



**Hitachi TagmaStore®
Adaptable Modular Storage 1000™
User and Reference Guide**

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Hazardous & toxic substances table

Part Name	Toxic and Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
RKHE	×	○	○	○	○	○
RKAJ	×	○	○	○	○	○
RKAJAT	×	○	○	○	○	○
RKNAS	×	○	○	○	○	○

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- Changed the table in China RoHS
- Changed section 1.2.2
- Added Note 3 to Table 2.8
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- Updated Table 8.2
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- Changed section 4.6.1
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- Updated Note 5 in section 7.4.7
- Changed Table C.1
- Added Table F.28, Table F.29, Table F.30, and Table F.31
- Changed Table I.2

Preface

This document describes the physical, functional, and operational characteristics of the AMS1000 storage system. This document also provides operation instructions, installation details, and configuration planning information for the AMS1000 storage system.

This User and Reference Guide assumes that:

- The user is familiar with the Hitachi TagmaStore[®] Adaptable Modular Storage AMS1000 storage system.
- The user is familiar with the Windows[®] 95, Windows[®] 98, Windows[®] 2000 or Windows NT[®] operating systems. These versions are abbreviated to **Windows[®]** in this document.

For further information, please contact your Hitachi Data Systems account team, or visit the Hitachi Data Systems worldwide web site at <http://www.hds.com>.

Note: This storage system complies with FDA radiation performance standards 21CFR, subchapter J.

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Software Version

This document revision applies to Hitachi TagmaStore Adaptable Modular Storage and Workgroup Modular Storage Products version 3.1 and higher.

EMI Regulation

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference in which case the user will be required to correct the interference at his own expense. Testing was done with shielded cables. Therefore, in order to comply with the FCC regulations, you must use shielded cables with you installation.

The EMI test was done in the following configuration.

If trouble occurs in a different configuration, the user may be requested to take appropriate preventive measures.

- AMS1000- RKH/RKHE+RKAJ(×1)+RKAJAT(×2)
- AMS1000- RKH/RKHE+RKAJ(×2)

Convention for Storage Capacity Values

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

- 1 KB (kilobyte) = 1,024 bytes
- 1 MB (megabyte) = 1,024² bytes
- 1 GB (gigabyte) = 1,024³ bytes
- 1 TB (terabyte) = 1,024⁴ bytes

Referenced Documents

- *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Cache Residency Manager Software User's Guide, MK-95DF716*
- *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User's Guide, MK-95DF711*
- *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Command Line Interface (CLI), MK-95DF712*
- *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage ShadowImage™ In-System Replication Software User's Guide, MK-95DF709*
- *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage TrueCopy™ Synchronous Remote Replication Software User's Guide, MK-95DF710*
- *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Copy-on-Write Snapshot™ User's Guide, MK-95DF708*
- *Hitachi Data Systems Global 19-Inch Rack Reference Guide, MK-93DF772*
- *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Performance Monitor Software User's Guide, MK-95DF706*

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Chapter 1 Overview of AMS1000 Storage System

This chapter includes the following:

- Introduction to the AMS Storage Systems (see section 1.1)
- Overview of AMS Features (see section 1.2)
- Rack-Mount Model (see section 1.3)

This chapter provides information on the Fibre, NAS, and iSCSI models. The following table illustrates sections that provide an explanation for each model.

- **Fibre model:** Connects disk array subsystem to a host computer with Fibre Channel interface.
- **NAS model:** Connects NAS Unit connected to disk array subsystem to a host computer with LAN interface.
- **iSCSI model:** Connects disk array subsystem to a host computer with iSCSI interface.

Sections		Fibre	NAS	iSCSI
1.1	Introducing the AMS Storage Systems	○	○	○
1.2	Overview Features	○	○	○
	1.2.1 High Data Availability	○	○	○
	1.2.2 Connectivity	○	○	○
	1.2.3 Scalability	○	○	○
	1.2.4 Performance Reporting and Monitoring	○	○	○
	1.2.5 Reliability, Availability, and Serviceability	○	○	○
	1.2.6 Hitachi Freedom Storage™ and Hitachi Freedom Data Networks™	○	○	○
1.3	Rack-Mount Model	○	○	○

○: An explanation is provided.

—: An explanation is not provided.

Note: Many references to the TrueCopy Extended Distance feature appear in this document. TrueCopy Extended Distance is a long distance remote replication business continuity application that will be available during the next release. Please contact your HDS representative for more information. We apologize for any inconvenience.

1.1 Introducing the AMS Storage Systems

Hitachi Data Systems networked storage solutions are designed to manage, maintain, and protect one of your company's most valuable assets - its data. HDS' scalable, high-performance systems can help your business manage its existing data and lay a flexible foundation for the future, while reducing the cost and complexity of satisfying the continuing demand for storage expansion and optimizing system performance and providing the high availability your applications require. No matter what the size of your organization or its challenges, HDS can tailor a lasting solution, ensuring that your company realizes the maximum business benefits of Application Optimized Storage™ solutions from Hitachi Data Systems.

Hitachi Data Systems works with hundreds of customers to understand their needs and requirements, and builds systems as described above to implement storage solutions to meet those requirements. HDS understands customer issues and bases storage solutions on how customer applications use data. Each application has unique requirements in terms of data access, performance, and retention. This calls for strategic alignment of application requirements with storage attributes. The result is better information performance and availability at reduced cost.

This approach—Application Optimized Storage™—integrates a portfolio of hardware, software, and services, enabling businesses to optimize their storage assets for diverse application requirements. That means current applications function smoothly as new ones are added with no disruption or downtime. In an era when huge amounts of data must be available 24/7 and retained longer, Hitachi Data Systems provides a competitive edge. Application Optimized Storage solutions are cost-effective, easy to deploy, and able to deliver maximum value today.

Hitachi TagmaStoreT Adaptable Modular Storage and TagmaStore Workgroup Modular Storage systems are scalable, high-performance, and high-availability storage systems that are rated the best in their category. Leveraging many high-end storage features such as cache partitioning and RAID-6, this family of products addresses needs across a broad range of organizations ranging in size from small and mid-sized businesses (SMBs) through mid-sized organizations and entry level enterprises which generate fast-growing amounts of data. These systems meet specific application requirements, including those for Microsoft Exchange and Oracle Financials, and provide high availability and performance in a small footprint. In addition to meeting the requirements of SMBs, these systems can also be deployed in tiered storage configurations in large enterprises, complementing the Hitachi Data Systems Universal Storage Platform and the Network Storage Controller.

The following sections in this chapter describe the features of one of the four HDS midrange storage systems available to provide the storage solutions described above.

1.2 Overview of System Features

The Hitachi TagmaStore® Adaptable Modular Storage AMS1000 storage system (hereafter referred to as the AMS1000) is available in a rack-mount model.

The AMS1000 rackmount model is a subsystem that combines the RKH/RKHE, the RKAJ/RKAJAT and the DF-700-RKNAS4G (hereafter referred to as RKNAS).

The following AMS1000 features are discussed in this section:

- High Data Availability
- Connectivity
- Scalability
- Performance Reporting and Monitoring
- Reliability, Availability, and Serviceability
- Hitachi Freedom Storage™ and Hitachi Freedom Data Networks™

1.2.1 High Data Availability

The AMS1000 is designed for high performance and protection of user data. See section 1.2.5 for additional information on the reliability and availability features of the AMS1000 subsystem.

1.2.2 Connectivity

The AMS1000 subsystem provides connectivity to most open systems through a standard Fibre Channel interface or Network interfaces. The following describes the features of Fibre Channel and Ethernet:

- **High-Speed Data Transfer**

Fibre Channel: With the 4Gbps Fibre Channel connection, the AMS1000 subsystem can transfer data between the host computer and the subsystem at a maximum speed of 400 MB/sec.

Ethernet: With the 1 G bps Ethernet connection, the subsystem can transfer data between host computer and the subsystem at a maximum speed of 100 M bytes/s per port via a network.

- **Cable**

Fibre Channel: With Fibre Channel, the subsystem can use 50/125 μ m, 62.5/125 μ m multimode Fibre Cable as defined in Table 1.1.

Table 1.1 Fibre Cable Length

Data transfer rate (MB/s)	100	200	400
Max 50/125 μ m multimode Fibre Cable length	500 m	300 m	150 m
Max 62.5/125 μ m multimode Fibre Cable length	300 m	150 m	70 m

Ethernet: With Ethernet, the subsystem can be located up to 100 meters from the host. The subsystem can be installed in the location far from the host.

- **The Number of Connectable Devices**

Fibre Channel: The AMS1000 subsystem supports systems that can connect up to 126 fibre channel devices by using the fibre channel interface and connecting the FC-AL and the FC-SW.

iSCSI: The subsystem supports systems that can connect up to 256 hosts for a physical port by using the switch.

- **Security Function**

- **Fibre Channel and Ethernet:** 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.

1.2.3 Scalability

- You can construct a variety of systems; example, a system with 15 disk drives can be configured by connecting an RKH/RKHE to an RKAJ. A more complex system can be set up using a maximum of 450 disk drives for FC or a maximum of 420 disk drives for S-ATA, expanded by connecting up to 30 RKAJs/RKAJATs to the RKH/RKHE.
- Up to 30 spare disks can be set up in any location. Use the system effectively by configuring each spare disk in a disk drive slot left unused due to system construction.
- From the host computer, the subsystem can be used not only as a single-large scale Disk drive but also as 4096 logical disks (LUs) at the maximum.

1.2.4 Performance Reporting and Monitoring

The Storage Navigator Modular 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.

1.2.5 Reliability, Availability, and Serviceability

The reliability, availability, and serviceability features of the AMS1000 subsystem include:

- **High reliability**

The Controller of the AMS1000 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 control unit, the automatic generation of the data assurance codes and the check sums are executed to enhance data reliability in data distribution/concentration control.

Up to 30 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 RAID0 configuration) and provides high reliability.

- **Redundant power supply systems**

Each AMS1000 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 AMS1000 can sustain the loss of a single power supply and still continue operation.

- **High capacity cache**

The AMS1000 subsystem supports a maximum of 8 GB high capacity cache per controller. Writing completion can be reported to the host system when data is written to cache.

- **Spare disk**

To maintain reliability, it is recommended that one spare disk is set for 15 disk drives in a subsystem with S-ATA disk drives.

1.2.6 Hitachi Freedom Storage and Hitachi Freedom Data Networks

Hitachi Data Systems' end-to-end Storage Solutions give you the freedom to locate storage wherever it makes the greatest business sense to do so and protect your investment in currently installed components. Made possible by the advent and proliferation of high-speed technologies, storage area networks break the traditional server/storage bond and enable total connectivity. As a result, you can consolidate large storage pools shareable across the enterprise, centralize management, and dramatically improve storage utilization while reducing costs.

Hitachi Data Systems' Storage Solutions enable you to increase data availability, counter spiraling information management costs, and take advantage of the speed and flexibility of SAN technology. In addition to supporting the Storage Networking Industry Association's open-systems standards, HDS Storage Solutions reduce total cost of ownership by minimizing support costs and downtime, and optimizing server and storage configurations.

The benefits of Hitachi Data Systems' Storage Solutions include:

- Server/storage system scalability
- Improved information access
- Enhanced application/backup performance
- Increased resource manageability and reliability
- Higher availability

Hitachi Freedom Data Networks (FDN) responds to the challenge of open architecture and multiple platforms. FDN is the locus of Hitachi's long-term vision for offering businesses complete freedom of choice in establishing data-centric enterprise networks, encompassing storage, switches, servers, management software, protocols, services, and networks developed by Hitachi, our alliance partners, and third party providers. FDN facilitates:

- Consolidation of server and storage resources
- Data sharing across the enterprise
- Centralized resource and data management
- Superior data security
- Increased availability and scalability
- Business continuity and disaster recovery

For further information on Freedom SAN™ and Freedom Data Networks, please contact your Hitachi Data Systems account team, or visit Hitachi Data Systems online at www.hds.com

1.3 Rack-Mount Model

The rack-mount model is composed of a combination of the RKH/RKHE, RKAJ/RKAJAT and RKNAS mounted on a rack frame. The RKH/RKHE includes a control unit to perform RAID control on the drives.

The RKAJ/RKAJAT is an additional unit that is capable of mounting up to 15 disk drives, and controls its drives through connection with an RKH/RKHE. The RKAJ/RKAJAT is provided with no control unit.

A diversified combination such as **RKH/RKHE (1 unit) + RKAJ (1 units) + RKAJ/RKAJAT (9 units)** or **RKH/RKHE (5 units) + RKAJ (5 units)** can be implemented. When connecting the RKNASs to the AMS1000, you can construct a system such as **RKH/RKHE (1 unit) + RKAJ (1 units) + RKAJ/RKAJAT (9 units) + RKNAS (2 units)** or **RKH/RKHE (2 unit) + RKAJ (2 units) + RKAJ/RKAJAT (6 units) + RKNAS (4 units)** conforming to your demand.

Notes:

- Since the RKH/RKHE controls the AMS1000 subsystem, at least one RKH/RKHE and one RKAJ must be mounted. For details, consult with the Hitachi Data Systems Customer Support.
- For information about the global rack-mount model, refer to the *Hitachi Data Systems Global 19-Inch Rack Reference Guide (MK-93DF772)*.

Chapter 2 Planning for Installation and Operation

This chapter provides information for planning and preparing a site before and during installation of the Hitachi AMS1000 subsystem. Please read this chapter carefully before beginning your installation planning.

If you would like to use any of the AMS1000 features or products (e.g., LUN Expansion, Cache Residency Manager), please contact your Hitachi Data Systems account team to obtain the appropriate 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 AMS1000 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 AMS1000 installations, contact your Hitachi Data Systems account team or the Hitachi Data Systems Support Center.

This chapter includes the following:

- User Responsibilities (see section 2.1)
- Safety Precautions (see section 2.2)
- General Specifications and Requirements (see section 2.3)
- Environmental Specifications and Requirements (see section 2.4)

This chapter provides information on the Fibre, NAS, and iSCSI models. The following table illustrates sections that provide explanations for each model.

- **Fibre model:** Connects disk array subsystem to a host computer with Fibre Channel interface.
- **NAS model:** Connects NAS Unit connected to disk array subsystem to a host computer with LAN interface.
- **iSCSI model:** Connects disk array subsystem to a host computer with iSCSI interface.

Sections		Fibre	NAS	iSCSI
2.1	User Responsibilities	○	○	○
2.2	2.2.1 Safety Precautions	○	○	○
	2.2.2 Repair, Modification, and Disassembly	○	○	○
	2.2.3 Precautions for Using the Equipment	○	○	○
	2.2.4 Precautions for Inspection and Cleaning	○	○	○
	2.2.5 Emergency Precautions	○	○	○
	2.2.6 Warning Notices	○	○	○
	2.2.7 Locations of Warning Labels on the Equipment	○	○	○
2.3	2.3.1 Dimensions and Weight	○	○	○
	2.3.2 Service Clearance Requirements	○	○	○
	2.3.3 Floor Load Rating	○	○	○
	2.3.4 Internal Logic Specifications	○	○	○
	2.3.5 Cable Function	○	○	○
2.4	2.4.1 Environmental Hazards	○	○	○
	2.4.2 Temperature and Humidity Requirements	○	○	○
	2.4.3 Input Power and Insulation Performance Specifications	○	○	○
	2.4.4 Air Flow Requirements	○	○	○
	2.4.5 Vibration and Shock Tolerances	○	○	○
	2.4.6 Reliability	○	○	○

○: An explanation is provided.

—: An explanation is not provided.

2.1 User Responsibilities

Before the AMS1000 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 AMS1000 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.
- This disk array is a **class 1 laser system** which does not emit a hazardous laser beam. Operate this subsystem using the instructions included in this guide; do not perform operations that are not specified. Otherwise, unexpected failures or accidents may result.

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 Warning Labels

The warning labels which appear on the subsystem and/or in this guide indicate potential safety hazards. When you see these symbols, observe the safety instructions that follow.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



Indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Figure 2-1 Warning Labels

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-Hydrate 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 Customer 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.
- When working on a machine which has a grounding terminal, verify that the terminal is properly connected to the facility's ground.

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 AMS1000 subsystem.
- Do not expose the battery to high temperatures.
- Use only the specified battery.

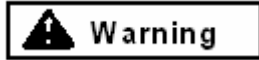
2.2.3.5 Nickel-Hydrate Rechargeable Battery Instructions

These instructions explain what you must observe when you use a nickel-hydrate 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:



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.



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.
15. 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 contact with 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 Customer Engineer.

2.2.4 Precautions for Inspecting 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

- Within the Subsystem:
 - 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.
- Outside the Subsystem:
 - If safely possible, follow shut down steps in Chapter 3 according to model type.

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 (see Table 2.1).

Table 2.1 Caution Statements

Warning Statement	Page
Cooling fans rotate at a high speed. Keep body parts and loose clothing away from the cooling fans.	14
When cleaning, take care not to touch electrically charged parts. Electric shock may result.	14, 15
Do not touch electrically charged components during parts replacement. Electric shock may result.	15



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:

- Rack-Mount Model RKH/RKHE
- Rack-Mount Model RKAJAT

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

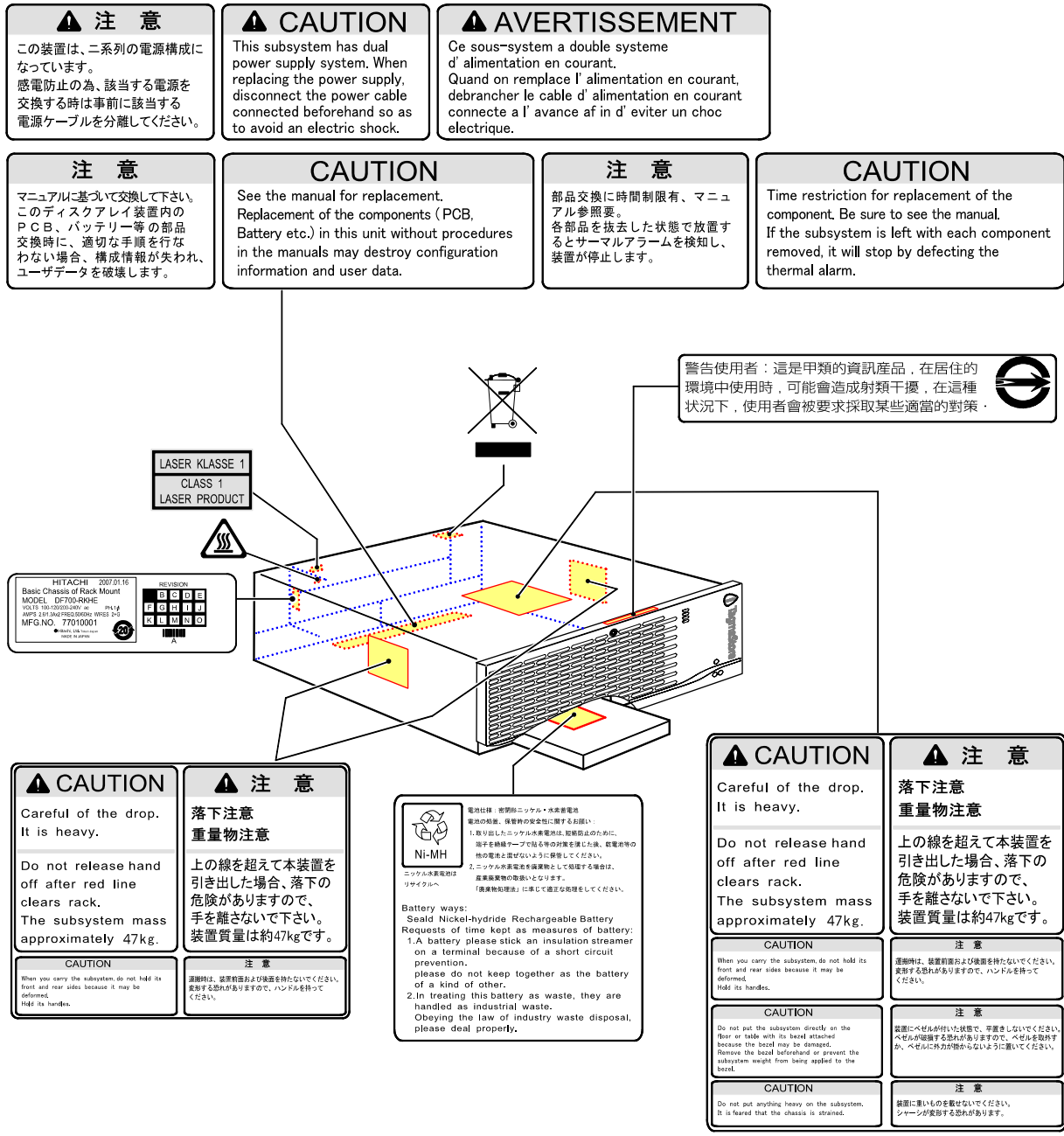


Figure 2-2 Positions and Contents of Labels on Rack-Mount Model RKH/RKHE

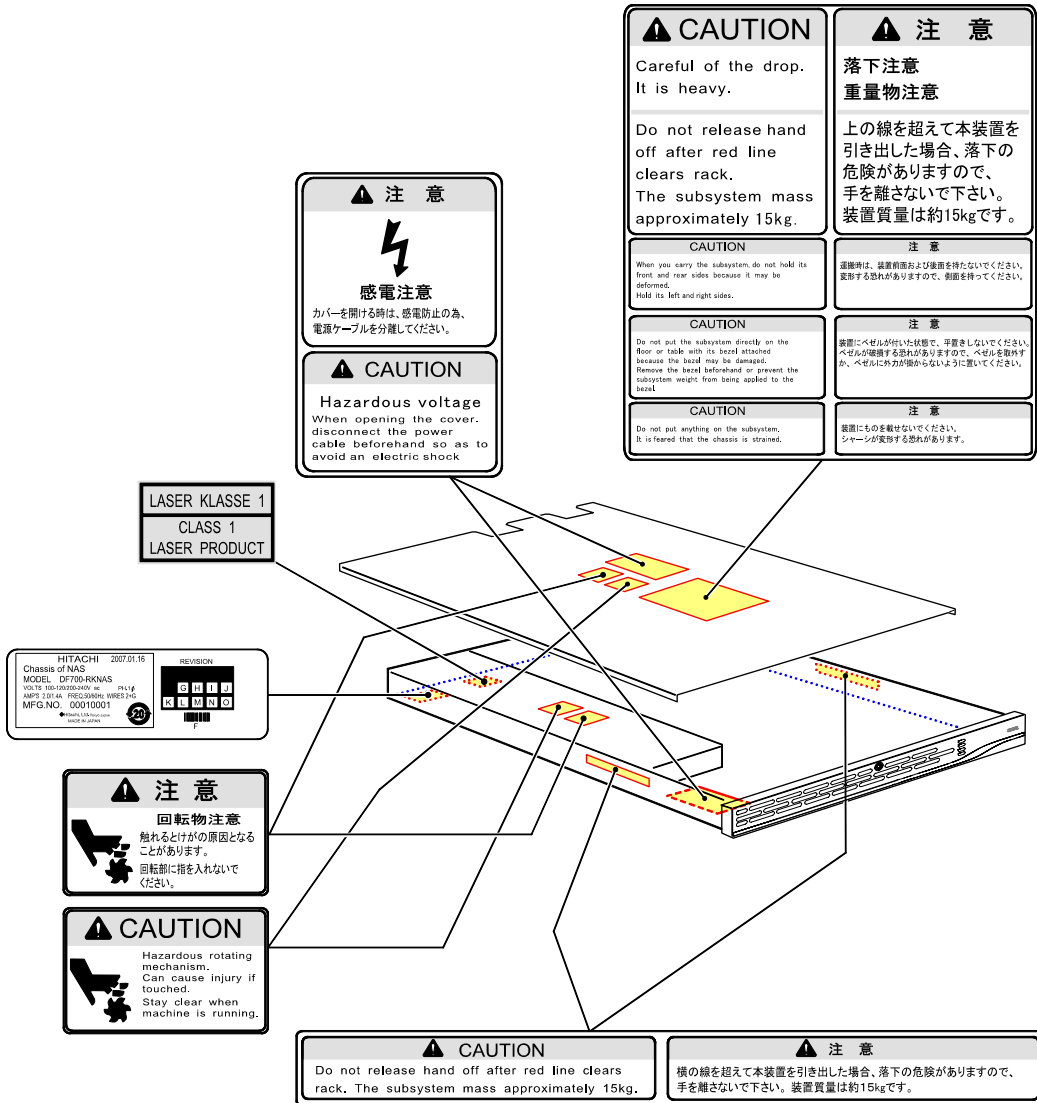


Figure 2-3 Positions and Contents of Labels on Rack-Mount Model RKNAS

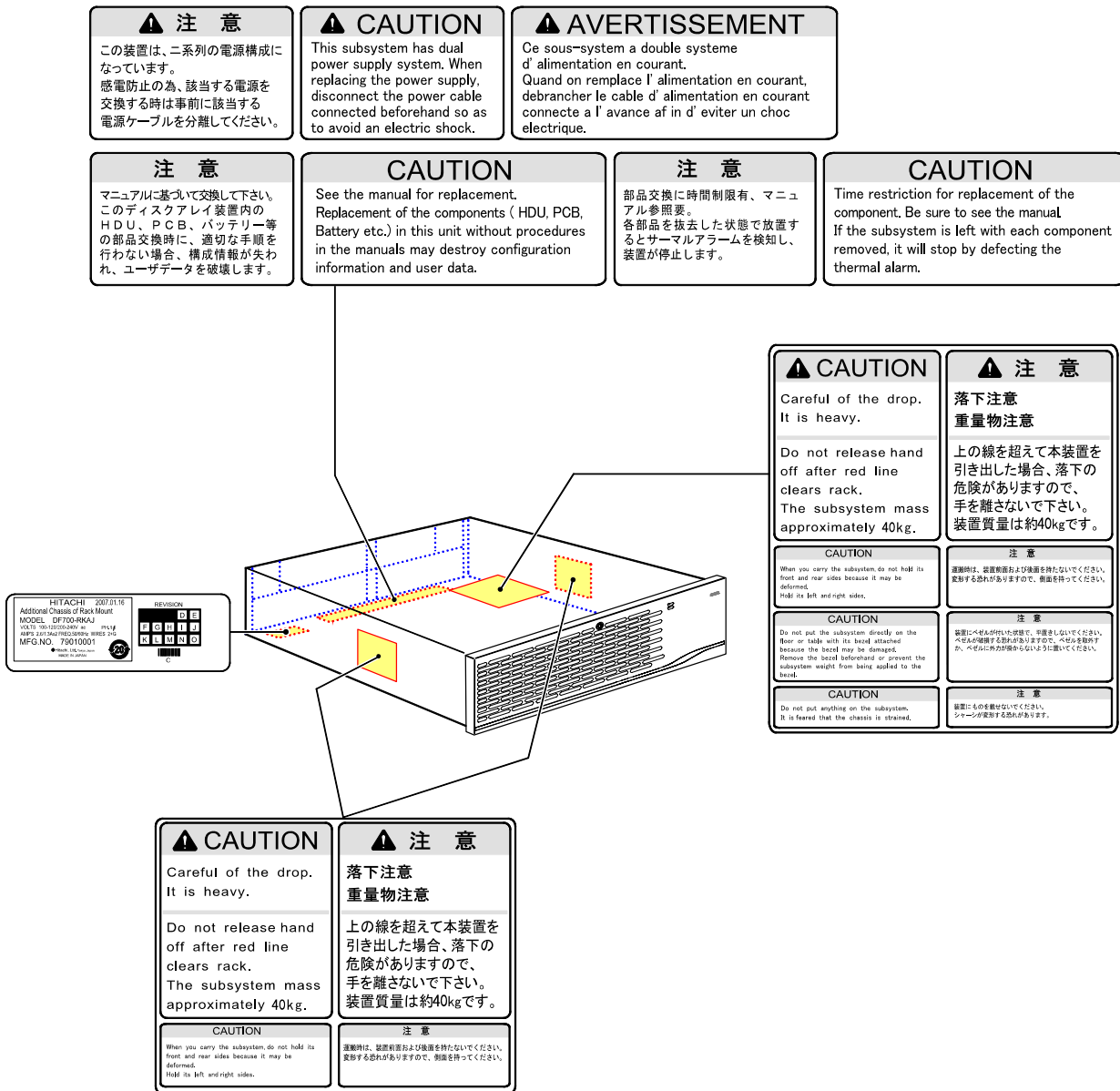


Figure 2-4 Positions and Contents of Labels on Rack-Mount Model RKAJ

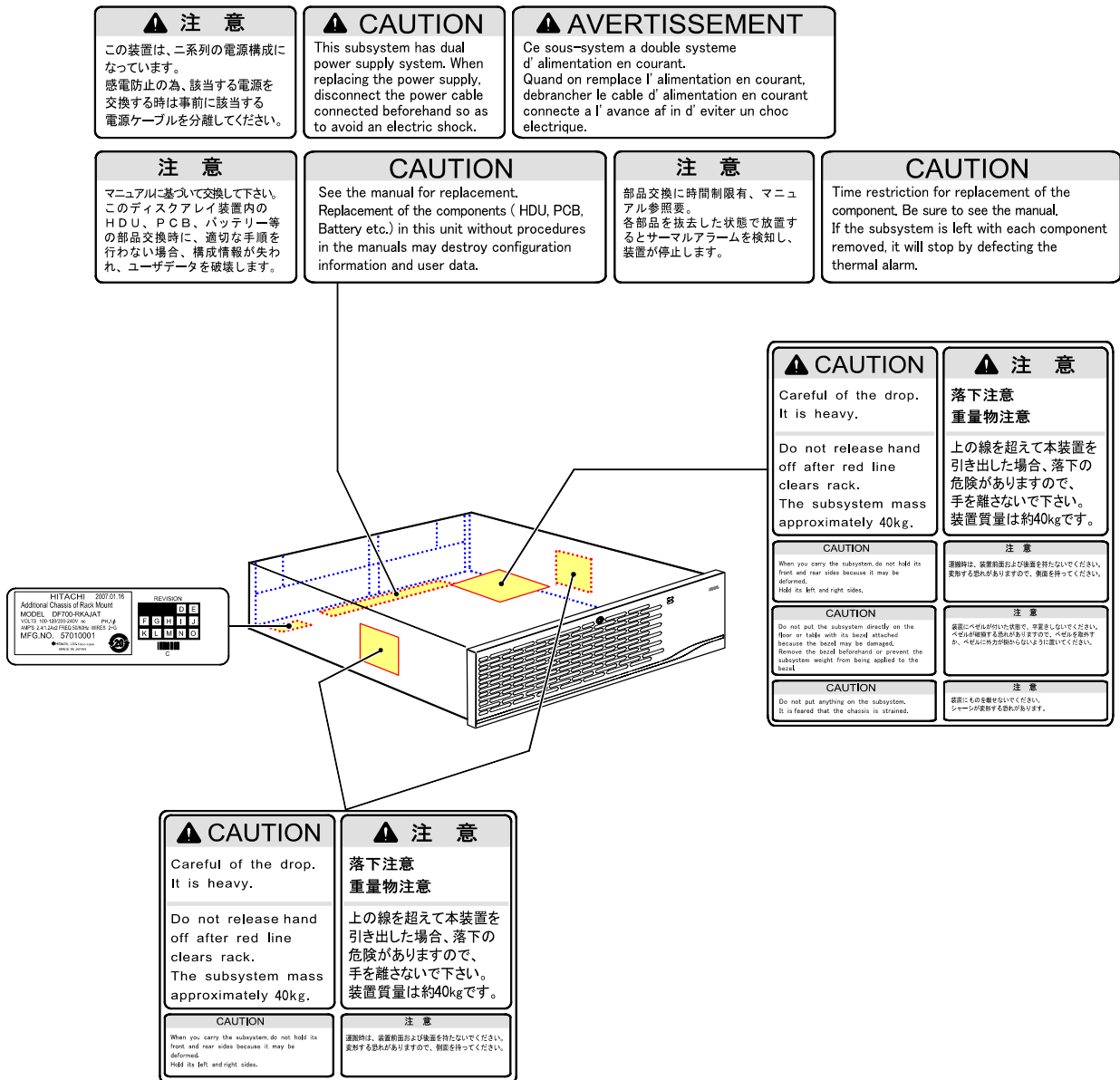


Figure 2-5 Positions and Contents of Labels on Rack-Mount Model RKAJAT

2.3 General Specifications and Requirements

This section describes the general specifications and requirements for the AMS1000 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

Table 2.3 and Table 2.4 illustrate the dimensions and weight of the AMS1000 rack-mount model.

Table 2.3 AMS1000 Dimensions and Weight of Rack-Mount Model

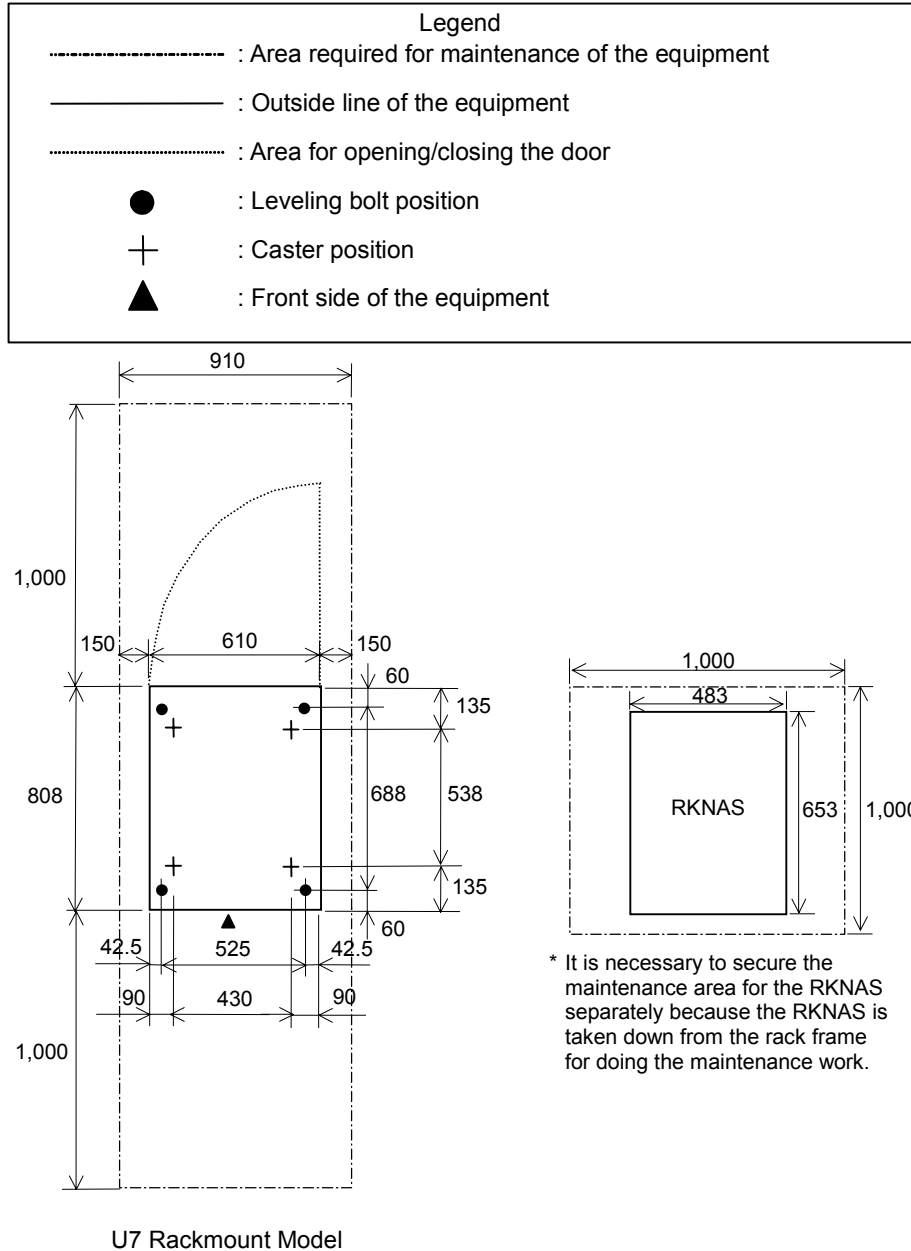
Item		Rack-Mount Model		
		RKH/RKHE	RKAJ	RKAJAT
Physical Specifications	Chassis size (W×D×H) (mm)	483×650×174	483×650×129	
	Mass (kg)	47 approx	40 approx	
	Acoustic noise (dB)	57 approx	60 approx	
	Required height (EIA unit)	4	3	

Table 2.4 AMS1000 Dimensions and Weight of NAS Unit

Item		RKNAS
Physical Specifications	Chassis size (W×D×H) (mm)	483×650×43
	Mass (kg)	15 approx
	Acoustic noise (dB)	60 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).



* It is necessary to secure the maintenance area for the RKNAS separately because the RKNAS is taken down from the rack frame for doing the maintenance work.

Figure 2-6 Floor Area Required for Installing Equipment

2.3.3 Floor Load Rating

This section includes:

- Floor Load Rating for the AMS1000 Rack-Mount Model

2.3.3.1 Floor Load Rating for AMS1000 Rack-Mount Model

In the maximum configuration, the rack-mount model can be configured with 1 RKH/RKHE and 30 additional units (RKAJs/RKAJATs and RKNAS). The total weight of the subsystem in this configuration is 1,940 kg.

Note: For information about the global rack-mount model, refer to the *Hitachi Data Systems Global 19-Inch Rack Reference Guide (MK-93DF772)*.

2.3.4 Internal Logic Specifications

Table 2.5 lists the internal logic specifications of the AMS1000.

Table 2.5 Internal Logic Specification of the AMS1000 Rack-Mount Model

Item		Specification (Notes)		
		RKH	RKHE	RKNAS
Internal logic	Control CPU	Power PC7447A (1.4 GHz)	Power PC7448 (1.7 GHz)	Intel LV-Xeon 2.8GHz
Specification	Control memory	Flash memory: 16 M bytes L2 cache memory: 512 k bytes SDRAM: 1 G bytes	Flash memory: 16 M bytes L2 cache memory: 1 M bytes SDRAM: 1 G bytes	Bios: 1 M bytes L2 cache memory: 1M bytes
	Data assurance method	Data bus: Parity Cache memory: ECC (1 bit for correction, 2 bits for detection) Disk drive: Data assurance code		Data bus: Through-parity Cache memory: ECC (1 bit for correction, 2 bits for detection)

Notes:

- RKAJ/RKAJAT is not included in these specifications.
- For information about the global rack-mount model, refer to the *Hitachi Data Systems Global 19-Inch Rack Reference Guide (MK-93DF772)*.

2.3.5 Cable Functions

Table 2.6 lists the principal functions of the AMS1000 and RKNAS cables. Fibre channel cables are available from Hitachi Data Systems.

Table 2.6 Principal Functions of AMS1000 Cables

Cable	Principal Use
Fibre Channel cable	Connect with a host or HBA/Switch.
LAN cable (Cross/ Straight)	Connect the PCs for user, monitoring and maintenance. Connect with a host or a HBA/Switch for Ethernet. (When iSCSI interface and RKNAS are connected) Connect between RKH/RKHE and RKNAS for maintenance management. (When RKNAS is connected)
ENC (ENCLOSURE) cable	Connect between the subsystems with Fibre Channel (FC_AL).
NAS interface cable	Connect between RKH/RKHE and RKNAS for NAS control. (When RKNAS is connected)

2.4 Environmental Specifications and Requirements

To maintain optimal AMS1000 performance, the AMS1000 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

Note: Do not store or install the equipment in a high temperature environment of 40 degrees centigrade or more; battery life will be shortened.

2.4.2 Temperature and Humidity Requirements

Table 2.7 lists the temperature and humidity requirements for the AMS1000 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 AMS1000 rack-mount models.

Conductors shall be provided with 30 A over current protection in accordance with Article 240 of the National Electrical Code, ANSI/NFPA 70, and the Canadian Electrical Code, Part 1, CSA C22.1, Section 14.

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

Item		Rack-Mount Model		
		RKH/RKHE	RKAJ	RKAJAT
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) (Note1) (Note2)	2.6×2/1.3×2	2.6×2/1.3×2	2.4×2/1.2×2
	Breaking current (A)	12.5	10.0	
	Required power (Note3)	Steady state (VA)	520 or less	520 or less
Starting state (VA)		520 or less	560 or less	480 or less
Heat value (kJ/h)		1,875 or less	1,875 or less	1,730 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: The power current of Nx2 described above is required for operation by a single power supply unit.

Note2: The power supplies are “Auto-Sensing”.

Note3: The correct power factor for the AMS1000 is “0.93 - 0.96”. The manual incorrectly states the value as “1”.

Table 2.9 Input Power and Insulation Performance Specifications for the NAS Unit

Item		RKNAS
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)	2.0/1.4
	Breaking current (A)	10.0
	Required power (Note)	Steady state (VA)
Starting state (VA)		280 or less
Heat value (kJ/h)		1,010 or less
Insulation performance	Insulation withstand voltage	AC 15,00V (10 mA, 1 min)
	Insulation resistance	DC 500V, 10 M Ω or more

Note: The correct power factor for the RKNAS is “0.70 - 0.90”. The manual incorrectly states the value as “1”.

2.4.4 Air Flow Requirements

The AMS1000 subsystem is air-cooled. Air must enter the subsystem through the airflow intakes at the front of each subsystem and must be exhausted out of the back.

2.4.5 Vibration and Shock Tolerances

Table 2.10 lists the vibration and shock tolerance data for the AMS1000 subsystem. The AMS1000 can tolerate vibration and shock within these limits and continue to perform normally. The user should consider these requirements if installing the AMS1000 near large generators located on the floor above or below the AMS1000 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 (5 to 300Hz)
	In non-operation (m/s ²)	5.0 or less (5 to 300Hz)
	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

AMS1000 reliability is described in the following tables.

The following reliability does not change even when the RKNAS is connected to the system.

Table 2.11 Reliability of AMS1000 Rack-Mount Model (RKH/RKHE/RKAJ)

Item		Rack-Mount Model	
		RKH/RKHE	RKAJ
Reliability	MTBDL (Mean Time Between Data Lost) (Note 1)	About 20 million hour or longer (in RAID 5 configuration) (Note 2) <ul style="list-style-type: none"> ▪ RAID 6 configuration $\frac{(\text{MTBF of the disk drive})^3}{n(n-1)(n-2) \times \text{Number of Parity group} \times \text{MTTR}^2}$ ▪ RAID 5 configuration $\frac{(\text{MTBF of the disk drive})^2}{n(n-1) \times \text{Number of Parity group} \times \text{MTTR}}$ ▪ RAID 0 configuration $\frac{\text{MTBF of the disk drive}}{n \times \text{Number of Parity group}}$ ▪ RAID 1 or RAID1+0 configuration $\frac{(\text{MTBF of the disk drive})^2}{n \times 1 \times \text{Number of Parity group} \times \text{MTTR}}$ MTTR: Mean Time To Repair n: Number of the mounted disk drive/Parity group	
	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)	

Note1: The value of the MTBDL is calculated in the following configuration: RAID 5:68 sp ((15D+1P)(4group+4(spare))). This value varies on user's system configuration.

Note2: Under the worst condition in the AMS1000 maximum configuration, the MTBDL is about 8 million hour (FC drive) or about 2 million hour (SATA drive).

Table 2.12 Reliability of AMS1000 Rack-Mount Model (RKH/RKHE/RKAJAT)

Item		Rack-Mount Model	
		RKH/RKHE	RKAJAT
Reliability	MTBDL (Mean Time Between Data Lost) (Note 1)	About 5 million hour or longer (in RAID 5 configuration) (Note 2) <ul style="list-style-type: none"> ▪ RAID 6 configuration $\frac{(\text{MTBF of the disk drive})^3}{n(n-1)(n-2) \times \text{Number of Parity group} \times \text{MTTR}^2}$ ▪ RAID 5 configuration $\frac{(\text{MTBF of the disk drive})^2}{n(n-1) \times \text{Number of Parity group} \times \text{MTTR}}$ ▪ RAID 1 or RAID1+0 configuration $\frac{(\text{MTBF of the disk drive})^2}{n \times 1 \times \text{Number of Parity group} \times \text{MTTR}}$ MTTR: Mean Time To Repair n: Number of the mounted disk drive/Parity group	
	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)	

Note1: The value of the MTBDL is calculated in the following configuration: RAID 5:68 sp ((15D+1P)(4group+4(spare))). This value varies on user's system configuration.

Note2: Under the worst condition in the AMS1000 maximum configuration, the MTBDL is about 8 million hour (FC drive) or about 2 million hour (SATA drive).

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 unless the WARNING or ALARM LED of the basic frame lights or blinks; you may use the subsystem.

This section describes power on/off procedures for the AMS1000 Rack-Mount (see section 3.1).

This chapter provides information on the Fibre, NAS, and iSCSI models. The following table illustrates sections that provide an explanation for each model:

- **Fibre model:** Connects disk array subsystem to a host computer with Fibre Channel interface.
- **NAS model:** Connects NAS Unit connected to disk array subsystem to a host computer with LAN interface.
- **iSCSI model:** Connects disk array subsystem to a host computer with iSCSI interface.

Sections		Fibre	NAS	iSCSI
3.1	3.1.1 Storage System Power On	○	○	○
	3.1.2 Storage System Power Off	○	○	○
	3.1.3 Stop/Start/Restart of the NAS OS	—	○	—

○: An explanation is provided.

—: An explanation is not provided.

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 unless the WARNING or ALARM LED of the basic frame lights or blinks; you may use the subsystem.

Notes:

- When the disk array subsystem is used as the remote side of TrueCopy Remote Replication/TrueCopy Extended Distance, restarting the subsystem will cause the following:
 - Both paths of TrueCopy Remote Replication/TrueCopy Extended Distance are blocked.
A notice regarding SNMP Agent Support Function and TRAP occurs in path blockade mode. Perform the functions in the notice and the check the Failure Monitoring Department in advance. Path blockade automatically recovers after restarting.
 - If the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance is PAIR or COPY, the pair status transmits to PSUE.

When the disk array subsystem must be restarted, transmit the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance to PSUS, and then restart the subsystem.

- If the array subsystem connected to the NAS Unit is restarted, the cluster between the NAS Units stops. When the array subsystem is unavoidably restarted, execute it after stopping the cluster between the NAS Units and stopping the NAS OS of both NAS Units. Start the cluster between the NAS Units again after completing the restart for the array subsystem.

3.1 AMS1000 Rack-Mount Model

The following steps describe power on/off procedures for the AMS1000 rack-mount model.

Note: For information about the global rack-mount model, refer to the *Hitachi Data Systems Global 19-Inch Rack Reference Guide (MK-93DF772)*.

3.1.1 Storage System 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 of the RKH/RKHE. However, it is not a problem if the EALM lamp (red) goes out during this period of time.

To power on the storage system:

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 is turned off.
4. When the RKNAS is mounted on the rack, verify that the AC Power Unit Switch of the power unit on the RKNAS is turned off.
5. Turn on the circuit breaker of the PDB.
6. Turn on the AC Power Unit Switch of the power unit on RKNAS.
7. Turn on the AC power unit switch of the power unit on RKAJ/RKAJAT.

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 (RKAJ/RKAJAT).

8. Turn on the AC power unit switch of the power unit on RKH/RKHE.
9. Turn on the main switch.

10. Verify that the READY LED (green) on the RKH/RKHE lights within five minutes. When the RKNAS is connected to the AMS1000, verify that the READY LED (green) on the RKNAS lights another three minutes later. If the READY LED (green) on the RKH/RKHE blinks at a high pace, it blinks for up to 15 minutes because the download of the ENC/SENC firmware is executed. Verify that the READY LED (green) on the RKH/RKHE lights in 40 to 60 minutes. Even when the READY LED (green) on the RKH/RKHE blinks at high speed, the subsystem is operational. If the ALARM LED (red) or WARNING LED (orange) lights or blinks slowly, refer to section 8.1.

Notes:

- The EALM lamp (red) of the controller (on the rear side of the subsystem) may come on between subsystem power-on and Ready status of the RKH/RKHE. However, it is not a problem if the EALM lamp (red) goes out during this period of time.
- A NAS system cannot be accessed from a host computer even though the READY LED of NAS unit illuminates. A NAS system accepts access from a host computer only in the "ACTIVE" NAS OS Condition.

3.1.2 Storage System Power Off

Note: If you stop the array storage system while the array storage system is used as the remote side of TrueCopy remote replication or TrueCopy Extended Distance, the following may occur:

- The paths of TrueCopy remote replication or TrueCopy Extended Distance are blocked.
 - The failure monitoring program (ASSIST-PC), the E-MAIL ASSIST function, notice of SNMP Agent Support Function, and the TRAP will occur at the time of the path block. Provide an advance check and notice to the Failure Monitoring. The path blockade will recover automatically after starting the array storage system.
 - When the pair status of TrueCopy remote replication or TrueCopy Extended Distance is PAIR or COPY, the pair status changes to PSUE.
 - When you stop the array storage system, change the pair status to PSUS, and then stop the array storage system.
1. Turn off the main switch.
 2. Verify that the POWER LED (green) on the panel of the RKH/RKHE is off.
 3. Turn off the AC power unit switch of the power unit.
 4. When the RKNAS is mounted on the rack, turn off the AC Power Unit Switch of the power unit on RKNAS.
 5. 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 Customer Engineer turn off the battery of the subsystem. For details on how to store the subsystem, refer to Chapter 9.

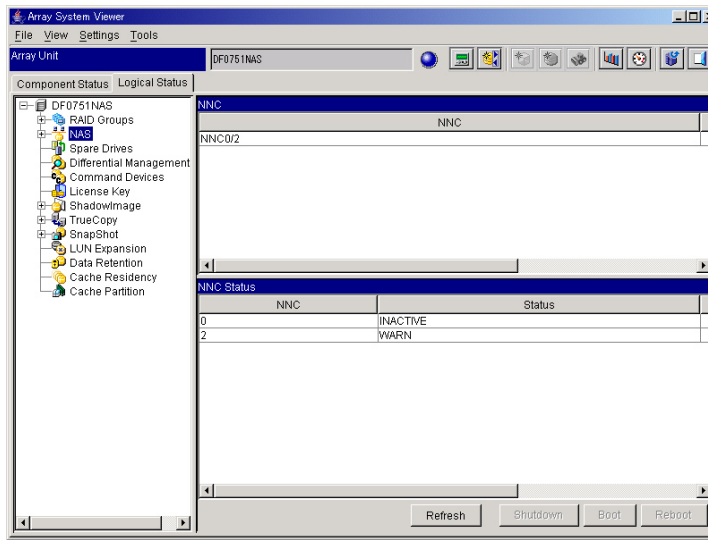
3.1.3 Restarting NAS OS

Stop/Start/Restart of the NAS OS and NNC (NAS unit) status display is performed using Storage Navigator Modular.

Note: In a mixed Fibre Channel and iSCSI interface configuration, if a stop/start/restart of the NAS OS is executed with the I/O load applied from the Fibre Channel/iSCSI interface, processing may terminate abnormally (time-out).

To stop / restart the NAS OS

1. Click the **Logical Status** tab on the Unit screen.
2. Click **NAS**.



- **NNC Status:** It displays the status of NAS OS.

Image	Status	Stop	Start	Restart
NEW	The NAS OS is not installed.	–	–	–
INST	The NAS OS is in installation process.	–	–	–
ACTIVE	The NAS OS is in operation and the Node is in operation.	○ (Note 2)	○	○
STOP (Note 4)	The NAS OS is normally stopped	–	○	○
DOWN	The NAS OS is abnormally stopped	–	○	○
BOOT	The NAS OS is in start process.	○	–	○
SHUTDOWN	The NAS OS is in stop process.	○	○	○
INACTIVE	The NAS OS is in operation and the Node is stopped.	○	○	○
DUMP	A NAS Dump is being collected.	○	○	○
HUNGUP	The NAS OS is hung-up.	–	○	○
WARN	The NAS Manager is not installed, or the NAS OS is in operation and the status of the Node is unknown.	○	○	○

DISUSE	The Control Unit is blocked, so the NAS OS of the NNC concerned cannot be used. (Note 1)	–	–	–
--------	---	---	---	---

○: Operation enabled

–: Operation disabled (**Note3**)

Note 1: It is necessary to recover the blocked status of the Control Unit connected to the NAS Unit on the side where “DISUSE” displays.

Note 2: The NAS OS system can only be stopped when the status of both NAS units in the cluster is “ACTIVE”.

Note 3: The button of Storage Navigator Modular can be clicked, but processing is not executed.

Note4: When the "STOP" is displayed, the NAS OS has already stopped. However, the NAS unit takes 10 seconds after the "STOP" is displayed to be completely powered off. When you perform the operation after this, wait for 10 seconds after the "STOP" is displayed and perform the operation.

■ Button

Button Name	Operation
Shutdown	Put the NAS OS into the stop status.
Boot	Start the NAS OS.
Reboot	Restart the NAS OS which is in the stop status. The operation is not different from the “Boot” button.
Refresh	Update the display information to the latest information.

Note: When starting the NAS OS, do not specify anything for the Boot Option.

3.1.3.1 Stopping the NAS OS

Note: The NAS OS can be stopped only when the status of both NAS Units in the cluster is “ACTIVE.” When the NAS OS stop/start status of a NNC (NAS Unit) is “STOP” or “DOWN”, the NAS OS is already stopped.

Note: Before attempting to stop the NAS OS from Storage Navigator Modular at either of the following times, ensure that the cluster and the resource group are available (see details below).

- Immediately after the power supply of the array subsystem was started
- If the NAS cluster was started from NAS Manager Modular

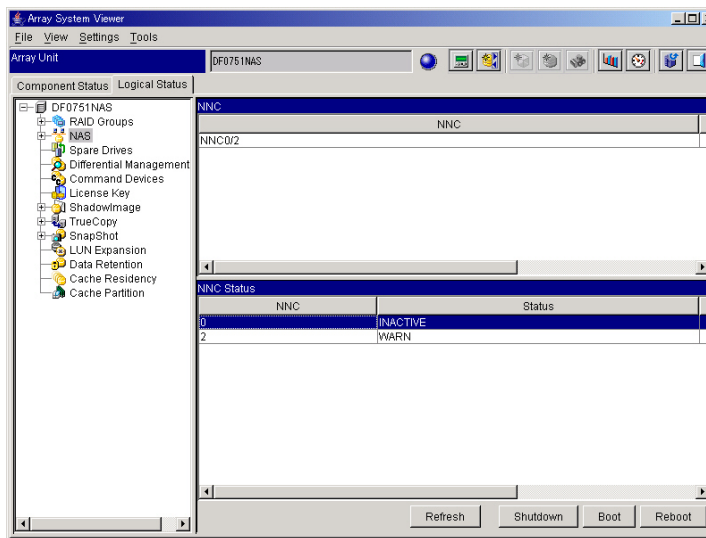
If the NAS OS is stopped at any time other than as described above, you may not be able to perform a subsequent cluster or resource group operation. For example, an attempt to stop a cluster from NAS Manager Modular may fail if the NAS Unit is not stopped. In this case, from Storage Navigator Modular, restart the NAS OS in the unit that is stopped.

Checking status of the cluster and resource group: The cluster and the resource group are available when the cluster status is “ACTIVE.” The resource group status can be either “Online” or “Offline”)

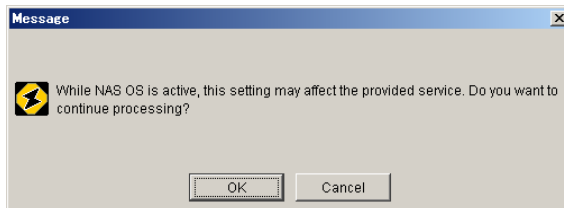
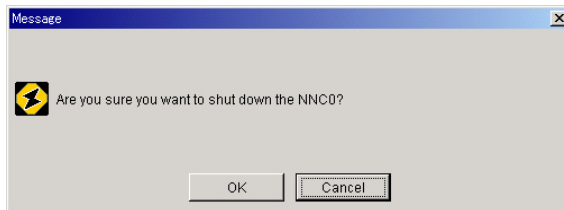
- Refer to the NAS Manager Modular User’s Guide “4.5.7 Viewing resource group status” for checking the status of the resource group.
- Refer to the NAS Manager Module User’s Guide “4.5.3 Viewing the status of a cluster and nodes” for checking the cluster status.

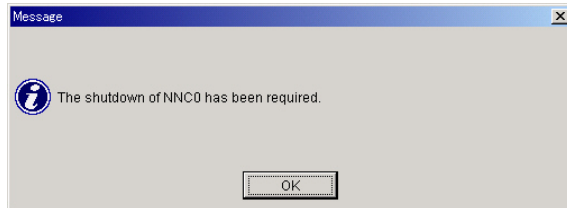
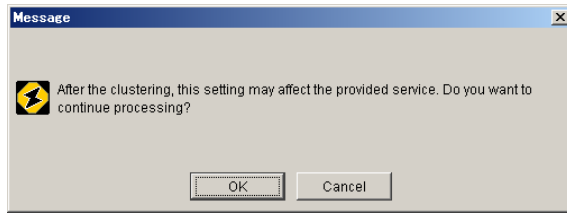
To stop the NAS OS:

1. Select NNC (NAS Unit) to stop the NAS OS from the NNC Status.



2. Click **Shutdown** at the lower right corner of the window.
3. A confirmation message displays. Click **OK**.



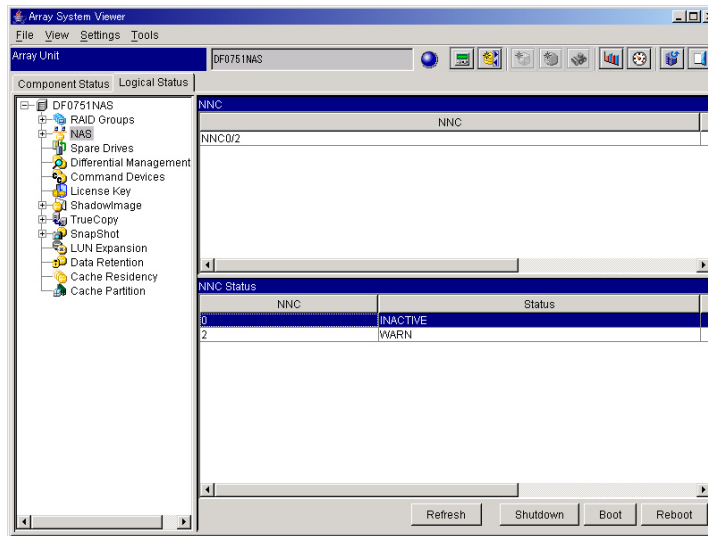


4. Check that **Status** of the NNC (NAS Unit) which stopped the NAS OS is “STOP”.

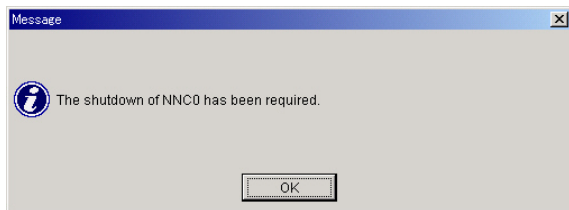
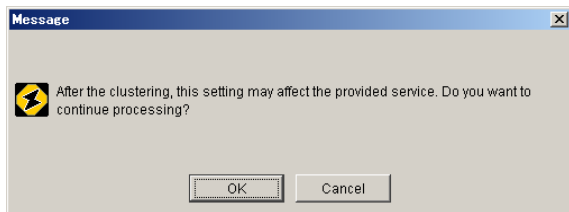
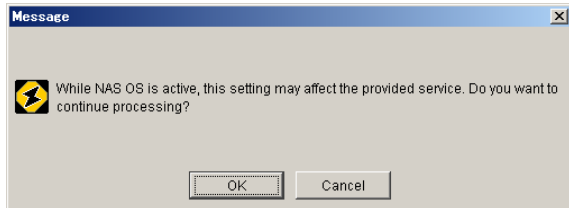
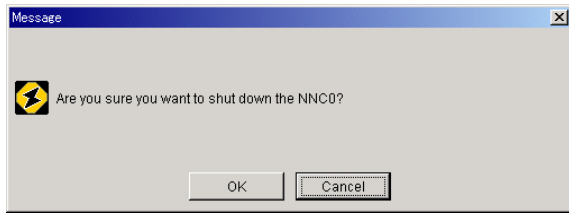
3.1.3.2 Starting the NAS OS

Note: When the status of the NNC (NAS Unit) to start the NAS OS is “NEW”, it cannot start because the NAS OS is not installed. When “Status” is other than “NEW”, “STOP”, and “DOWN”, the NAS OS has already started.

1. Select the NNC (NAS Unit) to start the NAS OS from the **NNC Status**.



2. Click **Boot** at the lower right of the window.
3. The start option setting window displays. Click **OK**.



4. A confirmation message displays. Click **OK**.
5. Verify that **Status** of the NNC (NAS Unit) which started the NAS OS is "INACTIVE" or "ACTIVE".

A NAS system accepts access from a host computer only in the "ACTIVE" NAS OS Condition (Refer to section 3.1.3).

3.1.3.3 Restarting the OS

Note: When the status of the NNC (NAS Unit) to restart the NAS OS is "STOP" or "DOWN", the NAS OS has already stopped. Please execute it according to Starting the NAS OS.

Note: When restarting the NAS OS from Storage Navigator Modular at either of the following times, ensure that the cluster and the resource group are available (see details below).

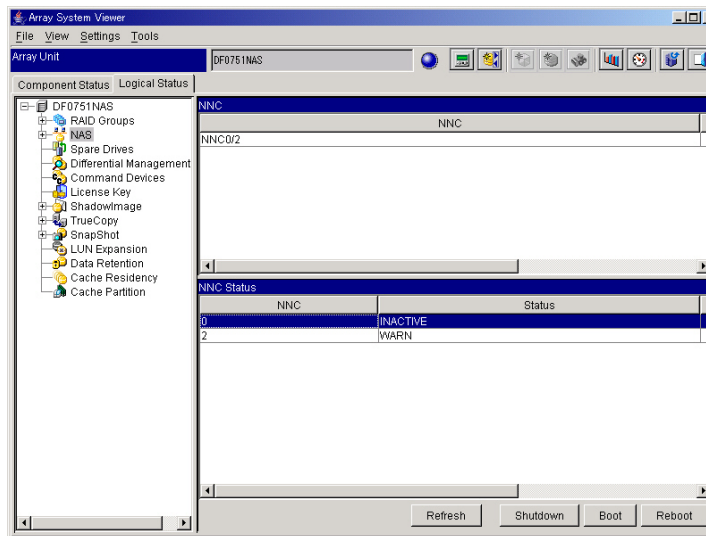
- Immediately after the power supply of the array subsystem was started
- If the NAS cluster was started from NAS Manager Modular

If the NAS OS is restarted at any time other than as described above, you may not be able to perform a subsequent cluster or resource group operation. For example, an attempt to stop a cluster from NAS Manager Modular may fail if the NAS Unit is not started. In this case, from Storage Navigator Modular, restart the NAS OS in the unit that is not restarted.

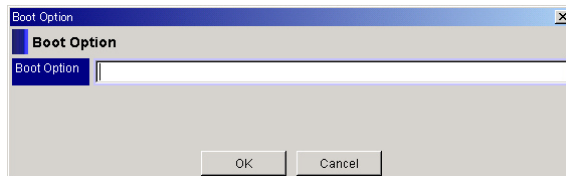
Checking status of the cluster and resource group: The cluster and the resource group are available when the cluster status is “ACTIVE.” The resource group status can be either “Online” or “Offline”).

- Refer to the NAS Manager Modular User’s Guide “4.5.7 Viewing resource group status” for checking the status of the resource group.
- Refer to the NAS Manager Module User’s Guide “4.5.3 Viewing the status of a cluster and nodes” for checking the cluster status.

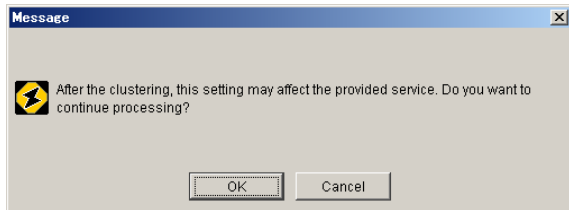
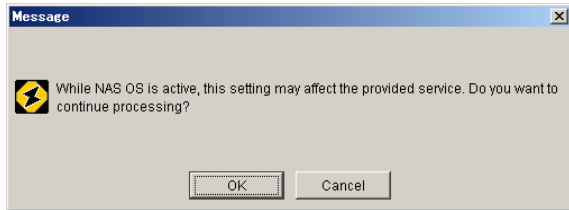
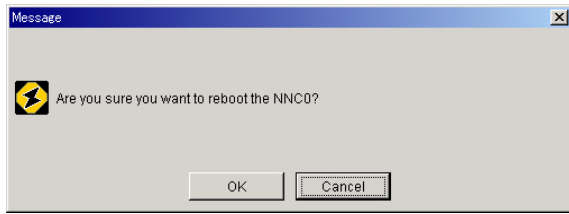
1. Select the NNC (NAS Unit) to restart the NAS OS from the **NNC Status**.



2. Click **Reboot** at the lower right of the window.
3. The start option setting window displays. Click **OK**.



4. A confirmation message displays. Click **OK**.



5. Verify that the Status of the NNC (NAS Unit) which restarted the NAS OS is "INACTIVE" or "ACTIVE".

A NAS system accepts access from a host computer only in the "ACTIVE" NAS OS Condition (Refer to section 3.1.3).

Chapter 4 Storage System Architecture and Components

This chapter includes the following:

- Configuration Block Diagrams (see section .4.1)
- Redundant Power Supplies (see section .4.2)
- Fibre Channel Interface (see section .4.3)
- NAS Interface (see section .4.4)
- iSCSI Interface (see section .4.5)
- Array Frames (see section .4.6)
- Component Names, Locations, and Functions (see section .4.7)

This chapter provides information on the Fibre, NAS, and iSCSI models. The following table illustrates sections that provide an explanation for each model.

- **Fibre model:** Connects disk array subsystem to a host computer with Fibre Channel interface.
- **NAS model:** Connects NAS Unit connected to disk array subsystem to a host computer with LAN interface.
- **iSCSI model:** Connects disk array subsystem to a host computer with iSCSI interface.

Sections		Fibre	NAS	iSCSI
4.1	Configuration Block Diagram	○	○/–	○
	4.1.1 AMS1000 Rack-Mount Model	○	–	○
4.2	Redundant Power Supplies	○	○	○
4.3	Fibre Channel Interface	○	–	–
4.4	NAS Interface	–	○	–
4.5	iSCSI Interface	–	–	○
4.6	4.6.1 AMS1000 Rack-Mount Model	○	○	○
4.7	Component Names, Locations, and Functions	○	○	○
	4.6.1 Front Bezel Component Locations and Functions			
	4.6.2 RKH/RKHE, RKAJ, and RKAJAT Component Locations	○	○	○
	4.6.3 Switch Locations and Functions	○	○	○
	4.6.4 Connector Locations and Functions	○	○	○
	4.6.5 LED Locations and Functions	○	○	○

○: An explanation is provided.

–: An explanation is not provided.

4.1 Configuration Block Diagrams

This section includes the block diagrams for the AMS1000 Rack-Mount Models.

4.1.1 AMS1000 Rack-Mount Model

The configuration block diagrams of the Rack-Mount models are shown below. The RKA/RKAJAT can mount up to 15 disk drives. (The RKH/RKHE has a controller that can control up to 450 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 30 spare disks can be mounted in any locations within the configuration.

- : Basic component and indispensable optional part
- : Option (additional) part

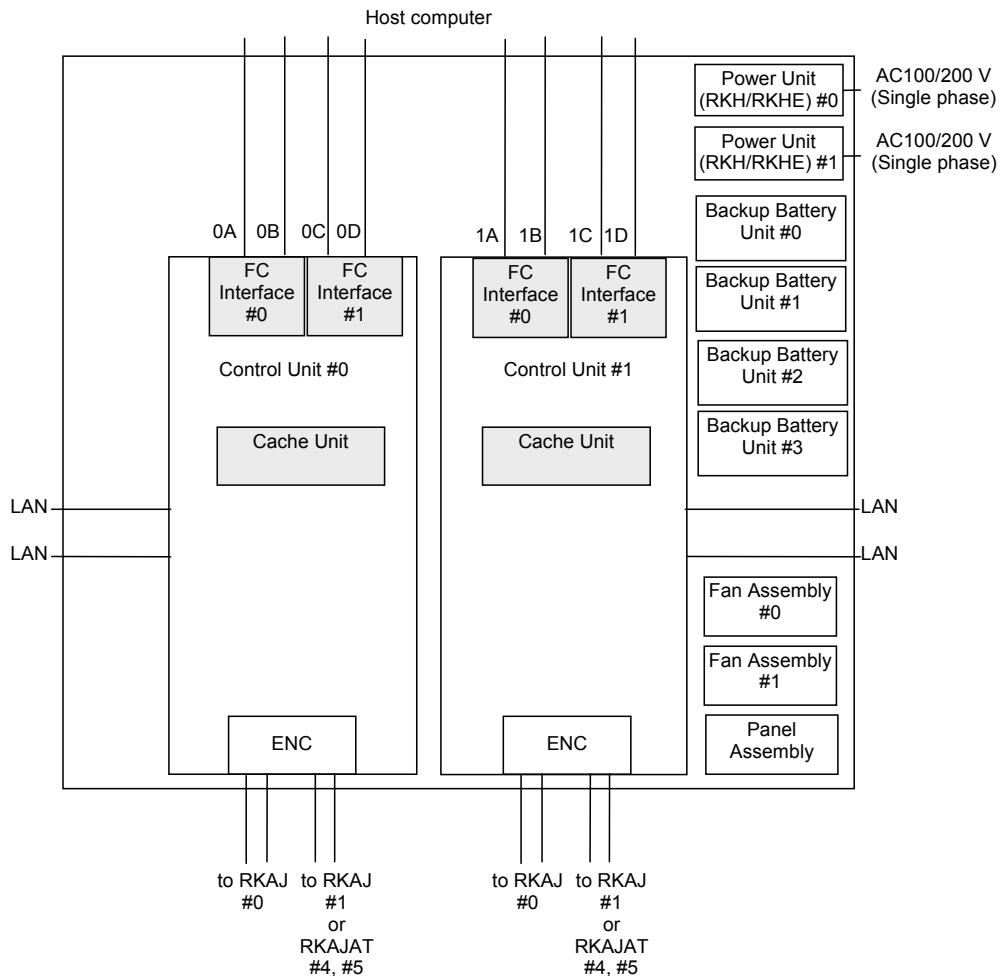


Figure 4-1 RKH/RKHE Unit System Configuration with Fibre Channel Interfaces

- : Basic component and indispensable optional part
- : Option (additional) part

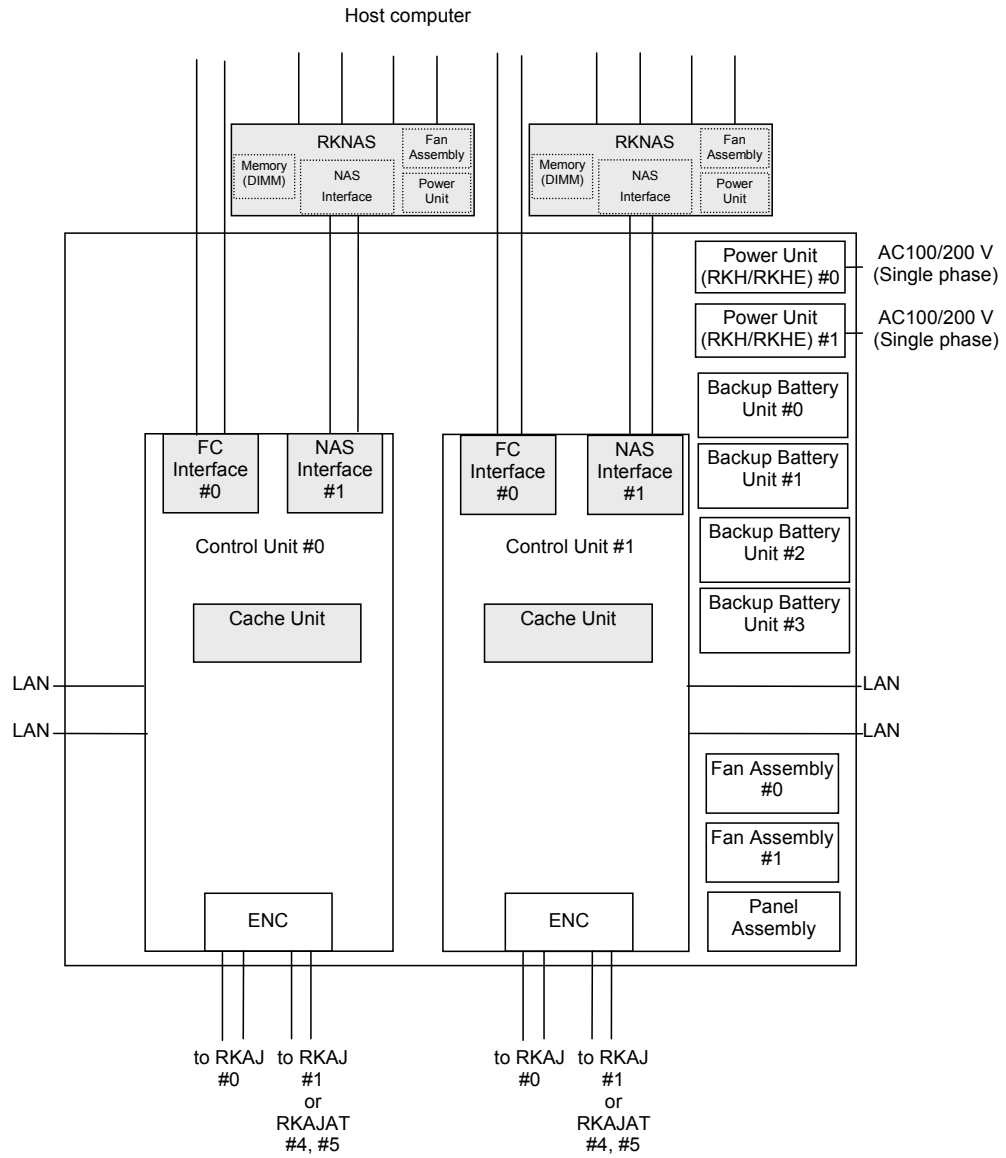


Figure 4-2 RKH/RKHE Unit System Configuration with NAS-Fibre Channel Interfaces

- : Basic component and indispensable optional part
- : Option (additional) part

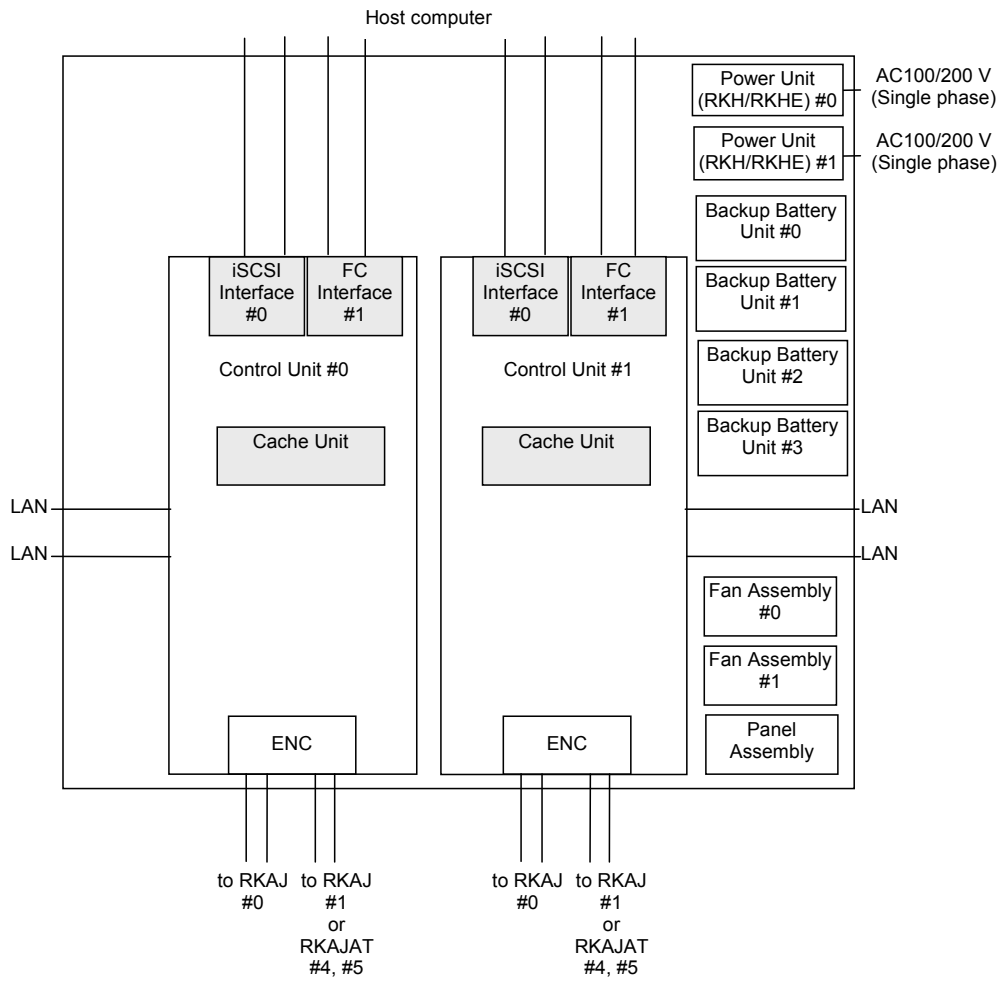


Figure 4-3 RKH/RKHE Unit System Configuration with iSCSI-Fibre Channel Interfaces

- : Basic component and indispensable optional part
- : Option (additional) part

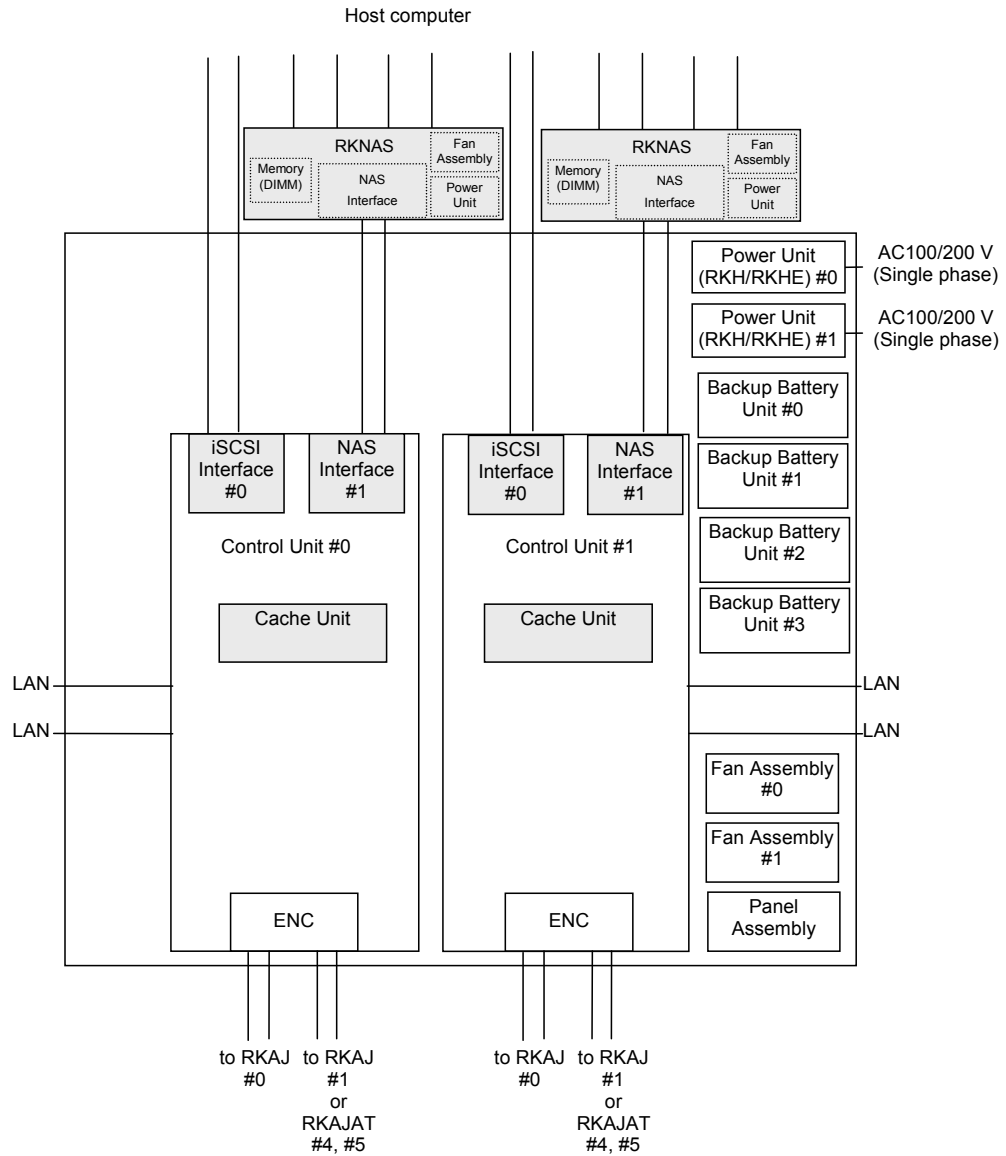


Figure 4-4 RKH/RKHE Unit System Configuration with iSCSI-NAS Channel Interfaces

- : Basic component and indispensable optional part
- : Option (additional) part

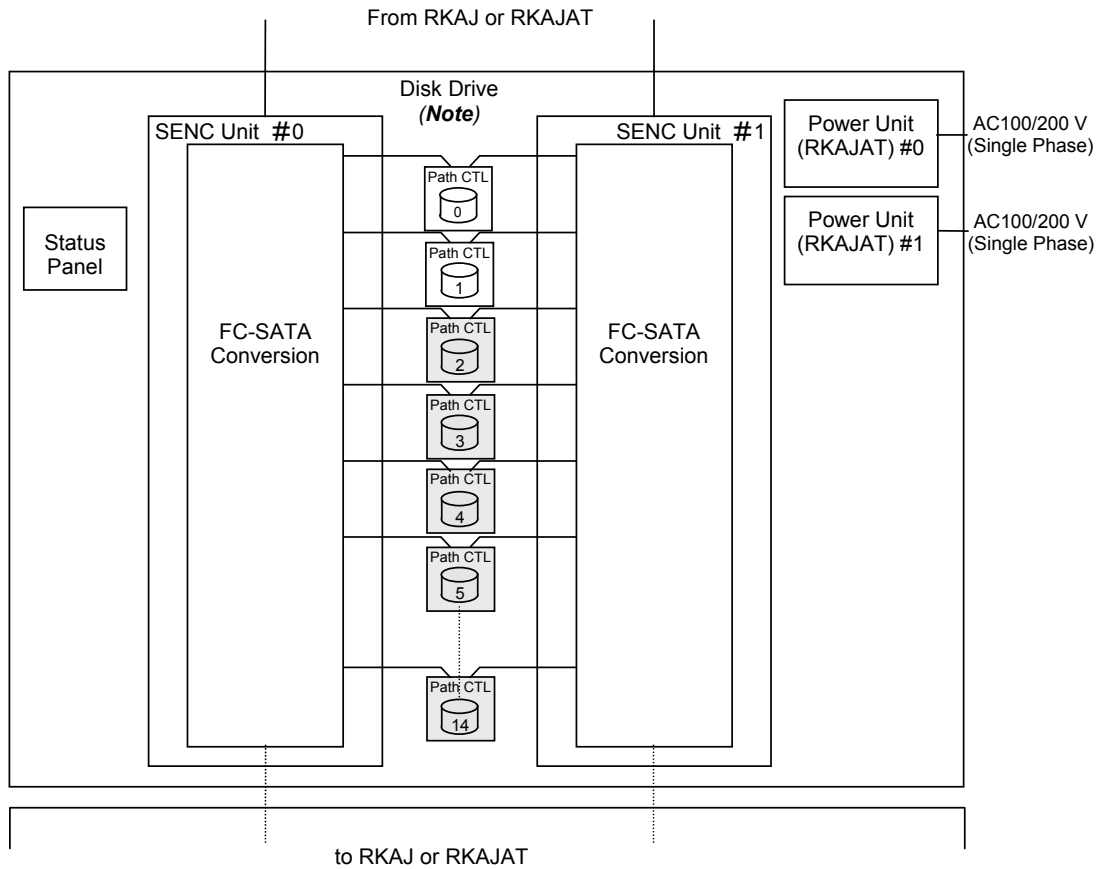


Figure 4-6 RKAJAT Unit System Configuration

Note: Disk drive: DF-F700-ATE250R, DF-F700-ATE400R, DF-F700-ATE500R, and DF-F700-ATE750R

4.2 Redundant Power Supplies

Each AMS1000 unit is powered by its own set of redundant power supplies, and each power supply is able to provide power for the entire RKH/RKHE or RKAJ unit, should it become necessary. Because of this redundancy, the AMS1000 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 AMS1000 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 AMS1000 subsystem can continue full operations using power from the alternate source.

RKNAS has no redundancy of power supplies.

4.3 Fibre Channel Interface

The AMS1000 subsystem supports open system operations. The AMS1000 subsystem supports up to 4 fibre-channel ports. The AMS1000 Fibre Channel interface is capable of operating at data transfer speeds of up to 400 MB/sec. The AMS1000 supports shortwave multimode optical cables. With these shortwave fibre channel cards, the AMS1000 subsystem can use 50/125 μm , 62.5/125 μm multimode Fibre Cable as defined in Table 4.1:

Table 4.1 Fibre Cable Length

Data transfer rate (MB/s)	100	200	400
Max 50/125 μm multimode Fibre Cable length	500 m	300 m	150 m
Max 62.5/125 μm multimode Fibre Cable length	300 m	150 m	70 m

Note: For additional information on the interface, see section D.1.

Note: Set the "Transfer Rate" of Fibre Channel to the value corresponding to the transfer rate of devices connected directly with an array subsystem according to the following table. When the AMS1000 is connected directly and externally with the TagmaStore Universal Storage Platform/TagmaStore Network Storage Controller, set the port transfer rate of both the TagmaStore Universal Storage Platform/TagmaStore Network Storage Controller and the AMS1000 to the fixed transfer rate (the same value for the TagmaStore Universal Storage Platform and the AMS1000 selecting any one of 1G bps, 2 Gbps, or 4 Gbps.).

Transfer Rate of Devices Connected with an Array Subsystem	Transfer Rate of an Array Subsystem
1G bps	1G bps
2G bps	2G bps
4G bps	4G bps
Auto (Maximum speed 4G bps)	4G bps
Auto (Maximum speed 2G bps)	2G bps
Auto (Maximum speed unknown)	Auto

Note: When connecting the AMS1000 directly and externally with the TagmaStore Universal Storage Platform/TagmaStore Network Storage controller, set the topologies of the both devices to "Loop".

4.4 NAS Interface

The AMS1000 provides up to 8 LAN ports and supports 1000 BASE-T for Gigabit LAN and 100 Mbps-BASE-TX. The AMS1000 supports transfer rates of 100 Mbytes/s and 10 Mbytes/s, and controls data transmission using the CSMA/CD method.

Note: See section D.2 *Ethernet Connection Specifications* for the supported conditions of switch and so on in this subsystem.

4.5 iSCSI Interface

The AMS1000 provides 4 iSCSI ports by adding an optional iSCSI interface board. The iSCSI interface is capable of operating at data transfer speed of up to 100 M bytes/s. The AMS1000 supports Ethernet (1000Base-T). With the HBA for iSCSI, Generic NIC + Software initiator, and Network Switch, the AMS1000 subsystem can be located up to 100 meters.

- Connect the switch based on the 1000BASE-T(full-duplex). Use the LAN cable with the following types and shapes.
- Cable type: category 5e or category 6
- Connector shape: RJ-45

For the physical port of the switch to be connected directly with the host and the iSCSI port of the AMS1000, do not set the Spanning Tree protocol function to ON. It may cause interference to communications.

Note: For additional information on iSCSI interface, see Appendix D *Interfaces*.

4.5.1 Setting iSCSI Information

The following iSCSI information is set for iSCSI ports. When the iSCSI interface board is not added to the control unit, this information is not set for each host connector that connects the AMS1000 Fibre Channel.

- iSCSI Port IP address
- iSNS Server
- Adding target
- Target option

Unlike Fibre Channel, for iSCSI the host should log into the specified target of AMS1000. (Refer to the manuals for the HBA or iSCSI software initiator regarding how to specify and log into the target. In some initiators, the subsequent reconnection will be done automatically.)

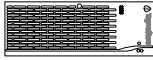
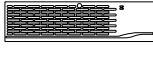
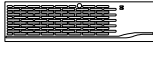
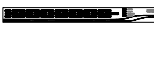
4.6 Array Frames

The following AMS1000 Rack-Mount Model array frames are described in this section.

4.6.1 AMS1000 Rack-Mount Model

Each RKAJ/RKAJAT 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 AMS1000 can be configured with 1 RKH/RKHE and up to 30 RKAJ units for a total of 450 disk drives at a maximum of 120.8 Tbytes RAID5(14D+1P) (using the 287.6 G disk drive). The AMS1000 can also be configured with 1 RKH/RKHE, 2 RKAJs, and up to 14 RKAJAT units for a total of 450 disk drives at a maximum of 297.1 Tbytes RAID5(14D+1P) (using the 287.6 G (RKAJ) and 737.4 G (RKAJAT) disk drives).

Table 4.2 Rack-Mount Model Basic Specifications

Item		Model	Rackmount Model			
			RKH/RKHE	RKAJ	RKAJAT	RKNAS
Configuration	Configuration		1 RKH/RKHE	1 RKAJ	1 RKAJAT	1 RKNAS
	System appearance					
Disk drive used	Disk drive size (W×D×H) (mm)		—	101.6×146.1×25.4		—
	Data capacity (G byte) (Note 1)		—	71.3/143.3/287.6	245.7/393.4/491.9/737.4	—
	Rotational speed (min ⁻¹)		—	10,000/15,000	7,200	—
	Maximum mountable quantity (unit)		—	15		—
Host interface	Interface type		4 G bps Fibre Channel Optical (Non-OFC) 1 Gbps iSCSI (Ethernet) (Note 2)	—		1Gbps Ethernet
	Data transfer speed (i.e. maximum speed for transfer to host)		400 M bytes/s (Fibre Channel) 100 M bytes/s (iSCSI) (Note 2)	—		100 Mbytes/s (Ethernet)
	Number of ports	Dual controller	Fibre Channel: 8 iSCSI: 4 (Note2)	—		8 (4 for 1RKNAS)
	Transferred block size (bytes)		512	—		

Note 1: The values of storage capacity are calculated as 1 G bytes = 1,000,000,000 bytes. This definition is different from (1 k bytes = 1,024 bytes) shown on your PC.

Note 2: This indicates the value when iSCSI interface board is added to the control unit.

Note: For information about the global rack-mount model, refer to the *Hitachi Data Systems Global 19-Inch Rack Reference Guide (MK-93DF772)*.

4.7 Component Names, Locations, and Functions

This section includes the following:

- Front Bezel Component Locations and Functions
- RKH/RKHE, RKAJ, and RKAJAT 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.

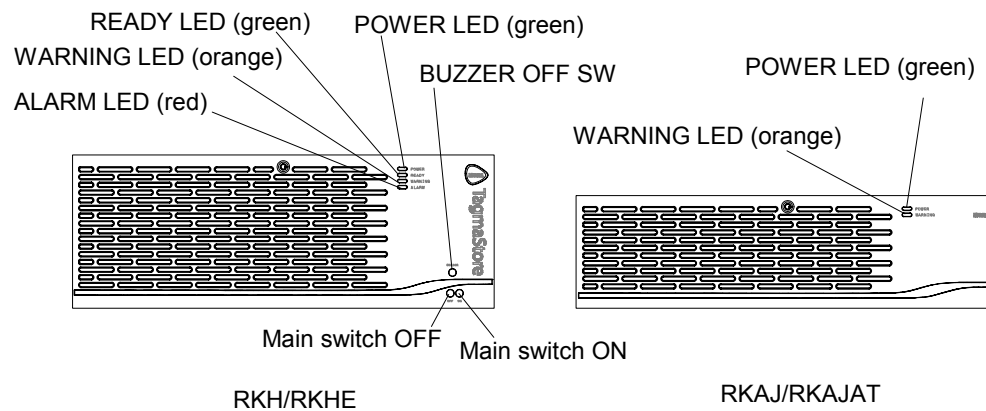
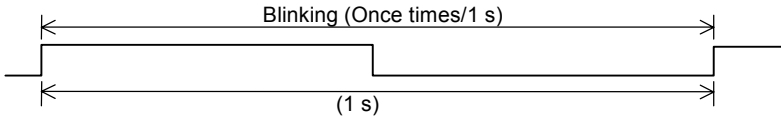


Figure 4-7 RKH/RKHE, RKAJ, and RKAJAT Front Bezel Component Locations

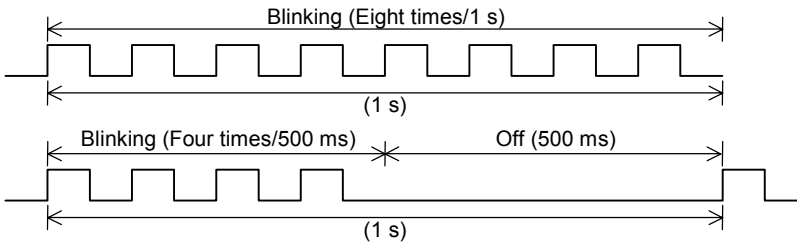
Table 4.3 RKH/RKHE, RKAJ, and RKAJAT Front Bezel Component Functions

Name	Function
ALARM LED (red)	Lighting Indicates that a failure has occurred which makes the subsystem inoperable. Blinking Low-speed blinking (Note 1): indicates that a serious failure has occurred while power on
WARNING LED (orange)	Lighting Indicates that a failure that allows the subsystem operation occurred. Blinking Low-speed blinking (Note 1): Indicates that a failure which does not stop operation occurred in unit (It must be deleted with WEB) High-speed blinking (Note 2): Indicates that a latest revision maintenance function of flash program is executed.
READY LED (green)	Lighting Indicates that the subsystem is operational Blinking High-speed blinking (Note 2): Indicates that the download of the ENC/SENC firmware is executed. (The READY LED (green) may blink for up to 15 minutes. Even if the READY LED (green) blinks, the subsystem is operational.) Low-speed blinking (Note 1): Indicates that the offline download processing ended. (It displays during the maintenance work.)
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.

Note 1: Low-speed blinking.



Note 2: High-speed blinking



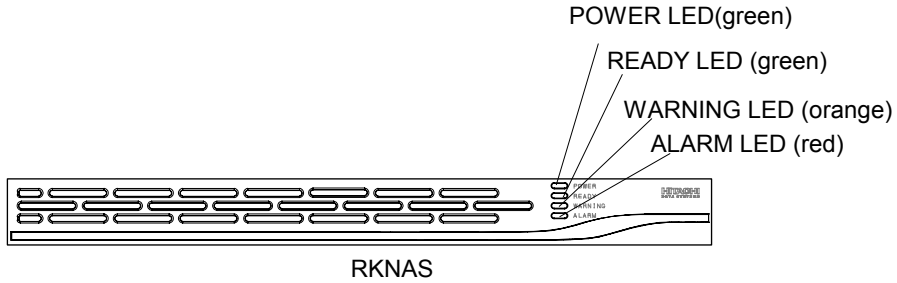


Figure 4-8 RKNAS Bezel Component Locations

Table 4.4 RKNAS Bezel Component Locations

Name	Function
ALARM LED (red)	Indicates that a failure has occurred which makes the RKNAS operable.
WARNING LED (orange)	Indicates that a failure occurred, but the RKNAS is currently operational.
READY LED (green)	Indicates that the RKNAS is operational (see Note)
POWER LED (green)	Indicates that the power is supplied to the RKNAS

Note: When the READY LED on the NAS Unit lights, the NAS unit cannot be accessed from a host computer. A NAS system accepts access from a host computer only in the "ACTIVE" NAS OS state. (Refer to section 3.1.3.)

4.7.2 RKH/RKHE and RKAJ and RKAJAT Component Locations

The locations of the RKH/RKHE, RKAJ, and RKAJAT components are shown in Figure 4-9.

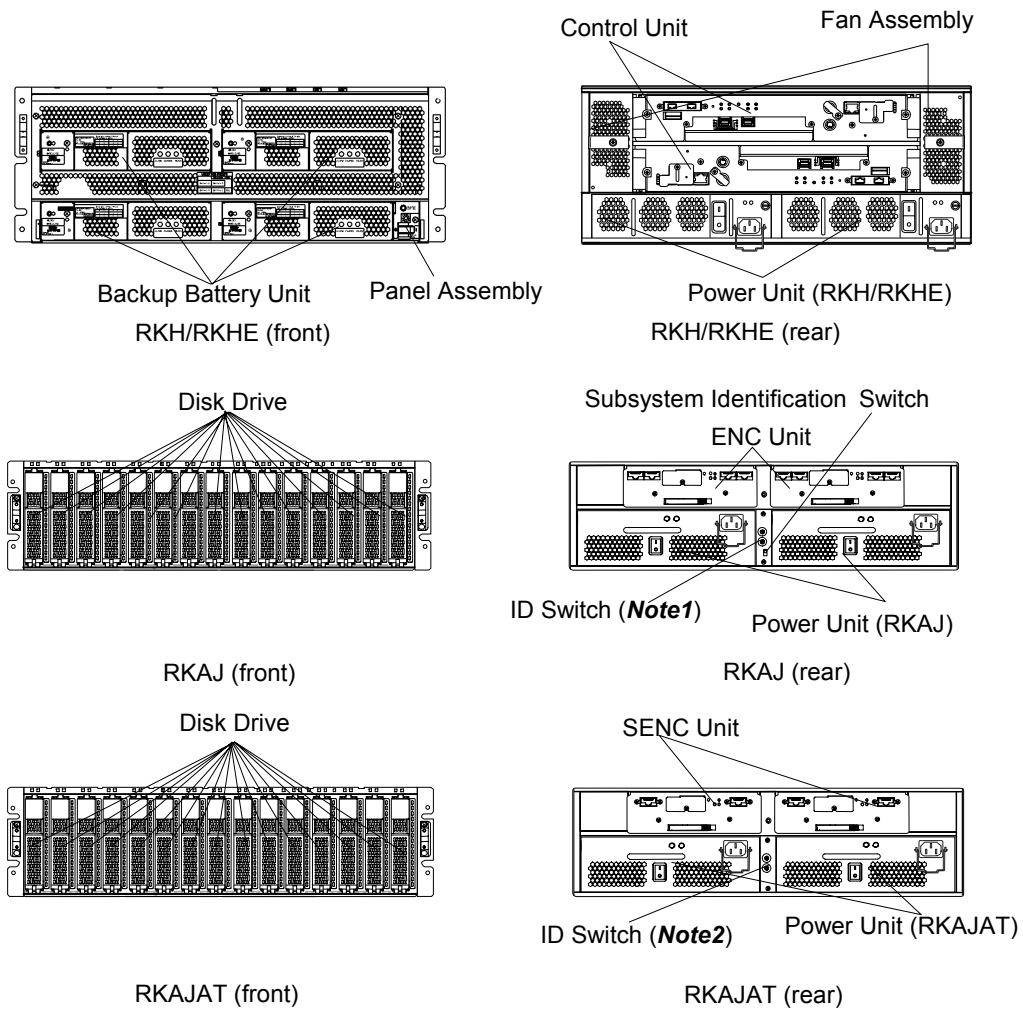


Figure 4-9 RKH/RKHE, RKAJ, and RKAJAT Component Locations

Note1: Sets the device ID of the RKAJ.

Note 2: Sets the device ID of the RKAJAT.

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
- Power Unit
- RKNAS

4.7.3.1 Panel Assembly

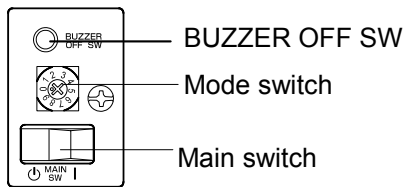


Figure 4-10 Panel Assembly Switch Location

Table 4.5 Panel Assembly Switch Functions

Switch	Function
Main switch	Turns on/off the power Power on ⏻ Power off
Mode switch	Sets the local/remote mode or USP connection by the combination of turning on and off of the four mode switches.
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 Power Unit (RKH/RKHE, RKJ/RKAJAT)

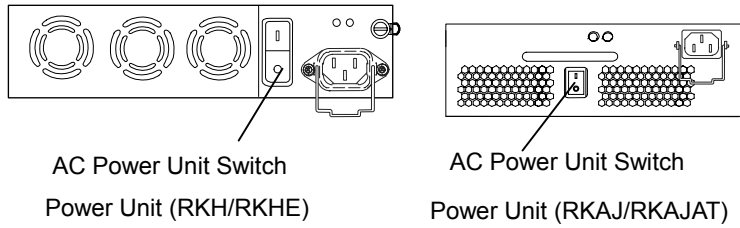


Figure 4-11 Power Unit Switch Locations

Table 4.6 Power Unit Switch Functions

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

4.7.3.3 RKNAS

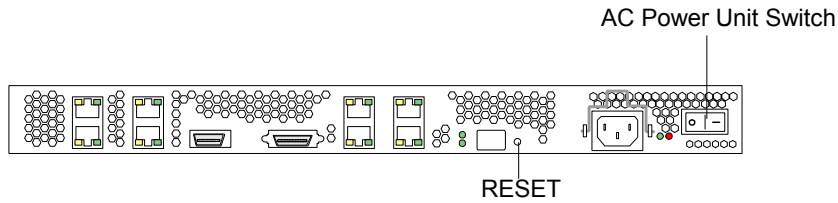


Figure 4-12 RKNAS Switch Locations

Table 4.7 RKNAS Switch Functions

Switch	Function
AC Power Unit Switch	Controls the power applied to the RKNAS
RESET	Is used to reset the RKNAS.

