HITACHI
DATA SYSTEMS

Hitachi Freedom Storage™ Lightning 9900™

Novell® NetWare® Configuration Guide

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- Novell-p.doc (STR RAID400 document).
- Lightning 9900™ LUN Manager User's Guide, MK-90RD006-1.
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Preface

The *Hitachi Freedom Storage™ Lightning 9900™ NetWare® Configuration Guide* describes and provides instructions for configuring the devices on the Lightning 9900™ disk array subsystem for operation with the Novell® NetWare® operating system. This configuration guide assumes that:

- the user has a background in data processing and understands direct-access storage device subsystems and their basic functions,
- the user is familiar with the Hitachi Lightning 9900™ array subsystem, and
- the user is familiar with the NetWare® operating system, the NetWare® server, and the fibre-channel adapters.

Note: The term "9900" refers to the entire Hitachi Lightning 9900™ subsystem family, unless otherwise noted. Please refer to the *Hitachi Freedom Storage™ Lightning 9900™ User and Reference Guide* (MK-90RD008) for further information on the 9900 disk array subsystems.

Note: For further information on the Novell® NetWare® operating system, please consult the NetWare® user documentation, or contact Novell® technical support.

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Chapter 1 Overview of 9900 NetWare® Configuration

1.1 9900 Novell® NetWare® Configuration

This document describes the requirements and procedures for connecting the 9900 subsystem to a NetWare® server and configuring the new 9900 devices for operation with the Novell® NetWare® operating system. The Hitachi Data Systems Customer Service representative performs the physical installation of the 9900 subsystem. The user prepares for 9900 subsystem installation and configures the new 9900 devices with assistance as needed from the Hitachi Data Systems representative.

Configuration of the 9900 disk devices for NetWare® operations includes:

- Verifying new device recognition (see section 3.1),
- Creating disk partitions (see section 3.2),
- Assigning the new devices to volumes (see section 3.3),
- Mounting the volumes (see section 3.4), and
- Verifying client operations (see section 3.5).

Note on the term "SCSI disk": The 9900 logical devices are defined to the host as SCSI disk devices, whether the interface is SCSI or fibre-channel.

1.2 Hitachi Lightning 9900™ Subsystem

The Hitachi Lightning 9900™ RAID subsystem supports concurrent attachment to multiple UNIX®-based and PC-server platforms. Please contact your Hitachi Data Systems account team for the latest information on platform support. The 9900 subsystem provides continuous data availability, high-speed response, scaleable connectivity, and expandable capacity for PC server and open-system storage. The 9900 subsystem can operate with multihost applications and host clusters, and is designed to handle very large databases as well as data warehousing and data mining applications that store and retrieve terabytes of data.

The Hitachi Lightning 9900™ subsystem can be configured with fibre-channel ports and/or Extended Serial Adapter™ (ExSA™) ports (compatible with ESCON® protocol) to provide connectivity with S/390® mainframe hosts as well as open-system hosts. For further information on the 9900 subsystem, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ User and Reference Guide* (MK-90RD008), or contact your Hitachi Data Systems account team.

1.3 Device Types and Configuration Procedures

The 9900 subsystem allows the following types of logical devices (also called volumes) to be installed and configured for operation with the Novell® NetWare® operating system. Table 1.1 lists the device specifications for the 9900 devices.

OPEN-x Devices. The OPEN-x logical units (LUs) (e.g., OPEN-3, OPEN-9) are disk devices of predefined sizes. The 9900 subsystem currently supports OPEN-3, OPEN-8, OPEN-9, OPEN-K, and OPEN-E devices. Please contact your Hitachi Data Systems account team for the latest information on supported LU types.

LUSE Devices (OPEN-x*n). The LUSE devices are combined LUs which can be from 2 to 36 times larger than standard OPEN-x LUs. The Logical Unit Size Expansion (LUSE) feature of the 9900 subsystem enables you to configure these custom-size devices. LUSE devices are designated as OPEN-x*n, where x is the LU type (e.g., OPEN-9*n) and $2 \leq n \leq 36$. For example, a LUSE device created from ten OPEN-3 LUs would be designated as an OPEN-3*10 disk device. This capability enables the server host to combine logical devices and access the data stored on the 9900 subsystem using fewer LU numbers (LUNs). For further information on the LUSE feature, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ LUN Manager User's Guide* (MK-90RD006).

CVS Devices (OPEN-x CVS). The CVS devices are custom-size LUs which are smaller than standard OPEN-x LUs. The Custom Volume Size (CVS) feature of the 9900 subsystem (also called Virtual LUN and Virtual LVI) enables you to configure CVS devices. The CVS capability enables you to "slice up" a single LU into several smaller LUs to best fit the application needs and improve host access to frequently used files. For further information on the CVS feature, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ Virtual LVI/LUN User's Guide* (MK-90RD005).

CVS LUSE Devices (OPEN-x*n CVS). The CVS LUSE devices combine CVS devices (instead of standard OPEN-x LUs) into LUSE devices. The CVS feature is used first to create custom-size devices, and then the LUSE feature is used to combine (concatenate) these CVS devices. The user can combine from 2 to 36 CVS devices into one CVS LUSE device. For example, an OPEN-3 LUSE volume that was created from ten OPEN-3 CVS volumes would be designated as an OPEN-3*10 CVS device.

Configuration of the 9900 SCSI disk devices for Novell® NetWare® operations includes:

- Verifying new device recognition (see section 3.1),
- Creating disk partitions (see section 3.2),
- Assigning the new devices to volumes (see section 3.3),
- Mounting the volumes (see section 3.4), and
- Verifying client operations (see section 3.5).

Table 1.1 9900 Device Specifications

Device Type *(Note 1)*	Category	Vendor Name	Product Name	# of Blocks (512-byte blk)	Sector Size (bytes)	# of Data Cylinders	# of Heads	# of Sectors per Track	Capacity MB *(Note 2)*
OPEN-3	SCSI disk	HITACHI	OPEN-3	4806720	512	3338	15	96	2347
OPEN-9	SCSI disk	HITACHI	OPEN-9	14423040	512	10016	15	96	7042
OPEN-K	SCSI disk	HITACHI	OPEN-K	3661920	512	2543	15	96	1788
OPEN-8	SCSI disk	HITACHI	OPEN-8	14351040	512	9966	15	96	7007
OPEN-E	SCSI disk	HITACHI	OPEN-E	28452960	512	19759	15	96	13888
OPEN-3*n	SCSI disk	HITACHI	OPEN-3*n	4806720*n	512	3338*n	15	96	2347*n
OPEN-9*n	SCSI disk	HITACHI	OPEN-9*n	14423040*n	512	10016*n	15	96	7042*n
OPEN-K*n	SCSI disk	HITACHI	OPEN-K*n	3661920*n	512	2543*n	15	96	1788*n
OPEN-8*n	SCSI disk	HITACHI	OPEN-8*n	14351040*n	512	9966*n	15	96	7007*n
OPEN-E*n	SCSI disk	HITACHI	OPEN-E*n	28452960*n	512	19759*n	15	96	13888*n
OPEN-3 CVS	SCSI disk	HITACHI	OPEN-3-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*
OPEN-9 CVS	SCSI disk	HITACHI	OPEN-9-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*
OPEN-K CVS	SCSI disk	HITACHI	OPEN-K-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*
OPEN-8 CVS	SCSI disk	HITACHI	OPEN-8-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*
OPEN-E CVS	SCSI disk	HITACHI	OPEN-E-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*
OPEN-3*n CVS	SCSI disk	HITACHI	OPEN-3*n-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*
OPEN-9*n CVS	SCSI disk	HITACHI	OPEN-9*n-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*
OPEN-K*n CVS	SCSI disk	HITACHI	OPEN-K*n-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*
OPEN-8*n CVS	SCSI disk	HITACHI	OPEN-8*n-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*
OPEN-E*n CVS	SCSI disk	HITACHI	OPEN-E*n-CVS	*Note 3*	512	*Note 4*	15	96	*Note 5*

Note 1: The availability of a specific 9900 device type depends on the level of microcode installed on the 9900 subsystem.

Note 2: The device capacity can sometimes be changed by the BIOS or host adapter board. Also, different capacities may be due to variations such as 1 MB = 1000^2 or 1024^2 bytes.

Note 3: The number of blocks for a CVS volume is calculated as follows:

# of blocks = (# of data cylinders) × (# of heads) × (# of sectors per track)

Example: For an OPEN-3 CVS volume with capacity = 37 MB:

# of blocks = (53 cylinders–see Note 5) × (15 heads) × (96 sectors per track) = 76320

(Notes continue on the next page.)

Note 4: The number of data cylinders for a CVS volume is calculated as follows (↑…↑ means that the value should be rounded up to the next integer):

- The number of data cylinders for an OPEN-x CVS volume =
  # of cylinders = ↑ (capacity (MB) specified on Remote Console PC) × 1024/720 ↑
  Example: For an OPEN-3 CVS volume with capacity = 37 MB:
  # of cylinders = ↑37 × 1024/720↑ = ↑52.62↑ (rounded up to next integer) = 53 cylinders
- The number of data cylinders for a CVS LUSE volume =
  # of cylinders = ↑ (capacity (MB) specified on Remote Console PC) × 1024/720 ↑ × n
  Example: For an OPEN-3 CVS LUSE volume with capacity = 37 MB and n = 4
  # of cylinders = ↑37 × 1024/720↑ × 4 = ↑52.62↑× 4 = 53 × 4 = 212
- The number of data cylinders for a 3390-3A/C or 3380-KA/C CVS volume =
  # of cylinders = (number of cylinders specified on Remote Console PC) + 9
- The number of data cylinders for a 3390-3B or 3380-KB CVS volume =
  # of cylinders = (number of cylinders specified on Remote Console PC) + 7

Note 5: The size of an OPEN-x CVS volume is specified by capacity in MB, not by number of cylinders. The user specifies the volume size using the Remote Console PC.

Chapter 2 Preparing for New Device Configuration

2.1 Configuration Requirements

The requirements for 9900 Novell® NetWare® configuration are:

- Hitachi Lightning 9900™ subsystem, all-open or multiplatform configuration.
  - The 9900 Remote Console PC and LUN Manager software are used to configure the fibre-channel (FC) ports. If the remote LUN Manager feature is not installed, please contact your Hitachi Data Systems account team for information on LUN and fibre-channel configuration services.

  Note: The availability of 9900 features and devices depends on the level of microcode installed on the 9900 subsystem.

- Novell® NetWare® PC server. Please refer to the Novell® NetWare® user documentation for PC server hardware and configuration requirements.

- Novell® NetWare® server operating system version 5.0E. Version 5.0E requires Netware5 Support Pack 3a, Client component: Novell® Client for Windows NT.

  Note: For the latest information on NetWare® version support, please contact your Hitachi Data Systems account team.

  Note: The NetWare® administrator password is required during 9900 device configuration.

