

PRELIMINARY RELEASE



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

**Performance Monitor (Performance Management)
User's Guide**

PRELIMINARY RELEASE

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- 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 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.
- RSD input via email review comments dated 04/16/02.
- RSD input via email review comments dated 04/17/02.

Referenced Documents

- *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100).
- *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi CruiseControl User's Guide* (MK-92RD106).
- *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 LUN Manager User's Guide* (MK-92RD105).

Preface

The *Hitachi Freedom Storage™ Lightning 9900™ V Series Performance Monitor User's Guide* (MK-92RD133) describes and provides instructions for using the Performance Monitor (Performance Management) software to allow you to obtain usage statistics about the physical hard disk drive, logical volumes, processors, or other resources in your disk subsystem. Performance Monitor (Performance Management) also lets you obtain statistics about workloads on disk drives and traffic between hosts and the disk subsystem. 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 both the *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100) and the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide* (MK-92RD101), 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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Make sure to include the document title, number, and revision.

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

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Contents

Chapter 1	Overview of Performance Monitor, CruiseControl and Priority Access.....	1
Chapter 2	Performance Monitor (Performance Management) Overview	3
2.1	Viewing Usage Statistics about Resources in Your Disk Subsystem	3
2.1.1	Viewing Parity Group Usage Statistics.....	4
2.1.2	Viewing Logical Volume Usage Statistics	4
2.1.3	Viewing Channel Processor Usage Statistics.....	4
2.1.4	Viewing Disk Processors Usage Statistics	5
2.1.5	Viewing Disaster Recovery and Regeneration Processor Usage Statistics	5
2.1.6	Viewing the Write Pending Rate	6
2.1.7	Viewing Access Path Usage Statistics.....	6
2.1.8	Viewing Disk Workload Statistics.....	7
2.1.9	Viewing Port Traffic Statistics.....	7
2.1.10	Viewing LU Path Traffic Statistics	8
2.1.11	Viewing Host Bus Adapters and Port Path Traffic Statistics	8
2.2	Monitoring the Disk Subsystem	8
2.2.1	Monitoring Resources in the Disk Subsystem	8
2.2.2	Monitoring Disk Drives, Ports, LU Paths and Host Bus Adapters.....	9
Chapter 3	Preparing for Hitachi Performance Monitor (Performance Management) Operations... 	11
3.1	System Requirements	11
3.2	Starting Remote Console - Storage Navigator™ and Configuring Your Client PC.....	11
3.3	Switching to Modify Mode	14
3.4	Setting Monitoring Options	15
3.4.1	Starting Long Range Monitoring Software	16
3.4.2	Stopping Long Range Monitoring Software.....	16
3.4.3	Starting Short Range Monitoring Software.....	16
3.4.4	Stopping Short Range Monitoring Software.....	17
Chapter 4	Reviewing Performance Monitor (Performance Management) Panels.....	19
4.1	The Monitoring Options Panel	19
4.2	The Performance Monitor (Performance Management) Panels.....	21
4.2.1	The Physical Tab of the Hitachi Performance Monitor (Performance Management) Panel	22
4.2.2	The LDEV Tab of the Hitachi Performance Monitor (Performance Management) Panel	24
4.2.3	The Port-LUN Tab of the Hitachi Performance Monitor (Performance Management) Panel	28
4.2.4	The WWN Tab of the Hitachi Performance Monitor (Performance Management) Panel	31

- Chapter 5 Performing Performance Monitor (Performance Management) Operations..... 35**
 - 5.1 Monitoring Resources in the Disk Subsystem35
 - 5.1.1 Collecting Statistics About Resource Usage36
 - 5.1.2 Viewing Usage Statistics About Parity Groups37
 - 5.1.3 Viewing Usage Statistics About Logical Volumes in Parity Groups39
 - 5.1.4 Viewing Usage Statistics About Channel Processors (CHPs)41
 - 5.1.5 Viewing Usage Statistics About Disk Processors (DKPs)42
 - 5.1.6 Viewing Usage Statistics About Disaster Recovery and Regeneration Processors (DRRs)43
 - 5.1.7 Viewing Write Pending Rates.....44
 - 5.1.8 Viewing Usage Statistics About Access Paths45
 - 5.1.9 Updating Usage Statistics48
 - 5.2 Monitoring Disk Drives49
 - 5.2.1 Collecting Statistics About Workloads on Disk Drives49
 - 5.2.2 Viewing I/O Rates50
 - 5.2.3 Viewing Transfer Rates.....53
 - 5.3 Monitoring Ports55
 - 5.3.1 Collecting Statistics About Traffic at Ports55
 - 5.3.2 Viewing I/O Rates56
 - 5.3.3 Viewing Transfer Rates.....58
 - 5.3.4 Viewing Detailed Information About the I/O Rate and the Transfer Rate60
 - 5.4 Monitoring LU Paths.....60
 - 5.4.1 Collecting Statistics About Traffic at LU Paths.....60
 - 5.4.2 Viewing I/O Rates61
 - 5.4.3 Viewing Transfer Rates.....62
 - 5.5 Monitoring Paths Between Host Bus Adapters and Ports64
 - 5.5.1 Collecting Statistics About Traffic Between HBAs and Ports64
 - 5.5.2 Viewing I/O Rates65
 - 5.5.3 Viewing Transfer Rates.....67
- Chapter 6 Troubleshooting 71**
 - 6.1 Troubleshooting in General71
 - 6.2 Troubleshooting Performance Monitor (Performance Management)72
 - 6.3 Calling the Hitachi Data Systems Technical Support Center73
- Acronyms and Abbreviations..... 75**

List of Figures

Figure 2.1	Access Paths.....	6
Figure 3.1	Remote Console Main Panel.....	12
Figure 3.2	Performance Monitor (Performance Management) (Performance Manager) Default Panel.....	13
Figure 3.3	Subsystem Information Icons	14
Figure 3.4	Monitoring Options Tab of the Performance Monitor (Performance Management) Panel	15
Figure 4.1	Performance Monitor (Performance Management) Panel	19
Figure 4.2	The Monitoring Options Panel of Performance Monitor (Performance Management)	20
Figure 4.3	Physical Tab	22
Figure 4.4	The LDEV Tab	24
Figure 4.5	The Port-LUN Tab	28
Figure 4.6	The graphs that Illustrate Changes in Workloads on a Port.....	31
Figure 4.7	The WWN Tab	32
Figure 5.1	The Processing Message	35
Figure 5.2	Setting Long Range Monitoring in the Monitoring Options Tab.....	36
Figure 5.3	The Physical Tab of the Performance Monitor (Performance Management) Panel.....	37
Figure 5.4	An Example of Parity Group Usage Rates Displayed in the Table.....	38
Figure 5.5	An Example of Logical Volume Usage Rates Displayed in the Table.....	40
Figure 5.6	An Example of Channel Processors Usage Rates Displayed in the Table.....	41
Figure 5.7	An Example of Disk Processor Usage Rates Displayed in the Table.....	43
Figure 5.8	An Example of DRR Usage Rates Displayed in the Table	44
Figure 5.9	An Example of Write Pending Rate Displayed in the Table	45
Figure 5.10	Examples of Usage Statistics Displayed in the Table	47
Figure 5.11	Setting Short Range Monitoring in the Monitoring Options Tab.	50
Figure 5.12	I/O Rates for Disks	52
Figure 5.13	Transfer Rates for Disks	54
Figure 5.14	I/O Rates for Ports	57
Figure 5.15	Transfer Rates for Ports.....	59
Figure 5.16	I/O Rates for LU Paths	61
Figure 5.17	Transfer Rates for LU Paths.....	63
Figure 5.18	I/O Rates for Host Bus Adapters	66
Figure 5.19	Transfer Rates for Host Bus Adapters	69

List of Tables

Table 4.1	Detailed Information that can be Displayed in the Graph.....	27
Table 4.2	Detailed Information that can be Displayed in the Graph.....	30
Table 6.1	General Error Conditions.....	71

Chapter 1 Overview of Performance Monitor, CruiseControl and Priority Access

Performance Monitor (Performance Management) 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 (Performance Management) also lets you obtain statistics about workloads on disk drives and traffic between hosts and the disk subsystem. The Hitachi Performance Monitor (Performance Management) 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 Chapter 2.

Hitachi CruiseControl lets you balance workload among hard disk drives, logical volumes, and processors to remove bottlenecks from your system. If Performance Monitor (Performance Management) 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. For details, see the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi CruiseControl User's Guide* (MK-92RD106).

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 Management) is not enabled, you cannot use Hitachi CruiseControl or Priority Access.

Chapter 2 Performance Monitor (Performance Management) Overview

Performance Monitor (Performance Management) tracks your disk subsystem and lets you obtain statistics about resources in your disk subsystem and statistics about workloads on disks and ports. If your system encounters a problem (for example, if server hosts suffer delayed response times), Performance Monitor (Performance Management) may help you detect the cause of the problem.

2.1 Viewing Usage Statistics about Resources in Your Disk Subsystem

If disk subsystem resources (e.g., hard disk drives) become overloaded, your system might require a lot of time for processing data and, in worst cases, the system might go down. To avoid such a situation, you must monitor utilization of resources and, if necessary, take preventive measures.

Performance Monitor (Performance Management) allows you to monitor your disk subsystem and obtain usage statistics about resources such as front-end and back-end processors, hard disk drives, and logical volumes every 15 minutes. The obtained statistics are automatically collected by the SVP twice a day (once in the morning and once in the afternoon). The Performance Monitor (Performance Management) panel allows you to view statistics about the resources and detect the resources on which workloads converge. The Performance Monitor (Performance Management) panel displays a line graph that helps you detect the peak time of the resource usage.

WARNING: Statistics collected more than three months previously (i.e., 93 days) are lost from the disk subsystem and are not displayed in the Performance Monitor (Performance Management) panel.

If workloads converge on some particular resources, you will need to balance the workloads by installing new hard disk drives or by using Hitachi CruiseControl. For details of Hitachi CruiseControl, please refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi CruiseControl User's Guide* (MK-92RD106).

The Performance Monitor (Performance Management) panel lets you view the following types of information:

- Parity Group Usage Statistics
- Logical Volumes Usage Statistics
- Channel Processor Usage Statistics
- Disk Processor Usage Statistics
- Disaster Recovery and Regeneration Processor Usage Statistics
- Write Pending Rate
- Access Path Usage Statistics

- Disk Workload Statistics
- Port Traffic Statistics
- LU Path Statistics
- Path Between Host Bus Adapter and Port Statistics

Each is briefly described in the following sections:

2.1.1 Viewing Parity Group Usage Statistics

A *parity group* is a group of hard disk drives (HDDs) which form the basic unit of storage for the 9900V subsystem. All HDDs in a parity group must have the same physical capacity. The 9900V supports both RAID-1 and RAID-5 parity groups. A RAID-1 parity group consists of two pairs of HDDs in a mirrored configuration. A RAID-5 parity group consists of four HDDs.

If the monitor data shows overall high parity group usage, you should consider installing additional HDDs and using Hitachi CruiseControl to migrate the high-usage volumes to the new parity groups. If the monitor data shows that parity group usage is not balanced, you can use Hitachi CruiseControl to migrate volumes from high-usage parity groups to low-usage parity groups.

For details on how to view usage statistics about parity groups, see section 5.1.1.

2.1.2 Viewing Logical Volume Usage Statistics

Performance Monitor (Performance Management) displays the average and maximum usage, including sequential and random access, of each logical volume (LDEV) in a parity group. The logical volume usage is the time in use (sequential and random access) of the physical drives of each LDEV, averaged by the number of physical drives in the parity group.

If the monitor data shows overall high logical volume usage, you should consider installing additional hardware (e.g., HDDs, disk adapters (DKAs), cache). If the monitor data shows that volume usage is not balanced, you can use Hitachi CruiseControl to migrate high-usage volumes to higher HDD classes and/or to lower-usage parity groups. The logical volume usage data can also be used to analyze the access characteristics of volumes and determine the appropriate RAID level and/or HDD type for the volumes.

For details on how to view usage statistics about logical volumes, see section 5.1.3.

2.1.3 Viewing Channel Processor Usage Statistics

A channel processor (CHP), which is contained in a channel adapter (CHA), processes host commands and controls data transfer between hosts and the cache. A channel adapter contains multiple channel processors (CHPs), which process host commands and control data transfer.

If the monitor data shows overall high CHP usage, you should consider installing additional CHAs. If the monitor data shows that CHP usage is not balanced, you should consider moving some devices that are defined on overloaded ports to ports with lower-usage CHPs to balance front-end usage.

For details on how to view usage statistics about channel adapters and channel processors groups, see section 5.1.4.

2.1.4 Viewing Disk Processors Usage Statistics

A disk processor (DKP), which is contained in a disk adapter (DKA), controls data transfer between the cache and the disk devices. A DISK ADAPTER contains multiple disk processors (DKPs).

If the monitor data shows overall high DKP usage, you should consider installing additional HDDs and/or DISK ADAPTERs, and then using Hitachi CruiseControl to migrate the high-write-usage volumes (especially sequential writes) to the new parity groups. If the monitor data shows that DKP usage is not balanced, you can use Hitachi CruiseControl to migrate logical volumes from high-usage parity groups to low-usage parity groups.

For details on how to view usage statistics about disk adapters and disk processors, see section 5.1.5.

Note: Hitachi CruiseControl cannot estimate DKP usage. Only use Hitachi CruiseControl migration for obvious cases of high or unbalanced DKP usage. Hitachi CruiseControl migration may not provide any performance improvement for cases in which DKP usage values vary only slightly, or for cases in which overall Disaster Recovery and Regeneration (DRR) usage values are relatively high.

2.1.5 Viewing Disaster Recovery and Regeneration Processor Usage Statistics

A Disaster Recovery and Regeneration Processor (DRR) is a microprocessor (located on the DKAs) which is used to generate parity data for RAID-5 parity groups. The DRR uses "old data + new data + old parity" to generate new parity.

If the monitor data shows overall high DRR usage, this can indicate a high write penalty condition. Please consult your Hitachi representative about high write penalty conditions. If the monitor data shows that DRR usage is not balanced, you should consider relocating volumes using Hitachi CruiseControl to balance DRR usage within the subsystem.

For details on how to view usage statistics on DRRs, see section 5.1.6.

2.1.6 Viewing the Write Pending Rate

The write pending rate indicates the ratio of write-pending data to cache memory capacity. The Performance Monitor (Performance Management) panel displays the average and the maximum write pending rate for the specified period of time. The panel also displays a graph that indicates how the write pending rate changes within that period.

For details on how to view the write pending rate, see section 5.1.7.

2.1.7 Viewing Access Path Usage Statistics

An *access path* is a path through which data and commands are transferred within a disk subsystem.

In a disk subsystem, channel adapters (CHAs) control data transfer between hosts and the cache memory. Also, disk adapters control data transfer between the cache memory and disk drives. Data transfer does not occur between channel adapters and disk adapters. Data is transferred via the cache switch (CSW) to the cache memory.

When hosts issue commands, the commands are transferred via channel adapters to the shared memory (SM). The content of the shared memory is checked by disk adapters.

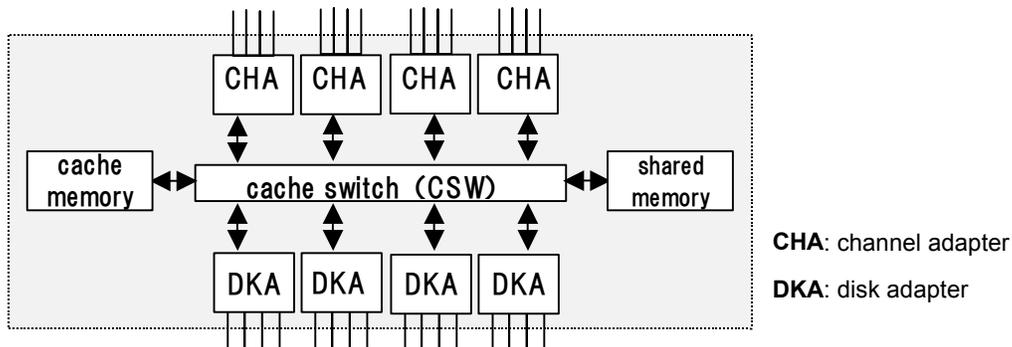


Figure 2.1 Access Paths

Performance Monitor (Performance Management) tracks and displays the usage rate for the following access paths.

- Paths between channel adapters and the cache switch
- Paths between disk adapters and the cache switch
- Paths between the cache switch and the cache memory
- Paths between channel adapters and the shared memory
- Paths between disk adapters and the shared memory

For details on how to view usage statistics about access paths, see section 5.1.8.

2.1.8 Viewing Disk Workload Statistics

If a lot of accesses are made to particular disks or data, the system performance might deteriorate. Performance Monitor (Performance Management) lets you view statistics about parity groups and logical devices to help you detect bottlenecks in your system. Performance Monitor (Performance Management) displays a line graph that indicates changes in access workloads, so that you will be able to detect the peak time of I/O accesses.

Note: You will be unable to view workload statistics that were obtained more than 24 hours previously because such statistics are erased from the disk subsystem.

