

Areca RAID Box

ARC-8050U3-6

(USB 3.1 Gen 2 to 12Gb/s SAS RAID storage)

User's Manual

Version: 1.0

Issue Date: November, 2018

Copyright and Trademarks

The information regarding products in this manual is subject to change without prior notice and does not represent a commitment on the part of the vendor, who assumes no liability or responsibility for any errors that may appear in this manual. All brands and trademarks are the properties of their respective owners. This manual contains materials protected under International Copyright Conventions. All rights reserved. No part of this manual may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the manufacturer and the author.

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-8050U3-6 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	10
1.1 Overview	10
1.2 Features	12
2. Installation.....	14
2.1 Before You First Installing.....	14
2.2 RAID Storage View	15
2.3 Locations of the Storage Component.....	16
2.3.1 Drive Tray LED Indicators	16
2.3.2 LCD Panel LED Indicators	17
2.4 Setting Up RAID Storage.....	18
2.4.1 Physically Install RAID Storage and Drives	18
2.4.2 Configure RAID Volumes	22
2.4.3 Format, Partition and Mount the RAID Storage Volume	23
3. LCD Configuration Menu	24
3.1 Starting LCD Configuration Utility	24
3.2 LCD Configuration Utility Main Menu Options.....	25
3.3 Configuring Raid Sets and Volume Sets	25
3.4 Designating Drives as Hot Spares.....	26
3.5 Using Easy RAID Configuration	26
3.6 Using Raid Set and Volume Set Functions	28
3.7 Navigation Map of the LCD	29
3.7.1 Quick Volume And Raid Setup	30
3.7.2 Raid Set Functions.....	30
3.7.2.1 Create A New Raid Set	31
3.7.2.2 Delete Raid Set	31
3.7.2.3 Expand Raid Set.....	32
3.7.2.4 Offline Raid Set	32
3.7.2.5 Activate Incomplete RaidSet.....	33
3.7.2.6 Create Hot Spare Disk.....	33
3.7.2.7 Delete Hot Spare Disk.....	33
3.7.2.8 Display Raid Set Information	33
3.7.3 Volume Set Functions	34
3.7.3.1 Create Raid Volume Set	34
3.7.3.2 Delete Existed Volume Set	37
3.7.3.3 Modify Volume Set Attribute.....	37
3.7.3.4 Check Volume Set Consistency	38
3.7.3.5 Stop Volume Set Consistency Check.....	39

3.7.3.6 Display Volume Set Information.....	39
3.7.4 Physical Drive Functions	39
3.7.4.1 Display Drive Information	41
3.7.4.2 Create Pass Through Disk	41
3.7.4.3 Modify Pass-Through Disk	41
3.7.4.4 Delete Pass-Through Disk	42
3.7.4.5 Identify The Selected Drive	42
3.7.5 Raid System Functions.....	42
3.7.5.1 Mute The Alert Beeper	44
3.7.5.2 Alert Beeper Setting	44
3.7.5.3 Change Password	44
3.7.5.4 JBOD/RAID Mode Configuration	44
3.7.5.5 Raid Rebuild Priority.....	45
3.7.5.6 SATA NCQ Mode Support	45
3.7.5.7 HDD Read Ahead Cache.....	45
3.7.5.8 Volume Data Read Ahead.....	45
3.7.5.9 Disk Write Cache Mode.....	46
3.7.5.10 Disk Capacity Truncation Mode.....	46
3.7.5.11 Shutdown The Controller.....	46
3.7.5.12 Restart Controller	47
3.7.6 Hdd Power Management.....	47
3.7.6.1 Stagger Power On Control.....	47
3.7.6.2 Time To Hdd Low Power Idle	48
3.7.6.3 Time To Hdd Low RPM Mode.....	48
3.7.6.4 Time To Spin Down Idle HDD	48
3.7.7 Ethernet Configuration	48
3.7.7.1 DHCP.....	48
3.7.7.2 Local IP Adress.....	49
3.7.7.3 HTTP Port Number	49
3.7.7.4 Telnet Port Number	49
3.7.7.5 SMTP Port Number.....	50
3.7.7.6 Ethernet Address	50
3.7.8 Show System Events	50
3.7.9 Clear all Event Buffers.....	50
3.7.10 Hardware Monitor Information.....	50
3.7.11 System Information	51

4. Web Browser-based Configuration 52

4.1 Start-up McRAID Storage Manager	52
• McRAID Storage Manager Through LAN Port (Out-of-Band) ..	53
4.2 McRAID Main Window	53
4.3 Main Menu	54
4.4 Quick Function.....	54

4.5	Raid Set Functions	55
4.5.1	Create Raid Set	55
4.5.2	Delete Raid Set	56
4.5.3	Expand Raid Set.....	57
4.5.4	Offline Raid Set.....	58
4.5.5	Rename Raid Set.....	58
4.5.6	Activate Incomplete Raid Set	59
4.5.7	Create Hot Spare	59
4.5.8	Delete Hot Spare.....	60
4.5.9	Rescue Raid Set	60
4.6	Volume Set Functions	61
4.6.1	Create Volume Set	62
•	Volume Name	62
•	Volume Raid Level	62
•	Capacity	62
•	Greater Two TB Volume Support.....	62
•	Initialization Mode.....	63
•	Stripe Size	63
•	Cache Mode	64
•	Volume Write Protection.....	64
•	Tagged Command Queuing	64
•	SCSI Channel/SCSI ID/SCSI Lun.....	64
4.6.2	Delete Volume Set.....	65
4.6.3	Modify Volume Set.....	65
4.6.3.1	Volume Growth	66
4.6.3.2	Volume Set Migration	66
4.6.3.3	Volume Write Protection	67
4.6.4	Check Volume Set	67
4.6.5	Schedule Volume Check	68
4.7	Security Function	69
4.7.1	Create SED RAID Set	69
4.7.2	Delete SED RAID Set	70
4.7.3	Delete ISE RAID Set	70
4.7.4	Security Key Setup	71
4.7.4.1	SED Key Management-Creation	71
4.7.4.2	SED Key Management-Modification	72
4.7.5	Import Security Key.....	73
4.7.6	Erase Failed Disk	74
4.7.7	RevertSP.....	74
4.8	Physical Drive	75
4.8.1	Create Pass-Through Disk.....	75
4.8.2	Modify Pass-Through Disk.....	75

4.8.3 Delete Pass-Through Disk	76
4.8.4 Clone Disk.....	76
4.8.4.1 Clone And Replace	77
4.8.4.2 Clone Only	77
4.8.5 Abort Cloning.....	78
4.8.6 Set Disk To Be Failed	78
4.8.7 Activate Failed Disk	79
4.8.8 Identify Enclosure	79
4.8.9 Identify Drive	79
4.9 System Controls	80
4.9.1 System Config	80
• System Beeper Setting	80
• Background Task Priority	80
• JBOD/RAID Configuration	80
• SATA NCQ Support	81
• HDD Read Ahead Cache	81
• Volume Data Read Ahead	81
• HDD Queue Depth	81
• Empty HDD Slot LED	81
• Max Command Length	82
• Auto Activate Incomplete Raid	82
• Disk Write Cache Mode	82
• Write Same For Initialization	82
• Hot Plugged Disk For Rebuilding	82
• Disk Capacity Truncation Mode	83
• Smart Option For HDD	83
• Smart Polling Interval	84
4.9.2 Advanced Configuration.....	84
• TLER Setting	84
• Timeout Setting	85
• Number of Retries	85
• Buffer Threshold	85
• Amount of Read Ahead	86
• Number of AV Stream	86
• Optimize AV Recording.....	86
• Read Performance Margin.....	87
• Write Performance Margin	87
• Read And Discard Parity Data	87
4.9.3 HDD Power Management	88
• Stagger Power On Control	88
• Time To Hdd Low Power Idle	89

• Time To Hdd Low RPM Mode	89
• SATA Power Up In Standby	89
4.9.4 Ethernet Configuration	89
• DHCP Function.....	90
• Local IP address.....	90
• Gateway IP address.....	91
• Subnet Mask	91
• HTTP Port Number.....	91
• Telnet Port Number	91
• SMTP Port Number	91
4.9.5 Alert By Mail Configuration	91
4.9.6 NTP Configuration	92
• NTP Sever Address.....	93
• Time Zone.....	93
• Automatic Daylight Saving.....	93
4.9.7 View Events/Mute Beeper	93
4.9.8 Generate Test Event	94
4.9.9 Clear Events Buffer.....	94
4.9.10 Modify Password.....	95
4.9.11 Update Firmware	95
4.10 Information	96
4.10.1 Raid Set Hierarchy	96
4.10.1.1 Hdd Xfer Speed	96
4.10.2 System Information	97
4.10.3 Hardware Monitor	98
Appendix A	99
Upgrading Flash ROM Update Process.....	99
Appendix B	102
Battery Backup Module (ARC-6120BA-T021-T3)	102
B-1 BBM Connector and Components	102
B-2 Status of BBM	102
B-3 Battery Pack Modules	103
B-4 Installation	103
Appendix C	107
Event Notification Configurations	107
A. Device Event.....	107
B. Volume Event.....	108
C. RAID Set Event	108
D. Hardware Monitor Event	109
Appendix D.....	110
RAID Concept	110

RAID Set	110
Volume Set	110
Ease of Use Features	111
• Foreground Availability/Background Initialization	111
• Online Array Roaming	111
• Online Capacity Expansion	111
• Online RAID Level and Stripe Size Migration	113
• Online Volume Expansion	114
High Availability	114
• Global/Local Hot Spares	114
• Hot-Swap Disk Drive Support	115
• Auto Declare Hot-Spare	115
• Auto Rebuilding	116
• Adjustable Rebuild Priority	116
High Reliability	117
• Hard Drive Failure Prediction	117
• Auto Reassign Sector	117
• Consistency Check	118
Data Protection	118
• Battery Backup	118
• Recovery ROM	119
Appendix E	120
Understanding RAID	120
RAID 0	120
RAID 1	121
RAID 10(1E)	122
RAID 3	122
RAID 5	123
RAID 6	124
Single Disk (Pass-Through Disk)	124
Summary of RAID Levels	125

SPECIFICATION

1. Introduction

This section presents a brief overview of the SAS RAID storage, ARC-8050U3-6. (10.0Gbps USB 3.1 to 12Gb/s SAS RAID storage)

1.1 Overview

Cutting-edge Host Interfaces

ARC-8050U3-6 RAID enclosure offers a truly innovative USB 3.1 (10.0Gbps) host interface solution for SOHO group professionals who work at home and or in the office. Using USB 3.1 to PCIe bridge and Areca existing ARC-8050T3-6 industry-proven hardware RAID controller, this RAID storage delivers the performance enhancement of USB 3.1 at the best of cost/performance value. With the much faster speed than ordinary USB 3.0 based storage, ARC-8050U3-6 is an alternative RAID storage for SOHO group professionals who need an affordable storage at home and or in the office. The advancement of 10Gbps USB3.1 connectivity allows the RAID storage to transfer end-to-end 10Gbps storage speed and fully backward compatible with USB 3.0/2.0 interconnection. ARC-8050U3-6 is OS independent, with no additional software or driver installation required, and also used on any Thunderbolt™ 3 USB-C port.

Unparalleled Performance

ARC-8050U3-6 RAID storage incorporates onboard high performance 1.2Ghz dual core 12G SAS Raid-on-Chip (ROC) and on-board 2GB DDR3-1866 SDRAM memory with ECC protection to deliver true hardware RAID without sharing the CPU computing power on the host system. 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. With hard drives, the unit USB 3.1 port can deliver peak speed of 1046 MB/sec reads and over 936 MB/sec writes on a RAID 5 volume. High transfer rates make this external storage well suited for different cost-effective RAID application, especially the rapidly growing demand from the Mac video editing markets.

Unsurpassed Data Availability

ARC-8050U3-6 supports the hardware RAID 6 engine to allow two HDDs failures without impact the existing data and performance. It allows users to hot swap drive in the event of a drive failure with zero downtime. Its high data availability and protection derives from the many advanced RAID features. ARC-8050U3-6 RAID storage allows easy scalability from JBOD to RAID. It can be configured to RAID levels 0, 1, 10, 1E, 3, 5, 6, Single Disk or JBOD. The RAID storage is the most cost-effective SAS/SATA disk drive RAID controller with completely integrated high-performance and data-protection capabilities for USB 3.1 users. ARC-8050U3-6 also supports a battery backup option that protects all data in cache memory in the event of unexpected power outage. Board-level hardware encryption manages any kinds of drives attached to ARC-8050U3-6 without impacting the performance for higher levels of security.

Easy RAID Management

Configuration and monitoring can be managed either through the LCD control panel or LAN port. The intelligent cooling continuously adapts to environmental conditions by automatically controlling the speed of the cooling fans for the rapidly growing demand from the video editing markets. You can even configure ARC-8050U3-6 to intelligently spin down drives during periods of inactivity to further reduce noise and save energy. ARC-8050U3-6 also provides API source code for users to incorporate the McRAID manager function into their manager utility. The "HDD Xfer Speed" is a firmware-level hard disk / SSD speed function that is used to measure the drive's read performance. If the read-only palimpsest benchmark drops below the normal curve, something may be wrong with this disk.

SPECIFICATION

1.2 Features

Controller Architecture

- 1.2Ghz dual core 12G SAS Raid-on-Chip (ROC) processor
- 2GB on-board DDR3-1866 SDRAM with ECC protection
- Write-through or write-back cache support
- Support 6 internal 12Gb/s SAS ports
- Support read/write cache allocation by policy
- Redundant flash image for controller availability
- RAID level 0, 1, 10(1E), 3, 5, 6, Single Disk or JBOD
- Multiple RAID selection
- Support up to 1MB stripe size
- Online array roaming
- Online RAID level/stripe size migration
- Instant availability and background initialization
- Support for native 4K and 512 byte sector SAS/SATA devices
- Support HDD firmware update
- Multiple pairs SSD/HDD disk clone function
- SSD automatic monitor clone (AMC) support
- Support global and dedicated hot spare
- Automatic drive insertion/removal detection and rebuilding
- Advanced configuration for smooth data streaming
- Firmware-level "Hdd Xfer Speed" to measure the HDD's read performance
- Battery Backup Module ready (optional)
- SED (self-encrypting drives) function support
- Controller-level hardware encryption support

RAID Management

- Push Buttons and LCD Display Panel for RAID configuration
- Firmware-embedded Browser-based RAID manager, SMTP manager, SNMP agent and Telnet function via LAN port
- Support RAID box's API library for customer to write its own AP

SPECIFICATION

Product Features

Form Factor	Compact - 6 Bays
Host Interface	1 * USB 3.1 Gen 2: Up to 10.0Gbps - Supports UASP (USB Attached SCSI Protocol) - Backwards compatible with USB 3.0/2.0
Host Burst Transfer Rates	RAID 0 : Up to 1046MB/s (read); Up to 1055MB/s (write) RAID 5 : Up to 1046MB/s (read); Up to 936MB/s (write)
Disk Interface	SAS 3.0 Compatible: Up to 12.0Gbps
System Requirements	Computer with a USB-C or Thunderbolt™ 3 port
Expansion Support	One SFF-8644 (2-lanes) Connector
Enclosure Management	LAN Port, and LCD
Cooling Fan	1 * 2700rpm/0.135A Brushless Fan
Operating Temperature	0 ~ 50°C
Operation Humidity	5% ~ 95 %, Non-condensing
Power Supply/In/out	180W / 100-240V AC
Dimension (W x H x D)	4.84 x 8.45 x 9.11 in (146 x 255 x 290 mm)
Weight (W/O Drives)	13.2 lbs / 6.0Kg

INSTALLATION

2. Installation

This section describes how to install the ARC-8050U3-6 USB 3.1 to 12Gb/s SAS RAID storage with host computer and disks.

2.1 Before You First Installing

Thanks for purchasing the ARC-8050U3-6 as your RAID data storage. The following manual gives simple step-by-step instructions for installing and configuring the ARC-8050U3-6 RAID storage.

Unpack

Unpack and install the hardware in a static-free environment. ARC-8050U3-6 RAID storage is packed inside an anti-static bag between two sponge sheets. Remove it and inspect it for damage. If the ARC-8050U3-6 RAID storage appears damaged, or if any items of the contents listed below are missing or damaged, please contact your dealer or distributor immediately.