- Fibre-channel adapters. Make sure to install all utilities and tools for the adapter(s).
  - The 9900 subsystem supports full-speed (100 MB/s) fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface, and multimode optical cables with SC connectors. Do not connect any OFC-type fibre-channel interface to the 9900 subsystem. For information on supported FC adapters, optical cables, hubs, and related hardware, please contact your Hitachi Data Systems account team or the Hitachi Data Systems Support Center (see section 5.2).

- Drivers. Do not install/load the driver(s) yet. Section 2.6 provides instructions on loading the drivers with the correct parameters and options for operation with the 9900 subsystem.

  The following FC adapters and drivers have been verified for use with the 9900 subsystem. For information on the driver requirements for other FC adapters, please refer to the user documentation for the adapter or contact the vendor.

FC Adapter	Driver(s)
Emulex LightPulse LP7000	Lp6000.ddi, Lp6000.ham version 1.22
QLogic QLA2100/2100F	QL2100.ddi, QL2100.ham version 4.15A

2.2 Installing the 9900 Subsystem

The 9900 subsystem comes with all hardware and cabling required for installation. Installation of the 9900 subsystem involves the following activities:

1. **Hardware installation**. The Hitachi Data Systems representative performs hardware installation as specified in the 9900 maintenance manual. Follow all precautions and procedures in the 9900 maintenance manual. Check all specifications to ensure proper installation and configuration. Hardware installation includes:
   - Assembling all hardware and cabling.
   - Loading the latest microcode and SVP updates for full fibre-channel support.
   - Installing and formatting the logical devices (LDEVs) using the SVP. Make sure to get the desired LDEV configuration information from the user, including the desired number of OPEN-x, LUSE, CVS, and CVS LUSE devices.
   - Installing the fibre-channel adapters and cabling: The total fibre cable length attached to each fibre-channel adapter must not exceed 500 meters (1,640 feet). Do not connect any OFC-type connector to the 9900 subsystem. Do not connect/disconnect fibre-channel cabling that is being actively used for I/O. This can cause the NetWare® system to hang. Always confirm that the devices on the fibre cable are offline before connecting/disconnecting the fibre cable.

     9900 FC Port: The fibre topology parameters for each 9900 fibre-channel port depend on the type of device to which the 9900 port is connected. Determine the topology parameters supported by the device, and set your topology accordingly (see section 2.3.2). The type of 9900 port is also important.

   Note: The Hitachi Data Systems representative must use the 9900 Maintenance Manual during all installation activities. Follow all precautions and procedures in the maintenance manual, and always check all specifications to ensure proper installation and configuration.

2. **Remote Console PC and LUN Manager installation**. The user or Hitachi Data Systems representative can perform this activity. You will use the LUN Manager software on the 9900 Remote Console PC to configure the 9900 fibre-channel ports. For instructions on installing the Remote Console PC and LUN Manager remote console software, please refer to the *9900 Remote Console User's Guide* (MK-90RD003) and the *9900 LUN Manager User's Guide* (MK-90RD006) respectively.

   Note: If the remote LUN Manager feature is not installed, the Hitachi Data Systems representative can configure FC ports for you using the SVP of the subsystem. Please contact your Hitachi Data Systems account team for further information on fibre-channel configuration services.

2.3 Preparing to Connect the 9900 Subsystem

Before the 9900 subsystem is connected to your Novell® NetWare® server, you need to:

- Set the host mode for the 9900 fibre-channel port(s) (see section 2.3.1), and
- Configure the 9900 fibre-channel ports (see section 2.3.2).

You will use the LUN Manager remote console software to set the host modes for and configure the 9900 fibre ports. For instructions on using the LUN Manager software, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ LUN Manager User's Guide* (MK-90RD006).

After completing these steps, you will:

- Shut down the NetWare® system, connect the 9900 subsystem, and restart the NetWare® system (see section 2.4),
- Configure the FC adapters connected to the 9900 subsystem (see section 2.5), and
- Load the device driver(s) (see section 2.6).

Note: If the remote LUN Manager feature is not installed, please contact your Hitachi Data Systems account team for information on fibre-channel configuration services.

2.3.1 Setting the Host Mode for the 9900 Ports

The 9900 ports have special modes which must be set for the connected operating system. Use the LUN Manager remote console software to set the host mode for each port (see Figure 2.1). The required host mode setting for 9900 NetWare® operations is **0A**.

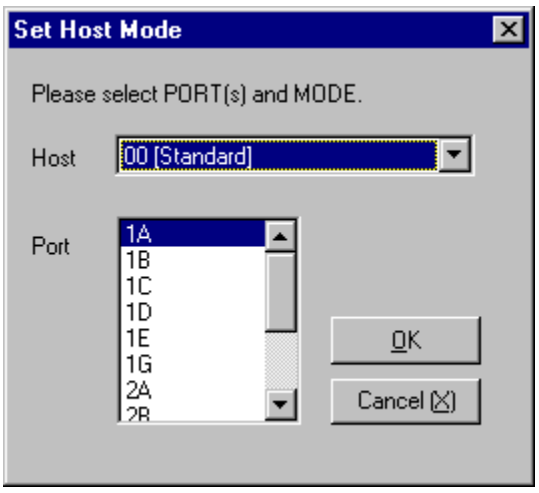

Figure 2.1 Setting the Host Mode

2.3.2 Configuring the 9900 Fibre-Channel Ports

You need to configure the 9900 FC ports to define the fibre parameters (see Figure 2.2 and Table 2.1) and port addresses (see Table 2.2). You will use the LUN Manager remote console software to configure the 9900 FC ports. For instructions on using LUN Manager, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ LUN Manager User's Guide* (MK-90RD006).

Note: The 9900 subsystem supports up to 256 LUs per fibre-channel port, but connectivity with Netware® systems is limited to 32 LUs per FC port.

Fibre topology. Figure 2.2 shows the Fibre Parameter panel (part of the LUN Manager software), and Table 2.1 explains the settings on this panel. You will select the appropriate settings for each 9900 FC port based on the device to which the port is connected. Determine the topology parameters supported by the device, and set your topology accordingly. The type of 9900 port is also important.

Port address. In fabric environments, the port addresses are assigned automatically by fabric switch port number and are not controlled by the 9900 port settings. In arbitrated loop environments, the port addresses are set by entering an AL-PA (arbitrated-loop physical address, or loop ID). Table 2.2 shows the available 9900 AL-PA values ranging from 01 to EF. Fibre-channel protocol uses the AL-PAs to communicate on the fibre-channel link, but the software driver of the platform host adapter translates the AL-PA value assigned to the 9900 port to a SCSI TID. See Appendix B for a description of the AL-PA-to-TID translation.

Note on loop ID conflict: The NetWare® system assigns port addresses from lowest (01) to highest (EF). To avoid loop ID conflict, assign the port addresses from highest to lowest (i.e., starting at EF). The AL-PAs should be unique for each device on the loop to avoid conflicts. Do not use more than one port address with the same TID in same loop (e.g., addresses EF and CD both have TID 0, refer to Table 2.2).

Table 2.1 Fibre Parameter Settings on the 9900 Remote Console PC

Fabric Parameter	Connection Parameter	Provides:
ON	*FC-AL*	*Not supported*
ON	*Point-to-Point*	*Not supported*
OFF	FC-AL	AL-port (private arbitrated loop)
OFF	*Point-to-Point*	*Not supported*

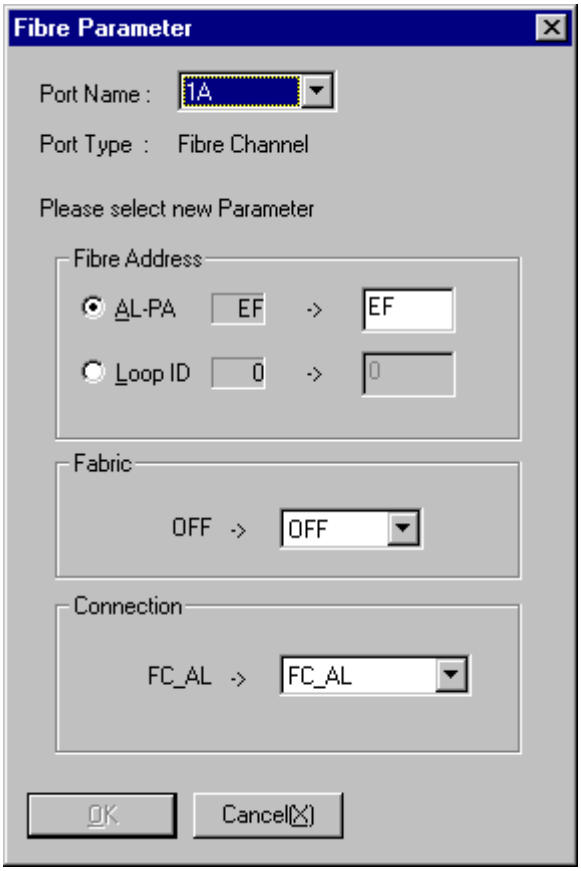

Figure 2.2 Fibre Parameter Panel (from the LUN Manager Software)

Table 2.2 Available AL-PA Values

EF	CD	B2	98	72	55	3A	25
E8	CC	B1	97	71	54	39	23
E4	CB	AE	90	6E	53	36	1F
E2	CA	AD	8F	6D	52	35	1E
E1	C9	AC	88	6C	51	34	1D
E0	C7	AB	84	6B	4E	33	1B
DC	C6	AA	82	6A	4D	32	18
DA	C5	A9	81	69	4C	31	17
D9	C3	A7	80	67	4B	2E	10
D6	BC	A6	7C	66	4A	2D	0F
D5	BA	A5	7A	65	49	2C	08
D4	B9	A3	79	63	47	2B	04
D3	B6	9F	76	5C	46	2A	02
D2	B5	9E	75	5A	45	29	01
D1	B4	9D	74	59	43	27	
CE	B3	9B	73	56	3C	26	

2.4 Connecting the 9900 Subsystem to the NetWare® Server

After you have configured the 9900 fibre-channel ports, you are ready to connect the 9900 subsystem to the Novell® NetWare® system. The 9900 subsystem comes with all hardware and cabling required for connection to the host system(s). To connect the 9900:

1. **Verify subsystem installation**. The Hitachi Data Systems representative verifies the fibre-port address configuration, LDEVs (status = normal), and FC adapters.
2. **Shut down the NetWare® system**. The user should perform this activity. You must shut down and power off the NetWare® system before connecting the 9900:
   a) Shut down the NetWare® system as usual (from the server console enter DOWN).
   b) When shutdown is complete, power off the NetWare® display.
   c) Power off all peripheral devices except for the 9900 subsystem.
   d) Power off the NetWare® system. You are now ready to connect the 9900 subsystem.
3. **Connect the 9900 to the NetWare® system**. The Hitachi Data Systems representative installs the fibre-channel cables between the 9900 and the NetWare® system. ***Note:*** The Hitachi Data Systems representative must use the 9900 maintenance manual during all installation activities. Follow all precautions and procedures in the maintenance manual, and always check all specifications to ensure proper installation and configuration.
4. **Power on and reboot the NetWare® system**. The user should perform this activity. To power on the NetWare® system after connecting the 9900 subsystem:
   a) Power on the NetWare® system display.
   b) Power on all peripheral devices. The 9900 should already be on, and the fibre-channel ports should already be configured. If the fibre-channel ports are configured after the NetWare® system is powered on, the system may need to be restarted in order to recognize the new devices.
   c) Confirm the ready status of all peripheral devices, including the 9900.
   d) Power on the NetWare® system connected to the 9900. If the 9900 is connected tp a QLogic FC adapter, get ready to press **<Alt><Q>** to run the Qlogic Fast! utility.

