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Hitachi TagmaStore®
Adaptable Modular Storage
and Workgroup Modular Storage

LUN Expansion (LUSE) User's Guide

MK-95DF702-04

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Document Revision Level

Revision	Date	Description
MK-95DF702-P	May 2005	Preliminary Release
MK-95DF702-00	June 2005	Initial Release, supersedes and replaces MK95DF702-P
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MK-95DF702-02	February 2006	Revision 2, supersedes and replaces MK95DF702-01
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Changes in this Revision

- Updated software version to 5.0 and higher
- Added Linux information to Table 1.1
- Updated Table 1.2
- Added Table 1.3 Characteristics of FC Drive and SATA Drive
- Updated sections 2.1, 2.2, and 2.3
- Updated Appendix A.1 and A.2
- Updated Appendix A.6 with AMS1000 support

Preface

Before using LUN Expansion, read the operating procedures and notices included in this guide.

This *LUN Expansion User's Guide* assumes that:

- You have a background in data processing and understand direct-access storage device subsystems and their basic functions.
- You are familiar with the Hitachi Disk array subsystem.
- You are familiar with the *Storage Navigator Modular (for GUI) User's Guide*, MK-95DF711.

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Throughout this manual, the term "TrueCopy" refers to the TrueCopy remote replication, the term "ShadowImage" refers to the ShadowImage in-system replication, the term "SnapShot" refers to the Copy-on-write SnapShot, and the term "TCE" refers to the TrueCopy Extended Distance.

Software Version

This document revision applies to TagmaStore Adaptable Modular Storage and Workgroup Modular Storage versions 7.1 and higher.

Convention for Storage Capacity Values

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

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

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

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

Referenced Documents

- *Hitachi TagmaStore™ Adaptable Modular Storage and Workgroup Modular Storage, Storage Navigator Modular Graphical User Interface (GUI) User's Guide,* MK-95DF711

Comments

Please send us your comments on this document. Make sure to include the document title, number, and revision. Please refer to specific section(s) and paragraph(s) whenever possible.

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Contents

List of Figures

List of Tables

Chapter 1 About LUN Expansion

The LUN Expansion feature enables you to unify logical units (LUs). Two or more LUs can be linked together (concatenated) within the storage subsystem; the result, from the host's point of view, is one single LU. This single LU is called a *unified LU*.

This chapter contains the following:

- Overview of LUN Expansion (section 1.1)
- Operating System Differences in LU Unification (section 1.2)
- LUN Expansion Specifications and Restrictions (section 1.3)

1.1 Overview of LUN Expansion

Conventional LUN expansion expands only the size of the last LU that existed within the same RAID group (see Figure 1.1). In conventional LUN expansion, the LU size cannot be expanded when doing so will exceed the open area of the RAID group.

In addition to the conventional LU expansion, 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 under-utilized LUs.

When you install additional drives, you can configure new LUs on the added drives and attach the new LUs to existing LUs to expand them.

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

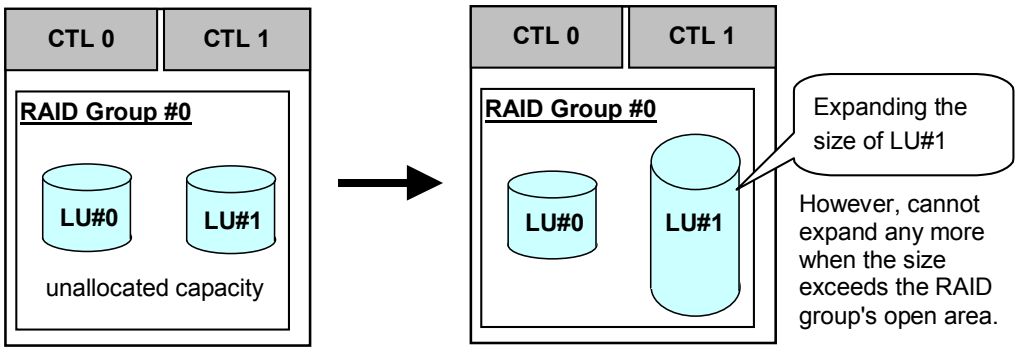
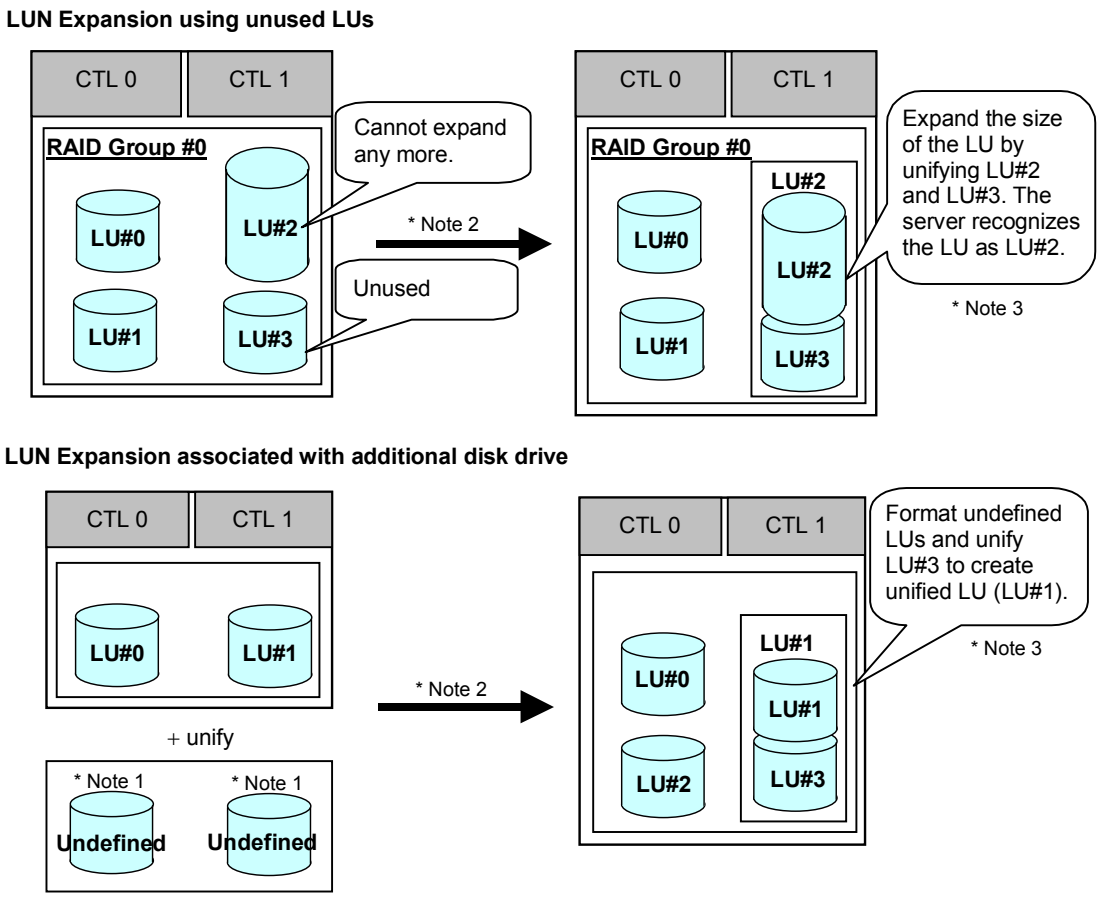


Figure 1.1 Conventional LUN Expansion



Note 1: Undefined LUs must be formatted before LUN Expansion.
Note 2: Backup the LU data from the server before LUN Expansion.
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 Additional LUN Expansion

In addition to LU unification, the LUN Expansion feature also enables you to re-unify a previously-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 LUN Expansion feature specifications, see section 1.3.

LUN Expansion feature operations can be performed from the Storage Navigator Modular (Navigator) via GUI or CLI. 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 Storage Navigator to perform LUN Expansion operation, see Chapter 2 and Chapter 3. If you are using the CLI, see Appendix A.

1.2 Operating System Differences in LU Unification

When unifying LUs, servers format the LU or reboot the system differently depending on the operating system. Follow the procedures shown in Table 1.1 when unifying the LUs.

Table 1.1 System Management Procedure for Operational Systems

Procedure		Solaris™	IRIX®	HP-UX	AIX®	Linux®	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***	√ ***Note***	—	—	—	—
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: LUs cannot be formatted if you have selected the **"Drive Detach Mode"** option in the Configuration Settings (Boot Option) of Storage Navigator. De-select the option, reboot the subsystem and format the LUs.

.		Vmware GSX Server 3.0.1 (for data store)	Vmware GSX Server (virtual machine: Windows Server 2003) (for RAW disk)	Vmware GSX Server (virtual machine: Linux) (for RAW disk)	Mac OS
1	Backup the LU data from the server.	√	√	√	√
2	Format the LU you want to unify. This will erase the label that was given when the operating system first recognized the LU.	—	—	—	—
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.	—	—	—	—

1.3 LUN Expansion Specifications and Restrictions

Table 1.2 lists the functional specifications and restrictions of the LUN Expansion feature.

