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RS8 HDS Professional VideoRAID Storage
Installation Guide

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ENHANCE | Technology

Every effort has been made to ensure that the information in this manual is accurate. Proavio is not responsible for printing or clerical errors.

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1.0 Welcome to RS8 HDS

Thank you for choosing RS8 HDS, professional SATA-to-SCSI storage solution designed for high resolution digital media production and general high performance storage requirements.

ⓘ **Note:** Your RS8 HDS storage solution features the latest in high-performance RAID technology, including an advanced 64-bit X-Scale core processor, high-speed SATA-II disks, cross-platform browser based management and next generation Ultra320 SCSI interface.

1.1 Getting Started with RS8 HDS

Getting Started with RS8 HDS

Before you begin, carefully remove any protective film from LCD panel and system. Inventory each array to ensure all necessary components are included. If you are missing any components, please contact your dealer for immediate replacement.

System Includes:

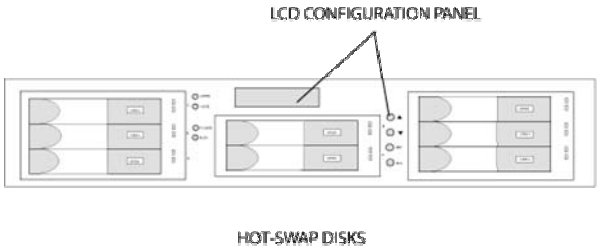
- Two eight disk, rack-optimized video RAID storage systems
- Two external Proavio certified Ultra320 SCSI cables
- Two Ultra320 diagnostic SCSI terminators
- Two RS232 terminal cables, DB-9 interface
- Two slide-rail kits for rack-mount configuration
- Advanced user guide on CD

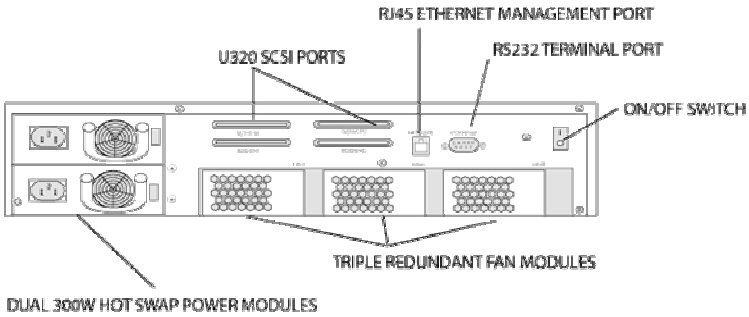
System Requirements:

- Host computer configured for desired application
- Qualified dual channel Ultra320 SCSI controller

1.2 Getting to Know Your RS8 HDS

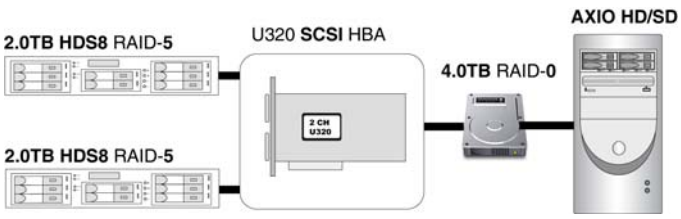
This chapter provides basic system information needed to operate your new RS8 HDS video arrays.





Note:
To learn more about re-configuring your HDS system, contact your local system dealer or call Enhance Technology at (562) 777-3488

HDS Configuration Diagram



Note:
Each system is factory configured for “independent” RAID level-5 which offers maximum performance & 100% media protection.

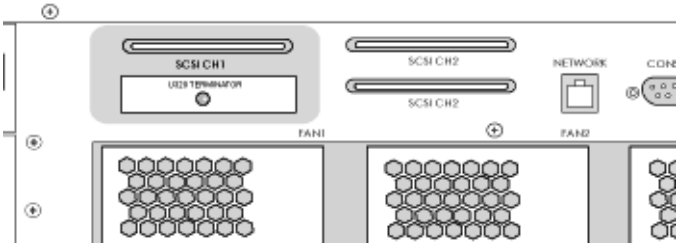
2.0 Hardware Installation

Before installing your new RS8 HDS system, please make sure that you have properly installed a certified U320 SCSI adapter in your workstation. To learn more about certified SCSI host adapters visit www.enhance-tech.com

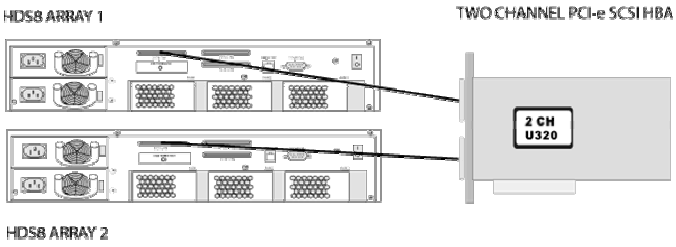
Installation Procedures:

- Place the two RS8 HDS systems next to your Axio editing system.

- Connect a SCSI cable to the CHANNEL1 port (left) on the each system. Do NOT connect to CHANNEL2.



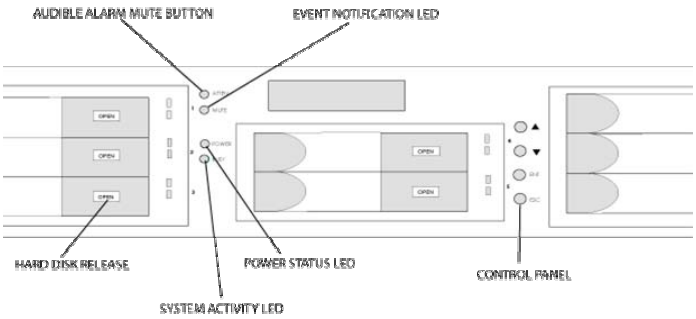
- Terminate each system using the supplied U320 terminators



- Power-on both RS8 HDS systems and wait for array to completely initialize. You will hear an audible beep when array initialization has completed.

- Power-on your workstation

3.0 Re-Configuration Using LCD Panel



Note:
Both systems are then combined (striped) within the OS to appear as a single large VOLUME. Data is written to and read across the two arrays, increasing format and frame size support.

Your HDS storage solution has been optimized & pre-configured at the factory for RAID level-5 protection on each array. This section provides advanced users with information on how to re-configure the storage.

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

After the system boots up, the following screen will be shown on the LCM:

```
ENHANCE
UltraStor RS8
                ←
```

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).

3.1 LCD Control Panel Menu Flow

Alarm Mute	Select **Alarm Mute** to mute the alarm.
Reset/Shutdown	Select **Reset** to restart the controller without powering down. Select **Shutdown** to prepare controller for shutdown prior to powering off. Before powering off system, it is recommended to do **Shutdown** from the controller to clear the data from cache.
Quick Install	Select **Quick Install** to setup a RAID array from the available drives. Please see Appendix for RAID level definitions and minimum requirements for each RAID level.
View IP Setting	Select **View IP Setting** to display current IP address, IP subnet mask, and IP Gateway.
Change IP Config	Select **Change IP Config** to modify IP address, IP subnet mask, and IP Gateway.
Reset to Default ↵	Reset to default will set password to default: **1234**, and set IP address to default. Default IP address: **192.168.0.1** Default subnet mask: **255.255.255.0** Default gateway: **192.168.0.254**

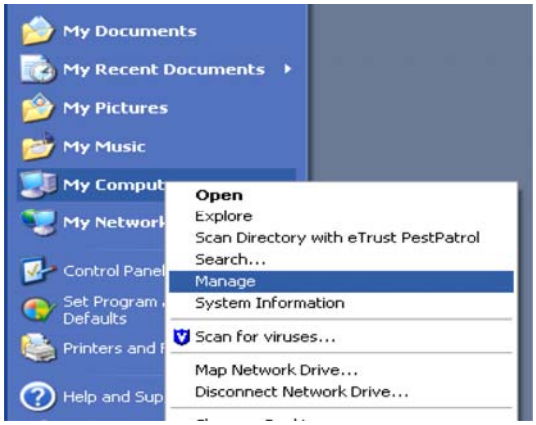
3.2 The following is LCD Panel Menu Hierarchy

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 MB	Volume Size (xxxxxx M)	Adjust Volume Size
			Bus ID (x)	Adjust Bus ID
			SCSI ID (xx)	Adjust SCSI ID
			LUN (x)	Adjust LUN
			Apply The Config	[▲Yes No▼]
	[View IP Setting]	[IP Config] [Static IP]		
		[IP Address] [192.168.000.001]		
		[IP Subnet Mask] [255.255.255.0]		
		[IP Gateway] [192.168.000.254]		
	[Change IP Config]	[DHCP]	[▲Yes No▼]	
		[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▼]		

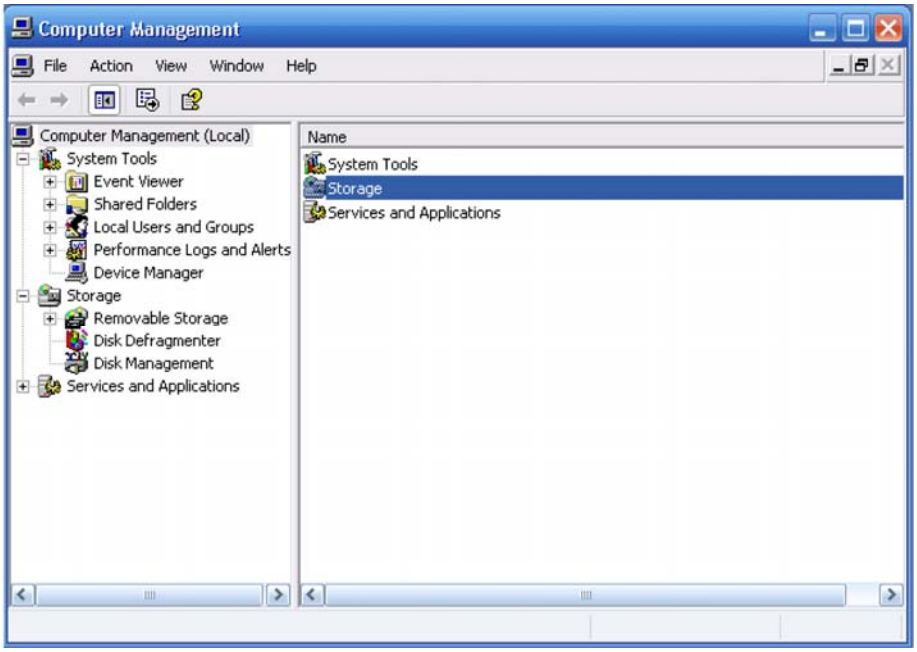
3.3 Striping under Windows XP

Volume Configuration under Windows XP

- Right click on “MY COMPUTER” and select “MANAGE”.

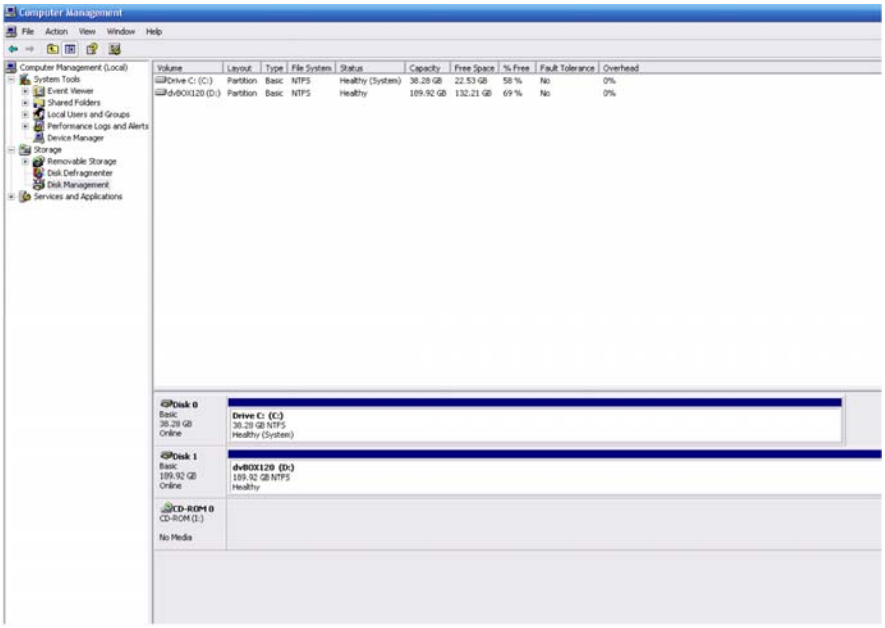


- A new window will open named “COMPUTER MANAGEMENT. Click on “STORAGE”,
  and then select “DISK MANAGEMENT”.

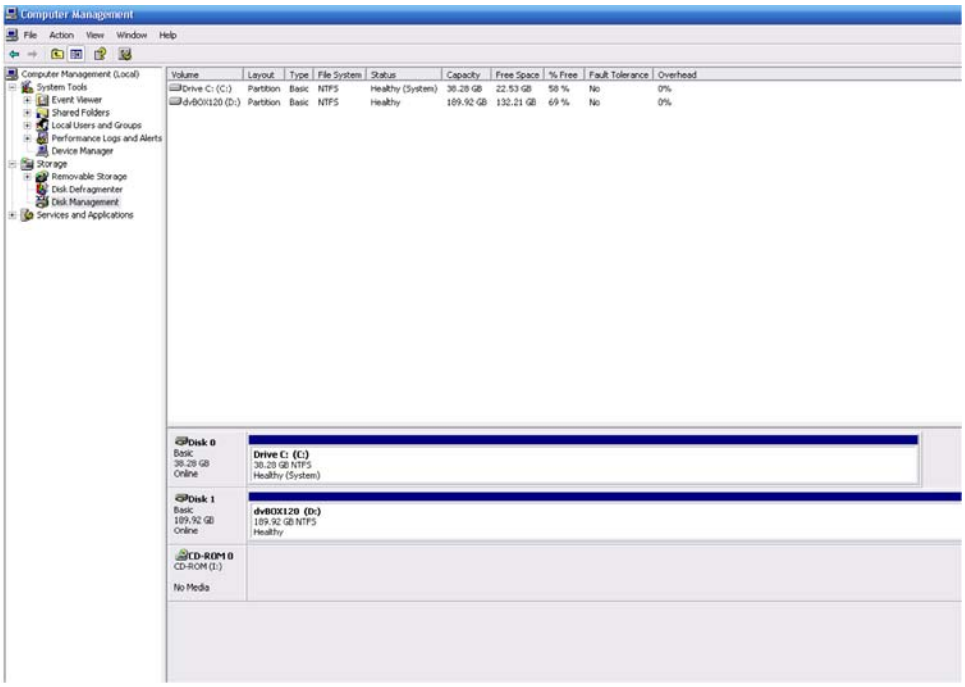


Note:
Windows XP is up to 2 Terabytes and Windows Server 2003 can over 2 Terabytes.

- Each array will be displayed as a “NEW VOLUME”. Right click each “NEW VOLUME” and select “CREATE DYNAMIC DISK” for each array volume.



- Right click on each new DYNAMIC DISK and select “FORMAT”. From the format options, select create a “striped set”. Select both volumes as part of the stripe.
  Continue the format process and assign the new SINGLE LARGE VOLUME a name.
-



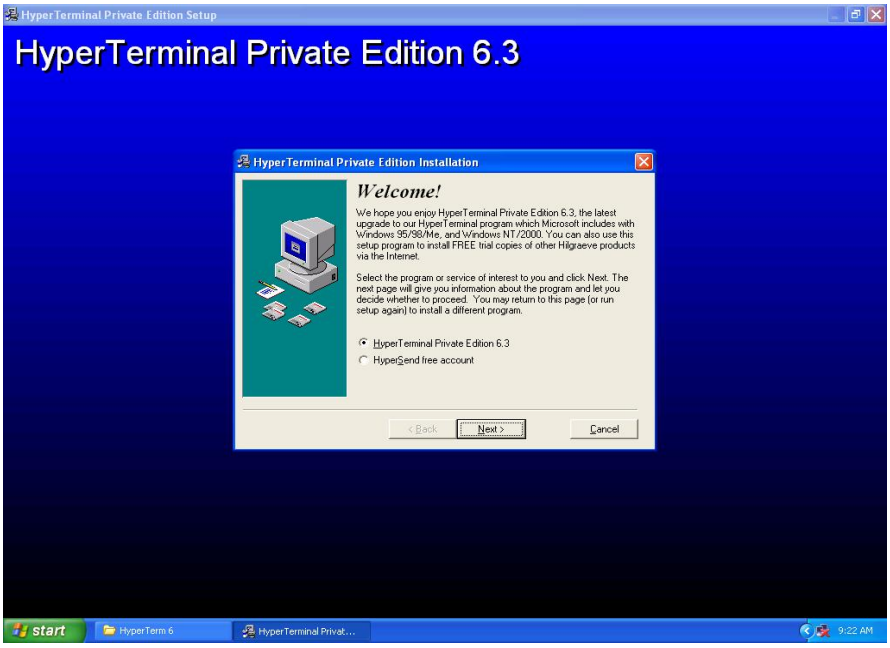
3.0 Re-Configure the RAID Controller – HyperTerminal RS232

RAID Settings & Configuration

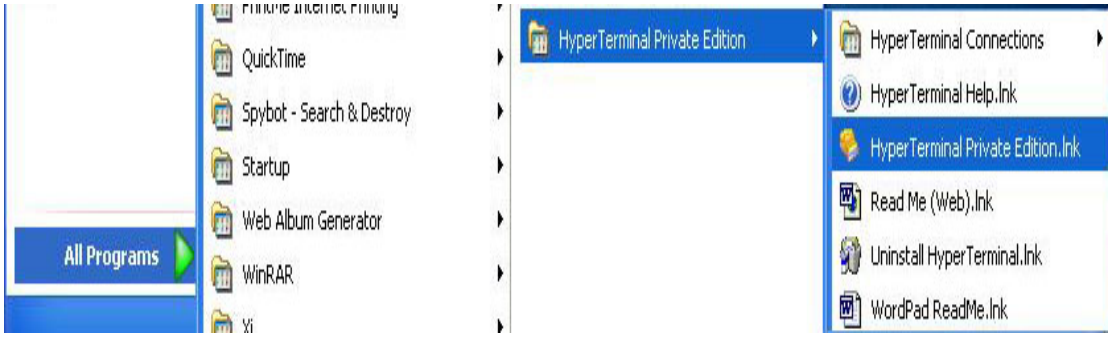
Warning: The UltraStor RS8 RAID controller is configured, at the factory, for RAID 5 and should NOT normally need to be changed. The procedure in this chapter outlines the steps involved to restore the RAID settings should anything happen to the factory default configuration and should be used ONLY under such circumstances.