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
- RKNAS

4.7.4.1 ENC Unit

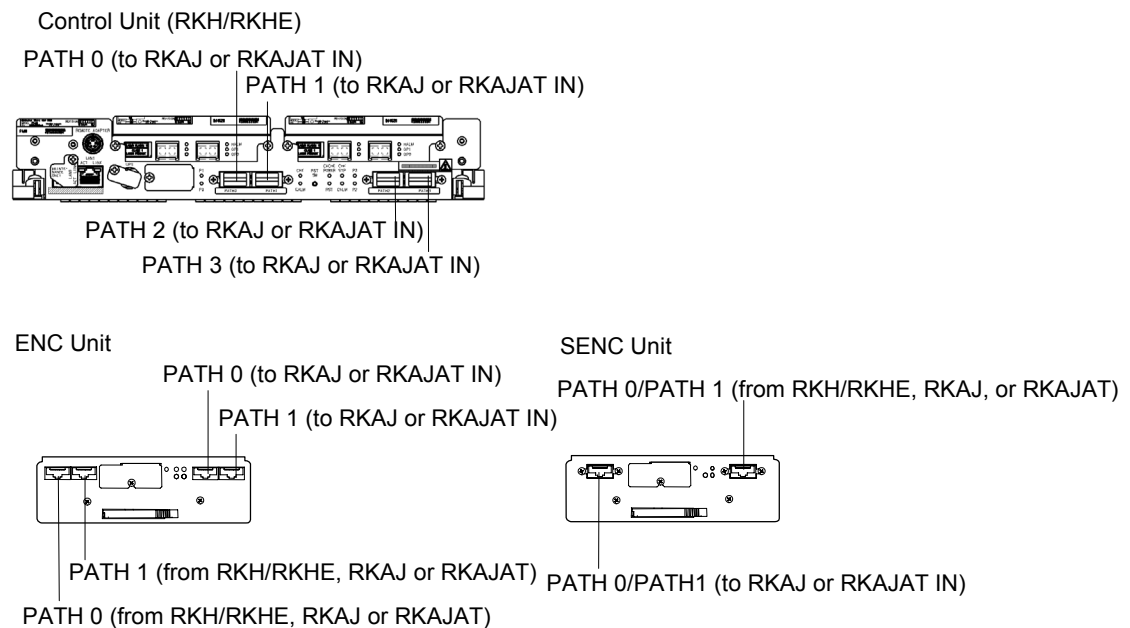


Figure 4-13 Connector Locations for ENC Unit

Table 4.8 Connector Functions for ENC Unit

Connector	Function
LOOP 0	Connection connector for RKAJ Unit ID = 0n (n=0,1,2....E) Connection connector for RKAJAT Unit ID = 2n (n=0,1,2....E)
LOOP 1	Connection connector for RKAJ Unit ID =0n (n=0,1,2....E) Connection connector for RKAJAT Unit ID =3n (n=0,1,2....E)
LOOP 2	Connection connector for RKAJ Unit ID = 1n (n=0,1,2....E) Connection connector for RKAJAT Unit ID = 4n (n=0,1,2....E)
LOOP 3	Connection connector for RKAJ Unit ID =1n (n=0,1,2....E) Connection connector for RKAJAT Unit ID =5n (n=0,1,2....E)

4.7.4.2 Power Unit

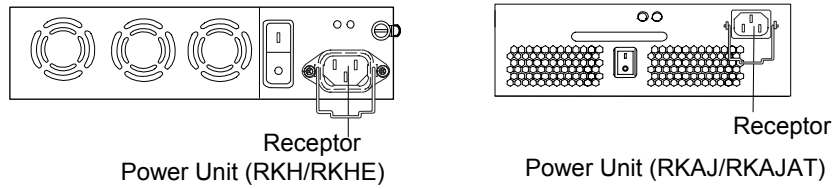


Figure 4-14 Connector Locations for Power Unit

Table 4.9 Connector Functions for Power Unit

Connector	Function
Receptor	Power cable receptacle on the unit side

4.7.4.3 Control Unit

Control Unit

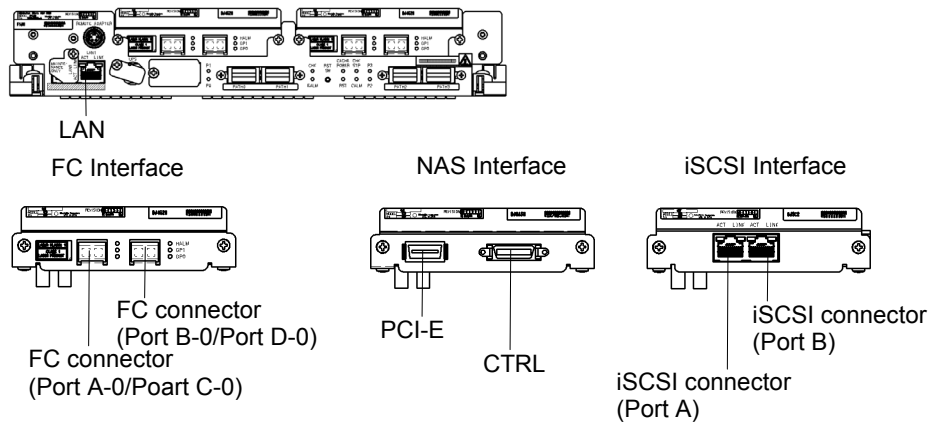


Figure 4-15 Connector Locations for Control Unit

Table 4.10 Connector Functions for Control Unit

Connector	Function
FC connector	Connector for a Fibre channel interface cable
LAN	Connector used to connect a LAN cable
PCI-E	Connector for a PCI-E cable
CTRL	Connector for a CTRL cable
iSCSI connector	Connector for an iSCSI interface cable

4.7.4.4 RKNAS

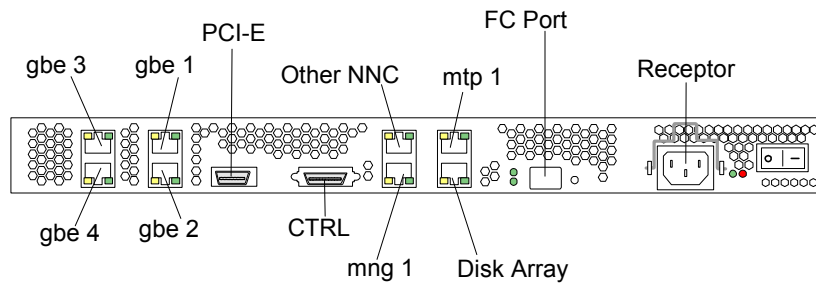


Figure 4-16 Connector Locations for RKNAS

Table 4.11 Connector Functions for RKNAS

Connector	Function
Receptor (J1)	Power cable receptacle on the RKNAS side.
gbe 1	Connector used to connect a cable for gbe 1.
gbe 2	Connector used to connect a cable for gbe 2.
gbe 3	Connector used to connect a cable for gbe 3.
gbe 4	Connector used to connect a cable for gbe 4.
CTRL	Connector used to connect a CTRL cable.
PCI-E	Connector used to connect a PCI-E cable.
mng 1	Connector used to connect a LAN cable for user management.
Other NNC	Connector used to connect a LAN cable for connecting with another RKNAS in the cluster configuration.
Disk Array	Connector used to connect with the LAN port for maintenance in the DF Controller.
mtp 1	Connector for the LAN for maintenance.
FC Port	Connector for the backup subsystem.

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
- SENC Unit
- Power Unit
- Fan Assembly
- Control Unit
- RKNAS

4.7.5.1 Disk Drive Display (RKAJ/RKAJAT)

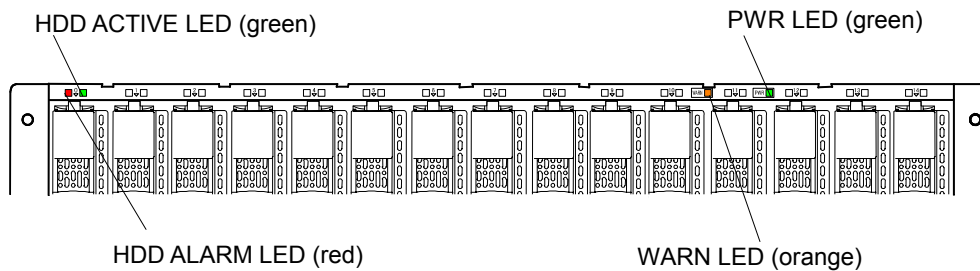


Figure 4-17 LED Locations for Disk Drive Display (RKAJ/RKAJAT)

Table 4.12 LED Functions for Disk Drive Display (RKAJ/RKAJAT)

LED	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.
WARN LED (orange)	When on, it indicates that a failure occurred in the unit; the unit is inoperable.
PWR LED (green)	When on, it indicates that electricity is supplied to the unit.

4.7.5.2 Battery Backup Unit

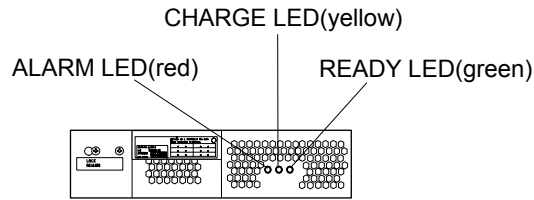


Figure 4-18 LED Locations for Battery Backup Unit

Table 4.13 LED Functions for Battery Backup Unit

LED	Function
READY LED (green)	The green LED indicates the overall condition of the battery as follows. On: normal status Flashing: charging status during start-up Off: abnormal status
CHARGE LED (yellow)	The yellow LED indicates the charging status of the battery. On: Battery is charging
ALARM LED (red)	The red LED indicates that a failure has occurred in the battery. On: a failure has occurred Flashing: Warning of impending failure Off: Normal status

4.7.5.3 ENC Unit

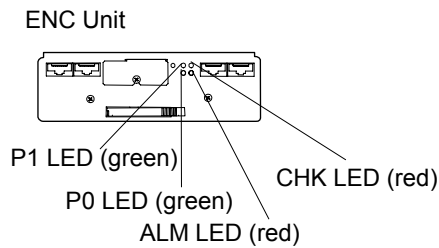
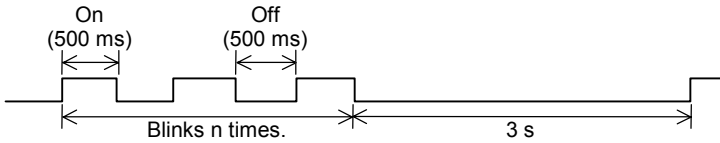


Figure 4-19 LED Locations for ENC Unit

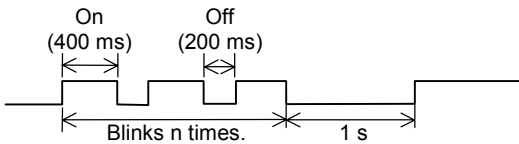
Table 4.14 LED Functions for ENC Unit

LED	Function
P1 LED (green)	When on, it indicates that the link status of FC-AL Loop X (Path 0 side) is normal.
P0 LED (green)	When on, it indicates that the link status of FC-AL Loop X (Path 1 side) is normal.
ALM LED (red)	When on, it indicates that a failure occurs in the ENC Unit, so the ENC Unit is inoperable.
CHK LED (red)	<p>It indicates, according to the number of times the LED flashes, what voltage is abnormal.</p> <p>Low-Speed blinking (Note 1) Once: Logic +5 V voltage is abnormal. Twice: Logic +12 V voltage is abnormal. Six times: Logic+2.5 V voltage on the ENC Unit is abnormal.</p> <p>The following blinking is fast because ENC microprogram detects CUDG error.</p> <p>High-speed blinking (Note 2) Once: SRAM error. Twice: ENC hard error. Three times: Microprogram error in flash memory.</p> <p>Not blinking: Boot section error of ENC microprogram, RAM error, or ENC hard configuration error.</p>

Note 1: Low-speed blinking.



Note 2: High-speed blinking (CHK LED).



4.7.5.4 SENC Unit

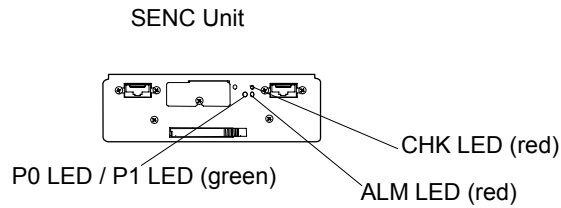
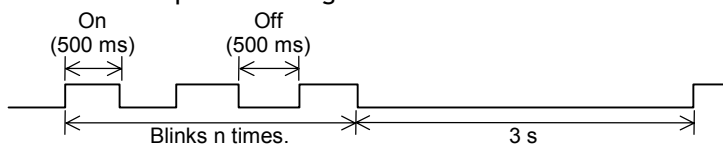


Figure 4-20 LED Locations for SENC Unit

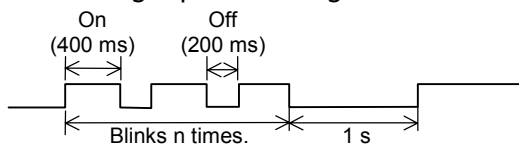
Table 4.15 LED Functions for SENC Unit

LED	Function
P0 LED/P1 LED (green)	When on, it indicates that the link status of FC-AL (loop 0 or loop 1 side) is normal.
ALM LED (red)	When on, it indicates that a failure occurs in the SENC Unit.
CHK LED (red)	<p>After turning on the power, it blinks for about 10 seconds (while CUDG is being executed). However, this blinking does not indicate an abnormal state. It indicates error factors by the frequency of blinks.</p> <p>Low-speed blinking (Note 1): Twice: CUDG error in SENC Eight times: Selector circuit of the fan is abnormal.</p> <p>Lighting: CUDG error in BOOT section of SENC</p> <p>High-speed blinking (Note 2): Five times: Fixed data error in flash memory. Six times: Significant surface error in flash memory Seven times: SUM check error in flash memory</p>

Note 1: Low-speed blinking.



Note 2: High-speed blinking.



4.7.5.5 Power Unit

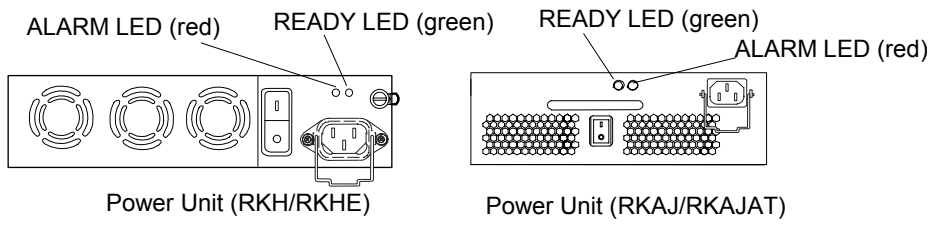


Figure 4-21 LED Locations for Power Unit

Table 4.16 LED Functions for Power Unit

LED	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.

4.7.5.6 Fan Assembly

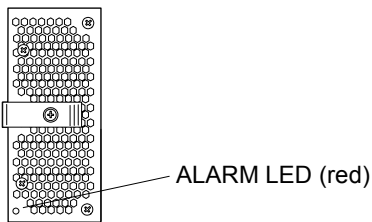


Figure 4-22 LED Locations for Fan Assembly

Table 4.17 LED Functions for Fan Assembly

LED	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.

4.7.5.7 Control Unit

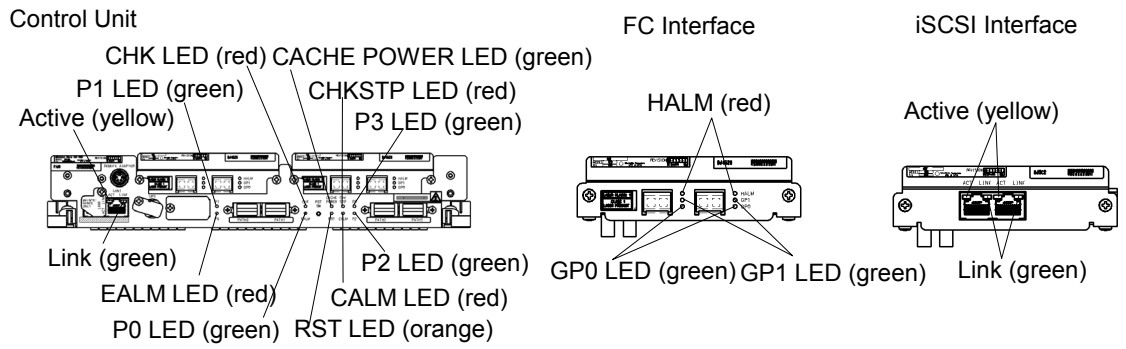
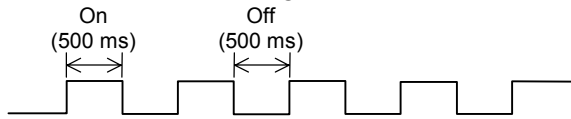


Figure 4-23 LED Locations for Control Unit

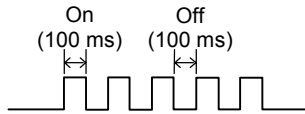
Table 4.18 LED Functions for Control Unit

LED	Function
P3 LED (green)	When on, it indicates that the link status of FC-AL (loop 3 side) is normal.
P2 LED (green)	When on, it indicates that the link status of FC-AL (loop 2 side) is normal.
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)	Indicates error factors by the lighting or blinking pattern. Lighting Indicates that a failure occurs, which makes the ENC in the control unit inoperable, occurred. Blinking Normal blinking (Note 1) (CHK LED is on): An exceptional process error detected by the ENC microprogram. High-speed blinking (Note 2) (CHK LED is on): An exceptional process error detected by the ENC microprogram. (stack over) Normal blinking (Note 1) (CHK LED is off): Indicates that FLASH write is performed during the ENC microprogram download. (It is not in the abnormal status.)
CHK LED (red)	It indicates error factors by the number of blinks. Low-Speed blinking (Note 3) Five times: Battery is abnormal. Six times: Voltage on the controller is abnormal. (Reset of the controller is not canceled) Nine times: Fan assembly is abnormal. The following blinking is fast because ENC microprogram detects CUDG error. High-speed blinking (Note 4) 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.
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 resetting.
CALM LED (red)	When on, it indicates that a failure occurred in the controller (CTL side), so the controller is inoperable.
CHKSTP (red)	When on, it indicates that a failure occurs in the control unit (CTL side), so the control unit is inoperable.
GP0 LED/GP1 LED (green)	It indicates the status of the interface installed in the controller is normal.
HALM	When on, it indicates that the host connector status is normal.
Active (yellow)	When on, it indicates that data is transferred.
Link (green)	When on, it indicates that the link status is being normal.

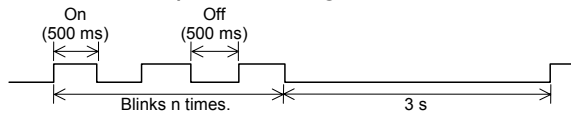
Note 1: Normal blinking.



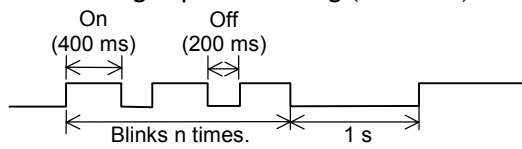
Note 2: High-speed blinking (EALM LED).



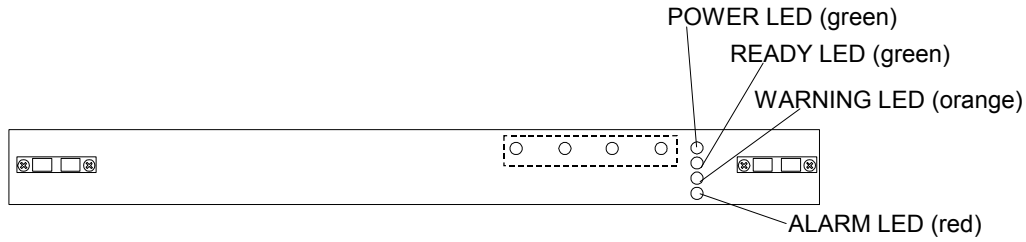
Note 3: Low-speed blinking.



Note 4: High-speed blinking (CHK LED).



4.7.5.8 RKNAS



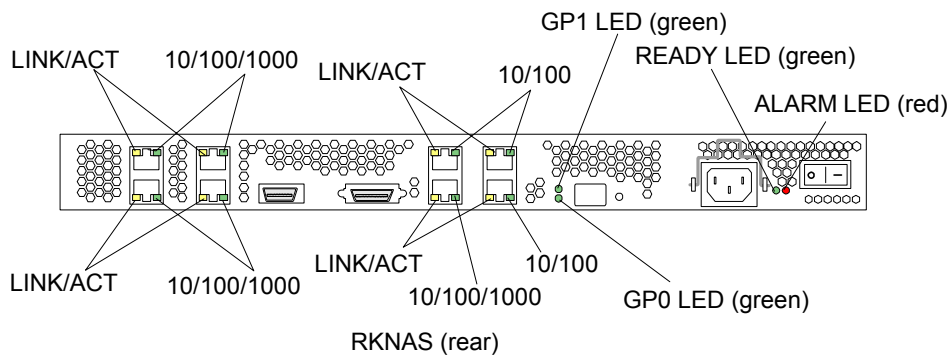
RKNAS (front)

Note: Mask A or Mask B has been affixed.

Figure 4-24 LED Locations for RKNAS (front)

Table 4.19 LED Functions for RKNAS (front)

Name	Function
ALARM LED (red)	Indicates that a failure has occurred which makes the RKNAS operable.
WARNING LED (orange)	Indicates that a failure occurred, but the RKNAS is currently operational.
READY LED (green)	Indicates that the RKNAS is operational
POWER LED (green)	Indicates that the power is supplied to the RKNAS



Note: Mask A or Mask B has been affixed.

Figure 4-25 LED Locations for RKNAS (rear)

Table 4.20 LED Functions for RKNAS (rear)

LED	Function
LINK/ACT	Indicates that the LAN for management is linked or transferring the data. Green: linked Yellow: during the data transfer
10/100/1000	Indicates the transfer rate of the LAN for management Off: 10 M, Green: 100M, Yellow: 1000M
10/100	Indicates the transfer rate of the LAN for management Off: 10 M, Green: 100M
READY LED (green)	When on, it indicates that the AC/DC power supply operates normally. When off, it indicates that the AC/DC power supply is abnormal or in a stop state.
ALARM LED (red)	When on, it indicates that a failure occurs in the AC/DC power supply.
GP0 LED (green)/ GP1 LED (green)	It indicates the status of the interface installed in the controller is normal.

Chapter 5 Functional and Operational Characteristics

This chapter includes a description of the following:

- New AMS1000 Features and Capabilities (see section .5.1)
- RAID Implementations (see section .5.2)
- Cache Management (see section .5.3)
- Logical Units (see section .5.4)
- Open Systems Features and Functions (see section .5.5)
- Data Management Features and Functions (see section .5.6)
- Copy Solution Features and Functions (see section .5.7)
- Performance Management Features and Functions (see section .5.8)
- NAS Features and Functions (see section .5.9)
- iSCSI Features and Functions (see section .5.10)
- Multi-Interface Configuration (see section .5.11)

This chapter provides information on the Fibre, NAS, and iSCSI models. The following table illustrates sections that provide an explanation for each model.

- **Fibre model:** Connects disk array subsystem to a host computer with Fibre Channel interface.
- **NAS model:** Connects NAS Unit connected to disk array subsystem to a host computer with LAN interface.
- **iSCSI model:** Connects disk array subsystem to a host computer with iSCSI interface.

Sections		Fibre	NAS	iSCSI
5.1	New AMS1000 Features and Capabilities	○	○	○
5.2	RAID Implementations	○	○	○
5.3	Cache Management	○	○	○
5.4	Logical Units (LUs)	○	○	○
5.5	5.5.1 Open System Middleware	○	—	○
	5.5.2 LUN Management	○	—	○
5.6	5.6.1 Cache Residency Manager Function	○	○	○
	5.6.2 LUN Manager Function	○	—	○
	5.6.3 Data Retention Utility Function	○	—	○
	5.6.4 LUN Expansion	○	○	○
	5.6.5 Password Protection Function	○	○	○
	5.6.6 Account Authentication Function	○	○	○
	5.6.7 Audit Logging Function	○	○	○
5.7	5.7.1 TrueCopy Synchronous Replication Function	○	—	—
	5.7.2 TrueCopy Synchronous Replication Extended Distance	○	—	—
	5.7.2 ShadowImage In-System Replication Function	○	—	○
	5.7.3 Copy-On-Write Snapshot™ Function	○	—	○
	5.7.4 Modular Volume Migration Function	○	○	○
	5.7.5 NAS Backup Restore Modular Function	—	○	—
	5.7.6 NAS SyncImage Modular Function	—	○	—
5.8	5.8.1 Performance Monitor Function	○	○	○
	5.8.2 Cache Partition Manager Function	○	○	○
5.9	NAS Features and Functions	—	○	—
5.10	iSCSI Features and Functions	—	—	○
5.11	Multi-Interface Configuration	○	○	○

○: An explanation is provided.

—: An explanation is not provided.

5.1 New AMS1000 Features and Capabilities

The Hitachi AMS1000 subsystem offers the following new or improved features and capabilities, which distinguish the AMS1000 subsystem from the 9500V series:

- Up to 30 spare disks installable (Floor [RKH+H1J] Model: up to 1)
- 4,096 LUNs maximum
- Multiple parity groups can be set to one RAID group.
- 90 RAID groups maximum
- The drive interface supports 2 Gbps fibre channel.
- A maximum of 16 GBs high capacity cache is supported in the dual configuration. This improves the cache percent hit rate.
- The file sharing function supported by connecting to the NAS unit.
- 1 Gbps iSCSI supported by adding an iSCSI interface.
- An interface mixture of Fibre Channel, NAS, and iSCSI is supported in a control unit.

5.2 RAID Implementations

The AMS1000 subsystem supports RAID0, RAID1+0, RAID1, RAID5, RAID6 or an intermix. RKAJAT does not support RAID0.

- RAID0 group stripes data across all disk drives in the group to attain higher throughput. There is no sparing disk drive function with this configuration.

Notes on using RAID0:

- When a failure occurs in a disk drive, data cannot be restored internally within the disk array because RAID0 has no redundancy of data; therefore, although the host receives an error message, the data is left in its current state.
- Unlike with an independent disk drive, error block management (assignment of alternative block for the independent disk drive with the Reassign Blocks command) is not done. Therefore, when a RAID0 disk drive becomes inaccessible due to a failure, all the LUs in the RAID0 configuration including the failed disk drive become inaccessible. Restoration of user data with backup data is essential after replacing the failed disk drive.
- Do not allow RAID0 to coexist with the other RAID group; do not form a group with two or more RAID0 systems. An example = $(4D + 1P) \times 2 + 2D$.
- Each time a failure occurs in a RAID0 disk drive, data that cannot be written into the disk drive (pinned data) is accumulated in the cache.
- When the amount of accumulated data exceeds a certain value, a write I/O instructed to the other RAID group cannot be accepted and the system goes down. (In this case, restoration of user data and resynchronization of a file system using the backup data are required for the entire subsystem; therefore, the time necessary for recovery is lengthy.)

- Do not adopt the RAID0 configuration to its fullest extent. Consider the above notes when building the configuration.
- RAID1+0 groups provide data redundancy like RAID1 by copying all the contents of two disk drives to another pair. Different from RAID1, 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 15 data disks and has a parity disk performing the data striping.
- RAID 6 uses from 2 to 28 data disks and has two parity disks performing the data striping. Configuration with two parity disks provides redundancy that can sustain two-point failures.

The RAID specifications are shown in Table 5.1.

Table 5.1 RAID Specifications of Rack-Mount Model

Item		Rack-Mount Model			
		RKH/RKHE	RKAJ (Range for Setup)	RKAJAT	
RAID specifications	RAID level	—	0/1/5/6/1+0	1/5/6/1+0	
	RAID configuration (unit of addition)	RAID0	—	2D to 16D	—
		RAID1	—	1D+1D	
		RAID5	—	2D+1P to 15D+1P	
		RAID6	—	2D+2P to 28D+2P	
	RAID1+0	—	2D+2D to 8D+8D		

Notes:

- Use the RAID configuration within 6D+1P.
- For information about the global rack-mount model, refer to the *Hitachi Data Systems Global 19-Inch Rack Reference Guide (MK-93DF772)*.

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 48 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.
- Optimum segment size can be specified by dividing cache memory into multiple partitions in accordance with applications, and then cache memory can be effectively used and tuned according to user system by occupying cache memory by certain logical units.
- When intermixing Fibre Channel and NAS interfaces, use different partitions for NAS logical units and Fibre Channel logical units by using the Cache Partition Manager function.

Cache specifications are shown in Table 5.2.

Table 5.2 Cache Specifications of Rack-Mount Model

Item		Rack-Mount Model		
		RKH/RKHE	RKAJ	RKAJAT
Cache specifications	Capacity (M bytes/CTL)	2,048, 4,096, 6,144, 8,192	—	
	Control method	Read LRU/Write after (Note 2)	—	
	Battery backup	Provided	—	
	Backup duration (h)	48 (When cache of 8,192 M bytes/CTL is installed)	—	

Note 1: For information about the global rack-mount model, refer to the *Hitachi Data Systems Global 19-Inch Rack Reference Guide (MK-93DF772)*.

Note 2: LRU is an abbreviation for Least Recently Used, and it is an algorithm which selects data that has not been used for longest to write data in the cache memory into disk drive when it needs to make room in data area of cache memory.

5.4 Logical Units

The AMS1000 supports up to 4,096 LUNs. Each LU is identified by fibre-channel port ID and LUN number. However, up to 256 LUs can be assigned to a host group.

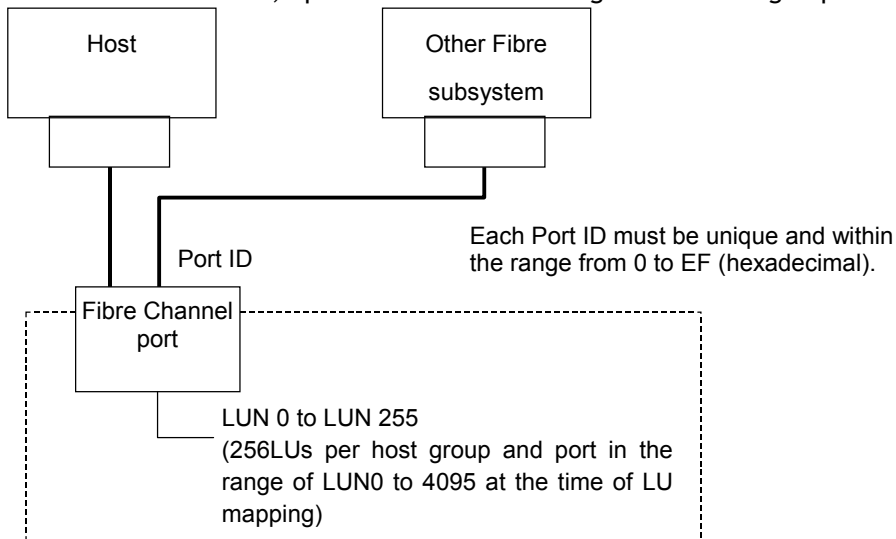


Figure 5-1 Logical Units

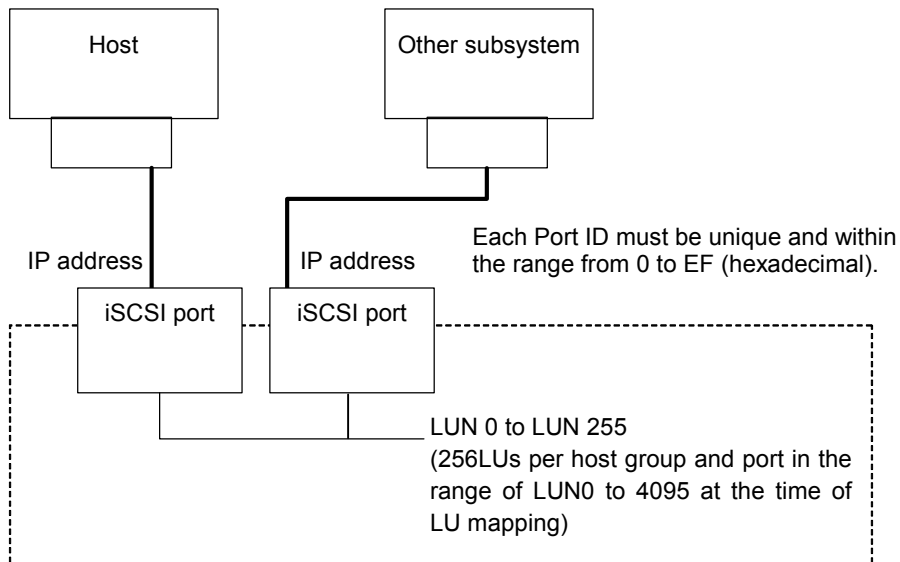


Figure 5-2 Logical Units (when iSCSI interface board is installed to control unit)

When the AMS1000 is used as NAS model, 9 logical units need to be assigned as system LU. A maximum of 4,087 logical units can be set for user LU.

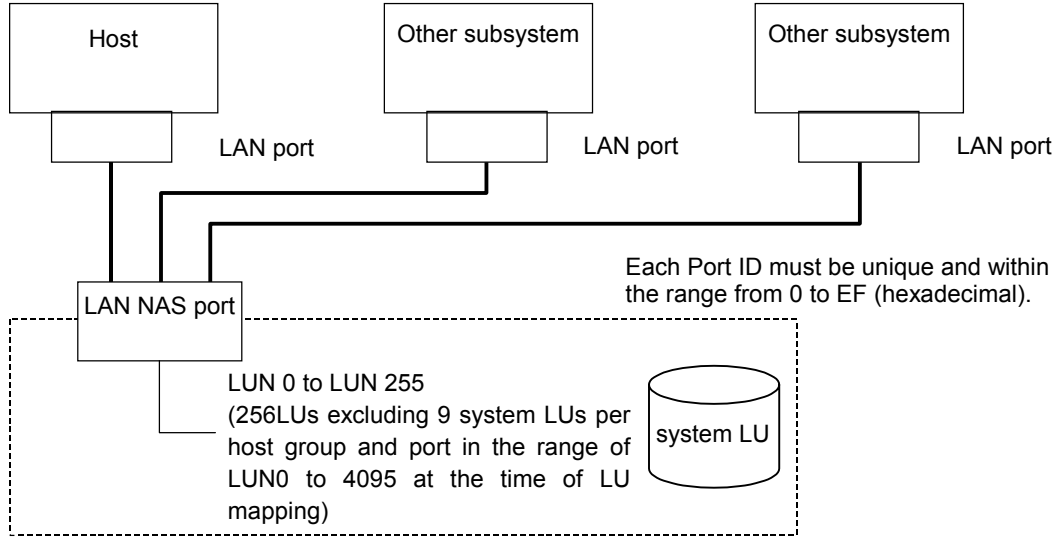


Figure 5-3 Logical Units (when NAS interface board is installed to control unit)

5.5 Open Systems Features and Functions

The AMS1000 subsystem offers many features and functions specifically for the open-systems environment. The AMS1000 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 Logical Unit Mapping

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

5.6 Data Management Features and Functions

These features include:

- Cache Residency Manager Function
- LUN Manager Function
- Data Retention Utility Function
- LUN Expansion Function
- Password Protection Function
- Account Authentication Function
- Audit Logging Function

5.6.1 Cache Residency Manager Function

The Cache Residency Manager 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.

5.6.2 LUN Manager Function

The LUN Manager has four main functions: Fibre security control and host group (for Fibre Channel interface), or iSCSI security control and target (for iSCSI interface).

- **Fibre Channel Interface**

The Fibre security control function controls the access from specific hosts or specific commands.

The host group function enables the subsystem to respond to each connected host (even within the same port) by grouping connected hosts within a port and setting the logical unit mapping and the Host Connection mode for each host group.

- **iSCSI Interface**

The iSCSI security function controls access from specified hosts or specific commands.

The target function enables the subsystem to respond to each connected host (even within the same port) by grouping the connected hosts within a port and setting the local unit mapping and Host Connection mode for each group. Up to 128 targets can be set for one port. Authentication can be performed for each target by using the CHAP authentication concurrently.

5.6.3 Data Retention Utility Function

The Data Retention Utility feature prevents the logical unit (volume) from being accessed illegally by the host.

5.6.4 LUN Expansion Function

The LUN Expansion function expands the size of logical unit (volume) to which a host computer accesses by combining multiple logical units (volumes) internally.

5.6.5 Password Protection Function

The Password Protection function restricts the number of Storage Navigator Modular users who are allowed to access to a disk array subsystem and prevents the simultaneous access from multiple users.

5.6.6 Account Authentication Function

The Account Authentication function authenticates login to the array unit based on the account information registered by the user and controls the access to the subsystem resource. This prevents the illegal operation by the unauthorized person.

5.6.7 Audit Logging Function

The Audit Logging function generates a syslog to audit the event when the user performs the setting operation for the disk array subsystem, and outputs the syslog to the external server.

5.7 Copy Solution Features and Functions

The AMS1000 subsystem provides features and functions which allow you to maintain remote and subsystem internal copies of all user data on the AMS1000 storage subsystem for data backup or duplication. These features include:

- TrueCopy Synchronous Remote Replication Function
- TrueCopy Extended Distance Function
- ShadowImage In-System Replication Function
- Copy-On-Write Snapshot™ Function
- Modular Volume Migration Function
- NAS Backup Restore Modular Function
- NAS Sync Image Modular Function

Note: TrueCopy Extended Distance is a long distance remote replication business continuity application that will be available during the next release. Please contact your HDS representative for more information. We apologize for any inconvenience.

5.7.1 TrueCopy Synchronous Remote Replication Function

The Synchronous TrueCopy feature enables you to maintain remote copies of all user data on the Hitachi AMS1000 storage subsystem for data backup or duplication. The duplicated volumes are created between subsystems that are connected with a Fibre Channel interface.

5.7.2 TrueCopy Extended Distance Function

The TrueCopy Extended Distance function equalizes the data of both disk subsystems connected via the fibre channel interface by periodically synchronizing their data.

5.7.3 ShadowImage In-System Replication Function

The Hitachi Data Systems ShadowImage In-System Replication function enables you to maintain subsystem-internal copies of all user data on the AMS1000 storage subsystem for purposes such as data backup or duplication. The duplicated volumes are created within the same AMS1000 subsystem as the primary volume.

ShadowImage In-System Replication 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 In-System Replication 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.

5.7.4 Copy-On-Write Snapshot™ Function

The Hitachi Copy-On-Write Snapshot™ feature enables you to maintain a logical copy of logical units (volumes) at a point in time between the disk array subsystems.

5.7.5 Modular Volume Migration Function

The Modular Volume Migration function migrates the LU which receives the host operation to another RAID group within a disk array subsystem.

5.7.6 NAS Backup Restore Modular Function

The NAS Backup Restore Modular function protects the data shared in the NAS Modular system. The NAS Backup Restore Modular function provides the following functions to protect data:

- Snapshot Function
- Backup Restore Function

5.7.7 NAS Sync Image Modular Function

The NAS Sync Image Modular function creates a snapshot for recovering the data to the state which existed before changes were executed, even when the client has erroneously changed the file system data shared in the NAS Modular system.

5.8 Performance Management Features and Functions

This feature includes:

- Performance Monitor function
- Cache Partition Manager function

5.8.1 Performance Monitor Function

The Performance Monitor acquires information about the performance of RAID groups and logical units, etc. of the subsystem. It also acquires utilization rates of resources such as hard disk drives and processors built in the subsystem. This information displays with line graphs in the monitor.

5.8.2 Cache Partition Manager Function

This function is to enhance the performance by cache area division, segment size specification, and assignment for separate LUNs.

5.9 NAS Features and Functions

The combination with the AMS1000 and RKNAS enabled the different servers connected via LAN to share data easily using the NFS/CIFS protocol of the LAN (GbE) interface. The AMS1000 supports the following function:

- NAS Data Control Modular
- NAS File Sharing Modular
- NAS Manager Modular
- NAS Backup Restore Modular
- NAS Sync Image Modular
- NAS Anti-Virus Agent Modular

5.9.1 NAS Data Control Modular Function

The NAS Data Control Modular function provides the basic functions of NAS system.

5.9.2 NAS File Sharing Modular Function

The NAS File Sharing Modular function provides the operating system function of NAS system.

5.9.3 NAS Manager Modular Function

The NAS Manager Modular function provides the setup, operation and management functions for the NAS system.

5.9.4 NAS Backup Restore Modular Function

Refer to section 5.7.6.

5.9.5 NAS Sync Image Modular Function

Refer to section 5.7.7.

5.9.6 NAS Anti Virus Agent Modular Function

The NAS Anti Virus Agent Modular function provides the NAS system virus scan function such as scan server registration, scan condition setting, and virus scan function start/stop.

5.10 iSCSI Features and Functions

1 Gbps iSCSI is supported by adding iSCSI interface to the AMS1000. The AMS1000 supports the following functions:

- CHAP Authentication
- iSNS Client

5.10.1 CHAP Authentication

User authentication is performed for each target.

5.10.2 iSNS Client

The iSNS client function enables you to use iSCSI device discovery, state change notification on the network easily.

5.10.3 Sending a Ping

The Ping Sending function verifies whether or not the network device at the specified address and the AMS1000 can communicate with IP network. This function specifies the address from the Storage Navigator Modular, sends the Ping from the iSCSI interface, and then displays the presence of the response. However, sending a Ping to an unreachable address can cause a delay and a time-out of host I/O processing on the controller. (The warning message will be displayed before starting the Ping test.) It is strongly recommended that the Ping test be executed when no host I/O exists on the controller.

5.11 Multi-Interface Configuration

The AMS1000 can be equipped with maximum of two of the following interfaces on the control unit. One array can be connected to multiple types of interfaces:

- **Fibre Channel:** FC interface board
- **NAS:** NAS interface board
- **iSCSI:** iSCSI interface board

5.11.1 Interface Board Configuration Rule when Mixing Interfaces

Install the interfaces on the AMS1000 by using only the configurations outlined in Table 5.3.

Table 5.3 Interface Board Locations

Installment Cases	Installment Location	
	Interface Board #0	Interface Board #1
1	FC interface board	—
2	—	NAS interface board
3	iSCSI interface board	—
4	FC interface board	FC interface board
5	FC interface board	NAS interface board
6	iSCSI interface board	FC interface board
7	iSCSI interface board	NAS interface board

5.11.1.1 Conditions and Cautions for an Interface Intermix

- Verify that you are using an identical type of interface on the same locations of Controllers #0 and #1.
- Install iSCSI boards only on Interface Board #0.
- Install NAS boards only on Interface Board #1.
- If the type of the installed interface board is changed, all of the configuration setting described below will be cleared for that changed port. Redo the setting after exchanging the interface board:
 - Host group information/Target Information
 - Host group option/Target Option
 - Mapping information
 - Fibre Channel port setting information/NAS connection information/iSCSI port setting information
 - CHAP authentication information (iSCSI)

5.11.2 Cautions for an Interface Intermix

5.11.2.1 Cautions when Intermixing Fibre Channel and iSCSI Interfaces

When intermixing Fibre Channel and iSCSI interfaces, the following conditions and cautions must be met:

- Install the iSCSI board onto Interface Board #0 only.
- As with multiple Fibre Channel ports, it is possible to access the same LU from the Fibre Channel interface and the iSCSI interface. However, if exclusive access is necessary at the application level, then it is recommended that you install exclusive access by LU mapping, as with multiple Fibre Channel ports.
- RAID Manager can be used shared between Fibre Channel and iSCSI interfaces. Therefore, it is possible to manage the LU used from a Fibre Channel interface via the iSCSI interface.
- Path failover software (such as HDLM) and a cluster configuration between Fibre Channel and iSCSI interfaces are not supported.

5.11.2.2 Cautions when Mixing Fibre Channel and NAS Interfaces

When intermixing Fibre Channel and NAS interfaces, the following conditions and cautions must be met:

- Install the NAS board onto Interface Board #1 only.
- When both Fibre Channel and NAS interfaced are used, perform LU mapping on all created LUs, and make sure that the LUs used by Fibre Channel and the LUs used by NAS are mapped exclusive of each other.
- When intermixing Fibre Channel and NAS interfaces, use different partitions for NAS logical units and Fibre Channel logical units by using the Cache Partition Manager function.
- When both Fibre Channel and NAS interfaced are used, and when NAS OS is shutdown, booted, or rebooted while there is I/O load from the Fibre Channel Interface, there may be cases where the process abnormally ends (e.g., timeout).
- When intermixing Fibre Channel and NAS interfaces, set user LUs and system LUs for NAS on RAID groups that are NOT used for LUs used for Fibre Channel access.
- When both Fibre Channel and NAS interfaces are used, the load on NAS can have impact on the Fibre Channel, or vice versa. Design the system with a good performance margin.
- When both Fibre Channel and NAS interfaces are used, Fibre Channel performance may be affected during such periods as failover processing due to NAS failure, or NAS maintenance operation (boot/reboot/shutdown of NAS OS, installation of NAS OS related P.P.). Design the system with a good performance margin.

5.11.2.3 Cautions when Mixing iSCSI and NAS Interfaces

When intermixing iSCSI and NAS interfaces, the following conditions/cautions must be met:

- Install the iSCSI board onto Interface Board #0 only, and the NAS board onto Interface Board #1 only.
- When both iSCSI and NAS interfaces are used, perform LU mapping on all created LUs, and verify that the LUs used by iSCSI and the LUs used by NAS are mapped exclusive of each other.
- When intermixing the iSCSI and the NAS interfaces, use different partitions for NAS logical units and iSCSI logical units by using the Cache Partition Manager function.
- When both iSCSI and NAS interfaces are used, and when NAS OS is shutdown, booted, or rebooted while there is an I/O load from the iSCSI Interface, the process may end abnormally (e.g., timeout).
- When intermixing iSCSI and NAS interfaces, set user LUs and system LUs for NAS on RAID groups that are NOT used for LUs used for iSCSI access.
- When both iSCSI and NAS interfaces are used, the load on NAS can have impact on the iSCSI, or vice versa. Design the system with good performance margin.
- When both iSCSI and NAS interfaces are used, iSCSI performance may be affected during failover processing due to NAS failure, or NAS maintenance operation (boot/reboot/shutdown of NAS OS, installation of NAS OS related P.P.). Design the system with good performance margin.

Chapter 6 Configuring the AMS1000 Storage System

This chapter includes the following:

- Configuration Overview (see section 6.1)
- Configuring AMS1000 Storage System LAN Interfaces (see section 6.2)
- Configuring the AMS1000 Storage System (see section 6.3)
- Registering the AMS1000 Storage System for Control by Storage Navigator Modular (see section 6.4)
- Configuring the AMS1000 Storage System for the Desired Application (see section 6.5)
- General Configuration of the AMS1000 Storage System (see section 6.6)

This chapter provides information on the Fibre, NAS, and iSCSI models. The following table illustrates sections that provide an explanation for each model.

- **Fibre model:** Connects disk array subsystem to a host computer with Fibre Channel interface.
- **NAS model:** Connects NAS Unit connected to disk array subsystem to a host computer with LAN interface.
- **iSCSI model:** Connects disk array subsystem to a host computer with iSCSI interface.

Sections		Fibre	NAS	iSCSI
6.1	Configuration Overview			
	6.1.1 Open Systems Configuration	○	–	○
	6.1.2 Defining LUNs	○	○	○
	6.1.3 Fibre Channel Interface Addressing	○	–	○
	6.1.4 iSCSI Interface Addressing	–	–	○
	6.1.5 Alternate Pathing	○	–	○
	6.1.6 NAS Configuration	–	○	–
6.2	Configuring AMS1000 Storage System LAN Interfaces	○	○	○
6.3	Configuring the AMS1000 Storage System	○	○	○
6.4	Registering the AMS1000 Storage System for Control by Storage Navigator – Modular	○	○	○
6.5	Configuring the AMS1000 Storage System for the Desired Application	○	○	○
6.6	General Configuration of the AMS1000 Storage System	○	○	○

○: An explanation is provided.

–: An explanation is not provided.

6.1 Configuration Overview

This section includes the following information on configuration:

- Open Systems Configuration
- Defining LUNs
- Fibre Channel Interface Addressing
- iSCSI Interface Addressing
- Alternate Pathing
- NAS Configuration

6.1.1 Open Systems Configuration

- **Fibre Channel**

The AMS1000 subsystem uses the HP 9000 series, Sun Fire™ series, Sun Enterprise™ series, RS/6000® family, and each vendor PC (HP-UX, Solaris™, AIX® IRIX® tru64, Linux®, Windows® 2000, Windows Server™ 2003) as a supported platform. For each open system, installation is required.

- **iSCSI**

The AMS1000 uses Linux, Windows Server 2003, Windows® XP as a supported platform. For each open system, installation is required.

If iSCSI HBA is used for iSCSI, the driver of the HBA should be installed. If iSCSI software initiator and NIC are used for iSCSI, the software initiator should be installed. (As the software initiator of Windows OS, Microsoft® iSCSI Software initiator revision 2.0 is required. The former versions are not supported.)

6.1.2 Defining LUNs

The Storage Navigator Modular software enables the user to define the LUN mapping for each device and reconfigure the mapping at any time. For further information on Storage Navigator Modular, please refer to the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User's Guide* (MK-95DF711) to use a GUI interface. See the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator - Modular Command Line Interface (CLI)* (MK-95DF712) to use the CLI version.

6.1.3 Fibre Channel Interface Addressing

The AMS1000 subsystem supports a maximum of 8 fibre-channel ports. Each fibre-channel port is assigned a unique target ID number. The AMS1000 can address up to 4,096 LUNs per port. The following figure illustrates fibre channel port-to-LUN addressing.

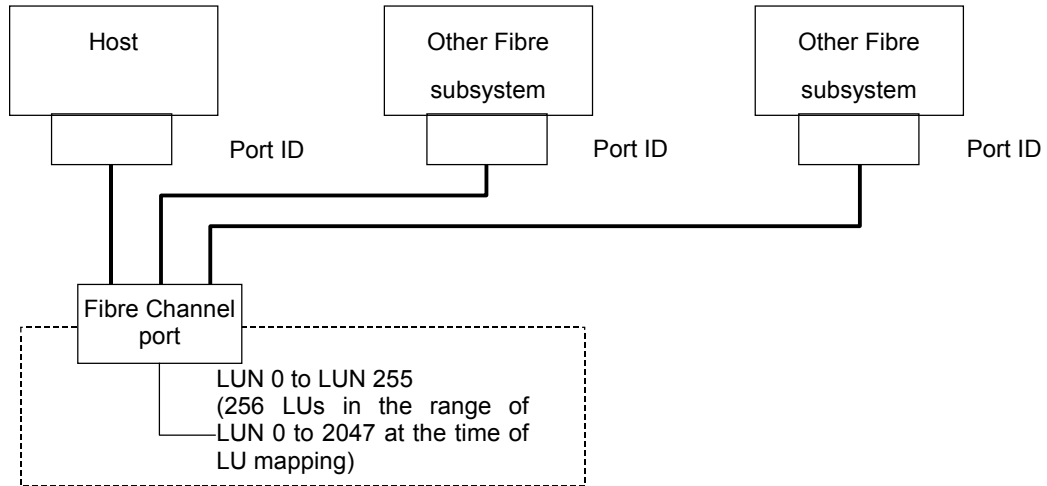


Figure 6-1 Fibre Channel Port-to-LUN Addressing

6.1.4 iSCSI Interface Addressing

1. CSI target under the iSCSI port. Target0 has been created as standard.
2. iSCSI Name is assigned automatically for each target (iSCSI target). Set the LU (H-LUN) to present to a host as LU mapping for each target.

Figure 6-2 illustrates iSCSI port addressing and logical unit number assignment.

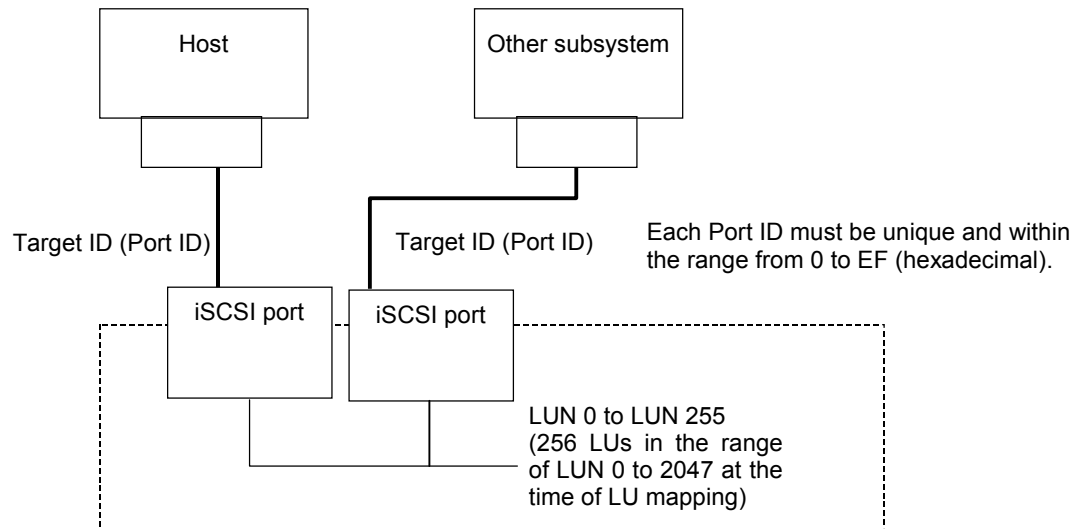


Figure 6-2 iSCSI Port-to-LUN Addressing (when iSCSI interface board is installed)

6.1.5 Alternate Pathing

Users should plan for alternate pathing to ensure the highest data availability. The AMS1000 provides up to 4 fibre channel ports or to accommodate alternate pathing for host attachment. Figure 6-3 and Figure 6-4 show samples of alternate pathing.

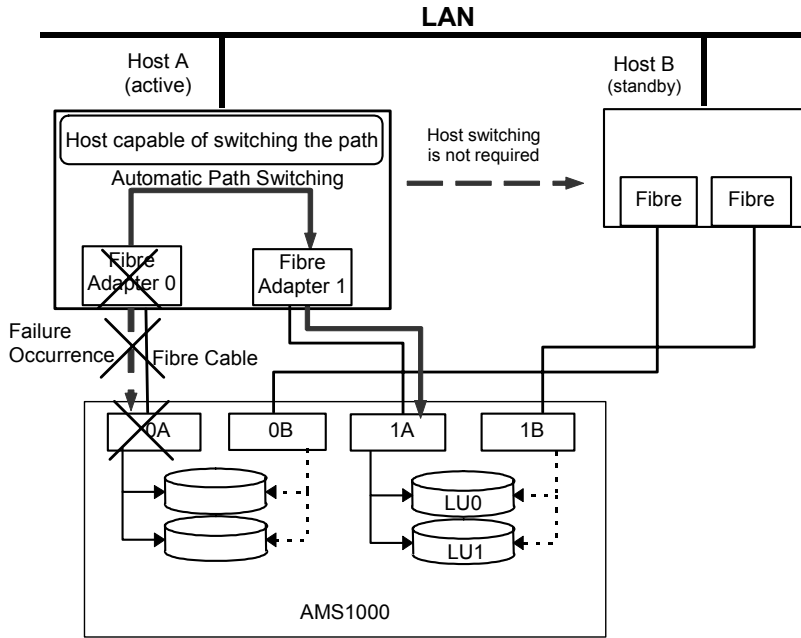


Figure 6-3 Alternate Pathing

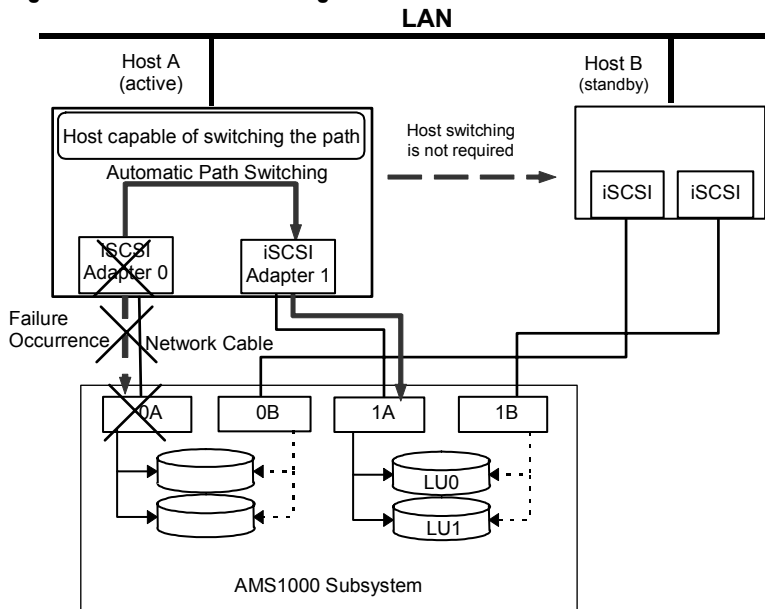


Figure 6-4 Alternate Pathing (when iSCSI Interface board is added)

6.1.6 NAS Configuration

NAS Modular system operation management software includes management software on the PC (Storage Navigator Modular, NAS Setup, and WEB browser) and NAS Manager Modular.

Operation management (NAS OS, disk array subsystem) on the disk array side from the NAS OS (NAS File Sharing Modular, NAS Data Control Modular) is performed by maintenance software on the PC. Operation management on the host side from the NAS OS (file system, fail-over function) is performed by NAS Manager Modular.

System administrator gives instructions to the NAS Manager Modular using the WEB browser from the NAS management console. The NAS Manager Modular, which received the instruction, performs the instructions coordinating with NAS OS or various software.

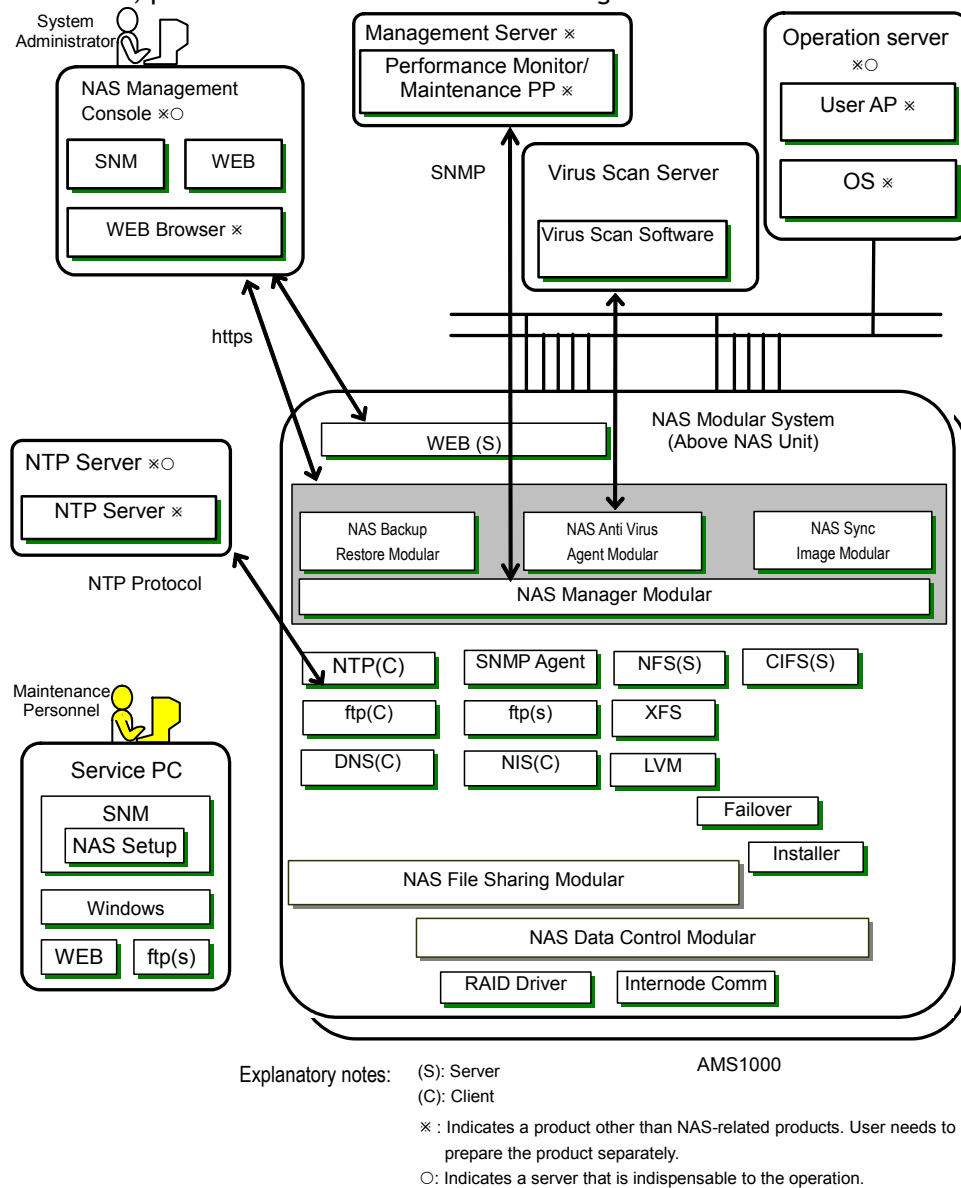


Figure 6-5 NAS Configuration

6.2 Configuring AMS1000 Storage System LAN Interfaces

When you use the following applications or functions via a LAN port of subsystem, the following settings are required:

Application / Function	Setting
- Obtaining subsystem information on WEB browser - SNMP Agent Support Function	1. IP address Setting 2. Negotiation Setting
- Referring information and setting parameters on Storage Navigator Modular	1. IP address Setting 2. Negotiation Setting 3. LAN port number Setting

If these settings are incorrect, the communication cannot be made normally.

Note: Set these settings after an array subsystem becomes Ready.

6.2.1 Setting the IP Addresses

The factory IP address settings are:

- IP address of controller: 192.168.0.16
- Subnet mask: 255.255.255.0
- Default gateway: 0.0.0.0

Use Storage Navigator Modular to set or change these IP addresses (refer to section 7.13).

If you set these addresses without using the DHCP function, note the following:

- Do not use the values: '0', '127' or '255' in the first field of the IP address. For example, you cannot set 0.xxx.xxx.xxx, 127.xxx.xxx.xxx, or 255.xxx.xxx.xxx.
- The following IP addresses are reserved for the NAS unit. You cannot assign these addresses to the management LAN port or the data LAN port of the NAS unit.
 - 172.29.1.xxx
 - 172.29.2.xxx
 - 172.29.3.xxx
 - 172.29.4.xxx
- Be sure to set the subnet mask correctly. Note that you cannot use a discontinuous one-bit IP address. An example of this is 255.0.255.0
- Do not use the values 0 or 255 to set the host or default gateway IP addresses. For example, when a subnet mask is 255.255.255.0, you cannot set 192.168.0.0 as the IP address and 192.168.0.255 for and default gateway address.
- Set the same IP address for both the host and the default gateway. For example, when the subnet mask is 255.255.255.0 and the IP address is 192.168.0.16, you cannot set 192.168.1.1 as the default gateway.

- Set the individual IP addresses for the user port and the maintenance port. For example, when a subnet mask is 255.255.255.0 and IP address of maintenance port is 10.0.0.16, you cannot set 10.0.0.xxx for user port.

Note: If no default gateway address is specified, set “0.0.0.0”.

Note: When the IP address of the LAN device which is connected via the gateway to the user management port is the same as the IP address of the maintenance port, the communication may fail because of the conflict between them. If this happens change either the IP address of the LAN device or the IP address of the maintenance port (refer to section 7.15).

- Negotiation Setting

Each controller is shipped with auto negotiation mode (10M/100M/half-duplex/full-duplex). Negotiation can be set or changed by Storage Navigator Modular. (Refer to section 7.13.)

Note: For best performance, set the negotiation settings of the subsystem to be the same as the negotiation settings of the device connected to the LAN port. If the negotiation of the subsystem is different from the negotiation of the device connected to LAN port, the throughput or response performance of network communication may decrease and the control Unit may not communicate with the destination device across a network.

- LAN Port Number Setting

The subsystem is shipped with LAN port number set “2000”. Use Storage Navigator Modular to set or change these IP addresses (refer to section 8.8)

Note: If you do not know the LAN port number, see the section titled “Confirming the LAN Port Number with Web” in section 8.9.2, and follow the instructions to obtain the LAN port number.

6.3 Configuring the AMS1000 Storage System

Follow these steps to configure the disk array:

1. Verify that the subsystem is connected to the LAN.
2. Install Storage Navigator Modular on the system that will be used as the management PC/Server.

See the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User’s Guide* (MK-95DF711) to use a GUI interface. See the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Command Line Interface (CLI)* (MK-95DF712) to use the CLI version.

3. Register the disk array for control by Storage Navigator Modular.
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.

Note: If the subsystem is configured when the disk array subsystem is used as the remote side of TrueCopy Remote Replication/TrueCopy Extended Distance, the following occurs:

- Both paths of TrueCopy Remote Replication/TrueCopy Extended Distance are blocked. A notice regarding SNMP Agent Support Function and TRAP occurs in path blockade mode. Perform the functions in the notice and check the Failure Monitoring Department in advance.
- If the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance is PAIR or COPY, the pair status transits to PSUE.

When the disk array subsystem must be configured, transmit the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance to PSUS, and then configure the subsystem.


Note: If the setting operation is performed for the array unit connected to the NAS unit, the cluster between the NAS Units stops. When the setting operation for the array subsystem is unavoidably performed, execute it after stopping the cluster between the NAS Units and stopping the NAS OS of both NAS Units. Start the cluster between the NAS Units again after completing the setting operation for the array subsystem.

6.4 Registering the AMS1000 Storage System for Control by Storage Navigator Modular

To operate the array unit from Storage Navigator Modular, register the array unit. You cannot temporarily register a non-existing array unit.

1. On the Edit menu, click Add Automatically.
2. On the Add Array Unit Automatically dialog box, enter the IP address for the From: and To: boxes of the IP Addresses to Search of Search Array Unit. Click Start.

The result of the search displays.

3. Select the name that you want to register, and click .
4. The selected array unit is moved from the Search Results list to the Array Units to Add list. Click OK.
4. A confirmation message displays. Click OK.
5. The Result screen displays. Click Close.

The Main screen is updated, and then displayed.

6.5 Configuring the AMS1000 Storage System for the Desired Application

Before configuring the AMS1000, 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 AMS1000 Storage System

Activating Management mode in Storage Navigator Modular will enable you to do a general configuration of the AMS1000 subsystem. Before it is possible to configure the AMS1000, management mode must be enabled in Storage Navigator Modular. Otherwise, it is only possible to monitor the status of the AMS1000.

To enable Management Mode:

1. On the **Tools** menu, click **Operation Mode**, and click **Set Password** on the Main screen.
2. Enter **Old Password**, **New Password** and **New Password** (for confirmation) and click **OK**.
Specify a password of up to 12 alphanumeric characters.
3. On the **Tools** menu, select **Operation Mode**, and click **Change**. Alternatively, click **Change Mode** in the toolbar.
4. When the **password-input** screen displays, input a password and click **OK**.

Management Mode displays in **Operation Mode** in the upper part of the Main screen. The Storage Navigator Modular program will operate in **Management Mode**.

Chapter 7 Configuring Storage on the AMS1000 Storage System

The process of configuring storage on the AMS1000 subsystem involves the following sub-processes:

- Software Composition (see section 7.1)
- Setting Fibre Channel Information (see section 7.2)
- Setting iSCSI Information (see section 7.3)
- Determining Space and RAID Level Requirements (see section 7.4)
- Setting Host Group Information (see section 7.5)
- Setting Target Information (see section 7.6)
- Setting CHAP Authentication (see section 7.7)
- Transferring Configurations from One Array to Another (see section 7.8)
- Storing Configuration Data (see section 7.9)
- Applying Configuration Data to Another AMS1000 Storage System (see section 7.10)
- Setting Host Connection Parameters (see section 7.11)
- Setting the Storage System When Using Special Mode (see section 7.12)
- Changing the Network Parameter (see section 7.13)
- Changing the Auto Diagnosis Threshold for Fibre Channel Loop (see section 7.14)
- Changing the IP Address for the Maintenance Port (see section 7.15)
- Setting the System LU and User LU in the NAS System (see section 7.16)
- Setting the NNC Management LAN Port Information in the NAS System (see section 7.17)
- Setting Time Zone (see section 7.18)
- Settings and Restrictions for Adding the Thunder 9500V FC Additional Unit (see section 7.19)

This chapter provides information on the Fibre, NAS, and iSCSI models. The following table illustrates sections that provide an explanation for each model.

- **Fibre model:** Connects disk array subsystem to a host computer with Fibre Channel interface.
- **NAS model:** Connects NAS Unit connected to disk array subsystem to a host computer with LAN interface.
- **iSCSI model:** Connects disk array subsystem to a host computer with iSCSI interface.

Sections		Fibre	NAS	iSCSI
7.1	7.1.1 Microprogram	○	○	○
	7.1.2 System Parameters	○	○	○
	7.1.3 Configuration Information	○	○	○
	7.1.4 SNMP Information	○	○	○
	7.1.5 Storage for Parameters	○	○	○
7.2	Setting Fibre Channel Information	○	—	—
7.3	Setting iSCSI Information	—	—	○
7.4	7.4.1 Setting a Spare Disk	○	○	○
	7.4.2 Canceling a Spare Disk Setting	○	○	○
	7.4.3 Setting a RAID Group	○	○	○
	7.4.4 Deleting a RAID Group	○	○	○
	7.4.5 Setting a Logical Unit	○	○	○
	7.4.6 Deleting the Last Logical Unit	○	○	○
	7.4.7 Formatting a Logical Unit	○	○	○
	7.4.8 Changing the Format Mode	○	○	○
	7.4.9 Changing the Default Controller in Charge of an LU	○	○	○
7.5	7.5.1 Setting Mapping Information	○	—	—
7.6	7.6.1 Setting Mapping Information	—	—	○
7.7	Setting CHAP authentication	—	—	○
7.8	Transferring Configuration	○	○	○
7.9	Storing Configuration Data	○	○	○
7.10	Applying Configuration Data to Another AMS1000 Storage System	○	○	○
7.11	7.11.1 Simple Setting	○	—	○
	7.11.2 Detailed Setting for Each Host Connection	○	—	○
7.12	Setting the Storage System When Using Special Mode	○	○	○
7.13	Changing the Network Parameter	○	○	○
7.14	Changing the IP Address for the Maintenance Port	○	○	○
7.15	Setting the System LU and User LU in the NAS System	—	○	—
7.16	Setting the NNC Management LAN Port Information in the NAS System	—	○	—
7.17	Setting Time Zone	○	○	○
7.18	Settings and Restrictions for Adding the Thunder 9500VFC Additional Unit	○	○	○

○: An explanation is provided.

—: An explanation is not provided.

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: **xxxxx/xx**.

The microprogram **07xxx/xx** (x is optional), is available. However, /x may not be included in the microprogram version number or another control system may control the microprograms.

NAS model has NAS OS and BIOS. NAS OS controls file service and NAS management function. The version is managed by the following numerical format: **xx-xx-xx** (x is optional). BIOS controls RKNAS initialization and NAS unit full memory dump (hereinafter referred to as NAS dump) collection function. The version is managed by the following numerical format: **xxxxxxx** (x is optional).

7.1.2 System Parameters

System parameters are necessary to start the subsystem (from turning on the main switch of RKH/RKHE to generation of the RDY LED (green) of RKH/RKHE). System parameters are stored in flash memory. They can be backed up on a disk drive. When the system parameter changes, make a backup copy on the disk drive.

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 Table 7.1.

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 are backed up to the following: <ul style="list-style-type: none">Fixed part program: Cannot be backed upFlash program: Automatically backed up to 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 RKH/RKHE frame. Therefore, the system area has redundancy for disk drives #0 to #4 in the RKH/RKHE frame.

7.2 Setting Fibre Channel Information

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

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

1. Turn on the power supply.
Note: If the power supply has been turned on, proceed to the next step.
2. Start the Storage Navigator Modular program, and set the operation mode to **Management Mode**.
3. Double-click the icon of an array unit on the Main window. Once the Array unit information displays, select the **Settings** menu. Click **Display Details** or click **Display Details** in the tool bar.

4. In the **Tools** menu, click **Configuration Settings** or click **Configuration Settings** on the toolbar.
5. Click the **Fibre Channel** tab.
6. Set a Port Address, Topology Information, and Transfer Rate:
 - Port Address:** Port address displays as a hexadecimal number.
 - The default setting is recommended.
 - Topology Information:** Indicates the topology status.
 - Loop (Arbitrated Loop)
 - Point-to-Point (Switched Fabric)
 - Transfer Rate:** Indicates the fibre transfer rate.
 - The default setting is recommended.

Note: Set the "Transfer Rate" of Fibre Channel to the same value as the transfer rate of devices connected directly with an array subsystem. When the AMS1000 is connected directly and externally with the TagmaStore Universal Storage Platform, set the port transfer rate of both the TagmaStore Universal Storage Platform and the AMS1000 to the fixed transfer rate (the same value for the TagmaStore Universal Storage Platform and the AMS1000 selecting any one of 1G bps, 2 Gbps, or 4 Gbps.).

Transfer Rate of Devices Connected with an Array Subsystem	Transfer Rate of an Array Subsystem
1G bps	1G bps
2G bps	2G bps
4G bps	4G bps
Auto (Note1)	Transfer Rate (Note2)

Note 1: When an array subsystem is connected to any of the following external storage devices, set the transfer rate of devices to other than "Auto", and set the transfer rate of the array subsystem to the same transfer rate as the transfer rate of the devices to which it is connected.

- TagmaStore Universal Storage Platform
- TagmaStore Network Storage Controller
- Lightning 9900V directly

Note2: Set the transfer rate of an array subsystem as follows.

Transfer Rate of Devices (maximum speed)	Transfer Rate of an Array Subsystem
Auto (2G bps)	2G bps
Auto (4G bps)	4G bps d
Auto (unknown)	Auto

7. Click **Apply**.

8. A confirmation message displays. After verifying that the I/O operation initiated by the host has stopped, click **OK**.
9. A message displays, stating that the setting is completed. Click **OK**.

7.3 Setting iSCSI Information

7.3.1 Setting iSCSI Port Information

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

To set iSCSI port information, follow these steps:

1. Turn on the power supply.
 - Note:** If the power supply has already been turned on, proceed to the next step.
2. Start the Storage Navigator-Modular program and set the operation mode in **Management Mode**.
3. Click the icon of an array unit on the Main window and select the **Settings** menu. Click **Display Details**.
4. Click **Configuration Settings**.
5. Click the **iSCSI** tab.

The screenshot shows the 'Configuration Settings' dialog box for an array unit (DF700M_75000018). The 'iSCSI' tab is selected. The configuration is for Controller 0, Port 0A. The 'Network' section is expanded, showing the following values:

Parameter	Value
IP Address	192.168.0.200
Subnet Mask	255.255.255.0
Default Gateway	0.0.0.0
Port Number	3260
Keep Alive Timer(sec)	60
MTU	1500
Ether Address	00:00:87:66:0B:00
Result	Normal

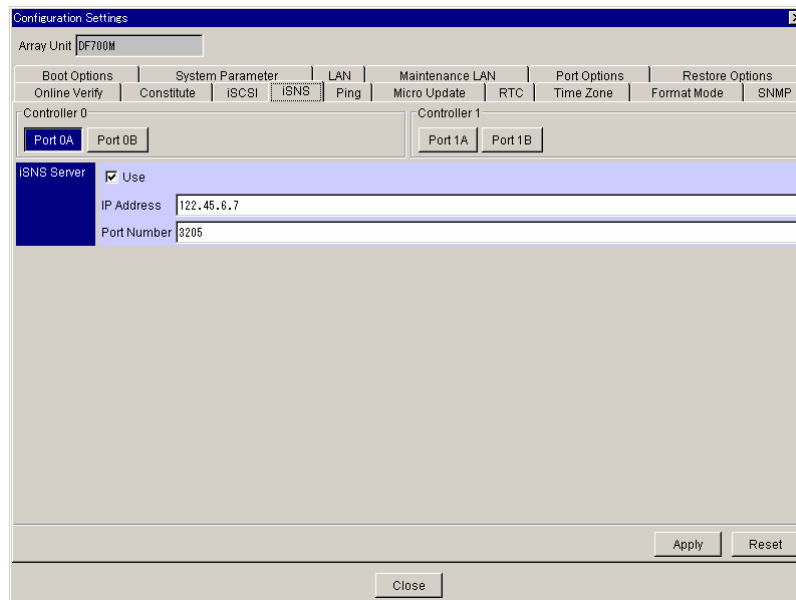
At the bottom of the dialog box, there are buttons for 'Refresh', 'Apply', 'Reset', and 'Close'.

6. Set a **IP Address, Subnet Mask, Default Gateway, Port Number, and Keep Alive Timer(sec.):**
 - IP Address:** Specify IP address.
 - Subnet Mask:** Specify subnet mask.
 - Default Gateway:** Specify default gateway address.
 - Port Number:** Specify port number. The default is 3260.
 - Keep Alive Timer (sec.):** Specify Keep Alive Timer. The default is 60 seconds.
7. Make the setting for the other ports in the same way as step 6.
8. Click **Apply**.
9. A confirmation message displays. After verifying that the I/O operation initiated by the host has stopped, click **OK**.
10. A message displays stating that the setting is completed. Click **OK**.

7.3.2 Setting iSNS Server Information

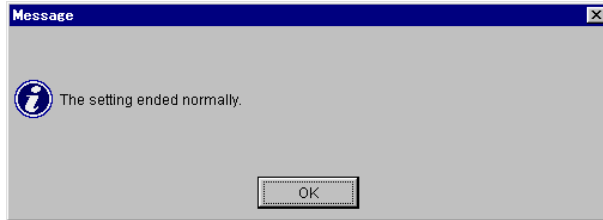
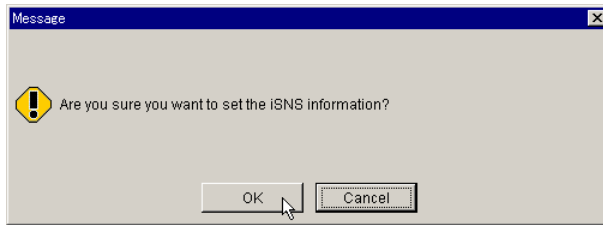
iSNS (Internet Storage Name Service) provides the same function as the Name Server of the Fabric Switch on the Fibre Channel interface. The iSNS information enables the host as iSCSI initiator to discover the iSCSI Name of the target with the specified IP address. The use of the iSNS is optional for the iSCSI. When using the iSNS, the disk array subsystem registers the iSCSI port information on the iSNS Server

1. On the **Tools** menu, click **Configuration Settings**.
2. Click the **iSNS** tab.



- **iSNS Server:** Specify whether to use iSNS Server or not. When using the iSNS server, specify the **IP Address** and **Port Number** of the iSNS Server.
3. Click **Apply**.

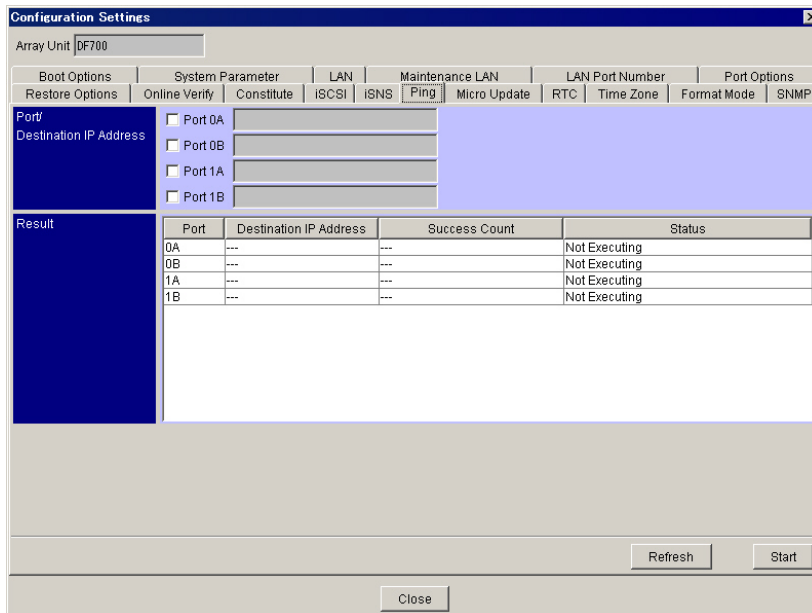
4. A confirmation message displays. Click **OK**.



7.3.3 Sending a Ping

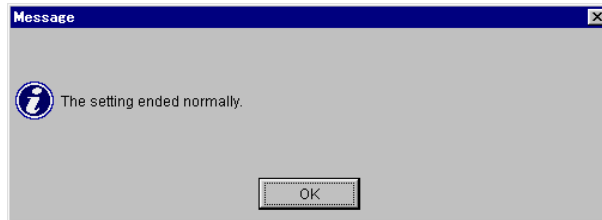
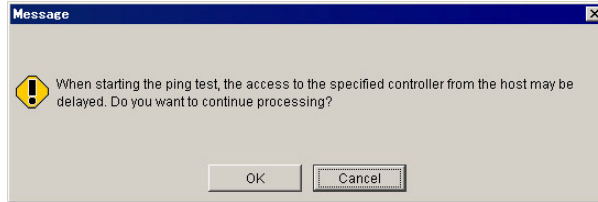
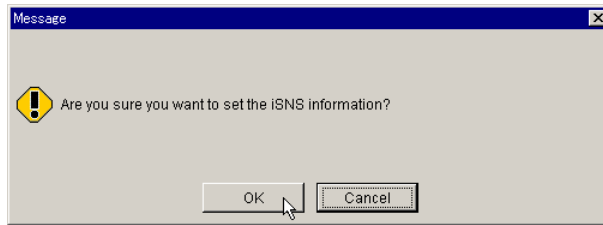
To send the ping to the initiator (host) and display the result of the sending, follow these steps:

1. On the **Tools** menu, click **Configuration Settings**.
2. Click the **Ping** tab.

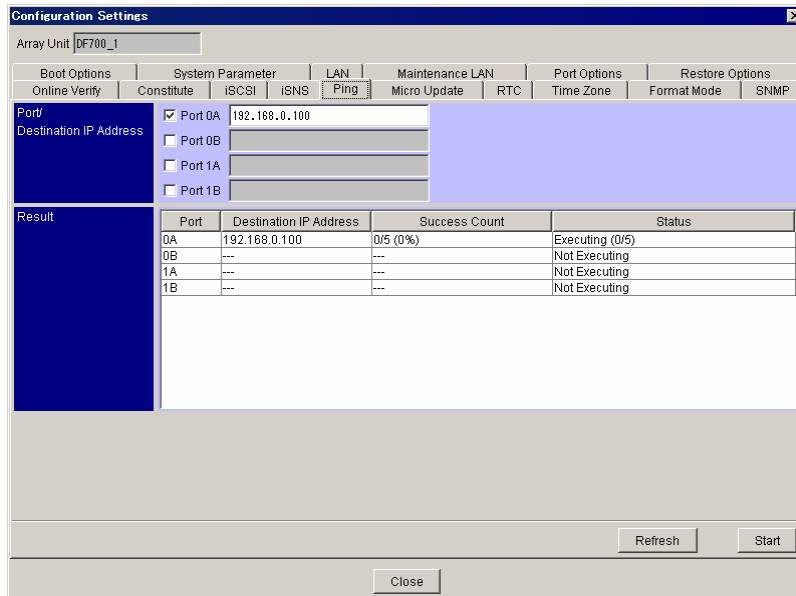


- **Port:** Select the port to send ping.
 - **Destination IP Address:** Specify the IP Address of the initiator.
3. Click **Start**.

- The following message displays. Click **OK**.



The result displays.



- As necessary, click **Refresh** to display the latest information.

7.4 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 (Read/Write 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:

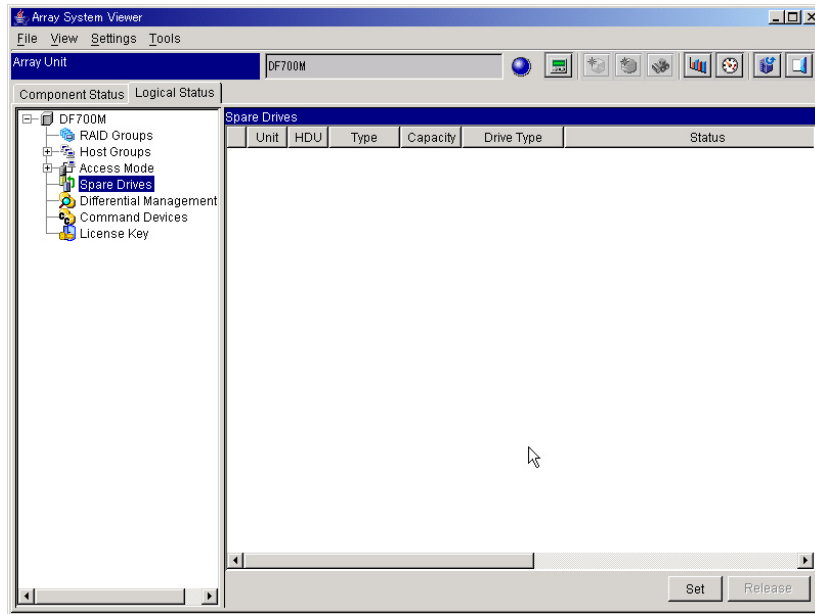
- Setting a Spare Disk
- Canceling a Spare Disk Setting
- Setting a RAID Group
- Deleting a RAID Group
- Setting a Logical Unit
- Deleting the Last Logical Unit
- Formatting a Logical Unit
- Change of the Controller in Charge of a Default LU

7.4.1 Setting a Spare Disk

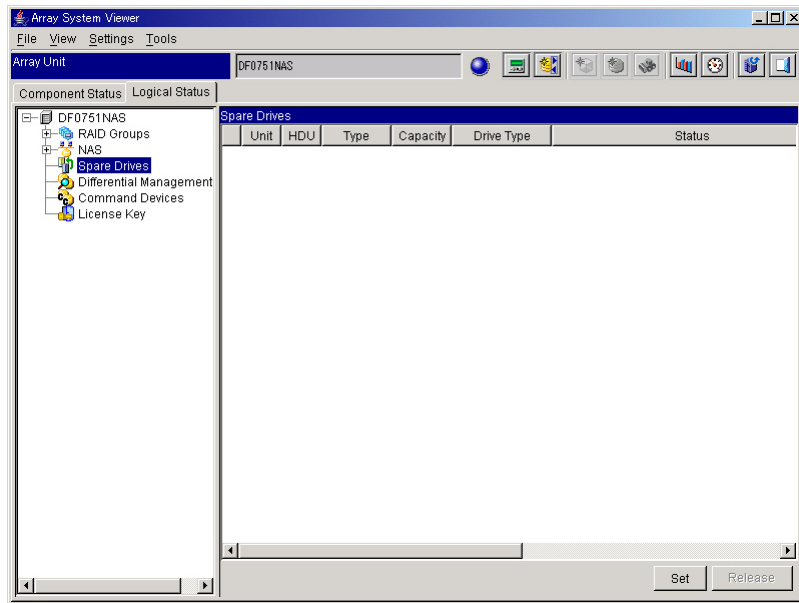
To set a spare disk, follow these steps:

1. Turn on the power supply.
Note: If the power supply has been turned on, proceed to the next step.
2. Start the Storage Navigator Modular program, and set the operation mode to **Management Mode**.
3. Double-click the **icon** of an array unit in the Main window. Once the array unit information displays, select the **Settings** menu.
4. On the **Settings** menu, select **Display Details**.

5. Click the **Logical Status** tab on the Unit Window.



(NAS)



6. Double-click the **Spare Drives** icon.
7. Click **Set**.

The **Spare Drives** dialog box displays (see Figure 7-1).

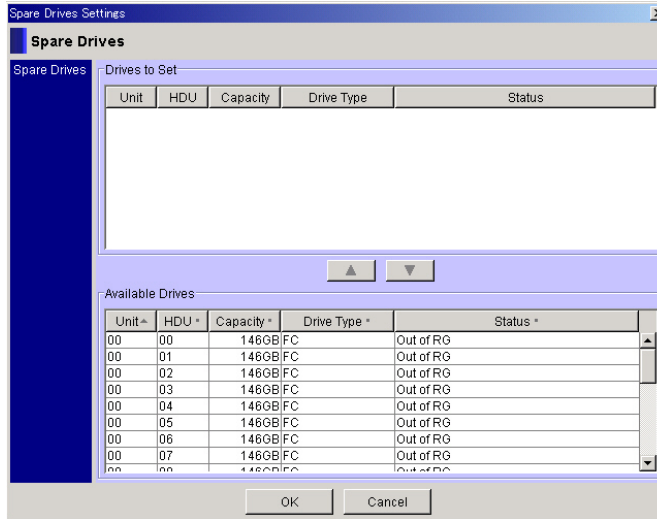



Figure 7-1 Spare Drive Dialog Box (before setting)

8. Select the HDU that you want to set as a spare drive from the **Available Drives** list and click .

The selected HDU is moved to the **Drives to Set** list. See Figure 7-2.

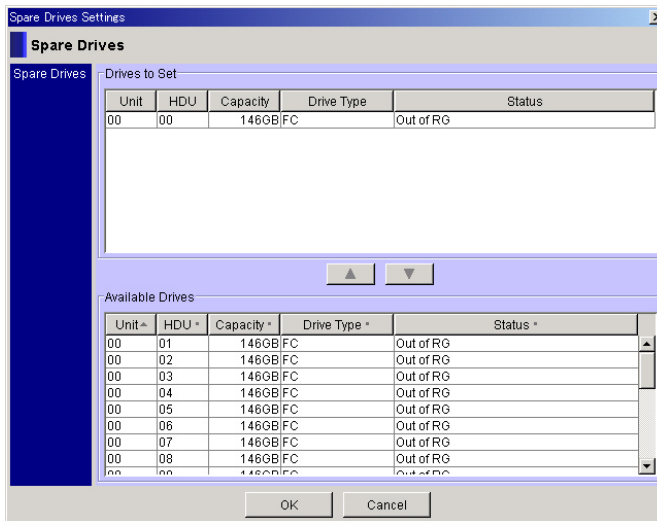
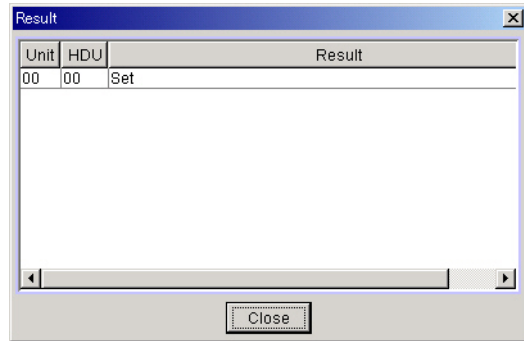
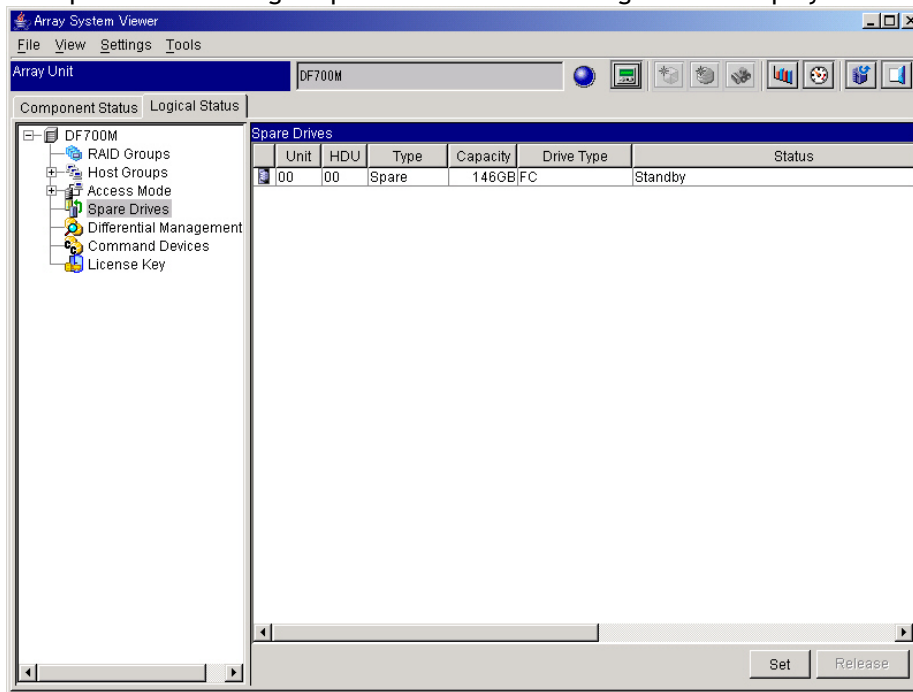


Figure 7-2 Spare Drive Dialog Box (after setting)

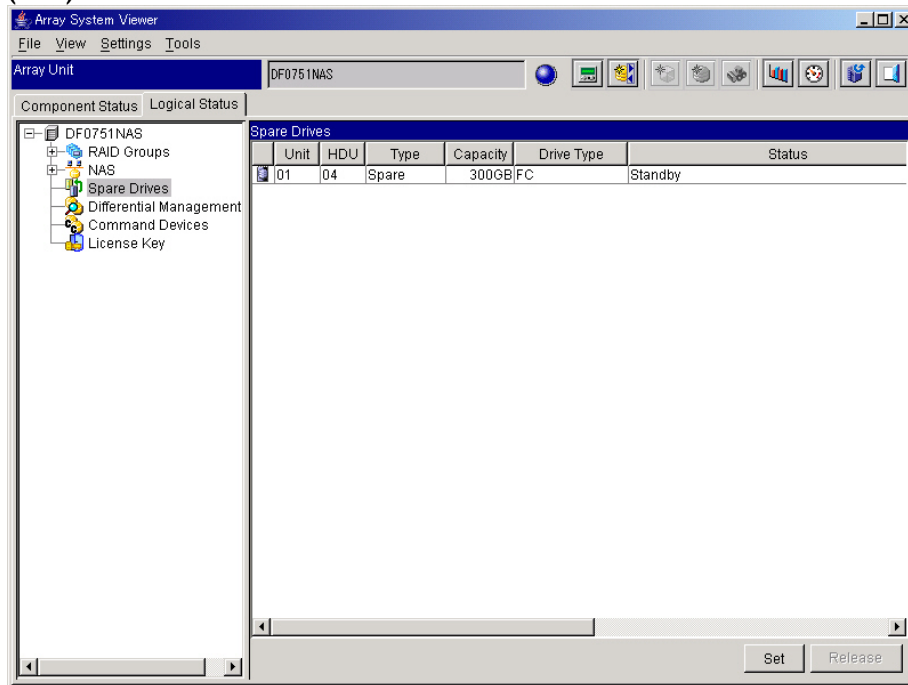
9. Click **OK**.
10. A message indicating that the setting is complete displays. Click **OK**.
11. A result window displays, indicating that the setting is completed.
Click **Close**.



The spare drive setting is updated and the following window displays:



(NAS)



7.4.2 Canceling a Spare Disk Setting

To cancel a spare disk setting, follow these steps:

1. Select the **Logical Unit** tab on the Unit window.
2. Select the **Spare Drives**.
3. Select the spare drive to be canceled, and click **Release**.
4. The confirmation message for spare drive canceled displays. Click **OK**.
5. A message displays, stating that the setting is complete. Click **Close**.

7.4.3 Setting a RAID Group

Note: Set at least four RAID Groups for RAID groups used at the time of NAS unit connection in order to make the NAS system LU for the usual operation, NAS system LU for the backup, and the NAS user LU into another RAID Group.

Note: The RAID group can be created by selecting one drive from the FC and SATA drives. Be sure they are not spare disks or blocked. The disk drives of the even numbered slots are allocated to Loop #0 and odd numbered slots are allocated to Loop #1. To ensure better load distribution, evenly select disks from both odd and even numbered slots. Also, evenly select drives in the basic and additional chassis.

To set a RAID group, follow these steps:

1. Turn on the power supply.

Note: If the power supply has been turned on, proceed to the next step.

2. Start the Storage Navigator Modular program, and set the operation mode to **Management Mode**.
3. Click the icon of an array unit on the Main window, and then select the **Settings** menu, click **Display Details**.
4. Click the **Logical Status** tab.
5. On the **Settings** menu, select **RAID Group**, and then click **Settings**. Alternatively, click **RAID Group Settings** in the tool bar. This operation can also be completed from the context menu of the **RAID Groups** box.
6. On the **RAID Group** dialog, select or input the **RAID Level**, **Drive Configuration**(**Drive Type**, **Drive Capacity**, **Combination**, and **Parity Groups**) and click **OK**. For the **Drives**, select the **Automatic Selection**.
7. A confirmation message displays, click **OK**.
8. If the RAID group setting is not successful, delete the affected RAID group, and try creating the RAID group again.

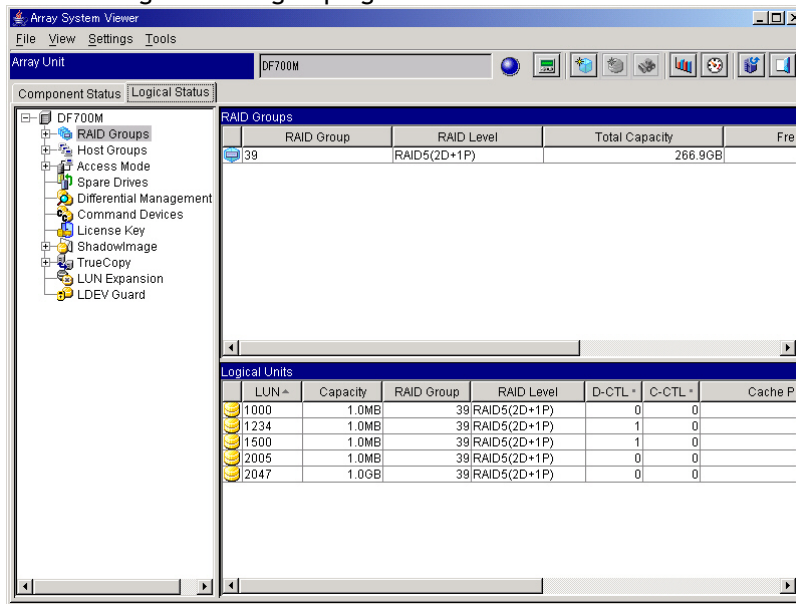


Figure 7-3 Logical Status Tab

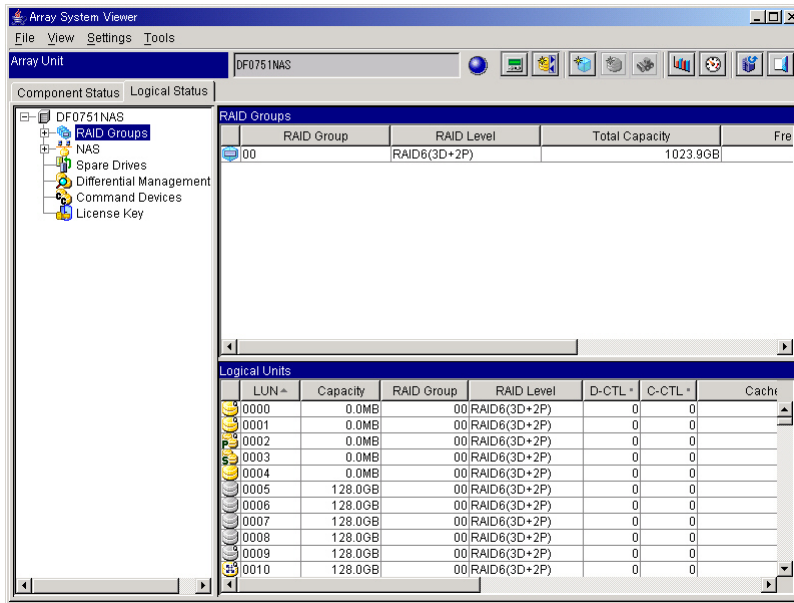


Figure 7-4 Logical Status Tab (NAS)

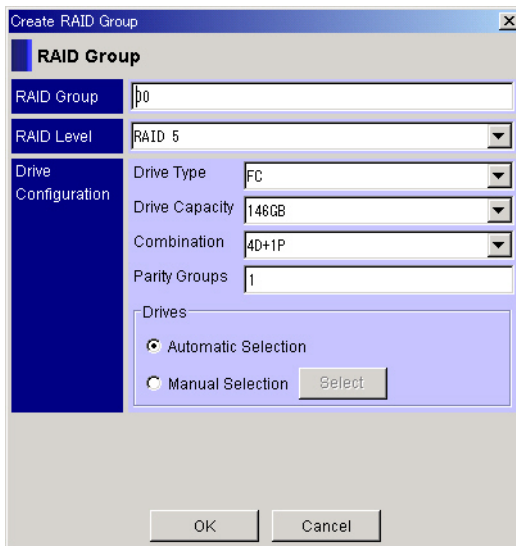


Figure 7-5 RAID Group Dialog

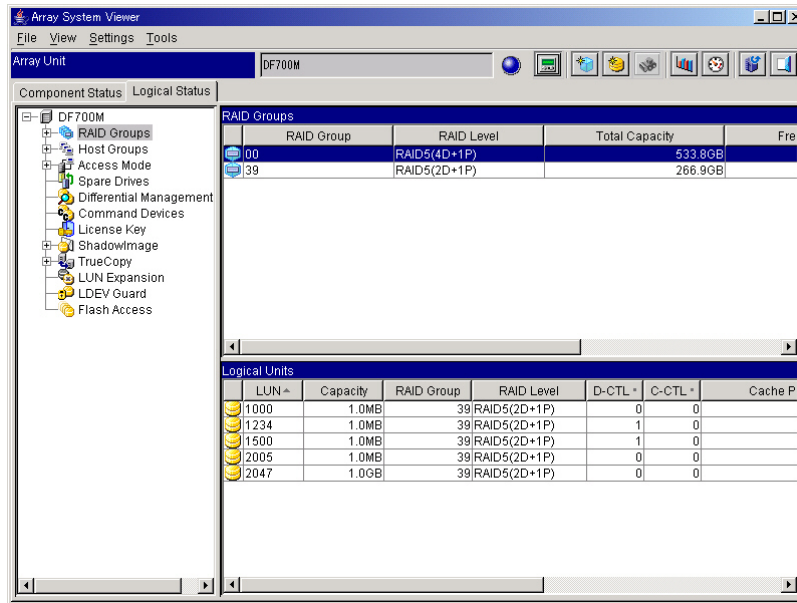


Figure 7-6 Updated RAID Group

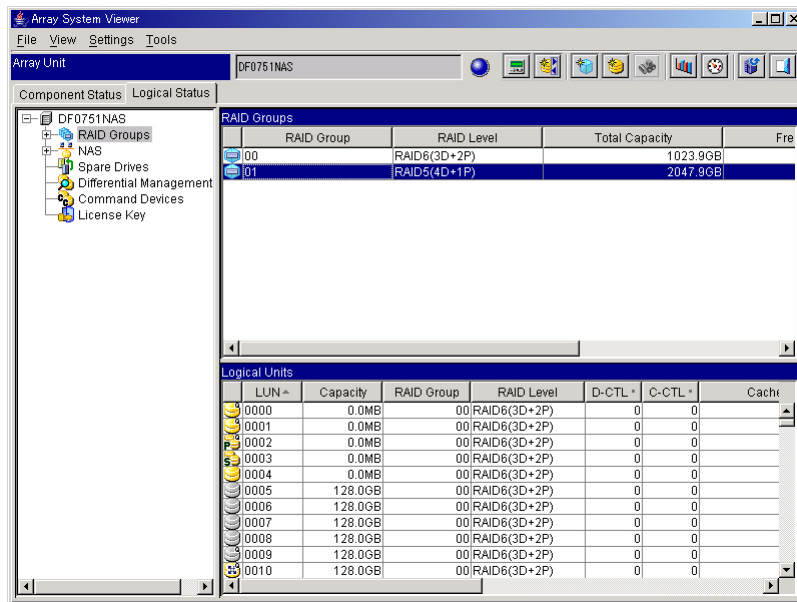


Figure 7-7 Updated Set RAID Group (NAS)

7.4.4 Deleting a RAID Group

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

Note: Even if the logical unit is defined in the RAID group to be deleted, the RAID group can be deleted.

The following logical units are defined in the RAID group, the RAID group cannot be deleted. Release all the LUs from the definition and then delete the RAID group.

- Command device
- DMLU
- Paired LU of ShadowImage In-System Replication
- Paired LU of Copy-On-Write Snapshot
- Pooled LU of Copy-On-Write Snapshot
- Paired LU of TrueCopy Remote Replication
- Paired LU of TrueCopy Extended Distance
- Pooled LU of TrueCopy Extended Distance
- Sub LU of the Unified LU
- NAS System LU
- NAS User LU
- Reserved LU of the Modular Volume Migration

Note: If a LU whose pair status of the Modular Volume Migration is COPY exists in the RAID group to be deleted, the RAID group cannot be deleted. Delete the RAID group after the pair status of the Modular Volume Migration transits to PSUS.

