

**RA8000/ESA12000 and  
MA8000/EMA12000 Solution  
Software V8.5b for Novell NetWare**

Installation Reference Guide

Fourth Edition (April 2000)  
Part Number AA-RFB9D-TE  
Compaq Computer Corporation

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# About This Guide

This guide is designed to be used as step-by-step instructions for installation and as a reference for operation, troubleshooting, and future upgrades.

## Text Conventions

This document uses the following conventions to distinguish elements of text:

<b>Keys</b>	Keys appear in boldface. A plus sign (+) between two keys indicates that they should be pressed simultaneously.
USER INPUT	User input appears in a different typeface and in uppercase.
<i>FILENAMES</i>	File names appear in uppercase italics.
Menu Options, Command Names, Dialog Box Names	These elements appear in initial capital letters.
COMMANDS, DIRECTORY NAMES, and DRIVE NAMES	These elements appear in uppercase.
Type	When you are instructed to <i>type</i> information, type the information <b>without</b> pressing the <b>Enter</b> key.
Enter	When you are instructed to <i>enter</i> information, type the information and then press the <b>Enter</b> key.

## Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.



**WARNING:** Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.

---



**CAUTION:** Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

---

**IMPORTANT:** Text set off in this manner presents clarifying information or specific instructions.

---

**NOTE:** Text set off in this manner presents commentary, sidelights, or interesting points of information.

## Symbols on Equipment

These icons may be located on equipment in areas where hazardous conditions may exist.



Any surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

**WARNING:** To reduce the risk of injury from electrical shock hazards, do not open this enclosure.

---



Any RJ-45 receptacle marked with these symbols indicates a Network Interface Connection.

**WARNING:** To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.

---



Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. If this surface is contacted, the potential for injury exists.

**WARNING:** To reduce the risk of injury from a hot component, allow the surface to cool before touching.

---



Power Supplies or Systems marked with these symbols indicate the equipment is supplied by multiple sources of power.

**WARNING:** To reduce the risk of injury from electrical shock, remove all power cords to completely disconnect power from the system.

---

## Rack Stability



**WARNING:** To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
  - The full weight of the rack rests on the leveling jacks.
  - The stabilizing feet are attached to the rack if it is a single rack installations.
  - The racks are coupled together in multiple rack installations.
  - A rack may become unstable if more than one component is extended for any reason. Extend only one component at a time.
- 

## Getting Help

If you have a problem and have exhausted the information in this guide, you can get further information and other help in the following locations.

### Compaq Technical Support

You are entitled to free hardware technical telephone support for your product for as long you own the product. A technical support specialist will help you diagnose the problem or guide you to the next step in the warranty process.

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Outside North America, call the nearest Compaq Technical Support Phone Center. Telephone numbers for world wide Technical Support Centers are

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<sup>1</sup> For continuous quality improvement, calls may be recorded or monitored.

listed on the Compaq website. Access the Compaq website by logging on to the Internet at <http://www.compaq.com>.

Be sure to have the following information available before you call Compaq:

- Technical support registration number (if applicable)
- Product serial number (s)
- Product model name(s) and numbers(s)
- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level
- Detailed, specific questions

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- In Canada, call 1-800-263-5868.
- Elsewhere, see the Compaq website for locations and telephone numbers.

# Chapter 1

## Prepare the RA8000/ESA12000 and MA8000/EMA12000

This chapter contains instructions for setting up the RA8000/ESA12000 and MA8000/EMA12000 for use with your Novell NetWare system.

### 1.1 Initial Setup Settings

#### Terms and Definitions:

It may be useful to be familiar with the following terms and definitions when making the necessary choices for initial setup.

*SCSI* – Data transfer protocol used in computers and storage systems. SCSI-3 is a superset of SCSI-2. Both types are available in the RA8000/ESA12000 and MA8000/EMA12000 and its supported computers.

*CCL* – Command Console LUN, a “SCSI Logical Unit Number” virtual-device used for communicating with Command Console Graphical User Interface (GUI) software.

*Failover* – The ability for HSG80 controllers to transfer control from one controller to another in the event of a controller failure. This ensures uninterrupted operation. Use Transparent Failover mode for single-server configurations. Use Multiple-bus mode for Secure Path-based configurations.

*Fibre Channel* – Very high speed data bus protocol and technology used to connect computer components. It is what connects the RA8000/ESA12000 and MA8000/EMA12000 to your server. Use Arbitrated Loop mode for hub configurations and Fabric mode for switches.

### **Settings:**

Your new storage system components must be initially configured using a serial cable connection to the HSG80 array controllers. You may change one or more of the following settings: SCSI-2 or SCSI-3 mode, CCL enabled or disabled, Transparent or Multiple-bus Failover mode, and Arbitrated Loop or Fabric mode.

The controllers are preset with the following settings:

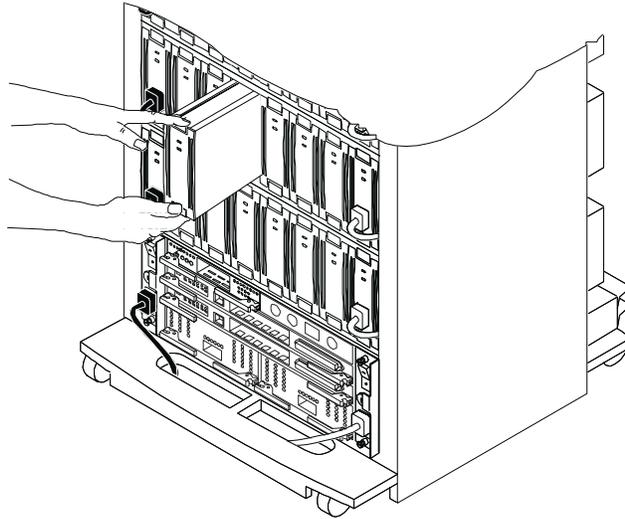
- SCSI-2 mode
- CCL enabled
- Transparent Failover mode
- Arbitrated Loop mode (fixed addresses)

For NetWare, use SCSI-2 mode with the ACS 8.5 version of HSG80 controller software. However, if you intend to use your storage system in a heterogeneous system environment, you may need to use a specific SCSI mode depending on what is required for the other, connected operating systems. Also, for NetWare, if you use the preset SCSI-2 mode, then you must change CCL to the disabled state. Instructions for making these changes are in *Chapter 2*, of this guide. For the HSG80 controllers, if you plan to connect to a Fibre Channel fabric switch, then you must change to Fabric mode. Information about other operating system and heterogeneous configuration requirements are available in application notes at the Compaq Support world wide web site: <http://www.compaq.com/support>.

## **1.2 Install the SBBs in the RA8000/ESA12000 Storage System Cabinet**

Perform the following steps to install SBBs into the storage cabinet and refer to Figure 1-1:

1. Insert an SBB into the shelf guide slots and slide the SBB into the shelf until the mounting tabs snap into place.
2. For optimum SCSI bus distribution, install the SBBs from left-to-right and from bottom-to-top.



SHR-1542

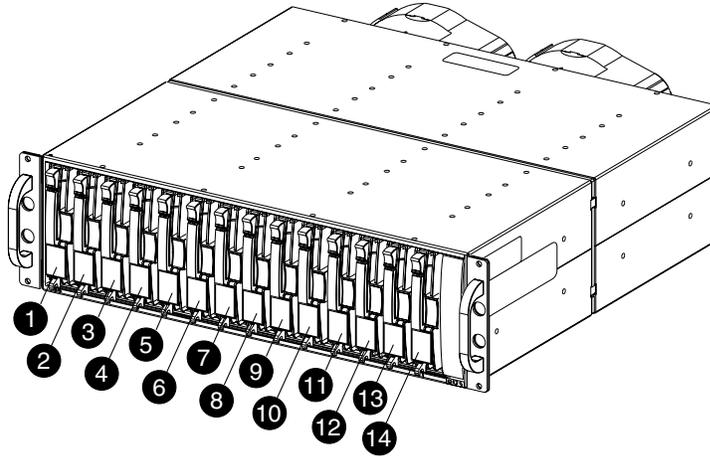
Figure 1-1. Installing SBBs into BA370 Storage System Cabinet

### 1.3 Install Disks in the Model 4200 Family Disk Enclosure for the MA8000/EMA12000 Storage System

Perform the following steps to install disks into Model 4200 family disk enclosure and refer to Figure 1–2:

1. Insert a disk into the enclosure guide slots and slide the disk into the shelf until it snaps into place.

**NOTE:** Only 12 disks are supported in the single-bus Model 4214 disk enclosure



CXO7219A

Model 4214 Disk Enclosure (Single-Bus)														
Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15

Model 4254 Disk Enclosure (Dual-Bus)														
Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	SCSI Bus A							SCSI Bus B						
	00	01	02	03	04	05	08	00	01	02	03	04	05	08

Figure 1-2. Model 4200 family disk enclosure

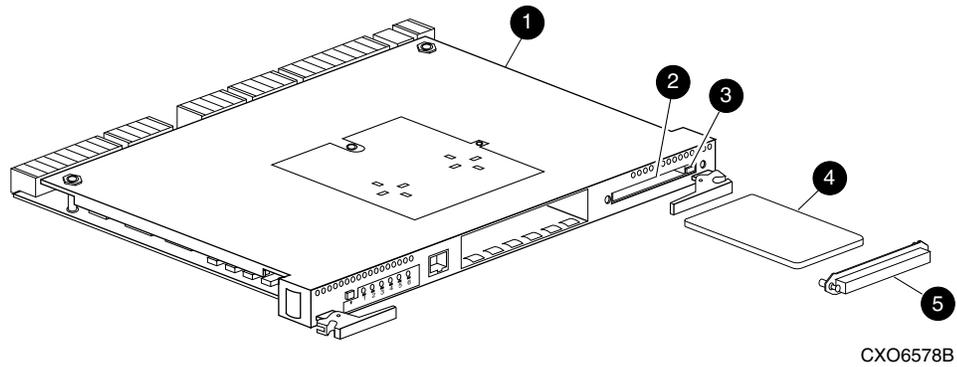
## 1.4 Install the PCMCIA Card into the HSG80 Controller

Install the PCMCIA card into the HSG80 controller as follows and refer to Figure 1-2.

1. Remove the ESD cover from the controller PCMCIA slot.
2. Insert the PCMCIA card in the controller slot.
3. Replace the ESD cover over the controller slot.
4. Repeat the procedure for a second controller.



**CAUTION:** If you bump against the SCSI ID selector switch above the top controller, you can change the switch setting by mistake. Check the setting before you go on and reset the switch if necessary; the switch should be set on 0 for the first cabinet, 2 for the second cabinet, and 3 for the third cabinet.



- ① Controller
- ② Program card slot
- ③ Program card ejection button
- ④ Program (PCMCIA) card
- ⑤ Program card ESD cover

Figure 1-3. Install PCMCIA Card into HSG80 Controller

You are now ready to connect to the HSG80 array controller via a serial line and prepare the initial setting.



# Installing SWCC Client and Setting Initial Controller Configuration

This chapter contains instructions for installing StorageWorks Command Console (SWCC) Client, a Graphical User Interface (GUI), configuring the HSG80 RAID controller for Novell NetWare operation, and creating your first virtual disk.

**NOTE:** For more information, use the online HELP in the SWCC Storage and CLI Windows.

## 2.1 Introduction

This chapter provides the instructions required to accomplish the following tasks:

- Initial Setup Settings.
- Installing the HSG80 Command Console software.
- Launching Command Console Client.
- Establishing communications with the HSG80 controller over the serial port.
- Configuring the HSG80 controller for NetWare operation.
- Creating your first virtual disk.

To create your first virtual disk, use the serial port:

Serial Port Connection – This method is required to create your first virtual disk. This chapter shows you how to create a virtual disk over the serial port using Command Console Client software. The serial port method provides a local, direct connection to your RAID array.

## 2.2 Initial Setup Settings

Your new storage system components must be initially configured using a serial cable connection to the HSG80 array controllers. You may change one or more of the following: SCSI-2 or SCSI-3 mode, Command Console LUN (CCL) enabled or disabled, Transparent or Multiple-bus Failover mode, and Arbitrated Loop or Fabric mode. The controllers are preset as follows: SCSI-2 mode, CCL enabled, and Transparent Failover mode.

Novell NetWare requires the HSG80 Controller to be set as follows:

**Table 2-1  
Controller Defaults**

Item	FC-AL Hub Setting	Switch Setting
Host Operating System = NETWARE	(Default is NT)	(Default is NT)
Controller configured for dual-redundancy. (Transparent Failover)	(Default)	(Default)
SCSI_VERSION = SCSI-2	(Default)	(Default)
CCL Disabled	(Default is Enabled)	(Default)
Port Profile set to PLDA	(Default)	NA
Port topology set to LOOP_HARD	(Default)	FABRIC
PORT_1_ALPA set to 71	(Default)	NA
PORT_2_ALPA set to 72	(Default)	NA

## 2.3 Installing Command Console Client

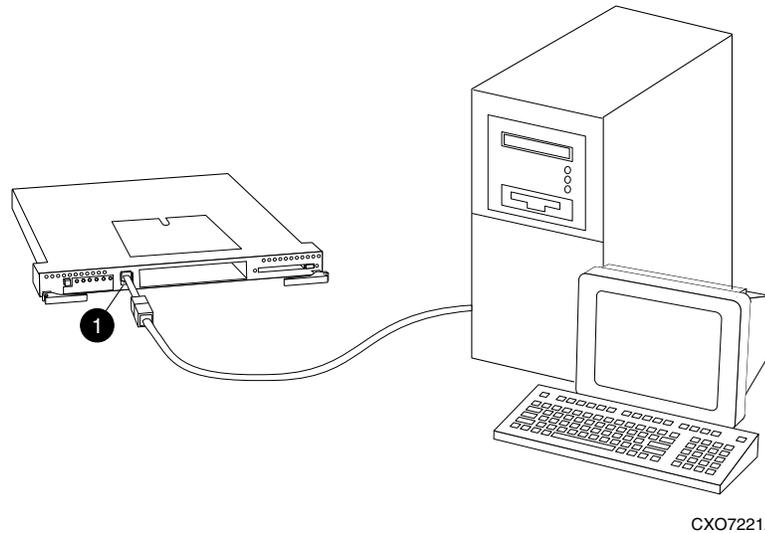
The minimum requirements to run Command Console Client are:

- PC Requirements:
  - Intel 486 processor, 66 MHz, 16-MB memory, 2 MB free disk space, and CD-ROM drive
- Operating System:
  - Microsoft Windows 95, Windows NT 3.51, or 4.0

Command Console Client is installed from a CD-ROM disk using a standard Windows installation routine on a Windows 95, Windows 98, or Windows NT platform. The program is self-extracting and stores Command Console Client into the directory C:\Program Files\SWCC by default. During setup, you have the option to change the disk or directory location.

**NOTE:** If you are upgrading to a new version of Command Console Client, run the uninstall program and remove the old version before installing the new version.

Connect the server to the HSG80 controller as shown in Figure 2-1.



CXO7221A

Figure 2-1. Connecting a PC as a maintenance terminal

### To install Command Console:

1. Place the platform kit CD in the CD-ROM drive.
2. Run *File Manager* or *Windows Explorer*.
3. Move to the folder: *drive\_letter:\SWCCClient\hsg80\_inel*
4. Choose *Intel client*; then double-click on *Setup*.
5. Follow the instructions in the *Setup* program to complete the installation.

## 2.4 Launching Command Console Client

To start Command Console from the *Start* menu, click the *HSG80 Storage Window* (Figure 2-2).



Figure 2-2. Command console client's start menu

The three choices Client provides you with at startup are:

- **CLI Window:** HS-series controllers provide a feature called the Command Line Interpreter (CLI) for configuring and monitoring your storage controllers using text-based commands. With the CLI, you can connect a maintenance terminal directly to your controller and manage it using the complete set of CLI commands. You can also use a host-based, virtual terminal, such as Command Console's CLI Window, to make the connection. See Appendix A, "Creating Your Storage Configuration with the CLI," for details.
- **HSG80ACS85 Storage Window:** Displays the Storage Window. This choice lets you monitor and configure one storage system using Client's graphical user interface. All connection choices are provided: serial line, host interface, and network (TCP/IP).

**NOTE:** HSG80ACS85 Storage Window is used with RA8000/ESA12000 and MA8000/EMA12000 storage systems using ACS V8.5 software. Older ACS versions (8.3 or 8.4) require the HSG80 Storage Window.

- **StorageWorks Command Console:** Displays the Navigation Window. The Navigation Window is a network navigation tool used to manage and monitor storage systems over a TCP/IP network. This choice lets you monitor and configure one or many storage systems over a network using Client's graphical tools.

## 2.5 Establishing a Serial Connection to the HSG80 Storage Window

To create your first virtual disk, establish a serial cable connection from one of the PC's COM ports to the storage system's CTR TOP or CTR BOTTOM configuration port (See *Chapter 6*) and:

1. Click *Start* on the taskbar.
2. Click *Programs*.
3. Click *Command Console*.
4. Click *HSG80ACS85 Storage Window*.
5. When the Connection Selection dialog box displays, click the *Serial* radio button (Figure 2-3), then click *OK* to display the *Connect Serial* dialog box (Figure 2-4).

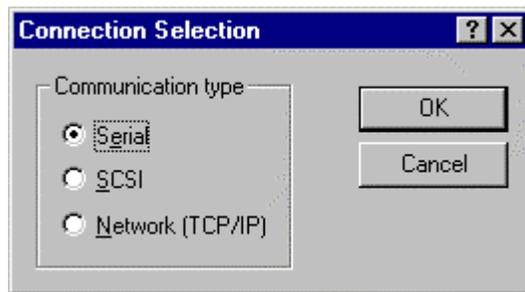


Figure 2-3. Connection selection dialog box

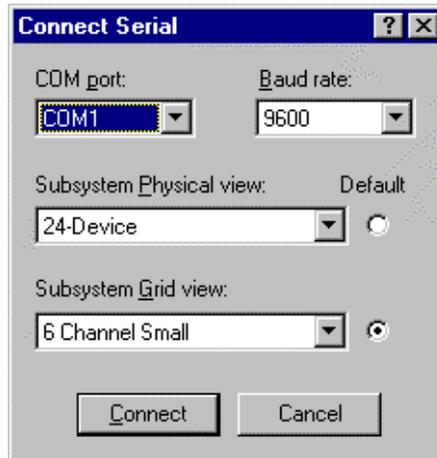


Figure 2-4. Connection serial dialog box for storage window

6. From the drop-down menu, in the *Connect Serial* dialog box, select the PC COM port your HSG80 controller is connected to, then select the baud rate (the controller default baud rate is 9600). Click *Connect* to display the Storage Window (Figure 2-5.). You are now connected to your storage system. The next step is configuring the controller.