1. Connect the RS232 serial cable (supplied with your RS8 storage system) to the RS232 Terminal Port
   Connect the other end of this same cable to the COM1 port (DB-9 serial port) on your computer.

2. Install the HyperTerminal 6 utility that was supplied on your UltraStor CD installation disk. Please contact Enhance Technology if are missing the installation CD.



3. In the Windows Start menu, go to: Programs-Hyper Terminal Private Edition. Click on Hyper Terminal Private Edition.lnk.



.

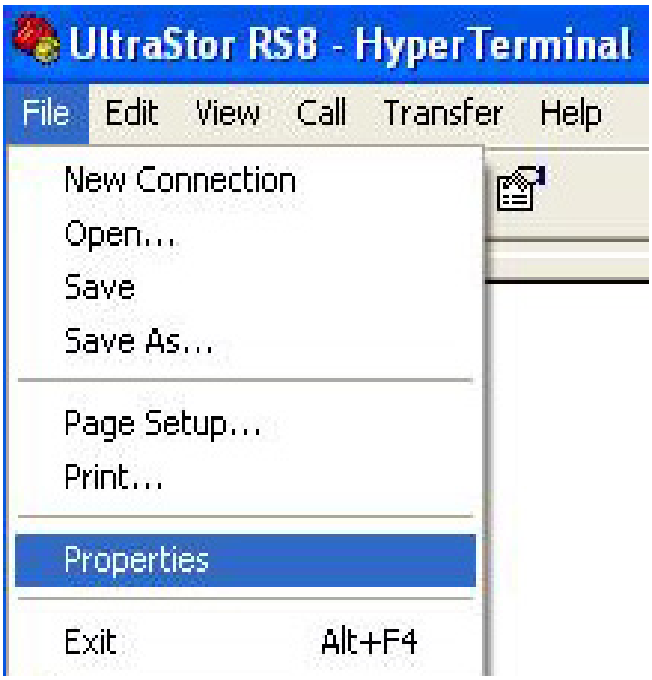
4. Enter a name for the new connection (eg. RS8 HDS) and press OK.

5. In the “Connect using:” list box, select COM1 and click OK.

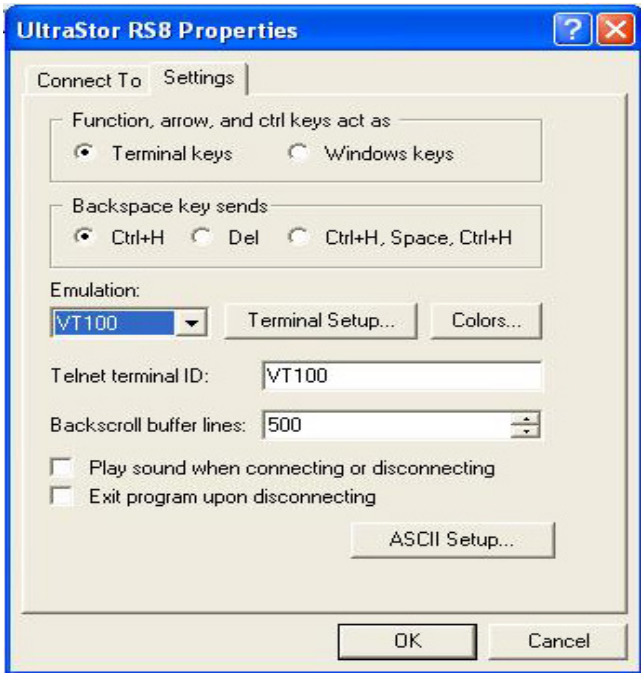
6. You should now see the Port Settings dialog box. You should set the parameters as show below and press OK.

Bits per Second:	115200
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	None

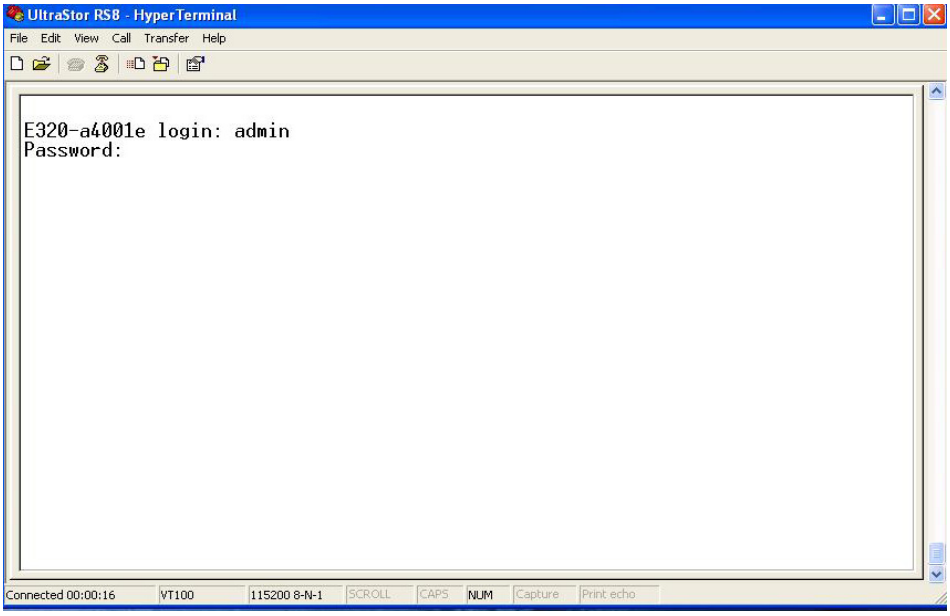
7. In the main HyperTerminal Window, select: File -> Properties



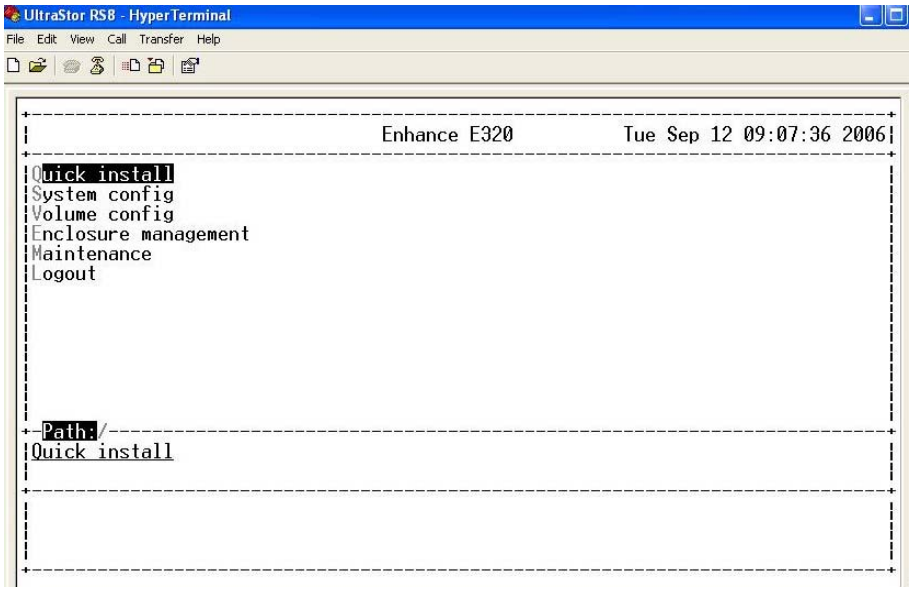
8. In the Emulation list box (on the Settings Tab), choose VT100 and click on OK



9. Enter the login name (admin) and password (1234) and press Enter (Make sure Caps Lock is not on)



You should now see the RS8 configuration screen.

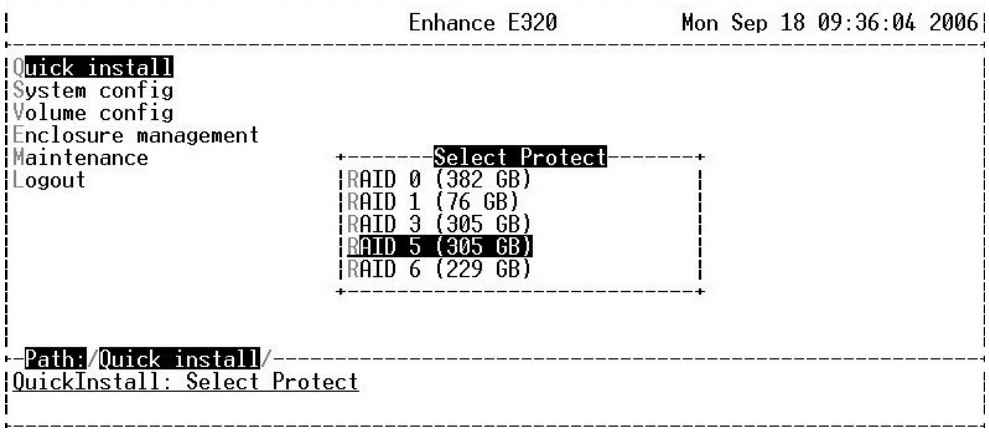


EnhanceRAID S-series Menu

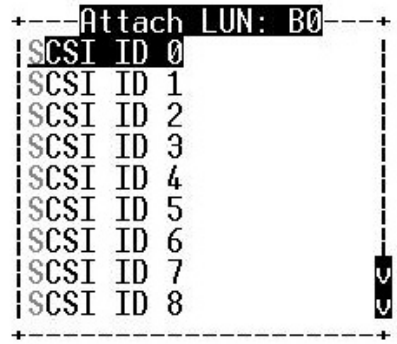
Quick Install	
Quick install	Step 1 / Step 2 / Step 3 / Confirm
System Config	
System name	Change Name
IP address	DHCP / Static
SCSI	Modify BUS Speed
Change Password	Administrative password change
Change Date	Date and time setting
Event log	View event log
Volume Config	
Physical disk	Free disc / Global spares / Dedicated spares / Details
Volume group	Create / Delete / Details / Rename / Migrate
User data volume	Create / Delete / Attach LUN / Snapshot / Details / rename / On/Off Line / Set read/write mode / Set priority / Resize Snapshot space / Auto Snapshot
Cache Volume	Create / Delete / Details / Resize
Logical unit	Attach / Detach
Enclosure Management	
SAF-TE config	SAF-TE enable/disable
Voltage & Temperature	View current voltage and temperature of system
Maintenance	
System Upgrade	Remote upgrade firmware
System Info	Current system firmware version
Reset to Factory Default	Reset to Default
Reset Controller	Reset
Shutdown Controller	Reboot / Shutdown
Logout	
Logout	Logout of system menu

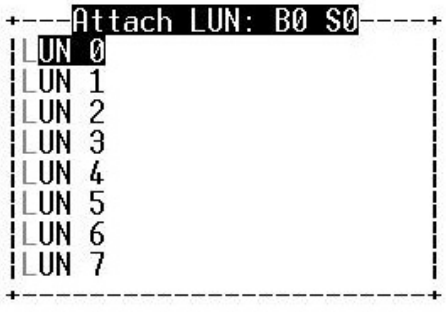
3.1 Quick install

Step 1: Select **"Quick install"** then choose the RAID level to set. After choosing the RAID level, press "Enter", it will show volume size and press "Enter "again.

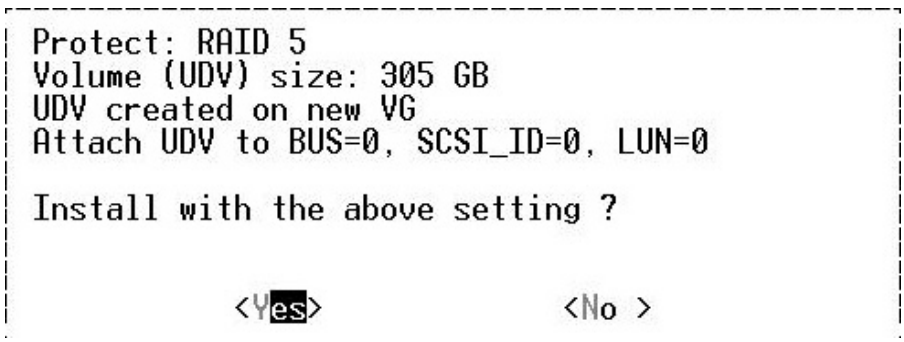


Step 2: Please select a number for each of them. Be careful to avoid the conflict of SCSI ID at the same SCSI bus.

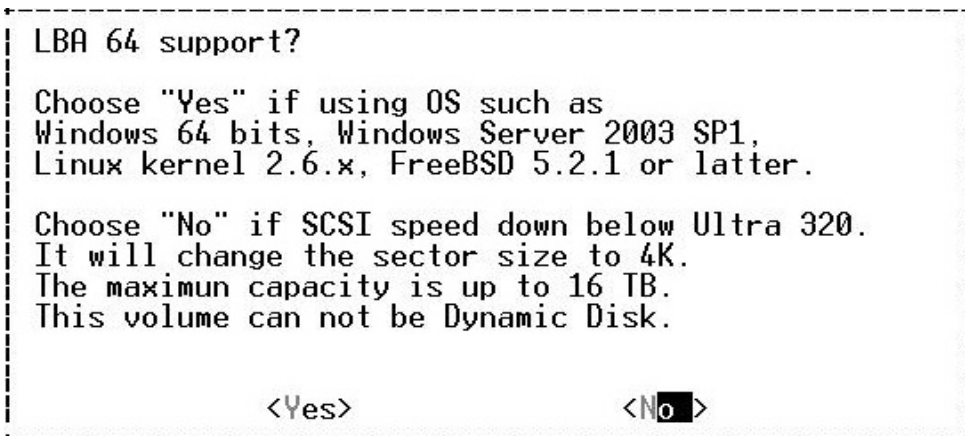




Step 3: Confirm page. Click "OK" if all setups are correct. Then a page with the "User data volume" just been created will be shown as Figure 2.2.1



. **Note:** LAB 64 Support?
→ Please choose ”YES” if using OS such as Windows 64 bits, Windows Server 2003 SP1, Linux kernel 2.6.x, FreeBSD 5.2.1 or latter.
→Please choose “NO” if SCSI speed down below Ultra 320 or OS doesn’t support 64 bits. The block size will automatically be changed to 4KB, therefore the maximum capacity for a single sub-system is up to 16TB. The trade-off is that this volume can not support Dynamic Disk due to limitation in Windows OS.



Done. It can be used as a disk.

