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Hitachi Freedom Storage™ Thunder 9570™ V Series

User and Reference Guide

Trademarks

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Document Revision Level

Revision	Date	Description
MK-92DF630-P	December 2002	Preliminary Release.
MK-92DF630-P1	January 2003	Preliminary Release. Supersedes and replaces MK-92DF630-P
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MK-92DF630-0	February 2003	Initial Release. Supersedes and replaces MK-92DF630-P2
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Document Revision Level

The following source documents were used to produce this User and Reference Guide:

- *SANRISE 9570V Series Disk Array Subsystem User's Guide*, 6th Edition.

- *Hitachi Freedom Storage™ Thunder 9570™ V Series User and Reference Guide*, RSD-92DF630-5.

Changes in this Revision:

- Added a note to Appendix D List of Storage Capacities Corresponding to RAID Levels and Configurations regarding storage capacity values

- Added a note to Appendix H Number of Logical Blocks regarding storage capacity values

- Changed the Applicable safety standard/rating in Table G.2 and Table G.3

- Changed Figure G.3 to reflect recent updates

- Added a note about the storage of subsystem to section 3.1.2 and section 3.2.2

- Changed the screens in step 2 and 3 of section 7.7.4.2 to reflect recent updates

- Changed the screens in step 1and 2 of section 7.7.4.4 to reflect recent updates

- Changed the screens in step 1 and 2 of section 7.7.4.6 to reflect recent updates

- Changed the screens in step 1and 2 of section 7.7.4.7 to reflect recent updates

- Changed the screens in step 1and 2 of section 7.7.4.8 to reflect recent updates

- Changed the screens in step 1 and 2 of section 7.7.4.9 to reflect recent updates

- Changed the screens in step 1 and 2 of section 7.7.4.10 to reflect recent updates

- Added "Online verify completed [odd unit]" message code I1E000, to Table 8.6

- Added "Online verify completed [even unit]" message code I1E100, to Table 8.6

- Deleted Serial Number in Configuration Information for HP and SUN in Table B.1

- Deleted Note 6 for Table B.1

- Deleted Serial Number in Configuration Information for IBM (AIX) and Sequent in Table B.1

- Deleted Note 5 for Table B.1

- Deleted Serial Number in Configuration Information for NT/Windows 2000 and Others in Table B.1

- Deleted Note 4 for Table B.1

- Changed the example of queue_depth setting in Table F.3

- Changed the Maximum Queue Depth for Initial to 8 in Table F.7.

- Changed the Maximum Queue Depth for direct FC-AL and Fabric witch to Optional in Table F.7

- Deleted *3 from Remarks for Maximum Number of LUNs in Table F.7

- Changed *3 for Table F.7

- Changed the value of Execution Throttle to Optional

- Changed the value for the Execution Throttle to Optional in Table F.8

- Added *1 to Note for Execution Throttle in Table F.8

- Changed the value of Execution Throttle to Optional in Table F.8

- Changed the value for the Execution Throttle to Optional in Table F.10

- Added *1 to Note for Execution Throttle in Table F.10

- Changed the value for the Execution Throttle to Optional in Table F.12

- Added *1 to Note for Execution Throttle in Table F.12

- Added F.9 Notes on Queue Depth

- Changed Table F.1

- Added *3 to Table F.1

- Changed Table F.2

- Changed the title of section F.7

- Changed the title of section F.8

- Changed "Up to 2 GBs (two pair of 512 MB DIMMs) of cache memory can be installed in each controller (or up to 4 GBs per subsystem)" to "Up to 2 GBs (one pair of 512 MB DIMMs) of cache memory can be installed in each controller (or up to 4 GBs per subsystem) in section 1.1.3

- Changed "The 9570V supports up to 128 LUNs" to "The 9530V supports up to 512 LUNs" in section 5.4

- Changed the description of open systems configuration in section 6.1.1

- Changed step 2 in section 7.4.1

- Changed step 8 in section 7.4.1

- Changed the figure in step 7 of 7.7.4.3

- Changed Figure 8.2 in section 8.3.2

- Changed Figure 8.3 in section 8.3.3

- Changed Figure 8.6 in section 8.3.4

- Changed Figure 8.7 in section 8.3.5

- Changed Figure 8.8 in section 8.3.6

- Changed Figure 8.9 in section 8.4.1

- Changed Figure 8.10 in section 8.4.2

- Changed Figure 8.11 in section 8.4.3

- Changed Figure 8.12 in section 8.4.3

- Changed Figure 8.13 in section 8.4.4

- Added *Note* 2 to Table 2.8

- Added *Note* to Table 2.9

- Added *Note* 3 to to the default setting value for the Subnet Mask in Table 8.3

- Deleted Variable IP in Table 8.3

- Changed *Note* 5 and *Note* 6 in Table C.1

- Changed the electric current for J2H to 15 A in Table F.1, F.2 and F.3

Referenced Documents

- *Hitachi Freedom Storage™ Thunder 9500™ V Series FlashAccess 9500V User's Guide* (MK-92DF612).

- *Hitachi Freedom Storage™ Thunder 9500™ V Series Resource Manager 9500V User's Guide Graphical User Interface (GUI)*, MK-92DF605.

- *Hitachi Freedom Storage ™ Thunder 9500 ™ V Series Resource Manager 9500V User's Guide Command Line Interface (CLI)*, MK-92DF603.

- *Hitachi Freedom Storage™ Thunder 9500™ V Series ShadowImage 9500V User's Guide* (MK-92DF607).

- *Hitachi Freedom Storage™ Thunder 9500™ V Series Synchronous TrueCopy 9500V User's Guide* (MK-92DF608).

Preface

The *Hitachi Freedom Storage™ Thunder 9570™ V Series User and Reference Guide* describes the physical, functional, and operational characteristics of the 9570V subsystem. This document also provides operation instructions, installation details, and configuration planning information for the 9570V subsystem.

This User and Reference Guide assumes that:

- The user has a background in data processing and understands direct-access storage device subsystems and their basic functions.

- The user is familiar with the Hitachi Freedom Storage™ Thunder 9570™ V Series array subsystem.

- The user is familiar with the Windows® 95, Windows® 98, Windows® 2000 or Windows NT® operating systems.

For further information on Hitachi Data Systems products and services, please contact your Hitachi Data Systems account team, or visit the Hitachi Data Systems worldwide web site at http://www.hds.com. For specific information on the supported host systems and platforms for the 9570V, please refer to the user documentation for the product, or contact the vendor's customer support service.

Terminology

Please note the following:

- The term DF600 refers to the Thunder 9500™ V Series subsystem.

COMMENTS

Please send us your comments on this document: doc.comments@hds.com.

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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Thank you!

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Chapter 1   Overview of the Thunder 9570™ V Series Subsystem

The Hitachi Freedom Storage™ Thunder 9570™ V Series subsystem is a high-performance, medium-capacity storage array with added features designed to reduce the possibility of data loss due to the failure of any single component. Disk array installation and setup are simplified using the Resource Manager 9500 program (optionally available). Many parts are replaceable while the disk array is online. Cache memory has a battery backup to preserve cache contents in the event of a power failure. For information regarding model types, see sections 1.2 Rack-Mount Model and 1.3 Floor Model.

This chapter includes the following:

- Overview Features

- Rack-Mount Model

- Floor Model

1.1   Overview Features

The following Hitachi Freedom Storage™ Thunder 9570™ V Series features are discussed in this section:

- High Data Availability

- Connectivity

- Enhanced Data Accessibility

- Scalability

- Performance Reporting and Monitoring

- Reliability, Availability, and Serviceability

1.1.1   High Data Availability

The 9570V is designed for high performance and protection of user data. See section 1.2 for additional information on the reliability and availability features of the Hitachi Thunder 9570™ V Series subsystem.

1.1.2   Connectivity

The Hitachi Thunder 9570™ V Series subsystem provides connectivity to most open systems through a standard Fibre Channel interface.

- With the Fibre Channel connection, the 9570V subsystem can transfer data between the host computer and the subsystem at a maximum speed of 200 MB/sec. The subsystem can be located up to 300 meters from the host.

- The 9570V subsystem enables you to construct a system which can connect up to 126 fibre channel devices by using the fibre channel interface and connecting the fibre-channel arbitrated loop (FC-AL) and the fibre channel switch (Fabric).

- When the system is configured to connect multiple hosts, a function is provided which rejects a boot by any host except a specified host. This function can prevent access from an illegal host.

1.1.3 Enhanced Data Accessibility

The 9570V supports command tag queuing, multi-initiator I/O, and most industry-standard middleware products providing host fail-over capability, I/O path fail-over support, and logical volume management. The 9570V also has many features that increase data accessibility and enable continuous user data access.

- FlashAccess 9500V allows a LUN to reside in cache memory for fastest possible access.

- LUNs can be created to suit customer needs using the Resource Manager 9500V.

- LUN Security 9500V allows the 9500V to control host access to LUNs by host Worldwide Name. Up to 128 Worldwide Names per port can be supported.

- Up to 2 GBs (one pair of 512 MB DIMMs) of cache memory can be installed in each controller (or up to 4 GBs per subsystem) to improve I/O performance.

- ShadowImage 9500V enables you to maintain subsystem-internal copies of all user data on the Thunder 9570™ V Series storage subsystem for purposes such as data backup or duplication.

1.1.4 Scalability

The architecture of the 9570V enables the user to scale the subsystem to meet a wide range of capacity and performance requirements.

- You can construct a variety of systems; for example, a system with 14 disk drives can be configured using a single RK, or a more complex system can be set up using the maximum of 224 disk drives, expanded by connecting up to 14 RKAs to the RK.

- Up to 15 spare disks can be set up and mounted in any location. Use the system effectively by mounting each spare disk in a disk drive slot left unused due to system construction.

  Note: Some disk drive slots cannot be used for spare disk. For additional information, contact Hitachi Data Systems Customer Support.

- From the host computer, the subsystem can be used as a single large-scale disk drive or as 512 logical disks (LUs) (maximum).

1.1.5 Performance Reporting and Monitoring

The Resource Manager 9500V program provides the capability to either monitor the disk array in real time or to collect historical data regarding the performance of the disk array.

1.1.6   Reliability, Availability, and Serviceability

The 9570V subsystem is not expected to fail in any way that would interrupt user access to data. The 9570V can sustain single component failures and still continue to provide full access to all stored user data.

Note: While access to user data will not normally be compromised, the failure of any single key component may degrade performance.

The reliability, availability, and serviceability features of the 9570V subsystem include:

- **High-Availability capability**. The 9570V subsystem provides high-availability capability for all critical components. The 9570V uses component and function redundancy to provide high availability for many subsystem components.

  The Controller of the Thunder 9570™ V Series subsystem increases data reliability by adding original 8-byte data assurance codes to data from a host computer by automatically generating them, writing them in the disk drive together with the data, and checking them when reading the data. On the data bus in the controller, the automatic generation of the data assurance codes and the check are executed to enhance data reliability in data distribution/concentration control, peculiar to the disk array.

  Up to 15 spare disks can be specified per subsystem; this function monitors the potential disk failure. Before failure occurs, the data copy operation can be automatically performed in the background. The dynamic sparing feature enables the subsystem to replace the spare disk due to redundancy (excluding RAID 0 configuration) and provides high reliability.

- **Redundant power supply systems**. Each 9570V unit has a set of two power supplies. Each power supply can provide power for the entire subsystem in the unlikely event of power supply failure. The power supplies of each set can be connected across power boundaries so that each set can continue to provide power if a power outage occurs. Each unit of the 9570V can sustain the loss of a single power supply and still continue operation.

- **High capacity cache.** The Thunder 9570™ V Series subsystem supports a maximum of 2 Gbs high capacity cache per controller. Writing completion can be reported to the host system when data is written to cache.

1.2   Rack-Mount Model

The rack-mount model is composed of a combination of the RK and RKA mounted on a rack frame. The RK is capable of mounting up to 14 disk drives; a controller to perform RAID control on the drives is included. The RKA is capable of mounting up to 15 disk drives and controls the drives through a connection with an RK. The RKA is provided with no controller.

Note: Since the RK controls the Thunder 9570™ V Series subsystem, at least one RK must be mounted. For details, consult with the Hitachi, Sales Division.

Note: For additional information about the rack-mount model, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series 19-Inch Rack Reference Guide* (MK-92DF654).

1.3   Floor Model

There are two floor model styles:

- Floor (RK+H1H) Model

- Floor (RK+RKA+H2H) Model

The Floor (RK+H1H) Model is capable of mounting up to 14 disk drives and include a controller to perform RAID control on the drives. The Floor (RK+RKA+H2H) model is capable of mounting up to 29 disk drives and includes a controller to perform RAID control on the drives.

Note: For the specifications of the Floor model, refer to Chapter 2 Planning for Installation and Operation.

Chapter 2   Planning for Installation and Operation

This chapter provides information for planning and preparing a site before and during installation of the Hitachi Thunder 9570™ V Series subsystem. Please read this chapter carefully before beginning your installation planning.

If you would like to use any of the 9570V features or products (e.g., LUN Security 9500V, FlashAccess 9500V), please contact your Hitachi Data Systems account team to obtain the appropriate license(s) and software key files.

Note: The general information in this chapter is provided to assist in installation planning and is not intended to be complete. The internal 9570V installation and maintenance documents used by Hitachi Data Systems personnel contain complete specifications. The exact electrical power interfaces and requirements for each site must be determined and verified to meet the applicable local regulations. For further information on site preparation for 9570V installations, contact your Hitachi Data Systems account team or the Hitachi Data Systems Support Center.

This chapter includes the following:

- User Responsibilities

- Safety Precautions

- Dimensions and Weight

- Service Clearance Requirements

- Floor Load Rating

- Internal Logic Specifications

- Cable Requirements

- Environmental Specifications

2.1   User Responsibilities

Before the 9570V subsystem arrives for installation, the user must provide the following items to ensure proper installation and configuration.

- Physical space necessary for proper subsystem function and maintenance activity
- Electrical input power
- Connectors and receptacles
- Air conditioning
- Floor ventilation areas (recommended but not required)
- Cable access holes

2.2   Safety Precautions

When using the 9570V disk array subsystem, follow these cautionary procedures:

- Perform operations in accordance with the instructions or procedures described in this manual.
- Follow the cautionary notes written on labels affixed to the equipment.
- Follow the cautionary notes written in this manual.

It is impossible to describe every hazard that may exist with this equipment. Please be aware of hazards not described in this manual. Work safely.

The following information is included in this section:

- Symbol Marks
- Repair, Modification, and Disassembly
- Precautions for Using the Equipment
- Precautions for Inspection and Cleaning
- Emergency Precautions
- Warning Notices

2.2.1 Symbol Marks

The ⚠ symbol followed by the word "CAUTION" in this manual indicates a potential safety hazard. When you see this symbol, observe the safety instructions that follow.

⚠ CAUTION	This symbol indicates the existence of a potential hazard which may cause a personal injury or serious damage to the equipment if the written contents are not observed.

2.2.2 Repair, Modification, and Disassembly

Users must not repair, remodel, or disassemble the equipment. Such actions may cause hazardous conditions for the user and/or the equipment.

2.2.3 Precautions for Using the Equipment

Use special precautions for the following:

- Equipment

- Cables

- Air Vents

- Battery Unit

- Nickel-Hydride Rechargeable Battery Instructions

- Other

2.2.3.1 Equipment

- If you notice unusual heat generation, odors, or smoke emission, shut off the power feed to the equipment and contact the maintenance engineer. Leaving such conditions unattended may result in hazardous physical conditions and equipment failure.

- Avoid physical disruption to the equipment. This may result in hazardous physical conditions and equipment failure.

- Do not place heavy objects on top of the disk array. Avoid using the equipment for any use other than its original purpose; otherwise, an injury or equipment failure may result.

2.2.3.2 Cables

- Avoid obstructing walkways when routing cables.

- Do not allow heavy material to be placed on cables. Do not place cables near any apparatus that generates heat. Do not step on or subject cables or connectors to shearing or pulling forces; the cable jacket can be damaged and can break, resulting in an electric shock, fire, or loss of data.

- Make sure that electrical and signal cables are clean before connecting them. Any dirt on a connector should be removed before inserting the connector into a socket.

2.2.3.3 Air Vents

- Make certain that the air vents are free of obstruction. They should be inspected periodically.

- Do not place metallic material such as paper clips or any combustible material such as paper into or near the air vents. This may result in electric shock or fire.

2.2.3.4 Battery Unit

Observe the following when handling the battery:

- Do not disassemble or tamper with the battery.

- Do not allow the battery to be physically damaged. If the battery is physically damaged, have it replaced as soon as possible.

- Do not connect the two terminals of the battery directly to each other; this will create a short circuit.

- Do not tamper with cable insulation.

- Do not connect the battery to any equipment other than the Thunder 9570™ V Series subsystem.

- Do not expose the battery to high temperatures.

- Use only the specified battery.

2.2.3.5 Nickel-Hydride Rechargeable Battery Instructions

These instructions explain what you must observe when you use a nickel-hydride rechargeable battery (hereafter it is referred to as the **battery**). If you use the battery incorrectly, it can overheat ignite, burst, or explode, damaging and deteriorating its performance/life. Read and follow the instructions below:

⚠ Danger

1. Do not disassemble the case; do not modify it or peel off the label. There are high voltage parts inside: if you attempt any of these actions, this can result in electrical shock or burning.

2. Do not disassemble the battery; this can cause short circuits inside or outside of the battery. If the components are exposed to the air, the battery can overheat, burst or ignite. Disassembling the battery can expose you to alkaline solution, which can be dangerous.

3. Do not cut the output cable. Do not modify the connector. If you attempt any of these actions, an electrical shock or burn can result. A short-circuit may cause abnormal chemical reactions inside the battery which leads to overheating, bursting or ignition.

4. Follow the instructions when you recharge the battery pack. If you recharge it in a way different from specified here, it may cause the following problems: The battery may become charged excessively; excessive current may be produced; or the battery cannot be recharged. As a result, the battery may leak, become overheated, burst, or ignite.

5. Do not use excessive force when you connect the battery pack to the charger or other devices. If you cannot connect it easily, check that the positive and negative positions are correct for the connector. If you connect the battery in reverse, it will be charged incorrectly and abnormal chemical reactions may occur inside. As a result, the battery may become overheated, burst or ignite.

6. Do not connect the battery to a power receptacle. If you apply an excessive amount of voltage to the battery, it may produce excessive current making the battery overheat, burst or ignite.

7. Do not use or leave the battery where the temperature can become high, such as, near a fire or a heating element. High temperatures can damage the battery's separator, which may cause short circuit, making it overheat, burst or ignite.

8. Do not incinerate or heat the battery pack. If you do so, the insulator may melt, the safety fuse/mechanism may be damaged, or the electrolyte may gush out. As a result, the battery can burst, explode or ignite.

9. Do not connect the negative terminal to the positive with metal wire. Do not carry or store the battery with other metal parts. This can cause a short circuit or produce an excessive current which can cause the battery to leak, overheat, burst or ignite.

10. Do not let the battery become wet by soaking it in the water or seawater. If the battery becomes wet, a short circuit can occur and an excessive amount of current can be produced, causing abnormal chemical reactions inside. As a result, the battery may become overheated, burst or ignite.

11. Do not nail or hammer the battery. The battery may be broken or dented and a short circuit may occur inside. As a result, the battery may become overheated, burst or ignite.

12. Do not solder directly to the battery. If you do so, heat will melt the insulator and damage the safety fuse/mechanism. As a result, the battery may leak or may become overheated, burst or ignite.

<div align="center">

⚠ Warning

</div>

13. If you find anything strange or unusual with the battery when you use/carry/store it, remove the battery from the device and stop using it. For example, strange smells, strange colors, or deformation are a sign you must stop using the battery.

14. If it takes longer than the specified time to complete recharging, stop recharging the battery; otherwise, the battery may become overheated, burst or ignite.

If the battery leaks and gets into your eyes, immediately flush your eyes with clean water (tap water) and do not rub your eye. Visit the doctor immediately. If you do not seek any treatment for your eyes, problems may occur later. Because the battery uses highly concentrated alkaline as electrolyte, it can burn; you may lose your sight if it makes contacts your eyes. If the battery's liquid contacts your skin or eyes, you must flush them with plenty of clean water and visit a doctor at once.

2.2.3.6   Other

When a failure occurs in the unit, take action according to the procedures recommended in this manual. If the difficulty does not correspond to the corrective measures documented in this manual, contact the maintenance engineer.

2.2.4   Precautions for Inspection and Cleaning

- If a maintenance activity requires that the unit be powered off, make sure that the power-off sequence described in the manual is performed before proceeding with maintenance.

- Do not work on the unit in a damp or flooded environment.

- Do not obstruct access to the unit with parts or tools.

- When performing the work with the door open, take off metal watches or jewelry to prevent electric shock. If you wear metal-frame glasses, do not touch the equipment.

- Ensure that loose clothing, jewelry, or hair do not become tangled in moving components.

- There are high-voltage parts in the equipment. Observe the cautionary statements in the manual to make sure that high-voltage components are not touched during maintenance. Another person should be on alert to shut off the power feed to the equipment.

- After the power feed to the equipment is shut off, electricity remains in the equipment for a period of time. Therefore, do not touch any components other than those indicated in this manual.

- The equipment can become extremely hot. Do not touch any part other than those indicated in this manual.

- When working with the door open, wear cotton gloves to prevent your hands from touching sharp objects.

2.2.5   Emergency Precautions

Follow these emergency precautions for the following:

- Electric Shock
- Fire

2.2.5.1   Electric Shock

- Do NOT immediately touch the person struck by electricity. You could be the second victim.
- To shut off the electric flow to a victim, disconnect the power feed cable of the equipment. In spite of this action, electricity may not be shut off. Separate the victim from the current source by using a non-conductive material such as dry wooden bar.
- Call an ambulance.
- When the victim has lost consciousness, practice artificial respiration on the victim. To prepare for such a case, learn how to practice artificial respiration.
- When the victim's heart has stopped, give a heart massage. This treatment should only be conducted by a person who has been trained and qualified.

2.2.5.2   Fire

- To shut off the electric flow to the equipment, pull out the power feed cable. This will terminate the power supply.
- If a fire cannot be extinguished when the electric flow has been shut off, use fire-fighting procedures and contact the fire department.

2.2.6 Warning Notices

2.2.6.1 **⚠ CAUTION** Statements

⚠ CAUTION statements described in this manual and the pages where they appear are listed below.

Table 2.1 **⚠ CAUTION** Statements

Warning Statement	Corresponding Page
Cooling fans rotate at a high speed. Keep body parts and loose clothing away from the cooling fans.	10
When cleaning, take care not to touch electrically charged parts. Electric shock may result.	10, 11
Do not touch electrically charged components during parts replacement. Electric shock may result.	11

2.2.7 Locations of Warning Labels on the Equipment

Warning labels are pasted on sections of equipment which require special care. Read the messages and observe the warning procedures. They are shown in the following figures:

- Floor Model RK+H1H
- Floor Model RK+RKA+H2H
- Rack-Mount Model RK
- Rack-Mount Model RKA

Table 2.2 lists and describes the symbols contained in warning labels.

Table 2.2 Symbols Contained in Warning Labels

Symbol Mark	Description
	Caution - electric shock.
	Caution - very hot.
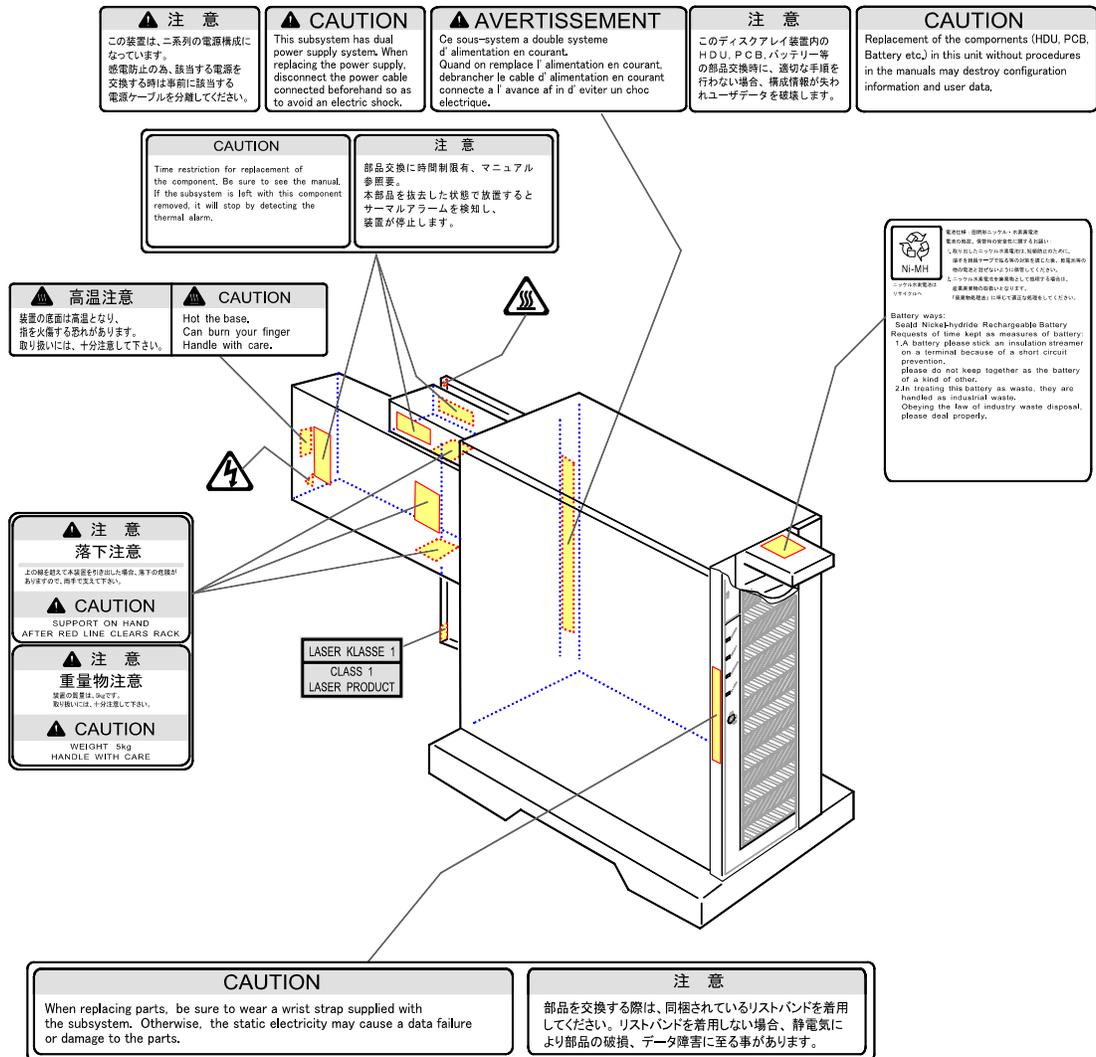
Figure 2.1   Positions and Contents of Labels on Floor Model RK+H1H
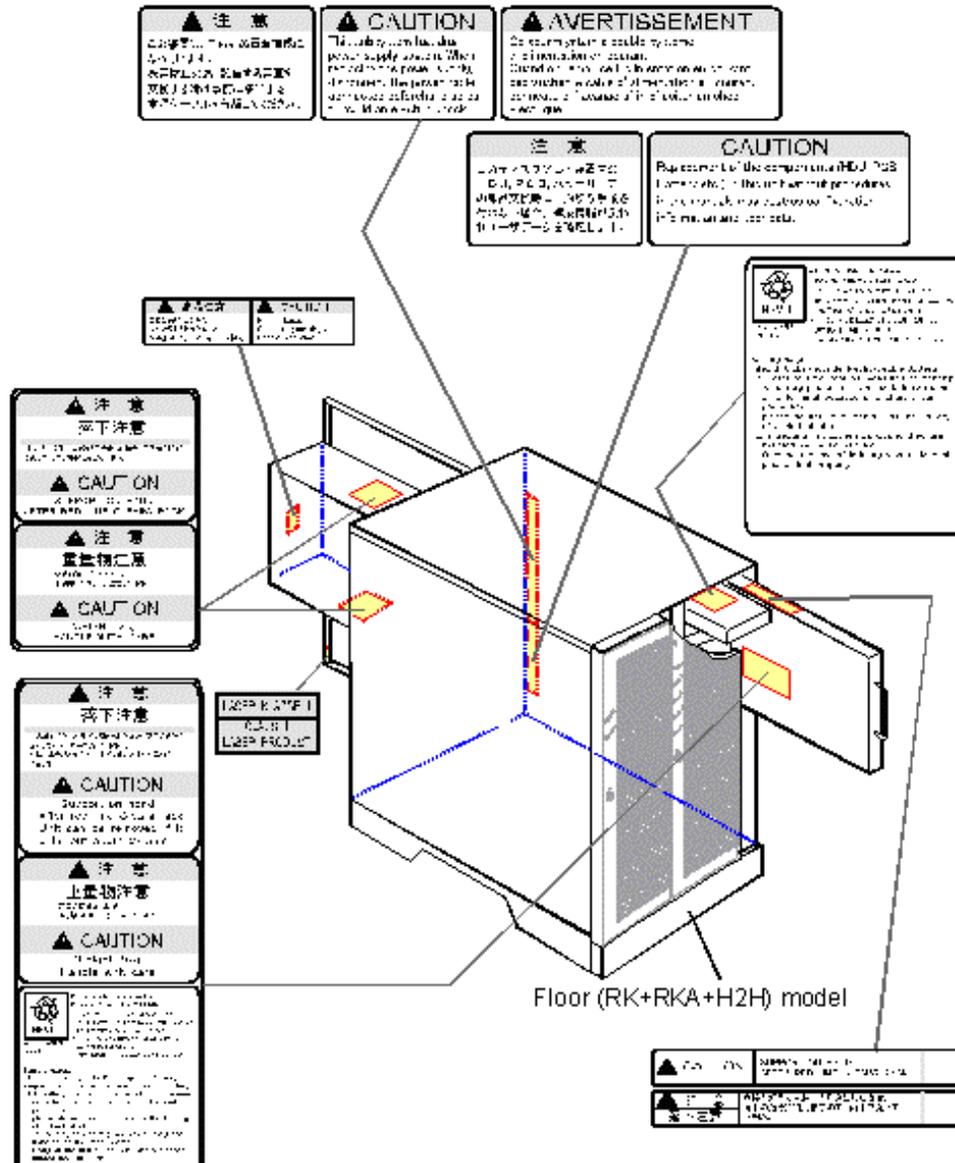
Figure 2.2   Positions and Contents of Labels on Floor Model RK+RKA+H2H

Figure 2.3   Positions and Contents of Labels on Rack-Mount Model RK
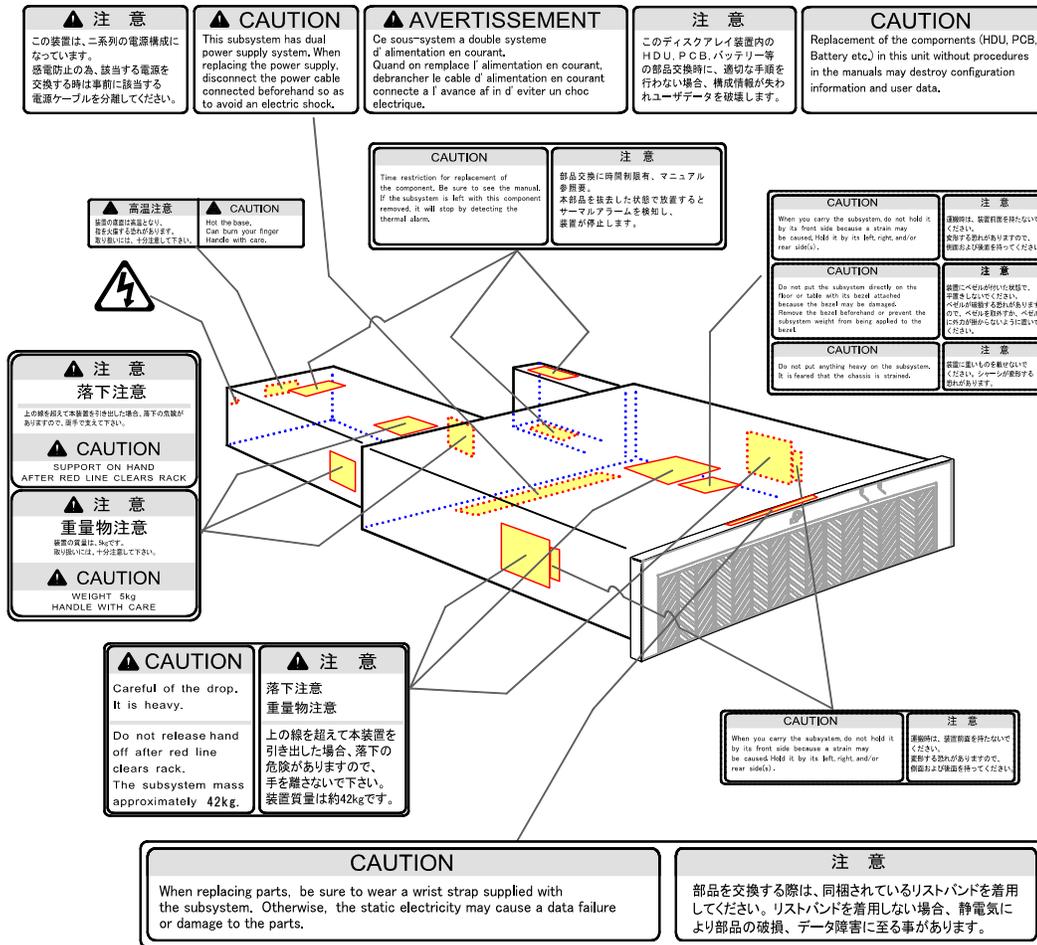
Figure 2.4 Positions and Contents of Labels on Rack-Mount Model RKA

2.3   General Specifications and Requirements

This section describes the general specifications and requirements for the Thunder 9570™ V Series subsystem. The following are included:

- Dimensions and Weight

- Service Clearance Requirements

- Floor Load Rating

- Internal Logic Specifications

- Cable Requirements

2.3.1   Dimensions and Weight

The following table illustrates the dimensions and weight of the 9570V rack-mount model and the 9570V floor model.

Table 2.3   9570V Dimensions and Weight of the Rack-Mount Model

Item	Model	Rack-Mount Model	
		RK	RKA
Physical Specifications	Chassis size (W×D×H) (mm)	483×656×129	
	Mass (kg)	44 approx	42 approx
	Acoustic noise (dB)	57 approx	58 approx
	Required height (EIA unit)	3	

Table 2.4   9570V Dimensions and Weight of the Floor Model

Item	Model	Floor Model	
		Floor (RK+H1H) Model	Floor (RK+RKA+H2H) Model
Physical Specifications	Chassis size (W×D×H) (mm)	260×737×540	309×737×540
	Mass (kg)	80 approx	125 approx
	Acoustic noise (dB)	53 approx	56 approx

2.3.2   Service Clearance Requirements

The following figure shows the floor area required for installing the equipment. Install the equipment in a place with the area shown in the figure to avoid problems such as inadequate service clearance or insufficient ventilation. All distances in the following figure are stated in millimeters (mm).
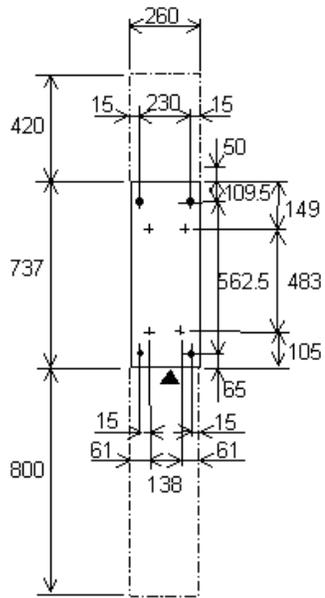
Floor (RK+H 1H) Model
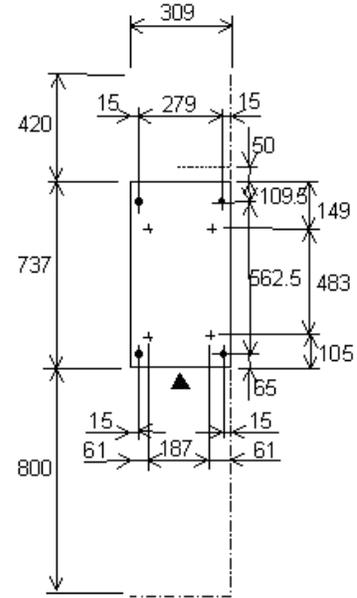
Floor (RK+RKA+H 2H) Model

2.3.3   Floor Load Rating

This section includes:

- Floor Load Rating for the 9570V Rack-Mount Model
- Floor Load Rating for the 9570V Floor Model

2.3.3.1   Floor Load Rating for the 9570V Rack-Mount Model

In the maximum configuration, the rack-mount model can be configured with 1 RK and 14 RKAs. The total weight of the subsystem in this configuration is 1,030 kg.

Note: For additional information about the rack-mount model, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series 19-Inch Rack Reference Guide* (MK-92DF654).

2.3.3.2   Floor Load Rating for the 9570V Floor Model

The Floor (RK+H1H) Model contains controller boards (up to 2) and disk drives (up to 14). A maximum configuration weighs 80 kg.

The Floor (RK+RKA+H2H) Model contains controller boards (up to 2) and disk drives (up to 29). A maximum configuration weighs 125 kg.

To assure adequate load-bearing capacity, plan for the maximum configuration.

2.3.4   Internal Logic Specifications

The following table lists the internal logic specifications of the 9570V.

Table 2.5   Internal Logic Specification of the 9570V Rack-Mount Model

Item		Specification (Note)
Internal logic specification	Control CPU	Power PC7455 (667 MHz)
	Control OS	VxWorks
	Control memory	Flash memory: 2 Mbytes L2 cache memory: 512 Kbytes SRAM: 64 M bytes
	Data bus performance	Cache access: 2.44 Gbytes/s
	Data assurance method	Data bus: Through-parity Cache memory: ECC (1 bit for correction, 2 bits for detection) Disk drive: Data assurance code

Note: RKA is not included in these specifications.

Note: For additional information about the rack-mount model, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series 19-Inch Rack Reference Guide* (MK-92DF654).

2.3.5   Cable Functions

The following table lists the principal functions of the 9570V cable. Fibre channel cables are available from Hitachi Data Systems.

Table 2.6   Principal Functions of 9570V Cables

Cable	Function
Fibre Channel cable	Connect with a host or HBA/Switch.
ENC (ENCLOSURE) cable	Connect between subsystems with 4 loops Fibre Channel (FC_AL).
LAN Cross cable	Connect the PCs for user, monitoring and maintenance.

2.4   Environmental Specifications and Requirements

To maintain optimal Thunder 9570V performance, the 9570V subsystem must be installed in a proper environment. This section discusses the following necessary environmental specifications and requirements:

- Environmental Hazards

- Temperature and Humidity Requirements

- Input Power and Insulation Performance Specifications

- Air Flow Requirements

- Vibration and Shock Tolerances

- Reliability

2.4.1   Environmental Hazards

Do not install the subsystem in the places described below; the life of equipment functioning will be shortened and equipment failures will occur. **Avoid** the following:

- Direct sunlight exposure

- Temperature and humidity variation (for example, near an air conditioner)

- Close proximity to a device that generates electrical noise and motion (for example, air conditioner that is not grounded and washing machine motor)

- Close proximity to an apparatus that generates a strong magnetic field

- Excessive dust

- Frequent vibrations

- An inclined floor

2.4.2   Temperature and Humidity Requirements

Table 2.7 lists the temperature and humidity requirements for the 9570V subsystem.

Table 2.7   Environmental Specifications

Item		Specification
Temperature	In operation (°C)	10 to 40
	In non-operation (°C)	-10 to 50
	In transport/storage (°C)	-30 to 60
	Temperature change rate (°C/h)	10 or less
Humidity	In operation (%)	8 to 80
	In non-operation (%)	8 to 90
	Maximum wet bulb temperature (°C)	29 (non-condensing)
Altitude	In operation (m)	-300 to 3,000
	In non-operation (m)	-300 to 12,000

2.4.3   Input Power and Insulation Performance Specifications

The following tables list the input power and insulation performance specifications for the 9570V rack-mount models and the 9570V floor model.

Table 2.8   Input Power and Insulation Performance Specifications for the Rack-Mount Model

Item	Model	Rack-Mount Model	
		RK	RKA
Input power specification	Input voltage (V)	AC 100/200 (100-120/200-240)	
	Frequency (Hz)	50/60 ± 1	
	Number of phases, cabling	Single-phase with protective grounding	
	Steady-state current (A) (See **Note1** and **Note2**)	4.4×2/2.2×2	3.2×2/1.6×2
	Breaking current (A)	16.0	
	Required power	Steady state (VA)	880 of less	640 of less
		Starting state (VA)	920 of less	720 of less
Heat value	Steady state (kJ/h)	3,170 or less	2,300 or less
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)	
	Insulation resistance	DC 500 V, 10 M Ω or more	

Note1: This indicates the current consumption in the usual state. When a power supply failure occurs, the power consumption is provided by the single power supply for the subsystem.

Note2: The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

Table 2.9   Input Power and Insulation Performance Specifications for the Floor Model

Item	Model		Floor Model	
			Floor (RK+H1H) Model	Floor (RK+RKA+H2H) Model
Input power specification	Input voltage (V)		AC 100/200 (100-120/200-240)	
	Frequency (Hz)		50/60 ± 1	
	Number of phases, cabling		Single-phase with protective grounding	
	Steady-state current (A)		4.4×2/2.2×2	4.4×2+3.2×2/ 2.2×2+1.6×2
	Breaking current (A) (see **Note**)		16.0	
	Required power	Steady state (VA)	880 of less	1,520 of less
		Starting state (VA)	920 of less	1,640 of less
Heat value	Steady state (kJ/h)		3,170 or less	2,300 or less
Insulation performance	Insulation withstand voltage		AC 1,500 V (10 mA, 1 min)	AC 1,500 V (100 mA, 1 min)
	Insulation resistance		DC 500 V, 10 M Ω or more	

Note: The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

2.4.4   Air Flow Requirements

The 9570V subsystem is air-cooled. Air must enter the subsystem through the airflow intakes at the back of each subsystem and must be exhausted out of the front, so it is very important that the air intakes and outlets remain clear.

