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Hitachi TagmaStore®
Adaptable Modular Storage
and Workgroup Modular Storage

HP-UX® Host Installation Guide

MK-95DF730-03a

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Document Revision Level

Revision	Date	Description
MK-95DF730-00	June 2005	Initial Release
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- RSD-95DF730-02
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Changes in this Revision

- Updated the document to include *Hitachi TagmaStore® Adaptable Modular Storage Model AMS1000 User and Reference Guide* (MK-95DF780) and *Hitachi TagmaStore Workgroup Modular Storage Model WMS100 User and Reference Guide* (MK-95DF738).

Preface

This host installation guide describes and provides instructions for configuring devices on the Hitachi Adaptable Modular Storage and Workgroup Modular Storage systems for operation with the HP-UX operating system. This guide assumes that the user:

- Has a background in data processing and understands direct-access storage device systems and their basic functions.
- Is familiar with the Hitachi Adaptable Modular Storage or Workgroup Modular Storage system.
- Is familiar with the HP-UX operating system, the HP® 9000 system, and the fibre-channel adapters.
- Is familiar with the UNIX® file system, system commands, and utilities.

Note: The terms "Adaptable Modular Storage" and "Workgroup Modular Storage" refer to the entire Hitachi Adaptable and Workgroup Modular Storage system family, unless otherwise noted. Refer to the *Hitachi TagmaStore Adaptable Modular Storage Model AMS1000 User and Reference Guide* (MK-95DF780), *Hitachi TagmaStore Adaptable Modular Storage Model AMS500 User's Guide* (MK-95DF714), *Hitachi TagmaStore Adaptable Modular Storage Model AMS200 User's Guide* (MK-95DF713) or *Hitachi TagmaStore Workgroup Modular Storage Model WMS100 User and Reference Guide* (MK-95DF738) for more information about the Adaptable Modular Storage and Workgroup Modular Storage systems.

Note: For more information about the HP-UX operating system, consult the HP-UX user documentation or contact HP technical support.

Microcode Version

This document revision applies to TagmaStore Adaptable Modular Storage and Workgroup Modular Storage versions 2.0 and higher.

Convention for Storage Capacity Values

Storage capacity values for hard disk drives (HDDs) on the AMS and WMS systems are calculated based on the following values:

1 KB = 1,000 bytes
1 MB = $1{,}000^2$ bytes
1 GB = $1{,}000^3$ bytes
1 TB = $1{,}000^4$ bytes

Storage capacity values for logical units (LUs) on the AMS and WMS systems are calculated based on the following values:

1 KB = 1,024 bytes
1 MB = $1,024^2$ bytes
1 GB = $1,024^3$ bytes
1 TB = $1,024^4$ bytes

Referenced Documents

- *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage: Storage Navigator - Modular Command Line Interface (CLI) User's Guide (MK-95DF712)*
- *Hitachi TagmaStor ® Adaptable Modular Storage and Workgroup Modular Storage: Storage Navigator - Modular Graphical User Interface (GUI) User's Guide (MK-95DF711)*
- *Hitachi TagmaStore® Adaptable Modular Storage: Storage Navigator Web User's Guide (MK-95DF719)*
- *Hitachi TagmaStor ® Adaptable Modular Storage Model AMS1000 User and Reference Guide (MK-95DF780)*
- *Hitachi TagmaStore® Adaptable Modular Storage Model AMS500 User and Reference Guide (MK-95DF714)*
- *Hitachi TagmaStore® Adaptable Modular Storage Model AMS200 User and Reference Guide (MK-95DF713)*
- *Hitachi TagmaStore® Workgroup Modular Storage Model WMS100 User and Reference Guide (MK-95DF738)*
- *Hitachi Dynamic Link Manager® User's Guide for HP-UX Systems (MK-92DLM112)*

Comments

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Chapter 1 Introduction

Welcome to the HP-UX® Host Installation Guide for Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage.

This guide describes the requirements and procedures for connecting Adaptable Modular Storage and Workgroup Modular Storage systems to an HP-UX system. It also describes how to configure the new Adaptable Modular Storage disk devices for operation with the HP-UX operating system. The Hitachi Data Systems representative performs the initial physical installation of the Adaptable Modular Storage system. The user then configures the new Adaptable Modular Storage devices with assistance as needed from the Hitachi Data Systems representative.

Configuration of the Adaptable Modular Storage disk devices for HP-UX operations involves the following steps:

- Verifying new device recognition (section 3.1)
- Verifying the device files and driver (section 3.2)
- Partitioning the disk devices (section 3.3)
- Creating the file systems for the new volumes (section 3.4)
- Setting the device parameters for the disk devices (section 3.5)
- Creating the mount directories (section 3.6)
- Mounting and verifying the file systems (section 3.7)
- Setting and verifying the automount parameters (see section 3.8)

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

1.1 Adaptable Modular Storage System

The Hitachi Adaptable Modular Storage Series system is a high-performance, medium-capacity storage system, with added features for increasing data accessibility and enabling continuous user data access. The architecture of the Adaptable Modular Storage enables the user to scale the system to meet a wide range of capacity and performance requirements. The Adaptable Modular Storage system provides connectivity to most open systems through a standard fibre-channel interface.

- For more information about the Adaptable Modular Storage system, refer to the *Hitachi TagmaStore Adaptable Modular Storage Model AMS1000 User and Reference Guide* (MK-95DF780), *Hitachi TagmaStore Adaptable Modular Storage Model AMS500 User's Guide* (MK-95DF714), the *Hitachi TagmaStore Adaptable Modular Storage Model AMS200 User's Guide* (MK-95DF713), the *Hitachi TagmaStore Adaptable Modular Storage Model AMS1000 User and Reference Guide* (MK-95DF780), the *Hitachi TagmaStore Workgroup Modular Storage Model WMS100 User and Reference Guide* (MK-95DF738), or contact your Hitachi Data Systems account team.

Chapter 2 Preparing for New Device Configuration

This chapter covers the following topics:

- Configuration requirements (section 2.1)
- Installing an Adaptable Modular Storage™ system (section 2.2)
- Preparing to connect Adaptable Modular Storage (section 2.3)
- Connecting the Adaptable Modular Storage system to an HP-UX system (section 2.4)
- Setting disk and device parameters (section 2.5)
- Configuring host fibre-channel adapters (section 2.6)
- Rebooting HP-UX system (section 2.7)

2.1 Configuration Requirements

The requirements for undertaking an Adaptable Modular Storage HP-UX configuration are:

- **Hitachi TagmaStore Adaptable Modular Storage system**

  The Storage Navigator software for Adaptable Modular Storage is required to configure the fibre-channel (FC) ports on the Adaptable Modular Storage system.

  Note: The availability of Adaptable Modular Storage features and functions depends on the level of microcode installed on the Adaptable Modular Storage system.

- **HP 9000/800 series system**

  For assistance with other HP models, contact the Hitachi Data Systems Support Center.

- **HP-UX operating system version 10.20, 11.0, or 11i**

  Important: Contact HP to ensure that the most current operating system patches are installed on the HP-UX system. For more information about supported HP-UX versions, contact Hitachi Data Systems.

- **Fibre-channel adapters**

  Be sure to install all utilities, tools, and drivers that come with the adapter(s).

  – The Adaptable Modular Storage system supports full-speed (1 and 2 Gbps), shortwave, non-OFC (open fibre control) optical fibre-channel interface and multimode optical cables with SC and/or LC connectors. Do not connect OFC-type fibre-channel interfaces to the Adaptable Modular Storage system.

  Note: It is recommended that users read all vendor release notes and vendor installation guides before setting up HBA configuration files.

- **High-availability (HA) software (optional)**

  The Adaptable Modular Storage currently supports the following HA software products for the HP-UX operating system. Contact your Hitachi Data Systems account team for the latest information about supported software products.

