

Tri-Mode RAID Adapters

ARC-1886 Series

(PCIe Gen 4.0 Tri-Mode RAID Adapters)

User Manual

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FCC Statement

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

Manufacturer's Declaration for CE Certification

We confirm ARC-1886 has been tested and found compliant with the requirements in the council directive relating to the EMC Directive 2004/108/EC. Regarding to the electromagnetic compatibility, the following standards were applied:

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

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

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INTRODUCTION

1. Introduction

This section presents a brief overview of PCIe Gen 4.0 tri-mode RAID adapter, ARC-1886 series.

1.1 Overview

The new fourth generation ARC-1886 family offers advanced technology for increased performance and improved enterprise data protection. They were designed with 1.6 GHz dual core ROC processor, DDR4-2666 memory and PCIe 4.0 interface for the most performance-hungry database and IT applications. Based on the Broadcom SAS3916 and SAS3908 PCIe 4.0 x8 to SAS/SATA/PCIe RAID on Chip (ROC) adapter, the ARC-1886 RAID adapters can offer both PCIe Gen 4.0 host and 12Gb/s SAS/SATA/PCIe (NVMe) tri-Mode storage interfaces.

Unparalleled Performance

The ARC-1886 RAID adapters raise the standard to higher performance levels with several enhancements including new high performance 1.6GHz dual core ROC processor, a DDR4-2666 memory, 12Gb/s SAS/SATA/PCIe (NVMe) tri-Mode storage and high performance PCIe 4.0 interface bus interconnection. The low profile adapters by default support on-board 8G of ECC DDR4-2666 SDRAM memory. The ARC-1886 RAID adapters are compatible with existing PCI Express SFF-8639 Module (U.2) backplanes allowing users to boost performance for increasing bandwidth requirements. The ARC-1886 RAID adapters will provide maximum read/write performance improvements for the most performance-hungry database and IT applications.

Guaranteed Data Protection

Designed and leveraged with Areca's existing high performance RAID solution, ARC-1886 adapters provide superior levels performance and enterprise level data protection for the most demanding next-generation server and storage environments. The optional cache backup module provides power to the cache if it contains data not yet written to the drives when power is lost. The adapter

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based hardware encryption manages any kinds of drives attached to ARC-1886 adapter cards for higher levels of security. API code for third-party Enterprise Key Management systems integrates and manages encryption function. The on-board ROC incorporates advanced security through hardware secure boot. Hardware secure boot helps ensure that the firmware code running on ARC-1886 hardware platforms is authentic and unmodified.

Maximum Interoperability

SFF-TA-10001 Specification (U.3), which defines a common bay type for SAS, SATA and NVMe. This provides for a tri-mode host connection to the backplane that will accept a SAS/SATA or PCIe (NVMe) devices. The ARC-1886 RAID adapter can operate in all three modes concurrently servicing NVMe, SAS or SATA drives that offers the operation of NVMe, SAS or SATA storage devices in a single drive bay.. With a single ARC-1886 RAID adapter, system integrators can take full advantage of SAS, SATA and x1, x2, and x4 NVMe drives in existed U.2/future U.3 based backplane. Universal Backplane Management (UBM), which defines a common backplane control and management framework for a host to determine SAS/SATA/PCIe backplane capabilities. The ARC-1886 adapters are UBM ready, and customers can immediately integrate these adapters into their U.3 backplanes utilizing UBM. They support broad operating system including Windows, Linux (Open Source), FreeBSD (Open Source), Mac, VMware and more, along with key system monitoring features such as enclosure management (UBM, SES-2, SMP, & SGPIO) and SNMP function.

Intuitive RAID Management

The McBIOS RAID is a BIOS based utility used to simplify configure and manage RAID adapter via hot key at M/B BIOS boot-up screen. Without having to deploy an agent, you can also configure, deploy, update, and monitor the ARC-1886 series, via the GUI or through CLI utility. Customers can launch the firmware browser-based McRAID GUI through on-board Ethernet port or ArcHttp proxy server. Additionally, Areca ArcSAP storage manager allows the user to scan multiple RAID units in the network and perform GUI management operations across multiple RAID units.

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1.2 Features

Adapter Architecture

- Dual Core RAID-on-Chip (ROC) 1.6GHz processor
- x8 PCIe Gen 4.0 host interface
- 8GB on-board DDR4-2666 SDRAM with ECC
- Write-through or write-back cache support
- Support read/write cache allocation by policy
- Support up to 8/16 internal or 8 external 12Gb/s SAS/SATA/PCIe Gen 4.0 (NVMe) ports
- Multi-adapter support for large storage requirements
- BIOS boot array support for greater fault tolerance
- Supports up to 512 SATA or SAS devices using SAS expanders
- Up to 32 NVMe drives through PCIe switches
- Support for SAS tape devices and transport layer retries (TLR) for error handling
- Boot support for the uEFI host BIOS
- NVRAM for RAID event & transaction log
- Redundant flash image for adapter availability
- Cache backup module (CBM) ready (optional)
- Hardware secure boot ready
- Universal Bay Management (UBM) management
- SFF-9402 compliant connector pin-out

RAID Features

- RAID level 0, 1, 10(1E), 3, 5, 6, 30, 50, 60, Single Disk or JBOD
- Multiple RAID 0 and RAID 10(1E) support (RAID 00 and RAID 100)
- Multiple RAID selection
- Configurable stripe size up to 1MB
- Support HDD firmware update
- Online array roaming
- Online RAID level/stripe size migration
- Online capacity expansion and RAID level migration simultaneously
- Online volume set growth
- Instant availability and background initialization
- Support global and dedicated hot spare
- Automatic drive insertion/removal detection and rebuilding
- Support for native 4K and 512 byte sector SAS and SATA devices
- Support UNMAP command

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- S.M.A.R.T. support
- Multiple pairs SSD/HDD disk clone function
- SSD automatic monitor clone (AMC)
- Controller based hardware encryption function
- SED support for hardware disk encryption capable drives
- Support NTP protocol synchronize RAID adapter clock over onboard Ethernet port

Monitors/Notification

- System status indication through global activity/fault connector, individual fault connector, LCD/I²C connector and alarm buzzer
- SMTP support for email notification
- SNMP support for remote manager
- Enclosure management (SES-2, SMP and SGPIO) ready
- Support backplanes based on the SFF-TA-1005 specification (UBM)

RAID Management

- Field-upgradeable firmware in flash ROM
- Support Out-of-Band management via Ethernet port
- Hot key "boot-up" McBIOS RAID manager via M/B BIOS
- Web browser-based McRAID storage manager
- Support command-line interface (CLI)
- API library for developers to configure RAID adapters with their own utility
- Single Admin Portal (SAP) storage manager
- Support push button and LCD display panel (optional)

Operating System

- Windows 10 / Server 2019 / Server 2016
- Linux / FreeBSD / XenServer / unRAID
- VMware (Driver 7.x/6.7 support CLI in-band management)
- macOS

(For latest supported OS listing visit <https://www.areca.com.tw>)

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8-Ports PCIe Gen 4.0 Tri-Mode RAID Adapters		
Model Name	ARC-1886-8I	ARC-1886-8X
I/O Processor	Dual Core Tri-Mode RAID-on-Chip 1.6GHz	
Form Factor (L x H)	LP-MD2: 167.65(L) x 67.41(H) mm	
Host Bus Type	PCIe 4.0 x 8 Lanes	
Driver Connector	1 x SFF-8654 [x8]	2xSFF-8644 [x4]
Drive Support	12Gb/s SAS, 6Gb/s SATA, Gen 4.0 PCIe (NVMe)	
CBM Support	ARC-1886-CBM	
RAID Level	0, 1, 1E, 3, 5, 6, 10, 30, 50, 60, Single Disk, JBOD	
On-Board Cache	8GB on-board DDR4-2666 SDRAM	
Management Port	In-Band: PCIe Out-of-Band: BIOS, LCD, LAN Port	
Enclosure Ready	Individual Fault Header, SGPIO, SMP, UBM and SES2	
Power Consumption	Approximately 12 Watts	

12/16-Ports PCIe Gen 4.0 Tri-Mode RAID Adapters		
Model Name	ARC-1886-4X8I	ARC-1886-4X12I
I/O Processor	Dual Core Tri-Mode RAID-on-Chip 1.6GHz	
Form Factor (L x H)	LP-MD2: 167.65(L) x 67.41(H) mm	
Host Bus Type	PCIe 4.0 x 8 Lanes	
Driver Connector	1 x SFF-8654 [x8] 1 x SFF-8644 [x4]	2 x SFF-8654 [x8] 1 x SFF-8644 [x4]
Drive Support	12Gb/s SAS, 6Gb/s SATA, Gen 4.0 PCIe (NVMe)	
CBM Support	ARC-1886-CBM	
RAID Level	0, 1, 1E, 3, 5, 6, 10, 30, 50, 60, Single Disk, JBOD	
On-Board Cache	8GB on-board DDR4-2666 SDRAM	
Management Port	In-Band: PCIe Out-of-Band: BIOS, LCD, LAN Port	
Enclosure Ready	Individual Fault Header, SGPIO, SMP, UBM and SES2	
Power Consumption	Approximately 14 Watts	

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16-Ports PCIe Gen 4.0 Tri-Mode RAID Adapters		
Model Name	ARC-1886-8X8I	ARC-1886-16I
I/O Processor	Dual Core Tri-Mode RAID-on-Chip 1.6GHz	
Form Factor (L x H)	LP-MD2: 167.65(L) x 64.41(H) mm	
Host Bus Type	PCIe 4.0 x 8 Lanes	
Driver Connector	1 x SFF-8654 [x8] 2 x SFF-8644 [x4]	2 x SFF-8654 [x8]
Drive Support	12Gb/s SAS, 6Gb/s SATA, Gen 4.0 PCIe (NVMe)	
CBM Support	ARC-1886-CBM	
RAID Level	0, 1, 1E, 3, 5, 6, 10, 30, 50, 60, Single Disk, JBOD	
On-Board Cache	8GB on-board DDR4-2666 SDRAM	
Management Port	In-Band: PCIe Out-of-Band: BIOS, LCD, LAN Port	
Enclosure Ready	Individual Fault Header, SGPIO, SMP, UBM and SES2	
Power Consumption	Approximately 14 Watts	

HARDWARE INSTALLATION

2. Hardware Installation

This section describes the procedures for installing the tri-mode RAID adapters.

2.1 Before You First Installing

Thanks for purchasing the tri-mode RAID adapter as your RAID data storage system. This user manual gives simple step-by-step instructions for installing and configuring the tri-mode RAID adapter. To ensure personal safety and to protect your equipment and data, reading the following information package list carefully before you begin installing.

Package Contents

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

- 1 x Low-profile bracket
- 1 x Tri-mode RAID adapter in an ESD-protective bag
- 1 x ARC-1886 series quick installation guide

Note:

Low-profile bracket has included on the low profile board shipping package.

2.2 Board Layout

The x8 SFF-8654 (SlimSAS) connector is used for the ARC-1886 internal connections. The internal connector can direct attach to SAS, SATA, NVMe or drive attached through PCIe switches or SAS expanders using the proper cable. The ARC-1886 external SFF-8644 connectors support PCIe and SAS connections which can connect to PCIe switches, SAS expanders or directly attached SAS/SATA drive box. This section provides the board layout and connector/jumper for the tri-mode RAID adapter.

HARDWARE INSTALLATION

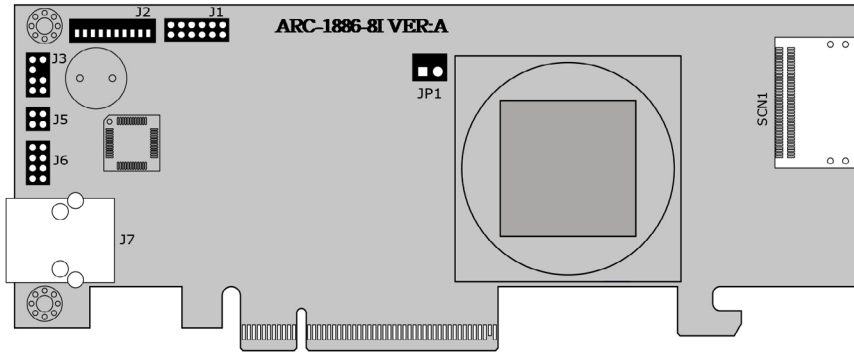


Figure 2-1, ARC-1886-8I Top View

Connector	Type	Description
1. (J1)	Manufacture Purpose Port	12-pin header
2. (J2)	Cache Backup Module Connector	10-pin box header
3. (J3)	I ² C/LCD Connector	7-pin header
4. (J5)	Global Fault/Activity LED	4-pin header
5. (J6)	Individaul Fault LED Header	8-pin header
6. (J7)	Ethernet Port	RJ45
7. (SCN1)	Storage Connection Connector 1-8 Ports (Internal)	x8 SFF-8654
8. (JP1)	Fan Connector	2-pin box header

Table 2-1, ARC-1886-8I Connectors

HARDWARE INSTALLATION

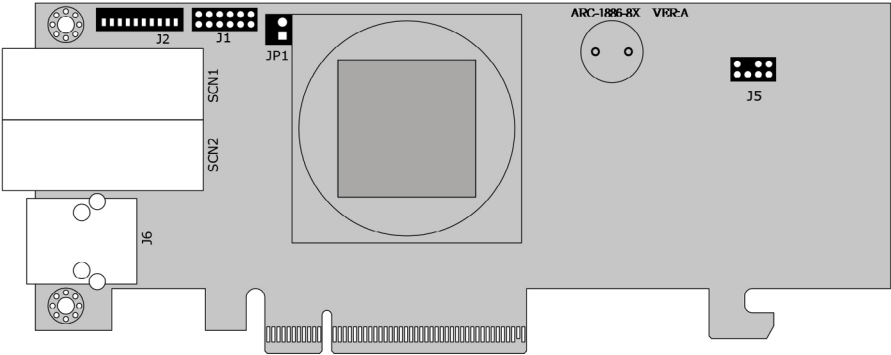


Figure 2-2, ARC-1886-8X Top View

Connector	Type	Description
1. (J1)	Manufacture Purpose Port	12-pin header
2. (J2)	Cache Backup Module Connector	10-pin box header
3. (J5)	I ² C/LCD Connector	7-pin header
4. (J6)	Ethernet Port	RJ45
5. (SCN1)	Storage Connection Connector 1-4 Ports (External)	x4 SFF-8644
6. (SCN2)	Storage Connection Connector 5-8 Ports (External)	x4 SFF-8644
7. (JP1)	Fan Connector	2-pin box header

Table 2-2, ARC-1886-8X Connectors

HARDWARE INSTALLATION

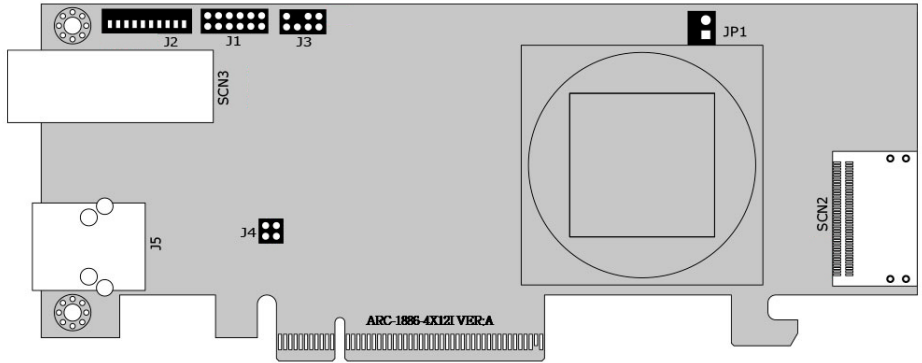


Figure 2-3, ARC-1886-4X8I Top View

Connector	Type	Description
1. (J1)	Manufacture Purpose Port	12-pin header
2. (J2)	Cache Backup Module Connector	10-pin box header
3. (J3)	I ² C/LCD Connector	7-pin header
4. (J4)	Global Fault/Activity LED	4-pin header
5. (J5)	Ethernet Port	RJ45
6. (SCN2)	Storage Connection Connector 1-8 Ports (Internal)	x8 SFF-8654
7. (SCN3)	Storage Connection Connector 9-12 Ports (External)	x4 SFF-8644
8. (JP1)	Fan Connector	2-pin box header

Table 2-3, ARC-1886-4X8I Connectors

HARDWARE INSTALLATION

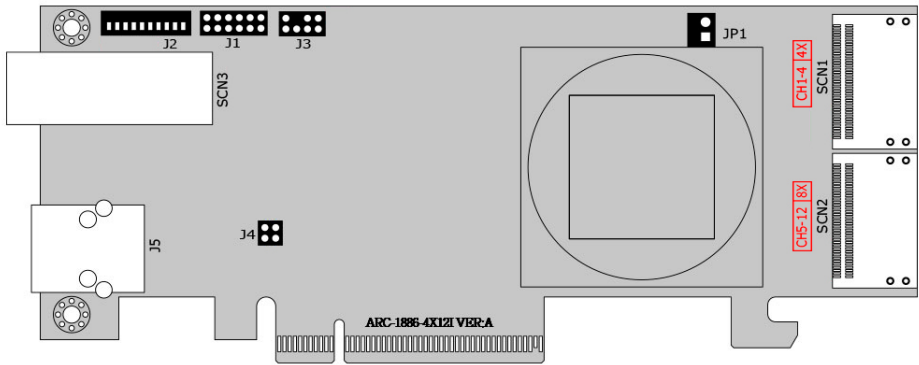


Figure 2-4, ARC-1886-4X12I Top View

Connector	Type	Description
1. (J1)	Manufacture Purpose Port	12-pin header
2. (J2)	Cache Backup Module Connector	10-pin box header
3. (J3)	I ² C/LCD Connector	7-pin header
4. (J4)	Global Fault/Activity LED	4-pin header
5. (J5)	Ethernet Port	RJ45
6. (SCN1)	Storage Connection Connector 1-4 Ports (Internal)	x8 SFF-8654
7. (SCN2)	Storage Connection Connector 5-12 Ports (Internal)	x8 SFF-8654
8. (SCN3)	Storage Connection Connector 13-16 Ports (External)	x4 SFF-8644
9. (JP1)	Fan Connector	2-pin box header

Table 2-4, ARC-1886-4X12I Connectors

HARDWARE INSTALLATION

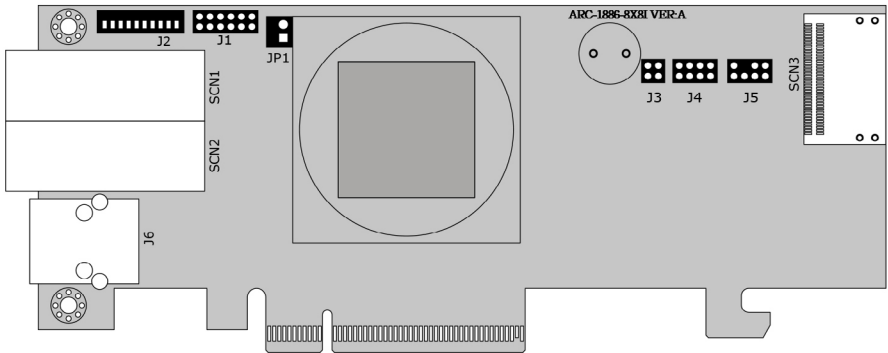


Figure 2-5, ARC-1886-8X8I Top View

Connector	Type	Description
1. (J1)	Manufacture Purpose Port	12-pin header
2. (J2)	Cache Backup Module Connector	10-pin box header
3. (J3)	Global Fault/Activity LED	4-pin header
4. (J4)	Individaul Fault LED Header	8-pin header
5. (J5)	I ² C/LCD Connector	7-pin header
6. (J6)	Ethernet Port	RJ45
7. (SCN1)	Storage Connection Connector 1-4 Ports (External)	x4 SFF-8644
8. (SCN2)	Storage Connection Connector 5-8 Ports (External)	x4 SFF-8644
9. (SCN3)	Storage Connection Connector 9-16 Ports (Internal)	x8 SFF-8654
10. (JP1)	Fan Connector	2-pin box header

Table 2-5, ARC-1886-8X8I Connectors

HARDWARE INSTALLATION

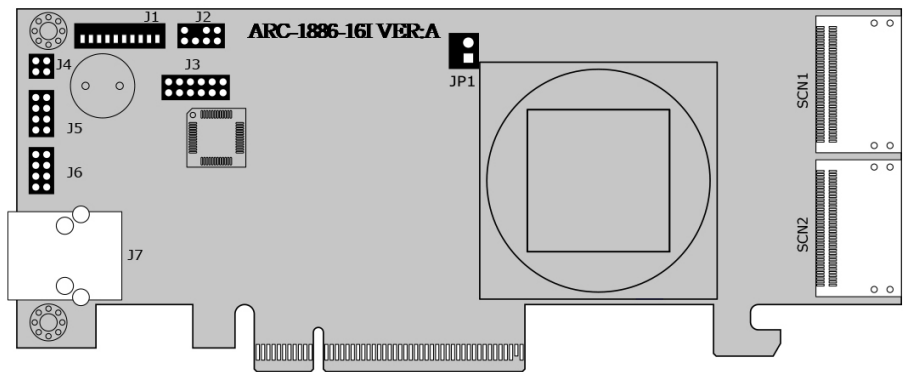


Figure 2-6, ARC-1886-16I Top View

Connector	Type	Description
1. (J1)	Cache Backup Module Connector	10-pin box header
2. (J2)	I ² C/LCD Connector	7-pin header
3. (J3)	Manufacture Purpose Port	12-pin header
4. (J4)	Global Fault/Activity LED	4-pin header
5. (J5,J6)	Individaul Fault LED Header	8-pin header
6. (J7)	Ethernet Port	RJ45
7. (SCN1)	Storage Connection Connector 1-8 Ports (Internal)	x8 SFF-8654
8. (SCN2)	Storage Connection Connector 9-16 Ports (Internal)	x8 SFF-8654
9. (JP1)	Fan Connector	2-pin box header

Table 2-6, ARC-1886-8X8I Connectors

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 tri-mode RAID adapter can be installed in an universal PCIe slot and requires a motherboard that:

ARC-1886 series RAID adapters requires:

- Comply with the PCIe 4.0 x8 lanes
It can work on the PCIe 4.0 x1, x4, x8, and x16 signal with x8 or x16 mechanical slot M/B.
- Backward-compatible with PCIe 1.0/2.0/3.0

Installation Tools

The following items may be needed to assist with installing the tri-mode RAID adapter into an available PCIe expansion slot.

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

Personal Safety Instructions

Use the following safety instructions to help you protect your computer system from potential damage and to ensure your own personal safety.

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

HARDWARE INSTALLATION

Electrostatic Discharge

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

- Do not remove the RAID adapter from its antistatic packaging until you are ready to install it into a computer case.
- Handle the RAID adapter by its edges or by the metal mounting brackets at its each end.
- Before you handle the 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.

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.

HARDWARE INSTALLATION

2.3 Installation

Use the instructions below to install a tri-mode RAID adapter.

Step 1. Unpack

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

Step 2. Power PC/Server Off

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

Step 3. Install the Tri-mode RAID Adapters

To install the tri-mode RAID adapter, remove the mounting screw and existing bracket from the rear panel behind the selected PCIe slot. Align the gold-fingered edge on the card with the selected PCIe slot. Press down gently but firmly to ensure that the card is properly seated in the slot, as shown in Figure 2-7. Then, screw the bracket into the computer chassis. ARC-1886 series adapters require a PCIe 4.0 x8 slot for better performance.

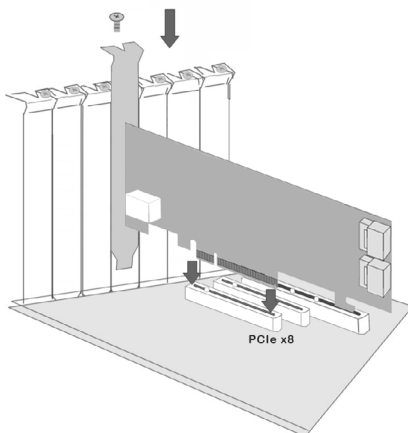


Figure 2-7, Insert into a PCIe Slot

HARDWARE INSTALLATION

Step 4. Mount the Drives

You can connect the SAS/SATA/NVMe drives to the adapter through direct cable and backplane solutions.

(1). In the direct connection:

The SAS/SATA/NVMe drives are directly connected to tri-mode RAID adapter PHY port with proper multi protocol cables. The tri-mode RAID adapter can support up to 16 PHY ports. Remove the front bezel from the computer chassis and install the cages or SAS/SATA/NVMe drives in the computer chassis. Loading drives to the drive tray if cages are installed. Be sure that the power is connected to either the cage backplane or the individual drives.

(2) In the backplane solution:

The SAS/SATA/NVMe drives are directly connected to system backplane or through an expander board. The number of SAS/SATA/NVMe drives is limited to the number of slots available on the backplane. Some backplanes support daisy chain expansion to the next backplanes.

• SAS/SATA Support

The following table shows the maximum number of tri-mode RAID adapter supported:

	Disks/Enclosure	Expander	Disks/Adapter	Volume
Max No.	128	12	256	128

Note:

The maximum no. is 32 disk drives included in a single RAID set.

HARDWARE INSTALLATION

• PCIe (NVMe) Support

The following table indicates the maximum directly attached number of NVMe drives or switches RAID adapter supported:

Controller	x4 Switch	x4 NVMe	x2 NVMe	x1 NVMe
ARC-1886-6N2I	N/A	2	6	6
ARC-1886-4N8I	2	2	8	12
ARC-1886-4N8X	2	0	4	4
ARC-1886-8X8I	4	2	4	8
ARC-1886-16I	4	4	8	16
ARC-1886-8I	2	2	4	8
ARC-1886-8X	2	0	0	0

Note:

The maximum no. is 24 NVMe drives through the PCIe switches per ARC-1886 RAID adapter. It does not support switch connections wider than x4.

Step 5. Install Storage Connection Cable

SFF-8612 or SFF-8654 are the preferred connectors to use for NVMe backplane or multiprotocol backplanes based on the SFF-TA-1001 universal bay definition (UBM). The preferred I/O connector for server legacy SAS/SATA backplanes is the internal SFF-8087/8643 connector.

For backplane connector supporting, please refer to the system backplane manual and choose the proper cable from Section 2.4 Storage cables for installation.

The following diagrams show how to cable a adapter to the drive or backplane.

HARDWARE INSTALLATION

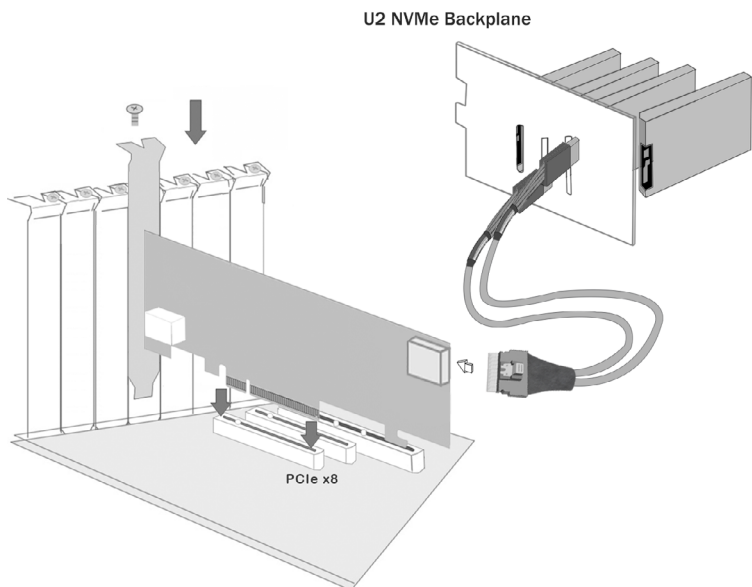


Figure 2-8, Connecting to NVMe Backplane

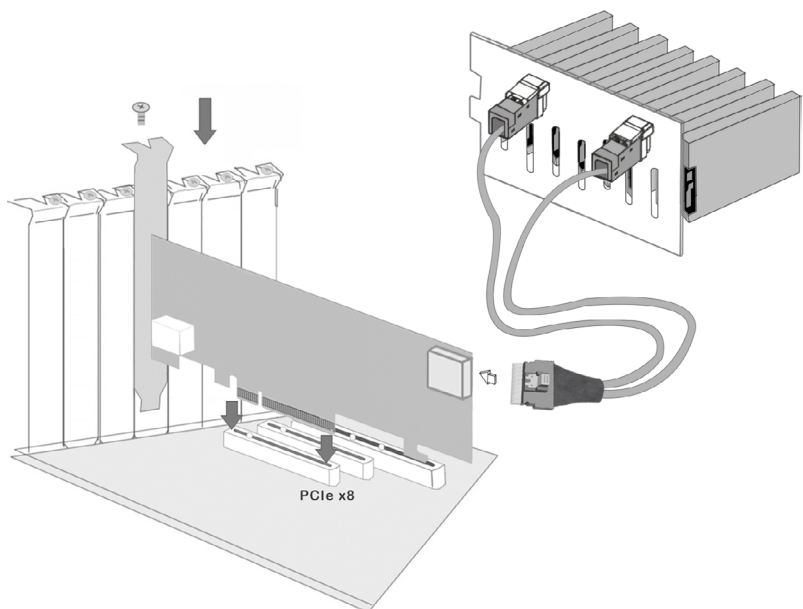


Figure 2-9, Connecting to HDD Backplane

HARDWARE INSTALLATION

Step 6. Install the LED Cable (Optional)

The ARC-1886 supports backplane management and LED operation for below backplane.

- (1). Backplane management of NVMe only,
- (2). SGPIO for SAS/SATA only legacy backplane management ,
- (3). Multiprotocol backplanes based on the SFF-TA-1005 specification (UBM), or
- (4). Old version SATA backplane using LED cable header for the fault/activity status

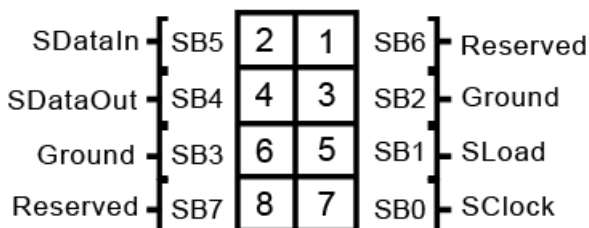
SFF-8612 or SFF-8654 are the preferred connectors to use for NVMe backplane or multiprotocol backplanes based on the SFF-TA-1001 universal bay definition (UBM). The preferred I/O connector for server SAS/SATA backplanes is the internal SFF-8087/8643 connector. Those connectors have included six pins side-band signals for backplane management and LED operation. For backplane without side-band signals supporting, please refer to Section 2.4 LED cables for fault/activity LED cable installation.

The following signals define the SGPIO assignments for the SFF-8654 in the 12Gb/s SAS/SATA RAID adapter.

Pin	Description	Pin	Description
SideBand0	SClock (Clock signal)	SideBand1	SLoad (Last clock of a bit stream)
SideBand2	Ground	SideBand3	Ground
SideBand4	SDataOut (Serial data output bit stream)	SideBand5	SDataIn (Serial data input bit stream)
SideBand6	Reserved	SideBand7	Reserved

The SFF-8654 to SAS/SATA with sideband cable follows the SFF-8448 specification. The SFF-8448 sideband signals cable is reserved for the backplane with header on it. The following signal defines the sideband connector which can work with Areca sideband cable on its SFF-8654 to SAS/SATA cable.

HARDWARE INSTALLATION



Sideband Pin Definitions

The sideband header is located at backplane. For SGPIO to work properly, please connect the 8-pin sideband cable to the sideband header as shown above.

Step 7. Adding a CBM Backup Module (Optional)

Please refer to Appendix B of the user manual for installing the cache backup module (CBM) in your ARC-1886 tri-mode RAID adapter.

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. Install the Adapter Driver

For a new system:

- Driver installation usually takes places as part of operating system installation. Please refer to Chapter 4 "Diver Installation" of the user manual for the detailed installation procedure.

In an existing system:

- To install the adapter driver into the existing operating system. For the detailed installation procedure, please refer to the Chapter 4 "Driver Installation" of the user manual.

HARDWARE INSTALLATION

Step 10. Install ArchHTTP Proxy Server

The tri-mode RAID adapter firmware has embedded the web-browser McRAID storage manager. ArchHTTP proxy server will launch the web-browser McRAID storage manager. It provides all of the creation, management and monitor tri-mode RAID adapter status. Please refer to the Chapter 5 of the user manual for the detail ArchHTTP Proxy Server Installation. For SNMP agent function, please refer to Appendix C of the user manual.

Step 11. Configure Volume Set

The adapter configures RAID functionality through the McBIOS RAID manager. Please refer to Chapter 3 of the user manual, McBIOS RAID Manager, for the detail. The RAID adapter can also be configured through the McRAID storage manager with ArchHTTP proxy server installed or through on-board LAN port and LCD module (refer to LCD manual). For McRAID storage manager option, please refer to Chapter 6 of the user manual, Web Browser-Based Configuration.

Step 12. Determining the Boot Sequences

For PC system:

Tri-mode RAID adapter is a bootable adapter. If your system already contains a bootable device with an installed operating system, you can set up your system to boot a second operating system from the new adapter. To add a second bootable adapter, you may need to enter setup of motherboard BIOS and change the device boot sequence so that the new RAID adapter heads the list. If the system BIOS setup does not allow this change, your system may be not configurable to allow the tri-mode RAID adapter to act as a second boot device.

For Intel-based Mac system:

Areca adapter has supported the EFI BIOS on the PCIe 4.0 tri-mode RAID adapter. You have other alternatively to add volumes on the Intel-based Mac bootable device listing. You can follow the following procedures to add tri-mode RAID adapter on the Mac bootable device listing.

HARDWARE INSTALLATION

1. Set the BIOS selection in System Controls: Advance Configuration to "uEFI" option for Intel-based MacPro boot.
2. Download macOS and DiskMaker X. Follow the DiskMaker X to make a bootable macOS USB install drive.
3. Restart your Mac and after you hear the chime sound, press the Option (Alt) key until you see the option to choose the flash drive to boot from.
4. Follow the on-screen prompts to complete Areca Volume Upgrade and Clean Install of macOS. Power up the Intel-based Mac and Areca volume will be added in the bootable device automatically.

HARDWARE INSTALLATION

2.4 Storage Connection Cables

You can connect the end devices to each other through direct cables or through the PCIe switch or SAS expander backplane connections. The following is an example of some internal storage connection cables and an external storage connection cable. Choose the proper cable for the given backplane type and connectors.

2.4.1 Internal SFF-8654[x8] to 2x U.2 SFF-8639 [x4]: Direct NVMe

This cable is used for direct connection between the tri-mode RAID adapter internal connectors and a U.2 NVMe drive. The following diagram shows the picture of SFF-8654[x8] to 2x U.2 SFF-8639[x4]: Direct NVMe cables.

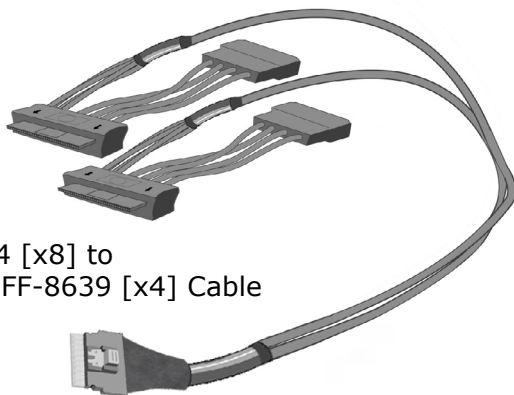


Figure 2-10, SFF-8654 [x8] to
2x U.2 SFF-8639 [x4] Cable

2.4.2 Internal SFF-8654 [x8] to 8x U.3 SFF-8639 [x1]: Direct SAS/NVMe

These adapters can be installed in a server RAID enclosure without a backplane. The kind of cable will attach directly to the SAS/SAT disk drives or U3 NVMe drive. The sideband signals cable is reserved for the backplane with header on it.

The following diagram shows the picture of the SFF-8654 [x8] to 8x U.3 SFF-8639 [x1]: Direct SAS/NVMe cables.

HARDWARE INSTALLATION

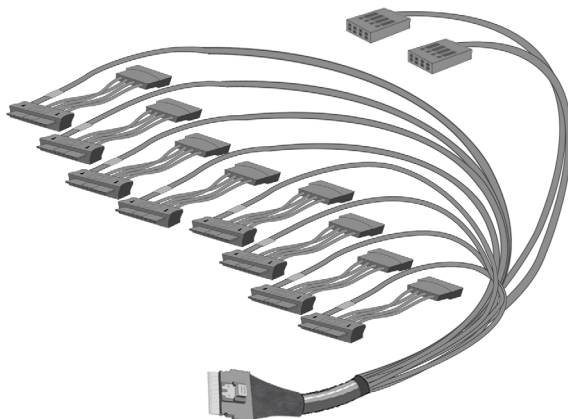


Figure 2-11, SFF-8654 [x8] to 8x U.3 SFF-8639 [x1] Cable

2.4.3 Internal SFF-8654 [x8] to 2x Oculink SFF-8612 [x4]: SFF-9402 SAS/NVMe

This cable is for backplanes that uses SFF-8612 connector follow the SFF-9402 specification. The pinout recommended in the PCI Express OCuLink Specification is equivalent to that recommended for SFF-9402. These adapters can be installed in a server RAID enclosure with an Oculink connector backplane. The kind of cable will attach directly to the an Oculink connector backplane. The following diagram shows the picture of SFF-8654 [x8] to 2x Oculink SFF-8612 [x4]: SFF-9402 SAS/NVMe cables.

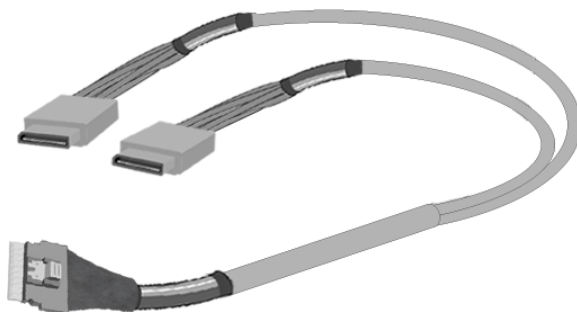


Figure 2-12, SFF-8654 [x8] to 2x Oculink SFF-8612 [x4] Cable

HARDWARE INSTALLATION

2.4.4 Internal SFF-8654 [x8] to 2x SFF-8643 [x4]: SFF-9402 SAS

This cable is for traditional SAS/SATA backplane. These adapters can be installed in a server RAID enclosure with SFF-8643 connector backplane. This SFF-8643 cable has eight signal pins to support four SAS/SATA drives and six pins for the SGPIO (Serial General Purpose Input/ Output) side-band signals. The SGPIO bus is used for efficient LED management and for sensing drive Locate status.

The following diagram shows the picture of SFF-8654 [x8] to 2x SFF-8643 [x4]: SFF-9402 SAS cables.

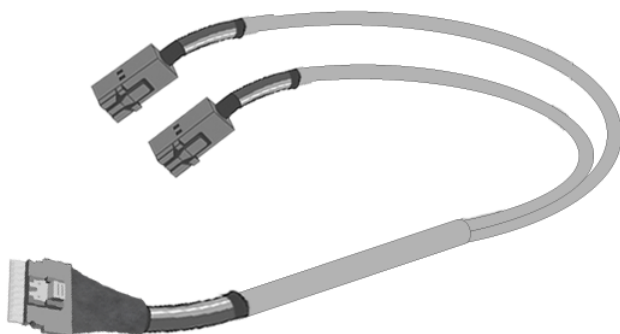


Figure 2-13, SFF-8654 [x8] to 2x SFF-8643 [x4] Cable

2.4.5 Internal SFF-8654 [x8] to 2x SFF-8654 [x4]: SFF-9402 SAS/NVMe

This cable is for backplane that uses SFF-8654 [x4] connector follow the SFF-9402 specification. The following diagram shows the picture of SFF-8654 [x8] to 2x SFF-8654 [x4]: SFF-9402 SAS/NVMe cables.

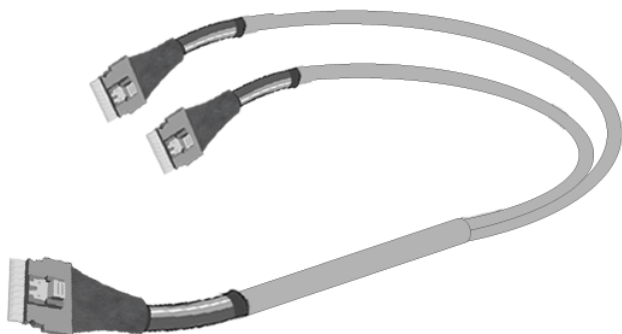


Figure 2-14, SFF-8654 [x8] to 2x SFF-8654 [x4] Cable

2.4.6 Internal SFF-8654 [x8] to SFF-8654 [x8] : SFF-9402 SAS/NVMe

This cable is for backplanes that use SFF-8654 [x8] connectors follow the SFF-9402 specification. The following diagram shows the picture of SFF-8654 [x8] to SFF-8654 [x8]: SFF-9402 SAS/NVMe cables.

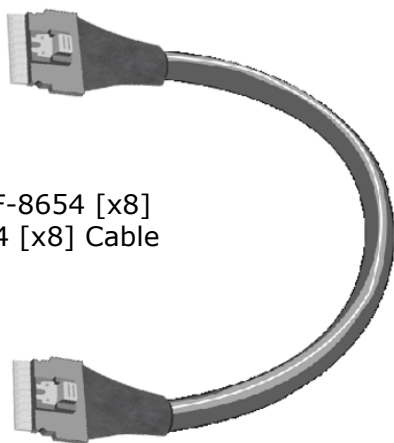


Figure 2-15, Internal SFF-8654 [x8]
to SFF-8654 [x8] Cable

HARDWARE INSTALLATION

2.4.7 Internal SFF-8654 [x8] to SATA Cable

This cable is used for direct connection between the tri-mode RAID adapter internal connectors and connectors on the SATA disk drives or SAS/SATA connector backplane.

The following diagram shows the picture of SFF-8654 [x8] to 8*SATA cables. Backplane supports SGPIO header can leverage the SGPIO function on the SATA RAID controller through the sideband cable. The SFF-8448 sideband signals cable is reserved for the backplane with header on it.

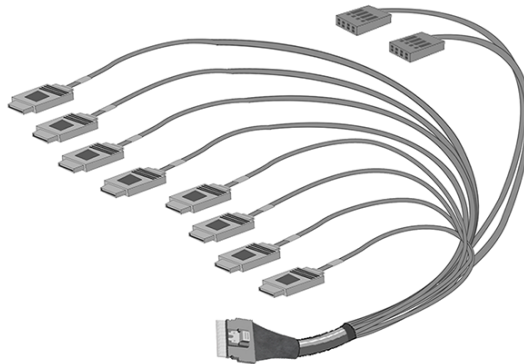


Figure 2-16, (26II-1C5407-1M00-SB)
SFF-8654 [x8] to 8x SATA Cable

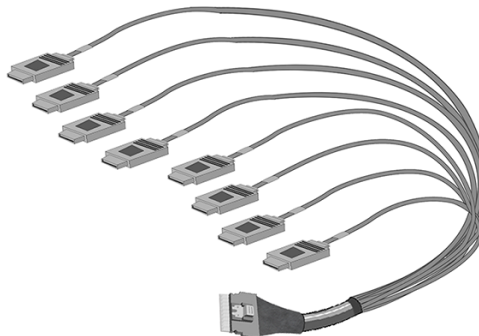


Figure 2-17, (26II-1C5407-1M00)
SFF-8654 [x8] to 8x SATA Cable (without sideband)

HARDWARE INSTALLATION

2.4.8 Internal SFF-8654 [x8] to Internal Min SAS 4i (SFF-8087) cable

This Min SAS 4i cable has eight signal pins to support four SAS/SATA drives and six pins for the SGPIO (Serial General Purpose Input/Output) side-band signals. The SGPIO bus is used for efficient LED management and for sensing drive Locate status.

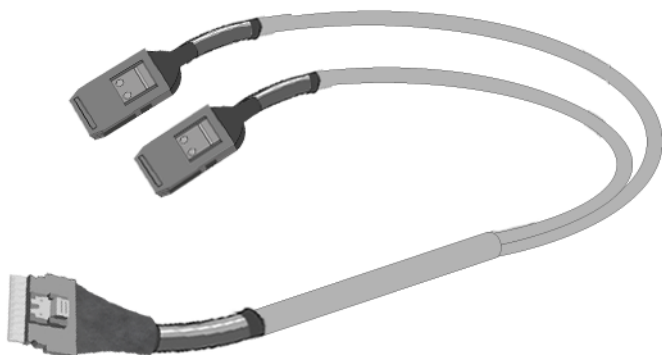


Figure 2-18, SFF-8654 [x8] to 2x SFF-8087 [x4] Cable

HARDWARE INSTALLATION

2.4.9 External SFF-8644 x4 Drive Boxes and Drive Expanders

The ARC-1886 RAID adapters with SFF-8644 external connector can support up to four multiprotocol signals. The SFF-8644 x4 external cables is used for connection between the RAID adapter external connector and connector on the external drive box or PCIe switch or SAS expander enclosure. For external PCIe JBOF connections, as defined by the PCI Express External Cabling Specification, the ARC-1886 does not connect REFCLK and PERST# to external connector. JBOF only supports an SRIS-capable endpoint so there will not be REFCLK pairs going through this cable.

