



**Hitachi TagmaStore®
Adaptable Modular Storage 500™
User and Reference Guide**

© 2007 Hitachi Data Systems Corporation, ALL RIGHTS RESERVED

Notice: No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or stored in a database or retrieval system for any purpose without the express written permission of Hitachi Data Systems Corporation (hereinafter referred to as “Hitachi Data Systems”).

Hitachi Data Systems reserves the right to make changes to this document at any time without notice and assumes no responsibility for its use. Hitachi Data Systems products and services can only be ordered under the terms and conditions of Hitachi Data Systems’ applicable agreements. All of the features described in this document may not be currently available. Refer to the most recent product announcement or contact your local Hitachi Data Systems sales office for information on feature and product availability.

This document contains the most current information available at the time of publication. When new and/or revised information becomes available, this entire document will be updated and distributed to all registered users.

Trademarks

Hitachi Data Systems is a registered trademark and service mark of Hitachi, Ltd., and the Hitachi Data Systems design mark is a trademark and service mark of Hitachi, Ltd.

TagmaStore, Adaptable Modular Storage 500 (AMS500), TrueCopy, ShadowImage, Freedom Storage, Freedom Data Networks, Freedom SAN, and Freedom NAS are trademarks or registered trademarks of Hitachi Data Systems Corporation.

BladeFrame and Egenera are registered trademarks of Egenera, Inc.

Emulex is a registered trademark of Emulex Corporation in the United States.

Serviceguard is a registered trademark of the Hewlett-Packard Company.

AIX and RS/6000 are registered trademarks of International Business Machines Corporation.

Pentium is a registered trademark of Intel Corporation.

Linux is a registered trademark of Linus Torvalds.

Microsoft, Windows, Windows NT, and Microsoft Server are registered trademarks of Microsoft Corporation.

NetApp and SnapRestore are registered trademarks, and Network Appliance, Data ONTAP, and Snapshot are trademarks of Network Appliance, Inc. in the U.S. and other countries.

Oracle is a registered trademark of Oracle Corporation.

QLogic is a registered trademark of QLogic Corporation in the United States.

IRIX is a registered trademark of Silicon Graphics Inc. in the United States.

TurboSPARC is a registered trademark of SPARC International, Inc.

Solaris, Sun, Sun Enterprise, and Sun Fire are trademarks Sun Microsystems, Inc.

UNIX is a registered trademark of The Open Group in the United States and other countries.

VERITAS is a registered trademark of VERITAS Software Corporation.

All other brand or product names are or may be registered trademarks, trademarks, or service marks of and are used to identify products or services of their respective owners.

Notice of Export Controls

Export of technical data contained in this document may require an export license from the United States government and/or the government of Japan. Contact the Hitachi Data Systems Legal Department for any export compliance questions.

China RoHS



The indication is given based on the Requirements for Controlling Pollution Caused by Electronic Information Products Regulation

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)
RKM	×	○	○	○	○	○
RKAJ	×	○	○	○	○	○
RKAJAT	×	○	○	○	○	○
RKNAS	×	○	○	○	○	○

○ : Indicates that this toxic or hazardous substances contained in all of the homogeneous materials for this part is below this limit requirement in SJ/T 11363-2006.
× : Indicates that this toxic or hazardous substances contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T 11363-2006.

Document Revision Level

Revision	Date	Description
MK-95DF714-00	June 2005	Initial Release
MK-95DF714-01	September 2005	Revision 1, supersedes and replaces MK-95DF714-00
MK-95DF714-02	November 2005	Revision 2, supersedes and replaces MK-95DF714-01
MK-95DF714-03	January 2006	Revision 3, supersedes and replaces MK-95DF714-02
MK-95DF714-04	February 2006	Revision 4, supersedes and replaces MK-95DF714-03
MK-95DF714-05	April 2006	Revision 5, supersedes and replaces MK-95DF714-04
MK-95DF714-06	April 2006	Revision 6, supersedes and replaces MK-95DF714-05
MK-95DF714-07	May 2006	Revision 7a, supersedes and replaces MK-95DF714-06
MK-95DF714-08	August 2006	Revision 8, supersedes and replaces MK-95DF714-07
MK-95DF714-09	January 2007	Revision 9, supersedes and replaces MK-95DF714-08
MK-95DF714-13	May 2007	Revision 13, supersedes and replaces MK-95DF714-09

Changes in this Revision

(V7.1)

- Changed the table in .China RoHS
- Changed section .1.2.2
- Added .Table 1.1
- Added Note 3 to .Table 2.9
- Added Note 2 to .Table 2.10
- Added Note 1 to .Table 2.11
- Changed section .4.3
- Updated .Table 8.2
- Updated Note 4 in .Table C.1
- Updated Note 4 in .Table C.2
- Updated Note 3 in .Table C.3
- Changed .Figure D.1
- Added Note to .Figure D.1
- Changed .Table D.1

(V7.5)

- Changed Notes for .Figure 4-1, .Figure 4-2, .Figure 4-3, .Figure 4-4, .Figure 4-5, .Figure 4-6, and .Figure 4-7
- Changed section .4.6.1 and .4.6.2

- Changed Table 4.2 and Table 4.3
- Changed Note 7 in section 7.4.7
- Changed Table C.1 and Table C.2
- 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 AMS500™ storage system. This document also provides operation instructions, installation details, and configuration planning information for the AMS500 storage system.

This User and Reference Guide assumes that:

- The user is familiar with the Hitachi TagmaStore™ Adaptable Modular Storage AMS500 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.

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

Note: 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>.

Notice: The use of Hitachi TagmaStore AMS500 and all other Hitachi Data Systems products is governed by the terms of your agreement(s) with Hitachi Data Systems.

Software Version

This document revision applies to Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Products version 3.5 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.

- AMS500-RKM+H1J
- AMS500-RKM+RKAJ+H2J

Backup

Make a backup copy of your data. Hitachi Data Systems does not accept responsibility for data that is lost due to system failure.

Unit parameters are restored after optional hardware components are added or replaced; therefore data backup is important.

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

Comments

Please send us your comments on this document. Make sure to include the document title, number, and revision. Please refer to specific section(s) and paragraph(s) whenever possible.

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

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

Contents

Chapter 1	Overview of the AMS500™ Storage System	1
1.1	Introducing the AMS Storage Systems	2
1.2	Overview Features	2
1.2.1	High Data Availability	3
1.2.2	Connectivity	3
1.2.3	Scalability	4
1.2.4	Performance Reporting and Monitoring	4
1.2.5	Reliability, Availability, and Serviceability	4
1.2.6	Hitachi Freedom Storage and Hitachi Freedom Data Networks	5
1.2.7	Hitachi Freedom NAS™ and HDS- NetApp® NAS Enterprise Gateways	6
1.3	Rack-Mount Model	7
1.4	Floor Model	7
Chapter 2	Planning for Installation and Operation	9
2.1	User Responsibilities	11
2.2	Safety Precautions	12
2.2.1	Warning Labels	13
2.2.2	Repair, Modification, and Disassembly	13
2.2.3	Precautions for Using Equipment	13
2.2.3.1	Equipment	14
2.2.3.2	Cables	14
2.2.3.3	Air Vents	14
2.2.3.4	Battery Unit	14
2.2.3.5	Nickel-Hydride Rechargeable Battery Instructions	15
2.2.3.6	Other	16
2.2.4	Precautions for Inspecting and Cleaning	17
2.2.5	Emergency Precautions	18
2.2.5.1	Electric Shock	18
2.2.5.2	Fire	18
2.2.6	Warning Notices	19
2.2.6.1	Caution Statements	19
2.2.7	Locations of Warning Labels on Equipment	20
2.3	General Specifications and Requirements	27
2.3.1	Dimensions and Weight	27
2.3.2	Service Clearance Requirements	28
2.3.3	Floor Load Rating	29
2.3.3.1	Floor Load Rating for AMS500 Rack-Mount Model	29
2.3.3.2	Floor Load Rating for AMS500 Floor Model	29
2.3.4	Internal Logic Specifications	30
2.3.5	Cable Functions	30
2.4	Environmental Specifications and Requirements	31
2.4.1	Environmental Hazards	31
2.4.2	Temperature and Humidity Requirements	32
2.4.3	Input Power and Insulation Performance Specifications	33
2.4.4	Air Flow Requirements	36
2.4.5	Vibration and Shock Tolerances	36
2.4.6	Reliability	37

Chapter 3	Powering On/Off Procedure	41
3.1	AMS500 Rack-Mount Model	43
3.1.1	Storage System Power On	43
3.1.2	Storage System Power Off	44
3.1.3	Stop/Start/Restart of NAS OS	44
3.1.3.1	Stopping NAS OS	47
3.1.3.2	Starting NAS OS	50
3.1.3.3	Restarting the OS	52
3.2	AMS500 Floor Model	55
3.2.1	Storage System Power On	55
3.2.2	Storage System Power Off	56
Chapter 4	Storage System Architecture and Components	59
4.1	Configuration Block Diagrams	60
4.1.1	AMS500 Rack-Mount Model	60
4.1.2	AMS500 Floor Model	65
4.2	Redundant Power Supplies	68
4.3	Fibre Channel Interface	68
4.4	NAS Interface	69
4.5	iSCSI Interface	69
4.5.1	Setting iSCSI Information	69
4.6	Array Frames	70
4.6.1	AMS500 Rack-Mount Model	70
4.6.2	Floor Model	72
4.7	Component Names, Locations, and Functions	74
4.7.1	Front Bezel Component Locations and Functions	74
4.7.2	RKM and RKAJ and RKAJAT Component Locations	77
4.7.3	Switch Locations and Functions	78
4.7.3.1	Panel Assembly	78
4.7.3.2	Power Unit	79
4.7.3.3	RKNAS	79
4.7.4	Connector Locations and Functions	80
4.7.4.1	ENC Unit	80
4.7.4.2	Power Unit	81
4.7.4.3	Control Unit	82
4.7.4.4	RKNAS	83
4.7.5	LED Locations and Functions	84
4.7.5.1	Disk Drive Display (RKM)	84
4.7.5.2	Disk Drive Display (RKAJ, RKAJAT)	86
4.7.5.3	Battery Backup Unit	87
4.7.5.4	ENC Unit	87
4.7.5.5	SENC Unit	89
4.7.5.6	Power Unit	90
4.7.5.7	Fan Assembly	90
4.7.5.8	Control Unit	91
4.7.5.9	RKNAS	93
Chapter 5	Functional and Operational Characteristics	97
5.1	New AMS500 Features and Capabilities	99

