HITACHI
DATA SYSTEMS

# Hitachi TagmaStore®
# Adaptable Modular Storage
# and Workgroup Modular Storage

# Cache Residency Manager Software
# User's Guide

MK-95DF716-09

## Trademarks



## Notice of Export Controls

## Document Revision Level

| Revision | Date | Description |
|---|---|---|
| MK-95DF716-00 | June 2005 | Initial Release |
| MK-95DF716-01 | August 2005 | Revision 1, supersedes and replaces MK-95DF716-00 |
| MK-95DF716-02 | October 2005 | Revision 2, supersedes and replaces MK-95DF716-01 |
| MK-95DF716-03 | February 2006 | Revision 3, supersedes and replaces MK-95DF716-02 |
| MK-95DF716-04 | April 2006 | Revision 4, supersedes and replaces MK-95DF716-03 |
| MK-95DF716-05 | May 2006 | Revision 5 supersedes and replaces MK-95DF716-04 |
| MK-95DF716-06 | May 2006 | Revision 6 supersedes and replaces MK-95DF716-05 |
| MK-95DF716-07 | July 2006 | Revision 7 supersedes and replaces MK-95DF716-06 |
| MK-95DF716-08 | October 2006 | Revision 8 supersedes and replaces MK-95DF716-07 |
| MK-95DF716-09 | February 2007 | Revision 9 supersedes and replaces MK-95DF716-08 |

## Source Documents for this Revision

- *Hitachi Freedom Storage™ Thunder 9500™ V Series FlashAccess 9500 V User's Guide*
- *Cache Residency Manager User's Guide (DF700), Candidate of Final*, K6603140 (Hitachi Ltd. source document)
- *Cache Residency Manager User's Guide (DF700), Final*, K6603140 (Hitachi Ltd. source document)
- RSD-MKDF716-P1 (Hitachi review of this document)
- RSD-95DF716-R01a
- RSD-95DF716-R01
- RSD-95df716-02
- RSD-95DF716-02a
- RSD-95DF716-03a
- RSD-95DF716-04a
- RSD-95DF716-04b
- *Cache Residency Manager User's Guide (DF700), Candidate of Final*, K6603140 (Hitachi Ltd. source document)
- RSD-95DF716-04_1

## Changes in this Revision

- Added figure cross references to the text.

# Preface

This document describes and provides instructions for installing and using the Cache Residency Manager function for the Hitachi TagmaStore™ AMS (hereafter referred to as AMS) subsystem. Before using the Cache Residency Manager, read the operating procedures and notices included in this document.

This document assumes the following:

- The user has a background in data processing and understands direct-access storage device (DASD) subsystems and their basic functions.
- The user is familiar with the Hitachi TagmaStore AMS subsystem.
- The user has read and understands the User Guide for the Hitachi subsystem (*Hitachi TagmaStore Adaptable Modular Storage Navigator Modular for GUI User's Guide*, MK-95DF711).

***Note:*** Cache Residency Manager is the name for the former FlashAccess (Flash Data Access).

***Note:*** The use of Cache Residency Manager and all other Hitachi Data Systems products is governed by your agreement(s) with Hitachi Data Systems.

## Microcode Version

This document revision applies to TagmaStore AMS/WMS version 7.0/A and higher.

## Convention for Storage Capacity Values

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

1 KB (kilobyte) = 1,024 bytes
1 MB (megabyte) = $1,024^2$ bytes
1 GB (gigabyte) = $1,024^3$ bytes
1 TB (terabyte) = $1,024^4$ bytes

## Referenced Documents

- *Hitachi TagmaStore™ Adaptable Modular Storage Navigator Modular for Web User's Guide*, MK-95DF719
- *Storage Navigator Modular (for GUI) User's Guide*, MK-95DF711
- *Hitachi TagmaStore™ Adaptable Modular Storage Cache Partition Manager User's Guide*, MK-95DF720

## 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.

- **E-mail:** doc.comments@hds.com
- **Fax:** 858-695-1186
- **Mail:**
  Technical Writing, M/S 35-10
  Hitachi Data Systems
  10277 Scripps Ranch Blvd.
  San Diego, CA 92131

***Thank you!*** (All comments become the property of Hitachi Data Systems Corporation.)

# Contents

# List of Figures

# List of Tables

# Chapter 1 Overview of Cache Residency Manager

The Cache Residency Manager function ensures that all data in a Logical Unit (LU) is stored in cache memory. All read/write commands to the LU can be executed at a 100% cache hit rate without accessing the drive. The system throughput is improved when this function is applied to an LU that contains data that is accessed frequently because no latency period is needed to access the disk drive.

As shown in Figure 1.1, part of the cache memory installed in the controller is used for the Cache Residency Manager function. Cache memory uses a battery backup on both controllers. The data is duplicated on each controller for safety against power failure and cache package failure, etc.

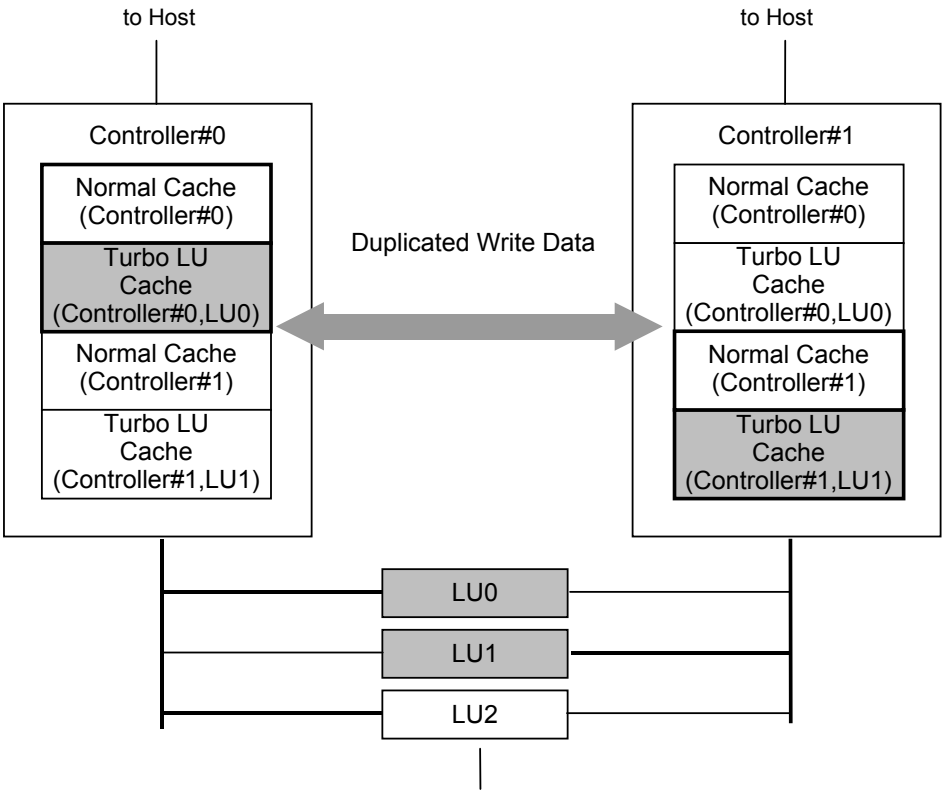



**Figure 1.1 Cache Residency Manager Overview**

***Note:*** Cache Residency Manager requires initial preplanning because of rules regarding cache capacity (see Chapter 5).

# Chapter 2 Cache Residency Manager Functions

This chapter includes the following:

- Cache Residency Manager Characteristics (section 2.1)
- Conditions that Terminate the Cache Residency Manager Operation (section 2.2)
- Conditions that Disable the Cache Residency Manager Operation (section 2.3)

## 2.1 Cache Residency Manager Characteristics

The controller executes read/write commands to the LU using the Cache Residency Manager function as follows:

- Read data accessed by the host is stored in the cache memory until the subsystem is turned off. Subsequent host access to the previously accessed area will transfer from the cache memory without accessing the disk drives.
- Write data from the host is stored in the cache memory and not written to disk drives until the subsystem is turned off.
- The cache memory uses a battery backup and the write data is duplicated (stored in the cache memory on both controllers).
- Write data stored in the cache memory is written to disk drives when the subsystem is turned off and when the Cache Residency Manager operation is stopped by failures.

As described previously, read/write commands to the LU with the Cache Residency Manager function can be processed without a substantial delay. The internal controller operation is the same as that of commands issued to other LUs, except that the read/write command to the LU with the Cache Residency Manager function can be transferred from/to the cache memory without accessing the disk drives.

A delay may happen in the following cases even if the Cache Residency Manager function is applied to the LU:

- The command execution may wait for the completion of commands issued to other LUs.
- The command execution may wait for the completion of commands other than read/write commands (such as the `mode select` command) issued to the same LU.
- The command execution may wait for the completion of processing for internal operation such as data reconstruction, etc.

The following sections detail the conditions that permit or prevent (halt) Cache Residency Manager operations.

To use Cache Residency Manager, all of the conditions listed in Table 2.1 must be met. Table 2.2 lists the restrictions configuration for Cache Residency Manager.

