

Areca RAID Controller

ARC-5066

(24-Port eSATA/USB 3.0/iSCSI to SATA RAID
Controller)

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-5066 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
1.1.1 Host Interface-eSATA/USB 3.0/iSCSI	12
1.1.2 RAID Controller Board	13
1.1.2.1 Maximum Host Interoperability.....	13
1.1.2.2 Unsurpassed Data Availability.....	14
1.1.2.3 Easy RAID Management	14
2. Hardware Installation	17
2.1 Before Your Begin Installation	17
2.2 Board Layout & Box Outline.....	18
2.2.1 SATA RAID Controller Board Layout.....	18
2.2.2 SATA RAID Controller Module Outline	21
2.2.3 SATA RAID LED Indicators	21
2.2.3.1 eSATA Ports Status	21
2.3 Installation.....	22
3. Configuration Methods	35
3.1 Using Local Front Panel Touch-control Keypad	35
3.2 VT100 Terminal (Using the Controller’s Serial Port)	37
3.2.1 RS-232C Port Pin Assignment.....	37
3.2.2 Start-up VT100 Screen.....	38
3.3 Web Browser-based RAID Manager.....	41
3.4 Configuration Menu Tree	41
4. LCD Configuration Menu	43
4.1 Starting LCD Configuration Utility	43
4.2 LCD Configuration Utility Main Menu Options.....	44
4.3 Configuring Raid Sets and Volume Sets	44
4.4 Designating Drives as Hot Spares.....	45
4.5 Using Easy RAID Configuration	45
4.6 Using Raid Set and Volume Set Functions	47
4.7 Navigation Map of the LCD	48
4.7.1 Quick Volume And Raid Setup	49
4.7.2 Raid Set Functions.....	49
4.7.2.1 Create A New Raid Set	50
4.7.2.2 Delete Raid Set	50
4.7.2.3 Expand Raid Set.....	51
4.7.2.4 Offline Raid Set	51
4.7.2.5 Activate Incomplete RaidSet.....	52

4.7.2.6 Create Hot Spare Disk	52
4.7.2.7 Delete Hot Spare Disk	52
4.7.2.8 Display Raid Set Information	52
4.7.3 Volume Set Functions	52
4.7.3.1 Create Raid Volume Set	53
4.7.3.1.1 Volume Name.....	54
4.7.3.1.2 Raid Level	54
4.7.3.1.3 Stripe Size	54
4.7.3.1.4 Cache Mode	54
4.7.3.1.5 Host Port#/Target Node/LUN	54
4.7.3.1.6 Tagged Queuing.....	55
4.7.3.1.7 Initialization Mode.....	55
4.7.3.2 Delete Existed Volume Set	56
4.7.3.3 Modify Volume Set Attribute.....	56
4.7.3.3.1 Volume Set Migration	57
4.7.3.4 Check Volume Set Consistency	57
4.7.3.5 Stop Volume Set Consistency Check.....	58
4.7.3.6 Display Volume Set Information.....	58
4.7.4 Physical Drive Functions	58
4.7.4.1 Display Drive Information	60
4.7.4.2 Create Pass-Through Disk	60
4.7.4.3 Modify Pass-Through Disk	60
4.7.4.4 Delete Pass-Through Disk	61
4.7.4.5 Identify The Selected Drive	61
4.7.5 Raid System Functions	61
4.7.5.1 Mute The Alert Beeper	63
4.7.5.2 Alert Beeper Setting	63
4.7.5.3 Change Password	63
4.7.5.4 JBOD/RAID Mode Configuration	63
4.7.5.5 Raid Rebuild Priority.....	64
4.7.5.6 SATA NCQ Mode Support	64
4.7.5.7 HDD Read Ahead Cache.....	64
4.7.5.8 Volume Data Read Ahead.....	64
4.7.5.9 Disk Write Cache HDD	65
4.7.5.10 Disk Capacity Truncation Mode.....	65
4.7.5.11 Restart Controller	65
4.7.6 Hdd Power Management.....	66
4.7.6.1 Stagger Power On Control.....	66
4.7.6.2 Time to Hdd Low Power Idle.....	66
4.7.6.3 Time To Hdd Low RPM Mode.....	67
4.7.6.4 Time To Spin Down Idle HDD	67
4.7.7 Ethernet Configuration	67

4.7.7.1 DHCP	67
4.7.7.2 Local IP Address.....	68
4.7.7.3 HTTP Port Number	68
4.7.7.4 Telnet Port Number	68
4.7.7.5 SMTP Port Number.....	68
4.7.7.6 Ethernet Address.....	69
4.7.8 Show System Events	69
4.7.9 Clear all Event Buffers.....	69
4.7.10 Hardware Monitor Information.....	69
4.7.11 System Information	70
5. VT-100 Utility Configuration	71
5.1 Configuring Raid Sets/Volume Sets.....	71
5.2 Designating Drives as Hot Spares.....	72
5.3 Using Quick Volume/Raid Setup Configuration	72
5.4 Using Raid Set/Volume Set Function Method	74
5.5 Main Menu	75
5.5.1 Quick Volume/Raid Setup	76
5.5.2 Raid Set Function	80
5.5.2.1 Create Raid Set	80
5.5.2.2 Delete Raid Set	82
5.5.2.3 Expand Raid Set.....	82
5.5.2.4 Offline Raid Set	84
5.5.2.5 Activate Raid Set.....	84
5.5.2.6 Create Hot Spare.....	85
5.5.2.7 Delete Hot Spare.....	85
5.5.2.8 Rescue Raid Set	86
5.5.2.9 Raid Set Information.....	86
5.5.3 Volume Set Function.....	87
5.5.3.1 Create Volume Set (0/1/10/3/5/6).....	88
5.5.3.1.1 Volume Name.....	90
5.5.3.1.2 Raid Level.....	90
5.5.3.1.3 Capacity	91
5.5.3.1.4 Stripe Size.....	92
5.5.3.1.5 Host Port Mapping	93
5.5.3.1.6 Target Node	93
5.5.3.1.7 LUN	94
5.5.3.1.8 Cache Mode	94
5.5.3.1.9 Write Protect.....	95
5.5.3.1.10 Tag Queuing	96
5.5.3.2 Create Raid 30/50/60.....	96
5.5.3.3 Delete Volume Set.....	97

5.5.3.4	Modify Volume Set.....	98
5.5.3.4.1	Volume Growth.....	98
5.5.3.4.2	Volume Set Migration	99
5.5.3.5	Check Volume Set.....	100
5.5.3.6	Stop Volume Set Check	100
5.5.3.7	Display Volume Set Info.	100
5.5.4	Physical Drives.....	101
5.5.4.1	View Drive Information	101
5.5.4.2	Create Pass-Through Disk	102
5.5.4.3	Modify Pass-Through Disk	102
5.5.4.4	Delete Pass-Through Disk	103
5.5.4.5	Set Disk To Be Failed.....	104
5.5.4.6	Activate Failed Disk.....	104
5.5.4.7	Identify Selected Drive	105
5.5.4.8	Identify Enclosure.....	105
5.5.5	Raid System Function	106
5.5.5.1	Mute The Alert Beeper	106
5.5.5.2	Alert Beeper Setting.....	107
5.5.5.3	Change Password	107
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.....	110
5.5.5.9	Hdd Queue Depth Setting	111
5.5.5.10	Empty HDD Slot LED	112
5.5.5.11	Disk Write Cache Mode	112
5.5.5.12	Auto Activate Raid Set.....	113
5.5.5.13	Write Same Support	113
5.5.5.14	Capacity Truncation	114
5.5.5.15	Shut Down Controller	115
5.5.5.16	Restart Controller	115
5.5.6	More System Functions	116
5.5.6.1	Smart Option For HDD	117
5.5.6.2	Smart Polling Interval	117
5.5.6.3	Hot Plugged Disk For Rebuilding	118
5.5.7	Hdd Power Management.....	119
5.5.7.1	Stagger Power On Control.....	120
5.5.7.2	Time To Hdd Low Power Idle	120
5.5.7.3	Time To Hdd Low RPM Mode.....	121
5.5.7.4	Time To Spin Down Idle HDD	121
5.5.7.5	SATA Power Up In Standby	122

5.5.8 iSCSI Port Configuration	123
5.5.8.1 Link Aggregation	123
5.5.8.2 DHCP Function	125
5.5.8.3 IP Address	125
5.5.8.4 Gateway Address	126
5.5.8.5 Subnet Mask	127
5.5.8.6 iSCSI Port Number	127
5.5.8.7 MTU (Maximum Transmission Unit)	128
5.5.8 Ethernet Configuration	129
5.5.8.1 DHCP Function	129
5.5.8.2 Local IP Address	130
5.5.8.3 HTTP Port Number	131
5.5.8.4 Telnet Port Number	131
5.5.8.5 SMTP Port Number	132
5.5.8.6 Ethernet Address	132
5.5.9 Alert By Mail Configuration	133
5.5.9.1 SMTP Server Configuration	133
5.5.9.2 Mail Address Configurations	134
5.5.9.3 Event Notification Configurations	134
5.5.10 View System Events	136
5.5.11 Clear Events Buffer	137
5.5.12 Hardware Monitor Information	137
5.5.13 System Information	138
6. Web Browser-based Configuration	139
6.1 Web Browser McRAID Storage Manager	139
6.2 Web Browser Start-up Screen	140
6.3 Main Menu	141
6.4 Quick Function	141
6.5 Raid Set Functions	142
6.5.1 Create a New Raid Set	142
6.5.2 Delete Raid Set	143
6.5.3 Expand Raid Set	143
6.5.4 Offline Raid Set	144
6.5.5 Rename Raid Set	145
6.5.6 Activate Incomplete Raid Set	145
6.5.7 Create Hot Spare	146
6.5.8 Delete Hot Spare	146
6.5.9 Rescue Raid Set	147
6.6 Volume Set Functions	147
6.6.1 Create Volume Set (0/1/10/3/5/6)	148
6.6.2 Create Raid 30/50/60 (Volume Set 30/50/60)	152

6.6.3 Delete Volume Set.....	153
6.6.4 Modify Volume Set.....	153
6.6.4.1 Volume Growth	154
6.6.4.2 Volume Set Migration	155
6.6.5 Check Volume Set	155
6.6.6 Schedule Volume Check	156
6.6.7 Stop Volume Check.....	156
6.7 Security Function	157
6.7.1 Create SED RAID Set	157
6.7.2 Delete SED RAID Set	158
6.7.3 Delete ISE RAID Set	158
6.7.4 Security Key Setup	159
6.7.4.1 SED Key Management-Creation	159
6.7.4.2 SED Key Management-Modification	160
6.7.5 Import Security Key.....	161
6.7.6 Erase Failed Disk.....	162
6.7.7 RevertSP	162
6.8 Physical Drive	163
6.8.1 Create Pass-Through Disk.....	163
6.8.2 Modify Pass-Through Disk.....	163
6.8.3 Delete Pass-Through Disk	164
6.8.4 Clone Disk.....	165
6.8.4.1 Clone And Replace	166
6.8.4.2 Clone Only	166
6.8.5 Abort Cloning.....	166
6.8.6 Set Disk To Be Failed	166
6.8.7 Activate Failed Disk	166
6.8.8 Identify Drive	167
6.9 System Controls	168
6.9.1 System Config	168
• System Beeper Setting	168
• Background Task Priority	168
• JBOD/RAID Configuration	168
• SATA NCQ Support	169
• HDD Read Ahead Cache	169
• Volume Data Read Ahead	169
• HDD Queue Depth	169
• Empty HDD Slot LED	169
• CPU Fan Detection.....	170
• Max Command Length	170
• Auto Activate Incomplete Raid	170
• Disk Write Cache Mode	170

• SATA Target Mode Speed.....	170
• Write Same For Initialization.....	170
• Hot Plugged Disk For Rebuilding.....	170
• Disk Capacity Truncation Mode.....	171
• Smart Option For HDD.....	172
• Smart Polling Interval.....	172
6.9.2 Advanced Configuration.....	173
6.9.3 Hdd Power Management.....	176
6.9.3.1 Stagger Power On Control.....	176
6.9.3.2 Time to Hdd Low Power Idle.....	177
6.9.3.3 Time To Hdd Low RPM Mode.....	177
6.9.3.4 Time To Spin Down Idle HDD.....	177
6.9.3.5 SATA Power Up In Standby.....	177
6.9.4 iSCSI Configuration.....	177
6.9.5 Ethernet Configuration.....	182
6.9.6 Alert By Mail Configuration.....	183
6.9.7 SNMP Configuration.....	183
• SNMP Trap Configurations.....	184
• SNMP System Configurations.....	184
• SNMP Trap Notification Configurations.....	184
6.9.8 NTP Configuration.....	184
6.9.9 View Events/Mute Beeper.....	186
6.9.10 Generate Test Event.....	186
6.9.11 Clear Events Buffer.....	187
6.9.12 Modify Password.....	187
6.9.13 Update Firmware.....	188
6.9.14 Restart Controller.....	188
6.10 Information.....	189
6.10.1 Raid Set Hierarchy.....	189
6.10.2 System Information.....	189
6.10.3 Hardware Monitor.....	190
Appendix A.....	191
Upgrading Flash ROM Update Process.....	191
Upgrade Firmware Through ANSI/VT-100 Terminal Emulation....	191
Upgrade Firmware Through Web Browser Manager (LAN Port) ...	194
Appendix B.....	196
Battery Backup Module (ARC-6120BA-T121-12G).....	196
Appendix C.....	200
SNMP Operation & Definition.....	200
Appendix D.....	202
Event Notification Configurations.....	202

A. Device Event.....	202
B. Volume Event.....	203
C. RAID Set Event	204
D. Hardware Monitor Event	204
Appendix E	206
RAID Concept	206
RAID Set.....	206
Volume Set.....	206
Easy of Use Features.....	207
• Instant Availability/Background	207
• Online Array Roaming/Offline RAID set.....	207
• Online Capacity Expansion.....	207
• Online RAID Level and Stripe Size Migration	208
High availability.....	209
• Creating Hot Spares	209
• Hot-Swap Disk Drive Support.....	209
• Hot-Swap Disk Rebuild.....	210
Understanding RAID	210
• RAID 0	211
• RAID 1	211
• RAID 10(1E).....	212
• RAID 3	213
• RAID 5	213
• RAID 6	214
• RAID x0.....	215
• JBOD.....	216
• Single Disk (Pass-Through Disk).....	216

INTRODUCTION

1. Introduction

This section presents a brief overview of the ARC-5066 entry level external RAID controller.

1.1 Overview

The ARC-5066 RAID controller is a family of 12/16/24 6.0Gbps SATA hard drive ports depending upon the amount of storage required. The ARC-5066 storage controller is designed to provide a truly innovative multiple host interfaces to address the needs of different cost-effective RAID storage requirements. When properly configured, the RAID controller can provide non-stop service with a high degree of fault tolerance through the use of RAID technology and advanced array management features. High transfer rates and more SATA disk channels provide a major benefit for those applications requiring cost-effective RAID solutions that take advantage of low cost, high capacity SATA disk drives, especially the rapidly growing demand from the VMware ESX server external storage, DVR markets and cold storage.

1.1.1 Host Interface-eSATA/USB 3.0/iSCSI

The ARC-5066 RAID controller host interface appears to the host system as a SATA III, USB 3.0 and iSCSI target device. Those host interfaces are divided into two groups-Connect to eSATA/USB channel and Connect to iSCSI-P0/P1/P2/P3 channel. Both channels can map to the same "Target Node:LUN (Driver#)" volume set, but user can only use one channel each time for data consistency. The following block diagram is the diagram of ARC-5066.



INTRODUCTION

For eSATAIUSB group, you can plug-in both interfaces (USB 3.0 & eSATA) to the host, but you can only use one connection at a time. Interface that is connected 1st has precedent. The following table is the map of hot port mapping, host interface and driver number assignment.

Host Port Mapping	Host	Target Node:LUN
eSATAIUSB	eSATA	eSATA Host with Port Multiplier: Target Node=0~7:LUN=0
		eSATA Host without Port Multiplier: Target Node=0:LUN=0
	USB 3.0	Target Node=0~7:LUN=0
iSCSI-P0/P1/P2/P3	GbE P0~P3	Target Node=0~15:LUN=0~7
eSATAIUSB & iSCSI-P0/P1/P2/P3	eSATA & GbE P0~P3	eSATA Host with Port Multiplier: Target Node=0~7:LUN=0
		eSATA Host without Port Multiplier: Target Node=0:LUN=0
	USB 3.0 & GbE P0~P3	Target Node=0~7:LUN=0

1.1.2 RAID Controller Board

The ARC-5066 RAID controller incorporates onboard high performance 1.2GHz storage processors and 2GB on-board DDR3-1200 SDRAM memory to deliver true hardware RAID. Designed and leveraged with Areca's existing high performance solution, this controller delivers high-capacity performance at the best of cost/performance value. Hardware RAID controller have their own local RAID processor onboard, plus dedicated onboard cache for full hardware offloading of RAID-processing functions. The ability of hardware RAID controllers to rebuild an array in the event of a drive failure is superior to what software RAID controller offer.

1.1.2.1 Maximum Host Interoperability

The ARC-5066 supports multiple host interfaces; eSATA III, iSCSI or USB 3.0 that can work with different application requirement. The 6.0Gbps eSATA host interface can be directly attached to host computers by widely-adopted and low-cost eSATA interface without add-on cards and device drivers, or being included inside a host system, such as digital video recorder. As video management

INTRODUCTION

systems continue to trend toward IP, iSCSI RAID controller has become increasingly popular to provide massive quantities of storage in a highly secure manner. The ARC-5066 is designed with 4 1.0Gbps host ports for a cost-effective and shared storage solution with Link Aggregation (LACP, Trunking), Multi-Path IO (MPIO), and iSCSI Multiple Connection per Session (MC/S) support. The ARC-5066 uses iSCSI protocol, which allows system designers significant flexibility in determining placement of storage within a network as well as how the storage is allocated across multiple NVRs.

1.1.2.2 Unsurpassed Data Availability

The ARC-5066 incorporates onboard 1.2GHz storage processors and 2GB on-board DDR3-1200 SDRAM memory to offer high-performance with the added advantage of central management and RAID protection. Designed and leveraged with Areca's existing high performance solution, this controller delivers high-capacity at the best of cost/performance value. It supports the hardware RAID 6 engine to allow two HDDs failures without impact the existing data and performance. Its high data availability and protection derives from the many advanced RAID features. The ARC-5066 allows easy scalability from JBOD to RAID. It can be configured to RAID levels 0, 1, 10, 1E, 3, 5, 6, 00, 100, 30, 50, 60, Single Disk or JBOD function selection for data protection.

1.1.2.3 Easy RAID Management

Configuration and monitoring can be managed either through the LCD control panel, RS232 port or Ethernet 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 is a remote management interface for configuration, monitoring and management of Areca RAID controllers. The ARC-5066 firmware and EPLD has implemented the disk fault/activity map to SGPIO based indicator LEDs. For backplane without SGPIO supporting, the ARC-5066 also provides two kinds of alternative LED cable header to support the individual fault/activity status indicator for those backplanes. In addition to meet different enclosure, the ARC-5066 has implemented autonomous chassis management of two power supplies status connectors,

INTRODUCTION

four fan monitor/speed control connectors. The Intelligent cooling continuously adapts to environmental conditions by automatically controlling the speed of the cooling fans.

Adapter Architecture

- 1.2GHz storage I/O processor
- 2GB on-board DDR3-1200 SDRAM with ECC protection
- Support up to 24 internal 6.0Gbps SATA ports
- NVRAM for event logs & transaction log
- Write-through or write-back cache support
- Redundant flash image for controller availability
- Battery backup module ready (optional)

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 RAID100)
- Multiple RAID selection
- Configurable stripe size up to 1024KB
- eSATA host: 8 volumes(with port multiplier), iSCSI host: 128 volumes or USB 3.0 host: 8 volumes
- Online array roaming
- Online RAID level/stripe size migration
- Online capacity expansion and RAID level migration simultaneously
- Online volume set growth
- Instant availability and background initialization
- Support global and dedicated hot spare
- Automatic drive insertion/removal detection and rebuilding
- Support for native 4K and 512 byte sector SATA devices
- Multiple pairs SSD/HDD disk clone function
- SSD automatic monitor clone (AMC) support
- Support HDD firmware update
- Support intelligent power management to save energy and extend service life

Host Interface

- 1 x 6.0Gbps eSATA
- 1 x 5.0Gbps USB 3.0
- 4 x 1.0Gbps GbE iSCSI
 - Jumbo frame support
 - Header/Data digest support

INTRODUCTION

- CHAP authentication
- MPIO, MC/S, Trunking and LACP(802.3ad) support

Disk Interface

- 12/16/24 x 6.0Gbps SATA ports
- Up to 6 x SFF-8087 drive connector

Monitors/Notification

- Environment and drive failure indication through LCD, LED and alarm buzzer
- Keep silent and adequate air flow and cooling by intelligent cooling fan speed control
- SMTP support for email notification
- SNMP support for remote manager
- Support 4 x 3-pin fan connector
- Support 2 x 2-pin power status connector

RAID Management

- Field-upgradeable firmware in flash ROM via RS-232 and LAN port
- Push Buttons and LCD for setup and status
- Firmware-embedded manager via RS-232 port
- Firmware-embedded Browser-based RAID manager, SMTP manager, SNMP agent and Telnet function via LAN port
- Support Out-of-Band API with sample and functional code for customer quickly customizing its AP

Mechanical

- Dimension (W x H x D): 146(W) x 43(H) x 200(D) mm

Environmental

- Temperature
Operating 0° to 40°C
Storage -40° to 70°C
- Humidity
Operating 10% to 80% (non-condensing)
Storage 5% to 95% (non-condensing)

Electrical

- Power Requirements
32W max. On +12V

HARDWARE INSTALLATION

2. Hardware Installation

This section describes the procedures for installing the cable solution external ARC-5066 SATA RAID controllers.

2.1 Before Your Begin Installation

Thanks for purchasing the cable solution external ARC-5066 series SATA RAID controller as your RAID data storage subsystem. This user manual gives simple step-by-step instructions for installing and configuring the SATA RAID controller. To ensure personal safety and to protect your equipment and data, reading the following information package list carefully before you begin installing.

Package Contents

If your package is missing any of the items listed below, contact your local dealers before you install. **(Disk drives and disk mounting brackets are not included)**

- 1 x ARC-5066 SATA RAID controller in an ESD-protective bag
- 1 x DB9 serial communications null-modem cable
- 1 x Adapter convert the 4 pin peripheral power cables into a PCI-E power cable
- 1 x Software installation CD – containing driver, relative software, an electronic version of this manual and other related manual
- 1 x Quick start guide

HARDWARE INSTALLATION

2.2 Board Layout & Box Outline

2.2.1 SATA RAID Controller Board Layout

The ARC-5066 RAID controller can support a family included internal 12/16/24 ports models with 3/4/6 Min SAS SFF-8087 connectors. This section provides the board layout and connector/jumper for the SATA RAID controller.

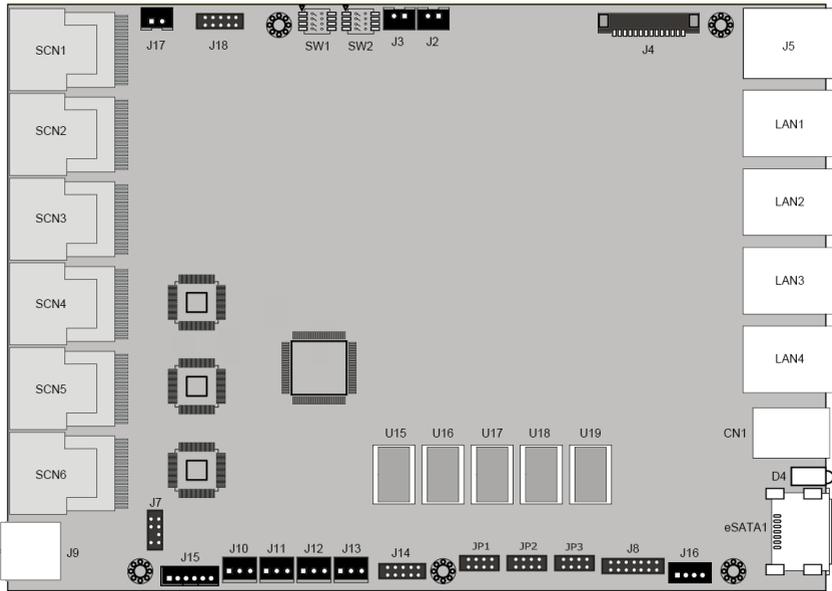


Figure 2-1, ARC-5066 Component Layout

HARDWARE INSTALLATION

Connector	Description	Type
1. (CN1)	USB 3.0 Host	USB
2. (D4)	LED for eSATA Link and Access	Bi-color DIP
3. (ESATA1)	eSATA 6.0 Gbps Host	eSATA
4. (J2)	Power Fault Input 2	2-Pin Header
5. (J3)	Power Fault Input 1	2-Pin Header
6. (J4)	Battery Backup Connector	14-Pin Wafer Connector
7. (J5)	Ethernet Port for RAID Manager	RJ-45 Connector
8. (J7)	Serial Bus/LCD Connector	7-Pin Header
9. (J8)	Manufacture Purpose Port	14-Pin Header
10. (J9)	Controller +12 Power Input	6-Pin PCI Express Power Connector
11. (J10)	Fan1 with RPM Sense	3-Pin Connector
12. (J11)	Fan2 with RPM Sense	3-Pin Connector
13. (J12)	Fan3 with RPM Sense	3-Pin Connector
14. (J13)	Fan4 with RPM Sense	3-Pin Connector
15. (J15)	Serial Bus/LCD Connector	6-Pin Wafer Connector
16. (J18)	External RS-232 DB9 Connector	10-Pin Header
17. (JP1)	Individual Fault LED Header for SATA 1-8 Ports	8-Pin Header
18. (JP2)	Individual Fault LED Header for SATA 9-16 Ports	8-Pin Header
19. (JP3)	Individual Fault LED Header for SATA 17-24 Ports	8-Pin Header
20. (LAN1)	GbE iSCSI CH0	RJ-45 Connector
21. (LAN2)	GbE iSCSI CH1	RJ-45 Connector
22. (LAN3)	GbE iSCSI CH2	RJ-45 Connector
23. (LAN4)	GbE iSCSI CH3	RJ-45 Connector
24. (SCN1)	SATA 1-4 Ports	SFF-8087 Connector
25. (SCN2)	SATA 5-8 Ports	SFF-8087 Connector
26. (SCN3)	SATA 9-12 Ports	SFF-8087 Connector
27. (SCN4)	SATA 13-16 Ports (for ARC-5066-16/24)	SFF-8087 Connector
28. (SCN5)	SATA 17-20 Ports (for ARC-5066-24)	SFF-8087 Connector
29. (SCN6)	SATA 21-24 Ports (for ARC-5066-24)	SFF-8087 Connector

HARDWARE INSTALLATION

30. (SW1)	<p>Fan1-Fan4 Function Definition</p> <table border="1"> <thead> <tr> <th>SW1-3</th> <th>SW1-2</th> <th>SW1-1</th> <th>FAN_NO.</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>NO</td> </tr> <tr> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>Fan1</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>OFF</td> <td>Fan1, Fan2</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>ON</td> <td>Fan1, Fan2, Fan3</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>Fan1, Fan2, Fan3, Fan4</td> </tr> </tbody> </table>	SW1-3	SW1-2	SW1-1	FAN_NO.	OFF	OFF	OFF	NO	OFF	OFF	ON	Fan1	OFF	ON	OFF	Fan1, Fan2	OFF	ON	ON	Fan1, Fan2, Fan3	ON	OFF	OFF	Fan1, Fan2, Fan3, Fan4	Micro DIP-Switch
SW1-3	SW1-2	SW1-1	FAN_NO.																							
OFF	OFF	OFF	NO																							
OFF	OFF	ON	Fan1																							
OFF	ON	OFF	Fan1, Fan2																							
OFF	ON	ON	Fan1, Fan2, Fan3																							
ON	OFF	OFF	Fan1, Fan2, Fan3, Fan4																							
31. (SW2)	<p>Power Detective Function Definition</p> <table border="1"> <thead> <tr> <th>SW2-2</th> <th>SW2-1</th> <th>POWER STATUS</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>OFF</td> <td>2-POWER DETECTION</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>1-POWER DETECTION</td> </tr> </tbody> </table> <p>RS232C Port Function Definition</p> <table border="1"> <thead> <tr> <th>SW2-4</th> <th>SW2-3</th> <th>J18</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>OFF</td> <td>TERMINAL</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>DEBUG</td> </tr> </tbody> </table>	SW2-2	SW2-1	POWER STATUS	ON	OFF	2-POWER DETECTION	OFF	ON	1-POWER DETECTION	SW2-4	SW2-3	J18	ON	OFF	TERMINAL	OFF	ON	DEBUG	Micro DIP-Switch						
SW2-2	SW2-1	POWER STATUS																								
ON	OFF	2-POWER DETECTION																								
OFF	ON	1-POWER DETECTION																								
SW2-4	SW2-3	J18																								
ON	OFF	TERMINAL																								
OFF	ON	DEBUG																								

Table 2-1, ARC-5066 Component Definition

HARDWARE INSTALLATION

2.2.2 SATA RAID Controller Module Outline

The ARC-5066 SATA RAID controller can support four 1.0Gbps iSCSI host ports, one 6.0Gbps eSATA host port and one 5.0Gbps USB 3.0 host port. Your SATA RAID controller module can be configured by using the LCD with keypad, a serial device (terminal emulation) and LAN port. This section provides the 6.0Gbps SATA RAID controller box outline.

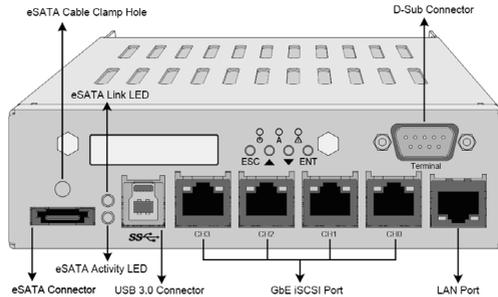
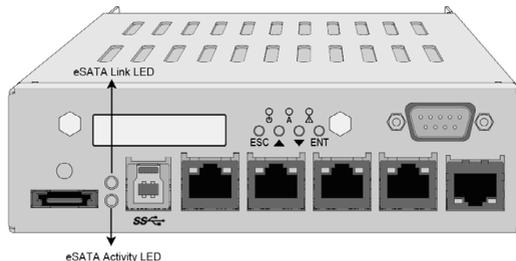


Figure 2-2, Front view of ARC-5066 RAID Box

2.2.3 SATA RAID LED Indicators

2.2.3.1 eSATA Ports Status

The following table describes the ARC-5066 eSATA host channel link/access LED.



eSATA Host Port LED	Status
Link LED (Green light)	When link LED illuminate light that indicates the eSATA channel host link has connected.
Activity LED (Blue light)	The eSATA channel host accesses to the ARC-5066 RAID controller.

HARDWARE INSTALLATION

2.3 Installation

The ARC-5066 RAID controller housed in a 5¼-inch half-height canister with a removable LCD module, 1 x 6.0Gbps eSATA port, 1 x USB 3.0 port, 4 x GbE iSCSI ports, a RJ-45 LAN port for RAID manager and a RS-232 port for debug or RAID manager. The RAID controller is provided for customers who want to use the existing SATA enclosure. It is designed to fit into one 5¼-inch half-height drive bays located in a server chassis or storage case. Standard mounting holes are located on both sides of the controller canister. These mounting holes accept commonly available No. 6-32 coarse-thread screws. Follow the instructions below to install the ARC-5066 RAID controller.

Step 1. Power the Enclosure Off

Turn off the enclosure and remove the AC power cord. Remove the enclosure's cover. For the instructions, please see the enclosure documentation.

Step 2. Unpack ARC-5066 RAID Controller

Unpack and remove the ARC-5066 RAID controller from the package. Inspect it carefully, if anything is missing or damaged, contact your local dealer.

Step 3. Mounting ARC-5066 into the Enclosure

Remove the enclosure cover and find a 5.25 inch CD-ROM wide place to fasten the ARC-5066 RAID controller in the external enclosure. The RAID controller requires one 5.25" half-height drive bay.

Step 4. Connecting ARC-5066 Controller Power

The ARC-5066 series RAID controller box supports 6-pin PCI-E power connector. There is a 6-pin PCI-E connector on the ARC-5066 labelled J9. You must plug in a PSU's PCI-E cable at all times to supply enough stable power for the controller.