2.4.5 Vibration and Shock Tolerances

Table 2.10 lists the vibration and shock tolerance data for the 9570V subsystem. The 9570V can tolerate vibration and shock within these limits and continue to perform normally. The user should consider these requirements if installing the 9570V near large generators located on the floor above or below the 9570V subsystem. Generators or any other source of vibration, if not insulated or shock-mounted, can cause excessive vibration that may affect the subsystem.

Table 2.10   Vibration and Shock Tolerances

Item		Specification
Vibration	In operation (m/s^2)	2.5 or less
	In non-operation (m/s^2)	5.0 or less
	In transport (packed) (m/s^2)	5.0 or less
Impact	In operation (m/s^2)	20 or less
	In non-operation (m/s^2)	50 or less
	In transport (packed) (m/s^2)	80 or less
Angle at which the subsystem will turn over (°)		15 or less

2.4.6 Reliability

The reliability of the 9570V is described in the following tables.

Table 2.11   Reliability of the 9570V Rack-Mount Model

Item	Model	Rack-Mount Model	
		RK	RKA
Reliability	Drop in package (JIS Z 0200-1997)	No abnormality must be caused by a free drop of level IV.	
	Radio frequency radiation	Conforms to FCC Class A	
	Instantaneous power failure	10 ms (100% dip)	

Table 2.12   Reliability of the 9570V Floor Model

Item	Model	Floor Model	
		Floor (RK+H1H) Model/	**Floor (RK+RKA+H2H) Model**
Reliability	Drop in package (JIS Z 0200-1997)	No abnormality must be caused by a free drop of level IV.	No abnormality must be caused by a drop of level IV. (one end is dropped while another end is supported.)
	Radio frequency radiation	Conforms to FCC Class A	
	Instantaneous power failure	10 ms (100% dip)	

Chapter 3   Powering On/Off Procedure

The disk drive may emit audible mechanical sounds when the disk drive is started (spun up), immediately after the subsystem is powered on and powered off (spun down). However, this does not indicate a problem if the WARNING or ALARM LED of the basic frame is off; you may use the subsystem.

This section describes power on/off procedures for the following:

■   9570V Rack-Mount Model

■   9570V Floor Model

3.1   9570V Rack-Mount Model

The following steps describe power on/off procedures for the 9570V rack-mount model.

Note: For additional information about the rack-mount model, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series 19-Inch Rack Reference Guide* (MK-92DF654).

3.1.1   Subsystem Power On

Note: The EALM lamp (red) of the controller (on the rear side of the subsystem) may come on between subsystem power-on and Ready status. However, it is not a problem if the EALM lamp (red) goes out during this period of time.

1.   Verify that the main switch is turned off.

2.   Verify that the AC power unit switch of each power unit is turned off.

3.   Verify that the circuit breaker (CB1) is turned off.

4.   Turn on the circuit breaker (CB1) of the PDB.

5.   Turn on the AC power unit switch of the power unit on RKA.

    Note: When two or more disk drives are not installed on the additional disk drive unit side, shut off the power to the power unit (RKA).

6.   Turn on the AC power unit switch of the power unit on RK.

7.   Turn on the main switch.

8.   Make sure that the READY LED (green) lights within five minutes. If the ALARM LED (red) or WARNING LED (orange) lights, refer to 8.1 Troubleshooting Based on LED Indications.

3.1.2   Subsystem Power Off

1. Turn off the main switch.

2. Verify that the POWER LED (green) on the panel is off.

3. Turn off the AC power unit switch of the power unit.

4. Turn off the circuit breaker (CB1) of the PDB.

Note: When storing the subsystem without turning on the power for long periods, request that the maintenance engineer turn off the battery of the subsystem. For details on how to store the subsystem, refer to Chapter 9 Periodic Maintenance.

3.2   9570V Floor Model

The following steps describe power on/off procedures for the 9570V floor model.

3.2.1   Subsystem Power On

Note: The EALM lamp (red) of the controller (on the rear side of the subsystem) may come on between subsystem power-on and Ready status. However, it is not a problem if the EALM lamp (red) goes out during this period of time.

1. Verify that the main switch is turned off.

2. Verify that the AC power unit switch of the power unit is turned off.

3. Turn on the AC power unit switch of the power unit on RKA.

   Note: When disk drives are not installed on the additional disk drive unit side, shut off the power to the power unit (RKA).

4. Turn on the AC power unit switch of the power unit on RK.

5. Turn on the main switch.

6. Verify that the READY LED (green) lights within five minutes. If the ALARM LED (red) or WARNING LED (orange) lights, refer to 8.1 Troubleshooting Based on LED Indications.
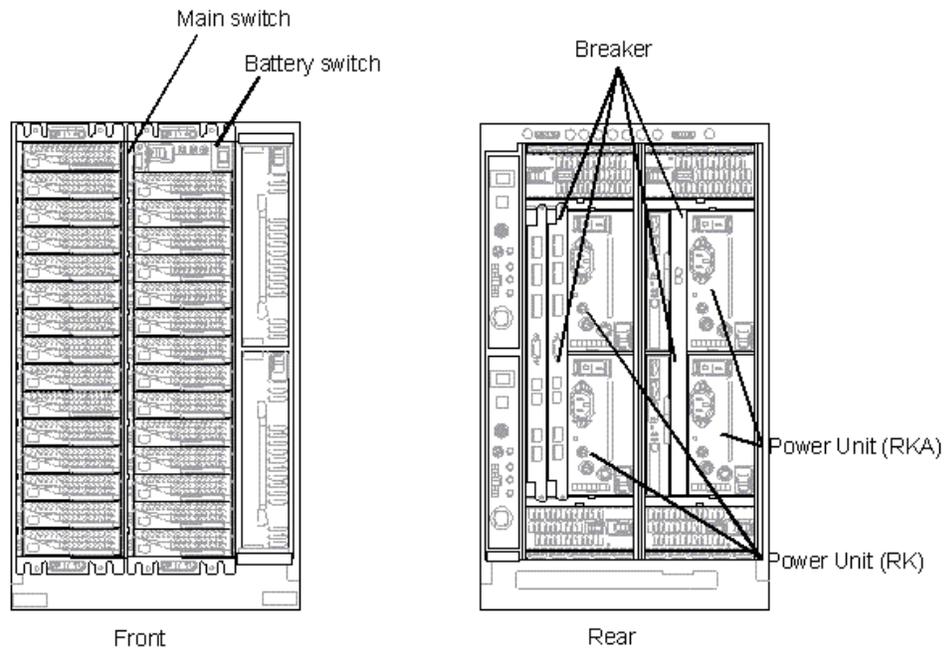
Figure 3.1   Subsystem Power On/Off (Example: Floor [RK+RKA+H2H] Model)

3.2.2   Subsystem Power Off

1. Turn off the main switch.

2. Verify that the POWER LED (green) on the panel is off.

3. Turn off the AC power unit switch of the power unit.

Note: When storing the subsystem without turning on the power for long periods, request that the maintenance engineer turn off the battery of the subsystem. For details on how to store the subsystem, refer to Chapter 9 Periodic Maintenance.

Chapter 4 Subsystem Architecture and Components

This chapter includes the following:

- Configuration Block Diagrams

- Redundant Power Supplies

- Fibre Channel Interface

- Array Frames

- Disk Array Groups

- Service Processor (SVP)

- Component Names, Locations, and Functions

- Periodical Replacement Parts and Parts with Limited Lives

4.1 Configuration Block Diagrams

This section includes block diagrams for the following:

- 9570V Rack-Mount Model
- 9570V Floor Model

4.1.1 9570V Rack-Mount Model

The configuration block diagrams of the RK and RKA Rack-Mount models are shown below. The RK and RKA can mount up to 14, 15 disk drives respectively. (The RK has a controller that can control up to 224 disk drives as RAID.)

The disk drives can be assigned to data disk(s), parity disk(s) (mirror disk(s)) depending on the RAID level.

Up to 15 spare disks can be mounted in any locations within the configuration.
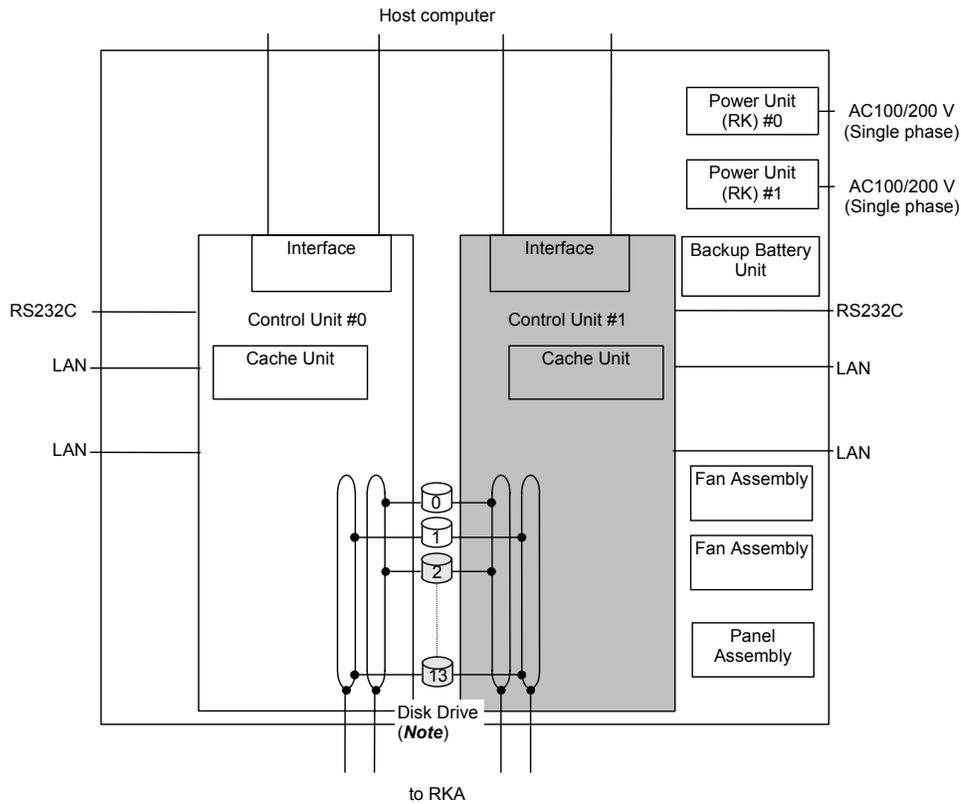
Note: Disk drive: DF-F600-AEH36, DF-F600-AEF72, DF-F600-AEH72, DF-F600-AEF146, DF-F600-AEH146

Figure 4.1   RK Unit System Configuration

□ : Basic component and indispensable optional part
▨ : Option (additional) part
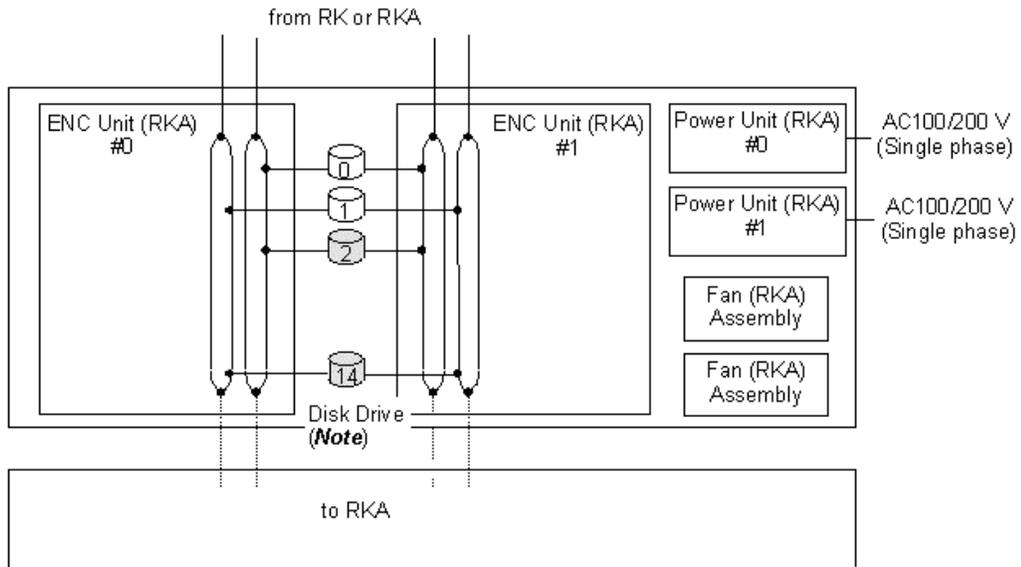
Note: Disk drive: DF-F600-AEH36, DF-F600-AEF72, DF-F600-AEH72, DF-F600-AEF146, DF-F600-AEH146

Figure 4.2   RKA Unit System Configuration

4.1.2   9570V Floor Model

The configuration block diagrams of the Floor (RK+H1H) Model and Floor (RK+RKA+H2H) Model are shown below.

The Floor (RK+H1H) Model can mount up to 14 disk drives. The Floor (RK+RKA+H2H) Model can mount up to 29 disk drives.

The disk drives can be assigned to data disk(s), parity disk(s) (mirror disk(s)) depending on the RAID level.

Up to 15 spare disks (for Floor [RK+H1H] Model: up to 1)can be mounted in any locations within the configuration.

☐ : Basic component and indispensable optional part
▨ : Option (additional) part
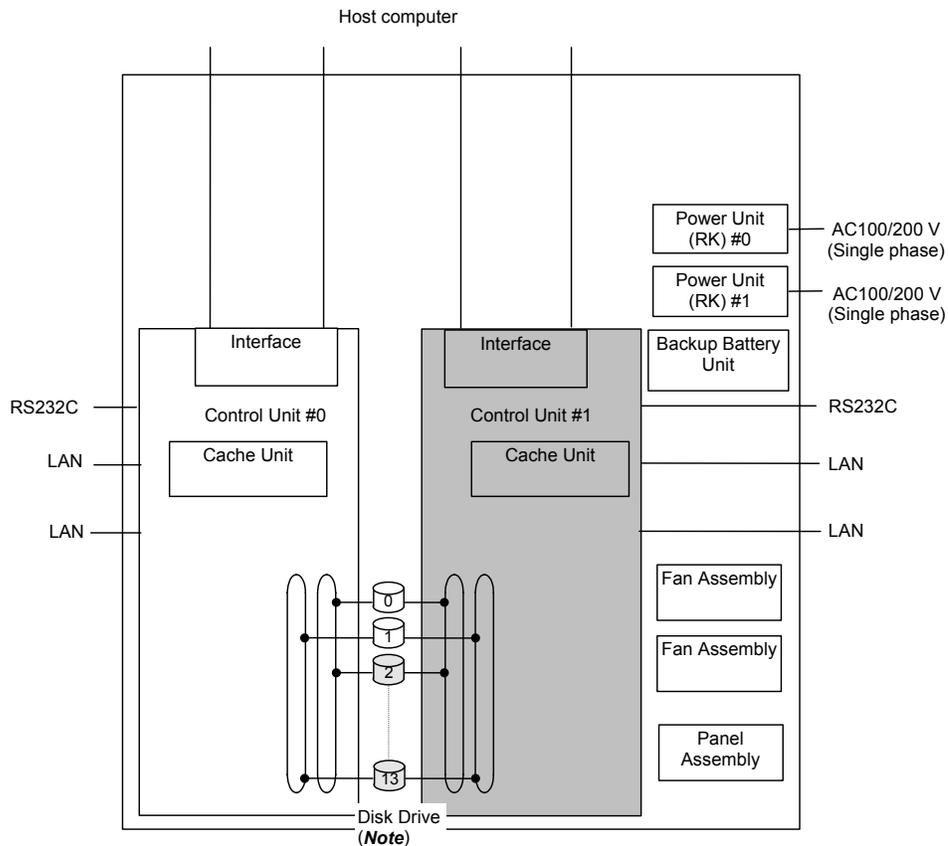
Note: Disk drive: DF-F600-AEH36, DF-F600-AEF72, DF-F600-AEH72, DF-F600-AEF146, DF-F600-AEH146

Figure 4.3   Floor (RK+H1H) Model System Configuration

: Basic component and indispensable optional part
: Option (additional) part
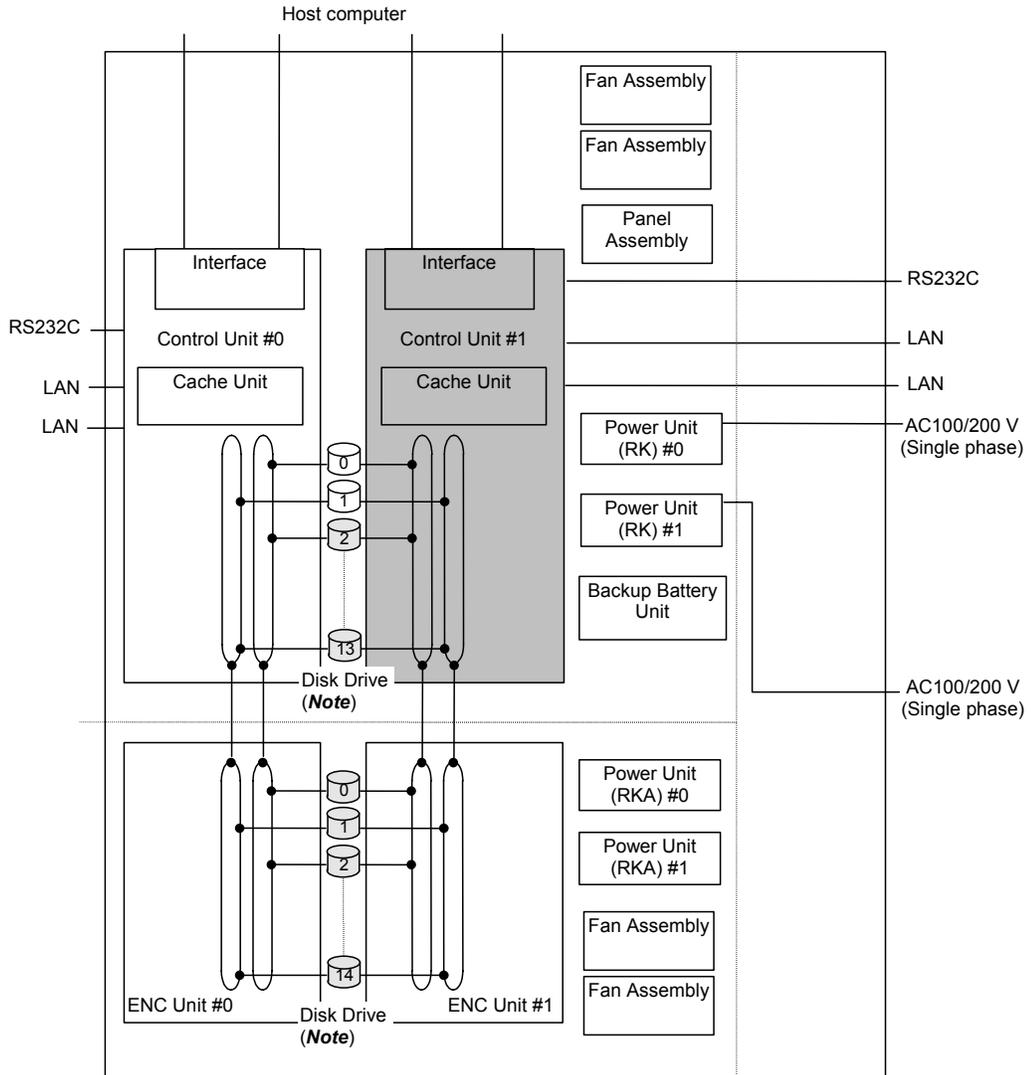
Note: Disk drive: DF-F600-AEH36, DF-F600-AEF72, DF-F600-AEH72, DF-F600-AEF146, DF-F600-AEH146

Figure 4.4   Floor (RK+RKA+H2H) Model System Configuration

4.2   Redundant Power Supplies

Each 9570V unit is powered by its own set of redundant power supplies, and each power supply is able to provide power for the entire RK or RKA unit, should it become necessary. Because of this redundancy, the Thunder 9570™ V Series subsystem can sustain the loss of multiple power supplies and still continue operation. To make use of this capability, the two power supplies of each 9570V unit should be connected either to dual power sources or to different power panels, so if there is a power failure on one of the sources, the Thunder 9570™ V Series subsystem can continue full operations using power from the alternate source.

4.3   Fibre Channel Interface

The Thunder 9570™ V Series subsystem supports open system operations. The Thunder 9570™ V Series subsystem supports up to 4 fibre-channel ports. The 9570V Fibre Channel interface is capable of operating at data transfer speeds of up to 200 MB/sec. The 9570V supports shortwave multimode optical cables. With these shortwave fibre channel cards, the 9570V subsystem can be located up to 300 meters from the open-system host.

4.4   Array Frame

The following array frames are described in this section:

- 9570V Rack-Mount Model
- 9570V Floor Model

4.4.1   9570V Rack-Mount Model

Each RK or RKA unit contains the physical disk drives, including the disk array groups and the dynamic spare disk drives. Each rack frame has dual AC power plugs, which should be attached to two different power sources or power panels. The 9570V can be configured with 1 RK and up to 14 RKA units for a total of 224 GB disk drives at a maximum of 32.0 Tbytes RAID0 (using the 146 G disk drive).

Table 4.1   Basic Specifications of the Rack-Mount Model

	Model	Rack-Mount model	
Item		1 RK	1 RKA
Configuration	Configuration	1 RK	1 RKA
	System appearance		
Disk drive used	Disk drive size (W×D×H) (mm)	101.6×146.1×25.5	
	Data capacity (Gbyte)	35.4/71.3/143.3	
	Rotational speed (min^{-1})	10,000/15,000	
	Maximum mountable quantity (unit)	14	15
Host interface	Interface type	2 Gbps Fibre Channel Optical (Non-OFC)	-
	Data transfer speed (i.e. maximum speed for transfer to host)	200 M bytes/s (Fibre Channel)	-
	Number of ports Single controller	Fibre Channel: 2	-
	Dual controller	Fibre Channel: 4	-
	Transferred block size (bytes)	512	-

Note: For additional information about the rack-mount model, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series 19-Inch Rack Reference Guide* (MK-92DF654).

4.4.2 Floor Model

Each floor model contains physical disk drives, including the disk array groups and the dynamic spare disk drives. Additionally, each floor model has dual AC power plugs, which should be attached to two different power sources or power panels.

Floor (RK+H1H) Model can be configured with 14 disk drives at a maximum of 1,001 Gbytes RAID0.

Floor (RK+RKA+H2H) Model can be configured with 29 disk drives at a maximum of 2,232 Gbytes RAID0 (using the 146 G disk drive).

Table 4.2   Basic Specifications of the Floor Model

Item	Model	Floor model	
		Floor (RK+H1H) Model/	**Floor (RK+RKA+H2H) Model**
Configuration	Configuration	1 RK +Floor setting kit (DF-F600-H1H)	1 RK+1 RKA+Floor setting kit (DF-F600-H2H)
	System appearance		
Disk drive used	Disk drive size (W×D×H) (mm)	101.6×146.1×25.5	
	Data capacity (Gbyte)	35.4/71.3/143.3	
	Rotational speed (min^{-1})	10,000/15,000	
	Maximum mountable quantity (unit)	14	29
Host interface	Interface type	2 Gbps Fibre Channel Optical (Non-OFC)	
	Data transfer speed (i.e. maximum speed for transfer to host)	200 M bytes/s (Fibre Channel)	
	Number of ports Single controller	Fibre Channel: 2	
	Dual controller	Fibre Channel: 4	
	Transferred block size (bytes)	512	

4.5   Disk Array Groups

The RAID group is the basic unit of storage capacity for the Thunder 9570™ V Series subsystem. All disk drives in a RAID group must have the same logical capacity. When a RAID group is configured with drives of different capacity, the RAID group is configured by assuming the minimum capacity of the drives.

The 9570V supports several different RAID levels.

Note: Details of the storage capacities, depending on the RAID level and subsystem configuration, are shown in Appendix E List of Storage Capacities Corresponding to RAID Levels and Configurations.

4.6   Service Processor (SVP)

The Thunder 9570™ V Series subsystem is controlled by the service processor (SVP). The SVP is integrated into the controller frame and is accessed through the Resource Manager 9500V program and service utilities. The SVP enables Hitachi Data Systems representatives to configure, maintain, and upgrade the 9570V subsystem.

4.7   Component Names, Locations, and Functions

This section includes the following:

- Front Bezel Component Locations and Functions

- RK and RKA Component Locations

- Switch Locations and Functions

- Connector Locations and Functions

- LED Locations and Functions

4.7.1   Front Bezel Component Locations and Functions

This section illustrates and describes the locations and functions for the front bezel.
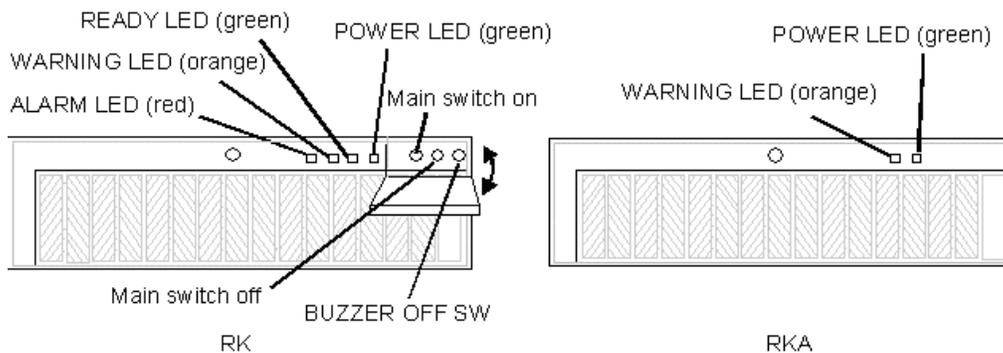
Figure 4.5   Front Bezel Component Locations

Table 4.3   Front Bezel Component Functions

Name	Function
ALARM LED (red)	Indicates that a failure has occurred which makes the subsystem inoperable.
WARNING LED (orange)	Indicates that a failure occurred, but the subsystem is currently operational.
READY LED (green)	Indicates that the subsystem is operational.
POWER LED (green)	Indicates that the power is supplied to the subsystem.
Main switch on	ON: Turns on the power.
Main switch off	OFF: Turns off the power.
BUZZER OFF SW	Press this switch when the buzzer sounds to stop the beep. When a serious hardware failure occurs, (electrical surges of both power supplies and so on), the buzzer does not stop even when the button is pushed.

4.7.2 RK and RKA Component Locations

The locations of the RK and RKA components are shown in the following diagram:
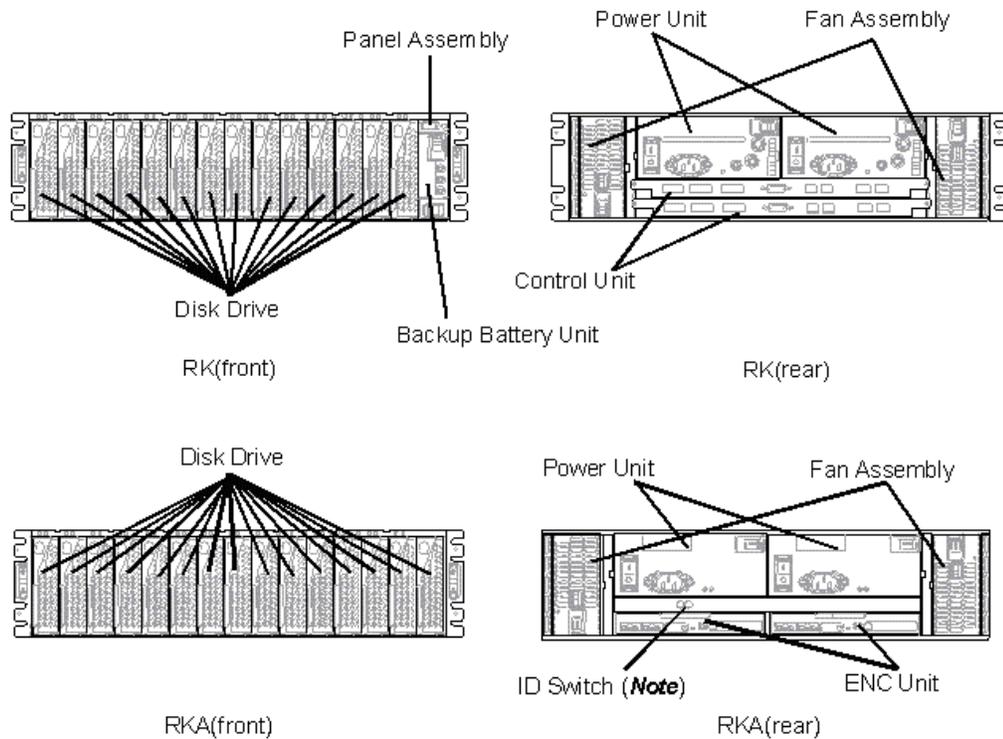
Figure 4.6   RK and RKA Component Locations

Note: Sets the device ID (1 to 14) of the RKA.

4.7.3   Switch Locations and Functions

This section illustrates and describes the locations and functions for switches in the following hardware components:

- Panel Assembly
- Backup Battery Unit
- Power Unit

4.7.3.1   Panel Assembly
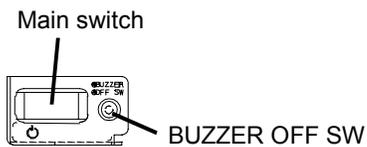
Figure 4.7   Panel Assembly Switch Location

Table 4.4   Panel Assembly Switch Functions

Switch	Function
Main switch	Turns on/off the power.
BUZZER OFF SW	Pressing this switch while the buzzer sounds stops the beep. When a serious hardware failure occurs, (electrical surges of both power supplies and so on), the buzzer does not stop even when the button is pushed.

4.7.3.2 Backup Battery Unit
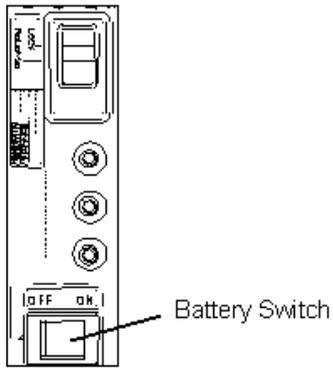
Figure 4.8   Backup Battery Unit Switch Location

Table 4.5   Backup Battery Unit Switch Functions

Switch	Function
Battery Switch	Turns on/off the battery power. When this switch is set to the off, the WARN LED comes on and the buzzer sounds.

4.7.3.3 Power Unit
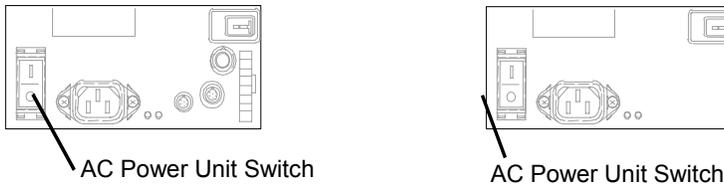
Figure 4.9   Power Unit Switch Locations

Table 4.6   Power Unit Switch Functions

Switch	Function
AC Power Unit Switch	Controls the power applied to the subsystem.

4.7.4 Connector Locations and Functions

This section illustrates and describes the locations and functions for connectors in the following hardware components:

- ENC Unit
- Power Unit
- Control Unit

4.7.4.1 ENC Unit
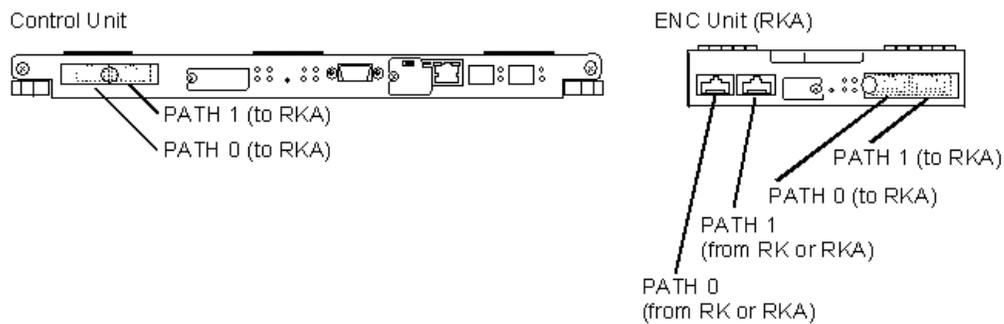
Figure 4.10   Connector Locations for the ENC Unit

Table 4.7   Connector Functions for the ENC Unit

Connector	Function
PATH 0	RK/RKA connection connector of PC-AL (loop 0 side)
PATH 1	RK/RKA connection connector of PC-AL (loop 1 side)

4.7.4.2 Power Unit
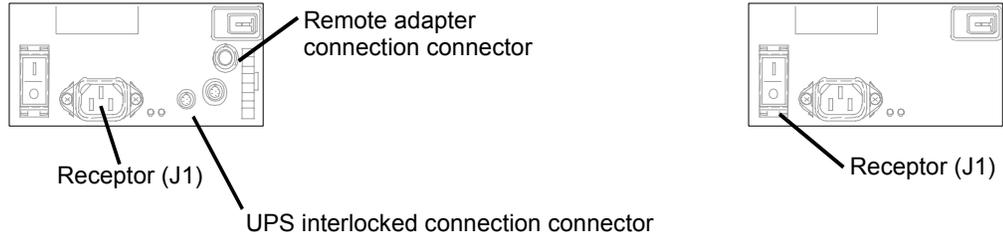
Figure 4.11   Connector Locations for the Power Unit

Table 4.8   Connector Functions for the Power Unit

Connector	Function
Remote adapter connection connector	Used to connect a Remote adapter.
UPS interlocked connection connector	Used to connect an UPS for Thunder 9570V.
Receptor (J1)	Power cable receptacle on the unit side.

4.7.4.3 Control Unit
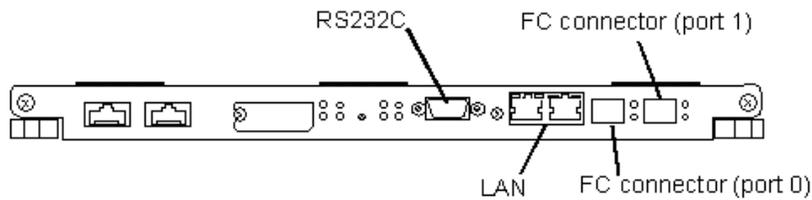
Figure 4.12   Connector Locations for the Control Unit

Table 4.9   Connector Functions for the Control Unit

Connector	Function
RS232C	Connector used to connect an RS232C.
FC connector	Connector for a Fibre channel interface cable.
LAN	Connector used to connect a LAN cable.

4.7.5   LED Locations and Functions

This section illustrates and describes the locations and functions of LEDs in the following hardware components:

- Disk Drive Display
- Battery Backup Unit
- ENC Unit
- Power Unit
- Fan Assembly
- Control Unit

4.7.5.1   Disk Drive Display
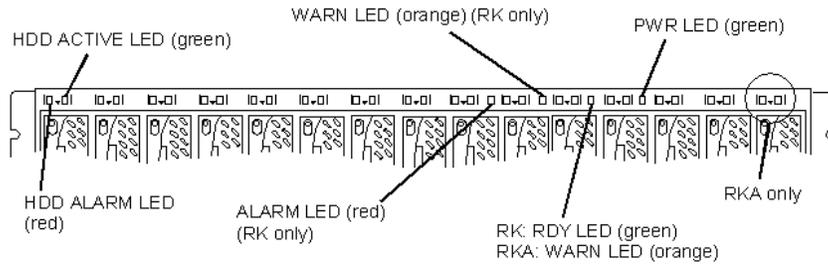
Figure 4.13   LED Locations for the Disk Drive Display

Table 4.10   LED Functions for the Disk Drive Display

Connector	Function
HDD ACTIVE LED (green)	When on or flashing, it indicates that the disk drive is operational.
HDD ALARM LED (red)	When on, it indicates that a failure occurred in the disk drive; the disk drive is inoperable.
ALARM LED (red)	When on, it indicates that a failure occurred in the unit; the unit is inoperable.
READY LED (green)	When on, it indicates that the unit is operable.
WARNING LED (orange)	When on, it indicates that a failure occurred in the unit; the unit is inoperable.
POWER LED (green)	When on, it indicates that electricity is supplied to the unit.

4.7.5.2   Battery Backup Unit
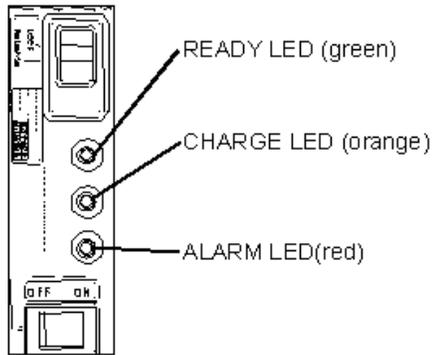
Figure 4.14   LED Locations for the Battery Backup Unit

Table 4.11   LED Functions for the Battery Backup Unit

Connector	Function
READY LED (green)	When on, flashing, or off, it indicates the condition of the battery.
CHARGE LED (orange)	When on or flashing, it indicates the charging status of the battery.
ALARM LED (red)	When on, it indicates that a failure occurs in the battery.

4.7.5.3 ENC Unit
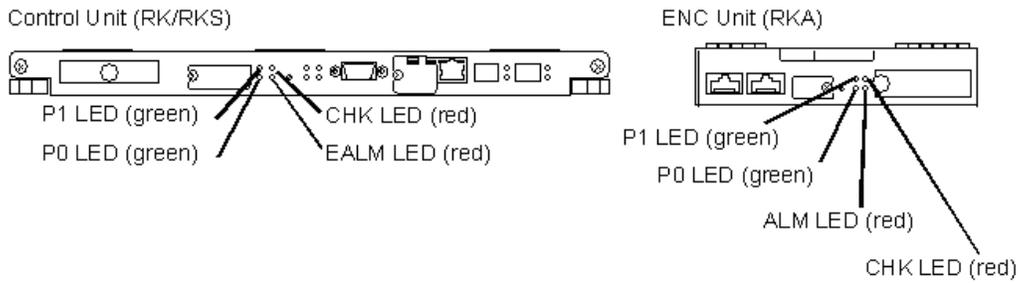
Figure 4.15   LED Locations for the ENC Unit

Table 4.12   LED Functions for the ENC Unit

Connector	Function
P1 LED (green)	When on, it indicates that the link status of FC-AL (loop 1 side) is normal.
P0 LED (green)	When on, it indicates that the link status of FC-AL (loop 0 side) is normal.
EALM LED (red)	When on, it indicates that a failure occurs in the controller (ENC side), so the controller is inoperable.
ALM LED (red)	When on, it indicates that a failure occurs in the ENC Unit, so the ENC Unit is inoperable.
CHK LED (red)	It indicates, according to the number of times the LED flashes, what voltage is abnormal. Once: Logic +5 V voltage is abnormal. Twice: Drive +12 V voltage is abnormal. Three times: Logic +3.3 V voltage is abnormal. Five times: Battery is abnormal. Six times: Voltage on the controller is abnormal. (Reset of the controller is not canceled) Seven times: BS 1.8 V, BS 3.3 V, or BS 12 V voltage is abnormal. The following blinking is fast because ENC microprogram detects CUDG error. Once: SRAM error. Twice: ENC hard error. Three times: Microprogram error in flash memory. Not blinking: Boot section error of ENC microprogram, RAM error, or ENC hard configuration error.

4.7.5.4 Power Unit
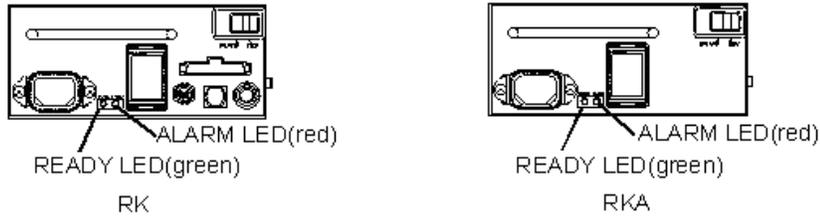
Figure 4.16   LED Locations for the Power Unit

Table 4.13   LED Functions for the Power Unit

Connector	Function
READY LED (green)	When on, it indicates the operating normally.
ALARM LED (red)	When on, it indicates the abnormal or in a stop state.

4.7.5.5 Fan Assembly
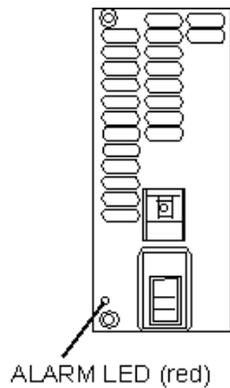
Figure 4.17   LED Locations for the Fan Assembly

Table 4.14   LED Functions for the Fan Assembly

Connector	Function
ALARM LED (red)	When on or off, it indicates the operating status of the fan assembly. on: It is abnormal. off: It is operating normally or in a stop state.

4.7.5.6 Control Unit
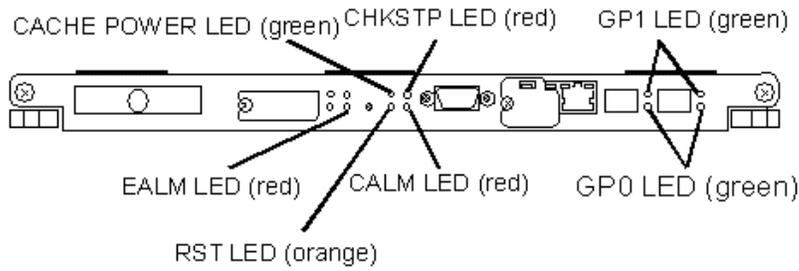
Figure 4.18   LED Locations for the Control Unit

Table 4.15   LED Functions for the Control Unit

Connector	Function
CACHE POWER LED (green)	When on or off, it indicates the status of the cache memory backup operation. on: Backup operation is in execution. off: Backup operation is not in execution.
RST LED (orange)	When on, it indicates that the controller is under resetting.
CALM LED (red)	When on, it indicates that a failure occurs in the controller (CTL side), so the controller is inoperable.
GP0 LED (green)	It indicates the status of the interface installed in the controller as standard.
GP1 LED (green)	It indicates the status of the interface installed in the controller as standard.
CHKSTP LED (red)	When on, it indicates that a failure occured in the controller (CTL side); the controller is inoperable.

