

# NVMe Hardware RAID

**ARC-1689-32I**

(PCIe 5.0 x16 NVMe Hardware RAID Adapter)

## 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-1689-32I 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

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## 1. Introduction

This section presents a brief overview of 4x MCIO (PCIe Gen5 x8 per MCIO) NVMe Hardware RAID adapters, PCIe Gen5 x16 ARC-1689-32I.

### 1.1 Overview

ARC-1689-32I presents the advanced hardware RAID technology in enhanced performance of using 4 MCIO[x8] Gen5 x4 NVMe device interface. This is designed in a PEX98048 48 lanes PCIe Gen5 switch, high performance RAID engine and PCIe Gen 5.0 host/device interface and supports AIC mode or hardware RAID levels 0, 1 (Simple/Multi-Mirroring), 10, Single Disk (Single/Dual/Triple) or JBOD, allowing customers to build the high bandwidth, low-latency, scalable, cost-effective, and robust performance storage for ML/AI, HPC and enterprise applications.

### NVMe Performance Gains for Fast Data

Based on the Broadcom's 48-Channel PEX89048 switch chip to provide x16 lanes of dedicated PCIe Gen 5.0 upstream bandwidth and x4 lanes of dedicated downstream bandwidth to each device interface, ARC-1689-32I NVMe RAID adapter raises the standard to higher performance levels with several enhancements including a new high performance RAID engine, outstanding performance PCIe Gen 5.0 host and PCIe Gen 5.0 (NVMe) interface bus interconnection. ARC-1689-32I provides an extremely fast, reliable, and ultra-compact solution for companies that need storage, is especially designed and featured in the accelerated computing, ML/AI, HPC and enterprise applications. This RAID adapter can back up to 8 NVMe on just one PCIe adapter, increasing the capacity/speed as more NVMe's are added to it. ARC-1689-32I supports both up to 8x4, 16x2, 32x1 NVMe SSD connection and combines them on a RAID adapter to maximize I/O performance for database applications and streaming digital media environments. A detriment of software RAID is the consumption of expensive compute and memory bandwidth on the host. The ARC-1689-32I hardware RAID relieves the RAID function burden from the host and maximize application processing performance.

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## **Guaranteed Data Protection**

In Areca's high-performance RAID solution, ARC-1689-32I brings PCIe NVMe to a superior performance hardware RAID at an elevated throughput, high IOPs and a low latency. It supports the hardware RAID levels 0, 1(Simple/Multi Mirroring), 10, Single Disk(Single/Dual/Triple) or JBOD. ARC-1689-32I hardware secure boot helps ensure that the firmware code running on ARC-1689-32I hardware platforms is authentic and unmodified. 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 NVMe drives. During the adapter firmware upgrade flash process, it is possible for a problem to occur resulting in corruption of the controller firmware. With our redundant flash image feature the adapter will reset back to the last known version of firmware and continue operating. ARC-1689-32I RAID adapter has included several innovative features, including true surprise add and removal, Downstream Port Containment and Read Tracking, which can avoid typical situations that would cause a kernel panic or blue screen event. The firmware can monitor and check the current attached device status. It includes slot control capabilities, slot link status, transaction error count reports and device information. User can use it to test new designs or watch over active systems to prevent problems.

## **Maximum Interoperability**

ARC-1689-32I RAID adapter enables support for maximum interoperability using standard system UEFI secure boot and OS in-box NVMe driver. The in-box plug-and-play function can automatic installation of the best-matched driver and no user intervention required for driver media insertion. The ARC-1689-32I RAID adapter supports broad operating system including Windows, Linux (kernel 3.10 or later), FreeBSD, Mac and more, along with key system monitoring features such as enclosure management and SNMP function. Our products and technology are based on extensive testing and validation processes, optimizing ARC-1689 series adapter in field-proven compatibility with operating systems, motherboards, applications, and device drivers.

## **Intuitive RAID Management**

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# INTRODUCTION

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The McBIOS RAID is a BIOS based utility used to simplify configurations and manage RAID adapter via hot keys at M/B BIOS boot-up screen. User can also configure, deploy, update, and monitor the ARC-1689-32I via the GUI from on-board lan port. Customers can launch the firmware browser based McRAID GUI through ArchHttp proxy server or on-board lan port. Additionally, Areca Arc-SAP storage manager allows the user to scan multiple RAID units in the network and perform GUI management operations across multiple RAID units.

## 1.2 Features

### **Adapter Architecture**

- PEX89048 Gen5 48 lanes switch/High-performance RAID engine
- PCIe Gen 5.0 x16 lane host interface
- Connection for up to 8x4, 16x2 and 32x1 NVMe SSD connect via direct cable or back/mid-plane
- Support 4x MCIO (PCIe Gen5 x8 per MCIO)
- Hardware secure boot
- Multi-adapter support for large storage requirements
- Delivers 64GB/s bandwidth & sustained transfer speeds up to 60GB/s
- Support SFF-9402 compliant connector pin-out
- Support for UEFI secure boot
- Redundant flash image for controller availability
- Support backplanes based on the SFF-TA-1005 specification (UBM) and VPP

### **RAID Features**

- RAID levels 0, 1, 10, Single Disk (Single/Dual/Triple) or JBOD
- Multiple RAID selections
- Online Array roaming
- Online RAID level/stripe size migration
- Online Capacity expansion/RAID level migration simultaneously
- Online Volume set growth
- Instant availability and background initialization
- Support global and dedicated hot spare
- NVMe-RAID TRIM support for Host
- Support NVMe S.M.A.R.T command
- SSD automatic monitor clone (AMC) and disk clone function
- SED support for hardware NVMe encryption capable drives

# INTRODUCTION

- Flexible reconfiguration downstream station port widths: x1, x2, x4, x8, and x16 using GUI interface (update to ARC-1289-32I firmware package)

## **Monitors/Notification**

- System status: LED, LCD/I<sup>2</sup>C connector and alarm buzzer
- SMTP support for email notification
- Bracket LED for each NVMe activity/fault status
- SNMP support for remote manager
- Support slot link control capabilities, link status and error count monitoring

## **RAID Management**

- RAID setup utility via firmware built-in EFI Shell (UEFI OS)
- Web browser-based McRAID storage manager via Archttp utility
- Support command-line interface (CLI)
- API library for developers to design their own utility
- Single Admin Portal (ArcSAP) storage manager
- Support Out-of-Band management via Lan port & PCIe VDM
- Support push button and LCD display panel (optional)

## **OS Native NVMe Driver Support**

- Windows 10/11 / Server2025 /2019 /2016
  - Linux (kernel 3.10 or later)
  - FreeBSD
  - macOS (one zoned Namespace and out-of-band management)
- Note: macOS (Areca driver for multi-volumes and in-band management)

<b>PCIe Gen5 x16 NVMe Hardware RAID Adapter</b>	
<b>Model Name</b>	ARC-1689-32I
<b>PCIe Switch</b>	PEX89048 Gen5 Switch/High-Performance RAID Engine
<b>Host Bus Type</b>	PCIe 5.0 x 16 Lanes
<b>Device Connector</b>	4x MCIO (PCIe 5.0 x8 per MCIO) Connector
<b>Form Factor (L x H)</b>	LP-MD2 : 64.41(H) x 167.65(L) mm
<b>RAID Level</b>	0, 1, 10, Single Disk (Single/Dual/Triple) or JBOD.
<b>Device Driver</b>	In-Box(Native) NVMe driver
<b>Management Port</b>	In-Band: PCIe/Out-of_band:Lan Port
<b>Power Consumption</b>	Approximately 18 Watts

# HARDWARE INSTALLATION

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## 2. Hardware Installation

This section describes the procedures for installing the ARC-1689-32I RAID adapters.

### 2.1 Before You First Installing

Thanks for purchasing the RAID adapter as your RAID data storage system. This user manual gives simple step-by-step instructions for installing and configuring the 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.

- 1 x ARC-1689-32I switch adapter with full-height profile bracket in an ESD-protective bagin
- 1 x Low-profile bracket

#### System Requirement

The ARC-1689-32I NVMe RAID adapter can be installed in an universal PCIe slot and requires a motherboard that:

ARC-1689-32I NVMe RAID adapter requires:

- Comply with the PCIe 5.0 x16 lanes  
It can work on the PCIe 5.0 x1, x4, x8, and x16 signal with x16 mechanical slot M/B.
- Backward-compatibe with PCIe 3.0/4.0

#### Installation Tools

The following items may be needed to assist with installing the ARC-1689-32I NVMe RAID adapter into an available PCIe slot.

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

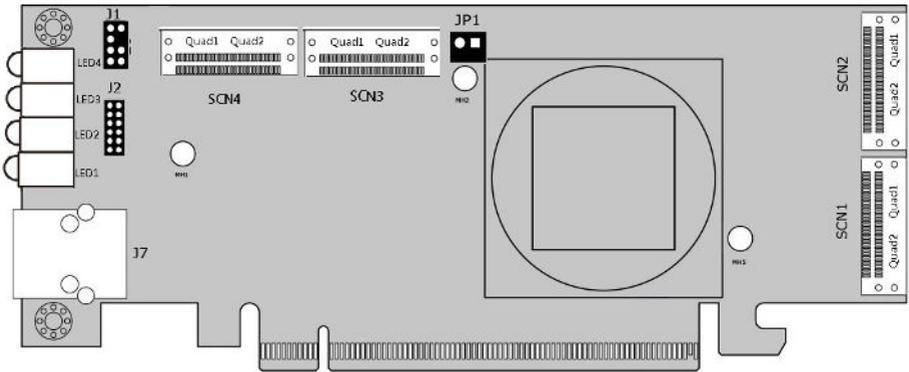
# HARDWARE INSTALLATION

## 2.2 Board Layout

The ARC-1689-32I offers 4x MCIO (PCIe 5.0 x8 per MCIO connectors). This section provides the board layout and connector/LED for the RAID adapter.

### 2.2.1 Top View Connectors

The following figure shows the key connectors of the ARC-1689-32I.



Components	Description	Type
1. (J1)	I2C/LCD Control Function	7-pin Header
2. (JP1)	Fan Connector	2-pin Box Header
3. (SCN1)~(SCN4)	1. 4x MCIO[x8] (Dedicated PCIe 5.0 x8 per MCIO) for PCIe Device 2. A MCIO [x8] includes two quads (Quad1 and Quad2)	MCIO[x8] Connector
4. (LED1), (LED2), (LED3), (LED4)	SCN 1 ~ 4 Activity/Fault NVMe SSD LED for directly attach to adapter	Dual-Color LED
5. (J2)	Manufacturer Reserved	12-pin Header
6. (J7)	Lan Port	RJ45

Table 2-1, ARC-1689-32I Components

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The following table is the activity/fault LED status behavior.

LED	Status	Indication
Green LED (Activity)	Off	There is not any I/O activity on that NVMe SSD.
	On (10 times/sec.)	There is a I/O activity on that NVMe SSD.
Red LED (Fault)	Off	This NVMe SSD is present and status is normal.
	On (6 times/ sec.)	Adapter is identifying this NVMe SSD.
	On (1 time/ sec.)	This NVMe SSD has failed and should be swapped immediately.

## 2.2.2 Connector Physical-to-Logical Mapping

The following table shows the ARC-1689-32I RAID adapter's physical connector to logical connector mapping as viewed from manager interface, when used with the web-browsed manager. The RAID adapter uses x8 MCIO connectors. Each connector is segregated into quads and mapped accordingly.

Physical Connector-to-Logical Connector Mapping			
Downstream Station	Adapter Label	Tool Mapping	Port Number
#2 (The PCIe switch groups 16 PCIe lanes into a station.)	SCN1(CNT#1)	Quad1	0~3
		Quad2	4~7
	SCN2(CNT#2)	Quad1	0~3
		Quad2	4~7
#1 (The PCIe switch groups 16 PCIe lanes into a station.)	SCN3(CNT#3)	Quad1	0~3
		Quad2	4~7
	SCN4(CNT#4)	Quad1	0~3
		Quad2	4~7

## 2.2.3 MCIO Connector

Mini Cool Edge (MCIO) Connectors offer increased flexibility by providing multiple circuit options and meet PCIe standards up to PCIe Generation 5 with high-speed data transmission rates. The following table defines the adapter's internal x8 MCIO connector (PCIe 5.0 x8 per MCIO connectors) pinouts. The adapter follows the SFF-9402 standard for connector sideband signal assignments. Each x8 connector includes eight PCIe transmit and receive lanes, and two sets of sidebands designated as A and B, in accordance with the SFF-9402 specification. The following table defines the ARC-1689-32I MCIO connector pin definition.

# HARDWARE INSTALLATION

(SCN1)~(SCN4)  
Defined IO

**MCIO x8 Connector Pin Definition (SFF-TA-1016)**

Pin	Name	Name	Pin
A1	GND	BND	B1
A2	PERp0	PETp0	B2
A3	PERn0	PETn0	B3
A4	GND	GND	B4
A5	PERp1	PETp1	B5
A6	PERn1	PETn1	B6
A7	GND	GND	B7
A8	PA_AUX_3V3	MCIO_SCL_A	B8
A9	N/C	MCIO_SDA_A	B9
A10	GND	GND	B10
A11	MCIO_CLK_A_Dp	PERSTNA_A_L3V3	B11
A12	MCIO_CLK_A_Dn	PA_CBL_DET	B12
A13	GND	GND	B13
A14	PERp2	PETp2	B14
A15	PERn2	PETn2	B15
A16	GND	GND	B16
A17	PERp3	PETp3	B17
A18	PERn3	PETn3	B18
A19	GND	GND	B19
A20	PERp4	PETp4	B20
A21	PERn4	PETn4	B21
A22	GND	GND	B22
A23	PERp5	PETp5	B23
A24	PERn5	PETn5	B24
A25	GND	GND	B25
A26	PB_AUX_3V3	MCIO_SCL_B	B26
A27	N/C	MCIO_SDA_B	B27
A28	GND	GND	B28
A29	MCIO_CLK_B_Dp	PERSTNB_B_L3V3	B29
A30	MCIO_CLK_B_Dn	PB_CBL_DET	B30
A31	GND	GND	B31
A32	PERp6	PETp6	B32
A33	PERn6	PETn6	B33
A34	GND	GND	B34
A35	PERp7	PETp7	B35
A36	PERn7	PETn7	B36
A37	GND	GND	B37

# HARDWARE INSTALLATION

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## 2.3 Installation

Use the instructions below to install a ARC-1689-32I 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.

### Electrostatic Discharge

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

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

### 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 NVMe RAID Adapters

To install the NVMe 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-1689-32I adapters require a PCIe 5.0 x16 slot for better performance.

# HARDWARE INSTALLATION

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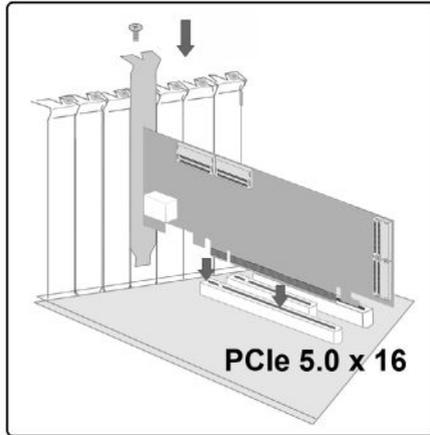


Figure 2-3, Insert into a PCIe Slot

## Step 4. Mount the NVMe Drives

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

(1). In the direct connection:

The NVMe drives are directly connected to NVMe RAID adapter PHY port with proper cables. The NVMe RAID adapter can support up to 32 PHY ports. Remove the front bezel from the computer chassis and install the cages or 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 NVMe drives are directly connected to system backplane or through a PCIe switch on the backplane board. The number of NVMe drives is limited to the number of slots available on the backplane. .

# HARDWARE INSTALLATION

## Step 5. Install Storage Connection Cable

The adapter has four x8 MCIO connectors. Each x8 connector provides two sets of SFF-9402 standard sidebands. It supports both the industry standard SFF-TA-1005 Specification for Universal Backplane Management (UBM) and maintains Virtual Pin Port (VPP) backplane management for legacy implementations. Choose the proper cable for the given backplane type and connectors. Connect the MCIO connector of the adapter to the backplane or NVMe SSD via the proper cable.

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

The following diagrams show how to cable a NVMe RAID adapter to the SFF-8612 connector backplane or 8 bays M.2 drive cage.

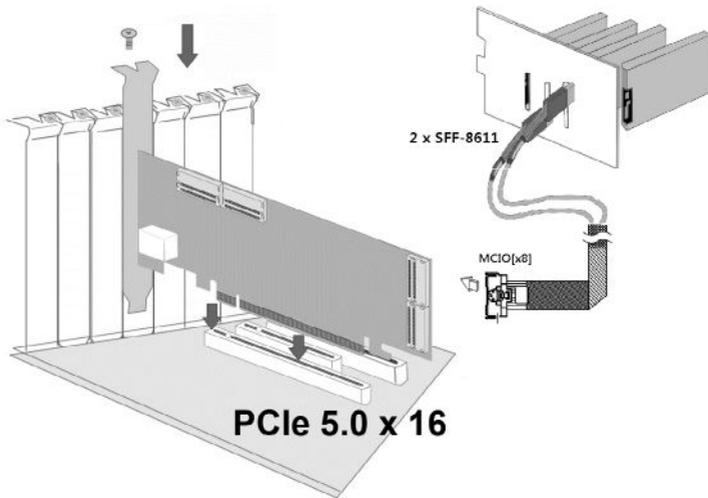


Figure 2-4, Connecting to NVMe Backplane

# HARDWARE INSTALLATION

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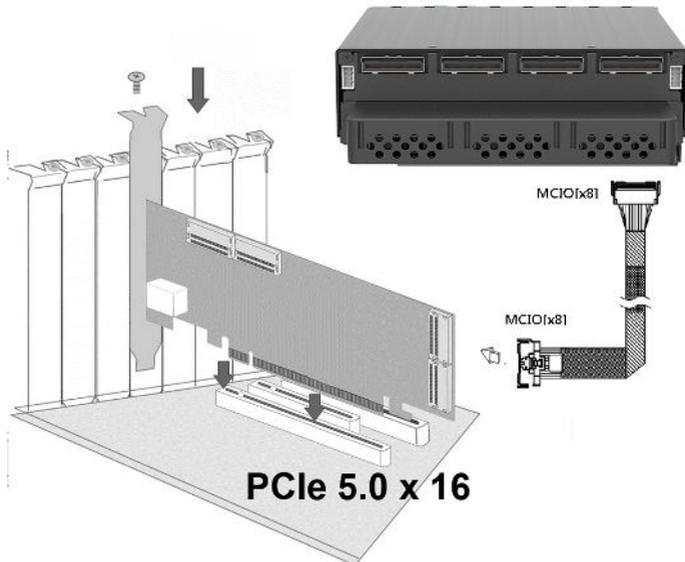


Figure 2-5, Connecting to NVMe Cadge

## Step 6. 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 6. Install the Adapter Driver

The ARC-1689 NVMe RAID adapter goes with any standard Windows (10 or above), Linux(Kernel 3.10 or above), FreeBSD or VMware in-box NVMe drivers, no driver installation needed. You do not need a special driver to install the OS or data on the ARC-1689. In-box driver is a native driver that is supplied with the Operating System.

## Step 7. Install ArchHTTP Proxy Server

The 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 cre-

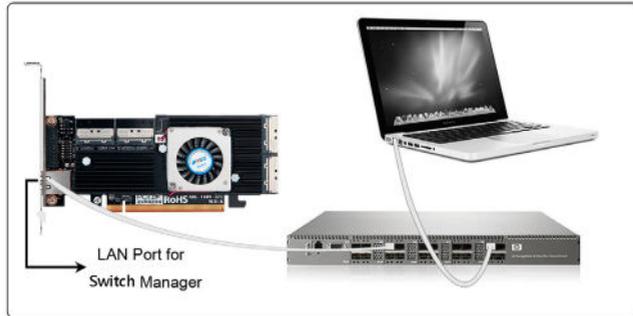
# HARDWARE INSTALLATION

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ation, management and monitor NVMe RAID adapter status. Please refer to the Chapter 5 of the user manual for the detail ArchHTTP Proxy Server Installation.

## Step 8. LAN Port Connection (Optional)

The ARC-1389-32I base switch adapter supports Ethernet port management and monitoring. The ARC-1389-32I base switch adapter has embedded the TCP/IP & web browser-based manager in the firmware. User can manage the adapter via standard web browsers directly connected to the RJ45 Ethernet port. Connect 10/100Mbit Ethernet port of the adapter to a Ethernet port or Ethernet switch. Refer to next section, Web Browser-based Configuration, for the detail.



## Step 8. Configure Volume Set

The RAID 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.

## 2.4 Serial Interface Bus

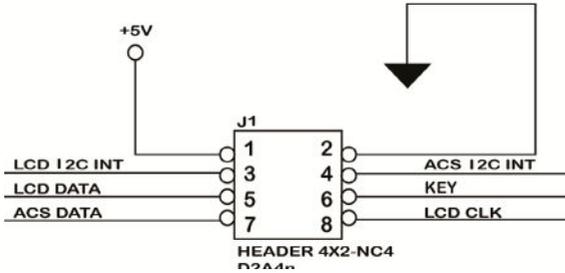
The serial interface connector can add optional accessories to add RAID adapter more functions. You can connect this interface to Areca LCD module for information, status indication, or menus or

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# HARDWARE INSTALLATION

adapter 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

Table 2-3, Areca Serial Bus Pin Definition

ARC-1689-32I RAID adapter supports one optional LCD front panel and keypad function to simply view RAID adapter information without any RAID/Volume creation function. The LCD status panel also informs user 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.

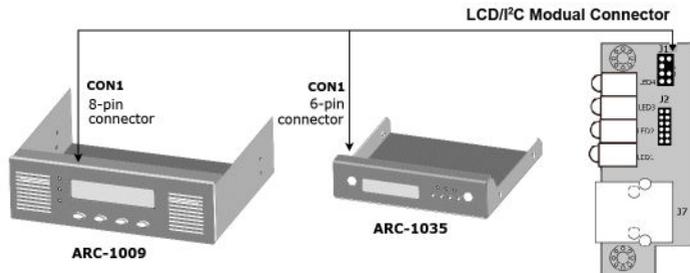


Figure 2-6, Connect to LCD Status Panel

# HARDWARE INSTALLATION

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## 2.5 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.

### 2.5.1 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 Red (Fault) LED illuminates on the bracket LED of RAID adapter if drives are failed.

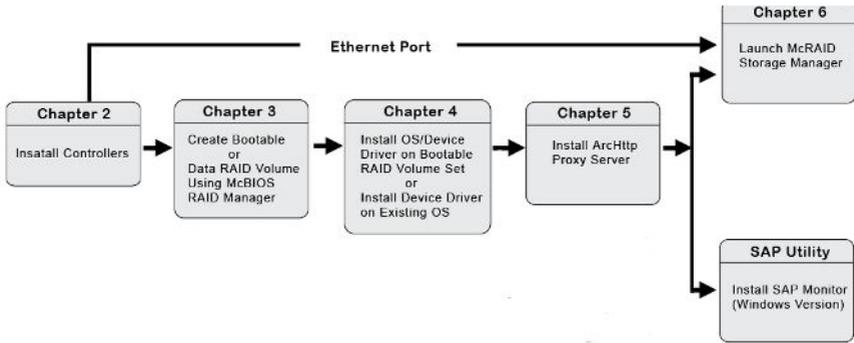
### 2.5.2 Replacing a Failed Drive

With RAID adapter 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 NVMe SSD will automatically assign as a hotspare NVMe SSD.