HARDWARE INSTALLATION

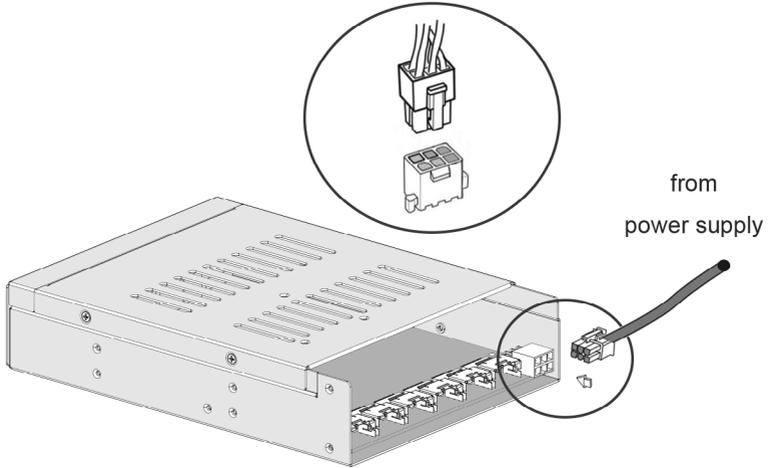


Figure 2-3, Connect Direct from Power Supply

If your power supply doesn't have a 6 pin PCI-E power cable then you can use the adapter to convert the 4 pin peripheral power cable into a PCI-E power cable.

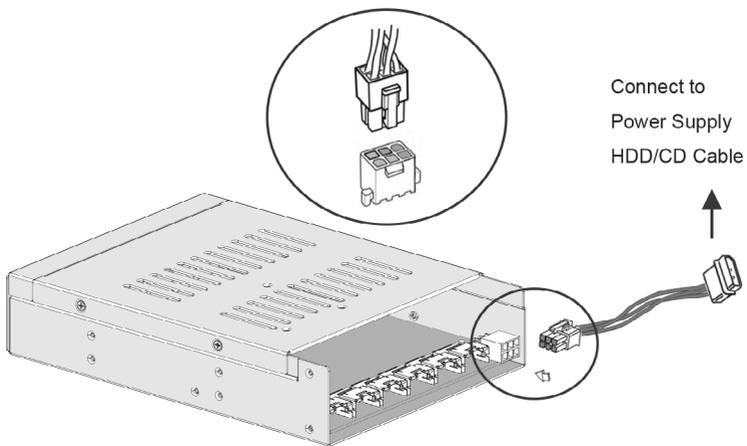


Figure 2-4, Connect through HDD/CD Cable

HARDWARE INSTALLATION

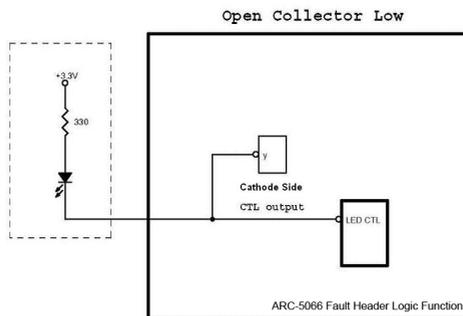
Step 5. Install the LED Cable (Optional)

Please check the method which controls fault LED on the backplane. If the backplane supports SGPIO feature, ignore the individual fault LED cable connection. The preferred I/O connector for server backplanes is the Min SAS 4i (SFF-8087) internal connector. This connector has eight signal pins to support four SATA drives and six pins for the SGPIO (Serial General Purpose Input/Output) side-band signals. The SGPIO bus is used for efficient fault/activity LED management and for sensing drive locate status. See SFF 8485 for the specification of the SGPIO bus. For backplane without SGPIO supporting, Please refer to section step5-1. LED Cables for Fault LED Installation.

Step 5-1. LED Cables for Fault LED Installation.

Make sure that the proper failed drive channel information is displayed by the fault LEDs. An improper fault LED cable connection will tell the user to "Hot Swap" the wrong drive. This can result in removing the wrong disk (one that is functioning properly) from the controller. This can result in failure and loss of system data.

The following electronics schematic is the ARC-5066 RAID controller fault connector logic level. The signal on each fault header is cathode (-) side.



Note:

Cables for the individual drive LEDs may come with a drive cage, or you may need to purchase them.

HARDWARE INSTALLATION

The following figure 2-5 show the drive number of the fault header.

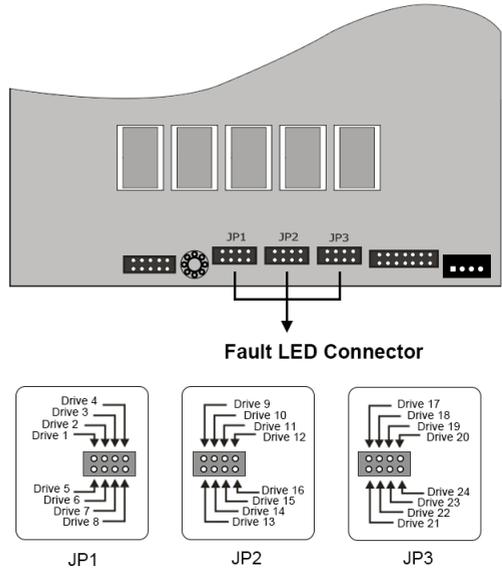


Figure 2-5, ARC-5066 RAID Controller Fault LED Header

Connect the cables for the drive fault LEDs between the backplane of the cage and the respective header on the ARC-5066 RAID controller. The following table describes the fault LED status.

LED	Normal Status	Problem Indication
Fault LED	<ol style="list-style-type: none"> When the fault LED is lit, there is no disk present. When the fault LED is not lit, then disk is present and status is normal. 	<ol style="list-style-type: none"> When the fault LED is blinking (2 times/sec), that disk drive has failed and should be hot swapped immediately. When the activity LED is lit and fault LED is fast blinking (10 times/sec) there is rebuilding activity on that disk drive.

HARDWARE INSTALLATION

Step 6. Install the Power Supply Status Cable (Optional)

You can verify the the indicator lights on each power supply that shows its operating status. If a power supply failure occurs, the indicator lights will be lit and active the power status signal: The power status connectors, designated J2, and J3 are used to check the status of each power supply. See the table for pin definitions as below.

Power Supply Status Connectors	
Pin	Definition
1	GND
2	Low: power ok ; High: power fail

SW2-2	SW2-1	Power Status
ON	OFF	2-Power Detection
OFF	ON	1-Power Detection

Controller hardware monitor can check the status of the power supply and show those power supply status on the controller's hardware information based on the SW2(2-1) micro switch definition shown in the table above. This RAID controller can monitor up to two power supply status.

Step 7. Install the System Fans Cable (Optional)

The 3-pin connectors, designated JP10, J12 and JP13 provide power to the fans. Each connector can only connect to one fan. You can directly connect the enclosure cooling fan to those 3-pin connector. These fans circulate air through the chassis as a means of lowering the chassis internal temperature. See the table for pin definitions as below.

Fan Connectors	
Pin	Definition
1	GND
2	+12V
3	Tachometer

SW1-3	SW1-2	SW1-1	FAN_NO.
OFF	OFF	OFF	NO
OFF	OFF	ON	Fan1
OFF	ON	OFF	Fan1, Fan2
OFF	ON	ON	Fan1, Fan2, Fan3
ON	OFF	OFF	Fan1, Fan2, Fan3, Fan4

Controller hardware monitor can check the RPM status of the cooling fans and show those fan status on the controller's hardware information based on the SW1(3-1) micro switch definition shown in the table above. Current limitation of total fan headers are 6A. This RAID controller can support up to four fans.

HARDWARE INSTALLATION

Step 8. Connecting SFF-8087 Cable to Backplane

The ARC-5066 RAID controller supports 3/4/6 SFF-8087 connectors on the back side. User uses suitable cable (depends on the backplane) to connect the RAID controller connector to the enclosure backplane.



Figure 2-6, Connect ARC-5066 RAID Controller and Backplane

Step 9. Install the Enclosure Top Cover

Check the installation thoroughly, reinstall the enclosure cover, and reconnect the power cord cables.

Step 10. Loading Drive to the Drive Tray

You can connect the SATA drives to the controller through direct cable and backplane solutions. In the direct connection, SATA drives are directly connected to SATA ports with SATA cables. Remove the front bezel from the computer chassis and install the cages or SATA drives in the computer chassis. Loading drives to the drive tray if cages are installed. Be sure that the power is connected to the individual drives or cage.

In the backplane solution, SATA drives are directly connected to SATA system backplane. The number of SATA drives is limited to the number of slots available on the back-plane. Your ARC-5066 RAID controller supports up to 12/16/24 SATA 6.0-Gbps 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 ARC-5066 RAID enclosure. Install the drives to 12-bays ARC-5066 RAID enclosure as shown in figure 2-7.

HARDWARE INSTALLATION

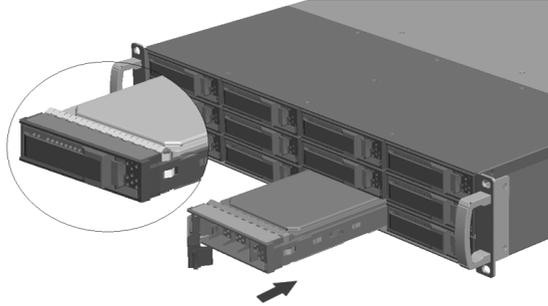
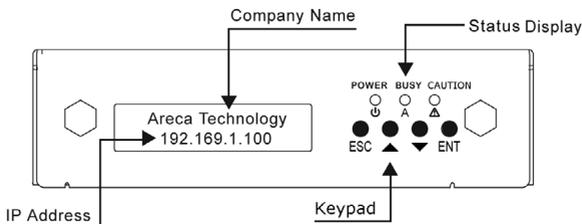


Figure 2-7, Install the Drives to 12-Bays ARC-5066 Controller Enclosure.

Step 11. Configure RAID Controller

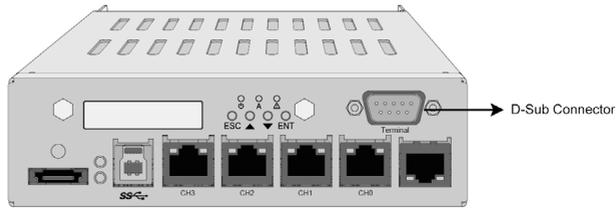
The ARC-5066 RAID controller is normally delivered with LCD pre-installed. Your ARC-5066 RAID enclosure can be configured by using the LCD with keypad, a serial device (terminal emulation) or LAN port.

- **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 controller see the Chapter 4 of LCD Configuration Menu. 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 below:



HARDWARE INSTALLATION

- Method 2: RS232C Port (Terminal) Connection



The SATA RAID controller 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 SATA RAID controller "D-Sub Connector" for access to the text-based setup menu.

Please configure the SW2(4-3) settings on the RAID controller to define the Terminal connector function: VT-100 for RAID debug port and VT-100 for RAID manager.

SW2-4	SW2-3	Terminal Port Function
ON	OFF	Controller RAID Manager
OFF	ON	Controller Debug Port

The ARC-5066 package includes one DB9-to-DB9 serial data cable. Use the DB9 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:

1. Attach one end of the DB9 serial data cable to the Terminal connector on the ARC-5066 RAID controllers.
2. Attach the other end of the DB9 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.

HARDWARE INSTALLATION

- Method 3: LAN Port Connection

The SATA RAID controller module has embedded the TCP/IP & web browser-based RAID manager in the firmware. User can remote manage the SATA RAID controller without adding any user specific software (platform independent) via standard web browsers directly connected to the 10/100 Ethernet RJ45 LAN port. Connect Ethernet port (LAN Port) of the SATA RAID controller using the included Ethernet cable and then to a LAN port or LAN switch. For additional information on using the LAN port to configure the RAID controller see the Chapter 6 of Web Browser-Based Configuration.

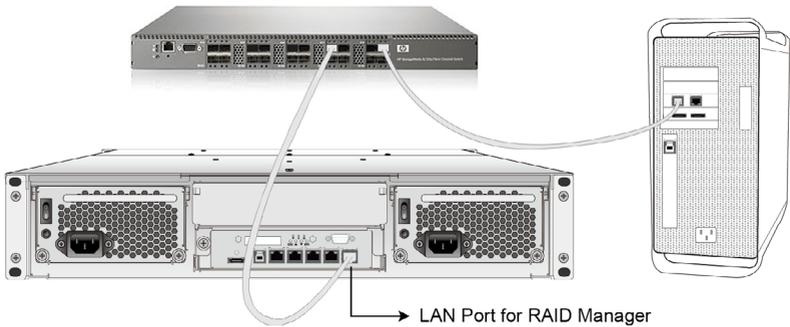


Figure 2-8, ARC-5066 Management Connection

Step 12. Connect to Host Interface

Once the ARC-5066 RAID enclosure has finished the initialization of the array, then you can connect it to a host computer. The ARC-5066 RAID enclosure can be connected to a host computer through the Hi-Speed USB 3.0, GbE iSCSI or eSATA interface. When the volume set is ready for system accesses, connect the USB 3.0, GbE iSCSI or/and eSATA cable to the ARC-5066 RAID enclosure and to the appropriate port on host computer.

Since eSATA and USB 3.0 host channel share one internal bus to the RAID controller, the internal bus is configured by the hardware plug-in detection. You can connect both interfaces to the host, but you can only use one connection assigned by ARC-5066 at a time. Interface that is connected 1st has precedent.

HARDWARE INSTALLATION

- eSATA Cables and Connectors

The ARC-5066 RAID enclosure uses the latest in eSATA technology, allowing interface (or bus) transfer rates of up to 6.0Gbps. The eSATA was developed for the use of shielded cables outside the PC. The eSATA cable is fully-shielded cable with separation of the outer shielding (for chassis ground) and signal ground, Hot-plugging supported and maximum length increased to 2 meters. Since the market demand for eSATA external storage is on the rise, a system released almost has added eSATA connectors in the mainboard connector requirements or install a PCI Host controller with external eSATA connection. This provides an easy and reliable way to equip a system with an external SATA connection. If systems without supporting eSATA connector, you can also use a cable from an internal SATA connector up to a receptacle on a PCI bracket, as shown in Figure 2-9. In this case, it should be noted that the signal from internal controller to the eSATA connector should meet eSATA the electrical compliance requirements outlined. Areca would suggest utilize a PCI or PCIe SATA host controller that supports hot swap and SATA PM connections. This can make user to leverage above features supported on the ARC-5066 RAID enclosure.

The threaded hole on eSATA host port for the cable clamp prevents the standard eSATA cable from being accidentally unplugged.

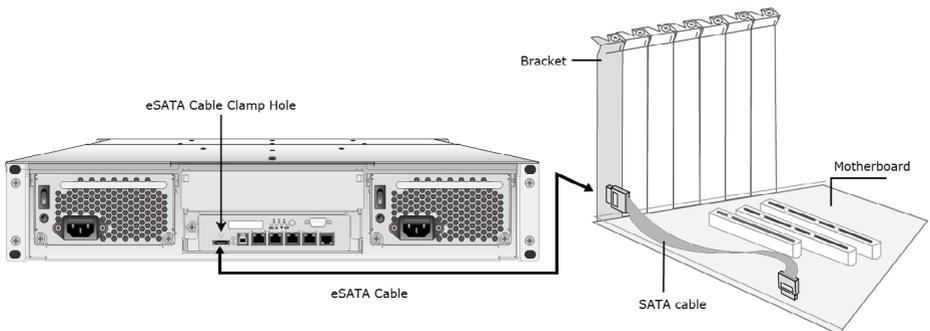


Figure 2-9, An eSATA host connection enabled with a bracket that is cabled to a motherboard SATA connector.

HARDWARE INSTALLATION

- Hi-Speed USB 3.0 Cables and Connectors

The ARC-5066 RAID controller uses a SuperSpeed USB (USB 3.0), providing an even greater enhancement in performance—up to 40 times faster than USB 2.0, with a design data rate of up to 5.0Gbps as opposed to USB 2.0’s 480Mbps. Your ARC-5066 RAID controller is shipped with a USB 3.0 cable, to ensure maximum data transfer performance when connected to a SuperSpeed USB (USB 3.0) port. If your computer only has a USB 2.0 connection, then ARC-5066 will auto-negotiate to USB 2.0 speeds. This makes it easier for ARC-5066 as an external higher speed storage solution.

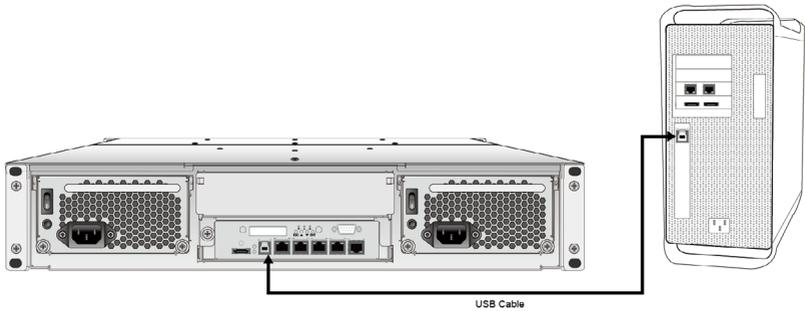


Figure 2-10, Connect ARC-5066 RAID Controller to the USB 3.0 Host Computer.

- GbE iSCSI Cables and Connectors

The ARC-5066 is a cost-effective IP SAN RAID controller designed for VMware ESX server external storage, DVR markets and cold storage. It has four (4) Ethernet RJ45 iSCSI data path port connectors for data path and one (1) Ethernet RJ-45 management port connector.

HARDWARE INSTALLATION

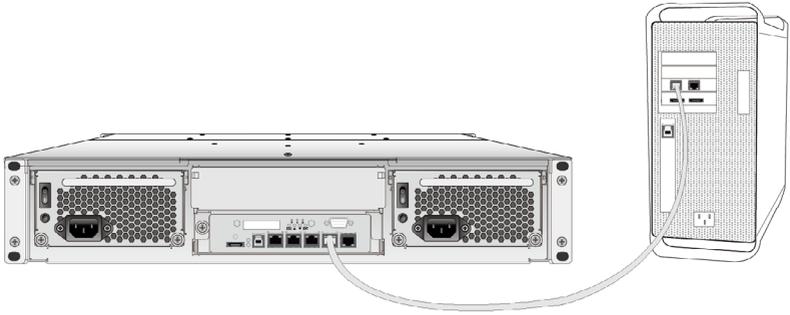


Figure 2-11, iSCSI Direct Attached Storage (DAS)

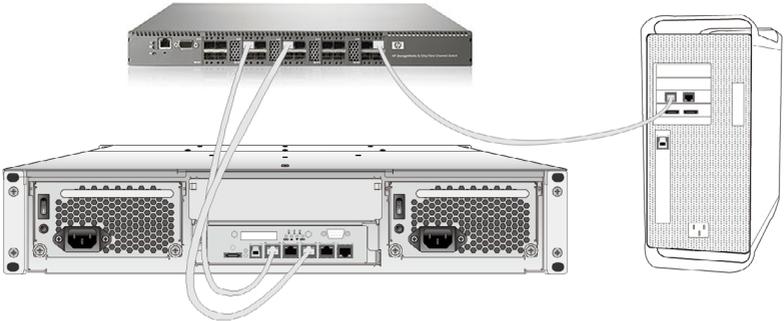


Figure 2-12, iSCSI Storage Area Network (SAN)

Note:

Only one iSCSI data cable is required between RAID controller and the network switch. However, you can attach multiple cables to create redundant data paths or trunking.

Step 13. Turn on Host Computer Power

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

HARDWARE INSTALLATION

Step 14. Format, Partition and Mount the ARC-5066 RAID Enclosure Volumes

After you create a unit, it needs to be partitioned, formatted, and mounted by the operating system. There are various steps, that is 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 ARC-5066 RAID enclosure can be fully used.

Note:

It is a good idea to turn on your ARC-5066 RAID controller before turning on the host computer. This will insure that the host computer recognizes the volumes and drives in the ARC-5066 RAID controller. If you turn on the host computer first, be sure of your host controller supporting hot-plug function or rescan command to recognize the ARC-5066 RAID controller again.

3. Configuration Methods

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

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

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

Note:

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

3.1 Using Local Front Panel Touch-control Keypad

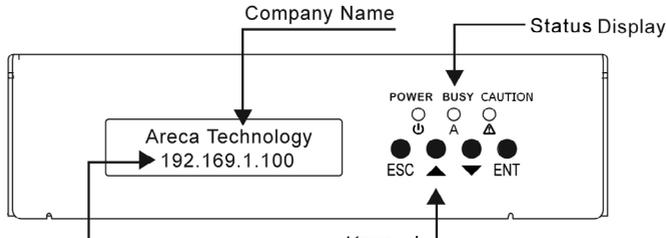
The front panel keypad and liquid crystal display (LCD) is the primary user interface for the RAID controller. All configuration and management of the controller and its properly connected disk arrays can be performed from this interface.

The front panel keypad and LCD are connected to the RAID controller 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 shown as below:



Function Key Definitions:

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

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

There are a variety of failure conditions that cause the RAID controller 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 RAID controller	Unlit or never flicker
Fault LED	Unlit	Solid red

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

CONFIGURATION METHOD

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

The serial port on the RAID controller's backside can be used in VT100 mode. 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.

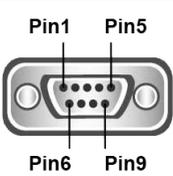
3.2.1 RS-232C Port Pin Assignment

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

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

If you don't configure the SW2(4-3) settings to define the Terminal connector function, please refer to table 2-1 "RS232C Port Function Definition" in chapter 2. The controller VT-100 connector pin assignments are defined as below.

RS-232 Pin Assignment					
Pin	Definition	Pin	Definition	Pin	Definition
1	NC	4	NC	7	NC
2	RXD	5	GND	8	NC
3	TXD	6	NC	9	NC



The diagram shows a 9-pin D-sub connector. The pins are arranged in a 3x3 grid. The top-left pin is labeled Pin1, the top-right pin is labeled Pin5, the bottom-left pin is labeled Pin6, and the bottom-right pin is labeled Pin9. The other four pins (2, 3, 4, 7) are not labeled.

CONFIGURATION METHOD

Keyboard Navigation

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

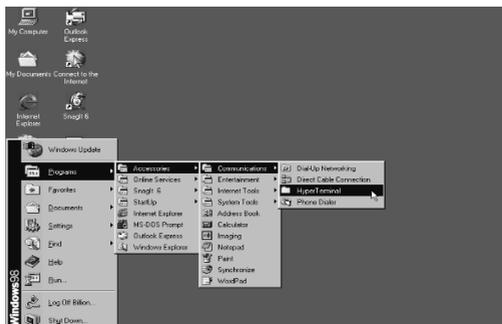
Key	Function
Arrow Key	Move cursor
Enter Key	Submit selection function
ESC Key	Return to previous screen
L Key	Line draw
X Key	Redraw

3.2.2 Start-up VT100 Screen

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

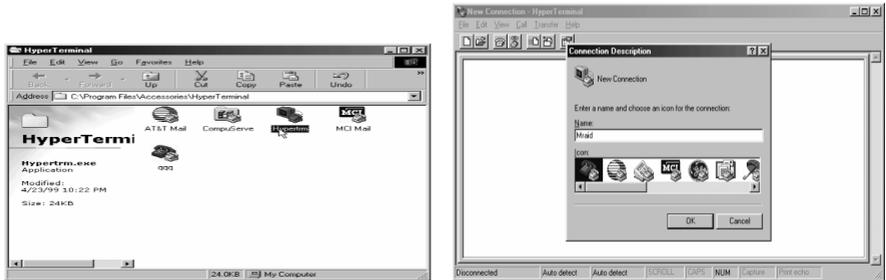
There are a wide variety of Terminal Emulation packages, but for the most part they should be very similar. The following setup procedure is an example setup VT100 Terminal in Windows system using Hyper Terminal use Version 3.0 or higher.

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)

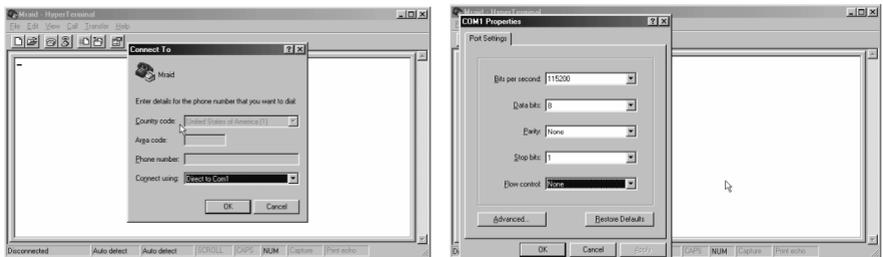


CONFIGURATION METHOD

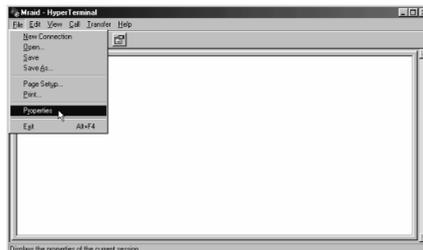
Step 2. Open **HYPERTERM.EXE** and enter a name for your Terminal. Click **OK**.



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**"

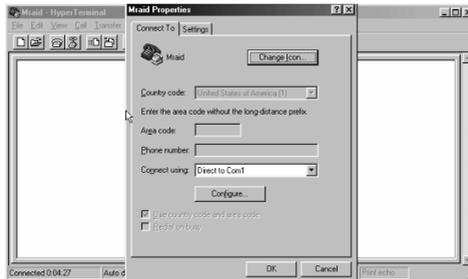


Step 4. Open the File menu, and then open Properties.

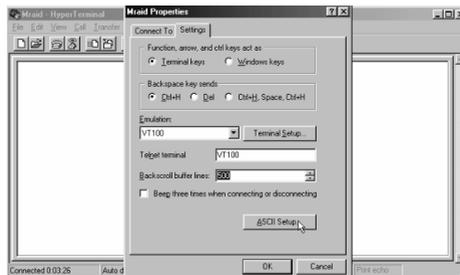


CONFIGURATION METHOD

Step 5. Open the Settings Tab.



Step 6. Open the Settings Tab. Function, arrow and Ctrl keys act as: Terminal Keys, Backspace key sends: **Ctrl+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 controller and Terminal together.

Press "X" key to display the disk array Monitor Utility screen on your VT100 Terminal.

CONFIGURATION METHOD

3.3 Web Browser-based RAID Manager

To configure RAID controller 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 RAID controller 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 controller and web browser-based RAID management, please connect the RAID controller LAN port to any LAN switch port.

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

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

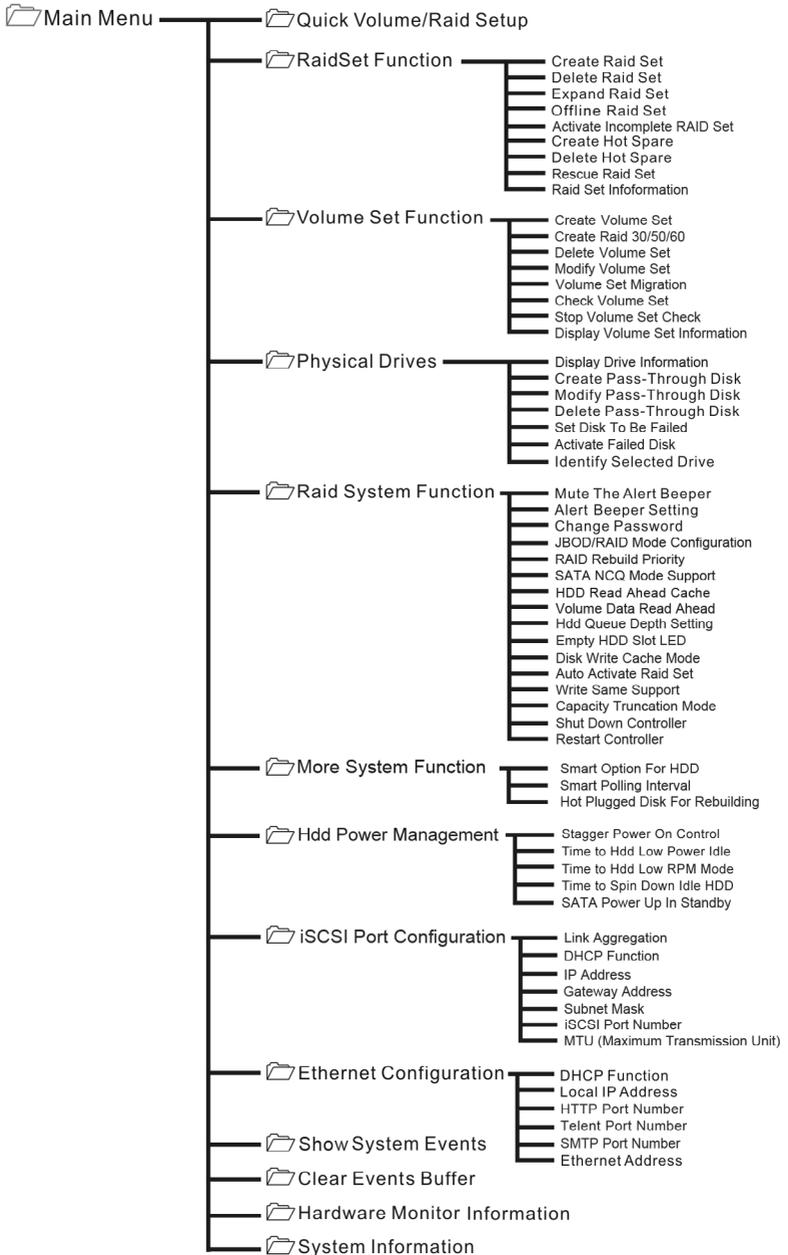
Note:

1. You must be logged in as administrator with local admin rights on the remote machine to remotely configure it.
2. The RAID controller 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. Alert By Mail Config, and SNMP Config can only be set in the web-based configuration.

CONFIGURATION METHOD



LCD CONFIGURATION MENU

4. LCD Configuration Menu

After the hardware installation, the disk drives connected to the RAID controller 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 controller. Except for the complex function, major of the configurations can be performed through this interface.

Function Key Definitions

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

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

4.1 Starting LCD Configuration Utility

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

LCD CONFIGURATION MENU

4.2 LCD Configuration Utility Main Menu Options

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

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

4.3 Configuring Raid Sets and Volume Sets

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

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

LCD CONFIGURATION MENU

4.4 Designating Drives as Hot Spares

To designate drives as hot spares, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Raid Set Functions" option and then press **ENT**. All RAID set functions will be displayed. Press **UP/DOWN** buttons to select the "Create Hot Spare Disk" option and then press **ENT**. The first unused physical device connected to the current RAID controller 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 as below:

Parameter	Setting
Volume Name	ARC-5066-VOL#000
Host Port#/Target Node/LUN	eSATA/USB/0/0
Cache Mode	Write-Back
Tag Queuing	Yes

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

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

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

LCD CONFIGURATION MENU

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

LCD CONFIGURATION MENU

4.6 Using Raid Set and Volume Set Functions

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

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

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

LCD CONFIGURATION MENU

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

4.7 Navigation Map of the LCD

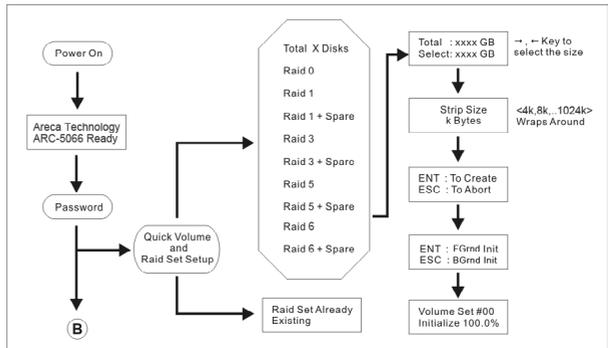
The password option allows user to set or clear the RAID controller's password protection feature. Once the password has been set, the user can only monitor and configure the RAID controller by providing the correct password. The password is used to protect the RAID controller from unauthorized entry. The RAID controller will check the password only when entering the main menu from the initial screen. The RAID controller will automatically go back to the initial screen when it does not receive any command in five minutes. The RAID controller's password is default setting at "**0000**" by the manufacture.

