

*PRELIMINARY RELEASE*



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

**Hitachi CruiseControl™ User's Guide**

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## Document Revision Level

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MK-92RD106-P	April 2002	Preliminary Release

## Changes in this Revision

- New panel captures added.
- New descriptions added.

## Source Documents Used in this Revision

The following source documents were used to produce this Hitachi Freedom Storage™ Lightning 9900™ V Series Performance Monitor User's Guide.

- Hitachi Lightning 9900™ V Series Performance Management User's Guide, RSD source document (RSD-Mon45d2), dated 03/08/02.
- Hitachi Lightning 9900™ V Series Performance Management User's Guide, RSD source document (RSD-Mon45d0a), dated 04/15/02.

## Referenced Documents

- *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100).
- *Hitachi Freedom Storage™ Lightning 9900™ V Series Performance Monitor User's Guide* (MK-92RD133).
- *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117).
- *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide* (MK-92RD101).
- *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console Error Codes* (MK-92RD132).
- *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117).

## Preface

The Hitachi CruiseControl User's Guide describes and provides instructions for using Hitachi CruiseControl software to balance workload among hard disk drives, logical volumes, and processors to remove bottlenecks from your system. This document assumes that:

- the user has a background in data processing and understands direct-access storage device (DASD) subsystems and their basic functions,
- the user has read and understands the *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100), the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide* (MK-92RD101), and the *Hitachi Freedom Storage™ Lightning 9900™ V Series Performance Monitor User's Guide* (MK-92RD133), and
- the user is familiar with the Microsoft® Windows NT® and/or Windows® 2000 operating systems (e.g., opening, closing, minimizing, and restoring windows; using the keyboard and mouse to navigate on screen and select objects).
- the user is familiar with various web browsers.

**Note:** The term "9900V" refers to the entire Lightning 9900™ V Series subsystem family, unless otherwise noted. The term "Web Console" refers to "Remote Console - Storage Navigator" unless otherwise noted. The term "Performance Management" refers to "Performance Monitor" unless otherwise noted. The terms "PPC" and "Prioritized Port Control" refer to "Priority Access" unless otherwise noted. For additional information on the 9900V disk array subsystems please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100) or contact your Hitachi account team. For additional information on the 9900V Remote Console PC, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide* (MK-92RD101) or contact your Hitachi account team.

### Microcode Level

This document revision applies to 9900V microcode versions 21-01-xx/xx and higher.

#### COMMENTS

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Please refer to specific page(s) and paragraph(s) whenever possible.**

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**Thank you!**

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# Contents

<b>Chapter 1</b>	<b>Overview of Hitachi Freedom Storage™ 9900™ V Series Performance Monitor, Hitachi CruiseControl and Priority Access.....</b>	<b>1</b>
<b>Chapter 2</b>	<b>Hitachi CruiseControl Overview .....</b>	<b>3</b>
2.1	Migrating Logical Volumes Manually .....	4
2.1.1	Procedure for Manually Migrating .....	4
2.1.2	Mechanisms for Manual Migration .....	4
2.2	Automating Volume Migrations .....	7
2.2.1	Procedure for Automating Migration Operations .....	7
2.2.2	Mechanism for Auto Migrations .....	8
2.3	Requirements and Restrictions .....	12
<b>Chapter 3</b>	<b>Preparing for Hitachi CruiseControl Operations.....</b>	<b>15</b>
3.1	System Requirements .....	15
3.2	Starting Remote Console - Storage Navigator™ and Configuring Your Client PC.....	15
3.3	Starting Hitachi CruiseControl .....	16
<b>Chapter 4</b>	<b>Reviewing the Hitachi CruiseControl Panel.....</b>	<b>19</b>
4.1	The Manual Plan Tab in the Hitachi CruiseControl Panel.....	20
4.2	The Auto Plan Tab in the Hitachi CruiseControl Panel .....	24
4.3	The Attribute Tab in the Hitachi CruiseControl Panel .....	28
4.4	The History Tab in the Hitachi CruiseControl Panel.....	31
<b>Chapter 5</b>	<b>Performing Hitachi CruiseControl Operations .....</b>	<b>33</b>
5.1	Reserving Migration Destinations for Logical Volumes .....	33
5.2	Creating Migration Plans and Manually Migrating.....	35
5.3	Automating Volume Migrations .....	40
5.3.1	Setting Fixed Parity Group .....	40
5.3.2	Changing the Maximum Disk Usage Rate for Each HDD Class .....	42
5.3.3	Setting Auto Migration Parameters .....	43
5.3.4	Remaking Auto Migration Plans.....	45
5.3.5	Deleting/Turning off Auto Migration Plans .....	45
5.4	Viewing the Migration History Log .....	46
<b>Chapter 6</b>	<b>Troubleshooting.....</b>	<b>51</b>
6.1	Troubleshooting .....	51
6.2	Hitachi CruiseControl Error Codes .....	53
6.3	Calling the Hitachi Data Systems Technical Support Center.....	56
	<b>Acronyms and Abbreviations .....</b>	<b>57</b>

# List of Figures

Figure 2.1	Example Migration Plan Displayed in the Hitachi CruiseControl Panel .....	4
Figure 2.2	Situation During a Hitachi CruiseControl Volume Migration Operation.....	5
Figure 2.3	Simulation After a Hitachi CruiseControl Volume Migration Operations .....	6
Figure 2.4	Migrating to Improve Disk Usage.....	9
Figure 2.5	Keeping Reserve Volumes in the High HDD Class Available .....	10
Figure 2.6	Migrating a Volume Automatically to a Lower HDD Class.....	10
Figure 2.7	Migrating a Volume Automatically Within the Same HDD Class.....	11
Figure 3.1	Physical Tab of the Performance Monitor Panel .....	17
Figure 3.2	The Hitachi CruiseControl Panel.....	18
Figure 4.1	Physical Tab in the Performance Monitor Panel .....	19
Figure 4.2	The Manual Plan Tab in the Hitachi CruiseControl Panel.....	20
Figure 4.3	Parity Group Information .....	21
Figure 4.4	Volume Information.....	22
Figure 4.5	The Auto Plan Tab in the Hitachi CruiseControl Panel.....	24
Figure 4.6	The Attribute Tab in the Hitachi CruiseControl Panel .....	28
Figure 4.7	Parity Group Information Relating to a Selected Class .....	29
Figure 4.8	Logical Volume Information Relating to a Selected Parity Group .....	30
Figure 4.9	The History Tab in the Hitachi CruiseControl Panel.....	31
Figure 5.1	The Attribute Tab .....	33
Figure 5.2	The Reserved LDEV Pop-Up Menu.....	34
Figure 5.3	The Manual Tab.....	36
Figure 5.4	Usage Rate for a Logical Volume Displayed in the Panel (example only) .....	36
Figure 5.5	Source and Target Text Boxes (example only) .....	37
Figure 5.6	Classes and Parity Groups Shown in the Attribute Tab (example only) .....	37
Figure 5.7	Estimated Usage Rate for Parity Groups (example only) .....	38
Figure 5.8	The Attribute Tab .....	40
Figure 5.9	Fixed Parity Group Pop-Up Menu .....	41
Figure 5.10	Change Class Threshold Pop-Up Menu .....	42
Figure 5.11	The Change Threshold for Class Panel.....	42
Figure 5.12	The Auto Plan Tab .....	43
Figure 5.13	Make New Plan Button in Auto Plan Tab .....	45
Figure 5.14	The History Tab .....	46



## List of Tables

Table 2.1	Non-Cascade Volumes and Hitachi CruiseControl Source Volumes .....	12
Table 2.2	Cascade Volumes and Hitachi CruiseControl Source Volumes.....	13
Table 5.1	Messages in the Auto Migration Logs (example only) .....	47
Table 5.2	Messages in the Migration Logs (example only).....	49
Table 6.1	General Error Conditions .....	52
Table 6.2	Error Codes on the History Tab.....	53

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## Chapter 1 Overview of Performance Monitor, CruiseControl and Priority Access

Performance Monitor serves as the foundation for a suite of programs that allow you to monitor and tune disk subsystem performance. This suite of software consists of:

- Performance Monitor (Performance Management)
- Hitachi CruiseControl
- Priority Access (Prioritized Port Control)

**Performance Monitor (Performance Management)** lets you obtain usage statistics about the physical hard disk drive, logical volumes, processors, or other resources in your disk subsystem. Performance Monitor also lets you obtain statistics about workloads on disk drives and traffic between hosts and the disk subsystem. The Hitachi Performance Monitor panel displays a line graph that indicates changes in the usage rates, workloads, or traffic. You can view information in the panel and analyze trends in disk I/Os and detect peak I/O time. If the system performance is low, you can use information in the panel to detect bottlenecks in the system. For details, see *Hitachi Freedom Storage™ Lightning 9900™ V Series Performance Monitor User's Guide* (MK-92RD133).

**Hitachi CruiseControl** lets you balance workload among hard disk drives, logical volumes, and processors to remove bottlenecks from your system. If Performance Monitor indicates that a lot of I/Os are made to certain hard disk drives, you can use Hitachi CruiseControl to distribute workloads to other disk drives.

**Priority Access (Prioritized Port Control)** lets you tune the system to provide high-priority hosts with relatively higher throughput. Priority Access can prevent production servers from suffering lowered performance. For details, see the *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117).

**Caution:** If Performance Monitor (Performance Manager) is not enabled, you cannot use Hitachi CruiseControl or Priority Access.



## Chapter 2 Hitachi CruiseControl Overview

Hitachi CruiseControl allows you to optimize your data storage and retrieval on the 9900V subsystem. Hitachi CruiseControl tuning operations can be used to balance resource utilization and resolve bottlenecks of system activity.

If I/O accesses from hosts converge on particular disk drives, the hosts might suffer response time delay. To overcome this situation, Hitachi CruiseControl lets you migrate high-usage volumes to a low-usage disk drive or a fast disk drive. Volume migration can balance workloads among disk drives and thus remove bottlenecks from the system. Volume migration can also balance workloads among disk processors, which control disk I/Os.

Volume migration operations are classified into *manual migrations* and *auto migrations*.

- Manual Migration - In manual migrations, the system administrator specifies the volumes to be migrated and the migration destinations, and then executes migrations.
- Auto Migration - In auto migrations, Hitachi CruiseControl automatically determines the volumes to be migrated and the migration destinations, and also executes migrations automatically.

Hitachi CruiseControl operations are completely nondisruptive - the data being migrated can remain online to all hosts for read and write I/O operations throughout the entire volume migration process.

**Note:** Hitachi CruiseControl migration should be performed only when you can expect a large improvement in subsystem performance. Hitachi CruiseControl migration may not provide significant improvement for cases in which parity group or volume usage varies only slightly, or for cases in which overall DKP or DRR usage is relatively high.

**Note:** Also keep in mind that subsystem-tuning operations can improve performance in one area while at the same time decreasing performance in another. For example, assume that parity groups A and B have average usage values of 20% and 90%, respectively. Hitachi CruiseControl estimates that if one logical volume is migrated from parity group B to parity group A, the usage values will become 55% and 55%. If you perform this migration operation, the I/O response time for parity group B will probably decrease, and the I/O response time for parity group A may increase, while the overall throughput may increase or decrease.

**Caution:** Do not use monitor data collected during an error condition as the basis for planning Hitachi CruiseControl migration operations. Resource usage can increase or become unbalanced when an error condition exists in the 9900 subsystem.

## 2.1 Migrating Logical Volumes Manually

Hitachi CruiseControl enables you to balance workloads among parity groups to improve system performance. To balance workloads, you select high-usage logical volumes from a high-usage parity group and then move the logical volumes to a different parity group. This is done by executing a migration plan.

### 2.1.1 Procedure for Manually Migrating

Before you can migrate a logical volume from one parity group to another, you must create a migration plan. A migration plan specifies the following:

- a logical volume to be migrated
- the migration destination or target

However, before you can create a migration plan, you must determine which volume should be migrated to which parity group (disk drive).

To determine which volume to migrate, you will use the CruiseControl Manual tab to check logical volume usage rates. You will want to migrate a volume with a high usage rate (for details, see sections 4.1 and 5.2).

To determine a migration destination, you will use the CruiseControl Attribute tab to find fast parity groups (i.e., fast disk drives). From these fast parity groups you will then choose a low-usage parity group to serve as the migration destination (for details, see sections 4.3 and 5.2).

Once created, migration plans are executed to carry out volume migration. Figure 2.1 shows an example of a migration plan. In this figure, **Source LDEV** indicates the volume that should be migrated. **Target LDEV** indicates the migration destination for the volume in **Source LDEV**.



DEL	%	Source LDEV						Target LDEV			
		LDEV	Emulation	Capacity	RAID	PG	HDD	LDEV	RAID	PG	HDD
-	-	 00:02	OPEN-3	2.29GB	1(2D+2D)	1-1	DKR1B-J047FC	 00:0C	5(3D+1P)	1-2	DKR1B-J047FC

Figure 2.1 Example Migration Plan Displayed in the Hitachi CruiseControl Panel

### 2.1.2 Mechanisms for Manual Migration

**Note:** The 9900V documents (including this manual) use the term *source volumes* to refer to volumes that should be migrated and the term *target volumes* to refer to volumes that should become migration destinations.

The Hitachi CruiseControl volume migration operation consists of two steps:

- Copy the source volume data to the target volume
- Transfer host access

### 2.1.2.1 Copying Source Volume Data

In this step, data on the Hitachi CruiseControl source volume is copied to the Hitachi CruiseControl target volume (see Figure 2.2).

The target volume is reserved prior to migration to prevent host access during migration. The source and target volumes can be located anywhere within the subsystem. The Hitachi CruiseControl copy operation copies the entire contents of the source volume to the target volume cylinder by cylinder (24 tracks at a time, not including the diagnostic and unassigned alternate tracks). If the source volume is updated by write I/Os during the copy operation, the 9900V keeps track of the updates on a cylinder map and performs additional copy operations after the initial copy is complete to duplicate the updates at the target volume.

**Note:** The Hitachi CruiseControl source volume can be online to hosts during migration.

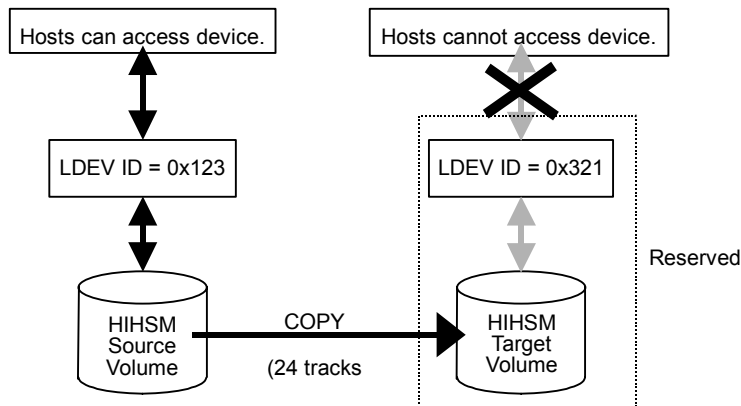


Figure 2.2 Situation During a Hitachi CruiseControl Volume Migration Operation

### 2.1.2.2 Transferring Host Access

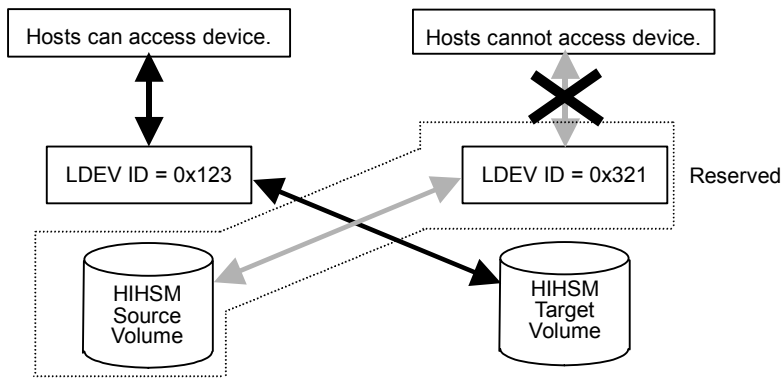
In this step, host access is transferred to the target volume to complete the migration (see Figure 2.3).

When the volumes are fully synchronized (no differential data on source volume), the 9900V completes the migration by swapping the reserve attribute (target is normal, source is reserved) and redirecting host access to the target volume. Hitachi CruiseControl performs all migration operations sequentially (i.e., one volume migration at a time).

**Note:** Approximate copy times with no other I/O activity are:

- OPEN-3 = 1.5 min
- OPEN-9 = 4.5 min
- OPEN-E = 9 min.