- I/O rate

The *I/O rate* indicates how many I/Os are made to the disk in one second. If the I/O rate is high, the hosts might consume a lot of time for accessing disks and the response time might be long.

- Transfer rate

The *transfer rate* indicates the size of data transferred to the disk in one second. If the transfer rate is high, the hosts might consume a lot of time for accessing disks and the response time might be long.

- The read hit ratio

For a read I/O, when the requested data is already in cache, the operation is classified as a read hit. For example, if ten read requests have been made from hosts to devices in a time period and the read data was already on the cache memory three times out of ten, the read hit ratio for that time period is 30 percent. A higher read hit ratio implies higher processing speed because fewer data transfers are made between devices and the cache memory.

- The write hit ratio

For a write I/O, when the requested data is already in cache, the operation is classified as a write hit. For example, if ten write requests were made from hosts to devices in a time period and the write data was already on the cache memory three cases out of ten, the write hit ratio for that time period is 30 percent. A higher write hit ratio implies higher processing speed because fewer data transfers are made between devices and the cache memory.

For details on how to view workload statistics about disks, see section 5.2.

2.1.9 Viewing Port Traffic Statistics

Performance Monitor (Performance Management) tracks host ports and disk subsystem ports to obtain statistics about I/O rates and transfer rates at these ports. If you analyze these I/O rates and transfer rates, you will be able to find out which host issues a lot of I/O requests to the disk and to find out which host transfers a lot of data to the disk. For details on how to view statistics about traffic at ports, see section 5.3.

Note: Workload statistics are deleted from the disk subsystem after 24 hours. You will not be able to view statistics more than 24 hours old.

2.1.10 Viewing LU Path Traffic Statistics

Performance Monitor (Performance Management) tracks LU paths to obtain statistics about I/O rates and transfer rates at these LU paths. If you analyze these I/O rates and transfer rates, you will be able to detect LU paths through which a lot of I/O requests are made to the disk. You will also detect LU paths through which a lot of data are transferred to the disk. For details on how to view workload statistics about LU paths, see section 5.4.

Note: Workload statistics are deleted from the disk subsystem after 24 hours. You will not be able to view statistics more than 24 hours old.

2.1.11 Viewing Host Bus Adapters and Port Path Traffic Statistics

Host bus adapters (HBAs) are adapters contained in hosts. HBAs, which serve as ports on hosts, are connected to ports on the disk subsystem.

If Priority Access is enabled, Performance Monitor (Performance Management) lets you view statistics about traffic between HBAs and disk subsystem ports. The traffic statistics reveals the number of I/O requests that have been made from hosts and also reveals the size of data transferred between hosts and disk subsystem ports. For details on how to view traffic statistics about HBAs, see section 5.5.

Note: Traffic statistics are deleted from the disk subsystem after 24 hours. You will not be able to view statistics more than 24 hours old.

2.2 Monitoring the Disk Subsystem

Performance Monitor (Performance Management) allows you to monitor disk subsystem resources and disk drives, ports, LU paths and Host Bus Adapters (HBAs).

2.2.1 Monitoring Resources in the Disk Subsystem

Performance Monitor (Performance Management) provides the ability to obtain statistics about resources and saves those statistics every 12 hours. By default, Performance Monitor (Performance Management) starts saving statistics on 0:00 a.m. and 0:00 p.m. However, you can change the times by using the **From** and **To** controls in the Monitoring Term area (for details, see section 4.2.1).

You can also specify the range of usage statistics saved in the disk subsystem that you are interested in viewing (for details, see section 4.2.1).

To view resource usage statistics that are saved in the disk subsystem, see section 5.1.

2.2.2 Monitoring Disk Drives, Ports, LU Paths and Host Bus Adapters

When monitoring ports, LU paths or host bus adapters, you can view the monitoring results in almost real time (information in the panel will be updated every minute). If you want to view the monitoring results in real time, you must use the **Real Time** option, which is included in the **Monitoring Term** area of the **Hitachi Performance Monitor (Performance Management)** panel.

Note: You cannot view the monitoring results in real time when monitoring disk drives.

If you prefer to view the monitoring results for a specified period of time, you can do that by setting a specific time period.

Note: You will be able to view the monitoring results for the last 24 hours. If more than 24 hours have passed since a monitoring result was obtained, the result is erased from the disk subsystem and you will not be able to view that monitoring result.

Chapter 3 Preparing for Hitachi Performance Monitor (Performance Management) Operations

3.1 System Requirements

To be able to use Hitachi Performance Monitor (Performance Management), you need:

- the 9900V subsystem installed
- the Performance Monitor (Performance Management) software enabled
- a client PC(s) connected to the 9900V subsystem via LAN (intended for use as a Remote Console(s))

To use Hitachi Performance Monitor (Performance Management), 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 Hitachi Performance Monitor (Performance Management) 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 Remote Console - Storage Navigator™ User's Guide (MK-92RD101)*.

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

Hitachi Performance Monitor (Performance Management) 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 *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator™ User's Guide (MK-92RD101)*.

Starting Performance Monitor (Performance Management)

Before starting Performance Monitor (Performance Management), verify Remote Console is installed (refer to 3.1 above).

To start Performance Monitor (Performance Management):

1. Log onto the Remote Console (refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator™ User's Guide (MK-92RD101)*). The Remote Console main panel appears (see Figure 3.1).

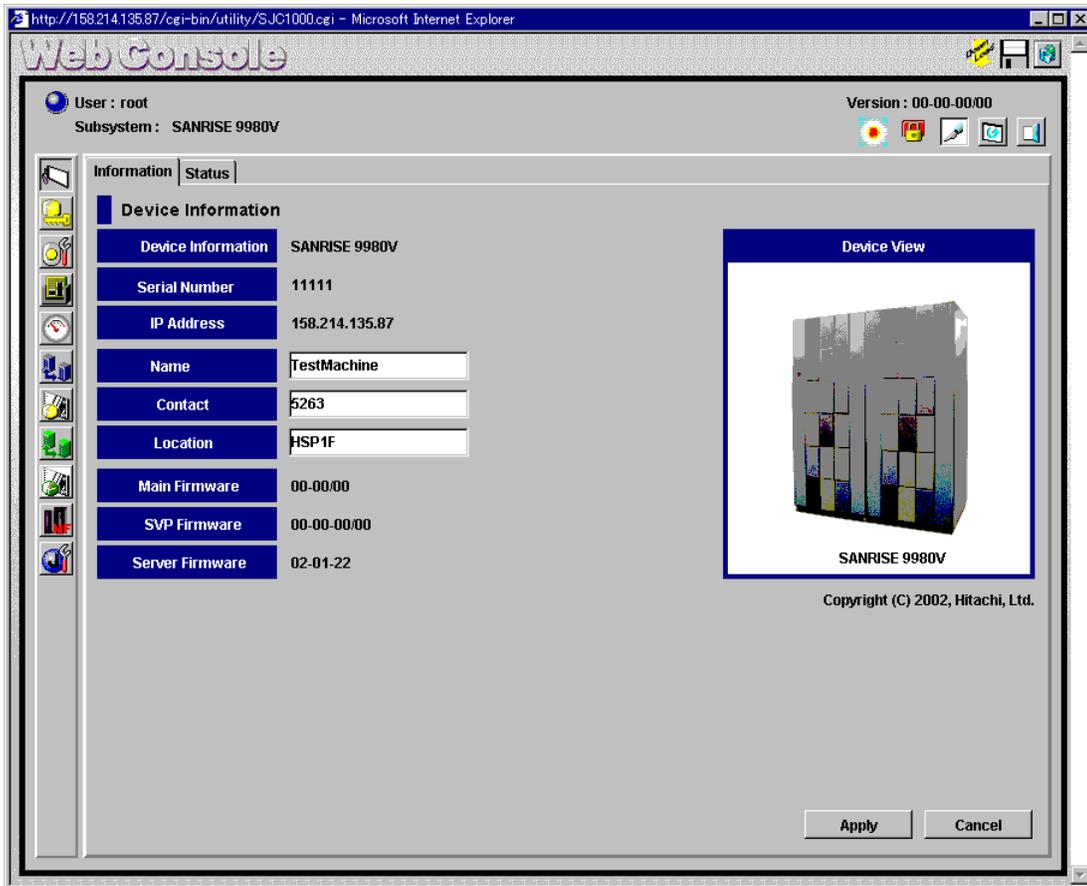


Figure 3.1 Remote Console Main Panel.

Note: Option buttons are displayed vertically along the left side.

2. In the Remote Console main panel, click the **Performance Monitor (Performance Management)** (📊) icon.

Performance Monitor (Performance Management) starts and the Hitachi Performance Monitor (Performance Management) panel appears as an overlay on the Remote Console Main panel (see Figure 3.1). **Note:** Performance Monitor (Performance Management) defaults to the Port-LUN tab.

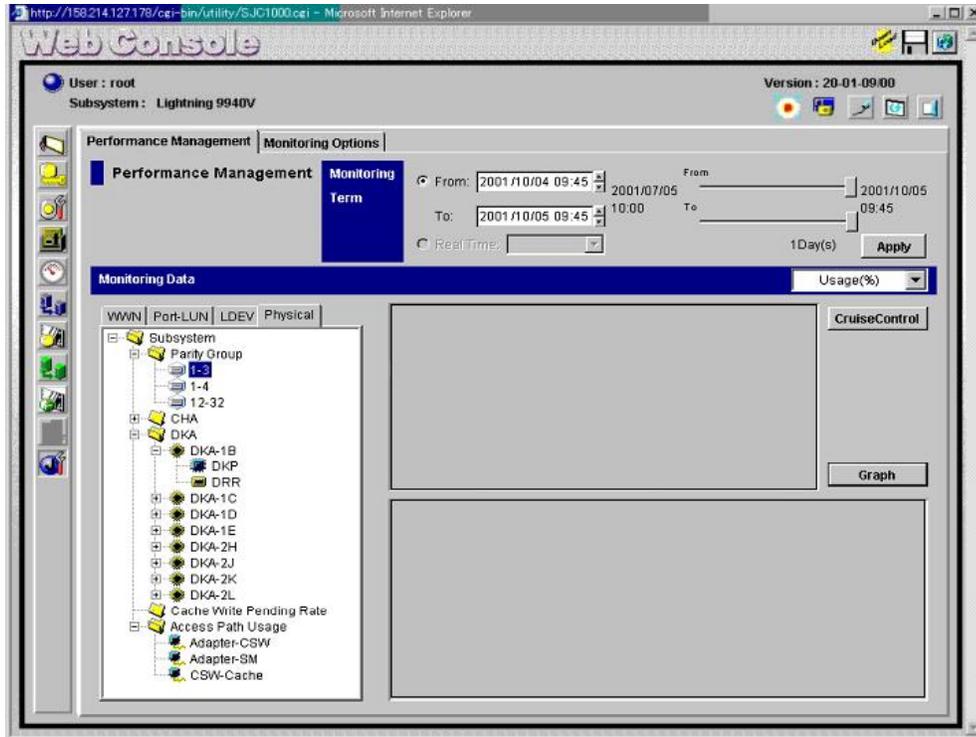


Figure 3.2 Performance Monitor (Performance Management) (Performance Manager) Default Panel

3.3 Switching to Modify Mode

If you are going to implement any changes in Performance Monitor (Performance Management), you must be in modify mode. The subsystem information icons are on the upper right corner of the Remote Console Main panel, as well as all of the option panels.

Note: The information might not be displayed correctly when the exclusive lock is effective or SVP maintenance is in progress or if SNMP operations are being performed.

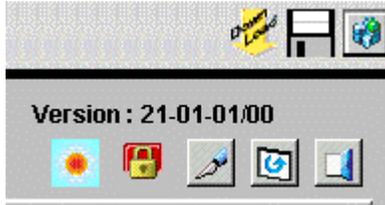


Figure 3.3 Subsystem Information Icons

These icons are described in detail in *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator (MK-92RD101)*. If you want to change from **View** mode to **Modify** mode and back, two of the icons are important:

- The exclusive lock icons indicate the operation mode of all currently logged-in users. If all users are operating in view mode, the **Unlocked** icon (🔓) is displayed. If a user is operating in the modify mode, the **Locked** icon (🔒) is displayed. **Note:** The display may show as **Locked** (🔒) when the SVP maintenance is in progress or if SNMP operations are being performed.
- The **Mode-Switching** buttons allow users to switch the operation mode between **View** mode (🖋️) and **Modify** mode (🔧). **Note:** Only one user at a time can be in **Modify** mode. Make sure that the subsystem is not locked before attempting to switch to **Modify** mode. If you select the **Mode-Switching** button a confirmation message will display.

To change from **View** mode to **Modify** mode:

1. You must have administrator or write access for the Performance Monitor (Performance Management) option. For details on assigning user access, see *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator (MK-92RD101)*.
2. Verify that the subsystem is unlocked. If all users are operating in view mode, the **Unlocked** icon (🔓) is displayed. If a user is operating in the modify mode, the **Locked** icon (🔒) is displayed, and you will not be able to implement changes (refer to Figure 3.3).
3. Select the **Mode Switching** icon, which should be in **View** mode (🖋️). A confirmation message will display. Select **OK** and the **Mode Switching** icon will change from a gray background to a yellow background, to indicate that you are in **Modify** mode (🔧) (refer to Figure 3.3). **Note:** The Unlocked icon changes to Locked.
4. Implement your desired changes, and then select the **Mode Switching** icon (🔧), to change back to **View** mode (🖋️). Click **OK** in the confirmation message. **Note:** The Locked icon changes to Unlocked.

3.4 Setting Monitoring Options

Before any data can be collected and statistics generated, monitoring options must be set in Performance Monitor (Performance Management).

To set the monitoring options:

1. From the Performance Monitor (Performance Management) panel, click the Monitoring Options tab.

The Monitoring Options panel appears as an overlay on the Remote Console Main panel (see Figure 3.2). **Note:** Only the overlay is shown here.

2. Set the appropriate monitoring settings as discussed below.

The screenshot shows the 'Monitoring Options' tab within the 'Performance Management' panel. It features two main sections: 'Long range monitoring S/W' and 'Short range monitoring S/W'. Each section includes a 'Current Status' field with radio buttons for 'ON' and 'OFF'. The 'Long range monitoring S/W' section also includes a 'Gathering Time' field with two dropdown menus for hours and minutes, followed by 'AM & PM'. At the bottom right, there are 'Apply' and 'Reset' buttons.

Figure 3.4 Monitoring Options Tab of the Performance Monitor (Performance Management) Panel

The Monitoring Options panel allows you make settings to obtain usage rates on disk drives, channel processors and disk processors. The Monitoring Options panel is divided into two functional areas: Long Range Monitoring and Short Range Monitoring.

- **Long Range Monitoring** allows collection of usage rates for disk subsystem resources.
 - **Current Status** specifies whether or not to monitor the disk subsystem. By default, **OFF** is selected.
 - **Gathering Time** specifies when statistics are collected. If **Current Status** is **ON**, statistics are collected at the specified times (once in the morning and once in the afternoon). The default is 0:00 (0:00 a.m. and 0:00 p.m.).

Note: When statistics are collected, a heavy workload is likely to be placed on servers. Therefore, the client processing might slow down.

- **Short Range Monitoring** allows collection of workload statistics for disks, ports, and LU paths. It defines settings for obtaining statistics on traffic between host bus adapters and disk subsystems ports.
 - **Current Status** specifies whether or not to monitor the disk subsystem. If **ON** is selected, the disk subsystem will be monitored. If **OFF** is selected, the disk subsystem will not be monitored. By default, **OFF** is selected.

Caution: If you select **ON** for the **Current Status** option, the option setting automatically changes to **OFF** 24 hours later.

Note: When monitoring data is collected, a heavy workload is likely to be placed on servers. Therefore, the client processing might slow down.

3.4.1 Starting Long Range Monitoring Software

To start long range monitoring:

1. Under Long range monitoring S/W, select **ON** for the Current Status option.
2. Specify the time when the SVP collects statistics using the two **Gathering Time** drop-down lists.
3. Click the **Apply** button. Performance Monitor (Performance Management) starts monitoring the disk subsystem.

3.4.2 Stopping Long Range Monitoring Software

To stop monitoring the disk subsystem:

1. Select **OFF** for the Current Status option.
3. Click **Apply**.

Note: If you stop monitoring, Performance Monitor (Performance Management) stops collecting statistics.

3.4.3 Starting Short Range Monitoring Software

To start short range monitoring:

1. Under Short range monitoring S/W, select **ON** for the Current Status option.
2. Click the **Apply** button. Performance Monitor (Performance Management) starts monitoring the disk subsystem.

3.4.4 Stopping Short Range Monitoring Software

To stop monitoring the disk subsystem:

1. Select **OFF** for the Current Status option.
2. Click **Apply**.

Note: If you stop monitoring, Performance Monitor (Performance Management) stops collecting statistics.