LCD CONFIGURATION MENU

4.7.1 Quick Volume And Raid Setup

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

Figure 4.7.1-1



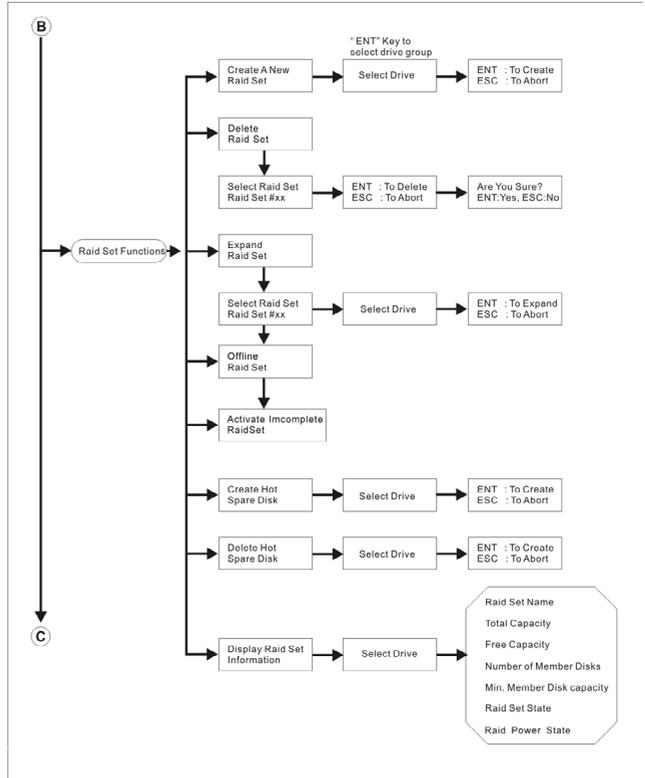
1. All of the physical disk drives are contained in a RAID set.
2. The RAID levels associated with hot spare, capacity, and stripe size are selected during the configuration process.
3. A single volume set is created and consumed all or a portion of the disk capacity available in this RAID set.
4. If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

4.7.2 Raid Set Functions

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

LCD CONFIGURATION MENU

Figure 4.7.2-1



4.7.2.1 Create A New Raid Set

For detailed procedure please refer to chapter section 4.6.

4.7.2.2 Delete Raid Set

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

LCD CONFIGURATION MENU

4.7.2.3 Expand Raid Set

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

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

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

Note:

1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.
2. If a disk drive fails during RAID set expansion and a hot spare is available, an auto rebuild operation will occur after the RAID set expansion completes.

4.7.2.4 Offline Raid Set

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

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 controller is power on. User can use the "Activate Incomplete RaidSet" option to active the RAID set. After user completed the function, the "Raid State" will change to "Degraded Mode".

4.7.2.6 Create Hot Spare Disk

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

4.7.2.7 Delete Hot Spare Disk

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

4.7.2.8 Display Raid Set Information

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

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

4.7.3 Volume Set Functions

A volume set is seen by the host system as a single logical device. It is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set capacity can consume all or a portion of the disk capacity available in a RAID set. Multiple volume sets can exist on a group of disks in a RAID set. Addi-

LCD CONFIGURATION MENU

tional volume sets created in a specified RAID set will reside on all the physical disks in the RAID set. Thus each volume set on the RAID set will have its data spread evenly across all the disks in the RAID set.

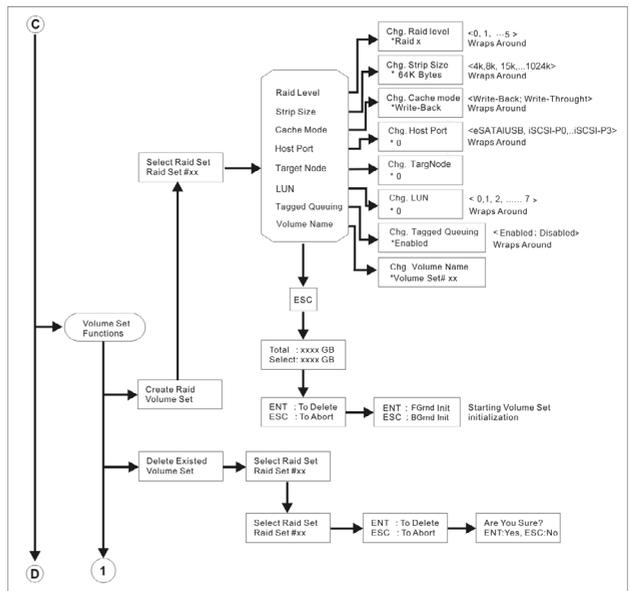
To enter the "Volume Set Functions", press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Volume Set Functions" option and then press **ENT** to enter further submenus. All volume set submenus will be displayed.

4.7.3.1 Create Raid Volume Set

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

The attributes for RAID controller series are Volume Name, Raid Level, Stripe Size, Cache Mode, Host Port#, Target Node, LUN, Write Protect and Tagged Queuing. See Figure 4.7.3.1-1.

Figure 4.7.3.1-1



LCD CONFIGURATION MENU

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

4.7.3.1.1 Volume Name

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

4.7.3.1.2 Raid Level

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

4.7.3.1.3 Stripe Size

This parameter sets the size of the segment written to each disk in a RAID 0, 1, 10(1E), 5 or 6 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128KB, 256KB, 512KB or 1024KB. A larger stripe size produces better-read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random reads more often, select a small stripe size.

4.7.3.1.4 Cache Mode

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

4.7.3.1.5 Host Port#/Target Node/LUN

Host Port# - There are three kinds of host interface connected to two internal channels for each volume. Different host interface can map and access to the same volume. But user can only write multiple hosts' volume through one host each time for data consistency.

LCD CONFIGURATION MENU

- **eSATA/USB Host:**

You can add both interfaces (eSATA & USB 3.0) connected to the host, but you can only use one connection at a time. Interface that is connected 1st has precedent.

eSATA: eSATA III host channel can access the volume set.

USB: The USB 3.0 host channel can access the volume set.

- **iSCSI-P0/P1/P2/P3 Host:**

iSCSI: The iSCSI host channel can access to the volume set.

Target Node - Each SATA device attached to the ARC-5066 RAID controller must be assigned a unique SATA ID number. A iSCSI host port can connect up to 128 (16 Target Node * 8 LUN) volume sets. A eSATA/USB 3.0 host RAID controller can only support up to 8 (Target Node=0~7:LUN=0) volume sets. The RAID controller is as many SATA devices. We should assign a Target Node from a list of Target Nodes.

LUN - Each Target Node can support up to 8 LUNs. The ARC-5066 RAID controller treats each LUN like a SATA 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 SATA 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 SATA drives that do not support command tag queuing.

4.7.3.1.7 Initialization Mode

Press **ENT** to define "FGrnd Init (Foreground initialization)" or press **ESC** to define "BGrnd Init (Background initialization)". When "FGrnd Init", the initialization proceeds must be

LCD CONFIGURATION MENU

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.

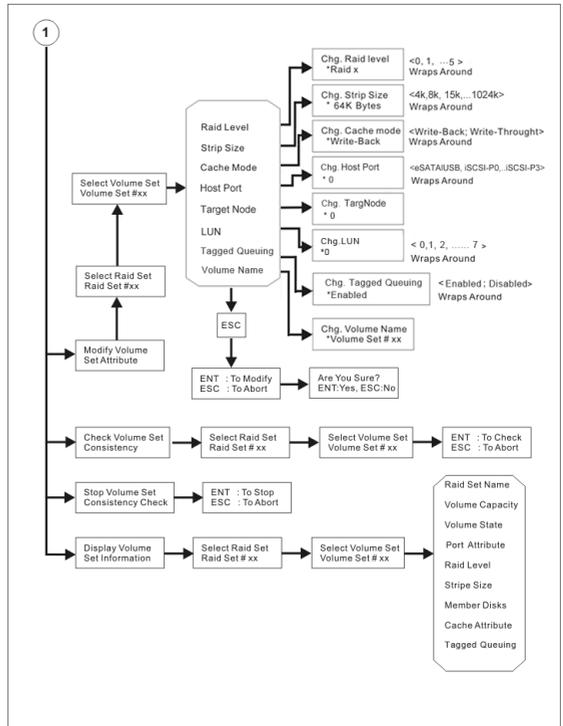
4.7.3.3 Modify Volume Set Attribute

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, Host Port#, Target Node, 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 can not be modified by this option.

4.7.4 Physical Drive Functions

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

LCD CONFIGURATION MENU

Figure 4.7.4-1

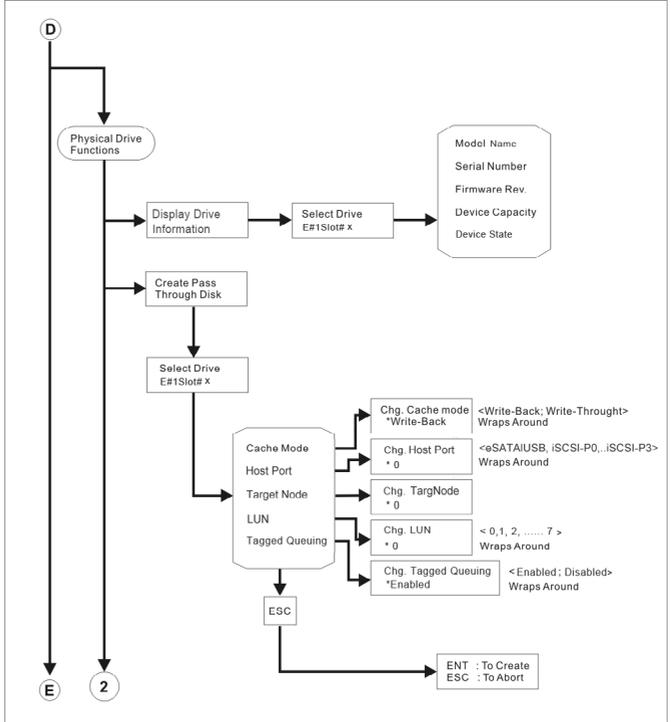
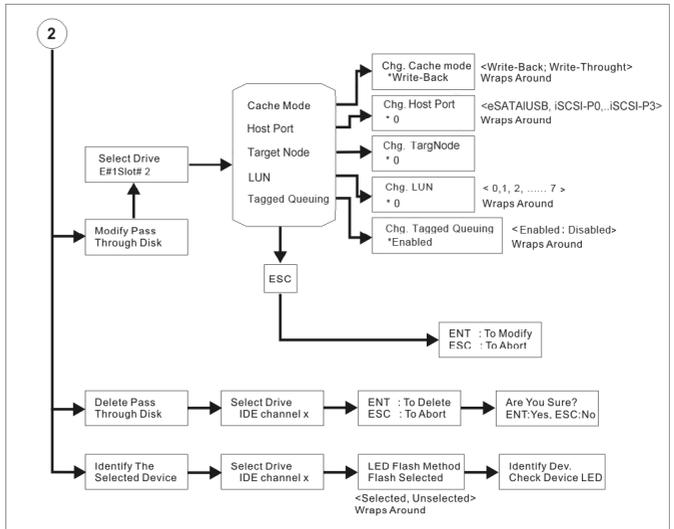


Figure 4.7.4-2



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 SATA number that user want to display. The drive information will be displayed. The SATA drive information screen shows the Model Name, Serial Number, Firmware Rev., Device Capacity, Current SATA, Supported SATA, and Device State.

4.7.4.2 Create Pass-Through Disk

Disk is not controlled by the RAID controller's firmware and thus can not be a part of a RAID set. The disk is available to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID controller'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 SATA number that user want to create. The drive attributes will be displayed.

The attributes for pass-through disk show the Volume Cache Mode, Host Port#, Target Node, 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, Host Port#, Target Node, LUN, Write Protect and Tagged Command Queuing. All values can be modified by user. Using **UP/DOWN** buttons to select attribute. Press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press **ENT** to accept the selection value. After completing the modification, press **ESC** to enter the confirmation screen and then press **ENT** to accept the "Modify Pass-Through Disk" function.

4.7.4.4 Delete Pass-Through Disk

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

4.7.4.5 Identify The Selected Drive

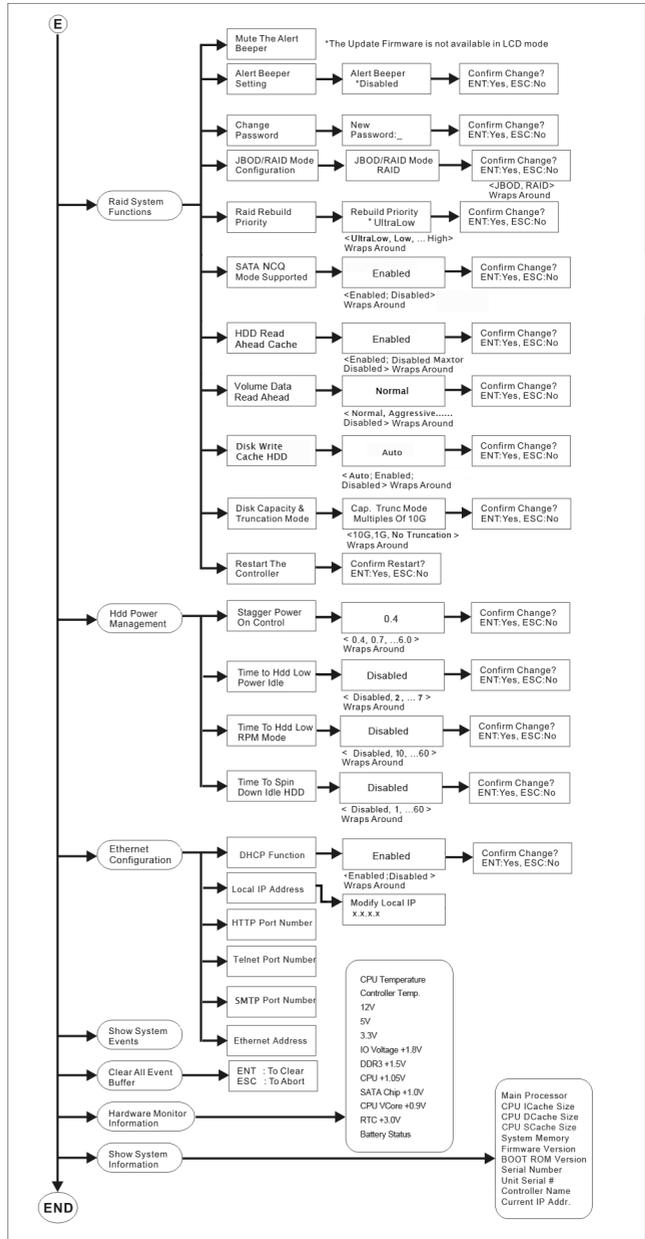
To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the "Identify The Selected Drive" function is selected. To identify selected drive from the physical drive pool, press **UP/DOWN** buttons to choose the "Identify The Selected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

4.7.5 Raid System Functions

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

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 controller 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 controller'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 controller's password, press the **UP/DOWN** buttons to select "Change Password" option and then press **ENT** to accept the selection. The "New Password:" screen appears and enter new password that users want to change. Using **UP/DOWN** buttons to set the password value. After completed the modification, the confirmation screen will be displayed and then press **ENT** to accept the function. To disable the password, press **ENT** only in the "New Password:" column. The existing password will be cleared. No password checking will occur when entering the main menu from the starting screen. The RAID controller 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 controller 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 controller 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 controller'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 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 controller 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 HDD

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

4.7.5.10 Disk Capacity Truncation Mode

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

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

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

Disabled - It does not truncate the capacity.

4.7.5.11 Restart Controller

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

LCD CONFIGURATION MENU

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 controllers 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 controller components. This damage can be avoided by allowing the RAID controller to stagger the spin-up of the drives. The 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 controller. It gives the RAID controller the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. Staggering drive spin-up in a multiple drive environment also avoids the extra cost of a power supply designed to meet short-term startup power demand as well as steady state conditions.

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

4.7.6.2 Time to Hdd Low Power Idle

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

LCD CONFIGURATION MENU

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 controller, press the **UP/DOWN** buttons to select "Ethernet Configuration" function and press **ENT**. Using **UP/DOWN** buttons to select DHCP, then press **ENT**.

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

LCD CONFIGURATION MENU

other devices on the network.

4.7.7.2 Local IP Adress

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

4.7.7.3 HTTP Port Number

To manually configure the "HTTP Port Number" of the RAID controller, 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 controller. 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 controller, 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 controller. You can then reassign the default "Telnet Port Number" of RAID controller.

4.7.7.5 SMTP Port Number

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

LCD CONFIGURATION MENU

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 controller. You can then reassign the default "SMTP Port Number" of RAID controller.

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

LCD CONFIGURATION MENU

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, controller firmware, serial number, unit serial, controller name, current IP and host 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 controller configuration utility is firmware-based and uses to configure RAID sets and volume sets. Because the utility resides in the RAID controller'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 are:

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	ARC-5066-VOL-#000
Host Port#/Target Node/LUN	eSATAIUSB/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.</p> <p>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.</p> <p>RAID 1 requires at least 2 physical drives.</p> <p>RAID 10(1E) 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 requires at least 4 physical drives.</p> <p>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.

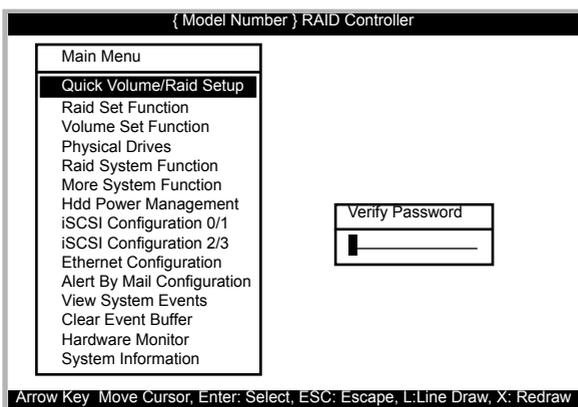
Step	Action
1	To setup the hot spare (optional), choose "Raid Set Function" from the main menu. Select the "Create Hot Spare" and press the Enter key to define the hot spare.
2	Choose "RAID Set Function" from the main menu. Select "Create Raid Set" and press the Enter key.
3	The "Select a Drive For Raid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

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
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 controller's password protection feature. Once the password has been set, the user can only monitor and configure the RAID controller by providing the correct password. The password is used to protect the internal RAID controller from unauthorized entry. The controller will prompt for the password only when entering the main menu from the initial screen. The RAID controller will automatically return to the initial screen when it does not receive any command in five minutes.

5.5.1 Quick Volume/Raid Setup

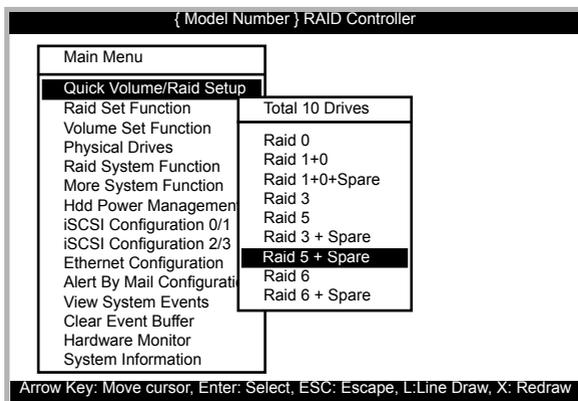
"Quick Volume/RAID Setup" is the fastest way to prepare a RAID set and volume set. It requires only a few keystrokes to complete. Although disk drives of different capacity may be used in the RAID Set, it will use the capacity of the smallest disk drive as the capacity of all disk drives in the RAID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

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

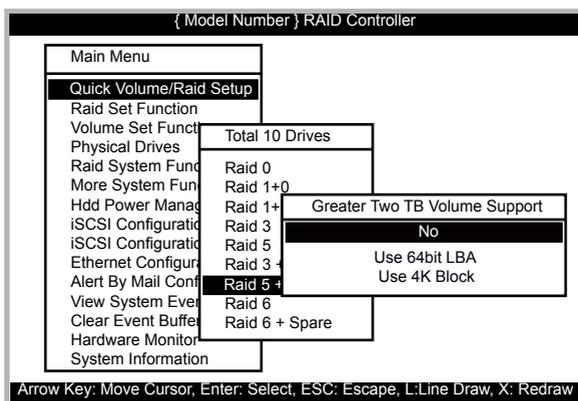
VT-100 UTILITY CONFIGURATION

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

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



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



- **No**

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

VT-100 UTILITY CONFIGURATION

- **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:

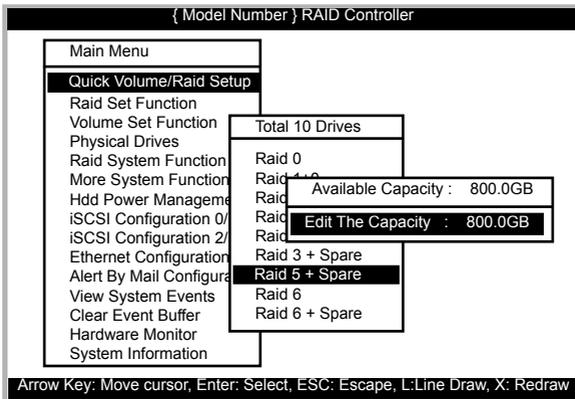
Windows 2003 with SP1 or later

Linux kernel 2.6.x or later

- **Use 4K Block**

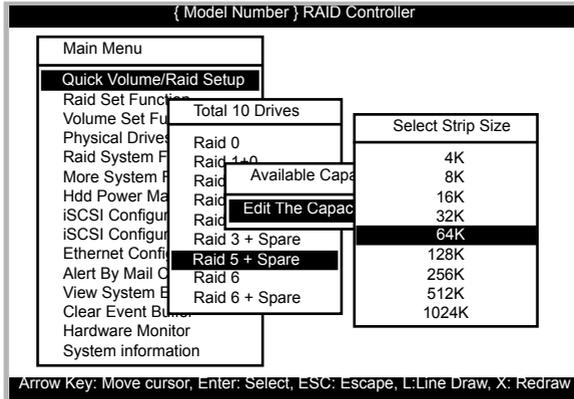
This option uses 16 bytes CDB and changes the sector size from default 512 bytes to 4k bytes. Windows XP only supports maximum volume capacity is up to 16TB.

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

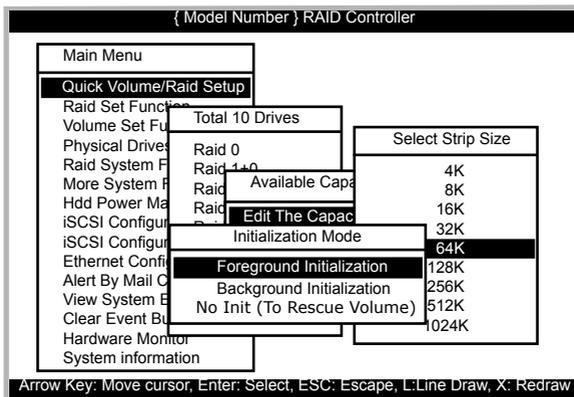
Stripe Size This parameter sets the size of the stripe written to each disk in a RAID 0, 1, 10(1E), 5, or 6 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128KB, 256KB, 512KB or 1024KB.



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

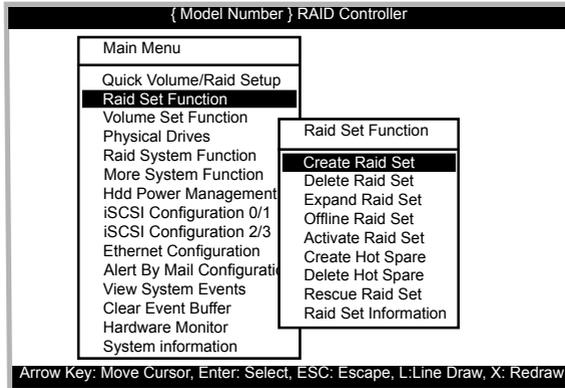
Select "Foreground (Faster Completion)" or "Background (Instant Available)" for initialization or "No Init (To Rescue Volume)" for recovering the missing RAID set configuration.



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 controller.

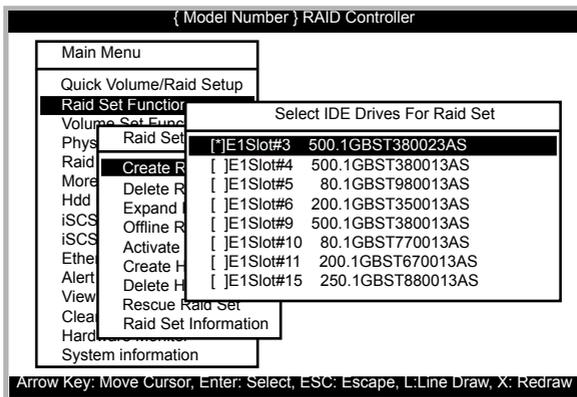
1. Up to 24 disk drives can be included in a single RAID set.
2. Up to 128 RAID sets can be created per controller. RAID level 30 50 and 60 can support up to eight sub-volumes (RAID set).

To define a RAID set, follow the procedures below:

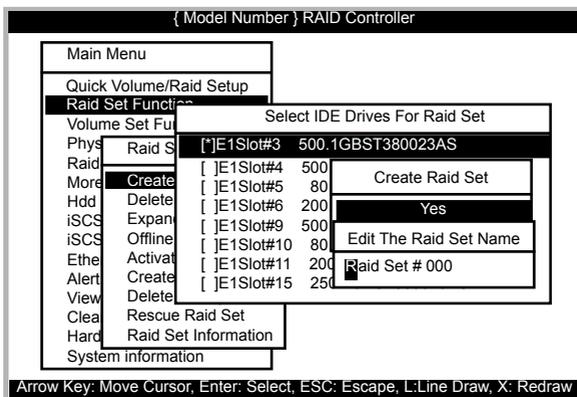
1. Select “Raid Set Function” from the main menu.
2. Select “Create Raid Set” from the “Raid Set Function” dialog box.
3. A “Select IDE Drive For Raid Set” window is displayed showing the SATA drives connected to the current controller. Press the **UP** and **DOWN** arrow keys to select specific physical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

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



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



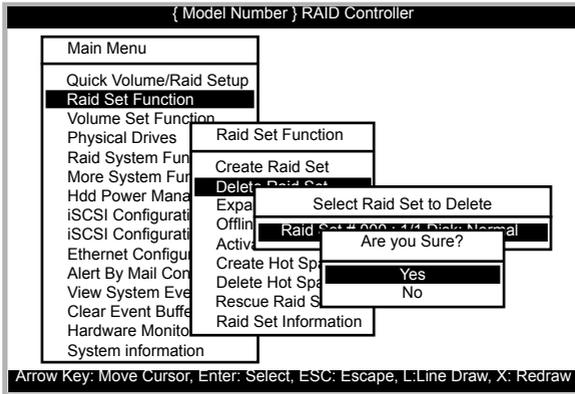
Note:

- You can only edit the Raid set name in "Create Raid Set".
- To create RAID 30/50/60 volume, you need to create multiple RAID sets first with the same disk members on each RAID set. The max no. disk drives per volume set: 24 for RAID 0/1/10(1E)/3/5/6/30/50/60.

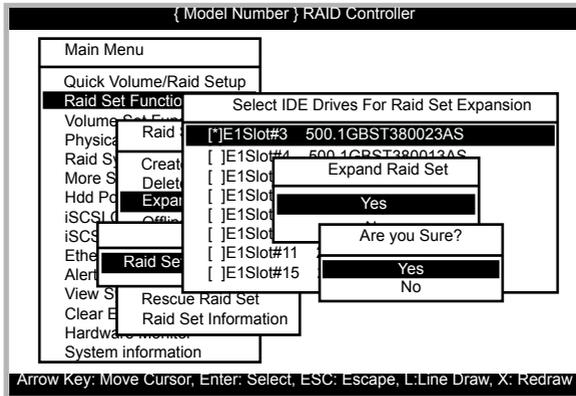
VT-100 UTILITY CONFIGURATION

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.



VT-100 UTILITY CONFIGURATION

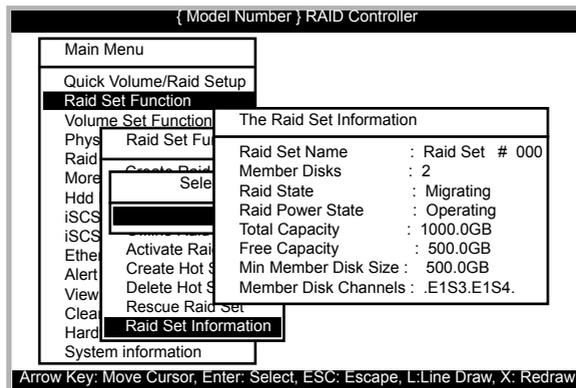


Note:

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

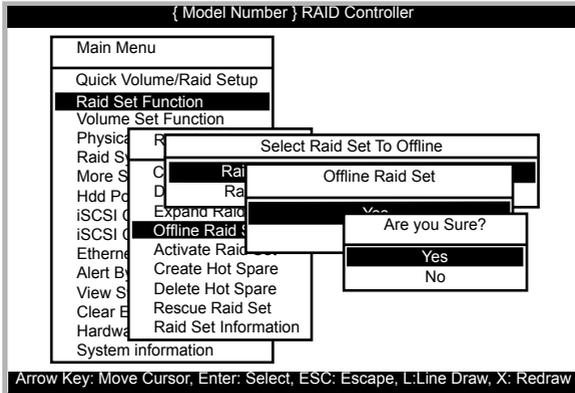
Migration occurs when a disk is added to a RAID set. Migrating state is displayed on the RAID state area of "The Raid Set Information" screen when a disk is being added to a RAID set. Migrating state is also displayed in the associated volume state area of the "Volume Set Information" which belongs this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



VT-100 UTILITY CONFIGURATION

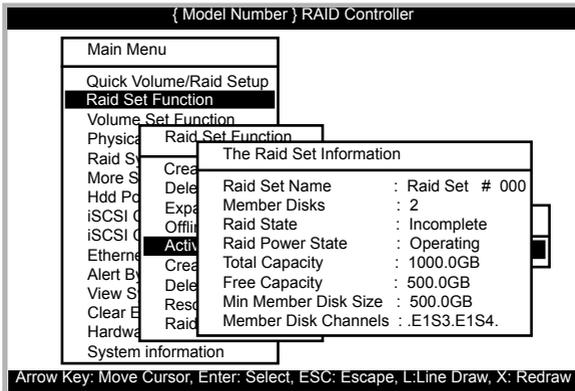
5.5.2.4 Offline Raid Set

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

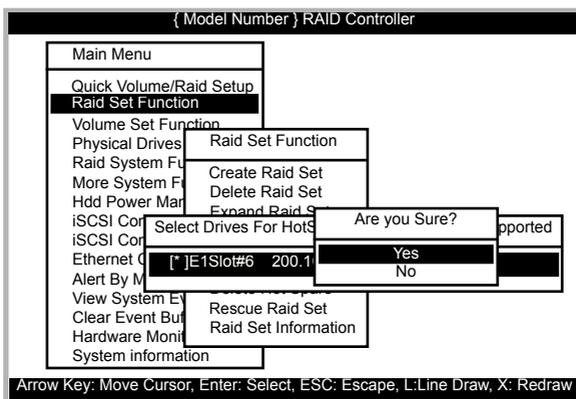
The following screen is used to activate the RAID set after one of its disk drive was removed in the power off state. When one of the disk drives is removed in power off state, the RAID set state will change to "Incomplete State". If user wants to continue to work while the RAID controller is powered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

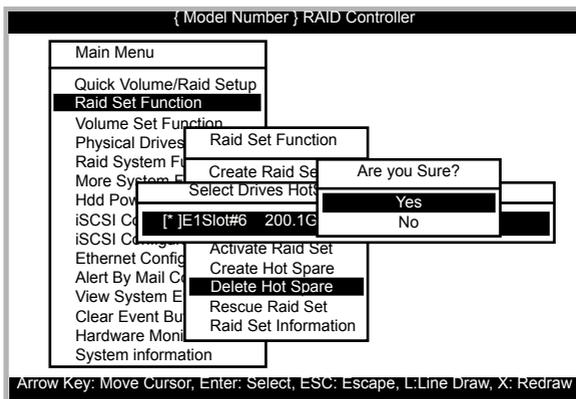
5.5.2.6 Create Hot Spare

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" option gives you the ability to define a global hot spare.



5.5.2.7 Delete Hot Spare

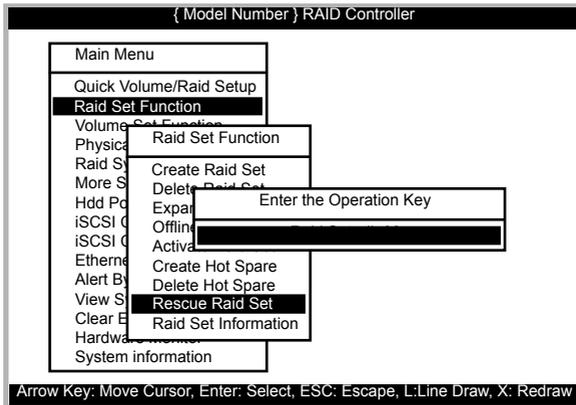
Select the target hot spare disk to delete by clicking on the appropriate check box. Press the **Enter** key to select a hot spare disk drive, and press **Yes** in the "Delete Hot Spare" screen to delete the hot spare.



