



**Hitachi Freedom Storage™
Lightning 9900™ V Series**

**LUN Expansion and Virtual LVI/LUN
User's Guide**

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- Added a note that public system option mode 269 must be set to ON if you want to use high-speed format (section 1.2.1)

Referenced Documents

- *Hitachi Lightning 9900™ V Series User and Reference Guide* (MK-92RD100)
- *Hitachi Lightning 9900™ V Series Remote Console - Storage Navigator User's Guide* (MK-92RD101)
- *Hitachi Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105)
- *Hitachi Lightning 9900™ V Series FlashAccess User's Guide* (MK-92RD102)

Preface

This *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Expansion and Virtual LVI/LUN User's Guide* provides instructions for using these options on the 9900V Storage Navigator, using the web client Java™ applet program for the 9900V subsystem.

This user's guide assumes that the:

- user has a background in data processing and understands direct-access storage device (DASD) subsystems and their basic functions,
- user is familiar with the Lightning 9900V subsystem and has read and understands the *Hitachi Lightning 9900™ V Series User and Reference Guide* (MK-92RD100) and the *Hitachi Lightning 9900™ V Series Storage Navigator User Guide* (MK-92RD101), and
- the user is familiar with the operating system (e.g., Windows®, HP-UX®, Solaris™ or Red Hat® Linux®) and web browser software (e.g., Internet Explorer, Netscape® or Mozilla™) on the system hosting the 9900V Storage Navigator remote console software.

Note: The term “9900V” refers to the entire Lightning 9900™ V Series subsystem family, unless otherwise noted. For further information on the 9900V, please contact your Hitachi Data Systems account team, or visit Hitachi Data Systems online at <http://www.hds.com>.

Note: The use of the Storage Navigator software and all other Hitachi Data Systems products is governed by the terms of your license agreement(s) with Hitachi Data Systems.

Note: The Storage Navigator panels shown in this document were captured on a Windows® system with the Internet Explorer® web browser. The Storage Navigator screens may display differently on other operating systems and browsers.

Microcode Level

This document revision applies to 9900V microcode versions 21-08-0x and higher.

Comments

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Contents

Chapter 1	Overview of LUN Expansion and Virtual LVI/LUN.....	1
1.1	Overview of LUSE Operations.....	1
1.1.1	General LUSE Specifications	1
1.1.2	Specifications for LUSE Operations Using a Path-Defined LDEV.....	3
1.1.3	Specifications for LUSE Devices Used With NetApp® gFiler™ Gateways.....	5
1.2	Overview of Virtual LVI/LUN.....	6
1.2.1	Virtual LVI/LUN Function.....	6
1.2.2	Virtual LVI/LUN Size Calculation.....	11
1.2.2.1	S/390® Size Calculation.....	11
1.2.2.2	Open Systems Size Calculation	12
1.2.3	SSID Requirements	13
1.2.4	Parity Group Configuration (Not Applicable to OPEN-V)	13
Chapter 2	Preparing to Use LUN Expansion or Virtual LVI/LUN	15
2.1	Preparing the 9900V Subsystem and Storage Navigator Computer(s)	15
2.2	Launching LUN Expansion or Virtual LVI/LUN	16
2.3	Changing to Modify Mode.....	17
Chapter 3	LUN Expansion (LUSE)	19
3.1	LUN Expansion Panels.....	19
3.1.1	LUSE/VLL Main Panel, LUSE Tab	19
3.1.2	LDEV Information Outline	20
3.1.3	LDEV Detail Table	21
3.1.4	LDEV Operation Detail.....	23
3.2	LUSE Operations	25
3.2.1	Viewing Concatenated Parity Groups	25
3.2.2	Creating a LUSE Volume.....	27
3.2.2.1	Creating a LUSE Volume From the LDEV Detail Table	27
3.2.2.2	Creating a LUSE Volumes Using the LDEV Operation Detail.....	31
3.2.2.3	Creating a LUSE Volume Using the Volume Count Window	33
3.2.3	Resetting an Unregistered LUSE Volume.....	35
3.2.4	Releasing a LUSE Volume.....	38
3.2.5	Changing LUSE Capacities.....	40
Chapter 4	Virtual LVI/LUN (VLL)	41
4.1	Virtual LVI/LUN Panels	41
4.1.1	LUSE/VLL Panel, VLL Tab	41
4.1.2	Parity Group - LDEV Outline	42
4.1.3	LDEV Information Table	43
4.1.4	Install CV Panel (1) for OPEN-V	45
4.1.5	Install CV Panel (1) for Other than OPEN-V	47
4.1.6	Install CV Panel (2) (All Emulation Types).....	49
4.1.7	Set SSID (Install CV) Panel (All Emulation Types)	51
4.1.8	Volume Initialize Panel (Other Than OPEN-V)	53
4.1.9	Set SSID (Volume Initialize) Panel (Other Than OPEN-V).....	55
4.1.10	Volume Initialize Confirmation Panel (Other Than OPEN-V)	57

4.1.11	Make Volume Panel (1) for OPEN-V	58
4.1.12	Make Volume Panel (1) for other than OPEN-V.....	60
4.1.13	Make Volume Panel (2).....	62
4.1.14	Set SSID (Make Volume) Panel (OPEN-V)	64
4.1.15	Make Volume Confirmation Panel (OPEN-V)	66
4.2	Virtual LVI/LUN Operations.....	67
4.2.1	Viewing Concatenated Parity Groups	67
4.2.2	Converting Logical Volumes to Space.....	69
4.2.3	Installing VLL Volumes (Other Than OPEN-V).....	73
4.2.4	Installing OPEN-V VLL Volumes	79
4.2.5	Deleting VLL Volumes	86
4.2.6	Initializing VLL Volumes (Other Than OPEN-V)	86
4.2.7	Making VLL Volumes	91
Chapter 5	Troubleshooting	99
5.1	Troubleshooting	99
5.2	Calling the Hitachi Data Systems Support Center.....	101
	Glossary, Acronyms, and Abbreviations	103
	Index	105

List of Figures

Figure 1.1	LUSE Configuration.....	4
Figure 1.2	Virtual LVI/LUN Volume Functions (for Volume Initialize to initialize the VDEVs).....	6
Figure 1.3	Virtual LVI/LUN Volume Functions (for Make Volume to create CVs).....	7
Figure 1.4	Parity Group Configuration (Not Applicable to OPEN-V)	14
Figure 1.5	VDEV Volume Configuration (Not Applicable to OPEN-V)	14
Figure 2.1	Storage Navigator Main Panel, Information Tab.....	16
Figure 2.2	Icons Showing Unlocked Status and View Mode	18
Figure 2.3	Mode Changing Confirmation Message	18
Figure 2.4	Icons Showing Locked Status and Modify Mode	18
Figure 3.1	LUSE/VLL Main Panel, LUSE Tab	19
Figure 3.2	LDEV Information Outline (From the LUSE/VLL Panel, LUSE Tab).....	20
Figure 3.3	LDEV Detail Table, Left Side (From the LUSE/VLL Panel, LUSE Tab)	21
Figure 3.4	LUSE Detail Table, Right Side (From the LUSE/VLL Panel, LUSE Tab)	21
Figure 3.5	LDEV Operation Detail (From the LUSE/VLL Panel, LUSE Tab).....	23
Figure 3.6	Concatenation List Pop-Up Menu	26
Figure 3.7	Concatenation List Panel.....	26
Figure 3.8	Selecting LDEVs for LUSE Volume From the LDEV Detail Table	28
Figure 3.9	Set LUSE Volume Pop-Up Menu.....	28
Figure 3.10	LUSE Path Definition Confirmation Panel.....	28
Figure 3.11	Set LUSE Volume Confirmation Panel	29
Figure 3.12	Data Initialize Warning Panel.....	29
Figure 3.13	New LUSE Volume Displayed.....	30
Figure 3.14	Apply Confirmation Message.....	30
Figure 3.15	Cancel Confirmation Message	30
Figure 3.16	Selecting Free LDEVs from the LDEV Operation Detail	32
Figure 3.17	LUSE Path Confirmation Panel	32
Figure 3.18	Set LUSE Confirmation Panel (2).....	32
Figure 3.19	Data Initialize Warning Panel.....	32
Figure 3.20	New LUSE Volumes Displayed	33
Figure 3.21	Selecting LUSE Volumes Using Volume Count.....	34
Figure 3.22	New LUSE Volumes Displayed	34
Figure 3.23	LDEVs That Have Not Been Released From a LUSE Volume.....	35
Figure 3.24	LDEVs That Have Previously Been Released From a LUSE Volume.....	36
Figure 3.25	Reset Selected Volume Pop-Up Menu	36
Figure 3.26	Reset LUSE Volume Confirmation Panel	37
Figure 3.27	Displaying Reset Volumes	37
Figure 3.28	Selecting LUSE Volume(s) To Be Released.....	39
Figure 3.29	Release LUSE Volume Pop-Up Menu	39
Figure 3.30	Release LUSE Volume Confirmation Panel.....	39
Figure 3.31	Displaying Newly Released LUSE Volume	40
Figure 4.1	LUSE/VLL Panel, VLL Tab	41
Figure 4.2	Parity Group - LDEV Outline (From the LUSE/VLL Panel, VLL Tab)	42
Figure 4.3	LDEV Information Table (From the LUSE/VLL Panel, VLL Tab)	43
Figure 4.4	Install CV Panel (1) for OPEN-V	45

Figure 4.5	Install CV Panel (1) For Other Than OPEN-V	47
Figure 4.6	Install CV Panel (2)	49
Figure 4.7	Set SSID (Install CV) Panel	51
Figure 4.8	Volume Initialize Panel	53
Figure 4.9	Set SSID (Volume Initialize) Panel	55
Figure 4.10	Volume Initialize Confirmation Panel	57
Figure 4.11	Make Volume Panel (1) for OPEN-V	58
Figure 4.12	Make Volume Panel (1) for other than OPEN-V	60
Figure 4.13	Make Volume Panel (2)	62
Figure 4.14	Set SSID (Make Volume) Panel	64
Figure 4.15	Make Volume Confirmation Panel	66
Figure 4.16	Virtual LVI/LUN Concatenation List Pop-Up Menu	68
Figure 4.17	Virtual LVI/LUN Concatenation List Panel	68
Figure 4.18	Volume to Space Pop-Up Menu	70
Figure 4.19	Volume to Space Confirmation Panel	71
Figure 4.20	Volume to Space Changes Made, But Not Yet Implemented	71
Figure 4.21	Apply Confirmation Message	72
Figure 4.22	Volume to Space Progress Indicator	72
Figure 4.23	Volume to Space Operation Complete	72
Figure 4.24	Cancel Confirmation Message	72
Figure 4.25	Install CV Pop-Up Menu	75
Figure 4.26	Install CV Panel (1)	75
Figure 4.27	Clear Pop-Up Menu	75
Figure 4.28	Specifying Capacity, Emulation Type and Size	76
Figure 4.29	Selecting CU, Interval, and LDEV Numbers	76
Figure 4.30	Confirming the SSID (Installing VLL Volumes)	77
Figure 4.31	Confirming the VLL Selections	77
Figure 4.32	VLL Volume Created But Changes Not Yet Implemented	78
Figure 4.33	Install CV Progress Indicator	78
Figure 4.34	Operation Complete Panel	78
Figure 4.35	Install CV Pop-Up Menu	81
Figure 4.36	Setting the Capacity	82
Figure 4.37	Selecting the CU Number, Interval, and LDEV Numbers	82
Figure 4.38	Clear Pop-Up Menu	83
Figure 4.39	Confirming the SSID	83
Figure 4.40	Confirming the Selections	84
Figure 4.41	Install OPEN-V CV Complete, Changes Pending	84
Figure 4.42	Install CV Progress Indicator	85
Figure 4.43	Install Operation Complete	85
Figure 4.44	Volume Initialize Pop-Up Menu	88
Figure 4.45	Selecting CU, Interval, and LDEV Numbers	88
Figure 4.46	Clear Pop-Up Menu	88
Figure 4.47	Selecting SSID (Initializing VLL Volumes)	89
Figure 4.48	Confirming Volume Initialize	89
Figure 4.49	Verifying Volume Initialize	90
Figure 4.50	Volume Initialize Progress Indicator	90
Figure 4.51	Volume Initialize Complete	90
Figure 4.52	Make Volume Pop-Up Menu	94
Figure 4.53	Setting the Capacity (OPEN-V shown)	95
Figure 4.54	Selecting VLL Volume Numbers, CU, Interval, and LDEV Numbers	95

Figure 4.55	Clear Pop-Up Menu	96
Figure 4.56	Deleted LDEV Numbers	96
Figure 4.57	Setting SSIDs	96
Figure 4.58	Confirming Selection of Normal Volumes.....	97
Figure 4.59	Implementing New Normal Volumes	97

List of Tables

Table 1.1	LUSE Specifications	3
Table 1.2	VLL LUSE Specifications	4
Table 1.3	Virtual LVI/LUN Specifications	9
Table 1.4	Minimum and Maximum Virtual LUN Volume Capacities (Open Systems)	10
Table 1.5	Control Cylinders/Control Area for Each LVI/LU Type	10
Table 1.6	SSID Requirements	13
Table 4.1	Emulation Groups	50
Table 5.1	General Error Conditions.....	100

Chapter 1 Overview of LUN Expansion and Virtual LVI/LUN

1.1 Overview of LUSE Operations

1.1.1 General LUSE Specifications

LUN Expansion (LUSE) operations allow hosts that can only use a limited amount of LUs per fibre interface to have access to larger amounts of data by using expanded LUs (see Figure 1.1). See Table 1.1 and for LUSE and VLL LUSE specifications.

LUSE operations include the following:

- Viewing concatenated parity groups (see section 3.2.1)
- Creating new LUSE volumes (see section 3.2.2)
- Resetting an unregistered LUSE volume (see section 3.2.3)
- Releasing a LUSE volume to individual LUs (see section 3.2.4)
- Changing the size of a LUSE volume (see section 3.2.5)

The following guidelines apply to LUSE operations:

- Access for the LU(s) to be expanded or released must be set to read/write. For more information on setting LDEV access, please see *Hitachi Freedom Storage™ Lightning 9900™ V Series Open LDEV Guard User's Guide* (MK-93RD158).
- A maximum of 256 expanded LUs can be configured on the same port.
- LDEVs that are to be combined into LUSE volumes should have no assigned SCSI paths and be unmounted from the host. These are known as free (or available) LDEVs. For instructions on deleting SCSI paths, please see *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105).
- Combining non-sequential LDEVs into a LUSE is supported, provided they are on the same CU.
- Combining normal volumes and LUSE volumes into the same LUSE volume, and combining existing LUSE volumes into another LUSE volume are supported, provided that all of the normal volumes that were used to create the LUSE volume(s) have the same capacity and are on the same CU.
- If you combine LDEVs number 00, 03 and 05 in to a LUSE volume ("LUSE 1"), then combine LDEVs number 02 and 04 into a second LUSE volume ("LUSE 2"), and LDEVs number 06 and 07 into a third LUSE volume ("LUSE 3"), you can then combine LUSE 1 and LUSE 3 into a LUSE volume, but you cannot combine LUSE 1 and LUSE 2, because the LDEV range of LUSE 1 overlaps the LDEV range of LUSE 2.

- Combining Virtual LVI/LUN volumes into a LUSE is supported, provided they are all of the same size and emulation type and are on the same CU. The order of operations is important: you must first create one or more Virtual LVI/LUN volumes, and then combine those VLL volumes into a LUSE volume. For more information on creating VLL volumes, see sections 4.2.4 and 4.2.3. For more information on creating LUSE devices see section 3.2.1.
- You cannot perform Virtual LVI/LUN operations on an existing LUSE volume because a LUSE volume must have a SCSI path already specified.
- Hitachi TrueCopy-S/390®, Hitachi TrueCopy, ShadowImage-S/390®, and ShadowImage pair volumes cannot be targets of LUSE operations because a LUSE volume must have a SCSI path already specified.
- Combining Virtual LVI/LUN volumes and normal volumes into the same LUSE is not supported.
- Combining command devices, Just In Time or CruiseControl volumes into a LUSE is not supported.
- Combining RAID 1 and RAID 5 volumes into the same LUSE is supported, but not recommended.
- Combining emulation types (OPEN-3, OPEN-8, OPEN-9, OPEN-E, OPEN-L or OPEN-V) into the same LUSE is not supported.
- Combining LUSE volumes into larger LUSE volumes is not supported.
- Some operating systems may experience slow disk access times with large logical units, particularly if they contain a large number of high-usage files.
- The size of a LUSE can affect the amount of time required to perform backups.
- Combining 9900V subsystem volumes and Hi-Copy volumes into the same LUSE volume is not supported.

Note: The queue depth for open systems can vary, depending on the type of platform. For more information on queue depth, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105) or contact your Hitachi Data Systems Customer Support Center for assistance.

WARNING: Except for systems running Windows NT® or Windows® 2000, creating and releasing LUSE volumes is a destructive process. Be sure to back up your data before proceeding.

1.1.2 Specifications for LUSE Operations Using a Path-Defined LDEV

When you create a LUSE volume, the top LUSE volume can be either an LDEV or a LUSE volume that has one or more paths defined to it. Creating LUSE volumes using path-defined LDEVs has the following restrictions:

- Only the top volume in the LUSE volume to be created can have any paths. The other volumes in the LUSE volume to be created must not have any paths. The maximum number of paths to an LDEV is the maximum group number (128) multiplied by the maximum number of ports (64). There is one path per group.
- The path(s) to the top volume must be defined from either a Windows® 2000 host (host mode 2C, Windows® Extension) or an AIX® 5.2 host (host mode 0F).
Note: If your Windows® 2000 host has a host mode of OC (Windows® standard host mode), you must change it to 2C (Windows® Extension) to use path-defined LDEVs.
- You cannot combine a path-defined LDEV with another path-defined LDEV.

Table 1.1 LUSE Specifications

Parameter	OPEN-3	OPEN-8	OPEN-9	OPEN-E	OPEN-L	OPEN-V
LU Capacity	2.4 GB	7.3 GB	7.3 GB	14.5 GB	36.4 GB	64.4 GB
Possible number of expanded LUs	2 - 36 LUs (including LDEVs in existing LUSE volumes)	2 - 36 LUs (including LDEVs in existing LUSE volumes)	2 - 36 LUs (including LDEVs in existing LUSE volumes)	2 - 36 LUs (including LDEVs in existing LUSE volumes)	2 - 36 LUs (including LDEVs in existing LUSE volumes)	2 - 36 LUs (including LDEVs in existing LUSE volumes)
Expanded LU Capacity	4.8 GB - 88.6 GB	14.6 GB - 264.4 GB	14.7 GB - 265.8 GB	29.1 GB - 524.4 GB	72.9 GB - 1312.2 GB	2.199 TB
Product Name	OPEN-3*n (n = # of LUs in the expanded LU)	OPEN-8*n (n = # of LUs in the expanded LU)	OPEN-9*n (n = # of LUs in the expanded LU)	OPEN-E*n (n = # of LUs in the expanded LU)	OPEN-L*n (n = # of LUs in the expanded LU)	OPEN-V*n (n = # of LUs in the expanded LU)

Table 1.2 VLL LUSE Specifications

Parameter	OPEN-3	OPEN-8	OPEN-9	OPEN-E	OPEN-V
LU Capacity	35 MB to 2.3 GB	35 MB to 6.8 GB	35 MB to 6.9 GB	35 MB to 13.5 GB	46 MB to 60.0 GB
Possible number of connected LUs	2 - 36 LUs (including LDEVs in existing LUSE volumes)	2 - 36 LUs (including LDEVs in existing LUSE volumes)	2 - 36 LUs (including LDEVs in existing LUSE volumes)	2 - 36 LUs (including LDEVs in existing LUSE volumes)	2 - 36 LUs (including LDEVs in existing LUSE volumes)
Capacity of expanded LUs	70 MB to 82.5 GB	70 MB to 246.4 GB	70 MB to 247.6 GB	70 MB to 488.4 GB	93 MB to 2 TB
Product Name	OPEN-3*n-VLL (n = # of LUs in the expanded LU)	OPEN-8*n-VLL (n = # of LUs in the expanded LU)	OPEN-9*n-VLL (n = # of LUs in the expanded LU)	OPEN-E*n-VLL (n = # of LUs in the expanded LU)	OPEN-V*n-VLL (n = # of LUs in the expanded LU)

Note: OPEN-L is not applicable to Virtual LVI/LUN.

Note: The values in this table assume that 1 kB = 1024 Bytes

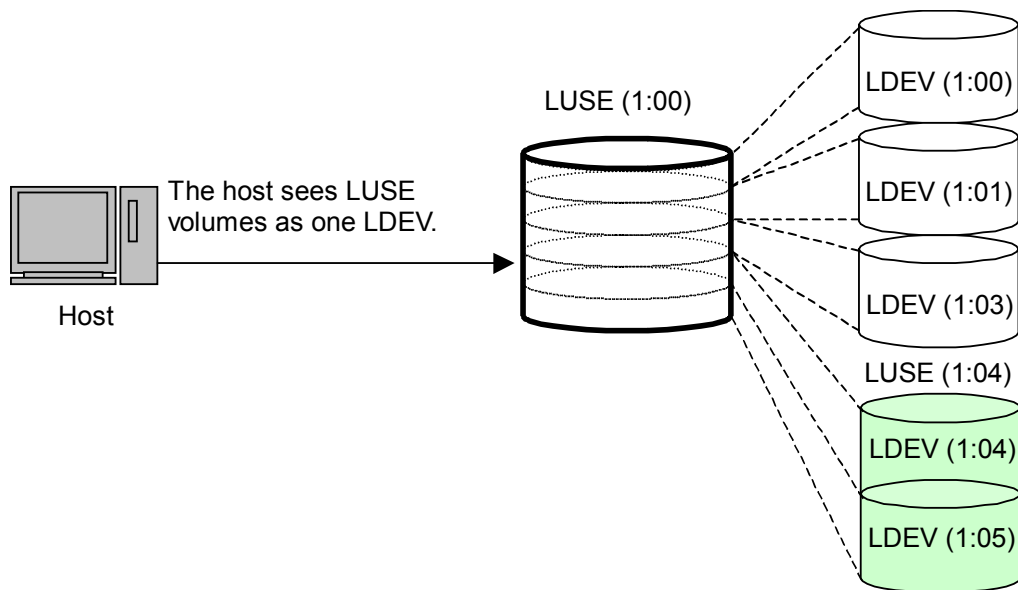


Figure 1.1 LUSE Configuration

1.1.3 Specifications for LUSE Devices Used With NetApp® gFiler™ Gateways

If you are using LUSE devices with NetApp® gFiler™ gateways, the following recommendations and restrictions apply:

- The minimum supported LUN size is 1 GB.
- The maximum supported LUN size is 500 GB.
- OPEN-V emulation is not supported.
- LUSE devices that are concatenated across more than one parity group should not be used with gFiler™ gateways. For more information on concatenated LUSE devices, see section 3.2.1.

1.2 Overview of Virtual LVI/LUN

1.2.1 Virtual LVI/LUN Function

Virtual LVI/LUN (VLL) allows you to configure variable-size volumes, which are usually smaller than normal (fixed-size) volumes. Virtual LVI/LUN improves data access performance by reducing logical device contention and host I/O queue times, particularly when several frequently accessed files are located on the same volume. Virtual LVI/LUN enables better utilization of the physical storage capacity of the 9900V, and reduces the amount of administrative effort required to balance I/O workloads.

Virtual LVI/LUN allows you to perform the following types of operations:

- Viewing concatenated parity groups (see section 4.2.1)
- Converting logical volumes to free space (see section 4.2.2)
- Creating VLL volumes (other than OPEN-V) (see section 4.2.3)
- Creating OPEN-V VLL volumes (see section 4.2.4)
- Deleting VLL volumes (see section 4.2.5)
- Initializing VLL volumes (other than OPEN-V) (see section 4.2.6)
- Making initial VLL volumes (see section 4.2.7)

Figure 1.2 and Figure 1.3 illustrate the available Virtual LVI/LUN functions.

Except for OPEN-V volumes, a normal volume consists of some fixed volumes (FV) and some free space. The number of fixed volumes is determined by the emulation type. A Virtual LVI/LUN volume usually consists of at least one fixed volume (FV), one or more customized volumes (VLL volumes), and some free space (see Figure 1.2). OPEN-V volumes always consist of variable sized volumes (CVs), instead of fixed-size volumes (FVs) (see Figure 1.3).

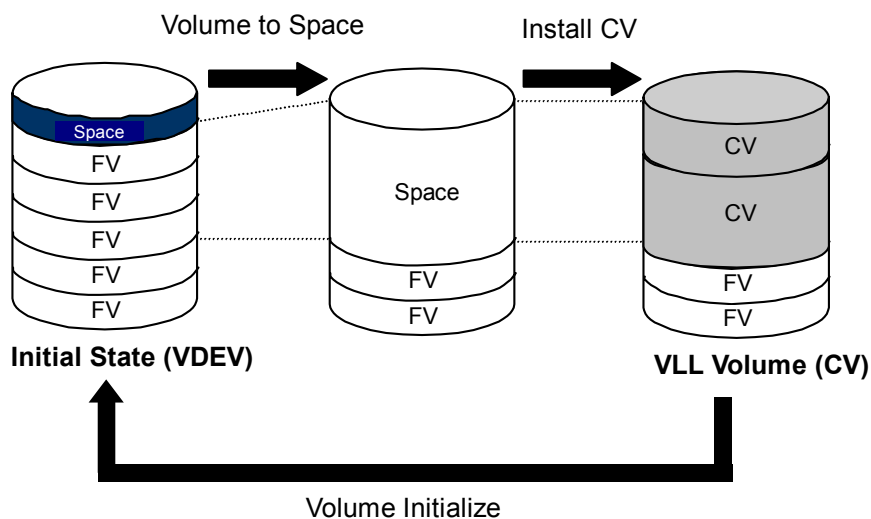


Figure 1.2 Virtual LVI/LUN Volume Functions (for Volume Initialize to initialize the VDEVs)

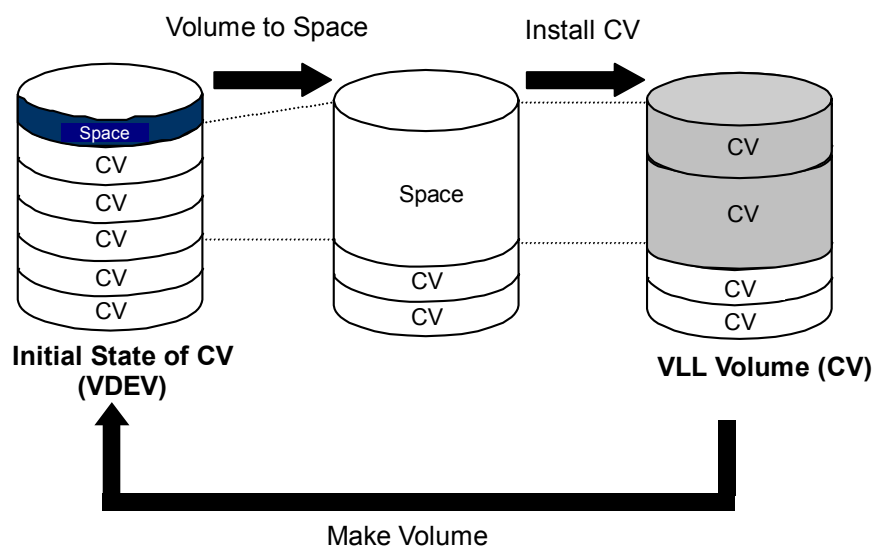


Figure 1.3 Virtual LVI/LUN Volume Functions (for Make Volume to create CVs)

Note: Virtual LVI/LUN used in conjunction with FlashAccess can achieve greater performance improvements than when either of these options is used individually. For more information on FlashAccess, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series FlashAccess User's Guide* (MK-92RD102).

A parity group is called a normal or fixed-size volume (FV) when all of its member LDEVs are of a fixed size. In a normal volume, the size of the member LDEVs is determined by type of device that is being emulated, and the number of LDEVs is determined by the physical size of the parity group.

Generally, each array group has a certain amount of free space available after the standard LDEVs for the array group have been defined. On the 9900V, Virtual LVI/LUN formats one or more of the LDEVs on a selected volume into free space. That free space can either be used to install one or more variable-sized volumes, or left as free space for future use.

Note: At least one LDEV must remain defined as a normal volume in each array group.

The following guidelines apply to Virtual LVI/LUN operations:

- Public system option mode 269 must be set to **ON** if you want to use high-speed format. Set it to **OFF** if you are not using high-speed format. For further information on system option mode 269, please contact your Hitachi Data Systems representative.
- Access for open volumes must be set to read/write. For more information on setting LDEV access, please see *Hitachi Freedom Storage™ Lightning 9900™ V Series Open LDEV Guard User's Guide* (MK-93RD158).
- S/390® volumes must be offline from the host OS, and open volumes must be either offline or unmounted from the host OS with no SCSI paths assigned to them. For more information on configuring SCSI paths, please see *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105).
- Secured open volumes are not available for Virtual LVI/LUN operations, because these volumes must have SCSI paths already defined. For more information on LUN Security, please see *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105).
- Combining Virtual LVI/LUN volumes into a LUSE is supported, provided they are the same size and emulation type and on the same CU. The order of operations is important: you must first create one or more Virtual LVI/LUN volumes, and then combine those VLL volumes into a LUSE volume.
- You cannot perform Virtual LVI/LUN operations on an existing LUSE volume because a LUSE volume must have a SCSI path already specified. For more information on creating VLL volumes, see sections 4.2.3 and 4.2.4. For more information on creating LUSE devices see section 3.2.1.
- Multiple LDEVs can be selected for conversion to Virtual LVI/LUN volumes but they must be in the same Virtual Device (VDEV).
- When space in an LDEV is converted to a Virtual LVI/LUN volume, you must assign an LDEV address to that Virtual LVI/LUN volume. For mainframes, each Virtual LVI volume also has its own assigned unit control block (UCB), which is controlled from the mainframe host.
- Virtual LUN operations are not available for OPEN-L volumes.
- When you convert a normal volume to a Virtual LVI/LUN volume, you can use all or part of the space previously assigned to that volume (for example, 3339 cylinders for a 3390-3) for use in Virtual LVI/LUN volumes. Each VDEV can support a total of 256 volumes, including both fixed-size and Virtual LVI/LUN volumes.