**NOTE:** The top windowpane displays the virtual disks you create. The bottom windowpane shows the devices you have installed in the RA8000/ESA12000 or MA8000/EMA12000 system. On startup, Command Console finds installed drives and displays them in a grid by channel and SCSI ID number.

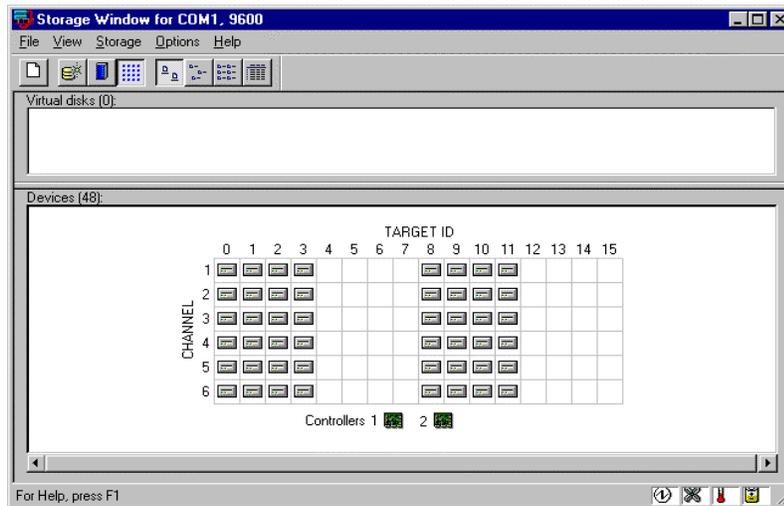


Figure 2-5. Storage window

## 2.6 Controller Properties

**NOTE:** This section discusses only one method for setting controller properties. Controller properties can also be set using the CLI, as described in *Chapter 4*.

Your controller's operating parameters are stored in property sheets. Controller property sheets are accessed by double-clicking on a controller icon in the Storage Window or right clicking the icon and selecting *Properties*. Property sheets are tabbed. To access a sheet, click its tab.

Changes in all fields cause a controller restart and put the changes into effect. The program prompts you for confirmation before it restarts your controller.

**NOTE:** After you change a parameter that causes a controller restart, there is an approximately 90-second delay while the controller reinitializes.

1. Access the controller's property sheets by double-clicking the controller's icon in the Storage Window. When you double-click a controller's icon, the *General* controller properties sheet displays (Figure 2-6). The controller has five property sheets. Each sheet is accessed by clicking on its tab.

2. Confirm the following:

- Allocation class is 0.
- SCSI modes are SCSI-2.

**NOTE:** SCSI-3 mode reserves ID0, LUN 0 for the Command Console Communications LUN (CCL). NetWare does not support CCL therefore use the SCSI-2 mode.

You can also set time and date general properties.

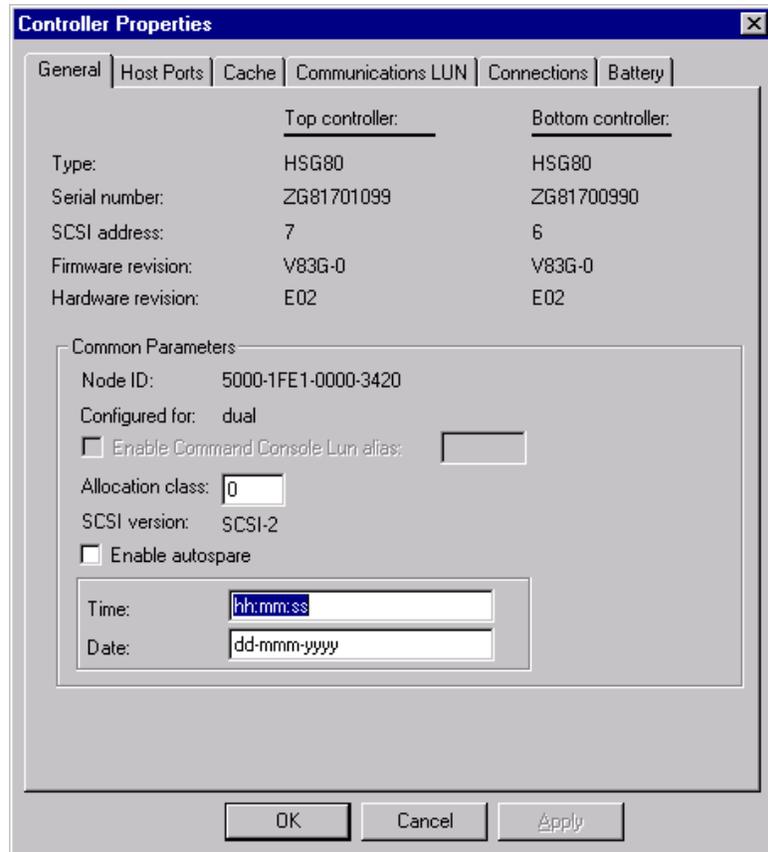


Figure 2-6. General controller properties tab

- Click the *Host Ports* tab to display the host port operating parameters and verify that the Requested Topology and Actual Topology settings appear as shown in Figure 2-7. For FC switch Host Port topologies see Figure 2-8.

To set the controller for loop\_hard, at the CLI type the following:

```
set this port_1_topology=loop_hard
set this port_1_al_pa=71
set other port_2_topology=loop_hard
set other port_2_al_pa=72
```

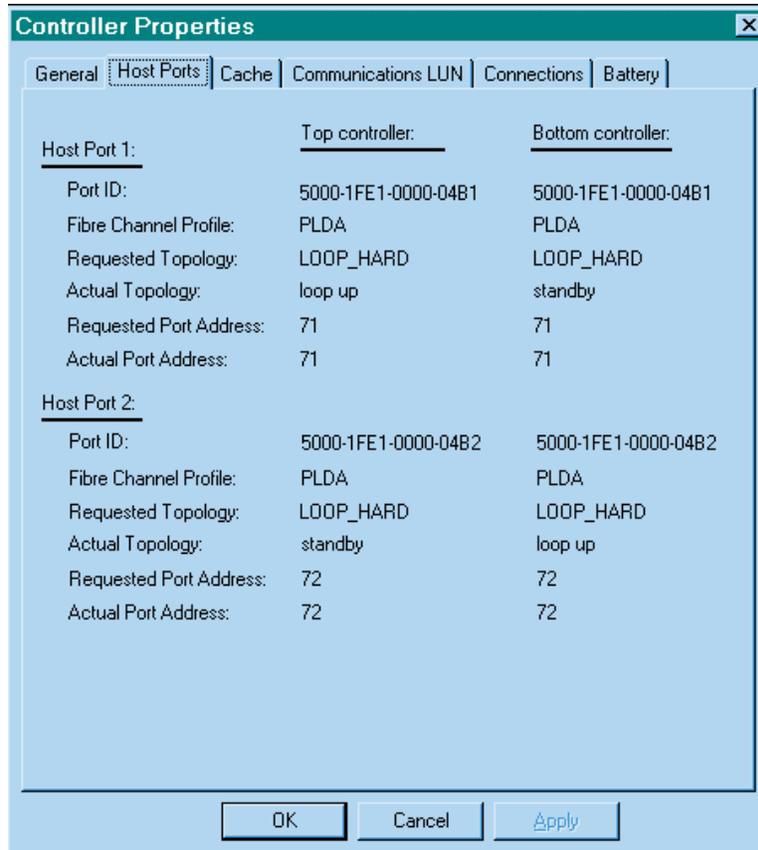


Figure 2-7. Host Ports controller properties tab, with hub topologies shown

For FC switch configurations, verify that the Requested Topology fields read FABRIC, and the Actual Topology field reads standby. (The Requested Port and Actual Port Address fields will not exist, and the words REMOTE COPY = none appears at the bottom of the window). For more details regarding host port settings, refer to the *Compaq StorageWorks Command Console V2.3 User Guide*.

To set the controller for FABRIC, at the CLI type the following:

```
port_1_topology = fabric
port_2_topology = fabric
```

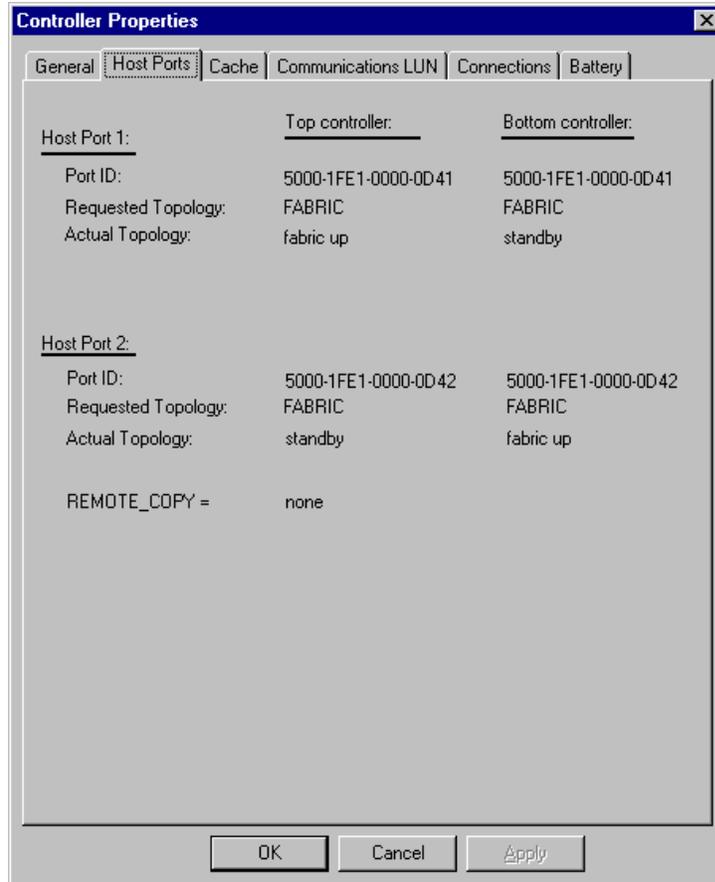


Figure 2-8. Host ports controller properties tab, FC switch topologies shown

4. Click the *Cache* tab to check cache size in Figure 2-9.

Confirm the following:

- Cache flush\_time: (seconds): is 10.
- Respond to internal cache battery condition is selected.

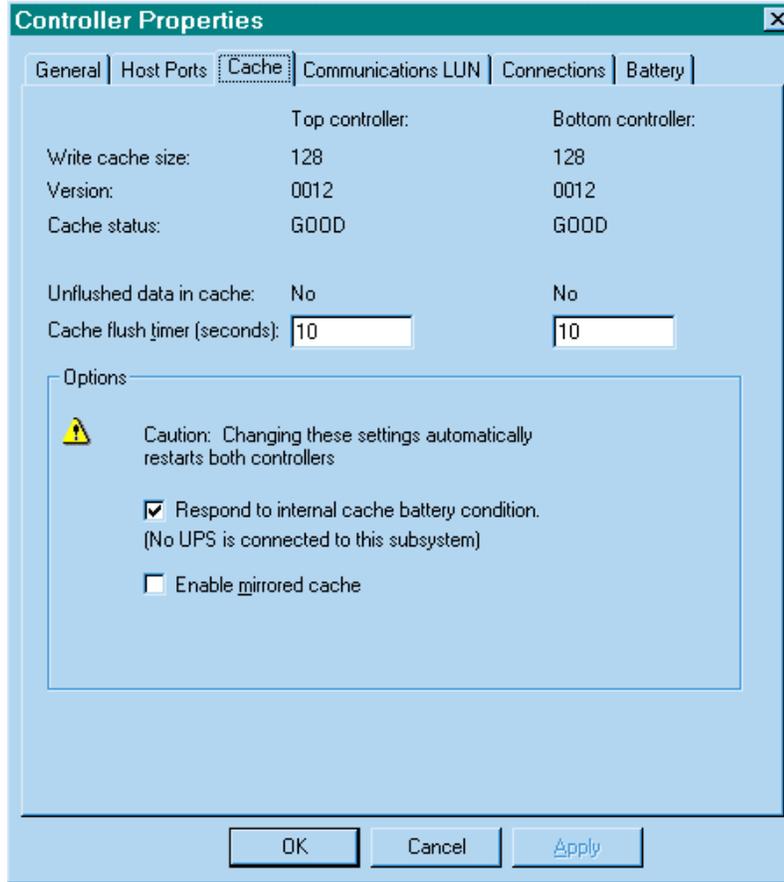


Figure 2-9. Cache controller properties tab

5. Click the *Communications LUN* tab (Figure 2-10).

The Communications LUN is not used with NetWare. It should be *disabled* (grayed out). If the Communications LUN is enabled, disable it using the CLI window. First close the Storage Window, and establish a CLI connection as described in *Chapter 6*. To invoke a CLI window from the *Command Console Client's Start* menu, select *Command Console V2.3*, then select the *CLI Window* option.

The *Connection Selection Window* (Figure 2-3) appears. Select *Serial*. At the next window select *9600 baud* rate and click *Connect* to invoke the CLI window. Type this command to disable the Communication LUN:

```
set this_controller nocommand_console_lun
```

Close the CLI window. Return to the Windows *Start* menu and select the *HSG80 Storage Window* option to re-open the storage window.

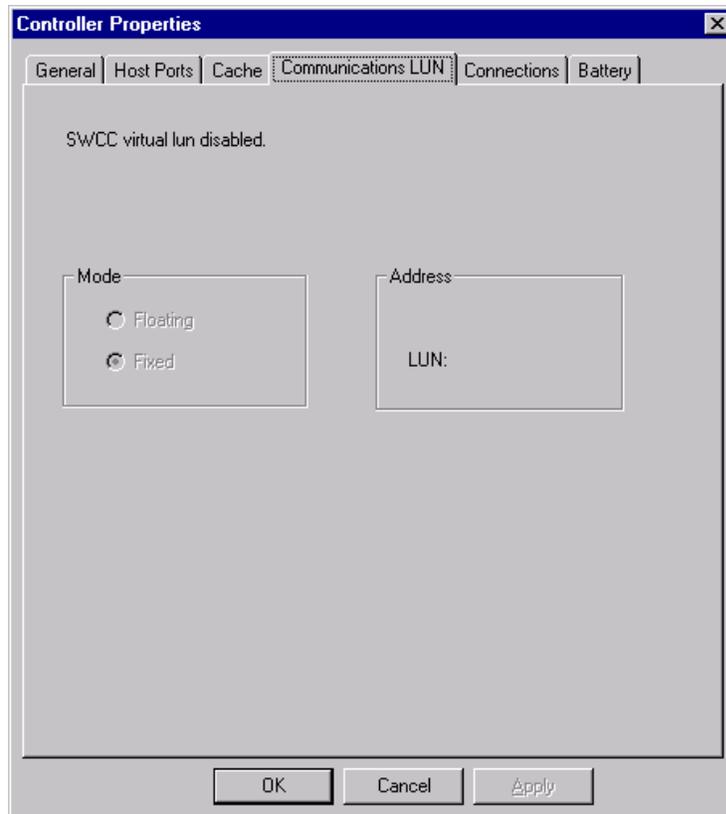


Figure 2-10. Communications LUN controller properties tab

6. Click the *Connections* tab (Figure 2-11).

Confirm the following:

- Use a NetWare Operating System with Novell NetWare.
- Unit Offset should be 0 for Port 1.

**NOTE:** Connection names will not be established until the driver is loaded on the server.

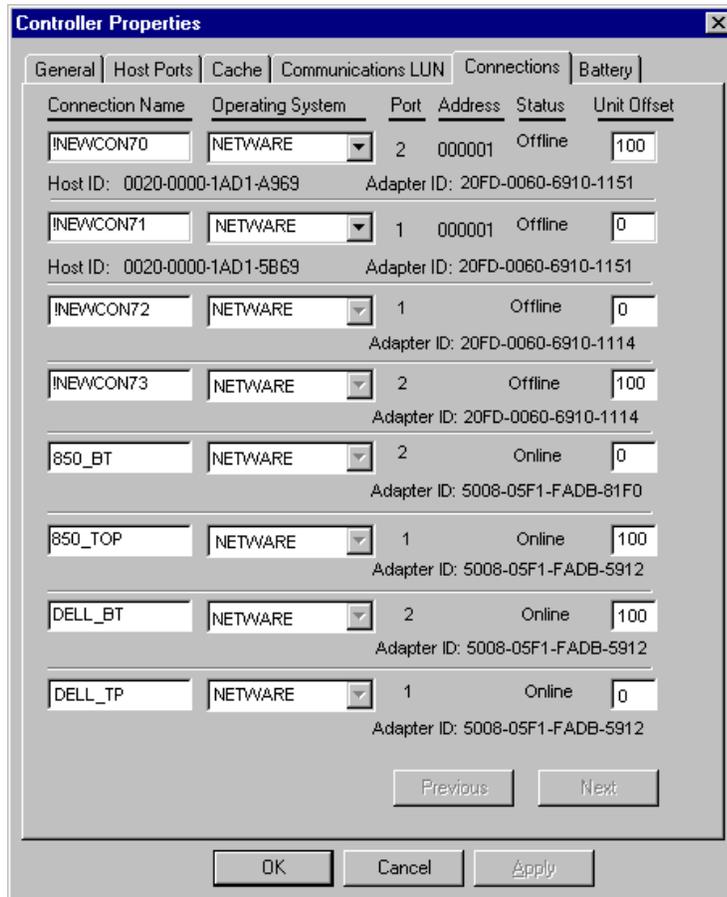


Figure 2-11. Connections controller properties tab

7. Click the *Battery* tab (Figure 2-12).

**NOTE:** Confirm that the battery is fully charged. If not, wait until it is fully charged before using the system.

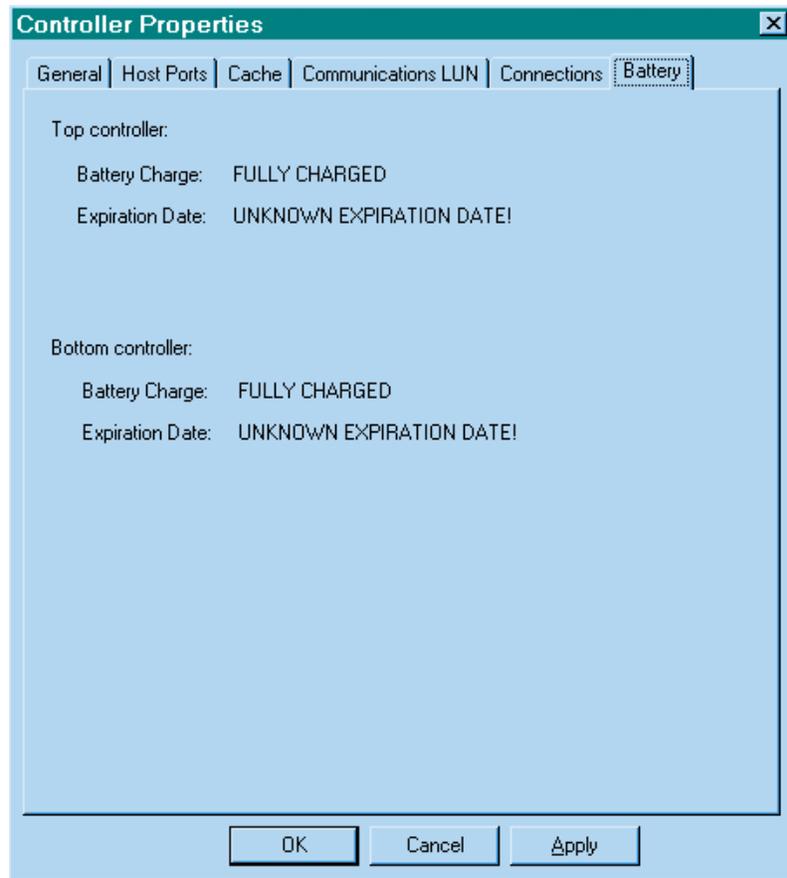


Figure 2-12. Battery controller properties tab

## 2.7 Creating Your First Virtual Disk

Command Console Client can create a number of different types of logical storage units, called virtual disks, on your RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel Storage System. You can create:

- Single-device virtual disks (JBODs)
- Striped virtual disks (RAID 0)
- Mirrored virtual disks (RAID 1)
- Striped mirrored virtual disks (RAID 0+1)
- Striped parity virtual disks with floating parity disk (RAID 3/5)

Virtual disks are created using Command Console Client's Virtual Disk Wizard.

