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Hitachi Freedom Storage™ Thunder 9200™

LU Expansion User's Guide

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Document Revision Level

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The following source document was used to produce this 9200 user guide:

- *LU Expansion Feature User's Guide (preliminary version)*, Second Edition.

Preface

The *Hitachi Freedom Storage™ Thunder 9200™ LU Expansion User's Guide* assumes that:

- The user has a background in data processing and understands direct-access storage device subsystems and their basic functions.
- The user is familiar with the Hitachi Freedom Storage™ Thunder 9200™ array subsystem.

This manual is divided into two parts:

- Part 1: Graphical User Interface (GUI)
- Part 2: Command Line Interface (CLI)

Note: The term "9200" refers to the Hitachi Thunder 9200™ subsystem, unless otherwise noted. Please refer to the *Hitachi Thunder 9200™ User and Reference Guide* (MK-90DF504) for further information on the 9200 disk array subsystem.

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Chapter 1 Overview of LU Expansion

The LU Expansion feature enables you to unify LUs. To unify multiple logical units (LUs), expand the size of the LU and create a single LU called a *unified LU*.

Conventionally, subsystems which installed microprogram version 0558/D and version 0508/D or earlier which used the LU Expansion feature, could only expand the size of the last LU that existed within the same RAID group (see Figure 1.1). However, the LU size could not be expanded when the size exceeded the open area of the RAID group.

In addition to the conventional LU expansion, for subsystems with microprogram version 0509 and version 0559 or later, multiple LUs can be combined together as one LU (see Figure 1.2) regardless of RAID group differences. This enables you to combine LUs that have insufficient capacity with unnecessary LUs. It also enables suitable environment settings due to additional disk drives or subsystem cabinets.

Unified LUs are recognized as a single LU from the server.

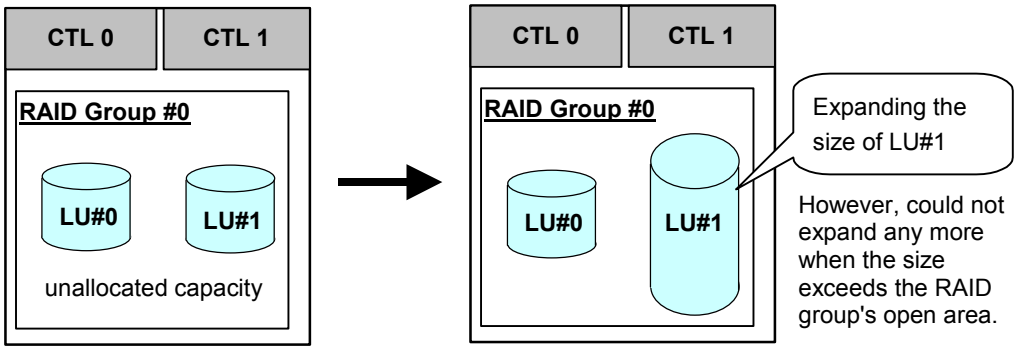
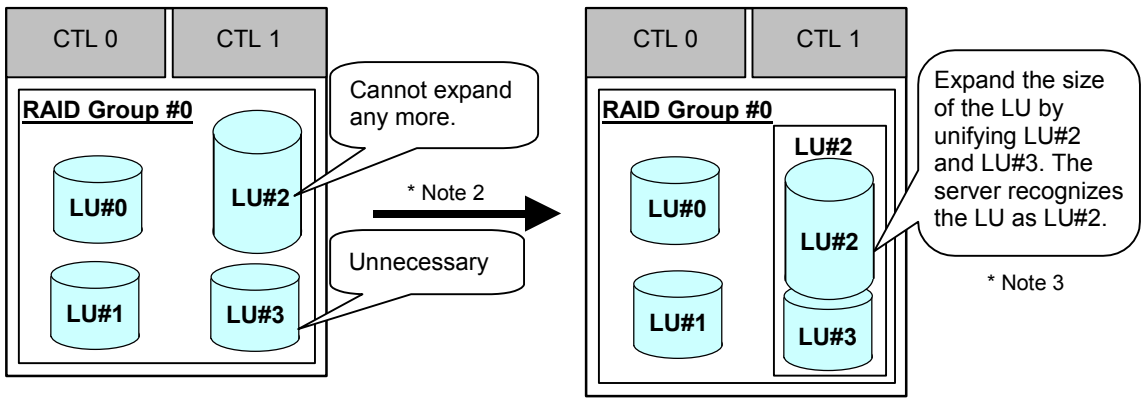
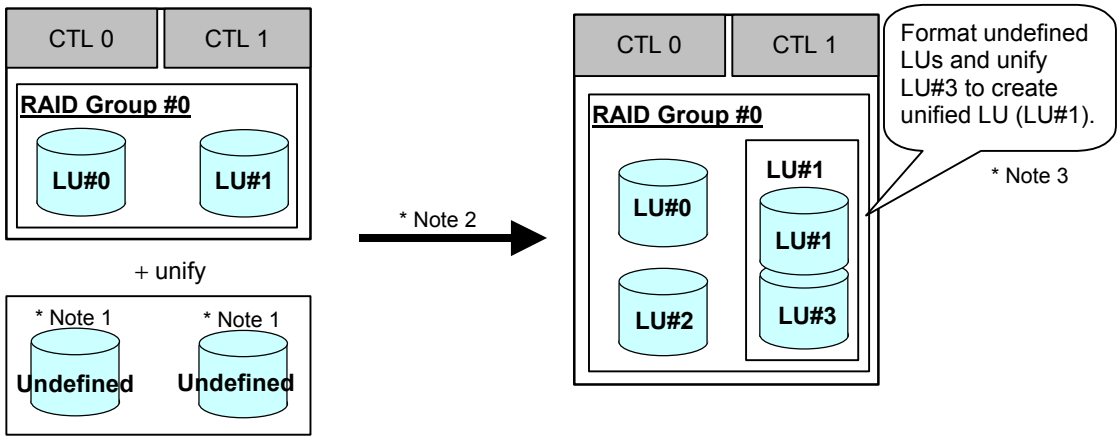


Figure 1.1 Conventional LU Expansion Feature

LU Unification using unnecessary LUs



LU Unification associated with additional disk drive or cabinet



Note 1: Undefined LUs must be formatted before LU unification.
Note 2: Backup the LU data from the server before LU unification.
Note 3: Proceed with the following after unifying the LUs:
1. Format the file system of the server. Some servers may need to reboot the system, depending on the operating system. For details, see section 1.1.
2. Restore the backup data.

Figure 1.2 LU Expansion Feature Now

In addition to LU unification, the LU Expansion feature also enables you to re-unify a unified LU, and release the unification of LUs (separating a unified LU into separate LUs, or separating only the last LU from the unified LU). For details on the LU Expansion feature specifications, see section 1.2.

The LU Expansion feature operations can be performed from the Resource Manager 9200 program via GUI or CLI, see *Hitachi Freedom Storage™ Thunder 9200™ Resource Manager 9200 User's Guide* (MK-91DF552). Command execution for unified LUs is identical to command execution for general LUs. You can also verify unified LU information when a failure occurs.

If you are using the GUI version of the Resource Manager 9200 program to perform LU Expansion operation, refer to Chapter 2 and Chapter 3. If you are using the CLI, refer to Chapter 4 and Chapter 5.

1.1 Notes

When performing the unification of LUs, servers format the LU or reboot the system differently depending on the operating system. Follow the procedures shown below when unifying the LUs.