Table 1.2 Function Specifications and Restrictions

No.	Item	Specification
1	User interface	Navigator (GUI or CLI)
2	Number of logical units	Maximum of 128 logical units can be unified. Numbers of the logical units that can be recognized from the server is less than 128.
3	LU unification	▪ A formatted logical unit, AND two internal LUs (per operation) with different parity width (mD+nP) can be unified. ▪ A LU that enables the server to see the information is called a *MainLU*, and a 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. ▪ A unified LU can be re-unified. ▪ 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. ▪ A LU to which the Reserve or Persistent Reserve command has been issued, can be unified or separated. ▪ A LU consisting of the FC drive and that consisting of the SATA drive cannot be unified. When integrating the LUs configured in the SATA drive, the use conditions of the SATA drive may be different (see Table 1.3).
4	LU configuration	The configuration of the logical unit can be browsed from Storage Navigator.
5	LU statuses	The Disk Array subsystem 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	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).
7	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.
8	LU attribute	▪ The attributes of the MainLU (LUN manager, 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.
9	LU size to be reported to the host	For AIX only. When unifying a LU, whose size is set to adjust automatically by the subsystem, unification is performed within the adjusted size.
10	LUN mapping	Mapping to the unified LU is set by specifying a MainLU.
11	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.
12	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 128.

13	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).
14	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. And then, unify each LU to the MainLU. ▪ Maximum size of unified LU is 2 TB. When re-unification is executed to such LU, a message is reported from Storage Navigator.
15	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.
16	Data assurance of the LUs to be unified	▪ When expanding the size or unifying LUs, data of a SubLU before the unifying cannot be assured. ▪ 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.
17	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. ▪ A unified LU can be quick-formatted. ▪ A LU being quick-formatted cannot be unified or separated.
18	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.
19	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).
20	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)".
21	Statistical information	▪ Information of the MainLU will be displayed in Storage Navigator as the information of the unified LU. ▪ Unlocking (enabling) the LUN Expansion feature enables Storage Navigator to display the statistical information of each SubLU.
22	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.
23	Controller in charge	When the controller in charge is different, change the controller, and then unify the LUs.
24	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.

25	RAID level	▪ RAID 5, RAID 1+0, RAID 1, RAID 6, 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 RAID 0.
26	TrueCopy	A unified LU can be assigned to a TrueCopy pair.
27	ShadowImage	A unified LU can be assigned to a ShadowImage pair.
28	SnapShot	▪ A LU can be unified to a P-VOL of SnapShot. ▪ A LU cannot be unified to a V-VOL of SnapShot. ▪ A LU cannot be unified to a POOL of SnapShot.
29	TCE	▪ A unified LU can be assigned to a TCE pair. ▪ A LU cannot be unified to a POOL of TCE.
30	Data Retention	A LU whose access level is other than Read/Write cannot be unified or separated.

Table 1.3 Characteristics of FC Drive and SATA Drive

Items	**SATA Drive**		**FC Drive**
	ATE250R/ATE400R	**Others**	
Drives presumed operation environment	The Read/Write access takes 330 hours/month or less on the average.	The Read/Write access takes 720 hours/month.	The Read/Write access takes 720 hours/month.
Drive warranty period	3 years	5 years	5 years

Chapter 2 Preparing for LUN Expansion

This chapter provides instructions for preparing for LU operations using the GUI version of Storage Navigator.

The LUN Expansion feature is usually locked (not selectable). To make it available, install the LUN Expansion feature and make its functions selectable for each disk array subsystem.

To install LUN Expansion, use the provided key code or key file.

LUN Expansion is installed and uninstalled using Storage Navigator.

This chapter contains the following:

- Installing the LUN Expansion Feature (section 2.1)
- Uninstalling the LUN Expansion Feature (section 2.2)
- Enabling and Disabling LUN Expansion (section 2.3)

2.1 Installing the LUN Expansion Feature

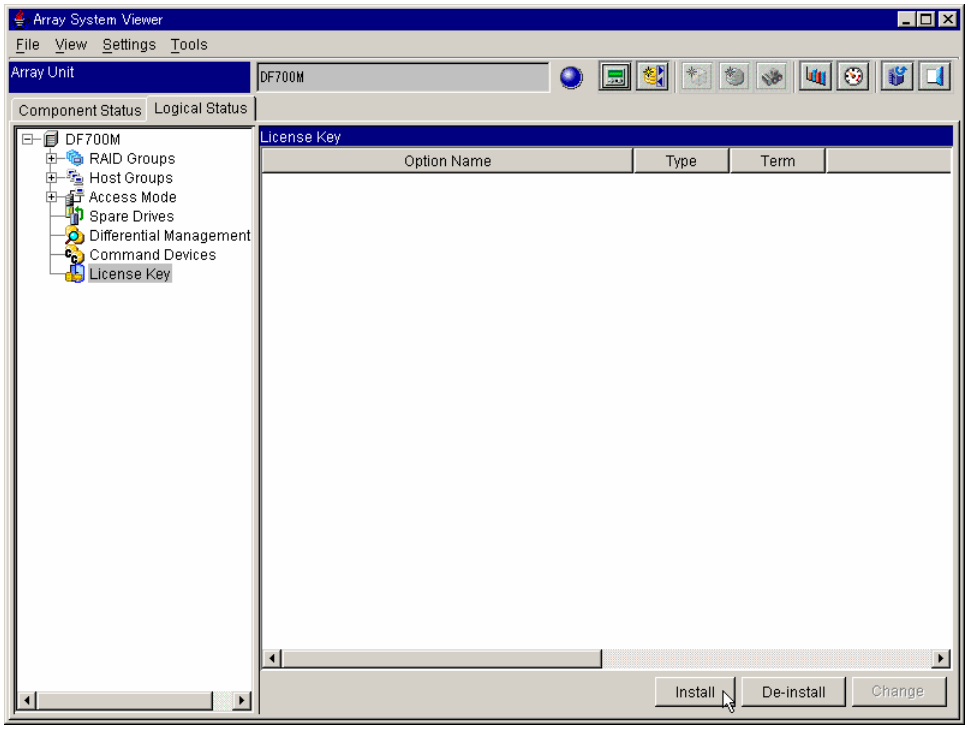
Before installing or uninstalling LUN expansion, make sure that the subsystem is in normal operating condition. If a failure such as a controller blockade has occurred, installation and uninstallation operations cannot be performed.

The installation described in the following procedure uses the GUI version of Storage Navigator.

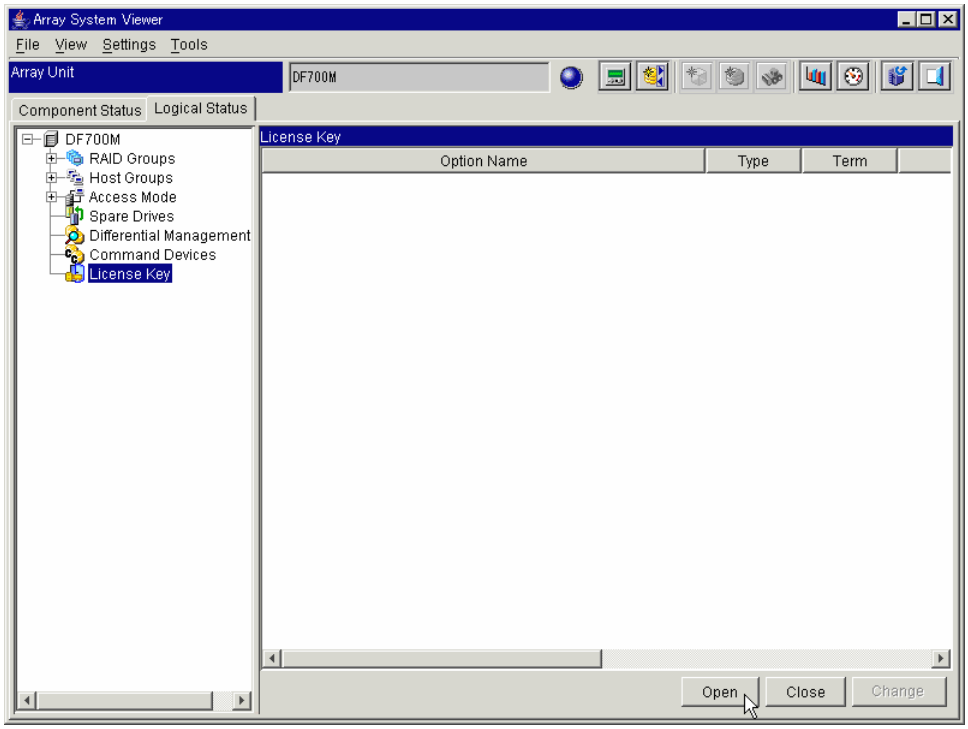
To install the LUN expansion feature:

1. Start Storage Navigator, and change the operating mode to **Management Mode** (administrator mode).
2. Register the subsystem in which you will install the LUN Expansion feature.

   The **Array System Viewer** window displays (see Figure 2.1) the connected subsystem.
3. Click the **Logical Status** tab.
4. Click the **License Key** icon.



