

## UltraStor RS8 SS



## UltraStor RS16 SS



## SAS to SATA II / SAS RAID Controller

# User Manual

Version 5.6 (March, 2008)

# Preface

## About this manual

This manual is the introduction of **UltraStor RS8 SS and RS16 SS** controller, and to help user to know the operation of the disk array system easily. Information contained in the manual has been reviewed for accuracy, but not for product warranty because of the various environments/OS/settings. Information and specification will be changed without further notice. For any update information, please visit [www.enhance-tech.com](http://www.enhance-tech.com) and your contact windows.

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## Package content

- One UltraStor SS series controllers
  - Backplane solution
    - **RS8 SS**: SAS (x2) -to- SATA II/SAS (8 bays) RAID controller.
    - **RS16 SS** SAS (x2) -to- SATA II/SAS (16 bays) RAID controller.
  - Cable solution
    - **E500**: SAS (x1) -to- SATA II (xN bays) RAID controller.

Please contact with "[sales@enhance-tech.com](mailto:sales@enhance-tech.com)" to get the latest user manual and firmware.

The RAM size for E500 is recommended **DDR-333 512MB** or above. **RS8 SS/RS16 SS** is recommended **DDR2-533 512MB** or above. Please refer to the certification list in Appendix A.

## Model comparisons

	<b>E500</b>	<b>RS8 SS</b>	<b>RS16 SS</b>
<b>Minimum RAM</b>	DDR-333 512MB	DDR2-533 512MB	DDR2-533 512MB
<b>Cable / Backplane</b>	Cable	Backplane	Backplane
<b>SAS channels</b>	1 (x4)	2 (x4)	2 (x4)
<b>MPIO</b>	No	No	No
<b>HDDs</b>	8	8	16
<b>Snapshot (ESnap)</b>	No	Yes	Yes
<b>HDD Auto Spin-down</b>	Yes	No	No
<b>SAF-TE or SES</b>	SES	SES	SES

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# Chapter 1 RAID introduction

## 1.1 Features

**UltraStor SS series** controller is a high-performance RAID controller.

- Backplane solution
  - **RS8 SS**: SAS (x2) -to- SATA II/SAS (8 bays) RAID controller.
  - **RS16 SS** SAS (x2) -to- SATA II/SAS (16 bays) RAID controller.
- Cable solution
  - **E500**: SAS (x1) -to- SATA II (xN bays) RAID controller.

**UltraStor SS series** controller features:

- RAID 6 ready
- Snapshot-on-the-box (ESnap) / rollback
- SATA II support with SATA I backward compatible
- N-way mirror
- On-line volume expansion and RAID level migration
- Global/dedicated cache configuration by volume
- S.M.A.R.T. enabled
- Support SES
- Disk roaming
- MPIO ready (initiator driver support needed)

With proper configuration, **ULTRASTOR** controller can provide non-stop service with a high degree of fault tolerance by the use of **ULTRASTOR** RAID technology and advanced array management features. The controller features are slightly different between the backplane solution and cable solution. For more detail, please contact with your direct sales or email to “[sales@enhance-tech.com](mailto:sales@enhance-tech.com)”.

**UltraStor SS series** controller connects to the host system using SASI interface. It can be configured to any RAID level. UltraStor Series controller provides reliable data protection for servers and the **RAID 6** function ready. The RAID 6 function allows two HDD failures without any impact on the existing data. Data can be recovered from the remaining data and parity drives. (Data can be recovered from the rest disks/drives.)

**Snapshot-on-the-box (E-Snap)** is a fully usable copy of a defined collection of data that contains an image of the data as it appeared at the point in time. It provides consistent and instant copies of data volumes without any system downtime. **ULTRASTOR** Snapshot-on-the-box (E-Snap) can keep up to 32

snapshots (ESnap) for all data volumes. **Rollback** feature is provided for restoring the previously-snapshot (ESnap) data easily while continuously using the volume for further data access. The data access is regular as usual including read/write without any impact to end users. The "on-the-box" terminology implies that it does not require any proprietary agents installed at host side. The snapshot (ESnap) is taken at target side and done by **ULTRASTOR** controller. It will not consume any host CPU time thus the server is dedicated to the specific or other application. The snapshot (ESnap) copies can be taken manually or by schedule every hour or every day, depends on the configurations.

**ULTRASTOR** RAID controller is the most cost-effective disk array controller with completely integrated high-performance and data-protection capabilities which meet or exceed the highest industry standards, and **the best data solution for small/medium size business users.**



#### **Caution**

Snapshot (ESnap) / rollback features need **512MB** RAM or more. Please refer to RAM certification list in Appendix A for more detail.

## **1.2 Terminology**

The document uses the following terms:

<b>RAID</b>	RAID is the abbreviation of “ <b>R</b> edundant <b>A</b> rray of Independent <b>D</b> isks”. There are different RAID levels with different degree of the data protection, data availability, performance to host environment.
<b>PD</b>	The <b>P</b> hysical <b>D</b> isk belongs to the member disk of one specific volume group.
<b>VG</b>	<b>V</b> olume <b>G</b> roup. A collection of removable media. One VG consists of a set of UDV's and owns one RAID level attribute.
<b>UDV</b>	<b>U</b> ser <b>D</b> ata <b>V</b> olume. Each VG could be divided into several UDV's. The UDV's from one VG share the same RAID level, but may have different volume capacity.
<b>CV</b>	<b>C</b> ache <b>V</b> olume. <b>ULTRASTOR</b> controller uses the on board memory as cache. All RAM (except for the part which is

	occupied by the controller) can be used as cache. Use can divide the cache for one UDV or sharing among all UDV's. Each UDV will be associated with one CV for data transaction. Each CV could be assigned different cache memory size.
<b>LUN</b>	<b>Logical Unit Number.</b> A logical unit number (LUN) is an unique identifier used on a SCSI/SAS bus which enables it to differentiate among separate devices (each of which is a logical unit).
<b>GUI</b>	<b>Graphic User Interface.</b>
<b>RAID width, RAID copy, RAID row</b> (RAID cell in one row)	RAID width, copy and row are used to describe one VG. E.g.: <ol style="list-style-type: none"> <li>1. One 4-disk RAID 0 volume: RAID width= 4; RAID copy=1; RAID row=1.</li> <li>2. One 3-way mirroring volume: RAID width=1; RAID copy=3; RAID row=1.</li> <li>3. One RAID 10 volume over 3 4-disk RAID 1 volume: RAID width=1; RAID copy=4; RAID row=3.</li> </ol>
<b>WT</b>	<b>Write-Through</b> cache writes policy. A caching technique in which the completion of a write request is not signaled until data is safely stored on non-volatile media. Each data is synchronized in both data cache and the accessed physical disks.
<b>WB</b>	<b>Write-Back</b> cache writes policy. A cache technique in which the completion of a write request is signaled as soon as the data is in cache and actual writing to non-volatile media occurs at a later time. It speeds up system write performance but needs to bear the risk where data may be inconsistent between data cache and the physical disks in one short time interval.
<b>RO</b>	Set the volume to be <b>Read-Only</b> .
<b>DS</b>	<b>Dedicated Spare</b> disks. The spare disks are only used by one specific VG. Others could not use these dedicated spare disks for any rebuilding purpose.
<b>GS</b>	<b>Global Spare</b> disks. GS is shared for rebuilding purpose. If some VGs need to use the global spare disks for rebuilding, they could get the spare disks out from the common spare



	disks pool for such requirement.
<b>DC</b>	<b>D</b> edicated <b>C</b> ache.
<b>GC</b>	<b>G</b> lobal <b>C</b> ache.
<b>DG</b>	<b>D</b> e <b>G</b> rade mode. Not all of the array's member disks are functioning, but the array is able to respond to application read and write requests to its virtual disks.
<b>S.M.A.R.T.</b>	<b>S</b> elf- <b>M</b> onitoring <b>A</b> nalysis and <b>R</b> eporting <b>T</b> echnology.
<b>WWN</b>	<b>W</b> orld <b>W</b> ide <b>N</b> ame.
<b>HBA</b>	<b>H</b> ost <b>B</b> us <b>A</b> dapter.
<b>MPIO</b>	<b>M</b> ulti- <b>P</b> ath <b>I</b> nput/ <b>O</b> utput.
<b>S.E.S.</b>	<b>S</b> CSI <b>E</b> nclosure <b>S</b> ervices.
<b>SCSI</b>	<b>S</b> mall <b>C</b> omputer <b>S</b> ystems <b>I</b> nterface.
<b>SAS</b>	<b>S</b> erial <b>A</b> ttached <b>S</b> CSI

## 1.3 RAID levels

<b>RAID 0</b>	Disk striping. <b>ULTRASTOR</b> RAID 0 needs at least one hard drive.
<b>RAID 1</b>	Disk mirroring over two disks. RAID 1 needs at least two hard drives.
<b>N-way mirror</b>	Extension to RAID 1 level. It has N copies of the disk.
<b>RAID 3</b>	Striping with parity on the dedicated disk. RAID 3 needs at least three hard drives.
<b>RAID 5</b>	Striping with interspersed parity over the member disks. RAID 3 needs at least three hard drives.

<b>RAID 6</b>	2-dimensional parity protection over the member disks. RAID 6 needs at least four hard drives.
<b>RAID 0+1</b>	Mirroring of the member RAID 0 volumes. RAID 0+1 needs at least four hard drives.
<b>RAID 10</b>	Striping over the member RAID 1 volumes. RAID 10 needs at least four hard drives.
<b>RAID 30</b>	Striping over the member RAID 3 volumes. RAID 30 needs at least six hard drives.
<b>RAID 50</b>	Striping over the member RAID 5 volumes. RAID 50 needs at least six hard drives.
<b>RAID 60</b>	Striping over the member RAID 6 volumes. RAID 60 needs at least eight hard drives.
<b>JBOD</b>	The abbreviation of “ <b>J</b> ust a <b>B</b> unch <b>O</b> f <b>D</b> isks”. JBOD needs at least one hard drive.

# Chapter 2 Getting started

## 2.1 Before starting

Before starting, prepare the following items.

1. Check the “Certification list” in Appendix A to confirm that the hardware setting is fully supported.
2. Read the latest release notes before upgrading. Release notes will accompany with firmware.
3. A server with a SAS HBA.
4. SAS cables.
5. CAT 5e, or CAT 6 network cables for management port.
6. Prepare storage system configuration plan.
7. Management port network information. When using static IP, please prepare static IP addresses, subnet mask, and default gateway.
8. Setup the hardware connection before power up servers and ULTRASTOR controllers. Connect SAS cables, console cable, and management port cable first.

## 2.2 Storage introduction

For UltraStor SS series offers advantages over older parallel technologies. The cables are more reliable, and the connectors are less bulky. Serial data transfer allows the use of longer cables than parallel data transfer.

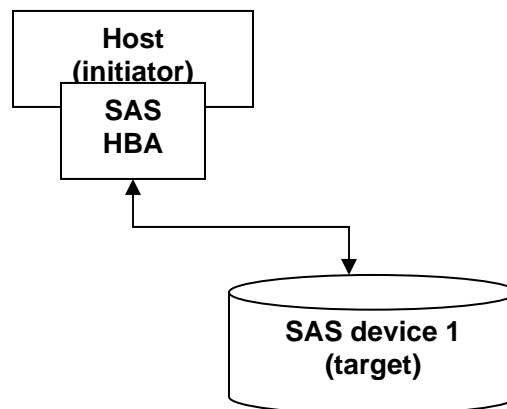


Figure 2.2.1

The target is the storage device itself or an appliance which controls and serves volumes or virtual volumes. The target is the device which performs the SCSI commands or bridges it to an attached storage device. The targets can be disks, tapes, RAID arrays, tape libraries, and etc.

## 2.3 Management methods

There are three management methods to manage UltraStor Series controller, describe in the following:

### 2.3.1 Web GUI

**UltraStor** controllers support graphic user interface to manage the system. Be sure to connect the LAN cable. The default setting of management port IP is DHCP and the DHCP address displays on LCM; user can check LCM for the IP first, then open the browser and type the IP address: (The IP address is dynamic and user may need to check every time after reboot again.) When DHCP service is not available, the controllers use zero config (Zeroconf) to get an IP address.

E.g., on LCM. the controller gets a DHCP address 192.168.10.50 from DHCP server.

192.168.10.50 UltraStor RS8SS ←
------------------------------------

<http://192.168.10.50>

or

<https://192.168.10.50> (https: connection with encrypted Secure Sockets Layer (SSL). Please be aware of the https function is slower than http.)

Click any function at the first time; it will pop up a dialog to authenticate current user.

Login name: **admin**  
Default password: **1234**

Or login with the read-only account which only allows seeing the configuration and cannot change setting.

Login name: **user**  
Default password: **1234**

## 2.3.2 Console serial port

Use NULL modem cable to connect console port.

The console setting is baud rate: **115200**, 8 bits, 1 stop bit, and no parity.

Terminal type: **vt100**

Login name: **admin**

Default password: **1234**

## 2.3.3 Remote control – secure shell

SSH (secure shell) is required for UltraStor Series controllers to remote login. The SSH client software is available at the following web site:

SSHWinClient WWW: <http://www.ssh.com/>

Putty WWW: <http://www.chiark.greenend.org.uk/>

Host name: **192.168.10.50 (Please check your DHCP address for this field.)**

Login name: **admin**

Default password: **1234**



### Tips

**UltraStor SS series** only support SSH for remote control. For using SSH, the IP address and the password are required for login.

## 2.4 Enclosure

### 2.4.1 LCM

There are four buttons to control **ULTRASTOR** LCM (LCD Control Module), including: ▲ (up), ▼ (down), **ESC** (Escape), and **ENT** (Enter).

After booting up the system, the following screen shows management port IP and model name:

```
192.168.10.50
UltraStor RS8 SS ←
```

Press “**ENT**”, the LCM functions “**Alarm Mute**”, “**Reset/Shutdown**”, “**Quick Install**”, “**View IP Setting**”, “**Change IP Config**” and “**Reset to Default**” will be rotate by pressing ▲ (up) and ▼ (down).

When there is WARNING or ERROR level of event happening, the LCM shows the event log to give users more detail from front panel too.

The following table is function description.

<b>Alarm Mute</b>	Mute alarm when error occurs.
<b>Reset/Shutdown</b>	Reset or shutdown controller.
<b>Quick Install</b>	Quick three steps to create a volume. Please refer to section 3.3 for operation in web UI.
<b>View IP Setting</b>	Display current IP address, subnet mask, and gateway.
<b>Change IP Config</b>	Set IP address, subnet mask, and gateway. There are 2 selections, DHCP (Get IP address from DHCP server) or set static IP.
<b>Reset to Default</b>	Reset to default will set password to default: <b>1234</b> , and set IP address to default as DHCP setting. Default IP address: <b>192.168.10.50 (DHCP)</b> Default subnet mask: <b>255.255.255.0</b> Default gateway: <b>192.168.10.254</b>

The following is LCM menu hierarchy.

Enhance Technology ▲▼	[Alarm Mute]	[▲Yes No▼]		
	[Reset/Shutdown]	[Reset]	[▲Yes No▼]	
		[Shutdown]	[▲Yes No▼]	
	[Quick Install]	RAID 0 (RAID 1/RAID 3/ RAID 5/RAID 6) xxxxxx GB	Volume Size (xxxxxx G) Apply The Config	Adjust Volume Size [▲Yes No▼]
		[IP Config] [Static IP]		
	[View IP Setting]	[IP Address] [192.168.010.050]		
		[IP Subnet Mask] [255.255.255.0]		
		[IP Gateway] [192.168.010.254]		
	[Change IP]	[DHCP]	[▲Yes No▼]	

	Config]	[Static IP]	[IP Address]	Adjust IP address
			[IP Subnet Mask]	Adjust Submask IP
			[IP Gateway]	Adjust Gateway IP
			[Apply IP Setting]	[▲Yes No▼]
	[Reset to Default]	[▲Yes No▼]		



### Caution

Before power off, it is better to execute “**Shutdown**” to flush the data from cache to physical disks.

## 2.4.2 System buzzer

The system buzzer features are describing in the following:

1. The system buzzer alarms 1 second when system boots up successfully.
2. The system buzzer alarms continuously when there is error level event happened. The alarm will be stopped after mute.
3. The alarm will be muted automatically when the error situation is resolved. E.g., when RAID 5 is degraded and alarm rings immediately, after user changes/adds one physical disk for rebuilding, and when the rebuilding is done, the alarm will be muted automatically.

## 2.4.3 LED

The LED features are describing as follows:

1. **Marquee/Disk Status/Disk Rebuilding LED:** The Marquee/Disk Status/Disk Rebuilding LEDs are displayed in the same LEDs. The LEDs behave for different functions in different stages.
  - I. **Marquee LEDs:** When system powers on and succeeds to boot up, the Marquee LED acts until the system is booting successful.
  - II. **Disk status LEDs:** the LEDs reflect the disk status for the tray. Only On/Off situation.
  - III. **Disk rebuilding LEDs:** the LEDs are blinking when the disks are under rebuilding.
2. **Disk Access LED:** Hardware activated LED when accessing disks (IO).

3. **Disk Power LED:** Hardware activated LED when the disks are plugged in and powered.
4. **System status LED:** Used to reflect the system status by turn on the LED when error occurs or RAID malfunctioning happens.
5. **Management LAN port LED:** GREEN LED is for LAN transmit/receive indication. ORANGE LED is for LAN port 10/100 LINK indication.
6. **BUSY LED:** Hardware activated LED when the front-end channel is busy.
7. **POWER LED:** Hardware activated LED when system is powered on.



# Chapter 3 Web GUI guideline

## 3.1 S-series GUI hierarchy

The below table is the hierarchy of S-series GUI.

