the number setting drives.

WEB BROWSER-BASED CONFIGURATION



If there's a certain location in the hard drive that is getting poor performance, hard drive read benchmarks can help confirm this. Above is a screenshot of a palimpsest benchmark on a hard drive. The length time of firmware takes to complete the drive test depends on its size.

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.


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.



WEB BROWSER-BASED CONFIGURATION

6.10.3 System Information

To view the SAS RAID controller's system information, move the mouse cursor to the main menu and click on the "System Information" link. The SAS RAID controller "RAID Subsystem Information" screen appears. Use this feature to view the SAS RAID controller's system information. The controller name, controller firmware version, Boot ROM version, SAS firmware version, serial number, main processor, CPU instruction/data cache size, system memory size/speed and current IP address appear in this screen.



open all|close all|


- 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**
 - Hardware Monitor
 - Debug Message

■ Raid Subsystem Information

Controller Name	ARC-5088
Firmware Version	V1.54 2017-01-04
BOOT ROM Version	V1.54 2016-12-28
PL Firmware Version	14.0.0.0
Serial Number	1100-2116-6633
Unit Serial #	
Main Processor	1.2GHz PPC476 RevC0E
CPU ICache Size	32KBytes
CPU DCache Size	32KBytes/Write Through
CPU SCache Size	512KBytes/Write Back
System Memory	2048MB/1866MHz/ECC
Current IP Address	192.168.0.61
SAS Address	50004095E0C4C800
SAS Port0 Link Status	8x600MB/Sec
SAS Port1 Link Status	Not Linked

6.10.4 Hardware Monitor

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



open all|close all|

- 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
 - Hardware Monitor**
 - Debug Message

☐ Stop Auto Refresh

■ Controller H/W Monitor

CPU Temperature	67 °C
Controller Temp.	45 °C
12V	12.038 V
5V	4.945 V
3.3V	3.360 V
IO Voltage +1.8V	1.776 V
DDR3 +1.5V	1.536 V
CPU VCore +0.9V	0.912 V
Ethernet +1.2V	1.248 V
DDR3 +0.75V	0.752 V
RTC 3.0V	3.312 V
Battery Status	Not Installed

■ Enclosure#1 : SAS RAID Subsystem V1.0

Voltage#1	3.408 V
Voltage#2	5.184 V
Voltage#3	12.058 V

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-5088XXXX.BIN Firmware Binary ("XXXX" refers to the function name:BOOT, FIRM and MBR0)

ARC-5088BOOT.BIN:→ RAID subsystem hardware initialization.

ARC-5088FIRM.BIN:→ RAID kernal program

ARC-5088MBR0.BIN:→ Master Boot Record for supporting Dual Flash Image in the RAID subsystem.

Readme.txt 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:.

Establishing the Connection for the RS-232

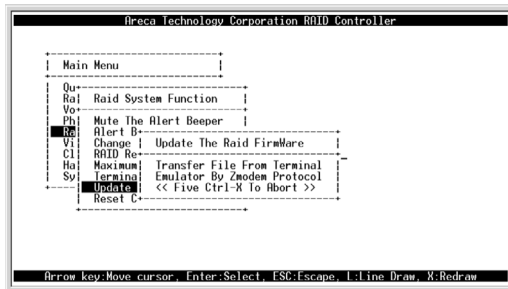
The firmware can be downloaded to the RAID subsystem controller by using an ANSI/VT-100 compatible terminal emulation program or HTTP web browser management. You must complete the appropriate installation procedure before proceeding with this firmware upgrade. Please refer to chapter 4.3, "VT100 terminal (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.

APPENDIX

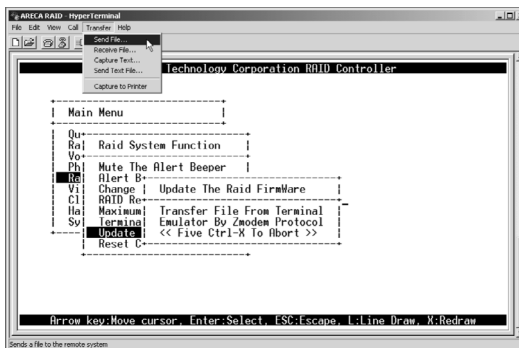
Upgrade Firmware Through ANSI/VT-100 Terminal Emulation

Get the new version firmware for your RAID subsystem controller. For Example, download the bin file from your 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 Firmware" dialog box appears.