### Start the Wizard:

After you have established a serial connection to your RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel System and have accessed the storage system's Storage Window, select *Add Virtual Disk* from the *Storage* menu to start the Virtual Disk Wizard.



Figure 2-13. Storage menu

### Create the Virtual Disk:

1. Click the radio button of the RAID level you want, then click *Next*.

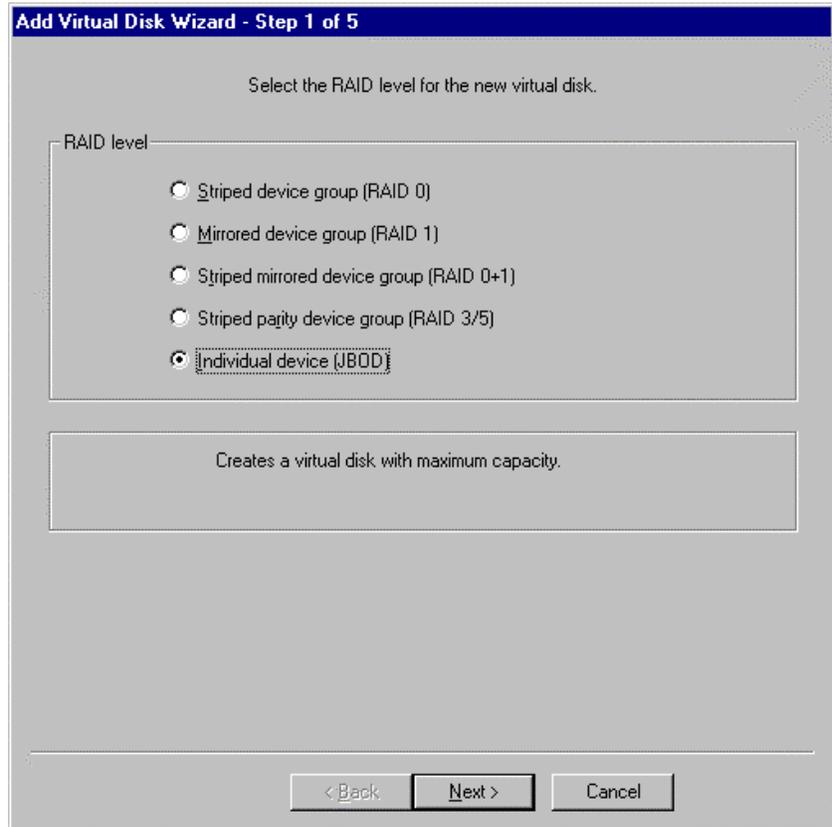


Figure 2-14. Add virtual disk wizard - step 1 of 5

2. Select the devices you want to include in the virtual disk from a list of available storage devices by clicking them in the *Available storage:* window in the dialog box. As you click them, they are listed in the *Selected devices:* windowpane. Click *Next* to complete this step, and proceed to Step 3 of the wizard.

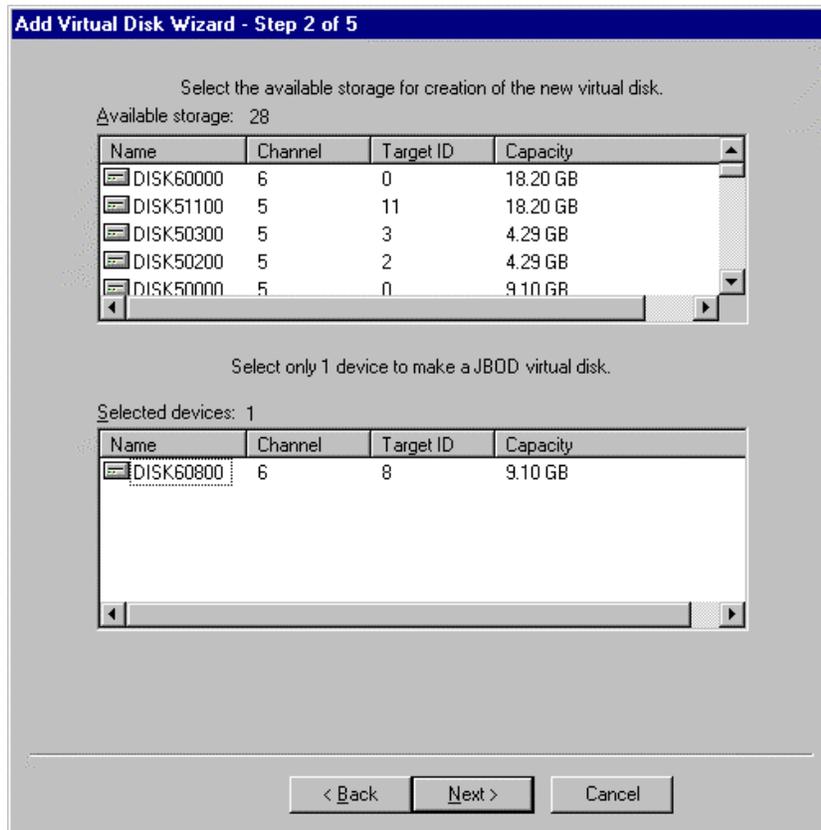


Figure 2-15. Add virtual disk wizard - step 2 of 5

3. The wizard offers the option of using only a portion of the capacity of the devices you have selected for your new virtual disk. It displays the total, available capacity of the devices you have selected in the capacity box. Enter the size of the virtual disk you want to create in the *Capacity for virtual disk* box, then click *Next*. If you want to create multiple partitions, complete all steps for this partition. Then access the wizard again, and enter the same choices to create another partitioned disk. When finished, click *Next*.

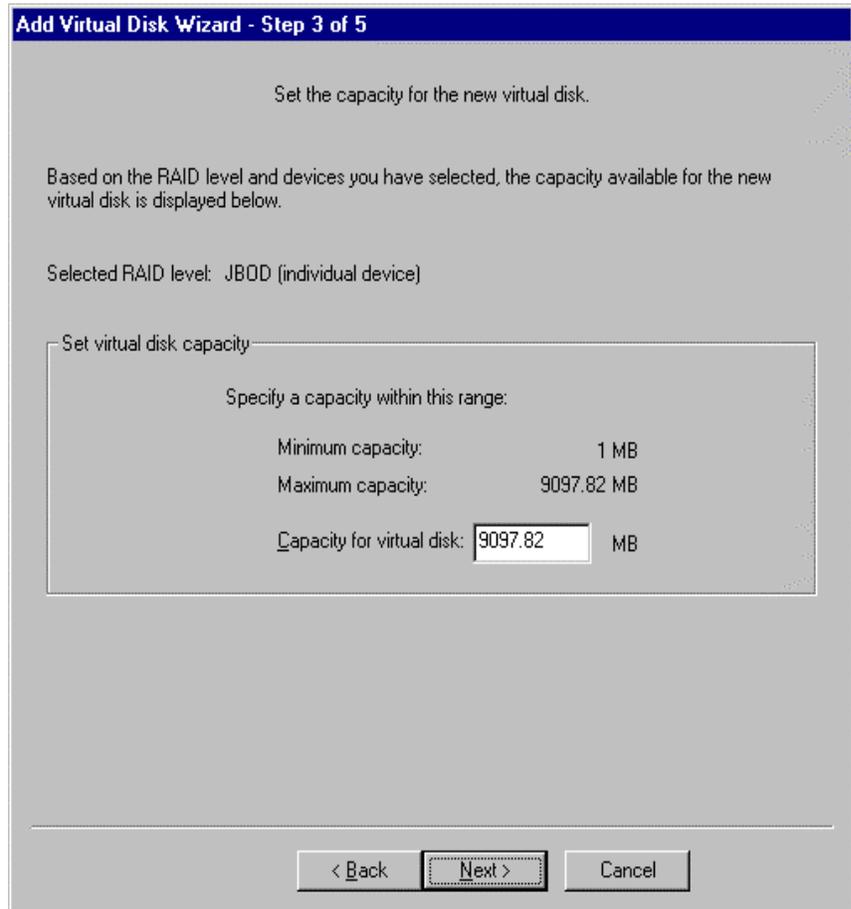


Figure 2-16. Add virtual disk wizard - step 3 of 5

4. Enter the virtual disk name. Enter the maximum cache transfer blocks, then click *Next*.

**NOTE:** Always assign all partitions of a storageset to the same host port (do not split partitioned storagesets across host ports).

**Add Virtual Disk Wizard - Step 4 of 5**

Set the options to be used when creating this new virtual disk.

Virtual Disk Name

Name ( i.e..D0 - D199 ):

Enable writeback cache      Maximum cached transfer: 32 blocks

Enable readahead cache

Host access ID: ALL

Save controller configuration to virtual disk

Replacement policy:

Read source:

Strip size (in blocks):

Copy speed:

Reconstruction rate:

< Back    Next >    Cancel

Figure 2-17. Add virtual disk wizard - step 4 of 5

5. The final Virtual Disk Wizard window, Step 5 reviews the choices you have made in steps 1 through 4. If you are satisfied with your choices, click *Finish*.

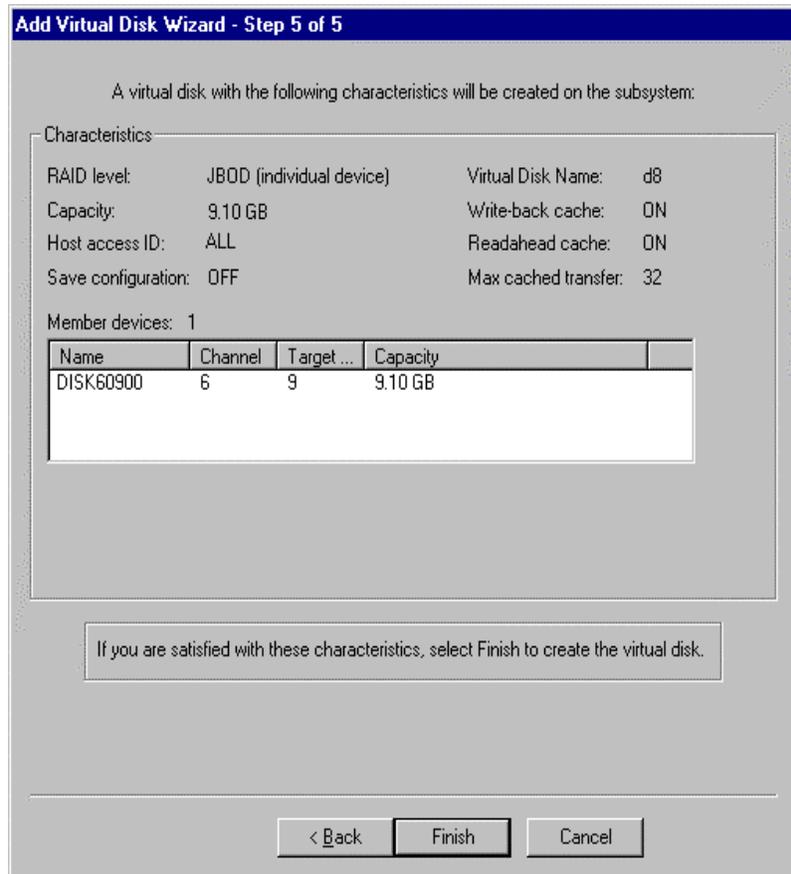


Figure 2-18. Add virtual disk wizard - step 5 of 5

When you click *Finish*, the storageset will start initialization.

6. You can view the virtual disks you have created by returning to the Storage Window. For additional information, see *Section 2, Establishing a Serial Connection to the HSG80 Storage Window*. Figure 2-19 displays the *Storage Window-Virtual Disk Window*.

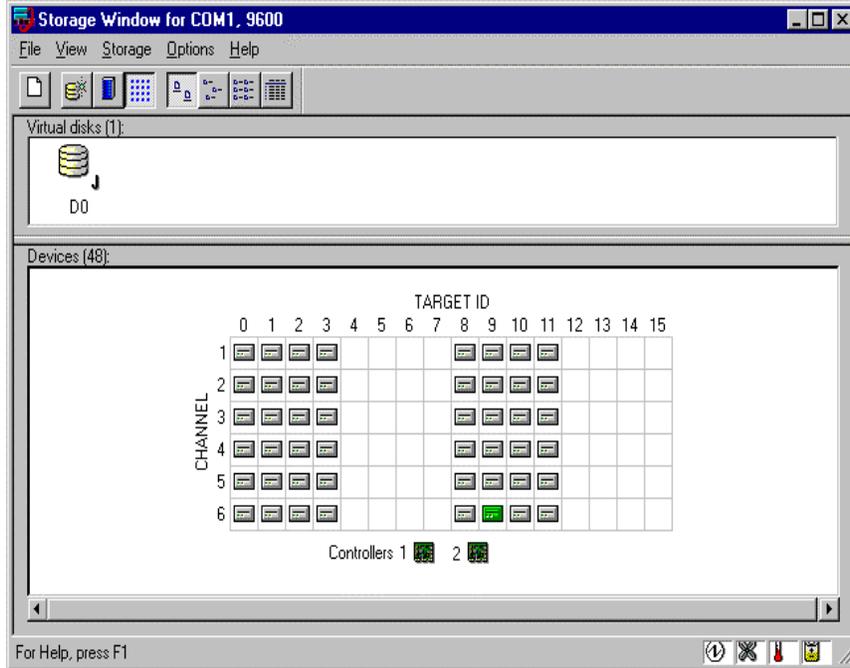


Figure 2-19. Storage window-virtual disk window

**NOTE:** For more information, use the online HELP in the SWCC Storage and CLI windows.

**NOTE:** Now that you have created at least one Storageset, you can prepare your host. For information on preparing your host refer to *Chapter 3* of this guide.



## Chapter **3**

# Preparing Your Novell NetWare Host for Use with the RA8000/ESA12000 and MA8000/EMA12000

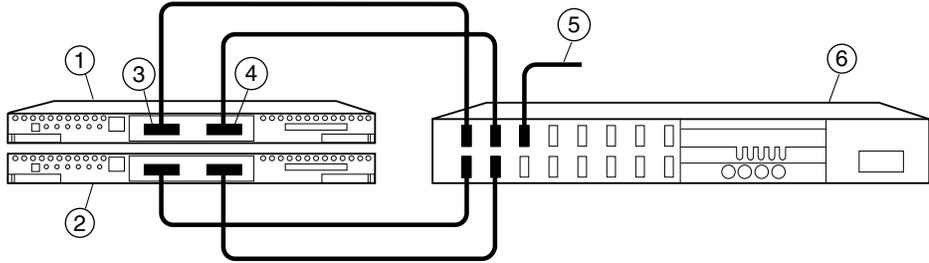
This chapter contains instructions for configuring your host adapter/host controller and installing the appropriate device driver in your host system.

### **3.1 Installing the Device Driver**

Perform the following procedure and then follow the installation instructions in one of the next two sections to install the device driver in your host system.

**NOTE:** Your adapter package and the RA8000/ESA12000 and MA8000/EMA12000 Solution Software V8.5 for Novell NetWare both include the required adapter-specific software. Use only the adapters and drivers supplied, since these are tested and certified to function with the RA8000/ESA12000 and MA8000/EMA12000 HSG80 controller.

1. Install your Compaq Fibre Channel host-bus adapter into your server. Refer to your Fibre Channel host-bus adapter documentation for instructions.
2. Connect your HSG80 array controller and server to the Fibre Channel switch as shown in Figure 3-1.



CXO6882A

Figure 3-1. Cabling two controllers and one switch

**Table 3-1**  
**Cabling Two Controllers and One Hub or Switch**

Figure Legend	Description
①	Controller A
②	Controller B
③	Host port 1
④	Host port 2
⑤	FC cable to host bus adapter
⑥	FC hub or switch

3. You can install the Novell NetWare Driver on the server from either the SmartStart CD or from the RA8000/ESA12000 and MA8000/EMA12000 Solution Software V8.5 for Novell NetWare CD.