## 2.6 Summary of the installation

The flow chart below describes the installation procedures for NVMe 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 NVMe RAID adapter software.

# HARDWARE INSTALLATION



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

Configuration Utility	Operating System Supported
McBIOS RAID Setup Utility	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 and macOS
ArcSAP	Windows and macOS

## McRAID Storage Manager

There are two ways to launch McRAID storage manager on the ARC-1689-32I NVMe RAID adapter: in-band PCIe host bus interface or out-of-band built-in LAN interface. 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 back-

# HARDWARE INSTALLATION

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ground 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>.

## **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

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## 3. McBIOS RAID Setup Utility

Support for UEFI boot, the Bootable RAID volumes must be created before an OS can be installed. The McBIOS RAID setup utility 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 UEFI.

### 3.1 Starting the McBIOS RAID Setup Utility

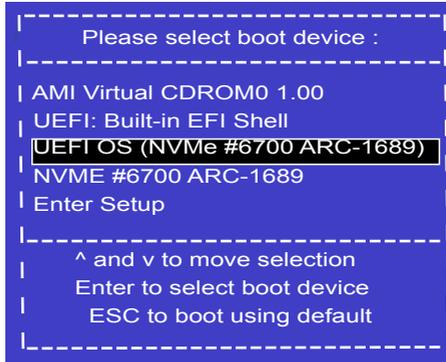
The McBIOS RAID setup utility is designed to be user-friendly. It is a menu-driven program, residing in the firmware, which allows you to scroll through various menus and sub-menus and select among the predetermined configuration options. This section explains how to launch the McBIOS RAID setup utility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

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

ARC1689FIRM.BIN code creates a virtual bootable disk (UEFI OS) for the ARC1689UEFI.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.

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- 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:**

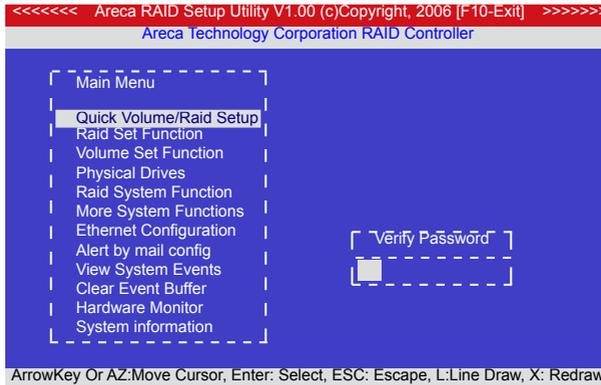
UEFI OS is not loaded when setting the 'Secure Boot' option=enabled in M/B BIOS setup.

- 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. 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.



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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 setup utility.



- d). Follow the on-screen prompts to complete the 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.

## **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

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## 3.2 McBIOS RAID Setup Utility

The McBIOS RAID setup utility is firmware-based and is used to configure RAID sets and volume sets. Because the utility resides in the NVMe 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.
- Define volume sets.
- Modify volume sets.
- Modify RAID level/stripe size.
- Define pass-through disk drives.
- Host DirectIO disk drives.
- Modify system functions.
- Designate drives as hot spares.

## 3.3 Configuring Raid Sets and Volume Sets

You can configure RAID sets and volume sets with McBIOS RAID setup utility 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

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## 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-1689-VOL#00
SCSI Channel/SCSI ID/SCSI LUN	0/0/0

# BIOS CONFIGURATION

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:

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>Highlight the desired RAID level for the volume set and press the <b>Enter</b> key to confirm.</p>
3	<p>The capacity for the current volume set is entered after highlighting the desired RAID level and pressing the <b>Enter</b> key.</p> <p>The capacity for the current volume set is displayed. Use the <b>UP</b> and <b>DOWN</b> arrow keys to set the capacity of the volume set and press the <b>Enter</b> key to confirm. The available stripe sizes for the current volume set are then displayed.</p>
4	<p>Use the <b>UP</b> and <b>DOWN</b> arrow keys to select the current volume set stripe size and press the <b>Enter</b> key to confirm. This parameter specifies the size of the stripes written to each disk in a RAID 0, 1 or 10(1E) volume set.</p> <p>You can set the stripe size to 64 KB, 128 KB, 256KB, 512KB, or 1024KB.</p> <p>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.</p>
5	When you are finished defining the volume set, press the <b>Yes</b> key to confirm the "Quick Volume And Raid Set Setup" function.
6	In "No Initialization", there is no initialization on this volume, No Init (To Rescue Volume)" for recovering the missing RAID set configuration
7	Initialize the volume set you have just configured
8	If you need to add additional volume set, using main menu "Create Volume Set" function.

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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 <b>Enter</b> key to define the hot spare.
2	Choose "Raid Set Function" from the main menu. Select "Create Raid Set" and press the <b>Enter</b> key.
3	The "Select a Drive For Raid Set" window is displayed showing the NVMe drives connected to the NVMe RAID adapter.
4	Press the <b>UP</b> and <b>DOWN</b> arrow keys to select specific physical drives. Press the <b>Enter</b> key to associate the selected physical drive with the current RAID set. It is recommended that you use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the RAID set will be set to the capacity of the smallest drive in the RAID set. The numbers of physical drives in a specific array determines which RAID levels that can be implemented in the array. RAID 0 requires 1 or more physical drives. RAID 1 requires at least 2 physical drives. RAID 10(1E) requires at least 3 physical drives.
5	After adding the desired physical drives to the current RAID set, press the <b>Enter</b> to confirm the "Create Raid Set" function.
6	An "Edit The Raid Set Name" dialog box appears. Enter 1 to 15 alphanumeric characters to define a unique identifier for this new RAID set. The default RAID set name will always appear as Raid Set. #. Press <b>Enter key</b> to finish the name editing.

# BIOS CONFIGURATION

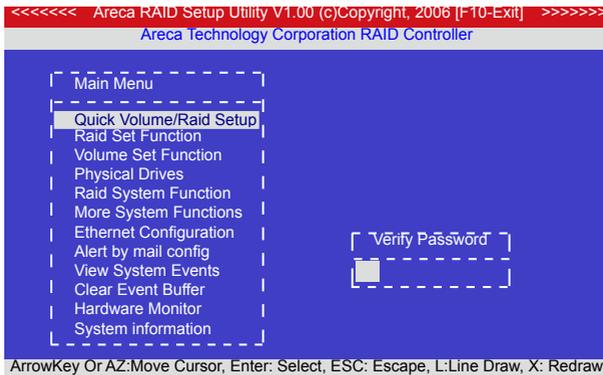
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7	Press the <b>Enter</b> key when you are finished creating the current RAID set. To continue defining another RAID set, repeat step 3. To begin volume set configuration, go to step 8.
8	Choose the "Volume Set Function" from the main menu. Select "Create Volume Set" and press the <b>Enter</b> key.
9	Choose a RAID set from the "Create Volume From Raid Set" window. Press the <b>Yes</b> key to confirm the selection.
10	In "No Initialization", there is no initialization on this volume, No Init (To Rescue Volume)" for recovering the missing RAID set configuration
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
More System Function	smart setting and Hot plug Disk for Rebuilding
Ethernet Config	On-board Lan port configuration
Alert By Mail Config	Mail notification setting sent by on-board lan port
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

# BIOS CONFIGURATION

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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.

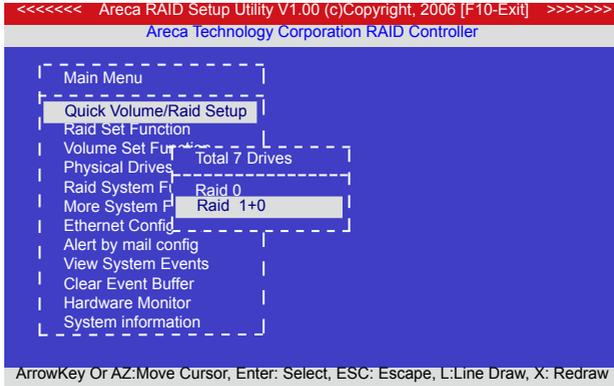
## 3.7.1 Quick Volume/Raid Setup

"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:

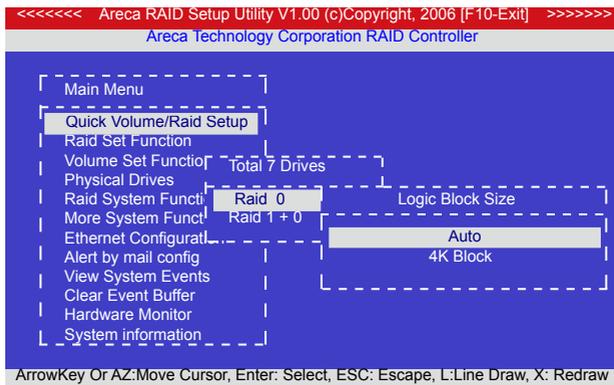
1. All of the physical drives are contained in one RAID set.
2. The RAID level, hot spare, capacity, and stripe size options are selected during the configuration process.
3. When a single volume set is created, it can consume all or a portion of the available disk capacity in this RAID set.
4. If you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

# BIOS CONFIGURATION



If volume capacity will exceed 2TB, adapter will show the "Logic Block Size" sub-menu.



- **Auto**

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.

- **4K Block**

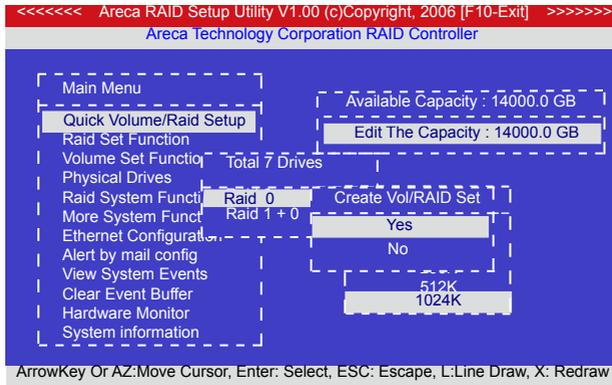
This option uses 16 bytes CDB and changes the sector size from default 512 bytes to 4k bytes.



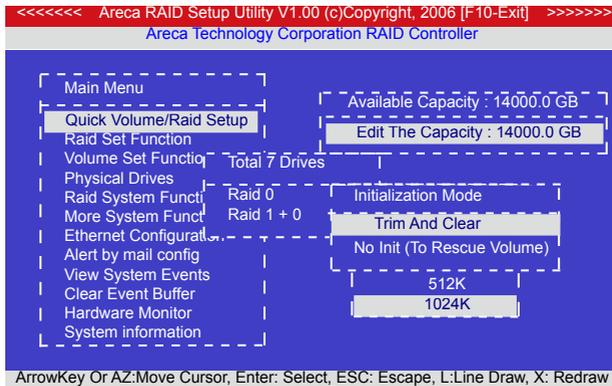
# BIOS CONFIGURATION

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

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

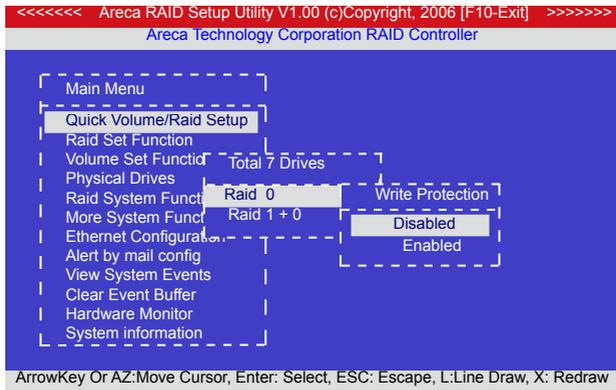


Select "Trim And Clear" there is no initialization on this volume "No Init (To Rescue Volume)" for recovering the missing RAID set configuration.



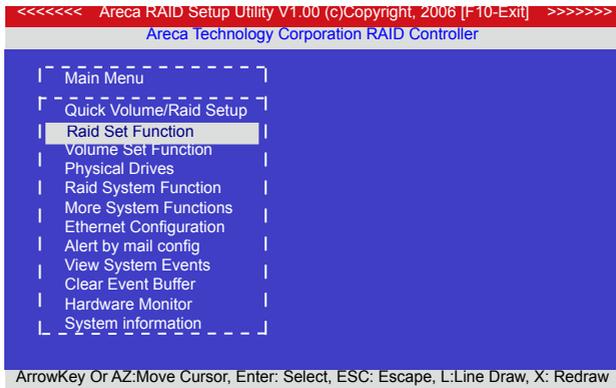
# BIOS CONFIGURATION

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.



## 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.



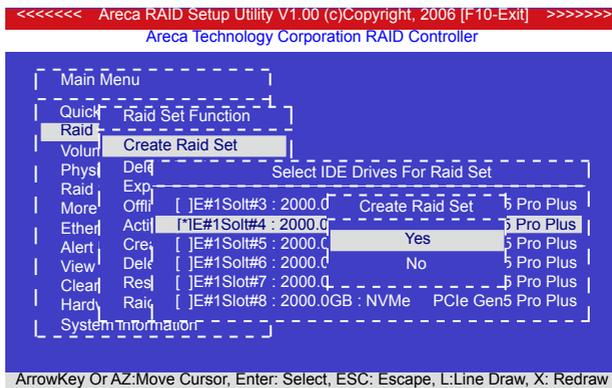
# BIOS CONFIGURATION

## 3.7.2.1 Create Raid Set

To define a RAID set, follow the procedures below:

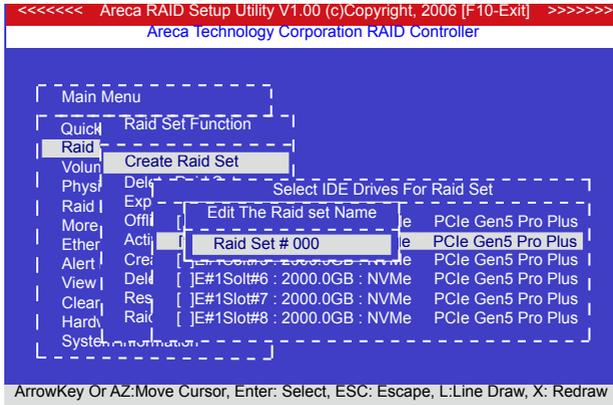
1. Select "Raid Set Function" from the main menu.
2. Select "Create Raid Set " from the "Raid Set Function" dialog box.
3. A "Select IDE Drive For Raid Set" window is displayed showing the NVMe drives connected to the current adapter. Press the **UP** and **DOWN** arrow keys to select specific physical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



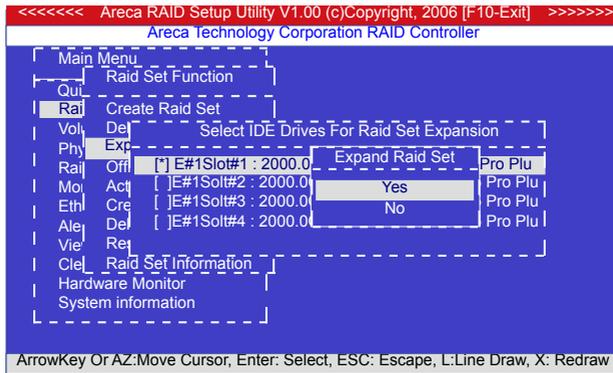
## 3.7.2.3 Expand Raid Set

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.

# BIOS CONFIGURATION

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.



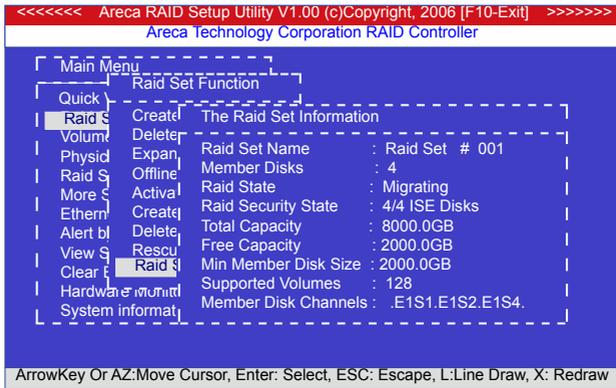
The new additional capacity can be utilized by one or more volume sets. The volume sets associated with this RAID set appear for you to have chance to modify RAID level or stripe size. Follow the instruction presented in the "Modify Volume Set" to modify the volume sets; operation system specific utilities 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.
2. If a disk drive fails during RAID set expansion and a hot spare is available, an auto rebuild operation will occur after the RAID set expansion completes.
3. RAID set expansion is a quite critical process, we strongly recommend customer backup data before expand. Unexpected accident may cause serious data corruption.

# BIOS CONFIGURATION

## • Migrating

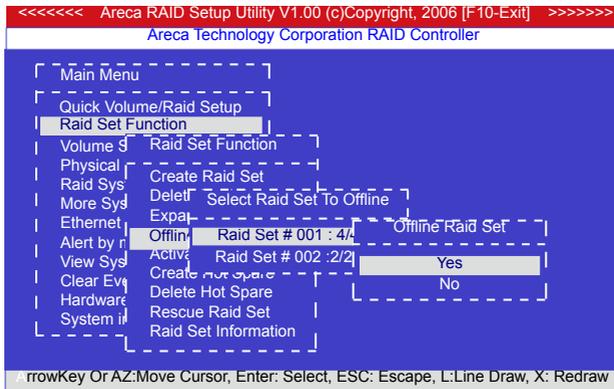


Migration occurs when a disk is added to a RAID set. Migrating state is displayed in the RAID state area of "The Raid Set Information" screen when a disk is being added to a RAID set. Migrating state is also displayed in the associated volume state area of the "Volume Set Information" which belongs this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

### 3.7.2.4 Offline Raid Set

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

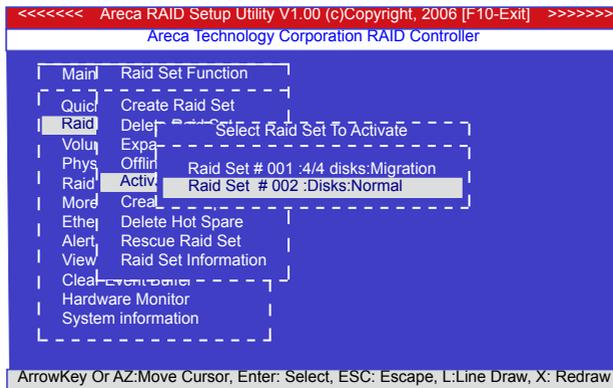
# BIOS CONFIGURATION



## 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 NVMe 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 Raidset state will change to "Degraded Mode" and Volumes in this Raidset will appears with corresponding state.



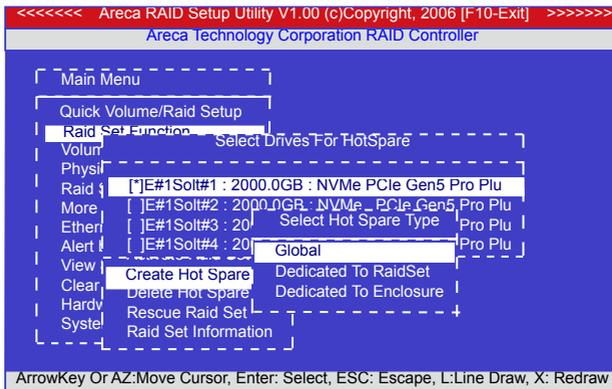
# BIOS CONFIGURATION

## 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. When a disk drive fails in the RAID set with a dedicated hot spare is pre-set, data on the disk drive is rebuild automatically on the dedicated hot spare disk.

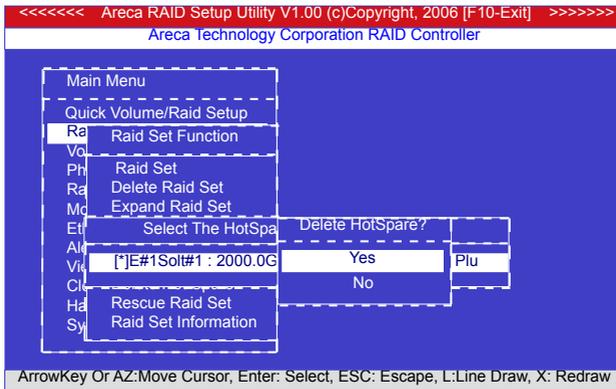


## 3.7.2.7 Delete Hot Spare

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

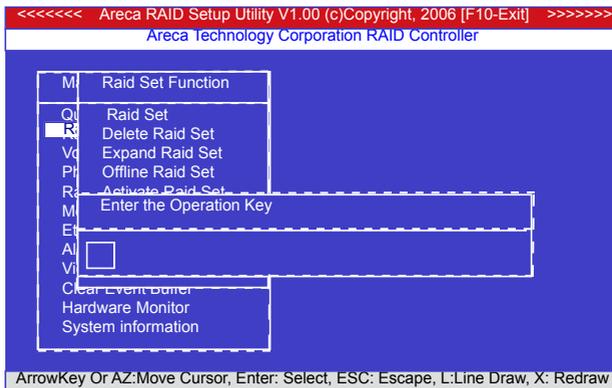
Press the **Enter** key to select a hot spare disk drive, and press **Yes** in the “Delete Hot Spare” screen to delete the hot spare.

# 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.



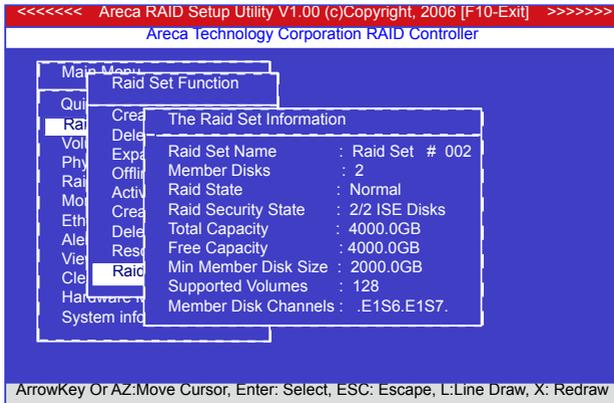
### Note:

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

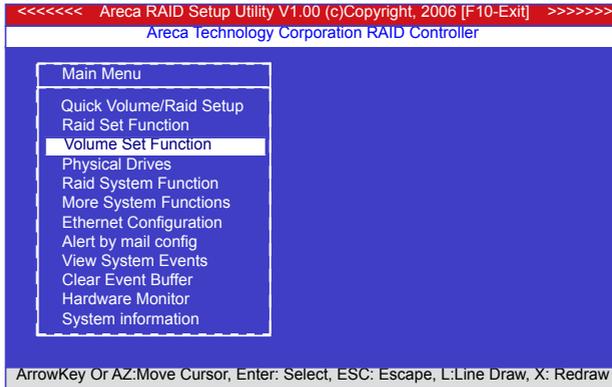
To display RAID set information, move the cursor bar to the desired RAID set number, then press the **Enter** key. The "Raid Set Information" will appear. You can only view information for the RAID set in this screen.



## 3.7.3 Volume Set Function

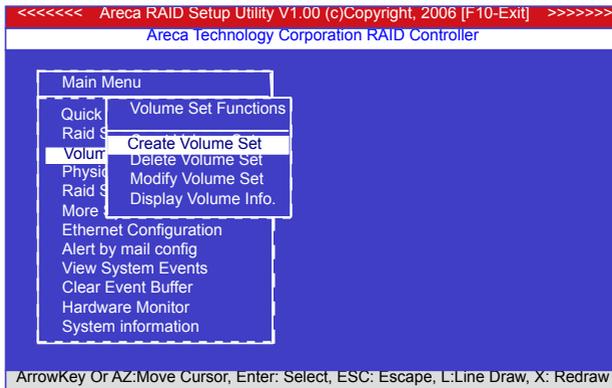
A volume set is seen by the host system as a single logical device; it is organized in a RAID level within the adapter utilizing one or more physical disks. RAID level refers to the level of data performance and protection of a volume set. A volume set can consume all of the capacity or a portion of 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 NVMe 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 adapter is capable of 64-bit LBA mode and 4K block mode.