5.2	RAID Implementations	100
5.3	Cache Management.....	102
5.4	Logical Units.....	103
5.5	Open Systems Features and Functions	105
5.5.1	Open Systems Middleware	105
5.5.2	Logical Unit Mapping.....	105
5.6	Data Management Features and Functions	106
5.6.1	Cache Residency Manager Function	106
5.6.2	LUN Manager Function.....	106
5.6.3	Data Retention Utility Function.....	106
5.6.4	LUN Expansion Function.....	107
5.6.5	Password Protection Function.....	107
5.6.6	Account Authentication Function.....	107
5.6.7	Audit Logging Function	107
5.7	Copy Solution Features and Functions	108
5.7.1	TrueCopy Synchronous Remote Replication Function	108
5.7.2	TrueCopy Extended Distance Function.....	108
5.7.3	ShadowImage In-System Replication Function.....	108
5.7.4	Copy-On-Write Snapshot™ Function	109
5.7.5	Modular Volume Migration Function.....	109
5.7.6	NAS Backup Restore Modular Function.....	109
5.7.7	NAS Sync Image Modular Function	109
5.8	Performance Management Features and Functions	110
5.8.1	Performance Monitor Function	110
5.8.2	Cache Partition Manager Function.....	110
5.9	NAS Features and Functions	111
5.9.1	NAS Data Control Modular Function	111
5.9.2	NAS File Sharing Modular Function	111
5.9.3	NAS Manager Modular Function	111
5.9.4	NAS Backup Restore Modular Function.....	111
5.9.5	NAS Sync Image Modular Function	111
5.9.6	NAS Anti Virus Agent Modular Function	111
5.10	iSCSI Features and Functions	112
5.10.1	CHAP Authentication.....	112
5.10.2	iSNS Client.....	112

Chapter 6 Configuring the AMS500 Storage System..... 113

6.1	Overview of Configuration	114
6.1.1	Open Systems Configuration.....	114
6.1.2	Defining LUNs	114
6.1.3	Fibre Channel Interface Addressing	115
6.1.4	iSCSI Interface Addressing	116
6.1.5	Alternate Pathing.....	117
6.1.6	NAS Configuration	118
6.2	Configuring LAN Interfaces of AMS500 Storage System.....	119
6.2.1	Setting the IP Addresses.....	119
6.3	Configuring the AMS500 Storage System	120
6.4	Registering AMS500 Storage System for Control by Storage Navigator-Modular	121
6.5	Configuring AMS500 Storage System for Desired Application.....	121
6.6	General Configuration of the AMS500 Storage System.....	122

Chapter 7	Configuring Storage on the AMS500 Storage System	123
7.1	Software Composition	125
7.1.1	Microprogram	125
7.1.2	System Parameters	125
7.1.3	Configuration Information	125
7.1.4	SNMP Information	126
7.1.5	Storage for Parameters	126
7.2	Setting Fibre Channel Information	127
7.3	Setting iSCSI Information	128
7.3.1	Setting iSCSI Port Information	128
7.3.2	Setting iSNS Server Information	130
7.3.3	Sending a Ping	131
7.4	Determining Space and RAID Level Requirements	132
7.4.1	Setting a Spare Disk	133
7.4.2	Canceling a Spare Disk Setting.....	136
7.4.3	Setting a RAID Group	136
7.4.4	Deleting a RAID Group.....	139
7.4.5	Setting a Logical Unit	142
7.4.6	Deleting the Last Logical Unit	145
7.4.7	Formatting a Logical Unit.....	148
7.4.8	Changing Format Mode.....	153
7.4.9	Changing the Default Controller in Charge of an LU	155
7.5	Setting Host Group Information.....	156
7.5.1	Setting Mapping Information	156
7.6	Setting Target Information	160
7.6.1	Changing Target Information.....	160
7.6.2	Initializing Target 0.....	162
7.6.3	Setting Mapping Information	163
7.7	Setting CHAP Authentication	166
7.7.1	Adding a CHAP User	167
7.7.2	Changing the CHAP User	168
7.7.3	Deleting the CHAP User	169
7.7.4	Changing Two-Way Authentication Information	171
7.8	Transferring Configurations from One Array to Another	172
7.9	Storing Configuration Data	173
7.9.1	System Parameter Information	173
7.9.2	RAID Group/LU Information	174
7.9.3	Port/Host Group Information	175
7.9.4	NAS System LU/User LU information.....	176
7.9.5	LAN information.....	177
7.10	Applying Configuration Data to another AMS500 Storage System	177
7.10.1	System Parameters	178
7.10.2	RAID Group/Logical Unit.....	179
7.10.3	Port/Host Group	180
7.10.4	LAN Information.....	180
7.11	Setting Host Connection Parameters.....	181
7.11.1	Simple Setting for Connecting to Host Computer	181
7.11.2	Detailed Setting for Each Host Connection	187
7.12	Setting Storage System using Special Mode	188
7.13	Changing the Network Parameter	190

7.14	Changing the Auto Diagnosis Threshold for Fibre Channel Loop	195
7.15	Changing the Maintenance Port IP Address.....	197
7.16	Setting System LU and User LU in NAS System.....	200
7.16.1	Setting the System LU	201
7.16.2	Setting User LU	203
7.17	Setting NNC Management LAN Port Information in NAS System.....	205
7.18	Setting Time Zone	208
7.19	Settings and Restrictions for Adding the Thunder 9500VFC Additional Unit	210
Chapter 8	Troubleshooting	215
8.1	Troubleshooting Based on LED Indications	217
8.1.1	POWER LED Does Not Turn On.....	218
8.1.2	POWER LED has Turned Off	219
8.1.3	READY LED does not Turn On, or Turns On Once then Turns Off	220
8.1.4	ALARM LED has Turned On	222
8.1.5	Warning LED has Turned On or Blinks	222
8.2	Web Overview.....	224
8.2.1	Operational Environment	224
8.2.2	Characteristics of Network Functions when Connecting with Web.....	227
8.3	Web Operational Procedures	228
8.3.1	Connecting to the Network using a LAN Interface	228
8.3.2	Screen Outlines	229
8.3.2.1	Menu Frame	231
8.3.2.2	Mainframe	232
8.3.2.3	Version Frame	232
8.3.3	Main Screen in Normal Mode	233
8.3.3.1	Patrol Lamp	234
8.3.3.2	Summary of Exchange Parts Status.....	234
8.3.3.3	Progress Condition Display.....	235
8.3.3.4	Page Refresh Button	235
8.3.4	Status Display of Replaceable Components	236
8.3.5	Information Message	246
8.3.6	Setting Buzzer Sound Volume	247
8.3.7	Clear Specified Factors of NNC Partial Alarm.....	248
8.4	Troubleshooting Using a Web Connection	251
8.4.1	Checking Subsystem Status	251
8.4.2	Checking the Progress Condition Display	252
8.4.3	Checking Component Status	253
8.4.4	Checking Log Messages	255
8.4.5	Troubleshooting using Messages	258
8.4.5.1	Errors Detected by CUDG	258
8.4.5.2	Flash Detected Messages.....	258
8.4.5.3	Progress Messages.....	260
8.4.5.4	Warning Messages	263
8.4.5.5	Failure Messages.....	263
8.4.6	Reading Failure Information	264
8.5	Determining Failure of Network Side in NAS System.....	267
8.6	Determining Failure of Local Tape in NAS System.....	269
8.7	Connecting Failure in Connection with the Web	274
8.7.1	Collecting Simple Trace	274

8.7.2	NAS Log Collection.....	278
8.7.3	NAS Dump Generation.....	282
8.7.3.1	Generating NAS Dump.....	282
8.7.3.2	Suspension of NAS Dump Generation	284
8.7.3.3	Registration and Changing the Password.....	286
8.8	Determining Failure on Network Side of an iSCSI System.....	287
8.9	Changing the LAN Port Number with Storage Navigator Modular.....	288
8.9.1	Changing the LAN Port Number.....	288
8.9.2	Changing the LAN Port Number.....	290
8.9.3	Troubleshooting.....	295
8.10	Calling the Hitachi Data Systems Support Center.....	298
Chapter 9	Periodic Maintenance	299
Appendix A	Acronyms.....	301
Appendix B	System Parameter Setting List.....	305
Appendix C	AMS500 Storage System Basic Specifications.....	317
Appendix D	Interfaces	327
D.1	Fibre Channel Connection Specifications.....	327
D.2	Ethernet Connection Specifications.....	354
Appendix E	Remote Adapter Specifications	357
E.1	Remote Adapter Specifications	357
E.2	Remote Adapter Dimensions	358
Appendix F	Storage Capacities Corresponding to RAID Levels and Configurations.....	359
Appendix G	Port Address Mapping Table.....	379
Appendix H	Power Cables.....	383
Appendix I	Number of Logical Blocks	385
Appendix J	Using LUN Security or LUN Management on a Fabric Switch Connection	391