WARNING: The Virtual LVI/LUN function is destructive. Make sure to back up your data before performing Virtual LVI/LUN operations.

Multiple LVI/LUN types can be configured within each Virtual LVI/LUN volume, so long as the device type is from the same device family (for example, all open volumes, or all 3390s). Open and S/390® volumes are not allowed in the same parity group.

Table 1.3 lists the Virtual LVI/LUN specifications, Table 1.4 lists the minimum and maximum Virtual LUN volume capacities for open systems, and Table 1.5 lists the Control Cylinders/Control Area for Each LVI/LU Type.

Table 1.3 Virtual LVI/LUN Specifications

Parameter	Mainframe	Open Systems	
Track format	3390	OPEN-3, OPEN-8, OPEN-9, OPEN-E	OPEN-V
Emulation type	3390-3, -3A, -3B, -3C, -3R, -9, -L	OPEN-3, OPEN-8, OPEN-9, OPEN-E	OPEN-V
Ability to intermix emulation type	Yes, for 3390. No, for open-system volumes.	Yes, by track geometry (except for AIX® systems). No, for S/390® volumes.	Yes, by track geometry (except for AIX® systems). No, for S/390® volumes.
Maximum number of volumes (normal and Virtual LVI/LUN) per VDEV	512 for RAID 5 (7D+1P) 256 for other RAID levels	512 for RAID 5 (7D+1P) 256 for other RAID levels	512 for RAID 5 (7D+1P) 256 for other RAID levels
Maximum number of volumes (normal and Virtual LVI/LUN) per subsystem	8,192	8,192	8,192
Minimum size for one Virtual LVI/LUN volume	1 user cylinder (+ control cylinders)	35 MB (+ control area)	46 MB
Maximum size for one Virtual LVI/LUN volume	See Table 1.4	See Table 1.4	737,256 MB (Maximum VDEV size)
Size increment	1 user cylinder	1 MB	1 MB
Disk location for Virtual LVI/LUN volumes	Anywhere	Anywhere	Anywhere

Note: VLL functions are not applicable to OPEN-L volumes.

Table 1.4 Minimum and Maximum Virtual LUN Volume Capacities (Open Systems)

Setting size (MB)	User Size (MB)	Notes
35	35.15625	Minimum VLL volume capacity (other than OPEN-V)
46	46.875	Minimum VLL volume capacity (OPEN-V)
500	500.625	
1000	1000.546875	
2000	2000.390625	
2347	2347.03125	Maximum OPEN-3 volume size
7007	7007.34375	Maximum OPEN-8 volume size
7042	7042.5	Maximum OPEN-9 volume size
13893	13893.04688	Maximum OPEN-E volume size
737256	737256.09375	Maximum OPEN-V volume size.

Note: User size is the capacity that is available to the users. It does not include control cylinders or capacity used for volume boundary control.

Note: If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Install CV and the Make Volume functions automatically create the VLL volume in LUSE configuration.

Table 1.5 Control Cylinders/Control Area for Each LVI/LU Type

LVI/LU Type	Control Cylinders/Control Area	Maximum User Capacity
3390-3 (A/B/C)	6 cylinders	3339 cylinders
3390-3R	6 cylinders	3339 cylinders
3390-9	25 cylinders	10017 cylinders
3390-L	23 cylinders	32,760 cylinders
OPEN-3	8 cylinders/5 MB	2347 MB
OPEN-8	27 cylinders/19 MB	7007 MB
OPEN-9	27 cylinders/19 MB	7042 MB
OPEN-E	13 MB	13,893 MB
OPEN-V	0 MB	737,256 MB (Maximum VDEV size)
OPEN-L	Not applicable	

Note: VLL functions are not applicable to OPEN-L volumes.

Note: If the specified capacity of an OPEN-V VLL volume exceeds 60 gigabytes (65,535 cylinders), the Install CV and the Make Volume functions automatically create the VLL volume in LUSE configuration.

1.2.2 Virtual LVI/LUN Size Calculation

The Virtual LVI/LUN Storage Navigator function enables you to configure LDEVs by dividing them into several devices. You can assign a specific number of physical cylinders or MB to each VLL volume for maximum control over the volume size.

1.2.2.1 S/390® Size Calculation

For S/390® systems, each Virtual LVI volume contains the user-specified number of user cylinders plus a predetermined number of control cylinders (see Table 1.5), which is calculated as follows:

If the RAID configuration for the LDEV is RAID-5 (3D+1P) or RAID1:

Number of tracks for boundary control = $\uparrow (\text{Number of cylinders specified by the user} + \text{Number of control cylinders}) \times 15 \div 48 \uparrow \times 48 - (\text{Number of cylinders specified by the user} + \text{Number of control cylinders}) \times 15$

Note: $\uparrow \uparrow$ indicates that you round up decimal digits, e.g., $\uparrow 3.96 \uparrow = 4.00$

If the RAID configuration for the LDEV is RAID-5 (7D+1P):

Number of tracks for boundary control = $\uparrow (\text{Number of cylinders specified by the user} + \text{Number of control cylinders}) \times 15 \div 56 \uparrow \times 56 - (\text{Number of cylinders specified by the user} + \text{Number of control cylinders}) \times 15$

Note: $\uparrow \uparrow$ indicates that you round up decimal digits, e.g., $\uparrow 3.96 \uparrow = 4.00$

For example, if you specify 1015 user cylinders for a 3390-3 Virtual LVI volume, the total number of physical cylinders allocated for that device is $1015 \times 15 + 6 \times 15 + 45 = 15360$ tracks (1024 cylinders).

1.2.2.2 Open Systems Size Calculation

In open systems the size of the Virtual LUN volume is expressed in MB. The total size of the Virtual LUN volume consists of the user-specified size plus an amount for the control area (refer to Table 1.5). The Virtual LUN software automatically assigns the amount for the control area. **Note:** OPEN-V volumes do not require a control area.

The size calculation for volumes other than OPEN-V is as follows:

If the RAID configuration for the LDEV is RAID-5 (3D+1P) or RAID-1:

X (in cylinders) = User-specified size (in megabytes) $\times 1,024 \div 720$ (The result is rounded up to an integer.)

$$Y = (\uparrow (X + C) \times 15 \div 48 \uparrow \times 48) \times 48 \div 1,024 \text{ (MB)}$$

If the RAID configuration for the LDEV is RAID-5 (7D+1P):

X (in cylinders) = User-specified size (in megabytes) $\times 1,024 \div 720$ (The result is rounded up to an integer.)

$$Y = (\uparrow (X + C) \times 15 \div 56 \uparrow \times 56) \times 48 \div 1,024 \text{ (MB)}$$

X is the value for converting the capacity specified by user into the number of cylinders.

Y is a value of converting value X into MB.

C is the number of control cylinders (refer to Table 1.5).

For example, when the user-specified capacity is 100 megabytes (MB) for an OPEN-3 RAID-5 (3D+1P), the allocated CV capacity is calculated as follows:

$$100 \times 1,024 \div 720 = 142.2222 \text{ (rounded up to 143)}$$

$$(\uparrow (143 + 8) \times 15 \div 48 \uparrow \times 48) \times 48 \div 1,024 = 108 \text{ (MB)}$$

The size calculation for OPEN-V volumes is as follows:

If the RAID configuration for the LDEV is RAID-5 (3D+1P) or RAID-1:

X (in cylinders) = User-specified size (in megabytes) $\times 1,024 \div 960$ (The result is rounded up to an integer.)

$$Y = (\uparrow X \times 15 \div 48 \uparrow \times 48) \times 64 \div 1,024 \text{ (MB)}$$

If the RAID configuration for the LDEV is RAID-5 (7D+1P):

X (in cylinders) = User-specified size (in megabytes) $\times 1,024 \div 960$ (The result is rounded up to an integer.)

$$Y = (\uparrow X \times 15 \div 56 \uparrow \times 56) \times 64 \div 1,024 \text{ (MB)}$$

For example, when the user-specified capacity is 100 megabytes (MB) for an OPEN-V RAID-5 (3D+1P), the allocated CV capacity is calculated as follows:

$$100 \times 1,024 \div 960 = 106.6666 \text{ (rounded up to 107)}$$

$$(\uparrow 107 \times 15 \div 48 \uparrow \times 48) \times 64 \div 1,024 = 102 \text{ (MB)}$$

1.2.3 SSID Requirements

The 9900V subsystem is configured with one SSID for each of 256 devices and up to four SSIDs per CU image. Each SSID must be unique within each host system. Table 1.6 shows the relationship between emulation types of controllers and SSIDs.

Table 1.6 SSID Requirements

Controller Emulation Type	SSID Requirement	LVI/LUN Support
3990-6, 3390-6E	(0104) _x - (FFFD) _x	3390, OPEN-3, OPEN-8 and OPEN-9 volumes
2105-F20	(0104) _x - (FFFD) _x	3390, OPEN-3, OPEN-8 and OPEN-9 volumes

1.2.4 Parity Group Configuration (Not Applicable to OPEN-V)

This section is not applicable to OPEN-V volumes, because OPEN-V volumes always consist of variable sized volumes (CVs), instead of fixed-size volumes (FVs).

A parity group consists of a maximum of 16 VDEVs. Each VDEV has a maximum of 512 fixed-size volumes (FVs) for RAID5 (7D+1P) levels, or 256 FVs for other RAID levels, plus a certain amount of free space. Each VDEV in a parity group has the same configuration, and is assigned the same FVs of the same size and RAID level.

The four VLL functions (Volume to Space, Install CV, Volume Initialize, and Make Volume) are performed on each VDEV. VDEVs are also separated from each other by the boundary limitation. Therefore, you cannot define a volume across two or more VDEVs beyond the boundaries.

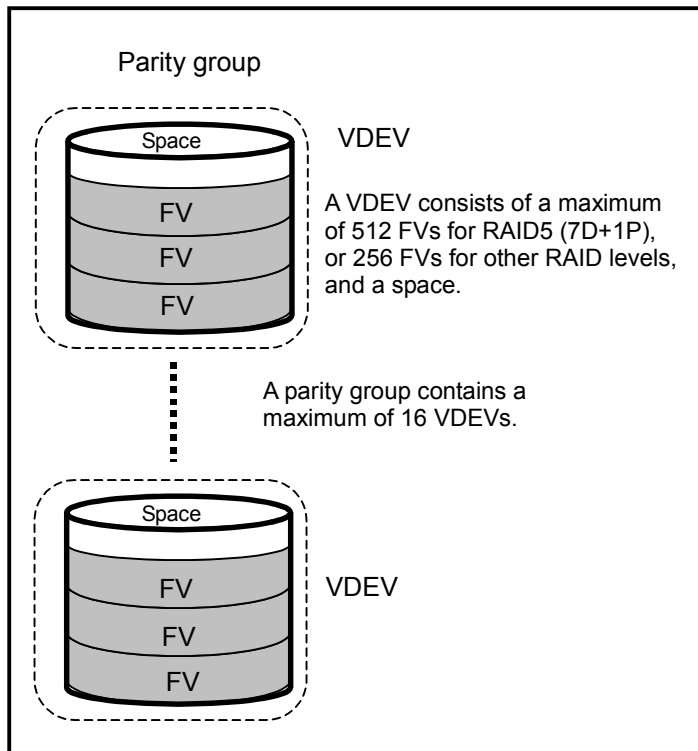


Figure 1.4 Parity Group Configuration (Not Applicable to OPEN-V)

As the result of VLL operations, a VDEV contains FVs, CVs, and free spaces that are delimited in logical cylinders. Sequential free spaces are combined into a single free space (see Figure 1.5).

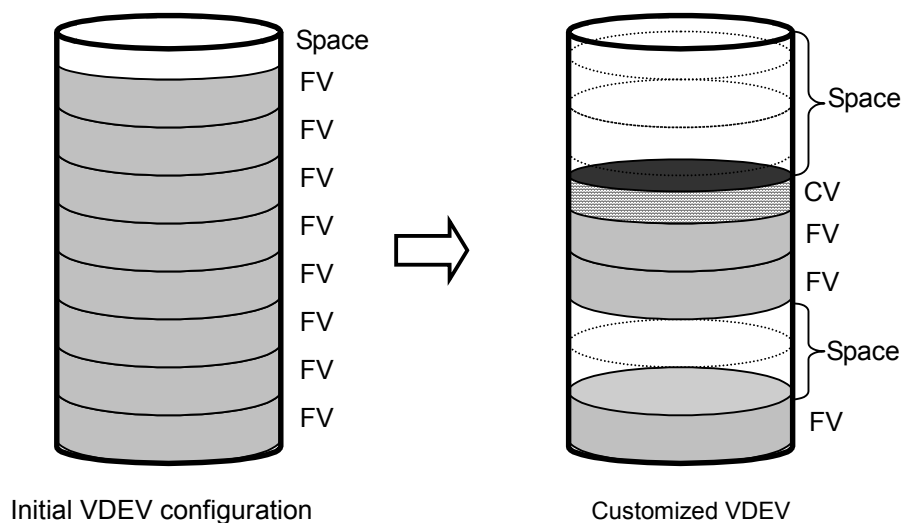


Figure 1.5 VDEV Volume Configuration (Not Applicable to OPEN-V)

Chapter 2 Preparing to Use LUN Expansion or Virtual LVI/LUN

2.1 Preparing the 9900V Subsystem and Storage Navigator Computer(s)

Before launching LUN Expansion or Virtual LVI/LUN, you must take several preliminary steps. These include the following:

- Install the 9900V subsystem.
- Install the computer(s) that you intend to use as Storage Navigators, and connect them to the 9900V internal LAN.
- Enable LUN Expansion and/or Virtual LVI/LUN on each subsystem where you intend to use these options.

For detailed instructions, please refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100) and *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator User's Guide* (MK-92RD101).

2.2 Launching LUN Expansion or Virtual LVI/LUN

To use LUN Expansion or Virtual LVI/LUN, first log on to the primary SVP. For detailed instructions on the login process, see *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator User's Guide* (MK-92RD101).

If you successfully log on to the primary SVP, the Storage Navigator main panel opens (see Figure 2.1). The option buttons are displayed on the left side of the panel. **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** () opens the LUSE/VLL panel.

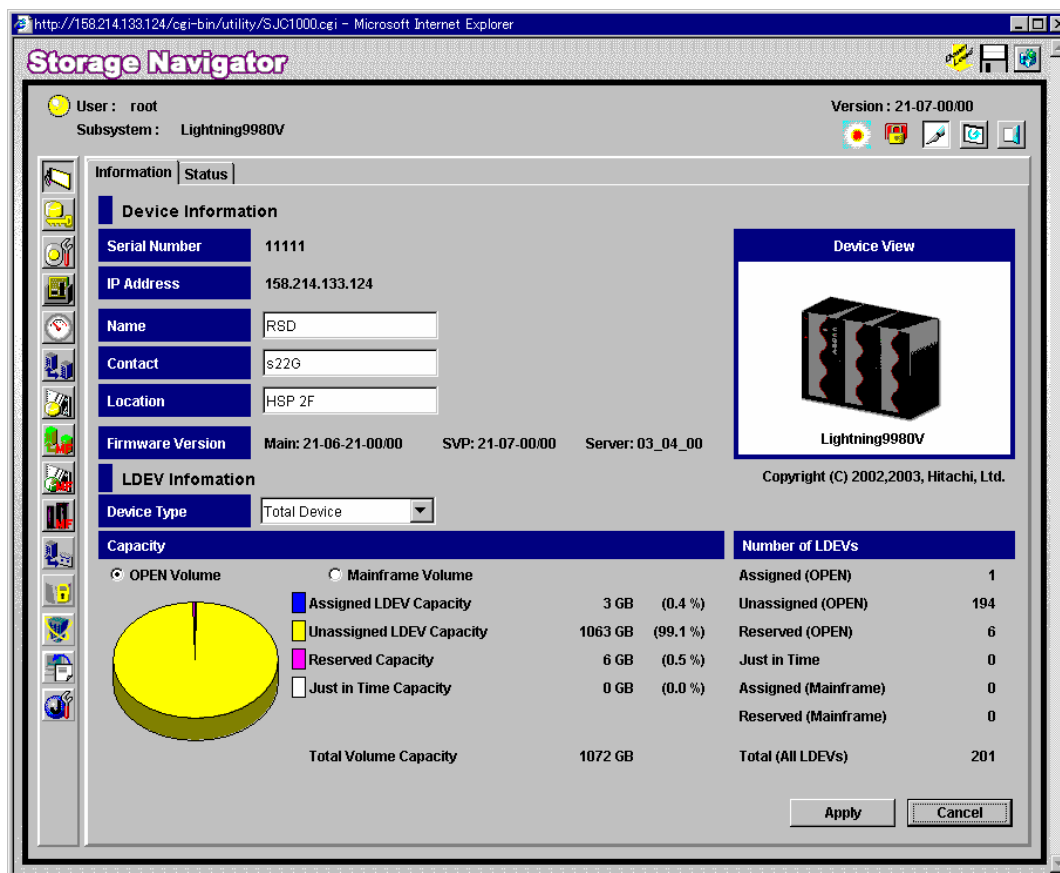


Figure 2.1 Storage Navigator Main Panel, Information Tab

2.3 Changing to Modify Mode

If you are going to implement any changes for LUN Expansion or Virtual LVI/LUN, you must be in **Modify** mode. The subsystem information icons (see Figure 2.2) are on the upper right corner. These icons are described in detail in *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator* (MK-92RD101). If you want to change from **View** mode to **Modify** mode and back, two of the icons are important:

- Exclusive lock icons indicate the operation mode of all currently logged-in users. If all users are operating in **View** mode, the **Unlocked** icon () is displayed. If a user is operating in **Modify** mode, or if subsystem maintenance or SNMP operations are being performed, the **Locked** icon () is displayed.
- **Mode-Changing** buttons allow users to change the operation mode between **View** mode () and **Modify** mode (). **Note:** Only one user at a time can be in **Modify** mode.

To change between **View** and **Modify** modes:

1. You must have administrator or write access for the option that you want to use. For details on assigning user access, see *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator* (MK-92RD101).
2. Verify that the subsystem is unlocked. If all users are operating in **View** mode, the **Unlocked** icon () and the **View Mode** icon () are displayed (see Figure 2.2). If a user is operating in **Modify** mode, or if subsystem maintenance is being performed, the **Locked** icon () is displayed, and you cannot change to **Modify** mode.
3. Select the **Mode Changing** icon () , which should be in **View** mode. A confirmation message displays (see Figure 2.3). Select **OK**.
4. The **Mode Changing** icon changes from **View** mode to **Modify** mode () . The **Locked** icon () displays (see Figure 2.4).
5. Change back to **View** mode once you have applied the change. Select the **Mode Changing** icon () . The confirmation message displays (see Figure 2.3).
6. Select **OK**, and you are returned to **View** mode.



Figure 2.2 Icons Showing Unlocked Status and View Mode

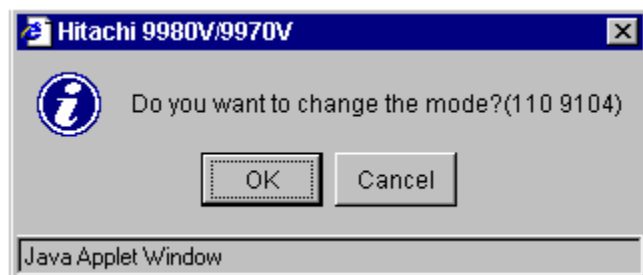


Figure 2.3 Mode Changing Confirmation Message



Figure 2.4 Icons Showing Locked Status and Modify Mode

Chapter 3 LUN Expansion (LUSE)

3.1 LUN Expansion Panels

3.1.1 LUSE/VLL Main Panel, LUSE Tab

LUN Expansion (LUSE)/Virtual LVI/LUN (VLL) button on the Storage Navigator Main panel () opens the LUSE/VLL panel. The LUSE tab is the default view (see Figure 3.1).

Note: The screens shown in this document include only the LUSE/VLL portion of the panel. The option buttons (along the left side of the panel) and the subsystem information icons (top right corner of the panel) are not shown.

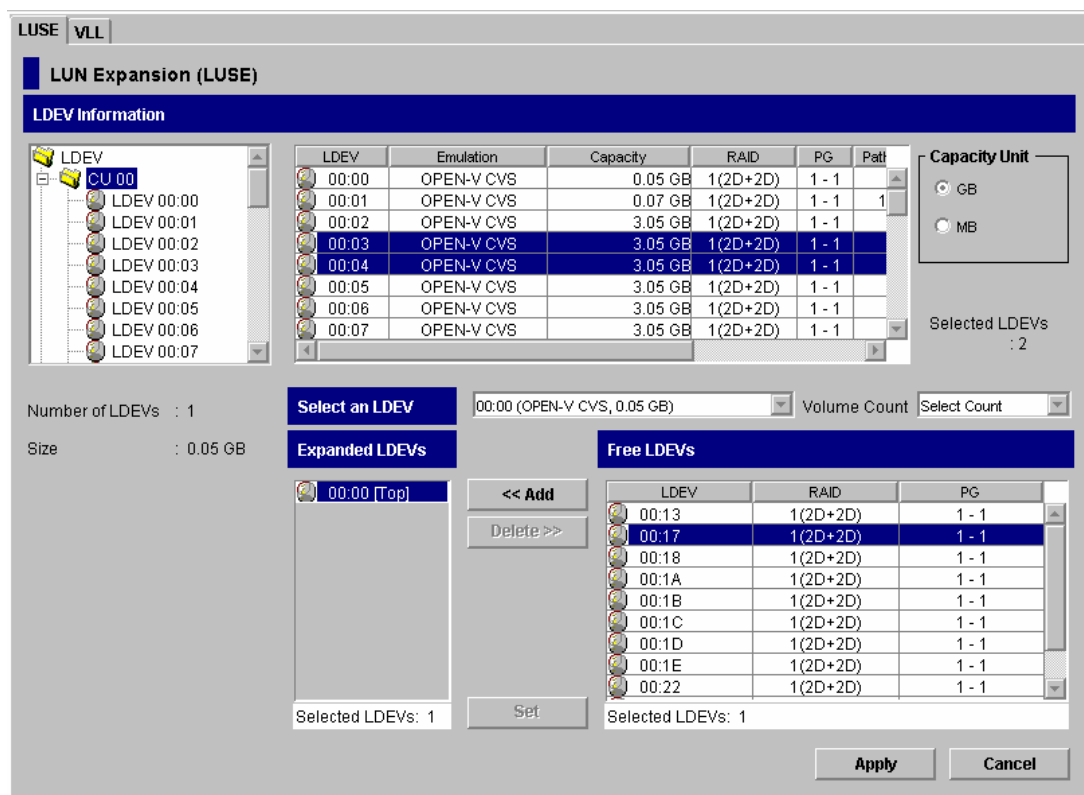


Figure 3.1 LUSE/VLL Main Panel, LUSE Tab

3.1.2 LDEV Information Outline

The **LDEV Information** outline is on the upper left of the **LUSE** tab (see Figure 3.2), and displays an outline view of the CU and LDEV numbers installed on the subsystem (for example, CU 01 has a number of LDEVs, including 01:00). The format of the LDEV number changes if the LDEV is an expanded (LUSE) volume (for example, if LDEV volume 01:00 consists of five concatenated LDEVs, its number is 01:00*5).

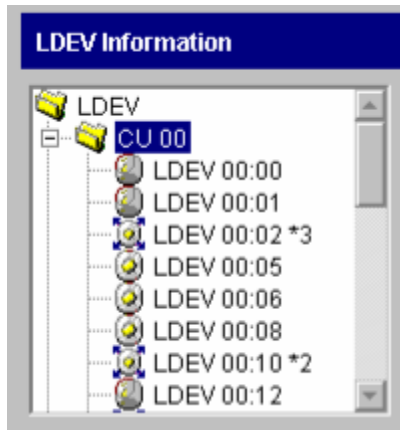


Figure 3.2 LDEV Information Outline (From the LUSE/VLL Panel, LUSE Tab)

The **LDEV Information** outline will display some or all of the following icons:

-  Normal (free) LDEV
-  Variable-sized volume (CV)
-  Expanded (LUSE) volume

3.1.3 LDEV Detail Table

The **LDEV Detail** table is on the upper right corner of the **LUSE** tab, and displays data for the LDEV that you select in the LDEV Information outline (see Figure 3.3).

LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-V CVS	0.05 GB	1(2D+2D)	1 - 1	
00:01	OPEN-V CVS	0.07 GB	1(2D+2D)	1 - 1	1
00:02	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	
00:03	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	
00:04	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	
00:05	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	
00:06	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	
00:07	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	

Figure 3.3 LDEV Detail Table, Left Side (From the LUSE/VLL Panel, LUSE Tab)

Capacity	RAID	PG	Paths	Access Attribute
33.94 GB	1(2D+2D)	1 - 1		Read/Write

Figure 3.4 LUSE Detail Table, Right Side (From the LUSE/VLL Panel, LUSE Tab)

The **LDEV Detail** table displays detailed information for all open-system LDEVs in the selected CU. If you have selected a normal LDEV, the information in this section is for the top LDEV. If you have selected a LUSE volume, the information in this table is for all of the LDEVs in the LUSE volume.

The **LDEV Detail** table displays the following information:

- **LDEV** includes the LDEV status icon, and the CU and LDEV number. If the selected LDEV is a LUSE volume, the LDEV number of the top LDEV in the LUSE volume is displayed.
Note: An LDEV number ending in # (e.g. 00:01#) indicates that the LDEV is a Hi-Copy volume. The icons indicate:
 - Normal (free) LDEV
 - Variable-sized volume (CV)
 - Expanded (LUSE) volume

- **Emulation** indicates the emulation type.
 - If the selected LDEV is a LUSE volume, the emulation type is displayed together with an asterisk and the number of volumes in the LUSE volume (e.g., **OPEN-E*5**).
 - If the selected LDEV is a VLL volume, the emulation type is displayed together with CVS (e.g., **OPEN-3 CVS**).
 - If the selected LDEV is a LUSE volume consisting of LDEVs that extend over two or more VDEVs, the number of volumes (*n), and each LDEV in the LUSE volume is displayed.
- **Capacity** displays the LDEV capacity in either MB or GB, depending on which unit is selected in the **Capacity Unit** box. If the selected LDEV is a LUSE volume, the capacity of a single LDEV is also displayed in parentheses (e.g., **6.87 (2.29) GB**).
- **RAID** shows the RAID level. **Note:** - indicates a Hi-Copy volume.
- **PG** shows the disk group and the parity group. If the LDEV extends over two or more parity groups, the **PG** column displays the smaller parity group number. A parity group number beginning with **E** (e.g., **E1-1**) indicates that the parity group consists of one or more Hi-Copy volumes.
- **Paths** shows the number of paths that are set for the LDEV. A notation of **(n)** indicates that no paths are set. If one or more paths are set to an LDEV or LUSE volume, you can use that LDEV as the top LDEV of a LUSE volume. See section 1.1.2 for specifications and restrictions.
- **Access Attribute** indicates the access attribute that is set for the LDEV. For more information on setting LDEV access, please see *Hitachi Freedom Storage™ Lightning 9900™ V Series Open LDEV Guard User's Guide* (MK-93RD158). The access levels are:
 - Read/Write
 - Read Only
 - Protect
- The **Capacity Unit** box shows the capacity of the LDEV selected for display in the **Capacity** column, in either **GByte** (default view) or **MByte**.
- **Selected LDEVs** shows the number of LDEVs selected in this table.

3.1.4 LDEV Operation Detail

The LDEV Operation detail is on the lower half of the LUSE tab (see Figure 3.5).

Number of LDEVs : 2
Size : 0.08 GB

Select an LDEV: 00:18 (OPEN-3 CVS, 0.04 GB) Volume Count: 2 (0.08 GB)

Expanded LDEVs

- 00:18 [Top]
- 00:1A

Selected LDEVs: 1

Free LDEVs

LDEV	RAID	PG
00:1B	1(2D+2D)	1 - 1
00:1C	1(2D+2D)	1 - 1
00:1D	1(2D+2D)	1 - 1
00:1E	1(2D+2D)	1 - 1
00:22	1(2D+2D)	1 - 1
00:23	1(2D+2D)	1 - 1
00:24	1(2D+2D)	1 - 1
00:25	1(2D+2D)	1 - 1

Selected LDEVs: 2

Buttons: << Add, Delete >>, Set, Apply, Cancel

Figure 3.5 LDEV Operation Detail (From the LUSE/VLL Panel, LUSE Tab)

The LDEV Operation Detail has the following features:

- **Number of LDEVs** indicates the number of LDEVs displayed in the Expanded LDEVs list.
- **Size** indicates the total capacity of the LDEVs displayed in the Expanded LDEVs list.
- The **Select an LDEV** drop-down box displays the LDEVs, VLL volumes, and LUSE volumes of the selected CU that are eligible to become part of a LUSE volume.
- The **Expanded LDEVs** list contains those LDEVs that are selected as LUSE volume components. An LDEV is added to this list when the <<Add button is selected (see below).
- The <<Add button is used to move a selected LDEV from the **Free LDEVs** list to the **Expanded LDEVs** list.
- The Delete>> button is used to move a selected LDEV from the **Expanded LDEVs** list to the **Free LDEVs** list.
- The **Free LDEVs** table displays the LDEVs that are eligible to become part of a LUSE volume.
- The **Volume Count** drop-down window lists the number of LDEVs that form a LUSE volume.

- The **Set** button is used to create a LUSE volume consisting of the free volumes currently in the **Expanded LDEVs** list. The new LUSE is displayed in *blue bold italics* on the **LDEV Detail** table (on the upper right corner of the **LUSE** tab; refer to Figure 3.3), but is not actually created until you select the **Apply** button (see below).
- The **LDEV** column shows an LDEV status icon, and the CU and LDEV number. If the selected LDEV is a LUSE volume, the LDEV number of the top LDEV in the LUSE volume is displayed. **Note:** An LDEV number ending in # indicates that the LDEV is a Hi-Copy volume. (e.g. **00:01#**). The icon will be one of the following:
 -  indicates a normal (free) LDEV
 -  indicates an expanded (LUSE) volume
- The **RAID** column shows the RAID level. **Note:** An unspecified RAID level (-) indicates a Hi-Copy volume.
- **PG** shows the disk group and the parity group.
 - If the LDEV extends over two or more parity groups, the **PG** column displays the smaller parity group number.
 - A parity group number beginning with E (e.g., **E1-1**) indicates that the parity group consists of one or more Hi-Copy volumes.
- The **Apply** button implements the settings to the subsystem.
- The **Cancel** button cancels the settings.