  – Hitachi Dynamic Link Manager™ for path failover

  – VERITAS Volume Manager™ (VxVM) for logical volume management

2.2 Installing an Adaptable Modular Storage System

The Adaptable Modular Storage system comes with all the hardware and cabling required for installation. Installation of the Adaptable Modular Storage system involves the following activities:

- **Hardware installation**

  A Hitachi Data Systems representative performs hardware installation as specified in the Hitachi TagmaStore Adaptable Modular Storage Maintenance Manual. Follow all precautions and procedures in the Adaptable Modular Storage maintenance manual. Check all specifications to ensure proper installation and configuration. Hardware installation includes:

  - Assembling all hardware and cabling
  - Installing the latest microcode level
  - Creating RAID groups and LUNs and formatting LUNs using the Storage Navigator Adaptable Modular Storage software. For information and instructions about using Storage Manager, refer to the following documents:
    - *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator Modular Command Line Interface (CLI) User's Guide* (MK-95DF712)
    - *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator - Modular Graphical User Interface (GUI) User's Guide* (MK-95DF711)
    - *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator Web User's Guide* (MK-95DF719)
  - Installing the fibre-channel adapters and cabling

- **Adaptable Modular Storage Fibre Channel Ports**

  Fibre topology parameters for each Adaptable Modular Storage fibre-channel port depend on the type of device to which the Adaptable Modular Storage port is connected. Determine topology parameters supported by the device, and set your topology accordingly (see section 2.3.1.1).

  Use Storage Navigator for Adaptable Modular Storage software to configure Adaptable Modular Storage fibre ports. For instructions about using Storage Navigator, refer to the following documents:

  - *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator Modular Command Line Interface (CLI) User's Guide* (MK-95DF712)
  - *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator - Modular Graphical User Interface (GUI) User's Guide* (MK-95DF711)
  - *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator Web User's Guide* (MK-95DF719)

2.3 Preparing to Connect Adaptable Modular Storage

Before connecting an Adaptable Modular Storage system, perform the following tasks:

- Set host-specific parameters for Adaptable Modular Storage fibre-channel ports (see section 2.3.1)
- Verify host bus adapter installation (see section 2.3.2)

Use Storage Navigator Adaptable Modular Storage software to configure Adaptable Modular Storage ports (see Figure 2.1). Some key configuration selections you can make include:

- **Topology (Connection):** Loop or Point-to-Point
- **Port Option:** Optional port settings that define the way the host accesses the port. Multiple options can be selected: reset/LIP mode (signal), reset/LIP mode (process), reset/ALL LIP port mode, reset target (reset bus device) mode, etc.
- **Host mode:** Standard, Open VMS, Wolfpack, TRESPASS, etc. Select the host mode for the connected platform to enable the host to "see" all LUNs on the port.
- **Extended Host Mode (Host Mode2):** Optional settings on the port that describe how the host accesses the port. Multiple options can be selected: VxVM DMP mode, HP connection mode, report inquiry page 83H, UA (06/2A00) suppress mode, etc.

For instructions about using Storage Navigator, refer to the following documents*:*

- *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator Modular Command Line Interface (CLI) User's Guide* (MK-95DF712)
- *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator - Modular Graphical User Interface (GUI) User's Guide* (MK-95DF711)
- *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator Web User's Guide* (MK-95DF719)

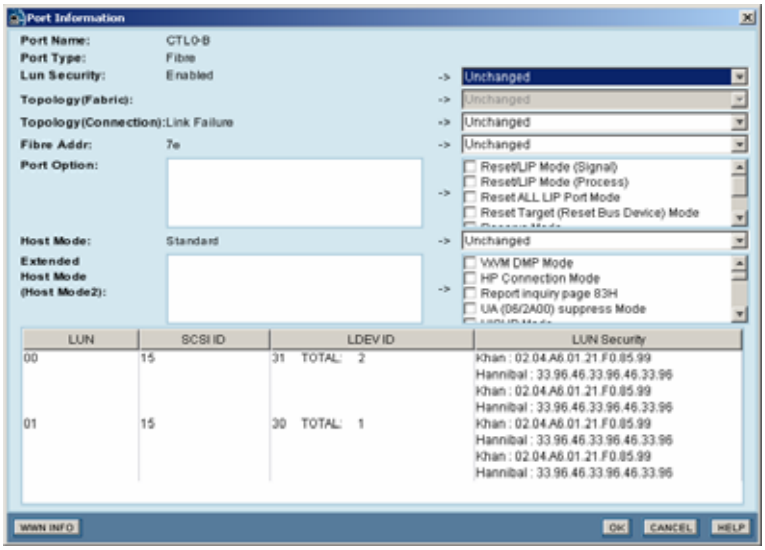

Figure 2.1 Example of Port Information

2.3.1 Setting Host-Specific Parameters for Adaptable Modular Storage Ports

Adaptable Modular Storage ports must be configured for the connected operating system. Use Storage Navigator Adaptable Modular Storage software to configure Adaptable Modular Storage™ fibre ports. For instructions about using Storage Navigator, refer to the following documents:

- *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator Modular Command Line Interface (CLI) User's Guide* (MK-95DF712)
- *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator - Modular Graphical User Interface (GUI) User's Guide* (MK-95DF711)
- *Hitachi TagmaStore Adaptable Modular Storage - Storage Navigator Web User's Guide* (MK-95DF719)

2.3.1.1 Fibre Topology

Configure Adaptable Modular Storage FC ports to define the fibre topology parameters and port addresses. Adaptable Modular Storage systems support up to 512 LUNs. Select appropriate settings for each Adaptable Modular Storage FC port based on the device to which the port is connected. Determine topology parameters supported by the device and set your topology accordingly.

Note: If you plan to connect different types of servers to the Adaptable Modular Storage via the same fabric switch, use either **zoning** on the switch or the Hitachi Volume Security (LUN Management) feature on Adaptable Modular Storage, or a combination of both.

2.3.1.2 Port Address

In fabric environments, port addresses are assigned automatically by fabric switch port number and are not controlled by the Adaptable Modular Storage port settings. In FC arbitrated-loop (FCAL) environments, port addresses are set by entering an AL-PA (arbitrated-loop physical address, or loop ID, or port address). The host communicates with the devices comprising the loop with 8-bit AL-PA (see Table 2.1).

Table 2.1 shows available Adaptable Modular Storage AL-PA values. Fibre-channel protocol uses AL-PAs to communicate on the fibre-channel link, but the software driver for the platform host adapter translates the AL-PA value assigned to the Adaptable Modular Storage port to a SCSI TID. See Appendix C for a description of the AL-PA-to-TID translation.

Note on loop ID conflict: The HP 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). 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 the same loop (e.g., addresses EF and CD both have TID 0, see Table C.1, Appendix C).

Table 2.1 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	

2.3.2 Verifying Host Fibre-Channel Adapter Installation

After configuring fibre-channel ports on the Adaptable Modular Storage system, verify that host fibre-channel adapters are installed properly using the **ioscan -f** command (see Figure 2.2). In particular, verify that underlined items are displayed as a result of an **ioscan-f** command. If these items are not displayed, the host environment may not be installed properly. In this case, check host adapter installation (hardware and driver installation) or the host configuration.

```
# ioscan -f
Class     I  H/W Path          Driver     S/W State H/W Type    Description
============================================================================
bc        0                    root       CLAIMED   BUS_NEXUS
bc        1  8                 bc         CLAIMED   BUS_NEXUS   Pseudo Bus Converter
bc        2  8/0               bc         CLAIMED   BUS_NEXUS   Bus Converter
tty       0  8/0.0             mux2       CLAIMED   INTERFACE   MUX
ext_bus   0  8/4               c720       CLAIMED   INTERFACE   GSC add on Fast/Wide SCSI
INTERFACE
target    0  8/4.5             tgt        CLAIMED   DEVICE
disk      0  8/4.5.0           sdisk      CLAIMED   DEVICE      SEGATE ST321S1W
target    1  8/4.7             tgt        CLAIMED   DEVICE
ct1       0  8/4.7.0           sct1       CLAIMED   DEVICE      Initiator
fc        0  8/12              fcT1       CLAIMED   INTERFACE   HP Fibre Channel Mass Storage
Adapter
lan       1  8/12.5            fcT1_cntl  CLAIMED   INTERFACE   HP Fibre Channel Mass Storage
Cntl
fcp       0  8/12.8            fcp        CLAIMED   INTERFACE   FCP Protocol Adapter
ext_bus   2  8/12.8.0.255.0    fcpdev     CLAIMED   INTERFACE   FCP Device Interface
target    7  8/12.8.0.255.0.6  tgt        CLAIMED   DEVICE
target    8  8/12.8.0.255.0.8  tgt        CLAIMED   DEVICE
target    9  8/12.8.0.255.0.9  tgt        CLAIMED   DEVICE
#
```

Figure 2.2 Verifying Host Fibre-Channel Adapter Installation

2.4 Connecting the Adaptable Modular Storage System to an HP-UX System

The Adaptable Modular Storage system comes with all the hardware and cabling required for connection to the host system(s). Adaptable Modular Storage system connection involves the following steps. Some of these steps are performed by a Hitachi Data Systems representative, while other steps are performed by the user.