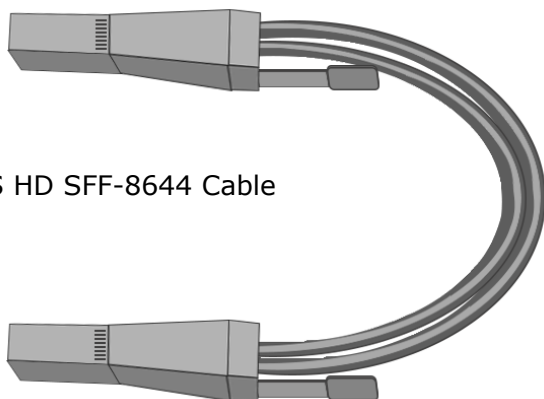


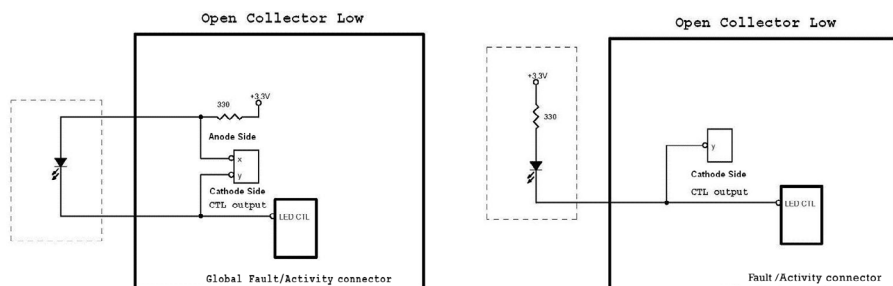
Figure 2-19, Mini SAS HD SFF-8644 Cable

HARDWARE INSTALLATION

2.5 LED Cables

There is no SGPIO supported in the most of old version SATA backplane. The tri-mode RAID adapter also provides two kinds of alternative LED cable header to support the fault status for those backplanes. The global indicator connector is used by the server global indicator LED.

The following electronics schematic is the tri-mode RAID adapter logical of fault/activity header. The signal for each pin is cathode (-) side. The following diagrams and descriptions describe each type of indicator connector.



1. Individual Activity/Fault LED and Global Indicator Connector

Most of the backplane has supported the HDD activity from the HDD. The tri-mode RAID adapter also provides the fault activity for fault LED. Connect the cables for the drive fault LEDs between the backplane of the cage and the respective connector on the tri-mode RAID adapter.

The following table is the fault LED signal behavior.

LED	Normal Status	Problem Indication
Fault LED	<ol style="list-style-type: none">1. When the fault LED is lit, there is no disk present.2. When the fault LED is not lit, then disk is present and status is normal.	<ol style="list-style-type: none">1. When the fault LED is blinking (2 times/sec), that disk drive has failed and should be hot swapped immediately.2. When the activity LED is lit and fault LED is fast blinking (10 times/sec) there is rebuilding activity on that disk drive.

HARDWARE INSTALLATION

If the system will use only a single global indicator, attach the LED to the two pins of the global activity/fault connector. The global fault pin pair connector is the overall fault signal. This signal will light up in any disk drive failure.

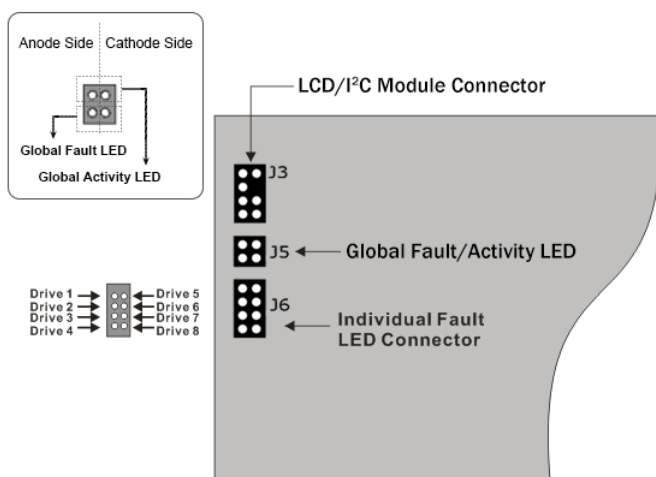


Figure 2-20, ARC-1886-8I LED Indicator Connector

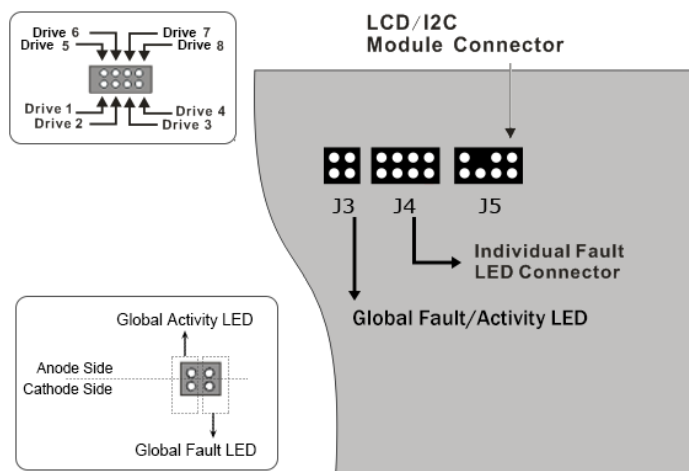


Figure 2-21,
ARC-1886-8X & ARC-1886-8X8I LED Indicator Connector

HARDWARE INSTALLATION

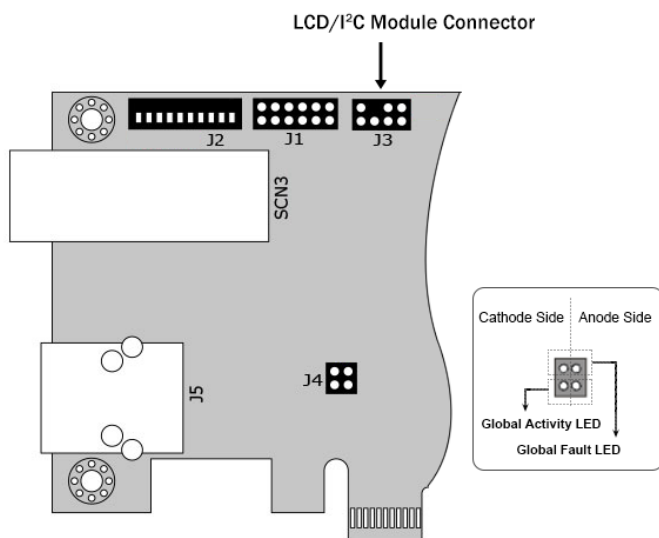


Figure 2-22,
ARC-1886-4X8I & ARC-1886-4X12I LED Indicator Connector

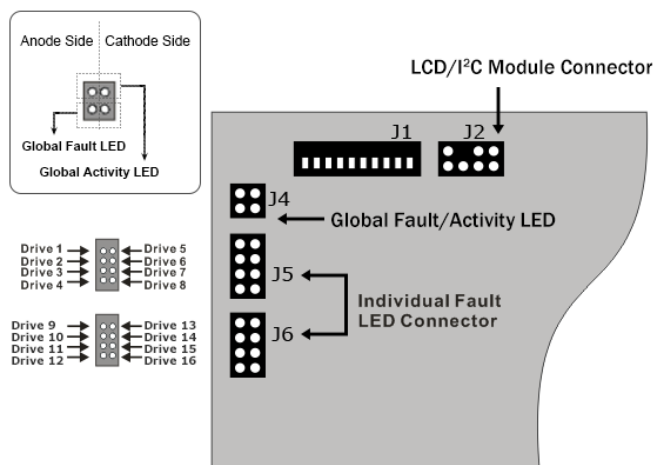


Figure 2-23,
ARC-1886-16I LED Indicator Connector

HARDWARE INSTALLATION

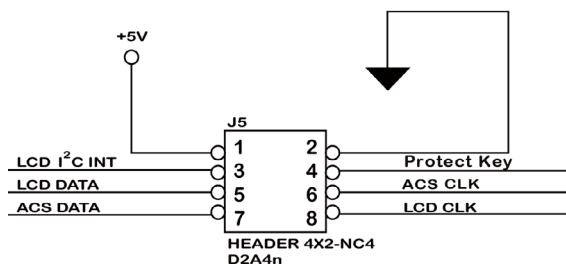
Note:

A cable for the global indicator comes with your computer system. Cables for the individual drive LEDs may come with a drive cage, or you may need to purchase them.

2. Areca Serial Bus Connector

The serial bus connector can add optional accessories to add RAID adapter more functions. You can connect this interface to Areca LCD module for information, status indication, or menus or Card LED indicator for status message. This interface can also cascade to another Areca serial bus accessories for the additional status display.

The following picture and table are the serial bus signal name description for LCD & fault/activity LED.



Pin	Description	Pin	Description
1	Power (+5V)	2	GND
3	LCD Module Interrupt	4	Protect Key
5	LCD Module Serial Data	6	Fault/Activity Clock
7	Fault/Activity Serial Data	8	LCD Module Clock

You can use one optional LCD front panel and keypad function to simply create the RAID volume. The LCD status panel also informs you of the disk array's current operating status at a glance. The LCD configuration is described in a separate manual: RAID Card_LCD manual. The LCD housed in a 5¼-inch half-height or 3.5-inch canister.

HARDWARE INSTALLATION

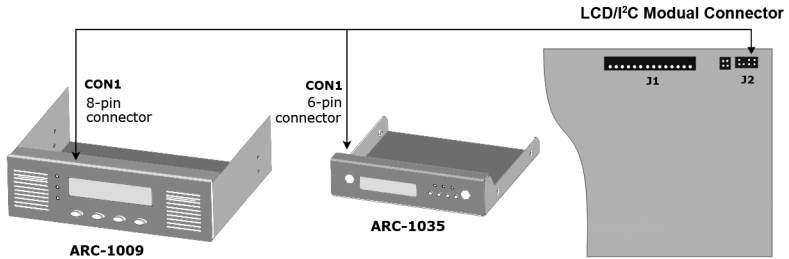


Figure 2-24, Connect to LCD Status Panel

2.6 Hot-plug Failed Drive Replacement

The RAID adapter supports the ability of performing a hot-swap drive replacement without powering down the system. A disk can be disconnected, removed, or replaced with a different disk without taking the system off-line. The RAID rebuilding will be processed automatically in the background. When a disk is hot swap, the RAID adapter may no longer be fault tolerant. Fault tolerance will be lost until the hot swap drive is subsequently replaced and the rebuild operation is completed.

2.6.1 Recognizing a Drive Failure

A drive failure can be identified in one of the following ways:

1. An error status message lists failed drives in the event log.
2. A fault LED illuminates on the front of RAID subsystem if failed drives are inside.

2.6.2 Replacing a Failed Drive

With RAID subsystem drive tray, you can replace a defective physical drive while your computer is still operating. When a new drive has been installed, data reconstruction will be automatically started to rebuild the contents of the disk drive. The adapter always uses the smallest hotspare that "fits". If a hotspare is used and the defective drive is exchanged online, the new inserted HDD will automatically assign as a hotspare HDD.

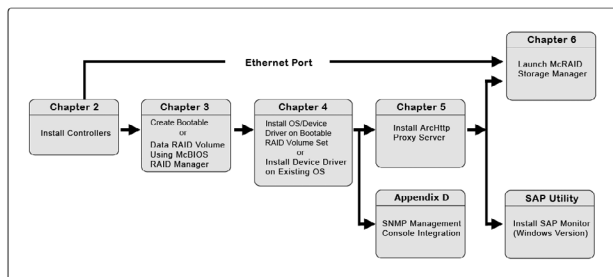
HARDWARE INSTALLATION

Note:

The capacity of the replacement drives must be at least as large as the capacity of the other drives in the raid set. Drives of insufficient capacity will be failed immediately by the RAID adapter without starting the "Automatic Data Rebuild".

2.7 Summary of the installation

The flow chart below describes the installation procedures for tri-mode RAID adapters. These procedures include hardware installation, the creation and configuration of a RAID volume through the McBIOS/McRAID manager, OS installation and installation of tri-mode RAID adapter software.



The table below shows the software components that configure and monitor the tri-mode RAID adapters.

Configuration Utility	Operating System Supported
McBIOS RAID Manager	OS-Independent
McRAID Storage Manager (Via Ethernet port)	OS-Independent
McRAID Storage Manager (Via ArchHTTP proxy server)	Windows, Linux, FreeBSD and macOS
ArchHTTP Proxy Server	Windows, Linux, FreeBSD and macOS
CLI Utility	Windows, Linux, FreeBSD, Vmware and macOS
SNMP Manager Console Integration	Windows, Linux and FreeBSD
SAP Monitor (Single Admin Portal to manage multiple RAID units in the network, via ArchHTTP proxy server)	macOS / Windows

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McRAID Storage Manager

Before launching the firmware-embedded web browser, McRAID storage manager through the PCIe bus, you need first to install the ArchHTTP proxy server on your server system. If you need additional information about installation and start-up of this function, see the McRAID Storage Manager section in Chapter 6 of the user manual.

ArchHTTP Proxy Server

ArchHTTP has to be installed for GUI RAID console (McRAID storage manager) to run. It is used to launch the web browser McRAID storage manager. It also runs as a service or daemon in the background that allows capturing of events for mail and SNMP traps notification. If you need additional information about installation and start-up of this function, see the ArchHTTP Proxy Server Installation section in Chapter 5 of the user manual.

CLI Utility

CLI (Command Line Interface) lets you set up and manage RAID adapter through a command line interface. CLI performs many tasks at the command line. You can download CLI manual from Areca website <https://www.areca.com.tw>.

SNMP Manager Console Integration

There are two ways to transport SNMP data on the tri-mode RAID adapter: in-band PCIe host bus interface or out-of-band built-in LAN interface. Enter the "SNMP Tarp IP Address" option on the firmware-embedded SNMP configuration function for user to select the SNMP data agent-side communication from the out-of-band built-in LAN interface. To use in-band PCIe host bus interface, keep blank on the "SNMP Tarp IP Address" option.

• Out of Band-Using LAN Port Interface

Out-of-band interface refers to transport SNMP data of tri-mode RAID adapters from a remote station connected to the adapter through a network cable. Before launching the SNMP manager on the client, you need firstly to enable the firmware-embedded SNMP agent function and no additional agent software inquired

HARDWARE INSTALLATION

on your server system. If you need additional information about installation and start-up this function, see the section 6.8.4 "SNMP Configuration" of the user manual.

- **In-Band-Using PCIe Host Bus Interface**

In-band interface refers to management of the SNMP data of RAID adapters from a PCIe host bus. In-band interface is simpler than out-of-band interface for it requires less hardware in its configuration. Since the tri-mode RAID adapter is already installed in the host system, no extra connection is necessary. Just load the necessary in-band Areca SNMP extension agent for the adapters. Before launching the SNMP agent in the sever, you need first to enable the firmware-embedded SNMP community configuration and install Areca SNMP extension agent in your server system. If you need additional information about installation and start-up the function, see the SNMP Operation & Installation section in the Appendix C of the user manual.

Single Admin Portal (ArcSAP) Monitor

This utility can scan and manage multiple RAID units in the local and remote systems and provide an effective mechanism to configure and monitor your RAID units. For additional information, see the utility manual (ArcSAP) from the web site **<https://www.areca.com.tw>**.

BIOS CONFIGURATION

3. McBIOS RAID Manager

The system mainboard BIOS automatically configures the following 6Gb/s SATA RAID controller parameters at power-up:

- I/O Port Address
- Interrupt Channel (IRQ)
- Controller ROM Base Address

Use McBIOS RAID manager to further configure the 6Gb/s SATA RAID controller to suit your server hardware and operating system.

3.1 Starting the McBIOS RAID Manager

The McBIOS RAID manager is designed to be user-friendly. It is a menu-driven program, residing in the firmware, which allows you to scroll through various menus and sub-menus and select among the predetermined configuration options. This section explains how to launch the McBIOS RAID setup utility to configure your RAID controllers that the installed motherboard 'BIOS Mode' is either **Legacy** or **UEFI**.

1. **M/B BIOS mode:** Legacy, or UEFI BIOS with the CSM (compatibility support module) option = enabled

When starting a system with a RAID controller installed, it will display the following message on the monitor during the start-up sequence (after the system BIOS startup screen but before the operating system boots):

```
ARC-1886 PCIEx8/8G RAID Controller - DRAM: 8192(MB) / #Channels: 8
BIOS: V1.31 / Date: 2020-08-15 - F/W: V1.64 / Date: 2022-09-15
```

```
▶ Bus/Dev/Fun= 4/0/0, I/O-Port=28000000h, IRQ=11, BIOS=C800 : 0h
▶▶ ID-LUN=00-0, Vol="Areca ARC-1886-VOL#000R001", Size=3.6 (TB)
▶▶ ID-LUN=00-1, Vol="Areca ARC-1886-VOL#001R001", Size=3.6 (TB)
▶▶ ID-LUN=00-2, Vol="Areca ARC-1886-VOL#002R001", Size=3.6 (TB)
▶▶ RAID adapter BIOS not installed
▶▶ Press <Tab/F6> to enter SETUP menu. 9 second(s) left <ESC> to Skip>..
```


BIOS CONFIGURATION

The McBIOS RAID manager message remains on your screen for about nine seconds, giving you time to start the configuration menu by pressing **Tab** or **F6**. If you do not wish to enter configuration menu, press **ESC** to skip configuration immediately. When activated, the McBIOS RAID manager window appears showing a selection dialog box listing the RAID controllers that are installed in the system. The legend at the bottom of the screen shows you what keys are enabled for the windows.

2. **M/B BIOS mode:** UEFI and CSM (compatibility support module) option = disabled

After firmware version 1.65 package, Areca RAID card ARC-1886FIRM.BIN code creates a virtual bootable disk (UEFI OS) for the ARC-1886UEFI.BIN code to launch the McBIOS setup utility. When user chooses to boot from the virtual disk in M/B setup, the McBIOS setup utility is launched through boot into UEFI OS during M/B boot. Follow below procedures to launch it.

- a). Add RAID controllers "UEFI OS(Areca A....)" in the M/B boot option: You must enter the setup of motherboard BIOS and add UEFI OS to the boot option if your motherboard BIOS does not automatically add it.
- b). Restart your motherboard to boot from UEFI OS. The motherboard vendors provide two methods for choosing a boot device: Enter boot menu by using hotkey or enter boot menu through BIOS configuration.

Note:

UEFI OS is not loaded when setting the 'Secure Boot' option=enabled in M/B BIOS setup.

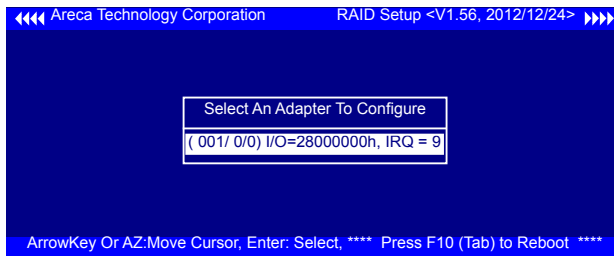
- c). When booted, the McBIOS RAID setup window appears showing the main menu of the RAID controllers that are installed in the system. If there have more than two RAID adapters installed in the system, it will show a selection for user to choose one to configure the RAID adapter.
- d). Follow the on-screen prompts to complete the configuration.

BIOS CONFIGURATION

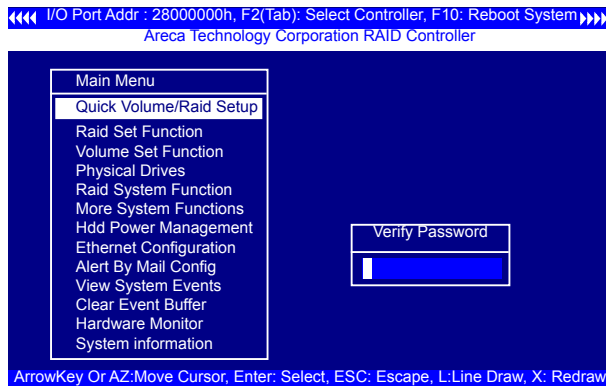
After using "F10" to exit, you can enter " shell>exit" or need to hard power cycle it.

- e). Enter the setup of motherboard BIOS to disable or adjust UEFI OS in the boot option priorities if it is the first priority of overall boot order. Otherwise the system will always boot into UEFI OS without using the hotkey.

McBIOS setup utility operates upon a single RAID controller at a time. A selection dialog box listing the RAID controllers that are installed in the system.



Use the **Up** and **Down** arrow keys to select the controller you want to configure. While the desired controller is highlighted, press the **Enter** key to enter the main menu of the McBIOS RAID manager.



Note:

The manufacture default password is set to **0000**; this password can be modified by selecting **Change Password** in the **Raid System Function** section.

BIOS CONFIGURATION

3.2 McBIOS RAID manager

The McBIOS RAID manager is firmware-based and is used to configure RAID sets and volume sets. Because the utility resides in the tri-mode RAID adapter firmware, operation is independent of any operating systems on your computer. This utility can be used to:

- Create RAID sets,
- Expand RAID sets,
- Add physical drives,
- Define volume sets,
- Modify volume sets,
- Modify RAID level/stripe size,
- Define pass-through disk drives,
- Modify system functions and
- Designate drives as hot spares.

3.3 Configuring Raid Sets and Volume Sets

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

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

BIOS CONFIGURATION

3.4 Designating Drives as Hot Spares

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

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

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

3.5 Using Quick Volume /Raid Setup Configuration

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

Parameter	Default Setting
Volume Name	ARC-1886-VOL#00
SCSI Channel/SCSI ID/SCSI LUN	0/0/0
Cache Mode	Write-Back
Tag Queuing	Yes

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

BIOS CONFIGURATION

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

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3.6 Using Raid Set/Volume Set Function Method

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

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

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

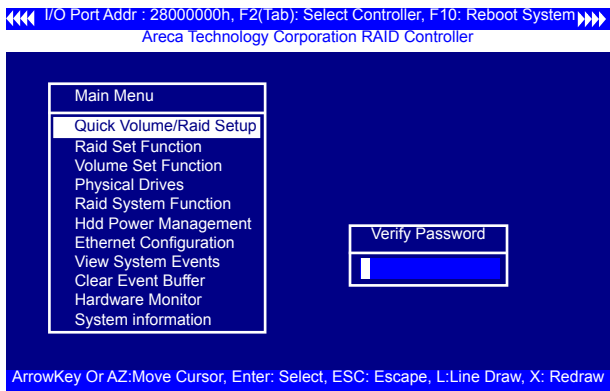
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6	An "Edit The Raid Set Name" dialog box appears. Enter 1 to 15 alphanumeric characters to define a unique identifier for this new RAID set. The default RAID set name will always appear as Raid Set. #. Press Enter key to finish the name editing.
7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

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3.7 Main Menu

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



Note:

The manufacture default password is set to **0000**; this password can be modified by selecting "Change Password" in the "Raid System Function" section.

Option	Description
Quick Volume/Raid Setup	Create a default configuration based on the number of physical disk installed
Raid Set Function	Create a customized RAID set
Volume Set Function	Create a customized volume set
Physical Drives	View individual disk information
Raid System Function	Setup the RAID system configuration
Hdd Power Management	Manage HDD power based on usage patterns
Ethernet Configuration	LAN port setting
View System Events	Record all system events in the buffer
Clear Event Buffer	Clear all information in the event buffer
Hardware Monitor	Show the hardware system environment status
System Information	View the adapter system information

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

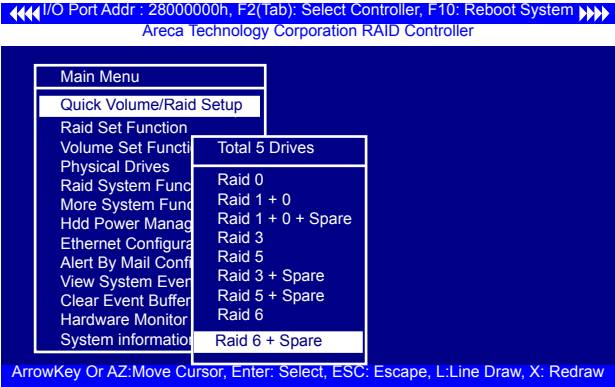
3.7.1 Quick Volume/Raid Setup

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

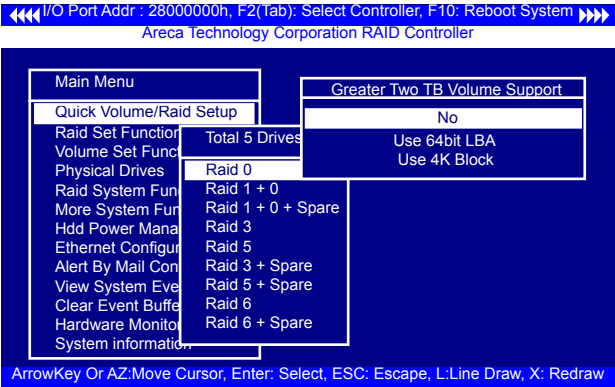
1. All of the physical drives are contained in one RAID set.
2. The RAID level, hot spare, capacity, and stripe size options are selected during the configuration process.
3. When a single volume set is created, it can consume all or a portion of the available disk capacity in this RAID set.
4. If you need to add an additional volume set, use the main menu "Create Volume Set" function.

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

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If volume capacity will exceed 2TB, adapter will show the “Greater Two TB Volume Support” sub-menu.



- **No**
When this option is enabled, it keeps the volume size with max. 2TB limitation.
For any hard disk drives working in the 4K native mode in the Raid set, the volume set directly sets and exposes 4KB sector size to the operating system.

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- **Use 64bit LBA**

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

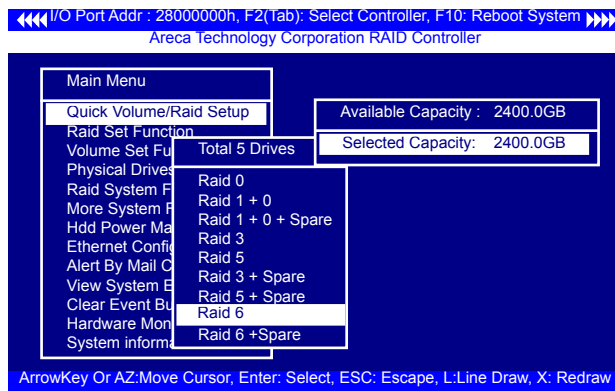
Windows 2003 with SP1 or later

Linux kernel 2.6.x or later

- **Use 4K Block**

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

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

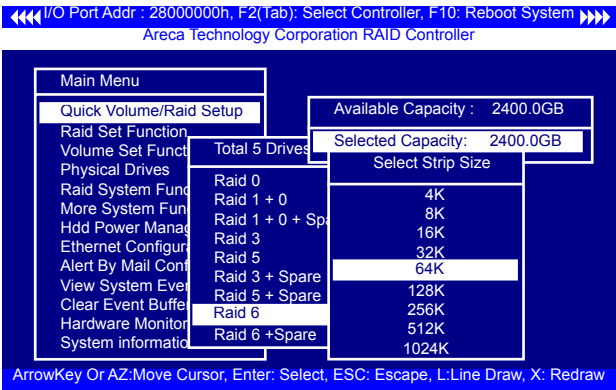


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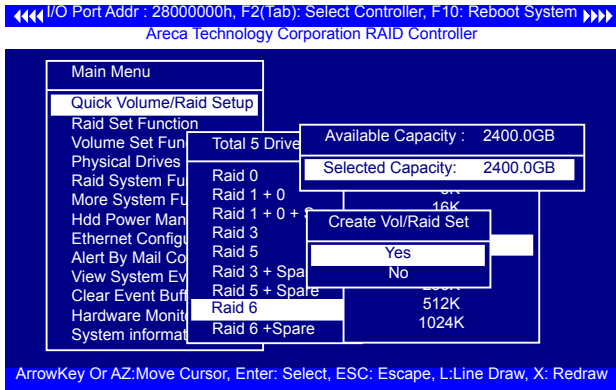
Stripe Size This parameter sets the size of the stripe written to each disk in a RAID 0, 1, 1E, 10, 5, or 6 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128 KB, 256KB, 512KB, or 1024KB.

Warning:

Roaming the stripe size 256K/512K/1024K Raid Set to firm-ware version older than 1.52 will cause data corruption.



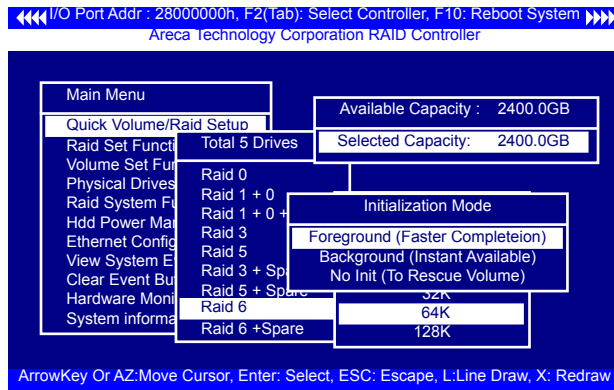
A larger stripe size produces better-read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer performs random reads more often, select a smaller stripe size.



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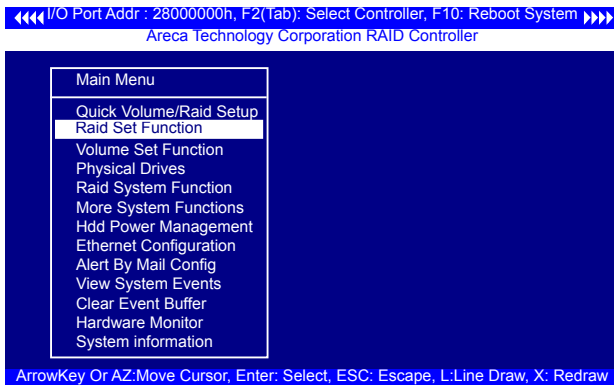
Press **Yes** key in the "Create Vol/Raid Set" dialog box, the RAID set and volume set will start to initialize it.

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



3.7.2 Raid Set Function

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



BIOS CONFIGURATION

3.7.2.1 Create Raid Set

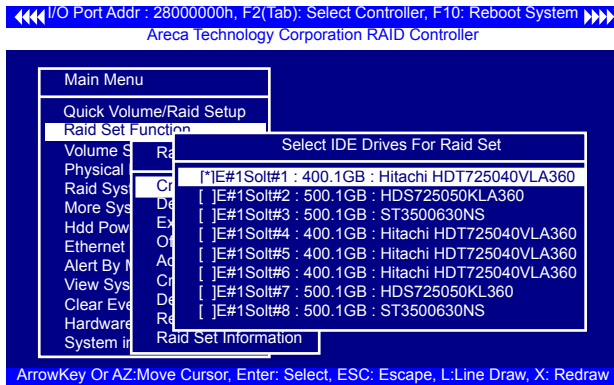
The following is the RAID set features for the tri-mode RAID adapter.

1. Up to 32 disk drives can be included in a single RAID set.
2. Up to 128 RAID sets can be created per adapter, but RAID level 30 50 and 60 only can support eight sub-RAID set.

To define a RAID set, follow the procedures below:

1. Select "Raid Set Function" from the main menu.
2. Select "Create Raid Set " from the "Raid Set Function" dialog box.
3. A "Select IDE Drive For Raid Set" window is displayed showing the SAS/SATA drives connected to the current adapter. Press the **UP** and **DOWN** arrow keys to select specific physical drives. Press the **Enter** key to associate the selected physical drive with the current RAID set. Repeat this step; the user can add as many disk drives as are available to a single RAID set.

When finished selecting SAS/SATA drives for RAID set, press **Esc** key. A "Create Raid Set Confirmation" screen will appear, select the **Yes** option to confirm it.



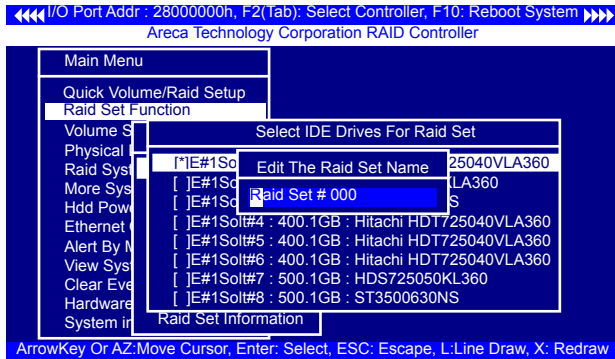
4. An "Edit The Raid Set Name" dialog box appears. Enter 1 to 15 alphanumeric characters to define a unique identifier for the RAID set. The default RAID set name will always appear as Raid Set. #.
5. Repeat steps 3 to define another RAID sets.

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Note:

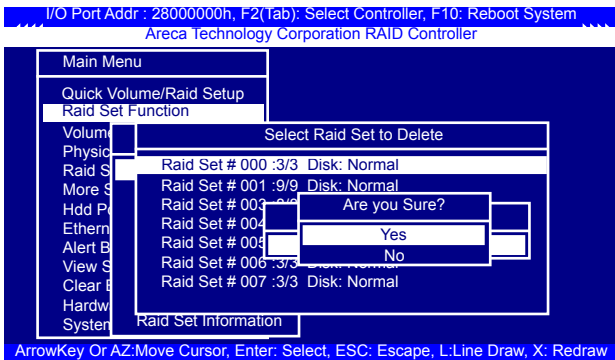
To create RAID 30/50/60 volume, you need create multiple RAID sets (up to 8 RAID sets) first with the same disk numbers on each RAID set. The max no. disk drives per volume set:

32 for RAID 0/1/10/3/5/6 and 128 for RAID 30/50/60.



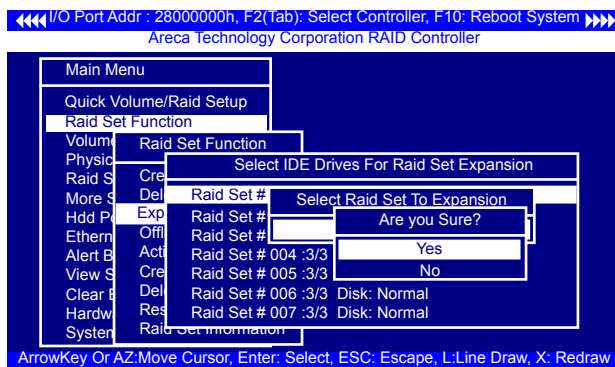
3.7.2.2 Delete Raid Set

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



BIOS CONFIGURATION

3.7.2.3 Expand Raid Set



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

To expand a RAID set:

1. Select the "Expand Raid Set" option. If there is an available disk, then the "Select SAS/SATA Drives For Raid Set Expansion" screen appears.
2. Select the target RAID set by clicking on the appropriate radius button. Select the target disk by clicking on the appropriate check box.
3. Press the **Yes** key to start the expansion on the RAID set.

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

Note:

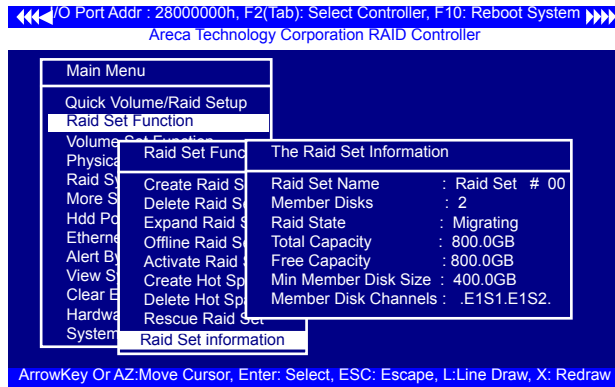
1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.

BIOS CONFIGURATION

Note:

2. If a disk drive fails during RAID set expansion and a hot spare is available, an auto rebuild operation will occur after the RAID set expansion completes.
3. RAID 30/50/60 doesn't support the "Expand Raid Set".
4. RAID set expansion is a quite critical process, we strongly recommend customer backup data before expand. Unexpected accident may cause serious data corruption.

● Migrating

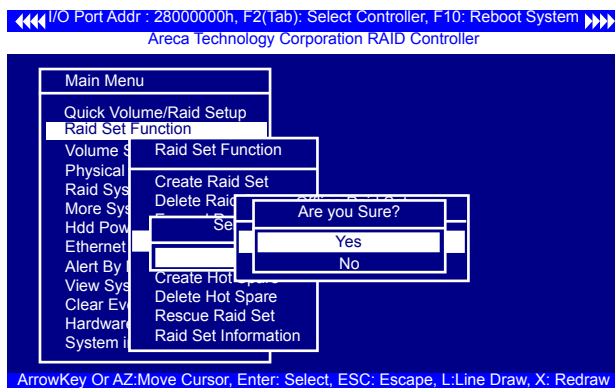


Migration occurs when a disk is added to a RAID set. Migrating state is displayed in the RAID state area of "The Raid Set Information" screen when a disk is being added to a RAID set. Migrating state is also displayed in the associated volume state area of the "Volume Set Information" which belongs to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

3.7.2.4 Offline Raid Set

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

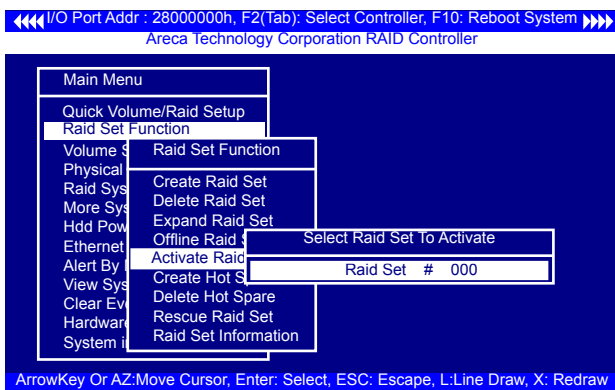
BIOS CONFIGURATION



3.7.2.5 Activate Raid Set

The following screen is used to activate the RAID set after one of its disk drive was removed in the power off state.

When one of the disk drives is removed in power off state, the RAID set state will change to "Incomplete State". If user wants to continue to work while the tri-mode RAID adapter is powered on, the user can use the "Activate Incomplete Raid Set" option to active the RAID set. After user selects this function, the RAID state will change to "Degraded Mode" and start to work.



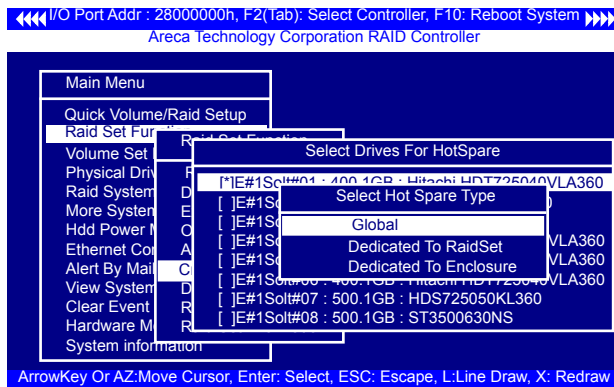
BIOS CONFIGURATION

3.7.2.6 Create Hot Spare

When you choose the "Create Hot Spare" option in the "Raid Set Function", all unused physical devices connected to the current adapter will result in the screen.

Select the target disk by clicking on the appropriate check box. Press the **Enter** key to select a disk drive and press **Yes** in the "Create Hot Spare" to designate it as a hot spare.

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

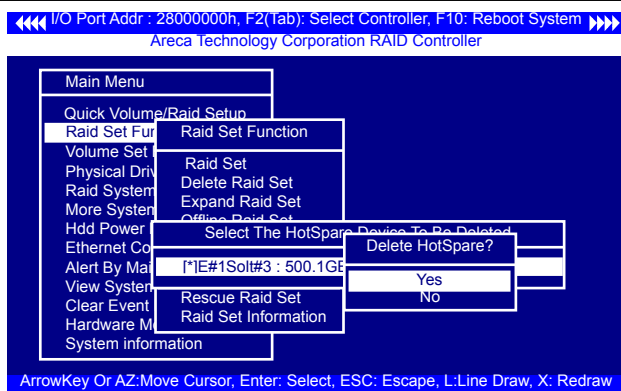


3.7.2.7 Delete Hot Spare

Select the target hot spare disk to delete by clicking on the appropriate check box.

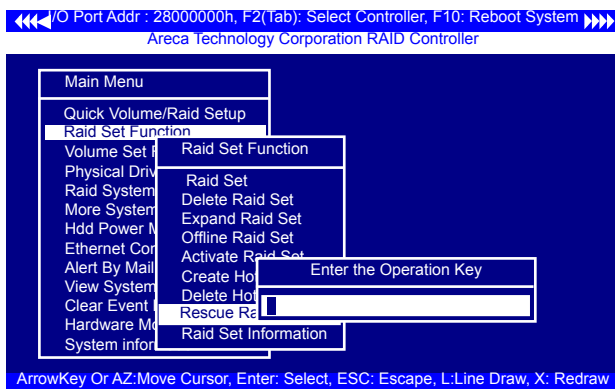
Press the **Enter** key to select a hot spare disk drive, and press **Yes** in the "Delete Hot Spare" screen to delete the hot spare.

BIOS CONFIGURATION



3.7.2.8 Rescue Raid Set

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



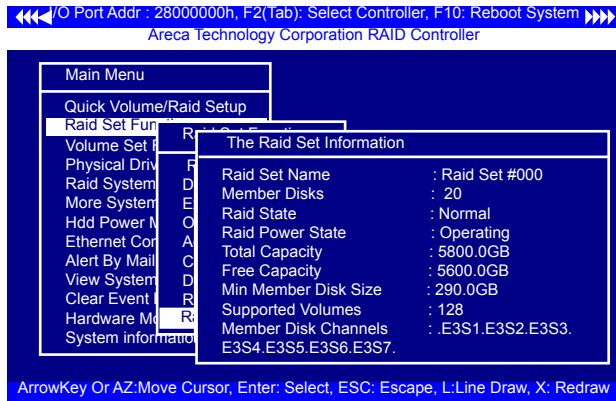
Note:

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

BIOS CONFIGURATION

3.7.2.9 Raid Set Information

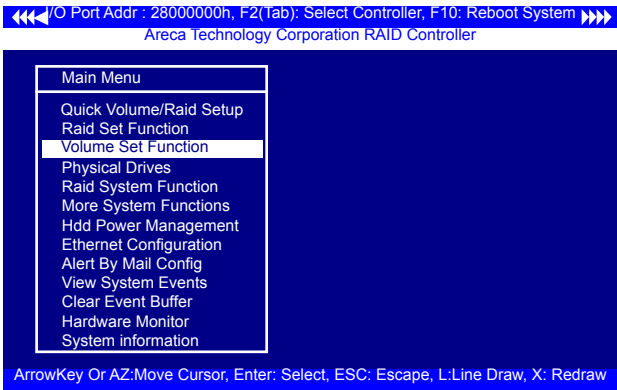
To display RAID set information, move the cursor bar to the desired RAID set number, then press the **Enter** key. The "Raid Set Information" will appear. You can only view information for the RAID set in this screen.



3.7.3 Volume Set Function

A volume set is seen by the host system as a single logical device; it is organized in a RAID level within the adapter utilizing one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set can consume all of the capacity or a portion of the available disk capacity of a RAID set. Multiple volume sets can exist on a RAID set. If multiple volume sets reside on a specified RAID set, all volume sets will reside on all physical disks in the RAID set. Thus each volume set on the RAID set will have its data spread evenly across all the disks in the RAID set rather than one volume set using some of the available disks and another volume set using other disks.

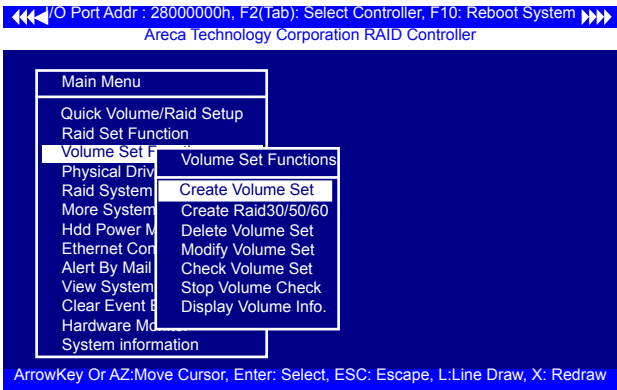
BIOS CONFIGURATION



The following is the volume set features for the tri-mode RAID adapter.

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

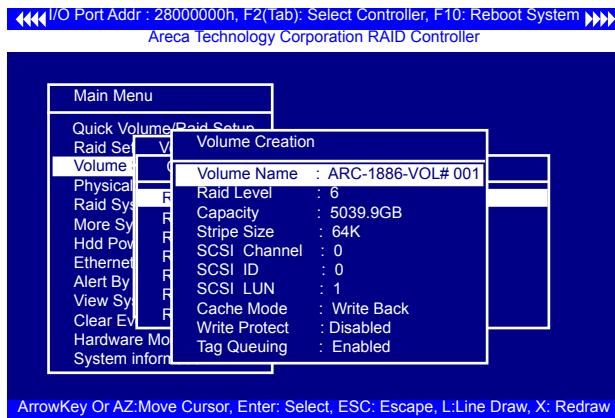
3.7.3.1 Create Volume Set (0/1/10/3/5/6)



BIOS CONFIGURATION

To create a volume set, follow the below steps:

1. Select the "Volume Set Function" from the main menu.
2. Choose the "Create Volume Set" from "Volume Set Functions" dialog box screen.
3. The "Create Volume From Raid Set" appears. This screen displays the existing arranged RAID sets. Select the RAID set number and press the **Enter** key. The "Volume Creation" dialog is displayed in the screen.
4. The new create volume set attribute allows user to select the Volume Name, Raid level, Capacity, Strip Size, SCSI Channel/SCSI ID/SCSI Lun, Cache Mode, Write protect and Tagged Command Queuing.

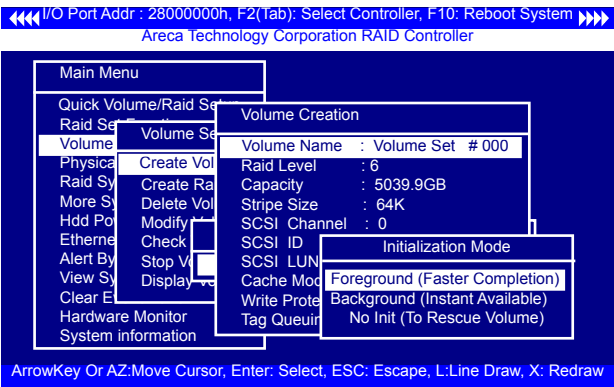


5. After completed the modification of the volume set, press the **Esc** key to confirm it. An "Initialization Mode" screen appears.