3.2 LUSE Operations

LUSE operations include the following:

- Viewing Concatenated Parity Groups (see section 3.2.1)
- Creating LUSE volumes (see section 3.2.2)
- Resetting unregistered LUSE volumes (see section 3.2.3)
- Releasing LUSE volumes (see section 3.2.4)
- Changing LUSE capacities (see section 3.2.5)

3.2.1 Viewing Concatenated Parity Groups

In the 9900V subsystem, data can be written to an LDEV that extends over two or more concatenated parity groups. Concatenation of parity groups enables faster access to data.

1. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button () to open the **LUSE/VLL** panel. The **LUSE** tab is the default view (refer to Figure 3.1).
2. Select a CU number from the **LDEV Information** outline (on the upper left corner of the **LUSE** tab; refer to Figure 3.2). The **LDEV Detail** table (on the upper right corner of the **LUSE** tab; refer to Figure 3.3) shows all LDEVs in the selected CU.
3. In the **LDEV Detail** table, select and then right click the LDEVs that you want to for the LUSE volume. If there are parity groups that are concatenated, this will display the **Concatenation List Pop-Up Menu** (see Figure 3.6).
4. Select **Concatenation List** to display the **Concatenation List** panel (see Figure 3.7).
5. When you are finished viewing the list, select **OK** to return to the **LUSE/VLL** panel, **LUSE** tab.

LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:06	Get LUSE Volume Release LUSE Volume Concatenation List		1(2D+2D)	1 - 1	1
00:07			1(2D+2D)	1 - 1	
00:08			5(3D+1P)	1 - 1	
00:10			1(2D+2D)	1 - 1	
00:11	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.6 Concatenation List Pop-Up Menu



Figure 3.7 Concatenation List Panel

3.2.2 Creating a LUSE Volume

WARNING: LUSE creation is a destructive operation. Move and/or back up your data before proceeding.

There are three ways to create a LUSE volume:

- Using the **LDEV Detail** table (see section 3.2.2.1)
- Using the **LDEV Operation** detail (see section 3.2.2.2)
- Using the **Volume Count** combo box (see section 3.2.2.3)

3.2.2.1 Creating a LUSE Volume From the LDEV Detail Table

To create a LUSE volume from the LDEV detail table:

1. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button () to open the **LUSE/VLL** panel. The **LUSE** tab is the default view (refer to Figure 3.1).
2. Select a CU number from the **LDEV Information** outline (on the upper left corner of the **LUSE** tab; refer to Figure 3.2). The **LDEV Detail** table (on the upper right corner of the **LUSE** tab; refer to Figure 3.3) shows all LDEVs in the selected CU.
3. In the **LDEV Detail** table, select and then right click the LDEVs that you want to include in the LUSE volume (see Figure 3.8). This will display the **Set LUSE Volume** pop-up menu (see Figure 3.9). If you want to use a path-defined LDEV as the top volume in the LUSE volume, see section 1.1.2 for specifications and restrictions.
4. Select **Set LUSE Volume**.
 - a) If the top LDEV in the LUSE volume has at least one path to it, the **LUSE Path Definition Confirmation** panel displays (see Figure 3.10). Select **OK** to continue, or select **Cancel** to cancel the operation. The **Set LUSE Confirmation** panel (1) (see Figure 3.11) displays. Select **OK** to continue, or select **Cancel** to cancel.
 - b) If the top LDEV in the LUSE volume has no paths to it, the **Data Initialize Warning** panel (see Figure 3.12) displays. Select **OK** to continue, or select **Cancel** to cancel the operation.
5. The new settings appear on the panel in **blue bold italics** but are not yet implemented (see Figure 3.13). If you want to reset the LUSE volume before it is implemented, see section 3.2.3).
6. If you want to apply the changes to the subsystem, select **Apply** and then select **OK** on the confirmation message (see Figure 3.14).
7. If you want to cancel the changes and not apply them to the subsystem, select **Cancel** and then select **OK** on the confirmation message (see Figure 3.15).

LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:06	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	1
00:07	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:08	OPEN-3	2.29 GB	5(3D+1P)	1 - 1	
00:10	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:11	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.8 Selecting LDEVs for LUSE Volume From the LDEV Detail Table

LDEV	Emulation	Capacity	RAID	PG	Paths
00:02	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	
00:03	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	
00:04	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	
00:05	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	
00:06	OPEN-V CVS	3.05 GB	1(2D+2D)	1 - 1	1
00:07	OPEN-V CVS			1 - 1	
00:08	OPEN-V			1 - 1	
00:09	OPEN-V			1 - 1	1
00:0A	OPEN-V			1 - 1	

Figure 3.9 Set LUSE Volume Pop-Up Menu

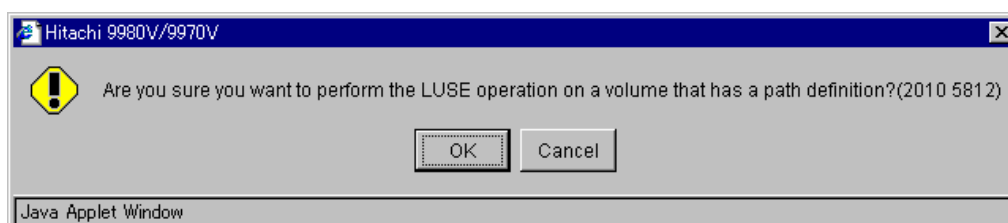


Figure 3.10 LUSE Path Definition Confirmation Panel

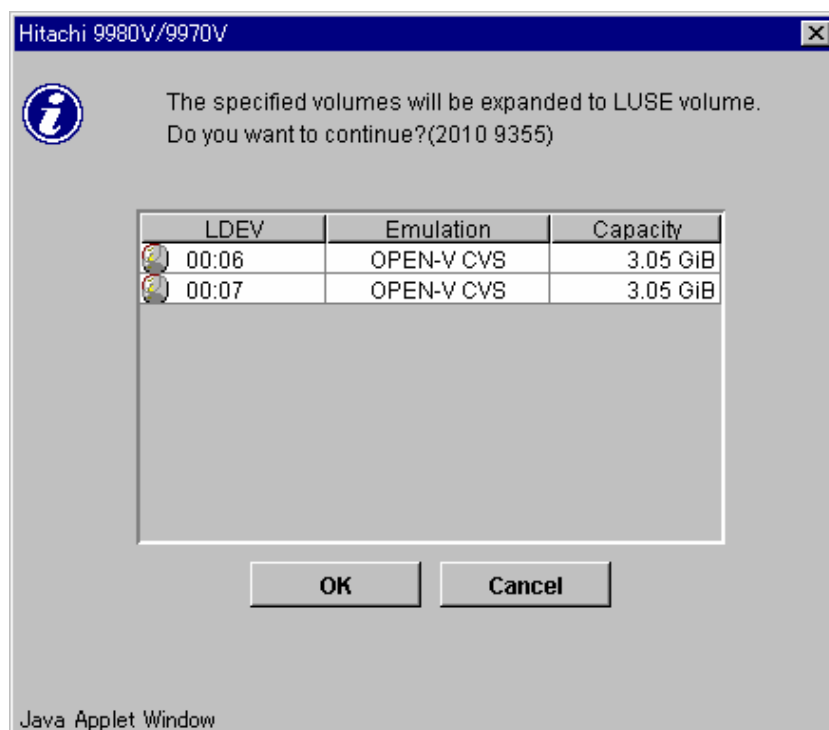


Figure 3.11 Set LUSE Volume Confirmation Panel

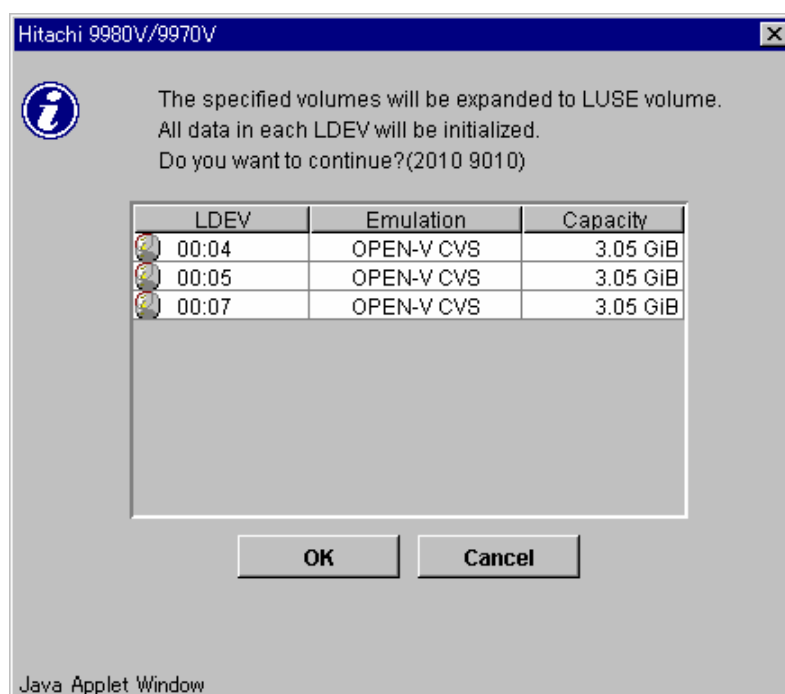


Figure 3.12 Data Initialize Warning Panel

LDEV	Emulation	Capacity	RAID	PG	Paths	
00:10	OPEN-V CVS	0.06 GB	1(2D+2D)	1 - 1		
00:11	OPEN-V CVS	0.06 GB	1(2D+2D)	1 - 1		
00:12	OPEN-V CVS	0.06 GB	1(2D+2D)	1 - 1		
00:13	OPEN-V *4 CVS	0.21(0.05) GB	1(2D+2D)	1 - 1		
00:14	OPEN-V CVS	0.07 GB	1(2D+2D)	1 - 1		
00:15	OPEN-V CVS	0.07 GB	1(2D+2D)	1 - 1		
00:16	OPEN-V CVS	0.07 GB	1(2D+2D)	1 - 1		
00:19	OPEN-V CVS	0.07 GB	1(2D+2D)	1 - 1		
00:1B	OPEN-V CVS	0.05 GB	1(2D+2D)	1 - 1		

Capacity Unit
☒ GByte
☐ MByte

Selected LDEVs : 0

Figure 3.13 New LUSE Volume Displayed

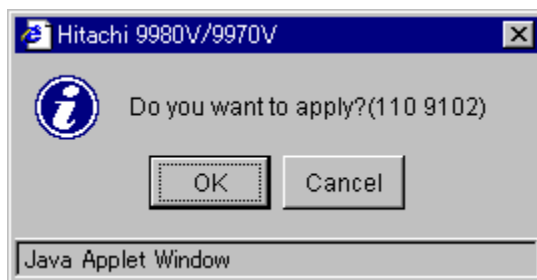


Figure 3.14 Apply Confirmation Message

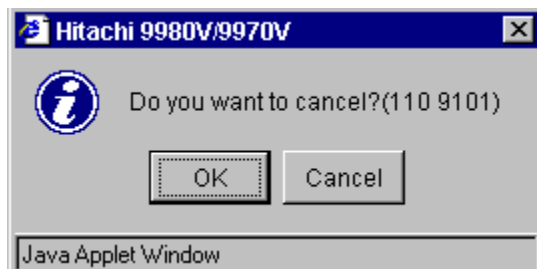


Figure 3.15 Cancel Confirmation Message

3.2.2.2 Creating a LUSE Volumes Using the LDEV Operation Detail

To create a LUSE volume using the LDEV Operation detail:

1. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button () to open the **LUSE/VLL** panel. The **LUSE** tab is the default view (refer to Figure 3.1).
2. Select a CU number from the **LDEV Information** outline (on the upper left corner of the **LUSE** tab; refer to Figure 3.2).
3. Select the **arrow** button in the **Select an LDEV** drop-down box (on the lower right of the panel; refer to Figure 3.5), then select the first LDEV for the LUSE from the **Free LDEVs** list (see Figure 3.16). If you want to use a path-defined LDEV as the top volume in the LUSE volume, see section 1.1.2 for specifications and restrictions.
4. Select one or more additional LDEVs for the LUSE volume, then select the **<<Add** button to move the selected LDEVs from the **Free LDEVs** list to the **Expanded LDEVs** list (see Figure 3.16).
5. If you want to delete an LDEV from the **Expanded LDEVs** list and move it back to the **Free LDEVs** list, select one or more volumes and then select the **Delete>>** button.
6. Select **Set LUSE Volume**.
 - a) If the top LDEV in the LUSE volume has at least one path to it, the LUSE Path Definition Confirmation panel displays (see Figure 3.17). Select **OK** to continue, or select **Cancel** to cancel the operation. The Set LUSE Confirmation panel displays (see Figure 3.18). Select **OK** to continue, or select **Cancel** to cancel.
 - b) If the top LDEV in the LUSE volume has no paths to it, the Data Initialize Warning panel (see Figure 3.19) displays. Select **OK** to continue, or select **Cancel** to cancel the operation.
7. The new settings appear on the panel in **blue bold italics** but are not yet implemented (see Figure 3.20). If you want to reset the LUSE volume before it is implemented, see section 3.2.3).
8. If you want to apply the changes to the subsystem, select **Apply** and then select **OK** on the confirmation message (refer to Figure 3.14).
9. If you want to cancel the changes and not apply them to the subsystem, select **Cancel** and then select **OK** on the confirmation message (refer to Figure 3.15).

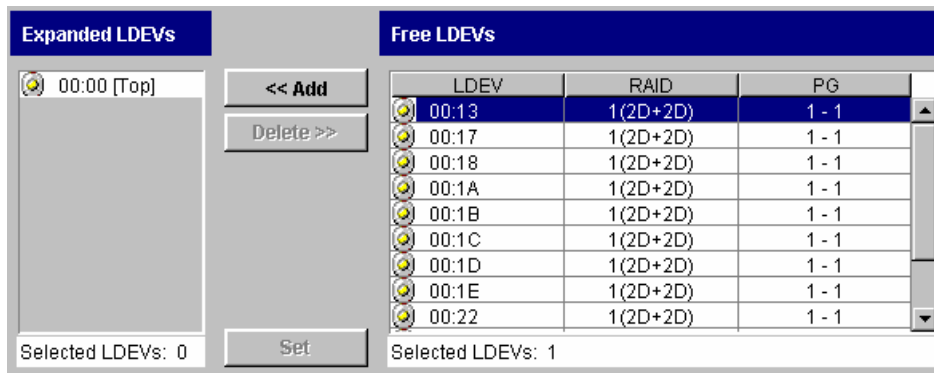


Figure 3.16 Selecting Free LDEVs from the LDEV Operation Detail

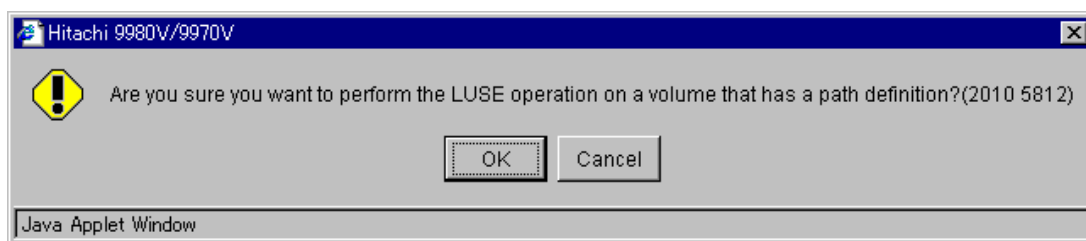


Figure 3.17 LUSE Path Confirmation Panel

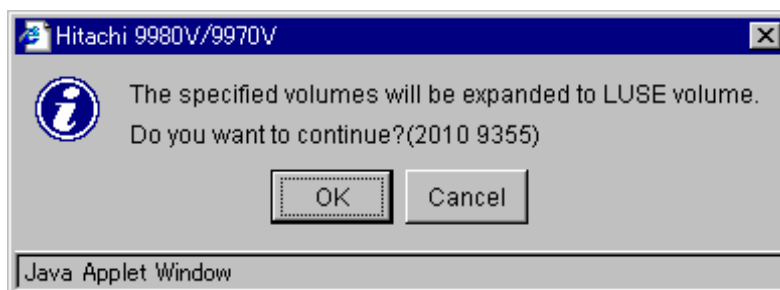


Figure 3.18 Set LUSE Confirmation Panel (2)

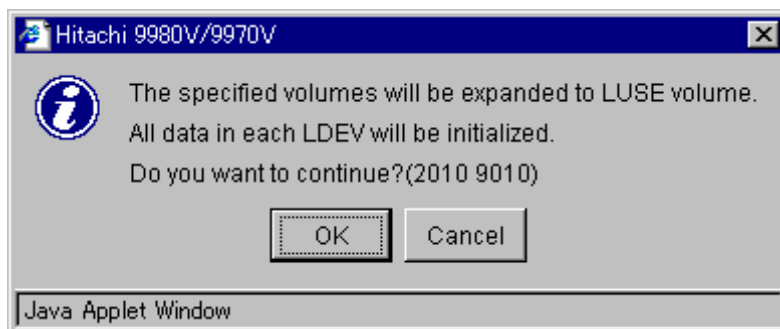


Figure 3.19 Data Initialize Warning Panel

LDEV	Emulation	Capacity	RAID	PG	Paths
 00:00	OPEN-V *3 CVS	0.16(0.05) GiB	1(2D+2D)	1 - 1	2
 00:01	OPEN-V CVS	0.07 GiB	1(2D+2D)	1 - 1	
 00:02	OPEN-V CVS	3.05 GiB	1(2D+2D)	1 - 1	
 00:03	OPEN-V CVS	3.05 GiB	1(2D+2D)	1 - 1	
 00:04	OPEN-V CVS	3.05 GiB	1(2D+2D)	1 - 1	
 00:05	OPEN-V CVS	3.05 GiB	1(2D+2D)	1 - 1	
 00:06	OPEN-V CVS	3.05 GiB	1(2D+2D)	1 - 1	1
 00:07	OPEN-V CVS	3.05 GiB	1(2D+2D)	1 - 1	
 00:08	OPEN-V	9.16 GiB	5(3D+1P)	1 - 1	

Figure 3.20 New LUSE Volumes Displayed

3.2.2.3 Creating a LUSE Volume Using the Volume Count Window

To create a LUSE volume using the **Volume Count** window:

1. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button () to open the **LUSE/VLL** panel. The **LUSE** tab is the default view (refer to Figure 3.1).
2. Select a CU number from the **LDEV Information** outline (on the upper left corner of the **LUSE** tab; refer to Figure 3.2).
3. From the **LDEV Operation Detail** (on the lower half of the **LUSE** tab; refer to Figure 3.5, select the arrow button in the **Select an LDEV** drop-down list (see Figure 3.21). Select the top LDEV of the LUSE volume from the drop-down list.
4. The selected top volume appears in the **Expanded LDEVs** list. LDEVs that can be used for a LUSE volume are displayed in the **Free LDEVs** list. If you want to use a path-defined LDEV as the top volume in the LUSE volume, see section 1.1.2 for specifications and restrictions.
5. Select the number of LDEVs needed to form a LUSE volume from the **Volume Count** box.
6. The **Expanded LDEVs** list displays the number of LDEVs that was specified in the **Volume Count** box. For example, if 3 is specified in **Volume Count**, three LDEVs appear in **Expanded LDEVs**.
7. If you want to add more LDEVs to the **Expanded LDEVs** list, select one or more LDEVs from the **Free LDEVs** list, then select **<<Add**.
8. To delete LDEVs from the **Expanded LDEVs** list, select one or more LDEVs from the **Expanded LDEVs** list, and select **Delete>>**.

9. Select Set LUSE Volume.
 - a) If the top LDEV in the LUSE volume has at least one path to it, the LUSE Path Definition Confirmation panel displays (see Figure 3.17). Select **OK** to continue, or select **Cancel** to cancel the operation. The Set LUSE Confirmation panel displays (refer to Figure 3.18). Select **OK** to continue, or select **Cancel** to cancel.
 - b) If the top LDEV in the LUSE volume has no paths to it, the Data Initialize Warning panel (refer to Figure 3.19) displays. Select **OK** to continue, or select **Cancel** to cancel.
10. The new settings appear on the panel in **blue bold italics** but are not yet implemented (refer to Figure 3.13). If you want to reset the LUSE volume before it is implemented, see section 3.2.3).
11. If you want to apply the changes to the subsystem, select **Apply** and then select **OK** on the confirmation message (refer to Figure 3.14).
12. If you want to cancel the changes and not apply them to the subsystem, select **Cancel** and then select **OK** on the confirmation message (refer to Figure 3.15).

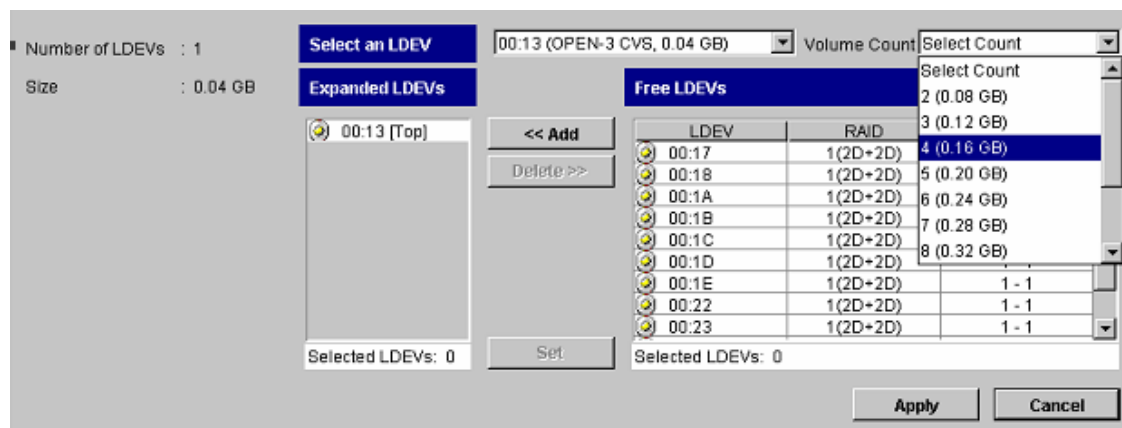


Figure 3.21 Selecting LUSE Volumes Using Volume Count

LDEV	Emulation	Capacity	RAID	PG	Paths
00:10	OPEN-V CVS	0.06 GB	1(2D+2D)	1 - 1	
00:11	OPEN-V CVS	0.06 GB	1(2D+2D)	1 - 1	
00:12	OPEN-V CVS	0.06 GB	1(2D+2D)	1 - 1	
00:13	OPEN-V *4 CVS	0.21(0.05) GB	1(2D+2D)	1 - 1	
00:14	OPEN-V CVS	0.07 GB	1(2D+2D)	1 - 1	
00:15	OPEN-V CVS	0.07 GB	1(2D+2D)	1 - 1	
00:16	OPEN-V CVS	0.07 GB	1(2D+2D)	1 - 1	
00:19	OPEN-V CVS	0.07 GB	1(2D+2D)	1 - 1	
00:1B	OPEN-V CVS	0.05 GB	1(2D+2D)	1 - 1	

Capacity Unit

☒ GByte

☐ MByte

Selected LDEVs : 0

Figure 3.22 New LUSE Volumes Displayed

3.2.3 Resetting an Unregistered LUSE Volume

After you have made the settings for a LUSE volume, but before you select **Apply** to implement those settings, the prospective LUSE volume is shown on the LUSE tab in *blue bold italics*. At the point in the process you can opt to reset the LUSE volume and release the individual LDEVs by using the reset LUSE volume function. This is different from merely canceling all of the stored actions, because you can choose to reset some but not all of the unregistered LUSE volumes.

Note: The reset LUSE function does not allow you to recover any LUSE volumes that have been previously released from a different LUSE volume.

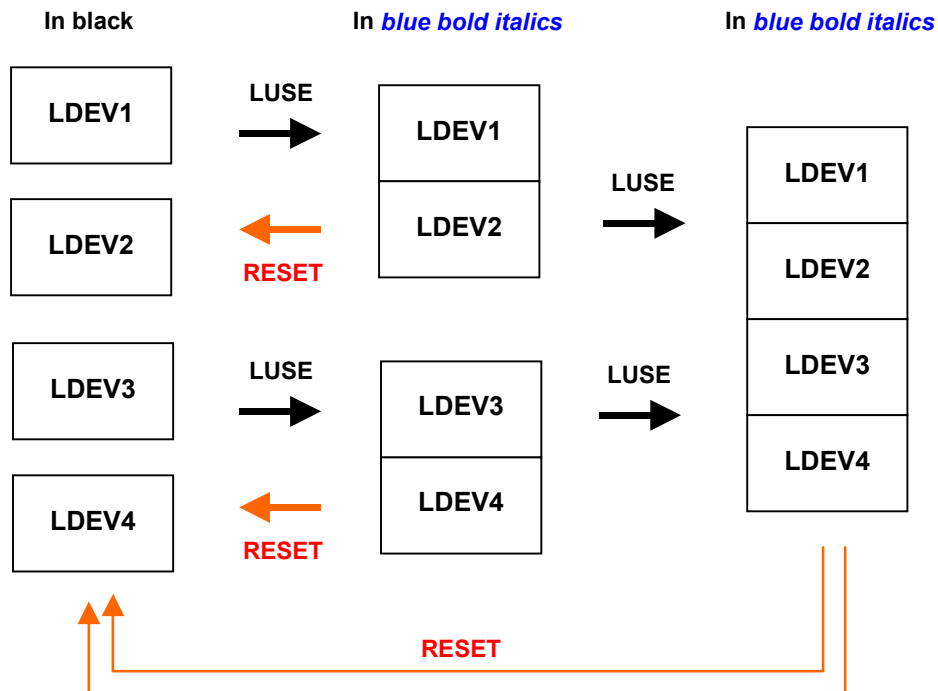


Figure 3.23 LDEVs That Have Not Been Released From a LUSE Volume

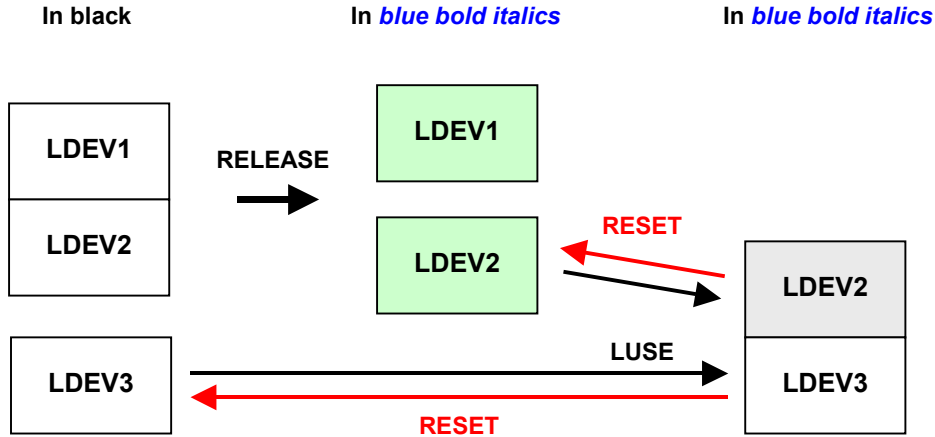


Figure 3.24 LDEVs That Have Previously Been Released From a LUSE Volume

To reset an unregistered LUSE volume:

1. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button (🔧) to open the **LUSE/VLL** panel. The **LUSE** tab is the default view (refer to Figure 3.1).
2. Select a CU number from the **LDEV Information** outline (on the upper left corner of the **LUSE** tab; refer to Figure 3.2).
3. The **LDEV Detail** table (on the upper right corner of the **LUSE** tab; refer to Figure 3.3) shows all LDEVs in the selected CU. LUSE volumes that have been created but have not yet been registered with the subsystem are shown in *blue bold italics*.
4. Select and then right-click an unregistered LUSE volume to display the **Reset Selected Volume** pop-up menu (see Figure 3.25).
5. Select **Reset Selected Volume** to display the Reset Selected Volume Confirmation panel (see Figure 3.26).
6. Select **OK** to confirm resetting the selected LUSE volume, or select **Cancel** to cancel.
7. The selected LUSE volume will be reset, and the LDEVs that were previously part of that LUSE volume will be displayed as separate volumes on the **LDEV Detail** table (see Figure 3.27).

