Thecus i Series

User's Manual

Preface

About this manual

This manual is the introduction of i Series, 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.thecus.com and your contact windows.

Thank you for using **Thecus Technology Corp.** products; Please contact with **"sales@thecus.com"** to get the latest user manual and firmware. If you have any question, please e-mail to **"sales@thecus.com"**. We will answer your question as soon as possible.

The RAM size of i Series is recommended **DDR-333 512MB** or above. Please refer to the certification list in Appendix A.

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Chapter 1 RAID introduction

1.1 Features

i Series features:

- Gigabit LAN (x2) -to- SATA II (xN bays) RAID controller.
- RAID 6 ready.
- 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 Microsoft VDS (Virtual Disk Service).
- Disk roaming.
- MPIO ready (initiator driver support needed).
- MC/S ready (initiator driver support needed).
- Support iSCSI header and data digest.
- Support CHAP authentication.

With proper configuration, i Series can provide non-stop service with a high degree of fault tolerance by the use of i Series RAID technology and advanced array management features. For more detail, please contact with your direct sales or email to **"sales@thecus.com"**.

i Series connects to the host system in iSCSI interface. It can be configured to any RAID level. i Series 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.)

Thecus RAID system is the most cost-effective disk array system 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 business (SMB) users.**

Caution
Please refer to RAM certification list in Appendix A for more detail.

1.2 Terminology

The document uses the following terms:

RAID	RAID is the abbreviation of **"R**edundant **A**rray of **I**ndependent **D**isks**"**. There are different RAID levels with different degree of the data protection, data availability, performance to host environment.
PD	The **P**hysical **D**isk belongs to the member disk of one specific volume group.
VG	**V**olume **G**roup. A collection of removable media. One VG consists of a set of UDVs and owns one RAID level attribute.
UDV	**U**ser **D**ata **V**olume. Each VG could be divided into several UDVs. The UDVs from one VG share the same RAID level, but may have different volume capacity.
CV	**C**ache **V**olume. i Series uses the on board memory as cache. All RAM (except for the part which is occupied by the controller) can be used as cache. User can divide the cache for one UDV or sharing among all UDVs. Each UDV will be associated with one CV for data transaction. Each CV could be assigned different cache memory size.
LUN	**L**ogical **U**nit **N**umber. A logical unit number (LUN) is an unique identifier used on a iSCSI connection which enables it to differentiate among separate devices (each of which is a logical unit).
GUI	**G**raphic **U**ser **I**nterface.
RAID width, RAID copy, RAID row (RAID cell in one row)	RAID width, copy and row are used to describe one VG. E.g.: 1. One 4-disk RAID 0 volume: RAID width= 4; RAID copy=1; RAID row=1. 2. One 3-way mirroring volume: RAID width=1; RAID copy=3; RAID row=1. 3. One RAID 10 volume over 3 4-disk RAID 1 volume: RAID width=1; RAID copy=4; RAID row=3.

WT	**W**rite-**T**hrough cache write 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.
WB	**W**rite-**B**ack cache write policy. A caching 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.
RO	Set the volume to be **R**ead-**O**nly.
DS	**D**edicated **S**pare disks. The spare disks are only used by one specific VG. Others could not use these dedicated spare disks for any rebuilding purpose.
GS	**G**lobal **S**pare 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.
DC	**D**edicated **C**ache.
GC	**G**lobal **C**ache.
DG	**D**e**G**raded 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.
S.M.A.R.T.	**S**elf-**M**onitoring **A**nalysis and **R**eporting **T**echnology.
WWN	**W**orld **W**ide **N**ame.
HBA	**H**ost **B**us **A**dapter.
MPIO	**M**ulti-**P**ath **I**nput/**O**utput.
MC/S	**M**ultiple **C**onnections per **S**ession
NIC	**N**etwork **I**nterface **C**ard.

iSCSI	**I**nternet **S**mall **C**omputer **S**ystems **I**nterface.
MTU	**M**aximum **T**ransmission **U**nit.
CHAP	**C**hallenge **H**andshake **A**uthentication **P**rotocol. An optional security mechanism to control access to an iSCSI storage system over the iSCSI data ports.
iSNS	**I**nternet **S**torage **N**ame **S**ervice.

1.3 RAID levels

RAID 0	Disk striping. RAID 0 needs at least one hard drive.
RAID 1	Disk mirroring over two disks. RAID 1 needs at least two hard drives.
N-way mirror	Extension to RAID 1 level. It has N copies of the disk.
RAID 3	Striping with parity on the dedicated disk. RAID 3 needs at least three hard drives.
RAID 5	Striping with interspersed parity over the member disks. RAID 3 needs at least three hard drives.
RAID 6	2-dimensional parity protection over the member disks. RAID 6 needs at least four hard drives.
RAID 0+1	Mirroring of the member RAID 0 volumes. RAID 0+1 needs at least four hard drives.
RAID 10	Striping over the member RAID 1 volumes. RAID 10 needs at least four hard drives.
JBOD	The abbreviation of **"J**ust a **B**unch **O**f **D**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 the hardware setting is fully supported.
2. Read the latest release notes before upgrading. Release notes accompany with release firmware.
3. A server with a NIC or iSCSI HBA.
4. CAT 5e, or CAT 6 network cables for management port and iSCSI data ports. Recommend CAT 6 cables for best performance.
5. Prepare storage system configuration plan.
6. Management and iSCSI data ports network information. When using static IP, please prepare static IP addresses, subnet mask, and default gateway.
7. CHAP security information, including CHAP usernames and secrets. (Optional)

2.2 iSCSI introduction

iSCSI (Internet SCSI) is a protocol which encapsulates SCSI (Small Computer System Interface) commands and data in TCP/IP packets for linking storage devices with servers over common IP infrastructures. iSCSI provides high performance SANs over standard IP networks like LAN, WAN or the Internet.

IP SANs are true SANs (Storage Area Networks) which allow few of servers to attach to an infinite number of storage volumes by using iSCSI over TCP/IP networks. IP SANs can scale the storage capacity with any type and brand of storage system. In addition, using any type of network (Ethernet, Fast Ethernet, Gigabit Ethernet) and combining operating systems (Microsoft Windows, Linux, Solaris, …etc.) within the SAN network. IP-SANs also include mechanisms for security, data replication, multi-path and high availability.

Storage protocol, such as iSCSI, has "two ends" in the connection. These ends are the initiator and the target. In iSCSI we call them iSCSI initiator and iSCSI target. The iSCSI initiator requests or initiates any iSCSI communication. It requests all SCSI operations like read or write. An initiator is usually located on the host/server side (either an iSCSI HBA or iSCSI SW initiator).

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

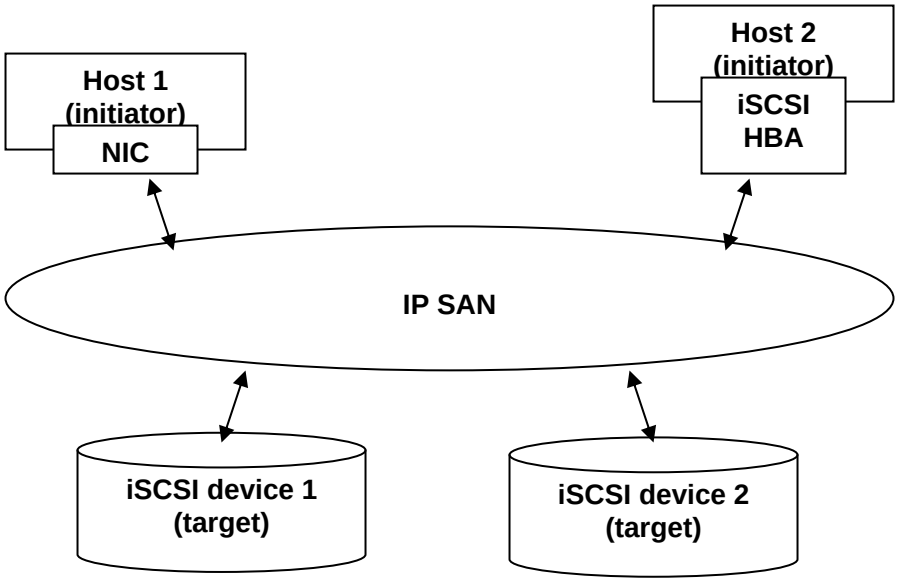


Figure 2.2.1

The host side needs an iSCSI initiator. The initiator is a driver which handles the SCSI traffic over iSCSI. The initiator can be software or hardware (HBA). Please refer to the certification list of iSCSI HBA(s) in Appendix A. OS native initiators or other software initiators use the standard TCP/IP stack and Ethernet hardware, while iSCSI HBA(s) use their own iSCSI and TCP/IP stacks on board.

Hardware iSCSI HBA(s) would provide its initiator tool. Please refer to the vendors' HBA user manual. **Microsoft**, **Linux** and **Mac** provide software iSCSI initiator driver. Below are the available links:

1. Link to download the Microsoft iSCSI software initiator:
   http://www.microsoft.com/downloads/details.aspx?FamilyID=12cb3c1a-15d6-4585-b385-befd1319f825&DisplayLang=en

   Please refer to Appendix C for Microsoft iSCSI initiator installation procedure.

2. Linux iSCSI initiator is also available. For different kernels, there are different iSCSI drivers. Please check Appendix A for software iSCSI initiator certification list. If user needs the latest Linux iSCSI initiator, please visit Open-iSCSI project for most update information. Linux-iSCSI (sfnet) and Open-iSCSI projects merged in April 11, 2005.

Open-iSCSI website: http://www.open-iscsi.org/
Open-iSCSI README: http://www.open-iscsi.org/docs/README
Features: http://www.open-iscsi.org/cgi-bin/wiki.pl/Roadmap
Support Kernels:
http://www.open-iscsi.org/cgi-bin/wiki.pl/Supported_Kernels
Google groups:
http://groups.google.com/group/open-iscsi/threads?gvc=2
http://groups.google.com/group/open-iscsi/topics
Open-iSCSI Wiki: http://www.open-iscsi.org/cgi-bin/wiki.pl

3. ATTO iSCSI initiator is available for Mac.
   Website: http://www.attotech.com/xtend.html

2.3 Management methods

There are two management methods to manage i Series, describe in the following:

2.3.1 Web GUI

i Series support graphic user interface to manage the system. Be sure to connect LAN cable. The default setting of management port IP is Static IP. Default IP address: **192.168.1.100**

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

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

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 Remote control – secure shell

SSH (secure shell) is required for **i Series** 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: **192.168.1.100**
Login name: **admin**
Default password: **admin**

Tips
Thecus i Series only support SSH for remote control. For using SSH, the IP address and the password is required for login.

2.4 Enclosure

2.4.1 LCM

There are four buttons to control 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:

```
192.168.1.100
i Series      ←
```

Press **"ENT"**, the LCM functions **"Alarm Mute"**, **"Reset/Shutdown"**, **"Quick Install"**, **"View IP Setting"**, **"Change IP Config"** and **"Reset to Default"** will 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.

Alarm Mute	Mute alarm when error occurs.
Reset/Shutdown	Reset or shutdown controller.
Quick Install	Quick three steps to create a volume. Please refer to section 3.3 for operation in web UI.
View IP Setting	Display current IP address, subnet mask, and gateway.
Change IP Config	Set IP address, subnet mask, and gateway. There are 2 selections, DHCP (Get IP address from DHCP server) or set static IP.
Reset to Default	Reset to default sets password to default: **admin**, and set IP address to default setting. Default IP address: **192.168.1.100 (Static IP)** Default subnet mask: **255.255.255.0** Default gateway: **192.168.1.1**

The following is LCM menu hierarchy.

▲▼	[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)	Adjust Volume Size
			Apply The Config	[▲Yes No▼]
	[View IP Setting]	[IP Config] [Static IP]		
		[IP Address] [192.168.001.100]		
		[IP Subnet Mask] [255.255.255.0]		
		[IP Gateway] [192.168.001.001]		
	[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▼]		

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 GUI hierarchy

The below table is the hierarchy of i Series GUI.

Quick Install	→	Step 1 / Step 2 / Step 3 / Confirm
System Config		
System name	→	System name
IP address	→	DHCP / Static / Address / Mask / Gateway / DNS / HTTP port / HTTPS port / SSH port
Language	→	Language
Login config	→	Auto logout / Login lock
Password	→	Old password / Password / Confirm
Date	→	Time zone / Date / Time / NTP Server
Mail	→	Mail-from address / Mail-to address / Sent events / SMTP relay / SMTP server / Authentication / Account / Password / Confirm / Send test mail
SNMP	→	SNMP trap address / Community / Send events
Messenger	→	Messenger IP/hostname / Send events
System log server	→	Server IP/hostname / Port / Facility / Event level
Event log	→	Filter / Download / Mute / Clear
iSCSI config		
Entity Property	→	Entity name / iSNS IP
NIC	→	Aggregation / IP settings for iSCSI ports / Become default gateway / Set MTU
Node	→	Change Authentication
Session	→	Delete
CHAP account	→	Create /Delete
Volume config		
Physical disk	→	Free disks / Global spares / Dedicated spares / More information / Auto Spindown
Volume group	→	Create / Delete / More information / Rename / Migrate
User data Volume	→	Attach / Create / Delete / More information / Rename / Extend / Set read/write mode
Cache volume	→	Create / Delete / More information / Resize
Logical unit	→	Attach / Detach
Enclosure management		
SES config	→	Enable / Disable
Hardware monitor	→	Auto shutdown
S.M.A.R.T.	→	
UPS	→	UPS Type / Shutdown Battery Level / Shutdown Delay / Shutdown UPS

Maintenance		
Upgrade	→	Browse the firmware to upgrade / Export config
Info	→	System information
Reset to default	→	Sure to reset to factory default?
Config import & export	→	Import/Export / Import file
Shutdown	→	Reboot / Shutdown
Logout		Sure to logout?

3.2 Login

i Series supports graphic user interface (GUI) to operate the system. Be sure to connect the LAN cable. The default IP **address is 192.168.1.100**; open the browser and enter:

http://192.168.1.100 (Please check IP address first on LCM)

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

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

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

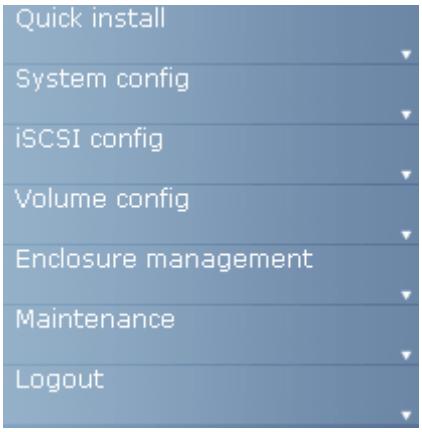


Figure 3.2.1

There are four 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.

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.

Quick Install function has a smarter policy. When the system is full inserted with 5 HDD, and all HDD are in the same size, **Quick Install** function lists all possibilities and sizes among different RAID levels, **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., 2*200G HDD and 3*80G, i Series 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 i Series'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.

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 >>", which links to another page, user can set up "LUN" here.

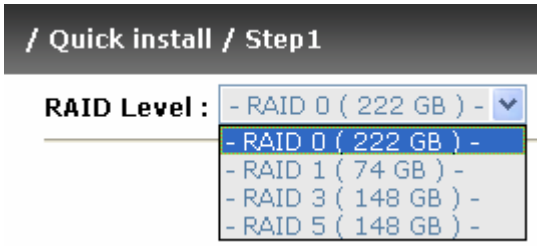


Figure 3.3.1

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 "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. You can start to use the system now.

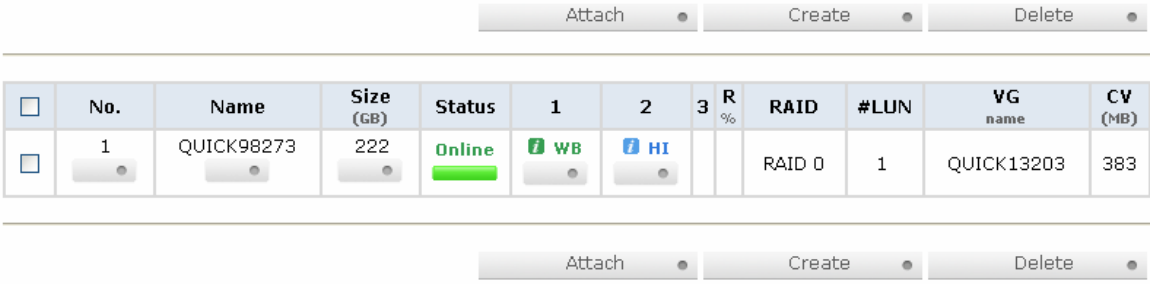


Figure 3.3.2

(Figure 3.3.2: A RAID 0 user data volume with the UDV name "QUICK98273", named by the system itself, with the total available volume size 222GB.)

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”**.

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

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 Static IP (192.168.1.100) enabled. User can change the HTTP, HTTPS, and SSH port number when the default port number is not allowed on host/server.

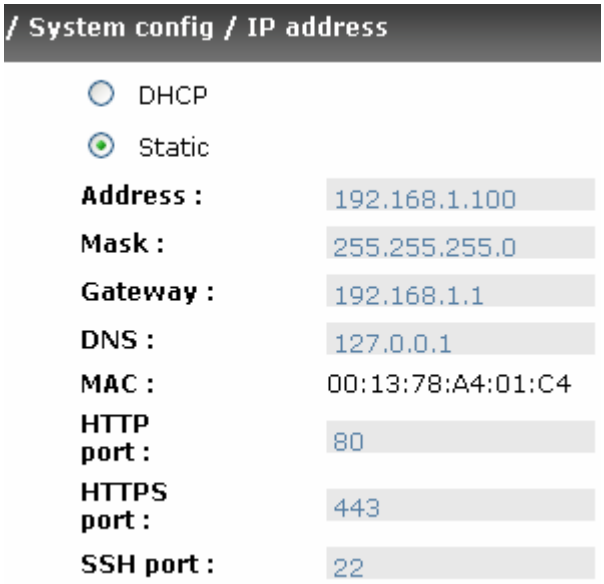


Figure 3.4.2.1

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.

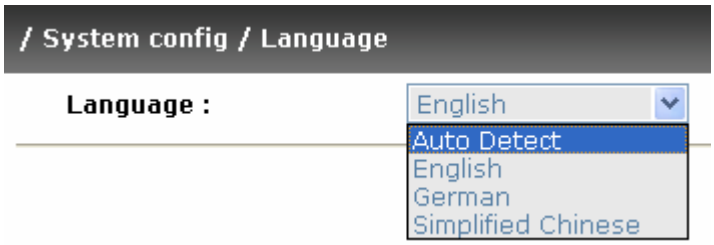


Figure 3.4.3.1

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.