**Note:** For manual and automatic migration operations, Hitachi CruiseControl checks the current subsystem *write pending rate* and cancels a migration operation if the *write pending rate* is higher than 60%. For auto migration, Hitachi CruiseControl also checks the current disk utilization of the source volumes and source and target parity groups, and cancels the auto migration operation if current disk utilization is higher than the user-specified maximum disk utilization for auto migration.



**Figure 2.3** Simulation After a Hitachi CruiseControl Volume Migration Operations

**Note:** Hitachi CruiseControl migration should be performed only when you can expect a large improvement in subsystem performance. Hitachi CruiseControl migration may not provide significant improvement for cases in which parity group or volume usage varies only slightly, or for cases in which overall DKP or DRR usage is relatively high. Also keep in mind that subsystem tuning operations can improve performance in one area while at the same time decrease performance in another. For example, assume that parity groups A and B have average usage values of 20% and 90%, respectively. Hitachi CruiseControl estimates that if one logical volume is migrated from parity group B to parity group A, the usage values will become 55% and 55%. If you perform this migration operation, the I/O response time for parity group B will probably decrease, and the I/O response time for parity group A may increase, while the overall throughput may increase or decrease.



## 2.2 Automating Volume Migrations

As explained in section 2.1, Hitachi CruiseControl allows you to create and execute migration plans. However, Hitachi CruiseControl also allows you to automate creation and execution of volume migration plans. If you automate creation and execution of migration plans, you will not need to analyze usage rates of subsystem resources and speed of disk drives. Hitachi CruiseControl automatically determines volumes to be migrated, determines migration destinations, and performs volume migrations.

**Caution:** Do not perform manual migration operations while the auto migration function is active. Always turn off the auto migration function and cancel any existing auto migration plans before performing manual migration operations (see section 5.3.5).

**Note:** If you use the manual migration function, you can analyze disk usage, processor usage, and access path usage when you create migration plans. If you use the auto migration function, Hitachi CruiseControl only uses disk usage and does not analyze processor usage and access path usage when creating migration plans.

### 2.2.1 Procedure for Automating Migration Operations

If you want to automate creation and execution of migration plans, the following operations must be performed:

- **Step 1: Use Performance Monitor to monitor disk usage.** Hitachi CruiseControl automatically analyzes past disk usage and then creates migration plans. To enable Hitachi CruiseControl to analyze disk usage, you must use Performance Monitor to collect disk usage statistics. For details, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Performance Monitor User's Guide (MK-92RD133)*.
- **Step 2: If necessary, specify fixed parity groups.** If you automate volume migrations, some of the logical volumes and parity groups might suffer delay in I/O speed. For example, if the logical volume 0:01 is migrated from the parity group Grp1-1 of the class A to the parity group Grp-2-1 of the class B, the volume 0:01 is migrated to a lower-speed disk drive and thus might suffer from delay in I/O speed.

Hitachi CruiseControl lets you prevent a parity group delay in I/O speed. If you specify a parity group as a *fixed parity group*, the parity group will not be affected by the auto migration function. For example, if you specify Grp1-1 as a fixed parity group, logical volumes in Grp1-1 will not be migrated to any other parity group. Also, no logical volumes will be migrated to Grp1-1. For details on how to specify fixed parity groups, see section 5.3.1.

- **Step 3: Review the disk usage limit for each HDD class.** Each HDD class is assigned a disk usage limit by default. Disk usage limits affect system performance after volume migrations. If the disk usage limit for one class is high, a lot of logical volumes might be migrated to parity groups in that class. If the disk usage limit for one class is low, fewer logical volumes might be migrated to parity groups in that class.

Hitachi CruiseControl lets you change the disk usage limit. The default usage limits are rough estimates only and may not provide the best results. For details on how to change the disk usage limit, see section 5.3.3.

- **Step 4: Specify the time period for which you want to improve disk access performance.** As explained earlier, Hitachi CruiseControl automatically analyzes past disk usage and then creates migration plans. To enable Hitachi CruiseControl to analyze disk usage, you must specify a time period to narrow disk usage statistics to be analyzed. It is recommended that you specify a time period for which you want to improve disk access performance. For example, if you want to improve disk access performance every day from 9:00 a.m. to 5:00 p.m., you are advised to specify *every day from 9:00 a.m. to 5:00 p.m.* Hitachi CruiseControl will analyze disk usage statistics for the specified time period and create migration plans based on the analysis. For how to specify a time period, see section 5.3.3.
- **Step 5: Specify the time when Hitachi CruiseControl executes migration plans.** You must specify the time when Hitachi CruiseControl executes migration plans. You are advised to specify a time when disk usage rate is low because volume migrations are likely to produce heavy workloads on disk drives.
- Hitachi CruiseControl executes migration plans every day at the specified time. For details on how to change the disk usage limit, see section 5.3.3.
- **Step 5: Specify parameters that affect the system performance.** The Hitachi CruiseControl panel lets you specify parameters that affect the system performance after volumes are migrated. You can specify these parameters, if necessary. For details, see section 5.3.3.
- **Step 6: Set the auto migration function to ON.** To automate creation and execution of migration plans, you must set the Auto Migration Function option to **ON**. For details, see section 5.3.3.

After you finish these operations, Hitachi CruiseControl automatically creates migration plans and executes the plans. Hitachi CruiseControl creates plans 30 minutes later than the time period specified in step 4 (For example, if 13:00 - 15:00 is specified, plan creation will be performed at 15:30). The migration plans will be executed every day at the time specified in step 5.

**Note:** You can change or cancel automatically created migration plans before Hitachi CruiseControl executes the plans. For details, see sections 5.3.4 and 5.3.5.

After auto migration finishes, you can use Performance Monitor to check whether the workloads on disk drives are balanced and the system performance is improved. If the migration results are not satisfactory, you can change settings for fixed parity groups, settings for disk usage limits, and/or change other parameters and then retry auto migrations.

## 2.2.2 Mechanism for Auto Migrations

The auto migration function allows you to specify the maximum usage rate for each HDD class in the 9900V subsystem. The maximum usage rate applies to all the parity groups in the HDD class. This section described how the specified usage limit affects auto migration behavior.

When a parity group exceeds the specified maximum usage rate, the auto migration function makes a plan to migrate one or more volumes in this parity group to another parity group in a higher HDD class (see Figure 2.4) or to a parity group in the same HDD class with lower utilization. This storage tuning method addresses, and can eliminate, bottlenecks of disk drive activity and also provides load balancing of disk drive usage. Hitachi CruiseControl uses the estimated usage rates to verify each proposed auto migration and will not perform a migration operation that might result in a target parity group exceeding the user-specified maximum disk usage rate.

**Note:** The default maximum usage values are rough estimates only and may not provide the best results.

As shown in Figure 2.4, the auto migration function identifies parity groups which exceed the user-specified usage limit, and then selects the high-usage volumes as the source volumes to be migrated to parity groups in higher HDD classes or to other parity groups in the same HDD class with lower utilization.

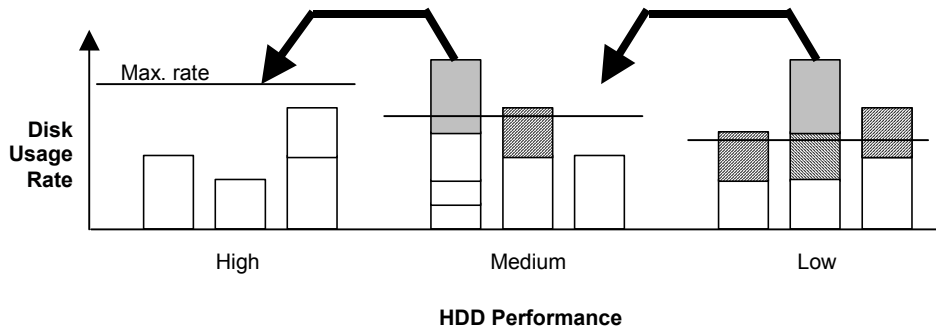
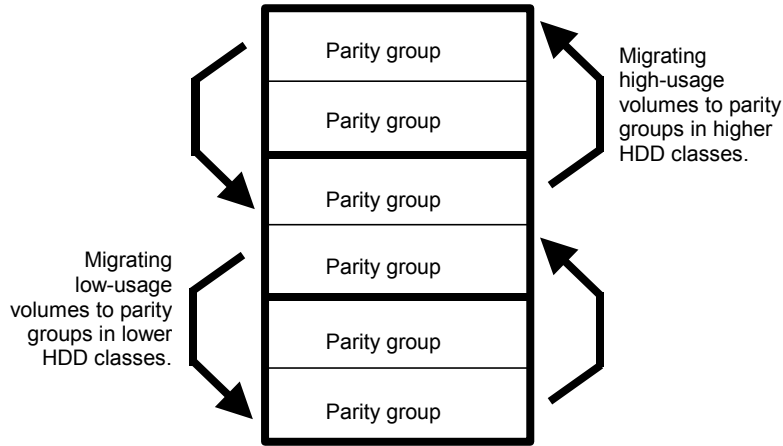


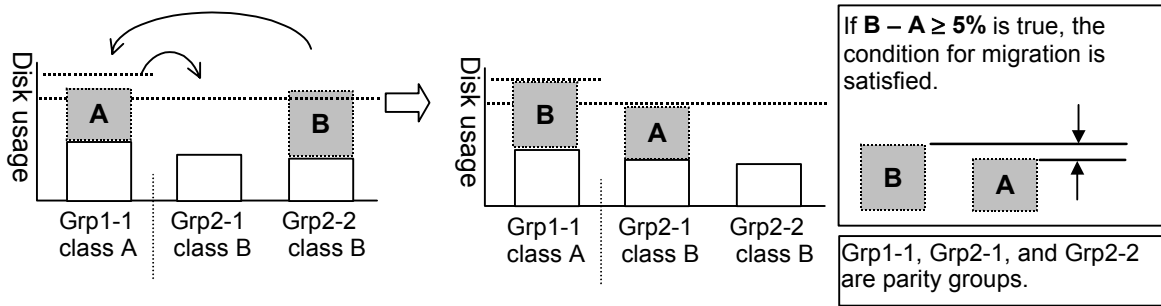
Figure 2.4 Migrating to Improve Disk Usage

When the parity groups in the highest HDD classes start to run out of reserved (empty) volumes, Hitachi CruiseControl automatically migrates low-usage volumes from higher HDD class groups to lower HDD class groups to maintain available reserve volumes (see Figure 2.5).



**Figure 2.5 Keeping Reserve Volumes in the High HDD Class Available**

As explained above, the auto migration function can move a high-usage volume to a higher HDD class group, forcing a low-usage volume out of that HDD class group. To be able to move one volume into a different HDD class group and then force another volume out of that class group, the auto migration function requires a minimum of five (5) percent difference in estimated disk usage between the two volumes (see Figure 2.6). If the difference in disk usage is less than 5%, this migration is considered ineffective, and the volume is not moved.



**Figure 2.6 Migrating a Volume Automatically to a Lower HDD Class**

The auto migration function can also move a volume from one parity group to another group of the same HDD class, forcing another volume out of the destination parity group. To be able to move one volume into a parity group of the same HDD class and force another volume out of that parity group, the auto migration function requires a minimum of twenty (20) percent difference in estimated disk usage between the two volumes (see Figure 2.7). If the difference in disk usage is less than 20%, this migration is considered ineffective, and the volume is not moved.

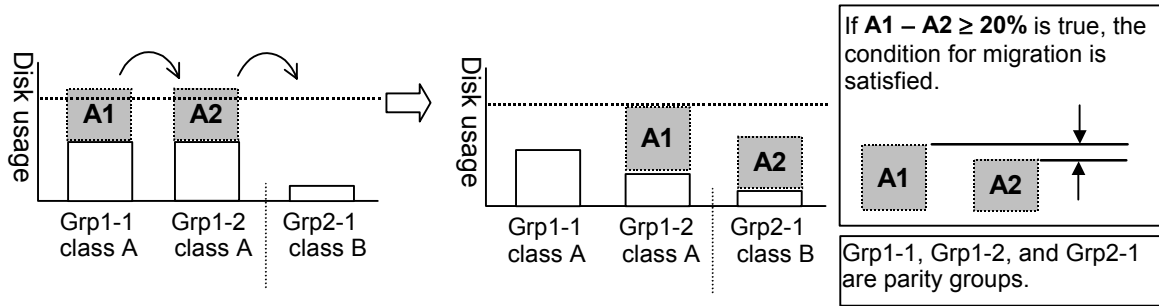


Figure 2.7 Migrating a Volume Automatically Within the Same HDD Class

## 2.3 Requirements and Restrictions

The requirements and restrictions for performing Hitachi CruiseControl operations are:

- **Logical volumes.** The source and target volumes must be specified by LDEV ID, not VOLSER or port/TID/LUN. The source and target volumes must be within the same 9900V subsystem and have the same emulation type and capacity.
- **Source volumes.** The following volumes cannot be used as source volumes:
  - Volumes set as command devices (reserved for use by the host).
  - Volumes which are in an abnormal or inaccessible condition (e.g., pinned track, fenced).
  - Volumes which have FlashAccess data or FlashAccess - S/390® data stored in cache.
  - Hitachi TrueCopy: If the status of a Hitachi TrueCopy volume is PSUS, PSUE, or SMPL, the volume can be used as a source volume. If not, the volume cannot be used as a source volume. When a Hitachi TrueCopy pair is deleted from the MCU, the status of both volumes changes to SMPL, and both volumes can be used as source volumes. When a Hitachi TrueCopy pair is deleted from the RCU, the status of the P-VOL changes to PSUS and the status of the S-VOL changes to SMPL, and both volumes can be used as source volumes.
  - ShadowImage: Usage of a ShadowImage volume as a source volume depends on the status and cascade configuration of the volume:

If the status of a ShadowImage volume is not split-pending **COPY(SP)** or **PSUS(SP)**, the volume can be used as a source volume. If the status is **COPY(SP)** or **PSUS(SP)**, the volume cannot be used as a source volume. This applies to cascade and non-cascade volumes.

Table 2.1 specifies which non-cascade volumes can be used as source volumes.

Table 2.2 specifies which cascade volumes can be used as source volumes.

**Table 2.1 Non-Cascade Volumes and Hitachi CruiseControl Source Volumes**

Pair Configuration [Status ≠ COPY(SP) or PSUS(SP)]	Can P-VOL be used as a source volume?	Can S-VOLs be used as source volumes?
Ratio of P-VOL to S-VOLs is 1:1	Yes	Yes
Ratio of P-VOL to S-VOLs is 1:2	Yes	Yes
Ratio of P-VOL to S-VOLs is 1:3	No	Yes

Table 2.2 Cascade Volumes and Hitachi CruiseControl Source Volumes

Pair Configuration [Status ≠ COPY(SP) or PSUS(SP)]	Can P-VOL be used as a source volume?	Can S-VOLs be used as source volumes?
L1 pair, ratio of P-VOL to S-VOLs is 1:1	Yes	Yes
L1 pair, ratio of P-VOL to S-VOLs is 1:2	Yes	Yes
L1 pair, ratio of P-VOL to S-VOLs is 1:3	No	Yes
L2 pair, ratio of P-VOL to S-VOLs is 1:1	Yes	No
L2 pair, ratio of P-VOL to S-VOLs is 1:2	No	No

**Caution:** If any of the following operations is performed on a Hitachi CruiseControl source volume during migration, the Hitachi CruiseControl volume migration process stops:

- Hitachi TrueCopy operation that changes the volume status to something other than PSUS, PSUE, or SMPL.
- ShadowImage operation that changes the volume status to COPY(SP) or PSUS(SP).
- **Expanded LUs as source volumes.** If you want to specify an expanded LU as a source volume for migration, you can specify individual LDEVs within the expanded LU (e.g., LDEVs with high usage), and Hitachi CruiseControl will migrate only the specified LDEVs. If desired, you can also specify all LDEVs of the expanded LU to relocate the entire expanded LU. In this case, you must make sure that the required reserved target LDEVs are available.
- **Target volumes.** Target volumes must be reserved prior to migration using the Hitachi CruiseControl software. Hosts cannot access reserved volumes.