### 3.1.2 Installing the Novell NetWare Driver on the Server from the SmartStart CD

1. From the NetWare 4.x console, type Load Install or from the NetWare 5.x console, type Load NWconfig.
2. Select *Product Options* from the menu and press the **Enter** key.
3. Select *Install a Product Not Listed* and press the **Enter** key.
4. Press **F3** to specify a different path.
5. Insert the Compaq SmartStart and Support Software CD-ROM V4.30 or later into the server's CD-ROM drive.
6. Execute one of the following procedures:
  - Either mount the CD-ROM as a NetWare volume and enter the path CPQSMST430:\CPQSUPSW\NSSD and press the **Enter** key. Volume name will vary pending SmartStart version.
  - Or if the DOS CD-ROM driver support is loaded, enter the path <CD-ROM drive letter>:\CPQSUPSW\NSSD and press the **Enter** key.
7. Press the **Enter** key to proceed past the *Welcome* screen.
8. Select *Compaq NWPA Storage Support* from the menu by scrolling cursor to it and press the **F5** key to mark the selection.
9. To access the Main menu, press the **Tab** key.
10. To select *Install Selected Files*, press the **Enter** key.
11. After reviewing the Install Results, press the **Enter** key.
12. Select *To Reboot Server* and follow the instructions displayed on the screen in order to install the upgraded and/or new device drivers loaded on the server.

**NOTE:** The *startup.ncf* file will automatically be updated with the appropriate driver load statements. See sample *startup.ncf*

```
LOAD CPQMPK.PSM
LOAD CPQSHD.CDM
LOAD IDECD.CDM
LOAD CPQSCSI.HAM SLOT=10002
LOAD CPQSCSI.HAM SLOT=10003
LOAD CPQFC.HAM
LOAD IDEATA.HAM PORT=1F0 INT=E
LOAD SCSIID.CDM
```

### **3.1.3 Installing the Novell NetWare Driver from the RA8000/ESA12000 and MA8000/EMA12000 Solution Software V8.5 for Novell NetWare CD**

1. Mount the RA8000\_V85\_NW CD as a NetWare volume.
2. Type *Load Install* from the NetWare 4.x console or type *Load NWCONFIG* from the NetWare 5.0 console.
3. Select *Driver Options* from the menu and press the **Enter** key.
4. Select *Configure Disk and Storage Device Drivers* from the menu and press the **Enter** key.
5. Select *Additional Drivers* from the menu and press the **Enter** key.
6. Press the **Insert** key to install an unlisted driver.
7. Press the **F3** key to specify an additional path.
8. Type the following path to the driver: RA8000\_V85\_NW:CPQFC\.
9. Select *CPQFC.HAM* and select *Yes* to copy the driver to the default server boot path C:\NWSERVER.
10. Select *Save the parameters and load the driver*.
11. Select *Load additional driver*.
12. Select *CPQSHD.CDM* and select *Yes* to copy the driver to the default server boot path C:\NWSERVER.
13. Reboot server.
14. Select *Save the parameter and load the driver*.

**NOTE:** The STARTUP.NCF file will automatically be updated with the appropriate driver loaded statements.

### 3.1.4 Logintmo Parameter

load cpqfc.ham logintmo = Number of seconds that the driver waits for the RA8000/ESA12000 to log back in with the initiator after a loop/link reset

In some cases, RA8000/ESA12000 and MA8000/EMA12000 configurations using large caches took longer during transparent failovers than the driver's default login timeout of 15 seconds allowed. The command line parameter "LOGINTMO=n" where "n" is in seconds and will over ride the 15 second timeout on HSG80 array controller.

Recommended values are from 15 to 30 seconds.

### 3.1.5 List Devices

```
1850B1:list devices
0x0001: [V500-A0-D0:0] Compaq 53C876 Slot 0 Port 1 ID 0 COMPAQ BD009122
0x0009: [V502-A2-D0:4] Compaq RA8000 ID 0 LUN 4 (5000-1FE1-0000-3420)
0x000A: [V502-A2-D3:0] Compaq RA8000 ID 3 LUN 0 (5000-1FE1-0000-3420)
0x000B: [V502-A2-D3:11] Compaq RA8000 ID 3 LUN 17 (5000-1FE1-0000-3420)
0x0017: [V025-A4-D1:0] COMPAQ CD-224E rev:9.0B
```

The "list devices" command show the RA8000/ESA12000 or MA8000/EMA12000 storage sets and the World Wide ID on the HSG80 controller that the storage set is created on. This is useful when configuring multiple arrays. To see the world wide ID of the HSG80 controller in the RA8000/ESA12000 or MA8000/EMA12000, use the command line interface to the HSG80 array controller and type "show this" and look at the NODE\_ID.

```
HSG80_1>sho this
Controller:
HSG80 ZG81701099 Software V85F-0, Hardware E02
NODE_ID      = 5000-1FE1-0000-3420
ALLOCATION_CLASS = 0
SCSI_VERSION  = SCSI-2
Configured for dual-redundancy with ZG81700990
  In dual-redundant configuration
Device Port SCSI address 7
Time: NOT SET
Command Console LUN is disabled
Host PORT_1:
Reported PORT_ID = 5000-1FE1-0000-3421
PORT_1_TOPOLOGY = FABRIC (fabric up)
Address          = 031000
```

Host PORT\_2:  
Reported PORT\_ID = 5000-1FE1-0000-3422  
PORT\_2\_TOPOLOGY = FABRIC (standby)  
Address = 031600  
NOREMOTE\_COPY

Cache:  
64 megabyte write cache, version 0012  
Cache is GOOD  
Unflushed data in cache  
CACHE\_FLUSH\_TIMER = DEFAULT (10 seconds)

Mirrored Cache:  
Not enabled

Battery:  
NOUPS  
FULLY CHARGED  
Expires: 28-JUN-2001

## 3.2 Completing Your Configuration under Novell NetWare

Novell NetWare will recognize new RA8000/ESA12000 and MA8000/EMA12000 Fibre Channel Storage subsystem devices or changes to existing configurations. You do not need to restart the NetWare server.

**NOTE:** You can now see the Stageset you created with SWCC serial connection.

You can either create all of your Stagesets now, or install the SWCC Agent and complete the HSG80 configuration later.

### 3.2.1 Configure A NetWare Volume on the Stageset for NetWare 5.0

1. From the NetWare 5.x console, type **load NWconfig**.
2. Select *Disk Options*.
3. Select *Modify disk partitions and Hot Fix*.
4. When the *Available Disk Drives* screen is displayed, select *Compaq StorageWorks FC Array Disk x Lun y*.

**NOTE:** X is a number that is created by the driver to signify the HSG80 port and Y represents the Stageset Lun number.

5. Select Create NetWare disk partition and press the **F10** key.
6. To create the NetWare partition, select Yes.

7. To continue to the Available Installation Disk Options screen, press the **Esc** key two times.
8. Select NetWare Volume Options from the Available Disk Options menu.
9. To add NetWare Volume, press the **Insert** key.
10. Select the newly created NetWare partition and press the **Enter** key.
11. Select Make this segment a new volume or Add this segment to an existing volume.
12. Provide a NetWare volume name in the text box and press the **Enter** key.
13. To save the volume name, press the **F10** key.
14. To exit the Volume creation menu, press the **F10** key, then the **Esc** key.
15. To save volume changes, select **Yes**.
16. Enter your administrator password.
17. Select Mount all volumes and press the **Esc** key.
18. To exit NWconfig, select **Yes**.

**NOTE:** Prior to deleting or reconfiguring Compaq StorageWorks virtual disks, you must delete NetWare volumes and partitions residing on them using INSTALL.NLM or NWCONFIG.NLM.



## Chapter 4

# Installing the RA8000/ESA12000 and MA8000/EMA12000 Netware SWCC Agent and Configurator

This chapter introduces you to Command Console's agent and provides instructions on how to establish communication over a network. The instructions include how to install and configure the agent and how to add storage subsystem host systems to the network using Command Console Client.

**NOTE:** For more information, use the on-line HELP in the SWCC Storage and CLI Windows.

## 4.1 Introduction

This chapter provides the procedures for installing the RA8000/ESA12000 and MA8000/EMA12000 NetWare Agents and Configurator on NetWare.

To communicate with your RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel Subsystem over a network, two software applications are required: 1) a client and 2) an agent. Command Console Client is a graphical user interface which installs and runs on either Windows 2000 or Windows NT host, while Command Console Agent installs and runs unseen in the background on the storage subsystem's host computer. Client was installed in *Chapter 2*, the Agent is installed in this chapter. Together the two provide the software link required for communication over a network.

**Agent:**

Agent runs on a host system as a server application. To establish communication over a network, you must install Agent on the host system that the storage subsystem is connected to.

Agent provides the software interface between the host storage subsystem and any number of Command Console Client sessions running on either the host or remote system, allowing you to configure and monitor your storage subsystem from many locations.

Agent also provides access protection and asynchronous fault notification. You can configure Agent to use TCP notification to Command Console Client or SNMP notification to an SNMP-compatible monitoring application.

**Client:**

Command Console Client is the control interface for your RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel Subsystem. Before you can communicate with your storage subsystem over a network, the client address must be added to the agent database.

**Before You Start:**

**NOTE:** Before installing the NetWare SWCC Agent, make sure that the NetWare server and the client can communicate over TCP/IP. You can test this by pinging the server from the client. You can also ping a client from a Novell server by typing at the server console:

SERVER: Load ping

If the server and client cannot ping each other by name, resolve this problem before you attempt to use the SWCC Agent.

The server must be able to communicate with the client over TCP. One way to do this is to edit the servers and client host file in SYS:ETC. This will allow you to ping by name versus ip number.

The following message on the console usually indicates that the steam.nlm cannot communicate to the client. Make sure your client.ini file has the correct name and that you ping, by name, the client.

Logfile=D2FD8CD4, msg len=115

WARNING: Socket error – connecting to colossus – Can't assign requested address (SP\_SOCKET: socketConnectByService).

- To run Agent your system resources must meet the minimum requirements listed in Table 4-1.

**Table 4-1**  
**Minimum Agent Host System Requirements**

Host Feature	Requirement
Operating System	NetWare 4.2 or 5x
Network Connection	TCP/IP-compatible network card
Controller Compatibility	StorageWorks HSG80 Array controller

- You will need password protection for Agent's host system. You must specify a password during Agent's Configuration Step 1 of 3.
- You will also need the IP name of Command Console Client's host system and you need a name for the storage subsystem(s) connected to Agent's host system.
- You need to have installed TCP/IP services on your Netware server.
- You need to have created a "communications" virtual disk on your RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel Subsystem using Command Console Client and a serial port connection (see Chapter 2).
- You need to have at least one NetWare partition created.

## 4.2 Installing the Agent and Configurator

1. Attach with administrative rights to the server you wish to install the agent to.
2. From the *RA8000\_NWSWCC\NETWARE\_AGENT* start *SETUP.EXE* (Figure 4-1).



Figure 4-1. Welcome screen

3. Click the *Next* button to continue.
4. Enter the name of the server you are installing to in the Server box.
5. If you wish to change the install directory for the agent change the location now in the path. This path is on the SYS: volume only. The default will create the directory SYS:OPT\STEAM.

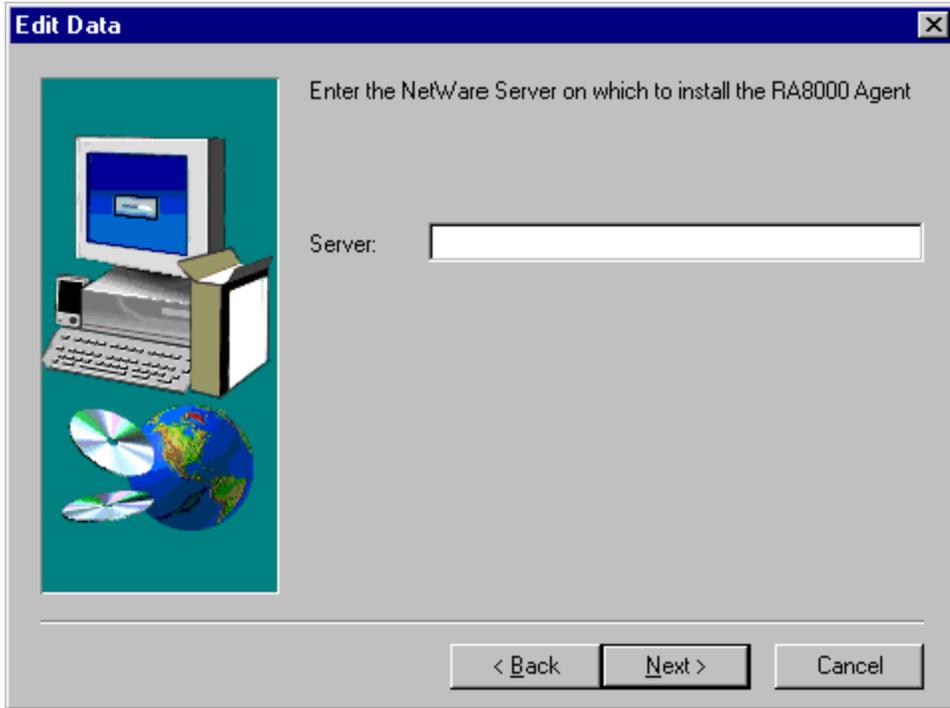


Figure 4-2. Edit data screen

6. If you are not attached to the server or you do not have administrator privileges you will see the following message (Figure 4-3):

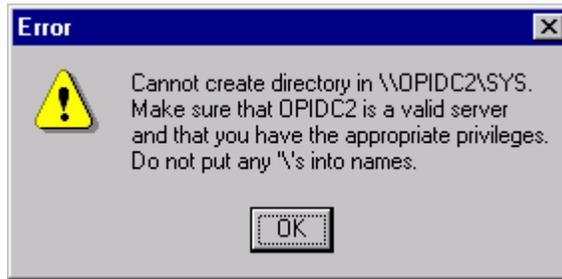


Figure 4-3. Error screen

7. The installer will place the software files in the proper locations.
8. The following directories and files will be installed to the server.

```
SYS:OPT\STEAM  
SYS:OPT\STEAM\ETC\BIN\DATA
```

9. The installation program adds the following two lines to the SYS:ETC\SERVICES file:

```
SPAGENT 4999/TCP  
SPGUI 4998/TCP
```

## 4.3 Configuring Agent Services

1. On the NetWare Console type:

load HSG80CFG

at the Main menu screen shown in Figure 4-4.

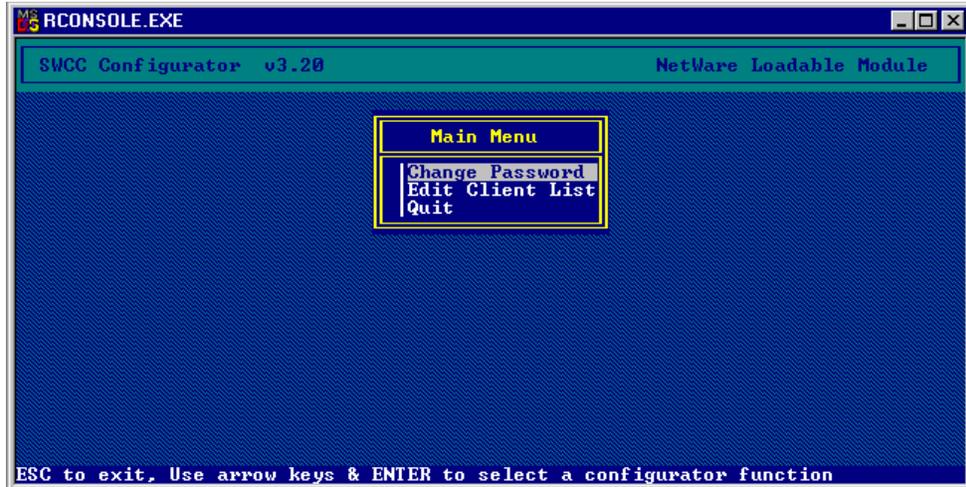


Figure 4-4. Main menu screen

**NOTE:** Ensure the information displayed matches the installed configuration if it does not.

Select *Edit Client List* (Figure 4-5). The list of clients will appear, if there are no defined clients the list will be empty.

2. Press the **INS** key to create a new client or highlight the client you wish to edit and then press the **Enter** key.

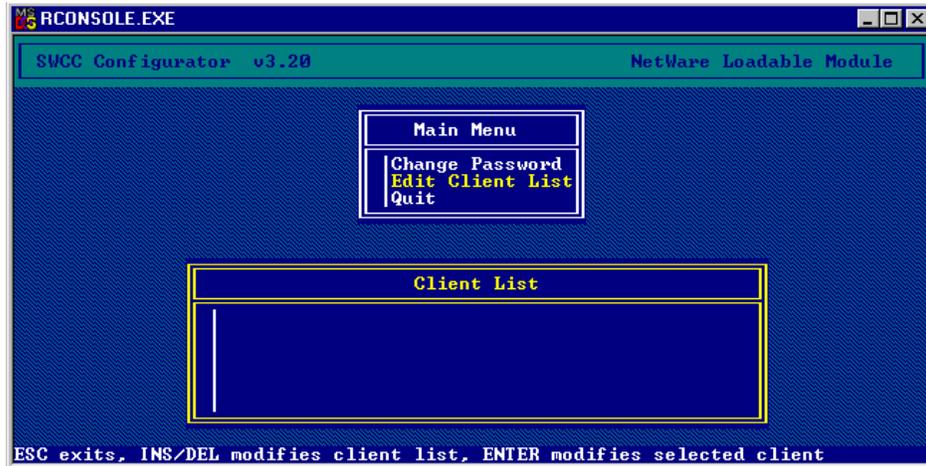


Figure 4-5. Client list screen

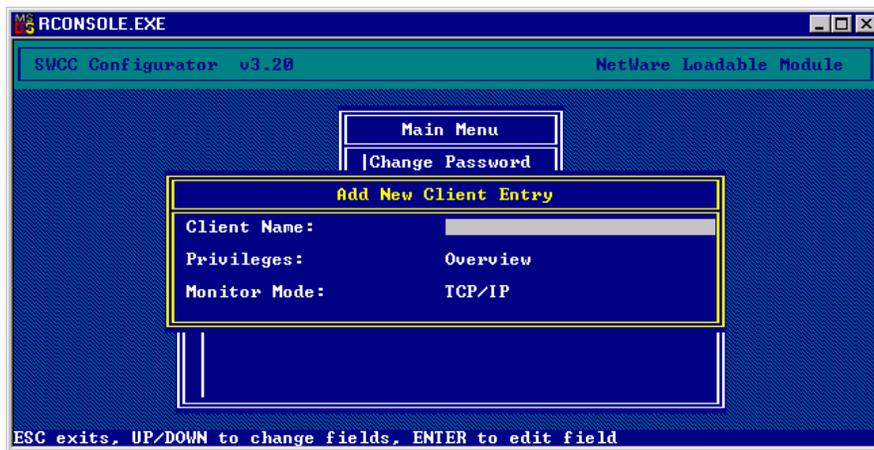


Figure 4-6. Add new client entry screen

3. Insert to add a new client entry (Figure 4-6).
4. Type in the client Host name in the Client Name field. The server must be able to communicate with the client over TCP. One way to do this is to edit the servers host file in SYS:ETC.