Note: The Hitachi Data Systems representative must use the Adaptable Modular Storage 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.

1. **Verify system installation.** A Hitachi Data Systems representative verifies the fibre port address configuration and the status of the FC adapters and LDEVs (normal).
2. **Shut down HP-UX system.** The user shuts down and powers off the HP-UX system before connecting the Adaptable Modular Storage system:
   a) Shut down HP system.
   b) When shutdown is complete, power off HP display.
   c) Power off all peripheral devices, except the Adaptable Modular Storage system.
   d) Power off the HP system. You can now connect the Adaptable Modular Storage system.
3. **Connect the Adaptable Modular Storage system to the HP system.** A Hitachi Data Systems representative installs fibre-channel cables between Adaptable Modular Storage and HP-UX system.

   Note: Use the Adaptable Modular Storage 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 the HP system.** The user or Hitachi Data Systems representative powers on the HP system after connecting the Adaptable Modular Storage system:
   a) Power on the HP system display.
   b) Power on all peripheral devices. Adaptable Modular Storage system should already be on and fibre-channel ports should already be configured. If Adaptable Modular Storage fibre ports are configured after HP system is powered on, the system must be restarted to recognize the new devices.
   c) Confirm ready status of all devices.
   d) Power on HP system.

2.5 Setting Disk and Device Parameters

To set or change the timeout value to 60 seconds for a disk in HP-UX, run the following commands:

```
#for i in `ls /dev/dsk/*`
#do
#pvchange -t 60 $i
#done
```

An IO_timeout value of zero (0) causes the system to use the default value supplied by the device driver associated with the physical device. IO_timeout is used by the device driver to determine how long to wait for disk transactions to complete before concluding that an IO request cannot be completed (and the device is offline or unavailable).

2.6 Configuring Host Fibre-Channel Adapters

After setting and recognizing LUs, configure host fibre-channel adapter(s) (HBAs) connected to Adaptable Modular Storage.

HBAs have many configuration options. Be sure to read MAN pages and user documentation for the adapter.

2.7 Rebooting the HP-UX System

After setting and recognizing LUs and configuring HBAs, reboot HP-UX system. After rebooting, configure new LUs, as described in Chapter 3.

Chapter 3 Configuring New Devices

After Adaptable Modular Storage installation and connection procedures have been performed and the HP-UX system has been rebooted, the new Adaptable Modular Storage devices are ready to be configured for use. Adaptable Modular Storage device configuration is performed by the user and requires root access to the HP-UX system.

This chapter covers the following Adaptable Modular Storage device configuration procedures:

- Verifying New Device Recognition (section 3.1)
- Verifying Device Files and Driver (section 3.2)
- Partitioning Disk Devices (section 3.3)
- Creating File Systems (section 3.4)
- Setting Device Parameters (section 3.5)
- Creating Mount Directories (section 3.6)
- Mounting and Verifying File Systems (section 3.7)
- Setting and Verifying Auto-Mount Parameters (section 3.8)

This document also provides the following supplemental information for configuring devices:

- Troubleshooting for device configuration (Chapter 4)
- Setting Maximum Number of Volume Groups Using SAM (Appendix A)
- Online Device Installation (Appendix B)
- SCSI TID Map for Fibre-Channel Adapters (Appendix C)

3.1 Verifying New Device Recognition

The first step in configuring Adaptable Modular Storage devices for HP-UX operations is to verify that the HP system recognizes the new devices on the Adaptable Modular Storage system. The devices must be installed and formatted and the fibre-channel ports defined before the host system is powered on. If the fibre ports are configured after the HP system is powered on, the user must halt and restart the system to allow the system to recognize the new devices.

To verify that the HP system recognizes new Adaptable Modular Storage devices:

1. Login to HP system as **root** (see Figure 3.1).
2. Display device data using the **ioscan -f** command, and verify that the system recognizes newly installed devices on the Adaptable Modular Storage system (see Figure 3.2). If desired, use the **-C disk** command option (**ioscan -fnC disk**) to limit output to disk devices only.

   Note: If **UNKNOWN** is displayed as the **Class** type, the HP system may not be configured properly. Refer to HP documentation or contact HP technical support.

   Note: If information for unused devices remains in the system, get the system administrator's permission to renew the device information. To renew device information, delete **/etc/ioconfig** and **/stand/ioconfig files** (**rm** command), reboot server, and then issue **ioinit -c** command. After that, issue **ioscan -f** command to recognize logical devices again. You may also remove unused device files with the command **rmsf -H** <***hardware address of unused devices***>.
3. Enter device data for each Adaptable Modular Storage device in your table, including device file name. Device file names have the following structure:
   c*X*t*Y*d*Z*

   In this filename structure:

   - **c** = controller
   - ***X*** = bus instance #
   - **t** = target ID
   - ***Y*** = target ID
   - **d** = device
   - ***Z*** = LUN

   Note: The SCSI target IDs are hexadecimal (0 through F) and the LUN is decimal (0 through 7).

4. Verify that SCSI TIDs correspond to the assigned port address for all connected ports (see mapping in Table C.1). If so, logical devices are recognized properly. If not:
   a) Use LUN Manager software to check AL-PA for each port. If the same port address is set for multiple ports on the same loop (AL with HUB), all port addresses except one changed to another value and the relationship between AL-PA and TID does not correspond to the mapping in Appendix D. Set a different address for each port, then verify new device recognition.
   b) If unused device information remains, TID-to-AL-PA mapping will not correspond to mapping given in Appendix C. Renew device information (see step 2 for instructions), then verify new device recognition.

```
The system is ready.

GenericSysName [HP Release B.10.20] (see /etc/issue)
Console Login: root                                          ← Log in as root.
Password:                                          ← Enter password (not displayed).
Please wait...checking for disk quotas
(c)Copyright 1983-1995 Hewlett-Packard Co.,  All Rights Reserved.
:
#
```

Figure 3.1 Logging In

```
# ioscan -fn
Class      I   H/W Path    Driver         S/W State H/W Type  Description
===========================================================================
bc         0               root           CLAIMED   BUS_NEXUS
bc         1   8           bc             CLAIMED   BUS_NEXUS Bus Converter
fc         0   8/12                fcT1   CLAIMED INTERFACE HP Fibre Channel Mass Storage
fcp        0   8/12.8              fcp    CLAIMED INTERFACE FCP Protocol Adapter
ext_bus    2   8/12.8.0.255.0      fcpdev CLAIMED INTERFACE FCP Device Interface
target     7   8/12.8.0.255.0.6    tgt    CLAIMED DEVICE
disk       3   8/12.8.8.255.0.6.0  sdisk  CLAIMED DEVICE      HITACHI DF600F
                         /dev/dsk/c2t6d0   /dev/rdsk/c2t6d0
disk       4   8/12.8.8.255.0.6.1  sdisk  CLAIMED DEVICE      HITACHI DF600F
                         /dev/dsk/c2t6d1   /dev/rdsk/c2t6d1
:
#
```

This sample screen shows the following new Adaptable Modular Storage devices recognized:
HITACHI DF600F device: bus number = 8/12, bus instance = 8, target ID = 6, LUN = 0, driver = sdisk.
HITACHI DF600F device: bus number = 8/12, bus instance = 8, target ID = 6, LUN = 1, driver = sdisk.

Figure 3.2 Verifying New Device Recognition

3.2 Verifying Device Files and Driver

Device files for all new devices should be created automatically during system startup. Each device should have a block-type device file in the **/dev/dsk** directory and a character-type device file in the **/dev/rdsk** directory. SCSI disk devices must have both device files. You also need to verify the HP-UX driver for the Adaptable Modular Storage system.