The following volumes cannot be reserved as target volumes:

- Expanded LUs
- Volumes which are set as command devices (devices reserved for use by the host).
- Volumes which are assigned to ShadowImage or Hitachi TrueCopy pairs.
- Volumes which are reserved for ShadowImage operations.
- Volumes which have FlashAccess data or FlashAccess - S/390® data stored in cache.
- Volumes which are in an abnormal or inaccessible condition (e.g., pinned track, fenced).
- **Number of volumes:**
  - The maximum number of Hitachi CruiseControl copy operations that can be requested at the same time is 36. Hitachi CruiseControl performs migration operations sequentially (one volume at a time).
  - If the number of CU images is 4 or fewer, the maximum possible number of Hitachi CruiseControl migration volumes plus ShadowImage/ShadowImage - S/390® pairs is 2,048.
  - If the number of CU images is 5 or greater, the maximum possible number of Hitachi CruiseControl migration volumes plus ShadowImage/ShadowImage - S/390® pairs is 4,096.

- **Auto migration planning.** Hitachi CruiseControl will **not** plan an auto migration operation when:
  - There is no reserve volume with the same emulation and capacity as the source volume in the same or next higher/lower HDD class (auto migration is performed only between consecutive classes or within the same class).
  - The usage rate for the target parity group cannot be estimated, because some condition is preventing Hitachi CruiseControl from estimating expected usage (e.g., invalid monitor data).
  - The estimated usage of the target parity group or volume is over the user-specified maximum disk utilization value for that HDD class.
  - The estimated performance improvement is not large enough.
- **Auto migration execution.** Hitachi CruiseControl will **not** execute an auto migration operation when:
  - The current usage (last 15 min) of the source or target parity group or volume is over the maximum disk utilization rate for auto migration.
  - The current write pending rate for the subsystem is 60% or higher.
- **Manual migration execution.** Hitachi CruiseControl will **not** execute a manual migration operation when the current write pending rate for the subsystem is 60% or higher.
- **Maintenance.** Do not perform Hitachi CruiseControl migration operations during subsystem maintenance activities (e.g., cache or drive installation, replacement, or deinstallation).

**Note:** Auto migration parameters are initialized when a change is made to the disk subsystem configuration. For example, the parameters are initialized when new drives or LDEVs are installed. The parameters include the disk usage limit and the migration time. After a change is made to the subsystem configuration, you must specify auto migration parameters again.



## Chapter 3 Preparing for Hitachi CruiseControl Operations

### 3.1 System Requirements

To be able to use Hitachi CruiseControl, you need:

- the 9900V subsystem installed
- the Hitachi Performance Monitor software enabled (refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide* (MK-92RD101))
- a client PC(s) connected to the 9900V subsystem via LAN (intended for use as a Remote Console(s))
- the Hitachi CruiseControl software enabled (refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide* (MK-92RD101))

To use Hitachi Performance Monitor, you must use the client PC(s) to log on to the SVP. When you are logged on, the Remote Console-Storage Navigator program, which is a Java applet, will be downloaded to the client PC(s). You will then be able to perform Performance Monitor operations within the Remote Console - Storage Navigator panel.

For details on all of the above, please refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide* (MK-92RD101).

### 3.2 Starting Remote Console – Storage Navigator™ and Configuring Your Client PC


Hitachi Performance Monitor and CruiseControl operations require the Remote Console program, which is downloaded to your client PC. Your client PC must be connected to the 9900V subsystem via LAN. Browser settings are also required on your client PC. For details, refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator™ User's Guide* (MK-92RD101).

### 3.3 Starting Hitachi CruiseControl



Before you can start Hitachi CruiseControl, Remote Console and Performance Monitor must be running (refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator™ User's Guide* (MK-92RD101) and the *Hitachi Freedom Storage™ Lightning 9900™ V Series Performance Monitor User's Guide* (MK-92RD133)).


#### To start Hitachi CruiseControl:

1. Ensure that the Remote Console main panel is in **Modify** mode.

The Remote Console main panel is in Modify mode if the background color of the  icon is light yellow. If the background color is gray, the panel is in **View** mode and you must change it to Modify mode by taking the following steps:

- a) Check to see if the background color of the lock icon  is blue.

If the background color is red , you will not be able to switch from View mode to Modify mode. Wait for a while and click the  button. If the background color turns blue, you can go to the next step.

- a) Click the  icon.

A message appears, asking whether you want to change the mode.

- b) Click **OK** to close the message.

The background color of the icon changes to light yellow. The mode changes to **Modify** mode.

2. Ensure that the **Physical** tab in the Hitachi Performance Monitor panel (see Figure 3.1) is selected (for details, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Performance Monitor User's Guide* (MK-92RD133)).

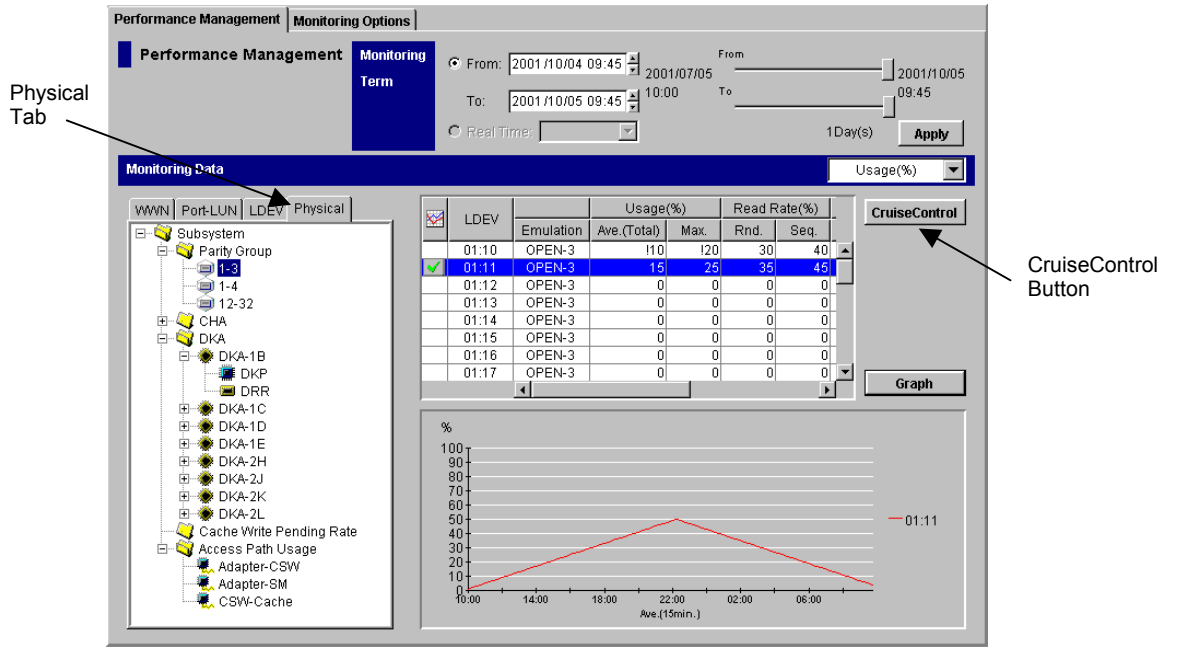


Figure 3.1 Physical Tab of the Performance Monitor Panel

3. Click the **CruiseControl** button.

The Hitachi CruiseControl panel appears (see Figure 3.2).

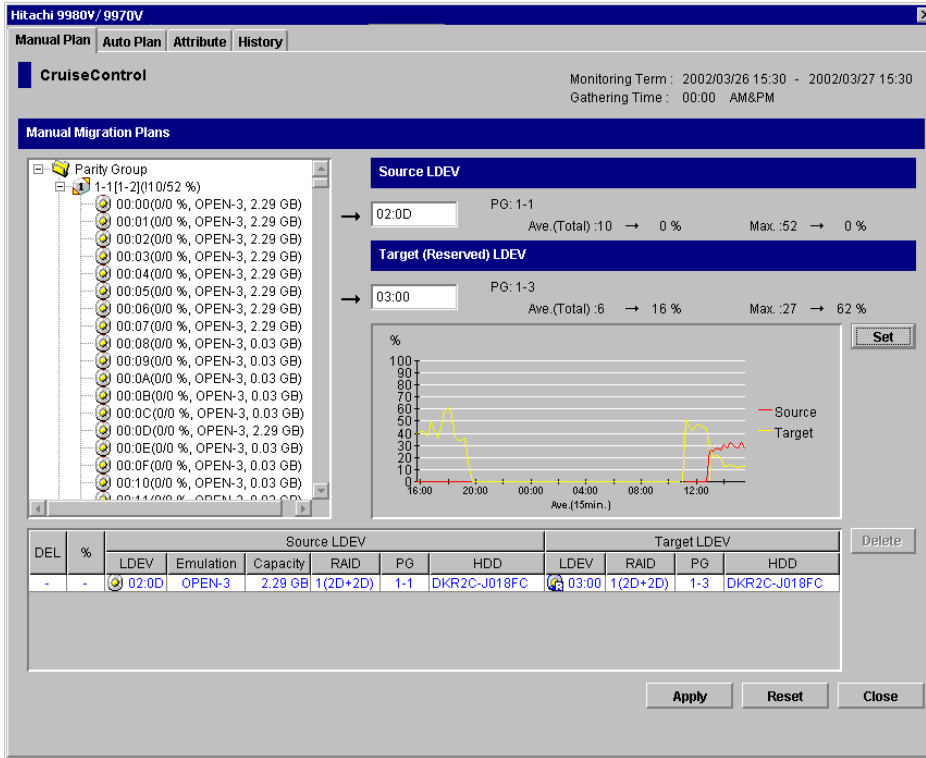


Figure 3.2 The Hitachi CruiseControl Panel

## Chapter 4 Reviewing the Hitachi CruiseControl Panel

The Hitachi CruiseControl Panel consists of the following four tabs.

- Manual Plan Tab
- Auto Plan Tab
- Attribute Tab
- History Tab

This chapter describes options, buttons and other components in the Hitachi CruiseControl panel and tabs.

**Note:** Performance Monitor must be running to allow CruiseControl operations. The CruiseControl panel appears when the CruiseControl button in the Performance Monitor Physical tab is clicked, as shown in Figure 4.1.

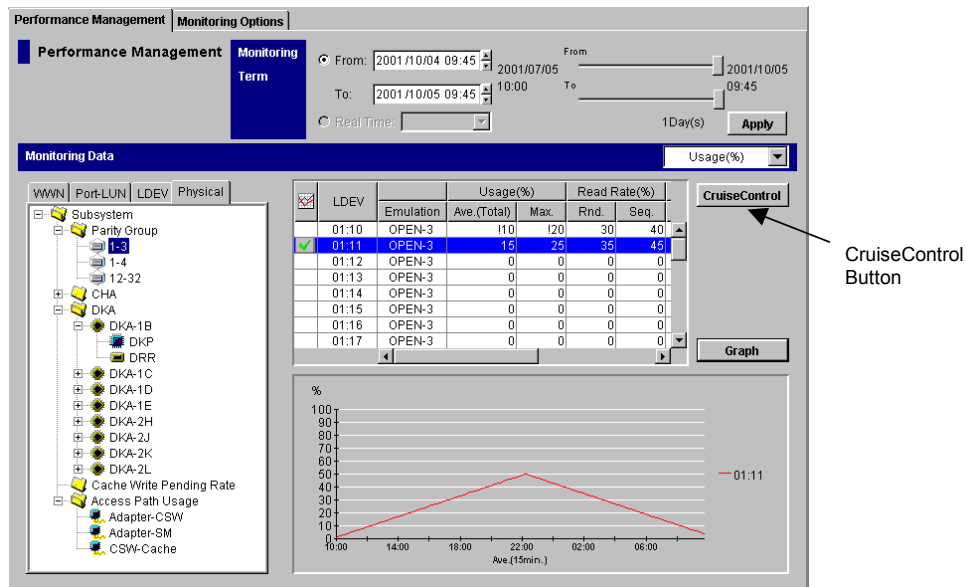


Figure 4.1 Physical Tab in the Performance Monitor Panel

## 4.1 The Manual Plan Tab in the Hitachi CruiseControl Panel

The **Manual Plan** tab lets you create and execute manual migration plans.

For details on operations in this tab, refer to section 5.2.

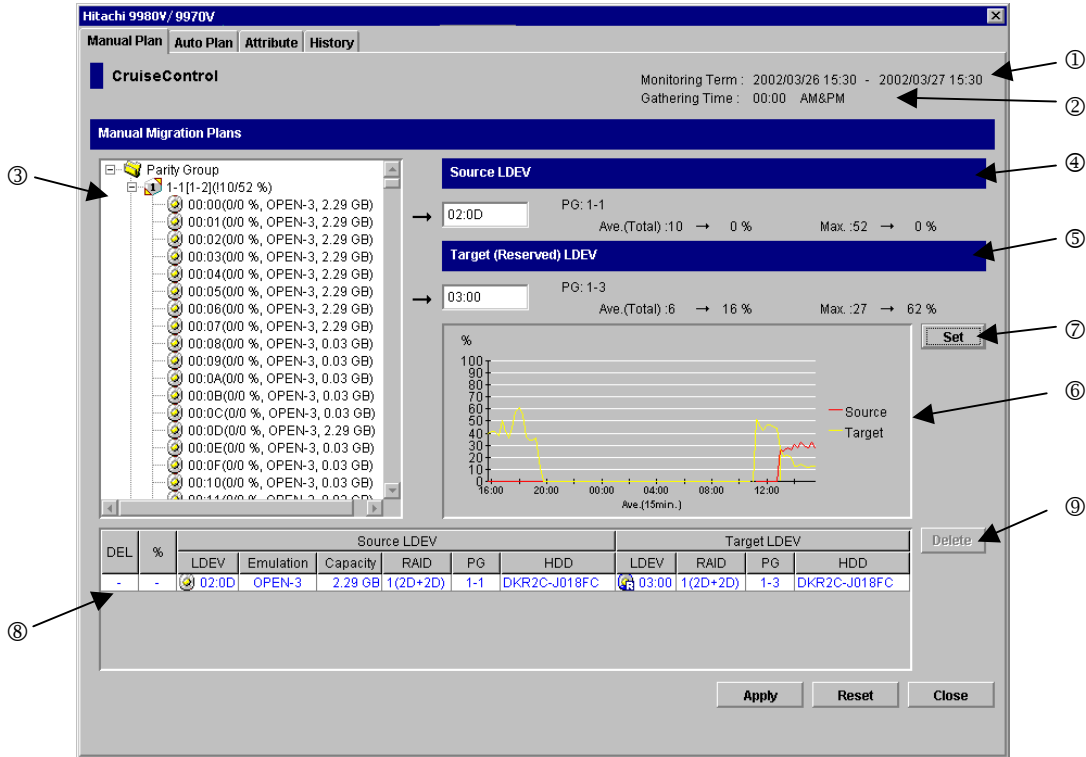



Figure 4.2 The Manual Plan Tab in the Hitachi CruiseControl Panel

The **Manual Plan** tab displays the following:

- Monitoring Term ①:** Displays the monitoring period specified in the Hitachi Performance Monitor panel of Performance Monitor.  
 Hitachi CruiseControl analyzes disk usage information collected by Performance Monitor during the monitoring period, and then calculates estimated usage rates of the source and target parity groups after a proposed volume migration.
- Gathering Time ②:** Displays the time specified in the Monitoring Options panel of Performance Monitor.  
 SVP collects usage statistics about resources (such as hard disk drives) at the specified **Gathering Time**. Then Hitachi CruiseControl uses the collected usage statistics to estimate usage rates of parity groups after a proposed volume migration.

- **Tree view** : The tree view lists parity groups in the disk subsystem. When you double-click a parity group icon, a list of logical volumes in that parity group appears.

The following icons can appear in the tree view:










-  (no pin) indicates a normal parity group.
-  (red pin) indicates a fixed parity group.
-  (green pin) indicates a fixed parity group containing volumes that can be used as target volumes for manual migration. When you specify a source volume, Hitachi CruiseControl checks each parity group for volumes that can be used as target volumes. If a parity group containing volumes that can be used as target volumes is found, the icon for the parity group is changed automatically. The color of the pin in the icon changes from **red** to **green**.
-  indicates a normal logical volume that can be migrated to a different parity group but cannot be used as a migration destination.
-  indicates a volume reserved as a migration destination. When you specify a source volume in the **Manual Plan** tab, Hitachi CruiseControl checks reserved volumes to find volumes that can be used as target volumes. If a reserved volume that can be used as target volumes is found, the volume icon is changed automatically to .
-  indicates a logical volume that can be used as a migration destination.

Figure 4.3 defines the information displayed to the right of a **parity group** icon:

 1-3(10/81%)  
 $\frac{\textcircled{1}}{\textcircled{2}}$

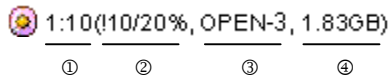
- ①The parity group ID. The number before the hyphen is the frame number.  
The number after the hyphen is the parity group number.
- ②The number before the slash is the average usage rate.  
The number after the slash is the maximum usage rate.