## **Note:**

The currently firmware is only exposed 16 volumes to the operating system (OS):

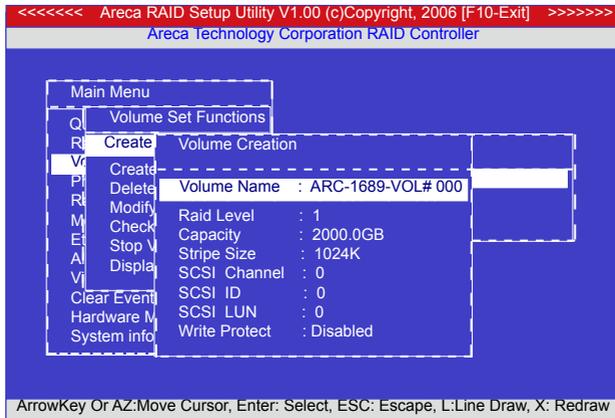
1. ID:0~1
2. LUN:0~7.

# BIOS CONFIGURATION

## 3.7.3.1 Create Volume Set

To create a volume set, follow the below steps:

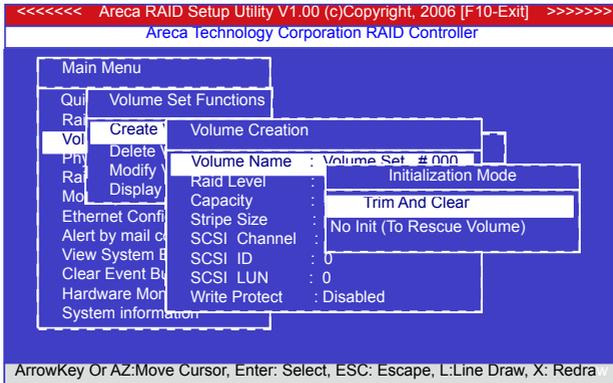
1. Select the "Volume Set Function" from the main menu.
2. Choose the "Create Volume Set" from "Volume Set Functions" dialog box screen.
3. The "Create Volume From Raid Set" appears. This screen displays the existing arranged RAID sets. Select the RAID set number and press the **Enter** key. The "Volume 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, 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 "Trim And Clear", there is no initialization of the selected volume set.
- Select "No Init (To Rescue Volume)" for no initialization of the selected volume.

# BIOS CONFIGURATION



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

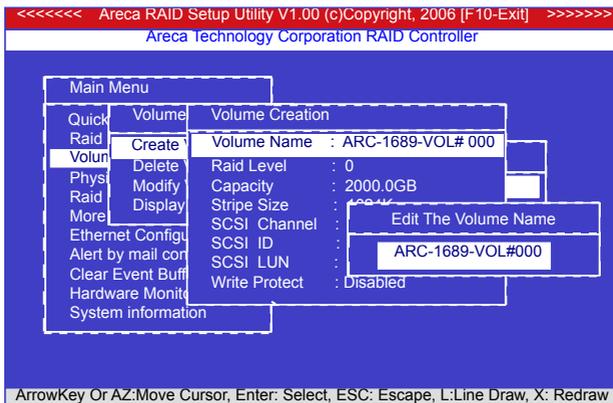
## Note:

Controller starts to initialize the volume in two conditions

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

## ● Volume Name

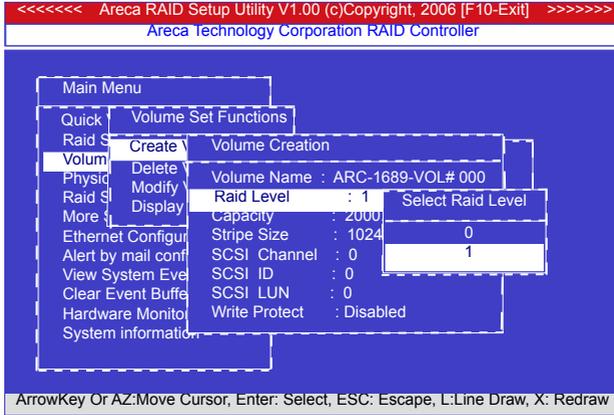
The default volume name will always appear as ARC-1689-8N-VOL #. You can rename the volume set providing it does not exceed the 15 characters limit.



# BIOS CONFIGURATION

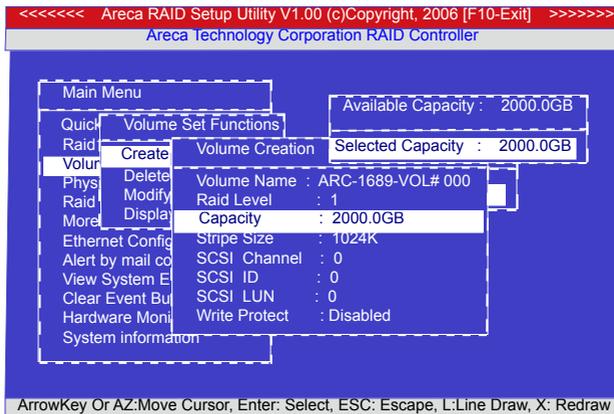
## ● Raid Level

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.



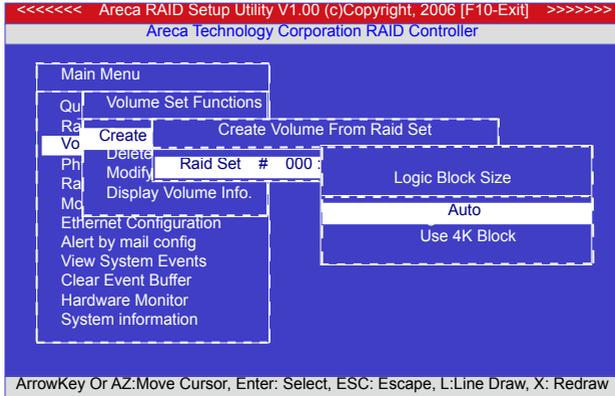
## ● Capacity

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.



# BIOS CONFIGURATION

If volume capacity will exceed 2TB, adapter will show the "Logic Block Size" sub-menu.



- **Auto**

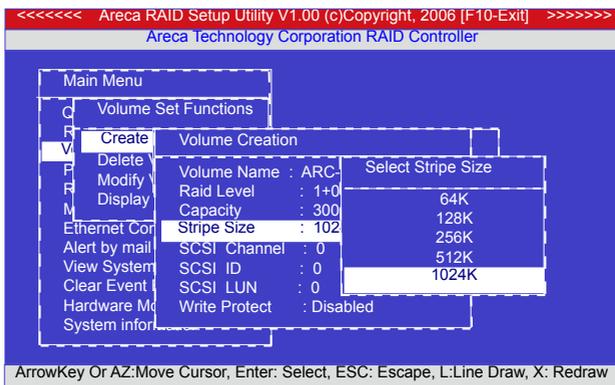
This option use 16 bytes CDB instead of 10 bytes. The maximum volume capacity up to 512TB. For any hard disk drives working in the 4K native mode in the Raid set, the volume set directly sets and exposes 4KB sector size to the operating system.

- **4K Block**

This option uses 16 bytes CDB and changes the sector size from default 512 bytes to 4k bytes.

- **Stripe Size**

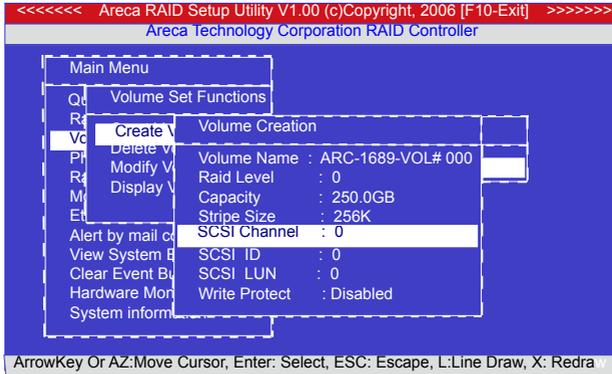
This parameter sets the size of segment written to each disk in a RAID 0, 1, 1E or 10 logical drive. You can set the stripe size to 64 KB, 128 KB, 256KB, 512KB, or 1024KB.



# BIOS CONFIGURATION

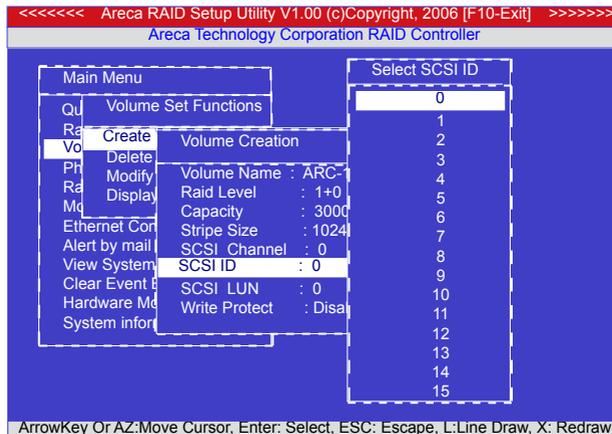
## ● SCSI Channel

The NVMe RAID adapter function simulates an 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.



## ● SCSI ID

Each device attached to the NVMe RAID adapter, as well as the NVMe 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.



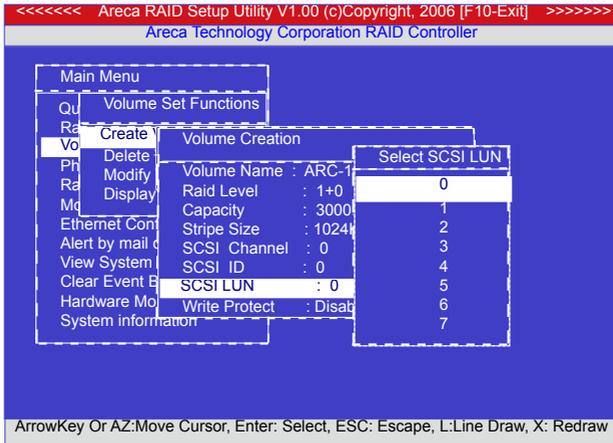
### **Note:**

The currently firmware is only exposed 16 volumes (ID:0~1) to the operating system (OS).

# BIOS CONFIGURATION

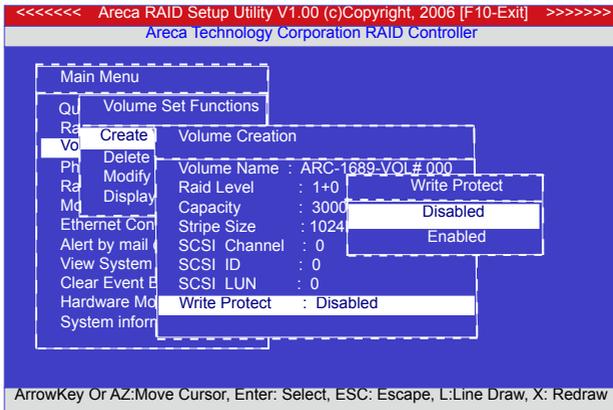
- **SCSI LUN**

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



- **Write Protect**

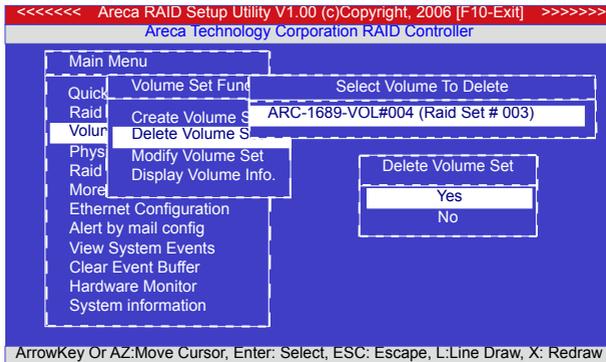
When "Write Protect" is enabled on the "Create Volume Set", host commands fail if they are issued to a volume in that RAID adapter and attempt to modify a volume's data or attributes. "Write Protection" is used primarily for customer-initiated disaster recovery testing.



# BIOS CONFIGURATION

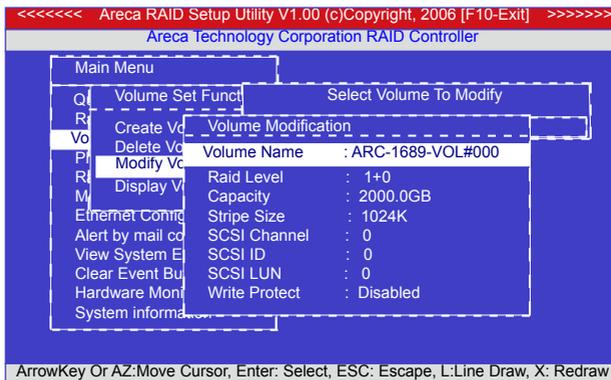
## 3.7.3.2 Delete Volume Set

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** 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.



## 3.7.3.3 Modify Volume Set

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



# BIOS CONFIGURATION

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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.

## 3.7.3.3.1 Volume Growth

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

### To expand an existing volume noticed:

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

## 3.7.3.3.2 Volume Set Migration

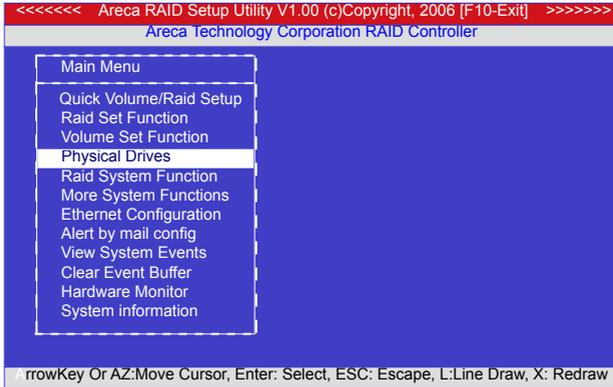
Migrating occurs when a volume set is migrating from one RAID level to another, when a volume set strip size changes, or when a disk is added to a RAID set. Migration state is displayed in the volume state area of the "Volume Set Information" screen.



# BIOS CONFIGURATION

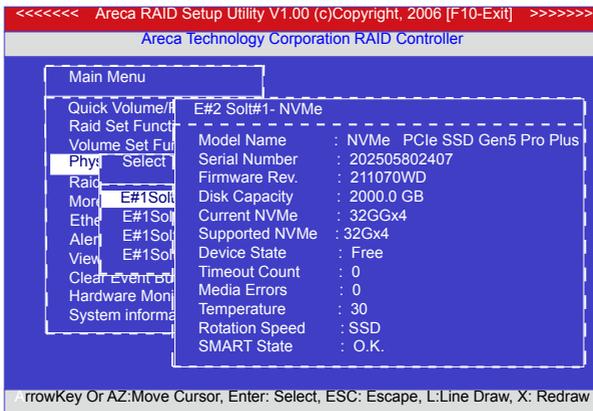
## 3.7.4 Physical Drives

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.



### 3.7.4.1 View Drive Information

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

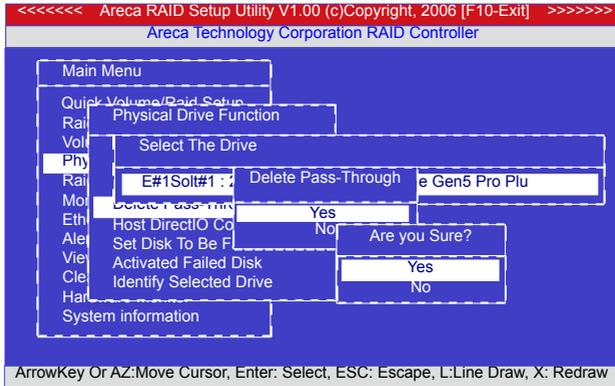




# BIOS CONFIGURATION

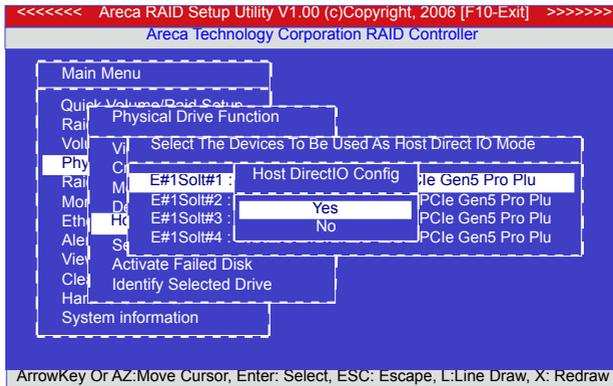
## 3.7.4.4 Delete Pass-Through Disk

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 Host DirectIO Config

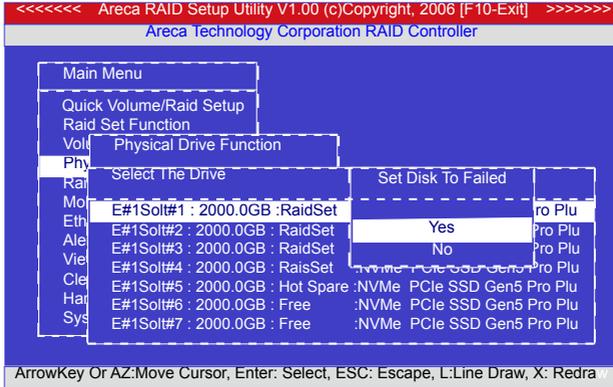
A Host DirectIO disk is not controlled by the NVMe RAID adapter firmware and thus cannot be a part of a volume set. The disk is available directly to the operating system as an individual disk. It is typically used on a system where the operating system is on a disk not controlled by the NVMe RAID adapter firmware



# BIOS CONFIGURATION

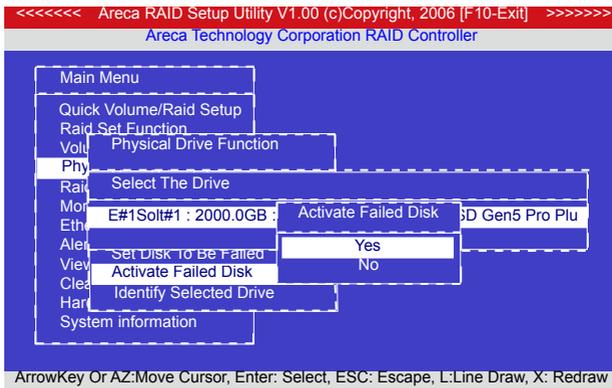
## 3.7.4.6 Set Disk To Be Failed

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



## 3.7.4.7 Activate Failed Disk

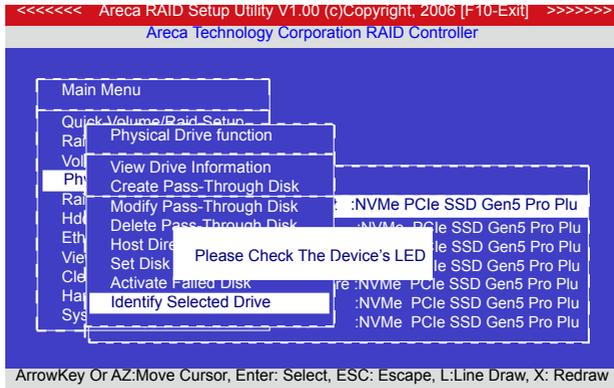
It forces the current “failed” disk in the system to be back on-line. “Activate Failed Disk” function has no effect on the removed disks, because a “removed” disk does not give the adapter a chance to mark it as “failure”.



# BIOS CONFIGURATION

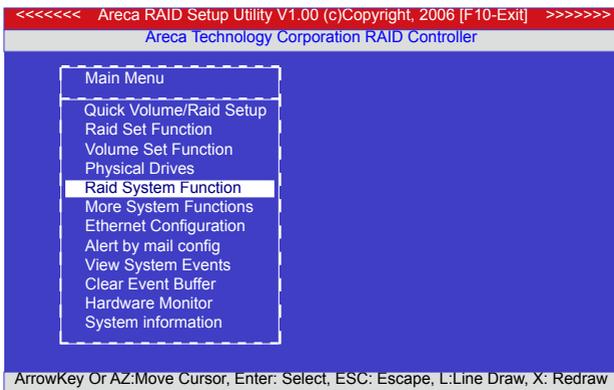
## 3.7.4.8 Identify Selected Drive

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.



## 3.7.5 Raid System Function

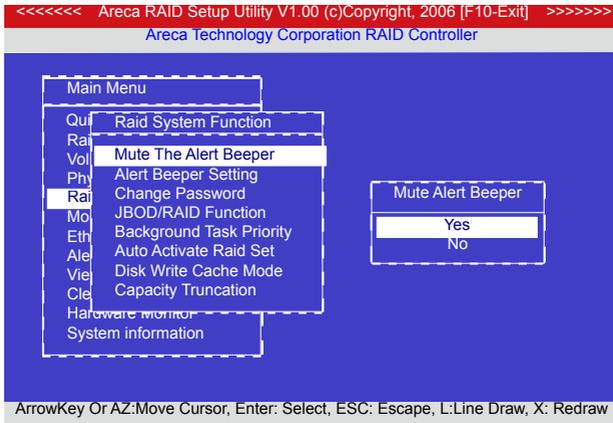
To set the "Raid System Function", move the cursor bar to the main menu and select the "Raid System Function" item and then press **Enter** key. The "Raid System Function" menu will show multiple items. Move the cursor bar to an item, and then press **Enter** key to select the desired function.



# BIOS CONFIGURATION

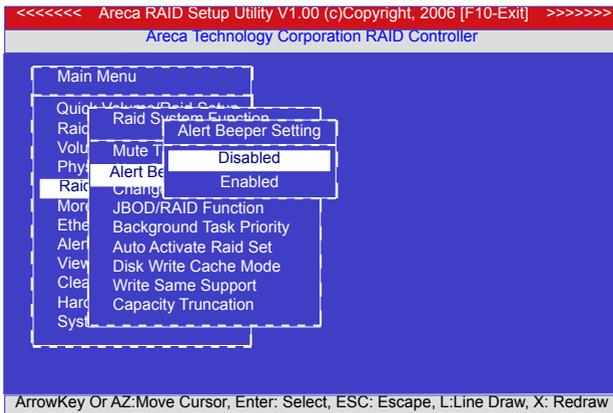
## 3.7.5.1 Mute The Alert Beeper

The “Mute The Alert Beeper” function item is used to control the NVMe 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

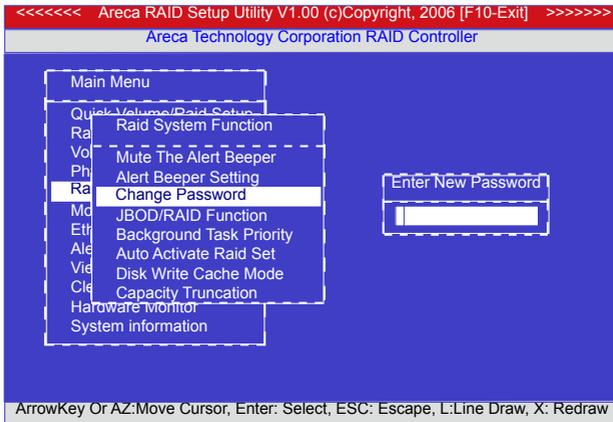
The “Alert Beeper Setting” function item is used to “Disabled” or “Enabled” the NVMe RAID adapter alarm tone generator. Select “Disabled” and press the **Enter** key in the dialog box to turn the beeper off.