Navigator: Version 5.00 or later

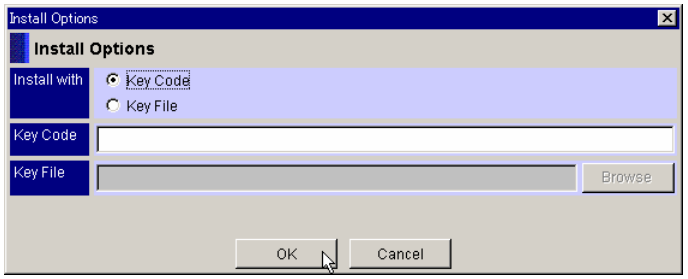


Navigator: Less than 5.00 version

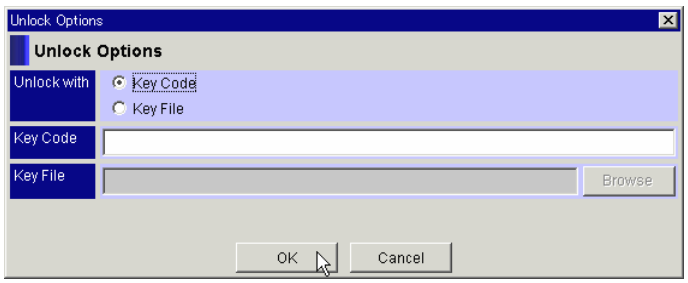
Figure 2.1 Array System Viewer Window (Logical Status Tab)

5. Click **Install**. The **Install Options** dialog box is displayed (see Figure 2.2). (Navigator: Version 5.00 or later)

   Click **Open**. The **Unlock Options** dialog box is displayed (see Figure 2.2). (Navigator: Less than 5.00 version)



Navigator: Version 5.00 or later



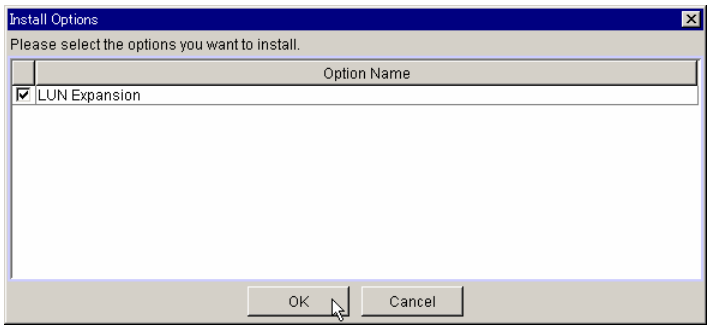
Navigator: Less than 5.00 version

Figure 2.2 Install/Unlock Options Dialog Box

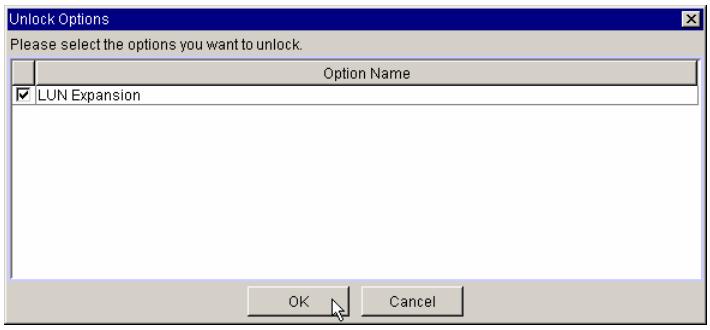
6. When installing options using the key code, select the **Key Code** radio button, and then set up the key code. When installing options using the key file, select the **Key File** radio button, and then set up the path for the key file. Click **OK**.

   Use **Browse** to set the path to a key file correctly.

7. When installing options using the key file, the **Install/Unlock Options** dialog box displays (see Figure 2.3). Ensure the correct **Option Name** is selected, and then click **OK**.



Navigator: Version 5.00 or later

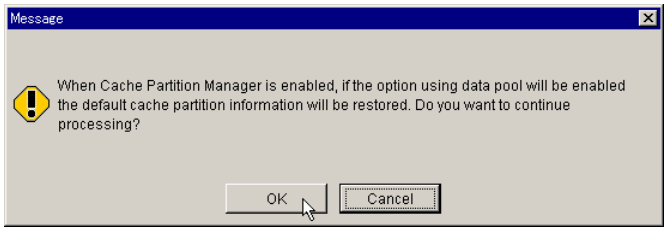


Navigator: Less than 5.00 version

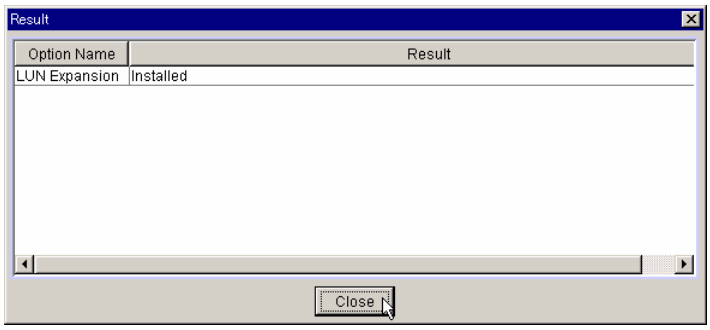
Figure 2.3 Install/Unlock Options Dialog Box

8. A screen requests confirmation to install LUN Expansion. Click **OK**.

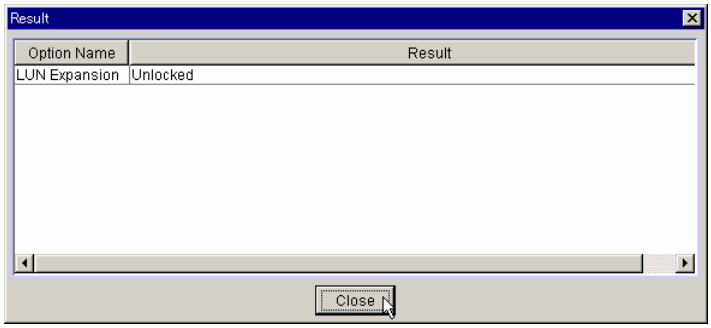
9. When Navigator version is 3.00 or later and Cache Partition Manager is enabled, the following message is displayed. Since LUN Expansion does not use the data pool, click the **OK** button at this point without doing anything else.



10. When installing options using the key file and the **Result** dialog box displays (see Figure 2.4), click **Close**.



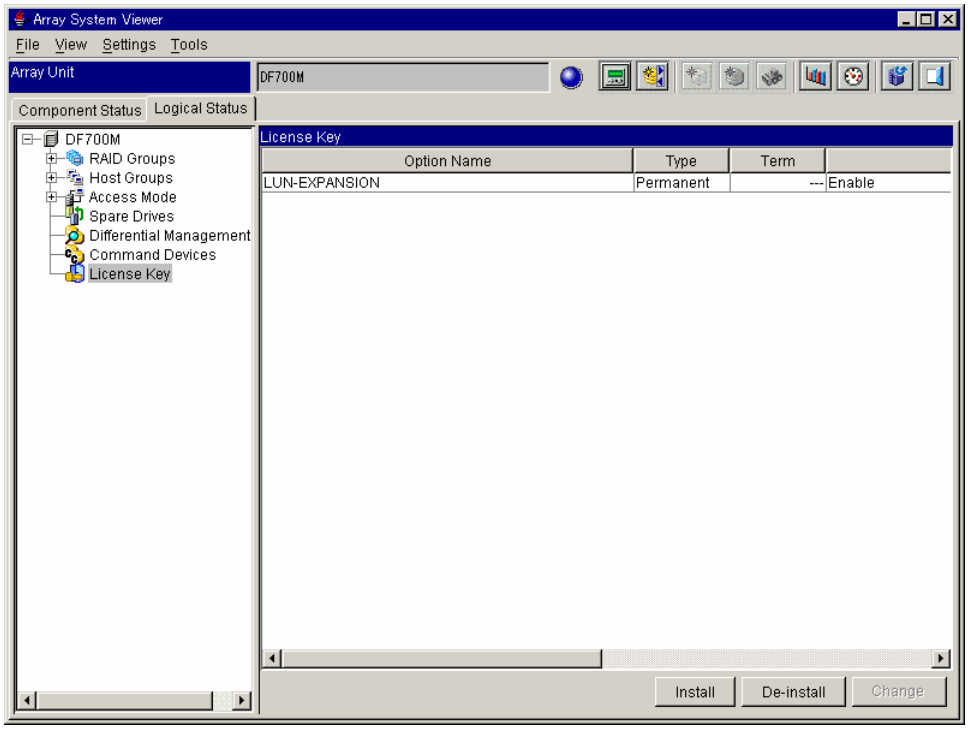
Navigator: Version 5.00 or later



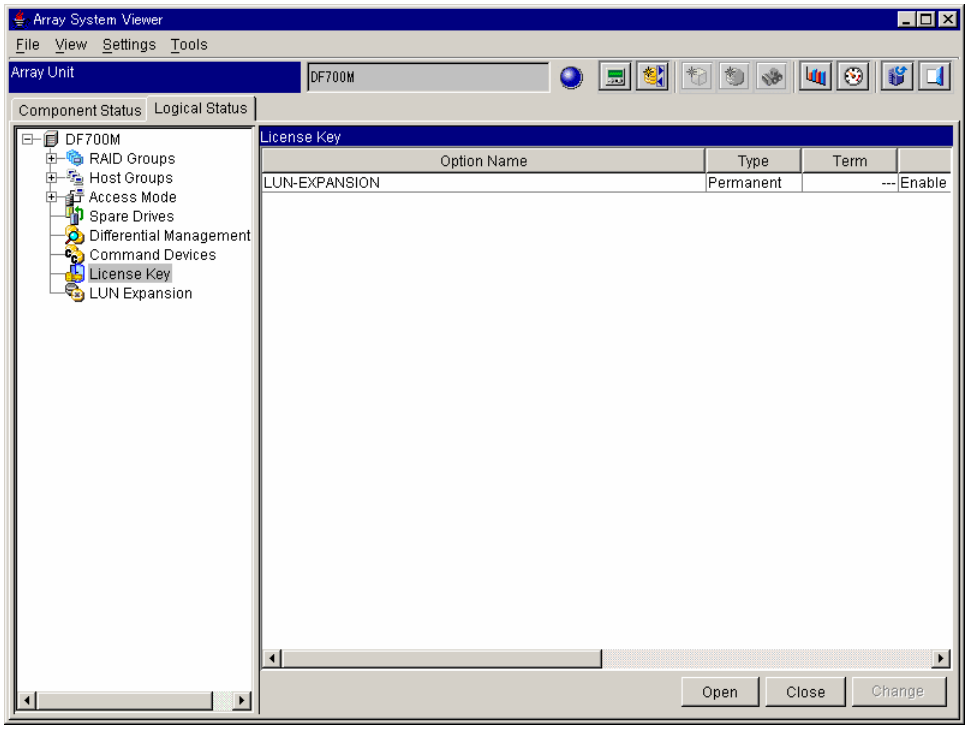
Navigator: Less than 5.00 version

Figure 2.4 Result Dialog Box

In the **License Key** window of the **Array System Viewer,** the Option Name **LUN-EXPANSION** displays with status as **Enable** (see Figure 2.5).