LDEV	Emulation	Capacity	RAID	PG	Paths
01:00	OPEN-V CVS	58.59 GB	1(2D+2D)	1 - 1	
<i>01:01</i>	<i>OPEN-V*6 CVS</i>	<i>254.56(50.50 GB)</i>	<i>1(2D+2D)</i>	<i>1 - 1</i>	
01:07	OPEN-V CVS		2D	1 - 1	
01:08	OPEN-V CVS		2D	1 - 1	
01:09	OPEN-V CVS		2D	1 - 1	
01:0A	OPEN-V CVS		2D	1 - 1	
01:0B	OPEN-V CVS		2D	1 - 1	
01:0C	OPEN-V CVS	18.09 GB	1(2D+2D)	1 - 1	
01:0D	OPEN-V CVS	18.09 GB	1(2D+2D)	1 - 1	

Figure 3.25 Reset Selected Volume Pop-Up Menu

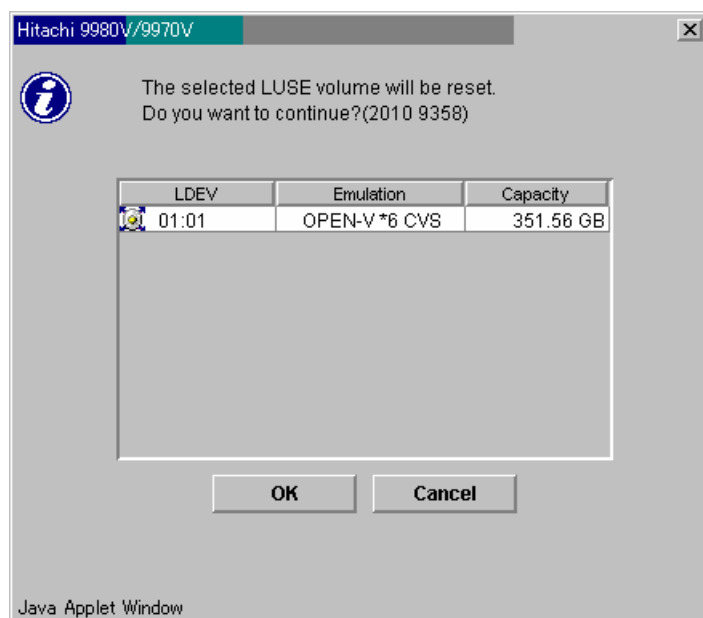


Figure 3.26 Reset LUSE Volume Confirmation Panel

LDEV	Emulation	Capacity	RAID	PG	Paths
01:00	OPEN-V CVS	58.59 GB	1(2D+2D)	1 - 1	
01:01	OPEN-V CVS	58.59 GB	1(2D+2D)	1 - 1	
01:02	OPEN-V *5 CVS	292.96(58.59) GB	1(2D+2D)	1 - 1	
01:07	OPEN-V CVS	58.59 GB	1(2D+2D)	1 - 1	
01:08	OPEN-V CVS	18.09 GB	1(2D+2D)	1 - 1	
01:09	OPEN-V CVS	18.09 GB	1(2D+2D)	1 - 1	
01:0A	OPEN-V CVS	18.09 GB	1(2D+2D)	1 - 1	
01:0B	OPEN-V CVS	18.09 GB	1(2D+2D)	1 - 1	
01:0C	OPEN-V CVS	18.09 GB	1(2D+2D)	1 - 1	

Figure 3.27 Displaying Reset Volumes

3.2.4 Releasing a LUSE Volume

WARNING: Releasing a LUSE volumes is a destructive operation. Move and/or back up your data before proceeding.

To release a LUSE volume:

1. Change to **Modify** mode. Delete all SCSI paths to the LUSE volume that you want released. For instructions on removing SCSI paths, please refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105).
2. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button () to open the **LUSE/VLL** panel. The **LUSE** tab is the default view (refer to Figure 3.1).
3. Select a CU number from the **LDEV Information** outline (on the upper left corner of the **LUSE** tab; refer to Figure 3.2). The **LDEV Detail** table (on the upper right corner of the **LUSE** tab; refer to Figure 3.3) shows all LDEVs in the selected CU.
4. Select a LUSE volume in the **LDEV Detail** table (on the upper right corner of the **LUSE** tab; refer to Figure 3.3). Right-click the LUSE volume to display the **Release LUSE Volume** pop-up menu (see Figure 3.29).
5. Select **Release LUSE Volume**.
6. The **Release LUSE Volume Confirmation** panel will display (see Figure 3.30). Verify that the LUSE volumes(s) listed in the confirmation panel are the one(s) that you want to release, then select **OK**. **Note:** The new settings will appear on the **LUSE** tab in **blue bold italics** but are not yet implemented (see Figure 3.31).
7. If you want to apply the changes to the subsystem, select **Apply** on the **LUSE** tab (refer to Figure 3.1) and then select **OK** on the confirmation message (refer to Figure 3.14).
8. If you want to cancel the changes and not apply them to the subsystem, select **Cancel** on the **LUSE** tab (refer to Figure 3.1) and then select **OK** on the confirmation message (refer to Figure 3.15).

LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:06	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	1
00:10	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:11	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:12	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:13	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.28 Selecting LUSE Volume(s) To Be Released

LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:06	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	1
00:10	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:11	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:12	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:13	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.29 Release LUSE Volume Pop-Up Menu

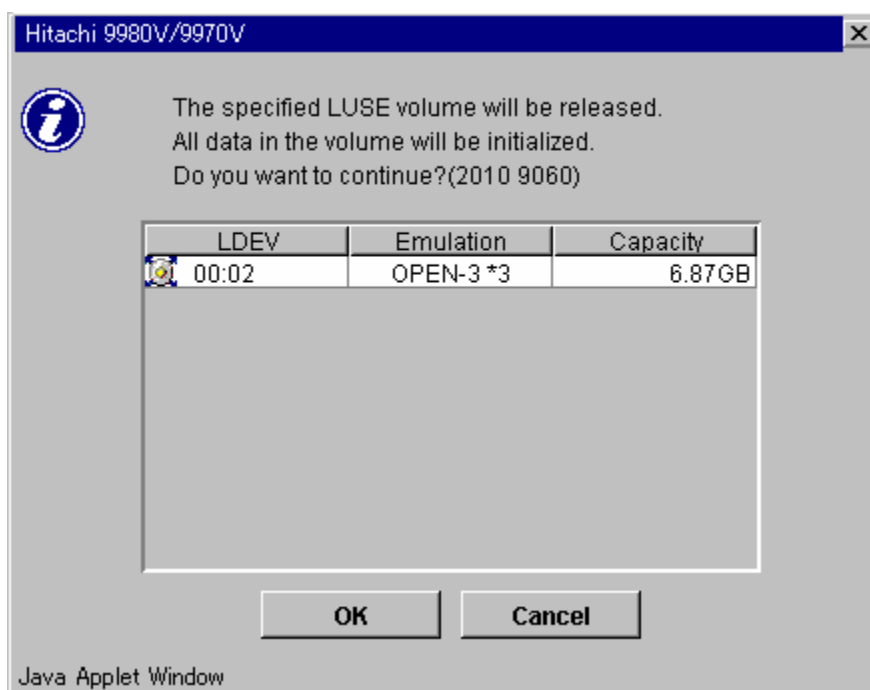


Figure 3.30 Release LUSE Volume Confirmation Panel

LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:06	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	1
00:07	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:08	OPEN-3	2.29 GB	5(3D+1P)	1 - 1	
00:10	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:11	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.31 Displaying Newly Released LUSE Volume

3.2.5 Changing LUSE Capacities

To expand the capacity of a LUSE volume, either select a LUSE volume that you want to expand, and then add LDEVs or LUSE volume(s), or first select LDEVs or LUSE volume(s) that you want to add, and then select a LUSE volume to be expanded. For further information, refer to section 3.2.2.

Note: Each LDEV or LUSE volume that you want to add must have the same capacity as each LDEV in the LUSE volume that you want to expand.

You may not reduce the capacity of an existing LUSE volume. If you want a LUSE volume to have a smaller capacity, you must first release the LUSE volume (refer to section 3.2.3) and then re-define the LUSE volume (refer to section 3.2.2).

Chapter 4 Virtual LVI/LUN (VLL)

4.1 Virtual LVI/LUN Panels

4.1.1 LUSE/VLL Panel, VLL Tab

The LUN Expansion (LUSE)/Virtual LVI/LUN (VLL) button () opens the LUSE/VLL panel. The LUSE tab is the default view. Select the VLL tab (see Figure 4.1). **Note:** The option buttons (along the left side of the panel) and the subsystem information icons (in the top right corner of the panel) have been omitted.

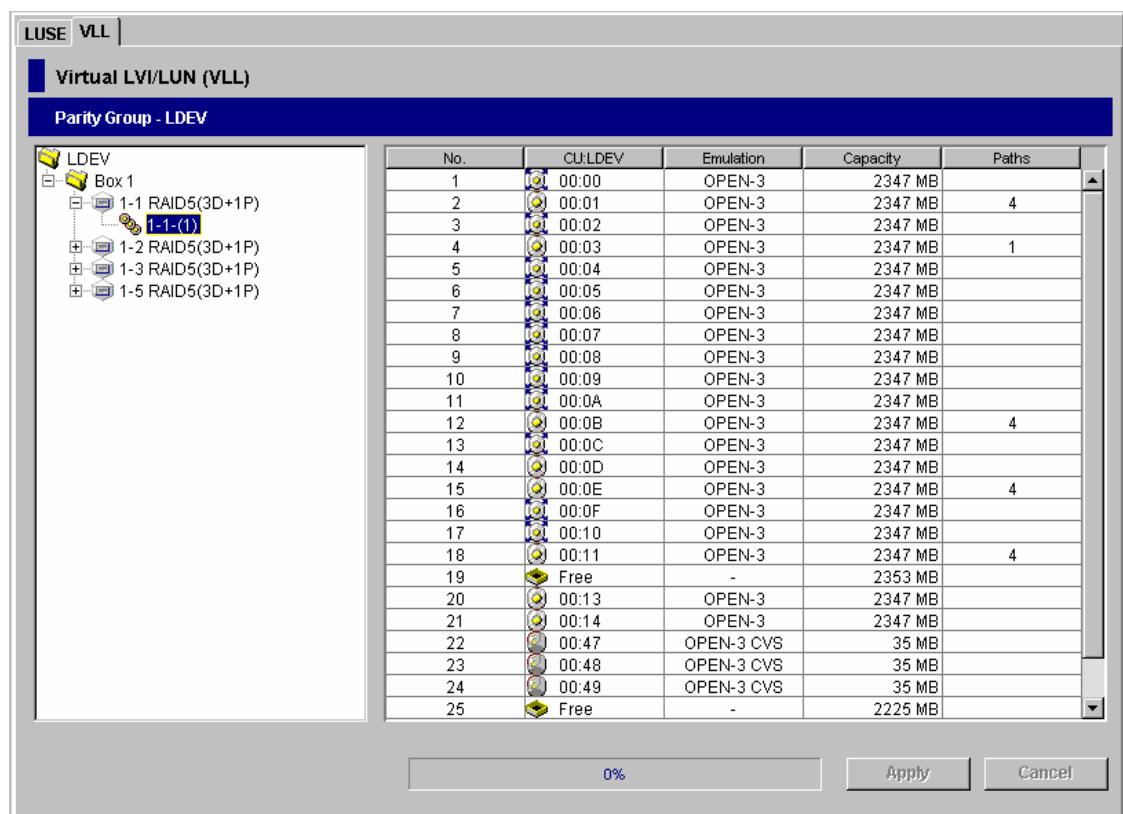


Figure 4.1 LUSE/VLL Panel, VLL Tab

4.1.2 Parity Group - LDEV Outline

The Parity Group - LDEV outline (on the upper left of the VLL tab; see Figure 4.2) shows the hierarchical structure of the subsystem, including a disk group number (e.g., Box 1), the parity group number (e.g., 1-1), the RAID level (e.g., 3D+1P), and the VDEV number (e.g., 1-1-(1)).



Figure 4.2 Parity Group - LDEV Outline (From the LUSE/VLL Panel, VLL Tab)

- Parity Group icons:
 - The  icon indicates a parity group.
 - The  icon indicates a set of parity groups that are concatenated.
- VDEV status icons:
 - The  icon indicates that there are no pending VLL actions on that VDEV.
 - The  icon indicates that VLL actions have been stored, but not yet implemented on the subsystem.

4.1.3 LDEV Information Table

When you select a VDEV in the **Parity Group - LDEV** outline, the **LDEV Information** table (on the upper right of the **VLL** tab; see Figure 4.3) displays information about the logical volumes in that VDEV.)

No.	CU:LDEV	Emulation	Capacity	Paths
1	00:00	OPEN-3	2347 MB	
2	00:01	OPEN-3	2347 MB	4
3	00:02	OPEN-3	2347 MB	
4	00:03	OPEN-3	2347 MB	1
5	00:04	OPEN-3	2347 MB	
6	00:05	OPEN-3	2347 MB	
7	00:06	OPEN-3	2347 MB	
8	00:07	OPEN-3	2347 MB	
9	00:08	OPEN-3	2347 MB	
10	00:09	OPEN-3	2347 MB	
11	00:0A	OPEN-3	2347 MB	
12	00:0B	OPEN-3	2347 MB	4
13	00:0C	OPEN-3	2347 MB	
14	00:0D	OPEN-3	2347 MB	
15	00:0E	OPEN-3	2347 MB	4
16	00:0F	OPEN-3	2347 MB	
17	00:10	OPEN-3	2347 MB	
18	00:11	OPEN-3	2347 MB	4
19	Free	-	2353 MB	
20	00:13	OPEN-3	2347 MB	
21	00:14	OPEN-3	2347 MB	
22	00:47	OPEN-3 CVS	35 MB	
23	00:48	OPEN-3 CVS	35 MB	
24	00:49	OPEN-3 CVS	35 MB	
25	Free	-	2225 MB	

0% Apply Cancel

Figure 4.3 LDEV Information Table (From the LUSE/VLL Panel, VLL Tab)

- The **No** column shows the volume number. **Note:** Only 25 volumes will fit on a page. The remaining volumes can be displayed by scrolling.
- The **CU:LDEV** column shows an icon and the CU and LDEV number. **Free** indicates free space. **Note:** An LDEV number ending in # indicates that the LDEV is a Hi-Copy volume. (e.g. 00:01#). An unspecified RAID level (-) indicates a Hi-Copy volume. The icon will be one of the following:
 -  indicates a normal LDEV
 -  indicates a LUSE volume
 -  indicates an LDEV reserved for Hitachi CruiseControl
 -  indicates a VLL volume
 -  indicates a VLL volume that is reserved for Hitachi CruiseControl
 -  indicates free space
 -  indicates an LDEV secured by Hitachi SANTinel - S/390®
- The **Emulation** column shows the emulation type.
- The **Capacity** column shows the capacity of the volume, in MB for open-system volumes and in cylinders (Cyl) for mainframe volumes.
- The **Paths** column shows the number of LU paths. Blank indicates no LU paths.
- **Access Attribute** (not shown in the screen shot) indicates the access attribute that is set for the LDEV. For more information on setting LDEV access, please see *Hitachi Freedom Storage™ Lightning 9900™ V Series Open LDEV Guard User's Guide (MK-93RD158)*. The access levels are:
 - Read/Write
 - Read Only
 - Protect
- The **Apply** button implements the settings that have been made in this panel.
- The **Cancel** button cancels the settings that have been made in this panel.

4.1.4 Install CV Panel (1) for OPEN-V

Hitachi 9980V/9970V

Install CV

Parity Group: 1-2 (1)

Emulation Type: OPEN-V

How to Create Volumes

No.	Emulation	Capacity (MB)	Capacity (Cyl)
1	OPEN-V	46 MB	50 Cyl
2	OPEN-V	46 MB	50 Cyl
3	OPEN-V	46 MB	50 Cyl
4	OPEN-V	46 MB	50 Cyl
5	OPEN-V	46 MB	50 Cyl
6	OPEN-V	46 MB	50 Cyl
7	OPEN-V	46 MB	50 Cyl
8	OPEN-V	46 MB	50 Cyl
9	OPEN-V	46 MB	50 Cyl
10	OPEN-V	46 MB	50 Cyl

available LDEVs : 239

Capacity Unit ☒ MB ☐ Cyl

☒ Specify size and number

Size: 46 MB 50 Cyl
(46 - 6560 MB) (50 - 6998 Cyl)

Number: 10 (1 - 136)

☐ Divide free space by number

Number:

☐ Divide free space by size

Size: MB Cyl

☐ Set remaining space as volume

Set Delete Clear

Next >> Cancel

Java Applet Window

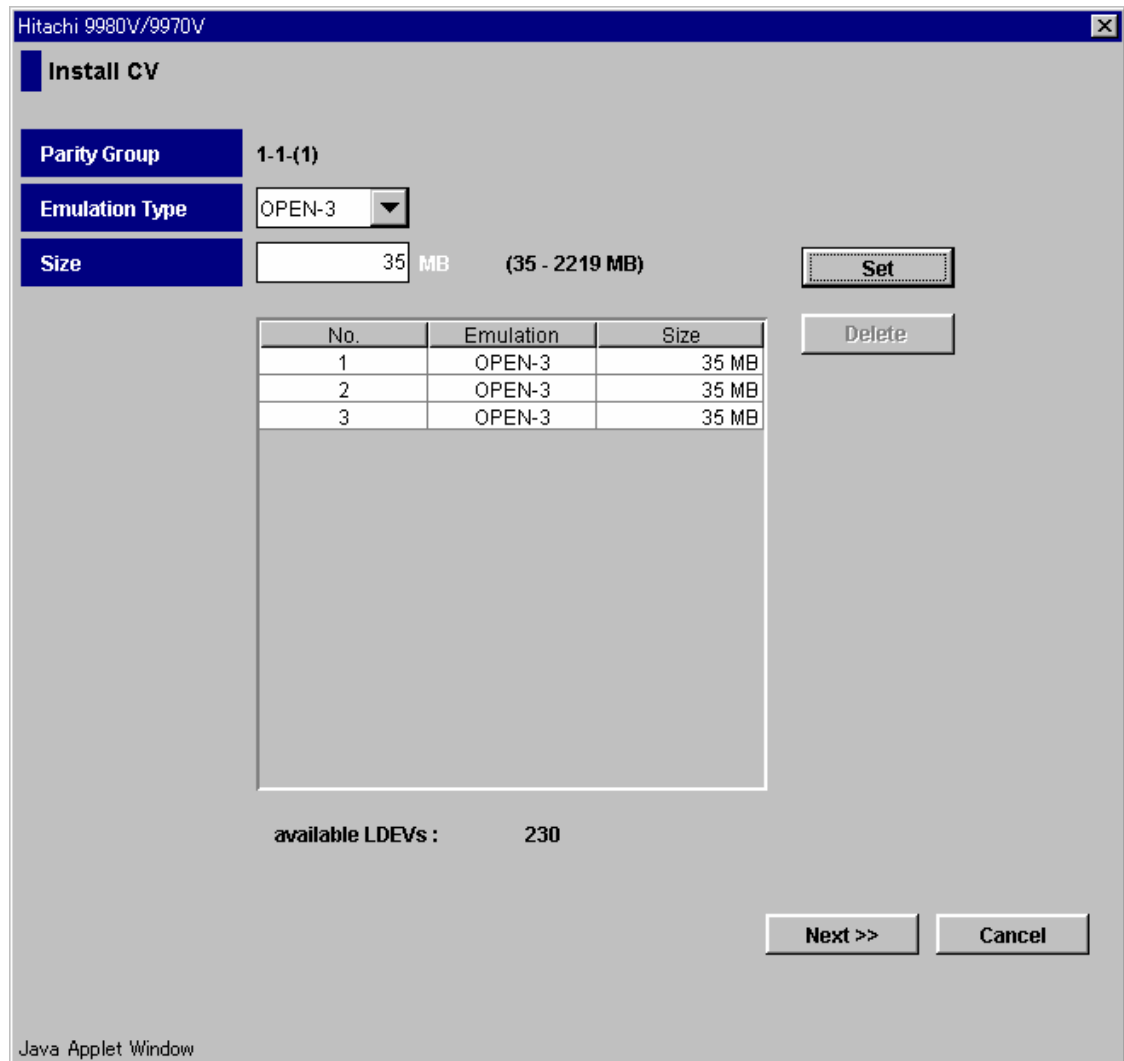
Figure 4.4 Install CV Panel (1) for OPEN-V

The Install CV Panel (1) for OPEN-V has the following features:

- The **Parity Group** field indicates the VDEV number of the selected free space. A parity group number beginning with E (e.g., E1-1) indicates that the parity group consists of one or more Hi-Copy volumes.
- The **Emulation** field indicates OPEN-V as the emulation type.
- The **LDEV information** table displays the following information about the VLL volume settings.
 - **No.** indicates the number of the VLL volume in the table.
 - **Emulation** indicates OPEN-V as the emulation type.
 - **Capacity (MB)** indicates the capacity of the VLL volume in MB.
 - **Capacity (Cyl)** indicates the capacity of the VLL volume in cylinders.
 - **Note:** When you create a VLL volume for use as a Hi-Copy volume, you must specify the capacity in cylinders.

- **available LDEVs** displays the number of LDEVs that can be created in the VDEV. The maximum is 512 LDEVs for RAID5 (7D+1P), and 256 LDEVs for other RAID levels.
- The **Capacity Unit** field allows you to select whether you will measure the capacity of the VLL volume in MB or in cylinders (Cyl).
- The **Specify size and number** field allows you to specify the capacity and the number of CVs in the VLL volume that you want to create. **Note:** If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Install CV function automatically creates the VLL volume in LUSE configuration.
 - The **Size** text box allows you to enter the capacity of the VLL volume, in either MB or Cyl, which is determined by what you specified in the preceding field. The available capacity range (minimum - maximum) is shown underneath. In the example above, the available capacity is 46 - 6720 MB or 50 - 7168 Cyl.
 - The **Number** text box allows you to enter the number of volumes of that size. The available range is shown on the right to the box.
- The **Divide Free Space by number** field is not available if there is more than one free space. If you select this option you can opt to divide the available free space into a specified number of VLL volumes. **Note:** If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Install CV function automatically creates the VLL volume in LUSE configuration.
- The **Divide free space by size** field is not available if there is more than one free space. If you select this option you can opt to specify the size of the VLL volumes to be created out of the available free space. **Note:** If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Install CV function automatically creates the VLL volume in LUSE configuration.
- The **Set Remaining Space as Volume** field is not available if there is more than one free space. If you select this option you can opt to create a VLL volume out of the remaining free space. **Note:** If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Install CV function automatically creates the VLL volume in LUSE configuration.
- The **Set** button displays the selected settings in the **LDEV information** table on the left.
- The **Delete** button deletes the settings from the VLL volume that is selected in the LDEV information table.
- The **Clear** button deletes all the settings in the LDEV information table.
- The **Next>>** button displays the **Install CV panel (2)** (see Figure 4.6).
- The **Cancel** button cancels the selected settings and returns you to the **LUSE/VLL** panel, **VLL** tab (refer to Figure 4.1).

4.1.5 Install CV Panel (1) (Other than OPEN-V)



The dialog box is titled "Hitachi 9980V/9970V" and contains the following elements:

- Install CV** (Section Header)
- Parity Group**: 1-1-(1)
- Emulation Type**: OPEN-3 (dropdown menu)
- Size**: 35 MB (input field) (35 - 2219 MB) (range)
- Buttons**: Set, Delete, Next >>, Cancel
- Table**:

No.	Emulation	Size
1	OPEN-3	35 MB
2	OPEN-3	35 MB
3	OPEN-3	35 MB
- available LDEVs :** 230
- Java Applet Window** (Footer)

Figure 4.5 Install CV Panel (1) For Other Than OPEN-V

The Install CV Panel (1) for emulation types other than OPEN-V has the following features:

- The **Parity Group** field indicates the VDEV number of the selected free space. A parity group number beginning with E (e.g., E1-1) indicates that the parity group consists of one or more Hi-Copy volumes.
- The **Emulation** field indicates the emulation type.
- The **Size** text box allows you to enter the capacity of the VLL volume, in either MB or Cyl, which is determined by what you specified in the preceding panel. The available capacity range (minimum - maximum) is shown to the right.
- The LDEV information table displays the following information about the VLL volume settings.
 - **No.** indicates the setting number of the VLL volume in the table.
 - **Emulation** indicates the emulation type.
 - **Capacity** indicates the capacity of the VLL volume.
- **available LDEVs** displays the number of LDEVs that can be created in the VDEV. The maximum is 512 LDEVs for RAID 5 (7D+1P), and 256 LDEVs for other RAID levels.
- The **Set** button displays the selected settings in the LDEV information table on the left.
- The **Delete** button deletes the VLL volume that is selected in the LDEV information table.
- The **Next>>** button displays the Install CV panel (2) (see Figure 4.6).
- The **Cancel** button cancels the selected settings and returns you to the Virtual LVI/LUN main panel (refer to Figure 4.1).

4.1.6 Install CV Panel (2) (All Emulation Types)

Hitachi 9980V/9970V

Install CV

ParityGroup 1-4-(1)

No.	Emulation	Size	CU:LDEV
7	OPEN-V	8126 MB (8668 Cyl)	00:36
8	OPEN-V	8126 MB (8668 Cyl)	00:37
9	OPEN-V	8126 MB (8668 Cyl)	00:38
10	OPEN-V	8126 MB (8668 Cyl)	00:39

Select LDEV Num... Please click the following cell Select CU No. CU 00 Interval 0

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+a	+b	+c	+d	+e	+f
+00																
+10																
+20																
+30																
+40																
+50																
+60																
+70																
+80																
+90																
+a0																
+b0																
+c0																
+d0																
+e0																
+f0																

<< Before Next >> Cancel

Java Applet Window

Figure 4.6 Install CV Panel (2)

The Install CV panel (2) is the same for all emulation types. It has the following features:

- **Parity Group** is the parity group number for the VDEV to be created. A parity group number beginning with E (e.g., E1-1) indicates that the parity group consists of one or more Hi-Copy volumes.
- The **VLL Volume Information** table (on the upper right of the panel) displays the following information about the VLL volumes that are to be created:
 - **No.** indicates the setting number of the VLL volume.
 - **Emulation** is the emulation type of the VLL volume.
 - **Size** is the capacity of the VLL volume you want to create, either in MB for open systems or in cylinders (Cyl) for mainframe volumes. **Note:** For OPEN-V volumes, the capacity is displayed in both MB and cylinders (Cyl) (e.g., 8126 MB or 8668 Cyl).

- **CU:LDEV** is the CU number and LDEV number for the VLL volume to be created. The default is blank. **Note:** An LDEV number ending in # (e.g. **00:01#**) indicates that the LDEV is a Hi-Copy volume.
- The **Select CU No.** drop-down list allows you to select a CU number. The default is CU 00. The LDEV numbers for the selected CU number are displayed in the **Select LDEV number** grid below.
- **Interval:** When you select more than one volume, this combo box allows you to set the interval between the LDEV numbers that need to be assigned to the newly created volumes. The default value is set to 0. When you select 0, the LDEV numbers that will be assigned will be consecutive.
Note: The value you specify as the interval between LDEV numbers counts only the available LDEV numbers and skips those that are not selectable.
- The **Select LDEV number** grid allows you to set LDEV numbers for the VLL volume to be created. Gray indicates LDEV numbers that are not selectable, white indicates unused LDEV numbers, and blue indicates available LDEV numbers. You can select an LDEV number from the white LDEV numbers in the table. **Note:** LDEV numbers that are not selectable may be already in use or already assigned to another emulation group (grouped by 32 LDEV numbers) (see Table 4.1).
- The <<Before button returns you to the **Install CV panel (1)** (see Figure 4.4).
- The Next>> button opens one of the following panels:
 - If the boundary area of the selected LDEV number does not have an SSID, the **Set SSID (Install CV)** panel (see Figure 4.7) will display.
 - If the boundary area of the selected LDEV number has an SSID, the **Install CV Confirmation** panel (see Figure 4.40) displays.
- The **Cancel** button cancels the selected settings and returns you to the **VLL** tab (refer to Figure 4.1).
- The **Clear** button removes a CU:LDEV number that is already assigned. To remove a CU:LDEV number, select a VLL volume number corresponding to the CU:LDEV number that you want to remove, right-click, and then select **Clear** from the pop-up menu.

Table 4.1 Emulation Groups

Emulation group	Emulation type
Group 1 3390	3, 3A, 3B, 3C, L
Group 2 3390	3R
Group 4 OPEN	3, 8, 9, E
Group 6 OPEN	V

4.1.7 Set SSID (Install CV) Panel (All Emulation Types)

The Set SSID (Install CV) panel displays during the creation of VLL volumes, if the boundary area of the selected LDEV number does not have an SSID. The **Set SSID (Install CV)** panel is the same for all emulation types. It has the following features:

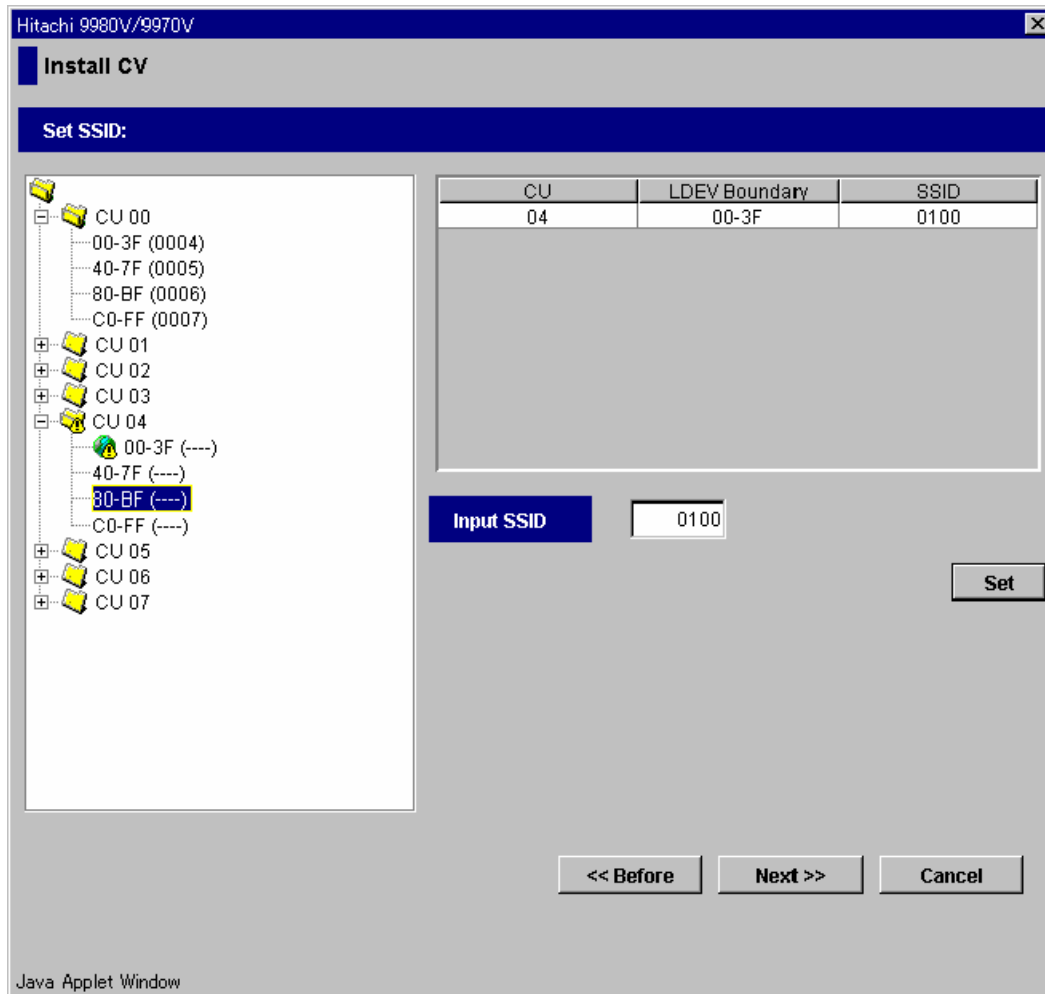


Figure 4.7 Set SSID (Install CV) Panel

The Set SSID (Install CV) panel is the same for all emulation types. It has the following features:

- The **SSID outline** displays CU numbers (e.g., CU 00), SSID boundary areas (e.g., 00-3F), and SSID (e.g., 0004).
 - ---- indicates a boundary area with no SSID
 -  indicates that the CU number is not extracted
 -  indicates that the CU number is extracted
 -  indicates the LDEV boundary area
- The **SSID table** is used to set the SSID boundary area.
 - The **CU** column shows a CU number that contains an LDEV boundary with no SSID.
 - The **LDEV boundary** column shows the boundary area of the LDEV number with no SSID.
 - The **SSID** field shows the specified SSID. The initial value is blank.
- The **Input SSID** box allows you to enter the desired SSID.
- The <<**Before** button will cancel the SSID setting and return you to the Install CV Panel (2) (refer to Figure 4.6).
- The **Next>>** button will take you to the Install CV Confirmation Panel (see Figure 4.40).
- The **Cancel** button will cancel the SSID setting and return you to the **LUSE/VLL panel**, **VLL** tab (refer to Figure 4.1).