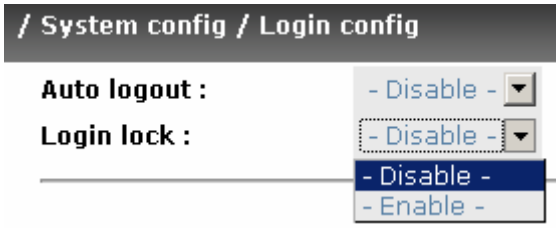


Figure 3.4.4.1

3.4.5 Password

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

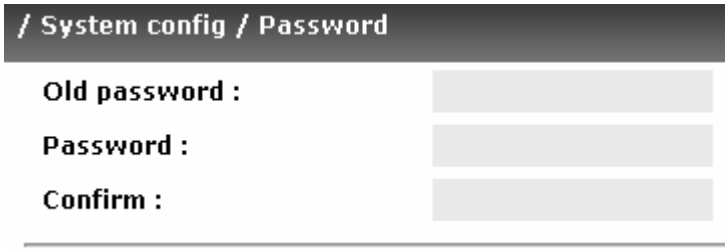


Figure 3.4.5.1

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.

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.

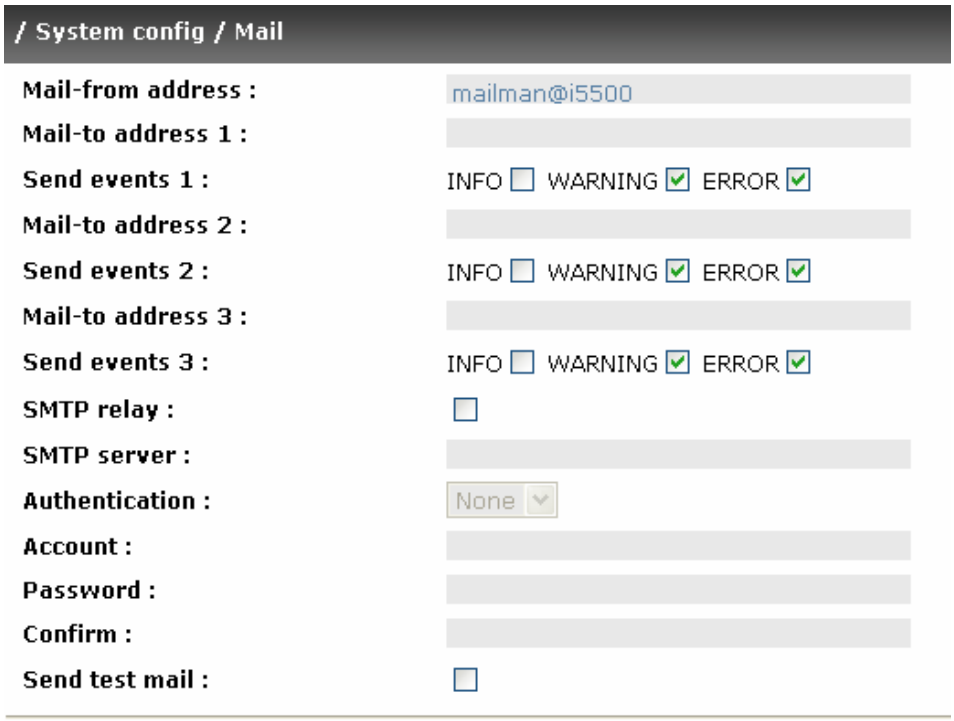


Figure 3.4.7.1

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.

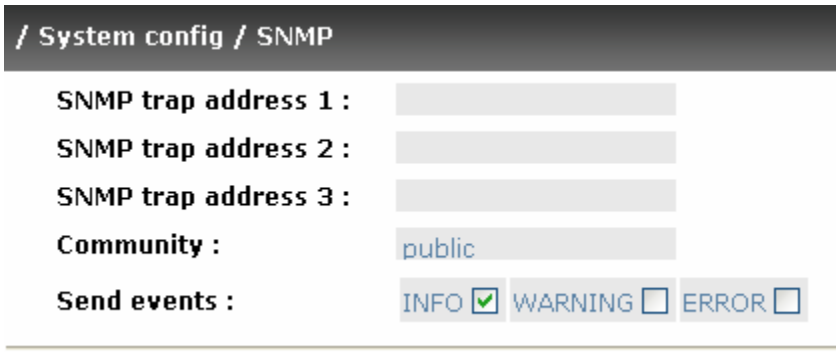


Figure 3.4.8.1

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.

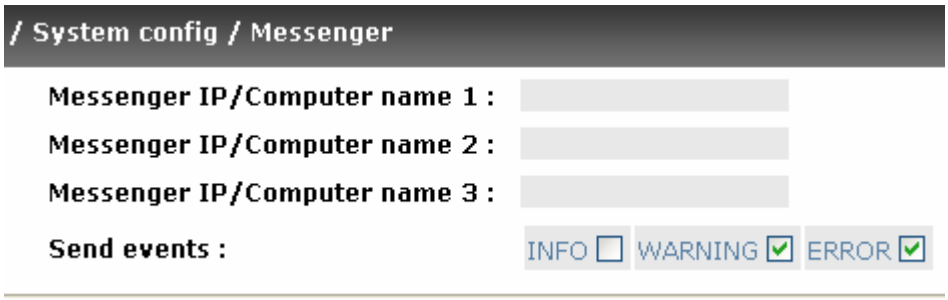


Figure 3.4.9.1

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 WARNING and ERROR event logs enabled.

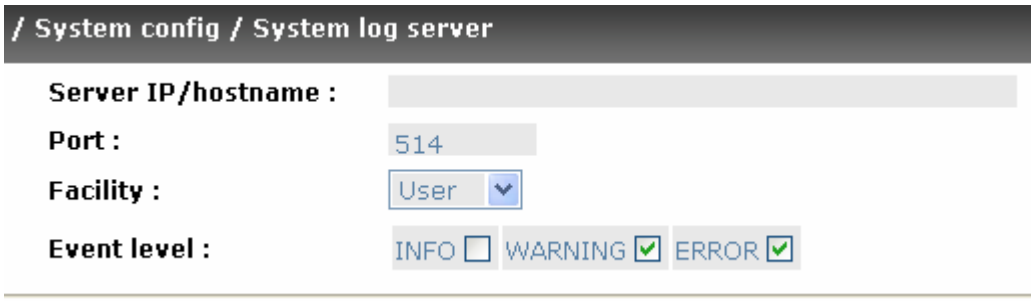


Figure 3.4.10.1

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". Press **"Clear"** button will clear event log. Press **"Mute"** button will stop alarm if system alerts.

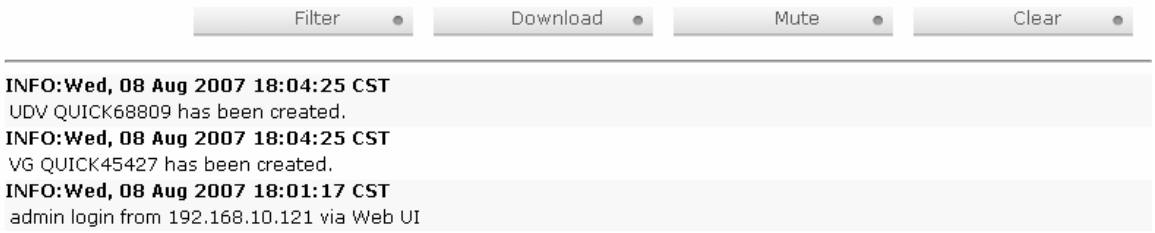


Figure 3.4.11.1

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.

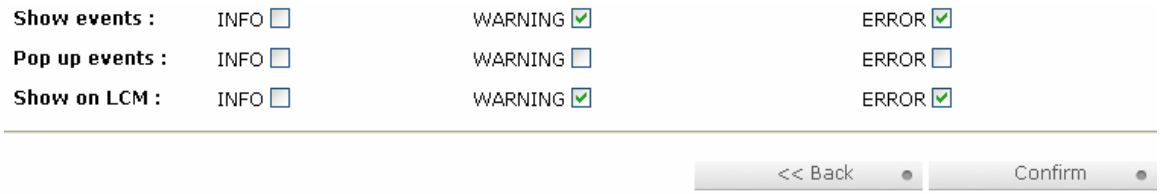


Figure 3.4.11.2

The event log is displayed in reverse order which means the latest event log is on the first page. The event logs are 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 iSCSI config

“iSCSI config” selection is for the setup of **“Entity Property”**, **“NIC”**, **“Node”**, **“Session”**, and **“CHAP account”**.

Entity property	iSCSI entity property
NIC	iSCSI portal configuration
Node	iSCSI node configuration
Session	iSCSI session information
CHAP account	Add/Remove account for iSCSI node

Figure 3.5.1

3.5.1 Entity property

Select **“Entity property”** to view the view the entity name of the controller, and setup **“iSNS IP”** for iSNS (Internet Storage Name Service). Add an iSNS server IP address to the iSNS servers list which the iSCSI initiator service can send queries. The entity name cann’t be changed.

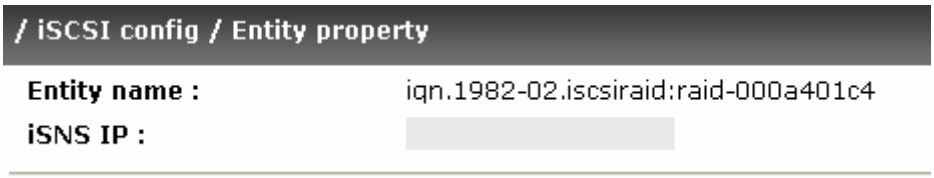


Figure 3.5.1.1

3.5.2 NIC

Select **"NIC"** to change IP addresses of iSCSI data ports.

Name	DHCP	IP address	Netmask	Gateway	MTU	MAC address	Link
LAN1	no	192.168.1.1	255.255.255.0	192.168.1.254	1500	00:13:78:04:00:4a	up
LAN2	no	192.168.2.1	255.255.255.0	192.168.2.254	1500	00:13:78:04:00:4b	up

Figure 3.5.2.2

(Figure 3.5.2.2: there are 2 iSCSI data ports. MTU is 1500.)

User can change IP address by clicking the button " " in the **"DHCP"** column. There are 2 selections, DHCP (Get IP address from DHCP server) or static IP.

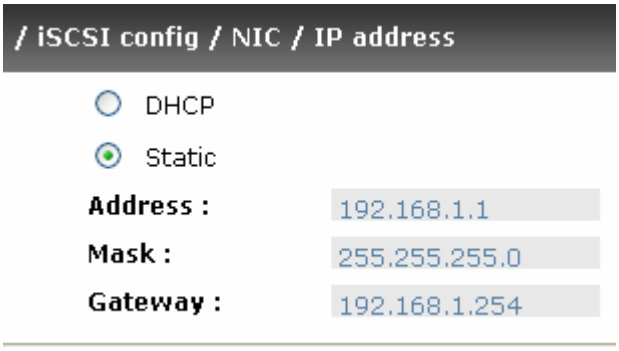


Figure 3.5.2.3

Default gateway can be changed by clicking the button " " in the **"Gateway"** column. There is only one default gateway.

MTU (**M**aximum **T**ransmission **U**nit) size can be changed by clicking the button " " in the **"MTU"** column.

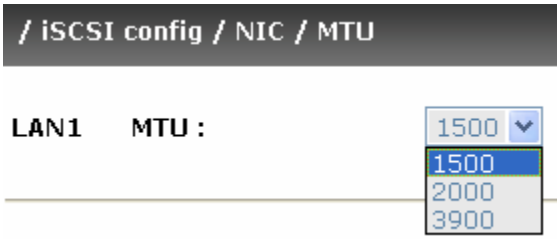


Figure 3.5.2.4

The range of MTU size is between from 1500 to 3900. Default MTU size is 1500. If it is changed, the setting of MTU size on switching hub and HBA should be set to the same size.

Caution
The MTU size of switching hub and HBA on host must be the same as controller. Otherwise, the LAN connection can not work properly.

3.5.3 Node

Select **"Node"** to view the target name for iSCSI initiator.The node name of i Series exists by default and can not be changed.

Name	Auth
iqn.1982-02.iscsiraid:raid-000a401c4:default-target	None

Figure 3.5.3.1

CHAP:

CHAP is the abbreviation of **C**hallenge **H**andshake **A**uthorization **P**rotocol. CHAP is a strong authentication method used with point-to-point for user login. It's a type of authentication in which the authentication server sends the client a key to be used for encrypting the username and password. CHAP enables the username and password to transmitting in an encrypted form for protection.

1. Click " " in Auth column.
2. Select **"CHAP"**.
3. Go to **/ iSCSI config / CHAP** page to create account and password.

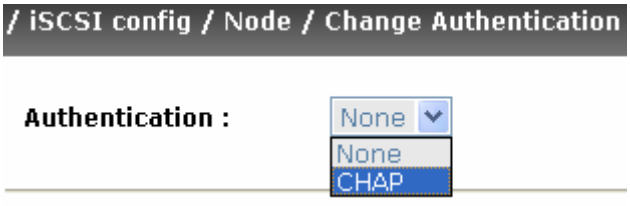


Figure 3.5.3.2

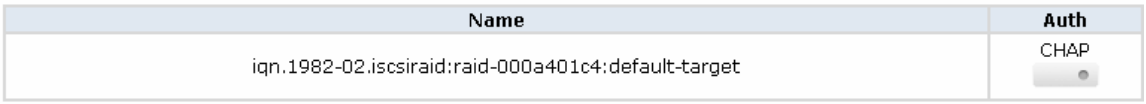


Figure 3.5.3.3

4. Select **"None"** to disable CHAP.

Tips
After setting CHAP, the initiator in host/server should be set the same Account/Password. Otherwise, user cannot login.

3.5.4 Session

Enter **"Session"** function; it will display iSCSI session and connection information, including the following items:

1. Host (Initiator Name)
2. Error Recovery Level
3. Error Recovery Count
4. Detail of Authentication status and Source IP: port number.

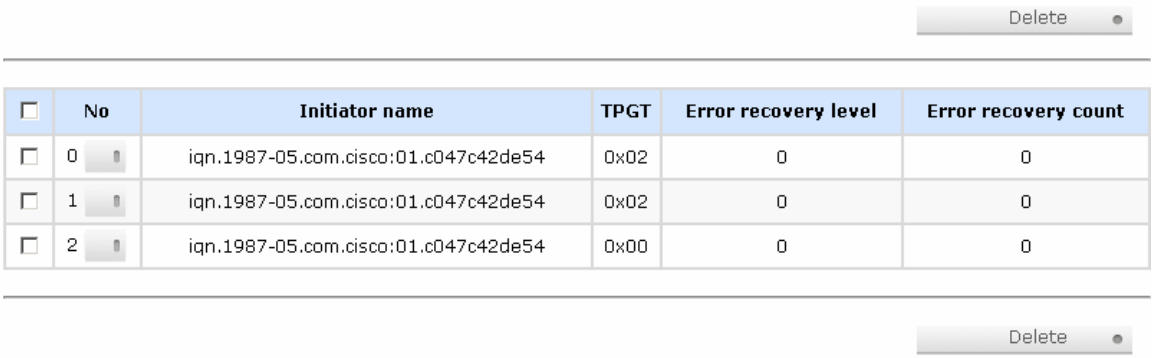


Figure 3.5.4.1

(Figure 3.5.4.1: iSCSI Session.)

Pressing the button " " will display connection(s).

Figure 3.5.4.2

(Figure 3.5.4.2: iSCSI Connection.)

3.5.5 CHAP account

Enter **"CHAP account"** function to create/delete a CHAP account for authentication.

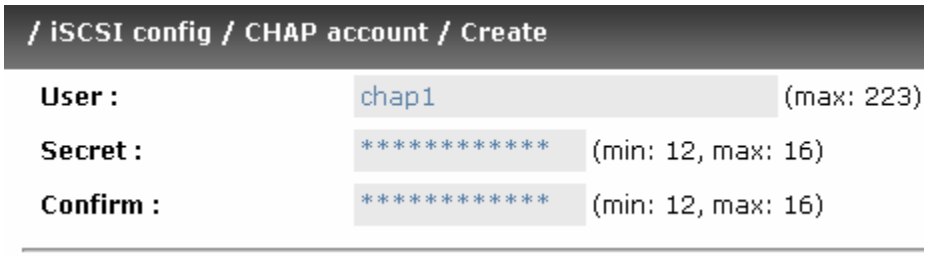


Figure 3.5.5.1

(Figure 3.5.5.1: Press "Create" to create a CHAP account.)

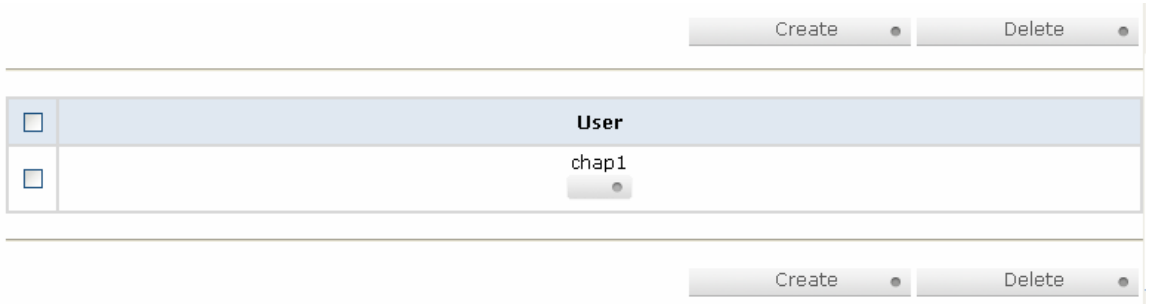


Figure 3.5.5.2

(Figure 3.5.5.2: Create a CHAP account named "chap1".)