Note: Some HP-compatible systems do not create device files automatically. If device files were not created, see section 3.2.1 for instructions about creating device files.

To verify that device files for Adaptable Modular Storage devices were successfully created:

1. Display block-type device files in the **/dev/dsk** directory using the **ll** command (equivalent to **ls -l**) with the output piped to **more** (see Figure 3.3). Verify that there is one block-type device file for each Adaptable Modular Storage device.
2. Use your completed device data table to verify that the block-type device file name for each device is correct.
3. Display the character-type device files in the **/dev/rdsk** directory using the **ll** command with the output piped to **more** (see Figure 3.4). Verify that there is one character-type device file for each Adaptable Modular Storage device.
4. Use your completed device data tab to verify that the character-type device file name for each device is correct.
5. After verifying the block-type and character-type device files, verify the HP-UX driver for the Adaptable Modular Storage system using **ioscan -fn** command (see Figure 3.5).

```
# ll /dev/dsk | more                                          ← Check block-
total 0                                                         type files.
brw-r-----  1 bin   sys    28 0x000000 Oct  4 11:01 c0t0d0
brw-r-----  1 bin   sys    28 0x006000 Dec  6 15:08 c0t6d0
brw-r-----  1 bin   sys    28 0x006100 Dec  6 15:08 c0t6d1      ← Block-type
     Bus instance # = 0, SCSI target ID = 6, LUN = 1 ↗            device file.
```

Figure 3.3 Verifying Block-Type Device Files

```
# ll /dev/rdsk | more                                         ← Check character-
total 0                                                         type files.
crw-r-----  1 bin   sys   177 0x000000 Oct  4 11:01 c0t0d0
crw-r-----  1 bin   sys   177 0x006000 Dec  6 15:08 c0t6d0
crw-r-----  1 bin   sys   177 0x006100 Dec  6 15:08 c0t6d1   ← Character-type
    Bus instance # = 0, SCSI target ID = 6, LUN = 1 ↗           device file.
```

Figure 3.4 Verifying Character-Type Device Files

```
# ioscan -fn
Class      I   H/W Path          Driver S/W State H/W Type  Description
=============================================================================
bc         0                       root   CLAIMED   BUS_NEXUS
bc         1   8                   bc     CLAIMED   BUS_NEXUS Bus Converter
fc         0   8/12                fcT1   CLAIMED INTERFACE HP Fibre Channel Mass Storage
fcp        0   8/12.8              fcp    CLAIMED INTERFACE FCP Protocol Adapter
ext_bus    2   8/12.8.0.255.0      fcpdev CLAIMED INTERFACE FCP Device Interface
target     7   8/12.8.0.255.0.6    tgt    CLAIMED DEVICE
disk       3   8/12.8.8.255.0.6.0  sdisk  CLAIMED DEVICE    HITACHI DF600F
                         /dev/dsk/c2t6d0   /dev/rdsk/c2t6d0
disk       4   8/12.8.8.255.0.6.1  sdisk  CLAIMED DEVICE    HITACHI DF600F
                         /dev/dsk/c2t6d1   /dev/rdsk/c2t6d1
:
#
```

Figure 3.5 Verifying HP-UX Driver

3.2.1 Creating Device Files

If device files were not created automatically when the HP system restarted, issue **insf-e** command in **/dev** directory (see Figure 3.6) to instruct HP system to create device files. After executing this command, repeat the procedures to verify new device recognition and device files and driver (refer to sections 3.1 and 3.2).

```
# cd /dev
# insf -e
insf: Installing special files for mux2 instance 0 address 8/0/0
       :          :         :        :
       :          :         :        :
#
```

Figure 3.6 Creating Device Files

3.3 Partitioning Disk Devices

The HP-UX system uses Logical Volume Manager (LVM) to manage disk devices on all peripheral storage devices, including the Adaptable Modular Storage Series system. Under LVM disk management, a volume group consisting of multiple disks is formed, and then the volume group is divided into logical partitions and managed as a logical volume. These procedures should be executed for all device files corresponding to the new Adaptable Modular Storage SCSI disk devices.

To partition the Adaptable Modular Storage SCSI disk devices for LVM operations:

- Create a physical volume for each new SCSI disk device (see section 3.3.1).
- Create new volume groups as desired (see section 3.3.2). If you need to increase the maximum volume groups (**maxvgs**) setting, refer to section A.2 for instructions.
- Create a logical volume for each new SCSI disk device (see section 3.3.3).

This section provides general instructions and basic examples for partitioning Adaptable Modular Storage SCSI devices for LVM operations using UNIX® commands. These instructions do not cover all LVM configuration issues. For more information about LVM configuration, refer to the appropriate user documentation or contact HP technical support.

3.3.1 Creating Physical Volumes (PVs)

The first step in partitioning new devices is to create a physical volume for each new disk device. Once physical volumes are created, you can assign them to new or existing volume groups for management by LVM.

To create physical volumes for new Adaptable Modular Storage disk devices:

1. Create physical volume using the **pvcreate** command with character-type device file as the argument (see Figure 3.7). Specify the **/dev/rdsk** directory for the character file. You can only create one physical volume at a time.

   WARNING: Do not use the **-f** (force) option with the **pvcreate** command. This option creates a new physical volume forcibly and overwrites the existing volume.

2. Repeat step 1 for each new logical volume on the Adaptable Modular Storage system.

```
# pvcreate /dev/rdsk/c2t6d0                          ← Create physical volume.
                        ↖ Character-type file for disk device.
Physical volume "/dev/rdsk/c2t6d0" has been successfully created.
# pvcreate /dev/rdsk/c2t6d1
Physical volume "/dev/rdsk/c2t6d1" has been successfully created.
:
#
```

Figure 3.7 Creating Physical Volumes

3.3.2 Creating Volume Groups (VGs)

After you create physical volumes for the disk devices, create new volume groups for new physical volumes as needed. If desired, you can also use the **vgextend** command to add new physical volumes on the Adaptable Modular Storage system to existing volume groups. The physical volumes, which make up one volume group, can be located in the same disk system or in different disk systems.

Note: You may need to modify the HP system kernel configuration (**maxvgs** setting) to allow more volume groups to be created. Refer to Appendix A for instructions.

To create a volume group:

1. Use the **ls** command to display existing volume groups (see Figure 3.8).
2. Use the **mkdir** command to create a directory for the new volume group (see Figure 3.9). Choose a name for the new volume group that is different from all other group names. Be careful not to use an existing volume group name.

   Note: If you need to delete a directory, use the **rmdir** command (e.g., **rmdir /dev/vg*nn***).
3. Use the **ls** command to verify the new directory (see Figure 3.9).
4. Verify minor numbers for existing group files using the **ll** command, with the output piped to **grep** to display only files containing "group" (see Figure 3.10).
5. Choose a minor number for the new group file in sequential order. For example, if the existing volume groups are **vg00-vg05** and the next group name is **vg06**, use minor number **06** for the vg06 group file. Do not duplicate minor numbers.

   Note: Minor numbers are hexadecimal (e.g., the tenth minor number is 0x0a0000, not 0x100000).
6. Use the **mknod** command to create a group file for the new directory (see Figure 3.11). Be sure to specify the correct volume group name, major number, and minor number. The major number for all group files is **64**.

   Note: If you need to delete a group file, use the **rm -r** command to delete the group file and the directory at the same time (e.g., **rm -r /dev/vg*nn***), and start again at step (2)).
7. Repeat steps 5 and 6 for each new volume group.
8. Use the **vgcreate** command to create a volume group (see Figure 3.12).

   To allocate more than one physical volume to the new volume group, add the other physical volumes separated by a space (e.g., **vgcreate /dev/vg06 /dev/dsk/c0t6d0 /dev/dsk/c0t6d1**).