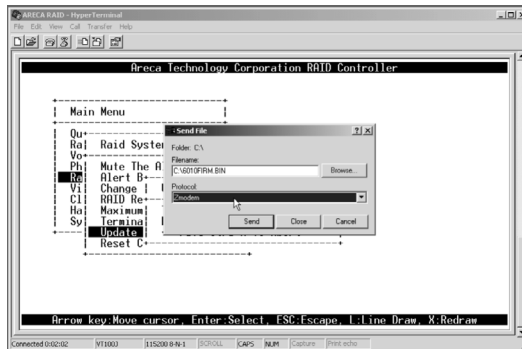


3. Go to the tool bar and select "Transfer". Open "Send File".

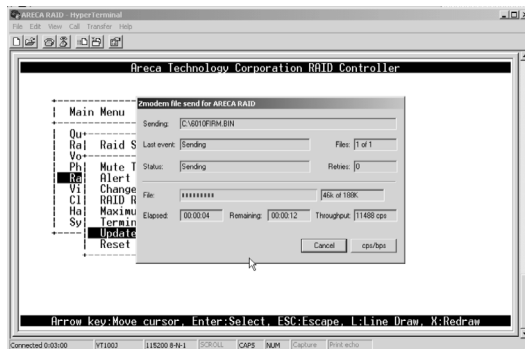


4. Select "ZMODEM modem" under Protocol. ZMODEM as the file transfer protocol of your terminal emulation software.

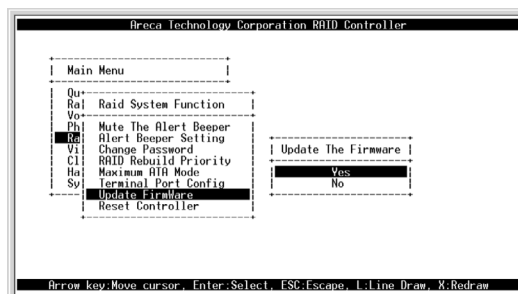
- Click "Browse". Look in the location where the firmware upgrade software is located. Select the File name:



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

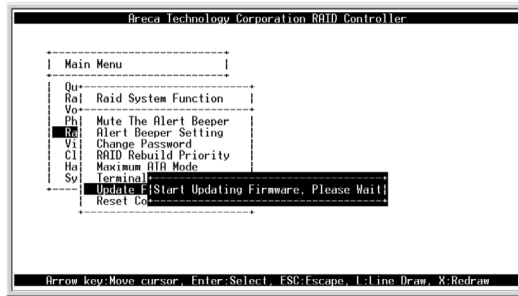


- When the firmware completes downloading, the confirmation screen appears. Press **Yes** to start program the flash ROM.

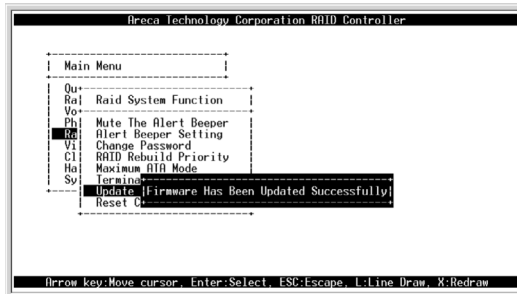


APPENDIX

- 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 us the vaules 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.

Upgrade Firmware Through Web Browser Manager (LAN Port)

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-5088FIRM.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

Appendix B

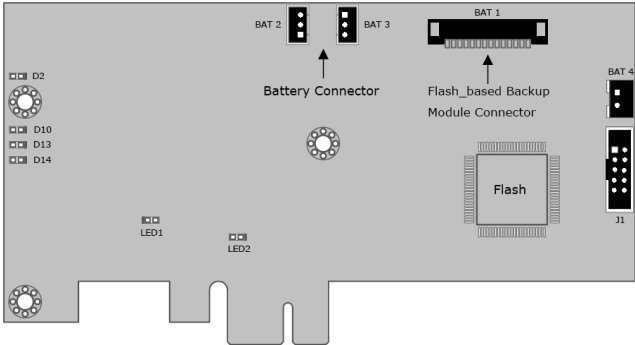
Flash-based Backup Module (ARC-1883-BAT/CAP)

B-1 Overview

The ARC-1883-BAT/CAP kit includes the Flash-based module (FBM), and one cable. The FBM features NAND flash memory and super capacitor technology that provides cache offload capability to protect cached data in case of system power loss. The ARC-1883-CAP (Flash+Supercap) module is mounted super-capacitor pack that provides power for the backup of your data. The ARC-1883-BAT (Flash+LiOn Battery) module is mounted battery pack that provides power for the backup of your data. When the module detects loss of power, the super capacitor keeps parts of the ARC-72xx RAID subsystem (ARC-5088 RAID controller) active long enough to allow cache data to be copied to the flash memory. The module attaches directly to the 12 Gb/s SAS RAID controller by the cable.

B-2 FBM Components

The following figure provides the board layout and connector/jumper of the FBM.



B-3 FBM Outline

The following figures provide the upper and top view of the FBM using supercap and battery.