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.

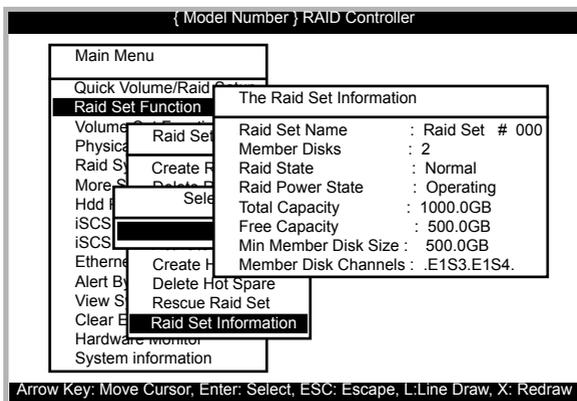


Once can manually fail a drive, which is useful in kill-off slow speed disk. There is nothing physically wrong with the disk. A manually failed the drive can be rebuilt by the hot spare and brought back on-line.

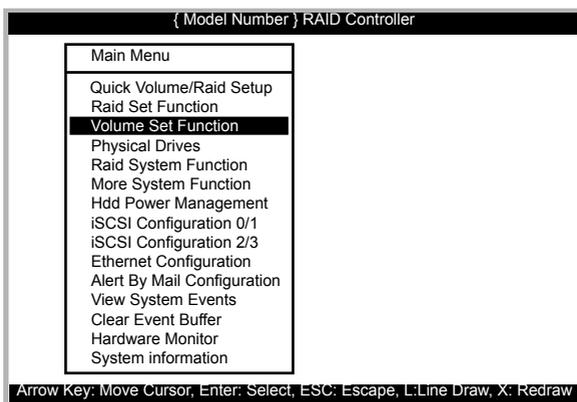
5.5.2.9 Raid Set Information

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

VT-100 UTILITY CONFIGURATION

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.

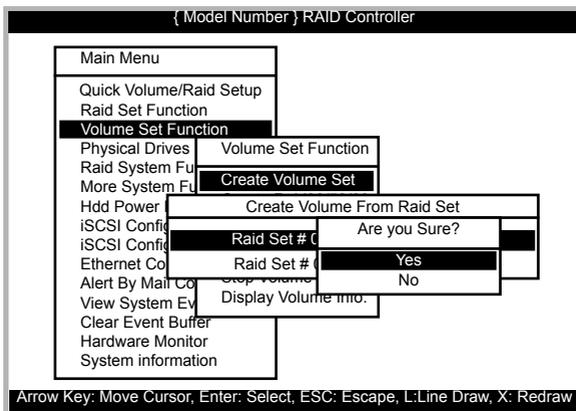
The following is the volume set features for the RAID controller.

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

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

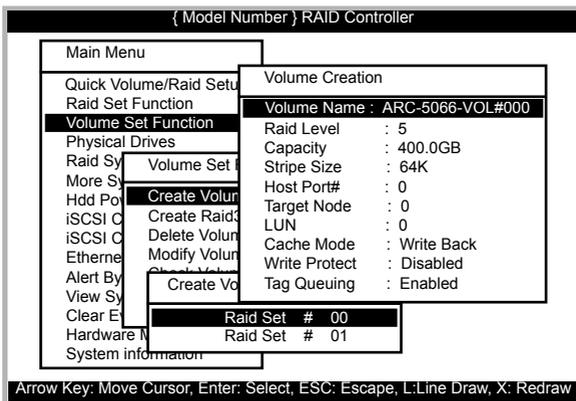
To create a volume set, following the steps:

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

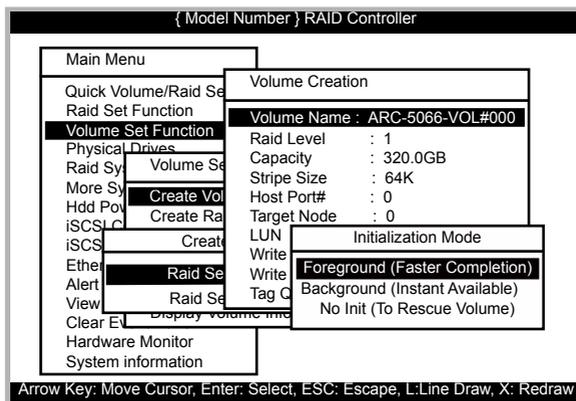


VT-100 UTILITY CONFIGURATION

- The new create volume set attribute allows user to select the Volume Name, Raid Level, Capacity, Strip Size, Host Port#, target Node, LUN, Cache Mode, Write Protect, and Tagged Command Queuing.



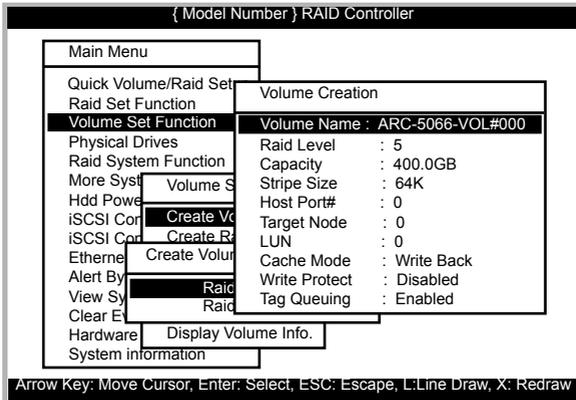
- After completed the modification of the volume set, press the **Esc** key to confirm it. An "Initialization Mode" screen appears.
 - Select "Foreground (Faster Completion)" for faster initialization of the selected volume set.
 - Select "Background (Instant Available)" for normal initialization of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



VT-100 UTILITY CONFIGURATION

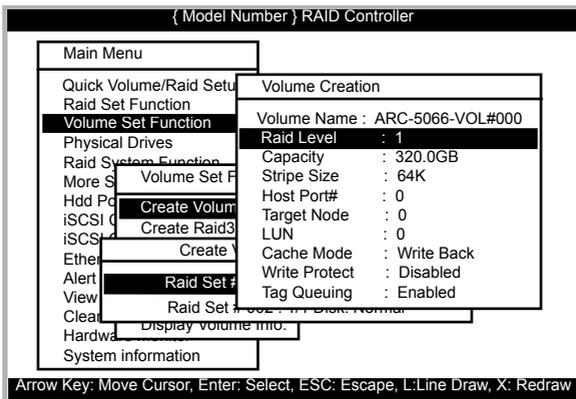
5.5.3.1.1 Volume Name

The default volume name will always appear as ARC-5066-VOL #. You can rename the volume set providing it does not exceed the 15 characters limit.



5.5.3.1.2 Raid Level

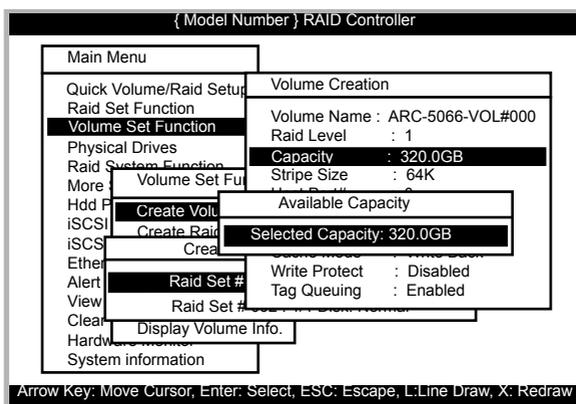
Set the RAID level for the volume set. Highlight "Raid Level" and press the **Enter** key. The available RAID levels for the current volume set are displayed. Select a RAID level and press the **Enter** key to confirm.



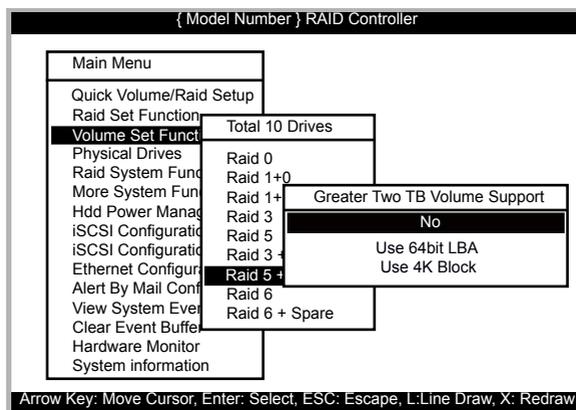
VT-100 UTILITY CONFIGURATION

5.5.3.1.3 Capacity

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



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



VT-100 UTILITY CONFIGURATION

- No

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

- 64bit LBA

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

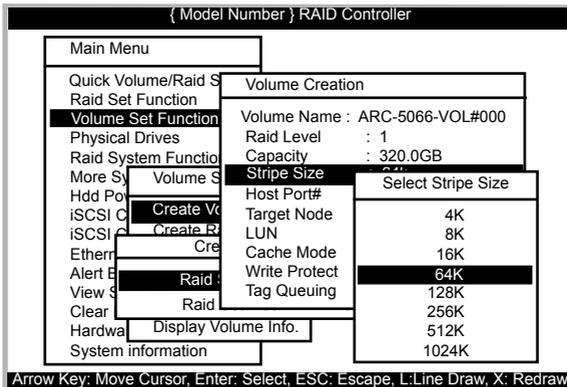
This option works on different OS which supports 16 bytes CDB. Such as:
Windows 2003 with SP1 or later
Linux kernel 2.6.x or later

- Use 4K Block

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

5.5.3.1.4 Stripe Size

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



VT-100 UTILITY CONFIGURATION

5.5.3.1.5 Host Port Mapping

There are three kinds of host interface connected to two internal channels for each volume. Different host interface can map and access to the same volume. But user can only write multiple hosts' volume through one host each time for data consistency.

- eSATA|USB Host:

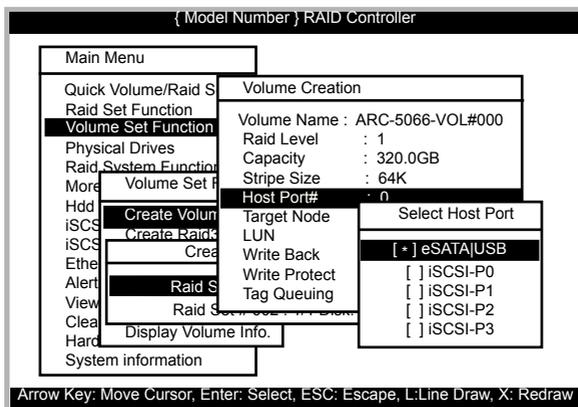
You can add both interfaces (eSATA & USB 3.0) connected to the host, but you can only use one connection at a time. Interface that is connected 1st has precedent.

eSATA: The eSATA|lll host channel can access the volume set.

USB: The USB 3.0 host channel can access the volume set.

- iSCSI-P0/P1/P2/P3 Host:

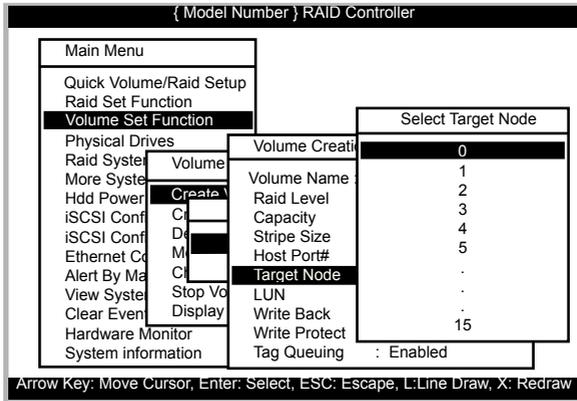
iSCSI: The iSCSI host channel can access to the volume set.



5.5.3.1.6 Target Node

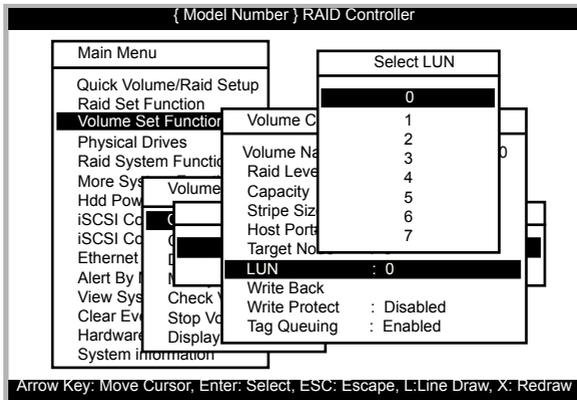
Target Node - Each SATA device attached to the ARC-5066 RAID controller must be assigned a unique ID number. A iSCSI host port can connect up to 128 (16 Target Node * 8 LUN) volume sets. A eSATA/USB 3.0 host RAID controller can only support up to 8 (Target Node=0~7:LUN=0) volume sets. The RAID controller is as many SATA devices. We should assign a Target Node from a list of Target Nodes.

VT-100 UTILITY CONFIGURATION



5.5.3.1.7 LUN

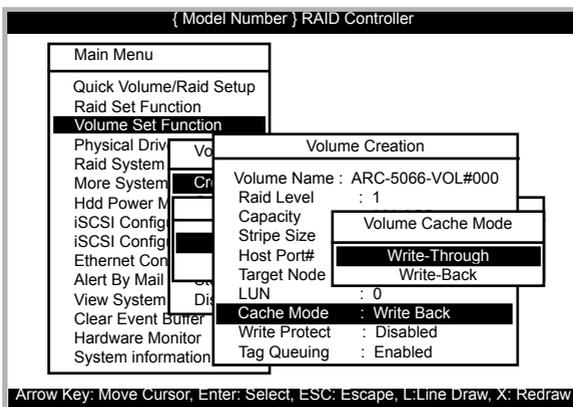
LUN - Each Target Node can support up to 8 LUNs. ARC-5066 RAID controller treats each Target:LUN like a SATA disk.



5.5.3.1.8 Cache Mode

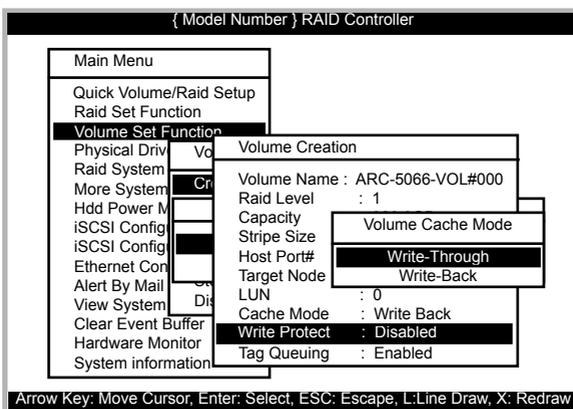
User can set the cache mode to: "Write-Through" or "Write-Back".

VT-100 UTILITY CONFIGURATION



5.5.3.1.9 Write Protect

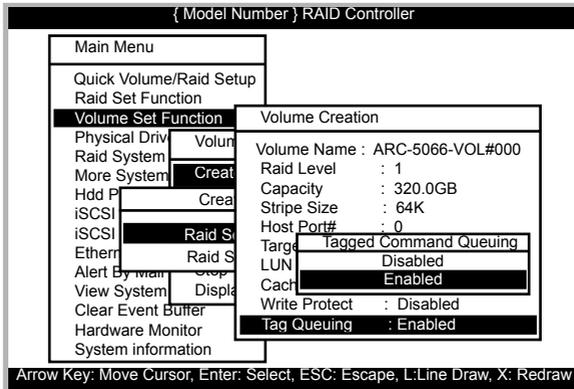
When "Write Protect" is enabled on the "Create Volume Set", host commands fail if they are issued to a volume in that RAID controller and attempt to modify a volume's data or attributes. "Write Protection" is used primarily for customerinitiated disaster recovery testing.



VT-100 UTILITY CONFIGURATION

5.5.3.1.10 Tag Queuing

This option, when enabled, can enhance overall system performance under multi-tasking operating systems. The Command Tag (Drive Channel) function controls the SATA command tag queuing support for each drive channel. This function should normally remain enable. Disabled this function only when using older drives that do not support command tag queuing. Tagged Command Queuing (TCQ) is a technology built into SATA 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 SATA drives that do not support command tag queuing.

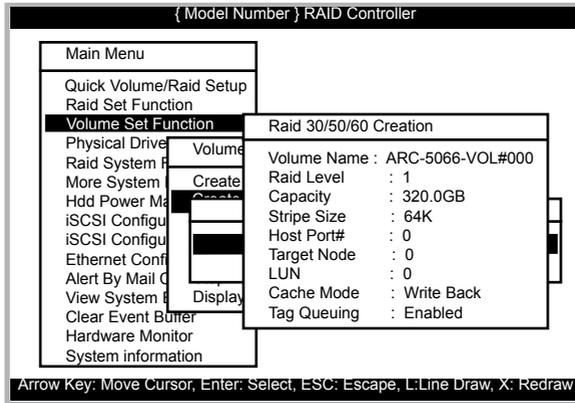


5.5.3.2 Create Raid 30/50/60

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, Stripe Size, Host Port#, target Node, 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

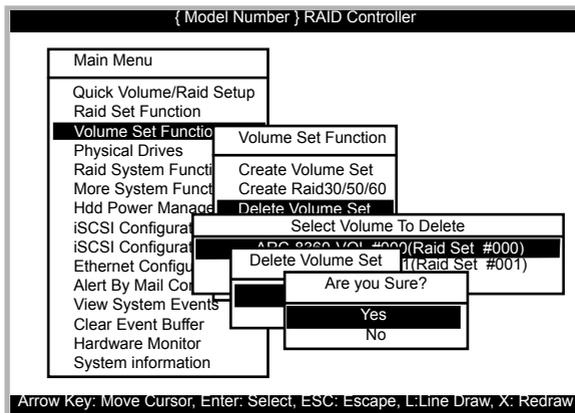


Note:

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

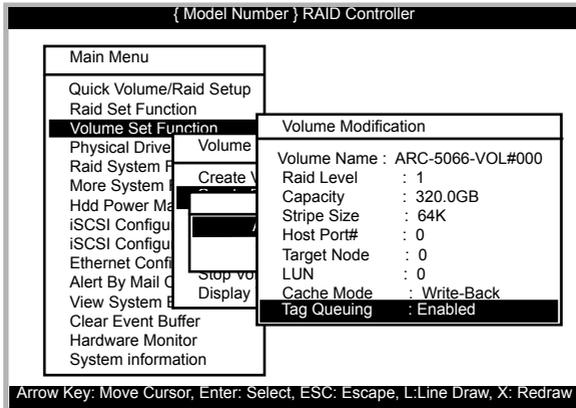
5.5.3.3 Delete Volume Set

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



VT-100 UTILITY CONFIGURATION

5.5.3.4 Modify Volume Set



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

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

5.5.3.4.1 Volume Growth

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

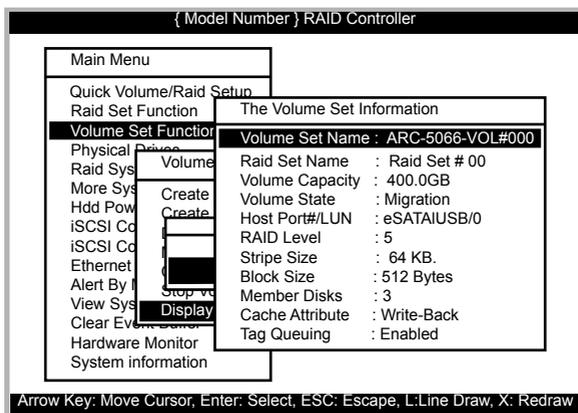
VT-100 UTILITY CONFIGURATION

To expand an existing volume noticed:

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

For greater 2TB expansion:

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



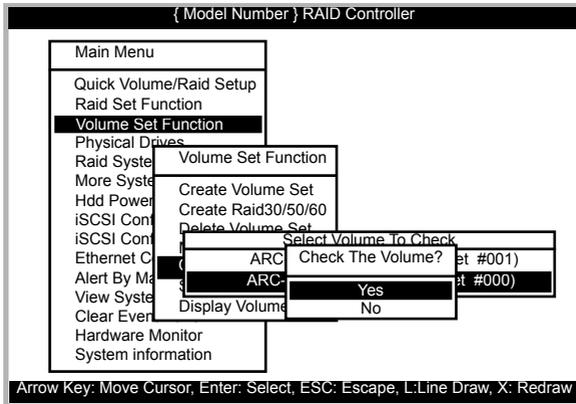
5.5.3.4.2 Volume Set Migration

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.

VT-100 UTILITY CONFIGURATION

5.5.3.5 Check Volume Set

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



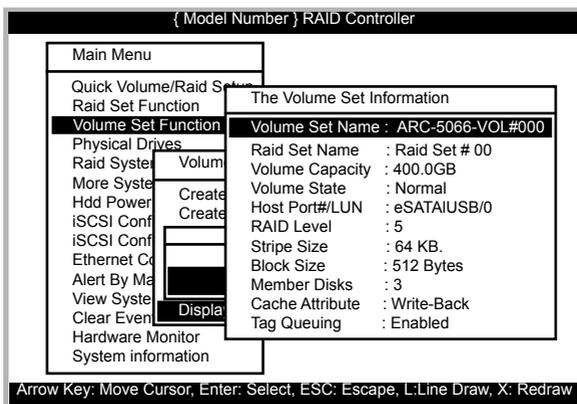
5.5.3.6 Stop Volume Set Check

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

5.5.3.7 Display Volume Set Info.

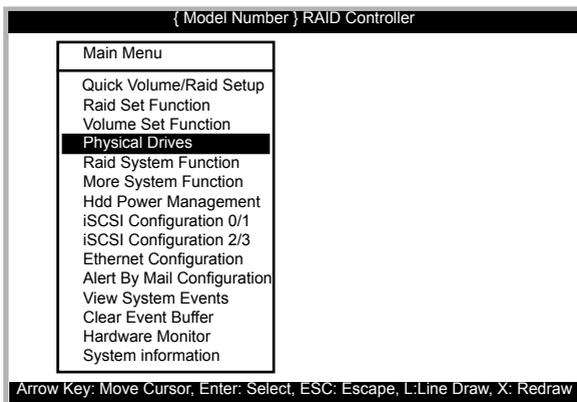
To display volume set information, move the cursor bar to the desired volume set number and then press the **Enter** key. The "Volume Set Information" screen will be shown. You can only view the information of this volume set in this screen, but can not modify it.

VT-100 UTILITY CONFIGURATION



5.5.4 Physical Drives

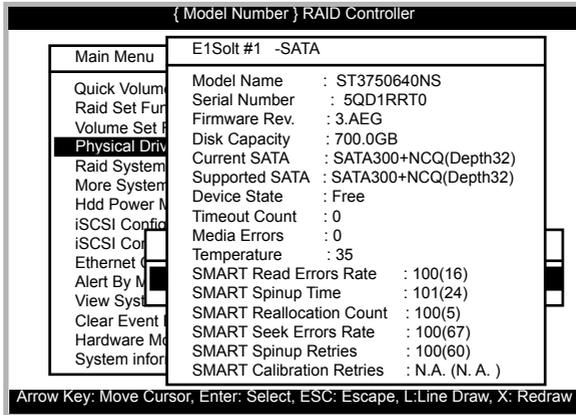
Choose this option from the main menu to select a physical disk and perform the operations listed above. Move the cursor bar to an item, then press **Enter** key to select the desired function.



5.5.4.1 View Drive Information

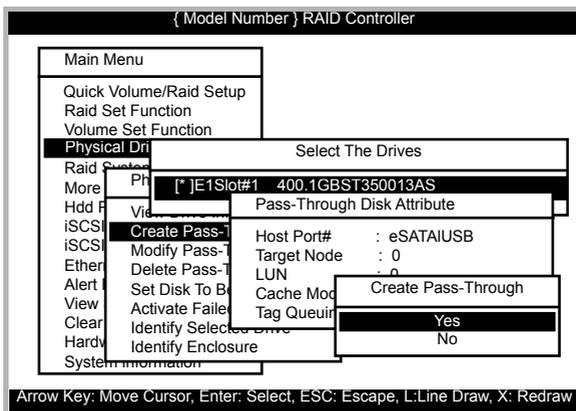
When you choose this option, the physical disks connected to the RAID controller are listed. Move the cursor to the desired drive and press **Enter** key to view drive information.

VT-100 UTILITY CONFIGURATION



5.5.4.2 Create Pass-Through Disk

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

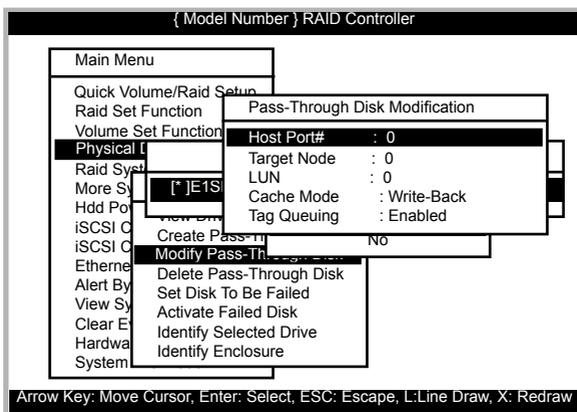


5.5.4.3 Modify Pass-Through Disk

Use this option to modify "Pass-Through Disk Attributes". To select and modify a pass-through disk from the pool of pass-

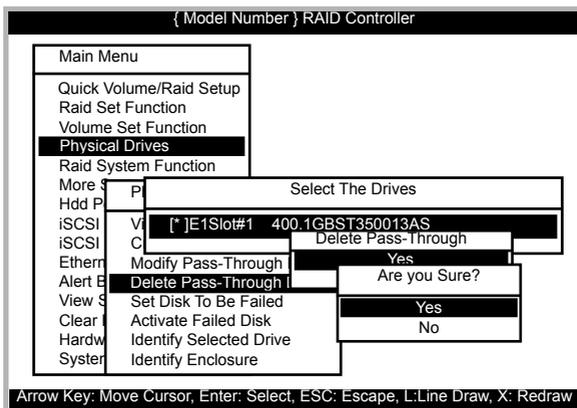
VT-100 UTILITY CONFIGURATION

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



5.5.4.4 Delete Pass-Through Disk

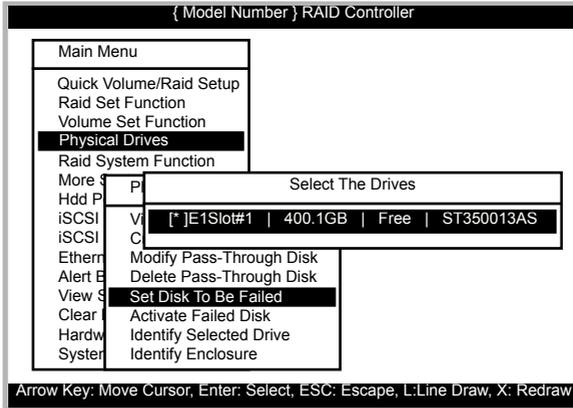
To delete a pass-through drive from the pass-through drive pool, move the cursor bar to the "Delete Pass-Through Drive" item, then press the **Enter** key. The "Delete Pass-Through confirmation" screen will appear; select **Yes** to delete it.



VT-100 UTILITY CONFIGURATION

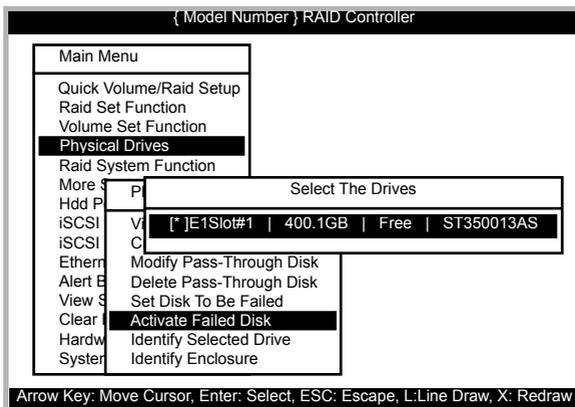
5.5.4.5 Set Disk To Be Failed

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



5.5.4.6 Activate Failed Disk

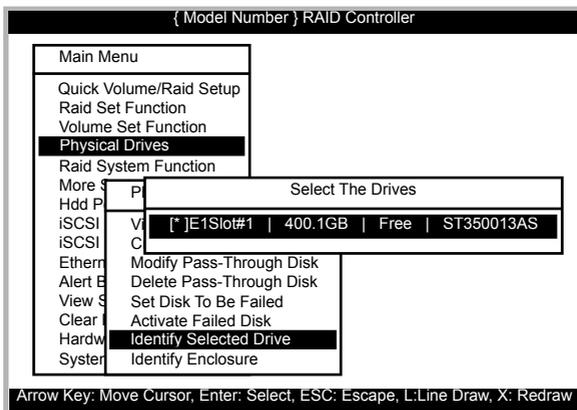
It forces the current “failed” disk in the system to be back on-line. “Activate Failed Disk” function has no effect on the removed disks, because a “removed” disk does not give the controller a chance to mark it as “failure”.



VT-100 UTILITY CONFIGURATION

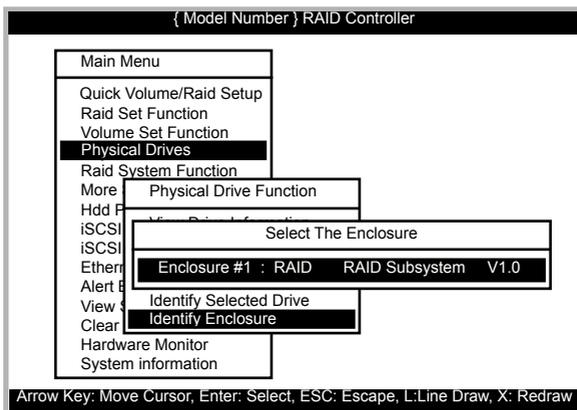
5.5.4.7 Identify Selected Drive

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



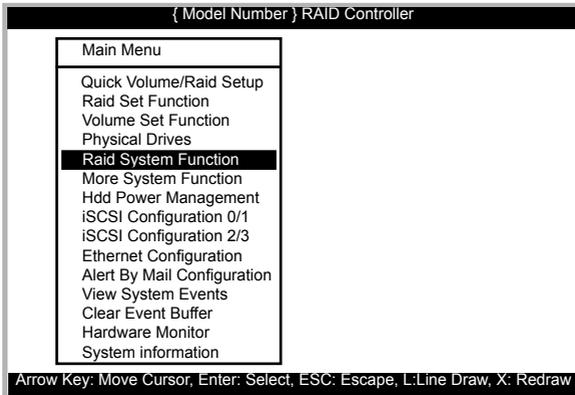
5.5.4.8 Identify Enclosure

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



VT-100 UTILITY CONFIGURATION

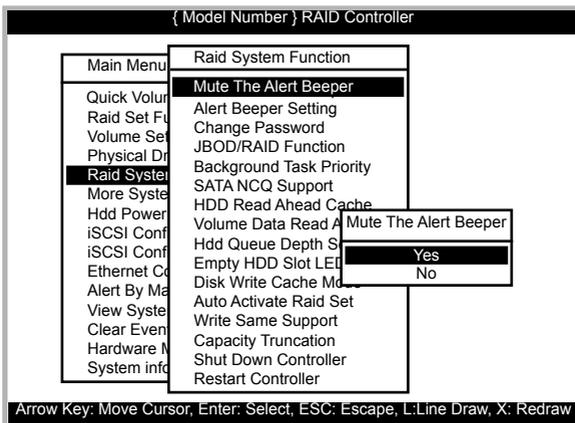
5.5.5 Raid System Function



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

5.5.5.1 Mute The Alert Beeper

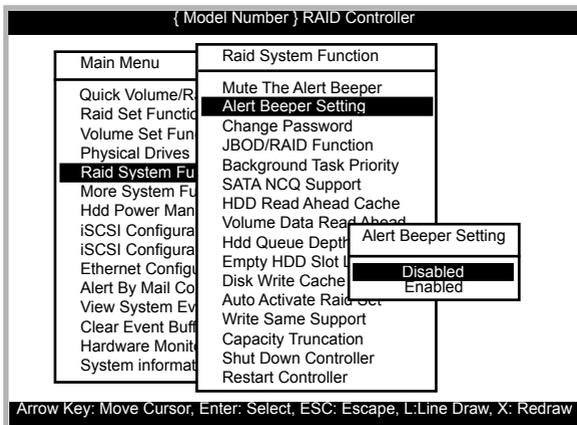
The “Mute The Alert Beeper” function item is used to control the RAID controller beeper. Select **Yes** and press the **Enter** key in the dialog box to turn the beeper off temporarily. The beeper will still activate on the next event.



