

# External SATA RAID Cards

## **ARC-1110ML/1120ML**

( 4/8-port PCI-X External SATA RAID Adapters )

## **ARC-1210ML/1220ML/1211x/1221x**

( 4/8-port PCI-Express to External SATA RAID Adapters )

## **USER Manual for Mac OS X**

Version: 1.1

Issue Date: April, 2007

## **Copyright and Trademarks**

The information of the 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. All inquiries should be addressed to Areca Technology Corporation.

## **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.

# Contents

<b>1. Introduction .....</b>	<b>6</b>
1.1 Overview .....	6
1.1 Features .....	7
<b>2. Hardware Installation .....</b>	<b>10</b>
2.1 Before Your begin Installation .....	10
2.2 Board Layout.....	11
2.3 Installation.....	13
<b>3. Driver &amp; Software Installation.....</b>	<b>19</b>
3.1 Installation Procedures .....	19
<b>4. Web Browser-based Configuration .....</b>	<b>20</b>
4.1 Start-up McRAID Storage Manager .....	20
4.2 SATA RAID controller McRAID Storage Manager .....	21
4.3 Main Menu .....	21
4.4 Quick Function.....	22
4.5 RaidSet Functions .....	23
4.5.1 Create Raid Set .....	23
4.5.2 Delete Raid Set .....	23
4.5.3 Expand Raid Set.....	24
4.5.4 Activate Incomplete Raid Set .....	24
4.5.5 Create Hot Spare .....	24
4.5.6 Delete Hot Spare.....	24
4.5.7 Rescue Raid Set .....	25
4.6 Volume Set Functions .....	25
4.6.1 Create Volume Set.....	26
• Volume Name .....	26
• Raid Level .....	26
• Capacity .....	26
• Greater Two TB Volume Support.....	26
• Strip Size .....	27
• Cache Mode .....	27
• SCSI Channel/SCSI ID/SCSI Lun.....	27
• Tag Queuing .....	27
4.6.2 Delete Volume Set.....	28
4.6.3 Modify Volume Set.....	28
4.6.3.1 Volume Set Migration .....	29
4.6.4 Check Volume Set .....	29
4.6.5 Stop VolumeSet Check .....	29

4.7 Physical Drive .....	29
4.7.1 Create Pass-Through Disk .....	30
4.7.2 Modify Pass-Through Disk .....	30
4.7.3 Delete Pass-Through Disk .....	31
4.8 System Controls .....	31
4.8.1 System Config .....	31
• System Beeper Setting .....	32
• Background Task Priority .....	32
• JBOD/RAID Configuration .....	32
• Maximun SATA Supported .....	32
• HDD Read Ahead Cache .....	32
• Stagger Power on .....	32
• Empty HDD Slot LED .....	33
• HDD SMART Status Polling.....	33
• Disk Write Cache Mode .....	34
• Disk Capacity Truncation Mode.....	34
4.8.2 View Events/Mute Beeper .....	34
4.8.3 Generate Test Event .....	35
4.8.4 Clear Events Buffer.....	35
4.8.5 Modify Password .....	35
4.8.6 Update Firmware .....	35
4.9 Information .....	36
4.9.1 RaidSet Hierarchy.....	36
4.9.2 System Information .....	36
4.9.3 Hardware Monitor.....	36
<b>Appendix A .....</b>	<b>37</b>
Upgrading Flash ROM Update Process.....	37
<b>Appendix B.....</b>	<b>38</b>
Battery Backup Module (ARC-6120-BAT).....	38
BBM Components .....	38
Status of BBM .....	38
Installation .....	38
Battery Backup Capacity.....	39
Operation .....	39
Changing the Battery Backup Module .....	40
BBM Specifications.....	40
<b>Appendix C.....</b>	<b>41</b>
ArcHttp Configuration.....	41
<b>Appendix D.....</b>	<b>45</b>
Event Notification Configurations .....	45
A. Device Event.....	45

B. Volume Event.....	46
C. RAID Set Event .....	47
D. Hardware Monitor Event .....	47
<b>Appendix E .....</b>	<b>49</b>
Understanding RAID .....	49
RAID 0 .....	49
RAID 1 .....	50
RAID 1E .....	50
RAID 3 .....	51
RAID 5 .....	52
RAID 6 .....	53
<b>Appendix F .....</b>	<b>56</b>
RAID Concept .....	56
RAID Set .....	56
Volume Set .....	56
Ease of Use Features .....	57
• Foreground Availability/Background Initialization .....	57
• Array Roaming .....	57
• Online Capacity Expansion .....	57
• Online RAID Level and Stripe Size Migration .....	59
• Online Volume Expansion .....	60
High availability .....	60
• Global Hot Spares .....	60
• Hot-Swap Disk Drive Support .....	61
• Auto Declare Hot-Spare .....	61
• Auto Rebuilding .....	62
• Adjustable Rebuild Priority .....	62
High Reliability .....	63
• Hard Drive Failure Prediction .....	63
• Auto Reassign Sector .....	63
• Consistency Check .....	64
Data Protection .....	64
• Battery Backup .....	64
• Recovery ROM .....	65

# INTRODUCTION

---

## 1. Introduction

This section presents a brief overview of the External SATA RAID Series Adapter, 1110ML/1120ML( 4/8-port PCI-X SATA RAID Adapters ) and 1210ML/1220ML/1211x/1221x (4/8-port PCI-Express to SATA RAID Adapters) for your Power Mac G5 and Mac Pro systems.

### 1.1 Overview

Areca External SATA RAID Adapters support 4 and 8 SATA II peripheral devices on a single host adapter. These External SATA RAID Adapters have the same RAID kernel of its field-proven External SATA RAID Adapters. External enclosure benefits all functions from these Adapters.

### Unparalleled Performance

The External SATA RAID Adapters raise the standard to higher performance levels with several enhancements including Intel high-performance I/O Processor, a new memory architecture and high performance PCI-X/Express bus interconnection. The ARC-1x10ML/1x20ML default supports 256MB on-board ECC DDR333 SDRAM memory. ARC-12x1x default supports 256MB on board ECC DDR2-533 SDRAM memory.

### Unsurpassed Data Availability

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. The External SATA RAID Adapters with extreme performance RAID 6 engine supported provide the highest RAID 6 feature to meet this requirement. The adapter can concurrently compute two parity blocks and get comparable with RAID 5 performance.

The External SATA RAID Adapters can also provide RAID levels 0, 1, 1E, 3, 5, 6 and JBOD RAID for maximum configuration flexibility. Its high data availability and protection derives from the following capabilities: Online RAID Capacity Expansion, Array Roam-

# INTRODUCTION

---

ing, Online RAID Level/Stripe Size Migration, Global Online Spare, Automatic Drive Failure Detection, Automatic Failed Drive Rebuilding, Disk Hot-Swap, Online Background Rebuilding, Instant Availability/ Background Initialization, Auto Reassign sector, and Battery Backup.

With 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. Greater than 2TB support allows for very large volume set application in 64-bit environment such as data-mining and managing large databases.

## Easy RAID Management

The BIOS contains an embedded McBIOS RAID manager that can access via hot key at BIOS boot-up screen. This pre-boot RAID manager can use to simplify the setup and management of RAID adapter. The adapter firmware also contains and browser-based McRAID storage manager that can access through the Http Proxy server in Windows, FreeBSD and Linux environment. The McRAID manager allows local and remote to create and modify RAID set, volume set, and monitor RAID status from standard web browser. The Single Admin Portal (SAP) monitor utility can support one application to scan multiple RAID units in the network.

## 1.1 Features

### **Adapter Architecture**

- Intel IOP 331 I/O processor (ARC-1110ML/1120ML)
- Intel IOP 332/IOP 333 I/O processor (ARC-1210ML/1220ML)
- Intel IOP341 I/O processor (ARC-1211x/1221x)
- 64-bit/133MHz PCI-X Bus compatible
- PCI Express X8 compatible
- 256MB on-board SDRAM with ECC protection
- Support up to 4/8 SATA II drives
- Write-through or write-back cache support
- Multi-adapter support for large storage requirements
- Supports extreme performance Intel RAID 6 functionality
- NVRAM for RAID event & transaction log

# INTRODUCTION

---

- Battery backup module (BBM) ready (Depend on mother board)

## **RAID Features**

- RAID level 0, 1, 1E, 3, 5, 6 (R6 engine inside) and JBOD
- Multiple RAID selection
- Array roaming
- Online RAID level/stripe size migration
- Online capacity expansion & RAID level migration simultaneously
- Online volume set growth
- Instant availability and background initialization
- Automatic drive insertion / removal detection and rebuilding
- Greater than 2TB per volume set for 64-bit LBA
- Redundant flash image for adapter availability
- Support S.M.A.R.T, NCQ and OOB staggered spin-up capable drives

## **Monitors/Notification**

- System status indication through LED/LCD connector, HDD activity/fault connector, and alarm buzzer
- SMTP support for email notification
- SNMP trap supports for remote SNMP Manager
- I2C Enclosure Management Ready (IOP331/332/333)

## **RAID Management**

- Field-upgradeable firmware in flash ROM
- Browser-based management utility via ArchHttp proxy server
- Support Command Line Interface (CLI)
- Push Button and LCD display panel (Option)

## **Operating System**

- Mac OS 10.X (no\_bootable)  
(For latest supported OS listing visit <http://www.areca.com.tw>)

### **Note:**

Areca External SATA RAID Adapter also can be used in a system running Microsoft, Linux, FreeBSD, Solaris or Novell. Please refer to SATA RAID Controller User's Manual for those systems installation from the Areca website or software CD <CD-ROM>\DOCS directory.