List of Figures

Figure 2-1	Positions and Contents of Labels on Floor Model RKM+H1J.....	21
Figure 2-2	Positions and Contents of Labels on Floor Model RKM+RKAJ/RKAJAT+H2J	22
Figure 2-3	Positions and Contents of Labels on Rack-Mount Model RKM.....	23
Figure 2-4	Positions and Contents of Labels on Rack-Mount Model RKNAS.....	24
Figure 2-5	Positions and Contents of Labels on Rack-Mount Model RKAJ/RKAJAT	25
Figure 3-1	Subsystem Power On/Off (Floor [RKM+RKAJ+H2J] Model example).....	55
Figure 4-1	RKM Unit System Configuration	61
Figure 4-2	RKM and RKNAS Unit System Configuration	62
Figure 4-3	RKAJ Unit System Configuration	63
Figure 4-4	RKAJAT Unit System Configuration	64
Figure 4-5	Floor (RKM+H1J) Model System Configuration	65
Figure 4-6	Floor (RKM+RKAJ+H2J) Model System Configuration.....	66
Figure 4-7	Floor (RKM+RKAJAT+H2J) Model System Configuration	67
Figure 4-8	RKM, RKAJ, and RKAJAT Front Bezel Component Locations.....	74
Figure 4-9	RKNAS Front Bezel Component Locations	76
Figure 4-10	RKM, RKAJ, and RKAJAT Component Locations.....	77
Figure 4-11	Panel Assembly Switch Location	78
Figure 4-12	Power Unit Switch Locations	79
Figure 4-13	RKNAS Switch Locations	79
Figure 4-14	Connector Locations for ENC Unit	80
Figure 4-15	Connector Locations for Power Unit	81
Figure 4-16	Connector Locations for Control Unit	82
Figure 4-17	Connector Locations for RKNAS	83
Figure 4-18	LED Locations for Disk Drive Display (RKM,)	84
Figure 4-19	LED Locations for Disk Drive Display (RKAJ, RKAJAT)	86
Figure 4-20	LED Locations for Battery Backup Unit	87
Figure 4-21	LED Locations for ENC Unit	87
Figure 4-22	LED Locations for SENC Unit.....	89
Figure 4-23	LED Locations for Power Unit	90
Figure 4-24	LED Locations for Fan Assembly.....	90
Figure 4-25	LED Locations for Control Unit	91
Figure 4-26	LED Locations for RKNAS (front)	93
Figure 4-27	LED Locations for RKNAS (rear)	94
Figure 5-1	Logical Units	103
Figure 5-2	Logical Units (when iSCSI interface board is installed to control unit)	103
Figure 5-3	Logical Units (NAS Model).....	104
Figure 6-1	Fibre Channel Port-to-LUN Addressing.....	115
Figure 6-2	iSCSI Port-to-LUN Addressing (when iSCSI interface board is installed)	116
Figure 6-3	Alternate Pathing	117
Figure 6-4	Alternate Pathing (when iSCSI Interface board added)	117
Figure 7-1	Spare Drive Dialog Box (before setting)	134
Figure 7-2	Spare Drive Dialog Box (after setting)	134
Figure 7-3	Logical Status Tab.....	137

Figure 7-4	RAID Group Dialog	138
Figure 7-5	Set RAID Group is Updated	138
Figure 7-6	Setting the Logical Unit Dialog Box	143
Figure 7-7	Logical Unit Detail Dialog Box	144
Figure 7-8	Select Area.....	145
Figure 7-9	Mapping Dialog	158
Figure 7-10	Options (Simple) Dialog Box.....	182
Figure 7-11	Additional Parameters Property	184
Figure 8-1	LAN Connector Location	228
Figure 8-2	Main Screen Outline	229
Figure 8-3	Main Screen Outline (NAS).....	230
Figure 8-4	Main Screen Outline (iSCSI).....	230
Figure 8-5	Subsystem Condition Display	233
Figure 8-6	Patrol Lamp Display	234
Figure 8-7	Exchange Parts Status Display	235
Figure 8-8	Component Status Screen (Disk Drive)	236
Figure 8-9	Component Status Screen (Controller/Battery/Cache/Loop/Host Computer)	237
Figure 8-10	Component Status Screen (AC/ENC/FAN).....	237
Figure 8-11	NNC Information Screen	238
Figure 8-12	Revision Information Screen	244
Figure 8-13	Warning Information Screen	245
Figure 8-14	Information Message Screen.....	246
Figure 8-15	Buzzer Volume Screen	247
Figure 8-16	Subsystem Status Screen.....	251
Figure 8-17	Progress Condition Display	252
Figure 8-18	Replace Part Summary Screen (HDD)	253
Figure 8-19	Path Information Screen.....	254
Figure 8-20	NNC Information Screen	254
Figure 8-21	Information Message Screen.....	255
Figure 8-22	Message Analysis Example	266
Figure 8-23	Configuration Diagram	269
Figure 8-24	LAN Port Number Setting	290

List of Tables

Table 2.1	Caution Statements	19
Table 2.2	Symbols Contained in Warning Labels.....	20
Table 2.3	AMS500 Dimensions and Weight of Rack-Mount Model	27
Table 2.4	AMS500 Dimensions and Weight of Floor Model	27
Table 2.5	AMS500 Dimensions and Weight of NAS Unit	28
Table 2.6	Internal Logic Specification of AMS500 Rack-Mount Model	30
Table 2.7	Principal Functions of AMS500 Cables.....	30
Table 2.8	Environmental Specifications.....	32
Table 2.9	Input Power and Insulation Performance for Rack-Mount Model	33
Table 2.10	Input Power and Insulation Performance for Floor Model	34
Table 2.11	Input Power and Insulation Performance for NAS Unit	35
Table 2.12	Vibration and Shock Tolerances.....	36
Table 2.13	Reliability of AMS500 Rack-Mount Model (RKM/RKAJ)	37
Table 2.14	Reliability of AMS500 Rack-Mount Model (RKM/RKAJAT).....	38
Table 2.15	Reliability of AMS500 Floor Model	39
Table 4.1	Basic Specifications of Rack-Mount Model.....	71
Table 4.2	Basic Specifications of Floor Model.....	72
Table 4.3	RKM, RKAJ, and RKAJAT Front Bezel Component Functions.....	75
Table 4.4	RKNAS Front Bezel Component Functions	76
Table 4.5	Panel Assembly Switch Functions.....	78
Table 4.6	Power Unit Switch Functions	79
Table 4.7	RKNAS Switch Functions.....	79
Table 4.8	Connector Functions for ENC Unit	80
Table 4.9	Connector Functions for Power Unit	81
Table 4.10	Connector Functions for Control Unit.....	82
Table 4.11	Connector Functions for RKNAS	83
Table 4.12	LED Functions for Disk Drive Display (RKM)	85
Table 4.13	LED Functions for Disk Drive Display (RKAJ, RKAJAT)	86
Table 4.14	LED Functions for Battery Backup Unit	87
Table 4.15	LED Functions for ENC Unit	88
Table 4.16	LED Functions for SENC Unit.....	89
Table 4.17	LED Functions for Power Unit	90
Table 4.18	LED Functions for Fan Assembly	90
Table 4.19	LED Functions for Control Unit.....	91
Table 4.20	LED Functions for RKNAS (front).....	93
Table 4.21	LED Functions for RKNAS (rear)	94
Table 5.1	RAID Specifications of Rack-Mount Model	101
Table 5.2	RAID Specifications of Floor Model	101
Table 5.3	Cache Specifications of Rack-Mount Model	102
Table 5.4	Cache Specifications of Floor Model	102
Table 7.1	Storage for Parameters.....	126
Table 7.2	Simple Setting Item List.....	183
Table 7.3	List of Additional Parameter Setting Items	184
Table 7.4	Capacity Restriction of System LU.....	200

Table 8.1	Web Operational Environment.....	224
Table 8.2	AMS500 Web Function Support Browser/Version.....	225
Table 8.3	Network Parameters.....	227
Table 8.4	Message Code Types.....	258
Table 8.5	Flash Detected Messages	258
Table 8.6	Progress Messages (continues on the next page)	260
Table 8.6	Progress Messages (continues on the next page)	261
Table 8.6	Progress Messages (continued).....	262
Table 8.7	Warning Messages.....	263
Table 8.8	Failure Messages	263
Table 8.9	How to Read Failure Information.....	264
Table 8.10	Collection Mode	278
Table B.1	Host Connection Parameters: HP-UX	306
Table B.2	Host Connection Parameters: Solaris™	308
Table B.3	Host Connection Parameters: AIX®	310
Table B.4	Host Connection Parameters: Windows® 2000/2003	312
Table B.5	Host Connection Parameters: Linux®, Tru64®, and Others	314
Table C.1	Basic Specifications of AMS500 Floor Model	317
Table C.2	Basic Specifications of AMS500 Rackmount Model	321
Table C.3	Basic Specifications of NAS Unit (RKNAS)	325
Table D.1	Cable Specification	328
Table D.2	Ordered Set.....	330
Table D.3	SOF Delimiters.....	331
Table D.4	EOF Delimiters.....	332
Table D.5	Frame Format	335
Table D.6	Frame Format	336
Table D.7	Frame Format	337
Table D.8	Link Control Frames	338
Table D.9	Link Service Frames Supported by the AMS500	339
Table D.10	Information Unit	340
Table D.11	Frame Header Format.....	341
Table D.12	FCP_CMND Payload	342
Table D.13	FCP_LUN Format	343
Table D.14	FC-4 Device Data Frame	345
Table D.15	Link Initialization Process	345
Table D.16	Link Initialization Process	352
Table D.17	Response when Receiving ELS without PLOGI	353
Table D.18	Response when Receiving ELS without PLOGI	354
Table E.1	Remote Adapter Specifications.....	357
Table F.1	List of Capacities Corresponding to RAID0 (72 GB)	359
Table F.2	List of Capacities Corresponding to RAID1 (72 GB)	360
Table F.3	List of Capacities Corresponding to RAID5 (72 GB)	360
Table F.4	List of Capacities Corresponding to RAID6 (72 GB)	361
Table F.5	List of Capacities Corresponding to RAID1+0 (72 GB)	362
Table F.6	List of Capacities Corresponding to RAID0 (146 GB).....	362

