ExaSAN A16T2-Share

User Guide

Accusys Storage Ltd.,

Version: V1.1

Revision Sheet

Release No.	Date	Revision Description
V1.0	2015/6/11	Release version
V1.1	2015/8/28	Add Chapter 3.4 Quick Setup Add Appendix. Array Definition for Quick Setup

PREFACE

Notice

The product features and specifications described in this guide are subject to change without notice.

The manufacturer shall not be liable for any damage, or the loss of data resulting from the performance or use of the information contained herein.

About This Guide

Congratulations on your purchase of the ExaSAN A16T2-Share, the 16 bay shareable Thunderbolt rack mount model of the ExaSAN family, specifically designed for all post production workflow. It delivers stability, outstanding performance, and scalability..

This guide also contains instructions for installing and using the ExaSAN A16T2-Share system setting up of RAID (Redundant Array of Independent Disks) and using RAIDGuardX (ExaSAN's RAID management software).

Guide to Conventions

Inside the double boxes are important information and warnings that users should be aware of:

Caution
This indicates the existence of a potential hazard that could result in personal injury, damage to your equipment or loss of data if the safety instruction is not observed.

Note
This indicates useful tips on getting the most from your Accusys RAID system.

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

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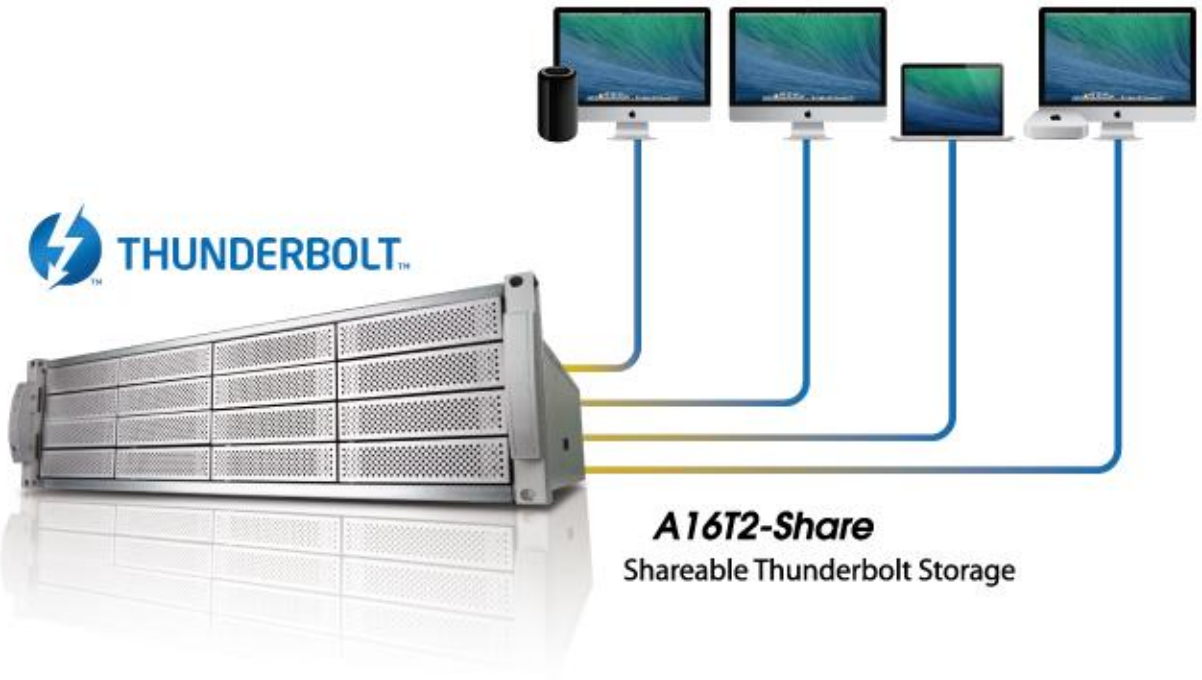
1. Introducing ExaSAN shareable Thunderbolt Storage System

1. Introducing ExaSAN shareable Thunderbolt Storage System

1.1 Overview

1.1.1 What is the ExaSAN shareable Thunderbolt Storage System

The A16T2-Share equip with the functionality of a complete SAN solution within a single Thunderbolt storage device, the high performance of Thunderbolt 2.0 without any protocol conversion latency, and the reliability derived from an independent hardware RAID system. These features give A16T2-Share its uniqueness different from other Thunderbolt storage products in the market, and helps create a brand new working experience for Thunderbolt users.



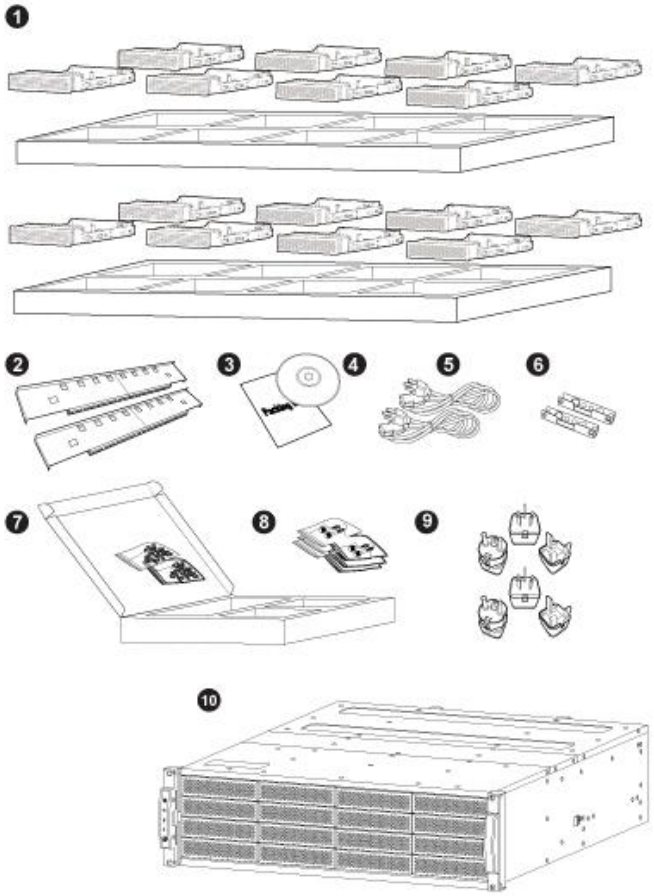
Accusys has leveraged its years of experience as a PCIe SAN designer and high performance transmission technology provider within the video post-production industry, and created the all-in-one A16T2-Share Thunderbolt shareable storage solution, which takes the original peer to peer Thunderbolt interface and transforms it into a more flexible Thunderbolt storage network well suited for Media and Entertainment budgets and workflows. The advanced technology and innovative thinking will eliminate the high cost of Thunderbolt networking over Fibre Channel SAN or 10 Gigabit Ethernet. With the full performance of Thunderbolt 2.0 in a shared storage environment, A16T2-Share will be the perfect storage solution for the burgeoning 4K video market.

1.1.2 ExaSAN A16T2-SHARE features

1. **Hardware Specifications**
   - Thunderbolt2.0 x 4, the bandwidth of each port is 2000GB/s
   - Support 16 x 3.5”/2.5” SAS/SATA HDD and SSD
   - Hardware XOR/Multi-Parity engine
   - 2GB DDRIII memory, ECC-protected
2. **Software Specifications**
   - Multiple RAID levels: 0,1,5,6, 0+1 and JBOD
   - Up to 5 disk array groups
   - Selective initialization method (on-the-fly and performance evaluation)
   - Online RAID set expansion and level migration
   - Controller and Disk Cache Control to optimize read/write performance
   - Support write-back and write-through caching
   - Automatic rebuilding
   - Online bad block data recovery
   - Disk health monitoring by S.M.A.R.T.
   - NVRAM-based transaction log and auto parity resynchronization
   - Array roaming and disk traveling
   - Dual firmware images for firmware recovery
   - Disk Lag Proof technology to guarantee disk timely response
   - Equalization mode to smooth the performance of sequential data transfers
3. **Management**
   - Java-based GUI, RAIDGuardX
   - LED indicator to monitor status of RAID enclosure
   - Event notification by email (SMTP)
   - Centralized multiple RAID system management
   - Support SNMP
4. **Enclosure**
   - Dimensions: L: 567mm, W:441mm, H: 131mm
   - Weight: 19.4 Kg or 42.7 lbs (w/o drives)
5. **Support OS**
   - MAC: OS X(10.9, 10.10 and later)
6. **Operating Conditions**
   - Humidity: 5% - 85%
   - Operating Temperature: 0C – 40C
   - Certification: RoHS, UL, CE, FCC, C-Tick, BSMI

1.2 What's in the Box

Your ExaSAN A16T2-SHARE is shipped in special package to provide protection during transportation. Carefully check your carton contents against the included packing list, or the inside flap of the box, and your original purchase order. You should have the items as described in the sections below.



A16T2-SHARE packing list

The Accessories package includes the following items. These items can also be ordered and shipped separately from Accusys.

1. Disk tray (x16)
2. Rail set (x2)
3. Packing list (x1)
4. Installation DVD (x1)
5. AC power cord cable (x2)
6. Rail extender (x2)
7. Screw pack for disk tray (x2)
8. Bolts pack for rack mount (x6)
9. Plug adapter (x6)
10. ExaSAN A16T2-SHARE storage (x1)

1.3 Your A16T2-SHARE at a Glance

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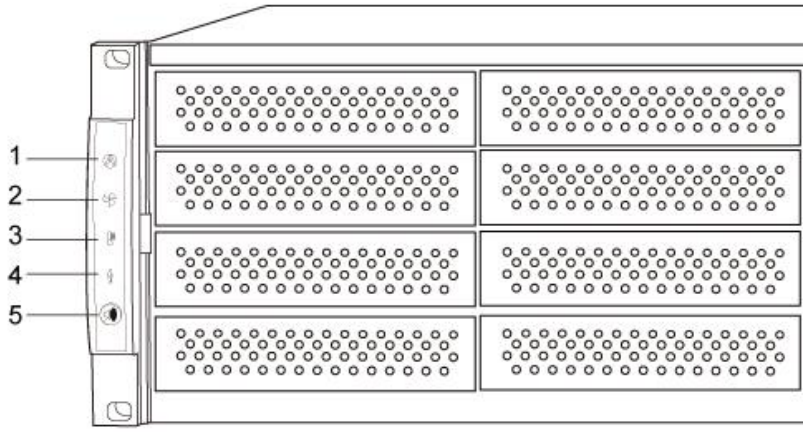
1.3.1 A16T2-SHARE Front Panel & LED Indicators



Item	Name	Description	
1	Controller Status	**Steady Blue**	controller is working normally
		Flashing Blue	host is accessing
		Red	controller failed
2	System Fan	**Blue**	fan modules are working normally
		Red	fan module failed
3	System Temperature	**Blue**	system temperature is normal
		Red	system temperature is overheat
4	System Power	**Blue**	power supplies are working normally
		Red	power supply failed
5	Mute Button	Pushing the button for 2 seconds will mute the system beeper. If another abnormal event occurs, the beeper will alarm again.	

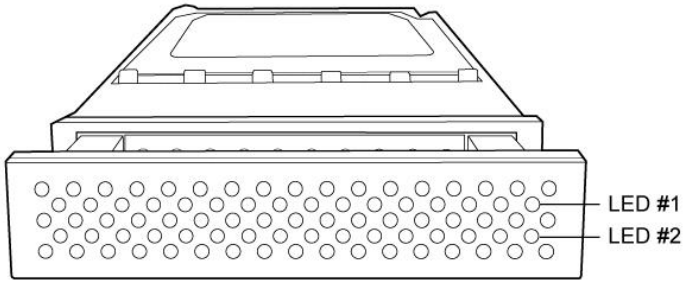
1.3.1.1 Beeper Codes

Controller Status	Beeper mode
Turn on the Controller	A short beep at boot up
System Panic	A Long beep
Disk init, rebuild, expansion, migratrion snapshot	Repeat a short beep
Error of Fan, Power, RAID or Disk locked	Repeat three short beeps
System cannot boot up	Repeat three rapid short beeps

1.3.1.2 Disk Mapping

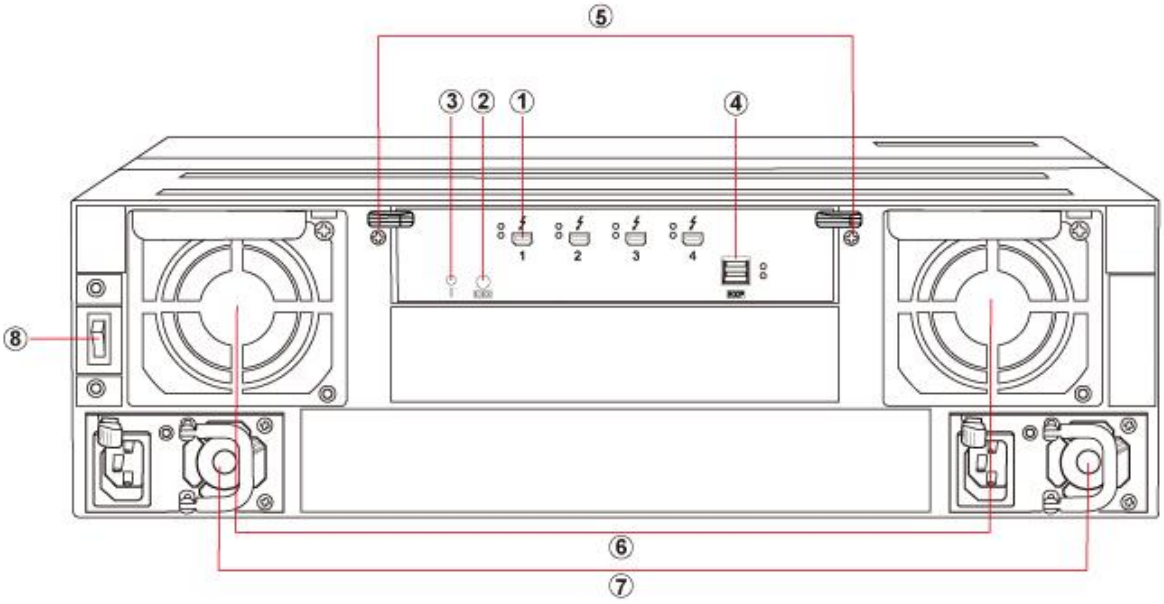
Disk 1	Disk 5	Disk 9	Disk 13
Disk 2	Disk 6	Disk 10	Disk 14
Disk 3	Disk 7	Disk 11	Disk 15
Disk 4	Disk 8	Disk 12	Disk 16