1. FBM with SuperCap

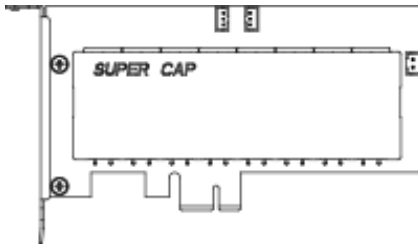


Figure B-1, ARC-1883-CAP
(top view)



Figure B-2, ARC-1883-CAP
(upper view)

2. FBM with Battery

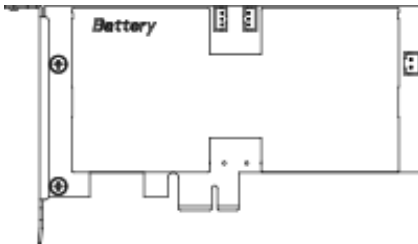
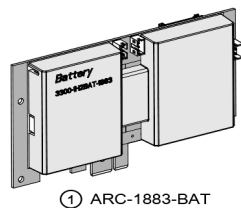


Figure B-3, ARC-1883-BAT
(top view)

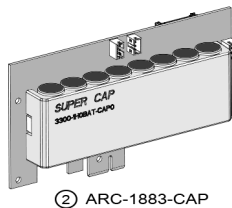


Figure B-4, ARC-1883-BAT
(upper view)

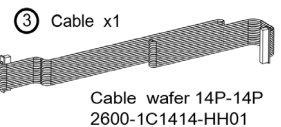
B-4 Battery Pack Modules



① ARC-1883-BAT



② ARC-1883-CAP



④ Screw_TM3x6mm x3

Figure-B-5, ARC-1883-BAT/CAP Pack Modules

APPENDIX

B-5 Status of FBM

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.

B-6 Installation - for ARC-7208/ARC-7212

1. Loosen the screws and remove the cover from the ARC-7208/ARC-7212 enclosure, as shown in Figure B-6.

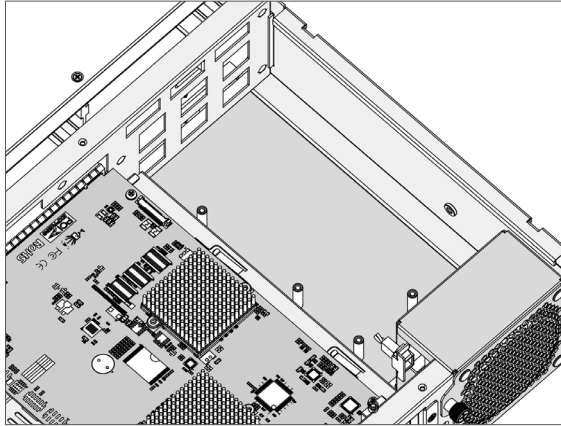


Figure B-6, Removing the Cover

2. After removing the cover, then secure the battery pack module (ARC-1883-BAT/CAP, reference NO.1 and NO.2 in Figure B-5) in the bottom of the enclosure (for ARC-7208/ARC-7212), as shown in Figure B-7.

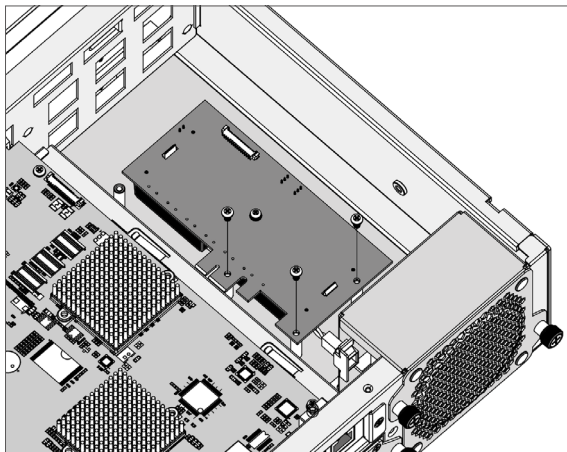


Figure B-7, Secure the Battery Module

APPENDIX

3. Insert the cable connector into the **BAT1** (14-pin box header battery connector on ARC-1883-BAT/CAP module), and also insert another side of the cable connector into the **J4** (14-pin box header battery connector on ARC-5088 backplane), as shown in Figure B-8.