Table F.7	List of Capacities Corresponding to RAID1 (146 GB)	363
Table F.8	List of Capacities Corresponding to RAID5 (146 GB)	363
Table F.9	List of Capacities Corresponding to RAID6 (146 GB)	364
Table F.10	List of Capacities Corresponding to RAID1+0 (146 GB)	365
Table F.11	List of Capacities Corresponding to RAID0 (300 GB)	365
Table F.12	List of Capacities Corresponding to RAID1 (300 GB)	366
Table F.13	List of Capacities Corresponding to RAID5 (300 GB)	366
Table F.14	List of Capacities Corresponding to RAID6 (300 GB)	367
Table F.15	List of Capacities Corresponding to RAID1+0 (300 GB)	368
Table F.16	List of Capacities Corresponding to RAID1 (250 GB)	368
Table F.17	List of Capacities Corresponding to RAID5 (250 GB)	369
Table F.18	List of Capacities Corresponding to RAID6 (250 GB)	370
Table F.19	List of Capacities Corresponding to RAID1+0 (250 GB)	371
Table F.20	List of Capacities Corresponding to RAID1 (400 GB)	371
Table F.21	List of Capacities Corresponding to RAID5 (400 GB)	372
Table F.22	List of Capacities Corresponding to RAID6 (400 GB)	373
Table F.23	List of Capacities Corresponding to RAID1+0 (400 GB)	374
Table F.24	List of Capacities Corresponding to RAID1 (500 Gbytes)	374
Table F.25	List of Capacities Corresponding to RAID5 (500 Gbytes)	374
Table F.26	List of Capacities Corresponding to RAID6 (500 Gbytes)	375
Table F.27	List of Capacities Corresponding to RAID1+0 (500 Gbytes)	376
Table G.1	Limits for TIDs on Operating Systems	379
Table G.2	Port Addresses for HP-UX	379
Table G.3	Port Addresses for Solaris™	380
Table G.4	Port Addresses for Windows NT® (Fibre Board: Emulex®)	381
Table G.5	Port Addresses for Windows NT® (Fibre Board: QLogic®)	382
Table H.1	J1H Power Cable	383
Table H.2	J2H Power Cable	384
Table H.3	J2H5 and J2H10 Power Cables	384
Table I.1	Number of Logical Blocks and RAID Levels	385
Table I.2	Number of Logical Blocks of One Parity Group	388

Chapter 1 Overview of the AMS500™ 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)
- Floor Model (see section 1.4)

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	○	○	○
1.4	Floor 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 Features

The Hitachi TagmaStore® Adaptable Modular Storage AMS500 storage system (hereafter referred to as the AMS500) is available in two models: the floor model and the rackmount model.

There are two types of the AMS500 floor model. The first type is a combination of the DF-F700-RKM (hereafter referred to as the RKM) and the floor standing kit DF-F700-H1J (hereafter referred to as the Floor [RKM+H1J] Model). The second type is a combination of the RKM, the DF700-RKAJ (hereafter referred to as RKAJ)/the DF700-RKAJAT (hereafter referred to as RKAJAT), and the floor standing kit DF-f700-H2J (hereafter referred to as the Floor [RKM+RKAJ/RKAJAT+H2J] Model).

The AMS500 rackmount model is a subsystem that combines the RKM the RKAJ/RKAJAT, and the DF-700-RKNAS4G (hereafter referred to as RKNAS). For information regarding model types, see sections .1.3 and .1.4.

The following AMS500 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 AMS500 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 AMS500 subsystem.

1.2.2 Connectivity

The AMS500 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 AMS500 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 μm , 62.5/125 μm multimode Fibre Cable defined by .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 enables you to construct a system which 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 enables you to construct a system which 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

The architecture of the AMS500 enables the user to scale the subsystem to meet a wide range of capacity and performance requirements 88.5TB SATA and 67.5TB FC.

- The minimum number of disks is 4 fibre channel and the maximum is 225 FC or 210 SATA.
- Up to 15 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.
Note: AMS500 supports 15 hot global spares which can be configured in any location except for slots 0 - 4 in the RKM.
- 2048 logical disks (LUs) (maximum) are supported.

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 AMS500 subsystem include:

- **High-availability capability**

The Controller of the AMS500 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. 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 15 spare disks can be specified per subsystem; this function monitors the potential disk failure. Before failure occurs, the data copy operation can be automatically performed in the background. The dynamic sparing feature enables the subsystem to replace the spare disk due to redundancy (excluding RAID0 configuration) and provides high reliability.

- **Redundant power supply systems**

Each AMS500 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 AMS500 can sustain the loss of a single power supply and still continue operation.

- **High capacity cache**

The AMS500 subsystem supports a maximum of 4 GBs 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.

1.2.7 Hitachi Freedom NAS™ and HDS- NetApp® NAS Enterprise Gateways

Hitachi Freedom NAS enables you to expand configuration alternatives and boost data access. Freedom NAS enables rapid information access in a modular, rapidly deployed file server. Combined, HDS NAS and SAN technologies create a single pool of centrally managed storage, eliminating storage islands and giving you unmatched capacity, performance, and availability. Freedom NAS is an excellent solution for:

- File/Web serving
- Document/record imaging
- Streaming media
- Video design
- Telco call centers
- Manufacturing

As part of our continued commitment to deliver intelligent information infrastructures, HDS has joined forces with Network Appliance™, the NAS industry leader, to co-develop the HDS-NetApp® NAS Enterprise Gateways. The Gateways leverage the powerful Hitachi TagmaStore family of products to offer the high performance, availability, and scalability of SAN and the simplicity and cost effectiveness of NAS.

The HDS- NetApp® NAS Gateways enable you to consolidate all of your data—SAN and NAS—into one storage system. The Gateways can be attached directly to the Hitachi Lightning 9900V™ storage subsystems (and AMS500) via fiber-channel switch. The Gateways come with a high-availability clustered configuration as an option, and offer NetApp® Data ONTAP™ operating system and all major supporting utilities including Snapshot™ and SnapRestore® for seamless data backup and recovery.

The benefits of the HDS-NetApp® NAS Gateways include:

- Accelerated response times for NAS (and SAN) applications
- Leveraging existing storage infrastructure
- Minimizing overhead through consolidation and reduced complexity
- Simplifying management
- Increased availability and reliability
- Providing comprehensive data protection solutions
- Eliminating storage islands
- Installing quickly and easily
- Reducing operational costs

For further information on Freedom NAS™ and NAS Gateways, 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 RKM RKAJ/RKAJAT, and RKNAS mounted on a rack frame. The RKM is capable of mounting up to 15 disk drives; a controller to perform RAID control on the drives is included. The RKAJ/RKAJAT is capable of mounting up to 15 disk drives and controls the drives through a connection with an RKM. The RKAJ/RKAJAT is provided with no controller.

Notes:

- Since the RKM controls the AMS500 subsystem, at least one RKM 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)*.

1.4 Floor Model

There are two floor model styles:

- Floor (RKM+H1J) Model
- Floor (RKM+RKAJ/RKAJAT+H2J) Model

The Floor (RKM+H1J) Model is capable of mounting up to 15 disk drives and include a controller to perform RAID control on the drives. The Floor (RKM+RKAJ/RKAJAT+H2J) model is capable of mounting up to 30 disk drives and includes a controller to perform RAID control on the drives.

Note: For the specifications of the Floor model, see Chapter 2.

Chapter 2 Planning for Installation and Operation

This chapter provides information for planning and preparing a site before and during installation of the Hitachi AMS500 subsystem. Please read this chapter carefully before beginning your installation planning.

If you would like to use any of the AMS500 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 AMS500 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 AMS500 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	○	○	○
	2.3.3.1 Floor Load Rating for the AMS500 Rack-Mount Model	○	○	○
	2.3.3.2 Floor Load Rating for the AMS500 Floor Model	○	—	○
	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 AMS500 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 AMS500 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.

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 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 AMS500 subsystem.
- Do not expose the battery to high temperatures.
- Use only the specified battery.

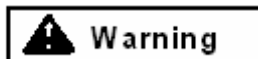
2.2.3.5 Nickel-Hydrate Rechargeable Battery Instructions

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.



1. 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.
2. If it takes longer than the specified time to complete recharging, stop recharging the battery; otherwise, the battery may become overheated, burst or ignite.

If the battery leaks and gets into your eyes, immediately flush your eyes with clean water (tap water) and do not rub your eye. Visit the doctor immediately. If you do not seek any treatment for your eyes, problems may occur later. Because the battery uses highly concentrated alkaline as electrolyte, it can burn; you may lose your sight if it makes 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.