# INTRODUCTION

PCI-X RAID Card Comparison (ARC-11XXML)		
	1110ML	1120ML
RAID processor	IOP331	
Host Bus Type	PCI-X 64bit/133MHz	
RAID 6 support	Yes	YES
Cache Memory	256MB	256MB
Drive Support	4 * SATA II	8 * SATA II
Disk Connector	Infinband	Infinband

Internal PCI-Express RAID Card Comparison (ARC-12XX)				
	1210ML	1220ML	1211x	1221x
RAID processor	IOP332	IOP333	IOP341	IOP341
Host Bus Type	PCI-Express X8			
RAID 6 support	N/A	YES	YES	YES
Cache Memory	256MB	256MB	256MB	256MB
Drive Support	4 * SATA II	8 * SATA II	4 * SATA II	8 * SATA II
Disk Connector	SFF-8088	2*SFF-8088	SFF-8088	SFF-8088

# HARDWARE INSTALLATION

---

## 2. Hardware Installation

This section describes the procedures for installing the External SATA RAID Adapters.

### 2.1 Before Your begin Installation

Thanks for purchasing the External SATA RAID Adapters as your RAID data storage and management system. This user guide gives simple step-by-step instructions for installing and configuring the External SATA RAID Adapters. To ensure personal safety and to protect your equipment and data, carefully read the information following the package content list before you begin installing.

#### Package Contents

If any items listed in your package is missing, please contact your local dealer before proceeding with installation **(disk drives and disk mounting brackets are not included)**:

ARC-11x0ML/12x1ML/12x1x Series External SATA RAID Adapters

- 1 x PCI-X/PCIe External SATA RAID Adapter in an ESD-protective bag
- 1 x Installation CD
- 1 x User Manual

# HARDWARE INSTALLATION

## 2.2 Board Layout

Follow the instructions below to install a External SATA RAID Card into your PC / Server.

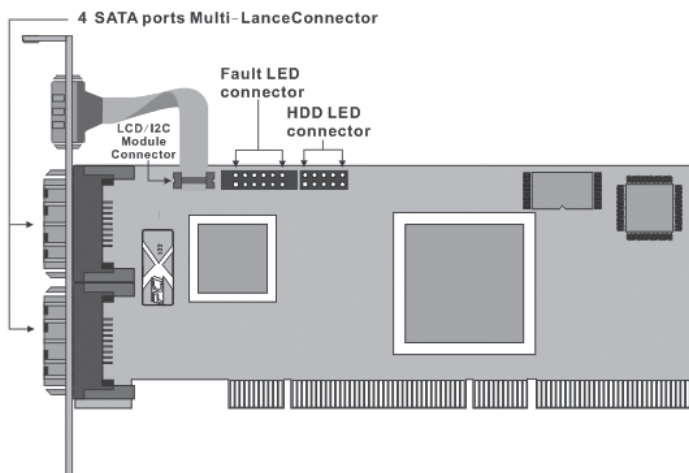


Figure 2-1, ARC-1110ML/1120ML (4/8-port PCI-X External SATA RAID Adapters)

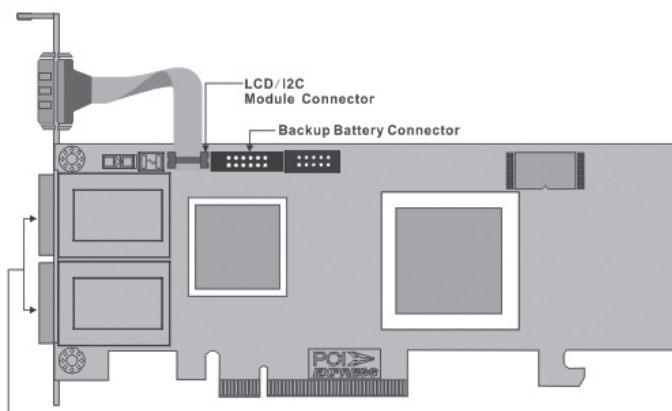


Figure 2-2, ARC-1210ML/1211x/1220/1221x (4-port PCI Express External SATA RAID Adapters)

# HARDWARE INSTALLATION

---

## Tools Required

An ESD grounding strap or mat is required. Also required are standard hand tools to open your system's case.

## System Requirement

The External SATA RAID Adapter can be installed in a universal PCI and requires a motherboard that:

ARC-11xx series required one of the following:

- Power Mac G5 with the PCI-X 64-bit 66/100/133 MHz, 3.3V.

ARC-12x1ML and ARC-12x1x series requires:

- Power Mac G5 and Mac Pro with the PCI-Express X8

The External SATA RAID Adapter may be connected to up to 4 or 8 SATA II hard drives using the supplied cables.

Optional I2C cables are required to connect drive activity LEDs and fault LEDs on the enclosure to the External SATA RAID Adapter.

## Installation Tools

The following items may be needed to assist with installing the External SATA RAID Adapter into an available PCI expansion slot.

- Small screwdriver
- Host system hardware manuals and manuals for the disk or enclosure being installed.

## Personal Safety Information

To ensure personal safety as well as the safety of the equipment:

- Always wear a grounding strap or work on an ESD-protective mat.
- Before opening the system cabinet, turn off power switches and unplug the power cords. Do not reconnect the power cords until you have replaced the covers.

## **Warning:**

High voltages may be found inside computer equipment. Before installing any of the hardware in this package or removing the protective covers of any computer equipment, turn off power switches and disconnect power cords. Do not reconnect the power cords until you have replaced the covers.

## **Electrostatic Discharge**

Static electricity can cause serious damage to the electronic components on this External SATA RAID Adapter. To avoid damage caused by electrostatic discharge, observe the following precautions:

- Do not remove the External SATA RAID Adapter from its anti-static packaging until you are ready to install it into a computer case.
- Handle the External SATA RAID Adapter by its edges or by the metal mounting brackets at its each end.
- Before you handle the External SATA RAID Adapter in any way, touch a grounded, anti-static surface, such as an unpainted portion of the system chassis, for a few seconds to discharge any built-up static electricity.

## **2.3 Installation**

Follow the instructions below to install an External SATA RAID Adapter into your PowerMac G5 or MacPro.

### **Step 1. Unpack**

Unpack and remove the External SATA RAID Adapter from the package. Inspect it carefully, if anything is missing or damaged, contact your local dealer.

### **Step 2. Shut down PowerMac G5 or MacPro**

Turn off computer and remove the AC power cord. Remove the system's cover. See the computer system documentation for instruction.

# HARDWARE INSTALLATION

---

## Step 3. Install the External SATA RAID Controllers

To install the External SATA RAID Adapter remove the mounting screw and existing bracket from the rear panel behind the selected PCI slot. Align the gold-fingered edge on the card with the selected PCI expansion slot. Press down gently but firmly to ensure that the card is properly seated in the slot, as shown in Figure 2-3. Next, screw the bracket into the computer chassis. ARC-11xxML adapters can fit in PCI-X slots of PowerMac G5. ARC-12x1ML and ARC-12x1x adapters require a PCI-Express 8X slot of MacPro.

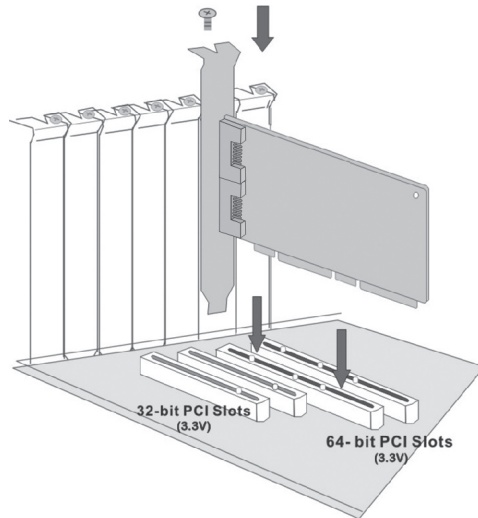


Figure 2-3, Insert External SATA RAID Adapter into a PCI-X slot

## Step 4. Install the Drivers in the External Box

Follow the instructions in your External Box User Guide for installing drives.