4.8   Parts with Limited Lives

In the Thunder 9570™ V Series subsystem, parts with limited lives are used. Part replacement is required to maintain high-quality operation performance.

■   Replacement of the designated parts is basically covered by the maintenance service contract. Otherwise, the customer is responsible for purchasing genuine replacement parts periodically and replacing the parts.

■   Special maintenance (overhaul) of the subsystem is required to replace parts with limited lives.

■   The battery mounted in the subsystem is a periodical replacement part with an indication of the part to be recycled.

Table 4.16   Periodical Replacement Parts and Parts with Limited Lives

Classification	Part name	Life	Treatment
Part with limited life	Battery unit	Two years	Periodical replacement is required. When the maintenance service contract is made, periodical replacement is performed as a part of maintenance service. If not, the periodical replacement must be performed by the user. The genuine parts must be used. Follow the given procedure to dispose of the used battery.
Part with limited life	Disk drive	Five years (***Note 1***)	This part must be replaced through the special maintenance when its life is expires. (After the time limit, the possibility of hardware failure leading to data loss increases.) Life of the subsystem main body is eight years after the shipping from the factory even though special maintenance is performed.

Note 1: The expected useful life of the disk drive varies depending on the environment in which the customer uses it. For details, please consult Hitachi Data Systems Customer Service.

Chapter 5   Functional and Operational Characteristics

This chapter includes a description of the following:

- New 9570V Features and Capabilities

- RAID Implementations

- Cache Management

- Logical Units

- Open System Features and Functions

- Data Management Features and Functions

- Copy Solution Features and Functions

5.1   New 9570V Features and Capabilities

The Hitachi Thunder 9570™ V Series subsystem offers the following new or improved features and capabilities, which distinguish the 9570V subsystem from the 9200 subsystem:

- Up to 15 spare disks installable

- 512 LUNs maximum/45 RAID groups maximum

- The drive interface supports 2 Gbs fibre channel.

- A maximum of 4 Gbs high capacity cache per controller is supported in the dual configuration. This improves the cache percent hit rate.

5.2   RAID Implementations

The Thunder 9570™ V Series subsystem supports RAID0, RAID0+1, RAID1, RAID5 or an intermix.

- RAID 0 group stripes data across all disk drives in the group to attain higher throughput. There is no sparing disk drive function with this configuration.

- RAID 0+1 groups provide data redundancy like RAID 1 by copying all the contents of two disk drives to another pair. Different from RAID 1, data striping is performed for a maximum of 16 sets of two disk drives.

- RAID1 array groups consist of at least two disk drives in a mirrored configuration. Data is mirrored across the groups of two adjacent drives. The stripe consists of two data chunks.

- RAID5 uses from 2 to 5 data disks and has a parity disk performing the data striping.

The RAID specifications are shown in the following tables:

Table 5.1   RAID Specifications of the Rack-Mount Model

Item	Model		Rack-Mount Model	
			RK	**RKA (range for setup)**
RAID specifications	RAID level		0/1/5/0+1	-
	RAID configuration (unit of addition)	RAID 0	2D to 14D	2D to 16D
		RAID 1	1D+1M	-
		RAID 5	2D+1P to 13D+1P	2D+1P to 15D+1P
		RAID 0+1	2D+2M to 7D+7M	2D+2M to 8D+8M

Note: For additional information about the rack-mount model, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series 19-Inch Rack Reference Guide* (MK-92DF654).

Table 5.2   RAID Specifications of the Floor Model

Item	Model		Floor Model	
			Floor (RK+H1H) Model	**Floor (RK+RKA+H2H) Model**
RAID specifications	RAID level		0/1/5/0+1	
	RAID configuration (unit of addition)	RAID 0	2D to 14D	2D to16D
		RAID 1	1D+1M	
		RAID 5	2D+1P to 13D+1P	2D+1P to 15D+1P
		RAID 0+1	2D+2M to 7D+7M	2D+2M to 8D+8M

5.3   Cache Management

Cache management features include the following:

- Data is stored in cache when reading and writing; it is dynamically managed, depending on the workload read and write I/O characteristics. A high percent cache hit rate is expected, due to transaction processing (data is updated after it is referenced). System throughput is increased by the reduced data writing time.

- Writing completion is reported to the host at the same time the data is written onto the cache; the write operation onto the disk will be asynchronously performed later. The host can perform the next process without waiting for the write operation onto disk.

- The data written onto the cache is saved in the event of an electric power failure due to the nonvolatile cache. The data is assured for 24 hours on the full charge of a standard configuration.

- One specified logical unit on each controller can be resident in cache. High throughput can be realized for the specified logical unit since a 100% cache percent hit rate is expected when reading and writing from the host.

Cache specifications are shown in the following tables:

Table 5.3   Cache Specifications of the Rack-Mount Model

Model Item		Rack-Mount Model	
		RK	**RKA**
Cache specifications	Capacity (M bytes/CTL)	1,024 to 2,048	-
	Control method	Read LRU/Write after	-
	Battery backup	Provided	-
	Backup duration (h)	24 (When cache of 2,048 M bytes/CTL is installed)	-

Note: For additional information about the rack-mount model, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series 19-Inch Rack Reference Guide* (MK-92DF654).

Table 5.4   Cache Specifications of the Floor Model

Item	Model	Floor Model	
		Floor (RK+H1H) Model/	**Floor (RK+RKA+H2H) Model**
Cache specifications	Capacity (M bytes/CTL)	1,024 to 2,048	1,024 to 2,048
	Control method	Read LRU/Write after	
	Battery backup	Provided	
	Backup duration (h)	24 (When cache of 2,048 M bytes/CTL is installed)	24 (When cache of 2,048 M bytes/CTL is installed)

5.4 Logical Units (LUs)

The 9570V supports up to 512 LUNs. Each LU is identified by fibre-channel port ID and LUN number.
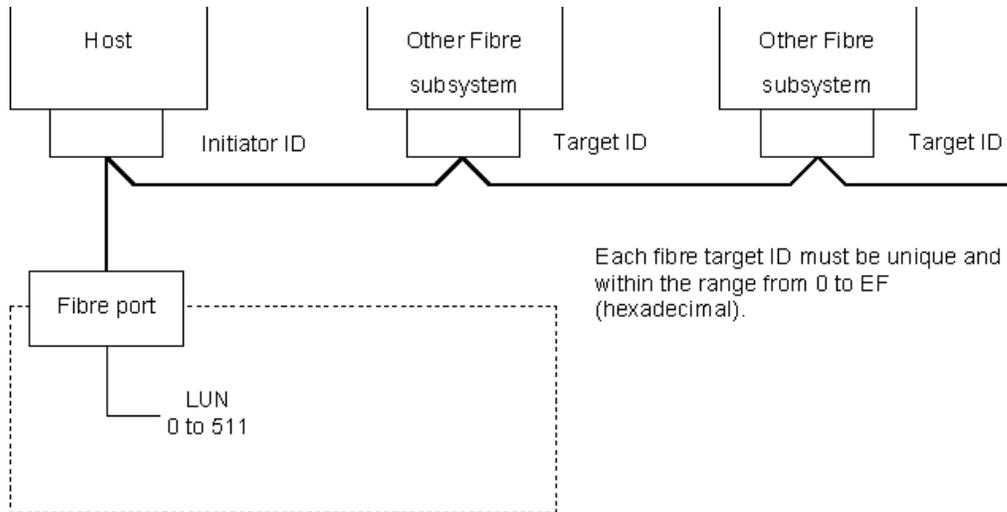
Figure 5.1   Logical Units

5.5 Open Systems Features and Functions

The Thunder 9570™ V Series subsystem offers many features and functions specifically for the open-systems environment. The 9570V subsystem also supports important open-system functions such as fibre-channel arbitrated-loop (FC-AL) and fabric topologies, command tag queuing, multi-initiator I/O, and most industry-standard software and middleware products which provide host fail-over, I/O path fail-over, and logical volume management functions.

5.5.1 Open Systems Middleware

Open-system middleware products provide host fail-over capability, I/O path fail-over support, and logical volume management in the open-systems environment. Middleware is not usually supplied as part of the basic operating system.

5.5.2 LUN Management

Each LUN can be assigned to multiple fibre-channel ports to provide I/O path fail-over with middleware support.

5.6 Data Management Features and Functions

These features include:

- Flash Access
- Fibre Security

5.6.1 FlashAccess

The FlashAccess function ensures that all data in an LU is stored in cache memory. All read/write commands to the LU can be executed by cache hit 100% without accessing the drive. The system throughput is improved when this function is applied to an LU that contains data accessed frequently because no latency period is needed to access the disk drive.

For additional information, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series FlashAccess 9500V User's Guide (*MK-92DF612).

5.6.2 Fibre Security

The Fibre Security function prevents data from being destroyed by illegal accesses. Only specified hosts are permitted to access LUNs (Host Storage Domain).

5.7 Copy Solution Features and Functions

The 9570V subsystem provides features and functions which allow you to maintain remote and subsystem internal copies of all user data on the 9570V storage subsystem for data backup or duplication. These features include:

■ Synchronous TrueCopy

■ ShadowImage

5.7.1 Synchronous TrueCopy

The Synchronous TrueCopy feature enables you to maintain remote copies of all user data on the Hitachi 9570V storage subsystem for data backup or duplication. The duplicated volumes are created between subsystems that are connected with a Fibre Channel interface.

Synchronous TrueCopy operations are non-disruptive and allow the primary (main) volume of each volume pair to remain online to all hosts for both read and write I/O operations. Once established, Synchronous TrueCopy operations continue unattended to provide synchronous remote data backup. Usability is further enhanced through a resynchronization capability that reduces data duplication requirements and backup time, thereby increasing user productivity.

For additional information, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series Synchronous TrueCopy 9500V User's Guide* (MK-92DF608).

5.7.2 ShadowImage

The Hitachi Data Systems ShadowImage 9500V features enable you to maintain subsystem-internal copies of all user data on the 9570V storage subsystem for purposes such as data backup or duplication. The duplicated volumes are created within the same 9570V subsystem as the primary volume.

ShadowImage 9500V operations are non-disruptive and allow the primary (main) volume of each volume pair to remain online to all hosts for both read and write I/O operations. Once established, ShadowImage 9500V operations continue unattended to provide asynchronous internal data backup. Usability is further enhanced through a resynchronization capability that reduces data duplication requirements and backup time, thereby increasing user productivity.

For additional information, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series ShadowImage 9500V User's Guide* (MK-92DF607).

Chapter 6   Configuring the Thunder 9570™ V Series Subsystem

This chapter includes the following:

- Overview of Configuration

- Configuring the LAN Interface of the Thunder 9570™ V Series Subsystem

- Configuring the Thunder 9570™ V Series Subsystem

- Registering the Thunder 9570™ V Series Subsystem for Control by Resource Manager 9500V

- Configure the Thunder 9570™ V Series Subsystem for the Desired Application

- General Configuration of the Thunder 9570™ V Series Subsystem

- Starting the Parameter Wizard in Resource Manager 9500V

- Configuring the Basic Parameters for the Thunder 9570™ V Series Subsystem

6.1   Overview of Configuration

This section includes the following information on configuration:

- Open Systems Configuration

- Defining LUNs

- Fibre Channel Interface Addressing

- Alternate Pathing

6.1.1   Open Systems Configuration

The Thunder 9570™ V Series subsystem is compatible with Open Systems Operating Systems including HP9000 series, SUN Fire series, SUN Enterprise series, RS6000 Family, and several x86 PC Operating Systems, including Net Ware 5.0, Linux, Windows NT 4.0, Windows 2000 and XP) as a supported platform.

6.1.2   Defining LUNs

The Resource Manager 9500V software enables the user to define the LUN mapping for each device and reconfigure the mapping at any time. For further information on Resource Manager 9500V, please refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series Resource Manager 9500V User's Guide Graphical User Interface (GUI),* MK-92DF605, to use a GUI interface. See the *Hitachi Freedom Storage ™ Thunder 9500 ™ V Series Resource Manager 9500V User's Guide Command Line Interface (CLI),* MK-92DF603, to use the CLI version. You can also contact your Hitachi Data Systems account team.

6.1.3   Fibre Channel Interface Addressing

The 9570V subsystem supports a maximum of 4 fibre-channel ports. Each fibre-channel port is assigned a unique target ID number. The 9570V can address up to 512 LUNs per port. The following figure illustrates fibre port-to-LUN addressing.
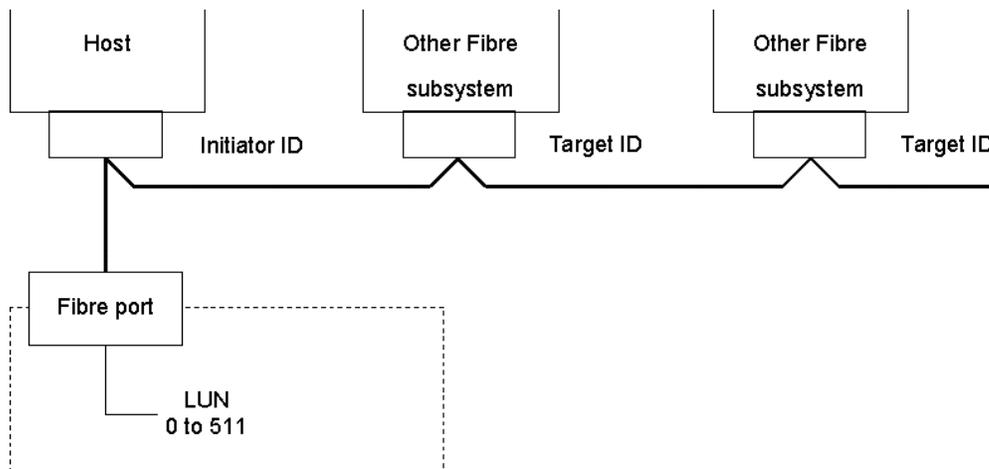
Figure 6.1   Fibre Port-to-LUN Addressing

6.1.4   Alternate Pathing

The user should plan for alternate pathing to ensure the highest data availability. The 9570V provides up to 4 fibre channel ports or to accommodate alternate pathing for host attachment. The following figure shows a sample of alternate pathing.
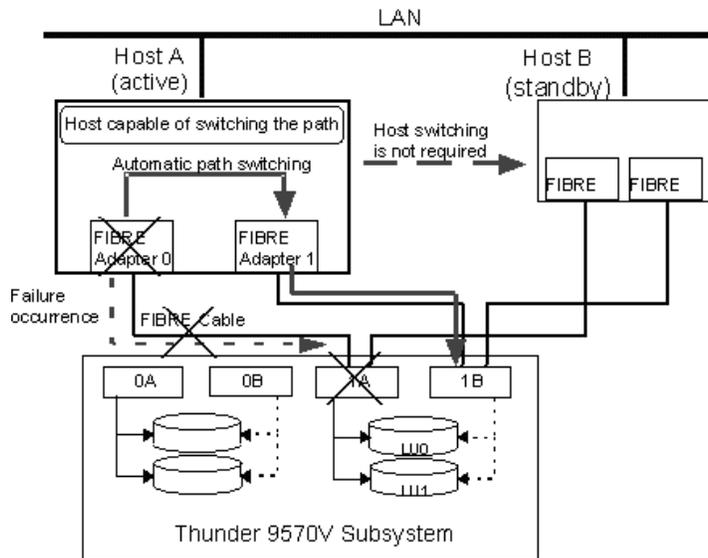
Figure 6.2   Alternate Pathing

6.2 Configuring the LAN Interfaces of the Thunder 9570™ V Series Subsystem

Each controller is shipped with a default IP address of 192.168.0.16 and netmask of 255.255.255.0 (the netmask number may differ). The IP address can be set using the Resource Manager 9500V program.

If the Resource Manager 9500V program is used to configure the IP addresses, also refer to the procedure in 7.8 Changing the Network Parameter.

If you wish to use Resource Manager 9500V to configure the IP addresses, please refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series Resource Manager 9500V User's Guide Graphical User Interface (GUI),* MK-92DF605, to use a GUI interface. Refer to the *Hitachi Freedom Storage ™ Thunder 9500 ™ V Series Resource Manager 9500V User's Guide Command Line Interface (CLI),* MK-92DF603, to use the CLI version.

6.3 Configuring the Thunder 9570™ V Series Subsystem

The following steps must be performed to configure the disk array:

1. Verify that the subsystem is connected to the LAN.

2. Install Resource Manager 9500V on the system that will be used as the management PC/Server.

   See the *Hitachi Freedom Storage™ Thunder 9500™ V Series Resource Manager 9500V User's Guide Graphical User Interface (GUI),* MK-92DF605, to use a GUI interface. See the *Hitachi Freedom Storage ™ Thunder 9500 ™ V Series Resource Manager 9500V User's Guide Command Line Interface (CLI),* MK-92DF603, to use the CLI version.

   Refer to the section titled "Installing Resource Manager 9500V" for instructions on how to install the program.

3. Register the disk array for control by Resource Manager 9500V.

4. Set the system parameters using the appropriate installation guide for the desired host platform(s).

5. Reboot the disk array to complete the configuration.

6.4 Registering the Thunder 9570™ V Series Subsystem for Control by Resource Manager 9500V

To operate the array unit from Resource Manager 9500V, register the array unit. You cannot temporarily register a non-existing array unit.

1. On the **Add** menu, click **Register Array Unit** or click **Register Array Unit** button in the tool bar.

2. Input the **registration information** and click the **OK** button.

3. When a registration completion message appears, click the **OK** button.

4. The Main screen is updated and then displayed.

6.5 Configure the Thunder 9570™ V Series Subsystem for the Desired Application

Before configuring the 9570V make sure that you know the following:

- The required RAID level, based on performance and pricing criteria

- The number and size of LUNs you wish to create

- The controller path you wish to use to access the data on the LUNs

- If there are any special options that need to be set that are specific to the host platform(s) being used. These will be detailed in the Host Installation Manual for the host platform being used.

6.6 General Configuration of the Thunder 9570™ V Series Subsystem

Activating Management mode in Resource Manager 9500V will enable you to do a general configuration of the 9570V subsystem. Before it is possible to configure the 9570V, management mode must be enabled in Resource Manager 9500V. Otherwise, it is only possible to monitor the status of the 9570V.

To enable Management mode:

1. On the **Settings** menu, click **Password**.

2. Enter **New Password** and **New Password** (for confirmation) and click the **OK** button. Specify a password of up to 12 alphanumeric characters.

3. On the **File** menu, click **Change Mode** or click **Change Mode** button in the tool bar.

4. When the **password-input** screen appears, input a password and click the **OK** button. **Management Mode** is displayed in **Active Mode:** in the upper part of the Main screen. The Resource Manager 9500V program will operate in **Management Mode**.

6.7   Starting the Parameter Wizard in Resource Manager 9500V

1. Click the icon of an array unit on the Main screen.

2. Select the **Settings** menu, click **Display Details**. Or, click the **Display Details** button in the tool bar.

3. On the **Settings** menu, select **System Parameter Wizard** or click **System Parameter Wizard** button in the tool bar.

6.8   Configuring the Basic Parameters for the Thunder 9570™ V Series Subsystem

Set the system parameters in the Wizard format.

1. On the **Settings** menu, select **System Parameter Wizard** or click **System Parameter Wizard** button in the tool bar.

2. Click the **Basic Settings**. Click the **Next** button.
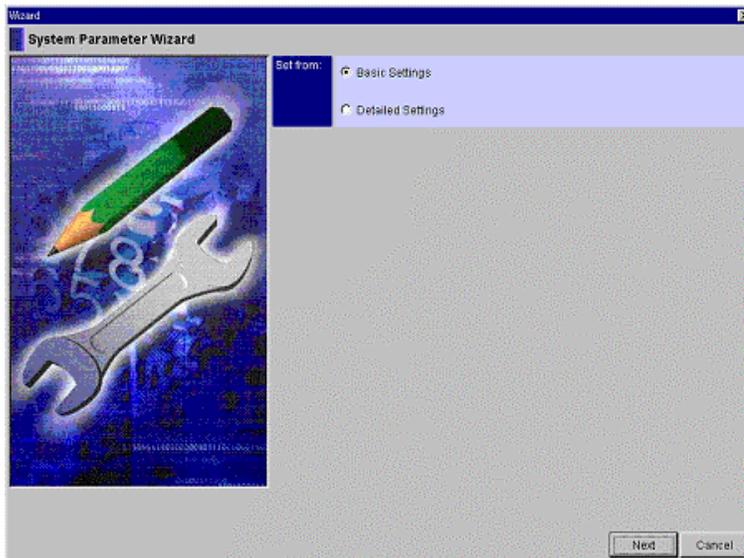
3. The system parameter window is displayed, starting with **System Startup Settings**. The window displays the items that are currently set. Check the displayed contents on the window and set each displayed item to the desired configuration.

    To perform the next setting, click the **Next** button. When you click the **Back** button, the previous window will appear.

    To stop the setting, click the **Cancel** button.
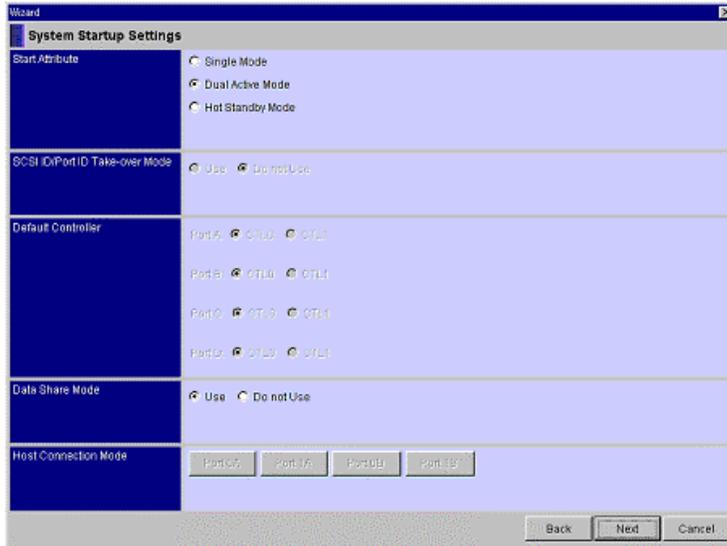
4. **Common 1**, **Option 1**, and **Option 2** screens are shown. Perform the settings for each item. For options, you can make multiple selections.

5. The window for the **Option 2** setting is the final window. Click the **Next** button, then displayed **Detailed Settings**.

    If you set the **Detailed Settings** items in succession, select **Yes** or select **No**, and then click the **Next** button.
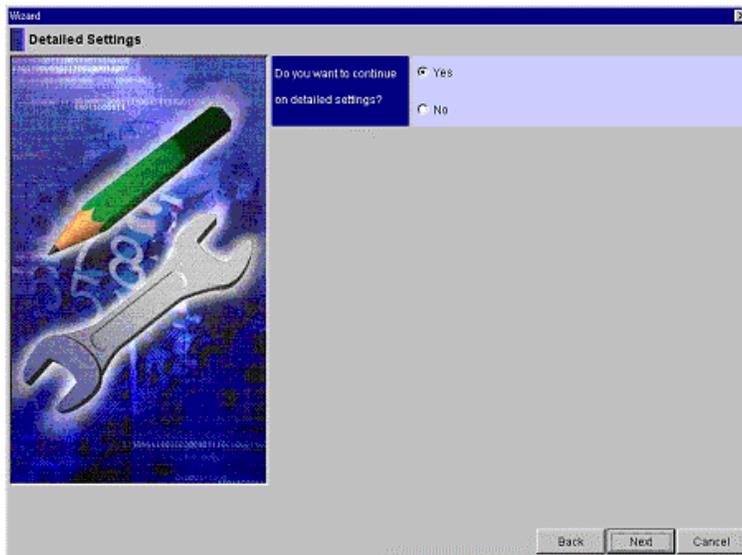
When you select **No**, the **System Parameter Setting Completed** screen will be displayed.

When the setting is completed, restart the array unit; connect it to the host and the Resource Manager 9500V program.

Chapter 7   Configuring Storage on the Thunder 9570™ V Series Subsystem

The process of configuring storage on the 9570V subsystem involves the following sub-processes:

- Software Composition

- Setting Fibre Channel Information

- Determining Space and RAID Level Requirements

- Setting Host Group Information

- Transferring Configurations from One Array to Another

- Storing Configuration Data

- Applying Configuration Data to an Additional Thunder 9570™ V Series Subsystem

- Setting the Subsystem when Using Special Mode

7.1   Software Composition

This section includes the following:

- Microprogram

- System Parameters

- Configuration Information

- SNMP Information

- Storage for Parameters

7.1.1   Microprogram

A microprogram controls basic hardware operations which accompany the execution of given instructions performed by a CPU. The version of the microprogram is controlled by the following numerical format: **xxxx/x**.

The microprogram for fibre channel, **065x/x** (x is optional) is available. However, **/x** may not be included in the microprogram version number or another control system may control the microprograms.

7.1.2   System Parameters

System parameters are necessary to start the subsystem (from turning on the main switch to generation of the RDY LED (green). System parameters are stored in flash memory.

7.1.3 Configuration Information

The configuration information is a record of customer data on the subsystem, such as the RAID configuration and LU capacity. The configuration information exists in the disk drive when the main switch is turned off; it is transmitted onto the main memory of the controller when the main switch is turned on. When configuration information is changed, the information on the disk drive is updated simultaneously.

7.1.4 SNMP Information

The SNMP parameter enables the SNMP function to operate effectively. When SNMP information activates the SNMP function, the template contained in the SNMP information (in the SNMP directory on the provided CD-R) is edited and registered in the subsystem.

7.1.5 Storage for Parameters

The storage areas where the parameters on the controller are stored are described in the following table:

Table 7.1   Storage for Parameters

No.	Parameter	Storage	Description
1	Fixed Part Program Flash Program System Parameters	Flash Memory (and backup FD)	The parameters are stored in flash memory. No provision of storage against a power shut off is required for the parameters because flash memory can retain information when power is shut off. Parameters can be backed up to the following: • Fixed part program: Cannot be backed up program • Flash program: Automatically backed up to the system area. • System parameters: Automatically backed up to the disk drive.
2	Microprogram Configuration Information SNMP Information	Disk Drive (System Area)	Generally, information in a RAM is erased when the main switch is turned off. Therefore, the subsystem also stores the parameters used on the RAM on the disk drive. (An area is reserved in the disk drive to store them. This area is called the system area.) The system area is provided on the disk drives #0 to #4 in the RK frame. Therefore, the system area has redundancy for disk drives #0 to #4 in the RK frame.

7.2   Setting Fibre Channel Information

Follow the steps below to set and display fibre channel information:

Note: Back up all data before performing this procedure. (If a mistake in operation is made, user data in the subsystem can be lost.)

1. Turn on the power supply.

2. Start the Resource Manager 9500V program and set the operation mode in the **Maintenance Mode**.

3. Click the icon of an array unit on the Main window and select the **Settings** menu. Click **Display Details** or click the **Display Details** button in the tool bar.

4. On the **Settings** menu, click **Configuration Settings** or click the **Configuration Settings** button in the tool bar.

5. Click the **Fibre Channel** tab.

6. Set a **Port Address**, **Topology Information**, **Transfer Rate**.

    Port Address: Port address is displayed as a hexadecimal number.
    Topology Information: Indicates the topology status.
    Transfer Rate: Indicates the fibre transfer rate.

7. Click the **Apply** button.

8. A confirmation message appears. After verifying that the I/O operation initiated by the host has stopped, click the **OK** button.

9. A message appears, stating that the setting is completed. Click the **OK** button.

7.3 Determining Space and RAID Level Requirements

This process will depend on the customer requirements, however Hitachi Data Systems recommends certain configuration guidelines that will provide good performance and adequate protection of data integrity in most circumstances.

This function can be used in the device ready state (R/W cannot be executed from the host in operation. When a host command is received, Not Ready is reported to the host computer).

This section includes:

- Setting a Spare Disk
- Canceling a Spare Disk Setting
- Setting a RAID Group
- Deleting a RAID Group
- Setting a Logical Unit
- Deleting the Last Logical Unit
- Formatting a Logical Unit
- Change of the Controller in Charge of a Default LU

7.3.1 Setting a Spare Disk

To set a spare disk, follow these steps:

Note: Disk drives that can be set as spare drives do not yet have a defined RAID group; this excludes disk drive #0 to #4 in Unit 0.

1. Turn on the power supply.

2. Start the Resource Manager 9500V program and set the operation mode in the **Maintenance Mode**.

3. Click the icon of an array unit on the Main window, and then select the **Settings** menu. Click **Display Details** or click the **Display Details** button in the tool bar.

4. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.

5. Click the **Spare Drive** tab.

6. To set up the spare drive, double-click the icon of the disk drive to be setup as a spare drive.

7. The confirmation message for spare drive setup is displayed. Click the **OK** button.

8. A message indicating that the setting is complete is displayed. Click the **OK** button. The icon of the disk drive that is set up is updated and displayed.

Data disk
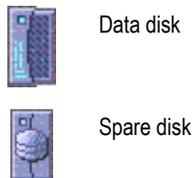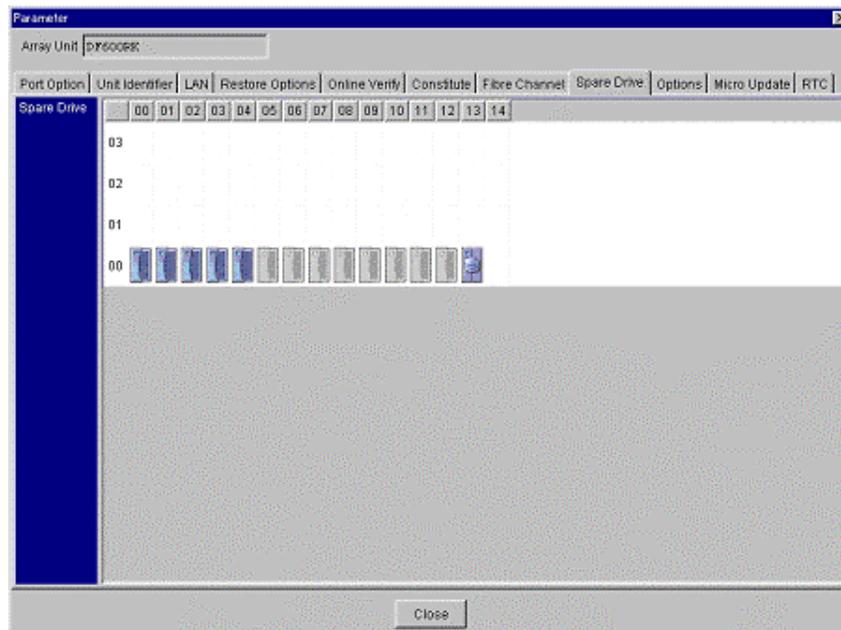
Spare disk

Figure 7.1   Spare Disk Tub Screen

7.3.2   Canceling a Spare Disk Setting

To cancel a spare disk setting, follow these steps:

1. On the **Settings** menu, click **Configuration Settings** or click the **Configuration Settings** button in the tool bar.

2. To cancel the spare drive setup, click the icon of the disk drive to be canceled.

3. The confirmation message for spare drive canceled is displayed. Click the **OK** button.

4. A message is displayed, stating that the setting is complete. Click the **OK** button.

7.3.3   Setting a RAID Group

To set a RAID group, follow these steps:

1. Turn on the power supply.

2. Start the Resource Manager 9500V program and set the operation mode in the **Maintenance Mode**.

3. Click the icon of an array unit on the Main window. Select the **Settings** menu and click **Display Details** or click the **Display Details** button in the tool bar.

4. Click the **Logical Status** tab.

5. Click the top drive of a selected RAID. The drive that is selected is highlighted.

6. Hold down the **shift** key and click the last drive of the RAID group to be created. The drives of the RAID group to be created are enclosed by a **rectangular** box.

7. On the **Settings** menu, select **RAID Group**, and click the **Settings**. Alternatively, click **RAID Group Settings** button in the tool bar.

    This operation can also be completed from the context menu of the **RAID Group** box.

8. Select a RAID level and click the **OK** button.

9. A message appears, stating that the setting is complete. Click the **OK** button. The set RAID group is updated and the window is displayed.

    If the RAID group setting is not successful, delete the affected RAID group and try creating the RAID group again.
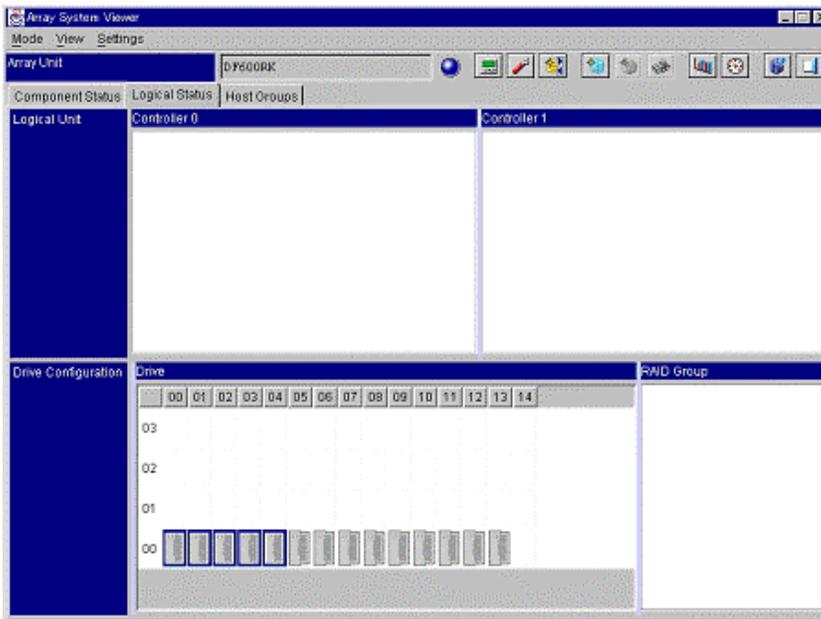
Figure 7.2   Select the Disk Drive
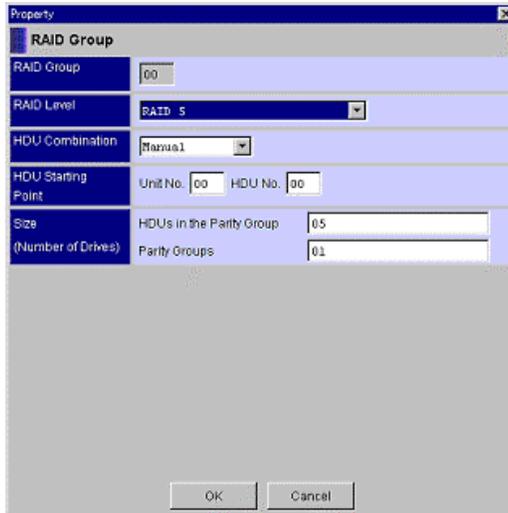
Figure 7.3   Setting the RAID Group Property
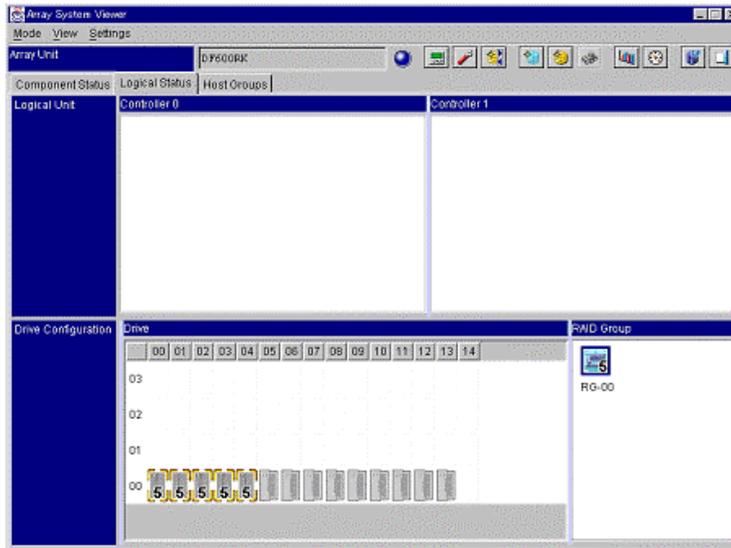
Figure 7.4   Set RAID Group is Updated

7.3.4 Deleting a RAID Group

This section includes the following:

- Deleting All RAID Groups
- Deleting a Specified RAID Group

7.3.4.1 Deleting All RAID Groups

To delete all RAID groups, follow these steps:

Note: All user data on all LUNs will be lost if all RAID groups are deleted. Backup the user data before performing this operation.

The unified LU cannot be unified or split unless the LU unifying function (a priced option) is validated. When a unified LU is defined, the RAID group cannot be deleted. Delete the RAID group after splitting all the unified LUs in the RAID group. For the procedure for splitting a unified LU, refer to the **LU Unifying Function User's Guide**.

1. Click the **Logical Status** tab on the Unit screen.
2. On the **Settings** menu, select **RAID Group** and click the **Delete All**.
3. A message appears, requesting confirmation to delete all RAID groups. Click the **OK** button.

   The deleted RAID group is updated and a window is displayed.

7.3.4.2 Deleting a Specified RAID Group

Note: All user data on all LUNs will be lost if all RAID groups are deleted. Backup the user data before performing this operation.

If the "Unified LU" function has been enabled, make sure that no unified Lus are present in the RAID group to be deleted. It will be impossible to delete a RAID group containing unified Lus until the unified Lus are split.

Delete the RAID group after splitting all the unified LUs in the RAID group. Refer to the **LU Unifying Function User's Guide** for the procedure for splitting a unified LU.

When a logical unit is deleted, user data is erased. Perform the deletion after verifying the number of the logical unit to be deleted and backing up the data.

To delete a specified RAID group, follow these steps:

1. Click the **Logical Status** tab on the Unit screen.
2. Click the icon of a RAID group on the Unit screen. On the **Settings** menu, select **RAID Group** and click **Delete Specified RAID Group**.

3. A message appears, requesting confirmation to delete the specified RAID group. Click the **OK** button.

   The deleted RAID group is updated and the window is displayed.

7.3.5 Setting a Logical Unit

To set a logical unit, follow these steps:

1. Turn on the power supply.

2. Start the Resource Manager 9500V program and set the operation mode in the **Management Mode**.

3. Right-click the icon of an array unit on the Main window. Select the **Settings** menu and click **Display Details** or click the **Display Details** button in the tool bar.

4. Click the **Logical Status** tab on the Unit screen.

5. Click the icon of a logical unit on the Unit screen. On the **Settings** menu, select **Logical Unit** and click the **Settings**. Alternatively, click the **Logical Unit Settings** button in the tool bar.

   This operation can also be completed from the context menu of the **Logical Unit** box.

6. Select a controller in charge in the **Default** box and enter the size in Gigabytes, Megabytes or blocks.

7. A created logical unit number is displayed for the **Logical Unit No.** and the RAID group number in which logical units are defined for the **RAID Group**. Additionally, a logical unit capacity that can be created is displayed.

Note: To specify a size explicitly in figures, select a unit to specify the size from among the **GB**, **MB**, and **Block**. Specify the size to be allocated in decimal number. The subsystem can be divided into a maximum of 512 logical units.

Note: The logical unit number may be set optionally when the logical unit is created. However, logical unit number 0 is assigned to the logical unit created first.

8. After the setting is complete, click the **OK** button.

9. The set logical unit information is updated and the window is displayed.
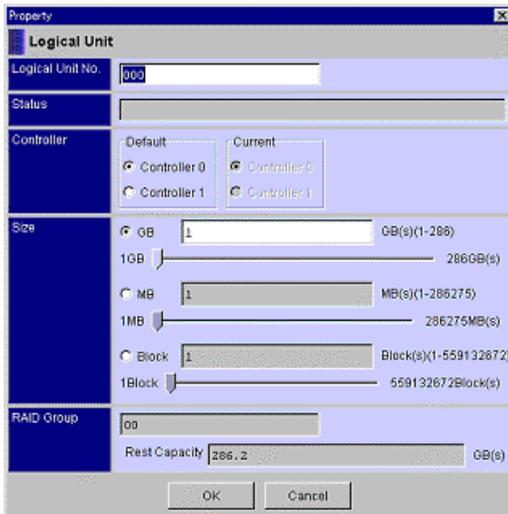
Figure 7.5   Setting the Logical Unit Property

7.3.6   Deleting the Last Logical Unit

To delete the last logical unit, follow these steps:

Note: The last logical unit is the final logical unit, which is unified. Delete the final logical unit after verifying its number.

When any logical unit is deleted, the user data in the logical unit will be lost.

1. Click the **Logical Status** tab on the Unit window.

2. On the Settings menu, select Logical Unit and click Delete Last Defined Logical Unit.

3. A confirmation message is displayed indicating whether or not the last logical units should be deleted.

    Click the **OK** button, and last logical units will be deleted. When any logical unit is deleted, the user data in the logical unit will be lost.

    The logical unit information in which the last logical unit has been deleted is updated and the window is displayed.

7.3.7 Invalidating a Logical Unit

To invalidate a logical unit which has already been set, follow these steps:

1. Click the **Logical Status** tab on the Unit window.

2. Click the icon of the logical unit to be invalidated.

   On the **Settings** menu, select **Logical Unit** and click **Invalidate**.

3. A message appears, inquiring whether or not the logical unit should be invalidated.

   Click the **OK** button, and logical unit will be invalidated.