VT-100 UTILITY CONFIGURATION

5.5.5.2 Alert Beeper Setting

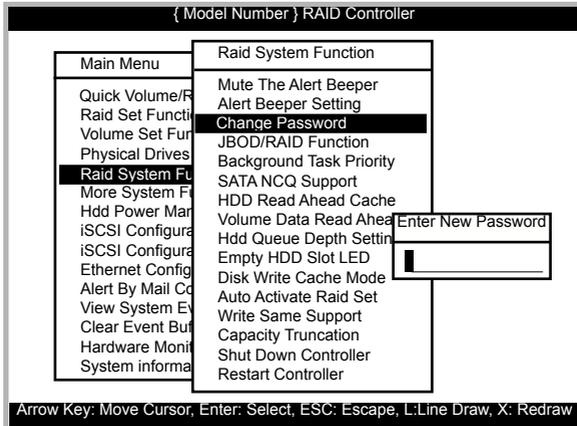
The "Alert Beeper Setting" function item is used to "Disabled" or "Enabled" the RAID controller alarm tone generator. Select "Disabled" and press the **Enter** key in the dialog box to turn the beeper off.



5.5.5.3 Change Password

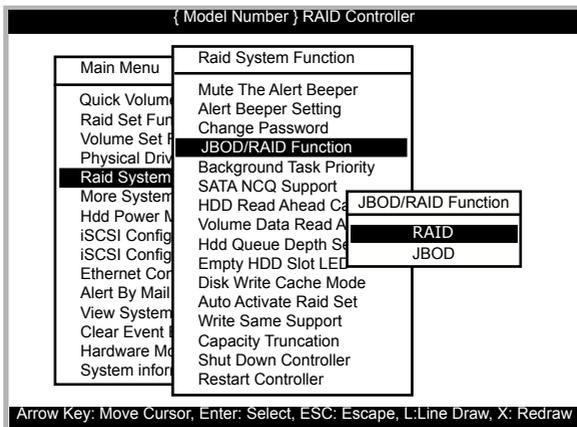
The manufacture default password is set to 0000. The password option allows user to set or clear the password protection feature. Once the password has been set, the user can monitor and configure the controller only by providing the correct password. This feature is used to protect the internal RAID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

VT-100 UTILITY CONFIGURATION



5.5.5.4 JBOD/RAID Function

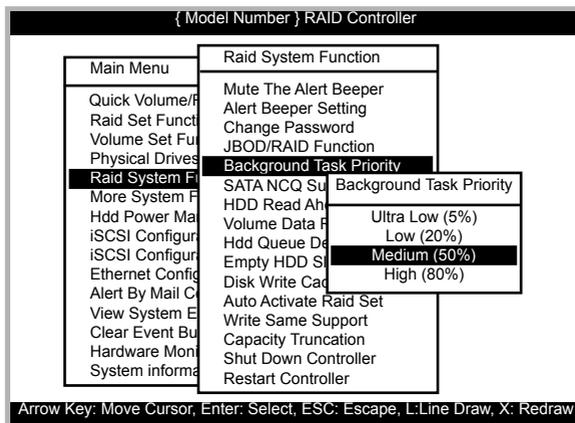
JBOD is an acronym for “Just a Bunch Of Disk”. A group of hard disks in a RAID controller are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to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



VT-100 UTILITY CONFIGURATION

5.5.5.5 Background Task Priority

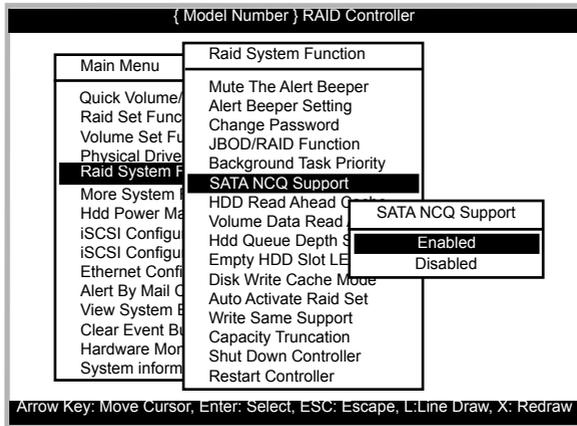
The “Background Task Priority” is a relative indication of how much time the controller devotes to a rebuild operation. The RAID controller allows the user to choose the rebuild priority (UltraLow, Low, Normal, High) to balance volume set access and rebuild tasks appropriately.



5.5.5.6 SATA NCQ Support

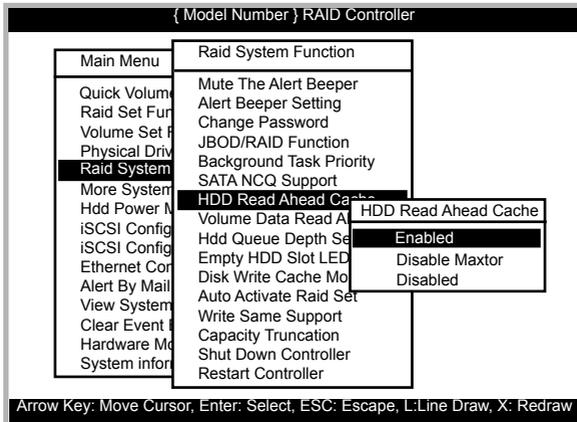
The controller supports both SAS and SATA disk drives. The SATA NCQ allows multiple commands to be outstanding within a drive at the same time. Drives that support NCQ have an internal queue where outstanding commands can be dynamically rescheduled or re-ordered, along with the necessary tracking mechanisms for outstanding and completed portions of the workload. The RAID controller allows the user to select the SATA NCQ support: “Enabled” or “Disabled”.

VT-100 UTILITY CONFIGURATION



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.

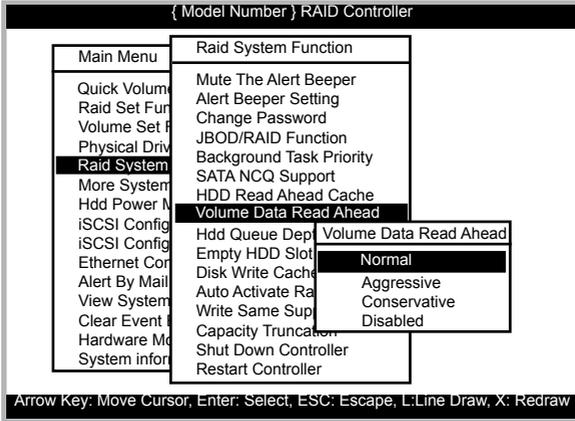


5.5.5.8 Volume Data Read Ahead

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

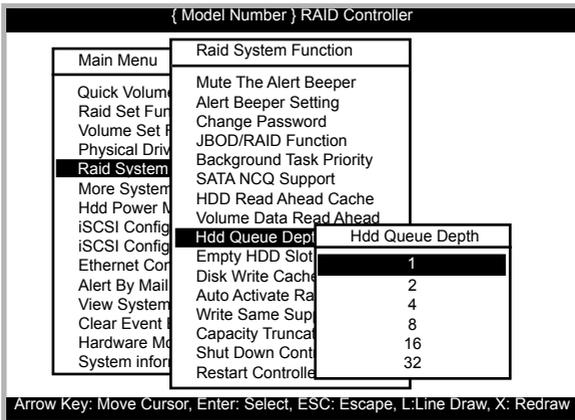
VT-100 UTILITY CONFIGURATION

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

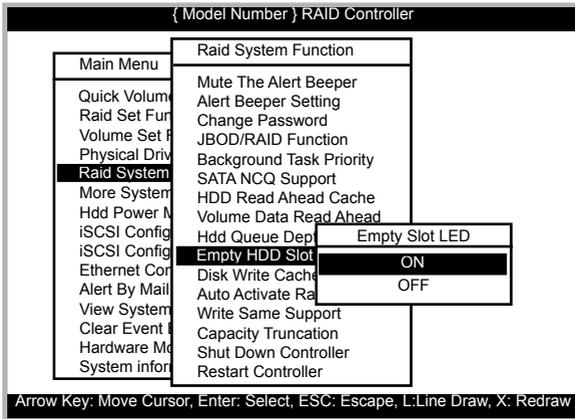
This parameter is adjusted the queue depth capacity of NCQ (SATA HDD) or Tagged Command Queuing (SATA HDD) which transmits multiple commands to a single target without waiting for the initial command to complete.



VT-100 UTILITY CONFIGURATION

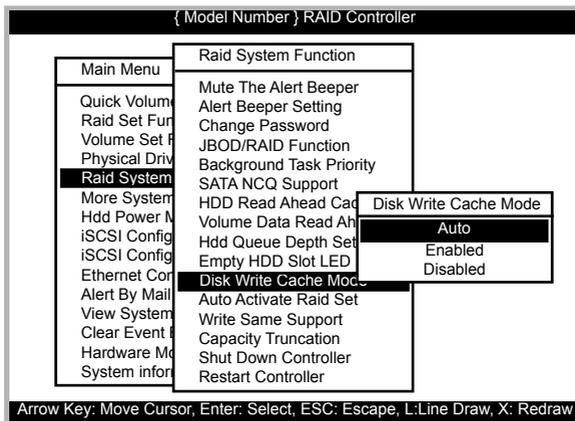
5.5.5.10 Empty HDD Slot LED

The firmware has added the "Empty HDD Slot LED" option to setup the fault LED light "ON "or "OFF" when there is no HDD installed. When each slot has a power LED for the HDD installed identify, user can set this option to "OFF". Choose option "ON", the SAS RAID controller will light the fault LED; if no HDD installed.



5.5.5.11 Disk Write Cache Mode

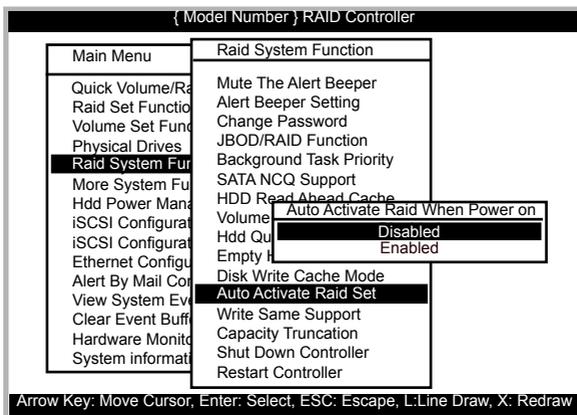
A user can set the "Disk Write Cache Mode": Auto, Enabled, or Disabled.



VT-100 UTILITY CONFIGURATION

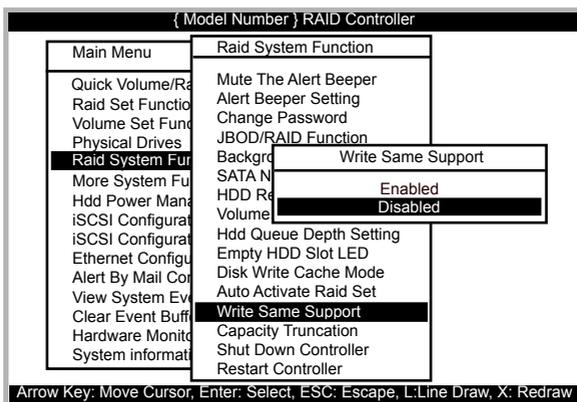
5.5.5.12 Auto Activate Raid Set

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 controller is powered on, then user can set the "Auto Activate Raid Set" option to "Enabled". The RAID state will change to "Degraded Mode" while it powers on.



5.5.5.13 Write Same Support

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 "Enabled" or "Disabled" for the controller initialization.



VT-100 UTILITY CONFIGURATION

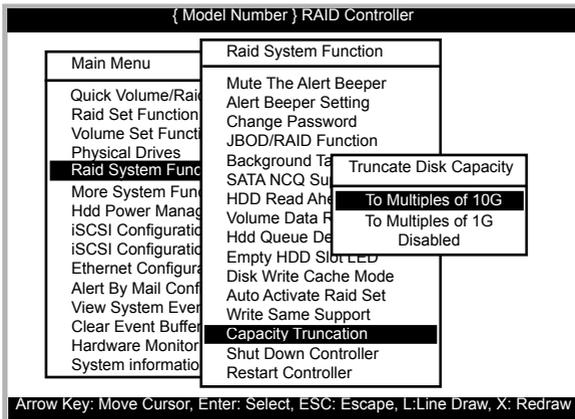
5.5.5.14 Capacity Truncation

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

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

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

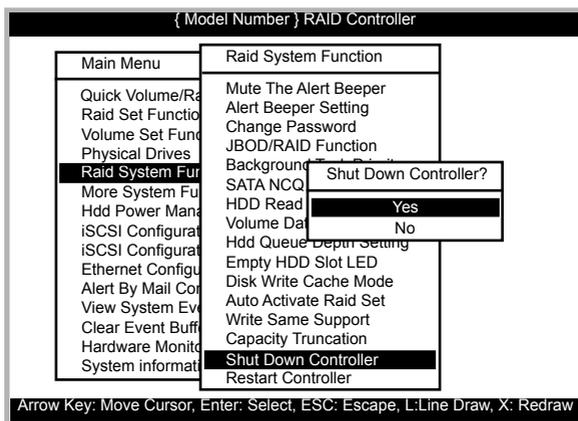
Disabled - It does not truncate the capacity.



VT-100 UTILITY CONFIGURATION

5.5.5.15 Shut Down Controller

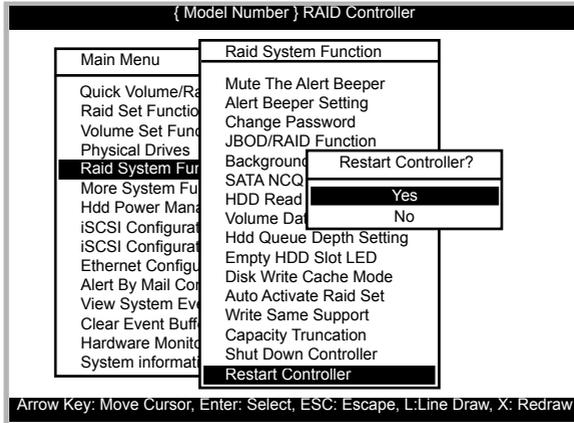
Use the "shutdown Controller" function to flash the cache data to HDD and shutdown the controller, move the cursor bar to the main menu "Raid System Function" item and then press the **Enter** key. The "Raid system Function" menu appears on the screen. Press **Enter** key to select "Shutdown Controller" item. The shutdown controller confirmation screen appears. Select **Yes** key to flash the cache to HDD.



5.5.5.16 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.

VT-100 UTILITY CONFIGURATION

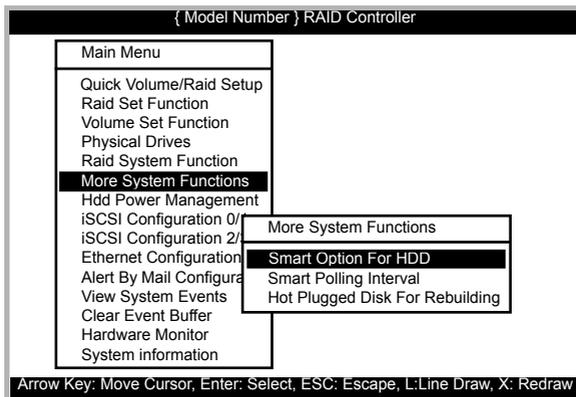


Note:

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

5.5.6 More System Functions

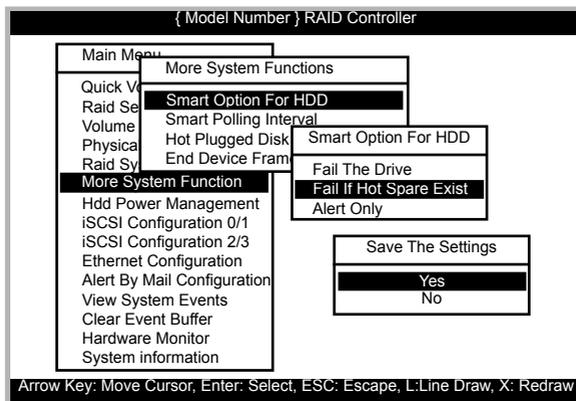
To set the "More System Functions", move the cursor bar to the main menu and select the "More System Functions" item and then press **Enter** key. The "More System Functions" menu will show multiple items. Move the cursor bar to an item, then press **Enter** key to select the desired function.



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.

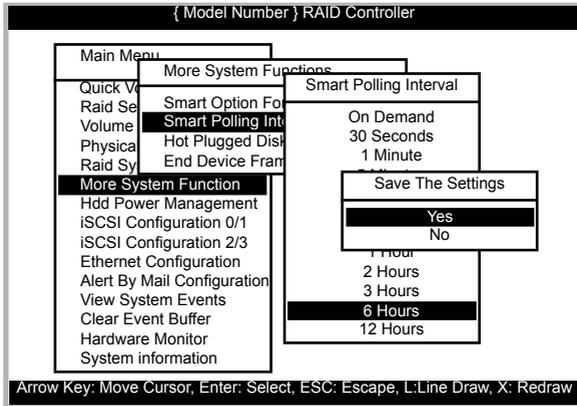
Fail If Hot Spare Exist – controllers kill off the SMART fail disk if hot spare drive is existed.

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

5.5.6.2 Smart Polling Interval

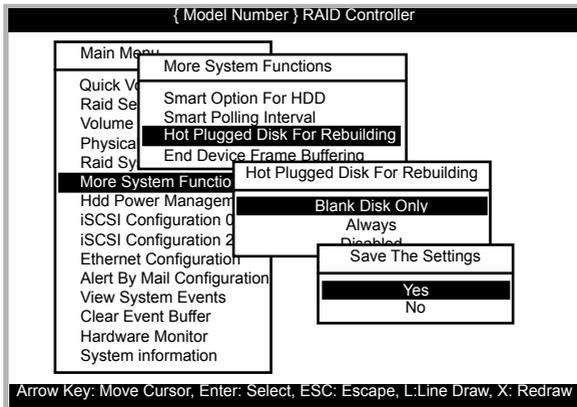
Besides the scheduled volume check, user can define the Smart Pulling Interval to pull the SMART status of each disk. The default is **“on demand”**. User can schedule every certain period of time interval to pull the SMART status of each disk. When SMART pulling is executed, disk activity will be temporarily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

VT-100 UTILITY CONFIGURATION



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

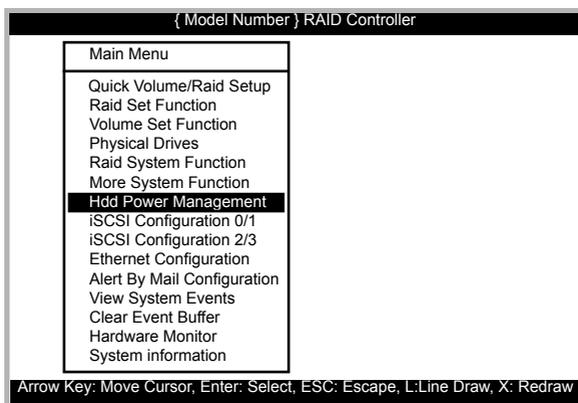
Always – it is what it was before. Whenever a disk is inserted/re-inserted whether new or previously existed, it always trigger a rebuilding for the Degraded RAID set/Volume.

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.

5.5.7 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.

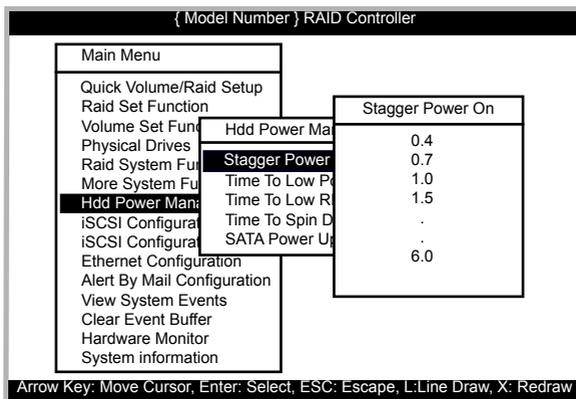


VT-100 UTILITY CONFIGURATION

5.5.7.1 Stagger Power On Control

In a RAID controllers 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 controller components. This damage can be avoided by allowing the RAID controller to stagger the spin-up of the drives. The 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 controller. 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.

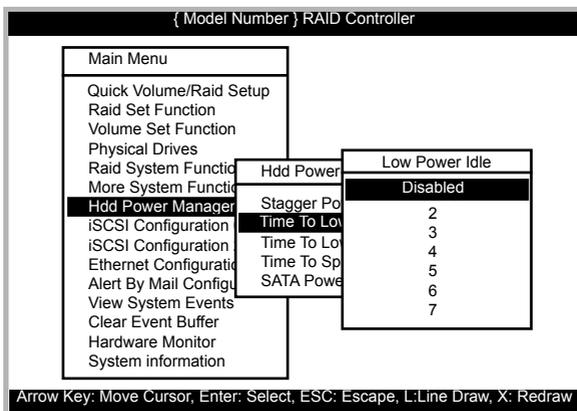
Areca RAID controller has included the option for customer to select the disk drives sequentially stagger power up value. The values can be selected within the range 0.4 to 6 seconds per step which powers up one drive groups.



5.5.7.2 Time To Hdd Low Power Idle

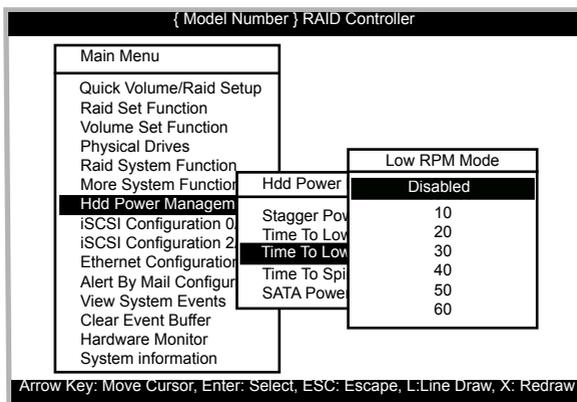
This option delivers lower power consumption by automatically unloading recording heads during the setting idle time. The values can be selected "Disabled" or within the range 2 to 7 minutes.

VT-100 UTILITY CONFIGURATION



5.5.7.3 Time To Hdd Low RPM Mode

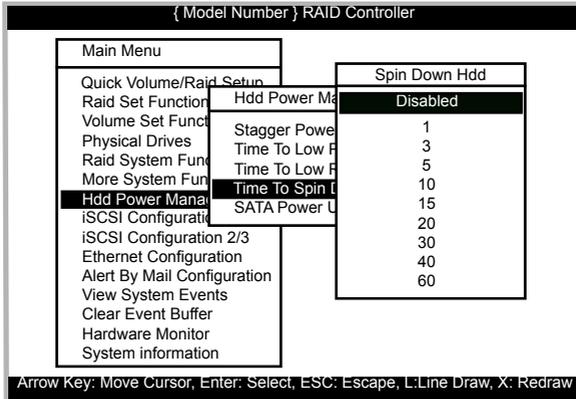
This function can automatically spin disks at lower RPM if there have not been used during the setting idle time. The values can be selected "Disabled" or within the range 10 to 60 minutes.



5.5.7.4 Time To Spin Down Idle HDD

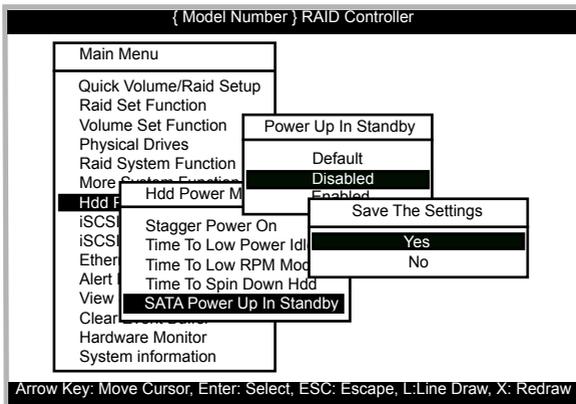
This function can automatically spin down the drive if it hasn't been accessed for a certain amount of time. This value is used by the drive to determine how long to wait (with no disk activity, before turning off the spindle motor to save power). The values can be selected "Disabled" or within the range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

VT-100 UTILITY CONFIGURATION



5.5.7.5 SATA Power Up In Standby

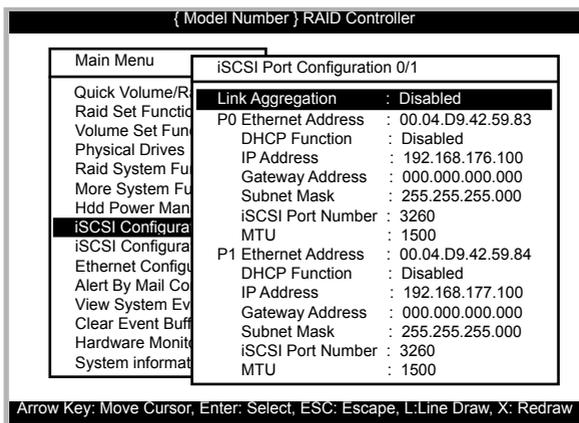
SATA Power Up In Standby (power management 2 mode, PM2) is a SATA disk drive configuration which prevents the drive from automatic spinup when power is applied. "Enabled" option allows the drive to be powered-up into the standby power management state to minimize inrush current at power-up and to allow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



VT-100 UTILITY CONFIGURATION

5.5.8 iSCSI Port Configuration

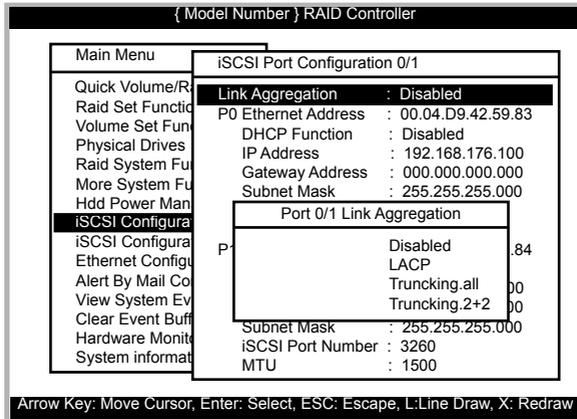
Use this feature to set the controller iSCSI port configuration. It is not necessary to create reserved disk space on any hard disk for the iSCSI port and HTTP service to function; these functions are built into the controller firmware. To setup the iSCSI Channel 0/1/2/3 Configuration function, move the mouse cursor to the main menu and click on the iSCSI Configuration 0/1 and iSCSI Configuration 2/3 . The iSCSI Port Configuration screen will be shown.



5.5.8.1 Link Aggregation

Link Aggregation for Gigabit Interfaces feature allows you to bundle Gigabit Ethernet links to one logical link that functions as a single, higher-speed link providing dramatically increased bandwidth. All Gigabit Ethernet links must be point-to-point connections between the switch and ARC-5066 iSCSI port for link aggregation enable (LACP and Trunking). Two (P0&P1 or P2&P3) or four (P0&P1&P2&P3) Gigabit Ethernet connections are combined in order to increase the bandwidth capability and to create resilient and redundant links on the ARC-5066 RAID controller. The ARC-5066 offers these options for Link Aggregation that can be used within the switched environment;

VT-100 UTILITY CONFIGURATION



- **Disabled**

Each of Gigabit Ethernet link is connected by itself and is not set to LACP and Trunking. The ARC-5066 RAID controller supports four Gigabit Ethernet links to transmit data. Each of them must be assigned to individual port parameters in "Disabled" mode unless the link aggregation is enabled.

- **LACP (IEEE 802.3ad)**

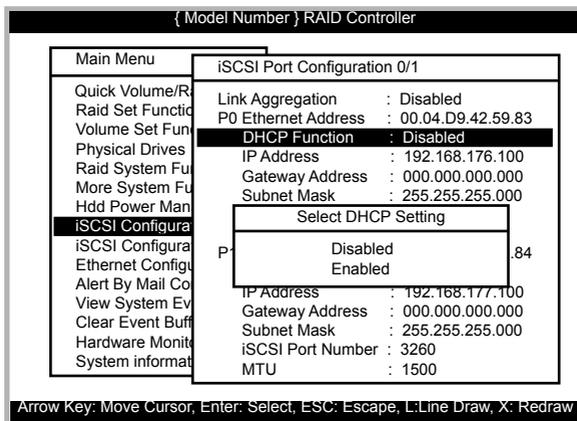
LACP is part of the IEEE specification 802.3ad that allows you to bundle several Gigabit Ethernet links to form a single logical link. ARC-5066 RAID controller implements it as active mode which means that LACP port sends LACP protocol packets automatically. For this to work, both ends of the link must be dynamic LACP. If four ports are set in LACP mode, Port 0 parameters will be used for the Link Aggregated Group.

- **Trunking (Non-protocol)**

Trunking allows you to combine multiple Gigabit Interfaces in parallel to one logical link that functions as a single interface, higher-speed link providing dramatically increased bandwidth. If four ports are set in Trunking mode (Trunking.all), Port 0 parameters will be used for the Link Aggregated Group. If every two ports are set in Trunking mode (Trunking.2+2), Port 0&2 parameters will be used for the Link Aggregated Group.

VT-100 UTILITY CONFIGURATION

5.5.8.2 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.

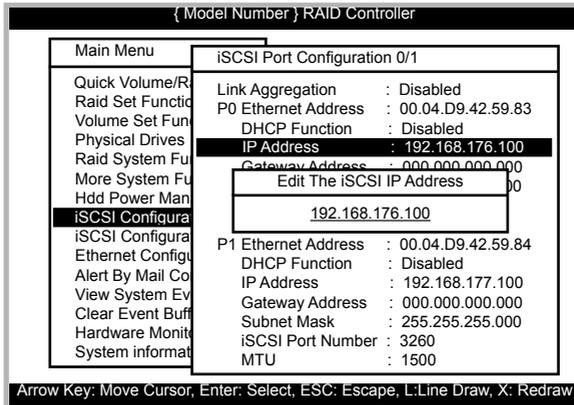
To manually configure the IP address of the controller, move the cursor bar to DHCP Function item, then press Enter key to show the DHCP setting. Select the "Disabled" or "Enabled" option to enable or disable the DHCP function. If DHCP is disabled, it will be necessary to manually enter a static IP address that does not conflict with other devices on the network.

5.5.8.3 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

VT-100 UTILITY CONFIGURATION

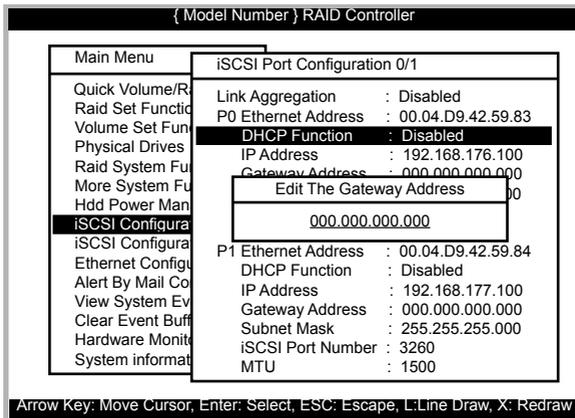
if that option is available on your network. An IP address allocation scheme will reduce the time it takes to set-up client computers and eliminate the possibilities of administrative errors and duplicate addresses.



To manually configure the IP address of the iSCSI port, move the cursor bar to "IP Address" item, then press the Enter key to show the default address setting in the iSCSI port. You can then reassign the static IP address of the iSCSI Port Configuration.

5.5.8.4 Gateway Address

The gateway address is a router interface connected to the local network that sends packets out of the local network.

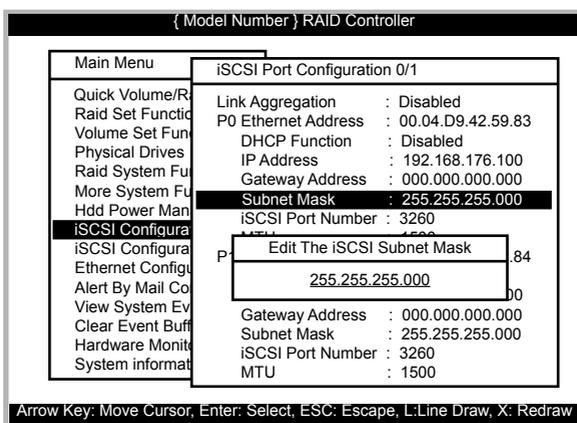


VT-100 UTILITY CONFIGURATION

To manually configure the Gateway address of the iSCSI port, move the cursor bar to "Gateway Address" item, then press the Enter key to show the default address setting in the iSCSI port. Then you can reassign the default "Gateway Address" of the iSCSI Port Configuration.