# 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.



## 3.7.5.4 JBOD/RAID Function

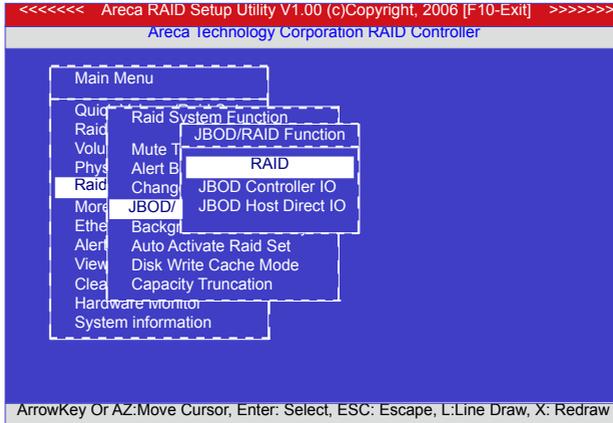
JBOD is an acronym for "Just a Bunch Of Disk". A group of NVMe disks in a RAID box are not set up as any type of RAID configuration. All NVMe drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to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

**JBOD Controller IO:** All NVMe drives in "JBOD Controller IO"

# BIOS CONFIGURATION

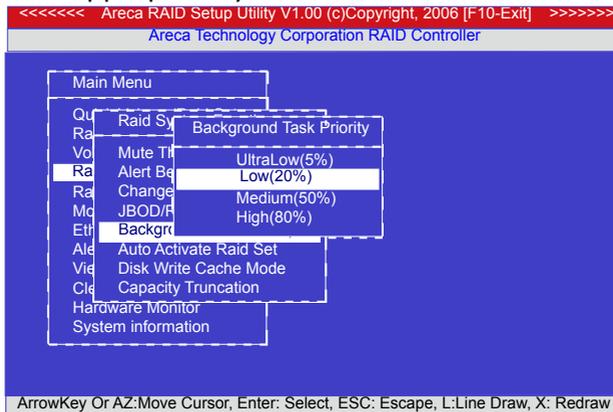
are controlled by the NVMe RAID adapter firmware and thus cannot be a part of a volume set.

**JBOD Host Direct IO:** All attached NVMe drives in “JBOD Host Direct IO” mode are not controlled by the NVMe 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 NVMe RAID adapter firmware.



## 3.7.5.5 Background Task Priority

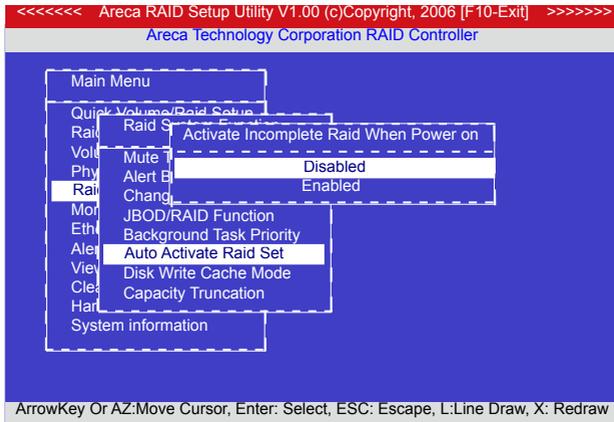
The “Background Task Priority” is a relative indication of how much time the adapter devotes to a rebuild operation. The NVMe RAID adapter allows the user to choose the rebuild priority (UltraLow, Low, Medium, High) to balance volume set access and rebuild tasks appropriately.



# BIOS CONFIGURATION

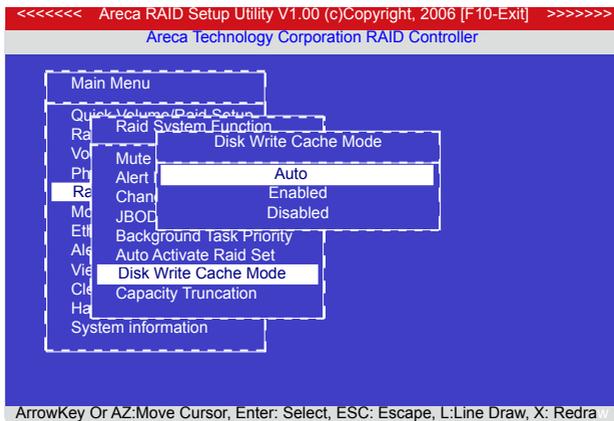
## 3.7.5.6 Auto Activate Raid Set

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 NVMe 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.



## 3.7.5.7 Disk Write Cache Mode

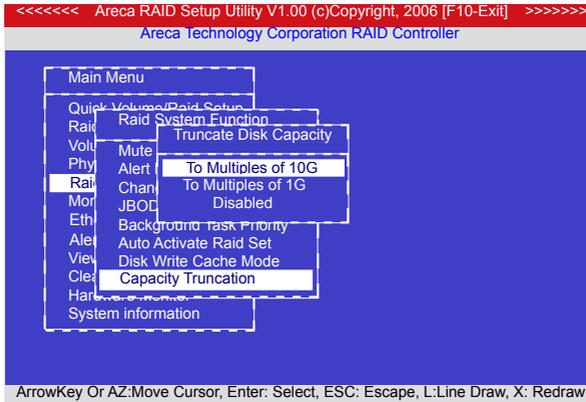
User can set the “Disk Write Cache Mode” to Auto, Enabled, or Disabled. “Enabled” increases speed, “Disabled” increases reliability.



# BIOS CONFIGURATION

## 3.7.5.8 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.

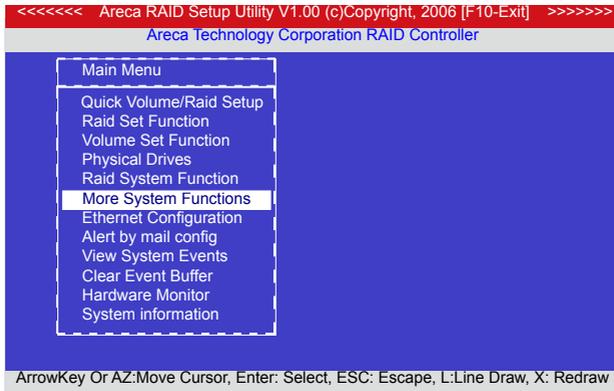
**Multiples Of 1G:** If you have 123 GB drives from different vendors; chances are that the capacity varies slightly. For example, one drive might be 123.5 GB, and the other 123.4 GB. "Multiples Of 1G" truncates the fractional part. This makes the same capacity for both of these drives so that one could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

**Disabled:** It does not truncate the capacity.

# BIOS CONFIGURATION

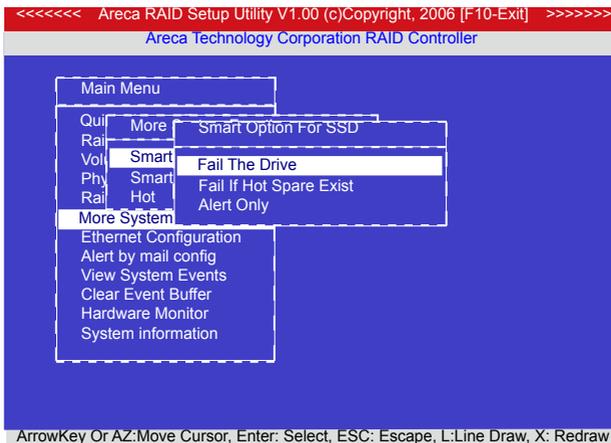
## 3.7.6 More System Functions

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 SSD

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



# BIOS CONFIGURATION

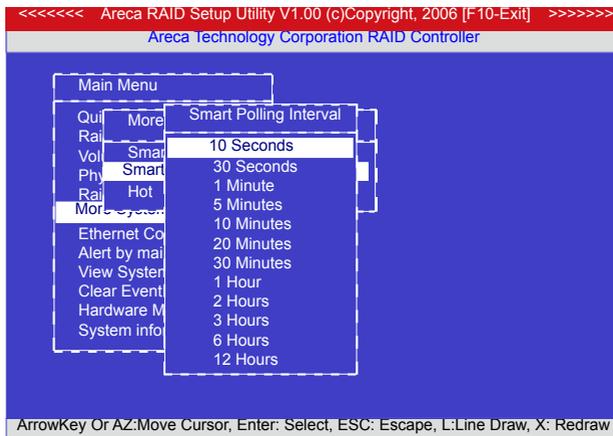
“**Fail The Drive**”- adapters kill off the SMART fail drive immediately.

“**Fail 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 fail drive.

## 3.7.6.2 Smart Polling Interval

User can define the Smart Pulling Interval to pull the SMART status of each disk. The default is “10 seconds”.



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

## 3.7.6.3 Hot Plugged Disk For Rebuilding

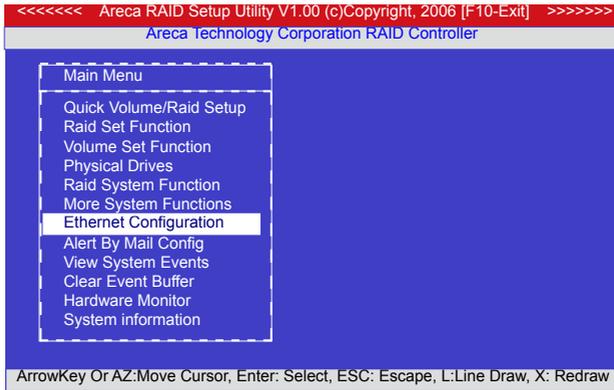
It defines if the RAID array volume should start rebuilding or not when detects a disk is inserted/re-inserted during online. The options are: “**Blank Disk Only**”, “**Always**”, and “**Disabled**”. The default is “Blank Disk Only”.



# BIOS CONFIGURATION

## 3.7.8 Ethernet Configuration

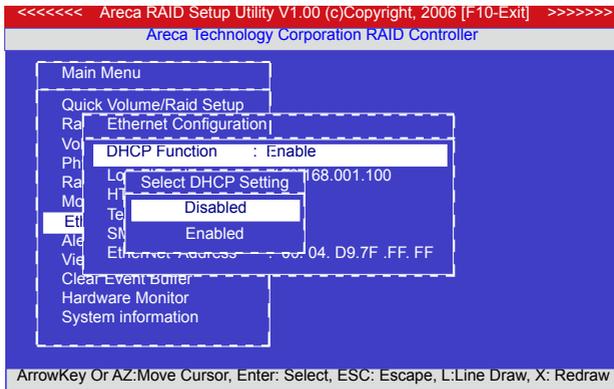
Use this feature to set the adapter Ethernet port configuration. It is not necessary to create reserved disk space on any hard disk for the Ethernet port and HTTP service to function; these functions are built into the adapter firmware. move the cursor bar to the main menu "Ethernet Configuration Function" 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 allows network administrators centrally manage and automate the assignment of IP addresses on a computer network. When using the TCP/IP 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 necessary to manually enter a static IP address that does not conflict with other devices on the network.

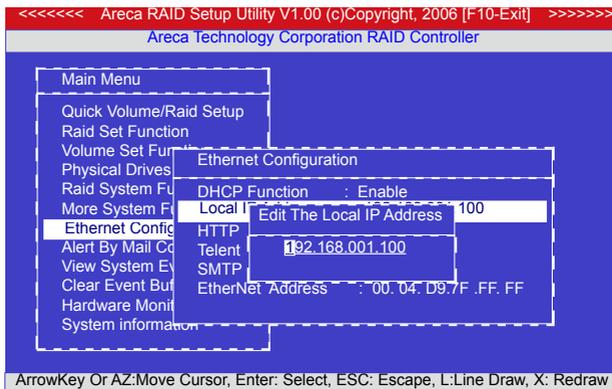
# BIOS CONFIGURATION



## 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 recommended 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.

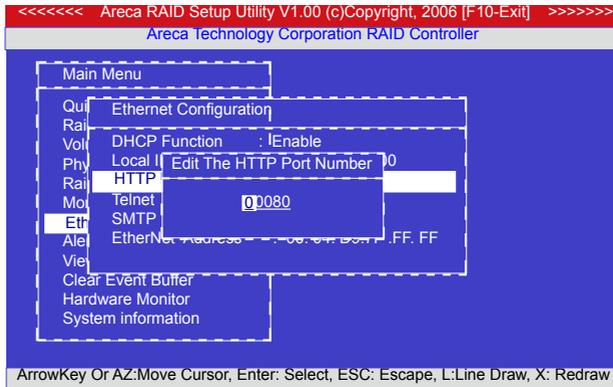
To manually configure the IP address of the adapter, move the cursor bar to Local IP address item, then press the **Enter** key to show the default address setting in the RAID adapter. You can then reassign the static IP address of the adapter.



# BIOS CONFIGURATION

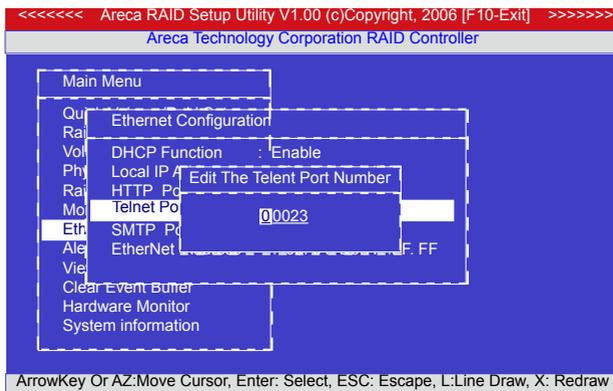
## 3.7.8.3 HTTP Port Number

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

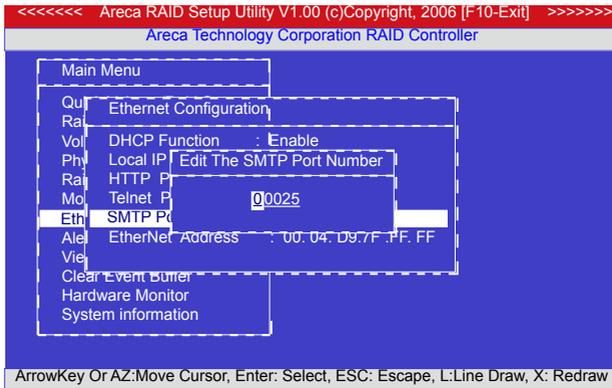
To manually configure the “Telnet Port Number” of the adapter, move the cursor bar to “Telnet Port Number” item, then press the **Enter** key to show the default address setting in the RAID adapter. You can then reassign the default “Telnet Port Number” of the adapter.



# BIOS CONFIGURATION

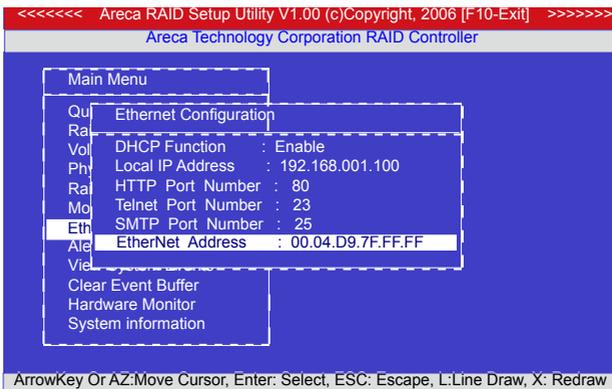
## 3.7.8.5 SMTP Port Number

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

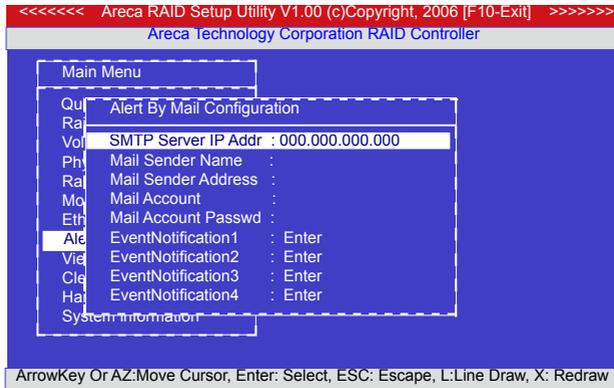
Each Ethernet port has its unique Mac address, which is also factory assigned. Usually, Ethernet address is used to uniquely identify a port in the Ethernet network.



# BIOS CONFIGURATION

## 3.7.9 Alert By Mail Config

To configure the 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.



**SMTP Server IP Addr:**

Enter IP address or domain name of the SMTP server to configure your mail program correctly. Ex: 192.168.0.2.

**Mail Sender Name:**

This is the sender name that the e-mail alerts will appear to be coming from. Ex: RaidController\_1.

**Mail Sender 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.

**Mail Account:** Enter the valid account if your SMTP mail server requires authentication.

**Mail Account Password:**

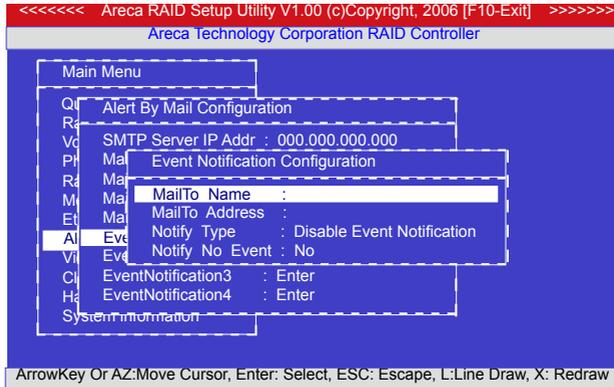
Enter the valid password if your SMTP mail server requires authentication.

# BIOS CONFIGURATION

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## EventNotification# : Event Notification Configurations

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



### MailTo Name:

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

### MailTo Address:

Enter the receiver's e-mail address. This is the address you want the e-mail alerts sent to. Ex: admin@areca.com.tw.

### Notify Type:

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 No Event:

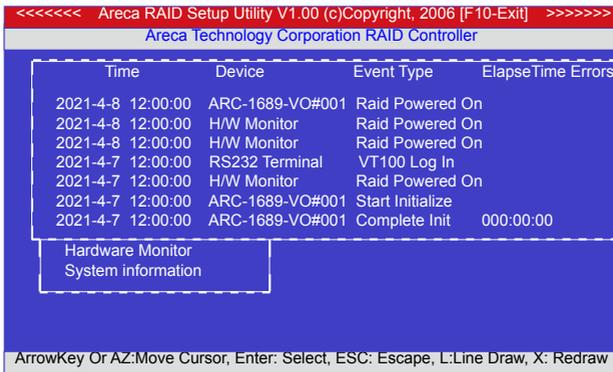
Notify user if no event occurs within 24 hours.

# BIOS CONFIGURATION

## 3.7.10 View System Events

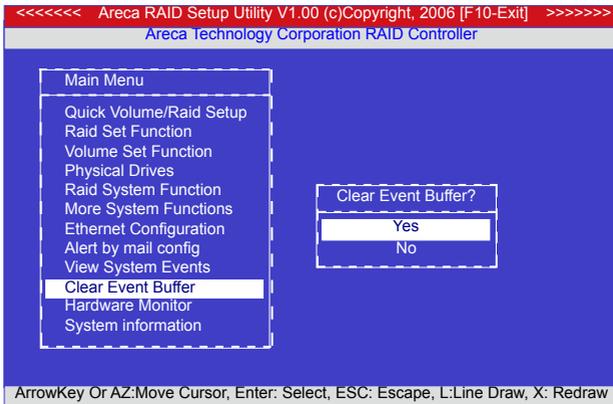
To view the NVMe RAID adapter's system events information, move the cursor bar to the main menu and select the "View System Events" link, then press the **Enter** key. The NVMe RAID adapter's events screen appear.

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 NVMe RAID adapter powered on.



## 3.7.11 Clear Events Buffer

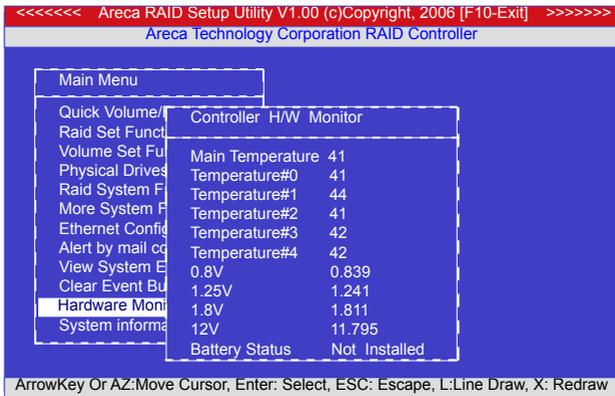
Use this feature to clear the entire events buffer.



# BIOS CONFIGURATION

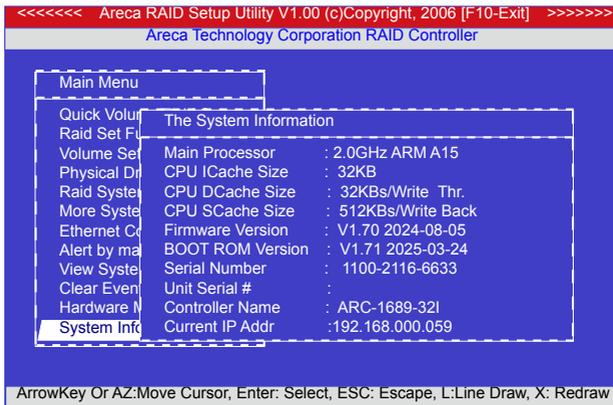
## 3.7.12 Hardware Monitor

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 main temperature, adapter temperature and voltage of the NVMe RAID adapter.



## 3.7.13 System Information

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



# macOS DRIVER INSTALLATION

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## 4. macOS Driver Installation (Optional)

The ARC-1689-32I NVMe RAID adapter goes with any standard Windows (10 or above), Linux(Kernel 3.10 or above), FreeBSD or macOS in-box NVMe drivers. You do not need a special driver to install the OS or data on the ARC-1689-32I. In-box driver is a native driver that is supplied with the Operating System. But Mac macOS only supports one zoned namespace and without management interface support. Areca supports macOS driver for multiple namespaces and management support. This chapter describes how to install the Mac macOS NVMe RAID adapter driver.

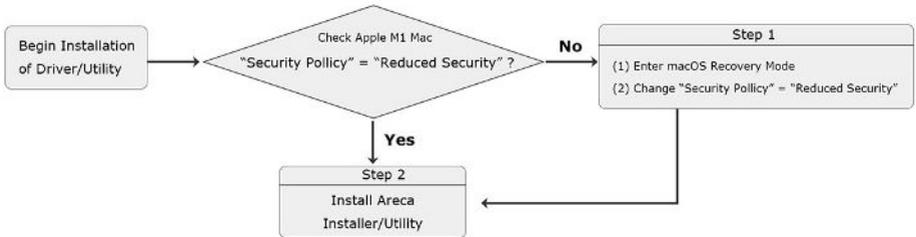
After hardware installation, the NVMe SSDs connected to the NVMe RAID adapter must be configured and the volume set units initialized by the adapter before they are ready to use by the system. This section describes detailed instructions for installing the Areca Mac driver for the ARC-1689-32I on your Mac. You must have administrative level permissions to install Mac driver & utility.

On November 10, 2020, Apple revealed new Mac hardware with the revolutionary Apple Silicon M series 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 M series 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 ARC-1689 NVMe RAID adapter 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.