5. Select appropriate client privileges (Modify, Overview or ReadOnly) and then press the **Enter** key (Figure 4-7).

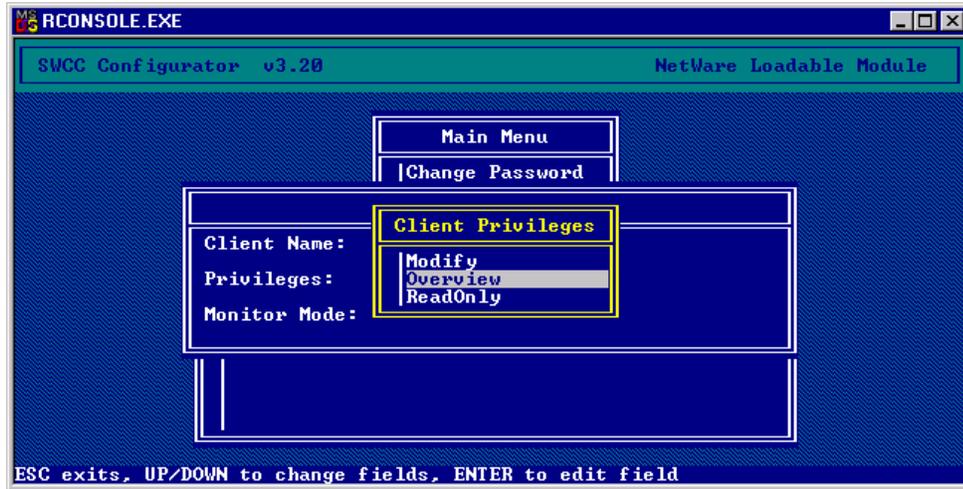


Figure 4-7. Client privileges screen

- The Monitor Mode will be TCP/IP only. Press the **Esc** key to save and go back to the client menu, press the **Esc** key again to return to the Main Menu (Figure 4-8).

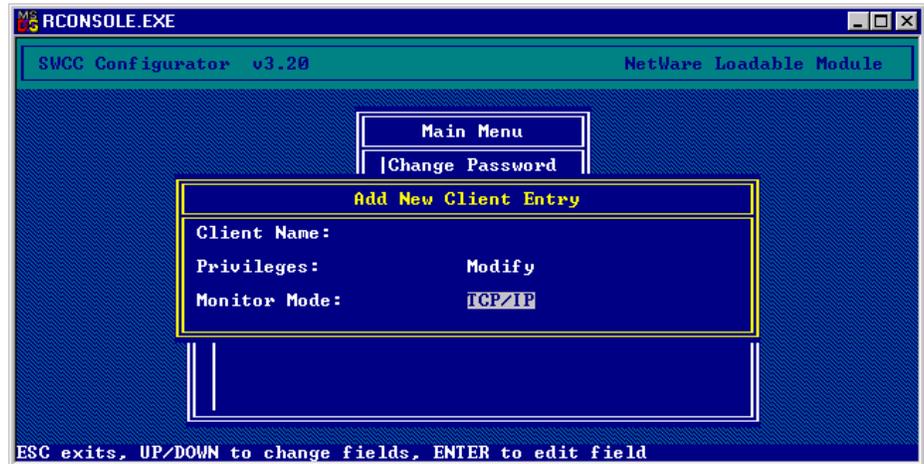


Figure 4-8. Add new client entry screen (monitor mode)

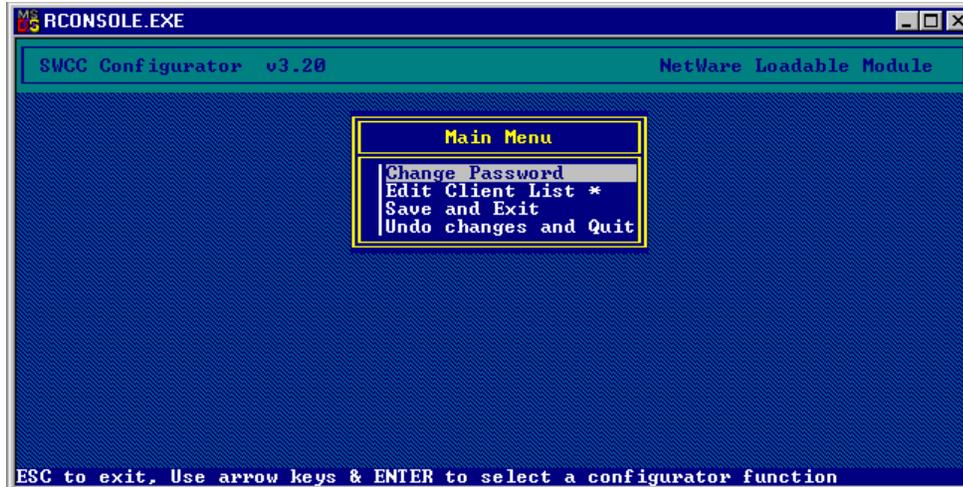


Figure 4-9. Main menu screen

7. To change password for client access select Change Password and then press the **Enter** key.
8. Type in the new password and then press the **Enter** key. You will be prompted to verify the new password by typing it a second time and then pressing the **Enter** key.

Items that have been changed and not saved will be indicated by an \* on the menu selection line.

**NOTE:** This password is independent of the NetWare operating system passwords and security.

9. Select Save and Exit and then press the **Enter** key.
10. To load the NetWare SWCC Agents, type the following at the Server Console

```
load RAIDCDM
```

and

```
load STEAM
```

You are now ready to connect to the Array Using the SWCC Management Console. See the supplied SWCC documentation for information on how to use it.

## 4.4 Adding Storage Subsystems and their Hosts to the Network

Storage subsystems and their host systems are added to the network using Command Console Client. Command Console Client can be installed locally in the storage subsystem's host system or in a remotely located PC connected to the network. Client installs and runs only on Windows 95 or Windows NT PCs. To complete the network link proceed as follows:

1. Install Command Console Client (Refer to *Chapter 4* in this guide.) in the system you will use to configure and monitor your RAID Array.
2. Make sure that you have properly installed and configured an agent on the storage subsystem host system.
3. Select StorageWorks Command Console from the *Command Console Start Menu* (Figure 4-10). After a short wait, Client will display the *Navigation Window* (Figure 4-11). The Navigation Window lets you monitor and manage storage subsystems over the network.



Figure 4-10. Command console start menu



Figure 4-11. Navigation window

4. From the *Navigation Window's File Menu* (Figure 4-12), select *Add System* to display the *Add System Dialog Box* (Figure 4-13).



Figure 4-12. Navigation window's file menu

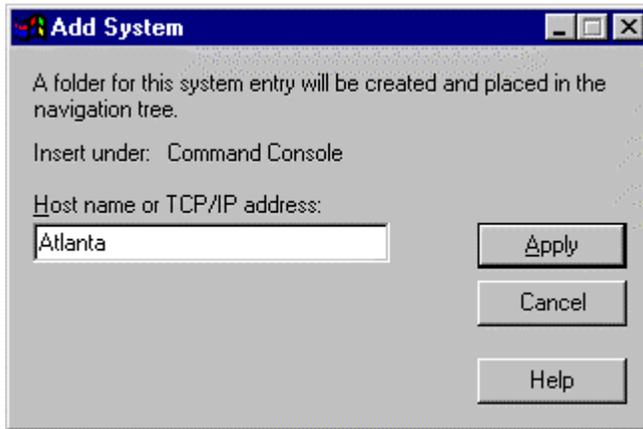


Figure 4-13. Add system dialog box

5. Enter the host platform name, as defined in Agent, then click the *Apply* button. Command Console Client searches for, finds; then displays the storage subsystem's host system as an icon in the *Navigation Window* (Figure 4-14).



Figure 4-14. Navigation window showing storage host system "Atlanta"

6. Click on the plus sign to expand the host computer icon. When expanded, the Navigation Window displays an icon for the storage subsystem (Figure 4-15). In this example the storage subsystem is named *subsys1*. To access the *subsys1*'s Storage System, double-click on the *Storage Window* icon.



Figure 4-15. Navigation window showing expanded "Atlanta" host icon

Double-click on the Storage Window icon to open a Storage Window to monitor and manage your RAID Array 8000.

**NOTE:** For more information, use the on-line HELP in the SWCC Storage and CLI Windows.



# Chapter 5

## Configuration Guidelines

This chapter describes typical RA8000/ESA12000 and MA8000/EMA12000 FC NetWare configurations based on the configuration maximums listed (see Section 5.1 below). For detailed configuration information refer to the *Compaq StorageWorks HSG80 Array Controller ACS V8.5 Configuration Guide* included in this kit. Refer also to the Compaq website for the latest application notes.

### 5.1 General Configuration Guidelines for FC-AL

Fibre Channel storage technology offers more configuration flexibility than parallel SCSI storage.

**NOTE:** It is strongly recommended that you not exceed the maximums listed.

The maximums and notes listed apply to all configurations, additional information specific to particular configurations is provided in each configuration section.

### 5.2 FC-AL Rules

- 500 meters per optical cable segment, 1 kilometer distance between server and storage
- For the maximum number of FC HBAs per server, please refer to your server documentation.
- Controller Transparent Failover Mode.

- 4 servers on a single loop with 2 HSG80's storage systems.
- Up to 8 servers on two loops (4 servers per loop) with 1 storage system.
- The maximum storage capacity stated (1.3 TB) assumes 18 GB disks, increases in disk drive capacity will increase overall storage capacity for the same enclosure footprint.

### 5.3 General Configuration Notes

- All configurations shown in this document utilize dual HSG80 controllers to support transparent failover capability. Single HSG80 controller configurations are supported, but not shown in this document. These configuration guidelines also apply to single controller configurations.
- Dual-redundant controllers should be configured for Transparent Failover Mode.
- All configuration diagrams show a front view of the storage system, Controller A is the top controller; Controller B is the bottom controller. Controller Host Port 1 is the left port; Host Port 2 is the right port.
- Each storage system can be configured using SWCC or the Command Line Interface (CLI) configured through the HSG80 controller maintenance serial port.
- All configurations utilize ACS V8.5F (Array Controller Software).
- All configurations utilize short wavelength lasers and multi-mode Fibre Channel optical cables in each cable segment. Label both ends of each FC cable with the same unique identification marking (number, letter, etc.) prior to installation.
- All configurations require the Connection Name *Operating System* parameter set to "NETWARE"
- By default the HSG80 Command Console LUN (CCL) is enabled. This must be disabled for NetWare (using the CLI, "SET *controller* NOCOMMAND\_CONSOLE\_LUN").
- All configurations require the Arbitrated Loop Physical Address (ALPA) to be set to hard and a unique address for each port.
  - Set *controllername* port\_1\_topology = loop\_hard
  - Set *controllername* port\_1\_al\_pa=71

- ❑ Set *controllername* port\_2\_topology = loop\_hard
- ❑ Set *controllername* port\_2\_al\_pa=72
- Record the FC HBA *Worldwide ID* (WWID) IEEE address shown on the back of each FC HBA prior to installing into a server.
- Use the recorded WWID to identify the connection name displayed from the CLI at the controller using the SHOW CONNECTIONS command.
- Rename connection names. By default new connection names are automatically added to the controller connection name table as “!NEWCONnn” (where nn is a number from 1 to 32). The controllers add a connection when a path to an adapter from each active controller host port is detected. Once you have identified each connection using the FC HBA WWID, rename the connection names to a name meaningful to the specific configuration i.e., SERVER1P1, using the CLI, “RENAME *old-name new-name*”. (Note: Connection names can be a maximum of 9 characters).
- Each active controller host port on a loop presents one SCSI Target ID to each FC HBA on the same loop. LUNs (logical units) can consist of single disks (JBOD), a storage set of multiple disks or a partition, configured for a specific RAID level of 0, 1, 0 + 1, or 3/5.

## 5.4 Technical Contents

This application note describes four common RA8000/ESA12000 or MA8000/EMA12000 FC Novell NetWare FC-AL configurations, and provides the configuration and parts and reference information required to support it. The presentation of this material is listed in Table 5-1.

**Table 5-1**  
**Common Configurations**

Topic	Description
Configuration 1	One Server, Dual Controller Transparent Failover
Configuration 2	Up to 4 Servers, Dual Controller Transparent Failover
Configuration 3	Up to 8 Servers, Dual Controller, Transparent Failover

### 5.4.1 Configuration #1 - One Server, Dual Controller Transparent Failover

Configuration #1 is a two-controller configuration (Figure 5-1) and provides dual-redundant controllers configured in Transparent Failover mode. The configuration consists of an RA8000, ESA12000, MA8000, or EMA12000 storage enclosure with two HSG80 array controllers on a single loop. In normal operation Controller A provides the active path for all storagesets to the server through Port 1.

A second controller, Controller B is a hot standby. Controller B will automatically become active in the event of a failure in Controller A. All units being accessed through Port 1 of Controller A will become accessible through Port 1 of Controller B. In the initial configuration a single controller host port (Port 1) is active providing access up to 24 disks. An additional 48 disks can be added using two expansion enclosures. Additional servers can be added to this configuration as required using the existing hub.

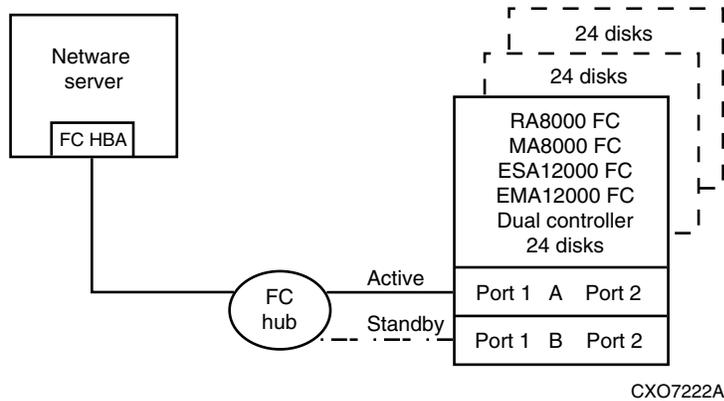


Figure 5-1. Configuration #1

Utilization of a second controller (Controller B) as an active controller can double LUN capacity and can be accomplished without sacrificing redundancy. Two Fibre Channel cables, one connected to Controller A Port 2, and one connected to Controller B Port 2, result in Configuration #1A, shown in Figure 5-2. This configuration provides full controller redundancy in the event that Controller A or Controller B fails. In either failover scenario the surviving controller will transition a standby port to the active state providing access to all units to the server.

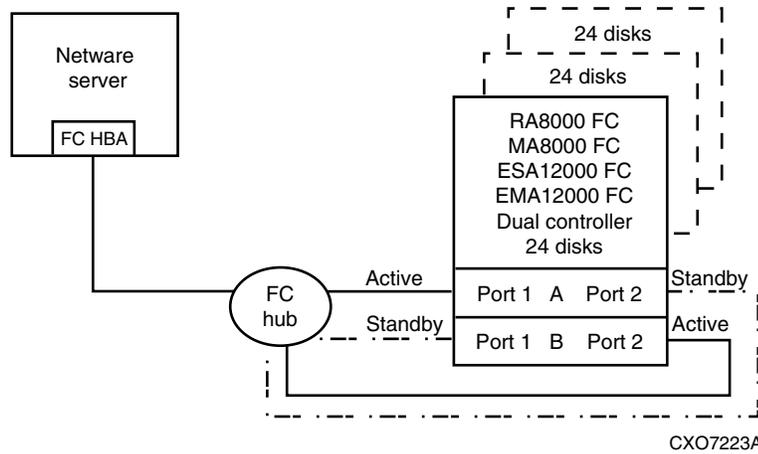


Figure 5-2. Configuration #1A (configuration 1 with double LUN capacity)

### Configuration #1A Notes

- Single Fibre Channel Loop.
- Dual HSG80 controllers configured in Transparent Failover Mode.
- Up to 500 meters per cable segment.
- Up to 72 disks with 2 optional expansion enclosures.
- A second RA8000 may be added to these configurations.  
Is this note specific to an RA8000? What about Modula?

## 5.4.2 Configuration # 2 – Up to Four Servers, Dual Controller Transparent Failover, Shared Storage Enclosure

Configuration #2 utilizes a dual-controller pair on a single loop to provide storage and controller redundancy for up to four separate servers (Figure 5-3). The servers can share the storage enclosure in either a non-cooperating mode using selective storage presentation, or in a cluster environment. See Section 5.5 for more information.