4. On the **View** menu, click **Refresh**.

   The logical unit information in which the logical unit has been invalidated is updated and the window is displayed.
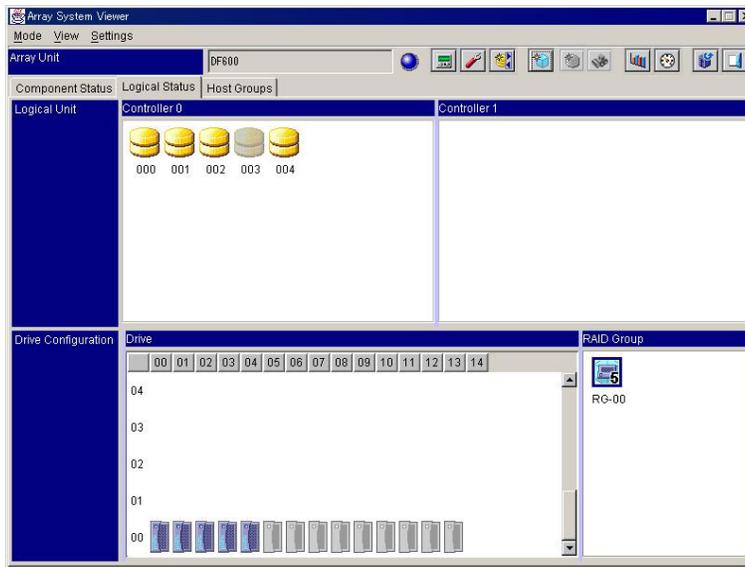
 : Invalidated logical unit

7.3.8 Restoring a Logical Unit

To restore a logical unit which has already been invalidated, follow these steps:

1. Click the **Logical Status** tab on the Unit window.

2. Click the icon of a logical unit to be restored.

   On the **Settings** menu, select **Logical Unit** and click **Restoration**.

3. A message appears, inquiring whether or not the logical unit should be restored.

   Click the **OK** button, and the logical unit will be restored.

4. On the **View** menu, click **Refresh**.

   The logical unit information in which the logical unit has been restored is updated and the window is displayed.

7.3.9 Reallocating a Logical Unit

To reallocate a logical unit which has been invalidated, follow these steps:

1. Click the **Logical Status** tab on the Unit window.

2. Click the icon of the logical unit to be reallocated.

   On the **Settings** menu, select **Logical Unit** and click **Reallocate**.

   The **Logical Unit Reallocation** dialog box is displayed.
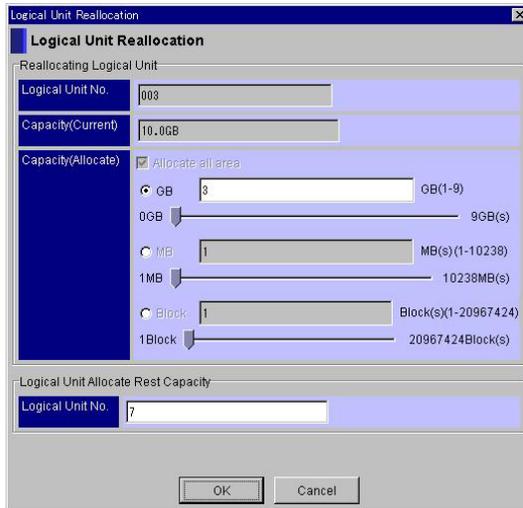
3. Input a capacity to be reassigned.

   Note: The capacity to be reassigned can be specified within a range not larger than that of the logical unit invalidated.

4. Click the **OK** button.

5. A message appears inquiring whether or not the logical unit should be reallocated.

   Click the **OK** button, and logical unit will be reallocated.

6. On the **View** menu, click **Refresh**.

   The logical unit information in which the logical unit has been reallocated is updated and the window is displayed.

7.3.10 Formatting a Logical Unit

There are two methods of formatting a logical unit:

- **Online Format**
  Specified logical units are formatted one by one and the progress of the formatting is displayed.

- **Offline Format**
  If multiple logical units are specified, up to six logical units are formatted concurrently, and the progress of formatting is displayed.

  When the logical units are configured for each drive, the time required for the formatting is reduced by 30 to 50 (%).

To format a logical unit, follow these steps:

Note: When formatting a logical unit with a logical unit capacity less than 100,000 (blocks), formatting may terminate abnormally. When formatting a logical unit with a logical unit capacity of 100,000 (blocks), select **Online Format**.

1. Click the icon of a logical unit on the Unit window. On the **Settings** menu, select **Logical Unit** and click **Online Format** or **Offline Format**.

   When you select multiple logical units, hold down the **Ctrl** key and click the icons of the logical units to format.

2. A confirmation message appears and confirms whether or not the selected logical units may be formatted.

Note: When a specified logical unit is formatted, the user data within the specified logical unit is lost. When incorrectly specifying an logical unit, press the **Cancel** button and redo processing by selecting an logical unit to be reformatted.

3. Click the **OK** button to format the specified logical units.

4. When a message is displayed indicating that the specified logical unit has been formatted, click the **OK** button.

If formatting is terminated abnormally, review the contents of the result.

The formatted logical information is updated and the window is displayed.

Table 7.2   Formatting Message

Displayed	Action to be taken
02-xxxx, 03-xxxx, 04-xxxx or 0B-xxxx	For the above code, a hardware fault is assumed. If the fault is not recovered after re-execution, contact Hitachi Data Systems.
05-xxxx	For the above code, an operation error is assumed. Upon checking the following items and re-execute processing. If the error is not recovered, contact Hitachi Data Systems.
05-2500 or 05-2581	Is logical unit 0 defined?
05-2600	In spite of none of drive mounted states, is ALL RAID specified and is an logical unit specified for ALL CAPA formatted?
05-2580	Is an attempt made to define an logical unit exceeding the capacity of the defined RAID group?
0B-FD01	Switching of a controller in charge of an logical unit occurred during formatting. Check the controller in charge and re-execute formatting from the controller in charge.
An error occurred in the communication with an array device.	The message indicating that **An error occurred in the communication with an array device**. at the time when selecting **Online Format** is output since the progress window cannot be displayed due to the interface failure between the Resource Manager 9500V program and a device. For logical unit formatting, only the logical unit being executed is continuously formatted.
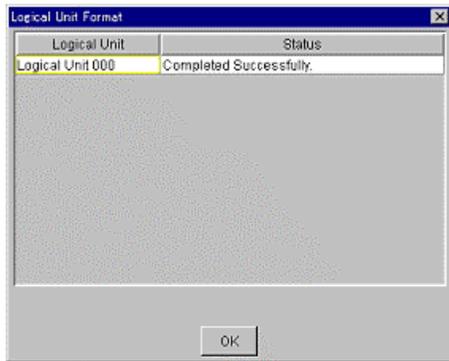
Figure 7.6   Logical Unit Format screen

7.3.11 Changing the Default Controller in Charge of an LU

Note: The controller in charge of a default LU can be changed only for the dual active mode configuration of a dual system.

To change the controller in charge of a default LU, follow these steps:

1. Start the Resource Manager 9500V program and set the operation mode in the **Management Mode**.

2. Click the icon of an array unit on the Main window and select the **Settings** menu. Click **Display Details** or click the **Display Details** button in the tool bar.

3. Click the **Logical Status** tab on the Unit screen.

4. Click the logical unit for which you want to change ownership.
    Resource Manager confirms by highlighting a box around the chosen LU.

5. On the **Settings** menu, select **Logical Unit** and select **Change Default Controller**.
    A message appears, requesting confirmation to change the default controller.

6. Click the **OK** button and default controller in charge of a logical unit will be changed.

7. A message appears, stating that the setting is complete. Click the **OK** button.

7.4　Setting Host Group Information

In the 9200, the Host Connection Mode was set for each port, and the port and host to be connected each other were fixed. In the 9570V, the Host Connection Mode, the mapping information of Logical Unit, and LUN security information are set to the group of hosts, not to the host. This enables you to select the host computer to which the subsystem is connected depending on each group of hosts.

For this version, only the Host Group 0 is supported. When only the host group 0 is used, the same functions that can be used in 9200 are available.

7.4.1　Setting Mapping Information

Modify Host Group Option is a function that integrates the Host Connection Mode 1 and 2 on the System Parameter in the 9200.

1. On the unit window, click the **Host Groups** tab.

2. On the unit window, double-click the **Controller** to be set for the connection mode with the host. Display the the **000:G000** by double-clicking the **Port**.
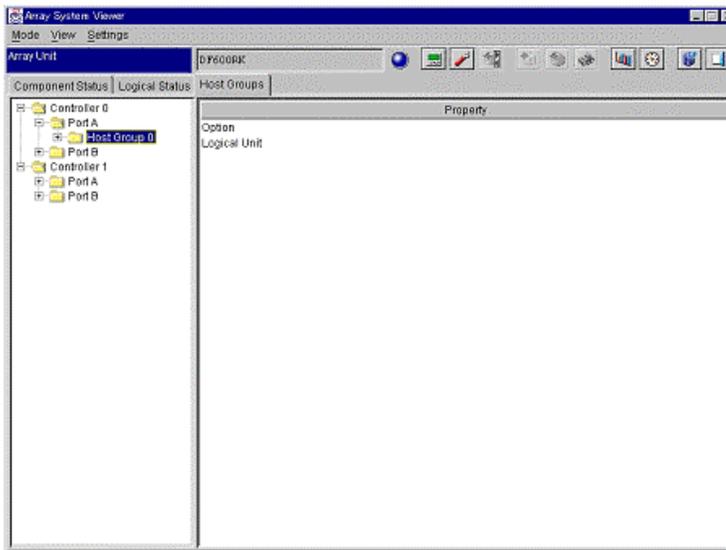
3. On the **Settings** menu, select **Mapping Mode** and click **Enable**.
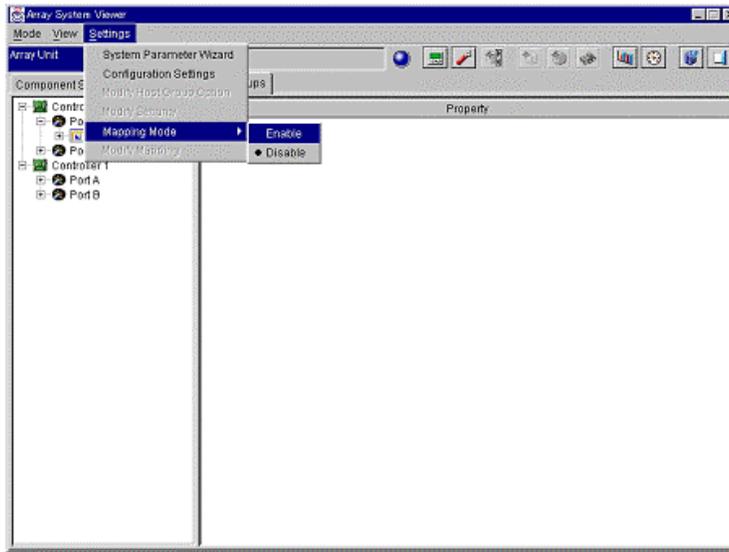
4. A message appears; click the **OK** button.
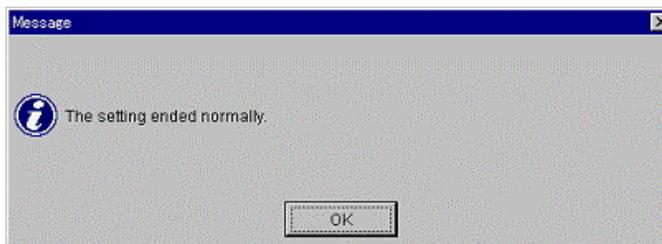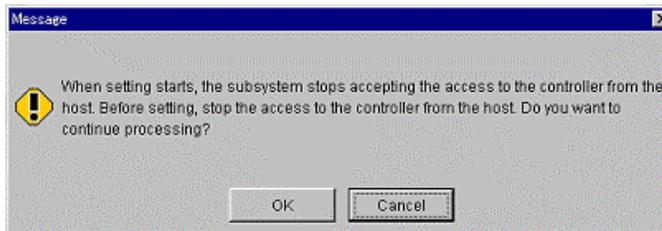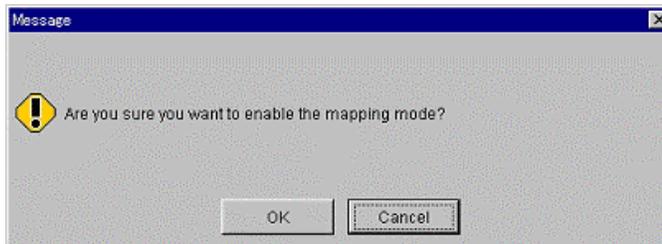
5. Click the Logical Unit.
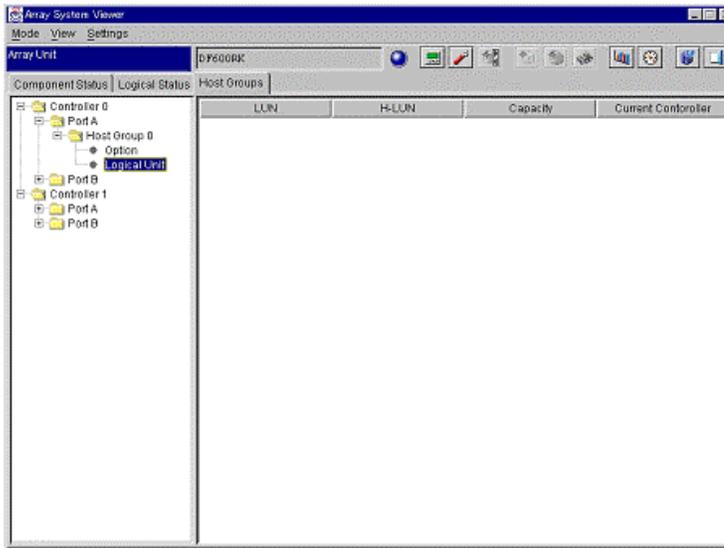
6. On the **Settings** menu, select **Modify Mapping**.
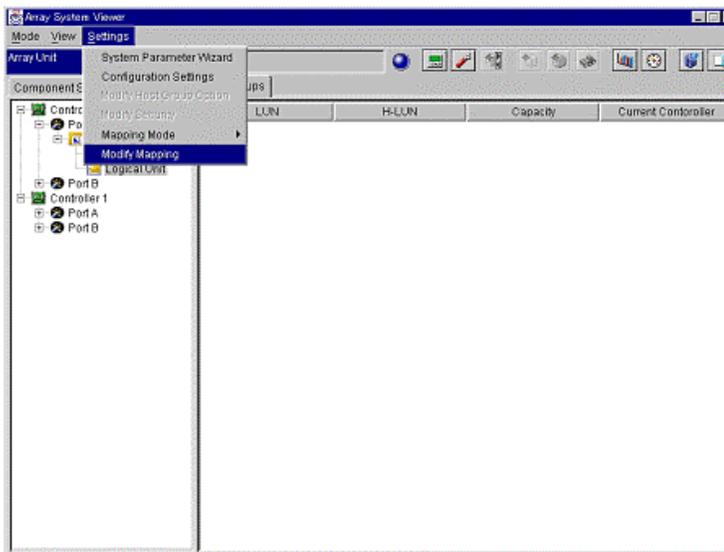
7. Select one **LUN** and one or more **Host LUNs**. Click the ▶ button. The added specification is displayed in the **Reserved Configuration**. For the **Host LUN**, multiple selections can be made.

To delete LUN mapping information, select the line that you want to delete from the **Reserved Configuration**, and click the **Delete** button. The deleted specification disappears from the **Reserved Configuration** display.
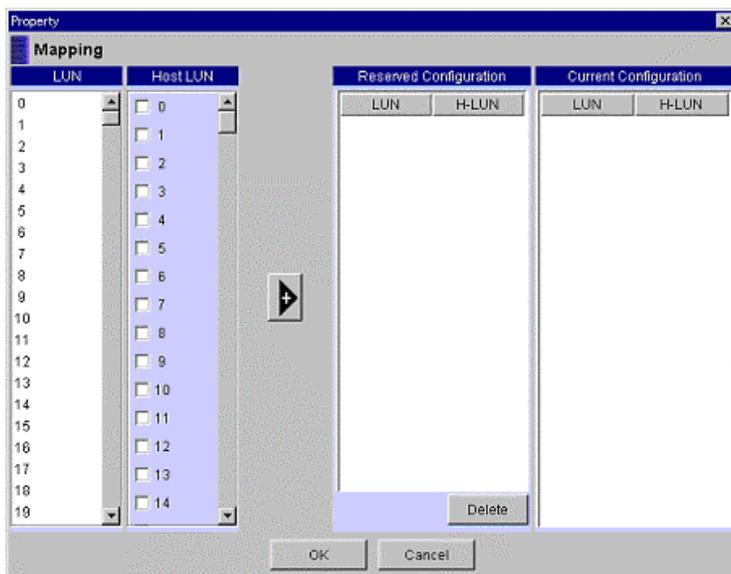
8. A message appears; click the **OK** button.

⬇
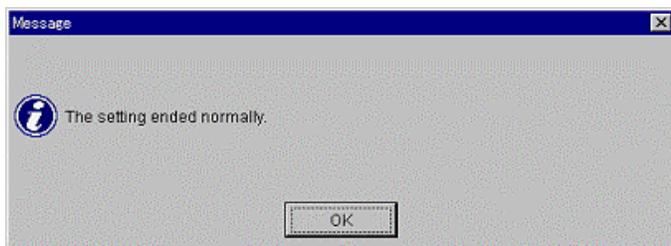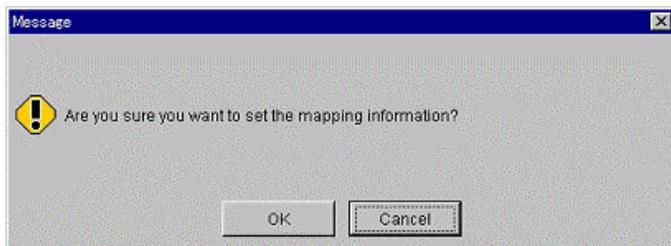
The mapping information is updated and the following window is displayed.
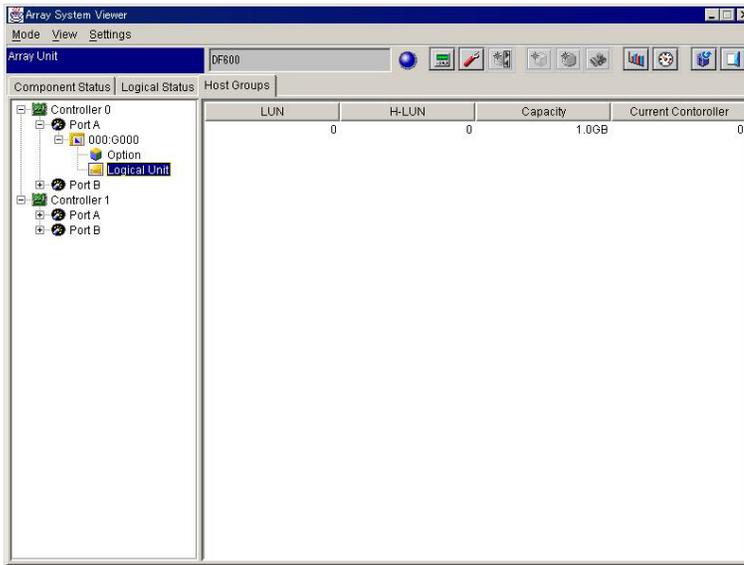
7.5   Transferring Configurations from One Array to Another

Output the configuration information of the array unit in a text file or set configuration using a text file. The configuration information output in a text file includes the status of the system parameters, RAID group/logical unit and the constituent parts of the array unit. The configuration to be set includes the system parameters and RAID group/logical unit. The status of the constituent parts of the array unit cannot be set.

Configuration information is handled with separate text files for the system parameters and for RAID group/logical unit.

Copying configuration information between array units can be executed by outputting a text file of the configuration from an array unit, then using the output text file to set another array unit.

Note: IP addresses will be reset based on file input. The user must edit the text file to include the correct IP addresses in order to transfer a configuration from one unit to another.

Editing a text file to set an array unit can be executed, but it is recommended that this function be used for the configuration of the same array unit. To change the configuration, use individual functions.

7.6 Storing Configuration Data

This section includes the following:

■ System Parameter Information

■ RAID Group/LU Information

■ Port/Host Group Information

7.6.1 System Parameter Information

To output the setting of the system parameters for an array unit in text form to a specified file:

1. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.

2. Click the **Constitute** tab.
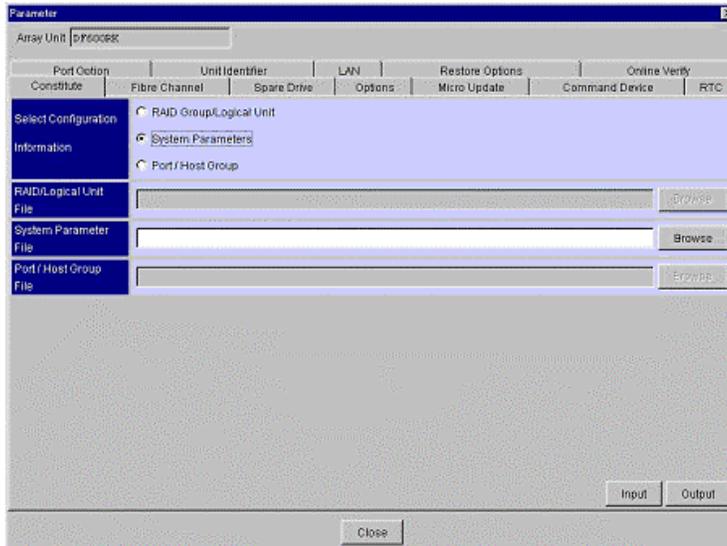
3. Check the **System Parameters** in the **Select Configuration Information** box.

4. Click the **Browse** button. Specify the directory and file name to which the configuration file will be output.

5. Click the **Output** button.

6. When a message appears, confirm that the system parameter information is output with the specified file name. Click the **OK** button.
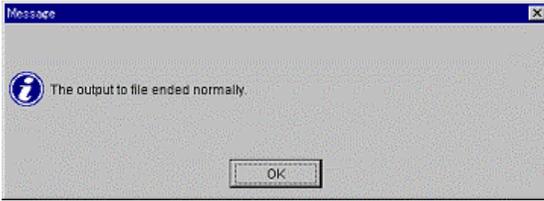
System parameter information is saved in the form of a text file with the specified file name.

7.6.2 RAID Group/LU information

To output the RAID group/logical unit definition information already set in an array unit to a specified file in a text format:

1. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.

2. Click the **Constitute** tab.
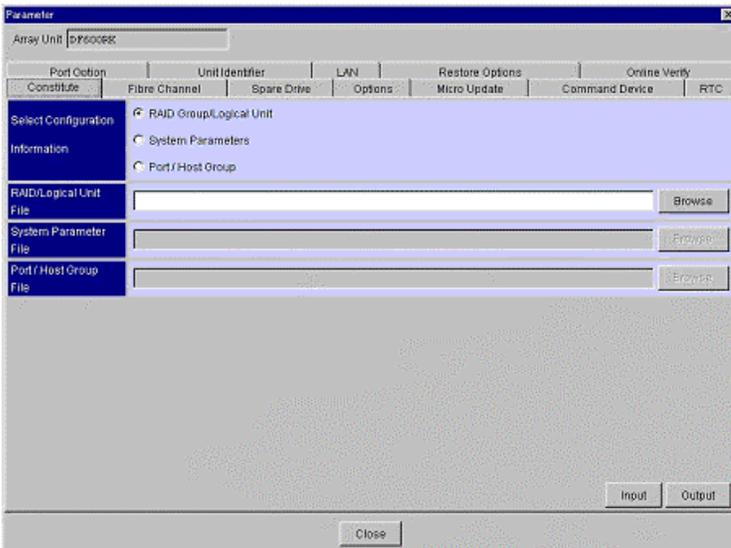
3. Check **RAID Group/Logical Unit** in the **Select Configuration Information** box.

4. Click the **Browse** button, and specify the directory and file name to output the file of the configuration.

5. Click the **Output** button.

6. A message appears, confirming that the system parameter information is output with the specified file name. Click the **OK** button.

RAID group/LU information is saved in the form of a text file with the specified file name.

7.6.3 Port/Host Group Information

To output Port/Host group definition information previously set in an array unit to a specified file in a text format:

1. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.

2. Click the **Constitute** tab.

3. Check the **Port/Host Group** in the **Select Configuration Information** box.
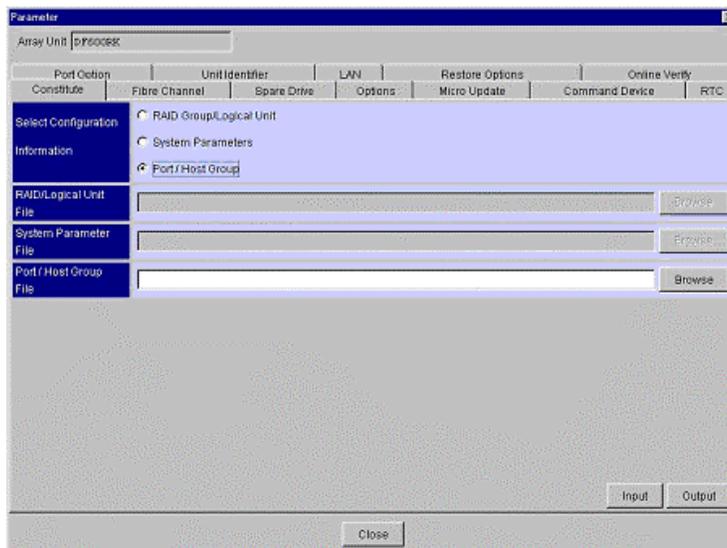
4. Click the **Browse** button, and specify the directory and file name to output the file of the configuration.

5. Click the **Output** button.

A message appears, confirming that the system parameter information is output with the specified file name. Click the **OK** button.
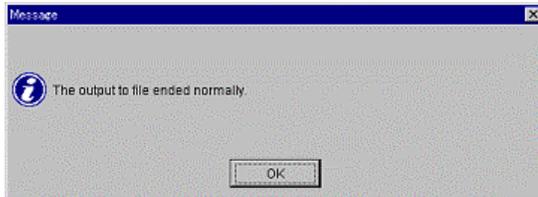
Port/Host group information is saved in the form of a text file with the specified file name.

7.7 Applying Configuration Data to Another Thunder 9570™ V Series Subsystem

This section includes the following:

- System Parameters
- RAID Group/Logical Unit
- Port/Host Group

7.7.1 System Parameters

Use the modes discussed in this section only when recommended by an Hitachi Data Systems Host or Optional Product installation guide.

Set the system parameters in the array unit with the information described in the file. If you set the system parameters using a file that was output when a priced optional feature is in an unlocked state, the setting may terminate abnormally. To set system parameters, use a file that was output when all priced optional features are in a locked state.

For a dual system, the setting cannot be executed if one of the controllers is detached. Confirm that the array unit is operating normally.

When system parameters are set, the array unit cannot execute commands from the host. The functions of Resource Manager 9500V can no longer work with the exception of the Wizard for setting the system parameters and failure monitoring. After setting, restart the array unit. Confirm that it is operating successfully, then connect to the host and the Resource Manager 9500V management program.

1. Edit the file for which you will set system parameters to set the array unit. This file has a specified format. The format of the file is the same as that of the file output by the array unit. To format a file, refer to the file output in 7.6 Storing Configuration Data.

2. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.

3. Click the **Constitute** tab.

4. Click the **System Parameter** radio button.

5. Click the **Browse** button, and specify the directory and file name of the file that describes the system parameters edited in 1. The specified file name will be shown in the text box.

6. Click the **Input** button.

Note: To validate the set system parameters, restart the array unit. The previous settings stay valid until restarting. The array unit cannot access the host until the reboot is completed and the system restarts. Therefore, be certain the host has stopped accessing data before beginning the restart process.

7.7.2   RAID Group/Logical unit

Note: Back up all data before performing this procedure. All user data is lost when the logical unit is deleted.

Set the array unit according to the RAID group/logical unit setting information described in a file. If the setup of RAID group/logical unit is configured and completed, all user data previous data will be lost; RAID group/logical unit configuration as specified in the file will be set after deleting the current RAID group/logical unit. If user data is needed, configure the setting after backing up the system.

1. Edit the file for which you will set system parameters to set the array unit. This file has a specified format. The format of the file is the same as that of the file output by the array unit. To format a file, refer to the file output in 7.6 Storing Configuration Data.

2. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.

3. Click the **Constitute** tab.

4. Click the **RAID Group/Logical Unit** radio button.

5. Click the **Browse** button, and specify the directory and name of the file that describes the RAID group definition and logical unit definition edited in 1. The specified file name will be shown in the text box.

6. Click the **Input** button.

To check the configuration, select the **Logical Status** tab.

7.7.3   Port/Host Group

1. Edit the file for which you will set system parameters to set the array unit. This file has a specified format. The format of the file is the same as that of the file output by the array unit. To format a file, refer to the file output in 7.6 Storing Configuration Data.

2. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.

3. Click the **Constitute** tab.

4. Click the **Port/Host Group** radio button.

5. Click the **Browse** button, and specify the directory and name of the file that describes the RAID group definition and logical unit definition edited in 1. The specified file name will be shown in the text box.

6. Click the **Input** button.

7.7.4 Setting the Subsystem When Using Special Mode

This section includes the following:

- Using Resource Manager 9500V

- Using the I/O Bus Switching Function in the Sequent NUMA-Q Connection

- Using the Subsystem in LU Blockade Mode

- Using the WolfPack Mode

- Using VxVM (Version 3.2P2+PP or later) on the Host Side

- Making Nine or More LUs Recognized by Using Qlogic HBA or Emulex HBA on Windows 2000/NT

- Making LUs, Numbers 8 – 63 useable when the Subsystem is Connected to the HP Server

- Using the SUN Cluster 3.0

- Using the ftServer

- Using the Synchronous TrueCopy Function

- Using the Microsoft Cluster Server

7.7.4.1   Using Resource Manager 9500V

To set the subsystem from the Resource Manager 9500V, perform the following steps:

1. Start the Resource Manager 9500V program and set the operation mode in the **Management Mode.** Refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series Resource Manager 9500V User's Guide Graphical User Interface (GUI),* MK-92DF605.

2. Click the icon of an array unit on the Main window, and then select the **Settings** menu. Click **Display Details** or click the **Display Details** button in the tool bar.
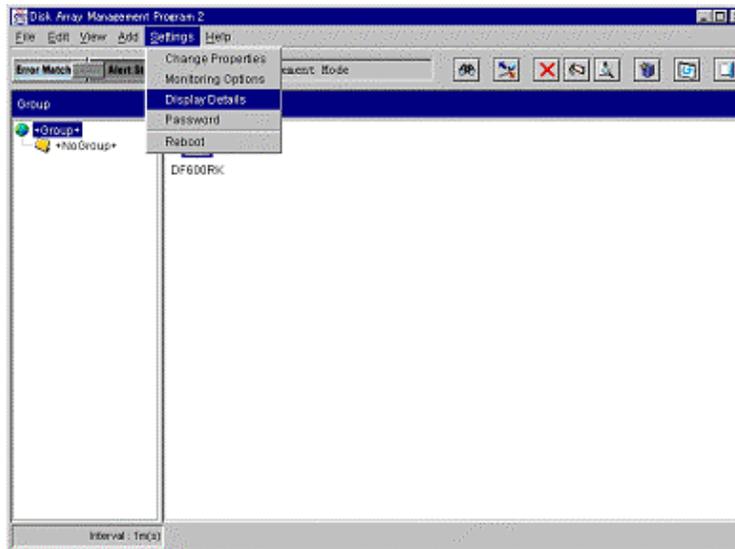
Perform the appropriate operation corresponding to the model to be set.
For detailed operation, see the following table:

Note: The procedure for changing to special mode is performed when the host group setting is in normal mode.

Table 7.3   Model Operations

Operations	Page
Using I/O Bus Switching Function in the Sequent NUMA-Q Connection	94
Using the Subsystem in LU Blockade Mode	97
Using the WolfPack Mode	99
Using VxVM (Version 3.2P2+PP or later) on the Host Side	102
Making Nine or More LUs Recognized by Using Qlogic HBA or Emulex HBA on Windows 2000	103
Making LUs, Numbers 8 – 63 when the Subsystem is Connected to the HP Server	105
Using the SUN Cluster 3.0	107
Using the ftServer	109
Using the Hitachi SynchronousTrueCopy Function	111
Using the Microsoft Cluster Server	113
Connecting the Subsystem as a Boot Disk or a Dump Device of an HP Server	114

7.7.4.2   Using the I/O Bus Switching Function in Sequent NUMA-Q Connection

1. On the unit window, double-click the **Controller** to be set for the connection mode with the host. Display **Host group 0** by double-clicking the **Port**.

2. Display the **Option** and **Logical Unit** by double-clicking the **Host group 0**, select the **Option**.
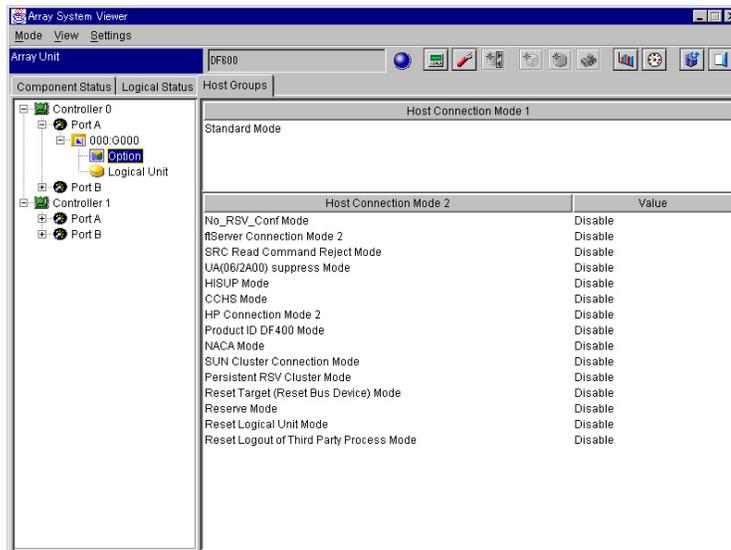
3. On the **Settings** menu, select **Modify Host Group Option**.
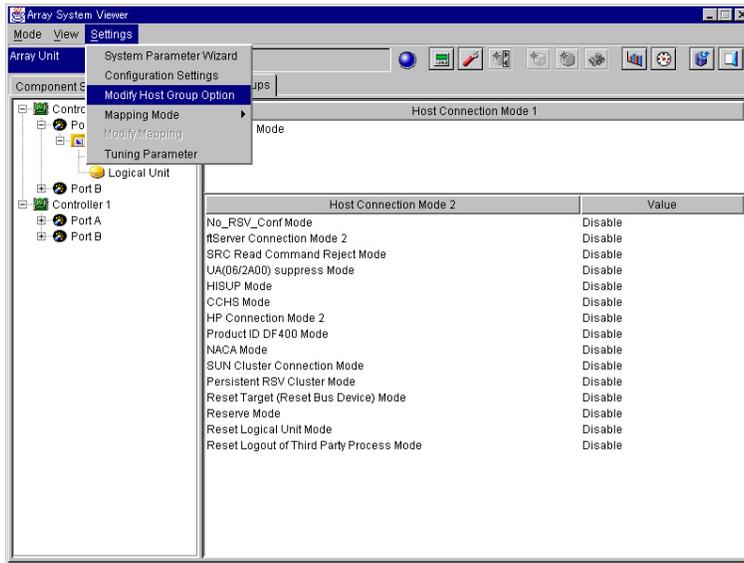
4. Select the **TRESPASS Mode** in **Host Connection Mode 1**. Click the **OK** button.
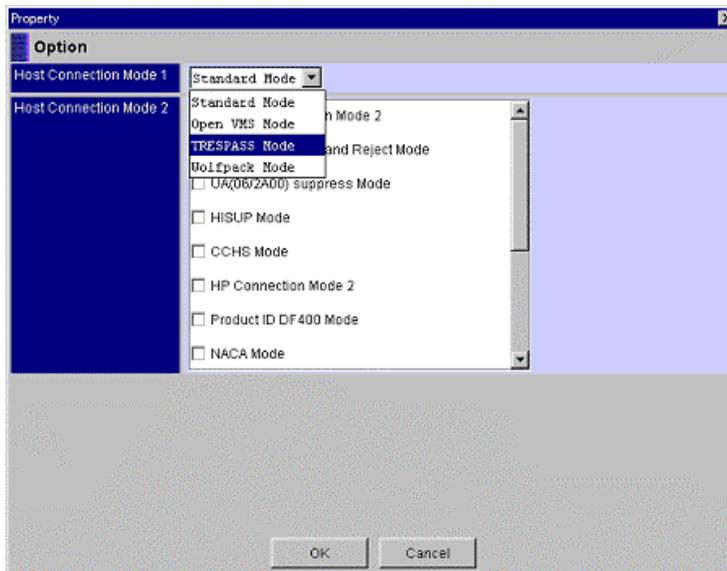
5. A message appears; click the **OK** button.

6. A message appears stating that the setting is complete. Click the **OK** button.
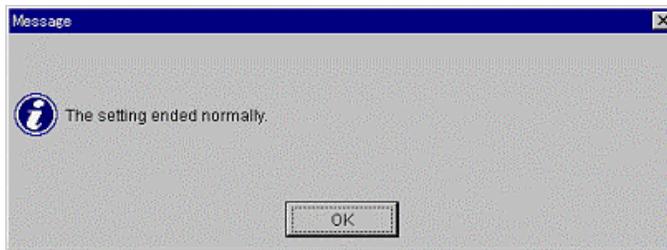
7. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** in the tool bar.

8. Click the **Unit Identifier** tab.
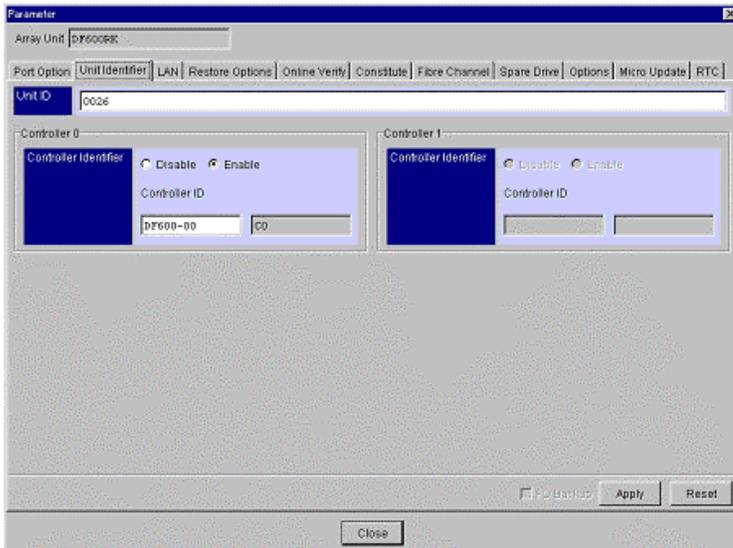
9. After **Controller Option** is displayed, click **Enable** in the **Controller Identifier**. If nothing is input to a **Controller ID**, **DF600-00** (default value) is reported.

   A controller identifier needs to be set for every device. When connecting only one device under control of a host computer, the default value can be used. From the second host computer the controller identifier needs to be changed.
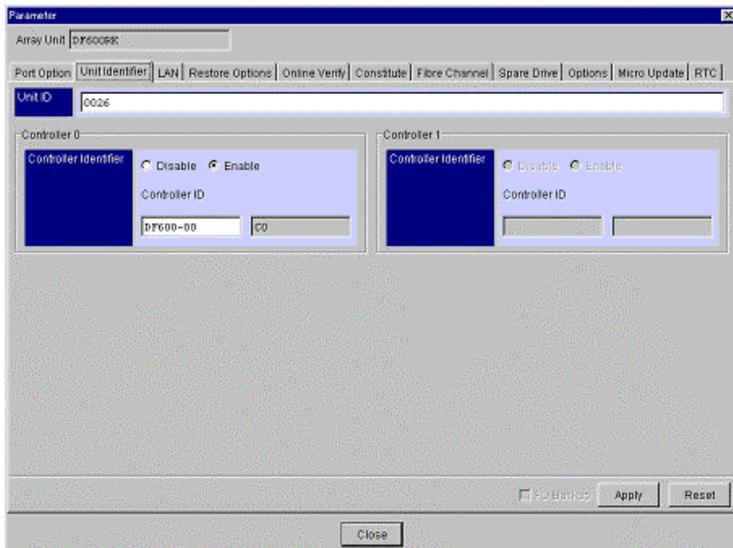
10. Click the **Apply** button.

11. A message appears, stating that the setting is complete. Click the **OK** button.
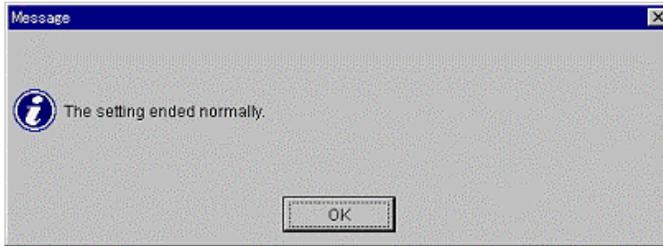
12. Click the **Close** button.