Checklist

- 1 x ARC-8050U3-6 6-bays RAID storage unit
- 1 x 10Gbps USB Type-C Cable (1 meter) cable
- 1 x RJ-45 LAN cable
- 1 x Power cord
- 24 x Drive mounting screws (4 per drive tray)
- 1 x Quick installation guide

System Requirements

- Computer with a USB-C or Thunderbolt 3 port (Requires USB-C cable)

Thunderbolt 3: Transfer rates up to 10Gb/s

SuperSpeed USB 3.1 Gen 2: Transfer rates up to 10Gb/s

SuperSpeed USB 3.1 Gen 1: Transfer rates up to 5Gb/s

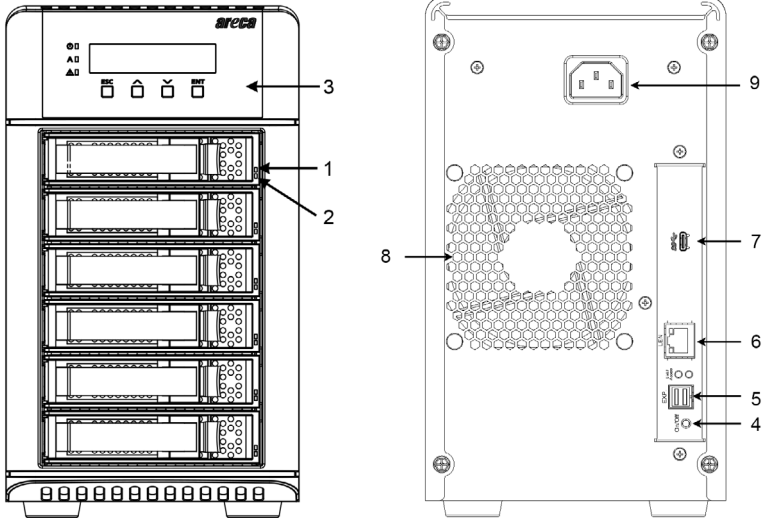
SuperSpeed USB 3.0: Transfer rates up to 5Gb/s

Hi-Speed USB 2.0: Transfer rates up to 480 Mb/s

INSTALLATION

2.2 RAID Storage View

The following diagram is the RAID storage front view and rear view.



Front View	Rear View
1. Disk Activity LED 2. Disk Fault / Link LED 3. LCD Panel with Keypad	4. Reset Button 5. SAS expansion Port 6. LAN Port (For McRAID Web Manager) 7. USB 3.1 Port 8. System Fan 9. Power Connector

INSTALLATION

2.3 Locations of the Storage Component

The following components come with LEDs that inform ARC-8050U3-6 RAID storage managers about the operational status.

2.3.1 Drive Tray LED Indicators

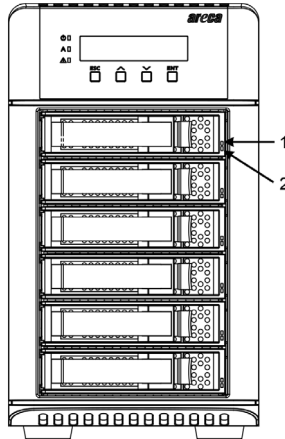


Figure 2-1, Activity/Fault LED

The following table describes the RAID storage disk drive tray LED behavior.

Tray LED	Normal Status	Problem Indication
1. Activity LED (Blue)	<ol style="list-style-type: none"> 1. When the activity LED is lit, there is I/O activity on that disk drive. 2. When the LED is not lit; there is no activity on that disk drive. 	N/A
2. Fault/Link LED (Red/Green)	<ol style="list-style-type: none"> 1. When the fault LED is lit, there is no disk present. 2. When the link LED is lit, there is a disk present. 	<ol style="list-style-type: none"> 1. When the fault LED is off, the disk is present and status is normal. 2. When the fault LED is blinking (2 times/sec.), the disk drive has failed and should be hot-swapped immediately. 3. When the activity LED is lit and fault LED is fast blinking (10 times/sec.) there is re-building activity on that disk drive.

2.3.2 LCD Panel LED Indicators

There are a variety of status conditions that cause the RAID storage panel monitoring LED to light. The front panel LCD comes with three (3) status-indicating LEDs. The LEDs on the front panel are defined, from top to bottom, Power, Busy, and Caution, as shown in Figure 2-2.

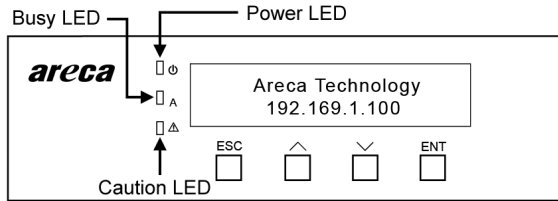


Figure 2-2, LCD Panel LED

The following table provides a summary of the front panel LED.

Panel LED	Normal Status	Problem Indication
1. Power LED (Green)	Solid green, when power on.	Unlit, when power on.
2. Busy LED (Amber)	Blinking amber during host accesses RAID storage.	Unlit or never flicker.
3. Caution LED (Red)	Unlit indicates that the RAID storage and all its components are operating correctly.	Solid indicates that one or more component failure/Urgent events have occurred.

INSTALLATION

2.4 Setting Up RAID Storage

Setting up your ARC-8050U3-6 RAID storage involves these main steps:

- Physically Install the RAID Storage and Drives
- Configure RAID Volumes

Details about these steps are described in the following sections.

2.4.1 Physically Install RAID Storage and Drives

Please follow the steps below in order they are given to ensure that your ARC-8050U3-6 connected on your computer.

Step 1. Install the Drives in the ARC-8050U3-6 RAID Storage

Your RAID storage supports up to 6 x 3.5-inch disk drives or 6 x 2.5-inch SAS or SATA 6.0Gb/s drives, each one contained in its individual hole on the disk carrier. Each drive is hot-pluggable, allowing you to remove and insert drives without shutting down your RAID storage. Installation in this section describes how to install or remove 3.5 inch drives in your RAID storage.

1. Gently slide the drive tray out from the ARC-8050U3-6 RAID storage.
2. Install the drive into the drive tray and secure the drive to the drive tray by four of the mounting screws.



Figure 2-3-1. Installing 2.5-inch SAS/SATA Drive

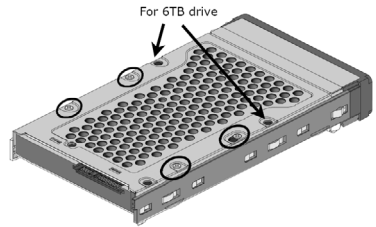


Figure 2-3-2. Installing 3.5-inch SAS/SATA Drive

INSTALLATION

3. After all drives are in the drive tray, slide all of them back into the ARC-8050U3-6 RAID storage and make sure you latch the drive trays.

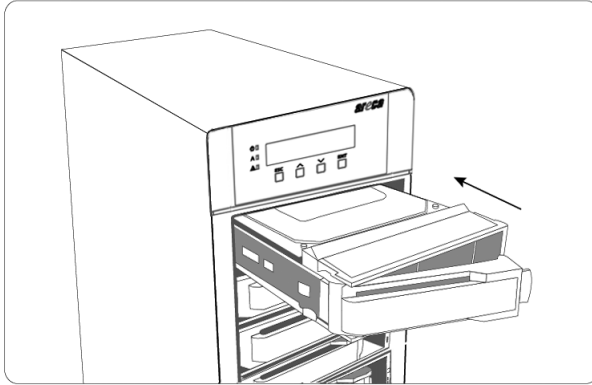


Figure 2-4, Sliding Drive Tray into Enclosure

INSTALLATION

Step 2. Connecting RAID Storage to USB 3.1 Type-C Port

By installing USB 3.1 Type-C technology capable computer and ARC-8050U3-6 USB 3.1 Gen 2 Type-C port using the Type-C cable which is included in your USB 3.1 capable computer. Then connect ARC-8050U3-6 RAID storage and USB 3.1 Type-C technology capable computer port as shown below:

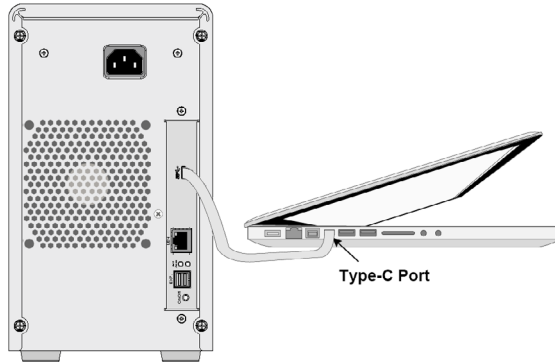


Figure 2-6, Connecting USB 3.1 Port to Host Computer

Note:

The ARC-8050U3-6 is fully compatible with Thunderbolt 3 and backwards compatible with USB 2.0, USB 3.0 and USB 3.1 Gen 1 (5Gbps).

Step 3. Connecting Monitor Port

You can connect LAN port to the manager clinet system, if you want to configure and manage the RAID storage from the clinet system through out-of-band manager.

• LAN Port Connection

User can remote manage the RAID enclosure without adding any user specific software (platform independent) via standard web browsers directly connected to the 1000Mbit RJ45 LAN

port. Connect LAN port of the ARC-8050U3-6 using the included Ethernet cable and then to a LAN port or LAN switch.

Step 4. Connecting RAID Storage Power

To power the RAID storage:

1. Using the included power cord, connect this power cord to a grounded electrical outlet and to the ARC-8050U3-6 RAID storage.
2. ARC-8050U3-6 RAID storage will automatically turn on when host computer power on status is received from the USB-C cable. It takes about 30 seconds to fully start up the RAID storage.

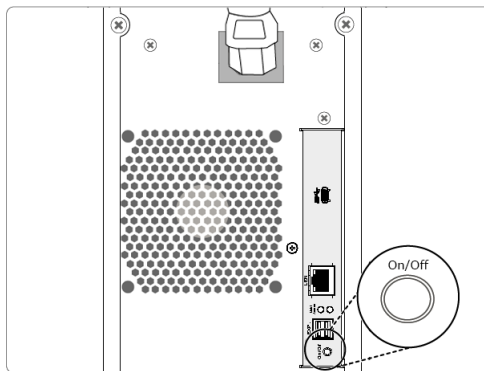


Figure 2-7, Connecting the Power to Enclosure.

3. ARC-8050U3-6 RAID storage automatically turns off when the computer to which it is attached sleeps or is disconnected.

When you are finished installing the ARC-8050U3-6 RAID storage, you can set up the RAID volume using McRAID storage manager or LCD to set up RAID volumes.

Note:

You can press and hold the "Reset" button for 3 seconds to force the RAID storage power on or off.

INSTALLATION

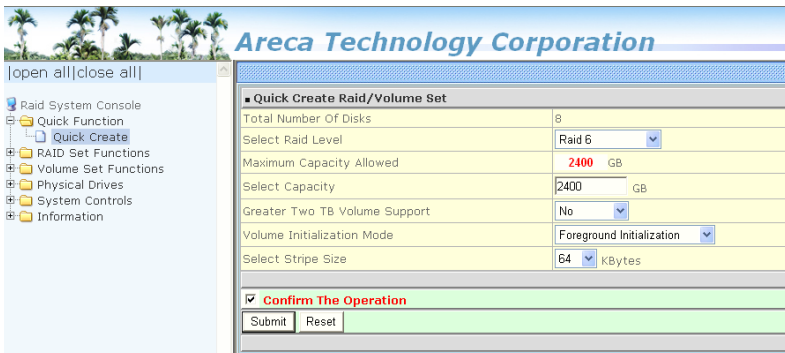
2.4.2 Configure RAID Volumes

There are often multiple ways to accomplish the same configuration and maintenance tasks for your RAID storage. Your ARC-8050U3-6 RAID storage can be configured by one of the following methods:

1. McRAID Storage Manager Through LAN port.
2. LCD Panel with Keypad.

- Method 1: McRAID Storage Manager Through LAN Port

User can remote manage the RAID storage directly connected to the 1000Mbps RJ45 LAN port via standard web browsers. To configure ARC-8050U3-6 RAID storage using a LAN port, you need to know its IP address. The default IP address will be shown on the LCD initial screen. Launch your web browser-based McRAID storage manager by entering `http://[IP Address]` in the web browser. Enter RAID storage default User Name "admin" and the Password "0000" when the login page prompted for it. After logging in, the McRAID storage manager process starts. Follow the on-screen steps, responding as needed, to configure RAID volume.

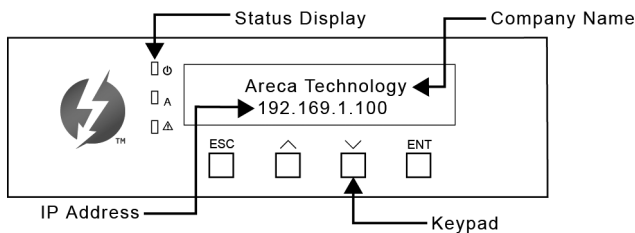


Click on the "Quick Create" in the main menu, your volume is automatically configured based on the number of disks in your system. You can create a RAID set associated with exactly one volume set. The user can change the Raid Level, Capacity, Initialization Mode, and Stripe Size. A hot spare option is also

created, depending on the exist configuration. Tick on the "Confirm The Operation" check box and click on the "Submit" button, the RAID set and volume set will start to initialize. If you prefer to customize your volume set, please use the "Raid Set Functions" and "Volume Set Functions". See chapter 4 of ARC-8050U3-6 user manual for information on customizing your RAID volumes using McRAID storage manager.

- Method 2: 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. The LCD configuration is described in a separate manual: LCD manual. It is available on your Areca CD, in the /docs folder. 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. ARC-8050U3-6 RAID storage default User Name is "**admin**" and the Password is "**0000**".

The LCD initial screen is shown below:



2.4.3 Format, Partition and Mount the RAID Storage Volume

After the volume set is ready for system accesses, it needs to be partitioned, formatted, and mounted by the operating system. There are various steps, that depend on what operating system you are using (Mac, Windows, Linux or FreeBSD, etc.). Detailed steps for each operating system are provided on their disk utility. After that, the ARC-8050U3-6 RAID storage can be fully used.

LCD CONFIGURATION MENU

3. LCD Configuration Menu

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

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

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

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

Function Key Definitions

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

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

3.1 Starting LCD Configuration Utility

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

LCD CONFIGURATION MENU

3.2 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 3.7.2. The configuration utility main menu options are:

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

3.3 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

3.4 Designating Drives as Hot Spares

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

3.5 Using Easy RAID Configuration

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

The volume set default settings will be:

Parameter	Setting
Volume Name	Volume Set # 00
SCSI Channel/SCSI ID/SCSI LUN	0/0/0
Cache Mode	Write-Back
Tag Queuing	Yes

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

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

LCD CONFIGURATION MENU

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

LCD CONFIGURATION MENU

3.6 Using Raid Set and Volume Set Functions

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

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

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

LCD CONFIGURATION MENU

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

3.7 Navigation Map of the LCD

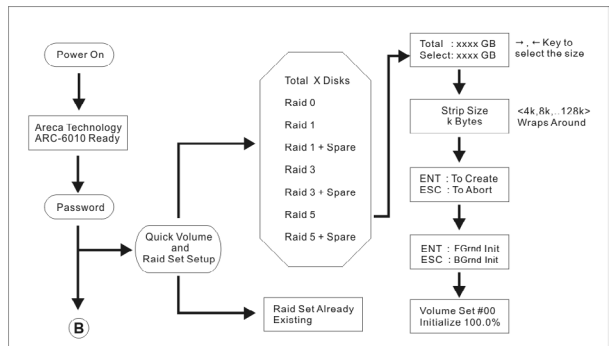
The password option allows user to set or clear the RAID subsystem's password protection feature. Once the password has been set, the user can only monitor and configure the RAID subsystem by providing the correct password. The password is used to protect the RAID subsystem from unauthorized entry. The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

LCD CONFIGURATION MENU

3.7.1 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 3.7.1-1



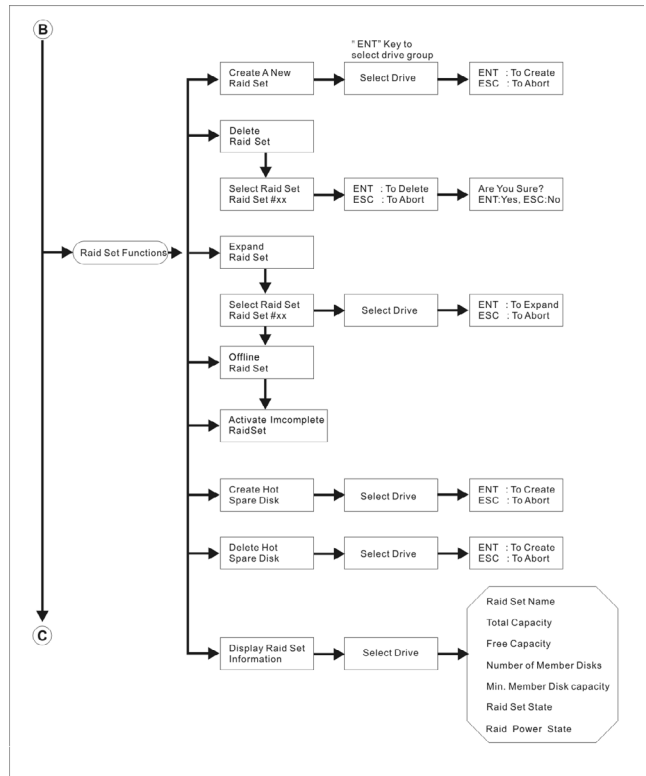
1. All of the physical disk drives are contained in a RAID set.
2. The RAID levels associated with hot spare, capacity, and stripe size are selected during the configuration process.
3. A single volume set is created and consumed all or a portion of the disk capacity available in this RAID set.
4. If you need to add additional volume set, using main menu “Volume Set functions”. Detailed procedure refer to this chapter section 3.7.3.