Navigator: Version 5.00 or later



Navigator: Less than 5.00 version

Figure 2.5 Array System Viewer Window (Logical Status Tab, License Key, Option Name - Enable)

LUN Expansion installation is complete.

2.2 Uninstalling the LUN Expansion Feature

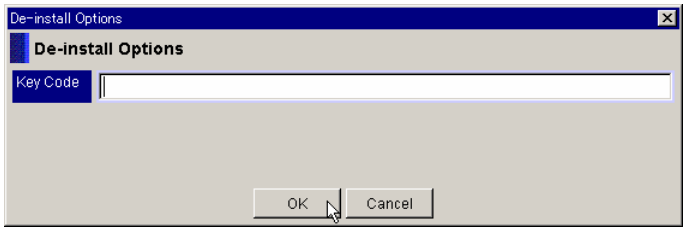
Follow the instructions below to uninstall the LUN Expansion feature. When it is uninstalled, the LUN Expansion feature is locked and unavailable until it is installed by key code or key file.

Note: All unified LUs must be separated in order to uninstall the LUN Expansion feature. The status of the LUs and the specification of command devices are not significant factors in this process.

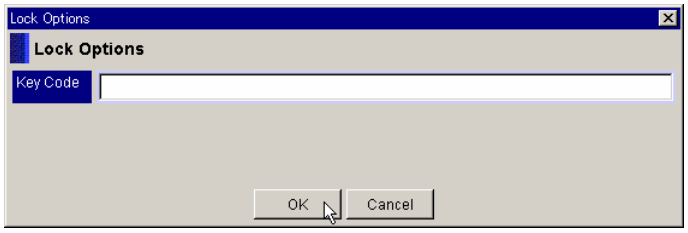
To uninstall the LUN Expansion feature:

1. Start Navigator and change the operation mode to **Management Mode** (administrator mode).
2. Register the subsystem in which you will uninstall the LUN Expansion feature.
3. Connect to the subsystem. The **Array System Viewer** window displays the connected subsystem.
4. Click the **Logical Status** tab.
5. Click the **License Key** icon.
6. Click **De-install**. The **De-install Options** dialog box is displayed (see Figure 2.6). (Navigator: Version 5.00 or later)

   Click **Close**. The **Lock Options** dialog box is displayed (see Figure 2.6). (Navigator: Less than 5.00 version)



Navigator: Version 5.00 or later



Navigator: Less than 5.00 version

Figure 2.6 De-install/Lock Options Dialog Box

7. Enter a **Key Code** in the text box, and then click **OK**.
8. A window requests confirmation to uninstall LUN Expansion. Click **OK**.

LUN Expansion is uninstalled.

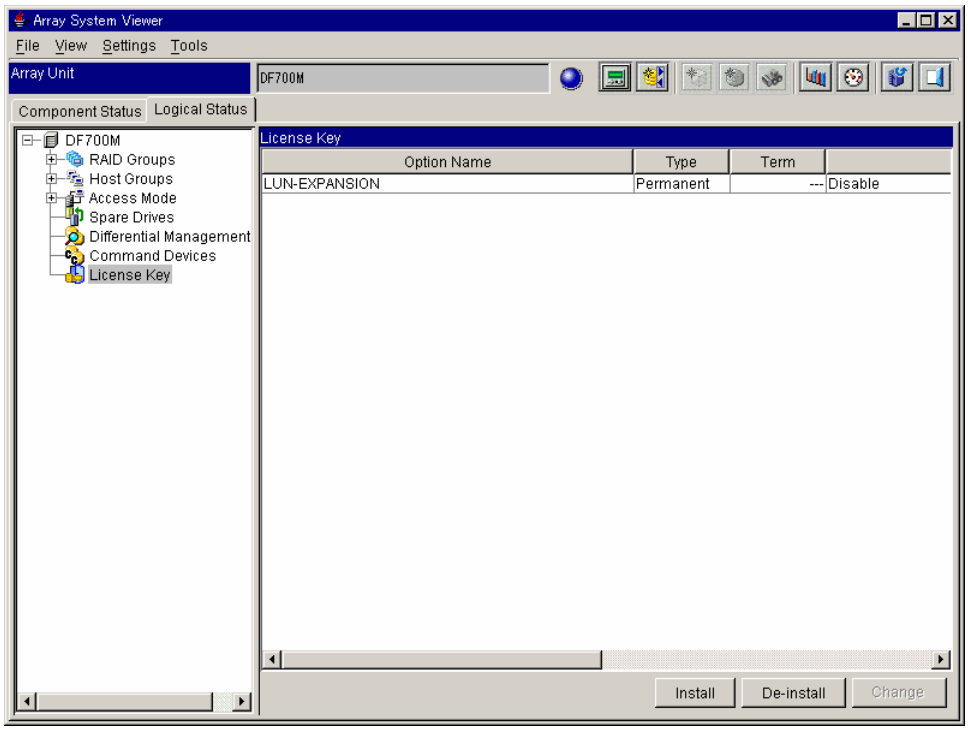
2.3 Enabling and Disabling LUN Expansion

You can enable or disable the LUN expansion feature after installing it.

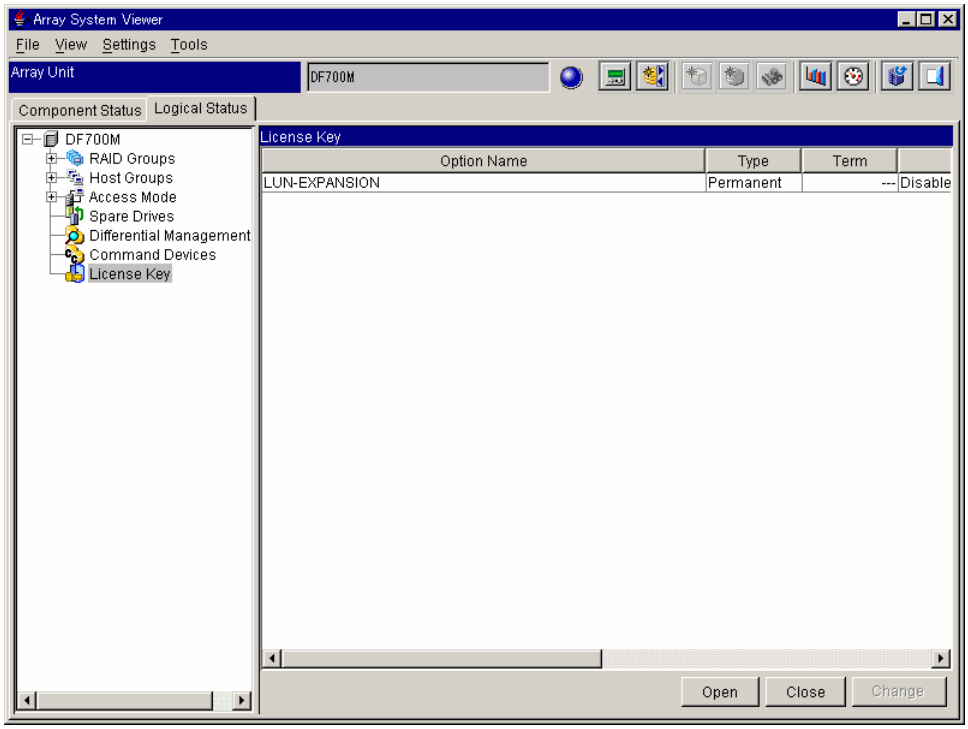
Note: All unified LUs must be separated in order to uninstall the LUN Expansion feature. The status of the LUs and the specification of command devices are not significant factors in this process.

To enable or disable LUN Expansion:

1. Start Navigator and change the operation mode to **Management Mode** (administrator mode).
2. Register the subsystem in which you will change the status of the LUN Expansion feature.
3. Connect to the subsystem. The **Array System Viewer** window displays the connected subsystem.
4. Click the **Logical Status** tab.
5. Click the **License Key** icon (refer to Figure 2.5).
6. Under Option Name, select **LUN-EXPANSION**, then select **Change** (see Figure 2.7).
7. A message confirming that you want to change the status (enable or disable) displays. Click **OK**.



Navigator: Version 5.00 or later



Navigator: Less than 5.00 version

Figure 2.7 Array System Viewer Window (Logical Status Tab, Option Name - Disable)

Status of LUN Expansion feature is changed (enabled/disabled).

Chapter 3 Performing LUN Expansion Operations

This chapter explains how to execute the LUN Expansion feature using the GUI version of the Navigator.

This chapter includes the following:

- Unifying LUs (section 3.1)
- Re-Unifying LUs (section 3.2)
- Separating the Last LU from the Unified LU (section 3.3)
- Separating All Unified LUs (section 3.4)
- Confirming Status of Unified LUs (section 3.5)

3.1 Unifying LUs

Multiple LUs can be combined to create a “unified LU”.