# HARDWARE INSTALLATION

## Step 5. Connect the External Box Cable

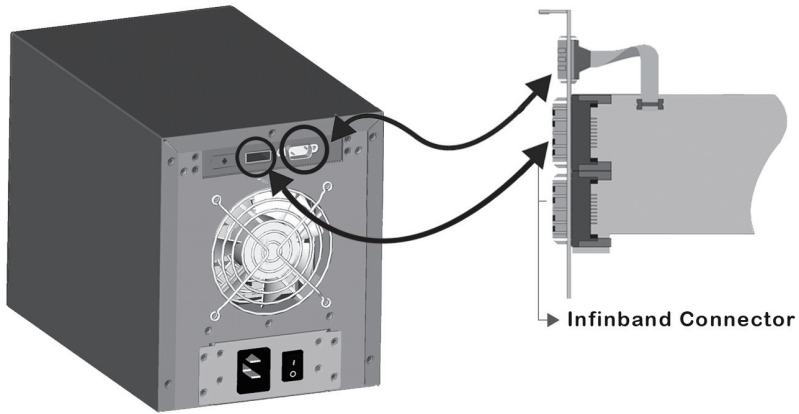


Figure 2-4, Connector connected between External SATA RAID Adapter & External Box

Model ARC-1110ML/1120ML have External Infiniband connectors, each of them can support up to four SATA drives.

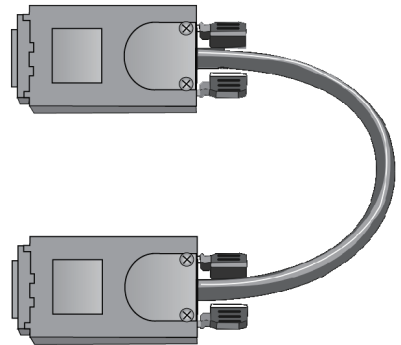


Figure 2-5, External Infiniband to Infiniband Cable

Model ARC-1210ML/1220ML/1211x/1221x have Min SAS 4x (SFF-8088) connectors, each of them can support up to four SATA drives.

# HARDWARE INSTALLATION

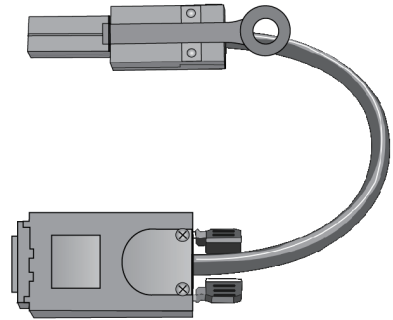
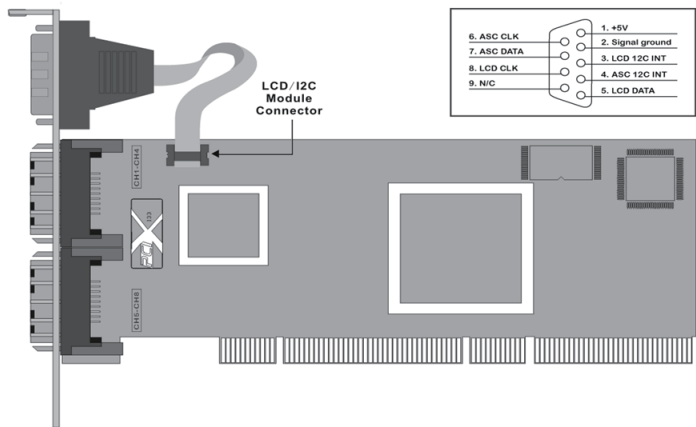


Figure 2-6, External Min SAS 4x to Infiniband Cable

## Step 6. Install the External I2C LED cable (optional)

You can also connect the I2C interface to a proprietary SATA back-plane enclosure. This signal provide the drive status information including activity LED and fault LED.

The following is the I2C signal name description for LCD & Fault/Activity LED.



PIN	Description	PIN	Description
1	power (+5V) 2 GND	3	LCD Module Interrupt 4 Fault/Activity Interrupt
5	LCD Module Serial Data 6 Fault/Activity clock	7	Fault/Activity Serial Data 8 LCD Module clock



# HARDWARE INSTALLATION

---

The following describes the fault/activity LED.

LED	Normal Status	Problem Indication
Activity LED	When the activity LED is illuminated, there is I/O activity on that disk drive. When the LED is dark; there is no activity on that disk drive.	N/A
Fault LED	When the fault LED is solid illuminated, there is no disk present.	When the fault LED is off, that disk is present and status is normal. When the Red LED is slow blinking (2 times/sec), that disk drive has failed and should be hot-swapped immediately. When the activity LED is illuminated and Red LED is fast blinking (10 times/sec) there is rebuilding activity on that disk drive.

## Step 7. Re-check the SATA HDD LED and Fault LED Signal connections

Be sure that the proper failed drive channel information is displayed by the Fault and HDD Activity LEDs. An improper signal connection will tell the user to “Hot Swap” the wrong drive. This will remove the wrong disk (one that is functioning properly) from the controller. This can result in failure and loss of system data.

## Step 8. Power up the System

Thoroughly check the installation, reinstall the computer cover, and reconnect the power cord cables. Turn on the power switch at the rear of the computer (if equipped) and then press the power button at the front of the host computer.

## Step 9. Installing the controller driver

Install the External SATA RAID Asapter driver into the existing Mac OSX operating system. Please refer to the Chapter 3, Driver Installation, for the detailed installation procedure.

# HARDWARE INSTALLATION

---

## **Step 10. Configuring volume set**

The External SATA RAID Adapter configures RAID functionality through the McRAID storage manager software. For this option, please refer to Chapter 4, Web Browser-Based Configuration menu.

## **Step 11. Making Volume Sets Available to Mac OS X**

When you create a volume through McRAID storage manager, the Mac OS X recognizes that a new disk is avail, and displays a message asking what you next want to do. It is similar as the following figure. If the message does not show up, start the Macintosh Disk Utility manually from the Finder. Follow the on-screen prompts to create a volume set and to assign a disk drive letter.

## **Step 12. Determining the Boot sequences**

The currently Mac OS X can not directly install the OS to the controller's volume and boot up from that volume. Areca External SATA RAID Adapter can use as a secondary storage. All Intel Macs use EFI to boot (not Open Firmware, which was used for PPC Macs). Areca has supported the EFI BIOS on its External PCIe SATA RAID adapter. You have other alternatively to add Areca volume set on the bootable device listing on the Mac Pro computer. You can follow the following procedure to add Areca PCIe SATA RAID controller on the bootable device listing.

(1). Upgrade the EFI BIOS from shipping <CD-ROM>\Firmware\Mac\ directory or from the [www.areca.com.tw](http://www.areca.com.tw), if the controllers default ship with a legacy BIOS. Please follow the Appendix A Upgrading the Flash ROM update process to update the legacy BIOS to EFI BIOS.

(2).Ghost (such as Carbon Copy Cloner ghost utility) the Mac OS X disk on the Mac Pro to the Areca External PCIe SATA RAID adapter volume set. Carbon Copy Cloner is an archival type of back up software. You can take your whole Mac OS X system and make a carbon copy or clone to Areca volume set like an other hard drive.

(3). Power up the Mac Pro machine, it will take about 30 seconds for controller firmware ready. This periodic will let the boot up screen blank before Areca volume in the bootable device list.

## 3. Driver & Software Installation

After hardware installation, the SATA disk drives connected to the External SATA RAID Adapter must be configured and the volume set units initialized by the controller before they are ready to use by the system.

### 3.1 Installation Procedures

You must have administrative level permissions to install Areca Mac Driver & Software. You can install Driver & Software on your Power Mac G5 or Mac Pro as below:

1. Insert the Areca Mac Driver & Software CD that came with your Areca External SATA RAID Adapter.
2. Double-click on the following file that resides at <CD-ROM>\packages\MacOS to add the installer on the Finder.
  - a). install\_mraid\_mac.dmg (For Power Mac G5)
  - b). install\_mraid\_macpro.dmg (For MacPro)
3. Launch the installer by double-clicking the install\_mraid\_mac or install\_mraid\_macpro virtual volume on the Finder.
4. Follow the installer steps to install Areca driver, archttp64 and arc\_cli utility at the same time.
5. Reboot your Power Mac G5 or MacPro system

Normally archttp64 and arc\_cli are installed at the same time you install the driver for your Areca external SATA RAID adapter. Once archttp64 and arc\_cli have been installed, the background task automatically starts each time you start your computer. There is one MARID icon showing on your desktop. This icon is for you to start up the McRAID storage manager (by archttp64) and arc\_cli utility.

Arc-cli can performance many tasks at the command line. You can download arc-cli manual from Areca website or from software CD <CD-ROM>\DOCS directory.

## 4. Web Browser-based Configuration

The McRAID storage manager is firmware-based and used to configure raid sets and volume sets. Because the utility resides in the External SATA RAID Adapter firmware and a HTML-based application which is accessible via the browser installed on your Mac operating system. The McRAID storage manager will be launched by ArchHttp Proxy Server which is installed at the same time you install the driver. This utility can be used to:

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

### 4.1 Start-up McRAID Storage Manager

You can start the McRAID Storage Manager in one of the following ways:

1. In the Desktop, double-click the MRAID icon. The archttp64 will be prompted, double-click on the archttp64 icon. Your web browser will open and go to the URL for McRAID Storage Manager.

Or

1-1. Launch your McRAID Storage Manager by entering `http://[localhost IP]:[port number]` in the web browser. The default listen port address `http://[localhost IP]:[81]` is stored in the `archttpsrv.conf` file during installation. Please reference Appendix E to change the listen port or edit the `archttpsrv.conf` if necessary.