3.7.2 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 3.7.2-1



3.7.2.1 Create A New Raid Set

For detailed procedure please refer to chapter section 3.6.

3.7.2.2 Delete Raid Set

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

LCD CONFIGURATION MENU

3.7.2.3 Expand Raid Set

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

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

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

Note:

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

3.7.2.4 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

3.7.2.5 Activate Incomplete RaidSet

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

3.7.2.6 Create Hot Spare Disk

Please refer to this chapter section 3.4. Designating drives as hot spares.

3.7.2.7 Delete Hot Spare Disk

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

3.7.2.8 Display Raid Set Information

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

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

LCD CONFIGURATION MENU

3.7.3 Volume Set Functions

A volume set is seen by the host system as a single logical device. It is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set capacity can consume all or a portion of the disk capacity available in a RAID set. Multiple volume sets can exist on a group of disks in a RAID set. Additional volume sets created in a specified RAID set will reside on all the physical disks in the RAID set. Thus each volume set on the RAID set will have its data spread evenly across all the disks in the RAID set.

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

3.7.3.1 Create Raid Volume Set

To create a volume set, please refer to this chapter section 3.7, using "Raid Set Functions" and "Volume Set Functions". The volume set attributes screen shows the volume set default configuration values that have currently being configured.

The attributes for RAID subsystem series are Volume Name, Raid Level, Stripe Size, Cache Mode, SCSI Channel/SCSI ID/SCSI LUN, Write Protect, Tagged Queuing and Initialization Mode, see Figure 4.7.3.1-1.

All values can be changed by user. Press the **UP/DOWN** buttons to select attribute. Press **ENT** to modify the default value. Using the **UP/DOWN** buttons to select attribute value and press **ENT** to accept the default value. The following is the attributes descriptions. Please refer to this chapter section 3.7 using "Raid Set Function" and "Volume Set Functions" to complete the create volume set function.

LCD CONFIGURATION MENU

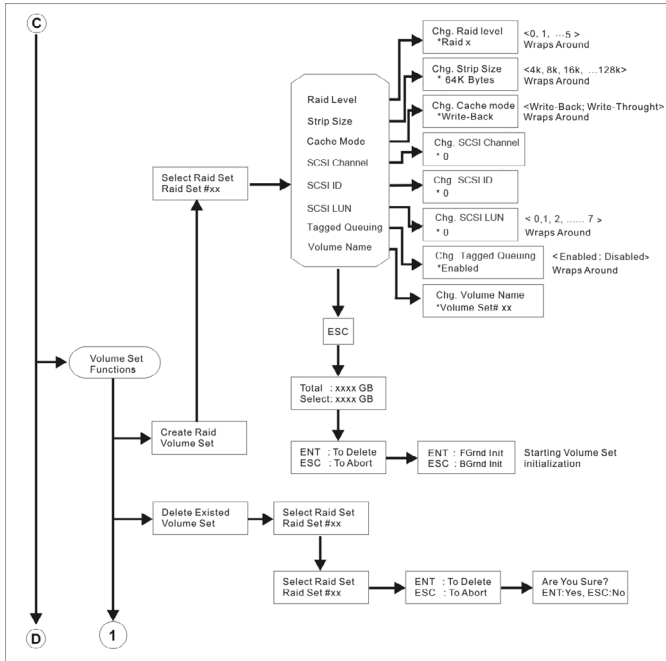


Figure 3.7.3.1-1

3.7.3.1.1 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.

3.7.3.1.2 Raid Level

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

3.7.3.1.3 Stripe Size

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

LCD CONFIGURATION MENU

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

3.7.3.1.4 Cache Mode

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

3.7.3.1.5 SCSI Channel/SCSI ID/SCSI LUN

SCSI Channel - The ARC-8050U3-6 RAID storage function is simulated as an external SAS RAID controller. The host bus is represented as a SCSI channel. The ARC-8050U3-6 SCSI Channel is always assigned as "0".

SCSI ID - Each SCSI device attached to the SCSI card, as well as the card itself, must be assigned a unique SCSI ID number. A SCSI channel can connect up to 15 devices. The ARC-8050U3-6 RAID storage is a large SAS device. The ARC-8050U3-6 SCSI ID is always assigned as "0".

Each SCSI LUN can support up to 8 LUNs. Most SAS host adapter treats each LUN like a SAS disk. The currently version ARC-8050U3-6 firmware only supports one volume and assigned as SCSI Channel/SCSI LUN/SCSI ID=0/0/0.

3.7.3.1.6 Tagged Queuing

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

LCD CONFIGURATION MENU

3.7.3.1.7 Initialization Mode

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

3.7.3.2 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.

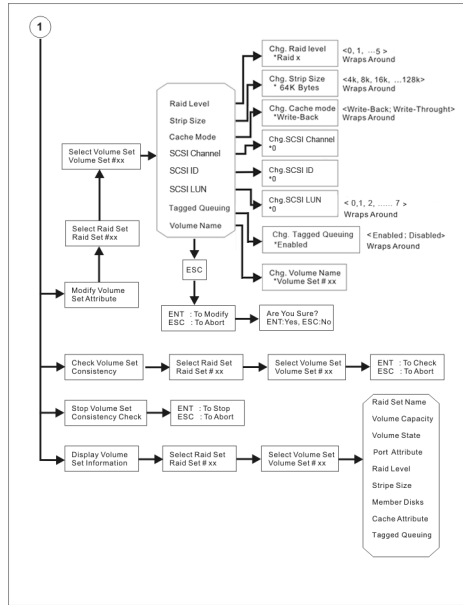
3.7.3.3 Modify Volume Set Attribute

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, SCSI Channel/SCSI ID/SCSI 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 3.7.3.3-1



3.7.3.3.1 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.

3.7.3.4 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

3.7.3.5 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.

3.7.3.6 Display Volume Set Information

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

3.7.4 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 3.7.4-1

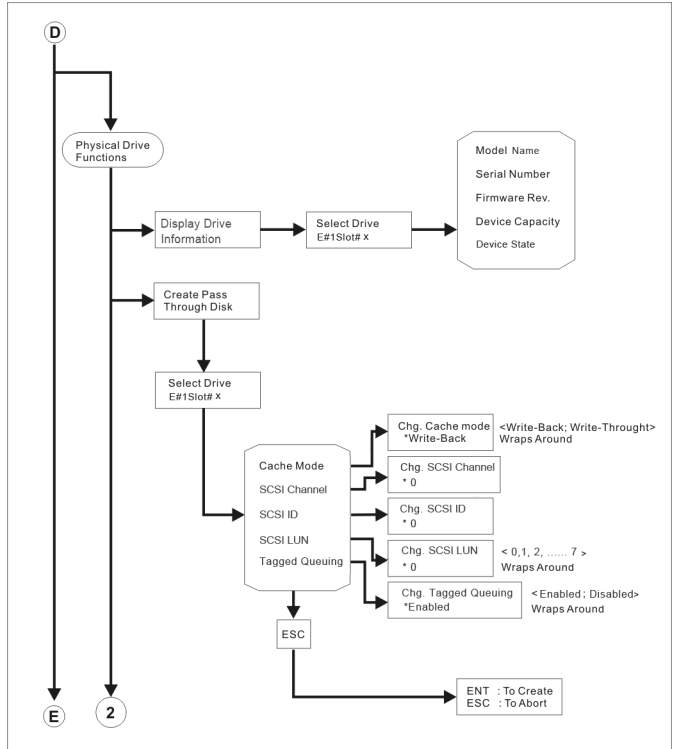
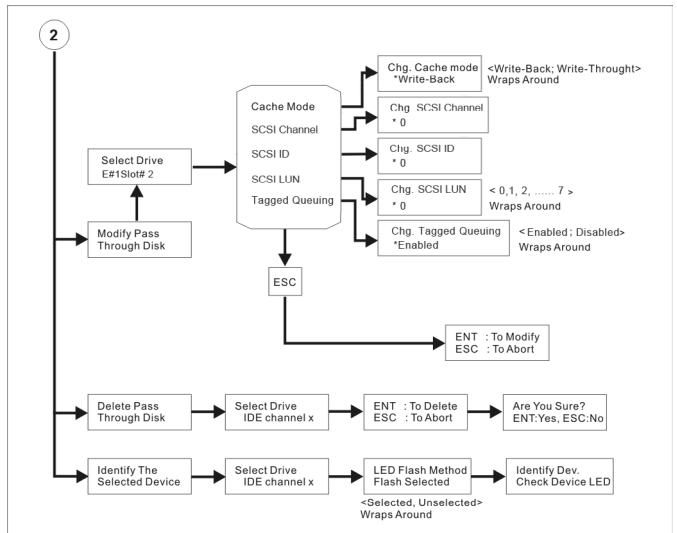


Figure 3.7.4-2



LCD CONFIGURATION MENU

3.7.4.1 Display Drive Information

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

3.7.4.2 Create Pass Through Disk

Disk is no controlled by the RAID subsystem's firmware and thus cannot be a part of a RAID set. The disk is available to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID subsystem's firmware. Using **UP/DOWN** buttons to choose the "Create Pass Through Disk" option and press **ENT**. Using **UP/DOWN** buttons to select the drive SAS/SATA number that user want to create. The drive attributes will be displayed.

The attributes for pass-through disk show the Volume Cache Mode, SCSI Channel/SCSI ID/SCSI 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.

3.7.4.3 Modify Pass-Through Disk

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

LCD CONFIGURATION MENU

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

3.7.4.4 Delete Pass-Through Disk

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

3.7.4.5 Identify The Selected Drive

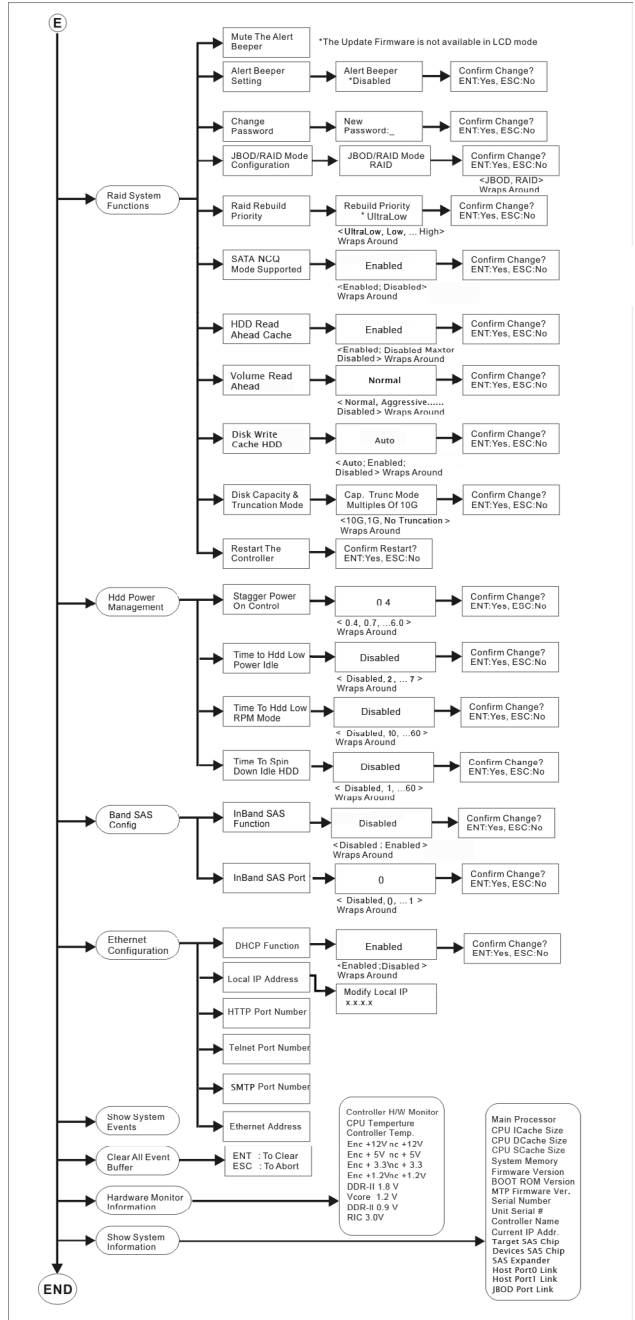
To prevent removing the wrong drive, the selected disk Fault LED indicator will light for physically locating the selected disk when the "Identify The Selected Drive" function is selected. To identify selected drive from the physical drive pool, press **UP/DOWN** buttons to choose the "Identify The Selected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

3.7.5 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 3.7.5-1



LCD CONFIGURATION MENU

3.7.5.1 Mute The Alert Beeper

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

3.7.5.2 Alert Beeper Setting

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

3.7.5.3 Change Password

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

3.7.5.4 JBOD/RAID Mode Configuration

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

LCD CONFIGURATION MENU

3.7.5.5 Raid Rebuild Priority

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

3.7.5.6 SATA NCQ Mode Support

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

3.7.5.7 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.

3.7.5.8 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.

3.7.5.9 Disk Write Cache Mode

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

3.7.5.10 Disk Capacity Truncation Mode

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

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

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

Disabled: It does not truncate the capacity.

3.7.5.11 Shutdown The Controller

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

LCD CONFIGURATION MENU

3.7.5.12 Restart Controller

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

Note:

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

3.7.6 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.

3.7.6.1 Stagger Power On Control

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

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

LCD CONFIGURATION MENU

3.7.6.2 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.

3.7.6.3 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.

3.7.6.4 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.

3.7.7 Ethernet Configuration

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

3.7.7.1 DHCP

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

LCD CONFIGURATION MENU

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

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

3.7.7.2 Local IP Adress

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

3.7.7.3 HTTP Port Number

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

3.7.7.4 Telnet Port Number

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

LCD CONFIGURATION MENU

can then reassign the default "Telnet Port Number" of RAID subsystem.

3.7.7.5 SMTP Port Number

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

3.7.7.6 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.

3.7.8 Show System Events

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

3.7.9 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.

3.7.10 Hardware Monitor Information

To view the RAID subsystem monitor information, press **ENT** to enter the main menu. Press **UP/DOWN** buttons to select the "Hardware Information" option, and then press **ENT**. All hard-

LCD CONFIGURATION MENU

ware monitor information will be displayed. Press **UP/DOWN** buttons to browse all the hardware information. The hardware information provides the CPU temperature, Controller temperature, fan speed (chassis fan), battery status and voltage of the RAID subsystem. All items are also unchangeable. The warning messages will indicate through the LCD, LED and alarm buzzer.

3.7.11 System Information

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

WEB BROWSER-BASED CONFIGURATION

4. Web Browser-based Configuration

If you need to use a RAID volume from ARC-8050U3-6 RAID storage unit, you must first create a RAID volume by using LCD or McRAID storage manager. This chapter shows you how to set up RAID volumes using the McRAID storage manager application on a computer with an ARC-8050U3-6 RAID storage.

The McRAID storage manager is firmware-based utility, which is accessible via the web browser installed on your operating system. The web browser-based McRAID storage manager is a HTML-based application, which utilizes the browser (Safari, IE and Mozilla etc) installed on your monitor station. It can be accessed through the out-of-band onboard LAN port.

The firmware-embedded web browser-based McRAID storage manager allows local or remote to access it from any standard internet browser. The firmware-embedded SMTP manager monitors all system events and user can select either single or multiple user notifications to be sent with "Plain English" e-mails. The firmware-embedded SNMP agent allows remote to monitor events with no SNMP agent required. Use the McRAID storage manager 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
- Designate drives as hot spares

4.1 Start-up McRAID Storage Manager

With McRAID Storage Manager, you can remotely managed systems by TCP/IP connection.

WEB BROWSER-BASED CONFIGURATION

● McRAID Storage Manager Through LAN Port (Out-of-Band)

ARC-8050U3-6 RAID storage also offers an alternative out-of-band method for McRAID storage manager. User can access the built-in configuration without running the ArcHTTP proxy server on the host system. The web browser-based McRAID storage manager is a HTML-based application, which utilizes the browser installed on your remote system. To ensure proper communications between the RAID storage and McRAID storage manager, please connect the RAID storage LAN port to any LAN switch port.

The RAID storage has embedded the TCP/IP & web browser-based McRAID storage manager in the firmware. User can remote manage the SAS RAID storage without adding any user specific software (platform independent) via standard web browsers directly connected to the 1000Mbit RJ45 LAN port.