<b>Quick Install</b>	→ Step 1 / Step 2 / Step 3 / Confirm
<b>System Config</b>	
<b>System name</b>	→ System name
<b>IP address</b>	→ DHCP / Static / Address / Mask / Gateway / DNS / HTTP port / HTTPS port / SSH port
<b>Language</b>	→ Language
<b>Login config</b>	→ Auto logout / Login lock
<b>Password</b>	→ Old password / Password / Confirm
<b>Date</b>	→ Time zone / Date / Time / NTP Server
<b>Mail</b>	→ Mail-from address / Mail-to address / Sent events / SMTP relay / SMTP server / Authentication / Account / Password / Confirm / Send test mail
<b>SNMP</b>	→ SNMP trap address / Community / Send events
<b>Messenger</b>	→ Messenger IP/hostname / Send events
<b>System log server</b>	→ Server IP/hostname / Port / Facility / Event level
<b>Event log</b>	→ Filter / Download / Mute / Clear
<b>Volume config</b>	
<b>Physical disk</b>	→ Free disks / Global spares / Dedicated spares / More information / Auto Spin-down
<b>Volume group</b>	→ Create / Delete / More information / Rename / Migrate
<b>User data volume</b>	→ Attach / Snapshot / Create / Delete / More information / Rename / Extend / Set read/write mode / Set priority / Resize Snapshot space / Auto Snapshot
<b>Cache volume</b>	→ Create / Delete / More information / Resize
<b>Logical unit</b>	→ Attach / Detach
<b>Enclosure management</b>	
<b>SES config</b>	→ Enable / Disable
<b>Hardware monit</b>	→ Auto shutdown
or	
<b>S.M.A.R.T.</b>	→ <b>SATA Disks only.</b>
<b>UPS</b>	→ UPS Type / Shutdown Battery Level / Shutdown Delay / Shutdown UPS
<b>Maintenance</b>	
<b>Upgrade</b>	→ Browse the firmware to upgrade / Export config
<b>Info</b>	→ System information
<b>SAS</b>	→ SAS Topology
<b>Reset to default</b>	→ Sure to reset to factory default?
<b>Config import &amp; export</b>	→ Import/Export / Import file

**Shutdown** → Reboot / Shutdown

**Logout**

Sure to logout?

## 3.2 Login

**S series** controller supports graphic user interface (GUI) to operate the system. Be sure to connect the LAN cable. The default IP setting is **DHCP**; open the browser and enter:

**http://192.168.10.50 (Please check the DHCP address first on LCM)**

Click any function at the first time; it will pop up a dialog for authentication.

Login name: **admin**

Default password: **1234**

After login, you can choose the function blocks on the left side of window to do configuration.

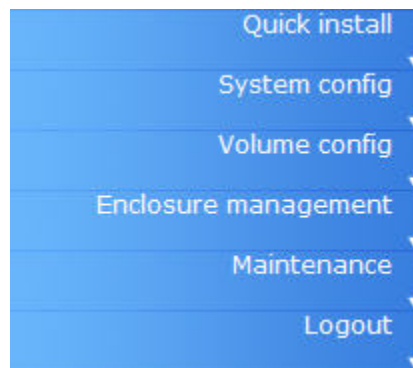







Figure 3.2.1

There are six indicators at the top-right corner for backplane solutions, and cabling solutions have three indicators at the top-right corner.



Figure 3.2.2

1.  **RAID light:** Green means RAID works well. Red represents RAID failure happening.

2.  **Temperature light:** Green is normal. Red represents abnormal temperature.
3.  **Voltage light:** Green is normal. Red represents abnormal voltage status.
4.  **UPS light:** Green is normal. Red represents abnormal UPS status.
5.  **Fan light:** Green is normal. Red represents abnormal fan status.  
(Only for backplane solution)
6.  **Power light:** Green is normal. Red represents abnormal power status. (Only for backplane solution)

### 3.3 Quick install

It is easy to use “**Quick install**” function to create a volume. Depend on how many physical disks or how many residual spaces on created VGs are free, the system will calculate maximum spaces on RAID levels 0/1/3/5/6. “**Quick install**” function will occupy all residual VG space for one UDV, and it has no space for snapshot (ESnap) and spare. If snapshot (ESnap) function is needed, please create volumes by manual, and refer to section 4.4 for more detail.

**ULTRASTOR Quick Install** function has a smarter policy. When the system is full inserted with 8 HDD or 16 HDD, and all HDD are in the same size, **ULTRASTOR Quick Install** function lists all possibilities and sizes among different RAID levels, **ULTRASTOR Quick Install** will use all available HDD for the RAID level which user decides. But, when the system is inserted with different sizes of HDD, e.g., 8\*200G HDD and 8\*80G, ULTRASTOR controller also lists all possibilities and combinations of different RAID Level and different sizes. After user chooses RAID level, user may finds there are still some HDD are not used (Free Status). The result is from ULTRASTOR’s smarter policy on **Quick Install** which gives user:

1. Biggest capacity of RAID level which user chooses and,
2. The fewest disk number for the RAID level/volume size.

E.g., user chooses RAID 5 and the controller has 12\*200G HDD + 4\*80HDD inserted. Then if using all 16 HDD for a RAID 5, then the volume max size is 1200G (80G\*15). But in **ULTRASTOR** controller, we do smarter check and find out the most efficient use of HDDs, which results controller only use the 200G HDD (Volume size is 200G\*11=2200G). Then, the volume size is bigger, and full use of HDD capacity.

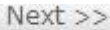
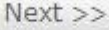

**Step 1:** Select “**Quick install**” then choose the RAID level to set. Please refer to Figure 3.3.1. After choosing the RAID level, click “”, which links to another page, user can set up “LUN” here.



Figure 3.3.1

**Step 2:** Please select a LUN number. Access control of host would show as a wildcard “\*”, which means every host can access this volume. In this page, the “Volume size” can be changed. The maximum volume size is shown. To re-enter the size be sure it has to be less or equal to maximum volume size. Then click “”.

**Step 3:** Confirm page. Click “” if all setups are correct. Then a page with the “User data volume” just been created will be shown as Figure 3.3.2.

**Done.** You can start to use the system now.

<div> <div>Attach</div> <div>Snapshot</div> <div>Create</div> <div>Delete</div> </div>												
<input type="checkbox"/>	No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	Snapshot (GB)	VG name
<input type="checkbox"/>	1	QUICK68809	609	Online					RAID 0	1	0.00/0.00	QUICK45427
<div> <div>Attach</div> <div>Snapshot</div> <div>Create</div> <div>Delete</div> </div>												
CV (MB)												
663												

Figure 3.3.2

(Figure 3.3.2: A RAID 0 user data volume with the UDV name “QUICK68809”, named by the system itself, with the total available volume size 609GB.)

## 3.4 System configuration

“System config” selection is for the setup of “System name”, “IP address”, “Language”, “Login config”, “Password”, “Date”, “Mail”, “SNMP”, “Messenger”, “System log server” and view “Event log”.

<a href="#">System name</a>	System name for identification
<a href="#">IP address</a>	Internet Protocol(IP) address for remote administration
<a href="#">Language</a>	Language preference for WebUI
<a href="#">Login config</a>	Configuration for auto logout and login lock
<a href="#">Password</a>	Administrator's password
<a href="#">Date</a>	System time for event log
<a href="#">Mail</a>	Alert by e-mail
<a href="#">SNMP</a>	Alert via Simple Network Management Protocol(SNMP)
<a href="#">Messenger</a>	Transmits net send and Alerter service messages between clients and servers
<a href="#">System log server</a>	Alert to remote system log server
<a href="#">Event log</a>	System event log to record critical events

Figure 3.4.1

### 3.4.1 System name

Select “System name” to change system name. Default system name composed by model name and serial number of this system, e.g.: S500C-A00001.

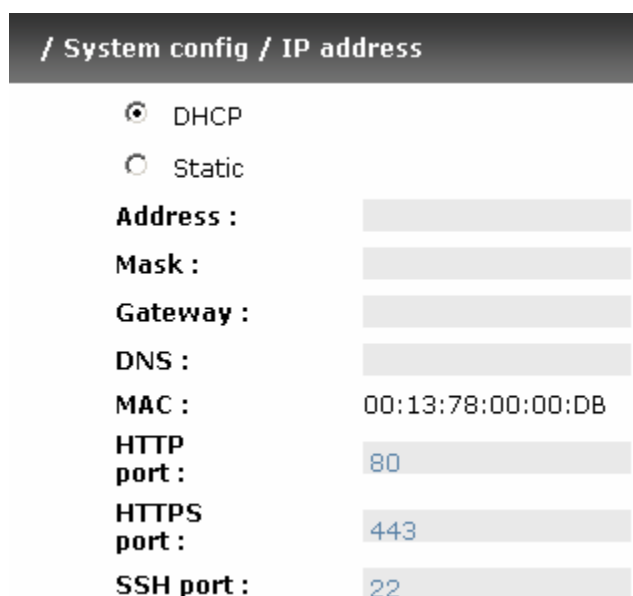
/ System config / System name

System name : S500C-A00001

Figure 3.4.1.1

### 3.4.2 IP address

Select “**IP address**” to change IP address for remote administration usage. There are 2 selections, DHCP (Get IP address from DHCP server) or static IP. The default setting is DHCP enabled. User can change the HTTP, HTTPS, and SSH port number when the default port number is not allowed on host/server.



/ System config / IP address

☒ DHCP  
☐ Static

Address :

Mask :

Gateway :

DNS :

MAC : 00:13:78:00:00:DB

HTTP port :

HTTPS port :

SSH port :

Figure 3.4.2.1

### 3.4.3 Language

Select “**Language**” is to set the language shown in Web UI. The option “Auto Detect” will be detected by browser language setting.



/ System config / Language

Language :

Auto Detect  
English  
Simplified Chinese

Figure 3.4.3.1

### 3.4.4 Login config

Select “**Login config**” is to set only one admin and set the auto logout timing. The only one admin can prevent multiple users access the same controller in the same time.

1. Auto logout: The options are (1) Disable; (2) 5 mins; (3) 30 mins; (4) 1 hour. The system will log out automatically when the user is no response for a period of time.
2. Login lock: Disable/Enable. When the login lock is enabled, the system allows only one user to login/modify the system settings.

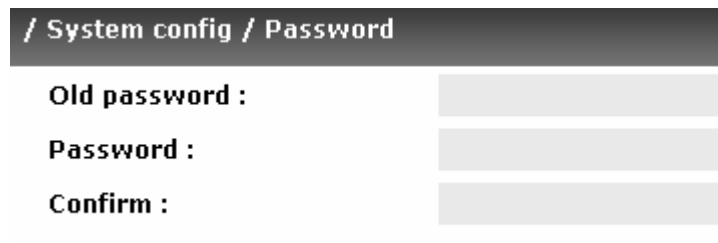


The screenshot shows a web interface for system configuration. At the top, a dark grey header bar contains the text "/ System config / Login config". Below this, there are two settings: "Auto logout :" and "Login lock :". Each setting has a dropdown menu. The "Auto logout" dropdown is currently set to "- Disable -". The "Login lock" dropdown is also set to "- Disable -", but it is open, showing two options: "- Disable -" and "- Enable -". The "- Enable -" option is highlighted with a blue background.

Figure 3.4.4.1

### 3.4.5 Password

Select “**Password**” is for changing administrator password. The maximum length of admin password is 12 characters.



The screenshot shows a web interface for changing the administrator password. At the top, a dark grey header bar contains the text "/ System config / Password". Below this, there are three input fields: "Old password :", "Password :", and "Confirm :". Each field is represented by a light grey rectangular box.

Figure 3.4.5.1

### 3.4.6 Date

Select “**Date**” to set up the current date, time, and time zone before using or synchronize time from NTP(Network Time Protocol) server.

/ System config / Date

Now :

2007/8/1 16:16:18

Time zone :

Asia/Taipei

☒ Setup date and time manually

Date :

2007

/

8

/

1

Time :

16

:

15

:

53

☐ NTP

Server :

Figure 3.4.6.1

### 3.4.7 Mail

Select “**Mail**” to enter at most 3 mail addresses for receiving the event notification. Some mail servers would check “**Mail-from address**” and need authentication for anti-spam. Please fill the necessary fields and select “**Send test mail**” to check whether the email works fine. User can also select which levels of event logs are needed to be sent out by Mail. Default setting is only ERROR and WARNING event logs enabled.



/ System config / Mail

Mail-from address :	mailman@controller
Mail-to address 1 :	
Send events 1 :	INFO <input type="checkbox"/> WARNING <input checked="" type="checkbox"/> ERROR <input checked="" type="checkbox"/>
Mail-to address 2 :	
Send events 2 :	INFO <input type="checkbox"/> WARNING <input checked="" type="checkbox"/> ERROR <input checked="" type="checkbox"/>
Mail-to address 3 :	
Send events 3 :	INFO <input type="checkbox"/> WARNING <input checked="" type="checkbox"/> ERROR <input checked="" type="checkbox"/>
SMTP relay :	<input type="checkbox"/>
SMTP server :	
Authentication :	None <input type="button" value="v"/>
Account :	
Password :	
Confirm :	
Send test mail :	<input type="checkbox"/>

Figure 3.4.7.1

### 3.4.8 SNMP

Select “**SNMP**” to set up SNMP trap for alert via SNMP. It allows up to 3 SNMP trap addresses. Default community setting is “public”. User can choose the event log levels and the default value of SNMP is INFO event log enabled only.

/ System config / SNMP

SNMP trap address 1 :	
SNMP trap address 2 :	
SNMP trap address 3 :	
Community :	public
Send events :	INFO <input checked="" type="checkbox"/> WARNING <input type="checkbox"/> ERROR <input type="checkbox"/>

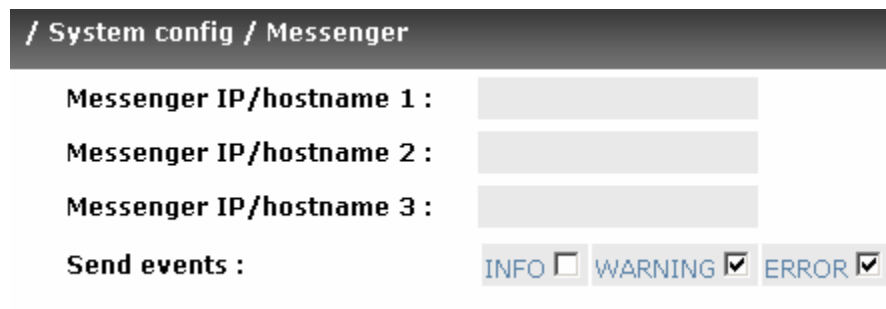
Figure 3.4.8.1

There are many SNMP tools. The following web sites are for reference:

SNMPc: <http://www.snmpc.com/>  
Net-SNMP: <http://net-snmp.sourceforge.net/>

### 3.4.9 Messenger

Select “**Messenger**” to set up pop-up message alert via Windows messenger (not MSN). User must enable the service “Messenger” in Windows (Start → Control Panel → Administrative Tools → Services → Messenger), and then event logs can be received. It allows up to 3 messenger addresses. User can choose the event log levels and the default values are WARNING and ERROR event logs enabled only.



/ System config / Messenger

Messenger IP/hostname 1 :

Messenger IP/hostname 2 :

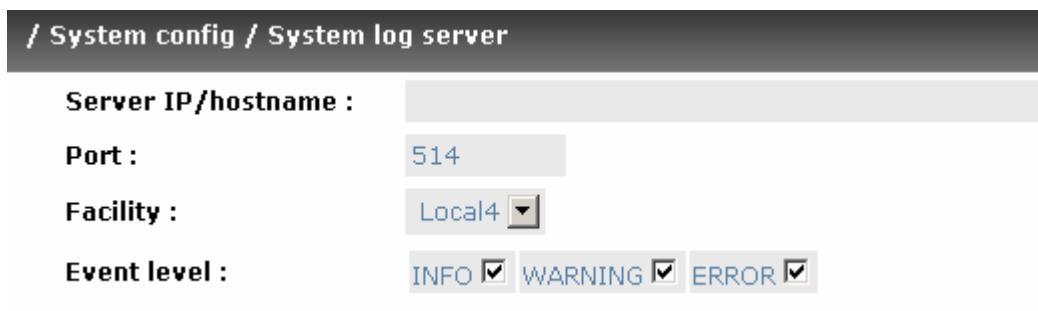
Messenger IP/hostname 3 :

Send events : INFO ☐ WARNING ☒ ERROR ☒

Figure 3.4.9.1

### 3.4.10 System log server

Select “**System log server**” to set up alert via syslog protocol. The default port of syslog is 514. User can choose the facility and the event log level. The default values of event level are INFO, WARNING and ERROR event logs enabled.



/ System config / System log server

Server IP/hostname :

Port :

Facility :

Event level : INFO ☒ WARNING ☒ ERROR ☒

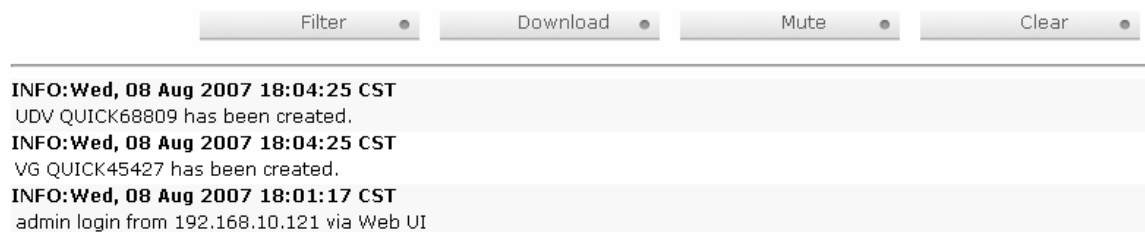
Figure 3.4.10.1

There are some syslog server tools. The following web sites are for reference:  
WinSyslog: <http://www.winsyslog.com/>

Kiwi Syslog Daemon: <http://www.kiwisyslog.com/>  
Most UNIX systems build in syslog daemon.

### 3.4.11 Event log

Select “**Event log**” to view the event messages. Press “**Filter**” button to choose the display. Press “**Download**” button will save the whole event log as text file with file name “log-ModelName-SerialNumber-Date-Time.txt” (E.g., log-S500C-A00001-20070801-120000.txt). Press “**Clear**” button will clear event log. Press “**Mute**” button will stop alarm if system alerts.



Filter • Download • Mute • Clear •

---

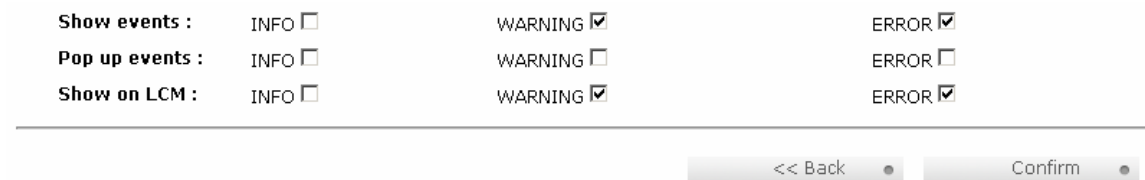
INFO:Wed, 08 Aug 2007 18:04:25 CST  
UDV QUICK68809 has been created.