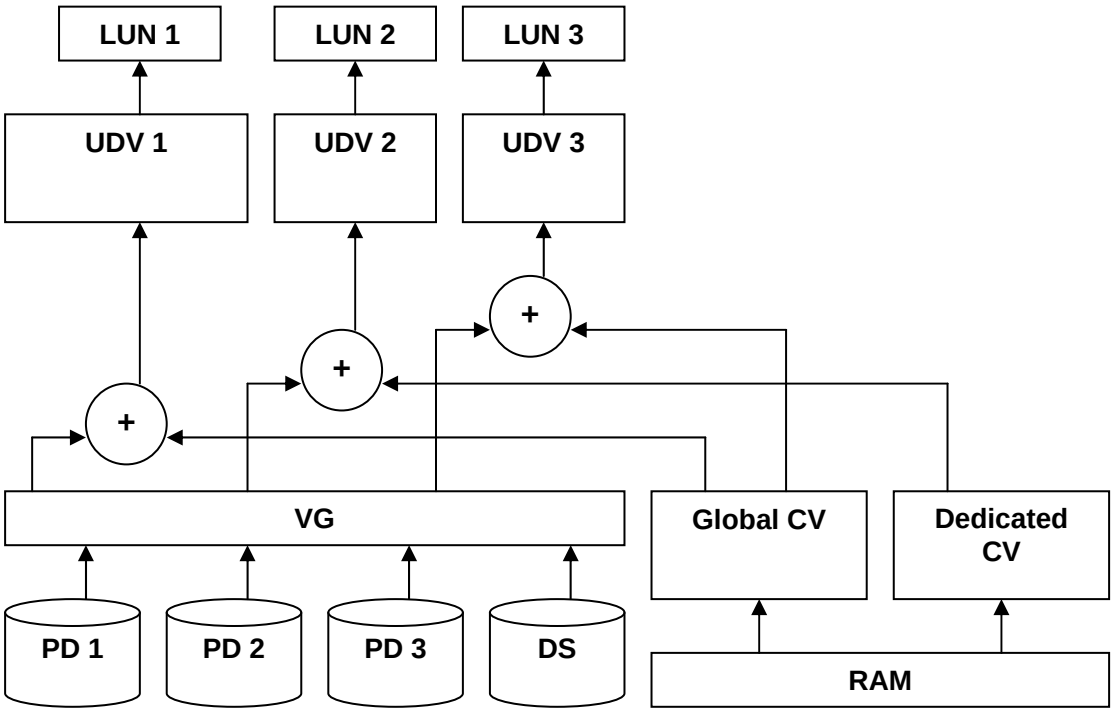
3.6 Volume configuration

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

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

Figure 3.6.1

3.6.1 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 can be divided into several UDVs. The UDVs from one VG share the same RAID level, but may have different volume capacity. Each UDV will be associated with one specific CV (Cache Volume) to execute the data transaction. Each CV could have different cache memory size from user's modification/setting. LUN is the logical volume/unit, which the users could access through SCSI commands.

3.6.2 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.

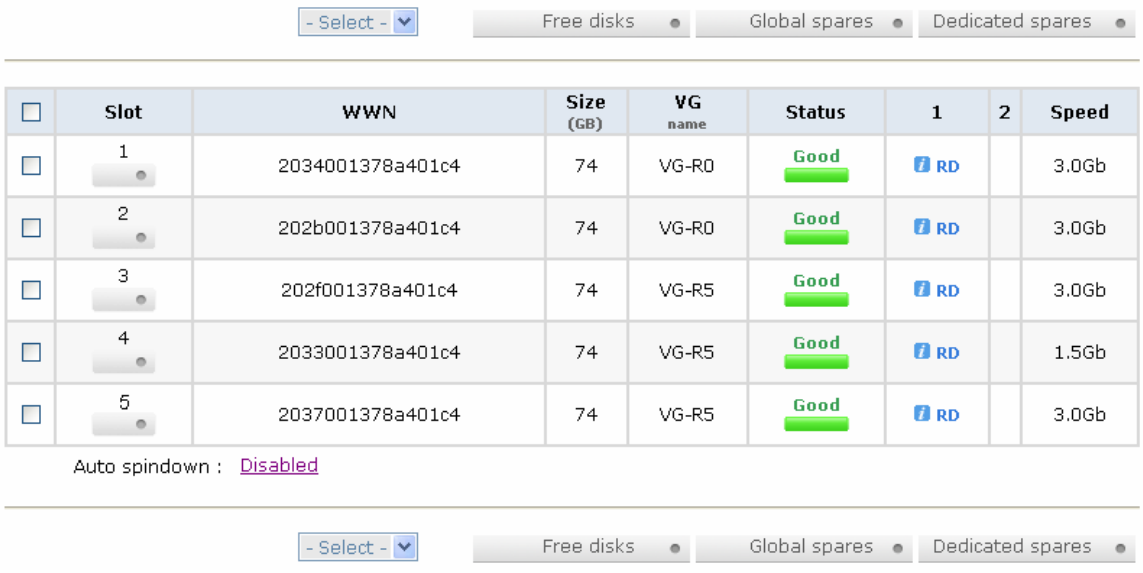


Figure 3.6.2.1

(Figure 3.6.2.1: Physical disks of slot 1,2 are created for a VG named "VG-R0". Physical disks of slot 3,4,5 are created for a VG named "VG-R5".)

- **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 **"More Information"** indication. It shows the details of the hard drive.
WWN	**W**orld **W**ide **N**ame.
Size (GB)	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 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.
Status 2	**"R"** → **R**ebuild. The hard drive is doing rebuilding. **"M"**→ **M**igration. The hard drive is doing migration.
Speed	**3.0G** → 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). **1.5G** → 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). **Unknown** → The disk doesn't support above command, so the speed is defined as unknown.

- **PD operations description:**

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

In this page, i Series also provides HDD auto spindown down function to save power. The default value is disabled. User can set up in physical disk page, too.

Figure 3.6.2.2

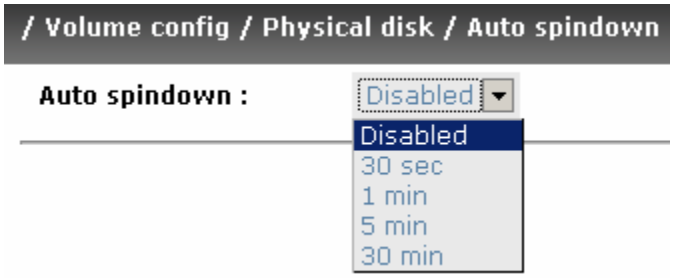


Figure 3.6.2.3

3.6.3 Volume group

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

- **VG column description:**

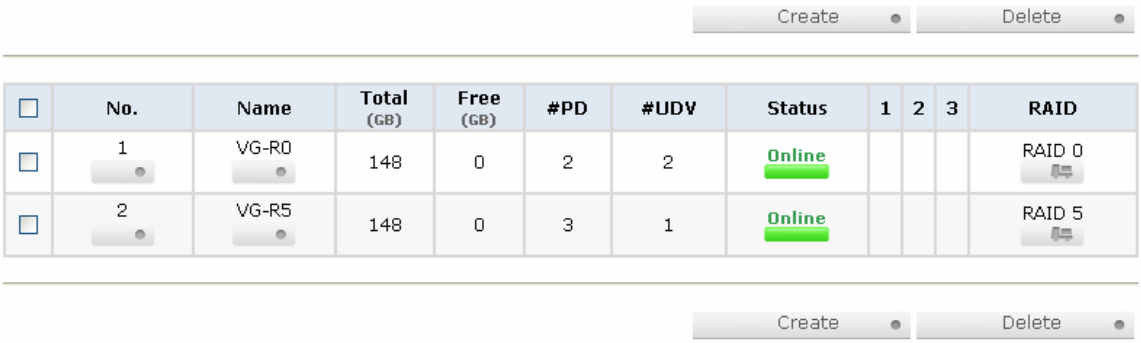


Figure 3.6.3.1

(Figure 3.6.3.1: There is a RAID 0 with 2 physical disks, named “VG-R0”, total size is 148GB, related to 2 UDV. Another is a RAID 5 with 3 physical disks, named “VG-R5”.)

No.	Number of volume group. The button next to the No. is **“More Information”** indication. It shows the details of the volume group.
Name	Volume group name. The button next to the Name is **“Rename”** function.
Total(GB)	Total capacity of this volume group.
Free(GB)	Free capacity of this volume group.
#PD	The number of physical disks of the volume group.
#UDV	The number of user data volumes related to the volume group.
Status	The status of volume group. **“Online”** → volume group is online. **“Fail”** → volume group is fail.
Status 1	**“DG”** → **D**e**G**raded 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 of the volume group. The 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 a volume group

3.6.4 User data volume

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

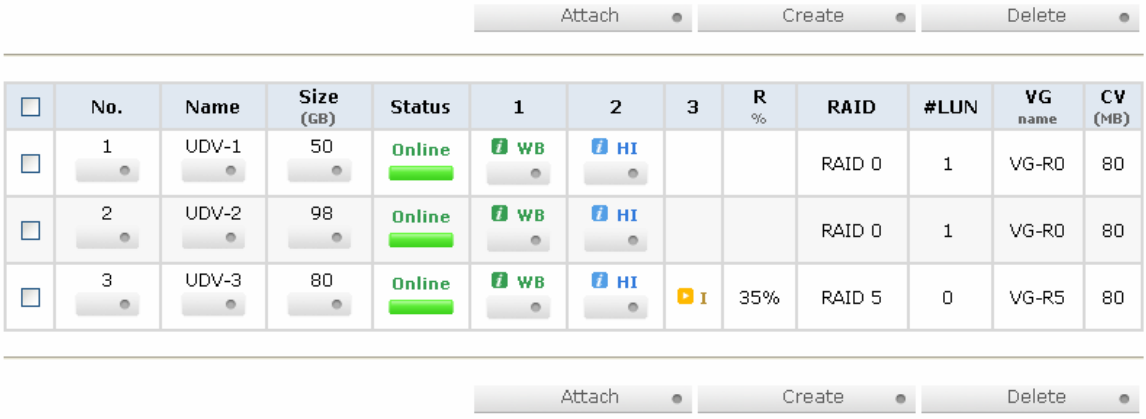


Figure 3.6.4.1

(Figure 3.6.4.1: Create a UDV named “UDV-1”, related to “VG-R0”, size is 50GB, status is online, write back, high priority, related to 1 LUN, with cache volume 80MB,)

- **UDV column description:**

No.	Number of this user data volume. The 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 button in below to the UDV Name is **"Rename"** function.
Size(GB)	Total capacity of this user data volume. The 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. **"RO"** → **R**ead **O**nly. The 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 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. **"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.
VG name	The VG name of the user data volume.
CV (MB)	The cache volume of the user data volume.

- **UDV operations description:**

Attach	Attach to a LUN.
Create	Create a user data volume function.
Delete	Delete a user data volume function.

3.6.5 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.

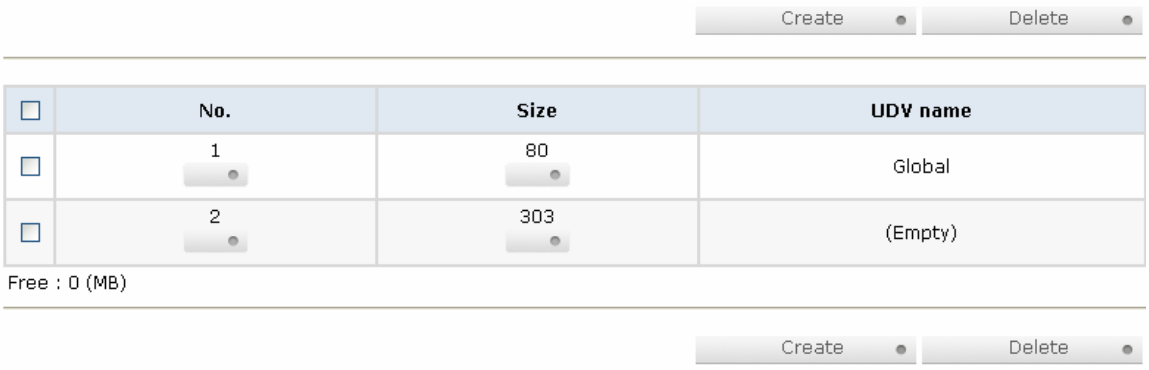


Figure 3.6.5.1

- **CV column description:**

No.	Number of the Cache volume. The button next to the CV No. is **"More Information"** indication**.** It shows the details of the cache volume.
Size(MB)	Total capacity of the cache volume The 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 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**.

3.6.6 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 "Attach". Please refer to Figure 3.6.6.1. **"Host"** must input an initiator node name for access control, or fill-in wildcard **"*",** which means every host can access the volume. Choose LUN number and permission, then click "Confirm". Please refer to Figure 3.6.6.2. Users can assign up to 256 LUNs per system (controller). For host connections, the number of simultaneous hosts are limited to 32 hosts per system (controller). For single user data volumes (UDV), up to three hosts can access one UDV at the same time.

Tips
Three hosts access the same UDV in the same time. The function is depending on the software installed on the client PC (i.e. MetaSAN).

Figure 3.6.6.1

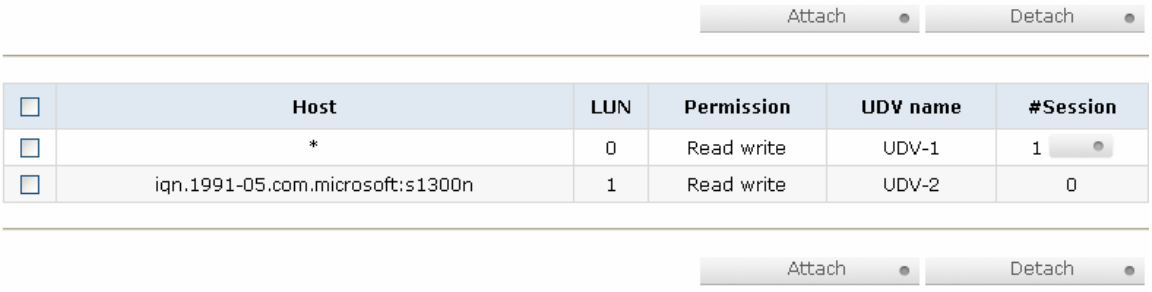


Figure 3.6.6.2

(Figure 3.6.6.2: UDV-01 is attached to LUN 0 with every host can access. UDV-02 is attached to LUN 1 with only initiator note named "iqn.1991-05.com.microsoft:s1300n" can access.)

- **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.

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 "iqn.host1", LUN 1. The other host "iqn.host2" can login because it matches the rule 1.

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

3.6.7 Examples

The followings are examples for creating volumes. Example 1 is to create two UDVs sharing 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 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:

Figure 3.6.7.1

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

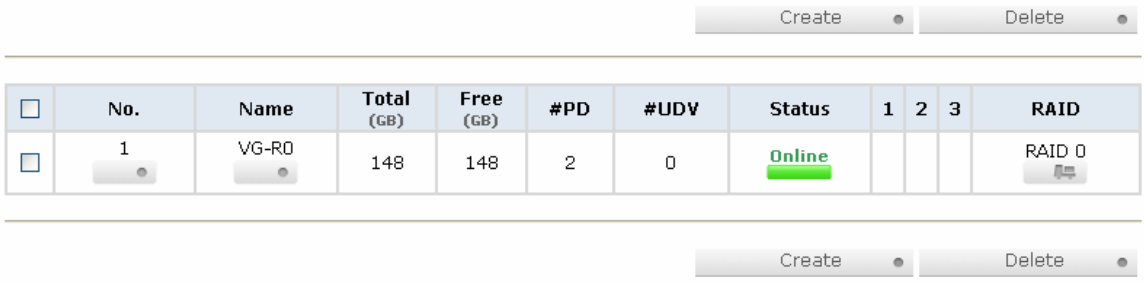


Figure 3.6.7.2

(Figure 3.6.7.2: Creating a RAID 0 with 2 physical disks, named "VG-R0". The total size is 148GB. Because of no related UDV there, free size still remains 148GB.)

Step 2: Create UDV (User Data Volume).

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

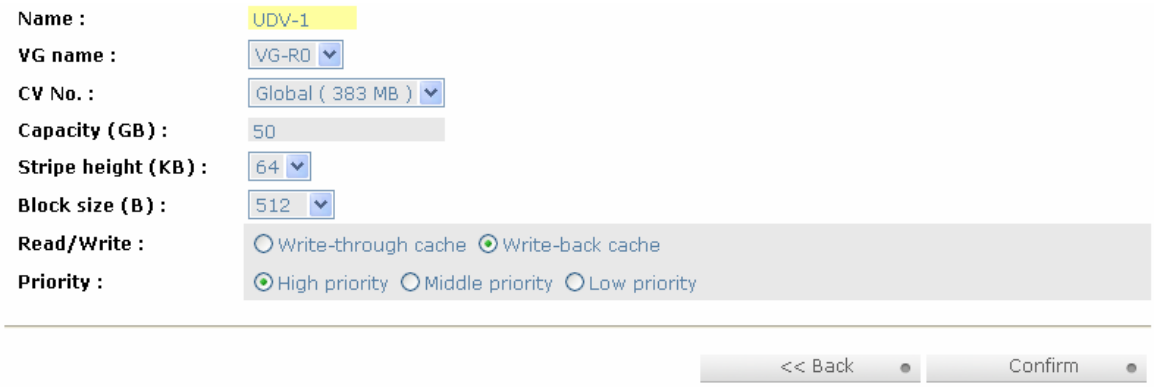


Figure 3.6.7.3

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.

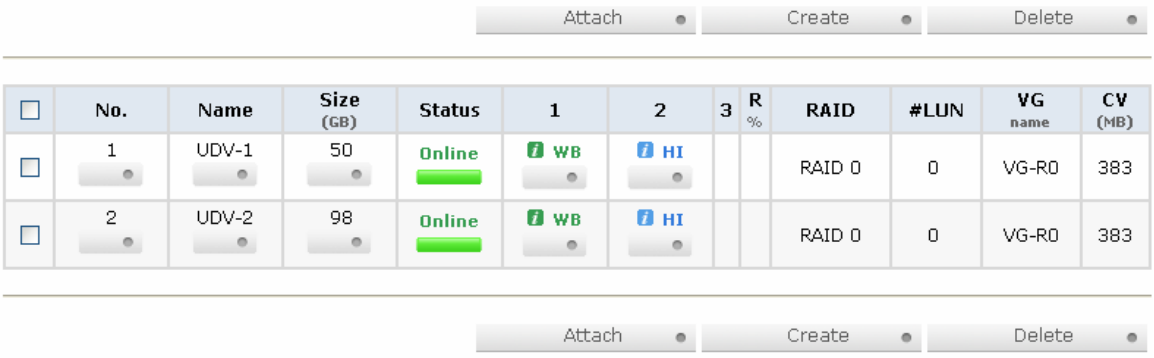


Figure 3.6.7.4

(Figure 3.6.7.4: Create UDVs named "UDV-1" and "UDV-2", related to "VG-R0", the size of "UDV-1" is 50GB, the size of "UDV-2" is 98GB. The status of these UDVs are online, write back, high priority with cache volume 383MB. 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:

Figure 3.6.7.5

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.