   Note: If you need to delete a volume group, use the **vgremove** command (e.g., **vgremove /dev/vg*nn***). If **vgremove** command does not work because the volume group is not active, use **vgexport** command (e.g., **vgexport /dev/vg*nn***).
9. Use **vgdisplay** command to verify that the volume group was created correctly (see Figure 3.13). The **-v** option displays detailed volume group information.

```
# ls /dev/vg*                                  ← Display existing volume group nemes.
vg00
:
vg05
#
```

Figure 3.8 Displaying Existing Volume Group Names

```
# mkdir /dev/vg06                              ← Make directory for new volume group.
# ls /dev/vg*                                  ← Verify directory for new volume group.
vg00
 :
vg06
#
```

Figure 3.9 Creating and Verifying Directory for New Volume Group

```
# ll /dev/vg* | grep group                          ← Display existing group files.
crw-rw-rw     1 root    root    64 0x000000 Nov 7 08:13 group
                                   ↖ Minor number of existing group file = 00
:
#
```

Figure 3.10 Displaying Minor Numbers for Existing Group Files

```
# mknod /dev/vg06/group c 64 0x060000                ← Create new group file.
               ↖          ↖    ↖ Group name = vg06, major number of group file
                                  = 64, Minor number of new group file = 06
#
```

Figure 3.11 Creating Group File Name for New Volume Group

```
# vgcreate /dev/vg06 /dev/dsk/c2t6d0                 ← Create new volume group.
                ↖ Vol group name  ↖ Device file name
Volume group "/dev/vg06" has been successfully created.
Volume group configuration for /dev/vg06 has been saved in /etc/1vmconf/vg06.cof.
:
# vgcreate -s 8 -e 15845 /dev/vg09 /dev/dsk/c2t7d0  ← Example for LUSE with n=18.
             ↖PE Size  ↖ Max Physical Extent Size (MPE)
Volume group "/dev/vg09" has been successfully created.
Volume Group configuration for /dev/vg09 has been saved in /etc/lvmconf/vg09.conf
```

Figure 3.12 Creating New Volume Group

```
# vgdisplay /dev/vg06                                  ← Verify new volume group.
--- Volume groups ---
VG Name                     /dev/vg06
VG Write Access             read/write
VG Status                   available
Max LV                      255
Cur LV                      0
Open LV                     0
Max PV                      16
Cur PV                      1
Act PV                      1
Max PE per PV               1016                  ← Verify MPE for LUSE devices.
VGDA                        2
PE Size (Mbytes)            4                      ← Verify PE for LUSE devices.
Total PE                    586
Alloc PE                    0
Free PE                     586
Total PVG                   0
```

Figure 3.13 Verifying New Volume Group

3.3.3 Creating Logical Volumes

After you create desired new volume groups, create logical volumes (**lvol**) for each new volume group.

To create logical volumes:

1. Use **lvcreate -L** command to create a logical volume. Specify volume size and volume group for the new logical volume (see Figure 3.14). The HP system assigns logical volume numbers automatically (**lvol1, lvol2, lvol3,** …). Use **vgdisplay** command to display physical extent size (**PE Size**) and usable number of physical extents (**Free PE**) for the volume (see Figure 3.15). Calculate the maximum size value (in MB) as follows:

   S1 = (PE Size) × (Free PE)

2. Use **lvdisplay** command to verify that the logical volume was created correctly (see Figure 3.16). If desired, you can wait until all logical volumes have been created and then verify all volumes at one time by using the ***** wildcard character with the **lvdisplay** command (e.g., **lvdisplay /dev/vg06/lvol***).

3. Repeat steps 1 and 2 for each logical volume created. You can only create one logical volume at a time, but you can verify more than one logical volume at a time.

Note: To delete a logical volume, use the **lvremove** command (e.g., **lvremove /dev/vgnn/lvol*x***). To increase the size of an existing logical volume, use the **lvextend** command (e.g., **lvextend -L size /dev/vgnn/lvol*x***). To decrease the size of an existing logical volume, use the **lvreduce** command (**lvreduce -L size /dev/vgnn/lvol*x***).

```
# lvcreate -r N -L 2344 /dev/vg06                    ← Create new logical volume.
                  ↖ Size of volume = 2344 MB
Logical volume "/dev/vg06/lvol1" has been successfully created with character device
"/dev/vg06/rlvol1".
Logical volume "/dev/vg06/lvol1" has been successfully extended.
Volume Group configuration for /dev/vg06 has been saved in /etc/lvmconf/vg06.cof.
```

Figure 3.14 Creating a Logical Volume

```
# vgdisplay /dev/vg01
--- Volume groups ---
VG Name                     /dev/vg01
VG Write Access             read/write
VG Status                   available
Max LV                      255
Cur LV                      0
Open LV                     0
Max PV                      16
Cur PV                      1
Act PV                      1
Max PE per PV               1016
VGDA                        2
PE Size (Mbytes)            4          ← Physical extent size.
Total PE                    586        ← Number of physical extents size.
Alloc PE                    0
Free PE                     586        ← Number of free physical extents.
Total PVG                   0
```

This example shows the following information for /dev/vg01: physical extent size = 4, usable number of physical extents = 586. Therefore, maximum size value = 4 × 586 = 2344

Figure 3.15 Calculating Volume Size for VLL, LUSE, and VLL LUSE Devices

```
# lvdisplay /dev/vg06/lvol1                  ← Verify new logical volume.
--- Logical volume ---
LV Name                     /dev/vg06/lvol1
VG Name                     /dev/vg06
LV Permission               read/write
LV Status                   available/syncd
Mirror copies               0
Consistency Recovery        MWC
Schedule                    parallel
LV Size (Mbytes)            2344                    ← 2344 = 586 x 4
Current LE                  586                   ← LE = logical extent
Allocated PE                586                   ← PE = physical extent
Stripes                     0
Stripe Size (Kbytes)        0
Bad block                   on
```

Figure 3.16 Verifying a Logical Volume

3.4 Creating File Systems

After you partition and label all new disks, create file systems for logical volumes.

Note: Do not create file systems or mount directories for raw devices. Raw devices do not require further configuration after being partitioned and labeled.

To create file systems for newly installed logical volumes:

1. Use **newfs /dev/vg*xx*/rlvol*Y*** command to create file system (see Figure 3.17).
2. Repeat step 1 for each new SCSI disk device on the Adaptable Modular Storage system.

```
# newfs -o largefiles -F /dev/vg03/rlvol1                ← Create file system.
newfs: /etc/default/fs is used for determining the file system type
     version 3 layout
     2093056 sectors, 2093056 blocks of size 1024, log size 1024 blocks
     unlimited inodes, 2093056 data blocks, 2091440 free data blocks
     64 allocation units of 32768 blocks, 32768 data blocks
     last allocation unit has 28672 data blocks
     first allocation unit starts at block 0
     overhead per allocation unit is 0 blocks
#
```

Figure 3.17 Creating File Systems

3.5 Setting Device Parameters

When device files are created, the HP-UX system sets the queue depth parameter to its default value (usually 8). You must change these values for all new disk devices on the Adaptable Modular Storage system. The following sections describe this procedure.

3.5.1 Setting Queue Depth Parameter

The HP-UX system automatically sets queue depth to the default value. This value typically is 8, although it may be different depending on installed HP options and drivers. The queue depth for Adaptable Modular Storage disk devices must be set as specified in Table 3.1.

Table 3.1 Queue Depth Requirements

Parameter	Required Value
Queue depth per LU	≤ 32
Queue depth per port	≤ 512

The **scsictl** command lets you view and change queue depth parameter for each device one volume at a time. However, queue depth will be reset to the default value the next time the system restarts. Therefore, you need to create and register a start-up script to set queue depth for Adaptable Modular Storage disk devices each time the system restarts (see section 3.5.2).

Note: Do not set queue depth for raw devices.

To set the queue depth parameter for Adaptable Modular Storage SCSI disk devices:

1. If you cannot shut down and restart the system at this time, use **scsictl** command to set queue depth for each Adaptable Modular Storage device (see Figure 3.18). The **scsictl** command to set queue depth should be registered as HP-UX start-up script for future reboot.
2. Check **/sbin/init.d** and **/sbin/rc1.d** directories to see whether the script name **queue** is already used (link name **Sxxxqueue** or **Kxxxqueue**) (see Figure 3.19). Choose a unique name for start-up script as follows:
   a) If there is no script named **queue** and no link file named **Sxxxqueue** or **Kxxxqueue**, use the name **queue** for the new script, and skip to step 3.
   b) If script **queue** and link file **Sxxxqueue** or **Kxxxqueue** already exist and script is already used for setting queue depth for other previously installed Adaptable Modular Storage systems, check script file to be sure queue depth is set to the desired number (per Table 3.1) and add a line for each new Adaptable Modular Storage disk device. If necessary, restart HP system to set queue depth for new volumes.
   c) If script **queue** and link file **Sxxxqueue** or **Kxxxqueue** already exist and script is not used for setting queue depth for Adaptable Modular Storage, use some other name for new queue-depth script for Adaptable Modular Storage (e.g., **hitachi_q**), and go to step (3).