INFO:Wed, 08 Aug 2007 18:04:25 CST  
VG QUICK45427 has been created.

INFO:Wed, 08 Aug 2007 18:01:17 CST  
admin login from 192.168.10.121 via Web UI

Figure 3.4.11.1

For customizing your own display of event logs, there are total three display methods, on Web UI/Console event log page, popup windows on Web UI, and on LCM. The default setting of these three displays is WARNING and ERROR event logs enabled on Web UI and LCM. The popup is default disabled.



Show events :	INFO <input type="checkbox"/>	WARNING <input checked="" type="checkbox"/>	ERROR <input checked="" type="checkbox"/>
Pop up events :	INFO <input type="checkbox"/>	WARNING <input type="checkbox"/>	ERROR <input type="checkbox"/>
Show on LCM :	INFO <input type="checkbox"/>	WARNING <input checked="" type="checkbox"/>	ERROR <input checked="" type="checkbox"/>

---

<< Back • Confirm •

Figure 3.4.11.2

The event log is displayed in reverse order which means the latest event log is on the first page. The event log is actually saved in the first four hard drives, each hard drive has one copy of event log. For one controller, there are four copies of event logs to guarantee users can check event log most of the time when there is/are failed disk(s).



#### Tips

Please plug-in anyone of first four hard drives, and then event logs can be saved and appeared in next system boot up. Otherwise, event logs would be gone.

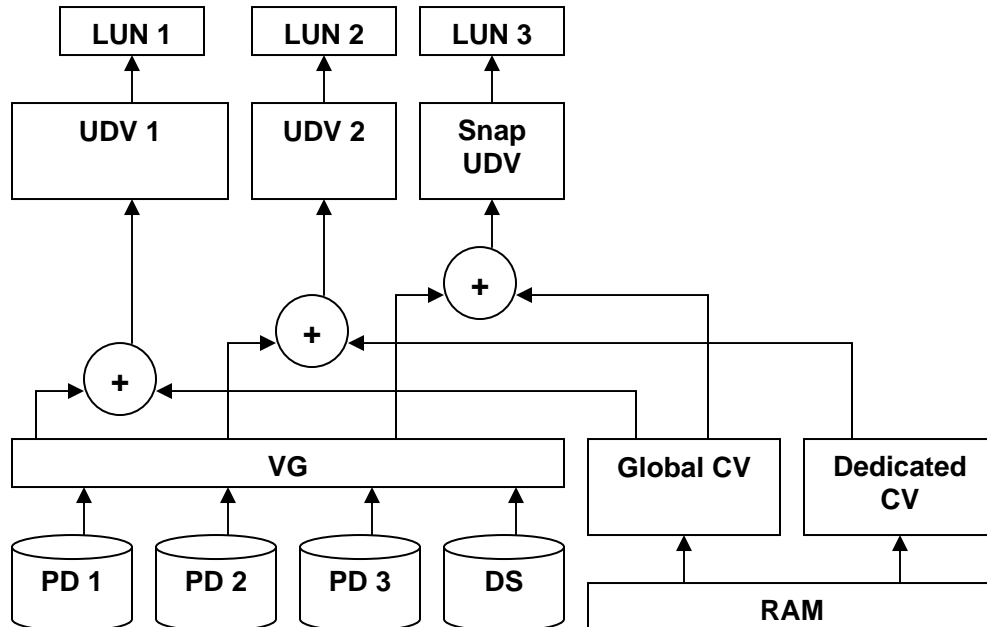
## 3.5 Volume configuration

“**Volume config**” selection is for the setup of volume configurations including “**Physical disk**”, “**Volume group**”, “**User data volume**”, “**Cache volume**”, and “**Logical unit**” functions.

<a href="#">Physical disk</a>	Hard disks to store data
<a href="#">Volume group</a>	Sets of physical disks with RAID functions
<a href="#">User data volume</a>	Slices of volume groups
<a href="#">Cache volume</a>	Dedicated or global cache space for user data volume
<a href="#">Logical unit</a>	Target volumes for hosts access

Figure 3.5.1

### 3.5.1 Volume relationship diagram



The above diagram describes the relationship of RAID components. One VG (Volume Group) consists of a set of UDV (User Data Volume) and owns one RAID level attribute. Each VG can be divided into several UDV. The UDV from one VG share the same RAID level, but may have the different volume capacity.

Each UDV will be associated with one specific CV (Cache Volume) to execute the data transaction. Each CV could have the different cache memory size from user's modification/setting. LUN is the logical volume/unit, which the users could access by using the SCSI commands.

### 3.5.2 Physical disk

Enter “**Physical disk**” to view the status of hard drives inserted in the system. The following are operation tips:

1. Multiple select. Select one or more checkboxes in front of the slot number. Or select the checkbox at the top left corner will select all. Check again will select none.
2. The list box will disappear if there is no VG or only VG of RAID 0, JBOD. Because these RAID levels cannot be set as dedicated spare disk.
3. These three functions “**Free disks**”, “**Global spares**”, “**Dedicated spares**” can do multiple selects, too.
4. The operations of the other web pages (e.g.: volume config of VG, UDV, CV, LUN pages) are similar to previous steps.

- Select -
Free disks
Global spares
Dedicated spares

<input type="checkbox"/>	Slot	WWN	Size (GB)	VG name	Status	1	2	Speed
<input type="checkbox"/>	1	2071001378a8a002	74	VG-R0	Good	RD		3.0Gb
<input type="checkbox"/>	2	207c001378a8a002	74	VG-R0	Good	RD		3.0Gb
<input type="checkbox"/>	3	207b001378a8a002	74	VG-R0	Good	RD		3.0Gb
<input type="checkbox"/>	4	207a001378a8a002	74	VG-R0	Good	RD		3.0Gb
<input type="checkbox"/>	5	2079001378a8a002	74		Good	FR		3.0Gb
<input type="checkbox"/>	6	207d001378a8a002	74	VG-R6	Good	RD		3.0Gb
<input type="checkbox"/>	7	206f001378a8a002	74	VG-R6	Good	RD		3.0Gb
<input type="checkbox"/>	8	2070001378a8a002	74	VG-R6	Good	RD		3.0Gb
<input type="checkbox"/>	9	2078001378a8a002	74	VG-R6	Good	RD		3.0Gb
<input type="checkbox"/>	10	2072001378a8a002	74		Good	FR		3.0Gb
<input type="checkbox"/>	11	2073001378a8a002	74	VG-R6	Good	DS		3.0Gb
<input type="checkbox"/>	12	2074001378a8a002	74		Good	FR		3.0Gb
<input type="checkbox"/>	13	2075001378a8a002	74		Good	FR		3.0Gb
<input type="checkbox"/>	14	2076001378a8a002	74		Good	FR		3.0Gb
<input type="checkbox"/>	15	2077001378a8a002	74		Good	FR		3.0Gb
<input type="checkbox"/>	16	20f5001378a8a002	74		Good	FR		3.0Gb

Auto spindown : [Disabled](#)

- Select -
Free disks
Global spares
Dedicated spares

Figure 3.5.2.1

(Figure 3.5.2.1: Physical disks of slot 1,2,3,4 are created for a VG named “VG-R0”. Physical disks of slot 6,7,8,9 are created for a VG named “VG-R6”. Slot 11 is set as dedicated spare disk of VG named “VG-R6”. The others are free disks.)

- PD column description:

Slot	The position of hard drives. The number of slot begins from left to right at the front side. The button next to the number of slot is “ <b>More Information</b> ” indication. It shows the details of the hard drive.
------	---

<b>WWN</b>	<b>World Wide Name.</b>
<b>Size (GB)</b>	Capacity of hard drive.
<b>VG Name</b>	Related volume group name.
<b>Status</b>	<p>The status of hard drive.</p> <p><b>“GOOD”</b> → the hard drive is good.</p> <p><b>“DEFECT”</b> → the hard drive has the bad blocks.</p> <p><b>“FAIL”</b> → the hard drive cannot work in the respective volume.</p>
<b>Status 1</b>	<p><b>“RD”</b> → <b>RAID Disk</b>. This hard drive has been set to RAID.</p> <p><b>“FR”</b> → <b>FR</b>ee disk. This hard drive is free for use.</p> <p><b>“DS”</b> → <b>D</b>edicated <b>S</b>pare. This hard drive has been set to the dedicated spare of the VG.</p> <p><b>“GS”</b> → <b>G</b>lobal <b>S</b>pare. This hard drive has been set to a global spare of all VGs.</p> <p><b>“RS”</b> → <b>ReS</b>erve. The hard drive contains the VG information but cannot be used. It may be caused by an uncompleted VG set, or hot-plug of this disk in the running time. In order to protect the data in the disk, the status changes to reserve. It can be reused after setting it to “FR” manually.</p>
<b>Status 2</b>	<p><b>“R”</b> → <b>Re</b>build. The hard drive is doing rebuilding.</p> <p><b>“M”</b> → <b>M</b>igration. The hard drive is doing migration.</p>
<b>Speed</b>	<p><b>3.0G</b> → From SATA ATAPI standard, if the disk can support ATAPI IDENTIFY PACKET DEVICE command, and the speed can achieve Serial ATA Gen-2 signaling speed (3.0Gbps).</p> <p><b>1.5G</b> → From SATA ATAPI standard, if the disk can support ATAPI IDENTIFY PACKET DEVICE command, and the speed can achieve Serial ATA Gen-1 signaling speed (1.5Gbps).</p> <p><b>Unknown</b> → The disk doesn't support above command, so the speed is defined as unknown.</p>

- **PD operations description:**

<b>Free disks</b>	Make the selected hard drive to be free for use.
<b>Global spares</b>	Set the selected hard drive(s) to global spare of all VGs.
<b>Dedicated spares</b>	Set hard drive(s) to dedicated spare of selected VGs.

In this page, ULTRASTOR controller also provides HDD auto spindown down function to save power. The default value is disabled. User can set up in physical disk page, too. Auto spin-down is not supported on all models.



**Figure 3.5.2.2**



**Figure 3.5.2.3**

### 3.5.3 Volume group

Enter “**Volume group**” to view the status of each volume group.

- **VG column description:**



Create • Delete •											
<input type="checkbox"/>	No.	Name	Total (GB)	Free (GB)	#PD	#UDV	Status	1	2	3	RAID
<input type="checkbox"/>	1	VG-R0	297	267	4	1	Online				RAID 0
<input type="checkbox"/>	2	VG-R6	148	128	4	1	Online				RAID 6

Figure 3.5.3.1

(Figure 3.5.3.1: There is a RAID 0 with 4 physical disks, named “VG-R0”, total size is 297GB, free size is 267GB, related to 1 UDV. Another is a RAID 6 with 4 physical disks, named “VG-R6”).

<b>No.</b>	Number of volume group. The button next to the No. is “ <b>More Information</b> ” indication. It shows the details of the volume group.
<b>Name</b>	Volume group name. The button next to the Name is “ <b>Rename</b> ” function.
<b>Total(GB)</b>	Total capacity of this volume group.
<b>Free(GB)</b>	Free capacity of this volume group.
<b>#PD</b>	The number of physical disks of the volume group.
<b>#UDV</b>	The number of user data volumes related to the volume group.
<b>Status</b>	The status of volume group. “ <b>Online</b> ” → volume group is online. “ <b>Fail</b> ” → volume group is fail.
<b>Status 1</b>	“ <b>DG</b> ” → <b>DeGrade</b> mode. This volume group is not completed. The reason could be lack of one disk or failure of disk.
<b>Status 2</b>	“ <b>R</b> ” → <b>Rebuild</b> . This volume group is doing rebuilding.
<b>Status 3</b>	“ <b>M</b> ” → <b>Migration</b> . This volume group is doing migration.

<b>RAID</b>	The RAID level of the volume group. The button next to the RAID level is “ <b>Migrate</b> ” function. Click “ <b>Migrate</b> ” can add disk(s) to do expansion or change the RAID level of the Volume group.
-------------	--

- **VG operations description:**

<b>Create</b>	Create a volume group
<b>Delete</b>	Delete a volume group

### 3.5.4 User data volume

Enter “**User data volume**” function to view the status of each user data volume.

<div> <div>Attach</div> <div>Snapshot</div> <div>Create</div> <div>Delete</div> </div>													
<input type="checkbox"/>	No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	Snapshot (GB)	VG name	CV (MB)
<input type="checkbox"/>	1	UDV-01	30	Online	WB	HI			RAID 0	1	9.99/10.00	VG-R0	663
<input type="checkbox"/>	2	UDV-02	20	Online	WB	HI	I	46%	RAID 6	1	10.00/10.00	VG-R6	663
<div> <div>Attach</div> <div>Snapshot</div> <div>Create</div> <div>Delete</div> </div>													

Figure 3.5.4.1

(Figure 3.5.4.1: Create a UDV named “UDV-01”, related to “VG-R0”, size is 30GB, status is online, write back, high priority, related to 1 LUN, with cache volume 663MB, 10GB snapshot (ESnap) space. The other UDV is named “UDV-02”, initializing to 46%.)

- **UDV column description:**

<b>No.</b>	Number of this user data volume. The button in below to the UDV No. is “ <b>More Information</b> ” indication. It shows the details of the User data volume.
<b>Name</b>	Name of this user data volume. The button in below to the UDV Name is “ <b>Rename</b> ” function.

<b>Size(GB)</b>	Total capacity of this user data volume. The button in below to the size is “ <b>Extend</b> ” function.
<b>Status</b>	The status of this user data volume. “ <b>Online</b> ” → user data volume is online. “ <b>Fail</b> ” → user data volume is failed.
<b>Status 1</b>	“ <b>WT</b> ” → <b>Write Through</b> . “ <b>WB</b> ” → <b>Write Back</b> . “ <b>RO</b> ” → <b>Read Only</b> . The button in below to the status1 is “ <b>Set read/write mode</b> ” function.
<b>Status 2</b>	“ <b>HI</b> ” → <b>High</b> priority. “ <b>MD</b> ” → <b>MiD</b> priority. “ <b>LO</b> ” → <b>LOW</b> priority. The button in below to the status2 is “ <b>Set Priority</b> ” function.
<b>Status 3</b>	“ <b>I</b> ” → user data volume is doing initializing. “ <b>R</b> ” → user data volume is doing rebuilding. “ <b>M</b> ” → user data volume is doing migration. “ <b>P</b> ” → user data volume is doing QCopy.
<b>R %</b>	Ratio of initializing or rebuilding.
<b>RAID</b>	The RAID levels that user data volume is using.
<b>#LUN</b>	Number of LUN(s) that data volume is attaching.
<b>Snapshot (ESnap) (GB)</b>	The user data volume size that used for snapshot (ESnap). The button next to the snapshot (ESnap) is “ <b>Resize</b> ” function to decide the snapshot (ESnap) space. The button next to the resize function is “ <b>Auto snapshot (ESnap)</b> ” function to setup the frequency of taking snapshots (ESnap). The number means “ <b>Free snapshot (ESnap) space</b> ” / “ <b>Total snapshot (ESnap) space</b> ”. If the snapshot (ESnap) UDV has been created, this column will be the creation time.
<b>VG name</b>	The VG name of the user data volume.

<b>CV (MB)</b>	The cache volume of the user data volume.
----------------	---

- **UDV operations description:**

<b>Attach</b>	Attach to a LUN.
<b>Snapshot</b>	Choose a UDV to execute snapshot (ESnap).
<b>Create</b>	Create a user data volume function.
<b>Delete</b>	Delete a user data volume function.

### 3.5.5 Cache volume

Enter “**Cache volume**” function to view the status of cache volume.

The global cache volume is a default cache volume, which is created after power on automatically, and cannot be deleted. The size of global cache is based on the RAM size. It is total memory size minus the system usage.

<div> <div>Create</div> <div>Delete</div> </div>			
<input type="checkbox"/>	No.	Size	UDV name
<input type="checkbox"/>	1	663	Global
Free : 0 (MB)			
<div> <div>Create</div> <div>Delete</div> </div>			

**Figure 3.5.5.1**

- **CV column description:**


<b>No.</b>	Number of the Cache volume. The button next to the CV No. is “ <b>More Information</b> ” indication. It shows the details of the cache volume.
<b>Size(MB)</b>	Total capacity of the cache volume The button next to

	the CV size is “ <b>Resize</b> ” function. The CV size can be adjusted.
<b>UDV Name</b>	Name of the UDV.

- **CV operations description:**

<b>Create</b>	Create a cache volume function.
<b>Delete</b>	Delete a cache volume function.

If there is no free space for creating a new dedicated cache volume, cut down the global cache size first. After resized, then dedicated cache volume can be created.

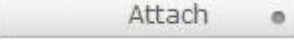



**Tips**

The minimum size of global cache volume is **40MB**. The minimum size of dedicated cache volume is **20MB**.

### 3.5.6 Logical unit number

Enter “**Logical unit**” function to view the status of attached logical unit number of each UDV.

User can attach LUN by clicking the “”. “**Host**” must input a SAS address for access control, or fill-in wildcard “\*”, which means every host can access the volume. Choose LUN number and permission, click “”.

UDV :

UDV-01 (30GB) ▼

Host :

\*

LUN :

- 0 - ▼

Permission :

☐ Read-only
☒ Read-write

<< Back ●

Confirm ●

**Figure 3.5.6.3**

<div> <div>Attach</div> <div>Detach</div> </div>					
<input type="checkbox"/>	Host	LUN	Permission	UDV name	#Session
<input type="checkbox"/>	*	0	Read write	UDV-01	2
<input type="checkbox"/>	500605B000482220	1	Read write	UDV-01	1
<div> <div>Attach</div> <div>Detach</div> </div>					

**Figure 3.5.6.4**

(Figure 3.5.6.4: LUN status)

- **LUN operations description:**

<b>Attach</b>	Attach a logical unit number to a user data volume.
<b>Detach</b>	Detach a logical unit number from a user data volume.

The matching rules of access control are from top to down by sequence. For example: there are 2 rules for the same UDV, one is “\*”, LUN 0; the other is “SAS address1”, LUN 1. The other host “SAS address2” can login because it matches the rule 1.

The access will be denied when there is no matching rule.

### 3.5.7 Examples

The followings are examples for creating volumes. Example 1 is to create two UDV's sharing the same CV (global cache volume) and set a global spare disk. Example 2 is to create two UDV's. One shares global cache volume, the other uses dedicated cache volume. Set a dedicated spare disk.