Table 1.1 System Management Procedure for Operational Systems

OS Procedure	Solaris	IRIX	HP-UX	AIX	Windows 2000
1. Backup the LU data from the server.	√	√	√	√	-
2. Format the LU you want to unify in order to erase the label that was given when the operating system first recognized the LU.	√ ***Note 1***	√ ***Note 1***	-	-	-
3. Unify the LUs from the subsystem.	√	√	√	√	√
4. Reboot the server to hide the messages for the internal LUs (SubLUs), and to re-recognize the LUs.	√	√	√	√	-
5. Restore the LU backup data.	√	√	√	√	-
6. Create an extended partition (disk) for the LU.	-	-	-	-	√

Note 1: LUs cannot be formatted if you have selected the "Drive Detach Mode" option in the System Parameter Wizard of the Resource Manager 9200 program. De-select the option, reboot the subsystem and format the LUs.

1.2 Function Specifications and Restrictions

The following table lists the function specifications and restrictions of the LU Expansion feature.

Table 1.2 Function Specifications and Restrictions

No.	Item	Specification
1	User interface	- Microprogram (Ver. 0509 or Ver. 0559 or later) - Resource Manager 9200 program (Ver. 5.30 or later) - Key FD or key code for LU Expansion feature
2	Number of logical units	Maximum of 64 logical units can be unified. Numbers of the logical units that can be recognized from the server is less than 64.
3	LU unification	- A formatted logical unit, AND two internal LUs (per operation) with different parity width (mD+nP) can be unified. - An LU that enables the server to see the information is called a *MainLU*, and an LU that cannot be seen from the server due to unification is called a *SubLU*. MainLU and SubLU can be specified when unifying the LU. - An already unified LU can be re-unified again. - After LU unification, SubLUs cannot be accessed from the server (the server cannot recognize SubLUs). - LUs that are being used by the server cannot be size expanded. - LUs cannot be unified when microcode is being changed online.

Table 1.2 Function Specifications and Restrictions (continued)

No.	Item	Specification
4	LU configuration	The configuration of the logical unit can be browsed from the Resource Manager 9200 program.
5	LU statuses	The Resource Manager 9200 program provides a Web Server Function that displays the operation result of the logical units in a message format. Since the Web Server Function displays information about the logical unit via a browser, the status of the logical unit (and the operation result) can be easily confirmed.
6	Usage of LU#0	LU#0 can be specified as MainLU (cannot specify as SubLU).
7	LU size expansion	When you have unified the last defined LU, it cannot be size extended (cannot perform the conventional LU expansion to the last defined LU after unification).
8	LU blockage	When the internal logical unit blockage occurs, the status of the unified LU becomes unformatted. In such cases, all the internal logical units that have been separated from the unified LU also become unformatted.
9	LU attribute	- The attributes of the MainLU (LUN security, LU mapping, RAID level, LU related information of SNMP, and statistical information) will be inherited as the attributes of the unified LU. - The capacity of a unified LU is a value obtained by adding the capacity of the internal LUs.
10	LU size to be reported to the host	For AIX only. When unifying an LU, whose size is set to adjust automatically by the subsystem, unification is performed within the adjusted size.
11	LUN mapping	Mapping to the unified LU is set by specifying a MainLU.
12	Separating the last LU	You can separate the logical unit (SubLU) that was last combined to the unified LU. This is useful when the user made an operational mistake.
13	Number of internal LUs in a unified LU	Unified LU is composed by two internal LUs. When re-unifying a unified LU, the numbers of the internal LU will be from 2 to 64.
14	Status of the unified LU	- LUs in Normal or Regression (degenerated) status can be unified. - LUs in Alarm or Unformat (blocked or unformatted) status cannot be unified (recover the Alarm status, format the LU, and then unify the LU).
15	Re-unifying a unified LU	- You can re-unify a unified LU by specifying it as a MainLU. - You cannot re-unify a unified LU by specifying it as a SubLU. If you want to specify an already unified LU as SubLU, release the unification and separate all logical units. Then unify each LU to the MainLU. - Unified LU with the size of 2 TB or more cannot be re-unified. When re-unification is executed to such LU, a message is reported from the Resource Manager 9200 program.
16	Separating a unified LU into separate LUs	- You can release the unification of the LUs and separate it into individual LUs (e.g. if a unified LU is composed by three internal LUs, releasing the unification ends up in separating into three individual LUs). - You cannot specify a specific LU to be separated from the internal LUs that composes a unified LU.
17	Data assurance of the LUs to be unified	- When expanding the size or unifying LUs, data must be backed up previously from the server. - After expanding the size or unifying LUs, the file system of the server must be formatted and the backed up data must be restored.

Table 1.2 Function Specifications and Restrictions (continued)

No.	Item	Specification
18	Formatting the unified LU	- Format to the unified LU is also performed to all the internal LUs in sequence. - When the internal LU blockage/degeneration (Alarm/Regression) occurs while formatting, the status of the unified LU becomes blocked/degenerated at the time when formatting completes.
19	Blockage (Alarm status) of the unified LU	When a blockage occurs in the internal LU of the unified LU and the status changes to Unformat, the unified LU will also be in blocked (Alarm) status (when "Drive Detach Mode" is specified, the internal LU and the unified LU also becomes blocked and will be in Unformat status due to such as double malfunction of the disk drive.
20	Rebooting the server	Reboot the server when changing the LU size (in order to make the LU attribute information become effective on the server's operating system).
21	Access from the server	- When unifying the LUs, the access from the server is permitted to LUs excluding the LUs that are being unified. - When accessing a SubLU that is being unified, the response from the server will be "Check Condition (LU undefined)".
22	Statistical information	- Information of the MainLU will be displayed in the Resource Manager 9200 program as the information of the unified LU. - Unlocking (enabling) the LU Expansion feature enables the Resource Manager 9200 to display the statistical information of each SubLU.
23	Trace	- The execution of the LU unification and releasing the unification will be collected as trace data. - The command information to the unified LUN will be collected to the host's command device trace data.
24	Controller in charge	When the controller in charge is different, change the controller, reboot the subsystem and then unify the LUs.
25	Disk drive blockage	When the status of the internal LU is degenerated (Regression) due to disk drive blockage, the unified LU will also be degenerated.
26	Usage with MRCF	MRCF volumes in simplex status (SMPL) can be specified for LU unification (MRCF volumes in paired status (PAIR) cannot be unified).
27	RAID level	- RAID5, RAID0+1, RAID1 and unification of LUs between different RAID groups can be performed. - You can mix RAID groups (a confirmation message will be displayed whenever unifying the LUs). - You cannot unify a LU with RAID0.

PART 1: Graphical User Interface (GUI)

Chapter 2 Preparing for LU Unification Operations (GUI)

This chapter provides instructions for preparing for LU operations using the GUI version of the Resource Manager 9200 program. This section includes the following:

- Installing the LU Expansion Feature (required, see sections 2.1 and 2.1.1)
- Creating a New Logical Unit (optional, see section 2.2)
- Expanding the Size of the Last Logical Unit (optional, see section 2.3)

2.1 Installing and Uninstalling the LU Expansion Feature

The LU Expansion feature is usually unselectable (locked); to make it available, you must install the LU Expansion feature and make its functions selectable (unlocked). **To install this function, an option FD provided with the optional feature or the key code is required.**

Follow the instructions below to install The LU Expansion feature. LU Expansion is installed and uninstalled using Resource Manager 9200. To operate the Resource Manager 9200 program using a graphic interface, refer to the *Hitachi Freedom Storage™ Thunder 9200™ Resource Manager 9200 User's Guide* (MK-91DF552). See *Part 1: Graphical User Interface (GUI)*.