● Initialization Mode

- Select "Foreground (Faster Completion)" for faster initialization of the selected volume set.
- Select "Background (Instant Available)" for normal initialization of the selected volume set.
- Select "No Init (To Rescue Volume)" for no initialization of the selected volume.

BIOS CONFIGURATION



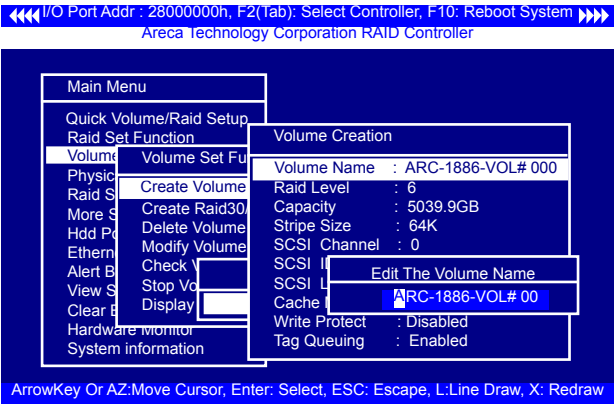
- Repeat steps 3 to 5 to create additional volume sets.
- The initialization percentage of volume set will be displayed at the bottom line.

Note:

- Controller starts to initialize the volume in two conditions
- Stay in adapter bios manager or
 - Boot into OS and the adapter driver loaded.

● **Volume Name**

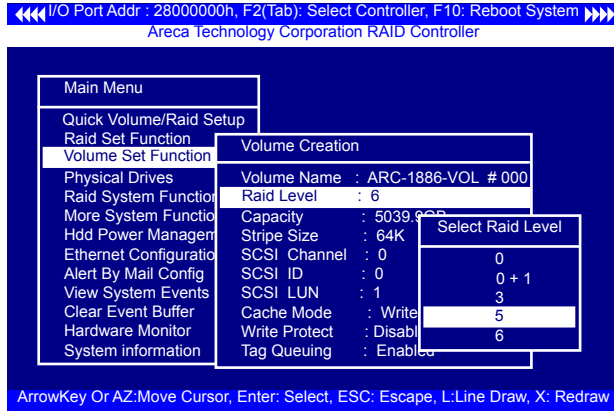
The default volume name will always appear as ARC-1886-VOL #. You can rename the volume set providing it does not exceed the 15 characters limit.



BIOS CONFIGURATION

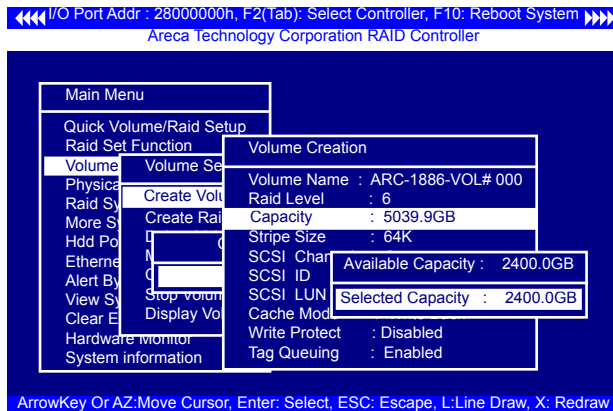
● Raid Level

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



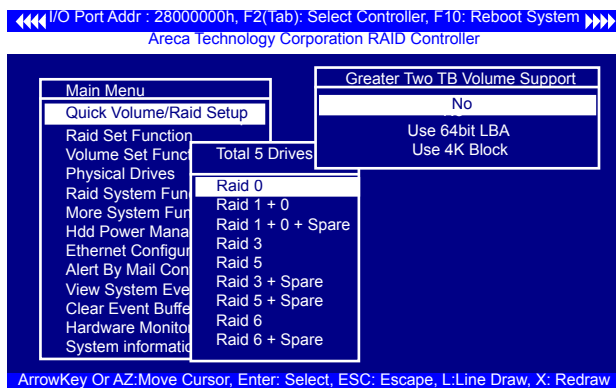
● Capacity

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



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



- **No**

When this option is enabled, it keeps the volume size with max. 2TB limitation.

For any hard disk drives working in the 4K native mode in the Raid set, the volume set directly sets and exposes 4KB sector size to the operating system.

- **Use 64bit LBA**

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

Windows 2003 with SP1 or later

Linux kernel 2.6.x or later

- **Use 4K Block**

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

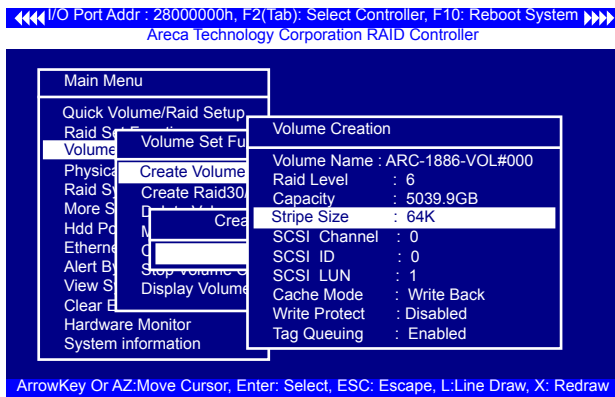
BIOS CONFIGURATION

● Stripe Size

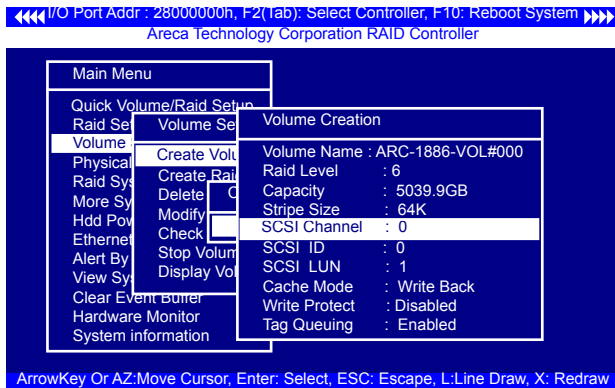
This parameter sets the size of segment written to each disk in a RAID 0, 1, 1E, 10, 5, 6, 50 or 60 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128 KB, 256KB, 512KB, or 1024KB.

Warning:

Roaming the stripe size 256K/512K/1024K Raid Set to firmware version older than 1.52 will cause data corruption.



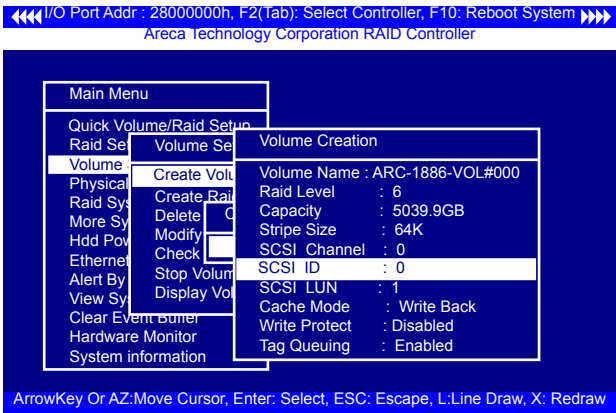
The tri-mode RAID adapter function simulates a external SCSI RAID adapter. The host bus represents the SCSI channel. Choose the "SCSI Channel". A "Select SCSI Channel" dialog box appears; select the channel number and press the **Enter** key to confirm it.



BIOS CONFIGURATION

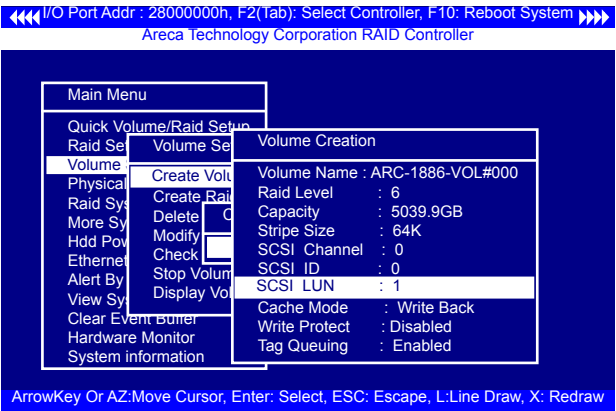
- **SCSI ID**

Each device attached to the tri-mode RAID adapter, as well as the tri-mode RAID adapter itself, must be assigned a unique SCSI ID number. A SCSI channel can connect up to 15 devices. It is necessary to assign a SCSI ID to each device from a list of available SCSI IDs.



- **SCSI LUN**

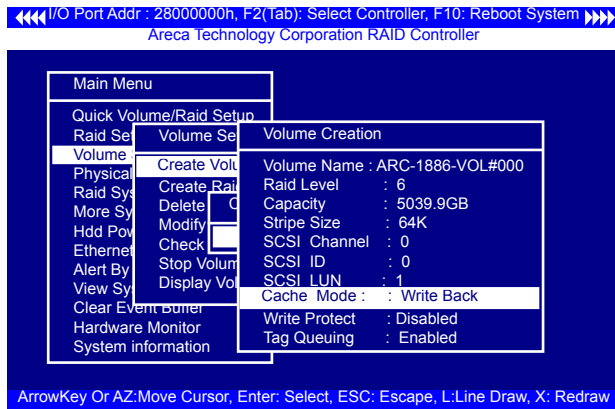
Each SCSI ID can support up to 8 LUNs. Most SAS adapters treat each LUN as if it were a SAS disk.



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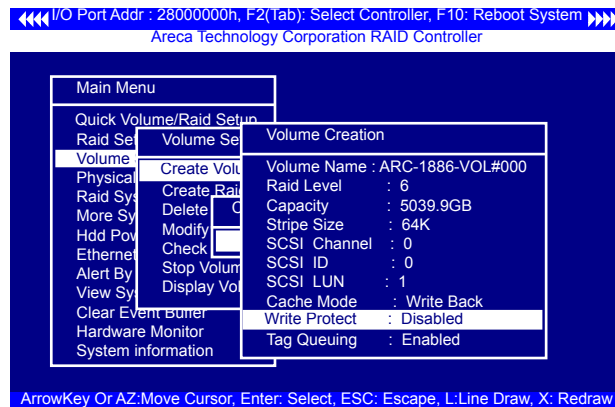
● Cache Mode

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



● Write Protect

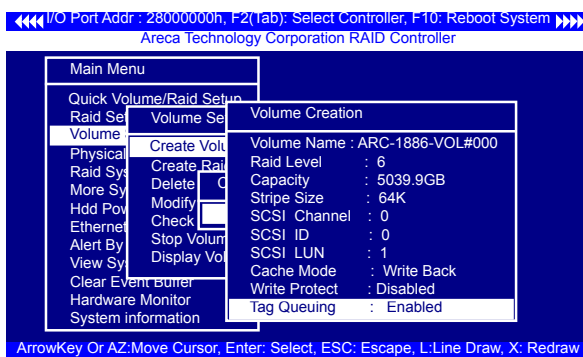
When "Write Protect" is enabled on the "Create Volume Set", host commands fail if they are issued to a volume in that RAID adapter and attempt to modify a volume's data or attributes. "Write Protection" is used primarily for customer-initiated disaster recovery testing.



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• Tag Queuing

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

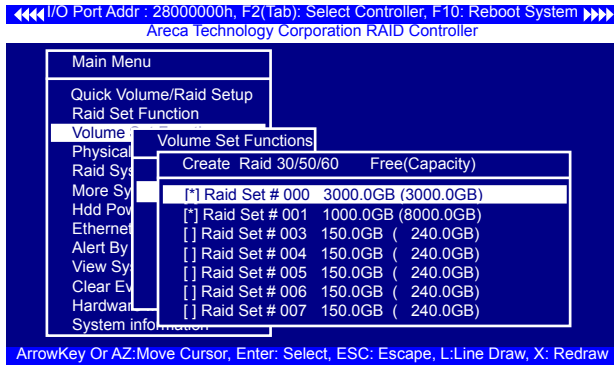


3.7.3.2 Create Raid30/50/60 (Volume Set 30/50/60)

To create 30/50/60 volume set from RAID set group, move the cursor bar to the main menu and click on the "Create Raid 30/50/60" link. The "Select The Raid Set To Create Volume On It" screen will show all RAID set number. Tick on the RAID set numbers (same number of disk per RAID set) that you want to create and then click on it.

The created new volume set attribute option allows users to select the Volume Name, Capacity, Raid Level, Strip Size, SCSI ID/LUN, Cache Mode, Write protect and Tagged Command Queuing. The detailed description of those parameters can refer to section 3.7.3.1. User can modify the default values in this screen; the modification procedures are in section 3.7.3.4.

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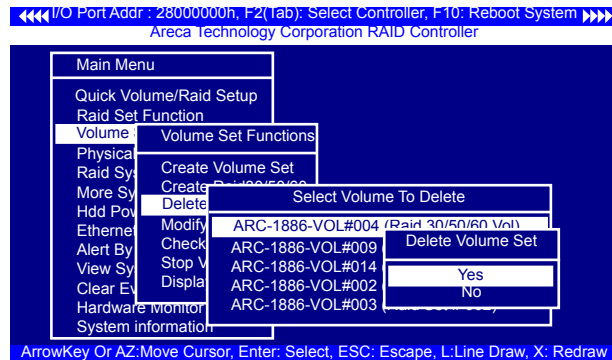


Note:

Raid Level 30 50 and 60 can support up to eight RAID sets (four pairs).

3.7.3.3 Delete Volume Set

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

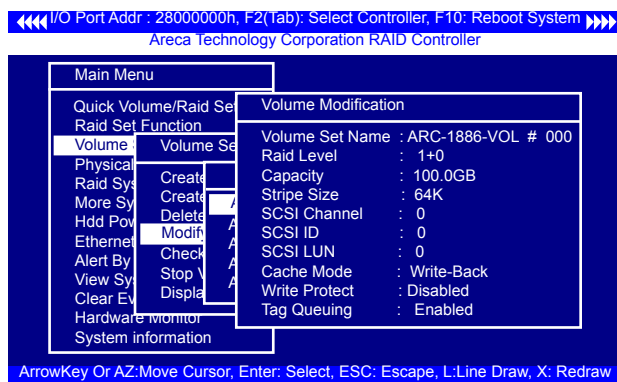


BIOS CONFIGURATION

3.7.3.4 Modify Volume Set

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

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



3.7.3.4.1 Volume Growth

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

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To expand an existing volume noticed:

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

For greater 2TB expansion:

- If your system installed in the volume, don't expand the volume capacity greater 2TB, currently OS can't support boot up from a greater 2TB capacity device.
- Expand over 2TB used 64bit LBA mode. Please make sure your OS supports 64bit LBA before expand it.

3.7.3.4.2 Volume Set Migration

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

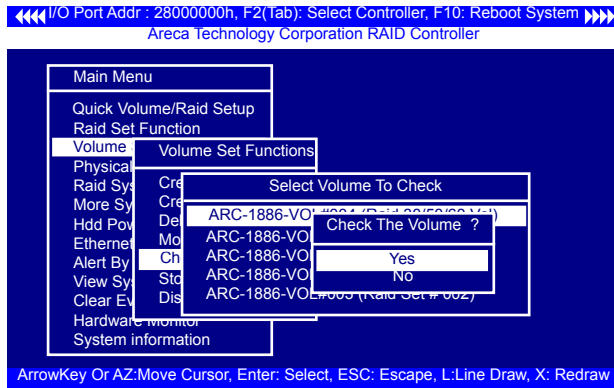
Note:

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

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3.7.3.5 Check Volume Set

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



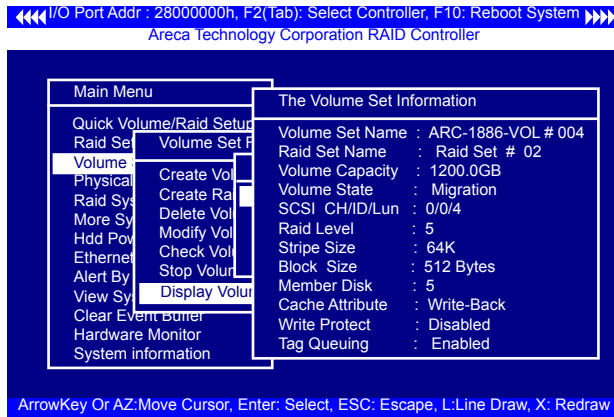
3.7.3.6 Stop Volume Check

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

3.7.3.7 Display Volume Set Info.

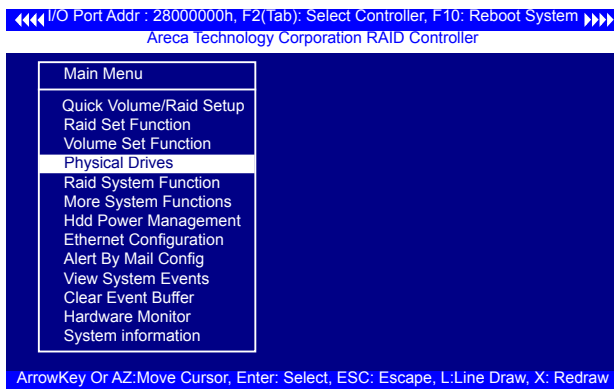
To display volume set information, move the cursor bar to the desired volume set number and then press the **Enter** key. The "Volume Set Information" screen will be shown. You can only view the information of this volume set in this screen, but can not modify it.

BIOS CONFIGURATION



3.7.4 Physical Drives

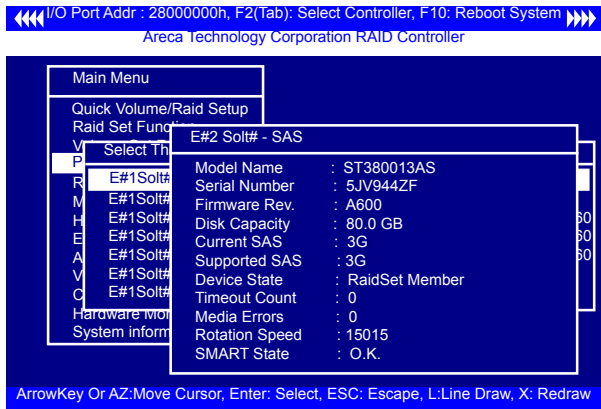
Choose this option from the main menu to select a physical disk and perform the operations listed above. Move the cursor bar to an item, then press **Enter** key to select the desired function.



BIOS CONFIGURATION

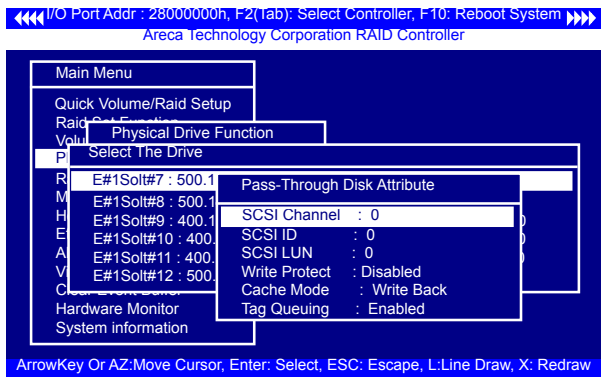
3.7.4.1 View Drive Information

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



3.7.4.2 Create Pass-Through Disk

A pass-through disk is not controlled by the tri-mode RAID adapter firmware and thus cannot be a part of a volume set. The disk is available directly to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the tri-mode RAID adapter firmware. The SCSI Channel/SCSI ID/SCSI LUN, Write Protect, Cache Mode, and Tag Queuing must be specified to create a pass-through disk.



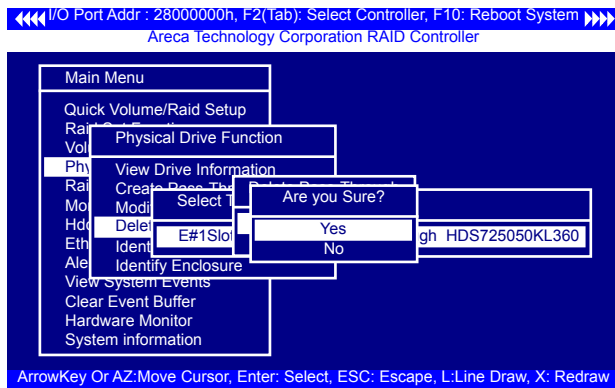
BIOS CONFIGURATION

3.7.4.3 Modify Pass-Through Disk

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

3.7.4.4 Delete Pass-Through Disk

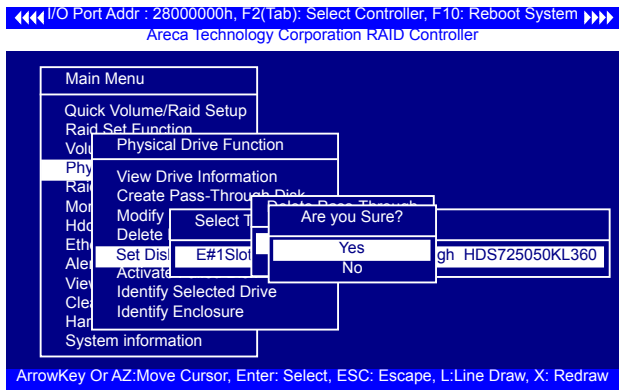
To delete a pass-through drive from the pass-through drive pool, move the cursor bar to the "Delete Pass-Through Drive" item, then press the **Enter** key. The "Delete Pass-Through confirmation" screen will appear; select **Yes** to delete it.



3.7.4.5 Set Disk To Be Failed

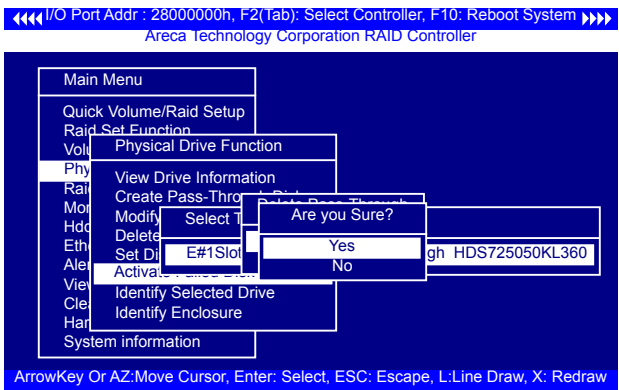
It sets a normal working disk as "failed" so that users can test some of the features and functions.

BIOS CONFIGURATION



3.7.4.6 Activate Failed Disk

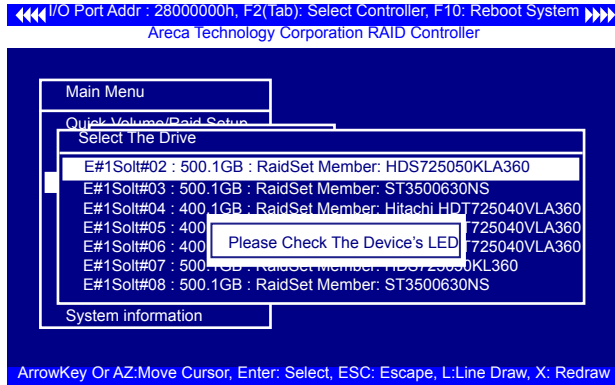
It forces the current “failed” disk in the system to be back on-line. “Activate Failed Disk” function has no effect on the removed disks, because a “removed” disk does not give the adapter a chance to mark it as “failure”.



3.7.4.7 Identify Selected Drive

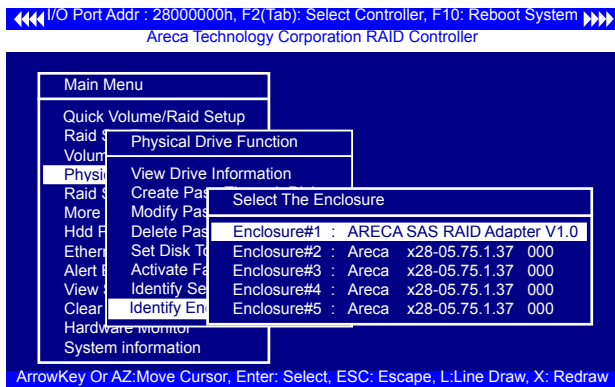
To prevent removing the wrong drive, the selected disk fault LED indicator will light for physically locating the selected disk when the “Identify Selected Device” is selected.

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3.7.4.8 Identify Enclosure

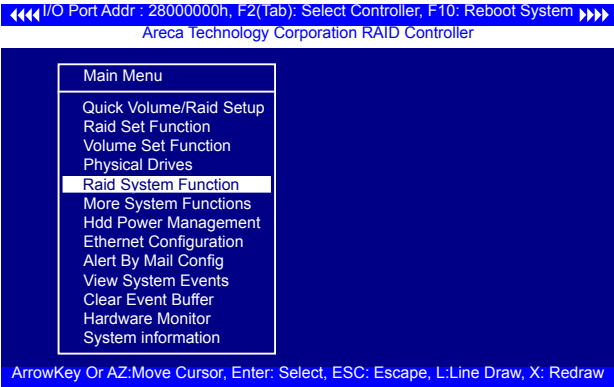
To prevent removing the wrong enclosure, the selected Areca expander enclosure all disks fault LED indicator will light for physically locating the selected enclosure when the "Identify Enclosure" is selected. This function will also light the enclosure LED indicator, if it is existed.



3.7.5 Raid System Function

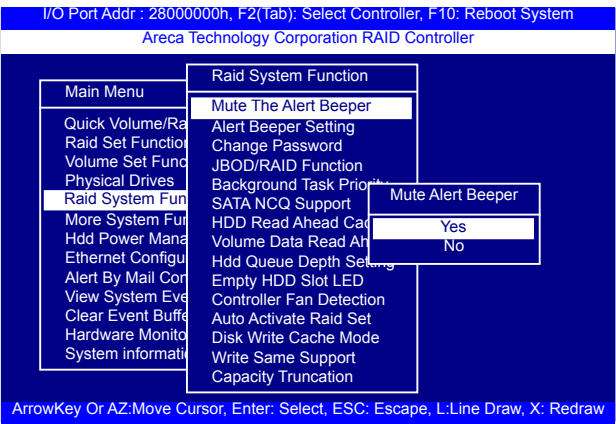
To set the "Raid System Function", move the cursor bar to the main menu and select the "Raid System Function" item and then press **Enter** key. The "Raid System Function" menu will show multiple items. Move the cursor bar to an item, and then press **Enter** key to select the desired function.

BIOS CONFIGURATION



3.7.5.1 Mute The Alert Beeper

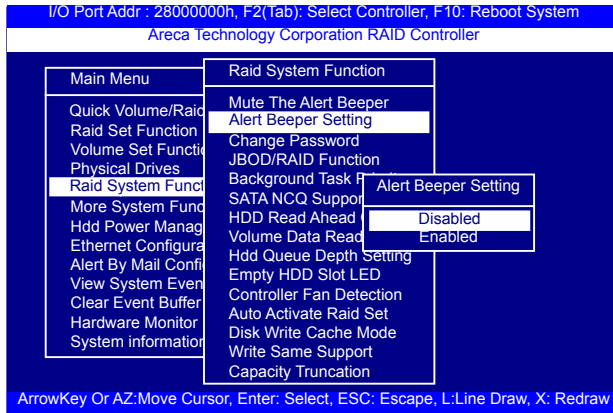
The “Mute The Alert Beeper” function item is used to control the tri-mode RAID adapter beeper. Select **Yes** and press the **Enter** key in the dialog box to turn the beeper off temporarily. The beeper will still activate on the next event.



3.7.5.2 Alert Beeper Setting

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

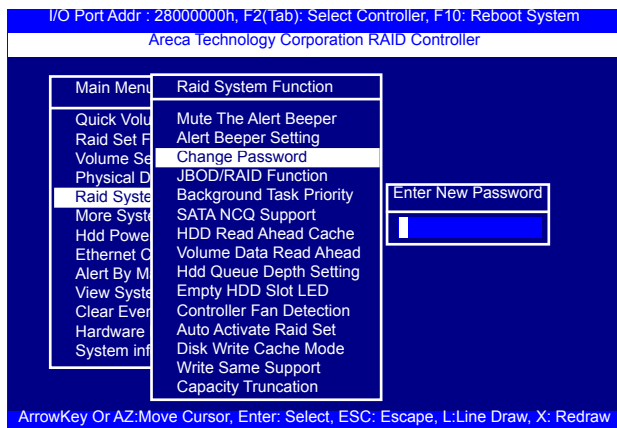
BIOS CONFIGURATION



3.7.5.3 Change Password

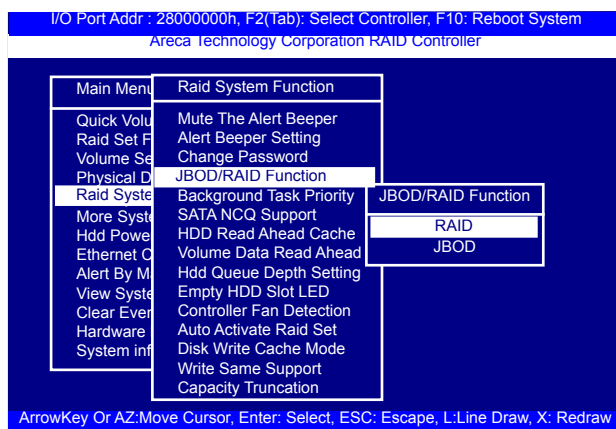
The manufacture default password is set to 0000. The password option allows user to set or clear the password protection feature. Once the password has been set, the user can monitor and configure the adapter only by providing the correct password. This feature is used to protect the internal RAID system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

BIOS CONFIGURATION



3.7.5.4 JBOD/RAID Function

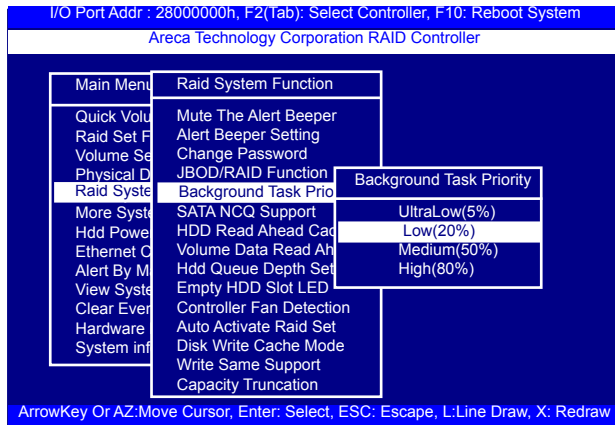
JBOD is an acronym for "Just a Bunch Of Disk". A group of hard disks in a RAID box are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to change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



BIOS CONFIGURATION

3.7.5.5 Background Task Priority

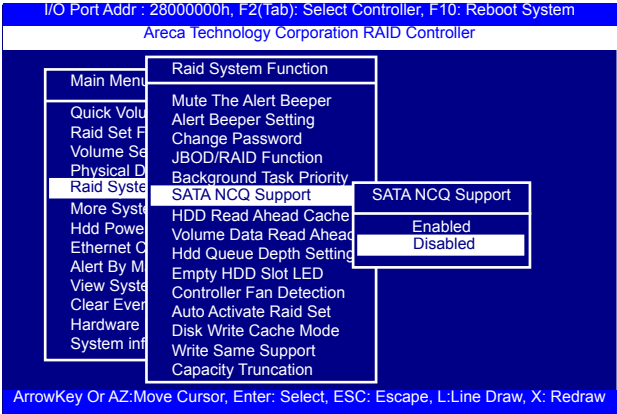
The “Background Task Priority” is a relative indication of how much time the adapter devotes to a rebuild operation. The tri-mode RAID adapter allows the user to choose the rebuild priority (UltraLow, Low, Normal, High) to balance volume set access and rebuild tasks appropriately.



3.7.5.6 SATA NCQ Support

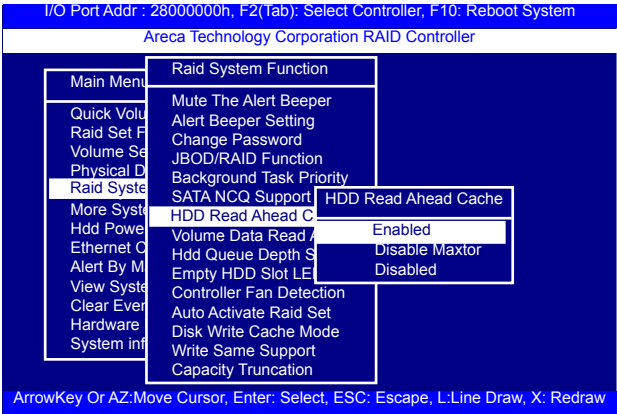
RAID adapter supports both SAS and SATA disk drives. The SATA NCQ allows multiple commands to be outstanding within a drive at the same time. Drives that support NCQ have an internal queue where outstanding commands can be dynamically rescheduled or re-ordered, along with the necessary tracking mechanisms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

BIOS CONFIGURATION



3.7.5.7 HDD Read Ahead Cache

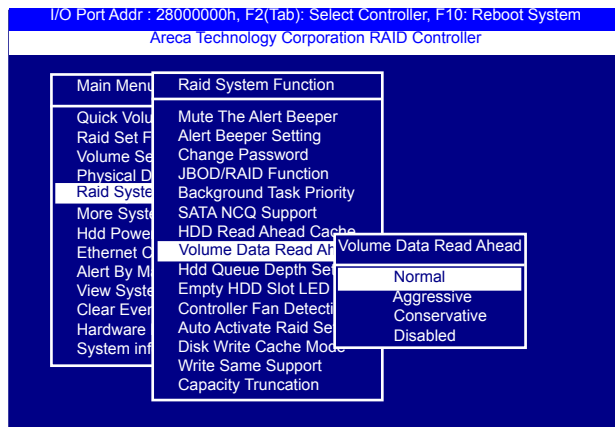
Allow Read Ahead (Default: Enabled)—When "Enabled", the drive's read ahead cache algorithm is used, providing maximum performance under most circumstances.



BIOS CONFIGURATION

3.7.5.8 Volume Data Read Ahead

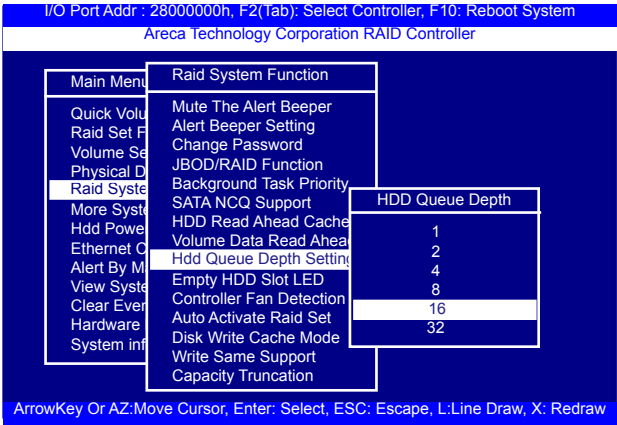
The volume read data ahead parameter specifies the adapter firmware algorithms which process the read ahead data blocks from the disk. The "Data Read Ahead" parameter is normal by default. To modify the value, you must set it from the "Raid System Function" using the "Volume Data Read Ahead" option.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



3.7.5.9 Hdd Queue Depth Setting

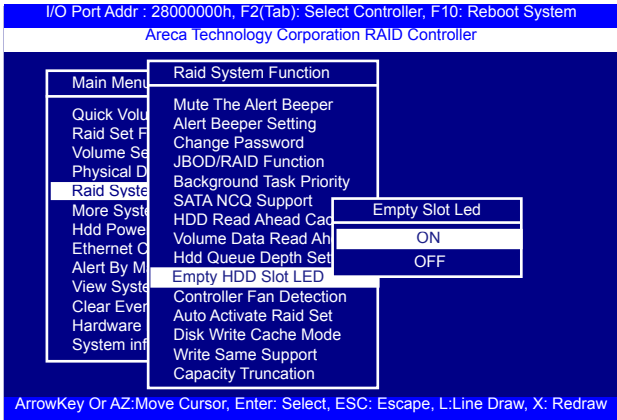
This parameter is adjusted the queue depth capacity of NCQ (SAS HDD) or Tagged Command Queuing (SAS HDD) which transmits multiple commands to a single target without waiting for the initial command to complete.

BIOS CONFIGURATION



3.7.5.10 Empty HDD Slot LED

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

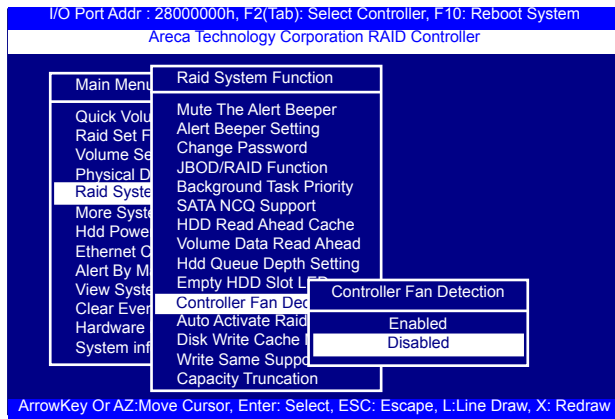


BIOS CONFIGURATION

3.7.5.11 Controller Fan Detection

The ARC-1886 series incorporate one big passive heatsink attaching a active cooling fan that allows the hot devices such as a ROC and expander chip to keep cool. In addition, newer systems already have enough air flow blowing over the adapter. If the systems have provided enough adequate cooling for ROC and expander chip, user can remove the attaching fan on the big passive heat sink.

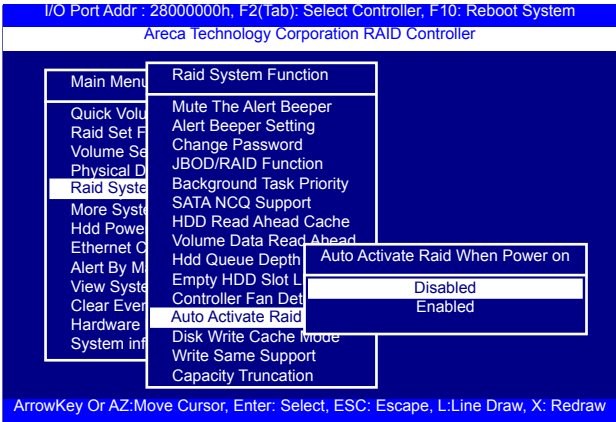
The "Controller Fan Detection" function is available in the firmware for detecting the cooling fan function on the ROC which uses the active cooling fan. When using the passive heatsink on the adapter, disable the "Controller Fan Detection" function through this McBIOS RAID manager setting. The following screen shot shows how to change the McBIOS RAID manager setting to disable the warning beeper function.



3.7.5.12 Auto Activate Raid Set

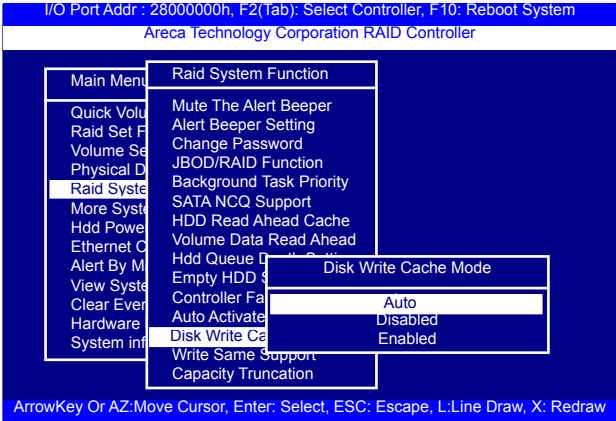
When some of the disk drives are removed in power off state or boot up stage, the RAID set state will change to "Incomplete State". But if a user wants to automatically continue to work while the tri-mode RAID adapter is powered on, then user can set the "Auto Activate Raid Set" option to "Enabled".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

BIOS CONFIGURATION



3.7.5.13 Disk Write Cache Mode

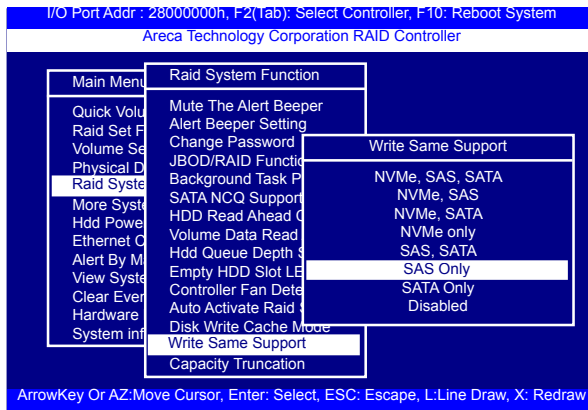
User can set the "Disk Write Cache Mode" to Auto, Enabled, or Disabled. "Enabled" increases speed, "Disabled" increases reliability.



3.7.5.14 Write Same Support

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

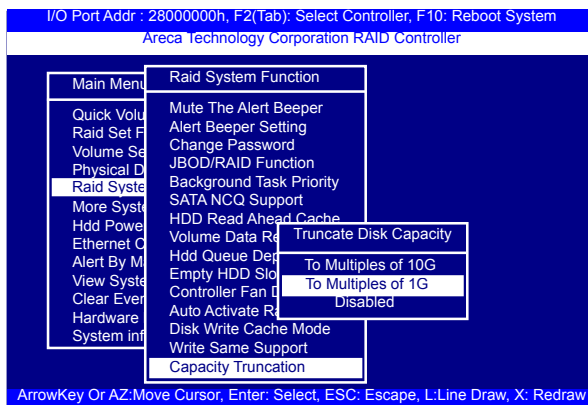
BIOS CONFIGURATION



3.7.5.15 Capacity Truncation

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

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



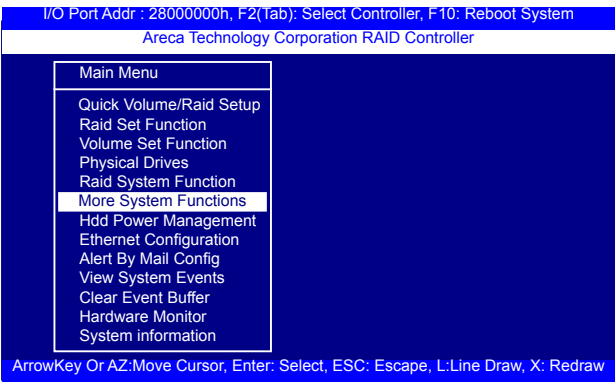
BIOS CONFIGURATION

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

Disabled: It does not truncate the capacity.

3.7.6 More System Functions

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



3.7.6.1 Smart Option For HDD

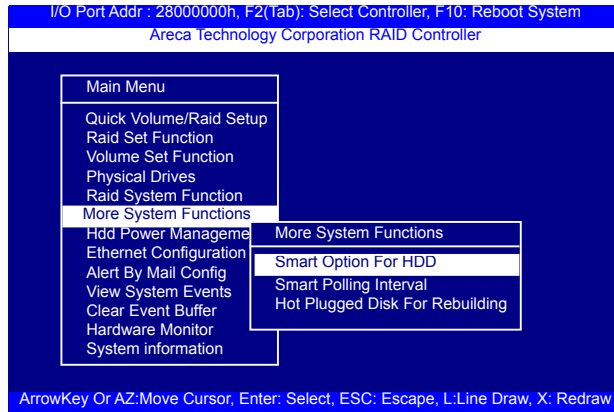
This option is used to increase the reliability of SSDs/HDDs by automatically copying data from a drive with potential to fail to a designated hot spare or newly inserted drive. The options are: "Failed The Drive", "Failed The Drive If Hot Spare Exist", and "Alert Only". The default is "Alert Only".

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

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

BIOS CONFIGURATION

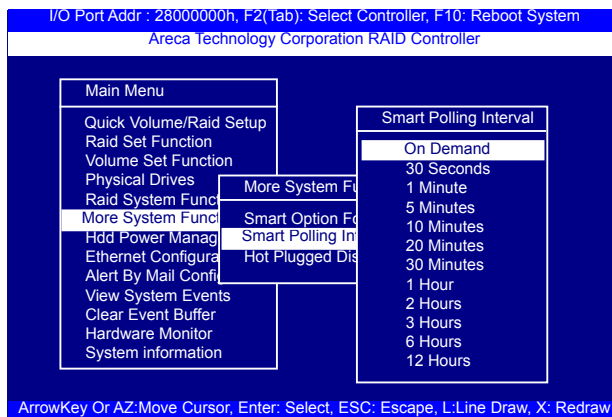
“Alert Only” – it will trigger alert when there happens a SMART fail drive.



3.7.6.2 Smart Polling Interval

Besides the scheduled volume check, user can define the Smart Pulling Interval to pull the SMART status of each disk. The default is “on demand”.