- **Example 1**

Example 1 is to create two UDV's in one VG, each UDV uses global cache volume. Global cache volume is created after system boots up automatically. So no action is needed to set CV. Then set a global spare disk. The last, delete all of them.

**Step 1:** Create VG (Volume Group).

To create the volume group, please follow the procedures:

Name :

RAID Level :

RAID PD slot :

---

Figure 3.5.7.1

1. Select “/ Volume config / Volume group”.
2. Click “”.
3. Input a VG Name, choose a RAID level from the picklist, press “” to choose the RAID PD slot(s), then press “”.
4. Check the outcome. Press “” if all setups are correct.
5. Done. A VG has been created.

---

<input type="checkbox"/>	No.	Name	Total (GB)	Free (GB)	#PD	#UDV	Status	1	2	3	RAID
<input type="checkbox"/>	1	VG-5	114	114	4	0	Online				RAID 5

---

Figure 3.5.7.2

(Figure 3.5.7.2: Creating a RAID 5 with 4 physical disks, named “VG-R5”. The total size is 114GB. Because of no related UDV there, free size still remains 114GB.)

## Step 2: Create UDV (User Data Volume).

To create a data user volume, please follow the procedures.

Name : UDV-R5-1  
 VG name : VG-5  
 CV No. : Global ( 120 MB )  
 Capacity (GB) : 50  
 Stripe height (KB) : 64  
 Block size (B) : 512  
 Read/Write : ☐ Write-through cache ☒ Write-back cache  
 Priority : ☒ High priority ☐ Middle priority ☐ Low priority

<< Back      Confirm

Figure 3.5.7.3

1. Select “/ Volume config / User data volume”.
2. Click “Create”.
3. Input a UDV name, choose a VG Name and input a size to the UDV; decide the stripe high, block size, read/write mode and set priority, finally click “Confirm”.
4. Done. A UDV has been created.
5. Do one more time to create another UDV.

Attach      Snapshot      Create      Delete

<input type="checkbox"/>	No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	Snapshot (GB)	VG name	CV (MB)
<input type="checkbox"/>	1	UDV-R5-1	50	Online	WB	HI	I	4%	RAID 5	0	0.00/0.00	VG-5	120
<input type="checkbox"/>	2	UDV-R5-2	64	Online	WB	HI	I	0%	RAID 5	0	0.00/0.00	VG-5	120

Attach      Snapshot      Create      Delete

Figure 3.5.7.4

(Figure 3.5.7.4: Create UDV named “UDV-R5-1” and “UDV-R5-2”, related to “VG-R5”, the size of “UDV-R5-1” is 50GB, the size of “UDV-R5-2” is 64GB. The status of these UDV are online, write back, high priority with cache volume 120MB. “UDV-R5-1” is initialing about 4%. There is no LUN attached.)

### Step 3: Attach LUN to UDV.

There are 2 methods to attach LUN to UDV.

1. In “/ Volume config / User data volume”, press “Attach”.
2. In “/ Volume config / Logical unit”, press “Attach”.

The procedures are as follows:



UDV : UDV-R5-1 (50GB) ▼

Host : \*

LUN : - 0 - ▼

Permission : ☐ Read-only ☒ Read-write

<< Back
Confirm

Figure 3.5.7.5

1. Select a UDV.
2. Input “**Host**”, which is an initiator node name for access control, or fill-in wildcard “\*”, which means every host can access this volume. Choose LUN and permission, then click “Confirm”.
3. Done.


Attach
Detach

<input type="checkbox"/>	Host	LUN	Permission	UDV name	#Session
<input type="checkbox"/>	*	0	Read write	UDV-R5-1	2 <span></span>
<input type="checkbox"/>	500605B000482220	1	Read write	UDV-R5-2	1 <span></span>

Attach
Detach

Figure 3.5.7.6

(Figure 3.5.7.6: UDV-R5-1 is attached to LUN 0. UDV-R5-2 is attached LUN 1.)



**Tips**  
The matching rules of access control are from top to down by sequence. Please refer 3.5.6 for details.

#### Step 4: Set global spare disk.

To set global spare disks, please follow the procedures.

1. Select “/ **Volume config / Physical disk**”.
2. Select the free disk(s) by clicking the checkbox of the row, then click “Global spares” to set as global spares.
3. There is a “GS” icon shown up at status 1 column.

- Select -

Free disks

Global spares

Dedicated spares

<input type="checkbox"/>	Slot	WWN	Size (GB)	VG name	Status	1	2	Speed
<input type="checkbox"/>	1	2007001378a40040	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	2	2017001378a202d9	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	3	2018001378a202d9	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	4	2019001378a202d9	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	5	201a001378a202d9	38		Good	GS		1.5Gb
<input type="checkbox"/>	6	20c4001378000108	38		Good	FR		1.5Gb
<input type="checkbox"/>	7	201c001378a202d9	38		Good	FR		1.5Gb
<input type="checkbox"/>	8	201b001378a202d9	38		Good	FR		1.5Gb

Figure 3.5.7.7

(Figure 3.5.7.7: Slot 5 is set as global spare disk.)

**Step 5:** Done. They can be used as SCSI disks.

Delete UDV's, VG, please follow the steps.

**Step 6:** Detach LUN from UDV.

In “/ Volume config / Logical unit”,


		Attach		Detach	
<input checked="" type="checkbox"/>	Host	LUN	Permission	UDV name	#Session
<input checked="" type="checkbox"/>	*	0	Read write	UDV-R5-1	2
<input checked="" type="checkbox"/>	500605B000482220	1	Read write	UDV-R5-2	1

Figure 3.5.7.8

1. Select LUNs by clicking the checkbox of the row, then click “Detach”. There will pop up a confirm page.
2. Choose “OK”.
3. Done.

**Step 7:** Delete UDV (User Data Volume).

To delete the user data volume, please follow the procedures:

1. Select **“/ Volume config / User data volume”**.
2. Select UDV by clicking the checkbox of the row.
3. Click “”. There will pop up a confirm page.
4. Choose “OK”.
5. Done. The UDV is deleted.




**Tips**

When deleting UDV, the attached LUN(s) related to this UDV will be detached automatically, too.

**Step 8:** Delete VG (Volume Group).

To delete the volume group, please follow the procedures:

1. Select **“/ Volume config / Volume group”**.
2. Select a VG by clicking the checkbox of the row, make sure that there is no UDV on this VG, or the UDV(s) on this VG must be deleted first.
3. Click “”. There will pop up a confirmation page.
4. Choose “OK”
5. Done. The VG is deleted.




**Tips**

The action of deleting one VG will succeed only when all of the related UDV(s) are deleted in this VG. Otherwise, it will have an error when deleting this VG.

**Step 9:** Free global spare disk.

To free global spare disks, please follow the procedures.

1. Select **“/ Volume config / Physical disk”**.
2. Select the global spare disk by clicking the checkbox of the row, then click “” to free disk.

**Step 10:** Done, all volumes have been deleted.

- **Example 2**

Example 2 is to create two UDV's in one VG. One UDV shares global cache volume, the other uses dedicated cache volume. First, dedicated cache volume should be created; it can be used in creating UDV. The last, delete them.

Each UDV is associated with one specific CV (cache volume) to execute the data transaction. Each CV could have the different cache memory size. If there is no special request in UDV's, it uses global cache volume. Or user can be created a dedicated cache for individual UDV manually. Using dedicated cache volume, the performance would not be affected by the other UDV's data access.

The total cache size depends on the RAM size and set all to global cache automatically. To create a dedicated cache volume, first step is to cut down global cache size for the dedicated cache volume. Please follow the procedures.

**Step 1: Create dedicated cache volume.**

Create Delete

<input type="checkbox"/>	No.	Size	UDV name
<input type="checkbox"/>	1	40	Global
<input type="checkbox"/>	2	20	(Empty)

Free : 603 (MB)

Create Delete

**Figure 3.5.7.9**

1. Select “/ Volume config / Cache volume”.
2. If there is no free space for creating a new dedicated cache volume, cut down the global cache size first by clicking the button “●” in the size column. After resized, click “Confirm” to return to cache volume page.
3. Click “Create” to enter the setup page.
4. Fill in the size and click “Confirm”.
5. Done. A new dedicated cache volume has been set.



**Tips**

The minimum size of global cache volume is **40MB**. The minimum size of dedicated cache volume is **20MB**.

## Step 2: Create VG (Volume Group).

Please refer to Step 1 of Example 1 to create VG.

## Step 3: Create UDV (User Data Volume).

Please refer to Step 2 of Example 1 to create UDV. To create a data user volume with dedicated cache volume, please follow the below procedures.

Name :	UDV-R5-2
VG name :	VG-5
CV No. :	Dedicated ( 20 MB )
Capacity (GB) :	64
Stripe height (KB) :	64
Block size (B) :	512
Read/Write :	<input type="radio"/> Write-through cache <input checked="" type="radio"/> Write-back cache
Priority :	<input checked="" type="radio"/> High priority <input type="radio"/> Middle priority <input type="radio"/> Low priority

<< Back

Confirm

Figure 3.5.7.10

1. Select “/ Volume config / User data volume”.
2. Click “Create”.
3. Input a UDV name, choose a VG Name, select **Dedicated** cache which is created at Step 1, and input the size for the UDV; decide the stripe height, block size, read/write mode and set priority, finally click “Confirm”.
4. Done. A UDV using dedicated cache has been created.

Attach Snapshot Create Delete

<input type="checkbox"/>	No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	Snapshot (GB)	VG name	CV (MB)
<input type="checkbox"/>	1	UDV-R5-1	50	Online	WB	HI			RAID 5	1	0.00/0.00	VG-5	40
<input type="checkbox"/>	2	UDV-R5-2	64	Online	WB	HI	I	5%	RAID 5	0	0.00/0.00	VG-5	20

Attach Snapshot Create Delete

Figure 3.5.7.11

(Figure 3.5.7.11: UDV named “UDV-R5-1” uses global cache volume 40MB, and “UDV-R5-2” uses dedicated cache volume 20MB. “UDV-R5-2” is initialing about 5%.)

<input type="checkbox"/>	No.	Size	UDV name
<input type="checkbox"/>	1	40	Global
<input type="checkbox"/>	2	20	UDV-R5-2

Free : 603 (MB)

**Figure 3.5.7.12**

(Figure 3.5.7.12: In “/ Volume config / Cache volume”, UDV named “UDV-R5-2” uses dedicated cache volume 20MB.)

**Step 4:** Attach LUN to UDV.

Please refer to Step 3 of Example 1 to attach LUN.

**Step 5:** Set dedicated spare disk.

To set dedicated spare disks, please follow the procedures:

1. Select “/ **Volume config / Physical disk**”.
2. Select a VG from the list box, then select the free disk(s), click “  ” to set as dedicated spare for the selected VG.
3. There is a “DS” icon shown up at status 1 column.

<input type="checkbox"/>	Slot	WWN	Size (GB)	VG name	Status	1	2	Speed
<input type="checkbox"/>	1	2007001378a40040	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	2	2017001378a202d9	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	3	2018001378a202d9	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	4	2019001378a202d9	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	5	201a001378a202d9	38	VG-R5	Good	DS		1.5Gb
<input type="checkbox"/>	6	20c4001378000108	38		Good	FR		1.5Gb
<input type="checkbox"/>	7	201c001378a202d9	38		Good	FR		1.5Gb
<input type="checkbox"/>	8	201b001378a202d9	38		Good	FR		1.5Gb

**Figure 3.5.7.13**

(Figure 3.5.7.13: Slot 5 has been set as dedicated spare disk of VG named “VG-R5”.)

**Step 6:** Done. The PDs can be used as SCSI disks.

Delete UDV, VG, please follow the steps.

**Step 7:** Detach LUN from UDV.

Please refer to Step 6 of Example 1 to detach LUN.

**Step 8:** Delete UDV (User Data Volume).


Please refer to Step 7 of Example 1 to delete UDV.

**Step 9:** Delete VG (User Data Volume).

Please refer to Step 8 of Example 1 to delete VG.


**Step 10:** Free dedicated spare disk.

To free dedicated spare disks, please follow the procedures:

1. Select “/ **Volume config / Physical disk**”.
2. Select the dedicated spare disk by clicking the checkbox of the row, then click “ “ to free disk.

**Step 11:** Delete dedicated cache volume.

To delete the cache volume, please follow the procedures:

1. Select “/ **Volume config / Cache volume**”.
2. Select a CV by clicking the checkbox of the row.
3. Click “ “. There will pop up a confirmation page.
4. Choose “OK”.
5. Done. The CV has been deleted.



**Caution**

Global cache volume cannot be deleted.

**Step 12:** Done, all volumes have been deleted.

## 3.6 Enclosure management

“**Enclosure management**” function allows managing enclosure information including “**SES config**”, “**Hardware monitor**”, “**S.M.A.R.T.**” and “**UPS**” functions. For the enclosure management, there are many sensors for different purposes, such as temperature sensors, voltage sensors, hard disks, fan sensors, power sensors, and LED status. And due to the hardware characteristics are different among these sensors, for different sensors, they have different polling intervals. Below is the detail polling time intervals:

1. Temperature sensors: 1 minute.
2. Voltage sensors: 1 minute.
3. Hard disk sensors: 10 minutes.
4. Fan sensors: 10 seconds, when there are continuous 3 times of error, controller sends ERROR event log.
5. Power sensors: 10 seconds, when there are continuous 3 times of error, controller sends ERROR event log.
6. LED status: 10 seconds.

<a href="#">SES config</a>	Access control for SES management
<a href="#">Hardware monitor</a>	System monitored voltage, temperature and battery backup module
<a href="#">S.M.A.R.T.</a>	Self-monitoring analysis and reporting technology for physical disks
<a href="#">UPS</a>	Uninterruptible power supply

Figure 3.6.1

### 3.6.1 SES configuration

**SES** represents **SCSI Enclosure Services**, one of the enclosure management standards. Enter “**SES config**” function can enable or disable the management of SES.



---

<input type="checkbox"/>	Host	LUN	Permission	UDV name
<input type="checkbox"/>	*	0	Read write	(SES)

---

**Figure 3.6.1.1**

(Figure 3.6.1.1: Enable SES in LUN 0, and can be accessed from every host)

The SES client software is available at the following web site:

SANtools: <http://www.santools.com/>

## 3.6.2 Hardware monitor

Enter “**Hardware monitor**” function to view the information of current voltage and temperature.

/ Enclosure management / Hardware monitor	
Item	Information
+1.5V:	+1.52 V (min = +1.44 V, max = +1.63 V)
+3.3V:	+3.28 V (min = +3.10 V, max = +3.55 V)
+5V:	+5.02 V (min = +4.80 V, max = +5.35 V)
+12V:	+12.08 V (min = +11.40 V, max = +12.80 V)
+2.5V:	+2.54 V (min = +2.45 V, max = +2.75 V)
PSU +5V(Backplane):	+5.10 V (min = +4.70 V, max = +5.35 V)
PSU +12V(Backplane):	+12.23 V (min = +11.40 V, max = +12.80 V)
PSU +3.3V(Backplane):	+3.31 V (min = +3.10 V, max = +3.55 V)
Daughter Board:	+43.0 (C) (hyst = +0.0 (C), high = +70.0 (C))
PCI-X BRG:	+33.5 (C) (hyst = +0.0 (C), high = +60.0 (C))
Core Processor:	+46.0 (C) (hyst = +0.0 (C), high = +75.0 (C))
Location 1(Backplane):	+29.0 (C) (hyst = +0.0 (C), high = +45.0 (C))
Location 2(Backplane):	+29.0 (C) (hyst = +0.0 (C), high = +45.0 (C))
Location 3(Backplane):	+29.5 (C) (hyst = +0.0 (C), high = +45.0 (C))
PSU1 (Backplane):	good
PSU2 (Backplane):	good
FAN1(Backplane):	good
FAN2(Backplane):	good
FAN3(Backplane):	good

Auto shutdown : ☒

**Figure 3.6.2.1**

If “**Auto shutdown**” has been checked, the system will shutdown automatically when voltage or temperature is out of the normal range. For better data protection, please check “**Auto Shutdown**”.

For better protection and to avoid single short period of high temperature triggering Auto shutdown, ULTRASTOR controllers use multiple condition judgments for Auto shutdown, below is the detail of when the Auto shutdown will be triggered.

1. There are 3 sensors placed on controllers for temperature checking, on core processor, on PCI-X bridge, and on daughter board. ULTRASTOR controller will check each sensor every 30 seconds. When one of there sensor is over the high temperature value for continuous 3 minutes, the Auto shutdown will be triggered immediately.
2. The core processor temperature limit is 85°. The PCI-X bridge temperature limit is 80°. The daughter board temperature limit is 80°.
3. If the high temperature situation doesn't last for 3 minutes, ULTRASTOR controller will not do auto shutdown.

### **3.6.3 Hard drive S.M.A.R.T. function support**

**S.M.A.R.T.** (Self-Monitoring Analysis and Reporting Technology) is a diagnostic tool for hard drives to give advanced warning of drive failures. **S.M.A.R.T.** provides users chances to take actions before possible drive failure.

S.M.A.R.T. measures many attributes of the hard drives all the time and decide the hard drives which are close to out of tolerance. The advanced notice of possible hard drive failure can allow users to back up hard drive or replace the hard drive. This is much better than hard drive crash when it is writing data or rebuilding a failed hard drive.

Enter “**S.M.A.R.T.**” function will display S.M.A.R.T. information of hard drives. The number is the current value; the number in parenthesis is the threshold value. The threshold values of hard drive vendors are different; please refer to vendors' specification for details.

S.M.A.R.T. information is only supported on SATA drive. SAS drive does not have. It will show N/A in this web page.

/ Enclosure management / S.M.A.R.T.								
Slot	Read error rate	Spin up time	Reallocated sector count	Seek error rate	Spin up retries	Calibration retries	Temperature (C)	Status
1		203(63)	253(63)	253(0)	253(157)	253(223)	41	Good
2	100(16)	107(24)	100(5)	100(67)	100(60)		31	Good
3	100(16)	104(24)	100(5)	100(67)	100(60)		32	Good
4	70(6)	96(0)	100(36)	75(30)	100(97)		31	Good
5	100(16)	102(24)	100(5)	100(67)	100(60)		32	Good
6		203(63)	253(63)	253(0)	253(157)	253(223)	28	Good
7	94(16)	99(24)	100(5)	100(67)	100(60)		31	Good
8	200(51)	171(21)	200(140)	200(51)	100(51)	100(51)	30	Good

Figure 3.6.3.1

## 3.6.4 UPS

Enter “**UPS**” function will set UPS (**U**ninterruptible **P**ower **S**upply).