      Note: If link **Sxxxqueue** and/or **Kxxxqueue** already exist but there is no script file named **queue**, delete link file(s), use the name **queue** for the new script, and go to step (3).
3. Choose a unique 3-digit number for link name. This number cannot be used in any other link. The link name is derived as follows: **S** stands for "start up script", **K** stands for "kill script", the three-digit number is unique to each link, and the script file name follows the three-digit number (e.g., **S890queue** or **S890hitachi_q**).
4. Create and register new start-up script for Adaptable Modular Storage. See section 3.5.2 for a start-up script example.
5. Shut down and restart HP system, so that the new start-up script sets the queue depth for Adaptable Modular Storage disk devices to specified value (per Table 3.1).
6. After restarting system or setting queue depths manually, use **scsictl** command to verify queue depth for each Adaptable Modular Storage disk device (see Figure 3.20).

```
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t6d0      ← Set queue depth
                                                                per Table 3.1.
                                                  ↖ Character-type device file
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t6d1
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t6d2
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t6d3
 :
 :
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t8d0
```

Figure 3.18 Changing Queue Depth

```
# ls /sbin/init.d                                              ← Check for QUEUE.
OspfMib     clean_ex   dfs        hpether    names      nis.server savecore   swconfig
SnmpHpunix clean_tmps diagnostic iforls     ncs        pd         sendmail   syncer
 :
clean_adm  ddfa       hparray    mrouted    nis.client rwhod      swcluster  xntpd
# ls /sbin/rc1.d                          ← Check for SxxxQUEUE and KxxxQUEUE.
K230audio       K340xntpd   K420dfs         K475rarpd       K630named      S420set_date
K240auditing    K356vjed    K430dce         K480rdpd        K660net        S440savecore
K250envd        K358egcd    K435OspfMib     K490gated       K700nettl      S500swap_start
K258diagnostic  K360kks     K435SnmpHpunix  K500inetd       K770ptydaemon  S520syncer
K270cron        K370vt      K435SnmpMib2    K510mrouted     K780syslogd
K278pd          K380xfs     K440SnmpMaster  K570nfs.client  K900swagentd
K280lp          K390rbootd  K450ddfa        K580nis.client  S100localmount
K290hparray     K400iforls  K460sendmail    K590nis.server  S320hostname
K300acct        K410ncs     K470rwhod       K600nfs.core    S400set_prvgrp
```

Figure 3.19 Checking Existing Script and Link Names

```
# /usr/sbin/scsictl -a /dev/rdsk/c0t6d0              ← Verify new queue depth.
                                        ↖ Character-type device file
immediate_report = 0; queue_depth = 8                  ← Queue depth = 8
:
:
# /usr/sbin/scsictl -a /dev/rdsk/c0t8d0              ← Verify new queue depth.
immediate_report = 0; queue_depth = 8                  ← Queue depth = 8
```

Figure 3.20 Verifying Queue Depth for Adaptable Modular Storage Disk Devices

3.5.2 Creating and Registering Queue Depth Start-Up Script

The **queue** (or **hitachi_q**) start-up script sets queue depth to 2 for all new volumes (SCSI disk devices) on the Adaptable Modular Storage system each time the HP system restarts.

- If the **queue** script already exists for an older (previously installed) Adaptable Modular Storage system, check script file to verify that queue depth value is set to desired value (see Table 3.1) and add a line for each new Adaptable Modular Storage volume (see Figure 3.21).
- If script does not exist, create and register script as shown in Figure 3.21. You can use UNIX® **vi** editor or any other similar text editor to create/edit the script.

Note: For questions about creating and registering the start-up script, see the UNIX® and/or HP user documentation, or ask your Hitachi Data Systems representative for assistance.

```
# cp /sbin/init.d/template /sbin/init.d/queue          ← Copy start-up script
                                                         template file.
# vi /sbin/init.d/queue                                ← Edit script file as
                                                         shown below.
-------------------------file(/sbin/init.d/queue)----------------------
# !/sbin/sh
#
# @(#) $Revision: 78.1 $
#
# NOTE:   This script is not configurable!  Any changes made to this
#          script will be overwritten when you upgrade to the next
#          release of HP-UX.
#
# WARNING: Changing this script in any way may lead to a system that
#          is unbootable.  Do not modify this script.
#
# <Insert comment about your script here>
#
# Allowed exit values:
#    0 = success; causes "OK" to show up in checklist.
#    1 = failure; causes "FAIL" to show up in checklist.
#    2 = skip; causes "N/A" to show up in the checklist.
#           Use this value if execution of this script is overridden
#        by the use of a control variable, or if this script is not
#        appropriate to execute for some other reason.
#       3 = reboot; causes the system to be rebooted after execution.
# Input and output:
#       stdin is redirected from /dev/null
#       stdout and stderr are redirected to the /etc/rc.log file
#       during checklist mode, or to the console in raw mode.
PATH=/usr/sbin:/usr/bin:/sbin
export PATH
# NOTE: If your script executes in run state 0 or state 1,then /usr
#      might not be available.  Do not attempt to access commands or
#      files in /usr unless your script executes in run state 2 or
#      greater.  Other file systems typically not mounted until run
#      state 2 include /var and /opt.
rval=0
# Check the exit value of a command run by this script. If non-zero,
# the exit code is echoed to the log file and the return value of this
# script is set to indicate failure.
```

Figure 3.21 Sample Start-up Script with Changes for Adaptable Modular Storage Devices (continues on the following pages)

```
set_return()  {
       x=$?
       if [ $x -ne 0 ]; then
              echo "EXIT CODE: $x"
              rval=1 # script FAILed
       fi
}
# Kill the named process(es).
# $1=<search pattern for your process>

killproc()  {
       pid=`ps -el | awk '( )$NF ~ /'"$1"'/) && ($4 !=mypid) && ($5 !=
mypid)  ){ print $4 }' mypid=$$ `
       if [ "X$pid" != "X" ]; then
              if kill "$pid"; then
                     echo "$1 stopped"
              else
                     rval=1
                     echo "Unable to stop $1"
              fi
       fi
}

case $1 in
'start_msg')
        # Emit a _short_ message relating to running this script with
        # the "start" argument; this message appears as part of the
        # checklist.
        echo "Setting the queue value"                    ← Edit text here.
        ;;
'stop_msg')
       # Emit a _short_ message relating to running this script with
       # the "stop" argument; this message appears as part of the
       # checklist.
       echo "Stopping the <specific> system"
       ;;

'start')
_____________________________________________________________________
       # source the system configuration variables                   |
       if [ -f /etc/rc.config ] ; then          ← Delete these lines.
              . /etc/rc.config                                       |
       else                                                          |
              echo "ERROR: /etc/rc.config defaults file MISSING"    |
       fi                                                            |
                                                                     |
       # Check to see if this script is allowed to run...           |
       if [ "$CONTROL_VARIABLE" != 1 ]; then                         |
              rval=2                                                 |
       else                                                          |
                                                                     |
       # Execute the commands to stop your system                    |
       :                                                            |
       fi                                                           |
_____________________________________________________________________|

       /usr/sbin/scsictl -m queue_depth=8 /dev/rdsk/c0t6d0    ← Add one line
       /usr/sbin/scsictl -m queue_depth=8 /dev/rdsk/c0t6d1       for each new
       /usr/sbin/scsictl -m queue_depth=8 /dev/rdsk/c0t8d0       disk device.
        :
       ;;
'stop')
```