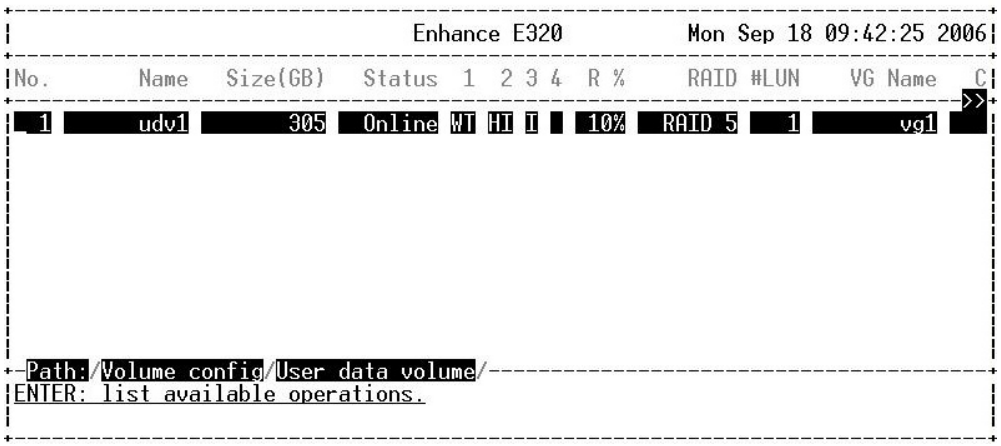
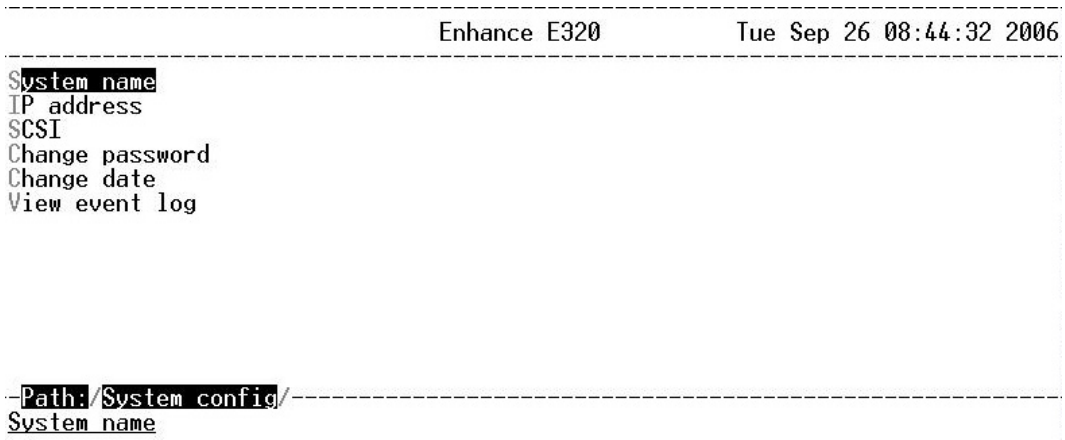


Figure 2.2.1

3.2 System configuration

“System config” selection is for the setup of **“System name”**, **“IP address”**, **“SCSI”**, **“Change Password”**, **“Change Date”** and **“View Event log”.**



3.2.1 System name

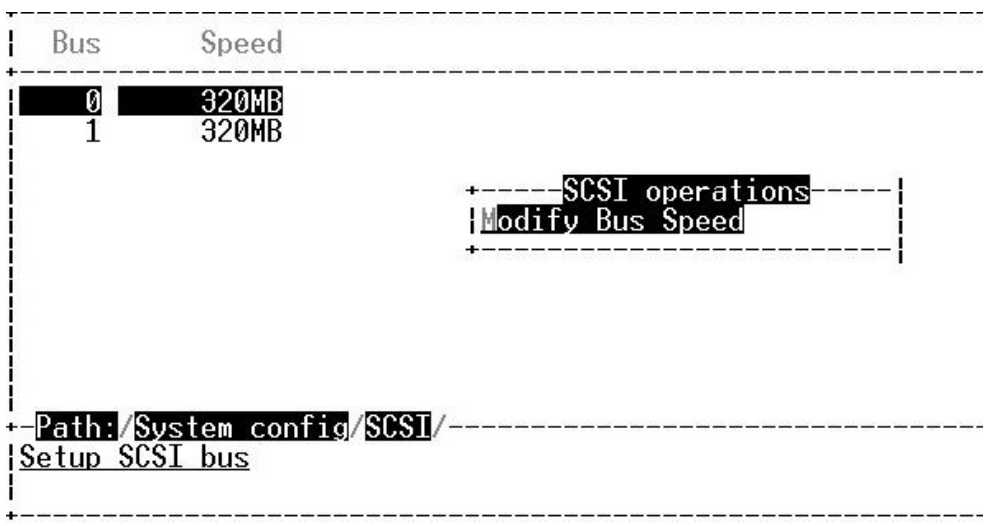
Select **“System name”** to change system name. Default system name composed by model name and serial number of this system, e.g.: E320-a40196.

3.2.2 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 set static IP.

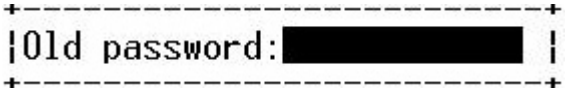
3.2.3 SCSI

Select “**SCSI**” can modify the BUS speed.



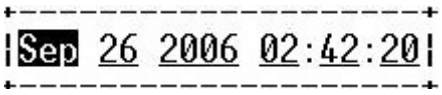
3.2.4 Change Password

Select **“Password”** is for changing administrator password.



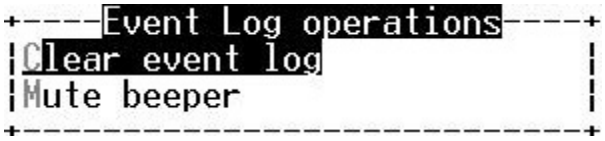
3.2.5 Change Date

Select **“Date”** to set up the current date and time before using.



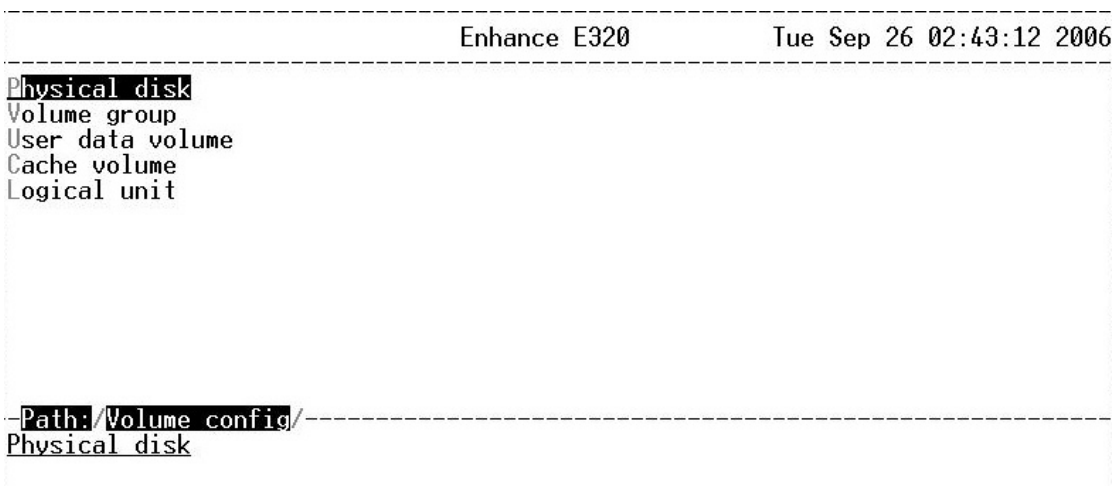
3.2.6 View Event log

Select **“Event log”** to view the event messages. Press **“Clear”** button will clear event log. Press **“Mute”** button will stop alarm if system alerts.



3.3 Volume configuration

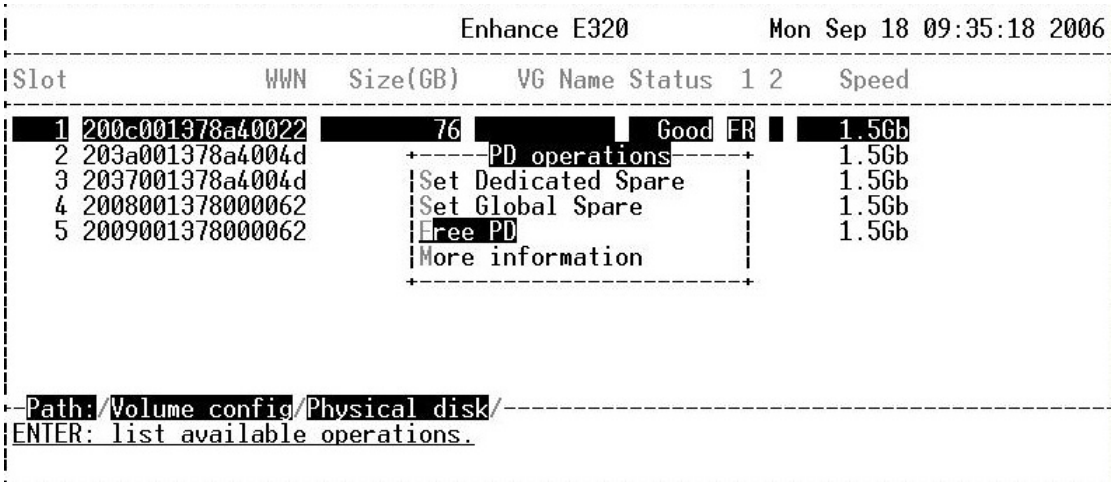
“Volume config” selection is for the setup of volume configurations including **“Physical disk”**, **“Volume group”**, **“User data volume”**, **“Cache volume”,** and **“Logical unit”** functions.



3.3.1 Physical disk

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

1. 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.
2. These three functions **"Set Dedicated Spare"**, **"Set Global Spares**", **"Free PD"** and "**More information**" can execute multiple selects.



- **PD column description:**

Slot	The position of hard drives. The number of slot begins from left to right at the front side. The blue square button next to the number of slot is **"More Information"** indication. It shows the details of the hard drive.
WWN	**W**orld **W**ide **N**ame.
Size (MB)	Capacity of hard drive.
VG Name	Related volume group name.
Status	The status of hard drive. **"GOOD"** → the hard drive is good.

	“DEFECT” → the hard drive has the bad blocks. **“FAIL”** → the hard drive cannot work in the respective volume.
Status 1	**“RD”** → **R**AID **D**isk. This hard drive has been set to RAID. **“FR”** → **FR**ee disk. This hard drive is free for use. **“DS”** → **D**edicated **S**pare. This hard drive has been set to the dedicated spare of the VG. **“GS”** → **G**lobal **S**pare. This hard drive has been set to a global spare of all VGs. **“RS”** → **R**e**S**erve. The hard drive contains the VG information but cannot be used. It may be caused by an uncompleted VG set, or hot-plug 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.
Status 2	**“R”** → **R**ebuild. The hard drive is doing rebuilding. **“M”**→ **M**igration. The hard drive is doing migration.

- **PD operations description:**

FREE DISC	Make this hard drive to be free for use.
GLOBAL SPARES	Set this hard drive(s) to global spare of all VGs.
DEDICATED SPARES	Set hard drive(s) to dedicated spare of selected VGs.

3.3.2 Volume group

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

- **VG column description:**

No.	Name	Total(GB)	Free(GB)	#PD	#UDV	Status	1	2	3	RAID
1	vg1	1163	0	5	1	Online				RAID 0

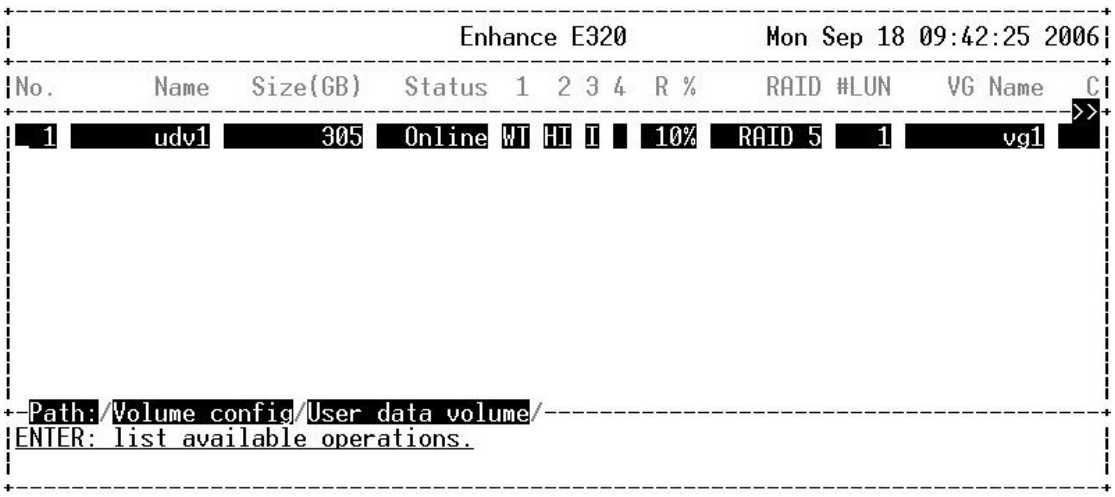
No.	Number of volume group. The blue square button next to the No. is **"More Information"** indication. It shows the details of the volume group.
Name	Volume group name. The blue square button next to the Name is **"Rename"** function.
Total(MB)	Total capacity of this volume group.
Free(MB)	Free capacity of this volume group.
#PD	The number of physical disks, which the volume group is using.
#UDV	The number of user data volumes related to this volume group.
Status	The status of volume group. **"Online"** → volume group is online. **"Fail"** → volume group is fail.
Status 1	**"DG"** → **D**e**G**rade mode. This volume group is not completed. The reason could be lack of one disk or failure of disk.
Status 2	**"R"** → **R**ebuild. This volume group is doing rebuilding.
Status 3	**"M"** → **M**igration. This volume group is doing migration.
RAID	The RAID level, which this volume group is using.

- **VG operations description:**

CREATE	Create a volume group
DELETE	Delete this volume group

3.3.3 User data volume

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



- **UDV column description:**

No.	Number of this user data volume. The blue square button in below to the UDV No. is **"More Information"** indication. It shows the details of the User data volume.
Name	Name of this user data volume. The blue square button in below to the UDV Name is **"Rename"**

	function.
Size(MB)	Total capacity of this user data volume. The blue square button in below to the size is **“Extend”** function.
Status	The status of this user data volume. **“Online”** → user data volume is online. **“Fail”** → user data volume is failed.
Status 1	**“WT”** → **W**rite **T**hrough. **“WB”** → **W**rite **B**ack. The blue square button in below to the status1 is **“Set read/write mode”** function.
Status 2	**“HI”** → **HI**gh priority. **“MD”** → **M**i**D** priority. **“LO”** → **LO**w priority. The blue square button in below to the status2 is **“Set Priority”** function.
Status 3	**“I”** → user data volume is doing initializing. **“R”** → user data volume is doing rebuilding.
Status 4	**“M”** → user data volume is doing migration.
R %	Ratio of initializing or rebuilding.
RAID	The RAID levels that user data volume is using.
#LUN	Number of LUN(s) that data volume is attaching.
Snapshot(MB)	The user data volume size that used for snapshot. The blue square button next to the snapshot is **“Resize”** function to decide the snapshot space. The blue square button next to the resize function is **“Auto snapshot”** function to setup how often snapshots take. The number means **“Free snapshot space” / “Total snapshot space”**. If the snapshot UDV has been created, this column will be

	the creation time.
VG name	The VG name that this user data volume belongs.
CV (MB)	The cache volume that user data volume is using.

- **UDV operations description:**

ATTACH LUN	Attach to a LUN.
SNAPSHOT	Choose a UDV to execute snapshot.
CREATE	Create a user data volume function.
DELETE	Delete this user data volume function.

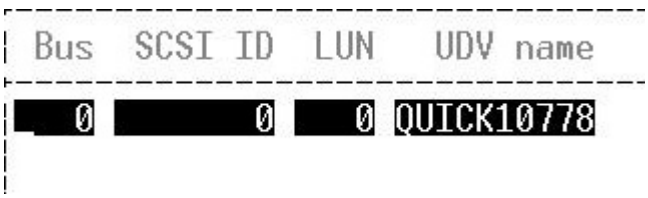
3.3.4 Cache volume

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

The global cache volume is a default cache volume, which has been created after power on automatically, and cannot be deleted. The size of global cache is base on the RAM size. It will be total memory size minus that system uses.

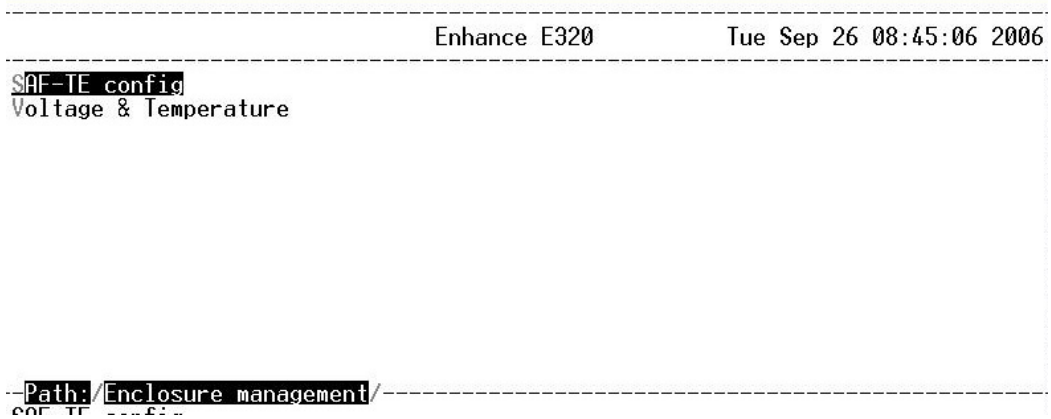
3.3.5 Logical unit number

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



3.4 Enclosure management

“Enclosure management” function allows managing enclosure information including **“SAF-TE config”** and **“Voltage & Temperature”** functions.

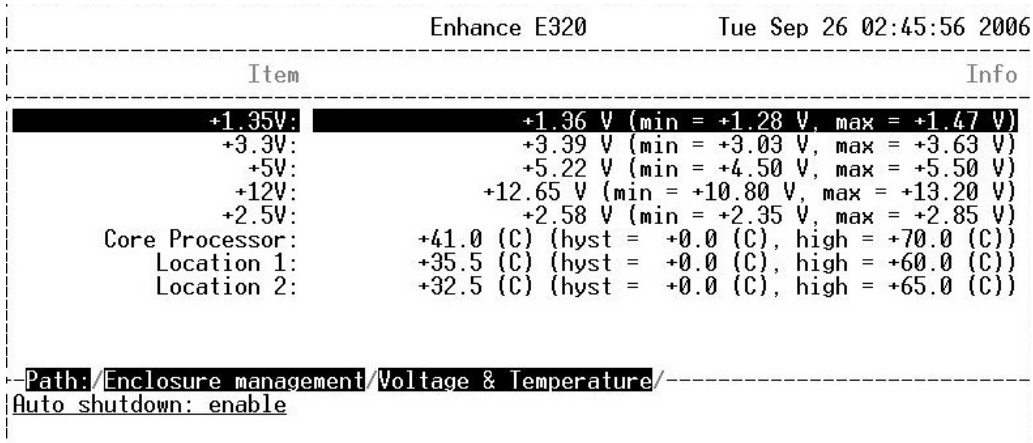


3.4.1 SAF-TE configuration

SAF-TE represents **S**CSI **A**ccessed **F**ault-**T**olerant **E**nclosures, one of the enclosure management standards. Enter **“SAF-TE config”** function can enable or disable the management of SAF-TE from buses.