1.3.1.3 Disk Tray and LED Indicators



Disk Status	LED #1 (Access LED)	LED #2 (Status LED)
Disk Online/Locked		Steady Green
No Disk/Disk Fail		Steady Red
Disk Access/Initialization	Flashing Blue	Steady Green
Disk Rebuild	Flashing Blue	Switching in Red and Green
Disk Expansion	Flashing Blue	Extend Drives: Steady Red Original Drives: Steady Green
Disk Migration	Flashing Blue	Migrate Drives: Steady Red Original Drives: Steady Green

1.3.1.4 A16T2-SHARE Rear Panel



No.	Name	Description
1	Thunderbolt port	Thunderbolt2.0 host port 1(left) ~ 4(right)
2	Debug port	For engineer debugging only.
3	Heart beat LED	Flashing green indicates work normal.
4	Expansion port	Expanding to another JBOD enclosure.
5	Controller Handler	Plug in/out controller for maintenance.
6	Redundant Fan	Hot swappable cooling Fan modules
7	Redundant Power	Hot swappable Power Supply modules
8	Power switch	Switch on/off the RAID system

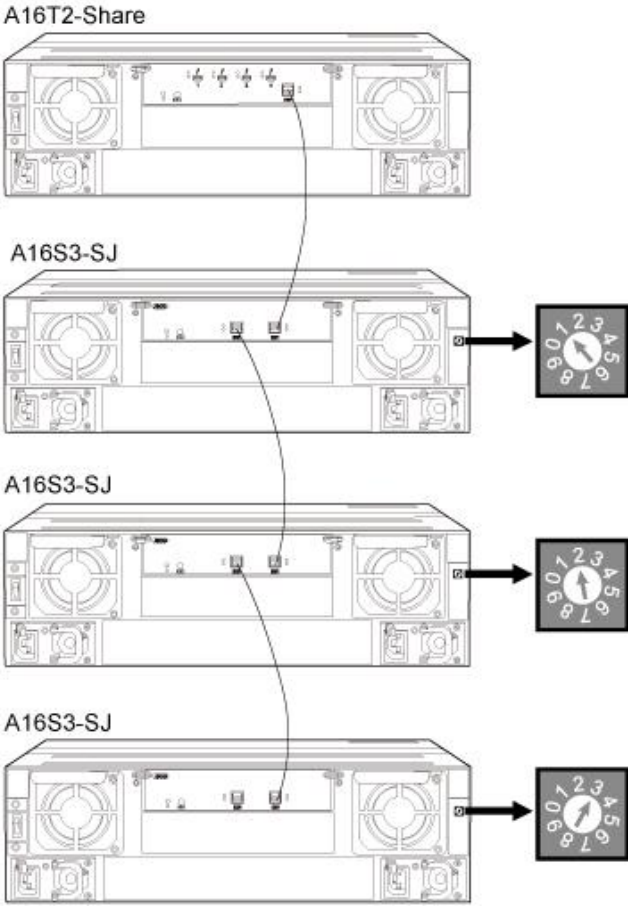
1.3.2 How to Connect Multiple JBOD with Mini SAS HD cable

Below diagram shows how to connect 3 JBOD enclosures to RAID system. Connect “mini SAS HD” cable to the “EXP” port of RAID system, the other side to right SAS port of JBOD enclosure, and so on, if there has more JBOD enclosure.

Ensure that “dip switch” on the JBOD chassis ID is set to 1 for the first JBOD, 2 for the second JBOD and 3 for the third, or it may not recognized by RAID system.

When booting up, first to power on all JBOD enclosures, power up the RAID system at last.

When shutting down, first to power off the RAID system, then power off all JBOD enclosures.



2. Preparing to Install ExaSAN A16T2-SHARE

2. Preparing to Install ExaSAN A16T2-SHARE

To ensure safe and smooth operation of your ExaSAN A16T2-SHARE, it is essential that you choose an appropriate location for the system, provide an appropriate operating environment, and adequate power for all components of the system. As you plan for installation, follow the guidelines below to ensure that the system and its environment are safely and appropriately positioned for efficient operation and service.

2.1 Precaution for Handling the System

Take the following precautions to avoid damage to the system or potential injury to you.

1. Prepare a flat, sturdy surface before removing the system from its package. The table or cart that will hold the system should be as close as possible to the system carton.
2. Ensure that all power switches have been turned off and all power cords disconnected to prevent personal injury and damage to the hardware.
3. Static electricity can damage electronic components of your system. Follow the guidelines below to avoid such damage:
    a. Work in a static-free environment
    b. Wear a grounded anti-static wrist strap
    c. Store uninstalled components in anti-static bags
    d. Handle circuit boards by their edges and avoid touching chips and connectors

2.2 Choosing the Location for the System

The ExaSAN A16T2-SHARE is designed as a rack mount solution. Depending on where your desk or rack mount cabinet or other install location is, you should keep the following points in mind when determining where to place your system.

1. Measure the available space on your desk. The space required for the A16T2-SHARE is L: 567mm, W:441mm, H: 131mm
2. Measure the distance between any two components that need to be connected via cable(s). This measurement will help you determine the length of the required cable(s). Or if you've already purchased the cables, determine the proximity of the components in question.
3. Leave sufficient room, at least two inches, around the unit to allow air ventilation.
4. Do not block or cover any of the ventilation holes in the front and back panels of the unit. Consistent airflow is essential to keep the system operating efficiently.
5. Allow additional room at the front and back of the unit for service.
6. The ExaSAN A16T2-SHARE uses several cables and cords. It's a good idea to determine how they will be arranged at the rear of the system, and where the cables will be routed to connect to the host systems and RAID disk systems.

2.3 Electrical Power

At your chosen location for the ExaSAN A16T2-SHARE, make sure that the electrical circuitry and power outlets are sufficient for the combined power needs of all hardware components. To plan for safe and adequate power to the system, follow these guidelines:

1. Check the documentation for all hardware components at the chosen location to determine their power requirements. Then make sure that the available power supply for that location is sufficient for the planned components.
2. When possible use surge protectors or power conditions as part of the installation.

3. When planning for electrical power, make sure you have more power than the total power requirements specified for all components. Also make certain that the power load is distributed evenly among circuits to that location. Consult an electrician or other expert if you need assistance with planning for the power needs for your components.
4. Make sure that the power outlets for all hardware components are grounded according to local and national standards. Consult an electrician if you need assistance with grounding.

2.4 Operating Environment

The operating environment for the ExaSAN A16T2-SHARE must meet certain requirements:

1. Verify that the temperature range of the chosen location is within the limits established for the system and all other components.
2. Make certain that the chosen location has adequate ventilation to maintain the necessary temperature range.
3. If there are multiple hardware components installed at the chosen location, consider additional cooling measures to assure efficient operation of the system and other components.
4. Environment parameters:
    a. Operating temperature: 0°C to 40°C (32°F to 104°F)
    b. Operating humidity: 5-85%, non-condensing
    c. Storage humidity:5%-95%, non-condensing

2.5 Security

To ensure the security of the ExaSAN A16T2-SHARE, make certain that the chosen location meets your security requirements.

3. Installing the ExaSAN A16T2-SHARE

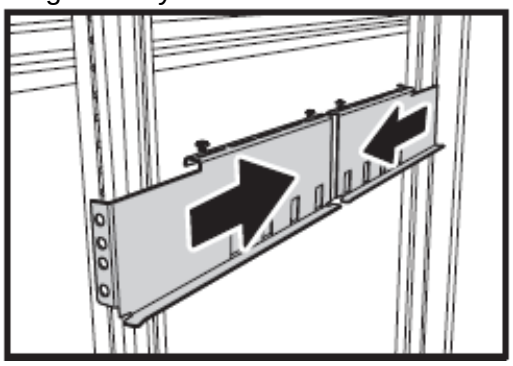
3. Installing the ExaSAN A16T2-SHARE

Follow the steps in this chapter to prepare your ExaSAN A16T2-SHARE system for installation.

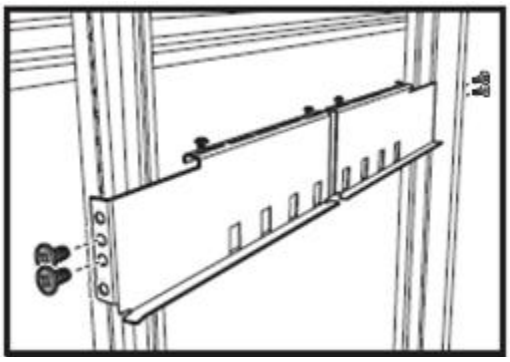
3.1 Rail set installation

A16T2-SHARE is designed as standard 19inch 3U chassis, support all standard rack. Follow the steps to properly install you RAID system into rack.

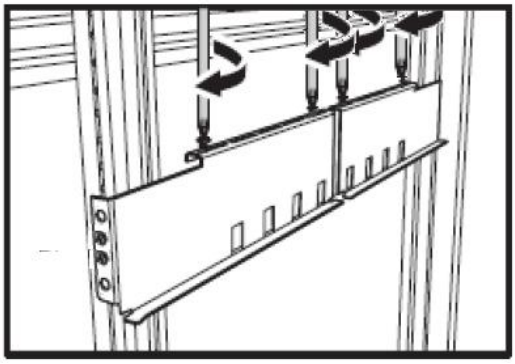
1. Loosen rail screws of rail set, and adjust the length to fit your rack



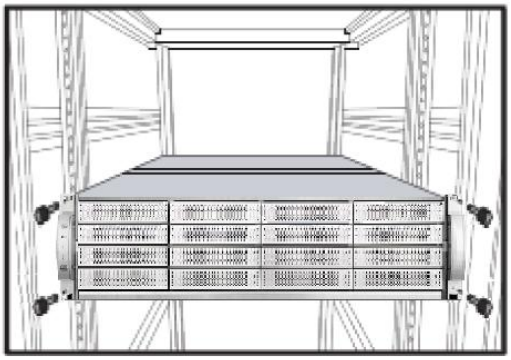
2. Tighten 2 rack screws in both front and rear side.



3. Tighten 4 rail screws.



4. Install RAID system into the rack and securing with 4 rack bolts.



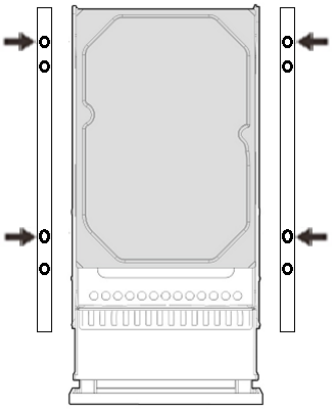
3.2 RAID System installation

Follow the instructions in this section to hook up all your hardware components of the ExaSAN A16T2-SHARE system. Do not turn the power on until all components are properly installed.

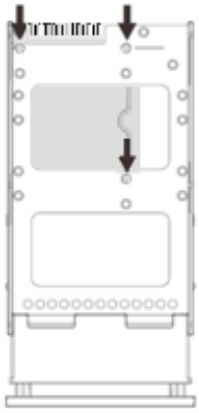
3.2.1 Installing Disk Drives

Follow the steps below to install your HDDs.

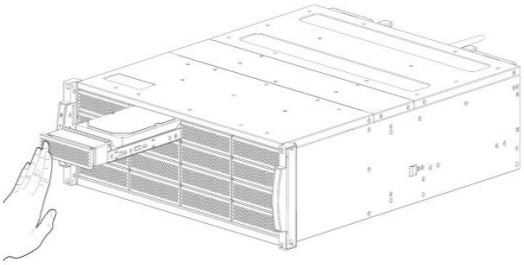
1. Place the HDD with connector align with the edge of the disk tray.
2. Secure HDD with screws as below figures.
3. Slide the disk tray into the disk bays of the chassis.



Four screws for 3.5”



Three screws for 2.5”



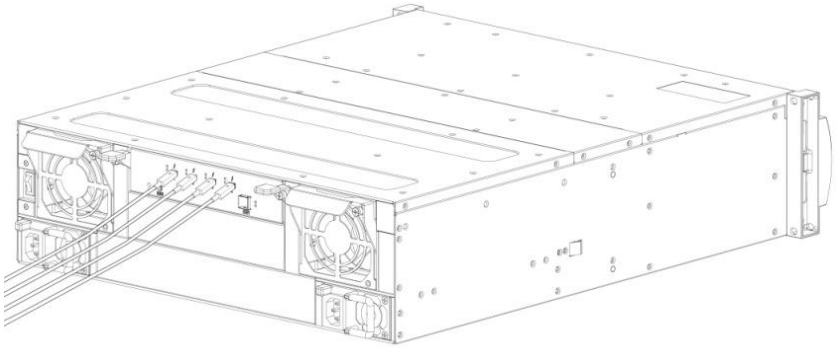
Insert tray into A16T2-SHARE

4. Push the tray inward until the tray firmly connects and you hear the tray click into place.
5. Repeat for all drives to be installed into the A16T2-SHARE.

> **Note**
> The hard drives in a RAID system should match in size and speed. All drives in an array should be identical models with the same firmware version.

3.2.2 Connecting cable to A16T2-Share

Supports Thunderbolt cables that are certified by Intel, refer to below picture on where to connect Thunderbolt cable.



3.3 Driver and GUI installation

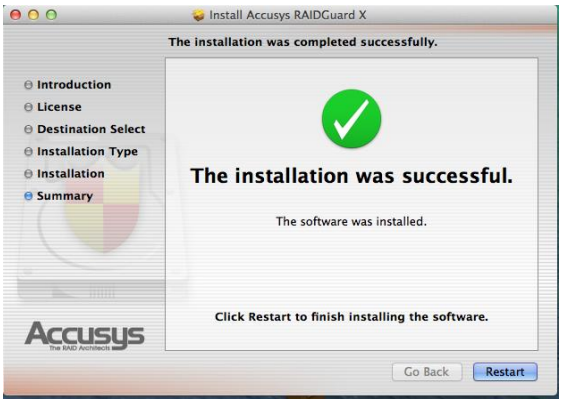
Before installing driver and GUI, make sure all connections and power on sequences are all correct.