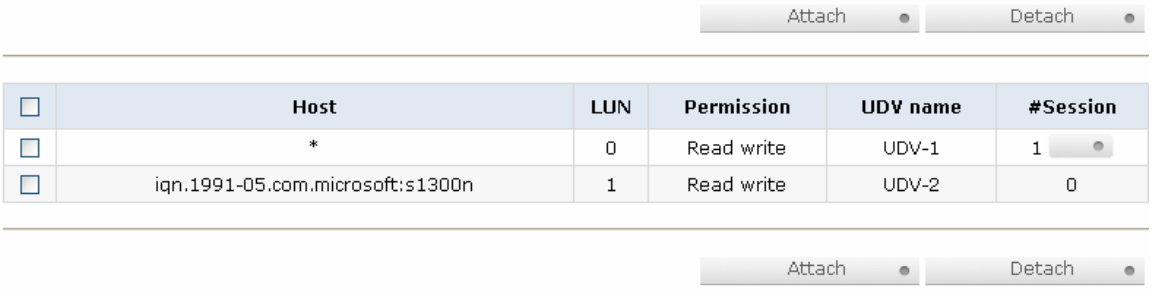


Figure 3.6.7.6

(Figure 3.6.7.6: UDV1 is attached to LUN 0 with any hosts can access. UDV2 is attached to LUN 1 with only initiator note named "iqn.1991-05.com.microsoft:s1300n" can access.)

Tips
The matching rules of access control are from top to down by sequence. Please refer 3.6.6 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.

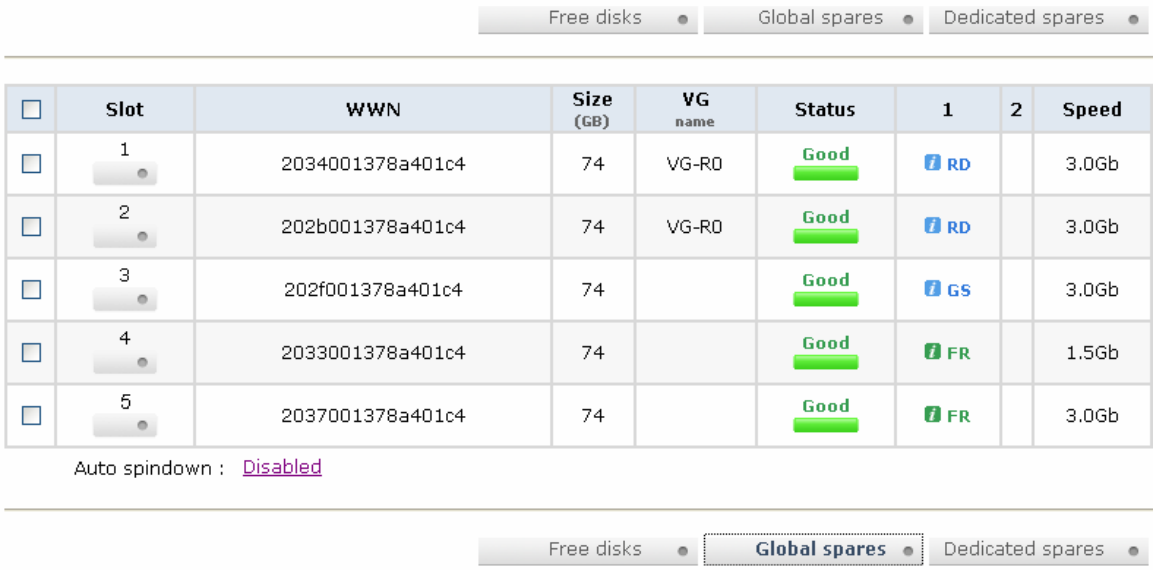


Figure 3.6.7.7

(Figure 3.6.7.7: Slot 5 is set as global spare disk.)

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

Delete UDVs, VG, please follow the steps.

Step 6: Detach LUN from UDV.

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

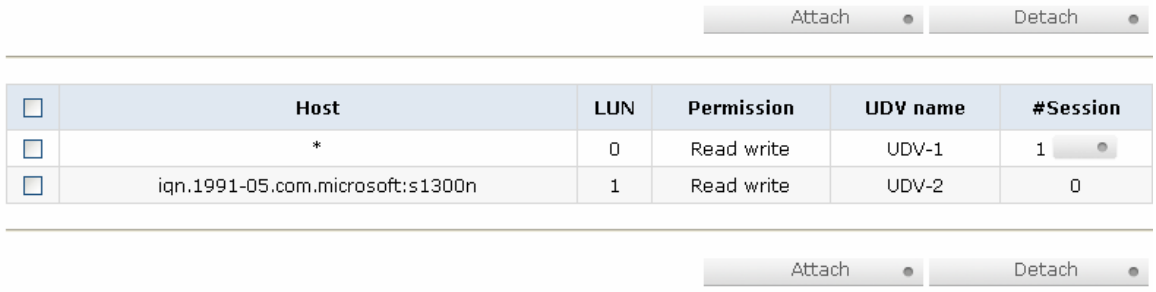


Figure 3.6.7.8

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 UDVs by clicking the checkbox of the row.
3. Click "Delete". There will pop up a confirm page.
4. Choose "OK".
5. Done. Then, the UDVs are 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 "Delete". There will pop up a confirmation 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 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 "Free disks" 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 is associated with one specific CV (cache volume) to execute the data transaction. Each CV could have different cache memory size. If there is no special request in UDVs, it uses global cache volume. Or user can create a dedicated cache for indivifual 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.

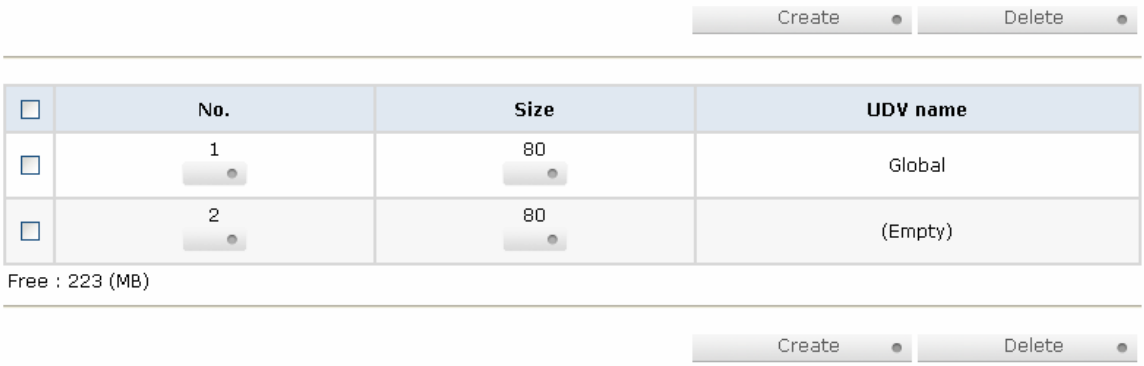


Figure 3.6.7.9

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.

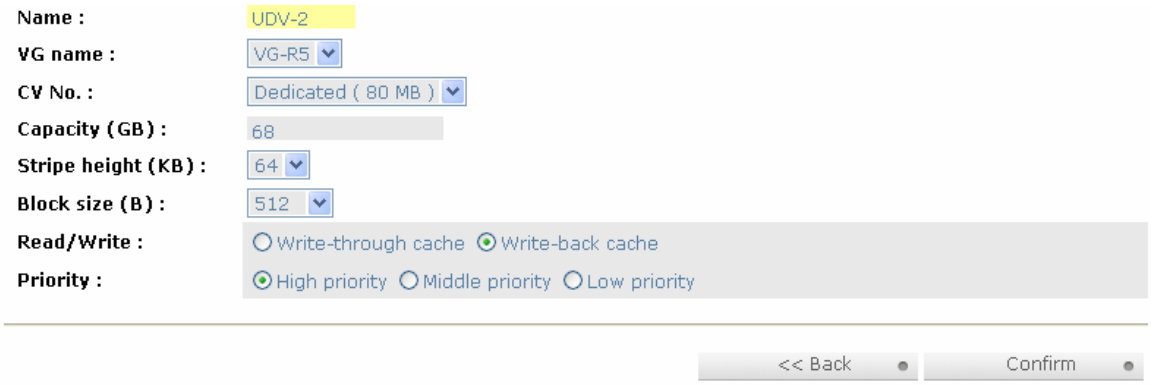


Figure 3.6.7.10

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.

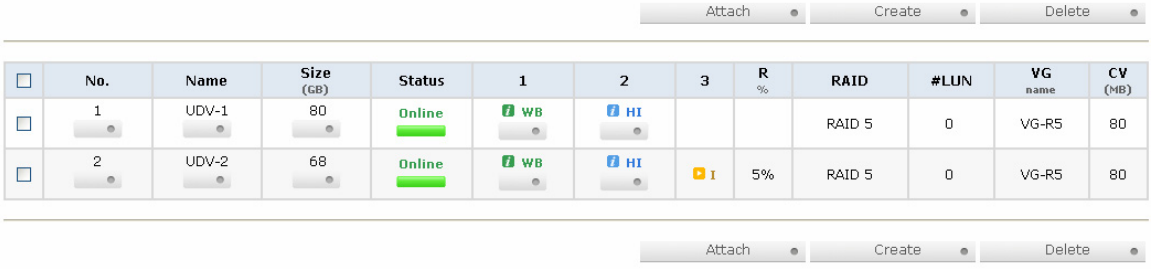


Figure 3.6.7.11

(Figure 3.6.7.11: UDV named "UDV-1" uses global cache volume 80MB, and "UDV-2" uses dedicated cache volume 80MB. "UDV-2" is initialing about 5%.)

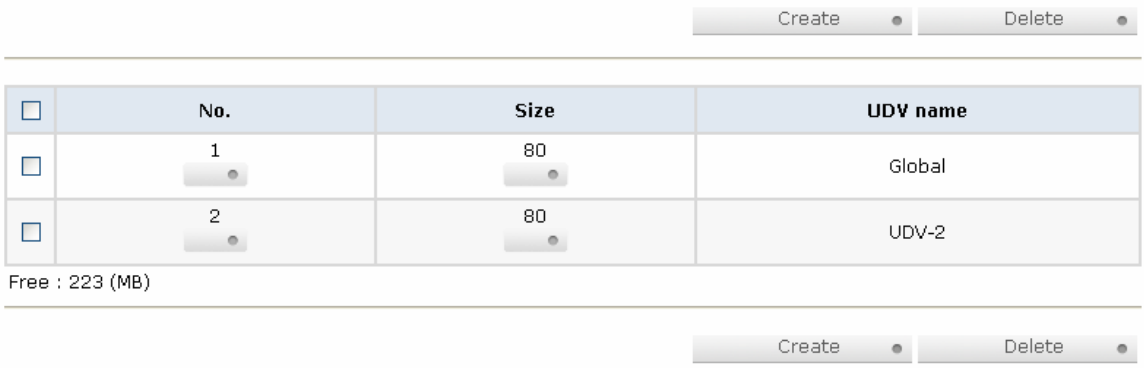


Figure 3.6.7.12

(Figure 3.6.7.12: In "/ Volume config / Cache volume", UDV named "UDV-2" uses dedicated cache volume 80MB.)

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.

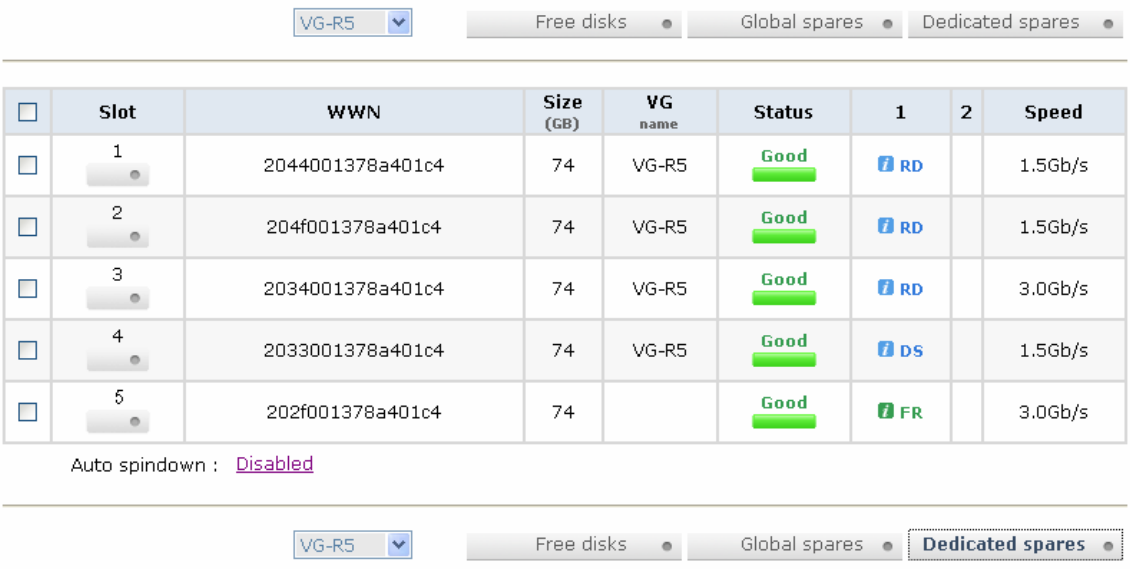


Figure 3.6.7.13

(Figure 3.6.7.13: Slot 4 has been set as dedicated spare disk of VG named "VG-R5".)

Step 6: Done. The PDs can be used as iSCSI 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 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.

3.7 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, 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. Power sensors: 10 seconds, when there are continuous 3 times of error, controller sends ERROR event log.
5. LED status: 10 seconds.

Figure 3.7.1

3.7.1 SES configuration

SES represents **S**CSI **E**nclosure **S**ervices, one of the enclosure management standards. Enter **“SES config”** function can enable or disable the management of SES.

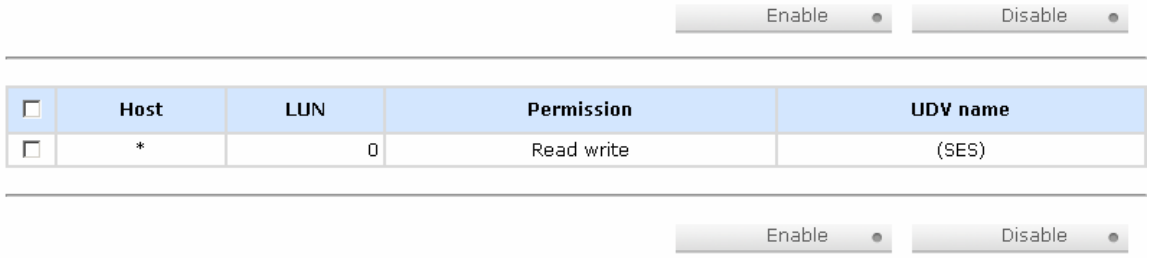


Figure 3.7.1.1

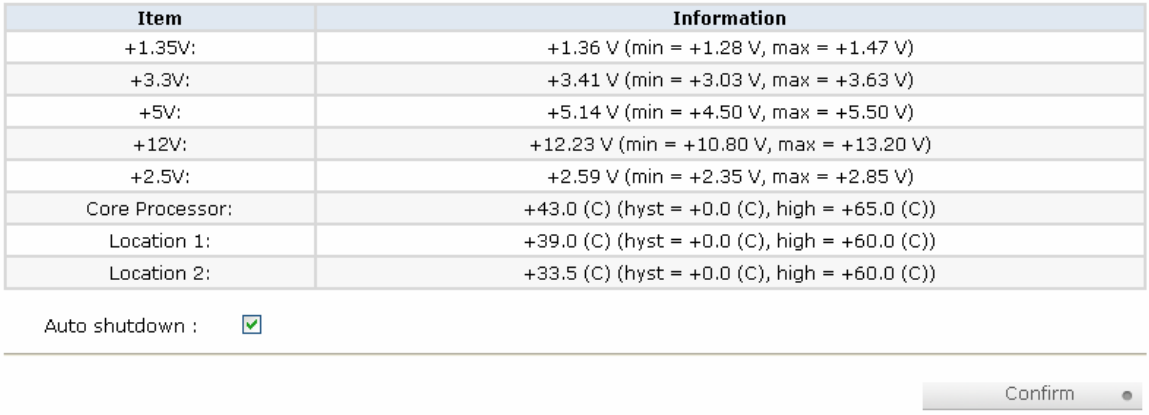
(Figure 3.7.1.1: Enable SES in LUN 0, and can be accessed from every host.)

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

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

3.7.2 Hardware monitor

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



Item	Information
+1.35V:	+1.36 V (min = +1.28 V, max = +1.47 V)
+3.3V:	+3.41 V (min = +3.03 V, max = +3.63 V)
+5V:	+5.14 V (min = +4.50 V, max = +5.50 V)
+12V:	+12.23 V (min = +10.80 V, max = +13.20 V)
+2.5V:	+2.59 V (min = +2.35 V, max = +2.85 V)
Core Processor:	+43.0 (C) (hyst = +0.0 (C), high = +65.0 (C))
Location 1:	+39.0 (C) (hyst = +0.0 (C), high = +60.0 (C))
Location 2:	+33.5 (C) (hyst = +0.0 (C), high = +60.0 (C))

Figure 3.7.2.1

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, i Series use multiple condition judgments for Auto shutdown, below is the detail of when the Auto shutdown will be triggered.

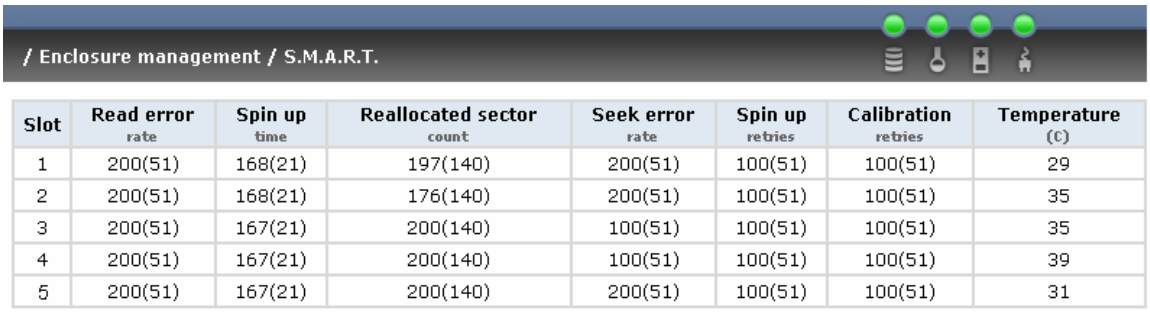
1. The core processor temperature limit is 85℃. i Series will check each sensor every 30 seconds. When sensor is over the high temperature value for continuous 3 minutes, the Auto shutdown will be triggered immediately.
2. If the high temperature situation doesn't last for 3 minutes, i Series will not do auto shutdown.

3.7.3 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 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 drive 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.