Chapter 4 Reviewing Performance Monitor (Performance Management) Panels

4.1 The Monitoring Options Panel

The Monitoring Options panel is available only after Remote Console has been installed (refer to 3.1) and Performance Monitor (Performance Management) has been started (refer to section 3.3). When Performance Monitor (Performance Management) starts, the Performance Monitor (Performance Management) panel appears (as an overlay on the Remote Console Main panel) as shown in Figure 4.2.

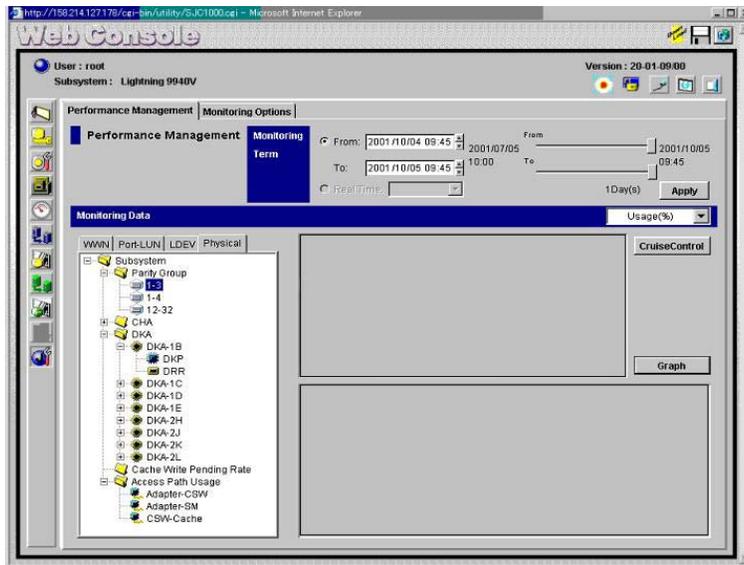


Figure 4.1 Performance Monitor (Performance Management) Panel

When you click the **Monitoring Options** tab, the Monitoring Options panel appears as an overlay on the Remote Console Main panel as shown in Figure 4.2. **Note:** Only the overlay is shown here.

The screenshot shows a web-based interface for 'Performance Management' with a 'Monitoring Options' tab. The main heading is 'Monitoring Options'. Below it, there are two distinct sections, each with a dark blue header bar. The first section is 'Long range monitoring SW'. It contains a 'Current Status' field with two radio buttons: 'ON' (unselected) and 'OFF' (selected). Below this is a 'Gathering Time' field consisting of two dropdown menus, both showing '00', followed by the text 'AM & PM'. The second section is 'Short range monitoring SW'. It contains a 'Current Status' field with two radio buttons: 'ON' (unselected) and 'OFF' (selected). At the bottom right of the panel, there are two buttons: 'Apply' and 'Reset'.

Figure 4.2 The Monitoring Options Panel of Performance Monitor (Performance Management)

The Monitoring Options panel allows you make settings to obtain usage rates on disk drives, channel processors and disk processors. The Monitoring Options panel is divided into two functional areas: Long Range Monitoring and Short Range Monitoring.

- **Long Range Monitoring** allows collection of usage rates for disk subsystem resources.
 - **Current Status** specifies whether or not to monitor the disk subsystem. By default, **OFF** is selected.
 - **Gathering Time** specifies when statistics are collected. If **Current Status** is **ON**, statistics are collected at the specified times (once in the morning and once in the afternoon). The default is 0:00 (0:00 a.m. and 0:00 p.m.).

Note: When statistics are collected, a heavy workload is likely to be placed on servers. Therefore, the client processing might slow down.

- **Short Range Monitoring** allows collection of workload statistics for disks, ports, and LU paths. It defines settings for obtaining statistics on traffic between host bus adapters and disk subsystems ports.
 - **Current Status** specifies whether or not to monitor the disk subsystem. If **ON** is selected, the disk subsystem will be monitored. If **OFF** is selected, the disk subsystem will not be monitored. By default, **OFF** is selected.

Caution: If you select **ON** for the **Current Status** option, the option setting automatically changes to **OFF** 24 hours later.

Note: When monitoring data is collected, a heavy workload is likely to be placed on servers. Therefore, the client processing might slow down.

- The **Apply** button applies settings in the Monitoring Options panel to the disk subsystem.
- The **Reset** button resets the settings in the Monitoring Options panel.

4.2 The Performance Monitor (Performance Management) Panels

The Performance Monitor (Performance Management)ing panel is available only after Remote Console has been installed (refer to 3.1) and Performance Monitor (Performance Management) has been started (refer to section 3.3). When Performance Monitor (Performance Management) starts, the Performance Monitor (Performance Management) panel appears as an overlay on the Remote Console Main panel (refer to Figure 4.2).

This section describes options, buttons and other components in Performance Monitor (Performance Management) panels.

Note: Only the overlay portion of each Performance Monitor (Performance Management) panel is depicted. All Remote Console Main panel Option buttons and Subsystem Information icons are available but not depicted. For details, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide (MK-92RD101)*.

4.2.1 The Physical Tab of the Hitachi Performance Monitor (Performance Management) Panel

The Hitachi Performance Monitor (Performance Management) panel includes four tabs: WWN, Port-LUN, LDEV, and Physical. The **Physical** tab, lets you view usage rates for parity groups, logical volumes, channel processors, and disk processors (see Figure 4.3).

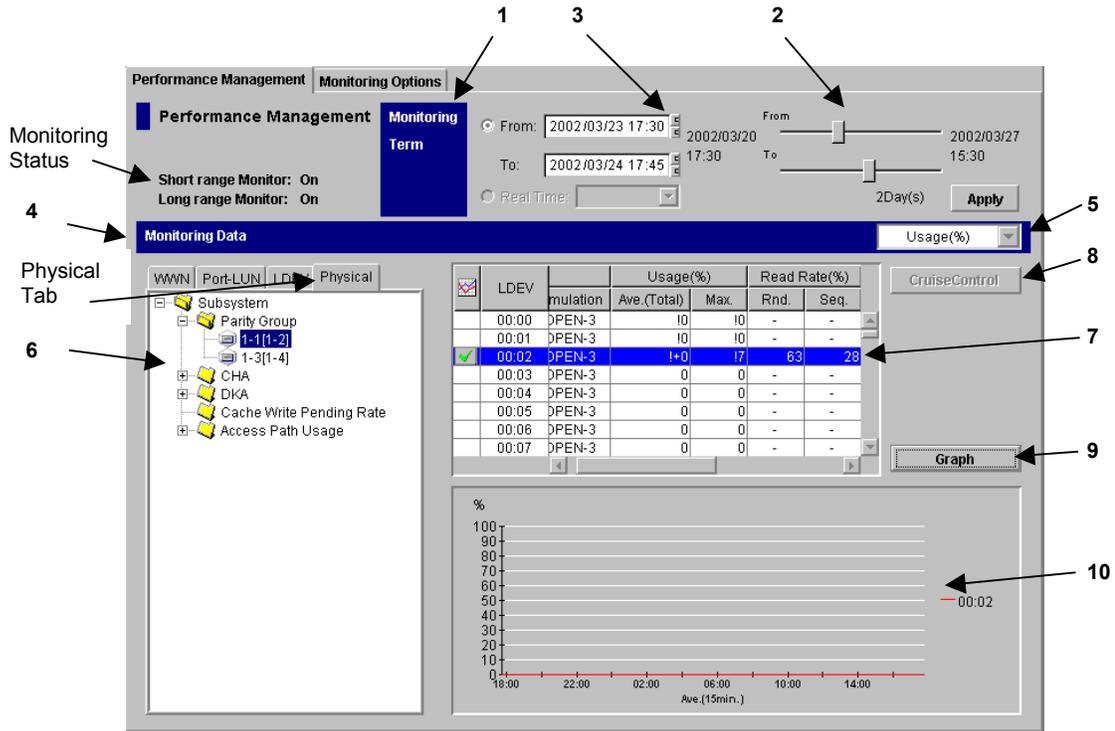


Figure 4.3 Physical Tab

When the **Physical** tab is active, the Hitachi Performance Monitor (Performance Management) panel contains the following items (each is numbered and corresponds to the figure numbering).

- **Monitoring Status:** lets you quickly determine current monitoring mode.
 - When **Short range Monitor** is **On**, Performance Monitor (Performance Management) is monitoring resources in the disk subsystem to obtain usage statistics. When Short range Monitor is **Off**, Performance Monitor (Performance Management) is not monitoring resources in the disk subsystem.
 - When **Long range Monitor** is **On**, Performance Monitor (Performance Management) is monitoring disks, ports, and LU paths to obtain workload statistics. Performance Monitor (Performance Management) is also measuring traffic between host bus adapters and ports. When Long range Monitor is **Off**, Performance Monitor (Performance Management) is not monitoring disks, ports, and LU paths. Performance Monitor (Performance Management) is not measuring traffic between host bus adapters and ports.

- **The Monitoring Term Area ①** - lets you narrow the range of usage statistics that should be displayed in the panel. For example, if you want to view usage statistics within the range of 10:30 July 1 2001 to 22:30 July 31 2001, you set 2001/07/01 10:30 in the **From** box, set 2001/07/31 22:30 in the **To** box, and then click the **Apply** button.

To set a date and time in the **From** and **To** boxes, do either of the following:

- Move the slider ② to the left or to the right.
- In the text box ③, select the number that you want to change. Next, click the upward or downward arrow button.

When you specify dates and time in the **From** and **To** boxes, Performance Monitor (Performance Management) calculates the length (in days) of the specified period and displays the calculated length. When calculating the length in days, Performance Monitor (Performance Management) rounds up the fraction.

Notes:

- The **From** and **To** boxes are grayed out if the monitoring data (that is, usage statistics) is not stored in the disk subsystem.
- The **Real Time** option is grayed out when the **Physical** tab is active.

- **The Monitoring Data Area ④** - provides a drop down list, a tree view, a table, and a line graph as follows:

- the drop-down list ⑤ specifies the type of statistics to be displayed in the panel. When the **Physical** tab is active, the drop-down list contains only one entry (i.e., **Usage**).
- The tree view ⑥ lists parity groups, channel adapters (CHAs), and disk adapters (DKAs).

The parity group icon (🗄️) can represent a single parity group. The parity group icon can also represent two or more parity groups that are connected together. If two or more parity groups are connected together, logical volumes can be striped across two or more drives. Therefore, connected parity groups provide faster access (particularly, faster sequential access) to data.

For example, if the parity group icon (🗄️) indicates a single parity group 1-3, the text 1-3 appears on the right of the icon. If the parity group icon indicates two or more parity groups that are connected together, all the connected parity groups appear on the right of the icon. For example, if the parity group 1-3 is connected with the parity group 1-4, the text 1-3[1-4] appears on the right of the parity group icon. (All the parity groups connected with 1-3 are enclosed by square brackets).

Note: Web Console does not allow you to connect two or more parity groups. If you want to use connected parity groups, contact the maintenance personnel.

- The table ⑦ area displays statistics about parity group usage, processor usage, etc. If you select connected parity groups in the tree view, the table displays usage statistics for all the connected parity groups.
- The **CruiseControl** button ⑧ starts the Hitachi CruiseControl option program if Hitachi CruiseControl is enabled. Hitachi CruiseControl lets you optimize disk drive performance. For details, see *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi CruiseControl User's Guide* (MK-92RD106).

- The **Graph** button  displays a line graph that illustrates changes in usage statistics. The graph can display up to eight lines simultaneously.
- The line graph  illustrates changes in usage statistics. The vertical axis indicates the usage rates (in percentage). The horizontal axis indicates dates and/or times. If you select connected parity groups in the tree view, the graph displays changes in usage statistics for all the connected parity groups.

4.2.2 The LDEV Tab of the Hitachi Performance Monitor (Performance Management) Panel

The Hitachi Performance Monitor (Performance Management) panel includes the **LDEV** tab, which lets you view statistics about disk access performance. For example, the panel displays the *I/O rate* (the number of I/Os per second) and the *transfer rate* (the size of data transferred per second) for parity groups and logical volumes.

For details on how to use this panel, see section 5.2.

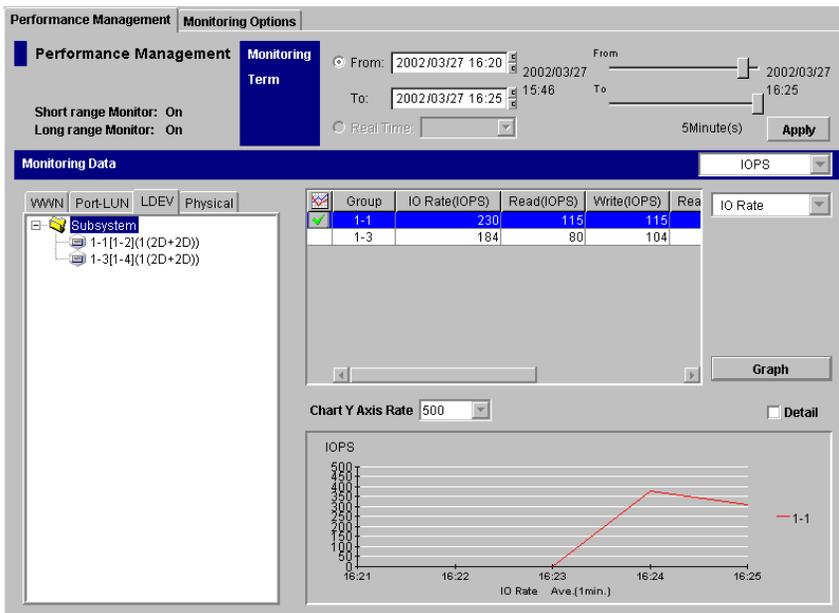


Figure 4.4 The LDEV Tab

When the **LDEV** tab is active, the Hitachi Performance Monitor (Performance Management) panel contains the following items:

- **Monitoring Status:** lets you quickly determine current monitoring mode.
 - When **Short range Monitor** is **On**, Performance Monitor (Performance Management) is monitoring resources in the disk subsystem to obtain usage statistics. When **Short range Monitor** is **Off**, Performance Monitor (Performance Management) is not monitoring resources in the disk subsystem.

- When **Long range Monitor** is **On**, Performance Monitor (Performance Management) is monitoring disks, ports, and LU paths to obtain workload statistics. Performance Monitor (Performance Management) is also measuring traffic between host bus adapters and ports. When Long range Monitor is **Off**, Performance Monitor (Performance Management) is not monitoring disks, ports, and LU paths. Performance Monitor (Performance Management) is not measuring traffic between host bus adapters and ports.
- **The Monitoring Term Area** - lets you narrow the range of usage statistics that should be displayed in the panel. For example, if you want to view usage statistics within the range of 10:30 July 1 2001 to 22:30 July 31 2001, you set 2001/07/01 10:30 in the **From** box, set 2001/07/31 22:30 in the **To** box, and then click the **Apply** button.

To set a date and time in the **From** and **To** boxes, do either of the following:

- Move the slider to the left or to the right.
- In the text box, select the number that you want to change. Next, click the upward or downward arrow button.

When you specify dates and time in the **From** and **To** boxes, Performance Monitor (Performance Management) calculates the length (in days) of the specified period and displays the calculated length. When calculating the length in days, Performance Monitor (Performance Management) rounds up the fraction.

Notes:

- The **From** and **To** boxes are grayed out if the monitoring data (that is, usage statistics) is not stored in the disk subsystem.
- The **Real Time** option is grayed out when the **LDEV** tab is active.
- **The Monitoring Data Area** - provides a drop down list, tree view, table area, graph button, Chart Y drop down, Detail check box, and line graph as follows:
 - The drop-down list lets you specify the type of statistics to be displayed in the panel. To view the I/O rate, select **IOPS** (I/Os per second) from the drop-down list. To view the transfer rate, select **MB/s** (megabytes per second) from the drop-down list.
 - The tree view lists parity groups. When you double-click a parity group, the table area lists logical volumes in the parity group.

The parity group icon () can represent a single parity group. The parity group icon can also represent two or more parity groups that are connected together. If two or more parity groups are connected together, logical volumes can be striped across two or more drives. Therefore, connected parity groups provide faster access (particularly, faster sequential access) to data.

For example, if the parity group icon () indicates a single parity group 1-3, the text 1-3 appears on the right of the icon. If the parity group icon indicates two or more parity groups that are connected together, all the connected parity groups appear on the right of the icon. For example, if the parity group 1-3 is connected with the parity group 1-4, the text 1-3[1-4] appears on the right of the parity group icon. (All the parity groups connected with 1-3 are enclosed by square brackets).

Note: Web Console does not allow you to connect two or more parity groups. If you want to use connected parity groups, contact the maintenance personnel.

- The table area displays statistics about disk access performance (for example, I/O rate, transfer rate, read hit ratio, and write hit ratio). For details on the table contents, see section 5.2.

If you select connected parity groups in the tree view, the table displays usage statistics for all the connected parity groups.