 1-3[1-4](10/81%)  
 $\frac{\textcircled{3}}$

- ③The parity group 1-3 is connected with the parity group 1-4.

**Figure 4.3 Parity Group Information**

Figure 4.4 defines the information displayed to the right of Volume icon:



- ① The logical volume ID. The number before the colon is the CU image number. The number after the colon is the LDEV number.
- ② The number before the slash is the average usage rate. The number after the slash is the maximum usage rate. If an exclamation symbol (!) appears before a usage rate, the usage rate might be incorrect.
- ③ The emulation type
- ④ The size of the logical volume

**Figure 4.4 Volume Information**

- **Source LDEV Area ④:** The text box lets you specify the source volume (that is, the logical volume that you want to migrate). To the right of the text box appear the following:
  - the current usage rate for the parity group to which the source volume belongs.
  - an estimated usage rate for the parity group after a proposed volume migration.
- **Target (Reserved) LDEV Area ⑤:** The text box lets you specify the target volume (that is, the location to which you want to migrate the source volume). To the right of the text box appear the following:
  - the current usage rate for the parity group that the target volume belongs to.
  - an estimated usage rate for the parity group after a proposed volume migration.
- **Line Graph Area ⑥:** The line graph illustrates how the usage rates have changed for the source volume and the target volume.
- **Set Button ⑦:** The **Set** button adds a new manual migration plan to the table. The new manual migration plan consists of the logical volume in **Source LDEV** and the logical volume in **Target (Reserved) LDEV**.
- **Table Area ⑧:** Each row in the table indicates a migration plan, which is a pair of a source volume and the corresponding target volume. **Note:** Newly created migration plans are displayed highlighted in **blue**. Migration plans awaiting execution or being executed are displayed highlighted in **black**.
- The **DEL** column displays the character “D” if you attempt to delete a migration plan that is waiting for execution. Migration plans indicated by “D” are actually deleted when you click the **Apply** button.
- The **%** column indicates the progress of the manual migration.
- The **Source LDEV** columns display information about source volumes:
  - **LDEV** indicates the logical volume ID. The number before the colon (:) is the CU image number. The number after the colon is the device ID.



- **Emulation** indicates the emulation type of the logical volume.
- **Capacity** indicates the capacity of the logical volume.
- **RAID** indicates the RAID type.
- **PG** indicates the parity group ID. The number before the hyphen (-) is the frame number. The number after the hyphen is the group number.
- **HDD** indicates the type of the hard disk drive.
- The **Target LDEV** columns display information about target volumes:
  - **LDEV** indicates the logical volume ID. The number before the colon (:) is the CU image number. The number after the colon is the device ID.
  - **RAID** indicates the RAID type.
  - **PG** indicates the parity group ID. The number before the hyphen (-) is the frame number. The number after the hyphen is the group number.
  - **HDD** indicates the type of the hard disk drive.
- **Delete Button** Ⓣ: The **Delete** button deletes the migration plan (that is, a row in the table) selected in the table.

If you select a black highlighted migration plan (i.e., a migration plan that is waiting for execution or is being executed) and click the **Delete** button, the **DEL** column displays the character “D” and the selected migration plan will not be deleted until you click the **Apply** button.

The **Delete** button does not take effect when both blue and black migration plans are selected. Confirm that only blue or black migration plans are selected before you click **Delete**.
- The **Apply** button applies manual migration plans in the table to the disk subsystem to start volume migrations.
- The **Reset** button: If you click this button after you click the **Apply** button, execution of manual migration plans will be canceled.
- The **Close** button closes the Hitachi CruiseControl panel.

## 4.2 The Auto Plan Tab in the Hitachi CruiseControl Panel

The Auto Plan tab lets you make settings for automating volume migrations.

For details on operations in this tab, see section 5.3.

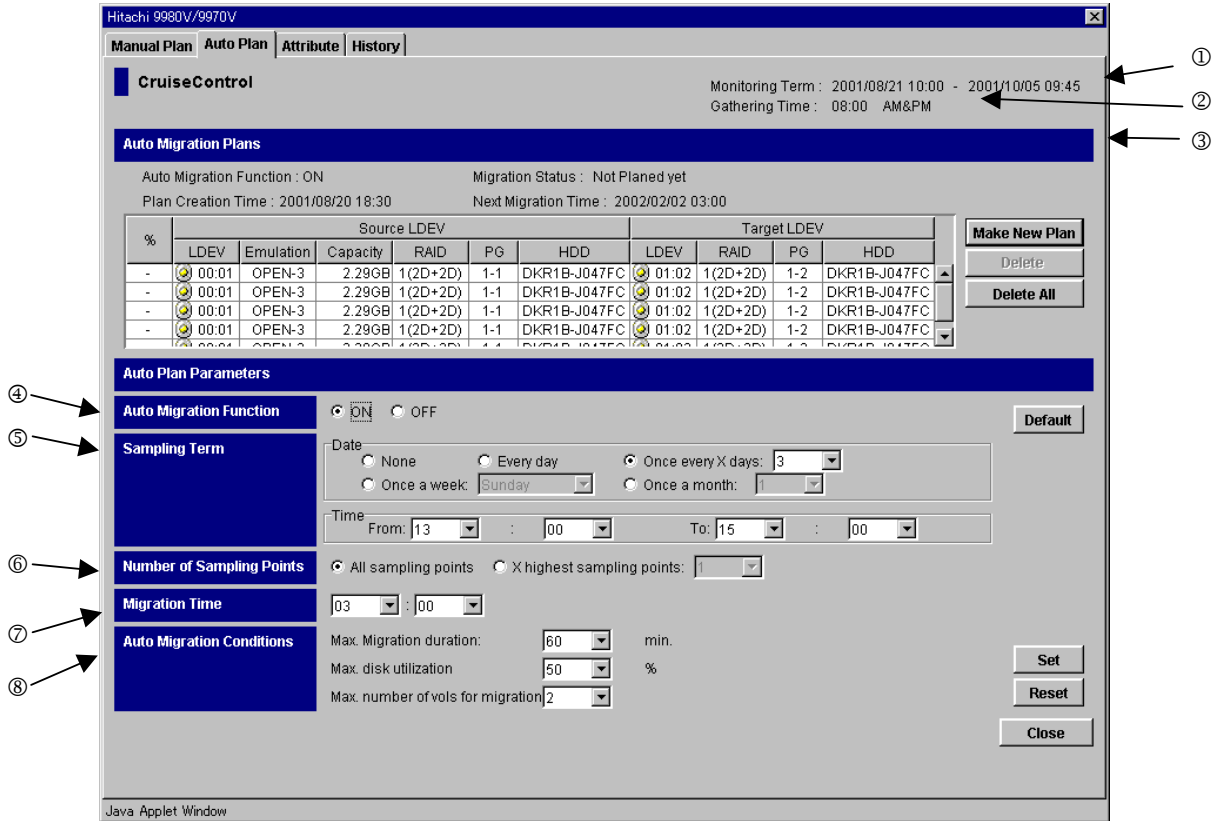


Figure 4.5 The Auto Plan Tab in the Hitachi CruiseControl Panel

The Auto Plan tab displays the following:

- **Monitoring Term ①:** Displays the monitoring period specified in the Hitachi Performance Monitor panel of Performance Monitor.  
Hitachi CruiseControl analyzes disk usage information collected by Performance Monitor during the monitoring period, and then creates auto migration plans based on that analysis.
- **Gathering Time ②:** Displays the time specified in the Monitoring Options panel of Performance Monitor.  
Hitachi CruiseControl analyzes disk usage information collected during the monitoring period, and then creates auto migration plans based on that analysis. The disk usage information is updated by the SVP at the specified **Gathering Time**.

- **Auto Migration Plans Area ③:** The following information is displayed above the table:
  - **Auto Migration Function** indicates whether auto migrations will take place. If this option is **ON**, auto migrations will take place at the specified **Next Migration Time**. If this option is **OFF**, auto migrations will not take place.
  - **Migration Status** indicates the progress of auto migration plans.
    - If **Not planned yet** is displayed, Hitachi CruiseControl has not yet created auto migration plans.
    - If **Not performed yet** is displayed, Hitachi CruiseControl has created auto migration plans but has not executed them yet.
    - If **Failed to make plan** is displayed, Hitachi CruiseControl failed to create auto migration plans.
    - If **Under migration** is displayed, Hitachi CruiseControl is executing an auto migration plan.
    - If **Last migration has been canceled (Please see log file)** is displayed, Hitachi CruiseControl has canceled the last migration plan.
    - **Migration successfully ended. X plans have been executed** is displayed, Hitachi CruiseControl successfully executed the auto migration plans.
  - **Plan Creation Time:** Indicates when the auto migration plans were created.
  - **Next Migration Time:** Indicates the next time that Hitachi CruiseControl will perform auto migration operations.
- Note:** The time values displayed on this panel are retrieved from the SVP, and may not correspond to the time displayed on the Remote Console PC.
- **Table Area:** The table displays auto migration plans (that is, pairs of the source volume and the target volume).
- The **% column** indicates the progress of the auto migration. A hyphen appears if Hitachi CruiseControl has not executed the auto migration plan yet.
- The **Source LDEV** columns display information about source volumes.
  - **LDEV** indicates the logical volume ID. The number before the colon (:) is the CU image number. The number after the colon is the device ID.
  - **Emulation** indicates the emulation type of the logical volume.
  - **Capacity** indicates the capacity of the logical volume.
  - **RAID** indicates the RAID type.
  - **PG** indicates the parity group ID. The number before the hyphen (-) is the frame number. The number after the hyphen is the group number.
  - **HDD** indicates the type of the hard disk drive.
- The **Target LDEV** columns display information about target volumes.
  - **LDEV** indicates the logical volume ID. The number before the colon (:) is the CU image number. The number after the colon is the device ID.
  - **RAID** indicates the RAID type.

- **PG** indicates the parity group ID. The number before the hyphen (-) is the frame number. The number after the hyphen is the group number.
- **HDD** indicates the type of the hard disk drive.

To the right of the table appear the following buttons:

- The **Make New Plan** button discards the existing auto migration plans and then creates new auto migration plans.
- The **Delete** button deletes the auto migration plan selected in the table.
- The **Delete All** button deletes all the auto migration plans in the table.
- **Auto Plan Parameters** lets you specify parameters that affect automatic creation and execution of migration plans.
  - **Auto Migration Function** Ⓞ: Specifies whether to automate volume migrations. If you select **ON**, logical volumes are automatically migrated. If you select **OFF**, logical volumes are not automatically migrated.
  - **Sampling Term** Ⓞ: The Hitachi CruiseControl auto migration function analyzes resource usage within the specified Sampling Term and then creates auto migration plans based on that analysis. Sampling Term is used to narrow resource usage statistics to be analyzed. **Note:** Hitachi CruiseControl does not analyze resource usage statistics outside of the specified sampling term.
  - **Date:**
    - If the **None** radio button is selected, Hitachi CruiseControl does not analyze resource usage statistics and does not create auto migration plans.
    - If the **Every day** radio button is selected, Hitachi CruiseControl creates auto migration plans every day.
    - If the **Once every X days** radio button is selected, Hitachi CruiseControl creates auto migration plans every X days. The drop-down list is used to specify the number of days (that is, the value of X).
    - If the **Once a week** radio button is selected, Hitachi CruiseControl creates auto migration plans on the selected day of the week. The drop-down list is used to select a day.
    - If the **Once a month** radio button is selected, Hitachi CruiseControl creates auto migration plans on the Xth day of the month. The drop-down list is used to specify a day.
  - **Time** lets you specify a period. Hitachi CruiseControl analyzes resource usage statistics within the specified period.
- **Number of Sampling Points** Ⓞ:
  - **All sampling points:** If this radio button is selected, Hitachi CruiseControl uses all the average usage rates during the **Sampling Term** to determine disk usage.
  - **X highest sampling points:** If this radio button is selected, Hitachi CruiseControl uses the Xth highest average usage rate during the **Sampling Term** to determine disk usage. The drop-down list is used to specify the value of X.

- **Migration Time** ⌚: Lets you specify the time when auto migration starts. If the **Auto Migration Function** option is **ON**, the auto migration operation starts at the specified time.
- **Auto Migration Conditions** Ⓢ: Lets you specify the following auto migration parameters:
  - **Max. migration duration** lets you specify the time limit (10-120 minutes) for an auto migration plan. If the auto migration plan is not complete within this limit, the remaining migration operation(s) are performed at the next scheduled execution time (if a new plan is not made).
  - **Max. disk utilization** lets you specify the disk usage limit (10-100%) during auto migration. If the most recent usage for any source or target parity group is over this limit when auto migration starts, Hitachi CruiseControl cancels the auto migration plan and will retry the plan at the next execution time (if a new plan is not made before then).
  - **Max. number of vols for migration** lets you specify the maximum number of volumes (1-40) that can be migrated during one auto migration plan.
- The **Default** button sets each parameter in **Auto Plan Parameters** to the default value and then issues the parameter to the disk subsystem.
- The **Set** button applies each parameter in **Auto Plan Parameters** to the disk subsystem.
- The **Reset** button restores each parameter in **Auto Plan Parameters** to the value before change.
- The **Close** button closes the Hitachi CruiseControl panel.

### 4.3 The Attribute Tab in the Hitachi CruiseControl Panel

The **Attribute** tab lets you find out which parity group belongs to which HDD class. The **Attribute** tab also lets you view information about parity groups, such as parity group usage, logical volume capacity, and RAID type.

You must use the **Attribute** tab to reserve target volumes.

For details on operations in this tab, see sections 5.1, 5.3.1, and 5.3.2.

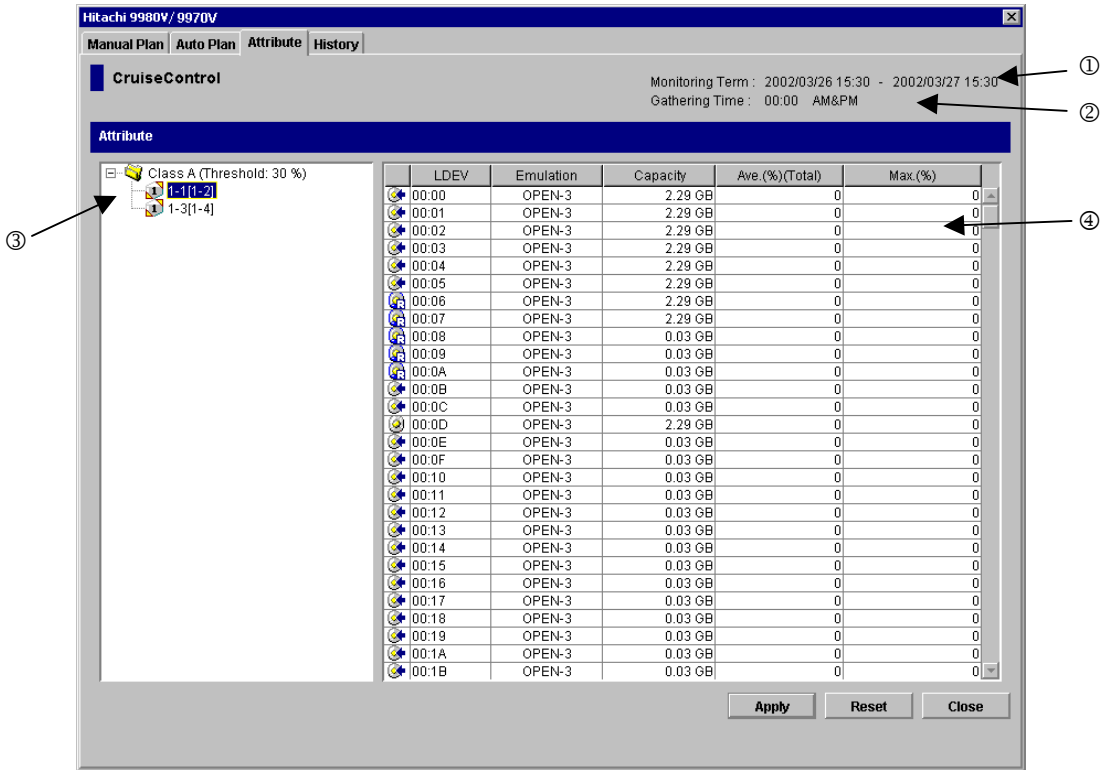




Figure 4.6 The Attribute Tab in the Hitachi CruiseControl Panel

The **Attribute** tab displays the following information:

- **Monitoring Term** ①: Displays the monitoring period specified in the Performance Monitor Hitachi Performance Monitor panel.
- **Gathering Time** ②: Displays the time specified in the Performance Monitor Monitoring Options panel.
- **Tree view** ③: The tree view lists HDD classes. When you double-click an HDD class icon, a list of parity groups in that HDD class appears.