Note: The RAID group cannot be deleted when a LU that applies to any of the following exists in the RAID group to be deleted:

In the Data Retention Utility setting:

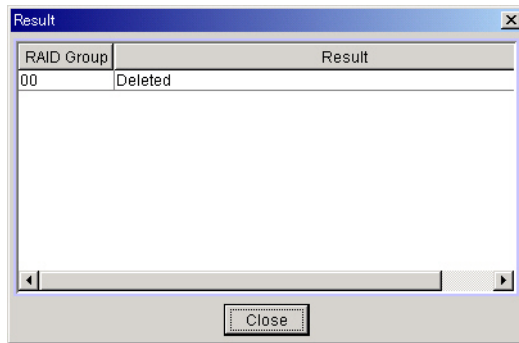
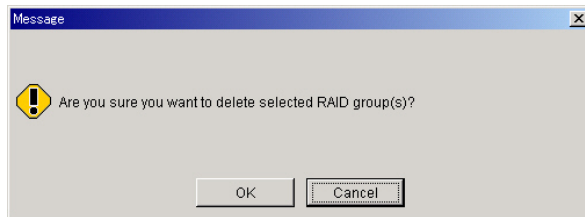
- the Attribute is set to "Read Only, Protect", or "Can't Guard".
- the S-VOL is set to "Disable" (the LU is inhibited from being set to S-VOL).
- the Mode is set to "Read Capacity 0 (Zer) ", or "hiding from Inquiry Command Mode (Zer/Inv)".

Delete the LU after setting the **Attribute** to "Read/Write", the **S-VOL** to "Enable(the LU can be set to S-VOL)", and the **Mode** to " --- (un-specifying)".

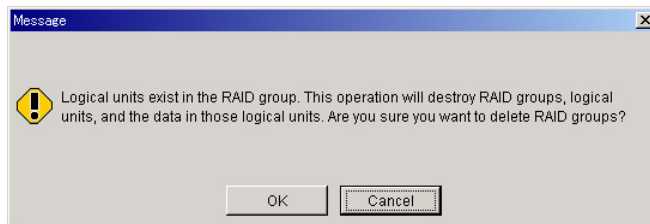
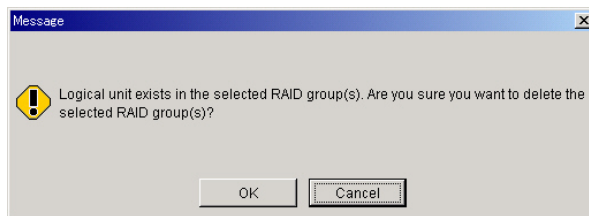
To delete a RAID Group, follow these steps:

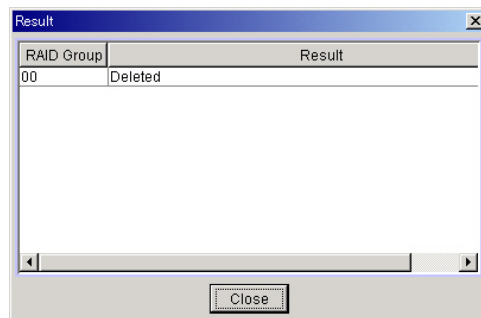
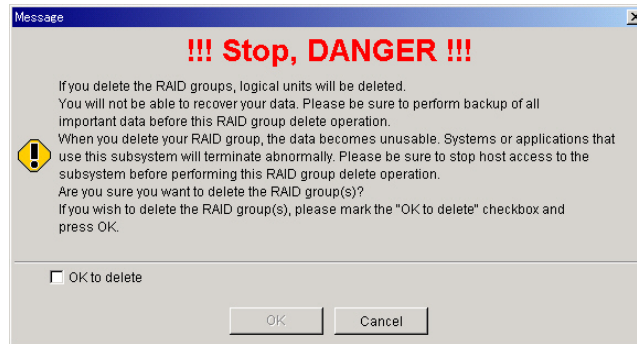
1. Click the **Logical Status** tab on the Unit screen.
2. Select the RAID group to be deleted from the **RAID Groups**.

3. On the **Settings** menu, select **RAID Group** and click the **Delete**.
4. A message displays requesting confirmation to delete the selected RAID groups. Depending on whether there are formatted logical units in the RAID group or not, the message description is different. Click **OK**.
 - When no logical unit exists in the RAID Group.



- When a logical unit exists in the RAID Group.





7.4.5 Setting a Logical Unit

Note: Execute the setting for the only system LU when the AMS1000 is connected to the NAS in accordance with the following restrictions:

No.	Internal LU Number (Note 1)	System LU	Capacity Restriction		Control unit in Charge (Note 2)
			Bytes Designation	Block Designation	
1	0	For system disk (CTL 0)	14,013 M bytes (or more)	28,698,624 blocks (or more)	0
2	1	For system disk (CTL 1)	14,013 M bytes (or more)	28,698,624 blocks (or more)	1
3	2	For volume for storing dump (CTL 0)	4,925 M bytes (or more)	10,086,400 blocks (or more)	0
4	3	For volume for storing dump (CTL 1)	4,925 M bytes (or more)	10,086,400 blocks (or more)	1
5	4	For command device	35 M bytes (or more)	71,680 blocks (or more)	0
6	5	For the work for storing the dump edit result.	4,195 M bytes (or more)	8,591,360 blocks (or more)	0
7	6	For the system sharing volume	2,537 M bytes (or more)	5,195,776 blocks (or more)	0
8	7	For the volume for backing up a shared volume	2,537 M bytes (or more)	5,195,776 blocks (or more)	0

No.	Internal LU Number (Note 1)	System LU	Capacity Restriction		Control unit in Charge (Note 2)
			Bytes Designation	Block Designation	
9	8	For the volume 2 for backing up a shared volume	2,537 M bytes (or more)	5,195,776 blocks (or more)	0
<p>Note 1: Internal LU Number is recommended value. If value other than the values described above is set, there is no problem in system operation.</p> <p>Note 2: Control unit in charge is recommended value. If value other than the values described above is set, there is no problem in system operation.</p>					

Note: When the AMS1000 is connected to the NAS, create the system LU and user LU in different RAID groups respectively.

Note: Set the user LUs and system LUs for NAS on RAID groups that are NOT used for LUs used for iSCSI access.

Note: When the array subsystem and the host computer are connected with the Fibre Channel interface, the logical unit of the array subsystem cannot be recognized unless the logical unit of number 0 is not created in the array subsystem depending on the host computer. When using this host computer, create the logical unit of number 0 or map the logical unit to Host LUN (H-LUN) 0.

To set a logical unit, follow these steps:

1. Turn on the power supply.

Note: If the power supply has been turned on, proceed to the next step.

2. Start the Storage Navigator Modular program, and set the operation mode to **Management Mode**.
3. Click the icon of an array unit on the Main window, and then select the **Settings** menu, click **Display Details**. Or, click **Display Details** in the tool bar.
4. Click the **Logical Status** tab on the Unit screen.
5. Click the icon of a RAID group from which you would like to create the Logical Unit. On the **Settings** menu, select **Logical Unit** and click the **Settings**. Alternatively, click **Logical Unit Settings** in the tool bar.

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

6. On the **Logical Unit** dialog, input or select **Logical Unit No.**, **Default Controller**, and **Size**. Click **OK**.
7. A created logical unit number displays 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 displays.

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 2,048 logical units.

Note: The logical unit number can be set to any value when the logical unit is created. The number with the lowest value of the unallocated numbers is automatically allocated to the logical unit number.

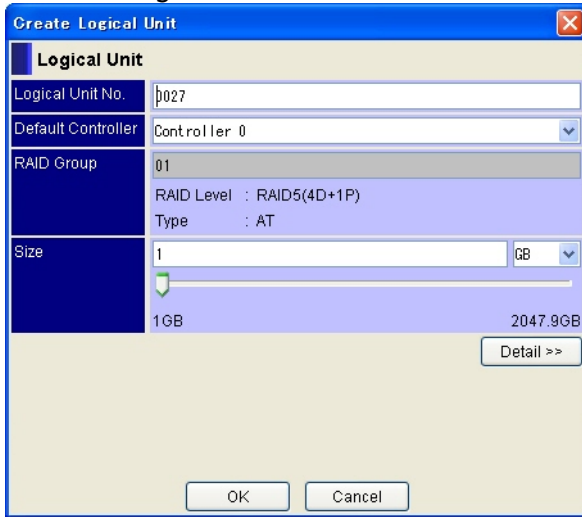


Figure 7-8 Setting the Logical Unit Property

When creating a logical unit again in the area where the logical unit was deleted, the free area needs to be selected to create a logical unit in the user data area. Click the **Detail** button to display the Logical Unit Detail dialog box.

Note: If there are noncontiguous areas in the RAID group where you are creating an LU, create an LU in the area with the largest free space. An LU is created in the contiguous address area and cannot be created across areas. However, when a logical unit is deleted, the space in the user area that it occupied is left free and is available for use by a new LU. Therefore, instead of using the default address, you can create an LU in any of the free spaces that exist in the user area, as long as the free space is large enough to hold the LU that you are creating.

Note: If you delete multiple LUs whose addresses are not contiguous, a free space will be left where each of the LUs were. However, because the free spaces are located separately in the user data area, you cannot create a new LU that uses all the free spaces together.

To create a logical unit in the same area where a logical unit was deleted:

1. Click **Select** in the Logical Unit Detail dialog box.
In the Select Area window, the free areas in the user data area are displayed.
2. In the Select Area window, select the free area to create a logical unit, and click the **OK** button.
3. Set the capacity of the new LU within the range displayed in the Logical Unit dialog (detail) box.

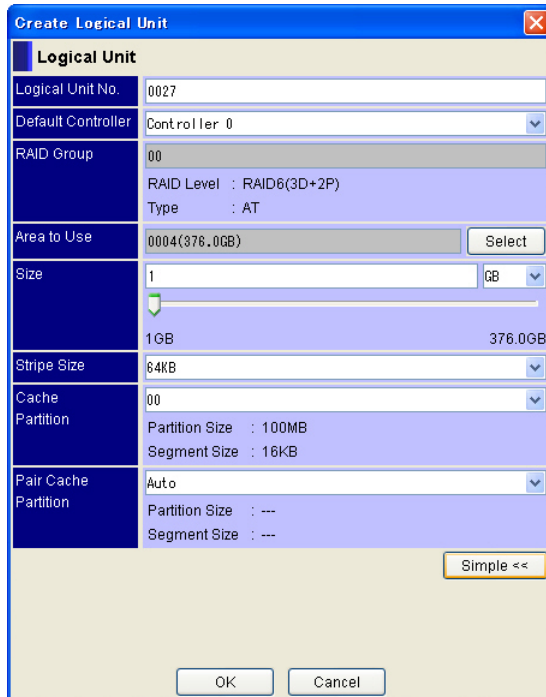


Figure 7-9 Logical Unit Dialog (detail)

The example for the Select Area window is shown below. The areas indicated in No.0000, No.0001, No.0002, and No.0003 in this window are the free areas produced by deleting a logical unit before. In these areas, logical unit can be created again within the range of capacity. The area with the biggest number (No.0004) is the unused free area.

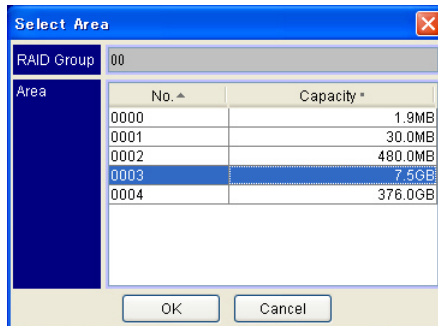


Figure 7-10 Select Area

1. After the setting is complete, click **OK**.
2. The logical unit settings are updated and the Create Logical Unit dialog box displays (see Figure 7-8).
3. When the subsystem is configured with a mixture of Fibre Channel/iSCSI interfaces and NAS interfaces, execute LU mapping for the created logical unit. For details on how to do LU mapping, refer to section 7.5.1.

Verify that LUs used by Fibre Channel/iSCSI and LUs used by NAS are mapped exclusive of each other.

7.4.6 Deleting the Last Logical Unit

To delete the last logical unit, follow these steps:

1. Click the **Logical Status** tab on the Unit window.
2. On the Unit window, select the icon of logical unit to be deleted.
3. On the Settings menu, select Logical Unit and click **Delete**.

Notes:

- The logical units being used in the NAS system may be unable to be deleted.
- The logical units defined below cannot be deleted. Release all the LUs from the definition and then delete the RAID group:
 - Command device
 - DMLU
 - Paired LU of the ShadowImage in-system replication
 - Paired LU of the Copy-on-Write Snapshot
 - Pooled LU of the Copy-on-Write Snapshot
 - Paired LU of the TrueCopy Remote Replication
 - Paired LU of TrueCopy Extended Distance
 - Pooled LU of TrueCopy Extended Distance
 - Sub LU of the Unified LU
 - NAS system LU
 - NAS user LU
 - Reserved LU of the Modular Volume Migration

Note: When an LU is deleted, the space in the user area that it occupied is left free and is available for use by a new LU. Therefore, instead of using the default address, you can create an LU in any of the free spaces that exist in the user area, as long as the free space is large enough to hold the LU that you are creating.

Note: If a paired LU whose pair status of the Modular Volume Migration is COPY exists, the LU cannot be deleted. Delete the LU after the pair status of the Modular Volume Migration transits to PSUS.

Note: The LU cannot be deleted when LU exists that applies to any of the following:

In the Data Retention Utility setting:

- the Attribute is set to "Read Only, Protect", or "Can't Guard".
- the S-VOL is set to "Disable" (the LU is inhibited from being set to S-VOL).
- the Mode is set to "Read Capacity 0 (Zer) ", or "hiding from Inquiry Command Mode (Zer/Inv)".

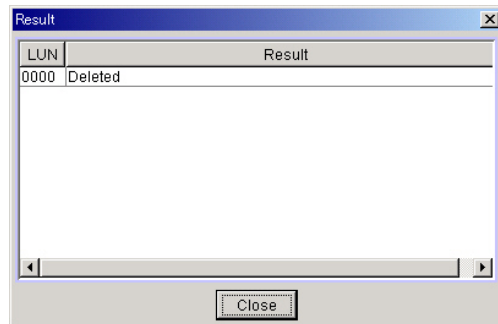
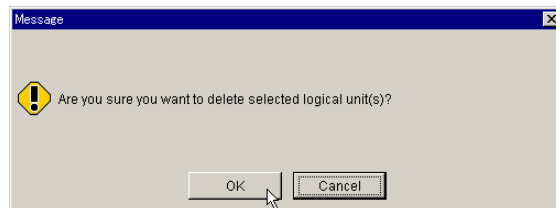
Delete the LU after setting the **Attribute** to "Read/Write", the **S-VOL** to "Enable(the LU can be set to S-VOL)", and the **Mode** to " --- (un-specifying)".

4. A confirmation message displays indicating whether selected logical units should be deleted or not. Depending on whether the logical units to be deleted are formatted or not, the message description is different.

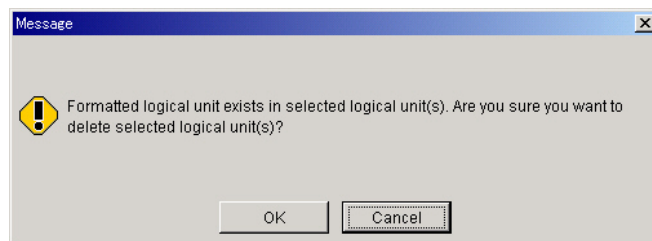
Click **OK**.

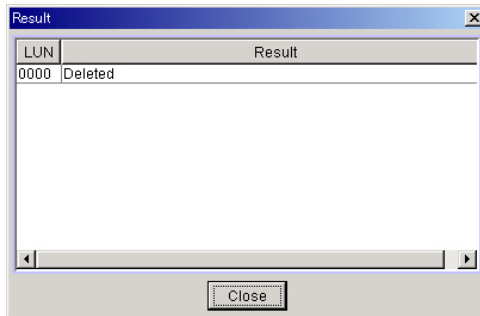
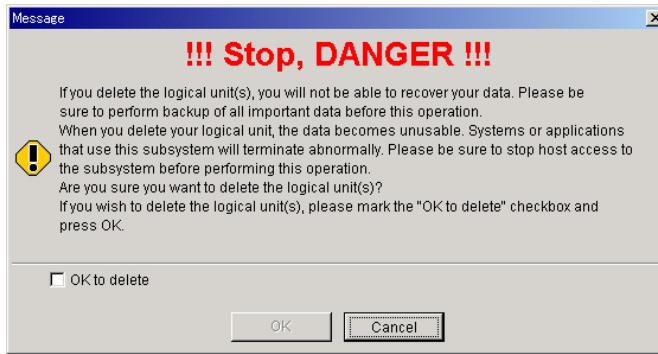
The logical unit information in which the logical unit has been deleted is updated and the window displays.

When no formatted logical unit exists:



When a formatted logical unit exists:





7.4.7 Formatting a Logical Unit

Note 1: When logical units are formatted, the user data will be initialized and completely deleted before the formatting takes place.

Note 2: For the logical unit that is being formatted in the background, it is best to perform operations to the host installation.

If a volatile failure for data in cache memory occurs due to subsystem power-off during formatting, the logical unit will be unformatted and data can be lost. Therefore, host installation operation should be performed from the first step for the logical unit.

Note 3: Formatting will impact the host access performance, especially on the logical unit being formatted and on the logical unit in the same RAID group as the logical unit being formatted. Do formatting during off-hours with less host access. When formatting a logical unit in the same RAID group as a NAS system LU, do not boot or reboot the NAS OS. This could result in boot failure or could increase the boot time of the NAS OS.

Note 4: When performing a fail-over or fail-back between clusters at the time of NAS connection, verify whether the LU is currently being formatted or not. If the LU is being formatted, change the **Format Priority Mode** to **Host**. When performing the formatting while the fail-over or fail-back is in execution, change the **Format Priority Mode** to **Host**. Unless the **Format Priority Mode** is changed to **Host**, the fail-over or fail-back terminates abnormally. If you change the **Format Priority Mode** during fail-over or fail-back, be sure to change the setting back to its original state (usually to **Normal**) after the fail-over or fail-back is complete. For details on how to change the **Format Priority Mode**, refer to section 7.4.8, **Changing Format Mode**.

Note 5: In the following cases, the LU cannot be formatted. When you perform the formatting, follow the procedure to solve each problem.

- LU format cannot be performed for the P-VOL or S-VOL of the ShadowImage in-system replication, TrueCopy remote replication, or TrueCopy Extended Distance. Release the PAIR and then format the LU.
- LU format cannot be performed for the P-VOL or V-VOL(SnapShot image) of the Copy-on-write SnapShot. Release the PAIR and format the LU.
- The Sub LU of the unified LU cannot be formatted. Specify the Main LU of the unified LU and perform the formatting. When you want to format the Sub LU of the unified LU, format the Sub LU after separating the Sub LU from the unified LU.
- LU format cannot be performed for the P-VOL or S-VOL that is performing the Modular Volume Migration. Format the LU after the Modular Volume Migration is complete. When you want to format the LU immediately, cancel the Modular Volume Migration, and format the LU.
- The LU registered in a data pool cannot be formatted. Delete the LU from the data pool, and then format the LU.
- In any of the following cases, the LU format cannot be performed:
In the Data Retention Utility,
 - "Read Only" or "Protect" is set for the LU access attribute.
 - "Read Capacity 0(Zero)" or "hiding from Inquiry Command Mode(Zer/inv)" is set for the Mode.
 - "Disable(the LU is inhibited from being set to S-VOL)" is set for the S-VOLFormat the LU after returning the LU access attribute to "Read/Write (default)".
- LU format cannot be performed for the NAS system LU or User LU. Release the LU from the allocation for the NAS system LU or NAS user LU, and then format the LU.
- Multiple logical units may not be formatted if their total capacity exceeds 200 Terabytes. Therefore, when selecting multiple units for formatting, ensure that their total capacity is less than 200 Terabytes.

Format

This mode enables the subsystem to start its operation earlier by formatting the specified LU in the background to make it usable by a host. Up to 2048 LUs can be specified for formatting. This number can also be increased; however, the number of LUs that can be simultaneously formatted in the background is six per CTL. When executing formatting, the Storage Navigator Modular program can perform operations (such as a RAID group creation) while the formatting is being executed.

When the Storage Navigator Modular program is terminated while formatting is executed, the formatting function is continued. When the Storage Navigator Modular program is terminated while formatting is executed, the formatting progress displays by percentage in the logical unit status column when the Storage Navigator Modular program is activated again.

When the host I/O is executed for the LU in formatting, Format completion may be delayed; from the 99 % progress status, it may take 400 seconds (maximum).

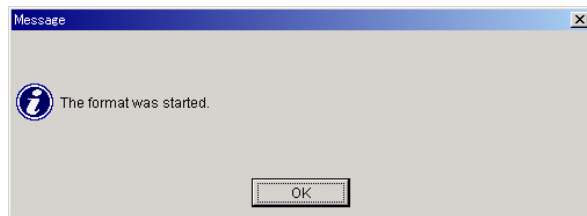
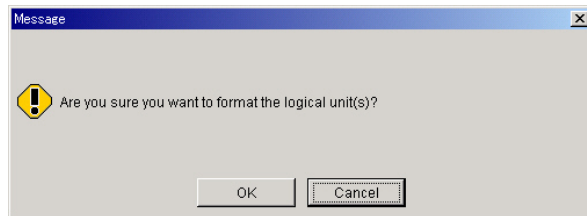
To format a logical unit, follow these steps:

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

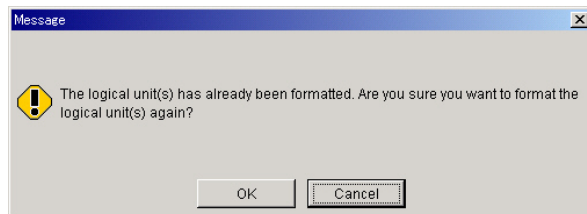
Notes:

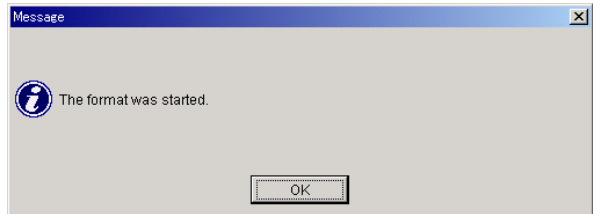
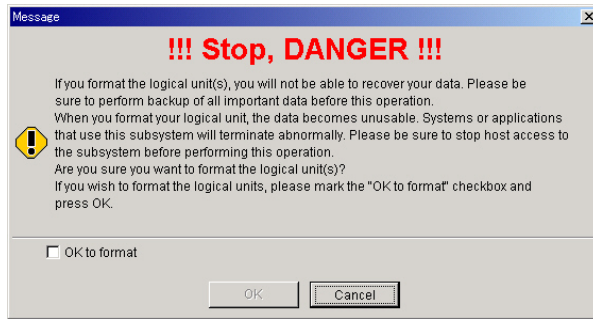
- When you select multiple logical units, hold down the **Ctrl** key and click the icons of the logical units to format.
 - When a logical unit is incorrectly specified, press **Cancel** and redo processing by selecting a logical unit to be reformatted.
 - In the ShadowImage in-system replication, TrueCopy Remote Replication, TrueCopy Extended Distance, or Copy-on-Write Snapshot, PAIR cannot be defined for the LU being formatted. LU defined as PAIR cannot be formatted.
2. A confirmation message displays and asks you to confirm whether the selected logical units may be formatted or not. Check the message, and click **OK**. Depending on whether there are formatted logical units among the logical units or not, the message description is different.

When there is no formatted logical unit:

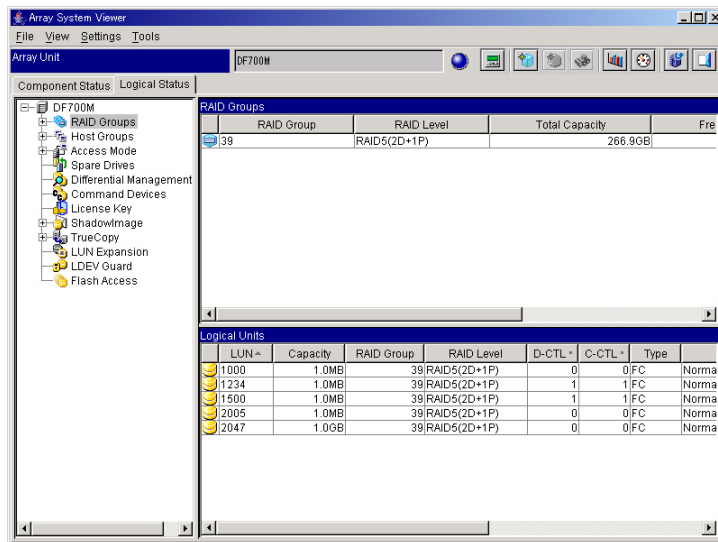


When there is a formatted logical unit:

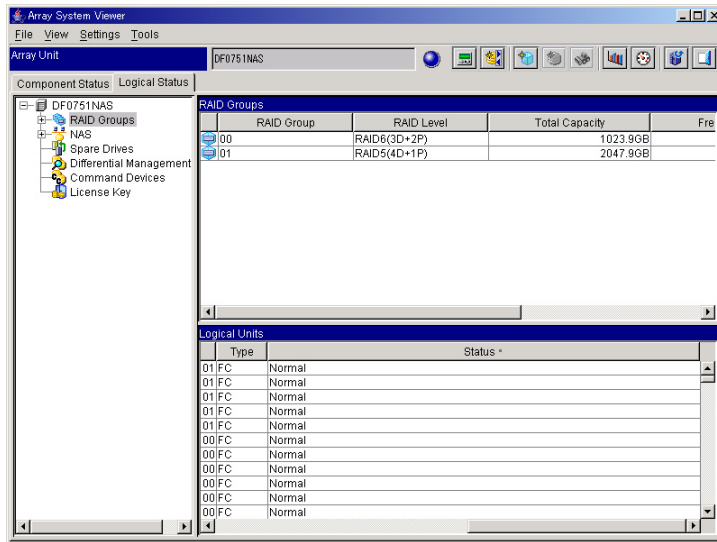




The progress rate of formatting process in the background displays in the Status box. The progress rate of formatting process is not displayed automatically.



(NAS)



To confirm the latest progress rate, click **Refresh**, and refresh the display.

3. **Normal** displays in the **Status** box. (When the formatting is in execution, the progress status displays.)

If formatting is terminated abnormally, see the contents of the result. The formatted logical unit information is updated, and then the window displays.

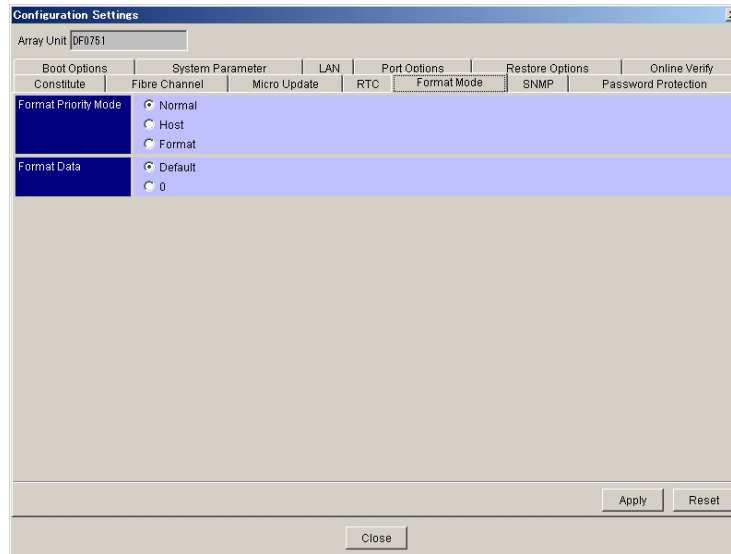
For examples of the messages displayed, see Table 2.1 AMS1000 Logical Unit Formatting Errors in *Hitachi TagmaStore® Adaptable Modular Storage (AMS) and Workgroup Modular Storage (WMS) Storage Navigator Modular Error Codes (MK-96DF788)*.

7.4.8 Changing Format Mode

This mode enables the subsystem to set the priority of host access and the format for the format in the background.

To set the Format Priority Mode, follow these steps:

1. Select **Configuration Settings** on the **Tools** menu or on the toolbar.
2. Click the **Format Mode** tab.
3. Click the desired radio button from the **Format Priority Mode**.



The following provides an explanation for each Format Priority mode.

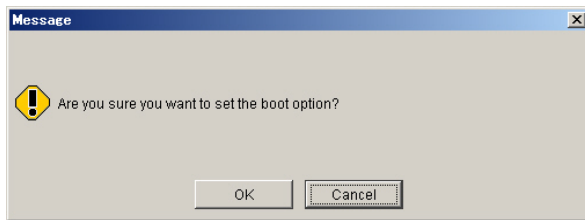
No.	Mode	Explanation
1	Normal (Default)	In the Normal mode, when the load of the host I/O is low, the format processing is executed continuously. If the load is high, the format processing is executed during every available interval.
2	Host	When the Format Priority mode is set to Normal, the copy/restoration performance may be significantly deteriorated if the format is performed during the copy/restoration of ShadowImage in-system replication, TrueCopy remote replication, TrueCopy Extended Distance, or Copy-on-write SnapShot. In that case, limit the operation of the formatting by setting the Format Priority mode to "Host." The format processing is then executed only during available intervals according to the load of the host I/O. This reduces the deterioration of the host I/O performance.
3	Format	The Format mode restricts the host access to a minimum, allowing the online format to complete quickly during the addition of a disk drive or during the recovery work after dual failures of the Disk Drive. The format processing is executed regardless of the load of the host I/O. The host access performance may be deteriorated when the Format mode is set because the host I/O processing decreases substantially.

Note: Formatting using the **Format Priority Mode** allows the subsystem to minimize the effects from host access and complete the format promptly. This applies to the online format during the disk addition of a drive, or during recovery work from a two point disk drive failure. When using this mode, host access performance may be significantly affected because the **Format** option of the **Format Priority Mode** restricts commands from host.

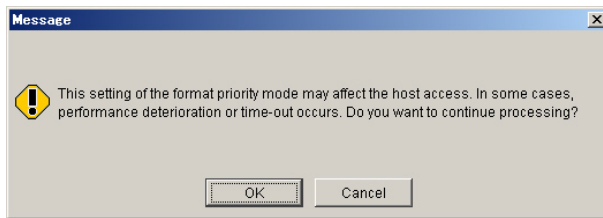
In the following cases, do not set the **Format Priority Mode** to **Format** because it may cause a significant deterioration in host access performance or a command time out.

- Accessing the host in which the logical unit is in the same RAID group as logical unit being formatted
- Formatting while using ShadowImage In-System Replication, TrueCopy Remote Replication, TrueCopy Extended Distance, or Copy-on-write

4. When the setting is complete, click **Apply** in the **Configuration Setting** dialog box. The following message displays. Click **OK**.



When the **Format Priority Mode** is set to **Format**, the following message is displayed. Click the **OK** button.



5. A confirmation message displays. Click **OK**, then click **Close** on the **Configuration Settings** screen.

Note: The **Format Mode** tab includes the **Format Data** items, from which format data can be selected. Normally, use the **Default**. Use the **0(zero)** in the **Format Data** only when it is necessary to clear the logical unit to **0(zero)** when connecting to TagmaStore USP/TagmaStore NSC.

7.4.9 Changing the Controller in Charge of a Default 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. Turn on the power supply.
Note: If the power supply has already been turned on, proceed to the next step.
2. Start the Storage Navigator Modular program and set the operation mode in **Management Mode**.
3. Double-click the icon of an array unit on the Main window. Select the **Settings** menu and click **Display Details**. Or, click the **Display Details** in the tool bar.
4. Click the **Logical Status** tab on the Unit screen.
5. Select the logical unit for which you want to change the Change Default Controller.
6. On the **Settings** menu, select **Logical Unit** and select **Change Default Controller**. A message displays, requesting confirmation to change the default controller.
7. Click **OK**, and the default controller in charge of a logical unit will be changed.
8. A message displays, stating that the setting is complete. Click **OK**.

7.5 Setting Host Group Information

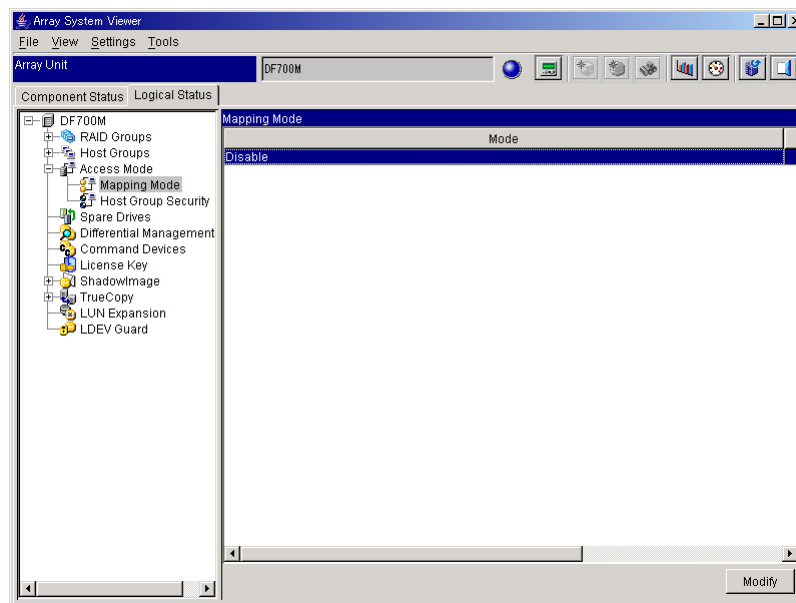
In the AMS1000, the Host Connection Mode, the mapping information of Logical Unit, and LUN security information are set to the group of hosts, not to the host. This enables you to select the host computer to which the subsystem is connected depending on each group of hosts.

- Host groups support only **000:G000**.
- Up to 128 host groups can be set when the LUN Manager (an extra cost optional feature) is used.

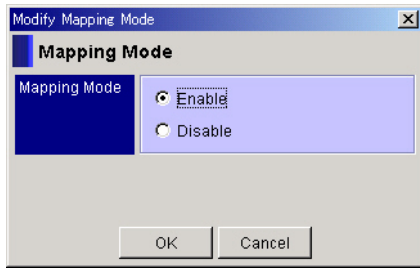
Note: When an array subsystem and a host computer are connected with the Fibre Channel interface, the logical unit of the array subsystem must be set to 0 (zero) or it will not be recognized by the host computer. When using this host computer, create a logical unit set to 0 or map the logical unit to Host LUN (H-LUN) 0.

7.5.1 Setting Mapping Information

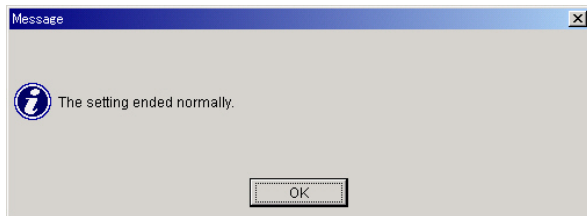
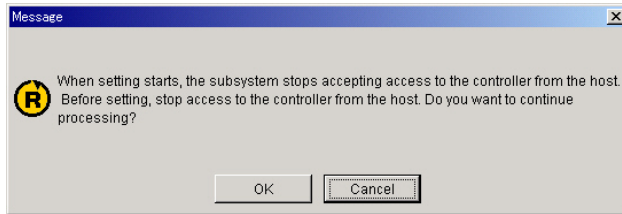
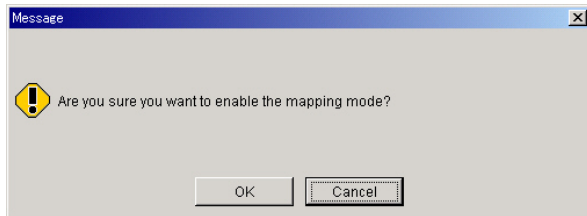
1. In the unit window, click the **Logical Status** tab.
2. Double-click the **Access Mode**, and select the **Mapping Mode**.
3. On the Mode list, select **Disable**, then click **Modify**.



4. On the **Mapping Mode** dialog, click the **Enable** radio button, and click **OK**.

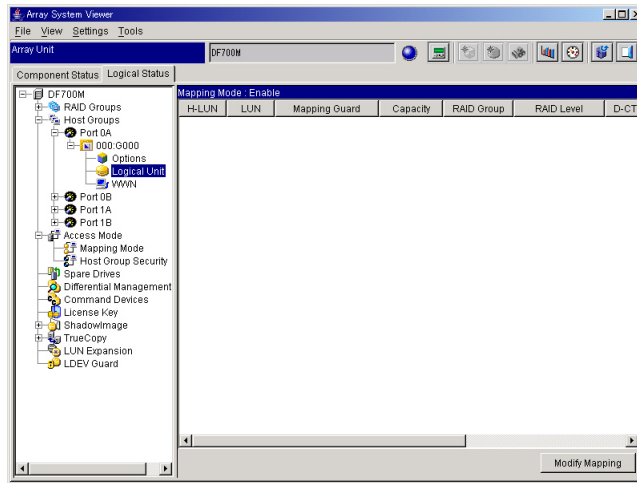


5. A confirmation message displays. Click **OK**.



6. On the Unit window, double click the **Host Groups**, and double-click the **Port** which you want to set for the connection mode with the host. Display the **000:G000** by double-clicking the **Port**.

7. Display the **Option** and **Logical Unit** by clicking the **000:G000**, and then click the **Logical Unit**.



8. Click **Modify Mapping**. The **Mapping** dialog box displays (see Figure 7-11).

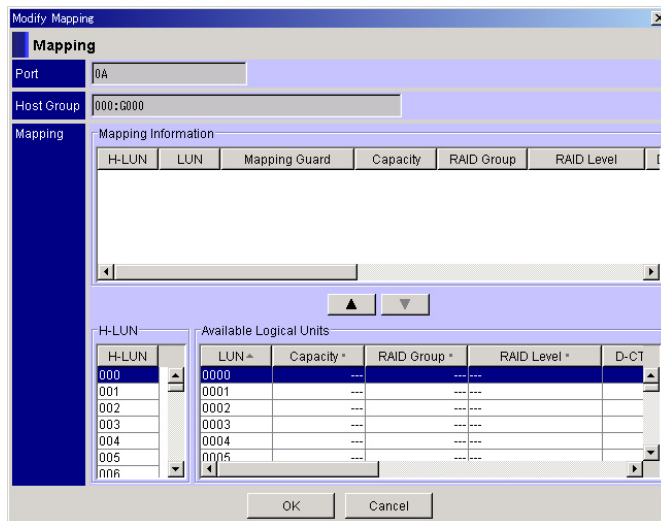



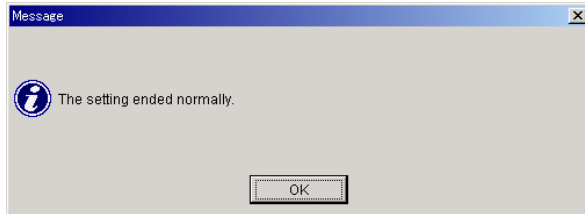
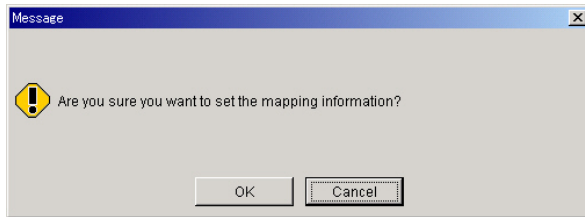
Figure 7-11 Mapping Dialog Box

9. Select one H-LUN from the **H-LUN** list, select an LUN that you want to map for the H-LUN from the **Available Logical Units** list, and click .

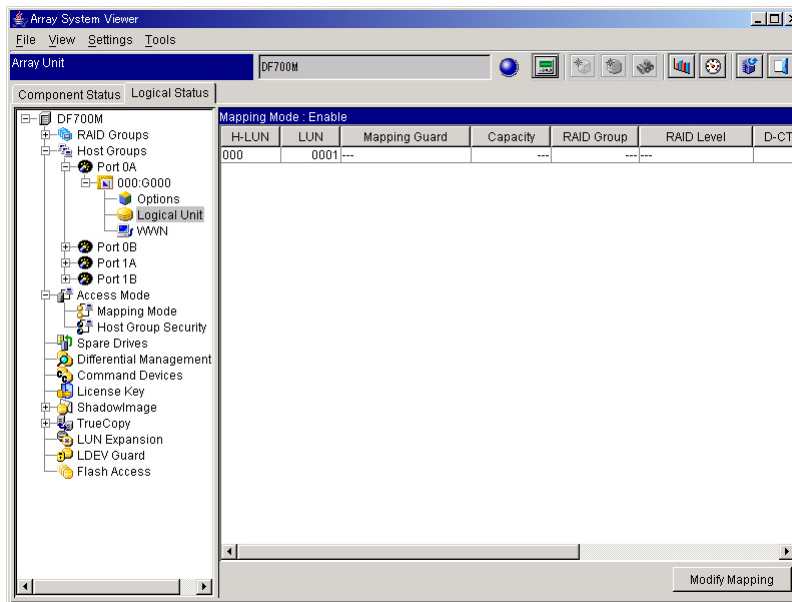
The selected H-LUN and LUN will be moved to the **Mapping Information** list.

10. Repeat step 9 to complete the Mapping Information list.
11. Click **OK**.

12. A confirmation message displays, click **OK**.



The mapping information is updated and the following window displays:



7.6 Setting Target Information

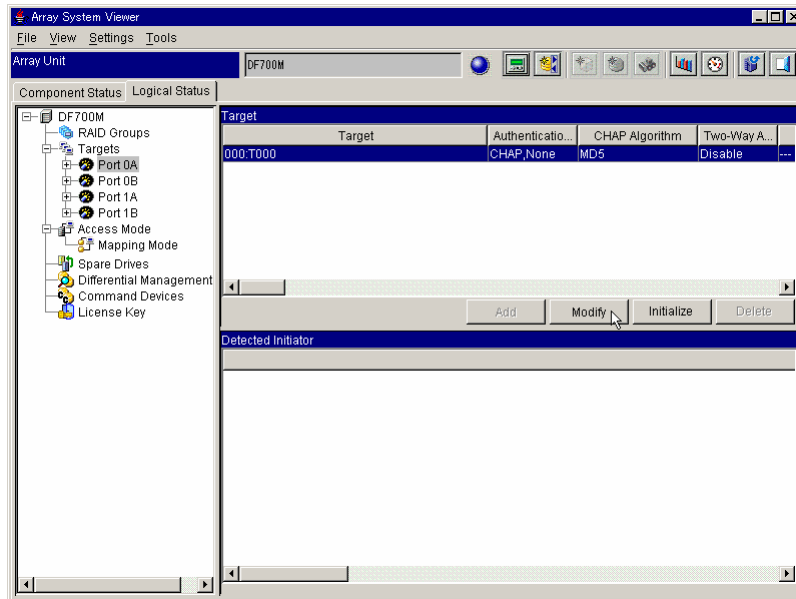
In the AMS1000, the Host Connection Mode, the mapping information of Logical Unit, and LUN security and iSCSI User information for authentication are set to the targets, not to the ports at the time of iSCSI interface addition. This enables you to select the host computer to which the subsystem is connected, depending on each target.

- For targets, only the **000:T000** is supported.
- Up to 256 targets can be set when the LUN Manager (an extra cost optional feature) is used.

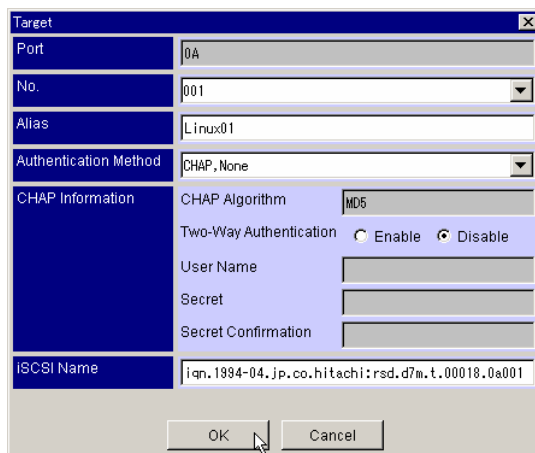
7.6.1 Changing Target Information

This enables you to change the iSCSI Name, Alias, Authentication Method, and CHAP User information of Two-Way Authentication about the Target.

1. Click the **Logical Status** tab on the Unit screen.
2. Click the Port.
3. Select the Target to be changed from the **Target** list.
4. Select **Modify**.

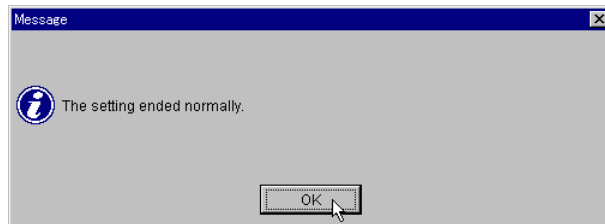
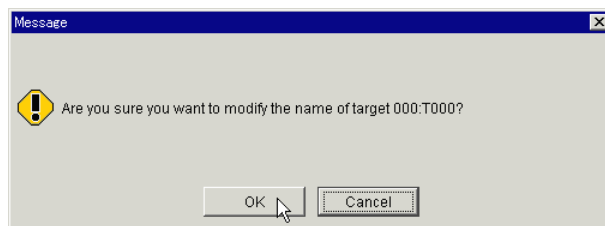


The Target dialog box displays.



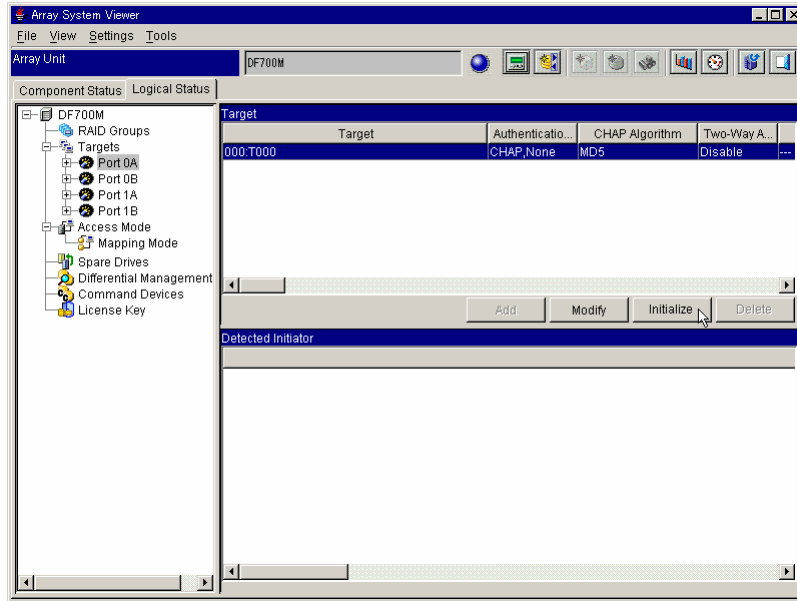
5. In the **Target** dialog, enter the Alias and iSCSI Name.

6. Select the authentication method from the drop-down list:
 - **Alias:** Enter the alias of the Target with 32 or less alphanumeric character.
(Excluding \, /, : , , ;, *, ?, “, <, >, | and ‘)
Spaces at the top or end are ignored. An identical name cannot be used in an identical Port.
 - **Authentication Method:** Select the **CHAP, None, or CHAP, None.**
 - **iSCSI Name:** Enter the name of the iSCSI Name with 233 or less alphanumeric character. A period (.), hyphen (-), and colon (:) can be used.
7. Select **OK**.
8. The confirmation message displays. Select **OK**.

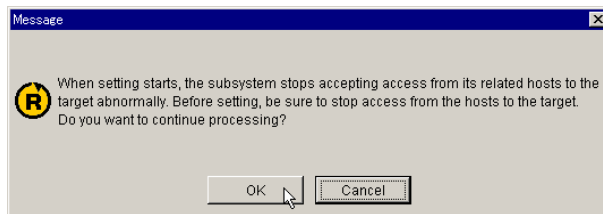
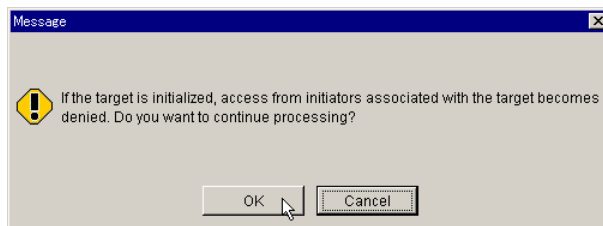
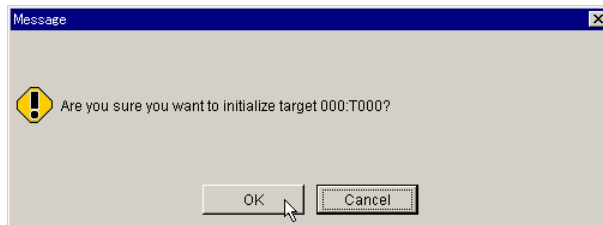


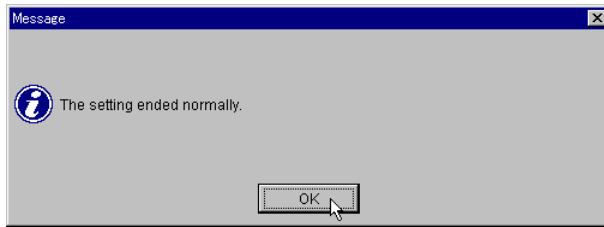
7.6.2 Initializing the Target 0

1. Click the **Logical Status** tab on the Unit screen.
2. Click the Port.
3. Select the Target to be initialized from the **Target** list.
4. Select **Initialize**.



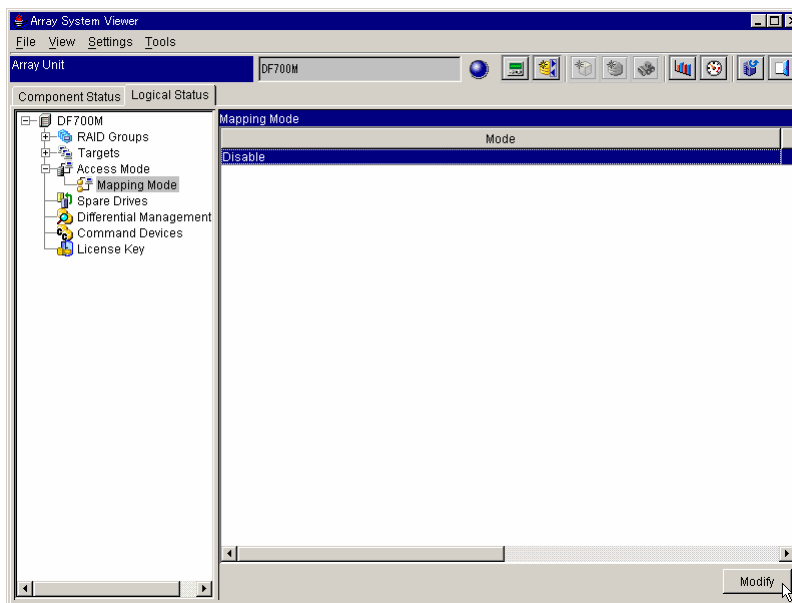
5. The confirmation message displays. Click OK.



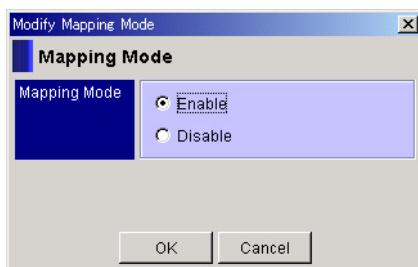


7.6.3 Setting Mapping Information

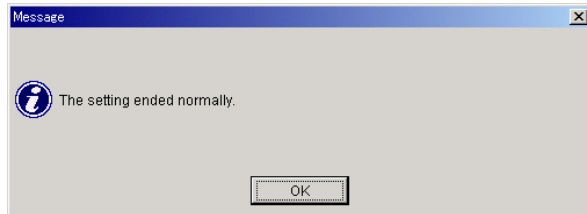
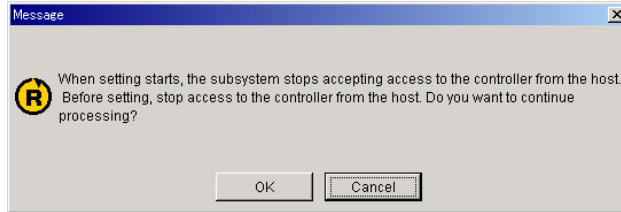
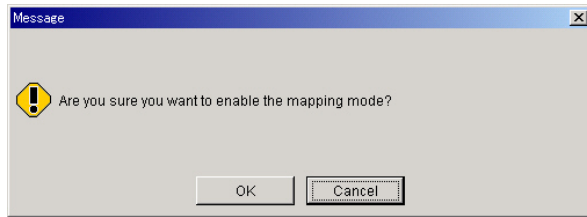
1. Click the **Logical Status** tab on the Unit screen.
2. Double-click the **Access Mode**, and select the **Mapping Mode**.
3. On the **Mode** list, select the **Disable**. Click **Modify**. The **Mapping Mode** dialog box displays.



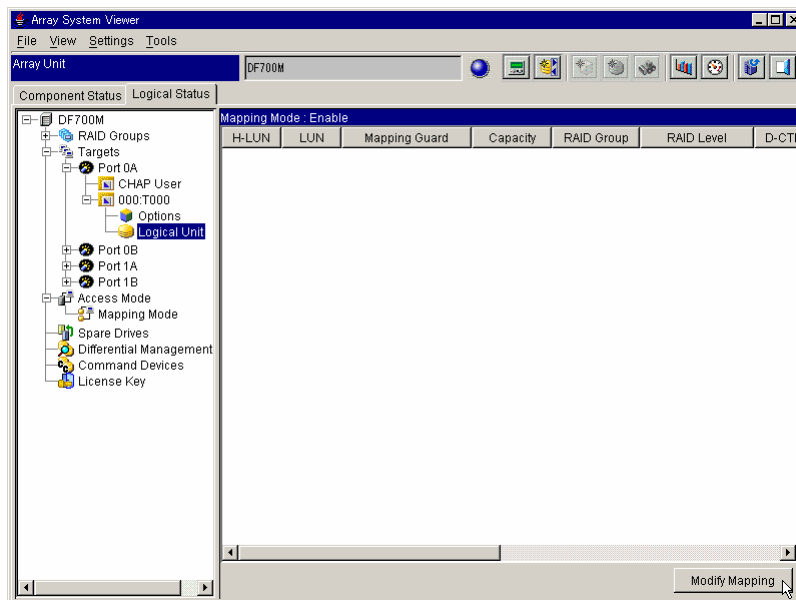
4. On the **Mapping Mode** dialog, click the **Enable** radio button, and click **OK**.



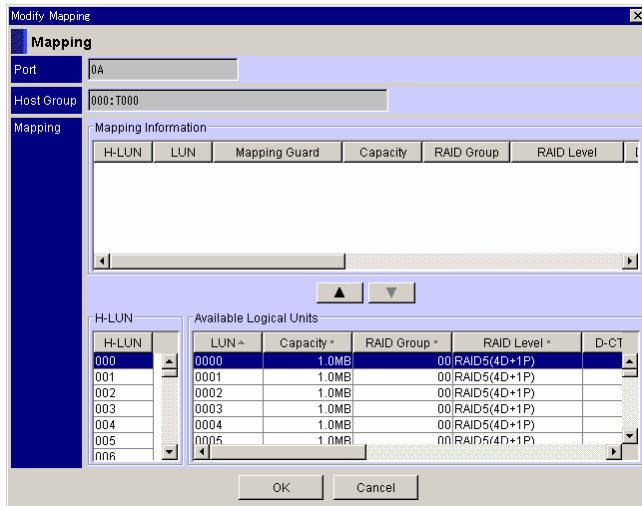
5. A confirmation message displays; click **OK**.




6. On the Unit window, double click the **Target**, and double-click the **Port** which you want to set for the connection mode with the host. Display **000:T000** by double-clicking the **Port**.
7. Display the **Options** and **Logical Unit** by clicking **000:T000**, then click the **Logical Unit**.



8. Click **Modify Mapping**. The **Modify Mapping** dialog box displays.

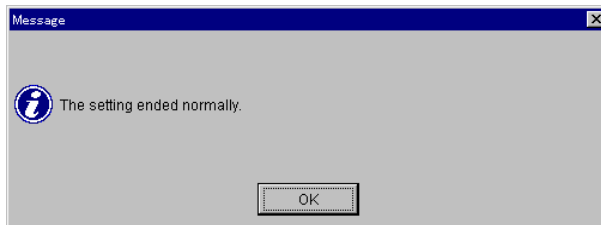
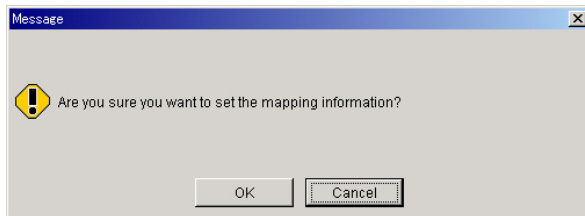


9. Select one H-LUN from the **H-LUN** list, select an LUN that you want to map for the H-LUN from the **Available Logical Units** list, and click .

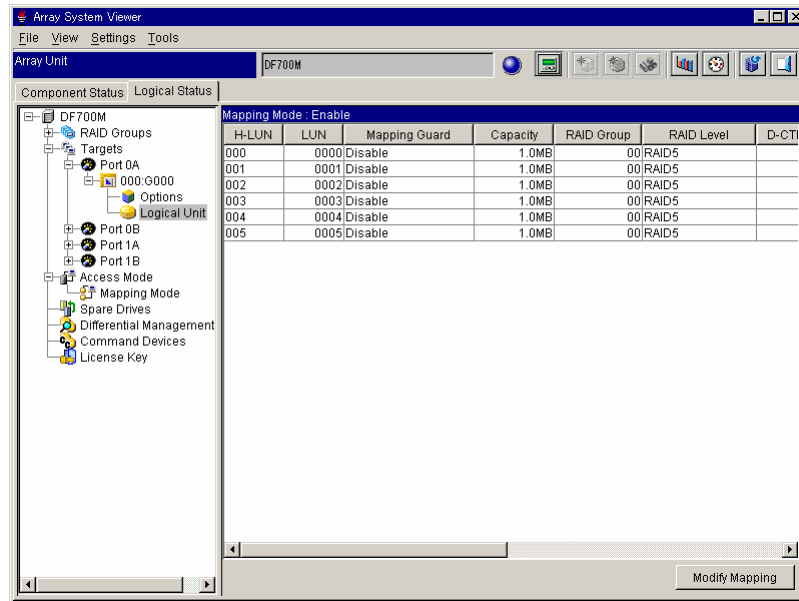
The selected H-LUN and LUN will be moved to the **Mapping Information** list.

10. Repeat step 9 to complete the **Mapping Information** list.

11. A confirmation message displays; click **OK**.



The mapping information is updated and the following window displays:



12. Set the settings for the other ports using the same procedure.

7.7 Setting CHAP Authentication

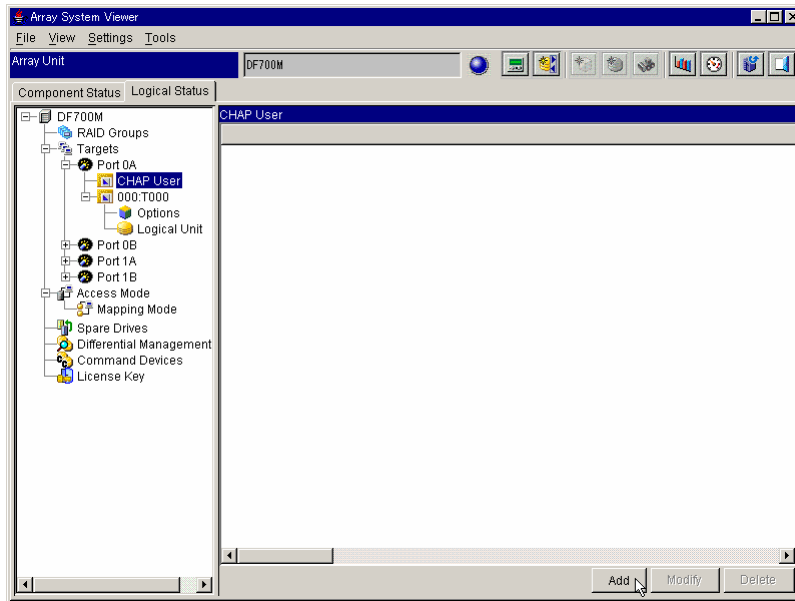
The disk array subsystem can authenticate both the iSCSI User Initiator Authentication and Two-Way Authentication (Target Authentication) with the CHAP (Challenge Handshake Authentication Protocol). This can prevent the unauthorized access from the host (or by the user of the host).

Set the same iSCSI User information (User Name/ Secret) on both the host side and the disk array subsystem side for Initiator Authentication. Set the same iSCSI User information (User Name/ Secret) on both the host side and the disk array subsystem side for Two-Way Authentication(Target Authentication).

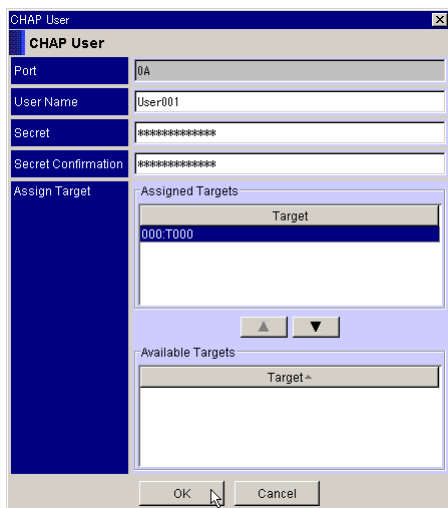
7.7.1 Adding a CHAP User


To authenticate the initiator, set the CHAP User to the port and assign it to the Target. The CHAP User can register up to 512 users for each iSCSI port.

1. Click the **Logical Status** tab on the Unit screen.
2. Double-click the **Port** to which you want to add the CHAP User and select **CHAP User**.
3. Click **Add** .

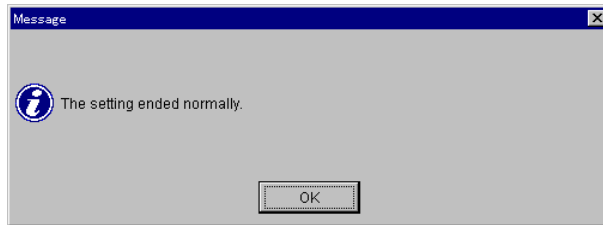


The CHAP User dialog box displays:



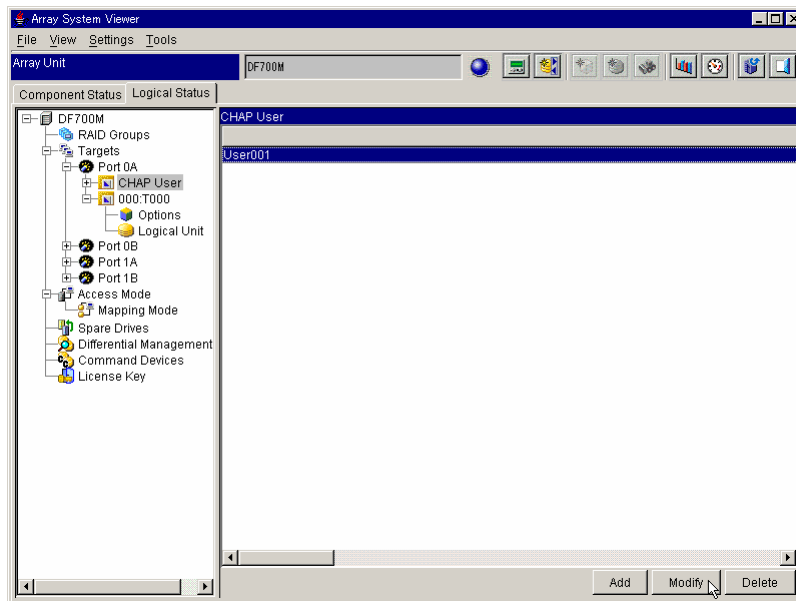
4. In the **CHAP User** dialog, enter the **User Name**, **Secret**, and **Secret Confirmation**:
 - **User Name**: Enter the name of the User with 256 or less alphanumeric character. The following symbols can be used: (. - + @ _ = : / [] , ~ (space)).
 - **Secret**: Enter the Secret from 12 through 32 alphanumeric characters. The following symbols can be used: (. - + @ _ = : / [] , ~ (space)). However, when the Microsoft® iSCSI Software initiator is used on the host side, the length of Secret must be from 12-character to 16-character.
 - **Secret Confirmation**: Enter the characters that enter into the **Secret**.
5. From the **Available Targets** list, select the target to be assigned, select .
6. Click **OK**.

7. A confirmation message displays; click **OK**.

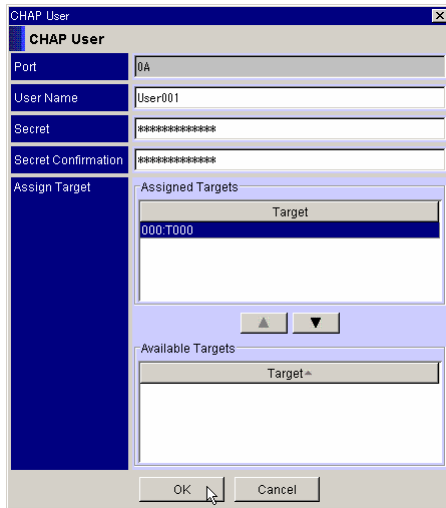


7.7.2 Changing the CHAP User

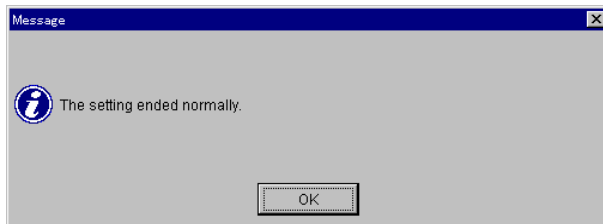
1. Click the **Logical Status** tab on the Unit screen.
2. Double-click the **Port** of which you want to change the CHAP User, and then select the **CHAP User**.
3. Select the **CHAP User** to be changed from the **CHAP User** list.
4. Select **Modify**.



The CHAP User dialog box displays:

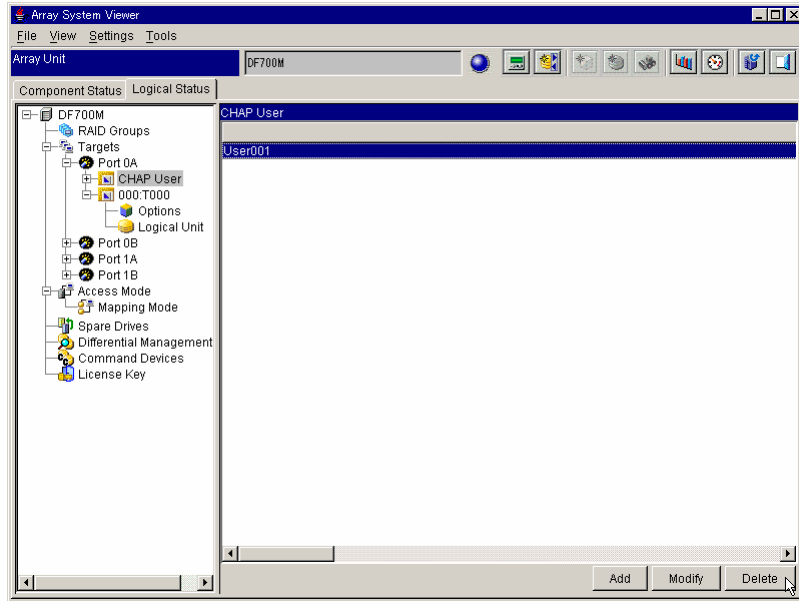


5. As necessary, enter the **User Name**, **Secret**, and **Secret Confirmation**.
6. As necessary, change the assigned Target, and then select **OK**.
7. A confirmation message displays. Select **OK**.

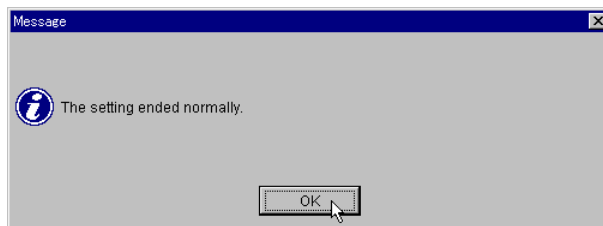
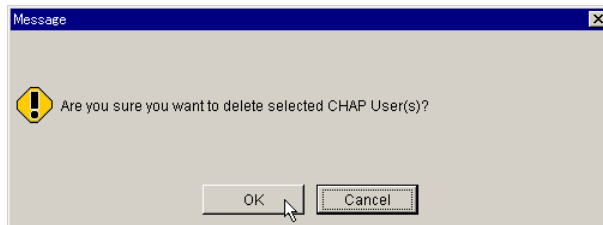


7.7.3 Deleting the CHAP User

1. Click the **Logical Status** tab on the Unit screen.
2. Double-click the **Port** of which you want to delete the CHAP User and select **CHAP User**.
3. Select the **CHAP User** to be deleted from the **CHAP User** list.
4. Click **Delete**.

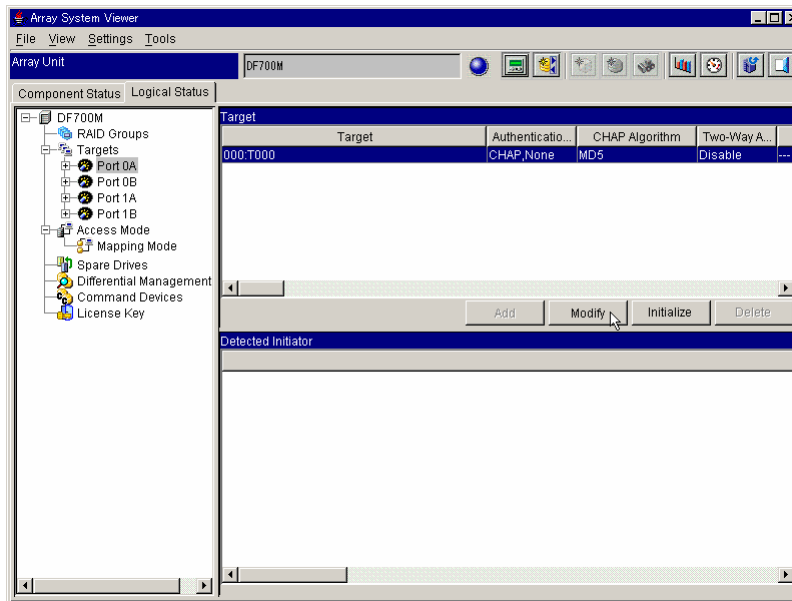


5. The confirmation message displays. Select **OK**.

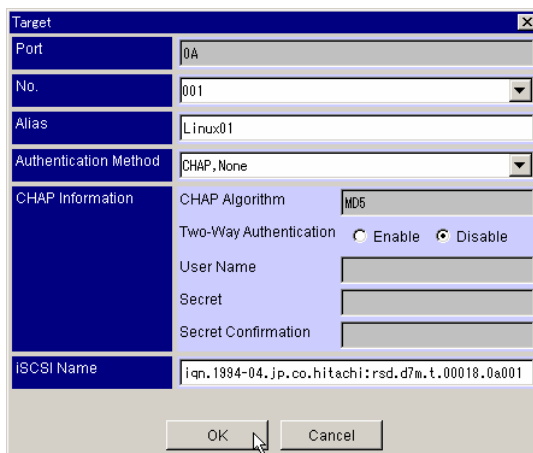


7.7.4 Changing Two-Way Authentication Information

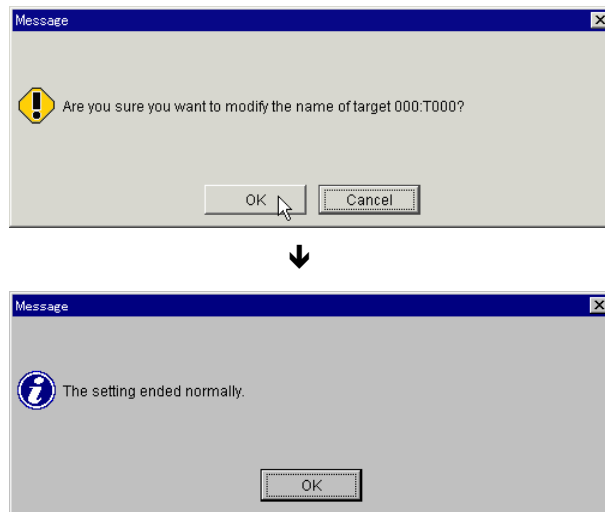
1. Click the **Logical Status** tab on the Unit screen.
2. Click the **Port**.
3. Select the **Target** to be changed about Two-Way Authentication from the **Target** list.
4. Select **Modify**.



The **Target** dialog box displays:



5. In the **Target** dialog box, select the **Two-Way Authentication** radio button:
 - **User Name:** Enter the name of the User with 256 or less alphanumeric character.
The following symbols can be used: (. - + @ _ = : / [] , ~ (space))
However, when the Microsoft iSCSI Software initiator is used on the host side, the length of Secret must be from 12-character to 16-character.
 - **Secret:** Enter the Secret from 12 through 32 alphanumeric characters.
The following symbols can be used.
6. Select **OK**.
7. A confirmation message displays. Click **OK**.



7.8 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, port/host group information, the constituent parts of the array unit and LAN parameters. The configuration to be set includes the system parameters and RAID group/logical unit, port/host group information, and LAN parameter. 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, for RAID group/logical unit, for port/host group information, and for LAN parameters.

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.

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.

7.9 Storing Configuration Data

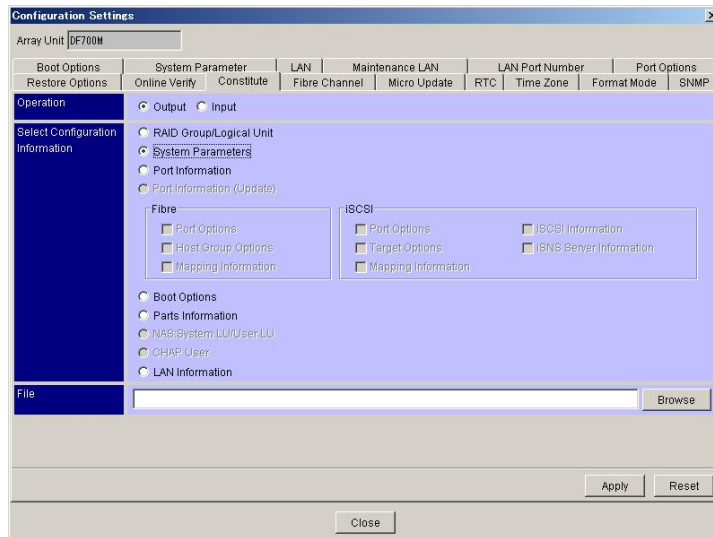
This section includes the following:

- System Parameter Information
- RAID Group/LU Information
- Port/Host Group Information
- NAS System LU/User Information

7.9.1 System Parameter Information

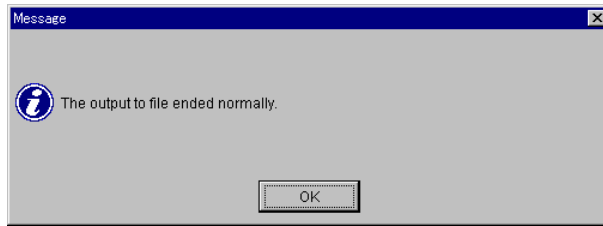
To output the setting of the system parameters for an array unit in text form to a specified file:

1. On the **Tools** menu, select **Configuration Settings** or click **Configuration Settings** on the toolbar.
2. Click the **Constitute** tab.
3. Check the **System Parameters** in the **Select Configuration Information** box.



4. Click **Browse**. Specify the directory and file name to which the configuration file will be output for the **File** box.
5. Click **Apply**.

- When a message displays confirming that the system parameter information is output with the specified file name, click **OK**.

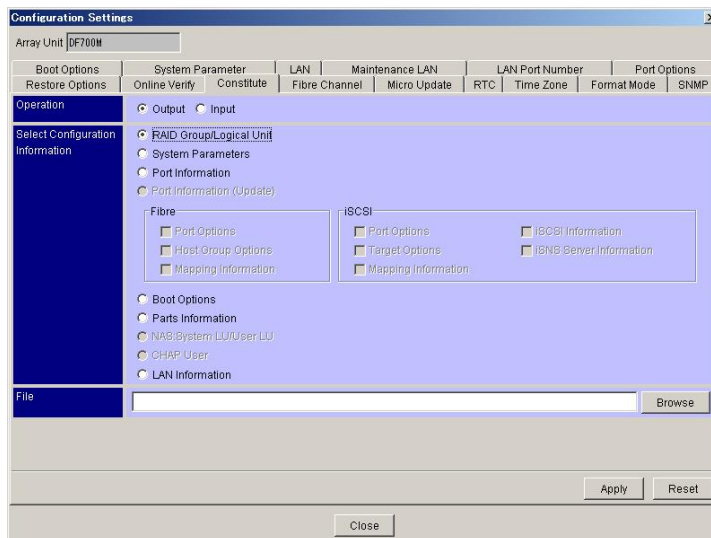


System parameter information is saved in the form of a text file with the specified file name.

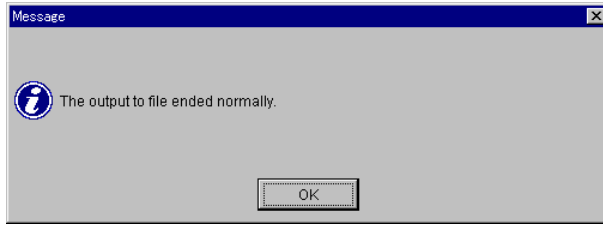
7.9.2 RAID Group/LU Information

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

- On the **Tools** menu, select **Configuration Settings**, or click the **Configuration Settings** on the toolbar.
- Click the **Constitute** tab.
- Check the **RAID Group/Logical Unit** in the **Select Configuration Information** box.



- Click **Browse**, and specify the directory and file name to output the file of the configuration.
- Click **Apply**.
- A message displays confirming that the system parameter information is output with the specified file name. Click **OK**.



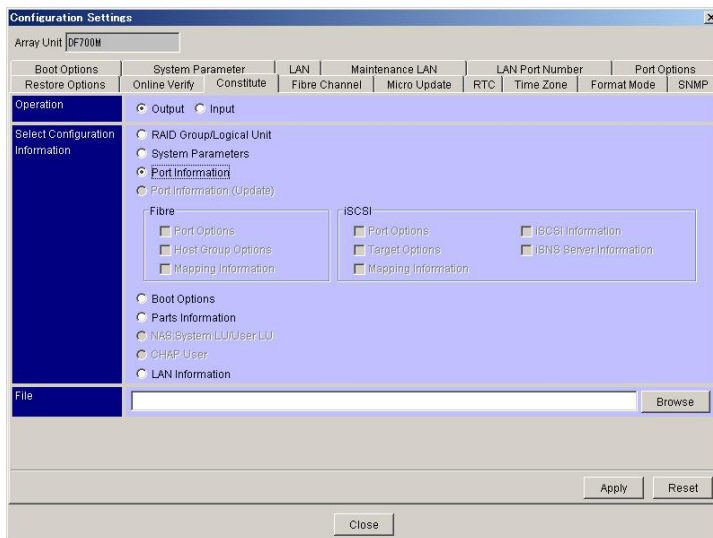
RAID group/LU information is saved in the form of a text file with the specified file name.

7.9.3 Port/Host Group Information

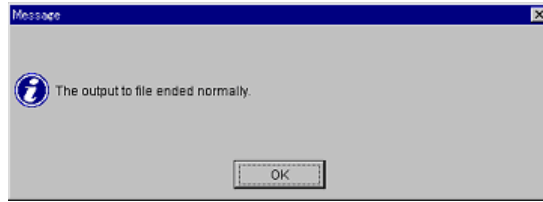
This setting is not required for the NAS system.

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

1. On the **Tools** menu, select **Configuration Settings**, or click the **Configuration Settings** on the toolbar.
2. Click the **Constitute** tab.
3. Check the **Port Information** radio button in the **Select Configuration Information** box.



4. Click **Browse**, and specify the directory and file name to output the file of the configuration for the **File**.
5. Click **Apply**.
6. A message displays confirming the system parameter information is output with the specified file name. Click **OK**.



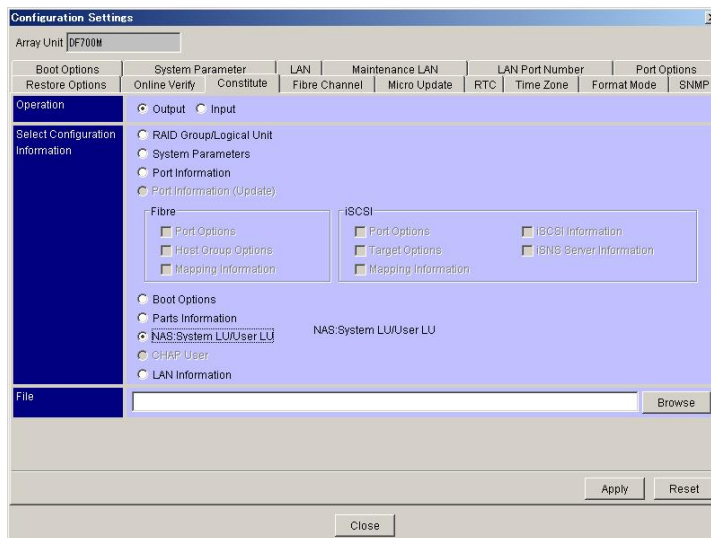
Port/Host group information is saved in the form of a text file with the specified file name.

7.9.4 NAS System LU/User LU information

This setting is required only for the NAS system.

To output NAS System LU/User LU information already set in an array unit to a specified file in a text format:

1. On the **Tools** menu, select **Configuration Settings**, or click **Configuration Settings** on the toolbar.
2. Click the **Constitute** tab.
3. Check the **NAS: System LU/User LU** in the **Select Configuration Information** box.



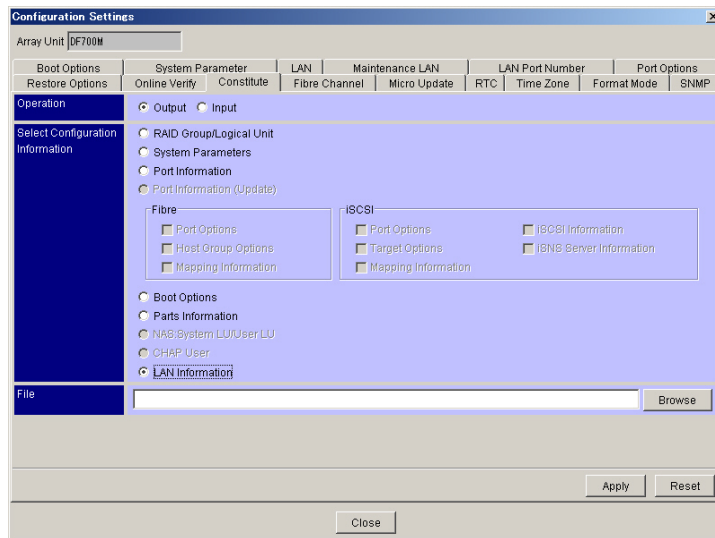
4. Click **Browse**, and specify the directory and file name to output the file of the configuration for the **File**.
5. Click **Apply**.
6. A message displays confirming that the system parameter information is output with the specified file name. Click **OK**.

NAS System LU/User LU information is saved in the form of a text file with the specified file name.

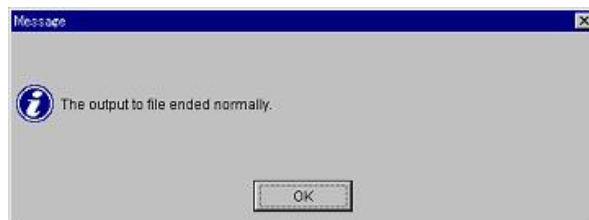
7.9.5 LAN information

To output LAN information already set in an array unit to a specified file in a text format:

1. On the **Tools** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.
2. Click the **Constitute** tab.
3. Check the **LAN Information** 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 for the **File**.
5. Click the **Apply** button.
6. A message appears, confirming that the system parameter information is output with the specified file name. Click the **OK** button.



LAN information is saved in the form of a text file with the specified file name.

7.10 Applying Configuration Data to an Additional AMS1000 Storage System

This section includes the following:

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

7.10.1 System Parameters

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 Storage Navigator Modular 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, and then connect to the host and the Storage Navigator Modular management program.

Note: If the subsystem is configured when the disk array subsystem is used as the remote side of TrueCopy Remote Replication/TrueCopy Extended Distance, the following occurs:

- Both paths of TrueCopy Remote Replication/TrueCopy Extended Distance are blocked. A notice regarding SNMP Agent Support Function and TRAP occurs in path blockade mode. Perform the functions in the notice and check the Failure Monitoring Department in advance.
- If the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance is PAIR or COPY, the pair status transits to PSUE.

When the disk array subsystem must be configured, transmit the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance to PSUS, then configure the subsystem.

Note: If the system parameter setting operation is performed for the array unit connected to the NAS unit, the cluster between the NAS Units stops. When the system parameter setting operation for the array subsystem is unavoidably performed, execute it after stopping the cluster between the NAS Units and stopping the NAS OS of both NAS Units. Start the cluster between the NAS Units again after completing the system parameter setting operation.

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 section 7.9.
2. On the **Tools** menu, select **Configuration Settings**, or click **Configuration Settings** on the toolbar.
3. Click the **Constitute** tab.
4. Click the **Input** radio button in the **Operation** dialog box.
5. Click the **System Parameter** radio button in the **Select Configuration Information** box.
6. Click **Browse**, 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 textbox.
7. Click **Apply**.

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.

7.10.2 RAID Group/Logical Unit



CAUTION

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 section 7.9.
2. On the **Tools** menu, select **Configuration Settings**, or click **Configuration Settings** on the toolbar.
3. Click the **Constitute** tab.
4. Click the **Input** radio button in the **Operation** dialog box.
5. Click the **RAID Group/Logical Unit** radio button in the **Select Configuration Information** box.
6. Click **Browse**, and specify the directory and name of the file that describes the RAID group definition and logical unit definition edited in step 1. The specified file name will be shown in the textbox.
7. Click **Apply**.
8. A message displays stating whether the setting should be made. Click **OK**.

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

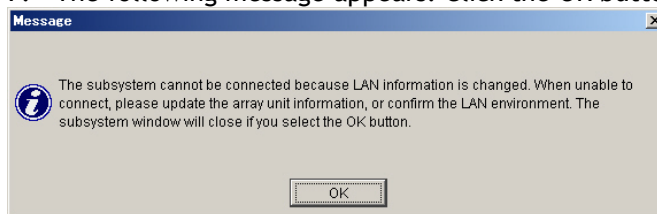
7.10.3 Port/Host Group

Note: This setting is not required for the NAS system.

1. On the **Settings** menu, select **Configuration Settings**, or click **Configuration Settings** on the toolbar.
2. Click the **Constitute** tab.
3. Click the **Input** radio button in the **Operation** box.
4. Click the **Port/Host Group** radio button in the **Select Configuration Information** box.
5. Select the item that you want to set from the **Setting Information for Input**. If nothing is selected, an error will occur. (If LUN Manager function is enabled, WWN information is also displayed in the **Setting Information for Input**.)
6. Click **Browse**, and specify the directory and name of the file to which the Port/Host Group information is input for the **File** box.
7. Click **Apply**.

7.10.4 LAN Information

1. On the **Tools** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.
2. Click the **Constitute** tab.
3. Click the **Input** radio button in the **Operation**.
4. Check the **LAN Information** in the **Select Configuration Information** box.
5. Click the **Browse** button, and specify the directory and name of the file.
6. Click the **Apply** button.
The setting confirmation window is displayed. Click the **OK** button.
7. The following message appears. Click the **OK** button. The unit window closes.



Note: When you input LAN Information file, note the following:

- If the “Maintenance Port IP Address Automatic Change Mode” is “ON” in the file; the IP address of maintenance port written in the file will be ignored. However, do not delete the setting of maintenance port written in the file.
- If “Maintenance Port IP Address Automatic Change Mode” is “OFF” in the file; only the network address for the IP address of maintenance port written in the file is reflected.

7.11 Setting Host Connection Parameters

There are two methods for setting options:

- **Simple Setting for Connecting to the Host Computer**

When using the simple setting, select the environmental elements of the host computer to be connected. When the selection is made, the host group options (host connection mode 1 and 2) necessary for the host computer to be connected are set automatically.

- **Detail Setting for Each Host Connection**

When using the detail setting, directly set the necessary host group options (host connection mode 1 and 2) in the same way as the conventional one.

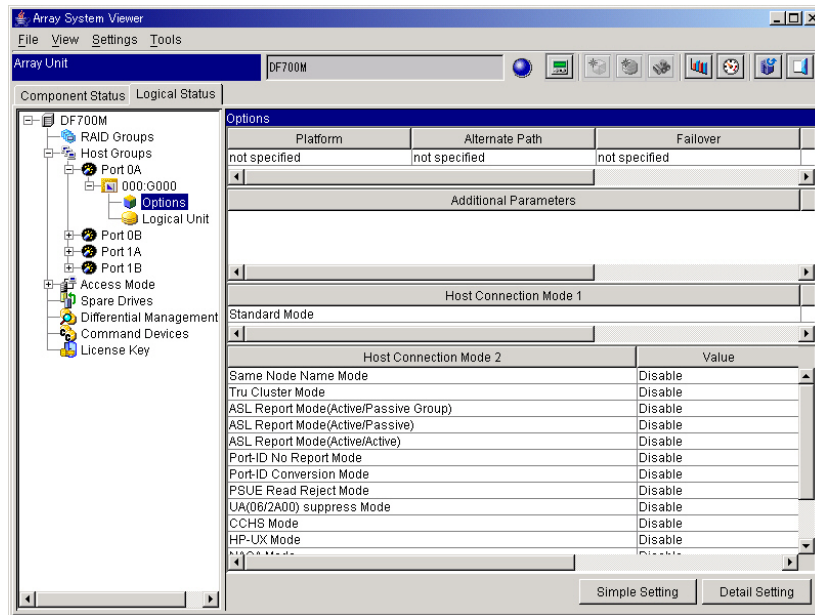
The host connection parameters do not need to be set for the NAS system.

7.11.1 Simple Setting for Connecting to Host Computer

Set the host group options (host connection mode 1 and 2) that are necessary for the host computer to be connected. To do this, select the environmental elements of the host, such as platform, alternative path, fail-over, and additional parameter. Some host environments require a detailed setting as well as the simple setting. For details, see to Table B.2.

1. On the unit window, click the **Logical Status** tab.
2. Double-click **Host Groups** or **Target** (when iSCSI interface board is added). Double-click the **Port** that you want to set for the connection mode with the host, to display **000:G000**.

Display the **Options** and **Logical Unit** by double-clicking **000:G000** and selecting the **Options**.



3. Click **Simple Setting**.
4. The **Simple Setting** dialog box displays (see Figure 7-12).
Select **Platform**, **Alternative Path**, and **Fail-Over** according to an environment of the host to be connected.

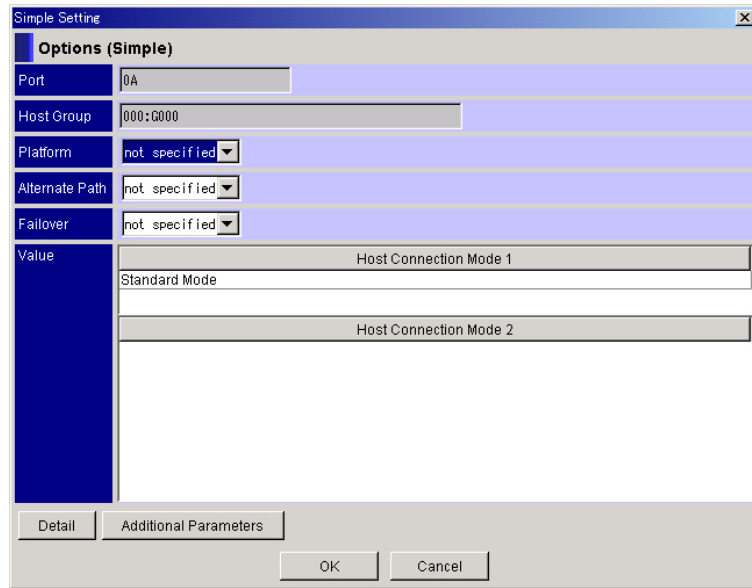


Figure 7-12 Simple Setting Dialog Box

Simple Setting dialog box menu items and parameters are outlined and described in Table 7.2.

Table 7.2 Simple Setting Menu Items and Parameters

No.	Menu Item	Description		Factory Settings
		Parameters	Selection Method	
1	Platforms	Not specified	Select one of items	Not specified
		HP-UX		
		Solaris™		
		AIX®		
		Windows NT®		
		Windows® 2000		
		Windows® 2003		
		Linux®		
		Tru64®		
2	Alternate Path	Not specified	Select one of items	Not specified
		PV Link		
		HDLM		
		VxVM		
		MPxIO		
3	Fail-over	Not specified	Select one of items	Not specified
		MC/Serviceguard®		
		Sun™ Cluster		
		VCS		
		HACMP™		
		MSCS		
		TruCluster		

Note: When the host to be connected is Windows® XP (only for iSCSI), select "Not specified" for all the items.

- Click **Additional Parameters**. The Additional Parameters dialog box displays (see Figure 7-13). Select only appropriate items (if inapplicable item has been selected, uncheck the box of the item) and click OK. (The routine returns to Figure 7-12.)

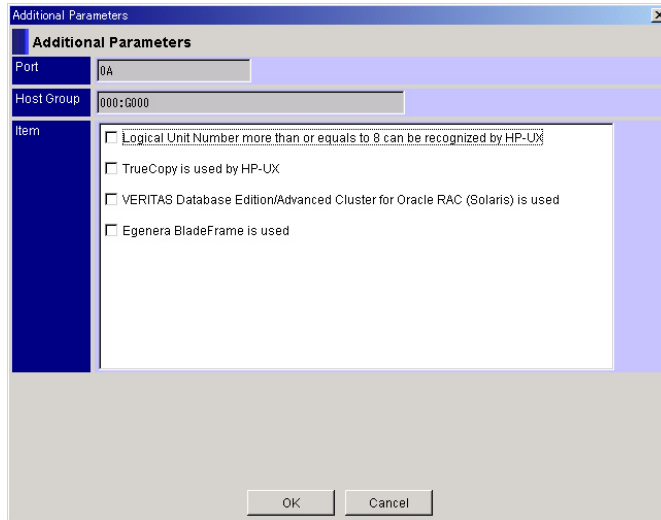


Figure 7-13 Additional Parameters Dialog Box

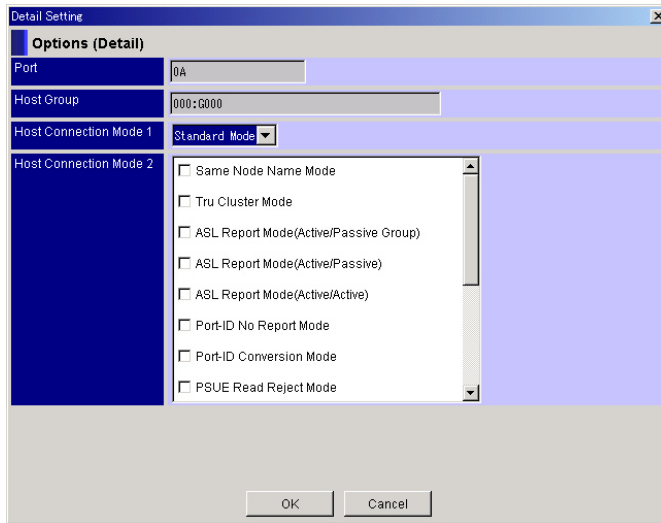
Additional Parameter dialog box menu items and parameters are outlined and described in Table 7.3.

Table 7.3 Additional Parameter Menu Items and Parameters

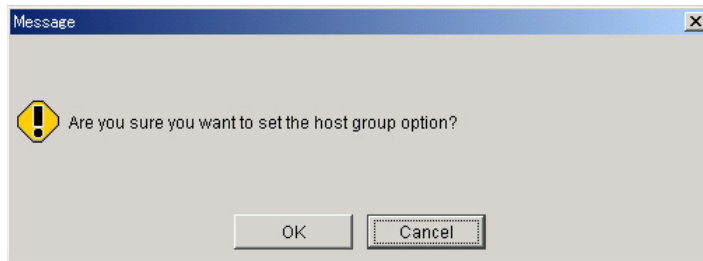
No.	Menu Item	Description		Setting Made at the Factory
		Parameters	Selection Method	
1	Additional Parameter	Logical Unit Numbers more than or equal to 8 can be recognized by HP-UX	Selection	Not selected
		TrueCopy (Note) is used by HP-UX	Selection	Not selected
		VERITAS Database Edition™/Advanced Cluster for Oracle® RAC (Solaris) is used	Selection	Not selected
		Egenera® BladeFrame® is used	Selection	Not selected

Note: True Copy displayed on parameter means TrueCopy Remote Replication and TrueCopy Extended Distance.

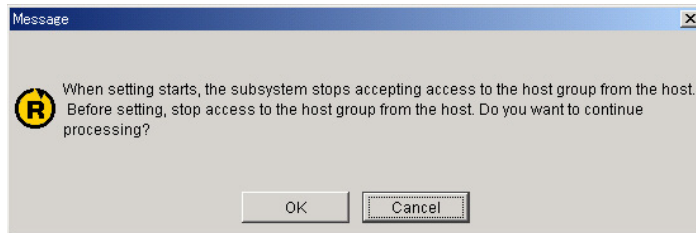
6. Click **Detail** as needed. Select **Host Connection Mode 1** and **Host Connection Mode 2**, and click **OK**. (The screen returns to Figure 7-12.)



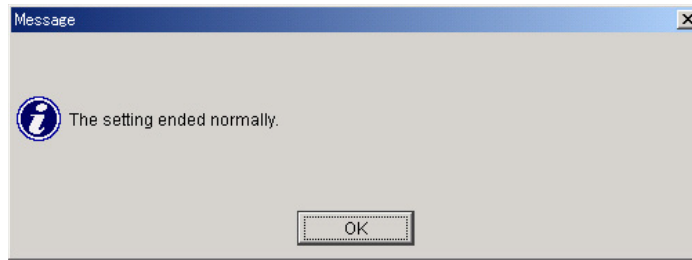
7. Click **OK** in the **Option (Simple)** dialog box.
8. A confirmation message displays. Click **OK**.



9. A message displays requesting you to verify that an I/O requested by the host has been stopped. Stop it and click **OK**.

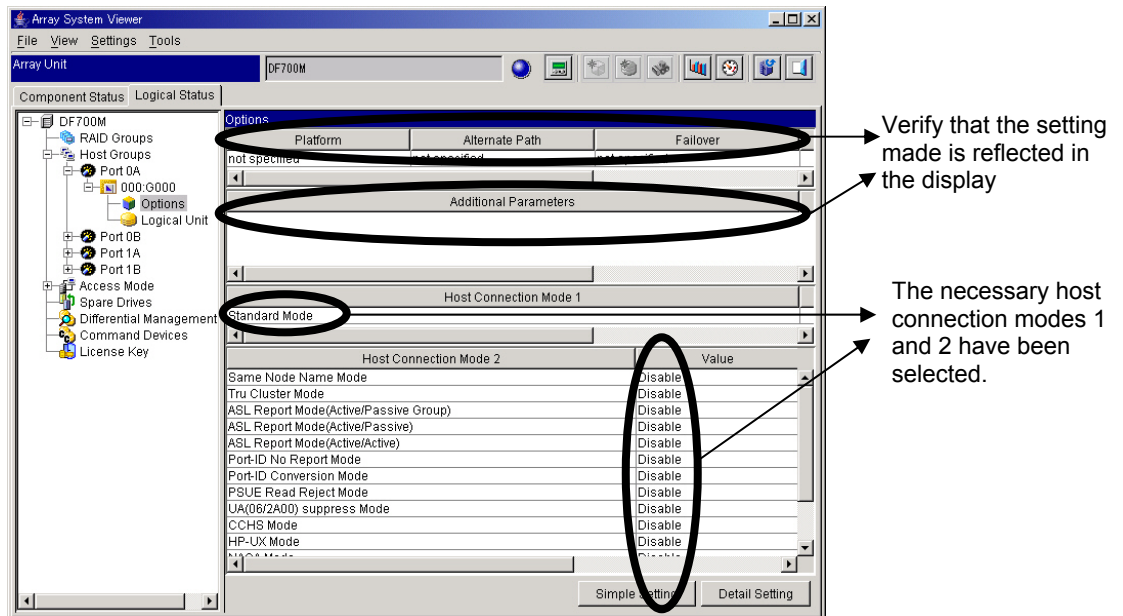


10. A message displays stating that the setting is complete. Click **OK**.



11. The setting displays.

Verify that the selected host environment (platform, alternative path, and fail-over) and the Additional Parameter are reflected in the display. When you have set host connection mode 1 and 2 directly, verify that the mode that has been set is reflected in the display.



12. Set the settings for the rest of the ports in the same way.

7.11.2 Detailed Setting for Each Host Connection

This operation is performed using the Storage Navigator Modular.

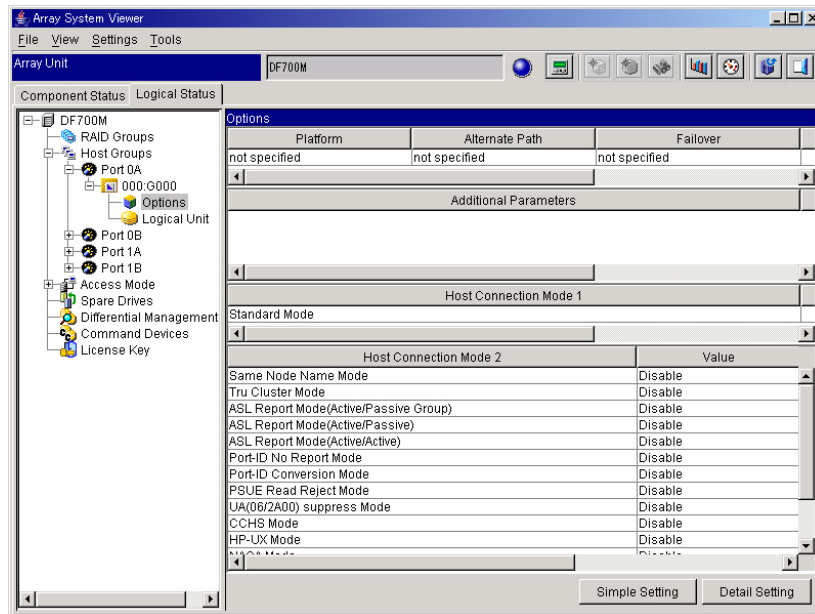
The following describes the procedure for setting a subsystem offline when the host group option setting is required for a combination that simple setting does not have.

Follow these steps:

1. On the unit window, click the **Logical Status** tab.
2. Double-click the **Host Groups** or **Target** (when iSCSI interface board is added). Display the 000:G000 by double-click the **Port** which you want to set for the connection mode with the host.