- The **Graph** button displays a line graph that illustrates changes in the I/O rate and the transfer rate. The graph can display up to eight lines simultaneously.
- Before clicking the **Graph** button, you should use the drop-down list at the lower-right corner of the table to specify the type of information that will be displayed in the graph. The drop-down list contains the following items:
 - **IO Rate** (The I/O rate. The number of I/O accesses per second)
 - **Read** (The number of read accesses per second)
 - **Write** (The number of write accesses per second)
 - **Read Hit** (Read hit ratio)
 - **Write Hit** (Write hit ratio)
 - **Back Transfer** (Backend transfer. The number of data transfers between the cache memory and the disk)
 - **Trans. Rate** (The transfer rate. The size of data transferred per second)
- The **Chart Y Axis Rate** drop-down list lets you select the highest value of the Y-axis (the vertical axis) of the graph.
- If you select the **Detail** check box, the graph displays detailed statistics as described in Table 4.1. The information in the graph depends on the item selected in the drop-down list on the left of the **Detail** check box.

Table 4.1 Detailed Information that can be Displayed in the Graph

If you select Detail and also select this item in the drop-down list	The graph presents
IO Rate (the number of I/Os per second)	- statistics in sequential access mode
Read (the number of read accesses per second)	- statistics in random access mode
Write (the number of write accesses per second)	- statistics in CFW (cache fast write) mode
Read Hit (the read hit ratio)	Note: If the read hit ratio or the write hit ratio is high, random access mode is used for transferring data instead of sequential access mode. For example, random access mode is likely to be used for transferring data to disk areas to which the FlashAccess function is applied.
Write Hit (the write hit ratio)	
Back Transfer (backend transfer; the number of I/Os between the cache memory and disk drives)	- the number of data transfers from the cache memory to disk drives - the number of data transfers from disk drives to the cache memory in sequential access mode - the number of data transfers from disk drives to the cache memory in random access mode
Trans. Rate (the number of data transfers)	The graph does not display detailed information.

- The line graph illustrates changes in the I/O rate and the transfer rate. The vertical axis indicates the usage rates (in percentage). The horizontal axis indicates dates and/or times.

4.2.3 The Port-LUN Tab of the Hitachi Performance Monitor (Performance Management) Panel

The Hitachi Performance Monitor (Performance Management) panel includes the **Port-LUN** tab, which lets you view statistics about I/O rates and transfer rates at disk subsystem ports and LU paths.

For details on how to use this panel, see sections 5.3 and 5.4.

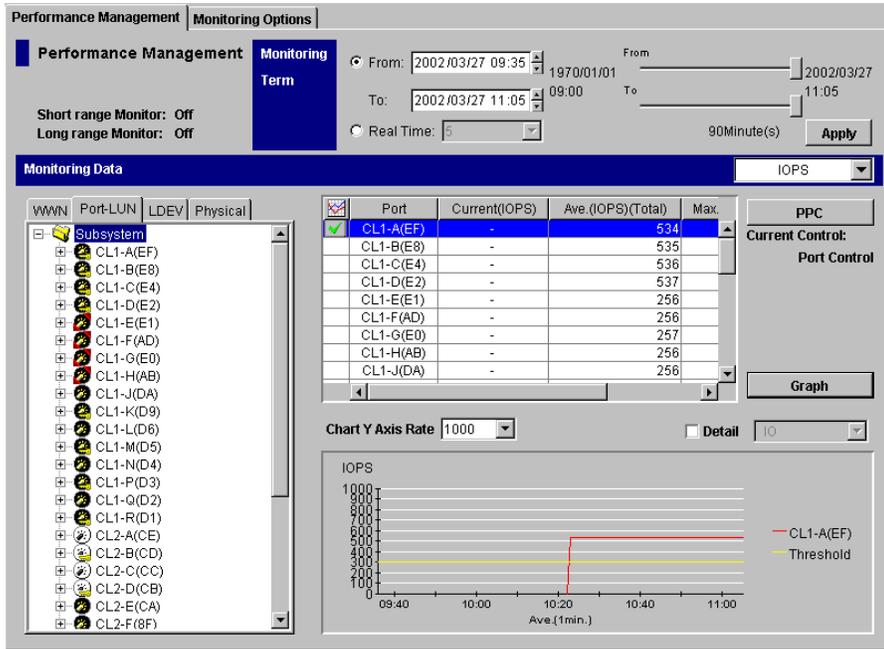


Figure 4.5 The Port-LUN Tab

When the **Port-LUN** tab is active, the Hitachi Performance Monitor (Performance Management) panel contains the following items:

- **Monitoring Status:** lets you quickly determine current monitoring mode.
 - When **Short range Monitor** is **On**, Performance Monitor (Performance Management) is monitoring resources in the disk subsystem to obtain usage statistics. When Short range Monitor is **Off**, Performance Monitor (Performance Management) is not monitoring resources in the disk subsystem.
 - When **Long range Monitor** is **On**, Performance Monitor (Performance Management) is monitoring disks, ports, and LU paths to obtain workload statistics. Performance Monitor (Performance Management) is also measuring traffic between host bus adapters and ports. When Long range Monitor is **Off**, Performance Monitor (Performance Management) is not monitoring disks, ports, and LU paths. Performance Monitor (Performance Management) is not measuring traffic between host bus adapters and ports.

- **The Monitoring Term Area** - provides **From** and **To** options and **Real Time** options as follows:
 - The **From** and **To** options let you narrow the range of statistics that should be displayed in the panel. For example, if you want to view statistics within the range of 10:30 July 1 2001 to 10:30 July 2 2001, you set 2001/07/01 10:30 in the **From** box, set 2001/07/02 10:30 in the **To** box, and then click the **Apply** button.

To set a date and time in the **From** and **To** boxes, do either of the following:

 - Move the slider to the left or to the right.
 - In the text box, select the number that you want to change. Next, click the upward or downward arrow button.

When you specify dates and time in the **From** and **To** boxes, Performance Monitor (Performance Management) calculates the length (in minutes) of the specified period and displays the calculated length. When calculating the length in minutes, Performance Monitor (Performance Management) rounds up the fraction.

Note: The **From** and **To** boxes are grayed out if the monitoring data (that is, obtained statistics) is not stored in the disk subsystem.
 - The **Real Time** option lets you view statistics in real-time mode. The statistics will be updated every minute.

The drop-down list lets you specify the range of data that should be displayed in the graph. For example, if you select **90**, the graph displays statistics for the last 90 minutes.
- **The Monitoring Data Area** - provides a drop down list, tree view, table area, Priority Access (PPC) button, graph button, Chart Y drop down, Detail check box, and line graph as follows:
 - The drop-down list lets you specify the type of statistics to be displayed in the panel. To view I/O rates, select **IOPS** (I/Os per second) from the drop-down list. To view transfer rates, select **MB/s** (megabytes per second) from the drop-down list.
 - The tree view area contains the Subsystem folder. Below the Subsystem folder are ports (such as  and ). When you double-click a port, the Host Storage Domains () that correspond to that port appear. When you double-click a host group, an item named **LUN** () appears. When you select **LUN**, the table area lists LU paths. For details of Host Storage Domains and LU paths, refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105).
 - The table displays statistics (that is, I/O rates or transfer rates). For details on the table contents, see sections 5.3 and 5.4.
 - The Priority Access (PPC) button starts the Priority Access option program if Priority Access is enabled. For details on Priority Access, refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117).
 - If the **Current Control** label displays **Port Control**, the system is controlled by the upper limits and the threshold specified in the **Port** tab of the Priority Access (Prioritized Port Control) panel (refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117), Figure 4.1).

If the **Current Control** label displays **WWN Control**, the system is controlled by the upper limits and the threshold specified in the **WWN** tab of the Priority Access (Prioritized Port Control) panel (refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117), Figure 4.2).

If the **Current Control** label displays **No Control**, system performance is not controlled by Priority Access (Prioritized Port Control).

- The **Graph** button displays a line graph that illustrates changes in the I/O rate or the transfer rate. The graph can display up to eight lines simultaneously.
- The **Chart Y Axis Rate** drop-down list lets you select the highest value of the Y-axis (the vertical axis) of the graph.
- If you select the **Detail** check box, the graph displays information as explained below:
 - If you select a port in the table, select the **Detail** check box and then select the **Graph** button, the graph displays detailed statistics about workloads on the port selected in the table.

If you select **LUN** (🗄️) in the tree view, select the **Detail** check box and then select the **Graph** button, the graph displays detailed statistics as explained in Table 4.2. The information in the graph depends on the item selected in the drop-down list on the right of the **Detail** check box.

Table 4.2 Detailed Information that can be Displayed in the Graph

If you select Detail and also select this item in the drop-down list	The graph presents
IO Rate (the number of I/Os per second)	- statistics in sequential access mode
Read (the number of read accesses per second)	- statistics in random access mode
Write (the number of write accesses per second)	- statistics in CFW (cache fast write) mode
Read Hit (the read hit ratio)	Note: If the read hit ratio or the write hit ratio is high, random access mode is used for transferring data instead of sequential access mode. For example, random access mode is likely to be used for transferring data to disk areas to which the FlashAccess function is applied.
Write Hit (the write hit ratio)	
Back Transfer (backend transfer; the number of I/Os between the cache memory and disk drives)	- the number of data transfers from the cache memory to disk drives - the number of data transfers from disk drives to the cache memory in sequential access mode - the number of data transfers from disk drives to the cache memory in random access mode
Trans. Rate (the number of data transfers)	The graph does not display detailed information.

- The line graph illustrates changes in the I/O rate or the transfer rate. The vertical axis indicates the I/O rate or the transfer rate. The horizontal axis indicates dates and/or times.

When the graph displays I/O rates or the transfer rates for a port controlled by an upper limit or a threshold, the graph also displays a line that indicates the upper limit or the threshold.

For example, if you select the port CL1-A in the table and then click **Graph**, the graph contents changes as explained in Figure 4.6 below. The figure explains the following facts:

- The workload on the port CL1-A is 200 IO/s at 8:00, and 300 IO/s at 10:00 (see the graph on the left).
- For the period of 7:59 to 8:00, the maximum workload on CL1-A is 300 IO/s. The average workload on CL1-A is 200 IO/s. The minimum workload on CL1-A is 100 IO/s (see the graph on the right).
- For the period of 9:59 to 10:00, the maximum workload on CL1-A is 400 IO/s. The average workload on CL1-A is 300 IO/s. The minimum workload on CL1-A is 200 IO/s (see the graph on the right).
- When **Detail** is deselected, only one line appears in the graph. This line is equivalent to the line *Ave. (1 min)*, which appears when **Detail** is selected.

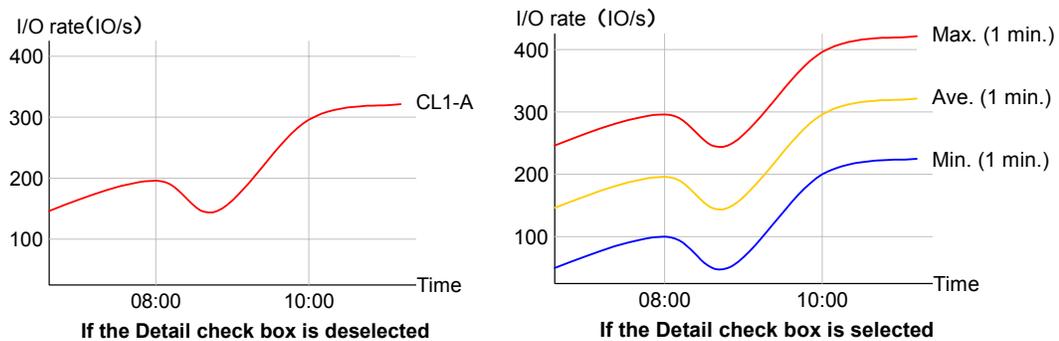


Figure 4.6 The graphs that illustrate Changes in Workloads on a Port

4.2.4 The WWN Tab of the Hitachi Performance Monitor (Performance Management) Panel

The Hitachi Performance Monitor (Performance Management) panel includes the **WWN** tab, which lets you view statistics (I/O rates and transfer rates) about traffic between host bus adapters in the hosts and ports on the disk subsystem.

Caution: The **WWN** tab is grayed out and cannot be used if Priority Access is not enabled (for details, please refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117)).

Note: A **WWN** (Worldwide Name) is a 16-digit hexadecimal number used as the unique identifier for a host bus adapter. Host bus adapters are contained in hosts and serve as ports for connecting the hosts and the disk subsystem. One WWN represents one host bus adapter.

For details on how to use this panel, see section 5.5.

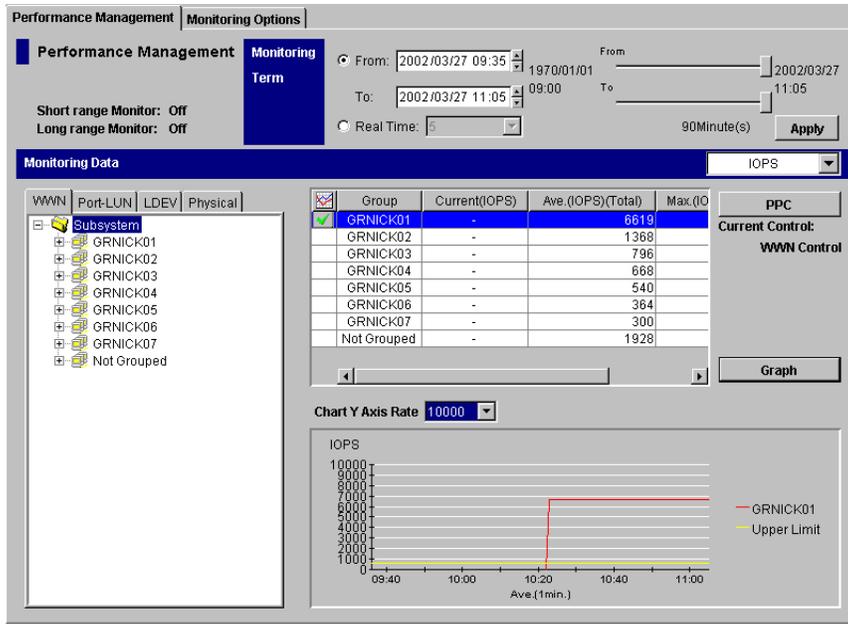


Figure 4.7 The WWN Tab

When the **WWN** tab is active, the Hitachi Performance Monitor (Performance Management) panel contains the following items:

- **Monitoring Status:** lets you quickly determine current monitoring mode.
 - When **Short range Monitor** is **On**, Performance Monitor (Performance Management) is monitoring resources in the disk subsystem to obtain usage statistics. When Short range Monitor is **Off**, Performance Monitor (Performance Management) is not monitoring resources in the disk subsystem.
 - When **Long range Monitor** is **On**, Performance Monitor (Performance Management) is monitoring disks, ports, and LU paths to obtain workload statistics. Performance Monitor (Performance Management) is also measuring traffic between host bus adapters and ports. When Long range Monitor is **Off**, Performance Monitor (Performance Management) is not monitoring disks, ports, and LU paths. Performance Monitor (Performance Management) is not measuring traffic between host bus adapters and ports.

- **The Monitoring Term Area** - provides **From** and **To** options and **Real Time** options as follows:
 - The **From** and **To** options let you narrow the range of statistics that should be displayed in the panel. For example, if you want to view statistics within the range of 10:30 July 1 2001 to 10:30 July 2 2001, you set 2001/07/01 10:30 in the **From** box, set 2001/07/02 10:30 in the **To** box, and then click the **Apply** button.
 - To set a date and time in the **From** and **To** boxes, do either of the following:
 - Move the slider to the left or to the right.
 - In the text box, select the number that you want to change. Next, click the upward or downward arrow button.

When you specify dates and time in the **From** and **To** boxes, Performance Monitor (Performance Management) calculates the length (in minutes) of the specified period and displays the calculated length. When calculating the length in minutes, Performance Monitor (Performance Management) rounds up the fraction.

Note: The **From** and **To** boxes are grayed out if the monitoring data (that is, obtained statistics) is not stored in the disk subsystem.
 - The **Real Time** option lets you view statistics in real-time mode. The statistics will be updated every minute.

The drop-down list lets you specify the range of data that should be displayed in the graph. For example, if you select **90**, the graph displays statistics for the last 90 minutes.
- **The Monitoring Data Area** - provides a drop down list, tree view, table area, Priority Access (PPC) button, graph button, Chart Y drop down, and line graph as follows:
 - The drop-down list lets you specify the type of statistics to be displayed in the panel. To view I/O rates, select **IOPS** (I/Os per second) from the drop-down list. To view transfer rates, select **100KB/s** (megabytes per second) from the drop-down list.
 - The tree area view contains the Subsystem folder. Below the Subsystem folder are *Priority Access (PPC) groups*, which are groups of multiple *WWNs*. When you double-click a Priority Access (PPC) group (📁), the host bus adapters (🖨️) belonging to that Priority Access (PPC) group appear. On the right of the 🖨️ icon appear the *WWN* and the *Priority Access (PPC) name* of the host bus adapter. A *WWN* is a 16-digit hexadecimal number used to identify a host bus adapter. The system administrator assigns a *Priority Access (PPC) name* to each host bus adapter so that the host bus adapter can easily be identified.
 - If you double-click **Not Grouped** in the tree view, host bus adapters (*WWNs*) that do not belong to any Priority Access group appear.
 - Note:** If the *WWN* of a host bus adapter is displayed by red in the tree view, the host bus adapter is connected to two or more ports, but the traffic between the HBA and some of the ports are *not* controlled by Priority Access (Prioritized Port Control). Refer to section 6.2 for how to control the traffic between the HBA and the all the connected ports.
 - The table area displays statistics (that is, I/O rates or transfer rates). For details on the table contents, see section 5.5.