Slot	Read error rate	Spin up time	Reallocated sector count	Seek error rate	Spin up retries	Calibration retries	Temperature (C)
1	200(51)	168(21)	197(140)	200(51)	100(51)	100(51)	29
2	200(51)	168(21)	176(140)	200(51)	100(51)	100(51)	35
3	200(51)	167(21)	200(140)	100(51)	100(51)	100(51)	35
4	200(51)	167(21)	200(140)	100(51)	100(51)	100(51)	39
5	200(51)	167(21)	200(140)	200(51)	100(51)	100(51)	31

Figure 3.7.3.1

3.7.4 UPS

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

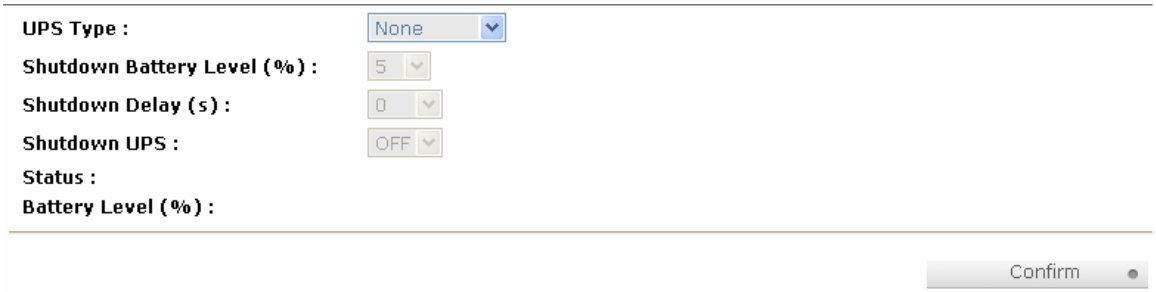


Figure 3.7.4.1

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.

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 shutdown. Setting level to **"0"** will disable UPS function.
Shutdown Delay (s)	If power failure occurred, and the system can not return back to the setting value period, the system will shutdown. Setting delay to **"0"** will disable the function.
Shutdown UPS	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.
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.

3.8 System maintenance

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

Upgrade	Remote upload firmware
Info	System information
Reset to default	Reset to factory default
Config import & export	Import/export configurations
Shutdown	Reboot or shutdown system

Figure 3.8.1

3.8.1 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.

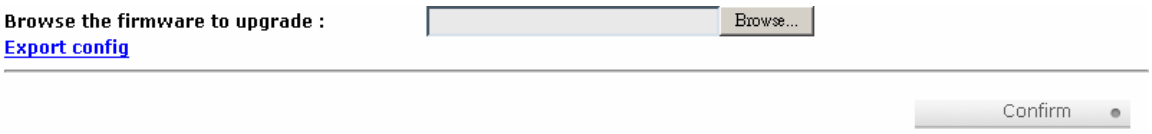


Figure 3.8.1.1

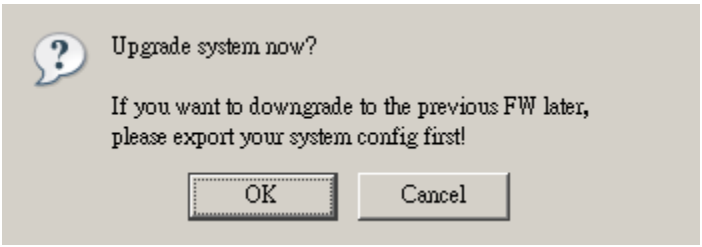


Figure 3.8.1.2

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

Tips
Please contact with www.thecus.com for latest firmware.

3.8.2 Info

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

3.8.3 Reset to default

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

Figure 3.8.3.1

Reset to default sets password to default: **admin**, and set IP address to default as Static IP.

Default IP address: **192.168.1.100 (Static IP)**

Default subnet mask: **255.255.255.0**

Default gateway: **192.168.1.1**

3.8.4 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 confliction/date-deleting 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.

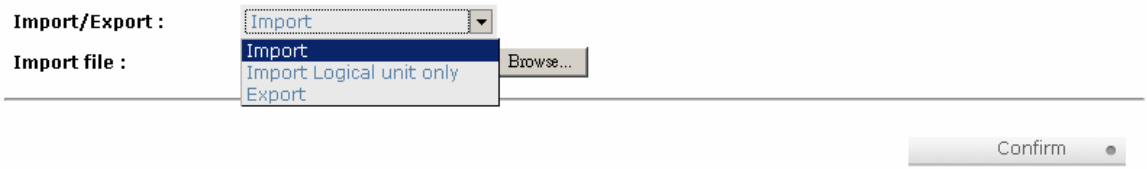


Figure 3.8.4.1

1. **Import:** Import all system configurations including volume config.
2. **Import Logical unit only:** No system and volume configurations.

3. **Export:** Export all configurations to a file.

> **Caution**
> Import function will import all system configurations including volume config, the user's current data will be cleared.

3.8.5 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 3.8.5.1

3.9 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 degraded mode, the system will search/detect spare disk to **rebuild** the degraded VG to a complete one. It will detect dedicated spare disk as rebuild disk first, then global spare disk.

i Series 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, i Series 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, i Series 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 i Series 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. **Thecus** 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, i Series starts Auto-Rebuild immediately. And in RAID 6, if there is another disk failure happening during the time of rebuilding, i Series 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 degraded 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.

RAID 0	Disk striping. No protection of data. VG fails if any hard drive fails or unplugs.
RAID 1	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.
N-way mirror	Extension to RAID 1 level. It has N copies of the disk. N-way mirror allows N-1 hard drives fails or unplugging.
RAID 3	Striping with parity on the dedicated disk. RAID 3 allows one hard drive fail or unplugging.
RAID 5	Striping with interspersed parity over the member disks. RAID 5 allows one hard drive fail or unplugging.
RAID 6	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.
RAID 0+1	Mirroring of the member RAID 0 volumes. RAID 0+1 allows two hard drives fails or unplugging, but at the same array.
RAID 10	Striping over the member RAID 1 volumes. RAID 10 allows two hard drives fails or unplugging, but at different arrays.
JBOD	The abbreviation of **"J**ust a **B**unch **O**f **D**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 " RAID 5 ". There will be a pup-up which 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. 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 " Next >> ".
5. Finally a confirmation page shows detail RAID info. If no problem, click " Confirm " 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 3" 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%"**.

Figure 4.2.1

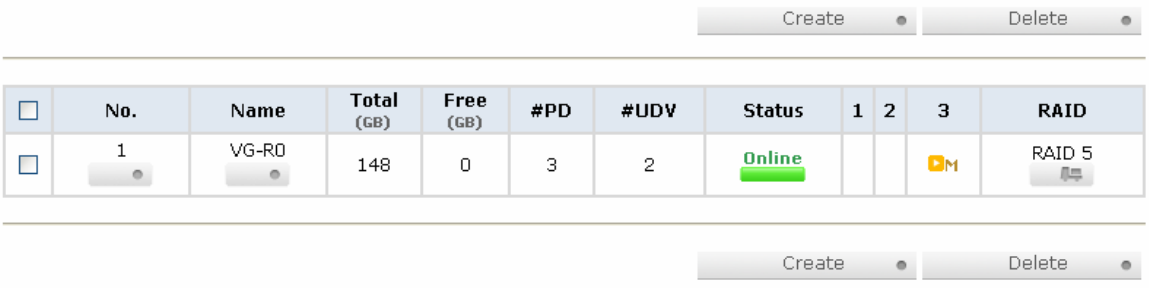


Figure 4.2.2

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

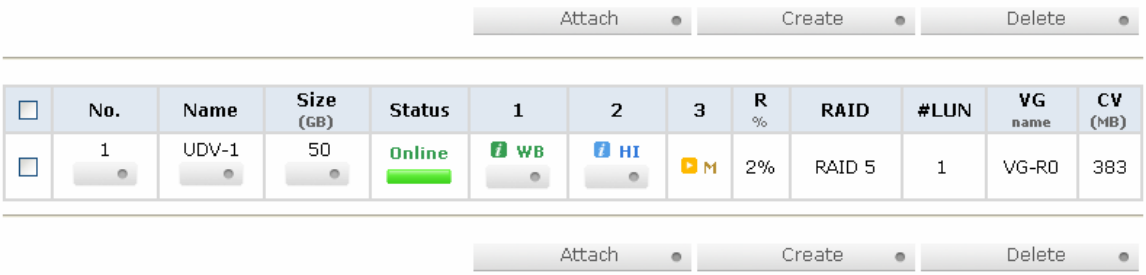


Figure 4.2.3

(Figure 4.2.3: A RAID 0 migrates to RAID 5, complete percentage is 2%.)

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 " Confirm " 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 4.3.1: Extend UDV-R0 from 80GB to 90GB.)

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

Caution
UDV Extension cannot be executed during rebuild or migration.

4.4 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**

  i Series RAM Spec: 184pins, DDR333(PC2700), Reg.(register) or UB(Unbufferred), 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
Trenscend	256MB DDR-333 (ECC, Reg.) with PSC
Trenscend	512MB DDR-333 (ECC, Reg.) with Winbond
Trenscend	1GB DDR-333 (ECC, Reg.) with Micron
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

- **iSCSI Initiator (Software)**

OS	Software/Release Number
Microsoft Windows	Microsoft iSCSI Software Initiator Version 2.04 System Requirements: 1. Windows XP Professional with SP2 2. Windows 2000 Server with SP4 3. Windows Server 2003 with SP1 4. Windows Server 2003 R2
Linux	The iSCSI Initiators are different for different Linux Kernels. 1. For Red Hat Enterprise Linux 3 (Kernel 2.4), install linux-iscsi-3.6.3.tar 2. For Red Hat Enterprise Linux 4 (Kernel 2.6), use the build-in iSCSI initiator iscsi-initiator-utils-4.0.3.0-4 in kernel 2.6.9 3. For Red Hat Enterprise Linux 5 (Kernel 2.6), use the build-in iSCSI initiator iscsi-initiator-utils-6.2.0.695-0.7.e15 in kernel 2.6.18
Mac	ATTO XTEND 2.0x SAN / Mac iSCSI Initiator System Requirements: 1. Mac® OS X v10.3.5 or later

- **iSCSI HBA card**

Vendor	Model
Adaptec	ASC-7211C (PCI-X, Gigabit, 1 port, TCP/IP offload, iSCSI offload)
HP	NC380T (PCI-Express, Gigabit, 2 ports, TCP/IP offload, iSCSI offload)
QLogic	QLA4010C (PCI-X, Gigabit, 1 port, TCP/IP offload, iSCSI offload)
QLogic	QLA4052C (PCI-X, Gigabit, 2 ports, TCP/IP offload, iSCSI offload)

- **NIC**

Vendor	Model
D-Link	DGE-530T (PCI, Gigabit, 1 port)
HP	NC7170 (PCI-X, Gigabit, 2 ports)
HP	NC360T (PCI-Express, Gigabit, 2 ports, TCP/IP offload)
IBM	NetXtreme 1000 T (73P4201) (PCI-X, Gigabit, 2 ports, TCP/IP offload)
Intel	PWLA8490MT (PCI-X, Gigabit, 1 port, TCP/IP offload)
Intel	PWLA8492MT (PCI-X, Gigabit, 2 ports, TCP/IP offload)
Intel	PWLA8494MT (PCI-X, Gigabit, 4 ports, TCP/IP offload)

- **GbE Switch**

Vendor	Model

Dell	PowerConnect 5324
Dell	PowerConnect 2724
Dell	PowerConnect 2708
HP	ProCurve 1800-24G
D-Link	DGS-3024

- **Hard drive**

i Series 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 3Gb/s, 16M, NCQ
Seagate	NL35, ST3400633NS, 400G, 7200RPM, SATA 3Gb/s, 16M
Seagate	NL35, ST3500641NS, 500G, 7200RPM, SATA 3Gb/s, 16M
Westem Digital	Caviar SE, WD800JD, 80GB, 7200RPM, SATA, 8M
Westem Digital	Caviar SE, WD1600JD, 160GB, 7200RPM, SATA, 8M
Westem Digital	Raptor, WD360GD, 36.7GB, 10000RPM, SATA, 8M
Westem Digital	Caviar RE2, WD4000YR, 400GB, 7200RPM, SATA, 16M, NCQ
Westem Digital	Caviar RE2, WD4000YS, 400GB, 7200RPM, SATA, 16M, NCQ

B. Event notifications

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

Level	Type	Description
Info	Disk inserted	Info: Disk <slot> is inserted.
Info	Disk removed	Info: Disk <slot> is removed.
Warning	S.M.A.R.T. threshold exceed condition	Warning: Disk <slot> S.M.A.R.T. threshold exceed condition occurred for attribute of 1. read error rate 2. spin up time 3. reallocated sector count 4. seek error rate 5. spin up retries 6. calibration retries
Warning	S.M.A.R.T. information	Warning: Disk <slot>: Failure to get S.M.A.R.T information

- **Physical HW events**

Level	Type	Description
Warning	ECC error	Warning: Single-bit ECC error is detected.
Error	ECC error	Error: Multi-bit ECC error is detected.
Info	ECC DIMM Installed	Info: ECC Memory is installed.
Info	Non-ECC installed	Info: Non-ECC Memory is installed.
Error	Host chip failure	Error: Host channel chip failed.
Error	Drive chip failure	Error: Drive channel chip failed.
Warning	Ethernet port failure	Warning: GUI Ethernet port failed.

- **HDD IO events**

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

- **SES events**

Level	Type	Description

Info	SES load conf. OK	Info: SES configuration has been loaded.
Warning	SES Load Conf. Failure	Error: Failed to load SES configuration. The SES device is disabled.
Info	SES is disabled	Info: The SES device is disabled.
Info	SES is enabled	Info: The SES device is enabled

- **Environmental events**

Level	Type	Description
Info	Admin Login OK	Info: Admin login from <IP or serial console> via <Web UI or Console UI>.
Info	Admin Logout OK	Info: Admin logout from <IP or serial console> via <Web UI or Console UI>.
Info	iSCSI data port login	Info: iSCSI login from <IQN> (<IP:Port Number>) succeeds.
Warning	iSCSI data port login reject	Warning: iSCSI login from <IQN> (<IP:Port Number>) was rejected, reason of 1. initiator error 2. authentication failure 3. authorization failure 4. target not found 5. unsupported version 6. too many connections 7. missing parameter 8. session does not exist 9. target error 10. out of resources 11. unknown
Error	Thermal critical	Error: System Overheated!!! The system will do the auto shutdown immediately.
Warning	Thermal warning	Warning: System temperature is a little bit higher.
Error	Voltage critical	Error: System voltages failed!!! The system will do the auto shutdown immediately
Warning	Voltage warning	Warning: System voltage is a little bit higher/lower.
Info	PSU restore	Info: Power <number> is restored to work.
Error	PSU Fail	Error: Power <number> is out of work.
Info	Fan restore	Info: Fan <number> is restore to work.
Error	Fan Fail	Error: Fan <number> is out of work.
Error	Fan non-exist	Error: System cooling fan is not installed.
Error	AC Loss	Error: AC loss for the system is detected.
Info	UPS Detection OK	Info: UPS detection succeed
Warning	UPS Detection Fail	Warning: UPS detection failed
Error	AC Loss	Error: AC loss for the system is detected
Error	UPS power low	Error: UPS Power Low!!! The system will do the auto shutdown immediately.
Info	Mgmt Lan Port Active	Info: Management LAN Port is active.
Warning	Mgmt Lan Port Failed	Warning: Fail to manage the system via the LAN Port.
Info	RTC Device OK	Info: RTC device is active.

Warning	RTC Access Failed	Warning: Fail to access RTC device
Info	Reset Password	Info: Reset Admin Password to default.
Info	Reset IP	Info: Reset network settings set to default.

- **System config events**

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

- **System maintenance events**

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

- **LVM events**

Level	Type	Description
Info	VG Created OK	Info: VG <name> has been created.

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

	read/write error	<read | write> failed.
Error	PD read/write error	Error: PD <#> lba <#> length <#> <read | write> error.
Error	UDV recoverable read/write error	Error: UDV <name> stripe <#> PD <#> lba <#> length <#> <read | write> recoverable
Error	UDV unrecoverable read/write error	Error: UDV <#> stripe <#> PD <#> lba <#> length <#> <read | write> unrecoverable
Info	UDV stripe rewrite start/fail/succeed	Info: UDV <name> stripe <#> rewrite column bitmap <BITMAP> <started | failed | finished>.

C. Microsoft iSCSI Initiator

Here is the step by step to setup Microsoft iSCSI Initiator. Please visit Microsoft website for latest iSCSI initiator. The following setup may not use the latest Microsoft iSCSI initiator.