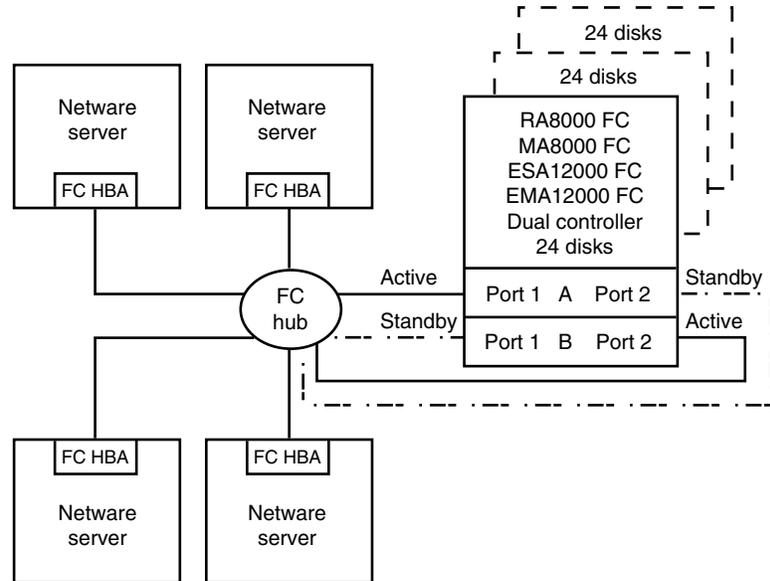


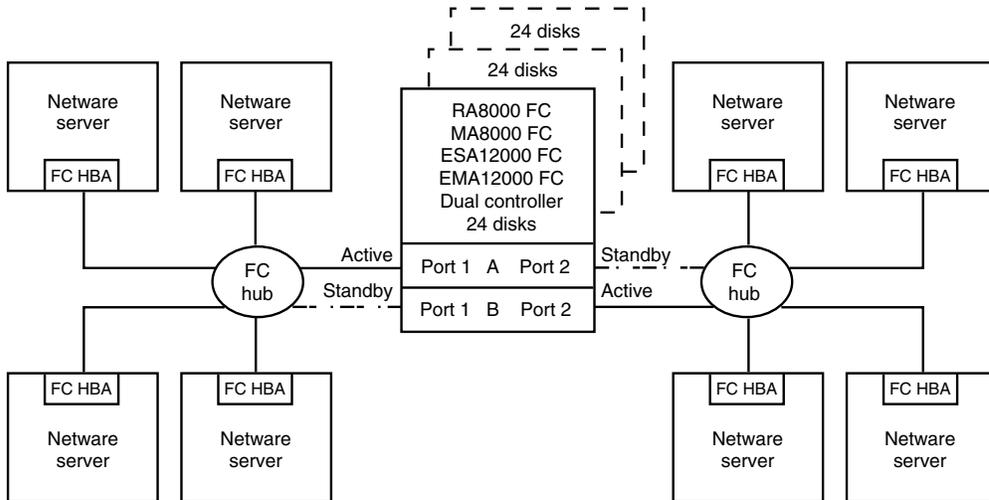
Figure 5-3. Configuration #2

### Configuration # 2 Notes

- Single Fibre Channel Loop.
- Dual HSG80 controllers configured in Transparent Failover Mode.
- Up to 500 meters per cable segment.
- A second RA8000 may be added to this configuration.

### 5.4.3 Configuration #3 – Up to Eight Servers, Dual Controller Transparent Failover, Shared Storage Enclosure

Configuration #3 (Figure 5-4) utilizes a dual controller pair on two Fibre Channel loops to provide storage and controller redundancy to two groups of up to four separate servers. The servers can share the storage enclosure in either a non-cooperating mode using selective storage presentation, or in a cluster environment. See section 5.5 for more information. Additional levels of access control are necessary for this configuration because each group of four servers is sharing the same loop.



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Figure 5-4. Configuration #3

#### Configuration # 3 Notes

- Two Fibre Channel Loops.
- Dual HSG80 controllers configured in Transparent Failover Mode.
- Up to 500 meters per cable segment.
- Up to 72 disks with 2 optional expansion enclosures.
- A second RA8000 may be added to this configuration.

## 5.5 Switch Fabric Rules

- Up to 4 Fibre Channel switches total in a single Fabric - a SAN with all switches interconnected.
- NetWare supports the Compaq 16 (158223-B21) and 8 (158222-B21) port SAN switches.
- NetWare requires that the switch support FL-Port logins.
- A server can attach to multiple multi-switch Fabrics (Figure 1). The number of separate Fabrics per server or total number of switches per server in separate Fabrics is based on the specific server model capabilities and the maximum number of FC HBAs supported.
- Within a single Fabric, maximum of 1 switch hop between servers and storage, maximum of 2 switch hops worst case with a single fault - a Fabric can re-route to a 2-hop path on a single link failure. A hop is defined as 1 or more connections between two FC switches, for example; 2 switches cascaded = 1 hop. Server to FC switch segments and Storage to FC switch segments are not counted as hops.
- Within a single Fabric where switches are interconnected, each FC switch must have a unique domain number (Domain\_ID).
- Up to 16 inter-switch links (ISLs) between any 2 switches, up to 8 active to the same destination.
- Minimum cable segment length is 2 meters.
- Up to 200 meters per cable segment using short-wavelength laser GBICs and 62.5 micron multi-mode fiber optic cable. With multiple cable segments 600 meters total distance nominal, 800 meters worst case with a single fault re-route, between server and storage.
- Up to 500 meters per cable segment using short-wavelength laser GBICs and 50 micron multi-mode Fibre optic cable. With multiple cable segments 1.5 km total distance nominal, 2.0 km worst case with a single fault re-route, between server and storage.
- All configurations require the port technology is set to fabric. Type:  
set [controller] port\_1\_topology = fabric  
set [controller] port\_2\_topology = fabric

### 5.5.1 Novell NetWare Server/Storage Rules

- All configurations are supported under NetWare 4.2 and 5.x and Novell Cluster Server.

- For NetWare, all server connections into the SAN use a FC-Fabric FL-port based HBA. FC-AL HBA connections into the SAN are not supported for NetWare platforms.
- The maximum number of FC HBAs per server is 4, or total allowed in the server if less than 4. Use Selective Storage Presentation (see below) to assign specific LUNs exclusively to each HBA.
- The maximum number of active controller ports per FC HBA is 4.
- Any combination of NetWare Servers - standalone or clustered, and RA8000/ESA12000 or MA8000/EMA12000 storage systems is allowed per SAN configuration, provided these rules are followed:
  - a. A maximum of 16 NetWare servers (assumes 1 FC HBA per server) per RA8000, ESA12000, MA8000, or EMA12000 dual controller storage system, with a maximum of 8 servers configured on each active port.
  - b. All specific SAN configuration rule limits are followed. Refer to the individual SAN Fabric configurations
- All configurations require the *Connection Name Operating System* parameter set to "NETWARE".
- When configuring HSG80 controllers for access from NetWare servers only, the controller SCSI mode should be set to "SCSI-2" and the Command Console LUN (CCL) must be disabled.
- Each active controller host port presents one SCSI Target ID that has a connected path through the Fabric to the port.
- The maximum number of LUNs per HSG80 controller pair is 30.
- Dual-redundant controllers must be configured for Transparent Failover Mode.
- Each storage system can be configured using SWCC or the Command Line Interface (CLI) through either the HSG80 controller maintenance serial port or a TCP/IP interface.
- All configurations utilize ACS V8.5F (Array Controller Software) configured for FABRIC topology.
- ACS V8.5 provides for up to 64 connection name entries. For dual controllers in Transparent Failover Mode, up to 2 connection entries are created for each server HBA, thus a total of 32 server HBAs are visible to a storage system at any given time.

**NOTE:** The maximum number of server HBAs supported on a storage system is 16. Each storage system in the SAN will automatically add connection name entries upon initial power up. As a result, in certain SAN configurations it is possible to exceed the number of available connection name entries in a storage system prior to the addition of entries for the specific server HBAs that you want access to. This could result in the inability of a storage system to properly connect to a desired server HBA in the SAN. To avoid this, you can configure specific server HBAs and specific storage systems into FC Switch Zones of up to 32 Servers in Transparent Failover.

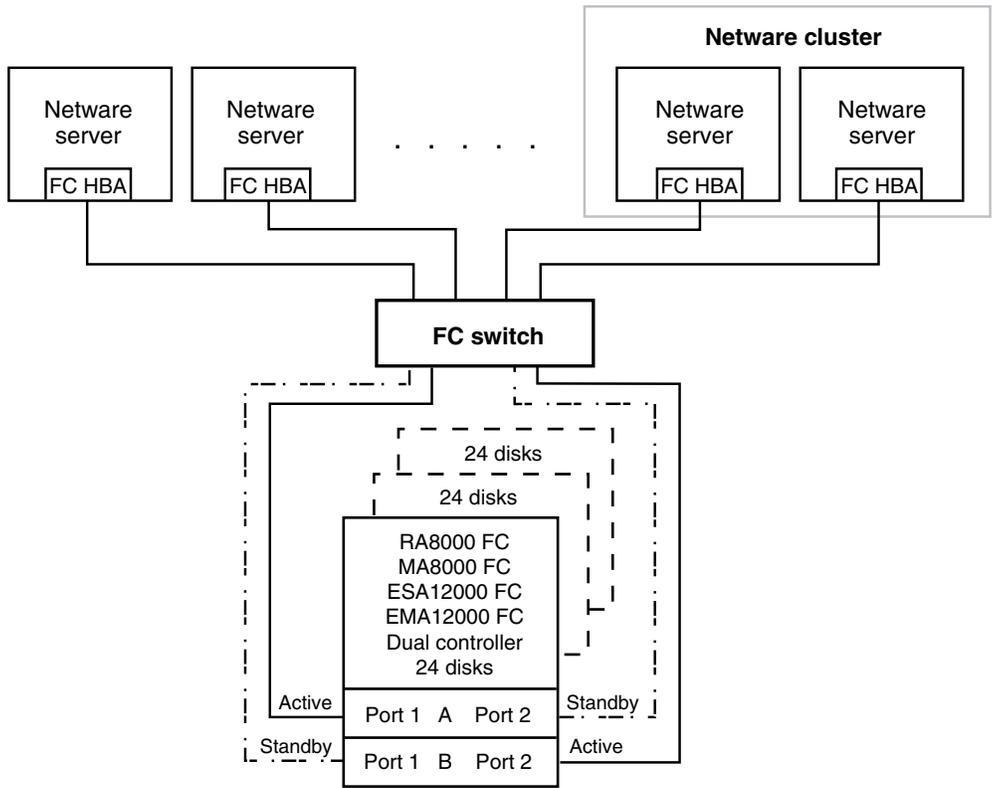
- Rename connection names. By default new connection names are automatically added to the controller connection name table by the controllers when they detect a path to an adapter from each active controller host port. The default connection name assigned by the controllers will be “!NEWCONnn”, where nn is a number from 1 to 64. After the controllers detect all paths, rename each connection name to be more meaningful to the configuration i.e., SERVER1P1, SERVER1P2, etc. (connection names can be a maximum of 9 characters).
- Selective Storage Presentation - for configurations with more than 1 FC HBA in a server or more than one server accessing through the same HSG80 controller host port.

Use the Unit *Connection Name* parameter to allow exclusive access to units from each server or HBA (using the CLI type: “SET unit-number DISABLE\_ACCESS\_PATH = ALL  
Then type:ENABLE\_ACCESS\_PATH = *connection-name*”)

**NOTE:** Shared access between different servers to the same storage unit (LUN) requires specific application software (i.e., Novell Cluster Server) to ensure proper data preservation.

### 5.5.2 Switch Fabric Configuration 1 - One FC Switch, Controller Transparent Failover Mode

SAN Fabric Configuration 1 (Figure 5-5) is a general-purpose configuration that provides connectivity for multiple servers and disk storage all on a single SAN. Up to 12 separate non-cooperating servers or up to 8 clustered cooperating servers can be connected through a 16-port switch providing access from all servers to a single storage system. With an 8-port FC switch up to 4 servers can be connected to 1 storage system. With either switch type the number of storage systems can be increased if the number of servers is reduced to provide additional switch ports for storage. The HSG80 array controllers within the RA8000, ESA12000, MA8000, or EMA12000 storage enclosure are configured in Transparent failover mode providing full controller redundancy in the unlikely event of either controller failing.



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Figure 5-5. One FC switch, controller transparent failover mode

## 5.6 NetWare Cluster Services

The RA8000/ESA12000 and MA8000/EMA12000 in a Fibre Channel Arbitrated Loop can share its storage among different server attached to the same Fibre SAN. The configuration of the RA8000/ESA12000 or MA8000/EMA12000 depends on the desired application. In a Cluster configuration, all storage must be accessible from each server. The Novell Cluster Server provides the controlled access to each storage unit.

NetWare Cluster Services (NCS) is the clustering software system implemented on servers to ensure high availability and manageability of critical network resources, including data(volumes), applications, server licenses, and services. It is a multinode, NDS-enabled clustering product of NetWare 5 that supports failover, failback, and migration (load balancing) of individually managed cluster resources. NCS provides important features to help you ensure and manage the availability of your network resources. These features include:

- Support for shared disk configurations or local disk configurations.
- Multinode all-active cluster. Any server in the cluster can restart resources (applications, services, IP addresses, and volumes) from a failed server in the cluster.
- Single point of administration through a Java-based ConsoleOne cluster configuration and monitoring graphical user interface.
- The ability to tailor a cluster to the specific applications and hardware infrastructure that fit your organization.
- Dynamic assignment and reassignment of server storage on an as-needed basis.

To configure a Novell Cluster in a SAN, each server in the cluster must be able to access all the same storagesets. There are 2 methods of configuring access to storage in a SAN.

Selective Storage Presentation (SSP) – The RAID Array SSP feature provides a means to control access at the LUN. SSP is an exclusive RA8000/ESA12000 and MA8000/EMA12000 storage system feature that allows multiple servers or host bus adapters (HBA) to share access to the same RAID array reliably, with each server or HBAs storagesets (LUNs) presented exclusively to those that are allowed access. Additionally, SSP allows the setting of host modes and LUN offsets for each HBA connected to the array. Section 5.7 has more in formation on Selective Storage presentation.

Switch Fabric Zoning – The FC switch Zoning feature provides a means to control SAN access at the node port level. Zoning can be used to separate one physical Fabric into many virtual Fabrics consisting of selected server and storage ports. This capability allows you to setup barriers between different operating environments, to deploy logical Fabric subsets by creating defined server and/or storage groups, or to create temporary server and storage zones for tape backup. Zones may be configured dynamically and the number of zones and zone membership are effectively unlimited. Nodes can be in multiple zones to allow for overlapping depending on the desired access control. Use of Zoning is supported in both homogeneous NetWare SAN configurations and heterogeneous mixed platform SAN configurations.

## 5.7 Selective Storage Presentation

**NOTE:** Selective Storage Presentation is a feature that prevents unauthorized systems from accessing a storage device on a shared RAID array. Normally, many operating systems running on hosts “grab” all the storage they can discover. Furthermore, when these operating systems grab the storage, they tend to write their own information on the devices. This could corrupt the data .

Selective Storage Presentation within HSG80 Array Controllers provides methods for:

- Tracking the numerous adapters within the hosts attached to the SAN.
- Accessing control for each host adapter allowing No Access, Full Access, or Selective Adapter Access.
- Setting up host modes for each adapter connected to the array. A particular host mode corresponds to a specific operating system which is specially tailored to the communication techniques of the operating system.
- Facilitating Fibre Channel protocols for less sophisticated operating systems by providing a LUN offset. The host sees a LUN at an offset from the internal LUN within the array. This is necessary because some operating systems only see LUNs in a specific range of LUN numbers.

Host connections are made when an adapter logs into the array controller over one or more of the controller’s ports. When this connection is made, the controller makes an entry in its internal connection table which is kept in each array’s Non-Volatile RAM (NVRAM).

Each host connection is identified to the controller in two ways. The first, and most important method, uses the World Wide Identifier (WWID) of the adapter that has logged into the array controller, an ID that is unique to every adapter in the world. The controller uses this ID to recognize the connection as a unique connection. The second method uses the name of the connection. Each host may have more than one adapter; however, each adapter makes its own connection to the array controller, and each connection is treated separately by the controller.

Storagesets can have more than one connection enabled from access, as may be needed in a cluster configuration.

The connections are named sequentially, starting with NEWCON1, NEWCON2, and so on. After the connection has been made, the user may rename the connection to any name desired, but typically the most common naming convention corresponds to the type of host and its order within the customer's configuration (e.g., NTHOST1 or VMSHOSTn). The Command Line Interpreter (CLI) command, which sets the name to a different naming convention, is:

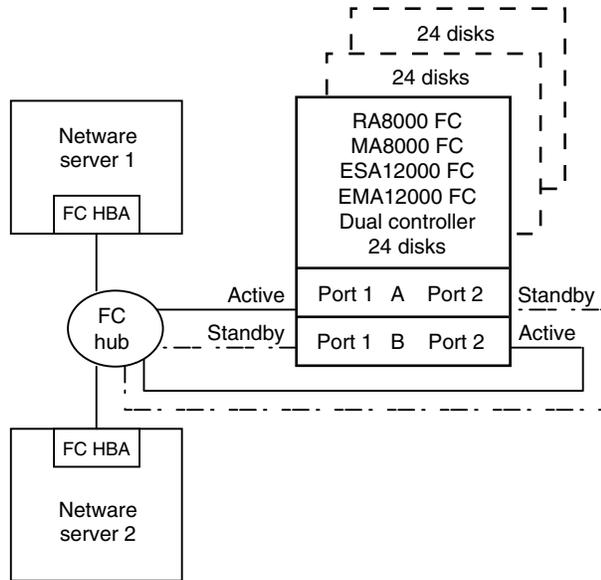
```
Set Connection Name = " "
```

The CLI command:

```
Show Connections
```

displays the list of any current or past connections that have been made to the array.

This section explains how to configure the HSG80 controllers of a Fibre Channel RAID Array system to support FC-AL shared storage in a NetWare environment (Figure 5-6).



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Figure 5-6. Configuring HSG80 controllers (Fibre channel RAID array system)

### 5.7.1 HSG80 Shared Storage Configuration Settings for NetWare

By default, units d0 - d99 will only be accessible on port 1 and units d100 - d199 will only be accessible on port 2. We create units D0 and D1 (on port 1) and D100 and D101 (on port 2). IN THIS EXAMPLE, with the exclusive access set, we want Server 1 to access only D0 and D100, Server 2 to only access D1 and D101. All examples are shown using the CLI

From the CLI prompt, type:

```
HSG80> show this
Controller:
HSG80 ZG81701099 Software V83G-0, Hardware E02
NODE_ID          = 5000-1FE1-0000-3420
ALLOCATION_CLASS = 0
SCSI_VERSION     = SCSI-2
Configured for dual-redundancy with ZG81700990
  In dual-redundant configuration
Device Port SCSI address 7
Time: 21-MAY-1999 14:45:05
Command Console LUN is disabled
Host PORT_1:
Reported PORT_ID = 5000-1FE1-0000-3421
PORT_1_PROFILE  = PLDA
```

```
PORT_1_TOPOLOGY = LOOP_HARD (loop up)
PORT_1_AL_PA    = 71 (71 negotiated)
Host PORT_2:
  Reported PORT_ID = 5000-1FE1-0000-3422
  PORT_2_PROFILE  = PLDA
  PORT_2_TOPOLOGY = LOOP_HARD (standby)
  PORT_2_AL_PA    = 72 (72 negotiated)
Cache:
  64 megabyte write cache, version 0012
  Cache is GOOD
  Unflushed data in cache
  CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
  64 megabyte write cache, version 0012
  Cache is GOOD
  Unflushed data in cache
Battery:
  FULLY CHARGED
  Expires: WARNING: UNKNOWN EXPIRATION DATE!
  WARNING: AN UNKNOWN NUMBER OF DEEP DISCHARGES HAVE OCCURRED!
  NOCACHE_UPS
```

After you start the server and load the CPQFC.HAM and CPQSHD.CDM, the connection will be established. From the CLI window type:

```
HSG80> show connection
Connection
Name          Operating system Controller Port Address  Status  Offset
Unit

!NEWCON1  NETWORK  OTHER  2  000001  OL other  100
          HOST_ID=5008-05F1-FADB-81F0  ADAPTER_ID=5008-05F1-FADB-81F0

!NEWCON2  NETWORK  THIS   1  000001  OL this   0
          HOST_ID=5008-05F1-FADB-81F0  ADAPTER_ID=5008-05F1-FADB-81F0
HSG80>
```

These connections are the world wide ID of each host bus adapter on the loop. This number is assigned to each board and is listed on the back of the board. Record this number and write it down for each system before you install the adapter. Then you can rename the connection to a meaningful name. In this example the last 4 digits of the world wide ID on the adapter in SERVER 1 is 81F0.