Note: Before installing and uninstalling, make sure that the array unit is in normal operating condition. If a failure such as a controller blockade has occurred, installation and uninstallation operations cannot be performed.

2.1.1 Installing the LU Expansion Feature

The following paragraphs describe installation procedures performed by using the GUI version of Resource Manager 9200.

1. Start the Resource Manager 9200, and change the operation mode to **Management Mode** (administrator mode).
2. Register the subsystem (array unit) in which you will install the LU Expansion feature. Connect to the subsystem.

The Array System Viewer panel appears; it displays the connected subsystem.

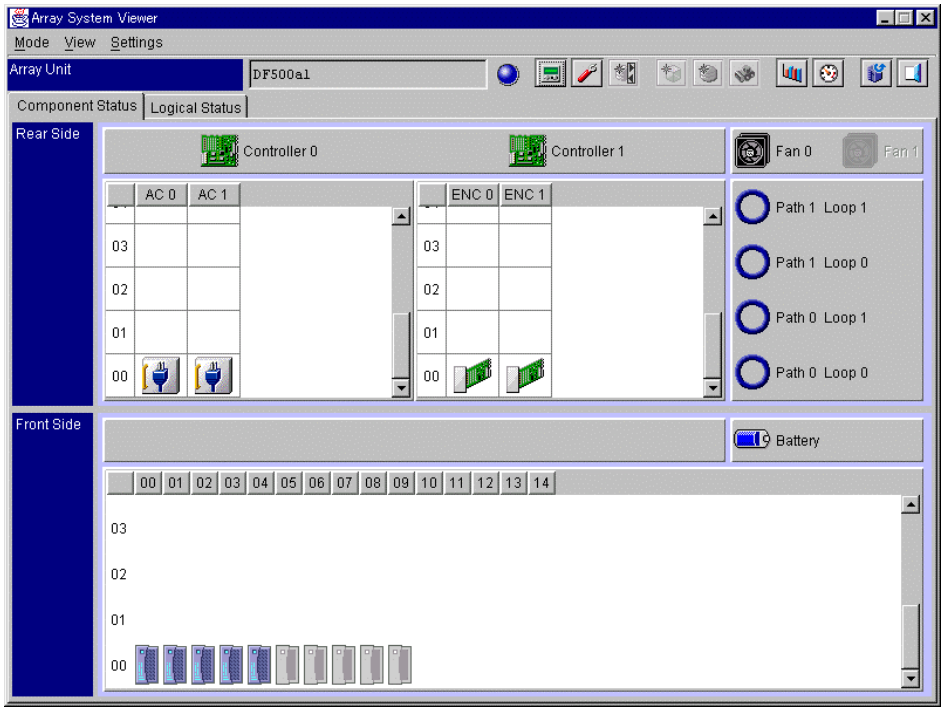


Figure 2.1 Array System Viewer Panel (Component Status page)

3. From the **Settings** menu, select **Configuration Settings**. Alternatively, from the tool bar, select the **Configuration Settings** button.

   The Parameter panel is displayed.

4. On the Parameter panel, select the **Options** tab.

   The **Options** page is displayed in front.

5. Unlock the optional feature by using either of the following:
   - LU Expansion Key FD
   - LU Expansion Key Code

LU Expansion Key FD

a) Insert the key FD into the FDD of the system where Resource Manager 9200 is installed.

b) Click the **Directory** radio button to enter a path to the FD.

c) Click the **Unlock** button.

d) A screen appears, requesting confirmation to unlock LU Expansion. Click the **OK** button.

e) In the **Option Name**, "LU-EXPANSION" is displayed; the status is "Enable".

LU Expansion Key Code

a) Click the **Key Code** radio button to enter a key code in the text box.

b) Click the **Unlock** button.

c) A screen appears, requesting confirmation to unlock LU Expansion. Click the **OK** button.

d) In the **Option Name**, "LU-EXPANSION" is displayed; the status is "Enable".

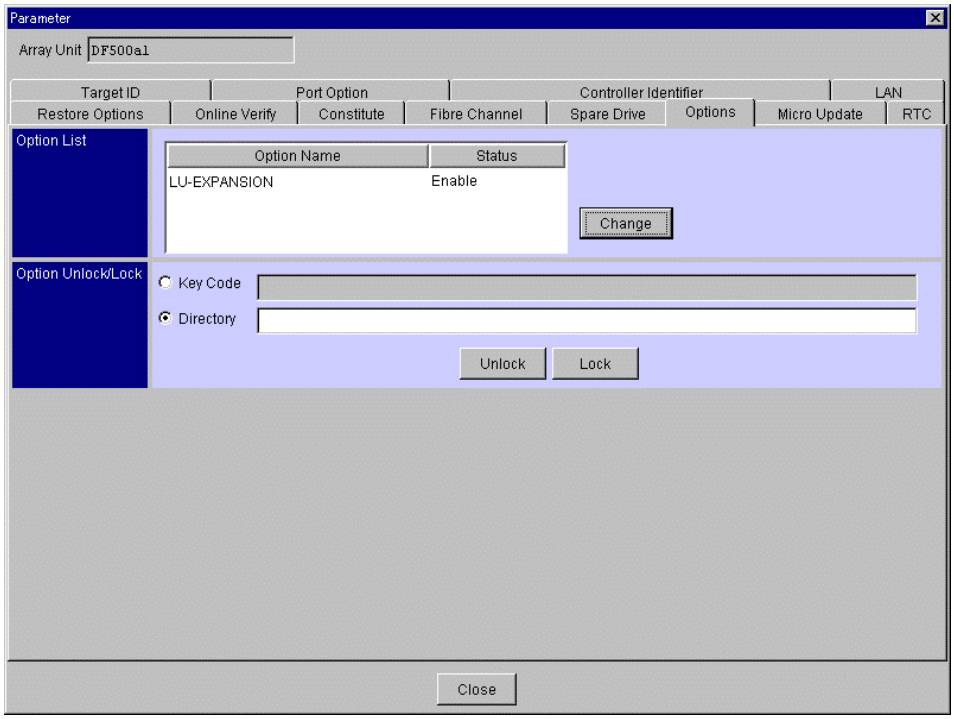


Figure 2.2 Parameter Panel (unlocked)

The installation of the LU Expansion feature is now complete. To perform other operations, connect to the subsystem again and open the Array System Viewer panel.

2.1.2 Uninstalling the LU Expansion Feature

Follow the instructions below to uninstall the LU Expansion feature. When it is uninstalled, the LU Expansion feature is not available (locked) until it is opened by the Option floppy disk or the key code.

Note: The following condition must be satisfied in order to uninstall the LU Expansion feature.

– All unified LUs must be separated.

Note that the status of the LUs and the specification of command devices are not significant factors in this process.

Follow the instructions below to uninstall LU Expansion:

1. Start the Resource Manager 9200 program and change the operation mode to **Management Mode** (administrator mode).
2. Register the subsystem (array unit) in which you will uninstall the LU Expansion feature. Connect to the subsystem.

   The Array System Viewer panel (Figure 2.1) appears; it displays the connected subsystem.
3. From the **Settings** menu, select **Configuration Settings**. Alternatively, from the tool bar, select the **Configuration Settings** button.