The icon  (no pin) indicates a **normal** parity group.

The icon  (red pin) indicates a **fixed** parity group disallowing auto migration. Volumes cannot automatically be migrated from and to fixed parity groups.

The icon  (green pin) indicates a **fixed** parity group allowing manual migration. Volumes cannot automatically be migrated from and to fixed parity groups. However, use of this icon indicates the fixed parity group contains volumes that can be used as target volumes for **manual** migration.




- **Table Area ④:** When you select a **class** in the tree view, the table displays information about parity groups in that class as shown in Figure 4.7.

Parity group icons can represent a single parity group. Parity group icons can also represent two or more parity groups that are connected together. For example, if the text 1-3 appears on the right of an icon, the icon represents the parity group 1-3. If the text 1-3[1-4] appears on the right of an icon, the icon represents two parity groups (that is, 1-3 and 1-4) that are connected together.

PG	HDD	Ave.%(Total)	Max.(%)	Total	Reserved
 1-1	DKR1B-J047FC	10	81	24	0
 1-2	DKR1B-J047FC	10	81	8	6

**Figure 4.7 Parity Group Information Relating to a Selected Class**

The following describes each of the table columns:

- **PG** indicates the parity group ID. The number before the hyphen (-) is the frame number. The number after the hyphen is the group number.  
The icon  (no pin) indicates a normal parity group.  
The icon  (red pin) indicates a fixed parity group disallowing auto migration. Volumes cannot automatically be migrated from and to fixed parity groups.  
The icon  (green pin) indicates a fixed parity group allowing manual migration. Volumes cannot automatically be migrated from and to fixed parity groups. However, use of this icon indicates the fixed parity group contains volumes that can be used as target volumes for **manual** migration.
- **HDD** indicates the type of the hard disk drive.
- **Ave.** indicates the average usage rate for the parity group.  
If an exclamation mark (!) is displayed, the reported usage rate is likely to be inaccurate, because the configuration has changed (e.g., volumes have been moved by Hitachi CruiseControl or changed by Virtual LVI).
- **Max.** indicates the maximum usage rate for the parity group.  
If an exclamation mark (!) is displayed, the reported usage rate is likely to be inaccurate, because the configuration has changed (e.g., volumes have been moved by Hitachi CruiseControl or changed by Virtual LVI).
- **Total** indicates the total number of logical volumes in the parity group.
- **Reserved** indicates the number of reserved logical volumes.

When you select a **parity** group in the tree view, the table displays information about logical volumes in that parity group as shown in Figure 4.8.












	LDEV	Emulation	Capacity	Ave.%(Total)	Max.(%)
	00:00	OPEN-3	2.29GB	!10	!20
	00:01	OPEN-3	2.29GB	15	25
	00:02	OPEN-3	2.29GB	0	0
	00:03	OPEN-3	2.29GB	0	0
	00:04	OPEN-3	2.29GB	0	0
	00:05	OPEN-3	2.29GB	0	0
	00:06	OPEN-3	2.29GB	0	0
	00:07	OPEN-3	2.29GB	0	0


Figure 4.8 Logical Volume Information Relating to a Selected Parity Group

The following describes each of the table columns:

- **LDEV** indicates the logical volume ID. The number before the colon (:) is the CU image number. The number after the colon is the device ID.

The icon  indicates a normal logical volume that cannot be used as a migration destination.

The icon  indicates a *reserved volume*, which are reserved as a migration destination. When you specify a source volume in the **Manual Plan** tab, Hitachi CruiseControl checks reserved volumes to find volumes that can be used as target volumes. If Hitachi CruiseControl finds a reserved volume that can be used as target volumes, Hitachi CruiseControl changes the volume icon to .

The icon  indicates a volume that can be used as a migration destination.

**Note:** The table does not display logical volumes that are used as an LUSE.

- **Emulation** indicates the emulation type of the logical volume.
- **Capacity** indicates the capacity of the logical volume.
- **Ave.** indicates the average usage rate for the logical volume.

If an exclamation mark (!) is displayed, the reported usage rate is likely to be inaccurate, because the configuration has changed (e.g., volumes have been moved by Hitachi CruiseControl or changed by Virtual LVI).

- **Max.** indicates the maximum usage rate for the logical volume.

If an exclamation mark (!) is displayed, the reported usage rate is likely to be inaccurate, because the configuration has changed (e.g., volumes have been moved by Hitachi CruiseControl or changed by Virtual LVI).

- The **Apply** button applies the settings in the **Attribute** tab to the disk subsystem.
- The **Reset** button discards changes in the **Attribute** tab and restores the original settings.
- The **Close** button closes the Hitachi CruiseControl panel.



#### 4.4 The History Tab in the Hitachi CruiseControl Panel

The **History** tab displays information about auto migration operations and manual migration operations in the past. For example, you can find out when migration operations took place and also find out whether migration operation finished successfully.

For details on operations in this tab, see section 5.4.

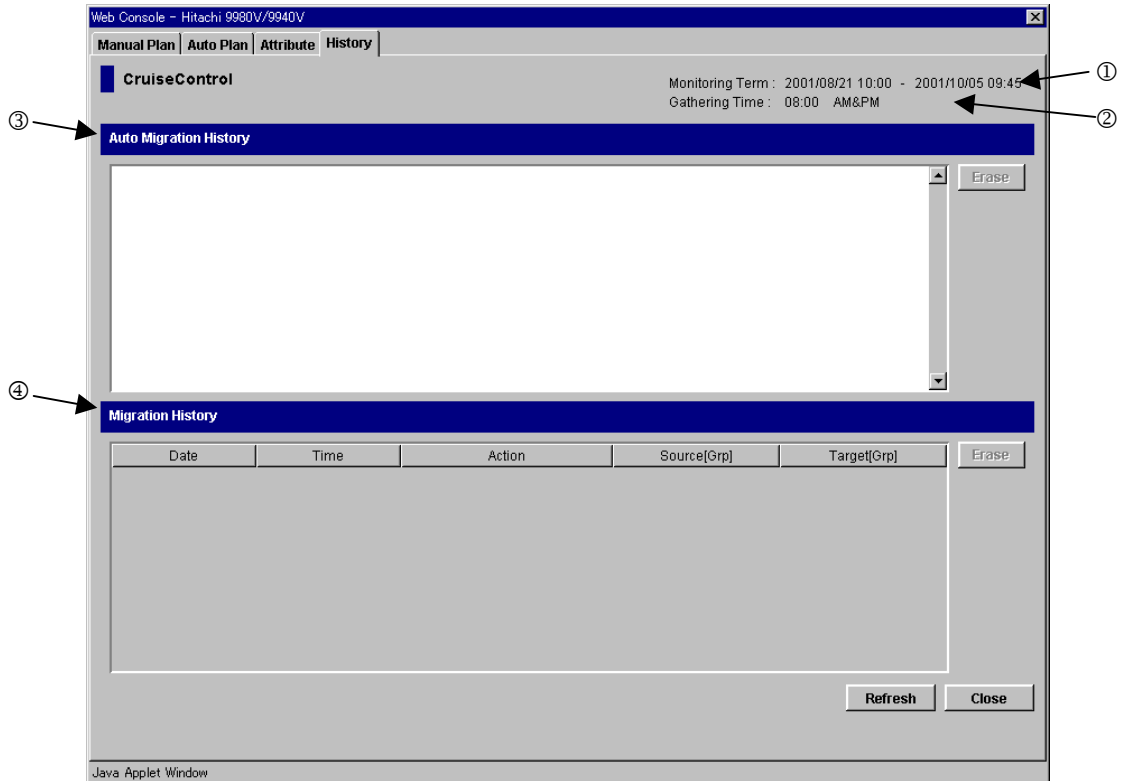


Figure 4.9 The History Tab in the Hitachi CruiseControl Panel

The **History** tab displays the following information:

- **Monitoring Term ①**: Displays the monitoring period specified in the Hitachi Performance Monitor panel of Performance Monitor.
- **Gathering Time ②**: Displays the time specified in the Monitoring Options panel of Performance Monitor.
- **Auto Migration History ③**: Displays logs of creation and execution of auto migration plans.
  - The **Erase** button lets you erase the entire information.
- **Migration History ④**: Displays logs of volume migration events.

***PRELIMINARY RELEASE***

- The **Table Area**: Displays the following information:
  - The date and time when the event occurs.
  - The event.
  - The source volume and the parity group.
  - The target (destination) volume and the parity group.
- The **Refresh** button updates information in the **History** tab.
- The **Close** button closes the Hitachi CruiseControl panel.

## Chapter 5 Performing Hitachi CruiseControl Operations

Hitachi CruiseControl can be used to balance workloads among disk drives and thus remove bottlenecks from the system. Hitachi CruiseControl can migrate logical volumes from the current parity group to another parity group. Volume migrations can be performed manually by the system administrator or automatically by Hitachi CruiseControl as described earlier (for details, refer to sections 2.1 and 2.2.)

**Note:** Various requirements and restrictions apply to Hitachi CruiseControl. For details, please refer to section 2.3.

### 5.1 Reserving Migration Destinations for Logical Volumes

To be able to migrate volumes, you must reserve disk spaces (actually, logical volumes) that can be used for migration destinations. You must reserve volumes regardless of migration methods (manual migration or automatic migration). Migration will not take place without a reserved logical volume.

To reserve a logical volume as a migration destination:

1. Start Hitachi CruiseControl (see section 3.3).
2. From the Hitachi CruiseControl panel, click the **Attribute** tab (see Figure 5.1).

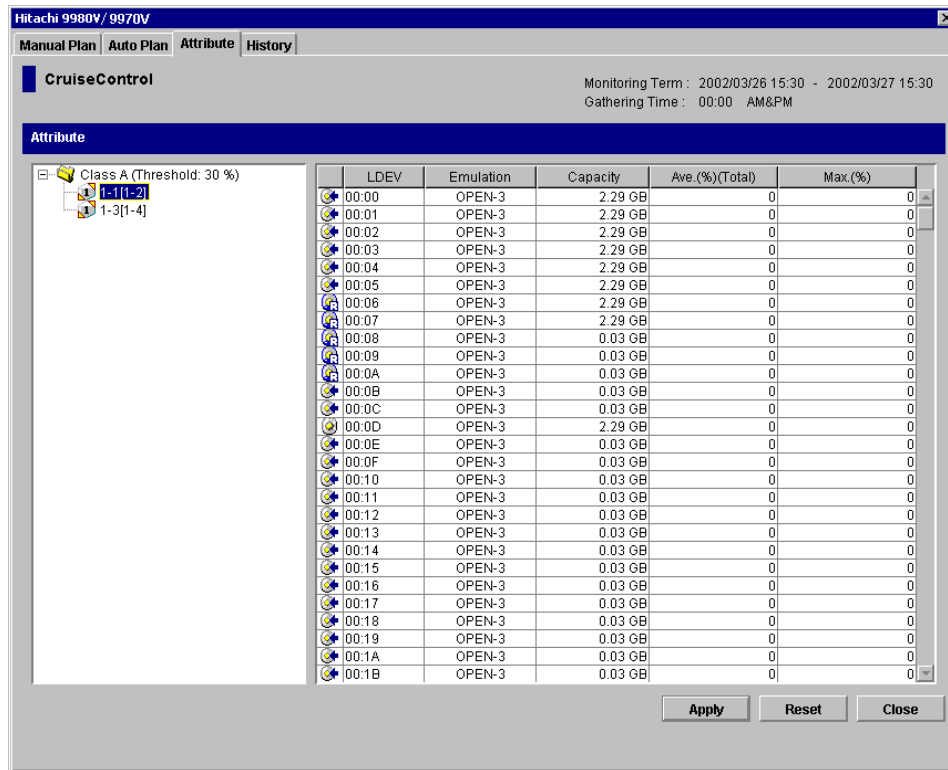



Figure 5.1 The Attribute Tab

3. In the tree view, locate a logical volume that you want to use as a migration destination.

To locate a volume, first double-click an **HDD class** in the tree view to display a list of parity groups in that class. Next, click a **parity group**. The table on the right displays a list of logical volumes in that group.


4. In the table to the right of the tree view, locate logical volumes preceded by the  icon. From those logical volumes select the desired logical volume and **right-click** it.

**Note:** If you want to reserve two or more logical volumes, you can select the desired logical volumes and right-click the selection.

5. From the resulting pop-up menu, select **Reserved LDEV** as shown in Figure 5.2.





Figure 5.2 The Reserved LDEV Pop-Up Menu

The icon changes to .

6. Click the **Apply** button.

The settings in the panel are applied to the disk subsystem. The specified logical volume is reserved as a migration destination.

**Notes:**



- When you click the Apply button one time, up to 64 logical volumes can be reserved as migration destinations. If you click the Apply button to reserve more than 64 logical volumes, an error occurs. If you want to reserve more than 64 logical volumes, you must follow the above procedure at least twice. For example, if you want to reserve 100 logical volumes, you need to reserve 64 or fewer logical volumes and then reserve the remaining logical volumes.
- If you right-click the logical volumes preceded by the  icon (reserved volume) and then choose **Normal LDEV** from the pop-up menu, you will not be able to use the volume as a migration destination.
- Throughout the 9900V documentation set, the term “**reserved volume**” is used to refer to a volume that is reserved for use as a migration destination (). The term “**normal volume**” is used to refer to a volume that is not reserved as a migration destination.

## 5.2 Creating Migration Plans and Manually Migrating

To be able to migrate logical volumes manually, you must create migration plans. A migration plan is a pairing of a source volume and a corresponding target (destination) volume. If you want to migrate more than one logical volume, you must create a migration plan for each migration.

However, before you can create a migration plan, you must determine which volume should be migrated to which parity group (disk drive). You should choose a volume with a high usage rate as your migration source (the volume to migrate). To determine a migration target or destination, you first need to find fast parity groups (i.e., fast disk drives). From these fast parity groups you will choose a low-usage parity group to serve as the migration destination. As you make these choices, you are in fact building a migration plan. When you are finished, CruiseControl will estimate the results of the proposed migration and display that information to you.

### Notes:

- When you use Hitachi CruiseControl for the first time, you must reserve logical volumes for migration destinations. Reserved volumes are indicated by the  icon. For details, see section 5.1.
- 9900V documents sometimes use the term *reserve volumes* to refer to disk areas reserved as migration destinations (that is, volumes preceded by the  icon).

**Caution:** Do not perform manual migration operations while the auto migration function is active. Always turn off auto migration and cancel any existing auto migration plan before performing a manual migration (for details, see section 5.3.5).

### To create a migration plan and perform a manual migration:

1. Start Hitachi **CruiseControl** (refer to section 3.3).
2. From the Hitachi **CruiseControl** panel, click the **Manual Plan** tab (see Figure 5.3).

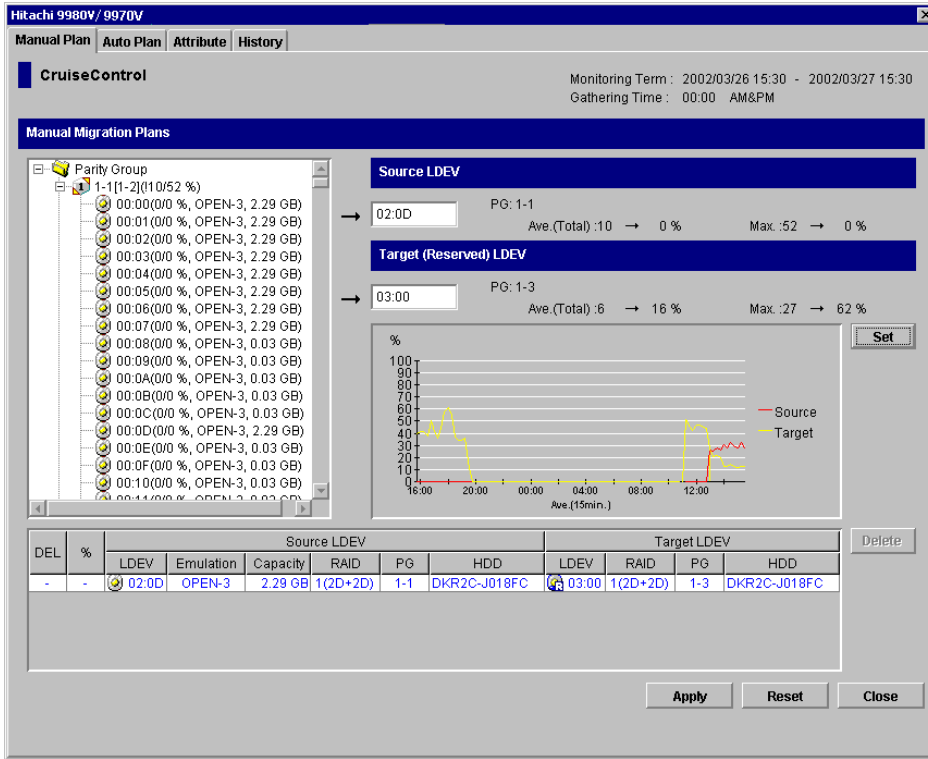



Figure 5.3 The Manual Tab

3. In the **tree view**, locate the source volume (i.e., the logical volume that you want to migrate).

To locate the logical volume, double-click a parity group in the tree view. A list of logical volumes in that parity group appears.