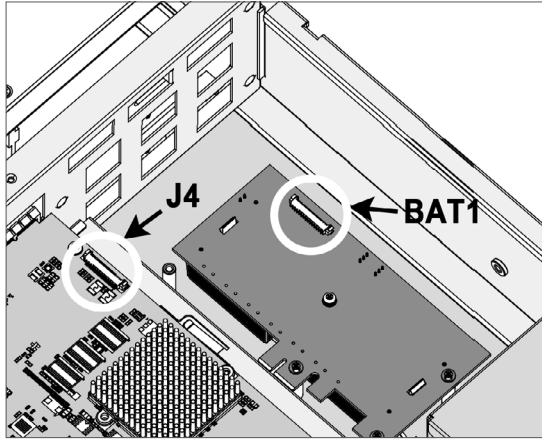


Figure B-8, Insert the cable connector into BAT1 & J4

B-7 Installation - for ARC-7216

1. Loosen the screws and remove the cover from the ARC-7216 enclosure, as shown in Figure B-9.

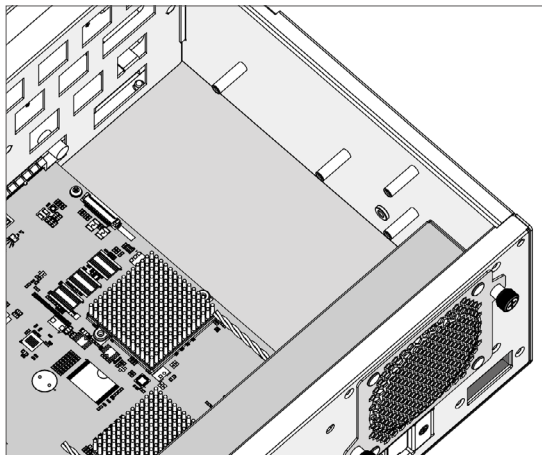


Figure B-9, Removing the Cover

2. After removing the cover, then secure the battery pack module (ARC-1883-BAT/CAP, reference NO.1 and NO.2 in Figure B-5) on the right side within the enclosure (for ARC-7208 & ARC-7212), as shown in Figure B-10.

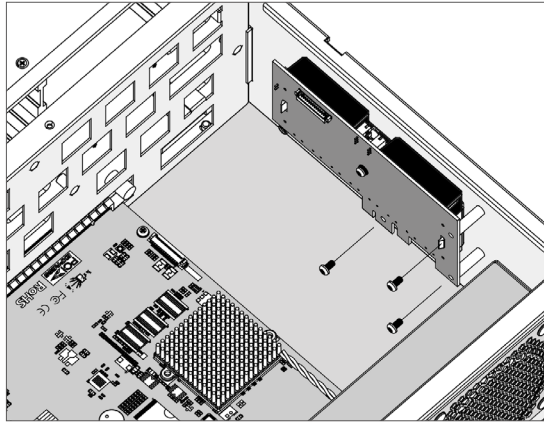


Figure B-10, Secure the Battery Module

3. Insert the cable connector into the **BAT1** (14-pin box header battery connector on ARC-1883-BAT/CAP module), and also insert another side of the cable connector into the **J4** (14-pin box header battery connector on ARC-5088 backplane), as shown in Figure B-11.

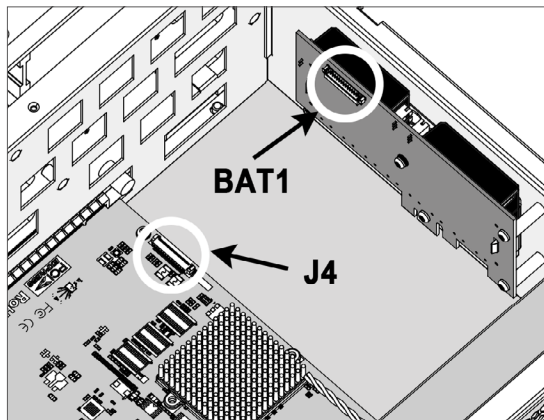


Figure B-11, Secure the Battery Module

APPENDIX

B-8 Flash-based Backup Capacity

The FBM 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 on ARC-1883-CAP/BAT. The FBM can support up to 2GB memory chips that installed on the 12Gb/s SAS RAID controller.

B-9 Operation

1. There are no manual procedures for FBM conditioning or preconditioning to be performed by the user.
2. No further power is required once the super capacitor is fully charged.

Note:

Do not remove FBM while system is running.

B-10 FBM Functionality Test Procedure:

1. Writing amount of data into controller volume, about 5GB or bigger.
2. Waiting for few seconds, power failed system by remove the power cable.
3. Power on system, and press Tab/F6 to login controller.
4. Check the controller event log, make sure the event shows "Power On With Battery Backup".

B-11 FBM Specifications

Mechanical

- Module Dimension (W x H x D):
 - with battery: 64.4 x 16.97 x 127 mm
 - with supercap: 64.4 x 18.72 x 127 mm
- BBM Connector: (1*14) box header

Environmental

- Operating Temperature: 0°C to +50°C
- Typical Life Expectancy: 5 years at 50°C
- Cache Memory Size Supported: up to 2GB (super capacitor/battery)

APPENDIX

Appendix C

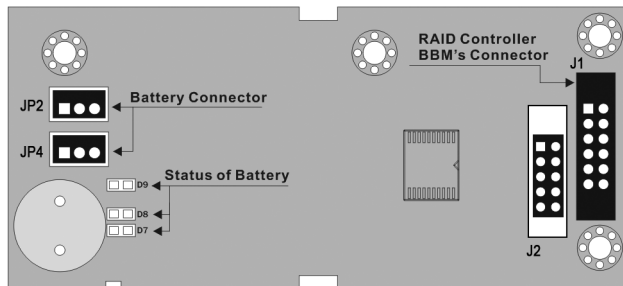
Battery Backup Module (ARC-6120BA-T121-7)

C-1 Overview

The RAID controller operates using cache memory. The Battery Backup Module is an add-on module that provides power to the RAID controller cache memory in the event of a power failure. The Battery Backup Module 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.