7.7.4.3   Using the Subsystem in LU Blockade Mode

1.   On the **Settings** menu, click **System Parameter Wizard** or click the **System Parameter Wizard** in the tool bar.
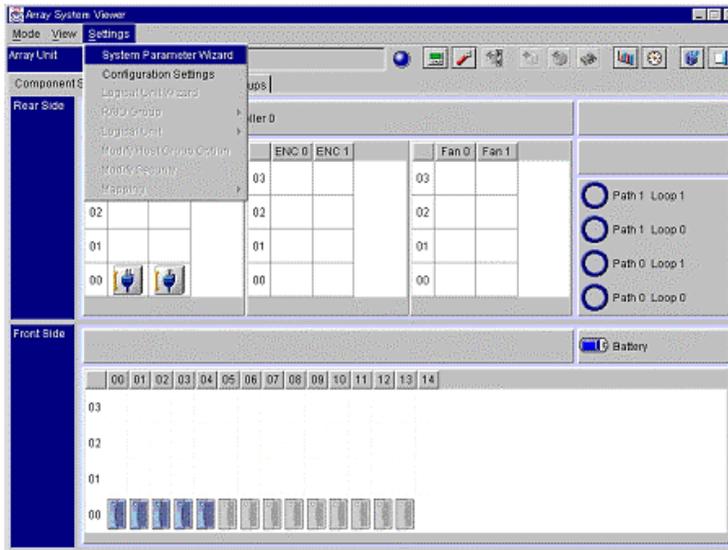
2. Click the **Basic Settings**, then click the **Next** button.
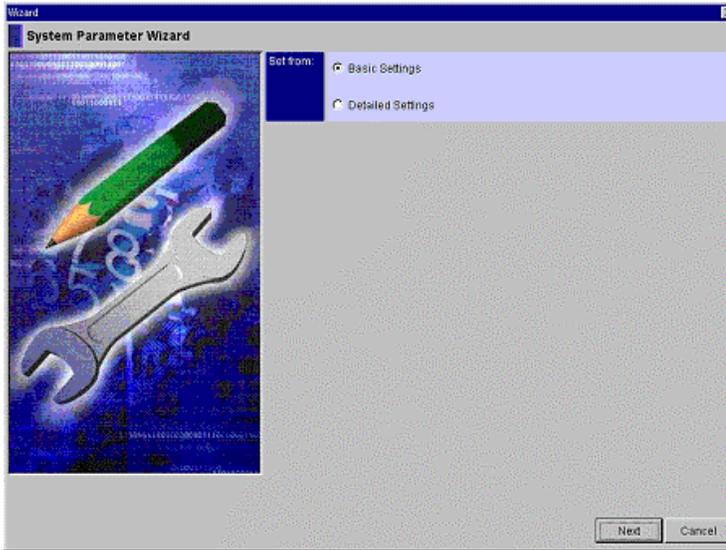
3. Click the **Next** button until **Option 1** is displayed.

4. After **Option 1** has been displayed, click the **Drive Detach Mode** in the **SCSI/Fibre-Channel Common Options**.
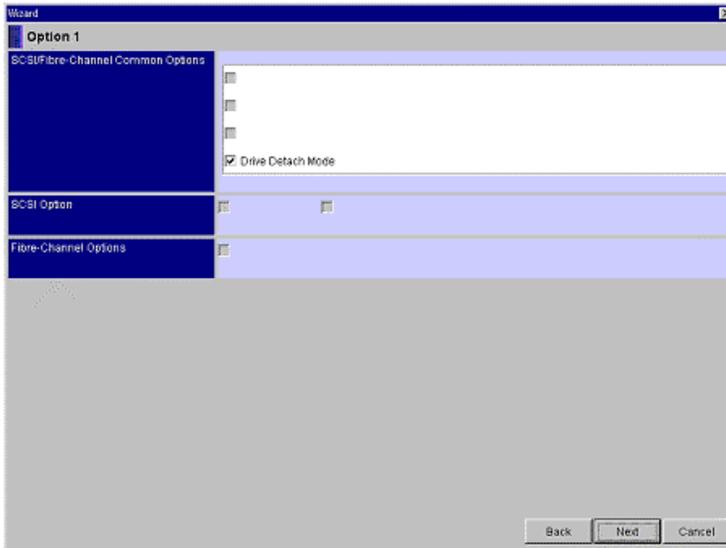
5. Click the **Next** button until **System Parameter Setting Completed** is displayed.

6. Click the **OK** button.

7. When terminated, set the system parameters. The following window is displayed. Click the **OK** button.

8. Click the **OK** button.

9. A message appears, stating that the restart is successful. Click the **OK** button.
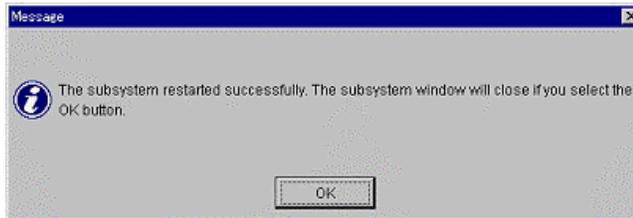
The Unit screen is closed. To perform other operations on the Main screen, select an array unit from the Main screen and open the selected Unit screen.

7.7.4.4 Using the WolfPack Mode

1. In the unit window, double-click the **Controller** to be set for the connection mode with the host. Display the **Host group 0** by double-clicking the **Port**.

   Display the **Option** and **Logical Unit** by double-clicking the **Host group 0** and select the **Option**.
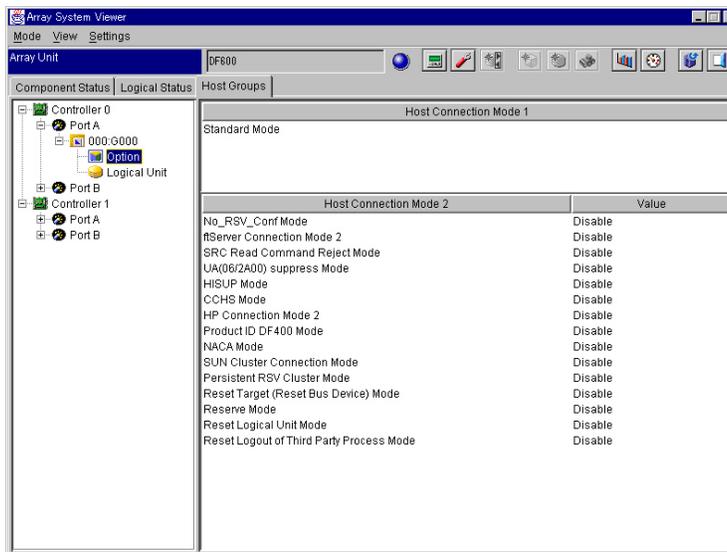
2. On the **Settings** menu, select **Modify Host Group Option**.
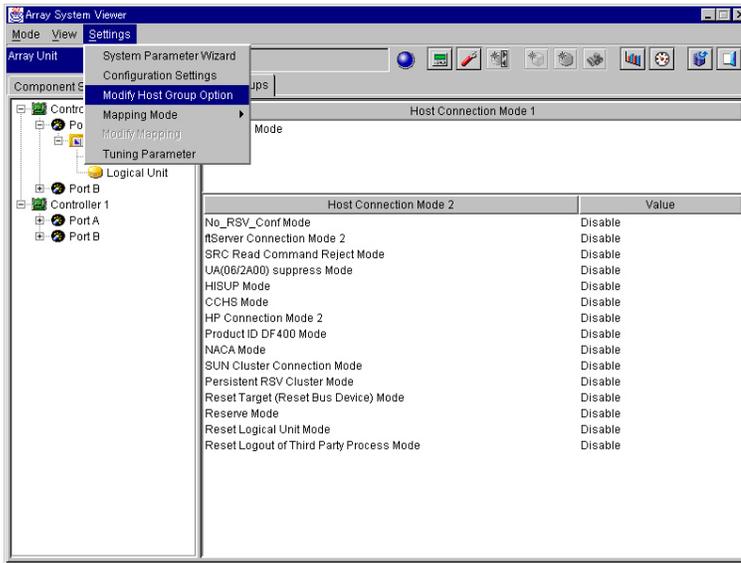
3. Select the **Wolfpack Mode** in the **Host Connection Mode 1**. Click the **OK** button.
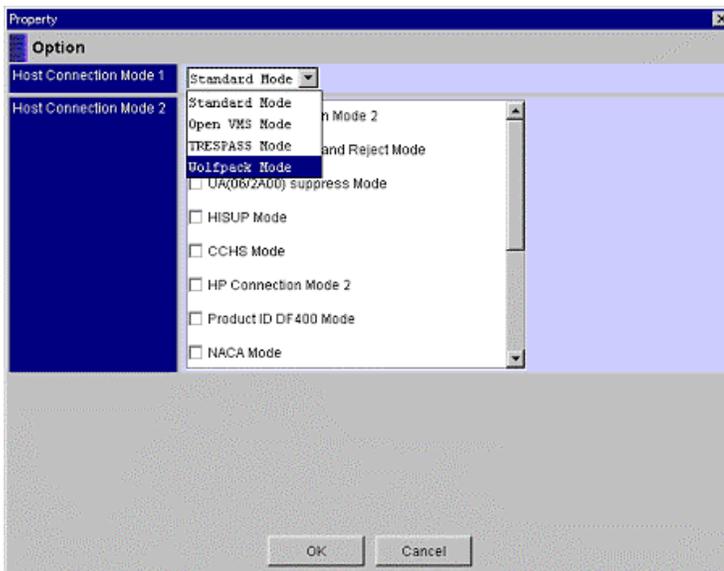
4. A message appears; click the **OK** button.

5. A message appears stating that the setting is complete is displayed. Click the **OK** button.
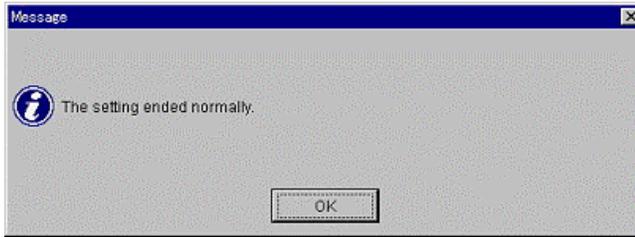
6. On the Settings menu, select **Configuration Settings** or click **Configuration Settings** in the tool bar.

7. Click the **Port Option** tab.

8. Select **Reset ALL LIP Port Mode** of the **Port Option**.
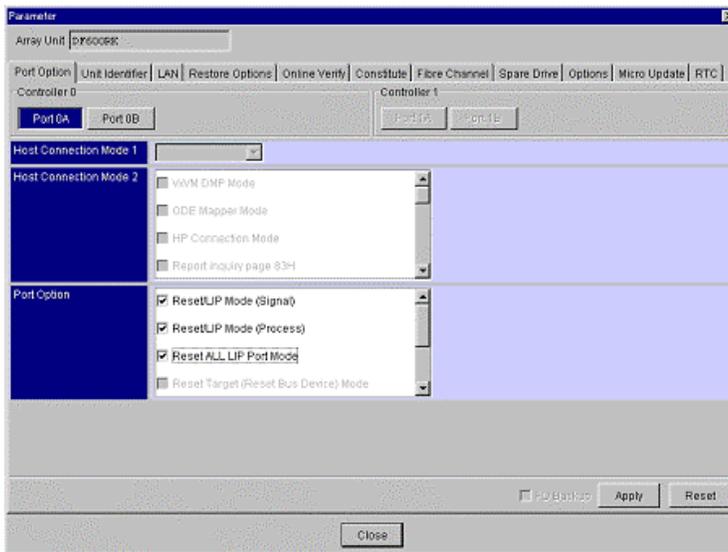
9. Click the **Apply** button.

10. A message appears stating that the setting is complete. Click the **OK** button.
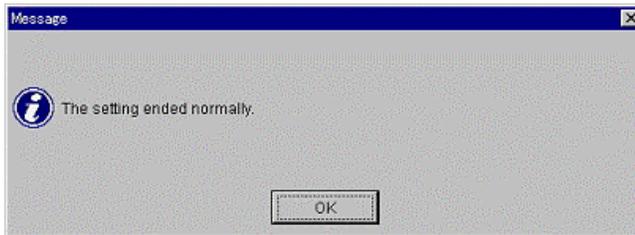
11. Click the **Close** button.

7.7.4.5 Using VxVM (Version 3.2P2+PP or later) on the Host Side

1. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** in the tool bar.

2. Click the **Unit Identifier** tab.

3. After **Controller Option** is displayed, click **Enable** in the **Controller Identifier**.

    If nothing is input to a **Controller ID**, **DF600-00** (default value) is reported. A controller identifier needs to be set for every device. When connecting only one device under control of a host computer, a default value can be used. From the second host computer, the controller identifier needs to be changed.
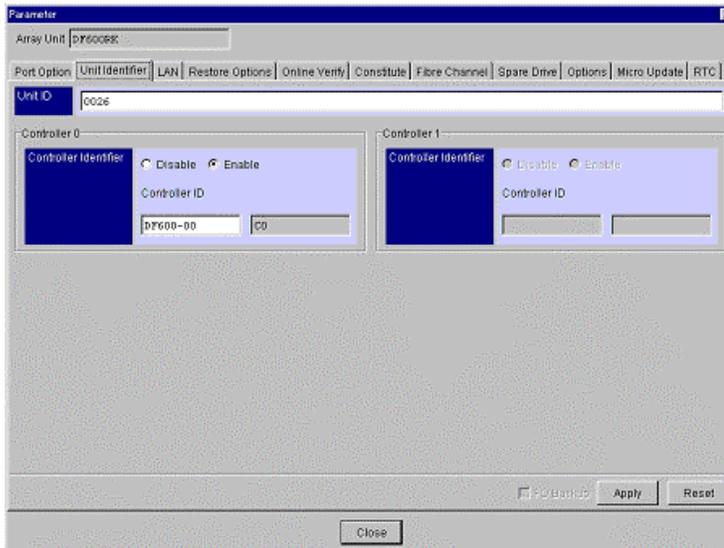
4. Click the **Apply** button.

5. A message appears indicating that the setting is complete. Click the **OK** button.
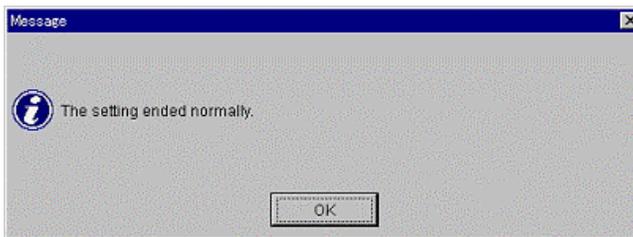
6. Click the **Close** button.

7.7.4.6 Making Nine or More LUs Recognized by Using Qlogic HBA or Emulex HBA on

Windows 2000

1. On the unit window, double-click the **Controller** to be set for the connection mode with the host, then display the **Host group 0** by double-clicking the **Port**.

   Display **Option** and **Logical Unit** by double-clicking the **Host group 0** and select the **Option**.

Array System Viewer
Mode View Settings

| Array Unit | DF600 |

Component Status | Logical Status | Host Groups

- Controller 0
  - Port A
    - 000:G000
      - Option
      - Logical Unit
  - Port B
- Controller 1
  - Port A
  - Port B

Host Connection Mode 1
Standard Mode

Host Connection Mode 2	Value
No_RSV_Conf Mode	Disable
ftServer Connection Mode 2	Disable
SRC Read Command Reject Mode	Disable
UA(06/2A00) suppress Mode	Disable
HISUP Mode	Disable
CCHS Mode	Disable
HP Connection Mode 2	Disable
Product ID DF400 Mode	Disable
NACA Mode	Disable
SUN Cluster Connection Mode	Disable
Persistent RSV Cluster Mode	Disable
Reset Target (Reset Bus Device) Mode	Disable
Reserve Mode	Disable
Reset Logical Unit Mode	Disable
Reset Logout of Third Party Process Mode	Disable

2. On the **Settings** menu, select **Modify Host Group Option**.

Array System Viewer
Mode View Settings

| Array Unit | | |

Component S | | ups

Settings menu:
- System Parameter Wizard
- Configuration Settings
- Modify Host Group Option
- Mapping Mode
- Modify Mapping
- Tuning Parameter

- Contro
  - Po
  - Logical Unit
  - Port B
- Controller 1
  - Port A
  - Port B

Host Connection Mode 1
Mode

Host Connection Mode 2	Value
No_RSV_Conf Mode	Disable
ftServer Connection Mode 2	Disable
SRC Read Command Reject Mode	Disable
UA(06/2A00) suppress Mode	Disable
HISUP Mode	Disable
CCHS Mode	Disable
HP Connection Mode 2	Disable
Product ID DF400 Mode	Disable
NACA Mode	Disable
SUN Cluster Connection Mode	Disable
Persistent RSV Cluster Mode	Disable
Reset Target (Reset Bus Device) Mode	Disable
Reserve Mode	Disable
Reset Logical Unit Mode	Disable
Reset Logout of Third Party Process Mode	Disable

3. Select the **HISUP Mode** in **Host Connection Mode 2**. Click the **OK** button.
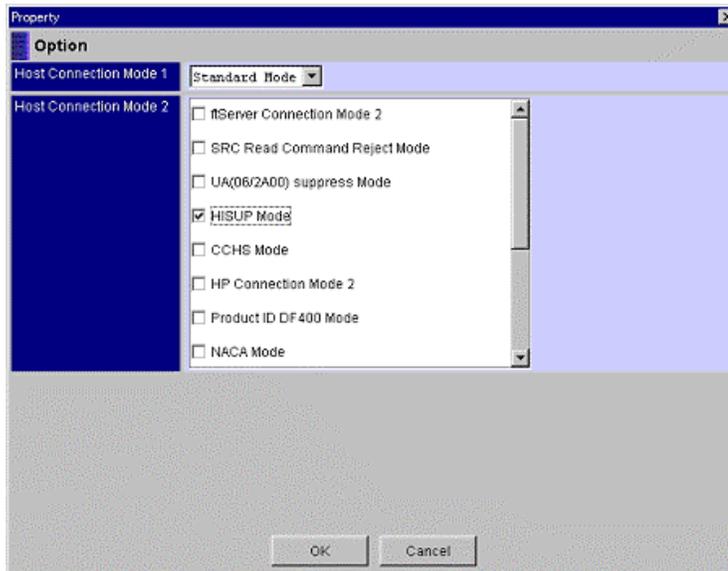
4. A message appears; click the **OK** button.

5. A message appears, stating that the setting is complete. Click the **OK** button.
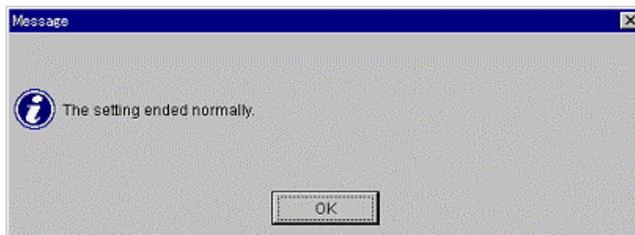
7.7.4.7 Making LU Numbers 8 to 63, Recognized when the Subsystem is Connected to the HP Server

1. On the unit window, double-click the **Controller** to be set for the connection mode with the host, then display the **Host group 0** by double-clicking the **Port**.

   Display the **Option** and **Logical Unit** by double-clicking **Host group 0** and select the **Option**.

   Array System Viewer
   Mode   View   Settings
   Array Unit   DF600
   Component Status | Logical Status | Host Groups

   - Controller 0
     - Port A
       - 000:G000
         - Option
         - Logical Unit
     - Port B
   - Controller 1
     - Port A
     - Port B

   Host Connection Mode 1
   Standard Mode

Host Connection Mode 2	Value
No_RSV_Conf Mode	Disable
ftServer Connection Mode 2	Disable
SRC Read Command Reject Mode	Disable
UA(06/2A00) suppress Mode	Disable
HISUP Mode	Disable
CCHS Mode	Disable
HP Connection Mode 2	Disable
Product ID DF400 Mode	Disable
NACA Mode	Disable
SUN Cluster Connection Mode	Disable
Persistent RSV Cluster Mode	Disable
Reset Target (Reset Bus Device) Mode	Disable
Reserve Mode	Disable
Reset Logical Unit Mode	Disable
Reset Logout of Third Party Process Mode	Disable

2. On the Settings menu, select **Modify Host Group Option**.

   Array System Viewer
   Mode   View   Settings
   Array Unit
   Component S   ups

   Settings menu:
   - System Parameter Wizard
   - Configuration Settings
   - Modify Host Group Option
   - Mapping Mode
   - Modify Mapping
   - Tuning Parameter

   - Contro
     - Po
     - Logical Unit
     - Port B
   - Controller 1
     - Port A
     - Port B

   Host Connection Mode 1
   Mode

Host Connection Mode 2	Value
No_RSV_Conf Mode	Disable
ftServer Connection Mode 2	Disable
SRC Read Command Reject Mode	Disable
UA(06/2A00) suppress Mode	Disable
HISUP Mode	Disable
CCHS Mode	Disable
HP Connection Mode 2	Disable
Product ID DF400 Mode	Disable
NACA Mode	Disable
SUN Cluster Connection Mode	Disable
Persistent RSV Cluster Mode	Disable
Reset Target (Reset Bus Device) Mode	Disable
Reserve Mode	Disable
Reset Logical Unit Mode	Disable
Reset Logout of Third Party Process Mode	Disable

3. Select the **HP Connection Mode 2** in the **Host Connection Mode 2**. Click the **OK** button.
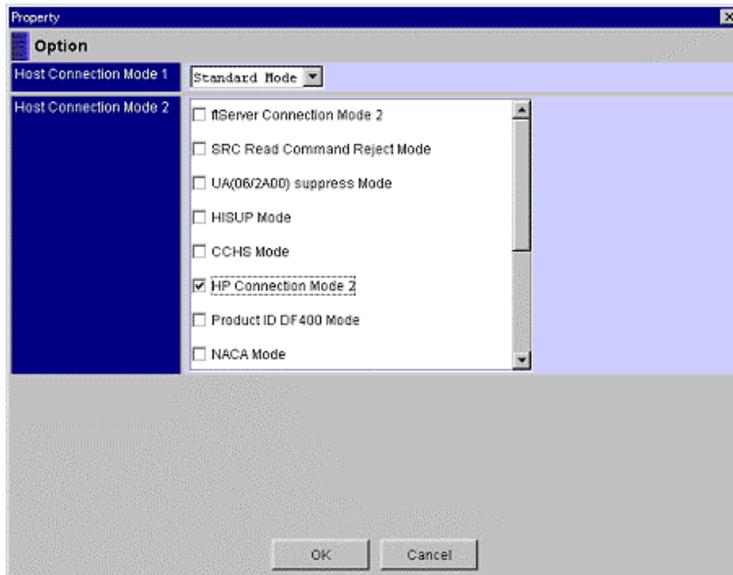
4. A message appears; click the **OK** button.

5. A message appears stating that the setting in complete. Click the **OK** button.
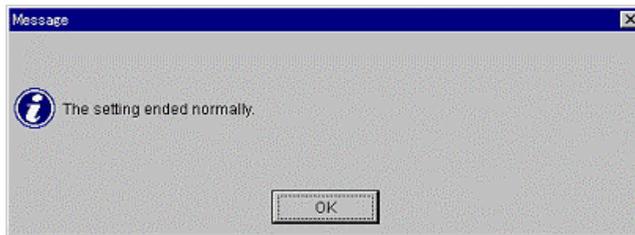
7.7.4.8 Using SUN Cluster 3.0

1. On the unit window, double-click the **Controller** to be set for the connection mode with the host, then display the **Host group 0** by double-clicking the **Port**.

    Display the **Option** and **Logical Unit** by double-clicking the **Host group 0** and select the **Option**.
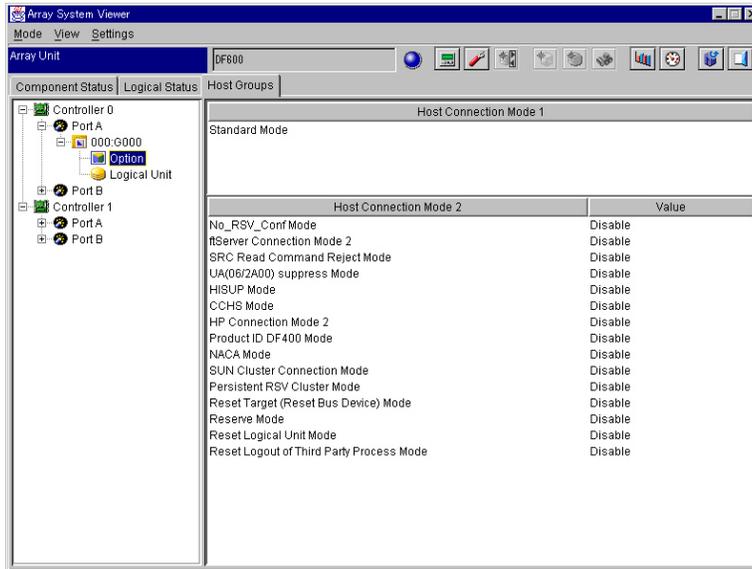
2. On the **Settings** menu, select **Modify Host Group Option**.
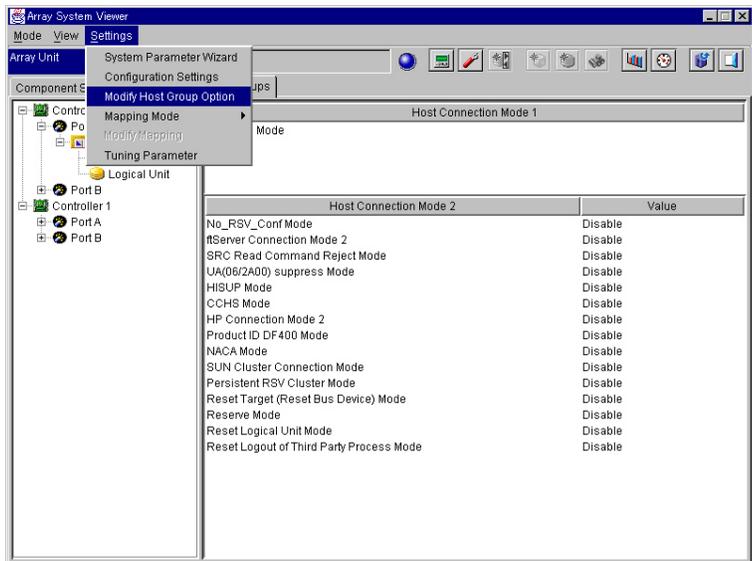
3. Select the **SUN Cluster Connection Mode** in **Host Connection Mode 2**. Click the **OK** button.
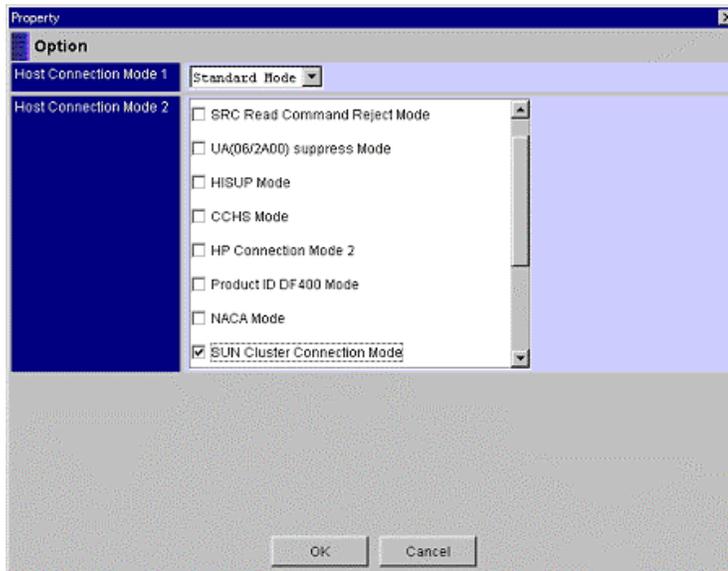
4. A message appears; click the **OK** button.

5. A message appears stating that the setting is complete. Click the **OK** button.
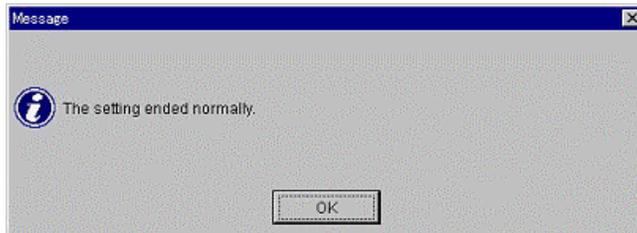
7.7.4.9　Using the ftServer

1. On the unit window, double-click the **Controller** to be set for the connection mode with the host. Display the **Host group 0** by double-clicking the **Port**.

   Display **Option** and **Logical Unit** by double-clicking **Host group 0;** select the **Option**.
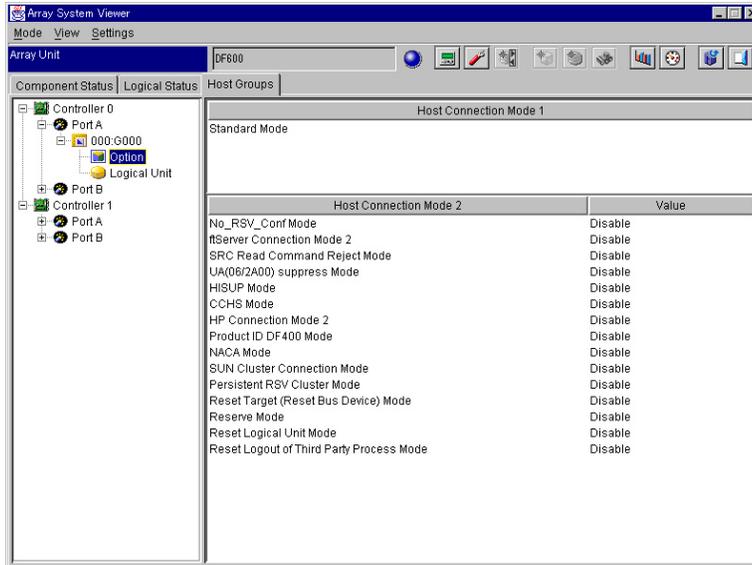
2. On the **Settings** menu, select **Modify Host Group Option**.
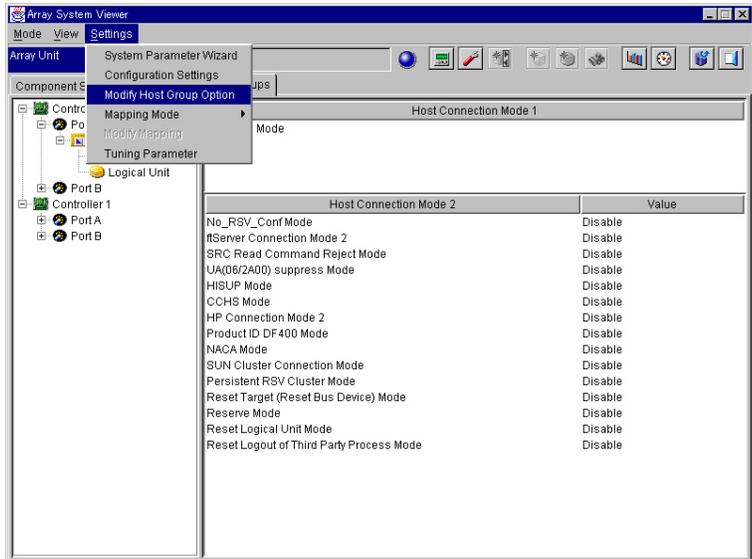
3. Select the **ftServer Connection Mode 2** in the **Host Connection Mode 2**. Click the **OK** button.
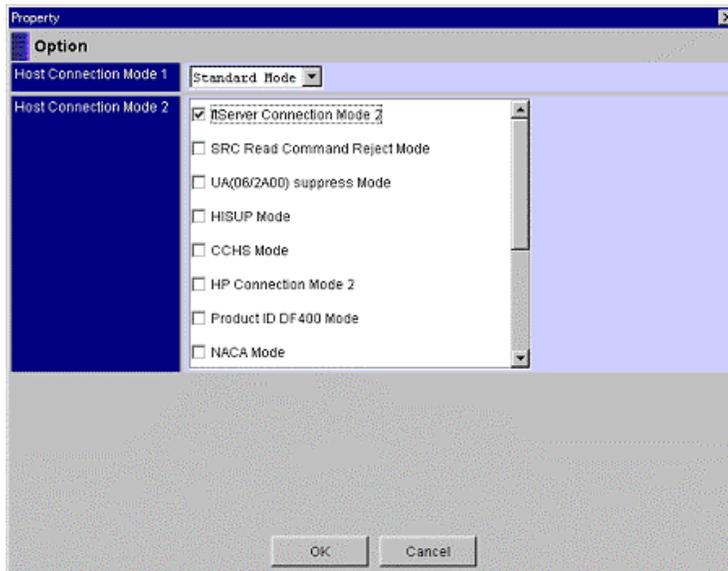
4. A message appears; click the **OK** button.

5. A message appears stating that the setting is complete. Click the **OK** button.

7.7.4.10 Using Synchronous TrueCopy

1. On the unit window, double-click the **Controller** to be set for the connection mode with the host. Display the **Host group 0** by double-clicking the **Port**.

   Display **Option** and **Logical Unit** by double-clicking the **Host group 0** and selecting **Option**.
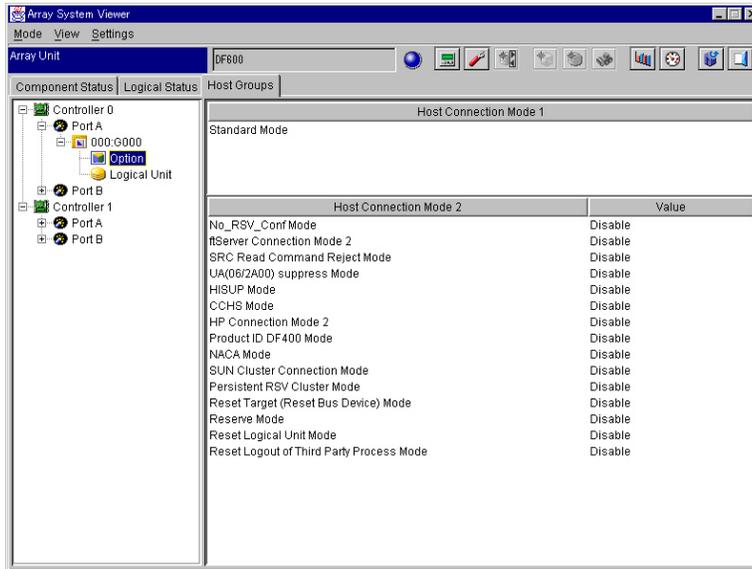
2. On the **Settings** menu, select **Modify Host Group Option**.
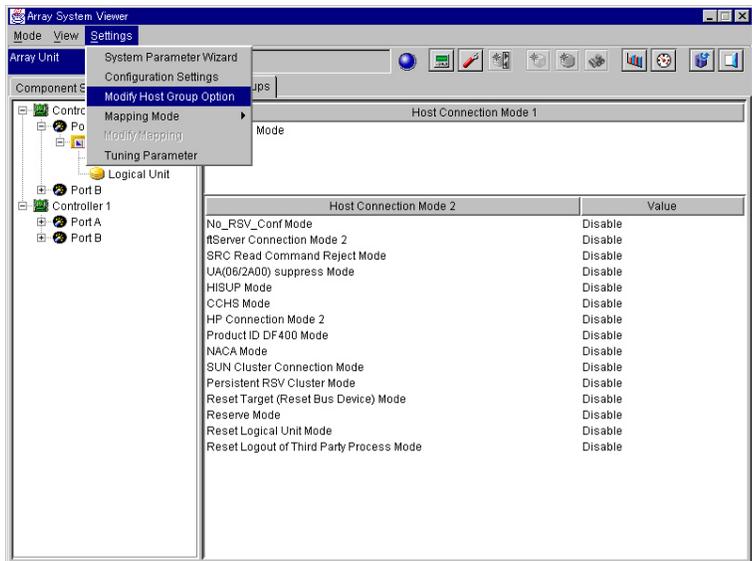
3. If you want to use the subsystem, suppressing read access to the P-VOL when the mode is changed to PSUE, select **SRC Read Command Reject Mode** for the **Host Connection Mode 2**.
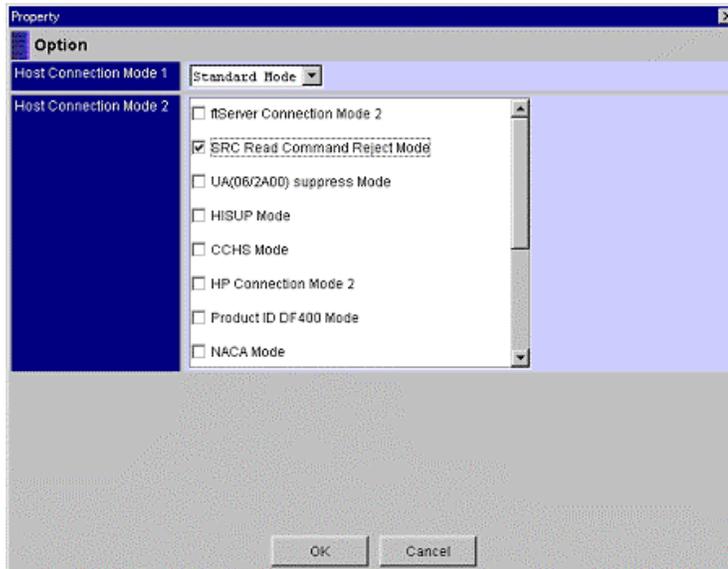
   Click the **OK** button.

4. A message appears; click the **OK** button.

5. A message appears, stating that the setting is complete. Click the **OK** button.
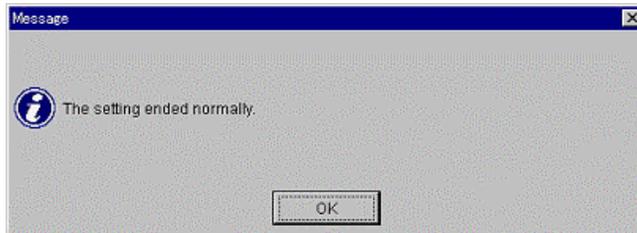
7.7.4.11 Using the Microsoft Cluster Server

When connecting to Microsoft Cluster Server via Fabric Switch, Zoning on Fabric Switch must be set for each HBA as shown below:
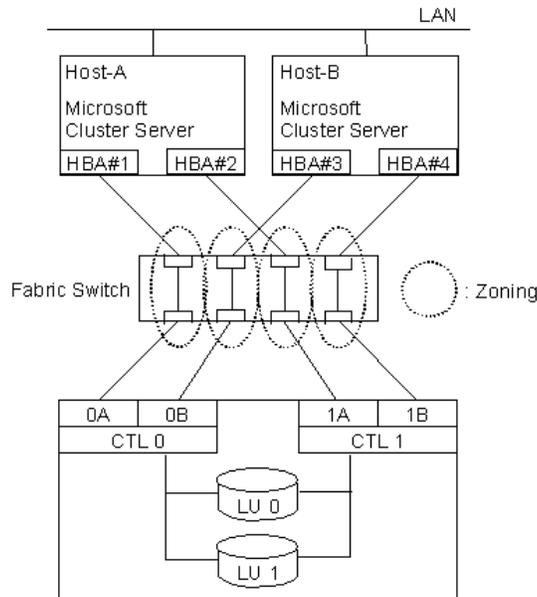
Figure 7.7   Configuration Example (without Port Sharing)
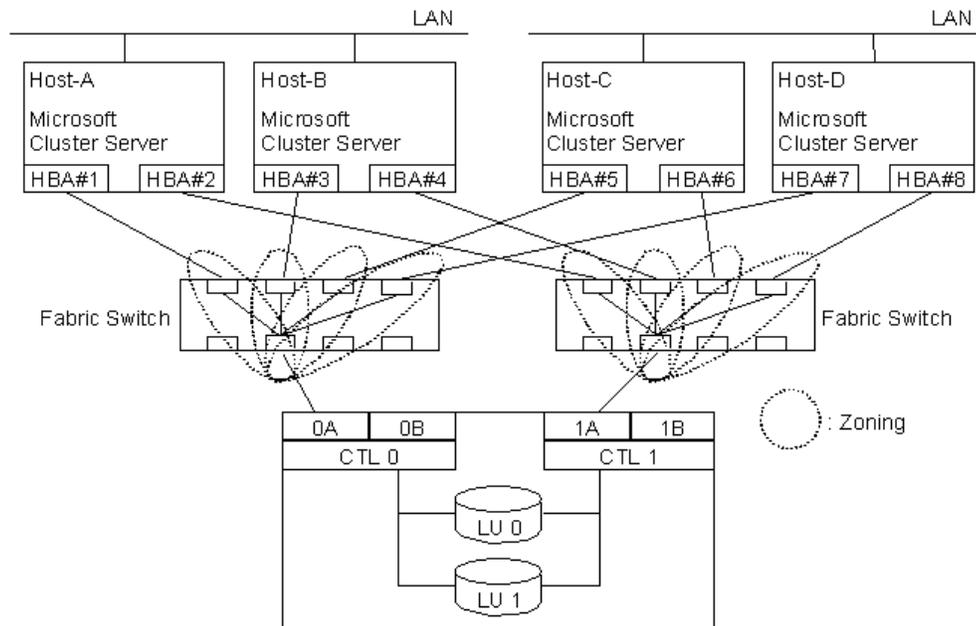
Figure 7.8   Configuration Example (with Port Sharing)

7.7.4.12 Connecting the Subsystem as a Boot Disk or a Dump Device of an HP Server

1. On the Settings menu, select Configuration Settings or click Configuration Settings in the tool bar.

2. Click the Port Option tab.

3. Select Read Frame Min 128 Byte Mode of the Port Option.
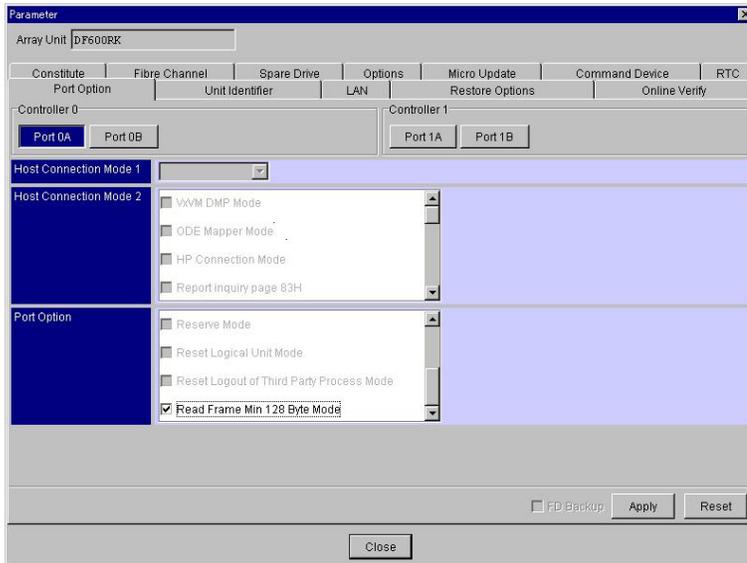
4. Click the Apply button.