A unified LU consists of MainLU and SubLU. Once unified, it is recognized as a MainLU by the server. You can combine more LUs (SubLUs) on a unified LU (MainLU); this is referred to as “Re-unifying LUs”.

You cannot combine a unified LU (MainLU) on a SubLU.

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, refer to section 1.2.

To unify LUs:

1. Start Navigator and then connect to the subsystem where you want to operate the LUs. The **Array System Viewer** window displays the connected subsystem.
2. Click the **Logical Status** tab.
3. Click the **LUN Expansion** icon (see Figure 3.1).

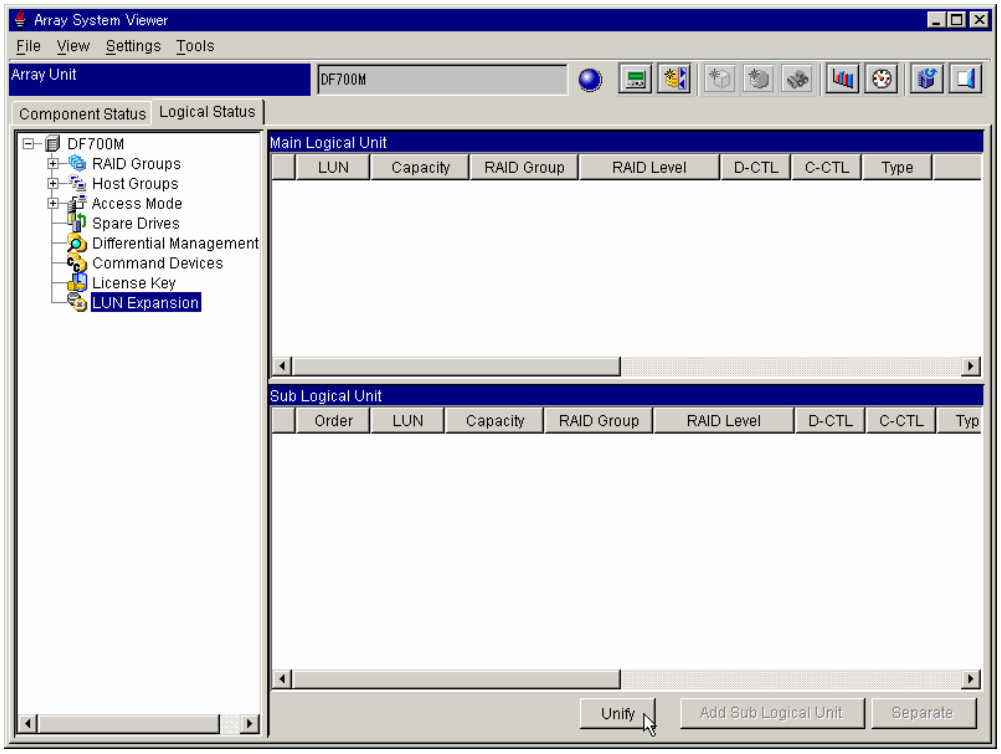


Figure 3.1 Array System Viewer Window (LUN Expansion Page)

4. Click **Unify**. The **Logical Unit Unification** dialog box displays (see Figure 3.2).

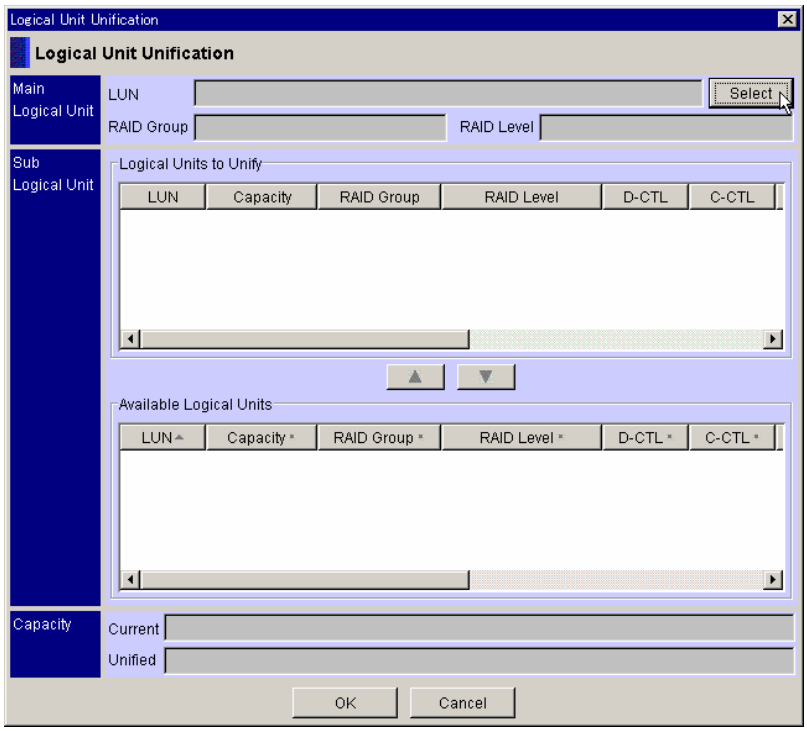


Figure 3.2 Logical Unit Unification Dialog Box

5. Click **Select**. The **Select Logical Unit** dialog box displays (see Figure 3.3).

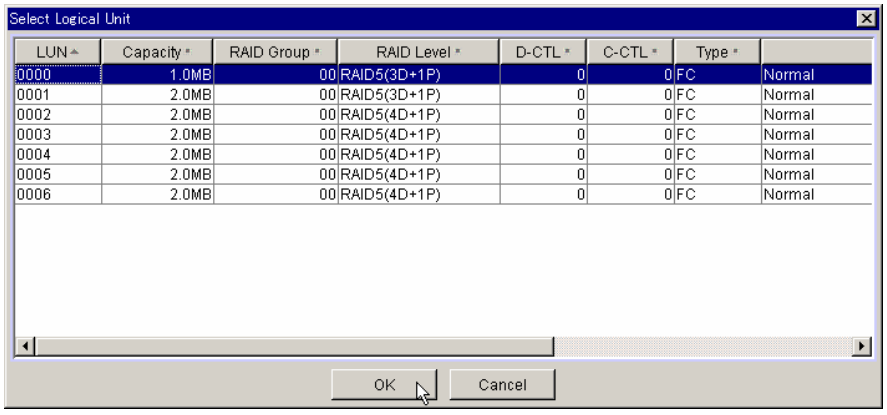


Figure 3.3 Select Logical Unit Dialog Box

6. Select the **LUN** to set the MainLU, and then click **OK**. The selected **LUN** displays as shown in Figure 3.4.

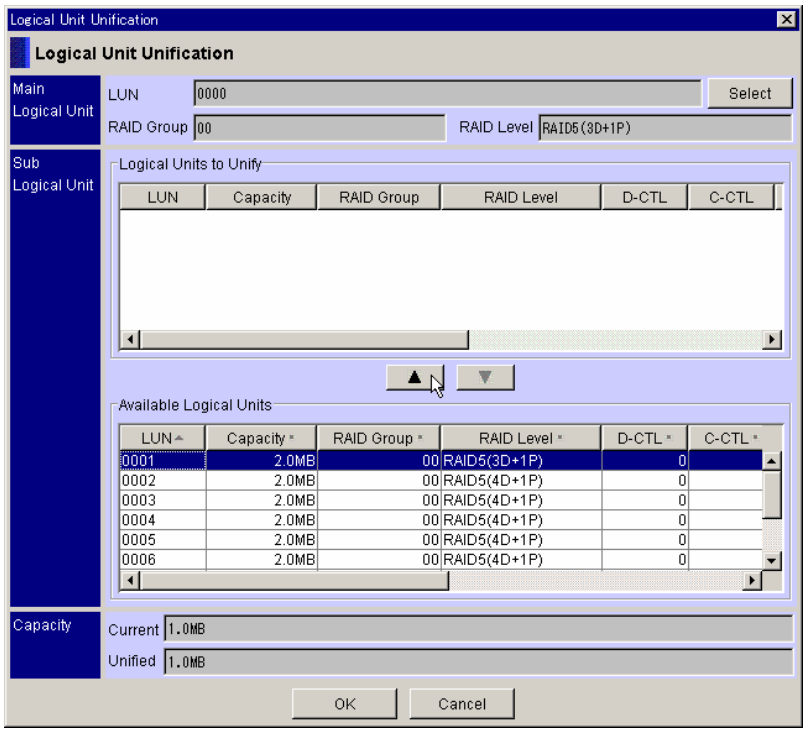


Figure 3.4 Logical Unit Unification Dialog Box (Settled MainLU)

7. Select the **LUN** to set the SubLU from the **Available Logical Units** list, and then click ▲. The selected **LUN** displays in the **Logical Units to Unify** list (see Figure 3.5).