(2). When connection is established, the System Login screen appears. The McRAID Storage Manager default User Name is "admin" and the Password is "0000"

# WEB BROWSER-BASED CONFIGURATION

## 4.2 SATA RAID controller McRAID Storage Manager

The McRAID Storage Manager firstly launched screen displays the current configuration of your SATA RAID Adapter. It displays the Raid Set List, Volume Set List, and Physical Disk List. The RAID set information, volume set information, and drive information can also be viewed by clicking on the "Raid Set Hierarchy" screen. The current configuration can also be viewed by clicking on "Raid Set Hierarchy" in the menu.

Quick Function


RaidSet Functions

VolumeSet Functions

Physical Drives

System Controls

Information

Areca Technology Corporation

Raid Set Hierarchy

Raid Set	IDE Channels	Volume Set(ChId/Ln)	Volume State	Capacity
Raid Set # 00	Ch01	ARC-1120-VOL#00 (00/00)	Normal	500.1GB
	Ch02			
Raid Set # 00	Ch03	ARC-1210-VOL#00 (00/00)	Normal	250.0GB
Raid Set # 00	Ch05	ARC-1260-VOL#00 (00/00)	Normal	250.0GB

IDE Channels

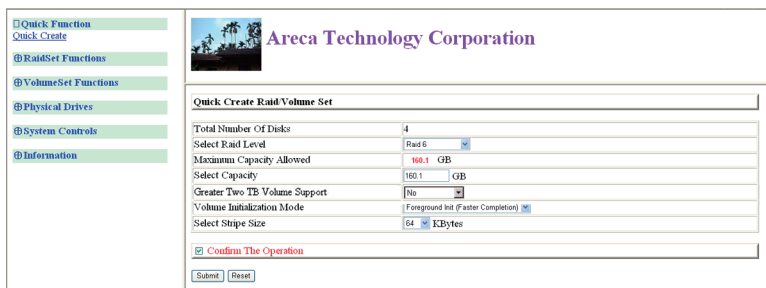
Channel	Usage	Capacity	Model
Ch01	Raid Set # 00	250.1GB	WDC WD2500SD-01ECB0
Ch02	Raid Set # 00	250.1GB	WDC WD2500SD-01ECB0
Ch03	Raid Set # 00	250.1GB	WDC WD2500SD-22HBB0
Ch04	N.A.	N.A.	N.A.
Ch05	Raid Set # 00	250.1GB	WDC WD2500SD-22HBB0
Ch06	N.A.	N.A.	N.A.
Ch07	N.A.	N.A.	N.A.
Ch08	N.A.	N.A.	N.A.

## 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.
RaidSet Functions	Create a customized raid set.
VolumeSet 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 LED).
System Controls	Setting the raid system configuration.
Information	Viewing the adapter information. The Raid Set Hierarchy can be viewed through the RaidSet Hierarchy item.

## 4.4 Quick Function



The screenshot shows the 'Quick Function' menu on the left with options: Quick Function, Quick Create, RAIDSet Functions, VolumeSet Functions, Physical Drives, System Controls, and Information. The main area is titled 'Areca Technology Corporation' and 'Quick Create RAID/Volume Set'. It contains a form with the following fields:

Quick Create RAID/Volume Set	
Total Number Of Disks	4
Select Raid Level	Raid 0
Maximum Capacity Allowed	160.1 GB
Select Capacity	160.1 GB
Greater Two TB Volume Support	No
Volume Initialization Mode	Foreground Init (Faster Completion)
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 Function and Volume Set Function if you prefer to customize your system.

The number of physical drives in the External SATA RAID Adapter determines the RAID levels that can be implemented with the RAID set. You can create a RAID set associated with exactly one volume set. The user can change the RAID level, stripe size, and capacity. A hot spare option is also created depending upon the existing configuration.

Click the "Confirm The Operation" check box and click on the Submit button in the Quick Create screen, the RAID set and volume set will start to initialize.

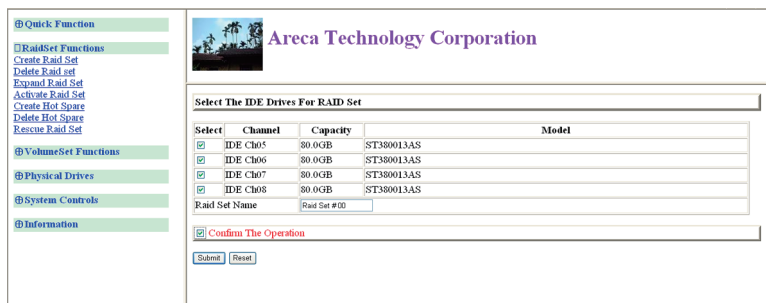
### **Note:**

If volume capacity exceeds 2TB, controller will show the Greater 2 TB volume Support sub-menu. Greater Two TB Volume Support No, 64bit LBA and for Windows.

For more details please download PDF file from **[ftp://ftp.areca.com.tw/RaidCards/Documents/Manual\\_Spec/Over2TB\\_050721.zip](ftp://ftp.areca.com.tw/RaidCards/Documents/Manual_Spec/Over2TB_050721.zip)**

## 4.5 RaidSet Functions

Use the "Raid Set Function" and "Volume Set Function" if you prefer to customize your system. 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.)



Select	Channel	Capacity	Model
<input checked="" type="checkbox"/>	IDE Ch05	30.0GB	ST330013AS
<input checked="" type="checkbox"/>	IDE Ch06	30.0GB	ST330013AS
<input checked="" type="checkbox"/>	IDE Ch07	30.0GB	ST330013AS
<input checked="" type="checkbox"/>	IDE Ch08	30.0GB	ST330013AS

Raid Set Name:

☒ Confirm The Operation

### 4.5.1 Create Raid Set

To create a raid set, click on the "Delete Raid Set" link. A "Select The Drive For RAID Set" screen will be displayed showing the drive(s) connected to the current controller. Click on the selected physical drives within the current raid set. The default raid set name will always appear as "Raid Set. #". Click the "Confirm The Operation" check box and click on the "Submit" button on the screen; the RAID set will start to initialize.

### 4.5.2 Delete Raid Set

To delete a RAID set, click on the "Deleted Raid Set" link. The "**Select The RAID SET To Delete**" screen is displayed showing all existing RAID sets in the current controller. Click the RAID set number you which to delete in the select column on the delete screen.

Click the "Confirm The Operation" check box and click on the "Submit" button in the screen to delete it.

# WEB BROWSER-BASED CONFIGURATION

---

## 4.5.3 Expand Raid Set

Use this option to expand a RAID set when a disk is added to your system. This function becomes active when at least one drive is available.

To expand a raid set, click on the "Expand Raid Set" link. Select the target RAID set to be expanded. Click the available disk and the "Confirm The Operation" check box and then click on the "Submit" button on the screen to add disks to the RAID set.

## 4.5.4 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 power-on the SATA RAID controller, the user can use the "Activate Raid Set" option to activate the RAID set. After the user completes this function, the Raid State will change to Degraded Mode.

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 SATA RAID controller will continue to work in degraded mode.

## 4.5.5 Create Hot Spare

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

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



# WEB BROWSER-BASED CONFIGURATION

## 4.5.6 Delete Hot Spare

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

Click the "Confirm The Operation" check box and click the "**Submit**" button on the screen to delete the hot spares.

## 4.5.7 Rescue Raid Set

When the system is powered off in the RAID set update/creation period, it possibly could disappear due to this abnormal condition. The "**RESCUE**" function can recover the missing RAID set information. The RAID adapter 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.

## 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.

Quick Function

RaidSet Functions

VolumeSet Functions

Create Volume Set

Delete Volume Set

Modify Volume Set


Check Volume Set

Stop Volume Set Check

Physical Drives

System Controls

Information

Areca Technology Corporation

Enter Volume Attribute On Raid Set # 00

Volume Name	Volume Set #00
Member Disks	4
Volume Raid Level	RAID 5
Max Capacity Allowed	100.1 GB
Select Volume Capacity	100.1 GB
Greater Two TB Volume Support	No
Volume Initialization Mode	Foreground (Faster Completion)
Volume Stripe Size	64 Kbytes
Volume Cache Mode	Write Back
Tagged Command Queuing	Enabled
SCSI Channel SCSI ID/SCSI LUN	0 : 0 : 0

☒ Confirm The Operation

Submit Reset

# WEB BROWSER-BASED CONFIGURATION

---

## 4.6.1 Create Volume Set

1. Volume sets of different RAID levels may coexist on the same raid set.
2. Up to 16 volume sets can be created by the SATA RAID Adapter.
3. The maximum addressable size of a single volume set is not limited to 2 TB because the controller is capable of 64-bit mode. However, the operating system itself may not be capable of addressing more than 2 TB. See the Areca website for details.

To create a volume set on a raid set, move the cursor bar to the main menu and click on the "Create Volume Set" link. This "Select The Raid Set To Create On It" screen will show all RAID set numbers. Click the RAID set number that to be used and then click the "Submit" button. The "create new volume set" option allows users to select the Volume name, capacity, RAID level, strip size, SCSI ID/LUN, Cache mode, and tag queuing.

### ● Volume Name

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

### ● Raid Level

Set the RAID level for the volume set. Highlight the desired Raid Level and press Enter.