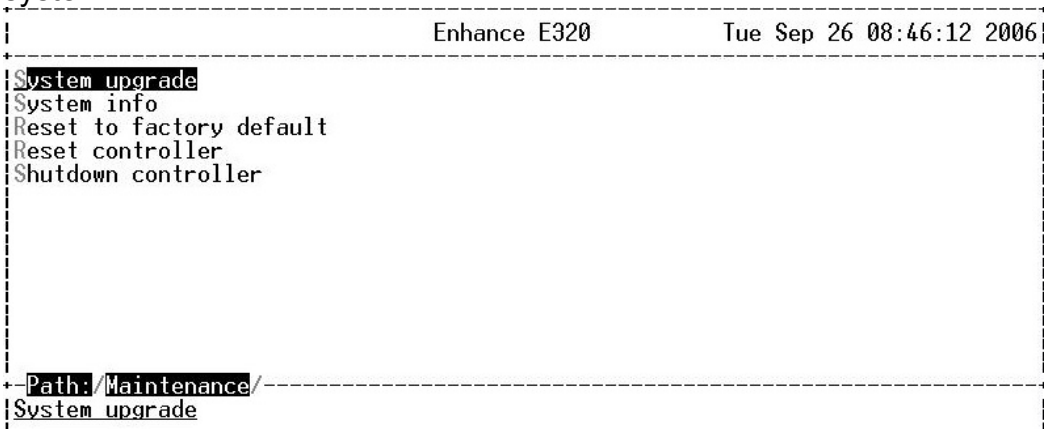
3.4.2 Voltage and Temperature

Enter **“Voltage & Temperature”** function to view the information of current voltage and temperature.



3.5 Maintenance

"Maintenance" function allows operation of the system functions including "**System Upgrade"** to the latest firmware, **"System Info"** to show the system version and **"Reset, Shutdown Controller"** to either reboot or shutdown the system.



3.5.1 System Upgrade

Enter **"System Upgrade"** function to upgrade firmware. Please prepare new firmware file named **"xxxx.bin"** in local hard drive, then press "Transfer -> Send File" to select the file. It will start to upgrade firmware.

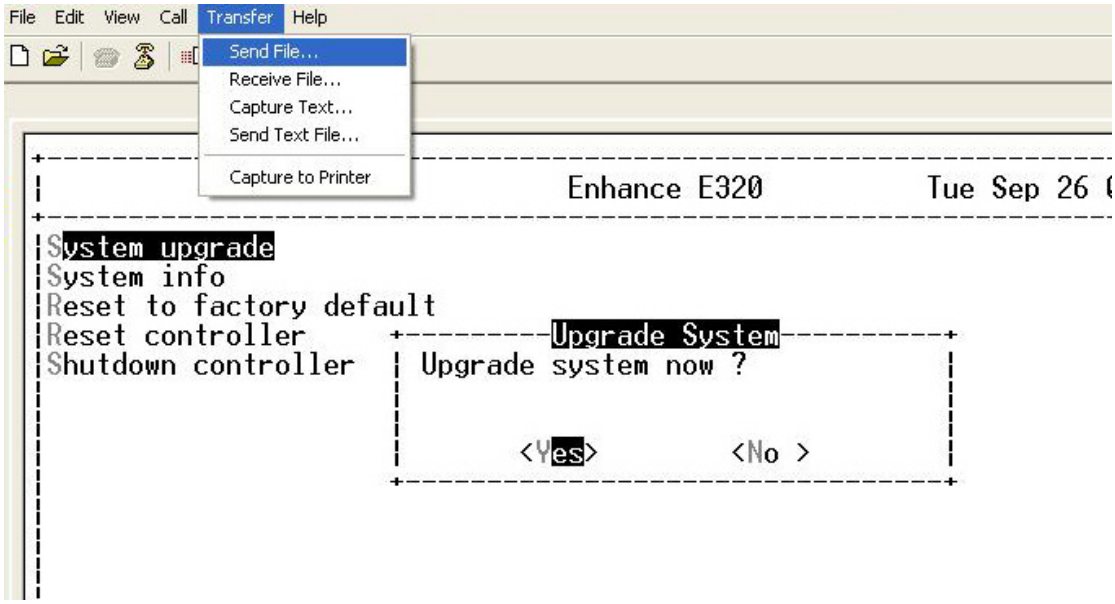


Figure 3.7.1.1

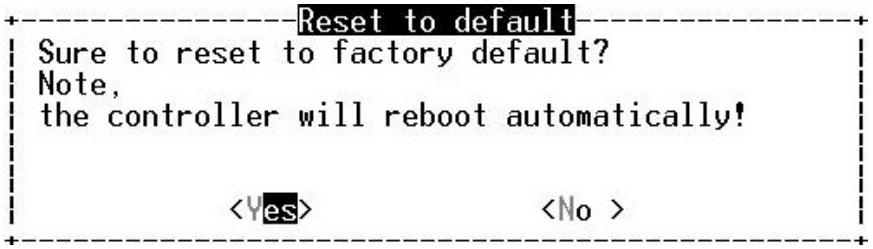
When upgrading, there is a progress bar running. After finished upgrading, the system must reboot manually.

3.5.2 System Info

Enter **"System Info"** function will display firmware version.

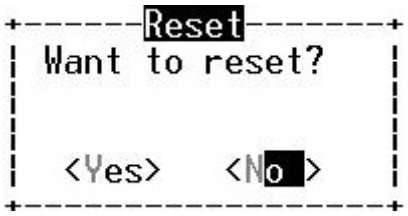
3.5.3 Reset to factory default

Enter this function; it will reset to factory default.



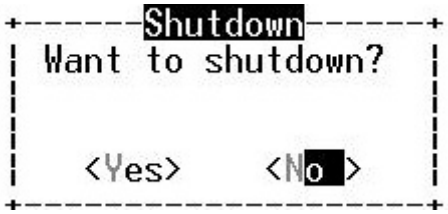
3.5.4 Reset Controller

This function can reset the controller.



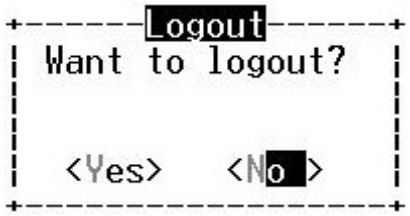
3.5.5 Shutdown Controller

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.



3.6 Logout

For security reason, **"Logout"** function will allow logout while none is operating the system. Re-login the system by entering username and password.



4.0 Re- Configure the RAID Controller – Web GUI

Each RS8 HDS storage system has been optimized & pre-configured at the factory for RAID level-5 protection. This configuration offers fail-safe data

protection & speed needed for real-time HD video production. If necessary, your HDS solution can be re-initialized to support a wide variety of RAID configurations.

EnhanceRAID S-series Menu

Quick install	
Quick install	Step 1 / Step 2 / Step 3 / Confirm
System config	
IP address	DHCP / Static
Password	Administrative password change
Date	Date and time setting
Mail	Email alert setting
SNMP	SNMP alert setting
Event log	View event log
Volume config	
Physical disk	Free disc / Global spares / Dedicated spares / Details
Volume group	Create / Delete / Details / Rename / Migrate
User data volume	Create / Delete / Attach LUN / Snapshot / Details / rename / On/Off Line / Set read/write mode / Set priority / Resize Snapshot space / Auto Snapshot
Cache Volume	Create / Delete / Details / Resize
Logical unit	Attach / Detach
Enclosure management	
SAF-TE config	SAF-TE enable/disable
Voltage & Temperature	View current voltage and temperature of system
SMART	View SMART disk monitor
Maintenance	
Upgrade	Remote upgrade firmware
Info	Current system firmware version
Shutdown	Reboot / Shutdown
Logout	
Logout	Logout of system menu

3.7 Login

UltraStor series controller supports graphic user interface to manage the system. Be sure to connect LAN cable. The default IP is **192.168.0.200**; so open the browser and type:

http://192.168.0.200

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

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

After login, the selections listed on the left can be operated.

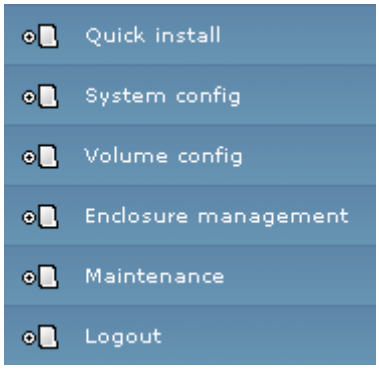


Figure 3.2.1

There are three indicators at the top-right corner.

1. **Voltage light:** Green is normal. Red represents abnormal voltage status. Please refer to section 3.6.2 for more detail.

2. **Temperature light:** Green is normal. Red represents abnormal temperature.

3. **RAID light:** Green means RAID works fine. Red represents RAID failed happens.

4.2 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. If snapshot function is needed, please create volumes by manual, and refer to section 4.4 for more detail.

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 " NEXT ", it will be linked to another page required to set up the "Bus ID" / "SCSI ID" / "LUN".

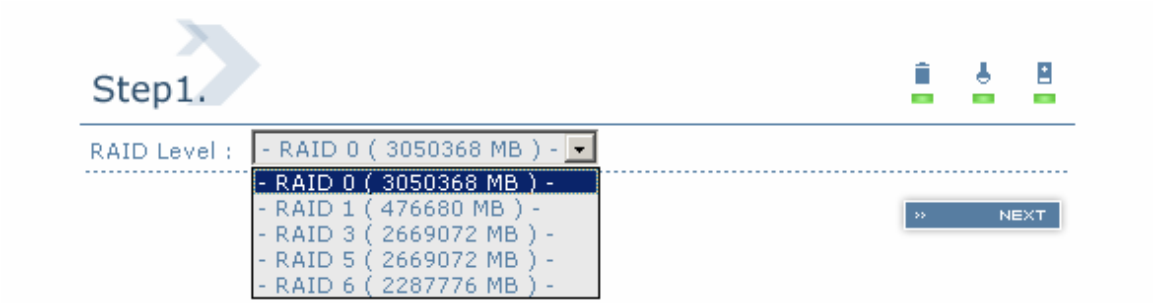


Figure 3.3.1

Step 2: Please select a number for each of them. Be careful to avoid the conflict of SCSI ID at the same SCSI bus. 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 " NEXT ".

Step 3: Confirm page. Click “ » CONFIRM ” 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. It can be used as a disk.

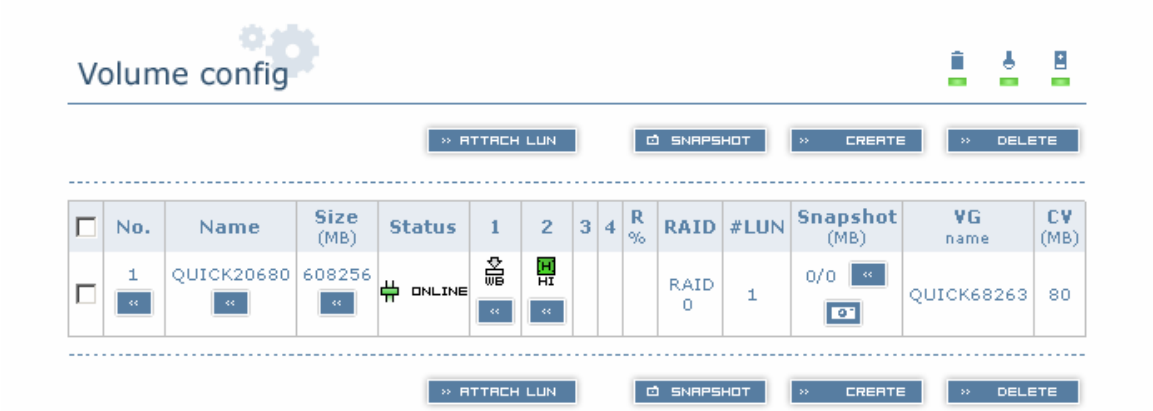


Figure 3.3.2

(Figure 3.3.2: A RAID 0 user data volume with the UDV name “QUICK20680”, named by the system itself, with the total available volume size 608256MB.)

3.8 System configuration

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

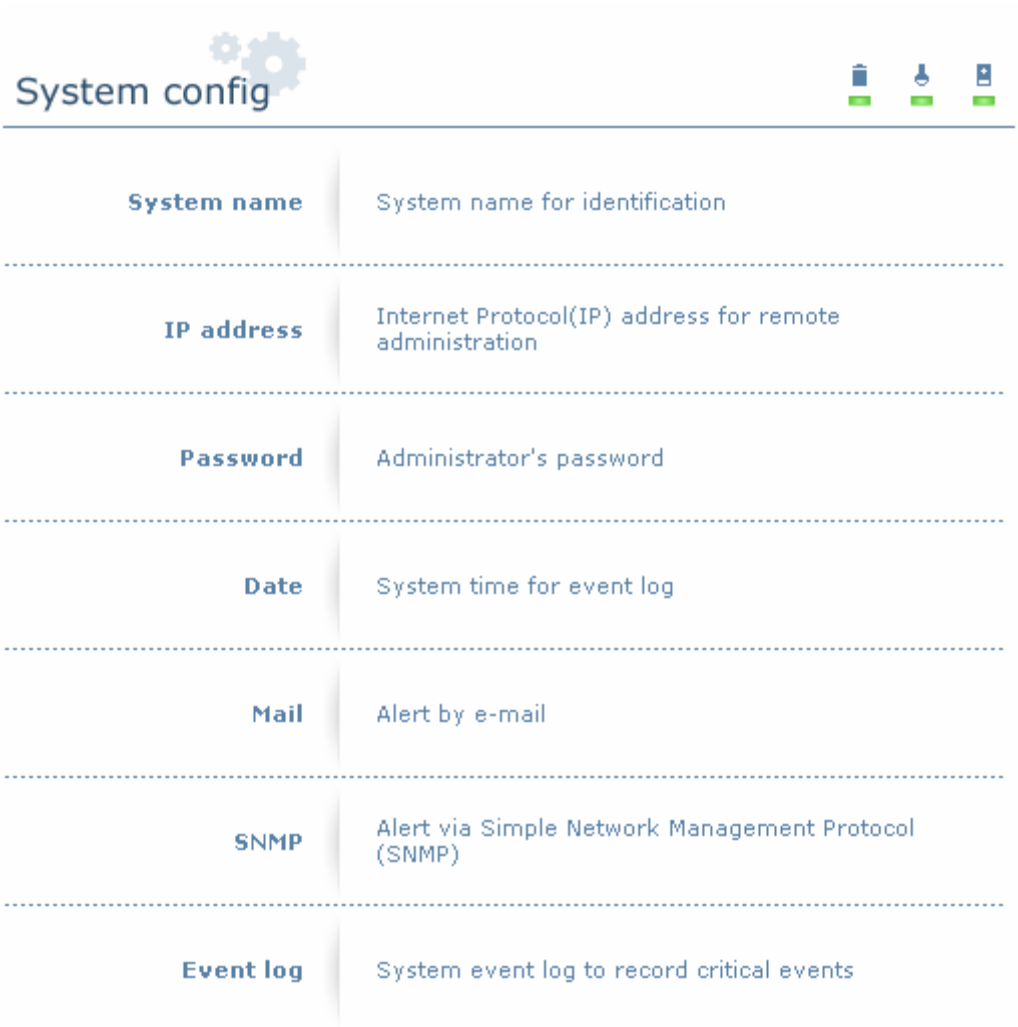


Figure 3.4.1

4.3 System name

Select **“System name”** to change system name. Default system name composed by model name and serial number of this system, e.g.: S120-000001.

Figure 3.4.1.1

4.4 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 set static IP.

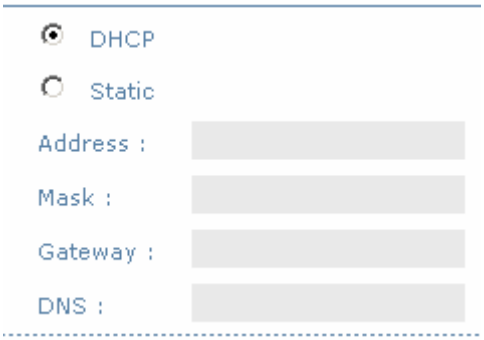


Figure 3.4.2.1

4.5 Password

Select **“Password”** is for changing administrator password.

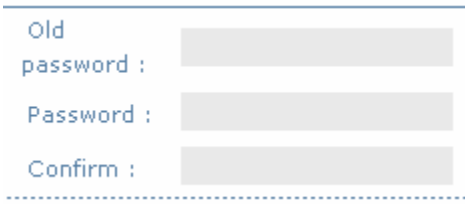


Figure 3.4.3.1

4.6 Date

Select **“Date”** to set up the current date and time before using.