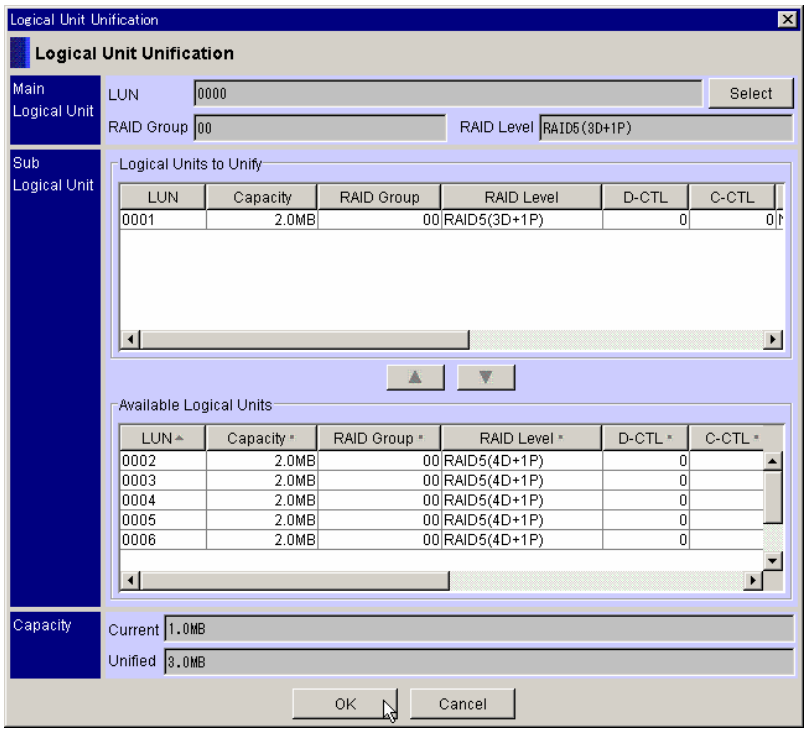
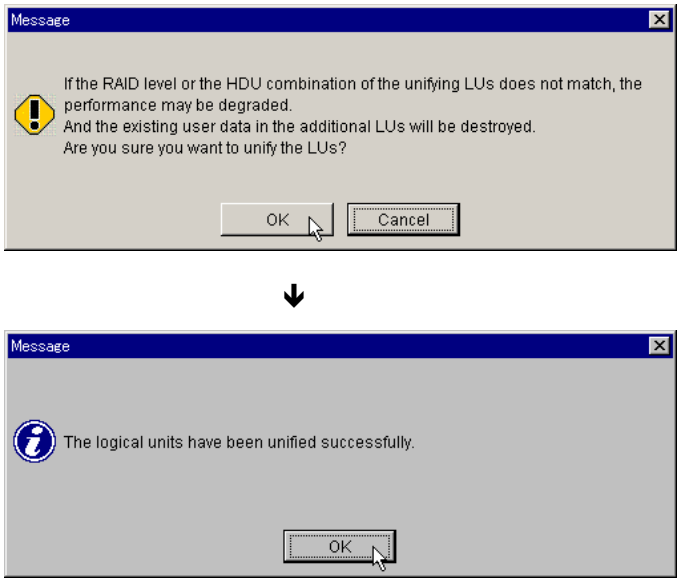


Figure 3.5 Logical Unit Unification Dialog Box (Settled SubLU)

The unified capacity is displayed in the **Capacity** (Unified) field.

8. Click **OK**.
9. A message box displays. Click **OK**.



3.2 Re-unifying LUs

To re-unify LUs:

1. Start Navigator and then connect to the subsystem where you want to operate the LUs. The **Array System Viewer** window displays the connected subsystem (see Figure 3.6).
2. Click the **Logical Status** tab.
3. Click the **LUN Expansion** icon.

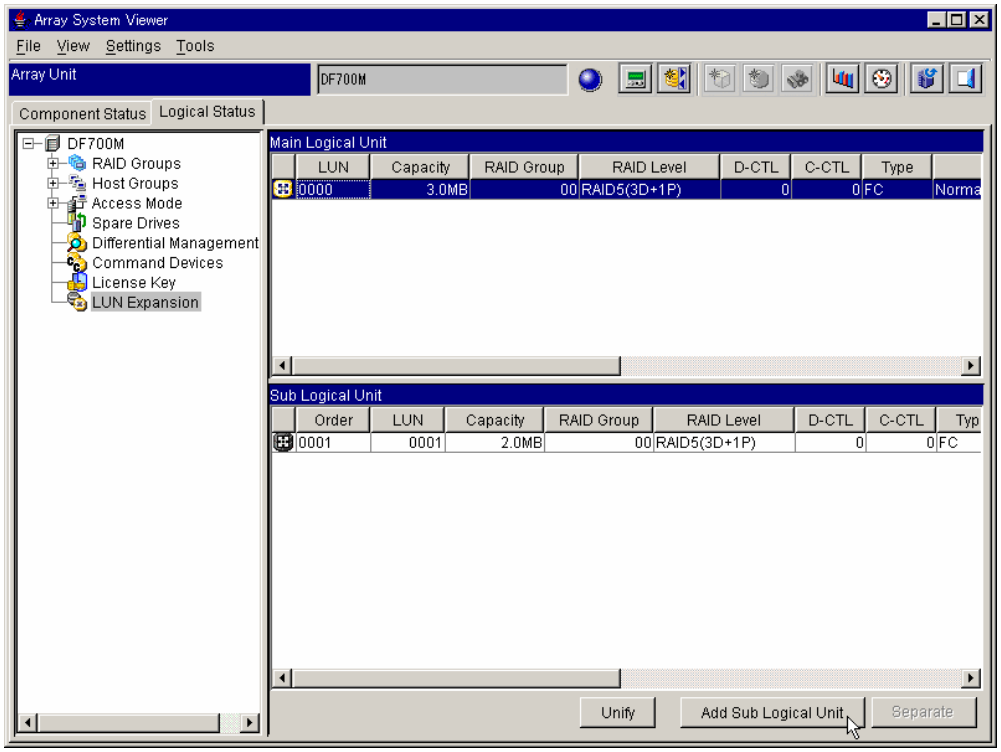


Figure 3.6 Array System Viewer Window (LUN Expansion Page)

4. From the **Main Logical Unit** list, select the **LUN** to re-unify, and then click **Add Sub Logical Unit**. The **Logical Unit Unification** dialog box displays (see Figure 3.7).

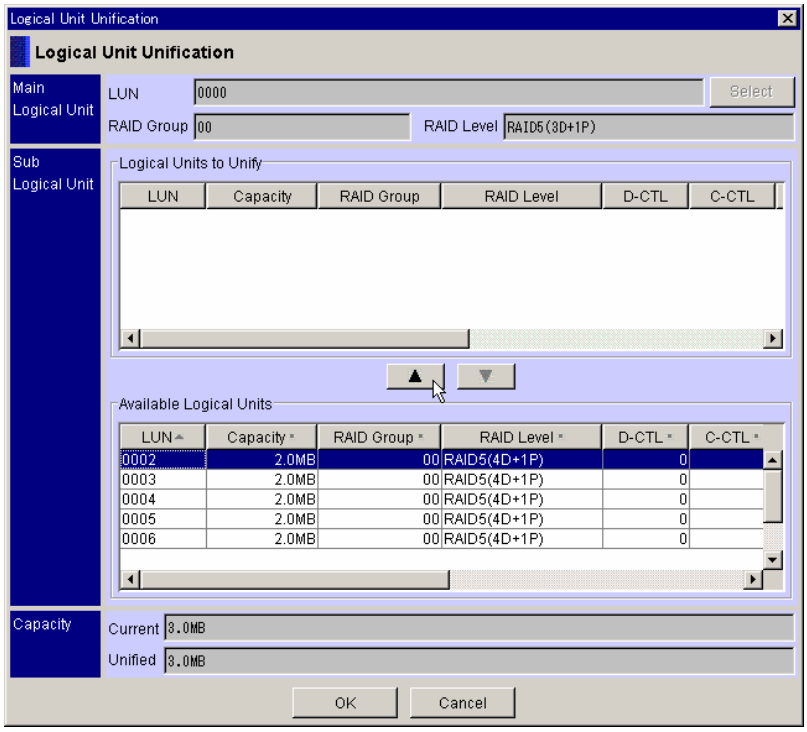


Figure 3.7 Logical Unit Unification Dialog Box (Settled MainLU)

5. To set the SubLU in the **Available Logical Units** list (see Figure 3.8), select the appropriate **LUN**, and then click ▲.

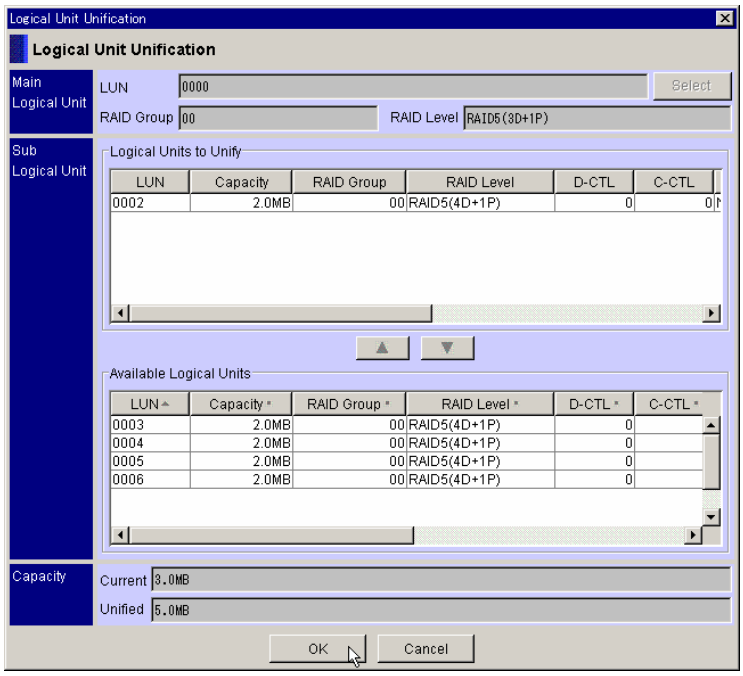
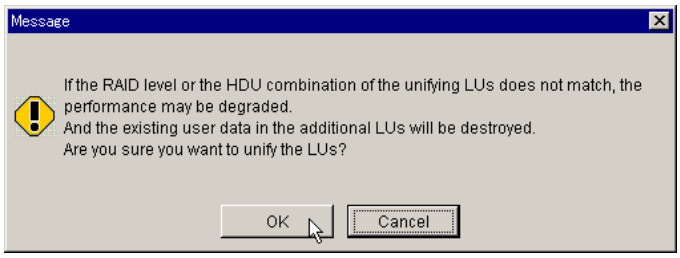