C-2 BBM Components

This section provides the board layout and connector/jumper for the BBM.



C-3 Status of BBM

- D7 (Green) : light when BBM activated
- D8 (Green) : light when BBM normal
- D9 (Red) : light when BBM charging

Note:

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

C-4 Battery Pack Modules

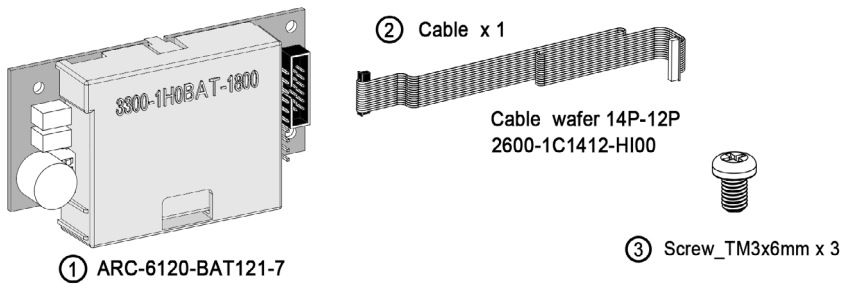


Figure-C-1, ARC-6120-BAT121-7 Pack Modules

C-5 Installation - for ARC-7208/ARC-7212

1. Loosen the screws and remove the cover from the ARC-7208/ ARC-7212 enclosure, as shown in Figure C-2.

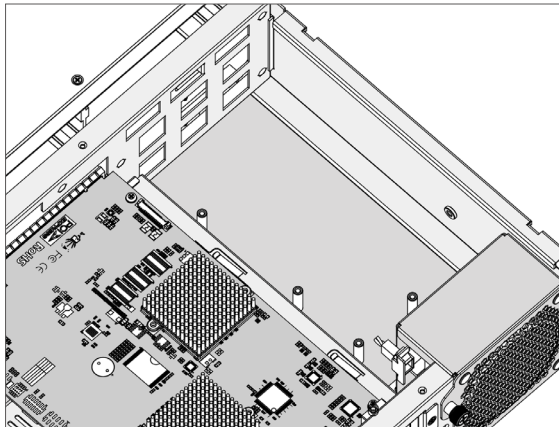


Figure C-2, Removing the Cover

APPENDIX

2. After removing the cover, then secure the battery pack module (ARC-6120-BAT121-7, reference NO.1 in Figure C-1) in the bottom of the enclosure (for ARC-7208/ARC-7212), as shown in Figure C-3.

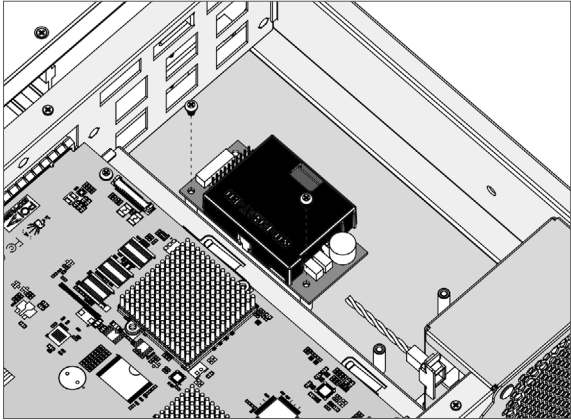


Figure C-3, Secure the Battery Module

3. Insert the cable connector into the **J1** (12-pin box header battery connector on ARC-6120-BAT121-7 module), and also insert another side of the cable connector into the **J4** (14-pin box header battery connector on ARC-5088 backplane), as shown in Figure C-4.

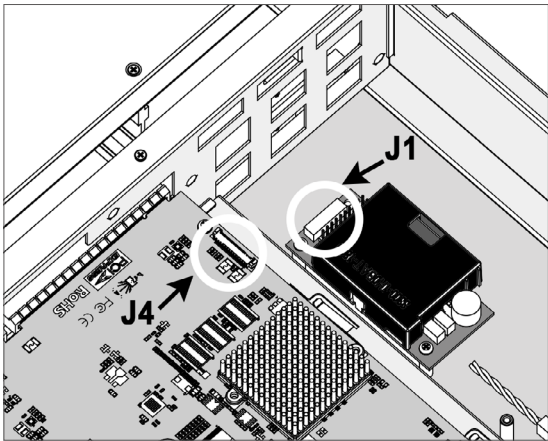


Figure C-4, Insert the cable connector into J1 & J4

C-6 Installation - for ARC-7216

1. Loosen the screws and remove the cover from the ARC-7216 enclosure, as shown in Figure C-5.

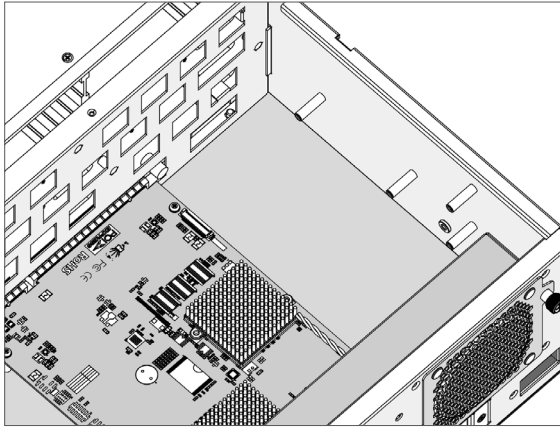


Figure C-5, Removing the Cover

2. After removing the cover, then secure the battery pack module (ARC-6120-BAT121-7, reference NO.1 in Figure C-1) on the right side within the enclosure (for ARC-7216), as shown in Figure C-6.