4.1.8 Volume Initialize Panel (Other Than OPEN-V)

Hitachi 9980V/9970V

Volume Initialize

ParityGroup 1-1-(1)

No.	Emulation	Size	CU:LDEV
1	OPEN-3	2347 MB	03:00
2	OPEN-3	2347 MB	03:01
3	OPEN-3	2347 MB	03:02
4	OPEN-3	2347 MB	03:03

Select LDEV No.: Please click the following cell Select CU No. CU 03 Interval 0

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+a	+b	+c	+d	+e	+f
+00																
+10																
+20																
+30																
+40																
+50																
+60																
+70																
+80																
+90																
+a0																
+b0																
+c0																
+d0																
+e0																
+f0																

Next >> Cancel

Java Applet Window

Figure 4.8 Volume Initialize Panel

The Volume Initialize panel has the following features:

- The **Parity Group** field identifies the VDEV number of the VLL volume to be initialized. A parity group number beginning with E (e.g., E1-1) indicates that the parity group consists of one or more Hi-Copy volumes.
- The **LDEV information** table (on the upper left of the panel) displays detailed information about the VLL volume settings.
 - **No.** is the setting number of the VLL volume in the table.
 - **Emulation** indicates the emulation type of the VLL volume.
 - **Size** indicates the capacity of the VLL volume to be initialized, in either MB for open-system volumes, or cylinders (Cyl) for mainframe volumes.
 - **CU:LDEV** indicates the CU number and LDEV number for the VLL volume to be initialized. The default is blank. An LDEV number ending in # (e.g. 00:01#) indicates that the LDEV is a Hi-Copy volume.
- The **Select CU No.** drop-down list allows you to select a CU number. The default is CU 00. The LDEV numbers for the selected CU number are displayed in the **Select LDEV Number** table.
- **Interval** - When you select more than one volume, this combo box allows you to set the interval between the LDEV numbers that need to be assigned to the newly created volumes. The default value is set to 0. When you select 0, the LDEV numbers that will be assigned will be consecutive.

Note: The value you specify as the interval between LDEV numbers counts only the available LDEV numbers and skips those that are not selectable.
- The **Select LDEV number** grid allows you to select LDEV numbers for the VLL volume to be created. Gray indicates LDEV numbers that are not selectable, white indicates unused LDEV numbers, and blue indicates available LDEV numbers. You can select an LDEV number from the white LDEV numbers in the table. **Note:** LDEV numbers that are not selectable may be already in use, or already assigned to the other emulation group (grouped by 32 LDEV numbers; refer to Table 4.1).
- The **Next>>** button opens one of the following panels:
 - If the boundary area of the selected LDEV number does not have an SSID, the Set SSID (Volume Initialize) panel displays (see Figure 4.9).
 - If the boundary area of the selected LDEV number has an SSID, the Volume Initialize Confirmation panel displays (see Figure 4.10).
- The **Cancel** button cancels the selected settings and returns you to the **LUSE/VLL panel, VLL tab** (refer to Figure 4.1).
- The **Clear** button removes a CU:LDEV number that is already assigned. To remove a CU:LDEV number, select a VLL volume number corresponding to the CU:LDEV number that you want to remove, right-click, and then select **Clear** from the pop-up menu.

4.1.9 Set SSID (Volume Initialize) Panel (Other Than OPEN-V)

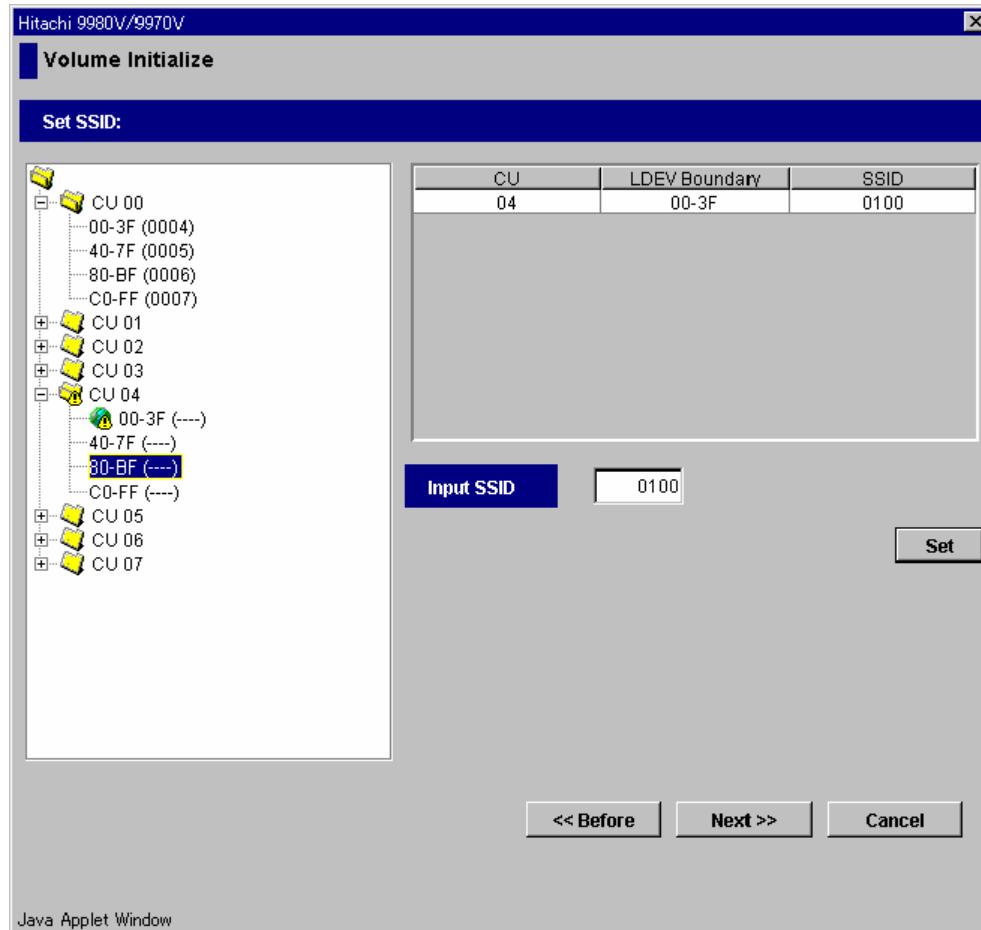


Figure 4.9 Set SSID (Volume Initialize) Panel

The Set SSID (Volume Initialize) panel has the following features:

- The **SSID outline** displays CU numbers (e.g., CU 00), SSID boundary areas (e.g., 00-3F), and SSID (e.g., 0004).
 - ---- indicates a boundary area with no SSID
 -  indicates that the CU number is not extracted
 -  indicates that the CU number is extracted
 -  indicates the LDEV boundary area
- The **SSID table** is used to set the SSID boundary area.
 - The **CU** column shows a CU number that contains an LDEV boundary with no SSID.
 - The **LDEV boundary** column shows the boundary area of the LDEV number with no SSID.
 - The **SSID** field shows the specified SSID. The initial value is blank.
- The **Input SSID** box allows you to enter the desired SSID.
- The <<**Before** button will cancel the SSID setting and return you to the Volume Initialize panel (refer to Figure 4.8).
- The **Next**>> button will take you to the Volume Initialize Confirmation panel (see Figure 4.48).
- The **Cancel** button will cancel the SSID setting and return you to the **LUSE/VLL panel**, **VLL** tab (refer to Figure 4.1).

4.1.10 Volume Initialize Confirmation Panel (Other Than OPEN-V)

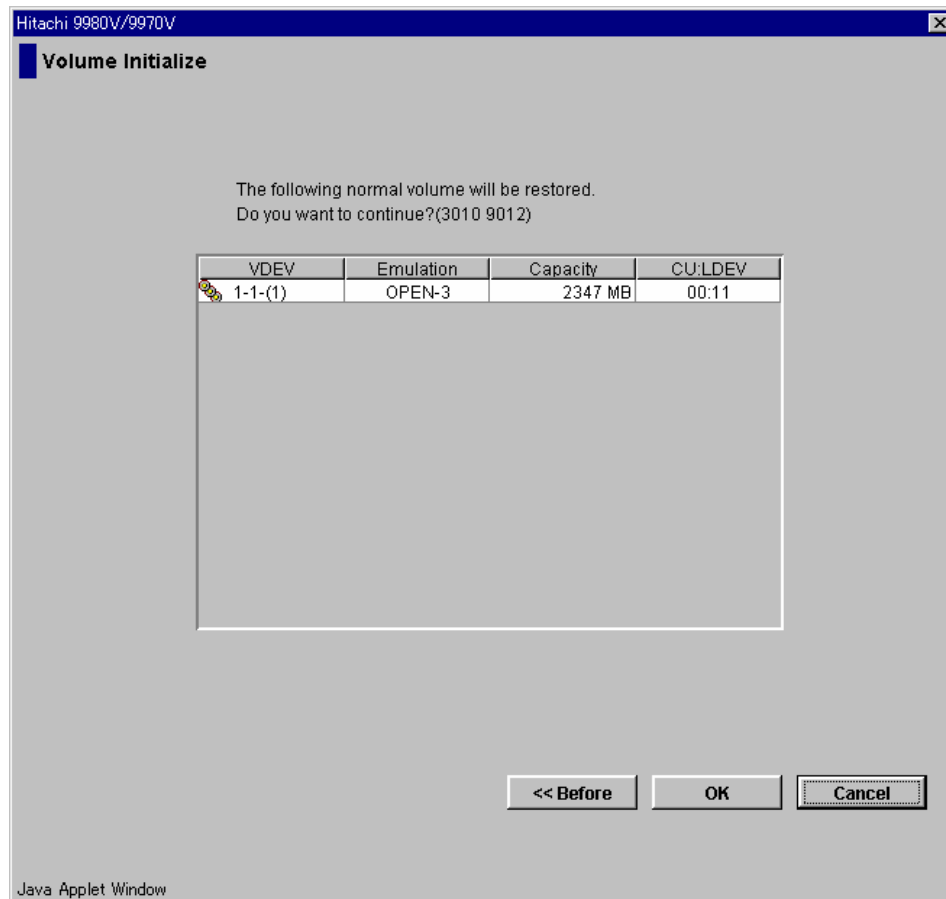


Figure 4.10 Volume Initialize Confirmation Panel

The Volume Initialize Confirmation panel has the following features:

The VLL volume-setting table displays a list of VLL volumes to be initialized, with the following information:

- **VDEV** displays the VDEV number.
 - **Emulation** displays the emulation type.
 - **Capacity** displays the capacity of the VLL volume to be created, either in MB for open systems or in cylinders (Cyl) for mainframe volumes)
 - **CU:LDEV** displays the CU:LDEV number. An LDEV number ending in # (e.g. 00:01#) indicates that the LDEV is a Hi-Copy volume.
- The **<<Before** button returns you to the previous panel.
 - The **OK** button confirms the selected settings, and returns you to the Virtual LVI/LUN main panel (refer to Figure 4.1).
 - The **Cancel** button cancels the selected settings, and returns you to the Virtual LVI/LUN main panel (refer to Figure 4.1).

4.1.11 Make Volume Panel (1) for OPEN-V

Hitachi 9980V/9970V

Make Volume

Parity Group: 1-4.(1)

Emulation Type: OPEN-V

How to Create Volumes

No.	Emulation	Capacity (MB)	Capacity (Cyl)
1	OPEN-V	8126 MB	8668 Cyl
2	OPEN-V	8126 MB	8668 Cyl
3	OPEN-V	8126 MB	8668 Cyl
4	OPEN-V	8126 MB	8668 Cyl
5	OPEN-V	8126 MB	8668 Cyl
6	OPEN-V	8126 MB	8668 Cyl
7	OPEN-V	8126 MB	8668 Cyl
8	OPEN-V	8126 MB	8668 Cyl
9	OPEN-V	8126 MB	8668 Cyl
10	OPEN-V	8126 MB	8668 Cyl

available LDEVs : 502

Capacity Unit: ☒ MB ☐ Cyl

☐ Specify size and number

Size: MB Cyl

Number:

☒ Divide free space by number

Number: (0)

☐ Divide free space by size

Size: MB Cyl

☐ Set remaining space as volume

Set Delete Clear

Next >> Cancel

Java Applet Window

Figure 4.11 Make Volume Panel (1) for OPEN-V

The Make Volume panel (1) for OPEN-V has the following features:

- The **Parity Group** field identifies the VDEV number of the VLL volume to be initialized. A parity group number beginning with E (e.g., E1-1) indicates that the parity group consists of one or more Hi-Copy volumes.
- The **Emulation Type** field displays OPEN-V.
- The LDEV information table (on the upper left of the panel) displays detailed information about the VLL volume settings.
 - **No.** is the setting number of the VLL volume in the table.
 - **Emulation** indicates OPEN V as the emulation type of the VLL volume.
 - **Capacity (MB)** indicates the capacity of the VLL volume in MB.
 - **Capacity (Cyl)** indicates the capacity of the VLL volume in cylinders (Cyl).

- **available LDEVs** displays the number of LDEVs that can be created in the VDEV. The maximum is 512 LDEVs for RAID5 (7D+1P), and 256 LDEVs for other RAID levels.
- The **Capacity Unit** buttons allow you to select whether the capacity of the VLL volume will be measured in MB or in cylinders (Cyl).
- The **Specify size and number** buttons allows you to create VLL volumes by specifying the capacity and the number of CVs in the VLL volume to be created. **Note:** If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Make Volume function automatically creates the VLL volume in LUSE configuration.
 - The **Size** field allows you to enter the capacity of the VLL volumes to be created, in either MB or cyl, as selected by the **Specify size and number** buttons. If this option is selected the available capacity range (minimum - maximum) is shown under the **Size** field.
 - The **Number** field allows you to enter the number of CVs. If this option is selected the available range is shown on the right to the box.
- The **Divide free space by number** button allows you to create VLL volumes by specifying the number of CVs in the VLL volume to be created. **Note:** If the capacity of the VLL volume exceeds 60 gigabytes (65,535 cylinders), the Make Volume function automatically creates the VLL volume in LUSE configuration.
 - The **Number** field allows you to enter the number of CVs in the VLL volume. If this option is selected the available range is shown on the right to the box.
- The **Divide free space by size** button allows you to create VLL volumes by specifying the capacity of CVs in the VLL volume to be created. **Note:** If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Make Volume function automatically creates the VLL volume in LUSE configuration.
 - The **Size** field allows you to enter the capacity of the VLL volumes to be created. The available capacity range (minimum - maximum) is shown under the **Size** field. For example, 46 - 6720 MB or 50 - 7168 Cyl.
- The **Set remaining space as volume** button allows you to create a VLL volume using the remaining space on the VDEV. For example, you can first select **Specify size and number** to create one or more VLL volumes, and then select **Set remaining space as volume** to create another VLL volume. **Note:** If the capacity of the VLL volume exceeds 60 gigabytes (65,535 cylinders), the Make Volume function automatically creates the VLL volume in LUSE configuration.
- The **Set** button displays the selected volume in the LDEV information table.
- The **Delete** button deletes the VLL volume selected in the LDEV information table.
- The **Clear** button deletes all the settings in the LDEV information table.
- The **Next>>** button opens the Make Volume panel (2) (see Figure 4.13).
- The **Cancel** button cancels the settings for the VLL volume, and returns you to the Virtual LVI/LUN main panel.

4.1.12 Make Volume Panel (1) for other than OPEN-V

Hitachi 9980V/9970V

Make Volume

Parity Group: 1-4 (1)

Emulation Type: OPEN-V

How to Create Volumes

No.	Emulation	Capacity (MB)	Capacity (Cyl)
1	OPEN-V	8126 MB	8668 Cyl
2	OPEN-V	8126 MB	8668 Cyl
3	OPEN-V	8126 MB	8668 Cyl
4	OPEN-V	8126 MB	8668 Cyl
5	OPEN-V	8126 MB	8668 Cyl
6	OPEN-V	8126 MB	8668 Cyl
7	OPEN-V	8126 MB	8668 Cyl
8	OPEN-V	8126 MB	8668 Cyl
9	OPEN-V	8126 MB	8668 Cyl
10	OPEN-V	8126 MB	8668 Cyl

available LDEVs : 502

Capacity Unit: ☒ MB ☐ Cyl

☐ Specify size and number

Size: MB Cyl

Number:

☒ Divide free space by number

Number: 10 (0)

☐ Divide free space by size

Size: MB Cyl

☐ Set remaining space as volume

Set Delete Clear

Next >> Cancel

Java Applet Window

Figure 4.12 Make Volume Panel (1) for other than OPEN-V

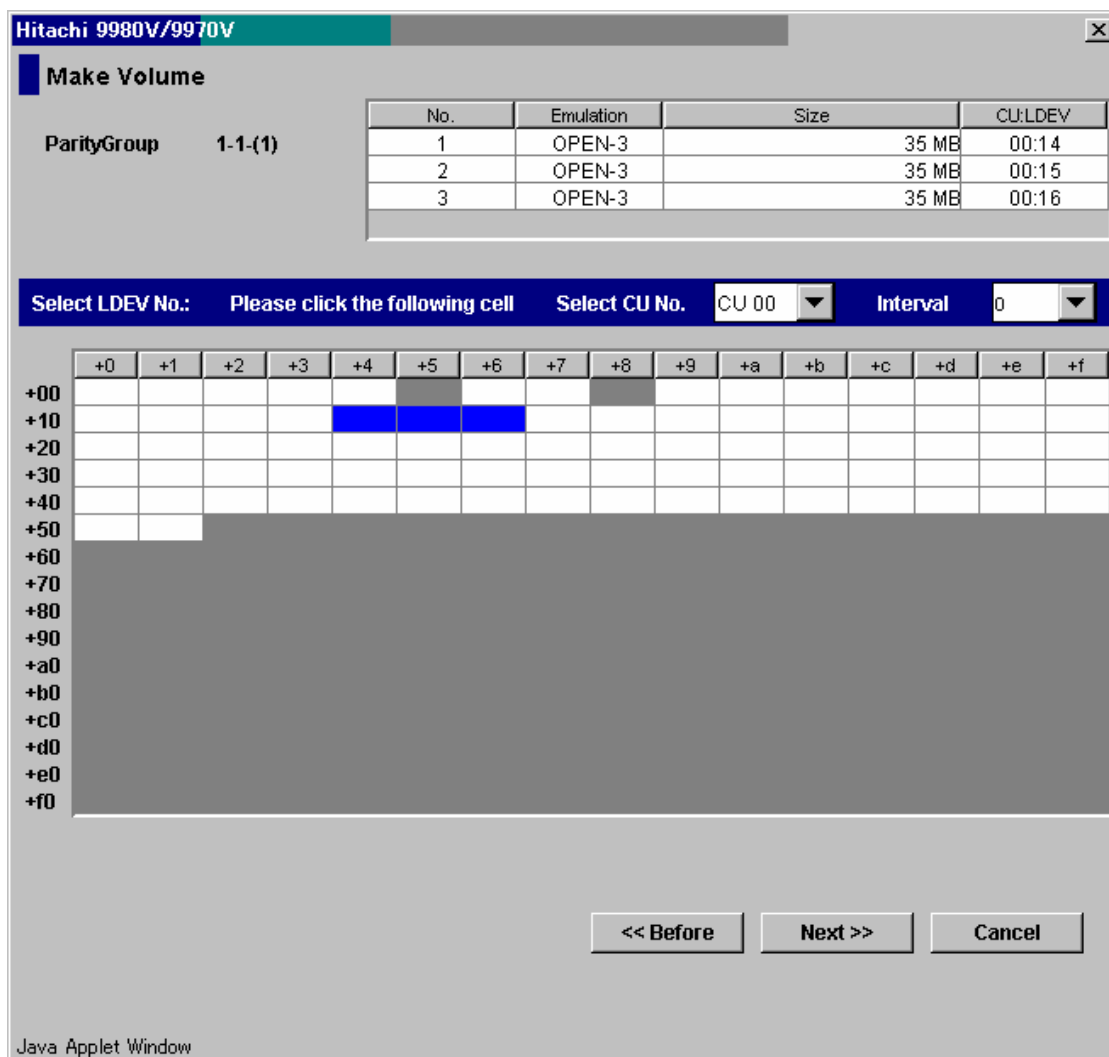
The Make Volume panel (1) for other than OPEN-V has the following features:

- **Parity Group** - VDEV number of the selected free space.
Note: A VDEV number that starts with a letter “E” indicates that the VDEV belongs to a parity group that consists of one or more external LUs. (e.g. E1-1)
- **Emulation Type** - Allows you to select the emulation type in the **Emulation Type** drop-down list.
- **Size** - Allows you to enter the capacity of the VLL volume you want to create, either in MB for open systems or in cylinders (Cyl) for mainframe volumes. The available capacity range (minimum - maximum) is shown to the right of the Size field. The value can be incremented by one MB (open systems) or by one Cylinder (mainframe systems).

- **Set** - Displays the selected volume in the table on the left.
- **Delete** - Deletes the VLL volume selected in the table.
- **LDEV Information** table (on the upper right of the panel) displays detailed information about the LDEVs of the selected VDEV.
 - **No.** - Setting number of the VLL volume in the table.
 - **Emulation** - Emulation type of the VLL volume.
 - **Size** - Capacity of the VLL volume.
- **available LDEVs** - Number of LDEVs that can be created in the VDEV. A maximum of 512 LDEVs for **RAID5 (7D+1P)** levels, or 256 LDEVs for other RAID levels, are available in one VDEV.
- **Next>>** - Displays the Make Volume panel (2).
- **Cancel** - Cancels the settings for the VLL volume, and returns you to the Virtual LVI/LUN main panel.

4.1.13 Make Volume Panel (2)

The Make Volume (2) panel opens when you select the **Next>>** button on the Make Volume Panel (1), and allows you to assign a CU number and an LDEV number for the VLL volumes to be created.



The screenshot shows the 'Hitachi 9980V/9970V' window with the 'Make Volume' tab selected. The 'ParityGroup' is set to '1-1-(1)'. A table lists three volumes with their emulation type, size, and CU:LDEV values. Below this is a grid for selecting LDEV numbers (rows +00 to +f0) and CU numbers (columns +0 to +f). The grid shows that CU 00 is selected for LDEVs +00, +10, +20, +30, +40, +50, +60, +70, +80, +90, +a0, +b0, +c0, +d0, +e0, and +f0. The 'Interval' is set to 0. Navigation buttons '<< Before', 'Next >>', and 'Cancel' are at the bottom right. The window is a Java Applet Window.

No.	Emulation	Size	CU:LDEV
1	OPEN-3	35 MB	00:14
2	OPEN-3	35 MB	00:15
3	OPEN-3	35 MB	00:16

Select LDEV No.: Please click the following cell Select CU No. CU 00 Interval 0

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+a	+b	+c	+d	+e	+f
+00																
+10																
+20																
+30																
+40																
+50																
+60																
+70																
+80																
+90																
+a0																
+b0																
+c0																
+d0																
+e0																
+f0																

<< Before Next >> Cancel

Java Applet Window

Figure 4.13 Make Volume Panel (2)

The Make Volume panel (2) has the following features:

- **Parity Group** is the parity group number for the VDEV to be created. A parity group number beginning with E (e.g., E1-1) indicates that the parity group consists of one or more Hi-Copy volumes.
- The VLL volume-information table (on the upper right of the panel) displays the following information about the VLL volumes that are to be created:
 - **No.** indicates the setting number of the VLL volume.
 - **Emulation** is the emulation type of the VLL volume.
 - **Size** is the capacity of the VLL volume you want to create. **Note:** For OPEN-V volumes, the capacity is displayed in both MB and cylinders (Cyl) (e.g., 8126 MB (8668 Cyl.))
 - **CU:LDEV** is the CU number and LDEV number for the VLL volume to be created. The default is blank. An LDEV number ending in # (e.g. 00:01#) indicates that the LDEV is a Hi-Copy volume.
- The **Select CU No.** drop-down list allows you to select a CU number. The default is CU 00. The LDEV numbers for the selected CU number are displayed in the **Select LDEV number** grid below.
- The **Select LDEV number** grid allows you to set LDEV numbers for the VLL volume to be created. Gray indicates LDEV numbers that are not selectable, white indicates unused LDEV numbers, and blue indicates available LDEV numbers. You can select an LDEV number from the white LDEV numbers in the table. **Note:** LDEV numbers that are not selectable may be already in use, or already assigned to another emulation group. Emulation groups consist of 32 pre-assigned LDEVs (refer to Table 4.1).
- **Interval** - When you select more than one volume, this combo box allows you to set the interval between the LDEV numbers that need to be assigned to the newly created volumes. The default value is set to 0. When you select 0, the LDEV numbers that will be assigned will be consecutive.

Note: The value you specify as the interval between LDEV numbers counts only the available LDEV numbers and skips those that are not selectable.
- The **Next>>** button opens one of the following panels:
 - If the boundary area of the selected LDEV number does not have an SSID, the Set SSID (Make Volume) panel displays (see Figure 4.14).
 - If the boundary area of the selected LDEV number has an SSID, the Make Volume Confirmation panel displays (see Figure 4.15).
- The **Cancel** button cancels the selected settings and returns you to the Virtual LVI/LUN main panel (refer to Figure 4.1).
- The **Clear** button removes a CU:LDEV number that is already assigned. To remove a CU:LDEV number, select a VLL volume number corresponding to the CU:LDEV number that you want to remove, right-click, and then select **Clear** from the pop-up menu.

4.1.14 Set SSID (Make Volume) Panel (OPEN-V)

The Set SSID (Make Volume) panel displays during the creation of OPEN-V VLL volumes if the boundary area of the selected LDEV number does not have an SSID.

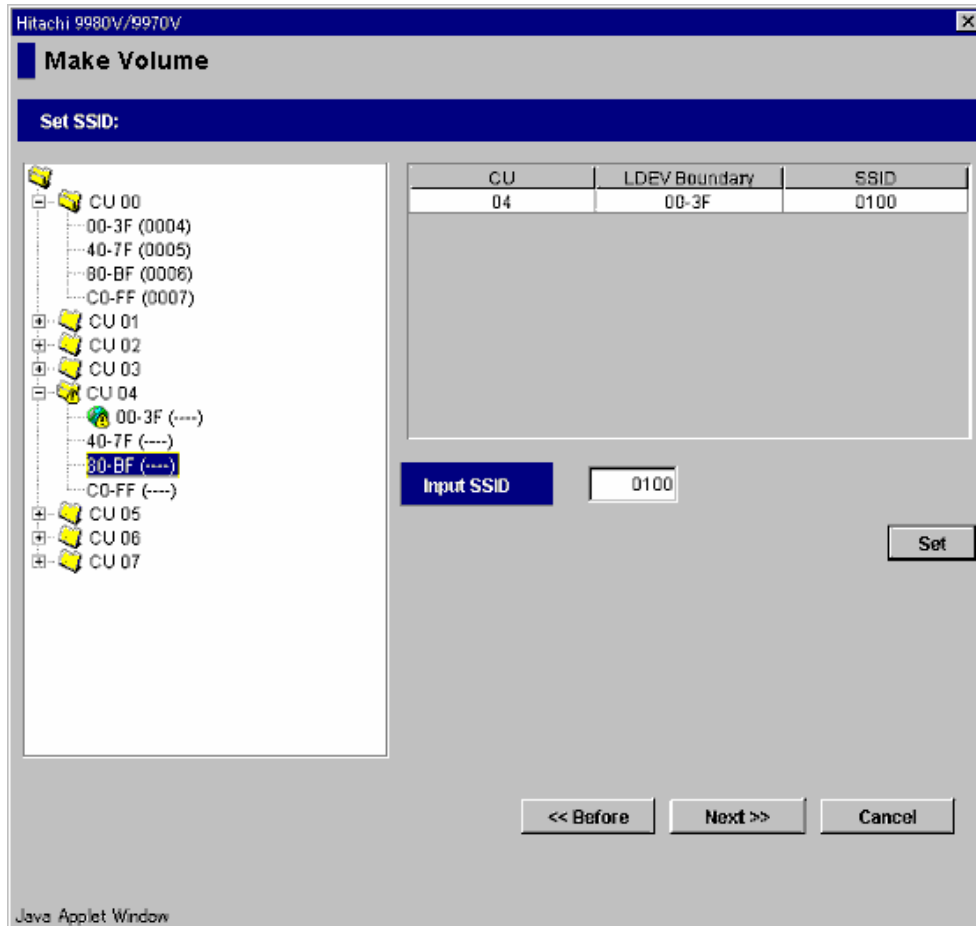


Figure 4.14 Set SSID (Make Volume) Panel

The Set SSID (Make Volume) panel has the following features:

- The **SSID outline** displays CU numbers (e.g., CU 00), SSID boundary areas (e.g., 00-3F), and SSID (e.g., 0004).
 - indicates a boundary area with no SSID
 -  indicates that the CU number is not extracted
 -  indicates that the CU number is extracted
 -  indicates the LDEV boundary area
- The **SSID table** is used to set the SSID boundary area.
 - The **CU** column shows a CU number that contains an LDEV boundary with no SSID.
 - The **LDEV boundary** column shows the boundary area of the LDEV number with no SSID.
 - The **SSID** field shows the specified SSID. The initial value is blank.
- The **Input SSID** box allows you to enter the desired SSID.
- The <<**Before** button will cancel the SSID setting and return you to the Make Volume panel (2) (refer to Figure 4.13).
- The **Next**>> button will take you to the Make Volume Confirmation panel (see Figure 4.15).
- The **Cancel** button will cancel the SSID setting and return you to the **LUSE/VLL panel**, **VLL** tab (refer to Figure 4.1).