Display the **Option** and **Logical Unit** by double-clicking the 000:G000, and select the **Option**.

3. Select **Detail Setting**.



Perform the operation corresponding to the model to be set.

7.12 Setting Storage System Using Special Mode

This operation (using the subsystem in drive blockade mode) is performed using Storage Navigator- Modular.

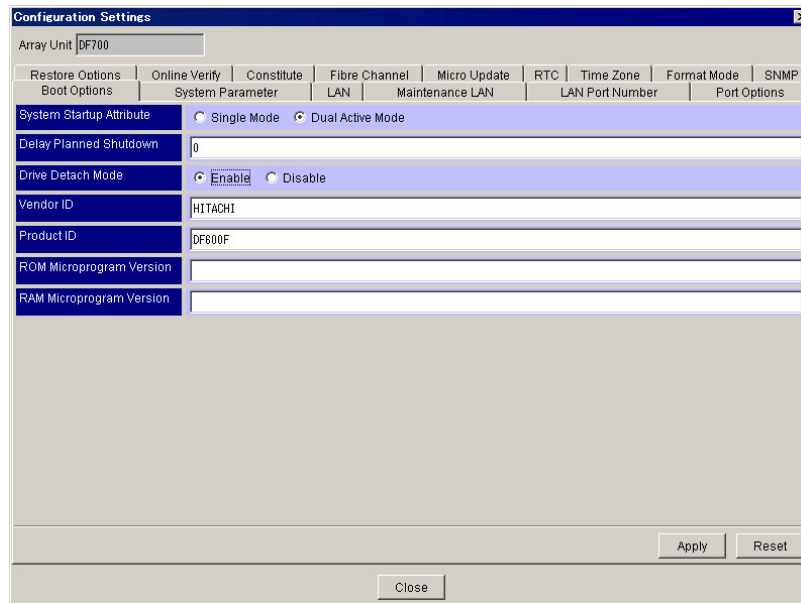
Note: If the subsystem is configured when the disk array subsystem is used as the remote side of TrueCopy Remote Replication/TrueCopy Extended Distance, the following occurs:

- Both paths of TrueCopy Remote Replication/TrueCopy Extended Distance are blocked. A notice regarding SNMP Agent Support Function and TRAP occurs in path blockade mode. Perform the functions in the notice and the check the Failure Monitoring Department in advance.
- If the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance is PAIR or COPY, the pair status transits to PSUE.

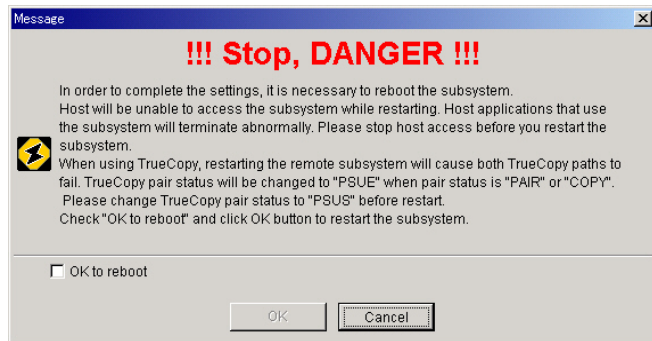
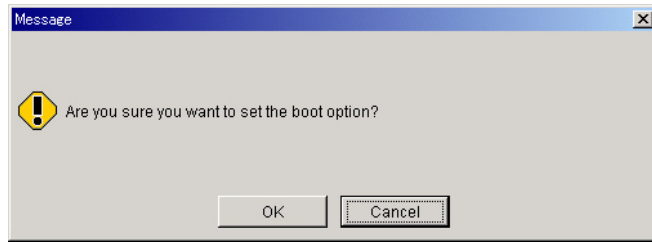
When the disk array subsystem must be configured, transmit the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance to PSUS, then configure the subsystem.

Note: If the special mode setting operation is performed for the array unit connected to the NAS unit, the cluster between the NAS Units stops. When the special mode setting operation for the array subsystem is unavoidably performed, execute it after stopping the cluster between the NAS Units and stopping the NAS OS of both NAS Units. Start the cluster between the NAS Units again after completing the special mode setting operation for the array subsystem.

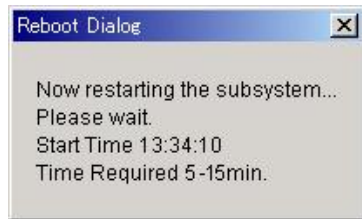
1. On the **Tools** menu, select **Configuration Settings**. Or, click **Configuration Settings** in the tool bar.
2. Click the **Boot Option** tab.
3. For the **Drive Detach Mode**, select the **Enable** radio button.



4. Click **Apply**.
5. A confirmation message displays. Click **OK**.



When restarting the array unit, the time the array unit restarts will be displayed. It takes approximately five to 15 minutes to restart the array unit.



Note: Depending on the status of array unit, the array unit may take time to respond. If the array unit does not respond after 15 minutes or more, check the status of the array unit.

7.13 Changing the Network Parameter

Note: When the network address of the LAN device, which is connected via the Gateway in the extension of the User management port, is the same as that of the Maintenance port, communication cannot be made due to the conflict between them. If this occurs, set the network address to be other than the maintenance port in the LAN device which is connected via the Gateway in the extension of the User management port, or set the maintenance port other than the network address of LAN device which is connected via the Gateway. (Refer to section 7.15.)

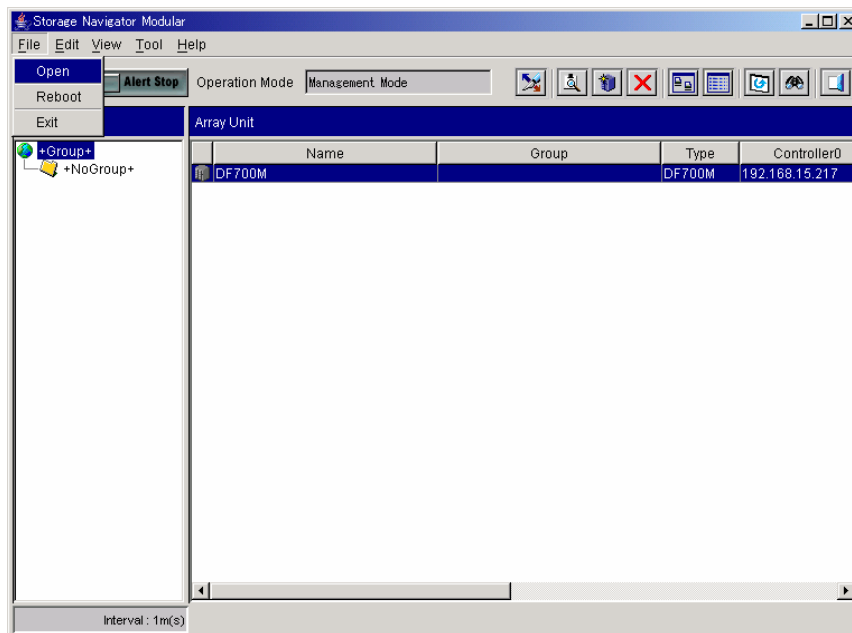
Note: When the LAN access such as the Storage Navigator Modular, WEB and SNMP is provided for the LAN port to be set, the LAN setting cannot be performed. Perform the LAN setting after stopping LAN access to the LAN port to be set.

When the WEB window is opened for the LAN port to be set, the LAN setting cannot be performed. Close the WEB window.

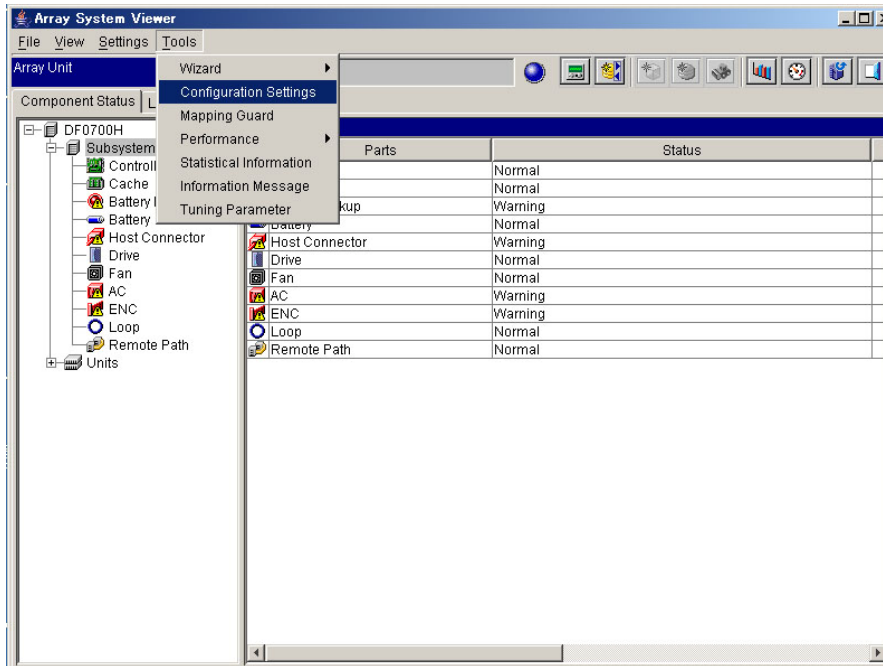
When the **Apply** button is clicked although there is LAN access, an error message is displayed. According to the error message, refer to “netstat.inf” file in the directory where Storage Navigator Modular is installed, stop the LAN access to the LAN port to be set, and try again.

Follow these steps:

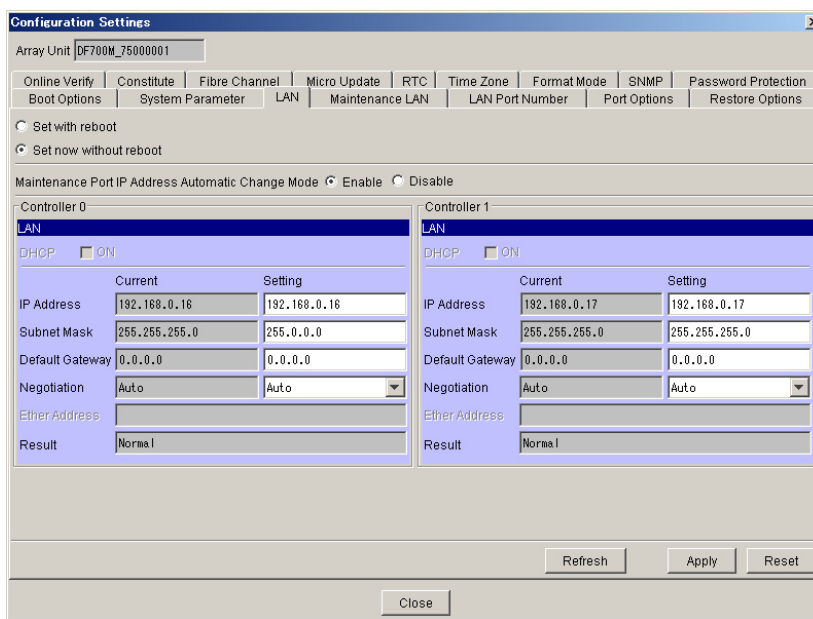
1. Turn on the power supply.
2. Start the Storage Navigator Modular and set the operation mode in **Management Mode**. Refer to the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User’s Guide (MK-95DF711)*.
3. Click the icon of an array unit on the Main window, then select the **File** menu. Click **Open**. Alternatively, click **Display Details** in the tool bar.



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



5. Click the LAN tab. Select **Set now without reboot**. When you want to change the DHCP function, select **Set with reboot**. See the Notes following the next illustration for additional information.



Notes:

Note1: The dialog box does not immediately display the changed values after you enter the LAN information and click Apply, because the values are not yet applied to the subsystem. You must reboot the system to apply the values. When the reboot is complete, the dialog box displays the new values.

Note2: Do not perform the LAN setting with the subsystem reboot when the READY LED (green) blinks at high speeds (A maximum of 40 to 60 minutes).

Note3: When the array subsystem connected to the NAS unit is rebooted, the cluster between the NAS units stops. When the array subsystem is unavoidably rebooted, execute it after stopping the cluster between the NAS units and stopping the NAS OS of both NAS units. Start the cluster between the NAS Units again after completing the array subsystem reboot.

Note4: When the array subsystem to be restarted is remote disk subsystem with the TrueCopy Remote Replication/TrueCopy Extended Distance enabled, restart the array subsystem after the TrueCopy Remote Replication/TrueCopy Extended Distance pair status (S-VOL) transits to the PSUS.

If a restart is executed, it becomes a path blockade and a notice regarding SNMP Agent Support Function and TRAP occurs. Perform the functions in the notice and the check the Failure Monitoring Department in advance. Path blockade automatically recovers after restarting.

6. Set the Maintenance Port IP Address Automatic Change Mode.

Note1: If the Maintenance Port IP Address Automatic Change Mode is enabled, the IP address of maintenance port is changed automatically by IP address of user management port as follows. If maintenance port is used, be careful to the IP address of maintenance port changed automatically.

- 10.xxx.xxx.xxx --- CTL0: 192.168.0.16, CTL1: 192.168.0.17
- other than 10.xxx.xxx.xxx --- CTL0: 10.0.0.16, CTL1: 10.0.0.17

However, in the case of following, this option cannot be selected.

- “DHCP” is enabled.
- using the NAS model.

Note2: If the Maintenance Port IP Address Automatic Change Mode is enabled, in changing IP address process, following IP address of maintenance port may be set temporarily. Check following IP address is not used in the network of maintenance LAN port.

No.	Current IP address of user management port	Setting IP address of user management port	Temporarily IP address of maintenance port
1	172.xxx.xxx.xxx	10.xxx.xxx.xxx	CTL0: 192.168.0.16, CTL1: 192.168.0.17
2	other than 172.xxx.xxx.xxx	other than 10.xxx.xxx.xxx	CTL0: 10.0.0.16, CTL1: 10.0.0.17
3	10.xxx.xxx.xxx	172.xxx.xxx.xxx	CTL0: 192.168.0.16, CTL1: 192.168.0.17
4	other than 10.xxx.xxx.xxx	other than 172.xxx.xxx.xxx	CTL0: 172.23.211.16, CTL1: 172.23.211.17
5	other than 10.xxx.xxx.xxx, and other than 172.xxx.xxx.xxx	172.xxx.xxx.xxx	CTL0: 10.0.0.16, CTL1: 10.0.0.17
6	other than 10.xxx.xxx.xxx, and other than 172.xxx.xxx.xxx	other than 172.xxx.xxx.xxx	CTL0: 172.23.211.16, CTL1: 172.23.211.17

7. Set the LAN Information.

Notes:

Note 1: Do not enter the values ‘0’, ‘127’, or ‘255’ in the first field of the IP address. If any one of these values is set, an error will result when you click **Apply** in the **Parameter** window.

Note 2: If the **Maintenance Port IP Address Automatic Change Mode** is disabled, the IP address or default gateway address that has the same network address as the IP address currently set for the user-managed port cannot be set. If the IP address is set, it will be an error when **Apply** is clicked on the **Parameter** screen. When the network parameter of the maintenance port or the user-managed port is being changed, the setting of the user-managed port network parameter cannot be changed. An error will occur when **Apply** is clicked on the **Parameter** screen during a setting change.

Note 3: When you use the option “Change maintenance port IP address automatically”, selects “Set with reboot array unit”. When this option is enabled, the maintenance port is automatically changed to any of the following addresses depending on IP address of user management port;

- CTL0: 10.0.0.16 or 192.168.0.16
- CTL1: 10.0.0.17 or 192.168.0.17

However, in any of the following cases, this option cannot be selected:

- The microprogram is less than Ver.0733 and the Storage Navigator Modular is less than Ver.3.30.
- “Set now” is selected.
- “DHCP” checkbox is checked.
- Using the NAS model.

Note 4: Set the negotiation settings of the device connected to the subsystem to the same negotiation settings as the subsystem. If the negotiation settings are different, the communication between the device and the subsystem may fail.

		Device Connected to the Subsystem				
		Auto	10Mbps Half	10Mbps Full	100Mbps Half	100Mbps Full
Subsystem	Auto	○	×	×	×	×
	10Mbps Half	×	○	×	×	×
	10Mbps Full	×	×	○	×	×
	100Mbps Half	×	×	×	○	×
	100Mbps Full	×	×	×	×	○

○: Available for communication ×: Not available for operation

7. Click **Apply** on the Configuration Settings screen after the setting is completed. Close the unit screen, and verify that the Storage Navigator Modular can connect to the subsystem with the set IP address. (Refer to section 6.4.)

If the connection cannot be accessed after starting the setting change after more than 5 minutes, connect to the subsystem with the IP address before the change, and follow the message of setting result displayed on the LAN setting screen.

No.	Display in the Setting Result	Failure and Measure
1	---	An unexpected setting result value was received from through Storage Navigator Modular. Press Refresh again to refresh the display. When the "---" displays no matter how many times the update is repeated, make the setting again. If the same information displays in spite of the above operation, contact the maintenance personnel.
2	Setting in progress	The setting is being changed. Wait for about 5 minutes, and then press Refresh again to refresh the display. If the same information displays no matter how many times the update is repeated, contact the maintenance personnel.
3	Abnormal (Time-out of the waiting for the connection)	The setting could not be changed because the effective connection was set for the maintenance port. When the failure monitor service is used with the ASSIST through a maintenance port connection, contact the maintenance personnel. In cases other than the above case, make the setting again. If the same information displays in spite of the above operation, contact the maintenance personnel.
4	Abnormal (Occurrence of a DF internal failure.)	The setting could not be changed because the processing could not continue inside the subsystem. When a failure occurs in the subsystem, contact the maintenance personnel. When no failure occurs in the subsystem, make the setting again. If the same information displays in spite of the above operation, contact the maintenance personnel.

When the **Apply** button is clicked, although there is LAN access, an error message is displayed. According to the error message, refer to "netstat.inf" file in the directory where Storage Navigator Modular is installed, stop LAN access to the LAN port to be set, and try again.

```

netstat.inf - Notepad
File Edit Format Help
Date: 2006/05/02 Tue 14:00:30.333

CTL0
Local Address      Foreign Address    State
192.168.0.16: 2000  192.168.0.70: 3001  4:ESTABLISHED
10.0.0.16: 80      10.0.0.150: 3010  4:ESTABLISHED

CTL1
Local Address      Foreign Address    State
10.0.0.17: 80      10.0.0.151: 3020  4:ESTABLISHED
  
```

Local Address: IP address of the subsystem and LAN port number

Foreign Address: IP address of PC and LAN port number connecting with the subsystem

State: status of TCP connection

Regardless of "Status" in the netstat.inf file, stop the all appreciation currently connecting from "Foreign address"

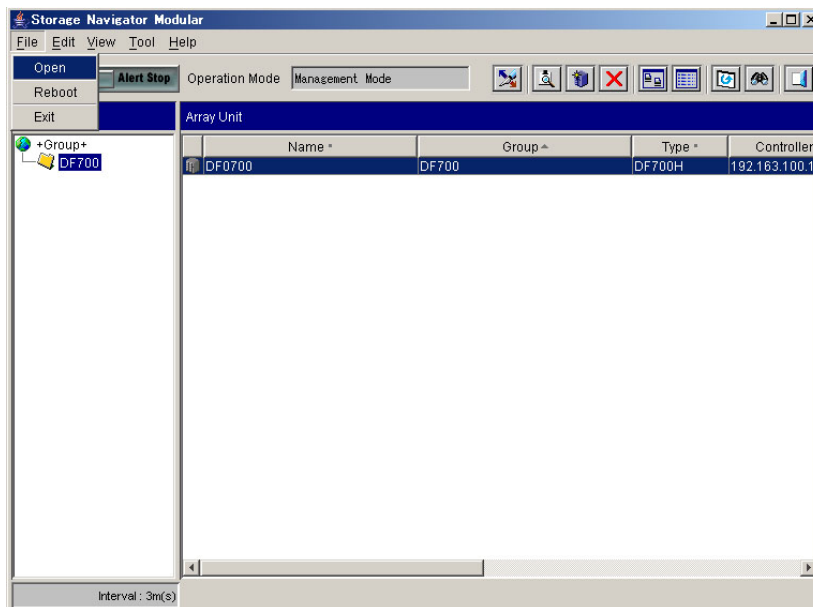
- 0:CLOSE : There are no connections
- 2:SYN_SENT : Waiting for reply of connection request
- 3:SYN_RCVD : Waiting for confirmation of connection reply
- 4:ESTABLISHED : Establishing connection
- 5:CLOSE_WAIT : Waiting for request of connection termination from application
- 6:FIN_WAIT_1 : Waiting for request of connection termination, or waiting for reply of connection termination sent
- 7:CLOSING : Waiting for reply of request for connection termination
- 8:LAST_ACK : Waiting for confirmation of request for connection termination
- 9:FIN_WAIT_2 : Waiting for request of connection termination
- 10:TIME_WAIT : Waiting for connection termination
- 99:--- : The status which is not assumed

7.14 Changing the Auto Diagnosis Threshold for Fibre Channel Loop

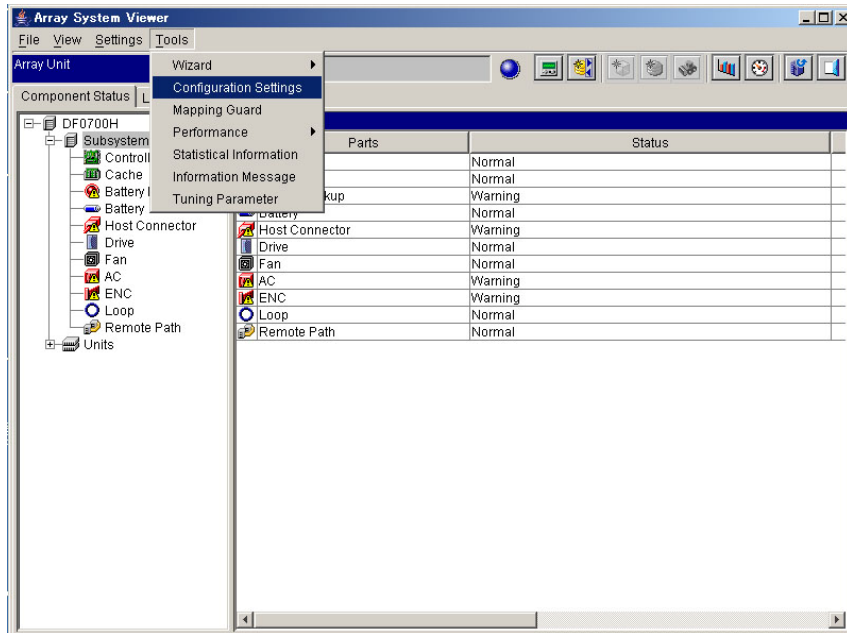
The auto diagnosis threshold for Fibre Channel loop on the drive side of the subsystem can be changed to any number within a range from 1 to 255. The default value is "10". However, this threshold is not normally changed.

This operation is performed using Storage Navigator- Modular.

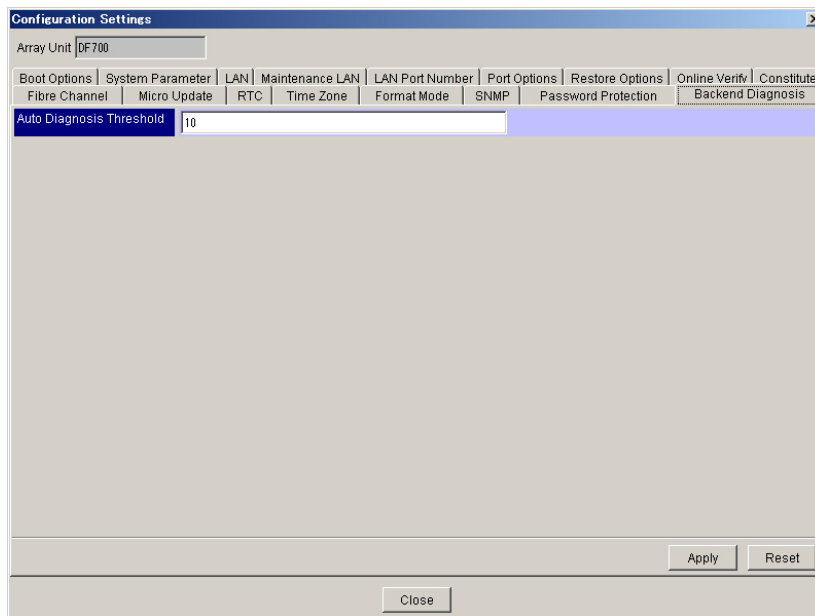
1. Turn on the power supply.
2. Start the Storage Navigator Modular and set the operation mode in **Management Mode**. Refer to the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User's Guide (MK-95DF711)*.
3. Click the icon of an array unit on the Main window, then select the **File** menu. Click **Open**. Alternatively, click **Display Details** in the tool bar.



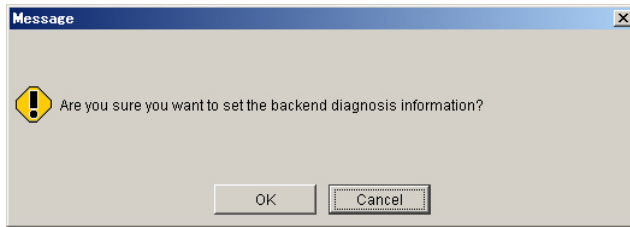
- On the **Tools** menu, select **Configuration Settings** or click **Configuration Settings** in the tool bar.



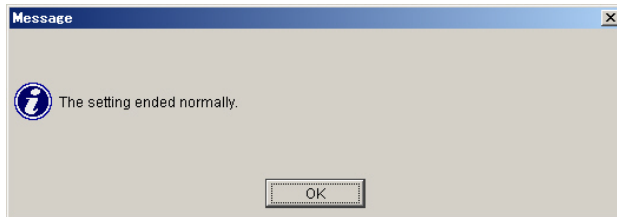
- Click the **Backend Diagnosis** tab on the **Parameter** screen.



- Set the **Auto Diagnosis Threshold** within a range from 1 to 255.
- After completing the above settings, click **Apply**.
- A confirmation message appears. Click **OK**.



9. A message indicating that the changes to the Auto Diagnosis Threshold are complete is displayed. Click **OK**.



10. Verify that the Auto Diagnosis Threshold has been changed.

7.15 Changing the IP Address for Maintenance Port

This operation is performed using the Storage Navigator Modular.

Notes:

Note 1: The IP address for the maintenance port is used for the maintenance work performed by the maintenance personnel when a failure occurs. Use one of the following network addresses as an IP address for the maintenance port; "10.0.0.xxx", "192.168.0.xxx", "192.168.233.xxx", "172.23.211.xxx", "10.197.181.xxx". Do not use the same network address used for maintenance port for other user-managed ports.

Do not change the IP address for the maintenance port, if its change is not particularly needed.

Note 2: If the user management port is incorrectly set, the setting of maintenance port will fail, and an error may be displayed. Set the value of user management port according to error message. (Refer to section 7.13.)

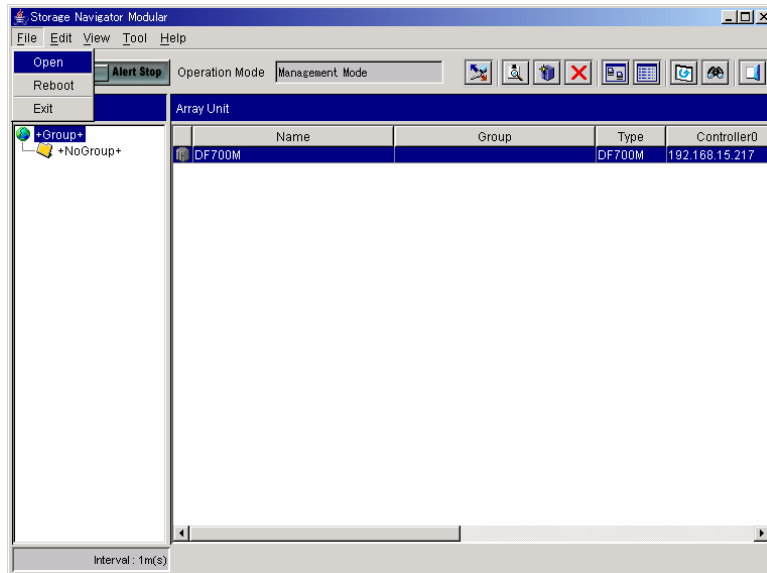
Note 3: If the "Maintenance Port IP Address Automatic Change Mode" is enabled, the IP address of maintenance port cannot be changed.

If you change maintenance LAN setting, set the "Maintenance Port IP Address Automatic Change Mode" to "Disable". (Refer to section 7.13.)

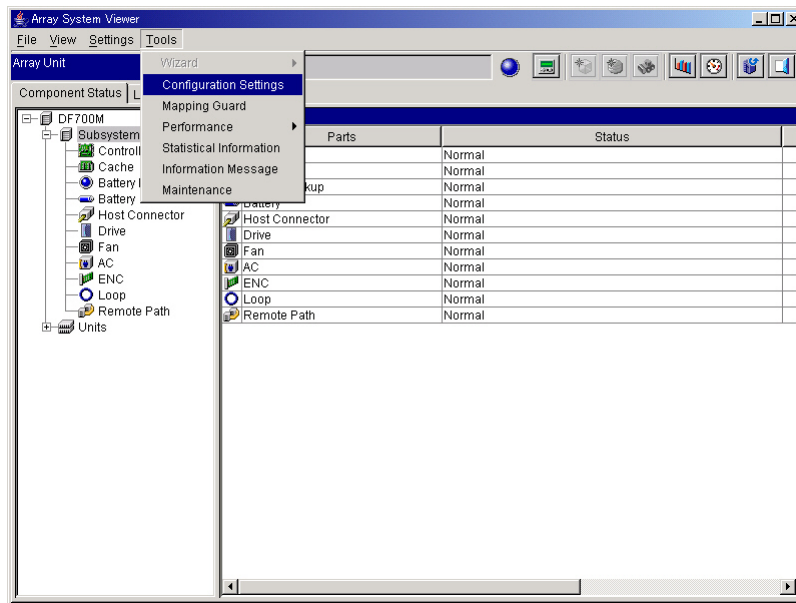
To change the IP address for the maintenance port, follow these steps:

1. Turn on the power supply.
2. Start the Storage Navigator Modular and set the operation mode in **Management Mode**. Refer to the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User's Guide* (MK-95DF711).

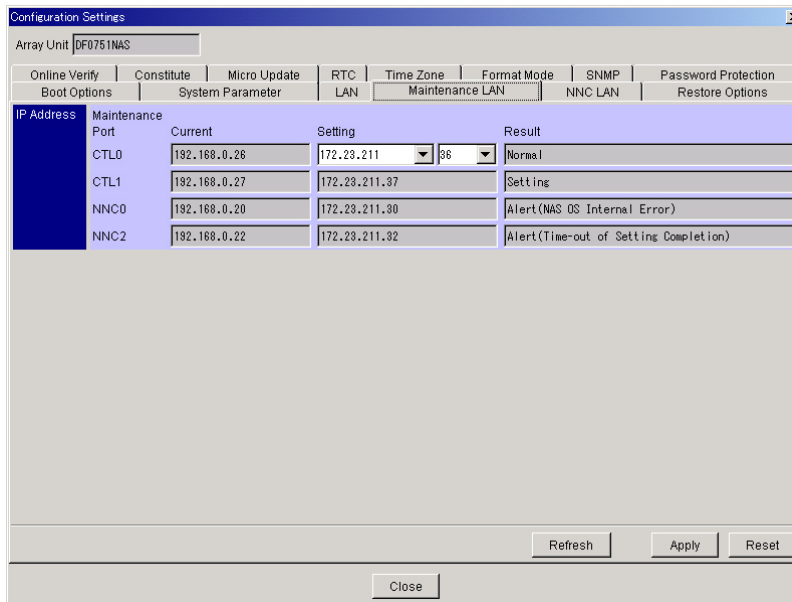
3. Click the icon of an array unit on the Main window, and then select the **File** menu. Click **Open**. Alternatively, click **Display Details** in the tool bar.



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



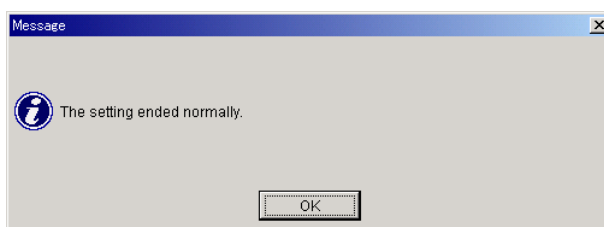
- Click the **Maintenance LAN** tab on the **Configuration Settings** dialog box.



- Set the **Maintenance LAN Information**.

Note: The IP address which has the same network address as the IP address currently set for the user-managed port or the NCC management port cannot be set. Even if that IP address is set, it will initiate an error when clicking **Apply** on the **Parameter** screen.

- Click **Apply** on the **Configuration Settings** screen after the setting is completed.
- A confirmation message displays; click **OK**.



- When all the **Current** values are the same as the set value on the **Configuration Settings** screen, and the **Normal** displays on the **Result** window, the setting is completed. If the **Setting** displays in the **Result** window, click **Refresh** on the **Configuration Settings** screen after a brief interval.

When the setting does not terminate correctly, refer to Table 3.2 Fixing AMS1000 IP Address Errors for the Maintenance Port in *Hitachi TagmaStore® Adaptable Modular Storage (AMS) and Workgroup Modular Storage (WMS) Storage Navigator Modular Error Codes (MK-96DF788)*.

7.16 Setting System LU and User LU in NAS System

This operation is performed using the Storage Navigator Modular.

The capacity of system LU is restricted to the capacity listed in Table 7.4.

Table 7.4 List of Additional Parameter Setting Items

No.	System LU	Capacity Restriction	
		Byte Designation	Block Designation
1	For system disk (CTL 0)	15 G bytes (or more)	28,698,624 blocks (or more)
2	For system disk (CTL 1)	15 G bytes (or more)	28,698,624 blocks (or more)
3	For volume for storing dump (CTL 0)	5 G bytes (or more)	10,086,400 blocks (or more)
4	For volume for storing dump (CTL 1)	5 G bytes (or more)	10,086,400 blocks (or more)
5	For command device (Note)	35 M bytes (or more)	71,680 blocks (or more)
6	For the work for storing the dump edit result.	5 G bytes (or more)	8,591,360 blocks (or more)
7	For the system sharing volume	3 G bytes (or more)	5,195,776 blocks (or more)
8	For the volume for back-upping a shared volume	3 G bytes (or more)	5,195,776 blocks (or more)
9	For the volume 2 for back-upping a shared volume	3 G bytes (or more)	5,195,776 blocks (or more)

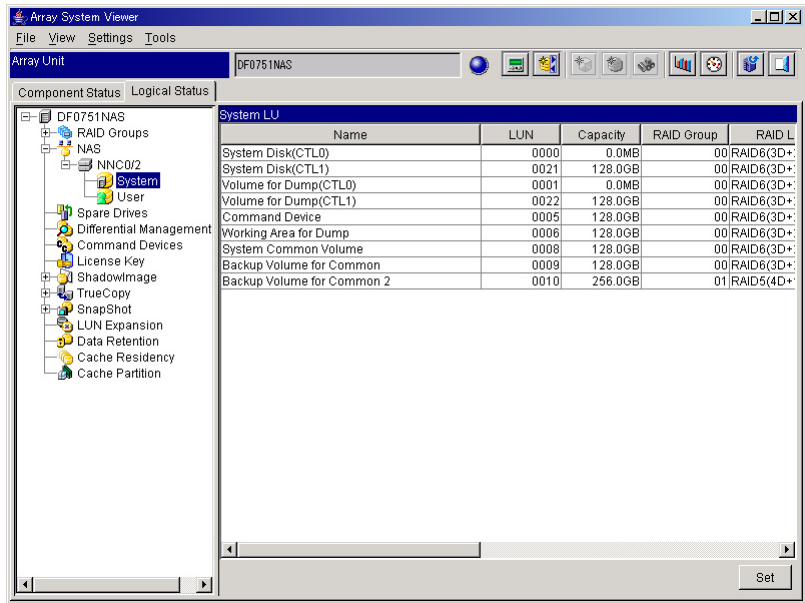
Note: ShadowImage in-system replication, Copy-on-write SnapShot, TrueCopy Remote Replication, TrueCopy Extended Distance, and Backup Restore are required.

7.16.1 Setting the System LU

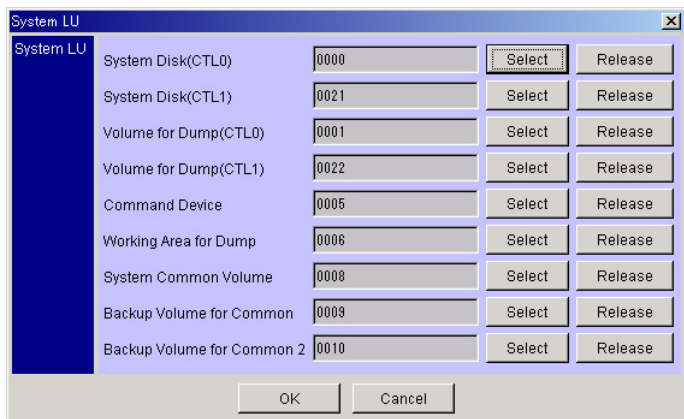
To set the System LU:

1. On the Unit screen, click the **Logical Status** tab.
2. Display the **NNC0/2** by double-clicking the **NAS**.

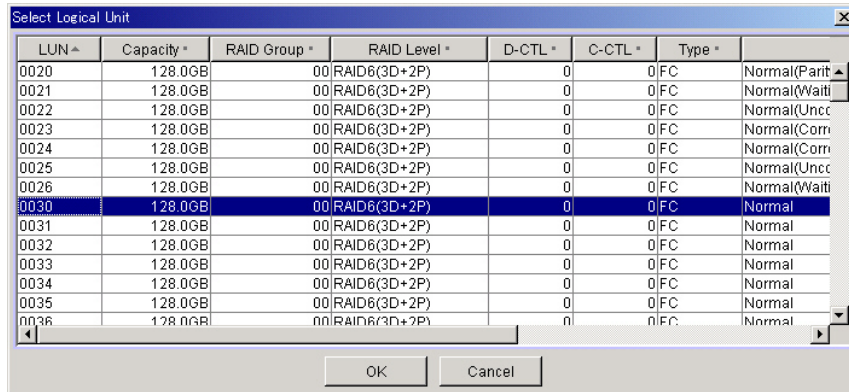
Display the **System** and **User** by double-clicking the **NNC0/2**, and select the **System**.
A list of system LU displays.



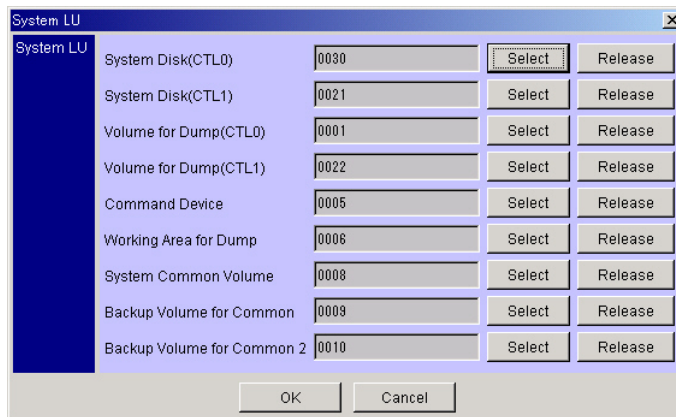
3. Click **Set** in the lower right portion of the screen.
The **System LU** dialog box displays.
4. Click **Select** for the system LU that you want to set.



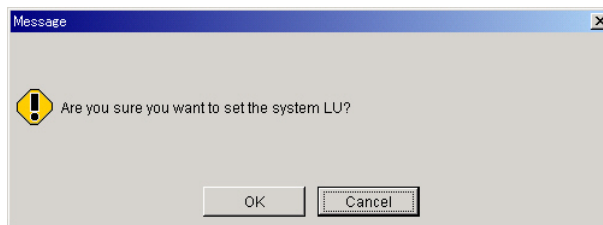
- The Select Logical Unit dialog box displays.
Select the LUNs to be assigned, then click **OK**.



- Verify that the selected LU(s) was(were) reflected to the System LU dialog box, and then click **OK**.



- A confirmation message displays; click **OK**.



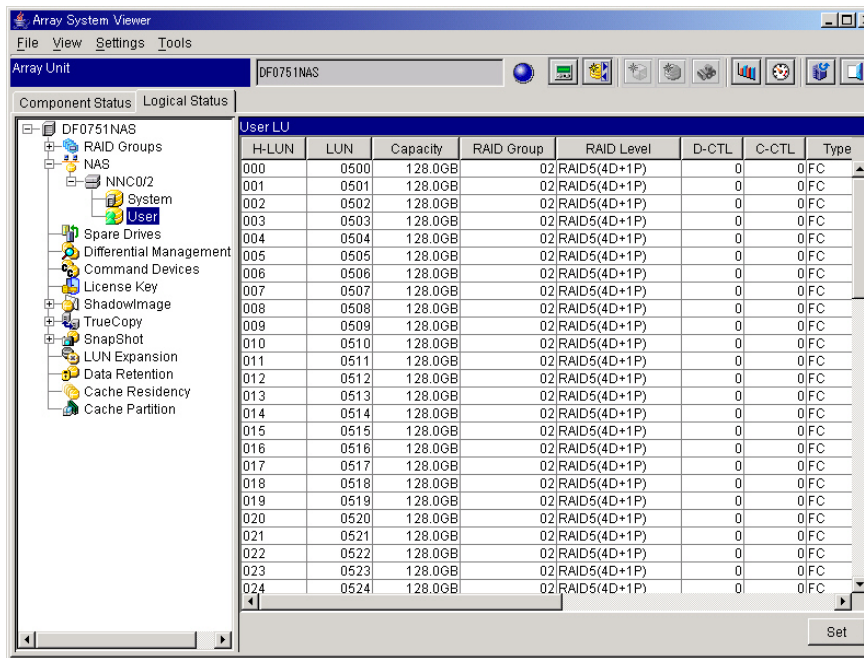
7.16.2 Setting User LU

Before cancelling the setting of the user LU for NAS, check the status of the user LU device file. If the device file of the user LU is reserved for the copy destination of the file system, release the device file before cancelling the setting. Refer to the **NAS Backup Restore Modular User's Guide** For information about reserving and releasing a device file.


To set the User LU:

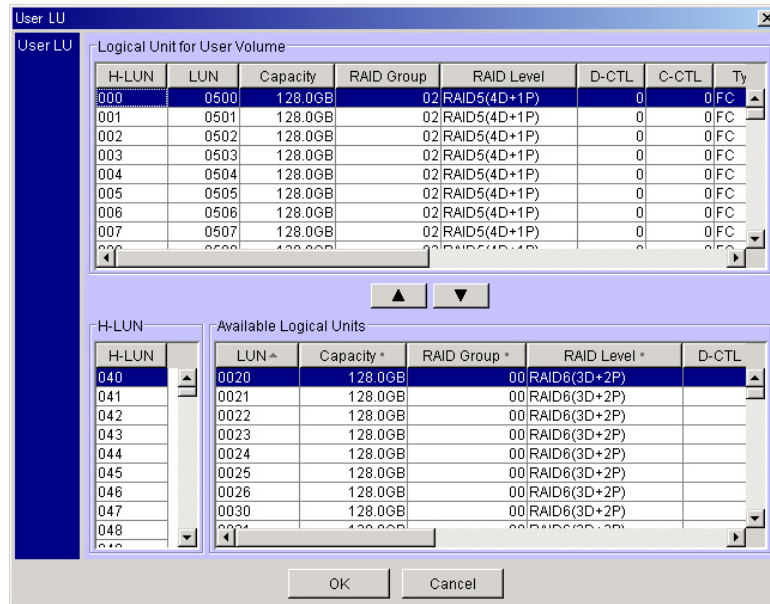
1. On the Unit screen, click the **Logical Status** tab.
2. Display the **NNC0/2** by double-clicking the **NAS**.

Display the **System** and **User** by double-clicking the **NNC0/2**, and select the **User**. A list of system LU displays.



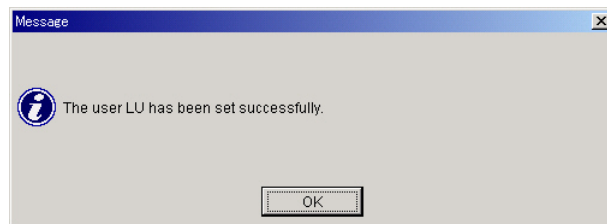
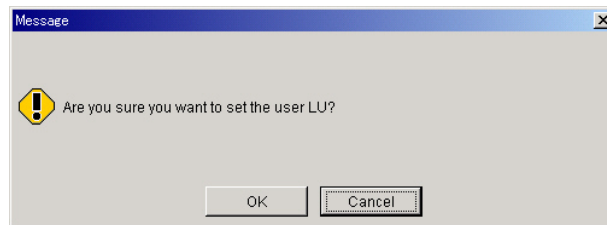
3. Click **Set** in the lower right portion of the screen.
The **User LU** dialog box displays.

- Select one H-LUN from the **H-LUN** list in the User LU dialog box, select an LUN that you want to assign for the H-LUN from the **Available Logical Units** list, and click .



The selected H-LUN and LUN will be moved to the **Logical Unit for User Volume** list.

- Repeat step 4 until all the LUNs that you want to assign are moved to the **Logical Unit for User Volume**, click **OK**.
- A confirmation message displays; click **OK**.



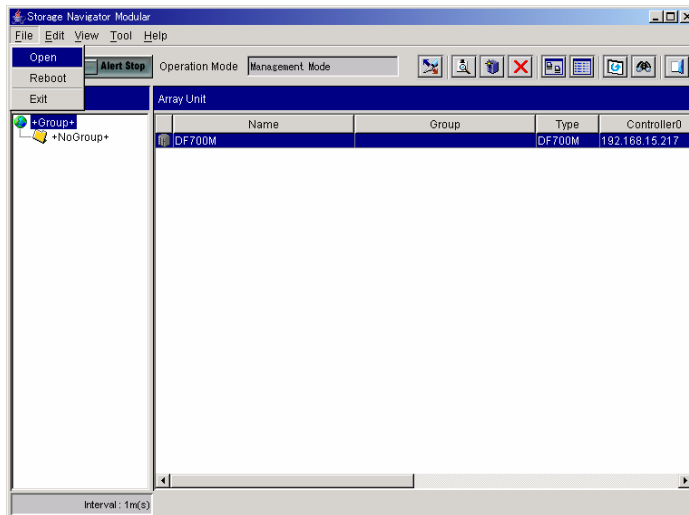
7.17 Setting NNC Management LAN Port Information in NAS System

This operation is performed using the Storage Navigator Modular.

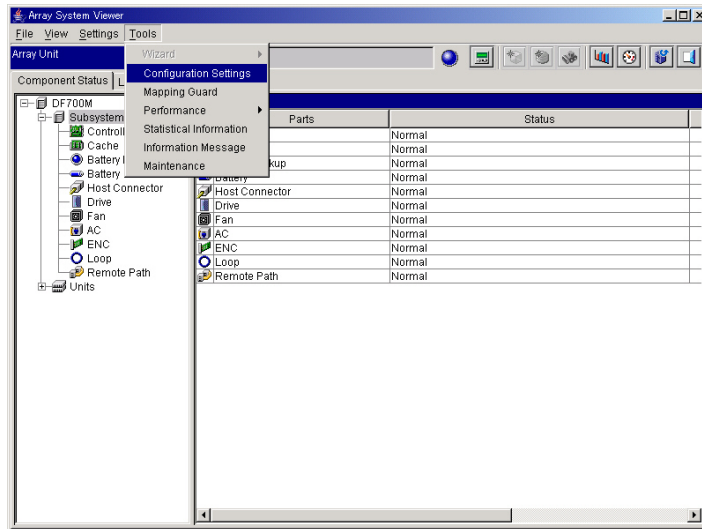
Note: Do not change the NNC Management LAN configuration (LAN cable connect/disconnect and so on) during the setting.

To set the NNC management port in the network, follow these steps:

1. Turn on the power supply.
2. When the node in the cluster is "ACTIVE", stop the cluster, and make the cluster "INACTIVE".
3. Start the Storage Navigator Modular and set the operation mode in the **Management Mode** (Refer to the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User's Guide* (MK-95DF711)).
4. Click the icon of an array unit on the Main screen, and then select the **File** menu, click **Open**. Or, click **Display Details** in the tool bar.

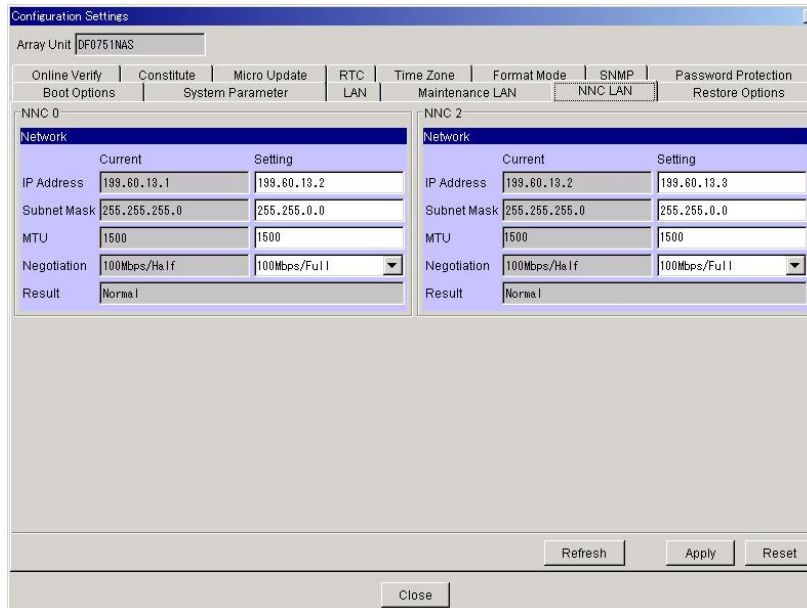


- On the Tools menu, select Configuration Settings or click Configuration Settings in the tool bar.



- Click the NNC LAN tab on the Configuration Settings screen.

Note: The combination of the NNC to be set differs, depending on the subsystem configuration. The following screen shows NNC 0 and NNC 2, but the combination may be NNC 1 and NNC 3 depending on the subsystem configuration. There is no difference for the setting items.



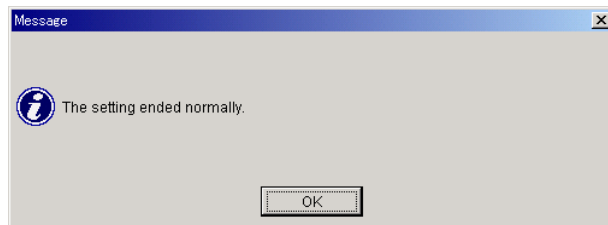
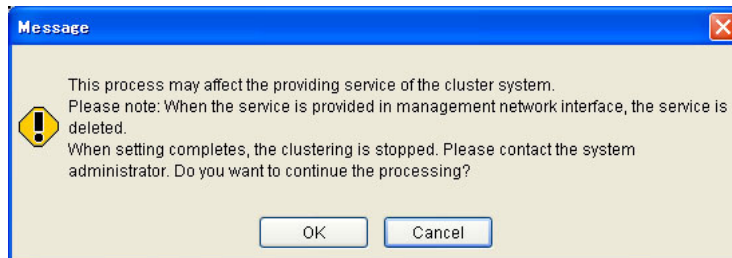
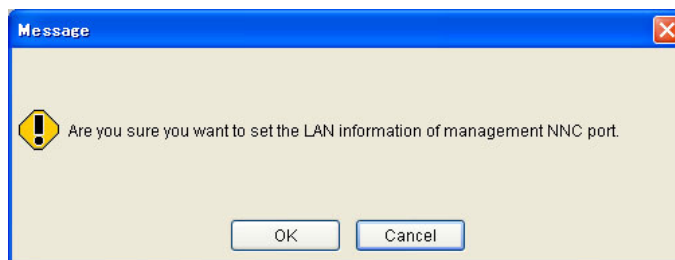
7. Set the LAN Information.

LAN information: Refer to and set the network setting of NNC management port:

- **IP Address:** Displays the current value of IP address and specifies the setting value.
- **Subnet Mask:** Displays the current value of subnet mask and specifies the setting value.
- **MTU:** Displays the current value of MTU and specifies the setting value. The setting value can be specified in the range of 1500 to 16110. Set the same value for both NNCs. The recommended value is the default value (1500).
- **Negotiation:** Displays the current value of Negotiation and specifies the setting value.

8. Click **Apply** on the **Configuration Settings** screen after the setting is completed.

9. A confirmation message displays; click **OK**.



- When all the **Current** values are the same as the set value on the **Configuration Settings** screen, and the **Normal** displays on the **Result**, the setting is completed.
If the **Setting** displays in the **Result**, click the **Refresh** on the **Configuration Settings** screen after a brief interval.

When the setting does not terminate correctly, refer to Table 3.3 Fixing AMS1000 NNC Management LAN Port Errors in a NAS System in *Hitachi TagmaStore® Adaptable Modular Storage (AMS) and Workgroup Modular Storage (WMS) Storage Navigator Modular Error Codes (MK-96DF788)*.

- Reboot the NAS OS of both nodes.

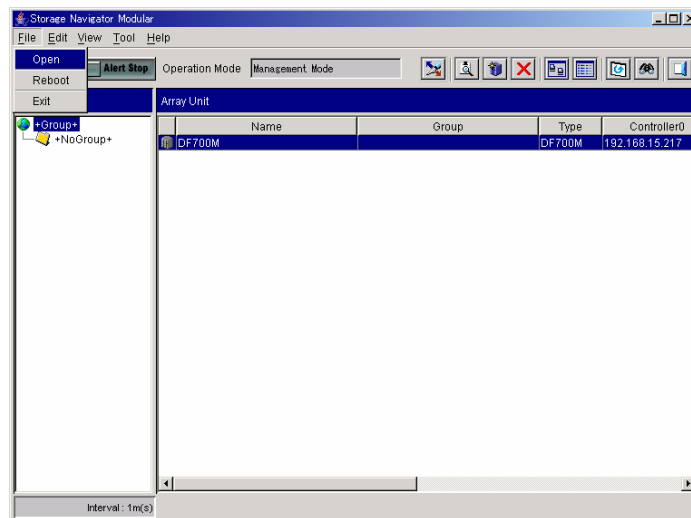
7.18 Setting Time Zone

This operation is performed using the Storage Navigator Modular.

When connecting the NAS unit, this operation is necessary. This operation is not necessary after the NAS unit is connected. If an NTP server is onsite and you wish to synchronize the clock of the array unit to the NTP server, execute this operation.

To set the time zone, follow these steps:

- Turn on the power supply.
- Start the Storage Navigator Modular and set the operation mode in **Management Mode**. Refer to the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User's Guide (MK-95DF711)*.
- Click the icon of an array unit on the Main window, and then select the **File** menu. Click **Open**. Alternatively, click **Display Details** in the tool bar.

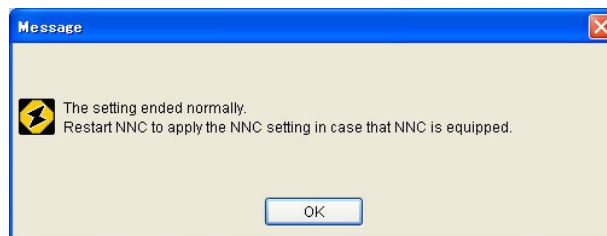
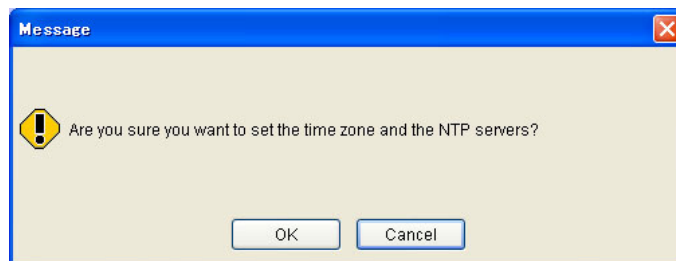


6. Set the IP addresses of **Time Zone** and **NTP Server**:
 - **Time Zone**: Refers to and sets the time zone. Default value: (GMT+09:00) Osaka/ Sapporo/ Tokyo.
 - **Automatically adjust clock for daylight saving changes**: Specifies whether to use the summer time.
 - **NTP Server**: Refers to and sets the IP address of the NTP server.

Note: Input is surely required for Server 1. Input is not indispensable to Server 2 because Server 2 is for standby.

7. Click **Apply** on the **Configuration Settings** screen after the setting is completed.
8. A confirmation message displays; click **OK**.

Note: When the NAS is not installed, click **Cancel**.



9. When the node in the cluster is "ACTIVE", stop the cluster, and make the cluster "INACTIVE".
10. Reboot the NAS OS of both nodes.

7.19 Settings and Restrictions for Adding the Thunder 9500VFC Additional Unit

The TagmaStore AMS1000 can be connected to the Thunder 9500V FC additional unit (DF600-RKA). To add the DF600-RKA to the TagmaStore AMS1000, order the support kit p/n DF-F700-K1BUP.

The disk drives of the DF600-RKA set by default are out of the Copy Backless (**Note 1**). However, in the microprogram revision version 0740/C or later, the disk drives of the DF600-RKA are the target of the copy backless because the Copy Backless condition is changed (**Note 2**) by setting the **Applying No Copy Back Mode On All the Units** in the **Spare Drive Operation Mode** on the **Restore Options** tab from the Storage Navigator Modular. This setting does not apply to a SATA disk drive.

Before setting this parameter, follow the restriction shown in (a). In an unavoidable case, observe the operational restriction shown in (b).

- (a) An FC disk drive to be installed in the subsystem must be matched to the disk drive with the same rotational speed.
- (b) If the system includes FC disk drives with different rotational speeds, the I/O performance to the FC disk drive to be installed in the subsystem, the copy performance of the copy system function of the options (ShadowImage in-system replication, etc.), the format performance and the disk drive restoration performance must be designed as the FC disk drive of 10,000 min⁻¹ rotation.

When FC disk drives with different rotational speeds are installed in the subsystem without following the operational restrictions described above, and if the copy backless is running, the RAID Group may be configured with FC disk drives of different rotational speeds. Under these circumstances, even if a RAID Group is created by a disk drive of 15,000 min⁻¹ RPM, a disk drive of 10,000 min⁻¹ rotation can be added to the disk drive which configures the RAID Group. However, if you do this, the I/O performance to the LUs created in the RAID Group, the performance of the copy system function (ShadowImage in-system replication, etc.), the performance of formatting and disk drive restoration will deteriorate.

Before disabling the setting, check to see whether there is RAID group where the FC disk drives with different rotational speed are installed, and verify that the following have no performance problems:

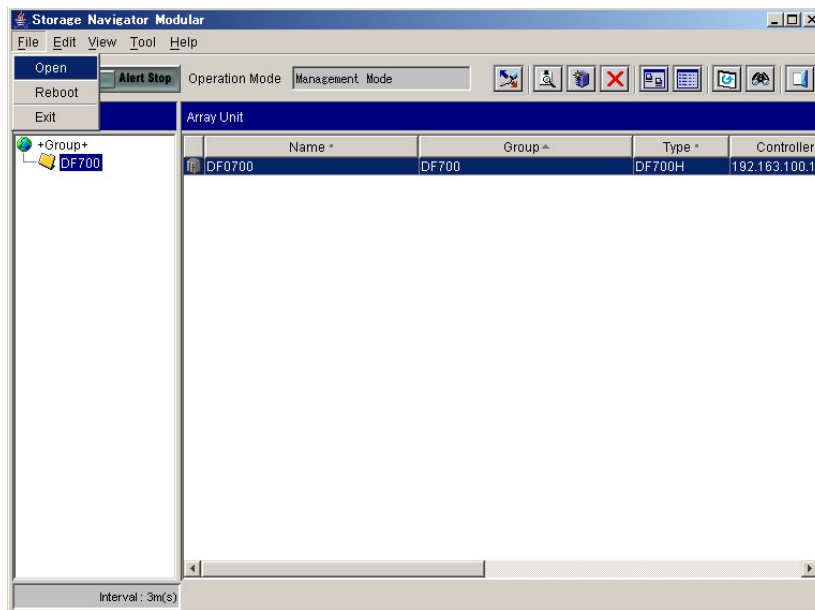
- I/O performance
- copy system function of the options (ShadowImage in-system replication, etc.)
- the format performance,
- disk drive restoration performance have no problems.

Note 1: When a failed disk is replaced or restored and the failure is corrected, even if the capacity and the rotational speed of the replacement disk matches the failed disk and both of the drives are not RKA drives, copy backless will not operate because the IDs of the data disk and spare disk are switched. Therefore, there is no I/O performance deterioration due to the copy back start after replacing the disk

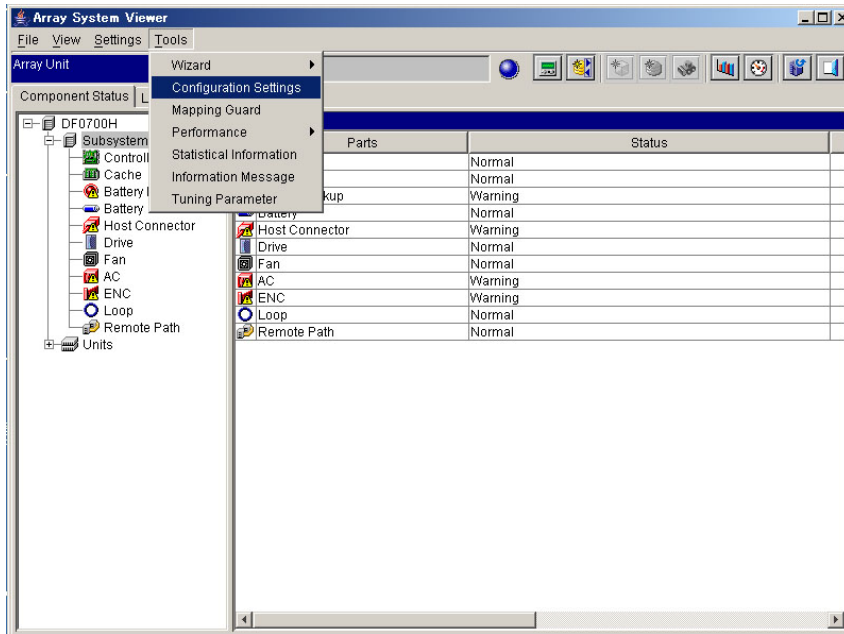
. **Note 2:** When the dynamic sparing or the correction copy that was a result of disk drive blockage is completed, if the capacity of the data disk drive and the spare disk drive which recovered the data are the same, even if the failed disk drive is replaced, the copy backless does not operate because the attribute of the data disk and spare disk are switched.

To make the DF600-RKA copy backless function the target, follow these steps:

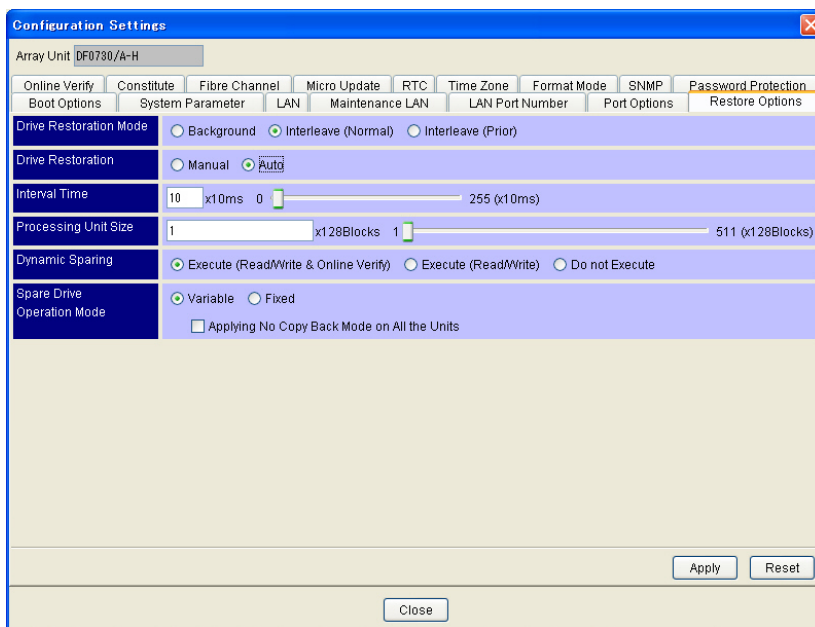
1. Turn on the power supply.
2. Start the Storage Navigator Modular and set the operation mode in the **Management Mode** (Refer to the **Storage Navigator Modular (for GUI) User's Guide**)
3. Click the icon of an array unit on the Main window and select the **File** menu. Click the **Open** or click the **Display Details** button on the toolbar.



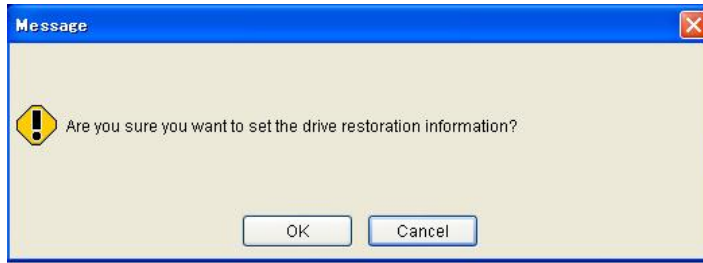
4. On the **Tools** menu, click **Configuration Settings** or click the **Configuration Settings** button on the toolbar.



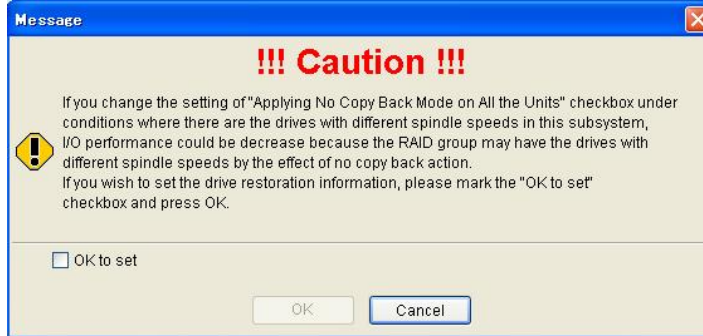
5. Click the Restore Options tab.



6. Select the Applying No Copy Back Mode on All the Units check box.
7. Click the Apply button on the Configuration Settings screen after the setting is completed.
8. A message appears, click the OK button.



9. The following message is displayed. Verify that the operational restriction has no problems and select the **OK to set** check box. Click the **OK** button.



10. For the subsequent messages, according to the messages, click the **OK** button.

Chapter 8 Troubleshooting

This section includes the following:

- Troubleshooting Based on LED Indications (see section .8.1)
- Web Overview (see section .8.2)
- Web Operational Procedures (see section .8.3)
- Troubleshooting Using a Web Connection (see section .8.4)
- Determining Failure of Network Side in the NAS System (see section .8.5)
- Determining Failure of Local Tape in NAS System (see section .8.6)
- Collecting Failure Information in Connection with Web (see section .8.7)
- Determining Failure on the Network Side of an iSCSI System (see section .8.8)
- Changing the LAN Port Number with the Storage Navigator Modular (see section .8.9)
- Calling the Hitachi Data Systems Support Center (see section .8.10)

This chapter provides information on the Fibre, NAS, and iSCSI models. The following table illustrates sections that provide an explanation for each model.

- **Fibre model:** Connects disk array subsystem to a host computer with Fibre Channel interface.
- **NAS model:** Connects NAS Unit connected to disk array subsystem to a host computer with LAN interface.
- **iSCSI model:** Connects disk array subsystem to a host computer with iSCSI interface.

		Fibre	NAS	iSCSI
8.1	8.1.1 The POWER LED Does Not Turn On	○	○	○
	8.1.2 The POWER LED Has Turned off	○	○	○
	8.1.3 If the READY LED Does Not Turn on, or the READY LED Has Turned on Once and then Turned off	○	○	○
	8.1.4 The Alarm LED Has Turned on	○	○	○
	8.1.5 The WARNING LED Has Turned on or Blinks	○	○	○
8.2	8.2.1 Operational Environment	○	○	○
	8.2.2 Characteristics of Network Functions	○	○	○
8.3	8.3.1 Connecting to the Network using a LAN Interface	○	○	○
	8.3.2 Screen Outlines	○	○	○
	8.3.3 Main Screen in Normal Mode	○	○	○
	8.3.4 Status Display of Replaceable Components	○	○	○
	8.3.5 Information Message	○	○	○
	8.3.6 Setting the Buzzer Sound Volume	○	○	○
	8.3.7 Clear Specified Factors of NNC Partial Alarm	–	○	–
8.4	8.4.1 Checking Storage System Status	○	○	○
	8.4.2 Checking the Progress Condition Display	○	○	○
	8.4.3 Checking Component Status	○	○	○
	8.4.4 Checking Log Messages	○	○	○
	8.4.5 Troubleshooting Using Messages	○	○	○
	8.4.6 Reading Failure Information	○	○	○
8.5	Determining Failure of Network Side in NAS System	–	○	–
8.6	Determining Failure of Local Tape in NAS System	–	○	–
8.7	8.7.1 Collecting Simple Trace	–	○	–
	8.7.2 NAS Log Collection	–	○	–
	8.7.3 NAS Dump generation	–	○	–
8.8	Determining Failure of Network Side in iSCSI system	–	–	○
8.9	Changing the LAN Port Number with the Storage Navigator Modular	○	○	○

○: An explanation is provided.

–: An explanation is not provided.

8.1 Troubleshooting Based on LED Indications

This section includes the following:

- POWER LED Does Not Turn on.
- POWER LED Has Turned off.
- READY LED Does Not Turn on, or READY LED Has Turned on Once and then Turned off.
- ALARM LED Has Turned on.
- WARNING LED Has Turned on or Blinks.

Note: When the disk array subsystem is used as the remote side of TrueCopy Remote Replication/TrueCopy Extended Distance, restarting the subsystem will result in the following:

- Both paths of TrueCopy Remote Replication/TrueCopy Extended Distance are blocked. A notice regarding SNMP Agent Support Function and TRAP occurs in path blockade mode. Perform the functions in the notice and check the Failure Monitoring Department in advance. Path blockade automatically recovers after restarting.
- If the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance is PAIR or COPY, the pair status transits to PSUE.

When the disk array subsystem must be restarted, transmit the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance to PSUS, and then restart the subsystem.

Note: If the array subsystem connected to the NAS Unit is restarted, the cluster between the NAS Units stops. When the array subsystem is unavoidably restarted, execute it after stopping the cluster between the NAS Units and stopping the NAS OS of both NAS Units. Start the cluster between the NAS Units again after completing the restart for the array subsystem.

Note: A NAS system cannot be accessed from a host computer even though the READY LED of NAS unit illuminates. A NAS system accepts access from a host computer only when of "ACTIVE" NAS OS Condition.

8.1.1 POWER LED does not Turn On

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

1. Set all the AC power unit switches on; set the main switch to on.
2. Has the POWER LED on the RKH/RKHE turned on?
Yes: Go to step 11.
No: Power-on the host computer.
3. Has the POWER LED on the RKH/RKHE turned on?
Yes: Go to step 11.
No: Set the main switch to off; set the AC power unit switch of the RKH/RKHE to off.
4. Check the PDB to verify that electricity is being supplied to the unit.
5. Verify that the AC cable is correctly connected to the plug socket and the equipment.
6. Set all the AC power unit switches to on; set the main switch to on.
7. Has the POWER LED on the RKH/RKHE turned on?
Yes: Go to step 11.
No: Set the main switch to off; set the AC power unit switch to off.
8. Call your Customer Engineer. Go to step 10.
9. Is the READY LED on?
Yes: Continue to use the equipment in its current operational state. When the READY LED (green) blinks continuously, the download of the ENC/SENC firmware is executed. The subsystem is operational even though the READY LED (green) is blinking.
No: Verify that the READY LED does not turn on or that the READY LED has turned on once and then turned off. (See section 8.3.1.)
10. Is the RKNAS connected to the AMS1000?
Yes: If the POWER LED on the RKNAS does not light, set the AC power unit switch of the RKNAS to off, and call the Engineer.
No: Go to step 11.
11. End of procedure

8.1.2 POWER LED Has Turned Off

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

1. Is electricity supplied to the equipment?
Yes: Go to step 2.
No: Supply electricity to the unit, and then restart the unit. Go to step 2.
2. Set the main switch to off, then set all the AC power unit switches to off.
3. After waiting for more than one minute, set all the AC power unit switches to on, then set the main switch to on.
4. Has the POWER LED on the RKH/RKHE turned on?
Yes: Go to step 7.
No: Set the main switch to off, then set the AC power unit switch to off.
5. Call your Customer Engineer. Go to step 8.
6. Has the READY LED on the RKH/RKHE turned on?
Yes: Continue to use the equipment in its current operational state. When the READY LED (green) blinks continuously, the download of the ENC/SENC firmware is executed. The subsystem is operational even though the READY LED (green) is blinking.
No: Refer to **READY LED Does Not Turn on, or READY LED Has Turned on Once and then Turned off.**
7. Is the RKNAS connected?
Yes: If the POWER LED on the RKNAS does not light, set the AC power unit switch of the RKNAS to off, and call your Customer Engineer.
No: Go to step 8.
8. End of procedure

8.1.3 READY LED does not Turn On, or Turns On Once then Turns Off

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

1. Is the POWER LED on the RKH/RKHE on?
Yes: Go to step 2.
No: Go to step 4 in **POWER LED Does Not Turn on.**
2. Is the ALARM LED on the RKH/RKHE on?
Yes: Refer to **ALARM LED Has Turned on.**
No: Go to step 3.
3. Is the RKNAS connected to the AMS1000?
Yes: Go to step 4.
No: Go to step 5.
4. Is the POWER LED on the RKNAS on? Is the ALARM LED on the RKNAS off?
Yes: Go to step 4.
No:
 - If the POWER LED on the RKNAS is not on;
Go to step 5 in **The POWER LED Does Not Turn on.**
 - If the ALARM LED on the RKNAS is on;
Refer to **The ALARM LED Has Turned on.**
5. Does the WARNING LED (orange) on the RKH/RKHE blink at high speed?
Yes: Wait until the READY LED (green) on the RKH/RKHE lights because the update of the flash program is executed.
No: Go to step 6.
6. Does the READY LED (green) on the RKH/RKHE blink at high speed?
Yes: Wait for up to 40 to 60 minutes until this READY LED (green) lights because the download of the ENC/SENC firmware is executed.
No: Go to step 7.
7. Turn off the main switch.
8. After waiting for more than one minute, set the AC power unit switch to on, then set the main switch to on.

9. Has the READY LED on the RKH/RKHE turned on?
Yes: Continue to use the equipment in its current operational state. When the READY LED (green) on the RKH/RKHE blinks continuously, the download of the ENC/SENC firmware is executed. The subsystem is operational even though the READY LED (green) on the RKH/RKHE is blinking.
Go to step 14.
No: Go to step 10.
10. Set the main switch to off, then set the AC power unit switch to off.
11. Is the RKNAS connected?
Yes: Go to step 12.
No: Go to step 13.
12. Is the READY LED on the RKNAS on?
Yes: Go to step 13.
No: Set the AC power unit switch of the RKNAS to off.
13. Call your Customer Engineer.
14. End of procedure

8.1.4 ALARM LED has Turned On

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

1. Identify in which components the failure resides.
Note: Refer to section 4.7.5 to identify failed component LEDs and their respective failures.
2. Set the main switch to off, then set the AC power unit switch to off.
3. Call your Customer Engineer and do not disturb the equipment.

8.1.5 Warning LED

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

1. Does the WARNING LED (orange) on the RKH/RKHE blink at high speed?
Yes: Wait until the READY LED (green) on the RKH/RKHE is off, and the READY LED (green) on the RKH/RKHE lights because the update of the flash program is executed.
No: Go to step 2.
2. Does the WARNING LED on the RKH/RKHE blink slowly?
Yes: Call your Customer Engineer. Go to step 11.
No: Go to step 3.
3. Is the RKNAS connected?
Yes: Go to step 4.
No: Go to step 5.
4. Does the WARNING LED on the RKNAS blink?
Yes: Call your Customer Engineer. Go to step 6.
No: Go to step 5.
5. Is the READY LED on the RKH/RKHE on?
Yes: Go to step 6.
No: Refer to section 8.1.3.
6. Is the RKNAS connected?
Yes: Go to step 7.
No: Go to step 8.
7. Is the READY LED on the RKNAS on?
Yes: Go to step 8.
No: Refer to section 8.1.3.
8. Identify in which components a failure resides in the RKH/RKHE.
Note: Refer to section 4.7.5 to identify failed component LEDs and their respective failures.
9. Is the RKNAS connected?
Yes: Identify in which components a failure resides in the RKNAS.
No: Go to step 11.
10. Continue to use the equipment, and contact the Customer Engineer.
11. End of procedure

8.2 Web Overview

This section includes the following:

- Operational Environment
- Characteristics of Network Functions

8.2.1 Operational Environment

The Web operational environment and the necessary requirements are shown in Table 8.1 and Table 8.2.

Table 8.1 Web Operational Environment

No.	Item	Description
1	OS	Microsoft® Windows® 98/NT 4.0/2000/XP/2003, Solaris™ 8, IRIX® 6.5, AIX4.3, 5.1.
2	PC	Pentium® (Pentium II(233 M Hz or more) is recommended), Memory 40 M bytes or more (64 M bytes or more is recommended).
3	WS	TurboSPARC® 170 M Hz, Memory 256 M bytes or more. R10000 195M Hz, Memory 128 M bytes or more.
4	Disk requirement	50 M bytes.

Table 8.2 AMS1000 Web Function Support Browser/Version

No.	Platform	OS	Ver.	Browser	Ver. (Note)	Supported/Not Supported	Java Applet Supported/Not Supported (Note 2) (Note 3)	
1	WS	IRIX®	6.5	Netscape Navigator	4.76	○	×	
			2.6	Netscape Navigator	4.76	○	×	
		Solaris	8	Netscape Navigator	4.76	○	×	
			AIX	4.3	Mozilla	1.5	○	×
				5.1	Mozilla	1.7	○	×
2	PC	Windows®	98	Internet Explorer	6.0	○	○	
			NT®/2000	Internet Explorer	6.0	○	○	
			XP	Internet Explorer	6.0	○	○	
			2003(IA32)	Internet Explorer	6.0	○	○	
			2003(IA64)	Internet Explorer	6.0	○	×	
					6.0 (32Bit)	○	○	
3	PC	Windows®	98	Netscape Navigator	7.1 (J)	○	×	
					7.2 (E)	○	×	
			NT/2000/XP	Netscape Navigator	7.1 (J)	○	×	
					7.2 (E)	○	×	
			2003 (IA32/IA64)	Netscape Navigator	7.1 (J)	○	×	
					7.2 (E)	○	×	

O: Supported

X: Not Supported

Note: Service Pack 1 is included.

Notes on the Supported Browser:

For Windows® 2003, the strict security level is set by default; therefore, the Web function is disabled. Change the security setting to enable the browser by following these steps:

1. In the browser (Internet Explorer), click the **Tools** menu, and then click **Internet Options**.
2. Click the **Security** tab, and then click **Custom Level**.
3. Specify **Medium** or **lower** for **Custom Setting Reset**, then click **Reset**.

Specifying a **Medium** setting solves the problem. However, if you want to use Windows® 2003 and leave the security level at **High**, make the following **Custom Level** settings:

- Enable **Active scripting** for **Scripting**.
 - Enable **Allow META REFRESH** for **Miscellaneous**.
 - Enable **File download** for **Downloads**.
 - Enable **Run ActiveX controls and plug-ins** for **ActiveX controls and plug-ins**.
- A new line may be started in a window depending on the setting of the browser. In this situation, make the character size smaller.

< Method of character size change >

For Internet Explorer:

Select a **Middle** or smaller size for the **Character Size** in the **Display**.

For Netscape Navigator:

Select the **Reduction of Font Size** in the **Display** and keep it selected until paragraphs are easily readable.

- An empty dialogue box may be displayed during operation in the **Maintenance** mode. In this situation, close the window by clicking on the “x” in the upper left corner of the dialogue box. Restart the browser, then retry from the entry of the URL.
 - When a window size is changed while a page displays by Netscape, the succeeding operation in **Refresh** mode may not be completed normally. In this situation, display the page again by clicking **Re-Display**.
 - When using Netscape:
 - Memory cache: 1024 k bytes (default) or larger
 - Disk cache: 7680 k bytes (default) or larger
- < Method of cache size setting >
- Select the **Edition**, **Setting**, **Details**, and **Cache** in this order.
- Specify sizes of the memory cache and disk cache.
- When obtaining trace information etc. with Netscape, a sub-screen which specifies the file download destination may not automatically close. In this situation, press **Close** on the upper right corner of the sub-screen when the download is complete.

- When using Netscape navigator 7.x, select Edit | Preference... | Advanced-HTTP Networking, and set Use HTTP 1.0 in the Direct Connection Options and Proxy Connection Options. When this setting is omitted, the summary window is not displayed correctly.

8.2.2 Network Functions Characteristics when Connecting with Web

This section discusses the following network function characteristics when connecting with the web:

- **LAN Interface**

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

- **Network Parameter**

The AMS1000 has the following network parameters; they can be set or changed by the Web browser or Storage Navigator Modular, concerning only port 1 (for user management) of each controller.

Table 8.3 Network Parameters

Network parameter	Description	Factory Setting Value (see <i>Note 1</i>)	
		Controller 0	Controller 1
		For User-managed Port	For User-managed Port
IP Address	The IP Address is changed/set up.	192.168.0.16 (see <i>Note 1</i>)	192.168.0.17 (see <i>Note 1</i>)
Subnet Mask	The Subnet Mask is changed/set up.	255.255.255.0 (see <i>Note 3</i>)	255.255.255.0 (see <i>Note 3</i>)
Default Gateway	The Default Gateway is changed/set up.	0.0.0.0	0.0.0.0
DHCP (see <i>Note 2</i>)	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 Storage Navigator Modular or the Web cannot be used via a LAN.)

Note 3: In this case, you can acquire the IP Address by starting up the DHCP server or by setting the DHCP function correctly when necessary.

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.

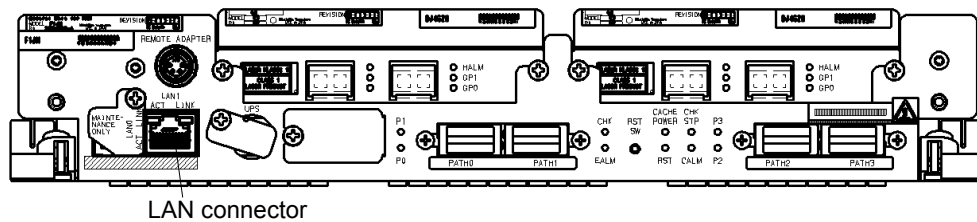


Figure 8-1 LAN Connector Location

Input the address of the web browser. Input the IP Address of the controller connected with the network.

In a dual system, the status of the devices (both controllers) can be monitored from one controller.

8.3.2 Screen Outlines

If the Normal Mode function displays and clicked in the menu screen, the chosen function can be executed. Figure 8-2 displays the main screen outline of Normal Mode.

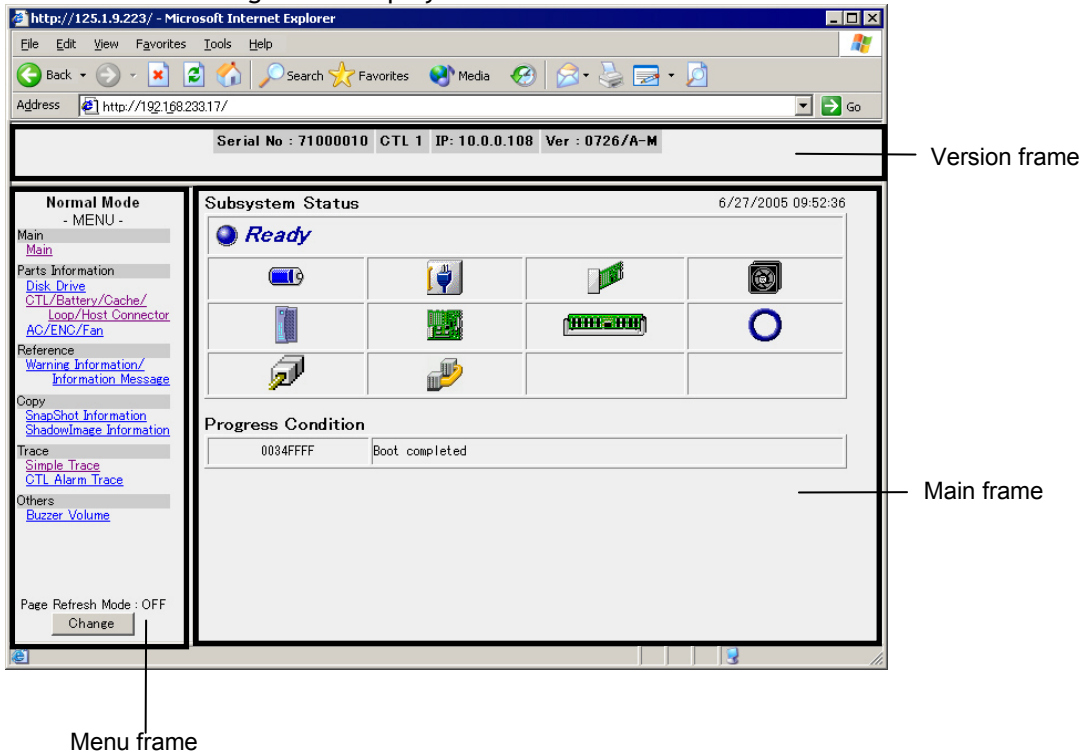


Figure 8-2 Main Screen Outline

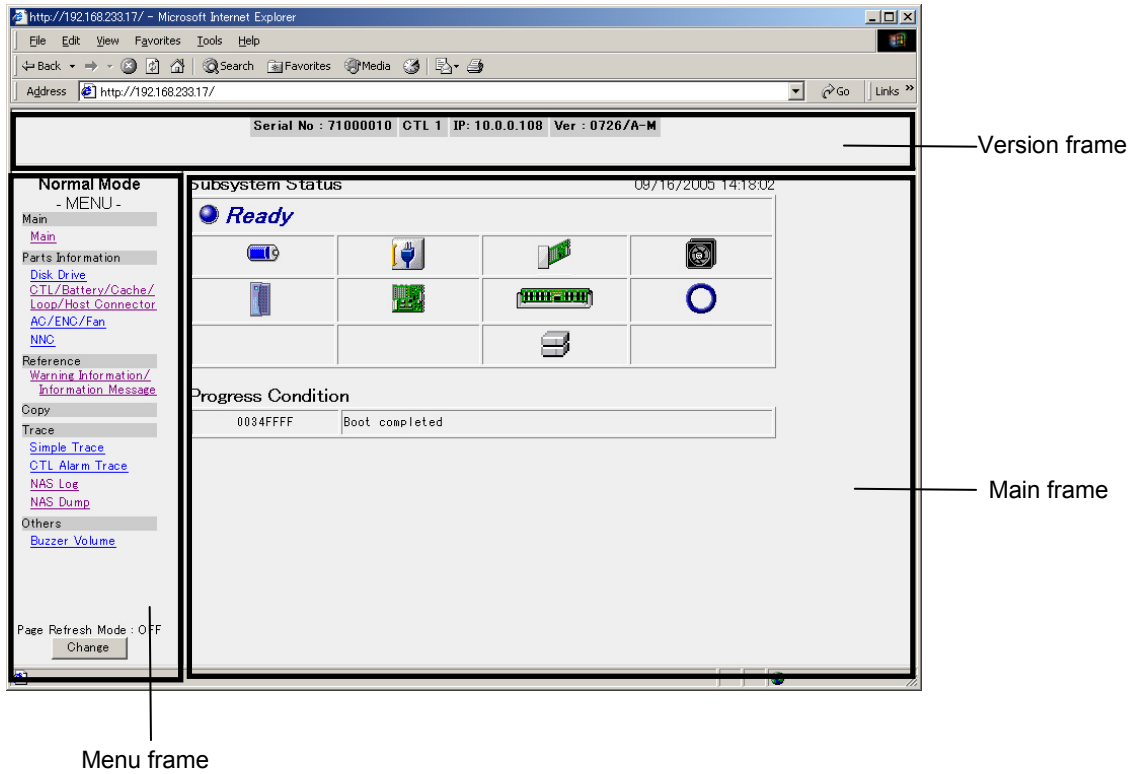


Figure 8-3 Main Screen Outline (NAS)

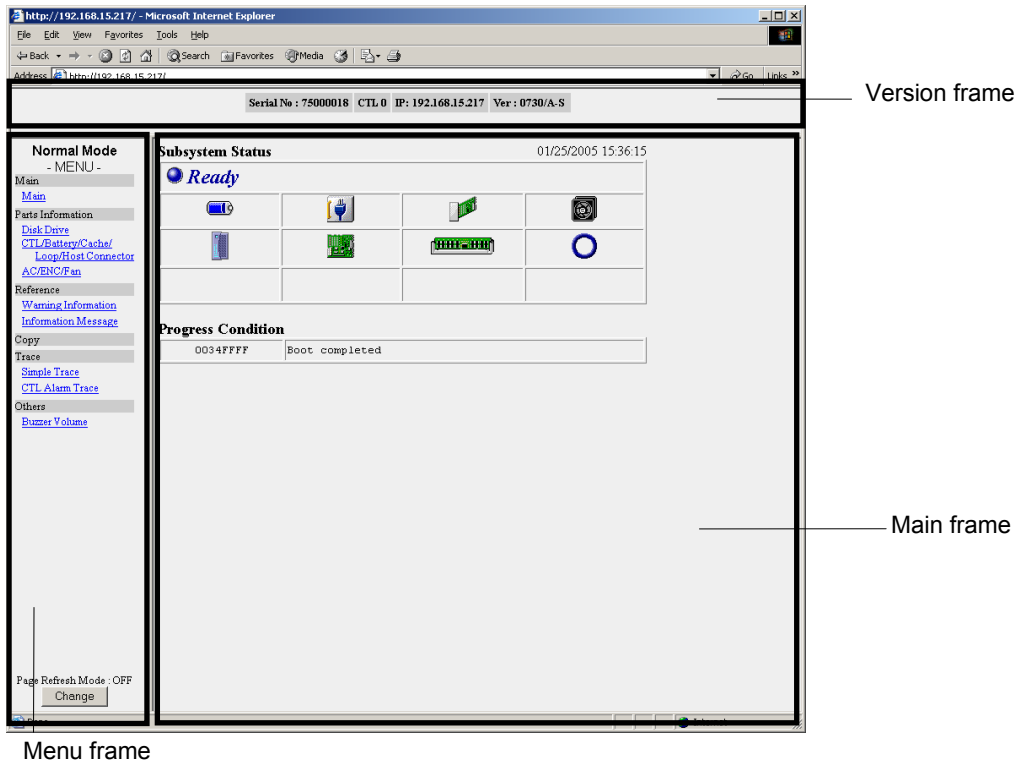


Figure 8-4 Main Screen Outline (iSCSI)

This section includes the following:

- Menu Frame
- Main Frame
- Version Frame

8.3.2.1 Menu Frame

If the Normal Mode displays with the menu frame, then clicked, the proper function is executed.

The main frame displays the following information:

- **Main**
Main: The main screen of Normal Mode displays.
- **Parts Information**
Disk Drive: The status of disk drives displays.
CTL/Battery/Cache/Loop/Host Connector: The status of controllers, cache, loop, and host connector displays.
AC/ENC/Fan: The status of the power supply unit, ENC/SENC unit, and fan assembly displays.
- **Reference**
Warning Information: Fault information that was detected during device information status displays.
Information Message: Fault information detected during device operation and device information status are displayed.
- **Trace**
Simple Trace: A window for collecting the Simple trace displays.
CTL Alarm Trace: A window for collecting the CTL Alarm trace displays.
- **Others**
Buzzer Volume: The screen where Buzzer Volume is set up displays.
- **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) displays at the top right.

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 Mainframe

The mainframe 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 displays.

8.3.2.3 Version Frame

The version frame displays the following information:

- **Web title:** The Web title set by a user displays. When it is not set, nothing displays.
- **Serial No:** The subsystem serial number displays.
- **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

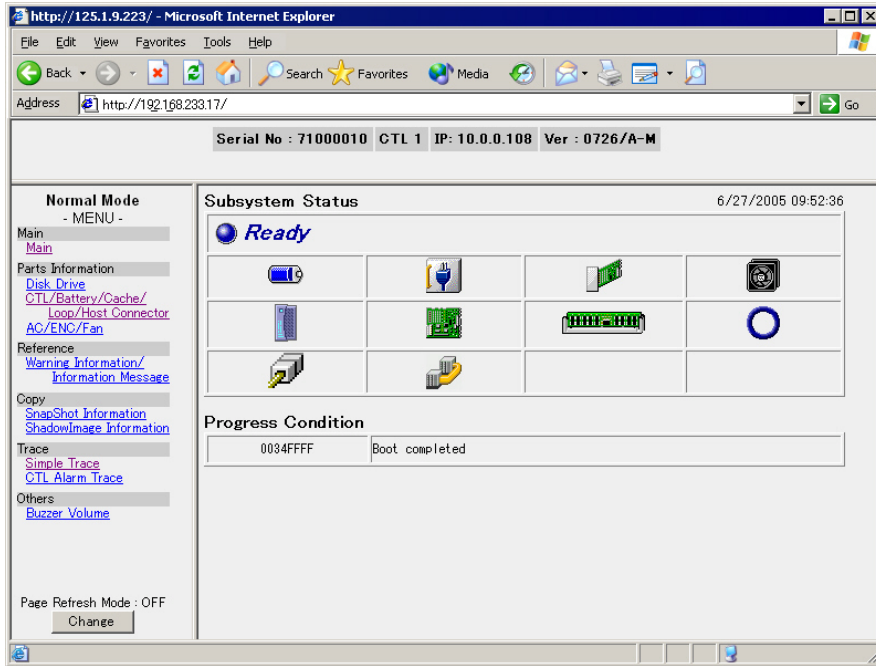


Figure 8-5 Subsystem Condition Display

8.3.3.1 Patrol Lamp

While monitoring the device, the status displays.




Image	Status
<i>Booting...</i>	During the start
 Ready blue	Normal
 Warning yellow	Warning status
 Alarm red	Alarm status

Figure 8-6 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 displays by clicking the part icon.



























Parts		Image		Notes
		Normal	Abnormal	
Power Unit		 blue	 red	—
Disk Drive	FC	 blue	 red	—
	S-ATA	 blue	 red	—
Cache Unit		 green	 red	—
Fan Assembly		 black	 red	—
Backup Battery Unit		 blue	 red	—
Control Unit		 green	 red	—
ENC Unit		 green	 red	—
SENC Unit		 green	 red	—
Fibre Loop at the drive side		 blue	 red	—
Remote Path		 orange	 red	When displayed in the TrueCopy Synchronous Remote Replication/ TrueCopy Extended Distance function is effective (see Note).
Host Connector		 gray	 red	Displayed only in the Fibre configuration
NNC		 gray	 red	Displayed only in the NAS configuration

Figure 8-7 Exchange Parts Status Display

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

8.3.3.3 Progress Condition Display

The progress condition, as the device is booting, displays 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) displays at the top right.

8.3.4 Replaceable Components Status Display

The status display screen of replaceable components displays the status of the Disk Drive, Control Unit, Cache Unit, and Fiber Channel Loop at the drive side, 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 displays.

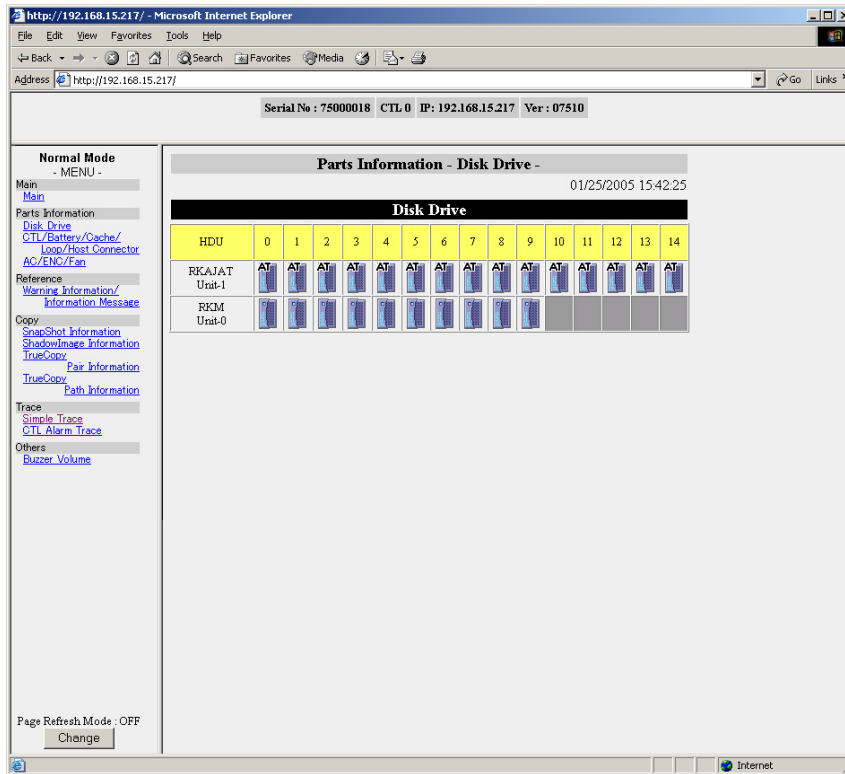


Figure 8-8 Component Status Screen (Disk Drive)

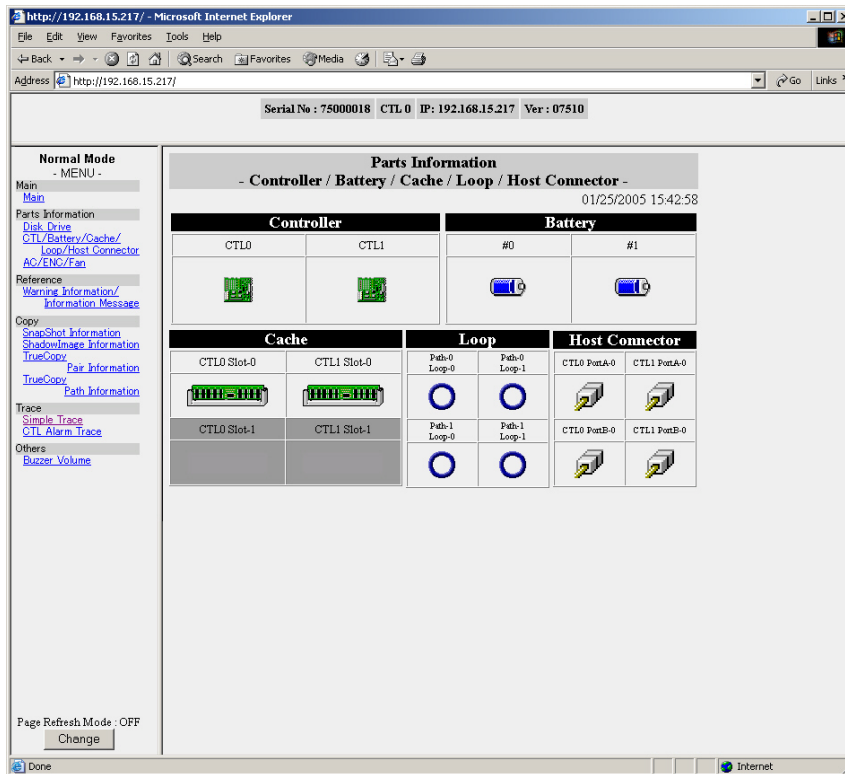


Figure 8-9 Component Status Screen (Controller/Battery/Cache/Loop/Host Computer)

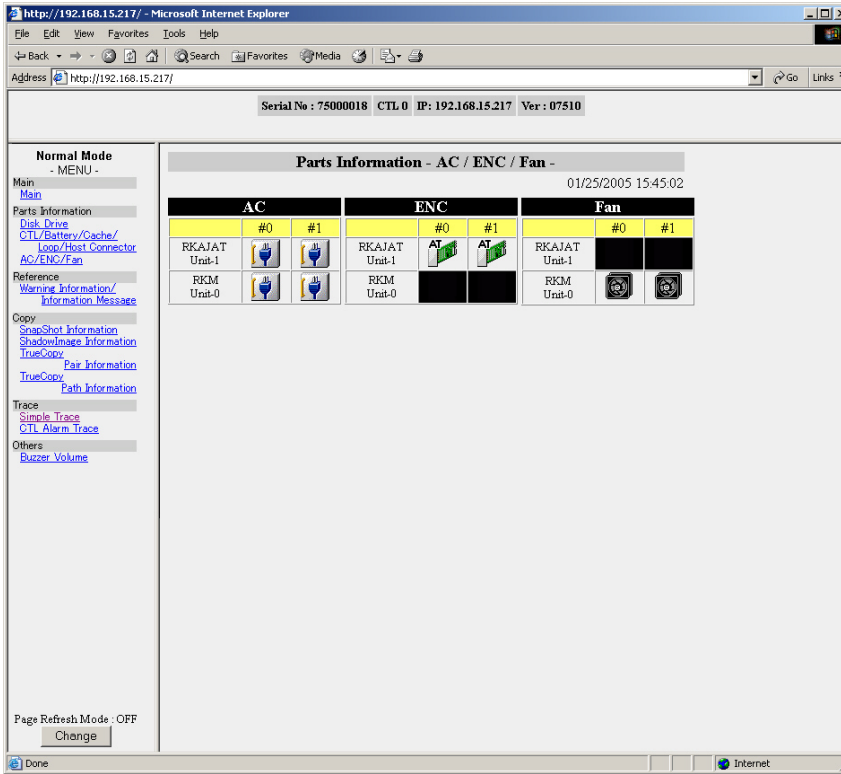


Figure 8-10 Component Status Screen (AC/ENC/FAN)

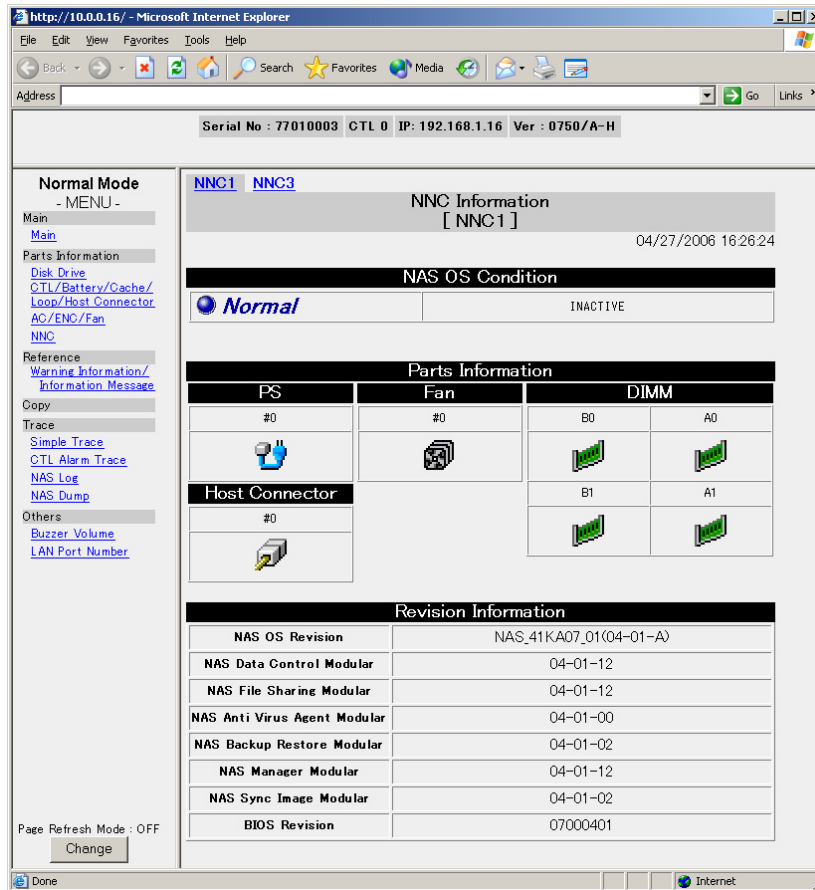








Figure 8-11 NNC Information Screen




Disk Drive (FC)

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).