**Table 2.1 Conditions Necessary for Cache Residency Manager**

| No. | Item | Conditions | Remarks |
|---|---|---|---|
| 1 | Controller Configuration | Dual Controller configuration and controller is not blockade. | |
| 2 | RAID Level | RAID 5, RAID 6, or RAID 1+0 | |
| 3 | Cache Partition | Only the LU belonging to a master partition. | |
| 4 | LU Size | To be resident able LU size. | For details, see Chapter 5. |
| 5 | Number of LUs with Cache Residency Function | 1/controller (2/subsystems). | |

**Table 2.2 Restrictions Configuration for Cache Residency Manager**

| No. | Item | Conditions | Remarks |
|---|---|---|---|
| 1 | Changing of the default controller to a Cache Residency LU | Not available. | It is necessary to cancel a Cache Residency LU once. |
| 2 | Concurrent use of Snapshot | The LU specified for Cache Residency Manager (LU cache residence) cannot be set to P-VOL, V-VOL, or POOL. | When concurrent use of Snapshot, a capacity of an LU that can be specified as a Cache Residency is limited.<br>For details see Chapter 5. |
| 3 | Concurrent use of TCE | The LU specified for Cache Residency Manager (LU cache residence) cannot be set to P-VOL, S-VOL, or POOL. | With the concurrent use of TCE, the LU capacity that can be specified as a Cache Residency is limited.<br>For details see Chapter 5. |
| 4 | Concurrent use of Cache Partition Manager | Cache Residency Manager and Cache Partition Manager can be used together simultaneously, but you cannot change an affiliation partition to Cache Residency LU. | Once Cache Residency LU is cancelled, it is necessary to re-set up.<br>Refer to the Cache Partition Manager User's Guide for the details of the operation to a partition. |
| 5 | Concurrent use of Volume Migration | Cache Residency Manager and Volume Migration can be used simultaneously, but the LU specified for Cache Residency Manager (LU cache residence) cannot be set to P-VOL or S-VOL. | Once Cache Residency LU is cancelled, it is necessary to re-set up. |

## 2.2 Conditions that Terminate the Cache Residency Manager Operation

When the subsystem is working properly, the Cache Residency Manager operation continues until the subsystem is powered-off. If the configuration changes or failures listed in Table 2.3 occur, the Cache Residency Manager operation will stop.

**Table 2.3 Conditions that Terminate the Cache Residency Manager Operation**

| No. | Conditions | Remarks |
|---|---|---|
| 1 | When the subsystem is powered off. | Normal case |
| 2 | When the cache capacity is changed and the available capacity of the cache memory is less than the LU size. | Cache uninstallation |
| 3 | When a controller failure occurs. | Failures |
| 4 | When the battery alarm occurs. | |
| 5 | When a battery backup circuit failure occurs. | |
| 6 | When the number of the PIN data (data unable to be written to disk drives because of some failures) exceeded the threshold value. | |

The Cache Residency Manager operation will be restarted after failures are corrected.

## 2.3 Conditions that Disable the Cache Residency Manager Operation

The Cache Residency Manager operation is disabled under the conditions listed in Table 2.4.

***Note:*** Pay special attention when you change the configuration of the subsystem and reset the LU with Cache Residency Manager.

**Table 2.4 Conditions that Terminate Cache Residency Manager Operation**

| No. | Conditions | Remarks |
|---|---|---|
| 1 | When the setting of Cache Residency Manager is cleared. | All of these conditions are caused by the operator. |
| 2 | When Cache Residency Manager is disabled or uninstalled (locked). | |
| 3 | When the LU with Cache Residency Manager is deleted, or the RAID group of the LU is deleted. | |
| 4 | When the controller configuration is changed (Dual to/from Single). | |

***Note:*** When the controller configuration is changed from single to dual after setting up Cache Residency LU, the Cache Residency LU will be cancelled. You may open the Cache Residency Manager in single configuration, but setup or operation cannot be performed.

# Chapter 3 Installing and Uninstalling Cache Residency Manager

This chapter provides instructions for installing, uninstalling, enabling and disabling Cache Residency Manager using the GUI version of Storage Navigator Modular (Storage Navigator).

***Note:*** When installing or uninstalling Cache Residency Manager where the disk array subsystem is used on a TrueCopy or TCE remote site, the following occurs when the disk array subsystem is restarted:

- Both paths of TrueCopy or TCE are blocked. When a path is blocked, a TRAP (notification to the SNMP Agent Support Function) occurs. Should this occur, notify all affected departments immediately. A blocked path of TrueCopy or TCE recovers automatically when the subsystem is restarted.
- The pair status of TrueCopy or TCE is PAIR or COPY changes to PSUE.

When you restart the disk array subsystem, install or uninstall Cache Residency Manager **after** changing the pair status of TrueCopy or TCE to PSUS.

For details on installing Cache Residency Manager using CLI, see Appendix A. To use Cache Residency Manager, you must install it and make its functions selectable (unlocked). To install Cache Residency Manager, the key code or key file provided with the optional feature is required.

***Notes:***

- Installing, uninstalling, enabling, and disabling of the Cache Residency Manager function is set for each disk array subsystem.
- 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.
- If you install, uninstall, enable, or disable the Cache Residency Manager on a subsystem connected to a NAS, you must also stop the clusters between the NAS units. When restarting the subsystem, you must restart the clusters.

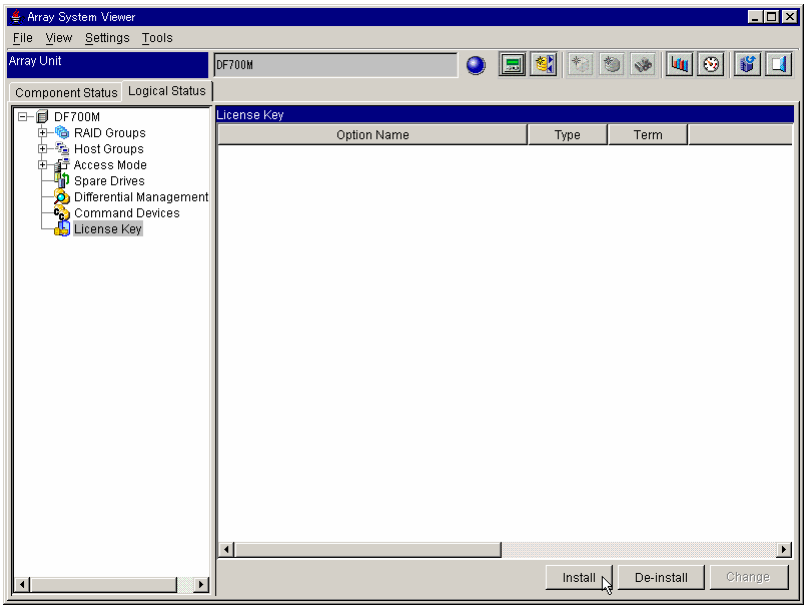
## 3.1 Installing Cache Residency Manager

To install Cache Residency Manager using the GUI version of Storage Navigator:

1. Start Storage Navigator and switch to **Management Mode**.
2. Register the subsystem in which you will install Cache Residency Manager, and connect to that subsystem.

   The **Array System Viewer** window appears and displays the connected subsystem.
3. Click the **Logical Status** tab.
4. Click the **License Key** icon (see Figure 3.1).

Storage Navigator version 5.0 or later




Storage Navigator versions earlier than 5.0

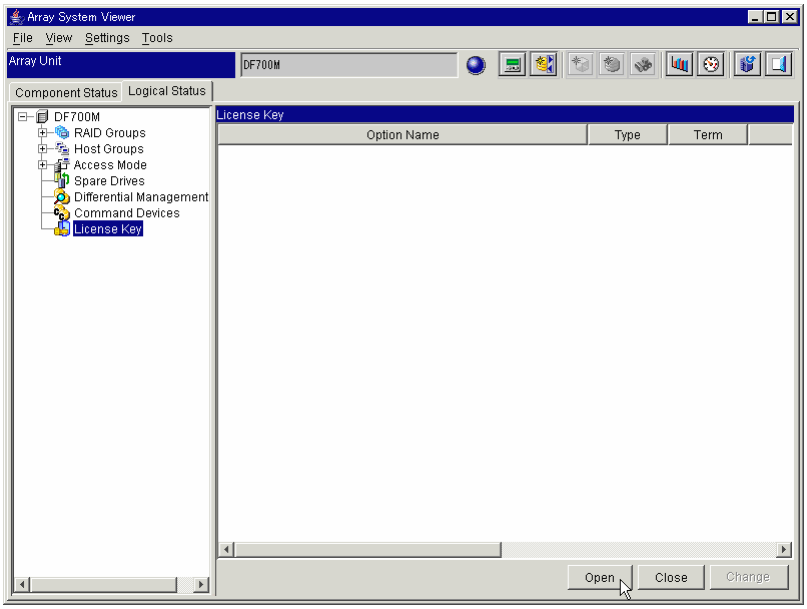



**Figure 3.1 Array System Viewer Window (Logical Status Tab)**

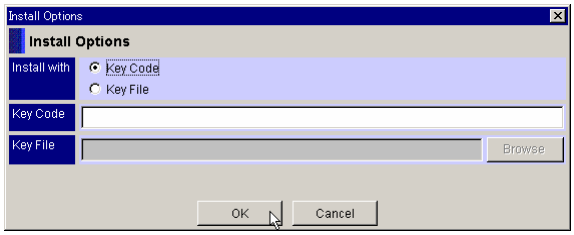
5. Click **Install**. (Storage Navigator version 5.0 or later)

   The **Install Options** dialog box displays (see Figure 3.2).

   Click **Open**. (Storage Navigator versions earlier than 5.0)

   The **Unlock Options** dialog box displays (see Figure 3.2).

   Storage Navigator version 5.0 or later




Storage Navigator versions earlier than 5.0

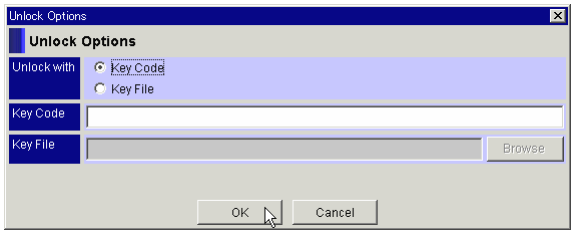


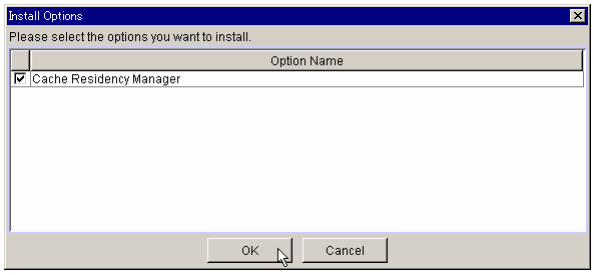

**Figure 3.2 Install/Unlock Options Dialog Box**

6. To install the option using the key code, click the **Key Code** radio button, then set up the key code. To install the options using the key file, click 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.