   The Parameter panel is displayed.
4. On the Parameter panel, select the **Options** tab.

   The **Options** page (Figure 2.2) is displayed in front.
5. Lock the optional feature by using either of the following:
   - LU Expansion Key FD
   - LU Expansion Key Code

LU Expansion Key FD

a) Insert the key FD into the FDD of the system where Resource Manager 9200 is installed.

b) Click the **Directory** radio button to enter a path to the FD.

c) Click the **Lock** button.

d) A screen appears, requesting confirmation to lock LU Expansion. Click the **OK** button.

LU Expansion Key Code

a) Click the **Key Code** radio button to enter a key code in the text box.

b) Click the **Lock** button.

c) A screen appears, requesting confirmation to lock LU Expansion. Click the **OK** button.

The LU Expansion feature is now uninstalled. To perform other operations, connect to the subsystem again and open the Array System Viewer panel.

2.1.3 Enabling or Disabling the LU Expansion Feature

The LU Expansion feature can be set to enable or disable when it is installed.

Note: The following condition must be satisfied in order to uninstall the LU Expansion feature.

- All unified LUs must be separated.

Note that the status of the LUs and the specification of command devices are not significant factors in this process.

Follow the instructions below to enable/disable LU Expansion:

1. Start the Resource Manager 9200 program and change the operation mode to **Management Mode** (administrator mode).
2. Register the subsystem (array unit) in which you will change the status of the LU Expansion feature. Connect to the subsystem.

   The Array System Viewer panel appears; it displays the connected subsystem.
3. From the **Settings** menu, select **Configuration Settings**. Alternatively, from the tool bar, select the **Configuration Settings** button.

   The Parameter panel is displayed.
4. On the Parameter panel, select the **Options** tab.

   The **Options** page is displayed in front.

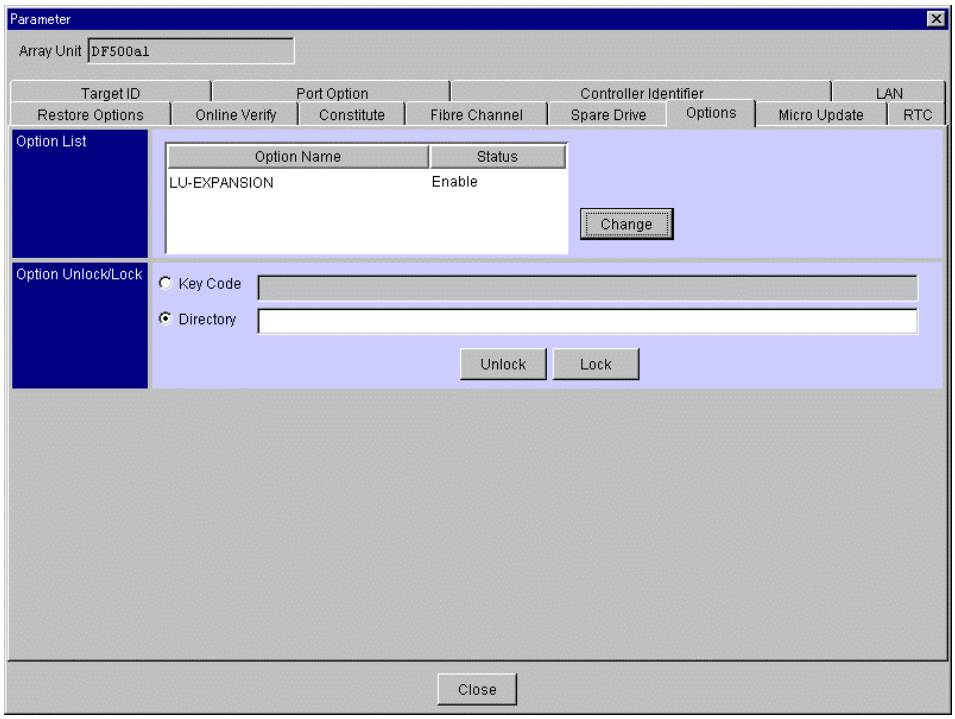


Figure 2.3 Parameter Panel (enabled)

5. In the **Option Name**, "LU-EXPANSION" is displayed; the status is "Enable".
6. A message appears, confirming that you want to change the status (enable or disable). Click the **OK** button.

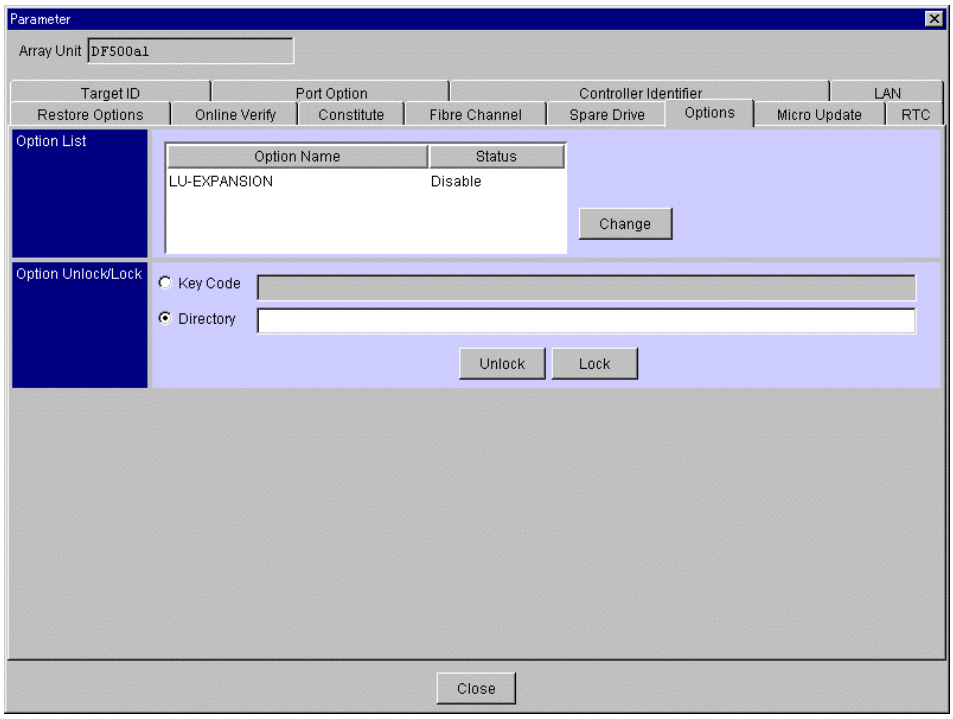


Figure 2.4 Parameter panel (disabled)

The status of LU Expansion feature is now changed (enabled/disabled). To perform other operations, connect to the subsystem again and open the Array System Viewer panel.

2.2 Creating a New Logical Unit

More than two LUs are required for unification of LUs.

Follow the instructions below to create a new LU:

1. In the Array Viewer panel, from the **Logical Status** page, select the RAID group where you want to create the LU.
2. From the **Settings** menu, select **Logical Unit**, then select **Settings**.
3. On the Property panel, enter the capacity for the LU in **Size**, then select the **OK** button.
   The LU size is set.
4. A message is displayed when the process is complete. Click the **OK** button.
   You will return to the Array System Viewer panel. The LU you created will be displayed.
5. Format the LU.