The available RAID levels for the current volume set are displayed. Select a RAID level and press "Enter" to confirm.

### ● Capacity

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

### ● Greater Two TB Volume Support

If volume capacity exceeds 2TB, controller will show the "Greater 2 TB volume Support" sub-menu. Greater Two TB Volume Support No, 64bit LBA and For Windows options.

For more details please download PDF file from **[ftp://ftp.areca.com.tw/RaidCards/Documents/Manual\\_Spec/Over2TB\\_050721.zip](ftp://ftp.areca.com.tw/RaidCards/Documents/Manual_Spec/Over2TB_050721.zip)**

# WEB BROWSER-BASED CONFIGURATION

---

## ● Initialization Mode

Press "Enter" key to define fast initialization or Selected the Background (Instant Available). 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 Fast Initialization, the initialization proceeds must be completed before the volume set ready for system accesses.

## ● Strip Size

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

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

Note: RAID level 3 can't modify strip size.

## ● Cache Mode

The External SATA RAID Adapter supports Write-Through Cache and Write-Back Cache.

## ● SCSI Channel/SCSI ID/SCSI Lun

SCSI Channel: The External SATA RAID Adapter function is simulated as a SCSI RAID adapter. The host bus is represented as a SCSI channel. Choose the SCSI Channel.

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 SATA RAID controller is a large SCSI device. Assign an ID from a list of SCSI IDs.

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

## ● Tag Queuing

The Enabled option is useful for enhancing overall system performance under multi-tasking operating systems. The Command Tag (Drive Channel) function controls the SCSI command tag queuing support for each drive channel. This func-

# WEB BROWSER-BASED CONFIGURATION

---

tion should normally remain enabled. Disable this function only when using older SCSI drives that do not support command tag queuing

## 4.6.2 Delete Volume Set

To delete a volume set 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. Use this option to modify the volume set configuration. To modify volume set attributes from "Raid Set System" function, move the cursor bar to the volume set attribute menu and click it. The "modify value" screen appears. Move the cursor to an attribute item and then click the attribute to modify the value. After you complete the modification, click the "Confirm The Operation" check box and click the "Submit" button to complete the action. The user can modify all values except 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.

### **For Greater 2TB expansion:**

- If your system installed in the volume, do not expanded the volume capacity greater 2TB, currently OS can't support boot

- up from a greater 2TB capacity device.
- Expanded over 2TB used LBA64 mode. Please make sure your OS supports LBA 64 before expand it.

## 4.6.3.1 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 status area of the RaidSet Hierarchy screen when one RAID level to another, a volume set strip size changes or when a disk is added to a RAID set.

## 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 RaidSet Hierarchy in the main menu.

## 4.6.5 Stop VolumeSet Check

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

## 4.7 Physical Drive

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

Quick Function

RaidSet Functions


VolumeSet Functions

Physical Drives

- Create Pass Through
- Modify Pass Through
- Delete Pass Through
- Identify Drive

System Controls

Information

Areca Technology Corporation

Select the IDE drive For Pass Through

Select	Channel	Capacity	Model
<input checked="" type="radio"/>	IDE Ch06	80.0GB	ST390013AS
<input type="radio"/>	IDE Ch07	80.0GB	ST390013AS
<input type="radio"/>	IDE Ch08	80.0GB	ST390013AS

Enter Pass Through Disk Attribute

Volume Cache Mode

Write Back

Tagged Command Queuing

Enabled

SCSI Channel

SCSI\_ID

SCSI\_Lun

0

0

0

☒ Confirm The Operation

Submit

Reset

## 4.7.1 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 SATA RAID controller firmware, it cannot be a part of a volume set. The disk is available to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID firmware. The user can also select the cache mode, Tagged Command Queuing, SCSI channel/SCSI\_ID/SCSI\_LUN for this volume.

## 4.7.2 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 checkbox for the Pass-Through Disk from the pass-through drive pool and click on the "Submit" button to select drive. When the "Enter Pass-Through Disk Attribute" screen appears, modify the drive attribute values, as you want. After you complete the selection, mark the checkbox for "Confirm The Operation" and click on the "Submit" button to complete the selection action.

# WEB BROWSER-BASED CONFIGURATION

## 4.7.3 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 checkbox for “Confirm The Operation” and click the “Submit” button to complete the delete action.

## 4.7.4 Identify Selected Drive

To prevent removal of the wrong drive, the selected Fault LED will blink so as to physically locate the intended disk when “Identify Selected Drive” is selected. To identify the selected drive from the drives pool, click “Identify Selected Drive”. The “Select The IDE Device For Identification” screen appears mark the checkbox for the IDE device from the drive pool and select the Flash method. After completing the selection, click on the “Submit” button to identify selected drive.

## 4.8 System Controls

### 4.8.1 System Config

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

**Areca Technology Corporation**

**System Configurations**

System Beep Setting	Enabled
Background Task Priority	Low(20%)
JBOD/RAID Configuration	RAID
Max SATA Mode Supported	SATA300+NCQ
HDD Read Ahead Cache	Enabled
Stagger Power On Control	0.4
Empty HDD Slot LED	0.7
HDD SMART Status Polling	1.0
Disk Write Cache Mode	2.0
Disk Capacity Truncation Mode	3.0

☐ Confirm The Operation

# WEB BROWSER-BASED CONFIGURATION

---

## ● **System Beeper Setting**

The Alert Beeper function item is used to Disabled or Enable the External SATA RAID Adapter alarm tone generator.

## ● **Background Task Priority**

The Raid Rebuild Priority is a relative indication of how much time the controller devotes to a rebuild operation. The External SATA RAID Adapter allows the user to choose the rebuild priority (ultraLow, Low, Normal, 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 Disks**". It represents a volume set that is created by the concatenation of partitions on the disk. The OS can see all disks when this option is selected. It is necessary to delete a RAID set if the disks in that set are to be converted to JBOD mode.

## ● **Maximun SATA Supported**

The External SATA RAID Adapter can support up to SATA II, which runs up to 300MB/s. NCQ is a command protocol in Serial ATA that can only be implemented on native Serial ATA hard drives. It allows multiple commands to be outstanding within a drive at the same time. Drives that support NCQ have an internal queue where outstanding commands can be dynamically rescheduled or re-ordered, along with the necessary tracking mechanisms for outstanding and completed portions of the workload. The RAID subsystem allows user to choose the SATA Mode (slowest to fastest): SATA150, SATA150+NCQ, SATA300, SATA300+NCQ.

## ● **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.

## ● **Stagger Power on**

In a PC system with only one or two drives, the power is able to supply enough power to spin up both drives simultaneously. But in systems with more than two drives, the startup current from



# WEB BROWSER-BASED CONFIGURATION

---

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. New SATA drives have support staggered spin-up capabilities to boost reliability. Staggered spin-up is a very useful feature for managing multiple disk drives in a storage subsystem. It gives the host the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. Staggering drive spin-up in a multiple drive environment also avoids the extra cost of a power supply designed to meet short-term startup power demand as well as steady state conditions.

Areca has supported the fixed value staggered power up function in its previous version firmware. But from firmware version 1.39 and later, External SATA RAID Adapter has included the option for customer to select the disk drives sequentially stagger power up value. The values can be selected from 0.4ms to 6ms per step which powers up one drive.

## ● **Empty HDD Slot LED**

From firmware version 1.39 date: 04/01/2006 and later, the firmware has added the "Empty HDD Slot LED" option to setup the Failed LED light "ON" or "OFF". When each slot has a power LED for the HDD installed identify, user can set this option to "OFF". Choose this option "ON", the failed LED light will flash red light; if no HDD installed.

## ● **HDD SMART Status Polling**

An External SATA RAID enclosure has the hardware monitor in the dedicated backplane that can report HDD temperature status to the controller. However, PCI type controllers do not use backplanes if the drives are internal to the main server chassis. The type of enclosure cannot report the HDD temperature to the controller. For this reason, HDD SMART Status Polling was added to enable scanning of the HDD temperature function in the version 1.36 date: 2005-05-19 (and later). It is necessary to enable "HDD SMART Status Polling" function before SMART information is accessible. This function is disabled by default.

# WEB BROWSER-BASED CONFIGURATION

---

The following screen shot shows how to change the BIOS setting to enable the Polling function.

## ● **Disk Write Cache Mode**

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

## ● **Disk Capacity Truncation Mode**

External SATA RAID Adapters use drive truncation from differing vendors that are more likely 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 **No Truncation**.

**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. Areca drive Truncation mode **Multiples Of 10G** uses 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. Areca drive Truncation mode **Multiples Of 1G** uses the same capacity for both of these drives so that one could replace the other.

**No Truncation:** It does not truncate the capacity.

## 4.8.2 View Events/Mute Beeper

To view the External SATA RAID Adapter’s information, click on the “System Information” link. The External SATA RAID Adapter events Information screen appears.

Choose this option to view the system events information: Timer, Device, Event type, Elapse Time and Errors. The RAID system does not have a built-in real time clock. The Time information is the relative time from the External SATA RAID Adapter power on.

## 4.8.3 Generate Test Event

Use this feature is to generate events for testing purposes.

## 4.8.4 Clear Events Buffer

Use this feature to clear the entire events buffer information.