To configure RAID storage on a remote machine, you need to know its IP address. The IP address is default shown on the LCD initial start-up screen. Launch your McRAID storage manager by entering `http://[IP Address]` in the web browser.

4.2 McRAID Main Window

The following login screen is displayed in the browser. This screen displays the initial start-up configuration.

The screenshot displays the web browser-based McRAID storage manager interface for Areca Technology Corporation. The interface includes a navigation menu on the left and a main content area with two tables.

RaidSet Hierarchy

RAID Set	Devices	Volume Set(CH/D/Lun)	Volume State
raid set # 000	l#1301F2	ARC-8050U3-6000000000	Normal
	l#1301F4	ARC-0000-1016R01000001	Normal
	l#1301F5		
	l#1301F6		
	l#1301F7		
	l#1301F8		

Enclosure#1 : ARECA SAS RAID Adapter#1.0

Device	Usage	Capacity	Model
Slot#1	U.S.A.	U.S.A.	U.S.A.
Slot#2	Raid Set # 000	600.1GB	SEAGATE ST360005750
Slot#3	U.S.A.	U.S.A.	U.S.A.
Slot#4	Raid Set # 000	600.1GB	SEAGATE ST360005750
Slot#5	Raid Set # 000	600.1GB	SEAGATE ST360005750

The RaidSet Hierarchy 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 "RAID Set Hierarchy" on the main menu screen.

WEB BROWSER-BASED CONFIGURATION

- To display RAID set information, move the mouse cursor to the desired RAID set number, then click on it. The RAID set information will be displayed.
- To display volume set information, move the mouse cursor to the desired volume set number, then click it. The volume set information will be displayed.
- To display drive information, move the mouse cursor to the desired physical drive number, then click it. The drive information will be displayed.

4.3 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.

4.4 Quick Function

The Quick Create option configures the arrays with just a few steps. Although drives of different sizes may be used in the array, Quick Create will only operate upon drives of the same physical size.

The number of physical drives in the RAID storage 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

WEB BROWSER-BASED CONFIGURATION

can change the RAID Level, Capacity, Initialization Mode, and Stripe Size. A hot spare option is also created, depending on the exist configuration. Tick on 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.

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", "Physical Drives", "System Controls", and "Information". The main content area is titled "Quick Create Raid/Volume Set" and contains the following configuration fields:

Quick Create Raid/Volume Set	
Total Number Of Disks	8
Select Raid Level	Raid 6
Maximum Capacity Allowed	2400 GB
Select Capacity	2400 GB
Greater Two Tb Volume Support	No
Volume Initialization Mode	Foreground Initialization
Select Stripe Size	64 KBytes
<input checked="" type="checkbox"/> Confirm The Operation	
<input type="button" value="Submit"/> <input type="button" value="Reset"/>	

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.

4.5 Raid Set Functions

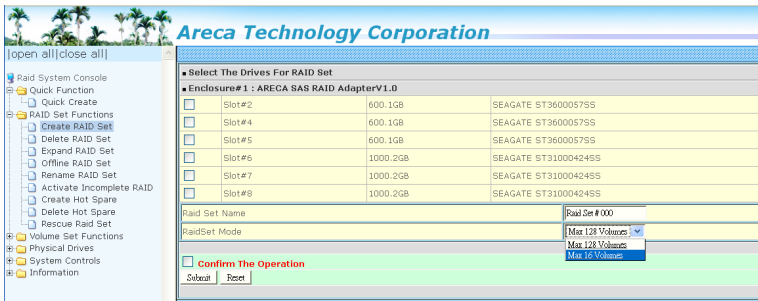
Use the "Raid Set Function" and "Volume Set Function" if you prefer to customize your volume set. Manual configuration can provide full control of the RAID set settings, but it will take longer to complete than the "Quick Volume/Raid Setup" configuration. Select the "Raid Set Function" to manually configure 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.)

4.5.1 Create 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 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 RAID set. The default RAID set name will always appear as "Raid Set #".

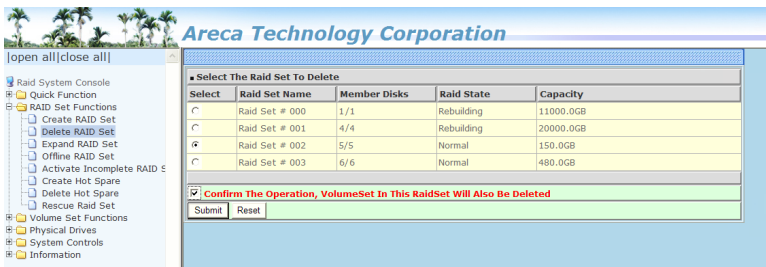
WEB BROWSER-BASED CONFIGURATION

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 SAS RAID storage. The “Max 16 volumes” mode is used for support roaming this raidset to Areca SATA RAID controllers. The SATA RAID controller is designed to support up to 16 volumes only. You have to use “Max 16 volumes” on the raidset mode if you plan to roam this raidset between SAS RAID controller and SATA RAID controller.



4.5.2 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, 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 RAID Set”. It will be deleted by this action.



WEB BROWSER-BASED CONFIGURATION

4.5.3 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 SAS/SATA Drives For Raid Set Expansion" screen appears.
2. Select the target RAID set by clicking on the appropriate radio button. Select the target disk by clicking on the appropriate check box.
3. Click on the "Submit" button 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.

Select	Raid Set Name	Member Disks	Raid State	Capacity
<input type="radio"/>	Raid Set # 000	1/1	Rebuilding	11000.0GB
<input type="radio"/>	Raid Set # 001	4/4	Rebuilding	20000.0GB
<input checked="" type="radio"/>	Raid Set # 002	5/5	Normal	150.0GB
<input type="radio"/>	Raid Set # 003	6/6	Normal	480.0GB

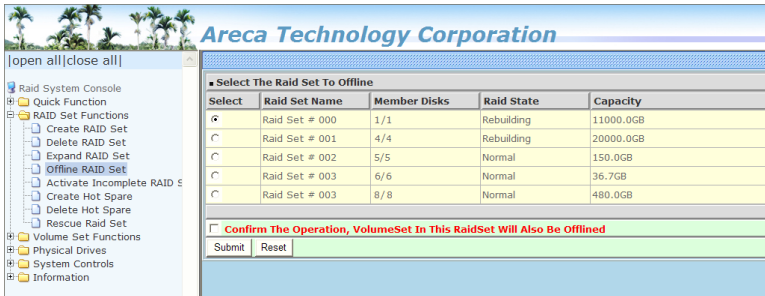
Note:

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 set expansion is a quite critical process, we strongly recommend customer backup data before expand. Unexpected accident may cause serious data corruption.

WEB BROWSER-BASED CONFIGURATION

4.5.4 Offline Raid Set

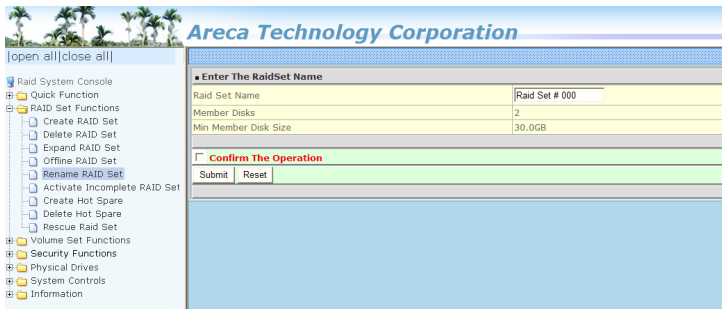
This function is for customer being able to unmount and remount a multi-disk volume. All Hdds of the selected RAID set will be put into offline state, spun down and fault LED in fast blinking mode. User can remove those Hdds and insert new Hdds on those empty slots without needing power down the controller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



4.5.5 Rename Raid Set

The default RAID set name will always appear as "Raid Set #" when it is first 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.



WEB BROWSER-BASED CONFIGURATION

4.5.6 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 storage, the user can use the "Activate Incomplete Raid Set" option to active the RAID set. After the user completes this function, the Raid State will change to "Degraded Mode" and start to work. To activate the incomplete the RAID set, click on the "Activate Raid Set" link. A "Select The Raid Set To Activate" screen is displayed showing all RAID sets existing on the current controller. Click the RAID set number to activate in the select column. Click on the "Submit" button on the screen to activate the RAID set that had a disk removed (or failed) in the power off state. The RAID storage will continue to work in degraded mode.

The screenshot shows the RAID System Console interface for Areca Technology Corporation. The left sidebar contains a tree view with the following items: Raid System Console, Quick Function, RAID Set Functions (expanded), Create RAID Set, Delete RAID Set, Expand RAID Set, Offline RAID Set, **Activate Incomplete RAID Set** (selected), Create Hot Spare, Delete Hot Spare, Rescue Raid Set, Volume Set Functions, Physical Drives, System Controls, and Information. The main content area is titled "Select The Raid Set To Activate" and contains a table with the following data:

Select	Raid Set Name	Member Disks	Raid State	Capacity
<input type="radio"/>	Raid Set # 000	1/1	Rebuilding	11000.0GB
<input type="radio"/>	Raid Set # 001	4/4	Rebuilding	20000.0GB
<input checked="" type="radio"/>	Raid Set # 002	5/5	Normal	150.0GB
<input type="radio"/>	Raid Set # 003	6/6	Normal	480.0GB

Below the table are "Submit" and "Reset" buttons.

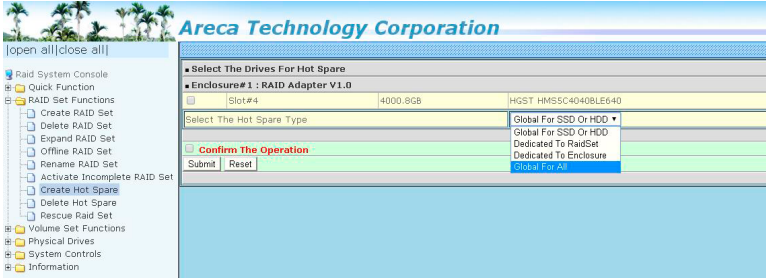
4.5.7 Create Hot Spare

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. Tick on the "Confirm The Operation" check box and click the "Submit" button in the screen to create the hot spares.

The "Create Hot Spare" gives you the ability to define a global or dedicated hot spare. Firmware default ("Global For SSD or HDD") only uses SSD to rebuild SSD array or HDD to rebuild HDD array. If you want rebuild a SSD array with a HDD, please configure the HDD as hotspare disk for both HDD and SSD ("Global For All") to activate the rebuilding of the new array. "Dedicated to RaidSet"

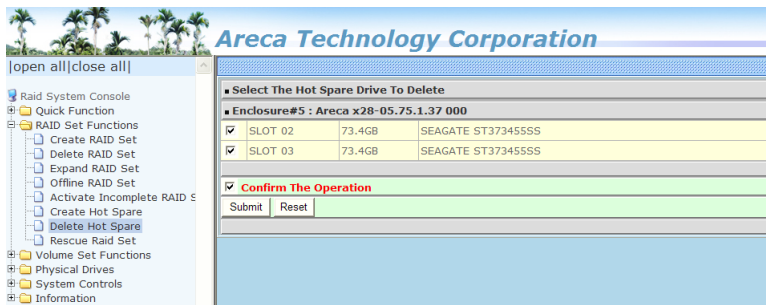
WEB BROWSER-BASED CONFIGURATION

and “Dedicated to Enclosure” can only be used with a specific RAID set or Enclosure. When a disk drive fails in the RAID set or enclosure with a dedicated hot spare is pre-set, data on the disk drive is rebuild automatically on the dedicated hot spare disk.



4.5.8 Delete Hot Spare

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



4.5.9 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 storage 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.

WEB BROWSER-BASED CONFIGURATION



Caution:

Please contact us to make sure if you need to use rescue function. Improperly usage may cause configuration corruption.

4.6 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 storage.

1. Volume sets of different RAID levels may coexist on the same RAID set and up to 128 volume sets per controller.
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.
4. The currently ARC-8050U3-6 firmware limitations: a single volume mounts on the host: 1 x volume (SCSI Ch/Id/Lun=0/0/0). You can swap others volumes SCSI Channel/SCSI ID/SCSI Lun with SCSI Ch/Id/Lun=0/0/0 if you need to use it.

WEB BROWSER-BASED CONFIGURATION

4.6.1 Create Volume Set

To create volume set from RAID set storage, move the cursor bar to the main menu and click on the "Create Volume Set" link. The "Select The Raid Set To Create On It" screen will show all RAID set number. Tick on a RAID set number that you want to create and then click on the "Submit" button.

The new create volume set attribute allows user to select the Volume Name, RAID Level, Capacity, Greater Two TB Volume Support, Initialization Mode, Strip Size, Cache Mode, Tagged Command Queuing, and SCSI Channel/SCSI ID/SCSI Lun.

The screenshot shows the "Enter The Volume Attribute" configuration page. The interface includes a navigation menu on the left with options like "Quick Function", "RAID set functions", "Volume Set Functions", "Physical Drives", "System Controls", and "Information". The main configuration area contains the following fields:

Field	Value
Volume Name	ARC-8050-VOL#12
Member Disks	2
Volume Raid Level	Raid 1
Max Capacity Allowed	300 GB
Select Volume Capacity	300 GB
Greater Two TB Volume Support	No
Volume Initialization Mode	No Initialization
Volume Stripe Size	64 KBytes
Volume Cache Mode	Write Back
Volume Write Protection	Disabled
Volume IO Mode	Cached IO
Tagged Command Queuing	Enabled
SCSI Channel:SCSI ID:SCSI Lun	0 : 0 : 2
Volumes To Be Created	1

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

- **Volume Name**

The default volume name will always appear as "ARC-8050U3-6-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 from the available levels option.

- **Capacity**

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

- **Greater Two TB Volume Support**

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".

WEB BROWSER-BASED 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 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.

-Use 4K Block

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

● **Initialization Mode**

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

● **Stripe Size**

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

WEB BROWSER-BASED CONFIGURATION

Note:

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

- **Cache Mode**

The RAID storage supports "Write Through" and "Write Back" cache.

- **Volume Write Protection**

When "Volume Write Protection" is enabled on the "Modify 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 SAS drives that do not support command tag queuing.

- **SCSI Channel/SCSI ID/SCSI Lun**

SCSI Channel: The RAID storage function is simulated as an external SCSI RAID controller. The host bus is represented as a SCSI channel. The ARC-8050U3-6 SCSI Channel is always assigned as "0".

SCSI ID: Each SCSI device attached to the SCSI card, as well as the card itself, must be assigned a unique SCSI ID number. A SCSI channel can connect up to 15 devices. The RAID storage is a large SCSI device. The ARC-8050U3-6 SCSI ID is always assigned as "0".

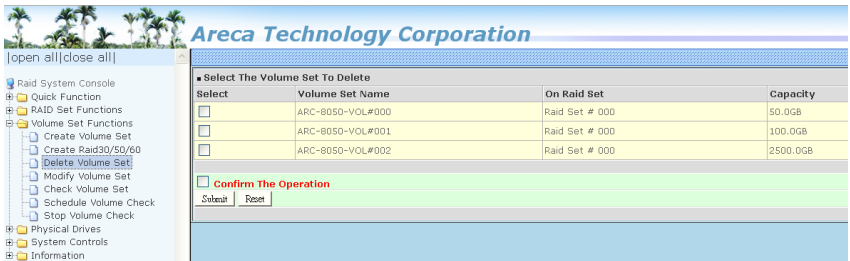
SCSI LUN: Each SCSI ID can support up to 8 LUNs. Most SAS controllers treat each LUN like a SAS disk.

The currently version firmware only supports one volume (SCSI /ID/LUN=0/0/0).

WEB BROWSER-BASED CONFIGURATION

4.6.2 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.



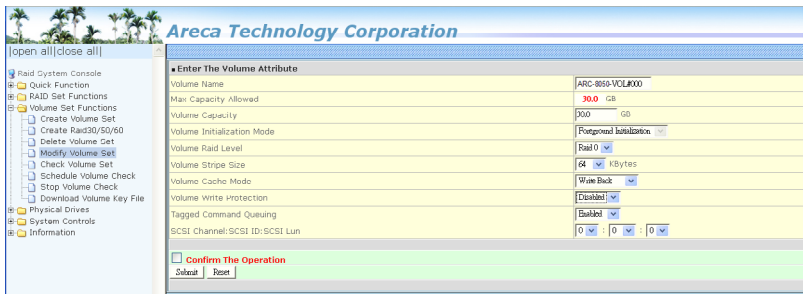
Click a volume set number and the "Confirm The Operation" check box and then click the "Submit" button to delete the volume set.

4.6.3 Modify Volume Set

To modify a volume set from a RAID set:

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

Click the "Submit" button. The following screen appears.



WEB BROWSER-BASED CONFIGURATION

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, tick on 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.