Double-click a fixed parity group (  ) containing high-usage volumes (for details, refer to section 4.1).

From the expanded parity group list, choose a volume with a high usage rate (see Figure 5.4)

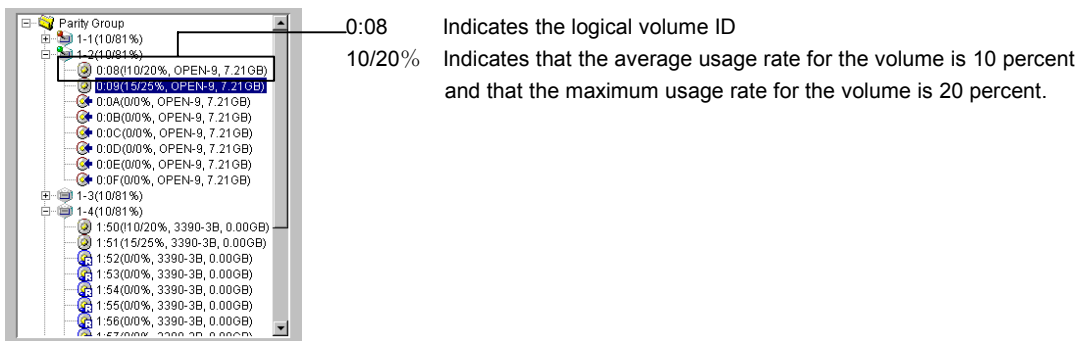


Figure 5.4 Usage Rate for a Logical Volume Displayed in the Panel (example only)

4. Drag the source volume from the tree view and drop it to the **Source LDEV** text box (see Figure 5.5).

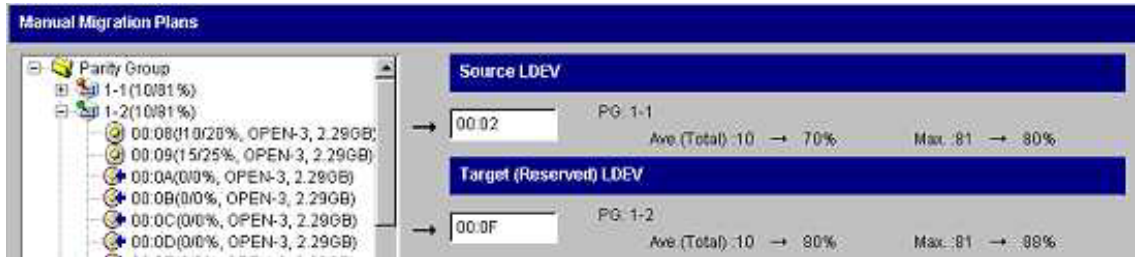


Figure 5.5 Source and Target Text Boxes (example only)

5. In the **tree view**, double-click the parity group to which you want to migrate the source volume. A list of logical volumes in that parity group appears.

Select a parity group with a fast class designation. **Classes** indicate disk access speed for parity groups. Classes are ranked A, B, C, and so on. The fastest parity groups (or groups of fastest disks) belong to class A.

**Note:** In the 9900V documentation set, the terms *class* and *HDD class* mean the same thing.

To view parity group class designations, from the Hitachi CruiseControl panel, click the Attribute tab (see Figure 5.6).

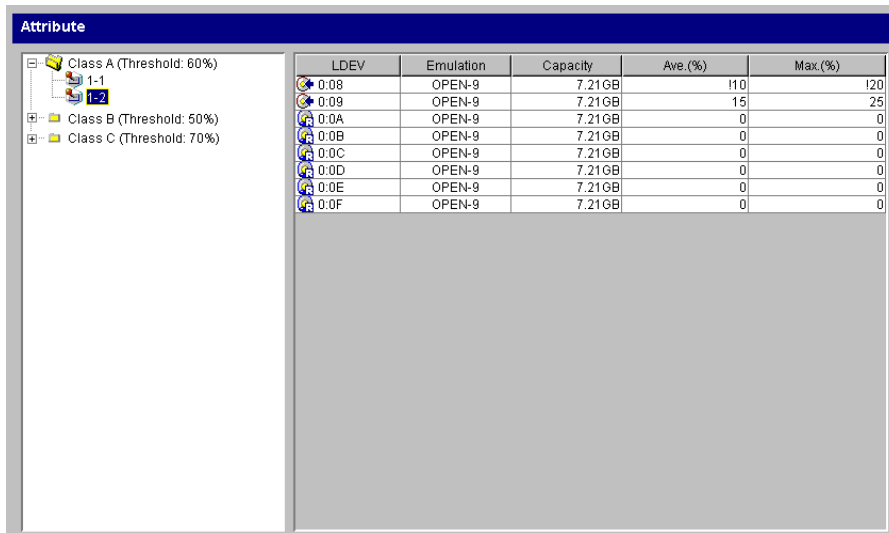



Figure 5.6 Classes and Parity Groups Shown in the Attribute Tab (example only)

From the Attribute tab tree view, find a parity group with a fast class designation. You will select this parity group as target volume in the next step.

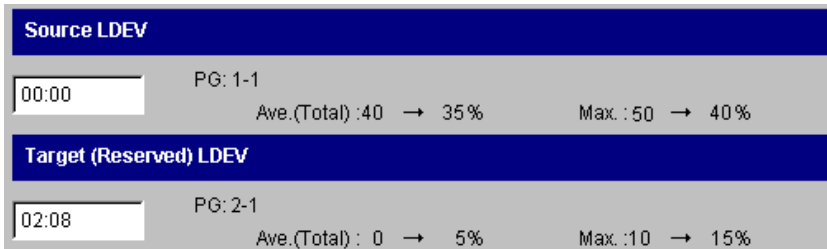
6. Returning to the **Manual tab**, in the tree view, locate and drag the **target** (destination) volume and drop it to the **Target LDEV** text box (refer to Figure 5.5).

**Note:** Only the volumes preceded by the  icon (reserved volume) can be used as migration destinations (for details, refer to section 5.1).

7. Check the estimated results in **Source LDEV**, **Target LDEV** and the graph.

Hitachi CruiseControl calculates an estimated usage rate of the source and target parity group. The estimated results are displayed to the right of the **Source LDEV** and the **Target LDEV** text box.

Hitachi CruiseControl uses past resource usage rates, the type of the hard disk drive, and the RAID level when calculating the estimated usage rate. In the example shown in Figure 5.7, if the logical volume 00:00 in the parity group 1-1 is migrated the reserved volume 02:08 in the parity group 2-1, the parity group 1-1 can expect 5 percent decrease in the average usage rate (from 40 percent to 35 percent). The destination parity group 2-1 can expect 5 percent increase in the average usage rate (from 0 percent to 5 percent). If the estimated result is not satisfactory, you can change the migration destination by repeating the above steps.



**Figure 5.7** Estimated Usage Rate for Parity Groups (example only)

The line graph in the Manual Migration Plans area indicates how the usage rate has changed for the source volume and the target volume.

- If you think this proposed migration plan will produce the desired disk performance, go to the next step:
- If not, return to step 4 or 6 to change the source and target volumes.

**Note:** You can create more than one migration plan. If there are any other high-usage volumes, you can continue to create migration plans. If you finish creating migration plans, you can execute the migration plans to start volume migrations.

**Restriction:** In the current version of Hitachi CruiseControl, you cannot execute more than one migration plan at one time. If you want to execute two or more plans, you must create and execute one plan after another.

8. Click the **Set** button.

A new migration plan, consisting of the specified source and target volumes, is added to the table. The new migration plan is highlighted in blue.

**Note:** Throughout the 9900V documentation set, the terms “migration plan” and “Hitachi CruiseControl pair” are used to refer to a pairing of a source volume and a corresponding target volume.



If you want to migrate more than one logical volume manually, repeat the previous steps to add migration plans.

9. Click the **Apply** button.

The migration plan is applied to the disk subsystem. The font color of the migration plan changes from **blue** to **black**.

When a logical volume starts migration, the progress of the migration is displayed in the % column of the table.

**Related topics:**

- To delete a migration plan, select a migration plan and then click the **Delete** button.
- If you select a migration plan in **black** (a migration plan that is waiting for execution or being executed) and then click the **Delete** button, the character “D” appears in the **DEL** column, and the migration plan will not be deleted until you click the **Apply** button.

**Caution:**

- If you delete a migration plan that is being executed, the data in the target volume will not be guaranteed.
- When an error condition exists in the 9900V subsystem, resource usage can increase or become unbalanced. **Do not** use usage statistics collected during an error condition as the basis for planning Hitachi CruiseControl migration operations.

### 5.3 Automating Volume Migrations

You can make settings so that volume migrations automatically take place every day at the specified time. This section explains the following procedures for automating volume migrations:

- Setting fixed parity group
- Changing the maximum disk usage rate for each HDD class
- Setting Auto Migration parameters
- Remaking Auto Migration plans

#### 5.3.1 Setting Fixed Parity Group

A fixed parity group is a parity group that cannot be used by the auto migration function. If you want to exclude a parity group (all logical volumes in the group) from auto migration operations, you need to fix the parity group. Volumes in fixed parity groups will not be used for auto migration operations, but can be used as needed for manual migration operations.

To fix a parity group so that it cannot be migrated manually:

1. Start Hitachi CruiseControl (refer to section 3.3).
2. From the Hitachi CruiseControl panel, click the **Attribute** tab (see Figure 5.8).

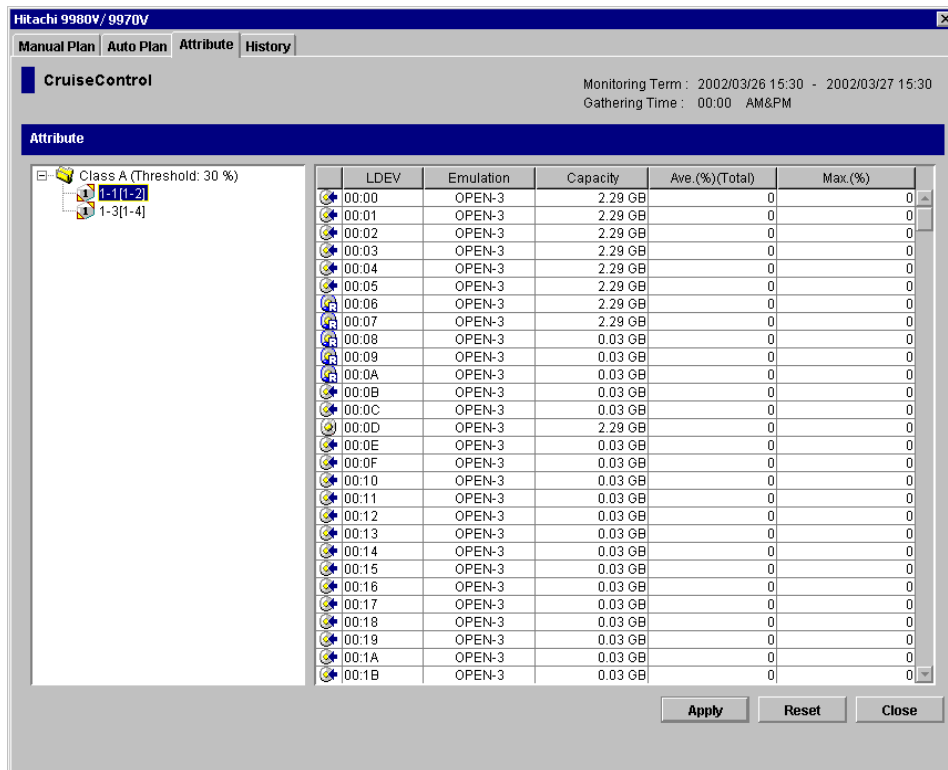







Figure 5.8 The Attribute Tab

3. In the tree view, double-click an **HDD class** folder.

The table to the right of the tree view displays a list of parity groups in the HDD class. The  (no pin) normal parity group icon indicates parity groups that can include source or target volumes. The  (red pin) parity group icon indicates “fixed” parity groups, which cannot include source nor target volumes.

4. From the  normal parity groups, select a parity group that you want to exclude from auto migration operations. Next, right click the  normal parity group icon and select **Fixed PG** from the pop-up menu (see Figure 5.9). The selected parity group is indicated by the  (red pin) parity group icon and becomes “fixed.”

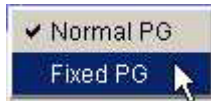



Figure 5.9 Fixed Parity Group Pop-Up Menu

5. Click the **Apply** button in the Hitachi CruiseControl panel.

*Tip:* If you want to enable logical volumes in a fixed parity group to be moved to another parity group, you must change the fixed parity group to a “normal” parity group. To do this, right-click the fixed parity group (indicated by the  (red pin) icon) and then select **Normal PG** from the pop-up menu (refer to Figure 5.9).

### 5.3.2 Changing the Maximum Disk Usage Rate for Each HDD Class

By default, each HDD class is assigned a certain limit on disk usage rate. As explained earlier, this limit affects auto migration behavior. If necessary, you can change the limit on disk usage rate.

To change the limit on disk usage rate for an HDD class:

1. Start Hitachi CruiseControl (refer to section 3.3).
2. From the Hitachi CruiseControl panel, click the **Attribute** tab (refer to Figure 5.8).
3. In the tree view, right-click an HDD class folder and then select **Change Class Threshold** from the pop-up menu (see Figure 5.10).



Figure 5.10 Change Class Threshold Pop-Up Menu

The Change Threshold for Class panel appears (see Figure 5.11).

4. From the **Threshold** drop-down list, select the value that you want to use as the limit and then click **OK**.

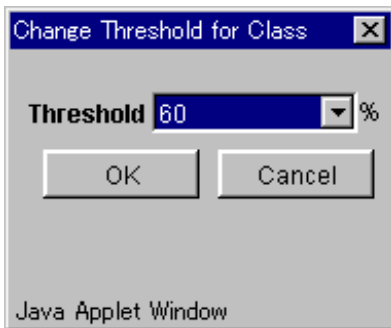


Figure 5.11 The Change Threshold for Class Panel

In the tree view, the selected value appears to the right of the specified class (**Threshold: 60%**).

5. Click the **Apply** button in the Hitachi CruiseControl panel.  
The specified limit is applied to the disk subsystem.

### 5.3.3 Setting Auto Migration Parameters

To be able to automate volume migration, you must specify migration parameters such as the migration time.

To configure auto migration parameters:

1. Start Hitachi CruiseControl (refer to section 3.3).
2. From the Hitachi CruiseControl panel, click the **Auto Plan** tab (see Figure 5.12).