## 4.8.5 Modify Password

To set or change the External SATA RAID Adapter password, select "Raid System Function" from the menu and click on the "Change Password" link. The Modify System Password screen appears.

**The manufacture default password is set to 0000.** The password option allows user to set or clear the External SATA RAID Adapter's password protection feature. Once the password has been set, the user can only monitor and configure the External SATA RAID Adapter by providing the correct password.

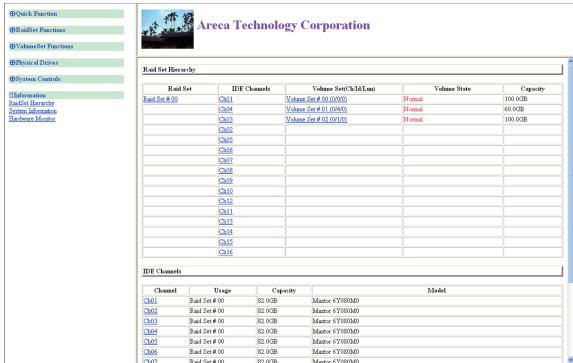
The password is used to protect the External SATA RAID Adapter from unauthorized entry. The adapter will check the password only when entering the Main menu from the initial screen. The External SATA RAID Adapter will automatically go back to the initial screen when it does not receive any command in ten seconds.

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. Afterwhich, no password checking will occur when entering the main menu from the starting screen.

## 4.8.6 Update Firmware

Please refer to the appendix A firmware utility.

## 4.9 Information



Raid Set	IDE Channels	Volume Set(s) (Set List)	Volume State	Capacity
Raid Set # 01	CH01	Volume Set # 01 (0000)	Normal	100 KGB
	CH04	Volume Set # 01 (0000)	Normal	400 KGB
	CH02	Volume Set # 02 (0000)	Normal	100 KGB
	CH05			
	CH06			
	CH07			
	CH08			
	CH09			
	CH10			
	CH11			
	CH12			
	CH13			
	CH14			
	CH15			
	CH16			

Channel	Usage	Capacity	Model
CH01	Raid Set # 01	02 KGB	Master CT1000AD
CH02	Raid Set # 01	02 KGB	Master CT1000AD
CH03	Raid Set # 01	02 KGB	Master CT1000AD
CH04	Raid Set # 01	02 KGB	Master CT1000AD
CH05	Raid Set # 01	02 KGB	Master CT1000AD
CH06	Raid Set # 01	02 KGB	Master CT1000AD
CH07	Raid Set # 01	02 KGB	Master CT1000AD

### 4.9.1 RaidSet Hierarchy

Use this feature to view the External SATA RAID Adapter current raid set, current volume set and physical disk configuration. Please reference the this chapter **“Configuring Raid Sets and Volume Sets”**

### 4.9.2 System Information

To view the External SATA RAID Adapter’s information, move the mouse cursor to the main menu and click on the “System Information” link. The “External SATA RAID Adapter Information” screen appears.

Use this feature to view the SATA RAID controller’s information. The controller name, firmware version, serial number, main processor, CPU data/Instruction cache size and system memory size/speed appear in this screen.

### 4.9.3 Hardware Monitor

To view the RAID adapter’s hardware monitor information, move the mouse cursor to the main menu and click the “Hardware Monitor” link. The “Hardware Information” screen appears.

The “Hardware Monitor Information” provides the temperature, and fan speed (I/O Processor fan) of the SATA RAID controller.

## Appendix A

### Upgrading Flash ROM Update Process

Since the External SATA RAID Adapter features flash firmware, it is not necessary to change the hardware flash chip in order to upgrade the RAID firmware. The user can simply re-program the old firmware through the In-Band PCI-X/PCIe bus or Out-of-Band Ethernet port McRAID Storage manager. New releases of the firmware are available in the form of a DOS file on the shipped CD or Areca's web site. The files available at the FTP site for each model contain the following files in each version:

ARCXXXNNN.BIN Software Binary Code (where "XXXX" refers to the model name and "NNNN" refers to the software code type)

ARCXXXBIOS.BIN :→ PCI card BIOS for system board using

ARCXXXBOOT.BIN :→ RAID controller hardware initialization

ARCXXXFIRM.BIN :→ RAID kernel program

ARCXXXMBR0.BIN:→ Master Boot Record for supporting Dual Flash Image in the External SATA II RAID Adapter

README.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 the ARCXXXBIOS.BIN for system M/B compatibility and ARCXXXFIRM.BIN for RAID function upgrades.

#### **Note:**

Please update all Binary Code (BIOS, BOOT and FIRM) before you reboot system. Otherwise, a mixed firmware package may hang the adapter.

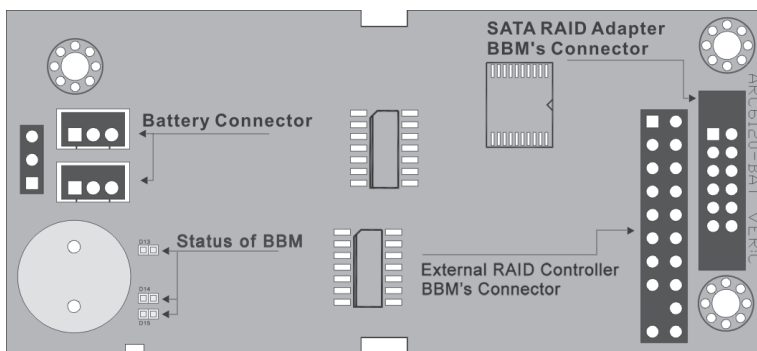
# APPENDIX

## Appendix B

### Battery Backup Module (ARC-6120-BAT)

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

#### BBM Components

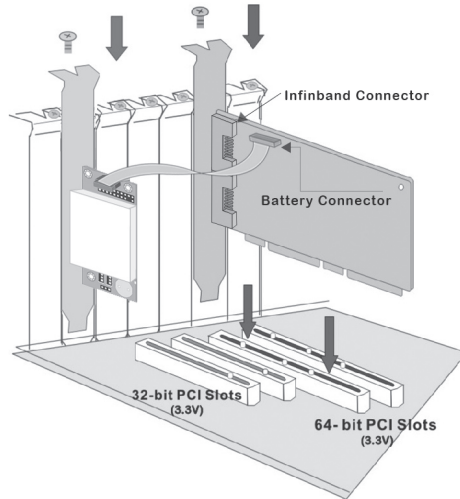


#### Status of BBM

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

#### Installation

1. Make sure all power to the system is disconnected.
2. Connector J1 is available for the optional battery backup module. Connect the BBM cable to the 12-pin battery connector on the controller.



3. Integrators may provide pre-drilled holes in their cabinet for securing the BBM using its three mounting positions.

## Battery Backup Capacity

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

Capacity	Memory Type	Battery Backup duration (Hours)
256MB DDR	Low Power (15mA)	74

## 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.

# APPENDIX

---

## Changing the Battery Backup Module

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

1. Shutdown the operating system properly. Make sure that cache memory has been flushed.
2. Disconnect the battery backup module cable from J2 on the SATA RAID controller.
3. Disconnect the battery pack cable from JP2 on the Battery Backup Module.
4. Install a new battery pack and connect the new battery pack to JP2.
5. Connect the Battery Backup Module to J2 on the External SATA RAID Adapter.
6. Disable the write-back function from the BIOS or Utility.

### **Note:**

Do not remove BBM while system running.

## BBM Specifications

### Mechanical

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

### Environmental

- Operating Temperature  
Temperature: -25° C to +60° C
- Humidity: 45-85%, non-condensing
- Storage Temperature  
Temperature: -40° C to 85° C
- Humidity: 45-85%, non-condensing

### Electrical

- Input Voltage  
+3.6VDC
- On Board Battery Capacity  
1100mAH (1\*1100mAH)



## Appendix C

### ArcHttp Configuration

The ArcHttp proxy server will automatically assign one additional port for setup its configuration. If you want to change the "archttp-srv.conf" setting up of ArcHttp configuration, For example: General configuration, Mail Configuration, and SNMP Configuration, please start Web Browser `http://localhost: Cfg Assistant`. Such as `http://localhost: 82`. The port number for ArcHttp configuration is McRAID storage manager port number plus 1.

The ArcHttp configuration starts as following:

- **General Configuration:**

### ARCHTTP Configurations

[General Configuration](#)  
[Mail Configuration](#)  
[SNMP Tran Configuration](#)

General Configurations	
Binding IP	0.0.0.0
HTTP Port#	8080
Display HTTP Connection Information To Console	127.0.0.1 192.168.0.44
Scanning PCI Device	<input checked="" type="radio"/> Yes <input type="radio"/> No
Scanning RS-232 Device	<input type="radio"/> Yes <input checked="" type="radio"/> No
Scanning Inband Device	<input type="radio"/> Yes <input checked="" type="radio"/> No
<input type="checkbox"/> Confirm The Operation	
<input type="button" value="Submit"/> <input type="button" value="Reset"/>	

Binding IP: Restrict ArcHttp proxy server to bind only single interface (If more than one physical network in the server).

HTTP Port#: Value 1~65535

Display HTTP Connection Information To Console: Select "Yes" to show Http send bytes and receive bytes information in the console.