7. When you install the options using the key file, the **Options Selection** dialog box displays (see Figure 3.3). Select the desired **Option Name** and click **OK**.

   Storage Navigator version 5.0 or later




Storage Navigator versions earlier than 5.0

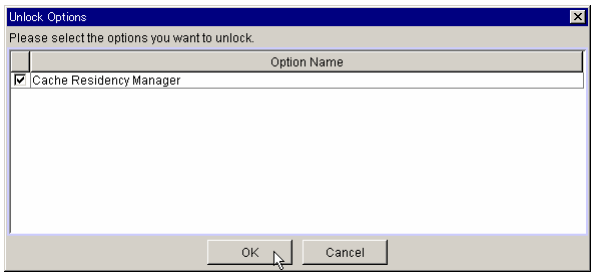
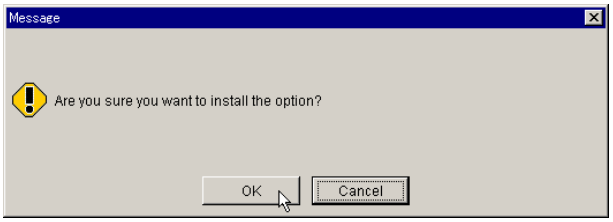



**Figure 3.3 Options Selection Dialog Box**

8. A screen appears requesting a confirmation to install the **Cache Residency Manager** option. Click **OK** (see Figure 3.4).

   Storage Navigator version 5.0 or later




   Storage Navigator versions earlier than 5.0

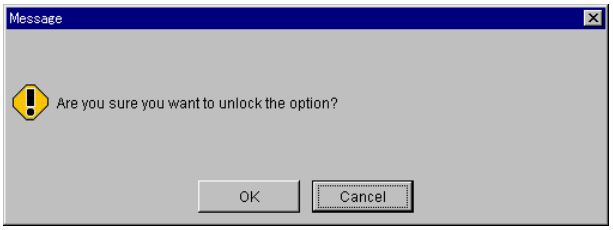
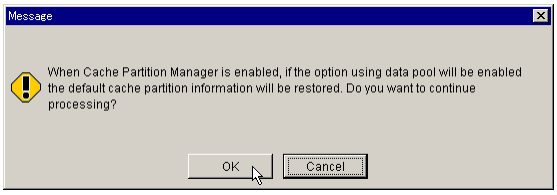


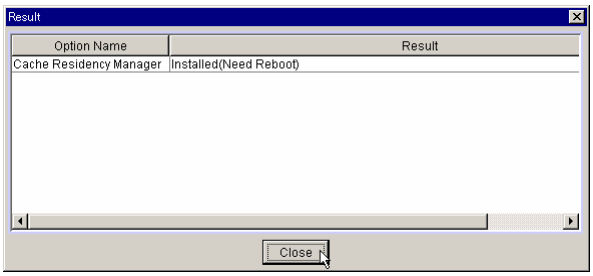

**Figure 3.4 The Install/Unlock Confirmation Request Message**

9. When Storage Navigator version is 3.00 or later and Cache Partition Manager is enabled, the following message displays. Because Cache Residency Manager does not use the data pool, click the **OK** button.




10. When you install the options using the key file, the **Result** dialog box displays (see Figure 3.5) Click **Close**.

    Storage Navigator version 5.0 or later




    Storage Navigator versions earlier than 5.0

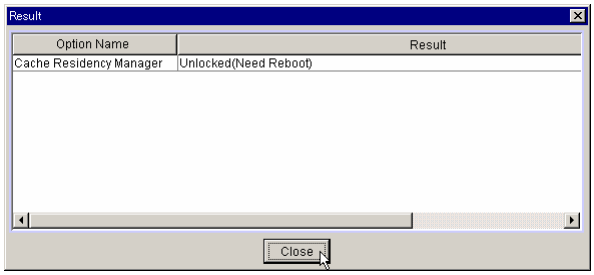
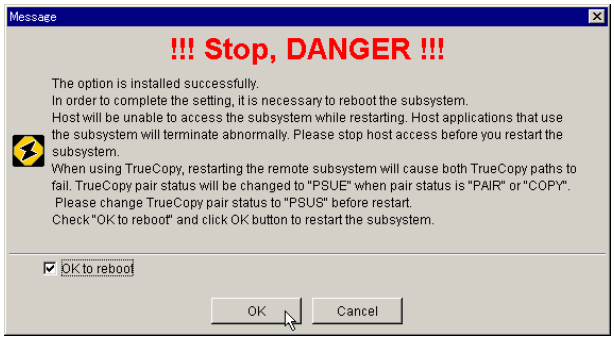


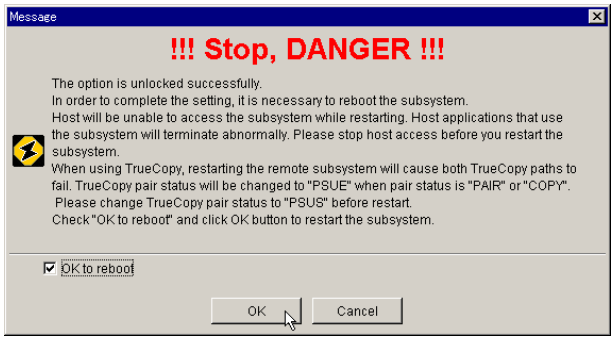

**Figure 3.5 Result Dialog Box**

11. A message appears confirming that this optional feature is installed. Click **OK**.

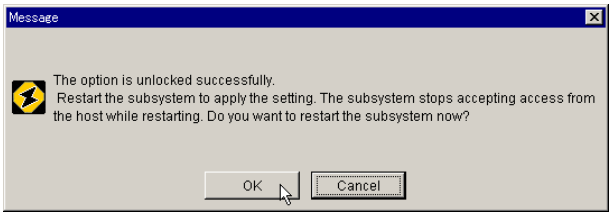
    Storage Navigator version 5.0 or later

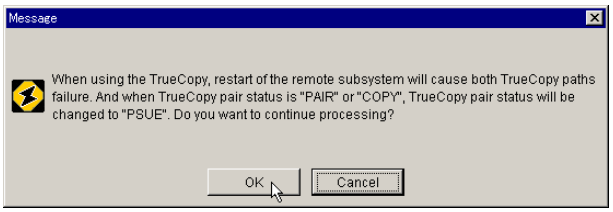



    Storage Navigator: version 4.03 or later

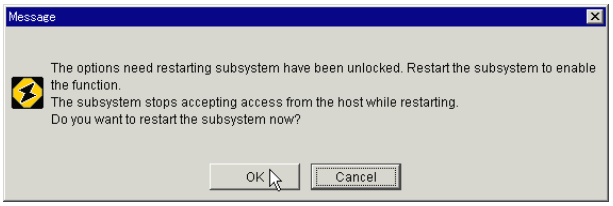


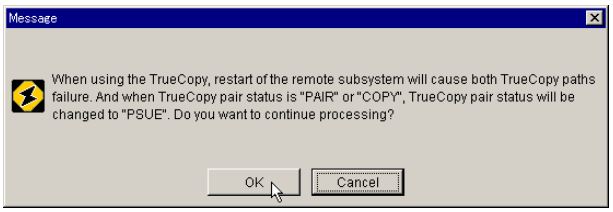

    Storage Navigator: versions earlier than 4.03 (case by key code)




Storage Navigator: versions earlier than 4.03 (case by key file)




***Note:*** To install the option, restart the subsystem. The feature will close upon restarting the subsystem. The subsystem cannot access the host until the reboot is completed and the system restarts. Make sure that the host has stopped accessing data before beginning the restart process.

When you restart the subsystem, the time the restart began is displayed. Restart usually takes from 4 to 15 minutes (see Figure 3.6).

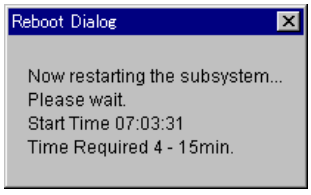
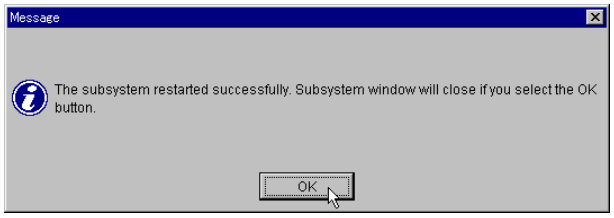



**Figure 3.6 Reboot Dialog Box**

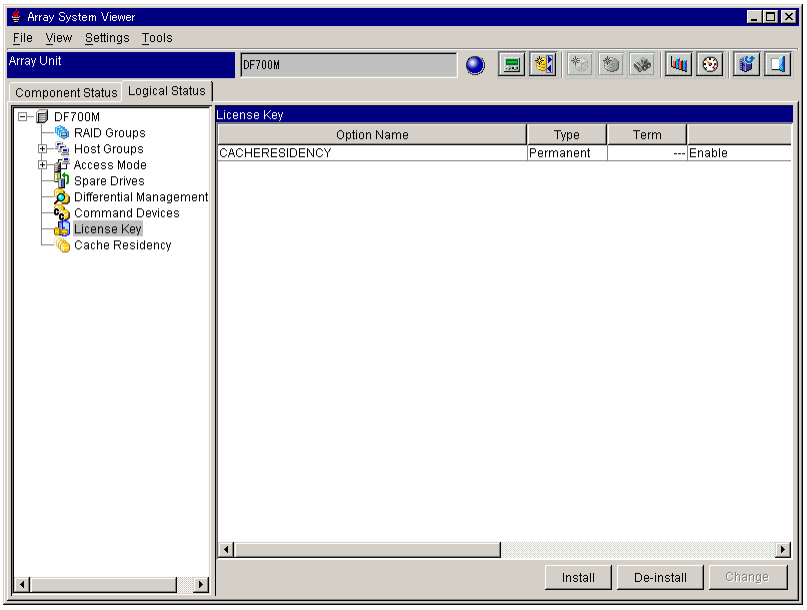
***Note:*** It may take time for the subsystem to respond, depending upon the condition of the subsystem. If it does not respond after 15 minutes or more, check the condition of the subsystem.