- The **Priority Access (PPC)** button starts the Priority Access option program if Priority Access is enabled. For details on Priority Access, refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117).
- If the **Current Control** label displays **Port Control**, the system is controlled by the upper limits and the threshold specified in the **Port** tab of the Priority Access (Prioritized Port Control) panel (refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117), Figure 4.1).

If the **Current Control** label displays **WWN Control**, the system is controlled by the upper limits and the threshold specified in the **WWN** tab of the Priority Access (Prioritized Port Control) panel (refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide* (MK-92RD117), Figure 4.2).
- If the **Current Control** label displays **No Control**, system performance is not controlled by Priority Access (Prioritized Port Control).
- The **Graph** button displays a line graph that illustrates changes in the I/O rate or the transfer rate. The graph can display up to eight lines simultaneously.
- The **Chart Y Axis Rate** drop-down list lets you select the highest value of the Y-axis (the vertical axis) of the graph.
- The line graph illustrates changes in the I/O rate or the transfer rate. The vertical axis indicates the usage rates (in percentage). The horizontal axis indicates dates and/or times.

When the graph displays I/O rates or the transfer rates for a host bus adapter or a Priority Access (PPC) group controlled by an upper limit or a threshold, the graph also displays a line that indicates the upper limit or the threshold.

Chapter 5 Performing Performance Monitor (Performance Management) Operations

After you have prepared for Performance Monitor (Performance Management) operations as described in Chapter 3, you are ready to start performing monitoring operations that include:

- Monitoring Resources in the Disk Subsystem (see section 5.1)
- Monitoring Disk Drives (see section 5.2)
- Monitoring Ports (see section 5.3)
- Monitoring LU Paths (see section 5.4)
- Monitoring Paths Between Host Bus Adapters and Ports (see section 5.5)

5.1 Monitoring Resources in the Disk Subsystem

This section describes how to view usage statistics on resources in the disk subsystem.

Notes:

- To be able to view the latest statistics, you must be in the Modify mode of Remote Console prior to selecting the Physical tab from the Performance Monitor (Performance Management) (for details, refer to sections 3.3 and 5.1.9).
- You will be able to view usage statistics that have been obtained for the last three months (i.e., 93 days). You will not be able to view usage statistics that were obtained 94 days ago or earlier because such statistics are erased from the disk subsystem.
- When you are using Performance Monitor (Performance Management), the following message might appear (see Figure 5.1). When this message is displayed, the SVP is calculating obtained statistics to update information in the panel. This message might disappear as fast as in a couple of seconds, but sometimes in a couple of minutes. For example, this message might remain for a long time if SVP is forced to perform a lot of processing.



Figure 5.1 The Processing Message

5.1.1 Collecting Statistics About Resource Usage

To start monitoring the disk subsystem:

1. In the Performance Monitor (Performance Management) panel, click the Monitoring Options tab.
The Monitoring Options panel appears (see Figure 5.2).
2. In **Long range monitoring S/W**, select **ON** for the **Current Status** option.
3. Using the two **Gathering Time** drop-down lists, specify the time when the SVP collects statistics.
4. Click **Apply**. Performance Monitor (Performance Management) starts monitoring the disk subsystem.

Tip: To stop monitoring the disk subsystem, refer to section 3.4.2.

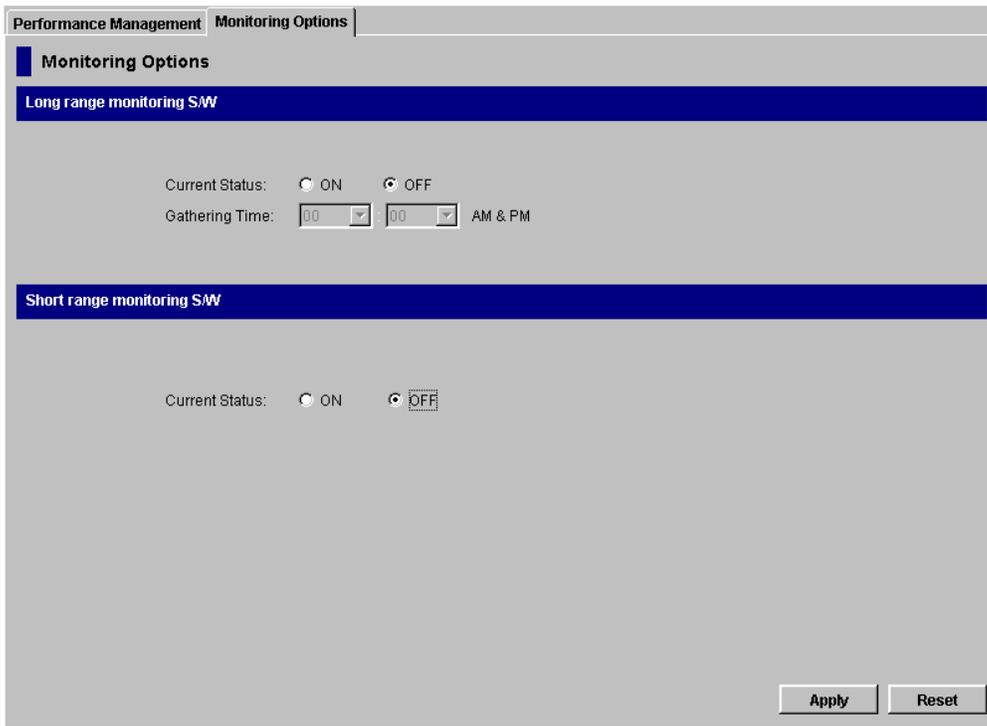


Figure 5.2 Setting Long Range Monitoring in the Monitoring Options Tab

5.1.2 Viewing Usage Statistics About Parity Groups

Performance Monitor (Performance Management) tracks parity groups and lets you view the average and the maximum usage rate in a specified period. Performance Monitor (Performance Management) also displays a graph that illustrates changes in parity group usage within that period.

Note: You must be monitoring the disk subsystem before usage statistics can be viewed (for details, refer to section Error! Reference source not found.).

To view usage statistics about parity groups:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. In the tree view, click the **Physical** tab and select the **Parity Group** folder (see Figure 5.3).

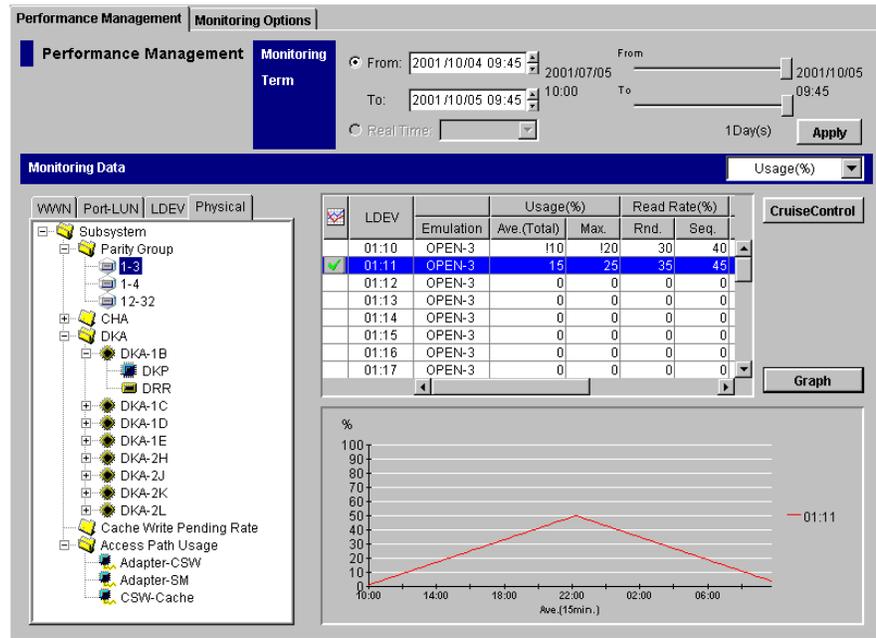


Figure 5.3 The Physical Tab of the Performance Monitor (Performance Management) Panel

The table area displays usage statistics about parity groups (see Figure 5.4). The displayed statistics are the average and the maximum usage rates for the period specified in the From and To boxes.

Notes:

- If you change the date and time in the **From** and **To** boxes and then click the **Apply** button, Performance Monitor (Performance Management) recalculates usage rates and updates information in the table. To change the date and time in the **From** and **To** boxes, use the arrow buttons and the sliders (for details, refer to section 4.2.1).
 - If an exclamation mark (!) is displayed before a usage rate, the reported parity group usage rate is likely to be inaccurate, because the configuration has changed (e.g., volumes have been moved by Hitachi CruiseControl or ShadowImage, or changed by Virtual LVI).
3. To display a graph that illustrates changes in usage rate for parity groups, select the desired parity groups in the table area and then click the **Graph** button (see Figure 5.4)

Note: The length of the monitoring period affects the time period represented by a graduation on the horizontal axis.

Caution: If the graph does not display changes in the usage rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

	PG			Usage(%)	
		RAID	Drive Type	Ave.(Total)	Max.
<input checked="" type="checkbox"/>	1-3	5(3D+1P)	DKR1B-J047F...	10	81
<input type="checkbox"/>	1-4	5(7D+1P)	DKR1B-J047F...	10	81
<input type="checkbox"/>	12-32	1(2D+2D)	DKR1B-J047F...	10	81

Note: It is possible that the usage rate for a parity group is not equal to the sum of the usage rate for each logical volume in that parity group (see section 5.1.3). This is because the Performance Monitor (Performance Management) panel rounds off fractions below the decimal point to the nearest whole number when displaying the usage rate for each logical volume.

Figure 5.4 An Example of Parity Group Usage Rates Displayed in the Table

The table displays the following items:

- : When the check mark icon appears in this column, the graph illustrates changes in usage rate for the parity group.
- **PG:** This column indicates IDs of parity groups.
- **RAID:** This column indicates the RAID level (RAID-5 or RAID-1).
- **Drive Type:** This column indicates types of HDDs (hard disk drives).
- **Usage:**
 - The **Ave. (Total)** column displays the average usage rate in the specified period.
 - The **Max.** column displays the maximum usage rate in the specified period.

5.1.3 Viewing Usage Statistics About Logical Volumes in Parity Groups

Performance Monitor (Performance Management) tracks logical volumes in parity groups and lets you view the average and the maximum usage rate in a specified period. Performance Monitor (Performance Management) also displays a graph that illustrates changes in logical volume usage within that period.

Note: You must be monitoring the disk subsystem before usage statistics can be viewed (for details, refer to section **Error! Reference source not found.**).

To view usage statistics about logical volumes in a parity group:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. In the tree view, click the **Physical** tab and double-click the **Parity Group** folder (refer to Figure 5.3).

The folder opens. A list of parity groups appears below the folder.

3. Select the desired parity group.

The table area displays usage statistics about logical volumes in the specified parity group (see Figure 5.5). The displayed statistics are the average and the maximum usage rates for the period specified in the **From** and **To** boxes.

Notes:

- If you change the date and time in the **From** and **To** boxes and then click the **Apply** button, Performance Monitor (Performance Management) recalculates usage rates and updates information in the table. To change the date and time in the **From** and **To** boxes, use the arrow buttons and the sliders (for details, refer to section 4.2.1).
 - If an exclamation mark (!) is displayed before a usage rate, the reported logical volume usage rate is likely to be inaccurate, because the configuration has changed (e.g., volumes have been moved by Hitachi CruiseControl or ShadowImage, or changed by Virtual LVI).
4. To display a graph that illustrates changes in usage rate for logical volumes, select the desired logical volumes in the table and then click the **Graph** button.

Note: The length of the monitoring period affects the time period represented by a graduation on the horizontal axis.

Caution: If the graph does not display changes in the usage rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

PRELIMINARY RELEASE

	LDEV	Emulation	Usage(%)		Read Rate(%)		Write Rate(%)		Grp.Use[Exp](%)	
			Ave.(Total)	Max.	Rnd.	Seq.	Rnd.	Seq.	Ave.(Total)	Max.
	0:00	OPEN-3	110	120	30	40	50	60	10 -> 70	81 -> 80
	0:01	OPEN-3	15	25	35	45	55	65	10 -> 75	81 -> 85
	0:02	OPEN-3	0	0	0	0	0	0	10 -> 0	81 -> 0
	0:03	OPEN-3	0	0	0	0	0	0	10 -> 0	81 -> 0
	0:04	OPEN-3	0	0	0	0	0	0	10 -> 0	81 -> 0
	0:05	OPEN-3	0	0	0	0	0	0	10 -> 0	81 -> 0
	0:06	OPEN-3	0	0	0	0	0	0	10 -> 0	81 -> 0
	0:07	OPEN-3	0	0	0	0	0	0	10 -> 0	81 -> 0

Note: It is possible that the sum of the usage rate for each logical volume in a parity group is not equal to the usage rate for that parity group (refer to section 5.1.2). This is because the Performance Monitor (Performance Management) panel rounds off fractions below the decimal point to the nearest whole number when displaying the usage rate for each logical volume.

Figure 5.5 An Example of Logical Volume Usage Rates Displayed in the Table

The table displays the following items:

- : When the check mark icon  appears in this column, the graph illustrates changes in usage rate for the logical volume.
- **LDEV:** This column indicates logical volumes (LDEVs). The number on the left of the colon is the CU image number. The number of the right of the colon is the LDEV number.
- **Emulation:** This column indicates device emulation types.
- **Usage:**
 - The **Ave. (Total)** column displays the average usage rate in the specified period.
 - The **Max.** column displays the maximum usage rate in the specified period.
- **Read Rate:**
 - The **Rnd.** column indicates random read rates. A random read rate is the ratio of random read requests to read and write requests.
 - The **Seq.** column indicates sequential read rates. A sequential read rate is the ratio of sequential read requests to read and write requests.
- **Write Rate:**
 - The **Rnd.** column indicates random write rates. A random write rate is the ratio of random write requests to read and write requests.
 - The **Seq.** column indicates sequential write rates. A sequential write rate is the ratio of sequential write requests to read and write requests.
- **Grp. Use:** Assumes the volume might be migrated out of the parity group (or de-installed) and indicates expected (estimated) average and maximum usage rates of the parity group. The **Ave. (Total)** column indicates an estimated change in the average usage rate. The **Max.** column indicates an estimated change in the maximum usage rate.

For example, if the **Ave. (Total)** box for the volume 0:01 displays “20 -> 18”, the average usage rate of the parity group that the volume belongs to is 20 percent. If the volume were migrated out of the parity group, the average usage rate of that group is expected to drop to 18 percent.

5.1.4 Viewing Usage Statistics About Channel Processors (CHPs)

Performance Monitor (Performance Management) tracks channel processors in each channel adapter and lets you view the average and the maximum usage rate in a specified period. Performance Monitor (Performance Management) also displays a graph that illustrates changes in channel processor usage within that period.

Note: You must be monitoring the disk subsystem before usage statistics can be viewed (for details, refer to section **Error! Reference source not found.**).

To view usage statistics about channel processors:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. In the tree view, click the **Physical** tab and double-click the **CHA** folder (refer to Figure 5.3).

The **CHA** folder opens. Below this folder appears a list of channel adapters.

3. Select the desired channel adapter.

The table area displays usage statistics about channel processors in the selected channel adapter (see Figure 5.6). The displayed statistics are the average and the maximum usage rates for the period specified in the **From** and **To** boxes.

Note: If you change the date and time in the **From** and **To** boxes and then click the **Apply** button, Performance Monitor (Performance Management) recalculates usage rates and updates information in the table. To change the date and time in the **From** and **To** boxes, use the arrow buttons and the sliders (for details, refer to section 4.2.1).

4. To display a graph that illustrates changes in usage rate for channel processors, select the desired channel processors in the table and then click the **Graph** button.

Note: The length of the monitoring period affects the time period represented by a graduation on the horizontal axis.

Caution: If the graph does not display changes in the usage rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

	ID	Usage(%)	
		Ave.(Total)	Max.
	CHP00-1P	20	82
	CHP01-1P	20	82
	CHP02-1P	20	82
	CHP03-1P	20	82

Figure 5.6 An Example of Channel Processors Usage Rates Displayed in the Table

The table displays the following items:

- : When the check mark icon  appears in this column, the graph illustrates changes in usage rate for the channel processor.
- **ID**: This column displays ID numbers for channel processors.
- **Usage**:
 - The **Ave. (Total)** column displays the average usage rate in the specified period.
 - The **Max.** column displays the maximum usage rate in the specified period.

5.1.5 Viewing Usage Statistics About Disk Processors (DKPs)

Performance Monitor (Performance Management) tracks disk processors and lets you view the average and the maximum usage rate in a specified period. Performance Monitor (Performance Management) also displays a graph that illustrates changes in disk processor usage within that period.