5.5.8.5 Subnet Mask

There may have several network cards targeting this iSCSI port. You may also wish to set up masking, as well.

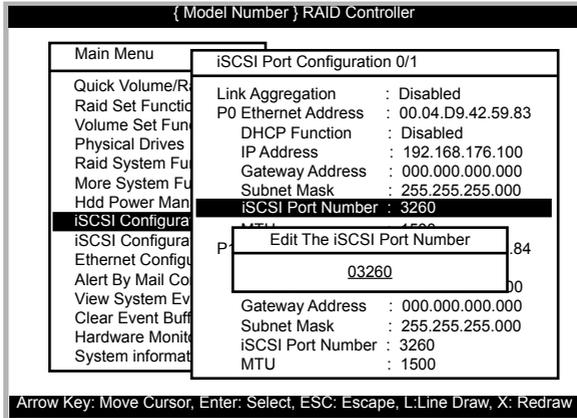


To manually configure the iSCSI subnet mask of the iSCSI port, move the cursor bar to "iSCSI Subnet Mask" item, then press the Enter key to show the default port number setting in the iSCSI port. Then you can reassign the default "iSCSI Subnet Mask" of the iSCSI Port Configuration.

5.5.8.6 iSCSI Port Number

iSCSI Port Number: specify the port number to which the iSCSI port attempts to connect to the host adapter. Values within 1024 ~ 65535, excluding the registered ports, could be used. It's a good practice to keep this as 3260.

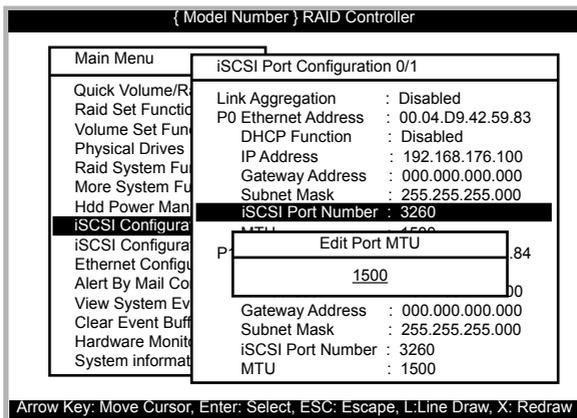
VT-100 UTILITY CONFIGURATION



To manually configure the iSCSI port number of the iSCSI port, move the cursor bar to "iSCSI Port Number" item, then press the Enter key to show the default port number setting in the iSCSI port. Then you can reassign the default "iSCSI Port Number" of the iSCSI Port Configuration.

5.5.8.7 MTU (Maximum Transmission Unit)

This parameter specifies the payload size of the GbE port, rather than the MTU of layer 3 packets. If Jumbo Frame is enabled by setting MTU to 1501 ~ 9000, make sure all the Ethernet switches and nodes are set to the same MTU. If unsure, set the MTU to 1500 for better compatibility.

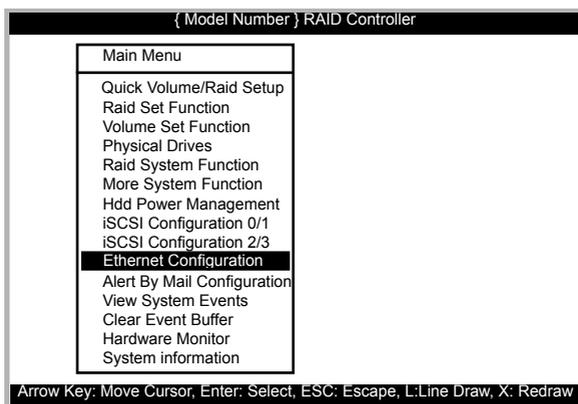


VT-100 UTILITY CONFIGURATION

To configure the Maximum Transmission Unit of the iSCSI port, move the cursor bar to the "MTU" item, then press Enter key to show the default setting in the iSCSI port. You can then reassign the default "MTU" of iSCSI Port Configuration.

5.5.8 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.

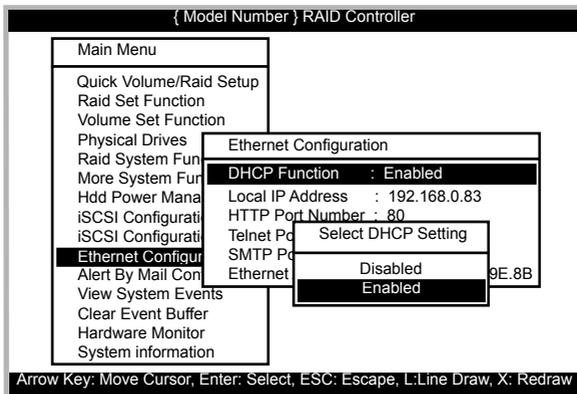


5.5.8.1 DHCP Function

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

VT-100 UTILITY CONFIGURATION

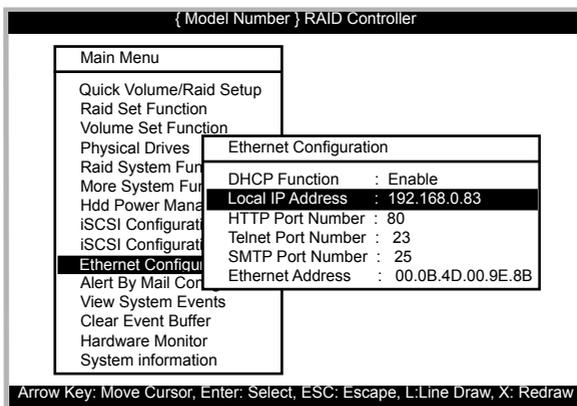
distribute IP addresses from a central point. The purpose of DHCP is to provide the automatic (dynamic) allocation of IP client configurations for a specific time period (called a lease period) and to minimize the work necessary to administer a large IP network. To manually configure the IP address of 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.



5.5.8.2 Local IP Address

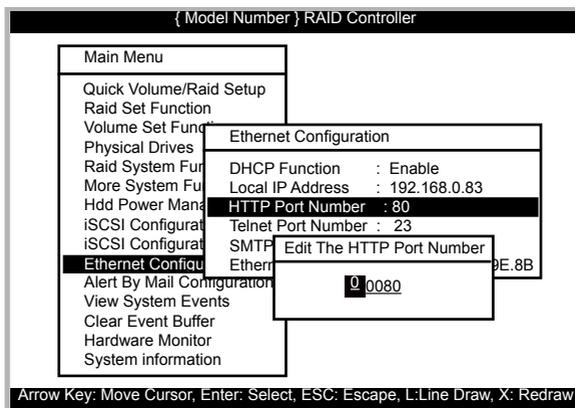
If you intend to set up your client computers manually (no DHCP), make sure that the assigned IP address is in the same range as the default router address and that it is unique to your private network. However, it is highly recommend to use DHCP if that option is available on your network. An IP address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

VT-100 UTILITY CONFIGURATION



5.5.8.3 HTTP Port Number

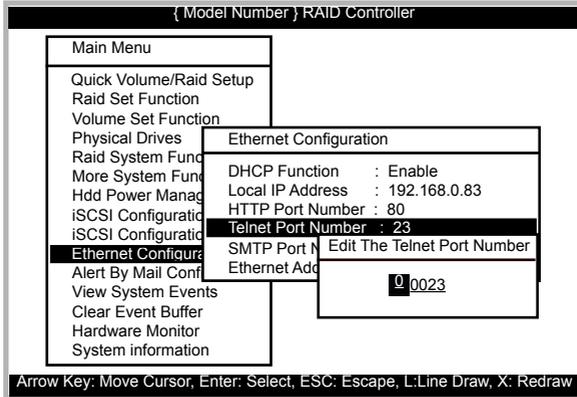
To manually configure the “HTTP Port Number” of the controller, move the cursor bar to “HTTP Port Number” item, then press the **Enter** key to show the default address setting in the RAID controller. Then You can reassign the default “HTTP Port Number” of the controller.



5.5.8.4 Telnet Port Number

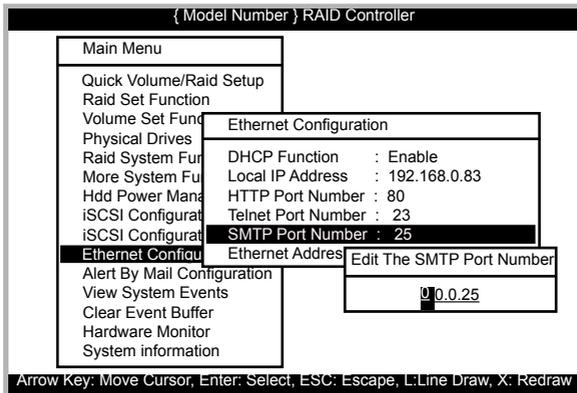
To manually configure the “Telnet Port Number” of the controller, move the cursor bar to “Telnet Port Number” item, then press the **Enter** key to show the default address setting in the RAID controller. You can then reassign the default “Telnet Port Number” of the controller.

VT-100 UTILITY CONFIGURATION



5.5.8.5 SMTP Port Number

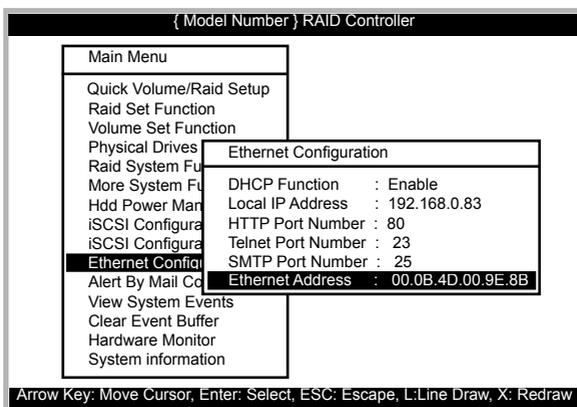
To manually configure the "SMTP Port Number" of the controller, move the cursor bar to the main menu "Ethernet Configuration" function item and then press **Enter** key. The "Ethernet Configuration" menu appears on the screen. Move the cursor bar to "SMTP Port Number" item, then press **Enter** key to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



5.5.8.6 Ethernet Address

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

VT-100 UTILITY CONFIGURATION

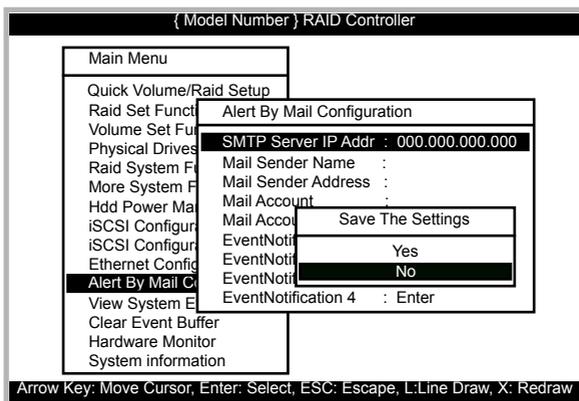


5.5.9 Alert By Mail Configuration

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.

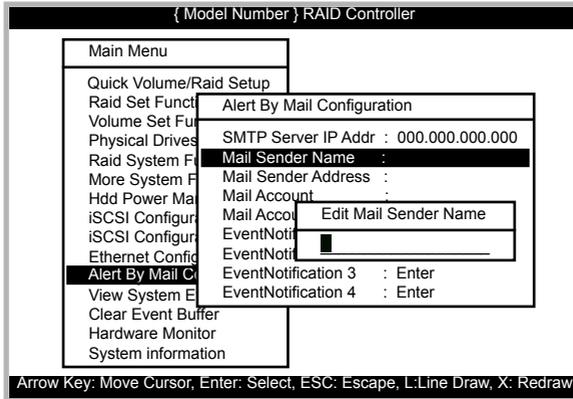
5.5.9.1 SMTP Server Configuration

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



VT-100 UTILITY CONFIGURATION

5.5.9.2 Mail Address Configurations



- **Mail Sender Name**

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

- **Mail Sender address**

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

- **Mail Account**

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

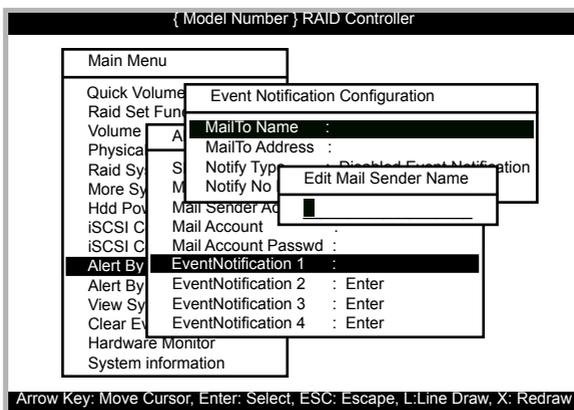
- **Mail Account Password**

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

5.5.9.3 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.

VT-100 UTILITY CONFIGURATION



• Mail To Name

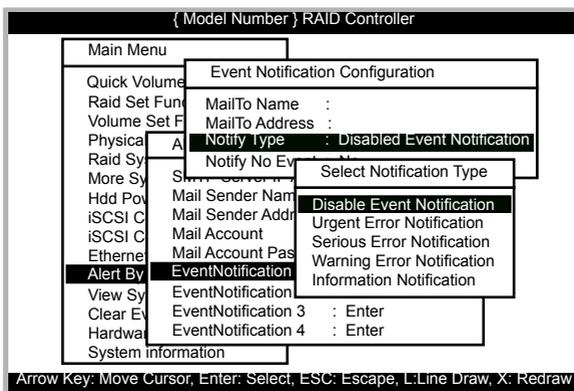
Enter the alert receiver name that will be shown in the outgoing mail.

• Mail To 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:

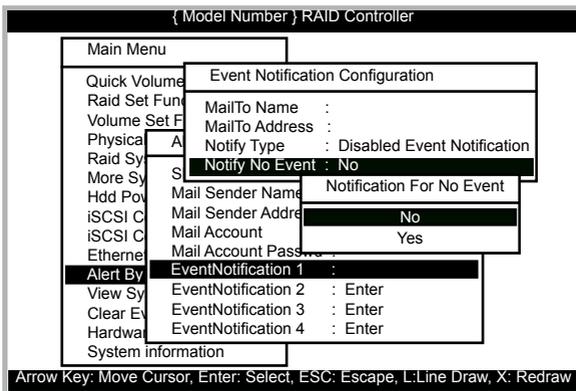


VT-100 UTILITY CONFIGURATION

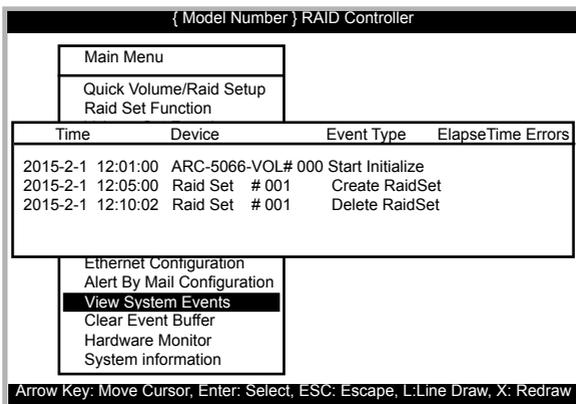
- Disable Event Notification: No event notification will be sent.
- Urgent Error Notification: Send only urgent events.
- Serious Error Notification: Send urgent and serious events.
- Warning Error Notification: Send urgent, serious and warning events.
- Information Notification: Send all events.

- **Notify No Event**

Notify user if no event occurs within 24 hours.



5.5.10 View System Events



VT-100 UTILITY CONFIGURATION

To view the RAID controller'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 controller's events screen appear.

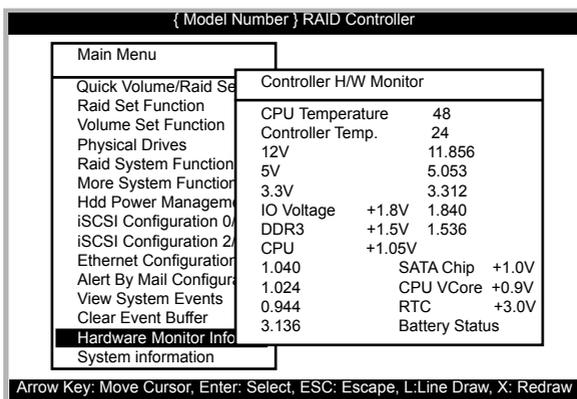
Choose this option to view the system events information: Timer, Device, Event type, Elapsed Time, and Errors. The RAID system does not have a build-in real time clock. The time information is the relative time from the RAID controller powered on.

5.5.11 Clear Events Buffer

Use this feature to clear the entire events buffer.

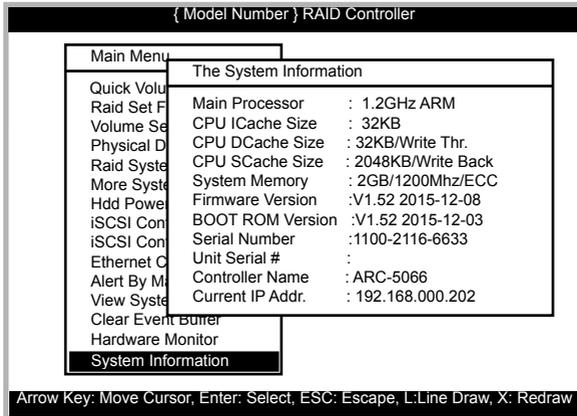
5.5.12 Hardware Monitor Information

To view the RAID controller'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 controller.



VT-100 UTILITY CONFIGURATION

5.5.13 System Information



Choose this option to display main processor, CPU Instruction cache and data cache size, firmware version, serial number, controller model name, and the cache memory size. To check the system information, move the cursor bar to "System Information" item, then press **Enter** key. All major controller system information will be displayed.

6. Web Browser-based Configuration

The RAID controller 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 controller, you must first create a RAID volume by using LCD panel, RS232 or LAN port.

6.1 Web Browser McRAID Storage Manager

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

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

To configure RAID controller 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 controller 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 controller. 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.

The screenshot shows the web browser interface for Areca Technology Corporation. The main content area displays the RAID Set Hierarchy and Enclosure#1: RAID Subsystem V1.0. The RAID Set Hierarchy table shows RAID Set # 000 with Volume Set (Pv/Torg/Lun) ABC-5066-VOL#000(0/0/0) and Volume State Normal, with a Capacity of 2000.0GB. The Enclosure#1: RAID Subsystem V1.0 table shows 15 slots with their respective usage, capacity, and model.

RAID Set	Devices	Volume Set(Pv/Torg/Lun)	Volume State	Capacity
Raid Set # 000	#1Slot#1	ABC-5066-VOL#000(0/0/0)	Normal	2000.0GB
	#1Slot#2			
	#1Slot#3			
	#1Slot#4			

Device	Usage	Capacity	Model
Slot#1	Raid Set # 000	500.1GB	WDC WD5000AAKX-U01CAU
Slot#2	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0
Slot#3	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0
Slot#4	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0
Slot#5	N.A.	N.A.	N.A.
Slot#6	N.A.	N.A.	N.A.
Slot#7	N.A.	N.A.	N.A.
Slot#8	N.A.	N.A.	N.A.
Slot#9	N.A.	N.A.	N.A.
Slot#10	N.A.	N.A.	N.A.
Slot#11	N.A.	N.A.	N.A.
Slot#12	N.A.	N.A.	N.A.
Slot#13	N.A.	N.A.	N.A.
Slot#14	N.A.	N.A.	N.A.
Slot#15	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.

WEB BROWSER-BASED CONFIGURATION

6.3 Main Menu

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

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

6.4 Quick Function

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

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

At the bottom of the configuration area, there is a checkbox labeled 'Confirm The Operation' and two buttons: 'Submit' and 'Reset'.

The number of physical drives in the RAID controller 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.

WEB BROWSER-BASED CONFIGURATION

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 controllers. 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.

The screenshot shows the "Areca Technology Corporation" web interface. The main content area is titled "Select The Drives For RAID Set" and displays a table of available drives for enclosure #1. The table has columns for Slot#, Capacity, and Model. Slot #1 is selected with a checkmark. Below the table, the "Raid Set Name" is set to "Raid Set #000". At the bottom, there is a "Confirm The Operation" checkbox which is checked, and "Submit" and "Reset" buttons.

Slot#	Capacity	Model
<input checked="" type="checkbox"/> Slot#1	400.1GB	Hitachi HD725040VLA360
<input type="checkbox"/> Slot#2	400.1GB	ST3400832AS
<input type="checkbox"/> Slot#3	80.0GB	ST380013AS
<input type="checkbox"/> Slot#4	80.0GB	ST380013AS
<input type="checkbox"/> Slot#5	250.1GB	ST3250620NS
<input type="checkbox"/> Slot#6	500.1GB	HDS725080PLA360
<input type="checkbox"/> Slot#9	500.1GB	WUH W15000V5-01M9R0
<input type="checkbox"/> Slot#10	80.0GB	ST380013AS
<input type="checkbox"/> Slot#11	80.0GB	ST380013AS
<input type="checkbox"/> Slot#14	500.1GB	WDC WD5000YS-01M9B0
<input type="checkbox"/> Slot#15	500.1GB	ST3500630NS
<input type="checkbox"/> Slot#16	500.1GB	ST3500630NS

Raid Set Name:

Confirm The Operation

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:
24 for RAID 0/1/10(1E)/3/5/6/30/50/60.

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

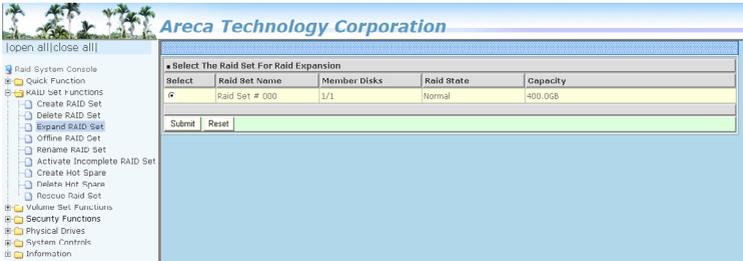


6.5.3 Expand Raid Set

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

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

WEB BROWSER-BASED CONFIGURATION



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

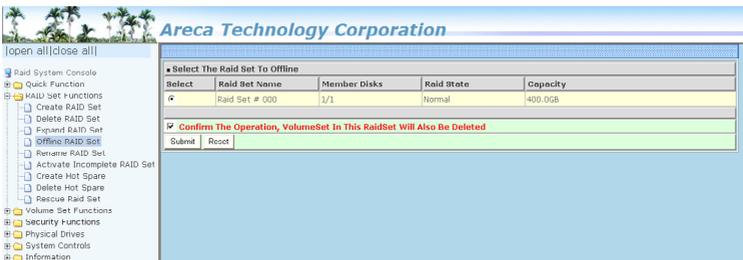
The new additional capacity can be utilized by one or more volume sets. The volume sets associated with this RAID set appear for you to have chance to modify RAID level or stripe size. Follow the instruction presented in the "Modify Volume Set" to modify the volume sets; operation system specific utilities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

Note:

1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.
2. If a disk drive fails during RAID set expansion and a hot spare is available, an auto rebuild operation will occur after the RAID set expansion completes.
3. RAID 30/50/60 does not support the "Expand Raid set".

6.5.4 Offline Raid Set

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



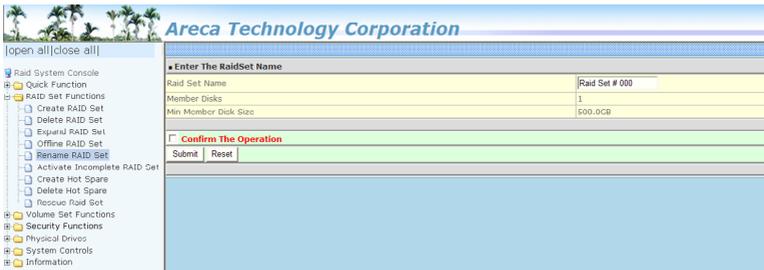
WEB BROWSER-BASED CONFIGURATION

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.

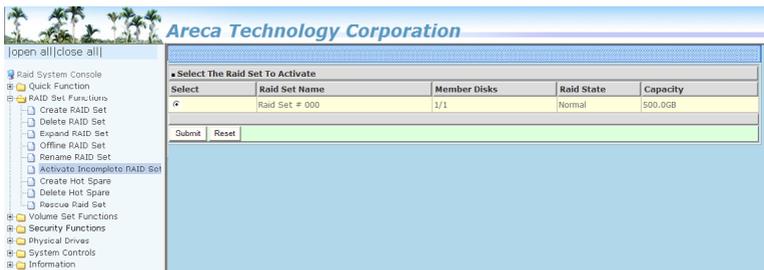
To rename a RAID set from a group of RAID sets:

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 controller, the user can use the "Activate Incomplete Raid Set" option to activate the RAID set. After the user completes this function, the Raid State will change to "Degraded Mode" and start to work.



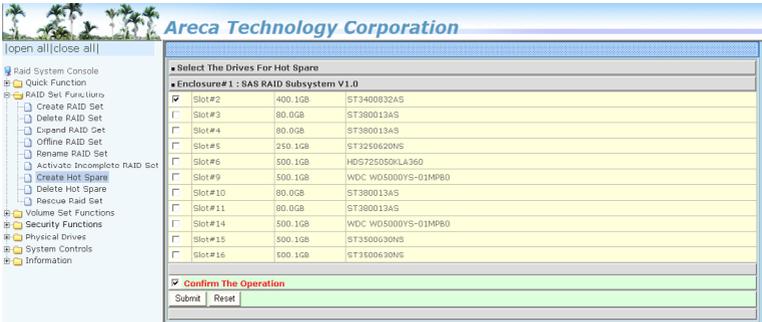
To activate the incomplete the RAID set, click on the "Activate Raid Set" link. A "Select The RAID Set To Activate" screen is displayed showing all RAID sets existing on the current controller. Click the RAID set number to activate in the select column.

WEB BROWSER-BASED CONFIGURATION

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 controller 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" option gives you the ability to define a global hot spare.



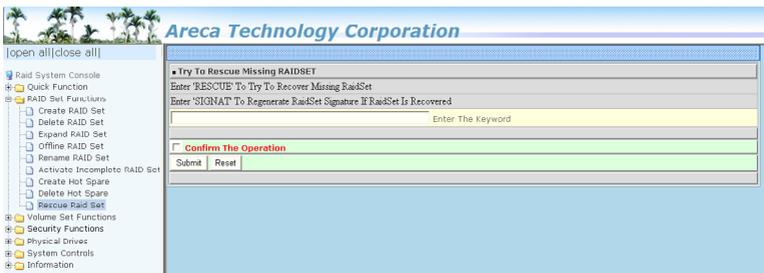
6.5.8 Delete Hot Spare

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



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 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. 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 controller.

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

WEB BROWSER-BASED CONFIGURATION

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

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

The screenshot shows the "Enter The Volume Attribute" configuration page. The left sidebar contains a navigation menu with options like "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", and "Information". The main content area is a form with the following fields:

Enter The Volume Attribute	
Volume Name	ARC-5066-VOL#002
Member Disk	4
Volume Raid Level	Raid 5
Max. Capacity Allowed	14775 GB
Select Volume Capacity	14775 GB
Greater Two TB Volume Support	64bitLBA
Volume Initialization Mode	Foreground Initialization
Volume Stripe Size	64 KBytes
Volume Cache Mode	Write Back
Volume Write Protection	Disabled
Tagged Command Queuing	Enabled
Host Port Mapping	<input checked="" type="checkbox"/> SATA0-1-0 <input type="checkbox"/> iSCSI-P0 <input type="checkbox"/> iSCSI-P1 <input type="checkbox"/> iSCSI-P2 <input type="checkbox"/> iSCSI-P3
Target Node:LUN	0 2
Volumes To Be Created	1
<input type="checkbox"/> Confirm The Operation	
Submit Reset	

- **Volume Name**

The default volume name will always appear as "ARC-5066-VOL". You can rename the volume set providing it does not exceed the 15 characters limit.

- **Volume Raid Level**

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

- **Capacity**

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

WEB BROWSER-BASED CONFIGURATION

- **Greater Two TB Volume Support**

Controller uses the "Greater Two TB Volume Support" sub-menu to set the volume capacity and sector size. Greater Two TB Volume Support option: "No", "64bit LBA" and "Use 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 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

- **4K Block**

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

- **Initialization Mode**

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

WEB BROWSER-BASED CONFIGURATION

- **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.

- **Cache Mode**

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

- **Volume Write Protection**

When "Volume Write Protection" is enabled on the "Create Volume Set", host commands fail if they are issued to a volume in that RAID controller and attempt to modify a volume's data or attributes. Volume Write Protection is used primarily for customer-initiated disaster recovery testing.

- **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 SATA 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 SATA drives that do not support command tag queuing.

WEB BROWSER-BASED CONFIGURATION

● Host Port Mapping & Target Node:LUN

There are three kinds of host interface connected to two internal channels for each volume. Different host interface can map and access to the same volume. But user can only write multiple hosts' volume through one host each time for data consistency.

- eSATAIUSB Host:

You can add both interfaces (eSATA & USB 3.0) connected to the host, but you can only use one connection at a time. Interface that is connected 1st has precedent.

eSATA: The eSATA III host channel can access the volume set.

USB: The USB 3.0 host channel can access the volume set.

The following table is the map of host mapping, host interface and driver number assignment.

Host Port Mapping	Host	Target Node:LUN
eSATAIUSB	eSATA	eSATA Host with Port Multiplier: Target Node=0~7/LUN=0
		eSATA Host without Port Multiplier: Target Node=0/LUN=0
	USB 3.0	Target Node=0~7/LUN=0

Target Node: Each SATA device attached to ARC-5066 RAID controller must be assigned a unique ID number. A eSATA/USB 3.0 host port can connect up to 8 (Target Node=0~7:LUN=0) volume sets.

LUN: Each iSCSI Target Node can support up to 8 LUNs. ARC-5066 RAID controller treats each Target Node:LUN like an SATA disk.

- iSCSI-P0/P1/P2/P3 Host:

iSCSI: The iSCSI host channel can access to the volume set.

The following table is the map of host mapping, host interface and driver number assignment.

Host Port Mapping	Host	Target Node:LUN
iSCSI-P0/P1/P2/P3	GbE P0~P3	Target Node=0~15/LUN=0~7

WEB BROWSER-BASED CONFIGURATION

Target Node: A iSCSI host RAID controller can connect up to 16 Target Nodes. The iSCSI RAID controller is as a large SATA devices. You should assign a Target Node from a list of Target Nodes. A iSCSI channel can connect up to 128(16 Target Node * 8 LUN) volumes. Up to 128 volumes can support on each ARC-5066 RAID controller.

LUN: Each Target Node can support up to 8 LUNs. ARC-5066 RAID controller treats each Target:LUN like a SATA disk.

- Multiple Host:

Dual host channels can be applied to the same drive number volume. But user can only use one channel each time for data consistency.

The following table is the map of host mapping, host interface and driver number assignment.

Host Port Mapping	Host	Target Node:LUN
eSATAIUSB & iSCSI-P0~P3	eSATA & GbE P0~P3	eSATA Host with Port Multiplier: Target Node=0~7/LUN=0
		eSATA Host without Port Multiplier: Target Node=0/LUN=0
	USB 3.0 & GbE P0~P3	Target Node=0~7/LUN=0

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



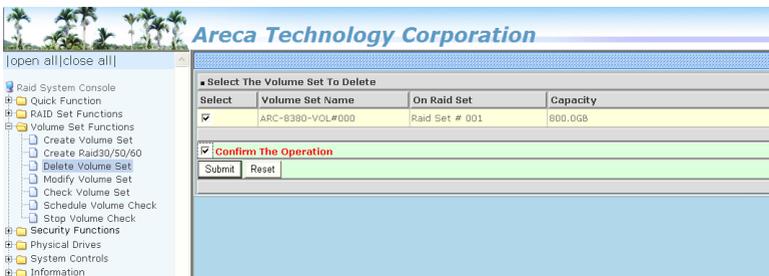
WEB BROWSER-BASED CONFIGURATION

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

The new create volume set attribute allows user to select the Volume Name, RAID Level, Capacity, Greater Two TB Volume Support, Initialization Mode, Stripe Size, Cache Mode, Write Protect, Tagged Command Queuing, Hot Port Mapping, Target Node: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.