# macOS 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"**.

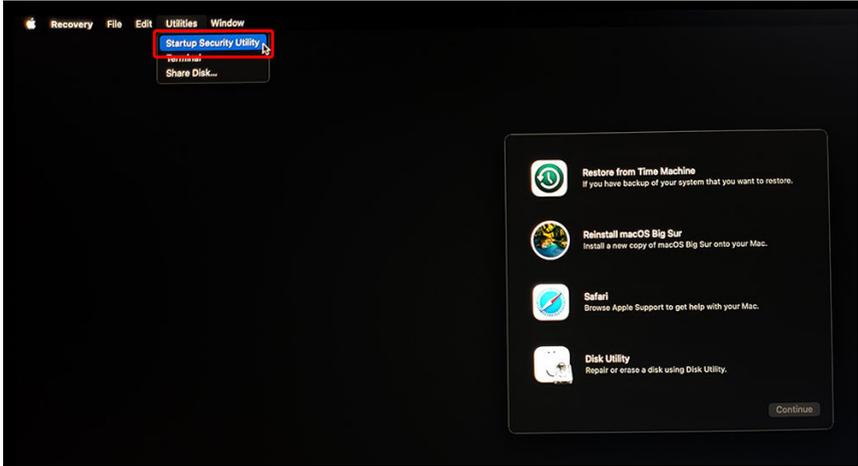
(1-2). Press and hold the power button on your Mac until you see **"Loading startup options"**.

(1-3). Click **"Options"**, then click **"Continue"**. If requested, enter the password for an administrator account.



# macOS 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.



# macOS 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.

# macOS DRIVER INSTALLATION

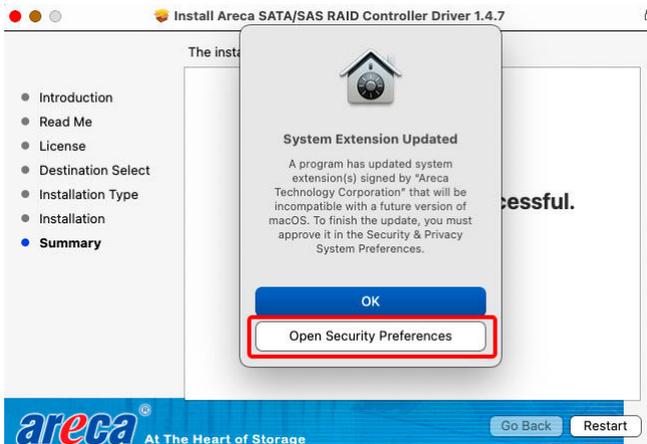
## Step 2. Installing Areca driver

- (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.



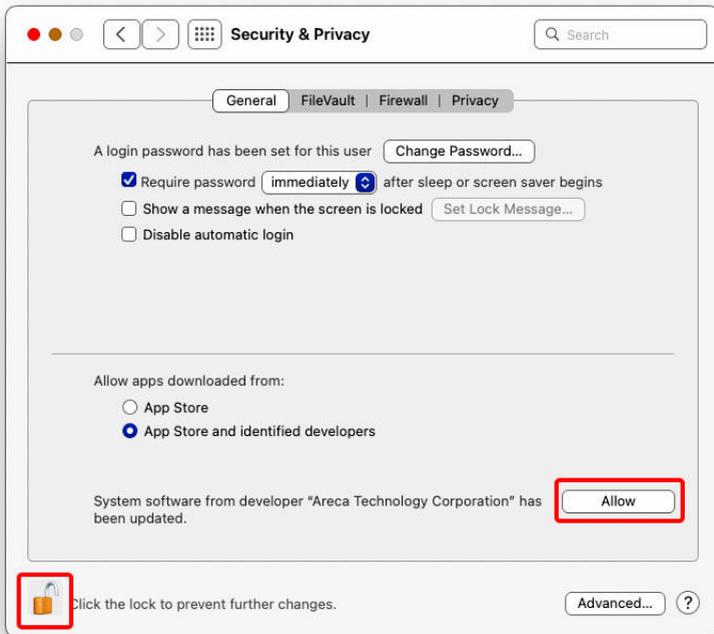
Follow the installer on-screen steps to complete the installation.

- (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.



# macOS 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**".



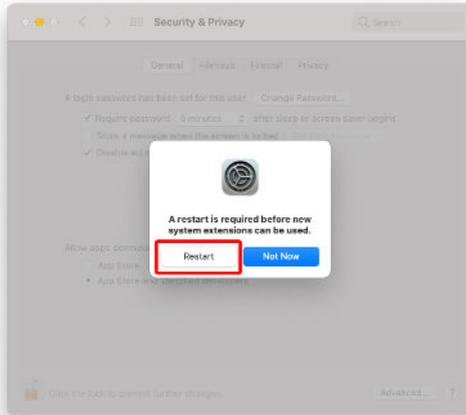
- \* This message about being blocked is only displayed for only 30 minutes after installing the driver. When 30 minutes have passed after installing, the message is no longer displayed.
- \* In the following condition, no message is displayed. Loading of the driver is permitted.

# macOS DRIVER INSTALLATION

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- 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.

# ARCHTTP PROXY SERVER INSTALLATION

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## 5. ArchHTTP Proxy Server Installation

### Overview

After hardware installation, the NVMe/SAS/SATA disk drives connected to the NVMe 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 NVMe RAID adapter is provided on the areca website. This software utility can monitor, test, and support the NVMe RAID adapter. The software utility and McRAID storage manager can configure and monitor the NVMe RAID adapter via ArchHTTP proxy server interface. The following table outlines their functions:

<b>Configuration Utility</b>	<b>Operating System Supported</b>
McBIOS RAID Setup Utility	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.

# ARCHTTP PROXY SERVER INSTALLATION

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## 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.



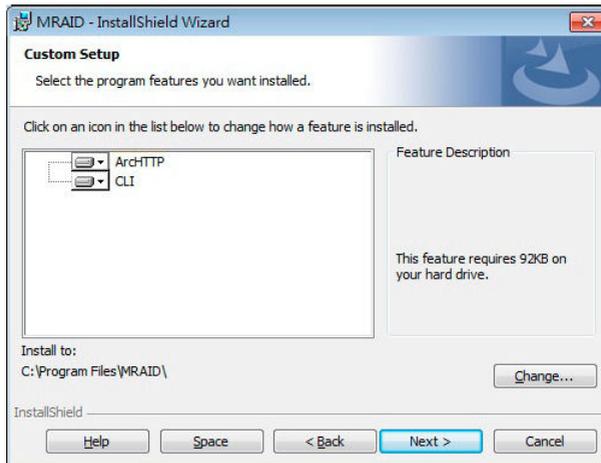
6. On the Setup Type screen, use the settings to specify these things: and click on the "Next" button to continue.



# ARCHTTP PROXY SERVER INSTALLATION

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- “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.

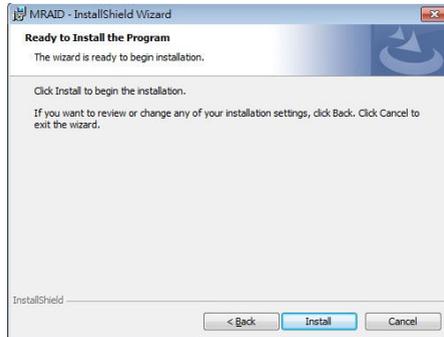


- **ArchHTTP** has to be installed for GUI RAID console (McRAID storage manager) to run. It also runs as a service or daemon in the background that allows capturing of events for mail and SNMP traps notification. Refer to the section 5.5 ArchHTTP Configuration on ARC-1689-8N user manual, for details 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

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7. When you reach the installation page, click on the **“Install”** button to continue.



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

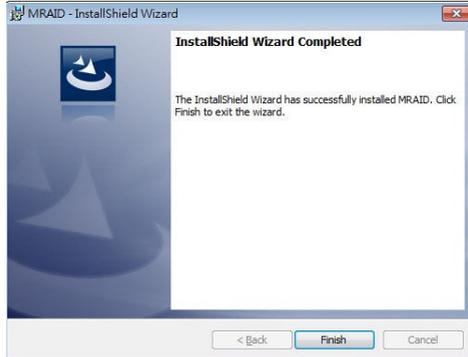


When this screen completes, you have completed the MRAID installation. If you have no ARC-1689-8N yet installed a “MRAID Installer Information” message displays.



9. 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 localhost RAID units on the system and creates an total Controller icon located in the left column screen. The child element belonged each RAID adapter appears on the right column screen. Locate "ARC-1689-8N" and launch the McRAID storage manager.



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 5.5 ArchHTTP Configuration.

# ARCHTTP PROXY SERVER INSTALLATION

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## 5.2 For Linux

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

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

1. Login as root. Copy the ArchHTTP file to a local directory. Download from the [www.areca.com.tw](http://www.areca.com.tw) or from the email attachment.
2. You must have administrative level permissions to install and run RAID adapter ArchHTTP proxy server software. This procedure assumes that the NVMe 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 ArchHTTP proxy server software.

- (a). Run the ArchHTTP 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, ArchHTTP 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 ArchHTTP configuration (Cfg Assistant). Such as: `archttp64 1553`
- (b). ArchHTTP server console started, Controller card detected then ArchHTTP proxy server screen appears.

# ARCHTTP PROXY SERVER INSTALLATION

---

Copyright (c) 2004-2024 Areca, Inc. All Rights Reserved.  
Areca HTTP proxy server, Version: v3.0.0, Arclib: 390, Date:  
Oct23 2024

Starting HTTP Proxy Server...Please wait(MAX = 5 minutes)  
Controller(s) list

-----  
Cfg Assistant : Listen to port[81].  
Controller[1](NVME) : Listen to port[82].  
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!!  
#####

- (c). If you need the "Cfg Assistant", please refer to section 5.5 ArchTTP Configuration.
  
- (d). Launch your McRAID storage manager by entering `http://[Computer IP Address]:[Port Number]` in the web browser. For detailing about McRAID storage manager to customize your RAID volume set is discussed in Chapter 6.

# ARCHTTP PROXY SERVER INSTALLATION

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## 5.3 For FreeBSD

You must have administrative level permissions to install NVMe RAID software. This procedure assumes that the NVMe RAID hardware and FreeBSD are installed and operational in your system.

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

1. Login as root. Copy the ArchHTTP file to a local directory. Download from the [www.areca.com.tw](http://www.areca.com.tw) or from the email attachment.
2. This procedure assumes that the NVMe RAID hardware and driver are installed and operational in your system. The following details are the installation procedure of the NVMe RAID adapter ArchHTTP proxy server software.
  - (a). Run the ArchHTTP 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, ArchHTTP 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 ArchHTTP configuration (Cfg Assistant). Such as: `archttp64 1553`
  - (b). ArchHTTP server console started, Controller card detected then ArchHTTP proxy server screen appears.

# ARCHTTP PROXY SERVER INSTALLATION

---

Copyright (c) 2004-2024 Areca, Inc. All Rights Reserved.  
Areca HTTP proxy server, Version: v3.0.0, Arclib: 390, Date:  
Oct 23 2024

Starting HTTP Proxy Server...Please wait(MAX = 5 minutes)  
Controller(s) list

-----  
Cfg Assistant : Listen to port[81].  
ARCHTTP PROXY SERVER INSTALLATION  
Controller[1](NVME) : Listen to port[82].  
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!!  
#####

- (c). If you need the "Cfg Assistant", please refer to section 5.5 ArchTTP Configuration.
- (d). Launch your McRAID storage manager by entering `http://[Compute IP Address]:[Port Number]` in the web browser. For detailing about McRAID storage manager to customize your RAID volume set is discussed in Chapter 6.

# ARCHTTP PROXY SERVER INSTALLATION

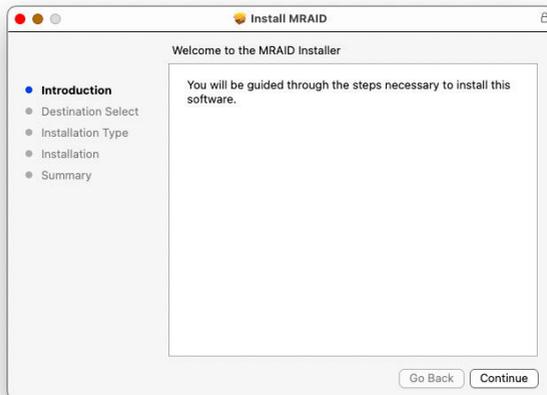
## 5.4 For macOS

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.

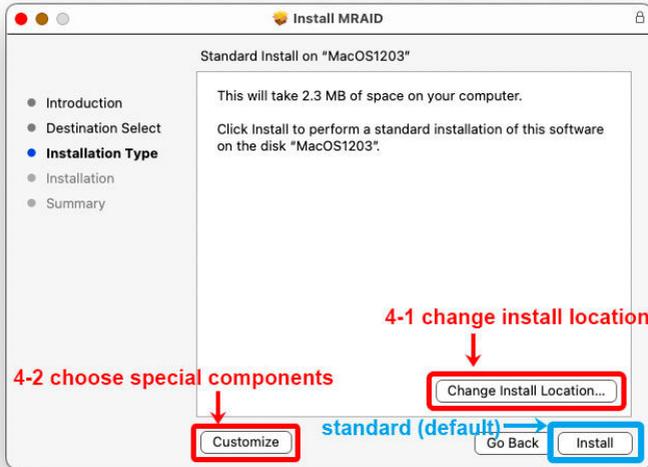


3. Click on the "**Continue**" button to begin the installation.

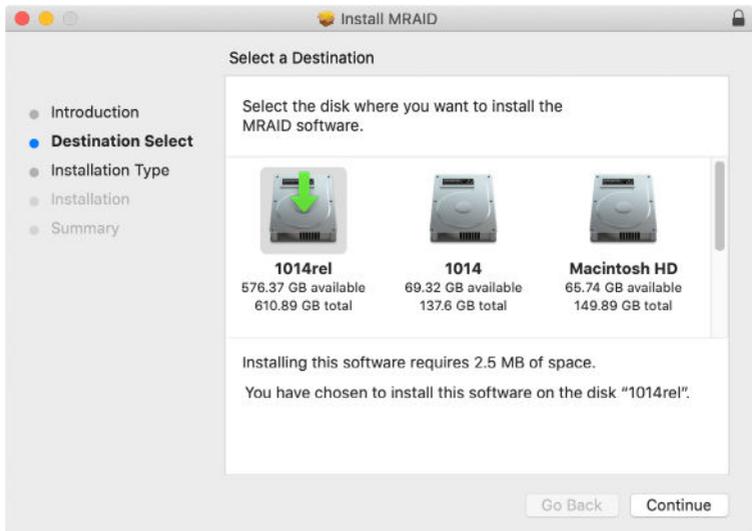


# ARCHTTP PROXY SERVER INSTALLATION

- 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.

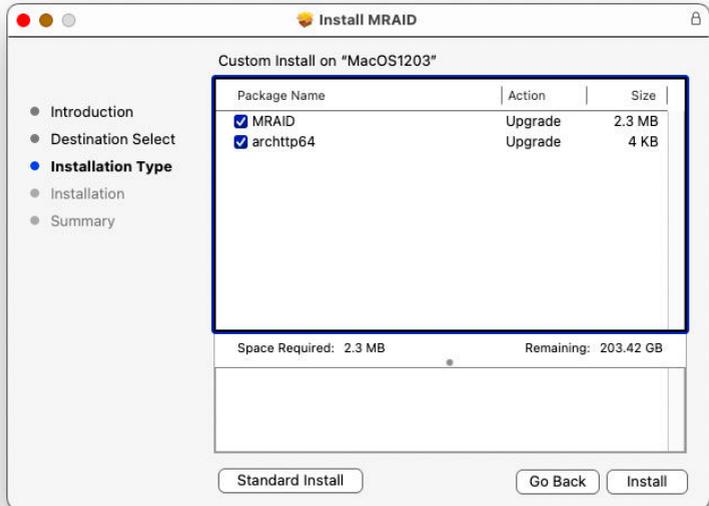


- Click on the **"Change Install Location"** button to select the disk where you want to install the MRAID software.



# ARCHTTP PROXY SERVER INSTALLATION

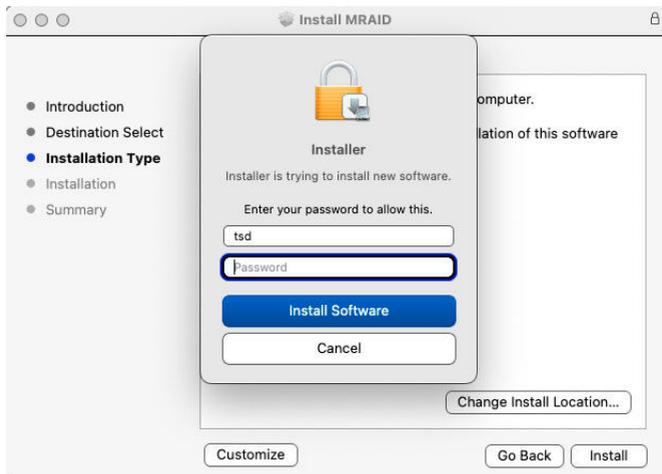
4-2, Click on the "**Customize**" button to choose special components. Click on an icon to install special components and click the "Install" button to continue.



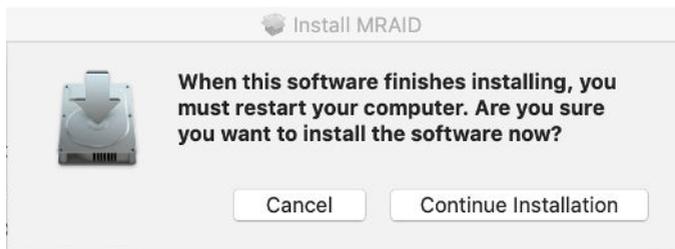
- **MRAID** is included below two applications.
  - *ArchHTTP* has to be installed for GUI RAID console (McRAID storage manager) to run. It also runs as a service or daemon in the background that allows capturing of events for mail and SNMP traps notification. Refer to the chapter 5 ArchHTTP Configuration on ARC-1689series 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.
- **ArchHTTP64** is required for ArchHTTP running as a service or daemon, and have it automatically start the proxy for all controllers found.

# ARCHTTP PROXY SERVER INSTALLATION

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



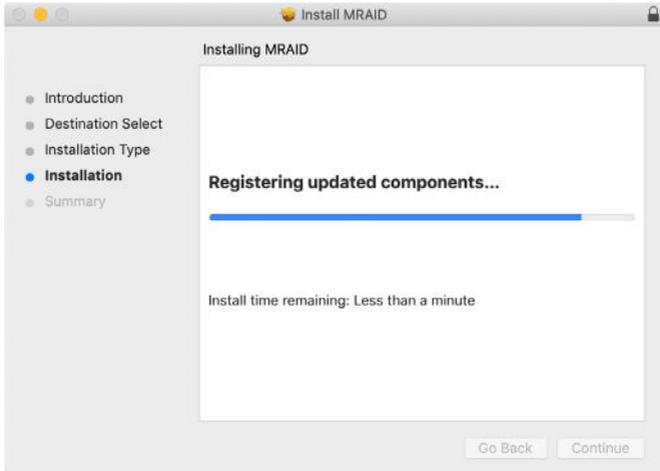
6. The system will need to be restarted when the installation is complete. Click “**Continue Installation**” button.



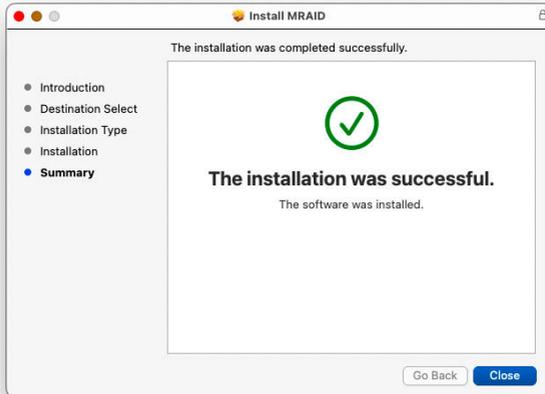
# ARCHTTP PROXY SERVER INSTALLATION

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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.

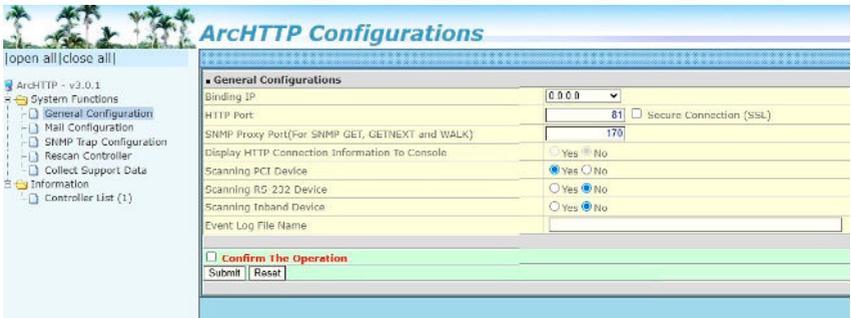
# ARCHTTP PROXY SERVER INSTALLATION

## 5.5 ArchHTTP Configuration

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.



### ● **General Configuration:**



#### 1. **Binding Ip:**

Restrict ArchHTTP proxy server to bind only single interface (If more than one physical network in the server).

#### 2. **HTTP Port#:**

Value 1~65535. Click on the "check box" to enable the SSL.

#### 3. **SNMP Proxy Port (For SNMP GET, GET NEXT and WALK):**

The ArchHttp can send get requests to an SNMP agent to obtain data. After receiving a get request, the SNMP agent executes the corresponding instruction in the MIB and sends the result to the ArchHttp. It does not need a subagent.

# ARCHTTP PROXY SERVER INSTALLATION

- 4. Display HTTP Connection Information to Console:**  
Select "Yes" to show Http send bytes and receive bytes information in the console.
  - 5. Scan PCI Device:**  
Select "Yes" for ARC-1XXX series adapter.
  - 6. Scan RS-232 Device:**  
Select "No" for ARC-1XXX series adapter.
  - 7. Scan Inband Device:**  
Select "No" for ARC-1XXX series adapter.
  - 8. Event Log File Name:**  
Redefine the file name for "Collect Data" function.
- **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:

Notification Option	Notification Action
<input type="checkbox"/> Disable Event Notification	No Event Notification Will Be Sent
<input type="radio"/> Urgent Error Notification	Send Only Urgent Event
<input type="radio"/> Serious Error Notification	Send Urgent And Serious Event
<input type="radio"/> Warning Error Notification	Send Urgent, Serious And Warning Event
<input type="radio"/> Information Notification	Send All Event
<input type="checkbox"/> Notification for No Event	Notify User if No Event Occurs Within 24 Hours

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 or domain name of the SMTP server to configure your mail program correctly.  
Ex: 192.168.0.2. or smtp.gmail.com

# ARCHTTP PROXY SERVER INSTALLATION

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## 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.

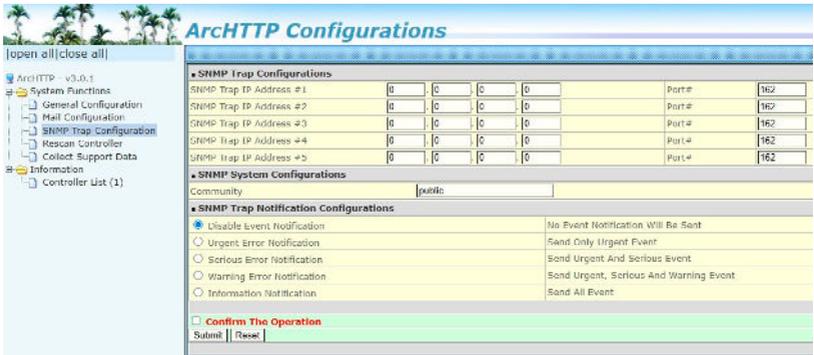
Information Notification: Send all events.

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 adapter, 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 to send the trap without needing to install the SNMP extension agent on the host.