2.5 Configuring the Host Fibre-Channel Adapters

After connecting the 9900 subsystem and rebooting the NetWare® server, you are ready to configure the fibre-channel adapter(s) connected to the 9900. The HBA setup utilities (e.g., QLogic Fast!) allow you to configure the adapter settings while the system is booting up. The host bus adapters have many configuration options. This section provides the following minimum requirements for configuring FC adapters for operation with the 9900 subsystem.

- The queue depth requirements for the 9900 devices are specified in Table 2.3.
- The BIOS may need be disabled to prevent the system from trying to boot from the 9900.
- In addition to the queue depth and BIOS, several other parameters (e.g., FC-AL) may also need to be set. Please refer to the user documentation which came with your HBA to determine whether other options are required to meet your operational requirements.

Note: Make sure to use the same settings and device parameters for all 9900 devices.

The following sample instructions apply to the QLogic 2100/2100F adapter. For instructions on configuring other adapters, refer to the user documentation for the adapter.

Table 2.3 Queue Depth Requirements for the 9900 Devices

Parameter	Required Value
Queue depth per LU (MAX_QDEPTH, MAX_TAGS)	≤ 32
Queue depth per port	≤ 256

Note: You can adjust the queue depth for the 9900 devices later as needed (within the specified range) to optimize the I/O performance of the 9900 devices.

To configure a QLogic 2100/2100F fibre-channel adapter connected to the 9900:

1. When prompted during boot-up, press **<Alt><Q>** to start the Qlogic Fast! Utility.
2. Go to **Configuration Settings**, then **Host Adapter Settings**, and confirm the following settings:
   Host Adapter BIOS ----------Disabled
   Execution Throttle ----------Refer to Table 2.3 (execution throttle = queue depth)
   Adapter Hard ID ----------Enabled
   Hard ID ----------Larger than any port addresses
3. Verify all other required settings for your operational environment. For example, the QLogic adapter defaults to eight **LUNs per target**, so you may need to change that setting to 32. Refer to the user documentation for the adapter as needed.
4. Repeat steps (2) and (3) for each QLogic FC adapter connected to the 9900 subsystem.
5. When you are finished configuring the adapter(s), exit the Qlogic Fast! Utility. Do not finish booting until you have configured all HBAs connected to the 9900.
6. When all HBAs connected to the 9900 have been configured, you can finish booting the NetWare® server. You will load the device driver(s) next (see section 2.6).

2.6 Loading the Device Driver(s)

After configuring the fibre-channel adapter(s), you must load the device driver(s) with specific settings and options enabled for operation with the 9900 subsystem. Refer to Table 2.3 above for the queue depth requirements for the 9900 devices.

The following sample instructions apply to the Emulex LightPulse LP7000 and QLogic QLA2100/2100F fibre-channel adapters. For instructions on configuring other FC adapters, please refer to the user documentation for the adapter. For further information on the LOAD command, please refer to the NetWare® user documentation.

To load the device drivers for the Emulex LightPulse and QLogic adapters:

1. Make sure that the HBA was configured during startup as described in section 2.5.
2. Change directories to the NetWare® directory: `DOS prompt> CD NWSERVER`
   (where NWSERVER = name of NetWare® directory; your name may be different)
3. Start the server program: `DOS prompt> SERVER`
4. At the server console, load the required device driver as follows:

   For NetWare® 5.0 E and the Emulex Lp6000.ham driver, enter:

   ```
   LOAD C:\NWSERVER\LP6000.HAM SLOT=1 /LUN MAX_LUN=120 N_TIMEOUT=90 MAX_QDEPTH=8
   ```

   Specify the following LOAD command line options:
   /LUN = activates multi-lun support of the driver.
   MAX_LUN = maximum number of LUNs which can be on the same node.
   N_TIMEOUT = use the default value (90).
   MAX_QDEPTH = specifies the length of the request queue to any particular LUN under the control of the driver. Use the values specified in Table 2.3 above.

   For NetWare® 5.0E and the QLogic QL2100.ham driver, enter:

   ```
   LOAD C:\NWSERVER\QL2100.HAM SLOT=1 /LUNS
   ```

   Specify the following LOAD command line option:
   /LUNS = activates multi-lun support of the driver.
5. Verify that the driver is loaded correctly by checking the messages displayed on screen.
6. After verifying correct loading of the driver, add the LOAD command line to the server's **startup.ncf** file.

Chapter 3 Configuring the New Devices

After 9900 installation has been completed and new device recognition has been verified, the devices on the newly installed 9900 subsystem are ready to be configured for use. Configuration of the 9900 devices is performed by the user. The activities involved in configuring the 9900 devices are:

- Verifying new device recognition (see section 3.1),
- Creating the disk partitions (see section 3.2),
- Assigning the new devices to volumes (see section 3.3),
- Mounting the volumes (see section 3.4), and
- Verifying client operations (see section 3.5).

AL-PA to SCSI TID mapping. For information on the fibre-channel AL-PA to SCSI TID mapping, please refer to Appendix B.

Note on the term "SCSI disk": The 9900 logical devices are defined to the host as SCSI disk devices, even though the interface is fibre-channel.

3.1 Verifying New Device Recognition

The first step in configuring the newly installed 9900 devices is to verify that the NetWare® system recognizes the new devices. You will display the device information using the LIST DEVICES command and verify that the system recognizes the 9900 devices. You will also record the device number which is used during disk partitioning and volume creation. Table 3.1 shows a sample worksheet for recording the device information for the new 9900 devices.

To verify that the NetWare® system recognizes the new 9900 devices:

1. If you just finished loading the device driver, you are already at the server console. If not, go to the NetWare® directory, and enter SERVER to get to the server console.
2. At the server console, enter LIST DEVICES to display all disk devices (use the **Pause** key as needed). The device number (e.g., 0x000B) and device type (e.g., Hitachi OPEN-3) are displayed for each device.
3. Record the device number for each new device on your SCSI Device Information Worksheet (see Table 3.1). This information will be used during disk partitioning and volume creation.
4. Verify that all of the new 9900 devices are listed (see Figure 3.1). If any devices are not listed, see section 5.1 for troubleshooting information.

```
NetWare prompt>  LIST DEVICES

0x000B: [V6E0-A2-D7D:0] HITACHI OPEN-3 rev:0111
0x000C: [V6E0-A2-D7D:1] HITACHI OPEN-3 rev:0111
0x000D: [V6E0-A2-D7D:2] HITACHI OPEN-3 rev:0111
:
:
```

Figure 3.1 Verifying New Device Recognition

Table 3.1 Sample SCSI Device Information Worksheet

LDEV (CU:LDEV)	Device Number	Device Type	CVS (size)	LUSE (*n)
0:00				
0:01				
0:02				
0:03				
0:04				
0:05				
0:06				
0:07				
0:08				
0:09				
0:0a				
0:0b				
0:0c				
0:0d				
0:0e				
0:0f				
0:10				
0:11				
0:12				
0:13				
0:14				
0:15				
and so on...				

3.2 Creating the Disk Partitions

The first step in configuring the newly installed 9900 devices is to create disk partitions on these new devices. Figures 3.2 through 3.8 show the sequence of screens displayed on the NetWare® server during the disk partitioning process.

Note: Do not create a partition on a disk device that will be accessed as a raw device (e.g. some database applications use raw devices).

To create disk partitions on the new SCSI disk devices:

1. At the server console, enter LOAD NWCONFIG to load the Configuration Options module (see Figure 3.2).
2. On the Configuration Options screen, select **Standard disk options**, and press **Enter** to access the NetWare® disk options (see Figure 3.3).
3. On the Available Disk Options screen, select **Modify disk partitions and Hot Fix** and press **Enter**.
4. The Available Devices screen (see Figure 3.4) lists the devices by device number. The device numbers should be recorded on your SCSI Path Worksheet (step (3) in section 3.1). On the Available Disk Drives screen, select the device to be partitioned and press **Enter**.
5. If the partition table has already been initialized, skip this step. If the partition table has not yet been initialized, the partition table message is displayed (see Figure 3.5). Press **Enter** to confirm the message. When the **Initialize the partition table?** message appears, select **Yes** and press **Enter** to initialize the partition table.
6. On the Disk Options screen (see Figure 3.6), select **Create NetWare disk partition**, and press **Enter**.
7. You are now prompted to create the partition either automatically or manually. Select the desired option, and press **Enter**. If you select automatic partitioning, NetWare® will create the disk partition and hot fix area using the available disk space (the hot fix area will be approximately two percent of the partition size). If you select manual partitioning, you must enter the desired partition size and hot fix area.
8. On the Disk Partition Information screen (see Figure 3.7), verify (or enter) the partition size and hot fix data area size, and press **F10** to save the changes. You are returned to the Disk Options screen.
9. Select **Create NetWare disk partition** again, and press **Enter**.
10. When the **Create NetWare Partition?** message appears (see Figure 3.8), select **Yes** and press **Enter** to create the specified disk partition on the selected device.
11. Press **Esc** until you are returned to the Available Devices screen (refer to Figure 3.4). Repeat steps (4) through (10) to create the disk partition on each new SCSI disk device.
12. When you are finished creating disk partitions, return to the Available Disk Options screen (refer to Figure 3.3).