12. A message appears stating that the restart is successful. Click the **OK** button.




The Unit screen is closed. To perform other operations on the Main screen, select a subsystem from the Main screen, and open the selected Unit screen (see Figure 3.7).

Storage Navigator version 5.0 or later




Storage Navigator versions earlier than 5.0

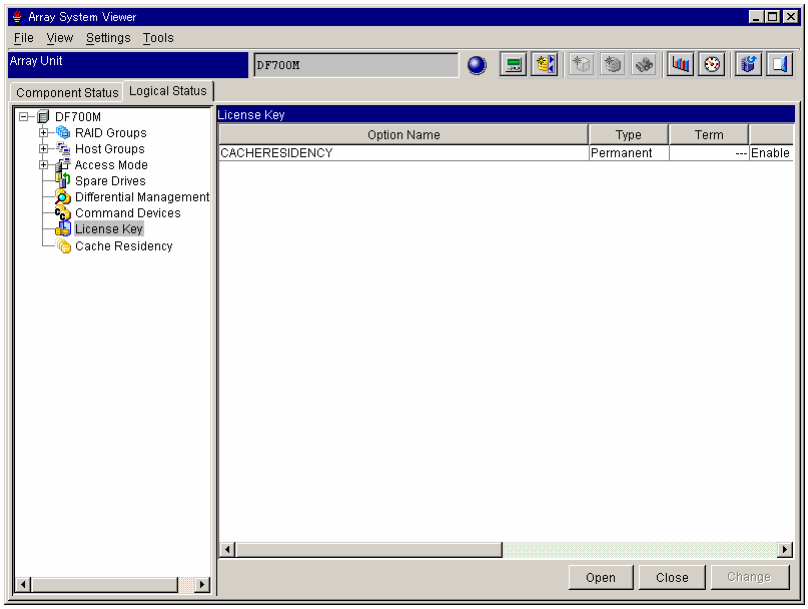



**Figure 3.7 Array System Viewer Window (Logical Status Tab)**

## 3.2 Uninstalling Cache Residency Manager

To uninstall Cache Residency Manager using the GUI version of Storage Navigator:

1. Start Storage Navigator and switch to **Management Mode**.
2. Register the subsystem in which you will uninstall the Cache Residency Manager function, and connect to that registered subsystem.

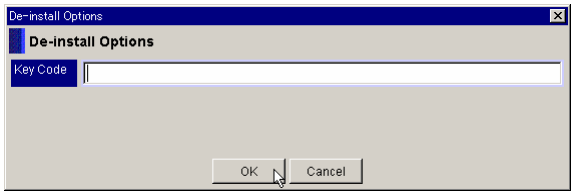
   A unit window for the connected subsystem will be displayed.
3. Click the **Logical Status** tab.
4. Click the **License Key** icon (see Figure 3.7).
5. Click **De-install**. (Storage Navigator version 5.0 or later)

   The **De-install Options** dialog box displays (see Figure 3.8).

   Click **Close**. (Storage Navigator versions earlier than 5.0)

   The **Lock Options** dialog box displays (see Figure 3.8).

   Storage Navigator version 5.0 or later




Storage Navigator versions earlier than 5.0

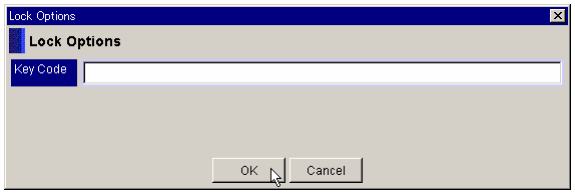
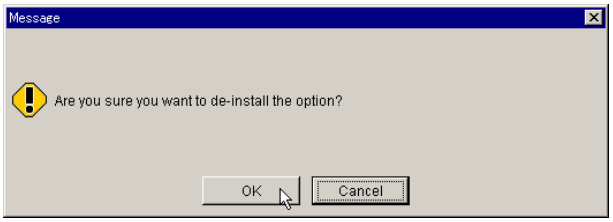



**Figure 3.8 De-install/Lock Options Dialog Box**

6. Enter a **key code** in the text box and click **OK**.

7. A message appears requesting a confirmation to uninstall the **Cache Residency Manager** option. Click **OK** (see Figure 3.9).

   Storage Navigator version 5.0 or later




   Storage Navigator versions earlier than 5.0

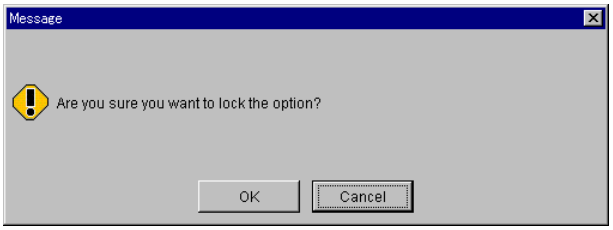
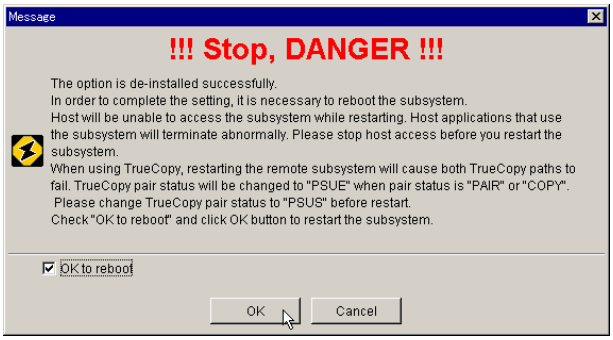


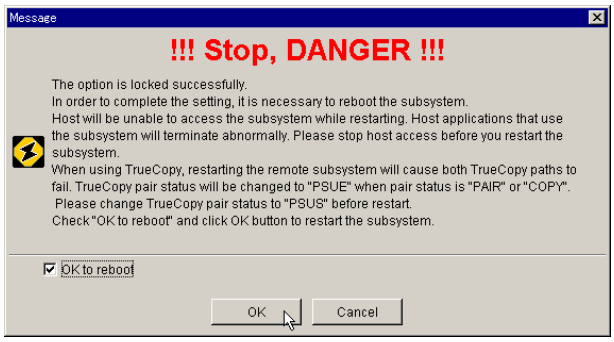

**Figure 3.9 Lock Confirmation Request Message**

8. A message appears confirming that this optional feature is uninstalled. Click **OK** (see Figure 3.10).

   Storage Navigator version 5.0 or later



Storage Navigator: version 4.03 or later




Storage Navigator: versions earlier than 4.03

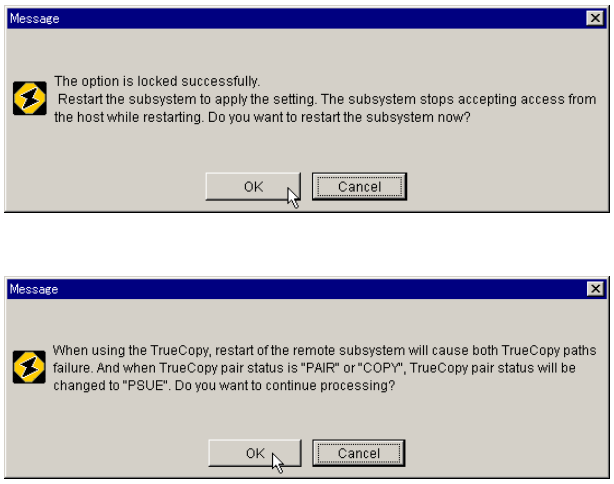



**Figure 3.10 The Lock Confirmation Message**

***Note:*** To uninstall the option that you have operated, restart the subsystem. The feature will close upon restarting the subsystem. The subsystem cannot access the host until the reboot is completed and the system restarts. Make sure that the host has stopped accessing data before beginning the restart process.

When you restart the subsystem, the time the restart began is displayed. Restart usually takes 4 to 15 minutes (see Figure 3.11).

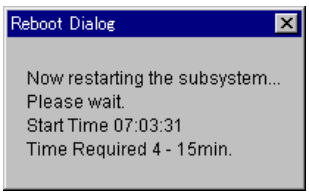



**Figure 3.11 Reboot Dialog Box**

***Note:*** It may take time for the subsystem to respond, depending upon the condition of the subsystem. If it does not respond after 15 minutes or more, check the condition of the subsystem.

9. A message appears stating that the restart is successful (see Figure 3.12). Click **OK**.

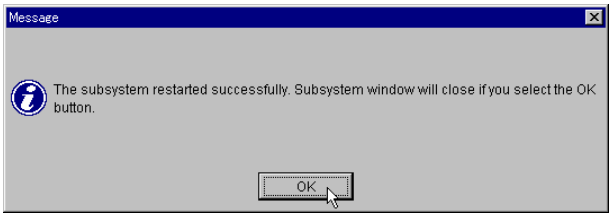



**Figure 3.12 Successful Restart**

The Unit window is closed. To perform other operations on the Main window, select the subsystem from the Main window and open the selected Unit window.

## 3.3 Enabling or Disabling Cache Residency Manager

To enable or disable Cache Residency Manager (without uninstalling this function) using the GUI version of Storage Navigator:

1. Start Storage Navigator and switch to **Management Mode**.
2. Register the subsystem in which you will set the Cache Residency Manager. A unit screen for the connected subsystem appears.
3. Click the **Logical Status** tab.
4. Click the **License Key** icon (see to 3.1).
5. Click **CACHERESIDENCY** in the **Option Name** text box, and then click **Change**.
6. In the resulting message. Click **OK** (see Figure 3.13).