5. A message indicating completion of setting is displayed. Click the OK button.
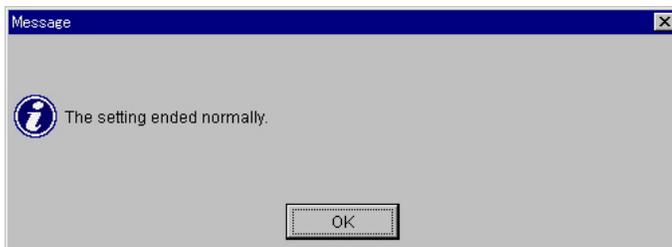
6. Click the Close button.

7.8   Changing the Network Parameter

To set a network parameter from the Resource Manager 9500V program, use the following procedure:

1. Turn on the power supply.

2. Start the Resource Manager 9500V program and set the operation mode to Management Mode Refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series Resource Manager 9500V User's Guide Graphical User Interface (GUI)*, MK-92DF605.

3. Click the icon of an array unit on the Main window, and select the **Settings** menu.

4. Click **Display Details** or click the **Display Details** button in the tool bar.
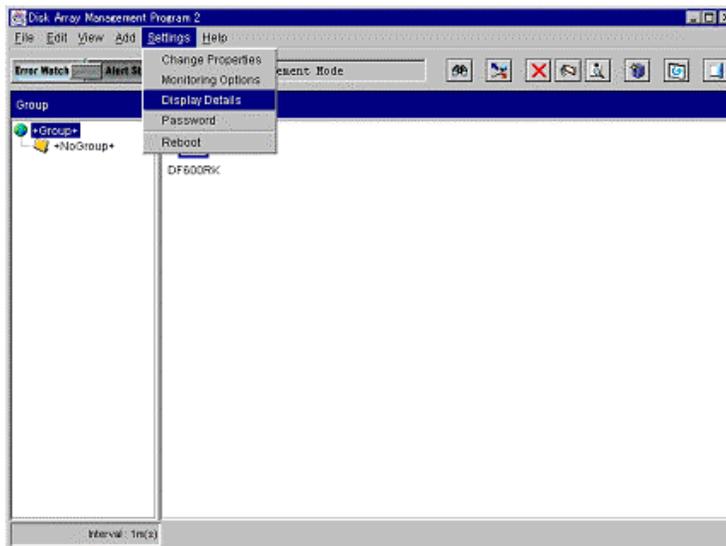
5. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** in the tool bar.

6. Click the **LAN** tab on the Unit screen.
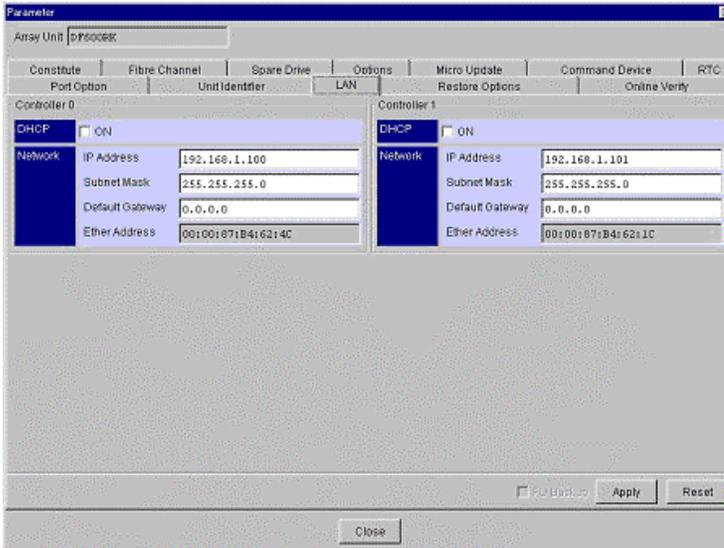
7. Set the Network parameter for the Network.

8. Click the **Apply** button.

9. A message appears, stating that the network parameter has been changed. A confirmation message appears, asking you to verify that you wish to restart. Click the **OK** button to restart.

Note: When a restart is initiated, the array unit is not ready to access data from the host for duration of this process. Therefore, verify that the host has stopped accessing data before initiating a restart.
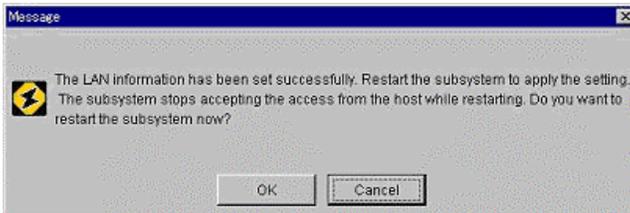
10. A message appears, stating that the restart has terminated. Click the **OK** button.

When the **OK** button is clicked, the unit window is closed. To perform other operations, select an array unit on the main window and open the unit window.

Chapter 8   Troubleshooting

The Hitachi Freedom Storage™ Thunder 9570™ V Series subsystem provides high data availability and is not expected to fail in any way that would prevent access to user data.

This section includes the following:

- Troubleshooting Based on LED Indications
- Web Overview
- Web Operational Procedures
- Troubleshooting Using a Web Connection

8.1   Troubleshooting Based on LED Indications

This section includes the following:

- The POWER LED does not Turn On.
- The POWER LED is Turned Off.
- The READY LED does not Turn On or the READY LED has Turned On Once, then Turned Off.
- The ALARM LED has Turned On.
- The WARNING LED has Turned On or Blinks.

8.1.1   The POWER LED does not Turn On

When the POWER LED does not turn on, follow these steps:

1. Set the AC power unit switch on; set the main switch to on.

2. Has the POWER LED turned on?

    Yes: Go to step 9.
    No: If the power control has been set to **Remote**, power-on the host computer.

3. Has the POWER LED turned on?

    Yes: Go to step 9.
    No: Set the main switch to off; set the AC power unit switch to off.

4. Check the PDB to verify that electricity is supplied to the unit.

5. Verify that the AC cable is correctly connected to the plug socket and the equipment.

6. Set the AC power unit switch to on; set the main switch to on.

7. Has the POWER LED turned on?

    Yes: Go to step 9.
    No: Set the main switch to off; set the AC power unit switch to off.

8. Call your maintenance engineer. Go to step 10.

9. Has the READY LED turned on?

    Yes: Continue to use the equipment as it is.
    No: Verify that the READY LED does not turn on or that the READY LED has turned on once and then turned off.

10. End of the procedure.

8.1.2 The POWER LED has Turned Off

When the POWER LED has turned off, follow these steps:

1. Electricity is received by the equipment?

    Yes: Remove anything that would prohibit electricity from being supplied to the unit and restart the unit. Go to step 7.
    No: Verify that the AC cable is correctly connected to the plug socket, then restart the unit.

2. Set the main switch to off, then set the AC power unit switch to off.

3. After waiting for more than one minute, set the AC power unit switch to on, then set the main switch to on.

4. Has the POWER LED turned on?

    Yes: Go to step 6.
    No: Set the main switch to off, then set the AC power unit switch to off.

5. Call your maintenance engineer.

6. Has the READY LED turned on?

    Yes: Continue to use the equipment as it is.
    No: Refer to READY LED does not turn on or READY LED has turned on once, then turned off.

7. End of procedure.

8.1.3 READY LED does not Turn On or the READY LED has Turned On Once, then Turned Off

If the READY LED does not turn on or the READY LED has turned on once, then turned off, follow these steps:

1. Is the POWER LED on?

    Yes: Go to step 2.
    No: Go to step 4 in **POWER LED does not turn on**.

2. Is the ALARM LED on?

    Yes: Refer to **ALARM LED has turn on**.
    No: Go to step 3.

3. Turn off the main switch.

4. After waiting for more than one minute, set the AC power unit switch to on, then set the main switch to on.

5. Has the READY LED turned on?

   Yes: Continue to use the equipment as it is. Go to step 8.
   No: Go to step 6.

6. Set the main switch to off, then set the AC power unit switch to off.

7. Call your maintenance engineer.

8. End of the procedure.

8.1.4   The Alarm LED has Turned On

When the ALARM LED has turned on, follow these steps:

1. Identify in which components the failure is resident.

Note: Refer to 4.7.5 LED Locations and Functions to identify failed components whose LEDs indicate their respective failures.

2. Set the main switch to off, then set the AC power unit switch to off.

3. Call your maintenance engineer.

8.1.5   The WARNING LED has Turned On or Blinks

When the WARNING LED has turned on or blinks, follow these steps:

1. Does the WARNING LED blink?

   Yes: Call your maintenance engineer. Go to step 5
   No: Go to step 2.

2. Is the READY LED on?

   Yes: Go to step 3.
   No: Refer to: READY LED does not turn on or READY LED has turned on once and then turned off.

3. Identify in which components a failure is resident.

Note: Refer to 4.7.5 LED Locations and Functions to identify failed components whose LEDs indicate their respective failures.

4. Continue to use the equipment and contact the maintenance engineer.

5. End of the procedure.

8.2 Web Overview

This section includes the following:

- Operational Environment
- Characteristics of Network Functions
- Connecting to the Network

8.2.1 Operational Environment

The Web operational environment and the necessary requirements are shown in the following tables.

Table 8.1   Web Operational Environment

No.	Item	Description
1	OS	Microsoft Windows 95/98/2000/Me/XP/NT 4.0, Solaris 2.6/8.0, IRIX 6.4
2	PC	Pentium (Pentium II[233 M Hz or more] is recommended), Memory 40 M bytes or more (64 Mbytes or more is recommended or more)
3	WS	Turbo Sparc 170 M Hz, Memory 256 Mbytes or more R10000 195M Hz, Memory 128 Mbytes or more
4	Disk requirement	50 Mbytes

Table 8.2   Web Operational Requirements

No.	Platform	OS	Browser	Ver.	Supported or Not Supported	Microprogram Supported or Not Supported
1	WS	IRIX	Netscape Navigator	4.7	○	X
				4.76	○	X
		Solaris 2.6	Netscape Navigator	4.7	○	X
				4.76	○	X
		Solaris 8.0	Netscape Navigator	4.78	○	X
2	PC	Windows	Internet Explorer	5.0	○	X
				5.5 (*Note 1*)	○	○
				6.0	○	○
			Netscape Navigator	4.7	○	X
				4.73	○	X
				4.74	○	X
				4.75	○	X
				4.76	○	X
				4.78	○	X
				6.2	○	X

Note 1: The Service Pack 1 is included.

8.2.2   Characteristics of Network Functions

This section discusses the following network function characteristics:

- LAN Interface:
  The connector for 10Base-T/100Base-TX is equipped with the controller. 10Base-T/100Base-TX is selected automatically.

- Network Parameter:
  The 9570V has the following network parameters; they can be set or changed by the Web browser or the Resource Manager 9500V, concerning only port 1 (for users) of each controller.

Table 8.3   Network Parameters

Network parameter	Description	Factory Setting Value (*Note 1*)	
		Controller 0	**Controller 1**
IP Address	The IP Address is changed/set up.	192.168.0.16 (*Note 1*)	192.168.0.16 (*Note 1*)
Subnet Mask	The Subnet Mask is changed/set up.	255.255.255.0 (*Note 3*)	255.255.255.0 (*Note 3*)
Default Gateway	The Default Gateway is changed/set up.	0.0.0.0	0.0.0.0
DHCP (*Note 2*)	Enable/Disable of the DHCP function is set up.	Off	Off

Note 1: Manage the IP Address after the IP Address is changed from the IP Address of factory setting.

Note 2: When the DHCP mode is validated, the IP Address is acquired from the DHCP server.
If the DHCP server is not started up or the DHCP function has been wrongly set, the acquisition of the IP Address will fail and the IP Address of the subsystem will remain **0.0.0.0**. (This is a state in which Disk Array management program 2 or the Web cannot be used via a LAN.)
In this case, you can acquire the IP Address by starting up the DHCP server or by setting the DHCP function correctly when necessary.

Note 3:
Microprogram revision 0653/B or earlier
(1) When the user's port address is set to other than 10.x.x.x, 10.x.x.x cannot be used for the IP address for LAN device to be connected to user's port through a gateway. Therefore, set the IP address to other than 10.x.x.x.
(2) When the user's port address is set to 10.x.x.x, 192.168.0.x cannot be used for the IP address for LAN device to be connected to user's port through a gateway. Therefore, set the IP address to other than 192.168.0.x.
Microprogram revision 0653/C or later
(1) When the user's port address is set to other than 10.x.x.x, 10.0.0.(0 to 31) cannot be used for the IP address for LAN device to be connected to user's port through a gateway. Therefore, set the IP address to other than 10.0.0.(0 to 31).
(2) When the user's port address is set to 10.x.x.x, 192.168.0.(0 to 31) cannot be used for the IP address for LAN device to be connected to user's port through a gateway. Therefore, set the IP address to other than 192.168.0.(0 to 31).

8.3   Web Operational Procedures

This section contains the following information:

- Connecting to the Network using a LAN Interface

- Screen Outlines

- Main Screen in Normal Mode

- Status Display of Replaceable Components

- Information Message

- Setting the Buzzer Sound Volume

8.3.1   Connecting to the Network using a LAN Interface

To use a LAN interface, follow these steps:

1. The connector for 10Base-T/100Base-TX is equipped with the controller. 10Base-T/100Base-TX is selected automatically.

2. Connect the LAN cable with the LAN connector shown in the Figure 8.1.
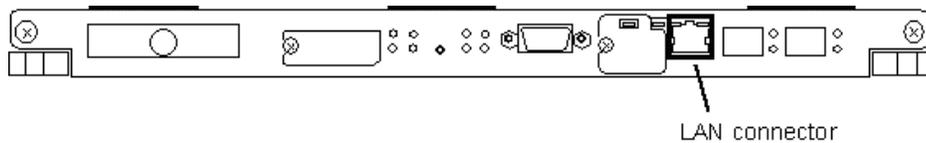
Figure 8.1   LAN Connector Location

Change the IP Address of the controller set up to the Address of the Web browser, to enter Normal Mode. Set the IP Address of the controller connected with the network as a dual system configuration. The status of the devices (both controllers) can be monitored from one controller.

8.3.2   Screen Outlines

If the Normal Mode function is displayed and clicked in the menu screen, the chosen function can be executed. The following figure displays the main screen outline of Normal Mode.
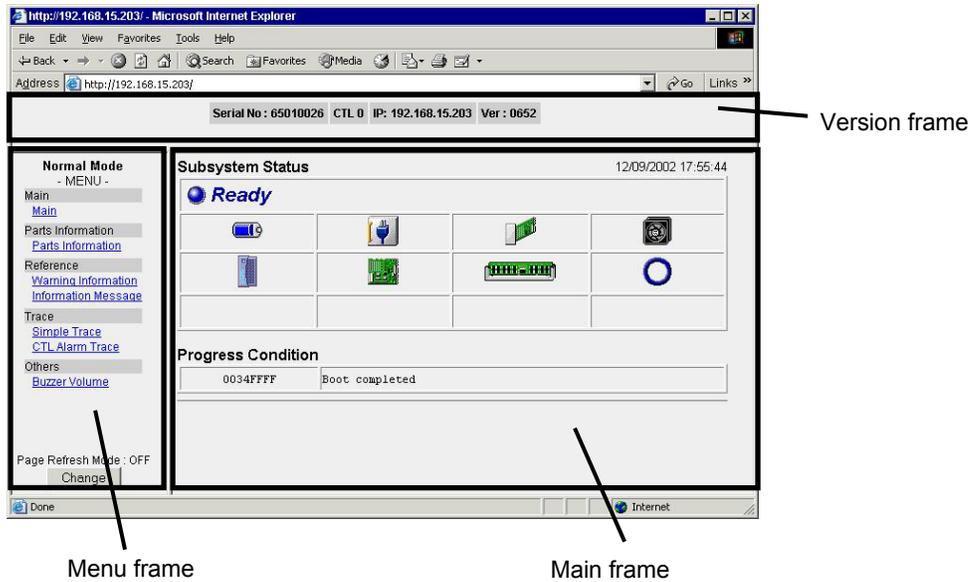
Figure 8.2   Main Screen Outline

This section includes the following:

■   Menu Frame

■   Main Frame

■   Version Frame

8.3.2.1   Menu Frame

The main frame displays the following information:

Main: The main screen of Normal Mode is displayed.

Parts Information: The status of exchange parts is displayed.

Warning Information: Fault information that was detected during device information status is displayed.

Information Message: Fault information, detected during device operation and device information status is displayed.

Simple Trace: A window for collecting the Simple trace is displayed.

CTL Alarm Trace: A window for collecting the CTL Alarm trace is displayed.

Buzzer Volume: The screen where Buzzer Volume is set up is displayed.

Page Refresh Mode: This button sets up an on/off an automatic redisplay function. When clicked, the on/off mode changes.

> **OFF** display: This is not refreshed.
>
> **ON** display: The screen of the mainframe is refreshed every 5 seconds. The refresh time currently (RTC) is displayed on the right top.

Note: When the PC enters suspension status during operation while the **Page Refresh Mode** is set to **ON**, the Web may not operate correctly after the PC is released from suspension status. When the Web is connected for status monitoring, etc., set the power management of the PC so that the PC does not enter suspension status.

8.3.2.2   Main frame

The main frame displays the following information:

Subsystem Status: The device status and the exchange parts status are displayed.

Progress Condition: The Progress Condition as the device is booting is displayed.

8.3.2.3   Version Frame

The version frame displays the following information:

Web title: The Web title set by a user is displayed. When it is not set, nothing is displayed.

Serial No: The subsystem serial number is displayed.

CTL: The connected controller number is shown.

IP: The connected IP Address of the controller is shown.

Rev: The device version of the microprogram is shown.

8.3.3 Main Screen in Normal Mode

The main screen of normal mode consists of the following:

- Patrol Lamp

- Summary of Exchange Parts Status

- Progress Condition Display

- Page Refresh Button
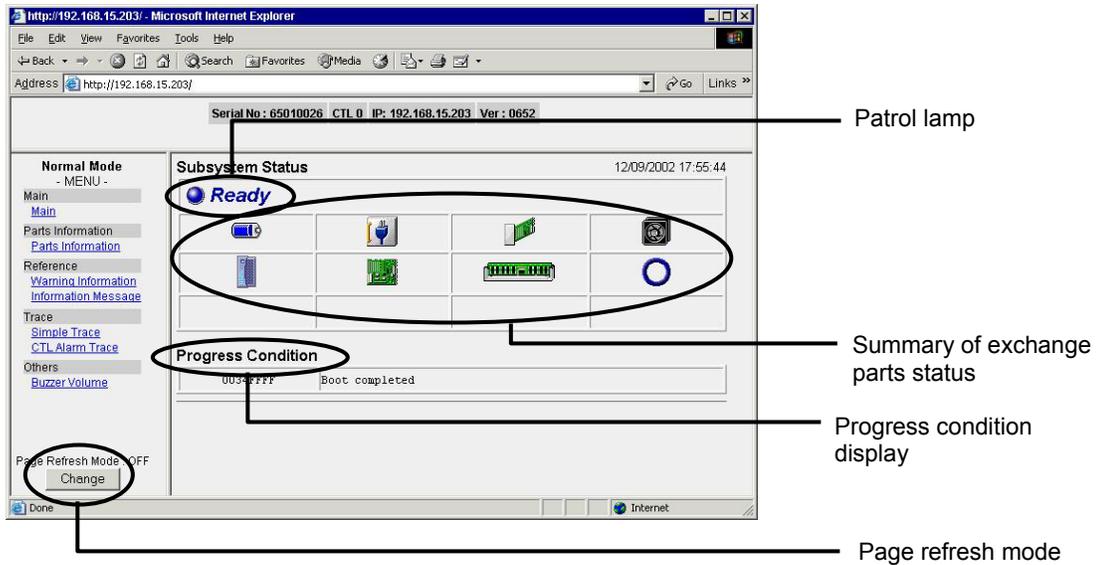
Figure 8.3   Subsystem Condition Display

8.3.3.1 Patrol Lamp

While monitoring the device, the status is displayed.

Image	Status
Booting...	During the start
● *Ready* blue	Normal
○ *Warning* yellow	Warning status
● *Alarm* red	Alarm status

Figure 8.4   Patrol Lamp Display

8.3.3.2   Summary of Exchange Parts Status

The summary of exchange parts status displays the condition of the exchange parts by changing the color. Detailed information of the specific part is displayed by clicking the part icon.

Parts	Image		
	Normal	**Abnormal**	
Power Unit	blue	red	
Disk Drive	blue	red	
Cache Unit	green	red	
Fan Assembly	black	red	
Backup Battery Unit	blue	red	
Control Unit	green	red	
ENC Unit	green	red	
Fibre Loop	blue	red	
Remote Path	orange	red	When displayed in the Synchronous TrueCopy function is effective. (***Note***)

Note: A path blockage that occurred while using the Hitachi TrueCopy function (even if the remote subsystem was off) also occurs. The remote subsystem is turned on and automatically recovered when the remote subsystem is Ready. If a path blockage is not recovered (even when Ready), contact Hitachi Customer Service.

Figure 8.5   Exchange Parts Status Display

8.3.3.3 Progress Condition Display

The progress condition, as the device is booting, is displayed in the progress condition display box.

8.3.3.4 Page Refresh Button

This button sets the on/off function of the automatic redisplay function. If clicked, the on/off mode changes.

OFF display: The screen is not refreshed.

ON display: The screen of the mainframe is refreshed every 5 seconds. The refresh time currently (RTC) is displayed on the right top.

8.3.4 Status Display of Replaceable Components

The status display screen of replaceable components displays the status of the Disk Drive, Control Unit, Cache Unit, Fiber Channel Loop, Fan Assembly, Backup Battery Unit, Power Unit/Power Unit (DC), and ENC Unit that are implemented.

This screen is not displayed if the component is not implemented. When the replaceable component has an abnormal status, a red image is displayed.
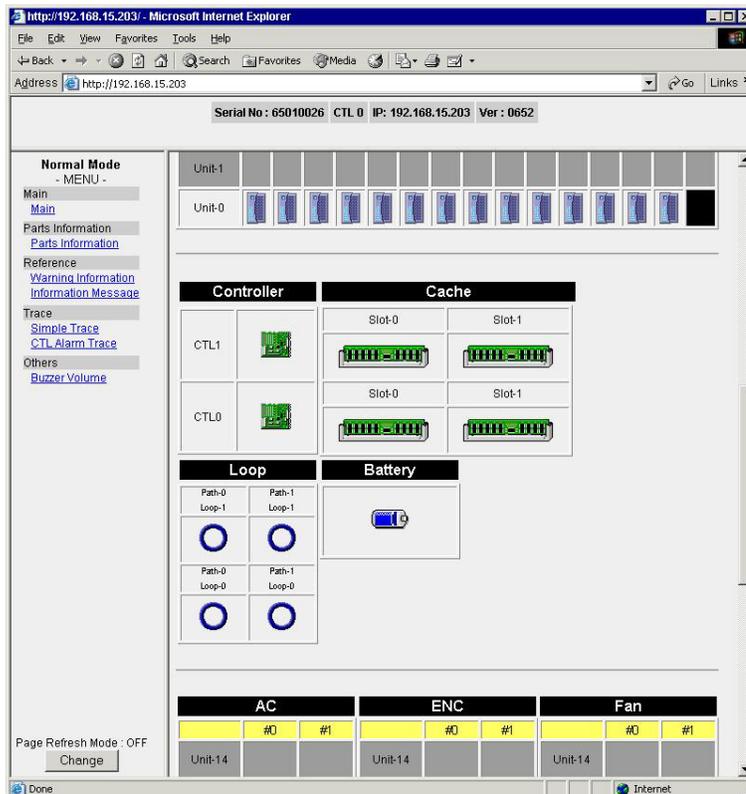
Figure 8.6   Component Status Screen

Disk Drive

Image	Status
blue	Normal
red	A fault has occurred to the disk drive
red and black	The disk drive port where the fault occurred is not implementing the disk drive
No display	The disk drive is not implemented (the disk drive where the fault occurred was drawn out)

Control Unit

Image	Status
green	Normal
red	Shutdown of the control unit (status where it is not implemented with the setting of the dual system configuration is included)
yellow	Fault of the battery backup circuit
No display	The fault has not occurred without being implemented with the setting of a single system configuration

Cache Unit
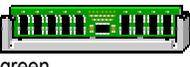
Image	Status
green	Normal
red	Fault (status when the unit is not implemented and the extracted fault cache unit is included)

Battery Backup Unit

Image	Status
blue	Normal
red	There is a fault or the unit is not implemented

Fan Assembly

Image	Status
black	Normal
red	There is a fault or the fan assembly is not implemented (The condition that an AC power supply is not supplied is contained)

Power Unit/Power Unit (DC)

Image	Status
blue	Normal
red	A fault occurred or the unit is not implemented (The condition that an AC power supply/DC power supply is not supplied is contained)

ENC Unit

Image	Status
green	Normal
red	A fault occurred or the unit is not implemented

Fibre Loop

Image	Status
blue	Normal
red	Fault

8.3.5 Information Message

Fault information and status information of the device that detected it during the device operation are displayed.

Fault information and status information after the device completes a boot are displayed in the **Controller 0/1 Common** box.

Fault information and status information as the device is booting are displayed in the box of **Controller 0** and **Controller 1** for every the controller.
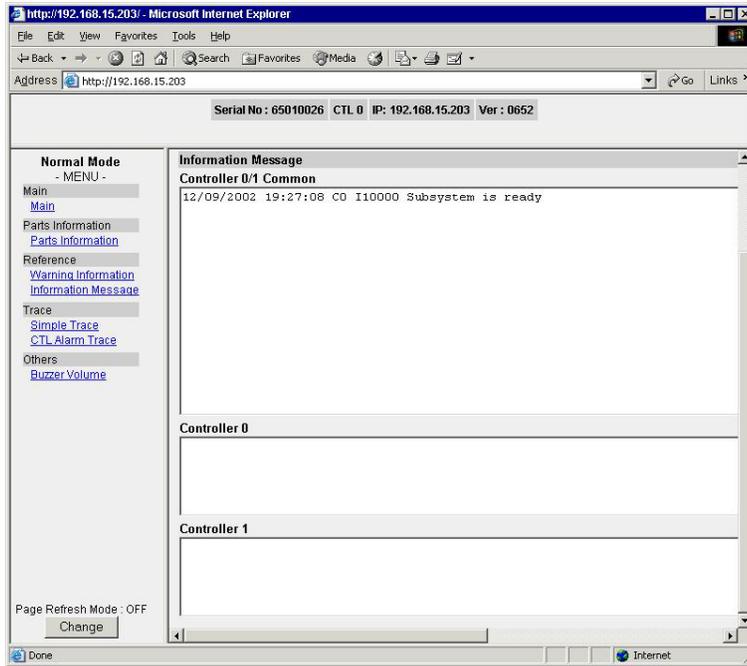
Figure 8.7   Information Message Screen

8.3.6   Setting the Buzzer Sound Volume

Note: Set the buzzer volume for the environment in which I/Os from a host are not issued while the system is maintained or before the host is started up.

The buzzer volume can be adjusted for 5 stages. Click the **Buzzer Volume** of the menu frame to enter into the buzzer volume-setting screen. If the buzzer volume is designated with the radio button and the **OK** button is clicked, the buzzer volume is changed.
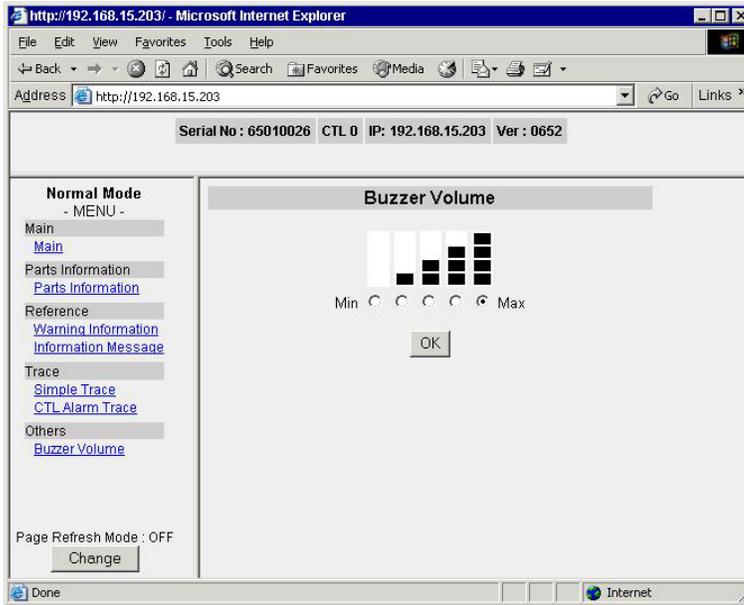
Figure 8.8   Buzzer Volume Screen

8.4   Troubleshooting Using a Web Connection

This section includes the following:

- Checking Subsystem Status

- Checking the Progress Condition Display

- Checking Component Status

- Checking Log Messages

- Troubleshooting using Messages

- Reading Failure Information

8.4.1   Checking Subsystem Status

Check the position of the failed part of the unit on the main window in the normal mode of the Web.
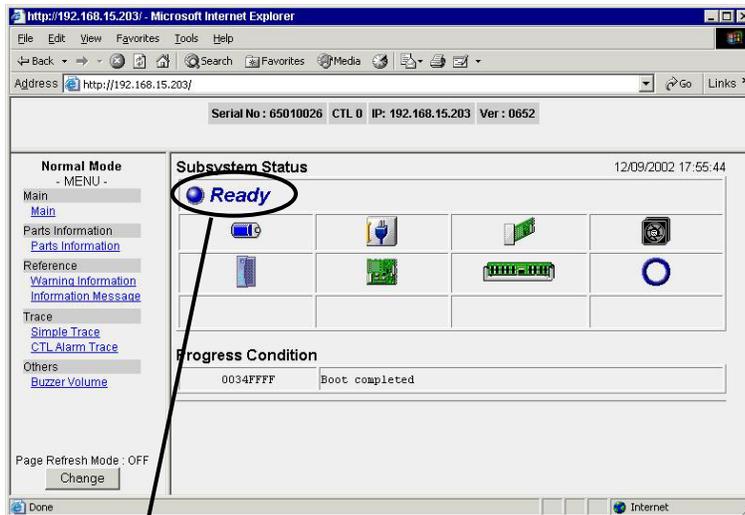
Subsystem Status

Booting	Ready	Warning	Alarm
Booting... black	● _Ready_ blue	● _Warning_ yellow	● _Alarm_ red

Figure 8.9   Subsystem Status Screen

8.4.2 Checking the Progress Condition Display

If **Booting...** is indicated in the window (the controller is being started up), the progress of the start-up operation can be confirmed according to the following procedure:

1. Turn on the page refresh mode (click the **ON** button).

   The window is updated automatically at 5-second intervals. (If the **OFF** button of the page refresh mode is activated, this operation is not necessary.)

   If the page refresh mode is not activated in the main window, press the **update** button of the browser to update the window.

2. Observe the condition-in-progress within the window.

   If the start-up operation is completed, **Boot completed** is indicated in this part.
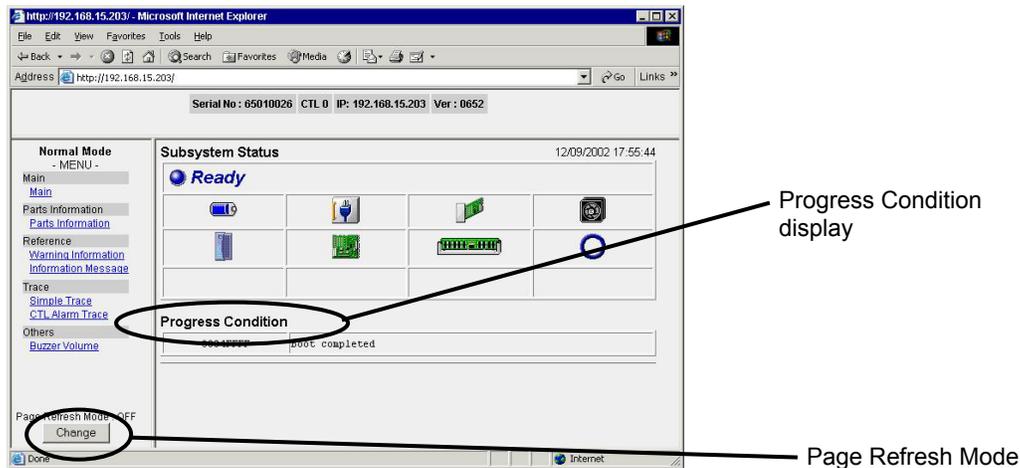
Figure 8.10   Progress Condition Display

8.4.3 Checking Component Status

Click each part of Replace Part Summary in the main window; the following window appears and the state of the part is displayed.

In this example, the selected (clicked) part is at the head of the window. You can also select this window by clicking the **Parts Information** menu in the main window. In this window, you can confirm the state of each part in detail. If a part fails, its corresponding icon turns red.
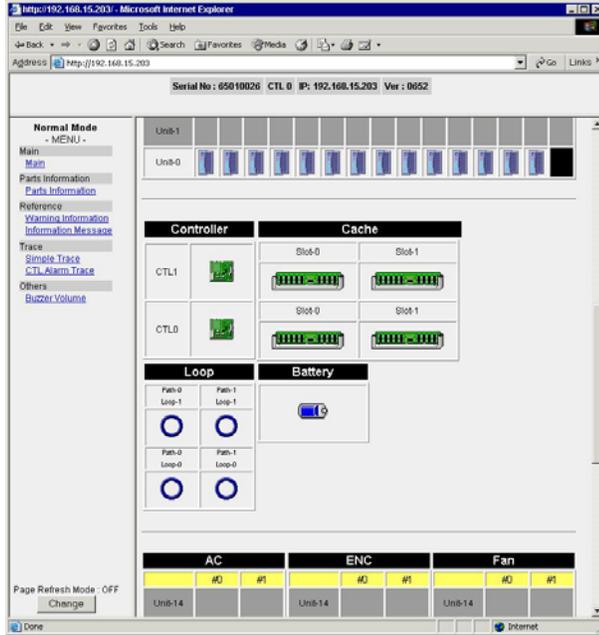
Figure 8.11   Replace Part Summary Screen (HDD)

The following screen is displayed only when the icon of a remote path is clicked. This screen is displayed only when the Synchronous TrueCopy function is effective.
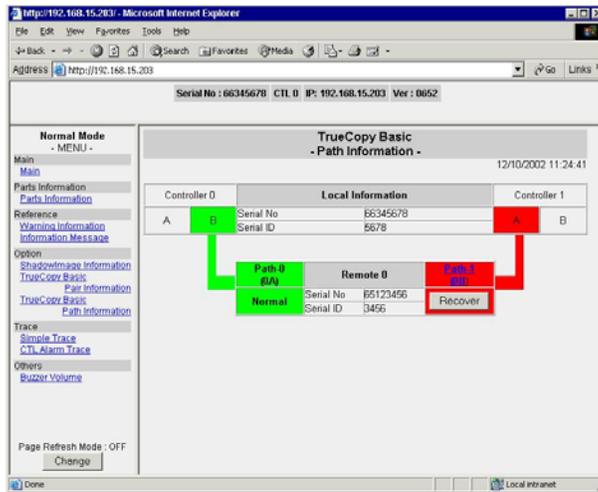
Figure 8.12   Path Information Screen

8.4.4   Checking Log Messages

To check log messages:

1. Click the **Information Message** menu in the main window.

    The Information Message window appears.

2. In the Information Message window, identify the cause of the failure and confirm the recovery measures.

    The information on the detected failures during operation of the unit and the state of the unit are displayed in the above window.

    The information on the failures and the state at the start-up time of the unit is displayed for each Controller in the **Controller 0** and **Controller 1** boxes.
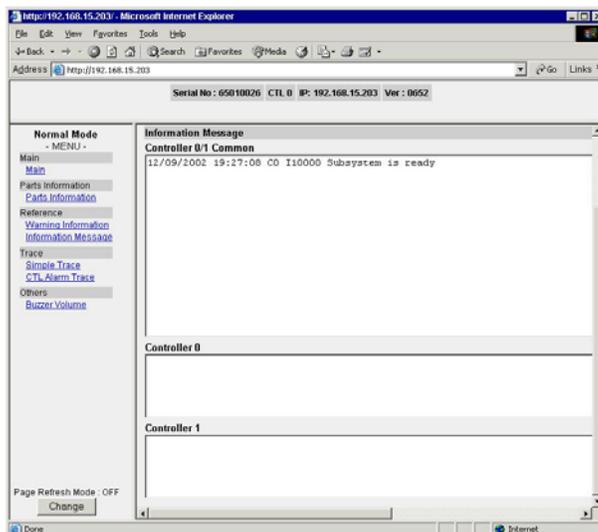
Figure 8.13   Information Message Screen

The contents of each message are shown in the following examples:

- CUDG (Self-test at power-on) Detection Message

    The CUDG detection message is displayed in the **Controller 0** or **Controller 1** box as shown in the following example:

Example:

```
MM/DD/YYY HH:MM:SS Cx  54 ◆◆◆◆◆◆◆◆
MM/DD/YYY HH:MM:SS Cx  50 ◆◆◆◆◆◆◆◆
MM/DD/YYY HH:MM:SS Cx  4C ◆◆◆◆◆◆◆◆
MM/DD/YYY HH:MM:SS Cx  48 ◆◆◆◆◆◆◆◆
MM/DD/YYY HH:MM:SS Cx  44 ◆◆◆◆◆◆◆◆
MM/DD/YYY HH:MM:SS Cx  40 ■■■■■■■■
MM/DD/YYY HH:MM:SS Cx  3C ■■■■■■■■
MM/DD/YYY HH:MM:SS Cx  38 ■■■■■■■■
MM/DD/YYY HH:MM:SS Cx  34 ■■■■■■■■
MM/DD/YYY HH:MM:SS Cx  30 ■■■■■■■■
MM/DD/YYY HH:MM:SS Cx  2C ■■■■■■■■
MM/DD/YYY HH:MM:SS Cx  28 ■■■■■■■■
MM/DD/YYY HH:MM:SS Cx  24 ■■■■■■■■
MM/DD/YYY HH:MM:SS Cx  20 ●●●●●●●●
MM/DD/YYY HH:MM:SS Cx  ○○○○○○○○○○○○
MM/DD/YYY HH:MM:SS Cx  CTLx
```

MM/DD/YYYY: Data of occurrence

HH:MM:SS: Time of occurrence

Cx: # of Controller in which failure is detected

◆◆◆◆◆◆◆◆: PCI Config information

■■■■■■■■: Detailed information

●●●●●●●●: Message code

○○○○○○○○○○○○: Message text (Any number of letters)

CTLx: CUDG executing controller #

- Flash/RAM Micro Detection Message
  The Flash/RAM micro detection message is displayed in the **Controller 0/1 Common**, **Controller 0**, of **Controller 1** box as shown in the following example. The latest one is shown on the top line.

  Note: The date and time the RTC is set in the detection controller is displayed in this message. If the RTC is different from one control to another, the displayed time of occurrence may differ within messages (the message on the upper line is issued prior to the message on the lower line).

In this example, the latest message is also indicated at the top.

Example:

```
MM/DD/YYY HH:MM:SS Cx ●●●●●● ○○○○○○○○○○○          :■■■■■■/◆◆◆◆
MM/DD/YYY HH:MM:SS Cx ●●●●●● ○○○○○○○○○○○          :■■■■■■/◆◆◆◆
                                  :
                                  :
```

MM/DD/YYYY: Confirmed data

HH:MM:SS: Confirmed times

Cx: Error detected Controller #

●●●●●●: Message code (**Rxxxxx**: Flash detected messages, **Ixxxxx**: Progress messages, **Wxxxxx**: Warning messages, **Hxxxxx**: Failure messages)

○○○○○○○○○○○: Message text (Any number of letters)

■■■■■■: Recovery measures code

◆◆◆: Collecting failure information code

8.4.5 Troubleshooting Using Messages

The contents of each failure detected during operation are reported by a message. The failures detected during operation and the state of the unit, after the main switch of this unit is turned on, are reported.

The five types of message codes are displayed in the following table:

Table 8.4   Message Code Types

Message code	Measures
018xxxxx	Errors detected by CUDG
Rxxxxx	Flash detected messages
Ixxxxx	Progress messages
Wxxxxx	Warning messages
Hxxxxx	Failure messages

8.4.5.1 Errors Detected by CUDG

When the Errors detected by CUDG are displayed, call your maintenance personnel.

8.4.5.2   Flash Detected Messages

When the following Flash detected messages are displayed, follow the instructions to resolve the problem.

Table 8.5   Flash Detected Messages

Message code	Message Text	Recovery Measures
RA00xx	Microprogram error [FLS]	Restarting the equipment.
RA7000	Microprogram revision mismatch	
RB0000	Upload system error	Check the microprogram you want to install and install it over again.
RB0600	No micro program	Perform the new installation upgrade.
RB0A00	Upload file SUM check error	A sum check error occurred in a read file during a upload. Check the microprogram you want to install and install it over again.
RB0E00	Up grade check NG	The upgrade check of the microprogram failed. (An upgrade version of a microprogram does not conform to the microprogram being upgraded.) Do a new install of the microprogram.
RB3000	File size error	Check the microprogram you wish to install.
RB3100	File open error	
RB3200	File read error	
RB3500	Bad block ID	
RB3600	Bad LBA in START 600 DAT	
RB7000	Program size too large	
RB8000	Old microprogram exists	If the installation can be continued, the RAID group and LU deformation are initialized. (In this case, all the data in the disk drive are deleted. When the data in the disk drive need to be saved, stop the work and perform the update installation.
RB8300	Empty system retry full install	The update installation cannot be executed because a system does not exist in the disk drive. Execute a new installation.
RBA000	Down grade check NG	The present microprogram version cannot be updated to a specified microprogram version. Check the work procedure. Execute a new installation.

When a Flash detected message other than those shown above is displayed, inform maintenance personnel of the message code.

8.4.5.3 Progress Messages

When the following Progress messages are displayed, follow the instructions to resolve the problem.