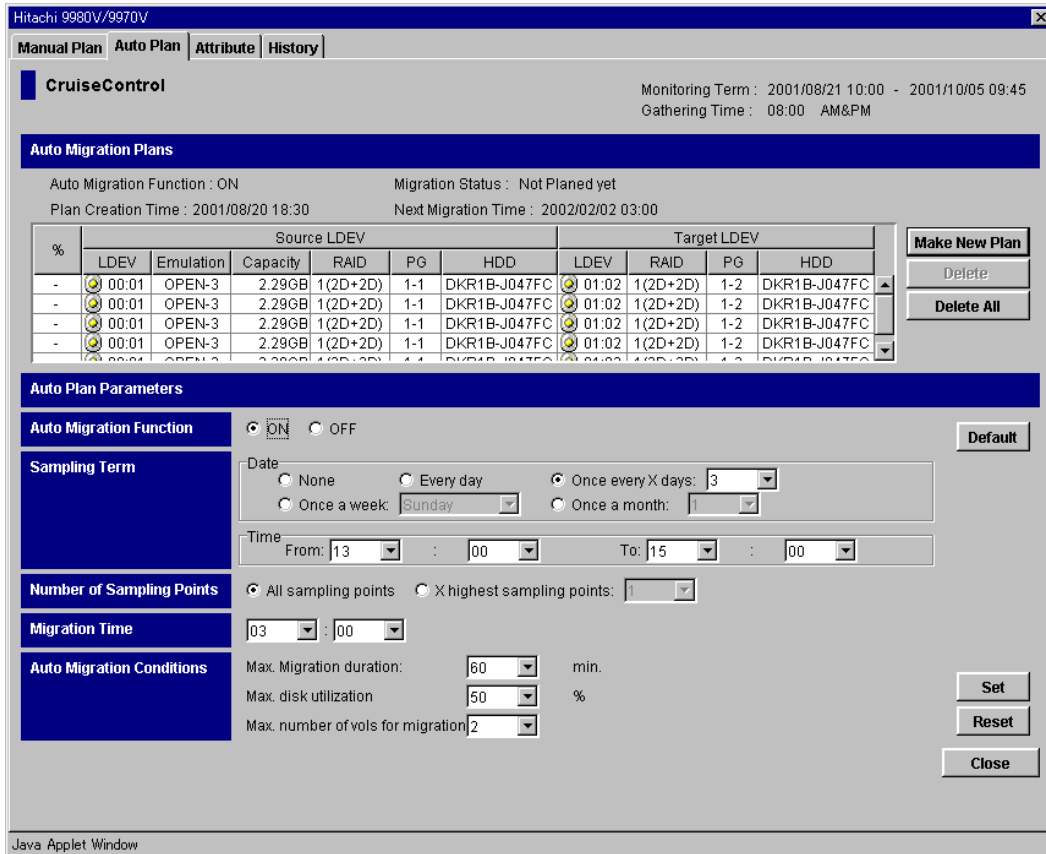


Figure 5.12 The Auto Plan Tab

3. In Auto Migration Function, select ON.
4. In the in **Sampling Term** area, use the **Date** and **Time** boxes to specify a period so that Hitachi CruiseControl analyzes resource usage statistics for that period.

For example, if you want to improve disk access speed every day from 9:00 a.m. to 5:00 p.m., you should specify the period as “*every day from 9:00 a.m. to 5:00 p.m.*”

**Important:** Make sure that the data term and the auto migration execution time are separated by at least an hour. For example, if the sampling term is from 10:00 to 14:00, auto migration should not be performed between 09:00 and 15:00.

**Note:** Auto migration plans will **not** be created if you select **None** in the **Date** box.

5. In **Number of Sampling Points**, do either of the following:
  - To enable Hitachi CruiseControl to analyze all the average usage rates in the sampling term, select **All sampling points**.
  - To enable Hitachi CruiseControl to analyze only the X highest average usage rates in the sampling term, select **X highest sampling points** and then select the value of X from the drop-down list.
6. In **Migration Time**, specify when to start auto migration operations.

**Cautions:**

- Volume migrations might impose heavy workloads on disks. For this reason, you are advised to specify a time when disk usage rates are low.
  - Auto migration is likely to place a heavy workload on servers. Therefore, auto migration might slow down processing on the clients.
  - The migration time must precede the specified **Sampling Term** start time by the specified **Max. migration duration** plus at least **15 minutes**.
  - The migration time must be at least **60 minutes** later than the specified **Sampling Term** end time.
7. If necessary, specify auto migration parameters as follows:
    - a) Use the **Max. migration duration** drop-down list to set a time limit for auto migrations.

**Note:** If auto migration is not complete within this limit, Hitachi CruiseControl cancels the incomplete operations.
    - b) Use the **Max. disk utilization** drop-down list to set a disk usage limit.
    - c) Use the **Max. number of vols for migration** drop-down list to specify the maximum number of volumes that can be auto migrated at the same time.
  8. Click the **Set** button.

The settings in this panel will be applied to the disk subsystem.

Migration plans will be automatically created **30 minutes** later than the specified sampling term. For example, if you specified 13:00 - 15:00 for the sampling term, plan creation will be performed at 15:30.

9. Click the **Close** button to close the Hitachi CruiseControl panel.

**Related topics**

- To delete all the auto migration plans, click the **Delete All** button.
- To delete an auto migration plan, select the plan in the table and then click the **Delete** button.

### 5.3.4 Remaking Auto Migration Plans

If auto migration operations did not produce enough improvements in disk access performance, you can discard the current migration plans and make new auto migration plans.

To make new auto migration plans:

1. If necessary, do the following:
  - Change the limit on disk usage rate for HDD classes. For details, refer to section 5.3.2.
  - Change parameters in **Auto Plan Parameters**. For details see section 5.3.3.
2. In the **Auto Plan** tab, click the **Make New Plan** button (see Figure 5.13).

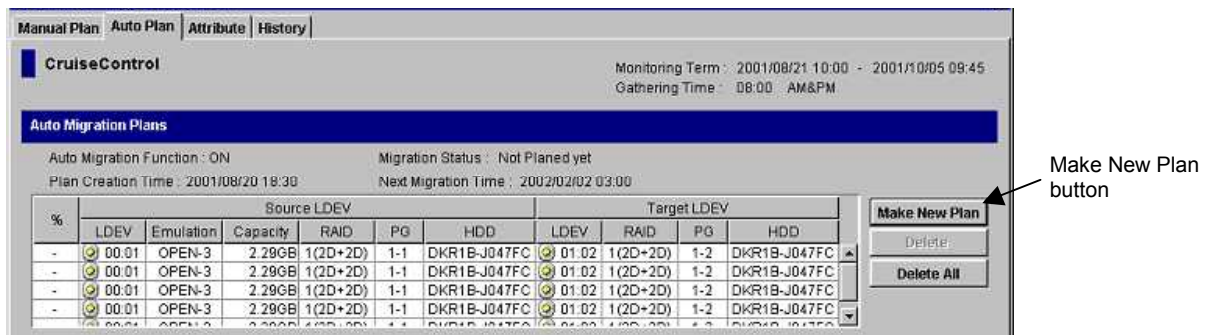


Figure 5.13 Make New Plan Button in Auto Plan Tab

All the existing auto migration plans are deleted and new auto migration plans are created.

3. Click the **Close** button to close the Hitachi CruiseControl panel.

### 5.3.5 Deleting/Turning off Auto Migration Plans

To delete/turn off auto migration:

1. From the **CruiseControl Panel**, click the **Auto Plan** tab (for details, refer to Figure 5.12)
2. In the **Auto Migration Plans** area, click the **Delete All** button to remove all the auto migration plans.
3. In the **Auto Migration Function** area, select the **OFF** radio button.
4. Click the **Set** button to apply the settings to the disk subsystem.

## 5.4 Viewing the Migration History Log

The **History** tab displays logs of auto migration operations and manual migration operations (see Figure 5.14).

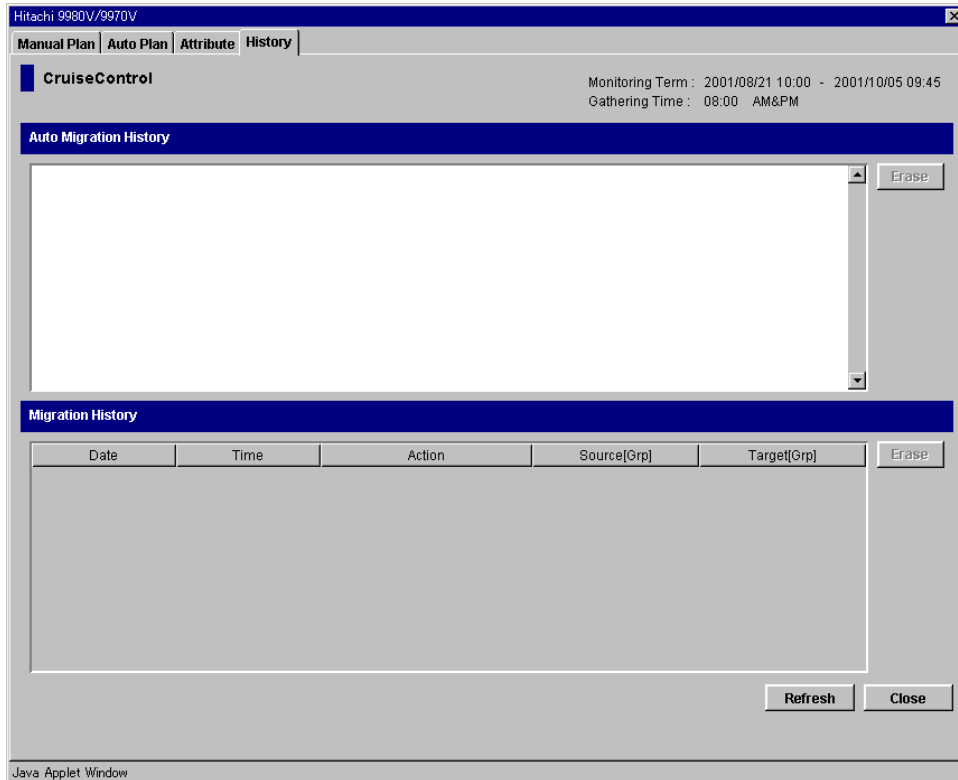


Figure 5.14 The History Tab

### To view migration logs:

1. Start Hitachi CruiseControl (refer to section 3.3).
2. From the Hitachi CruiseControl panel, click the **History** tab.
  - To view logs of auto migration operations, look at **Auto Migration History**. Table 5.1 shows an example of messages that might appear in **Auto Migration History**.
  - To view logs of manual migration operations, look at **Migration History**. Table 5.2 shows an example of messages that might appear in **Migration History**.

**Note:** It is possible that the messages in the **History** tab are not arranged in the order the corresponding events take place.



**Table 5.1 Messages in the Auto Migration Logs (example only)**

<p><b>Plan execution was finished normally:</b></p> <p>yyyy/mm/dd hh:min : Migration plan executed (CU:LDEV-&gt;CU:LDEV)</p> <p>(a) (b) (c)</p> <p>(a) Execution end time                  (b) Source volume                  (c) Target volume</p>																		
<p><b>Migration was canceled (over the limit duration):</b></p> <p>Migration canceled (CU:LDEV-&gt;CU:LDEV) Start:yyyy/mm/dd hh:min:sec -&gt; End:yyyy/mm/dd hh:min:sec</p> <p>(a) (b) (c) (d)</p> <p>(a) Source volume                  (b) Target volume                  (c) Copy start time                  (d) Copy end time</p>																		
<p><b>Migration was canceled (invalid parity group):</b></p> <p>Migration canceled (CU:LDEV (X-X)-&gt;CU:LDEV (X-X)) yyyy/mm/dd hh:min:sec (Invalid Parity Group)</p> <p>(a) (b) (c) (d) (e)</p> <p>(a) Source volume                  (b) Parity group of the source volume                  (c) Target volume                  (d) Parity group of the target volume                  (e) Canceled time</p>																		
<p><b>Migration was stopped (other reason):</b></p> <p>Migration stopped (CU:LDEV-&gt;CU:LDEV) yyyy/mm/dd hh:min:sec (XXXXXXXXXXXXX)</p> <p>(a) (b) (c) (d)</p> <p>(a) Source volume                  (b) Target volume                  (c) Canceled time                  (d) Reason for cancellation:</p> <table border="0"> <tr> <td>No reserve volume.</td> <td>No reserved volume is set. Please make another plan.</td> </tr> <tr> <td>Emulation type mismatch between reserve volumes.</td> <td>The reserved volume's emulation type is different.</td> </tr> <tr> <td>Utilization check.</td> <td>The usage rate is over the limit, or there is no monitor data.</td> </tr> <tr> <td>Migration failed. Error code: XXXX.</td> <td>The migration operation failed.</td> </tr> <tr> <td>Reserve volume size mismatch.</td> <td>Reserve volume size is different.</td> </tr> <tr> <td>Unsupported emulation type.</td> <td>The emulation type of reserved volume is not supported.</td> </tr> <tr> <td>Utilization check failed.</td> <td>The check of the usage rate finished abnormally.</td> </tr> <tr> <td>Reserve volume check failed.</td> <td>The check of the reserved volume finished abnormally.</td> </tr> <tr> <td>Unknown reserve check error.</td> <td>A reserve check error occurred.</td> </tr> </table>	No reserve volume.	No reserved volume is set. Please make another plan.	Emulation type mismatch between reserve volumes.	The reserved volume's emulation type is different.	Utilization check.	The usage rate is over the limit, or there is no monitor data.	Migration failed. Error code: XXXX.	The migration operation failed.	Reserve volume size mismatch.	Reserve volume size is different.	Unsupported emulation type.	The emulation type of reserved volume is not supported.	Utilization check failed.	The check of the usage rate finished abnormally.	Reserve volume check failed.	The check of the reserved volume finished abnormally.	Unknown reserve check error.	A reserve check error occurred.
No reserve volume.	No reserved volume is set. Please make another plan.																	
Emulation type mismatch between reserve volumes.	The reserved volume's emulation type is different.																	
Utilization check.	The usage rate is over the limit, or there is no monitor data.																	
Migration failed. Error code: XXXX.	The migration operation failed.																	
Reserve volume size mismatch.	Reserve volume size is different.																	
Unsupported emulation type.	The emulation type of reserved volume is not supported.																	
Utilization check failed.	The check of the usage rate finished abnormally.																	
Reserve volume check failed.	The check of the reserved volume finished abnormally.																	
Unknown reserve check error.	A reserve check error occurred.																	
<p><b>Migration plan was deleted (because the previous plan had been deleted):</b></p> <p>Hitachi CruiseControl failed to execute a migration plan. So, Hitachi CruiseControl deleted the remaining plans.                  (CU:LDEV-&gt;CU:LDEV) yyyy/mm/dd hh:min:sec</p> <p>(a) (b) (c)</p> <p>(a) Source volume                  (b) Target volume                  (c) Canceled time</p>																		
<p><b>Started making an auto migration plan:</b></p> <p>yyyy/mm/dd hh:min : MakePlan function starts</p> <p>(a)</p> <p>(a) Start time</p>																		
<p><b>Finished making an auto migration plan:</b></p> <p>yyyy/mm/dd hh:min : MakePlan function finishes</p> <p>(a)</p> <p>(a) End time</p>																		

<b>Output the auto migration plans:</b> X plans are output (a) (a) Number of plans															
<b>Contents of auto migration plan:</b> PlanXXX: Src LDEV CU:LDEV in Grp X-X, Dst LDEV CU:LDEV in Grp X-X (a) (b) (c) (d) (e) (a) Plan number (b) Source volume (c) Parity group of the source volume (d) Target volume (e) Parity group of the target volume															
<b>Failed making an auto migration plan:</b> ①yyyy/mm/dd hh:min : MakePlan is terminated by error: XXXXXXXXXXXX (a) (b) (a) End time (b) Reason for failure: <table border="0"><tr><td>Cannot make proper migration plan.</td><td>The program could not make a proper migration plan. Check the number of the reserved volumes and their locations. Check the maximum disk usage and change if necessary.</td></tr><tr><td>Not enough Hitachi CruiseControl data in the monitor data term.</td><td>The program did not have enough data to make the plan in the target term. Check the monitored data and/or gather more monitor data. Check the monitor data term.</td></tr><tr><td>Failed to get XXXXXXXXXXXX (information or data).</td><td>The program failed to get the information or data to make a plan. In the case of information, review the setting. In the case of data, check the status of gathered data and get them again.</td></tr><tr><td>Failed to write to XXXXXXXXXXXX (information or data).</td><td>The program failed to write the information to make a plan.</td></tr><tr><td>Invalid XXXXXXXXXXXX (information or data).</td><td>The required information/data could not be used because the information was invalid. In the case of information, review the setting. In the case of data, check the status of gathered data and get them again.</td></tr><tr><td>Memory allocation error.</td><td>The program failed to allocate the memory to make the plan.</td></tr><tr><td>②"C:\dkc200\others\hihsmatm.ini does not exist."</td><td>Hitachi CruiseControl failed to make plans because the hihsmatm.ini file did not exist. Contact the maintenance operator.</td></tr></table>		Cannot make proper migration plan.	The program could not make a proper migration plan. Check the number of the reserved volumes and their locations. Check the maximum disk usage and change if necessary.	Not enough Hitachi CruiseControl data in the monitor data term.	The program did not have enough data to make the plan in the target term. Check the monitored data and/or gather more monitor data. Check the monitor data term.	Failed to get XXXXXXXXXXXX (information or data).	The program failed to get the information or data to make a plan. In the case of information, review the setting. In the case of data, check the status of gathered data and get them again.	Failed to write to XXXXXXXXXXXX (information or data).	The program failed to write the information to make a plan.	Invalid XXXXXXXXXXXX (information or data).	The required information/data could not be used because the information was invalid. In the case of information, review the setting. In the case of data, check the status of gathered data and get them again.	Memory allocation error.	The program failed to allocate the memory to make the plan.	②"C:\dkc200\others\hihsmatm.ini does not exist."	Hitachi CruiseControl failed to make plans because the hihsmatm.ini file did not exist. Contact the maintenance operator.
Cannot make proper migration plan.	The program could not make a proper migration plan. Check the number of the reserved volumes and their locations. Check the maximum disk usage and change if necessary.														
Not enough Hitachi CruiseControl data in the monitor data term.	The program did not have enough data to make the plan in the target term. Check the monitored data and/or gather more monitor data. Check the monitor data term.														
Failed to get XXXXXXXXXXXX (information or data).	The program failed to get the information or data to make a plan. In the case of information, review the setting. In the case of data, check the status of gathered data and get them again.														
Failed to write to XXXXXXXXXXXX (information or data).	The program failed to write the information to make a plan.														
Invalid XXXXXXXXXXXX (information or data).	The required information/data could not be used because the information was invalid. In the case of information, review the setting. In the case of data, check the status of gathered data and get them again.														
Memory allocation error.	The program failed to allocate the memory to make the plan.														
②"C:\dkc200\others\hihsmatm.ini does not exist."	Hitachi CruiseControl failed to make plans because the hihsmatm.ini file did not exist. Contact the maintenance operator.														
<b>Log entry that the auto migration plan could not be made:</b> Cannot make plan: Class X Grp X-X (a) (b) (a) Class (b) Parity group															
<b>Some monitor data samples were invalidated:</b> Grp X-X: X samples are invalidated because of migration. To reduce the influence of migration during the monitor term, Hitachi CruiseControl made a plan without using some data samples.															
<b>New volumes have been installed:</b> New entries are added for following LDEVs: CU:LDEV, CU:LDEV, ...															