4.6.3.1 Volume Growth

Use "Expand Raid Set" function to add disk to a RAID set. The additional capacity can be used to enlarge the last volume set size or to create another volume set. The "Modify Volume Set" function can support the "Volume Modification" function. To expand the last volume set capacity, move the cursor bar to the "Capacity" item and entry the capacity size. When finished the above action, click on 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 expand volume capacity, you can't modify stripe size or modify RAID level simultaneously.
- You can expand volume capacity, but can't reduce 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, except your OS and controller can support boot up from a greater 2TB capacity device.
- Expand over 2TB used LBA64 mode. Please make sure your OS supports LBA64 before expand it.

4.6.3.2 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 "RAID Set Hierachy" screen.

WEB BROWSER-BASED CONFIGURATION

The screenshot shows the Areca Technology Corporation web browser-based configuration interface. The interface is divided into a navigation menu on the left and a main content area. The navigation menu includes options such as 'RAID Set Functions', 'Volume Set Functions', 'Physical Drives', 'System Controls', 'Information', 'RAID Set Hierarchy', 'Set One Information', 'System Information', and 'Hardware Monitor'. The main content area displays a table of RAID sets and a detailed view of a RAID adapter.

RAID Set	Devices	Volume Set (Cb/Id/Unit)	Volume State	Capacity
RAID Set # 000	E:1500#1 E:1500#2 E:1500#3 E:1500#4 E:1500#5 E:1500#6 E:1500#7 E:1500#8	ARC_RAID_VOL_#00000000	Migrating (31.9%)	100.0GB

Device	Usage	Capacity	Model
Slot#0(C)	Raid Set # 000	400.0GB	HTACHI HUSML400US600
Slot#1(D)	Raid Set # 000	400.0GB	HTACHI HUSML400AUS600
Slot#2(E)	Raid Set # 000	400.0GB	HTACHI HUSML400AUS600
Slot#3(F)	Raid Set # 000	400.0GB	HTACHI HUSML6000AUS600
Slot#4(G)	Raid Set # 000	36.7GB	HTACHI HUS11430VLS200
Slot#5(H)	Raid Set # 000	300.0GB	SEAGATE ST330005L750
Slot#6(I)	Raid Set # 000	73.4GB	SEAGATE ST973444SS
Slot#7(J)	Raid Set # 000	56.7GB	HTACHI HUS11430VLS300

Note:

Power failure may damage the migration data. Please backup the RAID data before you start the migration function.

4.6.3.3 Volume Write Protection

When "Volume Write Protection" is enabled on the "Modify 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.

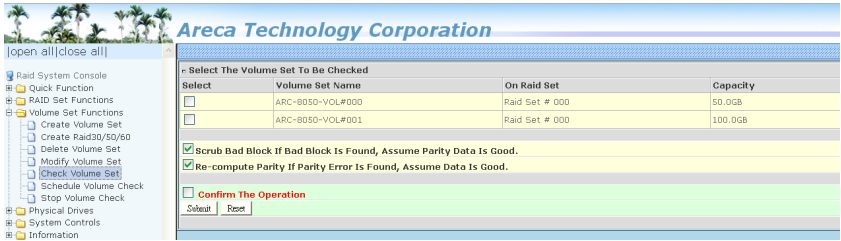
4.6.4 Check Volume Set

To check a volume set from a RAID set:

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

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

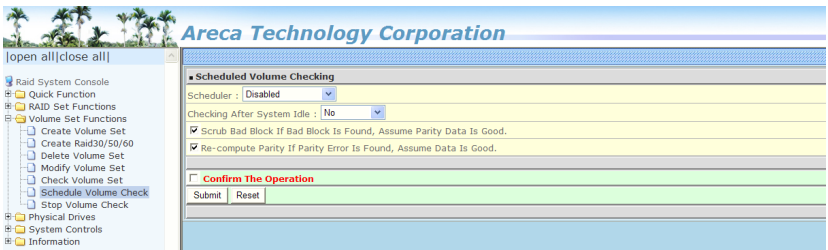
WEB BROWSER-BASED CONFIGURATION



4.6.5 Schedule Volume Check

A volume check is a process that verifies the integrity of redundant data. To verify RAID 3, 5 or 6 redundancy, a volume check reads all associated data blocks, computes parity, reads parity, and verifies that the computed parity matches the read parity.

Volume checks are very important because they detect and correct parity errors or bad disk blocks in the drive. A consistency check forces every block on a volume to be read, and any bad blocks are marked; those blocks are not used again. This is critical and important because a bad disk block can prevent a disk rebuild from completing. We strongly recommend that you run consistency checks on a regular basis—at least once per week (set on “Scheduler”). Volume checks degrade performance, so you can also run them when the system is idle (set on “Checking After System Idle”).



Note:

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

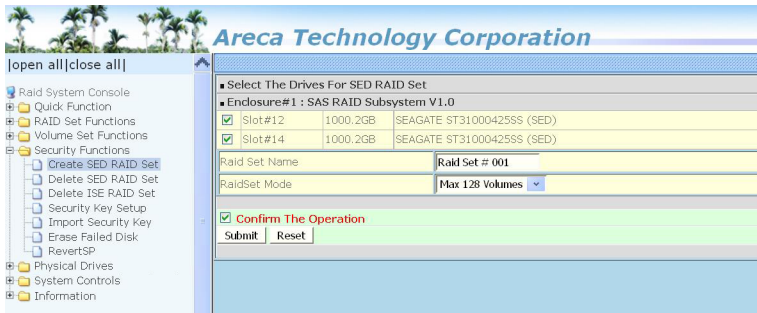
4.6.6 Stop Volume Set Check

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

4.7 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.

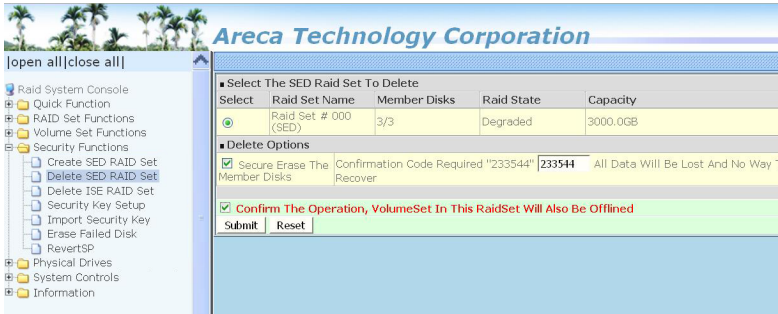
4.7.1 Create SED RAID Set



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

4.7.2 Delete SED RAID Set



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

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

4.7.3 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.

4.7.4 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.

4.7.4.1 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.



4.7.4.2 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.

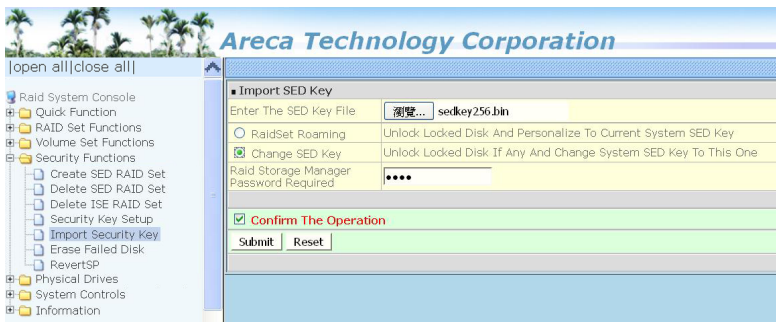
WEB BROWSER-BASED CONFIGURATION



4.7.5 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

4.7.6 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.



4.7.7 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.

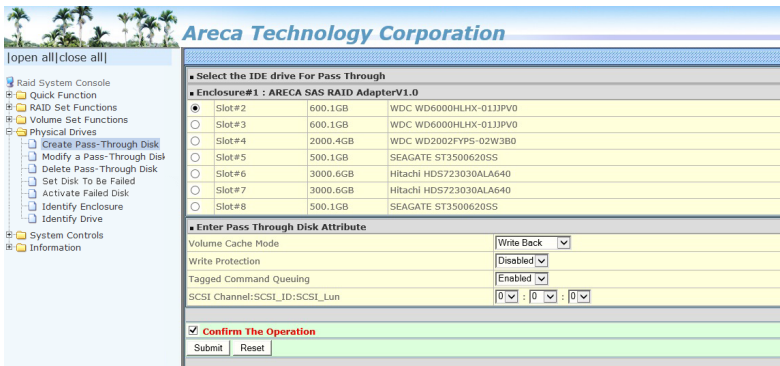


4.8 Physical Drive

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

4.8.1 Create Pass-Through Disk

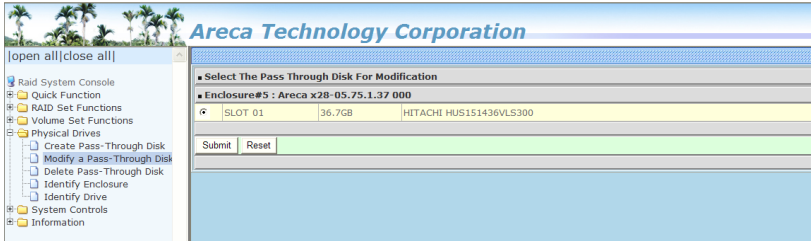
To create pass-through disk, move the mouse cursor to the main menu and click on the "Create Pass-Through" link. The relative setting function screen appears. A pass-through disk is not controlled by the RAID storage firmware; it can't be a part of a volume set. The disk is available to the operating 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, and SCSI channel/SCSI_ID/SCSI_LUN for this pass-through disk.



4.8.2 Modify Pass-Through Disk

Use this option to modify the pass-through disk attribute. The user can modify the Cache Mode, Tagged Command Queuing, and SCSI Channel/ID/LUN on an existing pass-through disk. To modify the pass-through drive attribute from the pass-through drive pool, move the mouse cursor bar and click on the "Modify 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.

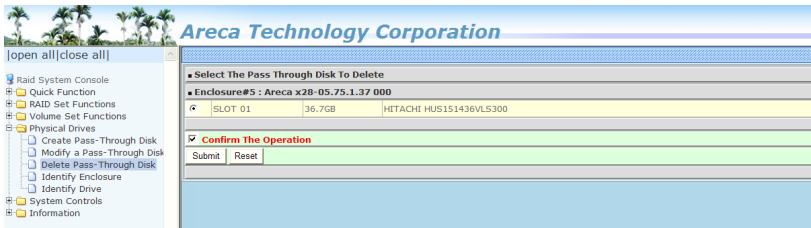
WEB BROWSER-BASED CONFIGURATION



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.

4.8.3 Delete Pass-Through Disk

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



4.8.4 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 the “Clone Disk” option on the “Physical Drives” link to enable the clone function. If there is an available disk, then the “Select The Drives For Cloning” screen appears. There are two “Clone Disk” function options: “Clone And Replace ” and “Clone Only.”

WEB BROWSER-BASED CONFIGURATION

Clone Disk Procedure

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

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

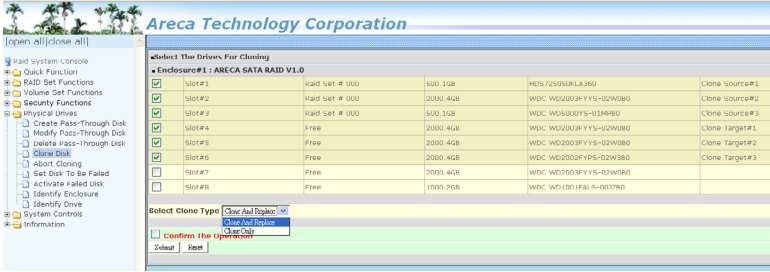
4.8.4.1 Clone And Replace

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".

4.8.4.2 Clone Only

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

WEB BROWSER-BASED CONFIGURATION



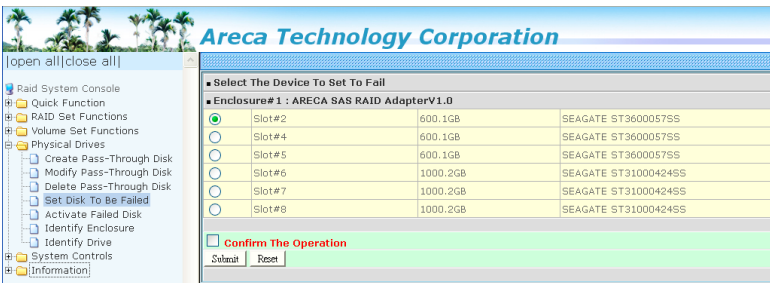
4.8.5 Abort Cloning

Use this function to stop the ongoing clone disk action.



4.8.6 Set Disk To Be Failed

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



WEB BROWSER-BASED CONFIGURATION

4.8.7 Activate Failed Disk

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

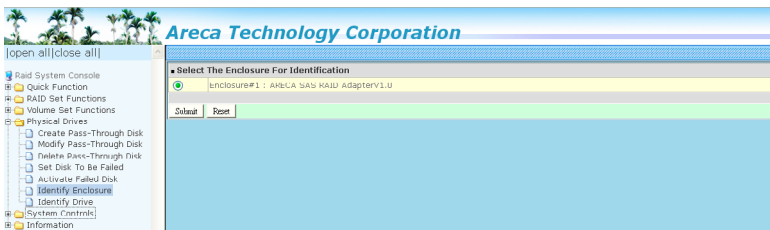
Followings are considered as “Removed-Disk”:

1. Manually removed by user.
2. Losing PHY connection due to bad connector, cable, backplane.
3. Losing PHY connection due to disk fail.

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

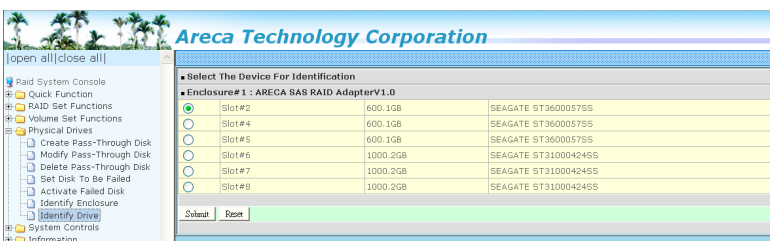
4.8.8 Identify Enclosure

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



4.8.9 Identify Drive

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

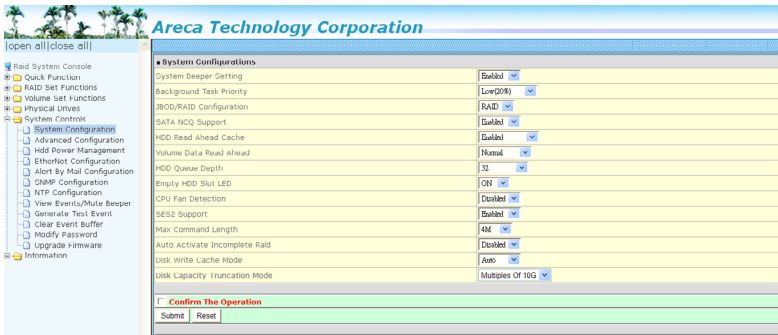


WEB BROWSER-BASED CONFIGURATION

4.9 System Controls

4.9.1 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, and then select the desired function.



- **System Beeper Setting**

The "System Beeper Setting" function is used to "Disabled" or "Enabled" the RAID storage 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 storage allows the user to choose the rebuild priority (UltraLow, Low, Medium 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 box are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to change the option from the RAID to the JBOD function.

WEB BROWSER-BASED CONFIGURATION

- **SATA NCQ Support**

The controller supports both SAS and SATA disk drives. The SATA NCQ allows multiple commands to be outstanding within a drive at the same time. Drives that support NCQ have an internal queue where outstanding commands can be dynamically rescheduled or re-ordered, along with the necessary tracking mechanisms for outstanding and completed portions of the workload. The RAID storage 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 volume read data ahead parameter specifies the controller firmware algorithms which process the Read Ahead data blocks from the disk. The read ahead parameter is normal by default. To modify the value, you must set it from the command line using the Read Ahead option. The normal option satisfies the performance requirements for a typical volume. The disabled value implies no read ahead. The most efficient value for the controllers depends on your application. Aggressive read ahead is optimal for sequential access but it degrades random access.

- **HDD Queue Depth**

This parameter is adjusted the queue depth capacity of NCQ (SATA HDD) or Tagged Command Queuing (SAS 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 storage will light the fault LED; if no HDD installed.

WEB BROWSER-BASED CONFIGURATION

- **Max Command Length**

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

- **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 storage 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**

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

- **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" command. User can set the "SAS And SATA", "SAS Only", "SATA Only" or "Disabled" for the controller initialization.

- **Hot Plugged Disk For Rebuilding**

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

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

"Always" – it is what it was before. Whenever a disk is inserted/re-inserted whether new or previously existed, it always

WEB BROWSER-BASED CONFIGURATION

triggers 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**

RAID storage 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.

● **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 Sapre Exist”, and “Alert Only”. The default is “Alert Only”.