UPS Type :	None
Shutdown Battery Level (%) :	5
Shutdown Delay (s) :	0
Shutdown UPS :	OFF
Status :	
Battery Level (%) :	

Confirm

Figure 3.6.4.1

Currently, the system only support and communicate with smart-UPS function of APC (American Power Conversion Corp.) UPS. Please check detail from <http://www.apc.com/>.

First, connect the system and APC UPS via RS-232 for communication. Then set up the shutdown values when the power is gone. UPS of other vendors can work fine, but they have no such function of communication.

<b>UPS Type</b>	Select UPS Type. Choose Smart-UPS for APC, None for other vendors or no UPS.
<b>Shutdown Battery Level</b>	When below the setting level, the system will shutdown. Setting level to “0” will disable UPS function.

(%)	
<b>Shutdown Delay (s)</b>	If power failure occurred, and the system can not return back to the setting value period, the system will issue shutdown. Setting delay to “0” will disable the function.
<b>Shutdown UPS</b>	Select ON, when power is gone, UPS will shutdown by itself after the system shutdown successfully. After power comes back, UPS will start working and notify system to boot up. OFF will not.
<b>Status</b>	The status of UPS. <b>“Detecting...”</b> <b>“Running”</b> <b>“Unable to detect UPS”</b> <b>“Communication lost”</b> <b>“UPS reboot in progress”</b> <b>“UPS shutdown in progress”</b> <b>“Batteries failed. Please change them NOW!”</b>
<b>Battery Level (%)</b>	Current percentage of battery level.

### 3.7 System maintenance

“**Maintenance**” function allows operation of the system functions including “**Upgrade**” to the latest firmware, “**Info**” to show the system version, “**SAS**” to show the SAS addresses, “**Reset to default**” to reset all controller configuration values to origin settings, “**Config import & export**” to export and import all controller configuration except for VG/UDV setting and LUN setting, and “**Shutdown**” to reboot or shutdown the system.

<a href="#">Upgrade</a>	Remote upload firmware
<a href="#">Info</a>	System information
<a href="#">SAS</a>	SAS topology
<a href="#">Reset to default</a>	Reset to factory default
<a href="#">Config import &amp; export</a>	Import/export configurations
<a href="#">Shutdown</a>	Reboot or shutdown system

Figure 3.7.1

### 3.7.1 Upgrade

Enter “**Upgrade**” function to upgrade firmware. Please prepare new firmware file named “**xxxx.bin**” in local hard drive, then press “**Browse...**” to select the file. Click “**Confirm**”, it will pop up a message “Upgrade system now? If you want to downgrade to the previous FW later, please export your system config first”, click “**Cancel**” to export system config first, then click “**OK**” to start to upgrade firmware.

Browse the firmware to upgrade :

[Export config](#)

Figure 3.7.1.1

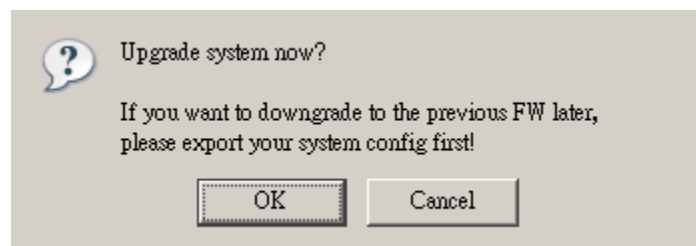


Figure 3.7.1.2

When upgrading, there is a progress bar running. After finished upgrading, the system must reboot manually.

**Tips**

Please contact with [tech@enhance-tech.com](mailto:tech@enhance-tech.com) for latest firmware.

### 3.7.2 Info

Enter “**Info**” function will display system information (including firmware version), CPU type, installed system memory, and controller serial number.

### 3.7.3 SAS

Enter “**SAS**” function, it shows SAS addresses.

No.	Device	SAS address
1	SAS Initiator	5006058000482224

Figure 3.7.3.1

### 3.7.4 Reset to default

Enter “**Reset to default**” function, it allows user to reset controller to the factory default setting.

Sure to reset to factory default?

Confirm

Figure 3.7.4.1

Reset to default sets password to default: **1234**, and set IP address to default as DHCP setting.

Default IP address: **192.168.10.50 (DHCP)**

Default subnet mask: **255.255.255.0**

Default gateway: **192.168.10.254**

### 3.7.5 Config import & export

Enter “**Config import & export**” function, it allows user to save system configurable values: export function, and to apply all configuration: import function. For the volume config setting, the values are available in export function and not available in import function which can avoid conflict/delete between two controllers. That says if one controller already has valuable data on the disks and user may forget it, use import function could return to the original

config. If the volume setting was also imported, the user's current data will be cleared.

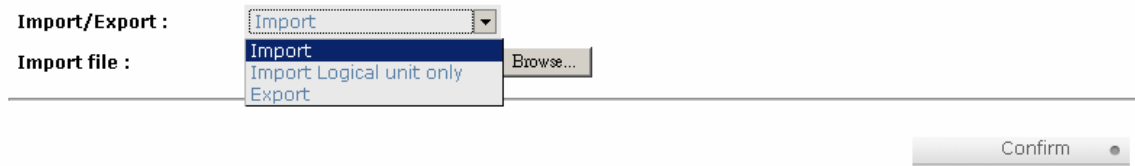
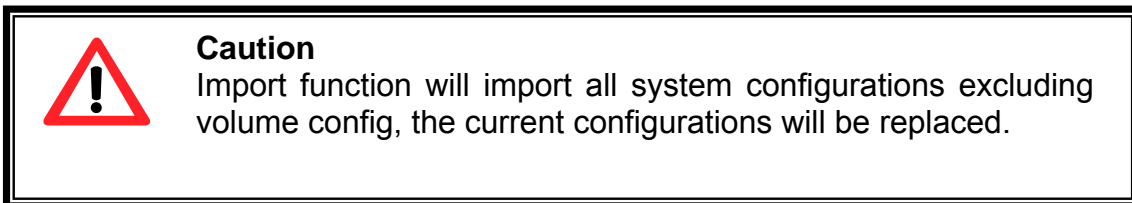


Figure 3.8.4.1

1. **Import:** Import all system configurations excluding volume config.
2. **Import Logical unit only:** No system and volume configurations, import LUN configurations only.
3. **Export:** Export all configurations to a file.



### 3.7.6 Shutdown

Enter “**Shutdown**” function; it will display “**Reboot**” and “**Shutdown**” buttons. Before power off, it's better to press “Shutdown” to flush the data from cache to physical disks. The step is better for the data protection.



Figure 3.7.6.1

## 3.8 Logout

For security reason, “**Logout**” function will allow logout while no user is operating the system. Re-login the system, please enter username and password again.

# Chapter 4 Advanced operation

## 4.1 Rebuild

If one physical disk of the VG which is set as protected RAID level (e.g.: RAID 3, RAID 5, or RAID 6) is FAILED or has been unplugged/removed, then, the VG status is changed to degrade mode, the system will search/detect spare disk to **rebuild** the degrade VG to a complete one. It will detect dedicated spare disk as rebuild disk first, then global spare disk.

**ULTRASTOR** controllers support Auto-Rebuild function. When the RAID level allows disk failures which the VG is protected, such as RAID 3, RAID 5, RAID 6, and etc, ULTRASTOR controller starts Auto-Rebuild as below scenario:

Take RAID 6 for example:

1. When there is no global spare disk or dedicated spare disk on the system, ULTRASTOR controller will be in degraded mode and wait until (A) there is one disk assigned as spare disk, or (B) the failed disk is removed and replaced with new clean disk, then the Auto-Rebuild starts. The new disk will be a spare disk to the original VG automatically.

- a. If the new added disk is not clean (with other ULTRASTOR VG information), it would be marked as RS (reserved) and the system will not start "auto-rebuild".

- b. If this disk is not belonging to any existing VG, it would be FR (Free) disk and the system will start Auto-Rebuild function.

- c. if user only removes the failed disk and plugs the same failed disk in the same slot again, the auto-rebuild will start by this case. But rebuilding in the same failed disk may impact customer data later from the unstable disk status. **ULTRASTOR** suggests all customers not to rebuild in the same failed disk for better data protection.

2. When there is enough global spare disk(s) or dedicated spare disk(s) for the degraded array, ULTRASTOR controller starts Auto-Rebuild immediately. And in RAID 6, if there is another disk failure happening during the time of rebuilding, ULTRASTOR controller will starts the above Auto-Rebuild scenario as well. And the Auto-Rebuild feature only works at "RUNTIME". It will not work the downtime. Thus, it will not conflict with the "Roaming" function.

In degrade mode, the status of VG is "**DG**".



When rebuilding, the status of PD/VG/UDV is “R”; and “R%” in UDV will display the ratio in percentage. After complete rebuilding, “R” and “DG” will disappear. VG will become complete one.



#### **Tips**

The list box doesn't exist if there is no VG or only VG of RAID 0, JBOD. Because user cannot set dedicated spare disk for these RAID levels.



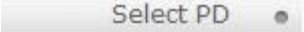



Sometimes, rebuild is called recover; these two have the same meaning. The following table is the relationship between RAID levels and rebuild.

<b>RAID 0</b>	Disk striping. No protection of data. VG fails if any hard drive fails or unplugs.
<b>RAID 1</b>	Disk mirroring over 2 disks. RAID 1 allows one hard drive fails or unplugging. Need one new hard drive to insert to the system and rebuild to be completed.
<b>N-way mirror</b>	Extension to RAID 1 level. It has N copies of the disk. N-way mirror allows N-1 hard drives fails or unplugging.
<b>RAID 3</b>	Striping with parity on the dedicated disk. RAID 3 allows one hard drive fail or unplugging.
<b>RAID 5</b>	Striping with interspersed parity over the member disks. RAID 5 allows one hard drive fail or unplugging.
<b>RAID 6</b>	2-dimensional parity protection over the member disks. RAID 6 allows two hard drives fails or unplugging. If it needs to rebuild two hard drives at the same time, it will rebuild the first one, then the other by sequence.
<b>RAID 0+1</b>	Mirroring of the member RAID 0 volumes. RAID 0+1 allows two hard drives fails or unplugging, but at the same array.
<b>RAID 10</b>	Striping over the member RAID 1 volumes. RAID 10 allows two hard drives fails or unplugging, but at the different arrays.
<b>RAID 30</b>	Striping over the member RAID 3 volumes. RAID 30 allows two hard drives fails or unplugging, but at the different arrays.

<b>RAID 50</b>	Striping over the member RAID 5 volumes. RAID 50 allows two hard drives fails or unplugging, but at the different arrays.
<b>RAID 60</b>	Striping over the member RAID 6 volumes. RAID 40 allows four hard drives fails or unplugging, but each two at the different arrays.
<b>JBOD</b>	The abbreviation of “ <b>J</b> ust a <b>B</b> unch <b>O</b> f <b>D</b> isks”. No protection of data. VG fails if any hard drive fails or unplugs.

## 4.2 VG migration and expansion

To migrate the RAID level, please follow the below procedures. If the VG migrates to the same RAID level of the original VG, it is expansion.

1. Select “/ **Volume config / Volume group**”.
2. Decide which VG to be migrated, click the button “” in the RAID column next the RAID level.
3. Change the RAID level by clicking the down arrow mark “”. There will be a pup-up which shows if the HDD is not enough to support the new setting RAID level, click “” to increase hard drives, then click “” to go back to setup page. When doing migration to lower RAID level, such as the original RAID level is RAID 6 and user wants to migrate to RAID 0, the controller will evaluate this operation is safe or not, and display “**Sure to migrate to a lower protection array?**” to give user warning.
4. Double check the setting of RAID level and RAID PD slot. If no problem, click “”.
5. Finally a confirmation page shows detail RAID info. If no problem, click “” to start migration. Controller also pops up a message of “**Warning: power lost during migration may cause damage of data!**” to give user warning. When the power is abnormally off during migration, the data is in high risk.
6. Migration starts and it can be seen from the “status” of a VG with a running square and an “M”. In “/ **Volume config / User data volume**”, it displays an “M” in “**Status 4**” and complete percentage of migration in “R%”.

Name : VG-R0

RAID Level : RAID 5

RAID PD slot : 1 2 3 4 5

Select PD

<< Back

Next >>

Figure 4.2.1

/ Volume config / Volume group

Create Delete

<input type="checkbox"/>	No.	Name	Total (GB)	Free (GB)	#PD	#UDV	Status	1	2	3	RAID
<input type="checkbox"/>	1	VG-R0	76	71	3	1	Online			M	RAID 5

Create Delete

Figure 4.2.2

(Figure 4.2.2: A RAID 0 with 2 physical disks migrates to RAID 5 with 3 physical disks.)

/ Volume config / User data volume

Attach Snapshot Create Delete

<input type="checkbox"/>	No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	Snapshot (GB)	VG name	CV (MB)
<input type="checkbox"/>	1	UDV-R0	5	Online	WB	HI	M	12%	RAID 5	0	0.00/0.00	VG-R0	100

Attach Snapshot Create Delete

Figure 4.2.3

(Figure 4.2.3: A RAID 0 migrates to RAID 5, complete percentage is 12%.)

To do migration/expansion, the total size of VG must be larger or equal to the original VG. It does not allow expanding the same RAID level with the same hard disks of original VG.

During setting migration, if user doesn't setup correctly, controller will pop up warning messages. Below is the detail of messages.

1. **Invalid VG ID:** Source VG is invalid.
2. **Degrade VG not allowed:** Source VG is degraded.
3. **Initializing/rebuilding operation's going:** Source VG is initializing or rebuilding.

4. **Migration operation's going:** Source VG is already in migration.
5. **Invalid VG raidcell parameter:** Invalid configuration. E.g., New VG's capacity < Old VG's capacity, New VG's stripe size < Old VG's stripe size. Or New VG's configuration == Old VG's configuration.
6. **Invalid PD capacity:** New VG's minimum PD capacity < Old VG's minimum PD capacity.





#### Caution

VG Migration cannot be executed during rebuild or UDV extension.

## 4.3 UDV Extension

To extend UDV size, please follow the procedures.

1. Select “/ Volume config / User data volume”.
2. Decide which UDV to be extended, click the button “” in the Size column next the number.
3. Change the size. The size must be larger than the original, and then click “” to start extension.
4. Extension starts. If UDV needs initialization, it will display an “I” in “**Status 3**” and complete percentage of initialization in “**R%**”.

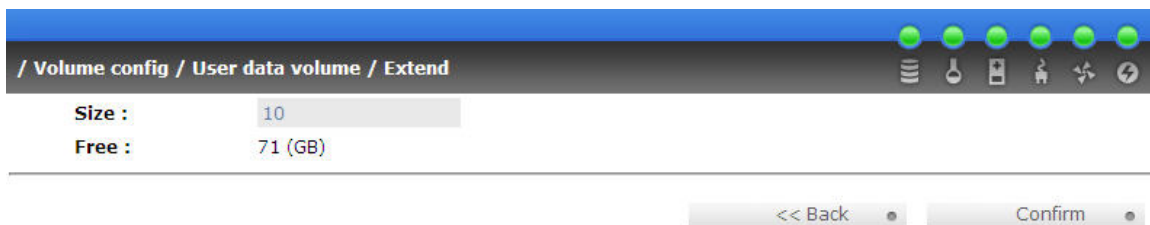


Figure 4.3.1

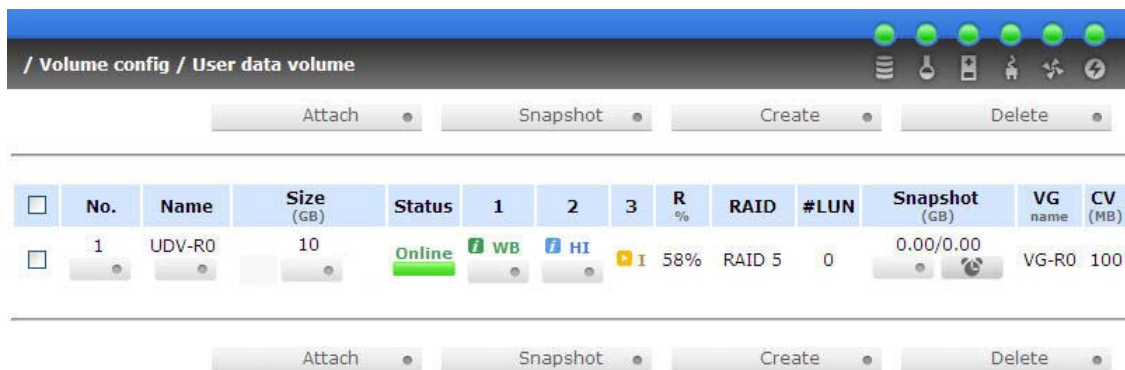


Figure 4.3.2

(Figure 4.3.2: Extend UDV-R0 from 5GB to 10GB.)



**Tips**

The size of UDV extension must be larger than original.



**Caution**

UDV extension cannot be executed during rebuild or migration.

## 4.4 Snapshot (ESnap)/Rollback

**UltraStor** Snapshot-on-the-box (ESnap) captures the instant state of data in the target volume in a logical sense. The underlying logic is Copy-on-Write -- moving out the to-be-written data to certain location whenever a write action occurs since the time of data capture. The certain location, named as **snap UDV**, is essentially a new UDV, which can be attached to a LUN thus provisioned to a host as a disk just like other ordinary UDVs in the system. **Rollback** function restores the data back to the state of any point in time previously captured for whatever unfortunate reason it might be (e.g. virus attack, data corruption, human errors and so on). Snap UDV is allocated within the same VG in which the snapshot (ESnap) is taken, we suggest to reserve **20%** of VG size or more for snapshot (ESnap) space. Please refer to Figure 4.4.1 for snapshot (ESnap) concept.

Only RS8SS and RS16SS support snapshot / rollback.