Table 2.1 Caution Statements

Warning Statement	Corresponding Page
Cooling fans rotate at a high speed. Keep body parts and loose clothing away from the cooling fans.	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 Equipment

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

- Floor Model RKM+H1J
- Floor Model RKM+RKAJ+H2J
- Rack-Mount Model RKM
- 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

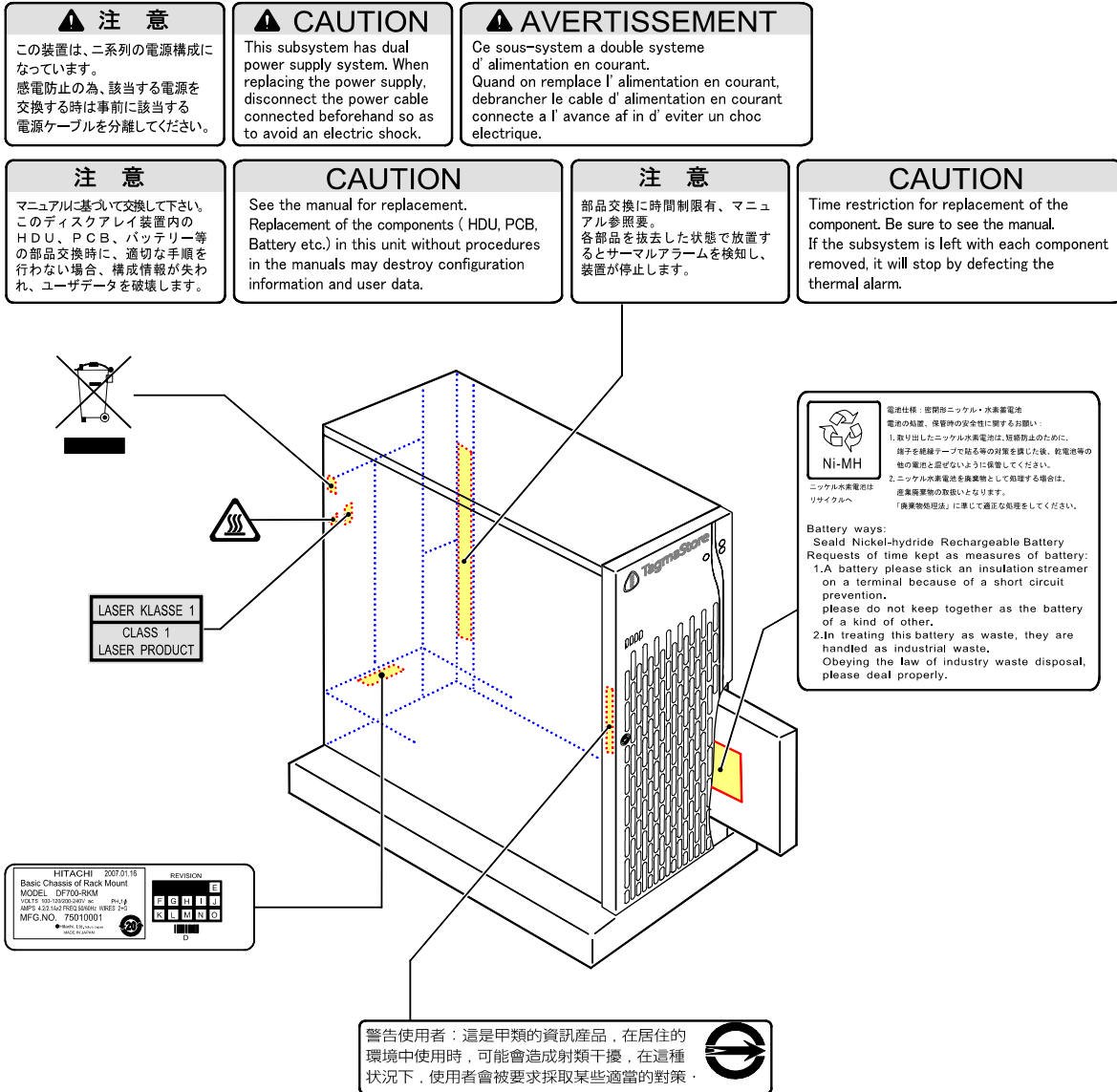


Figure 2-1 Positions and Contents of Labels on Floor Model RKM+H1J

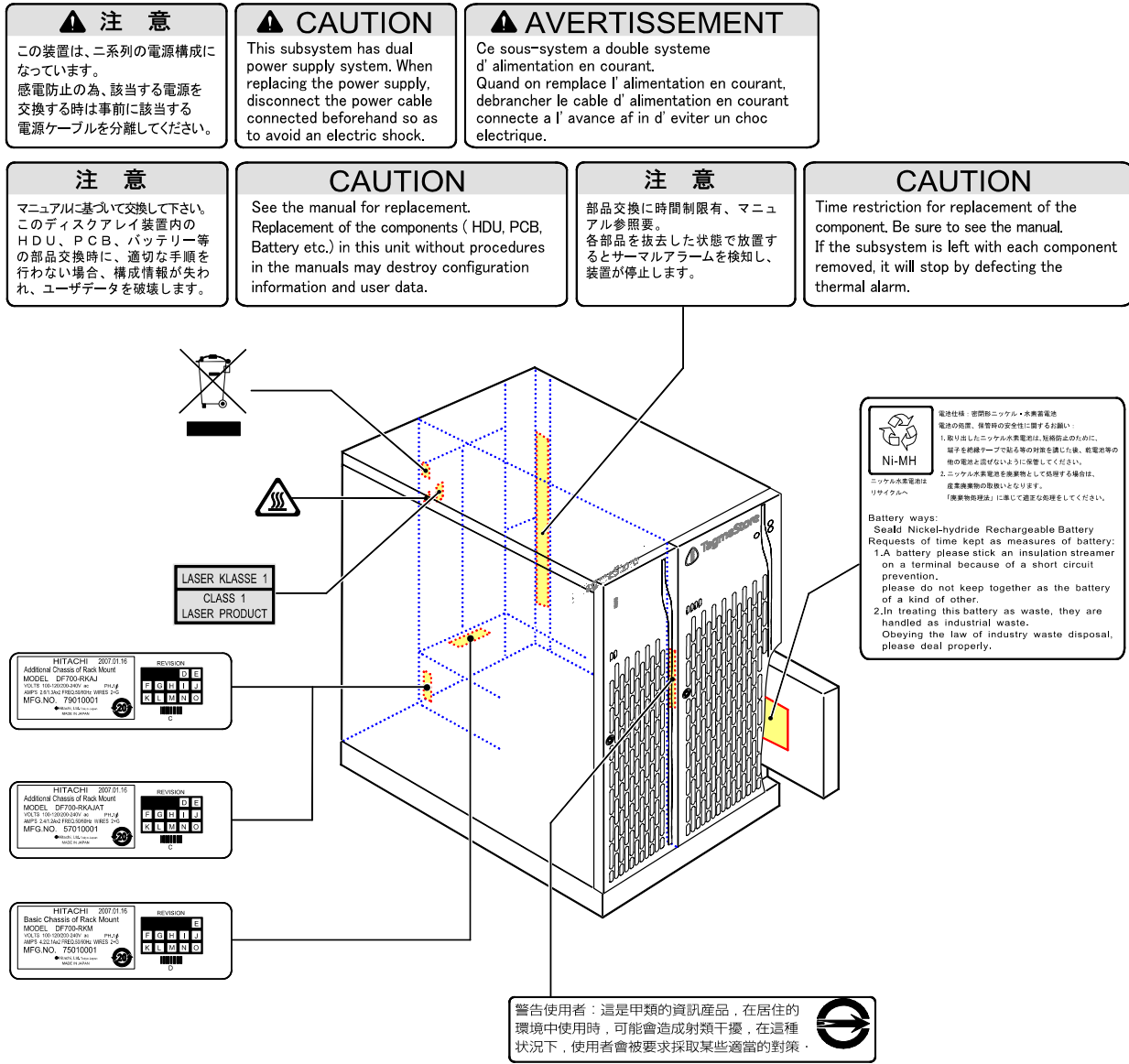


Figure 2-2 Positions and Contents of Labels on Floor Model RKM+RKAJ/RKAJAT+H2J

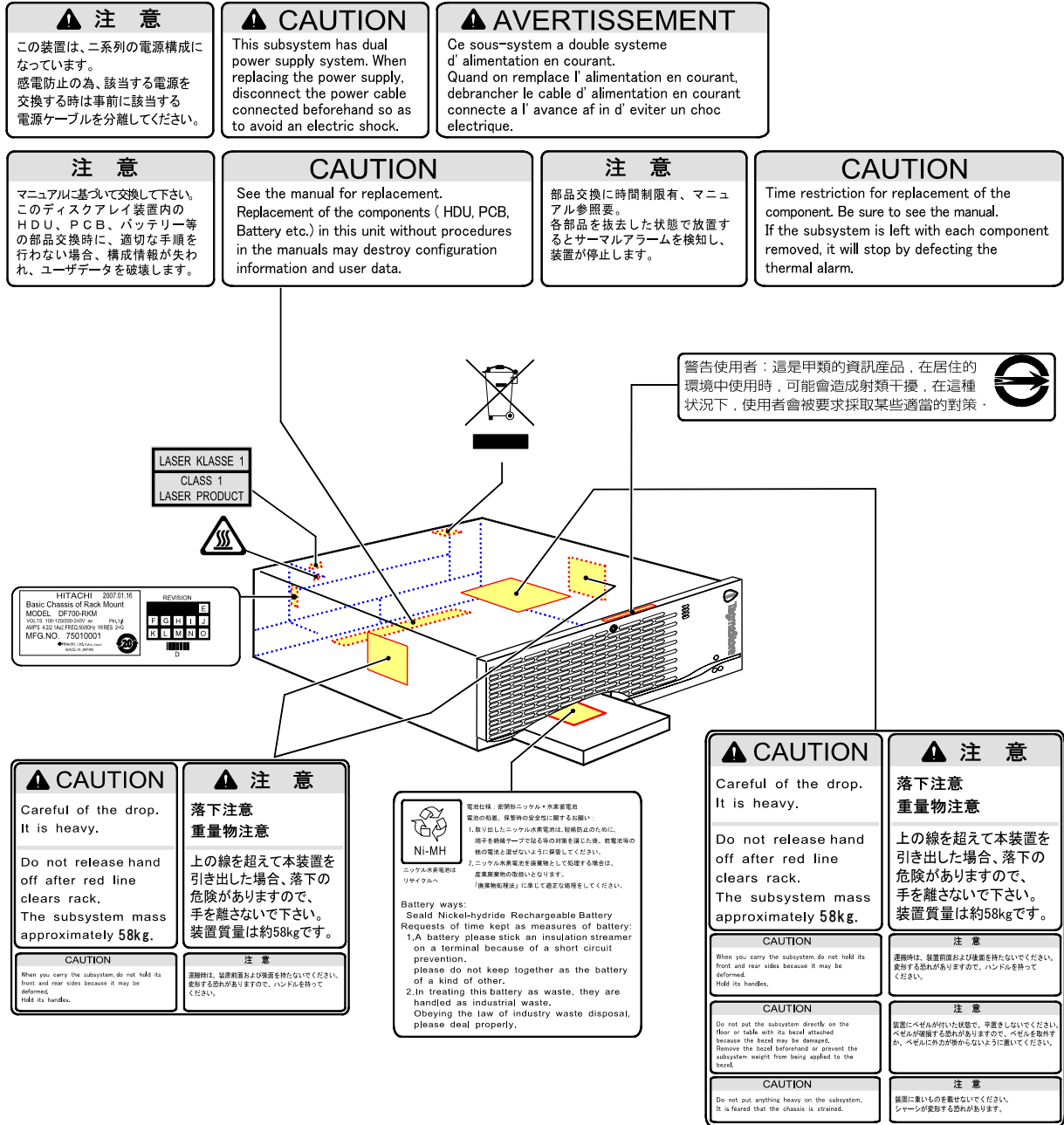


Figure 2-3 Positions and Contents of Labels on Rack-Mount Model RKM

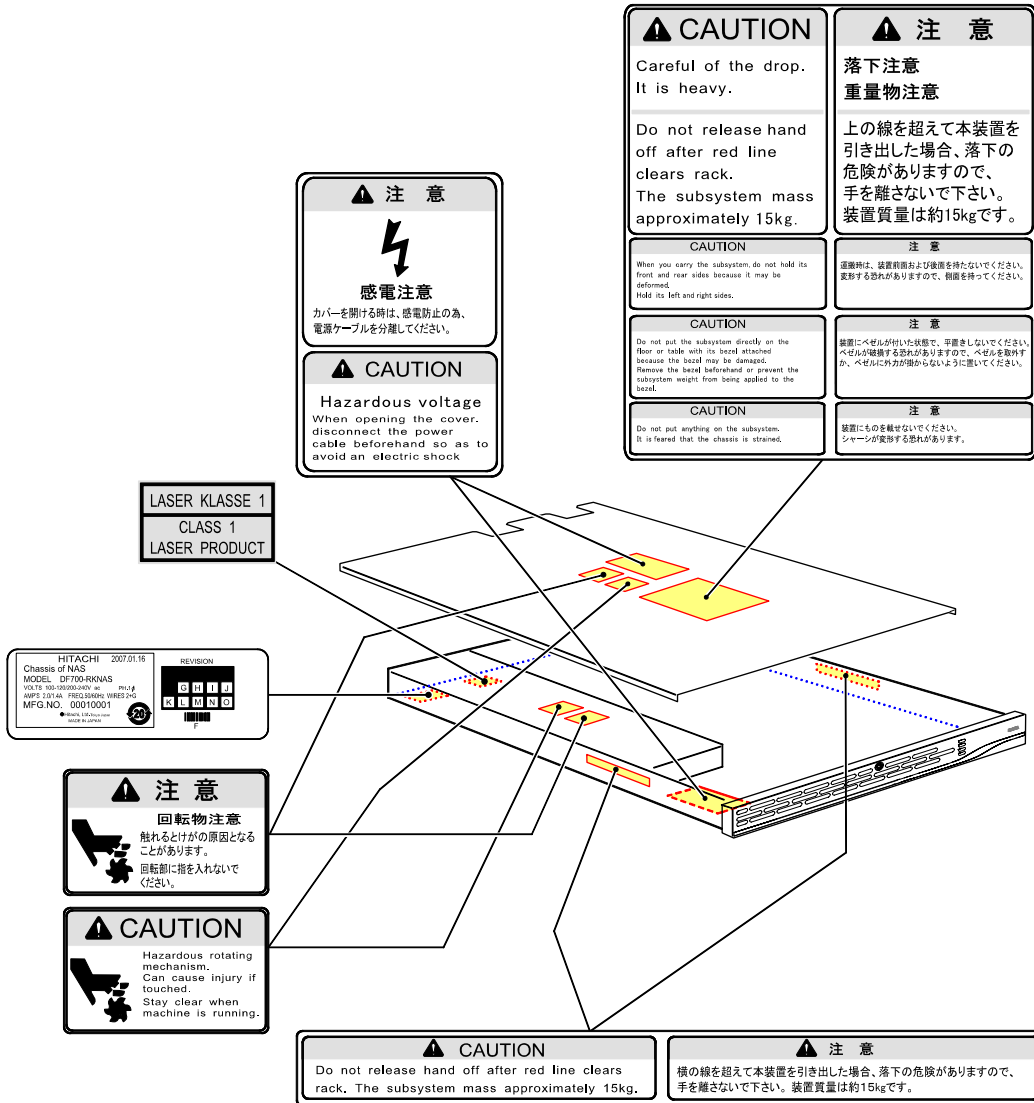


Figure 2-4 Positions and Contents of Labels on Rack-Mount Model RKNAS

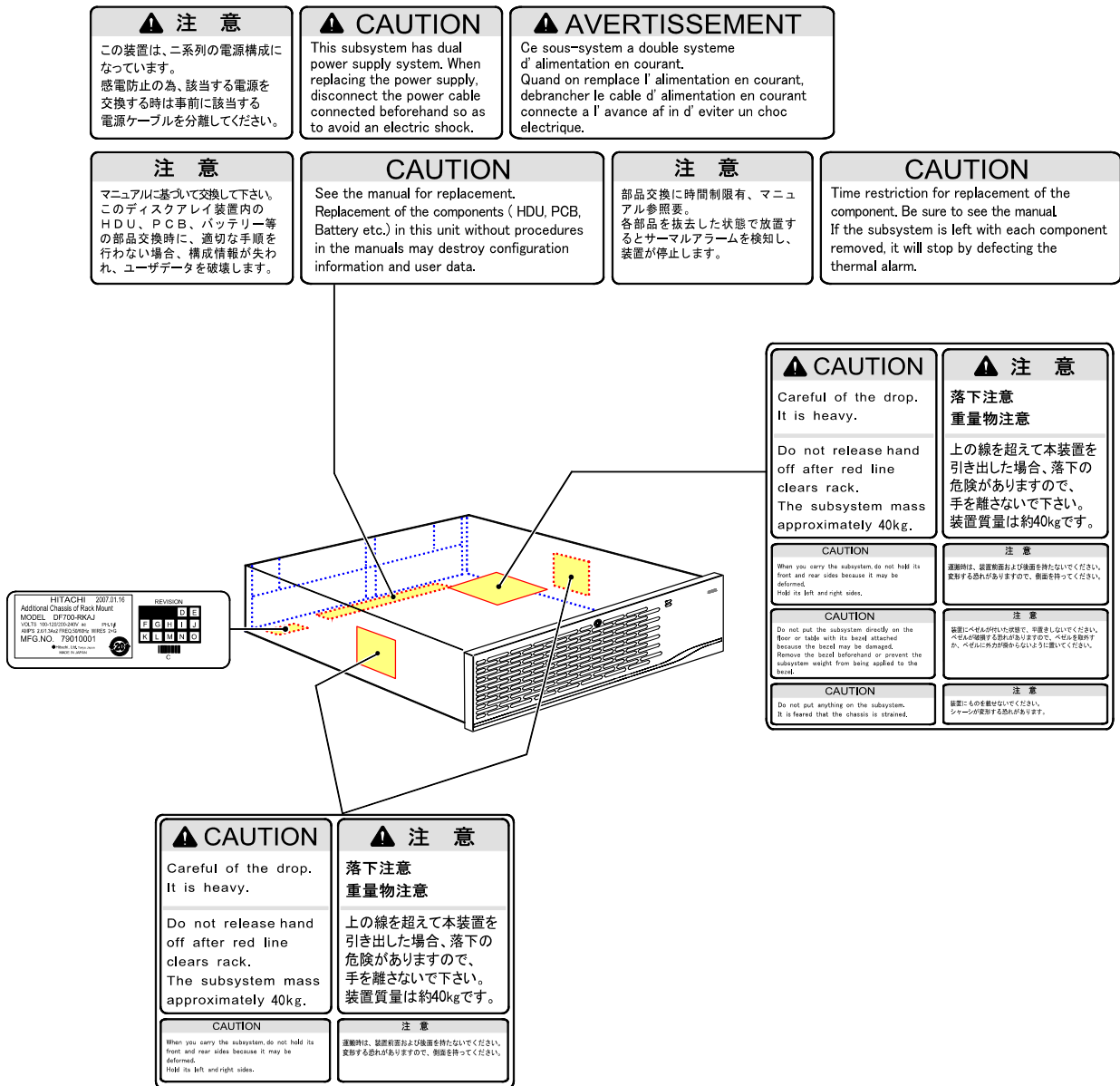


Figure 2-5 Positions and Contents of Labels on Rack-Mount Model RKAJ

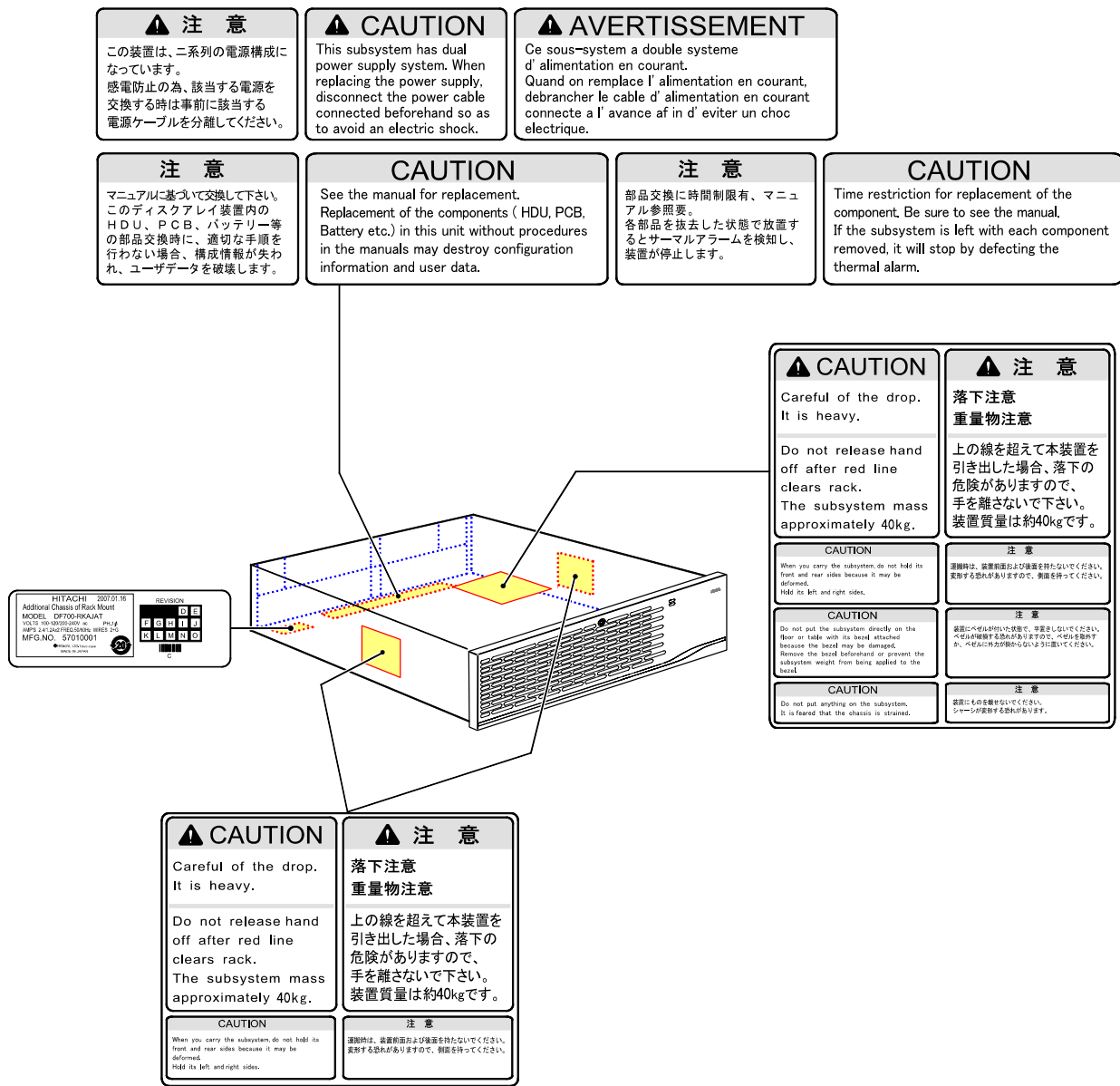


Figure 2-6 Positions and Contents of Labels on Rack-Mount Model RKAJAT

2.3 General Specifications and Requirements

This section describes the general specifications and requirements for the AMS500 subsystem. The following are included:

- Dimensions and Weight
- Service Clearance Requirements
- Floor Load Rating
- Internal Logic Specifications
- Cable Requirements

2.3.1 Dimensions and Weight

The following table illustrates the dimensions and weight of the AMS500 rack-mount model and the AMS500 floor model.

Table 2.3 AMS500 Dimensions and Weight of Rack-Mount Model

Item		Rackmount Model		
		RKM	RKAJ	RKAJAT