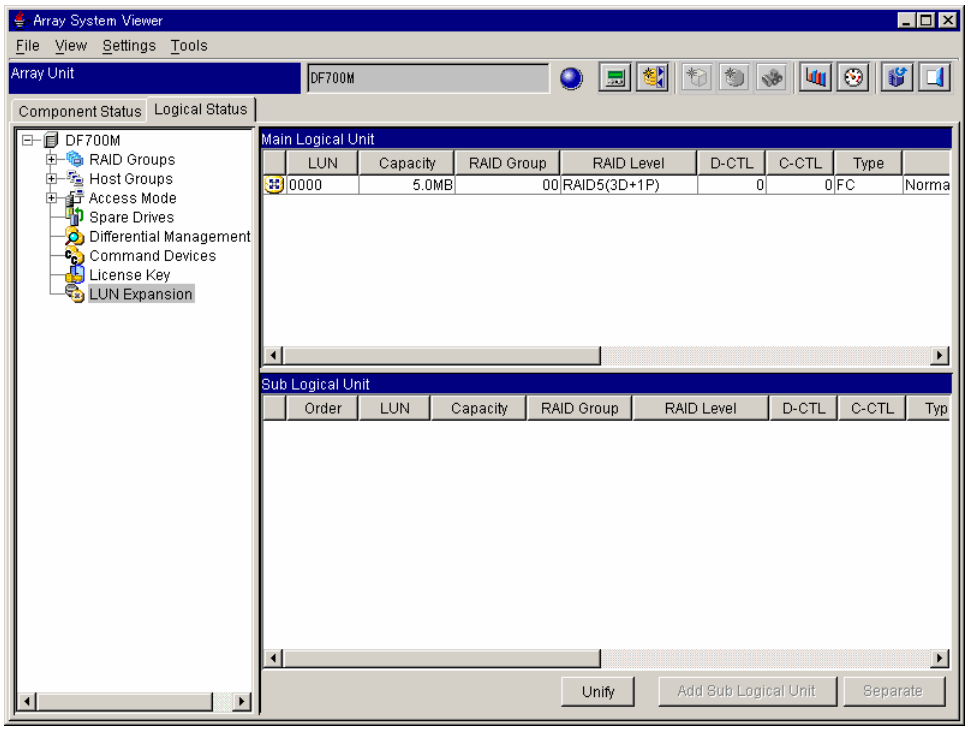
Figure 3.8 Logical Unit Unification Dialog Box (Settled SubLU)

The selected LUN displays in the Logical Units to Unify list.

6. Click **OK**.
7. Click **OK** on the Message box.



Setting information displays as shown in the following figure:



3.3 Separating Last LU from Unified LU

To separate the last LU from a unified LU:

1. Start Navigator and then connect to the subsystem where you want to operate the LUs. The **Array System Viewer** window displays the connected subsystem (see Figure 3.9).
2. Click the **Logical Status** tab.
3. Click the **LUN Expansion** icon.

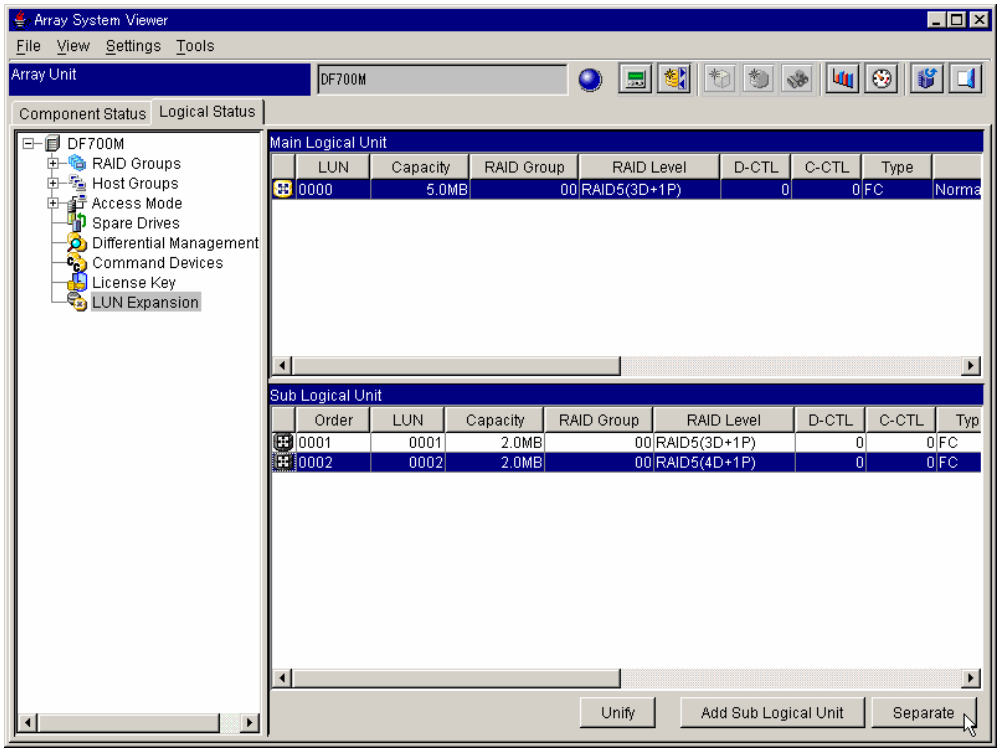
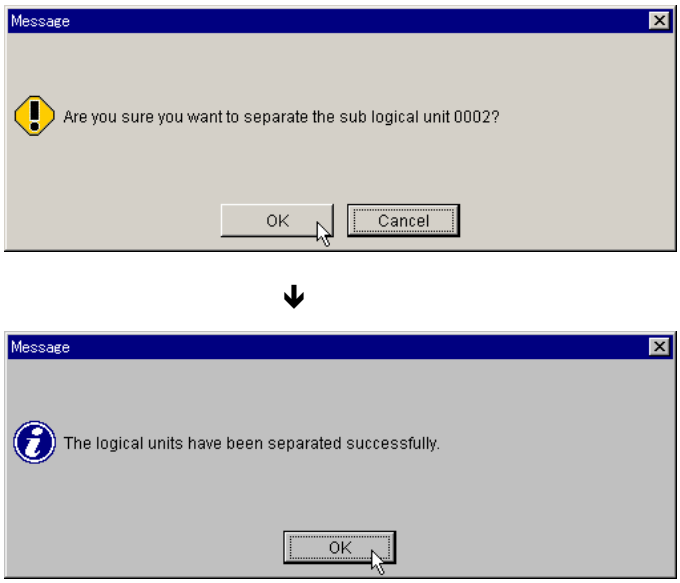


Figure 3.9 Array System Viewer Window (LUN Expansion Page)

4. From the **Sub Logical Unit** list, select the last **Logical Unit**, then click **Separate**.

5. Click **OK** on the Message box.



Setting information displays.

3.4 Separating All Unified LUs

LU unification can be released by separating the unified LU into each of its constituent individual LUs.

To separate individual LUs from a unified LU:

1. Start Navigator and then connect to the subsystem where you want to operate the LUs.

   The **Array System Viewer** window displays the connected subsystem (see Figure 3.10).