Scanning PCI Device: Select "Yes" for ARC-1XXX series adapter

Scanning RS-232 Device: No

Scanning Inband Device: No

# APPENDIX

## • Mail (Alert by Mail) Configuration:

To enable the adapter to send the email function, you need to configure the SMTP function on the ArchHttp software. To enable the raid adapter email sending function, click on the “Mail Configuration” link. The SMTP Server Configurations menu will show as following:

### ARCHTTP Configurations

[General Configuration](#)  
[Mail Configuration](#)  
[SNMP Trap Configuration](#)

SMTP Server Configuration	
SMTP Server IP Address <input type="text"/>	
Mail Address Configurations	
Sender Name : <input type="text"/>	Mail Address : <input type="text"/>
Account : <input type="text"/>	Password : <input type="text"/>
MailTo Name1 : <input type="text"/>	Mail Address : <input type="text"/>
MailTo Name2 : <input type="text"/>	Mail Address : <input type="text"/>
MailTo Name3 : <input type="text"/>	Mail Address : <input type="text"/>
MailTo Name4 : <input type="text"/>	Mail Address : <input type="text"/>
Event Notification Configurations	
<input checked="" type="radio"/> Disable Event Notification	No Event Notification Will Be Sent
<input type="radio"/> Urgent Error Notification	Send Only Urgent Event
<input type="radio"/> Serious Error Notification	Send Urgent And Serious Event
<input type="radio"/> Warning Error Notification	Send Urgent, Serious And Warning Event
<input type="radio"/> Information Notification	Send All Event
<input type="checkbox"/> Notification For No Event	Notify User If No Event Occurs Within 24 Hours
<input type="checkbox"/> Confirm The Operation	
<input type="button" value="Submit"/> <input type="button" value="Reset"/>	

When you open the mail configuration page, you will see following settings:

### • SMTP Server Configuration:

SMTP server IP Address: Enter the SMTP server IP address which is not MCRAID manager IP.

Ex: 192.168.0.2

### • Mail Address Configurations:

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

Ex: RaidController\_1

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

Ex: RaidController\_1@areca.com.tw

Account: Enter the valid account if your SMTP mail server need authentication.

Password: Enter the valid password if your SMTP mail server need authentication.

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

Mail Address: Enter the alert receiver mail address

Ex: admin@areca.com.tw

## • Event Notification Configurations:

According to your requirement, set the corresponding event level :

Disable Event Notification: No event notification will be sent.

Urgent Error Notification: Send only urgent event

Serious Error Notification: Send urgent and serious event

Warning Error Notification: Send urgent, serious and warning Event

Information Notification: Send all event

Notification For No Event: Notify user if no event occurs within 24 hours

### **Note:**

Event Notification Table refer to Appendix D.

After you confirm and submit configurations, you can use Generate Test Event feature to make sure these settings are correct.

## • SNMP Traps Configuration:

To enable the controller to send the SNMP traps to client SNMP manager, such as Net-SNMP manager, you need to configure the SNMP function the ArchHttp software. To enable the raid controller SNMP traps sending function, click on the "SNMP Configuration" link. The SNMP Traps Configurations menu will show as following:

## ARCTHTTP Configurations

[General Configuration](#)

[Mail Configuration](#)

[SNMP Trap Configuration](#)

SNMP Trap Configurations					
SNMP Trap IP Address #1	192	168	0	173	port# 162
SNMP Trap IP Address #2	0	0	0	0	port# 162
SNMP Trap IP Address #3	0	0	0	0	port# 162
SNMP System Configurations					
Community	public				
SNMP Trap Notification Configurations					
<input type="radio"/> Disable Event Notification	No Event Notification Will Be Sent				
<input checked="" type="radio"/> Urgent Error Notification	Send Only Urgent Event				
<input type="radio"/> Serious Error Notification	Send Urgent And Serious Event				
<input type="radio"/> Warning Error Notification	Send Urgent, Serious And Warning Event				
<input type="radio"/> Information Notification	Send All Event				
<input type="checkbox"/> Confirm The Operation					
<input type="button" value="Submit"/> <input type="button" value="Reset"/>					

### ● SNMP Trap Configurations

Enter the SNMP Trap IP Address.

### ● SNMP System Configurations

Community name acts as a password to screen accesses to the SNMP agent of a particular network device. Type the community names of the SNMP agent in this field. Before access is granted to a request station, this station must incorporate a valid community name into its request; otherwise, the SNMP agent will deny access to the system. Most network devices use "public" as default of their community names. This value is case-sensitive.

### ● SNMP Trap Notification Configurations

Before the client side manager application accepts the External SATA RAID Adapter traps, it is necessary to integrate the MIB into the management application's database of events and status indicator codes. This process is known as compiling the MIB into the application. This process is highly vendor-specific and should be well-covered in the User's Guide of your SNMP application. Ensure the compilation process successfully integrates the contents of the ARECARAID.MIB file into the traps database. Please refer to Appendix D of Event Notification table.

## **Appendix D**

### **Event Notification Configurations**

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

#### **A. Device Event**

<b>Event</b>	<b>Level</b>	<b>Meaning</b>	<b>Action</b>
Device Inserted	Warning	HDD inserted	
Device Removed	Warning	HDD removed	
Reading Error	Warning	HDD reading error	Keep Watching HDD status, maybe it is caused by noise or HDD unstable.
Writing Error	Warning	HDD writing error	Keep Watching HDD status, maybe it is caused by noise or HDD unstable.
ATA Ecc Error	Warning	HDD ECC error	Keep Watching HDD status, maybe it is 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, maybe it is 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 maybe caused by noise. If always happen, please check power supply or contact to us.
Device Failed(SMART)	Urgent	HDD SMART failure	Replace HDD

# APPENDIX

PassThrough Disk Created	Inform	Pass Through Disk Created	
PassThrough Disk Modified	Inform	Pass Through Disk Modified	
PassThrough Disk Deleted	Inform	Pass Through Disk Deleted	

## B. Volume Event

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

## C. RAID Set Event

Event	Level	Meaning	Action
Create RaidSet	Warning	New Raidset 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			
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 raidset member disks missing before power on	Check disk information to find out which channel missing.
HTTP Log In	Serious	a HTTP login detected	

# APPENDIX

---

Telnet Log	Serious	a Telnet login detected	
InVT100 Log In	Serious	a VT100 login detected	
API Log In	Serious	a API login detected	
Lost Rebuilding/ MigrationLBA	Urgent	Some rebuilding/ migrationraidset member disks missingbefore power on.	Reinserted the missing member diskback, controller will continued theincompleted rebuilding/ migration.



## Appendix E

### Understanding RAID

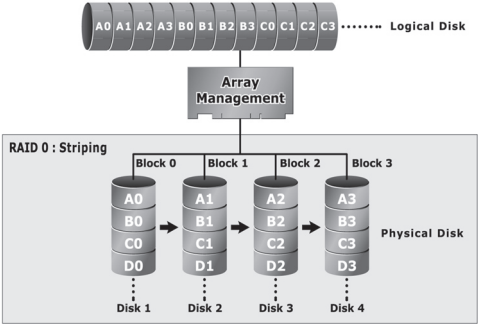
RAID is an acronym for Redundant Array of Independent Disks. It is an array of multiple independent hard disk drives that provides high performance and fault tolerance. The External SATA RAID Adapter implements several levels of the Berkeley RAID technology. An appropriate RAID level is selected when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

The External SATA RAID Adapter 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

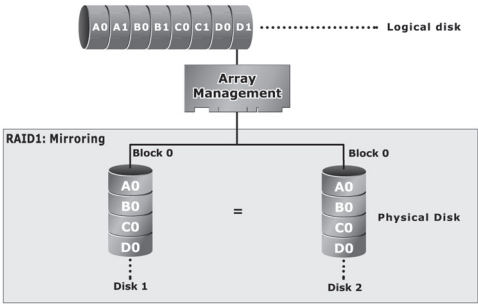
RAID 0, also referred to as striping, writes stripes of data across multiple disk drives instead of just one disk drive. RAID 0 does not provide any data redundancy, but does offer the best high-speed data throughput. RAID 0 breaks up data into smaller blocks and then writes a block to each drive in 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, due to a lack of redundancy, the reliability of RAID Level 0 is less because the entire array will fail if any one disk drive fails.