4.1.15 Make Volume Confirmation Panel (OPEN-V)

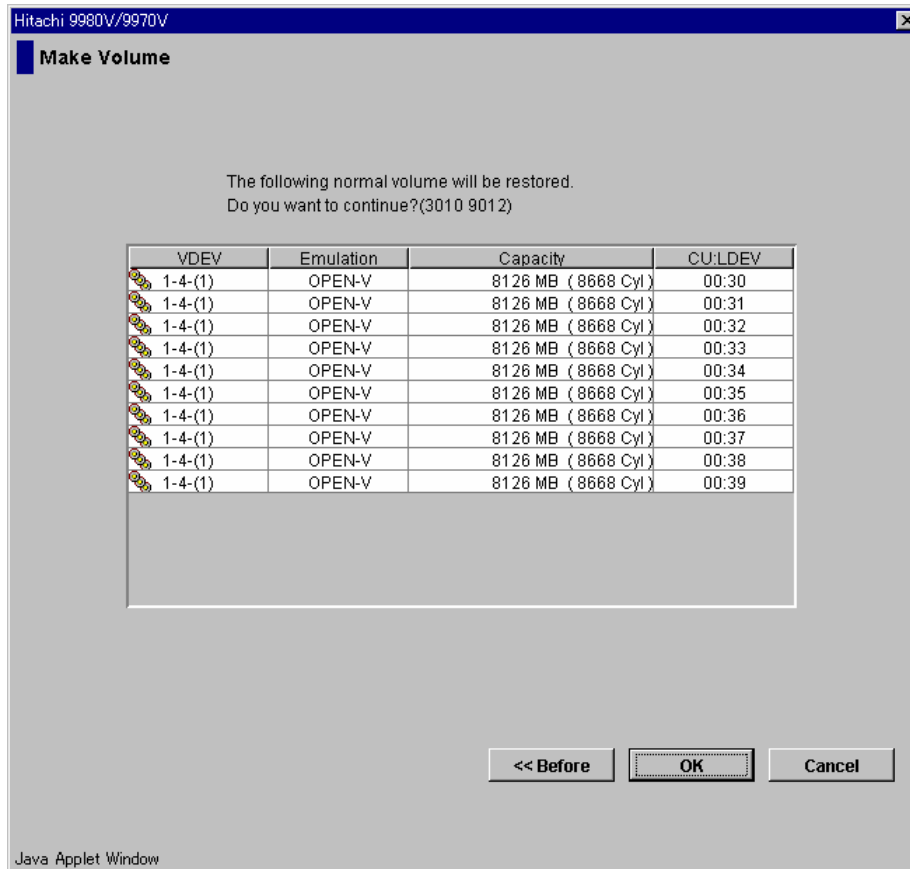


Figure 4.15 Make Volume Confirmation Panel

The Make Volume Confirmation panel displays a list of VLL volumes to be created, with the following information:

- **VDEV** displays the VDEV number. A number beginning with **E** (e.g., **E1-1**) indicates that the VDEV consists of one or more Hi-Copy volumes.
 - **Emulation** displays the emulation type.
 - **Capacity** displays the capacity of the VLL volume to be created, both in MB and cylinders (Cyl).
 - **CU:LDEV** displays the CU and LDEV number. An LDEV number ending in **#** (e.g., **00:01#**) indicates that the LDEV is a Hi-Copy volume.
- The **<<Before** button returns you to the previous panel.
 - The **OK** button confirms the selected settings, and returns you to the Virtual LVI/LUN main panel (refer to Figure 4.1).
 - The **Cancel** button cancels the selected settings, and returns you to the Virtual LVI/LUN main panel (refer to Figure 4.1).

4.2 Virtual LVI/LUN Operations

Before starting a VLL operation on a selected disk subsystem, make sure that the mainframe volumes are disconnected from the host, and/or remove the LU paths to the open volumes. For instructions on removing LU paths, please refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105).

Virtual LVI/LUN operations include:

- Viewing concatenated parity groups (see section 4.2.1)
- Converting logical volumes to free space (see section 4.2.2)
- Creating VLL volumes (other than OPEN-V) (see section 4.2.3)
- Creating OPEN-V VLL volumes (see section 4.2.4)
- Deleting VLL volumes (see section 4.2.5)
- Initializing VLL volumes (other than OPEN-V) (see section 4.2.6)
- Making initial VLL volumes (see section 4.2.7)

4.2.1 Viewing Concatenated Parity Groups

In the 9900V subsystem, data can be written to an LDEV that extends over two or more concatenated parity groups. Concatenation of parity groups enables faster access to data.

1. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button () to open the **LUSE/VLL** panel. The **LUSE** tab is the default view. Select the **VLL** tab (refer to Figure 4.1).
2. Select and right-click a set of parity groups () from the **Parity Group - LDEV** outline (on the upper left corner of the **VLL** tab; refer to Figure 4.2). If there are parity groups that are concatenated, this will display the **Concatenation List Pop-Up Menu** (see Figure 4.16). **Note:** If you select a parity group icon that does not indicate concatenated parity groups (), the **Concatenation List Pop-Up Menu** will not display.
3. Select **Concatenation List** to display the Concatenation List panel (see Figure 4.17).
4. When you are finished viewing the list, select **OK** to return to the **VLL** tab (refer to Figure 4.1).

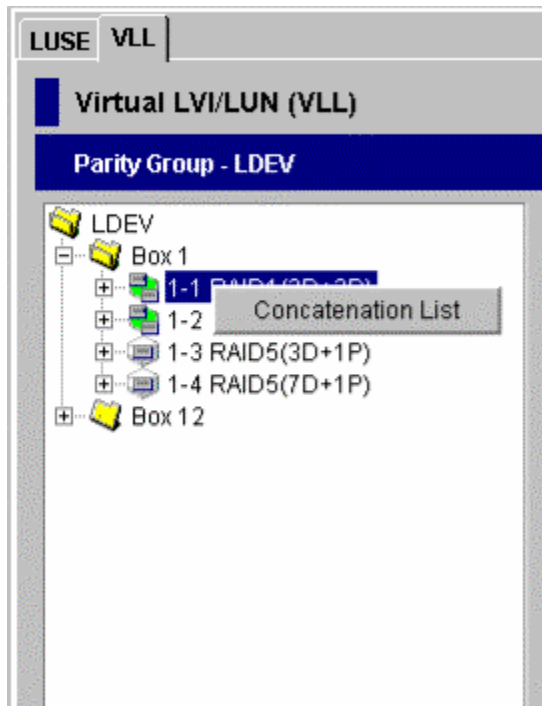


Figure 4.16 Virtual LVI/LUN Concatenation List Pop-Up Menu

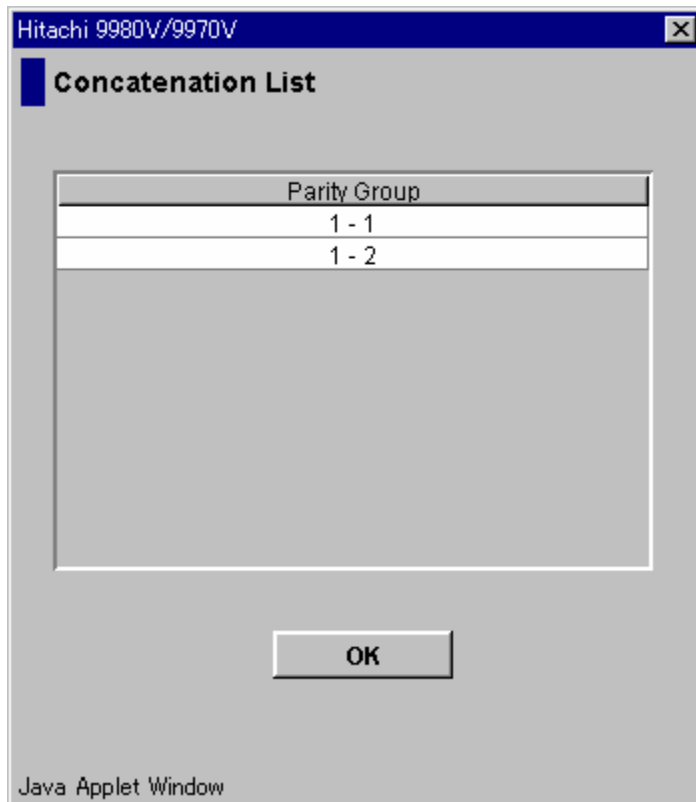


Figure 4.17 Virtual LVI/LUN Concatenation List Panel

4.2.2 Converting Logical Volumes to Space

WARNING: The volume to space function is a destructive operation. The data on the logical volume(s) being converted will be lost when the operation is complete. The user is responsible for backing up the data as needed before performing this operation.

The **Volume to Space** function applies to all supported emulation types, and allows you to convert one or more logical volumes (LDEVs) to space, which deletes the selected LDEVs from that VDEV. **Note:** The deleted LDEV(s) will remain as space in that VDEV. Any normal or Virtual LVI/LUN volume can be made into space. To delete the last Virtual LVI/LUN volume, you must use the Volume Initialize function (see section 4.2.6). You cannot convert the last normal volume into space because this defines the emulation of the VDEV.

The Volume to Space operation has the following restrictions:

- The LDEV should not have a path definition (including Hitachi TrueCopy - S/390®, Hitachi TrueCopy, ShadowImage - S/390®, and ShadowImage pair volumes).
- The LDEV should not be a component of a LUSE volume. The exception to this rule is OPEN-V LUSE volumes that have sequential LDEVs.
- The LDEV should not be reserved for Hitachi CruiseControl.

To convert a logical volume to space:

1. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button () to open the **LUSE/VLL** panel. The **LUSE** tab is the default view. Select the **VLL** tab (refer to Figure 4.1).
2. On the **Parity Group - LDEV** outline (on the upper left corner of the panel; refer to Figure 4.2), select the LDEV folder to open a list of VDEVs.
3. Select a VDEV, and the **LDEV Information** table (on the upper right of the panel; refer to Figure 4.3) displays detailed information about the LDEVs of the selected VDEV.
4. Select one or more LDEVs from the **CU:LDEV** list. **Note:** You must leave at least one normal or VLL volume on each LDEV. Right-click on the selected LDEV to display the **Volume to Space** pop-up menu (see Figure 4.18). **Note:** For OPEN-V, LUSE volumes can be also converted into free space. If the available LDEV is a LUSE volume, the emulation type is displayed together with an asterisk and the number of volumes in the LUSE volume (for example, OPEN-V*3) in the **Emulation** column.
5. After setting all CU numbers and LDEV numbers, select **Next**.
6. Select **Volume to Space** to display the **Volume to Space Confirmation** panel (see Figure 4.19).
7. If the listed volumes are correct, select **OK** on the confirmation panel.

8. The change is not yet implemented in the subsystem, but the following changes will appear in the LDEV Information table (see Figure 4.20):
 - The selected LDEVs will be listed as **Free**.
 - The figures in the Capacity column will not yet be updated.
 - The color of the VDEV icon that you manipulated in the Parity Group - LDEV outline view changes from red to blue. You cannot manipulate blue VDEVs until you select either the **Apply** button or the **Cancel** button (see below), but you can perform additional Volume to Space operations on VDEVs with red icons.
9. If you want to apply the changes to the subsystem, select **Apply** and then select **OK** on the confirmation message (see Figure 4.21). **Note:** A notation will appear across the bottom of the panel to indicate that the change is in process (see Figure 4.22), and then that the operation is complete (see Figure 4.23).

If you want to cancel the changes and not apply them to the subsystem, select **Cancel** and then select **OK** on the confirmation message (see Figure 4.24).

No.	CU:LDEV	Emulation	Capacity	Paths
1	01:10	OPEN-3 CVS	1787 MB	2
2	01:11	OPEN-3 CVS	1787 MB	2
3	Free	-	1786 MB	
4	01:13	OPEN-3 CVS	1787 MB	
5	01:14	OPEN-3 CVS	1787 MB	
6	01:15	OPEN-3 CVS	1787 MB	
7	01:16	OPEN-3 CVS	1787 MB	
8	01:17	OPEN-3 CVS	1787 MB	
9	01:18	Volume to Space	35155 MB	
10	01:19	OPEN-3 CVS	35155 MB	
11	01:1A	OPEN-3 CVS	35155 MB	
12	01:1B	OPEN-3 CVS	35155 MB	
13	01:1C	OPEN-3 CVS	35155 MB	
14	01:1D	OPEN-3 CVS	35155 MB	
15	01:1E	OPEN-3 CVS	35155 MB	
16	01:1F	OPEN-3 CVS	35155 MB	
17	01:40	OPEN-3 CVS	1787 MB	
18	01:41	OPEN-3 CVS	1787 MB	
19	01:42	OPEN-3 CVS	1787 MB	
20	01:43	OPEN-3 CVS	1787 MB	
21	01:44	OPEN-3 CVS	1787 MB	
22	01:45	OPEN-3 CVS	1787 MB	
23	01:46	OPEN-3 CVS	1787 MB	
24	Free	-	1786 MB	

0%

Apply

Cancel

Figure 4.18 Volume to Space Pop-Up Menu

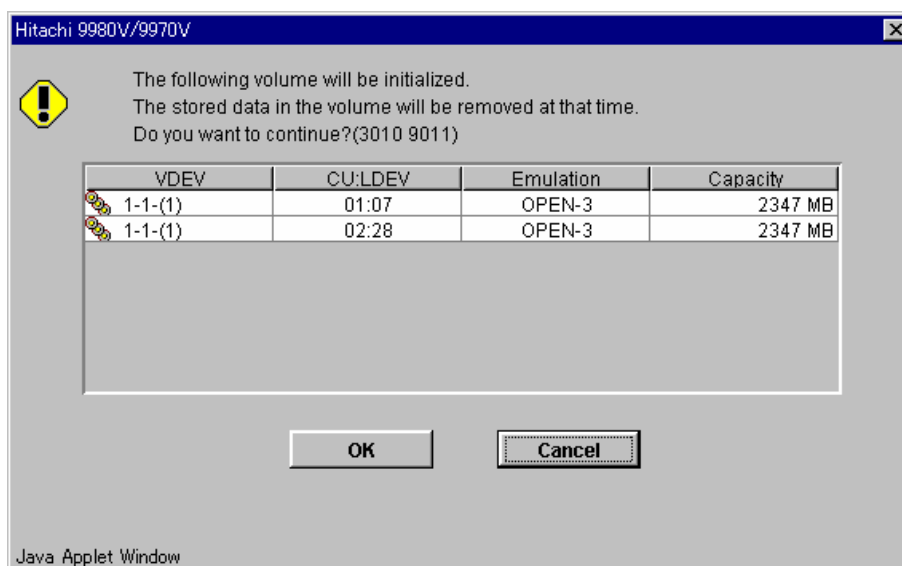


Figure 4.19 Volume to Space Confirmation Panel

No.	CU:LDEV	Emulation	Capacity	Paths
1	01:10	OPEN-3 CVS	1787 MB	2
2	01:11	OPEN-3 CVS	1787 MB	2
3	Free	-	1786 MB	
4	01:13	OPEN-3 CVS	1787 MB	
5	01:14	OPEN-3 CVS	1787 MB	
6	01:15	OPEN-3 CVS	1787 MB	
7	Free	-	1788 MB	
8	Free	-	1788 MB	
9	01:18	OPEN-3 CVS	35155 MB	
10	01:19	OPEN-3 CVS	35155 MB	
11	01:1A	OPEN-3 CVS	35155 MB	
12	01:1B	OPEN-3 CVS	35155 MB	
13	01:1C	OPEN-3 CVS	35155 MB	
14	01:1D	OPEN-3 CVS	35155 MB	
15	01:1E	OPEN-3 CVS	35155 MB	
16	01:1F	OPEN-3 CVS	35155 MB	
17	01:40	OPEN-3 CVS	1787 MB	
18	01:41	OPEN-3 CVS	1787 MB	
19	01:42	OPEN-3 CVS	1787 MB	
20	01:43	OPEN-3 CVS	1787 MB	
21	01:44	OPEN-3 CVS	1787 MB	
22	01:45	OPEN-3 CVS	1787 MB	
23	01:46	OPEN-3 CVS	1787 MB	
24	Free	-	1786 MB	

0% Apply Cancel

Figure 4.20 Volume to Space Changes Made, But Not Yet Implemented

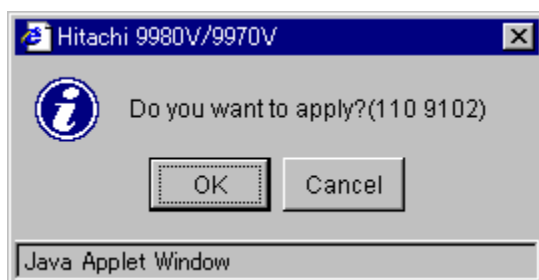


Figure 4.21 Apply Confirmation Message

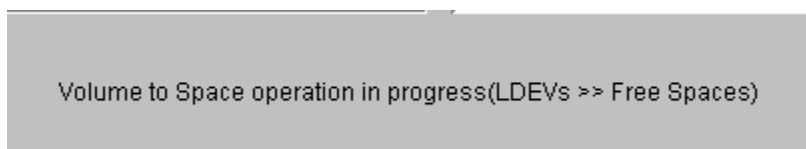


Figure 4.22 Volume to Space Progress Indicator

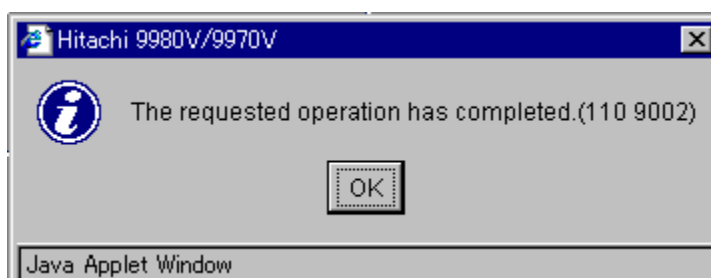


Figure 4.23 Volume to Space Operation Complete

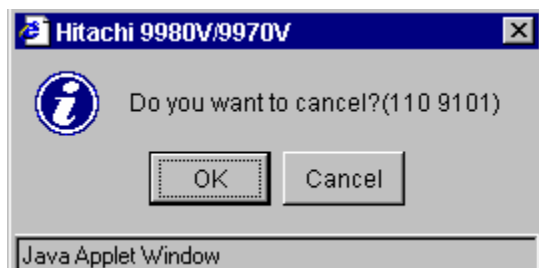


Figure 4.24 Cancel Confirmation Message

4.2.3 Installing VLL Volumes (Other Than OPEN-V)

The Install VLL Volume function allows you to define and install one or more Virtual LVI/LUN volumes under an existing volume.

Note: The Install VLL Volume function allocates VLL volumes in the order in which the function finds sufficient free space for the VLL volumes, so for optimum space allocation you should allocate VLL volumes in descending order of capacity. **Note:** When you specify the capacity and the emulation type, the Install CV function automatically creates and formats the VLL volume in sufficient free space.

1. Change to **Modify** mode. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** () to open the LUSE/VLL panel. The **LUSE** tab is the default view. Select the **VLL** tab.
2. On the **Parity Group - LDEV** outline (on the upper left corner of the panel) Select the **LDEV** folder to open a list of Control Units. Select a **VDEV**, and the **LDEV Information** table (on the upper right of the panel) displays detailed information about the LDEVs of the selected **VDEV**.
3. Right-click any part of the **Parity Group - LDEV** outline view to display the **Install CV** pop-up menu (see Figure 4.25).
4. Select **Install CV** to display the Install CV Panel (1) (see Figure 4.26). On this panel, do the following:
 - Select the emulation type in the **Emulation Type** drop-down window.
 - In the **Size** field enter the capacity of the VLL volume you want to create, either in MB for open systems or in cylinders (Cyl) for mainframe volumes. The available capacity range (minimum - maximum) is shown to the right of the **Size** field. The value can be incremented by one MB (open systems) or by one Cylinder (mainframe systems).
 - Select **Set**. The selected volume displays. Repeat the above steps to create other VLL volumes.
 - To delete a VLL volume, select the VLL volume, select **Delete**, and then select **OK** on the confirmation message. To delete all VLL volumes in the table, select **Clear** to display the **Clear** pop-up menu (see Figure 4.27), select **Clear**, and then select **OK** on the confirmation message.
5. Select **Next** to display the Install CV Panel (2) (see Figure 4.28), which displays the VLL volumes to be created in the table on the top. In this panel:
 - a) Select one or more VLL volume numbers to assign a CU number and an LDEV number.
 - b) Select a CU number from the **Select CU No.** drop-down list box.
 - c) If you selected more than one volume, the **Interval** combo box allows you to set the interval between the LDEV numbers that need to be assigned to the newly created volumes. The default value is set to 0. When you select 0, the LDEV numbers that will be assigned will be consecutive.

- d) Select an LDEV number from the white LDEV numbers in the **Select LDEV Number** table. Gray indicates LDEV numbers that are not selectable, white indicates unused LDEV numbers, and blue indicates available LDEV numbers. The CU and LDEV number appear in the **CU:LDEV** field of the VLL volume-setting information table (see Figure 4.29).
- e) Repeat steps (a)-(d) to set other VLL volumes.
 If you need to delete a VLL volume, select the VLL volume, select **Delete**, and then select **OK** on the confirmation message.
 To change a CU:LDEV number that is already assigned, select one or more VLL volume numbers corresponding to the CU: LDEV numbers that you want to remove, right-click and select **Clear** from the pop-up menu.
6. After setting all CU numbers and LDEV numbers, select **Next**.
7. If the boundary area of the selected LDEV has an SSID, skip this step and go to step 8. If the boundary area of the selected LDEV number does not have an SSID, the SSID setting panel appears (see Figure 4.30). In this panel:
 - Select the CU number.
 - Enter a new SSID in the **Input SSID** entry box.
 - Select **Set**. The SSID is displayed in the **SSID** field of the SSID setting area.
 - Repeat the above steps to set two or more SSIDs.
8. After setting all of the SSIDs, select **Next** to display the Install CV Confirmation panel (see Figure 4.31).
9. Select **OK**. The new settings are shown in blue. You are returned to the **LUSE/VLL** panel, **VLL** tab.
10. The change is not yet implemented in the subsystem, but the following changes appear in the **VLL** tab (see Figure 4.32):
 - The figures in the **Capacity** column are not yet updated.
 - The color of the VDEV icon that you manipulated in the **Parity Group - LDEV** outline view changes from red to blue. You cannot manipulate blue VDEVs until you select either **Apply** or **Cancel**, but you can install additional CVs in VDEVs with red icons. The new VLL volumes are shown in blue.
11. If you want to apply the changes to the subsystem, select **Apply** and then select **OK** on the confirmation message. **Note:** When LDEV formatting is in progress, a notation appears across the bottom of the panel (see Figure 4.33). You are notified when the operation is complete (see Figure 4.34).
 If you want to cancel the changes and not apply them to the subsystem, select **Cancel** and then select **OK** on the confirmation message.

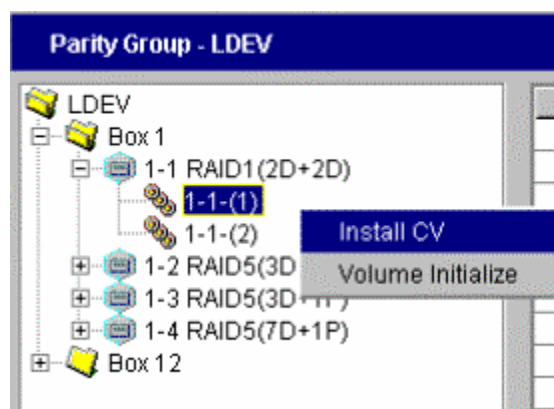


Figure 4.25 Install CV Pop-Up Menu

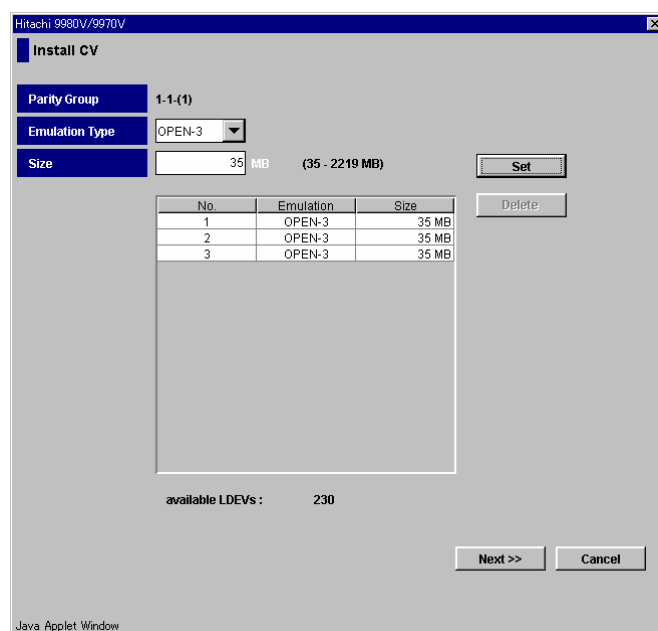


Figure 4.26 Install CV Panel (1)

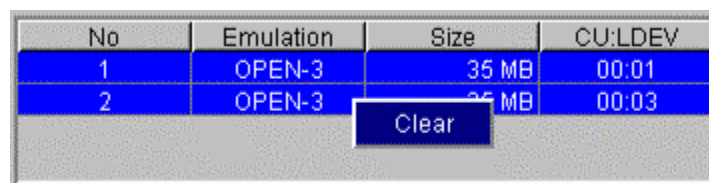


Figure 4.27 Clear Pop-Up Menu

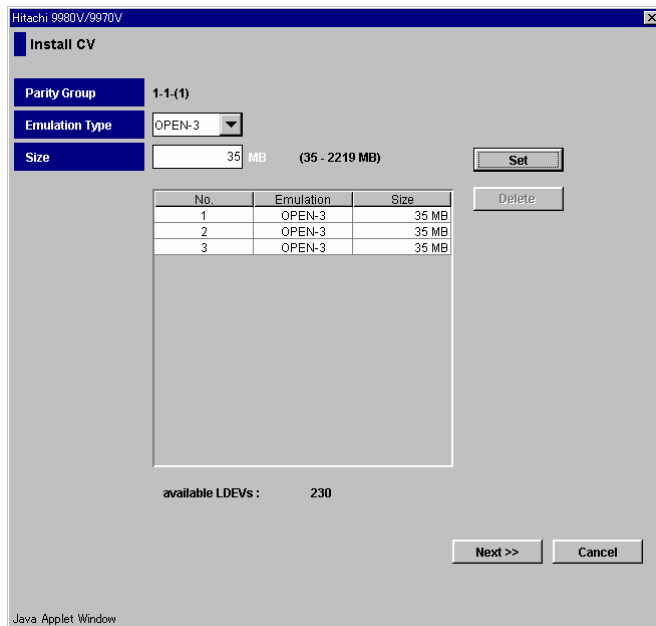


Figure 4.28 Specifying Capacity, Emulation Type and Size

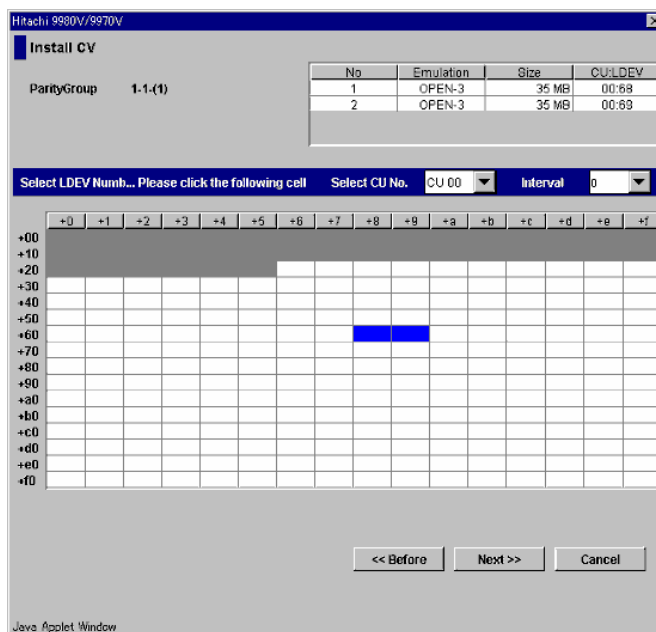


Figure 4.29 Selecting CU, Interval, and LDEV Numbers

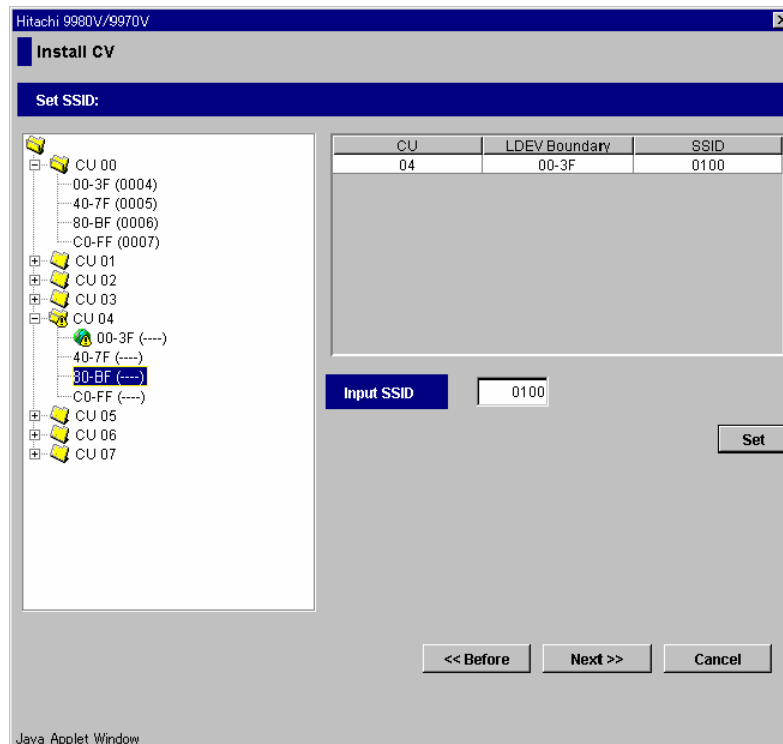


Figure 4.30 Confirming the SSID (Installing VLL Volumes)