Physical Specifications	Chassis size (W×D×H) (mm)	483×650×174	483×650×129	
	Mass (kg)	58 approx	40 approx	
	Acoustic noise (dB)	57 approx	60 approx	
	Required height (EIA unit)	4	3	

Table 2.4 AMS500 Dimensions and Weight of Floor Model

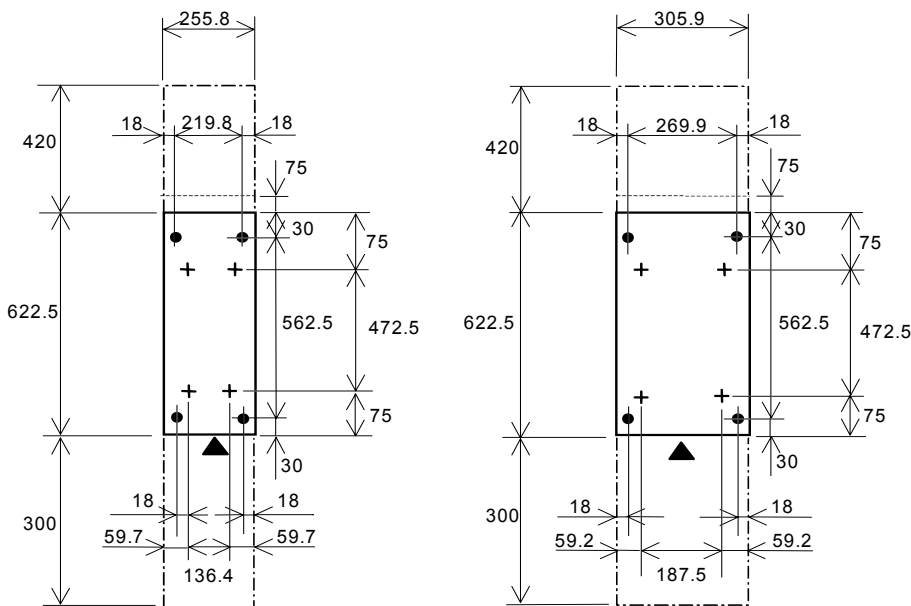
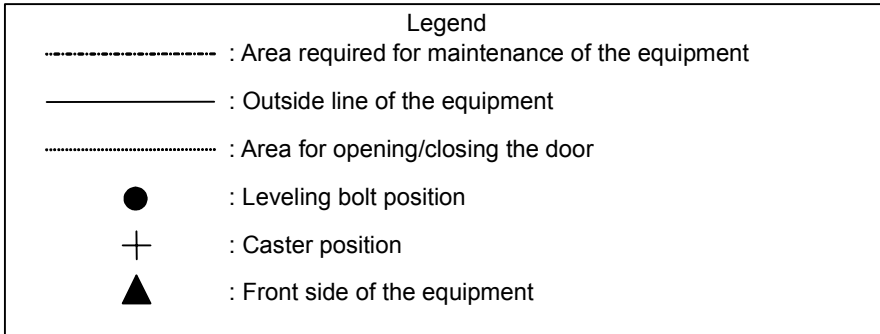
Item		Floor Model	
		Floor (RKM+H1J) Model	Floor (RKM+RKAJ/RKAJAT+H2J) Model
Physical Specifications	Chassis size (W×D×H) (mm)	260×737×540	309×737×540
	Mass (kg)	70 approx	115 approx
	Acoustic noise (dB)	56approx	59 approx

Table 2.5 AMS500 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).



Floor (RKM+H1J) Model

Floor (RKM+RKAJ/RKAJAT+H2J) Model

2.3.3 Floor Load Rating

This section includes:

- Floor Load Rating for the AMS500 Rack-Mount Model
- Floor Load Rating for the AMS500 Floor Model

2.3.3.1 Floor Load Rating for AMS500 Rack-Mount Model

In the maximum configuration, the rack-mount model can be configured with 1 RKM and 14 additional units (RKAJs/RKAJATs and RKNAS). The total weight of the subsystem in this configuration is 1,080 kg.

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

2.3.3.2 Floor Load Rating for AMS500 Floor Model

The Floor (RKM+H1J) Model contains controller boards (up to 2) and disk drives (up to 15). A maximum configuration weighs 70 kg.

The Floor (RKM+RKAJ/RKAJAT+H2J) Model contains controller boards (up to 2) and disk drives (up to 30). A maximum configuration weighs 115 kg.

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

2.3.4 Internal Logic Specifications

Table 2.6 lists the internal logic specifications of the AMS500.

Table 2.6 Internal Logic Specification of AMS500 Rack-Mount Model

Item		Specification (Notes)	