# APPENDIX



## RAID 1

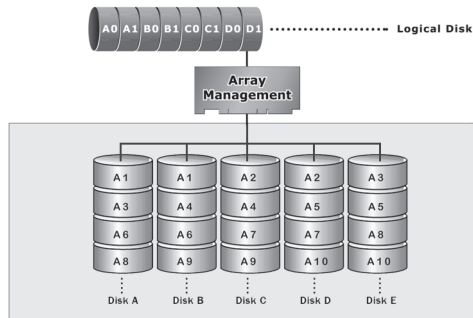
RAID 1 is also known as “disk mirroring”; data written on one disk drive is simultaneously written to another disk drive. Read performance will be enhanced if the array controller can, in parallel, access both members of a mirrored pair. During writes, there will be a minor performance penalty when compared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



## RAID 1E

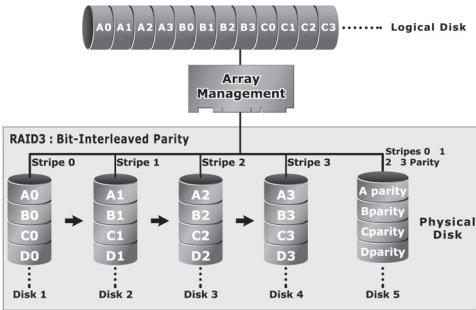
RAID 1E is a combination of RAID 0 and RAID 1, combining striping with disk mirroring. RAID Level 1E combines the fast per-

formance 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 1E 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 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. In fact this scheme - or a slightly modified version of it - is often referred to as RAID 1E and was originally proposed by IBM. When the number of disks comprising a RAID 1E is even, the striping pattern is identical to that of a traditional RAID 1E, with each disk being mirrored by exactly one other unique disk. Therefore, all the characteristics for a traditional RAID 1E apply to a RAID 1E when the latter has an even number of disks. Areca RAID 1E 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.



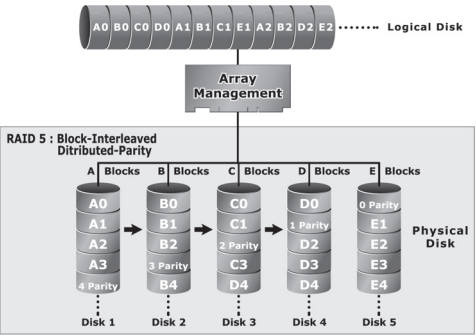
## RAID 3

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

1	Also known as mirroring All data replicated on N separated disks. N is almost always 2. This is a high availability solution, but due to the 100% duplication, it is also a costly solution. Half of drive capacity in array devoted to mirroring.	2	Lower than RAID 6; Higher than RAID 3, 5	Reads are higher than a single disk;  Writes similar to a single disk	Reads are twice as fast as a single disk;  Writes are similar to a single disk.
1E	Also known Block-Interleaved Parity. Data and parity information is subdivided and distributed across all disks. Parity must be the equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	3	Lower than RAID 6; Higher than RAID 3, 5	Transfer rates more similar to RAID 1 than RAID 0	Reads are twice as fast as a single disk;  Writes are similar to a single disk.
3	Also known Bit-Interleaved Parity. Data and parity information is subdivided and distributed across all disks. Parity data consumes the capacity of 1 disk drive. Parity information normally stored on a dedicated parity disk.	3	Lower than RAID 1, 1E, 6;  Higher than a single drive	Reads are similar to RAID 0;  Writes are slower than a single disk	Reads are close to being twice as fast as a single disk;  Writes are similar to a single disk.
5	Also known Block-Interleaved Distributed Parity. Data and parity information is subdivided and distributed across all disk. Parity data consumes the capacity of 2 disk drive.	3	Lower than RAID 1, 1E, 6;  Higher than a single drive	Reads are similar to RAID 0;  Writes are slower than a single disk	Reads are similar to RAID 0;  Writes are slower than a single disk.

6	RAID 6 provides the highest reliability. Similar to RAID 5, but does two different parity computations. RAID 6 offers fault tolerance greater than RAID 1 or RAID 5. Parity data consumes the capacity of 2 disk drives.	4	highest reliability	Reads are similar to RAID 0;  Writes are slower than a single disk	Reads are similar to RAID 0;  Writes are slower than a single disk.
---	--	---	---------------------	--	---

# APPENDIX

## Appendix F

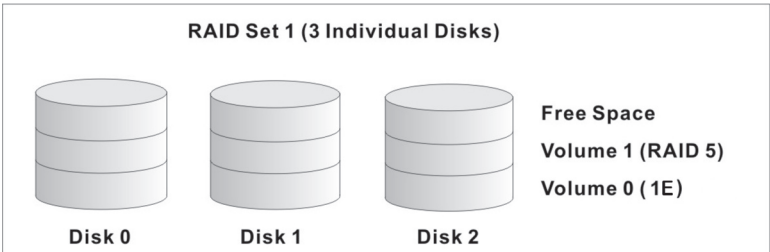
### RAID Concept

#### RAID Set

A RAID set is a group of disks connected to a External SATA RAID Adapter. 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, 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 External SATA RAID Adapter, 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 and 6 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.

### **• Array Roaming**

The External SATA RAID Adapters store RAID configuration information on the disk drives. The adapter therefore protect the configuration settings in the event of adapter failure. 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 External SATA RAID Adapters 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 RAID set. Then, data

# APPENDIX

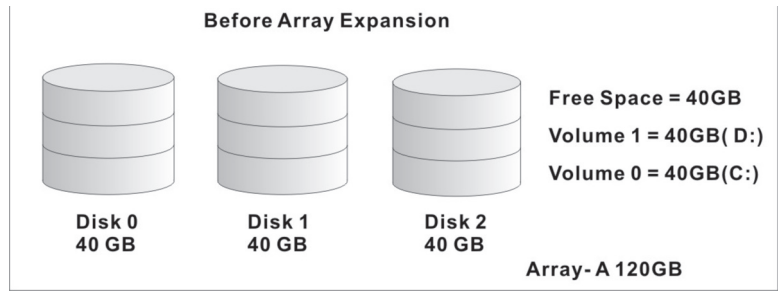
---

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.

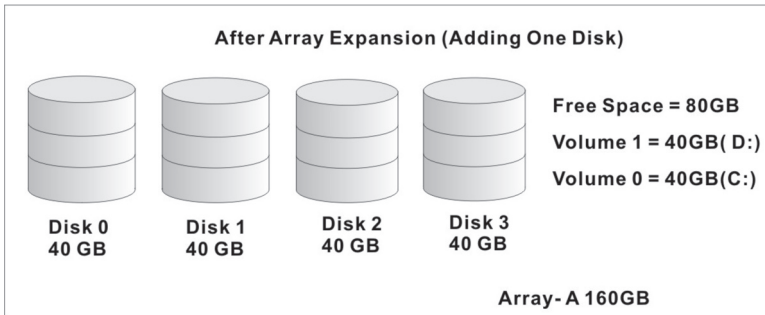
A disk, to be added to a RAID set, must be in normal mode (not failed), free (not spare, in a RAID set, or passed through to host) and must have at least the same capacity as the smallest disk capacity already in the RAID set.

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, 1E, 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 transitions 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 transitions to the "rebuilding" state.

The expansion process is illustrated as following figure.



The External SATA RAID Adapter 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.)



The External SATA RAID Adapter redistributes the original volume set over the original and newly added disks, using the same fault-tolerance configuration. The unused capacity on the expand raid set can then be used to create an additional volume sets, with a different fault tolerance setting if user need to change.

## ● Online RAID Level and Stripe Size Migration

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

The External SATA RAID Adapters can migrate both the RAID level and stripe size of an existing volume set, while the server is online and the volume set is in use. Online RAID level/stripe size migration can prove helpful during performance tuning activities as well as when additional physical disks are added to the External SATA RAID Adapter. 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 forth 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.

# APPENDIX

---

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, 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 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 lastest 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 Hot Spares

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

For this feature to work properly, the global hot spare must have at least the same capacity as the drive it replaces. Global Hot Spares only work with RAID level 1, 1E, 3, 5, or 6 volume set. You can configure up to three global hot spares with ARC-11x0ML/12xxML.

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

## ● **Hot-Swap Disk Drive Support**

The External SATA RAID Adapter chip includes a protection circuit that supports the replacement of 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 at prices much less than the cost of conventional SCSI hard disk RAID adapters. 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 External SATA RAID Adapters 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.

In the normal status, the newly installed drive will be reconfigured an online free disk. But, the newly-installed drive is auto-

# APPENDIX

---

matically 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 disappeared if the RAID subsystem 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, and 6.

## • Auto Rebuilding

If a hot spare is available, the rebuild starts automatically when a drive fails. The External SATA RAID Adapters 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.

The External SATA RAID Adapters will automatically restart the system and the rebuild 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 subsystem. The External SATA RAID Adapters 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 opera-

tion, such as rebuilding or migrating.

The External SATA RAID Adapter 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.

**Important:**

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

## 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 S.M.A.R.T. 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 External SATA RAID Adapter 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 administer 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.

# APPENDIX

---

External SATA RAID Adapter drives perform automatic defect re-assignment 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 recoverable 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 subsystem 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. For example, performing a consistency check of a mirrored drive assures that the data on both drives of the mirrored pair is exactly the same. To verify RAID 3, 5 or 6 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 External SATA RAID Adapters are armed with a Battery Back-up Module (BBM). While a Uninterruptible Power Supply (UPS) protects most servers from power fluctuations or failures, a BBM provides an additional level of protection. In the event of a power failure, a BBM supplies power to retain data in the External SATA RAID Adapter'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**

The External SATA RAID Adapter firmware is stored on the flash ROM and is executed by the I/O processor. The firmware can also be updated through the External SATA RAID Adapter bus port or Ethernet port (if equipped) without the need to replace any hardware chips. During the adapter 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 adapter will revert back to the last known version of firmware and continue operating. This reduces the risk of system failure due to firmware crash.