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

WEB BROWSER-BASED CONFIGURATION

“Failed The Drive If Hot Sapre Exist” – controllers kill off the SMART fail disk if hot sapre dive is existed.

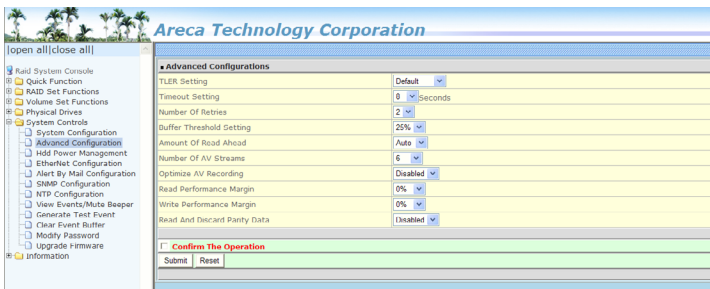
“Alert” – it will trigger alert when there happens a SMART fail drive.

- **Smart Polling Interval**

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

4.9.2 Advanced Configuration

To set the RAID storage advanced system function, move the cursor to the main menu and click the “Advanced Configuration” link. The “Advanced Configuration” menu will show all items, and 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

WEB BROWSER-BASED CONFIGURATION

drive from the array during this period. Default value is manufacture setting. You can select between 5, 6 and 7 second. This feature is used 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.

- **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 continued 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.

WEB BROWSER-BASED CONFIGURATION

- **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 storage. 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.

- **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 play out 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

WEB BROWSER-BASED CONFIGURATION

and Mode 3. Default value is "Disabled". Our controller cache uses LRU method; there have no special memory capacity reserved for read or write. The Mode 1, 2 and 3 are used to define the command sorting method. The default sorting method is helpful for normal applications, but not useful for AV applications, so we have defined three different sorting methods for these special applications. To decide how to optimize AV stream recording parameter, you need to adjust the Optimize AV Recording, and Write Buffer Threshold during runtime.

- **Read Performance Margin**

The "Read Performance Margin" is for controller to reserve n% read margin during AV stream recording. It is designed to eliminate the frame drop and ensure to provide the smooth and stable performance on the application.

- **Write Performance Margin**

The "Write Performance Margin" is for controller to reserve n% write margin AV stream recording. It is designed to eliminate the frame drop and ensure to provide the smooth and stable performance on the application.

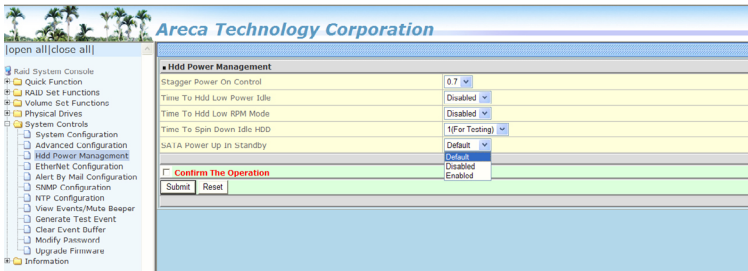
- **Read And Discard Parity Data**

This function is used to determine if parity data is to be read and discarded. It is designed to eliminate the frame drop and ensure to provide the smooth and stable performance on the application.

WEB BROWSER-BASED CONFIGURATION

4.9.3 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. To set the HDD power management function, move the cursor to the main menu and click the “HDD Power Management” link. The “HDD Power Management” menu will show all items, and then select the desired function.



● Stagger Power On Control

In a PC system with only one or two drives, the power can supply enough power to spin up both drives simultaneously. But in systems with more than two drives, the startup current from spinning up the drives all at once can overload the power supply, causing damage to the power supply, disk drives and other system components. This damage can be avoided by allowing the host to stagger the spin-up of the drives. The SAS/SATA drives have supported the staggered spin-up capabilities to boost reliability. The staggered drive spin-up is a very useful feature for managing multiple disk drives in a storage. It gives the host the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. The staggered 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.

With this option it gives the RAID storage the ability to spin up the disk drives sequentially staggered power up value. The

WEB BROWSER-BASED CONFIGURATION

values can be selected from 0.4 to 6 seconds per step which powers up one drive.

- **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.

- **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.

- **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.

- **SATA Power Up In Standby**

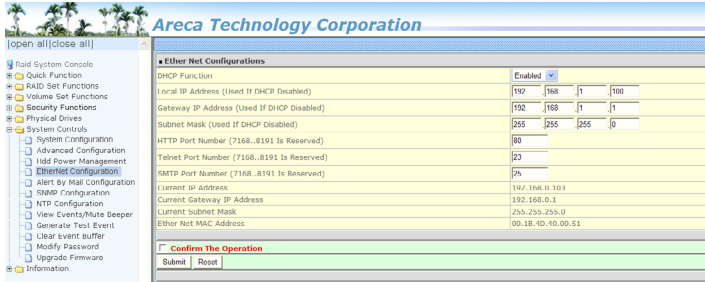
SATA Power Up In Standby (power management 2 mode, PM2) is a SATA disk drive configuration which prevents the drive from automatic spinup when power is applied. "Enabled" option allows the drive to be powered-up into the Standby power management state to minimize inrush current at power-up and to allow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

4.9.4 Ethernet Configuration

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

WEB BROWSER-BASED CONFIGURATION

patches required. To configure the RAID controller 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, and then select the desired function.



● DHCP Function

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.

● 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 reassign the static IP address of the controller.

WEB BROWSER-BASED CONFIGURATION

- **Gateway IP address**

A gateway is a node (a router) on a TCP/IP network that serves as an access point to another network. A default gateway is the node on the computer network that the network software uses when an IP address does not match any other routes in the routing table.

- **Subnet Mask**

A Subnet mask is a 32-bit number that masks an IP address, and divides the IP address into network address and host address.

- **HTTP Port Number**

To manually configure the "HTTP Port Number" of the controller, move the cursor bar to "HTTP Port Number" item, then reassign the default "HTTP Port Number" of the controller.

- **Telnet Port Number**

To manually configure the "Telnet Port Number" of the controller, move the cursor bar to "Telnet Port Number" item, then reassign the default "Telnet Port Number" of the controller.

- **SMTP Port Number**

To manually configure the "SMTP Port Number" of the controller, Move the cursor bar to "SMTP Port Number" item, then reassign the default "SMTP Port Number" of the controller.

Note:

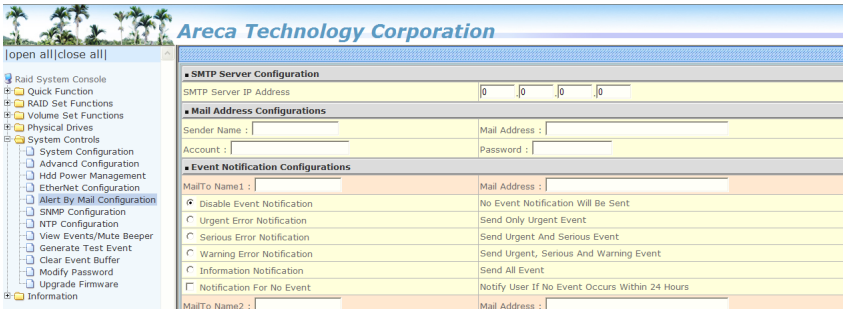
If you configure the HTTP Port Number to 0, the HTTP console will be closed.

4.9.5 Alert By Mail Configuration

To configure the RAID storage 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, and then select the desired function. This function can only be set via web-based configuration.

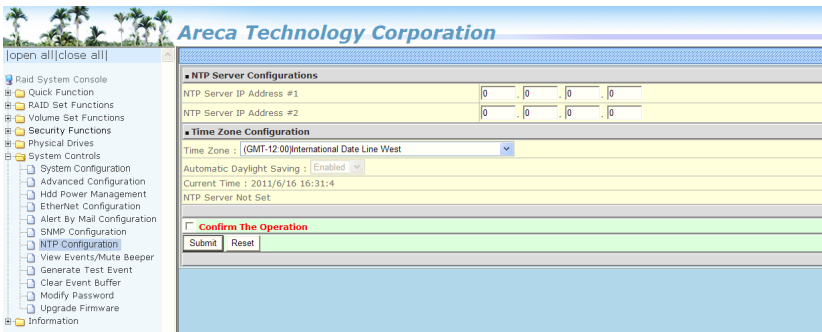
WEB BROWSER-BASED CONFIGURATION

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. (Please refer to SMTP Sever Configuration, Mail Address Configuration and Event Notification Configuration on chapter 3 “ArchHTTP Configuration”).



4.9.6 NTP Configuration

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



Note:

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

WEB BROWSER-BASED CONFIGURATION

● NTP Server Address

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

● Time Zone

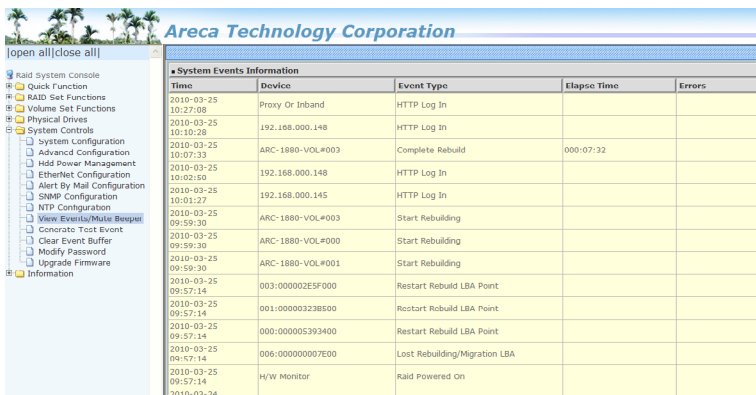
Time Zone conveniently runs in the system tray and allows you to easily view the date and time in various locations around the world. You can also quickly and easily add your own personal locations to customize time zone the way you want.

● Automatic Daylight Saving

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

4.9.7 View Events/Mute Beeper

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



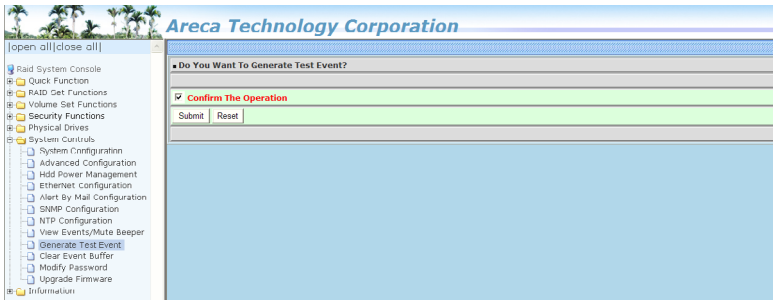
Time	Device	Event Type	Elapse Time	Errors
2010-03-25 10:27:08	Proxy Or Inband	HTTP Log In		
2010-03-25 10:10:28	192.168.000.148	HTTP Log In		
2010-03-25 10:07:33	ARC-1880-VOL#003	Complete Rebuild	000:07:32	
2010-03-25 10:02:09	192.168.000.148	HTTP Log In		
2010-03-25 10:01:27	192.168.000.145	HTTP Log In		
2010-03-25 09:59:30	ARC-1880-VOL#003	Start Rebuilding		
2010-03-25 09:59:30	ARC-1880-VOL#000	Start Rebuilding		
2010-03-25 09:59:30	ARC-1880-VOL#001	Start Rebuilding		
2010-03-25 09:57:14	003:000002E5F000	Restart Rebuild LBA Point		
2010-03-25 09:57:14	001:000003238500	Restart Rebuild LBA Point		
2010-03-25 09:57:14	000:000005393400	Restart Rebuild LBA Point		
2010-03-25 09:57:14	006:000000007E00	Lost Rebuilding/Migration LBA		
2010-03-25 09:57:14	H/W Monitor	Raid Powered On		
2010-03-24				

WEB BROWSER-BASED CONFIGURATION

Select this option to view the system events information: Time, Device, Event Type, Elapse Time and Errors. The RAID storage 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.

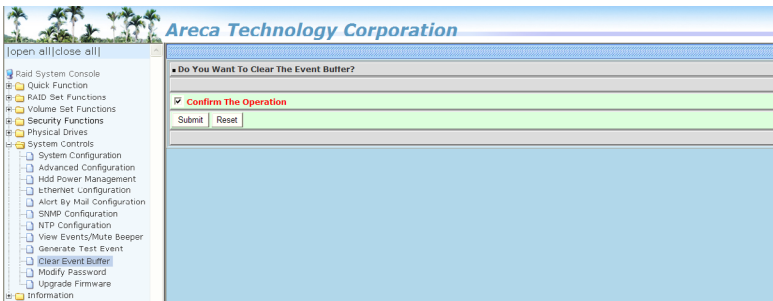
4.9.8 Generate Test Event

Use this feature to generate events for testing purposes.



4.9.9 Clear Events Buffer

Use this feature to clear the entire events buffer information.



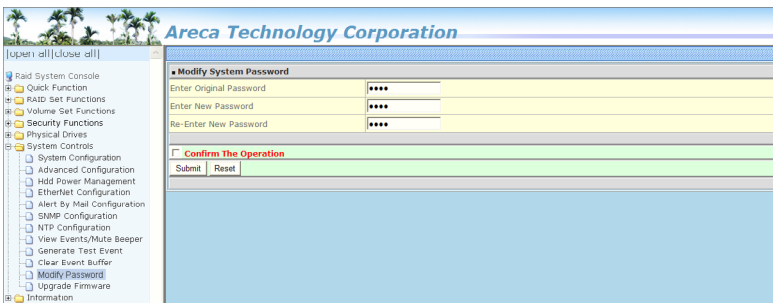
WEB BROWSER-BASED CONFIGURATION

4.9.10 Modify Password

To set or change the RAID storage password, select “System Controls” from the menu and click on the “Modify Password” link. The “Modify System Password” screen appears.

The password option allows user to set or clear the RAID storage’s password protection feature. Once the password has been set, the user can only monitor and configure the RAID storage by providing the correct password. The password is used to protect the RAID storage from unauthorized entry. The controller will check the password only when entering the main menu from the initial screen. The RAID storage will automatically go back to the initial screen when it does not receive any command in 5 minutes. Do not use spaces when you enter the password. If spaces are used, it will lock out the user.

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



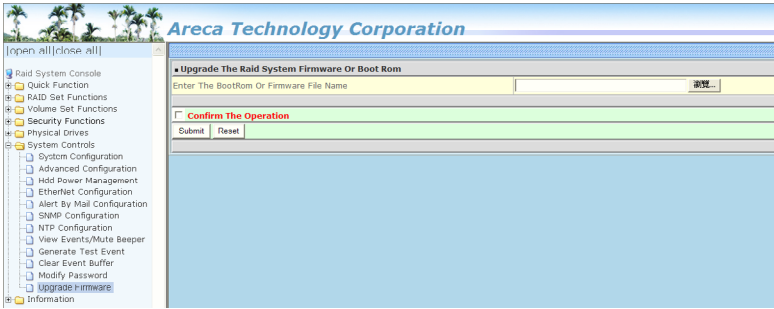
Note:

The manufacture default password is set to 0000.

4.9.11 Update Firmware

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

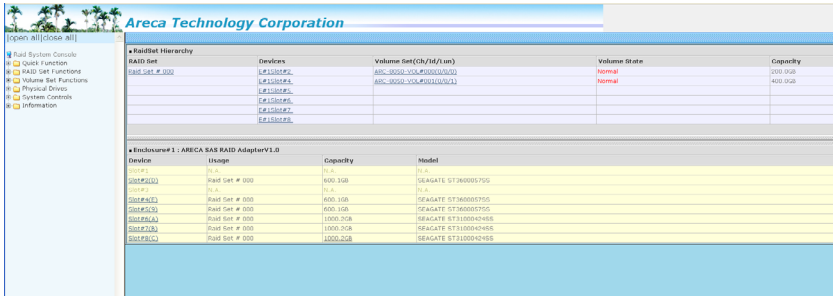
WEB BROWSER-BASED CONFIGURATION



4.10 Information

4.10.1 Raid Set Hierarchy

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

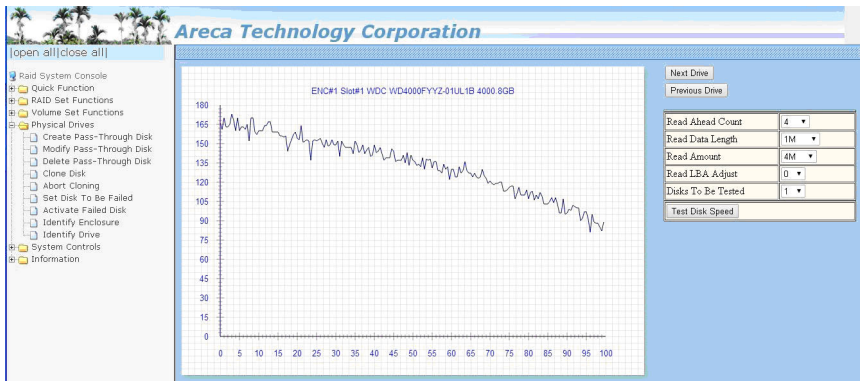


4.10.1.1 Hdd Xfer Speed

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

WEB BROWSER-BASED CONFIGURATION

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



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

4.10.2 System Information

To view the RAID storage’s system information, move the mouse cursor to the main menu and click on the “System Information” link. The RAID storage “RAID Subsystem Information” screen appears. Use this feature to view the RAID storage’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.