# ARCHTTP PROXY SERVER INSTALLATION



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 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 C. 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. 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.

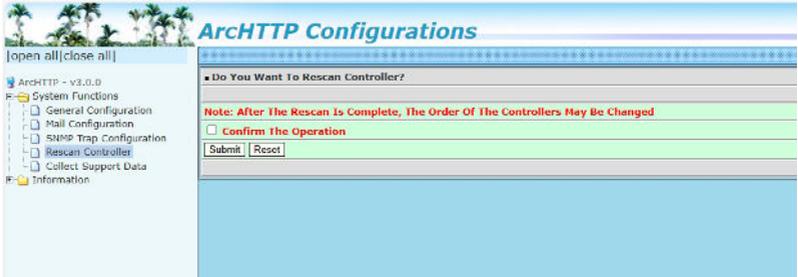
### Note:

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

# ARCHTTP PROXY SERVER INSTALLATION

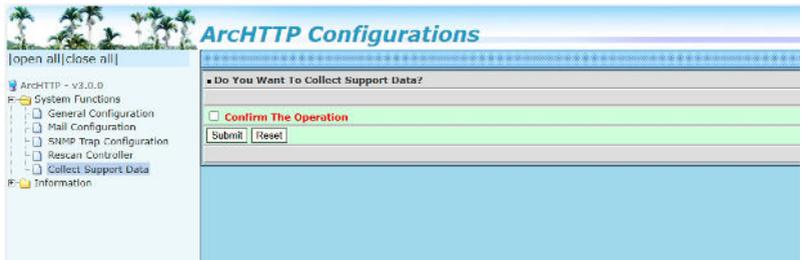
- **Rescan Device Configuration:**

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, raid/volume information, disk information and hardware information) to MRAID directory (file name:ctlrxx-xxxxx.log). It will be automatically started when URGENT or SERIOUS event has occurred.



# WEB BROWSER-BASED CONFIGURATION

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## 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 Setup Utility. 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 (Edge, 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.
- Modify volume set.
- Modify RAID level/stripe size.
- Define pass-through disk drives.
- Define Host DirectIO disk drives.
- Modify system function.
- Designate drives as hot spares.

# WEB BROWSER-BASED CONFIGURATION

## 6.1 Start-up McRAID Storage Manager

With McRAID storage manager, you can:

- Locally manage a system containing a supported RAID adapter that has Windows or macOS, ArchHTTP and a supported browser.

- **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 adapter 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 NVMe RAID adapter. From McRAID

# WEB BROWSER-BASED CONFIGURATION

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storage manager, you need to know its IP address. You can find the IP address assigned by the ArcHTTP proxy server installation: Binding IP:[X.X.X.X] and adapter listen port. See chapter 5.2/5.3 for ArcHTTP proxy server installation.

1. You can click on the individual adapter icon located on left column of the "ArcHTTP 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 NVMe RAID adapter default user name is "admin" and the password is "0000".
- **Start-up from Ethernet Port (Out-of-Band)**

The ARC-1689-32I RAID adapter also offers an alternative out-of-band method for McRAID storage manager. User can access the built-in configuration without running the ArcHttp proxy server on the host system. The web browser-based McRAID storage manager is a HTML-based application, which utilizes the browser installed on your remote system. To ensure proper communications between the NVMe 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 NVMe 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 NVMe 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 and McBIOS "System Information" option. 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 setup utility "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.

The screenshot shows the Areca Technology Corporation RAID System Console. The interface includes a navigation menu on the left and two main data tables. The first table, titled "RAID Set Hierarchy", lists RAID sets and their associated devices. The second table, titled "Enclosure#1: RAID Adapter V1.0", lists physical drives with their usage, capacity, link control, link status, errors, and model.

RAID Set	Devices	Volume Set(Ch/Id/Lun)	Volume State	Capacity
Raid Set # 000	E#1Slot#1 E#1Slot#2 E#1Slot#3 E#1Slot#4 E#1Slot#5 E#1Slot#6 E#1Slot#7 E#1Slot#8	ARC-1689-VOL+D00(0/0/0)	Normal	8000.0GB

Device	Usage	Capacity	Link Control	Link Status	Errors	Model
Slot#1	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#2	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#3	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#4	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#5	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#6	Raid Set # 000	2000.4GB	4xGS	4xGS	01	NVMe PCIe SSD Gen5 Pro Plus
Slot#7	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#8	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus

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. Use this feature to view the RAID switch adapter current physical NVMe device information. The firmware can monitor and check the current attached device status. It includes slot control capabilities, slot link status, transaction error count reports and device information.

# 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 NVMe 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.



# 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.

## 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 "Select The Drives For RAID Set" screen. The interface includes a navigation menu on the left, a header for "Areca Technology Corporation", and a main configuration area. The main area displays a table of available drives for selection, with checkboxes for each slot. Below the table, there are fields for "Raid Set Name" (defaulting to "Raid Set # 000") and "RaidSet Mode" (set to "Max 128 Volumes"). At the bottom, there is a "Confirm The Operation" checkbox and "Submit" and "Reset" buttons.

■ Enclosure#1 : RAID Adapter V1.0			
<input type="checkbox"/>	Slot#1	1000.2GB	NVMe Samsung SSD 9100 PRO 1TB (SED)
<input type="checkbox"/>	Slot#2	1000.2GB	NVMe Samsung SSD 9100 PRO 1TB (SED)
<input type="checkbox"/>	Slot#3	1000.2GB	NVMe Sabrent SB-RKT5-1TB (SED)
<input type="checkbox"/>	Slot#4	1000.2GB	NVMe Sabrent SB-RKT5-1TB (SED)
<input type="checkbox"/>	Slot#5	1000.2GB	NVMe CT1000T700S5D3 (SED)
<input type="checkbox"/>	Slot#6	1000.2GB	NVMe CT1000T700S5D3 (SED)
<input type="checkbox"/>	Slot#7	1000.2GB	NVMe Corsair MP700 ELITE (SED)
<input type="checkbox"/>	Slot#8	1000.2GB	NVMe Corsair MP700 ELITE (SED)

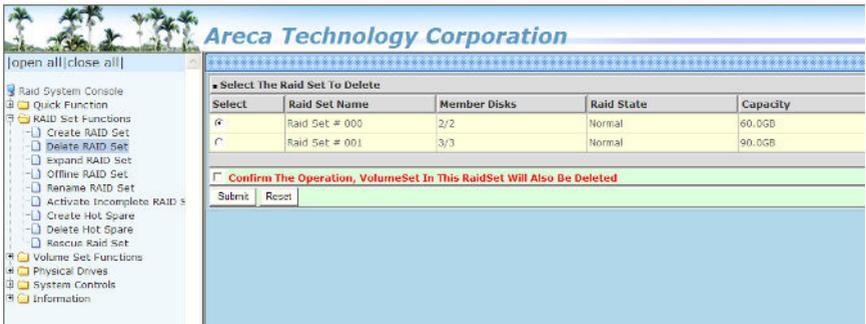
Raid Set Name:   
RaidSet Mode:

Confirm The Operation

# WEB BROWSER-BASED CONFIGURATION

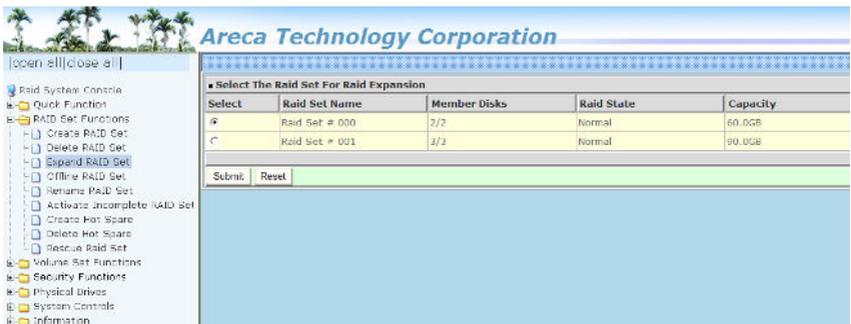
## 6.5.2 Delete Raid Set

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, click 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.



## 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

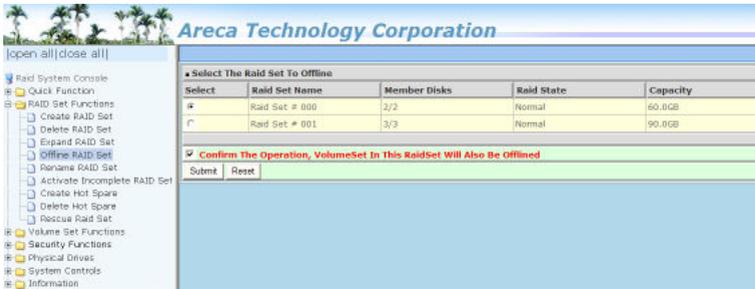
Select the "Expand Raid Set" option. If there is an available disk, then select the target RAID set by clicking on the appropriate check box. Select the target disk by clicking on the appropriate check box. Click on the "Submit" button to start the expansion on the RAID set. The new additional capacity 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 spare is available, an auto rebuild operation will occur after the RAID set expansion completes.
3. RAID set expansion is a quite critical process, we strongly recommend customer backup data before expand. Unexpected accident may cause serious data corruption.

## 6.5.4 Offline Raid Set

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



# WEB BROWSER-BASED CONFIGURATION

## 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

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 NVMe 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 Raidset state will change to "Degraded Mode" and Volumes in this Raidset will appears with corresponding state.



# WEB BROWSER-BASED CONFIGURATION

## 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.

The screenshot shows the "Areca Technology Corporation" web interface. On the left is a navigation tree with "RAID Set Functions" expanded to "Create Hot Spare". The main content area is titled "Select The Drives For Hot Spare" and shows "Enclosure#1 : RAID Adapter V1.0". It contains a table of available drives:

Slot	Capacity	Model
<input type="checkbox"/> Slot#5	1000.2GB	NVMe CT1000T700SSD3 (SED)
<input type="checkbox"/> Slot#6	1000.2GB	NVMe CT1000T700SSD3 (SED)
<input type="checkbox"/> Slot#7	1000.2GB	NVMe Corsair MP700 ELITE (SED)
<input type="checkbox"/> Slot#8	1000.2GB	NVMe Corsair MP700 ELITE (SED)

Below the table, "Select The Hot Spare Type" is set to "Global Hot Spare". There are two radio buttons: "Confirm The Operation" (checked) and "Dedicated To Enclosure". At the bottom are "Submit" and "Reset" buttons.

## 6.5.8 Delete Hot Spare

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

The screenshot shows the "Areca Technology Corporation" web interface for deleting a hot spare. The navigation tree on the left is expanded to "Delete Hot Spare". The main content area is titled "Select The Hot Spare Drive To Delete" and shows "Enclosure#1 : Areca VirtualSES R801". It contains a table of existing hot spares:

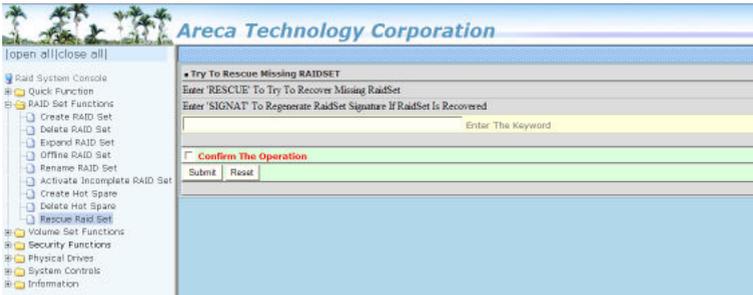
Slot	Capacity	Model
<input checked="" type="checkbox"/> Slot#1	250.1GB	NVMe WDC WD5250G2B0C- (SED)[Global-SSD]
<input type="checkbox"/> Slot#2	500.1GB	NVMe WD5500G1X0E-00AF (SED)[Global-SSD]

Below the table, "Confirm The Operation" is checked. At the bottom are "Submit" and "Reset" buttons.

# WEB BROWSER-BASED CONFIGURATION

## 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.

# WEB BROWSER-BASED CONFIGURATION

---

## 6.6 Volume Set Functions

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

The following is the volume set features for the NVMe 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 adapter is capable of 64-bit LBA mode and 4K block mode.

### 6.6.1 Create Volume Set

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. Click 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, Logic Block Size, Initialization Mode, Strip Size, Write Protect, and SCSI Channel/SCSI ID/SCSI Lun.

#### **Note:**

The currently firmware is only exposed 16 volumes to the operating system (OS):

1. ID:0~1
2. LUN:0~7.

# WEB BROWSER-BASED CONFIGURATION



- **Volume Name**

The default volume name will always appear as "ARC-1689-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.

- **Logic Block Size**

Controller uses the "Logic Block Size" sub-menu to set the volume capacity and sector size. It supports option: "Auto" and "4K Block".

# WEB BROWSER-BASED CONFIGURATION

---

## - **Auto**

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.

## - **4K Block**

This option uses 16 bytes CDB and changes the sector size from default 512 bytes to 4k bytes.

## ● **Initialization Mode**

"Trim And Clear", there is no initialization on this volume. "No Init" is for customer to rescue volume without losing data in the disk.

### **Note:**

Controller starts to initialize the volume in two conditions

1. Stay in adapter bios setup utility 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 or 10 logical drive. You can set the stripe size to 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.

## ● **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.

# WEB BROWSER-BASED CONFIGURATION

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

SCSI Channel: The NVMe 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 NVMe RAID adapter is a large SCSI device. Assign an ID from a list of SCSI IDs.

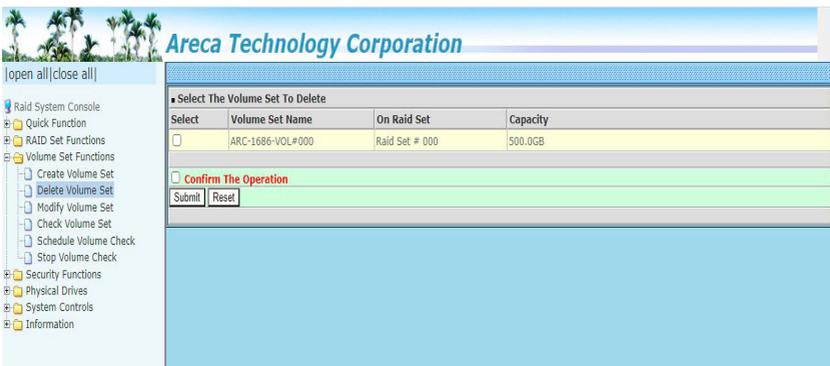
**Note:**

The current firmware is only exposed 16 volumes (ID:0~1) to the operating system (OS).

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

## 6.6.2 Delete Volume Set

To delete a volume from a 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.



# WEB BROWSER-BASED CONFIGURATION

## 6.6.3 Modify Volume Set

To modify a volume set from a RAID set:

1. Click the "Modify Volume Set" link.
2. Click the volume set check box from the list that you wish to modify. Click the "Submit" button. The following screen appears. Use this option to modify the volume set attributes. After you complete the modification, click the "Confirm The Operation" check box and click the "Submit" button to complete the action. The user can only modify the last volume set capacity.



### 6.6.3.1 Volume Growth

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

# WEB BROWSER-BASED CONFIGURATION

## To expand an existing volume noticed:

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

## For greater 2TB expansion:

- Expand over 2TB used LBA64 mode. Please make sure your OS supports LBA64 before expand it.

### 6.6.3.2 Volume Set Migration

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

RAID Set	Devices	Volume Set(Ch/Id/Len)	Volume State	Capacity
Raid Set # 000	E*1Slot*3	ARC-1086-VOL*000(0/0/0)	Normal	250.0GB

Device	Usage	Capacity	Model
Slot#1	N.A.	N.A.	N.A.
Slot#2	N.A.	N.A.	N.A.
Slot#3(12)	Free	250.1GB	NVMe KINGSTON SA2000H
Slot#4(18)	Free	250.1GB	NVMe WDC PC SM720 SDA
Slot#5(19)	Raid Set # 000	250.1GB	NVMe WDC WD5250G2B0C
Slot#6(1A)	Free	250.1GB	NVMe WDC WD5250G2B0C

### Note:

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

### 6.6.3.3 Volume Write Protection

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

## 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.

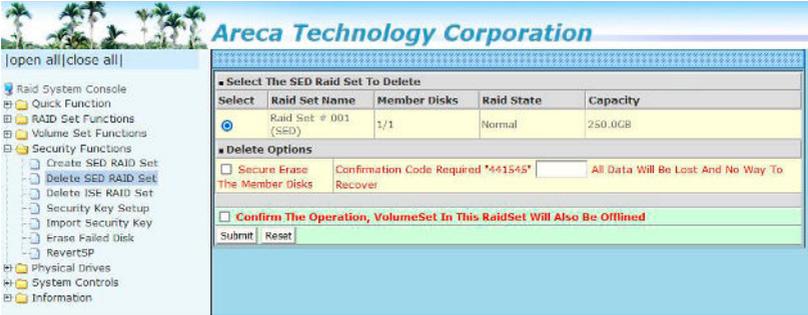
### 6.7.1 Create SED RAID Set



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. The currently firmware is only exposed 16 volumes to the operating system (OS): ID:0~1

# 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.

## 6.7.3 Delete ISE RAID Set



# WEB BROWSER-BASED CONFIGURATION

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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 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 ISE RAID Set". It will be deleted by this action.

## 6.7.4 Security Key Setup

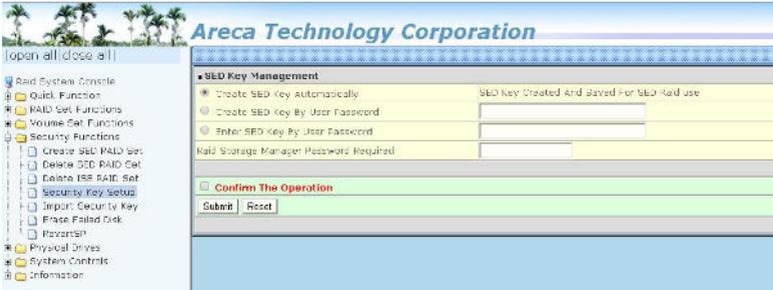
The Areca RAID adapters support Self-Encrypting Disks (SED) for protection of data against loss or theft of SEDs. Protection is achieved by the SED hard drive that automatically and continuously encrypts the data on the drive without any user interaction. There is one SED key per adapter. You can manage 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.



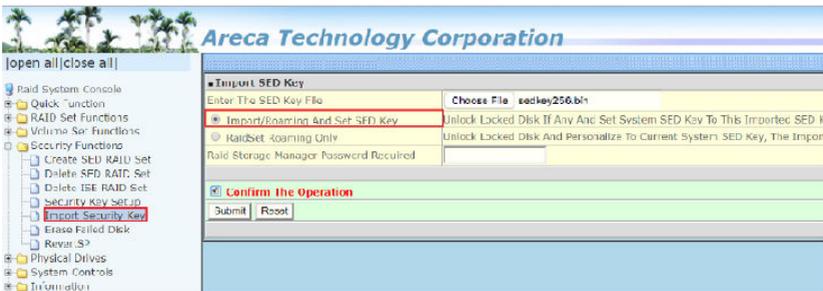
In some cases, you may want to export a SED key to store on removable media or to use on a different computer. If you want to create a backup copy of the SED key or use it on another computer, you must first export the SED key. Exporting the SED key puts it in a file (filename.bin) that you can then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

# WEB BROWSER-BASED CONFIGURATION



## 6.7.5 Import Security Key

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

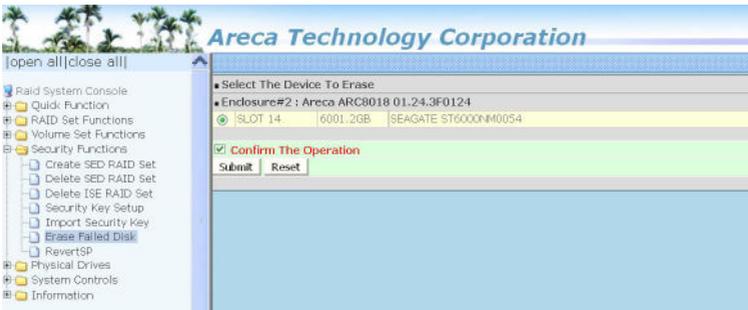


1. Select the "Import/Roaming And Set SED Key" option to unlock the locked disk and change to foreign SED key.
2. Select the "RaidSet Roaming Only" option to unlock the locked disk and personalize to new adapter's SED key. If there is an existing SED key on new adapter, RaidSet is updated with the new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

# WEB BROWSER-BASED CONFIGURATION

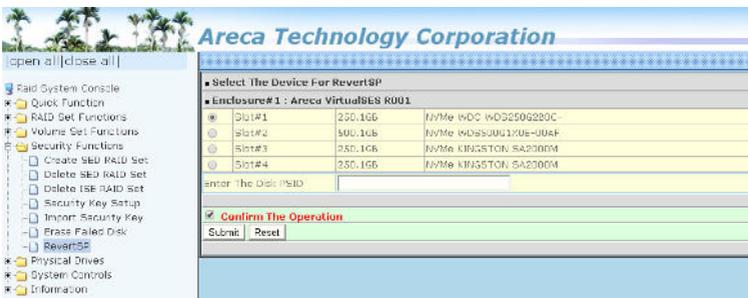
## 6.7.6 Erase Failed Disk

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. Click 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.



# WEB BROWSER-BASED CONFIGURATION

## 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 NVMe 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 Write Protection, Tagged Command Queuing, and SCSI channel/SCSI\_ID/SCSI\_LUN for this pass-through disk.

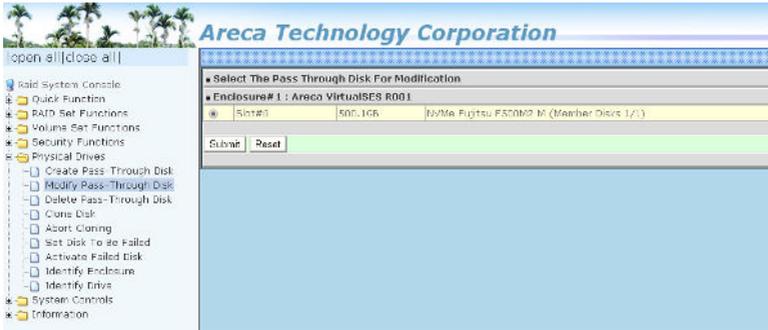


### 6.8.2 Modify Pass-Through Disk

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

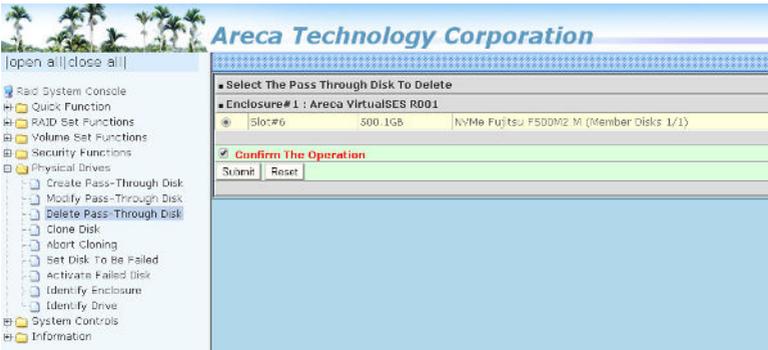
# WEB BROWSER-BASED CONFIGURATION

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



## 6.8.3 Delete Pass-Through Disk

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



# WEB BROWSER-BASED CONFIGURATION

## 6.8.4 Host DirectIO Config

A Host DirectIO disk is not controlled by the NVMe 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 NVMe RAID adapter firmware. Use “Host DirectIO Config” link, you can select which drives you want to config.