Figure 3.21 Sample Start-up Script with Changes for Adaptable Modular Storage Devices (continued)

```
       # source the system configuration variables
       if [ -f /etc/rc.config ] ; then
              . /etc/rc.config
       else
              echo "ERROR: /etc/rc.config defaults file MISSING"
       fi

       # Check to see if this script is allowed to run...
       if [ "$CONTROL_VARIABLE" != 1 ]; then
              rval=2
       else
        :
       # Execute the commands to stop your system

       fi
       ;;
*)
       echo "usage: $0 {start|stop|start_msg|stop_msg}"
       rval=1
       ;;
esac
exit $rval
--------------------------end of file(/sbin/init.d/queue)---------------------

# ls /sbin/rc1.d                                          ← Check link names.
K230audio       K340xntpd   K420dfs         K475rarpd       K630named      S420set_date
K240auditing    K356vjed    K430dce         K480rdpd        K660net        S440savecore
K250envd        K358egcd    K435OspfMib     K490gated       K700nettl      S500swap_start
K258diagnostic  K360kks     K435SnmpHpunix  K500inetd       K770ptydaemon  S520syncer
K270cron        K370vt      K435SnmpMib2    K510mrouted     K780syslogd
K278pd          K380xfs     K440SnmpMaster  K570nfs.client  K900swagentd
K280lp          K390rbootd  K450ddfa        K580nis.client  S100localmount
K290hparray     K400iforls  K460sendmail    K590nis.server  S320hostname
K300acct        K410ncs     K470rwhod       K600nfs.core    S400set_prvgrp

# ln -s /sbin/init.d/queue /sbin/rc1.d/S890queue          ← Create link file.
                                          ↖ Be sure this file name does not
                                            already exist.
```

Figure 3.21 Sample Start-up Script with Changes for Adaptable Modular Storage Devices (continued)

3.6 Creating Mount Directories

After file systems are created and device parameters are set, create mount directory for each volume. Choose a unique name for each mount directory that identifies the logical volume.

To create mount directories:

1. Create mount directory using **mkdir** command, with new mount directory name as argument (see Figure 3.22).

   Note: If you need to delete a mount directory, use **rmdir** command.

2. Use **ls -x** command to verify new mount directory (see Figure 3.22).

3. Repeat steps 1 and 2 for each new device on Adaptable Modular Storage system.

```
# mkdir /9500-LU00                                    ← Create new mount directory.
# ls –x                                               ← Verify new mount directory.
9500-LU00   bin     dev       device    etc       export
floppy      home    hstsboof  kadb      kernel    lib
#
```

Figure 3.22 Creating Mount Directories

3.7 Mounting and Verifying File Systems

After mount directories have been created, mount file system for each new logical volume and then verify file systems.

To mount and verify file systems:

1. Use the **mount** command to mount a file system for volume (see Figure 3.23).

   Note: If you need to unmount a file system, use **umount** (e.g., **umount /9500-LU00**).

2. Repeat step 1 for each new logical volume on Adaptable Modular Storage system.
3. Use **bdf** command to verify that file systems are correct (see Figure 3.24). Ensure capacity under **Kbytes** is correct for each device.
4. As a final verification, perform basic UNIX® operations (e.g., file creation, copying, and deletion) on each logical device to be sure new devices on the Adaptable Modular Storage system are fully operational (see Figure 3.25).

```
# mount /dev/vg06/lvol1 /9500-LU00                          ← Mount file system.
        ↖ Block-type lvol name  ↖ Mount directory name
#
```

Figure 3.23 Mounting File System

```
# bdf                                                       ← Verify file systems.
Filesystem          Kbytes    used   avail  %used  Mounted on
/dev/vg00/lvol1      59797   59364       0  100%   /
 :
/dev/vg06/lvol1    2348177       9 2113350    0%   /9500-LU00
/dev/vg07/lvol1    2348177       9 2113350    0%   /9500-LU01
/dev/vg08/lvol1    7052764       9 6347478    0%   /9500-LU02
```

Figure 3.24 Verifying File System

```
# mount /dev/vg06/lvol1 /9500-LU00                                  ← Mount LUN.
# cd /9500-LU00                                                ← Go to LUN mount directory.
# cp /bin/vi /9500-LU00/vi.back1                                   ← Copy any file to LUN.
# ll                                                                  ← Verify file copy.
drwxr-xr-t   2 root     root        8192 Mar 15 11:35  lost+found
-rwxr-xr-x   1 root     sys       217088 Mar 15 11:41  vi.back1
# cp vi.back1 vi.back2                                               ← Copy file again.
# ll                                                           ← Verify second file copy.
drwxr-xr-t   2 root     root        8192 Mar 15 11:35  lost+found
-rwxr-xr-x   1 root     sys       217088 Mar 15 11:41  vi.back1
-rwxr-xr-t   1 root     sys       217088 Mar 15 11:52  vi.back2
# rm vi.back1                                                  ← Delete first test file.
# rm vi.back2                                                 ← Delete second test file.
```

Figure 3.25 Final Verification of File System for One Volume

3.8 Setting and Verifying Auto-Mount Parameters

The final step in configuring Adaptable Modular Storage volumes for LVM operations is to set up and verify automount parameters for each new volume. The **/etc/fstab** file contains auto-mount parameters for logical volumes. If you do not plan to automount Adaptable Modular Storage devices, skip this section.

To set and verify automount parameters:

1. Edit **/etc/fstab** file to add a line for each new volume (SCSI disk device) on Adaptable Modular Storage system (see Figure 3.26). Table 3.2 shows automount parameters.
2. After you finish editing **/etc/fstab** file, reboot HP system. If you cannot reboot at this time, issue **mount -a** command.
3. Use **bdf** command to verify device file systems again (see Figure 3.24).

```
# cp -ip /etc/fstab /etc/fstab.standard            ← Make backup before editing.
# vi /etc/fstab                                      ← Edit the file (vi shown).
/dev/vg00/lvol1  /           hfs    rw        0    1   # root
/dev/vg00/lvol2  swap        ignore sw        0    0   # primary swap
 :
/dev/vg06/lvol1  /9500-LU00  hfs    defaults  0    2   # 9500-LU00
/dev/vg06/lvol2  /9500-LU01  vxfs   defaults  0    2   # 9500-LU01
      ①           ②         ③       ④      ⑤   ⑥        ⑦ ← See Table 3.2.
```

Figure 3.26 Setting Auto Mount Parameters

Table 3.2 Auto Mount Parameters

Parameter No.	Name	Description
①	Device to mount	Block-type device file name
②	Mount point	Mount directory name
③	File system	Type of file system (e.g., hfs, vxfs)
④	Mount options	Usually “defaults”
⑤	Enhance	“0”
⑥	File system check (fsck pass)	Order for performing file system checks
⑦	Comment	Any comment statement

Chapter 4 Failover

4.1 I/O Path Failover

The Adaptable Modular Storage system supports the Hitachi Dynamic Link Manager path failover product as well as the alternate link path failover function for the HP-UX operating system. After Adaptable Modular Storage system device configuration is complete, make sure to configure alternate links to the Adaptable Modular Storage system devices as needed using the **vgextend** command.

For assistance with alternate link operations, refer to the HP-UX user documentation (UNIX® man pages) or contact HP technical support. For assistance with Hitachi Dynamic Link Manager or specific configuration issues related to the Adaptable Modular Storage system, refer to the *Hitachi Dynamic Link Manager™ User's Guide* (MK-92DLM112) or contact your Hitachi Data Systems representative.

Chapter 5 Troubleshooting

5.1 Troubleshooting

For troubleshooting information about Adaptable Modular Storage system, refer to the *Hitachi TagmaStore® Adaptable Modular Storage Model AMS500 User's Guide* (MK-95DF714) the *Hitachi TagmaStore Adaptable Modular Storage Model AMS200 User's Guide* (MK-95DF713), the *Hitachi TagmaStore Adaptable Modular Storage Model AMS1000 User and Reference Guide* (MK-95DF780), or the *Hitachi TagmaStore Workgroup Modular Storage Model WMS100 User and Reference Guide* (MK-95DF738).

Table 5.1 lists potential error conditions during Adaptable Modular Storage device configuration for HP-UX and provides instructions for resolving each condition. If you are unable to resolve an error condition, contact your Hitachi Data Systems representative for help, or call the Hitachi Data Systems Support Center for assistance.