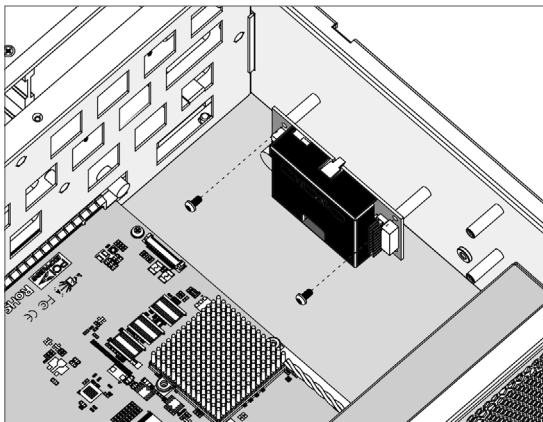


Figure C-6, Secure the Battery Module

APPENDIX

3. Insert the cable connector into the **J1** (12-pin box header battery connector on ARC-6120-BAT121-7 module), and also insert another side of the cable connector into the **J4** (14-pin box header battery connector on ARC-5088 backplane), as shown in Figure C-7.

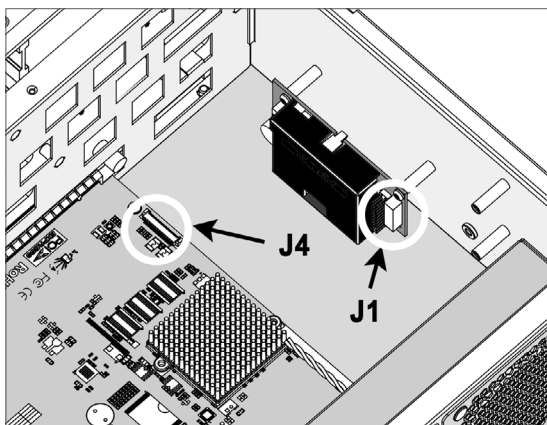


Figure C-7, Insert the cable connector into J1 & J4

C-7 Battery Backup Capacity

Battery backup capacity is defined as the maximum duration of a power failure for which data in the cache memory can be maintained by the battery. The BBM's backup capacity varied with the memory chips that installed on the RAID controller.

C-8 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.

C-9 Changing the Battery Backup 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. Shutdown the operating system properly. Make sure that cache memory has been flushed.
2. Disconnect the BBM cable from J4 on the RAID controller.
3. Disconnect the battery pack cable from JP2 on the BBM.
4. Install a new battery pack and connect the new battery pack to JP2.
5. Connect the BBM to J4 on the RAID controller.

Note:

Do not remove BBM while system is running.

C-10 Battery Functionality Test Procedure:

1. Writing 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, make sure the D9 is bright light, and battery beeps every few seconds.
4. Power on system and login controller.
5. Check the controller event log, make sure the event shows "Power On With Battery Backup".

APPENDIX

C-11 BBM Specifications

Mechanical

- Module Dimension (W x H x D): 37.3 x 13 x 81.6 mm
- BBM Connector: 2 x 6 box header

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
+3.6VDC
- On Board Battery Capacity
1880mAH (1 x 1880mAH)

Appendix D

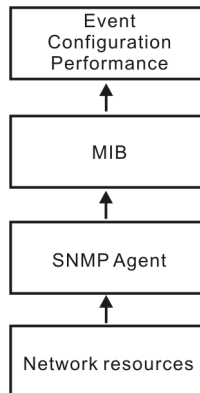
SNMP Operation & Definition

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 an SNMP manager) can monitor the disk array. An example of An 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

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

APPENDIX

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	

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 (over 60 degree)	Check air flow and cooling fan of the subsystem, and contact us.
Hdd Over Temperature	Urgent	Abnormally high temperature detected on Hdd (over 55 degree)	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			
Raid Powered On	Warning	RAID power on	
Test Event	Urgent	Test event	
Power On With Battery Backup	Warning	RAID power on with battery backed up	
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	

APPENDIX

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.