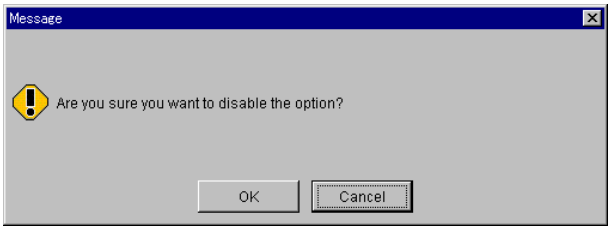
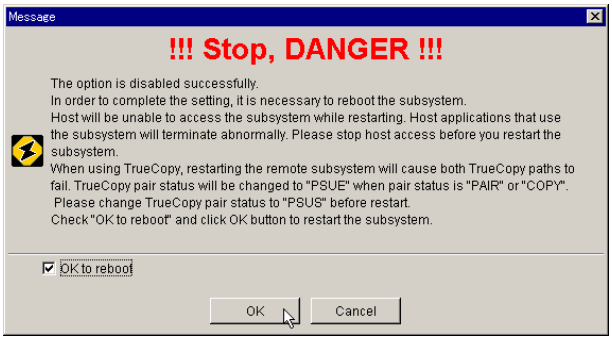


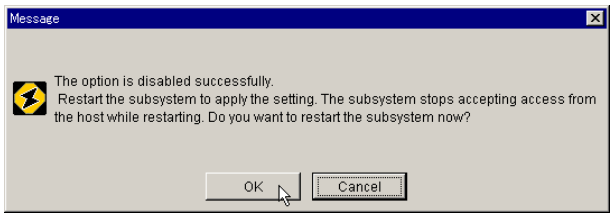

**Figure 3.13 Confirmation Message**

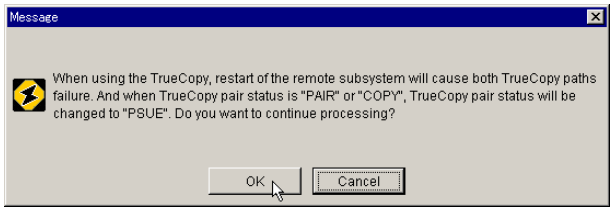
7. A message appears confirming that this optional feature is set. Click **OK**.

Storage Navigator: Version 4.03 and higher



Storage Navigator: versions earlier than 4.03




***Note:*** To set the option that you have operated, restart the subsystem. The feature will not set upon restarting the subsystem. The subsystem cannot access the host until the reboot is completed and the system restarts. Make sure that the host has stopped accessing data before beginning the restart process.

When you restart the subsystem, the time the restart began is displayed (see Figure 3.14). Restart usually takes 4 to 15 minutes.

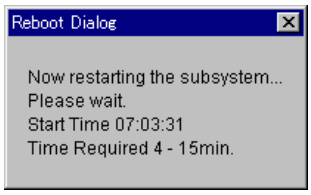



**Figure 3.14 Reboot Dialog Box**

***Note:*** It may take time for the subsystem to respond, depending upon the condition of the subsystem. If it does not respond after 15 minutes or more, check the condition of the subsystem.

8. A message appears, stating that the restart is successful (see Figure 3.15). Click **OK**.

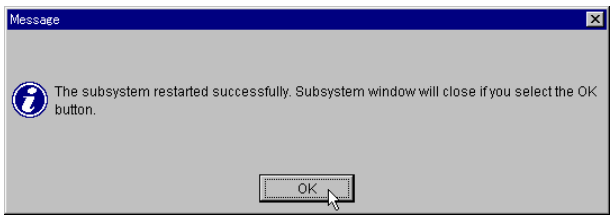
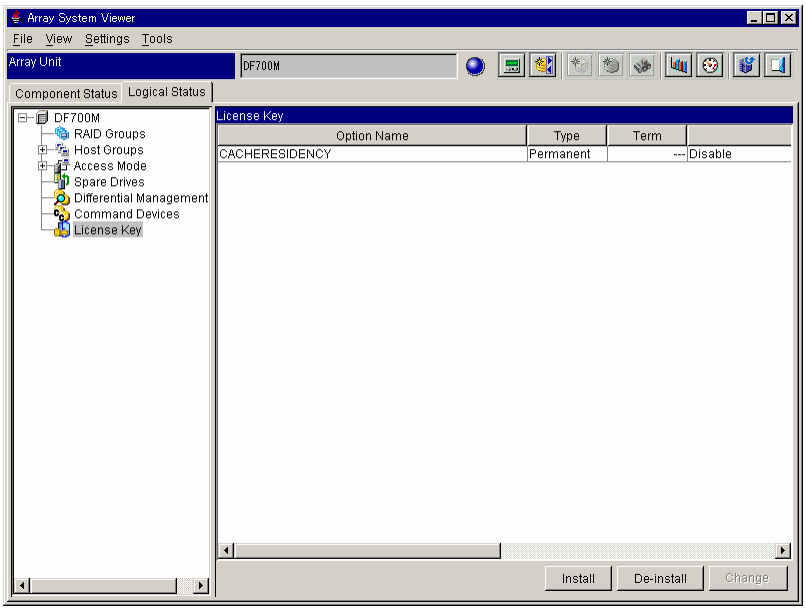



**Figure 3.15 Successful Restart**

The Unit window is closed. To perform other operations on the Main window, select the subsystem from the Main window and open the selected Unit window (see Figure 3.16).

Storage Navigator version 5.0 or later




Storage Navigator versions earlier than 5.0

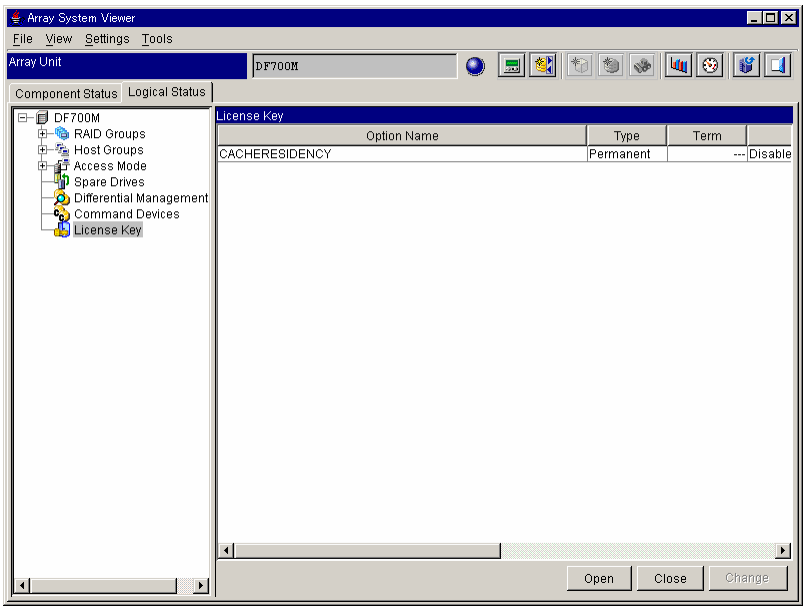



**Figure 3.16 Array System Viewer Window (Logical Status Tab: Option Disable)**

# Chapter 4 Setting/Referring/Canceling LUs with Cache Residency Manager

***Note:*** When installing or uninstalling Cache Residency Manager where the disk array subsystem is used on a TrueCopy or TCE remote site, the following occurs when the disk array subsystem is restarted:

- Both paths of TrueCopy or TCE are blocked. When a path is blocked, a TRAP (notification to the SNMP Agent Support Function) occurs. Should this occur, notify all affected departments immediately. A blocked path of TrueCopy or TCE recovers automatically when the subsystem is restarted.
- The pair status of TrueCopy or TCE is PAIR or COPY changes to PSUE.

When you restart the disk array subsystem, install or uninstall Cache Residency Manager **after** changing the pair status of TrueCopy or TCE to PSUS.

***Note:*** If you set or cancel the Cache Residency Manager on a subsystem connected to a NAS, you must also stop the clusters between the NAS units. When restarting the subsystem, you must restart the clusters.

You can set an LU using Storage Navigator by installing the Cache Residency Manager function. The LU that is set for the Cache Residency Manager function must be previously defined. If the LU is not defined, define the LU (choose an LU that already exists and that you would like to be a Cache Residency Manager LU). Confirm that the conditions required for Cache Residency Manager operations are present before performing the operation (refer to Table 2.1).

1. From the **Array System Viewer** window, click the **Logical Status** tab.
2. Click the **Cache Residency** icon (see Figure 4.1).

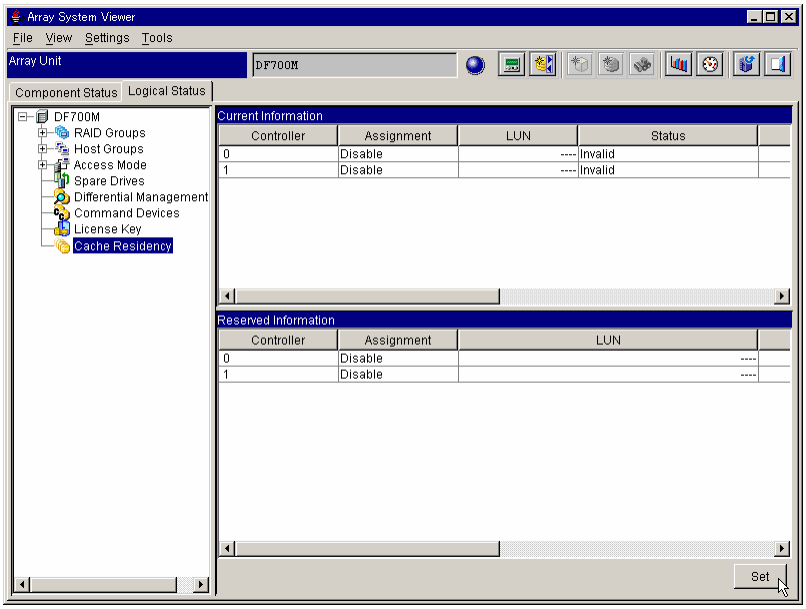



**Figure 4.1 Array System Viewer Window (Cache Residency)**

3. Click **Set**.

   The **Cache Residency** dialog box displays (see Figure 4.2).