Disk Drive(S-ATA)

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.



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.



SENC Unit

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

Fibre Loop




Image	Status
 blue	Normal
 red	Fault

Host Connector

Image	Status
 gray	Normal
 red	Fault

Patrol Lamp

Monitoring the device, the status displays.



Image	Status
 <i>Ready</i> blue	Normal
 <i>Warning</i> yellow	Warning status
 <i>Alarm</i> red	Alarm status

NAS OS Condition



The NAS OS Condition displays.

Display	Status
NEW	NAS OS has not been installed.
INST	NAS OS is being installed.
ACTIVE	NAS OS is in operation, and node is in operation.
STOP	NAS OS stops normally.
DOWN	NAS OS stops abnormally.
BOOT	NAS OS is in boot processing.
SHUTDOWN	NAS OS is in stop processing.
INACTIVE	NAS OS is in operation, and node stops.
DUMP	NAS Dump is being collected.
HUNGUP	Hung-up status.
WARN	NAS Manager has not been installed, or NAS OS is in operation and node status is unknown.
DISUSE	Control unit is blocked because the NAS OS of the appropriate NNC (NAS unit) cannot be used.



NNC (NAS Unit) PS

Image	Status
 blue	Normal
 red	Fault



NNC (NAS Unit) DIMM

Image	Status
 green	Normal
 red	Fault

NNC (NAS Unit) FAN

Image	Status
 black	Normal
 red	Fault

NNC (NAS Unit) Host Connector

Image	Status
 white	Normal
 red	Fault

Revision Information

NAS OS Revision: Indicates the NAS OS revision.

BIOS Revision: Indicates BIOS Revision.

For the NAS OS not installed (NEW), during installation (INST), in boot processing (BOOT), NAS OS installation failure, the screen shown in Figure 8-12 displays.

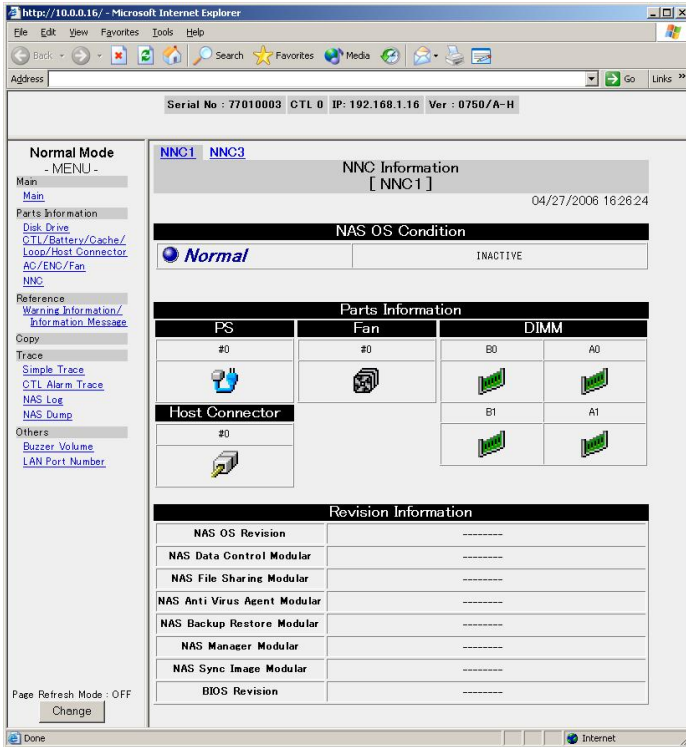


Figure 8-12 Revision Information Screen

To check the parts status by message, select “Warning Information” from the menu frame in the main screen (see Figure 8-13).

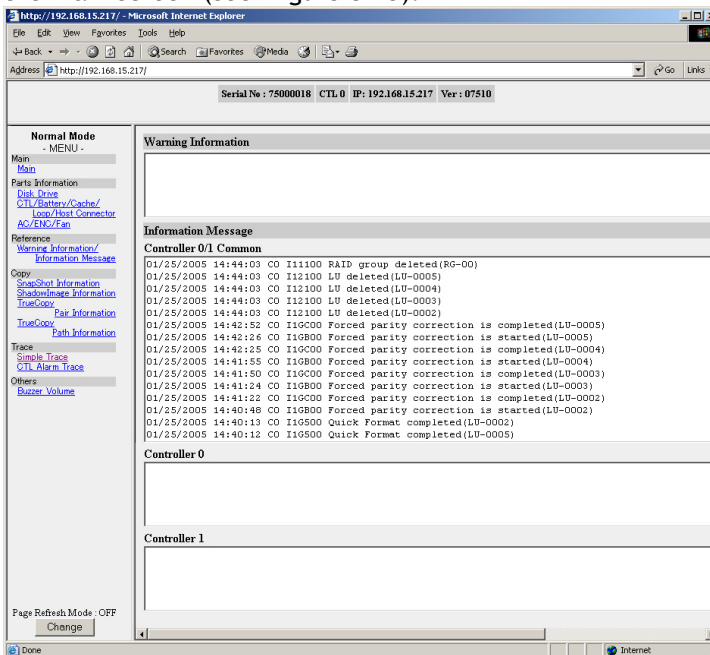


Figure 8-13 Warning Information Screen

8.3.5 Information Message

Fault information, and status information of the device that detected it during the device operation, are displayed as shown in Figure 8-14.

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 controller.

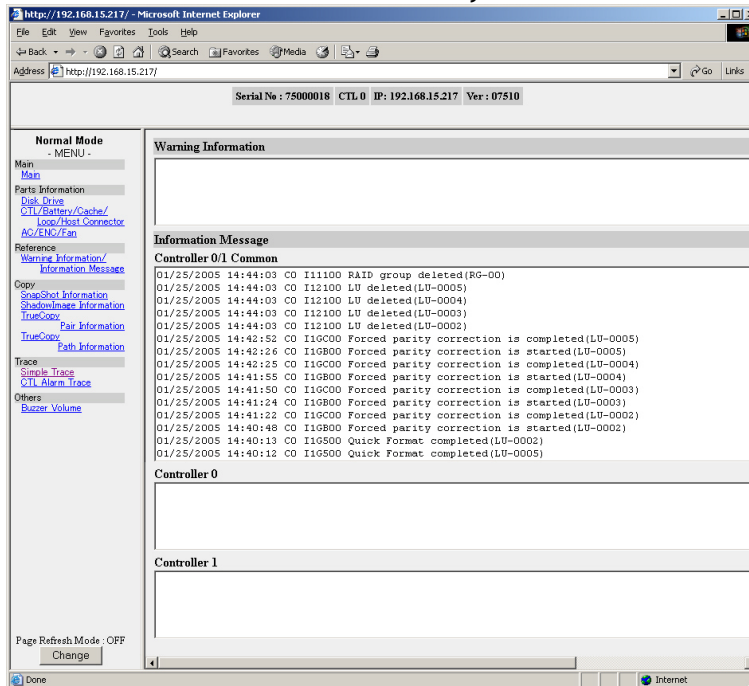


Figure 8-14 Information Message Screen

8.3.6 Setting 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 (see Figure 8-15). Click **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 **OK** is clicked, the buzzer volume is changed.

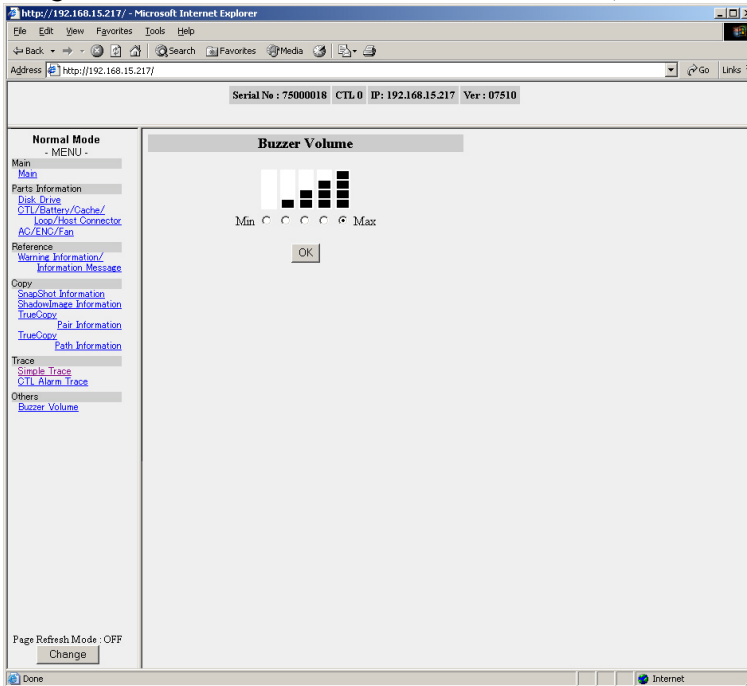


Figure 8-15 Buzzer Volume Screen

8.3.7 Clear Specified Factors of NNC Partial Alarm

The Warning status of the control unit may not be released when the WARNING LEDs on the array subsystem and the NAS unit are lighting up even though the recovery works for some specific NNC partial alarms.

Release the Warning status of the control unit and turn off each WARNING LED according to the following procedures. The “Clear specified factors of NNC partial alarm” can be executed only to the NNC (NAS unit) connected to the control unit.

1. Before operating “Clear specified factors of NNC partial alarm”.
2. Click the List of clearable factors.

Serial No : 77010003 CTL 0 IP: 192.168.1.16 Ver : 0750/A-H

[Normal Mode](#)
- MENU -

Main
[Main](#)

Parts Information
[Disk Drive](#)
[CTL/Battery/Cache/Loon/Host Connector](#)
[AC/ENG/Fan](#)
[NNC](#)

Reference
[Warning Information/Information Message](#)

Copy

Trace
[Simple Trace](#)
[CTL Alarm Trace](#)
[NAS Log](#)
[NAS Dump](#)

Others
[Buzzer Volume](#)
[LAN Port Number](#)


[NNC1](#) [NNC3](#)

NNC Information








[NNC-1]

04/27/2006 16:26:24

NAS OS Condition

 **Warning** WARN

Parts Information

PS	Fan	DIMM	
#0	#0	B0	A0
			
Host Connector		B1	A1
#0			
			

Revision Information

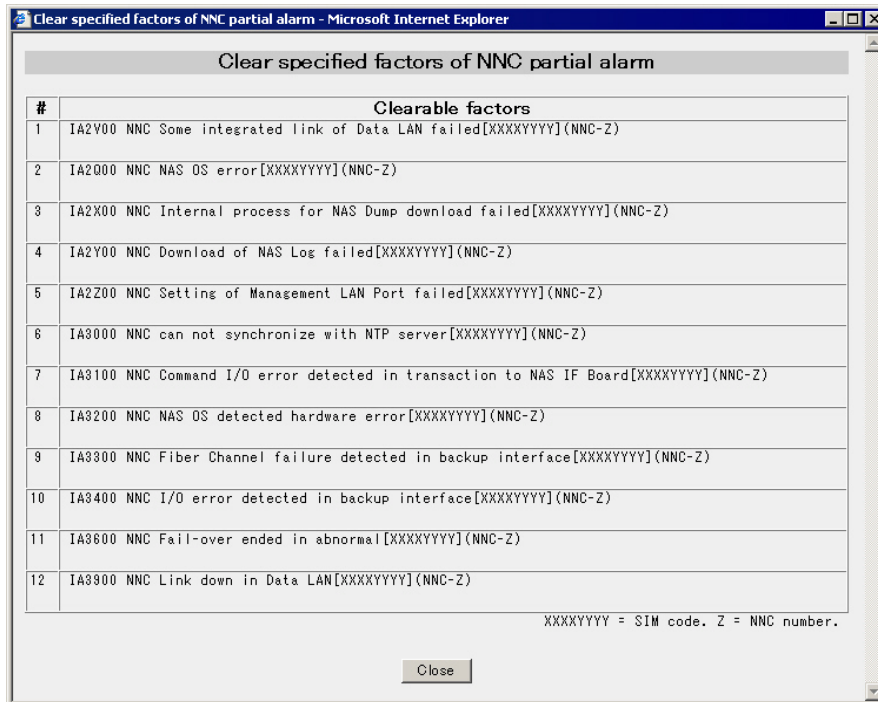
NAS OS Revision	NAS_41KA07_01(04-01-A)
NAS Data Control Modular	04-01-12
NAS File Sharing Modular	04-01-12
NAS Anti Virus Agent Modular	04-01-00
NAS Backup Restore Modular	04-01-02
NAS Manager Modular	04-01-12
NAS Sync Image Modular	04-01-02
BIOS Revision	07000401

Clear specified factors of NNC partial alarm

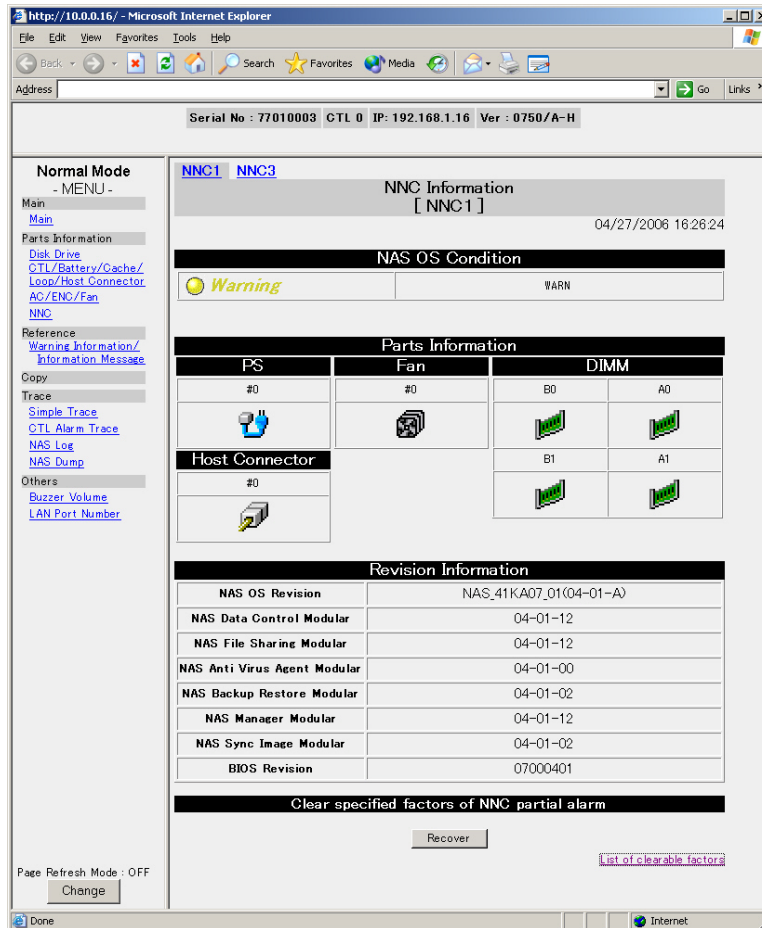
[List of clearable factors](#)

Page Refresh Mode : OFF

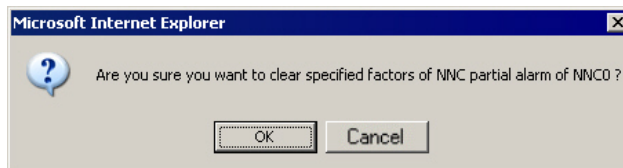
3. Verify that either of the lists where the failure factors are displayed.



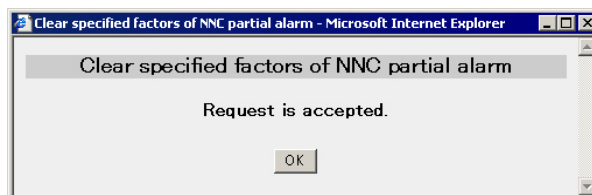
4. Clear specified factors of NNC partial alarm.
5. Click **Recovery**.



- A message displays asking you to verify the setting displays. Click **OK**.

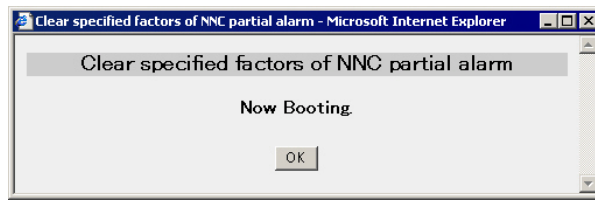


- Check the NNC partial alarm recovery. When the “Clear specified factors of NNC partial alarm” is completed normally.



- Click **OK**.
- Click **Warning Information** on the menu window, and check that the indication of the partial alarm is turned off.

10. If the array subsystem was booting at the time of clicking **Recovery**, click **OK**. Execute this again after the array subsystem is in the **READY** status.



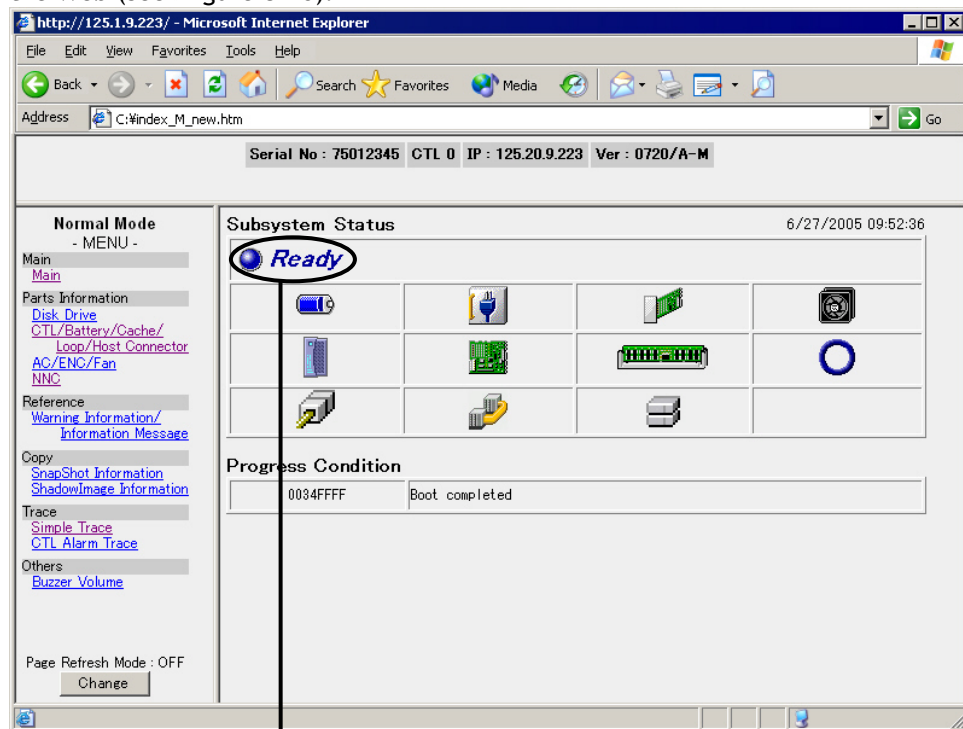
8.4 Troubleshooting using a Web Connection

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 (see Figure 8-16).



Subsystem Status

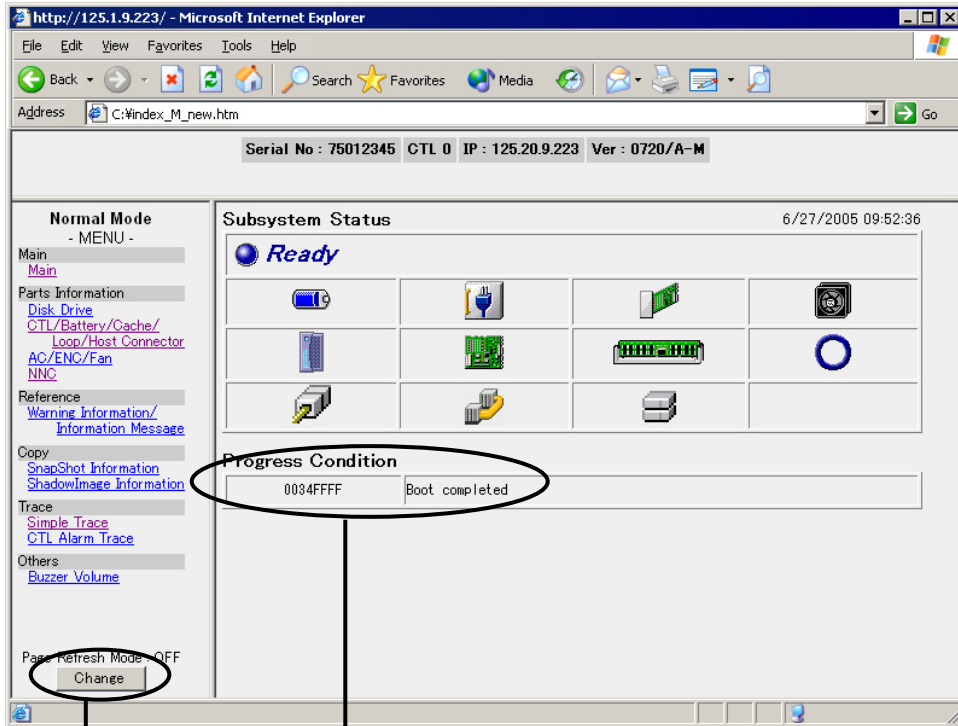
Booting	Ready	Warning	Alarm
<i>Booting...</i> black	<i>Ready</i> blue	<i>Warning</i> yellow	<i>Alarm</i> red

Figure 8-16 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 **ON**).
The window is updated automatically at 5-second intervals. (If **OFF** on the refresh mode is activated, this operation is not necessary.)
If the page refresh mode is not activated in the main window, press **update**.
2. Observe the condition-in-progress within the window (see Figure 8-17).
If the start-up operation is completed, **Boot completed** is indicated in this part.



Progress Condition display

Page Refresh Mode

Figure 8-17 Progress Condition Display

8.4.3 Checking Component Status

Click each part of Replace Part Summary in the main window; the following window displays and the state of the part displays (see Figure 8-18).

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.

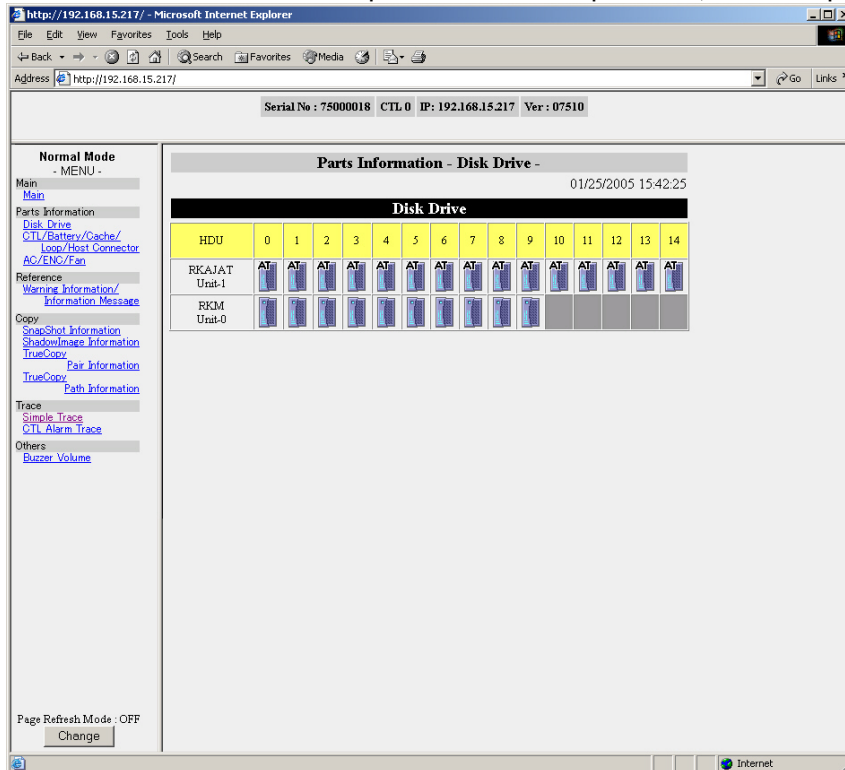


Figure 8-18 Replace Part Summary Screen (HDD)

The screen shown in Figure 8-19 displays only when the remote path icon of is clicked. This screen displays only when the TrueCopy Synchronous Remote Replication/TrueCopy Extended Distance function is effective.

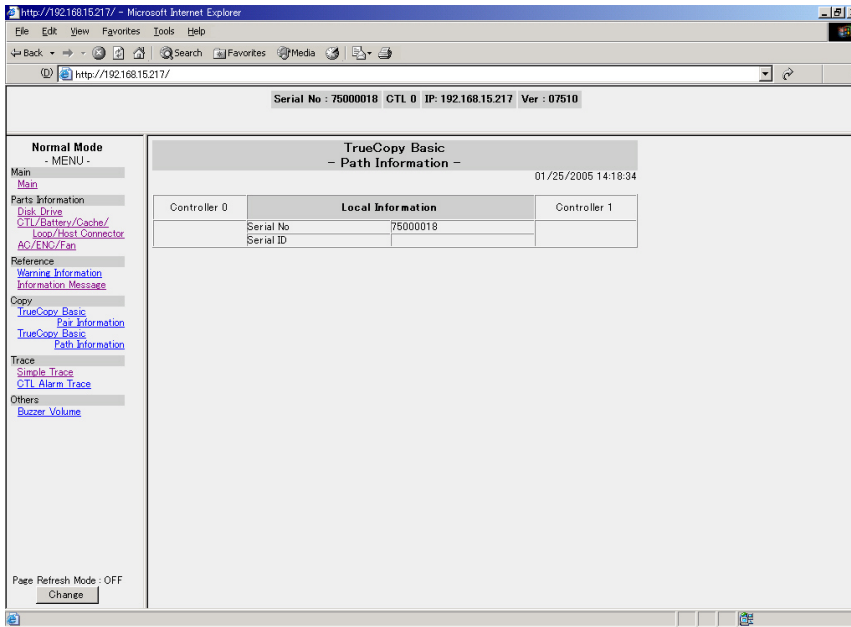


Figure 8-19 Path Information Screen

The screen shown in Figure 8-20 only displays when used in the NAS unit.

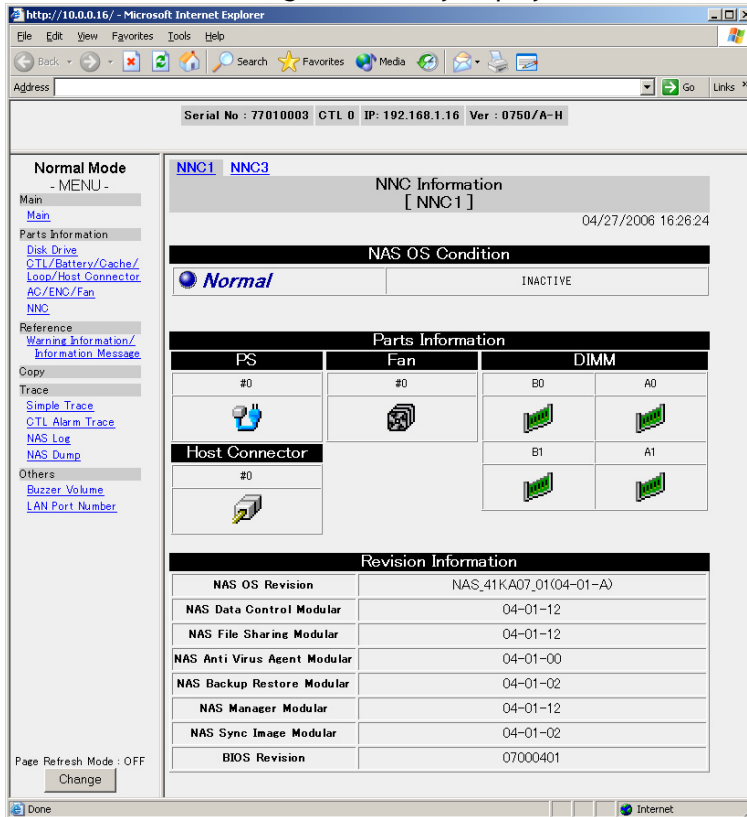


Figure 8-20 NNC Information Screen

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)
 Y Y M M D D : Date of occurrence
 H H M M S S : Time of occurrence
 ————— : Reservation area

CTLx: CUDG executing controller #

■ **Flash/RAM Micro Detection Message**

The Flash/RAM micro detection message displays 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 displays 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/YYYY HH:MM:SS Cx ●●●●●● ○○○○○○○○○○○ : ■■■■■■/◆◆◆◆
MM/DD/YYYY HH:MM:SS Cx ●●●●●● ○○○○○○○○○○○ : ■■■■■■/◆◆◆◆
:
:
```

MM/DD/YYYY: Confirmed data
 HH:MM:SS: Confirmed times
 Cx: Error detected Controller #
 ●●●●●●: Message code (Rxxxxx: Flash detected messages, lxxxxx: 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. For additional information about AMS1000 troubleshooting using messages, refer to section 3.4 AMS1000 Troubleshooting using Messages of *Hitachi TagmaStore® Adaptable Modular Storage (AMS) and Workgroup Modular Storage (WMS) Storage Navigator Modular Error Codes (MK-96DF788)*.

8.4.5.1 Errors Detected by CUDG

When the Errors detected by CUDG are displayed, call 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 8.4 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 8.5 Progress Messages (continues on the 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 (RAGE-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# (RKH=0-13, RKAJ=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.
IA100x	NNC power on (NNC-x)	NCC power supply was turned on. x: NNC # 0-3)
IA110x	NNC boot started (NNC-x)	NNC boot was started. x: NNC # 0-3)
IA120x	NNC is ready (NNC-x)	NNC is ready. x NNC # 0-3)
IA130x	NNC shutdown started (NNC-x)	NNC shutdown was started. x NNC # 0-3)
IA140x	NNC shutdown completed (NNC-x)	NNC shutdown was completed. x NNC # 0-3)
IA150x	NNC power off (NNC-x)	NNC power supply was turned off. x NNC # 0-3)
IA1P0x	NNC NAS OS installation completed (CTL-x, NNC-y)	NAS OS installation on the NNC. was completed x:Controller # 0-1) y NNC # 0-3)
IA1Q0x	NNC NAS OS installation started (CTL-x, NNC-y)	NAS OS installation on the NNC was started. x:Controller # 0-1) y NNC # 0-3)
IA1T0x	NNC NAS dump process started (NNC-x)	NNC Dump collection was started. x NNC # 0-3)
IA1U0x	NNC recovered from partial alarm (NNC-x)	NNC was recovered from a partial error. x NNC # 0-3)
IA1V0x	NNC recovered (NNC-x)	NNC was recovered from an error. x NNC # 0-3)
IA2R00	NNC PCI Express link recovered [x] (NNC-y)	The link of the NNC PCI Express was recovered. x Failed part code y NNC # 0-3)

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

Table 8.6 Progress Messages (continued)

Message Code	Message Text	Recovery Measures
IA2V00 (Note1)	NNC Some integrated link of Data LAN failed [xy] (NNC-z)	Identify failed part by checking the LED beside the data LAN port. Confirm if the LAN cable is firmly connected to the LAN port and if there is no failure in network switch. If there are some failures, get rid of them.
IA3000 (Note1)	NNC can not synchronize with NTP server [xy] (NNC-z)	Check the NTP server settings and network configuration, and then change them if necessary.
IA3300 (Note1)	NNC Fibre Channel failure detected in backup interface [xy] (NNC-z)	Check if the backup device is firmly connected to the NNC (NAS Unit) displayed in this message. If the backup device is not connected firmly, reconnect it firmly.
IA3400 (Note1)	NNC I/O error detected in backup interface [xy] (NNC-z)	
IA3900 (Note1)	NNC Link down in Data LAN [xy] (NNC-z)	Identify failed part by checking the LED beside the data LAN port. Confirm if the LAN cable is firmly connected to the LAN port and if there is no failure in network switch. If there are some failures, get rid of them.

Note1: After resolving the failure, execute it according to 8.3.7.

Note 2: When a Progress message other than those shown above is displayed, inform the Customer Engineer 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 8.6 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 the Customer Engineer 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 8.7 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 the Customer Engineer 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 8.8 How to Read Failure Information

No.	Description	Failure detected messages		Failure recovery messages	
1	Controller error/recovery	W00100	CTL alarm (CTL-x)	I0010x	CTL recovered (CTL-x)
2	Battery error/recovery	W0300x	Battery alarm	I00300	Battery recovered
		W0310x	Battery removed	I0030x	Battery recovered (Battery-x)
		W0320x	Battery SW off		
		W0330x	Battery Thermal alarm		
3	Battery backup circuit error/ recovery	W0340x	Battery backup circuit alarm (CTL-x)	I0040x	Battery backup circuit recovered (CTL-x)
4	Fan error/recovery	W040xy W042HH	FAN alarm (Unit-x, FAN-y)	I005xy 1005HH	FAN recovered (Unit-xx, FAN-y)
		W04100	FAN alarm (CTL-Unit, FAN-x)	I00500	FAN recovered (CTL-Unit, FAN-x)
5	Power supply error/recovery	W050xy W052HH	PS alarm (Unit-x, PS-y)	I006xy I006HH	PS recovered (Unit-x, PS-y)
		W0G400	PS alarm [RKA] (Unit-x, PS-y)		
		W0G500	PS alarm [RKAAT] (Unit-x, PS-y)		
		W0G600	PS alarm [RKAJ] (Unit-x, PS-y)		
		W0G700	PS alarm [RKAJAT] (Unit-x, PS-y)		
		W05100	PS alarm (CTL-Unit, PS-x)		
6	Disk Drive error/recovery	W060AT	SATA HDU alarm (Unit-x, HDU-y)	I007xy 1007HH	HDU recovered (Unit-x, HDU-y)
		W060xy W060HH	HDU alarm (Unit-x, HDU-y)		
		W0GG00	HDU alarm [RKA] (Unit-x, HDU-y)		
		W0GH00	HDU alarm [RKAJ] (Unit-x, HDU-y)		
7	Spare Disk error/recovery	W061AT	SATA Spare HDU alarm (Unit-x, HDU-y)	I009xy 1009HH	Spare HDU recovered (Unit-x, HDU-y)
		W061xy W061HH	Spare HDU alarm (Unit-x, HDU-y)		
		W0GJ00	Spare HDU alarm [RKA] (Unit-x, HDU-y)		
		W0GK00	Spare HDU alarm [RKAJ] (Unit-x, HDU-y)		
8	Loop error/recovery	W080xy	Loop alarm (Path-x, Loop-y)	I00Axy	Loop recovered (Path-x, Loop-y)

No.	Description	Failure detected messages		Failure recovery messages	
9	ENC Unit error/SENC Unit error/recovery	W090AT	SENC alarm (Unit-x, ENC-y)	I00Bxy 100BHH	ENC recovered (Unit-x, ENC-y)
		W090xy W090HH	ENC alarm (Unit-x, ENC-y)		
		W0GA00	ENC alarm [RKA] (Unit-x, ENC-y)		
		W0GB00	SENC alarm [RKAAT] (Unit-x, ENC-y)		
		W0GC00	ENC alarm [RKAJ] (Unit-x, ENC-y)		
		W0GD00	SENC alarm [RKAJAT] (Unit-x, ENC-y)		
10	UPS	W0C000	UPS alarm (UPS-x)	I00D00	UPS recovered (UPS-x)
11	Path failure (detachment)/recovery	W0F0xy	Path alarm (Remote-x, Path-y)	I030xy	Path recovered by web operation (Remote-x, Path-y)
				I031xy	Path recovered automatically
12	Occurrence/rectification of an incomplete writing	W0G0xy	Unreadable PIN detected (Unit-x, HDU-y)	I04000	Unreadable PIN recovered
		W0G100	Unreadable PIN detected (Unit-*, HDU-*)		
13	Issue/callback of a resident LU off warning	W440xy	Permanent LU warning (CTL-x, ERR-y)	I1A2xy	Permanent LU warning recovered (CTL-x, ERR-y)
14	Excess/rectification of the threshold value of the number of pinned sub-segments	W49100	PIN is over directory threshold [write through] (DIR-x)	I6EG00	PIN over recovered [directory threshold] (DIR-x)
		W49300	PIN is over partition threshold [write through] (DIR-x, PTT-y)	I6EH00	PIN over recovered [partition threshold] (DIR-x, PTT-y)
		W49500	PIN is over RAID group threshold [write through] (DIR-x, RG-y)	I6EJ00	PIN over recovered [RAID group threshold] (DIR-x, RG-y)
15	The DM-LU failure/recovery	W49700	DM-LU write disable (LU-x)	I6EM00	DM-LU recovered (LU-x)
		W49800	All DM-LU write disabled		
16	The host connector failure/recovery	W0G300	Host connector alarm (Portxy-z)	I53A00	Host connector recovered (Portxy-z)
17	NNC (NAS Unit) failure and recovery	W5000x	NNC alarm (NNC-x)	IA1V0x	NNC recovered (NNC-x)
18	NNC (NAS Unit) partial failure and recovery	W5010x	NNC partial alarm (NNC-x)	IA1U0x	NNC recovered from partial alarm (NNC-x)

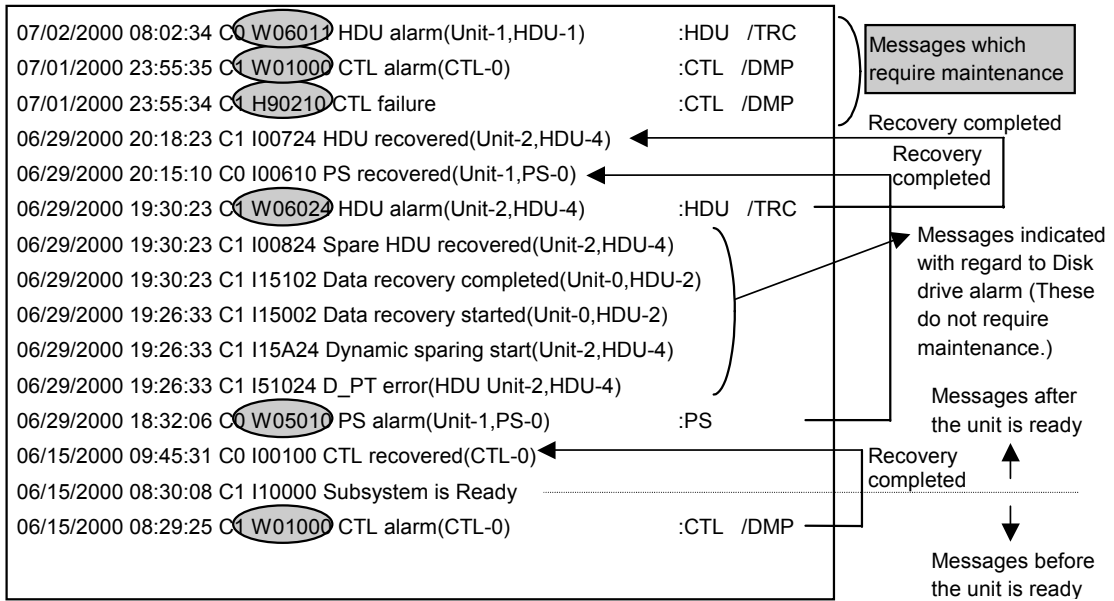
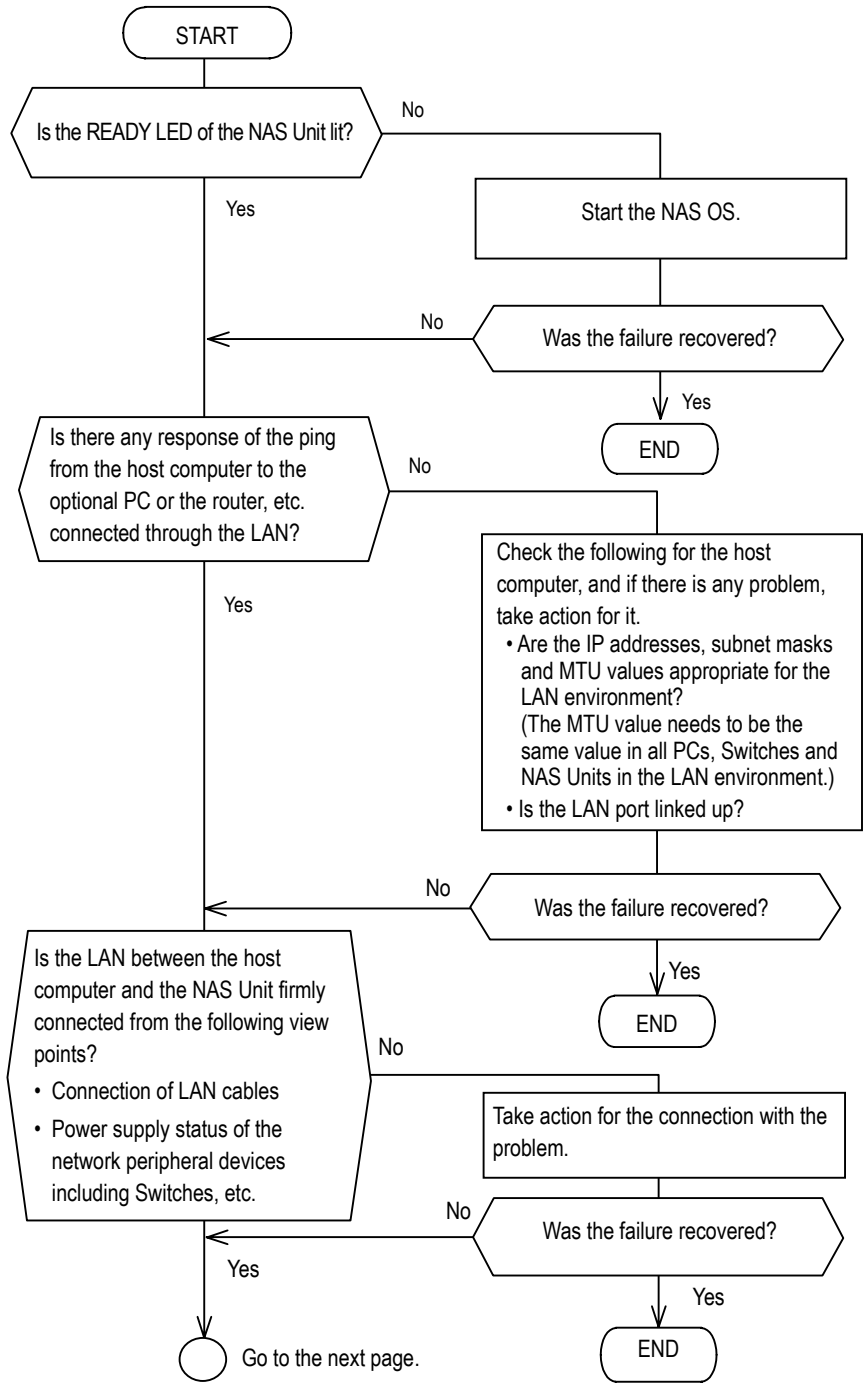
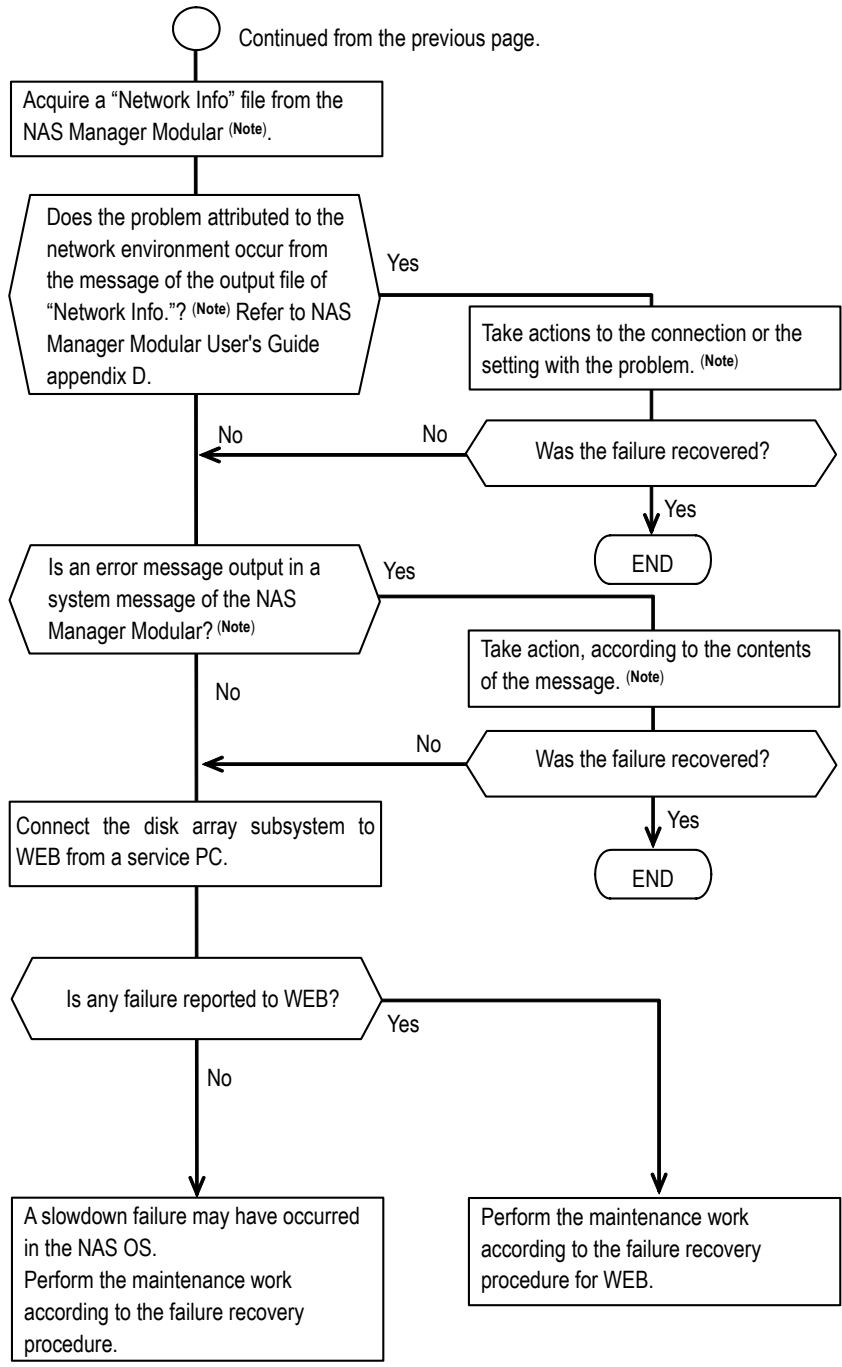


Figure 8-22 Message Analysis Example

8.5 Determining Network Side Failure in NAS System

When a failure occurs in the LAN environment between the host computer and the NAS Modular subsystem, or the NAS Modular subsystem, determine whether there is a failure in the NAS Modular subsystem according to the following flow.



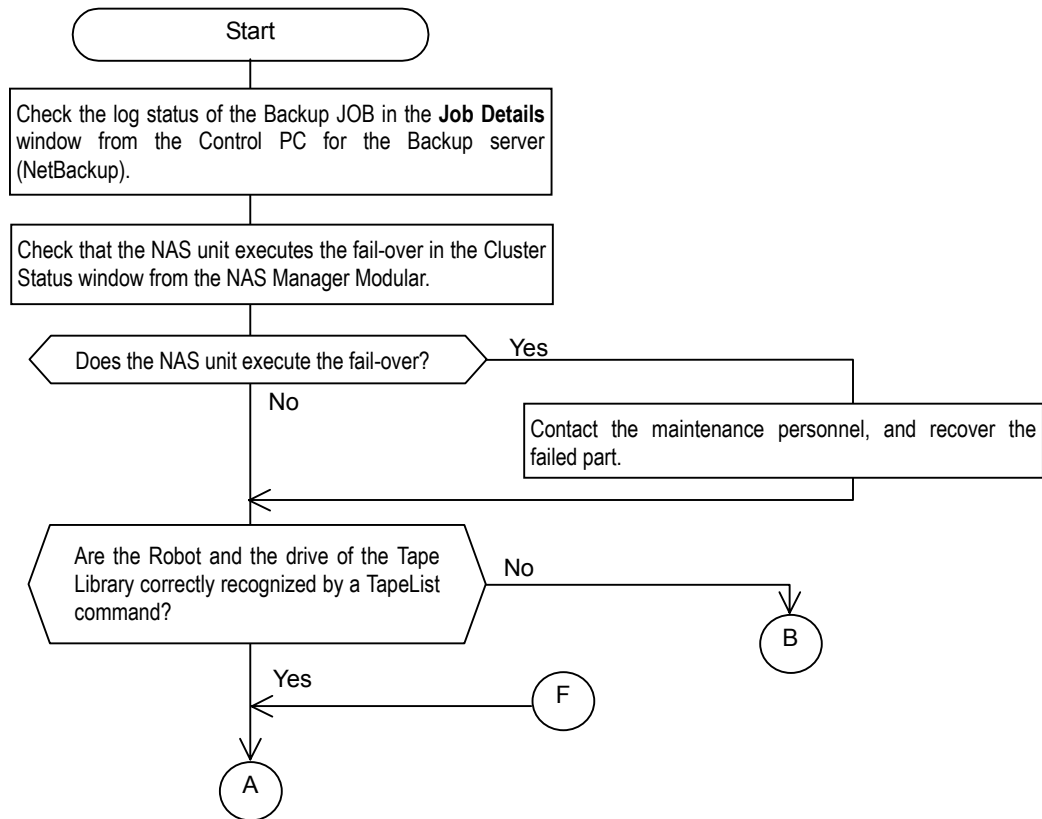
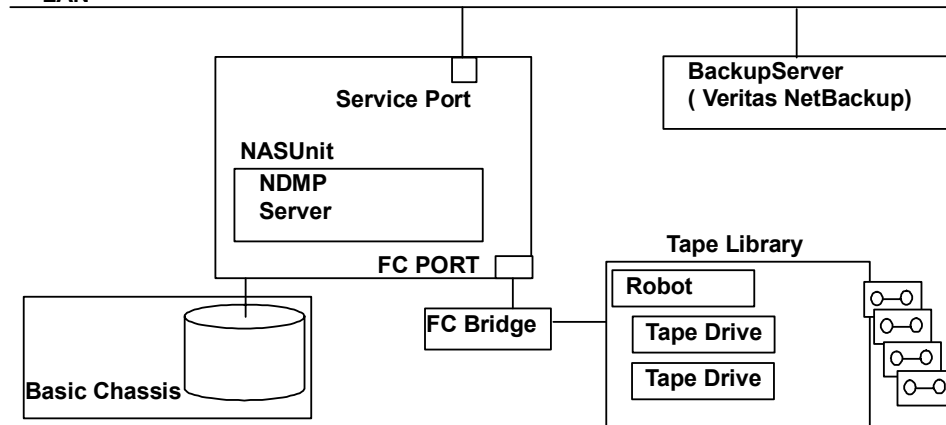


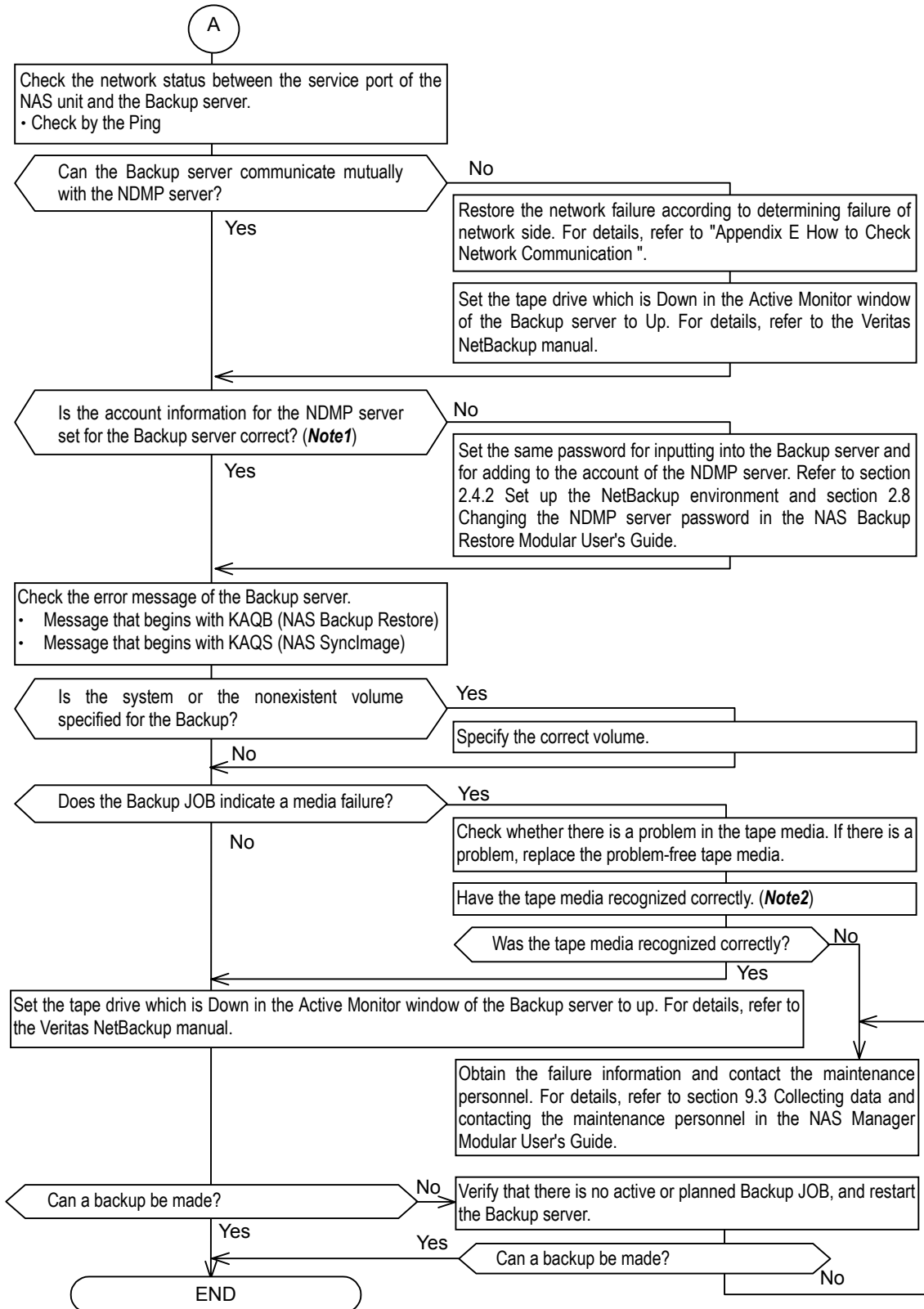
Note : Work to use NAS Manager Modular becomes charge of the system administrator. The system administrator must cooperate with the maintenance member.

8.6 Determining Failure of Local Tape in NAS System

Determine failures between the NAS unit and the local tape and between the NAS unit and the Backup server according to the following flow. Before determining failures, verify that the user setting is made correctly on the Backup server.

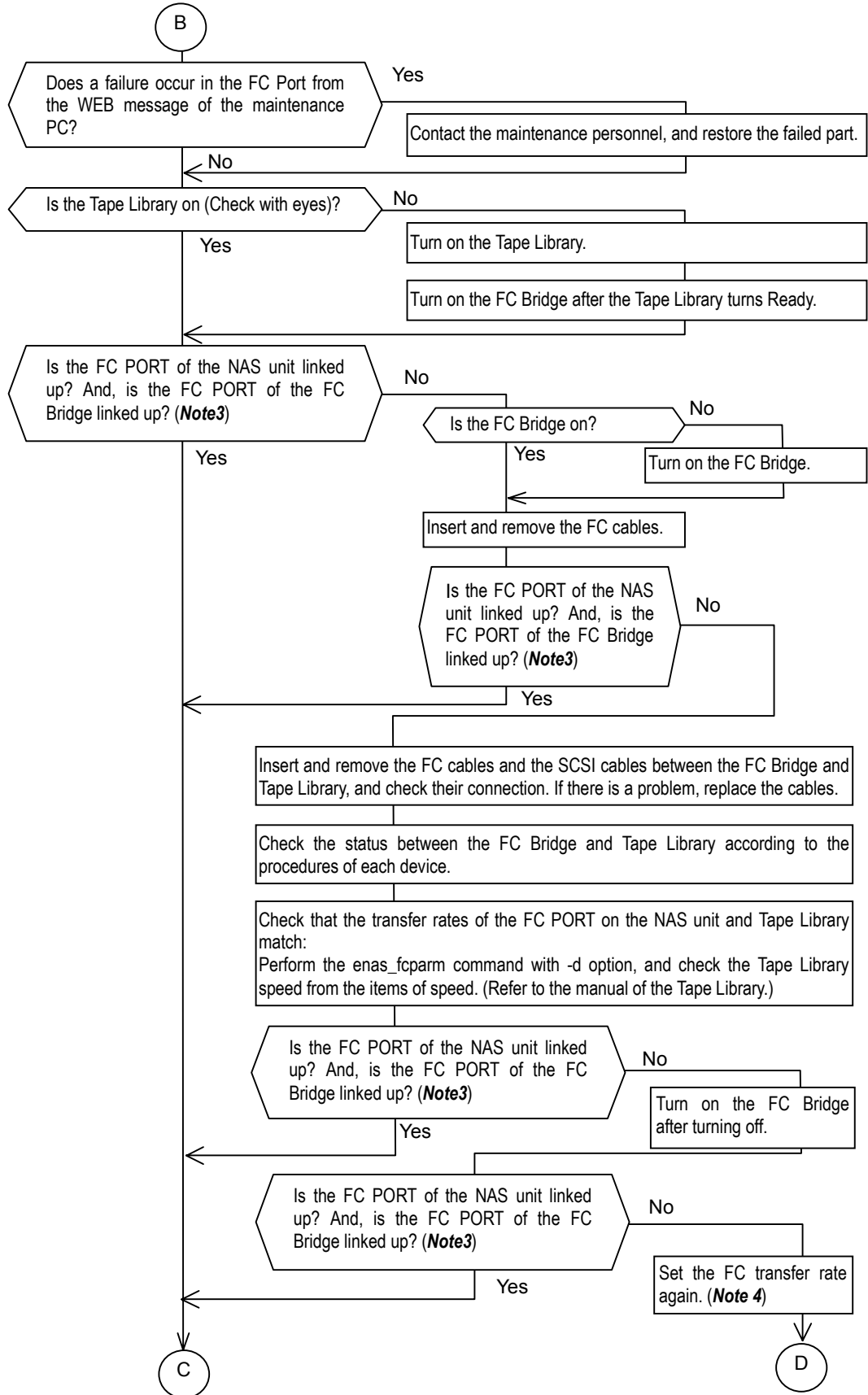
Figure 8-23 Configuration Diagram
LAN

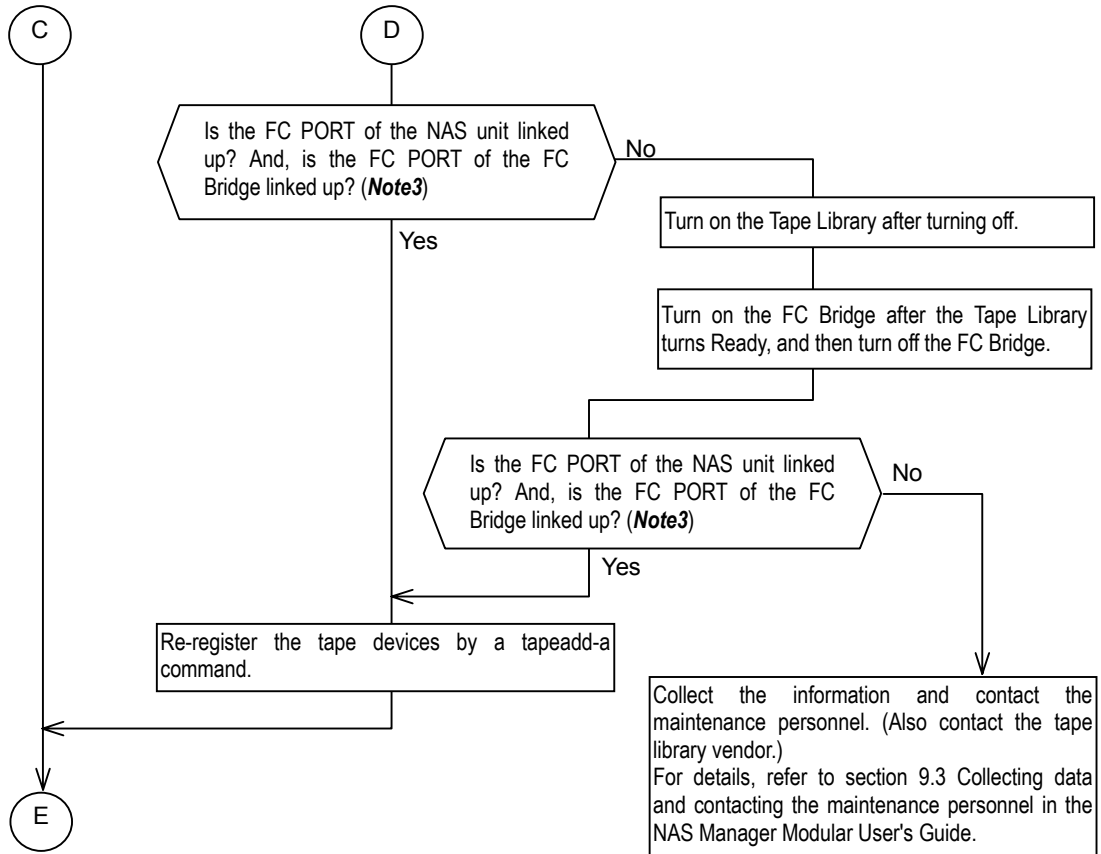




Note 1: In the CLI operation of the NetBackup, perform the `set_ndmp_attr-verify<NDMP server name>`. If "Login was successful" is displayed, the account information is correct.

Note 2: Select the **Update volume configuration** in the **Robot Inventory** registered in the Backup server (Veritas NetBackup) and click the **Start** button.



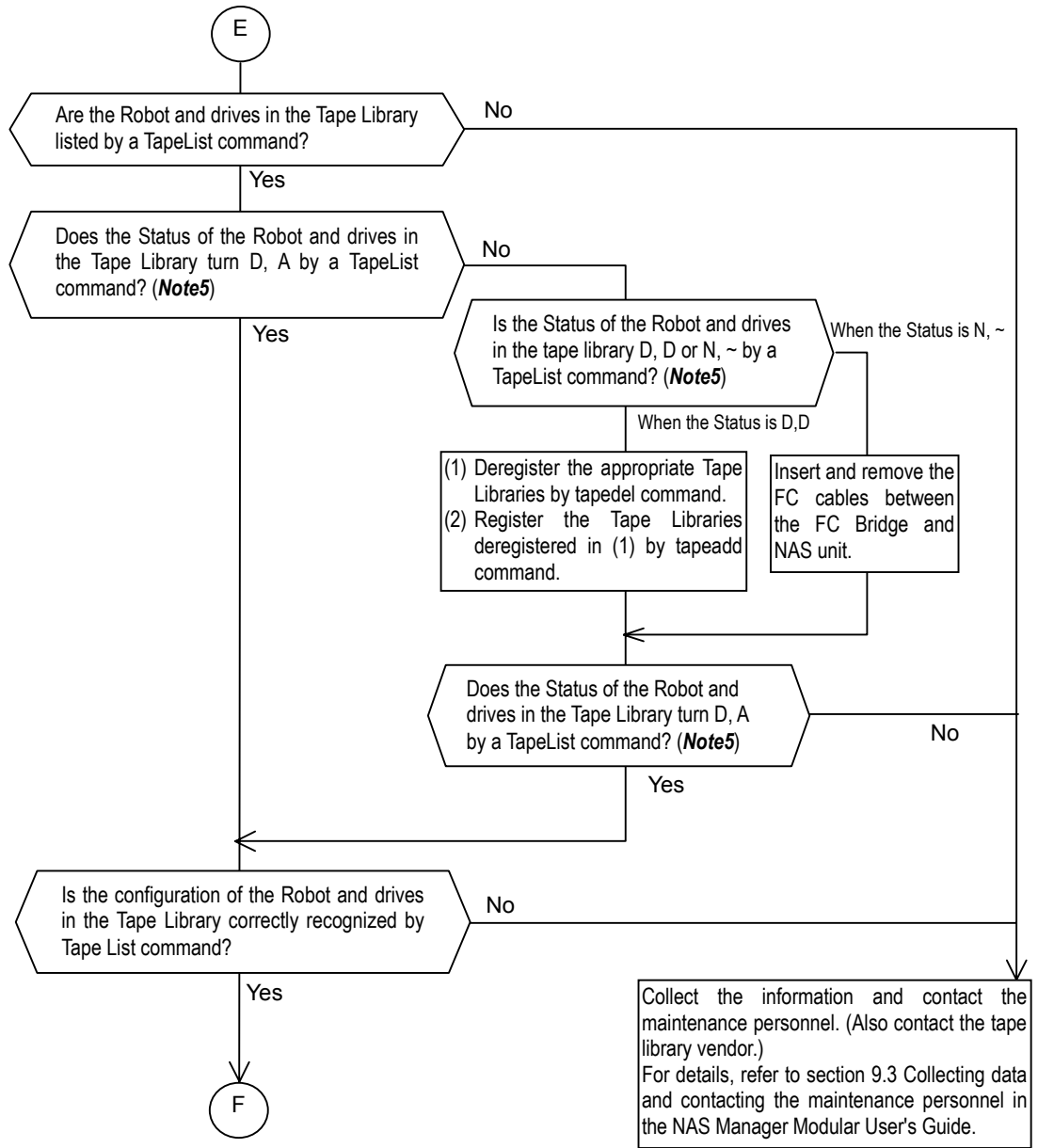


Note3: The conditions that the FC link is correct are the following (1) and (2).

- (1) The LED of the FC PORT on the FC bridge lights.
- (2) FC PORT is linked up by the following procedures (Refer to the NAS Manager Modular User's Guide).
 - (a) Display the List of RAS Information (List of Messages) by selecting the **RAS Management** from the **Main Menu**.
 - (b) Confirm the latest one with the following "Message ID":
 - KAQG35060-I: The connection to FC Port was linked up.
 - KAQG35061-W: The connection to FC Port was linked down.

Note4: Perform the entry into the NAS Manager Modular by ssh.

- (1) Delete all the tape drives registered by `tapedel` command.
- (2) Reset the FC PORT transfer rate to 2 Gb/s by `enas_fcparm -s 2` command, and restart the FC PORT.
- (3) Verify that the transfer rate was reflected by `enas_fcparm -d` command.



Note 5: Check the "Status" part in the following list.

It is correct that each device can be seen, and the status is D, A.

```

nasroot@D710001515:~$ sudo tapelist
Mar 23 11:58:56 KAQB11500-1 tapelist command execution has started.
Mar 23 11:58:56 KAQB12225-1 The list of tape device information will now be displayed.
LUN Model      Type      Status Path
-----
0 L40          Medium Changer D,A /dev/enas/100000e00202d78e/sg00
1 Ultrium 2-SCSI Sequential- Access D,A /dev/enas/100000e00202d78e/nst01
2 Ultrium 2-SCSI Sequential- Access D,A /dev/enas/100000e00202d78e/nst02
3 Ultrium 2-SCSI Sequential- Access D,A /dev/enas/100000e00202d78e/nst03
4 Ultrium 2-SCSI Sequential- Access D,A /dev/enas/100000e00202d78e/nst04
Mar 23 11:58:56 KAQB11501-1 tapelist command has finished.
nasroot@D710001515:~$
  
```

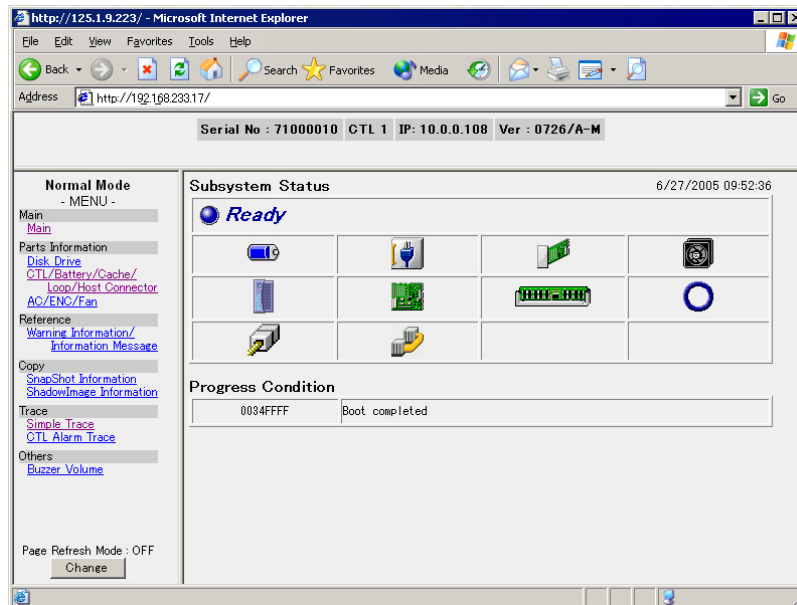
8.7 Connecting Failure in Connection with the Web

8.7.1 Collecting Simple Trace

This function is used to download current trace information. To perform the download, a free capacity of approximately 20 Mbytes is required in the PC.

Simple Trace of both the Control Units can be collected through one Control Unit. It is not necessary to collect from both the controllers. (When it is collected from Control Unit #0, File name is “smpL_trc0.dat”. When collected from Control Unit #1, file name is “smpL_trc1.dat.”)

1. Click **Simple Trace** in the menu frame.



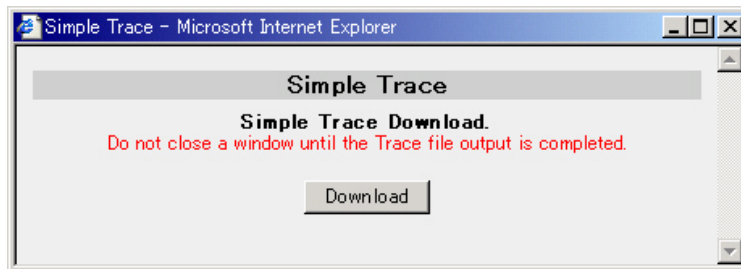
2. When the **Simple Trace** is clicked, the following window displays.



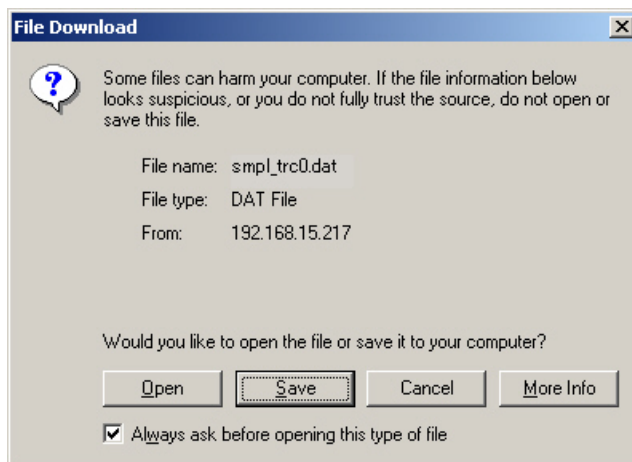
- When **OK** is clicked, the following window displays.



- The following window displays. Click **Download**.



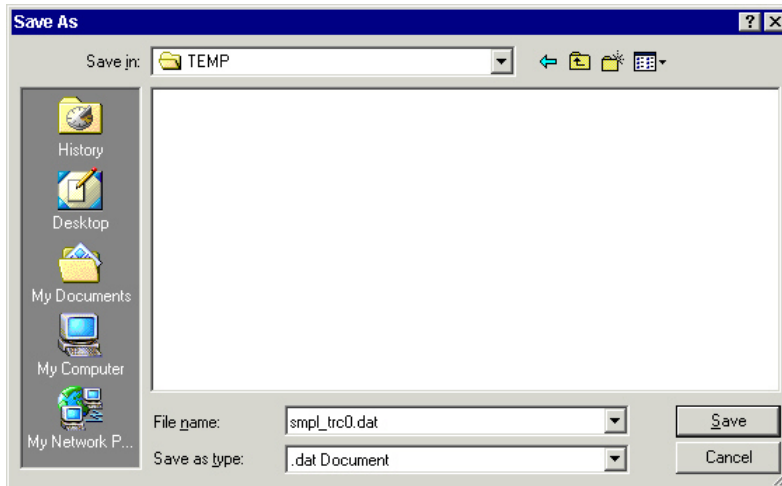
- Click **Save**, if it is continued. Click **Cancel**, if it is stopped.



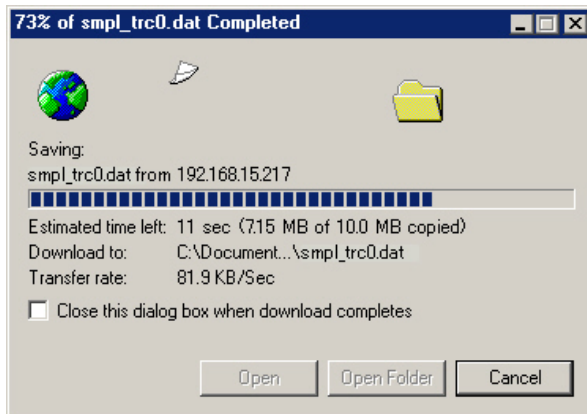
- If the following window displays, click **Save** after file name is setting, if it is continued. Click **Cancel**, if it is stopped.

Note: There may be a case where the default file name is given as “ctla_trc0.dat.dat” depending on the setting of the PC. In this case, reset the file name to “ctla_trc0.dat” or any other name.

Click **Cancel**, if it is stopped.

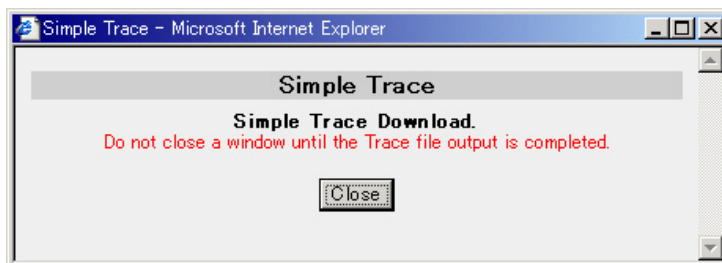


7. The following window displays during execution download.



8. The progress message window is closed when the download is completed.

9. Click Close.



8.7.2 NAS Log Collection

This function downloads the log information on the present NAS OS. The free capacity of approximately 4 M bytes in the Normal Mode, 12 M bytes in the Detail Mode and 150 M bytes in the Full Mode is required on the PC for downloading.

The NAS Log can collect only the information on the NNC (NAS unit) connected to the Control Unit. When no special instruction is given, collect the NAS log in Full Mode when a failure occurs.

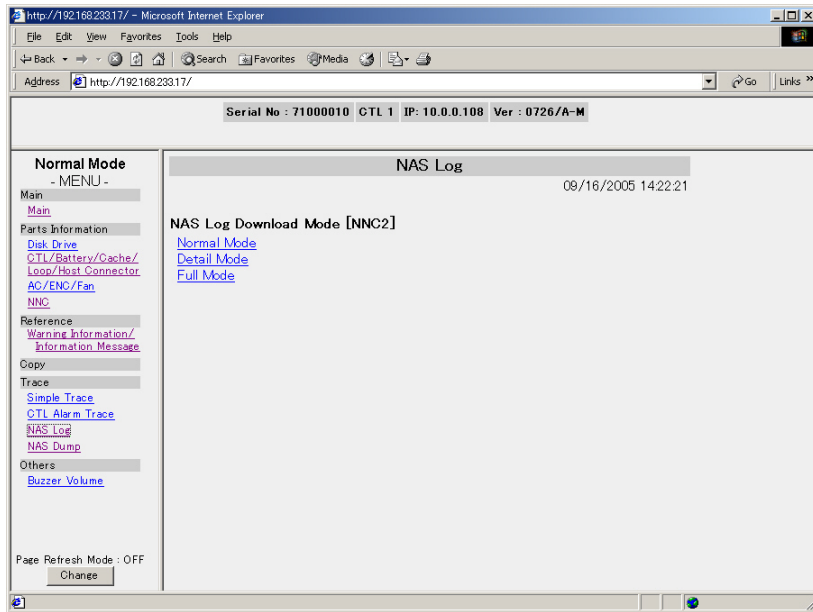
Table 8.9 Collection Mode

Collection Mode			
	Normal Mode	Detail Mode	Full Mode
Use	Collect it only when there is a special instruction. (It is limited to when the remote collection of Full Mode and Detail Mode is impossible on the capacity side.)	Collect it only when there is a special instruction. (It is limited to when the remote collection of Full Mode is impossible on the capacity side.)	Collect "Full Mode" uniformly unless otherwise instructed.
Capacity (Rough Indication)	About 4 M bytes per NNC	About 12 M bytes per NNC About 1 minute per NNC	About 150 M bytes per NNC
Collection time (Rough Indication)	About 1 minute per NNC	About 1 minute per NNC	About 4 minutes per NNC

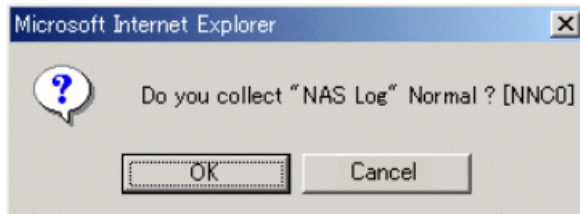
Notes:

- For one control unit, do not collect the next NAS Log until the NAS Log collection processing is complete. The operation is not assured when NAS Log collection is performed at the same time from multiple WEBs and external application.
- To require the access information between clusters for the analysis operation, collect NAS Logs of both NAS units in the cluster.
- When NAS Log is acquired from PC connected to the LAN for management, access both the user-managed port of disk array subsystem and the management port of NAS unit from the PC. (It is recommended that both IP addresses be in the same segment.)

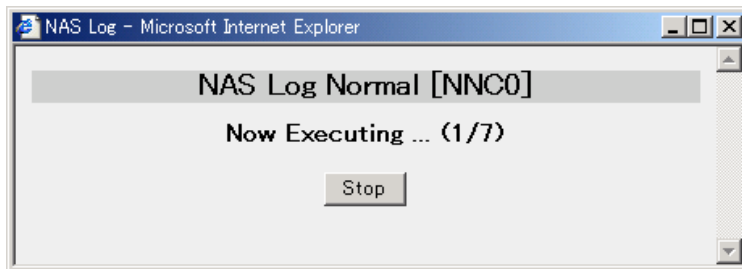
1. Click **NAS Log** in **Trace** in the menu frame.
2. Select the collection mode in **NAS Log**, and click it.



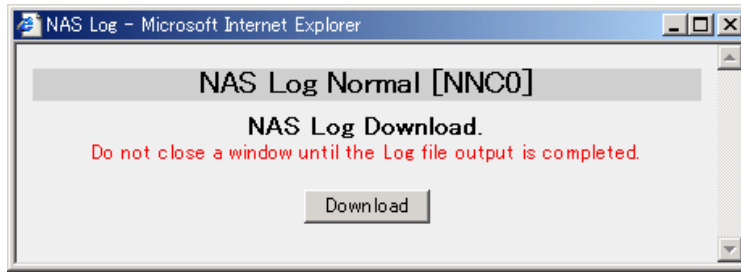
3. The confirmation message displays. Click **OK**.



The following dialog displays.

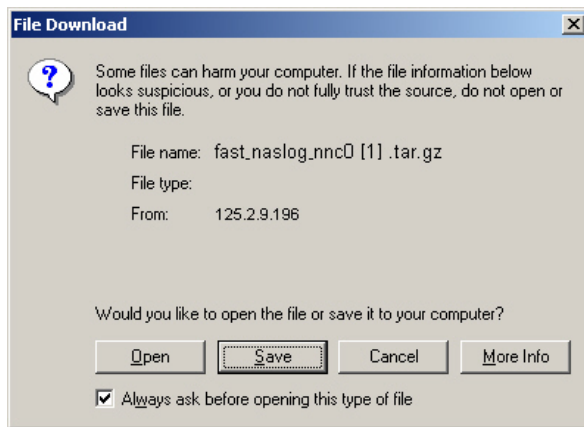


- The following dialog displays when ending. Click **Download**.



Note: Do not close this dialog while you download the NAS Log into the service PC. The NAS Log may not be able to be collected when closing it.

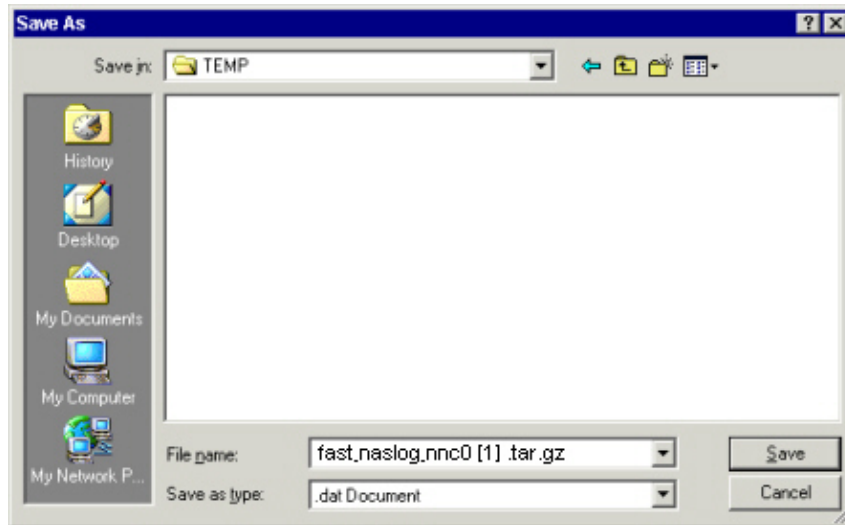
- The following dialog displays. Click **Save**.



- Specify the storage location of the file and the file name, and click **Save**.

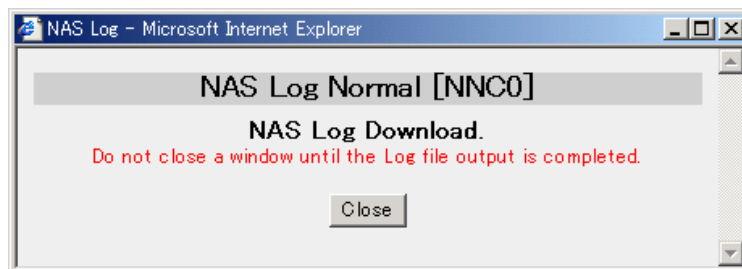
A file name can be changed to “optional file name.tar.gz”. A default file name is as follows in the collection mode.

	Collection Mode		
	Normal Mode	Detail Mode	Full Mode
NNC 0	fast_naslog_nnc0[1].tar.gz	naslog_nnc0[1].tar.gz	full_naslog_nnc0[1].tar.gz
NNC1	fast_naslog_nnc1[1].tar.gz	naslog_nnc1[1].tar.gz	full_naslog_nnc1[1].tar.gz
NNC 2	fast_naslog_nnc2[1].tar.gz	naslog_nnc2[1].tar.gz	full_naslog_nnc2[1].tar.gz
NNC 3	fast_naslog_nnc3[1].tar.gz	fast_naslog_nnc3[1].tar.gz	full_naslog_nnc3[1].tar.gz



The downloading is started and the progress indicating message window displays. When the downloading completes, click **Close**.

7. Click **Close**.

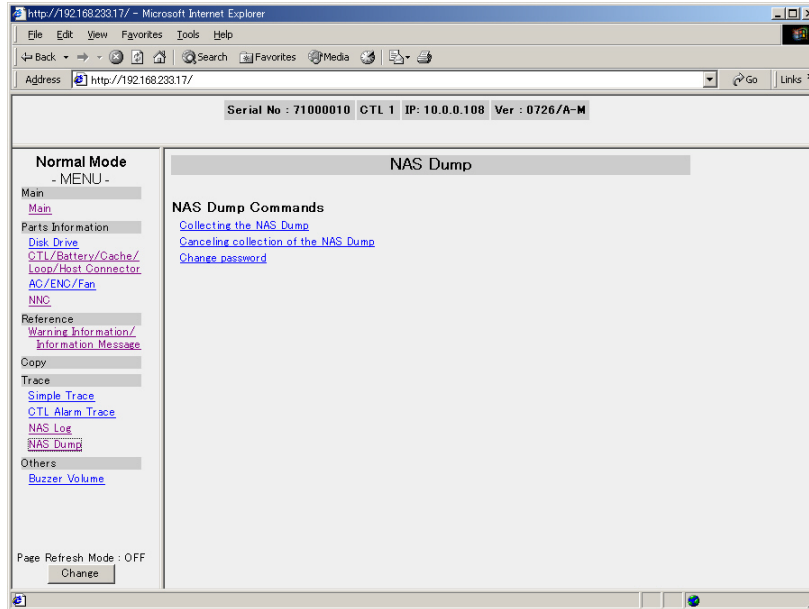


8.7.3 NAS Dump Generation

This function generates the full memory information on the present NNC (NAS unit) and collects it in the Disk Drive. The full memory information on the NNC (NAS unit) is not downloaded in the PC at the NAS Dump generation opportunity. The generation of the NAS Dump can be executed only in the NNC (NAS unit) connected to the Control Unit.

8.7.3.1 Generating NAS Dump

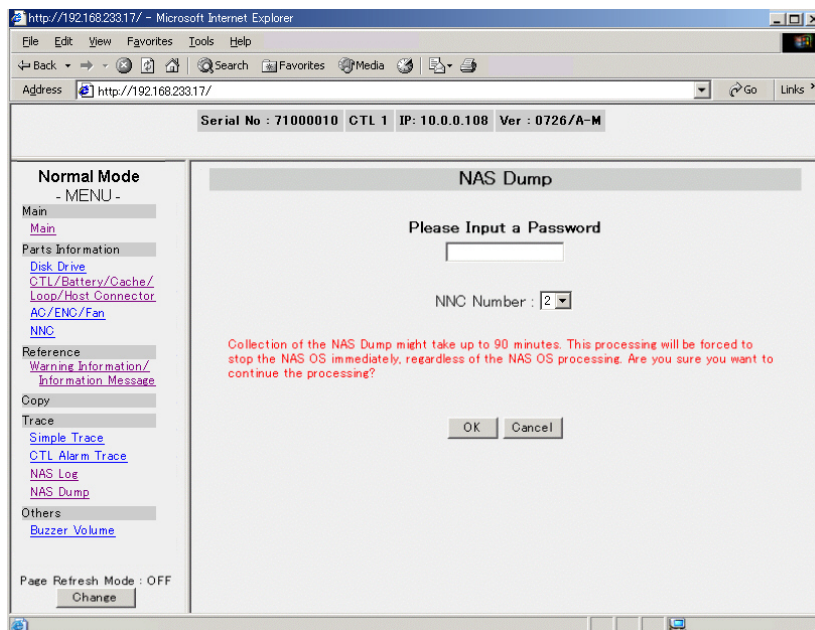
1. Click **NAS Dump** in **Trace** of the menu frame.
2. Select the **Collecting the NAS Dump**.



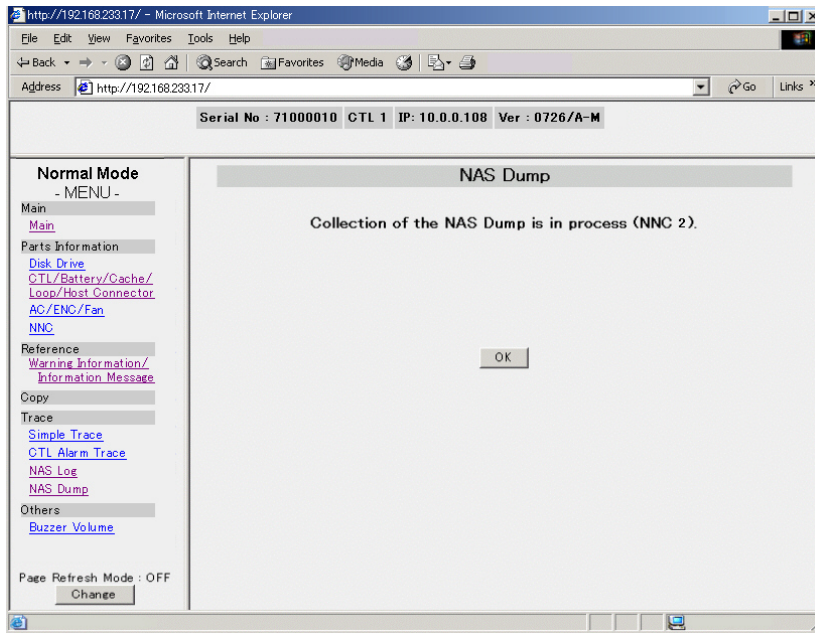
3. The confirmation message displays; click **OK**.



4. Input the registered password, and click **OK**.
(The default password is “user=NAS”)

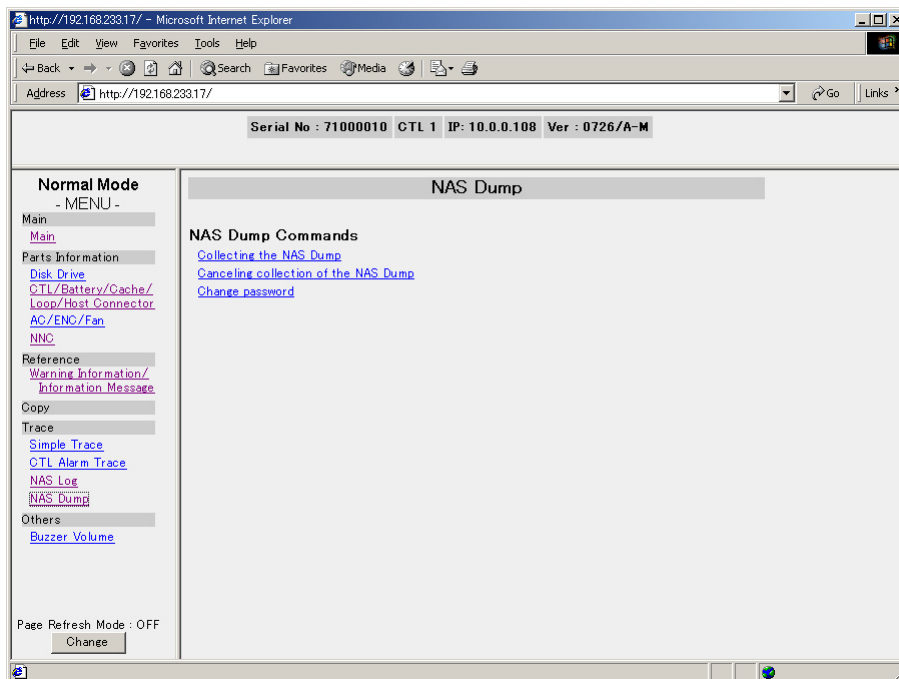


5. The following window displays. Click OK.

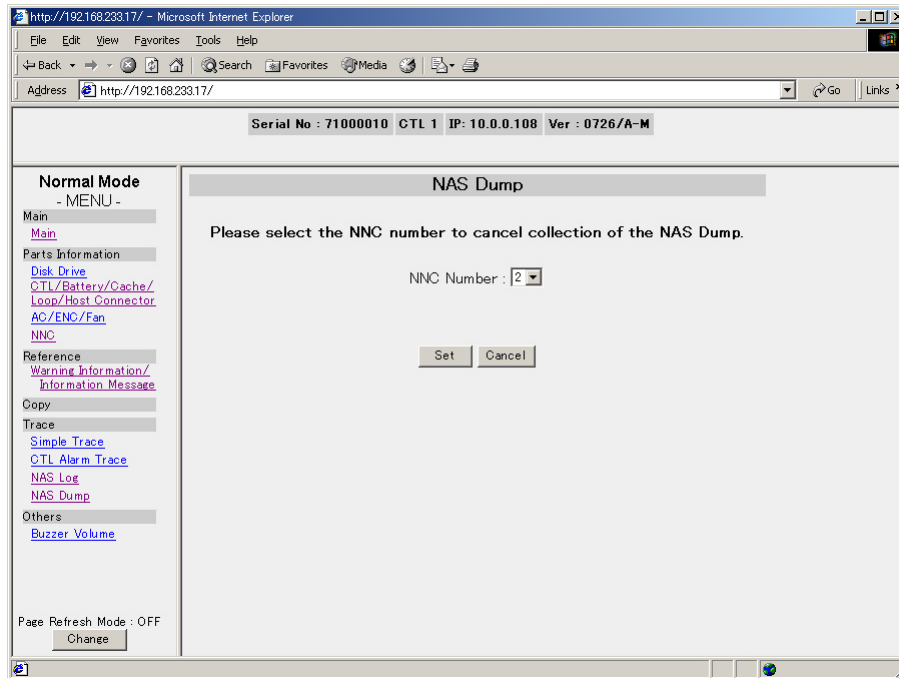


8.7.3.2 Suspension of NAS Dump Generation

1. Select the Canceling collection of the NAS Dump.



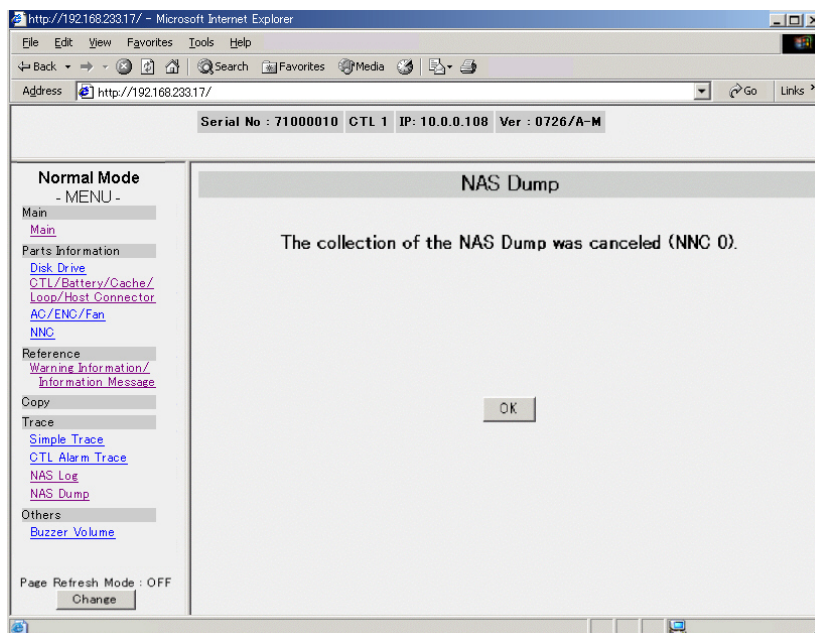
2. Specify the NNC(NAS Unit), which suspends the NAS Dump flushing, as “NNC Number”, and click Set.



3. The confirmation message displays. Click **OK**.

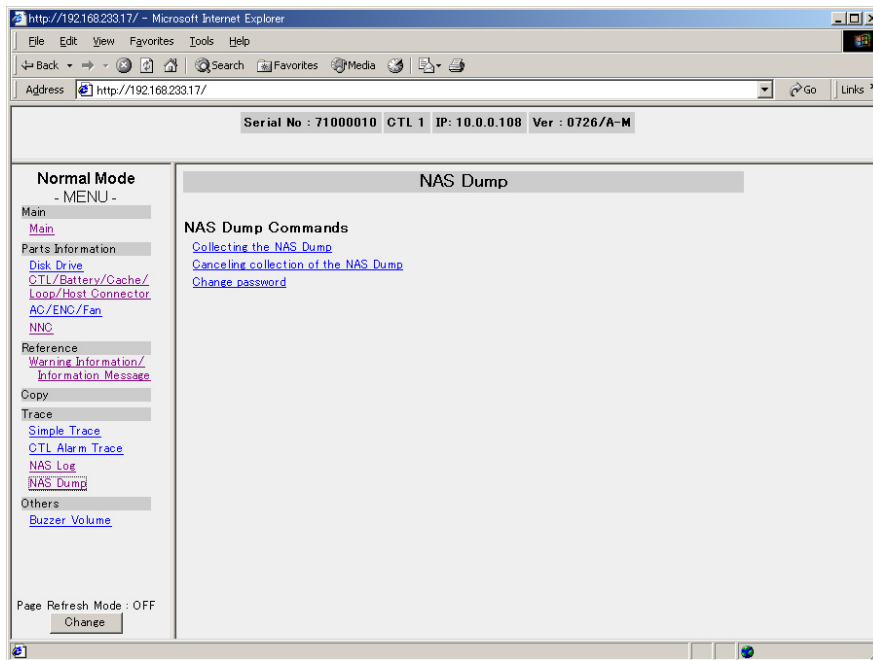


4. A suspension completion window displays. Click **OK**.

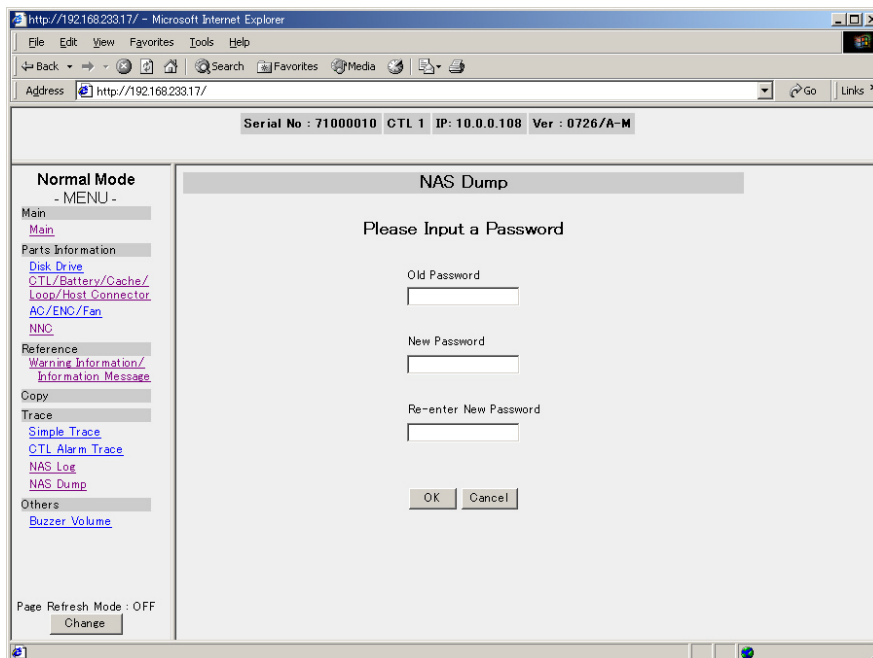


8.7.3.3 Registration and Changing the Password

1. Select the Change password.



2. Input the Old Password, New Password and Re-enter New Password (one to eight digits in half size alphanumeric character), and then click OK.



3. The window, indicating the completion of the password registration, displays. Click OK.

8.8 Determining Network Side Failure of iSCSI System

One of the following or two or more items are considered to be the causes that the host computer cannot communicate with the disk array subsystem. Check the validity of each item, and take necessary actions if there is any problem:

- The link status of LAN port in host computer is normal.
- All the Network peripherals (Switch, router, and NIC etc.) are powered on. If not, turn on the power.
- All the LAN cables between host computer and disk array subsystem are connected to the connector. If the LAN cable is connected loosely, connect it tightly.
- The port transfer rate of the HBA, Switch or NIC connected to the disk array subsystem is 1 Gbps. The port transfer rate of the disk array subsystem is 1 Gbps rate, and the communication mode is full-duplex.
- The VLAN setting is correct.
- The firewall setting is correct.
- The setting for L3 Switch or router is correct.
- The setting for the iSCSI driver of host computer is correct.
- The IPsec of the host computer is disabled for the iSCSI port of the disk array subsystem. The IPsec of the host computer needs to be disabled for the iSCSI port of the disk array subsystem.
- The setting of the IP address, subnet mask, default gateway and MTU value for both the disk array subsystem and the host computer meets the network. The MTU value needs to be set as the same value for all the devices (host computer, Switch, disk array subsystem, etc.) in the LAN network. The MTU value of DF700 is static and it is 1,500.
- The host computer recognizes the iSCSI driver.
- Doesn't it login with the correct IP address or the correct iSCSI Name of the Target is executed by the host computer.
- The TCP Port number of the iSCSI port of the subsystem is set correctly in the host computer.
- The "Discovery "and "Login" are executed by the host computer.
- The IP address of the iSNS server is set correctly in the host computer and disk array subsystem when iSCSI System has iSNS server.
- The iSNS server can newly register the information of the iSCSI device (IP address and iSCSI Name, etc.) when iSCSI System has iSNS server.
- The CHAP User of the Initiator is registered in the iSCSI port of the disk array subsystem when the Initiator authentication of the CHAP authentication is applied to the iSCSI System. If not, register the CHAP User of the Initiator newly.
- The Target name (example: [000:T000]) of the Target is registered in the CHAP User of the Initiator at the disk array subsystem when the Initiator authentication of the CHAP authentication is applied to the iSCSI System.

- The User Name and its Secret of the Target are set correctly in the host computer when the Initiator authentication of the CHAP authentication is applied to the iSCSI System.
- The iSCSI Name of HBA on the assigned Initiator list of the Initiator at the disk array subsystem is assigned to the Target of the disk array subsystem when Target security of LUN Manager is enabled in the iSCSI port of the disk array subsystem.
If not, assign the iSCSI Name of the HBA to the Target.

When a failure occurs in the LAN environment between the host computer and the iSCSI interface or in the AMS1000 subsystem, determine whether there is a failure in the AMS1000 subsystem according to the following flow diagram.

8.9 Changing LAN Port Number with Storage Navigator Modular

When the array subsystem cannot be accessed from the Storage Navigator Modular due to the duplication of the LAN port number, access to the array subsystem will be possible by changing the LAN port number which the Storage Navigator Modular uses.

When "Inspect skinny" option, which is the VoIP function option of Cisco firewall, is enabled, the Storage Navigator Modular cannot access to the array subsystem through the firewall. In this case, it is necessary to change the LAN port number.

8.9.1 Requirements for Changing LAN Port Number

■ Prerequisites

The LAN port number can be changed by the Storage Navigator Modular only when the prerequisites described below are all satisfied:

- The Storage Navigator Modular is available connecting to the LAN port of both control units.

Note: It is possible to change the LAN port number for every control unit from the user port management port.

■ Restrictions

The LAN port number cannot be changed in the following conditions:

- While the LAN port to be changed is used in the other application or the failure monitor.

In this case, change the LAN port number after stopping the program that is activated.

■ Points of Concern

When using this function, consider the following points:

- Use the number not used in the connected network in the range of 1024 to 49151 for the LAN port number that can be changed.
- When the HiCommand is used, the setting needs to be changed.
- When the initialization of the array subsystem and initial setup of the microprogram are performed, the set LAN port number returns to the initial value (2000).

- When changing the LAN port number, set the same LAN port number for both control units, and change the port number of all the array subsystems at the site concerned to the same number.
- When the LAN port number set to the array subsystem and the LAN port number described in the services file in the control PC to be connected do not correspond, the control PC cannot be connected to the LAN port of array subsystem. When the control PC cannot be connected to the LAN port of array subsystem after changing the LAN port number, check the LAN port number of the array subsystem and the LAN port number described in the services file in the service PC.

8.9.2 Changing LAN Port Number

1. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** in the tool bar.
2. Click the **LAN Port Number** tab.

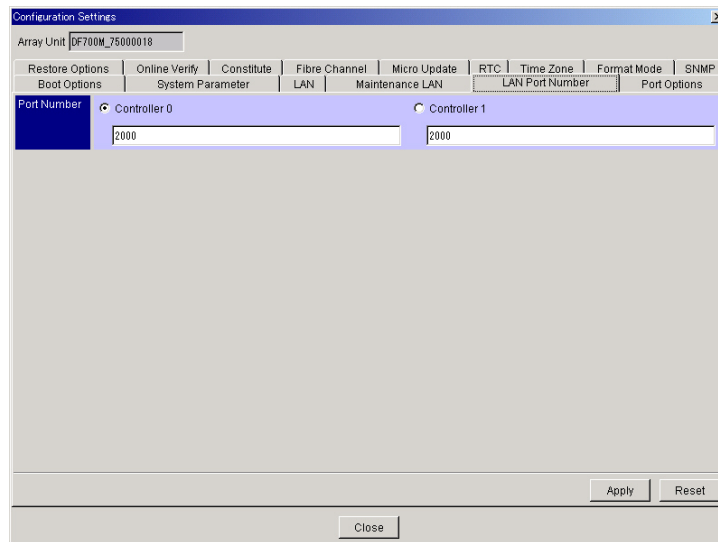
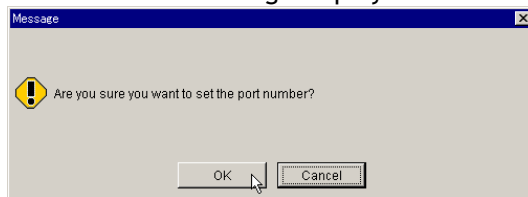
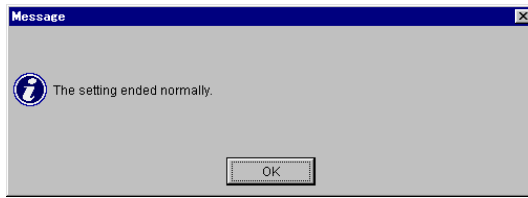


Figure 8-24 LAN Port Number Setting

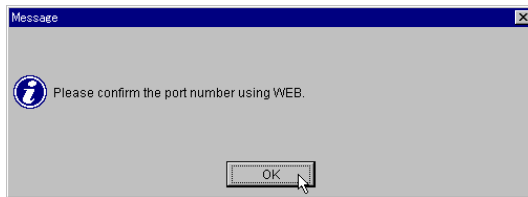
3. Click the **Controller 1** radio button, enter the port number to be set for the text field. Use the port number that is not used for the OS which activates the Storage Navigator Modular or other applications.
4. Click **Apply**.
A confirmation message displays. Click **OK**.



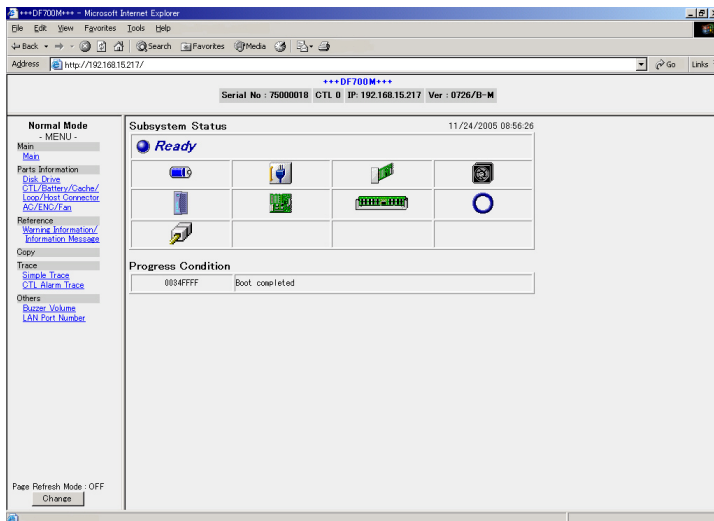
5. A message indicating completion of setting displays. Click **OK**.



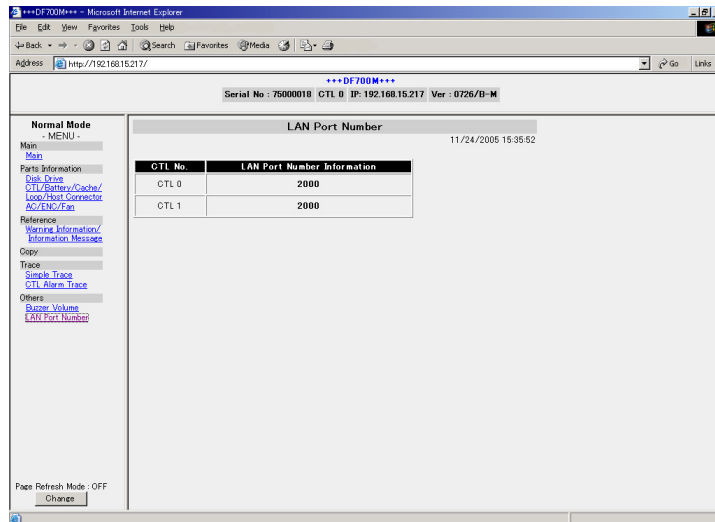
6. A confirmation message displays. Check that the LAN port number set in the Web browser is correct. Click **OK**.



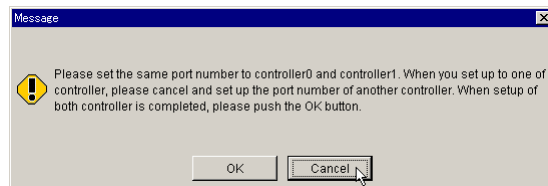
- **Confirming the LAN Port Number with Web:**
 - a) Enter the IP address of the array subsystem in the Web browser.
 - b) Click the LAN Port Number.



- c) Check that it corresponds with the set LAN port number.

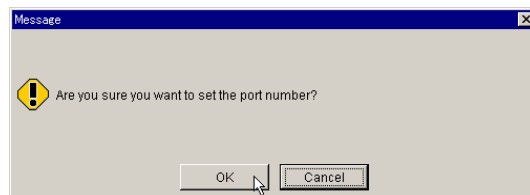


7. A confirmation message displays; click **Cancel**.

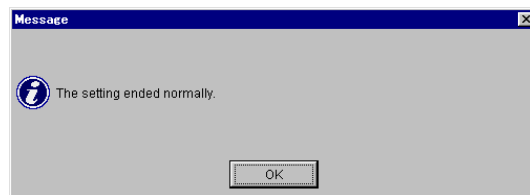


The routine is returned to .Figure 8-24.

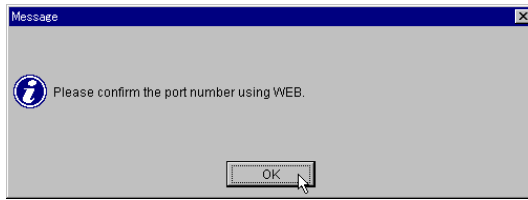
8. Click the **Controller 0** radio button, enter the port number to be set for the text field. Enter the value set for the **Controller1**.
9. A confirmation message displays; click **OK**.



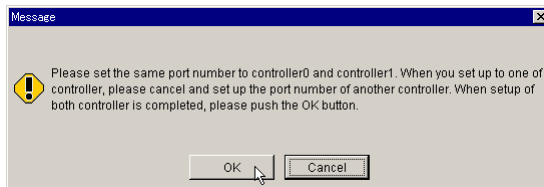
10. A message indicating completion of setting displays. Click **OK**.



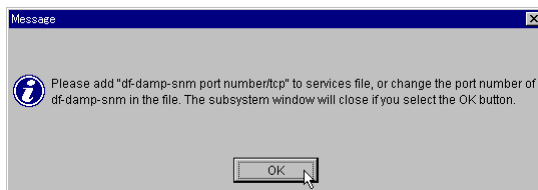
11. A confirmation message displays. Check that the LAN port number set in the Web browser is correct.



12. A confirmation message displays; click **OK**.



13. A confirmation message displays; click **OK**.
Unit screen will be closed by clicking **OK**.



14. Edit the services file, and then check that the Storage Navigator Modular can be activated again.

Examples of the services file (Windows® 2000/XP)

1. Open the services file (For the Windows 2000: C:\WINNT\system32\drivers\etc\services, For Windows XP: C:\WINDOWS\system32\drivers\etc\services) with a text editor such as Windows Notepad.
2. Add the LAN port number which the Storage Navigator Modular uses referencing to the following example, and overwrite and save it.

When adding it to the last line, a return code is required at the end of the input line.