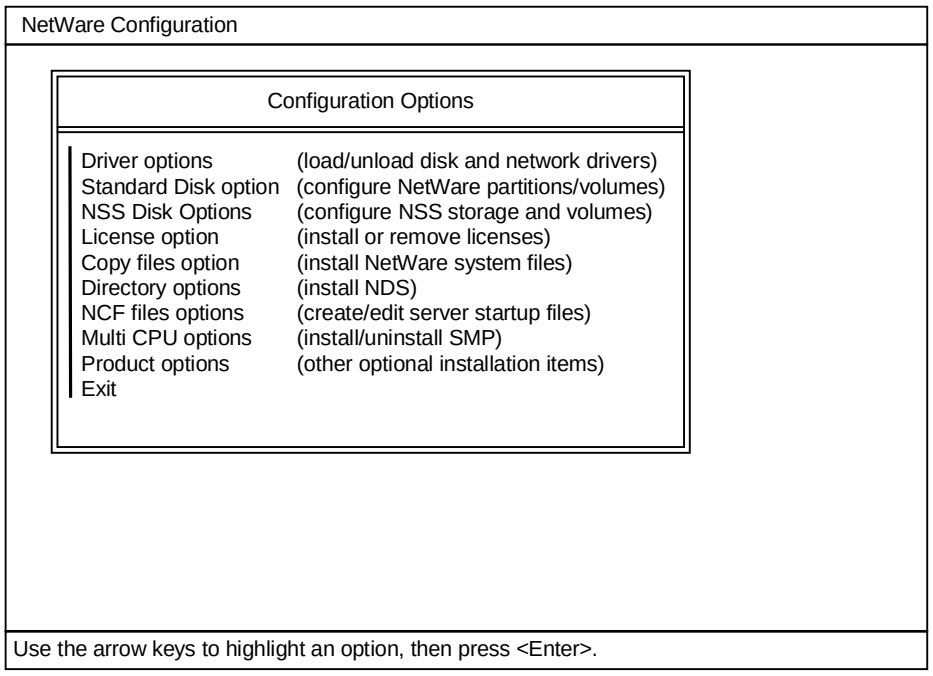

Figure 3.2 Loading the NetWare® Installation Option Module

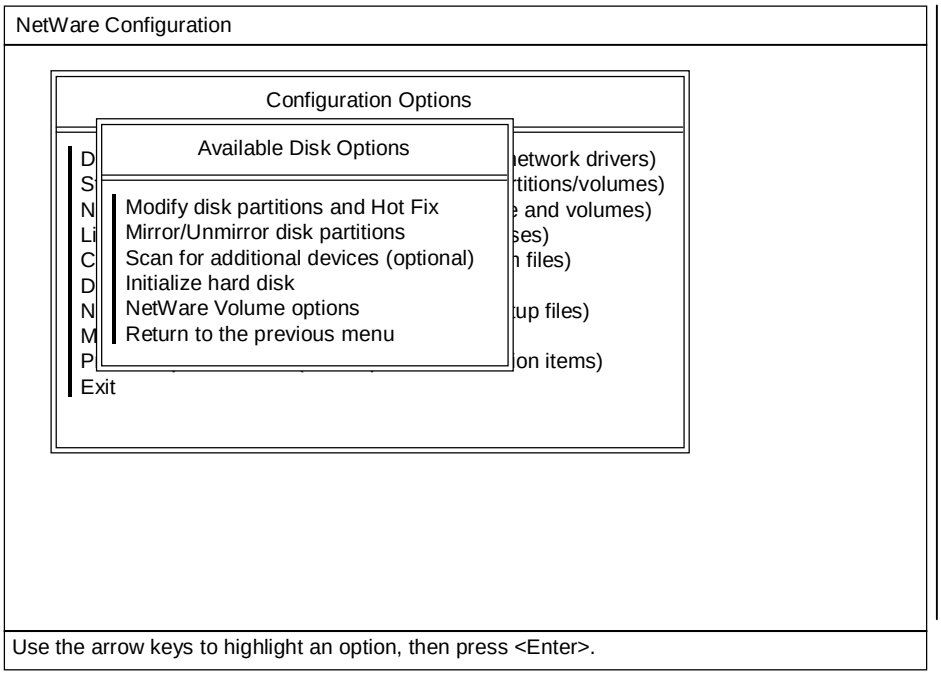

Figure 3.3 Accessing the NetWare® Disk Options

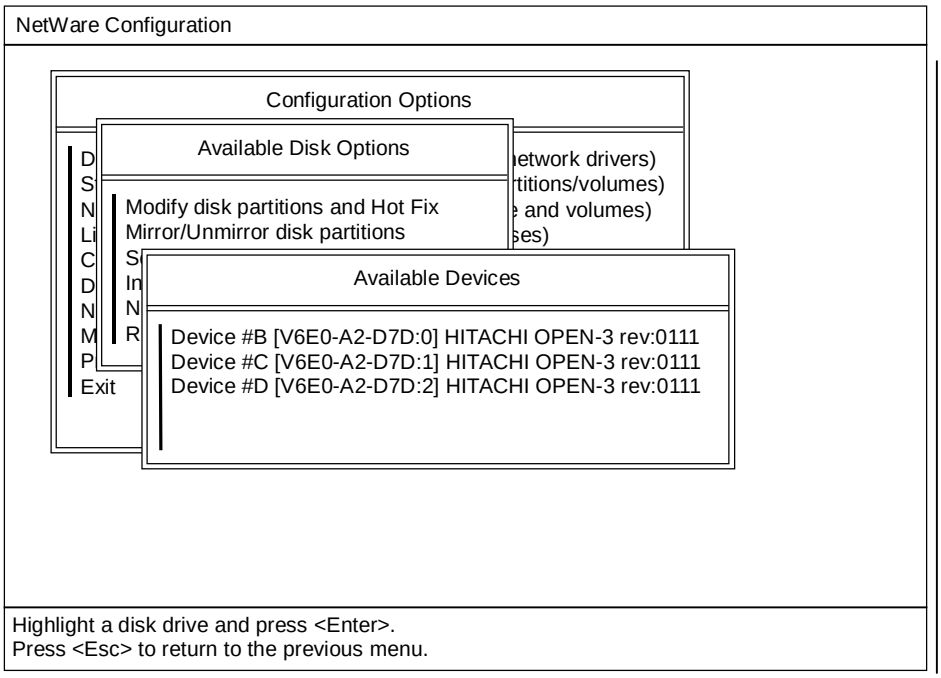

Figure 3.4 Selecting the Device to be Partitioned

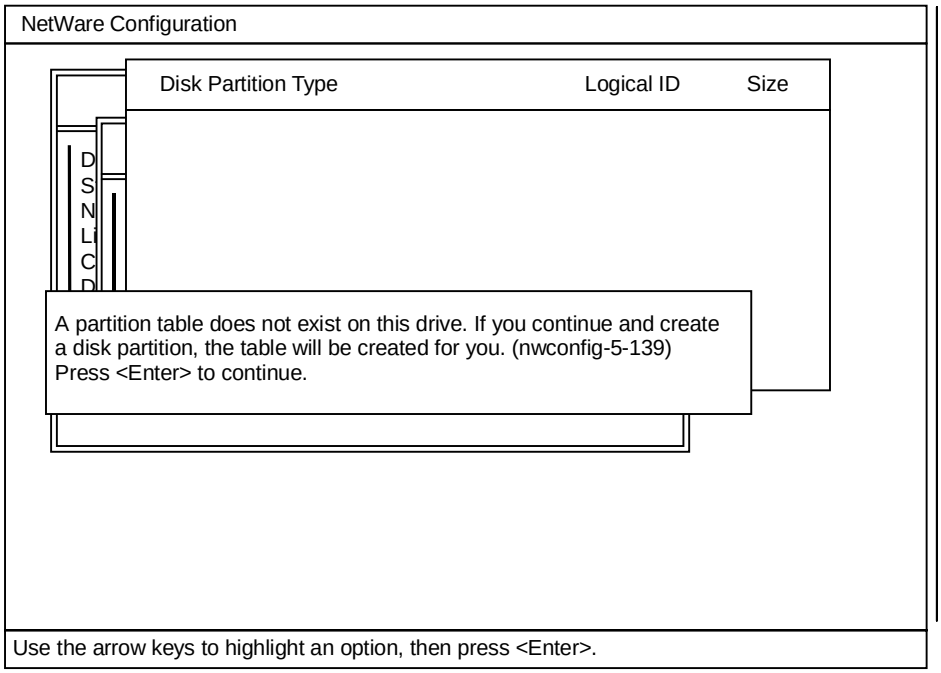

Figure 3.5 Confirming the Partition Table Message

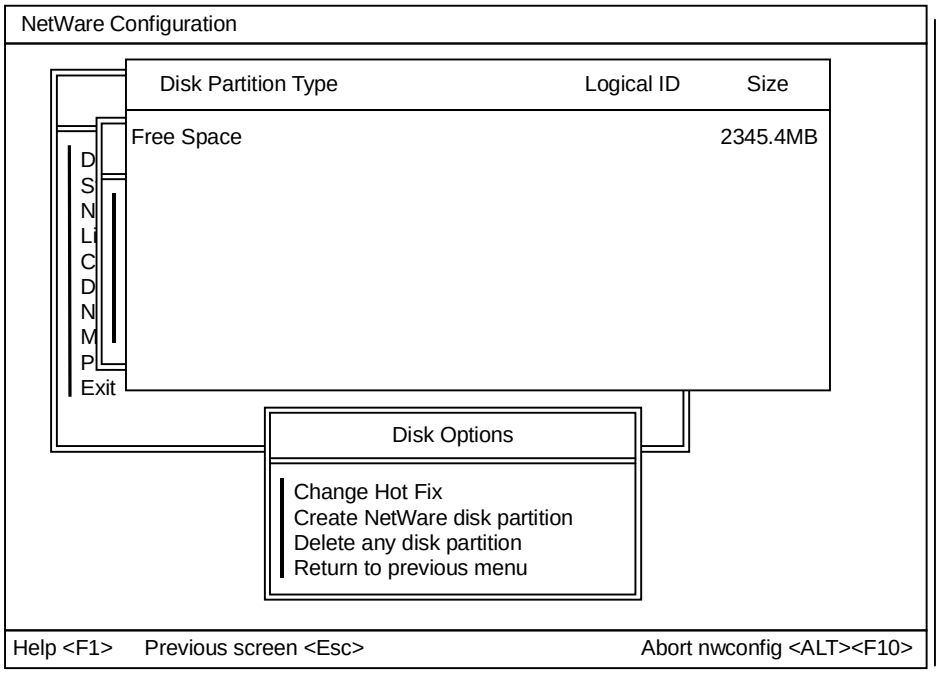

Figure 3.6 Starting to Create a Disk Partition

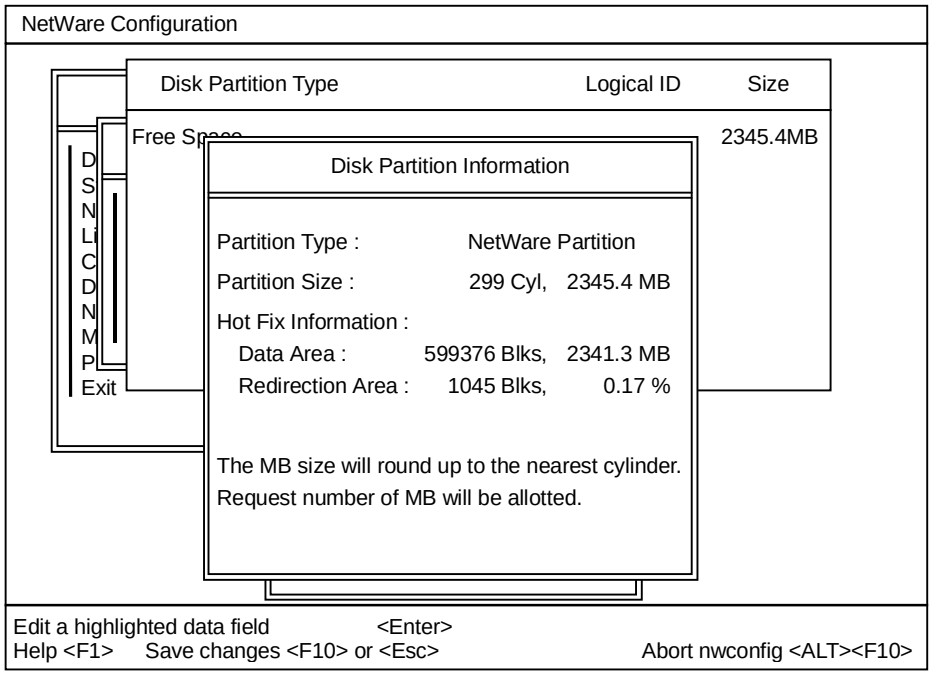

Figure 3.7 Entering the Disk Partition Information

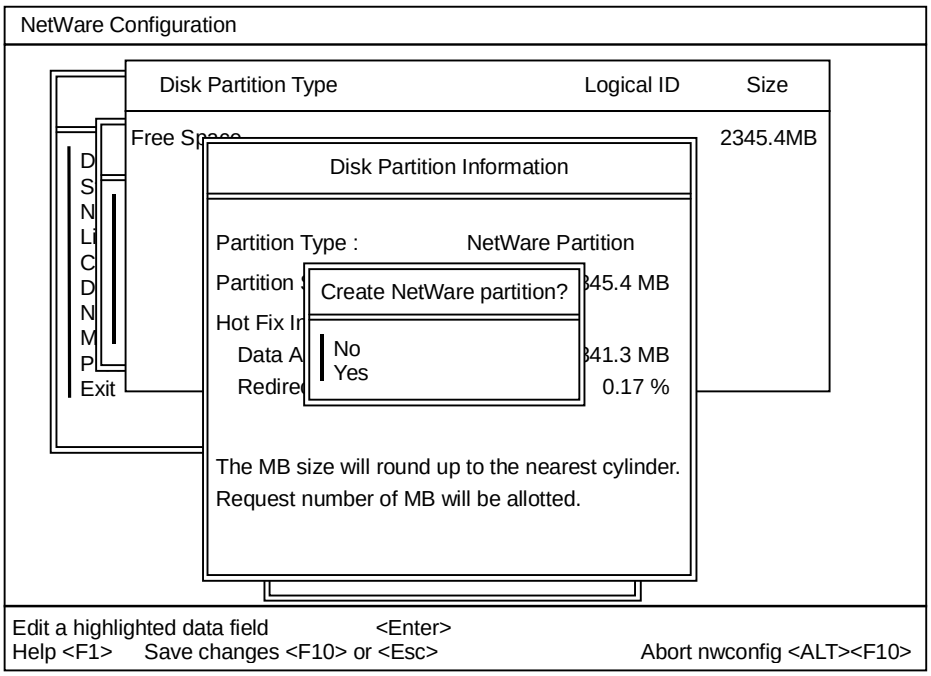

Figure 3.8 Creating the NetWare® Partition

3.3 Assigning the New Devices to Volumes

After you have created the disk partitions on the new devices, you are ready to assign the new SCSI disk devices to volumes, so that the NetWare® system can start writing to the new devices. Figures 3.9 through 3.15 show the sequence of screens displayed on the NetWare® server during the volume assignment process. ***Reminder:*** A volume can span as many as 32 devices, so you can assign more than one device to a volume.

Note: The addition of new volumes to the NetWare® server may require a memory upgrade. Please consult the NetWare® user documentation and/or contact Novell® technical support.

To assign the new SCSI disk devices to volumes:

1. After creating the disk partitions, you should have returned to the Available Disk Options screen. Select **NetWare Volume options**, and press **Enter** to display the volume options.
2. The existing volumes are listed by volume name, and the volume options are displayed at the bottom of the screen (see Figure 3.9). Execute the **Add/View/Modify volume segments** command by pressing the **Ins** or **F3** key.