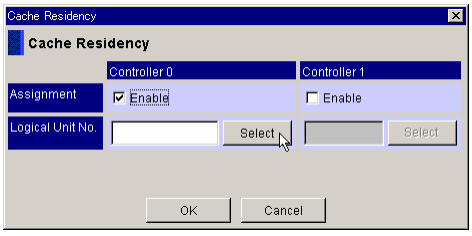



**Figure 4.2 Cache Residency Dialog Box**

4. In **Assignment**, specify **Enable** (checked) or Not Enable (unchecked).

   In **Logical Unit No.**, enter the logical unit number you want to set the Cache Residency information. Alternatively, click **Select** and specify the logical unit number.

   The **Select Logical Unit** dialog box displays (see Figure 4.3).

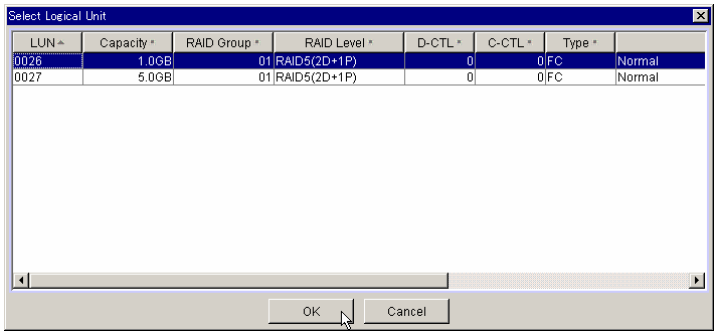



**Figure 4.3 Select Logical Unit Dialog Box**

5. Select a LUN and click **OK**.
6. The **Cache Residency** dialog box appears (see Figure 4.2). Click **OK**.
7. From the **Message** dialog box, click **OK** (see Figure 4.4).

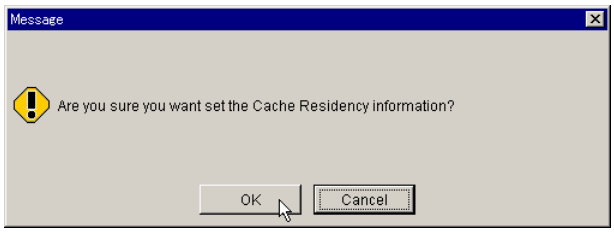
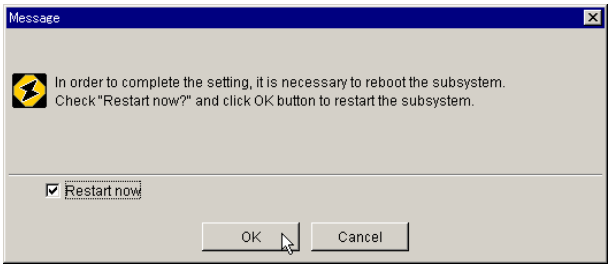
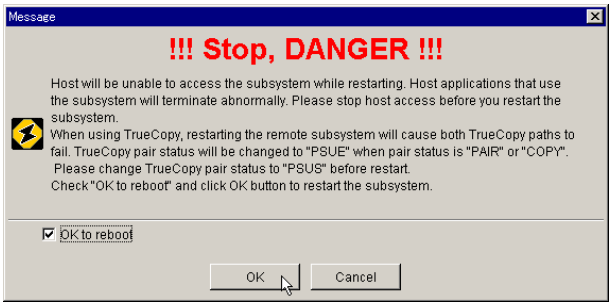



**Figure 4.4 Cache Residency Manager Information Message-1**

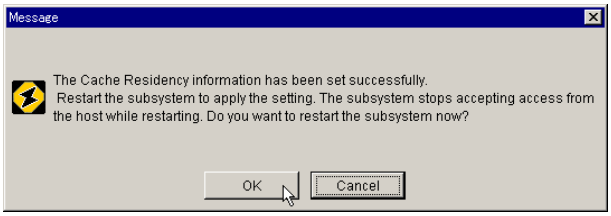
8. A message appears, click **OK**.

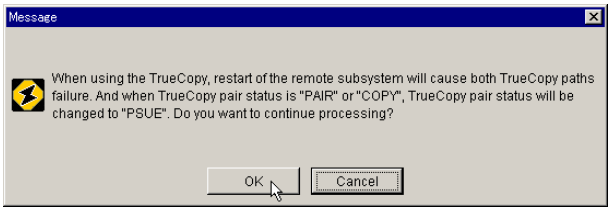
Storage Navigator: version 4.03 or later




Storage Navigator: versions earlier than 4.03




***Note:*** To unlock the option that you have operated, restart the subsystem. The feature will close upon restarting the subsystem. The subsystem cannot access the host until the reboot is completed and the system restarts. Make sure that the host has stopped accessing data before beginning the restart process.

When you restart the subsystem, the time the restart began is displayed (see Figure 4.5). Restart usually takes 4 to 15 minutes.

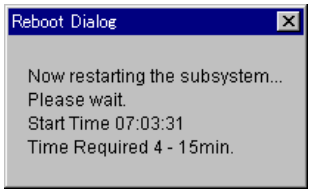
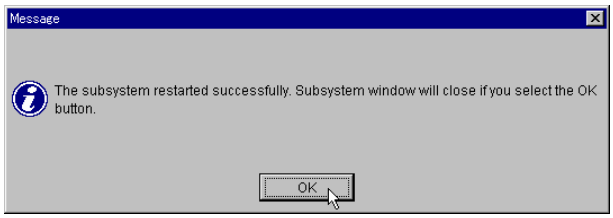



**Figure 4.5 Reboot Dialog Box**

***Note:*** It may take time for the subsystem to respond, depending upon the condition of the subsystem. If it does not respond after 15 minutes, check the condition of the subsystem.

9. A message appears stating that the restart is successful. Click **OK**.




The Unit window is closed. To perform other operations on the Main window, select the subsystem from the Main window and open the selected Unit window.

***Note:*** The Cache Residency Manager function is available as a separately purchased optional feature. If the Cache Residency Manager function is not installed or validated, LU cache cannot be set.

# Chapter 5 LU Capacity with Cache Residency Manager

The maximum size of the LU that is used for the Cache Residency Manager function depends on the capacity of the installed cache memory.

Supported capacity (see Table 5.1) may be modified through setting Cache Partition Manager and Snapshot/TCE. There are three cases:

**Case 1:** When Cache Partition Manager and Snapshot/TCE are invalid.

**Case 2:** When Cache Partition Manager is invalid and Snapshot/TCE is valid.

**Case 3:** When Cache Partition Manager is valid (and Snapshot/TCE is valid or invalid)

***Note:*** Cache Residency LU is assigned only a master partition.

Table 5.2 lists the maximum size of the LU used for the Cache Residency Manager function.

- **Case 1:** When Cache Partition Manager and Snapshot/TCE is invalid:

  The maximum capacity of Cache Residency LU is listed in Table 5.1.

**Table 5.1 Supported Capacity of Cache Residency LU (Cache Partition Manager and Snapshot/TCE Invalid)**

| Equipment Type | Installed Cache Memory | Maximum Capacity of Cache Residency LU |
|---|---|---|
| WMS100 | 512 MB/CTL | 60,480 blocks (approx. 29 MB) |
| | 1 GB/CTL | 483,840 blocks (approx. 236 MB) |
| AMS200 | 1 GB/CTL | 463,680 blocks (approx. 226 MB) |
| | 2 GB/CTL | 1,370,880 blocks (approx. 669 MB) |
| AMS500 | 1 GB/CTL | 302,400 blocks (approx. 147 MB) |
| | 2 GB/CTL | 1,048,320 blocks (approx. 511 MB) |
| | 3 GB/CTL | 1,995,840 blocks (approx. 974 MB) |
| | 4 GB/CTL | 2,903,040 blocks (approx. 1,417 MB) |
| AMS1000 | 2 GB/CTL | 887,040 blocks (approx. 433 MB) |
| | 4 GB/CTL | 2,741,760 blocks (approx. 1,338 MB) |
| | 6 GB/CTL | 4,616,640 blocks (approx. 2,254 MB) |
| | 8 GB/CTL | 6,451,200 blocks (approx. 3,150 MB) |

- **Case 2:** When Cache Partition Manager is invalid and Snapshot/TCE is valid:

  The maximum capacity of Cache Residency LU is listed in Table 5.2.

**Table 5.2 Supported Capacity of Cache Residency LU (Cache Partition Manager is Invalid and Snapshot /TCE is Valid)**

| Equipment Type | Installed Cache Memory | Maximum Capacity of Cache Residency LU |
|---|---|---|
| WMS100 | 512 MB/CTL | -(Snapshot is not available at this time) |
| | 1 GB/CTL | 181,440 blocks (approx. 88 MB) |
| AMS200 | 1 GB/CTL | 161,280 blocks (approx. 78 MB) |
| | 2 GB/CTL | 342,720 blocks (approx. 167 MB) |
| AMS500 | 1 GB/CTL | - (Snapshot is not available) |
| | 2 GB/CTL | 524,160 blocks (approx. 255 MB) |
| | 3 GB/CTL | 967,680 blocks (approx. 472 MB) |
| | 4 GB/CTL | |
| AMS1000 | 2 GB/CTL | 362,880 blocks (approx. 177 MB) |
| | 4 GB/CTL | 1,189,440 blocks (approx. 580 MB) |
| | 6 GB/CTL | 1,532,160 blocks (approx. 748 MB) |
| | 8 GB/CTL | 2,318,440 blocks (approx. 1,132 MB) |

***Note:*** When Snapshot/TCE is running on an AMS500, cache memory capacity is 3 GB/CTL and 4 GB/CTL, there is no change in the user data area. The maximum capacity of Cache Residency LU does not change either.