Note: You must be monitoring the disk subsystem before usage statistics can be viewed (for details, refer to section **Error! Reference source not found.**).

To view usage statistics about disk processors:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. In the tree view, click the **Physical** tab and double-click the **DKA** folder (refer to Figure 5.3).
A list of disk adapters appears.
3. Double-click one of the disk adapters.
4. Click **DKP** from below the disk adapter.

The table area displays usage statistics about disk processors in the disk adapter (Figure 5.7). The displayed statistics are the average and the maximum usage rates for the period specified in the **From** and **To** boxes.

Note: If you change the date and time in the **From** and **To** boxes and then click the **Apply** button, Performance Monitor (Performance Management) recalculates usage rates and updates information in the table. To change the date and time in the **From** and **To** boxes, use the arrow buttons and the sliders (for details, refer to section 4.2.1).

5. To display a graph that illustrates changes in usage rate for disk processors, select the desired disk processors in the table and then click the **Graph** button.

Note: The length of the monitoring period affects the time period represented by a graduation on the horizontal axis.

Caution: If the graph does not display changes in the usage rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

	ID	Usage(%)	
		Ave.(Total)	Max.
	DKP80-1B	30	83
	DKP81-1B	30	83
	DKP82-1B	30	83
	DKP83-1B	30	83

Figure 5.7 An Example of Disk Processor Usage Rates Displayed in the Table

The table displays the following items:

- : When the check mark icon  appears in this column, the graph illustrates changes in usage rate for the disk processor.
- **ID:** This column displays ID numbers for disk processors.
- **Usage:**
 - The **Ave. (Total)** column displays the average usage rate in the specified period.
 - The **Max.** column displays the maximum usage rate in the specified period.

5.1.6 Viewing Usage Statistics About Disaster Recovery and Regeneration Processors (DRRs)

Performance Monitor (Performance Management) tracks DRRs (disaster recovery and regeneration processors) and lets you view the average and the maximum usage rate in a specified period Hitachi Performance Monitor (Performance Management) also displays a graph that illustrates changes in DRR usage within that period.

Note: You must be monitoring the disk subsystem before usage statistics can be viewed (for details, refer to section **Error! Reference source not found.**).

To view usage statistics about DRRs:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. In the tree view, click the **Physical** tab and double-click the **DKA** folder (refer to Figure 5.3).
A list of disk adapters appears.
3. Double-click one of the disk adapters.
4. Click **DRR** from below the disk adapter.

The table area displays usage statistics about DRRs in the disk adapter (Figure 5.8). The displayed statistics are the average and the maximum usage rates for the period specified in the **From** and **To** boxes.

Note: If you change the date and time in the **From** and **To** boxes and then click the **Apply** button, Performance Monitor (Performance Management) recalculates usage rates and updates information in the table. To change the date and time in the **From** and **To** boxes, use the arrow buttons and the sliders (for details, refer to section 4.2.1).

- To display a graph that illustrates changes in usage rate for DRRs, select the desired DRRs in the table and then click the **Graph** button.

Note: The length of the monitoring period affects the time period represented by a graduation on the horizontal axis.

Caution: If the graph does not display changes in the usage rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

	ID	Usage(%)	
		Ave.(Total)	Max.
<input checked="" type="checkbox"/>	DRR80-1B	40	84
<input type="checkbox"/>	DRR81-1B	40	84
<input type="checkbox"/>	DRR82-1B	40	84
<input type="checkbox"/>	DRR83-1B	40	84

Figure 5.8 An Example of DRR Usage Rates Displayed in the Table

The table displays the following items:

- : When the check mark icon appears in this column, the graph illustrates changes in usage rate for the DRR.
- **ID:** This column displays ID numbers for DRRs.
- **Usage:**
 - The **Ave. (Total)** column displays the average usage rate in the specified period.
 - The **Max.** column displays the maximum usage rate in the specified period.

5.1.7 Viewing Write Pending Rates

Performance Monitor (Performance Management) lets you view write pending rates. A write pending rate indicates the ratio of write-pending data to the cache memory capacity. Performance Monitor (Performance Management) displays the average and the maximum write pending rate in a specified period. Performance Monitor (Performance Management) also displays a graph that illustrates changes in write pending rate within that period.

Note: You must be monitoring the disk subsystem before usage statistics can be viewed (for details, refer to section **Error! Reference source not found.**).

To view the write pending rate:

- Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
- In the tree view, click the **Physical** tab and select the **Cache Write Pending Rate** folder (refer to Figure 5.3).

The table area displays usage statistics about write pending rates (see Figure 5.9).

- The **Ave. (Total)** column displays the average write pending rate for the period specified in the **From** and **To** boxes.
- The **Moment Max.** column displays the maximum write pending rate for the period specified in the **From** and **To** boxes.

Note: If you change the date and time in the **From** and **To** boxes and then click the **Apply** button, Performance Monitor (Performance Management) recalculates usage rates and updates information in the table. To change the date and time in the **From** and **To** boxes, use the arrow buttons and the sliders (for details, refer to section 4.2.1).

3. To display a graph that illustrates changes in the write pending rate, select the write pending rate in the table and then click the **Graph** button.

Note: The length of the monitoring period affects the time period represented by a graduation on the horizontal axis.

Caution: If the graph does not display changes in the write pending rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

Cache Write Pending Rate(%)		
	Ave.(Total)	Moment Max.
	88	99

Figure 5.9 An Example of Write Pending Rate Displayed in the Table

- : When the check mark icon  appears in this column, the graph illustrates changes in the write pending rate.
- **Cache Write Pending Rate:**
 - The **Ave. (Total)** column displays the average write pending rate for the specified period.
 - The **Moment Max.** column displays the maximum write pending rate for the specified period.

5.1.8 Viewing Usage Statistics About Access Paths

The channel adapters (CHAs) and the disk adapters (DKAs) transfer data to the cache switch (CWS) and the shared memory (SM) when I/O requests are issued from hosts to the disk subsystem. Also, the cache switch transfers data to the cache memory.

Performance Monitor (Performance Management) tracks these data transfer paths and lets you view the average and the maximum usage rate for the paths in a specified period. Performance Monitor (Performance Management) also displays a graph that illustrates changes in path usage within that period.

Note: You must be monitoring the disk subsystem before usage statistics can be viewed (for details, refer to section **Error! Reference source not found.**).

To view usage statistics about paths:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. In the tree view, click the **Physical** tab and double-click the **Access Path Usage** folder (refer to Figure 5.3).
3. Do either of the following:
 - To check usage statistics about paths between adapters (CHAs and DKAs) and the cache switch, select **Adapter-CSW** from below the **Access Path Usage** folder.
 - To check usage statistics about paths between adapters (CHAs and DKAs) and the shared memory, select **Adapter-SM** from below the **Access Path Usage** folder.
 - To check usage statistics about paths between cache switches and the cache memory, select **CSW-Cache** from below the **Access Path Usage** folder.

The table area displays the average and maximum usage rate for the specified paths (see Figure 5.10). The displayed statistics are the average and the maximum usage rates for the period specified in the **From** and **To** boxes.

Note: If you change the date and time in the **From** and **To** boxes and then click the **Apply** button, Performance Monitor (Performance Management) recalculates usage rates and updates information in the table. To change the date and time in the **From** and **To** boxes, use the arrow buttons and the sliders (for details, refer to section 4.2.1).

4. To display a graph that illustrates changes in usage statistics about paths, select the desired paths in the table and then click the **Graph** button.

Note: The length of the monitoring period affects the time period represented by a graduation on the horizontal axis.

Caution: If the graph does not display changes in the usage rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

Paths between adapters and cache switches:

	Adapter	CSW	Usage(%)	
			Ave.(Total)	Max.
	CHA-1P	CSW-1N	60	86
	CHA-1P	CSW-1A	60	86
	CHA-1Q	CSW-1N	60	86
	CHA-1Q	CSW-1A	60	86
	CHA-1R	CSW-1N	60	86
	CHA-1R	CSW-1A	60	86
	CHA-1S	CSW-1N	60	86
	CHA-1S	CSW-1A	60	86

Paths between adapters and shared memories:

	Adapter	SM	Usage(%)	
			Ave.(Total)	Max.
	CHA-1P	Side-A	50	85
	CHA-1P	Side-B	50	85
	CHA-1Q	Side-A	50	85
	CHA-1Q	Side-B	50	85
	CHA-1R	Side-A	50	85
	CHA-1R	Side-B	50	85
	CHA-1S	Side-A	50	85
	CHA-1S	Side-B	50	85

Paths between cache switches and cache memory:

	CSW	Cache	Usage(%)	
			Ave.(Total)	Max.
	CSW-1N	CACHE-1T	70	87
	CSW-1A	CACHE-1T	70	87
	CSW-2M	CACHE-1T	70	87
	CSW-2Z	CACHE-1T	70	87
	CSW-1N	CACHE-1U	70	87
	CSW-1A	CACHE-1U	70	87
	CSW-2M	CACHE-1U	70	87
	CSW-2Z	CACHE-1U	70	87

Figure 5.10 Examples of Usage Statistics Displayed in the Table

- : When the check mark icon appears in this column, the graph illustrates changes in the write pending rate.
- **Adapter:** This column indicates adapters.
- **CSW:** This column indicates cache switches.
- **SM:** This column indicates shared memories.
- **Cache:** This column indicates the cache memories.
- **Usage:**
 - The **Ave. (Total)** column displays the average usage rate for the specified period.
 - The **Max.** column displays the maximum usage rate for the specified period.

5.1.9 Updating Usage Statistics

If you want to update usage statistics, you must first switch from View mode to Modify mode (for details, refer to section 3.3).

To update statistics:

1. In the **Remote Console** Main menu, switch to **Modify** mode (for details, refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator™ User's Guide* (MK-92RD101)).
2. In the **Performance Monitor (Performance Management)** panel, click the **Physical** tab. A message appears asking if you want to obtain the latest information.
3. Click **OK**.

Note: If you want to update statistics in the panel again later, you must quit and then restart **Performance Monitor (Performance Management)**.

5.2 Monitoring Disk Drives

The **LDEV** tab of the Hitachi **Performance Monitor (Performance Management)** panel lets you check workloads on physical disk drives (parity groups) or on logical volumes. The **LDEV** tab displays the *I/O rate* and the *transfer rate*. The *I/O rate* indicates the number of disk I/Os per second. The *transfer rate* indicates the size of data transferred to the disk in one second.

In addition, the **LDEV** tab displays the *read hit ratio* and the *write hit ratio*. For a read I/O, when the requested data is already in cache, the operation is classified as a *read hit*. For a write I/O, when the requested data is already in cache, the operation is classified as a *write hit*.

Note: To monitor disk drives, **Performance Monitor (Performance Management)** must be running (refer to section 0).

5.2.1 Collecting Statistics About Workloads on Disk Drives

Note: You must be monitoring disk drives before statistics can be viewed.

To start monitoring the disk subsystem:

1. Start Performance Monitor (Performance Management) (refer to section 3.3). The Hitachi Performance Monitor (Performance Management) panel appears (see Figure 5.11).
2. Click the Monitoring Options tab. The Monitoring Options panel appears.
3. In **Short range monitoring S/W**, select **ON** for the **Current Status** option.
4. Click **Apply**. Performance Monitor (Performance Management) starts monitoring the disk subsystem.

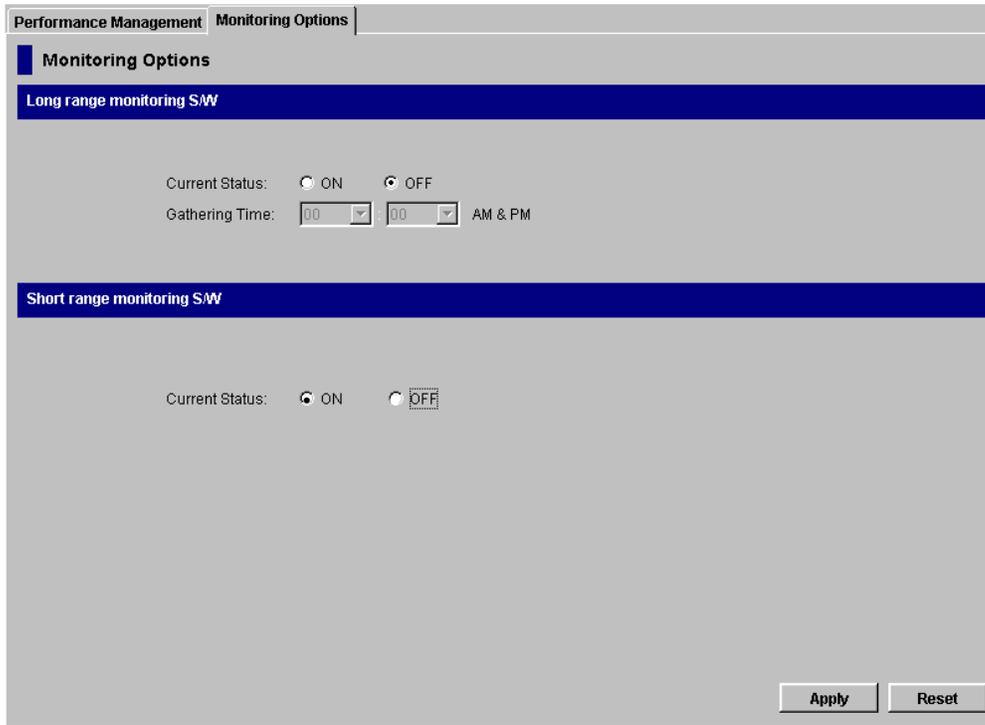


Figure 5.11 Setting Short Range Monitoring in the Monitoring Options Tab

Tips: To stop monitoring the disk subsystem, follow the procedure below. If you stop monitoring, Performance Monitor (Performance Management) stops collecting statistics.

To stop monitoring the disk subsystem:

1. Start Performance Monitor (Performance Management) and click the Monitoring Options tab. The Monitoring Options panel appears (refer to Figure 5.11).
2. In **Short range monitoring S/W**, select **OFF** for the **Current Status** option.
3. Click **Apply**.

5.2.2 Viewing I/O Rates

Performance Monitor (Performance Management) tracks disk drives and measures I/O rates (that is, the number of disk I/Os per second).

Note: You must be monitoring disk drives before statistics can be viewed (for details, refer to section 5.2.1).

To view I/O rates:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. Click the **LDEV** tab. The tree view displays a list of parity groups (refer to Figure 4.4).
3. Select **IOPS** from the drop-down list on the right side of the Monitoring Data panel.

4. In the tree view, do either of the following:
 - To view the I/O rate for each parity group, select **Subsystem**. The table area displays the I/O rate for each parity group (Figure 5.12).
 - To view the I/O rate for each logical volume in a parity group, select the parity group. The table area displays the I/O rate for each logical volume in the selected parity group (Figure 5.12).

The displayed statistics are the average and the maximum I/O rates for the period specified in the **From** and **To** boxes.

Note: If you change the date and time in the **From** and **To** boxes and then click the **Apply** button, Performance Monitor (Performance Management) recalculates usage rates and updates information in the table. To change the date and time in the **From** and **To** boxes, use the arrow buttons and the sliders (for details, refer to section 4.2.1).

5. To display a graph to find out how the I/O rate has been changed, take the following steps:
 - a) In the table, select the parity group(s) or the logical volume(s) that you want.
 - b) Use the drop-down list at the right side of the table to select the type of information that you want to view in the graph.
 - c) Click the Graph button.
 - d) A graph appears below the table. The horizontal axis indicates the time.

Caution: If the graph does not display changes in the I/O rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the Chart Y Axis Rate drop-down list. For example, if the largest value in the table is 200 and the value in Chart Y Axis Rate is 100, you should select a value larger than 200 from Chart Y Axis Rate.

- e) To view more detailed information in the graph, select the Detail check box at the lower right of the table and then click the Graph button. The graph contents change as described in Table 4.1.

Caution: If more than one parity group or logical volume is selected in the table, you cannot select the Detail check box to view detailed information.

I/O rate for parity groups:

	Group	IO Rate...	Read...	Write...	Read Hit...	Write Hit...	Back Tra...
<input type="checkbox"/>	1-3	0	0	0	0	0	0
<input type="checkbox"/>	1-4	0	0	0	0	0	0
<input type="checkbox"/>	12-32	0	0	0	0	0	0

I/O rate for logical volumes:

	LDEV	Type	IO R...	Read...	Write...	Read H...	Write H...	Ba...
<input type="checkbox"/>	01:10	OPEN-3	0	0	0	0	0	0
<input type="checkbox"/>	01:11	OPEN-3	0	0	0	0	0	0
<input type="checkbox"/>	01:12	OPEN-3	0	0	0	0	0	0
<input type="checkbox"/>	01:13	OPEN-3	0	0	0	0	0	0
<input type="checkbox"/>	01:14	OPEN-3	0	0	0	0	0	0

Note: It is possible that the I/O rate for a parity group is not equal to the sum of the I/O rate for each logical volume in that parity group. This is because the Performance Monitor (Performance Management) panel omits fractions below the decimal point when displaying the I/O rate for each logical volume.