In this case the !NEWCON1 shows the adapter ID as **81F0**, on port 2. Now rename these to something meaningful, as follows:

```
HSG80> rename !newcon1 SVR1_pt2
HSG80> rename !newcon2 SVR1_pt1
HSG80> show connection
```

Connection Name	Operating system	Controller	Port	Unit Address	Status	Offset
SVR1_PRT2	NETWARE	OTHER	2	000008	OL other	100
				HOST_ID=5008-05F1-FADB-81F0		ADAPTER_ID=5008-05F1-FADB-81F0
SVR_PRT1	NETWARE	THIS	1	000008	OL this	0
				HOST_ID=5008-05F1-FADB-81F0		ADAPTER_ID=5008-05F1-FADB-81F0

In the next example, the last 4 digits of the world wide ID on the adapter in Server2 is 5912.

SVR2_PRT2	NETWARE	OTHER	2	000001	OL other	100
				HOST_ID=5008-05F1-FADB-5912		ADAPTER_ID=5008-05F1-FADB-5912
SVR2_PRT1	NETWARE	THIS	1	000001	OL this	0
				HOST_ID=5008-05F1-FADB-5912		ADAPTER_ID=5008-05F1-FADB-5912

To show the units you have created, type:

```
HSG80>show units
D0
D1
D100
D101
```

To set exclusive access for a unit you must first disable access for all, type:

```
HSG80> set d0 disable_access = all
HSG80> set d1 disable_access = all
HSG80> set d100 disable_access = all
HSG80> set d101 disable_access = all
```

To enable d0 and d100 to be accessed by only the SERVER1 connection, type:

```
HSG80> set d0 enable_access = SVR1_PRT1
HSG80> set d100 enable_access = SVR1_PRT2
HSG80> show d0
LUN                Uses
-----
D0                  R1
LUN ID: 6000-1FE1-0000-3420-0009-8170-1099-01AF
NOIDENTIFIER
Switches:
  RUN                NOWRITE_PROTECT    READ_CACHE
  READAHEAD_CACHE    WRITEBACK_CACHE
  MAXIMUM_CACHED_TRANSFER_SIZE = 32
Access:
  SVR1_PRT1
State:
```

**5-18** RA8000/ESA12000 and MA8000/EMA12000 Solution Software V8.5b for Novell NetWare Installation Reference Guide

```

        ONLINE to this controller
        Not reserved
        Size: 16751956 blocks
        Geometry (C/H/S): ( 7413 / 20 / 113 )

HSG80> show d100
LUN                Uses
-----
D100                R2
LUN ID: 6000-1FE1-0000-3420-0009-8170-1099-01B3
NOIDENTIFIER

Switches:
RUN                NOWRITE_PROTECT    READ_CACHE
READAHEAD_CACHE    WRITEBACK_CACHE
MAXIMUM_CACHED_TRANSFER_SIZE = 32
Access:
SVR1_PRT2
State:
ONLINE to the other controller
Size: 16751956 blocks
Geometry (C/H/S): ( 7413 / 20 / 113 )
HSG80>
```

Now from the SERVER1 console, scan for new devices as shown below, or reboot the server and the LUNs should appear.

```

SERVER 1: Scan for New Devices
SERVER1:list devices
0x0001: [V500-A0-D0:10] Compaq 53C876 Slot 0 Port 1 ID 0 COMPAQ BD009122
0x0009 [V502-A2-D1:14] Compaq RA8000 ID 0 LUN 4 (5000-1FE1-0000-3420)
0x000A: [V502-A2-D3: 0] Compaq RA8000 ID 3 LUN 0 (5000-1FE1-0000-3420)
0x000B: [V502-A2-D3: 11] Compaq RA8000 ID 3 LUN 17 (5000-1FE1-0000-3420)
0x0017: [V025-A4-D1: 0] COMPAQ CD-224E rev: 9.0B
```

Continue this process until all units have been assigned as needed.

```

HSG80> set d1 enable_access = SVR2_PRT1
HSG80> set d101 enable_access = SVR2_PRT2
```

```

HSG80> show d1
  LUN                Uses
-----
D3                    R3
LUN ID: 6000-1FE1-0000-3420-0009-8170-1099-01B7
NOIDENTIFIER
Switches:
  RUN                NOWRITE_PROTECT    READ_CACHE
  READAHEAD_CACHE    WRITEBACK_CACHE

  MAXIMUM_CACHED_TRANSFER_SIZE = 32
Access:
  SVR2_PRT1
State:
  ONLINE to this controller
  Not reserved
Size: 35529666 blocks
Geometry (C/H/S): ( 10512 / 20 / 169 )
HSG80> show d101
  LUN                Uses
-----
D101                  R4
LUN ID: 6000-1FE1-0000-3420-0009-8170-1099-01BB
NOIDENTIFIER
Switches:
  RUN                NOWRITE_PROTECT    READ_CACHE
  READAHEAD_CACHE    WRITEBACK_CACHE

  MAXIMUM_CACHED_TRANSFER_SIZE = 32
Access:
  SVR2_PRT2
State:
  ONLINE to the other controller
Size: 35529666 blocks
Geometry (C/H/S): ( 10512 / 20 / 169 )
HSG80>

```

Now from the SERVER2 console, scan for new devices as shown below, or reboot the server, and the LUNs should appear.

```

SERVER 2: Scan for New Devices
SERVER2: list devices
0x0001: [V500-A0-D0:10] Compaq 53C876 Slot 0 Port 1 ID 0 COMPAQ BD009122
0x0009 [V502-A2-D1:14] Compaq RA8000 ID 0 LUN 4 (5000-1FE1-0000-3420)
0x000A: [V502-A2-D3: 0] Compaq RA8000 ID 3 LUN 0 (5000-1FE1-0000-3420)
0x000B: [V502-A2-D3: 11] Compaq RA8000 ID 3 LUN 17 (5000-1FE1-0000-3420)
0x0017: [V025-A4-D1: 0] COMPAQ CD-224E rev: 9.0B

```



# Chapter 6

## Creating Your Storage Configuration with the CLI

This chapter contains instructions for creating an initial storage configuration using the Command Line Interpreter (CLI). It briefly describes the CLI and how to access it. The configuration steps include: adding devices; creating and initializing RAIDsets, stripesets, mirrorsets, and striped mirrorsets; identifying a storageset as a unit to the host; and verifying and recording the final configuration.

**NOTE:** To create your storage configuration using the StorageWorks Command Console, refer to *Chapter 2*.

To configure the devices in your storage system into storagesets, you need to:

- Plan your configuration (see *Appendix A*).
- Add disks to the controller.
- Create storagesets.
- Save the configuration.
- Record the configuration.

### 6.1 Configuration Guidelines

Use the following guidelines to configure the HSG80 controller and your host system to optimize system performance.

### 6.1.1 Controller Device Configuration Guidelines

- The enclosure has six device ports (SCSI buses). Evenly distribute disk devices across the separate six device ports. This permits parallel activities on the controller's available device ports and the attached drives.
- Avoid configuring multiple mirrorsets with the first member being on the same device port. Configure multiple mirrorsets similar to the following example:

```
add mirrorset mirr_1 disk10000 disk20000
add mirrorset mirr_2 disk20100 disk10100
```

### 6.1.2 Controller Host System Configuration Guidelines

You must to assign a host logical unit number to each storageset or single disk unit that you want your host to know about in your storage system. The host uses these numbers to indicate the source or destination for every I/O request it sends to the controller.

Each logical unit number contains the following:

- A letter that indicates the kind of devices in the storage unit. For example, D for disk drives.
- A number from 0-99 or 100-199.

Each HSG80 controller has two host ports, Port 1 and Port 2, as shown in the following figures. Unit numbers D0-D99 are assigned to Host Port 1, and unit numbers D100-D199 are assigned to Host Port 2.

**NOTE:** Always assign all partitions of a storageset to the same host port (do not split partitioned storagesets across host ports).

<b>Controller A</b>	<b>Port 1 Active</b>	<b>Port 2 Unused</b>	
	EMPTY		
<b>Cache A</b>	EMPTY		

Figure 6-1. Single controller/single host

For single HSG80 controller configurations connected to a single host, configure logical units on Controller A - Host Port 1. Valid unit numbers are D0-D99. Controller A - Host Port 2 is unused.

<b>Controller A</b>	<b>Port 1 Active</b>	Port 2 Unused	
<b>Controller B</b>	Port 1 Standby	Port 2 Unused	
<b>Cache A</b>		<b>Cache B</b>	

Figure 6-2. Dual controller/Single host

For dual-redundant HSG80 controller configurations connected to a single host, configure logical units on Controller A - Host Port 1. Valid unit numbers are D0-D99. Controller B - Host Port 1 is automatically configured as a standby port for these same units. Controller A - Host Port 2 and Controller B - Host Port 2 are unused.

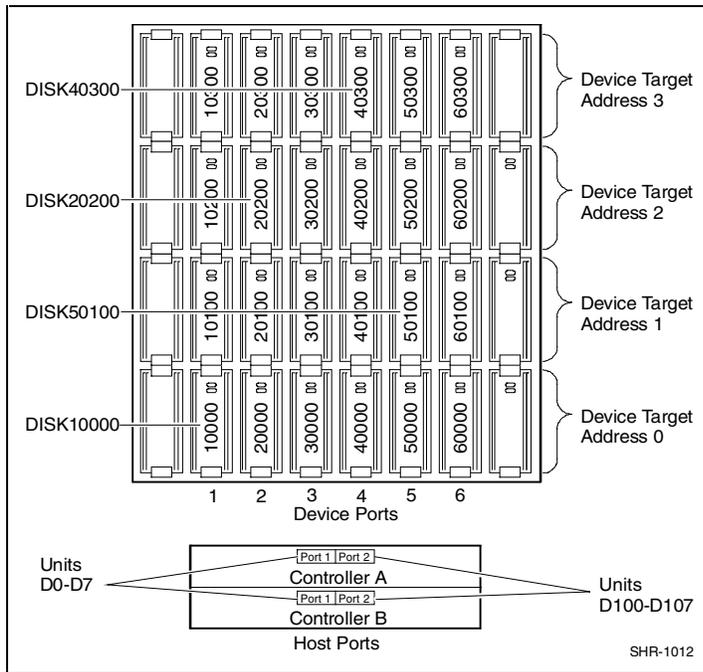


Figure 6-3. Mapping of device ports/targets and host ports in a BA370 enclosure (RA8000/ESA12000)

Model 4214 Disk Enclosure Shelf 1 (Single-Bus)							
<b>Bay</b>	1	2	3	4	5	6	7
<b>SCSI ID</b>	00	01	02	03	04	05	08
	DISK10000	DISK10100	DISK10200	DISK10300	DISK10400	DISK10500	DISK10800
<b>Bay</b>	8	9	10	11	12	13	14
<b>SCSI ID</b>	09	10	11	12	13	14	15
	DISK10900	DISK11000	DISK11100	DISK11200	DISK11300	DISK11400	DISK11500

Model 4254 Disk Enclosure Shelf 1 (Dual-Bus)							
<b>Bay</b>	1	2	3	4	5	6	7
<b>SCSI ID</b>	00	01	02	03	04	05	08
	DISK10000	DISK10100	DISK10200	DISK10300	DISK10400	DISK10500	DISK10800
<b>Bay</b>	8	9	10	11	12	13	14
<b>SCSI ID</b>	00	01	02	03	04	05	08
	DISK20000	DISK20100	DISK20200	DISK20300	DISK20400	DISK20500	DISK20800

Figure 6-4. Mapping of device ports/targets and host ports in a Model 4214 or Model 4254 disk enclosure (MA8000/EMA12000)

## 6.2 Accessing the CLI

The Command Line Interpreter (CLI) is a command line user interface to the HSG80 controller. It provides a series of commands to configure the storage system through the controller's firmware.

This chapter describes only the CLI commands required to create an initial configuration on the controller.

See the *Compaq StorageWorks HSG80 Array Controller ACS V8.5 CLI Reference Guide* for detailed descriptions of all CLI commands.

Make a serial connection to the HSG80 controller to access the CLI.

## 6.2.1 Connecting the Cable

To connect a maintenance terminal or PC to an HSG80 controller:

1. Locate the connecting cable that came with the HSG80 array controller. It has an RJ12 connector (similar to standard telephone plug) on one end and a 9-pin serial connector on the other end.
2. Plug the serial connector into the 9-pin serial port/com port 1 of the PC.
3. Plug the RJ12 connector from the PC or maintenance terminal into the maintenance port on the HSG80 controller (see Figure 6-5).

Note which serial port you use; you will need that information if using a communications program.

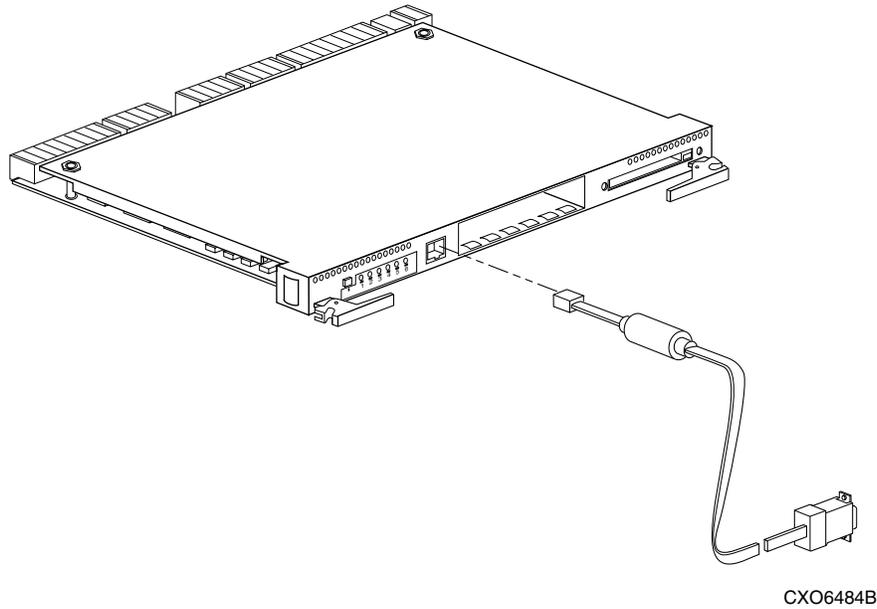


Figure 6-5. Making a serial connection to the HSG80 controller

## 6.2.2 Establishing Connection with a Host

To establish a connection between your PC and controller, you must use a communications program. Follow these steps to make the connection:

1. Start a communications program on your PC.
2. Set the communications program to use the serial port that is connected to the controller.
3. Set the communications parameters to:
  - 8 bits
  - 9600 baud
  - 1-stop bit
  - No parity
4. From your communications program, issue a connect command to establish a connection with the controller, and then press the **Enter** key. You should see the CLI prompt, which looks similar to:

```
HSG80 >
```

5. To view the status of the controller, type:

```
HSG80 > SHOW THIS_CONTROLLER
```

The controller displays information similar to the following example (dual-redundant configuration shown):

```
HSG> show this_controller
Controller:
  HSG80 ZG81000793 Software V83G-0, Hardware E01
  NODE_ID      = 5000-1FE1-0000-2370
  ALLOCATION_CLASS = 0
  SCSI_VERSION  = SCSI-2
  Configured for dual-redundancy with ZG81000729
    In dual-redundant configuration
  Device Port SCSI address 7
  Time: 30-SEP-98 12:03:57
  Command Console LUN is disabled
Host PORT_1:
  Reported PORT_ID = 5000-1FE1-0000-2371
  PORT_1_PROFILE  = PLDA
  PORT_1_TOPOLOGY = LOOP_HARD (loop up)
  PORT_1_AL_PA    = 02 (negotiated)
Host PORT_2:
  Reported PORT_ID = 5000-1FE1-0000-2372
  PORT_2_PROFILE  = PLDA
```

```

PORT_2_TOPOLOGY = LOOP_HARD (standby)
PORT_2_AL_PA    = 00 (negotiated)
Cache:
  64 megabyte write cache, version 0012
  Cache is GOOD
  No Unflushed data in cache
  CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
  64 megabyte write cache, version 0012
  Cache is GOOD
  No Unflushed data in cache
Battery:
  FULLY CHARGED
  Expires:      WARNING: UNKNOWN EXPIRATION DATE!
NOCACHE_UPS

```

**NOTE:** Verify that the output of the “SHOW THIS” command from your storage system is similar to that shown. If the controller presents a NODE\_ID of all zeros (0000-0000-0000-0000), or the appropriate host port does not report a LOOP\_UP condition, refer to the *Compaq StorageWorks HSG80 Array Controller ACS V8.5 CLI Reference Guide* controller for more information.