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



BIOS CONFIGURATION

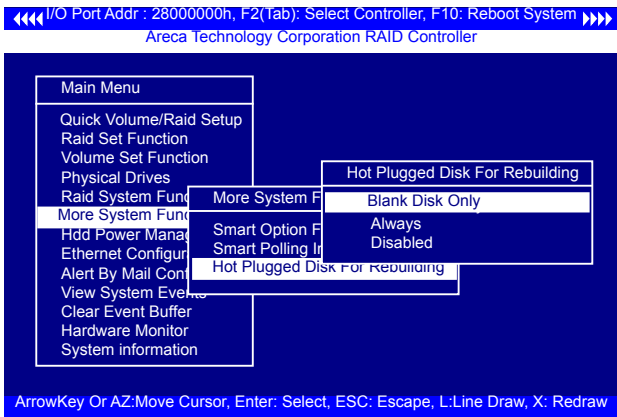
3.7.6.3 Hot Plugged Disk For Rebuilding

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

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

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

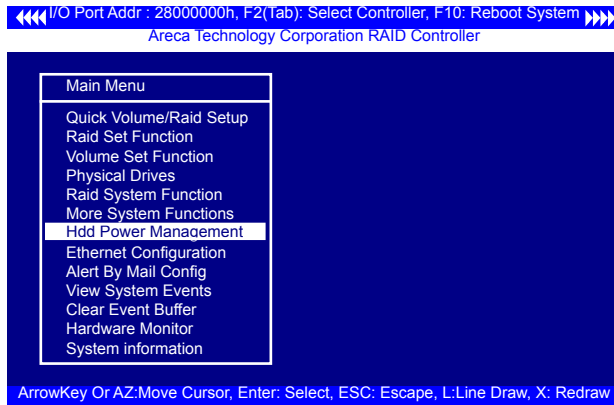
"Disable" – it will not trigger rebuilding regardless what sort of disk plugging in. When "Disable" and/or "Blank Disk Only" is selected, the re-inserted/previously removed disk will be identified as a disk in a separate RAID set with duplicated RAIDset# and with all the rest of RAID members missing.



BIOS CONFIGURATION

3.7.7 HDD Power Management

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

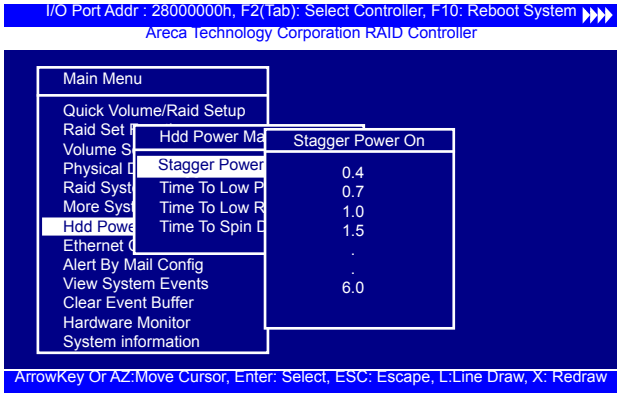


3.7.7.1 Stagger Power On

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

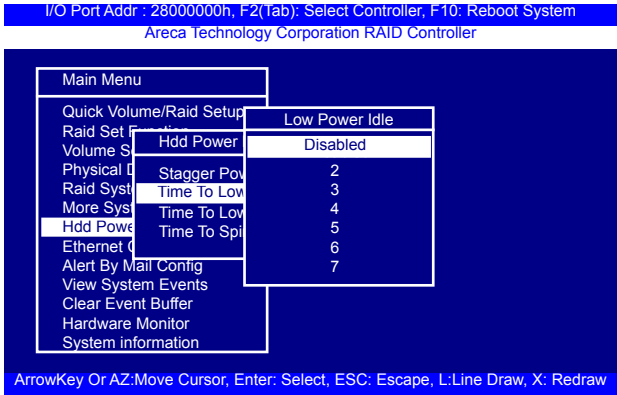
BIOS CONFIGURATION

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



3.7.7.2 Time To Hdd Low Power Idle

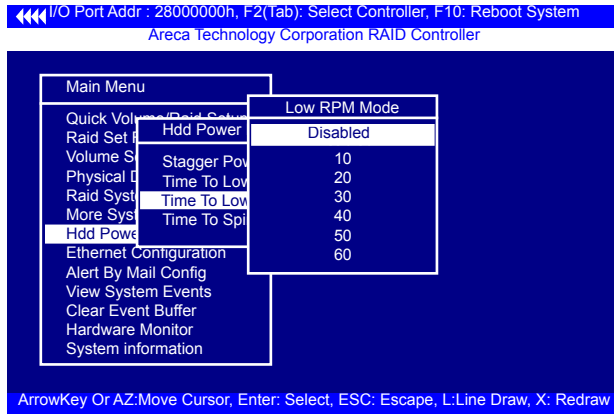
This option delivers lower power consumption by automatically unloading recording heads during the setting idle time. The values can be selected "Disabled" or within the range 2 to 7 minutes.



BIOS CONFIGURATION

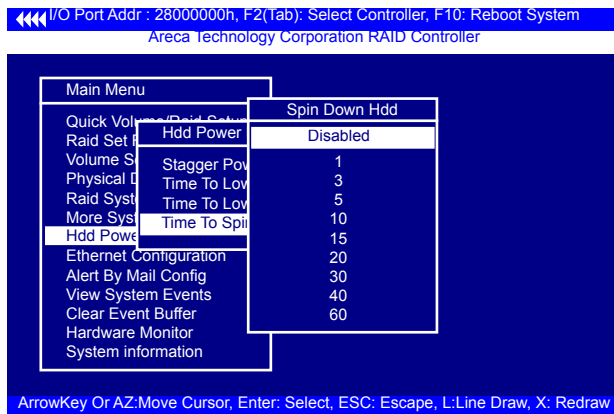
3.7.7.3 Time To Low RPM Mode

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



3.7.7.4 Time To Spin Down Idle Hdd

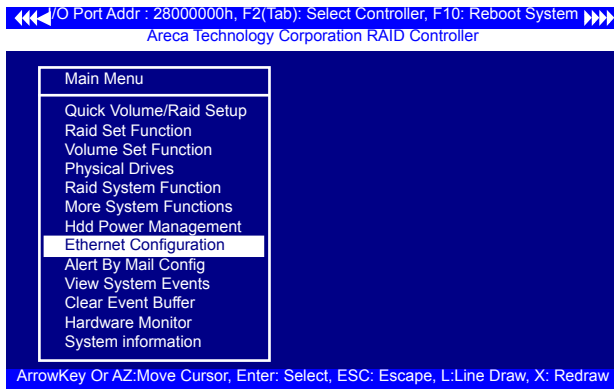
This function can automatically spin down the drive if it hasn't been accessed for a certain amount of time. This value is used by the drive to determine how long to wait (with no disk activity, before turning off the spindle motor to save power). The values can be selected "Disabled" or within the range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



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3.7.8 Ethernet Configuration

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

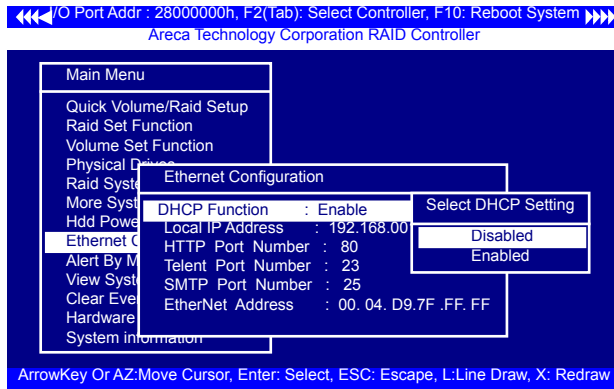


3.7.8.1 DHCP Function

DHCP (Dynamic Host Configuration Protocol) allows network administrators centrally manage and automate the assignment of IP (Internet Protocol) addresses on a computer network. When using the TCP/IP protocol (Internet protocol), it is necessary for a computer to have a unique IP address in order to communicate to other computer systems. Without DHCP, the IP address must be entered manually at each computer system. DHCP lets a network administrator supervise and distribute IP addresses from a central point. The purpose of DHCP is to provide the automatic (dynamic) allocation of IP client configurations for a specific time period (called a lease period) and to minimize the work necessary to administer a large IP network. To manually configure the IP address of the adapter, move the cursor bar to DHCP Function item, then press **Enter** key to show the DHCP setting. Select the "Disabled" or "Enabled" option to enable or disable the DHCP function. If DHCP is disabled, it will be neces-

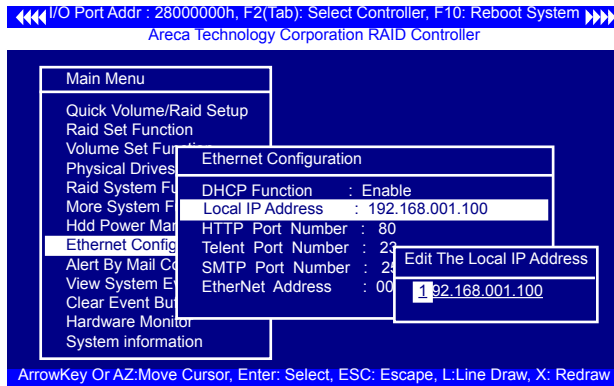
BIOS CONFIGURATION

sary to manually enter a static IP address that does not conflict with other devices on the network.



3.7.8.2 Local IP address

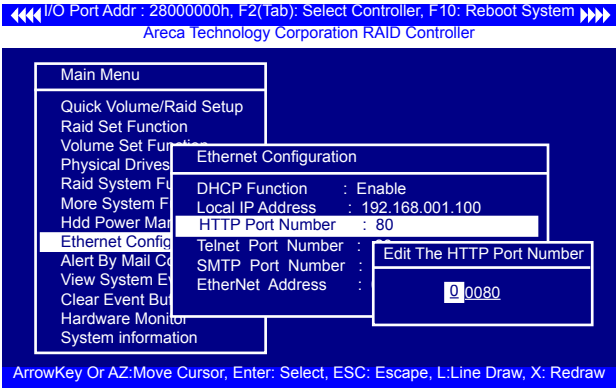
If you intend to set up your client computers manually (no DHCP), make sure that the assigned IP address is in the same range as the default router address and that it is unique to your private network. However, it is highly recommend to use DHCP if that option is available on your network. An IP address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



BIOS CONFIGURATION

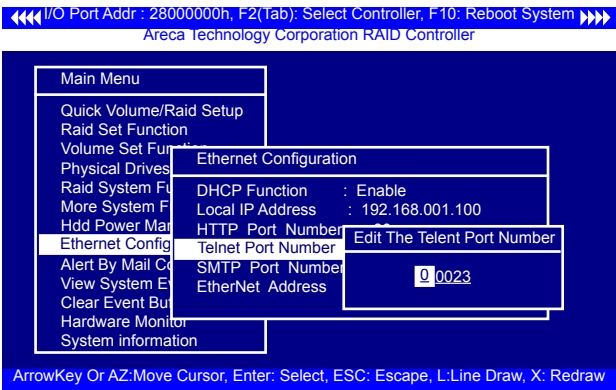
3.7.8.3 HTTP Port Number

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



3.7.8.4 Telnet Port Number

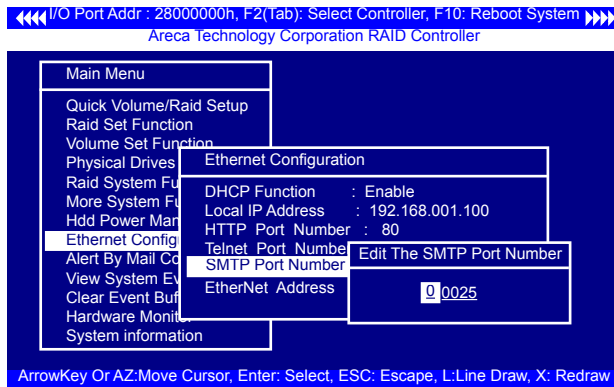
To manually configure the “Telnet Port Number” of the adapter, move the cursor bar to “Telnet Port Number” item, then press the **Enter** key to show the default address setting in the RAID adapter. You can then reassign the default “Telnet Port Number” of the adapter.



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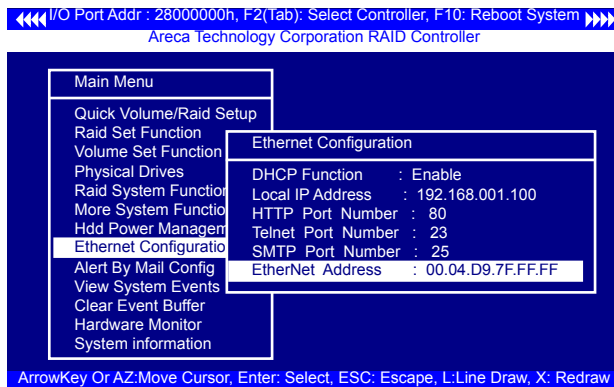
3.7.8.5 SMTP Port Number

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



3.7.8.6 Ethernet Address

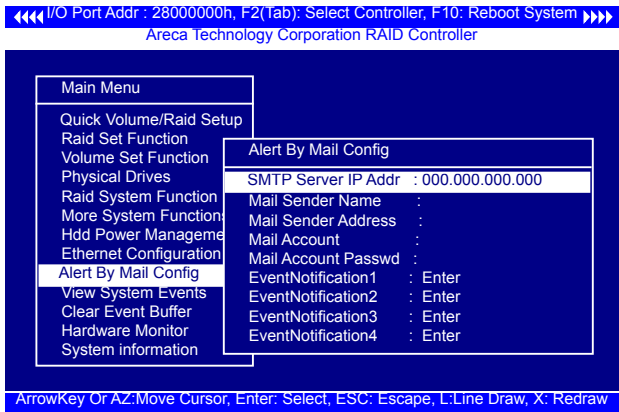
Each Ethernet port has its unique Mac address, which is also factory assigned. Usually, Ethernet address is used to uniquely identify a port in the Ethernet network.



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3.7.9 Alert By Mail Config

To configure the 6Gb/s tri-mode RAID adapter e-mail function, move the cursor bar to the main menu and click on the "Alert By Mail Config" link. The "Alert By Mail Config" menu will show all items. Move the cursor bar to the "Alert By Mail Config" item, then select the desired function.

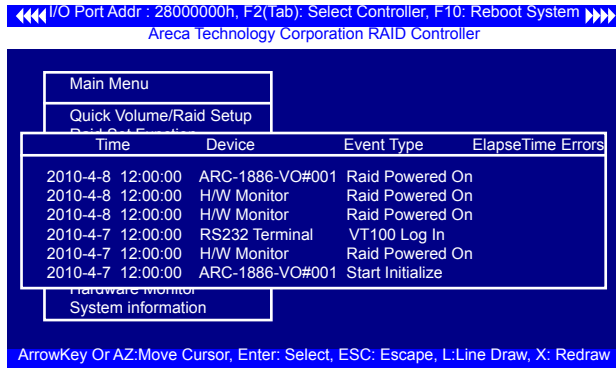


3.7.10 View System Events

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

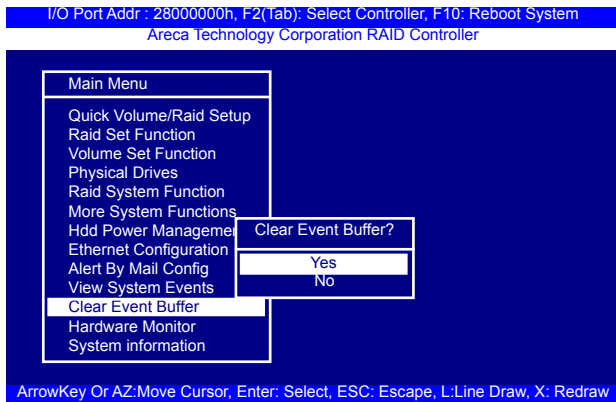
Choose this option to view the system events information: Timer, Device, Event type, Elapsed Time, and Errors. The RAID adapter does not have a build-in real time clock. The time information is the relative time from the tri-mode RAID adapter powered on.

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3.7.11 Clear Events Buffer

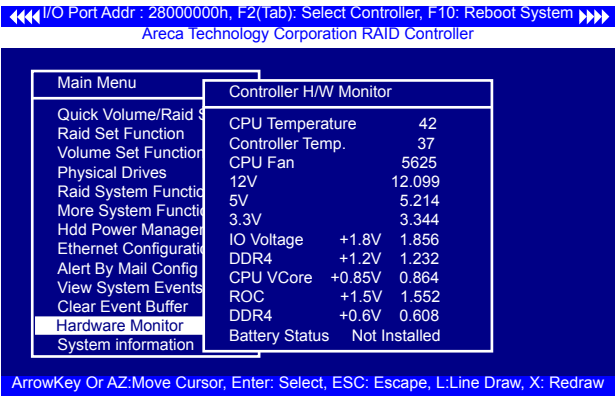
Use this feature to clear the entire events buffer.



3.7.12 Hardware Monitor

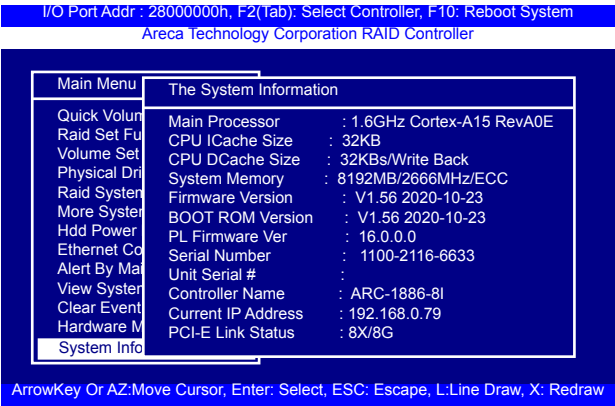
To view the RAID adapter's hardware monitor information, move the cursor bar to the main menu and click on the "Hardware Monitor" link. The "Controller H/W Monitor" screen appears. The "Controller H/W Monitor" provides the CPU temperature, adapter temperature and voltage of the tri-mode RAID adapter.

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3.7.13 System Information

Choose this option to display adapter name, firmware version, BOOT ROM version, SAS firmware version, serial number, main processor, CPU instruction cache and data cache size, system memory, and current IP address. To check the system information, move the cursor bar to "System Information" item, then press **Enter** key. All relevant adapter information will be displayed.



4. Driver Installation

This chapter describes how to install the tri-mode RAID adapter driver to your operating system. The installation procedures use the following terminology:

Installing operating system on SAS adapter's volume

If you have a new drive configuration without an operating system and want to install operating system on a disk drive managed by the tri-mode RAID adapter. The driver installation is a part of the operating system installation.

Installing tri-mode RAID adapter into an existing operating system

The computer has an existing operating system installed and the tri-mode RAID adapter is being installed as a secondary adapter.

Have all required system hardware and software components on hand before proceeding with the setup and installation.

Materials required:

- Microsoft Windows, Linux, FreeBSD and macOS installation
- Tri-mode RAID adapter installation guide
- Tri-mode RAID adapter

4.1 Creating the Driver Diskettes

You can download the latest version drivers for Windows, Linux, FreeBSD and macOS from the Areca web site at <http://www.areca.com.tw>

These driver files are intended for use with new operating system installations. You can copy the driver file to USB device and installed from it. Determine the correct kernel version and identify which files contain drivers for that kernel, and a screen with several choices will be displayed.

The driver diskette is made now. Proceed to the following instruction for installation procedures.

DRIVER INSTALLATION

4.2 Driver Installation for Windows

The tri-mode RAID adapter can be used with Microsoft Windows 10/8/Server 2019/2016 with StorPort Drivers.

4.2.1 Installing Windows on a RAID Volume

For completed details on installing Windows, see the Windows User's Manual. The following procedures detail installing the tri-mode RAID adapter driver while installing Windows. Have your bootable Microsoft Windows CD and follow the required procedure below to install tri-mode RAID adapter:

1. Make sure you follow the instructions in Chapter 2 "Hardware Installation" to install the adapter and connect the disk drives or enclosure.
2. Start the system and then press **Tab** or **F6** to access the Mc BIOS RAID manager. Use the McBIOS RAID manager to create the RAID set and volume set to which you will install Windows. For details, see Chapter 3 "McBIOS RAID manager". Once a volume set is created and configured, continue with next step to install the operating system.
3. Insert the Windows setup CD and reboot the system to begin the Windows installation.
4. Follow the on-screen instructions to begin the Windows installation.
5. When prompted to specify a location for Windows, select "**Load Driver**".
6. Insert the USB driver disk or floppy drive, browse to the driver location, then click "**OK**".
7. Window will check the floppy; select the correct card and CPU type for your hardware from the listing and press "**Next**" to install it.

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8. Click on "**Next**" again to accept the default partition configuration, or refer to your Windows documentation to configure partitions manually.
9. From this point on, simply follow the Microsoft Windows installation procedure. Follow the on-screen instructions, responding as needed, to complete the installation.
10. After the installation is completed, reboot the system to load the new driver/operating system.
11. See Chapter 6 in this manual to customize your RAID volume sets using McRAID storage manager.

After you finish creating additional volume, the following steps show how to make any new volumes or independent disks accessible to Windows.

- (a). Click "**Start**" ==> right-click "**Computer**" and select "**Manage**".
- (b). Click "**Disk Management**" in the left pane.
- (c). Scroll down to the bottom of the middle pane.
Windows will display a list of new drives attached to your system with a label such as "Disk 1" or "Disk 2", etc.
- (d). Right-click on the drive you want to partition and then again to format it
- (e). Once it's formatted, Windows automatically assigns the next available drive letter to it and then it will appear in Windows Explorer.

4.2.2 Installing Controller on an Existing Windows

In this scenario, you are installing the adapter in an existing Windows system. To install the driver:

DRIVER INSTALLATION

1. Follow the instructions in Chapter 2, the Hardware Installation Chapter, to install the adapter and connect the disk drives or enclosure.
2. Start the system and then press **Tab** or **F6** to enter the controller McBIOS RAID manager. Use the configuration utility to create the RAID set and volume set. For details, see Chapter 3, McBIOS RAID Manager. Once a volume set is created and configured, continue with installation of the driver.
3. Re-Boot Windows and the OS will recognize the tri-mode RAID adapter and launch the "Found New Hardware Wizard", this guides you in installing the tri-mode RAID driver.
4. The Windows will pop-up and provide a choice of how to proceed. so that you can choose a specific driver.
5. When the next screen queries the user about utilizing the currently installed driver, click on the "**Have Disk**" button.
6. Insert the tri-mode RAID adapter driver media to locate the correct path. Click on the "**Next**" button.
7. Windows automatically copies the appropriate driver files and rebuilds its driver database.
8. The summary screen appears; click on the "**close**" button.
9. Restart the computer to load the new drivers.
10. See Chapter 6 in this manual for information on customizing your RAID volumes using McRAID storage manager.

After you finish creating additional volume, the following steps show how to make any new volumes or independent disks accessible to Windows.

- (a). Click "**Start**" ==> right-click "**Computer**" and select "**Manage**".
- (b). Click "**Disk Management**" in the left pane.

DRIVER INSTALLATION

- (c). Scroll down to the bottom of the middle pane. Windows will display a list of new drives attached to your system with a label such as "Disk 1" or "Disk 2", etc.
- (d). Right-click on the drive you want to partition and then again to format it
- (e). Once it's formatted, Windows automatically assigns the next available drive letter to it and then it will appear in Windows Explorer.

4.2.3 Uninstall adapter from Windows

To remove the tri-mode RAID adapter driver from the Windows system, follow the instructions below.

1. Ensure that you have closed all applications and are logged in with administrative rights.
2. Open "Control Panel" and start the "Add/Remove Program" icon and uninstall software for the tri-mode RAID adapter.
3. Go to "Control Panel" and select "System". Select the "Hardware" tab and then click the "Device Manager" button. In device manager, expand the "SCSI and RAID Controllers" section. Right click on the tri-mode RAID adapter and select "Uninstall".
4. Click **Yes** to confirm removing the tri-mode RAID driver. The prompt to restart the system will then be displayed.

4.3 Driver Installation for Linux

This chapter describes how to install the tri-mode RAID adapter driver to Red Hat Linux, SuSE and other versions of Linux. Before installing the tri-mode RAID driver to the Linux, complete the following actions:

1. Install and configure the adapter and hard disk drives according to the instructions in Chapter 2 Hardware Installation.

DRIVER INSTALLATION

2. Start the system and then press **Tab** or **F6** to enter the McBIOS RAID manager configuration utility. Using the McBIOS RAID manager to create the RAID set and volume set. For details, see Chapter 3, McBIOS RAID Manager.

If you are using a Linux distribution for which there is not a compiled driver available from Areca, you can download the source from the Areca website and compile a new driver.

You can download updated versions of compiled and tested drivers for RedHat or SuSE Linux from the Areca web site at **<https://www.areca.com.tw>**. Included in these downloads is the Linux driver source, which can be used to compile the updated version driver for RedHat, SuSE and other versions of Linux.

Please refer to the "readme.txt" file on the included tri-mode RAID adapter website to make driver diskette and install driver to the system.

4.4 Driver Installation for FreeBSD

This chapter describes how to install the tri-mode RAID adapter driver to FreeBSD. Before installing the tri-mode RAID driver to FreeBSD, complete following actions:

1. Install and configure the adapter and hard disk drives according to the instructions in Chapter 2, Hardware Installation.
2. Start the system and then press **Tab** or **F6** to enter the McBIOS RAID Manager configuration utility. Use the McBIOS RAID manager to create the RAID set and volume set. For details, see Chapter 3, McBIOS RAID Manager.

The website supplied driver for the tri-mode RAID adapter includes compiled and tested drivers for FreeBSD 11.x (11.0 and onwards) and 12.x (12.0 and onwards). To check if a more current version driver is available, please see the Areca web site at <http://www.areca.com.tw>.

Please refer to the "readme.txt" file on the tri-mode RAID adapter website to make driver diskette and install driver to the system.

4.5 Driver Installation for macOS

After hardware installation, the SAS/SATA disk drives connected to the tri-mode RAID adapter must be configured and the volume set units initialized by the adapter before they are ready to use by the system.

4.5.1 Installation Procedures

This section describes detailed instructions for installing the Areca Mac driver & utility for the ARC-1886 series on your Intel-based Mac Pro. You must have administrative level permissions to install Mac driver & utility.

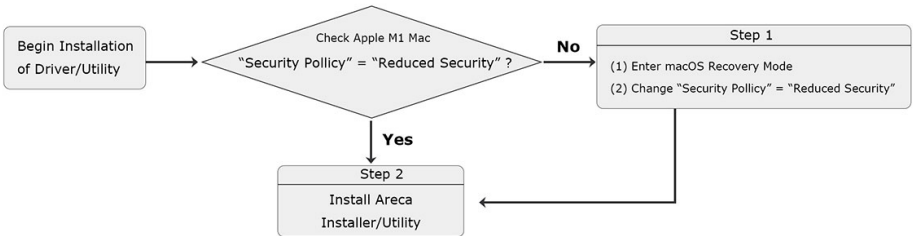
4.5.1.1 Install Areca driver for Mac

On November 10, 2020, Apple revealed new Mac hardware with the revolutionary Apple Silicon M1 processors. Since external boot via 3rd party drivers is not allowed on Apple Silicon based Macs, the default Areca driver doesn't work on new M1 Mac, only for Intel-based Macs.

The macOS 11 had not been integrated any universal KEXTs into macOS, which means that users need to install universal KEXT to support Areca Thunderbolt devices on Apple Silicon. Areca universal KEXT's on Apple Silicon can be installed in /Library/Extensions/, even if Areca RAID storage x86-only versions persists on the system in /System/Library/Extensions/. In order to use 3rd party kernel extensions on Apple Silicon Macs, users must enable system extensions by changing their Mac's Security Policy to Reduced Security and allow user management of kernel extensions from identified developers.

DRIVER INSTALLATION

Installing Areca Driver for Apple M1 Mac in macOS 11.0 or higher Flow Chart



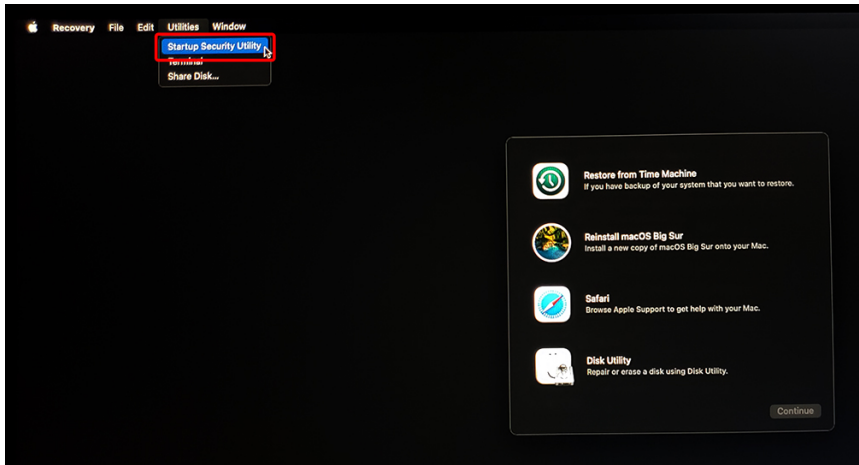
*** If your mac version is below 11.0, you can skip this step**
Step 1. Start up your computer in macOS Recovery

- (1-1). Choose "**Shut Down**".
- (1-2). Press and hold the power button on your Mac until you see "**Loading startup options**".
- (1-3). Click "**Options**", then click "**Continue**". If requested, enter the password for an administrator account.



DRIVER INSTALLATION

(1-4). In the Recovery app, choose **Utilities** > **Startup Security Utility**.



(1-5). Select the system you want to use to set the security policy and click "**Security Policy**". If the disk is encrypted with FileVault, click Unlock, enter the password and then click Unlock.



DRIVER INSTALLATION

- (1-6). Choose "**Reduced Security**" and enable "Allow user management of kernel extensions from identified developers".



- (1-7). Click "**OK**" and confirm the action by entering your administrator credentials.
- (1-8). Restart your Mac for the changes to take effect.

DRIVER INSTALLATION

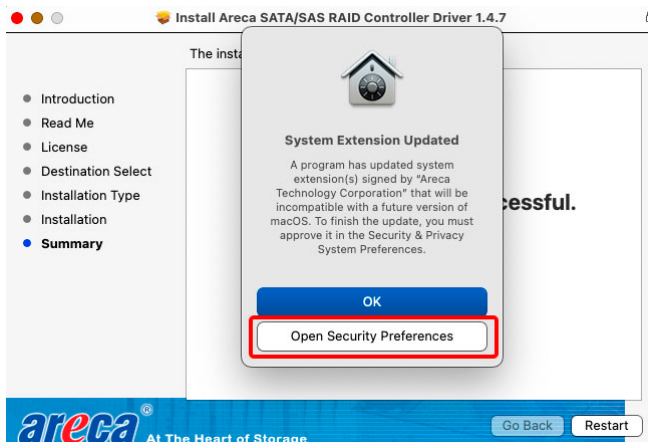
Step 2. Installing Areca driver

- (2-1). Download the driver from Areca website: <https://www.areca.com.tw/support/downloads.html>
- (2-2). Double-click [ArcMSRu.pkg] in the mounted disk image to start.



Follow the installer on-screen steps to complete the installation.

- (2-3). When Areca installation shows successful, system will pop the following "System Extension Updated" warning message: A program tried to load new system extension(s) signed by "Areca Technology corporation" but your security setting do not allow system extensions. To enable them, choose the **"Open Security Preferences"** to allow system extension.



DRIVER INSTALLATION

- (2-5). On Security & Privacy's General page
- Make sure the message "System software from developer "Areca Technology Corporation" was blocked from loading."
 - Make the setting to allow loading the driver. To unlock a preference pane, click the key icon at the lower left of the "Security & Privacy" screen. You are prompted to enter the password for the administrator account. Enter the information for "**User Name**" and "**Password**," then click "**OK**".
- (2-6). Make sure "Areca Technology Corporation" is displayed as the developer and click "**Allow**".

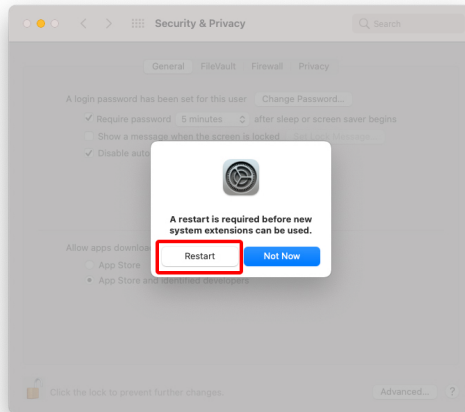


- * This message about being blocked is only displayed for only 30 minutes after installing the driver. When 30 minutes have passed after installing, the message is no longer displayed.
- * In the following condition, no message is displayed. Loading of the driver is permitted.

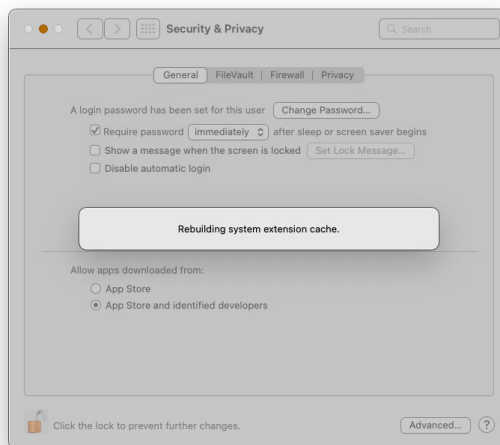
DRIVER INSTALLATION

- When a driver that has previously been allowed is reinstalled again.
- When you're using a Mac on which the driver was installed before now updating to macOS 11

A message prompting you to restart appears. Click "**Restart**".



This completes installation of the driver.



DRIVER INSTALLATION

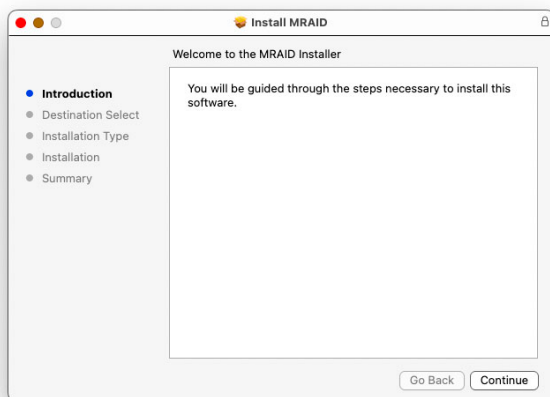
4.5.1.2 Install the MRAID Utility

This section describes detailed instructions for installing the Areca Mac utility on your Apple Thunderbolt capable machine. You must have administrative level permissions to install macOS utility. This can be done in just a few steps!

1. Download the install-mraid installer from the website at "<https://www.areca.com.tw/support/downloads.html>", the file name begins with "install-mraid" followed by the version control.
2. Navigate to your Downloads folder and double-click the install-mraid software. The Installer will open.

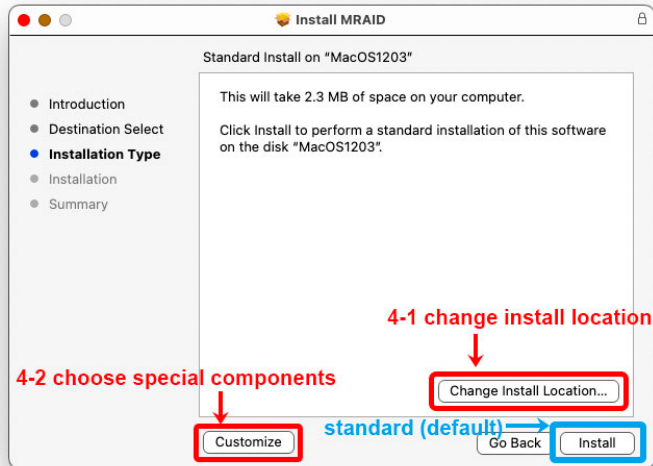


3. Click on the "**Continue**" button to begin the installation.

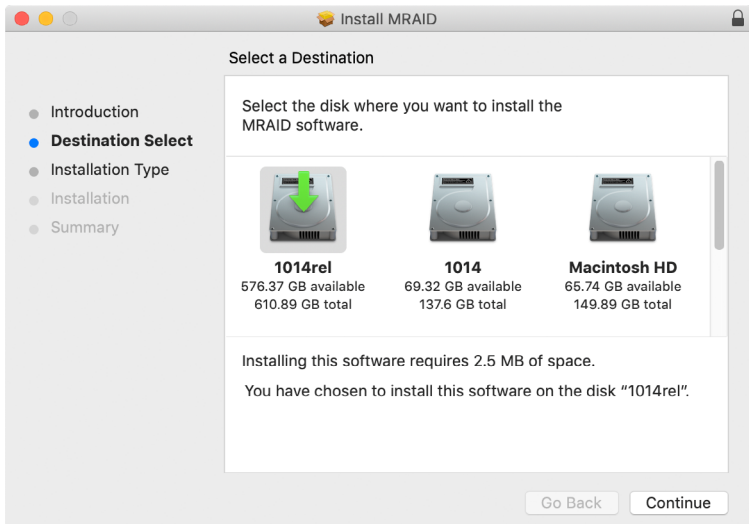


DRIVER INSTALLATION

4. If you have no need to change the install location or select to install special components, you can skip the step 4-1 and step 4-2, just click on the **"Install"** button to continue the standard (default) installation procedure.

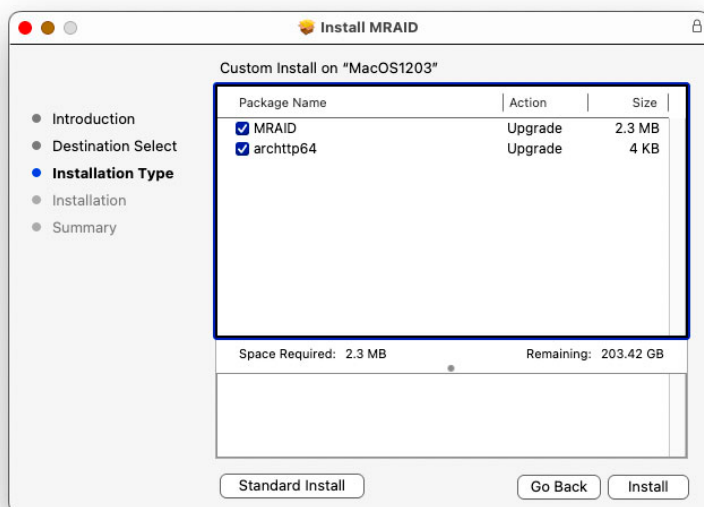


- 4-1. Click on the **"Change Install Location"** button to select the disk where you want to install the MRAID software.



DRIVER INSTALLATION

4-2, Click on the "**Customize**" button to choose special components. Click on an icon to install special components and click the "Install" button to continue.

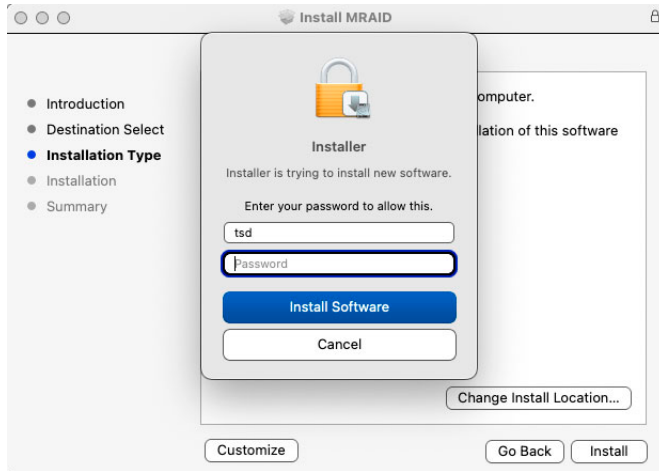


- **MRAID** is included below two applications.
 - *ArcHTTP* has to be installed for GUI RAID console (McRAID storage manager) to run. It also runs as a service or daemon in the background that allows capturing of events for mail and SNMP traps notification. Refer to the chapter 5 ArcHTTP Configuration on ARC-1886 series user manual, for details about the mail and SNMP traps configuration.
 - *CLI (Command Line Interface)* provides the functionality available in MRAID storage manager through a Command Line Interface. You can set up and manage RAID storage inline. CLI performs many tasks at the command line. You can download CLI manual from Areca website.

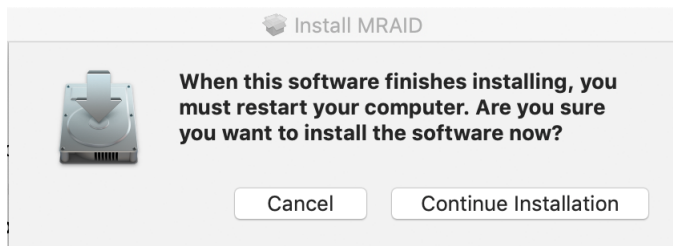
DRIVER INSTALLATION

- **ArchHTTP64** is required for ArchHTTP running as a service or daemon, and have it automatically start the proxy for all controllers found.

5. Enter your system password and click the “**Install Software**” button.

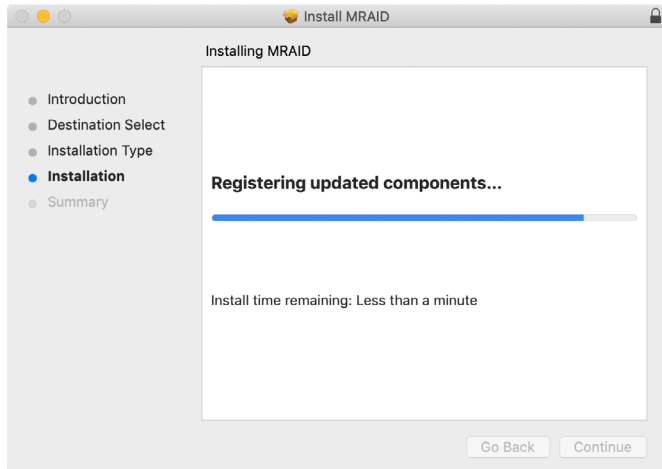


6. The system will need to be restarted when the installation is complete. Click “**Continue Installation**” button.

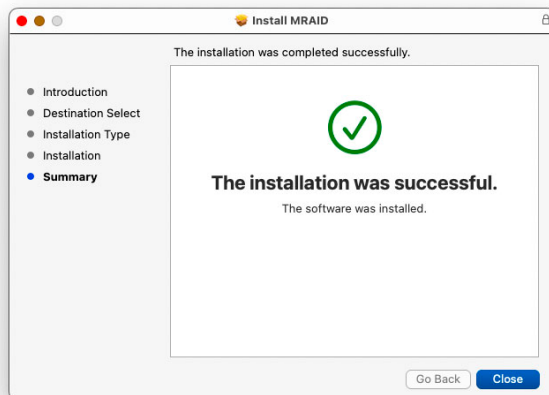


DRIVER INSTALLATION

7. A program bar appears that measures the progress of the driver installation.



8. When this screen shows, you have completed the installation and click on the "**Restart**" button to reboot your computer in order to complete installation.



9. There is a MRAID folder icon showing on your desktop. The folder contains two items (ArcCLI64 and ArcHTTP64) that are for you to launch the MRAID storage manager.

DRIVER INSTALLATION

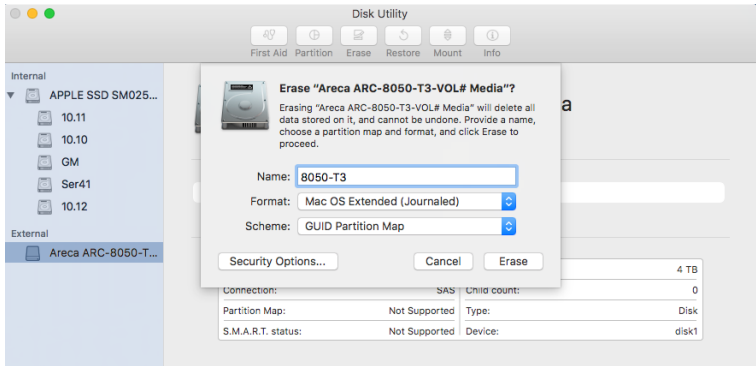
4.5.2 Making Volume Sets Available to macOS

After the volume set is ready for system accesses, it needs to be partitioned, formatted, and mounted by the operating system.

When you create a volume through McRAID storage manager, the macOS recognizes that a new disk is avail, and displays a message asking what you next want to do. If the message does not show up, start the "Disk Utility" manually from the "Finder", use the "Go" menu and open the "Utilities" folder. Double-click on the "Disk Utility" program.

To format and partition your unit

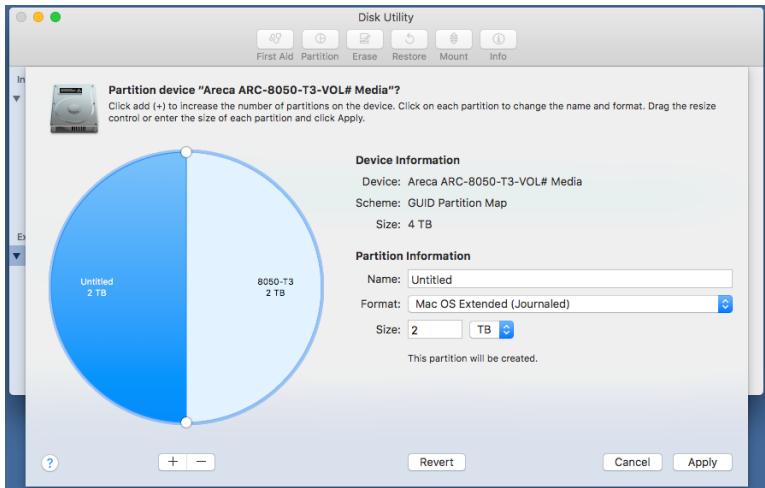
1. Formatting a drive in Disk Utility is easy, though Disk Utility uses a different term: Erase. When the Disk Utility window opens, find and select the desired drive in the sidebar that represents your RAID storage. This is how you prepare to erase and format the RAID storage.



Choose OS X Extended (Journaled) for the Format, and, for the Scheme, choose GUID Partition Map. You could also choose MS-DOS as the format, if you want to be able to use the drive on both a Mac and a PC. In that case, choose Master Boot Record for the Scheme. Click "**Erase**" button in the toolbar, and Disk Utility will erase and format the RAID storage. When it is complete, icons for this partition shows up on your desktop. It is now ready to use.

DRIVER INSTALLATION

2. You may want to divide a drive into more than one partition. When you do this, each partition is a volume, and each volume shows up as a separate drive on your Desktop. To partition a drive, select it in Disk Utility, and then click "**Partition**" in the toolbar. Disk Utility shows the RAID storage's space as a pie chart. By default, RAID storage only contain a single partition, but to add one, click the + icon; you'll see two partitions.