3.3.1 Installing ExaSAN driver and GUI RAIDGuardX

Installation files can be found in accessory DVD, you can also download the latest version from our website (http://www.accusys.com.tw/support/download.html). If you need more information or tech support, please contact reseller or Accusys FAE Dept. (see Appendix C “Customer Service and Technical Support” for more information)

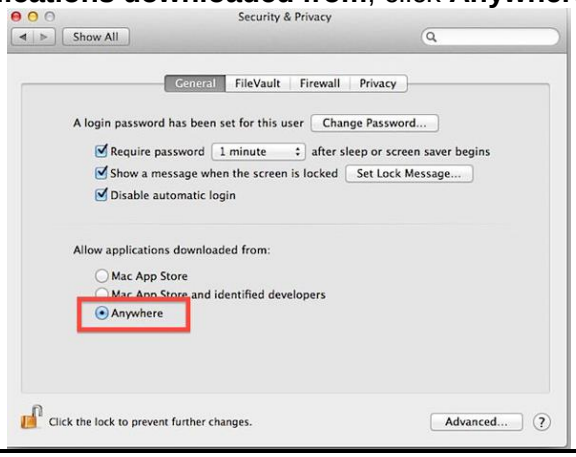
3.3.1.1 Installing on MAC and Windows

1. Insert the DVD into the computer
2. Double clicking the installer file, follow the onscreen instructions to install and click **Restart** to complete installation.



Note

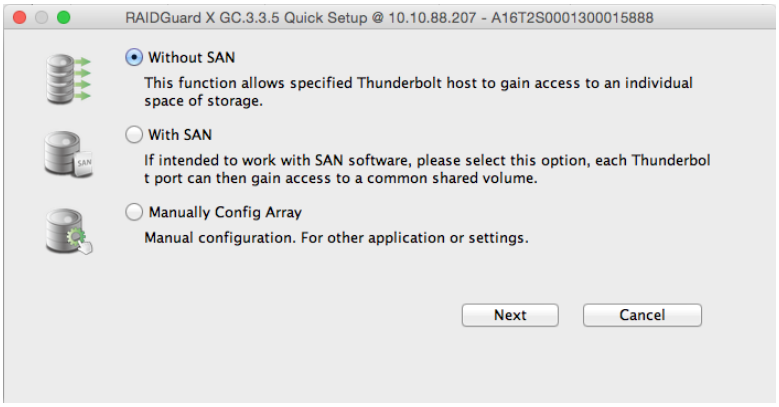
Once OS prompt “can’t be opened because it is from an unidentified developer”, open **System Preferences > Security &Privacy** , in part of **Allow applications downloaded from**, click **Anywhere**.



3.4 Quick Setup

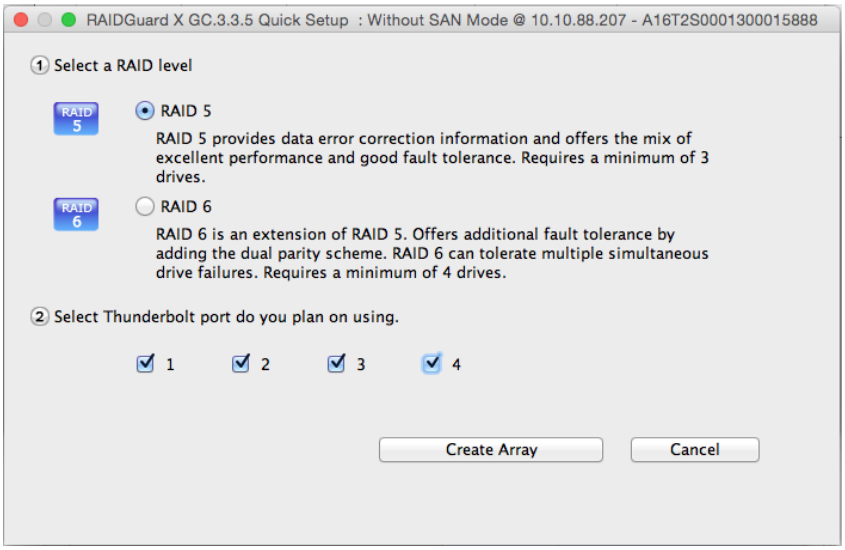
This chapter will guide you how to use RAIDGuardX to create disk array and make LUN available to Thunderbolt host port.

A16T2-Share provides 2 quick setup functions **Without SAN** and **With SAN** for quick configuration, and **Manually Config Array** function for manually create array by specified hard disks. Click icon **Create Array** on RAIDGuardX,then it will pop up a dialog as below picture:



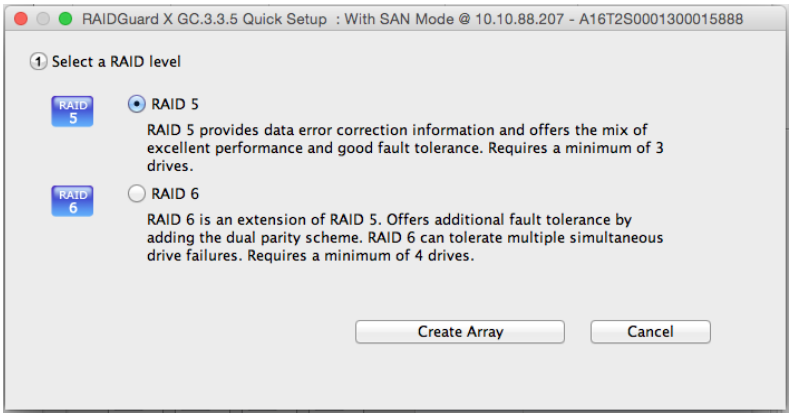
3.4.1 Without SAN

This function allows specified Thunderbolt ports to gain access to an individual space of storage. Once you choose RAID Level (5 or 6) and Thunderbolt ports, then array(s) will start to initiate (refer to **Appendix B. Array definition**) and auto configure LUNs map/connect done.



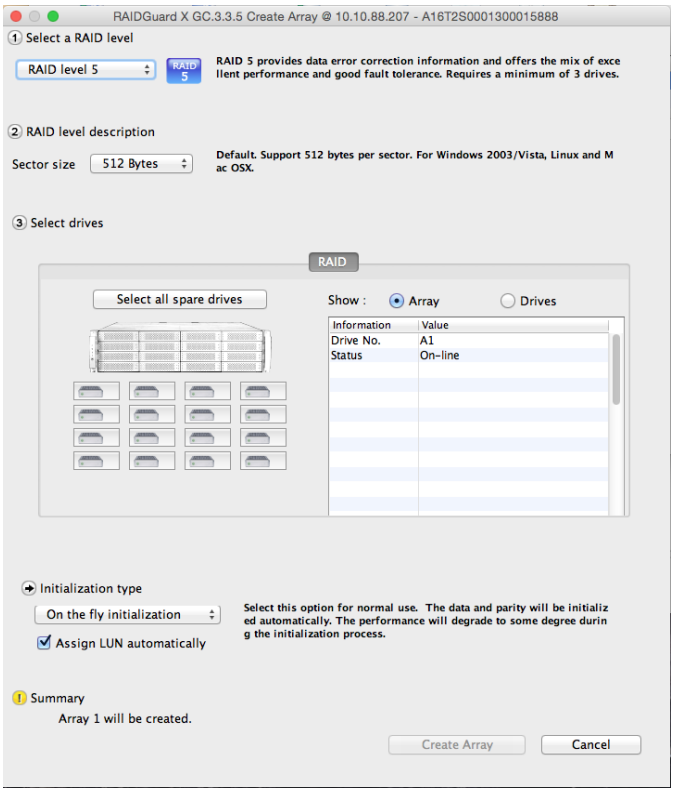
3.4.2 With SAN

Select this function if intended to work with SAN software, each Thunderbolt port will gain access to a common shared volume. You only need to choose RAID Level (5 or 6), then array(s) will start to initiate array for Xsan (refer to **Appendix B. Array definition**) and auto configure LUNs map/connect done.



3.4.3 Manually Config Array

In this function, you can manually setup array with specified RAID level, disk members and initialization method, then you have to manually setup LUN connect (refer to **Chapter 4.1.6.1. LUN connect**) to make LUN available to Thunderbolt host.



4. Configure A16T2-SHARE on RAIDGuardX

4. Using RAIDGuardX GUI

4.1 RAIDGuardX Overview

RAIDGuardX is a powerful GUI management tool, which support local and remote monitoring of multiple controllers that are connected to the same network. RAIDGuardX have to work with 2 components: RAIDGuardX-Server and RAIDGuardX-Client.

RAIDGuardX-Server: Once done with GUI installation, RAIDGuardX-Server default executed on OS background, handling the communication between RAIDGuardX-Client and RAID controller, it MUST be installed to the host directly connected to RAID system.

RAIDGuardX-Client: A java based console for managing and monitoring RAID system.

4.1.1 RAIDGuardX at a Glance

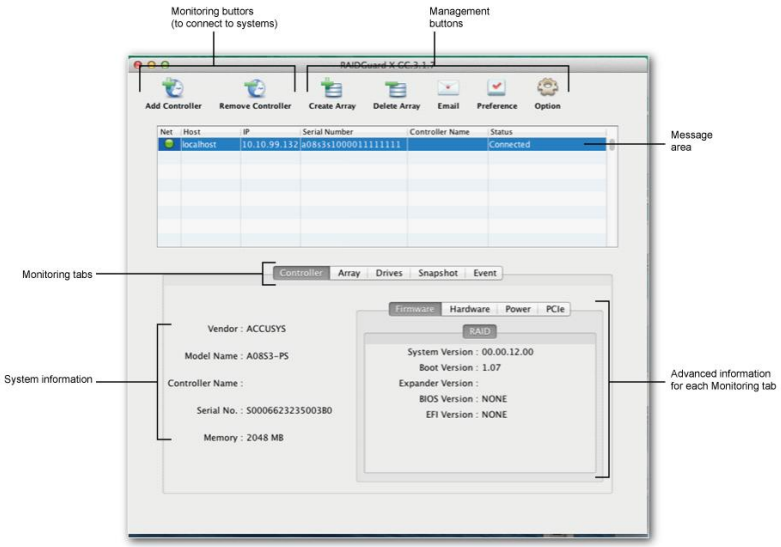
4.1.1.1 Menu Bar

The menu bar across the top contains the following functions:

Function		Description
File	Exit	Close the program
	Load Controller List	Refresh the controller list
	Language	English and Japanese are supported
Controller	Manual Add Controller	Manually search and add the controller
	Update	Update firmware (System Code, Boot Code, etc.)
	Dump controller log	Download the event log for troubleshooting
Help	Search	Search keyword in RAIDGuard X
	Help Center	Displays the help for RAIDGuard X

Note
Run **Dump controller log**, events are automatically logged and generate a zip file and saved on directory /Applications/RAIDGuard X/Log

4.1.1.2 *RAIDGuard X main console*



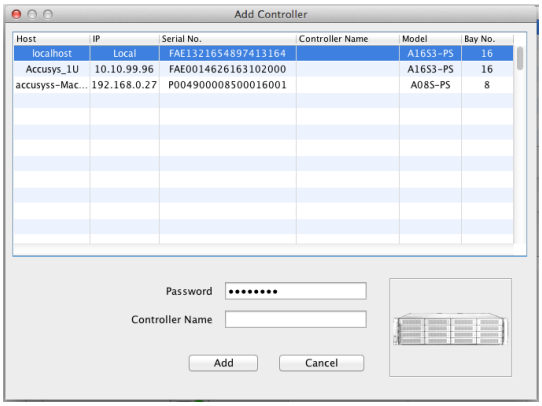
Function	Description	
Monitoring Buttons	**Add controller** into RAIDGuard X (for DAS only)	
	Remove controller from RAIDGuard X	
Management Buttons	**Create array** in the RAID system	
	Delete array in the RAID system	
	Email to set email notification	
	Preference	**Drive Lag Proof** Enable/ Disable
		NCQ mode Enable/ Disable
		SMART Mode Enable/ Disable
		Beeper Enable/ Disable
		Equalization Enable/ Disable
		Cache of controller and drives can be enable/disable
		MISC for controller Time setup
	Option	**Slicing** an existing array for multiple slices
		LUN Map setup for multiple slices
		LUN Connect setup for specific host port
		Expansion with new drive into an array
		Migration between different RAID level
		Snapshot for backup data in a particular time
		Health Center for check array status
		Unlock Drives from locked mode

4.1.2 Adding Controller

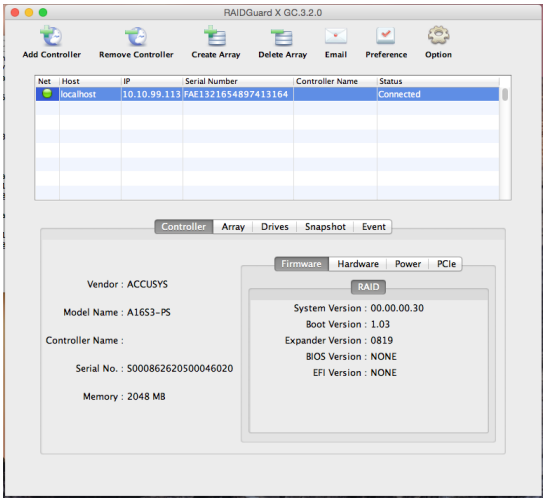
RAIDGuardX can manage the RAID controller locally or remotely via intranet access.

1. Click **Add Controller** to display a list of available controllers on local and network.

2. Click on a controller and enter password, default is 00000000 (8 zeros). (you can assign a name to the controller for remark)



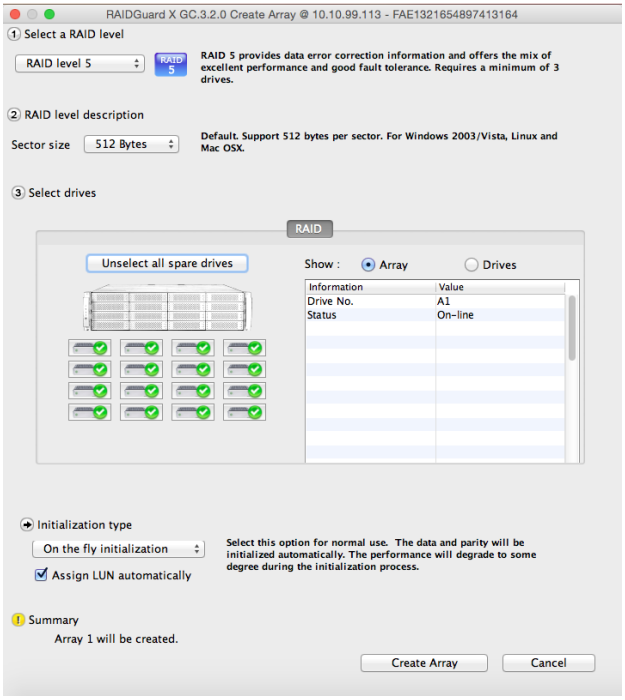
3. Click **Add** to main page.