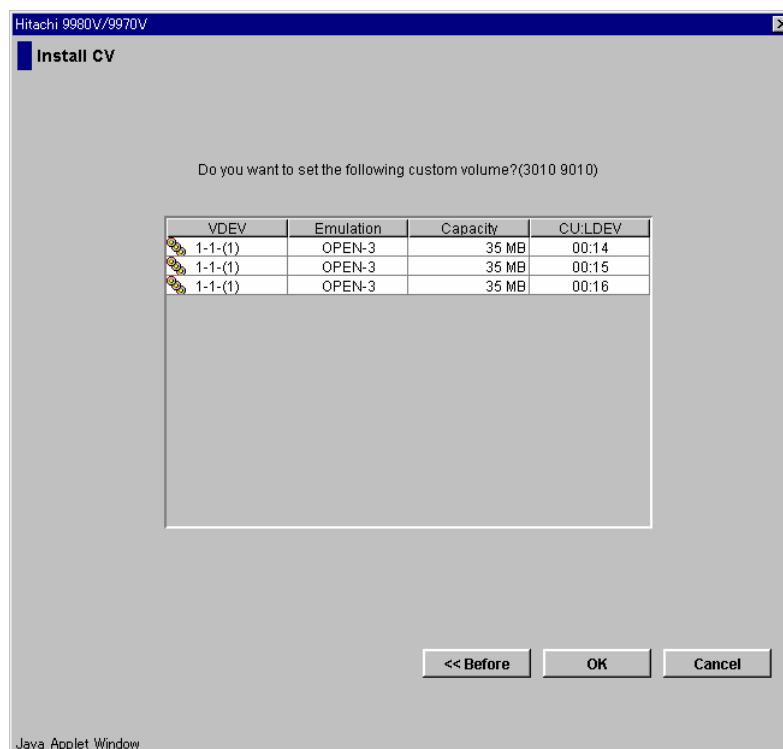


Figure 4.31 Confirming the VLL Selections

No.	CU:LDEV	Emulation	Capacity	Paths
17	00:1E	OPEN-3	35 MB	
18	00:1F	OPEN-9	35 MB	
19	00:20	OPEN-9	35 MB	
20	00:21	OPEN-9	35 MB	
21	00:22	OPEN-3	35 MB	
22	00:23	OPEN-3	35 MB	
23	00:24	OPEN-3	35 MB	
24	00:25	OPEN-3	35 MB	
25	00:26	OPEN-3	35 MB	
26	00:27	OPEN-3	35 MB	
27	Free	-	3431 MB	
28	00:02	OPEN-3	2340 MB	
29	00:03	OPEN-3	2340 MB	
30	00:04	OPEN-3	2340 MB	
31	00:05	OPEN-3	2340 MB	
32	00:06	OPEN-3	2340 MB	1
33	00:07	OPEN-3	2340 MB	
34	01:08	OPEN-M	13889 MB	
35	01:09	OPEN-M	13889 MB	
36	01:0A	OPEN-M	13889 MB	1
37	01:0B	OPEN-M	13889 MB	
38	01:0C	OPEN-M	13889 MB	1
39	01:0D	OPEN-M	13889 MB	1
40	01:0E	OPEN-M	13889 MB	1
41	01:0F	OPEN-M	13889 MB	

Figure 4.32 VLL Volume Created But Changes Not Yet Implemented



Figure 4.33 Install CV Progress Indicator

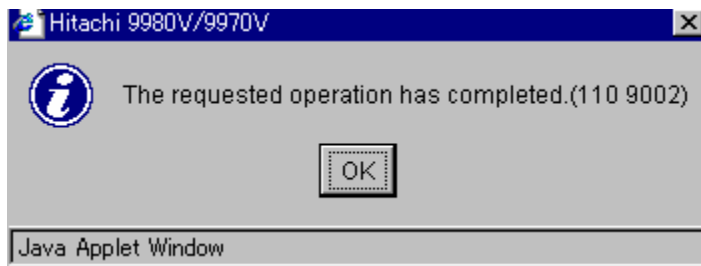


Figure 4.34 Operation Complete Panel

4.2.4 Installing OPEN-V VLL Volumes

The Install VLL Volume function allows you to define and install one or more Virtual LVI/LUN volumes under an existing volume.

Note: The Install VLL Volume function allocates VLL volumes in the order in which the function finds sufficient free space for the VLL volumes, so for optimum space allocation you should allocate VLL volumes in descending order of capacity.

For OPEN-V volumes, you can assign a specific number of physical cylinders or MB to each VLL volume and specify a desired number of VLL volumes. You can specify from 46 MB (50 cylinders) up to the maximum capacity of VDEV for the capacity of a VLL volume. If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Install VLL function automatically creates the VLL volume in LUSE configuration.

To create an OPEN-V VLL volume:

1. Change to **Modify** mode. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)**  to open the LUSE/VLL panel. The **LUSE** tab is the default view. Select the **VLL** tab.
2. On the **Parity Group - LDEV** outline (on the upper left corner of the panel) Select the LDEV folder to open a list of Control Units. Select a VDEV, and the **LDEV Information** table (on the upper right of the panel) displays detailed information about the LDEVs of the selected VDEV.
3. Right-click any part of the **Parity Group - LDEV** outline view to display the **Install CV** pop-up menu (see Figure 4.35).
4. Select **Install CV** to display the Install CV Panel (1) (OPEN-V)(see Figure 4.36).
Note: If the capacity of the VLL volume exceeds 60 gigabytes (65,535 cylinders), the Install CV function automatically creates VLL volume in LUSE configuration.
Note: The Install VLL Volume function allocates VLL volumes in the order in which the function finds sufficient free space for the VLL volumes, so for optimum space allocation you should allocate VLL volumes in descending order of capacity.
5. Select either **MB** or **Cyl** for the capacity unit in **Capacity Unit** field. **Note:** If you are configuring a VLL volume for use as a Hi-Copy volume, the capacity must be specified in cylinders.
6. Select one of the following methods to create a VLL volume:
 - a) Specify size and number
 - b) Divide free space by number
 - c) Divide free space by size
 - d) Set remaining space as volume

7. Specify the capacity of the VLL volume, and/or the number of CVs according to the selected method. **Note:** If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Install VLL function automatically creates the VLL volume in LUSE configuration. For example:
 - a) If you selected **Specify size and number**, specify the capacity (either in MB or Cylinders, as previously selected in the **Capacity Unit** field), and the number of CVs, in Size and Number respectively.
 - b) If you selected **Divide free space by number**, specify the number of CVs in Number. **Note:** This field is not available if there is more than one free space. If you want to use this method and there is more than one free space on the volume, see section 4.2.7 (Making OPEN-V VLL Volumes).
 - c) If you selected **Divide free space by size**, specify the capacity in Size. **Note:** This field is not available if there is more than one free space. If you want to use this method and there is more than one free space on the volume, see section 4.2.7 (Making OPEN-V VLL Volumes).
 - d) If you selected **Set remaining space as volume**, go to the next step. **Note:** This field is not available if there is more than one free space. If you want to use this method and there is more than one free space on the volume, see section 4.2.7 (Making OPEN-V VLL Volumes).
8. Select **Set**. The selected volume displays.
9. Repeat the preceding steps to create other VLL volumes.
10. To delete a VLL volume, select the VLL volume, select **Delete**, and then select **OK** on the confirmation message. To delete all VLL volumes in the table, select **Clear**, and then select **OK** on the confirmation message.
11. Select **Next** to display the Install CV Panel (2) (see Figure 4.37), which displays the VLL volumes to be created in the table on the top. In this panel:
 - a) Select one or more VLL volume numbers to assign a CU number and an LDEV number.
 - b) Select a CU number from the **Select CU No.** drop-down list box.
 - c) If you selected more than one volume, the **Interval** combo box allows you to set the interval between the LDEV numbers that need to be assigned to the newly created volumes. The default value is set to 0. When you select 0, the LDEV numbers that will be assigned will be consecutive.
 - d) Select an LDEV number from the white LDEV numbers in the **Select LDEV Number:** table. Gray indicates LDEV numbers that are not selectable, white indicates unused LDEV numbers, and blue indicates available LDEV numbers. The CU and LDEV number appear in the **CU:LDEV** field of the VLL volume-setting information table.
 - e) Repeat steps (a)-(d) to set other VLL volumes.
12. To change a CU:LDEV number that is already assigned, select one or more VLL volume numbers corresponding to the CU:LDEV numbers that you want to remove, right-click and select **Clear** from the pop-up menu (see Figure 4.38).
13. After setting all CU numbers and LDEV numbers, select **Next**.

14. If the boundary panel does have an SSID, the Install CV Confirmation panel will display. Skip this step and go to the next.
If the boundary area of the selected LDEV number does not have an SSID, the SSID setting panel displays (see Figure 4.39). In this panel:
 - a) Select the CU number.
 - b) Enter a new SSID in the **Input SSID** entry box.
 - c) Select **Set**. The SSID is displayed in the **SSID** field of the SSID setting area.
 - d) Repeat the above steps to set two or more SSIDs.
15. After setting all of the SSIDs, select **Next** to display the Install CV Confirmation panel (see Figure 4.40).
16. Select **OK**. The new settings are shown in blue. You are returned to the **LUSE/VLL** panel, **VLL** tab.
17. The change is not yet implemented in the subsystem, but the following changes appear in the **VLL** tab (see Figure 4.41):
 - a) The figures in the **Capacity** column are not yet updated.
 - b) The color of the VDEV icon that you manipulated in the **Parity Group - LDEV** outline view changes from red to blue. You cannot manipulate blue VDEVs until you select **Apply** or **Cancel**, but you can install additional CVs in VDEV with red icons.
 - c) The new CVs are shown in blue.
18. If you want to apply the changes to the subsystem, select **Apply** and then select **OK** on the confirmation message. **Note:** When LDEV formatting is in progress, a notation appears across the bottom of the panel (see Figure 4.42). You are notified when the operation is complete (see Figure 4.43).
If you want to cancel the changes and not apply them to the subsystem, select **Cancel** and then select **OK** on the confirmation message.

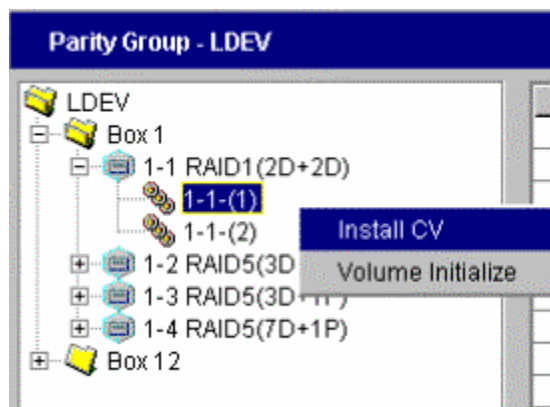


Figure 4.35 Install CV Pop-Up Menu

Hitachi 9980V/9970V

Install CV

Parity Group: 1-4 (1)

Emulation Type: OPEN-V

How to Create Volumes

No.	Emulation	Capacity (MB)	Capacity (Cyl)
1	OPEN-V	46 MB	50 Cyl
2	OPEN-V	46 MB	50 Cyl
3	OPEN-V	46 MB	50 Cyl
4	OPEN-V	46 MB	50 Cyl
5	OPEN-V	46 MB	50 Cyl
6	OPEN-V	46 MB	50 Cyl
7	OPEN-V	46 MB	50 Cyl
8	OPEN-V	46 MB	50 Cyl
9	OPEN-V	46 MB	50 Cyl
10	OPEN-V	46 MB	50 Cyl

Capacity Unit: ☒ MB ☐ Cyl

☒ Specify size and number

Size: 46 MB 50 Cyl
(46 - 6720 MB) (50 - 7168 Cyl)

Number: 10 (1 - 489)

☐ Divide free space by number

Number:

☐ Divide free space by size

Size: MB Cyl

☐ Set remaining space as volume

available LDEVs : 489

Set Delete Clear

Next >> Cancel

Java Applet Window

Figure 4.36 Setting the Capacity

Hitachi 9980V/9970V

Install CV

ParityGroup: 1-1-(1)

No.	Emulation	Size	CU:LDEV
1	OPEN-V	46 MB (50 Cyl)	00:75
2	OPEN-V	46 MB (50 Cyl)	00:76

Select LDEV No.: Please click the following cell

Select CU No.: CU 00 Interval: 0

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+a	+b	+c	+d	+e	+f
+00																
+10																
+20																
+30																
+40																
+50																
+60																
+70																
+80																
+90																
+a0																
+b0																
+c0																
+d0																
+e0																
+f0																

<< Before Next >> Cancel

Java Applet Window

Figure 4.37 Selecting the CU Number, Interval, and LDEV Numbers

No	Emulation	Size	CU:LDEV
1	OPEN-3	35 MB	00:01
2	OPEN-3	35 MB	00:03

Clear

Figure 4.38 Clear Pop-Up Menu

Hitachi 9980V/9970V

Install CV

Set SSID:

- CU 00
 - 00-3F (0004)
 - 40-7F (0005)
 - 80-BF (0006)
 - C0-FF (0007)
- CU 01
- CU 02
- CU 03
- CU 04
 - 00-3F (----)
 - 40-7F (----)
 - 80-BF (----)
 - C0-FF (----)
- CU 05
- CU 06
- CU 07

CU	LDEV Boundary	SSID
04	00-3F	0100

Input SSID

Set

<< Before Next >> Cancel

Java Applet Window

Figure 4.39 Confirming the SSID

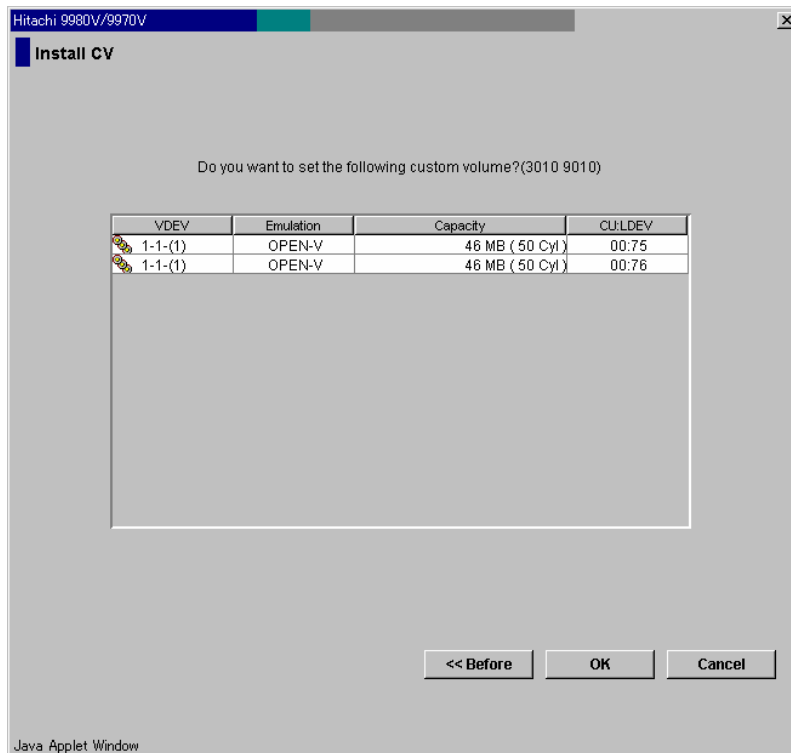


Figure 4.40 Confirming the Selections

No.	CU:LDEV	Emulation	Capacity	Paths
17	00:1E	3390-3C CVS	0 MB	
18	00:1F	3390-3C CVS	0 MB	
19	00:20	3390-3C CVS	0 MB	
20	00:21	3390-3C CVS	0 MB	
21	00:22	3390-3C CVS	0 MB	
22	00:23	3390-3C CVS	0 MB	
23	00:24	3390-3C CVS	0 MB	
24	00:75	OPEN-V CVS	46 MB	
25	00:76	OPEN-V CVS	46 MB	
26	Free	-	4650 MB	
27	00:02	OPEN-V CVS	3128 MB	2
28	00:03	OPEN-V CVS	3128 MB	1
29	00:04	OPEN-V CVS	3128 MB	
30	00:05	OPEN-V CVS	3128 MB	
31	00:06	OPEN-V CVS	3128 MB	
32	00:07	OPEN-V CVS	3128 MB	
33	01:08	OPEN-V CVS	3128 MB	
34	01:09	OPEN-V CVS	3128 MB	
35	01:0A	OPEN-V CVS	3128 MB	
36	01:0B	OPEN-V CVS	3128 MB	
37	01:0C	OPEN-V CVS	3128 MB	
38	01:0D	OPEN-V CVS	3128 MB	
39	01:0E	OPEN-V CVS	18524 MB	
40	01:0F	OPEN-V CVS	18524 MB	

Figure 4.41 Install OPEN-V CV Complete, Changes Pending



Figure 4.42 Install CV Progress Indicator

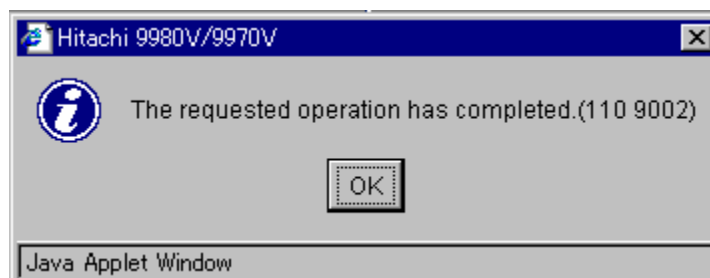


Figure 4.43 Install Operation Complete

4.2.5 Deleting VLL Volumes

To delete an individual Virtual LVI/LUN volume within a VDEV, use the volume to space operation (refer to section 4.2.2).

To convert a Virtual LVI/LUN volume to a normal volume (other than OPEN-V), initialize the volume (see section 4.2.6).

To convert an OPEN-V Virtual LVI/LUN volume to a normal volume, make the volume (see section 4.2.7).

4.2.6 Initializing VLL Volumes (Other Than OPEN-V)

WARNING: The Volume Initialize function is a destructive operation. The data on the Virtual LVI/LUN volume being converted is lost when the operation is complete. The user is responsible for backing up the data as needed before performing this operation.

The **Volume Initialize** function allows you to convert a Virtual LVI/LUN volume back to a normal volume. This operation de-installs all variable sized volumes under a Virtual LVI/LUN volume, and reformats the Virtual LVI/LUN volume as a normal volume (example, 3390-3).

The CVs for the Volume Initialize operation have the following restrictions. If the VDEV contains a CV that violates any of the restrictions, the Volume Initialize function is disabled. You must eliminate invalid CVs before executing the Volume Initialize function.

- The LDEV should not have a path definition (including Hitachi TrueCopy-S/390®, Hitachi TrueCopy, ShadowImage-S/390®, and ShadowImage pair volumes).
- The LDEV should not be a component of a LUSE volume.
- The LDEV should not be reserved for Hitachi CruiseControl.

To initialize a non OPEN-V volume:

1. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button () to open the LUSE/VLL panel. The **LUSE** tab is the default view. Select the **VLL** tab (refer to Figure 4.1)
2. On the **Parity Group - LDEV** outline (on the upper left corner of the panel; refer to Figure 4.2), select the LDEV folder to open a list of VDEVs. Select a VDEV, and the **LDEV Information** table (on the upper right of the panel; refer to Figure 4.3) displays detailed information about the LDEVs of the selected VDEV. **Note:** If the selected VDEV contains one or more CV that violates any restriction for the Volume Initialize operations, you cannot perform the Volume Initialize operations. Please remove all invalid CVs before performing the Volume Initialize operations.
3. Right-click any part of the **Parity Group - LDEV** outline view to display the Volume Initialize pop-up menu (see Figure 4.44).

4. Select **Volume Initialize** to display the **Volume Initialize** panel (see Figure 4.45). On this panel:
 - a) Select one or more VLL volume numbers.
 - b) Select a CU number from the **Select CU No.** drop-down list.
 - c) If you selected more than one volume, the **Interval** combo box allows you to set the interval between the LDEV numbers that need to be assigned to the newly created volumes. The default value is set to 0. When you select 0, the LDEV numbers that will be assigned will be consecutive.
 - d) Select an LDEV number from white LDEV numbers in the **Select LDEV Number:** table. The CU and LDEV number appear in the **CU:LDEV** field.
 - e) If you want to change a CU:LDEV number that is already assigned, select one or more volume numbers corresponding to the CU:LDEV numbers that you want to remove, right-click the mouse button, and then select **Clear** in the pop-up menu (see Figure 4.46).
5. After setting all CU numbers and LDEV numbers, select the **Next** button.
6. If the boundary area of the selected LDEV number does not have a SSID, the SSID setting panel (see Figure 4.47). On that panel:
 - a) Select the CU number.
 - b) Enter a new SSID in the **Input SSID** entry box.
 - c) Select the **Set** button.
7. After setting all SSIDs, select the **Next** button.
8. The Volume Initialize Confirmation Panel (see Figure 4.48) displays. Verify that the information is correct, then select **OK**.
9. A notation appears across the top of the panel to indicate that the volume has been initialized, and the color of the VDEV icon that you manipulated in the **Parity Group - LDEV** outline view changes from red to blue (see Figure 4.49). **Note:** You cannot manipulate VDEVs denoted by blue icons until you either apply the changes to the subsystem or cancel them (see below), but you can initialize additional VLL volumes in VDEVs denoted by red icons.
10. If you want to apply the changes to the subsystem, select **Apply** and then select **OK** on the confirmation message. **Note:** When LDEV formatting is in progress, a notation will appear across the bottom of the panel to indicate the progress (see Figure 4.50). You are notified when the operation is complete (see Figure 4.51).

If you want to cancel the changes and not apply them to the subsystem, select **Cancel** and then select **OK** on the confirmation message.

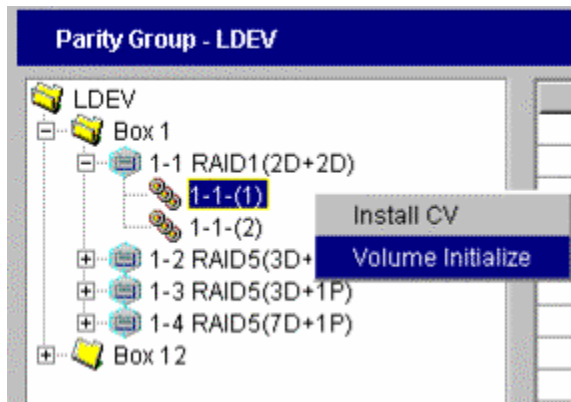


Figure 4.44 Volume Initialize Pop-Up Menu

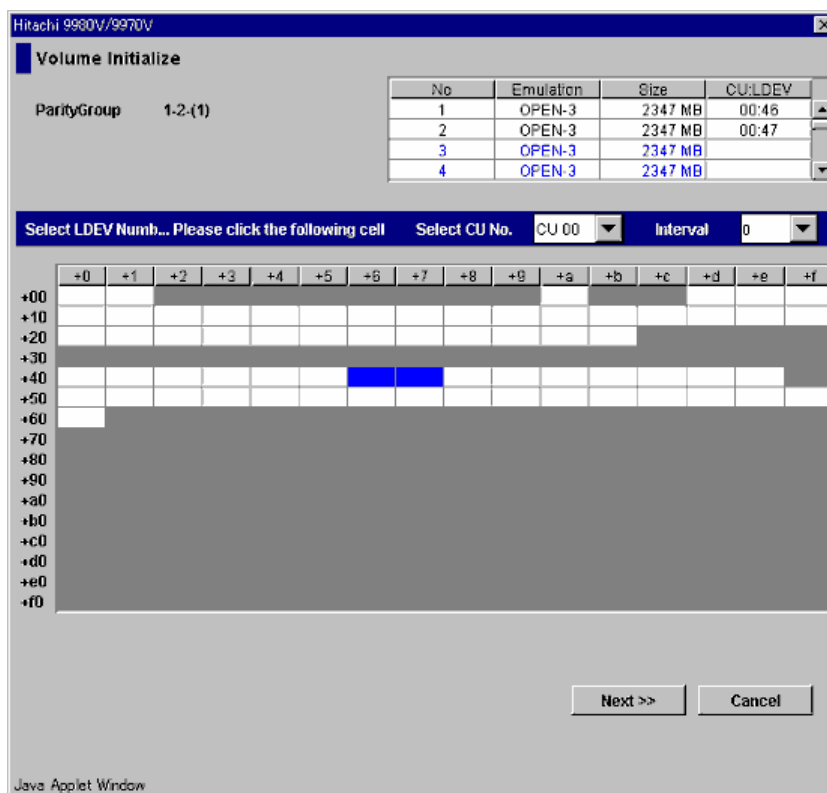


Figure 4.45 Selecting CU, Interval, and LDEV Numbers

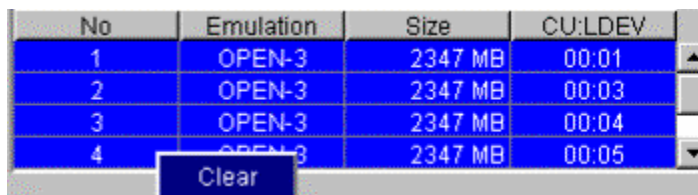


Figure 4.46 Clear Pop-Up Menu

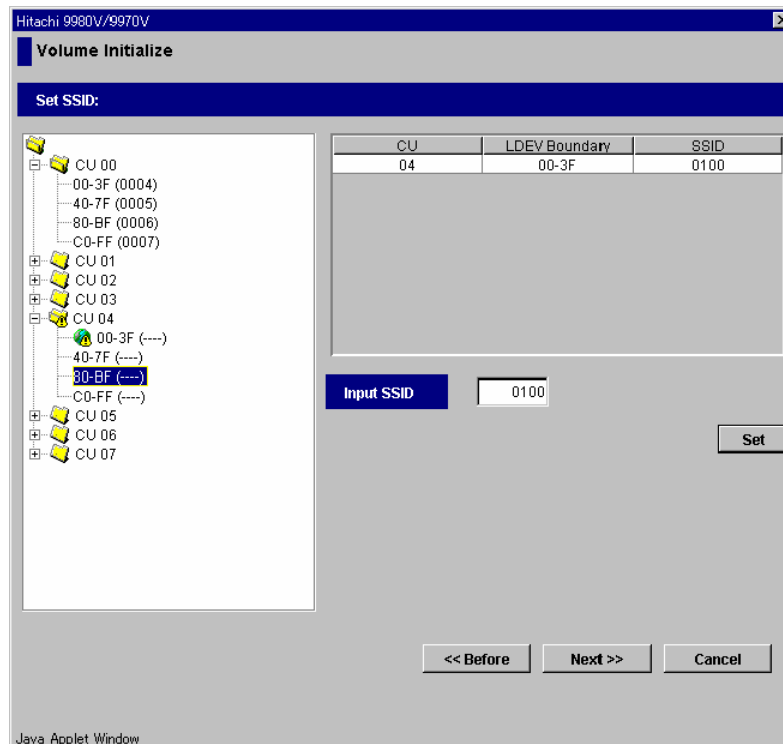


Figure 4.47 Selecting SSID (Initializing VLL Volumes)

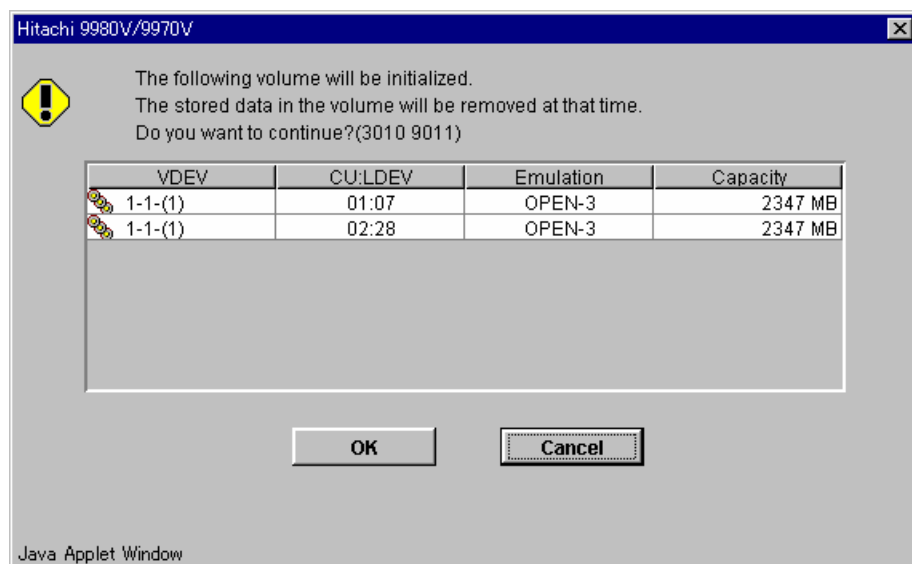


Figure 4.48 Confirming Volume Initialize

No	CU:LDEV	Emulation	Capacity	Paths
1	00:00	OPEN-3	2340 MB	
2	00:01	OPEN-3	2340 MB	
3	00:02	OPEN-3	2340 MB	
4	00:03	OPEN-3	2340 MB	
5	00:04	OPEN-3	2340 MB	
6	00:05	OPEN-3	2340 MB	
7	Free	-	2340 MB	
8	Free	-	2340 MB	
9	01:08	OPEN-M	13889 MB	1
10	01:09	OPEN-M	13889 MB	1
11	01:0A	OPEN-M	13889 MB	1
12	01:0B	OPEN-M	13889 MB	1
13	01:0C	OPEN-M	13889 MB	1
14	01:0D	OPEN-M	13889 MB	1
15	01:0E	OPEN-M	13889 MB	1
16	01:0F	OPEN-M	13889 MB	1

Figure 4.49 Verifying Volume Initialize

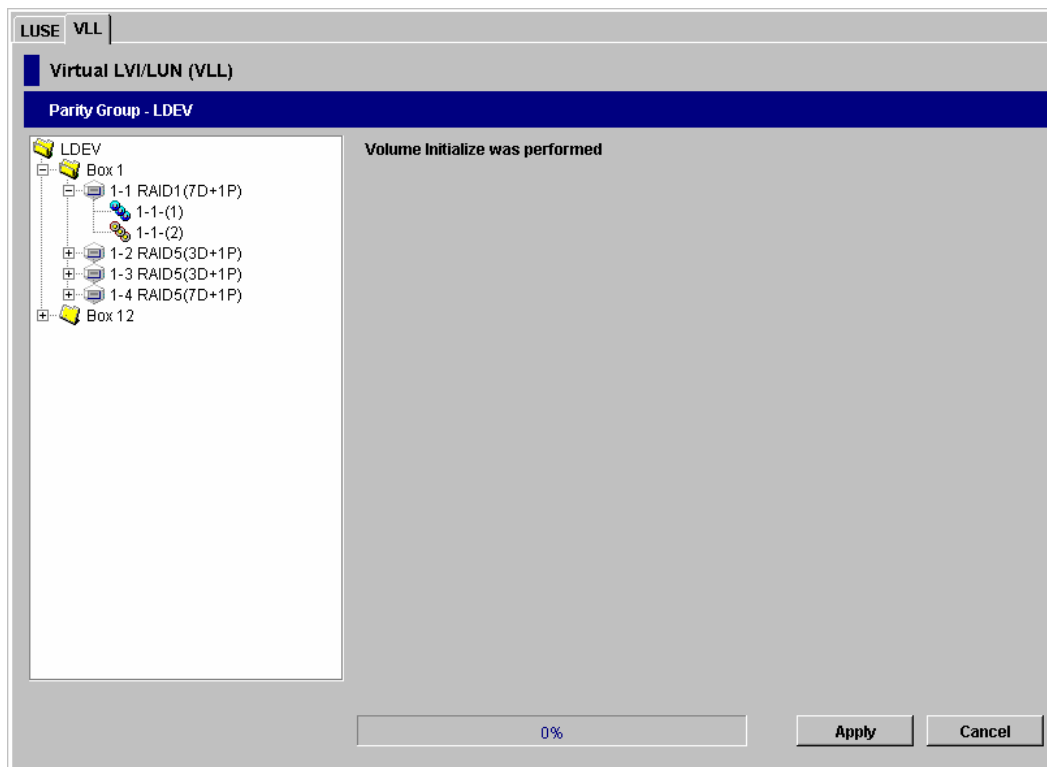


Figure 4.50 Volume Initialize Progress Indicator

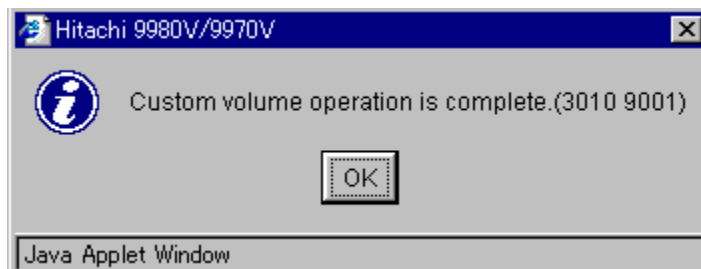


Figure 4.51 Volume Initialize Complete

4.2.7 Making VLL Volumes

WARNING: The Make Volume function is a destructive operation. The data on the Virtual LVI/LUN volume being converted is lost when the operation is complete. The user is responsible for backing up the data as needed before performing this operation.