1. Run Microsoft iSCSI Initiator version 2.03. Please see Figure C.1.
2. Click **"Discovery"**.

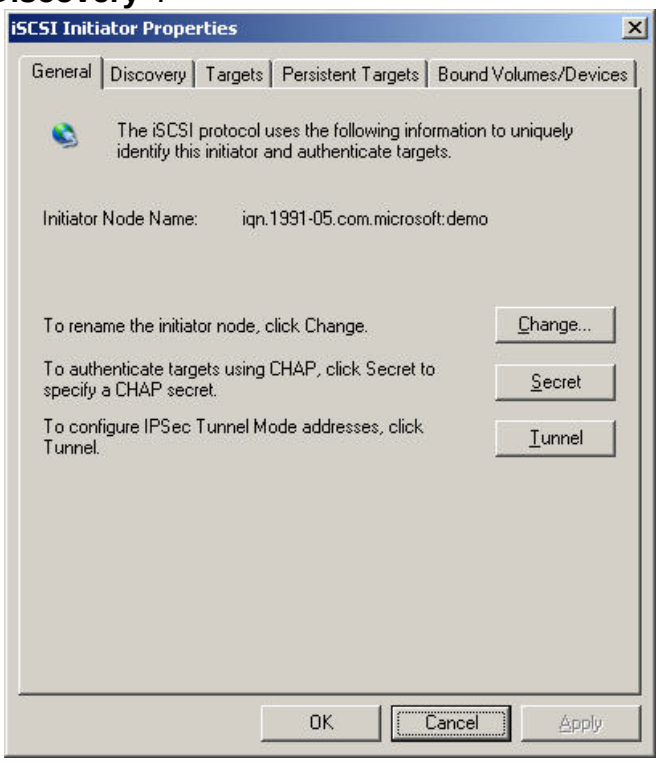


Figure C.1

3. Click **"Add"**. Input IP address or DNS name of iSCSI storage device. Please see Figure C.2.

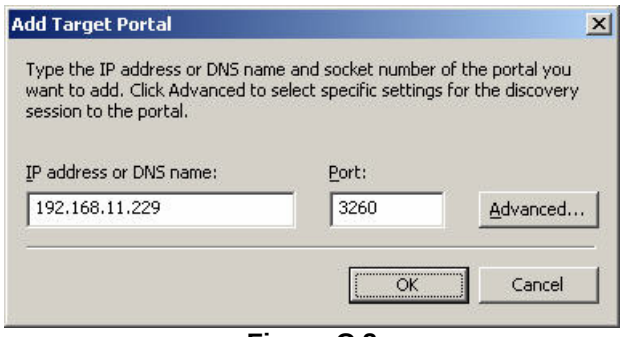


Figure C.2

4. Click **"OK"**. Please see Figure C.3.

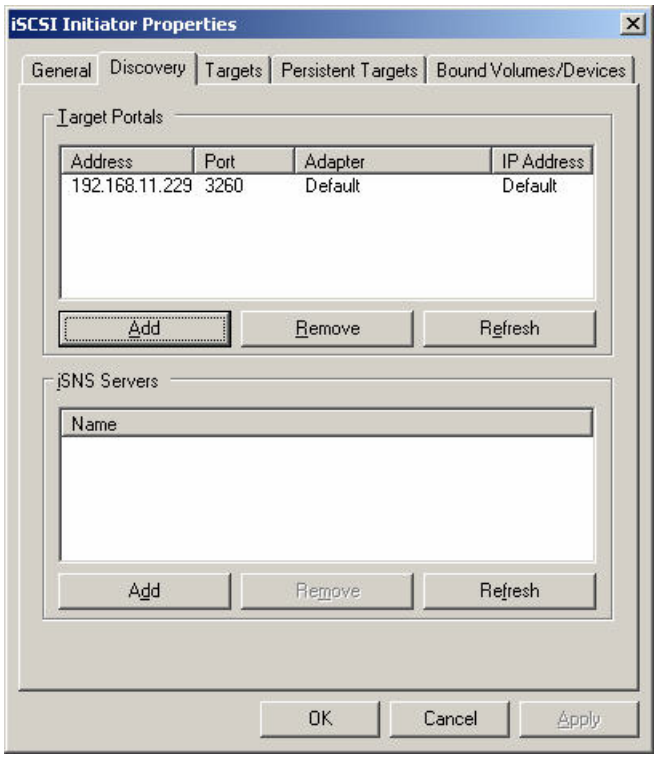


Figure C.3

5. Click **"Targets"**. Please see Figure C.4.

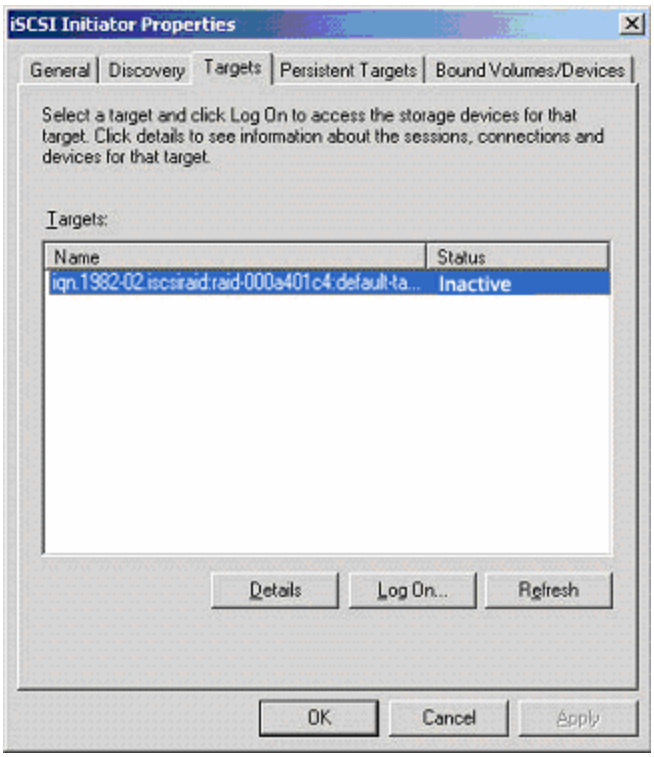


Figure C.4

6. Click **"Log On"**. Please see Figure C.5. Check **"Enable multi-path"** if running MPIO.

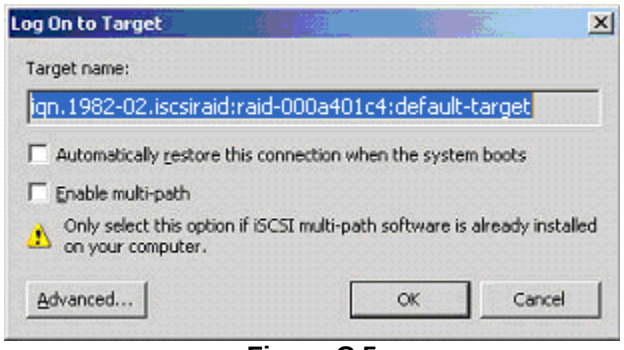


Figure C.5

7. Click **"Advance…"** if CHAP information is needed. Please see Figure C.6.

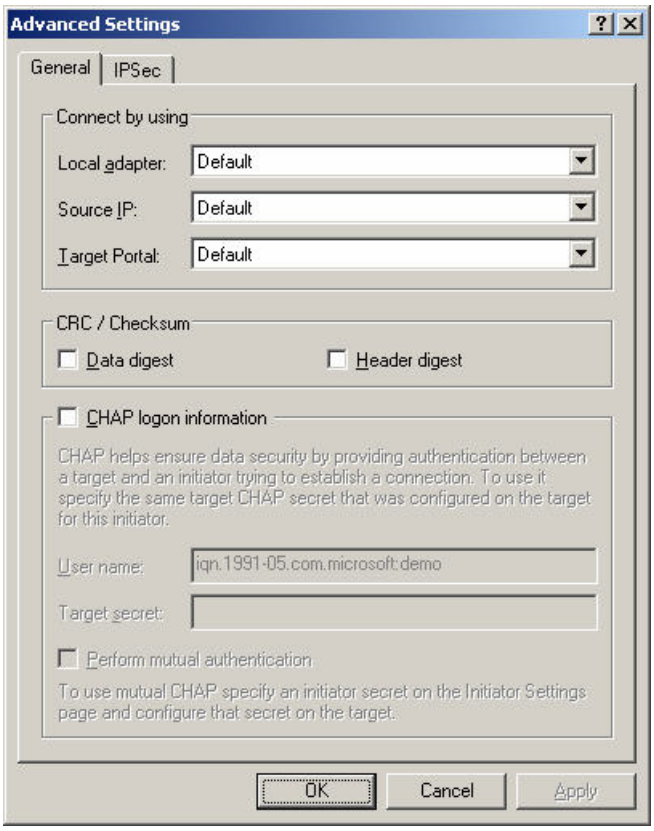


Figure C.6

8. Click **"OK"**. The status would be "Connected". Please see Figure C.7

9. Done, it can connect to an iSCSI disk.

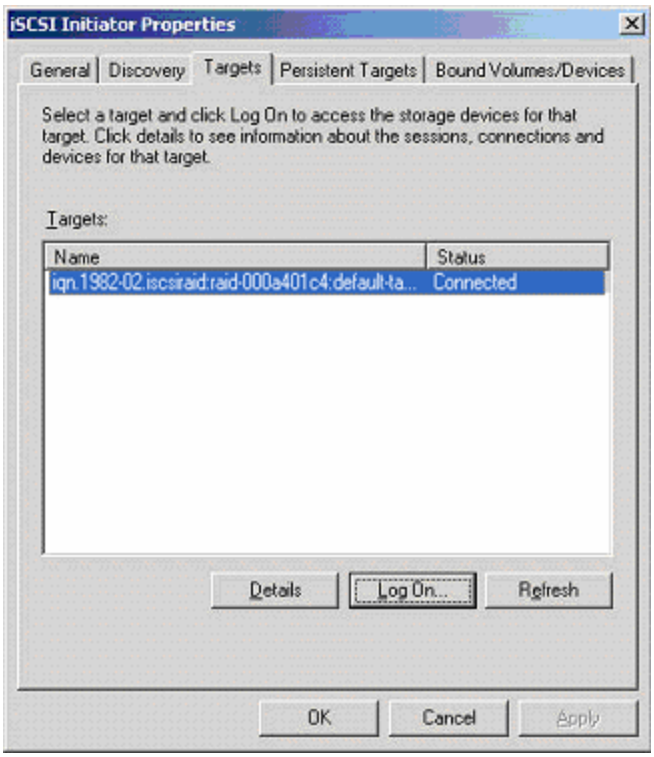


Figure C.7

The following procedure is to log off iSCSI device.

1. Click **“Details”**. Please see Figure C.8.

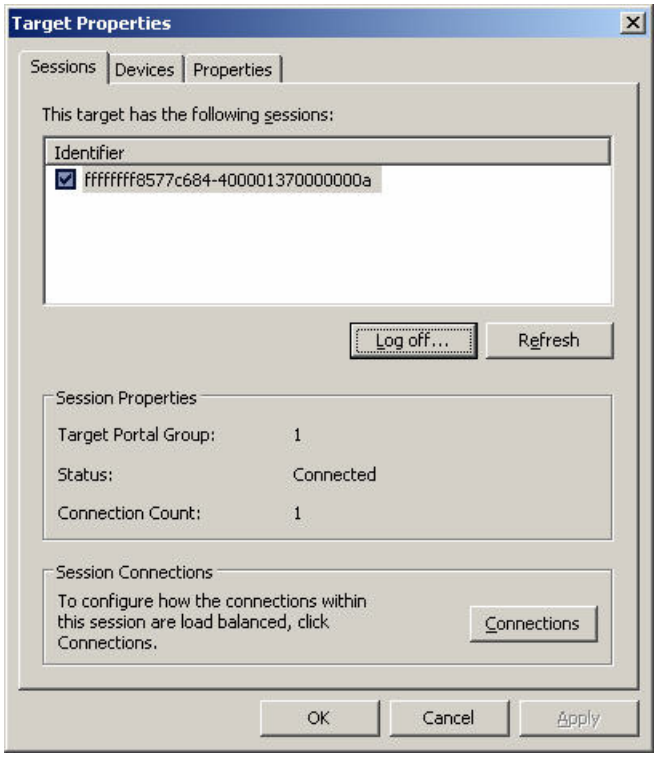


Figure C.8

2. Check the Identifier, which will be deleted.
3. Click **“Log off”**.
4. Done, the iSCSI device log off successfully.

D. MPIO and MC/S setup instructions

Here is the step by step to setup MPIO. There are 2 kinds of scenarios for MPIO. Please see Figure D.1. Thecus suggests using scenario 2 for better performance.

Known issues

Microsoft MPIO is not supported on Windows XP or Windows 2000 Professional. Using Windows Server 2003 or Windows 2000 server to run MPIO

- Network diagram of MPIO.

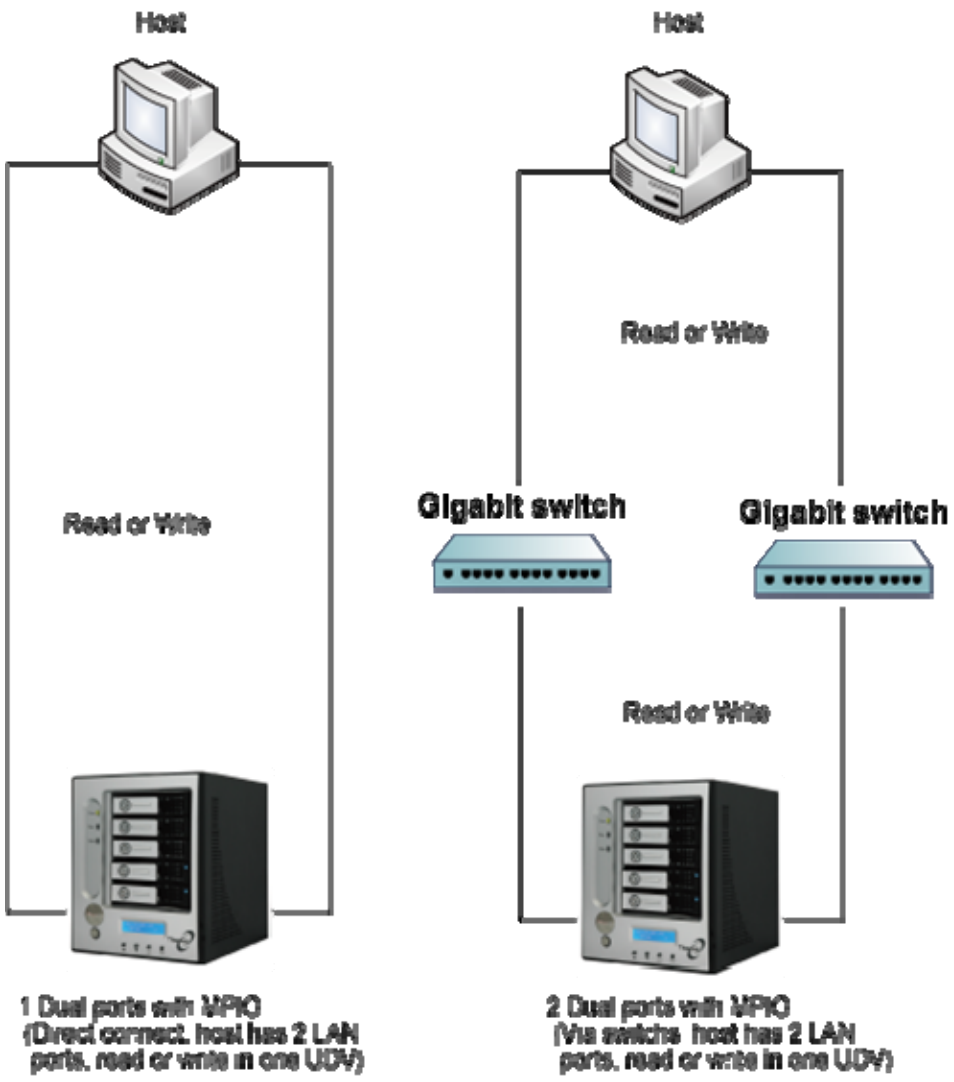


Figure D.1

The setup instructions are in the following figures.