WEB BROWSER-BASED CONFIGURATION

The screenshot displays the 'System Information' section of the Areca Technology Corporation web interface. The left sidebar shows a tree view with 'System Information' selected. The main content area is titled 'RAID Subsystem Information' and contains a table of system details.

RAID Subsystem Information	
Controller Name	ARC-8050
Firmware Version	V1.51 2012-07-27
BOOT ROM Version	V1.51 2012-07-27
FL Firmware Version	13.0.59.0
Serial Number	1100-2116-6653
Unit Serial #	
Main Processor	800MHz PPC440 RevD1
CPU ICache Size	32K Bytes
CPU DCache Size	32K Bytes/Write Back
CPU SCache Size	1024K Bytes/Write Through
System Memory	1024MB/1333MHz/ECC
PCI-E Link Status	4X/5G
Current IP Address	192.168.0.183

4.10.3 Hardware Monitor

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

The screenshot displays the 'Hardware Monitor' section of the Areca Technology Corporation web interface. The left sidebar shows a tree view with 'Hardware Monitor' selected. The main content area is titled 'Controller H/W Monitor' and contains a table of hardware status information.

Controller H/W Monitor	
CPU Temperature	55 °C
Controller Temp.	40 °C
12V	12.281 V
5V	5.080 V
3.3V	3.360 V
I/O Voltage +1.8V	1.868 V
DDR3 +1.5V	1.504 V
CPU VCore +1.0V	1.040 V
Analog +1.0V	0.992 V
DDR3 +0.75V	0.736 V
Battery Status	Not Installed
Enclosure#1 : ARECA SAS RAID AdapterV1.0	
Fan#1	1670 RPM
Fan#2	1759 RPM

Appendix A

Upgrading Flash ROM Update Process

A-1 Overview

Since the ARC-8050U3-6 SAS RAID storage features flash ROM 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 out-of-band LAN port McRAID storage manager. New releases of the firmware are available in the form of a DOS file on the shipped CD or Areca website. The files available at the FTP site for each model contain the following files in each version:

ARC1883NNNN.BIN: Software binary code (“NNNN” refers to the software code type)

ARC1883BOOT.BIN:→ RAID controller hardware initialization

ARC1883FIRM.BIN:→ RAID kernel program

ARC1883MBR0.BIN:→ Master Boot Record for supporting Dual Flash Image in the ARC-8050U3-6 SAS RAID storage

The release_note.txt contains the history information of the software code change in the main directory. Read this file first to make sure you are upgrading to the proper binary file. Select the right file for the upgrade. Normally, user upgrades ARC1883FIRM.BIN for RAID function. All these files in the firmware package are a part of the firmware. You should update all files in the package, no special update order needed. New firmware works after a system restart not instant available, so you can update all files before restart the system. The controller firmware is independent of the array; update firmware does not touch anything you stored in the array.

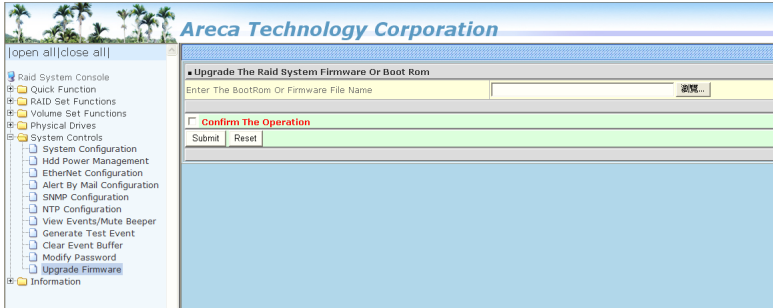
Note:

ARC-8050U3-6 RAID storage uses the same firmware package of ARC-1883 series RAID adapters. Please update all binary code (BOOT, FIRM and MBR0) before you reboot system. Otherwise, a mixed firmware package may hang the controller.

APPENDIX

A-2 Upgrading Firmware Through McRAID Storage Manager

Get the new version firmware for your RAID storage. For example, download the bin file from your OEM's web site onto the C: drive.



1. To upgrade the RAID storage firmware, move the mouse cursor to "Upgrade Firmware" link. The "Upgrade The Raid System Firmware or Boot Rom" screen appears.
2. Click "Browse". Look in the location to which the Firmware upgrade software was downloaded. Select the file name and click "Open".
3. Tick on "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".
6. After the new firmware package completes downloading, find a chance to restart the controller/computer for the new firmware to take effect.

The web browser-based McRAID storage manager can be accessed through the out-of-band LAN port. The out-of-band method allows local or remote to access the McRAID storage manager from any standard internet browser via a LAN or WAN with no software or patches required.

Controller with onboard LAN port, you can directly plug an Ethernet cable to the controller LAN port. After network connected, you can find the current IP address in the LCD panel.

From a remote pc, you can directly open a web browser and enter the IP address. Then enter user name and password to login and start your management. You can find the firmware update feature from the "Upgrade Firmware" option on the "System Controls".

A-3 Upgrading Firmware Through CLI

This Command Line Interface (CLI) provides you to configure and manage the RAID storage components. The CLI is useful in environments where a graphical user interface (GUI) is not available. Through the CLI, you perform firmware upgrade that you can perform with the McRAID storage manager GUI. The controller has added protocol on the firmware for user to update the controller firmware package (BOOT, FIRM and MBR0) through the CLI utility.

To update the controller firmware, follow the procedure below:

```
Parameter: <path=<PATH_OF_FIRMWARE_FILE>>  
Fn: Firmware Updating.  
Ex: Update Firmware And File Path Is In [C:\FW\ARC1883FIRM.BIN.]  
Command: sys updatefw path=c:\fw\arc1883firm.bin [Enter]
```

APPENDIX

Appendix B

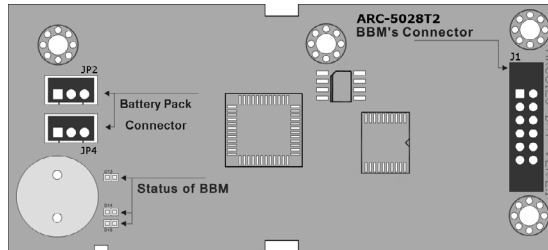
Battery Backup Module (ARC-6120BA-T021-T3)

ARC-8050U3-6 RAID storage operates using cache memory. The Battery Backup Module is an add-on module that provides power to the RAID storage cache memory in the event of a power failure. The BBM monitors the write back cache on the RAID storage, and provides power to the cache memory if it contains data not yet written to the hard drives when power failure occurs.

B-1 BBM Connector and Components

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

- D13 (Green): light when BBM activated
- D14 (Red): light when BBM charging
- D15 (Green): light when BBM normal



B-2 Status of BBM

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

Areca Technology Corporation	
[X] Stop Auto Refresh	
* Controller HW Monitor	
74 HC	74 HC
Controller Temp.	43 HC
12V	12.099 V
5V	4.972 V
3.3V	3.360 V
DDR#1 +1.8V	1.760 V
CRU +1.2V	1.700 V
CRU +1.2V	1.200 V
CRU +0.9V	0.993 V
DDR II +0.9V	0.864 V
RTC 3.0V	3.344 V
Battery Status	Not installed
* Enclosure#1 : ARECA RAID Subsystem V1.0	
Fan#1	1339 RPM
Fan#2	1218 RPM
* Enclosure#2 : Areca x3B-05.75-1.37 000 (26)	
1.2V	1.170 V

B-3 Battery Pack Modules

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

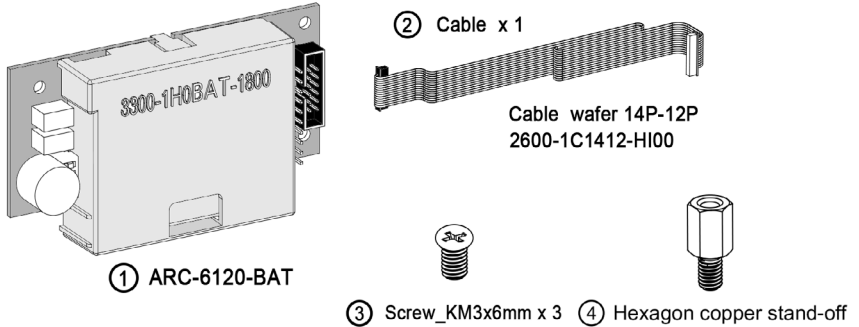
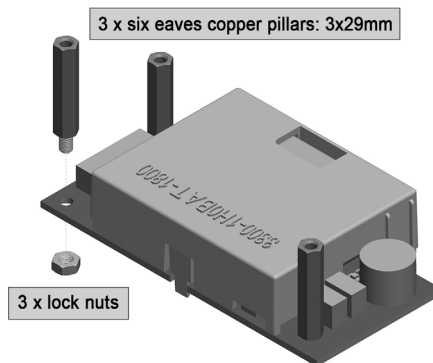


Figure-B-1, ARC-6120-BAT021-T3 Pack Modules

B-4 Installation

1. Make sure all power to the RAID storage is disconnected.
2. Install the "six eaves copper pillars" on the three mounting position (NH1, NH2 and NH3) and secures it using flat head screws.



3. Connector J1 is available for the optional battery backup module. Connect the BBM cable from this connector to the 14-pin (J6) battery connector on the RAID storage controller.

APPENDIX

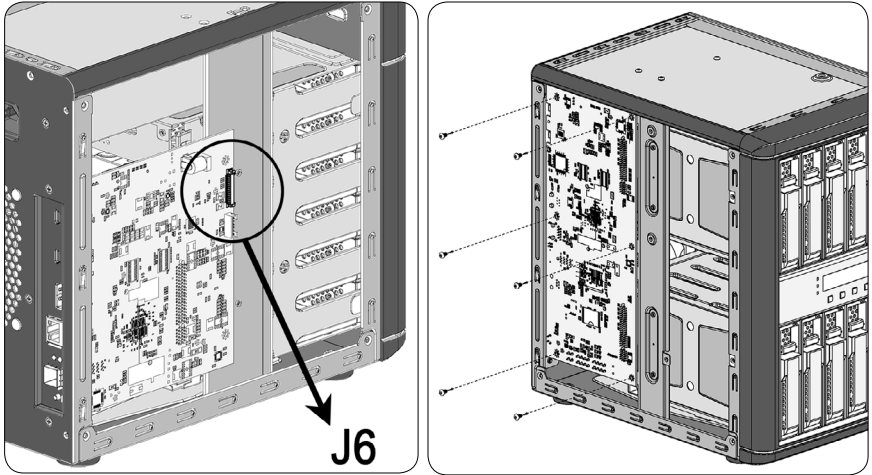


Figure B-2, J6 location of ARC-8050U3-6

4. Integrators provide pre-drilled holes in their cabinet for securing the three “six eaves copper pillars” on the BBM using flat head screws.

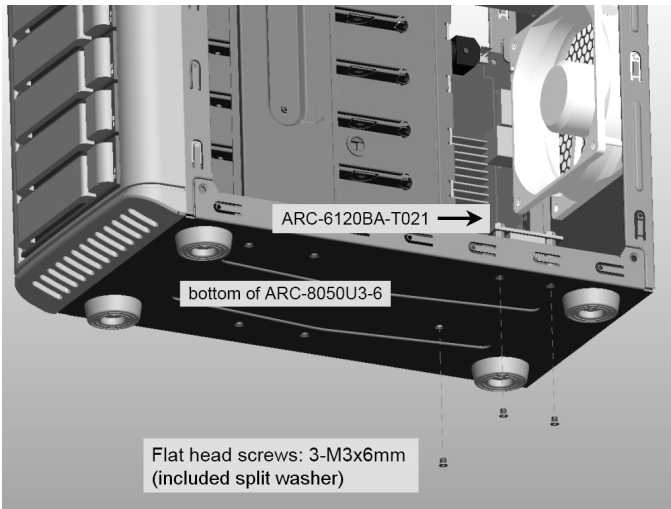


Figure B-3, securing the BBM on ARC-8050U3-6

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 duration can retain the cache content for a limited interval (typically 72 hours).

B-6 Operation

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

B-7 Battery Functionality Test Procedure

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

B-8 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. Power down the RAID storage properly. Make sure that cache memory has been flushed.
2. Remove all "Round head screws" from the cabinet.

APPENDIX

3. Disconnect the BBM cable from J6 on the RAID storage controller.
4. Disconnect the battery pack cable from JP2 on the BBM.
5. Install a new battery pack and connect the new battery pack to JP2.
6. Connect the BBM to J6 on the RAID storage controller.
7. Secure the "Round head screws" into the BBM.

B-9 BBM Specifications

Mechanical

- Module Dimension (W x H x D)
37.3 x 13 x 81.6 mm

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 * 1880mAH) for ARC-8050U3-6 RAID storage

Appendix C

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 that 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	

APPENDIX

B. Volume Event

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

C. RAID Set Event

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

D. Hardware Monitor Event

Event	Level	Meaning	Action
DRAM 1-Bit ECC	Urgent	DRAM 1-Bit ECC error	Check DRAM
DRAM Fatal Error	Urgent	DRAM fatal error encountered	Check the DRAM module and replace with new one if required.
Controller Over Temperature	Urgent	Abnormally high temperature detected on controller (over 60 degree)	Check air flow and cooling fan of the enclosure, and contact us.
Hdd Over Temperature	Urgent	Abnormally high temperature detected on Hdd (over 55 degree)	Check air flow and cooling fan of the enclosure.
Fan Failed	Urgent	Cooling Fan # failure or speed below 1700RPM	Check cooling fan of the enclosure 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	
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/ Migration LBA	Urgent	Some rebuilding/ migration raidset member disks missing before power on.	Reinserted the missing member disk back, controller will continue the incompleting rebuilding/ migration.

APPENDIX

Appendix D

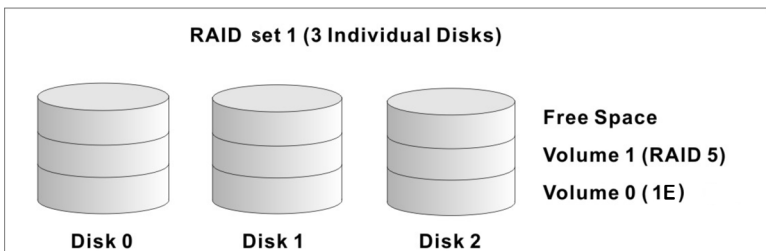
RAID Concept

RAID Set

A RAID set is a group of disks connected to a RAID controller. A RAID set contains one or more volume sets. The RAID set itself does not define the RAID level (0, 1, 1E, 3, 5, 6, 10, 30, 50, 60, etc); the RAID level is defined within each volume set. Therefore, volume sets are contained within RAID sets and RAID Level is defined within the volume set. If physical disks of different capacities 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

Each volume set is seen by the host system as a single logical device (in other words, a single large virtual hard disk). A volume set will use a specific RAID level, which will require one or more physical disks (depending on the RAID level used). RAID level refers to the level of performance and data protection of a volume set. The capacity of a volume set can consume all or a portion of the available disk capacity in a RAID set. Multiple volume sets can exist in a RAID set. For 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 about to become part of a RAID set). If there are pre-existing RAID sets with available capacity and enough disks for the desired RAID level, then the volume set can be created in the existing RAID set of the user's choice.



In the illustration, volume 1 can be assigned a RAID level 5 of operation while volume 0 might be assigned a RAID level 1E of operation. Alternatively, the free space can be used to create volume 2, which could then be set to use RAID level 5.

Ease of Use Features

- **Foreground Availability/Background Initialization**

RAID 0 and RAID 1 volume sets can be used immediately after creation because they do not create parity data. However, RAID 3, 5, 6, 30, 50 or 60 volume sets must be initialized to generate parity information. In Background Initialization, the initialization proceeds as a background task, and the volume set is fully accessible for system reads and writes. The operating system can instantly access the newly created arrays without requiring a reboot and without waiting for initialization to complete. Furthermore, the volume set is protected against disk failures while initialing. If using Foreground Initialization, the initialization process must be completed before the volume set is ready for system accesses.

- **Online Array Roaming**

RAID controllers store RAID configuration information on the disk drives. The controller therefore protects the configuration settings in the event of controller failure. Online array roaming allows the administrators the ability to move a complete RAID set to another system without losing RAID configuration information or data on that RAID set. Therefore, if a server fails, the RAID set disk drives can be moved to another server with an Areca RAID controllers and the disks can be inserted in any order.