Appendix F

RAID Concept

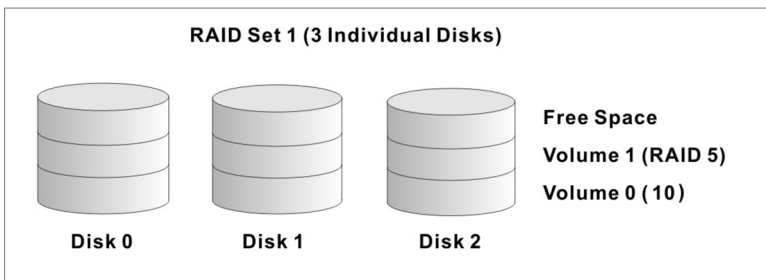
RAID Set

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**

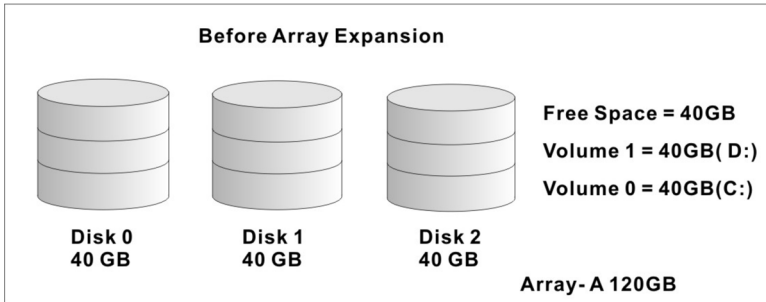
Initialization RAID 0 and RAID 1 volume set can be used immediately after the creation. But the RAID 3 and 5 volume sets must be initialized to generate the parity. In the Normal Initialization, the initialization proceeds as a background task, the volume set is fully accessible for system reads and 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 initialing. In Fast Initialization, the initialization proceeds must be completed before the volume set ready for system accesses.

- **Online Array Roaming/Offline RAID set**

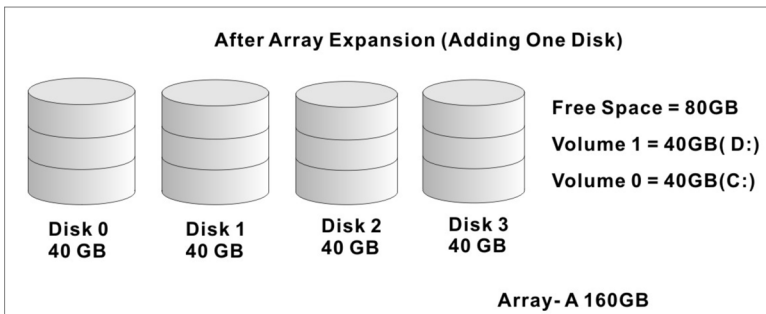
The RAID subsystem stores configuration information on the disk drives It can protect the configuration settings in the case of a disk drive or controller failure. Array roaming allows the administrators the ability to move a completely RAID set to another system without losing RAID configuration and 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 reconfigured 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.



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.

APPENDIX

High availability

• Global/Dedicated Hot Spares

A hot spare is an unused online available drive, which is ready for replacing the failure disk. The hot spare is one of the most important features that RAID controllers provide to deliver a high degree of fault-tolerance. A hot spare is a spare physical drive that has been marked as a hot spare and therefore is not a member of any RAID set. If a disk drive used in a volume set fails, then the hot spare will automatically take its place and the data previously located on the failed drive is reconstructed on the hot spare.

Dedicated hot spare is assigned to serve one specified RAID set. Global hot spare is assigned to serve all RAID set on the RAID controller. Dedicated hot spare has higher priority than the global hot spare. For this feature to work properly, the hot spare must have at least the same capacity as the drive it replaces. The hot spare function only works with RAID level 1, 1E, 3, 5, 6, 10, 30, 50, or 60 volume set.

The "Create Hot Spare" option gives you the ability to define a global/dedicated hot spare disk drive. To effectively use the hot spare feature, you must always maintain at least one drive that is marked as a global hot spare.

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 deliver "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.

● 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

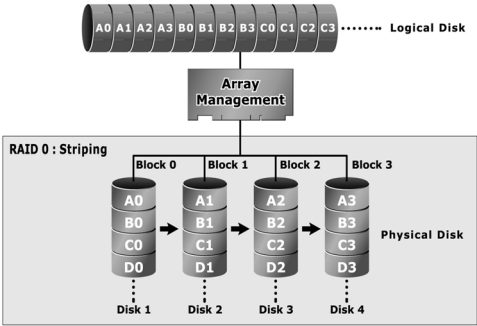
RAID is an acronym for Redundant Array of Independent Disks. It is an array of multiple independent hard disk drives that provide high performance and fault tolerance. The RAID subsystem implements several levels of the Berkeley RAID technology. An appropriate RAID level is selected when the volume sets 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

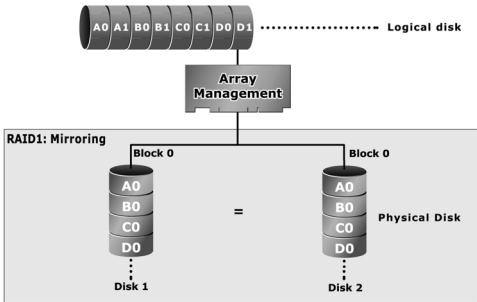
APPENDIX

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.