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<p><b>Invalid data:</b></p> <p>Too many invalid data: invalidated all data</p> <p>The contents of data in the indicated group or volumes is invalid. Hitachi CruiseControl made a plan without those data.</p>
<p><b>Volume utilization check failed:</b></p> <p>Utilization check failed</p> <p>Check volume usage failed because the necessary data could not be obtained. Please get the data again.</p>
<p><b>Volume reserve attribute check failed:</b></p> <p>Reserve volume check failed</p> <p>Check volume reserve attribute failed because the necessary data could not be obtained. Please get the data again.</p>
<p><b>Started to execute a plan:</b></p> <p>Yyyy/mm/dd hh:min : Migration started. (a)</p> <p>(a) Start time</p>
<p><b>Auto migration was stopped because the SVP was rebooted:</b></p> <p>Yyyy/mm/dd hh:min : SVP rebooted. Auto migration stopped. (a)</p> <p>(a) Time when auto migration was stopped</p>
<p><b>Hitachi CruiseControl failed to obtain statistics and stopped creating plans:</b></p> <p>Yyyy/mm/dd hh:min : Hitachi CruiseControl failed to obtain statistics and stopped creating plans. (a)</p> <p>(a) Time when plan creation was stopped</p>
<p><b>Hitachi CruiseControl failed to obtain statistics and stopped executing plans:</b></p> <p>Yyyy/mm/dd hh:min : Hitachi CruiseControl failed to obtain statistics and stopped auto migration. (a)</p> <p>(a) Time when migration was stopped</p>
<p><b>Hitachi CruiseControl finished plan execution:</b></p> <p>Yyyy/mm/dd hh:min : Migration ended. (a)</p> <p>(a) Time when migration ended</p>

**Table 5.2 Messages in the Migration Logs (example only)**

<b>Message</b>	<b>Meaning</b>
Migration Started	The migration operation started.
Migration Completed	The migration operation completed successfully.
Migration Canceled by User	The migration operation was canceled by the user.
Migration Failed	The migration operation failed.
Migration Canceled by Hitachi CruiseControl	The migration operation was canceled by Hitachi CruiseControl (e.g., volume usage rate exceeded specified maximum).



## Chapter 6 Troubleshooting


### 6.1 Troubleshooting in General

For troubleshooting information on the 9900V subsystem, refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100). For information on the 9900V Remote Console software error codes, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator Error Codes* (MK-92RD132).

The user is responsible for the operation and normal maintenance of the PC(s) that host the 9900V Remote Console software. Here are some guidelines for troubleshooting 9900V Remote Console software operations:

- **Check the cabling and the LAN.** Verify that both the computer and LAN cabling are firmly attached, and that the LAN is operating properly.
- **Reboot the PC.** Close any programs that are not responding. If necessary, reboot the PC and restart the 9900V Remote Console - Storage Navigator Java™ applet program.
- **Check for any General Error Conditions.** Table 6.1 describes some general error conditions, along with the recommended resolution for each item. If you are still unable to resolve an error condition, call the Hitachi Technical Support Center for assistance (see section 6.3).
- **Check the status lamp on the Hitachi Remote Console - Storage Navigator.** If the lamp becomes yellow (🟡) or red (🔴), confirm the severity level of the error on the Status panel. If you are unable to resolve an error condition, please contact the Hitachi Data Systems Support Center (see section 6.3).
- **Download the Remote Console trace files using the FD Dump Tool.** If you are unable to resolve an error condition, first copy the 9900V Remote Console configuration information onto floppy disk(s) using the FD Dump Tool (refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide* (MK-92RD101). Contact the Hitachi Data Systems Technical Support Center (see section 6.3), and give the information on the floppy disk(s) to the Hitachi Data Systems service personnel.

Table 6.1 General Error Conditions

Error Condition	Recommended Action
The program on the SVP is updated.	Exit all Web browsers on the Remote Console PC, and then restart the browsers. If in doubt, you should exit and restart the browsers.
The Remote Console PC experiences an error.	Save the Java log file on the Remote Console PC, and report to the Hitachi Data Systems Technical Support Center. For Windows 2000, the Java log file is in the following place:  c:\Documents and Settings\login user ID\plugin131.trace  Restart the Remote Console PC.
A network error occurred.	Restart the Remote Console PC.
Only the Exit and Refresh buttons are effective when accessing the SVP from the Remote Console PC.	The SVP might not be ready or perform some write processes from the other system. Wait for a while, and then select the Refresh button.
After dragging and dropping objects to another location or area, the scroll bar on that location becomes unusable.	Close all panels including the Storage Device List panel, and then log on to the Remote Console again.
A focus disappears from the edit box.	Close all panels including the Storage Device List panel, and then log on to the Remote Console again.
A Remote Console panel is closed by: - Clicking the  button on the panel, - Using the commands such as File and Exit on the Web browser, or - Pressing the Alt and F4 keys.	Wait for an RMI time-out (default is 6 min.), and then restart the Remote Console.
An internal error occurs, or a Web browser ends abnormally (forcibly).	Close all panels including the Storage Device List panel, and then log on to the Remote Console again. If the same error occurs, restart the Remote Console PC.
If you are unable to resolve an error condition.	Copy the 9900V Hitachi Remote Console-Storage Navigator configuration information onto floppy disk(s) using the FD Dump Tool (refer to <i>Hitachi Lightning 9900V Remote Console – Storage Navigator™ User's Guide (MK-92-RD101)</i> ), and contact the Hitachi Data Systems Technical Support Center.

## 6.2 Hitachi CruiseControl Error Codes

The Hitachi CruiseControl software displays error messages on the Remote Console PC when error conditions occur during Hitachi CruiseControl operations. The error message describes the error and provides a four-digit error code. The first two digits of the error code indicate the error type, and the last two digits provide more specific information about the error. The error message may also include an SVP error code.

If you need to call the Hitachi Data Systems Support Center, make sure to provide as much information about the problem as possible, including the Hitachi CruiseControl or other error codes displayed on the Remote Console PC.

Table 6.2 lists the error codes and messages displayed on the Auto Migration History box in the History tab (see section 4.4) and provides recommended actions for resolving the error conditions. For information on other error codes displayed on the Remote Console PC, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Remote Console Error Codes* (MK-92RD132-1).

**Table 6.2 Error Codes on the History Tab**

Code	Description	Recommended Action
0401	A locking time-out was detected during an internal processing. (A retry may result in a normal termination.)	Retry about five seconds later.
0801	The Hitachi CruiseControl could not be used.	Install the PP or the Hitachi CruiseControl.
0810	The issued command cannot accepted in this status. (The command was rejected.)	Check the pair status and confirm whether the command is allowed to be issued.
0811	The issued command is treated as an NOP.	The issued command is treated as an NOP.
0830	A pair cannot be created because the track format is different.	Make sure that the emulation type of the source volume and target volume is the same.
0831	A pair cannot be created because a number of slots is different.	Make sure that the capacity of the source volume and target volume is the same.
0834	The emulation type of the specified source volume is not supported by the Hitachi CruiseControl.	Make sure that the emulation type of the source volume is supported by Hitachi CruiseControl.
0835	The emulation type of the specified target volume is not supported by the Hitachi CruiseControl.	Make sure that the emulation type of the target volume is supported by Hitachi CruiseControl.
0836	The pair cannot be created.	Confirm whether the emulation type of the source and the target volume are the same.
0C70	The source volume is not installed.	Do not include uninstalled volumes in the object to be processed.
0C71	The source volume cannot be used.	Call the service personnel to make the source volume status normal.
0C72	The source volume is being formatted.	Wait until the formatting of the source volume is completes.
0C73	The source volume is command device.	The command device does not execute Hitachi CruiseControl function.
0C80	The target volume is not installed.	Volumes not installed are not included in the object to be processed.

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<b>Code</b>	<b>Description</b>	<b>Recommended Action</b>
0C81	The target volume cannot be used.	Call the service personnel to make the target volume status normal.
0C82	The target volume is being formatted.	Wait until the formatting of the target volume completes.
0C83	The target volume is command device.	The command device does not execute Hitachi CruiseControl function.
0C90	The LDEV specified to be a Reserve volume is not installed.	Volumes not installed are not included in the object to be processed.
0C91	The LDEV specified to be a Reserve volume cannot be used.	Call the service personnel to make the volume specified to be a Reserve volume normal.
0C92	The LDEV specified to be a Reserve volume is being formatted.	Wait until the formatting of the volume specified to be a Reserve volume completes.
0C93	The LDEV specified to be a Reserve volume is command device.	The command device does not execute Hitachi CruiseControl function.
1009	The multiplicity of the Hitachi CruiseControl exceeded its limit.	Delete some of the pairs.
1011	The number of the LDEV specified to be a Reserve volume has already been used for a Reserve volume.	Change the LDEV number for specifying a Reserve volume.
1012	The number of the LDEV specified to be a Reserve volume has already been used for a primary LDEV of the ShadowImage.	Change the LDEV number for specifying a Reserve volume.
1013	The number of the LDEV specified to be a Reserve volume has already been used for a source volume of the hierarchical control.	Change the LDEV number for specifying a Reserve volume.
1014	The number of the LDEV specified to be a Reserve volume has already been used for a target volume of the hierarchical control.	Change the LDEV number for specifying a Reserve volume.
1015	The LDEV specified to be a Reserve volume is not set as a Reserve volume.	Check the volume status.
1017	A Reserve volume cannot be set because the number of Reserve volumes allocated for them was exceeded.	Delete any of the Reserve volumes
102B	The specified volume as the "Reserved" has been set as the ShadowImage target volume.	Check the volume status.
102C	The specified source volume has been set as the TrueCopy-Basic source volume.	Check the volume status.
102D	The specified target volume has been set as the TrueCopy-Basic target volume.	Check the volume status.
102F	The specified source volume has been set as the Hitachi CruiseControl source volume.	Check the volume status.
1030	The specified source volume number does not exist.	Retry after refreshing the screen.
1031	The specified source volume has been set as a Reserve volume.	Check the pair status.
1034	The specified source volume has been set as other source volume.	Check the pair status.
1036	The specified source volume has been set as the ShadowImage source volume.	Delete the pair of the ShadowImage.
1037	The specified source volume has been set as a target volume of the ShadowImage.	Delete the pair of the ShadowImage.
103B	It is impossible to make a pair because Volume which was specified as a target volume is Root Volume already	It confirms a pair condition.



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<b>Code</b>	<b>Description</b>	<b>Recommended Action</b>
103C	It is impossible to make a pair because Volume which was specified as a target volume is Node Volume already	It confirms a pair condition.
1040	The specified target volume does not exist.	Execute "Refresh" and do again.
1041	The specified target volume does not set as the Reserve volume.	Check the volume status.
1042	The specified target volume has been used as other Hitachi CruiseControl target volume.	Check the volume status.
1043	The specified target volume has been used as ShadowImage target volume.	Delete pair of ShadowImage.
1046	The specified secondary LDEV is used as a P-VOL of the TrueCopy-Basic	Delete the TrueCopy-Basic pair.
1047	The specified secondary LDEV is used as a P-VOL of the TrueCopy-Basic.	Delete the TrueCopy-Basic-Basic pair.
104A	The specified secondary LDEV is used as a source volume of the ShadowImage.	Delete the ShadowImage pair.
104B	The specified target volume has been used as other Hitachi CruiseControl source volume.	Check the volume status.
104E	The LDEV specified as a Reserve volume is being used as an M?VOL of the TrueCopy-Basic.	Delete the TrueCopy-Basic pair.
104F	The LDEV specified as a Reserve volume is being used as an R?VOL of the TrueCopy-Basic.	Delete the TrueCopy-Basic pair.
1051	The LDEV numbers of the specified source and the target volumes are the same.	Retry after refreshing the screen.
1052	The volume specified as the source volume is an XRC volume.	Check the volume status. Reset the XRC operation.
1053	The volume specified as the target volume is an XRC volume.	Check the volume status. Reset the XRC operation.
1054	The volume specified as the Reserve volume is an XRC volume.	Check the volume status. Reset the XRC operation.
1055	The volume specified as the source volume is a CC volume.	Check the volume status. Reset the CC operation.
1056	The volume specified as the target volume is a CC volume.	Check the volume status. Reset the CC operation.
1057	The volume specified as the Reserve volume is a CC volume.	Check the volume status. Reset the CC operation.
1058	The volume specified as the source volume is a TrueCopy-Basic main/primary volume whose status is not suspended.	Check the volume status. Delete the TrueCopy-Basic pair or change the pair status to suspended.
1059	The volume specified as the source volume is a TrueCopy-Basic remote/secondary volume whose status is not suspended.	Check the volume status. Delete the TrueCopy-Basic pair or change the pair status to suspended.
105A	The volume specified as the source volume is a ShadowImage source/primary volume whose status is Split Pending.	Check the volume status. Delete the ShadowImage pair or change the pair status so that the status is not Split Pending.
105B	The volume specified as the source volume is a ShadowImage target/secondary volume whose status is Split Pending.	Check the volume status. Delete the ShadowImage pair or change the pair status so that the status is not Split Pending.
1085	The source volume was used for Reserve volume of Hitachi CruiseControl.	Check the source volume or Cancel the Reserve volume of Hitachi CruiseControl.
1088	The specified reserve volume has been set as FlashAccess.	Reset the FlashAccess.
1089	The specified source volume has been set as FlashAccess.	Reset the FlashAccess.

<b>Code</b>	<b>Description</b>	<b>Recommended Action</b>
108A	The specified target volume has been set as FlashAccess.	Reset the FlashAccess.
108B	The specified reserve volume has been constructed as LUSE.	Reset the LUSE.
108C	The specified reserve volume has been set as ShadowImage reserved volume.	Check the pair status.

### **6.3 Calling the Hitachi Data Systems Technical Support Center**

If you need to call the Hitachi Data Systems Technical Support Center, be 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 on the Remote Console. The worldwide Hitachi Data Systems Technical Support Centers are:

- Hitachi Data Systems North America/Latin America  
San Diego, California, USA  
1-800-348-4357
- Hitachi Data Systems Europe  
Contact Hitachi Data Systems Local Support
- Hitachi Data Systems Asia Pacific  
North Ryde, Australia  
011-61-2-9325-3300

## Acronyms and Abbreviations

CU	control unit (logical control unit)
DASD	direct-access storage device
DKA	disk adapter
DRR	Disaster Recovery and Regeneration Processor
HDD	Hard Disk Drive
LAN	local area network
LDEV	logical device
LU	logical unit
LUN	logical unit number
PC	personal computer
P-VOL	primary volume
RAID	redundant array of independent disks
SMPL	simplex
S-VOL	secondary volume
SVP	service processor
TID	target ID
VOLSER	volume serial number