The **Make Volume** operation deletes all variable sized volumes under a VLL volume, and creates new variable sized volumes (CVs) according to the specified settings. You can perform the following types of operations:

- Specify the capacity and the number of variable sized volumes (CVs) under a VLL volume. This is the same as the Install CV operation.
- Specify the number of variable sized volumes (CVs). A VLL volume that has the specified number of CVs is created (the VDEV is divided by the specified number).
- Specify the capacity of a variable sized volume (CV). A VLL volume that has CVs of the specified capacity is created (the VDEV is divided by the specified capacity).
- Specify the remaining capacity for a VLL volume. If some space remains in the VDEV after VLL volumes are created by the preceding operations, that space can also be converted into a VLL volume.

Note: If the specified capacity exceeds 60 gigabytes (65,535 cylinders), the Make Volume function automatically creates the VLL volume in LUSE configuration.

The CVs for the Make Volume operation have the following restrictions. If the VDEV contains a CV that violates any of the restrictions, the Make Volume function is disabled. You must eliminate invalid CVs before executing the Make Volume function.

- The CV should not have a path definition (including Hitachi TrueCopy, Hitachi TrueCopy - S/390®, ShadowImage, and ShadowImage - S/390® pair volumes).
- The LDEV should not be reserved for Hitachi CruiseControl.

To initialize a VDEV and create a new CV:

1. Change to **Modify** mode (refer to section 2.3 if you need instructions). Select the **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** button () to open the LUSE/VLL panel. The **LUSE** tab is the default view. Select the **VLL** tab (refer to Figure 4.1).
2. On the **Parity Group - LDEV** outline (on the upper left corner of the panel; refer to Figure 4.2), select the LDEV folder to open a list of VDEVs. Select a VDEV, and the **LDEV Information** table (on the upper right of the panel; refer to Figure 4.3) displays detailed information about the LDEVs of the selected VDEV.

Note: If the selected VDEV contains one or more volumes that violate any restriction for the Make Volume operation, you cannot perform the Make Volume operation. Please remove all invalid volumes before performing the Make Volume operation.
3. Right-click any part of the Parity Group - LDEV outline view to display the **Make Volume** pop-up menu (see Figure 4.52).

4. Select **Make Volume** to display the Make Volume panel (1).

When the emulation type of the VDEV you selected is OPEN-V, Make Volume panel (1) for OPEN-V (refer to Figure 4.11) will be displayed. Proceed to step 5.

When the emulation type of the selected VDEV is other than OPEN-V, Make Volume panel (1) for other than OPEN-V (refer to Figure 4.12) will be displayed. Proceed to step 6.

5. On the Make Volume panel (1) for OPEN-V (see Figure 4.53):
 - a) In the **Capacity Unit** field, select either **MB** or **Cyl** for the capacity unit for VLL volumes to be created.
 - b) Select one of the following methods to create a VLL volume:
 - Specify size and number
 - Divide free space by number
 - Divide free space by size
 - Set remaining space as volume
 - c) Specify the capacity of the VLL volume and/or the number of CVs according to the selected method. **Note:** If the capacity of the VLL volume exceeds 60 gigabytes (65,535 cylinders), the VLL volume in LUSE configuration is created automatically.

For example:

 - If you selected **Specify size and number**, specify the capacity (either in MB or Cylinders, as previously selected in the **Capacity Unit** field), and the number of CVs, in **Size** and **Number** respectively.
 - If you selected **Divide free space by number**, specify the number of CVs in **Number**.
 - If you selected **Divide free space by size**, specify the capacity in **Size**.
 - If you selected **Set remaining space as volume**, go to the next step.
 - d) Select **Set** to display the setting in the LDEV information table (on the upper right of the panel).

If you need to remove VLL volume settings displayed in the LDEV information table, do one of the following:

 - To remove a setting, select the VLL volume, and select **Delete**. When a confirmation message displays, select **OK**.
 - To remove all settings, select **Clear**. When a confirmation message displays, select **OK**.
 - e) To set other VLL volumes, repeat steps (a) through (d). After setting all of the VLL volumes, go to step 7.

6. On the Make Volume panel (1) for other than OPEN-V:
 - a) Select the emulation type in the **Emulation Type** drop-down list.
 - b) In the **Size** field enter the capacity of the VLL volume you want to create, either in MB for open systems or in cylinders (Cyl) for mainframe volumes. The available capacity range (minimum - maximum) is shown to the right of the **Size** field. The value can be incremented by one MB (open systems) or by one Cylinder (mainframe systems).

Note: The Install VLL Volume function allocates VLL volumes in the order in which the function finds sufficient free space for the VLL volumes, so for optimum space allocation you should allocate VLL volumes in descending order of capacity.
 - c) Select **Set**. The selected volume displays.

If you need to delete a VLL volume, select the VLL volume, and select **Delete**. When a confirmation message displays, select **OK**.
 - d) Repeat the above steps (a) - (c) to create other VLL volumes. After setting all of the VLL volumes, go to step 7.
7. Select **Next** to display the Make Volume panel (2) (see Figure 4.54).
8. On the Make Volume panel (2), do the following:
 - a) Select one or more VLL volume numbers.
 - b) Select a CU number from the **Select CU No.** drop-down list.
 - c) If you selected more than one volume, the **Interval** combo box allows you to set the interval between the LDEV numbers that need to be assigned to the newly created volumes. The default value is set to 0. When you select 0, the LDEV numbers that will be assigned will be consecutive.
 - d) Select an LDEV number from white LDEV numbers in the **Select LDEV Number** table. The CU and LDEV number appear in the **CU:LDEV** field.

Note: If you specify an LDEV number in the selected CU, free sequential LDEV numbers in LUSE configuration are automatically assigned. You cannot specify an LDEV number, if LDEV numbers in LUSE configuration are not available in either of the following CUs:

 - the CU displayed in **Select CU No.**
 - a CU whose CU number is larger than the CU number displayed in **Select CU No.**
 - e) To set other LDEV numbers for the VLL volumes, repeat steps (a)-(d). To change a CU:LDEV number that is already assigned, select one or more volume numbers corresponding to the CU:LDEV numbers that you want to remove. Right-click to display the **Clear** pop-up menu, and then select **Clear** (see Figure 4.55). The deleted LDEV numbers will show in white (see Figure 4.56).

9. After setting all CU numbers and LDEV numbers, select **Next**.
 10. If the boundary area of the selected LDEV number does not have a SSID, the SSID setting panel displays (see Figure 4.57). Go to step 11. If the boundary area of the selected LDEV number has an SSID, skip the next step and go to step 12.
 11. On the SSID setting panel:
 - a) Select the CU number.
 - b) Enter a new SSID in the **Input SSID** entry box.
 - c) Select **Set**.
 - d) Repeat steps (a)-(c) until all SSIDs are set.
 - e) After setting all SSIDs, select **Next**.
 12. The Make Volume confirmation panel displays (see Figure 4.58). Verify that the information is correct, and then select **OK**.
 13. The created VLL volumes are displayed in *blue bold italics* in the **LDEV Information** table on the Virtual LVI/LUN main panel (see Figure 4.59).

Note: You cannot manipulate VDEVs denoted by blue icons until you either apply the changes to the subsystem or cancel them, but you can initialize additional VLL volumes in VDEVs denoted by red icons.
 14. If you want to apply the changes to the subsystem, select **Apply**, and then select **OK** on the confirmation message. **Note:** When LDEV formatting is in progress, and at completion, a notation appears across the bottom of the panel to indicate the progress.
- If you want to cancel the changes and not apply them to the subsystem, select **Cancel** and then select **OK** on the confirmation message.

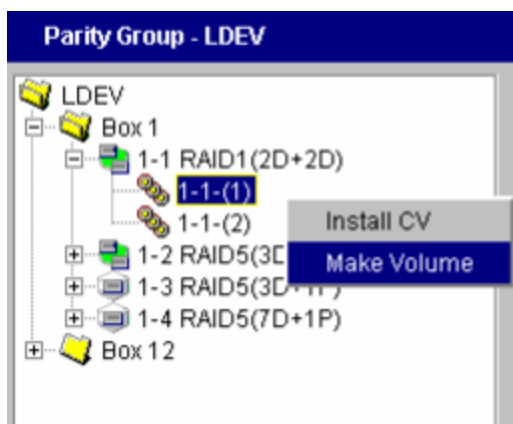


Figure 4.52 Make Volume Pop-Up Menu

Hitachi 9980V/9970V

Make Volume

Parity Group: 1-4 (1)

Emulation Type: OPEN-V

How to Create Volumes

No.	Emulation	Capacity (MB)	Capacity (Cyl)
1	OPEN-V	46 MB	50 Cyl
2	OPEN-V	46 MB	50 Cyl
3	OPEN-V	46 MB	50 Cyl
4	OPEN-V	46 MB	50 Cyl
5	OPEN-V	46 MB	50 Cyl
6	OPEN-V	46 MB	50 Cyl
7	OPEN-V	46 MB	50 Cyl
8	OPEN-V	46 MB	50 Cyl
9	OPEN-V	46 MB	50 Cyl
10	OPEN-V	46 MB	50 Cyl

Capacity Unit: ☒ MB ☐ Cyl

☒ Specify size and number

Size: 46 MB 50 Cyl
(46 - 80799 MB) (50 - 86186 Cyl)

Number: 10 (1 - 502)

☐ Divide free space by number

Number:

☐ Divide free space by size

Size: MB Cyl

☐ Set remaining space as volume

available LDEVs : 502

Set Delete Clear

Next >> Cancel

Figure 4.53 Setting the Capacity (OPEN-V shown)

Hitachi 9980V/9970V

Make Volume

ParityGroup: 1-4 (1)

No.	Emulation	Size	CU:LDEV
1	OPEN-V	8126 MB (8668 Cyl)	00:30
2	OPEN-V	8126 MB (8668 Cyl)	00:31
3	OPEN-V	8126 MB (8668 Cyl)	00:32
4	OPEN-V	8126 MB (8668 Cyl)	00:33

Select LDEV Num... Please click the following cell

Select CU No. CU 00 Interval 0

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+a	+b	+c	+d	+e	+f
+00																
+10																
+20																
+30																
+40																
+50																
+60																
+70																
+80																
+90																
+a0																
+b0																
+c0																
+d0																
+e0																
+f0																

<< Before Next >> Cancel

Java Applet Window

Figure 4.54 Selecting VLL Volume Numbers, CU, Interval, and LDEV Numbers

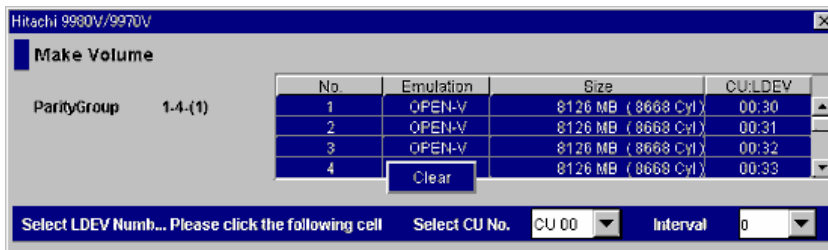


Figure 4.55 Clear Pop-Up Menu

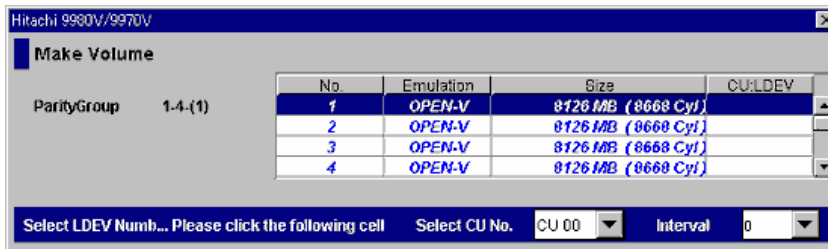


Figure 4.56 Deleted LDEV Numbers

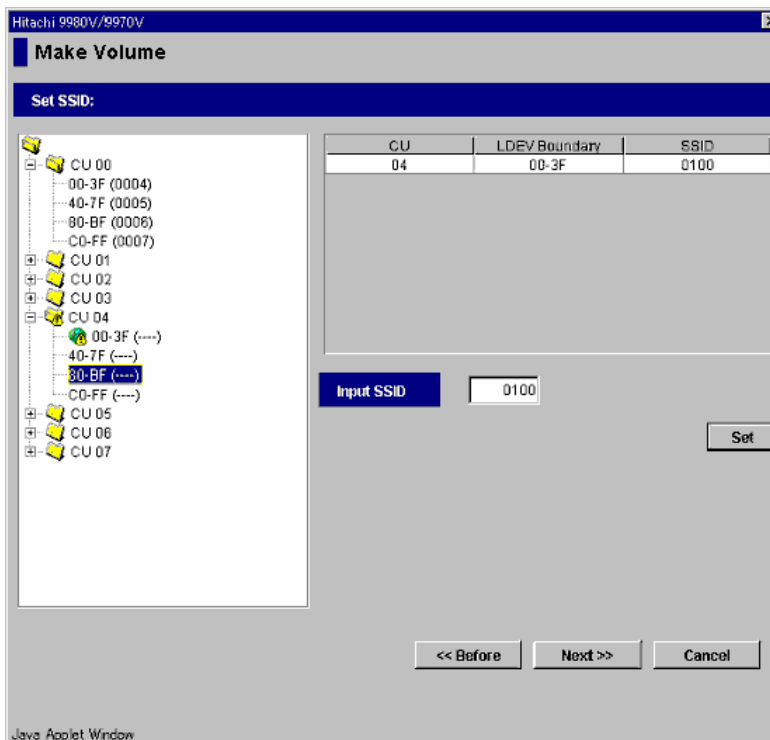


Figure 4.57 Setting SSIDs

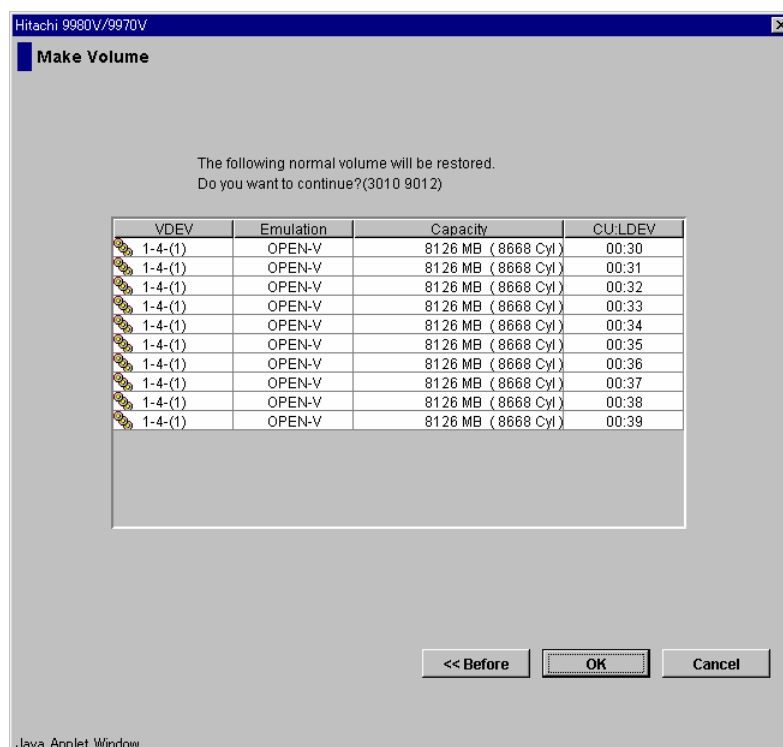


Figure 4.58 Confirming Selection of Normal Volumes

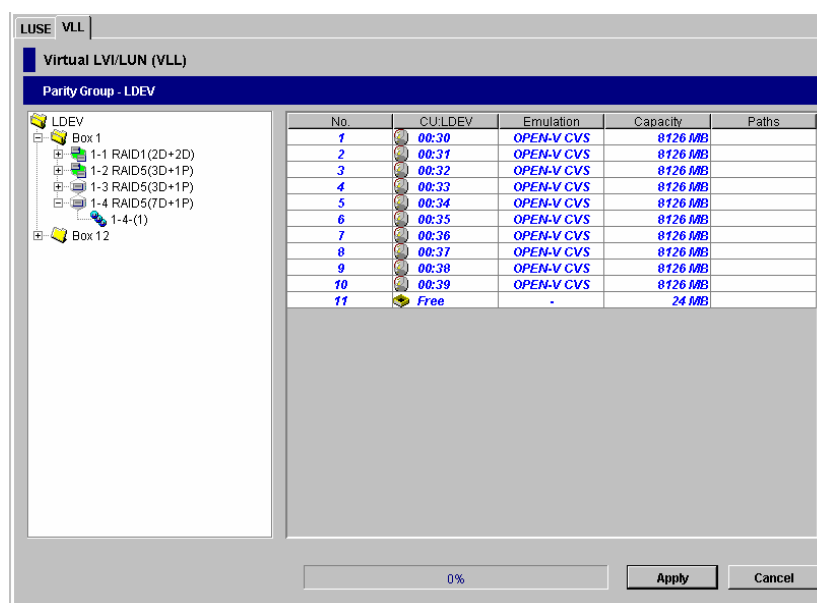


Figure 4.59 Implementing New Normal Volumes

Chapter 5 Troubleshooting

5.1 Troubleshooting

For troubleshooting information on the 9900V subsystem, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100).

For information on the 9900V Storage Navigator software error codes, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator Error Codes* (MK-92RD132).

For general error conditions, see Table 5.1.

The user is responsible for the operation and normal maintenance of the computer(s) that host the 9900V Storage Navigator software.

Here are some guidelines for troubleshooting 9900V Storage Navigator software operations:

- **Check the cabling and the LAN.** Verify that both the computer and LAN cabling are firmly attached, and that the LAN is operating properly.
- **Reboot the computer.** Close any programs that are not responding. If necessary, reboot the computer and restart the 9900V Storage Navigator Java™ applet program.
- **Check for any General Error Conditions.** Check the troubleshooting information in the *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator User's Guide* (MK92RD101). The document lists general error conditions, and provides recommended resolution for each condition. If you are still unable to resolve an error condition, please call the Hitachi Data Systems Support Center for assistance (see section 5.2 for contact information).
- **Check the status lamp on the Storage Navigator main Panel (Status tab).** If the lamp becomes yellow (🟡) or red (🔴), confirm the severity level of the error. If you are unable to resolve an error condition, please contact the Hitachi Data Systems Support Center (see section 5.2).
- **Download the Storage Navigator trace files using the FD Dump Tool.** If you are unable to resolve an error condition, copy the 9900V Storage Navigator configuration information onto a diskette using the FD Dump Tool. See *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator User's Guide* (MK92RD101) for instructions on using the FD Dump tool. Contact the Hitachi Data Systems Support Center (see section 5.2), and give this information to the Hitachi Data Systems service personnel.

Table 5.1 General Error Conditions

Error Condition	Probable Cause / Recommended Action
The Storage Navigator experiences an error.	Save the Java™ log file on the Storage Navigator, and report to the Hitachi Data Systems Support Center. For Windows® 2000, the Java™ log file is located as follows: c:\Documents and Settings\login user ID\plugin131.trace Restart the Storage Navigator computer.
Only the Exit and Refresh buttons are effective when accessing the SVP from the Storage Navigator.	The SVP might not be ready or perform some write processes from the other system. Wait for a while and select Refresh .
Abnormal End / No Response	
An internal error occurs, or a browser ends abnormally (forcibly).	Close all panels including the Storage Device List panel. Log on to the Storage Navigator again. If the same error occurs, restart the Storage Navigator.
A network error occurred. There is no response to an operation.	Restart the Storage Navigator.
Incorrect Display/ Disoperation	
After dragging and dropping objects to another location or area, the scroll bar on that location becomes unusable.	Close all panels including the Storage Device List panel. Log on to the Storage Navigator again.
A focus disappears from the edit box.	Close all panels including the Storage Device List panel. Log on to the Storage Navigator again.
The display of the browser becomes incorrect, because some GUI items such as labels and icons cannot be downloaded properly.	Log off from the Storage Navigator, and then re-log in.
A Storage Navigator panel is closed by: – Selecting the  button on the panel, – Using the commands such as File and Exit on the browser, or – Pressing the Alt and F4 keys.	Wait for an RMI™ time-out (default is 1 minute). Restart the Storage Navigator.
Maintenance / Other	
The program on the SVP is updated.	Exit all browsers on the Storage Navigator. Restart the viewers. If in doubt, exit and restart the viewers.
The time of the clock on the Storage Navigator is reset.	Clear the cache (the existing temporary Internet files) of the browser before logging on to the Storage Navigator.
Storage Navigator processing is temporarily delayed.	An internal process (for example, configuration change, Program Product. check, operational information acquisition) might be in progress on the SVP (web server).
If you are unable to resolve an error condition.	Copy the 9900V Storage Navigator configuration information onto floppy disk(s) using the FD Dump Tool . Contact the Hitachi Data Systems Support Center (see section 5.2).

5.2 Calling the Hitachi Data Systems Support Center

When you call the Hitachi Data Systems Support Center, make sure you provide as much information about the problem as possible. Include the circumstances surrounding the error or failure, the 9900V Storage Navigator configuration information saved in the floppy diskette(s) by the **FD Dump Tool**, the exact content of any messages displayed on the Storage Navigator, and the severity levels and reference codes displayed on the **Status** tab of the Storage Navigator main panel.

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

Acronyms and Abbreviations

CU	control unit
CV	custom volume
FD	floppy disk
FV	fixed volumes
GB	gigabyte
KB	kilobyte
LAN	local area network
LDEV	logical device
LU	logical unit
LUN	logical unit number, logical unit
LUSE	LUN Expansion, LU Size Expansion
LVI	logical volume image (also called device emulation)
MB	megabyte
OS	operating system
R-SIM	remote service information message
SCSI	small computer system interface
SIM	service information message
SNMP	simple network management protocol
SSID	storage subsystem ID
SVP	Service Processor
TID	target ID
VLL	Virtual LVI/LUN
VDEV	virtual device

Index

C

- changing LUSE capacities, 42
- contacting
 - technical support center, 105
- converting volume to space, 72-76
- creating a LUSE volume, 27-35
- creating LUSE volume
 - using LDEV Detail table, 27-30
 - using LDEV Operation detail, 31
 - using Volume Count, 34-35

D

- deleting VLL volumes, 90

G

- general error conditions (table), 104
- Glossary, acronyms and abbreviations, 107-8

I

- initializing VLL volumes, 90-94
- Install CV Panel (1) for OPEN-V, 47
- Install CV Panel (1) for other than OPEN-V, 49
- Install CV panel (2), 51
- installing VLL volumes, 77-82
 - OPEN-V, 83-89

L

- launching
 - LUSE or VLL, 16
- LUSE
 - guidelines, 1
 - launching, 16
 - overview, 1-4
 - panel descriptions, 19-24
 - LUSE tab, LDEV Detail table, 21
 - LUSE tab, LDEV Information outline, 20
 - LUSE tab, LDEV Operation Detail, 23
 - specifications (table), 3
 - specifications for NetApp® gFiler™ Gateways, 5
 - specifications for path-defined LDEVs, 3
- LUSE operations, 25-39
 - changing LUSE capacities, 42
 - creating LUSE volume
 - using LDEV Detail table, 27-30
 - using LDEV Operation detail, 31
 - using Volume Count, 34-35
 - releasing a LUSE volume, 35-39
 - viewing concatenated parity groups, 25-26
- LUSE/VLL panel, LUSE tab

- entire panel, 19
- LDEV Detail table, 21
- LDEV Information outline, 20
- LDEV Operation detail, 23
- LUSE/VLL panel, VLL tab, 43-46
 - entire panel, 43
 - LDEV Information table, 45
 - Parity Group - LDEV outline, 44

M

- Make Volume Confirmation panel, 69
- Make Volume panel (1) (other than OPEN-V), 63
- Make Volume panel (1) for OPEN-V, 61
- Make Volume panel (2), 65
- making VLL volumes, 95-101
- modify mode
 - changing to view mode
 - instructions, 17

O

- overview
 - LUSE operations, 1-4
 - VLL operations, 5-14

R

- releasing a LUSE volume, 35-39

S

- Set SSID (Install CV) panel, 53
- Set SSID (Make Volume) panel, 67
- Set SSID (Volume Initialize) panel, 57
- setting up
 - 9900V subsystem, 15
- specifications
 - LUSE (table), 3
 - VLL LUSE (table), 4

T

- technical support center
 - contacting, 105
- troubleshooting, 101-5

V

view mode

- changing to modify mode
- instructions, 17

viewing concatenated parity groups

- LUSE, 25-26
- VLL, 70-71

VLL

- general specifications (table), 9
- guidelines, 8
- launching, 16
- open-system volume capacities (table), 10
- panel descriptions, 43-69
 - Install CV Panel (1) for OPEN-V, 47
 - Install CV Panel (1) for other than OPEN-V, 49
 - Install CV Panel (2), 51
 - LUSE/VLL panel, VLL tab, 43-46
 - Make Volume Confirmation panel (1), 69
 - Make Volume Panel (1) (other than OPEN-V), 63
 - Make Volume Panel (1) for OPEN-V, 61
 - Make Volume panel (2), 65
 - Set SSID (Install CV) panel, 53
 - Set SSID (Make Volume panel (1), 67
 - Set SSID (Volume Initialize) panel, 57
 - VLL tab, LDEV Information table, 45
 - VLL tab, Parity Group-LDEV outline, 44
 - Volume Initialize Confirmation panel, 59
 - Volume Initialize panel, 55
- parity group configuration, 13
- size of control cylinders/control area (table), 10
- SSID Requirements (table), 13
- volume size calculation (open systems), 12
- volume size calculation ($S/390^{\text{®}}$), 11

VLL LUSE

- specifications (table), 4

VLL operations

- converting volume to space, 72-76
- deleting VLL volumes, 90
- initializing VLL volumes, 90-94
- installing VLL volumes, 77-82
 - OPEN-V, 83-89
- making OPEN-V volumes, 95-101
- overview, 5-14
- viewing concatenated parity groups, 70-71

Volume Initialize Confirmation panel, 59

Volume Initialize panel, 55