If you want to adjust their sizes, you can do so by dragging the circles dividing the partitions, or by typing a size into the Size field. When you click "**Apply**", Disk Utility erases the RAID storage and splits it into the number of partitions you have selected. Each partition will appear as a separate drive on your Desktop.

When a message asks you to confirm you want to partition the disk, click on the "**Partition**" button. This may take a couple of minutes, depending on the size of the drives in your RAID storage. When the partitioning is complete, icons for each new partition show up on your desktop. They are now ready to use.

5. ArchHTTP Proxy Server Installation

Overview

After hardware installation, the NVMe/SAS/SATA disk drives connected to the tri-mode RAID adapter must be configured and the volume set units initialized before they are ready to use.

The user interface for these tasks can be accessed through the built-in configuration that resides in the adapter's firmware. It provides complete control and management of the adapter and disk arrays, eliminating the need for additional hardware or software.

In addition, a software utility to configure the tri-mode RAID adapter is provided on the areca website. This software utility can monitor, test, and support the tri-mode RAID adapter. The software utility and McRAID storage manager can configure and monitor the tri-mode RAID adapter via ArchHTTP proxy server interface. The following table outlines their functions:

Configuration Utility	Operating System Supported
McBIOS RAID Manager	OS-Independent
McRAID Storage Manager (Via ArchHTTP proxy server)	Windows, Linux, FreeBSD and macOS
SAP Monitor (Single Admin Portal to scan for multiple RAID units in the network, Via ArchHTTP proxy server)	Windows and macOS

The HTTP management software (ArchHTTP) runs as a service or daemon, and have it automatically start the proxy for all adapters found. This way the adapter can be managed remotely without having to sign in the server. The HTTP management software (ArchHTTP) also has integrated the email notification and SNMP extension agent. The email notification can be configured in local or remote standard web browser.

Note:

If your adapters have onboard LAN port, you do not need to install ArchHTTP proxy server, you can use McRAID storage manager directly.

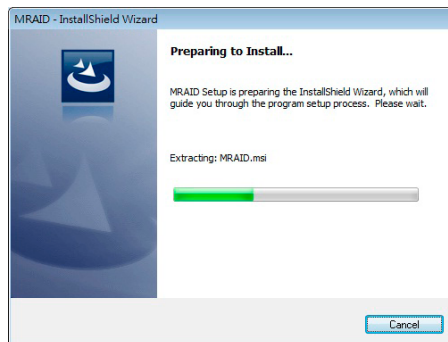
ARCHTTP PROXY SERVER INSTALLATION

5.1 For Windows

This section describes how to install the MRAID software to your operating system. The software installation includes ArchHTTP and CLI utility.

In this scenario, you are installing the MRAID software in an existing Windows system. You can use the installer to install ArchHTTP and CLI at once or "Custom" to install special components. Follow the steps below to install the utility for Windows.

1. Download the install_mraid installer from the website at "<https://www.areca.com.tw/support/downloads.html>", the file name begins with "install_mraid" followed by the version control.
2. Double-click on the zipped file that comes from the website to unzip it. Double-click on the "setup.exe" file for installing MRAID.
3. The screen shows Preparing to Install.

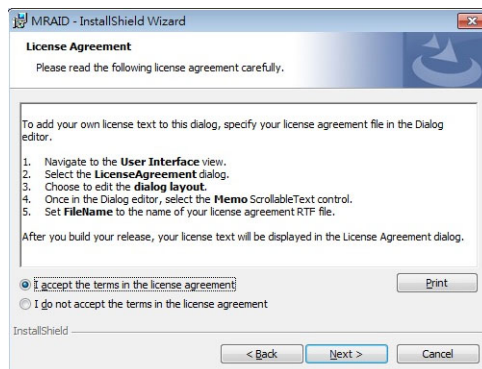


4. The MRAID Installer (or InstallShield Wizard) opens, preparing to install and click on the "**Next**" button to continue.

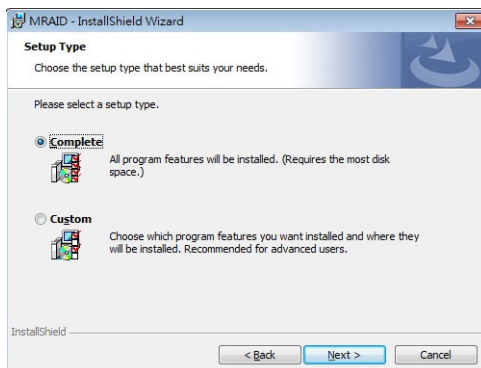
ARCHTTP PROXY SERVER INSTALLATION



5. When the License Agreement screen appears, read and agree to the license information; then let the InstallShield Wizard guide you through the installation process.



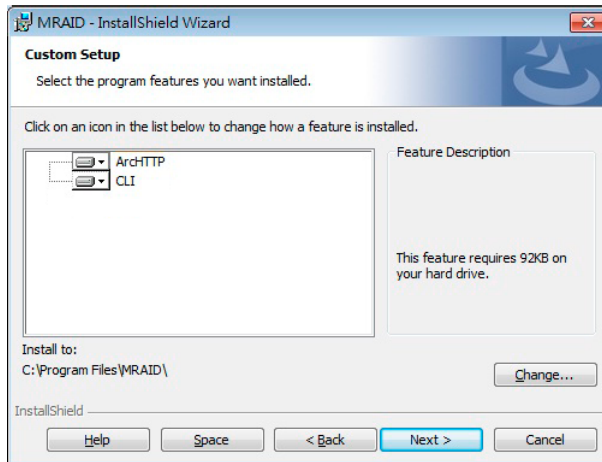
6. On the Setup Type screen, use the settings to specify these things: and click on the "**Next**" button to continue.



ARCHTTP PROXY SERVER INSTALLATION

- “Complete” to install ArchHTTP and CLI utility at once, check the first box.
- “Custom” to install special components and change the program directory. When this “**Custom**” check box is checked, go to the Custom Setup screen.

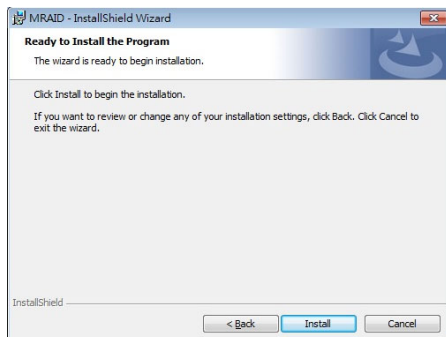
6-1. On the Custom Setup screen, click on an icon to install special components and click on the “**Next**” button to continue.



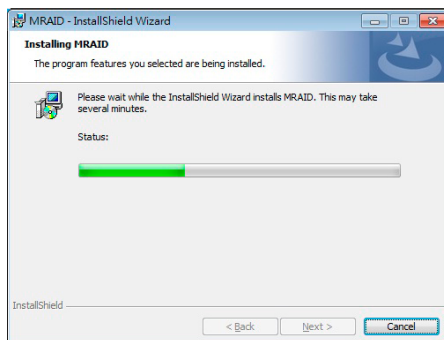
- **ArchHTTP** has to be installed for GUI RAID console (McRAID storage manager) to run. It also runs as a service or daemon in the background that allows capturing of events for mail and SNMP traps notification. Refer to the section 5.5 ArchHTTP Configuration on ARC-1886 user manual, for details about the mail and SNMP traps configuration.
- **CLI (Command Line Interface)** provides the functionality available in MRAID storage manager through a Command Line Interface. You can set up and manage RAID storage inline. CLI performs many tasks at the command line. You can download CLI manual from Areca website.

ARCHTTP PROXY SERVER INSTALLATION

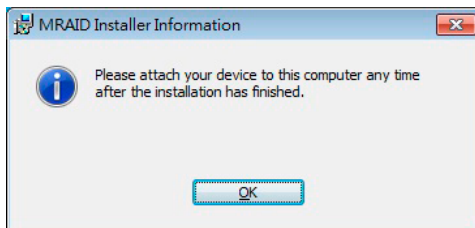
- When you reach the installation page, click on the **"Install"** button to continue.



- A program bar appears that measures the progress of the driver installation.

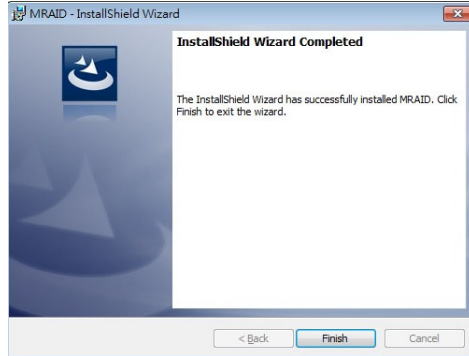


When this screen completes, you have completed the MRAID installation. If you have no ARC-1886 yet installed a "MRAID Installer Information" message displays.



- After installation is complete, click on the **"Finish"** button to exit the InstallShield Wizard.

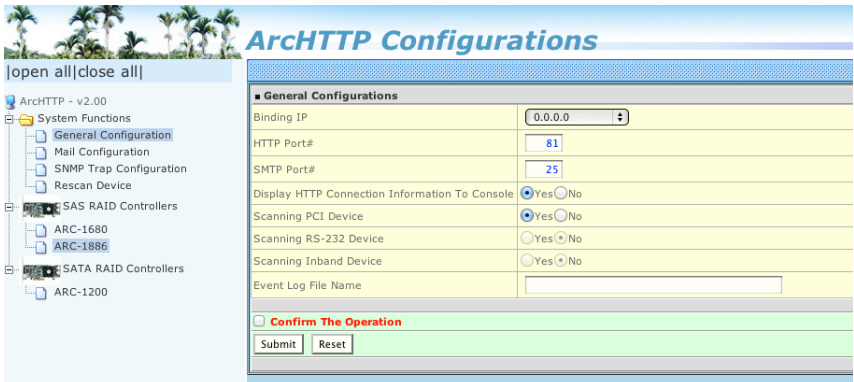
ARCHTTP PROXY SERVER INSTALLATION



10. Once ArchHTTP and CLI have been installed, the ArchHTTP background task automatically starts each time when you start your computer. There is one MRAID icon showing on your "Programs" folder. This icon is for you to start up the McRAID storage manager (by ArchHTTP) and CLI utility.



The "**ArchHTTP Taskbar**" icon shows on the button of system tray by default. Double click "ArchHTTP Taskbar" to launch the ArchHTTP Configuration screen. It automatically scans the local-host RAID units on the system and creates an individual RAID storage icon located in the left column screen. When you double click on a selected element the left column screen, child element belonged parent element appears. Locate "ARC-1886 Web Management" and launch the McRAID storage manager.



ARCHTTP PROXY SERVER INSTALLATION

1. See the next chapter detailing the McRAID Storage Manager to customize your RAID volume set.
2. If you need to configure the “System Function” of ArchHTTP, please refer to section 5.6 ArchHTTP Configuration.

ARCHTTP PROXY SERVER INSTALLATION

5.2 For Linux

You should have administrative level permissions to install tri-mode RAID software. This procedure assumes that the tri-mode RAID hardware and Linux are installed and operational in your system.

The following installation procedure explains how to install the tri-mode RAID software for Linux. The ArchTTP proxy server for the tri-mode RAID adapter card can download from the **<https://www.areca.com.tw>**. The firmware embedded McRAID storage manager can configure and monitor the tri-mode RAID adapter via ArchTTP proxy server.

1. Login as root. Copy the ArchTTP file to a local directory. Download from the www.areca.com.tw or from the email attachment.
2. You must have administrative level permissions to install tri-mode RAID adapter ArchTTP proxy server software. This procedure assumes that the tri-mode RAID hardware and driver are installed and operational in your system.

The following details are the installation procedure of the tri-mode RAID adapter for Linux ArchTTP proxy server software.

- (a). Run the ArchTTP proxy server by using the following command:
Usage: `./archttp32 (TCP_PORT)` or `./archttp64 (TCP_PORT)`.
It depends on your OS version.
Parameters: TCP_PORT value= 1~65535 (If TCP_PORT assigned, ArchTTP will start from this port. Otherwise, it will use the setting in the `archttpsrv.conf` or default 81). This is the port address assigning for the ArchTTP configuration (Cfg Assistant). Such as: `archttp64 1553`
- (b). ArchTTP server console started, Controller card detected then ArchTTP proxy server screen appears.

Copyright (c) 2004 Areca, Inc. All Rights Reserved.
Areca HTTP proxy server V2.4.0 for Areca RAID adapters.

ARCHTTP PROXY SERVER INSTALLATION

Controller(s) list

Cfg Assistant : Listen to port[1553].
Controller[1](PCI) : Listen to port[1554].
Binding IP:[0.0.0.0]
Note: IP[0.0.0.0] stands for any ip bound to this host.

Press CTRL-C to exit program!!

Controller [1] Http: New client [9] accepted
Controller [1] Http: New Recv 243 bytes
Controller [1] Http: Send [174] bytes back to the client

- (c). If you need the “Cfg Assistant”, please refer to section 5.6 ArchTTP Configuration.
- (d). For detailing about McRAID storage manager to customize your RAID volume set is discussed in Chapter 6.

For Mozilla user:

Because our management need Java support, so user may need upgrade to version 1.6 or later.

ARCHTTP PROXY SERVER INSTALLATION

5.3 For FreeBSD

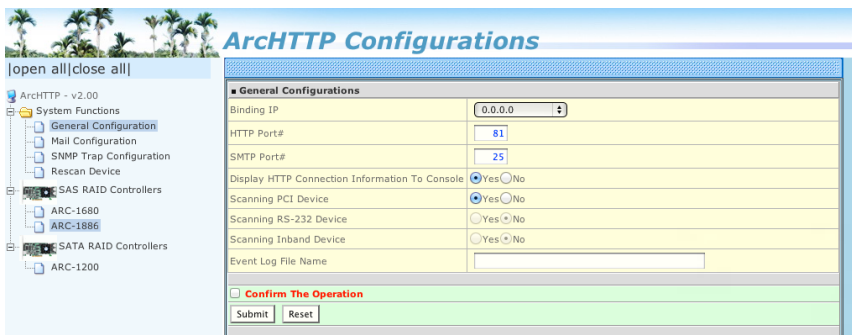
You must have administrative level permissions to install tri-mode RAID software. This procedure assumes that the tri-mode RAID hardware and FreeBSD are installed and operational in your system. The installation procedure how to install the tri-mode RAID software for FreeBSD is same as Linux. Please see the section 5.2 For Linux.

5.4 For macOS

The firmware embedded McRAID storage manager can configure and monitor the tri-mode RAID adapter via ArchHTTP proxy server. The ArchHTTP proxy server for macOS has combined with the CLI and driver on the install_mraid installer, please refer to Chapter 4.6 Driver Installation for macOS.

5.5 ArchHTTP Configuration

The ArchHTTP proxy server will automatically assign one additional port for setup its configuration. If you want to change the “archhttp-srv.conf” setting up of ArchHTTP proxy server configuration, for example: General Configuration, Mail Configuration, and SNMP Configuration, please start Web Browser `http://localhost: Cfg Assistant`. Such as `http://localhost: 81`. The port number for the first adapter McRAID storage manager is ArchHTTP proxy server configuration port number plus 1.



ARCHTTP PROXY SERVER INSTALLATION

• **General Configuration:**

Binding IP: Restrict ArchHTTP 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-1886 series adapter

Scanning RS-232 Device: No

Scanning Inband Device: No

• **Mail (alert by Mail) Configuration:**

Many users require that email notifications be sent to the appropriate administrators when an alert is detected. To set up your mail servers, click on the "Mail Configuration" link. The "SMTP Server Configurations" allows you to define settings for your mail server. This setup screen is shown as below:

The screenshot displays the 'ArchHTTP Configurations' web interface. On the left is a navigation tree with categories like 'System Functions', 'General Configuration', 'Mail Configuration', 'SNMP Trap Configuration', 'Rescan Device', 'SAS RAID Controllers', and 'SATA RAID Controllers'. The 'Mail Configuration' section is selected. The main content area is titled 'ArchHTTP Configurations' and contains several configuration sections:

- SMTP Server Configuration:** Includes a text field for 'SMTP Server IP Address'.
- Mail Address Configurations:** Includes fields for 'Sender Name', 'Account', 'Password', and four sets of 'MailTo Name' and 'Mail Address' pairs.
- Event Notification Configurations:** Includes radio buttons for 'Disable Event Notification', 'Urgent Error Notification', 'Serious Error Notification', 'Warning Error Notification', 'Information Notification', and 'Notification For No Event'. To the right of these are corresponding text labels for each notification level.
- Confirm The Operation:** A green bar at the bottom with 'Submit' and 'Reset' buttons.

The following article describes a best practice methodology for setting this up in the "SMTP Server Configurations".

1. SMTP Server Configuration:

SMTP Server IP Address: Enter IP address of the SMTP server to configure your mail program correctly.

Ex: 192.168.0.2.

ARCHTTP PROXY SERVER INSTALLATION

2. Mail Address Configurations:

Sender Name: This is the sender name that the e-mail alerts will appear to be coming from.

Ex: RaidController_1.

Mail address: This is the mail address that the e-mail alerts will appear to be coming from, 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 requires authentication.

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

3. Event Notification Configurations:

This step involves setting up of notification rules. Notification rules instruct ArchHTTP on the notifications that should be sent when certain types of alerts are detected.

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

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

Ex: admin@areca.com.tw.

According to your requirement, set the corresponding event level:

Disable Event Notification: No event notification will be sent.

Urgent Error Notification: Send only urgent events.

Serious Error Notification: Send urgent and serious events.

Warning Error Notification: Send urgent, serious and warning events.

Information Notification: Send all events.

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

• SNMP Traps Configuration:

This section discusses how to enable the SNMP traps on your RAID storage, and how to control the sending of SNMP traps from the ArchHTTP. To send the SNMP traps to client SNMP manager such as Net-SNMP manager using the IP address assigned to the operating system, you can simply use the SNMP function on the ArchHTTP. The ArchHTTP only provides one direction

ARCHTTP PROXY SERVER INSTALLATION

to send the trap to the SNMP manager without needing to install the SNMP extension agent on the host. If SNMP manager requests to query the SNMP information from RAID storage, please refer the Appendix C "SNMP Operation & Installation". To set up SNMP traps sending function, click on the "SNMP Configuration" link. SNMP Traps Configurations are set up on this page. This setup screen is shown as below:
The following article describes a best practice methodology for setting this up in the "SNMP Traps Configurations".

The screenshot displays the 'ArchHTTP Configurations' web interface. On the left is a navigation tree with categories like 'System Functions', 'SAS RAID Controllers', and 'SATA RAID Controllers'. The 'SNMP Trap Configuration' link is highlighted. The main content area is divided into three sections: 'SNMP Trap Configurations', 'SNMP System Configurations', and 'SNMP Trap Notification Configurations'. The first section contains three rows for setting trap IP addresses and ports. The second section has a 'Community' field set to 'public'. The third section contains radio buttons for different notification levels, with 'Disable Event Notification' selected. At the bottom, there is a 'Confirm The Operation' section with 'Submit' and 'Reset' buttons.

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

■ SNMP System Configurations	
Community	public

■ SNMP Trap 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

☐ Confirm The Operation

Submit Reset

1. SNMP Trap Configurations

Enter the SNMP trap IP address.

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

3. SNMP Trap Notification Configurations

Event Notification Table refers to Appendix D. Before the client side SNMP manager application accepts the RAID storage traps, it is necessary to integrate the MIB into the management application's database of events and status indicator codes. Ensure the compilation process successfully integrates the contents of the areca_sas.mib file into the traps database.

ARCHTTP PROXY SERVER INSTALLATION

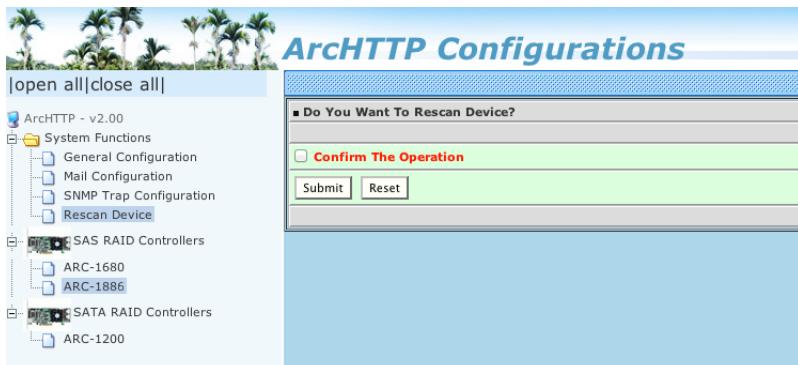
Please refer to Appendix C of "SNMP Operation & Installation".
The MIBs file can download from areca website.

Note:

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

● **Rescan Device Configuration:**

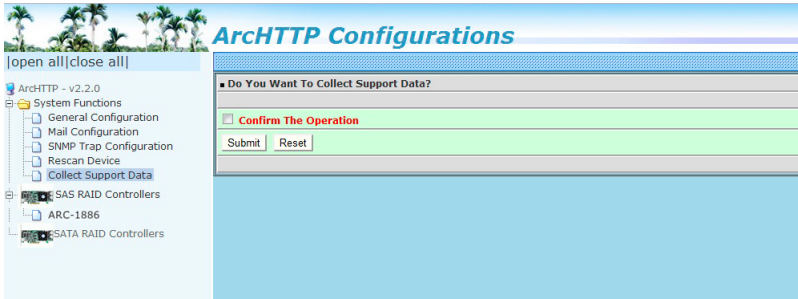
The ArchHTTP scans the RAID adapters on the system and creates an individual RAID adapter icon located on left column of the "ArchHTTP Configurations" screen. If any RAID adapter is missed at system start-up, then you can use the "Rescan Device" function to rescan the targets to allow a missed RAID storage to be added.



● **Collect Support Data:**

The "Collect Support Data" option on the ArchHTTP is used to download all adapter's information (system information, configuration, disk information and event log) to a supported file (file name:ctrlrxx-xxxxx.log). It will be automatically started when ERROR or SERIOUS event has occurred.

ARCHTTP PROXY SERVER INSTALLATION



6. Web Browser-based Configuration

Before using the firmware-based browser McRAID storage manager, do the initial setup and installation of this product. If you need to boot up the operating system from a RAID volume set, you must first create a RAID volume by using McBIOS RAID manager. Please refer to section 3.3 Using Quick Volume /Raid Setup Configuration for information on creating this initial volume set.

The McRAID storage manager is firmware-based utility, which is accessible via the web browser installed on your operating system. The web browser-based McRAID storage manager is a HTML-based application, which utilizes the browser (IE, Chrome and Mozilla etc.) installed on your monitor station.

It can be accessed through the in-band PCIe bus or out-of-band LAN port. ArchHTTP is used to launch the in-band web browser-based McRAID storage manager. The firmware-embedded web browser-based McRAID storage manager allows local or remote to access it from any standard internet browser via a LAN or WAN with no software or patches required. The firmware contains SMTP manager monitors all system events and user can select either single or multiple user notifications to be sent via LAN with "Plain English" e-mails. The firmware-embedded SNMP agent allows remote to monitor events via LAN with no SNMP agent required. Use the McRAID storage manager to:

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

6.1 Start-up McRAID Storage Manager

With McRAID storage manager, you can:

WEB BROWSER-BASED CONFIGURATION

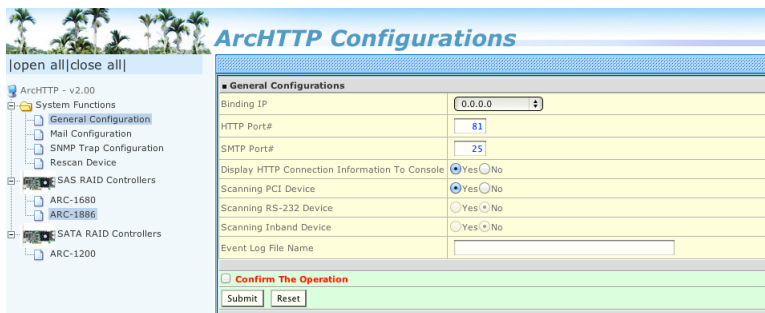
- Locally manage a system containing a supported RAID storage that has Windows or macOS, ArchHTTP and a supported browser.
- Remote and managed systems must have a TCP/IP connection.

• Start-up from Windows/Mac Local Administration

Once ArchHTTP and CLI have been installed, the ArchHTTP - background task automatically starts each time when you start your computer. There is one MARID icon showing on Mac "Desktop"



or one "**ArchHTTP Taskbar**" icon showing on Windows system tray. This icon is for you to start up the ArchHTTP (launch the McRAID storage manager). When you click on the ArchHTTP64 from MRAID or "**ArchHTTP Taskbar**" from system tray, it shows all RAID adapters available on the host system and create an individual RAID adapter icon located on left column of the "ArchHTTP Configurations" screen. This RAID controller icon is for user to launch the selected RAID adapter web browser McRAID storage manager.



The "Enter Network Password" dialog screen appears, type the User Name and Password. The RAID adapter default User Name is "admin" and the Password is "0000". After entering the user name and password, press **Enter** key to access the McRAID storage manager.

• Start-up McRAID Storage Manager from Linux/FreeBSD Local Administration

To configure the internal tri-mode RAID adapter. You need to

WEB BROWSER-BASED CONFIGURATION

know its IP address. You can find the IP address assigned by the ArchHTTP proxy server installation: Binding IP:[X.X.X.X] and adapter listen port.

1. You can click on the individual adapter icon located on left column of the "ArchHTTP Configurations" screen or Launch your McRAID storage manager by entering `http://[Computer IP Address]:[Port Number]` in the web browser.
2. When connection is established, the "System Login" screen appears. The tri-mode RAID adapter default user name is "admin" and the password is "0000".

● Start-up from Ethernet Port (Out-of-Band)

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

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

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

Note:

You can find adapter Ethernet port IP address in McBIOS RAID manager "System Information" option.

WEB BROWSER-BASED CONFIGURATION

6.2 McRAID Storage Manager

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

Areca Technology Corporation

[open all] [close all]

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

RAID Set Hierarchy				
RAID Set	Devices	Volume Set(Ch/Id/Lun)	Volume State	Capacity
Raid Set # 000 (SED)	E#1Slot#1	ABC-1886-VOL#000(0/0/0)	Normal	30.0GB
	E#1Slot#2	ABC-1886-VOL#001(0/0/1)	Normal	30.0GB
	E#1Slot#3	ABC-1886-VOL#002(0/0/2)	Normal	30.0GB
		ABC-1886-VOL#003(0/0/3)	Normal	30.0GB
		ABC-1886-VOL#004(0/0/4)	Normal	30.0GB

Enclosure # 1 : Areca VirtualSES R001(9)[30014090DCEE9000]			
Device	Usage	Capacity	Model
Slot#1(23)	Raid Set # 000	1920.4GB	XA1920LE10063
Slot#2(24)	Raid Set # 000	1920.4GB	XA1920LE10063
Slot#3(25)	Raid Set # 000	512.1GB	SanDisk SD9SNBW512G
Slot#4(26)	Free	512.1GB	SanDisk SD9SNBW512G
Slot#5(27)	Free	960.2GB	KINGSTON SEDC400S37960G
Slot#6(28)	Free	1920.4GB	XA1920LE10063
Slot#7(22)	Free	512.1GB	SanDisk SD9SNBW512G
Slot#8(24)	Free	512.1GB	SanDisk SD9SNBW512G

The RaidSet Hierarchy displays the "Raid Set List", "Volume Set List", and "Physical Disk List". The RAID set information, volume set information, and drive information can also be viewed by clicking on the "RAID Set Hierarchy" on the main menu screen.

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

WEB BROWSER-BASED CONFIGURATION

6.3 Main Menu

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

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

6.4 Quick Function

The Quick Create option configures the arrays with just a few steps. Although drives of different sizes may be used in the array, Quick Create will only operate upon drives of the same physical size. The number of physical drives in the tri-mode 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, Capacity, Initialization Mode, and Stripe Size. A hot spare option is also created, depending on the exist configuration. Tick on the "Confirm The Operation" check box and click on the "Submit" button in the "Quick Create" screen, the RAID set and volume set will start to initialize.

Areca Technology Corporation

Quick Create Raid/Volume Set

Total Number Of Disks: 16

Select Raid Level: Raid 5 + Spare

Maximum Capacity Allowed: 420 GB

Select Capacity: 420 GB

Volume Initialization Mode: Foreground Initialization

Select Stripe Size: 64 Kbytes

RaidSet Mode: Max 128 Volumes

☐ Confirm The Operation

Submit Reset

WEB BROWSER-BASED CONFIGURATION

Note:

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

6.5 Raid Set Functions

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

6.5.1 Create Raid Set

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

The screenshot shows the "Areca Technology Corporation" web interface. On the left is a navigation menu with options like "Raid System Console", "Quick Function", "RAID Set Functions", "Volume Set Functions", "Security Functions", "Physical Drives", "System Controls", and "Information". The "RAID Set Functions" menu is expanded, showing "Create RAID Set", "Delete RAID Set", "Expand RAID Set", "Offline RAID Set", "Rename RAID Set", "Activate Incomplete RAID Set", "Create Hot Spare", "Delete Hot Spare", "Rescue RAID Set", and "Volume Set Functions". The "Create RAID Set" option is selected. The main content area is titled "Select The Drives For RAID Set" and "Enclosure# 1 : Areca VirtualSES R001". It displays a table of available drives:

Slot	Capacity	Model
Slot#5	960.2GB	KINGSTON SEDC400S37960G (SED)
Slot#6	1920.4GB	XA1920LE10063 (SED)
Slot#7	512.1GB	SanDisk SD9SN8W512G (SED)
Slot#8	512.1GB	SanDisk SD9SN8W512G (SED)

Below the table, there are input fields for "Raid Set Name" (defaulting to "Raid Set #001") and "RaidSet Mode" (set to "Max 128 Volumes"). A green bar with the text "Confirm The Operation" is visible. At the bottom, there are "Submit" and "Reset" buttons.

WEB BROWSER-BASED CONFIGURATION

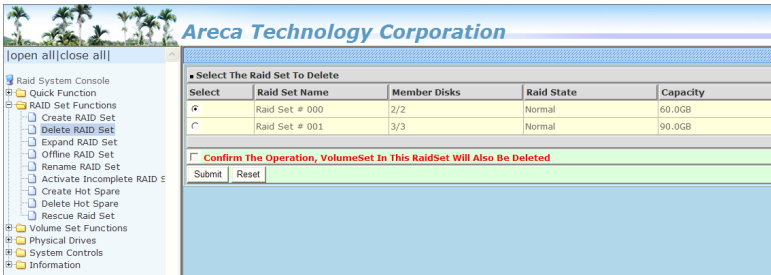
128 volumes is the default mode for tri-mode RAID adapter, the 16 volumes mode is used for support roaming this raidset to SATA RAID adapters. The SATA RAID adapter is designed to support up to 16 volumes only. You have to use "Max 16 volumes" on the raidset mode if you plan to roam this raidset between tri-mode RAID adapter and SATA RAID adapter.

Note:

To create RAID 30/50/60 volume, you need create multiple RAID sets first (up to 8 RAID sets) with the same disk numbers on each RAID set. The max no. disk drives per RAID set: 32 for RAID 0/1/10(1E)/3/50/60 and 128 for RAID 00/100/30/50/60.

6.5.2 Delete Raid Set

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

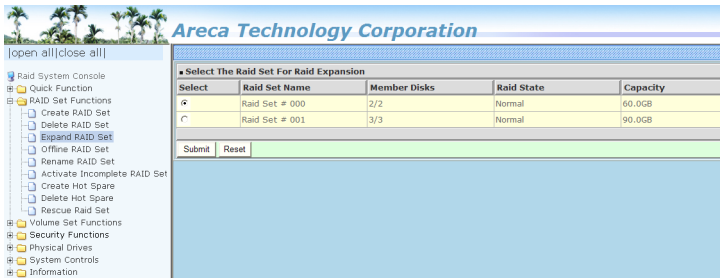


6.5.3 Expand Raid Set

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

WEB BROWSER-BASED CONFIGURATION

Select the "Expand Raid Set" option. If there is an available disk, then the "Select SAS/SATA Drives For Raid Set Expansion" screen appears.



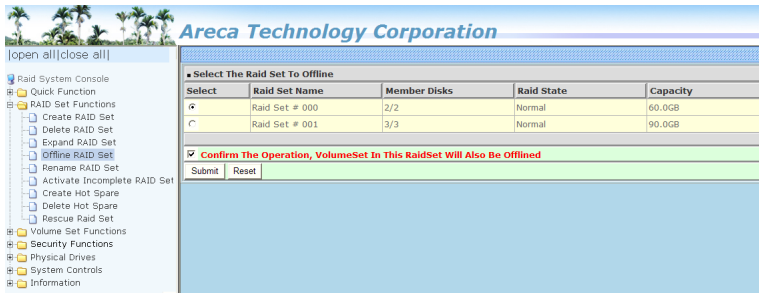
Select the target RAID set by clicking on the appropriate check box. Select the target disk by clicking on the appropriate check box. Click on the "Submit" button to start the expansion on the RAID set. The new additional capacity can be utilized by one or more volume sets. The volume sets associated with this RAID set appear for you to have chance to modify RAID level or stripe size. Follow the instruction presented in the "Modify Volume Set " to modify the volume sets; operation system specific utilities may be required to expand operating system partitions.

Note:

1. Once the "Expand Raid Set" process has started, user can not stop it. The process must be completed.
2. If a disk drive fails during RAID set expansion and a hot spare is available, an auto rebuild operation will occur after the RAID set expansion completes.
3. RAID 30/50/60 does not support the "Expand Raid set".
4. RAID set expansion is a quite critical process, we strongly recommend customer backup data before expand. Unexpected accident may cause serious data corruption.

6.5.4 Offline Raid Set

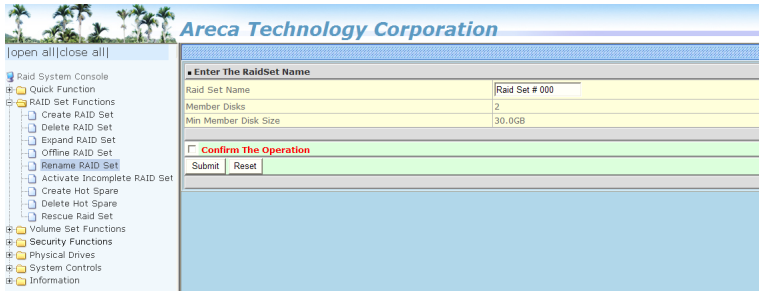
This function is for customer being able to unmount and remount a multi-disk volume. All Hdds of the selected RAID set will be put into offline state, spun down and fault LED in fast blinking mode. User can remove those Hdds and insert new Hdds on those empty slots without needing power down the adapter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



6.5.5 Rename Raid Set

The default RAID set name will always appear as "Raid Set #" when it is first created by the adapter. The "Rename Raid Set" function is for customer to rename the default RAID set name. To rename a RAID set from a group of RAID sets:

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

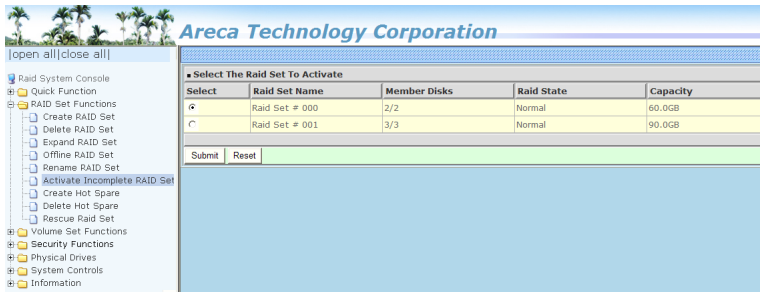


6.5.6 Activate Incomplete Raid Set

If one of the disk drives is removed in power off state, the RAID set state will change to "Incomplete State". If the user wants to continue to operate the adapter without power-off the tri-mode RAID adapter, the user can use the "Activate Incomplete Raid Set" option to active the RAID set. After the user completes this function, the Raid State will change to "Degraded Mode" and start to work. To activate the incomplete the RAID set, click on the "Activate Raid Set" link. A "Select The RAID SET To Activate" screen is displayed showing all RAID sets existing on the current adapter.

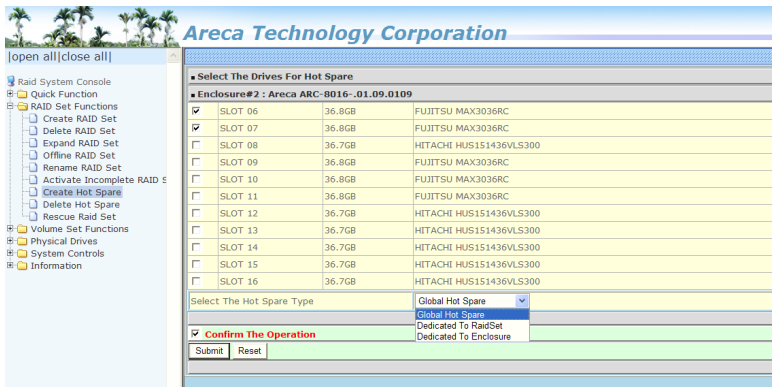
WEB BROWSER-BASED CONFIGURATION

Click on 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 tri-mode RAID adapter will continue to work in degraded mode.



6.5.7 Create Hot Spare

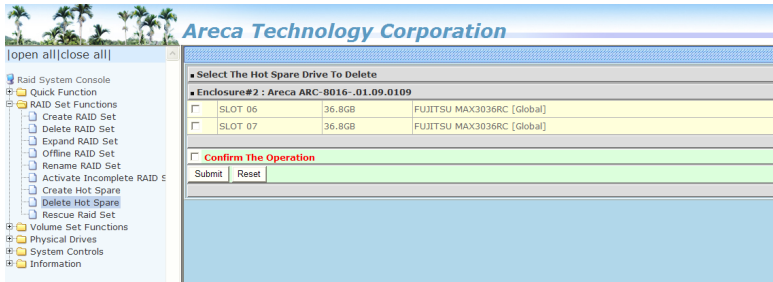
When you choose the "Create Hot Spare" option in the "Raid Set Function", all unused physical devices connected to the current adapter appear. Select the target disk by clicking on the appropriate check box. Tick on the "Confirm The Operation" check box and click on the "Submit" button in the screen to create the hot spares. The "Create Hot Spare" gives you the ability to define a global or dedicated hot spare. Unlike "Global Hot Spare" which can be used with any RAID sets, "Dedicated Hot Spare" can only be used with a specific RAID set or Enclosure. When a disk drive fails in the RAID set or enclosure with a dedicated hot spare is pre-set, data on the disk drive is rebuild automatically on the dedicated hot spare disk.



WEB BROWSER-BASED CONFIGURATION

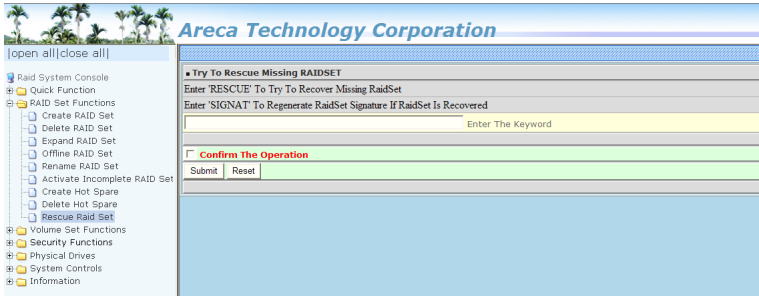
6.5.8 Delete Hot Spare

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



6.5.9 Rescue Raid Set

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



Note:

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

6.6 Volume Set Functions

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

The following is the volume set features for the tri-mode RAID adapter.

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

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

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

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

WEB BROWSER-BASED CONFIGURATION

Areca Technology Corporation

Volume Name: ARC-1886-VOL#005

Member Disks: 4

Volume Raid Level: Raid 5

Max Capacity Allowed: 1350 GB

Select Volume Capacity: 1350 GB

Greater Two TB Volume Support: 64bit LBA

Volume Initialization Mode: Foreground Initialization

Volume Stripe Size: 64 KBytes

Volume Cache Mode: Write Back

Volume Write Protection: Disabled

Full Volume Encryption: Disabled

Volume IO Mode: Cached IO

Tagged Command Queuing: Enabled

SCSI Channel:SCSI ID:SCSI Lun: 0:0:5

Volumes To Be Created: 1

Confirm The Operation

Submit Reset

- **Volume Name**

The default volume name will always appear as “ARC-1886-VOL”. You can rename the volume set providing it does not exceed the 15 characters limit.

- **Volume Raid Level**

Set the Raid Level for the volume set. Highlight the desired RAID Level from the available RAID levels option.

There are two circumstances when you choose RAID level 1 function:

RAID 1-Simple Mirroring is also known as “**two disk mirror**”; If your RAID set has two disks, data written on one disk drive is simultaneously written to another disk drive.

RAID 1-Multi Mirroring is also known as “**triple disk mirror**”; If your RAID set has three disks, data written on one disk drive is simultaneously written to another two disk drives.

- **Capacity**

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

WEB BROWSER-BASED CONFIGURATION

- **Greater Two TB Volume Support**

Controller uses the "Greater Two TB Volume Support" sub-menu to set the volume capacity and sector size. Greater Two TB Volume Support option: "No", "64bit LBA" and "Use 4K Block".

- **No**

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

- **64bit LBA**

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

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

- **Use 4K Block**

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

- **Initialization Mode**

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

WEB BROWSER-BASED CONFIGURATION

Note:

Controller starts to initialize the volume in two conditions

1. Stay in adapter bios manager or
2. Boot into OS and the adapter driver loaded.

● **Stripe Size**

This parameter sets the size of the stripe written to each disk in a RAID 0, 1, 10, 5, 6, 50 or 60 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, 128 KB, 256KB, 512KB, or 1024KB. A larger stripe size produces better read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random reads more often, select a smaller stripe size.

Note:

- RAID level 3 can't modify the cache stripe size.
- Roaming the stripe size 256K/512K/1024K Raid Set to firmware version older than 1.52 will cause data corruption.

● **Cache Mode**

The tri-mode RAID adapter supports "Write Through" and "Write Back" cache.

● **Volume Write Protection**

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

● **Full Volume Encryption**

ARC-1886 RAID adapters have featured with adapter based hardware encryption function. Controller based hardware encryption describes the encryption of data occurring at the disk array adapter before being sent to the disk drives. Since RAID adapter is a natural central point of all data therefore encryption at this level is inherent and also reduces deployment complexity. ARC-1886 RAID adapter has dedicated electronic

WEB BROWSER-BASED CONFIGURATION

circuitry for the cryptographic engine embedded in the ROC and operating at full channel speeds. The hardware encryption does not impact the performance of ARC-1886 RAID adapter and can implement on any kinds of HDD that is transparent to the user, the OS, and applications.

Encrypting your volume can give your data an extra layer of protection beyond setting up a adapter password. Encryption will conceal your volume's data and make accessing the files almost impossible for anyone who does not know your encryption key. Data saved in the volume will be hidden by Algorithm developed by Areca Technology. With this scramble process, no one can see and access into the hidden volume data without access key. ARC-1886 adapters support 128- and 256-bit encryption keys using AES (a key size of 128, or 256 bits), or password (a variable key size). Each encryption key size causes the algorithm to behave slightly differently, so the increasing key sizes not only offer a larger number of bits with which you can scramble the data, but also increase the complexity of the cipher algorithm. ARC-1886 adapters provide five new key options in the 'Full Volume Encryption:' 'Disable', '256Bit key, Password', '256Bit key, AES', '128Bit key, Password', '128Bit key, AES'. You can generate the new key by CLI utility or API code function.

This volume encryption function can only work with ARC-1886 series with any kinds of HDD. You can follow below steps to enable the function.

1. Create volume set with "Full Volume Encryption" capability in the web management.
2. Use CLI "vsf genkey" command or API code to generate key file.
3. Use "Download Volume Key File" in the web management or use CLI "vsf dlkey" command to download volume key file into firmware and unlock the volume.
4. Follow step 3. to unlock volume if volume locked.

Note:

The currently encryption feature only support key file interface to encrypt volumes.

WEB BROWSER-BASED CONFIGURATION

- **IO Mode:**

The Cache IO and Direct IO cache policies apply to read on a specific virtual disk. The IO mode options are as follows:

- **Cache Io**

Specifies that all reads are buffered in the controller cache memory.

- **Direct Io**

Specifies that reads are not buffered in cache memory. When using direct IO mode, data is transferred to the controller cache memory and the host system simultaneously during a read request.

If a subsequent read request requires data from the same data block, it can be read directly from the controller cache memory.

- **Tagged Command Queuing**

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

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

- **SCSI Channel**

The tri-mode RAID adapter function is simulated as a external 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.

WEB BROWSER-BASED CONFIGURATION

A SCSI channel can connect up to 15 devices. The tri-mode RAID adapter 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 SAS adapters treat each LUN like a SAS disk.

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

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

The new create volume set attribute allows user to select the Volume Name, Raid Level, Capacity, Greater Two TB Volume Support, Initialization Mode, Strip Size, Cache Mode, Write Protect, Full Volume Encryption, IO Mode, Tagged Command Queuing, and SCSI Channel/SCSI ID/SCSI Lun. Please refer to above section for details description of each item.