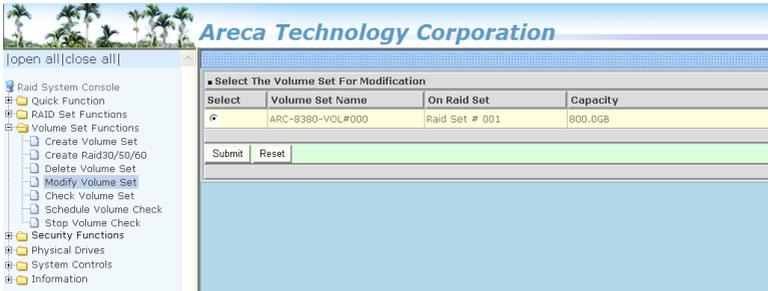
6.6.4 Modify Volume Set

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.

WEB BROWSER-BASED CONFIGURATION

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



6.6.4.1 Volume Growth

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

To expand an existing volume noticed:

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

WEB BROWSER-BASED CONFIGURATION

For greater 2TB expansion:

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

6.6.4.2 Volume Set Migration

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

The screenshot shows the Areca Technology Corporation web browser-based configuration interface. The interface is divided into a left-hand navigation menu and a main content area. The navigation menu includes options such as 'Raid System Console', 'Quick Function', 'RAID Set Functions', 'Volume Set Functions', 'Security Functions', 'Physical Entries', 'System Controls', and 'Information'. The main content area displays the 'RaidSet Hierarchy' table and the 'Enclosures# 1 : RAID Subsystem V1.0' table.

RAID Set	Devices	Volume Set(Px/Targ/Lun)	Volume State	Capacity
Baid_Set #_000	E#1Slot#1	ABC-S066-VOL#000(0/0/0)	Normal	2000.0GB
	E#1Slot#2			
	E#1Slot#3			
	E#1Slot#4			

Device	Usage	Capacity	Model
Slot#1	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0
Slot#2	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0
Slot#3	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0

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.

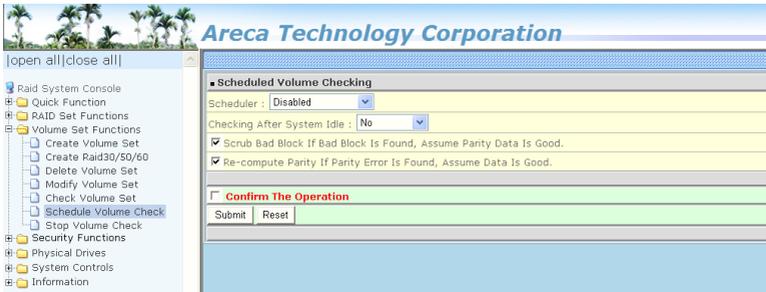
Tick on "Confirm The Operation" and click on the "Submit" button. Use this option to verify the correctness of the redundant data in

WEB BROWSER-BASED CONFIGURATION

a volume set. For example, in a system with dedicated parity, volume set check means computing the parity of the data disk drives and comparing the results to the contents of the dedicated parity disk drive. The checking percentage can also be viewed by clicking on "Raid Set Hierarchy" in the main menu.

6.6.6 Schedule Volume Check

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



6.6.7 Stop Volume Check

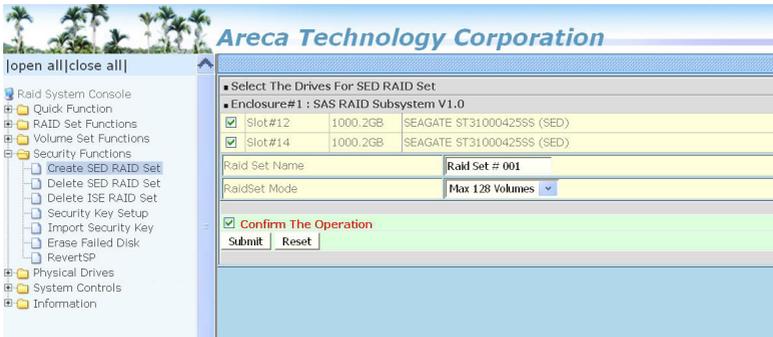
Use this option to stop the "Check Volume Set" function.



6.7 Security Function

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

6.7.1 Create SED RAID Set



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

WEB BROWSER-BASED CONFIGURATION

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 number which you want to delete in the select column on the delete screen. Then, tick on the "Confirm The Operation" check box and click on the "Submit" button in the screen to delete it. The volume sets included in the "Delete SED RAID Set". It will be deleted by this action. But for the Raid 30/50/60, you need to delete the volumes belonging to those SED RAID sets.

6.7.3 Delete ISE RAID Set



WEB BROWSER-BASED CONFIGURATION

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 controller firmware is designed to protect data from security breaches with minimal cost and complexity. The key can be escrowed in to a file using McRAID manager. Creating and managing SED key is an important part of the cryptographic process. The key must be kept secret from anyone who should not decrypt your data. This section describes how to generate and manage keys.

6.7.4.1 SED Key Management-Creation

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

WEB BROWSER-BASED CONFIGURATION

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.



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.

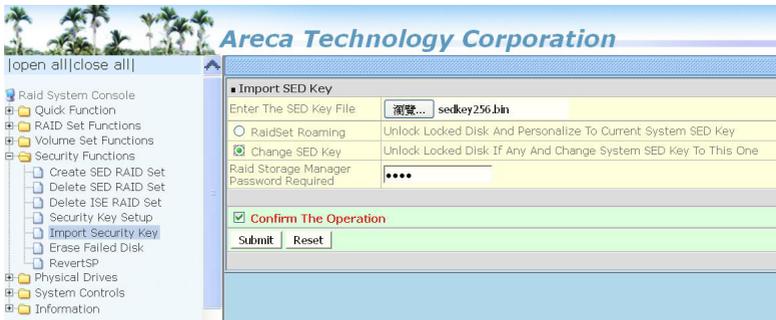
WEB BROWSER-BASED CONFIGURATION



6.7.5 Import Security Key

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

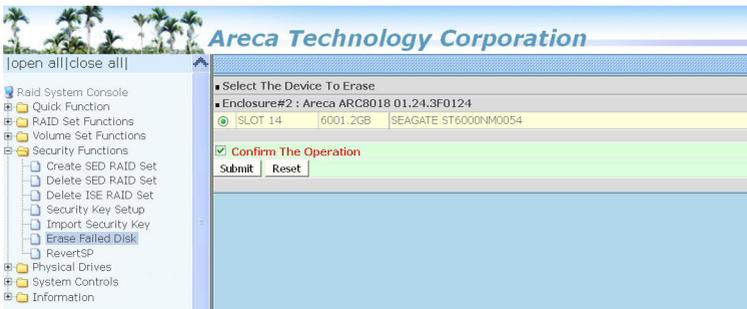
1. Select the "RaidSet Roaming" option to unlock the locked disk and personalize to new controller's SED key. If there is an existing SED key on new controller, RaidSet is updated with the new security key. If there is not an existing SED key on new controller, RaidSet is updated to unlock RaidSet.
2.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



WEB BROWSER-BASED CONFIGURATION

6.7.6 Erase Failed Disk

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



6.7.7 RevertSP

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



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 controller firmware, it can't 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, Hot Port Mapping, and Target Node:LUN for this pass-through disk.

The screenshot shows the 'Areca Technology Corporation' web interface. On the left is a navigation menu with options like 'Braid System Console', 'Quick Function', 'RAID Set Functions', 'Volume Set Functions', 'Security Functions', 'Physical Drives', 'System Controls', and 'Information'. The 'Physical Drives' section is expanded to show 'Create Pass-Through Disk', 'Modify Pass-Through Disk', and 'Delete Pass-Through Disk'. The main content area is titled 'Select the IDE drive For Pass Through' and shows a table of available drives for 'Enclosure#1 : ARECA SAS RAID AdapterV1.0'. Below the table is a section for 'Enter Pass Through Disk Attribute' with various settings and a 'Confirm The Operation' button.

■ Select the IDE drive For Pass Through		
■ Enclosure#1 : ARECA SAS RAID AdapterV1.0		
<input checked="" type="radio"/>	Slot#2	600.1GB WDC WD6000HLHX-01JJPV0
<input type="radio"/>	Slot#3	600.1GB WDC WD6000HLHX-01JJPV0
<input type="radio"/>	Slot#4	2000.4GB WDC WD2002FYPS-02W3B0
<input type="radio"/>	Slot#5	500.1GB SEAGATE ST3300620SS
<input type="radio"/>	Slot#6	3000.6GB Hitachi HDS723030ALA640
<input type="radio"/>	Slot#7	3000.6GB Hitachi HDS723030ALA640
<input type="radio"/>	Slot#8	500.1GB SEAGATE ST3300620SS

■ Enter Pass Through Disk Attribute	
Volume Cache Mode	<input type="text" value="Write Back"/>
Write Protection	<input type="text" value="Disabled"/>
Tagged Command Queuing	<input type="text" value="Enabled"/>
SCSI Channel:SCSI_ID:SCSI_Lun	<input type="text" value="0"/> : <input type="text" value="0"/> : <input type="text" value="0"/>

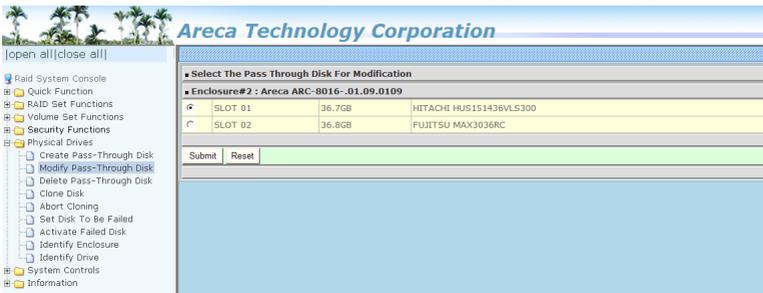
Confirm The Operation

6.8.2 Modify 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, Hot Port Mapping, and Target Node:LUN on an existing pass-through disk.

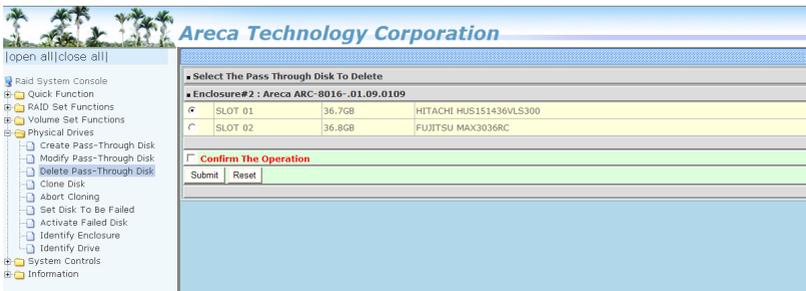
WEB BROWSER-BASED CONFIGURATION

To modify the pass-through drive attribute from the pass-through drive pool, move the mouse cursor bar and click on the “Modify 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.



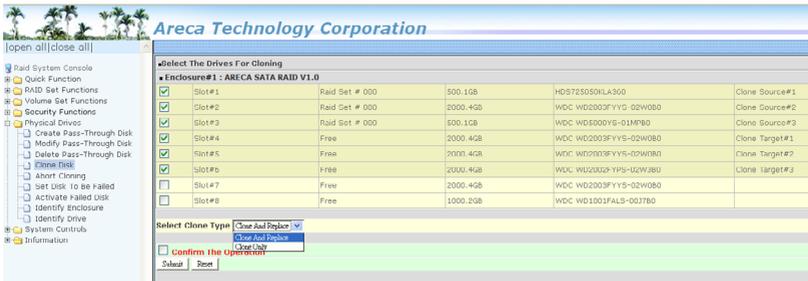
6.8.3 Delete Pass-Through Disk

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 on 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.”



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.

WEB BROWSER-BASED CONFIGURATION

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 “Of-flined” 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.

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.

Select The Device To Set To Fail		
Enclosure#3 : Areca ARC-8010-80.00.b000		
<input checked="" type="radio"/>	SLOT 01	1000.2GB WDC WD1001FALS-00J760
<input type="radio"/>	SLOT 02	1000.2GB WDC WD1002FAEX-00Z340
<input type="radio"/>	SLOT 03	300.0GB SEAGATE ST3300657S5
<input type="radio"/>	SLOT 04	36.7GB SEAGATE ST336754S5
<input type="radio"/>	SLOT 05	300.1GB WDC WD3000HLFS-01G650
<input type="radio"/>	SLOT 06	1000.2GB WDC WD1003F8YX-01Y760
<input type="radio"/>	SLOT 07	500.1GB WDC WD5000YS-01MP80
<input type="radio"/>	SLOT 08	1000.2GB WDC WD1001FALS-00J760
<input type="radio"/>	SLOT 09	600.1GB WDC WD6000HLHX-01J3P0
<input type="radio"/>	SLOT 10	600.1GB WDC WD6000HLHX-01J3P0
<input type="radio"/>	SLOT 11	500.1GB WDC WD5000ABPS-01Z2B0
<input type="radio"/>	SLOT 12	80.0GB ST380013AS

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”.

WEB BROWSER-BASED CONFIGURATION

Followings are considered as "Removed-Disk":

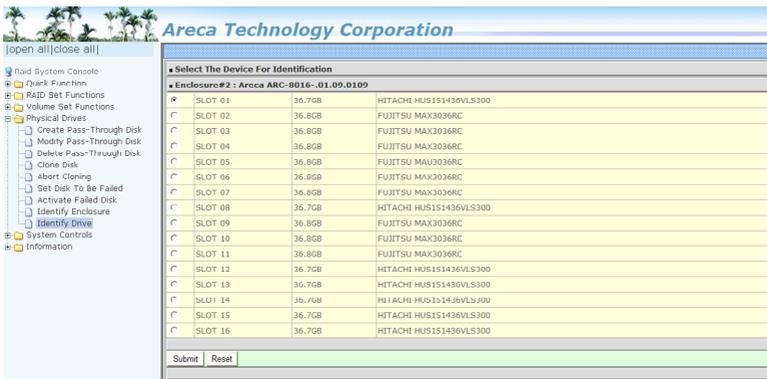
1. Manually removed by user.
2. Losing PHY connection due to bad connector, cable or back-plane.
3. Losing PHY connection due to disk fail.

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



6.8.8 Identify 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.

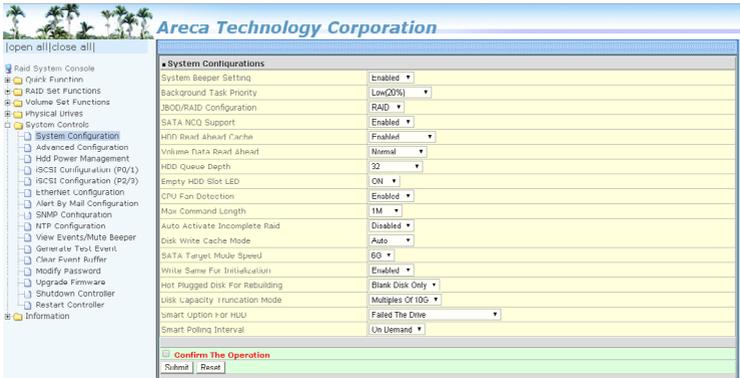


WEB BROWSER-BASED CONFIGURATION

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 controller 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 controller 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 controller 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 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 controller 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) which transmits multiple commands to a single target without waiting for the initial command to complete.

- **Empty HDD Slot LED**

The firmware has added the "Empty HDD Slot LED" option to setup the fault LED light "ON" or "OFF" when there is no HDD installed. When each slot has a power LED for the HDD installed identify, user can set this option to "OFF". Choose option "ON", the RAID controller will light the fault LED; if no HDD installed.

WEB BROWSER-BASED CONFIGURATION

- **CPU Fan Detection**

The "CPU Fan Detection" function is available in the firmware for detecting the cooling fan function on the ROC if you want to use the active cooling fan on the ARC-5066. When using the passive heatsink only on the controller, disable the "CPU Fan Detection" function through this from Web Browser.

- **Max Command Length**

Max Command Length is used to set a "best" IO size for the RAID controller.

- **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 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.

- **Disk Write Cache Mode**

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

- **SATA Target Mode Speed**

The eSATA host interface appears to the host adapter as 6.0Gbps SATA target device. It can set as 3.0Gbps SATA target device in case any 3.0Gbps host adapter compatibility issue.

- **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 "Enabled" 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".

WEB BROWSER-BASED CONFIGURATION

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

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

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

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

● **Disk Capacity Truncation Mode**

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

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

WEB BROWSER-BASED CONFIGURATION

- **Smart Option For HDD**

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

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

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

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

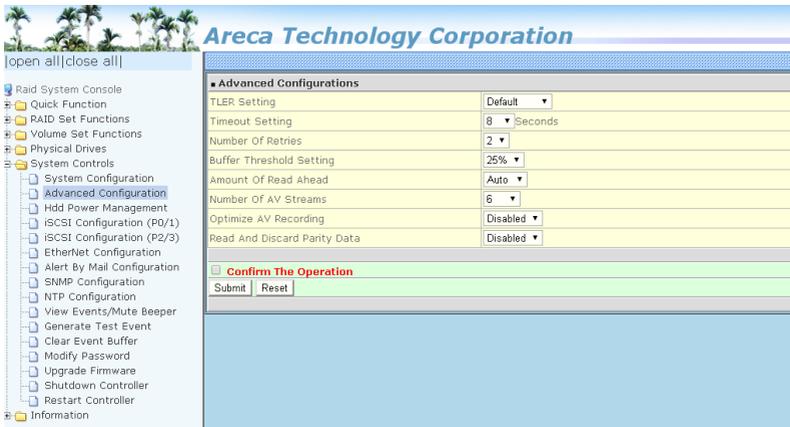
- **Smart Polling Interval**

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

WEB BROWSER-BASED CONFIGURATION

6.9.2 Advanced Configuration

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



- **TLER Setting**

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

- **Timeout Setting**

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

WEB BROWSER-BASED CONFIGURATION

- **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 video recording. This option will push data to disk early.

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

- **Amount of Read Ahead**

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

WEB BROWSER-BASED CONFIGURATION

- **Number of AV Stream**

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

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

- **Optimize AV Recording**

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

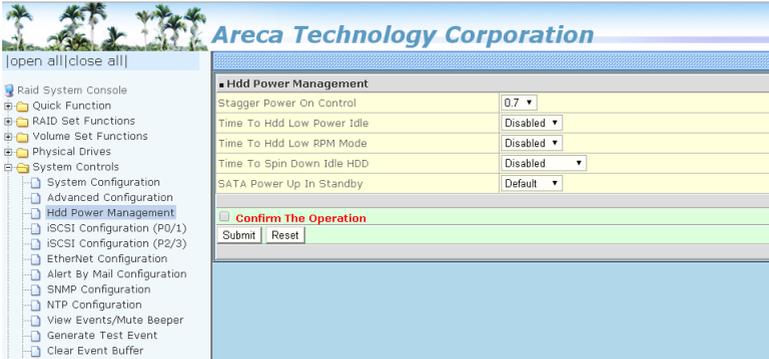
- **Read And Discard Parity Data**

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

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 controllers 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 controller components. This damage can be avoided by allowing the RAID controller to stagger the spin-up of the drives. The 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 controller. 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.

WEB BROWSER-BASED CONFIGURATION

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.

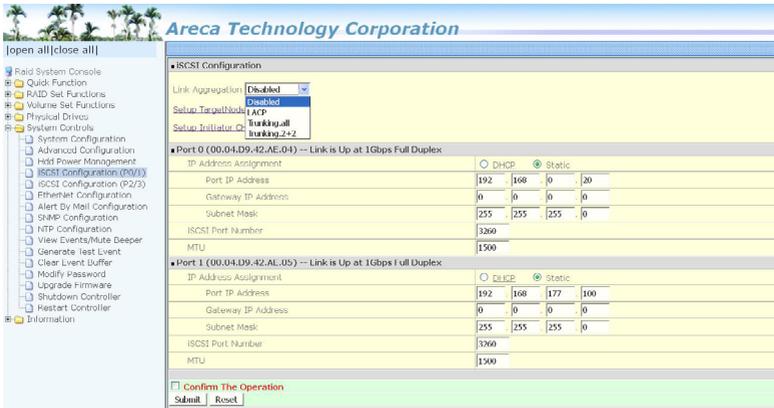
6.9.3.5 SATA Power Up In Standby

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.

6.9.4 iSCSI Configuration

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

WEB BROWSER-BASED CONFIGURATION



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

Three types of access control can be applied.

1. Link Aggregation

Link Aggregation for Gigabit Interfaces feature allows you to bundle Gigabit Ethernet links to one logical link that functions as a single, higher-speed link providing dramatically increased bandwidth. All Gigabit Ethernet links must be point-to-point

WEB BROWSER-BASED CONFIGURATION

connections between the switch and ARC-5066 iSCSI port for link aggregation enable (LACP and Trunking). Two (P0&P1 or P2&P3) or four (P0&P1&P2&P3) Gigabit Ethernet connections are combined in order to increase the bandwidth capability and to create resilient and redundant links on the ARC-5066 RAID controller. The ARC-5066 offers these options for Link Aggregation that can be used within the switched environment;

- * **Disabled:** Indicates that the conventional connection is applicable.
- * **LACP (IEEE 802.3ad):** Use the switch-negotiated dynamic LACP.
- * **Trunking (non-protocol):** Provide manually configured, static-only Trunking.

The advantages of link aggregation enable in contrast with conventional connection are:

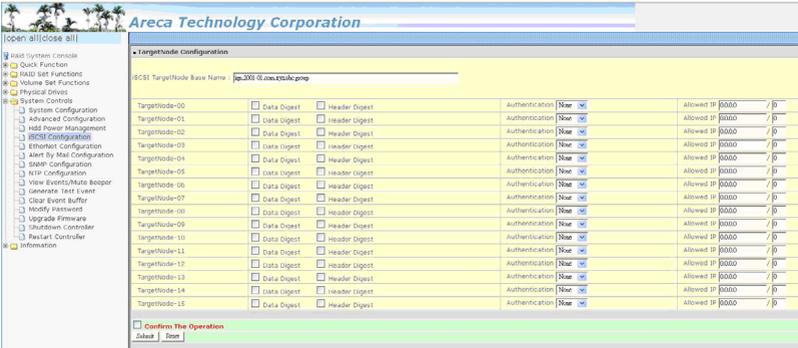
- higher potential transmission speed
- higher accessibility

- * **Disabled:** Each of Gigabit Ethernet link is connected by itself and is not set to LACP and Trunking. The ARC-5066 RAID controller supports four Gigabit Ethernet links to transmit data. Each of them must be assigned to individual port parameters in "Disabled" mode unless the link aggregation is enabled.
- * **LACP (IEEE 802.3ad):** LACP is part of the IEEE specification 802.3ad that allows you to bundle several Gigabit Ethernet links to form a single logical link. ARC-5066 RAID controller implements it as active mode which means that LACP port sends LACP protocol packets automatically. For this to work, both ends of the link must be dynamic LACP. If four ports are set in LACP mode, Port 0 parameters will be used for the Link Aggregated Group.
- * **Trunking (Non-protocol):** Trunking allows you to combine multiple Gigabit Interfaces in parallel to one logical link that functions as a single interface, higher-speed link providing dramatically increased bandwidth. If every two ports are set in Trunking mode (Trunking.2+2), Port 0&2 parameters will be used for the Link Aggregated Group. If four ports are set in Trunking mode (Trunking.All), Port 0 parameters will be used for the Link Aggregated Group.

WEB BROWSER-BASED CONFIGURATION

2. Per TargetNode IP filtering

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



- **Data/Header Digest:** The header/data digest fields are optional values in the iSCSI header to identify, reject and request retransmission of a corrupt PDU.
- **Authentication:** The Challenge Handshake Authentication Protocol (CHAP) is a protocol that is used to authenticate the peer of a connection and is based upon the peers sharing a secret (a security key that is similar to a password).

The options are: "None", and "CHAP". The default is "None".

- * **None:** To disable CHAP function.
- * **CHAP:** Go to /iSCSI Configuration/Setup Initiator CHAP Secret page to create user Name, Secret and TargNode Mask.
- **Allowed IP:** Allowed with or without CHAP enabled. Only the specified subrange of IP address can access specific TargetNode. The IP subrange notation is similar to CIDR notation as xxx.xxx.xxx.xxx/mm (xxx.xxx.xxx.xxx is the base IP address and mm is # of mask bits). MaskBits is allowed to be 0~32 (instead of 0~30 in CIDR) and specifies bits to be matched from MSB. When mm is set to 0, all IP will match successfully (IP filtering is effectively disabled). When mm is set to 32, only single IP (host) can access the specified TargetNode.

WEB BROWSER-BASED CONFIGURATION

3. Per Initiator TargetNode Mask

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

The screenshot shows the 'iSCSI Initiator CHAP Secret and TargetNode Selection' configuration page. The left sidebar lists various system settings. The main area has the following fields:

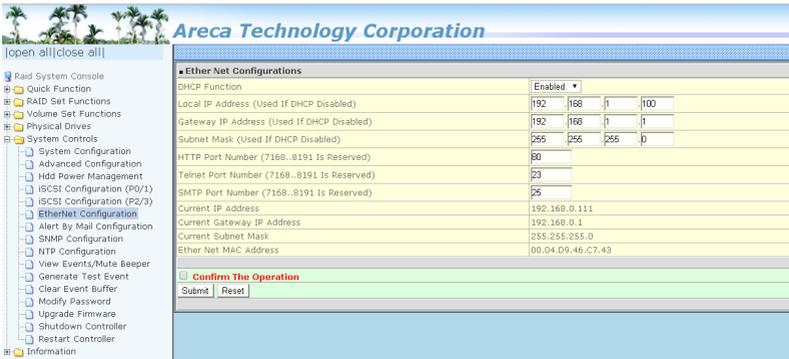
- User Name:
- Secret:
- Verify Secret:
- TargetNode Mask: A row of 16 checkboxes (15 to 0) and an 'ALL' button. Below it, the text reads: '(Leave User Name blank: if not Adding/Modifying CHAP entry)'
- Confirm The Operation: (checkbox) followed by 'Submit' and 'Reset' buttons.

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

WEB BROWSER-BASED CONFIGURATION

6.9.5 Ethernet Configuration

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



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

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

WEB BROWSER-BASED CONFIGURATION

6.9.6 Alert By Mail Configuration

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

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

The screenshot shows the web-based configuration interface for the RAID controller. The page title is "Areca Technology Corporation". On the left, there is a navigation menu with "Alert By Mail Configuration" selected. The main content area is divided into three sections: "SMTP Server Configuration", "Mail Address Configurations", and "Event Notification Configurations".

SMTP Server Configuration	
SMTP Server IP Address	<input type="text" value="p p p p"/>

Mail Address Configurations	
Sender Name :	<input type="text"/>
Mail Address :	<input type="text"/>
Account :	<input type="text"/>
Password :	<input type="text"/>

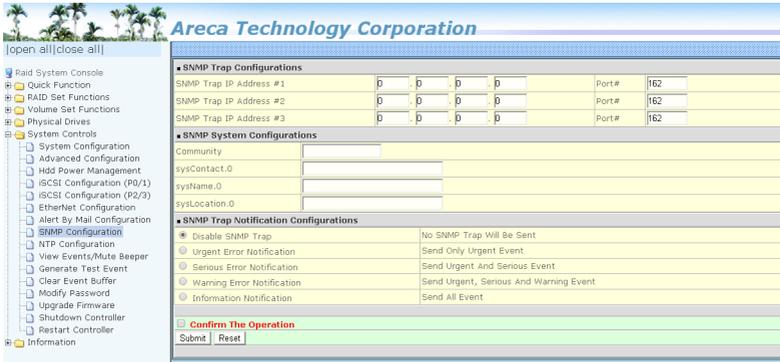
Event Notification Configurations	
MailTo Name1 :	<input type="text"/>
Mail Address :	<input type="text"/>
<input checked="" type="radio"/> Disable Event Notification	No Event Notification Will Be Sent
<input type="radio"/> Urgent Error Notification	Send Only Urgent Event
<input type="radio"/> Serious 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
<input type="checkbox"/> Notification For No Event	Notify User If No Event Occurs Within 24 Hours
MailTo Name2 :	<input type="text"/>
Mail Address :	<input type="text"/>
<input checked="" type="radio"/> Disable Event Notification	No Event Notification 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
<input type="checkbox"/> Notification For No Event	Notify User If No Event Occurs Within 24 Hours
MailTo Name3 :	<input type="text"/>
Mail Address :	<input type="text"/>
<input checked="" type="radio"/> Disable Event Notification	No Event Notification Will Be Sent
<input type="radio"/> Urgent Error Notification	Send Only Urgent Event

6.9.7 SNMP Configuration

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

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

WEB BROWSER-BASED CONFIGURATION



- **SNMP Trap Configurations**

Enter the SNMP Trap IP Address.

- **SNMP System Configurations**

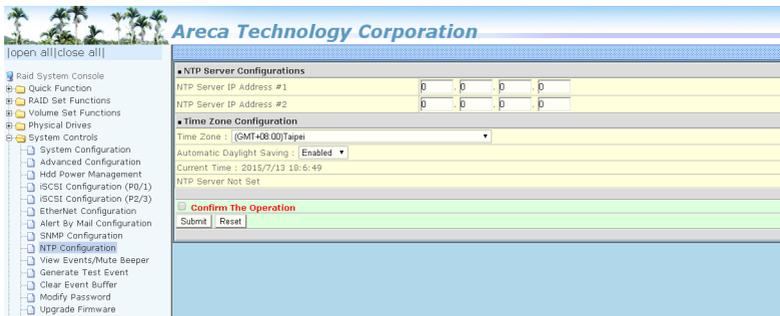
About community, Community name acts as a password to screen accesses to the SNMP agent of a particular network device. Type in the community names of the SNMP agent. Before access is granted to a request station, this station must incorporate a valid community name into its request; otherwise, the SNMP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

6.9.8 NTP Configuration



WEB BROWSER-BASED CONFIGURATION

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

- **NTP Sever Address**

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

- **Time Zone**

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

- **Automatic Daylight Saving**

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

Note:

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

WEB BROWSER-BASED CONFIGURATION

6.9.9 View Events/Mute Beeper

To view the RAID controller's event information, click on the "View Event/Mute Beeper" link. The RAID controller'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 controller does not have a built-in real time clock. The time information is the relative time from the system time setting. The maximum event no. is 256 per controller.

The screenshot shows the Areca Technology Corporation web interface. The left sidebar contains a navigation menu with options like 'Raid System Console', 'Quick Function', 'RAID Set Functions', 'Volume Set Functions', 'Physical Drives', 'System Controls', and 'Information'. The 'View Events/Mute Beeper' option is selected. The main content area displays a table titled 'System Events Information' with columns for Time, Device, Event Type, Elapse Time, and Errors. The table lists various events such as 'HTTP Log In', 'Complete Init', 'Start Initialize', 'Create Volume', 'Delete RaidSet', 'Abort Initialization', and 'Delete Volume'.

Time	Device	Event Type	Elapse Time	Errors
2008-3-14 13:49:20	192.168.0.00.157	HTTP Log In		
2008-3-14 12:45:0	ARC-8360-VOL#000	Complete Init	000:29:05	
2008-3-14 12:29:20	192.168.0.00.157	HTTP Log In		
2008-3-14 12:29:22	192.168.0.00.130	HTTP Log In		
2008-3-14 12:29:14	192.168.0.00.130	HTTP Log In		
2008-3-14 12:21:31	Enc#1 Slot#1	PassThrough Disk Created		
2008-3-14 12:15:54	ARC-8360-VOL#000	Start Initialize		
2008-3-14 12:15:52	ARC-8360-VOL#000	Create Volume		
2008-3-14 12:15:43	Raid Set # 001	Create RaidSet		
2008-3-14 12:15:5	Raid Set # 000	Create RaidSet		
2008-3-14 12:14:59	Raid Set # 000	Delete RaidSet		
2008-3-14 12:14:16	ARC-8360-VOL#000	Create Volume		
2008-3-14 12:13:16	Raid Set # 000	Create RaidSet		
2008-3-14 12:13:8	Raid Set # 004	Delete RaidSet		
2008-3-14 12:13:9	ARC-8360-VOL#002	Abort Initialization	000:01:01	
2008-3-14 12:13:6	Raid Set # 003	Delete RaidSet		
2008-3-14 12:13:4	Raid Set # 001	Delete RaidSet		
2008-3-14 12:13:4	ARC-8360-VOL#000	Abort Initialization	000:05:25	
2008-3-14 12:13:0	Raid Set # 002	Delete RaidSet		
2008-3-14 12:13:0	ARC-8360-VOL#001	Abort Initialization	000:05:13	
2008-3-14 12:12:55	Raid Set # 000	Delete RaidSet		
2008-3-14 12:12:23	ARC-8360-VOL#003	Modify Volume		
2008-3-14 12:12:11	ARC-8360-VOL#003	Create Volume		

6.9.10 Generate Test Event

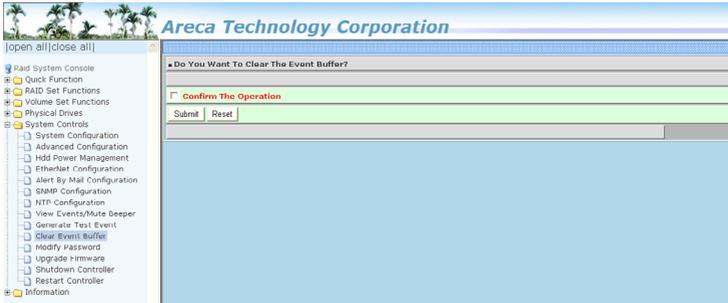
Use this feature to generate events for testing purposes. Such as test mail or SNMP trap settings.