The screenshot shows the "Host DirectIO Config" page for Enclosure#1: RAID Adapter V1.0. The left sidebar contains a navigation menu with options like "Raid System Console", "Quick Function", "RAID Set Functions", "Volume Set Functions", "Security Functions", and "Physical Drives". The "Host DirectIO Config" option is selected. The main content area displays a table of slots and their configurations:

■ Host DirectIO Config			
■ Enclosure#1 : RAID Adapter V1.0			
<input checked="" type="checkbox"/>	Slot#1	1000.2GB	NVMe Samsung SSD 9100 PRO 1TB
<input checked="" type="checkbox"/>	Slot#2	1000.2GB	NVMe Samsung SSD 9100 PRO 1TB
<input type="checkbox"/>	Slot#3	1000.2GB	NVMe Sabrent SB-RKT15-1TB
<input type="checkbox"/>	Slot#4	1000.2GB	NVMe Sabrent SB-RKT15-1TB
<input type="checkbox"/>	Slot#5	1000.2GB	NVMe CT1000T7005SD3
<input type="checkbox"/>	Slot#6	1000.2GB	NVMe CT1000T7005SD3
<input type="checkbox"/>	Slot#7	1000.2GB	NVMe Corsair MP700 ELITE
<input type="checkbox"/>	Slot#8	1000.2GB	NVMe Corsair MP700 ELITE

At the bottom, there is a "Confirm The Operation" section with "Submit" and "Reset" buttons.

## 6.8.5 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.”

The screenshot shows the "Select The Drives For Cloning" page for Enclosure#1: Areca VirtualB-S X8U1. The left sidebar is similar to the previous screenshot, with "Clone Disk" selected under "Physical Drives". The main content area displays a table of slots and their configurations:

■ Select The Drives For Cloning				
■ Enclosure#1 : Areca VirtualB-S X8U1				
<input type="checkbox"/>	Slot#1	Hot Spare	250.1GB	NVMe WD0500J2B0C (SE)
<input type="checkbox"/>	Slot#2	Hot Spare	200.1GB	NVMe WD5000LX0E-00AF (SE)
<input type="checkbox"/>	Slot#3	Raid Set # 000	250.1GB	NVMe KINGSTON SA2000M (SE)
<input type="checkbox"/>	Slot#4	Raid Set # 000	250.1GB	NVMe KINGSTON SA2000M (SE)
<input type="checkbox"/>	Slot#5	Raid Set # 000	250.1GB	NVMe FUJITSU P530M2 H
<input checked="" type="checkbox"/>	Slot#6	Import Through (U)	250.1GB	NVMe FUJITSU P530M2 H [Clone source#1]

Below the table, there is a "Select Clone Type" dropdown menu with "Clone And Replace" selected. There is also a "Confirm The Operation" section with "Submit" and "Reset" buttons.

# WEB BROWSER-BASED CONFIGURATION

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## 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.

### 6.8.5.1 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".

### 6.8.5.2 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.

### 6.8.6 Abort Cloning

Use this function to stop the ongoing clone disk action.

# WEB BROWSER-BASED CONFIGURATION

## 6.8.7 Set Disk To Be Failed

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



## 6.8.8 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 “Failed”.

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 will be considered as “Removed-Disk”.



# WEB BROWSER-BASED CONFIGURATION

## 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.

The screenshot shows the Areca Technology Corporation RAID configuration web interface. The left sidebar contains a tree view of configuration options, with "Identify Drive" selected. The main area displays a table for "Enclosure#1 : RAID Adapter V1.0" with columns for Slot#, Capacity, and Model. The "Identify Drive" option is selected in the left sidebar.

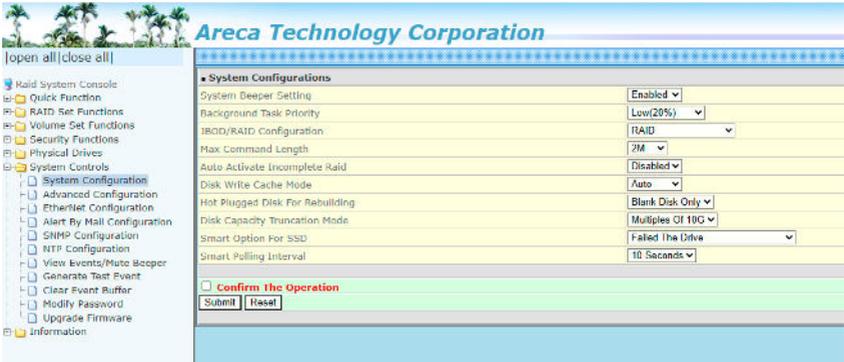
■ Select The Device For Identification		
■ Enclosure#1 : RAID Adapter V1.0		
<input checked="" type="radio"/>	Slot#1	1000.2GB NVMe Samsung SSD 9100 PRO 1TB
<input type="radio"/>	Slot#2	1000.2GB NVMe Samsung SSD 9100 PRO 1TB
<input type="radio"/>	Slot#3	1000.2GB NVMe Sabrent SB-RKT5-LTB
<input type="radio"/>	Slot#4	1000.2GB NVMe Sabrent SB-RKT5-LTB
<input type="radio"/>	Slot#5	1000.2GB NVMe CT1000T700SSD3
<input type="radio"/>	Slot#6	1000.2GB NVMe CT1000T700SSD3
<input type="radio"/>	Slot#7	1000.2GB NVMe Corsair MP700 ELITE
<input type="radio"/>	Slot#8	1000.2GB NVMe Corsair MP700 ELITE

# WEB BROWSER-BASED CONFIGURATION

## 6.9 System Controls

### 6.9.1 System Config

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



- **System Beeper Setting**

The “System Beeper Setting” function is used to “Disabled” or “Enabled” the NVMe RAID adapter alarm tone generator.

- **Background Task Priority**

The “Background Task Priority” is a relative indication of how much time the adapter devotes to a rebuild operation. The NVMe 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 NVMe disks in a RAID box are not set up as any type of RAID configuration. All NVMe drives are available to the operating system as an individual disk. JBOD does not provide data redundancy. User needs to delete the RAID set, when you want to change the option from the RAID to the JBOD function.

# WEB BROWSER-BASED CONFIGURATION

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JBOD Controller IO: All NVMe drives in "JBOD Controller IO" are controlled by the NVMe RAID adapter firmware and thus cannot be a part of a volume set.

JBOD Host Direct IO: All attached NVMe drives in "JBOD Host Direct IO" mode are not controlled by the NVMe 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 NVMe RAID adapter firmware.

- **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 NVMe 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.

- **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.

# WEB BROWSER-BASED CONFIGURATION

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

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

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

- **Disk Capacity Truncation Mode**

ARC-1689-32I 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 same capacity for both of these drives so that one could replace the other.

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

**Disabled:** It does not truncate the capacity.

- **Smart Option For SSD**

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.

# WEB BROWSER-BASED CONFIGURATION

“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

User can define the Smart Pulling Interval to pull the SMART status of each drive.

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

That is why you don’t want to set the interval too frequent. What to use is up to the users to decide based on their applications and experiment results.

## 6.9.2 Advanced Configuration

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



# WEB BROWSER-BASED CONFIGURATION

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- **Timeout Setting**

Disk time-out is a registry setting that defines the time that RAID adapter will wait for a NVMe drive 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.

- **PCIe Read Request Size**

The maximum read request size (MRRS) in PCIe defines the largest chunk of data that a device can request in a single read transaction. It's a configurable parameter, typically set to values like 128B, 256B, 512B, 1024B, 2048B, or 4096B. The MRRS, along with the Max Payload Size (MPS), helps optimize data transfer and prevent one device from monopolizing PCIe bandwidth.

- **PCIe Max Payload Size**

The PCIe Max Payload Size (MPS) determines the maximum amount of data that can be transmitted in a single PCIe Transaction Layer Packet (TLP). It's a configuration setting negotiated between the PCIe device and the host, and influences the efficiency of data transfer. Larger MPS values can lead to increased bandwidth utilization and potentially better performance, but also require more hardware resources for processing. It's a configurable parameter, typically set to values like 128B, 256B, 512B, 1024B, 2048B, or 4096B.

- **Fail Disk For 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.

# WEB BROWSER-BASED CONFIGURATION

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This function is the option that RAID adapter will kill off the NVMe for any time out. It can reduce the write cache size to buffer the raw data.

- **CPU Fan Control**

You can select "Full Speed" or "Auto" to control RAID adapter Fan.

- **Full Speed** : CPU fan always run at full speed.

- **Auto** : RAID adapter automatically adjust fan speed based on the current temperature of RAID adapter.

- **Save SED Key In Controller**

- **Enabled** : if key exists, save to setup.

- **Disabled** : clear SED Key saved in setup.

When configure to 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.

- **PCIE Host Speed**

Use the PCIE Host Speed option to PCI Express speed at which the server allows PCI Express devices to operate. The option can also used to address issues with problematic PCI Express devices. Setting this value to Maximum Supported configures the platform to run at the maximum speed supported by the platform or the PCIe device, whichever is lower. It's a configurable parameter, typically set to values like Auto, Gen2, Gen3, Gen4, or Gen5.

- **PCIE Host ASPM**

PCIe Host Active State Power Management (ASPM) is a power management mechanism implemented at the PCIe link layer. Its primary purpose is to automatically adjust the PCIe link to a low-power state without requiring direct involvement from the system software, thereby saving energy. When a PCIe link is idle or has low traffic, ASPM allows it to enter a lower power consumption state. t's a configurable parameter, typically set to values Enabled or Disabled.

# WEB BROWSER-BASED CONFIGURATION

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- **NVMe SSD ASPM**

NVMe SSD Active State Power Management (ASPM) is a power management mechanism implemented at the NVMe link layer. Its primary purpose is to automatically adjust the NVMe link to a low-power state without requiring direct involvement from the system software, thereby saving energy. When a NVMe link is idle or has low traffic, ASPM allows it to enter a lower power consumption state. It's a configurable parameter, typically set to values Enabled or Disabled.

- **CNT#x Speed (NVMe Speed)**

Each MCIO [x8] CNT# includes two quads (Quad1 and Quad2). Use the CNT#x Speed option to set slot speed at which the ARC-1689-32I allows NVMe device to operate. The option can also be used to address issues with problematic NVMe devices. Setting this value to Maximum Supported configures the platform to run at the maximum speed supported by the ARC-1689-32I or the NVMe device, whichever is lower. It's a configurable parameter, typically set to values like Auto, Gen2, Gen3, Gen4, or Gen5.

- **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 NVMe for reading error account setting value.

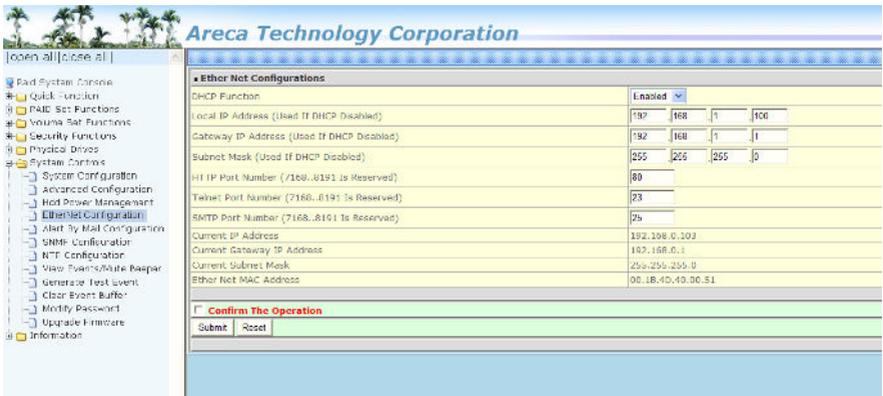
- 3 errors in 70 seconds: this option also includes 4 errors in 100 seconds, 5 errors in 120 seconds
- 6 errors in 2 minutes: this option also includes 8 errors in 180 seconds, 10 errors in 240 seconds
- 9 errors in 3 minutes: this option also includes 12 errors in 270 seconds, 15 errors in 360 seconds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

# WEB BROWSER-BASED CONFIGURATION

## 6.9.3 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 firmware-embedded web browser-based RAID manager can access it from any standard internet browser or from any host computer either directly connected or via a LAN or WAN with no software or patches required.

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.



### • DHCP Function

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

# WEB BROWSER-BASED CONFIGURATION

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(called a lease period) and to eliminate the work necessary to administer a large IP network. Select the "Disabled" or "Enabled" option to enable or disable the DHCP function. If DHCP is disabled, it will be necessary to manually enter a static IP address that does not conflict with other devices on the network.

- **Local IP Address (Used If DHCP Disabled)**

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. It shows the default address setting in the RAID controller. You can then reassign the static IP address of the controller.

- **Gateway IP Address (Used If DHCP Disabled)**

A gateway IP address is the address of a router on your local network that directs traffic to other networks, such as the internet. It acts as a "default gateway" for your devices, sending their requests to destinations outside your local network

- **Subnet Mask (Used If DHCP Disabled)**

The subnet mask defines the portion of the IP address that identifies the network, so selecting the correct subnet mask ensures that your device can communicate with other devices on the local network and the internet

- **HTTP Port Number**

This option manually configures the "HTTP Port Number" of the controller. It shows the default address setting in the RAID controller. Then You can reassign the default "HTTP Port Number" of the controller.

# WEB BROWSER-BASED CONFIGURATION

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## **Note:**

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

- **Telnet Port Number**

This option manually configures the "Telnet Port Number" of the controller. It shows the default address setting in the RAID controller. You can then reassign the default "Telnet Port Number" of the controller.

- **SMTP Port Number**

This option manually configures the "SMTP Port Number" of the controller. It shows the default address setting in the RAID controller. You can then reassign the default "SMTP Port Number" of the controller.

## **6.9.4 Alert By Mail Configuration**

To configure the NVMe 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.

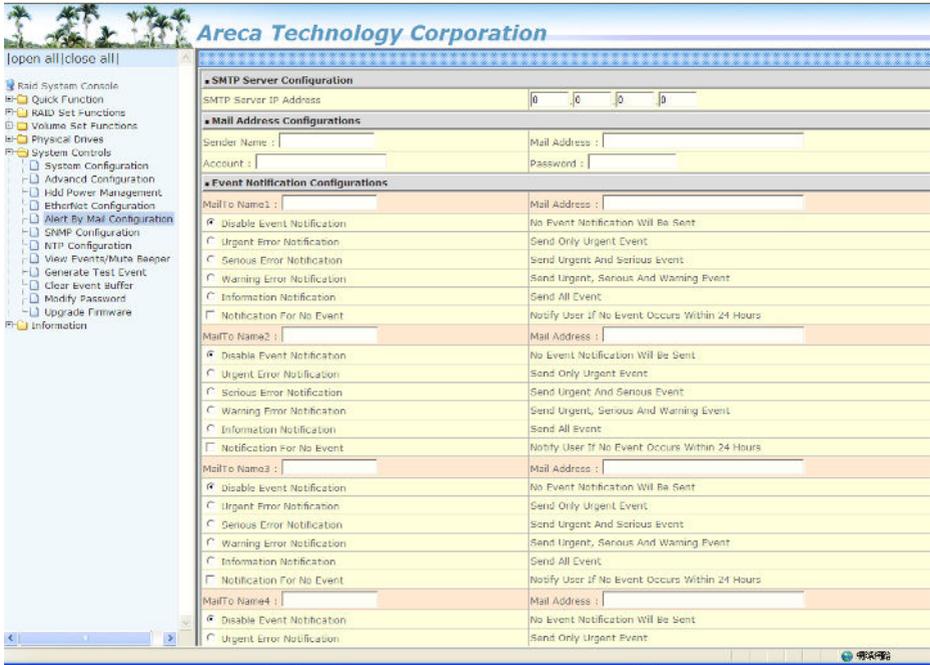
The following article describes a best practice methodology for setting this up in the "SMTP Server Configurations".

### **1. SMTP Server Configuration:**

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

Ex: 192.168.0.2. or smtp.gmail.com

# WEB BROWSER-BASED CONFIGURATION



## 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.

# WEB BROWSER-BASED CONFIGURATION

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.

## 6.9.5 SNMP Configuration

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

The screenshot shows the 'Areca Technology Corporation' web interface. On the left is a navigation tree with categories like RAID Set, Volume Set Functions, Security Functions, and Physical Drives. The main content area is titled 'SNMP Trap Configurations' and contains several sections:

- SNMP Trap Configurations:** A table with 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 list of notification types with radio buttons and descriptions:
  - 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 PCI Inband: Ethernet SNMP Is Disabled
- Confirm The Operation:** A green bar with 'Submit' and 'Cancel' buttons.

### 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.

# WEB BROWSER-BASED CONFIGURATION

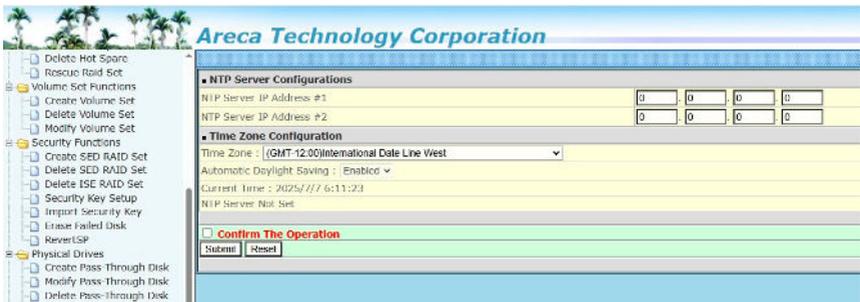
## 3. SNMP Trap Notification Configurations

Event Notification Table refers to Appendix B. 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.

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

## 6.9.6 NTP Configuration

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



### ● NTP Server Address

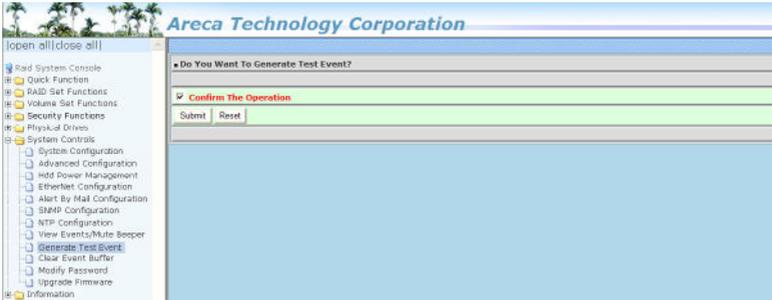
The most important factor in providing accurate, reliable time is the selection of NTP servers to be used in the configuration file. Typical NTP configurations utilize multiple redundant servers and diverse network paths in order to achieve high accuracy and reliability. Our NTP configuration supports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



# WEB BROWSER-BASED CONFIGURATION

## 6.9.8 Generate Test Event

Use this feature to generate events for testing purposes.



## 6.9.9 Clear Events Buffer

Use this feature to clear the entire events buffer information.



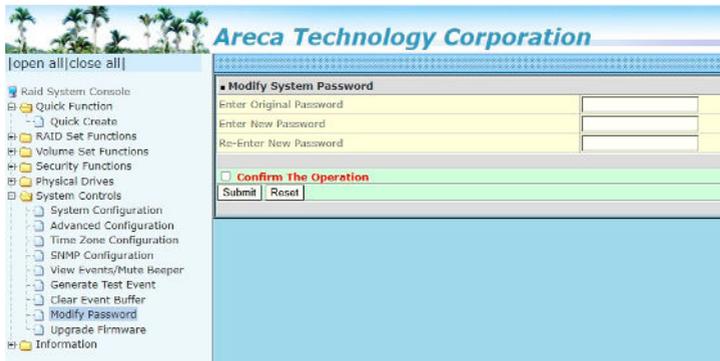
## 6.9.10 Modify Password

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

**The manufacture default password is set to 0000.**

The password option allows user to set or clear the 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.

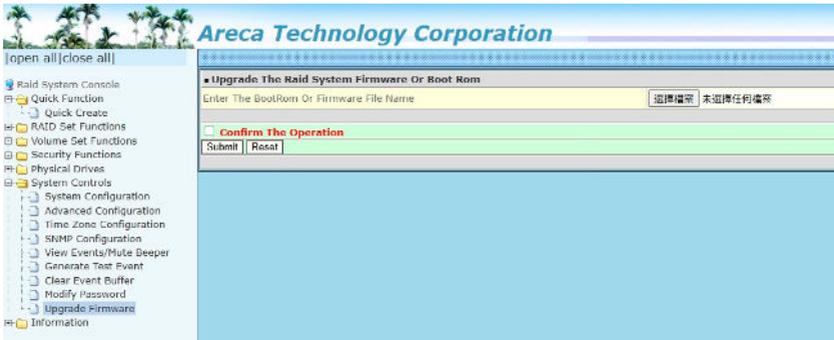
# WEB BROWSER-BASED CONFIGURATION



The system will automatically go back to the initial screen if it does not receive any command in 5 minutes. Do not use spaces when you enter the password, If spaces are used, it will lock out the user. To disable the password, leave the fields blank. Once the user confirms the operation and clicks the "Submit" button, the existing password will be cleared. Then, no password checking will occur when entering the main menu from the starting screen.

## 6.9.11 Update Firmware

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



# WEB BROWSER-BASED CONFIGURATION

## 6.10 Information

### 6.10.1 Raid Set Hierarchy

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

RAID Set	Devices	Volume Set(Ch/Id/Lun)	Volume State	Capacity
Raid Set # 000	E#1Slot#1 E#1Slot#2 E#1Slot#3 E#1Slot#4 E#1Slot#5 E#1Slot#6 E#1Slot#7 E#1Slot#8	ABC1689-VOL#000(00/0)	Normal	8000.0GB

Device	Usage	Capacity	Link Control	Link Status	Errors	Model
Slot#1	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#2	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#3	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#4	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus
Slot#5	Raid Set # 000	2000.4GB	4xGS	4xGS	00	NVMe PCIe SSD Gen5 Pro Plus

- **Raid Set Information**

To view the Raid Set function, move the cursor to the main menu and click the "Information" link. The "Raid Set Hierarchy" menu will show all items, and then select the "Raid Set" item.

Raid Set Information	
Raid Set Name	Raid Set # 000
Member Disks	3
Total Raw Capacity	6000.0GB
Free Raw Capacity	0.1GB
Min Member Disk Size	2000.0GB
Supported Volumes	128
Security Status	3/3 ISE Disks
Raid Set State	Normal

- **Device & Slot Signal Integrity Information**

The "Raid Set Hierarchy" menu will show all items, and then select the "Device" item. This area can view the RAID adapter current physical device and slot signal integrity information. The firmware can monitor and check the current attached device status. It includes slot control capabilities, slot link status, transaction error count reports and device information.

# WEB BROWSER-BASED CONFIGURATION

mation. A error count refers to the number of bit errors detected by the physical layer transceivers within the PCIe switch. These errors can be correctable, where the system can recover without data loss or intervention, or uncorrectable, which negatively impact the interface's function and a high rate can indicate underlying signal integrity issues that may impact performance (latency, bandwidth) or system failures.