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[open all][close all]

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

Enter The Volume Attribute

Volume Name	ARC-1883-VOL#011
Member Disks	2x3
Volume Raid Level	50
Max Capacity Allowed	3910.0 GB
Select Volume Capacity	3910.0 GB
Greater Two TB Volume Support	64bit LBA
Volume Initialization Mode	Foreground Initialization
Volume Stripe Size	64 KBytes
Volume Cache Mode	Write Back
Volume Write Protection	Disabled
Full Volume Encryption	Disabled
Tagged Command Queuing	Enabled
SCSI Channel:SCSI ID:SCSI Lun	0 : 0 : 7
Volumes To Be Created	1

☐ Confirm The Operation

Submit Reset

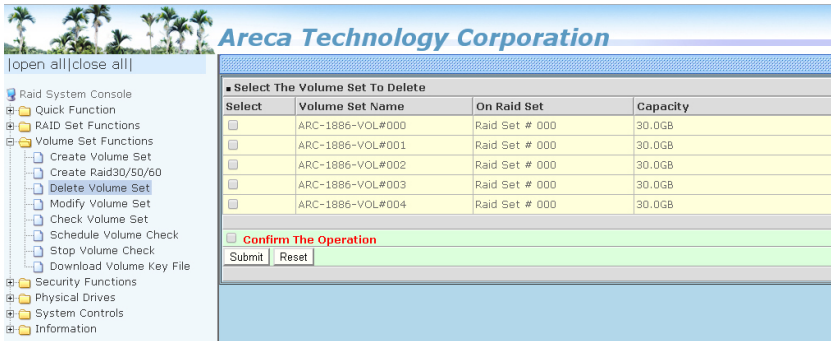
WEB BROWSER-BASED CONFIGURATION

Note:

RAID level 30 50 and 60 can support up to eight RAID set (four pairs), but it can not support expansion and migration.

6.6.3 Delete Volume Set

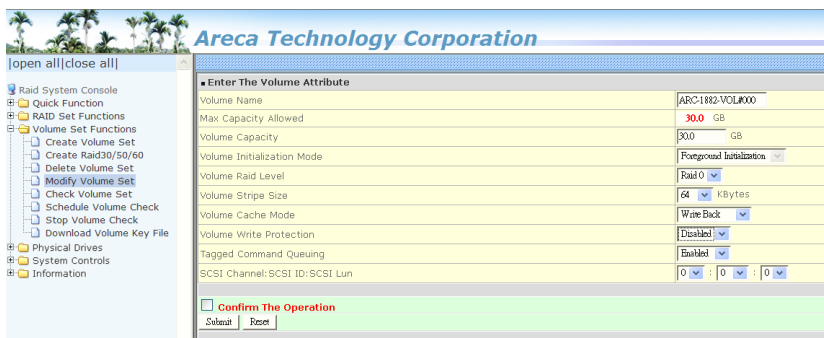
To delete a volume from RAID set, move the cursor bar to the main menu and click on the "Delete Volume Set" link. The "Select The Raid Set To Delete" screen will show all RAID set numbers. Click on a RAID set number and the "Confirm The Operation" check box and then click on the "Submit" button to show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



6.6.4 Modify Volume Set

To modify a volume set from a RAID set:

1. Click on the "Modify Volume Set" link.
2. Click on the volume set check box from the list that you wish to modify. Click on the "Submit" button. The following screen appears. Use this option to modify the volume set configuration. To modify volume set attributes, move the cursor bar to the volume set attribute menu on "Enter The Volume Attribute" screen and then click on the attribute to modify the value. After you complete the modification, tick on the "Confirm The Operation" check box and click on the "Submit" button to complete the action.



6.6.4.1 Volume Growth

Use "Expand RAID Set" function to add disk to a RAID set. The additional capacity can be used to enlarge the last volume set size or to create another volume set. The "Modify Volume Set" function can support the "Volume Modification" function. To expand the last volume set capacity, move the cursor bar to the "Capacity" item and entry the capacity size. When finished the above action, click on the "Submit" button to complete the action. The last volume set starts to expand its capacity. If you have free spaces from reserved or delete volumes, you can enlarge the last volume set size before the free spaces.

To expand an existing volume noticed:

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

For greater 2TB expansion:

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

WEB BROWSER-BASED CONFIGURATION

6.6.4.2 Volume Set Migration

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

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[open all] [close all]

RAID Set Hierarchy

RAID Set	Devices	Volume Set(Ch/Id/Lun)	Volume State	Capacity
Raid Set # 000 (SED)	E#1Slot#1	ARC-1886-VOL#000(0/0/0)	Normal	30.0GB
	E#1Slot#2	ARC-1886-VOL#001(0/0/1)	Normal	30.0GB
	E#1Slot#3	ARC-1886-VOL#002(0/0/2)	Normal	30.0GB
		ARC-1886-VOL#003(0/0/3)	Normal	30.0GB
		ARC-1886-VOL#004(0/0/4)	Normal	30.0GB

Enclosure#1 : Areca VirtualSES R001(9)[30014D90DC0EE9000]

Device	Usage	Capacity	Model
Slot#1(23)	Raid Set # 000	1920.4GB	XA1920LE10063
Slot#2(24)	Raid Set # 000	1920.4GB	XA1920LE10063
Slot#3(25)	Raid Set # 000	512.1GB	SanDisk SD9SNBW512G
Slot#4(26)	Free	512.1GB	SanDisk SD9SNBW512G
Slot#5(27)	Free	960.2GB	KINGSTON SEDC400S37960G
Slot#6(28)	Free	1920.4GB	XA1920LE10063
Slot#7(29)	Free	512.1GB	SanDisk SD9SNBW512G
Slot#8(2A)	Free	512.1GB	SanDisk SD9SNBW512G

Note:

1. If the volume is RAID level 30, 50, or 60, you can not change the volume to another RAID level. If the volume is RAID level 0, 1, 10(1E), 3, 5, or 6, you can not change the volume to RAID level 30, 50, or 60.
2. Power failure may damage the migration data. Please backup the RAID data before you start the migration function.

6.6.4.3 Volume Write Protection

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

6.6.5 Check Volume Set

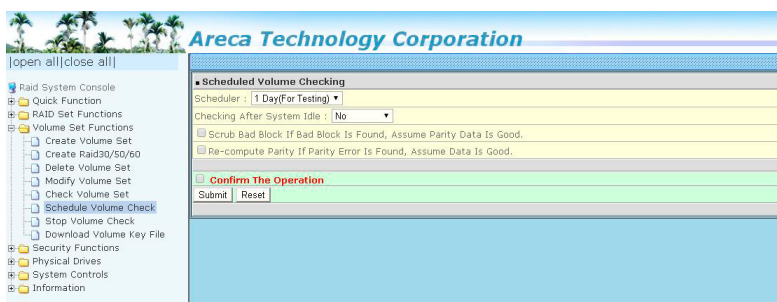
To check a volume set from a RAID set:

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

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

6.6.6 Schedule Volume Check

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



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

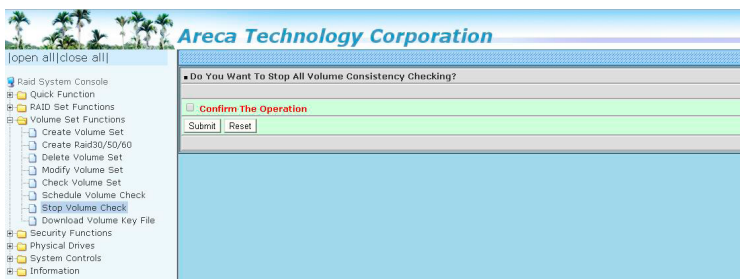
WEB BROWSER-BASED CONFIGURATION

Note:

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

6.6.7 Stop Volume Set Check

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



6.6.8 Download Volume Key File

Get the key file which was generated by CLI "vsf genkey" command or API code for your ARC-1886 adapters. You can follow below steps to download volume key file.

1. To download volume key file into the firmware, move the mouse cursor to "Download Volume Key file" link and click on it. The "Download Volume Encryption Key File" screen appears.
2. Click on "Browse". Look in the location to which the key file was generated. Select the file name and click "Open".
3. Tick "Confirm The Operation" and press the "Submit" button.
4. After the key file download is completed, a bar indicator will show "Key File Has Been Downloaded Successfully".



6.7 Security Function

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

6.7.1 Create SED RAID Set



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

WEB BROWSER-BASED CONFIGURATION

6.7.2 Delete SED RAID Set



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

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

6.7.3 Delete ISE RAID Set



WEB BROWSER-BASED CONFIGURATION

Instant Secure Erase (ISE) or Crypto Erase allows a drive to be instantly erased using industry-standard commands and options. An ISE RAID Set is a RAID Set that has been created by a group of mixing ISE and no-ISE disks using "Create Raid Set" function on a adapter. When you delete existing ISE RAID sets, there has one option available to perform an Instant Secure Erase. The "Secure Erase The Member Disks" function is the process of permanently erasing all data on the ISE disks and resetting the security attributes. The data on the ISE disk is lost.

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

6.7.4 Security Key Setup

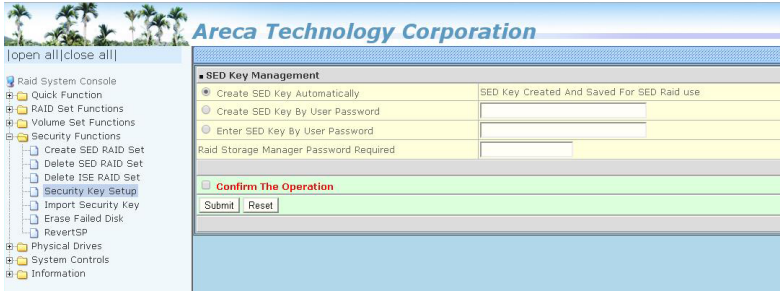
The Areca RAID adapters support Self-Encrypting Disks (SED) for protection of data against loss or theft of SEDs. Protection is achieved by the SED hard drive that automatically and continuously encrypts the data on the drive without any user interaction. There is one SED key per adapter. You can manage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

6.7.4.1 SED Key Management-Creation

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

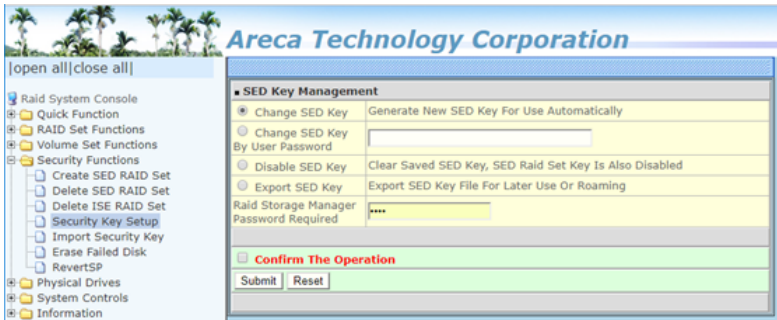
WEB BROWSER-BASED CONFIGURATION

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

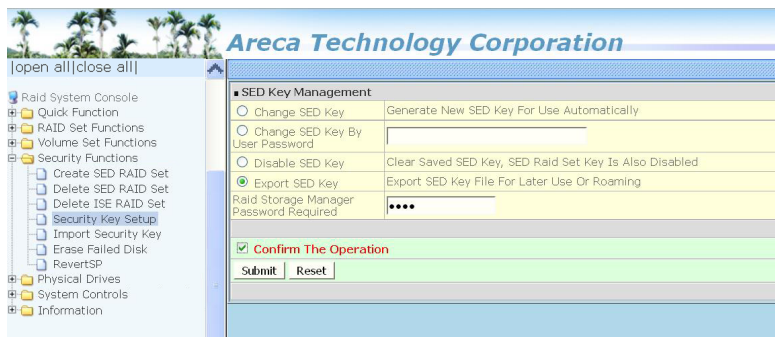


6.7.4.2 SED Key Management-Modification

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

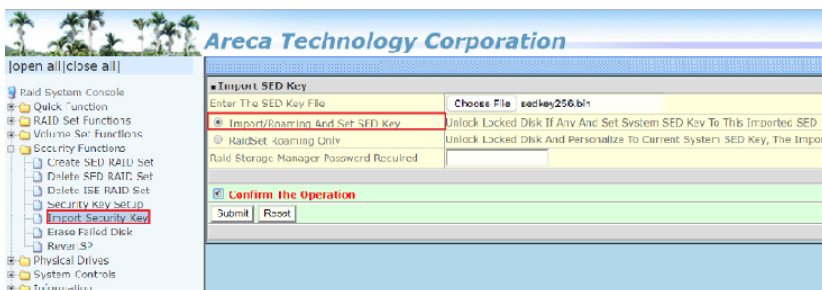


In some cases, you may want to export a SED key to store on removable media or to use on a different computer. If you want to create a backup copy of the SED key or use it on another computer, you must first export the SED key. Exporting the SED key puts it in a file (filename.bin) that you can then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



6.7.5 Import Security Key

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

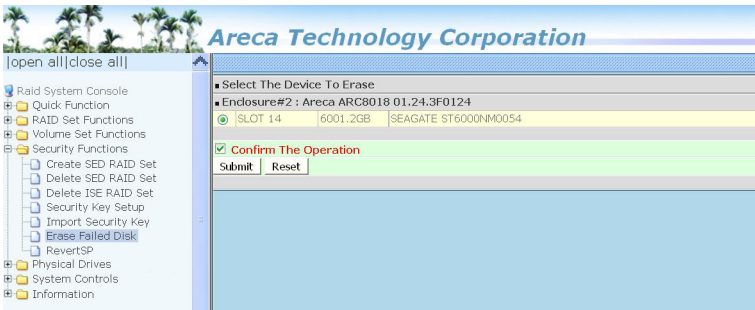


1. Select the "Import/Roaming And Set SED Key" option to unlock the locked disk and change to foreign SED key.
2. Select the "RaidSet Roaming Only" option to unlock the locked disk and personalize to new adapter's SED key. If there is an existing SED key on new adapter, RaidSet is updated with the new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

WEB BROWSER-BASED CONFIGURATION

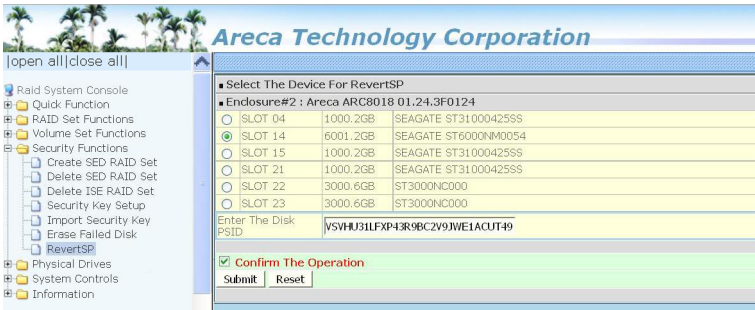
6.7.6 Erase Failed Disk

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



6.7.7 RevertSP

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

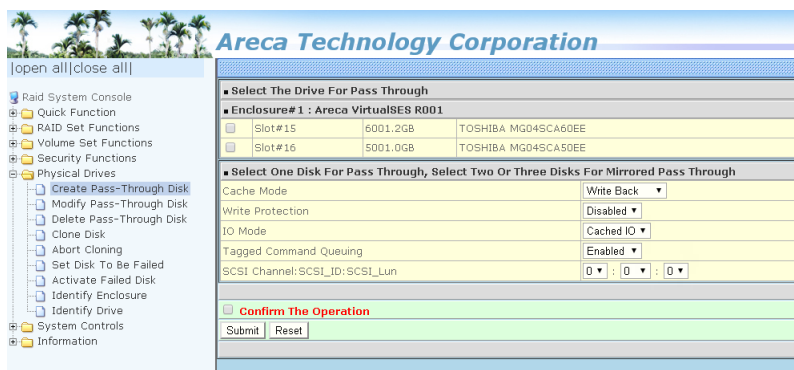


6.8 Physical Drive

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

6.8.1 Create Pass-Through Disk

To create pass-through disk, move the mouse cursor to the main menu and click on the "Create Pass-Through" link. The relative setting function screen appears. You can select one, dual or three disks for pass-through disk function. A mirrored pass-through mode means adapter will be regarded as the hard disk clone function, a host's data will write simultaneously into two or three hard disks in the RAID adapter. If you combine an SSD and HDDs in a mirrored pass-through hybrid solution, you can get all the reads from the SSD with SSD speed. A pass-through disk is not controlled by the tri-mode RAID adapter firmware, it can't be a part of a volume set. The disk is available to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID firmware. The user can also select the Volume Cache Mode, Write Protection, Tagged Command Queuing, and SCSI channel/SCSI_ID/SCSI_LUN for this pass-through disk.



- **Cache Mode**

The tri-mode RAID adapter supports "Write Through" and "Write Back" cache.

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- **Write Protection**

When "Write Protection" is enabled on the "Create Pass-Through Disk", host commands fail if they are issued to a pass-through disk in that RAID adapter and attempt to modify a pass-through disk's data or attributes. Write Protection is used primarily for customer-initiated disaster recovery testing.

- **IO Mode:**

The Cache IO and Direct IO cache policies apply to read on a specific virtual disk. The IO mode options are as follows:

- **Cache Io**

Specifies that all reads are buffered in the controller cache memory.

- **Direct Io**

Specifies that reads are not buffered in cache memory. When using direct IO mode, data is transferred to the controller cache memory and the host system simultaneously during a read request.

If a subsequent read request requires data from the same data block, it can be read directly from the controller cache memory.

- **Tagged Command Queuing**

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

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● SCSI Channel/SCSI ID/SCSI Lun

SCSI Channel: The tri-mode RAID adapter function is simulated as an external SCSI RAID adapter. The host bus is represented as a SCSI channel. Choose the SCSI Channel.

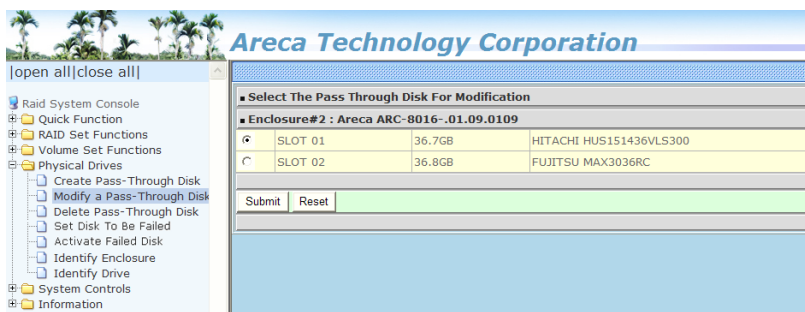
SCSI ID: Each SCSI device attached to the SCSI card, as well as the card itself, must be assigned a unique SCSI ID number. A SCSI channel can connect up to 15 devices. The tri-mode RAID adapter is a large SCSI device. Assign an ID from a list of SCSI IDs.

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

6.8.2 Modify Pass-Through Disk

Use this option to modify the pass-through disk attribute. The user can modify the Cache Mode, Write Protect, IO Mode, Tagged Command Queuing, and SCSI Channel/ID/LUN on an existing pass-through disk.

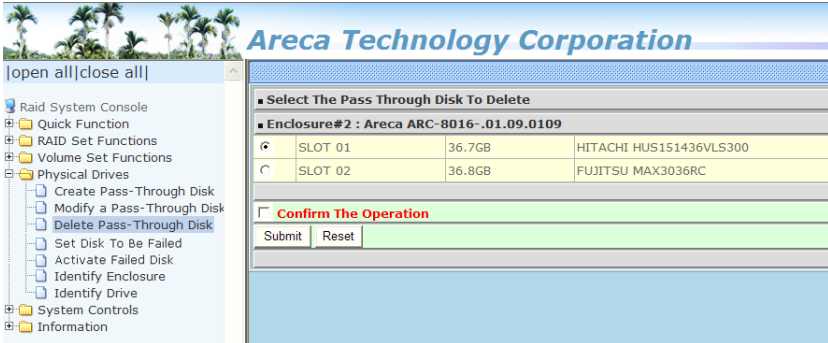
To modify the pass-through drive attribute from the pass-through drive pool, move the mouse cursor bar and click on the "Modify Pass-Through" link. The "Select The Pass Through Disk For Modification" screen appears mark the check box for the pass-through disk from the pass-through drive pool and click on the "Submit" button to select drive. When the "Enter Pass-Through Disk Attribute" screen appears, modify the drive attribute values, as you want. After you complete the selection, mark the check box for "Confirm The Operation" and click on the "Submit" button to complete the selection action.



WEB BROWSER-BASED CONFIGURATION

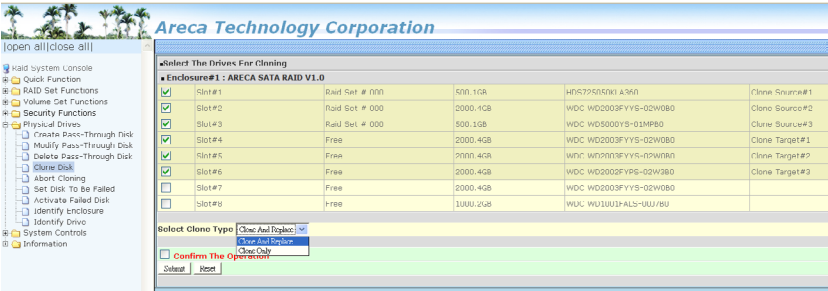
6.8.3 Delete Pass-Through Disk

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



6.8.4 Clone Disk

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



WEB BROWSER-BASED CONFIGURATION

Clone Disk Procedure

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

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

6.8.4.1 Clone And Replace

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

6.8.4.2 Clone Only

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

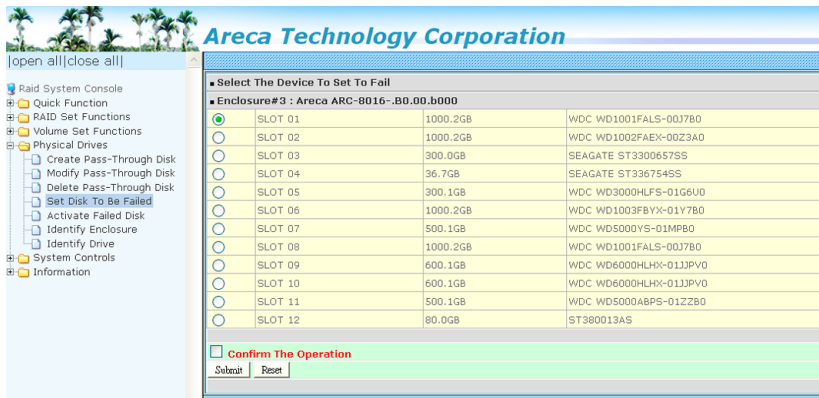
6.8.5 Abort Cloning

Use this function to stop the ongoing clone disk action.

WEB BROWSER-BASED CONFIGURATION

6.8.6 Set Disk To Be Failed

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



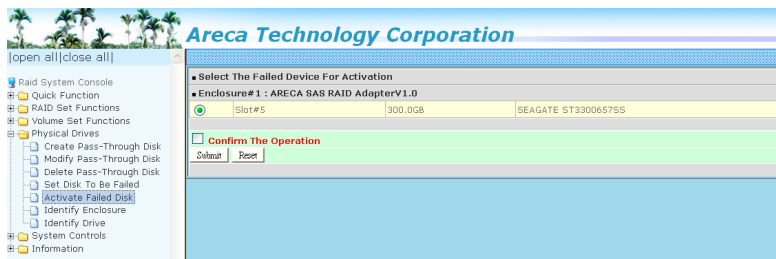
6.8.7 Activate Failed Disk

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

Followings are considered as “Removed-Disk”:

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

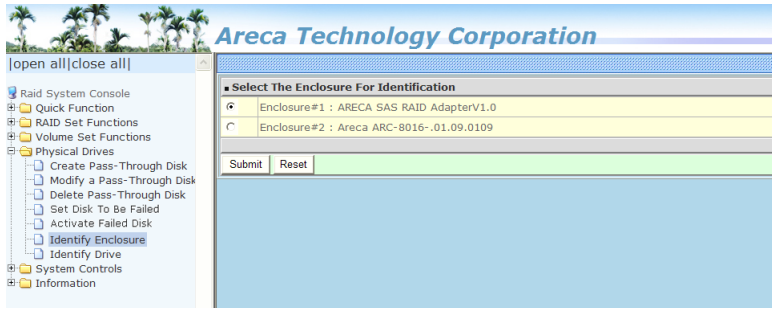
Basically, in the eyes of the adapter, the disk suddenly disappears due to whatever reason.



WEB BROWSER-BASED CONFIGURATION

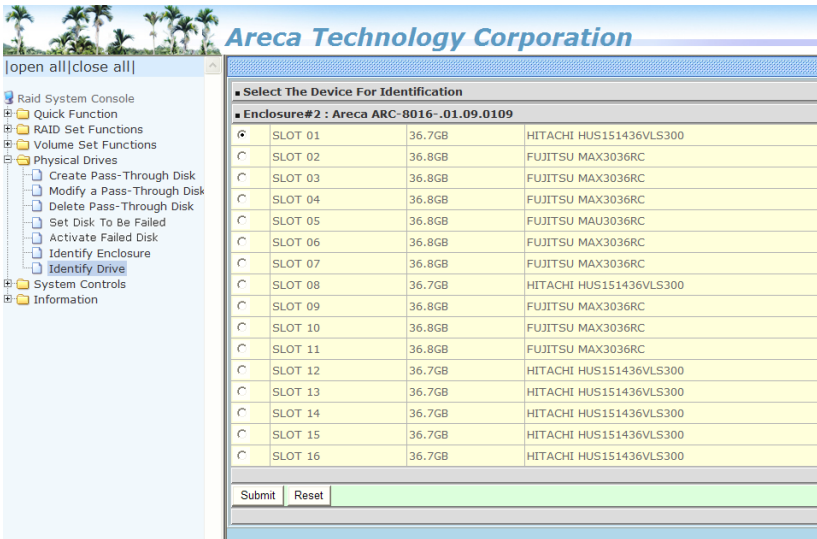
6.8.8 Identify Enclosure

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



6.8.9 Identify Drive

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



6.9 System Controls

6.9.1 System Config

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

Areca Technology Corporation

open all | close all |

- Raid System Console
 - Quick Function
 - RAID Set Functions
 - Volume Set Functions
 - Security Functions
 - Physical Drives
 - System Controls
 - System Configuration**
 - Advanced Configuration
 - Hdd Power Management
 - EtherNet Configuration
 - Alert By Mail Configuration
 - SNMP Configuration
 - NTP Configuration
 - View Events/Mute Beeper
 - Generate Test Event
 - Clear Event Buffer
 - Modify Password
 - Upgrade Firmware
 - Information

System Configurations	
System Beeper Setting	Enabled
Background Task Priority	Low(20%)
JBOD/RAID Configuration	RAID
SATA NCQ Support	Enabled
HDD Read Ahead Cache	Enabled
Volume Data Read Ahead	Normal
HDD Queue Depth	32
Empty HDD Slot LED	OFF
CPU Fan Detection	Enabled
Enclosure Type Supported	SES2
Max Command Length	4M
Auto Activate Incomplete Raid	Disabled
Disk Write Cache Mode	Auto
Write Same For Initialization	NVME, SAS, SATA
Hot Plugged Disk For Rebuilding	Always
DDR4 Speed	Default
SATA Port	Disabled
SES2 H/W Monitor	Enabled
Disk Capacity Truncation Mode	Multiples Of 10G
Smart Option For HDD	Failed The Drive
Smart Polling Interval - HDD	On Demand
Smart Polling Interval - SSD	On Demand
VPP Enclosure Mode	CNT#1 CNT#2 Separated

☐ Confirm The Operation

Submit Reset

- **System Beeper Setting**

The "System Beeper Setting" function is used to "Disabled" or "Enabled" the tri-mode RAID adapter alarm tone generator.

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- **Background Task Priority**

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

- **JBOD/RAID Configuration**

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

- **JBOD Cached IO**

The "JBOD Cached IO" configures all disks connected to the RAID controller as pass-through disk running on the cached IO mode.

- **JBOD Direct IO**

The "JBOD Direct IO" configures all disks connected to the RAID controller as pass-through disk running on the direct IO mode.

- **SATA NCQ Support**

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

- **HDD Read Ahead Cache**

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

WEB BROWSER-BASED CONFIGURATION

- **Volume Data Read Ahead**

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

- **HDD Queue Depth**

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

- **Empty HDD Slot LED**

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

- **CPU Fan Detection**

The ARC-1886 series incorporate one active cooling fan that allows the hot devices ROC chip to keep cool. In addition, newer systems already have enough air flow blowing over the controller. If the systems have provided enough adequate cooling for ROC, user can remove the attaching active fan and use a passive heat sink.

The "CPU Fan Detection" function is available in the firmware for detecting the cooling fan function on the ROC if you use the active cooling fan on the ARC-1886-8I/8X8I/16I low profile board. When using the passive heatsink on the adapter, disable the "CPU Fan Detection" function through this from McBIOS RAID manager setting or Web Browser.

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- **SES2 Support**

If your SAS backplane does not implement the correct SES2 function, you can disable the SES2 support on adapter. Controller will use SMP (only monitor PHY not environment) to communicate with SAS backplane, but you will be not able to monitor the backplane information.

- **Max Command Length**

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

- **Auto Activate Incomplete Raid**

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

- **Disk Write Cache Mode**

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

- **Write Same For Initialization**

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

- **Hot Plugged Disk For Rebuilding**

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

Blank Disk Only – it will trigger the rebuilding if and only if

WEB BROWSER-BASED CONFIGURATION

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

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

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

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

- **DDR4 Speed**

The "Down One/Two Grade" option is used to force ARC-1886 DRAM speed running down grade mode for compatible issue under DRAM DDR4-2666 chip. The "Default" mode is running at DDR4-2666 speed. You must restart the computer for the DRAM speed setting to take effect.

- **SES2 H/W Monitor**

Events with E# are reported by that specific enclosure through SES2 protocol. Raid adapters just forward these events. You can use identify enclosure feature to find out which enclosure is E#. After identify the enclosure, you can contact with the enclosure vendor for the explanation of these errors. If these events are fake events or you do not want to monitoring enclosures, you can disable the SES2 H/W monitoring feature in raid configuration menu.

- **Disk Capacity Truncation Mode**

Areca RAID adapters use drive truncation so that drives from differing vendors are more likely to be able to be used as spares for each other. Drive truncation slightly decreases the usable capacity of a drive that is used in redundant units. The adapter provides three truncation modes in the system

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configuration: "**Multiples Of 10G**", "**Multiples Of 1G**", and "**Disabled**".

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

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

Disabled – It does not truncate the capacity.

- **Smart Option For HDD**

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

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

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

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

- **Smart Polling Interval HDD**

Besides the scheduled volume check, user can define the Smart Pulling Interval to pull the SMART status of each HDD. The default is "on demand". User can schedule every certain period of time interval to pull the SMART status of each HDD. When SMART pulling is executed, disk activity will be tempo-

WEB BROWSER-BASED CONFIGURATION

rally halted until the SMART parameter reading is finished. That is why you don't want to set the interval too frequent. What to use is up to the users to decide based on their applications and experiment results.

- **Smart Polling Interval SSD**

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

- **VPP Enclosure Mode**

This option will be appeared for ARC-1886-16I installed.

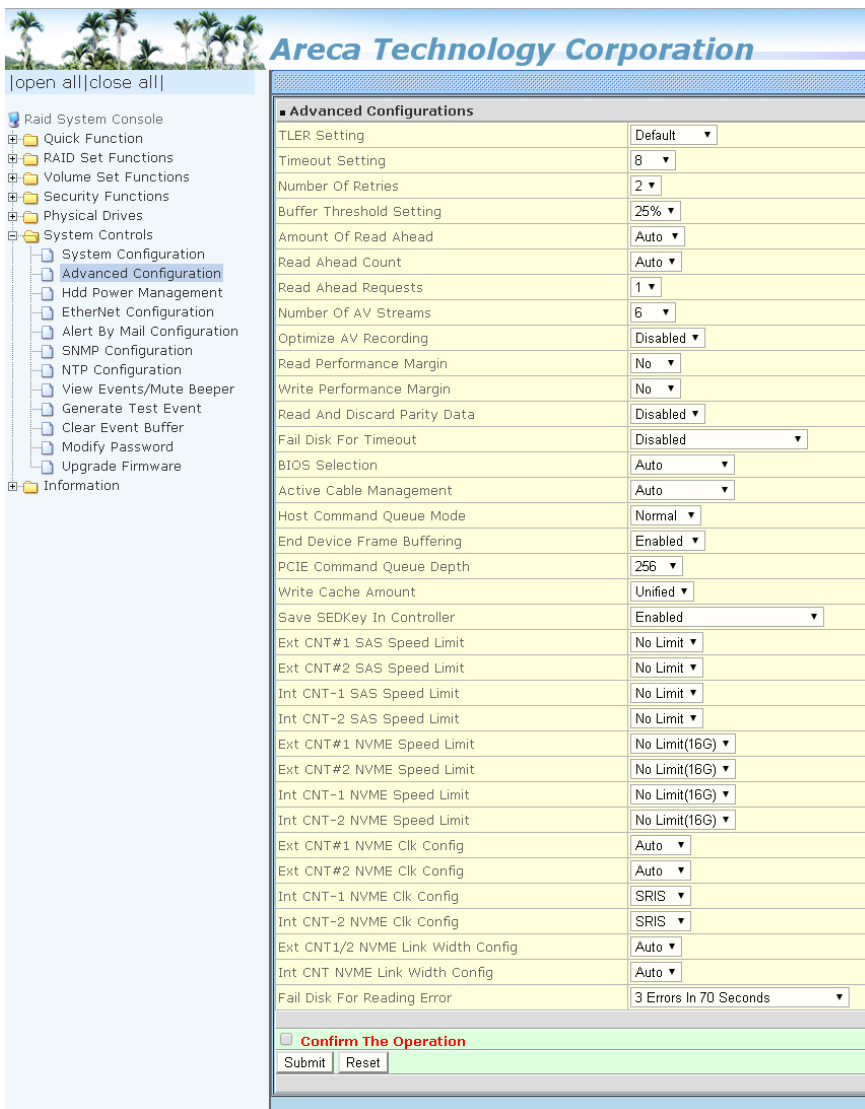
Select default "**CNT1# CNT2# Seperated**" option if ARC-1886 RAID adapter connects two backplane enclosure: one for CNT1# and the other for CNT2#.

Select "**CNT1# CNT2# S Combined**" option if ARC-1886 RAID adapter connects both CNT1# and CNT#2 to one hybrid backplane enclosure. The backplane is equipped with SFF-8639 connectors for adapting SAS/SATA and NVMe hybrid design on disk slots. The so-called 'hybrid' meaning the disk slots support either SATA, SAS or NVMe disk at a time.

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6.9.2 Advanced Configuration

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



The screenshot displays the RAID System Console interface. On the left is a navigation tree with categories like Quick Function, RAID Set Functions, Volume Set Functions, Security Functions, Physical Drives, and System Controls. The 'Advanced Configuration' option is highlighted under System Controls. The main area shows a list of configuration parameters with their current values and dropdown menus for selection. At the bottom, there is a 'Confirm The Operation' checkbox and 'Submit' and 'Reset' buttons.

■ Advanced Configurations	
TLER Setting	Default ▼
Timeout Setting	8 ▼
Number Of Retries	2 ▼
Buffer Threshold Setting	25% ▼
Amount Of Read Ahead	Auto ▼
Read Ahead Count	Auto ▼
Read Ahead Requests	1 ▼
Number Of AV Streams	6 ▼
Optimize AV Recording	Disabled ▼
Read Performance Margin	No ▼
Write Performance Margin	No ▼
Read And Discard Parity Data	Disabled ▼
Fail Disk For Timeout	Disabled ▼
BIOS Selection	Auto ▼
Active Cable Management	Auto ▼
Host Command Queue Mode	Normal ▼
End Device Frame Buffering	Enabled ▼
PCIE Command Queue Depth	256 ▼
Write Cache Amount	Unified ▼
Save SEDKey In Controller	Enabled ▼
Ext CNT#1 SAS Speed Limit	No Limit ▼
Ext CNT#2 SAS Speed Limit	No Limit ▼
Int CNT-1 SAS Speed Limit	No Limit ▼
Int CNT-2 SAS Speed Limit	No Limit ▼
Ext CNT#1 NVME Speed Limit	No Limit(16G) ▼
Ext CNT#2 NVME Speed Limit	No Limit(16G) ▼
Int CNT-1 NVME Speed Limit	No Limit(16G) ▼
Int CNT-2 NVME Speed Limit	No Limit(16G) ▼
Ext CNT#1 NVME Clk Config	Auto ▼
Ext CNT#2 NVME Clk Config	Auto ▼
Int CNT-1 NVME Clk Config	SRIS ▼
Int CNT-2 NVME Clk Config	SRIS ▼
Ext CNT1/2 NVME Link Width Config	Auto ▼
Int CNT NVME Link Width Config	Auto ▼
Fail Disk For Reading Error	3 Errors In 70 Seconds ▼

☐ **Confirm The Operation**

Submit Reset

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- **TLER Setting**

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

- **Timeout Setting**

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

- **Number of Retries**

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

- **Buffer Threshold**

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

This feature gives adapter extra buffer time in case of slow response from the hard drives within a given time. Conse-

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quently, this can prevent a pause in data flow and there will be continues data access and stream. This feature is very useful for the video streaming applications where there is high demand for constant non-stop data flow with no interruption due to lower performance of specific hardware.

- **Amount of Read Ahead**

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

- **Read Ahead Count**

The Read Ahead count is used to define how many times (1, 2, 3,, 10) of the "Amount of Read Ahead X Read Ahead Requests" data reading at a time. Default value is Auto: Controller will base on the HDD number to set the amount of Read Ahead Count value. You can select between Auto, 1, 2, or 10.

- **Read Ahead Requests**

The Read Ahead Requests is used to define how many times (1, 2, 3) of the "Amount of Read Ahead " data reading at a time. Default value is 1. You can select between 1, 2, or 3.

- **Number of AV Stream**

RAID adapters are required to have not only the function of processing ordinary data but also the function of dealing with AV (audio/video) stream data needing real-time processing. Since the bus cycle used in RAID adapter was designed to transfer the computer data exactly, it was unsuitable for the transfer of AV stream needing great band widths. They are required to do some setting for the handshaking during the processing of stream data. This setting is an object of transferring stream data efficiently on an existing RAID adapter.

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Normally you should not need to modify this value. Default value is 6. You can select between 6~256.

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

- **Optimize AV Recording**

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

- **Read Performance Margin**

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

- **Write Performance Margin**

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

AJA Mode Usage:

1. Controller needs to reboot when you adjust the following settings.
 - (1). Optimize For AV Recording: change any setting
 - (2). Read Performance Margin : No <-> X%
 - (3). Write Performance Margin : No <-> X%

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2. The following setting is changed for AJA mode, and reboot is required for the setting to take effect.

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

- <a>. Under Optimize For AV Recording mode: 3
Read Performance Margin and Write Performance Margin are enabled with "No" setting is 0%, reboot is not required to change Read Performance Margin and Write Performance Margin
- . If Read Performance Margin or Write Performance Margin are changed to X%, reboot is not required to change X% to Y%.
- <c>. For NON-VIDEO application, the following setting is recommended
Buffer Threshold Setting: 25%
Optimize AV Recording: disabled
- Example:
- (1). Only write throttling is required
- (a). Buffer Threshold Setting: 5%
 - (b). Optimize For AV Recording Mode left unchanged (Disabled)
 - (c). Read Performance Margin left unchanged (No)
 - (d). Write Performance Margin set to X%
 - (e). Reboot
 - (f). Adjust Write Performance Margin to fine tune the result (no reboot required)

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(2). Read/Write Throttling is required and sorting is to be disabled

(1). Buffer Threshold Setting: 5%

(2). Optimize For AV Recording Mode set to 3

(3). Reboot

(4). Adjust Read/Write Performance Margin to fine tune the result (no reboot required)

● **Read And Discard Parity Data**

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

● **Fail Disk For Any Timeout**

Imaging system products expect to have constant speed for writing raw data to the storage by constant speed without any data loss whenever a drive becomes failure in RAID system. This function is the option that RAID adapter will kill off the HDD for any time out. It can reduce the write cache size to buffer the raw data.

● **BIOS Selection**

It combines the "Legacy BIOS", "UEFI BIOS" and "EFI BIOS" into a single BIOS, and provides BIOS option in the GUI. In the old days, Areca provided separate BIOS files for each, and need to manually flash it in. Now flashing BIOS for different BIOS type is no longer needed, just make the BIOS selection in System Controls: Advance Configuration: BIOS Option.

The adapter provides three BIOS options.

- **Auto:** depends on the M/B PCIe slot setting for the RAID adapter installed.

- **UEFI:** for PC motherboards using UEFI boot.

- **Legacy INT13:** for PC motherboards that are using regular BIOS boot.

- **Disable:** disable adapter BIOS at POST (set to 0xFF)

==> If BIOS is to be disabled --> All data are 0xFF

● **PCIe Link Down Reset**

If tri-mode RAID adapters is experiencing problems with link down issue in some host M/B , please try to set the "PCIe Link Down Reset".

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Enable: The RAID-on-Chip (ROC) PCIe link will be down and need to be re-initialized to get the link up.

Disable: The RAID-on-Chip (ROC) PCIe link will ignore the "PCIe link Down Reset" command.

- **Active Cable Management**

An active cable requires power for circuitry that is integral to any of the TX/RX high speed serial channels supported by the cable. In addition, the active cable requires power to operate the management interface. There is one E2prom on the AOC cable that records the AOC capability 6 or 12 Gb/s, optical or no optical. This setting is for user to disable the E2prom value that it writes the wrong value. If select "Auto", it only works with the 8644 cable that has been programmed.

- **Host Command Queue Mode**

This option is used to solve the the problem with reads stalling that causes by out of order command completion. Choose the "Host Command Queue Mode" option="Ordered" on the "Advanced Configuration" if you want similar read/write throughputs. There the read and write get the same priority as they are scheduled and the reads are not pushed back.

- **End Device Frame Buffering**

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

- **PCIe Command Queue Depth**

This parameter is adjusted the commands per queue of PCIe bus which transmits multiple commands to a single target without waiting for the initial command to complete. User can set the "PCIe Command Queue Depth" to 256, 512, or 1024. Reboot is required for the setting to take effect.

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- **Write Cache Amount**

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

- **Save SED Key In Controller**

<a> If enable --> disable, clear SED Key saved in setup

 If disable --> enable, if key exists, save to setup

If enable--->disable, the key will not remain in the flash. So that next time power up again, it will need to input the key from the CLI or McRAID manager. You can also import the key file (Import Security Key) or key-in the password (Enter SED Key By Password) from the GUI interface.

- **Int Connector#1~#3 SAS/NVMe Speed Limit**

This option is used to limit the internal connector speed in case of compatible issue on low speed connected enclosure.

The options for "Int Connector# SAS Speed Limit" are: "No Limit", "3G", and "6G". The default is "No Limit (12G)".

The options for "Int Connector# NVMe Speed Limit" are: "No Limit (16G)", "8G", and "5G". The default is "No Limit (16G)".

- **Ext Connector#1~#2 SAS/NVMe Speed Limit**

This option is used to limit the external connector speed in case of compatible issue on low speed connected enclosure.

The options for "Ext Connector# SAS Speed Limit" are: "No Limit", "3G", and "6G". The default is "No Limit (12G)".

The options for "Ext Connector# NVMe Speed Limit" are: "No Limit (16G)", "8G", and "5G". The default is "No Limit (16G)".

- **Ext CNT#1/2 NVME Clk Config**

The PCIe standard specifies a 100 MHz clock at both the transmitting and receiving devices. This option can manually configure the NVMe clock mode for different clocking architectures: Common Clock, Separate Reference Clocks with No Spread-Spectrum Clocking (SRNS), and Separate Reference Clocks with Independent Spread-Spectrum Clocking (SRIS) for external connectors. The options for "Ext CNT#-1/2 Clk Config" are: "Auto", "SRIS", "SRNS" and "Common Clock". The default is "Auto" and configured as "SRIS" mode.

- **Int CNT-1/2 NVME Clk Config**

The PCIe standard specifies a 100 MHz clock at both the transmitting and receiving devices. This option can manually configure the NVMe clock mode for different clocking architectures: Common Clock, Separate Reference Clocks with No Spread-Spectrum Clocking (SRNS), and Separate Reference Clocks with Independent Spread-Spectrum Clocking (SRIS) for internal connectors. The options for "Int CNT-1/2 Clk Config" are: "Auto", "SRIS", "SRNS" and "Common Clock". The default is "Auto" and configured as "SRIS" mode.

- **Ext CNT1/2 NVME Link Width Config**

This option can manually configure the link lanes for the external connector. The options for "Ext CNT1/2 NVME Link Width Config" are: "Auto", "1X", "2X", "4X" and "8X". The default is "Auto" for configuring each connector 4X link lanes.

- **Int CNT NVME Link Width Config**

This option is used to support the backplane that it does not use neither UBM or VPP. This option can manually configure the link lanes for the internal connector. The options for "Int CNT1/2 NVME Link Width Config" are: "Auto", "1X", "2X", "4X" and "8X". The default is "Auto" for configuring each connector 1X link lane.

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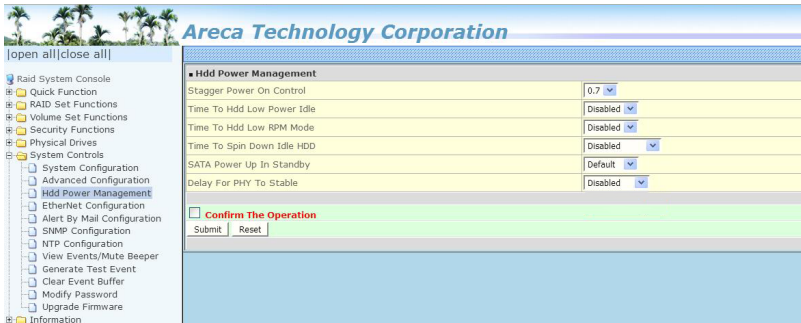
- **Fail Disk For Reading Error**

This option is available to improve the fail disk function if the disk has too many reading errors. This function is the option that RAID adapter will kill off the HDD for reading error account setting value.