The screenshot shows the Areca Technology Corporation web interface. The left sidebar is the same as in the previous screenshot. The main content area displays a dialog box titled 'Do You Want To Generate Test Event?'. The dialog box has a 'Confirm The Operation' button and 'Submit' and 'Reset' buttons.

WEB BROWSER-BASED CONFIGURATION

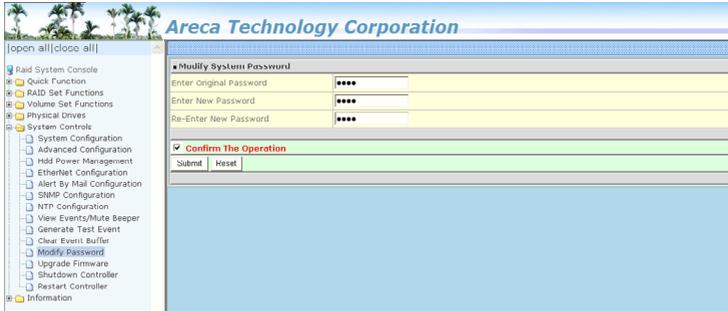
6.9.11 Clear Events Buffer

Use this feature to clear the entire events buffer information.



6.9.12 Modify Password

To set or change the RAID controller'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.

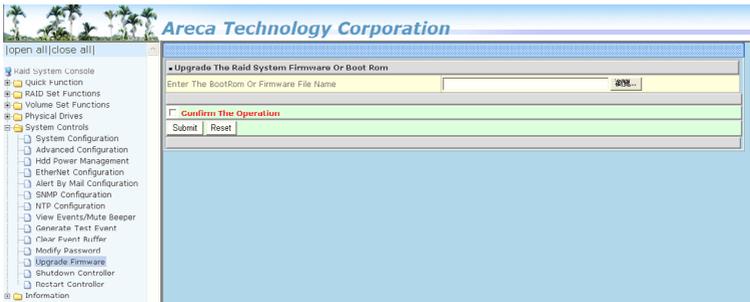
The password option allows user to set or clear the RAID controller's password protection feature. Once the password has been set, the user can only monitor and configure the RAID controller by providing the correct password. The password is used to protect the RAID controller from unauthorized entry. The controller will check the password only when entering the main menu from the initial screen. The RAID controller 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.

WEB BROWSER-BASED CONFIGURATION

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.

6.9.13 Update Firmware

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



6.9.14 Restart Controller

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



WEB BROWSER-BASED CONFIGURATION

6.10 Information

6.10.1 Raid Set Hierarchy

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

The screenshot shows the RAID Set Hierarchy screen. The left sidebar contains a navigation menu with the following items: Raid System Console, Quick Function, RAID Set Functions, Volume Set Functions, Physical Drives, System Controls, Information, RAID Set Hierarchy (selected), System Information, and Hardware Monitor. The main content area displays the RAID Set Hierarchy table and the Enclosure#1 RAID Subsystem V1.0 table.

RAID Set	Devices	Volume Set(Px/Targ/Lun)	Volume State	Capacity
Raid_Set # 000	#1Slot#1	ARC-5066-VOL#000(O/U/0)	Normal	2000.0GB
	#1Slot#2			
	#1Slot#3			
	#1Slot#4			

Device	Usage	Capacity	Model
Slot#1	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0
Slot#2	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0
Slot#3	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0
Slot#4	Raid Set # 000	500.1GB	WDC WD5000AAKX-001CA0
Slot#5	N.A.	N.A.	N.A.
Slot#6	N.A.	N.A.	N.A.
Slot#7	N.A.	N.A.	N.A.

6.10.2 System Information

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

The screenshot shows the RAID Subsystem Information screen. The left sidebar contains a navigation menu with the following items: Raid System Console, Quick Function, RAID Set Functions, Volume Set Functions, Physical Drives, System Controls, Information, RAID Set Hierarchy, System Information (selected), and Hardware Monitor. The main content area displays the RAID Subsystem Information table.

RAID Subsystem Information	
Controller Name	ARC-5066
Firmware Version	V1.52 2015-12-08
BOOT ROM Version	V1.52 2015-12-03
Serial Number	1100-2116-6633
Unit Serial #	
Main Processor	1200MHz ARM
CPU ICache Size	32KBytes
CPU DCache Size	32KBytes/Write Back
CPU SCache Size	2048KBytes/Write Back
System Memory	2048MB/1200MHz/ECC
Current IP Address	192.168.0.113

WEB BROWSER-BASED CONFIGURATION

6.10.3 Hardware Monitor

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

The screenshot displays the web browser-based configuration interface for Areca Technology Corporation. The interface includes a navigation menu on the left and a main content area on the right. The main content area shows the 'Controller H/W Monitor' section, which contains a table of hardware status information.

Areca Technology Corporation

Navigation: |open all|close all|

- Raid System Console
- Quick Function
- RAID Set Functions
 - Volume Set Functions
 - Physical Drives
 - System Controls
- Information
 - RAID Set Hierarchy
 - System Information
 - Hardware Monitor**

Stop Auto Refresh

Controller H/W Monitor

CPU Temperature	39 °C
Controller Temp.	31 °C
12V	12.281 V
5V	5.053 V
3.3V	3.360 V
CPU Analog +1.8V	1.872 V
DDR3 +1.5V	1.552 V
CPU +1.05V	1.056 V
SATA Chip +1.0V	1.024 V
CPU VCore +0.9V	0.960 V
RTC +3.0V	3.136 V
Battery Status	Not Installed

Enclosure# 1 : RAID Subsystem V1.0

Appendix A

Upgrading Flash ROM Update Process

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

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

ARC-5066BOOT.BIN:→ RAID controller hardware initialization.

ARC-5066FIRM.BIN:→ RAID kernel program

ARC-5066MBR0.BIN:→ Master Boot Record for supporting Dual Flash Image in the RAID controller.

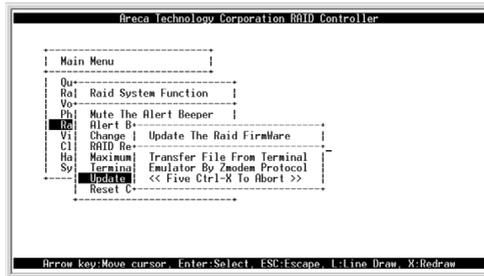
Release_note.txt file contains the history information of the firmware change. Read this file first before upgrading the firmware. These files must be extracted from the compressed file and copied to one directory in drive A: or C:. The firmware can be downloaded to the RAID controller controller by using an ANSI/VT-100 compatible terminal emulation program or HTTP web browser management. You must complete the appropriate installation procedure before proceeding with this firmware upgrade.

Upgrade Firmware Through ANSI/VT-100 Terminal Emulation

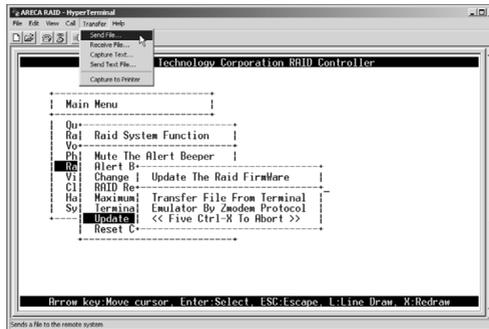
Please refer to chapter 3.2, "VT100 terminal (Using the controller's serial port)" for details on establishing the connection. Whichever terminal emulation program is used must support the ZMODEM file transfer protocol. Get the new version firmware for your RAID controller controller. For example, download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

APPENDIX

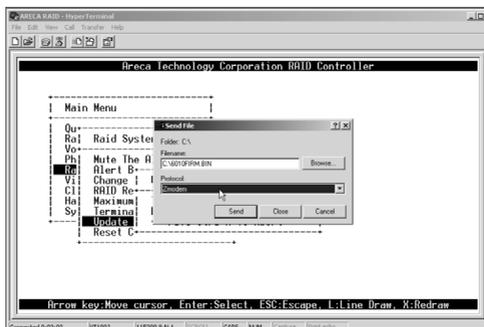
1. From the main menu, scroll down to "Raid System Function".
2. Choose the "Update Firmware", The "Update The Raid Firmware" dialog box appears.



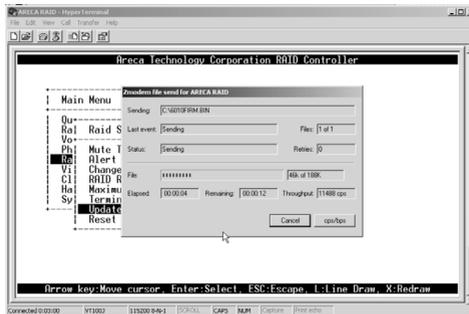
3. Go to the tool bar and select "Transfer". Open "Send File".



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



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



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



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



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

APPENDIX

10. After the Firmware upgrade is complete, a bar indicator will show "Firmware Has Been Updated Successfully".



Note:

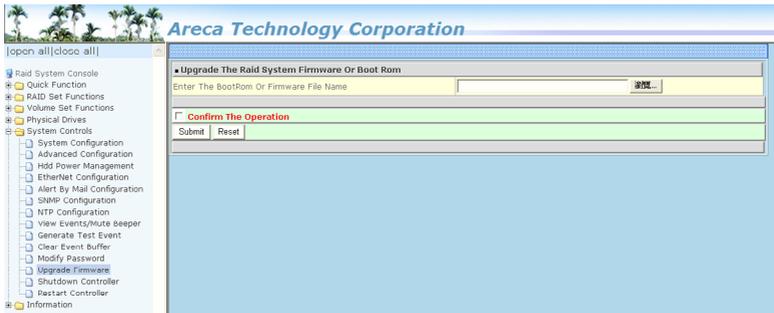
1. The user doesn't need to reconfigure all of the settings after the firmware upgrade is complete, because all of the settings will keep the values before upgrade.
2. Please update all binary code (BOOT, FIRM and MBR0) before you reboot the RAID controller. Otherwise, a mixed firmware package may hang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

Upgrade Firmware Through Web Browser Manager (LAN Port)

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

1. To upgrade the RAID controller firmware, move the mouse cursor to "Upgrade Firmware" link. The "Upgrade The Raid System Firmware" screen appears.
2. Click "Browse". Look in the location where the firmware upgrade file is located. Select the file name: "ARC-NNNNXXXX.BIN" and click open.

3. Click the "Confirm The Operation" and press the "Submit" button.



4. The Web Browser begins to download the firmware binary to the controller and start to update the flash ROM.
5. After the firmware upgrade is complete, a bar indicator will show "Firmware has Been Updated Successfully"

Note:

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

APPENDIX

Appendix B

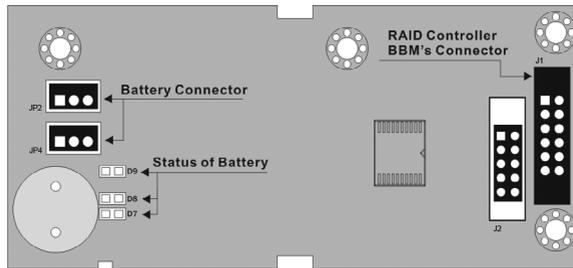
Battery Backup Module (ARC-6120BA-T121-12G)

B-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.

B-2 BBM Components

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



B-3 Status of BBM

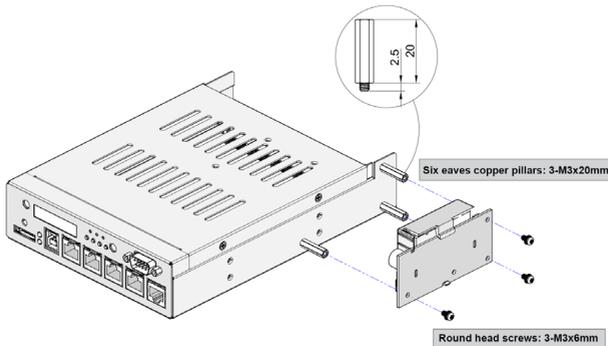
- D7 (Green) : light when BBM activated
- D8 (Green) : light when BBM normal
- D9 (Red) : light when BBM charging

Note:

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

B-4 Installation

1. Make sure all power to the system is disconnected.
2. Remove the mounting screw and existing bracket from the BBM.
3. Integrators provide pre-drilled holes in the controller cabinet for securing the three "six eaves copper pillars" on the BBM using round head screws.



4. Remove the cable that is included in the ARC-6120BAT121-12G kit box. The cable has a 14-pin connector on controller and 12-pin connector on BBM side.
5. Connector J4 on the RAID controller module is available for the optional battery backup module. Connect the BBM cable to the 14-pin battery connector on the controller.

B-5 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.

B-6 Operation

1. Battery conditioning is automatic. There are no manual procedures for battery conditioning or preconditioning to be performed by the user.

APPENDIX

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.

B-7 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.

B-8 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".

B-9 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 (Charge)
 - 0° C to +55° C (Discharge)
 - * Humidity: 45-85%, non-condensing
- Storage Temperature
 - * Temperature:
 - 20° C to +20° C (storing for less than 1year)
 - 20° C to +40° C (storing for less than 3months)
 - 20° C to +55° C (storing for less than 1month)
 - * Humidity: 45-85%, non-condensing

Electrical

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

APPENDIX

Appendix C

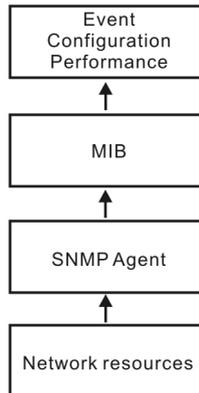
SNMP Operation & Definition

Overview

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



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 controller, 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_sata.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

Appendix D

Event Notification Configurations

The controller classifies disk array events into four levels depending on their severity. These include level 1: Urgent, level 2: Serious, level 3: Warning and level 4: Information. The level 4 covers notification events such as initialization of the controller and initiation of the rebuilding process; Level 2 covers notification events which once have happen; Level 3 includes events which require the issuance of warning messages; Level 1 is the highest level, and covers events the need immediate attention (and action) from the administrator. The following lists sample events for each level:

A. Device Event

Event	Level	Meaning	Action
Device Inserted	Warning	HDD inserted	
Device Removed	Warning	HDD removed	
Reading Error	Warning	HDD reading error	Keep Watching HDD status, may be it caused by noise or HDD unstable.
Writing Error	Warning	HDD writing error	Keep Watching HDD status, may be it caused by noise or HDD unstable.
ATA Ecc Error	Warning	HDD ECC error	Keep Watching HDD status, may be it caused by noise or HDD unstable.
Change ATA Mode	Warning	HDD change ATA mode	Check HDD connection
Time Out Error	Warning	HDD time out	Keep Watching HDD status, may be it caused by noise or HDD unstable.
Device Failed	Urgent	HDD failure	Replace HDD
PCI Parity Error	Serious	PCI parity error	If only happen once, it may be caused by noise. If always happen, please check power supply or contact to us.
Device Failed(SMART)	Urgent	HDD SMART failure	Replace HDD

PassThrough Disk Created	Inform	Pass Through Disk created	
PassThrough Disk Modified	Inform	Pass Through Disk modified	
PassThrough Disk Deleted	Inform	Pass Through Disk deleted	

B. Volume Event

Event	Level	Meaning	Action
Start Initialize	Warning	Volume initialization has started	
Start Rebuilding	Warning	Volume rebuilding has started	
Start Migrating	Warning	Volume migration has started	
Start Checking	Warning	Volume parity checking has started	
Complete Init	Warning	Volume initialization completed	
Complete Rebuild	Warning	Volume rebuilding completed	
Complete Migrate	Warning	Volume migration completed	
Complete Check	Warning	Volume parity checking completed	
Create Volume	Warning	New volume created	
Delete Volume	Warning	Volume deleted	
Modify Volume	Warning	Volume modified	
Volume Degraded	Urgent	Volume degraded	Replace HDD
Volume Failed	Urgent	Volume failure	
Failed Volume Revived	Urgent	Failed volume revived	
Abort Initialization	Warning	Initialization been abort	
Abort Rebuilding	Warning	Rebuilding aborted	
Abort Migration	Warning	Migration aborted	
Abort Checking	Warning	Parity check aborted	
Stop Initialization	Warning	Initialization stopped	
Stop Rebuilding	Warning	Rebuilding stopped	
Stop Migration	Warning	Migration stopped	
Stop Checking	Warning	Parity check stopped	

APPENDIX

C. RAID Set Event

Event	Level	Meaning	Action
Create RaidSet	Warning	New RAID set created	
Delete RaidSet	Warning	Raidset deleted	
Expand RaidSet	Warning	Raidset expanded	
Rebuild RaidSet	Warning	Raidset rebuilding	
RaidSet Degraded	Urgent	Raidset degraded	Replace HDD

D. Hardware Monitor Event

Event	Level	Meaning	Action
DRAM 1-Bit ECC	Urgent	DRAM 1-Bit ECC error	Check DRAM
DRAM Fatal Error	Urgent	DRAM fatal error encountered	Check the DRAM module and replace with new one if required.
Controller Over Temperature	Urgent	Abnormally high temperature detected on controller	Check air flow and cooling fan of the controller, and contact us.
Hdd Over Temperature	Urgent	Abnormally high temperature detected on Hdd	Check air flow and cooling fan of the controller.
Fan Failed	Urgent	Cooling Fan # failure or speed below 1700RPM	Check cooling fan of the controller and replace with a new one if required.
Controller Temp. Recovered	Serious	Controller temperature back to normal level	
Hdd Temp. Recovered	Serious	HDD temperature back to normal level	
Raid Powered On	Warning	RAID power on	
Test Event	Urgent	Test event	
Power On With Battery Backup	Warning	RAID power on with battery backup	
Incomplete RAID Discovered	Serious	Some RAID set member disks missing before power on	Check disk information to find out which channel missing.
HTTP Log In	Serious	a HTTP login detected	

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 continue the incompleted rebuilding/ migration.

APPENDIX

Appendix E

RAID Concept

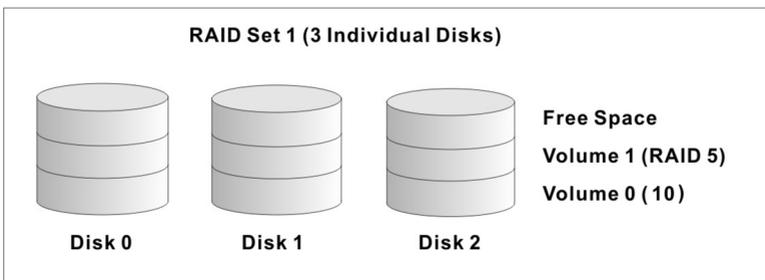
RAID Set

A RAID set is a group of disk containing one or more volume sets. It has the following features in the RAID controller. A volume Set must be created either on an existing RAID set or on a group of available individual disks (disks that are not yet a part of an RAID set). If there are pre-existing RAID sets with available capacity and enough disks for specified RAID level desired, then the volume set will be created in the existing RAID set of the user's choice. If physical disk of different capacity are grouped together in a RAID set, then the capacity of the smallest disk will become the effective capacity of all the disks in the RAID set.

Volume Set

A volume set is seen by the host system as a single logical device. It is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set capacity can consume all or a portion of disk capacity available in a RAID set. Multiple volume sets can exist on a group of disks in a RAID set.

In the illustration below, volume 1 can be assigned a RAID 5 level of operation while volume 0 might be assigned a RAID 0+1 level of operation.



Easy of Use Features

- **Instant Availability/Background**

Initialization RAID 0 and RAID 1 volume set can be used immediately after the creation. But the RAID 3 and 5 volume sets must be initialized to generate the parity. In the Normal Initialization, the initialization proceeds as a background task, the volume set is fully accessible for system reads and writes. The operating system can instantly access to the newly created arrays without requiring a reboot and waiting the initialization complete. Furthermore, the RAID volume set is also protected against a single disk failure while initializing. In Fast Initialization, the initialization proceeds must be completed before the volume set ready for system accesses.

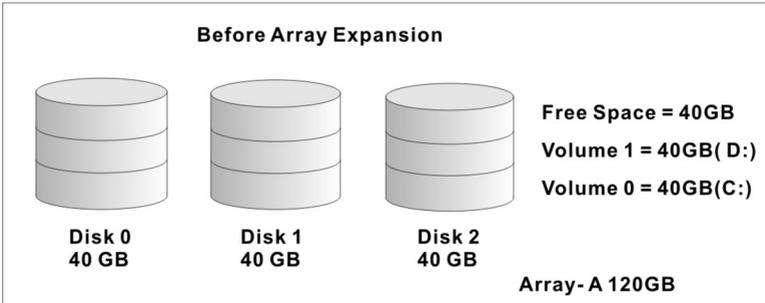
- **Online Array Roaming/Offline RAID set**

The RAID controller stores configuration information on the disk drives It can protect the configuration settings in case of a disk drive or controller failure. Array roaming allows the administrators the ability to move a completely RAID set to another system without losing RAID configuration and data on that RAID set. If a server fails to work, the RAID set disk drives can be moved to another server and inserted in any order.

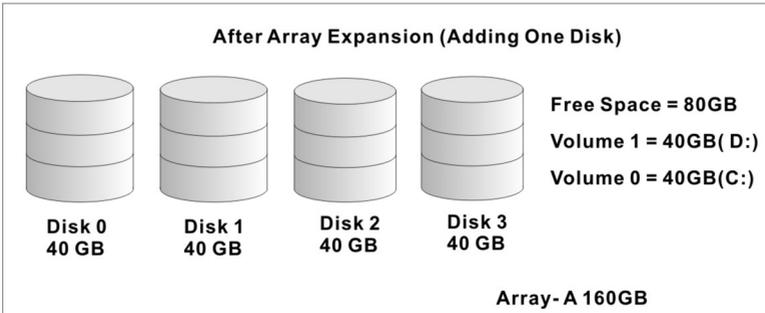
- **Online Capacity Expansion**

Online Capacity Expansion makes it possible to add one or more physical drive to a volume set, while the server is in operation, eliminating the need to store and restore after re-configured the RAID set. When disks are added to a RAID set, unused capacity is added to the end of the RAID set. Data on the existing volume sets residing on that RAID set is redistributed evenly across all the disks. A contiguous block of unused capacity is made available on the RAID set. The unused capacity can create additional volume set. The expansion process is illustrated as following figure.

APPENDIX



The RAID controller 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 controller. For example, in a system using two drives in RAID level 1, you could add capacity and retain fault tolerance by adding one drive. With the addition of third disk, you have the option of adding this disk to your existing RAID logical drive and migrating from RAID level 1 to 5. The result would be parity fault tolerance and double the available capacity without taking the system off.

High availability

- **Creating Hot Spares**

A hot spare drive is an unused online available drive, which is ready for replacing the failure disk drive. In a RAID level 1, 1E 3, 5, 6 or 10 raid set, any unused online available drive installed but not belonging to a raid set can be defined as a hot spare drive. Hot spares permit you to replace failed drives without powering down the system. When RAID subsystem detects a drive failure, the system will automatically and transparently rebuild using hot spare drives. The raid set will be reconfigured and rebuilt in the background, while the RAID controller continues to handle system request. During the automatic rebuild process, system activity will continue as normal, however, the system performance and fault tolerance will be affected. Basically, the newly installed drive will be reconfigured an online free disk. But, the newest installed drive will be automatically assigned as a hot spare, if any hot spare disk was used to rebuild and without new installed drive replaced it.

Important:

The hot spare must have at least the same capacity as the drive it replaces.

- **Hot-Swap Disk Drive Support**

The RAID controller has built the protection circuit to support the replacement of SATA II hard disk drives without having to shut down or reboot the system. The removable hard drive tray can de-liver "hot swappable," fault-tolerant RAID solutions at prices much less than the cost of conventional SCSI hard disk RAID controllers. We provide this feature for controllers to provide the advanced fault tolerant RAID protection and "online" drive replacement.

APPENDIX

● Hot-Swap Disk Rebuild

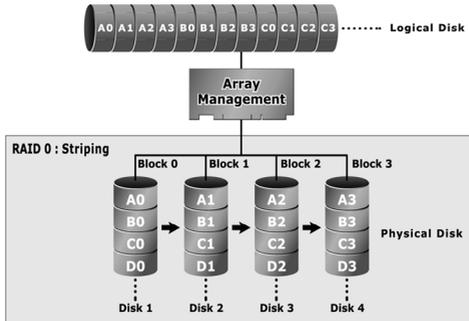
A Hot-Swap function can be used to rebuild disk drives in arrays with data redundancy such as RAID level 1, 10, 3, 5 and 6. If a hot spare is not available, the failed disk drive must be replaced with a new disk drive so that the data on the failed drive can be rebuilt. If a hot spare is available, the 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 controller 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 controller 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 controller. The RAID controller makes the RAID implementation and the disks' physical configuration transparent to the host operating system. This means that the host operating system drivers and software utilities are not affected, regardless of the RAID level selected. Correct installation of the disk array and the controller requires a proper understanding of RAID technology and the concepts.

● RAID 0

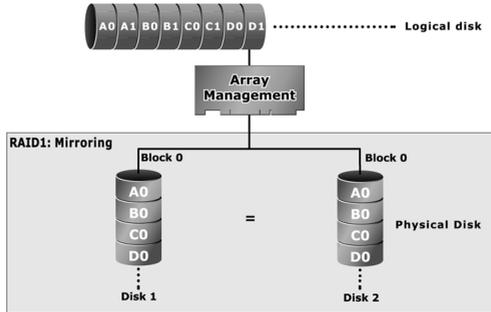
RAID 0, also referred to as striping, writes stripping of data across multiple disk drives instead of just one disk drive. RAID 0 does not provide any data redundancy, but does offer the best high-speed data throughput. RAID 0 breaks up data into smaller blocks and then writes a block to each drive in the array. Disk striping enhances performance because multiple drives are accessed simultaneously; but the reliability of RAID Level 0 is less than any of its member disk drives due to its lack of redundancy.



● RAID 1

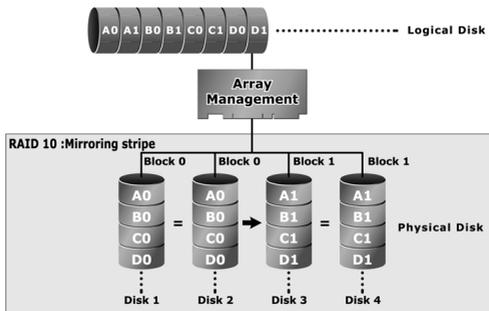
RAID 1 also known as “disk mirroring”, data written to one disk drive is simultaneously written to another disk drive. Read performance may be enhanced if the array controller can parallel accesses both members of a mirrored pair. During writes, there will be a minor performance penalty when compared to writing to a single disk. If one drive fails, all data (and software applications) are preserved on the other drive. RAID 1 offers extremely high data reliability, but at the cost of doubling the required data storage capacity.

APPENDIX



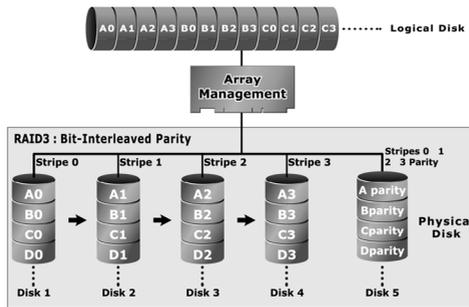
- **RAID 10(1E)**

RAID 10(1E) is a combination of RAID 0 and RAID 1, combining striping with disk mirroring. RAID Level 10(1E) combines the fast performance of Level 0 with the data redundancy of Level 1. In this configuration, data is distributed across several disk drives, similar to Level 0, which are a stripe across a number of mirrored sets for data protection. RAID 10(1E) provides the highest read/write performance of any of the Hybrid RAID levels, but at the cost of doubling the required data storage capacity.



● RAID 3

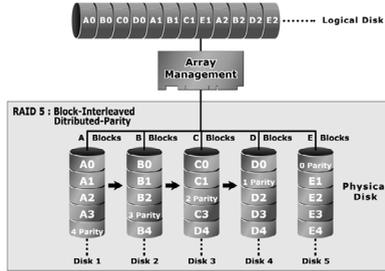
RAID 3 provides disk striping and complete data redundancy through a dedicated parity drive. RAID 3 breaks up data into smaller blocks, calculates parity by performing an exclusive-or on the blocks, and then writes the blocks to all but one drive in the array. The parity data created during the exclusive-or is then written to the last drive in the array. If a single drive fails, data is still available by computing the exclusive-or of the contents corresponding stripes of the surviving member disk. RAID 3 is best for applications that require very fast data-transfer rates or long data blocks.



● RAID 5

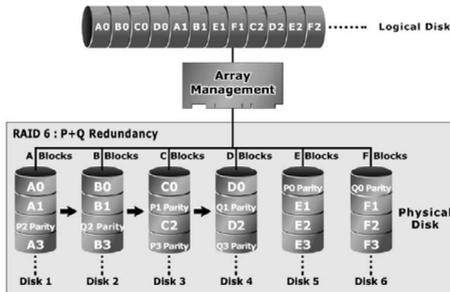
RAID 5 is sometimes called striping with parity at byte level. In RAID 5, the parity information is written to all of the drives in the controllers rather than concentrated on a dedicated parity disk. If one drive in the system fails, the parity information can be used to reconstruct the data from that drive. All drives in the array system can be used to seek operation at the same time, greatly increasing the performance of the RAID system. This relieves the write bottle-neck that characterizes RAID 4, and is the primary reason that RAID 5 is more often implemented in RAID arrays.

APPENDIX



- **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.

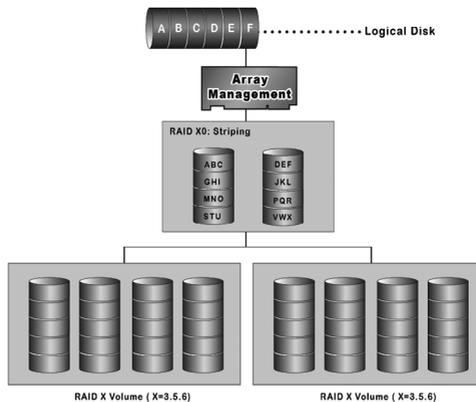


● RAID x0

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 controller 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 controller supports RAID Level 0, 1, 10(1E), 3, 5, 6, 30, 50 and 60. The following table provides a summary of RAID levels.

RAID Level Comparison			
RAID Level	Description	Disks Requirement (Minimum)	Data Availability
0	Also known as striping. Data distributed across multiple drives in the array. There is no data protection.	1	No data Protection
1	Also known as mirroring. All data replicated on 2 separated disks. N is almost always 2. Due to this is a 100 % duplication, so is a high costly solution.	2	Up to one disk failure
10(1E)	Also known as mirroring and striping. Data is written to two disks simultaneously, and allows an odd number of disk. Read request can be satisfied by data read from wither one disk or both disks.	3	Up to one disk failure in each sub-volume
3	Also known Bit-Interleaved Parity. Data and parity information is subdivided and distributed across all data disks. Parity information normally stored on a dedicated parity disk.	3	Up to one disk failure
5	Also known Block-Interleaved Distributed Parity. Data and parity information is subdivided and distributed across all disk. Parity information normally is interspersed with user data.	3	Up to one disk failure

APPENDIX

6	RAID 6 provides highest reliability, but not widely used. Similar to RAID 5, but does two different parity computations or the same computation on overlapping subsets of the data. The RAID 6 can offer fault tolerance greater than RAID 1 or RAID 5 but only consumes the capacity of 2 disk drives for distributed parity data.	4	Up to two disk failure
30	RAID 30 is a combination multiple RAID 3 volume sets with RAID 0 (striping)	6	Up to one disk failure in each sub-volume
50	RAID 50 is a combination multiple RAID 5 volume sets with RAID 0 (striping)	6	Up to one disk failure in each sub-volume
60	RAID 60 is a combination multiple RAID 6 volume sets with RAID 0 (striping)	8	Up to two disk failure in each sub-volume