- **Online Capacity Expansion**

Online Capacity Expansion makes it possible to add one or more physical drives to a volume set without interrupting server operation, eliminating the need to backup and restore after reconfiguration of the RAID set. When disks are added to a RAID set, unused capacity is added to the end of the

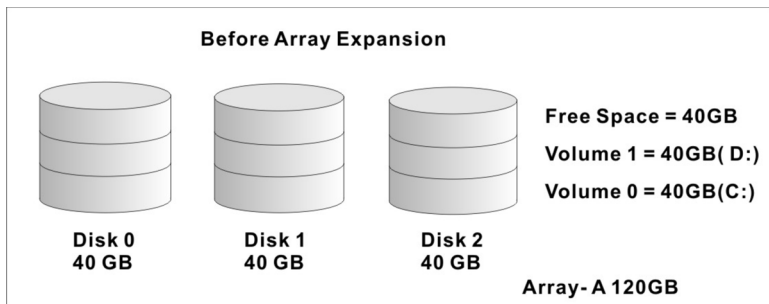
APPENDIX

RAID set. Then, data on the existing volume sets (residing on the newly expanded 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 be used to create additional volume sets.

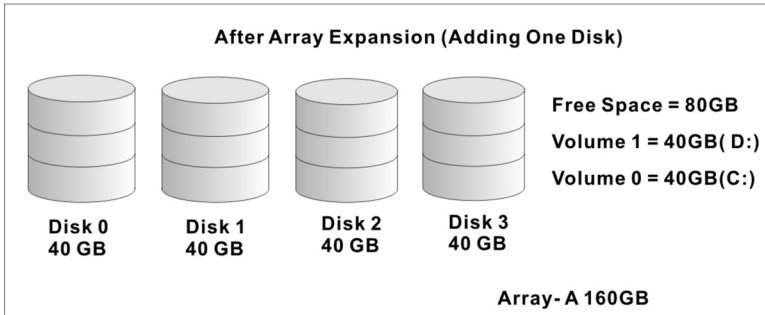
A disk, to be added to a RAID set, must be in normal mode (not failed), free (not spare, in a RAID set, or passed through to host) and must have at least the same capacity as the smallest disk capacity already in the RAID set.

Capacity expansion is only permitted to proceed if all volumes on the RAID set are in the normal status. During the expansion process, the volume sets being expanded can be accessed by the host system. In addition, the volume sets with RAID level 1, 10, 3, 5 or 6 are protected against data loss in the event of disk failure(s). In the case of disk failure, the volume set changes from "migrating" state to "migrating+degraded" state. When the expansion is completed, the volume set would then transition to "degraded" mode. If a global hot spare is present, then it further changes to the "rebuilding" state.

The expansion process is illustrated as following figure.



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 set, with a different fault tolerance setting (if required by the user.)



● Online RAID Level and Stripe Size Migration

For those who wish to later upgrade to any RAID capabilities, a system with online RAID level/stripe size migration allows a simplified upgrade to any supported RAID level without having to reinstall the operating system.

The RAID controllers can migrate both the RAID level and stripe size of an existing volume set, while the server is on-line and the volume set is in use. Online RAID level/stripe size migration can prove helpful during performance tuning activities as well as when additional physical disks are added to the RAID controller. For example, in a system using two drives in RAID level 1, it is possible to add a single drive and add capacity and retain fault tolerance. (Normally, expanding a RAID level 1 array would require the addition of two disks). A third disk can be added to the existing RAID logical drive and the volume set can then be migrated from RAID level 1 to 5. The result would be parity fault tolerance and double the available capacity without taking the system down. A fourth disk could be added to migrate to RAID level 6. It is only possible to migrate to a higher RAID level by adding a disk; disks in an existing array can't be reconfigured for a higher RAID level without adding a disk.

Online migration is only permitted to begin, if all volumes to be migrated are in the normal mode. During the migration process, the volume sets being migrated are accessed by the host system. In addition, the volume sets with RAID level 1, 1E, 10, 3, 5 or 6 are protected against data loss in the event

APPENDIX

of disk failure(s). In the case of disk failure, the volume set transitions from migrating state to (migrating+degraded) state. When the migration is completed, the volume set transitions to degraded mode. If a global hot spare is present, then it further transitions to rebuilding state.

● **Online Volume Expansion**

Performing a volume expansion on the controller is the process of growing only the size of the latest volume. A more flexible option is for the array to concatenate an additional drive into the RAID set and then expand the volumes on the fly. This happens transparently while the volumes are online, but, at the end of the process, the operating system will detect free space at after the existing volume.

Windows, NetWare and other advanced operating systems support volume expansion, which enables you to incorporate the additional free space within the volume into the operating system partition. The operating system partition is extended to incorporate the free space so it can be used by the operating system without creating a new operating system partition.

You can use the Diskpart.exe command line utility, included with Windows Server 2003 or the Windows 2000 Resource Kit, to extend an existing partition into free space in the dynamic disk.

Third-party software vendors have created utilities that can be used to repartition disks without data loss. Most of these utilities work offline. Partition Magic is one such utility.

High Availability

● **Global/Local Hot Spares**

A hot spare is an unused online available drive, which is ready for replacing the failure disk. The hot spare is one of the most important features that RAID controllers provide to deliver a high degree of fault-tolerance. A hot spare is a spare physi-

cal drive that has been marked as a hot spare and therefore is not a member of any RAID set. If a disk drive used in a volume set fails, then the hot spare will automatically take its place and the data previously located on the failed drive is reconstructed on the hot spare.

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

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

Important:

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

● Hot-Swap Disk Drive Support

The RAID controller chip includes a protection circuit that supports the replacement of SAS/SATA hard disk drives without having to shut down or reboot the system. A removable hard drive tray can deliver "hot swappable" fault-tolerant RAID solutions. This feature provides advanced fault tolerant RAID protection and "online" drive replacement.

● Auto Declare Hot-Spare

If a disk drive is brought online into a system operating in degraded mode, the RAID controllers will automatically declare the new disk as a spare and begin rebuilding the degraded volume. The Auto Declare Hot-Spare function requires that the smallest drive contained within the volume set in which the failure occurred.

APPENDIX

In the normal status, the newly installed drive will be reconfigured an online free disk. But, the newly-installed drive is automatically assigned as a hot spare if any hot spare disk was used to rebuild and without new installed drive replaced it. In this condition, the Auto Declare Hot-Spare status will be disappeared if the RAID storage has since powered off/on.

The Hot-Swap function can be used to rebuild disk drives in arrays with data redundancy such as RAID level 1, 1E, 3, 5, 6, 10, 30, 50 and 60.

● **Auto Rebuilding**

If a hot spare is available, the rebuild starts automatically when a drive fails. The RAID controllers automatically and transparently rebuild failed drives in the background at user-definable rebuild rates. 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 automatically rebuilt and so that fault tolerance can be maintained.

RAID controllers will automatically restart the system and rebuilding process if the system is shut down or powered off abnormally during a reconstruction procedure condition. When a disk is hot swapped, 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.

During the automatic rebuild process, system activity will continue as normal, however, the system performance and fault tolerance will be affected.

● **Adjustable Rebuild Priority**

Rebuilding a degraded volume incurs a load on the RAID storage. The RAID controllers allow the user to select the rebuild priority to balance volume access and rebuild tasks appropriately. The Background Task Priority is a relative indication of how much time the controller devotes to a background operation, such as rebuilding or migrating.

RAID controller allows user to choose the task priority (Ultra Low (5%), Low (20%), Medium (50%), High (80%)) to balance volume set access and background tasks appropriately. For high array performance, specify an Ultra Low value. Like volume initialization, after a volume rebuilds, it does not require a system reboot.

High Reliability

● Hard Drive Failure Prediction

In an effort to help users avoid data loss, disk manufacturers are now incorporating logic into their drives that acts as an "early warning system" for pending drive problems. This system is called SMART. The disk integrated controller works with multiple sensors to monitor various aspects of the drive's performance, determines from this information if the drive is behaving normally or not, and makes available status information to RAID storage firmware that probes the drive and look at it.

The SMART can often predict a problem before failure occurs. The controllers will recognize a SMART error code and notify the administrator of an impending hard drive failure.

● Auto Reassign Sector

Under normal operation, even initially defect-free drive media can develop defects. This is a common phenomenon. The bit density and rotational speed of disks is increasing every year, and so are the potential of problems. Usually a drive can internally remap bad sectors without external help using cyclic redundancy check (CRC) checksums stored at the end of each sector.

The RAID controller drives perform automatic defect reassignment for both read and write errors. Writes are always completed - if a location to be written is found to be defective, the drive will automatically relocate that write command to a new location and map out the defective location. If there is a re-

APPENDIX

coverable read error, the correct data will be transferred to the host and that location will be tested by the drive to be certain the location is not defective. If it is found to have a defect, data will be automatically relocated, and the defective location is mapped out to prevent future write attempts.

In the event of an unrecoverable read error, the error will be reported to the host and the location will be flagged as being potentially defective. A subsequent write to that location will initiate a sector test and relocation should that location prove to have a defect. Auto Reassign Sector does not affect disk storage performance because it runs as a background task. Auto Reassign Sector discontinues when the operating system makes a request.

- **Consistency Check**

A consistency check is a process that verifies the integrity of redundant data. To verify RAID 3, 5, 6, 30, 50 or 60 redundancy, a consistency check reads all associated data blocks, computes parity, reads parity, and verifies that the computed parity matches the read parity.

Consistency checks are very important because they detect and correct parity errors or bad disk blocks in the drive. A consistency check forces every block on a volume to be read, and any bad blocks are marked; those blocks are not used again. This is critical and important because a bad disk block can prevent a disk rebuild from completing. We strongly recommend that you run consistency checks on a regular basis—at least once per week. Note that consistency checks degrade performance, so you should run them when the system load can tolerate it.

Data Protection

- **Battery Backup**

The RAID controllers are armed with a Battery Backup Module (BBM). While a Uninterruptible Power Supply (UPS) protects most servers from power fluctuations or failures, a BBM pro-

vides an additional level of protection. In the event of a power failure, a BBM supplies power to retain data in the RAID controller's cache, thereby permitting any potentially dirty data in the cache to be flushed out to secondary storage when power is restored.

The batteries in the BBM are recharged continuously through a trickle-charging process whenever the system power is on. The batteries protect data in a failed server for up to three or four days, depending on the size of the memory module. Under normal operating conditions, the batteries last for three years before replacement is necessary.

- **Recovery ROM**

RAID controller firmware is stored on the flash ROM and is executed by the I/O processor. The firmware can also be updated through the RAID controllers Thunderbolt port or Ethernet port without the need to replace any hardware chips. During the controller firmware upgrade flash process, it is possible for a problem to occur resulting in corruption of the controller firmware. With our Redundant Flash Image feature, the controller will revert back to the last known version of firmware and continue operating. This reduces the risk of system failure due to firmware crash.

APPENDIX

Appendix E

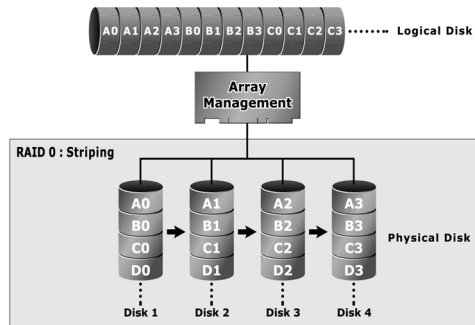
Understanding RAID

RAID is an acronym for Redundant Array of Independent Disks. It is an array of multiple independent hard disk drives that provides 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 should be based on the desired disk capacity, data availability (fault tolerance or redundancy), and disk performance. The following section discusses the RAID levels supported by the RAID controllers.

The RAID controllers 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.

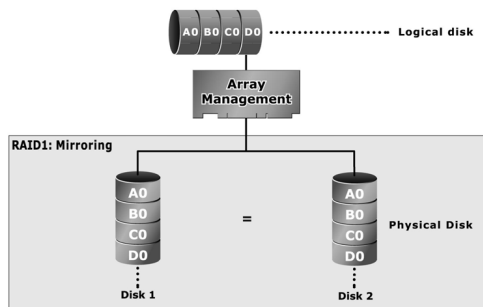
RAID 0

RAID 0, also referred to as striping, writes stripes 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; the reliability of RAID level 0 is less because the entire array will fail if any one disk drive fails.



RAID 1

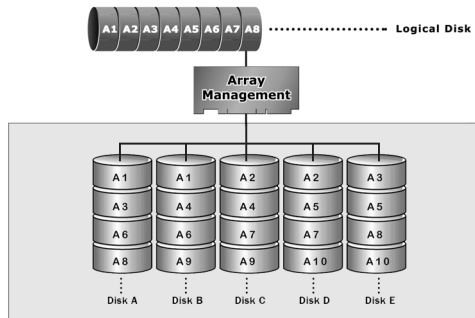
RAID 1 is also known as “disk mirroring”; data written on one disk drive is simultaneously written to another disk drive. Read performance will be enhanced if the array controller can, in parallel, access both members of a mirrored pair. During writes, there will be a minor performance penalty when compared 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

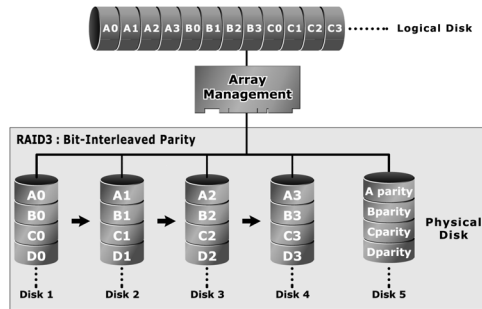
RAID 10(1E)

RAID 10(1E) is a combination of RAID 0 and RAID 1, combining striping with disk mirroring. RAID Level 10 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 then duplicated to another set of drive for data protection. RAID 10 has been traditionally implemented using an even number of disks, some hybrids can use an odd number of disks as well. Illustration is an example of a hybrid RAID 10(1E) array comprised of five disks; A, B, C, D and E. In this configuration, each strip is mirrored on an adjacent disk with wrap-around. Areca RAID 10 offers a little more flexibility in choosing the number of disks that can be used to constitute an array. The number can be even or odd.



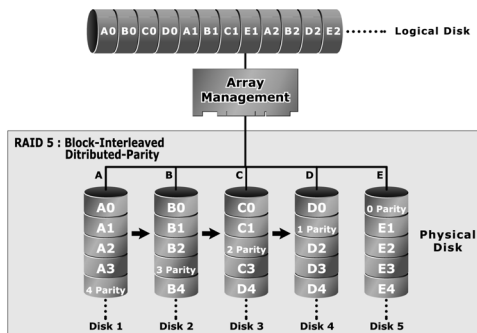
RAID 3

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



RAID 5

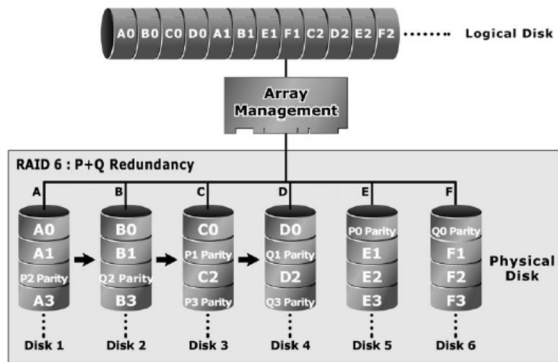
RAID 5 is sometimes called striping with parity at byte level. In RAID 5, the parity information is written to all of the drives in the controllers rather than being concentrated on a dedicated parity disk. If one drive in the system fails, the parity information can be used to reconstruct the data from that drive. All drives in the array system can be used for seek operations at the same time, greatly increasing the performance of the RAID system. This relieves the write bottleneck 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 the highest reliability. It is similar to RAID 5, but it performs two different parity computations or the same computation on overlapping subsets of the data. 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 but 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.



JBOD

(Just a Bunch Of Disks) A group of hard disks in a RAID box 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

ARC-8050U3-6 SAS RAID storage supports RAID Level 0, 1, 10(1E), 3, 5 and 6. 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 either one disk or both disks.	3	Up to one disk failure in each sub-volume
3	Also known Bit-Interleaved Parity. Data and parity information is subdivided and distributed across all data disks. Parity information normally stored on a dedicated parity disk.	3	Up to one disk failure
5	Also known Block-Interleaved Distributed Parity. Data and parity information is subdivided and distributed across all disk. Parity information normally is interspersed with user data.	3	Up to one disk failure
6	RAID 6 provides highest reliability, but not widely used. Similar to RAID 5, but does two different parity computations or the same computation on overlapping subsets of the data. The RAID 6 can offer fault tolerance greater than RAID 1 or RAID 5 but only consumes the capacity of 2 disk drives for distributed parity data.	4	Up to two disk failure