2. Click the **Logical Status** tab.

3. Click the **LUN Expansion** icon.

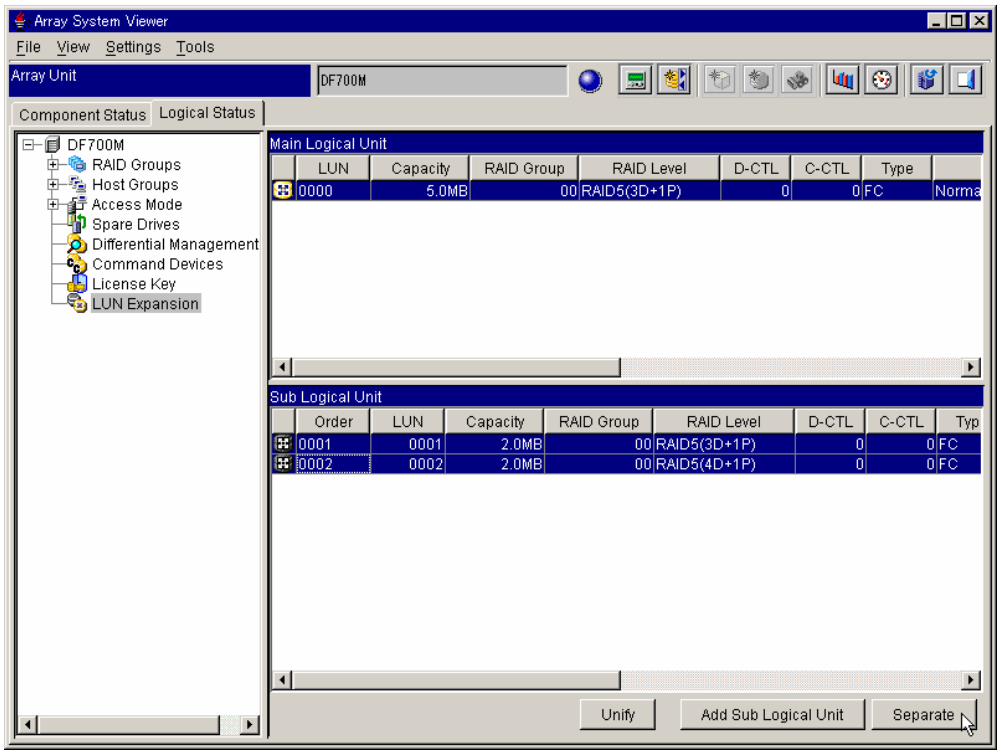
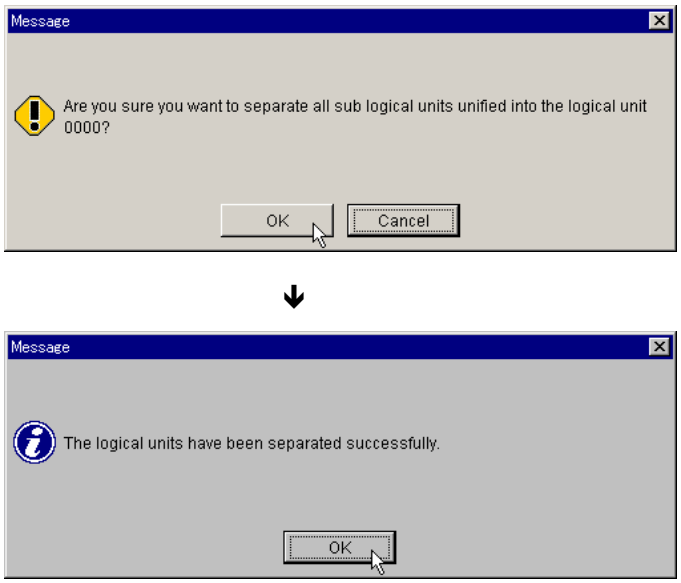


Figure 3.10 Array System Viewer Window (LUN Expansion Page)

4. From the **Sub Logical Unit** list, select all **Logical Units**, and then click **Separate**.

   To select multiple logical units, hold down the **Ctrl** key and click the appropriate logical unit icons.

5. Click **OK** on the Message box.



Setting information displays.

3.5 Confirming Status of Unified LUs

The status of unified LUs can be verified using Navigator. The status is displayed as an icon in the **Logical Status** page of the **Array System Viewer** window.

Table 3.1 provides details for Unified LU icons.

Table 3.1 Icons for Unified LUs

Icons	Color	Status	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.

Appendix A Operations Using CLI

This appendix explains how to execute the LUN Expansion feature using the CLI version of Navigator. This appendix includes the following:

- Installing (section A.1)
- Uninstalling (section A.2)
- Enabling or Disabling (section A.3)
- Unifying LUs (section A.4)
- Separating Unified LUs (section A.5)
- Separating the Last LU from the Unified LU (section A.6)

A.1 Installing

The LUN Expansion feature is usually unselectable (locked); to make it available, install the LUN Expansion feature and make its functions selectable (unlocked).

To install this function, use the key code or key file provided with the optional feature.

Follow the instructions below to install the LUN Expansion feature. LUN Expansion is installed and uninstalled using Navigator.

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

Installation using the CLI version of Storage Navigator:

1. From the command prompt, register the subsystem in which you will install the LUN Expansion feature and connect to the subsystem.
2. Install the optional feature by executing the `auopt` command as follows:

   Example:

   Navigator: Version 5.00 or later and Cache Partition Manager is enabled.

```
% auopt –unit subsystem–name –lock off –keycode manual–attached–keycode
Password: manager–password
Are you sure you want to install the option? (y/n [n]): y
When Cache Partition Manager is enabled, if the option using data pool will be enabled
the default cache partition information will be restored.
Do you want to continue processing? (y/n [n]): y
The option is installed successfully.
%
```

   Navigator: Less than version 5.00 and Cache Partition Manager is enabled.

```
% auopt –unit subsystem–name –lock off –keycode manual–attached–keycode
Password: manager–password
Are you sure you want to unlock the option? (y/n [n]): y
When Cache Partition Manager is enabled, if the option using data pool will be
enabled the default cache partition information will be restored.
Do you want to continue processing? (y/n [n]): y
The option is unlocked.
%
```

   Navigator: Less than version 3.00 and Cache Partition Manager is enabled.

```
% auopt –unit subsystem–name –lock off –keycode manual–attached–keycode
Password: manager–password
Are you sure you want to unlock the option? (y/n [n]): y
The option is unlocked.
%
```

The installation of the LUN Expansion feature is now complete and the status is “Enable”.

A.2 Uninstalling

Follow the instructions below to uninstall the LUN Expansion feature. When it is uninstalled, the LUN Expansion feature is locked (not available) until it is installed by the key code or key file.

Note: All unified LUs must be separated in order to uninstall the LUN Expansion feature. The status of the LUs and the specification of command devices are not significant factors in this process.

To uninstall LUN Expansion:

1. From the command prompt, register the subsystem in which you will uninstall the LUN Expansion feature and connect to the subsystem.
2. Uninstall the optional feature by executing the `auopt` command as follows:

   Example:

   Navigator: Version 5.00 or later

```
% auopt -unit subsystem-name -lock on -keycode manual-attached-keycode
Password: manager-password
Are you sure you want to de-install the option? (y/n [n]): y
The option is de-installed successfully.
%
```

   Navigator: Less than 5.00 version

```
% auopt -unit subsystem-name -lock on -keycode manual-attached-keycode
Password: manager-password
Are you sure you want to lock the option? (y/n [n]): y
The option is locked.
%
```

3. Execute the `auopt` command to verify that LUN Expansion is locked.

   Example:

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

LUN Expansion is uninstalled.

A.3 Enabling or Disabling

LUN Expansion can be set to enable or disable when it is installed.

Note: All unified LUs must be separate in order to uninstall LUN Expansion. The status of the LUs and the specification of command devices are not significant factors in this process.

To uninstall LUN Expansion, or enable/disable LUN Expansion:

1. From the command prompt, register the subsystem in which you will change the status of the LUN Expansion feature and connect to the subsystem.
2. Execute the `auopt` command to change the status (enable or disable) of the LUN Expansion feature.

   To change the status from disable to enable, enter **enable** after the **-st** option.

   Example:

```
% auopt –unit subsystem-name –option LUN-EXPANSION –st disable
Password: manager-password
Are you sure you want to disable the option? (y/n [n]): y
The option has been set successfully.
%
```

3. Execute the `auopt` command to verify that LUN Expansion status has changed.

   Example:

```
% auopt –unit subsystem-name -refer
Password: manager-password
Option Name                    Type      Term     Status
LUN-EXPANSION                  Permanent ---      Disable
%
```

Status of LUN Expansion is changed (enabled/disabled).

A.4 Unifying LUs

Multiple LUs can be combined to create a "unified LU".

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 1.2.

To unify LUs:

1. From the command prompt, register the subsystem in which you want to create a new LU and connect to the subsystem.
2. Execute the `aulumrg` command to specify the subsystem and LUs (MainLU and SubLU) to be unified.
   - For AMS200 or WMS100, specify LU numbers from 0 to 511.
   - For AMS500, specify LU numbers from 0 to 2,047.
   - For AMS1000, specify LU numbers from 0 to 4,095.

   Note: The CLI does not check the validity of the LU numbers or verify that the LUs are defined.

   Example:

```
% aulumrg –unit subsystem-name –lu MainLU-number SubLU-number
Password: manager-password
The capacity of the unified logical unit will be xx.xMbytes.
If the RAID level or the HDU combination of the unifying LUs does not match, the
performance may be degraded.
And the existing user data in the additional LUs will be destroyed.
Are you sure you want to unify the LUs? (y/n [n]): y
The logical units have been unified successfully.
%
```

   The LUs will be unified. If a failure occurs, an error message is displayed.

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
      1        1024  Normal
                     Sub LU
                         3
%
```

A.5 Separating All Unified LUs

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

To separate unified LUs into individual LUs:

1. From the command prompt, register the subsystem in which you want to operate the LU and connect to the subsystem.
2. Execute the `aumludiv` command to specify the subsystem and the unified LU.
   - For AMS200 or WMS100, specify LU numbers from 0 to 511.
   - For AMS500, specify LU numbers from 0 to 2,047.
   - For AMS1000, specify LU numbers from 0 to 4,095.

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

   Example:

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

   If a failure occurs, an error message is displayed.
3. Execute the `aumluref` command to verify that the LUs from the unified LU are separated.

   Example:

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

   Specified LU unification is released and all the individual LUs are separated.

A.6 Separating the Last LU from the Unified LU

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

To separate the last LU from the unified LU:

1. From the command prompt, register the subsystem in which you want to operate the LU and connect to the subsystem.
2. Execute the `aumludiv` command to specify the subsystem and the unified LU that contains the LU to be separated.
   - For AMS200 or WMS100, specify LU numbers from 0 to 511.
   - For AMS500, specify LU numbers from 0 to 2,047.
   - For AMS 1000, specify LU numbers from 0 to 4,095.

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

   Example:

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

   If a failure occurs, an error message is displayed.
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
      1        1024  Normal
                     Sub LU
                         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.

Acronyms and Abbreviations

AMS	Adaptable Modular Storage
GUI	graphical user interface
HDS	Hitachi Data Systems
HDU	hard disk unit
LU	logical unit
LUN	logical unit number
MB	Megabyte
RAID	redundant array of inexpensive disks
WMS	Workgroup Modular Storage

Index

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