3. The Volume Disk Segment List screen (see Figure 3.10) displays the existing devices by device number. The device numbers should be recorded on your SCSI Path Worksheet (step (3) in section 3.1). The **Volume assignment** column displays **(free space)** for each device which is not yet assigned to a volume.
4. Execute the **Make a volume assignment** command as follows: move the cursor to the line containing the desired device, then move the cursor over onto **(free space)** in the **Volume assignment** column, and press **Enter**.
5. When the **What would you like to do with this free segment?** message appears (see Figure 3.11), select the desired option, and press **Enter**. If you selected **Make this segment part of another volume**, select the volume you want to add this segment to, and press **Enter**.
6. On the Disk Segment Parameters screen, enter the new volume name (or verify the selected volume), and enter the disk segment size (see Figure 3.12). The segment size is the same as the partition size entered during disk partitioning (see step (8) in section 3.2).
7. Press **F10** to save the new volume information and return to the Volume Disk Segment List screen (see Figure 3.13).
8. On the Volume Disk Segment List screen, press **F10** to save the new volume information and return to the volume list (see Figure 3.14).
9. Repeat steps (2) through (8) until you have assigned all new 9900 devices to volumes.
10. When you are finished assigning new devices to volumes, press **Esc** to save your volume changes. When the confirmation message appears (see Figure 3.15), select **Yes** and then press **Enter** to save all changes and return to the Available Disk Options screen.