- 3 errors in 70 seconds: this option also includes 4 errors in 100 seconds, 5 errors in 120 seconds
- 6 errors in 2 minutes: this option also includes 8 errors in 180 seconds, 10 errors in 240 seconds
- 9 errors in 3 minutes: this option also includes 12 errors in 270 seconds, 15 errors in 360 seconds
- Reading Error Does Not Fail Disk

6.9.3 HDD Power Management

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



6.9.3.1 Stagger Power On Control

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

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

6.9.3.2 Time To Hdd Low Power Idle

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

6.9.3.3 Time To Hdd Low RPM Mode

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

6.9.3.4 Time To Spin Down Idle HDD

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

6.9.3.5 SATA Power Up In Standby

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

6.9.3.6 Delay for Phy to Stable

This function is used to increase the availability of the HDD unpredictable behavior. Delay timing can be set from 10 to 50 seconds, indicating the time that the controller waits, from the startup of the system until the hard drive is being detected. The default is Disabled.

WEB BROWSER-BASED CONFIGURATION

6.9.4 Ethernet Configuration

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

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

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

The screenshot displays the web browser-based configuration interface for Areca Technology Corporation. The interface has a blue header with the company name and a navigation menu on the left. The main content area is titled "Ethernet Net Configurations" and contains a table of configuration parameters. The "DHCP Function" is set to "Enabled". The "Local IP Address" is 192.168.1.100. The "Gateway IP Address" is 192.168.1.1. The "Subnet Mask" is 255.255.255.0. The "HTTP Port Number" is 80. The "Telnet Port Number" is 23. The "SMTP Port Number" is 25. The "Current IP Address" is 192.168.0.103. The "Current Gateway IP Address" is 192.168.0.1. The "Current Subnet Mask" is 255.255.255.0. The "Ether Net MAC Address" is 00.1B.4D.40.00.51. At the bottom, there is a "Confirm The Operation" section with "Submit" and "Reset" buttons.

■ Ethernet Net Configurations	
DHCP Function	Enabled
Local IP Address (Used If DHCP Disabled)	192.168.1.100
Gateway IP Address (Used If DHCP Disabled)	192.168.1.1
Subnet Mask (Used If DHCP Disabled)	255.255.255.0
HTTP Port Number (7168..8191 Is Reserved)	80
Telnet Port Number (7168..8191 Is Reserved)	23
SMTP Port Number (7168..8191 Is Reserved)	25
Current IP Address	192.168.0.103
Current Gateway IP Address	192.168.0.1
Current Subnet Mask	255.255.255.0
Ether Net MAC Address	00.1B.4D.40.00.51

Confirm The Operation

Submit Reset

WEB BROWSER-BASED CONFIGURATION

Note:

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

6.9.5 Alert By Mail Configuration

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

The firmware contains a SMTP manager monitoring all system events. Single or multiple user notifications can be sent via "Plain English" e-mails with no software required. (Please refer to section 5.6 ArcHTTP Configuration of SMTP Server Configuration, Mail Address Configuration and Event Notification Configuration.)

The screenshot displays the web-based configuration interface for the Areca Technology Corporation RAID system. The interface is divided into a left sidebar menu and a main configuration area. The sidebar menu includes options like "Raid System Console", "Quick Function", "RAID Set Functions", "Volume Set Functions", "Physical Drives", "System Controls", "System Configuration", "Advanced Configuration", "Hot Power Management", "Ethernet Configuration", "Alert By Mail Configuration" (which is selected), "SMTP Configuration", "NTD configuration", "View Events/Mute Beeper", "Generate Test Event", "Clear Event Buffer", "Modify Password", "Upgrade Firmware", and "Information". The main configuration area is titled "Alert By Mail Configuration" and contains several sections: "SMTP Server Configuration" with a field for "SMTP Server IP Address" (set to 0.0.0.0); "Mail Address Configurations" with fields for "Sender Name", "Mail Address", "Account", and "Password"; and "Event Notification Configurations" which lists four "MailTo" entries (MailTo Name1 through MailTo Name4). Each entry has a "Mail Address" field and a set of checkboxes for event notifications: "Disable Event Notification" (checked), "Urgent Error Notification", "Serious Error Notification", "Warning Error Notification", "Information Notification", and "Notification For No Event". The "Notification For No Event" option is disabled for all entries. The interface also includes a top navigation bar with "open all" and "close all" links, and a bottom status bar.

WEB BROWSER-BASED CONFIGURATION

6.9.6 SNMP Configuration

Please refer to Appendix C of SNMP Operation & Installation.

The screenshot shows the 'SNMP Trap Configurations' and 'SNMP System Configurations' sections of the Areca Technology Corporation web interface. The left sidebar contains a tree view with 'SNMP Configuration' selected. The main content area has the following sections:

- SNMP Trap Configurations:** Three rows for 'SNMP Trap IP Address #1', '#2', and '#3'. Each row has four input fields for IP octets and a 'Port#' field set to '162'.
- SNMP System Configurations:** Fields for 'Community', 'sysContact.0', 'sysName.0', and 'sysLocation.0'.
- SNMP Trap Notification Configurations:** A table with checkboxes for various notification types and their corresponding actions.

Notification Type	Action
<input type="checkbox"/> Disable SNMP Trap	No SNMP Trap Will Be Sent
<input type="checkbox"/> Urgent Error Notification	Send Only Urgent Event
<input type="checkbox"/> Serious Error Notification	Send Urgent And Serious Event
<input type="checkbox"/> Warning Error Notification	Send Urgent, Serious And Warning Event
<input type="checkbox"/> Information Notification	Send All Event
<input type="checkbox"/> SNMP Through PCI Inband	Ethernet SNMP Is Disabled
- Confirm The Operation:** 'Submit' and 'Reset' buttons.

6.9.7 NTP Configuration

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

The screenshot shows the 'NTP Server Configurations' and 'Time Zone Configuration' sections of the Areca Technology Corporation web interface. The left sidebar contains a tree view with 'NTP Configuration' selected. The main content area has the following sections:

- NTP Server Configurations:** Two rows for 'NTP Server IP Address #1' and '#2', each with four input fields for IP octets.
- Time Zone Configuration:** A 'Time Zone' dropdown menu set to '(GMT-12:00) International Date Line West', an 'Automatic Daylight Saving' dropdown set to 'Enabled', and a 'Current Time' display showing '2011/6/16 16:31:14'.
- Confirm The Operation:** 'Submit' and 'Reset' buttons.

Note:

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

WEB BROWSER-BASED CONFIGURATION

● NTP Server Address

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

● Time Zone

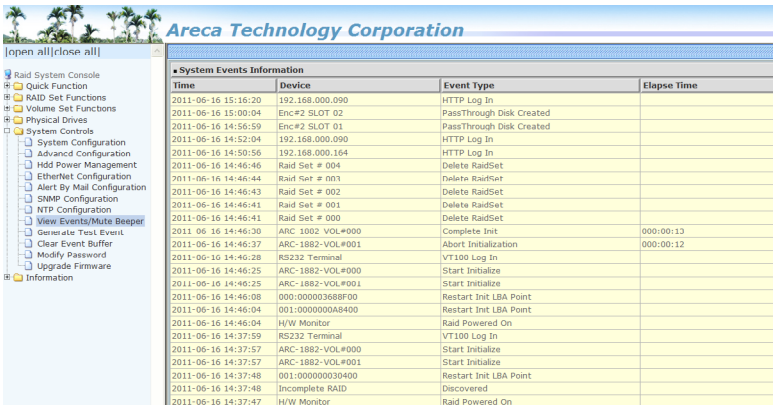
Time Zone conveniently runs in the system tray and allows you to easily view the date and time in various locations around the world. You can also quickly and easily add your own personal locations to customize time zone the way you want.

● Automatic Daylight Saving

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

6.9.8 View Events/Mute Beeper

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



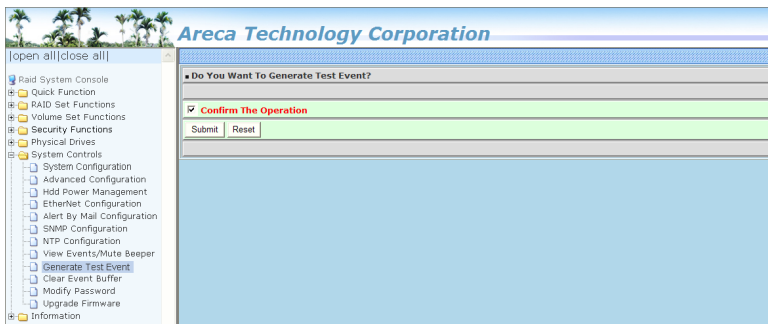
Areca Technology Corporation			
■ System Events Information			
Time	Device	Event Type	EIapse Time
2011-06-16 15:16:20	192.168.000.090	HTTP Log In	
2011-06-16 15:00:04	Enc#2 SLOT 02	PassThrough Disk Created	
2011-06-16 14:56:59	Enc#2 SLOT 01	PassThrough Disk Created	
2011-06-16 14:52:04	192.168.000.090	HTTP Log In	
2011-06-16 14:50:56	192.168.000.164	HTTP Log In	
2011-06-16 14:46:46	Raid Set # 004	Delete RaidSet	
2011-06-16 14:46:44	Raid Set # 003	Delete RaidSet	
2011-06-16 14:46:43	Raid Set # 002	Delete RaidSet	
2011-06-16 14:46:41	Raid Set # 001	Delete RaidSet	
2011-06-16 14:46:41	Raid Set # 000	Delete RaidSet	
2011-06-16 14:46:30	ARC-1002-VOL#000	Complete Init	000/00:13
2011-06-16 14:46:37	ARC-1802-VOL#001	Abort Initialization	000/00:12
2011-06-16 14:46:28	RS232 Terminal	VT100 Log In	
2011-06-16 14:46:25	ARC-1802-VOL#000	Start Initialize	
2011-06-16 14:46:25	ARC-1802-VOL#001	Start Initialize	
2011-06-16 14:46:08	001:000000368F00	Restart Init LBA Point	
2011-06-16 14:46:04	001:0000000A8400	Restart Init LBA Point	
2011-06-16 14:46:04	I/W Monitor	Raid Powered On	
2011-06-16 14:37:59	RS232 Terminal	VT100 Log In	
2011-06-16 14:37:57	ARC-1802-VOL#000	Start Initialize	
2011-06-16 14:37:57	ARC-1802-VOL#001	Start Initialize	
2011-06-16 14:37:48	001:000000039400	Restart Init LBA Point	
2011-06-16 14:37:48	Incomplete RAID	Discovered	
2011-06-16 14:37:47	I/W Monitor	Raid Powered On	

WEB BROWSER-BASED CONFIGURATION

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

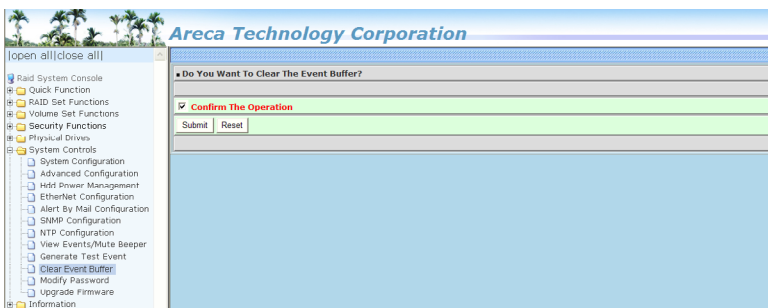
6.9.9 Generate Test Event

Use this feature to generate events for testing purposes.



6.9.10 Clear Events Buffer

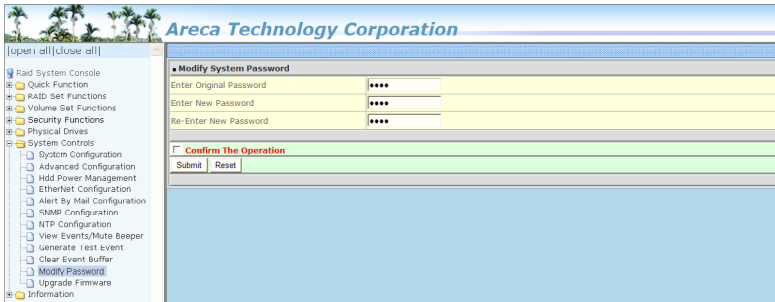
Use this feature to clear the entire events buffer information.



6.9.11 Modify Password

To set or change the tri-mode RAID adapter password, select "System Controls" from the menu and click on the "Modify Password" link. The "Modify System Password" screen appears.

WEB BROWSER-BASED CONFIGURATION

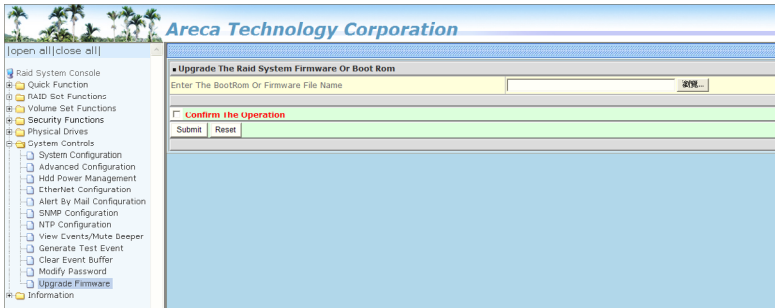


The manufacture default password is set to 0000.

The password option allows user to set or clear the tri-mode RAID adapter's password protection feature. Once the password has been set, the user can only monitor and configure the tri-mode RAID adapter by providing the correct password. The password is used to protect the tri-mode RAID adapter from unauthorized entry. The adapter will check the password only when entering the main menu from the initial screen. The tri-mode RAID adapter will automatically go back to the initial screen when it does not receive any command in 5 minutes. Do not use spaces when you enter the password, If spaces are used, it will lock out the user. To disable the password, leave the fields blank. Once the user confirms the operation and clicks on the "Submit" button, the existing password will be cleared. Then, no password checking will occur when entering the main menu from the starting screen.

6.9.12 Update Firmware

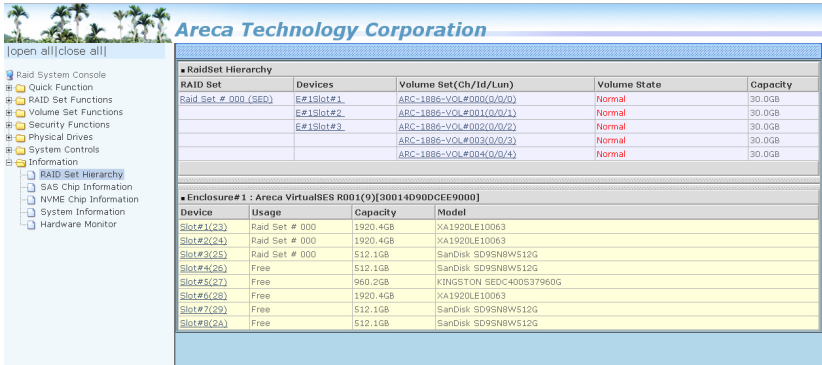
Please refer to the appendix A "Upgrading Flash ROM Update Process".



6.10 Information

6.10.1 Raid Set Hierarchy

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



Areca Technology Corporation

[open all][close all]

☐ Raid System Console
☐ Quick Function
☐ RAID Set Functions
☐ Volume Set Functions
☐ Security Functions
☐ Physical Drives
☐ System Controls
☐ Information
☒ RAID Set Hierarchy
☐ SAS Chip Information
☐ NVME Chip Information
☐ System Information
☐ Hardware Monitor

*RaidSet Hierarchy				
RAID Set	Devices	Volume Set(Ch/Id/Lun)	Volume State	Capacity
Raid Set # 000 (SED)	E#1Slot#1	ABC-1886-VOL#000(O/D/0)	Normal	30.0GB
	E#1Slot#2	ABC-1886-VOL#001(O/D/1)	Normal	30.0GB
	E#1Slot#3	ABC-1886-VOL#002(O/D/2)	Normal	30.0GB
		ABC-1886-VOL#003(O/D/3)	Normal	30.0GB
		ABC-1886-VOL#004(O/D/4)	Normal	30.0GB

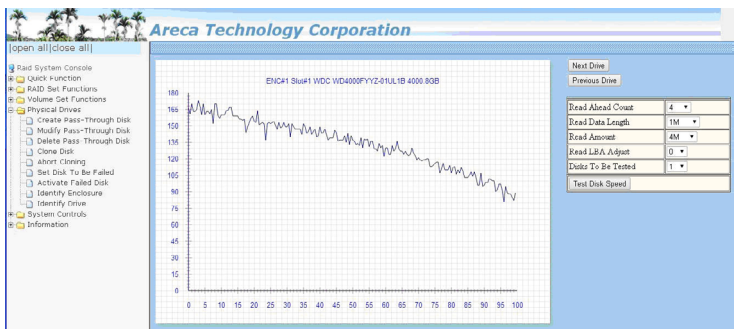
*Enclosure#1 : Areca VirtualSES R001(0)[30014D90DCFE9000]			
Device	Usage	Capacity	Model
Slot#1(233)	Raid Set # 000	1920.4GB	KA1920LE10063
Slot#2(24)	Raid Set # 000	1920.4GB	KA1920LE10063
Slot#3(25)	Raid Set # 000	512.1GB	SanDisk SD95N8W512G
Slot#4(26)	Free	512.1GB	SanDisk SD95N8W512G
Slot#5(27)	Free	960.2GB	KINGSTON SEDC400S37960G
Slot#6(28)	Free	1920.4GB	KA1920LE10063
Slot#7(29)	Free	512.1GB	SanDisk SD95N8W512G
Slot#8(2A)	Free	512.1GB	SanDisk SD95N8W512G

6.10.1.1 Hdd Xfer Speed

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

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

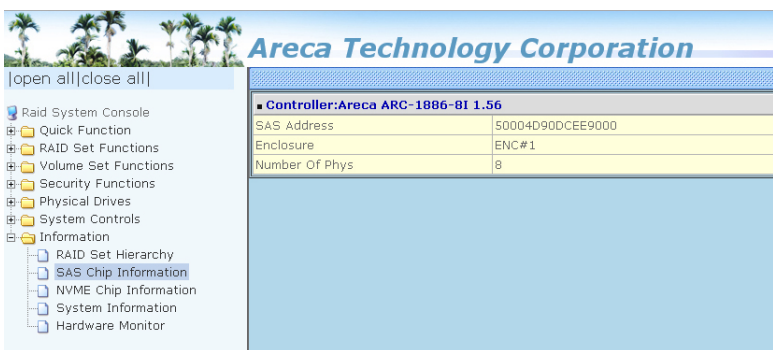
WEB BROWSER-BASED CONFIGURATION



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

6.10.2 SAS Chip Information

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



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

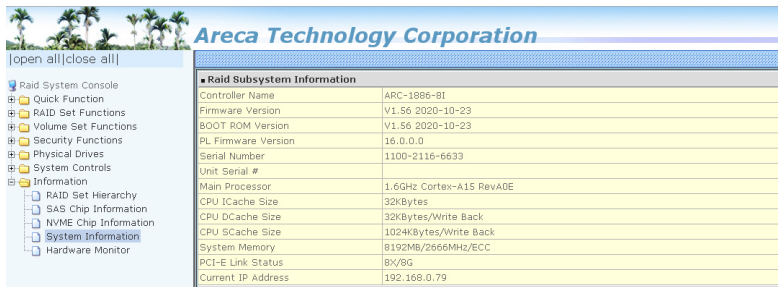
6.10.3 NVME Chip Information

To view the tri-mode RAID adapter's ROC and attached PCIe switch NVME chip information, move the mouse cursor to the main menu and click on the "NVME Chip Information" link. The tri-mode RAID adapter "NVME Chip Information" screen appears. User can click on tri-mode RAID adapter and PCIe switch# item on the "NVME Chip Information" screen. It will show statistic page for ports on the ROC RAID adapter and PCIe switch#. Click on the "Clear Error Log" to refresh the fully statistic page.



6.10.4 System Information


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



WEB BROWSER-BASED CONFIGURATION

6.10.5 Hardware Monitor

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



Areca Technology Corporation

open allclose all

Raid System Console

Quick Function

RAID Set Functions

Volume Set Functions

Security Functions

Physical Drives

System Controls

Information

RAID Set Hierarchy

SAS Chip Information

NVME Chip Information

System Information

Hardware Monitor

Stop Auto Refresh

Controller H/W Monitor

CPU Temperature	42 °C
Controller Temp.	37 °C
CPU Fan	5625 RPM
12V	12.099 V
5V	5.214 V
3.3V	3.344 V
IO Voltage +1.8V	1.856 V
DDR4 +1.2V	1.232 V
CPU VCore +0.85V	0.864 V
ROC +1.5V	1.552 V
DDR4 +0.6V	0.608 V
Battery Status	Not Installed

Enclosure# 1 : Areca VirtualSES R001(9)

Appendix A

Upgrading Flash ROM Update Process

A-1 Overview

Since the tri-mode RAID adapter features flash ROM firmware, it is not necessary to change the hardware flash chip in order to upgrade the RAID firmware. The user can simply re-program the old firmware through the in-band PCIe bus, out-of-band Ethernet port McRAID storage manager or nflash DOS utility. New releases of the firmware are available in the form of a DOS file on Areca website. The files available at the website for each model contain the following files in each version:

ARC1886UEFI.BIN:→ An EFI shell and a home brewed small application

ARC1886BIOS.BIN :→ PCIe BIOS for system board using

ARC1886BOOT.BIN :→ RAID adapter hardware initialization

ARC1886FIRM.BIN :→ RAID kernel program

Release_note_version-date.TXT contains the history information of the software code change in the main directory. This file can download from **<https://www.areca.com.tw/support/downloads.html>** page. 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 ARC1886BIOS.BIN for system M/B compatibility and ARC1886FIRM.BIN for RAID function. All these files in the firmware package are a part of the firmware. You should update all files in the package, no special update order needed. New firmware works after a system restart not instantant available, so you can update all files before restart the system. The adapter firmware is independent of the array, update firmware does not touch anything you stored in the array.

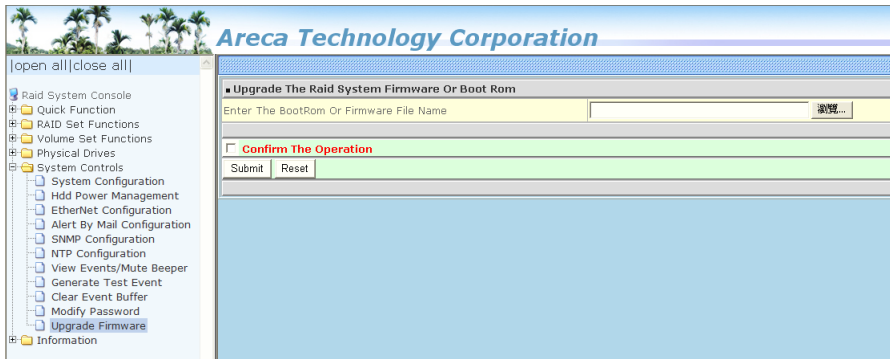
Note:

Please update all binary code (BIOS, UEFI, BOOT, FIRM and MBR0) before you reboot system. Otherwise, a mixed firmware package may result the adapter hang.

APPENDIX

A-2 Upgrading Firmware Through McRAID Storage Manager

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



1. To upgrade the tri-mode RAID adapter firmware, move the mouse cursor to "Upgrade Firmware" link. The "Upgrade The Raid System Firmware or Boot Rom" screen appears.
2. Click on "Browse". Look in the location to which the Firmware upgrade software was downloaded. Select the file name and click on "Open".
3. Tick on "Confirm The Operation" and press the "Submit" button.
4. The web browser begins to download the firmware binary to the adapter and start to update the flash ROM.
5. After the firmware upgrade is complete, a bar indicator will show "Firmware Has Been Updated Successfully".
6. After the new firmware package completes downloading, find a chance to restart the adapter/computer for the new firmware to take effect.

The web browser-based McRAID storage manager can be accessed through the in-band PCIe bus or out-of-band LAN port. The in-band method uses the ArchHTTP proxy server to launch the McRAID

storage manager. The out-of-band method allows local or remote to access the McRAID storage manager from any standard internet browser via a LAN or WAN with no software or patches required. Controller with onboard LAN port, you can directly plug an Ethernet cable to the adapter LAN port, then enter the McBIOS RAID manager to configure the network setting. After network setting configured and saved, you can find the current IP address in the McBIOS RAID manager "System Information" page.

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

A-3 Upgrading Firmware Through nflash DOS Utility

Areca now offers an alternative means communication for the tri-mode RAID adapter – Upgrade the all files (BIOS, BOOT and FIRM) without necessary system starting up to running the ArchHTTP proxy server. The nflash utility program is a DOS application, which runs in the DOS operating system. Be sure of ensuring properly to communicate between tri-mode RAID adapter and nflash DOS utility. Please make a bootable DOS floppy diskette or USB devices from other Windows operating system and boot up the system from those bootable devices.

● Starting the nflash Utility

You do not need to short any jumper cap on running nflash utility. The nflash utility provides an on-line table of contents, brief descriptions of the help sub-commands. The nflash utility can download from **[https:// www.areca.com.tw](https://www.areca.com.tw)**. You can run the <nflash> to get more detailed information about the command usage. Typical output looks as below:

APPENDIX

```
A:\nflash
Raid Controller Flash Utility
V1.56 2020-10-23
Command Usage:
NFLASH FileName
NFLASH FileName /cn --> n=0,1,2,3 write binary to adapter#0
FileName May Be ARC1886FIRM.BIN or ARC1886*
For ARC1886* Will Expand To ARC1886BOOT /FIRM/BIOS.BIN

A:\>nflash arc188~1.bin
Raid Controller Flash Utility
V1.56 2020-10-23
MODEL : ARC-1886
MEM FE620000 FE7FF000
File ARC188~1.BIN : >>*** => Flash OK
```

A-4 Upgrading Firmware Through CLI

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

To update the adapter firmware, follow the procedure below:

```
Parameter:<path=<PATH_OF_FIRMWARE_FILE>>
Fn: Firmware Updating.
Ex: Update Firmware And File Path Is In [C:\FW\ARC1886FIRM.BIN.]
Command: sys updatefw path=c:\fw\arc1886firm.bin [Enter]
```

Appendix B

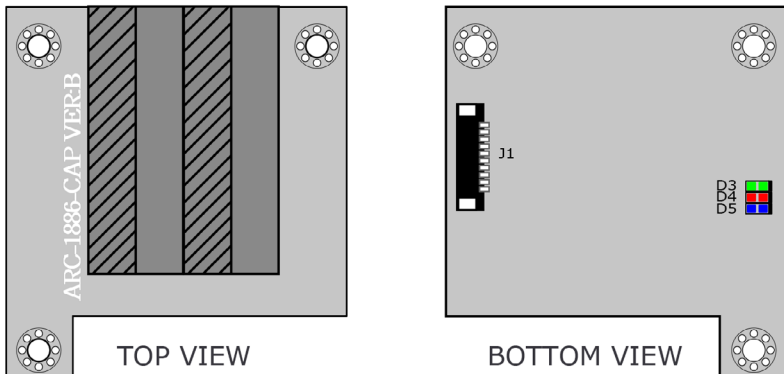
Cache Backup Module (ARC-1886-CBM)

B-1 Overview

The ARC-1886-CBM kit includes the cache backup module (CBM), and one cable. The CBM features controller circuit and supercapacitor technology that provides cache offload capability to protect cached data in case of system power loss. The ARC-1886-CBM module is mounted supercapacitor pack that provides power for the backup of your data. When the module detects loss of power, the supercapacitor keeps parts of the ARC-1886 tri-mode RAID adapter active long enough to allow cache data to be copied to the flash memory available on the ARC-1886 RAID adapter. The module attaches directly to the tri-mode RAID adapter by the cable.

B-2 CBM Components

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



APPENDIX

B-3 CBM Outline

The following figures provide the upper and top view of the CBM using supercapacitor.

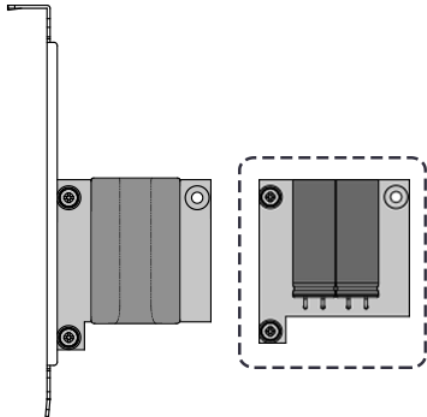


Figure B-1,
ARC-1886-CBM (top view)

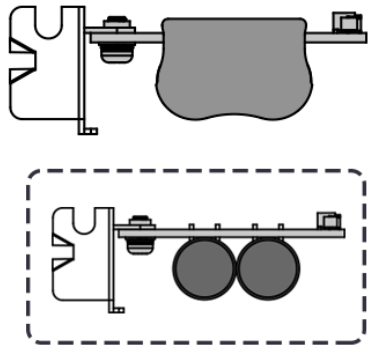


Figure B-2,
ARC-1886-CBM (upper view)

B-4 Status of CBM

The following table provides the LED status of the CBM.

D3 (Green)	Status
On	Power On
Off	Power Off

D5 (Blue)	Status
Charge	Quick Flash 1Hz
Charge-Done	On
Discharge	Slow Flash 10Hz

D4 (Red)	Status
Normal	Off
Fail	Quick Flash 10Hz
Calibration	Slow Flash 1Hz
Need Replace	On

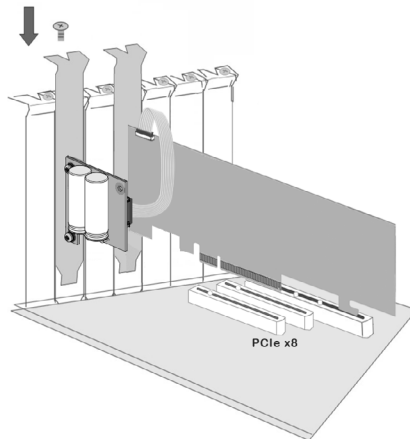
Note:

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

B-5 Installation

Follow these steps to attach the cache backup module to the ARC-1886 RAID adapter.

1. Turn off the system power, and unplug the power cords.
2. Remove the mounting screw and existing bracket from the rear panel behind the selected PCIe slot.
3. Insert the CBM in the PCIe slot and press down gently, but firmly, to ensure that the card is properly seated in the slot.
4. Screw the bracket into the computer chassis.
5. Remove the cable that is included in the ARC-1886-CBM kit box. The cable has a 10-pin connector on both ends.
6. Insert one end of the cable into the 10-pin cable connector on the tri-mode RAID adapter and the other end into the 10-pin J1 cable connector on the CBM with supercapacitor packs, as shown in below figure.



Note:

1. Low profile bracket also provided.
2. The CBM will occupy one PCI slot on the host backplane.

APPENDIX

B-6 Capacitor Backup Module Capacity

The CBM backup capacity is defined as the maximum duration of a power failure for which data in the cache memory can be written into the flash on ARC-1886 tri-mode RAID adapter. The CBM can support up to 8GB memory chips that installed on the tri-mode RAID adapter.

B-7 Operation

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

Note:

Do not remove CBM while system is running.

B-8 CBM Functionality Test Procedure:

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

B-9 CBM Specifications

Mechanical

- Module Dimension (W x H x D): 50 x 14.1 x 46 mm
- CBM Connector (J1): (1*10) box header

Environmental

- Operating Temperature: 0°C to +50°C
- Cache Memory Size Supported: up to 8GB

Appendix C

SNMP Operation & Installation

C-1 Overview

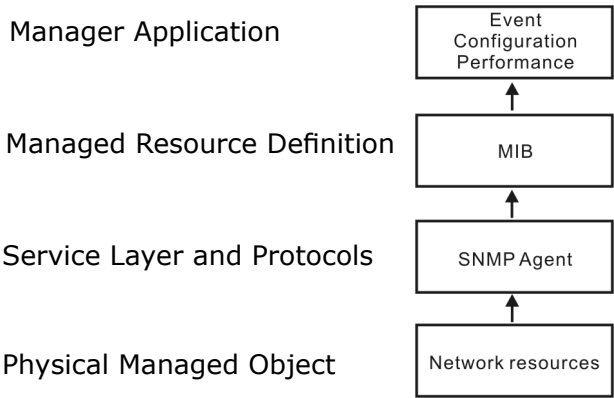
The McRAID storage manager includes a firmware-embedded Simple Network Management Protocol (SNMP) agent and SNMP Extension Agent for the Areca RAID adapter. An SNMP-based management application (also known as an SNMP manager) can monitor the disk array. An example of a SNMP management application is Hewlett-Packard's Open View, Net-SNMP or SNMPc. The SNMP extension agent can be used to augment the Areca RAID adapter if you are already running an SNMP management application at your site.

C-2 SNMP Definition

SNMP, an IP-based protocol, has a set of commands for getting the status of target devices. The SNMP management platform is called the SNMP manager, and the managed devices have the SNMP agent loaded. Management data is organized in a hierarchical data structure called the Management Information Base (MIB). These MIBs are defined and sanctioned by various industry associations. Each type of device on your network has its own specific MIB file. The MIB file defines the device as a set of managed objects — values that can be read or changed by the SNMP manager. The MIB file enables the SNMP manager to interpret trap messages from devices. To make sense out of a trap that's sent by a device, the SNMP manager needs to have access to the MIB that describes the format and content of the possible traps that the device can send. The objective is for all vendors to create products in compliance with these MIBs so that inter-vendor interoperability can be achieved. To be available for the SNMP manager, a command adds the MIB file for each of devices to the MIB database. This enables the devices to be managed via the SNMP manager.

The following figure illustrates the various components of an SNMP-based management architecture.

APPENDIX



C-3 SNMP Installation

Perform the following steps to install the Areca RAID adapter SNMP function into the SNMP manager. The installation of the SNMP manager is accomplished in several phases:

Step 1. Installing the SNMP manager software on the client

Installing the SNMP manager software on the client. This installation process is well-covered in the User's Guide of your SNMP manager application.

Step 2. Compiling the MIB description file with the management

Placing a copy of the RAID adapter's MIBs file in a directory which is accessible to the management application and compile the MIB description file with the SNMP management application database. Before the manager application accesses the Areca RAID adapter, 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 manager application. Ensure the compilation process successfully integrates the contents of the `areca_sas.mib` file into the traps database. The MIBs file can download from <https://www.areca.com.tw>.

Each RAID adapter needs to have its own MIBs file. Areca provide 4 adapters MIBs file for users. User can request it if more adapters install on one system.

Note:

1. The MIB compiler may be not installed by default with SNMP manager.
2. Some SNMP managers have unique rule on the format of MIB files, you may need to refer the error message to modify the mib file to be able to met the software requirement.

Step 3. SNMP Service Method

With Areca series RAID cards, there are 3 service methods to get snmp:

ArcHTTP, Onboard NIC and in-band PCIe + SNMP extension agent.

1. Service Method-1: using ArcHTTP Proxy Server

Pay attention to these:

- Do not check mark the option: "SNMP Through PCI".
- Make sure you have the latest driver and ArcHTTP, from this URL "<https://www.areca.com.tw/support/downloads.html>".
- ArcHTTP supports sending "traps" only, do not support the "get" command.

2. Service Method-2: using Onboard NIC.

Pay attention to these:

- Do not check mark the option: "SNMP Through PCI".
- Do need to fill out the "SNMP Trap Config".

3. Service Method-3: using in-band PCI + SNMP extension agent.

Pay attention to these:

- Download the snmp extension agent from Areca URL.
- The agent is to be installed on the system which has the Areca card.
- Check Mark the option: "SNMP Through PCI".
- To use in-band PCIe host bus interface, keep space (or zero) on all "SNMP Tarp IP Address" options.

APPENDIX

C-3-1 Using ArchHTTP

The HTTP management software (ArchHTTP) runs as a service or daemon, and have it automatically start the proxy for all adapters found. This way the adapter can be managed remotely without having to sign in the server. The HTTP management software (ArchHTTP) also has integrated the ability of sending SNMP trap. Please reference chapter 5. ArchHTTP Proxy Server Installation section to install it. The ArchHTTP proxy server will automatically assign one additional port for setup its configuration. If you want to change the "archttpsrv.conf" setting up of ArchHTTP proxy server configuration, for example: General Configuration, Mail Configuration, and SNMP Configuration, please start Web Browser <http://localhost: Cfg Assistant>. Such as <http://localhost: 81>. The port number for the first adapter McRAID storage manager is ArchHTTP proxy server configuration port number plus 1.

To enable the adapter to send the SNMP traps to client SNMP manager using the IP address assigned to the operating system, such as Net-SNMP manager, you can simply use the SNMP function on the ArchHTTP proxy server software. To enable the RAID adapter SNMP traps sending function, click on the "SNMP Configuration" link. The ArchHTTP proxy only provide one direction to send the trap to the SNMP manager without needing to install the SNMP extension agent on the host. If SNMP manager requests to query the SNMP information from RAID adapter, please refer the C-3-2 section. Using Onboard NIC and C-3-3 section. Using in-band PCI + SNMP extension agent.

For detailed information on using ArchHTTP to send the SNMP traps, please see SNMP Traps Configuration section on 5.6 ArchHTTP Configuration.

Note:

Event Notification Table refers to Appendix D. After you confirm and submit configurations, you can use "Generate Test Event" feature to make sure these settings are correct.

C-3-2 Using Onboard NIC Installation

By using the built-in LAN port on the RAID adapter- RAID adapter using built-in LAN interface. You can use the browser-based manager or CLI SNMP configuration to setup the firmware-based SNMP configuration. The following screen is the firmware-embedded SNMP configuration setup screen using browser-based manager:

The screenshot displays the 'Areca Technology Corporation' RAID System Console. The left sidebar shows a tree view with 'System Controls' selected, and 'SNMP Configuration' highlighted under 'System Controls'. The main area contains the following sections:

- SNMP Trap Configurations:** Three rows for configuring trap destinations. Each row has fields for IP Address (split into four octets) and Port (set to 162).
- SNMP System Configurations:** Fields for Community, sysContact.0, sysName.0, and sysLocation.0.
- SNMP Trap Notification Configurations:** A series of checkboxes and text labels:
 - ☒ Disable SNMP Trap: No SNMP Trap Will Be Sent
 - ☐ Urgent Error Notification: Send Only Urgent Event
 - ☐ Serious Error Notification: Send Urgent and Serious Event
 - ☐ Warning Error Notification: Send Urgent, Serious And Warning Event
 - ☐ Information Notification: Send All Event
 - ☐ SNMP through iSCSI Inband: Internet SNMP Is Disabled
- Confirm The Operation:** A green bar with 'Submit' and 'Reset' buttons.

To launch the above browser-based RAID adapter SNMP function, click on the "System Controls" link. The "System Controls" menu will show available items. Select the "SNMP Configuration" item. The firmware-embedded SNMP agent manager monitors all system events and the SNMP function becomes functional with no agent software required. The following article describes a best practice methodology for setting this up in the "SNMP Traps Configurations".

1. SNMP Trap Configurations

Enter the SNMP Trap IP Address.

2. SNMP System Configurations

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

APPENDIX

3. SNMP Trap Notification Configurations

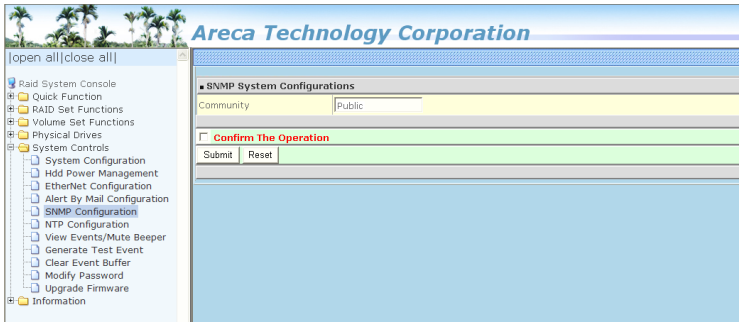
Please refer to Appendix D of Event Notification Configurations.

C-3-3 Using In-band PCI + SNMP Extension Agent Installation

By using the IP address assigned to the operating- RAID adapter using Areca SNMP extension agent through PCIe host bus interface.

1. Set only "Community" field and select the "SNMP Port" option on the firmware-embedded SNMP configuration function. There is no function to set other fields on "SNMP System Configuration".

The SNMP community and SNMP port can setup by using browser-based manager or CLI SNMP configuration. To launch the above browser-based RAID adapter SNMP function, click on the "System Controls" link. The "System Controls" menu will show available items. Select the "SNMP Configuration" item. The following "SNMP System Configuration" screen is launched by browser-based manager.



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

2. Mark the check box on the 'SNMP Through PCI Inband' setting and keep space (or zero) on all "SNMP Tarp IP Address" options.
3. Installing the SNMP extension agent on the server.
Please refer to next section of SNMP Extension Agent Installation for different operation system such as Windows, Linux and FreeBSD.

C-3-4 SNMP Extension Agent Installation

The SNMP extension agent on the device is able to return meaningful, highly useful information to the SNMP manager. The Areca RAID adapters have supported the extension agent for Windows, Linux and FreeBSD. This section is the detail procedures for those extension agent installation.

C-3-4-1 Windows

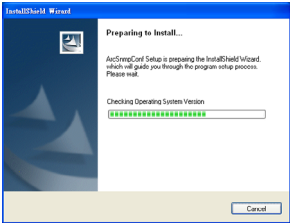
You must have administrative level permission to install tri-mode RAID adapter extension agent software. This procedure assumes that the RAID hardware and Windows are both installed and operational in your system. To enable the SNMP agent for Windows, configure Windows for TCP/IP and SNMP services. The Areca SNMP extension agent file is ARCSNMP.DLL.

Screen captures in this section are taken from a Windows XP installation. If you are running another version of Windows, your screens may look different, but the Areca SNMP extension agent installation is essentially the same.

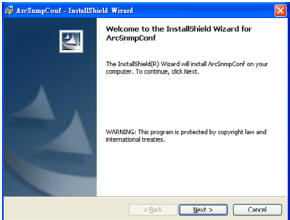
1. Download the file from **https://www.areca.us/support/s_windows/snmp/winsnmp_V1.0_180131.zip**.
2. Unzip and double-click on the install.exe file. (If SNMP service was not installed, please install SNMP service first.)

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3.The screen shows Preparing to Install.

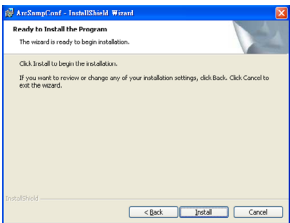


4. The InstallShield Wizard opens, preparing to install and click on the “Next” button to continue.

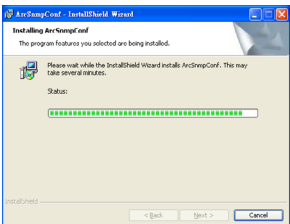


Follow the on-screen prompts to continue the Areca SNMP extension agent installation.

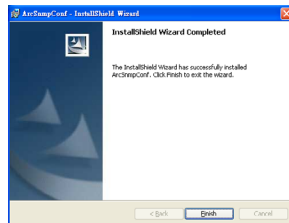
5. When you reach the installation page, click on the “Install” button to continue.



6. A Progress bar appears that measures the progress of the SNMP extension agent setup. When this screen completes, you have completed the Areca SNMP extension agent setup.



7. After a successful installation, the "Setup Complete" dialog box of the installation program is displayed. Click on the "Finish" button to complete the installation.



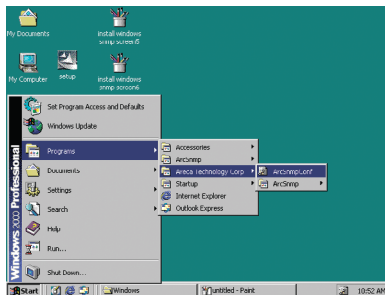
● Starting SNMP Trap Notification Configurations

To start "SNMP Trap Notification Configurations", There have two methods.

1. First, double-click on the "Areca RAID Controller".



2. Second, you may also use the "Taskbar Start/programs/ Areca Technology Corp/ArcSnmpConf" menus shown below.



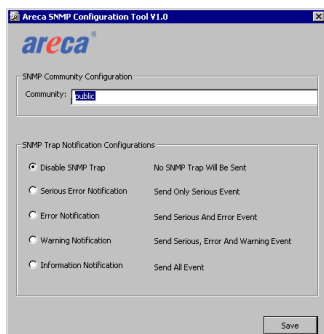
● SNMP Community Configurations

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

APPENDIX

● SNMP Trap Notification Configurations

The "Community Name" should be the same as firmware-embedded SNMP Community. The "SNMP Trap Notification Configurations" includes level 1: Serious, level 2: Error, level 3: Warning and level 4: Information. The level 4 covers notification events such as initialization of the adapter and initiation of the rebuilding process; Level 3 includes events which require the issuance of warning messages; Level 2 covers notification events which once have happen; Level 1 is the highest level, and covers events the need immediate attention (and action) from the administrator.



C-3-4-2 Linux

You must have administrative level permission to install Areca RAID software. This procedure assumes that the Areca RAID hardware and Linux are installed and operational in your system. The old version agent has to modify the open source project, integrate the changes from Areca manually, then take the modified binaries and manually deploy them. Users need to change source code from the linux distribution and then maintain it by themselves.

The new version agent provides the way to integrate with those codes into snmpd/snmptrapd and create a sub-agent for user easy to install it. The new version SNMP extension agent installation for Linux procedure, please download the file from **ftp://ftp.areca.com.tw/RaidCards/AP_Drivers/Linux/SNMP/V4.2/** and refer to the **readme.txt**.

C-3-4-3 FreeBSD

You must have administrative level permission to install Areca RAID software. This procedure assumes that the Areca RAID hardware and FreeBSD are installed and operational in your system. The old version agent has to modify the open source project, integrate the changes from Areca manually, then take the modified binaries and manually deploy them. Users need to change source code from the linux distribution and then maintain it by themselves.