Note
To change the controller password, refer to Section MISC.

4.1.3 Creating an Array

You can create array by clicking button **Create Array**, following window will show up.



Follow the steps below to create an array:

1. Select the RAID level from the drop down menu. Available levels are: 0, 1, 5, 6, 0+1, JBOD

> **Note**
> Each RAID level has a minimum disk requirement. Details on the RAID levels are in **Chapter 5 RAID Overview**.

2. Select the sector size from the drop down menu. Available sector sizes are 512 bytes (default) and 4096 bytes. The sector size 4096 bytes is only used on WinXP for recognized over 2TB volume. For other OSs, please select 512 bytes (default).

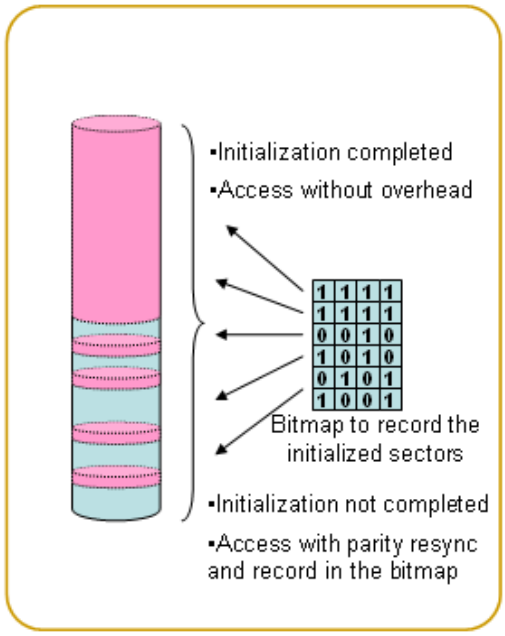
3. Click on the drives to be added to the array. You can also click on **Select all spare drivers**.

> **Note**
> Unselected drive will be set to Hot (Global) spare drive. If a array member drive fails, spare drive will start to rebuild automatically.

4. Initialization type: From the drop down menu, select either **On-the-fly initialization** or **Performance evaluation.**

On-the-fly initialization (Default) – ExaSAN RAID systems record the initialized sectors in the bitmap. All sectors are initialized only once. During on-the-fly initialization, you can still use the RAID system during the RAID initialization.

Select this option to ensure the completeness of array parity. The amount of time required for the initialization process varies depending on the disk size.

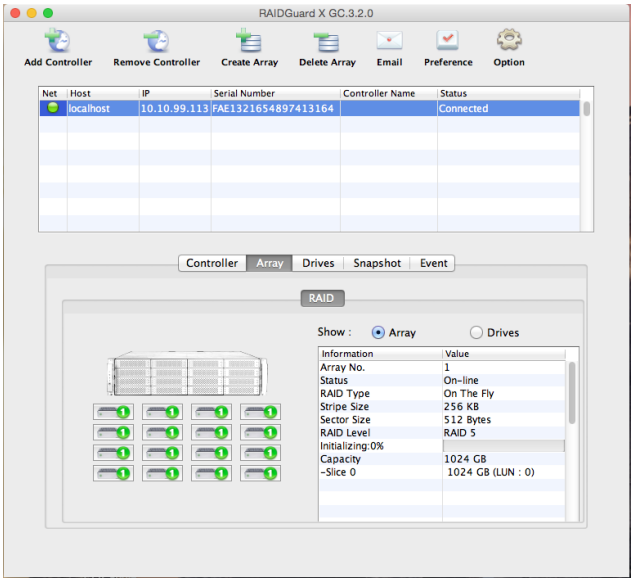


Performance evaluation – Select to evaluate the performance of the target array. It will take no time for array initialization. Because of the data and parity are not initialized, there is no data protection, only for testing purpose.

> **Caution**
> Array created by **Performance evaluation** could not do array rebuild, DO NOT use this type for read production environment.

5. Assign LUN automatically. Check this box to automatically assign a LUN. You may choose to assign LUN manually under **Options**. However, you will not be able to use the RAID volume until it has been assigned a LUN.

6. Click **Create Array** to complete the process.



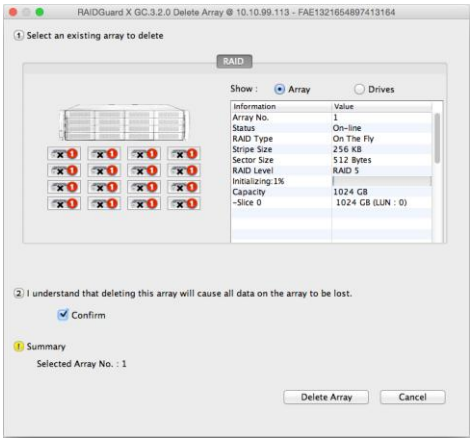
In the main screen, you can see the status of array initialization progress.

> **Note**
> A16T2-Share can support up to 5 array groups.

Delete an Array

1. Click on the drives of the array to be deleted.
2. Check the **Confirm** box. Click **Delete Array** to complete the process.

> **Note**
> Array cannot be deleted during any actions, e.g. initialing, rebuilding.



> **Caution**
> When delete an array, all data on the hard disk drives will be lost.

4.1.4 Email Notification

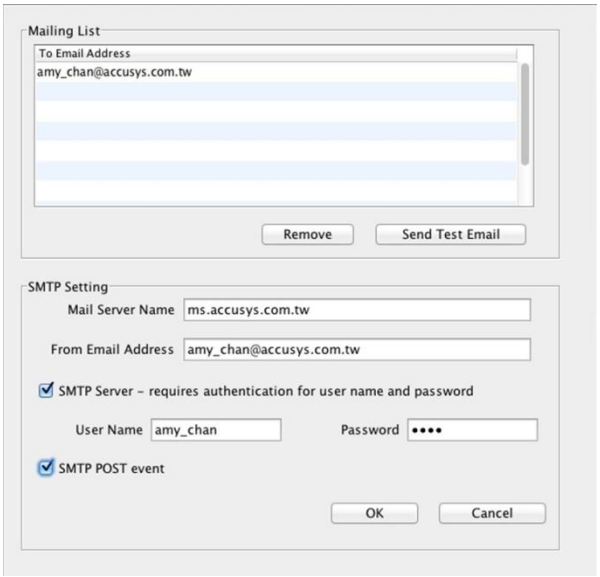
It may be necessary for network administrators to receive e-mails in the event of errors, alerts, and changes to the RAID array. These alerts can be e-mailed to a maximum of 20 e-mail addresses.

Mailing List
Enter the e-mail address(es) of people to receive controller error reports.
Click **Remove** to delete e-mail addresses from the list.
Click **Send Test Email** to check that the e-mail is working.

SMTP Setting
Mail Server Name – Enter the address of the mail server.
From Email Address – Enter the e-mail address of the mail server.
SMTP Server – requires authentication for user name and password
Check this box if your mail server requires a user name and password.

SMTP POST event
Check this box if wish to create a log for error events.

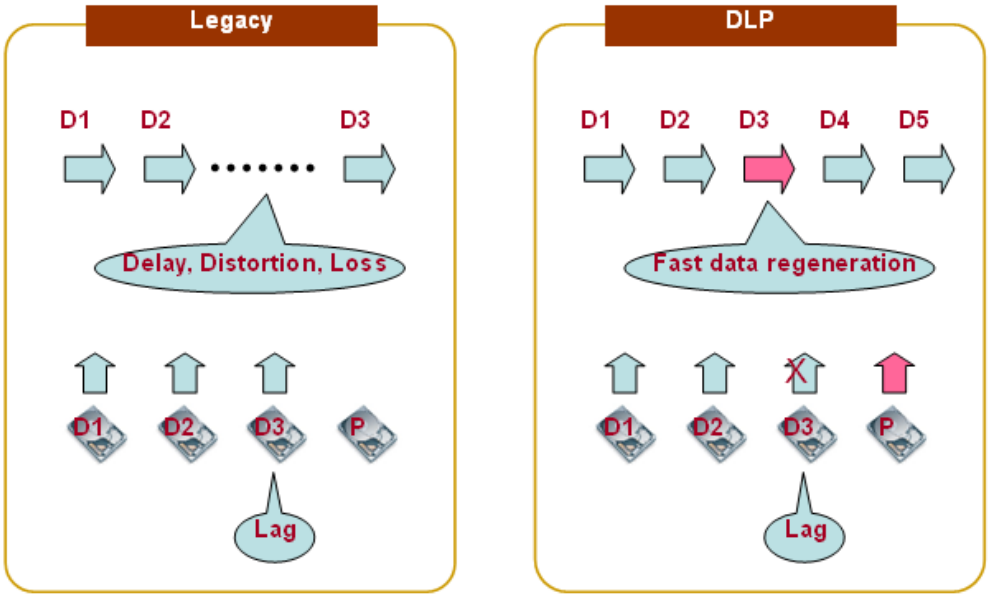
> **Note**
> 1. Ask your systems administrator for SMTP Server details.
> 2. Support outbound SMTP mail service, e.g. Gmail, Hotmail, Yahoo.
> 3. Contact to tech support for more detail.



4.1.5 Preference

4.1.5.1 Disk Lag Proof Mode

This feature ensures the stability and continuity of the RAID performance. In RAID 5 and RAID 6, DLP prevents the aging or slow responds of a single hard disk from influencing the overall performance. The advantage of this feature will not be felt until some hard disks fail to perform well.



DLP concept

In the event of performance degradation or delay of a single drive due to aging, the ExaSAN RAID system reads both data and parity stripes concurrently. It bypasses the slow reads and returns data to the host with the regenerated data and to provide stabled performance based on the RAID parity.

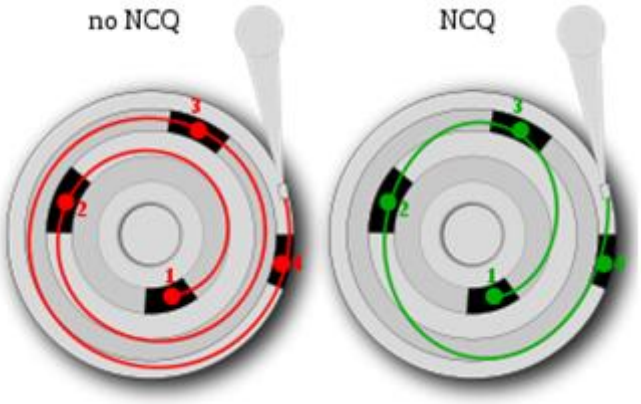
> **Note**
> Although slow responds of some hard disks can be tolerated in DLP mode, you may use S.M.A.R.T. function to check the conditions of hard disks in an array and replace the faulty ones.

> **Note**
> This function does not support RAID Level JBOD.

4.1.5.2 NCQ

NCQ (Native Command Queuing) – This mode is designed for increasing disk drive access on SCSI and SATA disk drives. It can do this under certain situations by allowing the individual hard disk to internally optimize the order in which it executes the read and write requests it receives. This can reduce the amount of unnecessary drive head movement and resulting in better performance for work loads where multiple read/write requests and outstanding at the same time.

This situation most often occurs in server-type applications. However, the current technology actually slows down disk drive access in certain applications, such as video editing and sequential reads and writes, because of the added latency induced by NCQ.



NCQ concept

The figure above illustrates the access sequence in NCQ and non-NCQ mode. The content sequences of the two hard disks are the same: 1, 2, 3, 4. However, the access sequence in NCQ mode may vary to improve the performance.

4.1.5.3 SMART Mode

S.M.A.R.T. is a monitoring system of disk drives to detect and report on various indicators of reliability, in the hope of anticipating failure. ExaSAN RAID system supports S.M.A.R.T. Once this function is selected, you can select the check interval from the drop-down list. Choose from 1 minute to 8 hours for SMART Mode to be active. The RAID controller will command each hard disk to perform S.M.A.R.T. according to the check interval selected. The check results will be shown as an Event message in the main menu.

When running S.M.A.R.T., the performance of the system will be slightly affected. The higher the check frequency, the more the sequential access is influenced. It is recommended to turn off S.M.A.R.T. if high frequency is needed. On the other hand, running S.M.A.R.T. constantly allows you to monitor the conditions of hard disks at any time.

The option of time to check disk's S.M.A.R.T are 1,15,30,60 minutes and 2,4,8 hours. We strongly suggest set to 8 hours. Frequently check time will reduce the life time of hard drives

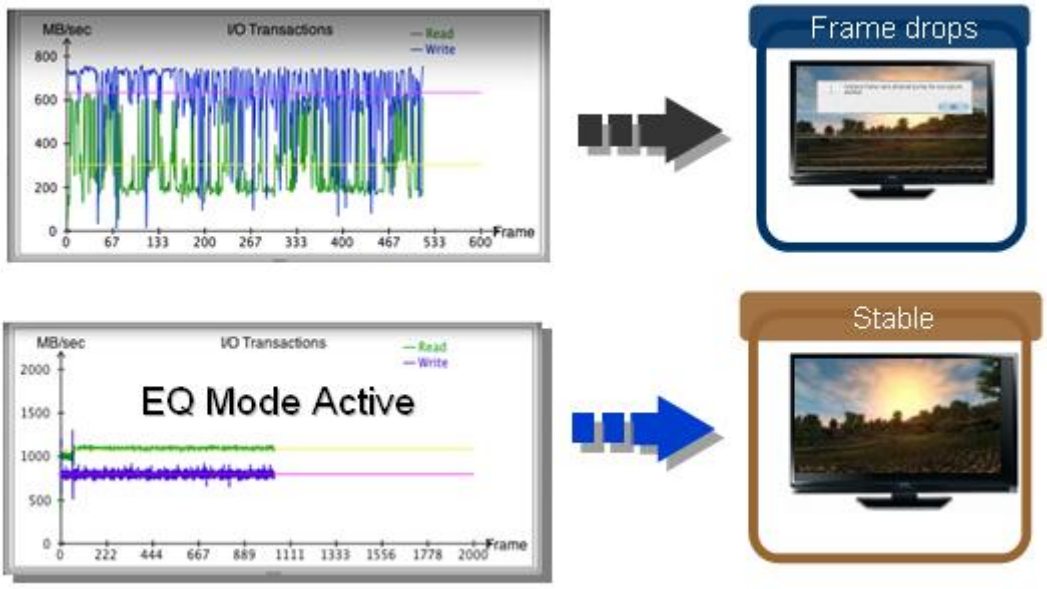
4.1.5.4 Beeper

Default Beeper option is enabled, the system will sound an audible alarm in the event of an error. Users can respond to the error promptly and carry out troubleshooting.