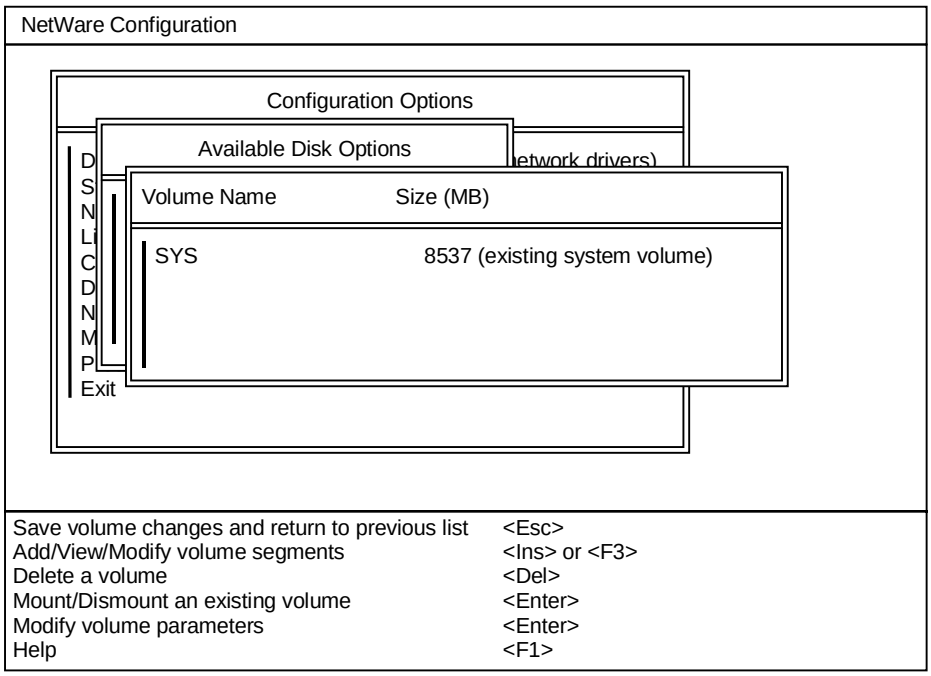

Figure 3.9 Displaying the Existing Volumes and Volume Options

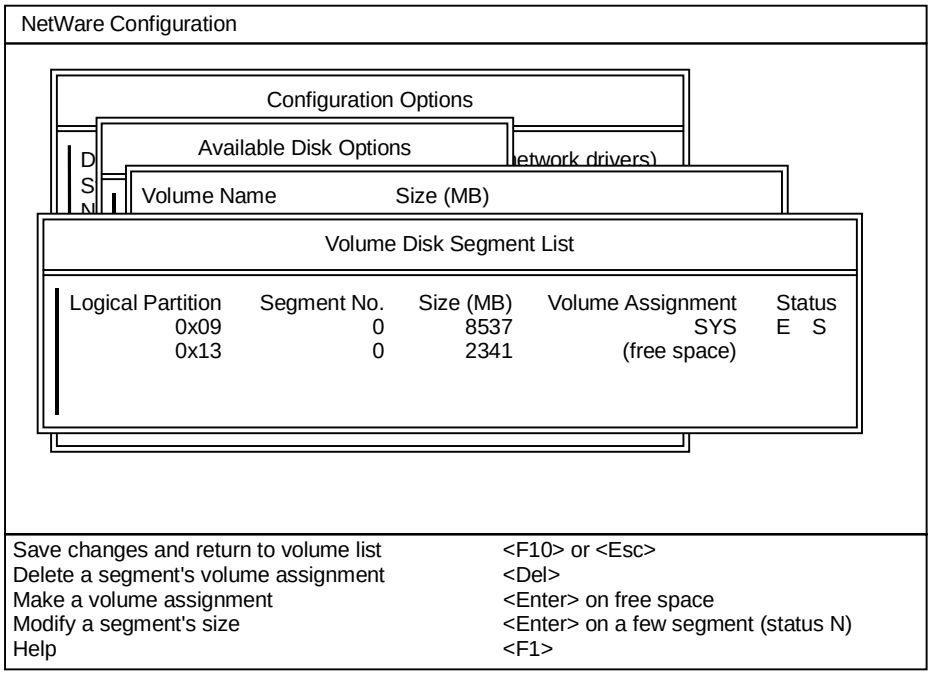

Figure 3.10 Displaying the Existing Devices and Selecting the Device

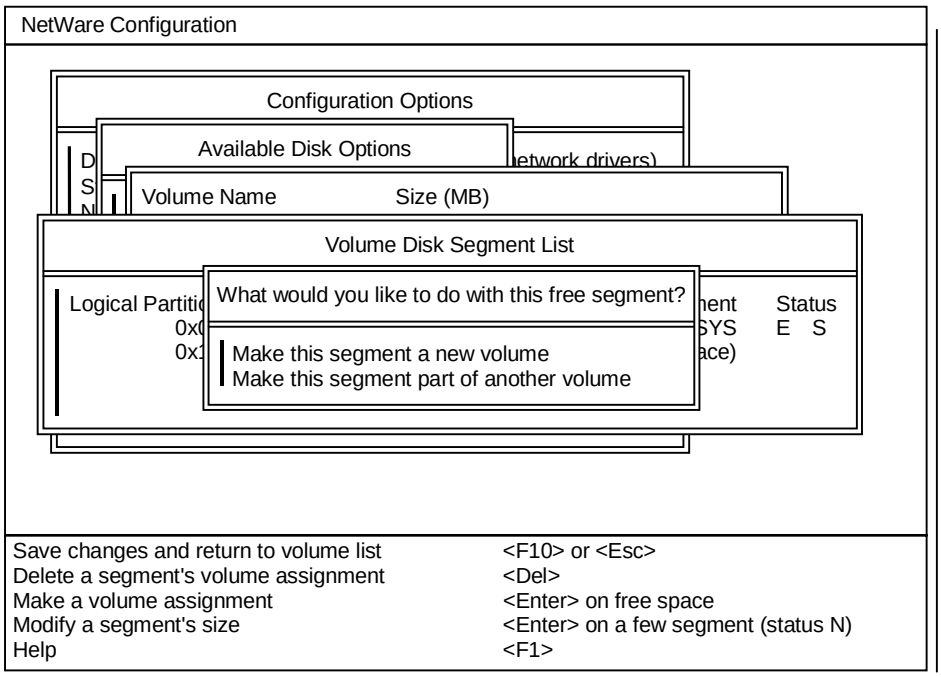

Figure 3.11 Creating a New Volume on the Selected Device

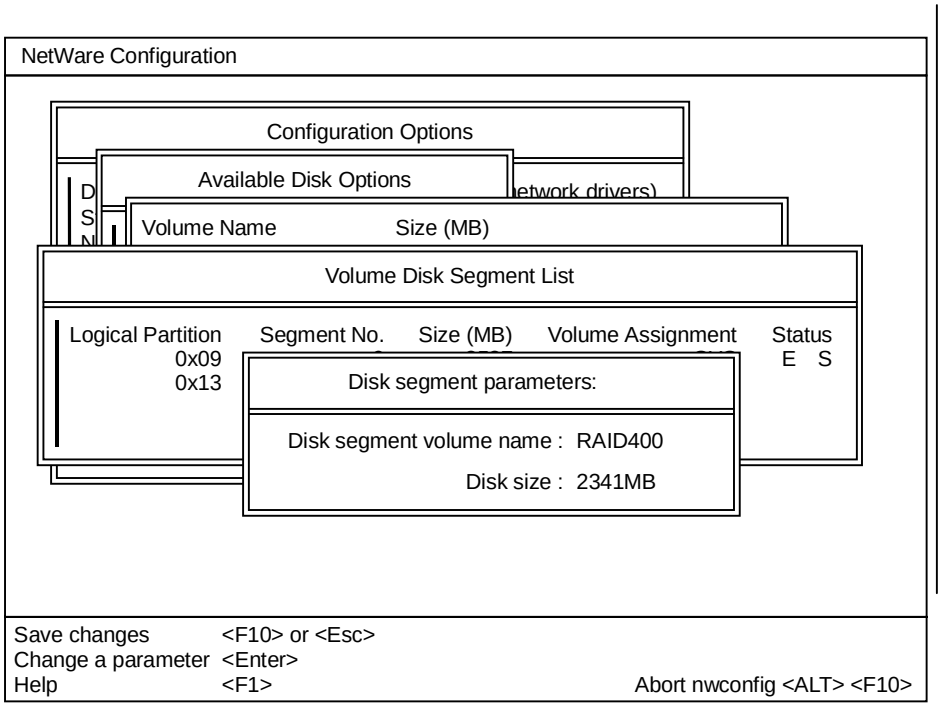

Figure 3.12 Entering the Disk Segment Parameters

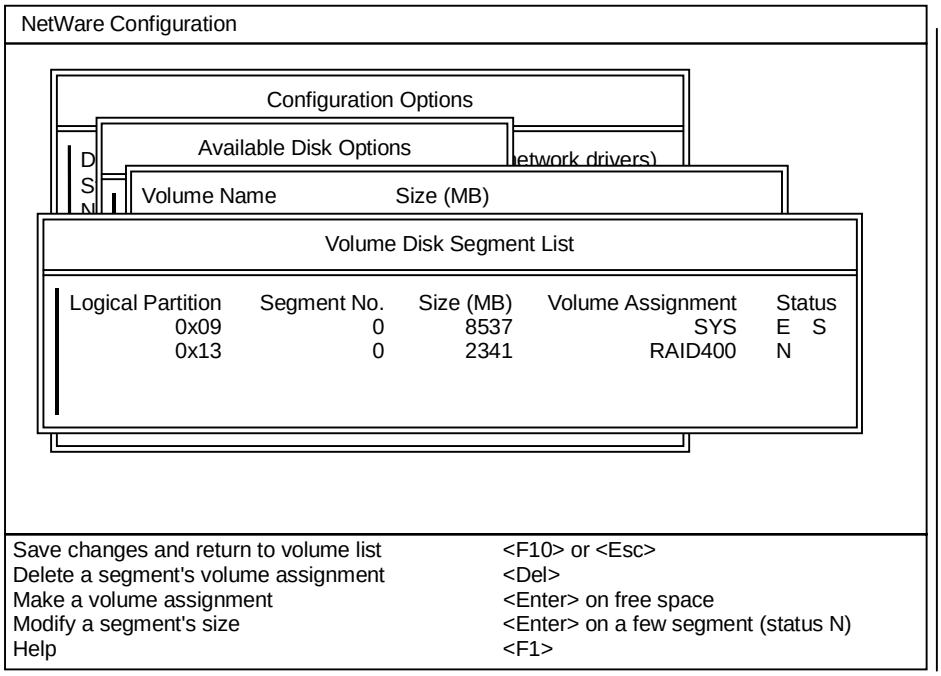

Figure 3.13 Saving the Disk Segment Parameters

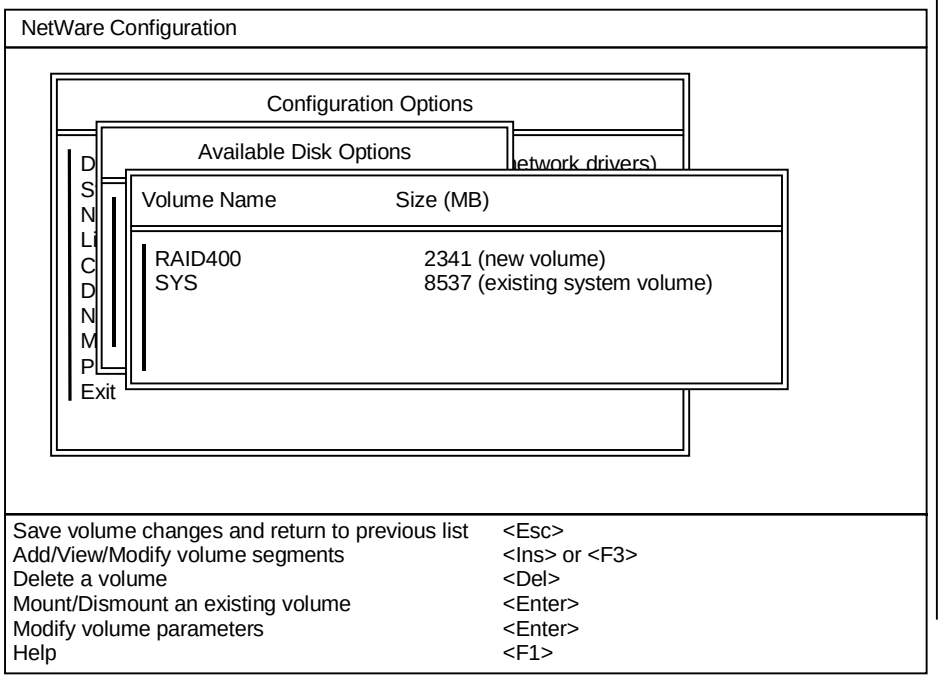

Figure 3.14 Saving the Specified New Volume

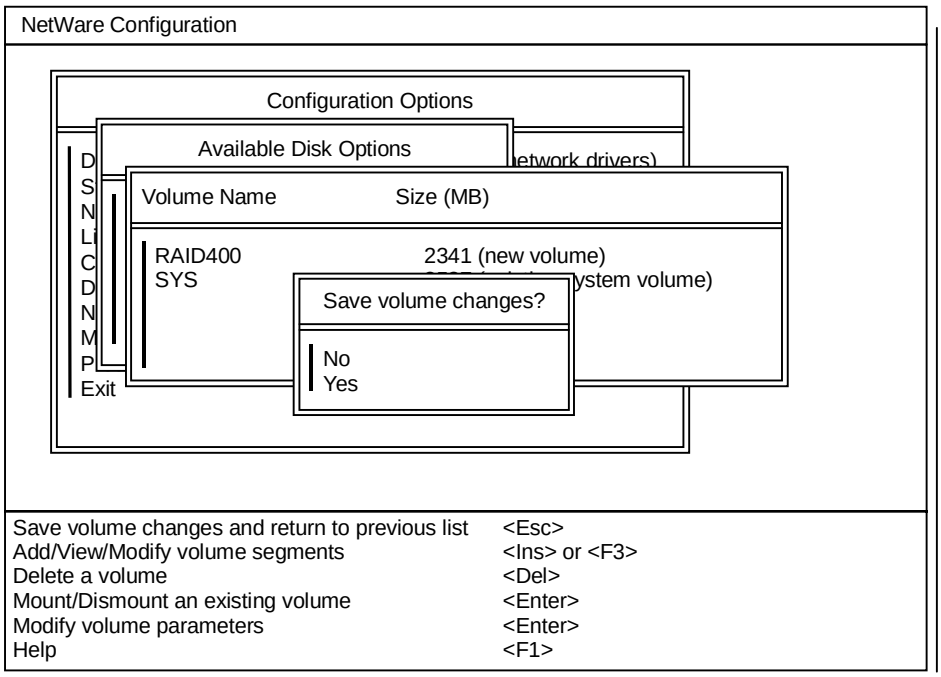

Figure 3.15 Saving All New Volumes

3.4 Mounting the New Volumes

After you have assigned the new 9900 devices to volumes, you are ready to mount the new volumes to verify that the NetWare® system can access the new devices. Figures 3.16 through 3.20 show the sequence of screens displayed on the NetWare® server during the volume mounting process. You should mount all new volumes.

To mount the new volumes:

1. After assigning the new devices to volumes, you should have returned to the Available Disk Options screen. Select **NetWare Volume options** to display the volume list and volume options, and then select **Mount/Dismount an existing volume** and press **Enter**.
2. The mount/dismount volume function requires the NetWare® administrator password. Enter the administrator password on the Directory Services Login screen, and then press **Enter** (see Figure 3.16).
3. An informational message displays the number of new volumes just added (see Figure 3.17). Press **Enter** to confirm this message.
4. You are now prompted to select the desired mount action (see Figure 3.18). Select either **Mount all volumes** or **Mount volumes selectively** as desired.
5. The mount status for all volumes is now displayed.
   a) If you chose to mount volumes selectively (see Figure 3.19), select the desired volume, press **Enter** to mount the volume, and then confirm that the volume's status changed to MOUNTED. Repeat this step for each new volume to confirm that all new volumes can be mounted successfully.
   b) If you chose to mount all volumes, the system mounts all volumes and then displays the mount status for all volumes (see Figure 3.20). Confirm that the status for all new volumes is MOUNTED.
6. When you have confirmed that all new volumes/devices were mounted successfully, you are finished with 9900 device configuration on the Novell® NetWare® PC server. Leave the new volumes mounted for now, so that you can verify that the NetWare® clients can access the new volumes.