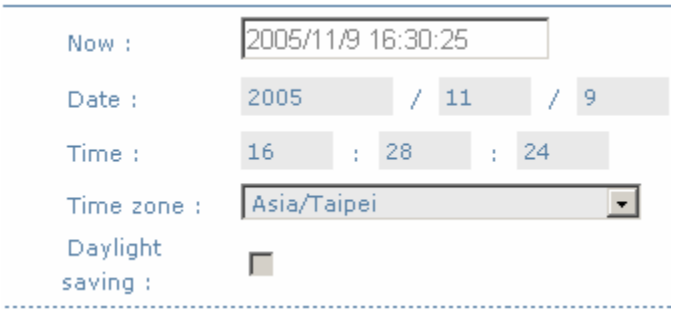


Figure 3.4.4.1

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.

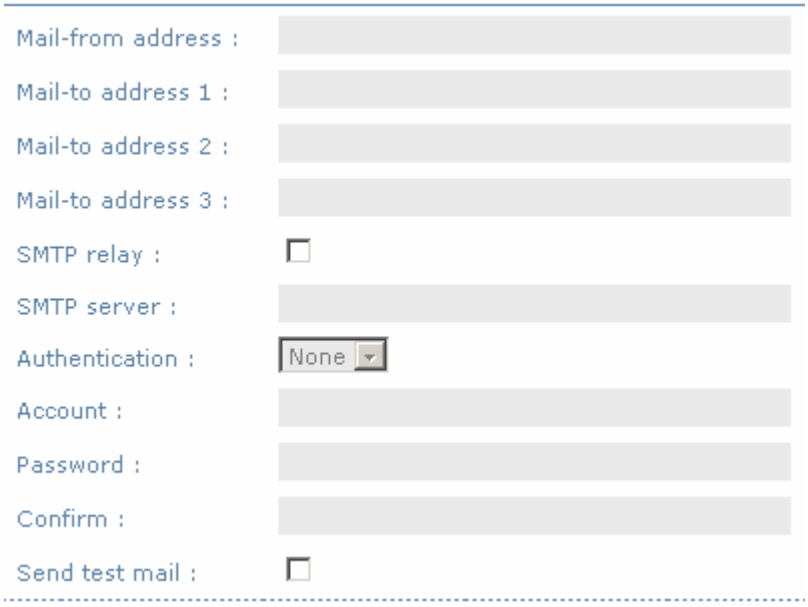


Figure 3.4.5.1

4.8 SNMP

Select **“SNMP”** to set up SNMP trap for alert via SNMP. It allows up to 3 SNMP trap addresses can be set for receiving SNMP trap. Default community setting is “public”.

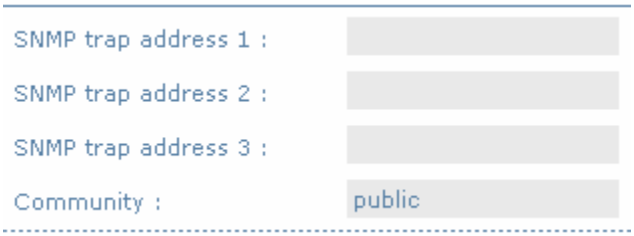


Figure 3.4.6.1

4.9 Event log

Select **“Event log”** to view the event messages. Press **“Clear”** button will clear event log. Press **“Mute”** button will stop alarm if system alerts.

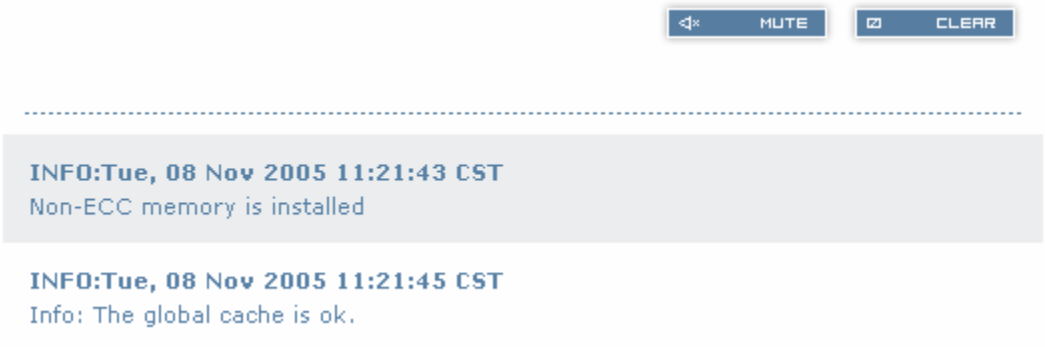


Figure 3.4.7.1

5.0 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.

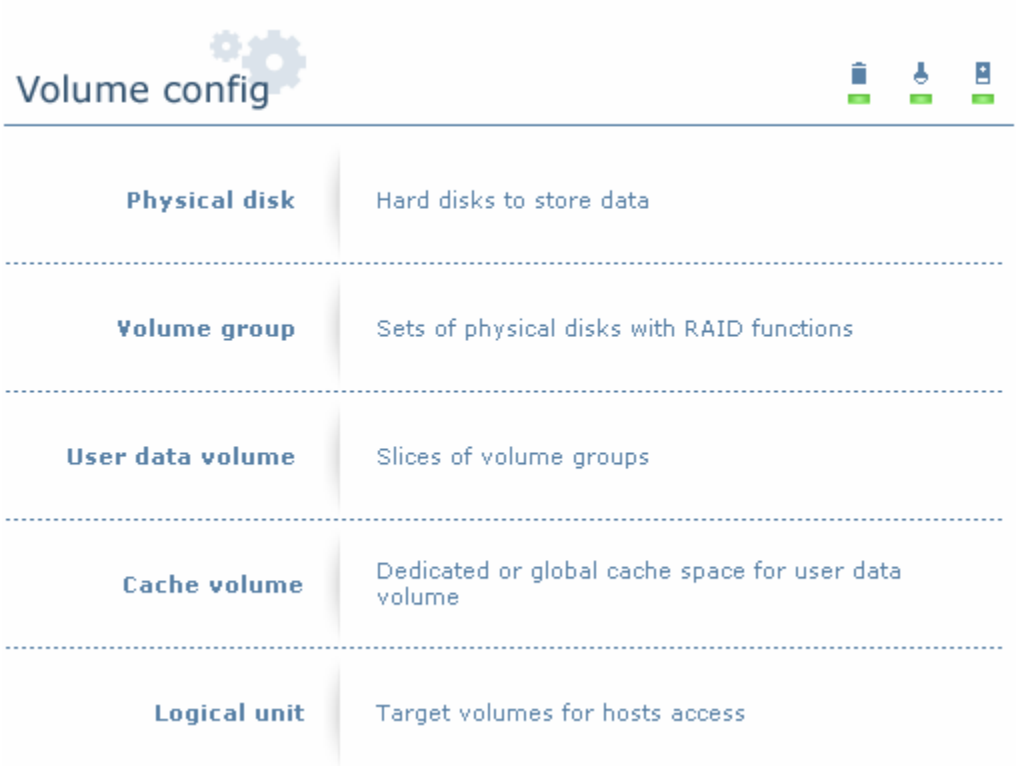
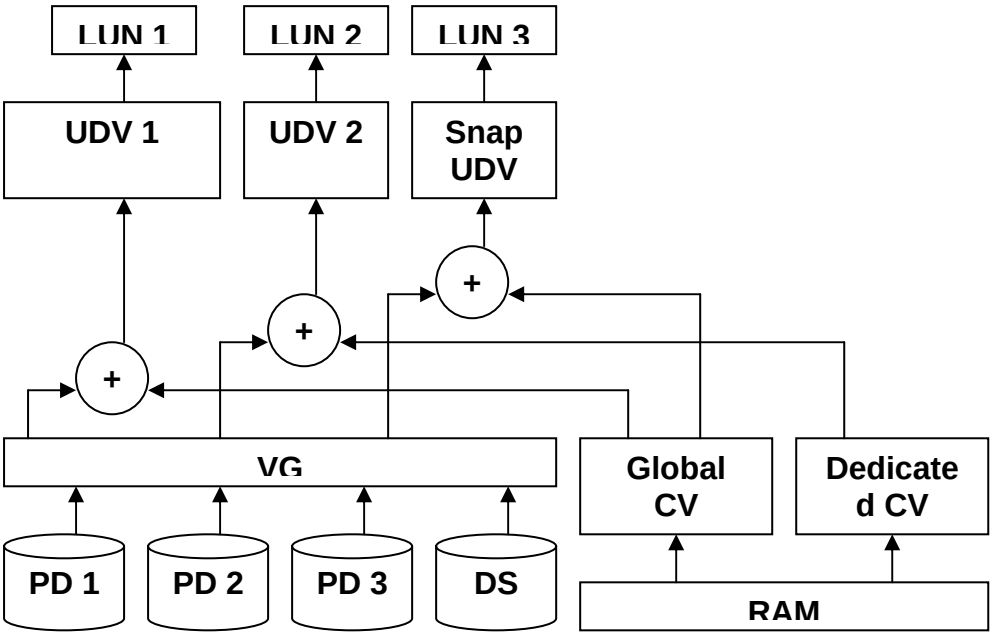


Figure 3.5.1

5.1 Volume relationship diagram



The above diagram describes the relationship of RAID components. One VG (Volume Group) consists of a set of UDVs (User Data Volume) and owns one RAID level attribute. Each VG could be divided into different UDVs. The UDVs from one VG share the same RAID level, but may own the different volume capacity. Each UDV will be associated with one specific CV (Cache Volume) to execute the data transaction. Each CV could own the different cache memory size. LUN is the logical volume, which the users could access by using the SCSI commands.

5.2 Physical disk

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

3. Multiple select can be done. Select one or many checkboxes in front of the slot number. Or select the checkbox at the top left corner will select all. Check again will select none.
4. 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.
5. These three functions **“Free disc”**, **“Global spares**”, **“Dedicated spares”** can execute multiple selects.
6. The operations of the other web pages (e.g.: volume config of VG, UDV, CV, LUN pages) are similar.

Figure 3.5.2.1

(Figure 3.5.2.1: Physical disks of slot 1, 2 have been created for a VG named “VG-R0”. Physical disks of slot 3, 4, 5 have been created for a VG named “VG-R5”. Slot 6 has been set as global spare disk. Slot 7 has been set as dedicated spare disk of VG named “VG-R5”. Slot 8 is a free disk.)

- **PD column description:**

Slot	The position of hard drives. The number of slot begins from left to right at the front side. The blue square button next to the number of slot is **"More Information"** indication. It shows the details of the hard drive.
WWN	**W**orld **W**ide **N**ame.
Size (MB)	Capacity of hard drive.
VG Name	Related volume group name.
Status	The status of hard drive. **"GOOD"** → the hard drive is good. **"DEFECT"** → the hard drive has the bad blocks. **"FAIL"** → the hard drive cannot work in the respective volume.
Status 1	**"RD"** → **R**AID **D**isk. This hard drive has been set to RAID. **"FR"** → **FR**ee disk. This hard drive is free for use. **"DS"** → **D**edicated **S**pare. This hard drive has been set to the dedicated spare of the VG. **"GS"** → **G**lobal **S**pare. This hard drive has been set to a global spare of all VGs. **"RS"** → **R**e**S**erve. The hard drive contains the VG information but cannot be used. It may be caused by an uncompleted VG set, or hot-plug 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.
Status 2	**"R"** → **R**ebuild. The hard drive is doing rebuilding. **"M"**→ **M**igration. The hard drive is doing migration.

- **PD operations description:**

FREE DISC	Make this hard drive to be free for use.
GLOBAL SPARES	Set this hard drive(s) to global spare of all VGs.
DEDICATED SPARES	Set hard drive(s) to dedicated spare of selected VGs.

5.3 Volume group

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

- **VG column description:**

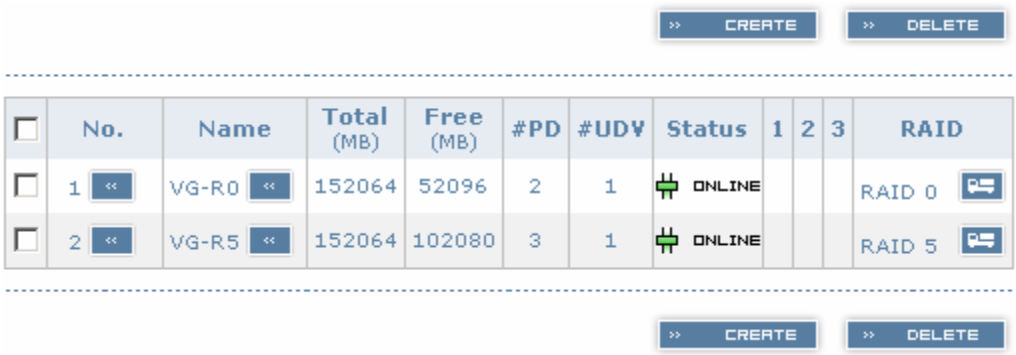


Figure 3.5.3.1

(Figure 3.5.3.1: There is a RAID 0 with 2 physical disks, named "VG-R0", total size is 152064MB, free size is 52096MB, related to 1 UDV. Another is a RAID 5 with 3 physical disks, named "VG-R5".)

No.	Number of volume group. The blue square button next to the No. is **"More Information"** indication. It shows the details of the

	volume group.
Name	Volume group name. The blue square button next to the Name is **"Rename"** function.
Total(MB)	Total capacity of this volume group.
Free(MB)	Free capacity of this volume group.
#PD	The number of physical disks, which the volume group is using.
#UDV	The number of user data volumes related to this volume group.
Status	The status of volume group. **"Online"** → volume group is online. **"Fail"** → volume group is fail.
Status 1	**"DG"** → **D**e**G**rade mode. This volume group is not completed. The reason could be lack of one disk or failure of disk.
Status 2	**"R"** → **R**ebuild. This volume group is doing rebuilding.
Status 3	**"M"** → **M**igration. This volume group is doing migration.
RAID	The RAID level, which this volume group is using. The blue square button next to the RAID level is **"Migrate"** function. Click **"Migrate"** can add disk(s) to do expansion or change the RAID level of the Volume group.

- **VG operations description:**

CREATE	Create a volume group
DELETE	Delete this volume group

5.4 User data volume

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

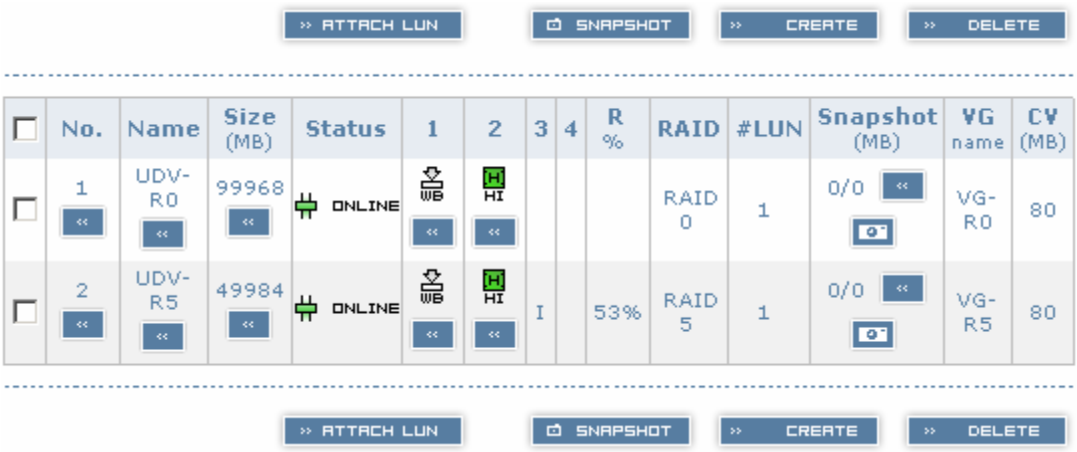


Figure 3.5.4.1

(Figure 3.5.4.1: Create a UDV named “UDV-R0”, related to “VG-R0”, size is 99968MB, status is online, write back, high priority, related to 1 LUN, with cache volume 80MB, no snapshot space. The other UDV is named “UDV-R5”, initializing to 53%)

- **UDV column description:**

No.	Number of this user data volume. The blue square button in below to the UDV No. is **“More Information”** indication. It shows the details of the User data volume.
Name	Name of this user data volume. The blue square button in below to the UDV Name is **“Rename”** function.
Size(MB)	Total capacity of this user data volume. The blue square button in below to the size is **“Extend”** function.
Status	The status of this user data volume. **“Online”** → user data volume is online. **“Fail”** → user data volume is failed.
Status 1	**“WT”** → **W**rite **T**hrough.

	“WB” → **W**rite **B**ack. The blue square button in below to the status1 is **“Set read/write mode”** function.
Status 2	**“HI”** → **HI**gh priority. **“MD”** → **MiD** priority. **“LO”** → **LO**w priority. The blue square button in below to the status2 is **“Set Priority”** function.
Status 3	**“I”** → user data volume is doing initializing. **“R”** → user data volume is doing rebuilding.
Status 4	**“M”** → user data volume is doing migration.
R %	Ratio of initializing or rebuilding.
RAID	The RAID levels that user data volume is using.
#LUN	Number of LUN(s) that data volume is attaching.
Snapshot(MB)	The user data volume size that used for snapshot. The blue square button next to the snapshot is **“Resize”** function to decide the snapshot space. The blue square button next to the resize function is **“Auto snapshot”** function to setup how often snapshots take. The number means **“Free snapshot space” / “Total snapshot space”**. If the snapshot UDV has been created, this column will be the creation time.
VG name	The VG name that this user data volume belongs.
CV (MB)	The cache volume that user data volume is using.