If the error indicated by the Beeper alarm has been resolved, you may uncheck the **Beeper** option.

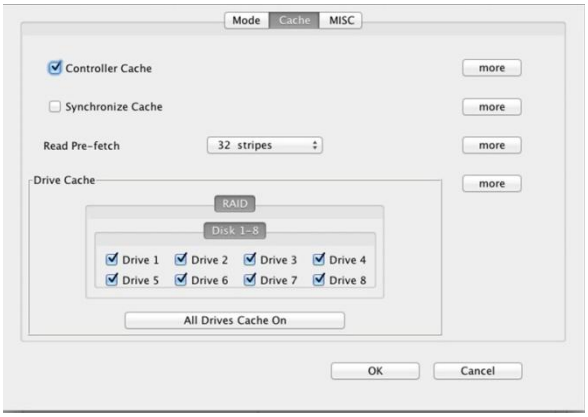
4.1.5.5 Equalization Mode

Regardless the transmission method, the data transmission speed cannot be guaranteed at all times. This feature allows the continuous I/Os to operate more smoothly and substantially reduce large fluctuations in efficiency during data transfer. For video editing, enable equalization to prevent video frame drops.



EQ mode concept

4.1.5.6 Cache



Controller Cache – Check this box to enable the controller cache. This speeds up the data transfer to and from the disks.

> **Caution**
> Data in cache may be erased if power down unexpected. Suggest using a UPS (uninterruptible power supply) to prevent this scenario.

Synchronize Cache – Check this box to enable cache synchronization with drives, to ensure all write data is correct, there is a frequently latency time within. For video capture, disable synchronization, because the video capture needs to be able to constantly write data to the RAID storage without long latency.

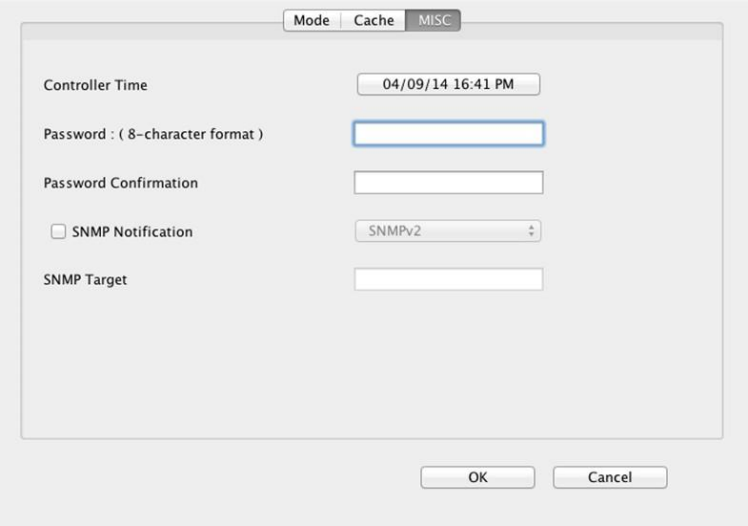
Read Pre-fetch – Identifies sequential access patterns and aggressively pre-fetches patters into cache. From the drop down list, choose the number of stripes to pre-fetch. The default is 32; this is the recommended number.

Drive Cache – Choose which drives to cache. When more than one application accesses the database, the first applications cache needs to synchronize with the second. Each drive contains a built in write cache; checking these boxes chooses which drives to enable the caching on. Caching improves the efficiency and speed of data transfer.

All Drives Cache On/All Drives Cache Off – Click this button to enable/disable the caching on for all available drives.

> **Note**
> If **Equalization mode** enabled, **Synchronize Cache** and **Read Pre-fetch** will be disabled automatically.

4.1.5.7 MISC



MSIC (Minimal Instruction Set Computer) has standard RAID controller time settings. The time of each event is displayed in the event logs in Event message.

Controller Time – Click this button to see a calendar and to change the time and date of the controller.

Password – Enter the new controller password. The default password is 00000000 (8 zeros). Type another 8 characters.

Password Confirmation – Confirm the new controller password.

> **Note:**
> Do not lose your password. If it is lost, you will have to contact your agent or the Accusys Support Team.

SNMP Notification – Select **SNMPv1** or **SNMPv2** to send notifications for error conditions and possible problems to the SNMP servers. SNMP stands for Simple Network Management Protocol.

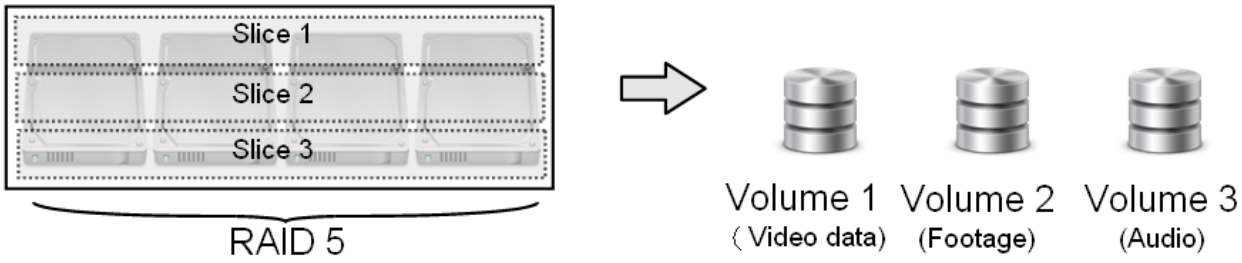
SNMP Target – Enter the IP address for sending the SNMP notifications.

4.1.6 Option

The Options menu provides the methods for managing array. Click on the radio button for the required option, and then click **Next** to proceed.

4.1.6.1 Slicing

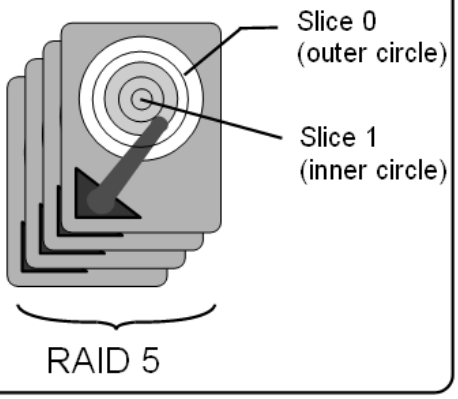
ExaSAN RAID slicing overcomes the inherent design of how data is stored on an HDD or RAID system by subdividing a RAID array into segments, or slices. These slices are effective hardware partitions of all drives in the array. Each slice is a separate LUN and appears as a separate volume on the host computer. After slicing, the LUN map must be set for each slice.



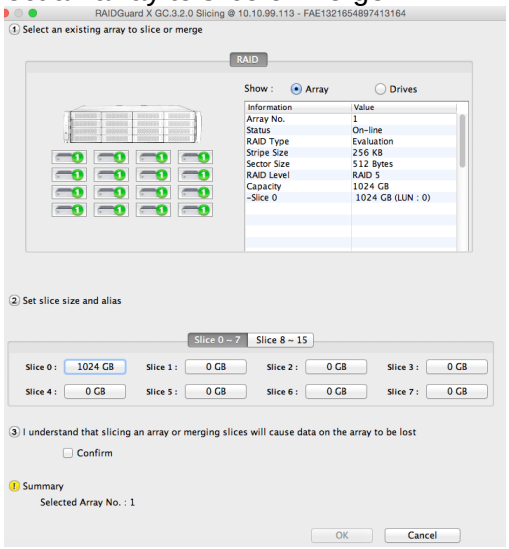
Slicing concept

Usage Scenario:

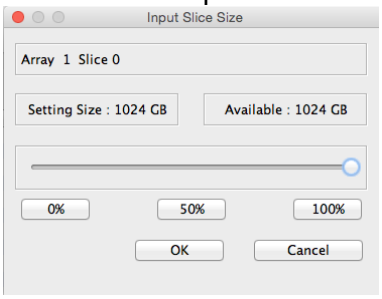
The access speed of the data stored in the outer circle is faster than that of the inner circle. Suppose that there are two slices in a hard drive. Slice 0 locates in the outer circles while Slice 1 the inner circle. In A/V making, you may store video data in Slice 0 and Audio data in random access in Slice 1.



Follow the steps below to select an array to slice or merge.



1. Select the array by clicking on a drive with an array number. The capacity is displayed. By default, Slice 0 contains the entire capacity of the disk array.
2. Click on Slice 0, use the slide bar or button of percentage to slice space and click OK to confirm. Repeat the same steps to slice more spaces if need.



Note

- Up to 16 slices per array.
- The total number of unique arrays' slices cannot exceed 16.

4.1.6.2 LUN Map

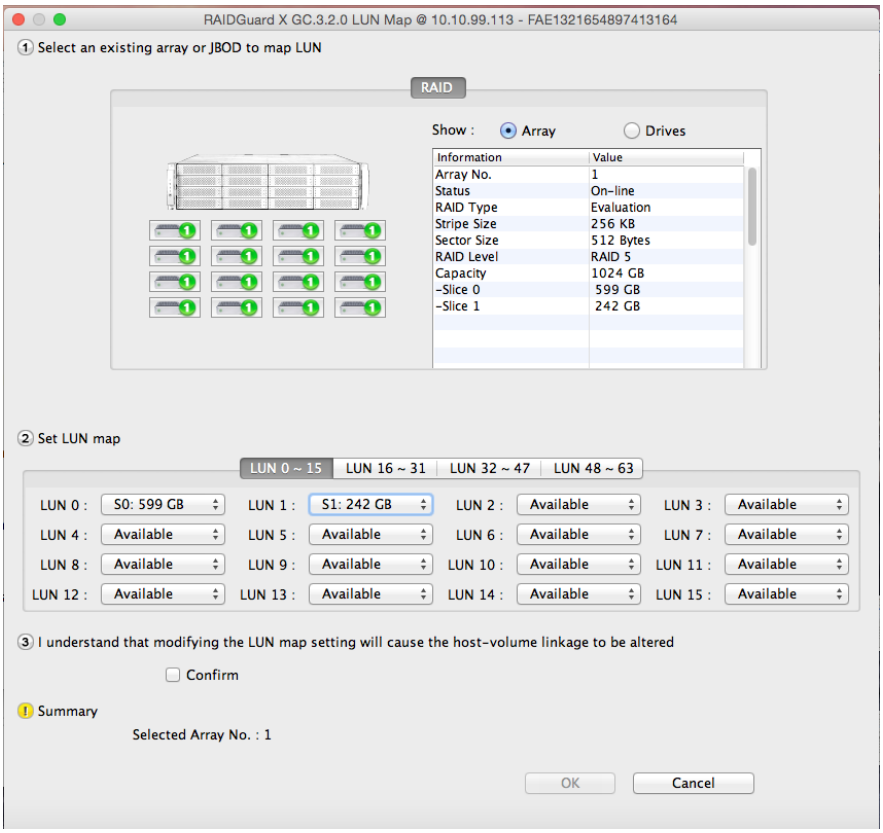
LUN, which stands for **L**ogical **U**nit **N**umber, is used to identify a logical unit in computer storage. When creating an array, you may select **Assign LUN automatically** to automatically assign a LUN to the new array. If **Assign LUN automatically** is not selected, you need to assign the LUN manually using LUN map.

> **Note**
> - One slice can only be assigned one LUN.
> - The ExaSAN RAID controller supports up to 64 LUNs

1. Select the array to map by clicking on a drive with an array number.

2. Choose a LUN and from the drop down list select a slice to map to, check the **Confirm** box and click **OK**.

3. Repeat the steps to set more LUN maps if need.



4.1.6.1 LUN Connect

In LUN Connect, user can manually define the read/write permission of LUN to specific host port; there are 2 modes, “with SAN” and “without SAN”.

- **With SAN:** LUN can be connected to multiple host ports.
- **Without SAN:** LUN can only be connected to single host port.

> **Note**
> - The ExaSAN RAID controller supports up to 64 LUNs

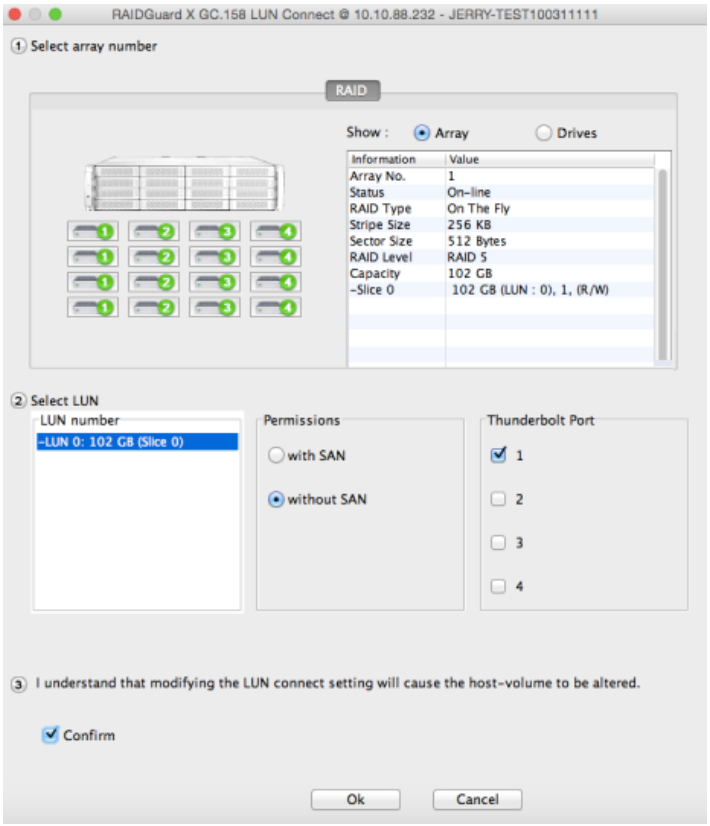
Follow the steps below to configure LUN Connect;

1. Select the array to connect by clicking on a drive with an array number.

2. In Select LUN area, define following settings
   - LUN number
   - Permission (with SAN or without SAN)
   - Thunderbolt Port (1~4)

3. Check the **Confirm** box and click **OK**.

4. Repeat the steps to create more LUN connect if need.



4.1.6.2 Expansion

Expansion adds spare disks or new hard drives to an existing array. This is no need to create a new array or stop an array; you may add new disks online while the array is in use. Expansion can enlarge the capacity and frequency of an array. Although you may still access the array while doing Expansion, its performance is affected considerably. You may check the progress of Expansion in the main view.