For details on creating or formatting the LU, refer to the *Hitachi Freedom Storage™ Thunder 9200™ Resource Manager 9200 User's Guide* (MK-91DF552). See *Part 1: Graphical User Interface (GUI)*.

2.3 Expanding the Size of the Last Logical Unit

You can expand the size of the last LU without unifying LUs, using the conventional process. For details, refer to the *Hitachi Freedom Storage™ Thunder 9200™ Resource Manager 9200 User's Guide* (MK-91DF552). See *Part 1: Graphical User Interface (GUI)*.

Chapter 3 Performing LU Unification Operations (GUI)

This chapter explains how to execute the LU Expansion feature using the GUI version of the Resource Manager 9200 program. This section includes the following:

- Unifying LUs (see section 3.1)
- Separating Unified LUs (see section 3.2)
- Separating the Last LU from the Unified LU (see section 3.3)
- Confirming the Status of Unified LUs (see section 3.4)

3.1 Unifying LUs

Multiple LUs can be combined together to create a "unified LU". If there is only one LU, create an LU(s) by following the procedure in section 2.2.

A unified LU consists of MainLU and SubLU. Once unified, it is recognized as a MainLU from the server. You can combine more LUs (SubLUs) on a unified LU (MainLU); this is referred to as: "Re-unifying LUs". Note that combining unified LU (MainLU) on a LU (SubLU) cannot be performed.

Note: Back up the LU data from the server before unifying LUs. Some servers may have to reboot the system, depending on the operating system. For details, see section 1.1.

Follow the instructions below to unify LUs:

1. Start the Resource Manager 9200 program connect to the subsystem where you want to operate the LUs.

The Array System Viewer panel appears; it displays the connected subsystem.

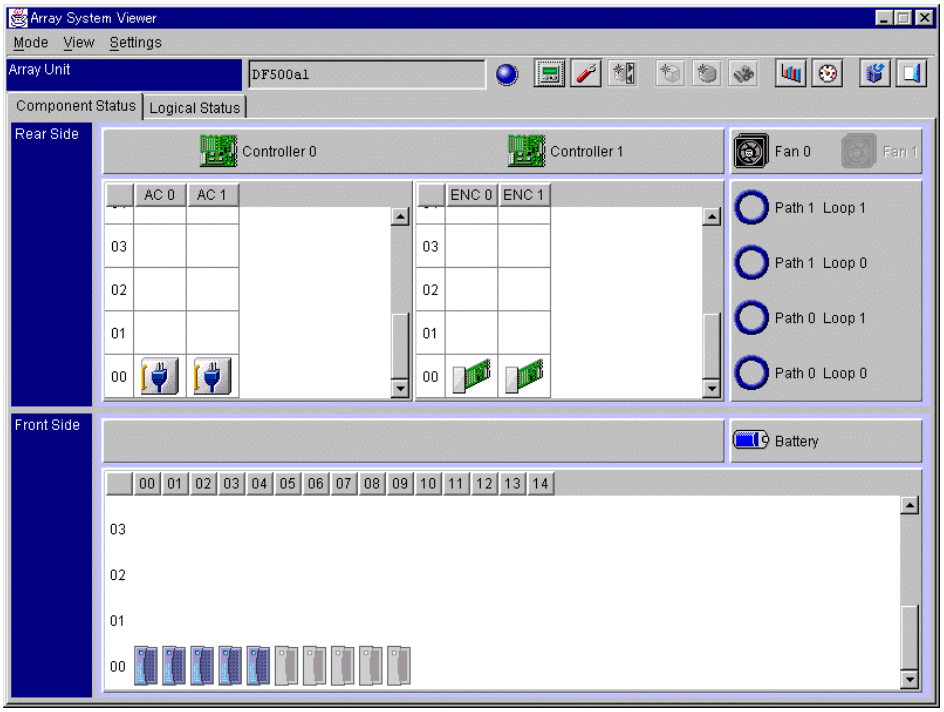


Figure 3.1 Array System Viewer panel (Component Status page)

2. On the Array System Viewer panel, select the **Logical Status** tab.

The **Logical Status** page is displayed in front.

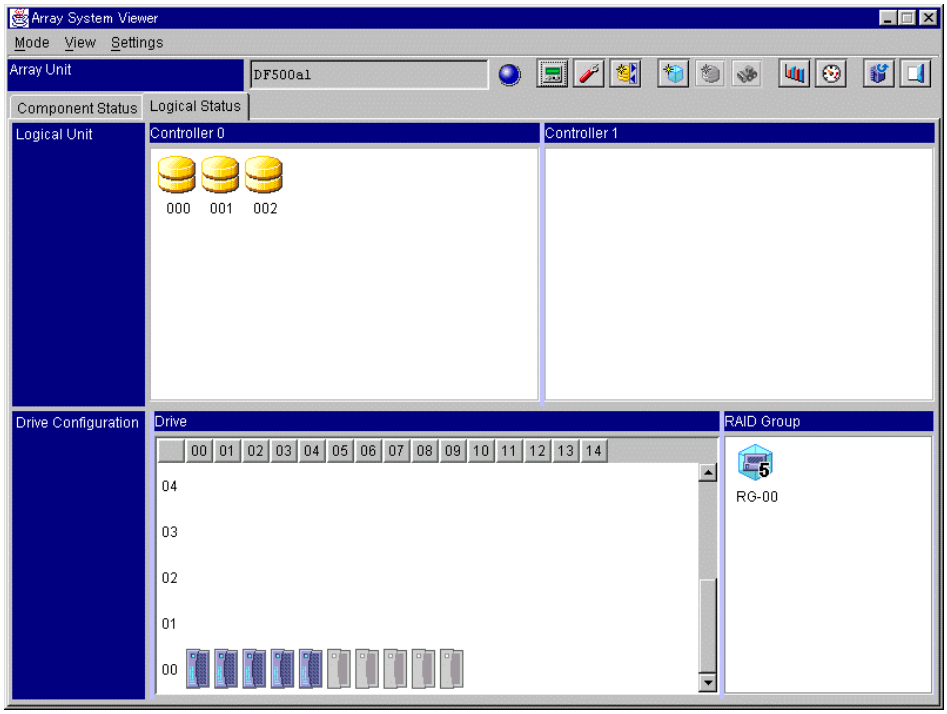


Figure 3.2 Array System Viewer panel (Logical Status page)

3. From **Logical Unit**, select an LU for MainLU.
4. From the **Settings** menu, select **Logical Unit** – **Unify Logical Units**.

   The Unify Logical Units panel opens, displaying the number of the selected LU in **Main Logical Unit No.** text box.

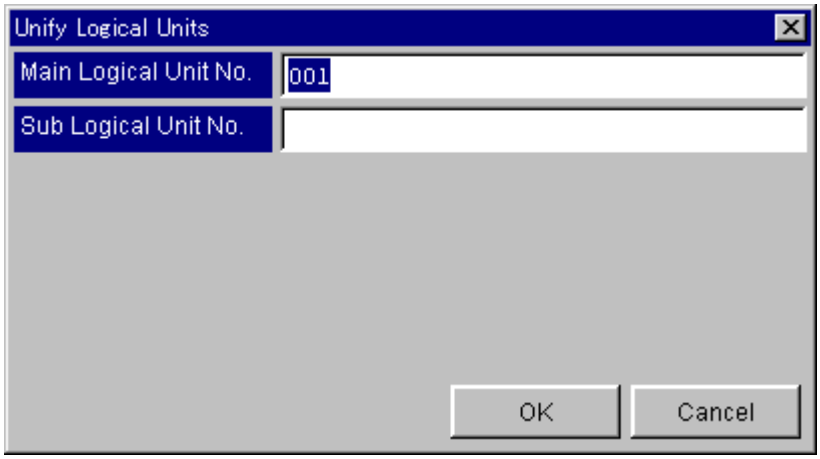


Figure 3.3 Unify Logical Units panel

5. Enter the number of the SubLU in the **Sub Logical Unit No.** text box, then select the **OK** button.

   The Resource Manager 9200 program checks the validity of the numbers (the LU numbers must be specified between 0 to 63).