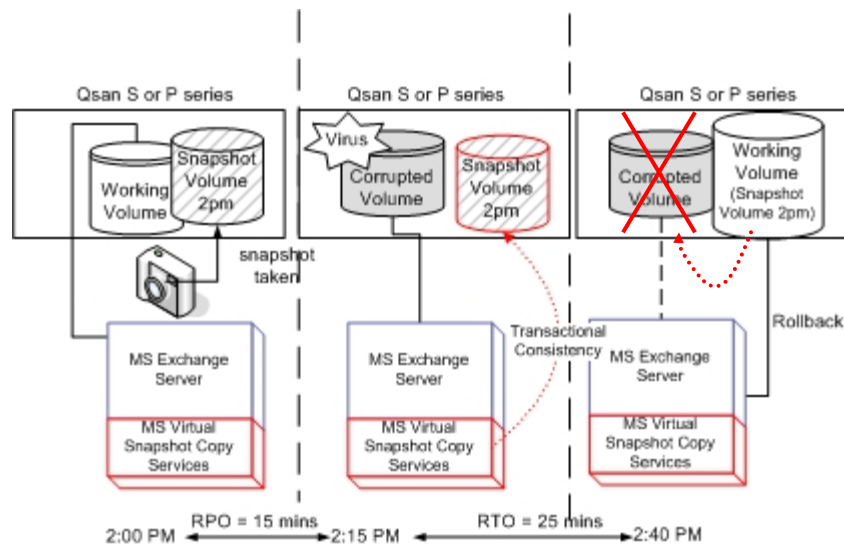


Figure 4.4.1






#### Caution

Snapshot (ESnap) / rollback features need **512MB** RAM at least. Please also refer to RAM certification list in Appendix A.

### 4.4.1 Create snapshot (ESnap) volume

To take a snapshot (ESnap) of the data, please follow the procedures.

1. Select “/ Volume config / User data volume”.
2. Choose a UDV to do snapshot (ESnap) by clicking the button “” in the “**Snapshot (ESnap) (GB)**” column, it will direct to a setup page. The maximum snapshot (ESnap) space is 2TB which user can setup the space no bigger than 2048GB.
3. Set up the size for snapshot (ESnap). The size is suggested to be **20%** of UDV size at least, then click “”. It will go back to the UDV page and the size will show in snapshot (ESnap) column. It may not be the same as the number entered because some is reserved for snapshot (ESnap) internal usage. There will be 2 numbers in “**Snapshot (ESnap) (GB)**” column. These numbers mean “**Free snapshot (ESnap) space**” and “**Total snapshot (ESnap) space**”.
4. Choose a UDV by clicking the checkbox of the row and then click “”.
5. A snapshot (ESnap) UDV is created with the date and time taken snapshot (ESnap) of the chosen UDV. The snapshot (ESnap) UDV

size is the same as the chosen UDV no matter the actual snapshot (ESnap) UDV data occupies.

6. Attach LUN to UDV, please refer to section 3.5.6 for more detail.
7. Done. It can be used as a disk.

No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	Snapshot (GB)	VG name	CV (MB)
1	UDV-R0	10	Online	WB	HI			RAID 0	1	10.00/10.00	VG-R0	100
2	UDV-R-1713	10	Online	RO	HI			RAID 0	0	02/14 17:13:35	VG-R0	100

Figure 4.4.1.1

(Figure 4.4.1.1: No.1 is a RAID 0 UDV. Set snapshot (ESnap) space to 10GB. And now its space is free to snapshot (ESnap). No.2 is a snap UDV taken on 02/14 17:13:35.)


Snapshot (ESnap) has some constraints as the following:

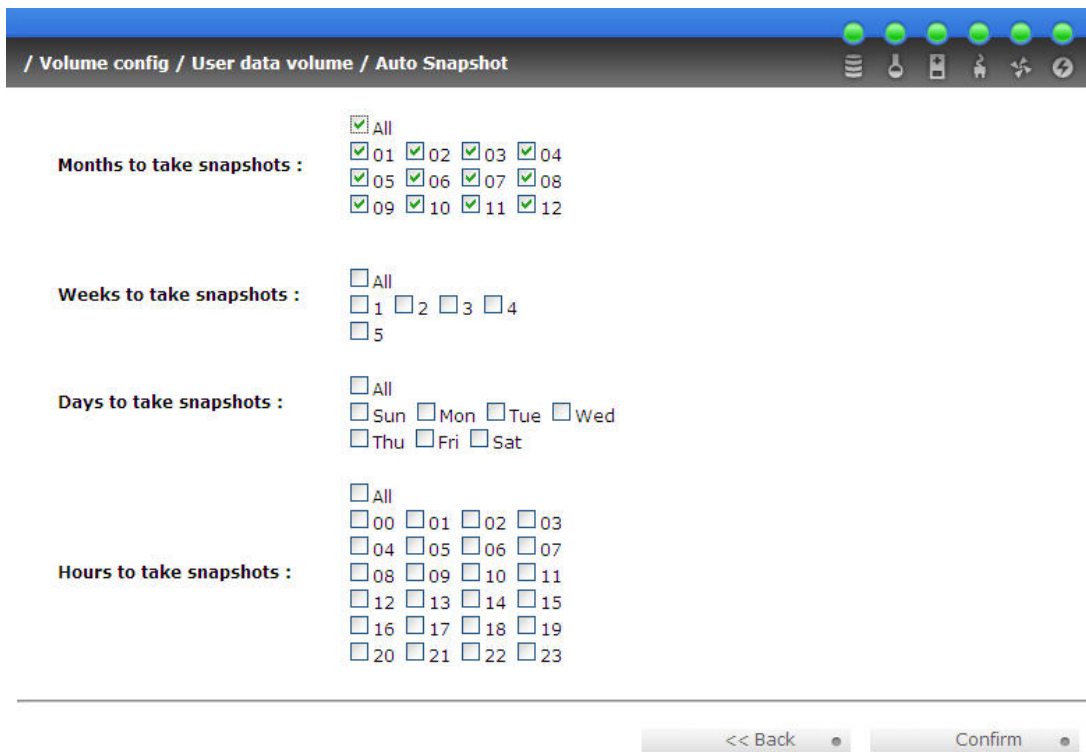
1. Minimum RAM size of enabling snapshot (ESnap) function is **512MB**.
2. For performance concern and future rollback, the system saves snapshot (ESnap) with names in sequences. For example: three snapshots (ESnap) has been taken and named “snap1” (first), “snap2” and “snap3” (last). When deleting “snap2”, both of “snap1” and “snap2” will be deleted because “snap1” are related to “snap2”.
3. For resource concern, the max number of snapshots (ESnap) is **32**.
4. If snapshot (ESnap) space is full, controller will send a warning message about space full and the new taken snapshot (ESnap) will replace the oldest snapshot (ESnap) by rotation sequence.
5. Snap UDV cannot be migrated, when doing migration of related VG, snap UDV will fail.
6. Snap UDV cannot be extended.

## 4.4.2 Auto snapshot (ESnap)

The snapshot (ESnap) copies can be taken manually or by schedule such as hourly or daily. Please follow the procedures.

1. Select “/ Volume config / User data volume”.

2. Create a snapshot (ESnap) space. Please refer to section 4.4.1 for more detail.
3. Click “” in “**Snapshot (ESnap) (GB)**” column to set auto snapshot (ESnap).
4. The auto snapshot (ESnap) can be set at the period of monthly, weekly, daily, or hourly.
5. Done. It will take snapshots (ESnap) automatically.



/ Volume config / User data volume / Auto Snapshot

**Months to take snapshots :**

☒ All  
☒ 01 ☒ 02 ☒ 03 ☒ 04  
☒ 05 ☒ 06 ☒ 07 ☒ 08  
☒ 09 ☒ 10 ☒ 11 ☒ 12

**Weeks to take snapshots :**

☐ All  
☐ 1 ☐ 2 ☐ 3 ☐ 4  
☐ 5

**Days to take snapshots :**

☐ All  
☐ Sun ☐ Mon ☐ Tue ☐ Wed  
☐ Thu ☐ Fri ☐ Sat

**Hours to take snapshots :**

☐ All  
☐ 00 ☐ 01 ☐ 02 ☐ 03  
☐ 04 ☐ 05 ☐ 06 ☐ 07  
☐ 08 ☐ 09 ☐ 10 ☐ 11  
☐ 12 ☐ 13 ☐ 14 ☐ 15  
☐ 16 ☐ 17 ☐ 18 ☐ 19  
☐ 20 ☐ 21 ☐ 22 ☐ 23

<< Back Confirm

Figure 4.4.2.1

(Figure 4.4.2.1: It will take snapshots (ESnap) every month, and keep the last 32 snapshot (ESnap) copies.)




#### Tips

Daily snapshot (QSnap) will be taken at every 00:00. Weekly snapshot (QSnap) will be taken on every Sunday 00:00. Monthly snapshot (QSnap) will be taken on every first day of month 00:00.

### 4.4.3 Rollback

The data in snapshot (ESnap) UDV can rollback to original UDV. Please follow the procedures.



1. Select “/ **Volume config / User data volume**”.
2. Take one or more snapshots (ESnap). Please refer to section 4.4.1 for more detail.
3. Click “” in “**Snapshot (ESnap) (GB)**” column to rollback the data, which user can recover data to the time that snapshot (ESnap) is taken.

Rollback function has some constraints as described in the following:

1. Minimum RAM size of enabling rollback function is **512MB**.
2. When doing rollback, the original UDV cannot be accessed for a while. At the same time, the system connects original UDV and snap UDV, and then starts rollback.
3. During rollback data from snap UDV to original UDV, the original UDV can be accessed and the data in it just like it finished rollback. At the same time, the other related snap UDV(s) can not be accessed.
4. After rollback process finished, the other related snap UDV(s) will be deleted, and snapshot (ESnap) space will be set to **0**.



#### **Caution**

Before executing rollback, it is better to dismount file system for flushing data from cache to disks in OS first. Enhance controller also sends pop-up message when user checks rollback function.

## **4.5 Disk roaming**

Physical disks can be re-sequenced in the same system or move whole physical disks from system-1 to system-2. This is called disk roaming. Disk roaming has some constraints as described in the following:

1. Check the firmware of two systems first. It is better that both have same firmware version or newer.
2. Whole physical disks of related VG should be moved from system-1 to system-2 together. The configuration of both VG and UDV will be kept but LUN configuration will be cleared to avoid conflict with system-2.

## **Appendix**

## A. Certification list

- **RAM**

**E500** RAM Spec: 184pins, DDR333 (PC2700), Reg. (register) or UB (Unbuffered), ECC or Non-ECC, from 64MB to 1GB, 32-bit or 64-bit data bus width, x8 or x16 devices, 9 to 11 bits column address.

Vendor	Model
ATP	AG64L72T8SQC4S, 512MB DDR-400 (ECC) with Samsung
ATP	AG28L64T8SHC4S, 1GB DDR-400 with Samsung
ATP	AG28L72T8SHC4S, 1GB DDR-400 (ECC) with Samsung
ATP	AB28L72Q8SHC4S, 1GB DDR-400 (ECC, Reg.) with Samsung
Unigen	UG732D6688KN-DH, 256MB DDR-333 (Unbuffered) with Hynix
Unigen	UG732D7588KZ-DH, 256MB DDR-333 (ECC, Reg.) with Elpida
Unigen	UG764D7588KZ-DH, 512MB DDR-333 (ECC, Reg.) with Elpida
Unigen	UG7128D7588LZ-DH, 1GB DDR-333 (ECC, Reg.) with Hynix
Unigen	UG7128D7488LN-GJF, 1GB DDR-400 (ECC) with Hynix
Unigen	UG7128D7588LZ-GJF, 1GB DDR-400 (ECC, Reg.) with Hynix
Unigen	UG7128D7588LZ-GJF, 1GB DDR-400 (ECC, Reg.) with Elpida
Unigen	UG732D6688KS-DH, 256MB DDR-333 (Unbuffered, Low profile) with Hynix
Unigen	UG764D6688LS-DH, 512MB DDR-333 (Unbuffered, Low profile) with Hynix
Unigen	UG718D6688LN-GJF, 1GB DDR-400 with Hynix
Unigen	UG718D6688LN-GJF, 1GB DDR-400 with Elpida

**RS8SS and RS16SS** RAM Spec: 240-pin, DDR2-533(PC4300), Reg.(register) or UB(Unbuffered), ECC, up to 2GB, 64-bit data bus width (and also 32-bit memory support), x8 or x16 devices, 36-bit addressable, up to 14-bit row address and 10-bit column address.

Vendor	Model
ATP	AJ28K64E8BHE6S, 1GB DDR2-667 (Unbuffered, non-ECC) with SEC
ATP	AJ28K72G8BHE6S, 1GB DDR2-667 (Unbuffered, ECC) with SEC
ATP	AJ64K72F8BHE6S, 512MB DDR2-667 (Unbuffered, ECC) with SEC
ATP	AJ56K72G8BJE6S, 2GB DDR2-667 (Unbuffered, ECC) with Samsung
Unigen	UG64T7200L8DU-6AL, 512MB DDR2-667 (Unbuffered, ECC) with Elpida
Unigen	UG12T7200L8DU-5AM, 1GB DDR2-533 (Unbuffered, ECC) with Elpida
Unigen	UG12T7200L8DR-5AC, 1GB DDR2-533 (Registered, ECC) with Elpida
Unigen	UG25T7200M8DU-5AM, 2GB DDR2-533 (Unbuffered, ECC) with

	Micron
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- **SAS HBA card**

Vendor	Model
LSI Logic	SAS3442X (PCI-X, 3 Gb/s, 1 external x4 SFF 8470 , 1 internal x4 SFF 8484)
LSI Logic	SAS3442E-R (PCI-Express, 3 Gb/s, 1 external x4 SFF 8470 , 1 internal x4 SFF 8484)
LSI Logic	SAS3800X (PCI-X, 3 Gb/s, 2 external x4 SFF-8470)
LSI Logic	SAS3801E (PCI-Express, 3 Gb/s, 2 external x4 SFF-8088 mini-SAS)

- **Hard drive**

**E500, RS8SS, RS16SS** support SATA I, II disks.

Vendor	Model
Hitachi	Deskstar 7K250, HDS722580VLSA80, 80GB, 7200RPM, SATA, 8M
Hitachi	Deskstar 7K80, HDS728080PLA380, 80GB, 7200RPM, SATA II, 8M
Hitachi	Deskstar E7K500, HDS725050KLA360, 500G, 7200RPM, SATA II, 16M
Hitachi	Deskstar 7K80, HDS728040PLA320, 40G, 7200RPM, SATA II, 2M
Hitachi	Deskstar T7K500, HDT725032VLA360, 320G, 7200RPM, SATA II, 16M
Maxtor	DiamondMax Plus 9, 6Y080M0, 80G, 7200RPM, SATA, 8M
Maxtor	DiamondMax 11, 6H500F0, 500G, 7200RPM, SATA 3.0Gb/s, 16M
Samsung	SpinPoint P80, HDSASP0812C, 80GB , 7200RPM, SATA, 8M
Seagate	Barracuda 7200.7, ST380013AS, 80G, 7200RPM, SATA 1.5Gb/s, 8M
Seagate	Barracuda 7200.7, ST380817AS, 80G, 7200RPM, SATA 1.5Gb/s, 8M, NCQ
Seagate	Barracuda 7200.8, ST3400832AS, 400G, 7200RPM, SATA 1.5Gb/s, 8M, NCQ
Seagate	Barracuda 7200.9, ST3500641AS, 500G, 7200RPM, SATA 3.0Gb/s, 16M, NCQ
Seagate	NL35, ST3400633NS, 400G, 7200RPM, SATA 3.0Gb/s, 16M
Seagate	NL35, ST3500641NS, 500G, 7200RPM, SATA 3.0Gb/s, 16M
Seagate	Barracuda ES, ST3500630NS, 500G, 7200RPM, SATA 3.0Gb/s, 16M
Seagate	Barracuda ES, ST3750640NS, 750G, 7200RPM, SATA 3.0Gb/s, 16M
Seagate	Barracuda ES.2, ST31000340NS, 1000G, 7200RPM, SATA 3.0Gb/s, 32M
Western Digital	Caviar SE, WD800JD, 80GB, 7200RPM, SATA 3.0Gb/s, 8M
Western Digital	Caviar SE, WD1600JD, 160GB, 7200RPM, SATA 1.5G/s , 8M
Western Digital	Raptor, WD360GD, 36.7GB, 10000RPM, SATA 1.5Gb/s, 8M
Western Digital	Caviar RE2, WD4000YR, 400GB, 7200RPM, SATA 1.5Gb/s, 16M, NCQ
Western Digital	RE2, WD4000YS, 400GB, 7200RPM, SATA 3.0Gb/s, 16M
Western Digital	Caviar RE16, WD5000AAKS, 500GB, 7200RPM, SATA 3.0Gb/s, 16M
Western Digital	RE2, WD5000ABYS, 500GB, 7200RPM, SATA 3.0Gb/s, 16M, NCQ

**RS8 SS and RS16 SS** support SAS disk.

Vendor	Model
Fujitsu	MAX3036RC, 36.7G, 15000RPM, SAS 3.0Gb/s, 16M
Fujitsu	MAX3073RC, 73.5G, 15000RPM, SAS 3.0Gb/s, 16M
Fujitsu	MAX3147RC, 147.0G, 15000RPM, SAS 3.0Gb/s, 16M
Hitachi	Ultrastar 15K147, HUS151436VLS300, 36G, 15000RPM, SAS 3.0Gb/s, 16M
Seagate	Cheetah 15K.4, ST336754SS, 36.7G, 15000RPM, SAS 3.0Gb/s, 8M
Seagate	Cheetah 15K.5, ST373455SS, 73.4G, 15000RPM, SAS 3.0Gb/s, 16M
Seagate	Cheetah 15K.5, ST3146855SS, 146.8G, 15000RPM, SAS 3.0Gb/s, 16M
Seagate	Cheetah NS, ST3400755SS, 400G, 10000RPM, SAS 3.0Gb/s, 16M

Some of SAS commands in Fujitsu SAS disks do not follow SAS standard. Although ULTRASTOR controller has workaround this problem, Fujitsu SAS disks are not recommended.

## B. Event notifications

- PD / S.M.A.R.T. events**

Level	Type	Description
<b>Info</b>	Disk inserted	Info: Disk <slot> is inserted.
<b>Info</b>	Disk removed	Info: Disk <slot> is removed.
<b>Warning</b>	S.M.A.R.T. threshold exceed condition	Warning: Disk <slot> S.M.A.R.T. threshold exceed condition occurred for attribute of <ol style="list-style-type: none"> <li>1. read error rate</li> <li>2. spin up time</li> <li>3. reallocated sector count</li> <li>4. seek error rate</li> <li>5. spin up retries</li> </ol> calibration retries
<b>Warning</b>	S.M.A.R.T. information	Warning: Disk <slot>: Failure to get S.M.A.R.T information

- Physical HW events**

Level	Type	Description
<b>Warning</b>	ECC error	Warning: Single-bit ECC error is detected.
<b>Error</b>	ECC error	Error: Multi-bit ECC error is detected.
<b>Info</b>	ECC DIMM	Info: ECC Memory is installed.