Figure 5.12 I/O Rates for Disks

The table displays the following:

- : When the check mark icon appears in this column, the graph displays workload statistics about the parity group or the logical volume.
- **Group:** Indicates the parity group ID.
- **LDEV:** Indicates the logical volume ID.
- **Type:** Indicates the emulation type.
- **IO Rate:** Indicates the number of I/O requests to the parity group (or the logical volume) per second.
- **Read:** Indicates the number of read requests to the parity group (or the logical volume) per second.
- **Write:** Indicates the number of write requests to the parity group (or the logical volume) per second. This column appears when **IOPS** is selected in the drop-down list at the upper right of the table.
- **Read Hit:** Indicates the read hit ratio.
- **Write Hit:** Indicates the write hit ratio.
- **Back Trans.:** Indicates the number of data transfers per second between the parity group (or the logical volume) and the cache memory.

5.2.3 Viewing Transfer Rates

Performance Monitor (Performance Management) tracks disk drives and measures transfer rates (that is, the size of data transferred in one second).

Note: You must be monitoring disk drives before statistics can be viewed (for details, refer to section 5.2.1).

To view transfer rates:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. Click the **LDEV** tab (Figure 4.4).
The tree view displays a list of parity groups.
3. Select **MB/s** from the drop-down list on the right side of the Monitoring Data panel.
4. In the tree view, do either of the following:
 - To view the transfer rate for each parity group, select **Subsystem**.
The table area displays the transfer rate for each parity group (Figure 5.13).
 - To view the transfer rate for each logical volume in a parity group, select the parity group.
The table area displays the transfer rate for each logical volume in the selected parity group (Figure 5.13).

The displayed statistics are the average and the maximum transfer rates for the period specified in the **From** and **To** boxes.

Note: If you change the date and time in the **From** and **To** boxes and then click the **Apply** button, Performance Monitor (Performance Management) recalculates usage rates and updates information in the table. To change the date and time in the **From** and **To** boxes, use the arrow buttons and the sliders (for details, refer to section 4.2.1).

5. To display a graph to find out how the transfer rate has been changed, take the following steps:
 - a) In the table, select the parity group(s) or the logical volume(s) that you want.
 - b) Use the drop-down list at the right side of the table to select the type of information that you want to view in the graph.
 - c) Click the **Graph** button.
 - d) A graph appears below the table. The horizontal axis indicates the time.

Caution: If the graph does not display changes in the transfer rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

- e) To view more detailed information in the graph, select the **Detail** check box at the lower right of the table and then click the **Graph** button. The graph contents change as described in Table 4.1.

Caution: If more than one parity group or logical volume is selected in the table, you cannot select the **Detail** check box to view detailed information.

Transfer rate for parity groups:

	Group	Trans.Rate...	Read Hit...	Write Hit...	Back Trans.(count/sec)
<input type="checkbox"/>	1-3	0	0	0	0
<input type="checkbox"/>	1-4	0	0	0	0
<input type="checkbox"/>	12-32	0	0	0	0

Transfer rate for logical volumes:

	LDEV	Type	Trans.Rate...	Read Hit...	Write Hit...	Back Trans...
<input type="checkbox"/>	01:10	OPEN-3	0	0	0	0
<input type="checkbox"/>	01:11	OPEN-3	0	0	0	0
<input type="checkbox"/>	01:12	OPEN-3	0	0	0	0
<input type="checkbox"/>	01:13	OPEN-3	0	0	0	0
<input type="checkbox"/>	01:14	OPEN-3	0	0	0	0

Note: It is possible that the transfer rate for a parity group is not equal to the sum of the transfer rate for each logical volume in that parity group. This is because the Performance Monitor (Performance Management) panel omits fractions below the decimal point when displaying the transfer rate for each logical volume.

Figure 5.13 Transfer Rates for Disks

The table displays the following:

- : When the check mark icon appears in this column, the graph displays workload statistics about the parity group or the logical volume.
- **Group:** Indicates the parity group ID.
- **LDEV:** Indicates the logical volume ID.
- **Type:** Indicates the emulation type.
- **Trans. Rate:** Indicates the size (in megabytes) of data transferred to the parity group (or the logical volume) per second.
- **Read Hit:** Indicates the read hit ratio.
- **Write Hit:** Indicates the write hit ratio.
- **Back Trans.:** Indicates the number of data transfers per second between the parity group (or the logical volume) and the cache memory.

5.3 Monitoring Ports

Performance Monitor (Performance Management) tracks ports on the disk subsystem and measures I/O rates (that is, the number of I/Os per second) and transfer rates (that is, the size of data transferred per second).

Note: To monitor ports, Performance Monitor (Performance Management) must be running (refer to section 3.3).

5.3.1 Collecting Statistics About Traffic at Ports

Note: You must be monitoring the disk subsystem before statistics can be viewed.

To start monitoring the disk subsystem:

1. Start Performance Monitor (Performance Management) (refer to section 3.3).
The Hitachi Performance Monitor (Performance Management) panel appears (refer to Figure 4.1).
2. Click the **Monitoring Options** tab.
The Monitoring Options panel appears (refer to Figure 5.11).
3. In **Short range monitoring S/W**, select **ON** for the **Current Status** option.
4. Click **Apply**. Performance Monitor (Performance Management) starts monitoring the disk subsystem.

Tips: To stop monitoring the disk subsystem, follow the procedure below. If you stop monitoring, Performance Monitor (Performance Management) stops collecting statistics.

To stop monitoring the disk subsystem:

1. Start Performance Monitor (Performance Management) and click the Monitoring Options tab.
The Monitoring Options panel appears (refer to Figure 5.11).
2. In **Short range monitoring S/W**, select **OFF** for the **Current Status** option.
3. Click **Apply**.

5.3.2 Viewing I/O Rates

Performance Monitor (Performance Management) tracks ports on the disk subsystem and measures I/O rates (that is, the number of disk I/Os per second).

Note: You must be monitoring the disk subsystem before statistics can be viewed (for details, refer to section 5.3.1).

To view I/O rates:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. Click the **Port-LUN** tab (Figure 4.5).
The tree view displays a list of ports. If you double-click a port icon (for example,  and ) , the Host Storage Domains () corresponding to that port appear.
3. Select **IOPS** from the drop-down list on the right side of the Monitoring Data panel.
4. In the Monitoring Term area, do either of the following:
 - To view the I/O rate in real time, you must select the **Real Time** option and then click **Apply**.
Note: If you use the drop-down list to specify a time before clicking **Apply**, the specified time affects the data range for the graph. For example, if you want to view I/O rates for the last ninety minutes, select 90 from the drop-down list.
 - To view I/O rates for a certain period of time in the last 24 hours, you must select the **From** option, change the date and time in the **From** and **To** boxes, and then click **Apply**. Use the arrow button and the sliders when you change the date and time in the **From** and **To** boxes (refer to section 4.2.3).
5. In the tree view, select the **Subsystem** folder.

The table area displays I/O rates for the ports on the subsystem (Figure 5.14).

Tips:

- If you select a port (for example,  and ) in the tree view, the table displays I/O rates for all the host bus adapters connected to the selected port (Figure 5.14).
 - If you select a host group () in the tree view, the table displays I/O rates for host bus adapters in the host group (Figure 5.14).
6. To display a graph to find out how the I/O rate has been changed, take the following steps:
 - a) In the table, select one or more ports or host bus adapters (WWNs).
 - b) Click the Graph button.

Caution: If the graph does not display changes in the I/O rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

I/O rate for ports:

	Port	Current(IOPS)	Ave.(IOPS)...	Max.(IOPS)	Attribute
<input checked="" type="checkbox"/>	CL1-A(EF)	-	534	-	Prio.
<input checked="" type="checkbox"/>	CL1-B(E8)	-	535	-	Prio.
<input checked="" type="checkbox"/>	CL1-C(E4)	-	536	-	Non-Prio.
<input checked="" type="checkbox"/>	CL1-D(E2)	-	537	-	Non-Prio.
<input checked="" type="checkbox"/>	CL1-E(E1)	-	256	-	Non-Prio.

I/O rate for host bus adapters connected to a specified port:

	WWN	PPC Name	Curr...	Ave...	Max...	Attribute
<input checked="" type="checkbox"/>	0000000000000003	NAME0003	-	293	293	Non-Prio.
<input checked="" type="checkbox"/>	0000000000000006	NAME0006	-	290	290	Prio.
<input checked="" type="checkbox"/>	0000000000000007	NAME0007	-	289	289	Non-Prio.
<input checked="" type="checkbox"/>	0000000000000004	NAME0004	-	292	292	Prio.
<input checked="" type="checkbox"/>	0000000000000005	NAME0005	-	291	291	Non-Prio.

I/O rates for host bus adapters in a host group

	WWN	Nickname	Current...	Ave...	Max...	Attribute
<input checked="" type="checkbox"/>	0000000000000003	M1	-	293	293	Non-Prio.
<input checked="" type="checkbox"/>	0000000000000004	M4	-	292	292	Prio.
<input checked="" type="checkbox"/>	0000000000000005	M5	-	291	291	Non-Prio.

Figure 5.14 I/O Rates for Ports

The table displays the following:

- : When the check mark icon appears in this column, the graph displays changes in workload statistics about the item.
- **Port:** Indicates ports on the disk subsystem.
- **WWN:** Indicates WWNs of the host bus adapters.
- **Priority Access (PPC) name:** Indicates Priority Access (PPC) names of the host bus adapters. Priority Access allows you to assign a *Priority Access (PPC) name* to each host bus adapter so that you can easily identify each host bus adapters in the Priority Access panels.
- **Nickname:** Indicates the nickname for the host bus adapters. LUN Manager allows you to assign a *nickname* to each host bus adapter so that you can easily identify each host bus adapter in the LUN Manager panels.
- **Current:** Indicates the current I/O rate.
- **Ave.:** Indicates the average I/O rate for the specified period.
- **Max.:** Indicates the maximum I/O rate for the specified period.
- **Attribute:** Indicates the priority of each port. **Prio.** indicates a prioritized port. **Non-Prio.** indicates a non-prioritized port.

5.3.3 Viewing Transfer Rates

Performance Monitor (Performance Management) tracks ports on the disk subsystem and measures transfer rates (that is, the size of data transferred in one second).

Note: You must be monitoring the disk subsystem before statistics can be viewed (for details, refer to section 5.3.1).

To view transfer rates:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.

2. Click the **Port-LUN** tab (Figure 4.5).

The tree view displays a list of ports. If you double-click a port icon (for example, ) and ) (and ) the Host Storage Domains () corresponding to that port appear.

3. Select **MB/s** from the drop-down list on the right side of the Monitoring Data panel.

4. In the Monitoring Term area, do either of the following:

- To view the transfer rate in real time, you must select the **Real Time** option and then click **Apply**.

Note: If you use the drop-down list to specify a time before clicking **Apply**, the specified time affects the data range for the graph. For example, if you want to view I/O rates for the last ninety minutes, select 90 from the drop-down list.

- To view transfer rates for a certain period of time in the last 24 hours, you must select the **From** option, change the date and time in the **From** and **To** boxes, and then click **Apply**. Use the arrow button and the sliders when you change the date and time in the **From** and **To** boxes (refer to section 4.2.3).

5. In the tree view, select the **Subsystem** folder.

The table area displays transfer rates for the ports on the subsystem.

Tips:

- If you select a port (for example,  and ) in the tree view, the table displays transfer rates for all the host bus adapters connected to the selected port (Figure 5.15).
- If you select a host group () in the tree view, the table displays transfer rates for host bus adapters in the host group (Figure 5.15). **Note:** You cannot view information about host bus adapters if the host group is not registered in LUN Manager.

6. To display a graph to find out how the transfer rate has been changed, take the following steps:

- a) In the table, select one or more ports or host bus adapters (WWNs).
- b) Click the Graph button.

Caution: If the graph does not display changes in the transfer rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

Transfer rate for ports:

	Port	Current(MB/s)	Ave.(MB/s)...	Max.(MB/s)	Attribute
	CL1-A(EF)	-	34	-	Prio.
	CL1-B(E8)	-	35	-	Prio.
	CL1-C(E4)	-	36	-	Non-Prio.
	CL1-D(E2)	-	37	-	Non-Prio.
	CL1-E(E1)	-	256	-	Non-Prio.

Transfer rate for host bus adapters connected to a specified port:

	WWN	PPC Name	Curr...	Ave...	Max...	Attribute
	0000000000000003	NAME0003	-	294	294	Non-Prio.
	0000000000000006	NAME0006	-	291	291	Prio.
	0000000000000007	NAME0007	-	290	290	Non-Prio.
	0000000000000004	NAME0004	-	293	293	Prio.
	0000000000000005	NAME0005	-	292	292	Non-Prio.

Transfer rates for host bus adapters in a host group

	WWN	Nickname	Current...	Ave...	Max...	Attribute
	0000000000000003	M1	-	294	294	Non-Prio.
	0000000000000004	M4	-	293	293	Prio.
	0000000000000005	M5	-	292	292	Non-Prio.

Figure 5.15 Transfer Rates for Ports

The table displays the following:

- : When the check mark icon appears in this column, the graph displays changes in workload statistics about the item.
- **Port:** Indicates ports on the disk subsystem.
- **WWN:** Indicates WWNs of the host bus adapters.
- **Priority Access (PPC) name:** Indicates Priority Access (PPC) names of the host bus adapters. Priority Access allows you to assign a *Priority Access (PPC) name* to each host bus adapter so that you can easily identify each host bus adapters in the Priority Access panels.
- **Nickname:** Indicates the nickname for the host bus adapters. LUN Manager allows you to assign a *nickname* to each host bus adapter so that you can easily identify each host bus adapter in the LUN Manager panels.
- **Current:** Indicates the current transfer rate.
- **Ave.:** Indicates the average transfer rate for the specified period.
- **Max.:** Indicates the maximum transfer rate for the specified period.
- **Attribute:** Indicates the priority of each port. **Prio.** indicates a prioritized port. **Non-Prio.** indicates a non-prioritized port.

5.3.4 Viewing Detailed Information About the I/O Rate and the Transfer Rate

Note: You must be monitoring the disk subsystem before statistics can be viewed (for details, refer to section 5.3.1).

To view detailed information about the I/O rate or the transfer rate for a port:

1. Select the **Subsystem** folder in the tree view.
2. Select a port from the table
3. Select the **Detail** check box at the lower right of the table, and then click the **Graph** button. The graph contents change as described in Figure 4.6 earlier in this chapter.

5.4 Monitoring LU Paths

Performance Monitor (Performance Management) tracks LU paths and measures I/O rates (that is, the number of I/Os per second) and transfer rates (that is, the size of data transferred per second).

Note: To monitor LU paths, Performance Monitor (Performance Management) must be running (refer to section 3.3).

5.4.1 Collecting Statistics About Traffic at LU Paths

To obtain statistics about traffic at LU paths, you must follow the procedure below to start monitoring the disk subsystem.

To start monitoring the disk subsystem:

1. Start Performance Monitor (Performance Management) (refer to section 3.3). The Hitachi Performance Monitor (Performance Management) panel appears.
2. Click the **Monitoring Options** tab. The Monitoring Options panel appears (refer to Figure 5.11).
3. In **Short range monitoring S/W**, select **ON** for the **Current Status** option.
4. Click **Apply**. Performance Monitor (Performance Management) starts monitoring the disk subsystem.

Tips: To stop monitoring the disk subsystem, follow the procedure below. If you stop monitoring, Performance Monitor (Performance Management) stops collecting statistics.

To stop monitoring the disk subsystem:

1. Start Performance Monitor (Performance Management) and click the Monitoring Options tab. The Monitoring Options panel appears (refer to Figure 5.11).
2. In **Short range monitoring S/W**, select **OFF** for the **Current Status** option.
3. Click **Apply**.

5.4.2 Viewing I/O Rates

Performance Monitor (Performance Management) tracks LU paths and measures I/O rates (that is, the number of disk I/Os per second).

Note: You must be monitoring the disk subsystem before statistics can be viewed (for details, refer to section 5.4.1).

To view I/O rates:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. Click the **Port-LUN** tab (refer to Figure 4.5).
The tree view displays a list of ports on the disk subsystem.
3. Select **IOPS** from the drop-down list on the right side of the Monitoring Data panel.
4. In the Monitoring Term area, do either of the following:
 - To view the I/O rate in real time, you must select the **Real Time** option and then click **Apply**.
Note: If you use the drop-down list to specify a time before clicking **Apply**, the specified time affects the data range for the graph. For example, if you want to view I/O rates for the last ninety minutes, select 90 from the drop-down list.
 - To view I/O rates for a certain period of time in the last 24 hours, you must select the **From** option, change the date and time in the **From** and **To** boxes, and then click **Apply**. Use the arrow button and the sliders when you change the date and time in the **From** and **To** boxes (refer to section 4.2.3).
5. In the tree view, double-click a port (for example,  or ) and then select a host group ().
The LUN icon () appears.
6. Select **LUN**.
The table area displays a list of LU paths and I/O rates (see Figure 5.16).