6. When the LU numbers are valid, a message appears, asking you to confirm that you want to unify the LUs. Click the **OK** button.

   The LUs will be unified. When the process is finished, a completion message is displayed. If a failure occurs, an error message is displayed. For details on error messages, see Appendix B.

You will return to the Array System Viewer panel. The icons of the unified LU (MainLU) and the SubLU have changed (see section 3.4).

Note: Using the Web Server Function enables you to confirm the operation result. The results are displayed as a Web Information Message and are displayed in a message format. The messages are output in order, from bottom to top (the newest message is displayed at the top).

The following is an example of the Web Information Message.

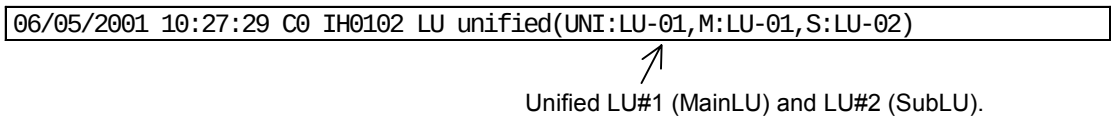


Figure 3.4 Web Information Message Example for Unification of Logical Units

3.2 Separating Unified LUs

The unification of LUs can be released by separating the unified LU into individual LUs. All LUs combined into the unified LU will be separated.

Follow the instructions below to separate individual LUs from a unified LU:

1. Start the Resource Manager 9200.
2. Connect to the subsystem from which you want to operate the LUs.

   The Array System Viewer panel appears (Figure 3.1); it displays the connected subsystem.
3. On the Array System Viewer panel, select the **Logical Status** tab.

   The **Logical Status** page is displayed in front (Figure 3.2).
4. From **Logical Unit**, select a unified LU.
5. From the **Settings** menu, select **Logical Unit** – **Separate All Logical Units**.

   A message appears, asking you to confirm that you want to release the unification of the LUs. Click the **OK** button.

The unification of LUs will be released and all LUs will be separated. When the process is finished, a completion message is displayed. If a failure occurs, an error message is displayed. For details on error messages, see Appendix B.

You will return to the Array System Viewer panel. You can verify that the individual LUs are separated from the unified LU.

Note: Using the Web Server Function enables you to confirm the operation result. The results are displayed as a Web Information Message and are displayed in a message format. The messages are output in order, from bottom to top (the newest message is displayed at the top).

The following is an example of the Web Information Message.

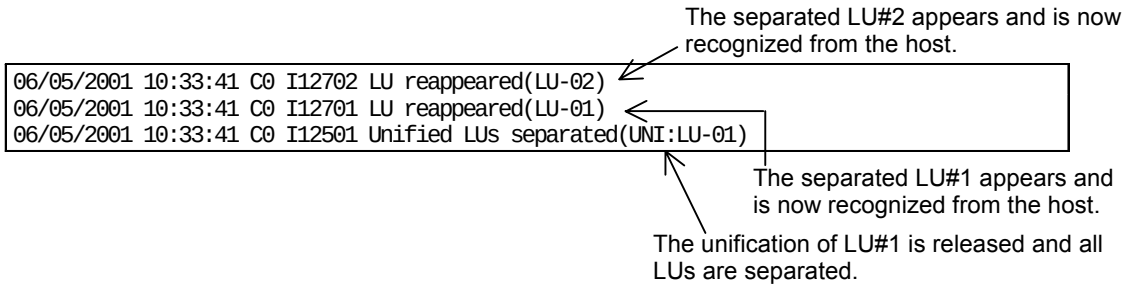


Figure 3.5 Web Information Message Example for Separating the Unified Logical Units

3.3 Separating the Last LU from the Unified LU

The last LU combined into the unified LU can be separated from the unified LU.

Follow the instructions below to separate the last LU from a unified LU:

1. Start the Resource Manager 9200.
2. Connect to the subsystem from which you want to operate the LUs.

   The Array System Viewer panel appears (Figure 3.1); it displays the connected subsystem.
3. On the Array System Viewer panel, select the **Logical Status** tab.

   The **Logical Status** page is displayed in front (Figure 3.2).
4. From **Logical Unit**, select an LU for MainLU .
5. From the **Settings** menu, select **Logical Unit** – **Separate Last from Unified Logical Unit**.

   A message appears, asking you to confirm that you want to separate the last LU combined into the unified LU. Click the **OK** button.

Only the last LU will be separated. When the process is finished, a completion message is displayed. If a failure occurs, an error message is displayed. For details on error messages, see Appendix B.

You will return to the Array System Viewer panel. You can verify that the last LU is separated from the unified LU.

Note: Using the Web Server Function enables you to confirm the operation result. The results are displayed as a Web Information Message and are displayed in a message format. The messages are output in order, from bottom to top (the newest message is displayed at the top).

The following is an example of the Web Information Message.

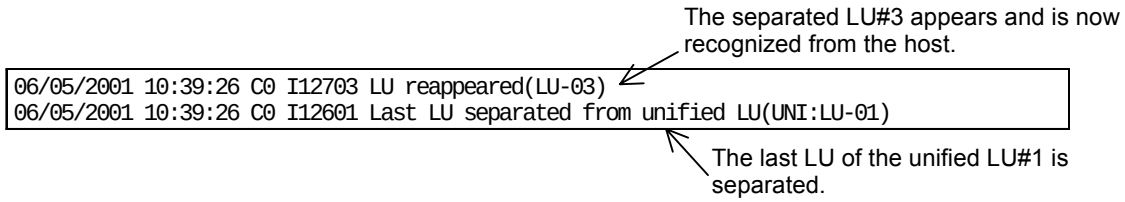


Figure 3.6 Web Information Message Example for Separating the Last Logical Unit

3.4 Confirming the Status of the Unified LUs

The status of unified LUs can be verified using the Resource Manager 9200 program. The status is displayed as an icon in the **Logical Status** page of the Array System Viewer panel.

Table 3.1 Icons for Unified LUs

Icons	Statuses	Meaning
 yellow	Normal	Indicates that the unified logical unit is in normal status.
 pink	Regression	Indicates that the unified logical unit is in degenerated status.
 red	Alarm	Indicates that the unified logical unit is in blocked status.
 light gray	Unformat	Indicates that the unified logical unit has not been formatted yet.
 dark gray	Sub Logical Unit	Indicates a SubLU.

You can verify the properties of the unified LU by double-clicking the icon. Alternatively, you can right-click the icon and from the displayed pop-up menu and select **Properties**.

The Property panel will be displayed.