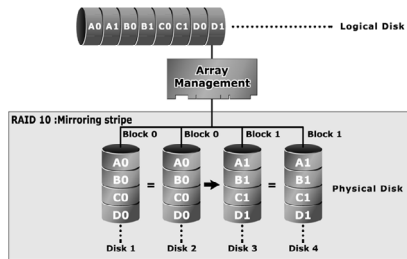
● RAID 1

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.



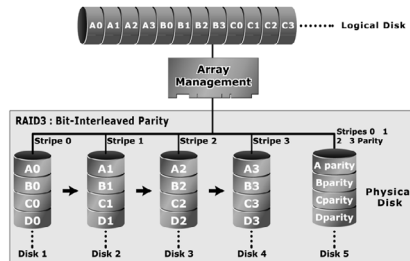
• RAID 10(1E)

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.



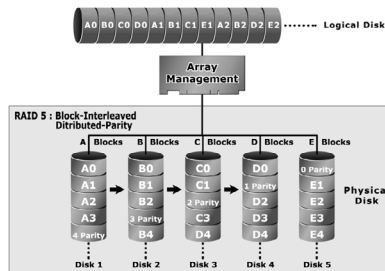
• RAID 3

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 strips of the surviving member disk. RAID 3 is best for applications that require very fast data-transfer rates or long data blocks.



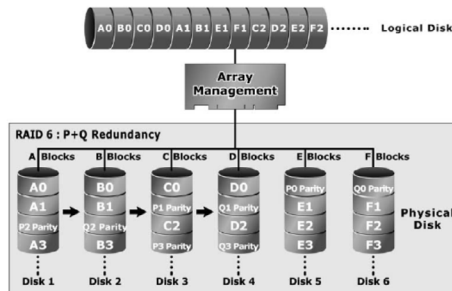
- **RAID 5**

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.

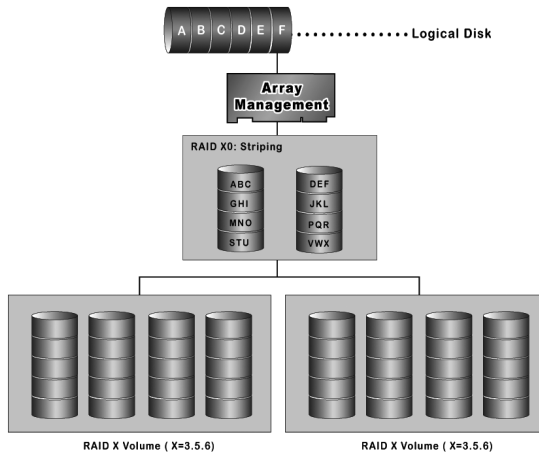


• RAID x0

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.

APPENDIX

• 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.

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.

Features and Performance					
RAID Level	Description	Disks requirement (Cost)	Data Reliability	Data Transfer Rate	I/O Request Rates
0	Also known as striping Data distributed across multiple drives in the array. There is no data protection	N	No data Protection	Very High	Very High for Both Reads and Writes
1	Also known as mirroring All data replicated on N Separated disks. N is almost always 2. This is a high availability Solution, but due to the 100% duplication, it is also a costly solution.	2	Lower than RAID 6; Higher than RAID 3,5	Reads are higher Than a single disk; Writes similar to a single disk	Reads are twice faster than a single disk; Write are similar to a single disk.
10(1E)	Also known Block-Interleaved Parity. Data and parity information is subdivided and distributed across all disk. Parity must be the equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	N (N>2)	Lower than RAID 6; Higher than RAID 3,5	Transfer rates more similar to RAID 1 than RAID 0	Reads are twice faster than a single disk; Writes are similar to a single disk.
3	Also known Bit-Interleaved Parity. Data and parity information is subdivided and distributed across all disk. Parity must be the equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	N+1	Lower than RAID 1, (10), 6; Higher than a single drive	Reads are similar to RAID 0; Writes are slower than a single disk	Reads are similar twice faster than a single disk; Writes are similar to a single disk.

3	Also known Bit-Interleaved Parity. Data and parity information is subdivided and distributed across all disk. Parity must be the equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	N+1	Lower than RAID 1, (10), 6; Higher than a single drive	Reads are similar to RAID 0; Writes are slower than a single disk	Reads are similar twice faster than a single disk; Writes are similar to a single disk.
5	Also known Block-Interleaved Distributed Parity. Data and parity information is subdivided and distributed across all disk. Parity must be the equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	N+1	Lower than RAID 1, (10), 6; Higher than a single drive	Reads are similar to RAID 0; Writes are slower than a single disk	Reads are similar to RAID 0; Writes are slower than a single disk.
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.	N+2	highest reliability	Reads are similar to RAID 0; Writes are slower than RAID 5	Reads are similar to RAID 0; Writes are slower than a RAID 5
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)	8	Up to two disk failure in each sub-volume		