- **UDV operations description:**

ATTACH LUN	Attach to a LUN.
SNAPSHOT	Choose a UDV to execute snapshot.
CREATE	Create a user data volume function.
DELETE	Delete this user data volume function.

5.6 Cache volume

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

The global cache volume is a default cache volume, which has been created after power on automatically, and cannot be deleted. The size of global cache is base on the RAM size. It will be total memory size minus that system uses.

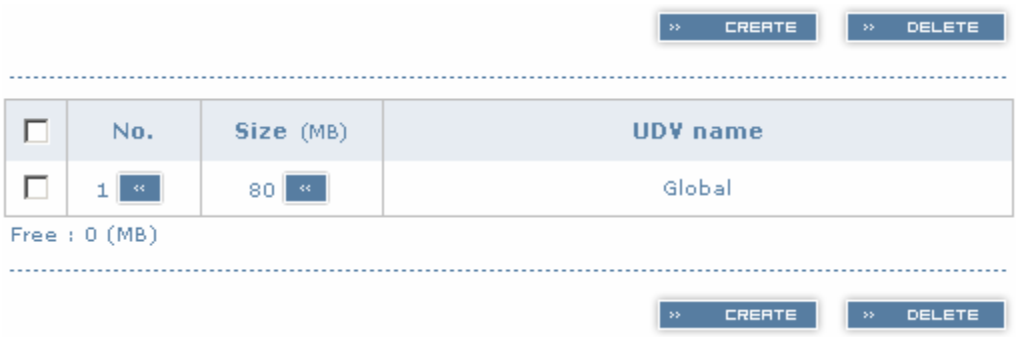


Figure 3.5.5.1

- **CV column description:**

No.	Number of this Cache volume. The blue square button next to the CV No. is **"More Information"** indication**.** It shows the details of the cache volume.
Size(MB)	Total capacity of this cache volume The blue square button next to the CV size is **"Resize"** function. The CV size can be adjusted.
UDV Name	Name of the UDV.

- **CV operations description:**

CREATE	Create a cache volume function.
DELETE	Delete this cache volume function.

5.7 Logical unit number

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

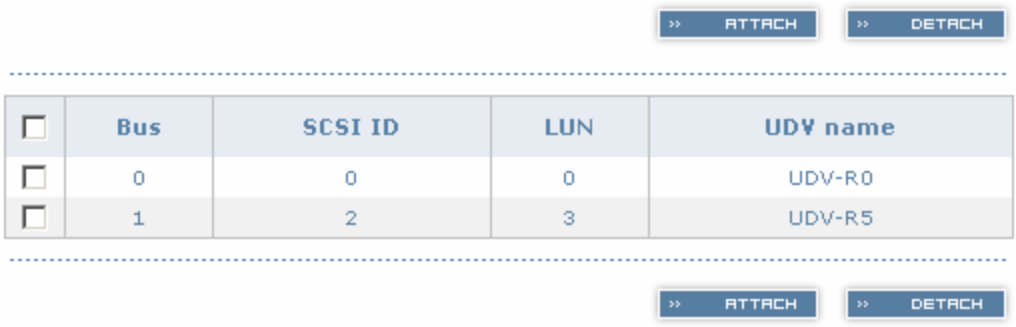


Figure 3.5.6.1

- **LUN operations description:**

ATTACH	Attach a logical unit number to a user data volume.
DETACH	Detach a logical unit number from a user data volume.

Caution
Notify that which bus the SCSI cable is connected; it must match the bus ID which is attached.

5.8 Examples

Take 2 examples to create volumes. Example 1 is to create two UDVs shared the same CV (global cache volume) and set a global spare disk. Example 2 is to create two UDVs. One shares global cache volume, the other uses dedicated cache volume. Set a dedicated spare disk.

- **Example 1**

Example 1 is to create two UDVs in one VG, each UDV uses global cache volume. Global cache volume has been created after system boots up. So it doesn't do anything about 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:

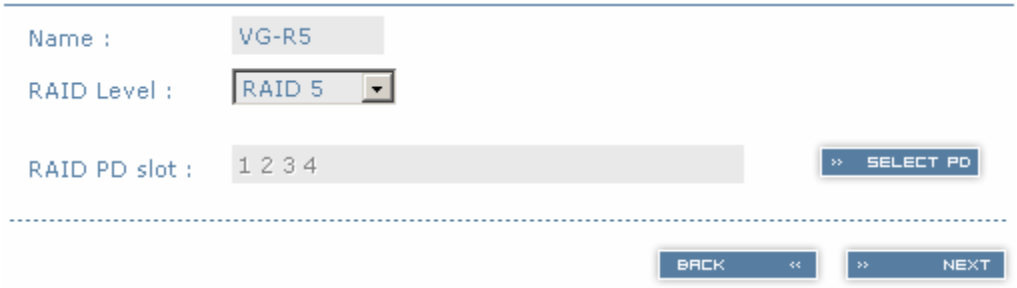


Figure 3.5.7.1

1. Select **"/ Volume config / Volume group"**.
2. Click " CREATE ".
3. Input a VG Name, choose a RAID level from the draw, press " SELECT PD " to choose the RAID PD slot, then press " NEXT ".
4. Check the outcome. Press " CONFIRM " if all setups are correct.
5. Done. A VG has been created.

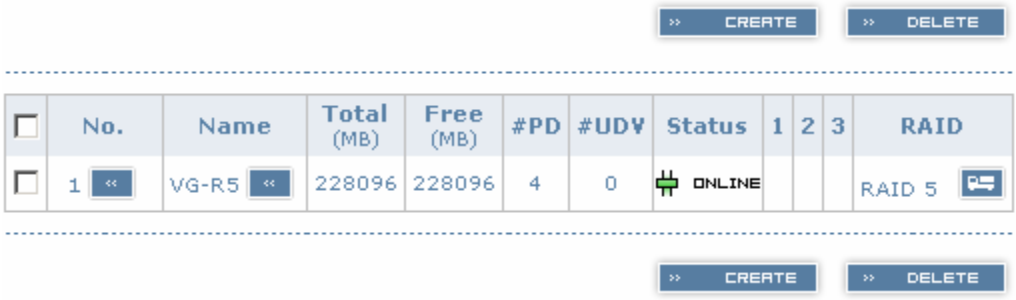


Figure 3.5.7.2

(Figure 3.5.7.2: Creating a RAID 5 with 4 physical disks, named "VG-R5". The total size is 228096MB. Because of no related UDV there, free size still remains 228096MB.)

Step 2: Create UDV (User Data Volume).

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

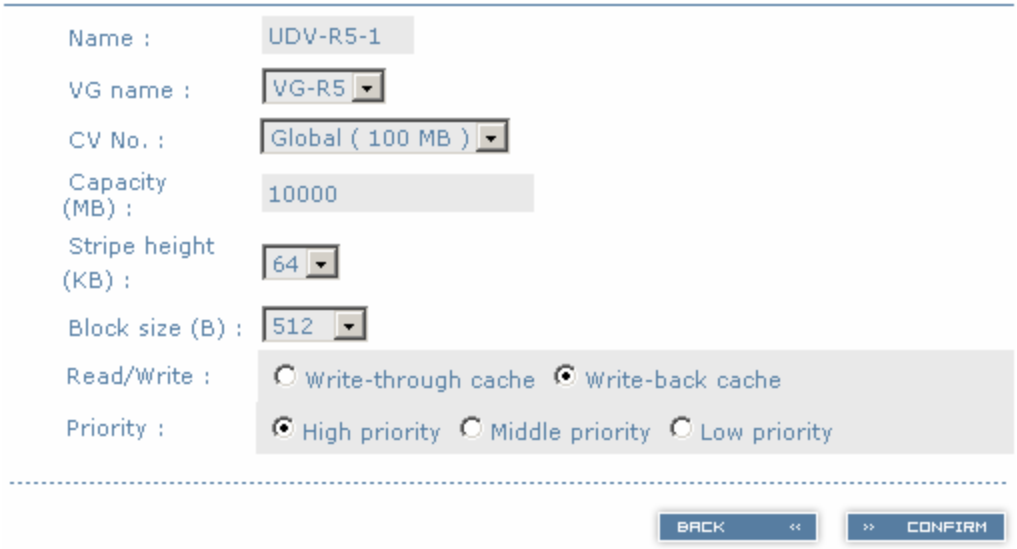


Figure 3.5.7.3

1. Select **"/ Volume config / User data volume"**.
2. Click " CREATE ".
3. Input a UDV name, choose a VG Name and input a size to be used; 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 to create another UDV.

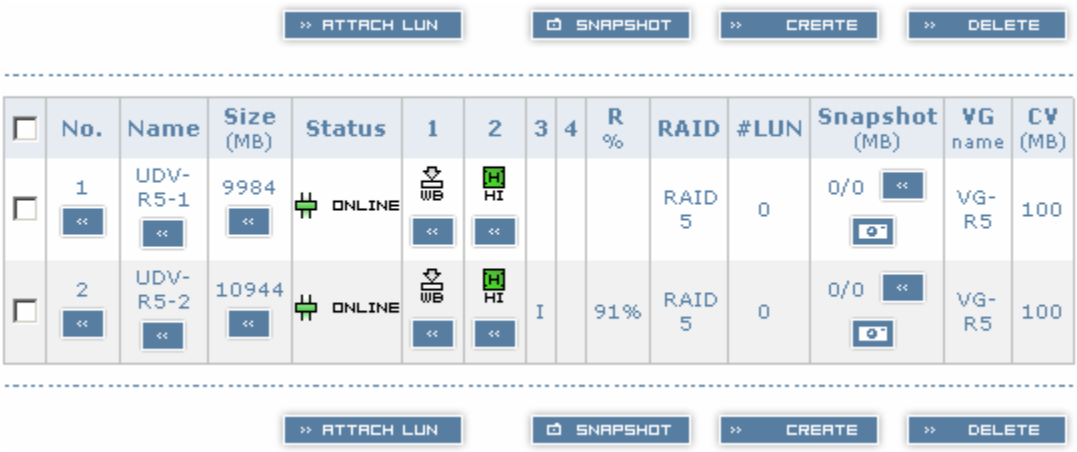


Figure 3.5.7.4

(Figure 3.5.7.4: Create UDVs named "UDV-R5-1" and "UDV-R5-2", related to "VG-R5", the size of "UDV-R5-1" is 9984MB (it's multiple of base stripe height, so the number may not be the same as the setting size.), the size of "UDV-R5-2" is 10944MB. The status of these UDVs are online, write back, high priority with cache volume 100MB. "UDV-R5-2" is initialing about 91%. 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 LUN ".
2. In **"/ Volume config / Logical unit"**, press " » ATTACH ".

The following screen will be shown, please follow the procedures:

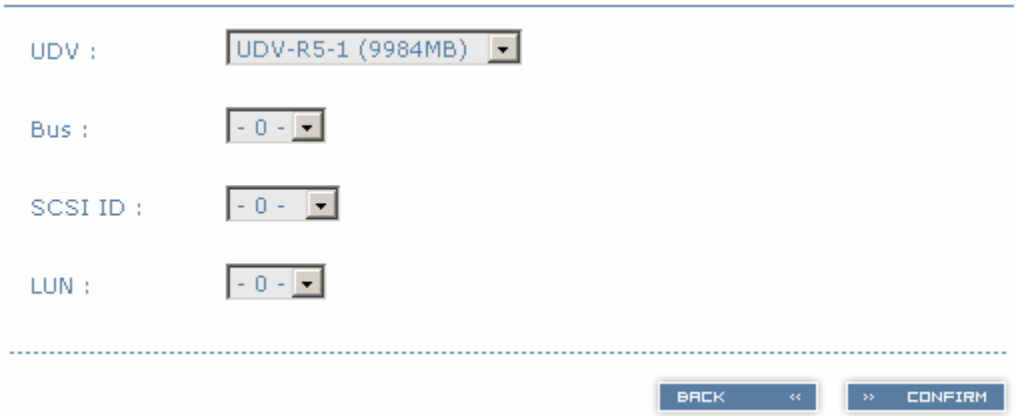


Figure 3.5.7.5

1. Select a UDV.
2. Choose Bus ID, SCSI ID and LUN to attach, then click “ CONFIRM ”.
3. Done.
4. Do one more to attach another UDV.

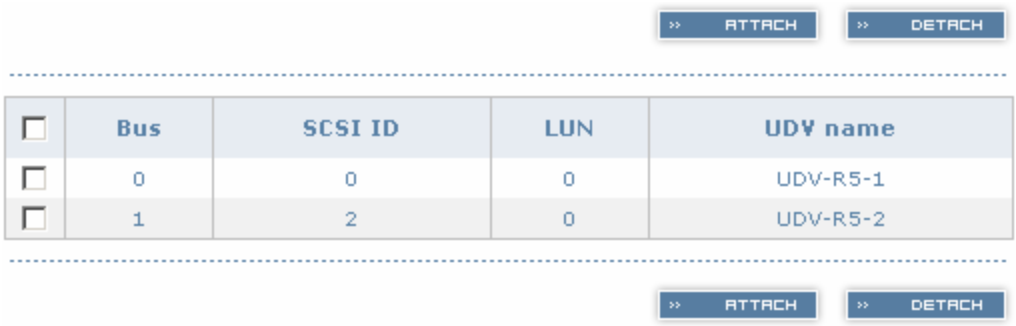


Figure 3.5.7.6(Figure 3.5.7.6: UDV-R5-1 is attached to Bus 0, SCSI ID 0, and LUN 0.UDV-R5-2 is attached to Bus 1, SCSI ID 2, and LUN 0.)

Caution
Be careful to avoid conflicts between SCSI ID at the same **SCSI bus**.

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.

Figure 3.5.7.7

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

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

Delete UDVs, VG, please follow the steps.

Step 6: Detach LUN from UDV.

In **"/ Volume config / Logical unit"**,

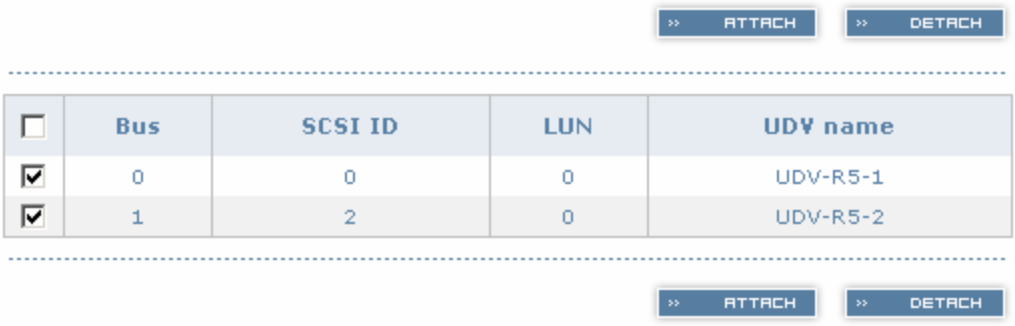


Figure 3.5.7.8

1. Select UDVs 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 UDVs by clicking the checkbox of the row.
3. Click "  ". There will pop up a confirm page.
4. Choose "OK".
5. Done. The UDVs have been deleted.

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

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 confirm page.
4. Choose "OK"
5. Done. The VG has been deleted.

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

Step 9: Free global spare disk.

To set 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 UDVs 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 will be associated with one specific CV (cache volume) to execute the data transaction. Each CV could own the different cache memory size. If there is no special request in UDVs, it will use global cache volume. Or it can be created a dedicated cache for indivifual UDV manually. Using dedicated cache volume, the performance would not be affected when the other UDV is excuting data access.

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

Step 1: Create dedicated cache volume.

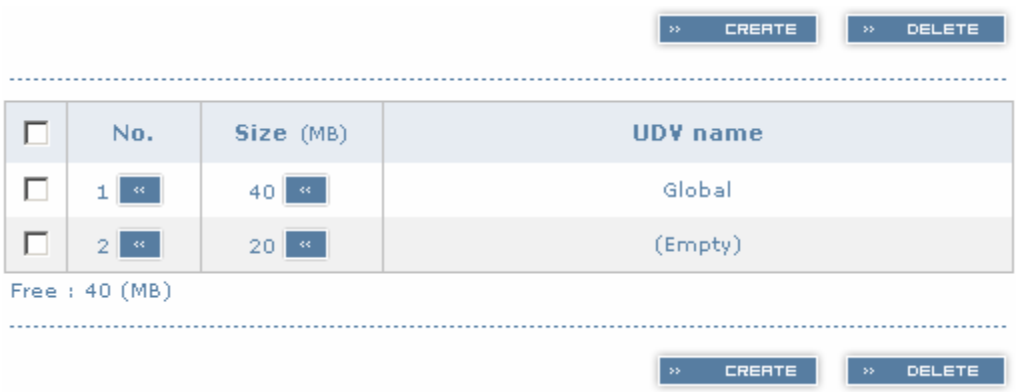


Figure 3.5.7.9

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 blue square 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 procedures.