- **Case 3:** When Cache Partition Manager is valid:

  Supported capacity of Cache Residency LU is not concerned whether Snapshot/TCE is valid or invalid. The maximum capacity is decided by the capacity of a master partition and is listed in Table 5.3.

**Table 5.3 Supported Capacity of Cache Residency LU (Cache Partition Manager Valid)**

| Equipment Type | Installed Cache Memory | Maximum Capacity of Cache Residency LU |
|---|---|---|
| WMS100 | 512 MB/CTL | (Cache Partition Manager is not available) |
| | 1 GB/CTL | (The master partition size (MB) ***Note 1***-100 MB) x 2,016 (Blocks)<br>(The master partition size (MB) ***Note 1***-100 MB) x 2,016 ÷ 2,048 (MB) ***Note 2*** |
| AMS200 | 1 GB/CTL | |
| | 2 GB/CTL | |
| AMS500 | 1 GB/CTL | (Cache Partition Manager is not available) |
| | 2 GB/CTL | (The master partition size (MB) ***Note 1***-180 MB) x 2,016 (Blocks)<br>(The master partition size (MB) ***Note 1***-180 MB) x 2,016 ÷ 2,048 (MB) ***Note 2*** |
| | 3 GB/CTL | |
| | 4 GB/CTL | |
| AMS1000 | 2 GB/CTL | (The master partition size (MB) ***Note 1***-180 MB) x 2,016 (Blocks)<br>(The master partition size (MB) ***Note 1***-180 MB) x 2,016 ÷ 2,048 (MB) ***Note 2*** |
| | 4 GB/CTL | |
| | 6 GB/CTL | |
| | 8 GB/CTL | |

***Note 1:*** The size (it becomes effective at the time of starting next time) reserved as the current size is one of the sizes of a master partition. Use the value of the smaller one in a formula.

***Note 2:*** 1 block = 512 bytes, and a fraction less than 2,047 MB is omitted.

# Chapter 6 Troubleshooting

## 6.1 Troubleshooting

The Hitachi TagmaStore Adaptable Modular Storage (AMS) provides continuous data availability and is not expected to fail in any way that would interrupt access to user data. For troubleshooting information on the AMS subsystem or Storage Navigator, refer to

- *Hitachi TagmaStore Adaptable Modular Storage 200 User and Reference Guide* (MK-95DF713)
- *Hitachi TagmaStore Adaptable Modular Storage 500 User and Reference Guide* (MK-95DF714)
- *Hitachi TagmaStore Workgroup Modular Storage 100 User and Reference Guide* (MK-95DF738)
- *Hitachi TagmaStore Adaptable Modular Storage 1000 User and Reference Guide* (MK-95DF780)
- *Hitachi TagmaStore Adaptable Modular Storage and Workgroup Storage Navigator Modular for Web User's Guide* (MK-95DF719),
  Storage Navigator *Modular Graphical User Interface (GUI) User's Guide* (MK-95DF711).

## 6.2 Calling the Hitachi Data Systems Technical Support Center

If you need to call the Hitachi Data Systems Technical Support Center, make sure to provide as much information about the problem as possible. Include the circumstances surrounding the error or failure and the exact content of any error codes and/or messages displayed.

The worldwide Hitachi Data Systems Technical Support Centers are:

- Hitachi Data Systems North America/Latin America
  San Diego, California, USA
  1-800-446-0744
- Hitachi Data Systems Europe
  Contact Hitachi Data Systems Local Support
- Hitachi Data Systems Asia Pacific
  North Ryde, Australia
  61-2-9325-3300

# Appendix A Cache Residency Manager Operations Using CLI

This appendix includes the following:

- Installing Cache Residency Manager (section A.1)
- Uninstallation (section A.2)
- Enabling/Disabling Cache Residency Manager (section A.3)
- Setting/Referring/Canceling LUs with Cache Residency Manager (section A.4.)

***Note:*** When installing or uninstalling Cache Residency Manager where the disk array subsystem is used on a TrueCopy/TCE remote site, the following occurs when the disk array subsystem is restarted:

- Both paths of TrueCopy/TCE are blocked.
- The pair status of TrueCopy/TCE is PAIR or COPY changes to PSUE.

When you restart the disk array subsystem, install or uninstall Cache Residency Manager after changing the pair status of TrueCopy/TCE to PSUS.

***Note:*** If you install, uninstall, enable, or disable the Cache Residency Manager on a subsystem connected to a NAS, you must also stop the clusters between NAS units. When restarting the subsystem, you must restart the clusters.

## A.1 Installing Cache Residency Manager

The Cache Residency Manager feature is usually unselectable (locked). To make the Cache Residency Manager available, you must install the Cache Residency Manager feature and make its functions selectable (unlocked). **To install this function, the key code or key file provided with the optional feature is required.**

Cache Residency Manager is installed and uninstalled using Storage 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.

To install the Cache Residency Manager using the CLI version of Storage Navigator:

1. From the command prompt, register the subsystem in which you will install the Cache Residency Manager feature and connect to the subsystem. For details, refer to Storage Navigator *Modular (for CLI) User's Guide*.
2. Install the optional features by using the following:

   Storage Navigator version 5.0 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 e
nabled the default cache partition information will be restored.
Do you want to continue processing? (y/n [n]): y
The option is installed successfully.
In order to complete the setting, it is necessary to reboot the subsystem.
Host will be unable to access the subsystem while restarting. Host applications
that use the subsystem will terminate abnormally. Please stop host access before
 you restart the subsystem.
Also, if you are logging in, the login status will be canceled when restarting b
egins.
When using TrueCopy, restarting the remote subsystem will cause both TrueCopy pa
ths to fail.
TrueCopy pair status will be changed to "PSUE" when pair status is "PAIR" or "CO
PY". Please change TrueCopy pair status to "PSUS" before restart.
Do you agree with restarting? (y/n [n]): y
Are you sure you want to execute? (y/n [n]): y
Now restarting the subsystem. Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

Storage Navigator versions 3.10 through 4.07 and Cache Partition Manager is enabled

```
% auopt -unit subsystem-name 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 e
nabled the default cache partition information will be restored.
Do you want to continue processing? (y/n [n]): y
The option is unlocked.
In order to complete the setting, it is necessary to reboot the subsystem.
Host will be unable to access the subsystem while restarting. Host applications
that use the subsystem will terminate abnormally. Please stop host access before
 you restart the subsystem.
Also, if you are logging in, the login status will be canceled when restarting b
egins.
When using TrueCopy, restarting the remote subsystem will cause both TrueCopy pa
ths to fail.
TrueCopy pair status will be changed to "PSUE" when pair status is "PAIR" or "CO
PY". Please change TrueCopy pair status to "PSUS" before restart.
Do you agree with restarting? (y/n [n]): y
Are you sure you want to execute? (y/n [n]): y
Now restarting the subsystem. Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

Storage Navigator versions earlier than 3.00 and Cache Partition Manager is enabled

```
% auopt -unit subsystem-name 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.
Restart the subsystem to apply the setting.
The subsystem stops accepting access from the host while restarting.
Also, if you are logging in, the login status will be cancelled when restarting
begins.
Do you want to restart the subsystem now? (y/n [n]): y
When using the TrueCopy, restart of the remote subsystem will cause both
TrueCopy paths failure. And when TrueCopy pair status is "PAIR" or "COPY",
TrueCopy pair status will be changed to "PSUE".
Do you want to continue processing? (y/n [n]): y
Now restarting the subsystem.  Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

***Example:***

```
% auopt -unit subsystem-name -refer
Password: manager-password
Option Name                    Type       Term     Status
CACHERESIDENCY                 Permanent  ---      Enable
%
```

## A.2 Uninstallation

To uninstall Cache Residency Manager using the CLI version of Storage Navigator:

1. From the command prompt, register the subsystem in which you will uninstall Cache Residency Manager and connect to the subsystem.

2. Lock the optional features by using the following:

   ***Example 1:***

   Storage Navigator version 5.0 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.
In order to complete the setting, it is necessary to reboot the subsystem.
Host will be unable to access the subsystem while restarting. Host applications
that use the subsystem will terminate abnormally. Please stop host access before
 you restart the subsystem.
Also, if you are logging in, the login status will be canceled when restarting begins.
When using TrueCopy, restarting the remote subsystem will cause both TrueCopy paths to
fail.
TrueCopy pair status will be changed to "PSUE" when pair status is "PAIR" or "CO
PY". Please change TrueCopy pair status to "PSUS" before restart.
Do you agree with restarting? (y/n [n]): y
Are you sure you want to execute? (y/n [n]): y
Now restarting the subsystem. Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

   Storage Navigator: version 4.03 or later

```
% 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.
In order to complete the setting, it is necessary to reboot the subsystem.
Host will be unable to access the subsystem while restarting. Host applications
that use the subsystem will terminate abnormally. Please stop host access before
 you restart the subsystem.
Also, if you are logging in, the login status will be canceled when restarting begins.
When using TrueCopy, restarting the remote subsystem will cause both TrueCopy
paths to fail.
TrueCopy pair status will be changed to "PSUE" when pair status is "PAIR" or
"COPY". Please change TrueCopy pair status to "PSUS" before restart.
Do you agree with restarting? (y/n [n]): y
Are you sure you want to execute? (y/n [n]): y
Now restarting the subsystem. Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

Storage Navigator: versions earlier than 4.03

```
% 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.
Restart the subsystem to apply the setting.
The subsystem stops accepting access from the host while restarting.
Also, if you are logging in, the login status will be cancelled when restarting begins.
Do you want to restart the subsystem now? (y/n [n]): y
When using the TrueCopy, restart of the remote subsystem will cause both
TrueCopy paths failure. And when TrueCopy pair status is "PAIR" or "COPY",
TrueCopy pair status will be changed to "PSUE".
Do you want to continue processing? (y/n [n]): y
Now restarting the subsystem.  Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

***Example 2:***

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

## A.3 Enabling or Disabling Cache Residency Manager

Cache Residency Manager can be enabled or disabled without uninstalling this function.