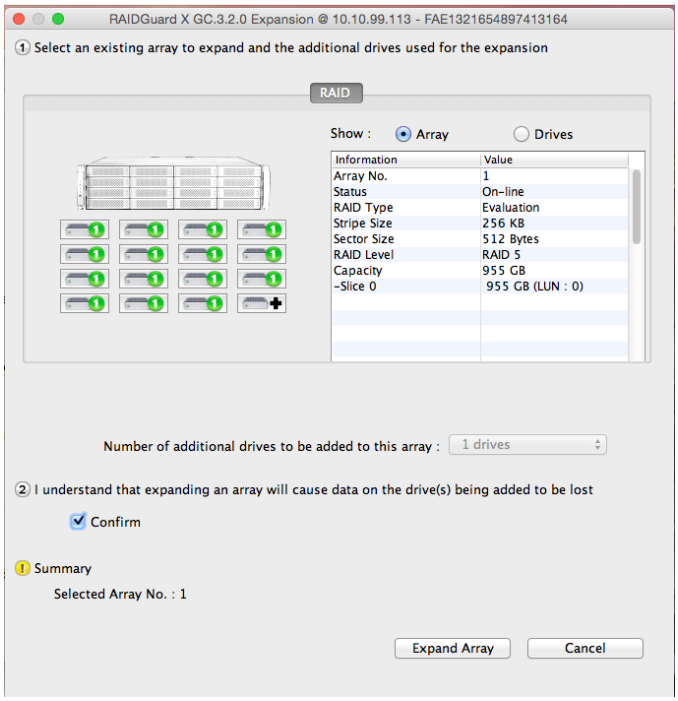
Example:

> **Note**
> The new hard drive must larger than existing drives of array.

Follow the steps below to select an array to expand.

1. Select the array to add additional drives to, and select the number of drives to be added. A "+" sign appears above the drives to be added.

2. Check the **Confirm** box and click **Expand Array**.

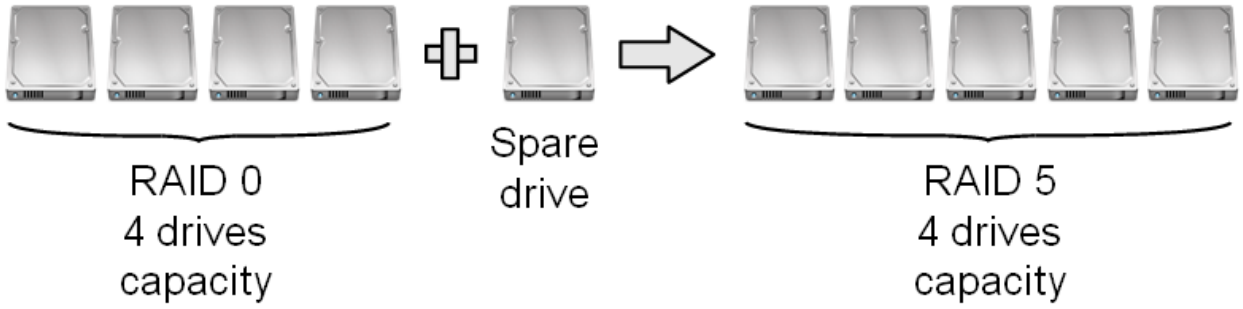


4.1.6.3 Migrations

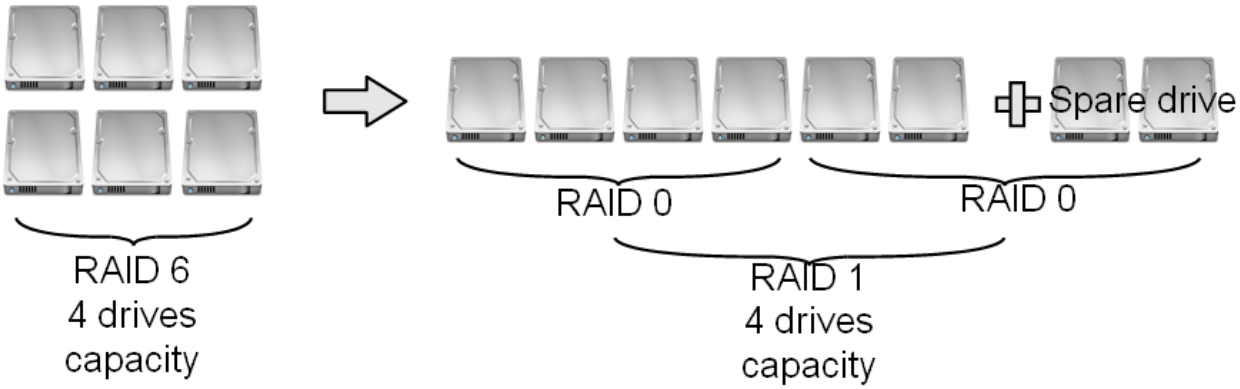
Different from Expansion, which enlarges an array by adding hard drives to a fixed RAID level, Migration changes the RAID level of an array. It allows live changes to the RAID without the need to delete the array and rebuild. This can be useful when new drives have been added, and a new array type needs to be created.

Example 1:
RAID 5 (12 drives) –Migrating→ RAID 0 (>11 drives)
RAID 5 (12 drives) –Migrating→ RAID 6 (>13 drives)
RAID 5 (12 drives) –Migrating→ RAID 0+1 (>22 drives)

Example 2:



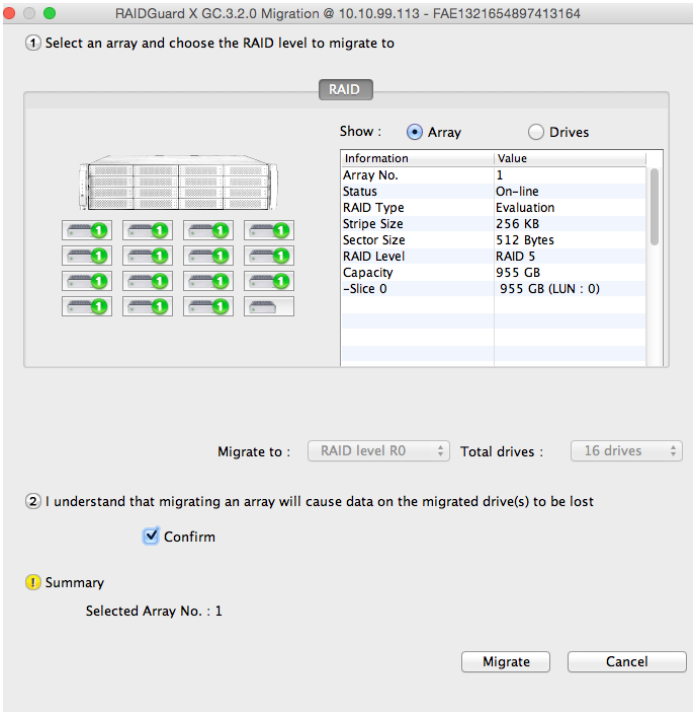
Example 3:



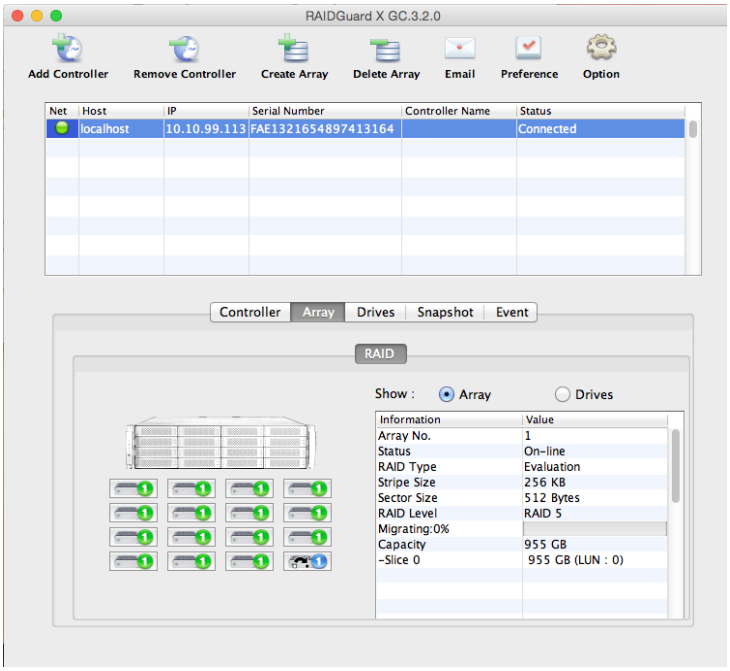
Note
The new hard drive must larger than existing drives of array.

Follow the steps below to select an array to migrate. This changes the RAID level, such as from RAID 1 to RAID 5.

1. Select the array to migrate. From the drop down menu, select the RAID level to migrate to, and then select the total number of drives to include in the array. A "+" appears above the drive(s) to be added, and a "-" sign above the drive(s) to be removed.
2. Check the **Confirm** box and click **Migrate**.



3. The main array information screen will indicate that the array is currently migrating.



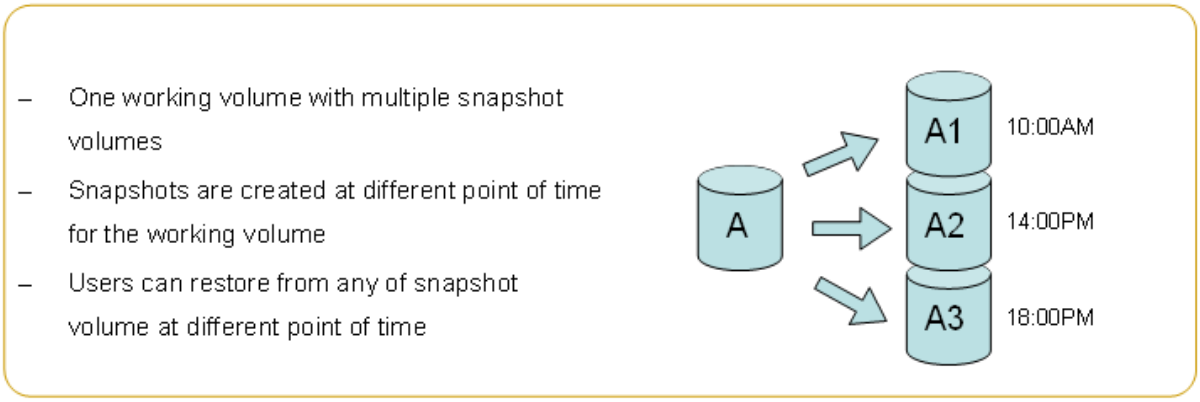
4.1.6.4 Snapshot

A snapshot is initialized with a data duplicate from a source to a target. The mirror snapshot is offered by the ExaSAN RAID controller.

> **Note**
> The source and target volume of the snapshot must be identical.

Before setting a snapshot, you need to set the slice in the array. The capacity of each slice and the number of shots should be in accordance with the space you need.

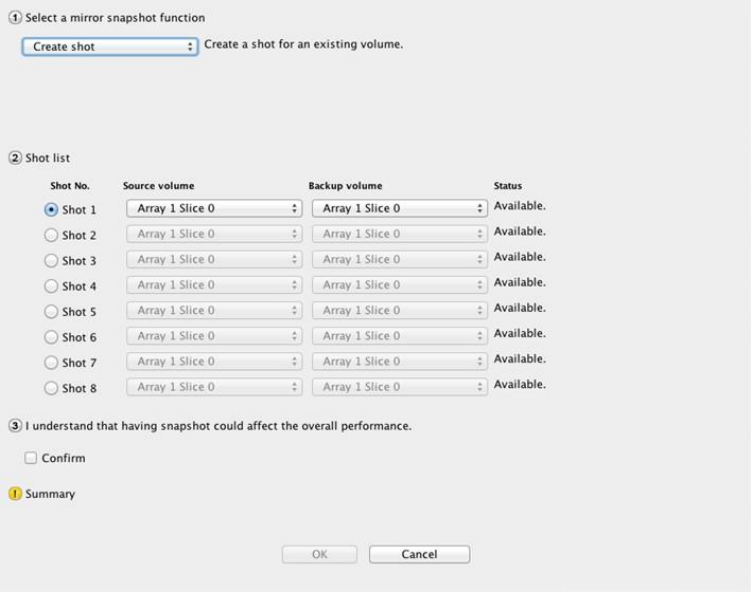
In the figure above, a snapshot can be created by splitting the source and target after the background sync is completed. The I/O mirroring is stopped, and the difference is under tracking in a bitmap table to support fast re-sync.



Create Shot

Create a snapshot of the selected slice. A maximum of 8 shots can be created. Once all shots have been used, older shots must be deleted before new ones can be taken.

1. Select the **Create Shot** function from the drop down menu.
2. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.
3. Check the **Confirm** box and click **OK** to take a snapshot.



Delete Shot
Delete the selected shot.

1. Select the **Delete Shot** function from the drop down menu.
2. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.
3. Check the **Confirm** box and click **OK** to delete a snapshot.

Split Shot
Split Now –
Split the selected shot or changes scheduling. The shot is split and read as two separate shots; therefore, it becomes two separate slices after being split.

1. Select the **Split Shot** function from the drop down menu.
2. Select the Split Now radio button.
3. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.
4. Check the **Confirm** box and click **OK** to split the snapshot.

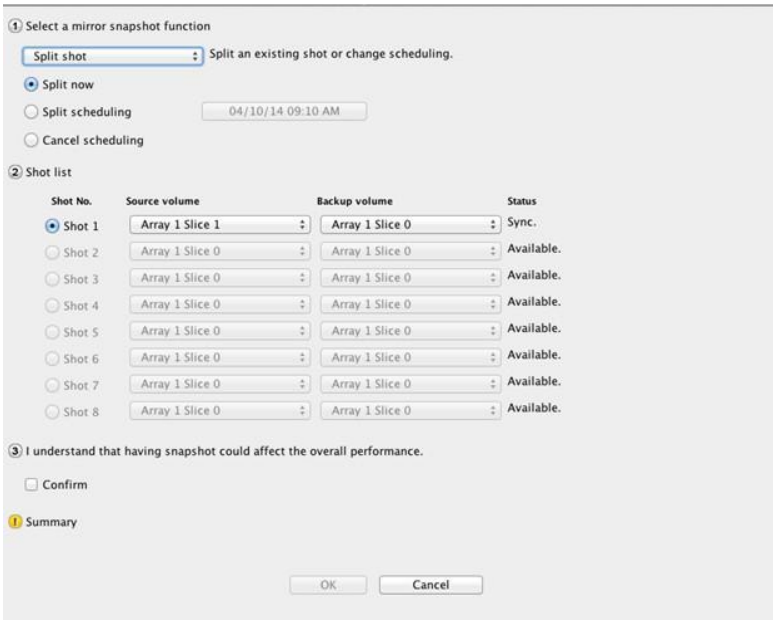
Split Scheduling –
Set any time to split shot.