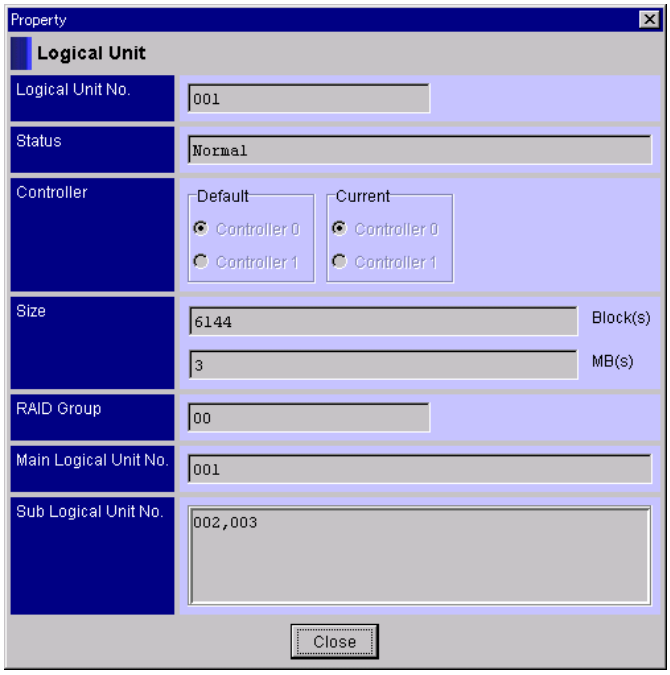


Figure 3.7 Property panel

PART 2: Command Line Interface (CLI)

Chapter 4 Preparing for LU Unification Operations (CLI)

This chapter provides instructions for preparing for LU operations using the CLI version of the Resource Manager 9200 program. This section includes the following:

- Installing the LU Expansion Feature (required, see sections 4.1 and 4.1.1)
- Creating a New Logical Unit (optional, see section 4.2)
- Expanding the Size of the Last Logical Unit (optional, see section 4.3)

4.1 Installing and Uninstalling the LU Expansion Feature

The LU Expansion feature is usually unselectable (locked); to make it available, you must install the LU Expansion feature and make its functions selectable (unlocked). **To install this function, an option FD provided with the optional feature or the key code is required.**

Follow the instructions below to install The LU Expansion feature. LU Expansion is installed and uninstalled using Resource Manager 9200. To operate the Resource Manager 9200 program using a graphic interface, refer to the *Hitachi Freedom Storage™ Thunder 9200™ Resource Manager 9200 User's Guide* (MK-91DF552). See *Part 2: Command Line Interface (CLI)*.

Note: Before installing and uninstalling, make sure that the array unit is in normal operating condition. If a failure such as a controller blockade has occurred, installation and uninstallation operations cannot be performed.

4.1.1 Installing the LU Expansion Feature

The following paragraphs describe installation procedures performed by using the CLI version of Resource Manager 9200.

1. From the command prompt, register the subsystem (array unit) in which you will install the LU Expansion feature. Connect to the subsystem.
2. Unlock the optional feature by using either of the following:
   - LU Expansion Key FD
   - LU Expansion Key Code

LU Expansion Key FD

Execute the **auopt** command to unlock the LU Expansion feature.

Example:

```
% auopt –unit subsystem-name –lock off –keyfd a:
Password: manager-password
Option was opened.
%
```

LU Expansion Key Code

Execute the **auopt** command to unlock the LU Expansion feature.

Example:

```
% auopt –unit subsystem-name –lock off –keycode manual-attached-keycode
Password: manager-password
Option was opened.
%
```

The installation of the LU Expansion feature is now complete and the status is "Enable".

4.1.2 Uninstalling the LU Expansion Feature

Follow the instructions below to uninstall the LU Expansion feature. When it is uninstalled, the LU Expansion feature is not available (locked) until it is opened by the Option floppy disk or the key code.

Note: The following condition must be satisfied in order to uninstall the LU Expansion feature.

- All unified LUs must be separated.

Note that the status of the LUs and the specification of command devices are not significant factors in this process.

Follow the instructions below to uninstall LU Expansion:

1. From the command prompt, register the subsystem (array unit) in which you will uninstall the LU Expansion feature. Connect to the subsystem.
2. Lock the optional feature by using either of the following:
   - LU Expansion Key FD
   - LU Expansion Key Code

LU Expansion Key FD

Execute the **auopt** command to lock the LU Expansion feature.

Example:

```
% auopt –unit subsystem-name –lock on –keyfd a:
Password: manager-password
Option was closed.
%
```

LU Expansion Key Code

Execute the **auopt** command to lock the LU Expansion feature.

Example:

```
% auopt –unit subsystem-name –lock on –keycode manual-attached-keycode
Password: manager-password
Option was closed.
%
```

3. Execute the **auopt** command to verify that the LU Expansion feature is locked.

Example:

```
% auopt –unit subsystem-name –refer
Password: manager-password
Option name        Status
DMEC002015: No information displayed.
%
```

The LU Expansion feature is now uninstalled.

4.1.3 Enabling or Disabling the LU Expansion Feature

The LU Expansion feature can be set to enable or disable when it is installed.

Note: The following condition must be satisfied in order to uninstall the LU Expansion feature.

- All unified LUs must be separated.

Note that the status of the LUs and the specification of command devices are not significant factors in this process.

Follow the instructions below to enable/disable LU Expansion:

1. From the command prompt, register the subsystem (array unit) in which you will change the status of the LU Expansion feature. Connect to the subsystem.
2. Execute the **auopt** command to change the status (enable or disable) of the LU Expansion feature.

   The following is an example of how to change the status from enable to disable. To change the status from disable to enable, enter **enable** after the **-st** option.

Example:

```
% auopt –unit subsystem-name –option LU-EXPANSION –st disable
Password: manager-password
Option modification completed successfully.
%
```

3. Execute the auopt command to verify that the LU Expansion feature status has changed.

Example:

```
% auopt –unit subsystem-name –refer
Password: manager-password
Option name         Status
LU-EXPANSION       Disable
%
```

The status of LU Expansion feature is now changed (enabled/disabled).

4.2 Creating a New Logical Unit

More than two LUs are required for unification of LUs.

Follow the instructions below to create a new LU:

1. From the command prompt, register the subsystem (array unit) in which you will change the status of the LU Expansion feature. Connect to the subsystem.
2. Execute the **auluadd** command to create an LU.

Example:

```
% auluadd –unit subsystem-name –lu lu-number –size lu-size –ctl ctl-number –rg RG-number
Password: manager-password
%
```

3. Format the LU.

For details on creating or formatting the LU, refer to the *Hitachi Freedom Storage™ Thunder 9200™ Resource Manager 9200 User's Guide* (MK-91DF552). See *Part 2: Command Line Interface (CLI)*.

4.3 Expanding the Size of the Last Logical Unit

You can expand the size of the last LU without unifying LUs, using the conventional process. For details, refer to the *Hitachi Freedom Storage™ Thunder 9200™ Resource Manager 9200 User's Guide* (MK-91DF552). See *Part 2: Command Line Interface (CLI)*.

Chapter 5 Performing LU Unification Operations (CLI)

This chapter explains how to execute the LU Expansion feature using the GUI version of the Resource Manager 9200 program. This section includes the following:

- Unifying LUs (see section 5.1)
- Separating Unified LUs (see section 5.2)
- Separating the Last LU from the Unified LU (see section 5.3)

5.1 Unifying LUs

Multiple LUs can be combined together to create a "unified LU". If there is only one LU, create an LU(s) by following the procedure in section 5.2.

A unified LU consists of MainLU and SubLU. Once unified, it is recognized as a MainLU from the server. You can combine more LUs (SubLUs) on a unified LU (MainLU); this is referred to as: "Re-unifying LUs". Note that combining unified LU (MainLU) on a LU (SubLU) cannot be performed.