	Installed	
<b>Info</b>	Non-ECC installed	Info: Non-ECC Memory is installed.
<b>Error</b>	Host chip failure	Error: Host channel chip failed.
<b>Error</b>	Drive chip failure	Error: Drive channel chip failed.
<b>Warning</b>	Ethernet port failure	Warning: GUI Ethernet port failed.

- **HDD IO events**

Level	Type	Description
<b>Warning</b>	Disk error	Error: Disk <slot> read block error.
<b>Warning</b>	Disk error	Error: Disk <slot> writes block error.
<b>Warning</b>	HDD failure	Error: Disk <slot> is failed.
<b>Warning</b>	Channel error	Error: Disk <slot> IO incomplete.

- **SES events**

Level	Type	Description
<b>Info</b>	SES load conf. OK	Info: SES configuration has been loaded.
<b>Warning</b>	SES Load Conf. Failure	Error: Failed to load SES configuration. The SES device is disabled.
<b>Info</b>	SES is disabled	Info: The SES device is disabled.
<b>Info</b>	SES is enabled	Info: The SES device is enabled

- **Environmental events**

Level	Type	Description
<b>Info</b>	Admin Login OK	Info: Admin login from <IP or serial console> via <Web UI or Console UI>.
<b>Info</b>	Admin Logout OK	Info: Admin logout from <IP or serial console> via <Web UI or Console UI>.
<b>Error</b>	Thermal critical	Error: System Overheated!!!! The system will do the auto shutdown immediately.
<b>Warning</b>	Thermal warning	Warning: System temperature is a little bit higher.
<b>Error</b>	Voltage critical	Error: System voltages failed!!!! The system will do the auto shutdown immediately
<b>Warning</b>	Voltage warning	Warning: System voltage is a little bit higher/lower.
<b>Info</b>	PSU restore	Info: Power <number> is restored to work.
<b>Error</b>	PSU Fail	Error: Power <number> is out of work.
<b>Info</b>	Fan restore	Info: Fan <number> is restore to work.
<b>Error</b>	Fan Fail	Error: Fan <number> is out of work.
<b>Error</b>	Fan non-exist	Error: System cooling fan is not installed.
<b>Error</b>	AC Loss	Error: AC loss for the system is detected.
<b>Info</b>	UPS Detection OK	Info: UPS detection succeed
<b>Warning</b>	UPS Detection Fail	Warning: UPS detection failed

<b>Error</b>	AC Loss	Error: AC loss for the system is detected
<b>Error</b>	UPS power low	Error: UPS Power Low!!! The system will do the auto shutdown immediately.
<b>Info</b>	Mgmt Lan Port Active	Info: Management LAN Port is active.
<b>Warning</b>	Mgmt Lan Port Failed	Warning: Fail to manage the system via the LAN Port.
<b>Info</b>	RTC Device OK	Info: RTC device is active.
<b>Warning</b>	RTC Access Failed	Warning: Fail to access RTC device
<b>Info</b>	Reset Password	Info: Reset Admin Password to default.
<b>Info</b>	Reset IP	Info: Reset network settings set to default.

- **System config events**

Level	Type	Description
<b>Info</b>	Sys Config. Defaults Restored	Info: Default system configurations restored.
<b>Info</b>	Sys NVRAM OK	Info: The system NVRAM is active.
<b>Error</b>	Sys NVRAM IO Failed	Error: Can't access the system NVRAM.
<b>Warning</b>	Sys NVRAM is full	Warning: The system NVRAM is full.

- **System maintenance events**

Level	Type	Description
<b>Info</b>	Firmware Upgraded	Info: System firmware has been upgraded
<b>Error</b>	Firmware Upgraded Failed	Error: System firmware upgrade failed.
<b>Info</b>	System reboot	Info: System has been rebooted
<b>Info</b>	System shutdown	Info: System has been shutdown.
<b>Info</b>	System Init OK	Info: System has been initialized OK.
<b>Error</b>	System Init Failed	Error: System cannot be initialized in the last boot up.

- **LVM events**

Level	Type	Description
<b>Info</b>	VG Created OK	Info: VG <name> has been created.
<b>Warning</b>	VG Created Fail	Warning: Fail to create VG <name>.
<b>Info</b>	VG Deleted	Info: VG <name> has been deleted.
<b>Info</b>	UDV Created OK	Info: UDV <name> has been created.
<b>Warning</b>	UDV Created Fail	Warning: Fail to create UDV <name>.
<b>Info</b>	UDV Deleted	Info: UDV <name> has been deleted.
<b>Info</b>	UDV Attached OK	Info: UDV <name> has been LUN-attached.
<b>Warning</b>	UDV Attached Fail	Warning: Fail to attach LUN to UDV <name>.

<b>Info</b>	UDV Detached OK	Info: UDV <name> has been detached.
<b>Warning</b>	UDV Detached Fail	Warning: Fail to detach LUN from Bus <number> SCSI_ID <number> LUN <number>.
<b>Info</b>	UDV_OP Rebuild Started	Info: UDV <name> starts rebuilding.
<b>Info</b>	UDV_OP Rebuild Finished	Info: UDV <name> completes rebuilding.
<b>Warning</b>	UDV_OP Rebuild Fail	Warning: Fail to complete UDV <name> rebuilding.
<b>Info</b>	UDV_OP Migrate Started	Info: UDV <name> starts migration.
<b>Info</b>	UDV_OP Migrate Finished	Info: UDV <name> completes migration.
<b>Warning</b>	UDV_OP Migrate Failed	Warning: Fail to complete UDV <name> migration.
<b>Warning</b>	VG Degraded	Warning: VG <name> is under degraded mode.
<b>Warning</b>	UDV Degraded	Warning: UDV <name> is under degraded mode.
<b>Info</b>	UDV Init OK	Info: UDV <name> completes the initialization.
<b>Warning</b>	UDV_OP Stop Initialization	Warning: Fail to complete UDV <name> initialization.
<b>Warning</b>	UDV IO Fault	Error: IO failure for stripe number <number> in UDV <name>.
<b>Warning</b>	VG Failed	Error: Fail to access VG <name>.
<b>Warning</b>	UDV Failed	Error: Fail to access UDV <name>.
<b>Warning</b>	Global CV Adjustment Failed	Error: Fail to adjust the size of the global cache.
<b>Info</b>	Global Cache	Info: The global cache is OK.
<b>Error</b>	Global CV Creation Failed	Error: Fail to create the global cache.
<b>Info</b>	UDV Rename	Info: UDV <name> has been renamed as <name>.
<b>Info</b>	VG Rename	Info: VG <name> has been renamed as <name>.
<b>Info</b>	Set VG Dedicated Spare Disks	Info: Assign Disk <slot> to be VG <name> dedicated spare disk.
<b>Info</b>	Set Global Disks	Info: Assign Disk <slot> to the Global Spare Disks.
<b>Info</b>	UDV Read-Only	Info: UDV <name> is a read-only volume.
<b>Info</b>	WRBK Cache Policy	Info: Use the write-back cache policy for UDV <name>.
<b>Info</b>	WRTHRU Cache Policy	Info: Use the write-through cache policy for UDV <name>.
<b>Info</b>	High priority UDV	Info: UDV <name> is set to high priority.
<b>Info</b>	Mid Priority UDV	Info: UDV <name> is set to mid priority.
<b>Info</b>	Low Priority UDV	Info: UDV <name> is set to low priority.
<b>Error</b>	PD configuration read/write error	Error: PD <slot> lba <#> length <#> config <read   write> failed.
<b>Error</b>	PD read/write error	Error: PD <#> lba <#> length <#> <read   write> error.
<b>Error</b>	UDV recoverable read/write error	Error: UDV <name> stripe <#> PD <#> lba <#> length <#> <read   write> recoverable
<b>Error</b>	UDV unrecoverable read/write error	Error: UDV <#> stripe <#> PD <#> lba <#> length <#> <read   write> unrecoverable

<b>Info</b>	UDV stripe rewrite start/fail/succeed	Info: UDV <name> stripe <#> rewrite column bitmap <BITMAP> <started   failed   finished>.
-------------	---------------------------------------	---

- **Snapshot (ESnap) events**

Level	Type	Description
<b>Warning</b>	Allocate Snapshot (ESnap) Mem Failed	Warning: Fail to allocate snapshot (ESnap) memory for UDV <name>.
<b>Warning</b>	Allocate Snapshot (ESnap) Space Failed	Warning: Fail to allocate snapshot (ESnap) space for UDV <name>.
<b>Warning</b>	Reach Snapshot (ESnap) Threshold	Warning: The threshold of the snapshot (ESnap) of UDV <name> has been reached.
<b>Info</b>	Snapshot (ESnap) Delete	Info: The snapshot (ESnap) of UDV <name> has been deleted.
<b>Info</b>	Snapshot (ESnap) replaced	Info: The oldest snapshot (ESnap) version of UDV <name> has been replaced by the new one.
<b>Info</b>	Take a Snapshot (ESnap)	Info: Take a snapshot (ESnap) to UDV <name>.
<b>Info</b>	Set Size for Snapshot (ESnap)	Info: Set the snapshot (ESnap) size of UDV <name> to <number> GB.
<b>Info</b>	Snapshot (ESnap) rollback start	Info: The snapshot (ESnap) of UDV <name> rollback start.
<b>Info</b>	Snapshot (ESnap) rollback finish	Info: The snapshot (ESnap) of UDV <name> rollback finish.

## C. Known issues

1. LSI Logic SAS HBA SAS3800X and SAS3442X windows driver V1.21.26 cannot support MPIO.

**Workaround solution:** User has to wait for windows driver update by LSI to use MPIO function on a single SAS HBA. Or user needs to install two SAS HBA to support MPIO.

## D. Installation Steps for Large Volume (TB)

### Introduction:

**ULTRASTOR** controllers are capable to support large volumes (>2TB) on all product lines. When connecting controllers to 64bit OS installed host/server, the host/server is inherently capable for large volumes from the 64bit address. On



the other side, if the host/server is installed with 32bit OS, user has to change the block size to 1KB, 2KB or 4KB to support volumes up to 4TB, 8TB or 16TB, for the 32bit host/server is not LBA (Logical Block Addressing) 64bit supported. For detail installation steps, please check below.

### Step A: Configure your target

1. Go to / **Volume config / Volume group**, create a VG.

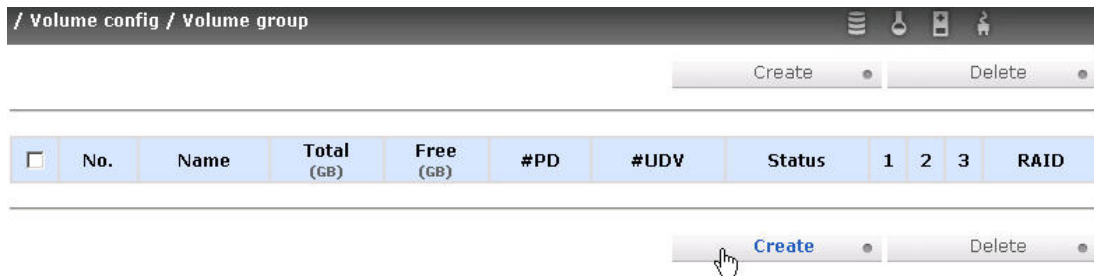


Figure H.1

2. Choose RAID level and disks.



Figure H.2

3. Confirm VG settings.

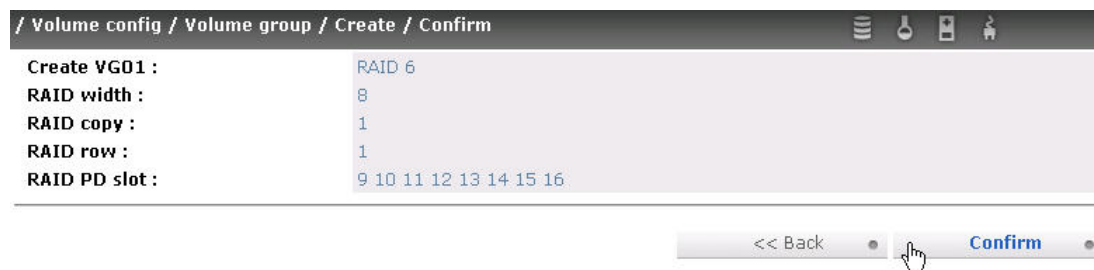


Figure H.3

4. A RAID 6 VG is created.

/ Volume config / Volume group

Create

Delete

<input type="checkbox"/>	No.	Name	Total (GB)	Free (GB)	#PD	#UDV	Status	1	2	3	RAID
<input type="checkbox"/>	1	VG01	2793	2793	8	0	Online				RAID 6

Create

Delete

Figure H.4

- Go to **/ Volume config / User data volume**, create a UDV

/ Volume config / User data volume

Attach

Create

Delete

<input type="checkbox"/>	No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	VG name	CV (MB)
--------------------------	-----	------	-----------	--------	---	---	---	-----	------	------	---------	---------

Attach

Create

Delete

Figure H.5

- Setup capacity, stripe height, and block size for UDV.

/ Volume config / User data volume / Create										
Name :	UDV01									
VG name :	VG01									
CV No. :	Global ( 136 MB )									
Capacity (GB) :	2793									
Stripe height (KB) :	64									
Block size (B) :	512									
Read/Write :	<input type="radio"/> Write-through cache <input checked="" type="radio"/> Write-back cache									
Priority :	<input checked="" type="radio"/> High priority <input type="radio"/> Middle priority <input type="radio"/> Low priority									
<div> <div>&lt;&lt; Back</div> <div>Confirm</div> </div>										

Figure H.6



### Tips

When the OS is 64bit, user can set the block size to any available value. If the OS is 32bit, user must change the block size to larger values than 512B. There will be a confirmation pop-up when UDV size is over 2TB for reminding.

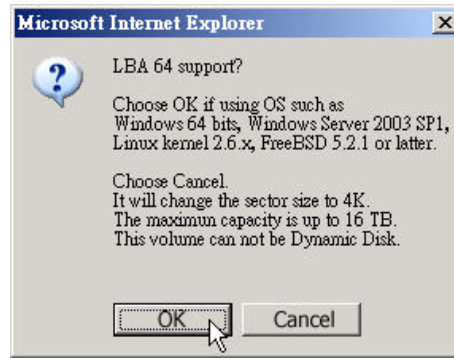


Figure H.7:

(Figure H.7: choose “OK” for 64bit OS, choose “Cancel” for 32bit OS, this step will change block size to 4K automatically.)

7. A 2.793TB UDV is created.

/ Volume config / User data volume												
			Attach		Create		Delete					
<input type="checkbox"/>	No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	VG name	CV (MB)
<input type="checkbox"/>	1	UDV01	2793	Online	WB	HI	I	1%	RAID 6	0	VG01	136
			Attach		Create		Delete					

Figure H.8: a 2793G UDV is created.

8. Check the detail information.

/ Volume config / User data volume / More information																		
UDV:																		
ID	No.	Name	Size (GB)	Status	1	2	3	R %	Strp (KB)	RAID	#LUN	Snap (GB)	Type	VG ID	VG Name	CV ID	CV (MB)	Config
1021826050	1	UDV01	2793	Online	WB	HI	I	1%	64	RAID 6	0	0.00	NORMAL	345494528	VG01	452869120	136	512
																		Block Size
																		Create Time
																		1173345654
																		<< Back

Figure H.9

(Figure H.9: block size = 512B, for 64bit OS setting.)

/ Volume config / User data volume / More information																		
UDV:																		
ID	No.	Name	Size (GB)	Status	1	2	3	R %	Strp (KB)	RAID	#LUN	Snap (GB)	Type	VG ID	VG Name	CV ID	CV (MB)	Config
891804674	1	UDV01	2793	Online	WB	HI	I	1%	64	RAID 6	0	0.00	NORMAL	345494528	VG01	452869120	136	4096
																		Block Size
																		Create Time
																		1173347651
																		<< Back

Figure H.10

(Figure H.10: block size = 4K, for 32bit OS setting.)

## 9. Attach LUN.

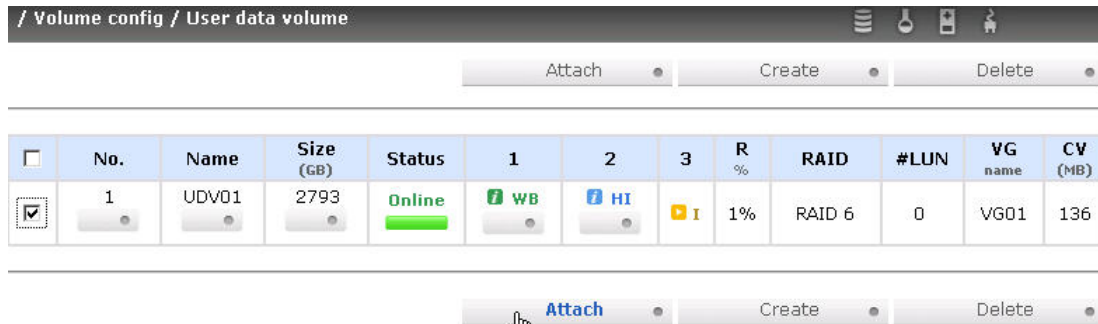


Figure H.11

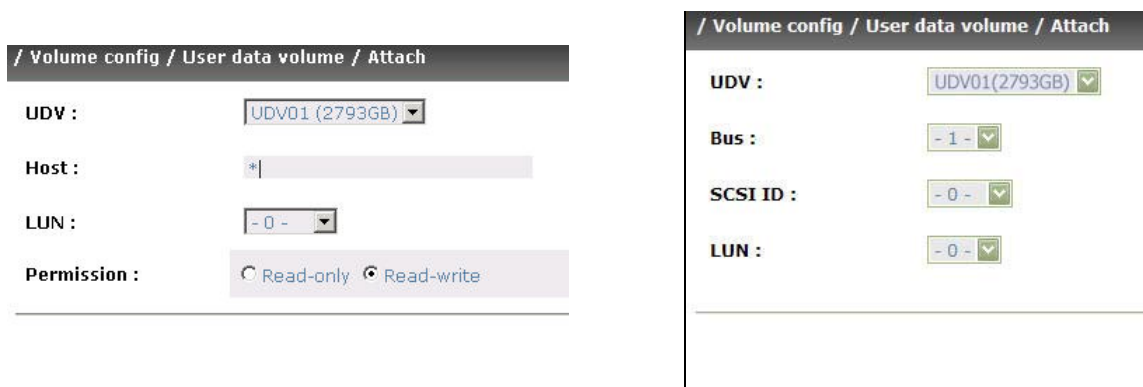


Figure H.12

(Figure H.12: Left: P series; Right: UltraStor Series attach LUN.)