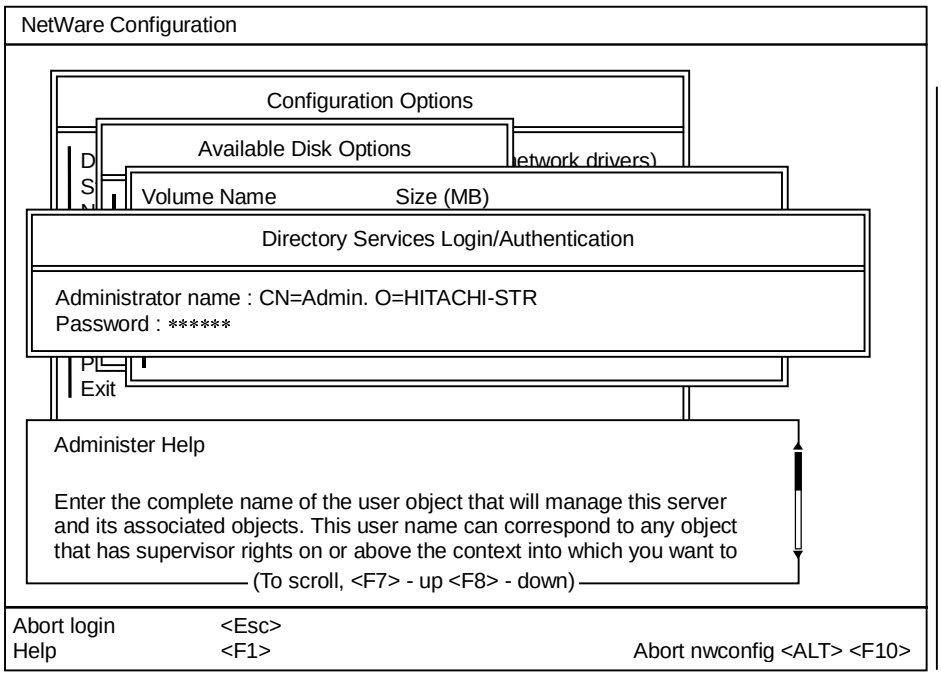

Figure 3.16 Entering the Administrator Password to Perform Mount Operations

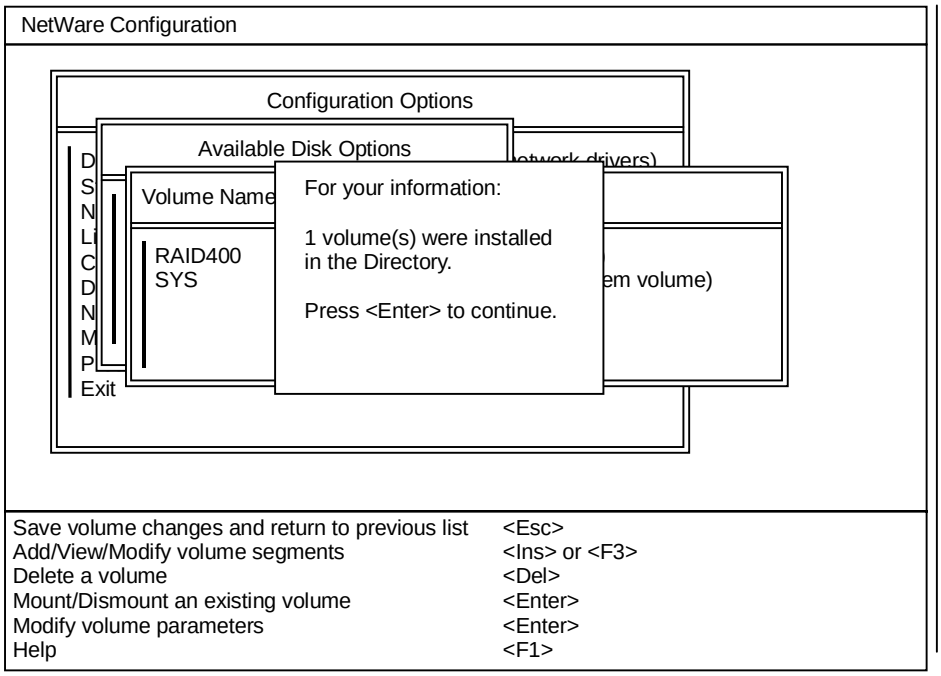

Figure 3.17 Confirming the New Volume Message

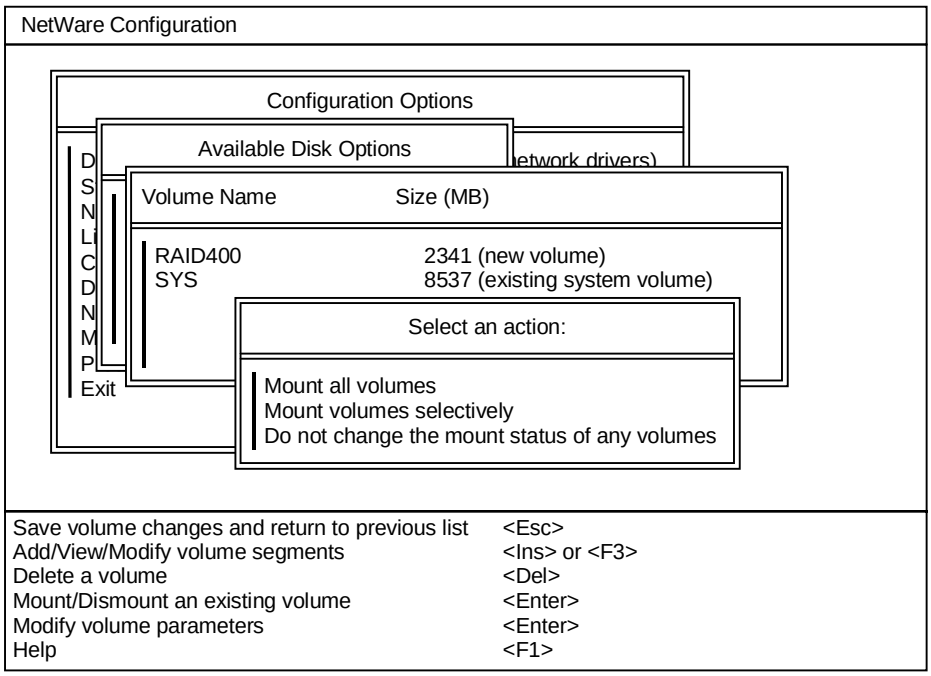

Figure 3.18 Selecting the Desired Mount Action

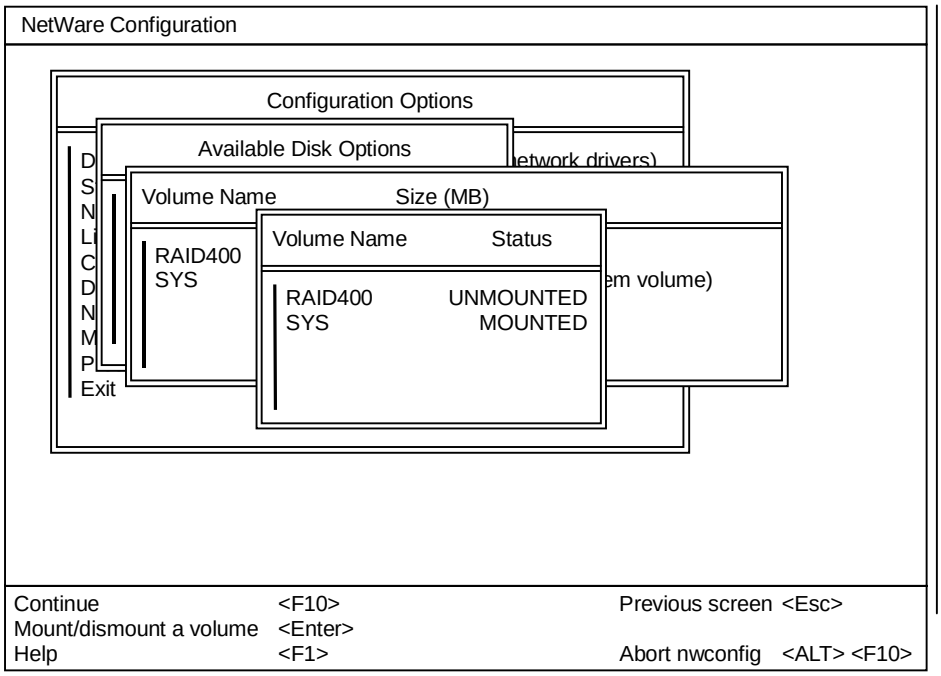

Figure 3.19 Selecting and Mounting the Volume

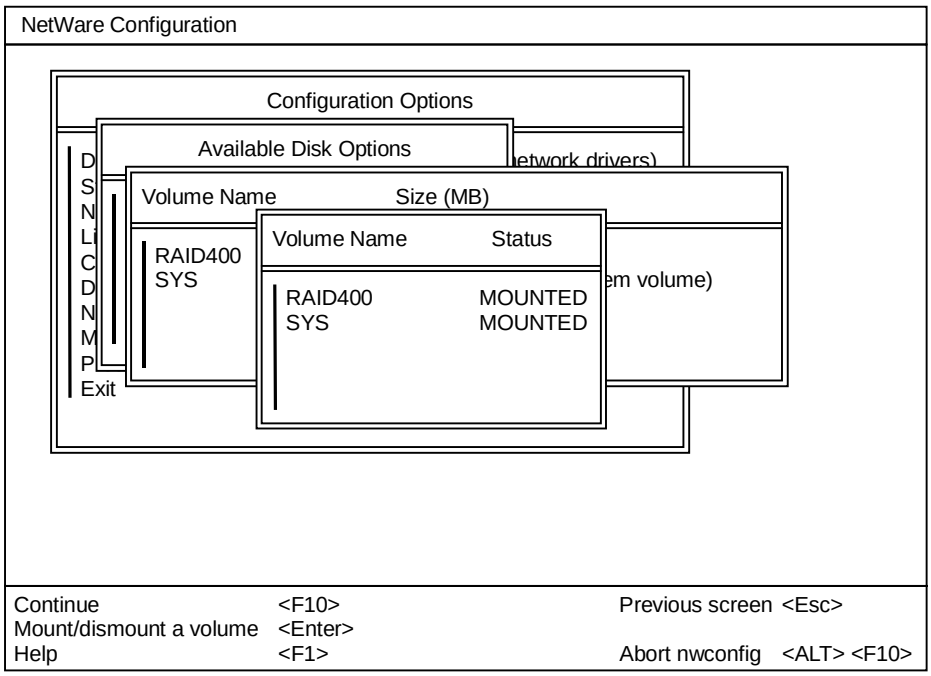

Figure 3.20 Confirming the MOUNTED Status of the New Volume(s)

3.5 Verifying Client Access

The last step in new device configuration is to verify that the NetWare® clients can access the new volumes. To verify access:

1. Copy an existing file onto each new volume.

   Note: This document does not provide instructions for copying a file to a mounted volume.

2. Verify that the file was copied successfully. If not, see section 5.1 for troubleshooting instructions.

Chapter 4 Failover and SNMP Configuration

The 9900 subsystem supports industry-standard products and functions which provide host and/or application failover, I/O path failover, and logical volume management (LVM). For the Novell® NetWare® environment, the 9900 subsystem supports the following products and functions (please contact your Hitachi Data Systems representative for the latest information):

- Novell® High Availability Server (NHAS) and System Fault Tolerance (SFT) III software products.