```

# Copyright (c) 1993-1999 Microsoft Corp.
#
# This file contains port numbers for well-known services defined by IANA
#
# Format:
#
# <service name> <port number>/<protocol> [aliases...] [#<comment>]
#
echo                7/tcp
echo                7/udp
:
:
radacct             1813/udp                #RADIUS accounting protocol
df-damp-snm        2001/tcp
fsd                 2049/udp    nfs          #NFS server
knetd               2053/tcp                #Kerberos de-multiplexor
man                 9535/tcp                #Remote Man Server

```

Examples of the services file (UNIX® OS)

1. Open the services file (/etc/services) with a text editor such as vi.
2. Add the LAN port number which the Storage Navigator Modular uses referencing to the following example, and save it.

When adding it to the last line, a return code is required at the end of the input line.

```

# /etc/services:
# $Id: services,v 1.31 2002/04/03 16:53:20 notting Exp $
#
# Network services, Internet style
#
# Note that it is presently the policy of IANA to assign a single well-known
# port number for both TCP and UDP; hence, most entries here have two entries
# even if the protocol doesn't support UDP operations.
# Updated from RFC 1700, ``Assigned Numbers'' (October 1994). Not all ports
# are included, only the more common ones.
#
# The latest IANA port assignments can be gotten from
# http://www.iana.org/assignments/port-numbers
# The Well Known Ports are those from 0 through 1023.
# The Registered Ports are those from 1024 through 49151
# The Registered Ports are those from 1024 through 49151
#
# Each line describes one service, and is of the form:
#
# service-name port/protocol [aliases ...] [# comment]
#
tcpmux              1/tcp                # TCP port service multiplexer
tcpmux              1/udp                # TCP port service multiplexer
:
:
gdp-port            1997/tcp                # Cisco Gateway Discovery Protocol
gdp-port            1997/udp                # Cisco Gateway Discovery Protocol
df-damp-snm         2001/tcp
nfs                  2049/tcp    nfsd
nfs                  2049/udp    nfsd