Table 5.1 Troubleshooting

Error Condition	Recommended Action
The logical devices are not recognized by the system.	Ensure READY indicator lights on Adaptable Modular Storage system are ON. Ensure fibre- cables are correctly installed and firmly connected. Ensure fibre channel ports, LUN Management, and/or switch zoning is properly defined. Ensure fibre adapter board(s) and driver(s) are properly installed.
A physical volume cannot be created (PVCREATE command).	Ensure Adaptable Modular Storage devices are properly formatted. Ensure character-type device file exists. Ensure correct character-type device file name is used with **pvcreate**.
A volume group cannot be created (VGCREATE command).	Ensure directory for new volume group exists. Ensure control file exists. Ensure correct major number (64) and minor number are used with **mknod**. Ensure block-type file exists and is entered correctly with **vgcreate**. Ensure physical volume is not allocated to another volume group.
A logical volume cannot be created (LVCREATE command).	Ensure specified capacity is not greater than 4096 MB. Ensure capacity of volume group is not less than capacity of desired logical volume.
File system cannot be created (newfs).	Ensure character-type device file is entered correctly with **newfs**.
The file system is not mounted after rebooting.	Ensure system was restarted properly. Ensure automount information in the **/etc/fstab** file is correct.

5.2 Calling Hitachi Data Systems Support Center

If you need to call Hitachi Data Systems Support Center, ensure that you provide as much information about the problem as possible, including circumstances surrounding error or failure and the exact content of error messages displayed on the host system(s).

The worldwide Hitachi Data Systems Support Centers are:

- Hitachi Data Systems North America/Latin America
  San Diego, California, USA
  1-800-446-0744
- 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 Setting Maximum Number of Volume Groups Using SAM

The HP system kernel specifies the maximum number of volume groups that can be created (default = 10). The Kernel Configuration function (next to Disks and File Systems in Figure A.1) allows you to change the maximum number of volume groups as needed; for example, to accommodate the new devices on the Adaptable Modular Storage system.

To change the maximum number of volume groups using SAM:

1. Select **Kernel Configuration** function (see Figure A.1), then select **Configurable Parameters**.
2. On **Configurable Parameters** panel, select **maxvgs** parameter, select **Actions** menu, and then select **Modify Configurable Parameter…**.
3. On the **Modify Configurable Parameter** panel, enter the desired maximum number of volume groups in the **Formula/Value** field, then select **OK**.
4. On the **Configurable Parameters** panel, ensure that none of the parameters are selected, then select the **Actions** menu and select **Create New Kernel**.
5. When the confirmation panel opens, select **Yes** to create the new kernel (or select **No** to return to the **Configurable Parameters** panel).
6. When **Reboot the System** panel opens, select **OK** to move new kernel into place and reboot the system.

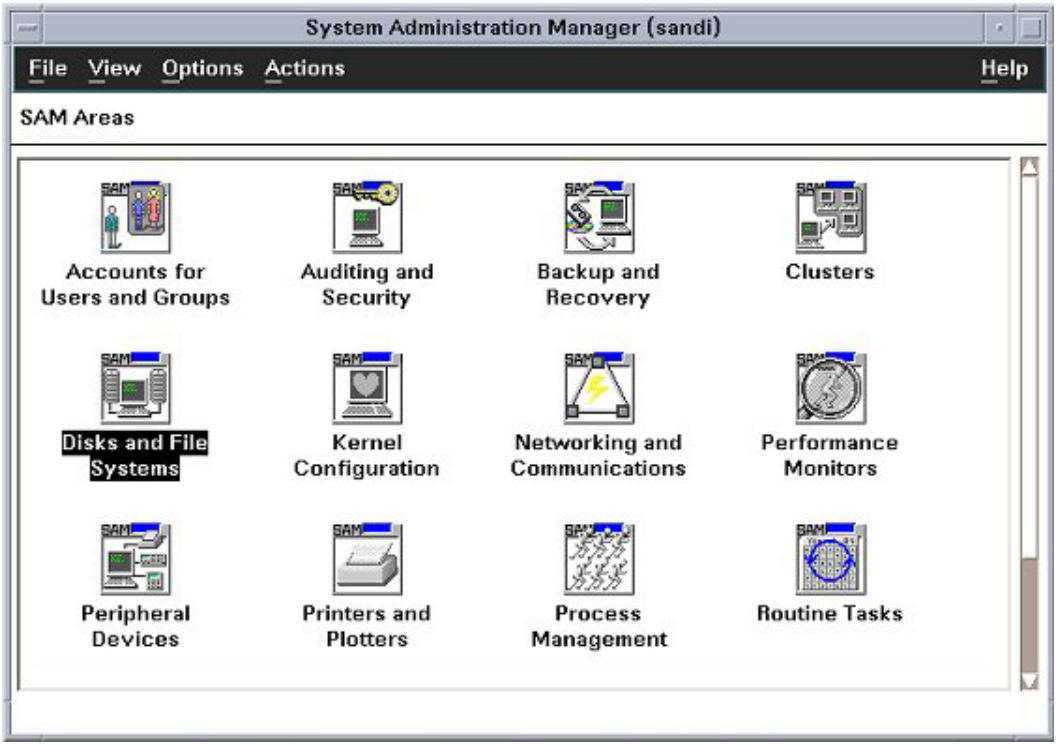

Figure A.1 SAM Areas

Appendix B Online Device Installation

This appendix provides instructions for configuring new Adaptable Modular Storage SCSI disk devices without rebooting the HP-UX system. Use the normal disruptive device configuration procedure in the following cases:

- **Fibre:** If a new fibre-channel connection (HBA) is being installed. New fibre-channel connections can only be installed when the host system is powered off. New devices under existing fibre-channel ports can be installed and configured nondisruptively.
- **Maxvgs**: If the **maxvgs** parameter needs to be changed. The procedure for changing the **maxvgs** value in the system kernel requires a system reboot (refer to Appendix A).

To perform online device installation and configuration:

1. Verify that new devices on the Adaptable Modular Storage system are ready to be configured. A Hitachi Data Systems representative should have completed hardware installation and verified normal status of new devices (refer to section 2.2).
2. Ensure that you are logged in as **root**.
3. Enter **insf -e** command to perform online device recognition. The **insf -e** command creates device files for the new devices on the existing fibre busses (refer to section 3.2).
4. Configure new Adaptable Modular Storage disk devices for HP-UX operations as described in sections 3.3 through 3.8. For new raw devices, you need only to verify device files and driver. Do not partition or create file systems on raw devices.

Appendix C SCSI TID Map for Fibre-Channel Adapters

When an arbitrated loop (AL) is established or re-established, port addresses are automatically assigned to prevent duplicate TIDs. With 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, AL-PA is used instead of TID to direct packets to the desired destination. Unlike traditional SCSI, once loop control is acquired, a point-to-point connection is established from initiator to target. To enable transparent use of FCP, HP-UX system "maps" a TID to each AL-PA.

The host maps SCSI protocol to fibre-channel protocol then 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. 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 C.1 identifies fixed mappings between TID values assigned by the HP-UX system and **FC** native addresses (**AL_PA/SEL_ID**) for FC adapters. For each device file (**/dev/dsk/c*t*d***), the **c** value is the adapter number, and the **t** value is the target ID.

Note: Mapping defined in Table C.1 cannot be guaranteed under the following conditions:

- When Adaptable Modular Storage 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 C.1 AL-PA to SCSI TID Mapping (t value) for HP-UX 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		

Acronyms and Abbreviations

AL	arbitrated loop
AL-PA	arbitrated loop physical address
CLI	command line interface
FC	fibre-channel
FCA	fibre-channel adapter
FC-AL	fibre-channel arbitrated loop
FCP	fibre-channel protocol
GUI	graphical user interface
H/W	hardware
HP	Hewlett-Packard Company
I/O, IO	input/output
LDEV	logical device
LU	logical unit
LUN	logical unit number, logical unit
LUSE	LU Size Expansion
LVM	Logical Volume Manager
MB	megabytes
MPE	maximum physical extent
OFC	open fibre control
OS	operating system
PA	physical address
PC	personal computer system
PE	physical extent
PV	physical volume
RAID	redundant array of independent disks
SAM	System Administration Manager
SCSI	small computer system interface
TID	target ID
VLL	Virtual LVI/LUN
VxVM	VERITAS Volume Manager™