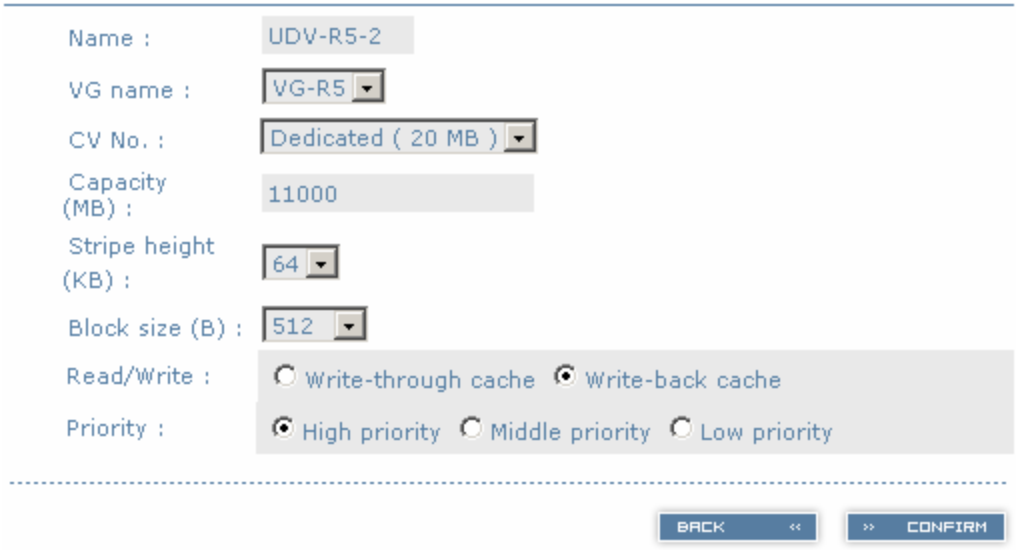


Figure 3.5.7.10

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 a size to be used; 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.

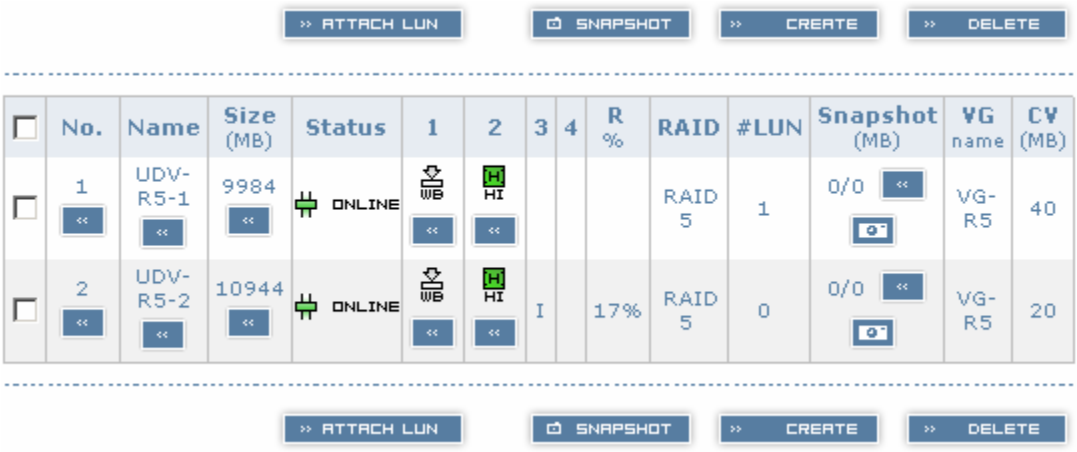


Figure 3.5.7.11

(Figure 3.5.6.11: 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 17%.)

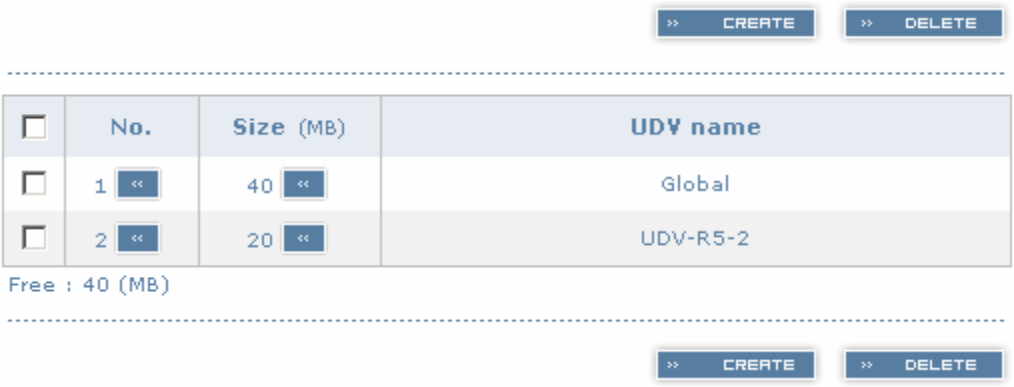


Figure 3.5.7.12

(Figure 3.5.6.12: 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 " » DEDICATED SPARES " to set as dedicated spare for the selected VG.
3. There is a "DS" icon shown up at status 1 column.

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. They can be used as SCSI disks.

Delete UDVs, 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 set 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 confirm 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.

5.9 Enclosure management

"Enclosure management" function allows managing enclosure information including **"SAF-TE config"**, **"Voltage & Temperature"**, **"S.M.A.R.T."** and **"UPS"** functions.

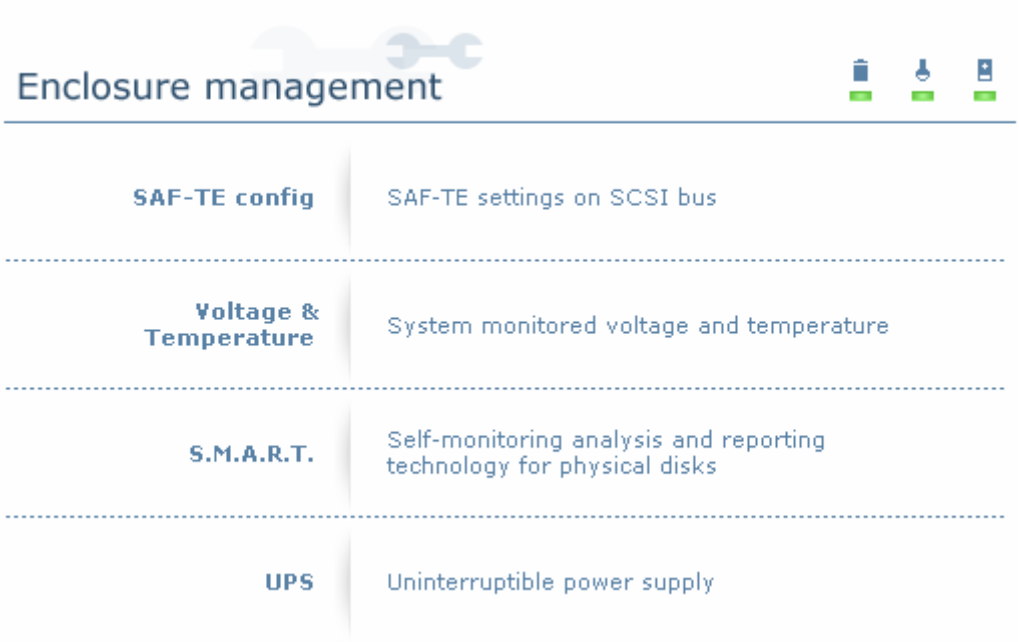


Figure 3.6.1

6.0 SAF-TE configuration

SAF-TE represents **S**CSI **A**ccessed **F**ault-**T**olerant **E**nclosures, one of the enclosure management standards. Enter **"SAF-TE config"** function can enable or disable the management of SAF-TE from buses.

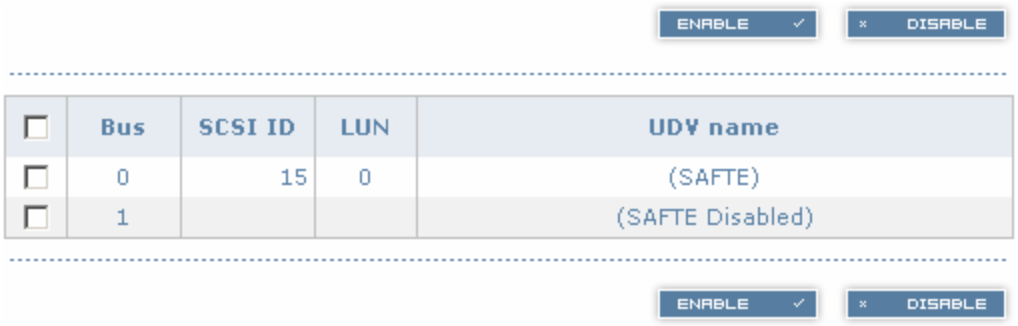


Figure 3.6.1.1

(Figure 3.6.1.1: Enable SAF-TE in Bus 0, SCSI ID 15, and LUN 0.)

The SAF-TE client software is available at the following web site:

safte-monitor: http://oss.metaparadigm.com/safte-monitor/
SANtools: http://www.santools.com/

6.1 Voltage and Temperature

Enter **"Voltage & Temperature"** function to view the information of current voltage and temperature.

Item	Information
+1.35V:	+1.38 V (min = +1.31 V, max = +1.43 V)
+3.3V:	+3.44 V (min = +3.10 V, max = +3.55 V)
+5V:	+4.95 V (min = +4.80 V, max = +5.25 V)
+12V:	+12.38 V (min = +11.40 V, max = +12.80 V)
+2.5V:	+2.61 V (min = +2.45 V, max = +2.70 V)
Core Processor:	+40.0 (C) (hyst = +0.0 (C), high = +70.0 (C))
Location 1:	+38.5 (C) (hyst = +0.0 (C), high = +60.0 (C))
Location 2:	+33.0 (C) (hyst = +0.0 (C), high = +65.0 (C))

Auto shutdown : ☑

Figure 3.6.2.1 (for S50C/S100C)

Item	Information
+1.5V:	+1.54 V (min = +1.44 V, max = +1.63 V)
+3.3V:	+3.31 V (min = +3.10 V, max = +3.55 V)
+5V:	+5.14 V (min = +4.70 V, max = +5.35 V)
+12V:	+12.27 V (min = +11.40 V, max = +12.80 V)
+2.5V:	+2.59 V (min = +2.45 V, max = +2.75 V)
PSU +5V(Backplane):	+5.14 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):	+3.34 V (min = +3.10 V, max = +3.55 V)
Daughter Board:	+54.0 (C) (hyst = +0.0 (C), high = +70.0 (C))
PCI-X BRG:	+37.0 (C) (hyst = +0.0 (C), high = +70.0 (C))
Core Processor:	+50.0 (C) (hyst = +0.0 (C), high = +75.0 (C))
Location 1(Backplane):	+38.0 (C) (hyst = +0.0 (C), high = +45.0 (C))
Location 2(Backplane):	+36.5 (C) (hyst = +0.0 (C), high = +45.0 (C))
Location 3(Backplane):	+40.5 (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 3.6.2.2 (for S60C/S120C)

If **"Auto shutdown"** has been checked, the system will shutdown automatically when voltage or temperature is out of the normal range.

6.2 Hard drive S.M.A.R.T. function support

S.M.A.R.T. (**S**elf-**M**onitoring **A**nalysis and **R**eporting **T**echnology) is a diagnostic method for hard drives to give advanced warning of drive failures. Administrators wanted to know in advance if a hard drive was going to fail, because this gave them the opportunity to take steps to protect their data.

S.M.A.R.T. measures many attributes of the hard drives over time and those hard drives can be decided if they are moving out of tolerance. Knowing that each hard drive is going to fail and doing something about it, is infinitely better than having one crash in the middle of writing data. Backing up hard drive and possibly replacing it are far better options than rebuilding a failed 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 value of every hard drive vendors are different, please refer to vendors for details.

Slot	Read error rate	Spin up time	Reallocated sector count	Seek error rate	Spin up retries	Calibration retries	Temperature (C)	Status
1	200 (51)	168 (21)	200(140)	200 (51)	100 (51)	100(51)	33	GOOD
2	200 (51)	166 (21)	199(140)	200 (51)	100 (51)	100(51)	35	GOOD
3	200 (51)	166 (21)	197(140)	200 (51)	100 (51)	100(51)	31	GOOD
4	200 (51)	168 (21)	200(140)	200 (51)	100 (51)	100(51)	29	GOOD
5	200 (51)	165 (21)	198(140)	200 (51)	100 (51)	100(51)	35	GOOD
6	200 (51)	167 (21)	199(140)	200 (51)	100 (51)	100(51)	28	GOOD
7	200 (51)	165 (21)	200(140)	200 (51)	100 (51)	100(51)	31	GOOD
8	200 (51)	166 (21)	200(140)	200 (51)	100 (51)	100(51)	33	GOOD

Figure 3.6.3.1

6.3 UPS Support Overview

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

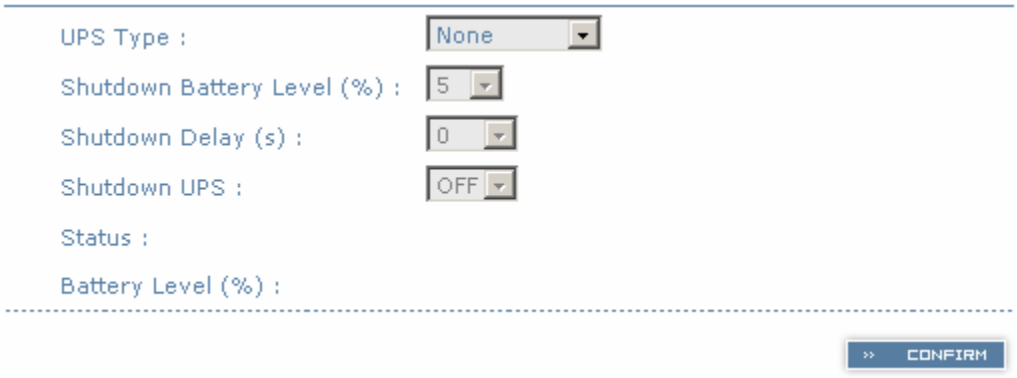


Figure 3.6.4.1

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

First, interconnect via RS-232 cable between the system and UPS in order that the system can communicate with APC UPS. Then set up the shutdown values when the power is broken. UPS of other vendors can work fine, but they have no such function.

6.4 UPS Support Overview - Continued

UPS Type	Select UPS Type. Choose Smart-UPS for APC, None for other vendors or no UPS.
Shutdown Battery Level (%)	When below the setting level, the system will issue shutdown. Setting level to **"0"** will be disabled.
Shutdown Delay (s)	If power failure occurred, and not return back in the setting value period, the system will issue shutdown. Setting delay to **"0"** will be disabled.
Shutdown UPS	Select ON, when power is broken, 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.
Status	The status of UPS. **"Detecting…"** **"Running"** **"Unable to detect UPS"** **"Communication lost"** **"UPS reboot in progress"** **"UPS shutdown in progress"** **"Batteries failed. Please change them NOW!"**
Battery Level (%)	Current percentage of battery level.

6.5 System maintenance

“Maintenance” function allows operation of the system functions including “**Upgrade”** to the latest firmware, **“Info”** to show the system version and **“Shutdown”** to either reboot or shutdown the system.

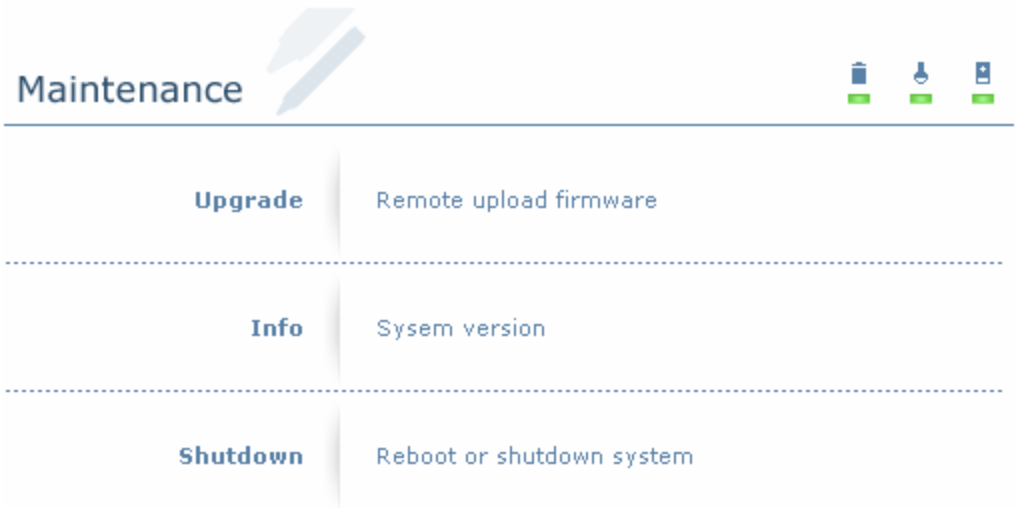


Figure 3.7.1

6.6 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 start to upgrade firmware.

Figure 3.7.1.1

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

6.7 Info

Enter **“Info”** function will display firmware version.

6.8 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.

Figure 3.7.3.1

6.9 Logout

For security reason, **“Logout”** function will allow logout while none is operating the system. Re-login the system by entering username and password.