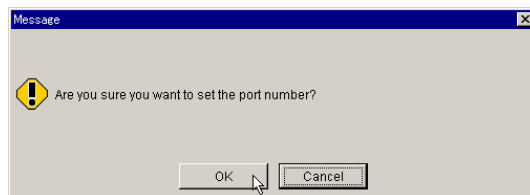
```

8.9.3 Troubleshooting

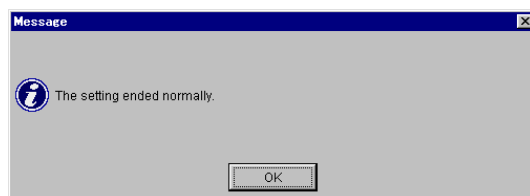
When the either control unit failed (Or, when the LAN port number for every control unit)
In this case, perform the LAN port number setting change connecting a LAN cable only to the control unit to be set.

When a problem occurs during the LAN port number change work, recover it according to the following procedure.

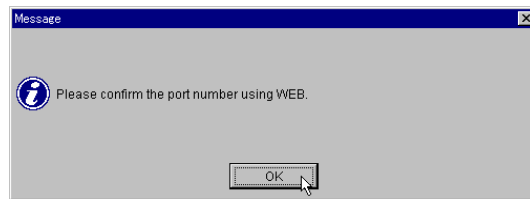
1. Set the LAN port number of the control unit to be set to the services file.
If it is unknown, check it using the Web browser.
2. Connect a LAN cable only to the control unit to be set, and register it in the Storage Navigator Modular with the IP address of the control concerned.
3. Start the Storage Navigator Modular.
4. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** in the tool bar.
5. Click the **LAN Port Number** tab.
6. Click the radio button of the control unit to be set, and enter the LAN port number to be set for the text field.
It is recommended to set the LAN port number of the other control unit which has already performed the setting change.
7. Click **Apply**.
8. A confirmation message displays; click **OK**.



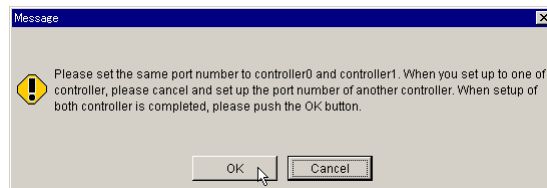
9. A message indicating completion of setting displays. Click **OK**.



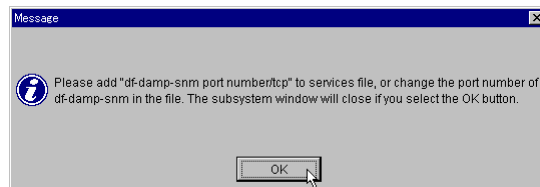
10. A confirmation message displays. Check that the LAN port number set in the Web browser is correct.



11. A confirmation message displays; click **OK**.



12. A confirmation message displays; click **OK**
Unit screen will be closed by clicking **OK**.



13. Edit the services file to change it to the new LAN port number, and then check that the Storage Navigator Modular can be activated again.
- Although the LAN port number of the services files and the LAN port number set to the array subsystem are same, the Storage Navigator Modular cannot be connected to the array subsystem:
 - Check the LAN port number of the services file and the LAN port number of the array subsystem by the Web browser again.
 - If the Storage Navigator Modular cannot be connected to the array subsystem yet, check the LAN connection such as the IP address or LAN cable.
 - The Storage Navigator Modular cannot have already been connected to the array subsystem:
 - Check the LAN port number with a Web browser. If the same LAN port address is set for both control units, register the same LAN port number in the services file, and start the Storage Navigator Modular.

- If the Storage Navigator Modular cannot be accessed to the array subsystem in spite of the execution of the above operation, the LAN port number may be duplicated with other devices. When this is verified, connect the LAN crossing cable directly to the LAN port of the control unit in the array subsystem, and change the LAN port number setting. Perform the either control unit fail procedure for every control unit.

8.10 Calling the Hitachi Data Systems Support Center

If you need to call the Hitachi Data Systems Support Center, provide as much information about the problem as possible, including:

- The circumstances surrounding the error or failure,
- The exact content of any error messages displayed on the host system(s)

The worldwide Hitachi Data Systems Support Centers are:

- Hitachi Data Systems North America/Latin America
San Diego, California, USA
1-800-446-0744
- Hitachi Data Systems Europe
Contact Hitachi Data Systems Local Support
- Hitachi Data Systems Asia Pacific
North Ryde, Australia
011-61-2-9325-3300

Chapter 9 Periodic Maintenance and Appendices

Note: If the subsystem is not energized for more than six months, the battery may over-discharge and unrecoverable damage may result. In this situation, the battery must be energized more than six hours at least once every six months. Alternatively, the subsystem can be stored with the switch of the battery turned off. However, even when the switch is turned off, the battery discharges naturally. The battery should be charged once every six months for longer than six hours because spontaneous discharge occurs.

The following appendices provide information on the Fibre, NAS, and iSCSI models. The following table illustrates sections that provide an explanation for each model.

- **Fibre model:** Connects disk array subsystem to a host computer with Fibre Channel interface.
- **NAS model:** Connects NAS Unit connected to disk array subsystem to a host computer with LAN interface.
- **iSCSI model:** Connects disk array subsystem to a host computer with iSCSI interface.

Sections		Fibre	NAS	iSCSI
Appendix A	Acronyms	○	○	○
Appendix B	System Parameter Setting List	○	–	○
Appendix C	Basic Specifications of the Storage System	○	○	○
Appendix D	Interfaces			
	D.1 Fibre Channel Connection Specifications	○	–	○
	D.2 Ethernet Connection Specifications	–	○	–
Appendix E	Remote Adapter Specifications			
	E.1 Remote Adapter Specifications	○	○	○
	E.2 Remote Adapter Dimensions	○	○	○
Appendix F	List of Storage Capacities Corresponding to RAID Levels and Configurations	○	○	○
Appendix G	Port Address Mapping Table	○	–	–
Appendix H	Power Cables	○	○	○
Appendix I	Number of Logical Blocks	○	○	○
Appendix J	Using LUN Security or LUN Management on a Fabric Switch Connection	○	–	–

○: An explanation is provided.

–: An explanation is not provided.

Appendix A Acronyms

Acronym	Expansion
A	Ampere
AL-PA	arbitrated loop-physical address
AMS	Adaptable Modular Storage
API	application programming interface
ASTM	American Society for Testing Materials
ATA	Advanced Technology Attachment standard
ATM	asynchronous transfer mode
BC	business continuity
BS	Basic (power) supply
BSA	bus adapter
BTU	British thermal unit
CCI	command control interface
CEC	Canadian Electroacoustic Community
CFW	cache fast write
CHAP	challenge handshake authentication protocol
CIFS	common internet file system
CKD	count-key data
CLI	command line interface
CSA	Canadian Standards Association
CSV	comma separated value
CTG	consistency group
CTL	controller
CU	controller unit
CUDG	control unit diagnosis
dB(A)	decibel (A-weighted)
D-CNT	default (owner) controller
DAMP	Disk Array Management Program
DDL	data definition language
DHCP	dynamic host configuration protocol
DKC	disk controller unit
DLM	data lifecycle management
DM-LU	differential management logical unit
DRAM	dynamic random access memory
DWDM	dense wavelength division multiplexer
EMI	electromagnetic interference
EPO	emergency power-off
FC	fibre channel
FC-AL	fibre channel-arbitrated loop
FCC	Federal Communications Commission
FCP	fibre-channel protocol
Gbps	gigabit per second

HA	high availability
HACMP	high availability cluster multi-processing
HBA	host bus adapter
HDLM	Hitachi Dynamic Link Manager
HORCM	Hitachi Open Remote Copy Manager
H-LUN	host logical unit
H-RAIN	heterogeneous redundant array of independent nodes
HSN	hierarchical star network
HWM	high water mark
IDE	integrated drive electronics; see also ATA.
IIS	Internet Information Service
IOPS	input output operations per second
IOS	internet work operating system
iSCSI	internet small computer system interface
JRE	Java 2 runtime environment
LCP	local control port
LD	logical device
LDEV	logical device
LDM	logical device manager
LIP	loop initialization primitive
LRU	least recently used
LUN	logical unit number
LUSE	LU size expansion
LVI	logical volume image
LVM	logical volume manager
MCU	main control unit
NDMP	Network Data Management Protocol
MDB	master directory block
MIB	message information block
μP	microprocessor
MR	magneto-resistive
MU	mirror unit
MVS	multiple virtual storage
MVS/ESA	multiple virtual storage /enterprise systems architecture
MVS/XA	multiple virtual storage /extended architecture
NAS	network attached storage
NBU	NetBackup (a Symantec product)
NEC	National Electrical Code
NFS	network file system
NIC	network interface card
NIS	network information service
NNC	network node controller
NSC	network storage controller
NTP	network time protocol

NVS	nonvolatile storage
OCI	Oracle Call Interface
ODM	object data manager
OFC	open fibre control
ORM	online read margin
OSI	open systems interconnection
PCI	power control interface
PDL	product documentation library
PFUS	pool full status
POSIX	portable operating system interface
PPRC	peer-to-peer remote copy
PSUE	pair suspended-error status
PSUS	pair suspended-split
PSUS(N)	pair suspended - not restored status
PV	physical volume
P-VOL	primary volume
RAID	redundant array of independent disks
RC	reference code
RCU	remote control unit
RPO	recovery point objective
RTC	real-time clock
RTO	recovery time objective
SAN	storage-area network
SATA	serial ATA
SCSI	small computer system interface
SIM	service information message
SM	shared memory module
SMB	server message block
SMTP	simple mail transfer protocol
SNIA	Storage Networking Industry Association
SNMP	simple network management protocol
SONET	synchronous optical network
SSL	secure socket layer
SSWS	suspend for swapping S-VOL
S-VOL	secondary volume
TID	target identifier
TPOF	tolerable points of failure
UDP	user diagram protocol
UL	Underwriters' Laboratories
USP	Universal Storage Platform
VCS	Veritas Cluster Server™
VDE	Verband Deutscher Elektrotechniker
VIB	volume information block
VOLID	volume identifier

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

Appendix B System Parameter Setting List

The following table lists the parameter settings using Storage Navigator Modular.

System Parameter		Description
1	System Startup Attribute	Depends on System Configuration
2	Drive Detach mode enable	Disable (Standard setting)
3	Turbo LU Warning	Disable (Standard setting)
4	Operation if the Processor failures Occurs	Reset a Fault (Standard setting)
5	ROM Microprogram Version	No change is needed
6	RAM Microprogram Version	No change is needed
7	Write & Verify Executing Mode	On (Standard setting)
8	DHCP (Note 2)	OFF (Standard setting)
9	Maintenance Port IP Address	To be set according to the network setting
10	IP Address	To be set according to the network setting
11	Subnet Mask	To be set according to the network setting
12	Default Gateway	To be set according to the network setting
Host Group		
1	LU Mapping Mode	Depends on System Configuration (Note 1)
Target (Note 3)		
1	LU Mapping Mode	Depends on System Configuration

Note 1: When the AMS1000 is connected, the logical unit which is not wanted to be accessed by the port must be masked by means of the LU mapping mode.

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 Storage Navigator Modular or the Web cannot be used via a LAN.) You can acquire the IP Address by starting up the DHCP server or by setting the DHCP function correctly when necessary.

Note 3: Effective only when the iSCSI interface is added.

Table B.1 Host Connection Parameters: HP-UX

Host Group Option						
Simple Setting						
Platforms	HP-UX					
Alternate Path	None		PV Link		VxVM (Note 1)	
Fail Over	None	MC/ Serviceguard	None	MC/ Serviceguard	None	
Detail Setting: The following parameters will be selected automatically according to simple setting.						
Host Connection Mode 1 (Select one of these modes)	Standard Mode	✓	✓	✓	✓	✓
	Open VMS Mode					
	Wolfpack Mode					
	TRESPASS Mode					
Host Connection Mode 2 (Multiple selections)	HP-UX Mode					
	PSUE Read Reject Mode					
	UA(06/2A00) Suppress Mode					
	NACA Mode					
	HISUP OFF Mode					
	Reset Propagation Mode					
	Unique Reserve Mode 1					
	ASL Report Mode (Active/Passive Group)					
	ASL Report Mode (Active/Passive)					
	ASL Report Mode (Active/Active)					
	Port ID No Report Mode					
	Port ID Conversion Mode					
	TruCluster Mode					
	Product Serial Response Mode					
Same Node Name Mode						

Host Group Option					
Simple Setting					
Platforms		HP-UX			
Alternate Path		None	PV Link		VxVM (Note 1)
Fail Over		None	MC/ Serviceguard	None	MC/ Serviceguard None
	CCHS Conversion Mode				
	SPC-2 Mode				
Additional Parameter: Select these parameters only when you use the appropriate function. When selected, the following parameters belonged to the appropriate Host Connection Mode will be selected automatically.					
Logical Unit Number more than or equals to 8 can be recognized by HP-		HP-UX Mode (Note 2)			
TrueCopy is used by Hp-UX (Note 3)		PSUE Read Reject Mode (Note 4)			
VERITAS Database Edition™/Advanced Cluster for Oracle® RAC (Solaris) is used		Not Selected			
Egenera® BladeFrame® Is used		Not Selected			

✓: Parameter that is selected automatically by simple setting.

blank: Parameter that is selected manually if needed.

Notes: When making the simple setting of the host group options, select items shown on gray backgrounds. Only when using the combination not described in the simple setting, select the required parameter from detail settings.

1. When using VERITAS Volume Manager™ (VxVM), Array Support Library (ASL) for AMS Series is required. Please download from the Web screen of VERITAS®.
2. Up to 256 logical units from logical unit number 0 to logical unit number 255 can be mapped for each host group. However, the maximum number of logical units a server can recognize is different depending on the platform.
3. TrueCopy displayed on parameter means TrueCopy Remote Replication and TrueCopy Extended Distance.
4. Set this mode when you want to suppress the read access to the P-VOL during the transition to PSUE using the fence level with "Data" in TrueCopy Remote Replication.

Table B.2 Host Connection Parameters: Solaris™

Host Group Option										
Simple Setting										
Platforms	Solaris									
Alternate Path	None			HDLM <i>(Note 1)</i>		VxVM <i>(Note 2)</i>		MpxIO <i>(Note 5)</i>		
Fail Over	None	Sun™ Cluster	VCS <i>(Note 3)</i>	None	Sun Cluster <i>(Note 4)</i>	None	VCS <i>(Note 3)</i>	None	Sun Cluster	
Detail Setting: The following parameters will be selected automatically according to simple setting.										
Host Connection Mode 1 (Select one of these modes)	Standard Mode	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Open VMS Mode									
	Wolfpack Mode									
	TRESPASS Mode									
Host Connection Mode 2 (Multiple selections)	HP-UX Mode									
	PSUE Read Reject Mode									
	UA(06/2A00) Suppress Mode									
	NACA Mode									
	HISUP OFF Mode									
	Reset Propagation Mode									
	Unique Reserve Mode 1									
	ASL Report Mode (Active/Passive Group)									
	ASL Report Mode (Active/Passive)									
	ASL Report Mode (Active/Active)									
	Port ID No Report Mode									
	Port ID Conversion Mode									
	TruCluster Mode									
Product Serial Response Mode										

Host Group Option										
Simple Setting										
Platforms		Solaris								
Alternate Path		None			HDLM <i>(Note 1)</i>		VxVM <i>(Note 2)</i>		MpxIO <i>(Note 5)</i>	
Fail Over		None	Sun™ Cluster	VCS <i>(Note 3)</i>	None	Sun Cluster <i>(Note 4)</i>	None	VCS <i>(Note 3)</i>	None	Sun Cluster
		Same Node Name Mode								
		CCHS Conversion Mode								
		SPC-2 Mode								
Additional Parameter: Select these parameters only when you use the appropriate function. When selected, the following parameters belonged to the appropriate Host Connection Mode will be selected automatically.										
Logical Unit Number more than or equals to 8 can be recognized by HP-UX		Not Selected								
TrueCopy is used by Hp-UX <i>(Note 6)</i>		Not Selected								
VERITAS Database Edition/Advanced Cluster for Oracle RAC (Solaris) is used		Not Selected	Unique Reserve Mode 1 <i>(Note 7)</i>	Not Selected	Unique Reserve Mode 1 <i>(Note 7)</i>	Not Selected	Not Selected	Not Selected	Not Selected	Not Selected
Egenera BladeFrame Is used		Not Selected								

✓: Parameter that is selected automatically by simple setting.
blank: Parameter that is selected manually if needed.

Notes: When making the simple setting of the host group options, select items shown on gray backgrounds. Only when using the combination not described in the simple setting, select the required parameter from detail settings.

1. When using Hitachi Dynamic Link Manager (HDLM), take notice of the following:
 - a) Vendor ID: If this text is changed, it cannot be managed by HDLM. Do not change this text.
 - b) Serial Number: When the multiple storages of same types exist, a different Serial Number needs to be allocated for each disk array subsystem.
2. When using VERITAS Volume Manager (VxVM), Array Support Library (ASL) for AMS Series is required. Please download from the Web screen of VERITAS.
3. VERITAS Cluster Server™.
4. The combination of the Sun Cluster and HDLM needs to set the "Reset Propagation Mode" depending on the HDLM version. Verify the Hardware note of the HDLM, and then set the Reset Propagation Mode from the detail setting.
5. SUN Multi Path (MPxIO)
6. TrueCopy displayed on parameter means TrueCopy Remote Replication and TrueCopy Extended Distance.
7. When using VERITAS Storage Foundation For Oracle® RAC or the IO fencing function supported from the VCS Ver4.0, the Unique Reserve Mode 1 needs to be set.

Table B.3 Host Connection Parameters: AIX®

Host Group Option							
Simple Setting							
Platforms		AIX					
Alternate Path		None		HDLM (Note 1)		VxVM (Note 2)	
Fail Over		None	HACMP	None	HACMP	None	VCS (Note 3)
Detail Setting: The following parameters will be selected automatically according to simple setting.							
Host Connection Mode 1 (Select one of these modes)	Standard Mode	✓	✓	✓	✓	✓	✓
	Open VMS Mode						
	Wolfpack Mode						
	TRESPASS Mode						
Host Connection Mode 2 (Multiple selections)	HP-UX Mode						
	PSUE Read Reject Mode						
	UA(06/2A00) Suppress Mode	✓	✓	✓	✓	✓	✓
	NACA Mode	✓	✓	✓	✓	✓	✓
	HISUP OFF Mode						
	Reset Propagation Mode		✓		✓		
	Unique Reserve Mode 1						
	ASL Report Mode (Active/Passive Group)						
	ASL Report Mode (Active/Passive)						
	ASL Report Mode (Active/Active)						
	Port ID No Report Mode						
	Port ID Conversion Mode						
	TruCluster Mode						
	Product Serial Response Mode						
	Same Node Name Mode						
CCHS Conversion Mode							
SPC-2 Mode							
Additional Parameter: Select these parameters only when you use the appropriate function. When selected, the following parameters belonged to the appropriate Host Connection Mode will be selected automatically.							
Logical Unit Number more than or equals to 8 can be recognized by HP-UX		Not Selected					
TrueCopy is used by Hp-UX (Note 4)		Not Selected					
VERITAS Database EditionAdvanced Cluster for Oracle RAC (Solaris) is used		Not Selected					Unique Reserve Mode 1 (Note 5)
Egenera BladeFrame Is used		Not Selected					

✓: Parameter that is selected automatically by simple setting.

blank: Parameter that is selected manually if needed.

Notes: When making the simple setting of the host group options, select items shown on gray backgrounds. Only when using the combination not described in the simple setting, select the required parameter from detail settings.

1. When using Hitachi Dynamic Link Manager (HDLM), take notice of the following:
 - a) Vendor ID: If this text is changed, it cannot be managed by HDLM. Do not change this text.
 - b) Serial Number: When the multiple storages of same types exist, a different Serial Number needs to be allocated for each disk array subsystem.
2. When using VERITAS Volume Manager (VxVM), Array Support Library (ASL) for AMS Series is required. Please download from the Web screen of VERITAS.
3. VERITAS Cluster Server.
4. TrueCopy displayed on parameter means TrueCopy Remote Replication and TrueCopy Extended Distance.
5. When using VERITAS Storage Foundation for Oracle RAC or the IO fencing function supported from the VCS Ver4.0, the Unique Reserve Mode 1 needs to be set.

Table B.4 Host Connection Parameters: Windows® 2000/2003

Host Group Option								
Simple Setting								
Platforms		Windows® 2000/2003						
Alternate Path		None		HDLM (<i>Note1</i>)		VxVM (<i>Note2</i>)		
Fail Over		None	MSCS	None	MSCS	None	VCS	MSCS
Detail Setting: The following parameters will be selected automatically according to simple setting.								
Host Connection Mode 1 (Select one of these modes)	Standard Mode	✓		✓	✓	✓	✓	✓
	Open VMS Mode							
	Wolfpack Mode		✓					
	TRESPASS Mode							
Host Connection Mode 2 (Multiple selections)	HP-UX Mode							
	PSUE Read Reject Mode							
	UA(06/2A00) Suppress Mode							
	NACA Mode							
	HISUP OFF Mode							
	Reset Propagation Mode		✓		✓		✓	✓
	Unique Reserve Mode 1							
	ASL Report Mode (Active/Passive Group)							
	ASL Report Mode (Active/Passive)							
	ASL Report Mode (Active/Active)							
	Port ID No Report Mode							
	Port ID Conversion Mode							
	TruCluster Mode							
	Product Serial Response Mode							
	Same Node Name Mode							
CCHS Conversion Mode								
SPC-2 Mode								
Additional Parameter: Select these parameters only when you use the appropriate function. When selected, the following parameters belonged to the appropriate Host Connection Mode will be selected automatically.								
Logical Unit Number more than or equals to 8 can be recognized by HP-UX		Not Selected						
TrueCopy is used by HP-UX (<i>Note3</i>)		Not Selected						
VERITAS® Database Edition/Advanced Cluster for Oracle RAC (Solaris) is used		Not Selected						
Egenera BladeFrame Is used		Not Selected						

✓: Parameter that is selected automatically by simple setting.
blank: Parameter that is selected manually if needed.

Notes: When making the simple setting of the host group options, select items shown on gray backgrounds. Only when using the combination not described in the simple setting, select the required parameter from detail settings.

1. When using Hitachi Dynamic Link Manager (HDLM), take notice of the following:
 - a) Vendor ID: If this text is changed, it cannot be managed by HDLM. Do not change this text.
 - b) Serial Number: When the multiple storages of same types exist, a different Serial Number needs to be allocated for each disk array subsystem.
2. When using VERITAS Volume Manager (VxVM), Array Support Library (ASL) for AMS Series is required. Please download from the Web screen of VERITAS.
3. TrueCopy displayed on parameter means TrueCopy Remote Replication and TrueCopy Extended Distance.

Table B.5 Host Connection Parameters: Linux®, Tru64® and Others

Host Group Option									
Simple Setting									
Platforms	Linux					Tru64®		Others Not specified	
Alternate Path	None		HDLM	VxVM (Note1)		None		None	
Fail Over	None	VCS (Note2)	None	None	VCS (Note2)	None	Tru Cluster	None	
Detail Setting: The following parameters will be selected automatically according to simple setting.									
Host Connection Mode 1 (Select one of these modes)	Standard Mode	✓	✓	✓	✓	✓	✓	✓	✓
	Open VMS Mode								
	Wolfpack Mode								
	TRESPASS Mode								
Host Connection Mode 2 (Multiple selections)	HP-UX Mode								
	PSUE Read Reject Mode								
	UA(06/2A00) Suppress Mode								
	NACA Mode								
	HISUP OFF Mode								
	Reset Propagation Mode								
	Unique Reserve Mode 1								
	ASL Report Mode (Active/Passive Group)								
	ASL Report Mode (Active/Passive)								
	ASL Report Mode (Active/Active)								
	Port ID No Report Mode								
	Port ID Conversion Mode								
	TruCluster Mode							✓	
	Product Serial Response Mode								
Same Node Name Mode									
CCHS Conversion Mode									
SPC-2 Mode									
Additional Parameter: Select these parameters only when you use the appropriate function. When selected, the following parameters belonged to the appropriate Host Connection Mode will be selected automatically.									
Logical Unit Number more than or equals to 8 can be recognized by HP-UX	Not Selected					Not Selected		Not Selected	
TrueCopy is used by Hp-UX (Note3)	Not Selected					Not Selected		Not Selected	
VERITAS Database Edition/Advanced Cluster for Oracle RAC (Solaris) is used	Not Selected	Unique Reserve Mode (Note4)	Not Selected	Not Selected	Unique Reserve Mode (Note4)	Not Selected		Not Selected	
Egenera BladeFrame Is used	Not Selected					Not Selected		Not Selected	

✓: Parameter that is selected automatically by simple setting.
blank: Parameter that is selected manually if needed.

Notes: When making the simple setting of the host group options, select items shown on gray backgrounds. Only when using the combination not described in the simple setting, select the required parameter from detail settings.


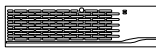

1. When using VERITAS Volume Manager (VxVM), Array Support Library (ASL) for AMS Series is required. Please download from the Web screen of VERITAS®.
2. VERITAS Cluster Server.
3. TrueCopy displayed on parameter means TrueCopy Remote Replication and TrueCopy Extended Distance.
4. When using VERITAS Storage Foundation For Oracle RAC or the IO fencing function supported from the VCS Ver4.0, the Unique Reserve Mode 1 needs to be set.

Appendix C Basic Specifications of the AMS1000 Storage System

Basic specifications of AMS1000 are shown in this chapter.

The basic specifications of the rackmount model are listed and described in Table C.1, and the basic specifications of the RKNAS are listed and described in Table C.2.

Table C.1 Basic Specifications of AMS1000 (continues on the following pages)

Item		Model	Rack Mount Model		
			RKH/RKHE	RKAJ	RKAJAT
Configuration	Configuration		1 RKH/RKHE	1 RKAJ	1 RKAJAT
	Subsystem appearance				
Disk drive used	Disk drive size (W×D×H) (mm)		—	101.6×146.1×25.4	
	Data capacity (G byte) (Note 1)		—	71.3/143.3/287.6	245.7/393.4/491.9/737.4
	Rotational speed (min ⁻¹)		—	10,000/15,000	7,200
	Maximum mountable quantity (unit)		—	15	
Host Interface	Interface type		4 G bps Fibre Channel Optional (Non-OFC) 1 G bps iSCSI (1000 Base-T) (Note 2)	—	
	Data transfer speed (i.e. maximum speed for transfer to host)		400 M bytes/s (Fibre Channel) 100 M bytes/s (iSCSI) (Note 2)	—	
	Number of ports	Dual controller	Fibre Channel: 8 (Note 3) iSCSI: 4 (Note 2)	—	
	Transferred block size (bytes)		512		

Note 1: The values of storage capacity are calculated as 1 G bytes = 1,000,000,000 bytes. This definition is different from that (1 k bytes = 1,024 bytes) shown on the PCs you are using.

Note 2: Indicates the value when the iSCSI interface board is added to the control unit.

Note 3: Indicates the value when the FC interface board is added to the control unit.

Table C.1 Basic Specifications of AMS1000 (continued)

Item	Model		Rackmount Model		
			RKH/RKHE	RKAJ	RKAJAT
RAID specifications (Note 1)	RAID level (Note 2)		0/1/5/6/1+0		1/5/6/1+0
	RAID Configuration (Unit of addition)	RAID 0	—	2D to 16D	—
		RAID 1	—	1D to 1D	—
		RAID 5	—	2D+1P to 15D+1P	—
		RAID 6	—	2D+2P to 28D+2P	—
		RAID 1+0	—	2D+2D to 8D+8D	—
Internal logic specifications	Control CPU		RKHE: Power PC7447A (1.4 G Hz) RKHE: Power PC7448 (1.7 G Hz)	—	
	Control memory		Flash memory: 16 M bytes L2 Cache memory: RKH: 512 k bytes RKHE: 1 M bytes SDRAM: 1 G bytes	—	
	Data assurance method		Data bus: 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)		483×650×174	483×650×129	
	Mass (kg) (Note 3)		47 approx.	40 approx.	
	Acoustic noise (dB) (Note 7)		57 approx.	60 approx.	
	Require height (EIA unit)		4	3	

Table C.1 Basic Specifications of AMS1000 (continued)

Item		Model	Rackmount Model			
			RKH/RKHE	RKAJ	RKAJAT	
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 4) (Note 5) (Note 6)	2.6×2/1.3×2	2.6×2/1.3×2	2.4×2/1.2×2		
	Breaking current (A)	12.5	10.0			
	Heat value (kJ/h)	1,875 or less	1,875 or less	1,730 or less		
	Required power (Note 4)	Steady State (VA)	520 or less	520 or less	480 or less	
		Starting state (VA)	520 or less	560 or less	480 or less	

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

Note 2: Although the subsystem with a configuration of RAID6, RAID 5, RAID 1, or RAID 1+0 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 uninterruptible 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.

The correct power factor for the AMS1000 is “0.93 - 0.96”. The manual incorrectly states the value as “1”.

Note 5: Power current of N×2 described in this table is required for operation by a single power supply unit.

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 the power supply facility in which the current carrying capacity of one of the power supply units is 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.

Note 9: The start-up time may be longer than five minutes depending on the configuration.

Table C.1 Basic Specifications of AMS1000 (continued)


Item		Model	Rackmount Model		
			RKH/RKHE	RKAJ	RKAJAT
Cache specifications	Capacity (M bytes/CTL)	2,048, 4,096, 6,144, 8,192	—		
	Control method	Read LRU/Write after	—		
	Battery backup	Provided	—		
	Backup duration (h) (Note)	48 (When cache of 8,192 M bytes/CTL)	—		
Maintenance specifications/ antifault specifications	Spare disk	Up to 30 disk drives can be set to spare disks in one system			
	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)			
	Insulation resistance	DC 500 V, 10 M Ω or more			

Notes:

- 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 6 hours at the latest. Even when the warning is being 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.
The battery is subject to the effect of the environmental temperature; therefore, avoid using a battery in unnecessarily continuous operation at a high temperature.
- If the subsystem is not energized for more than six months, over-discharging of the battery occurs and can result in unrecoverable damage. In this situation, the battery must be energized more than six hours at least once every six months.

Table C.2 lists and describes the basic specifications of RKNAS.

Table C.2 Basic Specifications of NAS Unit (RKNAS)

Items		RKNAS Specifications	
Configuration	Configuration	1 RKNAS	
	Subsystem appearance		
Physical specifications	Start-up time (min)	Standard: 3 (Note 2)	
	Chassis size (W×D×H) (mm)	483×650×43	
	Mass (kg)	15 approx.	
	Acoustic noise (dB) (Note 1)	60 approx.	
	Required height (EIA unit)	1	
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)	2.0/1.4	
	Breaking current (A)	10.0	
	Heat value (kJ/h)	1,010 or less	
	Required power	Steady state (VA)	280 or less
		(Note 3) Starting state (VA)	280 or less

Note 1: A noise emitted at the time of start is not included.

Note 2: The start-up time may be longer than three minutes depending on the configuration.

Note 3: Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterruptible 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.

The correct power factor for the RKNAS is “0.70 - 0.90”. The manual incorrectly states the value as “1”.

Appendix D Interfaces

The Fibre Channel (Non-OFC) and Ethernet are used for an interface with the host computer. The AMS1000 provides a Fibre Channel interface with the control unit as standard. The NAS unit and iSCSI interface provides Ethernet interface as standard.

D.1 Fibre Channel Connection Specifications

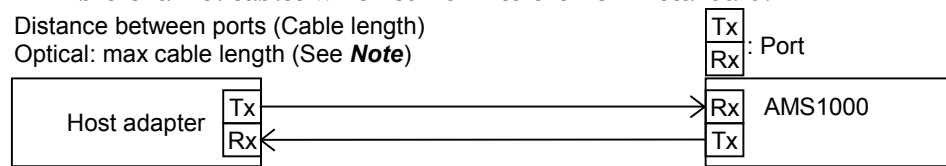
D.1.1 System Configuration

The maximum number of devices connectable to the FC-AL or FC-SW is 126 including AMS1000, host computers, and other Fibre Channel devices.

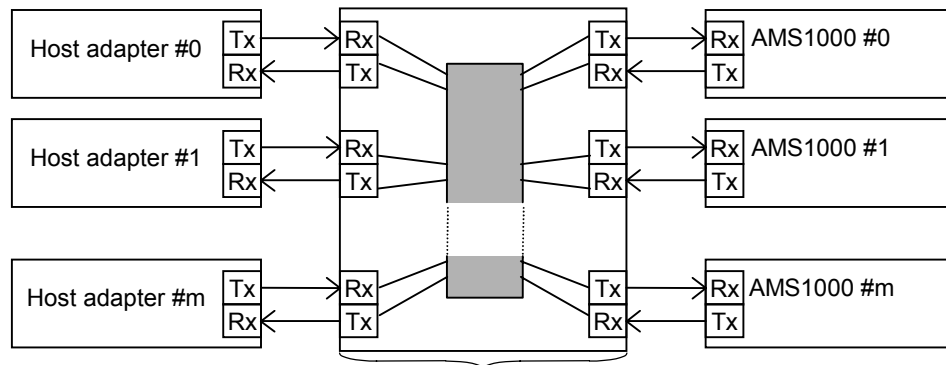
When constructing a system with the FC-AL or AC-SW, consider the following:

- Use the HUB which conforms to the FC-AL standard.
- If you use the least Fibre Channel devices connected with a Fibre Channel loop, you will have superior higher performance.
- Since high-speed serial data transfer is performed via Fibre Channel, use high-quality Fibre Channel cables which conform to the FC-PH standard.

Distance between ports (Cable length)
Optical: max cable length (See **Note**)



(a) Point to Point Connection



(b) FC-AL connection

Figure D.1 Fibre Channel Connection Specifications

Note:

Data transfer rate (MB/s)	100	200	400
Max 50/125 μ m multimode Fibre Cable length	500 m	300 m	150 m
Max 62.5/125 μ m multimode Fibre Cable length	300 m	150 m	70 m

D.1.2 Cable

Table D.1 shows specifications of the Fibre Channel interface cable. Figure D.2 shows the type of connector for the optical interface on the cable side.

Table D.1 Cable Specification

Cable Type	Interface Type	Cable Mode Name	Nominal		
			Cable	Connector	
				One Side	Other Side
SC-LC cable	Optical	Equivalent to sumitomo 3M 170AC-AAAA-XXX	50/125 μm , 62.5/125 μm Multimode	SC connector (JIS C 5973)	LC connector
LC-LC cable			Wavelength: 850 nm	LC connector	LC connector

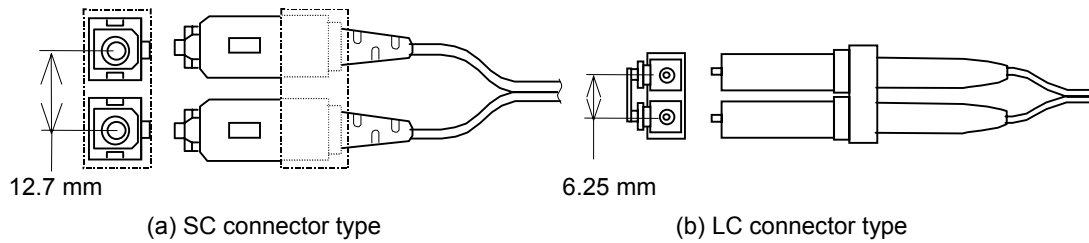


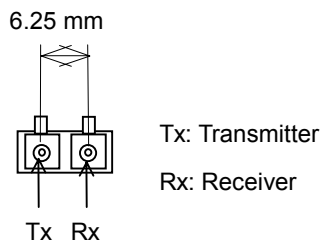
Figure D.2 Cable Side Connector

D.1.3 Connector on Storage System Side

Figure D.3 displays the type of connector for the optical interface on the subsystem side.

■ LC Connector Type

- Connector type: LC duplex receptacle connector
- Interval: 6.25 mm flat type two rows



LC connector type

Figure D.3 Shape of Connector

D.1.4 Ordered Set

Table D.2 displays the Ordered Sets defined by the Fibre Channel interface.

Table D.2 Ordered Set

No.	Classification	Name
1	Frame Delimiters	SOF (Start of Frame)
2		EOF (End of Frame)
3	Primitive Signals	IDLE
4		R_RDY (Receiver_Ready)
5		ARBx (Arbitrate)
6		OPNyx (Open full-duplex)
7		OPNyy (Open half-duplex)
8		OPNfr (Open broadcast replicate)
9		OPNyr (Open selective replicate)
10		CLS (Close)
11		MRKtx (Mark)
12		Primitive Sequence
13	OLS (Off-line)	
14	LR (Link Reset)	
15	LRR (Link Reset Response)	
16	LIP (Loop Initialization)	
17	LPEyx (Loop Port Enable)	
18	LPEfx (Loop Port Enable all)	
19	LPByx (Loop Port Bypass)	

- **Frame Delimiters**

The Frame Delimiter is an Ordered Sets that immediately precedes or follows a frame context, and consists of the SOF (Start of Frame) and the EOF (End of Frame).

- SOF (Start of Frame)

The SOF delimiter is an Ordered Set that immediately precedes the context of a frame. There are following SOF delimiters, shown in Table D.3, based on the service class, etc.

Table D.3 SOF Delimiters

No.	Name	Meaning	Remarks
1	SOFc1	A frame delimiter to be used to require the exclusive connection of the Class 1 service. Since the subsystem does not support the Class 1 service yet, it responds with R_RJT (Class not Supported) as to the frame.	—
2	SOFi1	A frame delimiter to be used when starting the sequence following the exclusive connection of the Class 1 service. Since the subsystem does not support the Class 1 service yet, it responds with R_RJT (Class not Supported) as to the frame.	—
3	SOFi2	This is used for the first frame that starts the sequence of the Class 2 service. Since the subsystem does not support the Class 2 service yet, it responds with R_RJT (Class not Supported) as to the frame.	—
4	SOFi3	This is used for the first frame that starts the sequence of the Class 3 service.	—
5	SOFn1	This is used for frames other than the first frame of the sequence of the Class 1 service. Since the subsystem does not support the Class 1 service yet, it responds with R_RJT (Class not Supported) as to the frame.	—
6	SOFn2	This is used for frames other than the first frame of the sequence of the Class 2 service. Since the subsystem does not support the Class 2 service yet, it responds with R_RJT (Class not Supported) as to the frame.	—
7	SOFn3	This is used for frames other than the first frame of the sequence of the Class 3 service.	—

– EOF (End of Frame)

The EOF delimiter is an Ordered Set that immediately follows the context of a frame. There are following EOF delimiters, shown in Table D.4, based on the service class, etc.

Table D.4 EOF Delimiters

No.	Name	Meaning	Remarks
1	EOFt	This shows that the sequence of the SEQ_ID which is owned by a frame.	—
2	EOFdt	This is used to cancel the exclusive connection. This identifies the final ACK of the sequence and shows that the sequence of the SEQ_ID owned by a frame has completed.	Class 1 is not supported.
3	EOFn	This is used when no other EOF delimiter (EOFt or EOFdt) which shows valid frame contents is required.	—
4	EOFdti	When the EOFdt has illegal contents, it is replaced with the EOFdti.	—
5	EOFni	When the EOFt or EOFn has illegal contents, it is replaced with the EOFni.	—
6	EOFa	This is used to terminate a partial frame owing to an error occurred during a transfer. A receiver must abandon the frame without making any response.	—

■ Primitive Signals

A Primitive Signal is a signal that has special meaning. The following Primitive Signals are defined:

– IDLE

An IDLE is a Primitive Signal transmitted on the link to indicate an operational Port facility is ready for frame transmission and reception. The IDLE is transferred when no frame, R_RDY, or primitive sequence is being transferred on a link.

– R_RDY(Receiver Ready)

The R_RDY indicates that a single Class 1 connect-request (SOFc1), Class 2, or Class 3 frame was received and that the interface buffer which received the frame is available for further frame reception.

– ARBx (Arbitrate) --- FC-AL

An ARBx is a Primitive Signal transmitted on a Loop by a participating L_Port to request access to the Loop. It may be sent instead of the IDLE when the AMS1000 is connected to the FC-AL.

– OPNyx (Open full-duplex) --- FC-AL

An OPNyx is a Primitive Signal transmitted on a Loop by a participating L_Port to indicate that it is ready for Data and Link Control frame transmission and reception.

– OPNy (Open half-duplex) --- FC-AL

An OPNy is a Primitive Signal transmitted on a Loop by a participating N_Port to indicate that it is ready for Data and Link Control frame transmission and Link Control frame reception.

– OPNfr (Open broadcast replicate) --- FC-AL

An OPNfr is a Primitive Signal transmitted on a Loop by a participating L_Port which desires to communicate with all participating L_Ports on the Loop.

– OPNsr (Open selective replicate) --- FC-AL

An OPNsr is a Primitive Signal transmitted on a Loop by a participating L_Port which desires to communicate with a subset of L_Ports on the Loop.

– CLS (Close) --- FC-AL

A CLS is sent by the L_Port. When the L_Port sends the CLS, it does not transfer the frame and the R_RDY to the current circuit.

The CLS shows that the control of the loop is ready to be abandoned or has already been abandoned.

– MRKtx (Mark) --- FC-AL

A MRKtx is a Primitive Signal transmitted on a Loop by a master control point to synchronize other Nodes.

■ Primitive Sequences

A Primitive sequences form an ordered set and they are transferred repeatedly and continuously while the certain condition exists. Types of the primitive sequence are shown below:

– NOS (Not Operational)

The NOS Primitive Sequence is transmitted to indicate that the Port transmitting this Sequence has detected a Link Failure condition or is Off-line, waiting for OLS to be received.

– OLS (Off-line)

The OLS Primitive Sequence is transmitted to indicate that the port transmitting this Sequence is:

- Initiating the Link Initialization Protocol,
- Receiving and recognizing NOS, or
- Entering the Off-line State.

– LR (Link Reset)

The LR Primitive Sequence is transmitted by a Port to initiate the Link Reset Protocol or to recover from a Link Time-out. Besides, the LR is possible to be sent when the N_Port which supports the Class 1 service becomes unable to decide the connection status.

– LRR (Link Reset Response)

The LRR Primitive Sequence is transmitted by a Port to indicate that it is receiving and recognizes the LR Primitive Sequence.

– LIP (Loop Initialization) --- FC-AL

The LIP Primitive Sequence is used by an L_Port to detect if it is part of a Loop or to recover from certain Loop errors.

– LPEyx (Loop Port Enable) ---FC-AL

The LPEyx is sent on the loop to reset the bypass circuit of the L_Port which was bypassed before and to put the L_Port in the enabled status.

– LPEfx (Loop Port Enable all) --- FC-AL

The LPEfx Primitive Sequence is transmitted on a Loop to reset all Bypass Circuit(s) that may have been previously set and enable all L_Port to participate on the Loop.

– LPByx (Loop Port Bypass) --- FC-AL

The LPByx Primitive Sequence is transmitted on a Loop to set the Bypass Circuit and to bypass an L_Port.

D.1.5 Frames

■ Frame Format

Table D.5 displays the frame format used with Fibre Channel.

Table D.5 Frame Format

Start of Frame (SOF)	Frame Header	Data File	CRC	End of Frame (EOF)
4 bytes	24 bytes	0 to 2112 bytes	4 bytes	4 bytes

– Start of Frame

The Start of Frame (SOF) delimiter is an Ordered Set that immediately precedes the frame context.

For the types of the SOF, refer to D.1.4).

– Frame Header

The Frame Header is used by the link control facility to control link operations, control device protocol transfers, and detect missing or out of order frames.

– Data Field

This field can take the following size depending on the frame type (see **Note**).

Link control frame: Data Field length = 0

Data frame: Data Field length = 0 to 2112

The optional header (see **Note**) may be supplied at the top of the Data Field of the data frame.

The data described in the data frame is Data Field excluding the option header.

This portion is called payload.

Note: The frame type and presence or absence of the optional header are prescribed by the Frame Header.

– CRC

The CRC is the Cyclic Redundancy Check code for checking data in the Frame Header and Data Field.

– End of Frame

The End of Frame (EOF) is a frame delimiter for identifying the end of a frame.

■ Header

The format of the Frame Header is shown in Table D.6.

Table D.6 Frame Format

Word	Bits 31 to 24	23 to 16	15 to 08	07 to 00
0	R_CTL	D_ID		
1	Reserved	S_ID		
2	TYPE	F_CTL		
3	SEQ_ID	DF_CTL	SEQ_CNT	
4	OX_ID		RX_ID	
5	Parameter			

- **R_CTL (Routing Control)**
The R_CTL field is used to categorize the frame function. Classification into the link control frame and data frame is done by the R_CTL.
- **D_ID (Destination ID)**
The D_ID field contains the address identifier of an N_Port or F_Port within the destination entity.
- **S_ID (Source ID)**
The S_ID field contains the address identifier of an N_Port or F_Port within the source entity.
- **TYPE (Data Structure Type)**
The TYPE field identifies the protocol of the frame content for Data Frames.
- **F_CTL (Frame Control)**
The F_CTL field contains control information relating to the frame contents. The control information includes the Exchange Context, Sequence Context, etc.
- **SEQ_ID (Sequence ID)**
The SEQ_ID field contains the SEQ_ID assigned by the Sequence Initiator, and it shall be unique for a specific D_ID and S_ID pair while the Sequence is Open.
- **DF_CTL (Data Field Control)**
The DF_CTL field specifies the presence of optional headers at the beginning of the Data Field.
- **SEQ_CNT**
The SEQ_CNT field indicates the sequential order of Data Frame transmission within a single sequence or multiple consecutive sequences for the same Exchange.

- **OX_ID (Originator Exchange ID)**

The OX_ID field identifies the Exchange ID assigned by the Originator of the Exchange.

Each Exchange shall be assigned an identifier unique to the Originator or Originator-Responder Pair.

- **RX_ID (Responder Exchange ID)**

The RX_ID is an identifier of the exchange assigned by the responder of the exchange. It is unique and locally significant for the responder.

- **Parameter**

In the link control frame, the parameter is used to transmit original information of the individual link control frame and in the data frame, it is used for the relative offset.

- **Header**

The presence of the Optional Headers is indicated by the DF_CTL field.

The treatment of the Optional Headers with the AMS1000 is shown in Table D.7.

Table D.7 Frame Format

No.	Name	Usage	Treatment with the Disk Array	Remarks
1	Expiration_Security Header	Used to specify the expiration time, etc. of the frame.	Ignores this header and processes the command.	16 bytes
2	Network Header	Used by a bridge or a gateway node which interfaces to an external Network.	Ignores this header and processes the command.	16 bytes
3	Association Header	Used to identify the process or process group.	Ignores this header and processes the command.	32 bytes
4	Device Header	Used by the upper level protocol.	Ignores this header and processes the command.	16 bytes 32 bytes 64 bytes

The AMS1000 does not add Optional Headers in a Data frame to be sent to other N_Ports.

The host computer shall not add Optional Headers in a frame sent to the AMS1000.

If the Optional Headers are added in the Data frames sent to the subsystem, correct operation in the AMS1000 is not guaranteed.

- **Link Control Frames**

Table D.8 displays the defined Link Control frames (FT-0) and supports Link Control frames. The AMS1000 supports link service frames shown in Table D.9.

Table D.8 Link Control Frames

No.	Name	Meaning	Support
1	ACK_1 (Acknowledge_1)	Indicates that a single Data frame is being acknowledged.	○ (<i>Note</i>)
2	ACK_0 (Acknowledge_0)	Indicates that all Data frames of a Sequence are being acknowledged.	×
3	ACK_N (Acknowledge_N)	Indicates that N consecutive Data frames of a Sequence are being acknowledged.	×
4	P_RJT (N_Port Reject)	Indicates that delivery of a frame is being denied. A four byte reject action and reason code is contained in the Parameter field.	○
5	F_RJT (Fabric Reject)	Indicates that delivery of a frame is being denied. A four byte reject action and reason code is contained in the Parameter field.	○
6	P_BSY (N_Port Busy)	Indicates that the responding N_Port is temporarily occupied with other link activity and is not able to accept the frame. A reason code is contained in the Parameter field.	○
7	F_BSY (Fabric Busy)	Indicates that the fabric or the destination N_Port is temporarily occupied with other link activity and the fabric is unable to deliver the frame. A reason code is contained in bits 31-28 of the TYPE field.	○
8	LCR (Link Credit Reset)	Indicates that the N_Port specified by the S_ID requests that the N_Port specified by the D_ID reset any buffers containing Data frames from the S_ID in order to allow the S_ID to reset its end-to-end Credit to its Login value.	○

Note: Support for the ACK_1 is given in the limited case where the PLOGI of the Class 2 is used.

■ **Data Frames**

The Data frames defined include:

- FC-4 Device_Data
- FC-4 Video_Data
- Link_Data
- FC-4 Device_Data is a frame which is used by the protocol prescribed by upper levels. (FCP Information Unit, etc.)
- FC-4 Video_Data is not supported by this equipment.
- Link_Data defines link services

D.1.6 Link Service

Table D.9 displays the Link Service frames supported by the AMS1000.

Table D.9 Link Service Frames Supported by AMS1000

No.	Classification	Name	Support	
			Issue	Receive
1	Basic Link Service	ABTS (Abort Sequence)	×	○
2		BA_ACC (Basic_Accept)	○	○
3		BA_RJT (Basic_Reject)	○	○
4		NOP (No Operation)	×	○
5		RMC (Remove Connection)	×	×
6	Extended Link Service	ABTX (Abort_Exchange)	×	×
7		ACC (Accept)	○	○
8		ADVC (Advice Credit)	×	×
9		ECHO (Echo)	×	×
10		ESTC (Estimate Credit)	×	×
11		PLOGI (N_Port Login)	○	○
12		LOGO (Logout)	○	○
13		LS_RJT (Link Service Reject)	○	○
14		FLOGI (Fabric Login)	○	○
15		RCS (Read Connection Status)	×	×
16		RES (Read Exchange Status Block)	×	×
17		RLS (Read Link Status)	×	○
18		RRQ (Reinstate Recovery Qualifier)	×	○
19		RSI (Request Sequence Initiative)	×	×
20		RSS (Read Sequence Status Block)	×	×
21		RTV (Read Time-out Value)	×	×
22		TEST (Test)	×	×
23		SCR (State Change Registration)	○	×
24		RSCN (Registered Status Change Notification)	○	○
25		FAN	×	○
26	Extended Link Service- Proc.	PRLI (Process Login)	×	○
27		PRLO (Process Logout)	○	○
28		SCN (State Change Notification)	×	×
29		TPLS (Test Process Login State)	×	×

No.	Classification	Name	Support	
			Issue	Receive
30	Extended Link Service-Alias	GAID (Get Alias_ID)	×	×
31		FACT (Fabric Activate Alias_ID)	×	×
32		FDACT (Fabric Deactivate Alias_ID)	×	×
33		NACT (N_Port Activate Alias_ID)	×	×
34		NDACT (N_Port Deactivate Alias_ID)	×	×
35	Extended Link Service-Class 4	QoS (Quality of Service Request)	×	×
36		RVCS (Read Virtual Circuit Status)	×	×
37	Extended Link Service - FC-AL	PDISC (Discover N_Port Service Parm)	×	○
38		FDISC (Discover F_Port Service Parm)	×	×
39		ADISC (Discover Address)	×	○
40		TPRLO (Third Party Process Logout)	×	○

D.1.7 FCP

- **Frame Format**

AMS1000 supports the six Information Units (IU) shown in Table D.10.

Table D.10 Information Unit

No.	Name	Meaning	Support
1	FCP_CMND	Transfers SCSI Command or Task Management	○
2	FCP_XFER_READY	Notifies FCP_DATA will be transferred.	○
3	FCP_DATA	Transfers Data.	○
4	FCP_RSP	Transfers Status Information	○
5	FCP_CMND+FCP_DATA	Transfers SCSI Command and the first Data within a single Information Unit. (Write Type Command)	×
6	FCP_DATA+FCP_RSP	Transfers last Data and the Status Information within a single Information Unit. (Read Type Command)	×

The format of the standard frame header used in the FCP is shown in Table D.11.

Table D.11 Frame Header Format

Bits	31 to 24	23 to 16	15 to 08	07 to 00
Word				
0	R_CTL	D_ID		
1	Reserved	S_ID		
2	TYPE	F_CTL		
3	SEQ_ID	DF_CTL	SEQ_CNT	
4	OX_ID		RX_ID	
5	RLTV_OFF			

- **R_CTL (Routing control)**
This is used to identify the information category of the FCP frame.
 - 1: FCP_DATA (Data In action, Data Out action)
 - 5: FCP_XFER_RDY (Data delivery request)
 - 6: FCP_CMND (Command/Task Management Request)
 - 7: FCP_RSP (Command/Task Management Response)
- **D_ID (Destination ID)**
This indicates the transmission destination of a frame. D_ID of the frame from the SCSI command issuer side (Exchange originator) is the target ID of SCSI-3.
- **S_ID**
This indicates the transmission destination of a frame. S_ID of the frame from the SCSI command issuer side (Exchange originator) is the initiator ID of SCSI-3.
- **TYPE (Data structure type)**
In the TYPE field of all frames of the FCP sequence, 0x08 is set.
- **F_CTL (Frame control)**
This consists of fields for controlling start of the sequence and exchange, and normal and abnormal terminations. For further details, refer to the FC-PH standard.
- **SEQ_ID (Sequence ID)**
This indicates an order of the frames in the sequence. For further details, refer to the FC-PH standard.
- **DF_CTL (Data field control)**
This indicates whether there is an optional header or not. The FCP requires no optional header.
- **OX_ID (Originator exchange ID)**
This indicates the exchange ID on the starting side of the exchange (initiator) and corresponds to the tag number of SCSI-3. (0xFFFF cannot be specified.)
- **RX_ID (Responder exchange ID)**
This indicates the exchange ID on the responding side of the exchange (target). Any value may be given to this. The responding side of the exchange can assign a unique value to OX_ID (tag).
- **RLTV_OFF (Relative offset)**
In the FCP-DATA IU, the offset (offset on the buffer allocated by the host) of the top byte of the payload of each frame is set. In other IU frames, 0 is set.

■ **FCP_CMND**

The FCP_CMND is sent from a host and is used for the task management instruction such as SCSI command issue and target reset. The payload of FCP_CMND is shown in Table D.1.12.

Table D.12 FCP_CMND Payload

Field Name	Definition	Size
FCP_LUN	Logical Unit Number	8 bytes
FCP_CNTL	byte 0: Reserved byte 1: Task Codes bit 7 to 3: Reserved bit 2 to 0: Task Attribute 000: SIMPLE_Q 001: HEAD_OF_Q 001: ORDERED_Q 100: ACA_Q (Not Supported) 101: UNTAGGED byte 2: Task Management Flags bit 7: TERMINATE TASK (Not Supported) bit 6: CLEAR ACA bit 5: TARGET RESET bit 4 to 3: Reserved bit 2: CLEAR TASK SET bit 1: ABORT TASK SET bit 0: Reserved byte 3: Execution Management Codes bit 7 to 2: Reserved bit 1: READ DATA bit 0: WRITE DATA	4 bytes
FCP_CDB	SCSI Command Descriptor Block	16 bytes
FCP_DL	Data Length	4 bytes

– **FCP_LUN**

The FCP_LUN field specifies the Logical Unit Number in which the issued SCSI Command is executed.

Table D.1.13 shows the format of the FCP_LUN field.

Table D.13 FCP_LUN Format

Byte	0	1	2	3	4	5	6	7
Logical unit number	0x00	LUN (Max.256)	0x00	0x00	0x00	0x00	0x00	0x00

– **FCP_CNTL**

The FCP_CNTL field contains the following control information.

– **Task Codes**

One of the following task attributes can be specified.

- **SIMPLE_QUEUE**

The SIMPLE_QUEUE attribute is specified when the task can be executed with the order that the array controller determines.

- **HEAD_OF_QUEUE**

The HEAD_OF_QUEUE attribute is specified when the task should be executed with the highest priority.

- **ORDERED_QUEUE**

The HEAD_OF_QUEUE attribute is specified when the task should be executed with the order of the task is issued.

- **ACA_QUEUE**

This attribute is not supported by the AMS1000.

- **UNTAGGED**

This attribute shows that a command has no tag.

– **Task Management Flags**

One of the following Task Management Flags can be specified.

- **TERMINATE TASK**

This Task Management Flag is not supported by the AMS1000.

- **CLEAR ACA**

Suspend the action of all the commands which is being executed with the Logical Unit from the host, or which is queuing, and then respond to ACA ACTIVE status. Also, release the Logical Unit from the ACA status.

- **TARGET RESET**

The TARGET RESET is used to clear all tasks in the AMS1000.

(Same as the SCSI-2 Bus Device Reset message)

- **CLEAR TASK SET**

The CLEAR TASK SET is used to clear all tasks in the specified Logical Unit.

(Same as the SCSI-2 Clear Queue message)

- **ABORT TASK SET**

The ABORT TASK SET is used to clear all tasks in the specified Logical Unit for the Initiator. (Same as the SCSI-2 Abort message)

The ABORT TASK (Same as the SCSI-2 Abort Tag message) is specified by the ABTS Link Service.

– **Execution Management**

The direction of the SCSI data transfer is specified in the Execution Management. The direction depends on the SCSI Command.

– **FCP_CDB**

The SCSI CDB (Command Descriptor Block) is contained in the FCP_CDB field.

The Command Link is not supported by the array controller.

The Link bit shall be set to 0.

When one of these bits is set to 1, the array controller terminates the command with a CHECK ONDITION status (Sense Key = ILLEGAL REQUEST).

– **FCP_DL**

The total length bytes of the SCSI data is set in the FCP_DL field. Data described with the number of bytes according to the data length set in the FCP_CDB is transferred irrespective of the value set in this field. The value in this field is checked when the status is sent, and the check result is reflected on the FCP_RSP.

D.1.8 FC-4 Device Data Frame/Name Server Request Commands

Table D.14 displays the FC-4 Device Data Frame/Name Server Request commands that the subsystem supports.

Table D.14 FC-4 Device Data Frame

No.	Name
1	FS_ACC
2	FS_RJT
3	RFT_ID (Register FC-4 TYPE)
4	RCS_ID (Register Class of Service)
5	RPT_ID (Register Port TYPE)
6	GPN_ID (Get Port Name)

D.1.9 Initialization Process

■ Link Initialization

When the array unit is turned on and becomes ready, the AMS1000 performs the Link Initialization process. The LR, LRR, NOS, OLS, and IDLE are exchanged between subsystem and the connected N_Port, and frames cannot be transmitted until the Active state.

The details of the Link Initialization process are shown in Table D.15.

At the beginning, the AMS1000 becomes OLS Transmit state, and the Link Initialization process continues until the Active state.

Table D.15 Link Initialization Process

Current State	Input and Next State					
	LR	LRR	NOS	OLS	IDLE	Los of Sync, Timeout
(OLS Transmit) Transmits OLS for min. 5 ms	(LR Receive)	State is not changed	(NOS Receive)	(OLS Receive)	State is not changed	(Wait for OLS)
(LR Receive) Transmits LRR	State is not changed	(LRR Receive)	(NOS Receive)	(OLS Receive)	(Active)	(NOS Transmit)
(OLS Receive) Transmits LR	(LR Receive)	(LRR Receive)	(NOS Receive)	State is not changed	State is not changed	(Wait for OLS)
(LRR Receive) Transmits IDLE	(LR Receive)	State is not changed	(NOS Receive)	(OLS Receive)	(Active)	(NOS Transmit)
(NOS Receive) Transmits OLS	(LR Receive)	State is not changed	State is not changed	(OLS Receive)	State is not changed	(NOS Transmit)
(Wait for OLS) Transmits NOS	(NOS Transmit)	(NOS Transmit)	(NOS Receive)	(OLS Receive)	State is not changed	State is not changed
(NOS Transmit) Transmits NOS	State is not changed	State is not changed	(NOS Receive)	(OLS Receive)	State is not changed	(NOS Transmit)
(Active)	(LR Receive)	(LRR Receive)	(NOS Receive)	(OLS Receive)	State is not changed	State is not changed

■ **Loop Initialization**

When the array unit is turned on and becomes ready and the Arbitrated Loop is detected, the AMS1000 performs the Loop Initialization process. The Loop Initialization is performed by ARBx (Arbitrate), LIP (Loop Initialization), CLS (Close), and the following Loop Initialization frames.

- **LISM:** Select Master based on 8-byte Port_Name
- **LIFA:** Fabric Assign AL_PA bit map
- **LIPA:** Previously Acquired AL_PA bit map
- **LIHA:** Hard Assigned AL_PA bit map
- **LISA:** Soft Assigned AL_PA bit map
- **LIRP:** Report AL_PA position map
- **LILP:** Loop AL_PA position map

The AMS1000 transmits LIP first. When LIP is detected by the AMS1000, the array controller transmits LISM. When the same LISM as the AMS1000 has transmitted is received at the array controller, the subsystem becomes a Loop Master, and the subsystem transmits and receives ARBx, LIFA, LIPA, LIHA, LISA, LIRP, and LILP with address map, and determines the AL_PA of each L_Port. At the end of the Loop Initialization, the subsystem transmits and receives CLS.

When the AMS1000 does not become a Loop Master, the transmission of LIFA, LIHA, LISA, LIRP, and LILP are initiated by the Loop Master. The AMS1000 receives bit map information, and may add own AL_PA, and transmits it to the next L_Port. At the end of the Loop Initialization, the subsystem receives and transmits CLS.

D.1.10 Fibre Channel Sequence Example

- FCP Information Unit

Read Commands

Sending all data with one FCP_DATA:

Initiator IU	Direction	Target IU
FCP_CMND	----->	
	<-----	FCP_XFER_READY
	<-----	FCP_DATA
	<-----	FCP_RSP

Sending all data dividing them into two or more FCP_DATAs.:

Initiator IU	Direction	Target IU
FCP_CMND	----->	
	<-----	FCP_XFER_READY
	<-----	FCP_DATA
	<-----	FCP_XFER_READY
	<-----	FCP_DATA
	<-----	FCP_XFER_READY
	<-----	FCP_DATA
	<-----	FCP_RSP

At the time of the Read Xfer Ready Disabled:

Initiator IU	Direction	Target IU
FCP_CMND	----->	
	<-----	FCP_XFER_DATA
	<-----	FCP_XFER_DATA
	<-----	FCP_RSP

The FCP_XFER_RDY is not sent before sending the FCP_XFER_DATA.

Write commands

Sending all data with the one FCP_DATA:

Initiator IU	Direction	Target IU
FCP_CMND	----->	
	<-----	FCP_XFER_READY
FCP_DATA	----->	
	<-----	FCP_RSP

Sending all data with the two or more FCP_DATAs:

Initiator IU	Direction	Target IU
FCP_CMND	----->	
	<-----	FCP_XFER_READY
FCP_DATA	----->	
	<-----	FCP_XFER_READY
FCP_DATA	----->	
	<-----	FCP_XFER_READY
FCP_DATA	----->	
	<-----	FCP_RSP

At the time of the Xfer Ready Disabled (not supported):

Initiator IU	Direction	Target IU
FCP_CMND	----->	
FCP_DATA	----->	
	<-----	FCP_XFER_READY
FCP_DATA	----->	
	<-----	FCP_XFER_READY
FCP_DATA	----->	
	<-----	FCP_RSP

The FCP_XFER_RDY is not sent before sending the first FCP_DATA.

Control commands (with no data transfer):

Initiator IU	Direction	Target IU
FCP_CMND	-----> <-----	FCP_RSP

Queue Full, Busy, and Check Condition (before data transfer):

Initiator IU	Direction	Target IU
FCP_CMND	-----> <-----	FCP_RSP

Status such as the Queue Full and Busy are stored in the FCP_RSP.

Task management FCP_CMND (Target, Reset, Clear Task Set, and Abort Task Set):

Initiator IU	Direction	Target IU
FCP_CMND	-----> <-----	FCP_RSP

- **Link service**

FLOGI, PLOGI, LOGO, PRLI, and PRLO

When the command is accepted normally:

LS_Command	Direction	LS_Command
Host Login (PLOGI)	-----> <-----	Accept (ACC)

When the command is rejected:

LS_Command	Direction	LS_Command
Host Login (PLOGI)	-----> <-----	Link Service Reject (LS_RJT)

- **Loop Initialization**

When the subsystem becomes the loop master:

<AMS1000>	Direction	
LIP, LIP	-----> <-----	LIP, LIP
LISM, LISM(*1)	-----> <-----	LISM, LISM
ARB (F0), ARB (F0)	-----> <-----	ARB (F0), ARB (F0)
LIFA	-----> <-----	LIFA
LIPA	-----> <-----	LIPA
LIHA	-----> <-----	LIHA
LISA	-----> <-----	LISA
LIRP	-----> <-----	LIRP
LILP	-----> <-----	LILP
CLS (Close)	----->	

Note: The subsystem becomes the loop master when it sends the LISM with AL_PA = EF and the same LISM is returned. The AL_PA is decided by the LIFA, LIPA, LIHA, LISA, LIRP, and LILP frames and the initialization is completed by the CLS.

When another loop master exists:

<AMS1000>	Direction	
LIP, LIP	<p style="text-align: center;">-----></p> <p style="text-align: center;"><-----</p>	LIP, LIP
LISM, LISM	<p style="text-align: center;">-----></p> <p style="text-align: center;"><-----</p> <p style="text-align: center;"><-----</p>	LISM, LISM ARB (F0), ARB (F0)
ARB (F0), ARB (F0)	<p style="text-align: center;">-----></p> <p style="text-align: center;"><-----</p>	LIFA
LIFA	<p style="text-align: center;">-----></p> <p style="text-align: center;"><-----</p>	LIPA
LIPA	<p style="text-align: center;">-----></p> <p style="text-align: center;"><-----</p>	LIHA
LIHA	<p style="text-align: center;">-----></p> <p style="text-align: center;"><-----</p>	LISA
LISA	<p style="text-align: center;">-----></p> <p style="text-align: center;"><-----</p>	LIRP
LIRP	<p style="text-align: center;">-----></p> <p style="text-align: center;"><-----</p>	LILP
LILP	<p style="text-align: center;">-----></p> <p style="text-align: center;"><-----</p>	CLS (Close)

- **Fabric Connection**

Table D.16 displays the basic sequence of the frame at the time of start-up when the subsystem is in the fabric connection.

Table D.16 Link Initialization Process

No	Opponent Party	Frame	Direction	Frame	<AMS1000>
1	<Fabric>	FAN	→		Is monitoring the PR_TOV timer
	<Fabric>		←	FLOGI	S_IDis issued with: PtoP=0x000000 FC_AL=0x0000AL_PA
		ACC	→		
2	<Name Server>		←	PLOGI	Logs in the name server.
		ACC	→		
3	<Name Server>		←	RCS_ID	Registers the support class.
		FS_ACC	→		
4	<Name Server>		←	RFT_ID	Registers the FC-4 type.
		FS_ACC	→		
5	<Name Server>		←	RPT_ID	Registers the type of own port as the N/NL.
		FS_ACC	→		
6	<Fabric Controller>		←	SCR	Receives and registers the RSCN. (=3: Full Registration)
		ACC	→		
7	<Fabric Controller>		←	RSCN	Requires a host computer for an issue of RSCN again. (ADR format = 0 Affected N_Port ID = Own port address)
		ACC	→		

- **Response when receiving the ELS without the PLOGI.**

Table D.17 displays the response made when receiving the ELS without the PLOGI.

Table D.17 Response when Receiving ELS without PLOGI

Frame Received	Response	
	In FC_AL	In Point-to-Point (fabric) Connection
FCP_CMND	No response (frame is abandoned.)	No response (frame is abandoned.)
PLOGI	Usual operation (Response in normal state: ACC Response when an error occurs: LS_RJT)	Usual operation (Response in normal state: ACC Response when an error occurs: LS_RJT)
FLOGI	Response with ACC (N_Port)	Response with ACC (N_Port)
LOGO	Usual operation (Response in normal state: ACC Response when an error occurs: LS_RJT)	Usual operation (Response in normal state: ACC Response when an error occurs: LS_RJT)
PRLI	Response with LOGO	Response with LOGO
PRLO	Response with LOGO	Response with LOGO
ADISC	Response with LOGO	Response with LOGO
PDISC	Response with LOGO	Response with LOGO
TPRLO	Response with LOGO	Response with LOGO
Other	Response with LOGO	Response with LOGO

The following response is made while the basic sequence (FLOGI to RSCN) of the frame is being executed when the subsystem starts up in the fabric connection.

When the received frame is the FAN, normal operation is done.

When the received frame is the PLOGI, ADISC, or PDISC, a response is made with the LS_RJT.

When the other frame is received, no response is made (the frame is abandoned).

D.2 Ethernet Connection Specifications

D.2.1 System Configuration

To configure this NAS system, use the switches complied with the following standards:

IEEE 802.1D STP
IEEE 802.1w RSTP
IEEE 802.3 CSMA/CD
IEEE 802.3u Fast Ethernet
IEEE 802.3z 1000BaseX
IEEE 802.1Q Virtual LANs
IEEE 802.3ad Dynamic LACP

RFC 768 UDP
RFC 783 TFTP
RFC 791 IP
RFC 793 TCP
RFC 1157 SNMP v1
RFC 1213 MIB II
RFC 1757 RMON
RFC 1901 SNMP v2

- Cable

Table D.18 lists and describes the cable specification for LAN interface and the connector type.

Table D.18 Response when Receiving ELS without PLOGI

Cable Type	Corresponding Transmission Band	Specification	
		Cable	Connector
Category 6	1000BASE-TX	UTP or STP (<i>Note</i>)	RJ-45

Note: It is recommended to use the STP cable that suppresses the radio noise.

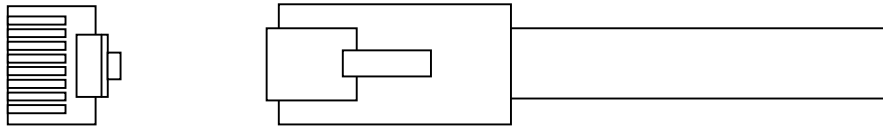


Figure D.4 Connector Type on the Cable Side

- **Connector Type on the Subsystem Side**

Figure D.5 shows the connector type for the LAN interface on the subsystem side.

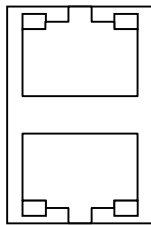


Figure D.5 Connector Type on Subsystem Side

D.2.2 Notes on iSCSI Connection

Do not change the host computer's registry(TCP/IP Stack), use the default value.

Appendix E Remote Adapter Specifications

E.1 Remote Adapter Specifications

Table E.1 Remote Adapter Specifications

Item		Remote Adapter (Main unit) (DF-F700-VR4A)	Remote Adapter (Hub) (DF-F700-VR4H)
Physical Specifications	Chassis size (W×D×H) (mm)	109×190×42	219×190×42
	Mass (kg)	1	2
Input power specifications	Input voltage (V)	AC100-120/200-240	
	Frequency (Hz)	50/60 ±1	
	Number of phases, cabling	Single-phase with protective grounding	
Steady-state current (A)		0.15	
Environmental specifications	Temperature (°C)	In operation: 10 to 40 In non-operation: -10 to 50 In transport/storage: -30 to 60	
	Humidity (%)	In operation: 8 to 80 In non-operation: 8 to 90 In transport/storage: 5 to 100	
	Vibration (m/s ²)	In operation: 2.5 or less (5 to 300Hz) In non-operation: 5.0 or less (5 to 300Hz) In transport/storage: 5.0 or less	
Insulation performance	Insulation withstand voltage	AC1,500 V (10 mA, 1 min)	
	Insulation resistance	DC500 V, 10 M Ω or more	

E.2 Remote Adapter Dimensions

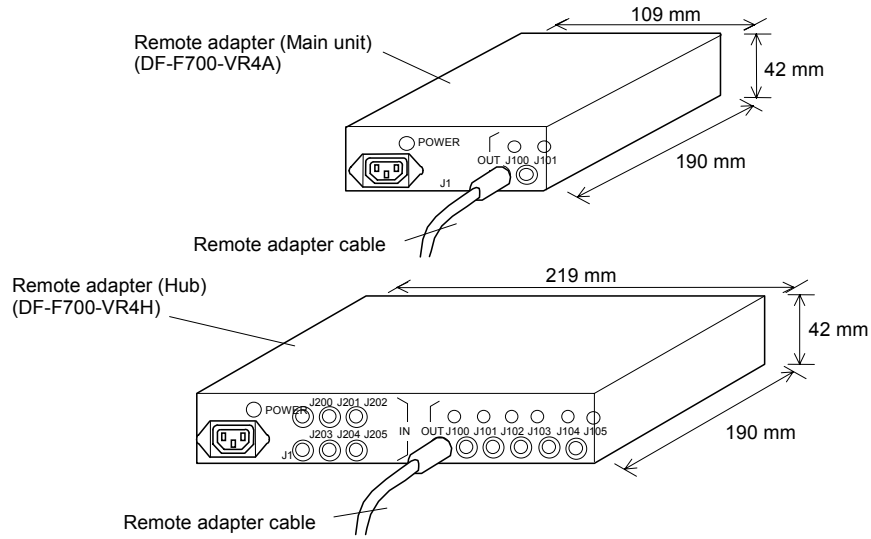


Figure E.1 Information Message Screen

Appendix F 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 GB = 1,000,000,000 bytes.

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

Table F.1 List of Capacities Corresponding to RAID0 (72 GB)

Disk capacity	71.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D	2 142.62	14 998.35	30 2139.33	44 3137.69	60 4278.67	74 5277.03	90 6418.01	104 7416.37	120 8557.35	134 9555.70	150 10696.68	164 11695.04	180 12836.02	194 13834.38	210 14975.36	224 15973.72
3D	3 213.93	15 1069.66	30 2139.33	45 3209.00	60 4278.67	75 5348.34	90 6418.01	105 7487.68	120 8557.35	135 9627.01	150 10696.68	165 11766.35	180 12836.02	195 13905.69	210 14975.36	225 16045.03
4D	4 285.24	12 855.73	28 1996.71	44 3137.69	60 4278.67	72 5134.41	88 6275.39	104 7416.37	120 8557.35	132 9413.08	148 10554.06	164 11695.04	180 12836.02	192 13691.76	208 14832.74	224 15973.72
5D	5 356.55	15 1069.66	30 2139.33	45 3209.00	60 4278.67	75 5348.34	90 6418.01	105 7487.68	120 8557.35	135 9627.01	150 10696.68	165 11766.35	180 12836.02	195 13905.69	210 14975.36	225 16045.03
6D	6 427.86	12 855.73	30 2139.33	42 2995.07	60 4278.67	72 5134.41	90 6418.01	102 7273.74	120 8557.35	132 9413.08	150 10696.68	162 11552.42	180 12836.02	192 13691.76	210 14975.36	222 15831.09
7D	7 499.17	14 998.35	28 1996.71	42 2995.07	56 3993.43	70 4991.78	84 5990.14	100 7487.68	119 8486.03	133 9484.39	147 10482.75	161 11481.11	175 12479.47	189 13477.82	210 14975.36	224 15973.72
8D	8 570.49	8 570.49	24 1711.47	40 2852.45	56 3993.43	72 5134.41	88 6275.39	104 7416.37	120 8557.35	128 9127.84	144 10268.82	160 11409.80	176 12550.78	192 13691.76	208 14832.74	224 15973.72
9D	9 641.80	9 641.80	27 1925.40	45 3209.00	54 3850.80	72 5134.41	90 6418.01	99 7059.81	117 8343.41	135 9627.01	144 10268.82	162 11552.42	180 12836.02	189 13477.82	207 14761.43	225 16045.03
10D	10 713.11	10 713.11	30 2139.33	40 2852.45	60 4278.67	70 4991.78	90 6418.01	100 7131.12	120 8557.35	130 9270.46	150 10696.68	160 11409.80	180 12836.02	190 13549.13	210 14975.36	220 15688.47
11D	11 784.42	11 784.42	22 1568.84	44 3137.69	55 3922.11	66 4706.54	88 6275.39	99 7059.81	110 7844.23	132 9413.08	143 10197.50	165 11766.35	176 12550.78	187 13335.20	209 14904.05	220 15688.47
12D	12 855.73	12 855.73	24 1711.47	36 2567.20	60 4278.67	72 5134.41	84 5990.14	96 6845.88	120 8557.35	132 9413.08	144 10268.82	156 11124.55	180 12836.02	192 13691.76	204 14547.49	216 15403.23
13D	13 927.04	13 927.04	26 1854.09	39 2781.13	52 3708.18	65 4635.23	78 5562.27	104 7416.37	117 8343.41	130 9270.46	143 10197.50	156 11124.55	169 12051.60	195 13905.69	208 14832.74	221 15759.78
14D	14 998.35	14 998.35	28 1996.71	42 2995.07	56 3993.43	70 4991.78	84 5990.14	98 6988.50	112 7986.86	126 8985.21	140 9983.57	154 10981.93	168 11980.29	182 12978.64	210 14975.36	224 15973.72
15D	15 1069.66	15 1069.66	30 2139.33	45 3209.00	60 4278.67	75 5348.34	90 6418.01	105 7487.68	120 8557.35	135 9627.01	150 10696.68	165 11766.35	180 12836.02	195 13905.69	210 14975.36	225 16045.03
16D	0 0.00	0 0.00	16 1140.98	32 2281.96	48 3422.94	64 4563.92	80 5704.90	96 6845.88	112 7986.86	128 9127.84	144 10268.82	160 11409.80	176 12550.78	192 13691.76	208 14832.74	224 15973.72

Table F.1 List of Capacities Corresponding to RAID0 (72 GB) (continued)

Disk capacity	71.3 G bytes														
Component unit	RKAJ														
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)
2D	240 17114.70	254 18113.05	270 19254.03	284 20252.39	300 21393.37	314 22391.73	330 23532.71	344 24531.07	360 25672.05	374 26670.41	390 27811.39	404 28809.74	420 29950.72	434 30949.08	450 32090.06
3D	240 17114.70	255 18184.37	270 19254.03	285 20323.70	300 21393.37	315 22463.04	330 23532.71	345 24602.38	360 25672.05	375 26741.72	390 27811.39	405 28881.05	420 29950.72	435 31020.39	450 32090.06
4D	240 17114.70	252 17970.43	268 19111.41	284 20252.39	300 21393.37	312 22249.11	328 23390.09	344 24531.07	360 25672.05	372 26527.78	388 27668.76	404 28809.74	420 29950.72	432 30806.46	448 31947.44
5D	240 17114.70	255 18184.37	270 19254.03	285 20323.70	300 21393.37	315 22463.04	330 23532.71	345 24602.38	360 25672.05	375 26741.72	390 27811.39	405 28881.05	420 29950.72	435 31020.39	450 32090.06
6D	240 17114.70	252 17970.43	270 19254.03	282 20109.77	300 21393.37	312 22249.11	330 23532.71	342 24388.45	360 25672.05	372 26527.78	390 27811.39	402 28667.12	420 29950.72	432 30806.46	450 32090.06
7D	238 16972.07	252 17970.43	266 18968.79	280 19967.15	294 20965.50	315 22463.04	329 23461.40	343 24459.76	357 25458.11	371 26456.47	385 27454.83	399 28453.19	420 29950.72	434 30949.08	448 31947.44
8D	240 17114.70	248 17685.19	264 18826.17	280 19967.15	296 21108.13	312 22249.11	328 23390.09	344 24531.07	360 25672.05	368 26242.54	384 27383.52	400 28524.50	416 29665.48	432 30806.46	448 31947.44
9D	234 16686.83	252 17970.43	270 19254.03	279 19895.84	297 21179.44	315 22463.04	324 23104.84	342 24388.45	360 25672.05	369 26313.85	387 27597.45	405 28881.05	414 29522.86	432 30806.46	450 32090.06
10D	240 17114.70	250 17827.81	270 19254.03	280 19967.15	300 21393.37	310 22106.48	330 23532.71	340 24245.82	360 25672.05	370 26385.16	390 27811.39	400 28524.50	420 29950.72	430 30663.84	450 32090.06
11D	231 16472.90	253 18041.74	264 18826.17	275 19610.59	297 21179.44	308 21963.86	330 23532.71	341 24317.13	352 25101.56	374 26670.41	385 27454.83	396 28239.25	418 29808.10	429 30592.52	440 31376.95
12D	240 17114.70	252 17970.43	264 18826.17	276 19681.90	300 21393.37	312 22249.11	324 23104.84	336 23960.58	360 25672.05	372 26527.78	384 27383.52	396 28239.25	420 29950.72	432 30806.46	444 31662.19
13D	234 16686.83	247 17613.88	260 18540.92	273 19467.97	299 21322.06	312 22249.11	325 23176.15	338 24103.20	351 25030.25	364 25957.29	390 27811.39	403 28738.43	416 29665.48	429 30592.52	442 31519.57
14D	238 16972.07	252 17970.43	266 18968.79	280 19967.15	294 20965.50	308 21963.86	322 22962.22	336 23960.58	350 24958.94	364 25957.29	378 26955.65	392 27954.01	420 29950.72	434 30949.08	448 31947.44
15D	240 17114.70	255 18184.37	270 19254.03	285 20323.70	300 21393.37	315 22463.04	330 23532.71	345 24602.38	360 25672.05	375 26741.72	390 27811.39	405 28881.05	420 29950.72	435 31020.39	450 32090.06
16D	240 17114.70	240 17114.70	256 18255.68	272 19396.66	288 20537.64	304 21678.62	320 22819.60	336 23960.58	352 25101.56	368 26242.54	384 27383.52	400 28524.50	416 29665.48	432 30806.46	448 31947.44

Table F.2 List of Capacities Corresponding to RAID1 (72 GB)

Disk capacity	71.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
1D+1D	2 71.31	14 499.17	30 1069.66	44 1568.84	60 2139.33	74 2638.51	90 3209.00	104 3708.18	120 4278.67	134 4777.85	150 5348.34	164 5847.52	180 6418.01	194 6917.19	210 7487.68	224 7986.86
Disk capacity	71.3 G bytes															
Component unit	RKAJ															
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)	
1D+1D	240 8557.35	254 9056.52	270 9627.01	284 10126.19	300 10696.68	314 11195.86	330 11766.35	344 12265.53	360 12836.02	374 13335.20	390 13905.69	404 14404.87	420 14975.36	434 15474.54	450 16045.03	

Table F.3 List of Capacities Corresponding to RAID5 (72 GB)

Disk capacity	71.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D+1P	3 142.62	15 713.11	30 1426.22	45 2139.33	60 2852.45	75 3565.56	90 4278.67	105 4991.78	120 5704.90	135 6418.01	150 7131.12	165 7844.23	180 8557.35	195 9270.46	210 9983.57	225 10696.68
3D+1P	4 213.93	12 641.80	28 1497.53	44 2353.27	60 3209.00	72 3850.80	88 4706.54	104 5562.27	120 6418.01	132 7059.81	148 7915.54	164 8771.28	180 9627.01	192 10268.82	208 11124.55	224 11980.29
4D+1P	5 285.24	15 855.73	30 1711.47	45 2567.20	60 3422.94	75 4278.67	90 5134.41	105 5990.14	120 6845.88	135 7701.61	150 8557.35	165 9413.08	180 10268.82	195 11124.55	210 11980.29	225 12836.02
5D+1P	6 356.55	12 713.11	30 1782.78	42 2495.89	60 3565.56	72 4278.67	90 5348.34	102 6061.45	120 7131.12	132 7844.23	150 8913.90	162 9627.01	180 10696.68	192 11409.80	210 12479.47	222 13192.58
6D+1P	7 427.86	14 855.73	28 1711.47	42 2567.20	56 3422.94	70 4278.67	84 5134.41	105 6418.01	119 7273.74	133 8129.48	147 8985.21	161 9840.95	175 10696.68	189 11552.42	210 12836.02	224 13691.76
7D+1P	8 499.17	8 499.17	24 1497.53	40 2495.89	56 3494.25	72 4492.60	88 5490.96	104 6489.32	120 7487.68	128 7986.86	144 8985.21	160 9983.57	176 10981.93	192 11980.29	208 12978.64	224 13977.00
8D+1P	9 570.49	9 570.49	27 1711.47	45 2852.45	54 3422.94	72 4563.92	90 5704.90	99 6275.39	117 7416.37	135 8557.35	144 9127.84	162 10268.82	180 11409.80	189 11980.29	207 13121.27	225 14262.25
9D+1P	10 641.80	10 641.80	30 1925.40	40 2567.20	60 3850.80	70 4492.60	90 5776.21	100 6418.01	120 7701.61	130 8343.41	150 9627.01	160 10268.82	180 11552.42	190 12194.22	210 13477.82	220 14119.62
10D+1P	11 713.11	11 713.11	22 1426.22	44 2852.45	55 3565.56	66 4278.67	88 5704.90	99 6418.01	110 7131.12	132 8557.35	143 9270.46	165 10696.68	176 11409.80	187 12122.91	209 13549.13	220 14262.25
11D+1P	12 784.42	12 784.42	24 1568.84	36 2353.27	60 3922.11	72 4706.54	84 5490.96	96 6275.39	120 7844.23	132 8628.66	144 9413.08	156 10197.50	180 11766.35	192 12550.78	204 13335.20	216 14119.62
12D+1P	13 855.73	13 855.73	26 1711.47	39 2567.20	52 3422.94	65 4278.67	78 5134.41	104 6845.88	117 7701.61	130 8557.35	143 9413.08	156 10268.82	169 11124.55	195 12836.02	208 13691.76	221 14547.49
13D+1P	14 927.04	14 927.04	28 1854.09	42 2781.13	56 3708.18	70 4635.23	84 5562.27	98 6489.32	112 7416.37	126 8343.41	140 9270.46	154 10197.50	168 11124.55	182 12051.60	210 13905.69	224 14832.74
14D+1P	15 998.35	15 998.35	30 1996.71	45 2995.07	60 3993.43	75 4991.78	90 5990.14	105 6988.50	120 7986.86	135 8985.21	150 9983.57	165 10981.93	180 11980.29	195 12978.64	210 13977.00	225 14975.36
15D+1P	0 0.00	0 0.00	16 1069.66	32 2139.33	48 3209.00	64 4278.67	80 5348.34	96 6418.01	112 7487.68	128 8557.35	144 9627.01	160 10696.68	176 11766.35	192 12836.02	208 13905.69	224 14975.36

Table F.3 List of Capacities Corresponding to RAID5 (72 GB) (continued)

Disk capacity	71.3 G bytes														
Component unit	RKAJ														
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)
2D+1P	240 11409.80	255 12122.91	270 12836.02	285 13549.13	300 14262.25	315 14975.36	330 15688.47	345 16401.58	360 17114.70	375 17827.81	390 18540.92	405 19254.03	420 19967.15	435 20680.26	450 21393.37
3D+1P	240 12836.02	252 13477.82	268 14333.56	284 15189.29	300 16045.03	312 16686.83	328 17542.56	344 18398.30	360 19254.03	372 19895.84	388 20751.57	404 21607.31	420 22463.04	432 23104.84	448 23960.58
4D+1P	240 13691.76	255 14547.49	270 15403.23	285 16258.96	300 17114.70	315 17970.43	330 18826.17	345 19681.90	360 20537.64	375 21393.37	390 22249.11	405 23104.84	420 23960.58	435 24816.31	450 25672.05
5D+1P	240 14262.25	252 14975.36	270 16045.03	282 16758.14	300 17827.81	312 18540.92	330 19610.59	342 20323.70	360 21393.37	372 22106.48	390 23176.15	402 23889.27	420 24958.94	432 25672.05	450 26741.72
6D+1P	238 14547.49	252 15403.23	266 16258.96	280 17114.70	294 17970.43	315 19254.03	329 20109.77	343 20965.50	357 21821.24	371 22676.97	385 23532.71	399 24388.45	420 25672.05	434 26527.78	448 27383.52
7D+1P	240 14975.36	248 15474.54	264 16472.90	280 17471.25	296 18469.61	312 19467.97	328 20466.33	344 21464.68	360 22463.04	368 22962.22	384 23960.58	400 24958.94	416 25957.29	432 26955.65	448 27954.01
8D+1P	234 14832.74	252 15973.72	270 17114.70	279 17685.19	297 18826.17	315 19967.15	324 20537.64	342 21678.62	360 22819.60	369 23390.09	387 24531.07	405 25672.05	414 26242.54	432 27383.52	450 28524.50
9D+1P	240 15403.23	250 16045.03	270 17328.63	280 17970.43	300 19254.03	310 19895.84	330 21179.44	340 21821.24	360 23104.84	370 23746.64	390 25030.25	400 25672.05	420 26955.65	430 27597.45	450 28881.05
10D+1P	231 14975.36	253 16401.58	264 17114.70	275 17827.81	297 19254.03	308 19967.15	330 21393.37	341 22106.48	352 22819.60	374 24245.82	385 24958.94	396 25672.05	418 27098.27	429 27811.39	440 28524.50
11D+1P	240 15688.47	252 16472.90	264 17257.32	276 18041.74	300 19610.59	312 20395.01	324 21179.44	336 21963.86	360 23532.71	372 24317.13	384 25101.56	396 25885.98	420 27454.83	432 28239.25	444 29023.68
12D+1P	234 15403.23	247 16258.96	260 17114.70	273 17970.43	299 19681.90	312 20537.64	325 21393.37	338 22249.11	364 23104.84	390 23960.58	403 25672.05	416 26527.78	429 27383.52	442 28239.25	450 29094.99
13D+1P	238 15759.78	252 16686.83	266 17613.88	280 18540.92	294 19467.97	308 20395.01	322 21322.06	336 22249.11	360 23176.15	378 24103.20	392 25030.25	406 25957.29	420 27811.39	434 28738.43	448 29665.48
14D+1P	240 15973.72	255 16972.07	270 17970.43	285 18968.79	300 19967.15	315 20965.50	330 21963.86	345 22962.22	360 23960.58	375 24958.94	390 25957.29	405 26955.65	420 27954.01	435 28952.37	450 29950.72
15D+1P	240 16045.03	240 16045.03	256 17114.70	272 18184.37	288 19254.03	304 20323.70	320 21393.37	336 22463.04	352 23532.71	368 24602.38	384 25672.05	400 26741.72	416 27811.39	432 28881.05	448 29950.72

Table F.4 List of Capacities Corresponding to RAID6 (72 GB)

Disk capacity	71.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15(Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D+2P	4 142.62	12 427.86	28 998.35	44 1568.84	60 2139.33	72 2567.20	88 3137.69	104 3708.18	120 4278.67	132 4706.54	148 5277.03	164 5847.52	180 6418.01	192 6845.88	208 7416.37	224 7986.86
3D+2P	5 213.93	15 641.80	30 1283.60	45 1925.40	60 2567.20	75 3209.00	90 3850.80	105 4492.60	120 5134.41	135 5776.21	150 6418.01	165 7059.81	180 7701.61	195 8343.41	210 8985.21	225 9627.01
4D+2P	6 285.24	12 570.49	30 1426.22	42 1996.71	60 2852.45	72 3422.94	90 4278.67	102 4849.16	120 5704.90	132 6275.39	150 7131.12	162 7701.61	180 8557.35	192 9127.84	210 9983.57	222 10554.06
5D+2P	7 356.55	14 713.11	28 1426.22	42 2139.33	56 2852.45	70 3565.56	84 4278.67	105 5348.34	119 6061.45	133 6774.56	147 7487.68	161 8200.79	175 8913.90	189 9627.01	210 10696.68	224 11409.80
6D+2P	8 427.86	8 427.86	24 1283.60	40 2139.33	56 2995.07	72 3850.80	88 4706.54	104 5562.27	120 6418.01	128 6845.88	144 7701.61	160 8557.35	176 9413.08	192 10268.82	208 11124.55	224 11980.29
7D+2P	9 499.17	9 499.17	27 1497.53	45 2495.89	54 2995.07	72 3993.43	90 4991.78	99 5490.96	117 6489.32	135 7487.68	144 7986.86	162 8985.21	180 9983.57	189 10482.75	207 11481.11	225 12479.47
8D+2P	10 570.49	10 570.49	30 1711.47	40 2281.96	60 3422.94	70 3993.43	90 5134.41	100 5704.90	120 6845.88	130 7416.37	150 8557.35	160 9127.84	180 10268.82	190 10839.31	210 11980.29	220 12550.78
9D+2P	11 641.80	11 641.80	22 1283.60	44 2567.20	55 3209.00	66 3850.80	88 5134.41	99 5776.21	110 6418.01	132 7701.61	143 8343.41	165 9627.01	176 10268.82	187 10910.62	209 12194.22	220 12836.02
10D+2P	12 713.11	12 713.11	24 1426.22	36 2139.33	60 3565.56	72 4278.67	84 4991.78	96 5704.90	120 7131.12	132 7844.23	144 8557.35	156 9270.46	180 10696.68	192 11409.80	204 12122.91	216 12836.02
11D+2P	13 784.42	13 784.42	26 1568.84	39 2353.27	52 3137.69	65 3922.11	78 4706.54	104 6275.39	117 7059.81	130 7844.23	143 8628.66	156 9413.08	169 10197.50	195 11766.35	208 12550.78	221 13335.20
12D+2P	14 855.73	14 855.73	28 1711.47	42 2567.20	56 3422.94	70 4278.67	84 5134.41	98 5990.14	112 6845.88	126 7701.61	140 8557.35	154 9413.08	168 10268.82	182 11124.55	210 12836.02	224 13691.76
13D+2P	15 927.04	15 927.04	30 1854.09	45 2781.13	60 3708.18	75 4635.23	90 5562.27	105 6489.32	120 7416.37	135 8343.41	150 9270.46	165 10197.50	180 11124.55	195 12051.60	210 12978.64	225 13905.69
14D+2P	0 0.00	0 0.00	16 998.35	32 1996.71	48 2995.07	64 3993.43	80 4991.78	96 5990.14	112 6988.50	128 7986.86	144 8985.21	160 9983.57	176 10981.93	192 11980.29	208 12978.64	224 13977.00
15D+2P	0 0.00	0 0.00	17 1069.66	34 2139.33	51 3209.00	68 4278.67	85 5348.34	102 6418.01	119 7487.68	119 7487.68	136 8557.35	153 9627.01	170 10696.68	187 11766.35	204 12836.02	221 13905.69
16D+2P	0 0.00	0 0.00	18 1140.98	36 2281.96	54 3422.94	72 4563.92	90 5704.90	90 5704.90	108 6845.88	126 7986.86	144 9127.84	162 10268.82	180 11409.80	180 11409.80	198 12550.78	216 13691.76
17D+2P	0 0.00	0 0.00	19 1212.29	38 2424.58	57 3636.87	76 4849.16	95 6061.45	114 7273.74	133 8486.03	133 8486.03	152 9698.33	171 10910.62	190 12122.91	209 13335.20	209 13335.20	224 14119.62
18D+2P	0 0.00	0 0.00	20 1283.60	40 2567.20	60 3850.80	80 5134.41	100 6418.01	120 7701.61	140 8985.21	160 10268.82	180 11552.42	180 11552.42	200 12836.02	200 12836.02	220 14119.62	220 14119.62
19D+2P	0 0.00	0 0.00	21 1354.91	42 2709.82	63 4064.74	84 5419.65	105 6774.56	105 6774.56	126 8129.48	147 9484.39	147 9484.39	168 10839.31	189 12194.22	210 13549.13	210 13549.13	224 14262.25
20D+2P	0 0.00	0 0.00	22 1426.22	44 2852.45	66 4278.67	88 5704.90	110 7131.12	132 8557.35	150 9983.57	150 9983.57	176 11409.80	180 11409.80	207 12836.02	207 12836.02	220 14262.25	220 14262.25
21D+2P	0 0.00	0 0.00	23 1497.53	46 2995.07	69 4492.60	92 5990.14	115 7487.68	138 8985.21	161 10482.75	161 10482.75	184 11980.29	184 11980.29	207 13477.82	207 13477.82	220 14262.25	220 14262.25
22D+2P	0 0.00	0 0.00	24 1568.84	48 3137.69	72 4706.54	96 6275.39	120 7844.23	144 9413.08	168 10981.93	168 10981.93	192 12550.78	192 12550.78	216 14119.62	216 14119.62	224 14262.25	224 14262.25
23D+2P	0 0.00	0 0.00	25 1640.15	50 3280.31	75 4920.47	100 6560.63	125 8200.79	150 9840.95	175 11481.11	175 11481.11	200 13121.27	200 13121.27	224 14262.25	224 14262.25	224 14262.25	224 14262.25
24D+2P	0 0.00	0 0.00	26 1711.47	52 3422.94	78 5134.41	104 6845.88	130 8557.35	156 10268.82	182 11980.29	182 11980.29	208 13691.76	208 13691.76	224 14262.25	224 14262.25	224 14262.25	224 14262.25
25D+2P	0 0.00	0 0.00	27 1782.78	54 3565.56	81 4920.47	108 6560.63	135 8200.79	162 9840.95	189 11481.11	189 11481.11	216 13121.27	216 13121.27	224 14262.25	224 14262.25	224 14262.25	224 14262.25
26D+2P	0 0.00	0 0.00	28 1854.09	56 3708.18	84 4920.47	112 5562.27	140 7416.37	168 9270.46	196 11124.55	196 11124.55	224 13691.76	224 13691.76	224 14262.25	224 14262.25	224 14262.25	224 14262.25
27D+2P	0 0.00	0 0.00	29 1925.40	58 3850.80	87 5134.41	116 5776.21	145 7701.61	174 9627.01	203 11552.42	203 11552.42	224 13691.76	224 13691.76	224 14262.25	224 14262.25	224 14262.25	224 14262.25
28D+2P	0 0.00	0 0.00	30 1996.71	60 3993.43	90 5990.14	120 7986.86	150 9983.57	180 11980.29	210 13977.00	210 13977.00	224 14262.25	224 14262.25	224 14262.25	224 14262.25	224 14262.25	224 14262.25

Table F.4 List of Capacities Corresponding to RAID6 (72 GB) (continued)

Disk capacity	71.3 G bytes														
Component unit	RKAJ														
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)
2D+2P	240 8557.35	252 8985.21	268 9555.70	284 10126.19	300 10696.68	312 11124.55	328 11695.04	344 12265.53	360 12836.02	372 13263.89	388 13834.38	404 14404.87	420 14975.36	432 15403.23	448 15973.72
3D+2P	240 10268.82	255 10910.62	270 11552.42	285 12194.22	300 12836.02	315 13477.82	330 14119.62	345 14761.43	360 15403.23	375 16045.03	390 16686.83	405 17328.63	420 17970.43	435 18612.23	450 19254.03
4D+2P	240 11409.80	252 11980.29	270 12836.02	282 13406.51	300 14262.25	312 14832.74	330 15688.47	342 16258.96	360 17114.70	372 17685.19	390 18540.92	402 19111.41	420 19967.15	432 20537.64	450 21393.37
5D+2P	238 12122.91	252 12836.02	266 13549.13	280 14262.25	294 14975.36	315 16045.03	329 16758.14	343 17471.25	357 18184.37	371 18897.48	385 19610.59	399 20323.70	420 21393.37	434 22106.48	448 22819.60
6D+2P	240 12836.02	248 13263.89	264 14119.62	280 14975.36	296 15831.09	312 16686.83	328 17542.56	344 18398.30	360 19254.03	368 19681.90	384 20537.64	400 21393.37	416 22249.11	432 23104.84	448 23960.58
7D+2P	234 12978.64	252 13977.00	270 14975.36	279 15474.54	297 16472.90	315 17471.25	324 17970.43	342 18968.79	360 19967.15	369 20466.33	387 21464.68	405 22463.04	414 22962.22	432 23960.58	450 24958.94
8D+2P	240 13691.76	250 14262.25	270 15403.23	280 15973.72	300 17114.70	310 17685.19	330 18826.17	340 19396.66	360 20537.64	370 21108.13	390 22249.11	400 22819.60	420 23960.58	430 24531.07	450 25672.05
9D+2P	231 13477.82	253 14761.43	264 15403.23	275 16045.03	297 17328.63	308 17970.43	330 19254.03	341 19895.84	352 20537.64	374 21821.24	385 22463.04	396 23104.84	418 24388.45	429 25030.25	440 25672.05
10D+2P	240 14262.25	252 14975.36	264 15688.47	276 16401.58	300 17827.81	312 18540.92	324 19254.03	336 19967.15	360 21393.37	372 22106.48	384 22819.60	396 23532.71	420 24958.94	432 25672.05	444 26385.16
11D+2P	234 14119.62	247 14904.05	260 15688.47	273 16472.90	299 18041.74	312 18826.17	325 19610.59	338 20395.01	351 21179.44	364 21963.86	390 23532.71	403 24317.13	416 25101.56	429 25885.98	442 26670.41
12D+2P	238 14547.49	252 15403.23	266 16258.96	280 17114.70	294 17970.43	308 18826.17	322 19681.90	336 20537.64	350 21393.37	364 22249.11	378 23104.84	392 23960.58	404 25672.05	434 26527.78	448 27383.52
13D+2P	240 14832.74	255 15759.78	270 16686.83	285 17613.88	300 18540.92	315 19467.97	330 20395.01	345 21322.06	360 22249.11	375 23176.15	390 24103.20	405 25030.25	420 25957.29	435 26884.34	450 27811.39
14D+2P	240 14975.36	240 14975.36	256 15973.72	272 16972.07	288 17970.43	304 18968.79	320 19967.15	336 20965.50	352 21963.86	368 22962.22	384 23960.58	400 24958.94	416 25957.29	432 26955.65	448 27954.01
15D+2P	238 14975.36	255 16045.03	255 16045.03	272 17114.70	289 18184.37	306 19254.03	323 20323.70	340 21393.37	357 22463.04	374 23532.71	391 24602.38	408 25672.05	425 26741.72	442 27811.39	
16D+2P	234 14832.74	252 15973.72	270 17114.70	270 17114.70	288 18255.68	306 19396.66	324 20537.64	342 21678.62	360 22819.60	360 22819.60	378 23960.58	396 25101.56	414 26242.54	432 27383.52	450 28524.50
17D+2P	228 14547.49	247 15759.78	266 16972.07	285 18184.37	285 18184.37	304 19396.66	323 20608.95	342 21821.24	342 21821.24	361 23033.53	380 24245.82	399 25458.11	418 26670.41	418 26670.41	437 27882.70
18D+2P	240 15403.23	240 15403.23	260 16686.83	280 17970.43	300 19254.03	300 19254.03	320 20537.64	340 21821.24	360 23104.84	360 23104.84	380 24388.45	400 25672.05	420 26955.65	440 28299.25	440 28299.25
19D+2P	231 14904.05	252 16258.96	252 16258.96	273 17613.88	294 18968.79	315 20323.70	336 21678.62	357 23033.53	375 24388.45	399 25743.36	420 27098.27	439 27098.27	459 27098.27	478 27098.27	497 28453.19
20D+2P	220 14262.25	242 15688.47	264 17114.70	264 17114.70	286 18540.92	308 19967.15	330 21393.37	352 22819.60	374 24245.82	396 25672.05	420 27098.27	444 27098.27	468 27098.27	492 28524.50	
21D+2P	230 14975.36	253 16472.90	253 16472.90	276 17970.43	299 19467.97	322 20965.50	345 22463.04	345 22463.04	368 23960.58	368 23960.58	391 25458.11	414 26955.65	414 26955.65	437 28453.19	
22D+2P	240 15688.47	240 15688.47	264 17257.32	264 17257.32	288 18826.17	312 20395.01	312 20395.01	336 21963.86	360 23532.71	360 23532.71	384 25101.56	384 25101.56	408 26670.41	432 28239.25	432 28239.25
23D+2P	225 14761.43	250 16401.58	250 16401.58	275 18041.74	300 19681.90	300 19681.90	325 21322.06	350 23222.06	375 24602.38	375 24602.38	400 26242.54	400 26242.54	425 27882.70	450 29522.86	
24D+2P	234 15403.23	234 15403.23	260 17114.70	260 17114.70	286 18826.17	312 20537.64	312 20537.64	338 22249.11	364 24249.11	364 24249.11	390 25672.05	390 25672.05	416 27383.52	442 29094.99	
25D+2P	216 14262.25	243 16045.03	270 17827.81	270 17827.81	297 19610.59	297 19610.59	324 21393.37	324 21393.37	351 23176.15	351 23176.15	378 24958.94	405 26741.72	405 26741.72	432 28524.50	432 28524.50
26D+2P	224 14832.74	252 16686.83	252 16686.83	280 18540.92	280 18540.92	308 20395.01	308 20395.01	336 22249.11	364 24249.11	364 24103.20	392 25957.29	392 25957.29	420 27811.39	448 29665.48	
27D+2P	232 15403.23	232 15403.23	261 17328.63	261 17328.63	290 19254.03	290 19254.03	319 21179.44	319 21179.44	348 23104.84	348 23104.84	377 25030.25	377 25030.25	406 26955.65	435 28881.05	435 28881.05
28D+2P	240 15973.72	240 15973.72	270 17970.43	270 17970.43	300 19967.15	300 19967.15	330 21963.86	330 21963.86	360 23960.58	360 23960.58	390 25957.29	390 25957.29	420 27954.01	450 29950.72	

Table F.5 List of Capacities Corresponding to RAID1+0 (72 GB)

Disk capacity	71.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D+2D	4 142.62	12 427.86	28 998.35	44 1568.84	60 2139.33	72 2567.20	88 3137.69	104 3708.18	120 4278.67	132 4706.54	148 5277.03	164 5847.52	180 6418.01	192 6845.88	208 7416.37	224 7986.86
3D+3D	6 213.93	12 427.86	30 1069.66	42 1497.53	60 2139.33	72 2567.20	90 3209.00	102 3636.87	120 4278.67	132 4706.54	150 5348.34	162 5776.21	180 6418.01	192 6845.88	210 7487.68	222 7915.54
4D+4D	8 285.24	8 285.24	24 855.73	40 1426.22	56 1996.71	72 2567.20	88 3137.69	104 3708.18	120 4278.67	128 4563.92	144 5134.41	160 5704.90	176 6275.39	192 6845.88	208 7416.37	224 7986.86
5D+5D	10 356.55	10 356.55	30 1069.66	40 1426.22	60 2139.33	70 2495.89	90 3209.00	100 3565.56	120 4278.67	130 4635.23	150 5348.34	160 5704.90	180 6418.01	190 6774.56	210 7487.68	220 7844.23
6D+6D	12 427.86	12 427.86	24 855.73	36 1283.60	60 2139.33	72 2567.20	84 2995.07	96 3422.94	120 4278.67	132 4706.54	144 5134.41	156 5562.27	180 6418.01	192 6845.88	204 7273.74	216 7701.61
7D+7D	14 499.17	14 499.17	28 998.35	42 1497.53	56 1996.71	70 2495.89	84 2995.07	98 3494.25	112 3993.43	126 4492.60	140 4991.78	154 5490.96	168 5990.14	182 6489.32	210 7487.68	224 7986.86
8D+8D	0 0.00	0 0.00	16 570.49	32 1140.98	48 1711.47	64 2281.96	80 2852.45	96 3422.94	112 3993.43	128 4563.92	144 5134.41	160 5704.90	176 6275.39	192 6845.88	208 7416.37	224 7986.86
Disk capacity	71.3 G bytes															
Component unit	RKAJ															
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)	
2D+2D	240 8557.35	252 8985.21	268 9555.70	284 10126.19	300 10696.68	312 11124.55	328 11695.04	344 12265.53	360 12836.02	372 13263.89	388 13834.38	404 14404.87	420 14975.36	432 15403.23	448 15973.72	
3D+3D	240 8557.35	252 8985.21	270 9627.01	282 10054.88	300 10696.68	312 11124.55	330 11766.35	342 12194.22	360 12836.02	372 13263.89	390 13905.69	402 14333.56	420 14975.36	432 15403.23	450 16045.03	
4D+4D	240 8557.35	248 8842.59	264 9413.08	280 9983.57	296 10554.06	312 11124.55	328 11695.04	344 12265.53	360 12836.02	368 13121.27	384 13691.76	400 14262.25	416 14832.74	432 15403.23	448 15973.72	
5D+5D	240 8557.35	250 8913.90	270 9627.01	280 9983.57	300 10696.68	310 11053.24	330 11766.35	340 12122.91	360 12836.02	370 13192.58	390 13905.69	400 14262.25	420 14975.36	430 15331.92	450 16045.03	
6D+6D	240 8557.35	252 8985.21	264 9413.08	276 9840.95	300 10696.68	312 11124.55	324 11552.42	336 11980.29	360 12836.02	372 13263.89	384 13691.76	396 14119.62	420 14975.36	432 15403.23	444 15831.09	
7D+7D	238 8486.03	252 8985.21	266 9484.39	280 9983.57	294 10482.75	308 10981.93	322 11481.11	336 11980.29	350 12479.47	364 12978.64	378 13477.82	392 13977.00	420 14975.36	434 15474.54	448 15973.72	
8D+8D	240 8557.35	240 8557.35	256 9127.84	272 9698.33	288 10268.82	304 10839.31	320 11409.80	336 11980.29	352 12550.78	368 13121.27	384 13691.76	400 14262.25	416 14832.74	432 15403.23	448 15973.72	

Table F.6 List of Capacities Corresponding to RAID0 (146 GB)

Disk capacity	143.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D	2 286.61	14 2006.29	30 4299.19	44 6305.49	60 8598.39	74 10604.69	90 12897.59	104 14903.88	120 17196.79	134 19203.08	150 21495.99	164 23502.28	180 25795.19	194 27801.48	210 30094.39	224 32100.68
3D	3 429.91	15 2149.59	30 4299.19	45 6448.79	60 8598.39	75 10747.99	90 12897.59	105 15047.19	120 17196.79	135 19346.39	150 21495.99	165 23645.59	180 25795.19	195 27944.79	210 30094.39	225 32243.99
4D	4 573.22	12 1719.67	28 4012.58	44 6305.49	60 8598.39	72 10318.07	88 12610.98	104 14903.88	120 17196.79	132 18916.47	148 21209.38	164 23502.28	180 25795.19	192 27514.87	208 29807.77	224 32100.68
5D	5 716.53	15 2149.59	30 4299.19	45 6448.79	60 8598.39	75 10747.99	90 12897.59	105 15047.19	120 17196.79	135 19346.39	150 21495.99	165 23645.59	180 25795.19	195 27944.79	210 30094.39	225 32243.99
6D	6 859.83	12 1719.67	30 4299.19	42 6018.87	60 8598.39	72 10318.07	90 12897.59	102 14617.27	120 17196.79	132 18916.47	150 21495.99	162 23215.67	180 25795.19	192 27514.87	210 30094.39	222 31814.07
7D	7 1003.14	14 2006.29	28 4012.58	42 6018.87	56 8025.17	70 10031.46	84 12037.75	105 15047.19	119 17053.48	133 19059.78	147 21066.07	161 23072.36	175 25078.65	189 27084.95	210 30094.39	224 32100.68
8D	8 1146.45	8 1146.45	24 3439.35	40 5732.26	56 8025.17	72 10318.07	88 12610.98	104 14903.88	120 17196.79	144 18343.24	160 20636.15	176 22929.06	192 25221.96	208 27514.87	224 29807.77	32100.68
9D	9 1289.75	9 1289.75	27 3869.27	45 6448.79	54 7738.55	72 10318.07	90 12897.59	99 14187.35	117 16766.87	135 19346.39	144 20636.15	162 23215.67	180 25795.19	189 27084.95	207 29664.47	225 32243.99
10D	10 1433.06	10 1433.06	30 4299.19	40 5732.26	60 8598.39	70 10031.46	90 12897.59	100 14330.66	120 17196.79	130 18629.86	150 21495.99	160 22929.06	180 25795.19	190 27228.25	210 30094.39	220 31527.45
11D	11 1576.37	11 1576.37	22 3152.74	44 6305.49	55 7881.86	66 9458.23	88 12610.98	99 14187.35	110 15763.72	132 18916.47	143 20492.84	165 23645.59	176 25221.96	187 26798.33	209 29951.08	220 31527.45
12D	12 1719.67	12 1719.67	24 3439.35	36 5159.03	60 8598.39	72 10318.07	84 12037.75	96 13757.43	120 17196.79	132 18916.47	144 20636.15	156 22355.83	180 25795.19	192 27514.87	204 29234.55	216 30954.23
13D	13 1862.98	13 1862.98	26 3725.97	39 5588.95	52 7451.94	65 9314.93	78 11177.91	104 14903.88	117 16766.87	130 18629.86	143 20492.84	156 22355.83	169 24218.81	195 27944.79	208 29807.77	221 31670.76
14D	14 2006.29	14 2006.29	28 4012.58	42 6018.87	56 8025.17	70 10031.46	84 12037.75	98 14044.04	112 16050.34	126 18056.63	140 20062.92	154 22069.22	168 24075.51	182 26081.80	210 30094.39	224 32100.68
15D	15 2149.59	15 2149.59	30 4299.19	45 6448.79	60 8598.39	75 10747.99	90 12897.59	105 15047.19	120 17196.79	135 19346.39	150 21495.99	165 23645.59	180 25795.19	195 27944.79	210 30094.39	225 32243.99
16D	0 0.00	0 0.00	16 2292.90	32 4585.81	48 6878.71	64 9171.62	80 11464.53	96 13757.43	112 16050.34	128 18343.24	144 20636.15	160 22929.06	176 25221.96	192 27514.87	208 29807.77	224 32100.68

Table F.6 List of Capacities Corresponding to RAID0 (146 GB) (continued)

Disk capacity	143.3 G bytes														
Component unit	RKAJ														
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)
2D	240 34393.59	254 36399.88	270 38692.78	284 40699.08	300 42991.98	314 44998.28	330 47291.18	344 49297.47	360 51590.38	374 53596.67	390 55889.58	404 57895.87	420 60188.78	434 62195.07	450 64487.98
3D	240 34393.59	255 36543.18	270 38692.78	285 40842.38	300 42991.98	315 45141.58	330 47291.18	345 49440.78	360 51590.38	375 53739.98	390 55889.58	405 58039.18	420 60188.78	435 62338.38	450 64487.98
4D	240 34393.59	252 36113.26	268 38406.17	284 40699.08	300 42991.98	312 44711.66	328 47004.57	344 49297.47	360 51590.38	372 53310.06	388 55602.97	404 57895.87	420 60188.78	432 61908.46	448 64201.36
5D	240 34393.59	255 36543.18	270 38692.78	285 40842.38	300 42991.98	315 45141.58	330 47291.18	345 49440.78	360 51590.38	375 53739.98	390 55889.58	405 58039.18	420 60188.78	435 62338.38	450 64487.98
6D	240 34393.59	252 36113.26	270 38692.78	282 40412.46	300 42991.98	312 44711.66	330 47291.18	342 49010.86	360 51590.38	372 53310.06	390 55889.58	402 57609.26	420 60188.78	432 61908.46	450 64487.98
7D	238 34106.97	252 36113.26	266 38119.56	280 40125.85	294 42132.14	315 45141.58	329 47147.87	343 49154.17	357 51160.46	371 53166.75	385 55173.05	399 57179.34	420 60188.78	434 62195.07	448 64201.36
8D	240 34393.59	248 35540.04	264 37832.94	280 40125.85	296 42418.76	312 44711.66	328 47004.57	344 49297.47	360 51590.38	368 52736.83	384 55029.74	400 57322.65	416 59615.55	432 61908.46	448 64201.36
9D	234 33533.75	252 36113.26	270 38692.78	279 39982.54	297 42562.06	315 45141.58	324 46431.34	342 49010.86	360 51590.38	369 52880.14	387 55459.66	405 58039.18	414 59328.94	432 61908.46	450 64487.98
10D	240 34393.59	250 35826.65	270 38692.78	280 40125.85	300 42991.98	310 44425.05	330 47291.18	340 48724.25	360 51590.38	370 53023.45	390 55889.58	400 57322.65	420 60188.78	430 61621.84	450 64487.98
11D	231 33103.83	253 36256.57	264 37832.94	275 39409.32	297 42562.06	308 44138.44	330 47291.18	341 48867.55	352 50443.93	374 53596.67	385 55173.05	396 56749.42	418 59902.16	429 61478.54	440 63054.91
12D	240 34393.59	252 36113.26	264 37832.94	276 39552.62	300 42991.98	312 44711.66	324 46431.34	336 48151.02	360 51590.38	372 53310.06	384 55029.74	396 56749.42	420 60188.78	432 61908.46	444 63628.14
13D	234 33533.75	247 35396.73	260 37259.72	273 39122.70	299 42848.68	312 44711.66	325 46574.65	338 48437.63	351 50300.62	364 52163.61	390 55889.58	403 57752.57	416 59615.55	429 61478.54	442 63341.52
14D	238 34106.97	252 36113.26	266 38119.56	280 40125.85	294 42132.14	308 44138.44	322 46144.73	336 48151.02	350 50157.31	364 52163.61	378 54169.90	392 56176.19	420 60188.78	434 62195.07	448 64201.36
15D	240 34393.59	255 36543.18	270 38692.78	285 40842.38	300 42991.98	315 45141.58	330 47291.18	345 49440.78	360 51590.38	375 53739.98	390 55889.58	405 58039.18	420 60188.78	435 62338.38	450 64487.98
16D	240 34393.59	240 34393.59	256 36686.49	272 38979.40	288 41272.30	304 43565.21	320 45858.12	336 48151.02	352 50443.93	368 52736.83	384 55029.74	400 57322.65	416 59615.55	432 61908.46	448 64201.36

Table F.7 List of Capacities Corresponding to RAID1 (146 GB)

Disk capacity	143.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
1D+1D	2 143.30	14 1003.14	30 2149.59	44 3152.74	60 4299.19	74 5302.34	90 6448.79	104 7451.94	120 8598.39	134 9601.54	150 10747.99	164 11751.14	180 12897.59	194 13900.74	210 15047.19	224 16050.34
Disk capacity	143.3 G bytes															
Component unit	RKAJ															
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)	
1D+1D	240 17196.79	254 18199.94	270 19346.39	284 20349.54	300 21495.99	314 22499.14	330 23645.59	344 24648.73	360 25795.19	374 26798.33	390 27944.79	404 28947.93	420 30094.39	434 31097.53	450 32243.99	

Table F.8 List of Capacities Corresponding to RAID5 (146 GB)

Disk capacity	143.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D+1P	3 286.61	15 1433.06	30 2866.13	45 4299.19	60 5732.26	75 7165.33	90 8598.39	105 10031.46	120 11464.53	135 12897.59	150 14330.66	165 15763.72	180 17196.79	195 18629.86	210 20062.92	225 21495.99
3D+1P	4 429.91	12 1289.75	28 3009.43	44 4729.11	60 6448.79	72 7738.55	88 9458.23	104 11177.91	120 12897.59	132 14187.35	148 15907.03	164 17626.71	180 19346.39	192 20636.15	208 22355.83	224 24075.51
4D+1P	5 573.22	15 1719.67	30 3439.35	45 5159.03	60 6878.71	75 8598.39	90 10318.07	105 12037.75	120 13757.43	135 15477.11	150 17196.79	165 18916.47	180 20636.15	195 22355.83	210 24075.51	225 25795.19
5D+1P	6 716.53	12 1433.06	30 3582.66	42 5015.73	60 7165.33	72 8598.39	90 10747.99	102 12181.06	120 14330.66	132 15763.72	150 17913.32	162 19346.39	180 21495.99	192 22929.06	210 25078.65	222 26511.72
6D+1P	7 859.83	14 1719.67	28 3439.35	42 5159.03	56 6878.71	70 8598.39	84 10318.07	105 12897.59	119 14617.27	133 16336.95	147 18056.63	161 19776.31	175 21495.99	189 23215.67	210 25795.19	224 27514.87
7D+1P	8 1003.14	8 1003.14	24 3009.43	40 5015.73	56 7022.02	72 9028.31	88 11034.61	104 13040.90	120 15047.19	128 16050.34	144 18056.63	160 20062.92	176 22069.22	192 24075.51	208 26081.80	224 28088.09
8D+1P	9 1146.45	9 1146.45	27 3439.35	45 5732.26	54 6878.71	72 9171.62	90 11464.53	99 12610.98	117 14903.88	135 17196.79	144 18343.24	162 20636.15	180 22929.06	189 24075.51	207 26368.41	225 28661.32
9D+1P	10 1289.75	10 1289.75	30 3869.27	40 5159.03	60 7738.55	70 9028.31	90 11607.83	100 12897.59	120 15477.11	130 16766.87	150 19346.39	160 20636.15	180 23215.67	190 24505.43	210 27084.95	220 28374.71
10D+1P	11 1433.06	11 1433.06	22 2866.13	44 5732.26	55 7165.33	66 8598.39	88 11464.53	99 12897.59	110 14330.66	132 17196.79	143 18629.86	165 21495.99	176 22929.06	187 24362.12	209 27228.25	220 28661.32
11D+1P	12 1576.37	12 1576.37	24 3152.74	36 4729.11	60 7881.86	72 9458.23	84 11034.61	96 12610.98	120 15763.72	132 17340.10	144 18916.47	156 20492.84	180 23645.59	192 25221.96	204 26798.33	216 28374.71
12D+1P	13 1719.67	13 1719.67	26 3439.35	39 5159.03	52 6878.71	65 8598.39	78 10318.07	104 13757.43	117 15477.11	130 17196.79	143 18916.47	156 20636.15	169 22355.83	195 25795.19	208 27514.87	221 29234.55
13D+1P	14 1862.98	14 1862.98	28 3725.97	42 5588.95	56 7451.94	70 9314.93	84 11177.91	98 13040.90	112 14903.88	126 16766.87	140 18629.86	154 20492.84	168 22355.83	182 24218.81	210 27944.79	224 29807.77
14D+1P	15 2006.29	15 2006.29	30 4012.58	45 6018.87	60 8025.17	75 10031.46	90 12037.75	105 14044.04	120 16050.34	135 18056.63	150 20062.92	165 22069.22	180 24075.51	195 26081.80	210 28088.09	225 30094.39
15D+1P	0 0.00	0 0.00	16 2149.59	32 4299.19	48 6448.79	64 8598.39	80 10747.99	96 12897.59	112 15047.19	128 17196.79	144 19346.39	160 21495.99	176 23645.59	192 25795.19	208 27944.79	224 30094.39

Table F.8 List of Capacities Corresponding to RAID5 (146 GB) (continued)

Disk capacity	143.3 G bytes														
Component unit	RKAJ														
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)
2D+1P	240 22929.06	255 24362.12	270 25795.19	285 27228.25	300 28661.32	315 30094.39	330 31527.45	345 32960.52	360 34393.59	375 35826.65	390 37259.72	405 38692.78	420 40125.85	435 41558.92	450 42991.98
3D+1P	240 25795.19	252 27084.95	268 28804.63	284 30524.31	300 32243.99	312 33533.75	328 35253.42	344 36973.10	360 38692.78	372 39982.54	388 41702.22	404 43421.90	420 45141.58	432 46431.34	448 48151.02
4D+1P	240 27514.87	255 29234.55	270 30954.23	285 32673.91	300 34393.59	315 36113.26	330 37832.94	345 39552.62	360 41272.30	375 42991.98	390 44711.66	405 46431.34	420 48151.02	435 49870.70	450 51590.38
5D+1P	240 28661.32	252 30094.39	270 32243.99	282 33677.05	300 35826.65	312 37259.72	330 39409.32	342 40842.38	360 42991.98	372 44425.05	390 46574.65	402 48007.71	420 50157.31	432 51590.38	450 53739.98
6D+1P	238 29234.55	252 30954.23	266 32673.91	280 34393.59	294 36113.26	315 38692.78	329 40412.46	343 42132.14	357 43851.82	371 45571.50	385 47291.18	399 49010.86	420 51590.38	434 53310.06	448 55029.74
7D+1P	240 30094.39	248 31097.53	264 33103.83	280 35110.12	296 37116.41	312 39122.70	328 41129.00	344 43135.29	360 45141.58	368 46144.73	384 48151.02	400 50157.31	416 52163.61	432 54169.90	448 56176.19
8D+1P	234 29807.77	252 32100.68	270 34393.59	279 35540.04	297 37832.94	315 40125.85	324 41272.30	342 43565.21	360 45858.12	369 47004.57	387 49297.47	405 51590.38	414 52736.83	432 55029.74	450 57322.65
9D+1P	240 30954.23	250 32243.99	270 34823.50	280 36113.26	300 38692.78	310 39982.54	330 42562.06	340 43851.82	360 46431.34	370 47721.10	390 50300.62	400 51590.38	420 54169.90	430 55459.66	450 58039.18
10D+1P	231 30094.39	253 32960.52	264 34393.59	275 35826.65	297 38692.78	308 40125.85	330 42991.98	341 44425.05	352 45858.12	374 48724.25	385 50157.31	396 51590.38	418 54456.51	429 55889.58	440 57322.65
11D+1P	240 31527.45	252 33103.83	264 34680.20	276 36256.57	300 39409.32	312 40985.69	324 42562.06	336 44138.44	360 47291.18	372 48867.55	384 50443.93	396 52020.30	420 55173.05	432 56749.42	444 58325.79
12D+1P	234 30954.23	247 32673.91	260 34393.59	273 36113.26	299 39552.62	312 41272.30	325 42991.98	338 44711.66	351 46431.34	364 48151.02	390 51590.38	403 53310.06	416 55029.74	429 56749.42	442 58469.10
13D+1P	238 31670.76	252 33533.75	266 35396.73	280 37259.72	294 39122.70	308 40985.69	322 42848.68	336 44711.66	350 46574.65	364 48437.63	378 50300.62	392 52163.61	420 55889.58	434 57752.57	448 59615.55
14D+1P	240 32100.68	255 34106.97	270 36113.26	285 38119.56	300 40125.85	315 42132.14	330 44138.44	345 46144.73	360 48151.02	375 50157.31	390 52163.61	405 54169.90	420 56176.19	435 58182.48	450 60188.78
15D+1P	240 32243.99	240 32243.99	256 34393.59	272 36543.18	288 38692.78	304 40842.38	320 42991.98	336 45141.58	352 47291.18	368 49440.78	384 51590.38	400 53739.98	416 55889.58	432 58039.18	448 60188.78

Table F.9 List of Capacities Corresponding to RAID6 (146 GB)

Disk capacity	143.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D+2P	4 286.61	12 859.83	28 2006.29	44 3152.74	60 4299.19	72 5159.03	88 6305.49	104 7451.94	120 8598.39	132 9458.23	148 10604.69	164 11751.14	180 12897.59	192 13757.43	208 14903.88	224 16050.34
3D+2P	5 429.91	15 1289.75	30 2579.51	45 3869.27	60 5159.03	75 6448.79	90 7738.55	105 9028.31	120 10318.07	135 11607.83	150 12897.59	165 14187.35	180 15477.11	195 16766.87	210 18056.63	225 19346.39
4D+2P	6 573.22	12 1146.45	30 2866.13	42 4012.58	60 5732.26	72 6878.71	90 8598.39	102 9744.85	120 11464.53	132 12610.98	150 14330.66	162 15477.11	180 17196.79	192 18343.24	210 20062.92	222 21209.38
5D+2P	7 716.53	14 1433.06	28 2866.13	42 4299.19	56 5732.26	70 7165.33	84 8598.39	105 10747.99	119 12181.06	133 13614.12	147 15047.19	161 16480.26	175 17913.32	189 19346.39	210 21495.99	224 22929.06
6D+2P	8 859.83	8 859.83	24 2579.51	40 4299.19	56 6018.87	72 7738.55	88 9458.23	104 11177.91	120 12897.59	128 13757.43	144 15477.11	160 17196.79	176 18916.47	192 20636.15	208 22355.83	224 24075.51
7D+2P	9 1003.14	9 1003.14	27 3009.43	45 5015.73	54 6018.87	72 8025.17	90 10031.46	99 11034.61	117 13040.90	135 15047.19	144 16050.34	162 18056.63	180 20062.92	189 21066.07	207 23072.36	225 25078.65
8D+2P	10 1146.45	10 1146.45	30 3439.35	40 4585.81	60 6878.71	70 8025.17	90 10318.07	100 11464.53	120 13757.43	130 14903.88	150 17196.79	160 18343.24	180 20636.15	190 21782.60	210 24075.51	220 25221.96
9D+2P	11 1289.75	11 1289.75	22 2579.51	44 5159.03	55 6448.79	66 7738.55	88 10318.07	99 11607.83	110 12897.59	132 15477.11	143 16766.87	165 19346.39	176 20636.15	187 21925.91	209 24505.43	220 25795.19
10D+2P	12 1433.06	12 1433.06	24 2866.13	36 4299.19	60 7165.33	72 8598.39	84 10031.46	96 11464.53	120 14330.66	132 15763.72	144 17196.79	156 18629.86	180 21495.99	192 22929.06	204 24362.12	216 25795.19
11D+2P	13 1576.37	13 1576.37	26 3152.74	39 4729.11	52 6305.49	65 7881.86	78 9458.23	104 12610.98	117 14187.35	130 15763.72	143 17340.10	156 18916.47	169 20492.84	195 23645.59	208 25221.96	221 26798.33
12D+2P	14 1719.67	14 1719.67	28 3439.35	42 5159.03	56 6878.71	70 8598.39	84 10318.07	98 12037.75	112 13757.43	126 15477.11	140 17196.79	154 18916.47	168 20636.15	182 22355.83	210 25795.19	224 27514.87
13D+2P	15 1862.98	15 1862.98	30 3725.97	45 5588.95	60 7451.94	75 9314.93	90 11177.91	105 13040.90	120 14903.88	135 16766.87	150 18629.86	165 20492.84	180 22355.83	195 24218.81	210 26081.80	225 27944.79
14D+2P	0 0.00	0 0.00	16 2006.29	32 4012.58	48 6018.87	64 8025.17	80 10031.46	96 12037.75	112 14044.04	128 16050.34	144 18056.63	160 20062.92	176 22069.22	192 24075.51	208 26081.80	224 28088.09
15D+2P	0 0.00	0 0.00	17 2149.59	34 4299.19	51 6448.79	68 8598.39	85 10747.99	102 12897.59	119 15047.19	136 17196.79	153 19346.39	170 21495.99	187 23645.59	204 25795.19	221 27944.79	221 27944.79
16D+2P	0 0.00	0 0.00	18 2292.90	36 4585.81	54 6878.71	72 9171.62	90 11464.53	108 14330.66	126 17196.79	144 18343.24	162 20636.15	180 22929.06	198 25221.96	216 25221.96	216 25221.96	216 25221.96
17D+2P	0 0.00	0 0.00	19 2436.21	38 4872.42	57 7308.63	76 9744.85	95 12181.06	114 14617.27	133 17053.48	152 19489.70	171 21925.91	190 24362.12	209 26798.33	209 26798.33	209 26798.33	209 26798.33
18D+2P	0 0.00	0 0.00	20 2579.51	40 5159.03	60 7738.55	80 10318.07	100 12897.59	120 15477.11	140 18056.63	160 20636.15	180 23215.67	200 25215.67	220 27595.19	220 27595.19	220 27595.19	220 27595.19
19D+2P	0 0.00	0 0.00	21 2722.82	42 5445.65	63 8168.47	84 10891.30	105 13614.12	126 16336.95	147 19059.78	168 21782.60	189 24505.43	210 27228.25	210 27228.25	210 27228.25	210 27228.25	210 27228.25
20D+2P	0 0.00	0 0.00	22 2866.13	44 5732.26	66 8598.39	88 11464.53	110 14330.66	132 17196.79	154 19196.79	176 20662.92	198 22929.06	220 25229.06	242 27959.19	264 28661.32	286 28661.32	308 28661.32
21D+2P	0 0.00	0 0.00	23 3009.43	46 6018.87	69 9028.31	92 12037.75	115 15047.19	138 17196.79	161 18056.63	184 21066.07	207 23645.59	230 26081.80	253 28661.32	276 28661.32	300 28661.32	324 28661.32
22D+2P	0 0.00	0 0.00	24 3152.74	48 6305.49	72 9458.23	96 12610.98	120 15763.72	144 18916.47	168 20636.15	192 22929.06	216 25221.96	240 27514.87	264 28661.32	288 28661.32	312 28661.32	336 28661.32
23D+2P	0 0.00	0 0.00	25 3296.05	50 6592.10	75 9888.15	100 13184.20	125 17196.79	150 20636.15	175 24075.51	200 28088.09	225 32166.47	250 36257.94	275 40349.41	300 44440.88	325 48532.35	350 52623.82
24D+2P	0 0.00	0 0.00	26 3439.35	52 6878.71	78 10318.07	104 13757.43	130 17196.79	156 20636.15	182 24075.51	208 28088.09	234 32166.47	260 36257.94	286 40349.41	312 44440.88	338 48532.35	364 52623.82
25D+2P	0 0.00	0 0.00	27 3582.66	54 7165.33	81 10747.99	108 14330.66	135 17913.32	162 21495.99	189 24959.99	216 28919.99	243 32879.99	270 36749.99	297 40579.99	324 44409.99	351 48239.99	378 52069.99
26D+2P	0 0.00	0 0.00	28 3725.97	56 7451.94	84 11177.91	112 14903.88	140 18629.86	168 22355.83	196 26081.80	224 29807.77	252 33553.74	280 37259.74	308 40715.74	336 44173.74	364 47629.74	392 50089.74
27D+2P	0 0.00	0 0.00	29 3869.27	58 7738.55	87 11607.83	117 15477.11	147 19346.39	177 23215.67	207 27084.95	237 30959.95	267 34819.95	297 38684.95	327 42549.95	357 46319.95	387 49984.95	417 53549.95
28D+2P	0 0.00	0 0.00	30 4012.58	60 8025.17	90 12037.75	120 16050.34	150 20062.92	180 24075.51	210 28088.09	240 32166.47	270 36257.94	300 40349.41	330 44440.88	360 48532.35	390 52623.82	420 56705.29

Table F.9 List of Capacities Corresponding to RAID6 (146 GB) (continued)

Disk capacity	143.3 G bytes														
Component unit	RKAJ														
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)
2D+2P	240 17196.79	252 18056.63	268 19203.08	284 20349.54	300 21495.99	312 22355.83	328 23502.28	344 24648.73	360 25795.19	372 26655.03	388 27801.48	404 28947.93	420 30094.39	432 30954.23	448 32100.68
3D+2P	240 20636.15	255 21925.91	270 23215.67	285 24505.43	300 25795.19	315 27084.95	330 28374.71	345 29664.47	360 30954.23	375 32243.99	390 33533.75	405 34823.51	420 36113.26	435 37403.02	450 38692.78
4D+2P	240 22929.06	252 24075.51	270 25795.19	282 26941.64	300 28661.32	312 29807.77	330 31527.45	342 32673.91	360 34393.59	372 35540.04	390 37259.72	402 38406.17	420 40125.85	432 41272.30	450 42991.98
5D+2P	238 24362.12	252 25795.19	266 27228.25	280 28661.32	294 30094.39	315 32243.99	329 33677.05	343 35110.12	357 36543.18	371 37976.25	385 39409.32	399 40842.38	420 42991.98	434 44425.05	448 45858.12
6D+2P	240 25795.19	248 26655.03	264 28374.71	280 30094.39	296 31814.07	312 33533.75	328 35253.42	344 36973.10	360 38692.78	368 39552.62	384 41272.30	400 42991.98	416 44711.66	432 46431.34	448 48151.02
7D+2P	234 26081.80	252 28088.09	270 30094.39	279 31097.53	297 33103.83	315 35110.12	324 36113.26	342 38119.56	360 40125.85	369 41129.00	387 43135.29	405 45141.58	414 46144.73	432 48151.02	450 50157.31
8D+2P	240 27514.87	250 28661.32	270 30954.23	280 32100.68	300 34393.59	310 35540.04	330 37832.94	340 38979.40	360 41272.30	370 42418.76	390 44711.66	400 45858.12	420 48151.02	430 49297.47	450 51590.38
9D+2P	231 27084.95	253 29664.47	264 30954.23	275 32243.99	297 34823.51	308 36113.26	330 38692.78	341 39982.54	352 41272.30	374 43851.82	385 45141.58	396 46431.34	418 49010.86	429 50300.62	440 51590.38
10D+2P	240 28661.32	252 30094.39	264 31527.45	276 32960.52	300 35826.65	312 37259.72	324 38692.78	336 40125.85	360 42991.98	372 44425.05	384 45858.12	396 47291.18	420 50157.31	432 51590.38	444 53023.45
11D+2P	234 28374.71	247 29951.08	260 31527.45	273 33103.83	299 36256.57	312 37832.94	325 39409.32	338 40985.69	351 42562.06	364 44138.44	390 47291.18	403 48867.55	416 50443.93	429 52020.30	442 53596.67
12D+2P	238 29234.55	252 30954.23	266 32673.91	280 34393.59	294 36113.26	308 37832.94	322 39552.62	336 41272.30	350 42991.98	364 44711.66	378 46431.34	392 48151.02	406 51590.38	420 53310.06	444 55029.74
13D+2P	240 29807.77	255 31670.76	270 33533.75	285 35396.73	300 37259.72	315 39122.70	330 40985.69	345 42848.68	360 44711.66	375 46574.65	390 48437.63	405 50300.62	420 52163.61	435 54026.59	450 55889.58
14D+2P	240 30094.39	240 30094.39	256 32100.68	272 34106.97	288 36113.26	304 38119.56	320 40125.85	336 42132.14	352 44138.44	368 46144.73	384 48151.02	400 50157.31	416 52163.61	432 54169.90	448 56176.19
15D+2P	238 30094.39	255 32243.99	255 32243.99	272 34393.59	289 36543.18	306 38692.78	323 40842.38	340 42991.98	357 45141.58	374 47291.18	391 49440.78	408 51590.38	425 53739.98	442 55889.58	
16D+2P	234 29807.77	252 32100.68	270 34393.59	280 34393.59	288 36686.49	306 38979.40	324 41272.30	342 43565.21	360 45858.12	360 45858.12	378 48151.02	396 50443.93	414 52736.83	432 55029.74	450 57322.65
17D+2P	228 29234.55	247 31670.76	266 34106.97	285 36543.18	285 36543.18	304 38979.40	323 41415.61	342 43851.82	342 43851.82	361 46288.04	380 48724.25	399 51160.46	418 53596.67	418 53596.67	437 56032.89
18D+2P	240 30954.23	240 30954.23	260 33533.75	280 36113.26	300 38692.78	300 38692.78	320 41272.30	340 43851.82	360 46431.34	360 46431.34	380 49010.86	400 51590.38	420 54169.90	420 54169.90	440 56749.42
19D+2P	231 29951.08	252 32673.91	252 32673.91	273 35396.73	294 38119.56	315 40842.38	315 40842.38	336 43565.21	357 46288.04	357 46288.04	378 49010.86	399 51733.69	420 54456.51	420 54456.51	441 57179.34
20D+2P	220 28661.32	242 31527.45	264 34393.59	264 34393.59	286 37259.72	308 40125.85	330 42991.98	330 42991.98	352 45858.12	374 48724.25	374 48724.25	396 51590.38	418 54456.51	418 54456.51	440 57322.65
21D+2P	230 30094.39	253 33103.83	253 33103.83	276 36113.26	299 39122.70	299 39122.70	322 42132.14	345 45141.58	345 45141.58	368 48151.02	368 48151.02	391 51160.46	414 54169.90	414 54169.90	437 57179.34
22D+2P	240 31527.45	240 31527.45	264 34680.20	264 34680.20	288 37832.94	312 40985.69	312 40985.69	336 44138.44	360 47291.18	360 47291.18	384 50443.93	384 50443.93	408 53596.67	432 56749.42	432 56749.42
23D+2P	225 29664.47	250 32960.52	250 32960.52	275 36256.57	300 39552.62	300 39552.62	325 42848.68	325 42848.68	350 46144.73	375 49440.78	375 49440.78	400 52736.83	425 55736.83	425 56032.89	450 59328.94
24D+2P	234 30954.23	234 30954.23	260 34393.59	260 34393.59	286 37832.94	312 41272.30	312 41272.30	338 44711.66	338 44711.66	364 48151.02	390 51590.38	390 51590.38	416 55029.74	416 55029.74	442 58469.10
25D+2P	216 28661.32	243 32243.99	270 35826.65	270 35826.65	297 39409.32	297 39409.32	324 42991.98	324 42991.98	351 46574.65	351 46574.65	378 50157.31	405 53739.98	405 53739.98	432 57322.65	432 57322.65
26D+2P	224 29807.77	252 33533.75	252 33533.75	280 37259.72	280 37259.72	308 40985.69	308 40985.69	336 44711.66	336 44711.66	364 48437.63	364 48437.63	392 52163.61	420 55889.58	420 55889.58	448 59615.55
27D+2P	232 30954.23	232 30954.23	261 34823.51	261 34823.51	290 38692.78	290 38692.78	319 42562.06	319 42562.06	348 46431.34	348 46431.34	377 50300.62	377 50300.62	406 54169.90	435 58039.18	435 58039.18
28D+2P	240 32100.68	240 32100.68	270 36113.26	270 36113.26	300 40125.85	300 40125.85	330 44138.44	330 44138.44	360 48151.02	360 48151.02	390 52163.61	390 52163.61	420 56176.19	420 56176.19	450 60188.78

Table F.10 List of Capacities Corresponding to RAID1+0 (146 GB)

Disk capacity	143.3 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D+2D	4 286.61	12 859.83	28 2006.29	44 3152.74	60 4299.19	72 5159.03	88 6305.49	104 7451.94	120 8598.39	132 9458.23	148 10604.69	164 11751.14	180 12897.59	192 13757.43	208 14903.88	224 16050.34
3D+3D	6 429.91	12 859.83	30 2149.59	42 3009.43	60 4299.19	72 5159.03	90 6448.79	102 7308.63	120 8598.39	132 9458.23	150 10747.99	162 11607.83	180 12897.59	192 13757.43	210 15047.19	222 15907.03
4D+4D	8 573.22	8 573.22	24 1719.67	40 2866.13	56 4012.58	72 5159.03	88 6305.49	104 7451.94	120 8598.39	128 9171.62	144 10318.07	160 11464.53	176 12610.98	192 13757.43	208 14903.88	224 16050.34
5D+5D	10 716.53	10 716.53	30 2149.59	40 2866.13	60 4299.19	70 5015.73	90 6448.79	100 7165.33	120 8598.39	130 9314.93	150 10747.99	160 11464.53	180 12897.59	190 13614.12	210 15047.19	220 15763.72
6D+6D	12 859.83	12 859.83	24 1719.67	36 2579.51	60 4299.19	72 5159.03	84 6018.87	96 6878.71	120 8598.39	132 9458.23	144 10318.07	156 11177.91	180 12897.59	192 13757.43	204 14617.27	216 15477.11
7D+7D	14 1003.14	14 1003.14	28 2006.29	42 3009.43	56 4012.58	70 5015.73	84 6018.87	98 7022.02	112 8025.17	126 9028.31	140 10031.46	154 11034.61	168 12037.75	182 13040.90	210 15047.19	224 16050.34
8D+8D	0 0.00	0 0.00	16 1146.45	32 2292.90	48 3439.35	64 4585.81	80 5732.26	96 6878.71	112 8025.17	128 9171.62	144 10318.07	160 11464.53	176 12610.98	192 13757.43	208 14903.88	224 16050.34
Disk capacity	143.3 G bytes															
Component unit	RKAJ															
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)	
2D+2D	240 17196.79	252 18056.63	268 19203.08	284 20349.54	300 21495.99	312 22355.83	328 23502.28	344 24648.73	360 25795.19	372 26655.03	388 27801.48	404 28947.93	420 30094.39	432 30954.23	448 32100.68	
3D+3D	240 17196.79	252 18056.63	270 19346.39	282 20206.23	300 21495.99	312 22355.83	330 23645.59	342 24505.43	360 25795.19	372 26655.03	390 27944.79	402 28804.63	420 30094.39	432 30954.23	450 32243.99	
4D+4D	240 17196.79	248 17770.02	264 18916.47	280 20062.92	296 21209.38	312 22355.83	328 23502.28	344 24648.73	360 25795.19	368 26368.41	384 27514.87	400 28661.32	416 29807.77	432 30954.23	448 32100.68	
5D+5D	240 17196.79	250 17913.32	270 19346.39	280 20062.92	300 21495.99	310 22212.52	330 23645.59	340 24362.12	360 25795.19	370 26511.72	390 27944.79	400 28661.32	420 30094.39	430 30810.92	450 32243.99	
6D+6D	240 17196.79	252 18056.63	264 18916.47	276 19776.31	300 21495.99	312 22355.83	324 23215.67	336 24075.51	360 25795.19	372 26655.03	384 27514.87	396 28374.71	420 30094.39	432 30954.23	444 31814.07	