Note: Back up the LU data from the server before unifying LUs. Some servers may have to reboot the system, depending on the operating system. For details, see section 1.1.

Follow the instructions below to unify LUs:

1. From the command prompt, register the subsystem (array unit) in which you want to create a new LU. Connect to the subsystem.
2. Execute the **aulumrg** command to specify the subsystem and LUs (MainLU and SubLU) to be unified. Specify a number from 0 to 63 for LUs; otherwise an error message will be displayed.

   Note: The CLI will not check the validity of the LU numbers or verify that the LUs are defined. See the following example.

Example:

```
% aulumrg –unit subsystem-name –lu MainLU-number SubLU-number
If the RAID level or the HDU combination of the unifying LUs does not match, the
performance may be degraded.
Are you sure you want to unify the LUs? (y/n [n]): y
Password: manager-password
%
```

The LUs will be unified. If a failure occurs, an error message is displayed. For details on error messages, see Appendix B.

3. Execute the **aumluref** command to verify that the LUs are unified. When this command is executed, the MainLU number, unified LU capacity, unified LU status, and the SubLUs are displayed in the order that they were combined into the MainLU.

   Note: The capacity of the unified LU can be displayed in a unit of megabytes or blocks. To display in megabytes, add –m after the subsystem name.

   In the following example, the unified LU is LU#1, SubLU is LU#3, and the capacity is shown in the unit of blocks.

Example:

```
% aumluref –unit subsystem-name
     Capacity
LU   [block]  Status  Sub LU
1     1024    Normal   3
%
```

5.2 Separating Unified LUs

The unification of LUs can be released by separating unified LUs into individual LUs. All LUs added to the unified LU will be separated.

Follow the instructions below to separate unified LUs into individual LUs:

1. From the command prompt, register the subsystem (array unit) in which you want to operate the LU. Connect to the subsystem.
2. Execute the **aumludiv** command to specify the subsystem and the unified LU. Specify a number from 0 to 63 for LUs; otherwise an error message will be displayed.

Note: The CLI will not check the validity of the LU numbers or verify that the LUs are defined. See the following example.

Example:

```
% aumludiv –unit subsystem-name –lu unified-LU all
Are you sure you want to separate the unified LU into separate LUs? (y/n [n]): y
Password: manager-password
%
```

If a failure occurs, an error message is displayed. For details on error messages, see Appendix B.

3. Execute the **aumluref** command to verify that the LUs from the unified LU are now separated. See the following example.

Example:

```
% aumluref –unit subsystem-name
DMEC002015: No information displayed.
%
```

The unification of the specified LU is released; all the individual LUs are separated.

5.3 Separating the Last LU from the Unified LU

The last LU added to the unified LU can be separated from the unified LU.

Follow the instructions below to separate the last LU from the unified LU:

1. From the command prompt, register the subsystem (array unit) in which you want to operate the LU. Connect to the subsystem.
2. Execute the **aumludiv** command to specify the subsystem and the unified LU that contains the LU to be separated. Specify a number from 0 to 63 for LUs; otherwise an error message will be displayed.

Note: The CLI will not check the validity of the LU numbers or verify that the LUs are defined. See the following example.

Example:

```
% aumludiv –unit subsystem-name –lu unified-LU last
Are you sure you want to separate the last LU from the unified LU? (y/n [n]): y
Password: manager-password
%
```

If a failure occurs, an error message is displayed. For details on error messages, see Appendix B.

3. Execute the **aumluref** command to verify that the last LU has been separated from the unified LU. The following example demonstrates separating the last LU of a unified LU (LU#1) in which SubLUs are combined in order from LU#3 to LU#2.

Example:

```
% aumluref –unit subsystem-name
    Capacity
LU  [block]  Status  SubLU
1    1024    Normal   3
%
```

The last LU (in this example, LU#2) that is added to the unified LU is separated and is not displayed as unified LU data.

Appendix A Acronyms and Abbreviations

CM	Cluster Manager
Command Device	The command device is a user-selected, dedicated logical volume on the 9200 subsystem which functions as the interface to the CCI software on the UNIX®/PC host.
FD	floppy disk
GUI	graphical user interface
LU	logical unit
LU Expansion Feature	Logical Unit Expansion Feature is a facility for unifying multiple logical units to expand the size of the logical unit. The unification is processed internally to make it seem as if it is a single logical unit to the host.
LUN	logical unit number
P-VOL	primary volume
RAID	redundant array of independent disks
SMPL	simplex
S-VOL	secondary volume
TID	target ID

Appendix B Troubleshooting

Table B.1 lists and describes the error messages that are displayed when a failure occurs while performing the unification of LUs, releasing the unification, or separating the last LU from the unified LU.

Table B.1 Error Messages

Message ID	Error Message	Cause	Recommended Action
DMES059558	The process cannot be performed because the specified LU is a unified LU, or unified LUs exist.	An incorrect unified LU is specified.	Verify that the LU is specified correctly and release the unification as necessary.
DMES059559	The process cannot be performed because the specified LU is a Turbo LU or a reserved Turbo LU. Disable the Turbo LU or the reserved Turbo LU and try again.	You have specified a Turbo LU.	Verify that the LU is specified correctly and disable the Turbo LU as necessary.
DMES05955A	The unification cannot be performed because the controllers in charge of the LUs do not match.	The controllers in charge of LUs are different.	Change the controller, reboot the subsystem, and retry again.
DMES05955B	The unification of LUs cannot be performed because the controller in charge of LU is reserved to be changed. Cancel the reservation and then try again.	You need to change the controller and reboot the subsystem.	Reboot the subsystem and try again.
DMES05955C	The LU of RAID0 cannot be unified. Specify an LU for which the RAID level is not RAID0.	The specified LU is an LU in level RAID0.	Select LU(s) in RAID5, RAID0+1, or in RAID1, and try again.
DMES05955D	The unification cannot be performed because the size of the unified LU will exceed 4294967295 blocks.	The size of the LU will exceed 2 TB (429496729 blocks).	Unify the LUs so that the size does not exceed 2 TB.
DMES05955E	The separation cannot be performed because the specified LU is not a unified LU. Specify a unified LU and then try again.	You are attempting to separate an LU that is not a unified LU.	Specify a unified LU.
DMES059562	The unification cannot be performed because the specified Sub LU is a unified LU. Specify a non-unified LU for Sub LU and then try again.	You have specified a unified LU for the SubLU.	Specify a non-unified LU for the SubLU.
DMES059563	The unification or separation cannot be performed because the specified LU is a Sub LU. Specify a Main LU (unified LU) and then try again.	You have specified a SubLU.	Specify a MainLU and the retry again.
DMES059564	LU0 cannot be specified as a Sub LU. Specify an LU other than LU0 for Sub LU and try again.	You have specified LU0 for SubLU.	LU0 cannot be specified for SubLU. Specify an LU other than LU0.
DMES059565	The unification cannot be performed because the status of the LU is not normal or degenerated. Specify an LU whose status is normal or degenerated and try again.	The status of the LU is not yet formatted, the expanded LU is not yet formatted, the LU is blocked, or the LU is not defined.	Recover the status and unify the LU.
DMES059566	The process cannot be performed because the LU number is over 63. Specify a number from 0 to 63 and then try again.	The specified value exceeds 63.	Specify a value from 0 to 63 for the LU number.