Chapter 4 Advanced operation

7.0 Rebuild

If one physical disk of the VG which sets to protected RAID level (e.g.: RAID 3 or RAID 5) is FAILED or has been plugged out, the VG becomes degrade mode, then the system will detect spare disk to **rebuild** the degrade VG to a complete one. It will detect dedicated spare as rebuild disk first, then global spare.

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

When rebuilding, the status of PD/VG/UDV will display **"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 will disappear if there is no VG or only VG of RAID 0, JBOD. Because these RAID level cannot be set dedicated spare disk.

Caution
The system will not rebuild when the physical disk plug out and insert into the same slot because of protecting the data in new inserted disk. The physical disk must be set to FREE and SPARE disk, then the system will start to rebuild.

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

System buzzer

The system buzzer features are describing on the following:

1. The system buzzer will alarm 3 seconds when system boots up successfully.
2. The system buzzer will alarm continuously when there are error level events happened in the system. The alarm will be stopped after pressing mute.

RAID 0	Disk striping. No protection. VG will fail if any hard drive fails or plugs out.
RAID 1	Disk mirroring over 2 disks. RAID 1 allows one hard drive fails or plugs out. Need one new hard drive to insert and rebuild to complete.
N-way mirror	Extension to RAID 1 level. It has N copies of the disk. N-way mirror allows N-1 hard drives fail or plug out.
RAID 3	Striping with parity on the dedicated disk. RAID 3 allows one hard drive fails or plugs out.
RAID 5	Striping with interspersed parity over the member disks. RAID 5 allows one hard drive fails or plugs out.
RAID 6	2-dimensional parity protection over the member disks. RAID 6 allows two hard drives fail or plug out. If it needs to rebuild two hard drives at the same time, it will rebuild the first one, then the other, by sequence.
RAID 0+1	Mirroring of the member RAID 0 volumes. RAID 0+1 allows two hard drives fail or plug out, but at the same array.
RAID 10	Striping over the member RAID 1 volumes. RAID 10 allows two hard drives fail or plug out, but at the different array.
RAID 30	Striping over the member RAID 3 volumes. RAID 30 allows two hard drives fail or plug out, but at the different array.
RAID 50	Striping over the member RAID 5 volumes. RAID 50 allows two hard drives fail or plug out, but at the different array.
RAID 60	Striping over the member RAID 6 volumes. RAID 40 allows four hard drives fail or plug out, but each two at the different array.
JBOD	The abbreviation of **"J**ust a **B**unch **O**f **D**isks**"**. No protection. VG will fail if any hard drive fails or plugs out.

7.1 VG migration and expansion

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

1. Select **"/ Volume config / Volume group"**.
2. Decide which VG to be migrated, click the blue square button " " in the RAID column next the RAID level.
3. Change the RAID level by clicking the down arrow mark " RAID 5 ". There will be a pup-up shows if the HDD is not enough to support the new setting RAID level, click " SELECT PD " to increase hard drives, then click " CONFIRM " to go back to setup page.
4. Double check the setting of RAID level and RAID PD slot. If no problem, click " NEXT ".
5. Finally a confirm page is shown with detail RAID info. If no problem, click " CONFIRM " to start migration.
6. Migration starts and it can be seen from the "status 3" of a VG with a running square and an **"M"**. In **"/ Volume config / User data volume"**, it will display a **"M"** in **"Status 4"** and complete percentage of migration in **"R%"**.

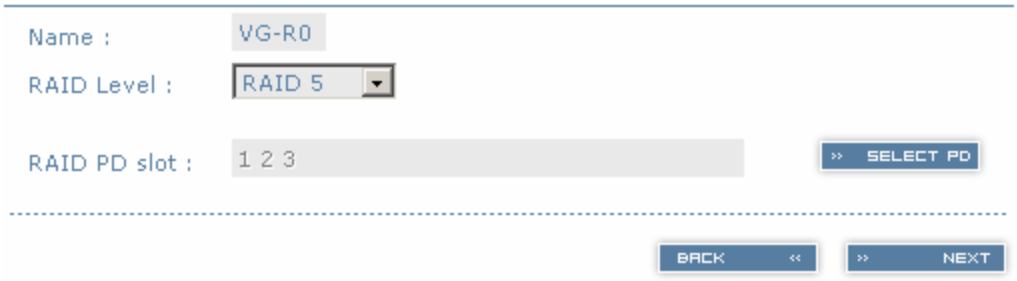


Figure 4.2.1

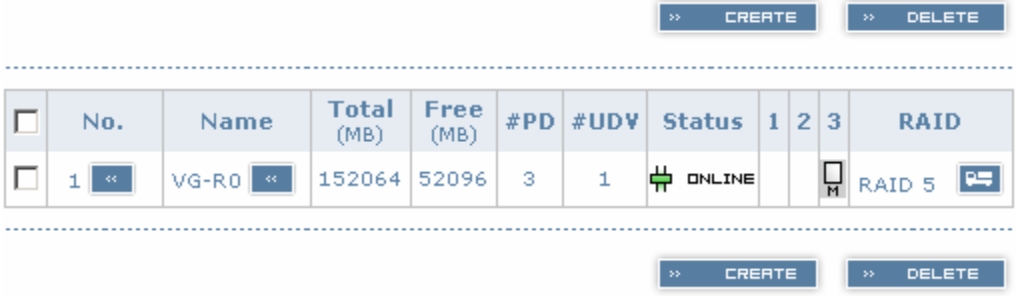


Figure 4.2.2

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

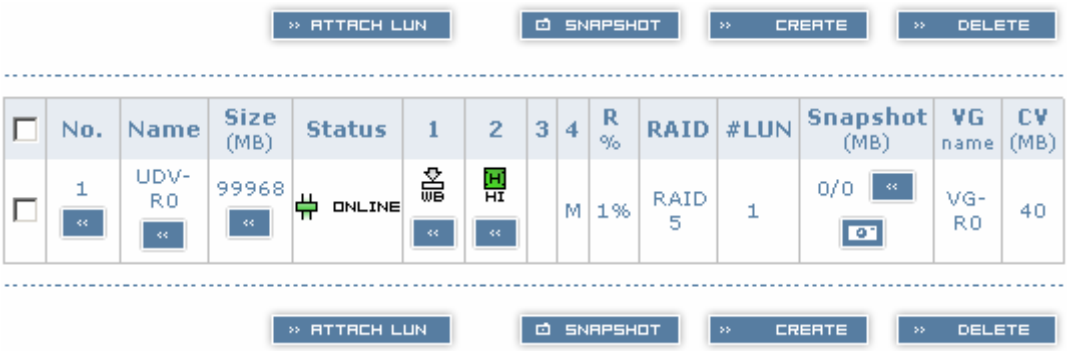


Figure 4.2.3

(Figure 4.2.3: A RAID 0 migrates to RAID 5, complete percentage is 1%.)

Tips
Executing 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.

Caution
VG Migration cannot be executed during rebuild or UDV extension.

7.2 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 blue square button "« " in the Size column next the number.
3. Change the size. The size must larger than the original, then click " » CONFIRM " to start extension.
4. Extension starts. If UDV needs initialized, it will display an **"I"** in **"Status 3"** and complete percentage of initialization in **"R%"**.

Figure 4.3.1

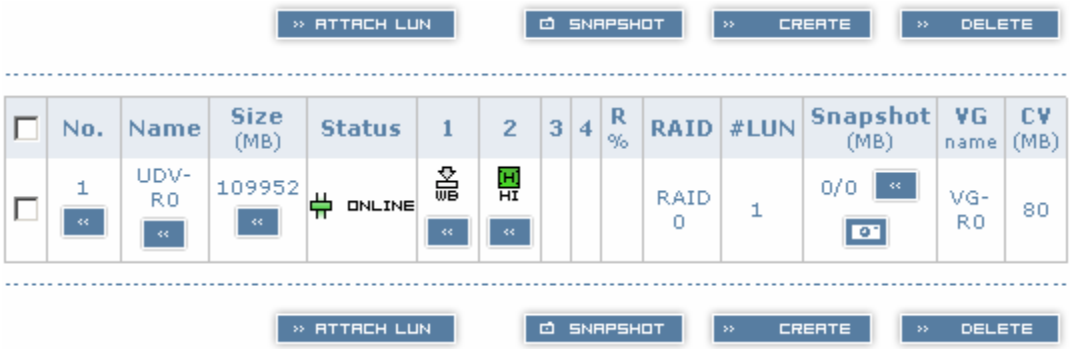


Figure 4.3.2

(Figure 4.3.2: Extend UDV-R0 from 99968MB to 109952MB (It's multiple of base stripe height, so the number may be less than the setting size.)

Tips
The size of UDV extension must be larger than original.

Caution
UDV extension cannot be executed during rebuild or migration.

7.3 Snapshot/Rollback (optional)

Snapshot function will freeze the data at the moment while taking snapshot. When executing snapshot, it will become a new **snap UDV**, which can be attached a LUN then use it as a disk. **Rollback** function can return the whole data back to the time taking snapshot in order to avoid virus intrusion or files deletion by accident. Snapshot uses the same disk space of associated VG,

we suggest to leave **20%** of VG size or more for snapshot space. Please refer to Figure 4.4.1 for snapshot concept.

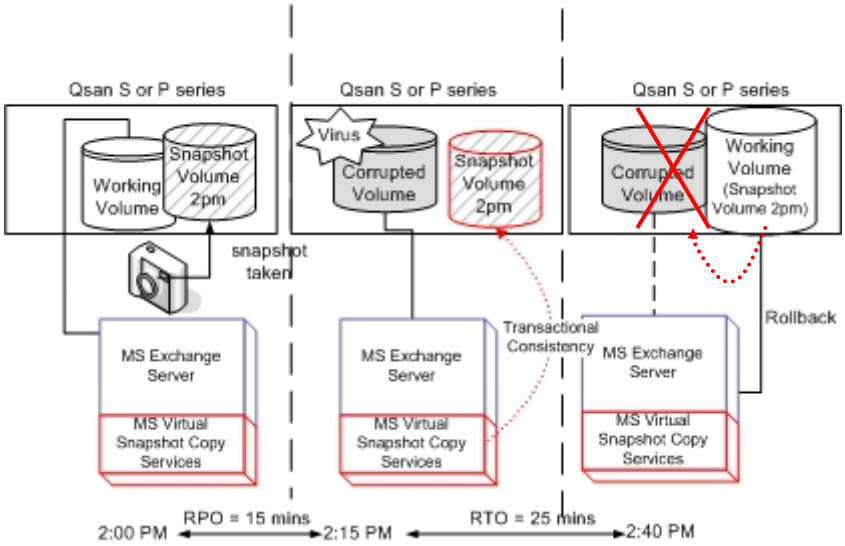


Figure 4.4.1

> **Caution**
> Snapshot/rollback features need **512MB** RAM or more. Please refer to a certification list for RAM in Appendix A.

7.4 Create snapshot volume

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

1. Select **"/ Volume config / User data volume"**.
2. Choose a UDV to execute the snapshot by clicking the blue square button " << " in the **"Snapshot (MB)"** column, it will direct to a setup page.
3. Set up the size for executing snapshot. The size is suggested to be **20%** of UDV size or more, then click " >> CONFIRM ". It will go back to the UDV page and the size will be shown in snapshot column. It may not be the same as the number entered because some space is reserved for snapshot internal usage. There will be 2 numbers in **"Snapshot (MB)"** column. These numbers mean **"Free snapshot space"** and **"Total snapshot space"**.

4. Choose a UDV by clicking the checkbox of the row and then click “ SNAPSHOT ”.
5. A snap UDV is created with the date and time taken snapshot of the chosen UDV.
6. Attach LUN to UDV, please refer to section 3.5.6 for more detail.
7. Done. It can be used as a disk.

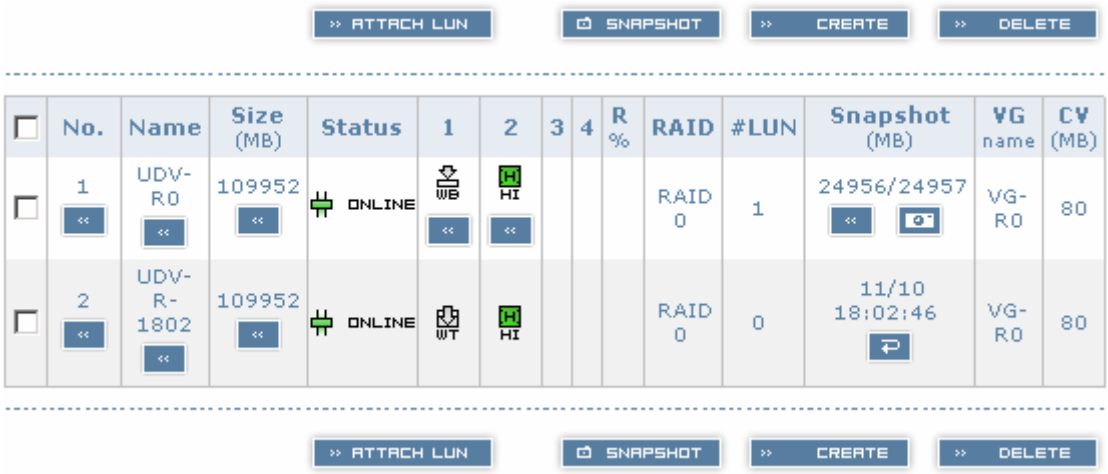


Figure 4.4.1.1

(Figure 4.4.1.1: No.1 is a RAID 0 UDV. Set snapshot space to 24957MB. And now its space is free to snapshot. No.2 is a snap UDV taken on 11/10 18:02:46.)

Snapshot has some constraints as described in the following:

1. Minimum RAM size of enabling snapshot function is **512MB**.
2. For performance concern, saving data of taking snapshots are incremental. For example: three snapshots have been taken and created as name “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 is **32**.
4. If snapshot space is full, snap UDV will fail.
5. Snap UDV cannot be migrated, when executing migration of related VG, snap UDV will fail.
6. Snap UDV cannot be extended.

7.5 Auto snapshot

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

1. Select **"/ Volume config / User data volume"**.
2. Create a snapshot space. Please refer to section 4.4.1 for more detail.
3. Click " " in **"Snapshot (MB)"** column to set auto snapshot.
4. The auto snapshot can be set at the period of weekly, daily, or hourly. Select the number means how many snapshot copies which will be kept. **"Hours to take snapshots"** function only enable when selecting **"Number of hourly snapshots"**. Last, click " CONFIRM ".
5. Done. It will take snapshots automatically.

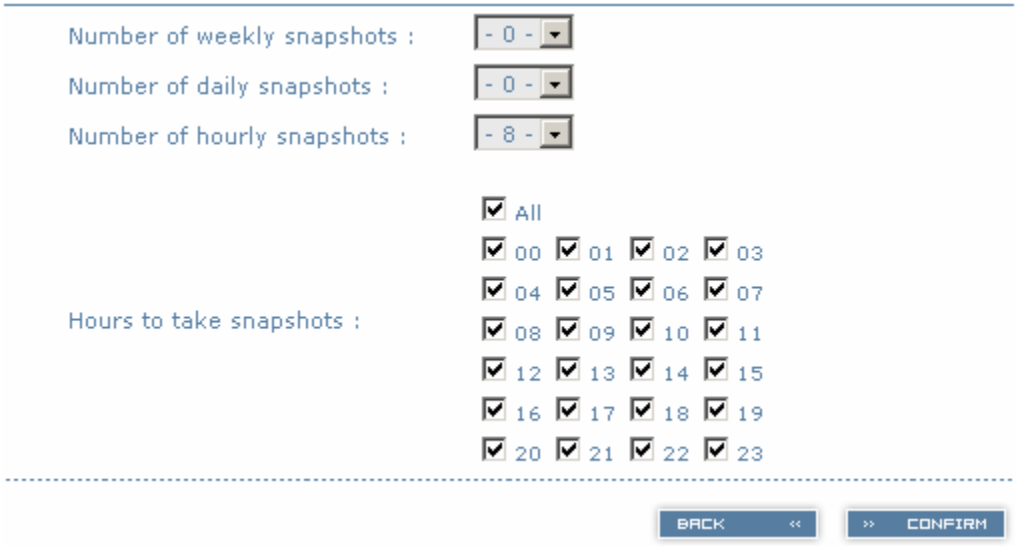


Figure 4.4.2.1

(Figure 4.4.2.1: It will take snapshots every hour, and keep the last 8 snapshot copies.)

Tips
Daily snapshot will be taken at every 00:00. Weekly snapshot will be taken on every Monday 00:00.

7.6 Rollback

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

1. Select **"/ Volume config / User data volume"**.
2. Take one or more snapshots. Please refer to section 4.4.1 for more detail.
3. Click "  " in **"Snapshot (MB)"** column to rollback the data, which is at the time of taking snapshot.

Rollback function has some constraints as described in the following:

1. Minimum RAM size of enabling rollback function is **512MB**.
2. When executing rollback, the original UDV cannot be accessed for a while. At this time, transfer connections from original UDV to snap UDV, and then start rollback.
3. During rollback data from snap UDV to original UDV, the original UDV can be accessed and the data in it shown just like finished rollback. At the same time, the other related snap UDV(s) will not be accessed.
4. After rollback process finished, the other related snap UDV(s) will be deleted, and snapshot 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.

7.7 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's 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. The configuration of both VG and UDV will be kept but LUN configuration will be cleared to avoid conflict with system-2.

The End