### Step B: Configure your host/server

1. Host/server side may need to reboot to make volumes available. Please refer to your HBA manual for more detail. For IP Series (iSCSI), user needs to setup software iscsi initiator or iSCSI HBA first.
2. Below is the configuration for Windows Server 2003 R2 with Microsoft iscsi initiator. Please install the latest Microsoft iscsi initiator from below link.

<http://www.microsoft.com/downloads/details.aspx?FamilyID=12cb3c1a-15d6-4585-b385-befd1319f825&DisplayLang=en>

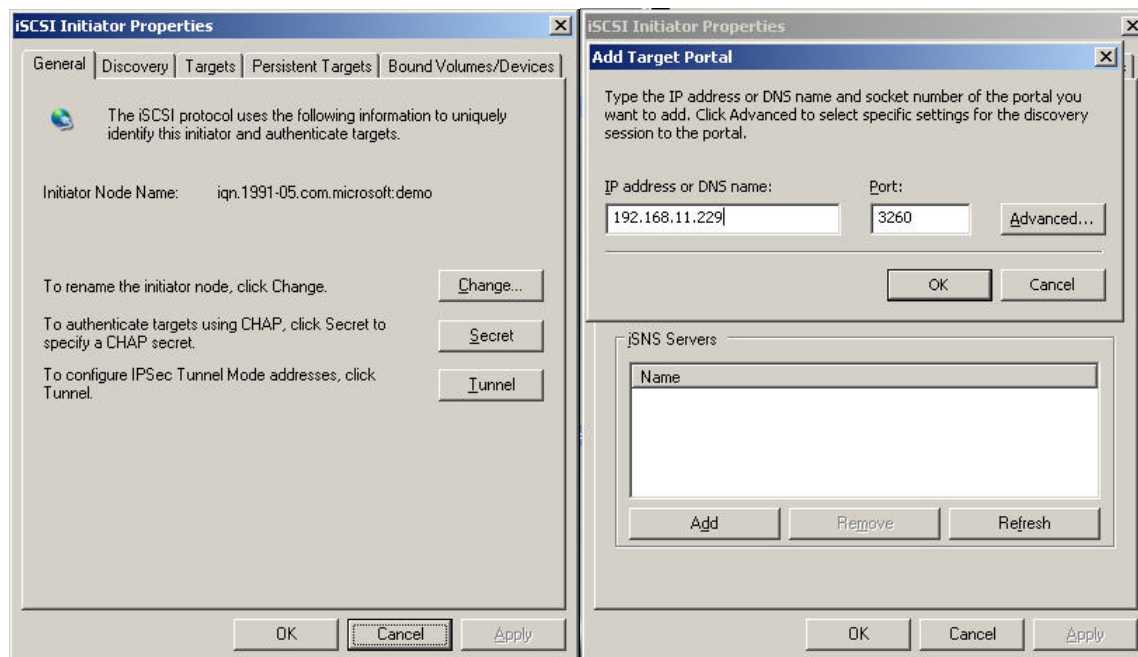


Figure H.13

(Figure H.13: Run MS iSCSI initiator, go to “Discovery” tab, add target portal (iSCSI data).)

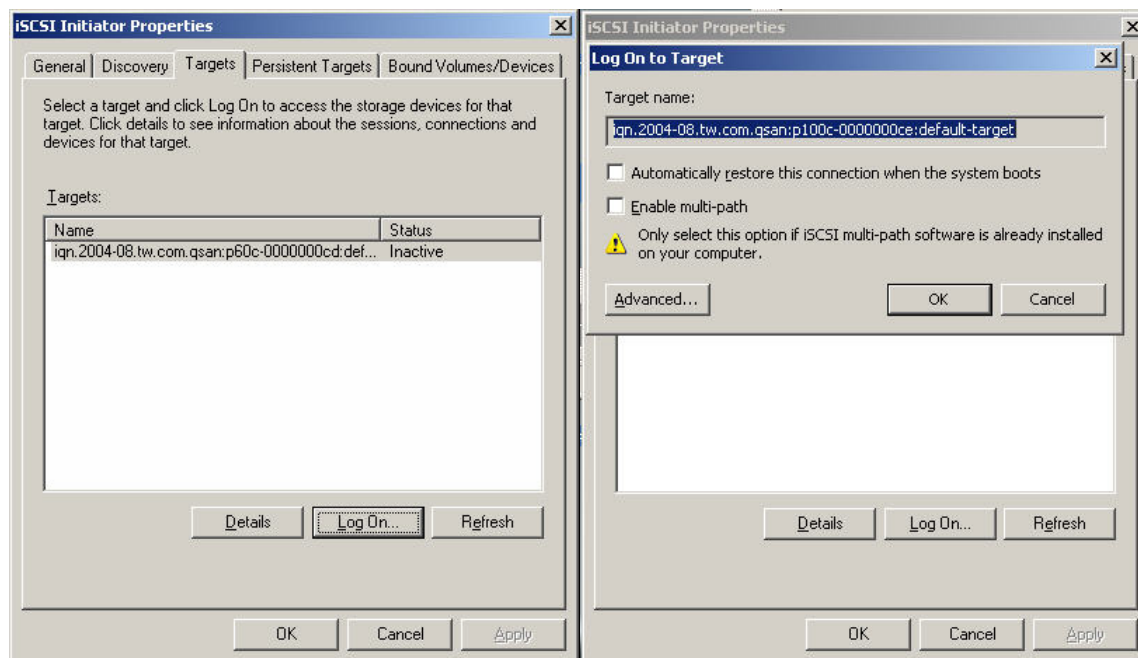
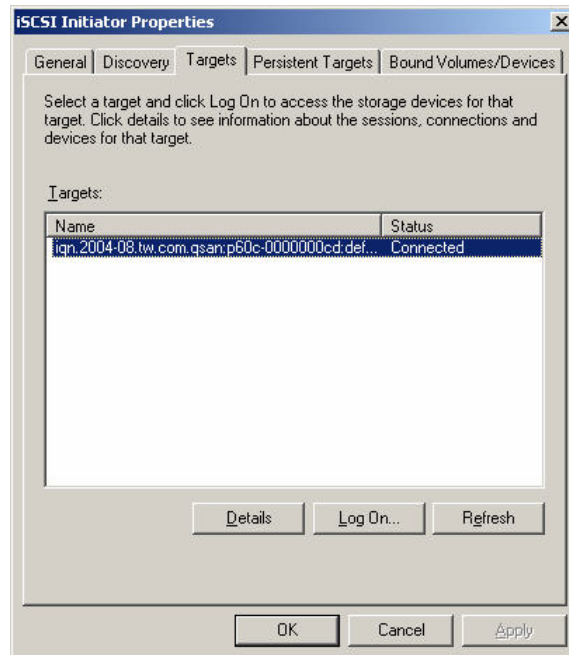


Figure H.14

(Figure H.14: go to “Targets” tab, click “Refresh”, and then “Log On...” the target.)



**Figure H.15**

(Figure H.15: Status is “Connected”, the initiator setting is done.)

### Step C: Initialize/Format/Mount the disk

1. Go to Start → Control Panel → Computer Management → Device Manger → Disk drives



**Figure H.16**

(Figure H.16: Disk drive status of ULTRASTOR controller.)

2. Go to Start → Control Panel → Computer Management → Disk Management, it displays a new disk.

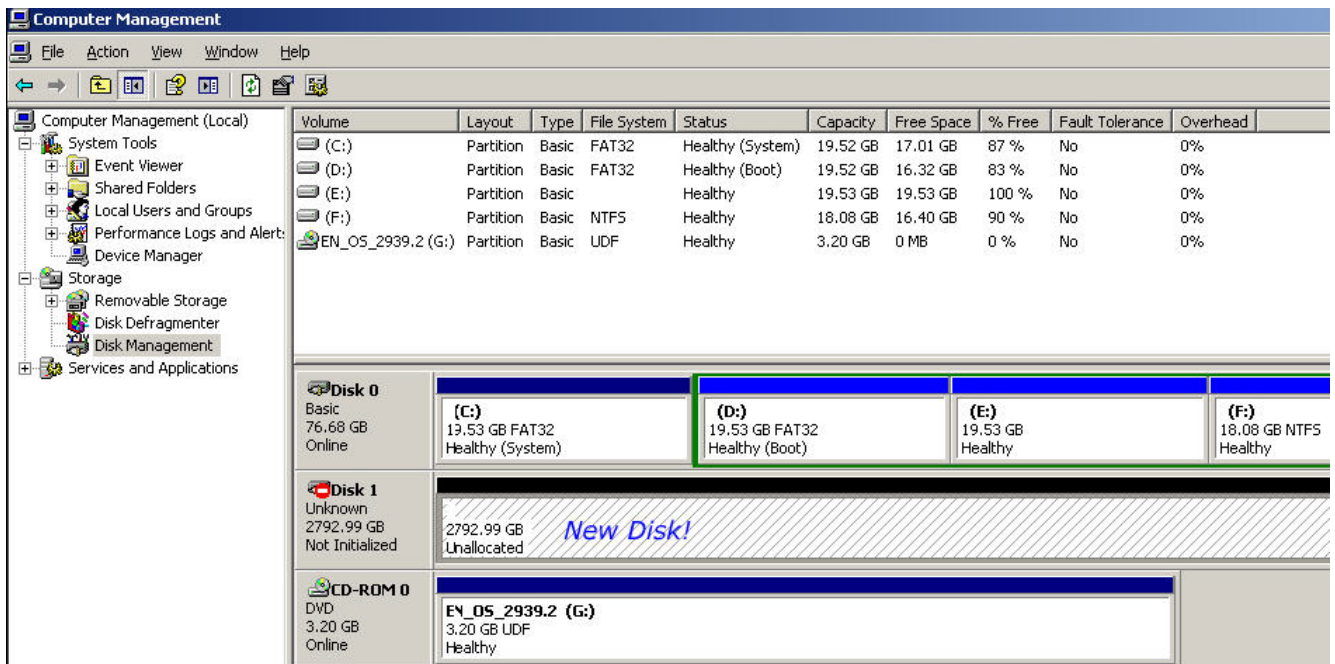


Figure H.17

### 3. Initialize disk.

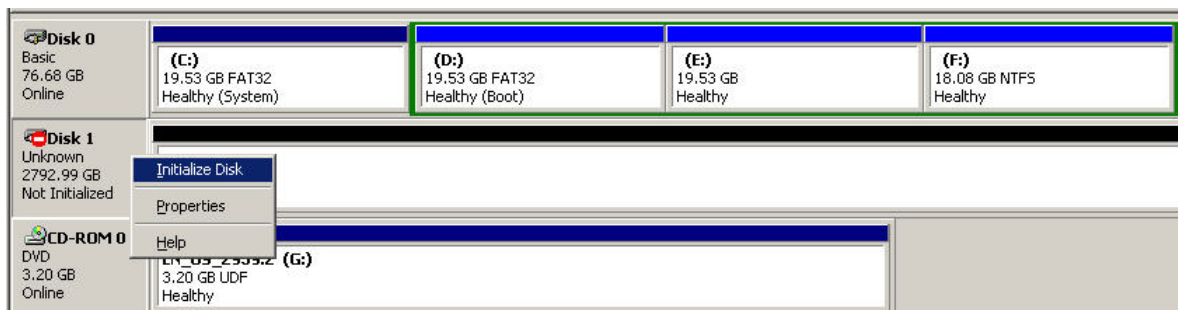


Figure H.18

### 4. Convert to GPT disk for over 2TB capacity. For more detail information about GPT, please visit

[http://www.microsoft.com/whdc/device/storage/GPT\\_FAQ.msp](http://www.microsoft.com/whdc/device/storage/GPT_FAQ.msp)

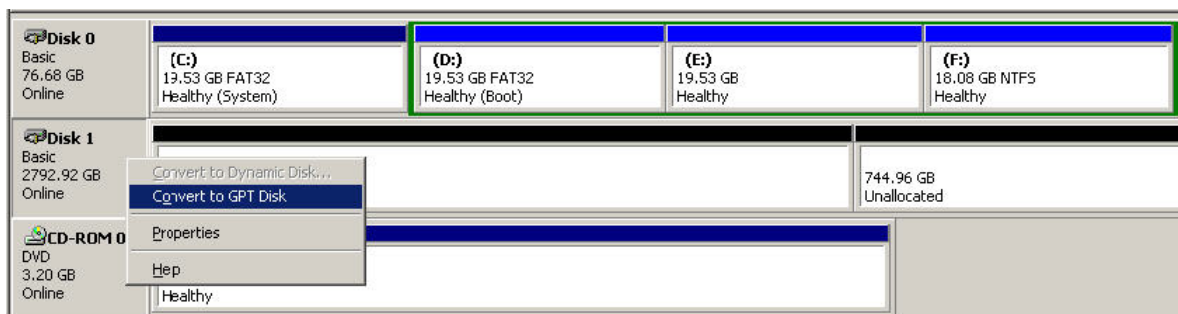


Figure H.19



5. Format disk.

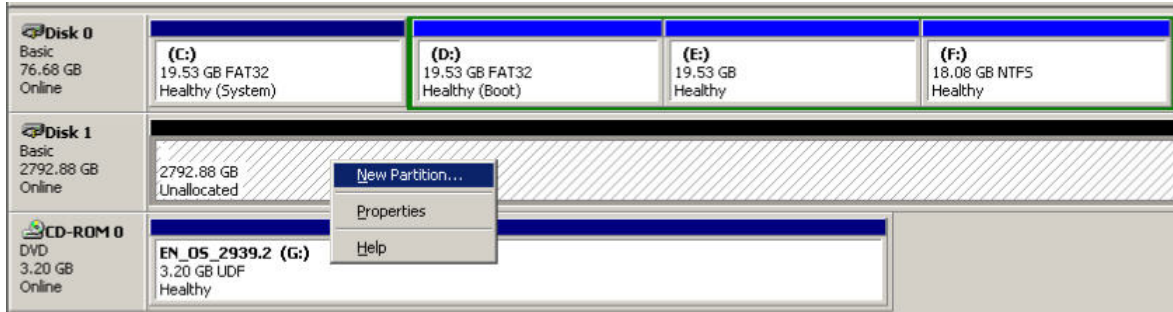


Figure H.20

6. Format disk is done.

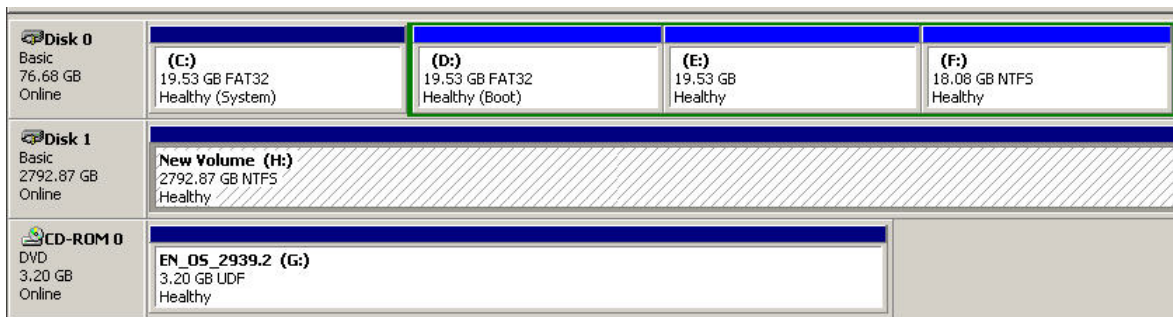


Figure H.21

7. The new disk is ready to go, available size = 2.72TB.

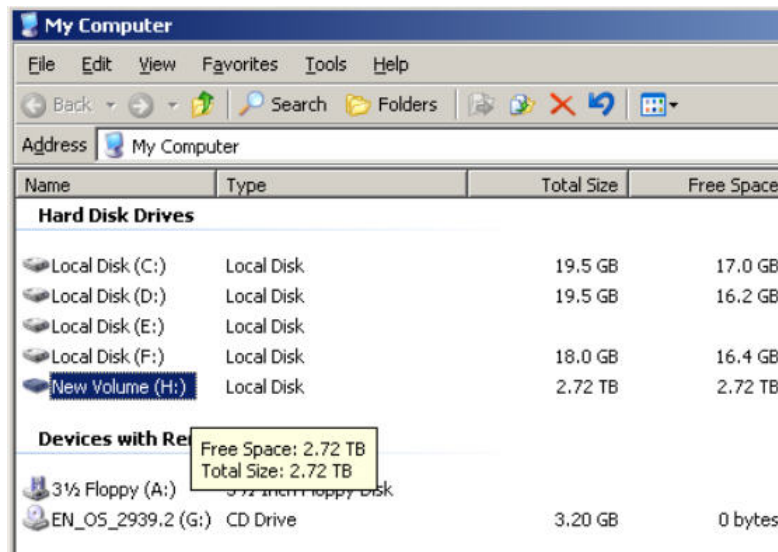


Figure H.22





### Caution

If user setup 512B block size for UDV and the host/server OS is 32bit, in the last step of formatting disk, user will find OS cannot format the area after 2048GB (2TB).

8. Wrong setting result: OS can not format area after 2048GB(2TB).

Disk 0 Basic 76.68 GB Online	(C:) 19.53 GB FAT32 Healthy (System)	(D:) 19.53 GB FAT32 Healthy (Boot)	(E:) 19.53 GB Healthy	(F:) 18.08 GB NTFS Healthy
Disk 1 Basic 2792.99 GB Online	New Volume (H:) 2048.00 GB NTFS Healthy			744.99 GB Unallocated OS cannot format this area!
CD-ROM 0 DVD 3.20 GB Online	EN_05_2939.2 (G:) 3.20 GB UDF Healthy			

Figure H.23