		RKM	RKNAS
Internal logic	Control CPU	Power PC7447A (1.0 GHz)	Intel LV-Xeon 2.8GHz
specification	Control memory	Flash memory: 16 M bytes L2 cache memory: 512 k 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 2.7 lists the principal functions of the AMS500 and RKNAS cables. Fibre channel cables are available from Hitachi Data Systems.

Table 2.7 Principal Functions of AMS500 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 HAB for Ethernet. (When iSCSI interface and RKNAS are connected) Connect between RKM and RKNAS for maintenance management.
ENC (ENCLOSURE) cable	Connect between the subsystems with Fibre Channel (FC_AL).
NAS interface cable	Connect between RKM and RKNAS for NAS control. (When RKNAS is connected)

2.4 Environmental Specifications and Requirements

To maintain optimal AMS500 performance, the AMS500 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 2.8 lists the temperature and humidity requirements for the AMS500 subsystem.

Table 2.8 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 AMS500 rack-mount models and the AMS500 floor model.

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 2.9 Input Power and Insulation Performance for Rack-Mount Model

Item		Rackmount Model		
		RKM	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) <i>(Note1) (Note2)</i>	4.2×2/2.1×2	2.6×2/1.3×2	2.4×2/1.2×2
	Breaking current (A)	16.0	10.0	
	Required power <i>(Note 3)</i>	Steady state (VA)	840 or less	520 or less
Starting state (VA)		840 or less	560 or less	480 or less
Heat value (kJ/h)		3,025 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 AMS500 is “0.90 - 0.96”. The manual incorrectly states the value as “1”.