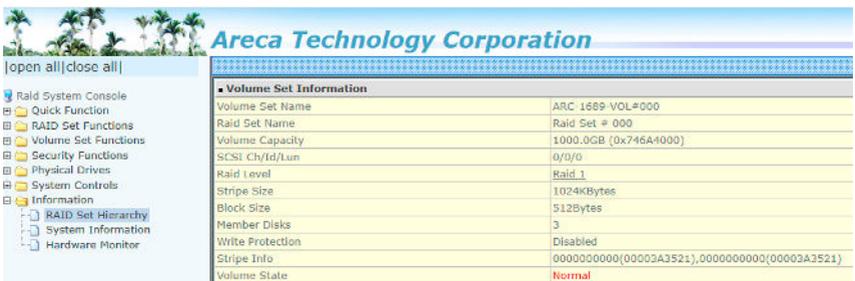


The screenshot shows the RAID System Console interface. On the left is a navigation tree with the following items: Raid System Console, Quick Function, RAID Set Functions, Volume Set Functions, Security Functions, Physical Drives, System Controls, and Information. Under Information, RAID Set Hierarchy is expanded to show RAID Set Hierarchy, System Information, and Hardware Monitor. The main content area displays the "Device Information" table.

Device Information	
Device Type	NVMe(6479A79E20000001)
Device Location	Enclosure#1 Slot#1
Model Name	NVMe PCIe SSD Gen5 Pro Plus
Serial Number	DBFB194C05AA0000002
Firmware Rev.	EQFM22.3
Disk Capacity	2000.4GB
Physical Block Size	512
Logical Block Size	512
Current NVMe Speed	32Gx4
Supported NVMe Speed	32Gx4
Device State	Normal
Security Capability	TCG-Opal SED
Security State	Disabled
Timeout Count	0
Media Error Count	0
Rotation Speed	SSD
Device Temperature	31 °C
SSD Trim Support	Return Zero
NVMe Revision	2.0
Max Data Transfer Size	512 KB

- **Volume Set Information**

The "Raid Set Hierarchy " menu will show all items, and then select the "Volume Set" item.



The screenshot shows the RAID System Console interface with the "Volume Set Information" table displayed. The navigation tree on the left is the same as in the previous screenshot, but "System Information" is now selected under the "Information" menu.

Volume Set Information	
Volume Set Name	ARC_1689-VOL#000
Raid Set Name	Raid Set # 000
Volume Capacity	1000.0GB (0x746A4000)
SCSI Ch/Id/Lun	0/0/0
Raid Level	Raid_1
Stripe Size	1024KBytes
Block Size	512Bytes
Member Disks	3
Write Protection	Disabled
Stripe Info	000000000(00003A3521),000000000(00003A3521)
Volume State	Normal

## 6.10.2 System Information

To view the NVMe RAID adapter's system information, move the mouse cursor to the main menu and click on the "System Information" link. The NVMe RAID adapter "RAID Subsystem Information" screen appears. Use this feature to view the NVMe RAID

# WEB BROWSER-BASED CONFIGURATION

adapter's system information. The adapter name, adapter firmware version, Boot ROM version, serial number, main processor, CPU instruction/data cache size, and PCI-E link status appear in this screen.

The screenshot shows the 'System Information' page of the RAID management interface. The left sidebar contains a tree view with 'System Information' selected. The main content area displays the following information:

■ RAID Subsystem Information	
Controller Name	ARC-1689-8X
Firmware Version	V1.70 2024-08-05
BOOT ROM Version	V1.71 2025-03-24
Serial Number	1100-2116-6633
Unit Serial #	
Main Processor	2.0GHz Cortex-A15 RevA0
CPU ICache Size	32KBytes
CPU DCache Size	32KBytes/Write Back
CPU SCache Size	512KBytes/Write Back
PCI-E Link Status	16X/8G

## 6.10.3 Hardware Monitor

Provides the PEX89048 switch chip temperature (Main Temperature and Temperature#0~4), Voltage, and installed NVMe SSD temperature and of the NVMe RAID adapter on this screen.

The screenshot shows the 'Hardware Monitor' page of the RAID management interface. The left sidebar contains a tree view with 'Hardware Monitor' selected. The main content area displays the following information:

Stop Auto Refresh

■ Controller H/W Monitor	
Main Temperature	43 °C
Temperature#0	43 °C
Temperature#1	46 °C
Temperature#2	48 °C
Temperature#3	45 °C
Temperature#4	45 °C
0.8V	0.840 V
1.25V	1.232 V
1.8V	1.818 V
12V	11.951 V
Battery Status	Not Installed

■ Enclosure#1 : RAID Adapter V1.0	
Slot#1 SSD Temp.	40 °C
Slot#2 SSD Temp.	39 °C
Slot#3 SSD Temp.	33 °C
Slot#4 SSD Temp.	32 °C
Slot#5 SSD Temp.	33 °C
Slot#6 SSD Temp.	34 °C
Slot#7 SSD Temp.	39 °C
Slot#8 SSD Temp.	47 °C

# APPENDIX

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## Appendix A

### Upgrading Flash ROM Update Process

#### A-1 Overview

Since the NVMe 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, 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:

ARC1689UEFI-32I.BIN:→ An EFI shell and home brewed small application

ARC1689BOOT-32I.BIN :→ RAID adapter hardware initialization

ARC1689FIRM-32I.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 ARC1689FIRM-32I.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.

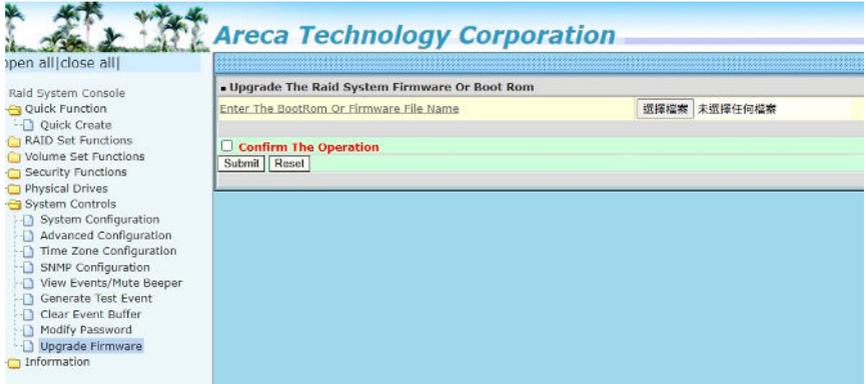
#### **Note:**

Please update all binary code (UEFI, BOOT, and FIRM) 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 NVMe RAID adapter. For example, download the bin file from your OEM's web site onto the C: drive.



1. To upgrade the NVMe 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 and out-of-band on-board lan port. The in-band method uses the ArchHTTP proxy server to launch the McRAID storage manager.

# APPENDIX

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## A-3 Upgrading Firmware Through nflash DOS Utility

Areca now offers an alternative means communication for the NVMe RAID adapter – Upgrade the all files (BOOT and FIRM) without necessary system starting up to running the ArcHTTP 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 NVMe RAID adapter and nflash DOS utility. Please make a bootable DOS USB devices from other Windows operating system and boot up the system from this bootable device.

- **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:

```
A:\nflash
Raid Controller Flash Utility
V1.61 2022-02-24
Command Usage:
NFLASH FileName
NFLASH FileName /cn --> n=0,1,2,3 write binary to adapter#0
FileName May Be ARC1689FIRM-32I.BIN or ARC1689*
For ARC1686* Will Expand To ARC1689BOOT-32I /FIRM-32I

A:\>nflash arc168~1.bin
Raid Controller Flash Utility
V1.61 2022-02-24
MODEL : ARC-1689-32I
MEM FE620000 FE7FF000
File ARC168~1.BIN : >>*** => Flash OK
```

# APPENDIX

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## A-4 Upgrading Firmware Through CLI

This Command Line Interface (CLI) provides you to configure and manage the NVMe 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 (UEFI, 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\ARC1689FIRM-32I.  
BIN.]  
Command: sys updatefw path=c:\fw\arc1689firm-32i.bin [Enter]
```

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## Appendix B

### 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	NVMe SSD inserted	
Device Removed	Warning	NVMe SSD removed	
Reading Error	Warning	NVMe SSD reading error	Keep Watching NVME SSD status, may be it caused by noise or NVME SSD unstable.
Writing Error	Warning	NVMe SSD writing error	Keep Watching NVME SSD status, may be it caused by noise or NVME SSD unstable.
Time Out Error	Warning	NVMe SSD time out	Keep Watching NVMe SSD status, may be it caused by noise or NVME SSD unstable.
Device Failed	Urgent	NVMe SSD failure	Replace NVMe SSD
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	NVMe SSD SMART failure	Replace NVMe SSD
PassThrough Disk Created	Inform	Pass Through Disk created	
PassThrough Disk Modified	Inform	Pass Through Disk modified	
PassThrough Disk Deleted	Inform	Pass Through Disk deleted	

# APPENDIX

## B. Volume Event

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

## C. RAID Set Event

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

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## D. Hardware Monitor Event

Event	Level	Meaning	Action
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 low speed margin	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	NVMe SSD temperature back to normal level	
Raid Powered On	Warning	RAID power on	
Test Event	Urgent	Test event	
Power On With Battery Backup	Warning	RAID power on with battery backup	
Incomplete RAID Discovered	Serious	Some RAID set member disks missing before power on	Check disk information to find out which channel missing.
HTTP Log In	Serious	a HTTP login detected	
Telnet Log	Serious	a Telnet login detected	
InVT100 Log In	Serious	a VT100 login detected	
API Log In	Serious	a API login detected	
Lost Rebuilding/ Migration LBA	Urgent	Some rebuilding/ migration RAID set member disks missing before power on.	Reinserted the missing member disk back, adapter will continue the incomplete rebuilding/ migration.

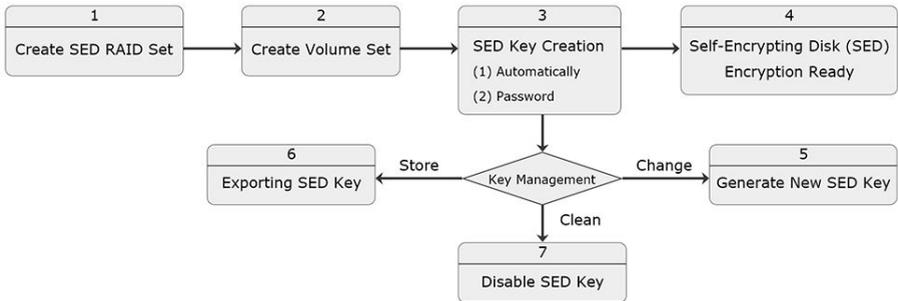
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## Appendix C

### 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**



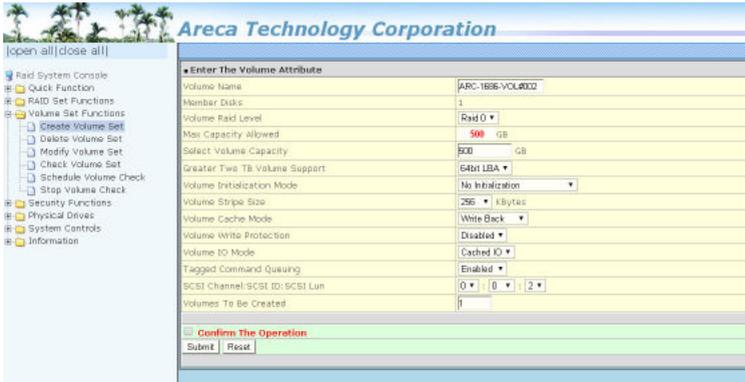
#### Step 1. Create SED RAID Set



# APPENDIX

## Step 2. Create Volume Set

Create volume set in the web management.



## 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.



## 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.

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## 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.

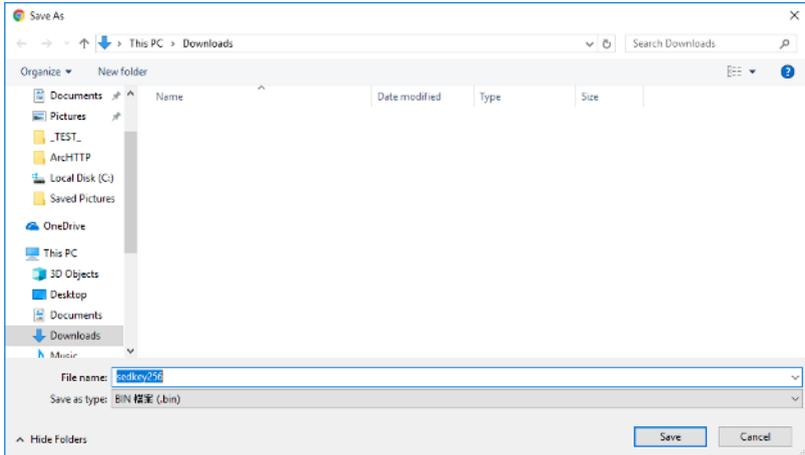


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Exporting the SED key puts it in a file (SEDKEY256.BIN) that you can then transfer to another computer or put in a safe place.



The key file (SEDKEY256.BIN) is stored on the specific location.

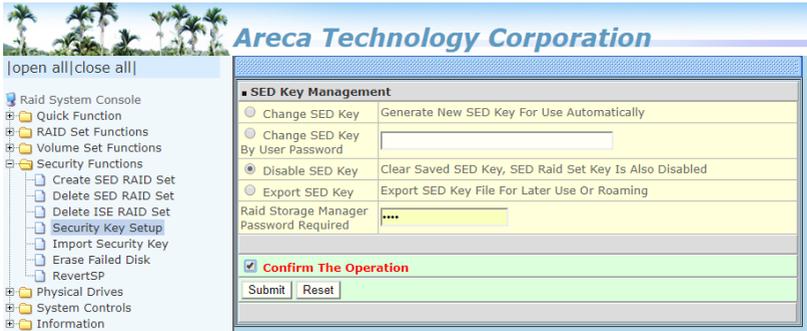


Without the proper authentication key (SED key), even if the SED RAID set is removed and placed in another new RAID adapter, the data remains inaccessible.

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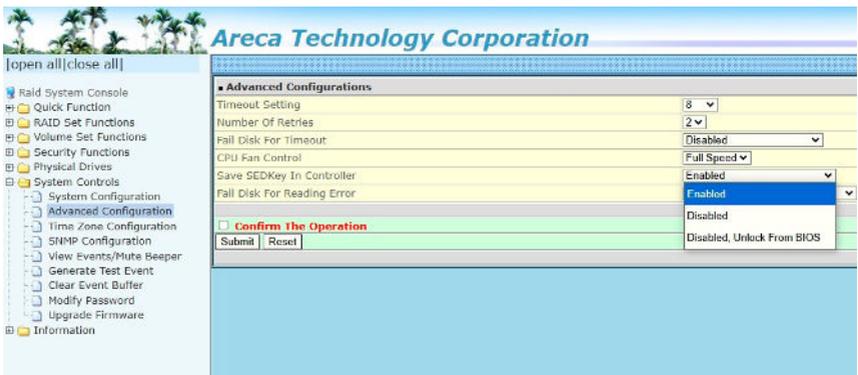
## Step 7. Clean Saved SED Key

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.



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- <a> If enable --> disable, clear SED Key saved in setup
- <b> If disable --> enable, if key exists, save to setup

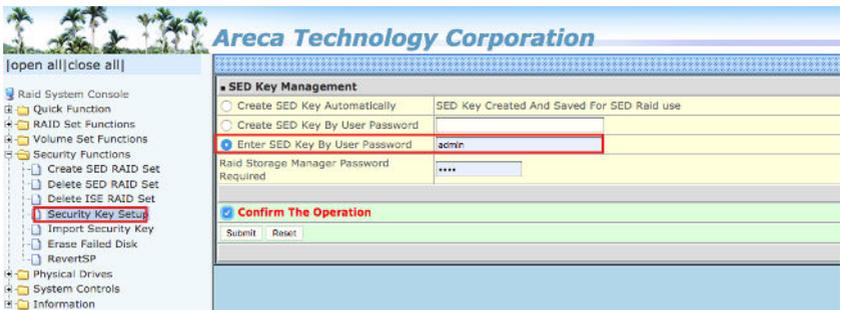
If you setup from enable--->disable, the key will not remain in the flash. So that next time power up again, it will need to input the key from the CLI or McRAID manager again. The adapter volume will be in the lock stage. It will be not available to the OS.

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



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## Appendix D

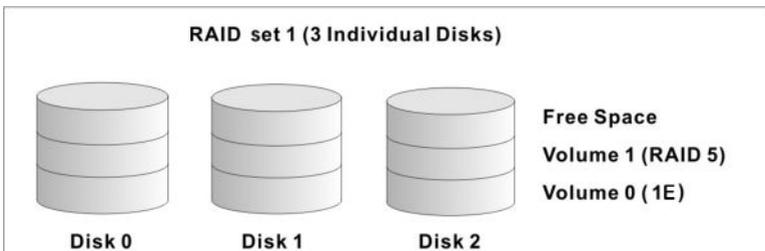
### RAID Concept

#### 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... 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.



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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 volume set can be used immediately after creation because they do not create parity data. However, RAID 1 or 1E 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 initializing. If using Foreground Initialization, the initialization process must be completed before the volume set is ready for system accesses.

- **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.

- **Capacity Expansion**

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

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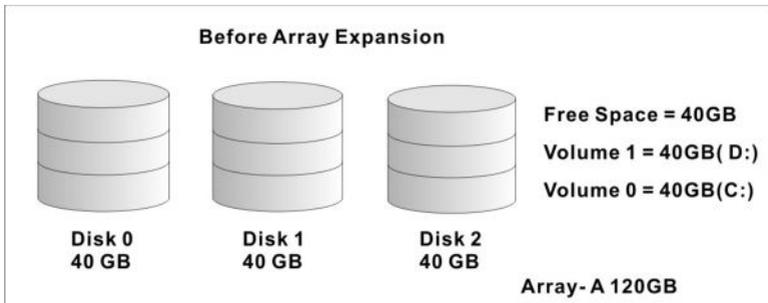
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Then, data on the existing volume sets (residing on the newly expanded RAID set) is redistributed evenly across all the disks. A contiguous block of unused capacity is made available on the RAID set. The unused capacity can be used to create additional 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 or 1E 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.

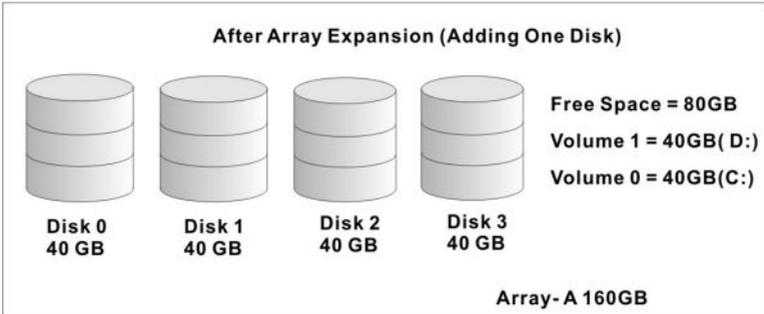
The expansion process is illustrated as following figure.



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.)

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## ● 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 one drive in RAID level 0, it is possible to add a single drive to migrate to RAID 1 and retain fault tolerance.

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 or 1E are protected against data loss in the event of disk failure(s). In the case of disk failure, the volume set transitions from migrating state to (migrating+degraded) state. When the migration is completed, the volume set transitions to degraded mode. If a global hot spare is present, then it further transitions to rebuilding state.

## ● Online Volume Expansion

Performing a volume expansion on the adapter is the pro-

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cess 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.

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 host spare function only works with RAID level 1 or 1E volume set.

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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.

### ● **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 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

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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 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 administer of an impending hard drive failure.

## Data Protection

### ● **Off Module Power (OMP) Loss Protection**

The RAID adapters are armed with a Off Module Power (OMP) Loss Protection. An enterprise storages need to ensure data integrity in the event of power losses and system crashes. The Power Loss Protection (PLP) is a hardware and firmware solution on the ARC-1689-8N RAID adapter to ensure that the NVMe SSDs integrity is maintained should a power loss event occur. While a Uninterruptible Power Supply (UPS) protects most servers from power fluctuations or failures, a Off Module

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Power (OMP) Loss Protection provides an additional level of protection. In the event of a power failure, a Off Module Power (OMP) Loss Protection supplies power for the backup of your data in the NVMe cache, thereby permitting any potentially dirty data in the cache to be flushed out to NAND flash in the NVMe when power is restored.

The supercapacitor in the controller are recharged continuously through a trickle-charging process whenever the system power is on. When the controller 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 NVMe.

## ● 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 E

### Understanding RAID

RAID is an acronym for Redundant Array of Independent Disks. It is an array of multiple independent hard disk drives that provides high performance and fault tolerance. The RAID 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.

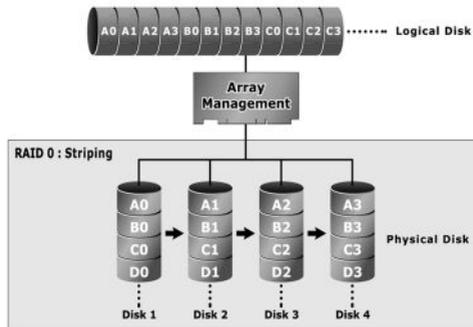
The RAID adapters makes the RAID implementation and the disks' physical configuration transparent to the host operating system. This means that the host operating system drivers and software utilities are not affected, regardless of the RAID level selected. Correct installation of the disk array and 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.

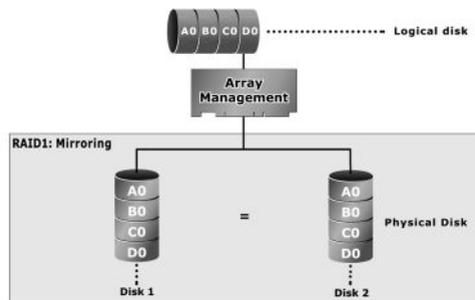
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## RAID 1 - Simple Mirroring

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.

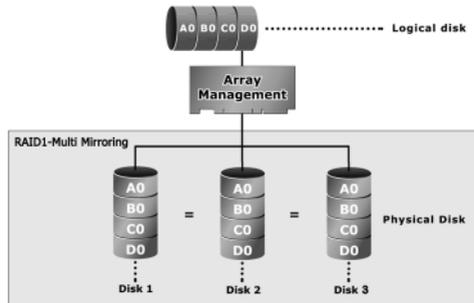


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## RAID 1 - Multi Mirroring

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.

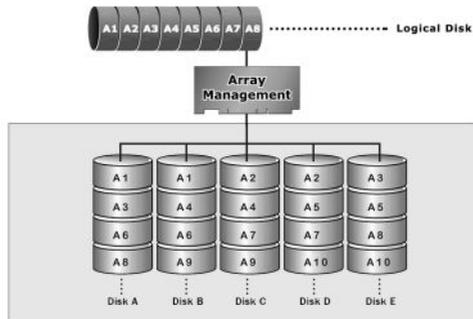


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## RAID 10(1E)

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.



## 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.

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## 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.

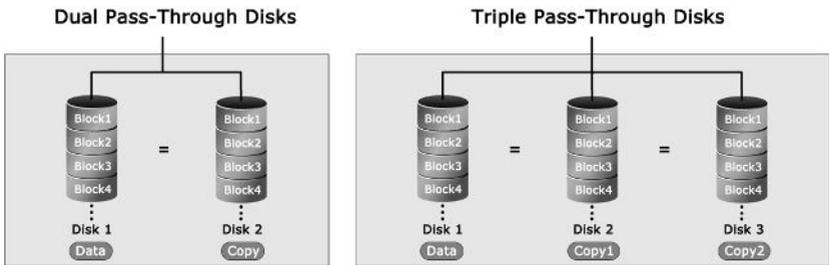


Figure G-1, Dual Pass-Through Disks & Triple Pass-Through Disks

# APPENDIX

## Summary of RAID Levels

NVMe RAID adapter supports RAID Level 0, 1, 10(1E) and Pass-Through Disk. The following table provides a summary of RAID levels.

<b>RAID Level Comparison</b>			
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
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