1. Select the **Split Shot** function from the drop down menu.
2. Select the Split Scheduling radio button.
3. Click on the time and date button to set split time.
4. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.

5. Check the **Confirm** box and click **OK** to split the snapshot.

Cancel Scheduling –
Cancel the split shot scheduling.

1. Select the **Split Shot** function from the drop down menu.
2. Select the Cancel Scheduling radio button.
3. Select the required shot by clicking on the Shot No. radio button. From the respective drop down menus, select the source volume and destination volume. Unavailable shots are grayed out.
4. Check the **Confirm** box and click **OK** to split the snapshot.



Resynchronize Shot
Resynchronize the selected shot. This function can speed up mirroring for previous snapshots.

1. Select the **Resynchronize shot** function from the drop down menu.
2. Select the required shot by clicking on the Shot No. radio button. You can only select split shot for resynchronization.
3. Check the **Confirm** box and click **OK** to split the snapshot.

Note
1. The destination volume must be equal or larger in size than the source volume.
2. The source volume and the destination volume can be on different arrays.
3. The destination volume must NOT be mapped to a LUN.
4. A shot will not be deleted if the details of the array change. The only way to delete a shot is using the Delete Shot function under Snapshot.

4.1.6.5 Health Center

To ensure the accuracy of the RAID parity data, ExaSAN RAID controller offers Background checking and “Rebuild parity data”. During checking or rebuilding parity, the performance of the array will be affected. You may check the progress of in the Main view or in the Health Center.

Follow the steps below to select an array to verify, rebuild, or condition.

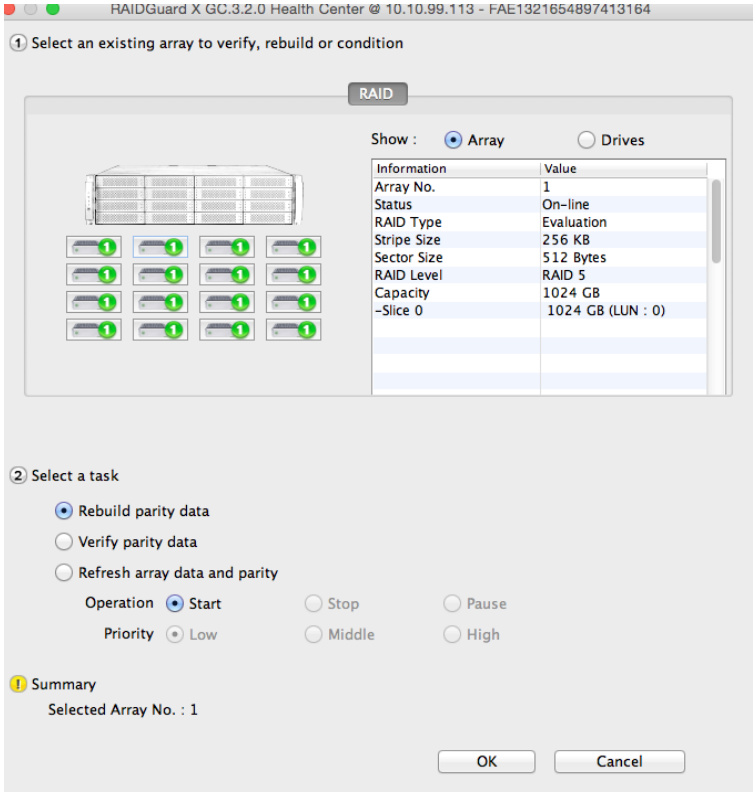
1. Select the Array to verify, rebuild, or condition.
2. Click the radio button to:

   Rebuild the parity data – Rebuilding parity on an array uses the data on the array to create new parity data, no repair problems with the data.

   Verify the parity data – Verify that the data is free of errors.

   Refresh array data and parity – Select the priority between Low, Med., or High. This process scans, rewrites, and scrubs bad data conditions caused by excessive vibration during drive I/Os, or data degradation caused by Adjacent Track Interference (ATI).

3. Click OK to start the operation.



4. The main array information screen will indicate that the array is undergoing rebuilding, verification, or refreshing.

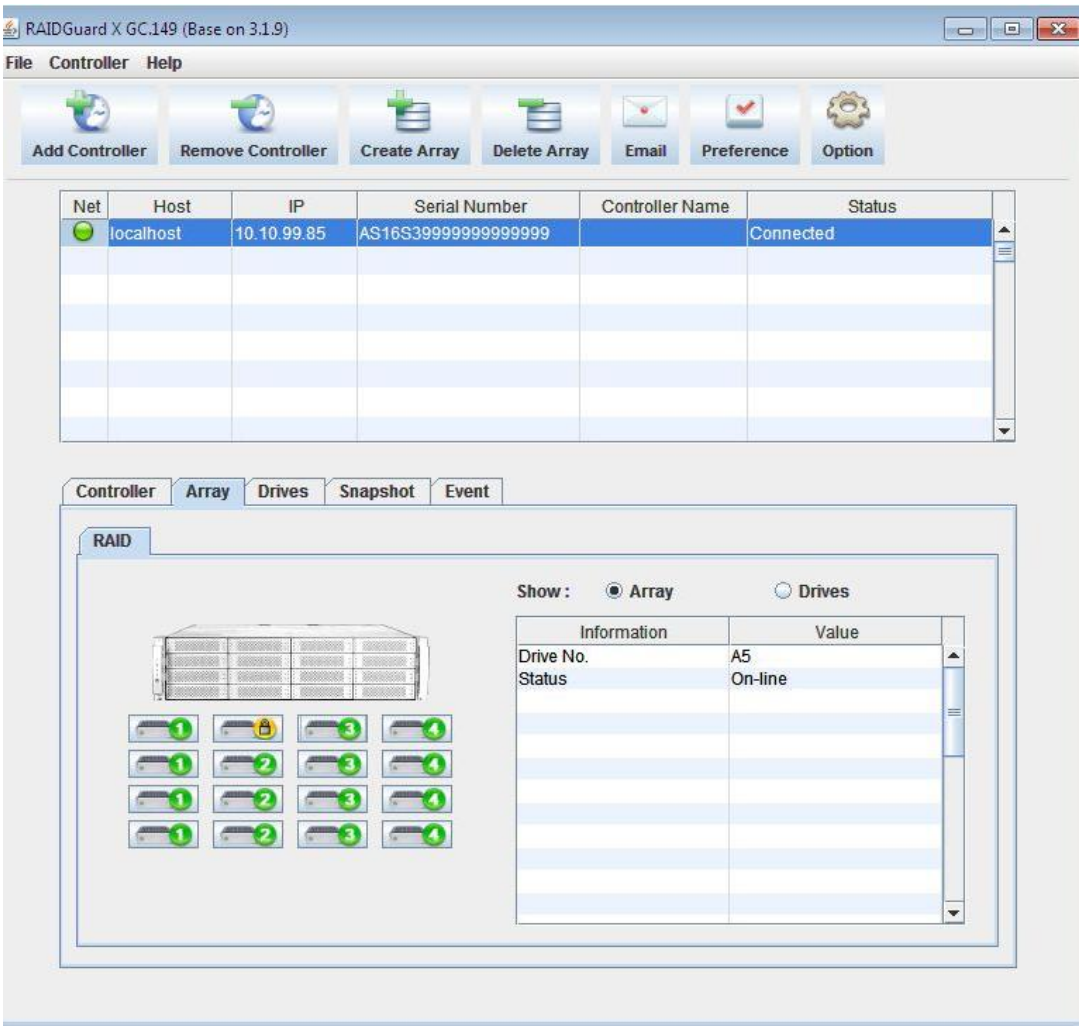
4.1.6.6 Unlock Drives

The RAID controller may lock abnormal drives in an array. You may unlock these drives and rejoin them in an array. Drives may be locked with one of two conditions:

1. If a drive returns data too slowly, the controller determines the drive is experiencing a fault and executes Drive Drop. When you unlock the drive, it will be added directly to the array if there has not been drive access during the locked period. Otherwise, the controller will rebuild parity data on the drive when the drive is online.

> **Note**
> If “Drive Drop" occurs, it is recommended to use S.M.A.R.T. to check the drive condition and replace it if necessary.

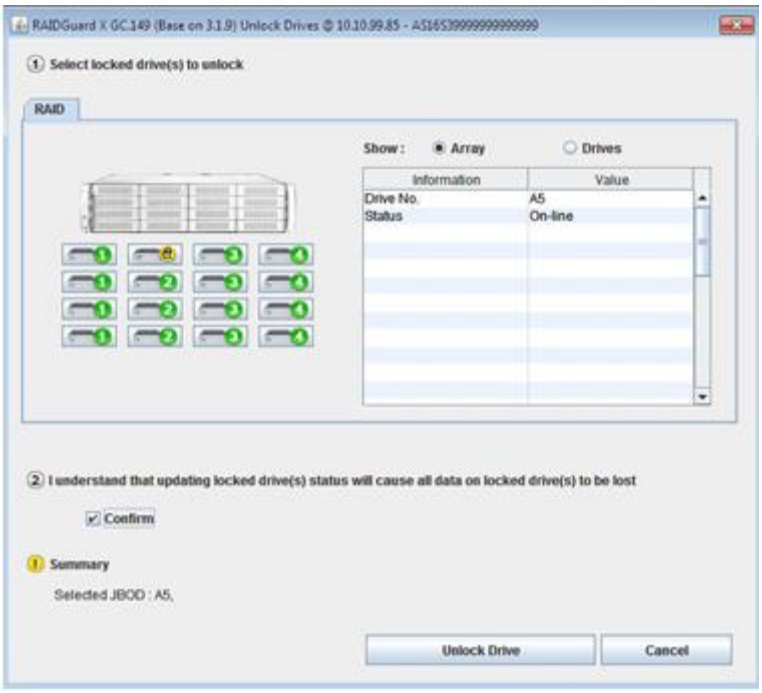
2. When a drive has been used by ExaSAN RAID system, that drive will be locked if insert it to another RAID system.



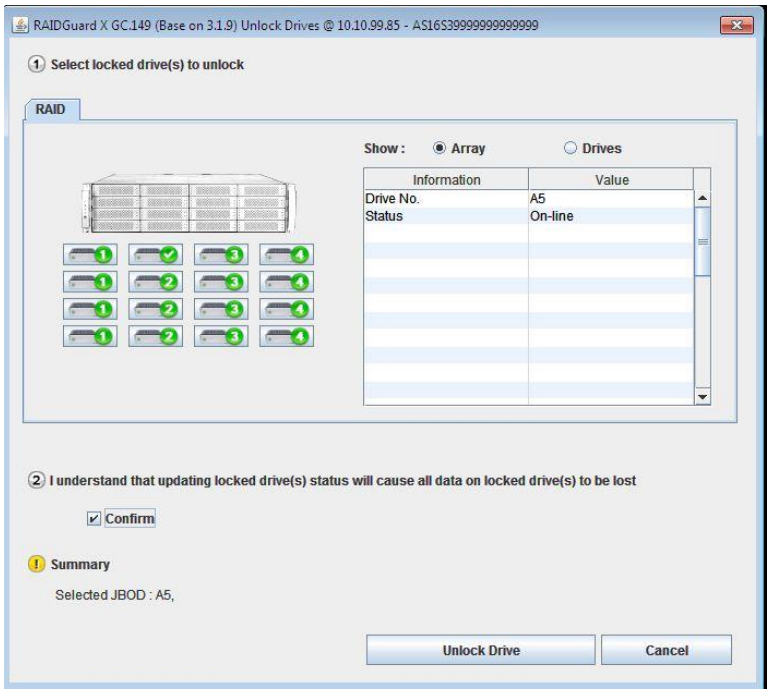
Drive 5 Locked

Follow the steps below to select a drive to unlock.

1. Select the drive with the  icon. It will change to the  icon.



2. Check the **Confirm** box and click **Unlock Drive**.



4.1.7 Updating the ExaSAN RAID system Firmware

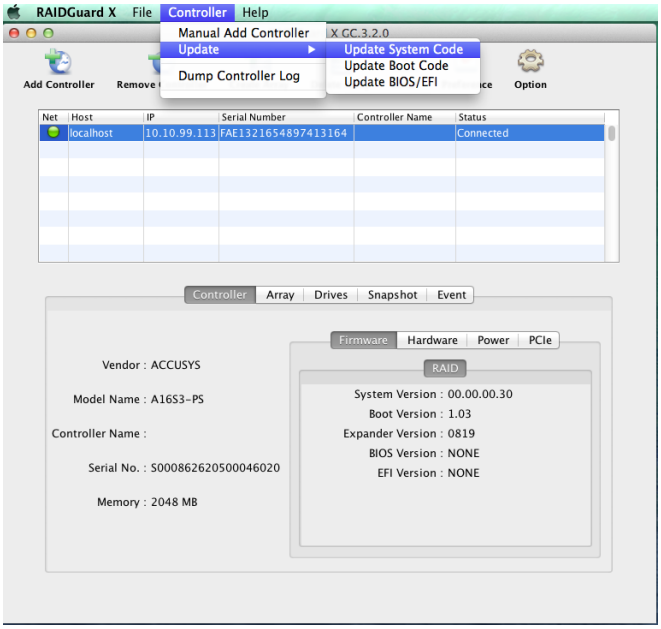
Follow the steps in this section to update the firmware of your ExaSAN RAID system. Use caution to prevent a loss of power to the ExaSAN RAID system during this process.

4.1.7.1 Preparing the Firmware Update Files

1. Note the current System Version, Boot Version, BIOS Version and EFI version on your ExaSAN RAID system. These can be viewed in the Main menu firmware tab.
2. Visit the website below:
3. http://www.accusys.com.tw/support/download.htm, Under the “Download” link, you can click the folder to look for your ExaSAN system model
4. Proceed to the next section to update the firmware files.