7D+7D	238 17053.48	252 18056.63	266 19059.78	280 20062.92	294 21066.07	308 22069.22	322 23072.36	336 24075.51	350 25078.65	364 26081.80	378 27084.95	392 28088.09	402 30094.39	434 31097.53	448 32100.68	
8D+8D	240 17196.79	240 17196.79	256 18343.24	272 19489.70	288 20636.15	304 21782.60	320 22929.06	336 24075.51	352 25221.96	368 26368.41	384 27514.87	400 28661.32	416 29807.77	432 30954.23	448 32100.68	

Table F.11 List of Capacities Corresponding to RAID0 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D	2 575.25	14 4026.80	30 8628.85	44 12655.65	60 17257.71	74 21284.51	90 25886.57	104 29913.37	120 34515.43	134 38542.23	150 43144.28	164 47171.08	180 51773.14	194 55799.94	210 60402.00	224 64428.80
3D	3 862.88	15 4314.42	30 8628.85	45 12943.28	60 17257.71	75 21572.14	90 25886.57	105 30201.00	120 34515.43	135 38829.85	150 43144.28	165 47458.71	180 51773.14	195 56087.57	210 60402.00	225 64716.43
4D	4 1150.51	12 3451.54	28 8053.60	44 12655.65	60 17257.71	72 20709.25	88 25311.31	104 29913.37	120 34515.43	132 37966.97	148 42569.03	164 47171.08	180 51773.14	192 55224.68	208 59826.74	224 64428.80
5D	5 1438.14	15 4314.42	30 8628.85	45 12943.28	60 17257.71	75 21572.14	90 25886.57	105 30201.00	120 34515.43	135 38829.85	150 43144.28	165 47458.71	180 51773.14	195 56087.57	210 60402.00	225 64716.43
6D	6 1725.77	12 3451.54	30 8628.85	42 12080.40	60 17257.71	72 20709.25	88 25886.57	102 29338.11	120 34515.43	132 37966.97	150 43144.28	162 46595.83	180 51773.14	192 55224.68	210 60402.00	222 63853.54
7D	7 2013.40	14 4026.80	28 8053.60	42 12080.40	56 16107.20	70 20134.00	84 24160.80	105 30201.00	119 34227.80	133 38254.60	147 42281.40	161 46308.20	175 50335.00	189 54361.80	210 60402.00	224 64428.80
8D	8 2301.02	8 2301.02	24 6903.08	40 11505.14	56 16107.20	72 20709.25	88 25311.31	104 29913.37	120 34515.43	128 36816.45	144 41418.51	160 46020.57	176 50622.63	192 55224.68	208 59826.74	224 64428.80
9D	9 2588.65	9 2588.65	27 7765.97	45 12943.28	54 15531.94	72 20709.25	90 25886.57	99 28475.23	117 33652.54	135 38829.85	144 41418.51	162 46595.83	180 51773.14	189 54361.80	207 59539.11	225 64716.43
10D	10 2876.28	10 2876.28	30 8628.85	40 11505.14	60 17257.71	70 20134.00	90 25886.57	100 28762.85	120 34515.43	130 37391.71	150 43144.28	160 46020.57	180 51773.14	190 54649.43	210 60402.00	220 63278.29
11D	11 3163.91	11 3163.91	22 6327.82	44 12655.65	55 15819.57	66 18983.48	88 25311.31	99 28475.23	110 31639.14	132 37966.97	143 41130.88	165 47458.71	176 50622.63	187 53786.54	209 60114.37	220 63278.29
12D	12 3451.54	12 3451.54	24 6903.08	36 10354.62	60 17257.71	72 20709.25	84 24160.80	96 27612.34	120 34515.43	132 37966.97	144 41418.51	156 44870.06	180 51773.14	192 55224.68	204 58676.23	216 62127.77
13D	13 3739.17	13 3739.17	26 7478.34	39 11217.51	52 14956.68	65 18695.85	78 22435.03	104 29913.37	117 33652.54	130 37391.71	143 41130.88	156 44870.06	169 48609.23	195 56087.57	208 59826.74	221 63565.91
14D	14 4026.80	14 4026.80	28 8053.60	42 12080.40	56 16107.20	70 20134.00	84 24160.80	98 28187.60	112 32214.40	126 36241.20	140 40268.00	154 44294.80	168 48321.60	182 52348.40	210 60402.00	224 64428.80
15D	15 4314.42	15 4314.42	30 8628.85	45 12943.28	60 17257.71	75 21572.14	90 25886.57	105 30201.00	120 34515.43	135 38829.85	150 43144.28	165 47458.71	180 51773.14	195 56087.57	210 60402.00	225 64716.43
16D	0 0.00	0 0.00	16 4602.05	32 9204.11	48 13806.17	64 18408.22	80 23010.28	96 27612.34	112 32214.40	128 36816.45	144 41418.51	160 46020.57	176 50622.63	192 55224.68	208 59826.74	224 64428.80

Table F.11 List of Capacities Corresponding to RAID0 (300 GB) (continued)

Disk capacity	287.6 G bytes														
Component unit	RKAJ														
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)
2D	240 69030.86	254 73057.66	270 77659.71	284 81686.51	300 86288.57	314 90315.37	330 94917.43	344 98944.23	360 103546.29	374 107573.09	390 112175.15	404 116201.95	420 120804.00	434 124830.80	450 129432.86
3D	240 69030.86	255 73345.29	270 77659.71	285 81974.14	300 86288.57	315 90603.00	330 94917.43	345 99231.86	360 103546.29	375 107860.72	390 112175.15	405 116489.57	420 120804.00	435 125118.43	450 129432.86
4D	240 69030.86	252 72482.40	268 77084.46	284 81686.51	300 86288.57	312 89740.12	328 94342.17	344 98944.23	360 103546.29	372 106997.83	388 111599.89	404 116201.95	420 120804.00	432 124255.55	448 128857.60
5D	240 69030.86	255 73345.29	270 77659.71	285 81974.14	300 86288.57	315 90603.00	330 94917.43	345 99231.86	360 103546.29	375 107860.72	390 112175.15	405 116489.57	420 120804.00	435 125118.43	450 129432.86
6D	240 69030.86	252 72482.40	270 77659.71	282 81111.26	300 86288.57	312 89740.12	330 94917.43	342 98368.97	360 103546.29	372 106997.83	390 112175.15	402 115626.69	420 120804.00	432 124255.55	450 129432.86
7D	238 68455.60	252 72482.40	266 76509.20	280 80536.00	294 84562.80	315 90603.00	329 94629.80	343 98656.60	357 102683.40	371 106710.20	385 110737.00	399 114763.80	420 120804.00	434 124830.80	448 128857.60
8D	240 69030.86	248 71331.89	264 75933.94	280 80536.00	296 85138.06	312 89740.12	328 94342.17	344 98944.23	360 103546.29	368 105847.32	384 110449.37	400 115051.43	416 119653.49	432 124255.55	448 128857.60
9D	234 67305.09	252 72482.40	270 77659.71	279 80248.37	297 85425.69	315 90603.00	324 93191.66	342 98368.97	360 103546.29	369 106134.95	387 111312.26	405 116489.57	414 119078.23	432 124255.55	450 129432.86
10D	240 69030.86	250 71907.14	270 77659.71	280 80536.00	300 86288.57	310 89164.86	330 94917.43	340 97793.72	360 103546.29	370 106422.57	390 112175.15	400 115051.43	420 120804.00	430 123680.29	450 129432.86
11D	231 66442.20	253 72770.03	264 75933.94	275 79097.86	297 85425.69	308 88589.60	330 94917.43	341 98081.34	352 101245.26	374 107573.09	385 110737.00	396 113900.92	418 120228.75	429 123392.66	440 126556.58
12D	240 69030.86	252 72482.40	264 75933.94	276 79385.49	300 86288.57	312 89740.12	324 93191.66	336 96643.20	360 103546.29	372 106997.83	384 110449.37	396 113900.92	420 120804.00	432 124255.55	444 127707.09
13D	234 67305.09	247 71044.26	260 74783.43	273 78522.60	299 86000.94	312 89740.12	325 93479.29	338 97218.46	351 100957.63	364 104696.80	390 112175.15	403 115914.32	416 119653.49	429 123392.66	442 127131.83
14D	238 68455.60	252 72482.40	266 76509.20	280 80536.00	294 84562.80	308 88589.60	322 92616.40	336 96643.20	350 100670.00	364 104696.80	378 108723.60	392 112750.40	420 120804.00	434 124830.80	448 128857.60
15D	240 69030.86	255 73345.29	270 77659.71	285 81974.14	300 86288.57	315 90603.00	330 94917.43	345 99231.86	360 103546.29	375 107860.72	390 112175.15	405 116489.57	420 120804.00	435 125118.43	450 129432.86
16D	240 69030.86	240 69030.86	256 73632.91	272 78234.97	288 82837.03	304 87439.09	320 92041.14	336 96643.20	352 101245.26	368 105847.32	384 110449.37	400 115051.43	416 119653.49	432 124255.55	448 128857.60

Table F.12 List of Capacities Corresponding to RAID1 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
1D+1D	2 287.62	14 2013.40	30 4314.42	44 6327.82	60 8628.85	74 10642.25	90 12943.28	104 14956.68	120 17257.71	134 19271.11	150 21572.14	164 23585.54	180 25886.57	194 27899.97	210 30201.00	224 32214.40
Disk capacity	287.6 G bytes															
Component unit	RKAJ															
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)	
1D+1D	240 34515.43	254 36528.83	270 38829.85	284 40843.25	300 43144.28	314 45157.68	330 47458.71	344 49472.11	360 51773.14	374 53786.54	390 56087.57	404 58100.97	420 60402.00	434 62415.40	450 64716.43	

Table F.13 List of Capacities Corresponding to RAID5 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D+1P	3 575.25	15 2876.28	30 5752.57	45 8628.85	60 11505.14	75 14381.42	90 17257.71	105 20134.00	120 23010.28	135 25886.57	150 28762.85	165 31639.14	180 34515.43	195 37391.71	210 40268.00	225 43144.28
3D+1P	4 862.88	12 2588.65	28 6040.20	44 9491.74	60 12943.28	72 15531.94	88 18983.48	104 22435.03	120 25886.57	132 28475.23	148 31926.77	164 35378.31	180 38829.85	192 41418.51	208 44870.06	224 48321.60
4D+1P	5 1150.51	15 3451.54	30 6903.08	45 10354.62	60 13806.17	75 17257.71	90 20709.25	105 24160.80	120 27612.34	135 31063.88	150 34515.43	165 37966.97	180 41418.51	195 44870.06	210 48321.60	225 51773.14
5D+1P	6 1438.14	12 2876.28	30 7190.71	42 10067.00	60 14381.42	72 17257.71	90 21572.14	102 24448.43	120 28762.85	132 31639.14	150 35953.57	162 38829.85	180 43144.28	192 46020.57	210 48321.60	222 50335.00
6D+1P	7 1725.77	14 3451.54	28 6903.08	42 10354.62	56 13806.17	70 17257.71	84 20709.25	105 25886.57	119 29338.11	133 32789.65	147 36241.20	161 39692.74	175 43144.28	189 46595.83	210 51773.14	224 55224.68
7D+1P	8 2013.40	8 2013.40	24 6040.20	40 10067.00	56 14093.80	72 18120.60	88 22147.40	104 26174.20	120 30201.00	128 32214.40	144 36241.20	160 40268.00	176 44294.80	192 48321.60	208 52348.40	224 56375.20
8D+1P	9 2301.02	9 2301.02	27 6903.08	45 11505.14	54 13806.17	72 18408.22	90 23010.28	99 25311.31	117 29913.37	135 34515.43	144 36816.45	162 41418.51	180 46020.57	189 48321.60	207 52923.66	225 57525.71
9D+1P	10 2588.65	10 2588.65	30 7765.97	40 10354.62	60 15531.94	70 18120.60	90 23297.91	100 25886.57	120 31063.88	130 33652.54	150 38829.85	160 41418.51	180 46595.83	190 49184.48	210 54361.80	220 56950.46
10D+1P	11 2876.28	11 2876.28	22 5752.57	44 11505.14	55 14381.42	66 17257.71	88 23010.28	99 25886.57	110 28762.85	132 34515.43	143 37391.71	165 43144.28	176 46020.57	187 48896.86	209 54649.43	220 57525.71
11D+1P	12 3163.91	12 3163.91	24 6327.82	36 9491.74	60 15819.57	72 18983.48	84 22147.40	104 25311.31	117 31639.14	130 34803.05	144 37966.97	156 41130.88	180 47458.71	192 50622.63	204 53786.54	216 56950.46
12D+1P	13 3451.54	13 3451.54	26 6903.08	39 10354.62	52 13806.17	65 17257.71	78 20709.25	104 27612.34	117 31063.88	130 34515.43	143 37966.97	156 41418.51	169 44870.06	195 51773.14	208 55224.68	221 58676.23
13D+1P	14 3739.17	14 3739.17	28 7478.34	42 11217.51	56 14956.68	70 18695.85	84 22435.03	104 26174.20	112 29913.37	126 33652.54	140 37391.71	154 41130.88	168 44870.06	182 48609.23	210 56087.57	224 59826.74
14D+1P	15 4026.80	15 4026.80	30 8053.60	45 12080.40	60 16107.20	75 20134.00	90 24160.80	105 28187.60	120 32214.40	135 36241.20	150 40268.00	165 44294.80	180 48321.60	195 52348.40	210 56375.20	225 60402.00
15D+1P	0 0.00	0 0.00	16 4314.42	32 8628.85	48 12943.28	64 17257.71	80 21572.14	96 25886.57	112 30201.00	128 34515.43	144 38829.85	160 43144.28	176 47458.71	192 51773.14	208 56087.57	224 60402.00

Table F.13 List of Capacities Corresponding to RAID5 (300 GB) (continued)

Disk capacity	287.6 G bytes														
Component unit	RKAJ														
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)
2D+1P	240 46020.57	255 48896.86	270 51773.14	285 54649.43	300 57525.71	315 60402.00	330 63278.29	345 66154.57	360 69030.86	375 71907.14	390 74783.43	405 77659.71	420 80536.00	435 83412.29	450 86288.57
3D+1P	240 51773.14	252 54361.80	268 57813.34	284 61264.88	300 64716.43	312 67305.09	328 70756.63	344 74208.17	360 77659.71	372 80248.37	388 83699.92	404 87151.46	420 90603.00	432 93191.66	448 96643.20
4D+1P	240 55224.68	255 58676.23	270 62127.77	285 65579.31	300 69030.86	315 72482.40	330 75933.94	345 79385.49	360 82837.03	375 86288.57	390 89740.12	405 93191.66	420 96643.20	435 100094.74	450 103546.29
5D+1P	240 57525.71	252 60402.00	270 64716.43	282 67592.71	300 71907.14	312 74783.43	330 79097.86	342 81974.14	360 86288.57	372 89164.86	390 93479.29	402 96355.57	420 100670.00	432 103546.29	450 107860.72
6D+1P	238 58676.23	252 62127.77	266 65579.31	280 69030.86	294 72482.40	315 77659.71	329 81111.26	343 84562.80	357 88014.34	371 91465.89	385 94917.43	399 98368.97	420 103546.29	434 106997.83	448 110449.37
7D+1P	240 60402.00	248 62415.40	264 66442.20	280 70469.00	296 74495.80	312 78522.60	328 82549.40	344 86576.20	360 90603.00	368 92616.40	384 96643.20	400 100670.00	416 104696.80	432 108723.60	448 112750.40
8D+1P	234 59826.74	252 64428.80	270 69030.86	279 71331.89	297 75933.94	315 80536.00	324 82837.03	342 87439.09	360 92041.14	369 94342.17	387 98944.23	405 103546.29	414 105847.32	432 110449.37	450 115051.43
9D+1P	240 62127.77	250 64716.43	270 69893.74	280 72482.40	300 77659.71	310 80248.37	330 85425.69	340 88014.34	360 93191.66	370 95780.32	390 100957.63	400 103546.29	420 108723.60	430 111312.26	450 116489.57
10D+1P	231 60402.00	253 66154.57	264 69030.86	275 71907.14	297 77659.71	308 80536.00	330 86288.57	341 89164.86	352 92041.14	374 97793.72	385 100670.00	396 103546.29	418 109298.86	429 112175.15	440 115051.43
11D+1P	240 63278.29	252 66442.20	264 69606.11	276 72770.03	300 79097.86	312 82261.77	324 85425.69	336 88589.60	360 94917.43	372 98081.34	384 101245.26	396 104409.17	420 110737.00	432 113900.92	444 117064.83
12D+1P	234 62127.77	247 65579.31	260 69030.86	273 72482.40	299 79385.49	312 82837.03	325 86288.57	338 89740.12	351 93191.66	364 96643.20	390 103546.29	403 106997.83	416 110449.37	429 113900.92	442 117352.46
13D+1P	238 63565.91	252 67305.09	266 71044.26	280 74783.43	294 78522.60	308 82261.77	322 86000.94	336 89740.12	350 93479.29	364 97218.46	378 100957.63	392 104696.80	420 112175.15	434 115914.32	448 119653.49
14D+1P	240 64428.80	255 68455.60	270 72482.40	285 76509.20	300 80536.00	315 84562.80	330 88589.60	345 92616.40	360 96643.20	375 100670.00	390 104696.80	405 108723.60	420 112750.40	435 116777.20	450 120804.00
15D+1P	240 64716.43	240 64716.43	256 69030.86	272 73345.29	288 77659.71	304 81974.14	320 86288.57	336 90603.00	352 94917.43	368 99231.86	384 103546.29	400 107860.72	416 112175.15	432 116489.57	448 120804.00

Table F.14 List of Capacities Corresponding to RAID6 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D+2P	4 575.25	12 1725.77	28 4026.80	44 6327.82	60 8628.85	72 10354.62	88 12655.65	104 14956.68	120 17257.71	132 18983.48	148 21284.51	164 23585.54	180 25886.57	192 27612.34	208 29913.37	224 32214.40
3D+2P	5 862.88	15 2588.65	30 5177.31	45 7765.97	60 10354.62	75 12943.28	90 15531.94	105 18120.60	120 20709.25	135 23297.91	150 25886.57	165 28475.23	180 31063.88	195 33652.54	210 36241.20	225 38829.85
4D+2P	6 1150.51	12 2301.02	30 5752.57	42 8053.60	60 11505.14	72 13806.17	90 17257.71	102 19558.74	120 23010.28	132 25311.31	150 28762.85	162 31063.88	180 34515.43	192 36816.45	210 40268.00	222 42569.03
5D+2P	7 1438.14	14 2876.28	28 5752.57	42 8628.85	56 11505.14	70 14381.42	84 17257.71	105 21572.14	119 24448.43	133 27324.71	147 30201.00	161 33077.28	175 35953.57	189 38829.85	210 43144.28	224 46020.57
6D+2P	8 1725.77	8 1725.77	24 5177.31	40 8628.85	56 12080.40	72 15531.94	88 18983.48	104 22435.03	120 25886.57	128 27612.34	144 31063.88	160 34515.43	176 37966.97	192 41418.51	208 44870.06	224 48321.60
7D+2P	9 2013.40	9 2013.40	27 6040.20	45 10067.00	54 12080.40	72 16107.20	90 20134.00	99 22147.40	117 26174.20	135 30201.00	144 32214.40	162 36241.20	180 40268.00	189 42281.40	207 46308.20	225 50335.00
8D+2P	10 2301.02	10 2301.02	30 6903.08	40 9204.11	60 13806.17	70 16107.20	90 20709.25	100 23010.28	120 27612.34	130 29913.37	150 34515.43	160 36816.45	180 41418.51	190 43719.54	210 48321.60	220 50622.63
9D+2P	11 2588.65	11 2588.65	22 5177.31	44 10354.62	55 12943.28	66 15531.94	88 20709.25	99 23297.91	110 25886.57	132 31063.88	143 33652.54	165 38829.85	176 41418.51	187 44007.17	209 49184.48	220 51773.14
10D+2P	12 2876.28	12 2876.28	24 5752.57	36 8628.85	60 14381.42	72 17257.71	84 20134.00	96 23010.28	120 28762.85	132 31639.14	144 34515.43	156 37391.71	180 43144.28	192 46020.57	204 48896.86	216 51773.14
11D+2P	13 3163.91	13 3163.91	26 6327.82	39 9491.74	52 12655.65	65 15819.57	78 18983.48	104 25311.31	117 28475.23	130 31639.14	143 34803.05	156 37966.97	169 41130.88	195 47458.71	208 50622.63	221 53786.54
12D+2P	14 3451.54	14 3451.54	28 6903.08	42 10354.62	56 13806.17	70 17257.71	84 20709.25	98 24160.80	112 27612.34	126 31063.88	140 34515.43	154 37966.97	168 41418.51	182 44870.06	210 51773.14	224 55224.68
13D+2P	15 3739.17	15 3739.17	30 7478.34	45 11217.51	60 14956.68	75 18695.85	90 22435.03	105 26174.20	120 29913.37	135 33652.54	150 37391.71	165 41130.88	180 44870.06	195 48609.23	210 52348.40	225 56087.57
14D+2P	0 0.00	0 0.00	16 4026.80	32 8053.60	48 12080.40	64 16107.20	80 20134.00	96 24160.80	112 28187.60	128 32214.40	144 36241.20	160 40268.00	176 44294.80	192 48321.60	208 52348.40	224 56375.20
15D+2P	0 0.00	0 0.00	17 4314.42	34 8628.85	51 12943.28	68 17257.71	85 21572.14	102 25886.57	119 30201.00	136 34515.43	153 38829.85	170 43144.28	187 47458.71	204 51773.14	221 56087.57	
16D+2P	0 0.00	0 0.00	18 4602.05	36 9204.11	54 13806.17	72 18408.22	90 23010.28	108 28120.60	126 32214.40	144 36816.45	162 41418.51	180 46020.57	198 50620.57	216 54622.63	234 58224.68	
17D+2P	0 0.00	0 0.00	19 4889.68	38 9779.37	57 14669.05	76 19558.74	95 24448.43	114 29338.11	133 34227.80	152 38227.80	171 42227.80	190 46020.57	209 49896.86	228 53786.54	247 57866.54	
18D+2P	0 0.00	0 0.00	20 5177.31	40 10354.62	60 15531.94	80 20709.25	100 25886.57	120 31063.88	140 36241.20	160 41418.51	180 46595.83	200 51773.14	220 56950.46	240 62124.68	260 67279.85	
19D+2P	0 0.00	0 0.00	21 5464.94	42 10929.88	63 16394.82	84 21859.77	105 27324.71	126 32789.65	147 38254.60	168 43719.54	189 49184.48	210 54649.43	231 59624.68	252 64699.43	273 69754.33	
20D+2P	0 0.00	0 0.00	22 5752.57	44 11505.14	66 17257.71	88 23010.28	110 28762.85	132 34515.43	154 40268.00	176 46020.57	198 51773.14	220 57525.71	242 63279.85	264 68950.46	286 74699.43	
21D+2P	0 0.00	0 0.00	23 6040.20	46 12080.40	69 18120.60	92 24160.80	115 30201.00	138 36241.20	161 42281.40	184 48321.60	207 54361.80	230 60441.80	253 66592.20	276 72822.60	300 79373.00	
22D+2P	0 0.00	0 0.00	24 6327.82	48 12655.65	72 18983.48	96 25311.31	120 31639.14	144 37966.97	168 44294.80	192 50622.63	216 56375.20	240 62124.68	264 67779.85	288 73530.46	312 79186.03	
23D+2P	0 0.00	0 0.00	25 6615.45	50 13230.91	75 19846.37	100 26461.83	125 32712.74	150 38829.85	175 44914.77	200 51049.74	225 57224.68	250 62779.85	275 68599.83	300 74349.80	325 80000.00	
24D+2P	0 0.00	0 0.00	26 6903.08	52 13806.17	78 19846.37	104 27079.25	130 32712.74	156 38829.85	182 44914.77	208 51049.74	234 57224.68	260 62779.85	286 68599.83	312 74349.80	338 80000.00	
25D+2P	0 0.00	0 0.00	27 7190.71	54 14381.42	81 21572.14	108 26461.83	135 32712.74	162 38829.85	189 44914.77	216 51049.74	243 57224.68	270 62779.85	297 68599.83	324 74349.80	351 80000.00	
26D+2P	0 0.00	0 0.00	28 7478.34	56 14956.68	84 21572.14	112 26461.83	140 32712.74	168 38829.85	196 44914.77	224 51049.74	252 57224.68	280 62779.85	308 68599.83	336 74349.80	364 80000.00	
27D+2P	0 0.00	0 0.00	29 7765.97	58 15531.94	87 23297.91	116 26461.83	145 32712.74	174 38829.85	203 44914.77	232 51049.74	261 57224.68	290 62779.85	319 68599.83	348 74349.80	377 80000.00	
28D+2P	0 0.00	0 0.00	30 8053.60	60 16107.20	90 24160.80	120 32214.40	150 38829.85	180 44914.77	210 51049.74	240 57224.68	270 62779.85	300 68599.83	330 74349.80	360 80000.00	390 80000.00	

Table F.14 List of Capacities Corresponding to RAID6 (300 GB) (continued)

Disk capacity	287.6 G bytes														
Component unit	RKAJ														
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)
2D+2P	240 34515.43	252 36241.20	268 38542.23	284 40843.25	300 43144.28	312 44870.06	328 47171.08	344 49472.11	360 51773.14	372 53498.91	388 55799.94	404 58100.97	420 60402.00	432 62127.77	448 64428.80
3D+2P	240 41418.51	255 44007.17	270 46595.83	285 49184.48	300 51773.14	315 54361.80	330 56950.46	345 59539.11	360 62127.77	375 64716.43	390 67305.09	405 69893.74	420 72482.40	435 75071.06	450 77659.71
4D+2P	240 46020.57	252 48321.60	270 51773.14	282 54074.17	300 57525.71	312 59826.74	330 63278.29	342 65579.31	360 69030.86	372 71331.89	390 74783.43	402 77084.46	420 80536.00	432 82837.03	450 86288.57
5D+2P	238 48896.86	252 51773.14	266 54649.43	280 57525.71	294 60402.00	315 64716.43	329 67592.71	343 70469.00	357 73345.29	371 76221.57	385 79097.86	399 81974.14	420 86288.57	434 89164.86	448 92041.14
6D+2P	240 51773.14	248 53498.91	264 56950.46	280 60402.00	296 63853.54	312 67305.09	328 70756.63	344 74208.17	360 77659.71	368 79385.49	384 82837.03	400 86288.57	416 89740.12	432 93191.66	448 96643.20
7D+2P	234 52348.40	252 56375.20	270 60402.00	279 62415.40	297 66442.20	315 70469.00	324 72482.40	342 76509.20	360 80536.00	369 82549.40	387 86576.20	405 90603.00	414 92616.40	432 96643.20	450 100670.00
8D+2P	240 55224.68	250 57525.71	270 62127.77	280 64428.80	300 69030.86	310 71331.89	330 75933.94	340 78234.97	360 82837.03	370 85138.06	390 89740.12	400 92041.14	420 96643.20	430 98944.23	450 103546.29
9D+2P	231 54361.80	253 59539.11	264 62127.77	275 64716.43	297 69893.74	308 72482.40	330 77659.71	341 80248.37	352 82837.03	374 88014.34	385 90603.00	396 93191.66	418 98368.97	429 100957.63	440 103546.29
10D+2P	240 57525.71	252 60402.00	264 63278.29	276 66154.57	300 71907.14	312 74783.43	324 77659.71	336 80536.00	360 86288.57	372 89164.86	384 92041.14	396 94917.43	420 100670.00	432 103546.29	444 106422.57
11D+2P	234 56950.46	247 60114.37	260 63278.29	273 66442.20	299 72770.03	312 75933.94	325 79097.86	338 82261.77	351 85425.69	364 88589.60	390 94917.43	403 98081.34	416 101245.26	429 104409.17	442 107573.09
12D+2P	238 58676.23	252 62127.77	266 65579.31	280 69030.86	294 72482.40	308 75933.94	322 79385.49	336 82837.03	350 86288.57	364 89740.12	378 93191.66	392 96643.20	420 103546.29	434 106997.83	448 110449.37
13D+2P	240 59826.74	255 63565.91	270 67305.09	285 71044.26	300 74783.43	315 78522.60	330 82261.77	345 86000.94	360 89740.12	375 93479.29	390 97218.46	405 100957.63	420 104696.80	435 108435.97	450 112175.15
14D+2P	240 60402.00	240 60402.00	256 64428.80	272 68455.60	288 72482.40	304 76509.20	320 80536.00	336 84562.80	352 88589.60	368 92616.40	384 96643.20	400 100670.00	416 104696.80	432 108723.60	448 112750.40
15D+2P	238 60402.00	255 64716.43	255 64716.43	272 69030.86	289 73345.29	306 77659.71	323 81974.14	340 86288.57	357 90603.00	374 94917.43	374 94917.43	391 99231.86	408 103546.29	425 107860.72	442 112175.15
16D+2P	234 59826.74	252 64428.80	270 69030.86	270 69030.86	288 73632.91	306 78234.97	324 82837.03	342 87439.09	360 92041.14	360 92041.14	378 96643.20	396 101245.26	414 105847.32	432 110449.37	450 115051.43
17D+2P	228 58676.23	247 63565.91	266 68455.60	285 73345.29	285 73345.29	304 78234.97	323 83124.66	342 88014.34	342 88014.34	361 92904.03	380 97793.72	399 102683.40	418 107573.09	418 107573.09	437 112462.77
18D+2P	240 62127.77	240 62127.77	260 67305.09	280 72482.40	300 77659.71	300 77659.71	320 82837.03	340 88014.34	360 93191.66	360 93191.66	380 98368.97	400 103546.29	420 108723.60	420 108723.60	440 113900.92
19D+2P	231 60114.37	252 65579.31	252 65579.31	273 71044.26	294 76509.20	315 81974.14	315 81974.14	336 87439.09	357 92904.03	357 92904.03	378 98368.97	399 103833.92	420 109298.86	420 109298.86	441 114763.80
20D+2P	220 57525.71	242 63278.29	264 69030.86	264 69030.86	286 74783.43	308 80536.00	330 86288.57	330 86288.57	352 92041.14	374 97793.72	374 97793.72	396 103546.29	418 109298.86	418 109298.86	440 115051.43
21D+2P	230 60402.00	253 66442.20	253 66442.20	276 72482.40	299 78522.60	299 78522.60	322 84562.80	345 90603.00	345 90603.00	368 96643.20	368 96643.20	391 102683.40	414 108723.60	414 108723.60	437 114763.80
22D+2P	240 63278.29	240 63278.29	264 69606.11	264 69606.11	288 75933.94	312 82261.77	312 82261.77	336 88589.60	360 94917.43	360 94917.43	384 101245.26	384 101245.26	408 107573.09	432 113900.92	432 113900.92
23D+2P	225 59539.11	250 66154.57	275 66154.57	275 72770.03	300 79385.49	300 79385.49	325 86000.94	325 86000.94	350 92616.40	375 99231.86	375 99231.86	400 105847.32	400 105847.32	425 112462.77	450 119078.23
24D+2P	234 62127.77	234 62127.77	260 69030.86	260 69030.86	286 75933.94	312 82837.03	312 82837.03	338 89740.12	338 89740.12	364 96643.20	390 103546.29	390 103546.29	416 110449.37	416 110449.37	442 117352.46
25D+2P	216 57525.71	243 64716.43	270 71907.14	270 71907.14	297 79097.86	297 79097.86	324 86288.57	324 86288.57	351 93479.29	351 93479.29	378 100670.00	405 107860.72	405 107860.72	432 115051.43	432 115051.43
26D+2P	224 59826.74	252 67305.09	252 67305.09	280 74783.43	280 74783.43	308 82261.77	308 82261.77	336 89740.12	336 89740.12	364 97218.46	364 97218.46	392 104696.80	420 112175.15	420 112175.15	448 119653.49
27D+2P	232 62127.77	232 62127.77	261 69893.74	261 69893.74	290 77659.71	290 77659.71	319 85425.69	319 85425.69	348 93191.66	348 93191.66	377 100957.63	377 100957.63	406 108723.60	435 116489.57	435 116489.57
28D+2P	240 64428.80	240 64428.80	270 72482.40	270 72482.40	300 80536.00	300 80536.00	330 88589.60	330 88589.60	360 96643.20	360 96643.20	390 104696.80	390 104696.80	420 112750.40	420 112750.40	450 120804.00

Table F.15 List of Capacities Corresponding to RAID1+0 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKAJ															
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
2D+2D	4 575.25	12 1725.77	28 4026.80	44 6327.82	60 8628.85	72 10354.62	88 12655.65	104 14956.68	120 17257.71	132 18983.48	148 21284.51	164 23585.54	180 25886.57	192 27612.34	208 29913.37	224 32214.40
3D+3D	6 862.88	12 1725.77	30 4314.42	42 6040.20	60 8628.85	72 10354.62	90 12943.28	102 14669.05	120 17257.71	132 18983.48	150 21572.14	162 23297.91	180 25886.57	192 27612.34	210 30201.00	222 31926.77
4D+4D	8 1150.51	8 1150.51	24 3451.54	40 5752.57	56 8053.60	72 10354.62	88 12655.65	104 14956.68	120 17257.71	128 18408.22	144 20709.25	160 23010.28	176 25311.31	192 27612.34	208 29913.37	224 32214.40
5D+5D	10 1438.14	10 1438.14	30 4314.42	40 5752.57	60 8628.85	70 10067.00	90 12943.28	100 14381.42	120 17257.71	130 18695.85	150 21572.14	160 23010.28	180 25886.57	190 27324.71	210 30201.00	220 31639.14
6D+6D	12 1725.77	12 1725.77	24 3451.54	36 5177.31	60 8628.85	72 10354.62	84 12080.40	96 13806.17	120 17257.71	132 18983.48	144 20709.25	156 22435.03	180 25886.57	192 27612.34	204 29338.11	216 31063.88
7D+7D	14 2013.40	14 2013.40	28 4026.80	42 6040.20	56 8053.60	70 10067.00	84 12080.40	98 14093.80	112 16107.20	126 18120.60	140 20134.00	154 22147.40	168 24160.80	182 26174.20	210 30201.00	224 32214.40
8D+8D	0 0.00	0 0.00	16 2301.02	32 4602.05	48 6903.08	64 9204.11	80 11505.14	96 13806.17	112 16107.20	128 18408.22	144 20709.25	160 23010.28	176 25311.31	192 27612.34	208 29913.37	224 32214.40
Disk capacity	287.6 G bytes															
Component unit	RKAJ															
Range	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Total range of Disk drives	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450(Max.)	
2D+2D	240 34515.43	252 36241.20	268 38542.23	284 40843.25	300 43144.28	312 44870.06	328 47171.08	344 49472.11	360 51773.14	372 53498.91	388 55799.94	404 58100.97	420 60402.00	432 62127.77	448 64428.80	
3D+3D	240 34515.43	252 36241.20	270 38829.85	282 40555.63	300 43144.28	312 44870.06	330 47458.71	342 49184.48	360 51773.14	372 53498.91	390 56087.57	402 57813.34	420 60402.00	432 62127.77	450 64716.43	
4D+4D	240 34515.43	248 35665.94	264 37966.97	280 40268.00	296 42569.03	312 44870.06	328 47171.08	344 49472.11	360 51773.14	368 52923.66	384 55224.68	400 57525.71	416 59826.74	432 62127.77	448 64428.80	
5D+5D	240 34515.43	250 35953.57	270 38829.85	280 40268.00	300 43144.28	310 44582.43	330 47458.71	340 48896.86	360 51773.14	370 53211.28	390 56087.57	400 57525.71	420 60402.00	430 61840.14	450 64716.43	
6D+6D	240 34515.43	252 36241.20	264 37966.97	276 39692.74	300 43144.28	312 44870.06	324 46595.83	336 48321.60	360 51773.14	372 53498.91	384 55224.68	396 56950.46	420 60402.00	432 62127.77	444 63853.54	
7D+7D	238 34227.80	252 36241.20	266 38254.60	280 40268.00	294 42281.40	308 44294.80	322 46308.20	336 48321.60	350 50335.00	364 52348.40	378 54361.80	392 56375.20	420 60402.00	434 62415.40	448 64428.80	
8D+8D	240 34515.43	240 34515.43	256 36816.45	272 39117.48	288 41418.51	304 43719.54	320 46020.57	336 48321.60	352 50622.63	368 52923.66	384 55224.68	400 57525.71	416 59826.74	432 62127.77	448 64428.80	

Table F.16 List of Capacities Corresponding to RAID1 (250 GB)

Disk capacity	245.7 G bytes																												
Component unit	RKAJAT																												
Range	1		2		3		4		5		6		7		8		9		10		11		12		13		14		
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210														
1D+1D	2	14	30	44	60	74	90	104	120	134	150	164	180	194	210														
	245.74	1720.22	3686.18	5406.41	7372.37	9092.59	11058.56	12778.78	14744.75	16464.97	18430.94	20151.16	22117.13	23837.35	25803.32														
Disk capacity	245.7 G bytes																												
Component unit	RKAJAT																												
Range	15		16		17		18		19		20		21		22		23		24		25		26		27		28		
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)															
1D+1D	224	240	254	270	284	300	314	330	344	360	374	390	404	420															
	27523.54	29489.51	31209.73	33175.70	34895.92	36861.89	38582.11	40548.08	42268.30	44234.27	45954.49	47920.45	49640.68	51606.64															

Table F.17 List of Capacities Corresponding to RAID5 (250 GB)

Disk capacity	245.7 G bytes																												
Component unit	RKAJAT																												
Range	1		2		3		4		5		6		7		8		9		10		11		12		13		14		
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210														
2D+1P	3	15	30	45	60	75	90	105	120	135	150	165	180	195	210														
	491.49	2457.45	4914.91	7372.37	9829.83	12287.29	14744.75	17202.21	19659.67	22117.13	24574.59	27032.05	29489.51	31946.97	34404.43														
3D+1P	4	12	28	44	60	72	88	104	120	132	148	164	180	192	208														
	737.23	2211.71	5160.66	8109.61	11058.56	13270.28	16219.23	19168.18	22117.13	24328.84	27277.79	30226.75	33175.70	35387.41	38336.36														
4D+1P	5	15	30	45	60	75	90	105	120	135	150	165	180	195	210														
	982.98	2948.95	5897.90	8846.85	11795.80	14744.75	17693.70	20642.65	23591.61	26540.56	29489.51	32438.46	35387.41	38336.36	41285.31														
5D+1P	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210														
	1228.72	2457.45	6143.64	8601.10	12287.29	14744.75	18430.94	20888.40	24574.59	27032.05	30718.24	33175.70	36861.89	39319.35	43005.54														
6D+1P	7	14	28	42	56	70	84	105	119	133	147	161	175	189	210														
	1474.47	2948.95	5897.90	8846.85	11795.80	14744.75	17693.70	22117.13	25066.08	28015.03	30963.98	33912.94	36861.89	39810.84	44234.27														
7D+1P	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208														
	1720.22	1720.22	5160.66	8601.10	12041.55	15481.99	18922.43	22362.88	25803.32	27523.54	30963.98	34404.43	37844.87	41285.31	44725.76														
8D+1P	9	9	27	45	54	72	90	99	117	135	144	162	180	189	207														
	1965.96	1965.96	5897.90	9829.83	11795.80	15727.74	19659.67	21625.64	25557.57	29489.51	31455.48	35387.41	39319.35	41285.31	45217.25														
9D+1P	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210														
	2211.71	2211.71	6635.14	8846.85	13270.28	15481.99	19905.42	22117.13	26540.56	28752.27	33175.70	35387.41	39810.84	42022.55	46445.98														
10D+1P	11	11	22	44	55	66	88	99	110	132	143	165	176	187	209														
	2457.45	2457.45	4914.91	9829.83	12287.29	14744.75	19659.67	22117.13	24574.59	29489.51	31946.97	36861.89	39319.35	41776.81	46691.72														
11D+1P	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204														
	2703.20	2703.20	5406.41	8109.61	13516.02	16219.23	18922.43	21625.64	27032.05	29735.25	32438.46	35141.67	40548.08	43251.28	45954.49														
12D+1P	13	13	26	39	52	65	78	104	117	130	143	156	169	195	208														
	2948.95	2948.95	5897.90	8846.85	11795.80	14744.75	17693.70	23591.61	26540.56	29489.51	32438.46	35387.41	38336.36	44234.27	47183.22														
13D+1P	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210														
	3194.69	3194.69	6389.39	9584.09	12778.78	15973.48	19168.18	22362.88	25557.57	28752.27	31946.97	35141.67	38336.36	41531.06	47920.45														
14D+1P	15	15	30	45	60	75	90	105	120	135	150	165	180	195	210														
	3440.44	3440.44	6880.88	10321.32	13761.77	17202.21	20642.65	24083.10	27523.54	30963.98	34404.43	37844.87	41285.31	44725.76	48166.20														
15D+1P	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208														
	0.00	0.00	3686.18	7372.37	11058.56	14744.75	18430.94	22117.13	25803.32	29489.51	33175.70	36861.89	40548.08	44234.27	47920.45														

Table F.17 List of Capacities Corresponding to RAID5 (250 GB) (continued)

Disk capacity	245.7 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)
2D+1P	225 36861.89	240 39319.35	255 41776.81	270 44234.27	285 46691.72	300 49149.18	315 51606.64	330 54064.10	345 56521.56	360 58979.02	375 61436.48	390 63893.94	405 66351.40	420 68808.86
3D+1P	224 41285.31	240 44234.27	252 46445.98	268 49394.93	284 52343.88	300 55292.83	312 57504.55	328 60453.50	344 63402.45	360 66351.40	372 68563.11	388 71512.07	404 74461.02	420 77409.97
4D+1P	225 44234.27	240 47183.22	255 50132.17	270 53081.12	285 56030.07	300 58979.02	315 61927.97	330 64876.92	345 67825.88	360 70774.83	375 73723.78	390 76672.73	405 79621.68	420 82570.63
5D+1P	222 45462.99	240 49149.18	252 51606.64	270 55292.83	282 57750.29	300 61436.48	312 63893.94	330 67580.13	342 70037.59	360 73723.78	372 76181.24	390 79867.43	402 82324.89	420 86011.08
6D+1P	224 47183.22	238 50132.17	252 53081.12	266 56030.07	280 58979.02	294 61927.97	315 66351.40	329 69300.35	343 72249.30	357 75198.25	371 78147.21	385 81096.16	399 84045.11	420 88468.54
7D+1P	224 48166.20	240 51606.64	248 53326.87	264 56767.31	280 60207.75	296 63648.19	312 67088.64	328 70529.08	344 73969.52	360 77409.97	368 79130.19	384 82570.63	400 86011.08	416 89451.52
8D+1P	225 49149.18	234 51115.15	252 55047.09	270 58979.02	279 60944.99	297 64876.92	315 68808.86	324 70774.83	342 74706.76	360 78638.70	369 80604.67	387 84536.60	405 88468.54	414 90434.50
9D+1P	220 48657.69	240 53081.12	250 55292.83	270 59716.26	280 61927.97	300 66351.40	310 68563.11	330 72986.54	340 75198.25	360 79621.68	370 81833.39	390 86256.82	400 88468.54	420 92891.96
10D+1P	220 49149.18	231 51606.64	253 56521.56	264 58979.02	275 61436.48	297 66351.40	308 68808.86	330 73723.78	341 76181.24	352 78638.70	374 83553.62	385 86011.08	396 88468.54	418 93383.45
11D+1P	216 48657.69	240 54064.10	252 56767.31	264 59470.51	276 62173.72	300 67580.13	312 70283.34	324 72986.54	336 75689.75	360 81096.16	372 83799.36	384 86502.57	396 89205.77	420 94612.18
12D+1P	221 50132.17	234 53081.12	247 56030.07	260 58979.02	273 61927.97	299 67825.88	312 70774.83	325 73723.78	338 76672.73	351 79621.68	364 82570.63	390 88468.54	403 91417.49	416 94366.44
13D+1P	224 51115.15	238 54309.85	252 57504.55	266 60699.24	280 63893.94	294 67088.64	308 70283.34	322 73478.03	336 76672.73	350 79867.43	364 83062.12	378 86256.82	392 89451.52	420 95840.91
14D+1P	225 51606.64	240 55047.09	255 58487.53	270 61927.97	285 65368.42	300 68808.86	315 72249.30	330 75689.75	345 79130.19	360 82570.63	375 86011.08	390 89451.52	405 92891.96	420 96332.41
15D+1P	224 51606.64	240 55292.83	240 55292.83	256 58979.02	272 62665.21	288 66351.40	304 70037.59	320 73723.78	336 77409.97	352 81096.16	368 84782.35	384 88468.54	400 92154.72	416 95840.91

Table F.18 List of Capacities Corresponding to RAID6 (250 GB)

Disk capacity	245.7 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+2P	4 491.49	12 1474.47	28 3440.44	44 5406.41	60 7372.37	72 8846.85	88 10812.82	104 12778.78	120 14744.75	132 16219.23	148 18185.19	164 20151.16	180 22117.13	192 23591.61	208 25557.57
3D+2P	5 737.23	15 2211.71	30 4423.42	45 6635.14	60 8846.85	75 11058.56	90 13270.28	105 15481.99	120 17693.70	135 19905.42	150 22117.13	165 24328.84	180 26540.56	195 28752.27	210 30963.98
4D+2P	6 982.98	12 1965.96	30 4914.91	42 6880.88	60 9829.83	72 11795.80	90 14744.75	102 16710.72	120 19659.67	132 21625.64	150 24574.59	162 26540.56	180 29489.51	192 31455.48	210 34404.43
5D+2P	7 1228.72	14 2457.45	28 4914.91	42 7372.37	56 9829.83	70 12287.29	84 14744.75	105 18430.94	119 20888.40	133 23345.86	147 25803.32	161 28260.78	175 30718.24	189 33175.70	210 36861.89
6D+2P	8 1474.47	8 1474.47	24 4423.42	40 7372.37	56 10321.32	72 13270.28	88 16219.23	104 19168.18	120 22117.13	128 23591.61	144 26540.56	160 29489.51	176 32438.46	192 35387.41	208 38336.36
7D+2P	9 1720.22	9 1720.22	27 5160.66	45 8601.10	54 10321.32	72 13761.77	90 17202.21	99 18922.43	117 22362.88	135 25803.32	144 27523.54	162 30963.98	180 34404.43	189 36124.65	207 39665.09
8D+2P	10 1965.96	10 1965.96	30 5897.90	40 7863.87	60 11795.80	70 13761.77	90 17693.70	100 19659.67	120 23591.61	130 25557.57	150 29489.51	160 31455.48	180 35387.41	190 37353.38	210 41285.31
9D+2P	11 2211.71	11 2211.71	22 4423.42	44 8846.85	55 11058.56	66 13270.28	88 17693.70	99 19905.42	110 22117.13	132 26540.56	143 28752.27	165 33175.70	176 35387.41	187 37599.12	209 42022.55
10D+2P	12 2457.45	12 2457.45	24 4914.91	36 7372.37	60 12287.29	72 14744.75	84 17202.21	96 19659.67	120 24574.59	132 27032.05	144 29489.51	156 31946.97	180 36861.89	192 39319.35	204 41776.81
11D+2P	13 2703.20	13 2703.20	26 5406.41	39 8109.61	52 10812.82	65 13516.02	78 16219.23	104 21625.64	117 24328.84	130 27032.05	143 29735.25	156 32438.46	169 35141.67	195 40548.08	208 43251.28
12D+2P	14 2948.95	14 2948.95	28 5897.90	42 8846.85	56 11795.80	70 14744.75	84 17693.70	98 20642.65	112 23591.61	126 26540.56	140 29489.51	154 32438.46	168 35387.41	182 38336.36	210 44234.27
13D+2P	15 3194.69	15 3194.69	30 6389.39	45 9584.09	60 12778.78	75 15973.48	90 19168.18	105 22362.88	120 25557.57	135 28752.27	150 31946.97	165 35141.67	180 38336.36	195 41531.06	210 44725.76
14D+2P	0 0.00	0 0.00	16 3440.44	32 6880.88	48 10321.32	64 13761.77	80 17202.21	96 20642.65	112 24083.10	128 27523.54	144 30963.98	160 34404.43	176 37844.87	192 41285.31	208 44725.76
15D+2P	0 0.00	0 0.00	17 3686.18	34 7372.37	51 11058.56	68 14744.75	85 18430.94	102 22117.13	119 25803.32	136 28752.27	153 33175.70	170 36861.89	187 40548.08	204 44234.27	
16D+2P	0 0.00	0 0.00	18 3931.93	36 7863.87	54 11795.80	72 15727.74	90 19659.67	108 23591.61	126 27523.54	144 31455.48	162 35387.41	180 39319.35	198 43251.28		
17D+2P	0 0.00	0 0.00	19 4177.68	38 8355.36	57 12533.04	76 16710.72	95 20888.40	114 25066.08	133 29243.76	152 33421.44	171 37599.12	190 41776.81	209 45954.49		
18D+2P	0 0.00	0 0.00	20 4423.42	40 8846.85	60 13270.28	80 17693.70	100 22117.13	120 26540.56	140 30963.98	160 35387.41	180 39810.84	200 44234.27			
19D+2P	0 0.00	0 0.00	21 4669.17	42 9338.34	63 14007.51	84 18676.69	105 23345.86	126 28150.03	147 32684.21	168 36861.89	189 42022.55	210 46691.72			
20D+2P	0 0.00	0 0.00	22 4914.91	44 9829.83	66 14744.75	88 19659.67	110 24574.59	132 29489.51	154 34404.43	176 39319.35	198 44234.27				
21D+2P	0 0.00	0 0.00	23 5160.66	46 5160.66	69 10321.32	92 15481.99	115 15481.99	138 20642.65	161 25803.32	184 25803.32	207 30963.98	210 36124.65	210 36124.65	210 41285.31	210 46445.98
22D+2P	0 0.00	0 0.00	24 5406.41	48 5406.41	72 10812.82	96 16219.23	120 21625.64	144 27032.05	168 27032.05	192 32438.46	216 32438.46	240 37844.87	264 43251.28	288 43251.28	
23D+2P	0 0.00	0 0.00	25 5652.15	50 5652.15	75 11304.31	100 16956.47	125 16956.47	150 22608.62	175 22608.62	200 28260.78	225 33912.94	250 33912.94	275 39565.09	300 39565.09	325 45217.25
24D+2P	0 0.00	0 0.00	26 5897.90	52 5897.90	78 11795.80	104 17693.70	130 23591.61	156 23591.61	182 29489.51	208 29489.51	234 35387.41	260 35387.41	286 41285.31	312 41285.31	338 47183.22
25D+2P	0 0.00	0 0.00	27 6143.64	54 6143.64	81 12287.29	108 12287.29	135 18430.94	162 18430.94	189 24574.59	216 30718.24	243 30718.24	270 36861.89	297 36861.89	324 43005.54	351 43005.54
26D+2P	0 0.00	0 0.00	28 6389.39	56 6389.39	84 12778.78	112 12778.78	140 19168.18	168 19168.18	196 25557.57	224 25557.57	252 31946.97	280 31946.97	308 38336.36	336 38336.36	364 44725.76
27D+2P	0 0.00	0 0.00	29 6635.14	58 6635.14	87 13270.28	116 13270.28	145 19905.42	174 19905.42	203 26540.56	232 26540.56	261 33175.70	290 33175.70	319 39810.84	348 39810.84	377 46445.98
28D+2P	0 0.00	0 0.00	30 6880.88	60 6880.88	90 13761.77	120 13761.77	150 20642.65	180 20642.65	210 27523.54	240 27523.54	270 34404.43	300 34404.43	330 41285.31	360 41285.31	390 48166.20

Table F.18 List of Capacities Corresponding to RAID6 (250 GB) (continued)

Disk capacity	245.7 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)
2D+2P	224 27523.54	240 29489.51	252 30963.98	268 32929.95	284 34895.92	300 36861.89	312 38336.36	328 40302.33	344 42268.30	360 44234.27	372 45708.74	388 47674.71	404 49640.68	420 51606.64
3D+2P	225 33175.70	240 35387.41	255 37599.12	270 39810.84	285 42022.55	300 44234.27	315 46445.98	330 48657.69	345 50869.41	360 53081.12	375 55292.83	390 57504.55	405 59716.26	420 61927.97
4D+2P	222 36370.39	240 39319.35	252 41285.31	270 44234.27	282 46200.23	300 49149.18	312 51115.15	330 54064.10	342 56030.07	360 58979.02	372 60944.99	390 63893.94	402 65859.91	420 68808.86
5D+2P	224 39319.35	238 41776.81	252 44234.27	266 46691.72	280 49149.18	294 51606.64	315 55292.83	329 57750.29	343 60207.75	357 62665.21	371 65122.67	385 67580.13	399 70037.59	420 73723.78
6D+2P	224 41285.31	240 44234.27	248 45708.74	264 48657.69	280 51606.64	296 54555.59	312 57504.55	328 60453.50	344 63402.45	360 66351.40	368 67825.88	384 70774.83	400 73723.78	416 76672.73
7D+2P	225 43005.54	234 44725.76	252 48166.20	270 51606.64	279 53326.87	297 56767.31	315 60207.75	324 61927.97	342 65368.42	360 68808.86	369 70529.08	387 73969.52	405 77409.97	414 79130.19
8D+2P	220 43251.28	240 47183.22	250 49149.18	270 53081.12	280 55047.09	300 58979.02	310 60944.99	330 64876.92	340 66842.89	360 70774.83	370 72740.79	390 76672.73	400 78638.70	420 82570.63
9D+2P	220 44234.27	231 46445.98	253 50869.41	264 53081.12	275 55292.83	297 59716.26	308 61927.97	330 66351.40	341 68563.11	352 70774.83	374 75198.25	385 77409.97	396 79621.68	418 84045.11
10D+2P	216 44234.27	240 49149.18	252 51606.64	264 54064.10	276 56521.56	300 61436.48	312 63893.94	324 66351.40	336 68808.86	360 73723.78	372 76181.24	384 78638.70	396 81096.16	420 86011.08
11D+2P	221 45954.49	234 48657.69	247 51360.90	260 54064.10	273 56767.31	299 62173.72	312 64876.92	325 67580.13	338 70283.34	351 72986.54	364 75689.75	390 81096.16	403 83799.36	416 86502.57
12D+2P	224 47183.22	238 50132.17	252 53081.12	266 56030.07	280 58979.02	294 61927.97	308 64876.92	322 67825.88	336 70774.83	350 73723.78	364 76672.73	378 79621.68	392 82570.63	420 88468.54
13D+2P	225 47920.45	240 51115.15	255 54309.85	270 57504.55	285 60699.24	300 63893.94	315 67088.64	330 70283.34	345 73478.03	360 76672.73	375 79867.43	390 83062.12	405 86256.82	420 89451.52
14D+2P	224 48166.20	240 51606.64	240 51606.64	256 55047.09	272 58487.53	288 61927.97	304 65368.42	320 68808.86	336 72249.30	352 75689.75	368 79130.19	384 82570.63	400 86011.08	416 89451.52
15D+2P	221 47920.45	238 51606.64	255 55292.83	255 55292.83	272 58979.02	289 62665.21	306 66351.40	323 70037.59	340 73723.78	357 77409.97	374 81096.16	374 81096.16	391 84782.35	408 88468.54
16D+2P	216 47183.22	234 51115.15	252 55047.09	270 58979.02	270 58979.02	288 62910.96	306 66842.89	324 70774.83	342 74706.76	360 78638.70	360 78638.70	378 82570.63	396 86502.57	414 90434.50
17D+2P	209 45954.49	228 50132.17	247 54309.85	266 58487.53	285 62665.21	285 62665.21	304 66842.89	323 71020.57	342 75198.25	342 75198.25	361 79375.94	380 83553.62	399 87731.30	418 91908.98
18D+2P	220 48657.69	240 53081.12	240 53081.12	260 57504.55	280 61927.97	300 66351.40	300 66351.40	320 70774.83	340 75198.25	360 79621.68	360 79621.68	380 84045.11	400 88468.54	420 92891.96
19D+2P	210 46691.72	231 51360.90	252 56030.07	252 56030.07	273 60699.24	294 65368.42	315 70037.59	315 70037.59	336 74706.76	357 79375.94	357 79375.94	378 84045.11	399 88714.28	420 93383.45
20D+2P	220 49149.18	220 49149.18	242 54064.10	264 58979.02	264 58979.02	286 63893.94	308 68808.86	330 73723.78	330 73723.78	352 78638.70	374 83553.62	374 83553.62	396 88468.54	418 93383.45
21D+2P	207 46445.98	230 51606.64	253 56767.31	253 56767.31	276 61927.97	299 67088.64	322 67088.64	322 72249.30	345 77409.97	345 77409.97	368 82570.63	368 82570.63	391 87731.30	414 92891.96
22D+2P	216 48657.69	240 54064.10	240 54064.10	264 59470.51	264 59470.51	288 64876.92	312 70283.34	312 70283.34	336 75689.75	360 81096.16	360 81096.16	384 86502.57	384 86502.57	408 91908.98
23D+2P	225 50869.41	225 50869.41	250 56521.56	250 56521.56	275 62173.72	300 67825.88	300 67825.88	325 73478.03	350 73478.03	350 73478.03	375 79130.19	375 84782.35	400 90434.50	400 90434.50
24D+2P	208 47183.22	234 53081.12	234 53081.12	260 58979.02	260 58979.02	286 64876.92	312 70774.83	312 70774.83	338 76672.73	338 76672.73	364 82570.63	364 82570.63	390 88468.54	416 94366.44
25D+2P	216 49149.18	216 49149.18	243 55292.83	270 61436.48	270 61436.48	297 67580.13	297 67580.13	324 73723.78	324 73723.78	351 79867.43	351 79867.43	378 86011.08	405 92154.72	405 92154.72
26D+2P	224 51115.15	224 51115.15	252 57504.55	252 57504.55	280 63893.94	280 63893.94	308 70283.34	308 70283.34	336 76672.73	336 76672.73	364 83062.12	364 83062.12	392 89451.52	420 95840.91
27D+2P	203 46445.98	232 53081.12	232 53081.12	261 59716.26	261 59716.26	290 66351.40	290 66351.40	319 72986.54	319 72986.54	348 79621.68	348 79621.68	377 86256.82	377 86256.82	406 92891.96
28D+2P	210 48166.20	240 55047.09	240 55047.09	270 61927.97	270 61927.97	300 68808.86	300 68808.86	330 75689.75	330 75689.75	360 82570.63	360 82570.63	390 89451.52	390 89451.52	420 96332.41

Table F.19 List of Capacities Corresponding to RAID1+0 (250 GB)

Disk capacity	245.7 G bytes														
Component unit	RKAJAT														
Range	1		2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+2D	4 491.49	12 1474.47	28 3440.44	44 5406.41	60 7372.37	72 8846.85	88 10812.82	104 12778.78	120 14744.75	132 16219.23	148 18185.19	164 20151.16	180 22117.13	192 23591.61	208 25557.57
3D+3D	6 737.23	12 1474.47	30 3686.18	42 5160.66	60 7372.37	72 8846.85	90 11058.56	102 12533.04	120 14744.75	132 16219.23	150 18430.94	162 19905.42	180 22117.13	192 23591.61	210 25803.32
4D+4D	8 982.98	8 982.98	24 2948.95	40 4914.91	56 6880.88	72 8846.85	88 10812.82	104 12778.78	120 14744.75	128 15727.74	144 17693.70	160 19659.67	176 21625.64	192 23591.61	208 25557.57
5D+5D	10 1228.72	10 1228.72	30 3686.18	40 4914.91	60 7372.37	70 8601.10	90 11058.56	100 12287.29	120 14744.75	130 15973.48	150 18430.94	160 19659.67	180 22117.13	190 23345.86	210 25803.32
6D+6D	12 1474.47	12 1474.47	24 2948.95	36 4423.42	60 7372.37	72 8846.85	84 10321.32	96 11795.80	120 14744.75	132 16219.23	144 17693.70	156 19168.18	180 22117.13	192 23591.61	204 25066.08
7D+7D	14 1720.22	14 1720.22	28 3440.44	42 5160.66	56 6880.88	70 8601.10	84 10321.32	98 12041.55	112 13761.77	126 15481.99	140 17202.21	154 18922.43	168 20642.65	182 22362.88	210 25803.32
8D+8D	0 0.00	0 0.00	16 1965.96	32 3931.93	48 5897.90	64 7863.87	80 9829.83	96 11795.80	112 13761.77	128 15727.74	144 17693.70	160 19659.67	176 21625.64	192 23591.61	208 25557.57
Disk capacity	245.7 G bytes														
Component unit	RKAJAT														
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)	
2D+2D	224 27523.54	240 29489.51	252 30963.98	268 32929.95	284 34895.92	300 36861.89	312 38336.36	328 40302.33	344 42268.30	360 44234.27	372 45708.74	388 47674.71	404 49640.68	420 51606.64	
3D+3D	222 27277.79	240 29489.51	252 30963.98	270 33175.70	282 34650.17	300 36861.89	312 38336.36	330 40548.08	342 42022.55	360 44234.27	372 45708.74	390 47920.45	402 49394.93	420 51606.64	
4D+4D	224 27523.54	240 29489.51	248 30472.49	264 32438.46	280 34404.43	296 36370.39	312 38336.36	328 40302.33	344 42268.30	360 44234.27	368 45217.25	384 47183.22	400 49149.18	416 51115.15	
5D+5D	220 27032.05	240 29489.51	250 30718.24	270 33175.70	280 34404.43	300 36861.89	310 38090.62	330 40548.08	340 41776.81	360 44234.27	370 45462.99	390 47920.45	400 49149.18	420 51606.64	
6D+6D	216 26540.56	240 29489.51	252 30963.98	264 32438.46	276 33912.94	300 36861.89	312 38336.36	324 39810.84	336 41285.31	360 44234.27	372 45708.74	384 47183.22	396 48657.69	420 51606.64	
7D+7D	224 27523.54	238 29243.76	252 30963.98	266 32684.21	280 34404.43	294 36124.65	308 37844.87	322 39565.09	336 41285.31	350 43005.54	364 44725.76	378 46445.98	392 48166.20	420 51606.64	
8D+8D	224 27523.54	240 29489.51	240 29489.51	256 31455.48	272 33421.44	288 35387.41	304 37353.38	320 39319.35	336 41285.31	352 43251.28	368 45217.25	384 47183.22	400 49149.18	416 51115.15	

Table F.20 List of Capacities Corresponding to RAID1 (400 GB)

Disk capacity	393.4 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
1D+1D	2 393.45	14 2754.21	30 5901.88	44 8656.10	60 11803.77	74 14557.99	90 17705.66	104 20459.88	120 23607.55	134 26361.77	150 29509.44	164 32263.66	180 35411.33	194 38165.54	210 41313.22
Disk capacity	393.4 G bytes														
Component unit	RKAJAT														
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)	
1D+1D	224 44067.43	240 47215.11	254 49969.32	270 53117.00	284 55871.21	300 59018.89	314 61773.10	330 64920.77	344 67674.99	360 70822.66	374 73576.88	390 76724.55	404 79478.77	420 82626.44	

Table F.21 List of Capacities Corresponding to RAID5 (400 GB)

Disk capacity	393.4 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+1P	3 786.91	15 3934.59	30 7869.18	45 11803.77	60 15738.37	75 19672.96	90 23607.55	105 27542.14	120 31476.74	135 35411.33	150 39345.92	165 43280.51	180 47215.11	195 51149.70	210 55084.29
3D+1P	4 1180.37	12 3541.13	28 8262.64	44 12984.15	60 17705.66	72 21246.80	88 25968.31	104 30689.82	120 35411.33	132 38952.46	148 43673.97	164 48395.49	180 53117.00	192 56658.13	208 61379.64
4D+1P	5 1573.83	15 4721.51	30 9443.02	45 14164.53	60 18886.04	75 23607.55	90 28329.06	105 33050.57	120 37772.08	135 42493.60	150 47215.11	165 51936.62	180 56658.13	195 61379.64	210 66101.15
5D+1P	6 1967.29	12 3934.59	30 9836.48	42 13771.07	60 19672.96	72 23607.55	90 29509.44	102 33444.03	120 39345.92	132 43280.51	150 49182.40	162 53117.00	180 59018.89	192 62953.48	210 68855.37
6D+1P	7 2360.75	14 4721.51	28 9443.02	42 14164.53	56 18886.04	70 23607.55	84 28329.06	105 35411.33	119 40132.84	133 44854.35	147 49575.86	161 54297.37	175 59018.89	189 63740.40	210 70822.66
7D+1P	8 2754.21	8 2754.21	24 8262.64	40 13771.07	56 19279.50	72 24787.93	88 30296.36	104 35804.79	120 41313.22	128 44067.43	144 49575.86	160 55084.29	176 60592.72	192 66101.15	208 71609.58
8D+1P	9 3147.67	9 3147.67	27 9443.02	45 15738.37	54 18886.04	72 25181.39	90 31476.74	99 34624.41	117 40919.76	135 47215.11	144 50362.78	162 56658.13	180 62953.48	189 66101.15	207 72396.50
9D+1P	10 3541.13	10 3541.13	30 10623.40	40 14164.53	60 21246.80	70 24787.93	90 31870.20	100 35411.33	120 42493.60	130 46034.73	150 53117.00	160 56658.13	180 63740.40	190 67281.53	210 74363.80
10D+1P	11 3934.59	11 3934.59	22 7869.18	44 15738.37	55 19672.96	66 23607.55	88 31476.74	99 35411.33	110 39345.92	132 47215.11	143 51149.70	165 59018.89	176 62953.48	187 66888.07	209 74757.26
11D+1P	12 4328.05	12 4328.05	24 8656.10	36 12984.15	60 21640.25	72 25968.31	84 30296.36	96 34624.41	120 43280.51	132 47608.57	144 51936.62	156 56264.67	180 64920.77	192 69248.83	204 73576.88
12D+1P	13 4721.51	13 4721.51	26 9443.02	39 14164.53	52 18886.04	65 23607.55	78 28329.06	104 37772.08	117 42493.60	130 47215.11	143 51936.62	156 56658.13	169 61379.64	195 70822.66	208 75544.17
13D+1P	14 5114.97	14 5114.97	28 10229.94	42 15344.91	56 20459.88	70 25574.85	84 30689.82	98 35804.79	112 40919.76	126 46034.73	140 51149.70	154 56264.67	168 61379.64	182 66494.61	204 76724.55
14D+1P	15 5508.42	15 5508.42	30 11016.85	45 16525.28	60 22033.71	75 27542.14	90 33050.57	105 38559.00	120 44067.43	135 49575.86	150 55084.29	165 60592.72	180 66101.15	195 71609.58	210 77118.01
15D+1P	0 0.00	0 0.00	16 5901.88	32 11803.77	48 17705.66	64 23607.55	80 29509.44	96 35411.33	112 41313.22	128 47215.11	144 53117.00	160 59018.89	176 64920.77	192 70822.66	208 76724.55

Table F.21 List of Capacities Corresponding to RAID5 (400 GB) (continued)

Disk capacity	393.4 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)
2D+1P	225 59018.89	240 62953.48	255 66888.07	270 70822.66	285 74757.26	300 78691.85	315 82626.44	330 86561.03	345 90495.63	360 94430.22	375 98364.81	390 102299.41	405 106234.00	420 110168.59
3D+1P	224 66101.15	240 70822.66	252 74363.80	268 79085.31	284 83806.82	300 88528.33	312 92069.46	328 96790.98	344 101512.49	360 106234.00	372 109775.13	388 114496.64	404 119218.15	420 123939.66
4D+1P	225 70822.66	240 75544.17	255 80265.69	270 84987.20	285 89708.71	300 94430.22	315 99151.73	330 103873.24	345 108594.75	360 113316.26	375 118037.78	390 122759.29	405 127480.80	420 132202.31
5D+1P	222 72789.96	240 78691.85	252 82626.44	270 88528.33	282 92462.92	300 98364.81	312 102299.41	330 108201.29	342 112135.89	360 118037.78	372 121972.37	390 127874.26	402 131808.85	420 137710.74
6D+1P	224 75544.17	238 80265.69	252 84987.20	266 89708.71	280 94430.22	294 99151.73	315 106234.00	329 110955.51	343 115677.02	357 120398.53	371 125120.04	385 129841.55	399 134563.07	420 141645.33
7D+1P	224 77118.01	240 82626.44	248 85380.66	264 90889.09	280 96397.52	296 101905.95	312 107414.38	328 112922.81	344 118431.24	360 123939.66	368 126693.88	384 132202.31	400 137710.74	416 143219.17
8D+1P	225 78691.85	234 81839.52	252 88134.87	270 94430.22	279 97577.89	297 103873.24	315 110168.59	324 113316.26	342 119611.61	360 125906.96	369 129054.64	387 135349.98	405 141645.33	414 144793.01
9D+1P	220 77904.93	240 84987.20	250 88528.33	270 95610.60	280 99151.73	300 106234.00	310 109775.13	330 116857.40	340 120398.53	360 127480.80	370 131021.93	390 138104.20	400 141645.33	420 148727.60
10D+1P	220 78691.85	231 82626.44	253 90495.63	264 94430.22	275 98364.81	297 106234.00	308 110168.59	330 118037.78	341 121972.37	352 125906.96	374 133776.15	385 137710.74	396 141645.33	418 149514.52
11D+1P	216 77904.93	240 86561.03	252 90889.09	264 95217.14	276 99545.19	300 108201.29	312 112529.35	324 116857.40	336 121185.45	360 129841.55	372 134169.61	384 138497.66	396 142825.71	420 151481.81
12D+1P	221 80265.69	234 84987.20	247 89708.71	260 94430.22	273 99151.73	299 108594.75	312 113316.26	325 118037.78	338 122759.29	351 127480.80	364 132202.31	390 141645.33	403 146366.84	416 151088.35
13D+1P	224 81839.52	238 86954.49	252 92069.46	266 97184.43	280 102299.41	294 107414.38	308 112529.35	322 117644.32	336 122759.29	350 127874.26	364 132989.23	378 138104.20	392 143219.17	420 153449.11
14D+1P	225 82626.44	240 88134.87	255 93643.30	270 99151.73	285 104660.16	300 110168.59	315 115677.02	330 121185.45	345 126693.88	360 132202.31	375 137710.74	390 143219.17	405 148727.60	420 154236.03
15D+1P	224 82626.44	240 88528.33	240 88528.33	256 94430.22	272 100332.11	288 106234.00	304 112135.89	320 118037.78	336 123939.66	352 129841.55	368 135743.44	384 141645.33	400 147547.22	416 153449.11

Table F.22 List of Capacities Corresponding to RAID6 (400 GB)

Disk capacity	393.4 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+2P	4 786.91	12 2360.75	28 5508.42	44 8656.10	60 11803.77	72 14164.53	88 17312.20	104 20459.88	120 23607.55	132 25968.31	148 29115.98	164 32263.66	180 35411.33	192 37772.08	208 40919.76
3D+2P	5 1180.37	15 3541.13	30 7082.26	45 10623.40	60 14164.53	75 17705.66	90 21246.80	105 24787.93	120 28329.06	135 31870.20	150 35411.33	165 38952.46	180 42493.60	195 46034.73	210 49575.86
4D+2P	6 1573.83	12 3147.67	30 7869.18	42 11016.85	60 15738.37	72 18886.04	90 23607.55	102 26755.23	120 31476.74	132 34624.41	150 39345.92	162 42493.60	180 47215.11	192 50362.78	210 55084.29
5D+2P	7 1967.29	14 3934.59	28 7869.18	42 11803.77	56 15738.37	70 19672.96	84 23607.55	105 29509.44	119 33444.03	133 37378.63	147 41313.22	161 45247.81	175 49182.40	189 53117.00	210 59018.89
6D+2P	8 2360.75	8 2360.75	24 7082.26	40 11803.77	56 16525.28	72 21246.80	88 25968.31	104 30689.82	120 35411.33	128 37772.08	144 42493.60	160 47215.11	176 51936.62	192 56658.13	208 61379.64
7D+2P	9 2754.21	9 2754.21	27 8262.64	45 13771.07	54 16525.28	72 22033.71	90 27542.14	99 30296.36	117 35804.79	135 41313.22	144 44067.43	162 49575.86	180 55084.29	189 57838.51	207 63346.94
8D+2P	10 3147.67	10 3147.67	30 9443.02	40 12590.69	60 18886.04	70 22033.71	90 28329.06	100 31476.74	120 37772.08	130 40919.76	150 47215.11	160 50362.78	180 56658.13	190 59805.80	210 66101.15
9D+2P	11 3541.13	11 3541.13	22 7082.26	44 14164.53	55 17705.66	66 21246.80	88 28329.06	99 31870.20	110 35411.33	132 42493.60	143 46034.73	165 53117.00	176 56658.13	187 60199.26	209 67281.53
10D+2P	12 3934.59	12 3934.59	24 7869.18	36 11803.77	60 19672.96	72 23607.55	84 27542.14	96 31476.74	120 39345.92	132 43280.51	144 47215.11	156 51149.70	168 59018.89	192 62953.48	204 66888.07
11D+2P	13 4328.05	13 4328.05	26 8656.10	39 12984.15	52 17312.20	65 21640.25	78 25968.31	104 34624.41	117 38952.46	130 43280.51	143 47608.57	156 51936.62	169 56264.67	195 64920.77	208 69248.83
12D+2P	14 4721.51	14 4721.51	28 9443.02	42 14164.53	56 18886.04	70 23607.55	84 28329.06	98 33050.57	112 37772.08	126 42493.60	140 47215.11	154 51936.62	168 56658.13	182 61379.64	210 70822.66
13D+2P	15 5114.97	15 5114.97	30 10229.94	45 15344.91	60 20459.88	75 25574.85	90 30689.82	105 35804.79	120 40919.76	135 46034.73	150 51149.70	165 56264.67	180 61379.64	195 66494.61	210 71609.58
14D+2P	0 0.00	0 0.00	16 5508.42	32 11016.85	48 16525.28	64 22033.71	80 27542.14	96 33050.57	112 38559.00	128 44067.43	144 49575.86	160 55084.29	176 60592.72	192 66101.15	208 71609.58
15D+2P	0 0.00	0 0.00	17 5901.88	34 11803.77	51 17705.66	68 23607.55	85 29509.44	102 35411.33	119 41313.22	136 47215.11	153 53117.00	170 59018.89	187 64920.77	204 70822.66	
16D+2P	0 0.00	0 0.00	18 6295.34	36 12590.69	54 18886.04	72 25181.39	90 31476.74	108 37772.08	126 44067.43	144 50362.78	162 56658.13	180 62953.48	198 69248.83		
17D+2P	0 0.00	0 0.00	19 6688.80	38 13377.61	57 20066.42	75 26755.23	93 33444.03	111 40132.84	129 46821.65	147 53510.46	165 60199.26	183 66888.07	201 73576.88		
18D+2P	0 0.00	0 0.00	20 7082.26	40 14164.53	60 21246.80	80 28329.06	100 35411.33	120 42493.60	140 49575.86	160 56658.13	180 63740.40	200 70822.66			
19D+2P	0 0.00	0 0.00	21 7475.72	42 14951.45	63 22427.17	84 29902.90	105 37378.63	126 44854.35	147 52330.08	168 59805.80	189 67281.53	210 74757.26			
20D+2P	0 0.00	0 0.00	22 7869.18	44 15738.37	66 23607.55	88 31476.74	110 39345.92	132 47215.11	154 55084.29	176 62953.48	198 70822.66				
21D+2P	0 0.00	0 0.00	23 8262.64	46 16525.28	69 24787.93	92 28329.06	115 37378.63	138 44854.35	161 52330.08	184 59805.80	207 67281.53				
22D+2P	0 0.00	0 0.00	24 8656.10	48 18656.10	72 25968.31	96 34624.41	120 43280.51	144 51936.62	168 59018.89	192 66101.15					
23D+2P	0 0.00	0 0.00	25 9049.56	50 18099.12	75 27148.68	100 36198.25	125 45247.81	150 54297.37	175 63346.94	200 72396.50					
24D+2P	0 0.00	0 0.00	26 9443.02	52 18886.04	78 28329.06	104 37772.08	130 47215.11	156 56658.13	182 64920.77	208 71609.58					
25D+2P	0 0.00	0 0.00	27 9836.48	54 19672.96	81 25968.31	108 33050.57	135 40919.76	162 49182.40	189 59018.89	216 69248.83					
26D+2P	0 0.00	0 0.00	28 10229.94	56 20459.88	84 25968.31	112 33050.57	140 40919.76	168 49182.40	196 59018.89	224 71609.58					
27D+2P	0 0.00	0 0.00	29 10623.40	58 21246.80	87 25968.31	116 33050.57	144 40919.76	172 49182.40	200 59018.89	228 71609.58					
28D+2P	0 0.00	0 0.00	30 11016.85	60 22033.71	90 30505.7	120 40674.3	150 5084.29	180 6101.15	210 7718.01						

Table F.22 List of Capacities Corresponding to RAID6 (400 GB) (continued)

Disk capacity	393.4 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420 (Max.)
2D+2P	224 44067.43	240 47215.11	252 49575.86	268 52723.54	284 55871.21	300 59018.89	312 61379.64	328 64527.32	344 67674.99	360 70822.66	372 73183.42	388 76331.09	404 79478.77	420 82626.44
3D+2P	225 53117.00	240 56658.13	255 60199.26	270 63740.40	285 67281.53	300 70822.66	315 74363.80	330 77904.93	345 81446.06	360 84987.20	375 88528.33	390 92069.46	405 95610.60	420 99151.73
4D+2P	222 58231.97	240 62953.48	252 66101.15	270 70822.66	282 73970.34	300 78691.85	312 81839.52	330 86561.03	342 89708.71	360 94430.22	372 97577.89	390 102299.41	402 105447.08	420 110168.59
5D+2P	224 62953.48	238 66888.07	252 70822.66	266 74757.26	280 78691.85	294 82626.44	315 88528.33	329 92462.92	343 96397.52	357 100332.11	371 104266.70	385 108201.29	399 112135.89	420 118037.78
6D+2P	224 66101.15	240 70822.66	248 73183.42	264 77904.93	280 82626.44	296 87347.95	312 92069.46	328 96790.98	344 101512.49	360 106234.00	368 108594.75	384 113316.26	400 118037.78	416 122759.29
7D+2P	225 68855.37	234 71609.58	252 77118.01	270 82626.44	279 85380.66	297 90889.09	315 96397.52	324 99151.73	342 104660.16	360 110168.59	369 112922.81	387 118431.24	405 123939.66	414 126693.88
8D+2P	220 69248.83	240 75544.17	250 78691.85	270 84987.20	280 88134.87	300 94430.22	310 97577.89	330 103873.24	340 107020.92	360 113316.26	370 116463.94	390 122759.29	400 125906.96	420 132202.31
9D+2P	220 70822.66	231 74363.80	253 81446.06	264 84987.20	275 88528.33	297 95610.60	308 99151.73	330 106234.00	341 109775.13	352 113316.26	374 120398.53	385 123939.66	396 127480.80	418 134563.07
10D+2P	216 70822.66	240 78691.85	252 82626.44	264 86561.03	276 90495.63	300 98364.81	312 102299.41	324 106234.00	336 110168.59	360 118037.78	372 121972.37	384 125906.96	396 129841.55	420 137710.74
11D+2P	221 73576.88	234 77904.93	247 82232.98	260 86561.03	273 90889.09	299 99545.19	312 103873.24	325 108201.29	338 112529.35	351 116857.40	364 121185.45	390 129841.55	403 134169.61	416 138497.66
12D+2P	224 75544.17	238 80265.69	252 84987.20	266 89708.71	280 94430.22	294 99151.73	308 103873.24	336 108594.75	350 113316.26	364 118037.78	378 122759.29	392 127480.80	420 132202.31	420 141645.33
13D+2P	225 76724.55	240 81839.52	255 86954.49	270 92069.46	285 97184.43	300 102299.41	315 107414.38	330 112529.35	345 117644.32	360 122759.29	375 127874.26	390 132989.23	405 138104.20	420 143219.17
14D+2P	224 77118.01	240 82626.44	240 82626.44	256 88134.87	272 93643.30	288 99151.73	304 104660.16	320 110168.59	336 115677.02	352 121185.45	368 126693.88	384 132202.31	400 137710.74	416 143219.17
15D+2P	221 76724.55	238 82626.44	255 88528.33	255 88528.33	272 94430.22	289 100332.11	306 106234.00	323 112135.89	340 118037.78	357 123939.66	374 129841.55	391 135743.44	408 141645.33	408
16D+2P	216 75544.17	234 81839.52	252 88134.87	270 94430.22	270 94430.22	288 100725.57	306 107020.92	324 113316.26	342 119611.61	360 125906.96	360 125906.96	378 132202.31	396 138497.66	414 144793.01
17D+2P	209 73576.88	228 80265.69	247 86954.49	266 93643.30	285 100332.11	285 100332.11	304 107020.92	323 113709.72	342 120398.53	361 120398.53	380 127087.34	399 133776.15	418 140464.95	418 147153.76
18D+2P	220 77904.93	240 84987.20	240 84987.20	260 92069.46	280 99151.73	300 106234.00	300 106234.00	320 113316.26	340 120398.53	360 127480.80	360 127480.80	380 134563.07	400 141645.33	420 148727.60
19D+2P	210 74757.26	231 82232.98	252 89708.71	252 89708.71	273 97184.43	294 104660.16	315 112135.89	315 112135.89	336 119611.61	357 127087.34	357 127087.34	378 134563.07	399 142038.79	420 149514.52
20D+2P	220 78691.85	220 78691.85	242 86561.03	264 94430.22	264 94430.22	286 102299.41	308 110168.59	330 118037.78	352 125906.96	374 133776.15	374 133776.15	396 141645.33	418 149514.52	418
21D+2P	207 74363.80	230 82626.44	253 90889.09	253 90889.09	276 99151.73	299 107414.38	299 107414.38	322 115677.02	345 123939.66	368 123939.66	368 132202.31	391 132202.31	414 140464.95	414 148727.60
22D+2P	216 77904.93	240 86561.03	240 86561.03	264 95217.14	264 95217.14	288 103873.24	312 112529.35	312 112529.35	336 121185.45	360 129841.55	360 129841.55	384 138497.66	384 138497.66	408 147153.76
23D+2P	225 81446.06	225 81446.06	250 90495.63	250 90495.63	275 99545.19	300 108594.75	300 108594.75	325 117644.32	350 117644.32	375 126693.88	375 135743.44	400 135743.44	400 144793.01	400 144793.01
24D+2P	208 75544.17	234 84987.20	234 84987.20	260 94430.22	260 94430.22	286 103873.24	312 113316.26	312 113316.26	338 122759.29	338 122759.29	364 132202.31	390 141645.33	390 141645.33	416 151088.35
25D+2P	216 78691.85	216 78691.85	243 88528.33	270 98364.81	270 98364.81	297 108201.29	324 108201.29	324 118037.78	351 118037.78	351 118037.78	378 127874.26	405 127874.26	405 137710.74	405 147547.22
26D+2P	224 81839.52	224 81839.52	252 92069.46	252 92069.46	280 102299.41	280 102299.41	308 112529.35	308 112529.35	336 122759.29	336 122759.29	364 132989.23	364 132989.23	392 143219.17	420 153449.11
27D+2P	203 74363.80	232 84987.20	232 84987.20	261 95610.60	261 95610.60	290 106234.00	290 106234.00	319 116857.40	319 116857.40	348 127480.80	348 127480.80	377 138104.20	406 138104.20	406 148727.60
28D+2P	210 77118.01	240 88134.87	240 88134.87	270 99151.73	270 99151.73	300 110168.59	300 110168.59	330 121185.45	330 121185.45	360 132202.31	360 132202.31	390 143219.17	390 143219.17	420 154236.03

Table F.23 List of Capacities Corresponding to RAID1+0 (400 GB)

Disk capacity	393.4 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+2D	4 786.91	12 2360.75	28 5508.42	44 8656.10	60 11803.77	72 14164.53	88 17312.20	104 20459.88	120 23607.55	132 25968.31	148 29115.98	164 32263.66	180 35411.33	192 37772.08	208 40919.76
3D+3D	6 1180.37	12 2360.75	30 5901.88	42 8262.64	60 11803.77	72 14164.53	90 17705.66	102 20066.42	120 23607.55	132 25968.31	150 29509.44	162 31870.20	180 35411.33	192 37772.08	210 41313.22
4D+4D	8 1573.83	8 1573.83	24 4721.51	40 7869.18	56 11016.85	72 14164.53	88 17312.20	104 20459.88	120 23607.55	128 25181.39	144 28329.06	160 31476.74	176 34624.41	192 37772.08	208 40919.76
5D+5D	10 1967.29	10 1967.29	30 5901.88	40 7869.18	60 11803.77	70 13771.07	90 17705.66	100 19672.96	120 23607.55	130 25574.85	150 29509.44	160 31476.74	180 35411.33	190 37378.63	210 41313.22
6D+6D	12 2360.75	12 2360.75	24 4721.51	36 7082.26	60 11803.77	72 14164.53	84 16525.28	96 18886.04	120 23607.55	132 25968.31	144 28329.06	156 30689.82	180 35411.33	192 37772.08	204 40132.84
7D+7D	14 2754.21	14 2754.21	28 5508.42	42 8262.64	56 11016.85	70 13771.07	84 16525.28	98 19279.50	112 22033.71	126 24787.93	140 27542.14	154 30296.36	168 33050.57	182 35804.79	210 41313.22
8D+8D	0 0.00	0 0.00	16 3147.67	32 6295.34	48 9443.02	64 12590.69	80 15738.37	96 18886.04	112 22033.71	128 25181.39	144 28329.06	160 31476.74	176 34624.41	192 37772.08	208 40919.76
Disk capacity	393.4 G bytes														
Component unit	RKAJAT														
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)	
2D+2D	224 44067.43	240 47215.11	252 49575.86	268 52723.54	284 55871.21	300 59018.89	312 61379.64	328 64527.32	344 67674.99	360 70822.66	372 73183.42	388 76331.09	404 79478.77	420 82626.44	
3D+3D	222 43673.97	240 47215.11	252 49575.86	270 53117.00	282 55477.75	300 59018.89	312 61379.64	330 64920.77	342 67281.53	360 70822.66	372 73183.42	390 76724.55	402 79085.31	420 82626.44	
4D+4D	224 44067.43	240 47215.11	248 48788.94	264 51936.62	280 55084.29	296 58231.97	312 61379.64	328 64527.32	344 67674.99	360 70822.66	368 72396.50	384 75544.17	400 78691.85	416 81839.52	
5D+5D	220 43280.51	240 47215.11	250 49182.40	270 53117.00	280 55084.29	300 59018.89	310 60986.18	330 64920.77	340 66888.07	360 70822.66	370 72789.96	390 76724.55	400 78691.85	420 82626.44	
6D+6D	216 42493.60	240 47215.11	252 49575.86	264 51936.62	276 54297.37	300 59018.89	312 61379.64	324 63740.40	336 66101.15	360 70822.66	372 73183.42	384 75544.17	396 77904.93	420 82626.44	
7D+7D	224 44067.43	238 46821.65	252 49575.86	266 52330.08	280 55084.29	294 57838.51	308 60592.72	322 63346.94	336 66101.15	350 68855.37	364 71609.58	378 74363.80	392 77118.01	420 82626.44	
8D+8D	224 44067.43	240 47215.11	240 47215.11	256 50362.78	272 53510.46	288 56658.13	304 59805.80	320 62953.48	336 66101.15	352 69248.83	368 72396.50	384 75544.17	400 78691.85	416 81839.52	

Table F.24 List of Capacities Corresponding to RAID1 (500 Gbytes)

Disk capacity	491.9 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
1D+1D	2	14	30	44	60	74	90	104	120	134	150	164	180	194	210
	491.94	3443.59	7379.12	10822.71	14758.24	18201.83	22137.36	25580.95	29516.49	32960.08	36895.61	40339.20	44274.73	47718.32	51653.86
Disk capacity	393.4 G bytes														
Component unit	RKAJAT														
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)	
1D+1D	224	240	254	270	284	300	314	330	344	360	374	390	404	420	
	55097.45	59032.98	62476.57	66412.10	69855.69	73791.22	77234.81	81170.35	84613.94	88549.47	91993.06	95928.59	99372.18	103307.72	

Table F.25 List of Capacities Corresponding to RAID5 (500 Gbytes)

Disk capacity	491.9 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+1P	3	15	30	45	60	75	90	105	120	135	150	165	180	195	210
	983.88	4919.41	9838.83	14758.24	19677.66	24597.07	29516.49	34435.90	39355.32	44274.73	49194.15	54113.56	59032.98	63952.39	68871.81
3D+1P	4	12	28	44	60	72	88	104	120	132	148	164	180	192	208
	1475.82	4427.47	10330.77	16234.07	22137.36	26564.84	32468.14	38371.43	44274.73	48702.21	54605.50	60508.80	66412.10	70839.57	76742.87
4D+1P	5	15	30	45	60	75	90	105	120	135	150	165	180	195	210
	1967.76	5903.29	11806.59	17709.89	23613.19	29516.49	35419.78	41323.08	47226.38	53129.68	59032.98	64936.28	70839.57	76742.87	82646.17
5D+1P	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210
	2459.70	4919.41	12298.53	17217.95	24597.07	29516.49	36895.61	41815.02	49194.15	54113.56	61492.69	66412.10	73791.22	78710.64	86089.76
6D+1P	7	14	28	42	56	70	84	105	119	133	147	161	175	189	210
	2951.64	5903.29	11806.59	17709.89	23613.19	29516.49	35419.78	44274.73	50178.03	56081.33	61984.63	67887.93	73791.22	79694.52	88549.47
7D+1P	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208
	3443.59	3443.59	10330.77	17217.95	24105.13	30992.31	37879.49	44766.67	51653.86	55097.45	61984.63	68871.81	75758.99	82646.17	89533.35
8D+1P	9	9	27	45	54	72	90	99	117	135	144	162	180	189	207
	3935.53	3935.53	11806.59	19677.66	23613.19	31484.25	39355.32	43290.85	51161.91	59032.98	62968.51	70839.57	78710.64	82646.17	90517.24
9D+1P	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210
	4427.47	4427.47	12382.42	17709.89	26564.84	30992.31	39847.26	44274.73	53129.68	57557.15	66412.10	70839.57	79694.52	84122.00	92976.94
10D+1P	11	11	22	44	55	66	88	99	110	132	143	165	176	187	209
	4919.41	4919.41	9838.83	19677.66	24597.07	29516.49	39355.32	44274.73	49194.15	59032.98	63952.39	73791.22	78710.64	83630.05	93468.89
11D+1P	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204
	5411.35	5411.35	10822.71	16234.07	27056.78	32468.14	37879.49	43290.85	54113.56	59524.92	64936.28	70347.63	81170.35	86581.70	91993.06
12D+1P	13	13	26	39	52	65	78	104	117	130	143	156	169	195	208
	5903.29	5903.29	11806.59	17709.89	23613.19	29516.49	35419.78	47226.38	53129.68	59032.98	64936.28	70839.57	76742.87	88549.47	94452.77
13D+1P	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210
	6395.23	6395.23	12790.47	19185.71	25580.95	31976.19	38371.43	44766.67	51161.91	57557.15	63952.39	70347.63	76742.87	83138.11	95928.59
14D+1P	15	15	30	45	60	75	90	105	120	135	150	165	180	195	210
	6887.18	6887.18	13774.36	20661.54	27548.72	34435.90	41323.08	48210.26	55097.45	61984.63	68871.81	75758.99	82646.17	89533.35	96420.53
15D+1P	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208
	0.00	0.00	7379.12	14758.24	22137.36	29516.49	36895.61	44274.73	51653.86	59032.98	66412.10	73791.22	81170.35	88549.47	95928.59

Table F.25 List of Capacities Corresponding to RAID5 (500 Gbytes) (Continued)

Disk capacity	491.9 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)
2D+1P	225 73791.22	240 78710.64	255 83630.05	270 88549.47	285 93468.89	300 98388.30	315 103307.72	330 108227.13	345 113146.55	360 118065.96	375 122985.38	390 127904.79	405 132824.21	420 137743.62
3D+1P	224 82646.17	240 88549.47	252 92976.94	268 98880.24	284 104783.54	300 110686.84	312 115114.31	328 121017.61	344 126920.91	360 132824.21	372 137251.68	388 143154.98	404 149058.28	420 154961.58
4D+1P	225 88549.47	240 94452.77	255 100356.07	270 106259.36	285 112162.66	300 118065.96	315 123969.26	330 129872.56	345 135775.86	360 141679.15	375 147582.45	390 153485.75	405 159389.05	420 165292.35
5D+1P	222 91009.18	240 98388.30	252 103307.72	270 110686.84	282 115606.25	300 122985.38	312 127904.79	330 135283.92	342 140203.33	360 147582.45	372 152501.87	390 159880.99	402 164800.41	420 172179.53
6D+1P	224 94452.77	238 100356.07	252 106259.36	266 112162.66	280 118065.96	294 123969.26	315 132824.21	329 138727.51	343 144630.80	357 150534.10	371 156437.40	385 162340.70	399 168244.00	420 177098.94
7D+1P	224 96420.53	240 103307.72	248 106751.31	264 113638.49	280 120525.67	296 127412.85	312 134300.03	328 141187.21	344 148074.39	360 154961.58	368 158405.17	384 165292.35	400 172179.53	416 179066.71
8D+1P	225 98388.30	234 102323.83	252 110194.90	270 118065.96	279 122001.49	297 129872.56	315 137743.62	324 141679.15	342 149550.22	360 157421.28	369 161356.82	387 169227.88	405 177098.94	414 181034.48
9D+1P	220 97404.42	240 106259.36	250 110686.84	270 119541.79	280 123969.26	300 132824.21	310 137251.68	330 146106.63	340 150534.10	360 159389.05	370 163816.52	390 172671.47	400 177098.94	420 185953.89
10D+1P	220 98388.30	231 103307.72	253 113146.55	264 118065.96	275 122985.38	297 132824.21	308 137743.62	330 147582.45	341 152501.87	352 157421.28	374 167260.11	385 172179.53	396 177098.94	418 186937.78
11D+1P	216 97404.42	240 108227.13	252 113638.49	264 119049.84	276 124461.20	300 135283.92	312 140695.27	324 146106.63	336 151517.99	360 162340.70	372 167752.06	384 173163.41	396 178574.77	420 189397.48
12D+1P	221 100356.07	234 106259.36	247 112162.66	260 118065.96	273 123969.26	299 135775.86	312 141679.15	325 147582.45	338 153485.75	351 159389.05	364 165292.35	390 177098.94	403 183002.24	416 188905.54
13D+1P	224 102323.83	238 108719.07	252 115114.31	266 121509.55	280 127904.79	294 134300.03	308 140695.27	322 147090.51	336 153485.75	350 159880.99	364 166276.23	378 172671.47	392 179066.71	420 191857.19
14D+1P	225 103307.72	240 110194.90	255 117082.08	270 123969.26	285 130856.44	300 137743.62	315 144630.80	330 151517.99	345 158405.17	360 165292.35	375 172179.53	390 179066.71	405 185953.89	420 192841.07
15D+1P	224 103307.72	240 110686.84	240 110686.84	256 118065.96	272 125445.08	288 132824.21	304 140203.33	320 147582.45	336 154961.58	352 162340.70	368 169719.82	384 177098.94	400 184478.07	416 191857.19

Table F.26 List of Capacities Corresponding to RAID6 (500 Gbytes)

Disk capacity	491.9 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+2P	4 983.88	12 2951.64	28 6887.18	44 10822.71	60 14758.24	72 17709.89	88 21645.42	104 25580.95	120 29516.49	132 32468.14	148 36403.67	164 40339.20	180 44274.73	192 47226.38	208 51161.91
3D+2P	5 1475.82	15 4427.47	30 8854.94	45 13282.42	60 17709.89	75 22137.36	90 26564.84	105 30992.31	120 35419.78	135 39847.26	150 44274.73	165 48702.21	180 53129.68	195 57557.15	210 61984.63
4D+2P	6 1967.76	12 3935.53	24 5893.83	36 10374.36	48 14967.66	60 20613.19	72 25164.49	84 30452.02	96 35355.32	108 40290.85	120 45194.15	132 50129.68	144 55032.98	156 60032.98	168 64936.28
5D+2P	7 2459.70	14 4919.41	21 7378.83	28 10858.24	35 14758.24	42 20613.19	49 27548.72	56 34435.90	63 41323.08	70 48210.26	77 55097.45	84 61984.63	91 68871.81	98 75758.99	105 82646.17
6D+2P	8 2951.64	16 5835.53	24 8754.94	32 12282.42	40 17709.89	48 23137.36	56 28564.84	64 34052.02	72 39055.32	80 44590.85	88 50129.68	96 55758.99	104 61492.69	112 67992.31	120 74532.98
7D+2P	9 3443.59	18 6754.94	27 10130.77	36 13530.77	45 18967.66	54 25813.19	63 33664.84	72 41519.78	81 49373.11	90 57236.44	99 65103.67	108 72939.20	117 80792.21	126 88547.26	135 96206.31
8D+2P	10 3935.53	20 7674.94	30 11506.59	40 15374.36	50 20613.19	60 27548.72	70 34435.90	80 41323.08	90 48210.26	100 55097.45	110 61984.63	120 68871.81	130 75758.99	140 82646.17	150 89533.35
9D+2P	11 4427.47	22 8594.94	33 12430.77	44 16282.42	55 22137.36	66 29064.84	77 36052.02	88 43055.32	99 50090.85	110 57129.68	121 64194.15	132 71329.68	143 78492.21	154 85692.31	165 92806.41
10D+2P	12 4919.41	24 9519.41	36 14306.59	48 18174.36	60 24067.66	72 31013.19	84 37964.49	96 44919.78	108 51873.11	120 58829.68	132 65794.15	144 72769.68	156 79742.21	168 86692.31	180 93647.41
11D+2P	13 5411.35	26 10435.53	39 15282.42	52 20182.42	65 26137.36	78 33084.84	91 39152.02	104 46203.32	117 53236.44	130 60329.68	143 67404.15	156 74492.21	169 81592.31	182 88692.31	208 103647.41
12D+2P	14 5903.29	28 11359.41	42 16282.42	56 21182.42	70 27137.36	84 34084.84	98 41152.02	112 48103.32	126 55159.68	140 62236.44	154 69329.68	168 76492.21	182 83692.31	196 90692.31	210 97647.41
13D+2P	15 6395.23	30 12282.42	45 17230.77	60 22182.42	75 28137.36	90 34084.84	105 40152.02	120 46203.32	135 52329.68	150 59404.15	165 66592.31	180 73892.31	195 81292.31	210 88692.31	210 97647.41
14D+2P	0 0.00	0 0.00	16 6887.18	32 13774.36	48 20613.19	64 27548.72	80 34435.90	96 41323.08	112 48210.26	128 55097.45	144 61984.63	160 68871.81	176 75758.99	192 82646.17	208 89533.35
15D+2P	0 0.00	0 0.00	17 7379.12	34 14758.24	51 22137.36	68 29064.84	85 36052.02	102 43055.32	119 50090.85	136 57129.68	153 64194.15	170 71329.68	187 78492.21	204 85692.31	210 92647.41
16D+2P	0 0.00	0 0.00	18 7871.06	36 15742.12	54 23137.36	72 31013.19	90 37964.49	108 44919.78	126 51873.11	144 58829.68	162 65794.15	180 72769.68	198 79742.21	204 84692.31	210 90647.41
17D+2P	0 0.00	0 0.00	19 8363.00	38 16726.01	57 25089.01	75 32084.84	93 39052.02	111 46203.32	129 53236.44	147 60329.68	165 67404.15	183 74492.21	201 81592.31	209 88692.31	210 95647.41
18D+2P	0 0.00	0 0.00	20 8854.94	40 17709.89	60 26564.84	80 34052.02	100 41323.08	120 48210.26	140 55097.45	160 61984.63	180 68871.81	200 75758.99	210 82646.17	210 89533.35	210 96474.11
19D+2P	0 0.00	0 0.00	21 9346.88	42 18693.77	63 25137.36	84 32084.84	105 39052.02	126 46203.32	147 54236.44	168 62236.44	189 69329.68	210 76492.21	210 83692.31	210 90692.31	210 97647.41
20D+2P	0 0.00	0 0.00	22 9838.83	44 19677.66	66 28137.36	88 34052.02	110 40152.02	132 48210.26	154 55097.45	176 61984.63	198 68871.81	210 75758.99	210 82646.17	210 89533.35	210 96474.11
21D+2P	0 0.00	0 0.00	23 10330.77	46 20613.19	69 27548.72	92 34052.02	115 41323.08	138 48210.26	161 55097.45	184 61984.63	207 68871.81	210 75758.99	210 82646.17	210 89533.35	210 96474.11
22D+2P	0 0.00	0 0.00	24 10822.71	48 21645.42	72 27548.72	96 34052.02	120 41323.08	144 48210.26	168 55097.45	192 61984.63	210 68871.81	210 75758.99	210 82646.17	210 89533.35	210 96474.11
23D+2P	0 0.00	0 0.00	25 11314.65	50 22629.31	75 27548.72	100 34052.02	125 41323.08	150 48210.26	175 55097.45	200 61984.63	210 68871.81	210 75758.99	210 82646.17	210 89533.35	210 96474.11
24D+2P	0 0.00	0 0.00	26 11806.59	52 23613.19	77 27548.72	102 34052.02	129 41323.08	156 48210.26	183 55097.45	210 61984.63	210 68871.81	210 75758.99	210 82646.17	210 89533.35	210 96474.11
25D+2P	0 0.00	0 0.00	27 12298.53	54 24597.07	81 27548.72	108 34052.02	135 41323.08	162 48210.26	189 55097.45	210 61984.63	210 68871.81	210 75758.99	210 82646.17	210 89533.35	210 96474.11
26D+2P	0 0.00	0 0.00	28 12790.47	56 25580.95	84 27548.72	111 34052.02	138 41323.08	165 48210.26	192 55097.45	210 61984.63	210 68871.81	210 75758.99	210 82646.17	210 89533.35	210 96474.11
27D+2P	0 0.00	0 0.00	29 13282.42	58 26564.84	87 27548.72	114 34052.02	141 41323.08	168 48210.26	195 55097.45	210 61984.63	210 68871.81	210 75758.99	210 82646.17	210 89533.35	210 96474.11
28D+2P	0 0.00	0 0.00	30 13774.36	60 27548.72	90 27548.72	120 34052.02	150 41323.08	180 48210.26	210 55097.45	210 61984.63	210 68871.81	210 75758.99	210 82646.17	210 89533.35	210 96474.11

Table F.26 List of Capacities Corresponding to RAID6 (500 Gbytes) (Continued)

Disk capacity	491.9 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420 (Max.)
2D+2P	224 55097.45	240 59032.98	252 61984.63	268 65920.16	284 69855.69	300 73791.22	312 76742.87	328 80678.41	344 84613.94	360 88549.47	372 91501.12	388 95436.65	404 99372.18	420 103307.72
3D+2P	225 66412.10	240 70839.57	255 75267.05	270 79694.52	285 84122.00	300 88549.47	315 92976.94	330 97404.42	345 101831.89	360 106259.36	375 110686.84	390 115114.31	405 119541.79	420 123969.26
4D+2P	222 72807.34	240 78710.64	252 82646.17	270 88549.47	282 92485.00	300 98388.30	312 102323.83	330 108227.13	342 112162.66	360 118065.96	372 122001.49	390 127904.79	402 131840.32	420 137743.62
5D+2P	224 78710.64	238 83630.05	252 88549.47	266 93468.89	280 98388.30	294 103307.72	315 110686.84	329 115606.25	343 120525.67	357 125445.08	371 130364.50	385 135283.92	399 140203.33	420 147582.45
6D+2P	224 82646.17	240 88549.47	248 91501.12	264 97404.42	280 103307.72	296 109211.01	312 115114.31	328 121017.61	344 126920.91	360 132824.21	368 135775.86	384 141679.15	400 147582.45	416 153485.75
7D+2P	225 86089.76	234 89533.35	252 96420.53	270 103307.72	279 106751.31	297 113638.49	315 120525.67	324 123969.26	342 130856.44	360 137743.62	369 141187.21	387 148074.39	405 154961.58	414 158405.17
8D+2P	220 86581.70	240 94452.77	250 98388.30	270 106259.36	280 110194.90	294 118065.96	310 122001.49	330 129872.56	340 133808.09	360 141679.15	370 145614.69	390 153485.75	400 157421.28	420 165292.35
9D+2P	220 88549.47	231 92976.94	253 101831.89	264 106259.36	275 110686.84	297 119541.79	308 123969.26	330 132824.21	341 137251.68	352 141679.15	374 150534.10	385 154961.58	396 159389.05	418 168244.00
10D+2P	216 88549.47	240 98388.30	252 103307.72	264 108227.13	276 113146.55	294 122985.38	312 127904.79	324 132824.21	336 137743.62	360 147582.45	372 152501.87	384 157421.28	396 162340.70	420 172179.53
11D+2P	221 91993.06	234 97404.42	247 102815.77	260 108227.13	273 113638.49	299 124461.20	312 129872.56	325 135283.92	338 140695.27	351 146106.63	364 151517.99	390 162340.70	403 167752.06	416 173163.41
12D+2P	224 94452.77	238 100356.07	252 106259.36	266 112162.66	280 118065.96	294 123969.26	308 129872.56	322 135775.86	336 141679.15	360 147582.45	372 153485.75	384 159389.05	392 165292.35	420 177098.94
13D+2P	225 95928.59	240 102323.83	255 108719.07	270 115114.31	285 121509.55	300 127904.79	315 134300.03	330 140695.27	345 147090.51	360 153485.75	375 159880.99	390 166276.23	405 172671.47	420 179066.71
14D+2P	224 96420.53	240 103307.72	240 103307.72	256 110194.90	272 117082.08	288 123969.26	304 130856.44	320 137743.62	336 144630.80	352 151517.99	368 158405.17	384 165292.35	400 172179.53	416 179066.71
15D+2P	221 95928.59	238 103307.72	255 110686.84	255 110686.84	272 118065.96	289 125445.08	306 132824.21	323 140203.33	340 147582.45	357 154961.58	374 162340.70	391 162340.70	408 169719.82	414 177098.94
16D+2P	216 94452.77	234 102323.83	252 110194.90	270 118065.96	270 118065.96	288 125937.03	306 133808.09	324 141679.15	342 149550.22	360 157421.28	378 165292.35	396 173163.41	414 181034.48	414 181034.48
17D+2P	209 91993.06	228 100356.07	247 108719.07	266 117082.08	285 125445.08	285 125445.08	304 133808.09	323 142171.10	342 150534.10	361 150534.10	380 158897.11	399 167260.11	418 175623.12	418 183986.13
18D+2P	220 97404.42	240 106259.36	240 106259.36	260 115114.31	280 123969.26	300 132824.21	300 132824.21	320 141679.15	340 150534.10	360 159389.05	360 159389.05	380 168244.00	400 177098.94	420 185953.89
19D+2P	210 93468.89	231 102815.77	252 112162.66	252 112162.66	273 121509.55	294 130856.44	315 140203.33	315 140203.33	336 149550.22	357 158897.11	357 158897.11	378 168244.00	399 177590.89	420 186937.78
20D+2P	220 98388.30	220 98388.30	242 108227.13	264 118065.96	264 118065.96	286 127904.79	308 137743.62	330 147582.45	330 147582.45	352 157421.28	374 167260.11	396 167260.11	418 177098.94	418 186937.78
21D+2P	207 92976.94	230 103307.72	253 113638.49	253 113638.49	276 123969.26	299 134300.03	299 134300.03	322 144630.80	345 154961.58	345 154961.58	368 165292.35	391 165292.35	414 175623.12	414 185953.89
22D+2P	216 97404.42	240 108227.13	240 108227.13	264 119049.84	264 119049.84	288 129872.56	312 140695.27	312 140695.27	336 151517.99	360 162340.70	360 162340.70	384 173163.41	384 173163.41	408 183986.13
23D+2P	225 101831.89	225 101831.89	250 113146.55	250 113146.55	275 124461.20	300 135775.86	300 135775.86	325 147090.51	350 147090.51	350 158405.17	375 169719.82	400 169719.82	400 181034.48	400 181034.48
24D+2P	208 94452.77	234 106259.36	234 106259.36	260 118065.96	260 118065.96	286 129872.56	312 141679.15	312 141679.15	338 153485.75	338 153485.75	364 165292.35	390 177098.94	390 177098.94	416 188905.54
25D+2P	216 98388.30	216 98388.30	243 110686.84	270 122985.38	270 122985.38	297 135283.92	297 135283.92	324 147582.45	324 147582.45	351 159880.99	351 159880.99	378 172179.53	405 184478.07	405 184478.07
26D+2P	224 102323.83	224 102323.83	252 115114.31	252 115114.31	280 127904.79	280 127904.79	308 140695.27	308 140695.27	336 153485.75	336 153485.75	364 166276.23	364 166276.23	392 179066.71	420 191857.19
27D+2P	203 92976.94	232 106259.36	232 106259.36	261 119541.79	261 119541.79	290 132824.21	290 132824.21	319 146106.63	319 146106.63	348 159389.05	348 159389.05	377 172671.47	406 172671.47	406 185953.89
28D+2P	210 96420.53	240 110194.90	240 110194.90	270 123969.26	270 123969.26	300 137743.62	300 137743.62	330 151517.99	330 151517.99	360 165292.35	360 165292.35	390 179066.71	390 179066.71	420 192841.07

Table F.27 List of Capacities Corresponding to RAID1+0 (500 Gbytes)

Disk capacity	491.9 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+2D	4 983.88	12 2951.64	28 6887.18	44 10822.71	60 14758.24	72 17709.89	88 21645.42	104 25580.95	120 29516.49	132 32468.14	148 36403.67	164 40339.20	180 44274.73	192 47226.38	208 51161.91
3D+3D	6 1475.82	12 2951.64	30 7379.12	42 10330.77	60 14758.24	72 17709.89	90 22137.36	102 25089.01	120 29516.49	132 32468.14	150 36895.61	162 39847.26	180 44274.73	192 47226.38	210 51653.86
4D+4D	8 1967.76	8 1967.76	24 5903.29	40 9838.83	56 13774.36	72 17709.89	88 21645.42	104 25580.95	120 29516.49	128 31484.25	144 35419.78	160 39355.32	176 43290.85	192 47226.38	208 51161.91
5D+5D	10 2459.70	10 2459.70	30 7379.12	40 9838.83	60 14758.24	70 17217.95	90 22137.36	100 24597.07	120 29516.49	130 31976.19	150 36895.61	160 39355.32	180 44274.73	190 46734.44	210 51653.86
6D+6D	12 2951.64	12 2951.64	24 5903.29	36 8854.94	60 14758.24	72 17709.89	84 20661.54	96 23613.19	120 29516.49	132 32468.14	144 35419.78	156 38371.43	180 44274.73	192 47226.38	204 50178.03
7D+7D	14 3443.59	14 3443.59	28 6887.18	42 10330.77	56 13774.36	70 17217.95	84 20661.54	98 24105.13	112 27548.72	126 30992.31	140 34435.90	154 37879.49	168 41323.08	182 44766.67	210 51653.86
8D+8D	0 0.00	0 0.00	16 3935.53	32 7871.06	48 11806.59	64 15742.12	80 19677.66	96 23613.19	112 27548.72	128 31484.25	144 35419.78	160 39355.32	176 43290.85	192 47226.38	208 51161.91

Disk capacity	491.9 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)
2D+2D	224 55097.45	240 59032.98	252 61984.63	268 65920.16	284 69855.69	300 73791.22	312 76742.87	328 80678.41	344 84613.94	360 88549.47	372 91501.12	388 95436.65	404 99372.18	420 103307.72
3D+3D	222 54605.50	240 59032.98	252 61984.63	270 66412.10	282 69363.75	300 73791.22	312 76742.87	330 81170.35	342 84122.00	360 88549.47	372 91501.12	390 95928.59	402 98880.24	420 103307.72
4D+4D	224 55097.45	240 59032.98	248 61000.74	264 64936.28	280 68871.81	296 72807.34	312 76742.87	328 80678.41	344 84613.94	360 88549.47	368 90517.24	384 94452.77	400 98388.30	416 102323.83
5D+5D	220 54113.56	240 59032.98	250 61492.69	270 66412.10	280 68871.81	300 73791.22	310 76250.93	330 81170.35	340 83630.05	360 88549.47	370 91009.18	390 95928.59	400 98388.30	420 103307.72
6D+6D	216 53129.68	240 59032.98	252 61984.63	264 64936.28	276 67887.93	300 73791.22	312 76742.87	324 79694.52	336 82646.17	360 88549.47	372 91501.12	384 94452.77	396 97404.42	420 103307.72
7D+7D	224 55097.45	238 58541.04	252 61984.63	266 65428.22	280 68871.81	294 72315.40	308 75758.99	322 79202.58	336 82646.17	350 86089.76	364 89533.35	378 92976.94	392 96420.53	420 103307.72
8D+8D	224 55097.45	240 59032.98	240 59032.98	256 62968.51	272 66904.04	288 70839.57	304 74775.11	320 78710.64	336 82646.17	352 86581.70	368 90517.24	384 94452.77	400 98388.30	416 102323.83

Table F.28 List of Capacities Corresponding to RAID1 (750 Gbytes)

Disk capacity	737.4 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
1D+1D	2	14	30	44	60	74	90	104	120	134	150	164	180	194	210
	737.49	5162.45	11062.39	16224.84	22124.78	27287.23	33187.17	38349.62	44249.57	49412.02	55311.96	60474.41	66374.35	71536.80	77436.75
Disk capacity	737.4 G bytes														
Component unit	RKAJAT														
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)	
1D+1D	224	240	254	270	284	300	314	330	344	360	374	390	404	420	
	82599.20	88499.14	93661.59	99561.53	104723.98	110623.92	115786.37	121686.32	126848.77	132748.71	137911.16	143811.10	148973.55	154873.50	

Table F.29 List of Capacities Corresponding to RAID5 (750 Gbytes)

Disk capacity	737.4 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+1P	3	15	30	45	60	75	90	105	120	135	150	165	180	195	210
	1474.98	7374.92	14749.85	22124.78	29499.71	36874.64	44249.57	51624.50	58999.42	66374.35	73749.28	81124.21	88499.14	95874.07	103249.00
3D+1P	4	12	28	44	60	72	88	104	120	132	148	164	180	192	208
	2212.47	6637.43	15487.35	24337.26	33187.17	39824.61	48674.52	57524.44	66374.35	73011.79	81861.70	90711.62	99561.53	106198.97	115048.88
4D+1P	5	15	30	45	60	75	90	105	120	135	150	165	180	195	210
	2949.97	8849.91	17699.82	26549.74	35399.65	44249.57	53099.48	61949.40	70799.31	79649.22	88499.14	97349.05	106198.97	115048.88	123898.80
5D+1P	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210
	3687.46	7374.92	18437.32	25812.25	36874.64	44249.57	55311.96	62686.89	73749.28	81124.21	92186.60	99561.53	110623.92	117998.85	129061.25
6D+1P	7	14	28	42	56	70	84	105	119	133	147	161	175	189	210
	4424.95	8849.91	17699.82	26549.74	35399.65	44249.57	53099.48	66374.35	75224.27	84074.18	92924.10	101774.01	110623.92	119473.84	132748.71
7D+1P	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208
	5162.45	5162.45	15487.35	25812.25	36137.15	46462.05	56786.95	67111.85	77436.75	82599.20	92924.10	103249.00	113573.90	123898.80	134223.70
8D+1P	9	9	27	45	54	72	90	99	117	135	144	162	180	189	207
	5899.94	5899.94	17699.82	29499.71	35399.65	47199.54	58999.42	64899.37	76699.25	88499.14	94399.08	106198.97	117998.85	123898.80	135698.68
9D+1P	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210
	6637.43	6637.43	19912.30	26549.74	39824.61	46462.05	59736.92	66374.35	79649.22	86286.66	99561.53	106198.97	119473.84	126111.27	139386.15
10D+1P	11	11	22	44	55	66	88	99	110	132	143	165	176	187	209
	7374.92	7374.92	14749.85	29499.71	36874.64	44249.57	58999.42	66374.35	73749.28	88499.14	95874.07	110623.92	117998.85	125373.78	140123.64
11D+1P	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204
	8112.42	8112.42	16224.84	24337.26	40562.10	48674.52	56786.95	64899.37	81124.21	89236.63	97349.05	105461.47	121686.32	129798.74	137911.16
12D+1P	13	13	26	39	52	65	78	104	117	130	143	156	169	195	208
	8849.91	8849.91	17699.82	26549.74	35399.65	44249.57	53099.48	70799.31	79649.22	88499.14	97349.05	106198.97	115048.88	132748.71	141598.62
13D+1P	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210
	9587.40	9587.40	19174.81	28762.22	38349.62	47937.03	57524.44	67111.85	76699.25	86286.66	95874.07	105461.47	115048.88	124636.29	143811.10
14D+1P	15	15	30	45	60	75	90	105	120	135	150	165	180	195	210
	10324.90	10324.90	20649.80	30974.70	41299.60	51624.50	61949.40	72274.30	82599.20	92924.10	103249.00	113573.90	123898.80	134223.70	144548.60
15D+1P	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208
	0.00	0.00	11062.39	22124.78	33187.17	44249.57	55311.96	66374.35	77436.75	88499.14	99561.53	110623.92	121686.32	132748.71	143811.10

Table F.29 List of Capacities Corresponding to RAID5 (750 Gbytes) (Continued)

Disk capacity	737.4 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)
2D+1P	225 110623.92	240 117998.85	255 125373.78	270 132748.71	285 140123.64	300 147498.57	315 154873.50	330 162248.42	345 169623.35	360 176998.28	375 184373.21	390 191748.14	405 199123.07	420 206498.00
3D+1P	224 123898.80	240 132748.71	252 139386.15	268 148236.06	284 157085.97	300 165935.89	312 172573.32	328 181423.24	344 190273.15	360 199123.07	372 205760.50	388 214610.42	404 223460.33	420 232310.25
4D+1P	225 132748.71	240 141598.62	255 150448.54	270 159298.45	285 168148.37	300 176998.28	315 185848.20	330 194698.11	345 203548.02	360 212397.94	375 221247.85	390 230097.77	405 238947.68	420 247797.60
5D+1P	222 136436.17	240 147498.57	252 154873.50	270 165935.89	282 173310.82	300 184373.21	312 191748.14	330 202810.53	342 210185.46	360 221247.85	372 228622.78	390 239685.17	402 247060.10	420 258122.50
6D+1P	224 141598.62	238 150448.54	252 159298.45	266 168148.37	280 176998.28	294 185848.20	315 199123.07	329 207972.98	343 216822.90	357 225672.81	371 234522.72	385 243372.64	399 252222.55	420 265497.42
7D+1P	224 144548.60	240 154873.50	248 160035.95	264 170360.85	280 180685.75	296 191010.65	312 201335.55	328 211660.45	344 221985.35	360 232310.25	368 237472.70	384 247797.60	400 258122.50	416 268447.40
8D+1P	225 147498.57	234 153398.51	252 165198.40	270 176998.28	279 182898.22	297 194698.11	315 206498.00	324 212397.94	342 224197.82	360 235997.71	369 241897.65	387 253697.54	405 265497.42	414 271397.37
9D+1P	220 146023.58	240 159298.45	250 165935.89	270 179210.76	280 185848.20	300 199123.07	310 205760.50	330 219035.37	340 225672.81	360 238947.68	370 245585.12	390 258859.99	400 265497.42	420 278772.30
10D+1P	220 147498.57	231 154873.50	253 169623.35	264 176998.28	275 184373.21	297 199123.07	308 206498.00	330 221247.85	341 228622.78	352 235997.71	374 250747.57	385 258122.50	418 265497.42	418 280247.28
11D+1P	216 146023.58	240 162248.42	252 170360.85	264 178473.27	276 186585.69	300 202810.53	312 210922.95	324 219035.37	336 227147.80	360 243372.64	372 251485.06	384 259597.48	396 267709.90	420 283934.75
12D+1P	221 150448.54	234 159298.45	247 168148.37	260 176998.28	273 185848.20	299 203548.02	312 212397.94	325 221247.85	338 230097.77	351 238947.68	364 247797.60	390 265497.42	403 274347.34	416 283197.25
13D+1P	224 153398.51	238 162985.92	252 172573.32	266 182160.73	280 191748.14	294 201335.55	308 210922.95	322 220510.36	336 230097.77	350 239685.17	364 249272.58	378 258859.99	392 268447.40	420 287622.21
14D+1P	225 154873.50	240 165198.40	255 175523.30	270 185848.20	285 196173.10	300 206498.00	315 216822.90	330 227147.80	345 237472.70	360 247797.60	375 258122.50	390 268447.40	405 278772.30	420 289097.20
15D+1P	224 154873.50	240 165935.89	240 165935.89	256 176998.28	272 188060.67	288 199123.07	304 210185.46	320 221247.85	336 232310.25	352 243372.64	368 254435.03	384 265497.42	400 276559.82	416 287622.21

Table F.30 List of Capacities Corresponding to RAID6 (750 Gbytes)

Disk capacity	737.4 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+2P	4 1474.98	12 4424.95	28 10324.90	44 16224.84	60 22124.78	72 26549.74	88 32449.68	104 38349.62	120 44249.57	132 48674.52	148 54574.47	164 60474.41	180 66374.35	192 70799.31	208 76699.25
3D+2P	5 2212.47	15 6637.43	30 13274.87	45 19912.30	60 26549.74	75 33187.17	90 39824.61	105 46462.05	120 53099.48	135 59736.92	150 66374.35	165 73011.79	180 79649.22	195 86286.66	210 92924.10
4D+2P	6 2949.97	12 5899.94	24 14749.85	36 20649.80	48 29499.71	60 35399.65	72 42249.57	84 50149.51	96 58999.42	108 64899.37	120 73749.28	132 79649.22	144 88499.14	156 94399.08	168 103249.00
5D+2P	7 3687.46	14 7374.92	28 14749.85	42 22124.78	56 29499.71	70 36874.64	84 44249.57	98 55311.96	112 62686.89	126 70061.82	140 77436.75	154 84811.67	168 92186.60	182 99561.53	196 106239.92
6D+2P	8 4424.95	16 8849.91	32 16499.81	48 24749.76	64 33049.71	80 41299.66	96 49549.61	112 57800.00	128 66050.00	144 74300.00	158 82550.00	172 90800.00	186 99050.00	200 107300.00	214 115550.00
7D+2P	9 5162.45	18 10734.82	36 21469.64	54 32204.56	72 42939.51	90 53679.46	108 64419.41	126 75159.36	144 85899.31	162 97279.26	180 109099.21	198 121119.16	210 133139.11	222 145179.06	234 157219.01
8D+2P	10 5899.94	20 13649.88	40 27299.76	60 40949.71	80 54649.66	100 68349.61	120 82049.56	140 95749.51	160 109449.46	180 123149.41	200 136849.36	220 150549.31	240 164249.26	260 177849.21	280 191349.16
9D+2P	11 6637.43	22 16569.86	44 33139.72	66 50209.67	88 66779.62	110 83359.57	132 100019.52	154 116679.47	176 133339.42	198 150659.37	210 164279.32	222 175219.27	234 185769.22	246 197309.17	258 208849.12
10D+2P	12 7374.92	24 18469.84	48 36939.68	72 55409.76	96 73879.84	120 92349.92	144 110819.96	168 129289.96	192 147819.96	210 164279.92	222 175219.88	234 185769.84	246 197309.80	258 208849.76	270 220329.72
11D+2P	13 8112.42	26 20369.84	52 40739.68	78 60609.84	104 80479.92	130 100349.96	156 120219.96	182 140089.96	208 160019.96	222 171519.92	234 182959.88	246 194899.84	258 206839.80	270 218779.76	282 230719.72
12D+2P	14 8849.91	28 22269.88	56 44539.76	84 66379.92	112 88239.96	140 109109.96	168 130019.96	196 150879.96	224 172699.96	240 185479.92	252 197019.88	264 208359.84	276 219239.80	288 230459.76	300 241579.72
13D+2P	15 9587.40	30 24169.90	60 48339.80	90 72509.90	120 96679.90	150 120849.90	180 145019.90	210 169189.90	240 193359.90	252 204799.86	264 216359.82	276 227859.78	288 238919.74	300 250019.70	312 261119.66
14D+2P	0 0.00	0 0.00	16 10324.90	32 20649.80	48 30974.70	64 41299.60	80 51624.50	96 61949.40	112 72274.30	128 82599.20	144 92924.10	160 103249.00	176 113573.90	192 123898.80	208 134223.70
15D+2P	0 0.00	0 0.00	17 11062.39	34 22124.78	51 33187.17	68 44249.57	85 55311.96	102 66374.35	119 77436.75	136 88499.14	153 99561.53	170 110623.92	187 121686.32	204 132748.71	221 143810.11
16D+2P	0 0.00	0 0.00	18 11799.88	36 23599.77	54 35399.65	72 47199.54	90 58999.42	108 70799.31	126 82599.20	144 94399.08	162 106198.97	180 117998.85	198 129798.74	216 141598.62	234 153198.50
17D+2P	0 0.00	0 0.00	19 12537.37	38 25074.75	57 37612.13	76 50149.51	95 62686.89	114 75224.27	133 87761.65	152 100299.02	171 112836.40	190 125373.78	209 137911.16	228 150488.54	247 163067.92
18D+2P	0 0.00	0 0.00	20 13274.87	40 26549.74	60 39824.61	80 53099.48	100 66374.35	120 79649.22	140 92924.10	160 106198.97	180 119473.84	200 132748.71	220 145593.58	240 158713.32	260 171832.86
19D+2P	0 0.00	0 0.00	21 14012.36	42 28024.72	63 42037.09	84 56049.45	105 70061.82	126 84074.18	147 98086.55	168 112098.91	189 126111.27	210 140123.64	231 154175.00	252 168238.72	273 182311.28
20D+2P	0 0.00	0 0.00	22 14749.85	44 29499.71	66 44249.57	88 58999.42	110 73749.28	132 88499.14	154 103249.00	176 117998.85	198 132748.71	220 147498.56	242 161998.42	264 176548.28	286 191098.04
21D+2P	0 0.00	0 0.00	23 15487.35	46 30974.70	69 46462.05	92 58311.96	115 72699.42	138 87436.75	161 102599.20	184 117749.00	207 132998.76	230 148248.52	253 163798.28	276 179047.84	300 194797.36
22D+2P	0 0.00	0 0.00	24 16224.84	48 32449.68	72 48674.52	96 64899.37	120 81124.21	144 97349.05	168 113573.90	192 129798.74	216 145998.48	240 161598.16	264 177397.84	288 192797.40	312 208196.96
23D+2P	0 0.00	0 0.00	25 16962.33	50 33924.67	75 50887.00	100 67849.34	125 84811.67	150 101774.01	175 118736.35	200 135698.68	225 152658.02	250 169577.36	275 186456.70	300 203275.28	325 219953.80
24D+2P	0 0.00	0 0.00	26 17699.82	52 35399.65	78 50999.48	104 67999.31	130 84999.14	156 101998.97	182 118198.80	208 135198.64	234 151398.40	260 167598.16	286 183997.92	312 200797.48	338 218197.04
25D+2P	0 0.00	0 0.00	27 18437.32	54 36874.64	81 53111.96	108 70199.42	135 87349.28	162 104849.14	189 121798.91	216 138698.82	243 155598.54	270 171498.26	297 188297.80	324 205097.32	351 221796.88
26D+2P	0 0.00	0 0.00	28 19174.81	56 38349.62	84 51624.50	112 68499.37	140 85749.28	168 103249.00	196 121686.32	224 140123.64	252 158043.28	280 175890.44	308 192737.60	336 209587.76	364 226287.12
27D+2P	0 0.00	0 0.00	29 19912.30	58 39824.61	87 59736.92	116 76699.25	145 95874.07	174 113573.90	203 132498.76	232 151398.52	261 169247.28	290 187095.80	319 204894.34	348 222591.40	377 239088.92
28D+2P	0 0.00	0 0.00	30 20649.80	60 41299.60	90 61949.40	120 82599.20	150 103249.00	180 123898.80	210 144798.70	240 165698.40	270 187498.10	300 209297.50	330 230996.90	360 252596.40	390 274195.90

Table F.30 List of Capacities Corresponding to RAID6 (750 Gbytes) (Continued)

Disk capacity	737.4 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420 (Max.)
2D+2P	224 82599.20	240 88499.14	252 92924.10	268 98824.04	284 104723.98	300 110623.92	312 115048.88	328 120948.82	344 126848.77	360 132748.71	372 137173.67	388 143073.61	404 148973.55	420 154873.50
3D+2P	225 99561.53	240 106198.97	255 112836.40	270 119473.84	285 126111.27	300 132748.71	315 139386.15	330 146023.58	345 152661.02	360 159298.45	375 165935.89	390 172573.32	405 179210.76	420 185848.20
4D+2P	222 109148.94	240 117998.85	252 123898.80	270 132748.71	282 138648.65	300 147498.57	312 153398.51	330 162248.42	342 168148.37	360 176998.28	372 182898.22	390 191748.14	402 197648.08	420 206498.00
5D+2P	224 117998.85	238 125373.78	252 132748.71	266 140123.64	280 147498.57	294 154873.50	315 165935.89	329 173310.82	343 180685.75	357 188060.67	371 195435.60	385 202810.53	399 210185.46	420 221247.85
6D+2P	224 123898.80	240 132748.71	248 137173.67	264 146023.58	280 154873.50	296 163723.41	312 172573.32	328 181423.24	344 190273.15	360 199123.07	368 203548.02	384 212397.94	400 221247.85	416 230097.77
7D+2P	225 129061.25	234 134223.70	252 144548.60	270 154873.50	279 160035.95	297 170360.85	315 180685.75	324 185848.20	342 196173.10	360 206498.00	369 211660.45	387 221985.35	405 232310.25	414 247472.70
8D+2P	220 129798.74	240 141598.62	250 147498.57	270 159298.45	280 165198.40	300 176998.28	310 182898.22	330 194698.11	340 200598.05	360 212397.94	370 218297.88	390 230097.77	400 235997.71	420 247797.60
9D+2P	220 132748.71	231 139386.15	253 152661.02	264 159298.45	275 165935.89	297 179210.76	308 185848.20	330 199123.07	341 205760.50	352 212397.94	374 225672.81	385 232310.25	396 238947.68	418 252222.55
10D+2P	216 132748.71	240 147498.57	252 154873.50	264 162248.42	276 169623.35	300 184373.21	312 191748.14	324 199123.07	336 206498.00	360 221247.85	372 228622.78	384 235997.71	396 243372.64	420 258122.50
11D+2P	221 137911.16	234 146023.58	247 154136.00	260 162248.42	273 170360.85	299 186585.69	312 194698.11	325 202810.53	338 210922.95	351 219035.37	364 227147.80	390 243372.64	403 251485.06	416 259597.48
12D+2P	224 141598.62	238 150448.54	252 159298.45	266 168148.37	280 176998.28	294 185848.20	308 194698.11	322 203548.02	336 212397.94	350 221247.85	364 230097.77	378 238947.68	392 247797.60	420 265497.42
13D+2P	225 143811.10	240 153398.51	255 162985.92	270 172573.32	285 182160.73	300 191748.14	315 201335.55	330 210922.95	345 220510.36	360 230097.77	375 239685.17	390 249272.58	405 258859.99	420 268447.40
14D+2P	224 144548.60	240 154873.50	240 154873.50	256 165198.40	272 175523.30	288 185848.20	304 196173.10	320 206498.00	336 216822.90	352 227147.80	368 237472.70	384 247797.60	400 258122.50	416 268447.40
15D+2P	221 143811.10	238 154873.50	255 165935.89	255 165935.89	272 176998.28	289 188060.67	306 199123.07	323 210185.46	340 221247.85	357 232310.25	374 243372.64	391 254435.03	408 265497.42	
16D+2P	216 141598.62	234 153398.51	252 165198.40	270 176998.28	270 176998.28	288 188798.17	306 200598.05	324 212397.94	342 224197.82	360 235997.71	378 247797.60	396 259597.48	414 271397.37	
17D+2P	209 137911.16	228 150448.54	247 162985.92	266 175523.30	285 188060.67	285 188060.67	304 200598.05	323 213135.43	342 225672.81	361 225672.81	380 238210.19	399 250747.57	418 263284.95	420 275822.32
18D+2P	220 146023.58	240 159298.45	240 159298.45	260 172573.32	280 185848.20	300 199123.07	300 199123.07	320 212397.94	340 225672.81	360 238947.68	360 238947.68	380 252222.55	400 265497.42	420 278772.30
19D+2P	210 140123.64	231 154136.00	252 168148.37	252 168148.37	273 182160.73	294 196173.10	315 210185.46	315 210185.46	336 224197.82	357 238210.19	357 238210.19	378 252222.55	399 266234.92	420 280247.28
20D+2P	220 147498.57	220 147498.57	242 162248.42	264 176998.28	264 176998.28	286 191748.14	308 206498.00	330 221247.85	330 221247.85	352 235997.71	374 250747.57	396 265497.42	418 280247.28	
21D+2P	207 139386.15	230 154873.50	253 170360.85	253 170360.85	276 185848.20	299 201335.55	299 201335.55	322 216822.90	345 232310.25	345 232310.25	368 247797.60	391 263284.95	414 278772.30	
22D+2P	216 146023.58	240 162248.42	240 162248.42	264 178473.27	264 178473.27	288 194698.11	312 210922.95	312 210922.95	336 227147.80	360 243372.64	360 243372.64	384 259597.48	408 275822.32	
23D+2P	225 152661.02	225 152661.02	250 169623.35	250 169623.35	275 186585.69	300 203548.02	300 203548.02	325 220510.36	350 220510.36	350 237472.70	375 254435.03	400 254435.03	400 271397.37	
24D+2P	208 141598.62	234 159298.45	234 159298.45	260 176998.28	260 176998.28	286 194698.11	312 212397.94	312 212397.94	338 230097.77	364 230097.77	364 247797.60	390 265497.42	416 283197.25	
25D+2P	216 147498.57	216 147498.57	243 165935.89	270 184373.21	270 184373.21	297 202810.53	297 202810.53	324 221247.85	324 221247.85	351 239685.17	351 239685.17	378 258122.50	405 276559.82	420 276559.82
26D+2P	224 153398.51	224 153398.51	252 172573.32	252 172573.32	280 191748.14	280 191748.14	308 210922.95	308 210922.95	336 230097.77	336 230097.77	364 249272.58	364 249272.58	392 268447.40	420 287622.21
27D+2P	203 139386.15	232 159298.45	232 159298.45	261 179210.76	261 179210.76	290 199123.07	290 199123.07	319 219035.37	319 219035.37	348 238947.68	348 238947.68	377 258859.99	406 268447.40	420 289097.20
28D+2P	210 144548.60	240 165198.40	240 165198.40	270 185848.20	270 185848.20	300 206498.00	300 206498.00	330 227147.80	330 227147.80	360 247797.60	360 247797.60	390 268447.40	420 268447.40	420 289097.20

Table F.31 List of Capacities Corresponding to RAID1+0 (750 Gbytes)

Disk capacity	737.4 G bytes														
Component unit	RKAJAT														
Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+2D	4 1474.98	12 4424.95	28 10324.90	44 16224.84	60 22124.78	72 26549.74	88 32449.68	104 38349.62	120 44249.57	132 48674.52	148 54574.47	164 60474.41	180 66374.35	192 70799.31	208 76699.25
3D+3D	6 2212.47	12 4424.95	30 11062.39	42 15487.35	60 22124.78	72 26549.74	90 33187.17	102 37612.13	120 44249.57	132 48674.52	150 55311.96	162 59736.92	180 66374.35	192 70799.31	210 77436.75
4D+4D	8 2949.97	8 2949.97	24 8849.91	40 14749.85	56 20649.80	72 26549.74	88 32449.68	104 38349.62	120 44249.57	128 47199.54	144 53099.48	160 58999.42	176 64899.37	192 70799.31	208 76699.25
5D+5D	10 3687.46	10 3687.46	30 11062.39	40 14749.85	60 22124.78	70 25812.25	90 33187.17	100 36874.64	120 44249.57	130 47937.03	150 55311.96	160 58999.42	180 66374.35	190 70061.82	210 77436.75
6D+6D	12 4424.95	12 4424.95	24 8849.91	36 13274.87	60 22124.78	72 26549.74	84 30974.70	96 35399.65	120 44249.57	132 48674.52	144 53099.48	156 57524.44	180 66374.35	192 70799.31	204 75224.27
7D+7D	14 5162.45	14 5162.45	28 10324.90	42 15487.35	56 20649.80	70 25812.25	84 30974.70	98 36137.15	112 41299.60	126 46462.05	140 51624.50	154 56786.95	168 61949.40	182 67111.85	210 77436.75
8D+8D	0 0.00	0 0.00	16 5899.94	32 11799.88	48 17699.82	64 23599.77	80 29499.71	96 35399.65	112 41299.60	128 47199.54	144 53099.48	160 58999.42	176 64899.37	192 70799.31	208 76699.25

Disk capacity	737.4 G bytes													
Component unit	RKAJAT													
Range	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Total range of Disk drives	225	240	255	270	285	300	315	330	345	360	375	390	405	420(Max.)
2D+2D	224 82599.20	240 88499.14	252 92924.10	268 98824.04	284 104723.98	300 110623.92	312 115048.88	328 120948.82	344 126848.77	360 132748.71	372 137173.67	388 143073.61	404 148973.55	420 154873.50
3D+3D	222 81861.70	240 88499.14	252 92924.10	270 99561.53	282 103986.49	300 110623.92	312 115048.88	330 121686.32	342 126111.27	360 132748.71	372 137173.67	390 143811.10	402 148236.06	420 154873.50
4D+4D	224 82599.20	240 88499.14	248 91449.11	264 97349.05	280 103249.00	296 109148.94	312 115048.88	328 120948.82	344 126848.77	360 132748.71	368 135698.68	384 141598.62	400 147498.57	416 153398.51
5D+5D	220 81124.21	240 88499.14	250 92186.60	270 99561.53	280 103249.00	300 110623.92	310 114311.39	330 121686.32	340 125373.78	360 132748.71	370 136436.17	390 143811.10	400 147498.57	420 154873.50
6D+6D	216 79649.22	240 88499.14	252 92924.10	264 97349.05	276 101774.01	300 110623.92	312 115048.88	324 119473.84	336 123898.80	360 132748.71	372 137173.67	384 141598.62	396 146023.58	420 154873.50
7D+7D	224 82599.20	238 87761.65	252 92924.10	266 98086.55	280 103249.00	294 108411.45	308 113573.90	322 118736.35	336 123898.80	350 129061.25	364 134223.70	378 139386.15	392 144548.60	420 154873.50
8D+8D	224 82599.20	240 88499.14	240 88499.14	256 94399.08	272 100299.02	288 106198.97	304 112098.91	320 117998.85	336 123898.80	352 129798.74	368 135698.68	384 141598.62	400 147498.57	416 153398.51

Appendix G Port Address Mapping Table

Fibre channel physical addresses are converted to target IDs (TIDs) using a conversion table. Table g.1 shows the current limits for TIDs on various operating systems.

Table G.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 G.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 G.3 Port Addresses for Solaris

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	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 G.4 Port Addresses for Windows NT (Fibre Board: Emulex®)

C5(PhId5)				C4(PhId4)				C3(PhId3)				C2(PhId2)			C1(PhId1)			
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
--	--	--	--	--	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 G.5 Port Addresses for Windows NT (Fibre Board: QLogic®)

C0(PhId0)				C1(PhId1)				C2(PhId2)				C3(PhId3)			
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 H Power Cables

This section includes descriptions of the following power cables:

- J1H
- J2H
- J2H5 and J2H10

Table H.1 J1H Power Cable

Cable Name	Part No.	Name	Quantity	Model	Applicable Safety Standard/Rating
DF-F700-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

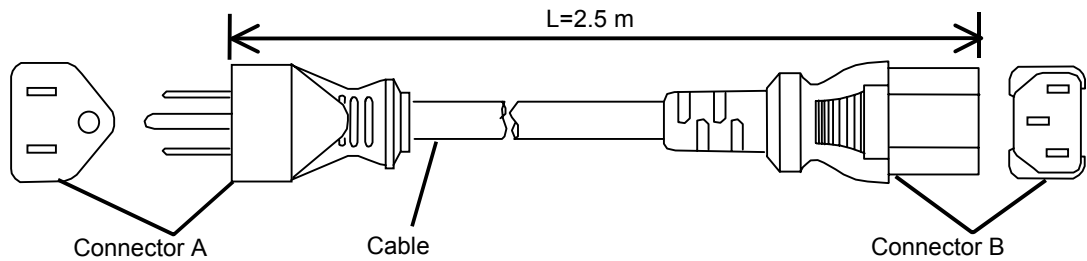


Figure H.1 J1H Power Cable

Table H.2 J2H Power Cable

Cable Name	Part No.	Name	Quantity	Model	Applicable Safety Standard/Rating
DF-F700-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

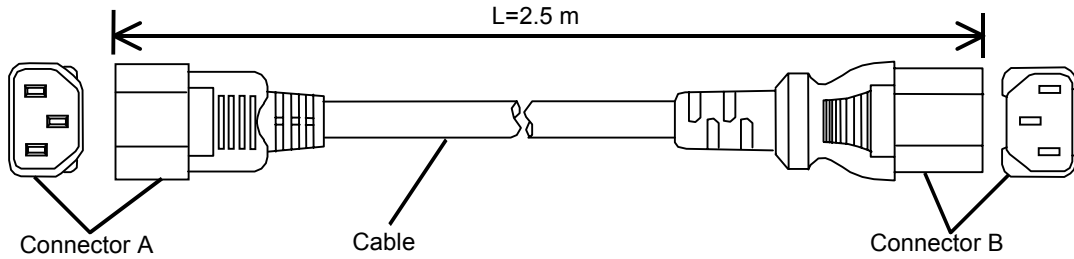


Figure H.2 J2H Power Cable

Table H.3 J2H5 and J2H10 Power Cables

Cable Name	Part No.	Name	Quantity	Model	Applicable Safety Standard/Rating
DF-F700-	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

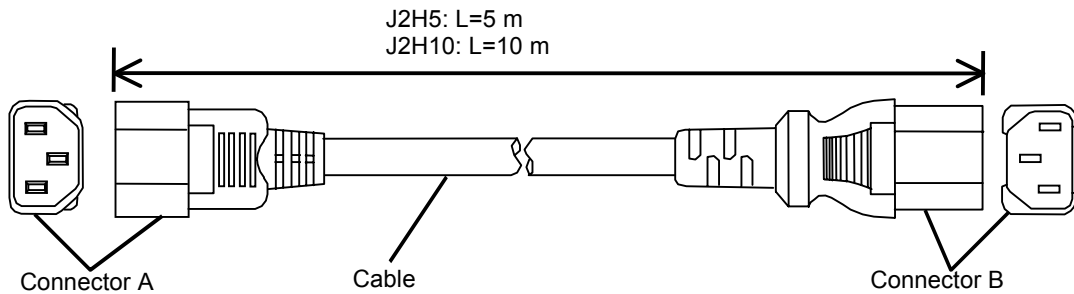


Figure H.3 J2H5 and J2H10 Power Cables

Appendix I 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 GB = 1,000,000,000 bytes.

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

A logical unit can divide all RAID groups into up to 2048.

Set the number of logical blocks set for each logical unit using the following multiples in accordance with RAID levels.

Table I.1 Number of Logical Blocks and RAID Levels (continues on the following pages)

RAID Level		Logical Block Number
RAID0	2D	4096
	3D	6144
	4D	8192
	5D	10240
	6D	12288
	7D	14336
	8D	16384
	9D	18432
	10D	20480
	11D	22528
	12D	24576
	13D	26624
	14D	28672
	15D	30720
	16D	32768
RAID1	(1D+1D)	2048

Table I.1 Number of Logical Blocks and RAID Levels (continued)

RAID Level		Logical Block Number
RAID5	(2D+1P)	4096
	(3D+1P)	6144
	(4D+1P)	8192
	(5D+1P)	10240
	(6D+1P)	12288
	(7D+1P)	14336
	(8D+1P)	16384
	(9D+1P)	18432
	(10D+1P)	20480
	(11D+1P)	22528
	(12D+1P)	24576
	(13D+1P)	26624
	(14D+1P)	28672
	(15D+1P)	30720

Table I.1 Number of Logical Blocks and RAID Levels (continued)

RAID Level		Logical Block Number
RAID 6	(2D+2P)	4096
	(3D+2P)	6144
	(4D+2P)	8192
	(5D+2P)	10240
	(6D+2P)	12288
	(7D+2P)	14336
	(8D+2P)	16384
	(9D+2P)	18432
	(10D+2P)	20480
	(11D+2P)	22528
	(12D+2P)	24576
	(13D+2P)	26624
	(14D+2P)	28672
	(15D+2P)	30720
	(16D+2P)	32768
	(17D+2P)	34816
	(18D+2P)	36864
	(19D+2P)	38912
	(20D+2P)	40960
	(21D+2P)	43008
	(22D+2P)	45056
	(23D+2P)	47104
	(24D+2P)	49152
	(25D+2P)	51200
	(26D+2P)	53248
	(27D+2P)	55296
	(28D+2P)	57344

Table I.1 Number of Logical Blocks and RAID Levels (continued)

RAID Level		Logical Block Number
RAID1+0	(2D+2D)	4096
	(3D+3D)	6144
	(4D+4D)	8192
	(5D+5D)	10240
	(6D+6D)	12288
	(7D+7D)	14336
	(8D+8D)	16384

When dividing RAID groups into multiple logical units, set the sum total of the number of logical blocks of each logical unit below the number of logical blocks per parity shown below. However, when creating multiple parity groups in each RAID group, set them below the number of logical blocks of one parity group multiplied by the number of parity groups. The number of logical blocks of one parity group is shown below.

Table I.2 Number of Logical Blocks of One Parity Group

Disk drive capacity		71.3 G bytes	143.3 G bytes	245.7 G bytes	287.6 G bytes	393.4 G bytes	491.9 G bytes	737.4 G bytes
RAID configuration								
RAID 0	(2D)	278,556,672	559,788,032	–	1,123,549,184	–	–	–
	(3D)	417,835,008	839,682,048	–	1,685,323,776	–	–	–
	(4D)	557,113,344	1,119,576,064	–	2,247,098,368	–	–	–
	(5D)	696,391,680	1,399,470,080	–	2,808,872,960	–	–	–
	(6D)	835,670,016	1,679,364,096	–	3,370,647,552	–	–	–
	(7D)	974,948,352	1,959,258,112	–	3,932,422,144	–	–	–
	(8D)	1,114,226,688	2,239,152,128	–	4,494,196,736	–	–	–
	(9D)	1,253,505,024	2,519,046,144	–	5,055,971,328	–	–	–
	(10D)	1,392,783,360	2,798,940,160	–	5,617,745,920	–	–	–
	(11D)	1,532,061,696	3,078,834,176	–	6,179,520,512	–	–	–
	(12D)	1,671,340,032	3,358,728,192	–	6,741,295,104	–	–	–
	(13D)	1,810,618,368	3,638,622,208	–	7,303,069,696	–	–	–
	(14D)	1,949,896,704	3,918,516,224	–	7,864,844,288	–	–	–
	(15D)	2,089,175,040	4,198,410,240	–	8,426,618,880	–	–	–
(16D)	2,228,453,376	4,478,304,256	–	8,988,393,472	–	–	–	
RAID 1	(1D+1D)	139,278,336	279,894,016	479,971,328	561,774,592	768,475,136	960,823,296	1,440,415,744
RAID 5	(2D+1P)	278,556,672	559,788,032	959,942,656	1,123,549,184	1,536,950,272	1,921,646,592	2,880,831,488
	(3D+1P)	417,835,008	839,682,048	1,439,913,984	1,685,323,776	2,305,425,408	2,882,469,888	4,321,247,232
	(4D+1P)	557,113,344	1,119,576,064	1,919,885,312	2,247,098,368	3,073,900,544	3,843,293,184	5,761,662,976
	(5D+1P)	696,391,680	1,399,470,080	2,399,856,640	2,808,872,960	3,842,375,680	4,804,116,480	7,202,078,720
	(6D+1P)	835,670,016	1,679,364,096	2,879,827,968	3,370,647,552	4,610,850,816	5,764,939,776	8,642,494,464
	(7D+1P)	974,948,352	1,959,258,112	3,359,799,296	3,932,422,144	5,379,325,952	6,725,763,072	10,082,910,208
	(8D+1P)	1,114,226,688	2,239,152,128	3,839,770,624	4,494,196,736	6,147,801,088	7,686,586,368	11,523,325,952
	(9D+1P)	1,253,505,024	2,519,046,144	4,319,741,952	5,055,971,328	6,916,276,224	8,647,409,664	12,963,741,696
	(10D+1P)	1,392,783,360	2,798,940,160	4,799,713,280	5,617,745,920	7,684,751,360	9,608,232,960	14,404,157,440
	(11D+1P)	1,532,061,696	3,078,834,176	5,279,684,608	6,179,520,512	8,453,226,496	10,569,056,256	15,844,573,184

RAID configuration	Disk drive capacity	71.3 G bytes	143.3 G bytes	245.7 G bytes	287.6 G bytes	393.4 G bytes	491.9 G bytes	737.4 G bytes
RAID 5	(12D+1P)	1,671,340,032	3,358,728,192	5,759,655,936	6,741,295,104	9,221,701,632	11,529,879,552	17,284,988,928
	(13D+1P)	1,810,618,368	3,638,622,208	6,239,627,264	7,303,069,696	9,990,176,768	12,490,702,848	18,725,404,672
	(14D+1P)	1,949,896,704	3,918,516,224	6,719,598,592	7,864,844,288	10,758,651,904	13,451,526,144	20,165,820,416
	(15D+1P)	2,089,175,040	4,198,410,240	7,199,569,920	8,426,618,880	11,527,127,040	14,412,349,440	21,606,236,160
RAID 6	(2D+2P)	278,556,672	559,788,032	959,942,656	1,123,549,184	1,536,950,272	1,921,646,592	2,880,831,488
	(3D+2P)	417,835,008	839,682,048	1,439,913,984	1,685,323,776	2,305,425,408	2,882,469,888	4,321,247,232
	(4D+2P)	557,113,344	1,119,576,064	1,919,885,312	2,247,098,368	3,073,900,544	3,843,293,184	5,761,662,976
	(5D+2P)	696,391,680	1,399,470,080	2,399,856,640	2,808,872,960	3,842,375,680	4,804,116,480	7,202,078,720
	(6D+2P)	835,670,016	1,679,364,096	2,879,827,968	3,370,647,552	4,610,850,816	5,764,939,776	8,642,494,464
	(7D+2P)	974,948,352	1,959,258,112	3,359,799,296	3,932,422,144	5,379,325,952	6,725,763,072	10,082,910,208
	(8D+2P)	1,114,226,688	2,239,152,128	3,839,770,624	4,494,196,736	6,147,801,088	7,686,586,368	11,523,325,952
	(9D+2P)	1,253,505,024	2,519,046,144	4,319,741,952	5,055,971,328	6,916,276,224	8,647,409,664	12,963,741,696
	(10D+2P)	1,392,783,360	2,798,940,160	4,799,713,280	5,617,745,920	7,684,751,360	9,608,232,960	14,404,157,440
	(11D+2P)	1,532,061,696	3,078,834,176	5,279,684,608	6,179,520,512	8,453,226,496	10,569,056,256	15,844,573,184
	(12D+2P)	1,671,340,032	3,358,728,192	5,759,655,936	6,741,295,104	9,221,701,632	11,529,879,552	17,284,988,928
	(13D+2P)	1,810,618,368	3,638,622,208	6,239,627,264	7,303,069,696	9,990,176,768	12,490,702,848	18,725,404,672
	(14D+2P)	1,949,896,704	3,918,516,224	6,719,598,592	7,864,844,288	10,758,651,904	13,451,526,144	20,165,820,416
	(15D+2P)	2,089,175,040	4,198,410,240	7,199,569,920	8,426,618,880	11,527,127,040	14,412,349,440	21,606,236,160
	(16D+2P)	2,228,453,376	4,478,304,256	7,679,541,248	8,988,393,472	12,295,602,176	15,373,172,736	23,046,651,904
	(17D+2P)	2,367,731,712	4,758,198,272	8,159,512,576	9,550,168,064	13,064,077,312	16,333,996,032	24,487,067,648
	(18D+2P)	2,507,010,048	5,038,092,288	8,639,483,904	10,111,942,656	13,832,552,448	17,294,819,328	25,927,483,392
	(19D+2P)	2,646,288,384	5,317,986,304	9,119,455,232	10,673,717,248	14,601,027,584	18,255,642,624	27,367,899,136
	(20D+2P)	2,785,566,720	5,597,880,320	9,599,426,560	11,235,491,840	15,369,502,720	19,216,465,920	28,808,314,880
	(21D+2P)	2,924,845,056	5,877,774,336	10,079,397,888	11,797,266,432	16,137,977,856	20,177,289,216	30,248,730,624
	(22D+2P)	3,064,123,392	6,157,668,352	10,559,369,216	12,359,041,024	16,906,452,992	21,138,112,512	31,689,146,368
	(23D+2P)	3,203,401,728	6,437,562,368	11,039,340,544	12,920,815,616	17,674,928,128	22,098,935,808	33,129,562,112
	(24D+2P)	3,342,680,064	6,717,456,384	11,519,311,872	13,482,590,208	18,443,403,264	23,059,759,104	34,569,977,856
	(25D+2P)	3,481,958,400	6,997,350,400	11,999,283,200	14,044,364,800	19,211,878,400	24,020,582,400	36,010,393,600
	(26D+2P)	3,621,236,736	7,277,244,416	12,479,254,528	14,606,139,392	19,980,353,536	24,981,405,696	37,450,809,344
	(27D+2P)	3,760,515,072	7,557,138,432	12,959,225,856	15,167,913,984	20,748,828,672	25,942,228,992	38,891,225,088
	(28D+2P)	3,899,793,408	7,837,032,448	13,439,197,184	15,729,688,576	21,517,303,808	26,903,052,288	40,331,640,832

Disk drive capacity		71.3 G bytes	143.3 G bytes	245.7 G bytes	287.6 G bytes	393.4 G bytes	491.9 G bytes	737.4 G bytes
RAID configuration								
RAID 1+0	(2D+2D)	278,556,672	559,788,032	959,942,656	1,123,549,184	1,536,950,272	1,921,646,592	2,880,831,488
	(3D+3D)	417,835,008	839,682,048	1,439,913,984	1,685,323,776	2,305,425,408	2,882,469,888	4,321,247,232
	(4D+4D)	557,113,344	1,119,576,064	1,919,885,312	2,247,098,368	3,073,900,544	3,843,293,184	5,761,662,976
	(5D+5D)	696,391,680	1,399,470,080	2,399,856,640	2,808,872,960	3,842,375,680	4,804,116,480	7,202,078,720
	(6D+6D)	835,670,016	1,679,364,096	2,879,827,968	3,370,647,552	4,610,850,816	5,764,939,776	8,642,494,464
	(7D+7D)	974,948,352	1,959,258,112	3,359,799,296	3,932,422,144	5,379,325,952	6,725,763,072	10,082,910,208
	(8D+8D)	1,114,226,688	2,239,152,128	3,839,770,624	4,494,196,736	6,147,801,088	7,686,586,368	11,523,325,952

Appendix J Using LUN Security or LUN Management on a Fabric Switch Connection

When using LUN Manager on a Fabric Switch connection:

- When connecting to the servers (HBA) or exchanging the HBA, connect to the servers (HBA) that access the Disk Array after the LUN Manager settings, including WWN registration, have been completed.
- Zoning on Fabric Switch must be set as shown below, to disturb the access from HBA that cannot be accessed from the Disk Array by LUN Manager.