1. Create a VG .

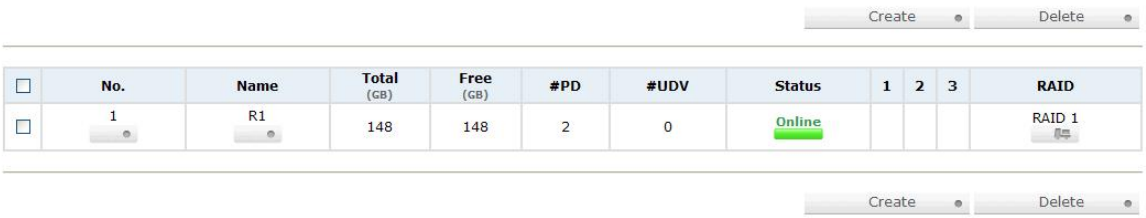


Figure D.2

2. Create a UDV.

Figure D.3

3. Run Microsoft iSCSI initiator and check the Initiator Node Name.

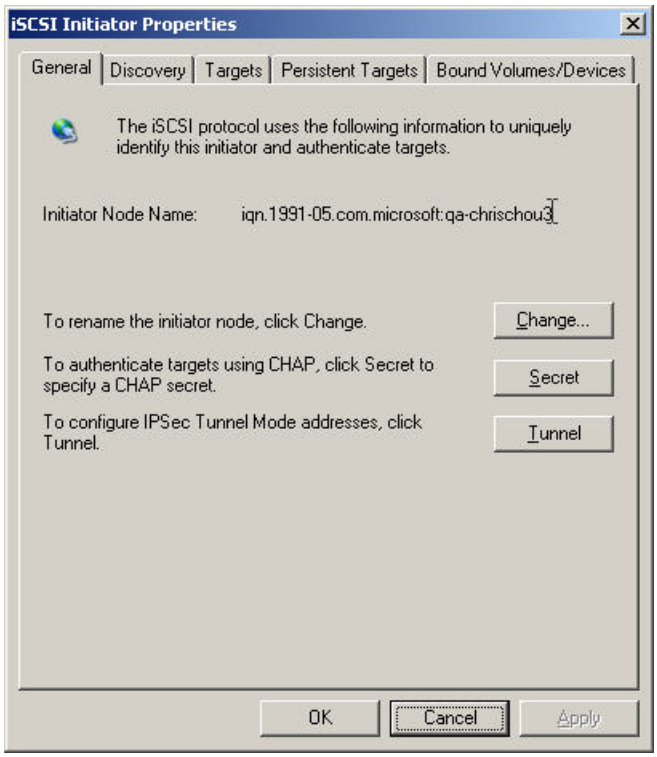


Figure D.4

4. Attaching LUN to UDV_1 UDV. Input the Initiator Node Name in Host field.

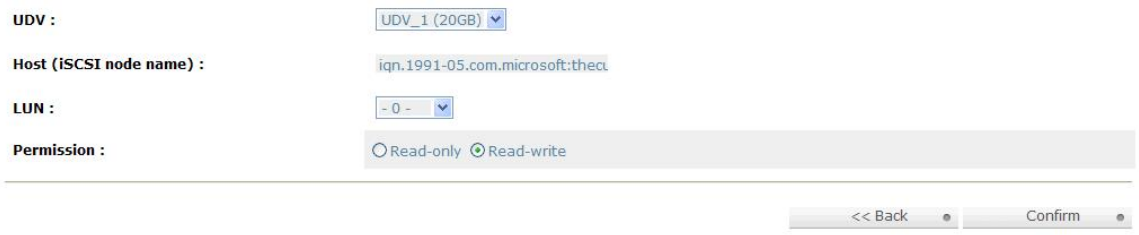


Figure D.5

5. The volume config setting is done.

Figure D.6

6. Check iSCSI settings. The IP address of iSCSI data port 1 is 192.168.11.229, port 2 is 192.168.12.229 for example.

Figure D.7

7. Add Target Portals on Microsoft iSCSI initiator.

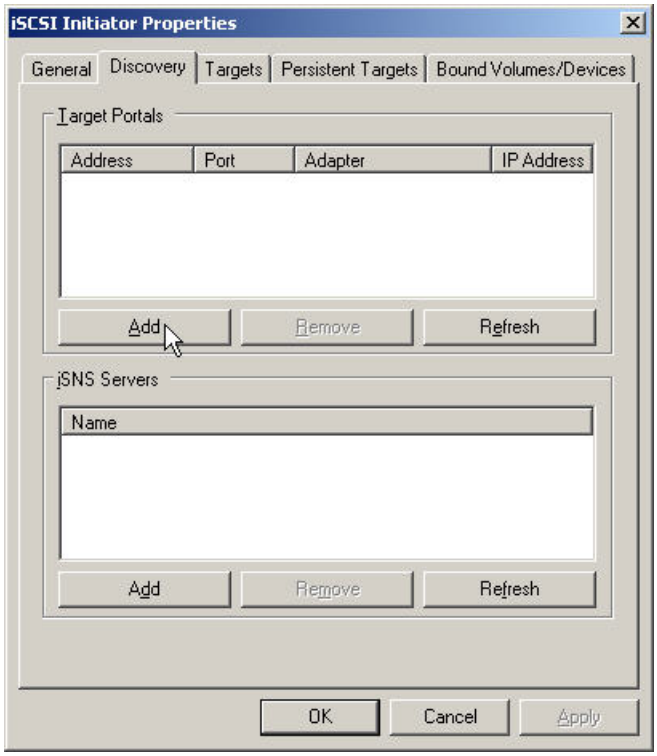


Figure D.8

8. Input the IP address of iSCSI data port 1 (192.168.11.229 as mentioned in previous page).

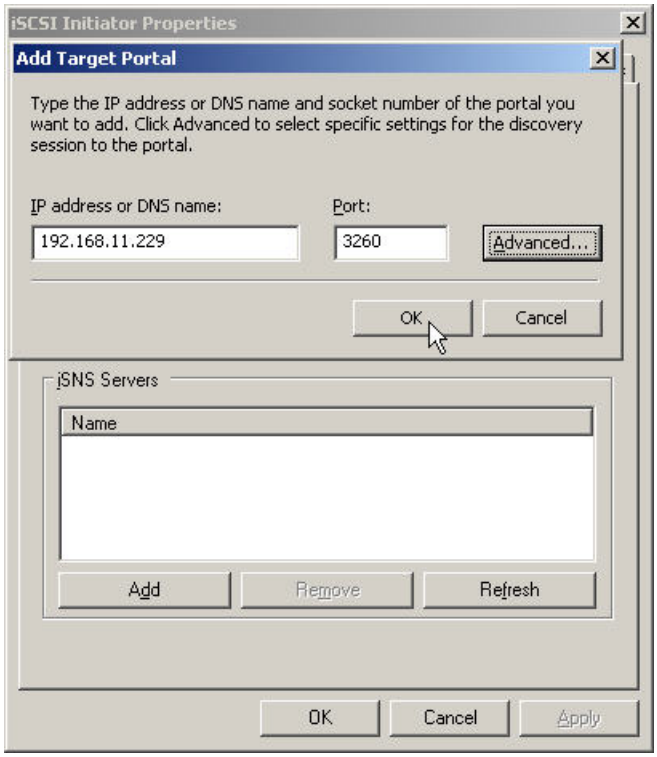


Figure D.9

9. Add second Target Portals on Microsoft iSCSI initiator.

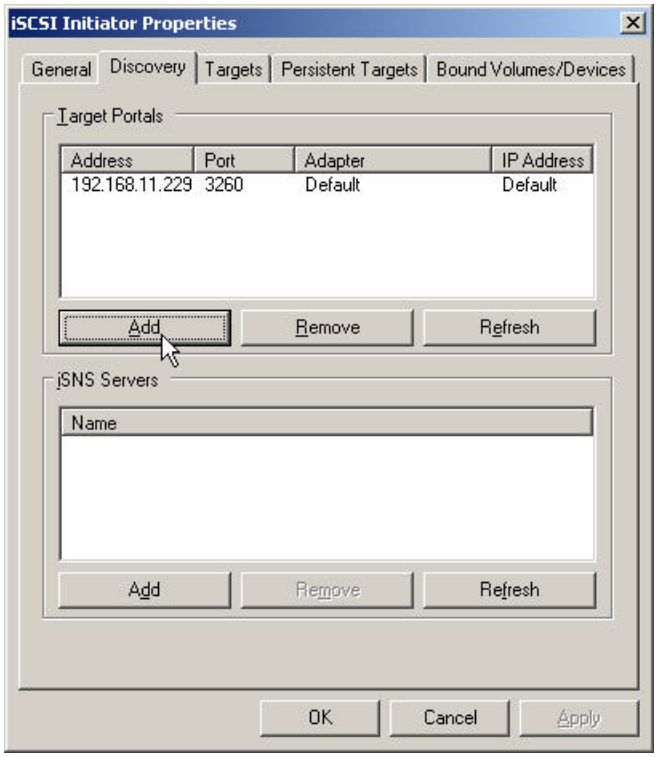


Figure D.10

10. Input the IP address of iSCSI data port 2 (192.168.12.229 as mentioned in previous page).

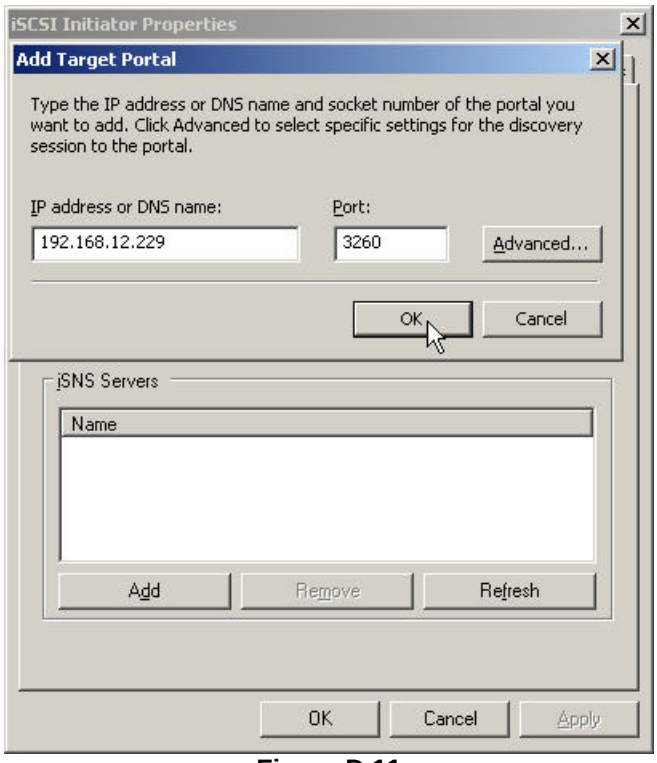


Figure D.11

11. The initiator setting is done.

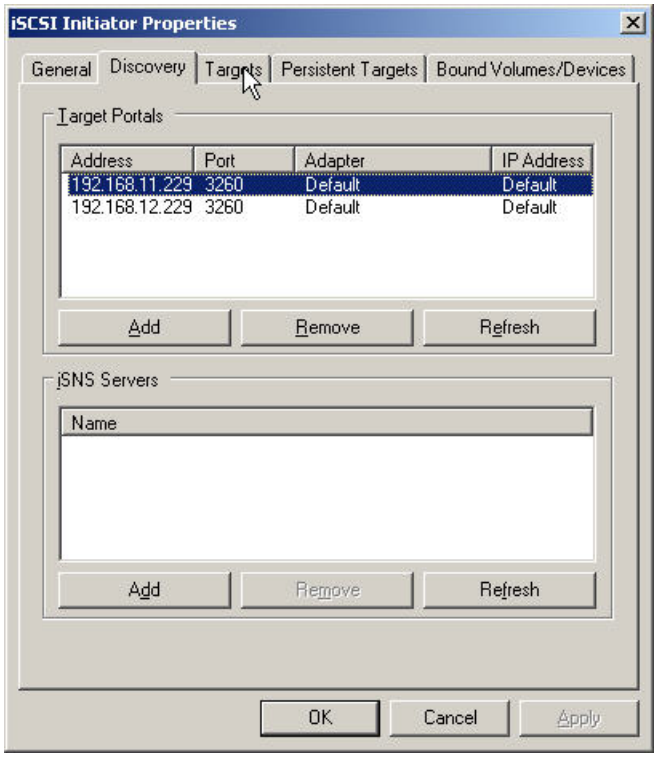


Figure D.12

12. Log on.

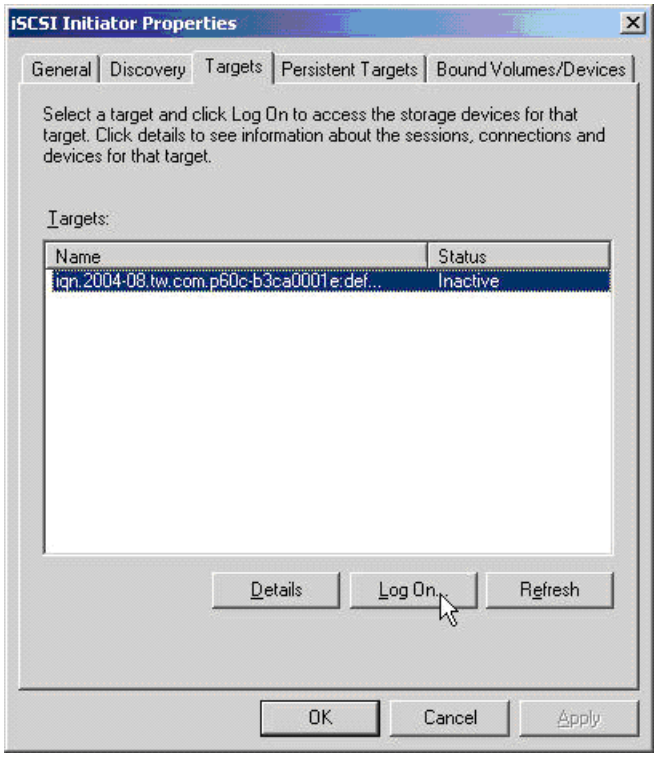


Figure D.13

13. Enable **“Enable multi-path”** checkbox. Then click **“Advanced”**.

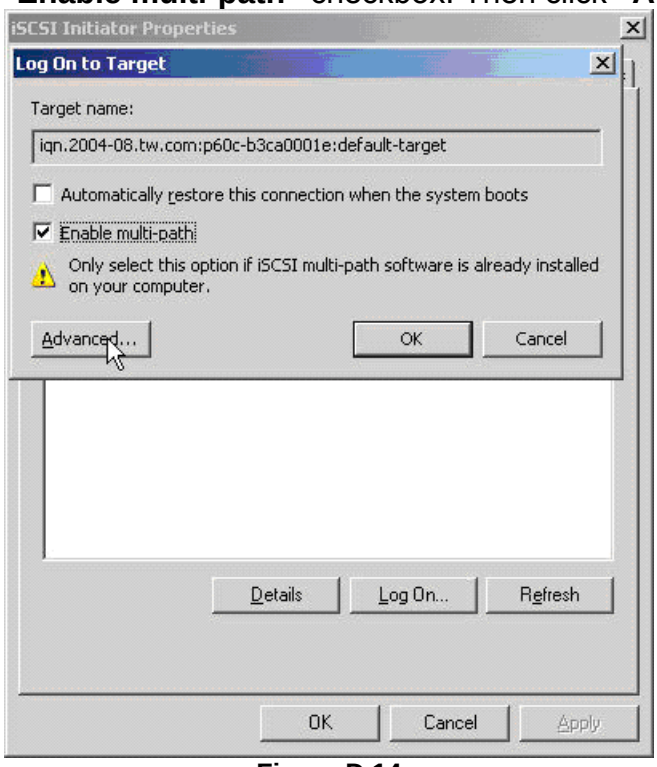


Figure D.14

14. Select Target Portal to iSCSI data port 1 (192.168.11.229). Then click **“OK”**

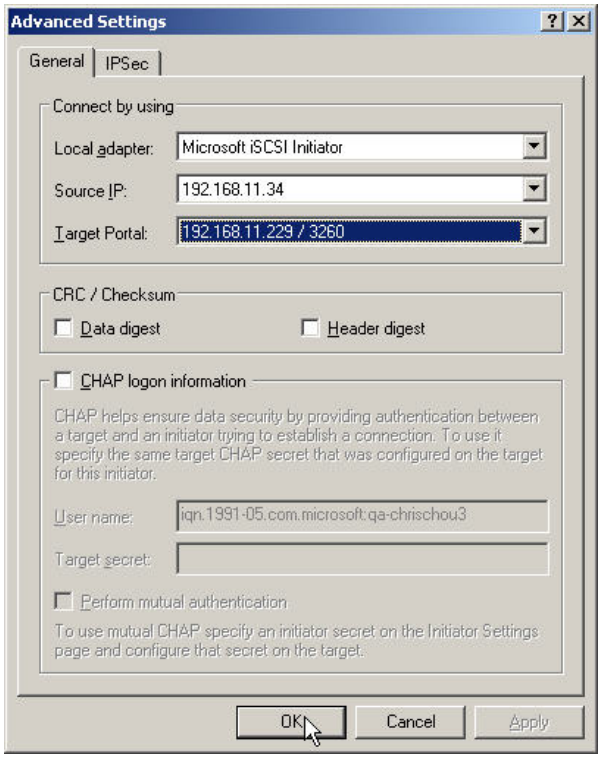


Figure D.15

15. Log on **"Enable multi-path"** again.

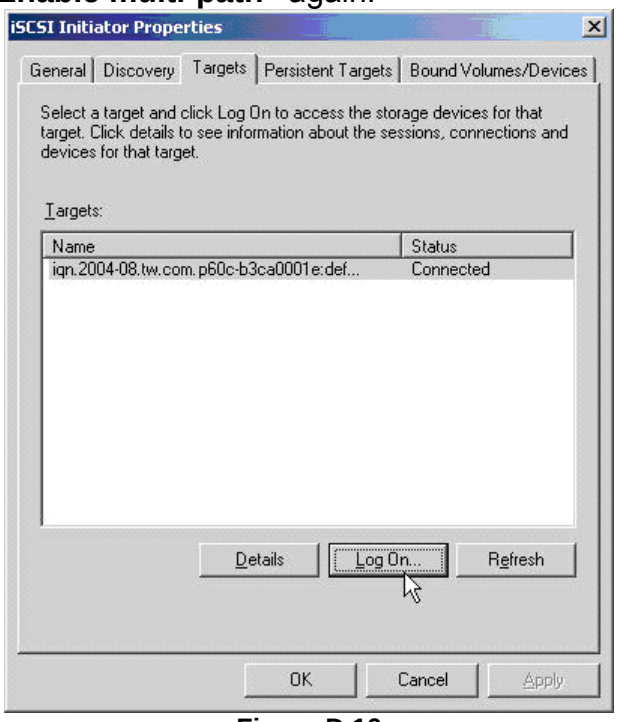


Figure D.16

16. Enable **"Enable multi-path"** checkbox. Then click **"Advanced…"**.

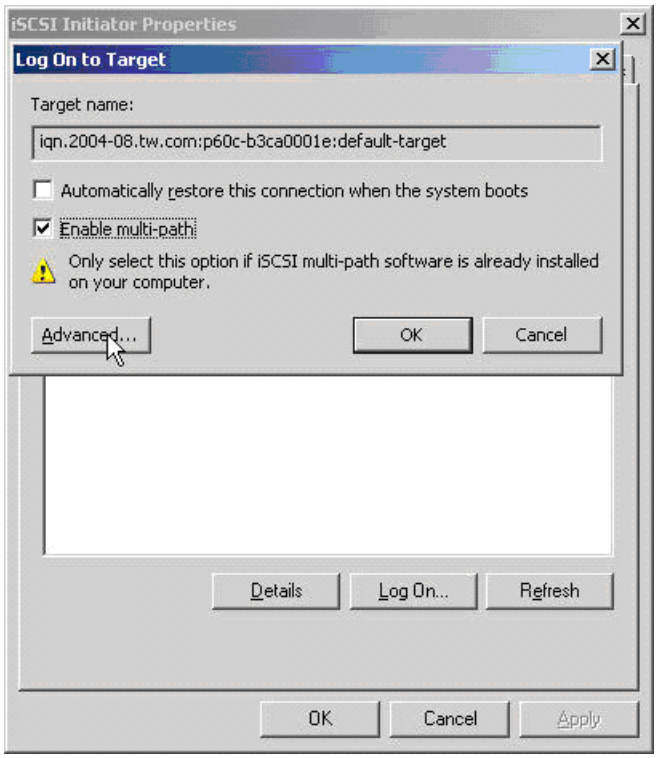


Figure D.17

17. Select Target Portal to iSCSI data port 2 (192.168.12.229). Then select **“OK”**

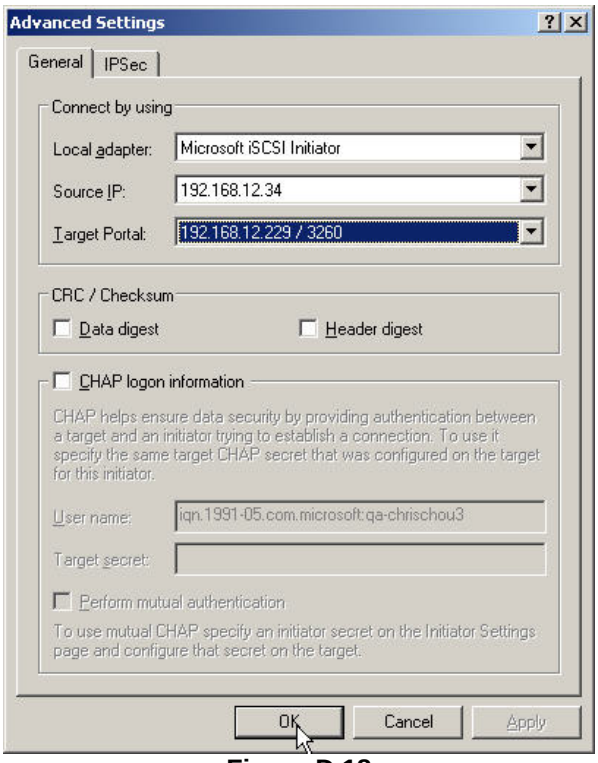


Figure D.18

18. iSCSI device is connected. Click **“Details”**.