Note: The logical volume management functions are included in the Novell® NetWare® server operating system (e.g., Configuration Option NetWare® Loadable Module, NWAdmin).

The 9900 subsystem also supports the industry-standard simple network management protocol (SNMP) for remote subsystem management from the UNIX®/PC server host. SNMP is used to transport management information between the 9900 service processor (SVP) and the SNMP manager on the host. The SNMP agent on the 9900 SVP sends status information to the host(s) when requested by the host or when a significant event occurs.

Note: The user is responsible for configuring the failover and SNMP management software on the UNIX®/PC server host. For assistance with failover and/or SNMP configuration on the host, please refer to the user documentation, or contact the vendor's technical support.

4.1 Host FailOver

The NHAS and SFT III software products provide hardware fault tolerance (i.e., host failover capability) for the Novell® NetWare® environment. If you plan to use the 9900 subsystem with these products, please contact your Hitachi Data Systems representative for the latest information on support and configuration requirements.

For assistance with NHAS and/or SFT III operations, please refer to the Novell® user documentation, or contact Novell® customer support.

4.2 SNMP Remote Subsystem Management

SNMP is a part of the TCP/IP protocol suite that supports maintenance functions for storage and communication devices. The 9900 subsystem utilizes SNMP to transfer status and management commands to the UNIX®/PC server host via the 9900 SVP (see Figure 4.1). When the SNMP manager requests status information or when a service information message (SIM) occurs, the SNMP agent on the 9900 SVP notifies the SNMP manager on the server host. Notification of 9900 error conditions is made in real time, providing server users with the same level of monitoring and support available to S/390® mainframe users. The SIM reporting enables the user to monitor the 9900 subsystem from the UNIX®/PC server host without having to check the Remote Console PC for remote SIMs (R-SIMs).

When a SIM occurs, the 9900 SNMP agent initiates trap operations, which alert the SNMP manager of the SIM condition. The SNMP manager receives the SIM traps from the SNMP agent, and can request information from the SNMP agent at any time.

Note: The user is responsible for configuring the SNMP manager on the UNIX®/PC server host. For assistance with SNMP manager configuration on the host, please refer to the user documentation, or contact the vendor's technical support.

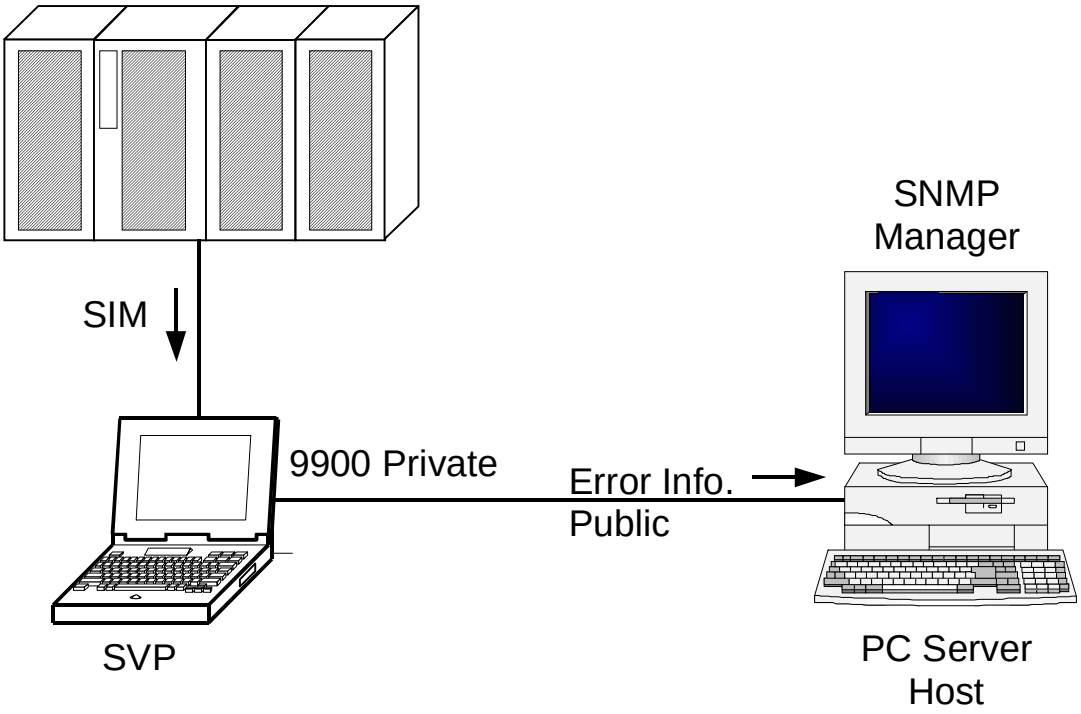

Figure 4.1 9900 SNMP Environment

Chapter 5 Troubleshooting

5.1 Troubleshooting

The Hitachi Lightning 9900™ array subsystem provides continuous data availability. For troubleshooting information for the 9900 subsystem, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ User and Reference Guide* (MK-90RD008).

Table 5.1 lists potential error conditions during 9900 NetWare® device configuration and provides instructions for resolving each condition. If you are unable to resolve an error condition, please consult your Hitachi Data Systems representative, or call the Hitachi Data Systems Support Center for assistance. See section 5.2 for instructions on calling the Hitachi Data Systems Support Center.

Table 5.1 Troubleshooting

Error Condition	Recommended Action
The devices are not recognized by the system.	Make sure that the READY indicator lights on the 9900 subsystem are ON. Make sure that the fibre-channel cables are correctly installed and firmly connected. Make sure that the fibre-channel adapter board(s) and driver(s) are properly installed.
The system hangs.	Verify the hardware configuration of the NetWare® server. For example, you may need to install the Ethernet network card into slot 9 in order for NetWare® to function properly on the HP® Netserver platform. Check your hardware platform for similar restrictions. Avoid sharing interrupts between cards (shared interrupts can be problematic). If interrupt sharing is required, then it should be done between cards of similar type (e.g., between several fibre host adapter cards). If problems persist, the user can also try: (1) Simplifying the firmware settings (e.g., disable disconnects) and/or the driver LOAD command parameters (e.g., disable multiple LUN support or tagged queuing), or (2) Loading a different version of the driver.

5.2 Calling the Support Center

If you need to call the Hitachi Data Systems Support Center, make sure to provide as much information about the problem as possible, including the circumstances surrounding the error or failure and the exact content of any error messages displayed on the host system(s). Please check the remote service information messages (R-SIMs) logged on the Remote Console PC, and note the reference codes and severity levels of the recent R-SIMs.

The worldwide Hitachi Data Systems Support Centers are:

- Hitachi Data Systems North America/Latin America
  San Diego, California, USA
  1-800-348-4357
- Hitachi Data Systems Europe
  Contact Hitachi Data Systems Local Support
- Hitachi Data Systems Asia Pacific
  North Ryde, Australia
  011-61-2-9325-3300

Appendix A Acronyms and Abbreviations

AL	arbitrated loop
AL-PA	arbitrated loop physical address
bd	board
blk	block
CU	control unit
CVS	custom volume size (also called Virtual LUN)
ESCON®	Enterprise System Connection (IBM trademark for optical channels)
ExSA™	Extended Serial Adapter™
FC	fibre-channel
FCP	fibre-channel protocol
HBA	host bus adapter
I/O	input/output
IBM	International Business Machines Corporation
LDEV	logical device
LU	logical unit
LUN	logical unit, logical unit number
LUSE	LU Size Expansion
MB	megabytes
NHAS	Novell® High Availability Server
OFC	open fibre control
P-P	point-to-point
PA	physical address
PC	personal computer system
PCI	power control interface
R-SIM	remote service information message
RAID	redundant array of independent disks
SCSI	small computer system interface
SFT	System Fault Tolerance
SIM	service information message
SNMP	simple network management protocol
SVP	service processor
TID	target ID

Appendix B SCSI TID Map for Fibre-Channel Adapters

When an arbitrated loop (AL) is established or re-established, the port addresses are assigned automatically to prevent duplicate TIDs. With the SCSI over fibre-channel protocol (FCP), there is no longer a need for target IDs in the traditional sense. SCSI is a bus-oriented protocol requiring each device to have a unique address since all commands go to all devices. For fibre channel, the AL-PA is used instead of the TID to direct packets to the desired destination. Unlike traditional SCSI, once control of the loop is acquired, a point-to-point connection is established from initiator to target. To enable transparent use of FCP, the NetWare® system "maps" a TID to each AL-PA.

The host maps SCSI protocol to fibre-channel protocol and detects and accesses fibre-connected devices using device files (/dev/dsk/c*t*d* and /dev/rdsk/c*t*d*) in the same way as for SCSI-connected devices. The device files for fibre-connected devices are configured in a different way than SCSI-connected devices, because fibre supports 126 addresses per path while SCSI supports 16 TIDs per path.

Table B.1 identifies the fixed mappings between the TID values assigned by the NetWare® system and the FC native addresses (AL_PA/SEL_ID) for FC adapters.

Note: The mapping defined in Table B.1 cannot be guaranteed under the following conditions:

- When 9900 devices and other types of devices are connected in the same loop,
- When information for unused devices remains in server system, or
- When multiple ports participate in the same arbitrated loop.

Table B.1 AL-PA to SCSI TID Mapping (t value) for NetWare® Systems

AL-PA	t value	AL-PA	t value	AL-PA	t value	AL-PA	t value	AL-PA	t value	AL-PA	t value	AL-PA	t value	AL-PA	t value
EF	0	CD	0	B2	0	98	0	72	0	55	0	3A	0	25	0
E8	1	CC	1	B1	1	97	1	71	1	54	1	39	1	23	1
E4	2	CB	2	AE	2	90	2	6E	2	53	2	36	2	1F	2
E2	3	CA	3	AD	3	8F	3	6D	3	52	3	35	3	1E	3
E1	4	C9	4	AC	4	88	4	6C	4	51	4	34	4	1D	4
E0	5	C7	5	AB	5	84	5	6B	5	4E	5	33	5	1B	5
DC	6	C6	6	AA	6	82	6	6A	6	4D	6	32	6	18	6
DA	7	C5	7	A9	7	81	7	69	7	4C	7	31	7	17	7
D9	8	C3	8	A7	8	80	8	67	8	4B	8	2E	8	10	8
D6	9	BC	9	A6	9	7C	9	66	9	4A	9	2D	9	0F	9
D5	10	BA	10	A5	10	7A	10	65	10	49	10	2C	10	08	10
D4	11	B9	11	A3	11	79	11	63	11	47	11	2B	11	04	11
D3	12	B6	12	9F	12	76	12	5C	12	46	12	2A	12	02	12
D2	13	B5	13	9E	13	75	13	5A	13	45	13	29	13	01	13
D1	14	B4	14	9D	14	74	14	59	14	43	14	27	14	00	-
CE	15	B3	15	9B	15	73	15	56	15	3C	15	26	15		