The new version agent provides the way to integrate with those codes into snmpd/snmptrapd and create a sub agent for user easy to install it. The new version SNMP extension agent installation for FreeBSD procedure, please download the file from [ftp://ftp. areca.com.tw/RaidCards/AP_Drivers/FreeBSD/SNMP/V4.1/](ftp://ftp.areca.com.tw/RaidCards/AP_Drivers/FreeBSD/SNMP/V4.1/) and refer to the readme.txt.

APPENDIX

Appendix D

Event Notification Configurations

The adapter 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 adapter and initiation of the rebuilding process; Level 2 covers notification events which once have happen; Level 3 includes events which require the issuance of warning messages; Level 1 is the highest level, and covers events that need immediate attention (and action) from the administrator. The following lists sample events for each level:

A. Device Event

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

B. Volume Event

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

C. RAID Set Event

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

APPENDIX

D. Hardware Monitor Event

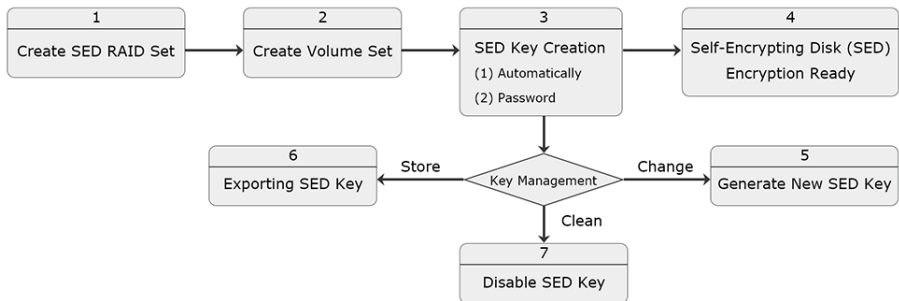
Event	Level	Meaning	Action
DRAM 1-Bit ECC	Urgent	DRAM 1-Bit ECC error	Check DRAM
DRAM Fatal Error	Urgent	DRAM fatal error encountered	Check the DRAM module and replace with new one if required.
Controller Over Temperature	Urgent	Abnormally high temperature detected on adapter	Check air flow and cooling fan of the enclosure, and contact us.
Hdd Over Temperature	Urgent	Abnormally high temperature detected on Hdd	Check air flow and cooling fan of the enclosure.
Fan Failed	Urgent	Cooling Fan # failure or speed below 1700RPM	Check cooling fan of the enclosure and replace with a new one if required.
Controller Temp. Recovered	Serious	Controller temperature back to normal level	
Hdd Temp. Recovered	Serious	HDD temperature back to normal level	
Raid Powered On	Warning	RAID power on	
Test Event	Urgent	Test event	
Power On With Battery Backup	Warning	RAID power on with battery backup	
Incomplete RAID Discovered	Serious	Some RAID set member disks missing before power on	Check disk information to find out which channel missing.
HTTP Log In	Serious	a HTTP login detected	
Telnet Log	Serious	a Telnet login detected	
InVT100 Log In	Serious	a VT100 login detected	
API Log In	Serious	a API login detected	
Lost Rebuilding/ MigrationLBA	Urgent	Some rebuilding/ migration raidset member disks missing before power on.	Reinserted the missing member disk back, adapter will continued the incompleting rebuilding/ migration.

Appendix E

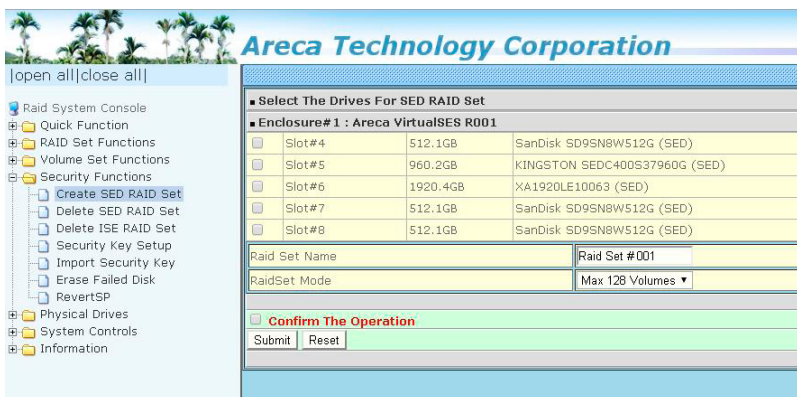
Self-Encrypting Disk (SED) Encryption

The “Security Function” on the firmware supports Self-Encrypting Disks (SED) for protection of data against loss or theft of SEDs. Protection is achieved by the use of encryption technology on the drives. The McRAID storage management allows SED keys to be created and managed as well as create/delete RAID sets.

Self-Encrypting Disk (SED) Encryption Flow Chart



Step 1. Create SED RAID Set



APPENDIX

Step 2. Create Volume Set

Create volume set in the web management.

The screenshot shows the 'Enter The Volume Attribute' form in the Areca Technology Corporation web management interface. The left sidebar contains a tree view with categories like 'Raid System Console', 'Quick Function', 'RAID Set Functions', 'Volume Set Functions', 'Security Functions', 'Physical Drives', 'System Controls', and 'Information'. The 'Volume Set Functions' category is expanded, showing options like 'Create Volume Set', 'Create Raid30/50/60', 'Delete Volume Set', 'Modify Volume Set', 'Check Volume Set', 'Schedule Volume Check', 'Stop Volume Check', and 'Download Volume Key File'. The 'Create Volume Set' option is selected. The main form contains the following fields:

Enter The Volume Attribute	
Volume Name	ARC-1883-VOL#012
Member Disks	2
Volume Raid Level	Raid 1
Max Capacity Allowed	300 GB
Select Volume Capacity	300 GB
Greater Two TB Volume Support	No
Volume Initialization Mode	No Initialization
Volume Stripe Size	64 KBytes
Volume Cache Mode	Write Back
Volume Write Protection	Disabled
Full Volume Encryption	Disabled
Tagged Command Queuing	Enabled
SCSI Channel:SCSI ID:SCSI Lun	0 : 0 : 2
Volumes To Be Created	1

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

Step 3. SED Key Creation

There is one SED key per adapter. You can create the SED key under McRAID manager. The key can be escrowed in to a file using McRAID manager. There is one SED key per adapter which stores in the adapter flash memory. Areca provides both automatically or password methods to generate a key.

The screenshot shows the 'SED Key Management' form in the Areca Technology Corporation web management interface. The left sidebar is the same as in Step 2, but the 'Security Functions' category is expanded, showing options like 'Create SED RAID Set', 'Delete SED RAID Set', 'Delete ISE RAID Set', 'Security Key Setup', 'Import Security Key', 'Erase Failed Disk', and 'RevertSP'. The 'Security Key Setup' option is selected. The main form contains the following fields:

SED Key Management	
Create SED Key Automatically	SED Key Created And Saved For SED Raid use
Create SED Key By User Password	
Enter SED Key By User Password	
Raid Storage Manager Password Required	

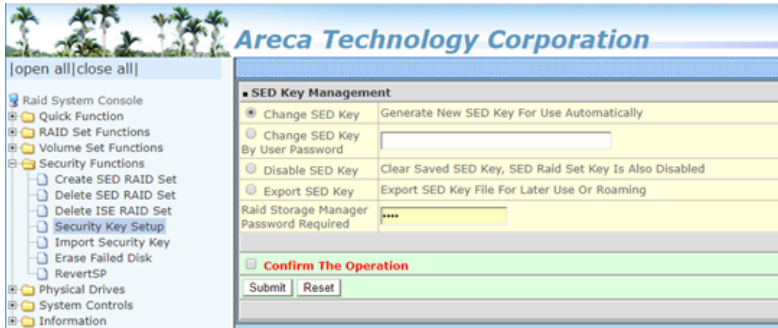
At the bottom of the form, there is a 'Confirm The Operation' section with 'Submit' and 'Reset' buttons.

Step 4. Self-Encrypting Disk (SED) Ready

Now, whenever you write data to the drive (e.g. create a file and save it to the SED volume), it gets encrypted with the SED key. And whenever you read data from the drive (e.g. access a file stored on the SED), it's decrypted with the same SED key.

Step 5. Generate New SED Key

If you have evidence that the SED key is known to unauthorized users, you can change the SED key again. Areca provides both automatically or password methods to generate a New key to replace the foreign SED key.



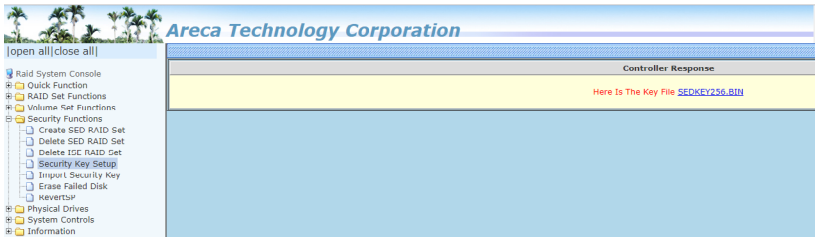
Step 6. Exporting SED Key

In some cases, you may want to export a SED key to store on removable media or to use on a different computer. If you want to create a backup copy of the SED key or use it on another computer, you must first export the SED key.

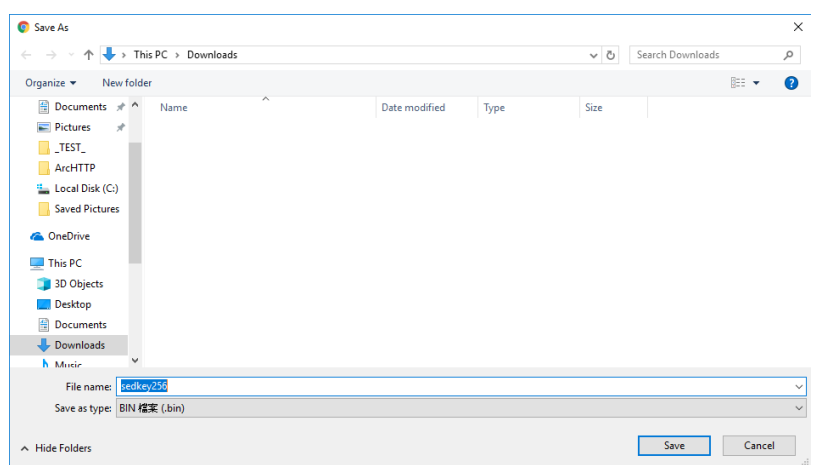


APPENDIX

Exporting the SED key puts it in a file (SEDKEY256.BIN) that you can then transfer to another computer or put in a safe place.



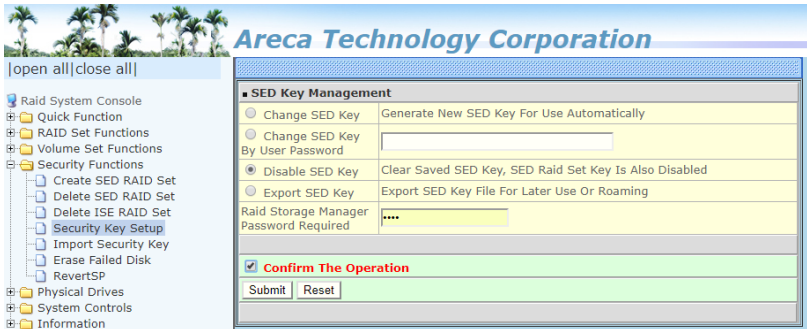
The key file (SEDKEY256.BIN) is stored on the specific location.



Without the proper authentication key (SED key), even if the SED RAID set is removed and placed in another new RAID adapter, the data remains inaccessible.

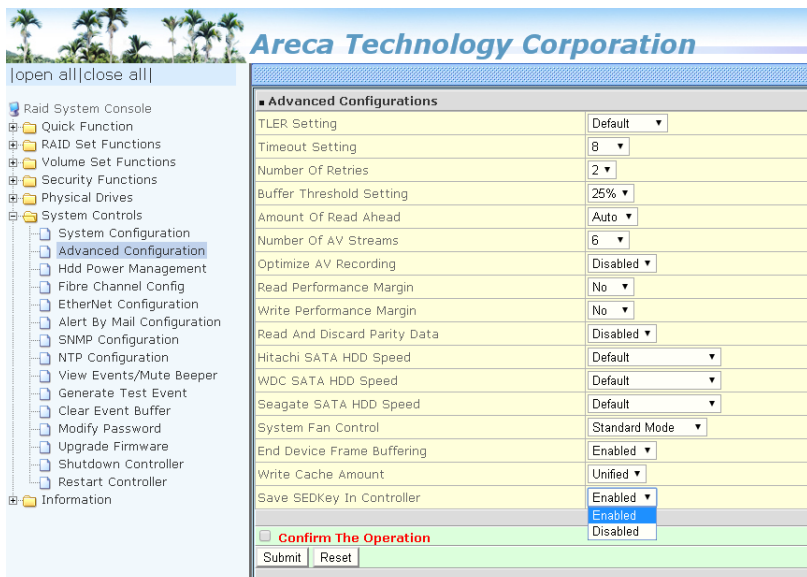
Step 7. Clean Saved SED Key

The 'Disable SED Key' function is used to clear SED key on adapter and RAID set members.



• Save SEDKey In Controller

There is one SED key per adapter which stores in the adapter flash memory. You can disable the SED Key saved in adapter flash using "Save SEDKey In Controller" on the Advanced Configurations. So that next time power up again, it will ask for key again.



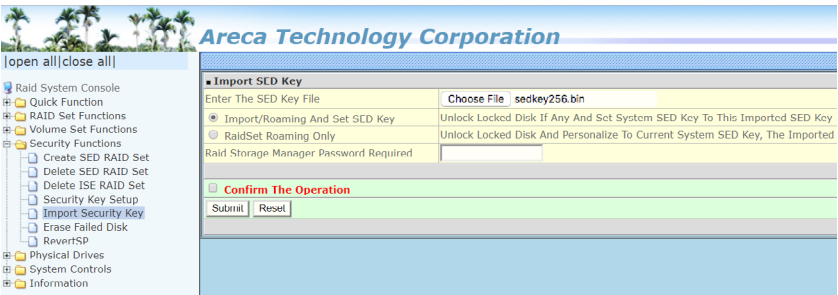
APPENDIX

- <a> If enable --> disable, clear SED Key saved in setup
- If disable --> enable, if key exists, save to setup

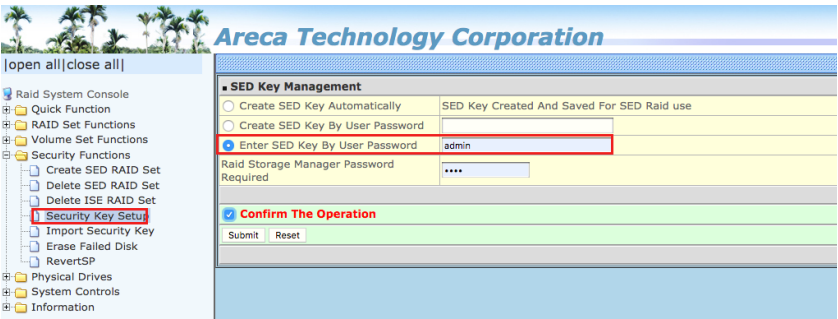
If you setup from enable--->disable, the key will not remain in the flash. So that next time power up again, it will need to input the key from the CLI or McRAID manager again. The adapter volume will be in the lock stage. It will be not available to the OS.

After your run the CLI to upload the key, volume will be unlocked and available to the OS. You can also import the key file (Import Security Key), keyin the password (Enter SED Key By User Password) from the GUI interface or keyin the password from the BIOS screen on startup to unlock the volume.

(1) Import Security Key



(2) Enter SED Key By User Password



(3) Enter At BIOS Screen On Startup

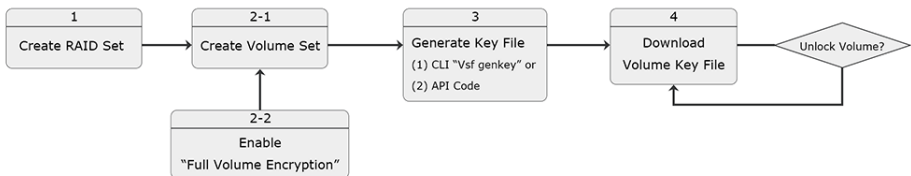


Appendix F

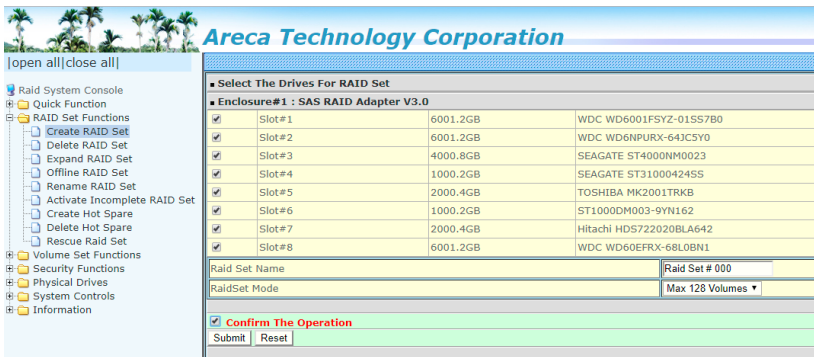
Full Volume Encryption

ARC-1886 RAID adapters have featured with adapter based hardware encryption function. Controller based hardware encryption describes the encryption of data occurring at the disk array adapter before being sent to the disk drives. The hardware encryption does not impact the performance of ARC-1886 RAID adapter and can implement on any kinds of HDD that is transparent to the user, the OS, and applications. You can follow below steps to enable the function.

Full Volume Encryption Flow Chart



Step 1. Create RAID Set



APPENDIX

Step 2. Create Volume and Enable “Full Volume Encryption”

Create volume set with “Full Volume Encryption” capability in the web management.

Areca Technology Corporation

Enter The Volume Attribute

Volume Name	ARC-1883-VOL#000
Member Disks	8
Volume Raid Level	Raid 0
Max Capacity Allowed	8000 GB
Select Volume Capacity	8000 GB
Greater Two TB Volume Support	64bit LBA
Volume Initialization Mode	No Initialization
Volume Stripes Size	64 KBytes
Volume Cache Mode	Write Back
Volume Write Protection	Disabled
Full Volume Encryption	Disabled
Tagged Command Queuing	Disabled
SCSI Channel:SCSI ID:SCSI Lun	256Bit Key, Password
Volumes To Be Created	128Bit Key, Password

Confirm The Operation

Submit Reset

ARC-1886 adapters provide five new key options in the 'Full Volume Encryption': "Disable", "256Bit key, Password", "256Bit key, AES", "128Bit key, Password", "128Bit key, AES".

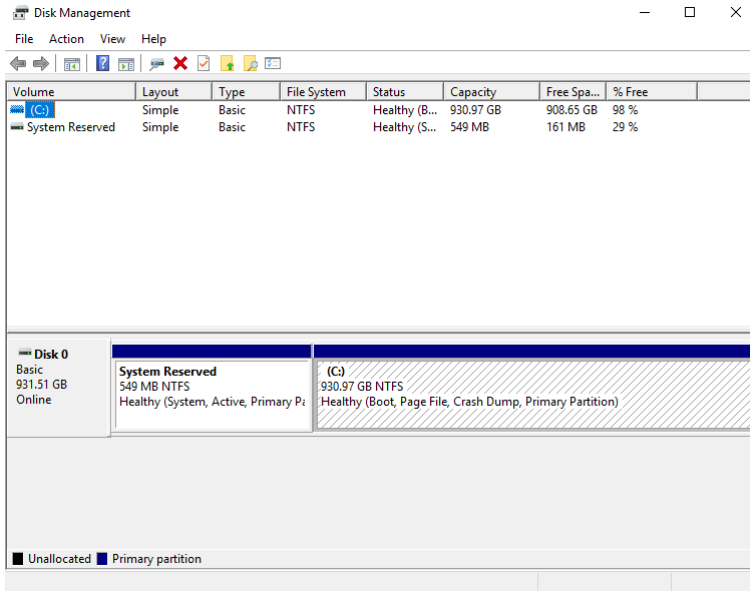
In the Volume Set Information, it is recorded "Encrypted, Locked" status.

Areca Technology Corporation

Volume Set Information

Volume Set Name	ARC-1883-VOL#000
Volume Serial	42ffb1314134367
Raid Set Name	Raid Set # 000
Volume Capacity	8000.0GB (0x3A3520000)
SCSI Ch/Id/Lun	0/0/0
Raid Level	Raid 0
Stripe Size	64KBytes
Block Size	512Bytes
Member Disks	8
Cache Mode	Write Back
Write Protection	Disabled
Volume Encryption	Encrypted, Locked
Tagged Queuing	Enabled
Stripe Info	0000000000(00003A3521),0000000000(00003A3521)
Volume State	Normal

The encrypted volume is not visible in the system Disk Management.



Step 3. Generate Key File

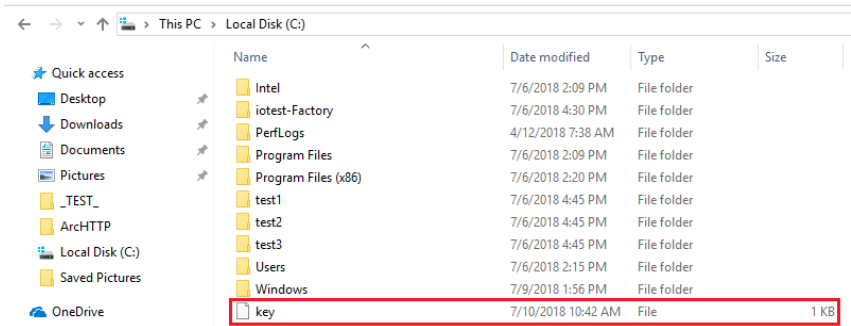
You can generate the new key by CLI utility or API code function.

```
CLI> vsf genkey path=C:\key
Key Information: C:\key

    0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F      ASCII
-----
0000 | 41 72 63 45 6E 63 72 79 70 74 69 6F 6E 4B 65 79 ArcEncryptionKey
0010 | 46 69 6C 65 20 20 20 20 20 20 20 20 20 20 20 20 File
0020 | 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
0030 | 20 20 20 20 20 20 20 20 00 00 00 00 A8 00 00 00 .....
0040 | 41 52 43 2D 31 38 38 33 2D 56 4F 4C 23 30 30 30 ARC-1883-VOL#000
0050 | 34 32 66 66 62 62 31 33 31 34 31 33 34 33 36 37 42ffbb1314134367
0060 | 01 00 40 00 44 78 76 7A 78 63 71 7A 6B 72 6B 6D ..@.Dxvzcqzkrkm
0070 | 70 61 65 6A 6A 75 6C 65 77 70 62 75 6F 77 6A 75 paejjulewpbuowju
0080 | 72 67 7A 79 7A 77 65 73 7A 76 79 72 76 69 6A 6D rgzyzweszvrvijm
0090 | 6E 76 6D 71 71 67 76 70 7A 6B 72 62 71 62 64 6A nvmqqgvpzkrbqbdj
00A0 | 6D 74 77 7A 37 15 41 F1 mtwz7.A.
-----
GuiErrMsg<0x00>: Success.
CLI>
```

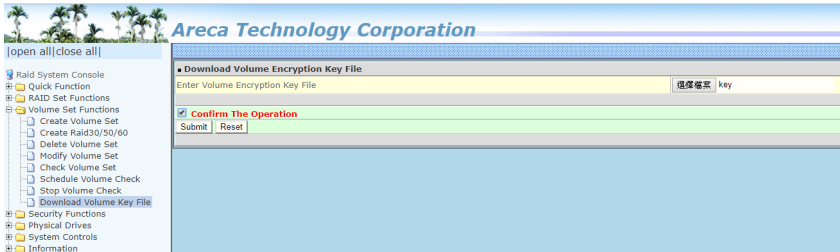
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The key file is stored on the C:\key

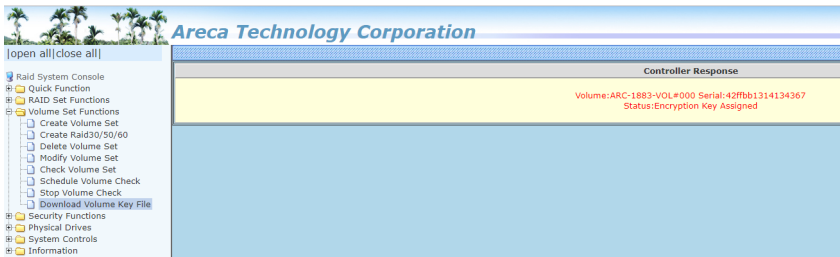


Step 4. Download Volume Key File

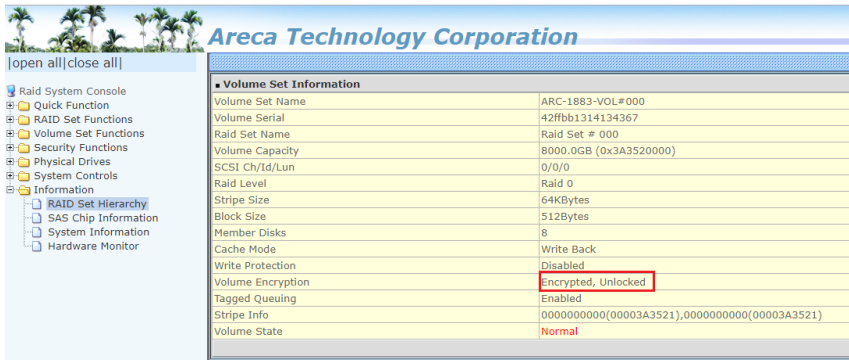
Use “Download Volume Key File” in the web management or use CLI “vsf dlkey” command to download volume key file into firmware and unlock the volume.



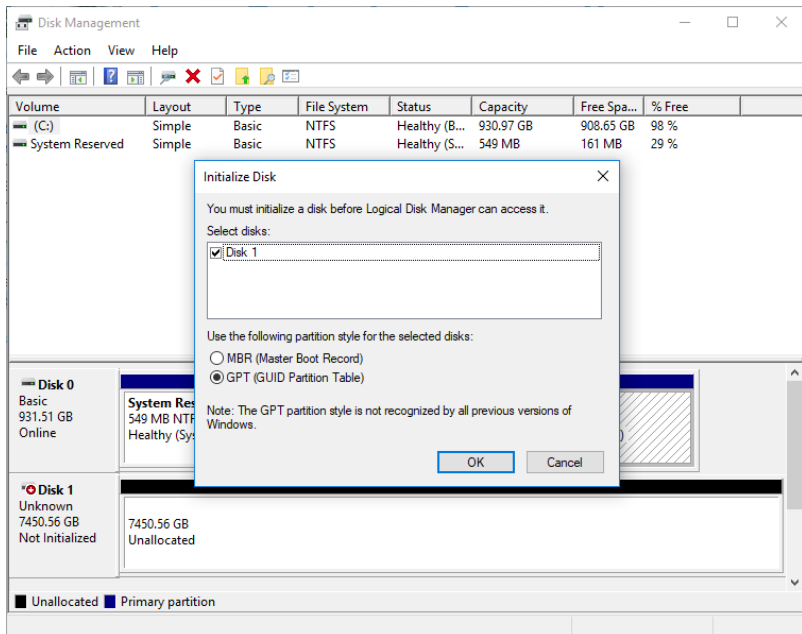
After you submit the key file, the following message is shown:



In the Volume Set Information, it is changed to "Encrypted, Unlocked" status.



The unencrypted volume is visible in the system Disk Management.



Follow step 4. to unlock volume if volume locked.

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Appendix G

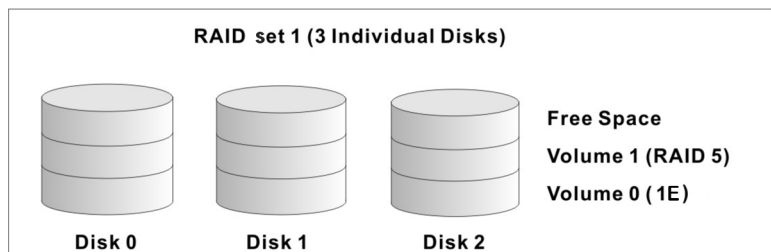
RAID Concept

RAID Set

A RAID set is a group of disks connected to a 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, 10, 30, 50 60, etc); the RAID level is defined within each volume set. Therefore, volume sets are contained within RAID sets and RAID Level is defined within the volume set. If physical disks of different capacities are grouped together in a RAID set, then the capacity of the smallest disk will become the effective capacity of all the disks in the RAID set.

Volume Set

Each volume set is seen by the host system as a single logical device (in other words, a single large virtual hard disk). A volume set will use a specific RAID level, which will require one or more physical disks (depending on the RAID level used). RAID level refers to the level of performance and data protection of a volume set. The capacity of a volume set can consume all or a portion of the available disk capacity in a RAID set. Multiple volume sets can exist in a RAID set. For the RAID 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, 6, 30, 50 or 60 volume sets must be initialized to generate parity information. In Background Initialization, the initialization proceeds as a background task, and the volume set is fully accessible for system reads and writes. The operating system can instantly access the newly created arrays without requiring a reboot and without waiting for initialization to complete. Furthermore, the volume set is protected against disk failures while initialing. If using Foreground Initialization, the initialization process must be completed before the volume set is ready for system accesses.

• Online Array Roaming

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

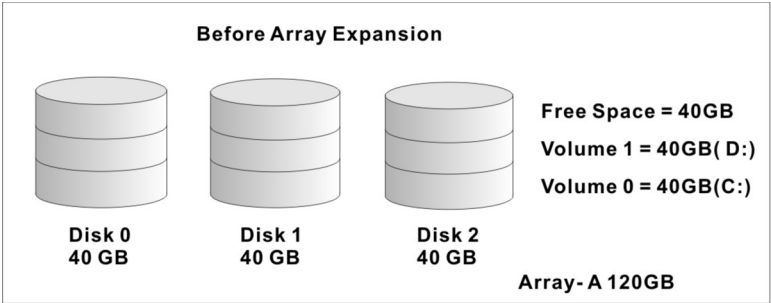
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set. Then, data on the existing volume sets (residing on the newly expanded RAID set) is redistributed evenly across all the disks. A contiguous block of unused capacity is made available on the RAID set. The unused capacity can be used to create additional volume sets.

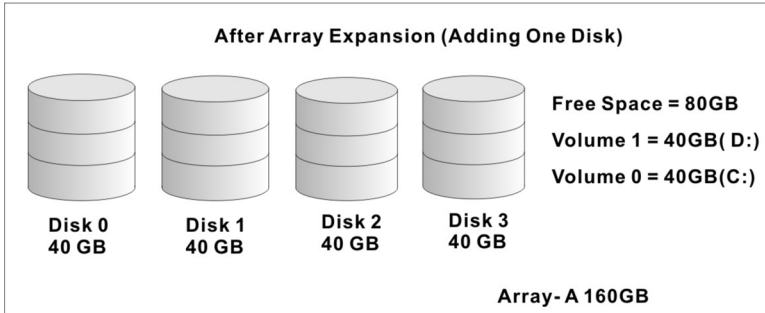
A disk, to be added to a RAID set, must be in normal mode (not failed), free (not spare, in a RAID set, or passed through to host) and must have at least the same capacity as the smallest disk capacity already in the RAID set.

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

The expansion process is illustrated as following figure.



RAID 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.)



● Online RAID Level and Stripe Size Migration

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

The RAID adapters can migrate both the RAID level and stripe size of an existing volume set, while the server is on line and the volume set is in use. Online RAID level/stripe size migration can prove helpful during performance tuning activities as well as when additional physical disks are added to the RAID 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 fourth disk could be added to migrate to RAID level 6. It is only possible to migrate to a higher RAID level by adding a disk; disks in an existing array can't be reconfigured for a higher RAID level without adding a disk.

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

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

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

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

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

High availability

• Global/Local Hot Spares

A hot spare is an unused online available drive, which is ready for replacing the failure disk. The hot spare is one of the most important features that RAID adapters provide to deliver a

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

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

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

Important:

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

● **Hot-Swap Disk Drive Support**

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

● **Auto Declare Hot-Spare**

If a disk drive is brought online into a system operating in degraded mode, the RAID 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.

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In the normal status, the newly installed drive will be reconfigured an online free disk. But, the newly-installed drive is automatically assigned as a hot spare if any hot spare disk was used to rebuild and without new installed drive replaced it. In this condition, the Auto Declare Hot-Spare status will be disappeared if the RAID 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, 6, 10, 30, 50 and 60.

● Auto Rebuilding

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

RAID adapters will automatically restart the system and rebuilding process if the system is shut down or powered off abnormally during a reconstruction procedure condition.

When a disk is hot swapped, although the system is functionally operational, the system may no longer be fault tolerant. Fault tolerance will be lost until the removed drive is replaced and the rebuild operation is completed.

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

● Adjustable Rebuild Priority

Rebuilding a degraded volume incurs a load on the RAID subsystem. The 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 adapter devotes to a background operation, such as rebuilding or migrating.

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.

High Reliability

● Hard Drive Failure Prediction

In an effort to help users avoid data loss, disk manufacturers are now incorporating logic into their drives that acts as an "early warning system" for pending drive problems. This system is called SMART. The disk integrated adapter 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 tri-mode RAID adapter firmware that probes the drive and look at it.

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

● Auto Reassign Sector

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

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The RAID adapter drives perform automatic defect reassignment for both read and write errors. Writes are always completed - if a location to be written is found to be defective, the drive will automatically relocate that write command to a new location and map out the defective location. If there is a 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. To verify RAID 3, 5, 6, 30, 50 or 60 redundancy, a consistency check reads all associated data blocks, computes parity, reads parity, and verifies that the computed parity matches the read parity.

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

Data Protection

● Cache Backup

The RAID adapters are armed with a Cache Backup Module (CBM). While a Uninterruptible Power Supply (UPS) protects most servers from power fluctuations or failures, a CBM provides an additional level of protection. In the event of a power failure, a CBM supplies power for the backup of your data in the 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 supercapacitor in the CBM are recharged continuously through a trickle-charging process whenever the system power is on. When the module detects loss of power, the supercapacitor keeps parts of the RAID adapter active long enough to allow cache data to be copied to the flash memory available on the RAID adapter.

● Recovery ROM

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 RAID adapters PCIe bus port or Ethernet port 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 adapter firmware. With our Redundant Flash Image feature, the controller will revert back to the last known version of firmware and continue operating. This reduces the risk of system failure due to firmware crash.

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Appendix H

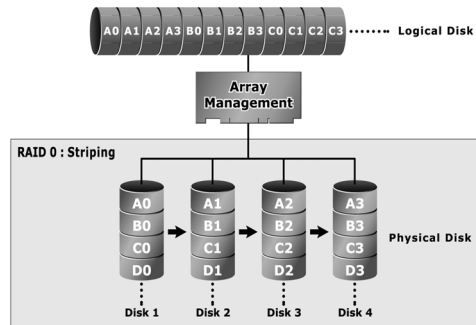
Understanding RAID

RAID is an acronym for Redundant Array of Independent Disks. It is an array of multiple independent hard disk drives that provides high performance and fault tolerance. The RAID 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 RAID adapters.

The RAID adapters 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 adapter requires a proper understanding of RAID technology and the concepts.

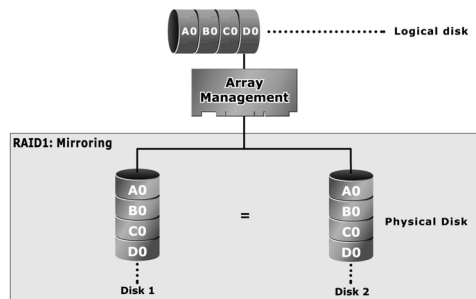
RAID 0

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



RAID 1 - Simple Mirroring

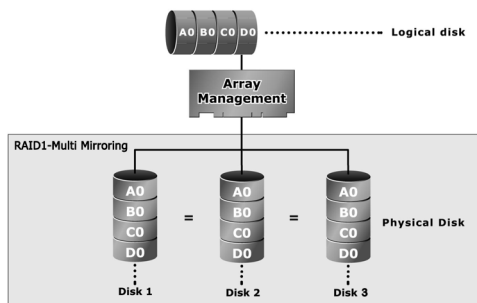
RAID 1-Simple Mirroring is also known as “two disk mirror”; data written on one disk drive is simultaneously written to another disk drive. Read performance will be enhanced if the array adapter can, in parallel, access both members of a mirrored pair. During writes, there will be a minor performance 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-Simple Mirroring offers extremely high data reliability, but at the cost of doubling the required data storage capacity. HDDs and SSDs have different characteristics. If you combine an SSD and a HDD in a RAID1-Simple Mirroring hybrid solution, you can get all the reads from the SSD with SSD speed and at the same time have the redundancy of RAID1 without the need to buy a second, expensive SSD.



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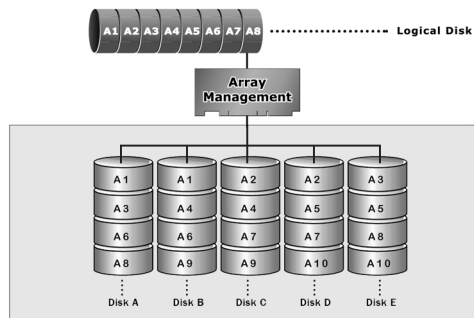
RAID 1 - Multi Mirroring

RAID 1-Multi Mirroring is also known as “triple disk mirror”; data written on one disk drive is simultaneously written to another two disk drives. Read performance will be enhanced if the array adapter can, in parallel, access all members of multi mirrored drives. During writes, there will be a minor performance penalty when compared to writing to a single disk. If one or two drive fails, all data (and software applications) are preserved on the healthy drive. RAID 1-Multi Mirroring writes three copies of everything, but its data storage capacity effective is 33.3%. HDDs and SSDs have different characteristics. If you combine an SSD and a HDD in a RAID1-Multi Mirroring hybrid solution, you can get all the reads from the SSD with SSD speed and at the same time have the redundancy of RAID1 without the need to buy a second, expensive SSD.



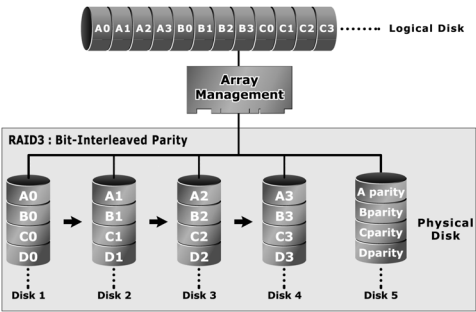
RAID 10(1E)

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



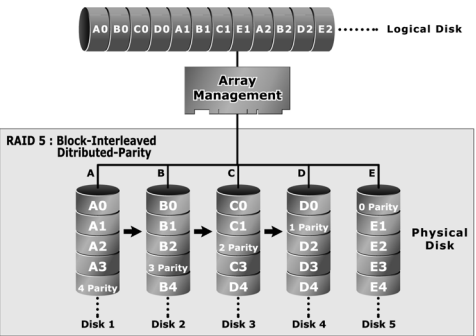
RAID 3

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



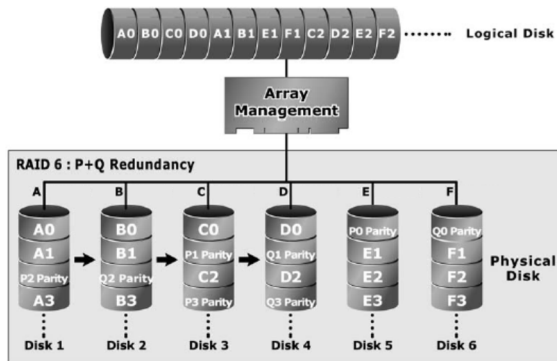
RAID 5

RAID 5 is sometimes called striping with parity at byte level. In RAID 5, the parity information is written to all of the drives in the adapters 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.



RAID 6

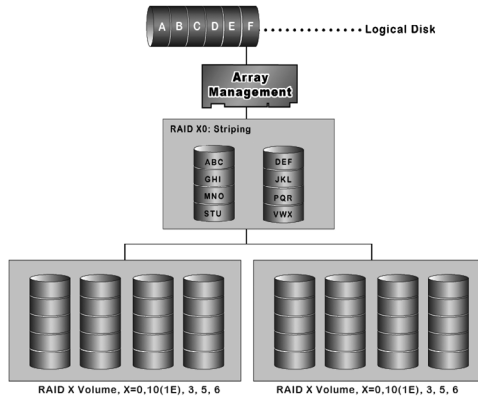
RAID 6 provides the highest reliability. It is similar to RAID 5, but it performs two different parity computations or the same computation on overlapping subsets of the data. RAID 6 can offer fault tolerance greater than RAID 1 or RAID 5 but only consumes the capacity of 2 disk drives for distributed parity data. RAID 6 is an extension of RAID 5 but uses a second, independent distributed parity scheme. Data is striped on a block level across a set of drives, and then a second set of parity is calculated and written across all of the drives.



RAID x0

RAID level-x0 refers to RAID level 00, 100, 30, 50 and 60. RAID x0 is a combination multiple RAID x volume sets with RAID 0 (striping). Striping helps to increase capacity and performance without adding disks to each RAID x array. The operating system uses the spanned volume in the same way as a regular volume. Up to one drive in each sub-volume (RAID 3 or 5) may fail without loss of data. Up to two drives in each sub-volume (RAID 6) may fail without loss of data. RAID level x0 allows more physical drives in an array. The benefits of doing so are larger volume sets, increased performance, and increased reliability.

The following illustration is an example of a RAID level x0 logical drive.



Important:

RAID level 00, 100, 30, 50 and 60 can support up to eight RAID set. If volume is RAID level 00, 100, 30, 50, or 60, you can't change the volume to another RAID level. If volume is RAID level 0, 1, 10(1E), 3, 5, or 6, you can't change the volume to RAID level 00, 100, 30, 50, or 60.

JBOD

(Just a Bunch Of Disks) A group of hard disks in a RAID box are not set up as any type of RAID configuration. All drives are available to the operating system as an individual disk. JBOD does not provide data redundancy.

Single Disk (Mirrored Pass-Through Disk)

Pass-through disks are attached to a RAID adapter and operate as if they were attached to a non-RAID adapter. No RAID configuration structure is stored on these physical disks. This feature is primarily targeted for users moving physical disks containing data from non-RAID adapters to RAID adapters. The disk is available directly to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the RAID adapter firmware. A mirrored pass-through mode means adapter will be

regarded as the hard disk clone function, a host's data will write simultaneously into two or three hard disks in the RAID adapter. Triple pass-through means "save three copies of the data such that you can survive two disks failure and still have everything." If you combine an SSD and HDDs in a mirrored pass-through hybrid solution, you can get all the reads from the SSD with SSD speed.

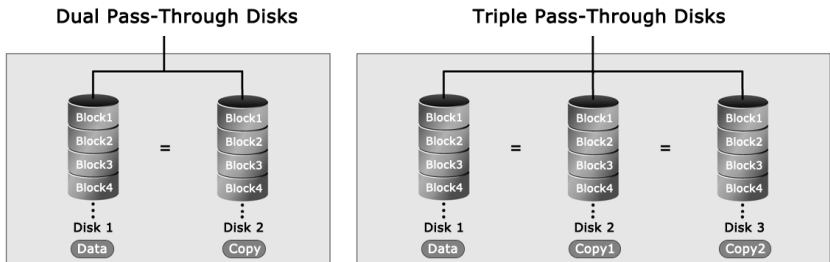


Figure G-1, Dual Pass-Through Disks & Triple Pass-Through Disks

APPENDIX

Summary of RAID Levels

Tri-mode RAID adapter supports RAID Level 0, 1, 10(1E), 3, 5, 6, 30, 50, 60 and Pass-Through Disk. The following table provides a summary of RAID levels.

RAID Level Comparson			
RAID Level	Description	Disks Requirement (Minimum)	Data Availability
0	Also known as striping. Data distributed across multiple drives in the array. There is no data protection.	1	No data Protection
1	Also known as simple mirroring. All data replicated on 2 separated disks. N is almost always 2. Due to this is a 100 % duplication, so is a high costly solution.	2	Up to one disk failure
1	Also known as Multi Mirroring. All data replicated on 3 separated disks. N is almost always 3. Due to this is a 100 % duplication, so is a high costly solution.	3	Up to two disks failure
10(1E)	Also known as mirroring and striping. Data is written to two disks simultaneously, and allows an odd number or disk. Read request can be satisfied by data read from wither one disk or both disks.	3	Up to one disk failure in each sub-volume
3	Also known Bit-Interleaved Parity. Data and parity information is subdivided and distributed across all data disks. Parity information normally stored on a dedicated parity disk.	3	Up to one disk failure
5	Also known Block-Interleaved Distributed Parity. Data and parity information is subdivided and distributed across all disk. Parity information normally is interspersed with user data.	3	Up to one disk failure
6	RAID 6 provides highest reliability, but not widely used. Similar to RAID 5, but does two different parity computations or the same computation on overlapping subsets of the data. The RAID 6 can offer fault tolerance greater that RAID 1 or RAID 5 but only consumes the capacity of 2 disk drives for distributed parity data.	4	Up to two disk failure

APPENDIX

30	RAID 30 is a combination multiple RAID 3 volume sets with RAID 0 (striping)	6	Up to one disk failure in each sub-volume
50	RAID 50 is a combination multiple RAID 5 volume sets with RAID 0 (striping)	6	Up to one disk failure in each sub-volume
60	RAID 60 is a combination multiple RAID 6 volume sets with RAID 0 (striping)	8	Up to two disk failure in each sub-volume
Pass-Through Disk	Pass-Through disk is attached to a RAID adapter and operate as if they were attached to a non-RAID adapter. No RAID configuration structure is stored on these physical disks.	1	No data Protection
Pass-Through Disk	Dual pass-through disks mean "save two copies of the data such that you can survive one disk failure and still have everything."	2	Up to one disk failure
Pass-Through Disk	Triple pass-through disks mean "save three copies of the data such that you can survive two disks failure and still have everything."	3	Up to two disks failure