	LUN	CU:LDEV	Type	Current(IOPS)	Ave.(IO...	Max.(IOP...
	000	00:00	OPEN-3 * 1	-	0	0
	001	00:01	OPEN-3 * 1	-	0	0
	002	00:02	OPEN-3 * 1	-	0	0
	003	00:03	OPEN-3 * 1	-	0	0
	004	00:04	OPEN-3 * 1	-	0	0

Figure 5.16 I/O Rates for LU Paths

7. To display a graph to find out how the I/O rate has been changed, take the following steps:
 - a) In the table, select one or more LUNs.
 - b) Click the Graph button.

Caution: If the graph does not display changes in the I/O rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

To view more detailed information in the graph, select the **Detail** check box at the lower right of the table and then click the **Graph** button. The graph contents change as described in Table 4.2.

Caution: If more than one row is selected in the table, you cannot select the Detail check box.

5.4.3 Viewing Transfer Rates

Performance Monitor (Performance Management) tracks LU paths and measures transfer rates (that is, the amount of data transferred in one second).

Note: You must ensure that statistics have been collected (for details, refer to section 5.4.1).

To view transfer rates:

1. Ensure that the Performance Monitor (Performance Management) panel is displayed.
2. Click the Port-LUN tab (Figure 4.4).
The tree view displays a list of ports on the disk subsystem.
3. Select MB/s from the drop-down list on the right side of the panel.
4. In Monitoring Term, do either of the following:
 - If you want to view the transfer rate in real time, you must select the Real Time option and then click Apply.
Note: If you use the drop-down list to specify a time before clicking Apply, the specified time affects the data range for the graph. For example, if you want to view transfer rates for the last ninety minutes, select 90 from the drop-down list.
 - If you want to view transfer rates for a certain period of time in the last 24 hours, you must select the From option, change the date and time in the From and To boxes, and then click Apply. Use the arrow button and the sliders when you change the date and time in the From and To boxes (refer to 4.2.3).
5. In the tree view, double-click a port (for example,  or ) and then select a host group ().
The LUN icon () appears
6. Select LUN.
The table on the right displays a list of LU paths and transfer rates (refer to Figure 5.17).

7. If you want to display a graph to find out how the transfer rate has been changed, take the following steps:
 - a. In the table, select one or more LUNs.
 - b. Click the Graph button.

Caution: If the graph does not display changes in the transfer rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the Chart Y Axis Rate drop-down list. For example, if the largest value in the table is 200 and the value in Chart Y Axis Rate is 100, you should select a value larger than 200 from Chart Y Axis Rate.

- c. If you want to view more detailed information in the graph, select the Detail check box at the lower right of the table and then click the Graph button. The graph contents change as described in Table 4.2.
- d. **Caution:** If more than one row is selected in the table, you cannot select the Detail check box.

	LUN	CU:LDEV	Type	Current(MB/s)	Ave.(MB/s...	Max.(M...
<input type="checkbox"/>	000	00:00	OPEN-3 * 1	-	0	0
<input type="checkbox"/>	001	00:01	OPEN-3 * 1	-	0	0
<input type="checkbox"/>	002	00:02	OPEN-3 * 1	-	0	0
<input type="checkbox"/>	003	00:03	OPEN-3 * 1	-	0	0
<input type="checkbox"/>	004	00:04	OPEN-3 * 1	-	0	0

Figure 5.17 Transfer Rates for LU Paths

The table displays the following:

- : When the icon appears on the left of an item, the graph displays changes in workload statistics about the item.
- **LUN:** Indicates LUNs (logical unit numbers).
- **CU:LDEV:** Indicates logical volumes. The number of the left of the colon is the CU image number. The number of the right of the colon is the LDEV number.
- **Type:** Indicates emulation types.
- **Current:** Indicates the current transfer rate.
- **Ave.:** Indicates the average transfer rate for the specified period.
- **Max.:** Indicates the maximum transfer rate for the specified period

5.5 Monitoring Paths Between Host Bus Adapters and Ports

If Priority Access is enabled, Performance Monitor (Performance Management) can be used to monitor paths between host bus adapters (HBAs) in host servers and ports on the disk subsystem. HBAs are contained in host servers and serve as ports for connecting the host servers to the disk subsystem.

Note: To monitor paths between HBAs and ports, Performance Monitor (Performance Management) must be running (refer to section 0).

5.5.1 Collecting Statistics About Traffic Between HBAs and Ports

Caution: To collect statistics about traffic between HBAs and ports, you must perform a Priority Access operation first, then you may proceed with monitoring the disk subsystem (please refer to the Measuring Traffic between Host Bus Adapters and Ports section in *Hitachi Freedom Storage™ Lightning 9900™ V Series Priority Access User's Guide (MK-92RD117)*).

To start monitoring the disk subsystem:

1. Start Performance Monitor (Performance Management) (refer to section 0).
The Hitachi Performance Monitor (Performance Management) panel appears.
2. Click the **Monitoring Options** tab.
The Monitoring Options panel appears (refer to Figure 5.11).
3. In **Short range monitoring S/W**, select **ON** for the **Current Status** option.
4. Click **Apply**. Performance Monitor (Performance Management) starts monitoring the disk subsystem.

Tips: To stop monitoring the disk subsystem, follow the procedure below. If you stop monitoring, Performance Monitor (Performance Management) stops collecting statistics.

To stop monitoring the disk subsystem:

1. Start Performance Monitor (Performance Management) and click the Monitoring Options tab. The Monitoring Options panel appears (refer to Figure 5.11).
2. In **Short range monitoring S/W**, select **OFF** for the **Current Status** option.
3. Click **Apply**.

5.5.2 Viewing I/O Rates

Performance Monitor (Performance Management) tracks traffic between HBAs in the hosts and ports on the disk subsystem, and measures I/O rates (that is, the number of disk I/Os per second).

Note: Statistics must be collected and stored in the disk subsystem before statistics can be viewed (for details, refer to section 5.5.1).

To view I/O rates:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. Click the **WWN** tab (Figure 4.7).
The tree view displays a list of Priority Access groups (📁). Below Priority Access (PPC) groups appears an item named **Not Grouped**.
 - If you double-click a Priority Access group, host bus adapters (📁) in the Priority Access group appear.
 - If you double-click **Not Grouped**, host bus adapters (📁) that do not belong to any Priority Access group appear.
3. Select **IOPS** from the drop-down list on the right side of the Monitoring Data panel.
4. In the Monitoring Term area, do either of the following:
 - To view the I/O rate in real time, you must select the **Real Time** option and then click **Apply**.
Note: If you use the drop-down list to specify a time before clicking **Apply**, the specified time affects the data range for the graph. For example, if you want to view I/O rates for the last ninety minutes, select 90 from the drop-down list.
 - To view I/O rates for a certain period of time in the last 24 hours, you must select the **From** option, change the date and time in the **From** and **To** boxes, and then click **Apply**. Use the arrow button and the sliders when you change the date and time in the **From** and **To** boxes (refer to section 4.2.4).
5. In the tree view, do either of the following:
 - To view the I/O rate for host bus adapters in a Priority Access group, select the Priority Access group. The table area displays the I/O rate (Figure 5.18).
 - To view the I/O rate for host bus adapters that do not belong to any Priority Access group, select **Not Grouped**. The table area displays the I/O rate (Figure 5.18).

Tips:

- If you select the **Subsystem** folder in the tree view, the table displays the I/O rate at each Priority Access group (Figure 5.18).
- If you select a host bus adapter (📁) in the tree view, the table displays the I/O rate at each port connected to the selected host bus adapter (Figure 5.18).

6. To display a graph to find out how the I/O rate has been changed, take the following steps:
 - a) In the table, select one or more Priority Access groups or WWNs. Note: In future versions, the graph can also be displayed when one or more ports are selected in the table.
 - b) Click the Graph button.

Caution: If the graph does not display changes in the I/O rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

Note: If the WWN of a host bus adapter is displayed by red in the tree view, the host bus adapter is connected to two or more ports, but the traffic between the HBA and some of the ports are *not* controlled by Priority Access (Prioritized Port Control). Refer to section 6.2 for how to control the traffic between the HBA and the all the connected ports.

I/O rate at host bus adapters

(Displayed when a Priority Access group or **Not Grouped** is selected)

	WWN	PPC Name	Current...	Ave....	Max....	Attribute
	0000000000000041	NAME65	-	71	71	Non-Prio.
	0000000000000042	NAME0066	-	70	70	Non-Prio.
	0000000000000043	NAME0067	-	69	69	Non-Prio.
	0000000000000044	NAME0068	-	68	68	Non-Prio.
	0000000000000045	NAME0069	-	67	67	Non-Prio.
	0000000000000046	NAME0070	-	66	66	Non-Prio.
	0000000000000047	NAME0071	-	65	65	Non-Prio.
	0000000000000048	NAME0072	-	64	64	Non-Prio.

I/O rate at each Priority Access group

(Displayed when the **Subsystem** folder is selected)

	Group	Current(IOPS)	Ave.(IOPS)(Total)	Max.(IOPS)	Attribute
	GRNICK01	-	7028	7028	Non-Prio.
	GRNICK02	-	924	924	Prio.
	GRNICK03	-	796	796	Non-Prio.
	GRNICK04	-	668	668	Prio.
	GRNICK05	-	540	540	Non-Prio.
	GRNICK06	-	364	364	Prio.
	GRNICK07	-	300	300	Non-Prio.
	Not Grouped	-	3672	3672	-

I/O rate at each port connected to a specified host bus adapter

(Displayed when a host bus adapter is selected)

	Port	Current(IOPS)	Ave.(IOPS)(Total)	Max.(IOPS)	Attribute
	CL1-A	-	-	-	Prio.
	CL1-B	-	-	-	Prio.

Figure 5.18 I/O Rates for Host Bus Adapters

The table displays the following:

- : When the check mark icon  appears in this column, the graph displays changes in workload statistics about the item.
- **Group:** Indicates Priority Access groups.
- **Priority Access (PPC) name:** Indicates Priority Access (PPC) names of host bus adapters. Priority Access allows you to assign a *Priority Access (PPC) name* to each host bus adapter so that you can easily identify each host bus adapters in the Priority Access panels.
- **Port:** Indicates ports on the disk subsystem.
- **Current:** Indicates the current I/O rate.
- **Ave.:** Indicates the average I/O rate for the specified period.
- **Max.:** Indicates the maximum I/O rate for the specified period.
- **Attribute:** Indicates the priority of each host bus adapter (HBA). **Prio.** indicates a high-priority HBA (a prioritized WWN). **Non-Prio.** indicates a low-priority HBA (a non-prioritized WWN).

5.5.3 Viewing Transfer Rates

Performance Monitor (Performance Management) tracks traffic between HBAs in the hosts and ports on the disk subsystem, and measures transfer rates (that is, the size of data transferred in one second).

Note: You must be monitoring the disk subsystem before statistics can be viewed (for details, refer to section 5.5.1).

To view transfer rates:

1. Ensure that the Hitachi Performance Monitor (Performance Management) panel is displayed.
2. Click the **WWN** tab (Figure 4.7).
The tree view displays a list of Priority Access groups (). Below Priority Access groups appears an item named **Not Grouped**.
 - If you double-click a Priority Access group, the tree view displays host bus adapters () in the Priority Access group.
 - If you double-click **Not Grouped**, the tree view displays host bus adapters () that do not belong to any Priority Access group.
3. Select **100KB/s** from the drop-down list on the right side of the Monitoring Data panel.

4. In the Monitoring Term area, do either of the following:
 - To view the transfer rate in real time, you must select the **Real Time** option and then click **Apply**.
Note: If you use the drop-down list to specify a time before clicking **Apply**, the specified time affects the data range for the graph. For example, if you want to view transfer rates for the last last ninety minutes, select **90** from the drop-down list.
 - To view transfer rates for a certain period of time in the last 24 hours, you must select the **From** option, change the date and time in the **From** and **To** boxes, and then click **Apply**. Use the arrow button and the sliders when you change the date and time in the **From** and **To** boxes (refer to section 4.2.4).
5. In the tree view, do either of the following:
 - To view the transfer rate for host bus adapters in a Priority Access group, select the Priority Access group.
The table area displays the transfer rate (Figure 5.19).
 - To view the transfer rate for host bus adapters that do not belong to any Priority Access group, select **Not Grouped**.
The table area displays the transfer rate (Figure 5.19).

Tips:

 - If you select the **Subsystem** folder in the tree view, the table displays the transfer rate at each Priority Access group (Figure 5.19).
 - If you select a host bus adapter () in the tree view, the table displays the transfer rate at each port connected to the selected host bus adapter (Figure 5.19).
6. To display a graph to find out how the transfer rate has been changed, take the following steps:
 - a) In the table, select one or more Priority Access groups or WWNs. **Note:** In future versions, the graph can also be displayed when one or more ports are selected in the table.
 - b) Click the Graph button.

Caution: If the graph does not display changes in the transfer rate (for example, if the line in the graph runs vertically), it is recommended that you change the value in the **Chart Y Axis Rate** drop-down list. For example, if the largest value in the table is 200 and the value in **Chart Y Axis Rate** is 100, you should select a value larger than 200 from **Chart Y Axis Rate**.

Note: If the WWN of a host bus adapter is displayed by red in the tree view, the host bus adapter is connected to two or more ports, but the traffic between the HBA and some of the ports are *not* controlled by Prioritized Port Control. Refer to section 6.2 for how to control the traffic between the HBA and the all the connected ports.

Transfer rate at host bus adapters

(Displayed when a Priority Access group or **Not Grouped** is selected)

	WWN	PPC Name	Current...	Ave...	Max...	Attribute
	0000000000000041	NAME65	-	72	72	Non-Prio.
	0000000000000042	NAME0066	-	71	71	Non-Prio.
	0000000000000043	NAME0067	-	70	70	Non-Prio.
	0000000000000044	NAME0068	-	69	69	Non-Prio.
	0000000000000045	NAME0069	-	68	68	Non-Prio.
	0000000000000046	NAME0070	-	67	67	Non-Prio.
	0000000000000047	NAME0071	-	66	66	Non-Prio.
	0000000000000048	NAME0072	-	65	65	Non-Prio.

Transfer rate at each Priority Access group

(Displayed when the **Subsystem** folder is selected)

	Group	Current...	Ave.(100KB/s)...	Max.(100KB/s)	Attribute
	GRNICK01	-	7174	7174	Non-Prio.
	GRNICK02	-	932	932	Prio.
	GRNICK03	-	804	804	Non-Prio.
	GRNICK04	-	676	676	Prio.
	GRNICK05	-	548	548	Non-Prio.
	GRNICK06	-	371	371	Prio.
	GRNICK07	-	308	308	Non-Prio.
	Not Grouped	-	3702	3702	-

Transfer rate at each port connected to a specified host bus adapter

(Displayed when a host bus adapter is selected)

	Port	Current(100KB/s)	Ave.(100KB/s)...	Max.(100KB/s)	Attribute
	CL1-A	-	-	-	Prio.
	CL1-B	-	-	-	Prio.

Figure 5.19 Transfer Rates for Host Bus Adapters

The table displays the following:

- : When the check mark icon  appears in this column, the graph displays changes in workload statistics about the item.
- **Group:** Indicates Priority Access groups.
- **WWN:** Indicates WWNs of host bus adapters.
- **Priority Access (PPC) name:** Indicates Priority Access (PPC) names of host bus adapters. Priority Access allows you to assign a *Priority Access (PPC) name* to each host bus adapter so that you can easily identify each host bus adapters in the Priority Access panels.
- **Port:** Indicates ports on the disk subsystem.
- **Current:** Indicates the current transfer rate.
- **Ave.:** Indicates the average transfer rate for the specified period.
- **Max.:** Indicates the maximum transfer rate for the specified period.
- **Attribute:** Indicates the priority of each host bus adapter (HBA). **Prio.** indicates a high-priority HBA (a prioritized WWN). **Non-Prio.** indicates a low-priority HBA (a non-prioritized WWN).

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) which 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.

PRELIMINARY RELEASE

Error Condition	Recommended Action
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 Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator™ User's Guide</i> (MK-92RD101), and contact the Hitachi Data Systems Technical Support Center.

6.2 Troubleshooting Performance Monitor (Performance Management)

If the WWN of a host bus adapter is displayed by red in the WWN tree view, the host bus adapter is connected to two or more ports, but the traffic between the HBA and some of the ports are not controlled by Prioritized Port Control. To control the traffic between the HBA and the all the connected ports, take the following steps:

1. Start Prioritized Port Control and ensure that the WWN tab is displayed.
2. In the upper-left tree view, double-click all the ports to which the HBA is connected.
3. Double-click all the Monitor entries and the No-Monitor entries that appear below the specified ports.
4. If you find any occurrence of the HBA below the No-Monitor entries, drag the HBA to Monitor.
5. Ensure that the HBA appears below each of the Monitor entries and click Apply.

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

CHA	channel adapter
CHP	channel processor
CSW	cache switch
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
RAID	redundant array of independent disks
SM	shared memory
SVP	service processor