Table 8.6   Progress Messages (Continued on next page)

Message Code	Message Text	Recovery Measures
I031xy	Path recovered automatically	The path recovered automatically. (x: Remote DF# (0), y: Path # (0 or 1))
I10000	Subsystem is ready	The unit is ready.
I11000	All raid group initialized	All RAID groups were deleted.
I111xx	RAID group deleted (RG-xx)	All LUs were deleted. (xx: RAID group# (0-14))
I12000	ALL LU initialized	All LUs were deleted. (This is also displayed when the LU#0 is created.)
I12100	LU deleted (LU-xxx)	LUs were deleted. (xxx: LU# (0-511))
I12200	LU format completed (LU-xxx)	LU formatting was completed. (xxx: LU# (0-511))
I12400	LU format start (LU-xxx)	An LU formatting was started. (xxx: LU# (0-511))
I12500	Unified LUs separated (Uni: LU-xxx)	Dissolution of all LU unification (to dissolve unification of all the unified LUs and to split them into internal LUs) was executed. (xxx: LU# (0 to 511) of a unified LU to be split)
I12600	Last LU separated from unified LU (Uni: LU-xxx)	A separation of a final LU of a unified LU (to separate the last one of the internal LUs which have been combined with a unified LU) was executed. (xxx: LU# (0 to 511) of a unified LU to be split)
I12700	LU reappeared (Uni: LU-xxx)	An internal LU(s) was validated again through splitting of all unified LUs or a separation of a final LU. (xxx: An LU# (0 to 511) of an internal LU which has been separated and validated)
I15Axy	Dynamic sparing start (Unit-x, HDU-y) [zzzzzzzzzz]	Dynamic sparing started. (x: Unit ID# (0-14), y: Disk drive# (RK=0-13, RKA=0-14), z: Detailed code)
I17002	Default LU-CTL change failed [PS OFF]	Set the equipment in the ready state and turn off the power, then turn on the power again
I17003	Default LU-CTL change failed [HOT]	Use the system as it is
I17004	Default LU-CTL change failed [LU] Permanent LU	
I1A00x	Permanent LU disable (Default CTL-x)	Set the equipment in the ready state and turn off the power, then turn on the power again
I1A10x	Permanent LU deleted (Default CTL-x)	LU residence is deleted. (When RAID group/LU is deleted) (x: Default Controller# (0 or 1))
I1A30x	Turbo-LU enable (Default CTL-x)	The FlashAccess function was turned on. (x: Default Controller# (0 or 1))

Table 8.6   Progress Messages (Continued)

Message Code	Message Text	Recovery Measures
I1B100	Forced parity correction completed	Forced parity recovery processing was finished.
I1C0xy	Loop diagnostic start (Path-x, Loop-y)	Loop diagnosis was started. (x: Path# (0 or 1), y: Loop# (0 or 1))
I1C1xy	Loop diagnostic end (Path-x, Loop-y)	Loop diagnosis was finished. (x: Path# (0 or 1), y: Loop# (0 or 1))
I1E000	Online verify completed [odd unit]	Check of the frames with even numbers was completed in the online verification.
I1E100	Online verify completed [even unit]	Check of the frames with odd numbers was completed in the online verification.
I61D00	Shutdown warning	Turn off power supply by main switch.

Note: When a Progress message other than those shown above is displayed, inform maintenance personnel of the message code.

8.4.5.4   Warning Messages

When the following Warning messages are displayed, follow the instructions to resolve the problem.

Table 8.7   Warning Messages

Message Code	Message Text	Recovery Measures
W03200	Battery SW off	Turn on the battery unit switch.

Note: When a Progress message other than those shown above is displayed, inform maintenance personnel of the message code.

8.4.5.5   Failure Messages

When the following Failure messages are displayed, follow the instructions and resolve the problem.

Table 8.8   Failure Messages

Message Code	Message Text	Recovery Measures
H90330	Connection unit excess	The number of connected units exceeded the limit.
HI0201	PS OFF failed [POFNONCLD]	Turn on PS, then off again.
HI0202	PS OFF failed [POFNOJOB]	

Note: When a Progress message other than those shown above is displayed, inform maintenance personnel of the message code.

8.4.6 Reading Failure Information

- The history of the unit, after it is turned on, is displayed in the **Information Message**.

- The **Subsystem is Ready** message displays the time when the unit is ready. Messages sent after the power is turned on until the unit is ready are displayed prior to this message. Messages sent after the unit is ready are displayed after this message.

- Carefully observe the following: **Wxxxxx** (Warning message), **Hxxxxx** (Failure message), and **Rxxxxx** (Flash detection message).

- The following messages are displayed when failures occur and when they are solved. If the recovery message is displayed after a failure occurrence message, the failure has been solved.

Table 8.9   How to Read Failure Information

No.	Description	Failure Detection Messages	Failure Recovery Messages
1	Controller error/ recover	**W0100x**: CTL alarm (CTL-x)	**I0010x**: CTL recovered (CTL-x)
2	error/recovery	**W0D0x0**: Cache alarm (CTL-y, CACHE-z)	**I0020z**: Cache recovered (CACHE-z)
3	Cache memory error/recovery	**W03000**:Battery alarm	**I00300**: Battery recovered
		W03100: Battery removed	
		W03200: Battery SW OFF	
		W03300: Battery thermal alarm	
4	Battery backup board error/recovery	**W0340x**: Battery backup circuit alarm (CTL-x)	**I0040x**: Battery backup circuit recovered (CTL-x)
5	Fan error/recovery	**W04000**: FAN alarm (Unit-x, FAN-y)	**I00500**: FAN recovered (Unit-x, FAN-y)
6	Power supply error/ recovery	**W050xy**: PS alarm (Unit-x, PS-y)	**I006xy**: PS recovered (Unit-x, PS-y)
7	Disk drive error/ recovery	**W060xy**: HDU alarm (Unit-x, HDU-y)	**I007xy**: HDU recovered (Unit-x, HDU-y)
8	Spare disk error/ recovery	**W061xy**: Spare HDU alarm (Unit-x, HDU-y)	**I009xy**: Spare HDU recovered (Unit-x, HDU-y)
9	Loop error/recovery	**W080xy**: Loop alarm (Path-x, Loop-y)	**I00Axy**: Loop recovered (Path-x, Loop-y)
10	ENC board error/ recovery	**W090xy**: ENC alarm (Unit-x, ENC-y)	**I00Bxy**: ENC recovered (Path-x, Loop-y)
11	UPS error/recovery	**W0C000**: UPS alarm (UPS-x)	**I00D00**: UPS recovered (UPS-x)
12	Path error/recovery	**W0F0xy**: Path alarm (Remote-x, Path-y)	**I030xy**: Path recovered by web operation (Remote-x, Path-y)
			I031xy: Path recovered automatically (Remote-x, Path-y)

```
07/02/2000 08:02:34 C0 W06011 HDU alarm(Unit-1,HDU-1)              :HDU   /TRC
07/01/2000 23:55:35 C1 W01000 CTL alarm(CTL-0)                    :CTL   /DMP
07/01/2000 23:55:34 C1 H90210 CTL failure                        :CTL   /DMP
06/29/2000 20:18:23 C1 I00724 HDU recovered(Unit-2,HDU-4)
06/29/2000 20:15:10 C0 I00610 PS recovered(Unit-1,PS-0)
06/29/2000 19:30:23 C0 W06024 HDU alarm(Unit-2,HDU-4)            :HDU   /TRC
06/29/2000 19:30:23 C1 I00824 Spare HDU recovered(Unit-2,HDU-4)
06/29/2000 19:30:23 C1 I15102 Data recovery completed(Unit-0,HDU-2)
06/29/2000 19:26:33 C1 I15002 Data recovery started(Unit-0,HDU-2)
06/29/2000 19:26:33 C1 I15A24 Dynamic sparing start(Unit-2,HDU-4)
06/29/2000 19:26:33 C1 I51024 D_PT error(HDU Unit-2,HDU-4)
06/29/2000 18:32:06 C0 W05010 PS alarm(Unit-1,PS-0)              :PS
06/15/2000 09:45:31 C0 I00100 CTL recovered(CTL-0)
06/15/2000 08:30:08 C1 I10000 Subsystem is Ready
06/15/2000 08:29:25 C0 W01000 CTL alarm(CTL-0)                   :CTL   /DMP
```

Messages which require maintenance

Recovery completed

Recovery completed

Messages indicated with regard to Disk drive alarm (These do not require maintenance.)

Messages after the unit is ready

Recovery completed

Messages before the unit is ready

Figure 8.14   Message Analysis Example

Chapter 9   Periodic Maintenance

If the subsystem is not energized for more than 18 days, the battery may over-discharge and unrecoverable damage may result. The battery must be energized more than 2 hours at least once every 18 days or, alternatively, the subsystem can be stored with the AC Power Unit Switch/DC Power Unit Switch of the battery turned off. However, when the AC Power Unit Switch/DC Power Unit Switch is turned off, the battery discharges naturally. In this case, the battery should be charged once every six months for longer than 2 hours because spontaneous discharge occurs.

Appendix A   Glossary

- Cache backup:
  Because a cache memory uses DRAM, information stored in it is lost when the subsystem power is shut off. To provide against unexpected power failure, the subsystem has an setup to maintain data in the cache memory by batteries.

  Cache backup is a state in which the data is protected by the batteries.

- CTL:
  Controller

- CUDG:
  Control Unit Diagnosis

- Destage:
  Automatically writes data in cache memory, not yet written on the disk drive, on the disk drive when the main switch is turned off.

- DHCP:
  DHCP is an abbreviation for Dynamic Host Configuration Protocol; it is a client/server type protocol according to which a server automatically assigns an IP address when each client has started.

- ECC:
  Error Checking and Correcting

- EIA:
  Electronic Industries Alliance
  EIA standard (1 EIA unit = 44.45 mm)

- FC-AL:
  Fibre Channel Arbitrated Loop

- FC-SW:
  Fibre Channel-Switch Topology

- Fibre channel:
  A set of standards of interfaces that are connected through optical fibre, etc. to achieve high-speed data transfer between devices.

- Fibre Channel HBA:
  Fibre Channel Host bus Adapter

- Fibre Channel HUB:
  An apparatus to connect and relay Fibre Channel cables, each connected to a Fibre Channel device in order to form an arbitrated loop of the Fibre Channel.

- Flash memory:
  ROM that can be electrically erased and reprogrammed. A type of EEPROM (Electrically Erasable and Programmable). It can retain information without electricity and is widely used as an external storage, etc.

- Host computer:
  A computer which manages devices. For the disk array, it is a computer which enables the disk array store data.

- Hot replacement:
  Used to replace an installed part with the subsystem power on. Usually, the major part is duplicated so that when one of the parts fails, the subsystem function is maintained by another part.

- I/F:
  Interface

- IP address:
  IP address is an abbreviation for Internet Protocol Address; it is a numeral string which shows an address of a computer connected to a network.

- LA:
  Logical Address

- LBA:
  Logical Block Address

- LED:
  Light-Emitting Diode

- LRC:
  Longitudinal Redundancy Check

- LSI:
  Large-service Interface

- LU:
  Logical Unit

- LVD:
  Low Voltage Differential

- Microprogram:
  A program that controls the basic hardware operation.

- Parity disk:
  When configuring RAID 5, one disk drive in a RAID group is designated as the parity disk and the other disk drives are designated as data disks. On the parity disk, parity data calculated from those of data disks is stored. When one of the disk drives in a RAID group fails, the subsystem can still be used and its data will not be damaged, by virtue of the parity data.

- PDB:
  Power Distribution Box

- Rack frame:
  A frame on which electronic equipment is mounted (using rails, etc.). Most rack frames have a width of 19 inches and are called 19-inch rack frames. The height of the equipment to be mounted is regulated by the EIA standard. The rack frame has screw holes to fasten equipment with bolts, etc.

- RAID:
  Redundant Array of Independent (Inexpensive) Disks
  A concept proposed in 1987 by a research group of the University of California, Berkeley. RAID distributes accesses among multiple disk drives, and thereby realizes a storage subsystem with high-speed accessibility, a large capacity, and high reliability.
  The University of California defined six levels of configurations from RAID 0 through RAID 5, and one of the levels is selected based on the trade-off in terms of cost and speed to meet the user's need.

- Remote Maintenance Function (SNMP):
  The SNMP agent support function reports failures to the workstation which monitors the network via the SNMP of the open platform.

- R/W:
  Read/Write

- SNMP:
  SNMP is an abbreviation for Simple Network Management Protocol, and it is one of the network protocols developed to manage a network.

- Spare disk:
  A disk drive which is mounted separately from the disk drives for usual write and read operation; when a failure occurs in a disk drive, data stored in the failed drive is copied to the spare disk drive so that the disk subsystem can continue to be available equivalently to the original subsystem.

- UPS:
  Uninterrupted Power Supply
  A backup power supply which is mounted on the Thunder 9570 unit to prevent shutdown of the unit even when power stoppage or momentary power interruption occurs.

- Write cache:
  When data is written from a host computer onto a disk array subsystem, it is not written directly on the disk drive but written in cache memory. In this way, the disk array subsystem can return a writing completion report promptly. This writing method using cache memory is called write cache.

Table B.1   System Parameter Setting List

	Platforms	HP			SUN			
HA	Alternate Path	None	Alternate Link	None	None	HPM (***Note 11***)/ HDLM (***Note 12***)	VxVM V3.2P2+PP or later (***Note 14***)	
	Fail Over	None		MC/ Service Guard	None	SC (***Note 7***)	VCS (***Note 5***)	None	First Watch/ VCS (***Note 5***)

	System Parameter	
1	System Startup Attribute	Depends on System Configuration (***Note 1***)
2	Data Share Mode	Depends on System Configuration (***Note 2***)
3	Drive Detach mode enable	Disable (Standard setting)
4	Report status (normal/warning)	Enable (Standard setting)
5	Turbo LU Warning	Disable (Standard setting)
6	Operation if the Processor failures Occurs	Reset a Fault (Standard setting)
7	Command Queuing Mode	On (Standard setting)
8	Vendor ID	HITACHI (Standard setting)
9	Product ID	DF600F (Standard setting)
10	ROM Microprogram Version	No change is needed
11	RAM Microprogram Version	No change is needed
12	RS232C Error Information Outflow Mode	When RS232C is used: On / When RS232C is not used: Off (Standard setting)
13	Write & Verify Executing Mode	On (Standard setting)
14	DHCP (***Note 8***)	OFF (Standard setting)
15	IP Address	To be set according to the network setting
16	Subnet Mask	To be set according to the network setting
17	Default Gateway	To be set according to the network setting

	Host Group					
1	Host Connection Mode (Option 2)	Without setting				
2	Host Connection Mode1	Standard Mode				
3	Host Connection Mode2	HP Connection mode 2 enable (***Note 6***)	(***Note 9***)	SUN Cluster Conne-ction Mode	Persistent RSV Cluster Mode (***Note 10***)	(***Note 9***)	Persistent RSV Cluster Mode (***Note 10***)
4	LU Mapping Mode	Depends on System Configuration (***Note 3***)				

	Configuration Information		
1	Reset/LIP Mode (Process)	Reset within the port (Standard setting)	
2	Reset/LIP Mode (Signal)	Reset within the port (Standard setting)	
3	LIP Reset Mode	Target Authentication (Standard setting)	
5	Controller Identifier	Disable (Standard setting)	Enable
6	Controller ID	–	DF600-00 (Standard setting (***Note 4***))
7	Read Frame Min 128 Byte Mode (***Note 13***)	OFF (Standard setting)	

Note 1: Hot Standby mode is used when only one of the two Controllers is normal.

Note 2: Data Share mode is used to prevent performance deterioration which results from LU ownership that is switched when a host computer issues commands frequently to a Controller to which the computer has no ownership, in the normal or regression status (owing to a path or host computer failure).

It is recommended that the subsystem in the Data Share mode be used when LU ownership switching may occur.

Note 3: When the 9570V is connected, the LU not intended to be accessed by the port must be masked by means of LU mapping mode.

Note 4: Make the controller IDs of the CTL-00 and CTL-01 of the 9570V identical. When two or more 9570Vs are connected to the system, set the Controller IDs which are not duplications of each other.

When one of the host computers connected to the 9570V requires a Controller ID, set the Controller identifier to Enabled.

Note 5: Veritas Cluster Server

Note 6: Set the HP Connection Mode 2 when LUs, whose LU numbers are 8 to 63, are recognized if the subsystem is connected to the HP server.

Note 7: SUN Cluster 3.0

Note 8: When the DHCP mode is validated, the IP Address is acquired from the DHCP server.
If the DHCP server is not started or the DHCP function has been incorrectly set, the acquisition of the IP Address will fail and the IP Address of the subsystem will remain "0.0.0.0". (When this occurs, the Resource Manager 9500V program or the Web cannot be used via a LAN.) In this case, acquire the IP Address by starting the DHCP server or by setting the DHCP function correctly when necessary.

Note 9: Without setting

Note 10: Set the Persistent RSV Cluster mode when using the "VERITAS Database Edition/Advanced Cluster for Oracle8i".

Note 11: Hitachi Path Manager.

Note 12: Hitachi Dynamic Link Manager

When using HDLM, please note the following:
Data Share Mode: Indispensable selection
Vendor ID: If this text is changed, it cannot be managed by HDLM. Do not change this text.
Serial Number: When multiple storages of same type exist, allocate a different Serial Number for each disk array subsystem.

Note 13: Set this mode when connecting the subsystem as a boot disk or a dump device of an HP server. No operation problem occurs if a device other than a boot disk or a dump device is connected to a port for which this mode is set. However, when lowering of the subsystem performance is not allowed, connect the boot disk/dump device of an HP server to a port separate from devices.

Note 14: Array Support Library (ASL): Indispensable selection.

Table B.1 System Parameter Setting List (Continued)

		Platforms	IBM (AIX)			Sequent
	HA	Alternate Path	None	HPM (*Note 7*)/HDLM (*Note 8*)		MP Driver
		Fail Over	None	HACMP	None	None
	System Parameter					
1	System Startup Attribute		Depends on System Configuration (*Note 1*)			
2	Data Share Mode		Depends on System Configuration (*Note 2*)			
3	Drive Detach mode enable		Disable (Standard setting)			
4	Report status (normal/warning)		Enable (Standard setting)			
5	Turbo LU Warning		Disable (Standard setting)			
6	Operation if the Processor failures Occurs		Reset a Fault (Standard setting)			
7	Command Queuing Mode		On (Standard setting)			
8	Vendor ID		HITACHI (Standard setting)			
9	Product ID		DF600F (Standard setting)			
10	ROM Microprogram Version		No change is needed			
11	RAM Microprogram Version		No change is needed			
12	RS232C Error Information Outflow Mode		When RS232C is used: On When RS232C is not used: Off (Standard setting)			
13	Write & Verify Executing Mode		On (Standard setting)			
14	DHCP (*Note 6*)		OFF (Standard setting)			
15	IP Address		To be set according to the network setting			
16	Subnet Mask		To be set according to the network setting			
17	Default Gateway		To be set according to the network setting			
	Host Group					
1	Host Connection Mode (Option 2)		Without setting			
2	Host Connection Mode1		Standard Mode			TRESPASS Mode
3	Host Connection Mode2		UA(06/2A00) suppress mode enable NACA mode enable (*Note 5*)			Without setting
4	LU Mapping Mode		Depends on System Configuration (*Note 3*)			
	Configuration Information					
1	Reset/LIP Mode (Process)		Reset within the port (Standard setting)			
2	Reset/LIP Mode (Signal)		Reset within the port (Standard setting)			
3	LIP Reset Mode		Target Authentication (Standard setting)			
5	Controller Identifier		Disable (Standard setting)			Enable
6	Controller ID		–			DF600-00 (Standard setting (*Note 4*)
7	Read Frame Min 128 Byte Mode		OFF (Standard setting)			

Note 1: Hot Standby mode is used when only one of the two Controllers is normal.

Note 2: Data Share mode is used to prevent performance deterioration which results from LU ownership that is switched when a host computer issues commands frequently to a Controller to which the computer has no ownership, in the normal or regression status (owing to a path or host computer failure).

It is recommended that the subsystem in the Data Share mode be used when LU ownership switching may occur.

Note 3: When the 9570V is connected, the LU not intended to be accessed by the port must be masked by means of LU mapping mode.

Note 4: Set the controller ID's of the CTL-00 and CTL-01 of the 9570V to be identical. When two or more 9570Vs are connected to the system, set the Controller IDs which are not duplications of each other.

When one of the host computers connected to the 9570V requires a Controller ID, set the Controller identifier to Enabled.

Note 5: Set the NACA mode when the subsystem is connected to an AIX server where the IBM genuine HBA (FC6227 or later) is installed.

[When LUN Management is not used (when LUN Security is used)]
Do not connect a server other than the AIX server where the IBM genuine HBA (FC6227 or later) is installed, to a port of the 9570V for which the NACA mode has been set. (In the Fibre Channel Loop connection or Fabric connection, do not connect the AIX server, in which the IBM genuine HBA (FC6227 or later) is installed, together with another type server, to a port of the 9570V for which the NACA mode has been set.)

[When LUN Management is used]
By registering the AIX server and the other servers at the separate host groups, you can connect the each server to the same port.

Note 6: When the DHCP mode is validated, the IP Address is acquired from the DHCP server.
If the DHCP server is not started or the DHCP function has been incorrectly set, the acquisition of the IP Address will fail and the IP Address of the subsystem will remain "0.0.0.0". (When this occurs, the Resource Manager 9500V program or the Web cannot be used via a LAN.) In this case, acquire the IP Address by starting the DHCP server or by setting the DHCP function correctly when necessary.

 Note 7: Hitachi Path Manager

Note 8: Hitachi Dynamic Link Manager
When using HDLM, note the following:
Data Share Mode: Indispensable selection
Vendor ID: If this text is changed, it cannot be managed by HDLM. Do not change this text.
Serial Number: When multiple storages of same type exist, a different Serial Number needs to be allocated for each disk array subsystem.

Table B.1   System Parameter Setting List (Continued)

	Platforms	NT/Windows 2000				Others
HA	Alternate Path	None	HPM (*Note 5*)/ HDLM7 (*Note 6*)	None	VVM V3.0SP1/ V3.1 (*Note 7*)	None
	Fail Over	None	MSCS		None	None
System Parameter						
1	System Startup Attribute	Depends on System Configuration (*Note 1*)				
2	Data Share Mode	Depends on System Configuration (*Note 2*)				
3	Drive Detach mode enable	Disable (Standard setting)				
4	Report status (normal/warning)	Enable (Standard setting)				
5	Turbo LU Warning	Disable (Standard setting)				
6	Operation if the Processor failures Occurs	Reset a Fault (Standard setting)				
7	Command Queuing Mode	On (Standard setting)				
8	Vendor ID	HITACHI (Standard setting)				
9	Product ID	DF600F (Standard setting)				
10	ROM Microprogram Version	No change is needed				
11	RAM Microprogram Version	No change is needed				
12	RS232C Error Information Outflow Mode	When RS232C is used: On When RS232C is not used: Off (Standard setting)				
13	Write & Verify Executing Mode	On (Standard setting)				
14	DHCP (*Note 4*)	OFF (Standard setting)				
15	IP Address	To be set according to the network setting				
16	Subnet Mask	To be set according to the network setting				
17	Default Gateway	To be set according to the network setting				
Host Group						
1	Host Connection Mode (Option 2)	Without setting				
2	Host Connection Mode1	Standard Mode		Wolfpack Mode	Trespass Mode	Standard Mode
3	Host Connection Mode2	Without setting	Reset Target (Reset Bus Device) Mode Reset Logout of Third Party Process Mode		Without setting	
4	LU Mapping Mode	Depends on System Configuration (*Note 3*)				
Configuration Information						
1	Reset/LIP Mode (Process)	Reset within the port (Standard setting)				
2	Reset/LIP Mode (Signal)	Reset within the port (Standard setting)				
3	LIP Reset Mode	Target Authentication (Standard setting)	LIP Port ALL Reset Mode		Target Authentication (Standard setting)	
5	Controller Identifier	Disable (Standard setting)			Enable	Disable (Standard setting)
6	Controller ID	–			DF500F	–
7	Read Frame Min 128 Byte Mode	OFF (Standard setting)				

Note 1: Hot Standby mode is used when only one of the two Controllers is normal.

Note 2: Data Share mode is used to prevent performance deterioration which results from LU ownership that is switched when a host computer issues commands frequently to a Controller to which the computer has no ownership, in the normal or regression status (owing to a path or host computer failure).

It is recommended that the subsystem in the Data Share mode be used when LU ownership switching may occur.

Note 3: When the 9570V is connected, the LU not intended to be accessed by the port must be masked by means of LU mapping mode.

Note 4: When the DHCP mode is validated, the IP Address is acquired from the DHCP server.
If the DHCP server is not started or the DHCP function has been incorrectly set, the acquisition of the IP Address will fail and the IP Address of the subsystem will remain "0.0.0.0". (When this occurs, the Resource Manager 9500V program or the Web cannot be used via a LAN.) In this case, acquire the IP Address by starting the DHCP server or by setting the DHCP function correctly when necessary.

Note 5: Hitachi Path Manager

Note 6: Hitachi Dynamic Link Manager
When using HDLM, note the following:
Data Share Mode: Indispensable selection
Vendor ID: If this text is changed, it cannot be managed by HDLM. Do not change this text.
Serial Number: When multiple storages of same type exist, a different Serial Number needs to be allocated for each disk array subsystem.

Note 7: VERITAS Volume Manager for Windows.

Appendix C   Basic Specifications of the 9570V Subsystem

This appendix includes the following:

- Basic Specifications

C.1   Basic Specifications

The basic specifications of the 9570V are described in this section.

Table C.1   Basic Specifications of 9570V (Continued on next page)

Item	Model	Floor Model			Rack-Mount Model
		Floor (RK+H1H) Model	Floor (RK+RKA+ H2H) Model	RK	RKA
Configuration	Configuration	-	-	1 RK	1 RKA
	Subsystem appearance				
Disk drive used	Disk drive size (W×D×H) (mm)	101.6×146.1×25.4			
	Data capacity (G byte)	35.4/71.3/143.3			
	Rotational speed (min⁻¹)	10,000/15,000			
	Maximum mountable quantity (unit)	14	29	14	15
Host interface	Interface type	2 G bps Fibre Channel Optical (Non-OFC)			-
	Data transfer speed (i.e. maximum speed for transfer to host)	200 M bytes/s (Fibre Channel)			-
	Number of ports Single controller	Fibre Channel: 2			-
	Dual controller	Fibre Channel: 4			-
	Transferred block size (bytes)	512			
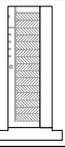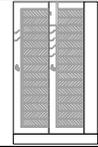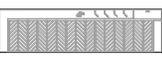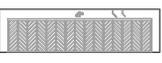
Note: For additional information about the rack-mount model, refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series 19-Inch Rack Reference Guide* (MK-92DF654).

Table C.1   Basic Specifications of 9570V (Continued)

Item	Model		Floor Model			Rack-Mount Model
			Floor (RK+H1H) Model	Floor (RK+RKA+ H2H) Model	RK	RKA
RAID specifications (***Note 1***)	RAID level (***Note 2***)		0/1/5/0+1			
	RAID confi-guration (unit of addition)	RIAD 0	2D to 14D	2D to 16D	2D to 14D	-
		RAID 1	1D+1M			-
		RAID 5	2D+1P to 13D+1P	2D+1P to 15D+1P	2D+1P to 13D+1P	-
		RAID 0+1	2D+2M to 7D+7M	2D+2M to 8D+8M	2D+2M to 7D+7M	-
Internal logic specifications	Control CPU		Power PC7455 (667 M Hz)			-
	Control OS		VxWorks			-
	Control memory		Flash memory: 2 Mbytes			-
			L2 Cache memory: 512 kbytes			
			SRAM: 64 M bytes			
	Data bus performance		Cache access 610 Mbytes/s			-
	Data assurance method		Data bus: Through-parity			-
			Cache memory: ECC (1 bit for correction, 2 bits for detection)			
			Disk drive: Data assurance code			
Physical Specifications	Start-up time (min)		Standard: 3 (***Note 8***)			-
	Chassis size (W×D×H) (mm)		260×737×540	309×737×540	483×656×129	483×656×129
	Mass (kg) (***Note 3***)		80 approx.	125 approx.	44 approx.	42 approx.
	Acoustic noise (dB) (***Note 7***)		53 or less	56 or less	53 or less	
	Required height (EIA unit)		-		3	
Input power specifications	Input voltage (V)		AC 100/200 (100 to 120/200 to 240)			
	Frequency (Hz)		50/60 ±1			
	Number of phases, cabling		Single-phase with protective grounding			
	Steady-state current (A) (***Note 5***) (***Note 6***)		4.4×2/2.2×2	4.4×2+3.2×2/ 2.2×2+1.6×2	4.4×2/2.2×2	3.2×2/1.6×2
	Breaking current (A)		16.0			
	Required power	Steady state (VA)	880 or less	1,520 or less	880 or less	640 or less
		Starting state (VA) (***Note 4***)	920 or less	1,640 or less	920 or less	720 or less
Heat value	Steady state (kJ/h)	3,170 or less	5,470 or less	3,170 or less	2,300 or less	Heat value

Note 1: D: Data disk, P: Parity disk

Note 2: Although the subsystem with a configuration of RAID 5, RAID 1, or RAID 0+1 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself. Therefore, users are requested to back up all data for restoration in case where the original data is lost.

Note 3: Value of maximum configuration (in the case where all the mountable Disk drives and Controller are mounted).

Note 4: Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example: 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

Note 5: The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

Note 6: When one of the two power supply units fails, another power supply unit requires electric current for the two power supply units. Therefore, plan for the power supply facility in which the current carrying capacity of one of the power supply units to be a total capacity of the two power supply units.

Note 7: A noise emitted at the time of start is not included.

Note 8: The start-up time may be longer than three minutes depending on the configuration.

Table C.1   Basic Specifications of 9570V (Continued)

Item	Model	Floor Model			Rack-Mount Model
		Floor (RK+H1H) Model	Floor (RK+RKA+H2H) Model	RK	RKA
Cache specifi- cations	Capacity (Mbytes/CTL)	1,024 to 2,048			-
	Control method	Read LRU/Write after			-
	Battery backup	Provided			-
	Backup duration (h) (**Note 1**)	24 (When cache of 2,048 M bytes/CTL)			-
Maintenance specifications/ antifault specifications	Spare disk	Up to fifteen of mounted Disk drives can be set to Spare disks			
	Display function	Status LEDs (POWER, READY, WARNING, and ALARM), LED of maintenance part			
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA、1 min)	AC 1,500 V (100 mA、1 min)	AC 1,500 V (10 mA、1 min)	
	Insulation resistance	DC 500 V、10 M Ω or more			

Note 1: Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk drives by turning off the power normally, and prevents the battery charge from being wasted.

When the subsystem enters the Cache Backup mode, a warning (lighting of the orange LED) informing of a voltage drop of the battery may be issued when the subsystem is started. It shows that the remaining capacity of the battery is not sufficient, and in this state, the subsystem operates disabling the Write Cache function automatically.

When the battery is charged, the warning indication disappears, and the subsystem continues the operation enabling the Write Cache function. The warning indication disappears within 2 hours at the latest. Even when the warning is indicated, normal functional operation is assured although the operation is performed in the Write-Through mode and the R/W performance is lowered because the Write Cache function is disabled.

Since the battery is subject to the effect of the environmental temperature, avoid using a battery in unnecessarily continuous operation at a high temperature.

If the subsystem is not energized for more than 18 days, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage. In this case, the battery must be energized more than 2 hours at least once a month, or store the subsystem with the switch of the battery turned off. Even when the switch is turned off, the battery discharges naturally. In this case, however, charge the battery once per six months for longer than 2 hours because spontaneous discharge is done.

Appendix D List of Storage Capacities Corresponding to RAID Levels and Configurations

The upper and lower values in each cell show the number of mounted disk drives and disk capacity respectively. No spare disk is included.

Note: All values of storage capacities in the following tables are calculated as 1 Gbyte = 1,000,000,000 bytes.

(This definition is different from 1 Kbyte = 1,024 bytes.)

Table D.1   List of Capacities Corresponding to RAID 0 (36 Gbytes)

Disk capacity	35.4 G bytes																
Component unit	RK		RKA														
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
2D	2 63.2	14 472.5	28 967.5	44 1533.2	58 2028.2	74 2593.9	88 3088.9	104 3654.6	118 4149.6	134 4715.3	148 5210.3	164 5776.0	178 6271.0	194 6836.7	208 7331.7	224 7897.4
3D	3 94.8	12 401.8	27 932.1	42 1462.5	57 1992.8	72 2523.2	87 3053.5	102 3583.9	117 4114.2	132 4644.6	147 5174.9	162 5705.3	177 6235.7	192 6766.0	207 7296.4	222 7826.7
4D	4 126.4	12 394.2	28 960.0	44 1525.7	56 1950.0	72 2515.7	88 3081.4	104 3647.1	116 4071.4	132 4637.1	148 5202.8	164 5768.5	176 6192.8	192 6758.5	208 7324.2	224 7889.9
5D	5 158.0	10 334.8	25 865.2	40 1395.5	55 1925.9	70 2456.2	85 2986.6	100 3516.9	115 4047.3	130 4577.6	145 5108.0	160 5638.3	175 6168.7	190 6699.1	205 7229.4	220 7759.8
6D	6 189.6	12 401.8	24 826.0	42 1462.5	54 1886.7	72 2523.2	84 2947.5	102 3583.9	114 4008.2	132 4644.6	144 5068.9	162 5705.3	174 6129.6	192 6766.0	204 7190.3	222 7826.7
7D	7 221.2	14 468.7	28 963.7	42 1458.7	56 1953.7	70 2448.7	84 2943.7	98 3438.7	119 4181.2	133 4676.2	147 5171.2	161 5666.2	175 6161.2	189 6656.2	203 7151.2	224 7893.7
8D	8 252.8	8 252.8	24 818.5	40 1384.2	56 1950.0	72 2515.7	88 3081.4	104 3647.1	112 3929.9	128 4495.7	144 5061.4	160 5627.1	176 6192.8	192 6758.5	208 7324.2	224 7889.9
9D	9 284.4	9 284.4	27 920.8	36 1239.1	54 1875.5	72 2511.9	81 2830.1	99 3466.5	117 4103.0	126 4421.2	144 5057.6	162 5694.0	171 6012.3	189 6648.7	207 7285.1	216 7603.3
10D	10 316.0	10 316.0	20 669.6	40 1376.7	50 1730.3	70 2437.4	80 2791.0	100 3498.2	110 3851.7	130 4558.9	140 4912.4	160 5619.6	170 5973.1	190 6680.3	200 7033.9	220 7741.0
11D	11 347.6	11 347.6	22 736.5	44 1514.4	55 1903.3	66 2292.3	88 3070.1	99 3459.0	110 3848.0	132 4625.8	143 5014.7	154 5403.7	176 6181.5	187 6570.5	209 7348.3	220 7737.2
12D	12 379.2	12 379.2	24 803.5	36 1227.8	48 1652.1	72 2500.6	84 2924.9	96 3349.2	108 3773.5	132 4622.1	144 5046.3	156 5470.6	168 5894.9	192 6743.5	204 7167.8	216 7592.1
13D	13 410.8	13 410.8	26 870.5	39 1330.1	52 1789.7	65 2249.4	78 2709.0	104 3628.3	117 4088.0	130 4547.6	143 5007.2	156 5466.9	169 5926.5	182 6386.2	208 7305.4	221 7765.1
14D	14 442.4	14 442.4	28 937.4	42 1432.4	56 1927.4	70 2422.4	84 2917.4	98 3412.4	112 3907.4	126 4402.4	140 4897.4	154 5392.4	168 5887.4	182 6382.4	196 6877.4	224 7867.4
15D	-	-	15 474.0	30 1004.4	45 1534.7	60 2065.1	75 2595.5	90 3125.8	105 3656.2	120 4186.5	135 4716.9	150 5247.2	165 5777.6	180 6307.9	195 6838.3	210 7368.6
16D	-	-	16 505.6	32 1071.3	48 1637.1	64 2202.8	80 2768.5	96 3334.2	112 3899.9	128 4465.6	144 5031.3	160 5597.0	176 6162.8	192 6728.5	208 7294.2	224 7859.9

Table D.2   List of Capacities Corresponding to RAID 1 (36 Gbytes)

Disk capacity	35.4 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
1D+1M	2 31.6	14 236.2	28 483.7	44 766.6	58 1014.1	74 1296.9	88 1544.4	104 1827.3	118 2074.8	134 2357.7	148 2605.2	164 2888.0	178 3135.5	194 3418.4	208 3665.9	224 3948.7

Table D.3   List of Capacities Corresponding to RAID 5 (36 Gbytes)

Disk capacity	35.4 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
2D+1P	3 63.2	12 267.8	27 621.4	42 975.0	57 1328.5	72 1682.1	87 2035.7	102 2389.3	117 2742.8	132 3096.4	147 3450.0	162 3803.5	177 4157.1	192 4510.7	207 4864.2	222 5217.8
3D+1P	4 94.8	12 295.7	28 720.0	44 1144.3	56 1462.5	72 1886.7	88 2311.0	104 2735.3	116 3053.5	132 3477.8	148 3902.1	164 4326.4	176 4644.6	192 5068.9	208 5493.2	224 5917.4
4D+1P	5 126.4	10 267.8	25 692.1	40 1116.4	55 1540.7	70 1965.0	85 2389.3	100 2813.5	115 3237.8	130 3662.1	145 4086.4	160 4510.7	175 4935.0	190 5359.2	205 5783.5	220 6207.8
5D+1P	6 158.0	12 334.8	24 688.4	42 1218.7	54 1572.3	72 2102.6	84 2456.2	102 2986.6	114 3340.1	132 3870.5	144 4224.1	162 4754.4	174 5108.0	192 5638.3	204 5991.9	222 6522.3
6D+1P	7 189.6	14 401.8	28 826.0	42 1250.3	56 1674.6	70 2098.9	84 2523.2	98 2947.5	119 3583.9	133 4008.2	147 4432.5	161 4856.7	175 5281.0	189 5705.3	203 6129.6	224 6766.0
7D+1P	8 221.2	8 221.2	24 716.2	40 1211.2	56 1706.2	72 2201.2	88 2696.2	104 3191.2	112 3438.7	128 3933.7	144 4428.7	160 4923.7	176 5418.7	192 5913.7	208 6408.7	224 6903.7
8D+1P	9 252.8	9 252.8	27 818.5	36 1101.4	52 1667.1	72 2232.8	81 2515.7	99 3081.4	126 3647.1	126 3929.9	144 4495.7	162 5061.4	171 5344.2	189 5909.9	207 6475.6	216 6758.5
9D+1P	10 284.4	10 284.4	20 602.6	40 1239.1	50 1557.3	70 2193.7	80 2511.9	100 3148.3	110 3466.5	130 4103.0	140 4421.2	160 5057.6	170 5375.8	190 6012.3	200 6330.5	220 6966.9
10D+1P	11 316.0	11 316.0	22 669.6	44 1376.7	55 1730.3	66 2083.9	88 2791.0	99 3144.6	110 3498.2	132 4205.3	143 4558.9	154 4912.4	176 5619.6	187 5973.1	209 6680.3	220 7033.9
11D+1P	12 347.6	12 347.6	24 736.5	36 1125.5	48 1514.4	72 2292.3	84 2681.2	96 3070.1	108 3459.0	132 4236.9	144 4625.8	156 5014.7	168 5403.7	192 6181.5	204 6570.5	216 6959.4
12D+1P	13 379.2	13 379.2	26 803.5	39 1227.8	52 1652.1	65 2076.4	78 2500.6	104 3349.2	117 3773.5	130 4197.8	143 4622.1	156 5046.3	169 5470.6	182 5894.9	208 6743.5	221 7167.8
13D+1P	14 410.8	14 410.8	28 870.5	42 1330.1	56 1789.7	70 2249.4	84 2709.0	98 3168.7	112 3628.3	126 4088.0	140 4547.6	154 5007.2	168 5466.9	182 5926.5	196 6386.2	224 7305.4
14D+1P	-	-	15 442.4	30 937.4	45 1432.4	60 1927.4	75 2422.4	90 2917.4	105 3412.4	120 3907.4	135 4402.4	150 4897.4	165 5392.4	180 5887.4	195 6382.4	210 6877.4
15D+1P	-	-	16 474.0	32 1004.4	48 1534.7	64 2065.1	80 2595.5	96 3125.8	112 3656.2	128 4186.5	144 4716.9	160 5247.2	176 5777.6	192 6307.9	208 6838.3	224 7368.6

Table D.4 List of Capacities Corresponding to RAID 0+1 (36 Gbytes)

Disk capacity	35.4 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
2D+2M	4 63.2	12 197.1	28 480.0	44 762.8	56 975.0	72 1257.8	88 1540.7	104 1823.5	116 2035.7	132 2318.5	148 2601.4	164 2884.3	176 3096.4	192 3379.3	208 3662.1	224 3945.0
3D+3M	6 94.8	12 200.9	24 413.0	42 731.2	54 943.4	72 1261.6	84 1473.7	102 1791.9	114 2004.1	132 2322.3	144 2534.4	162 2852.7	174 3064.8	192 3383.0	204 3595.1	222 3913.4
4D+4M	8 126.4	8 126.4	24 409.3	40 692.1	56 975.0	72 1257.8	88 1540.7	104 1823.5	112 1965.0	128 2247.8	144 2530.7	160 2813.5	176 3096.4	192 3379.3	208 3662.1	224 3945.0
5D+5M	10 161.8	10 158.0	20 334.8	40 688.4	50 865.2	70 1218.7	80 1395.5	100 1749.1	110 1925.9	130 2279.4	140 2456.2	160 2809.8	170 2986.6	190 3340.1	200 3516.9	220 3870.5
6D+6M	12 197.1	12 189.6	24 401.8	36 613.9	48 826.0	72 1250.3	84 1462.5	96 1674.6	108 1886.7	132 2311.0	144 2523.2	156 2735.3	168 2947.5	192 3371.7	204 3583.9	216 3796.0
7D+7M	14 232.5	14 221.2	28 468.7	42 716.2	56 963.7	70 1211.2	84 1458.7	98 1706.2	112 1953.7	126 2201.2	140 2448.7	154 2696.2	168 2943.7	182 3191.2	196 3438.7	224 3933.7
8D+8M	-	-	16 252.8	32 535.7	48 818.5	64 1101.4	80 1384.2	96 1667.1	112 1950.0	128 2232.8	144 2515.7	160 2798.5	176 3081.4	192 3364.2	208 3647.1	224 3929.9