To enable or disable Cache Residency Manager (without uninstalling this function) using the CLI version of Storage Navigator:

1. From the command prompt, register the subsystem in which you will change the status of the Cache Residency Manager feature and connect to the subsystem.

2. Execute the `auopt` command to change the status (enable or disable) of the Cache Residency Manager feature.

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

***Example 1:***

Storage Navigator: version 4.03 or later

```
% auopt -unit subsystem-name -option CACHERESIDENCY -st disable
Password: manager-password
Are you sure you want to disable the option? (y/n[n]): y
The option has been set successfully.
In order to complete the setting, it is necessary to reboot the subsystem.
Host will be unable to access the subsystem while restarting. Host applications
that use the subsystem will terminate abnormally. Please stop host access before
 you restart the subsystem.
Also, if you are logging in, the login status will be canceled when restarting b
egins.
When using TrueCopy, restarting the remote subsystem will cause both TrueCopy pa
ths to fail.
TrueCopy pair status will be changed to "PSUE" when pair status is "PAIR" or "CO
PY". Please change TrueCopy pair status to "PSUS" before restart.
Do you agree with restarting? (y/n [n]): y
Are you sure you want to execute? (y/n [n]): y
Now restarting the subsystem. Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

Storage Navigator: versions earlier than 4.03

```
% auopt -unit subsystem-name -option CACHERESIDENCY -st disable
Password: manager-password
Are you sure you want to disable the option? (y/n[n]): y
The option has been set successfully.
Restart the subsystem to apply the setting.
The subsystem stops accepting access from the host while restarting.
Also, if you are logging in, the login status will be cancelled when restarting begins.
Do you want to restart the subsystem now? (y/n [n]): y
When using the TrueCopy, restart of the remote subsystem will cause both
TrueCopy paths failure. And when TrueCopy pair status is "PAIR" or "COPY",
TrueCopy pair status will be changed to "PSUE".
Do you want to continue processing? (y/n [n]): y
Now restarting the subsystem.  Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

***Example 2***

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

## A.4 Setting/Referring/Canceling LUs with Cache Residency Manager

You can set an LU using Storage Navigator by installing the Cache Residency Manager function. The LU that is set for the Cache Residency Manager function must be previously defined. If the LU is not defined, define the LU (choose an LU that already exists and that you would like to be a Cache Residency Manager LU). Confirm that the conditions required for Cache Residency Manager operations are met before performing the operation (refer to Table 2.1).

1. From the command prompt, register the subsystem in which you want to set Cache Residency Manager and connect to the subsystem.

2. Execute the `auturbolu` command to specify the subsystem.

```
Host will be unable to access the subsystem while restarting. Host applications
that use the subsystem will terminate abnormally. Please stop host access before
 you restart the subsystem.
Also, if you are logging in, the login status will be canceled when restarting b
egins.
When using TrueCopy, restarting the remote subsystem will cause both TrueCopy pa
ths to fail.
TrueCopy pair status will be changed to "PSUE" when pair status is "PAIR" or "CO
PY". Please change TrueCopy pair status to "PSUS" before restart.
Do you agree with restarting? (y/n [n]): y
Are you sure you want to execute? (y/n [n]): y
Now restarting the subsystem. Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

Storage Navigator: versions earlier than 4.03

```
% auturbolu -unit subsystem-name -set -ctl1_assign enable -ctl1_lu 0
Password: manager-password
The Cache Residency information has been set successfully.
Restart the subsystem to apply the setting.
The subsystem stops accepting access from the host while restarting.
Also, if you are logging in, the login status will be cancelled when restarting begins.
Do you want to restart the subsystem now? (y/n [n]): y
When using the TrueCopy, restart of the remote subsystem will cause both
TrueCopy paths failure. And when TrueCopy pair status is "PAIR" or "COPY",
TrueCopy pair status will be changed to "PSUE".
Do you want to continue processing? (y/n [n]): y
Now restarting the subsystem.  Start Time hh:mm:ss Time Required 4 - 15min.
The subsystem restarted successfully.
%
```

3. Specify as shown in the following example. Check the information that has been set.

***Example:***

```
% auturbolu -unit subsystem-name -refer
Password: manager-password
Controller 0
Current Configuration
  Assignment : off
  LUN        :
  Status     :
Reserved Configuration
  Assignment : off
  LUN        :

Controller 1
Current Configuration
  Assignment : on
  LUN        : 0
  Status     : valid
Reserved Configuration
  Assignment : on
  LUN        : 0
%
```

# Acronyms and Abbreviations

| Acronym | Expansion |
|---|---|
| A | Ampere |
| AL-PA | arbitrated loop-physical address |
| AMS | Adaptable Modular Storage |
| API | application programming interface |
| ASTM | American Society for Testing Materials |
| ATA | Advanced Technology Attachment standard |
| ATM | asynchronous transfer mode |
| BC | business continuity |
| BS | Basic (power) supply |
| BSA | bus adapter |
| BTU | British thermal unit |
| CCI | command control interface |
| CEC | Canadian Electroacoustic Community |
| CFW | cache fast write |
| CHAP | challenge handshake authentication protocol |
| CIFS | common internet file system |
| CKD | count-key data |
| CLI | command line interface |
| CSA | Canadian Standards Association |
| CSV | comma separated value |
| CTG | consistency group |
| CTL | controller |
| CU | controller unit |
| CUDG | control unit diagnosis |

| | |
|---|---|
| dB(A) | decibel (A-weighted) |
| D-CNT | default (owner) controller |
| DAMP | Disk Array Management Program |
| DDL | data definition language |
| DHCP | dynamic host configuration protocol |
| DKC | disk controller unit |
| DLM | data lifecycle management |
| DM-LU | differential management logical unit |
| DRAM | dynamic random access memory |
| DWDM | dense wavelength division multiplexer |
| EMI | electromagnetic interference |
| EPO | emergency power-off |
| FC | fibre channel |
| FC-AL | fibre channel-arbitrated loop |
| FCC | Federal Communications Commission |
| FCP | fibre-channel protocol |
| Gbps | gigabit per second |
| HA | high availability |
| HACMP | high availability cluster multi-processing |
| HBA | host bus adapter |
| HDLM | Hitachi Dynamic Link Manager |
| HORCM | Hitachi Open Remote Copy Manager |
| H-LUN | host logical unit |
| H-RAIN | heterogeneous redundant array of independent nodes |
| HSN | hierarchical star network |
| HWM | high water mark |

| | |
|---|---|
| IDE | integrated drive electronics; see also ATA. |
| IIS | Internet Information Service |
| IOPS | input output operations per second |
| IOS | internet work operating system |
| iSCSI | internet small computer system interface |
| JRE | Java 2 runtime environment |
| LCP | local control port |
| LD | logical device |
| LDEV | logical device |
| LDM | logical device manager |
| LIP | loop initialization primitive |
| LRU | least recently used |
| LUN | logical unit number |
| LUSE | LU size expansion |
| LVI | logical volume image |
| LVM | logical volume manager |
| MCU | main control unit |
| NDMP | Network Data Management Protocol |
| MDB | master directory block |
| MIB | message information block |
| μP | microprocessor |
| MR | magneto-resistive |
| MU | mirror unit |
| MVS | multiple virtual storage |
| MVS/ESA | multiple virtual storage /enterprise systems architecture |
| MVS/XA | multiple virtual storage /extended architecture |

| | |
|---|---|
| NAS | network attached storage |
| NBU | NetBackup (a Symantec product) |
| NEC | National Electrical Code |
| NFS | network file system |
| NIC | network interface card |
| NIS | network information service |
| NNC | network node controller |
| NSC | network storage controller |
| NTP | network time protocol |
| NVS | nonvolatile storage |
| OCI | Oracle Call Interface |
| ODM | object data manager |
| OFC | open fibre control |
| ORM | online read margin |
| OSI | open systems interconnection |
| PCI | power control interface |
| PDL | product documentation library |
| PFUS | pool full status |
| POSIX | portable operating system interface |
| PPRC | peer-to-peer remote copy |
| PSUE | pair suspended-error status |
| PSUS | pair suspended-split |
| PSUS(N) | pair suspended – not restored status |
| PV | physical volume |
| P-VOL | primary volume |
| RAID | redundant array of independent disks |

| | |
|---|---|
| RC | reference code |
| RCU | remote control unit |
| RPO | recovery point objective |
| RTC | real-time clock |
| RTO | recovery time objective |
| SAN | storage-area network |
| SATA | serial ATA |
| SCSI | small computer system interface |
| SIM | service information message |
| SM | shared memory module |
| SMB | server message block |
| SMTP | simple mail transfer protocol |
| SNIA | Storage Networking Industry Association |
| SNMP | simple network management protocol |
| SONET | synchronous optical network |
| SSL | secure socket layer |
| SSWS | suspend for swapping S-VOL |
| S-VOL | secondary volume |
| TID | target identifier |
| TPOF | tolerable points of failure |
| UDP | user diagram protocol |
| UL | Underwriters' Laboratories |
| USP | Universal Storage Platform |
| VCS | Veritas Cluster Server™ |
| VDE | Verband Deutscher Elektrotechniker |
| VIB | volume information block |

| | |
|---|---|
| VOLID | volume identifier |
| V-VOL | virtual volume (Snapshot Image) |
| VxVM | Veritas Volume Manager |
| WDM | wavelength division multiplexing |

# Index