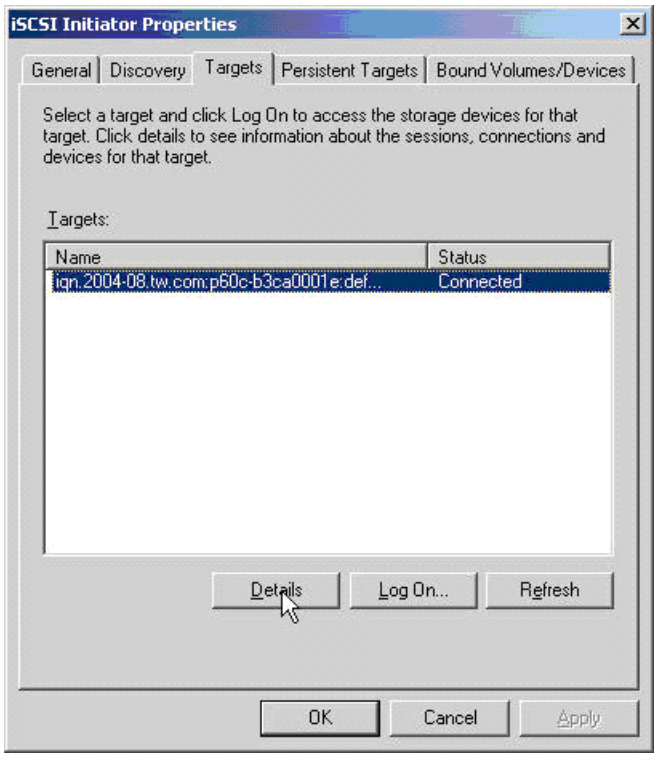


Figure D.19

19. Click **"Device"** tab, then click **"Advanced"**.

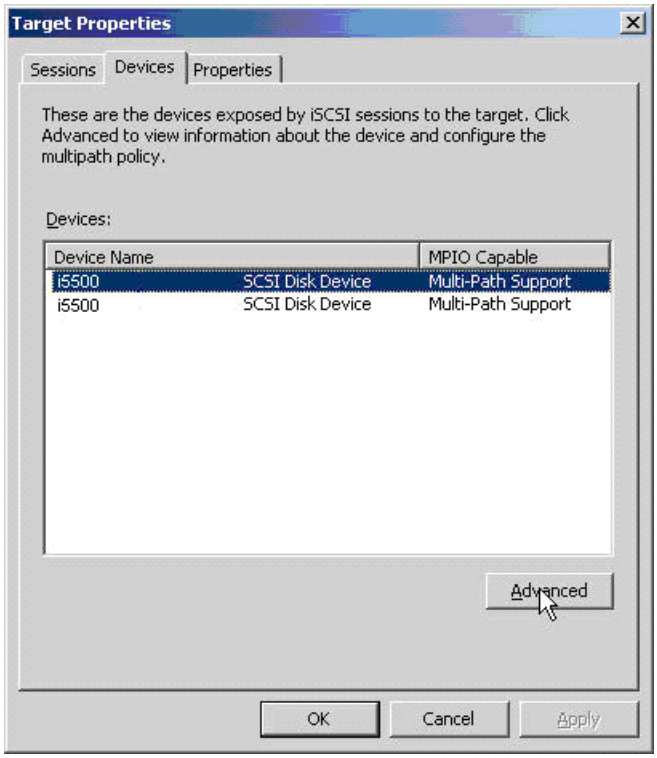


Figure D.20

20. Click **“MPIO”** tab, select **“Load Balance Policy”** to **“Round Robin”**.

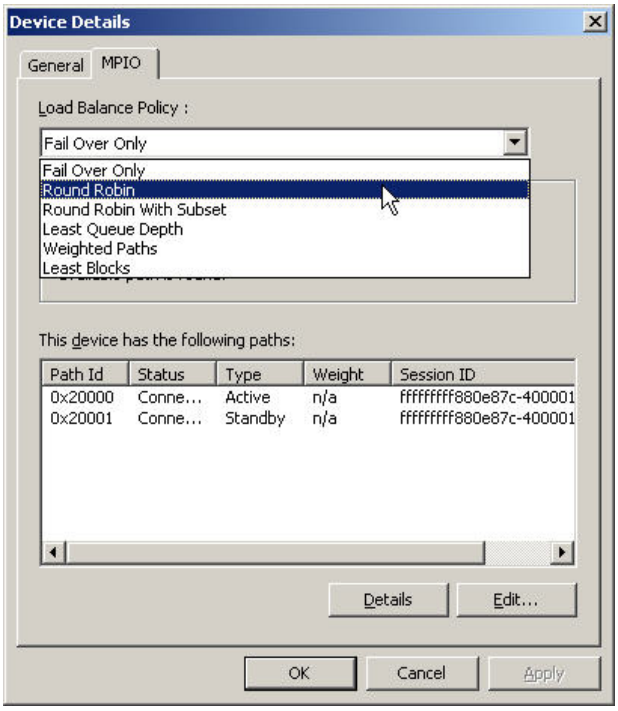


Figure D.21

21. Click **“Apply”**.

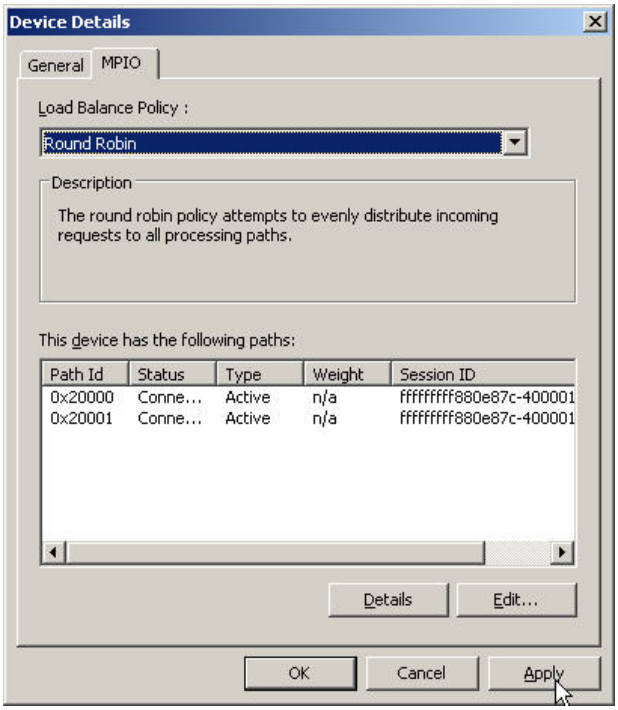


Figure D.22

22. Run **"Device Manage"** in Windows. Make sure MPIO device is available. Then the disk can be tested performance by IOMETER.

The **MC/S** setup instructions are very similar to MPIO, detail steps are in the following figures. For the target side setting, the steps are exactly the same as MPIO. Please refer to **Figure D.1 to Figure D.9**.

1. Create a VG.
2. Create a UDV.
3. Run Microsoft iSCSI initiator and check the Initiator Node Name.
4. Attaching LUN to UDV_1 UDV. Input the Initiator Node Name in Host field.
5. The volume config setting is done.
6. Check iSCSI settings. The IP address of iSCSI data port 1 is 192.168.11.229, port 2 is 192.168.12.229 for example.
7. Add Target Portals on Microsoft iSCSI initiator.
8. Input the IP address of iSCSI data port 1 (192.168.11.229 as mentioned in previous pages).

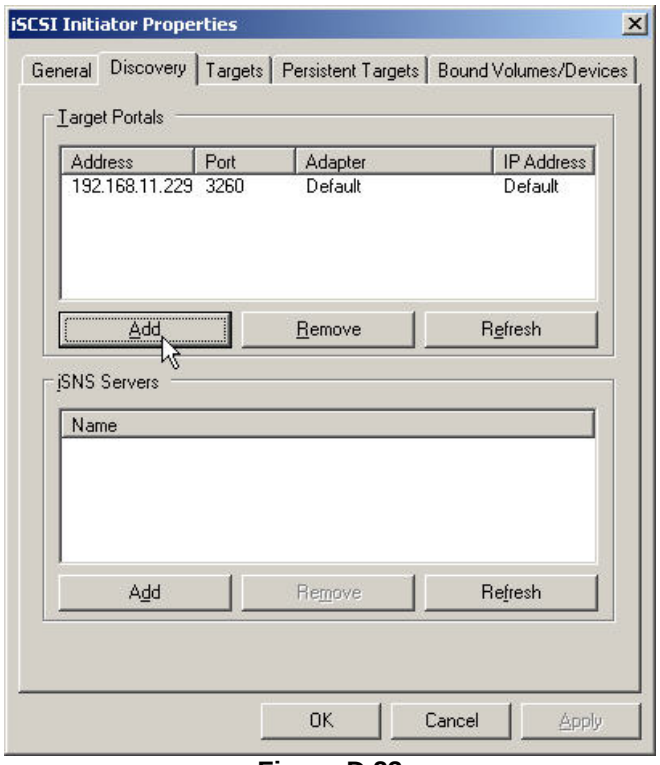


Figure D.23

9. Log on.

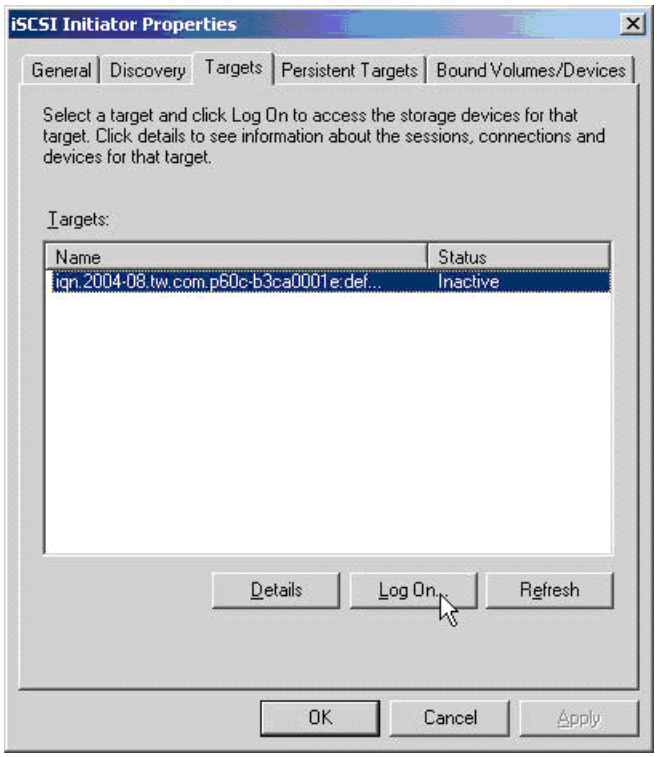


Figure D.24

10. Then click **"Advanced…"**.

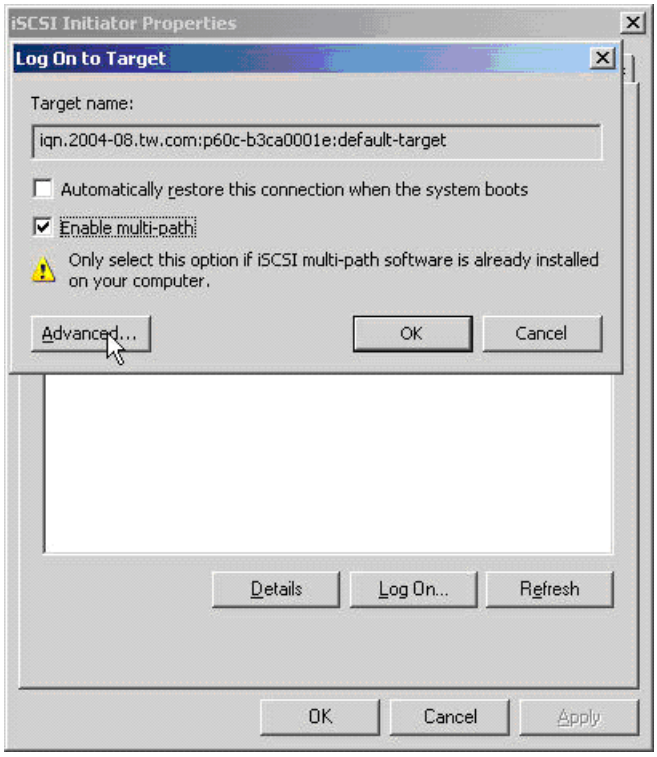


Figure D.25

11. Select set Local Adapter, Source IP, and Target Portal to iSCSI data port 1 (192.168.11.229). Then click **"OK"**.

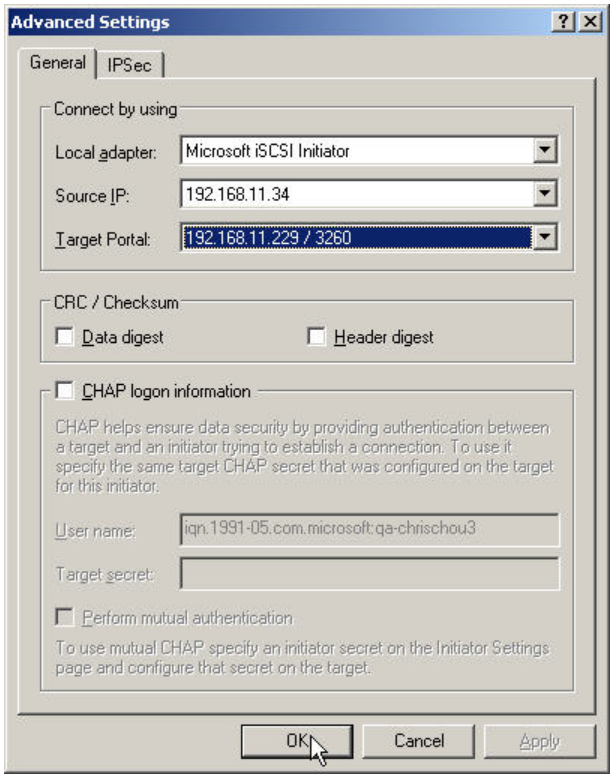


Figure D.26

12. After connected, click **"Details"**, then in the **"Session"** tab, click **"Connections"**.

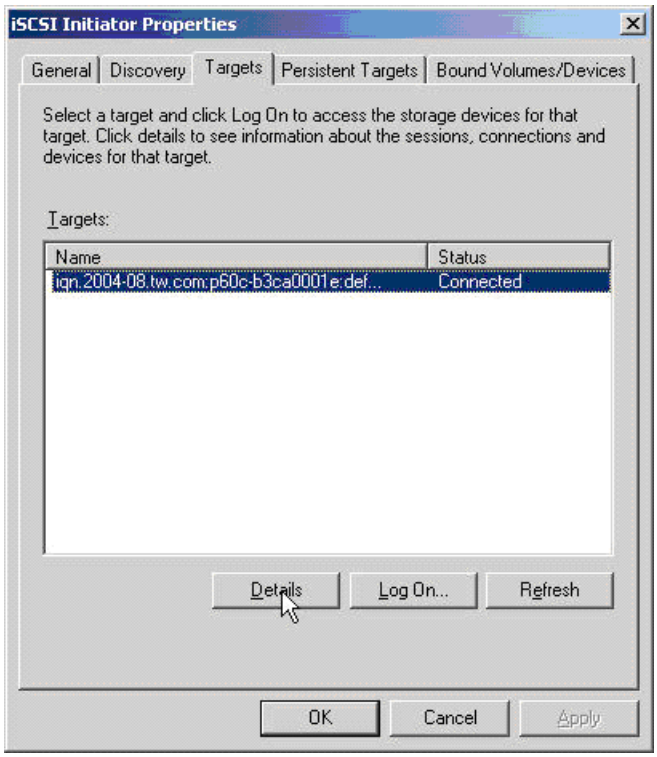


Figure D.27

13. Choose **"Round Robin"** for Load Balance Policy.
14. **"Add"** Source Portal for the iSCSI data port 2(192.168.12.229)

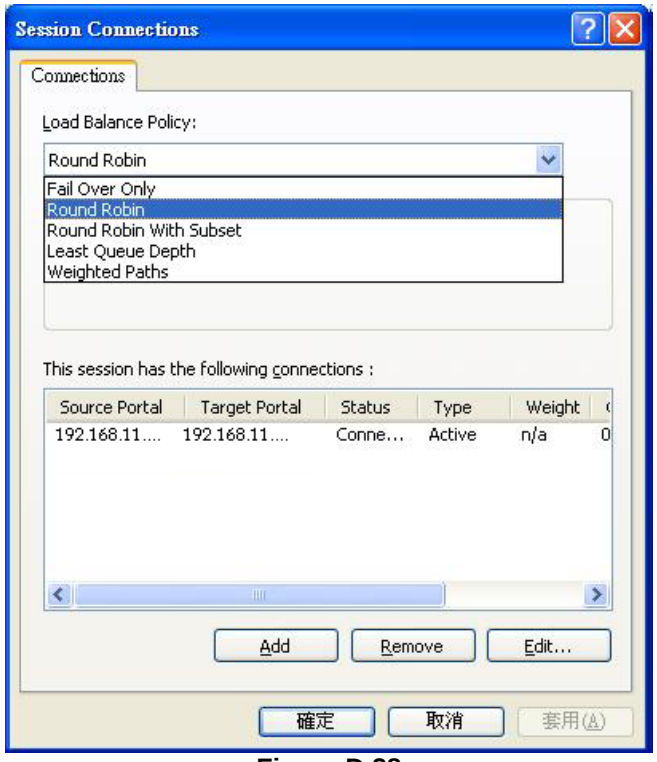


Figure D.28

15. Choose **“Adavanced”**

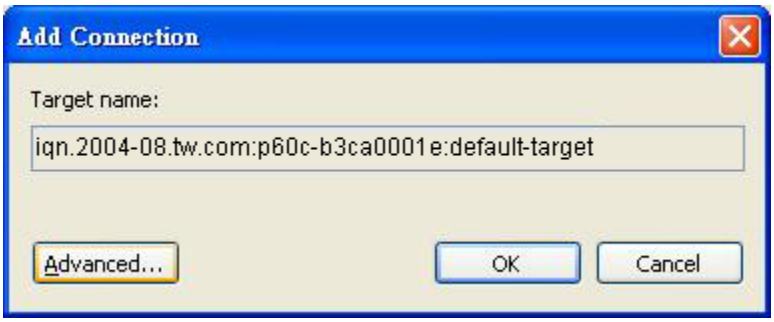


Figure D.29

16. Select Local adapter, Source IP, and Target Portal to iSCSI data port 2 (192.168.12.229). Then select **“OK”**.

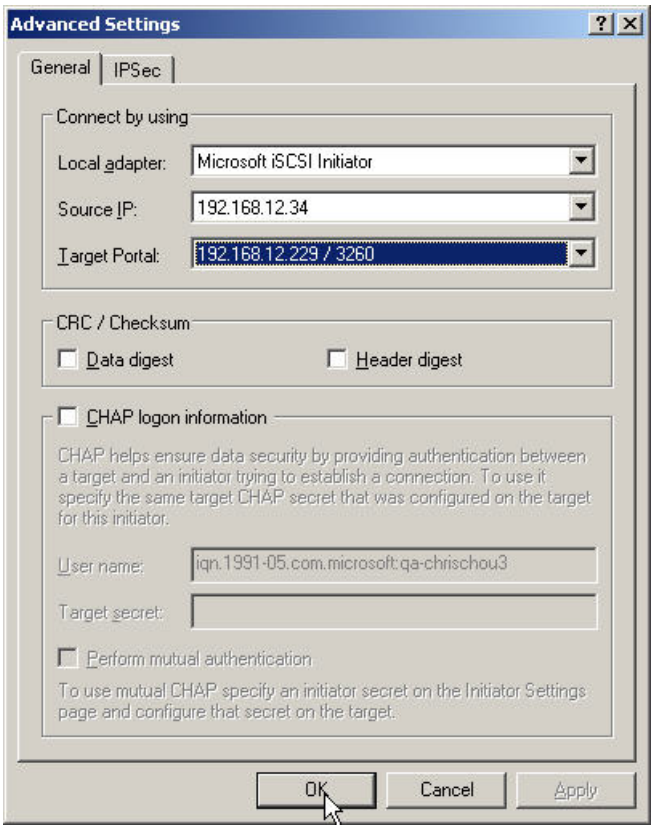


Figure D.30

17. The MC/S setting is done.