Table D.5 List of Capacities Corresponding to RAID 0 (72 Gbytes)

Disk capacity	71.3 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
2D	2 135.1	14 975.8	28 1974.2	44 3115.2	58 4113.5	74 5254.5	88 6252.8	104 7393.8	118 8392.2	134 9533.1	148 10531.5	164 11672.5	178 12670.8	194 13811.8	208 14810.2	224 15951.1
3D	3 202.7	12 833.2	27 1902.9	42 2972.5	57 4042.2	72 5111.9	87 6181.5	102 7251.2	117 8320.9	132 9390.5	147 10460.2	162 11529.9	177 12599.5	192 13669.2	207 14738.8	222 15808.5
4D	4 270.2	12 825.7	28 1966.7	44 3107.6	56 3963.4	72 5104.4	88 6245.3	104 7386.3	116 8242.0	132 9383.0	148 10524.0	164 11665.0	176 12520.7	192 13661.7	208 14802.6	224 15943.6
5D	5 337.8	10 694.3	25 1764.0	40 2833.7	55 3903.3	70 4973.0	85 6042.7	100 7112.3	115 8182.0	130 9251.7	145 10321.3	160 11391.0	175 12460.7	190 13530.3	205 14600.0	220 15669.6
6D	6 405.3	12 833.2	24 1688.9	42 2972.5	54 3828.3	72 5111.9	84 5967.6	102 7251.2	114 8106.9	132 9390.5	144 10246.3	162 11529.9	174 12385.6	192 13669.2	204 14524.9	222 15808.5
7D	7 472.9	14 972.1	28 1970.4	42 2968.8	56 3967.1	70 4965.5	84 5963.8	98 6962.2	119 8459.7	133 9458.1	147 10456.4	161 11454.8	175 12453.1	189 13451.5	203 14449.8	224 15947.4
8D	8 540.4	8 540.4	24 1681.4	40 2822.4	56 3963.4	72 5104.4	88 6245.3	104 7386.3	112 7956.8	128 9097.8	144 10238.7	160 11379.7	176 12520.7	192 13661.7	208 14802.6	224 15943.6
9D	9 608.0	9 608.0	27 1891.6	36 2533.4	54 3817.0	72 5100.6	81 5742.4	104 7026.0	117 8309.6	126 8951.4	144 10235.0	162 11518.6	171 12160.4	189 13444.0	207 14727.6	216 15369.4
10D	10 675.6	10 675.6	20 1388.7	40 2814.9	50 3528.0	70 4954.2	80 5667.3	100 7093.6	110 7806.7	130 9232.9	140 9946.0	160 11372.2	170 12085.3	190 13511.5	200 14224.7	220 15650.9
11D	11 743.1	11 743.1	22 1527.5	44 3096.4	55 3880.8	66 4665.2	88 5234.1	99 7018.5	110 7802.9	132 9371.7	143 10156.2	154 10940.6	176 12509.4	187 13293.9	209 14862.7	220 15647.1
12D	12 810.7	12 810.7	24 1666.4	36 2522.1	48 3377.9	72 5089.3	84 5945.1	96 6800.8	108 7656.5	132 9368.0	144 10223.7	156 11079.5	168 11935.2	192 13646.7	204 14502.4	216 15358.1
13D	13 878.2	13 878.2	26 1805.3	39 2732.3	52 3659.4	65 4586.4	78 5513.4	104 7367.5	117 8294.6	130 9221.6	143 10148.7	156 11075.7	169 12002.7	182 12929.8	208 14783.9	221 15710.9
14D	14 945.8	14 945.8	28 1944.1	42 2942.5	56 3940.8	70 4939.2	84 8937.6	98 6935.9	112 7934.3	126 8932.6	140 9931.0	154 10929.3	168 11927.7	182 12926.0	196 13924.4	224 15921.1
15D	-	-	15 1013.3	30 2083.0	45 3152.7	60 4222.3	75 5292.0	90 6361.7	105 7431.3	120 8501.0	135 9570.7	150 10640.3	165 11710.0	180 12779.7	195 13849.3	210 14919.0
16D	-	-	16 1080.9	32 2221.9	48 3362.8	64 4503.8	80 5644.8	96 6785.8	112 7926.8	128 9067.7	144 10208.7	160 11349.7	176 12490.7	192 13631.6	208 14772.6	224 15913.6

Table D.6   List of Capacities Corresponding to RAID 1 (72 Gbytes)

Disk capacity	71.3 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
1D+1M	2 / 67.6	14 / 487.9	28 / 987.1	44 / 1557.6	58 / 2056.8	74 / 2627.2	88 / 3126.4	104 / 3696.9	118 / 4196.1	134 / 4766.6	148 / 5265.7	164 / 5836.2	178 / 6335.4	194 / 6905.9	208 / 7405.1	224 / 7975.6

Table D.7   List of Capacities Corresponding to RAID 5 (72 Gbytes)

Disk capacity	71.3 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
2D+1P	3 / 135.1	12 / 555.5	27 / 1268.6	42 / 1981.7	57 / 2694.8	72 / 3407.9	87 / 4121.0	102 / 4834.1	117 / 5547.2	132 / 6260.3	147 / 6973.5	162 / 7686.6	177 / 8399.7	192 / 9112.8	207 / 9825.9	222 / 10539.0
3D+1P	4 / 202.7	12 / 619.3	28 / 1475.0	44 / 2330.7	56 / 2972.5	72 / 3828.3	88 / 4684.0	104 / 5539.7	116 / 6181.5	132 / 7037.3	148 / 7893.0	164 / 8748.7	176 / 9390.5	192 / 10246.3	208 / 11102.0	224 / 11957.7
4D+1P	5 / 270.2	10 / 555.5	25 / 1411.2	40 / 2266.9	55 / 3122.7	70 / 3978.4	85 / 4834.1	100 / 5689.9	115 / 6545.6	130 / 7401.3	145 / 8257.1	160 / 9112.8	175 / 9968.5	190 / 10824.3	205 / 11680.0	220 / 12535.7
5D+1P	6 / 337.8	12 / 694.3	24 / 1407.4	42 / 2477.1	54 / 3190.2	72 / 4259.9	84 / 4973.0	102 / 6042.7	114 / 6755.8	132 / 7825.4	144 / 8538.5	162 / 9608.2	174 / 10321.3	192 / 11391.0	204 / 12104.1	222 / 13173.8
6D+1P	7 / 405.3	14 / 833.2	28 / 1688.9	42 / 2544.7	56 / 3400.4	70 / 4256.1	84 / 5111.9	98 / 5967.6	119 / 7251.2	133 / 8106.9	147 / 8962.7	161 / 9818.4	175 / 10674.1	189 / 11529.9	203 / 12385.6	224 / 13669.2
7D+1P	8 / 472.9	8 / 472.9	24 / 1471.2	40 / 2469.6	56 / 3468.0	72 / 4466.3	88 / 5464.7	104 / 6463.0	112 / 6962.2	128 / 7960.5	144 / 8958.9	160 / 9957.3	176 / 10955.6	192 / 11954.0	208 / 12952.3	224 / 13950.7
8D+1P	9 / 540.4	9 / 540.4	27 / 1681.4	36 / 2251.9	54 / 3392.9	72 / 4533.9	81 / 5104.4	99 / 6245.3	117 / 7386.3	126 / 7956.8	144 / 9097.8	162 / 10238.7	171 / 10809.2	189 / 11950.2	207 / 13091.2	216 / 13661.7
9D+1P	10 / 608.0	10 / 608.0	20 / 1249.8	40 / 2533.4	50 / 3175.2	70 / 4458.8	80 / 5100.6	100 / 6384.2	110 / 7026.0	130 / 8309.6	140 / 8951.4	160 / 10235.0	170 / 10876.8	190 / 12160.4	200 / 12802.2	220 / 14085.8
10D+1P	11 / 675.6	11 / 675.6	22 / 1388.7	44 / 2814.9	55 / 3528.0	66 / 4241.1	88 / 5667.3	99 / 6380.4	110 / 7093.6	132 / 8519.8	143 / 9232.9	154 / 9945.0	176 / 11372.2	187 / 12085.3	209 / 13511.5	220 / 14224.7
11D+1P	12 / 743.1	12 / 743.1	24 / 1527.5	36 / 2312.0	48 / 3096.4	72 / 4665.2	84 / 5449.6	96 / 6234.1	108 / 7018.5	132 / 8587.3	144 / 9371.7	156 / 10156.2	168 / 10940.6	192 / 12509.4	204 / 13293.9	216 / 14078.3
12D+1P	13 / 810.7	13 / 810.7	26 / 1666.4	39 / 2522.1	52 / 3377.9	65 / 4233.6	78 / 5089.3	104 / 6800.8	117 / 7656.5	130 / 8512.3	143 / 9368.0	156 / 10223.7	169 / 11079.5	182 / 11935.2	208 / 13646.7	221 / 14502.4
13D+1P	14 / 878.2	14 / 878.2	28 / 1805.3	42 / 2732.3	56 / 3659.4	70 / 4586.4	84 / 5513.4	98 / 6440.5	112 / 7367.5	126 / 8294.6	140 / 9221.6	154 / 10148.7	168 / 11075.7	182 / 12002.7	196 / 12929.8	224 / 14783.9
14D+1P	-	-	15 / 945.8	30 / 1944.1	45 / 2942.5	60 / 3940.8	75 / 4939.2	90 / 5937.6	105 / 6935.9	120 / 7934.3	135 / 8932.6	150 / 9931.0	165 / 10929.3	180 / 11927.7	195 / 12926.0	210 / 13924.4
15D+1P	-	-	16 / 1013.3	32 / 2083.0	48 / 3152.7	64 / 4222.3	80 / 5292.0	96 / 6361.7	112 / 7431.3	128 / 8501.0	144 / 9570.7	160 / 10640.3	176 / 11710.0	192 / 12779.7	208 / 13849.3	224 / 14919.0

Table D.8   List of Capacities Corresponding to RAID 0+1 (72 Gbytes)

Disk capacity	71.3 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
2D+2M	4 135.1	12 412.8	28 983.3	44 1553.8	56 1981.7	72 2552.2	88 3122.7	104 3693.2	116 4212.0	132 4691.5	148 5262.0	164 5832.5	176 6260.3	192 6830.8	208 7401.3	224 7971.8
3D+3M	6 202.7	12 416.6	24 844.5	42 1486.3	54 1914.1	72 2555.9	84 2983.8	102 3625.6	114 4053.5	132 4695.3	144 5123.1	162 5764.9	174 6192.8	192 6834.6	204 7262.5	222 7904.3
4D+4M	8 270.2	8 270.2	24 840.7	40 1411.2	56 1981.7	72 2552.2	88 3122.7	104 3693.2	112 3978.4	128 4548.9	144 5119.4	160 5689.9	176 6260.3	192 6830.8	208 7401.3	224 7971.8
5D+5M	10 341.5	10 337.8	20 694.3	40 1407.4	50 1764.0	70 2477.1	80 2833.7	100 3546.8	110 3903.3	130 4616.4	140 4973.0	160 5686.1	170 6042.7	190 6755.8	200 7112.3	220 7825.4
6D+6M	12 512.8	12 405.3	24 833.2	36 1261.1	48 1688.9	72 2544.7	84 2972.5	96 3400.4	108 3828.3	132 4684.0	144 5111.9	156 5539.7	168 5967.6	192 6823.3	204 7251.2	216 7679.1
7D+7M	14 484.2	14 472.9	28 972.1	42 1471.2	56 1970.4	70 2469.6	84 2968.8	98 3468.0	112 3967.1	126 4466.3	140 4965.5	154 5464.7	168 5963.8	182 6463.0	196 6962.2	224 7960.5
8D+8M	-	-	16 540.4	32 1110.9	48 1681.4	64 2251.9	80 2822.4	96 3392.9	112 3963.4	128 4533.9	144 5104.4	160 5674.8	176 6245.3	192 6815.8	208 7386.3	224 7956.8

Table D.9   List of Capacities Corresponding to RAID 0 (146 Gbytes)

Disk capacity	143.3 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
2D	2 279.1	14 1983.8	28 3990.1	44 6283.0	58 8289.3	74 10582.2	88 12588.5	104 14881.4	118 16887.7	134 19180.6	148 21186.9	164 23479.8	178 25486.1	194 27779.0	208 29785.3	224 32078.2
3D	3 418.7	12 1697.1	27 3846.8	42 5996.4	57 8146.0	72 10295.6	87 12445.2	102 14594.8	117 16744.4	132 18894.0	147 21043.6	162 23193.2	177 25342.8	192 27492.4	207 29642.0	222 31791.6
4D	4 558.2	12 1689.6	28 3982.5	44 6275.5	56 7995.1	72 10288.1	88 12581.0	104 14873.9	116 16593.6	132 18886.5	148 21179.4	164 23472.3	176 25192.0	192 27484.9	208 29777.8	224 32070.7
5D	5 697.8	10 1414.3	25 3563.9	40 5713.5	55 7863.1	70 10012.7	85 12162.3	100 14311.9	115 16461.5	130 18611.1	145 20760.7	160 22910.3	175 25059.9	190 27209.6	205 29359.2	220 31508.8
6D	6 837.3	12 1697.1	24 3416.8	42 5996.4	54 7716.0	72 10295.6	84 12015.3	102 14594.8	114 16314.5	132 18894.0	144 20613.7	162 23193.2	174 24912.9	192 27492.4	204 29212.1	222 31791.6
7D	7 976.9	14 1980.0	28 3986.3	42 5992.6	56 7998.9	70 10005.2	84 12011.5	98 14017.8	119 17027.2	133 19033.5	147 21039.8	161 23046.1	175 25052.4	189 27058.7	203 29065.0	224 32074.5
8D	8 1116.4	8 1116.4	24 3409.3	40 5702.2	56 7995.1	72 10288.1	88 12581.0	104 14873.9	112 16020.3	128 18313.2	144 20606.2	160 22899.1	176 25192.0	192 27484.9	208 29777.8	224 32070.7
9D	9 1256.0	9 1256.0	27 3835.5	36 5125.2	54 7704.8	72 10284.3	81 11574.1	99 14153.6	117 16733.1	126 18022.9	144 20602.4	162 23181.9	171 24471.7	189 27051.2	207 29630.7	216 30920.5
10D	10 1395.5	10 1395.5	20 2828.6	40 5694.7	50 7127.8	70 9993.9	80 11427.0	100 14293.1	110 15726.2	130 18592.4	140 20025.4	160 22891.6	170 24324.6	190 27190.8	200 28623.8	220 31490.0
11D	11 1535.1	11 1535.1	22 3111.4	44 6264.2	55 7840.6	66 9416.9	88 12569.7	99 14146.1	110 15722.5	132 18875.2	143 20451.6	154 22028.0	176 25180.7	187 26757.1	209 29909.8	220 31486.2
12D	12 1674.6	12 1674.6	24 3394.3	36 5114.0	48 6833.7	72 10273.0	84 11992.7	96 13712.4	108 15432.1	132 18871.5	144 20591.2	156 22310.8	168 24030.5	192 27469.9	204 29189.6	216 30909.2
13D	13 1814.2	13 1814.2	26 3677.2	39 5540.1	52 7403.1	65 9266.1	78 11129.1	104 14855.1	117 16718.1	130 18581.1	143 20444.1	156 22307.1	169 24170.1	182 26033.0	208 29759.0	221 31622.0
14D	14 1953.7	14 1953.7	28 3960.0	42 5966.3	56 7972.6	70 9978.9	84 11985.2	98 13991.5	112 15997.8	126 18004.1	140 20010.4	154 22016.7	168 24023.0	182 26029.3	196 28035.6	224 32048.2
15D	-	-	15 2093.3	30 4242.9	45 6392.5	60 8542.1	75 10691.7	90 12841.3	105 14990.9	120 17140.5	135 19290.1	150 21439.7	165 23589.3	180 25738.9	195 27888.5	210 30038.1
16D	-	-	16 2232.8	32 4525.7	48 6818.6	64 9111.6	80 11404.5	96 13697.4	112 15990.3	128 18283.2	144 20576.1	160 22869.0	176 25161.9	192 27454.8	208 29747.8	224 32040.7

Table D.10 List of Capacities Corresponding to RAID 1 (146 Gbytes)

Disk capacity	143.3 G bytes																
Component unit	RK		RKA														
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)	
1D+1M	2 / 139.6	14 / 991.9	28 / 1995.0	44 / 3141.5	58 / 4144.6	74 / 5291.1	88 / 6294.2	104 / 7440.7	118 / 8443.8	134 / 9590.3	148 / 10593.5	164 / 11739.9	178 / 12743.1	194 / 13889.5	208 / 14892.7	224 / 16039.1	

Table D.11 List of Capacities Corresponding to RAID 5 (146 Gbytes)

Disk capacity	143.3 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
2D+1P	3 / 278.1	12 / 1131.4	27 / 2564.5	42 / 3997.6	57 / 5430.6	72 / 6863.7	87 / 8296.8	102 / 9729.9	117 / 11162.9	132 / 12596.0	147 / 14029.1	162 / 15462.1	177 / 16895.2	192 / 18328.3	207 / 19761.3	222 / 21194.4
3D+1P	4 / 418.7	12 / 1267.2	28 / 2986.9	44 / 4706.6	56 / 5996.4	72 / 7716.0	88 / 9435.7	104 / 11155.4	116 / 12445.2	132 / 14164.9	148 / 15884.5	164 / 17604.2	176 / 18894.0	192 / 20613.7	208 / 22333.4	224 / 24053.0
4D+1P	5 / 558.2	10 / 1131.4	25 / 2851.1	40 / 4570.8	55 / 6290.5	70 / 8010.2	85 / 9729.9	100 / 11449.5	115 / 13169.2	130 / 14888.9	145 / 16608.6	160 / 18328.3	175 / 20048.0	190 / 21767.6	205 / 23487.3	220 / 25207.0
5D+1P	6 / 697.8	12 / 1414.3	24 / 2847.4	42 / 4997.6	54 / 6430.0	72 / 8579.6	84 / 10012.7	102 / 12162.3	114 / 13595.4	132 / 15745.0	144 / 17178.1	162 / 19327.7	174 / 20760.7	192 / 22910.3	204 / 24343.4	222 / 26493.0
6D+1P	7 / 837.3	14 / 1697.1	28 / 3416.8	42 / 5136.5	56 / 6856.2	70 / 8575.9	84 / 10295.6	98 / 12015.3	119 / 14594.8	133 / 16314.5	147 / 18034.1	161 / 19753.8	175 / 21473.5	189 / 23193.2	203 / 24912.9	224 / 27492.4
7D+1P	8 / 976.9	8 / 976.9	24 / 2983.2	40 / 4989.5	56 / 6995.8	72 / 9002.0	88 / 11008.3	104 / 13014.6	112 / 14017.8	128 / 16024.1	144 / 18030.4	160 / 20036.7	176 / 22043.0	192 / 24049.3	208 / 26055.6	224 / 28061.9
8D+1P	9 / 1116.4	9 / 1116.4	27 / 3409.3	36 / 4555.8	54 / 6848.7	72 / 9141.6	81 / 10288.1	99 / 12581.0	117 / 14873.9	116 / 16020.3	144 / 18313.2	162 / 20606.2	171 / 21752.6	189 / 24045.5	207 / 26338.4	216 / 27484.9
9D+1P	10 / 1256.0	10 / 1256.0	20 / 2545.7	40 / 5125.2	50 / 6415.0	70 / 8994.5	80 / 10284.3	100 / 12863.8	110 / 14153.6	130 / 16733.1	140 / 18022.9	160 / 20602.4	170 / 21892.2	190 / 24471.7	200 / 25761.5	220 / 28341.0
10D+1P	11 / 1395.5	11 / 1395.5	22 / 2828.6	44 / 5694.7	55 / 7127.8	66 / 8560.9	88 / 11427.0	99 / 12860.1	110 / 14293.1	132 / 17159.3	143 / 18592.4	154 / 20025.4	176 / 22891.6	187 / 24324.6	209 / 27190.8	220 / 28623.8
11D+1P	12 / 1535.1	12 / 1535.1	24 / 3111.4	36 / 4687.8	48 / 6264.2	72 / 9416.9	84 / 10993.3	96 / 12569.7	108 / 14146.1	132 / 17298.8	144 / 18875.2	156 / 20451.6	168 / 22028.0	192 / 25180.7	204 / 26757.1	216 / 28333.5
12D+1P	13 / 1674.6	13 / 1674.6	26 / 3394.3	39 / 5114.0	52 / 6833.7	65 / 8553.3	78 / 10273.0	104 / 13712.4	117 / 15432.1	130 / 17151.8	143 / 18871.5	156 / 20591.1	169 / 22310.8	182 / 24030.5	208 / 27469.9	221 / 29189.6
13D+1P	14 / 1814.2	14 / 1814.2	28 / 3677.2	42 / 5540.1	56 / 7403.1	70 / 9266.1	84 / 11129.1	98 / 12992.1	112 / 14855.1	126 / 16718.1	140 / 18581.1	154 / 20444.1	168 / 22307.1	182 / 24170.1	196 / 26033.0	224 / 29459.0
14D+1P	-	-	15 / 1953.7	30 / 3960.0	45 / 5966.3	60 / 7972.6	75 / 9978.9	90 / 11985.2	105 / 13991.5	120 / 15997.8	135 / 18004.1	150 / 20010.4	165 / 22016.7	180 / 24023.0	195 / 26029.3	210 / 28035.6
15D+1P	-	-	16 / 2093.3	32 / 4242.9	48 / 6392.5	64 / 8542.1	80 / 10691.7	96 / 12841.3	112 / 14990.9	128 / 17140.5	144 / 19290.1	160 / 21439.7	176 / 23589.3	192 / 25738.9	208 / 27888.5	224 / 30038.1

Table D.12   List of Capacities Corresponding to RAID 0+1 (146 Gbytes)

Disk capacity	143.3 G bytes															
Component unit	RK		RKA													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	14 (Max)	29	44	59	74	89	104	119	134	149	164	179	194	209	224 (Max)
2D+2M	4 279.1	12 844.8	28 1991.3	44 3137.7	56 3997.6	72 5144.0	88 6290.5	104 7436.9	116 8296.8	132 9443.2	148 10589.7	164 11736.2	176 12596.0	192 13742.4	208 14888.9	224 16035.4
3D+3M	6 418.7	12 848.6	24 1708.4	42 2998.2	54 3858.0	72 5147.8	84 6007.6	102 7297.4	114 8157.2	132 9447.0	144 10306.8	162 11596.6	174 12456.4	192 13746.2	204 14606.0	222 15895.8
4D+4M	8 558.2	8 558.2	24 1704.7	40 2851.1	56 3997.6	72 5144.0	88 6290.5	104 7136.9	112 8010.2	128 9156.6	144 10303.1	160 11449.5	176 12596.0	192 13742.4	208 14888.9	224 16035.4
5D+5M	10 701.5	10 697.8	20 1414.3	40 2847.4	50 3563.9	70 4997.0	80 5713.5	100 7146.6	110 7863.1	130 9296.2	140 10012.7	160 11445.8	170 12162.3	190 13595.4	200 14311.9	220 15745.0
6D+6M	12 844.8	12 837.3	24 1697.1	36 2557.0	48 3416.8	72 5136.5	84 5996.4	96 6856.2	108 7716.0	132 9435.7	144 10295.6	156 11155.4	168 12015.3	192 13734.9	204 14594.8	216 15454.6
7D+7M	14 988.1	14 976.9	28 1980.0	42 2983.2	56 3986.3	70 4989.5	84 5992.6	98 6995.8	112 7998.9	126 9002.0	140 10005.2	154 11008.3	168 12011.5	182 13014.6	196 14017.8	224 16024.1
8D+8M	-	-	16 1116.4	32 2262.9	48 3409.3	64 4555.8	80 5702.2	96 6848.7	112 7995.1	128 9141.6	144 10288.1	160 11434.5	176 12581.0	192 13727.4	208 14873.9	224 16020.3

Appendix E   Port Address Mapping Table

Fibre channel physical addresses are converted to target IDs (TIDs) using a conversion table. The following table shows the current limits for TIDs on various operating systems.

Table E.1   Limits for TIDs on Operating Systems

Port	HP-UX		Solaris		Windows NT (SP4 or later)	
	TID	LUN	TID	LUN	TID	LUN
Fibre	0 to 15	0 to 255	0 to 125	0 to 255	0 to 31	0 to 255

AL-PA is an abbreviation for Arbitrated Loop Physical Address and indicates the physical address for Fibre Channel. TID indicates the target ID.

Table E.2   Port Addresses for HP-UX

C0		C1		C2		C3		C4		C5		C6		C7	
ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID
EF	0	CD	0	B2	0	98	0	72	0	55	0	3A	0	25	0
E8	1	CC	1	B1	1	97	1	71	1	54	1	39	1	23	1
E4	2	CB	2	AE	2	90	2	6E	2	53	2	36	2	1F	2
E2	3	CA	3	AD	3	8F	3	6D	3	52	3	35	3	1E	3
E1	4	C9	4	AC	4	88	4	6C	4	51	4	34	4	1D	4
E0	5	C7	5	AB	5	84	5	6B	5	4E	5	33	5	1B	5
DC	6	C6	6	AA	6	82	6	6A	6	4D	6	32	6	18	6
DA	7	C5	7	A9	7	81	7	69	7	4C	7	31	7	17	7
D9	8	C3	8	A7	8	80	8	67	8	4B	8	2E	8	10	8
D6	9	BC	9	A6	9	7C	9	66	9	4A	9	2D	9	0F	9
D5	10	BA	10	A5	10	7A	10	65	10	49	10	2C	10	08	10
D4	11	B9	11	A3	11	79	11	63	11	47	11	2B	11	04	11
D3	12	B6	12	9F	12	76	12	5C	12	46	12	2A	12	02	12
D2	13	B5	13	9E	13	75	13	5A	13	45	13	29	13	01	13
D1	14	B4	14	9D	14	74	14	59	14	43	14	27	14		
CE	15	B3	15	9B	15	73	15	56	15	3C	15	26	15		

Table E.3   Port Addresses for Solaris

C0 ALPA	TID	C1 ALPA	TID	C2 ALPA	TID	C3 ALPA	TID	C4 ALPA	TID	C5 ALPA	TID	C6 ALPA	TID	C7 ALPA	TID
EF	0	CD	16	B2	32	98	48	72	64	55	80	3A	96	25	112
E8	1	CC	17	B1	33	97	49	71	65	54	81	39	97	23	113
E4	2	CB	18	AE	34	90	50	6E	66	53	82	36	98	1F	114
E2	3	CA	19	AD	35	8F	51	6D	67	52	83	35	99	1E	115
E1	4	C9	20	AC	36	88	52	6C	68	51	84	34	100	1D	116
E0	5	C7	21	AB	37	84	53	6B	69	4E	85	33	101	1B	117
DC	6	C6	22	AA	38	82	54	6A	70	4D	86	32	102	18	118
DA	7	C5	23	A9	39	81	55	69	71	4C	87	31	103	17	119
D9	8	C3	24	A7	40	80	56	67	72	4B	88	2E	104	10	120
D6	9	BC	25	A6	41	7C	57	66	73	4A	89	2D	105	0F	121
D5	10	BA	26	A5	42	7A	58	65	74	49	90	2C	106	08	122
D4	11	B9	27	A3	43	79	59	63	75	47	91	2B	107	04	123
D3	12	B6	28	9F	44	76	60	5C	76	46	92	2A	108	02	124
D2	13	B5	29	9E	45	75	61	5A	77	45	93	29	109	01	125
D1	14	B4	30	9D	46	74	62	59	78	43	94	27	110		
CE	15	B3	31	9B	47	73	63	56	79	3C	95	26	111		

Table E.4   Port Addresses for Windows NT (Fibre Board: Emulex)

C5(PhId5)				C4(PhId4)				C3(PhId3)				C2(PhId2)				C1(PhId1)		
TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID	ALPA	TID
					CC	15			98	15			56	15			27	15
			E4	30	CB	14	B1	30	67	14	72	30	55	14	3C	30	26	14
			E2	29	CA	13	AE	29	90	13	71	29	64	13	3A	29	25	13
			E1	28	C9	12	AD	28	8F	12	6E	28	53	12	39	28	23	12
			E0	27	C7	11	AC	27	88	11	6D	27	52	11	36	27	1F	11
			DC	26	C6	10	AB	26	84	10	6C	26	51	10	35	26	1E	10
			DA	25	C5	9	AA	25	82	9	6B	25	4E	9	34	25	1D	9
			D9	24	C3	8	A9	24	81	8	6A	24	4D	8	33	24	1B	8
			D6	23	BC	7	A7	23	80	7	69	23	4C	7	32	23	18	7
			D5	22	BA	6	A6	22	7C	6	67	22	4B	6	31	22	17	6
			D4	21	B9	5	A5	21	7A	5	66	21	4A	5	2E	21	10	5
			D3	20	B6	4	A3	20	79	4	65	20	49	4	2D	20	0F	4
			D2	19	B5	3	9F	19	76	3	63	19	47	3	2C	19	08	3
			D1	18	B4	2	9E	18	75	2	5C	18	46	2	2B	18	04	2
	EF	1	CE	17	B3	1	9D	17	74	1	5A	17	45	1	2A	17	02	1
	E8	0	CD	16	B2	0	9B	16	73	0	59	16	43	0	29	16	01	0

Table E.5   Port Addresses for Windows NT (Fibre Board: Qlogic)

C0(PhId0)				C1(PhId1)				C2(PhId2)				C3(PhId3)				C4(PhId4)			
AL PA	TID	AL PA	TID	AL PA	TID	AL PA	TID	AL PA	TID	AL PA	TID	AL PA	TID	AL PA	TID	AL PA	TID	AL PA	TID
EF	0	CD	16	B2	0	98	16	72	0	55	16	3A	0	25	16				
E8	1	CC	17	B1	1	67	17	71	1	64	17	39	1	23	17				
E4	2	CB	18	AE	2	90	18	6E	2	53	18	36	2	1F	18				
E2	3	CA	19	AD	3	8F	19	6D	3	52	19	35	3	1E	19				
E1	4	C9	20	AC	4	88	20	6C	4	51	20	34	4	1D	20				
E0	5	C7	21	AB	5	84	21	6B	5	4E	21	33	5	1B	21				
DC	6	C6	22	AA	6	82	22	6A	6	4D	22	32	6	18	22				
DA	7	C5	23	A9	7	81	23	69	7	4C	23	31	7	17	23				
D9	8	C3	24	A7	8	80	24	67	8	4B	24	2E	8	10	24				
D6	9	BC	25	A6	9	7C	25	66	9	4A	25	2D	9	0F	25				
D5	10	BA	26	A5	10	7A	26	65	10	49	26	2C	10	08	26				
D4	11	B9	27	A3	11	79	27	63	11	47	27	2B	11	04	27				
D3	12	B6	28	9F	12	76	28	5C	12	46	28	2A	12	02	28				
D2	13	B5	29	9E	13	75	29	5A	13	45	29	29	13	01	29				
D1	14	B4	30	9D	14	74	30	59	14	43	30	27	14						
CE	15	B3	31	9B	15	73	31	56	15	3C	31	26	15						

Appendix F   Power Cables

This section includes descriptions of the following power cables:

- J1H

- J2H

- J2H5

- J2H10

- DC Power Cable

Table F.1   J1H Power Cable

Cable name	Part No.	Name	Quantity	Model	Applicable safety standard/ rating
DF-F600-J1H	1	Cable	-	PVC code	UL and CSA
Power cable	2	Connector A	1	NEMA Standard 5-15 P	For AC 125 V (13 A or 15 A)
	3	Connector B	1	EN60320-C13	For standard use
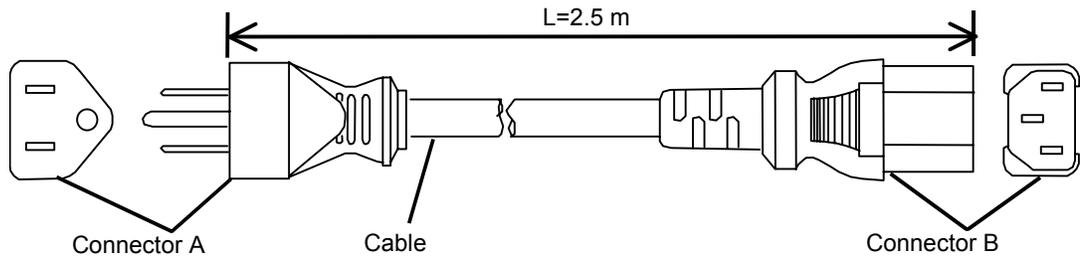
Figure F.1   Port Extender Dimensions

Table F.2   J2H Power Cable

Cable name	Part No.	Name	Quantity	Model	Applicable safety standard/ rating
DF-F600-J2H	1	Cable	-	PVC code	UL and CSA
Power cable	2	Connector A	1	EN60324-C14	For AC 250 V (13 A or 15 A)
	3	Connector B	1	EN60324-C13	For rack frame

L=2.5 m

Connector A   Cable   Connector B
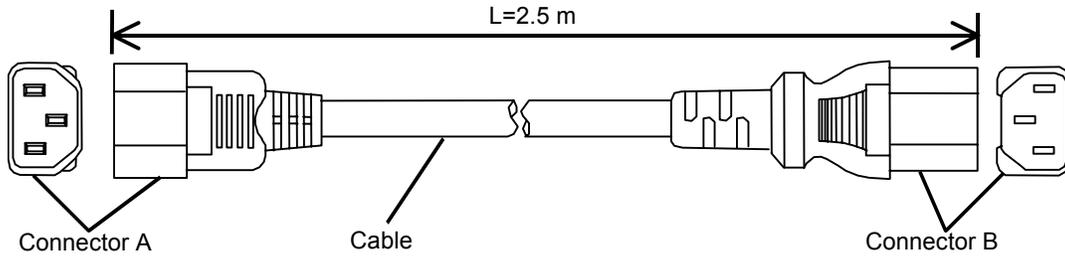
Figure F.2   J2H Power Cable

Table F.3   J2H5 and J2H10 Power Cables

Cable name	Part No.	Name	Quantity	Model	Applicable safety standard/ rating
DF-F600-	1	Cable	-	CENELEC	UL and CSA
J2H5/J2H10	2	Connector A	1	EN60320-C14	For AC 250 V (13 A or 15 A)
Power cable	3	Connector B	1	EN60320-C13	For rack frame

J2H5: L=5 m
J2H10: L=10 m

Connector A   Cable   Connector B

Figure F.3   J2H5 and J2H10 Power Cables

Appendix G   Number of Logical Blocks
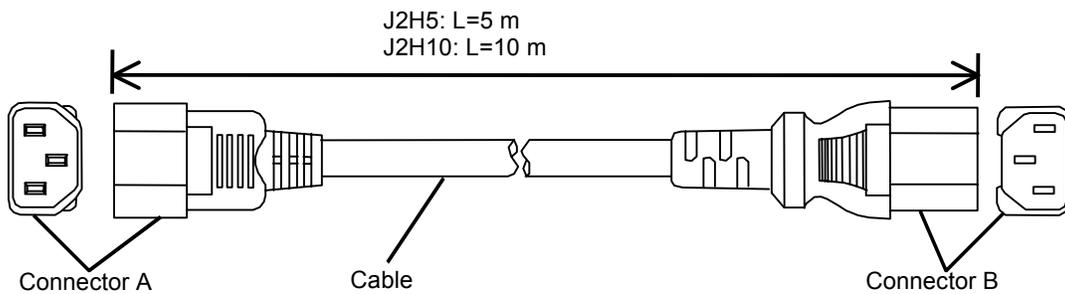
Set the number of logical blocks for each logical unit using the following multiples in accordance with RAID levels.

Note: All values of storage capacities in following tables are calculated as 1 Gbyte = 1,000,000,000 bytes.

(This definition is different from 1 Kbyte = 1,024 bytes.)

Table G.1 Number of Logical Blocks and RAID Levels

RAID level		Logical block number
RAID 0	(2D)	2048
	(3D)	3072
	(4D)	4096
	(5D)	5160
	(6D)	6144
	(7D)	7168
	(8D)	8192
	(9D)	9216
	(10D)	10240
	(11D)	11264
	(12D)	12288
	(13D)	13312
	(14D)	14336
	(15D)	15360
	(16D)	16384
RAID 1	(1D+1P)	1024
RAID 5	(2D+1P)	2048
	(3D+1P)	3072
	(4D+1P)	4096
	(5D+1P)	5160
	(6D+1P)	5144
	(7D+1P)	7168
	(8D+1P)	8192
	(9D+1P)	9216
	(10D+1P)	10240
	(11D+1P)	11264
	(12D+1P)	12288
	(13D+1P)	13312
	(14D+1P)	14336
	(15D+1P)	15360
RAID 1+0	(2D+2P)	2048
	(3D+3P)	3072
	(4D+4P)	4096
	(5D+5P)	5160
	(6D+6P)	5144
	(7D+7P)	7168
	(8D+8P)	8192

The number of logical blocks for one parity group is shown below.

Table G.2   Number of Logical Blocks of One Parity Group

RAID Level		Disk Drive capacity					
		35.4 G bytes		71.3 G bytes		143.3 G bytes	
		Number of Logical Blocks 1	Number of Logical Blocks 2	Number of Logical Blocks 1	Number of Logical Blocks 2	Number of Logical Blocks 1	Number of Logical Blocks 2
RAID 0	2D	138,113,024	123,443,200	278,558,720	263,888,896	559,790,080	545,120,256
	3D	207,169,536	185,164,800	417,838,080	395,833,344	839,685,120	817,680,384
	4D	276,226,048	246,886,400	557,117,440	527,777,792	1,119,580,160	1,090,240,512
	5D	345,282,560	308,608,000	696,396,800	659,722,240	1,399,475,200	1,362,800,640
	6D	414,339,072	370,329,600	835,676,160	791,666,688	1,679,370,240	1,635,360,768
	7D	483,395,584	432,051,200	974,955,520	923,611,136	1,959,265,280	1,907,920,896
	8D	552,452,096	493,772,800	1,114,234,880	1,055,555,584	2,239,160,320	2,180,481,024
	9D	621,508,608	555,494,400	1,253,514,240	1,187,500,032	2,519,055,360	2,453,041,152
	10D	690,565,120	617,216,000	1,392,793,600	1,319,444,480	2,798,950,400	2,725,601,280
	11D	759,621,632	678,937,600	1,532,072,960	1,451,388,928	3,078,845,440	2,998,161,408
	12D	828,678,144	740,659,200	1,671,352,320	1,583,333,376	3,358,740,480	3,270,721,536
	13D	897,734,656	802,380,800	1,810,631,680	1,715,277,824	3,638,635,520	3,543,281,664
	14D	966,791,168	864,102,400	1,949,911,040	1,847,222,272	3,918,530,560	3,815,841,792
	15D	1,035,847,680	925,824,000	2,089,190,400	1,979,166,720	4,198,425,600	4,088,401,920
	16D	1,104,904,192	987,545,600	2,228,469,760	2,111,111,168	4,478,320,640	4,360,962,048
RAID 1	1D+1P	69,056,512	61,721,600	139,279,360	131,944,448	279,895,040	272,560,128
RAID 5	2D+1P	138,113,024	123,443,200	278,558,720	263,888,896	559,790,080	545,120,256
	3D+1P	207,169,536	185,164,800	417,838,080	395,833,344	839,685,120	817,680,384
	4D+1P	276,226,048	246,886,400	557,117,440	527,777,792	1,119,580,160	1,090,240,512
	5D+1P	345,282,560	308,608,000	696,396,800	659,722,240	1,399,475,200	1,362,800,640
	6D+1P	414,339,072	370,329,600	835,676,160	791,666,688	1,679,370,240	1,635,360,768
	7D+1P	483,395,584	432,051,200	974,955,520	923,611,136	1,959,265,280	1,907,920,896
	8D+1P	552,452,096	493,772,800	1,114,234,880	1,055,555,584	2,239,160,320	2,180,481,024
	9D+1P	621,508,608	555,494,400	1,253,514,240	1,187,500,032	2,519,055,360	2,453,041,152
	10D+1P	690,565,120	617,216,000	1,392,793,600	1,319,444,480	2,798,950,400	2,725,601,280
	11D+1P	759,621,632	678,937,600	1,532,072,960	1,451,388,928	3,078,845,440	2,998,161,408
	12D+1P	828,678,144	740,659,200	1,671,352,320	1,583,333,376	3,358,740,480	3,270,721,536
	13D+1P	897,734,656	802,380,800	1,810,631,680	1,715,277,824	3,638,635,520	3,543,281,664
	14D+1P	966,791,168	864,102,400	1,949,911,040	1,847,222,272	3,918,530,560	3,815,841,792
	15D+1P	1,035,847,680	925,824,000	2,089,190,400	1,979,166,720	4,198,425,600	4,088,401,920
RAID 1+0	2D+2P	138,113,024	123,443,200	278,558,720	263,888,896	559,790,080	545,120,256
	3D+3P	207,169,536	185,164,800	417,838,080	395,833,344	839,685,120	817,680,384
	4D+4P	276,226,048	246,886,400	557,117,440	527,777,792	1,119,580,160	1,090,240,512
	5D+5P	345,282,560	308,608,000	696,396,800	659,722,240	1,399,475,200	1,362,800,640
	6D+6P	414,339,072	370,329,600	835,676,160	791,666,688	1,679,370,240	1,635,360,768
	7D+7P	483,395,584	432,051,200	974,955,520	923,611,136	1,959,265,280	1,907,920,896
	8D+8P	552,452,096	493,772,800	1,114,234,880	1,055,555,584	2,239,160,320	2,180,481,024

*1: Maximum number of blocks 1 is applied for the RAID Group excluding the Drives #0 to #4 of the Basic Chassis.
Maximum number of blocks 2 is applied for the RAID Group including at least one Drive of the Drives #0 to #4 of the Basic Chassis.