4.1.7.2 Installing the Firmware Update Files

1. Select Controller in the Menu bar and select **Update**.



2. Update System Code, Boot Code, BIOS/EFI individually from the download path. During the update process, the RAID system will stop all data access.

> **Caution**
> Do NOT interrupt or stop updates that are in progress.

3. Once the updates are complete, make sure to power off the ExaSAN RAID system and host using the proper power down sequence and then power on, again following the proper power on sequence.

5. RAID Overview

5. RAID Overview

This chapter gives an overview of RAID storage system within the context of recommended setting of ExaSAN based SAN environment to provide fast, shared storage to client computers.

5.1 How RAID Works

RAID, or Redundant Array of Independent Disks, is a data-storage technology that spreads data across multiple drives. This technology provides several benefits over a single large hard disk, including:

- Data redundancy for protection and availability
- Higher performance as a result of reading or writing on several drives simultaneously
- Scalability for expansion of storage

The ExaSAN-family RAID systems use a hardware controller, which manages up to 48 HDDs. By segmenting and writing or reading data on multiple drives simultaneously, the RAID controller achieves fast and highly efficient storage and access.

The way the controller stores and retrieves data on the RAID system is determined by the RAID level and storage method you choose. For ExaSAN applications, the recommended setting is mainly RAID 1 and RAID 5, which will be discussed in details later in this chapter.

Once you have defined a group of drive modules as a RAID set, the controller groups those drives into “logical disks.” On the ExaSAN RAID system, each logical disk appears to the client system as one Logical Unit (LUN), regardless of the number of actual drives in that logical unit.

5.2 Data Storage Methods

The controller stores and retrieves data on a RAID system using techniques such as “data striping”, “data mirroring”, and “data parity”.

5.2.1 Data Striping

Multiple hard disk drives in a RAID group, referred to as a “set” or “array,” are divided (partitioned) into stripes. The controller spreads stripes across the disks in alternating sections on each drive.

In data-intensive environments such as digital video editing, performance is optimized by writing data across small stripes, so that each record spans all drives. This method ensures that access to large records is very fast because data is transferred in parallel across multiple drives.

5.2.2 Data Mirroring

To mirror data, the RAID controller duplicates all data on two different disks. One disk is the primary; the other is the mirrored disk. The primary and mirrored disks are synchronized; that is, anything written to one disk is also written to the other. Mirrored data is very secure because if one disk fails, the data is available from the other disk.

5.2.3 Data Parity

The controller can generate “parity” for the ability to protect and rebuild data. Parity protects stored information without requiring data mirroring. When data is protected by parity, it is still available if a drive fails. Parity-protected data is reconstructed using the parity formula. You can remove and replace a failed disk (known as “hot swapping”), and the controller then rebuilds the data using the information on the remaining drives.

5.3 RAID Levels

The ExaSAN RAID system supports several RAID levels and configurations. Each level has a different architecture and provides varying degrees of performance and fault tolerance. Each level has characteristics to achieve maximum performance or redundancy depending on the data environment.

5.3.1 RAID 0: Striping

RAID level 0, striping only, is the fastest and most efficient array type, but offer no fault-tolerance. Any drive failure destroys the data in the array.

5.3.2 RAID 1: Mirroring

RAID level 1, mirroring, has been used for Metadata LUN because of its simplicity and high levels of reliability and availability. Mirroring uses two drives, each drive stores identical data. RAID 1 provides very high data reliability and improved performance for read-intensive applications, but this level has a high capacity cost because it retains a full copy of your data on each drive in mirror set.

In a RAID 1 configuration, the capacity of the smallest drive is the maximum storage area.

5.3.3 RAID 5: Independent data disks with distributed parity

By distributing the parity information across all drives in a set, RAID level 5 achieves high reliability and data availability. It also offers the highest read data transaction rate of all levels along with a medium write rate. The low ratio of ECC (Error Correction Code) parity disks to data disks offers hardware efficiency. Disk failure has a moderate impact on the total transfer rate.

5.3.4 RAID 6: Independent data disks with two Independent parity schemes

RAID level 6 extends RAID level 5 by adding an additional parity block; thus it uses block-level striping with two parity blocks distributed across all member disks. RAID 6 does not have a performance penalty for read operations, but it does have a performance penalty on write operations because of the overhead associated with parity calculations.

RAID 6 is no more space inefficient than RAID 5 with a hot spare drive when used with a small number of drives, but as arrays become bigger and have more drives the loss in storage capacity becomes less important and the probability of data loss is greater. RAID 6 provides protection against data loss during an array rebuild, when a second drive is lost, a bad block read is encountered, or when a human operator accidentally removes and replaces the wrong disk drive when attempting to replace a failed drive.

5.3.5 RAID 0+1: Striped set with Mirroring

RAID 0+1 combines the advantages of RAID 0 and RAID 1 with none of the disadvantages. RAID 0+1 creates a mirror of the primary striped set. RAID 0+1 provides optimal speed and reliability.

RAID Level	Description	Capacity
RAID 0	Striping, the fastest and most efficient array type but offers no fault-tolerance	Total of all drives
RAID 1	Mirroring, All disks have the same data	Total of one drive
RAID 5	Block-level striping with distributed parity, one disk fault tolerant	Total of all drives minus one drive
RAID 6	Block-level striping with double distributed parity, two disks fault tolerant	Total of all drives minus two drives
RAID 0+1	Combines the advantage of R0 and R1, provides optimal speed and reliability	One-half the total capacity of drives (Sum of RAID 1 member sets)
JBOD	Just a single disk	One disk

6. Appendices

Appendix A: FAQs

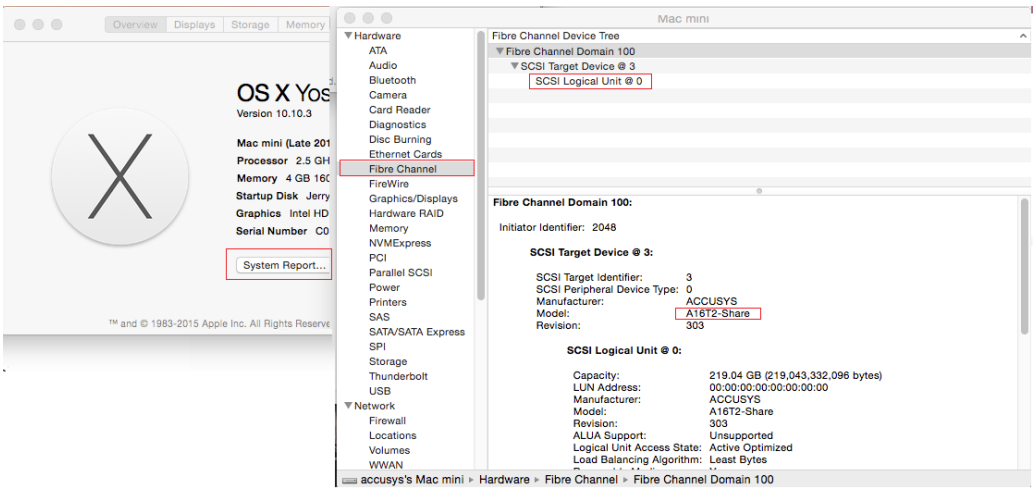
1. **Q: After creating an array in RAIDGuardX, the volume doesn't appear on the host?**
   A: Please check the LUN Mapping to ensure the array volume has been mapped to a LUN correctly. If this is not the case, try to check all connections and restart the whole systems.

2. **Q: Why doesn't the performance reach the expected levels while testing the A16T2-SHARE? Why isn't the performance steady enough?**
   A: If the performance is unsteady or not achieving the expected level, in many cases, the HDD is the cause. As a result, it is strongly recommended to use the latest enterprise level HDD.

3. **Q: On a MAC host, after entering the GUI and adding a controller, there is no device listed. How could this be resolved?**
   A: First, please confirm whether the hardware environment of the RAID system is functional. Also, ensure that the system drivers have been correctly installed. Next, go to "**Utilities > System Information> Software > Extensions"** and check whether ACS6x.kext is listed. Reload RAID Guard X Server service / Library/ Start up Items/ RGX_Accusys/ **DTRGuiSrv01_64** If the situation persists, please verify again that the hardware environment is not the source of the problem and reinstall using the MAC installer.

4. **Q: When inserting the HDD into my A16T2-SHARE, why does RAIDGuardX show the HDD mode as Lock?**
   A: The lock indicates that the HDD has been previous used in Accusys products and that it contains a portion of a RAID data. If the data can be deleted, you can unlock the HDD.

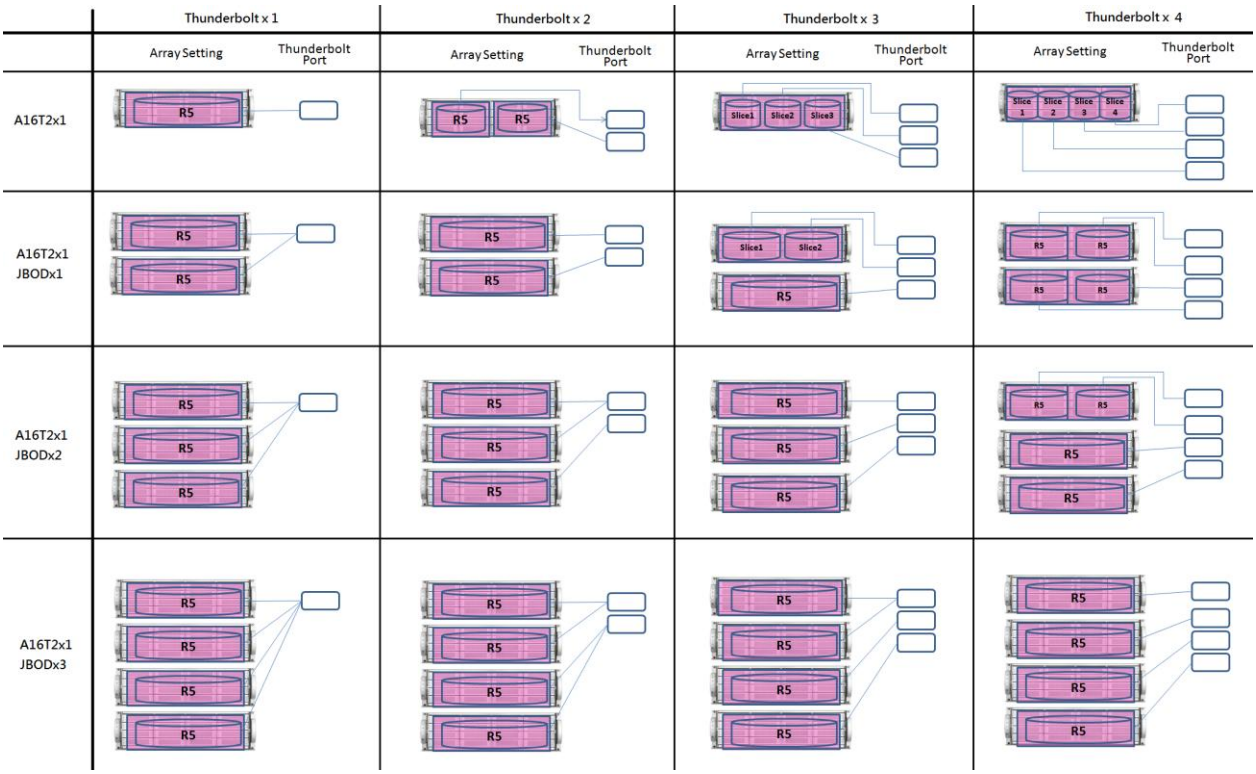
5. **Q: How can I make sure my MacOS has probably installed driver and recognized volume?**
   A: Click on **About This Mac** and click on the **More Info…** button, then Click on the **System Report…** button. Normally, MacOS will recognize ExaSAN as Fibre device, under the **Hardware** category, click on **Fibre Channel** to bring up information. If there is a volume created, a **SCSI logical unit** will be listed under **Fibre Channel Domain**.



Appendix B: Array Definition for Quick Setup

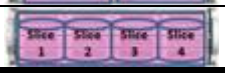
Once A16T2-Share (and JBODs) is filled with disks, Without SAN and With SAN quick setup options will automatically make the configuration of Array(s) and Thunderbolt Port connection as following table.

B.1 Without SAN

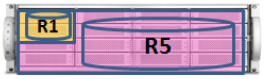
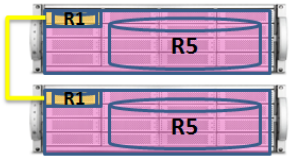
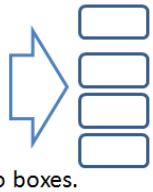
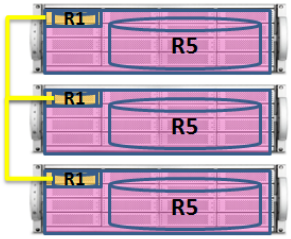
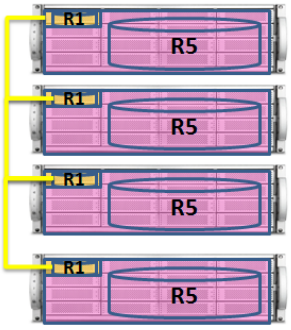


Note

The meaning of array configuration.

Icon	Configuration
	**Disk1~16 in a RAID5 array**
	**Disk1~8 in a RAID5 array, Disk9~16 in a RAID5 array**
	**Disk1~16 in a RAID5 array and divide as 4 slices**

B.2 With SAN

	Visible by all Thunderbolt ports	
	Array Setting	Thunderbolt Port
A16T2x1	 *R1 with disk*2 *R5 with disk*14	
A16T2x1 JBODx1	 *R1 with disk*2 cross two boxes. *R5 with disk*15.	
A16T2x1 JBODx2	 *R1 with disk*3 cross three boxes. *R5 with disk*15.	
A16T2x1 JBODx3	 *R1 with disk*4 cross four boxes. *R5 with disk*15.	

Appendix C: Customer Service and Support

C.1 System Log

When you contact us for technical support, our support staff might ask for your system log file for troubleshooting purpose.

1) RAID controller log by Dump controller log of RAIDGuard X
2) Client operation system log. (it's better to record related error message.)

C.2 Contact Us

For customer services and technical support, locate an Accusys office near you from the link below:

http://www.accusys.com.tw/about-accusys/contact-us.html

Or, you may email us at support@accusys.com.tw

C.3 Our Website

Please visit our websites frequently for the most up-to-date product and support information.

All countries: www.accusys.com.tw

Korea: http://accusys.co.kr