The Communications LUN is not used with NetWare if the HSG80 is set in the SCSI-2 mode. It should be *disabled* or grayed. If the Communications LUN is enabled, disable it by typing:

```
set this_controller nocommand_console_lun
```

## 6.3 Adding Disks to the Configuration

The CONFIG utility locates and adds disks to the controller. Run the CONFIG utility whenever you add new disks to the controller. (See *Chapter 2* for more information about installing/adding disks in the StorageWorks enclosure.) Enter the following command to start the configuration utility. The disk numbers will correspond to the disk locations for your storage system.

```
HSG80 > RUN CONFIG
```

The controller responds with a display similar to that shown below:

Config Local Program Invoked

Config is building its tables and determining what devices exist on the storage system. Please be patient.

```
add disk10000 1 0 0
add disk10100 1 1 0
add disk10200 1 2 0
add disk20000 2 0 0
add disk20100 2 1 0
add disk20200 2 2 0
add disk30000 3 0 0
add disk30100 3 1 0
add disk30200 3 2 0
add disk40000 4 0 0
add disk40100 4 1 0
add disk40200 4 2 0
add disk40300 4 3 0
add disk50000 5 0 0
add disk50100 5 1 0
add disk50200 5 2 0
add disk50300 5 3 0
add disk60000 6 0 0
add disk60100 6 1 0
add disk60200 6 2 0
add disk60300 6 3 0
```

Config – Normal Termination

In this example, the controller has located 21 new disks. The 5-digit number associated with each disk corresponds to Device Port Number, Target Number and Controller Logical Unit Number. The Controller Logical Unit Number will always be 0. DISK40000, in this example, corresponds to the disk located on Device Port 4, on controller Target 0, and Controller Logical Unit 0. DISK50100 corresponds to the disk located on Device Port 5, controller Target 1, and Controller Logical Unit 0. Figure 6-3 shows the mapping of Device Ports, Targets and Host Ports.

## 6.4 Creating a RAIDset

RAIDsets stripe user data over multiple drives and calculate parity information for data redundancy. Create RAIDsets to use redundant stripesets in your array. RAIDsets must have at least three members and can have as many as 14. This example creates two

3-member RAIDsets using the ADD RAIDSET command:

```
HSG80 > ADD RAIDSET DVGRPR0 DISK10000 DISK20000 DISK30000  
HSG80 > ADD RAIDSET DVGRPR1 DISK40000 DISK50000 DISK60000
```

In this example, “DVGRPR0” and “DVGRPR1” are the names of the RAIDsets, and they are followed by a list of disks to be included in each RAIDset. The names of the RAIDsets are user selectable. Performance of your RAIDsets will be optimized if each RAIDset includes disks from different ports as shown in the example.

### 6.4.1 Initializing a RAIDset

Prior to putting a RAIDset(s) into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the RAIDset and makes this space inaccessible to the host.

When you initialize a RAIDset, you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. We recommend using the default chunksize.

```
HSG80 > INITIALIZE DVGRPR0 CHUNKSIZE=DEFAULT  
HSG80 > INITIALIZE DVGRPR1 CHUNKSIZE=DEFAULT
```

### 6.4.2 Adding a RAIDset as a Logical Unit

To make a RAIDset available to the host computer, you must identify it as a host logical unit. For single or dual controllers on a single host, the unit numbers may range from D0 through D99 with a maximum of 32 units. For dual controllers/two hosts, the unit numbers may range from D0 through D99 for the first host and from D100 through D199 for the second host with a maximum of 32 units per host. Add units by using the ADD UNIT command:

```
HSG80 > ADD UNIT D1 DVGRPR0  
HSG80 > ADD UNIT D2 DVGRPR1
```

This example uses D1 and D2, as the first and second units identified on the controller.

### 6.4.3 Setting Writeback Cache

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire RAIDset:

```
HSG80 > SET D1 WRITEBACK_CACHE  
HSG80 > SET D2 WRITEBACK_CACHE
```

Where D1 and D2 represent the host logical units of the RAIDsets described above.

### 6.4.4 Setting Read Ahead Cache

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire RAIDset:

```
HSG80 > SET D1 READAHEAD_CACHE
```

Where D1 represent the host logical unit of the RAIDsets described above.

## 6.5 Creating a Stripset

Use stripsets to stripe data across multiple disks. Striping data across multiple disks increases I/O performance compared with the performance of a single disk. Stripsets must have at least 2 members and can have as many as 24. All members must be single disks. This example creates a 3-member stripset using the ADD STRIPESSET command.

```
HSG80 > ADD STRIPESSET DVGRPS0 DISK10100 DISK20100 DISK30100
```

In this example, “DVGRPS0” is the name of the stripset, and it is followed by a list of the disks to be included in the stripset. The names of the stripsets are user selectable. Performance of your stripsets will be optimized if each stripset includes disks from different device ports.

### 6.5.1 Initializing a Stripeset

Prior to putting a stripeset into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the stripeset and makes this space inaccessible to the host.

When you initialize a stripeset, you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. We recommend using the default chunksize.

```
HSG80 > INITIALIZE DVGRPS0 CHUNKSIZE=DEFAULT
```

### 6.5.2 Adding a Stripeset as a Logical Unit

To make a stripeset available to the host computer, you must identify it as a host logical unit. For single or dual controllers on a single host, the unit numbers may range from D0 through D99 with a maximum of 32 units. For dual controllers/two hosts, the unit numbers may range from D0 through D99 for the first host and from D100 through D199 for the second host with a maximum of 32 units per host. Add units by using the ADD UNIT command:

```
HSG80 > ADD UNIT D3 DVGRPS0
```

This example uses D3, since the stripeset is the third unit identified on the controller.

### 6.5.3 Setting Writeback Cache

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire stripeset:

```
HSG80 > SET D3 WRITEBACK_CACHE
```

Where D3 represents the host logical unit of the stripeset described above.

## 6.6 Creating a Mirrorset

Create mirrorsets to increase data availability and achieve data redundancy by maintaining at least two drives that have exactly the same data. Mirrorsets must have at least two members and can have as many as six. This example creates a two member mirrorset using the ADD MIRRORSET command.

```
HSG80 > ADD MIRRORSET DVGRPM0 DISK10200 DISK20200
```

In this example, DVGRPMO is the name of the mirrorset, and it is followed by a list of the disks to be included in the mirrorset. The names of the mirrorsets are user selectable. Performance of your mirror sets will be optimized if each mirrorset includes disks from different ports as shown in the example.

### **6.6.1 Initializing a Mirrorset**

Prior to putting a mirrorset into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the mirrorset and makes this space inaccessible to the host.

```
HSG80 > INITIALIZE DVGRPMO
```

### **6.6.2 Adding a Mirrorset as a Logical Unit**

To make a mirrorset available to the host computer, you must identify it as a host logical unit. For single or dual controllers on a single host, the unit numbers may range from D0 through D99 with a maximum of 32 units. For dual controllers/two hosts, the unit numbers may range from D0 through D99 for the first host and from D100 through D199 for the second host with a maximum of 32 units per host. Add units by using the ADD UNIT command:

```
HSG80 > ADD UNIT D4 DVGRPMO
```

### **6.6.3 Setting Writeback Cache**

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire mirrorset:

```
HSG80 > SET D4 WRITEBACK_CACHE
```

Where D4 represents the host logical unit of the mirrorset described above.

## **6.7 Creating a Striped Mirrorset**

Create a striped mirrorset to achieve high I/O performance and maximum data availability. Striped mirrorsets must have at least 2 mirrorset members, and can have as many as 24. All members must be mirrorsets. To create striped mirrorsets, first create mirrorsets and then create stripesets with those mirrorsets.

### 6.7.1 Creating Mirrorsets

These examples create two, 2-member mirrorsets for the striped mirrorset.

```
HSG80 > ADD MIRRORSET MIRR_0 DISK30200 DISK40200  
HSG80 > ADD MIRRORSET MIRR_1 DISK50200 DISK60200
```

In these examples, MIRR\_0 and MIRR\_1 are the names of the mirrorsets. Each is followed by the list of disks to be included in it.

### 6.7.2 Striping the Mirrorsets

Striped mirrorsets must have at least 2 members, and can have as many as 24. This example uses the ADD STRIPESET command to create a 2-member stripeset with the mirrorsets just created.

```
HSG80 > ADD STRIPESET DVGRPSM0 MIRR_0 MIRR_1
```

In this example, DVGRPSM0 is the name of the striped mirrorset, and it is followed by a list of mirrorsets to include in it. The name of the stripeset is user selectable. Performance of your striped mirrorset will be optimized if each mirrorset includes disks from different device ports as shown in Figure 6-3.

### 6.7.3 Initializing the Striped Mirrorset

Prior to putting a striped mirrorsets into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the striped mirrorset and makes this space inaccessible to the host.

When you initialize a striped mirrorset you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. We recommend using the default chunksize.

```
HSG80 > INITIALIZE DVGRPSM0 CHUNKSIZE=DEFAULT
```

### 6.7.4 Adding a Striped Mirrorset as a Logical Unit

To make a striped mirrorset available to the host computer, you must identify it as a host logical unit. For single or dual controllers on a single host, the unit numbers may range from D0 through D99 with a maximum of 32 units. For dual controllers/two hosts, the unit numbers may range from D0 through D99

for the first host and from D100 through D199 for the second host with a maximum of 32 units per host. Add units by using the ADD UNIT command:

```
HSG80 > ADD UNIT D5 DVGRPSM0
```

### **6.7.5 Setting Writeback Cache**

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire striped mirrorset:

```
HSG80 > SET D5 WRITEBACK_CACHE
```

Where D5 represents the host logical units of the striped mirrorset described above.

## **6.8 Adding Individual Disks as Logical Units**

To use an individual disk in a RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel storage system, you must initialize it and then add it as a logical unit.

### **6.8.1 Initializing Individual Disks**

Prior to putting an individual disk into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the disk and makes this space inaccessible to the host.

When you initialize a disk, you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. We recommend using the default chunksize.

```
HSG80 > INITIALIZE DISK40100 CHUNKSIZE=DEFAULT  
HSG80 > INITIALIZE DISK50100 CHUNKSIZE=DEFAULT
```

### **6.8.2 Adding as Logical Units**

To make an individual disk available to the host computer, you must identify it as a host logical unit. For single or dual controllers on a single host, the unit numbers may range from D0 through D99 with a maximum of 32 units. For dual controllers/two hosts, the unit numbers may range from D0 through D99

for the first host and from D100 through D199 for the second host with a maximum of 32 units per host. Add units by using the ADD UNIT command:

```
HSG80 > ADD UNIT D4 DISK40100  
HSG80 > ADD UNIT D5 DISK50100
```

## 6.9 Adding Devices to the Spareset

It is advisable to add devices to the spareset to create a pool of devices for the controller to use as replacements for devices in a RAIDset, mirrorset or striped mirrorset that fail. If no spareset exists, these redundant types of storagesets will run “reduced,” and you should replace the disabled disk as soon as possible. To create the spareset, identify the drive using the ADD SPARESET command:

```
HSG80 > ADD SPARESET DISK60100
```

In this example, DISK60100 was identified to the controller as a spareset.

**NOTE:** Any disk member added to the spareset must have the same storage capacity as the largest existing individual disk member of your logical storagesets.

## 6.10 Saving Copies of the Configuration

Use the following INITIALIZE command to save a copy of the entire controller configuration on a device or storageset in the storage system. Save a copy of the controller configuration on a device or storageset so that in the event of a controller failure, you will not need to create a new controller configuration.

The controller automatically updates the saved copy of the configuration whenever the configuration changes.

We recommend keeping a copy of the configuration on at least two devices or storagesets.

To save a copy of the configuration on disk, use the INITIALIZE command:

```
HSG80 > INITIALIZE DISK10000 SAVE_CONFIGURATION
```

**NOTE:** This command applies to single controller configurations. For dual controller configurations use the “SET FAILOVER COPY” command to save the configuration. Refer to the *Compaq StorageWorks HSG80 Array Controller ACS V8.5 CLI Reference Guide* for more information.

## 6.11 Recording your Configuration

You have now completed all the steps required to create an initial configuration for your controller. The following steps, verify and record your configuration for future reference. Additional worksheets are provided in this chapter for recording future new or modified configurations.

First, verify the Logical Units you have configured:

```
HSG80 > SHOW UNITS
```

The controller responds with a display similar to that shown below:

LUN	Uses
D1	DVGRPRO
D2	DVGRPR1
D3	DVGRPS0
D4	DISK40100
D5	DISK50100



**6-18** RA8000/ESA12000 and MA8000/EMA12000 Solution Software V8.5b for Novell NetWare Installation Reference Guide

Next, verify the storagesets you have configured:

```
HSG80 > show storagesets
```

The controller responds with a display similar to that shown below:

Name StorageSet	Uses	Used by
DVGRPS0	stripeset DISK10100 DISK20100 DISK30100	D3
DVGRPSM0	stripeset MIRR_0 MIRR_1	D5
DVGRPM0	mirrorset DISK10200 DISK20200	D4
MIRR_0	mirrorset DISK30200 DISK40200	DVGRPSM0
MIRR_1	mirrorset DISK50200 DISK60200	DVGRPSM0
DVGRPR0	raidset DISK10000 DISK20000 DISK30000	D1
DVGRPR1	raidset DISK40000 DISK50000 DISK60000	D2
SPARESET	spareset DISK60100	
FAILEDSET	failedset	

Individual devices are not displayed in this report. To display individual devices, enter the following:

```
HSG80 > SHOW DEVICES
```

Record the above information in the following table. In the event of a controller failure, the information that is recorded here will assist you in reconstructing the storageset on your RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel storage system.





## Planning Your Storage Configuration

This appendix describes the RAID configuration options and RAID concepts which you need to know to create your storage configuration.

### A.1 Planning Your Configuration

RAID stands for Redundant Array of Independent Disks. It is a way of configuring multiple physical disk drives to achieve high data availability and/or larger virtual disk devices. RAID is implemented as a set of multiple storage devices (disks, tapes, and solid-state disks), called an array, and a specialized array controller, which manages the distribution of data across the array.

A RAID array, whether it contains two, five, or seven physical drives, can be configured to look like one or more large virtual disk drives. Use a RAID array virtual drive just as you would a physical drive. You can partition it if you want, and you do not need to make any application changes to realize the benefits of RAID. A RAID array provides higher levels of data availability and performance than a single physical disk drive of similar capacity.

Data for a given file is divided into chunks that is then written across multiple drives. A *chunk* is a group of contiguous data blocks that are stored on a single physical disk drive. By using more than one physical drive, the data is transferred in chunks to multiple physical devices simultaneously, achieving transfer rates greater than each physical disk. Depending on the RAID level used, arrays also provide redundancy to protect the data availability. Arrays provide redundancy in two main ways: by mirroring and by generating parity.

The storage configuration options available depend upon your storage needs and the number of disks that you purchased for your RAID array. Table A-1 describes the storage options available and the minimum number of physical disks required to implement each.

You can use a variety of storageset containers within a single subsystem, providing you have the disk device resources to support them.

---

**Table A-1**  
**Configuration Options**

---

<b>Storage Method</b>	<b>Storageset Type</b>	<b>Number of Devices</b>	<b>Offers</b>
RAID 3/5  A redundant-stripeset combining the optimized data transfers of RAID 3 with the striping of parity of RAID 5.	RAIDset	3 - 14	Good throughput and read bandwidth for a high request rate of small to medium transfers.  High Data Availability.
RAID 0	Stripeset	2 - 14	Good performance for both read and write requests. Provides load balancing with each request requiring a single data operation.  Data availability equivalent to that of an individual disk device.

---

*continued*

**Table A-1**  
**Configuration Options** *continued*

Storage Method	Storageset Type	Number of Devices	Offers
RAID 1	Mirrorset	2 - 6 devices per mirrorset, up to 12 mirrorsets per RAID array	Good performance for read requests. High Data Availability.
RAID 0 + 1	Striped mirrorsets	2 - 12 mirrorsets	Performance for read requests surpassing that of an unstriped mirrorset since it can achieve load balancing. High Data Availability.
Individual Devices (JBOD)	Disk Drive	1	Provides the storage capacity and access speed of the disk used. If device fails, data is lost.

Once you select the type of storagesets to be used in your subsystem, create them using an appropriate configuration manager.



# Appendix **B**

## Valid ALPA Settings

This appendix provides a table of the valid arbitrated loop physical address (ALPA) settings available for hard addressing the Fibre Channel Arbitrated Loop.

### B.1 Valid ALPA Settings

Table B-1 lists the valid ALPA settings for hard addressing the fibre channel arbitrated loop.

---

**Table B-1**  
**Valid Arbitrated Loop Physical Address (ALPA) Settings**

---

0x01	0x02	0x04	0x08	0x0F	0x10	0x17	0x18	0x1B
0x1D	0x1E	0x1F	0x23	0x25	0x26	0x27	0x29	0x2A
0x2B	0x2C	0x2D	0x2E	0x31	0x32	0x33	0x34	0x35
0x36	0x39	0x3A	0x3C	0x43	0x45	0x46	0x47	0x49
0x4A	0x4B	0x4C	0x4D	0x4E	0x51	0x52	0x53	0x54
0x55	0x56	0x59	0x5A	0x5C	0x63	0x65	0x66	0x67
0x69	0x6A	0x6B	0x6C	0x6D	0x6E	0x71	0x72	0x73

*continued*

**Table B-1**  
**Valid Arbitrated Loop Physical Address (ALPA) Settings** *continued*

0x74	0x75	0x76	0x79	0x7A	0x7C	0x80	0x81	0x82
0x84	0x88	0x8F	0x90	0x97	0x98	0x9B	0x9D	0x9E
0x9F	0xA3	0xA5	0xA6	0xA7	0xA9	0xAA	0xAB	0xAC
0xAD	0xAE	0xB1	0xB2	0xB3	0xB4	0xB5	0xB6	0xB9
0xBA	0xBC	0xC3	0xC5	0xC6	0xC7	0xC9	0xCA	0xCB
0xCC	0xCD	0xCE	0xD1	0xD2	0xD3	0xD4	0xD5	0xD6
0xD9	0xDA	0xDC	0xE0	0xE1	0xE2	0xE4	0xE8	0xEF

## Appendix **C**

# Regulatory Compliance Notices

This appendix describes the compliances required for the operation of your system.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the manuals, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Restrictions apply to the use of the local-connection port on this series of controllers; failure to observe these restrictions may result in harmful interference. Always disconnect this port as soon as possible after completing the setup operation. Any changes or modifications made to this equipment may void the user's authority to operate the equipment.

**Warning!**

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

**Achtung!**

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

**Avertissement!**

Cet appareil est un appareil de Classe A. Dans un environnement résidentiel cet appareil peut provoquer des brouillages radioélectriques. Dans ce cas, il peut être demandé à l'utilisateur de prendre les mesures appropriées.

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

**USA**

This equipment generates, uses, and may emit radio frequency energy. The equipment has been type tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of FCC rules, which are designed to provide reasonable protection against such radio frequency interference. Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference. Any modifications to this device, unless expressly approved by the manufacturer, can void the user's authority to operate this equipment under part 15 of the FCC rules.

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