Table 2.10 Input Power and Insulation Performance for Floor Model

Item		Floor Model		
		Floor (RKM+H1J) Model	Floor (RKM+RKAJ+H2J) Model	Floor (RKM+RKAJAT+H2J) Model
Input power specification	Input voltage (V)	AC 100/200 (100-120/200-240)		
	Frequency (Hz)	50/60 ± 1		
	Number of phases, cabling	Single-phase with protective grounding		
	Steady-state current (A) (Note1)	4.2x2/2.1x2	4.2x2+2.6x2/2.1x2+1.3x2	4.2x2+2.4x2/2.1x2+1.2x2
	Breaking current (A)	16.0		
	Required power (Note 2)	Steady state (VA)	840 or less	1,360 or less
Starting state (VA)		840 or less	1,400 or less	1,320 or less
Heat value (kJ/h)		3,025 or less	4,900 or less	4,755 or less
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)	AC 1,500 V (100 mA, 1 min)	
	Insulation resistance	DC 500 V, 10 M Ω or more		

Note1: The power current of Nx2 described above is required for operation by a single power supply unit.

Note2: The correct power factor for the AMS500 is “0.90 - 0.96”. The manual incorrectly states the value as “1”.

Table 2.11 Input Power and Insulation Performance for NAS Unit

Item		RKNAS
Input power	Input voltage (V)	AC 100/200 (100-120/200-240)
specification	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 1)	Steady state (VA)
Starting state (VA)		280 or less
Heat value (kJ/h)		1,010 or less
Insulation	Insulation withstand voltage	AC 15,00V (10 mA, 1 min)
performance	Insulation resistance	DC 500V, 10 M Ω or more

Note1: 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 AMS500 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 2.12 lists the vibration and shock tolerance data for the AMS500 subsystem. The AMS500 can tolerate vibration and shock within these limits and continue to perform normally. The user should consider these requirements if installing the AMS500 near large generators located on the floor above or below the AMS500 subsystem. Generators or any other source of vibration, if not insulated or shock-mounted, can cause excessive vibration that may affect the subsystem.

Table 2.12 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

The reliability of the AMS500 is described in the following tables.

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

Table 2.13 Reliability of AMS500 Rack-Mount Model (RKM/RKAJ)

Item		Rackmount Model	
		RKM	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)	

Note 1: 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.

Note 2: Under the worst condition in the AMS 500 maximum configuration, the MTBDL is about 8 million hour (FC drive) or about 2 million hour (SATA drive).

Table 2.14 Reliability of AMS500 Rack-Mount Model (RKM/RKAJAT)

Item		Rackmount Model	
		RKM	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)	

Note 1: 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.

Note 2: Under the worst condition in the AMS 500 maximum configuration, the MTBDL is about 8 million hour (FC drive) or about 2 million hour (SATA drive).

Table 2.15 Reliability of AMS500 Floor Model

Item		Floor Model		
		Floor (RKM+H1J) Model	Floor (RKM+RKAJ+H2J) Model	Floor (RKM+RKAJAT+H2J) Model
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 RAID 0 + 1 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.	No abnormality must be caused by a drop of level IV. (one end is dropped while another end is supported.)	
	Radio frequency radiation	Conforms to FCC Class A		
	Instantaneous power failure	10 ms (100% dip)		

Note 1: 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.

Note 2: Under the worst condition in the AMS 500 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 following:

- AMS500 Rack-Mount Model (see section 3.1)
- AMS500 Floor Model (see section 3.2)

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	–	○	–
3.2	3.2.1 Storage System Power On	○	–	○
	3.2.2 Storage System Power Off	○	–	○

○: An explanation is provided.

–: An explanation is not provided.

Note: 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 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.

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.

3.1 AMS500 Rack-Mount Model

The following steps describe power on/off procedures for the AMS500 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 RKM. However, it is not a problem if the EALM lamp (red) goes out during this period of time.

1. Verify that the main switch is turned off.
2. Verify that the AC power unit switch of each power unit is turned off.
3. Verify that the circuit breaker (CB1) is turned off.
4. 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 (CB1) 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 RKM.
9. Turn on the main switch.
10. Verify that the READY LED (green) on the RKM lights within five minutes. When the RKNAS is connected to the AMS500, verify that the READY LED (green) on the RKNAS lights another three minutes later. If the READY LED (green) on the RKM 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 RKM lights in 30 to 50 minutes at a maximum. Even when the READY LED (green) on the RKM blinks at high speed, the subsystem is operational.

For a dual controller configuration, if the WARNING LED (orange) on the RKM blinks at high speed, wait until the READY LED (green) on the RKM lights because an update of the flash program is executed.

For a single controller configuration, when the WARNING LED (orange) on the RKM blinks at high speed, wait until the READY LED (green) on the RKM lights because an update of the flash program or the automatic download of the ENC/SENC firmware at the time of powering-on is executed. When an automatic download of the ENC/SENC is in operation, the WARNING LED (orange) blinks for up to 30 to 85 minutes, then the READY LED (green) lights.

If the ALARM LED (red) or WARNING LED (orange) lights or blinks slowly, see section 8.1.

Note: A NAS system may not 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:

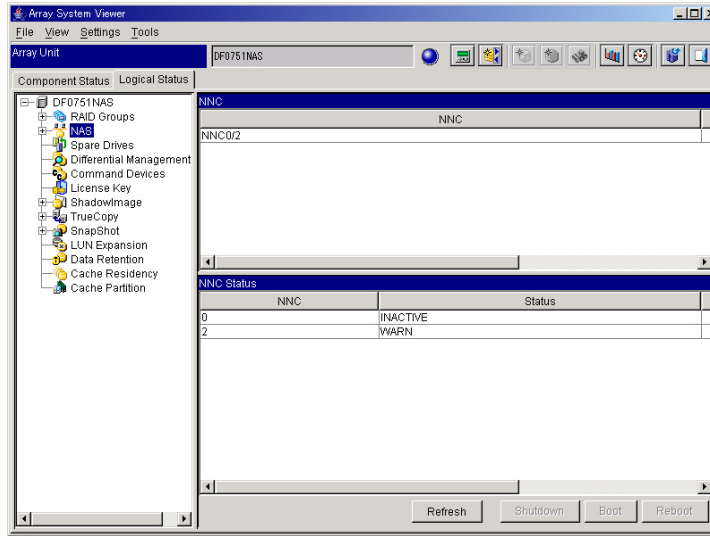
- The paths of TrueCopy remote replication or TrueCopy Extended Distance are blocked.
 - The failure monitoring program (ASSIST-PC), the E-MAIL ASSIST function, notice of SNMP Agent Support Function, and the TRAP will occur at the time of the path block. Provide an advance check and notice to the Failure 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 RKM 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, see Chapter 9.

3.1.3 Stop/Start/Restart of NAS OS

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

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

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

Note 2: Only when the status of both NAS units in the cluster is "ACTIVE", NAS OS can be stopped.

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

Note 4: When "STOP" is displayed, the NAS OS has already stopped. However, the NAS unit takes 10 seconds after "STOP" is displayed to be completely powered off. When you perform an operation after this, wait 10 seconds after "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 NAS OS

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

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

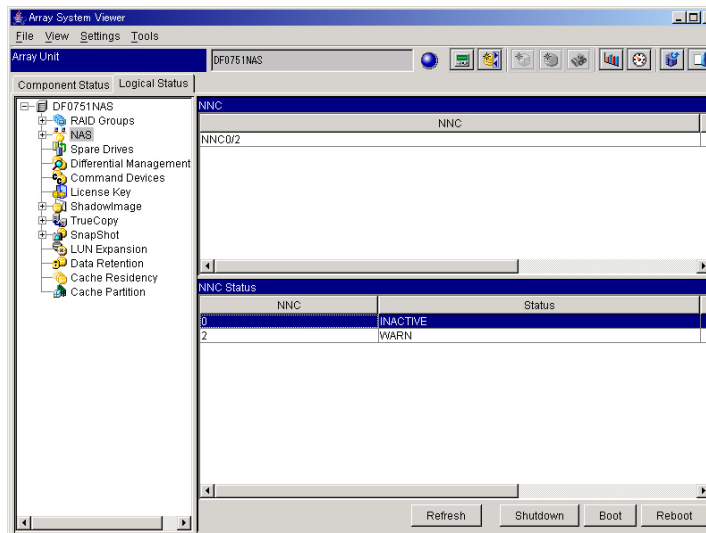
If the NAS OS is stopped at any time other than as described above, you may not be able to perform a subsequent cluster or resource group operation. For example, an attempt to stop a cluster from NAS Manager Modular may fail if the NAS Unit is not stopped. In this case, from Storage Navigator Modular,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

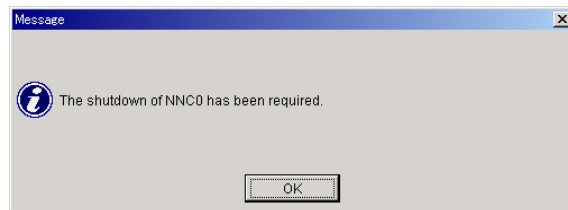
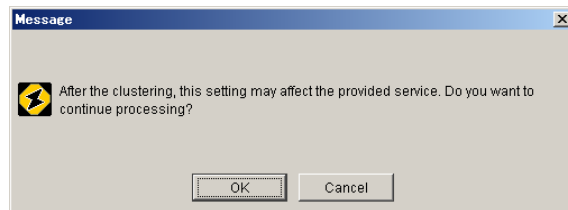
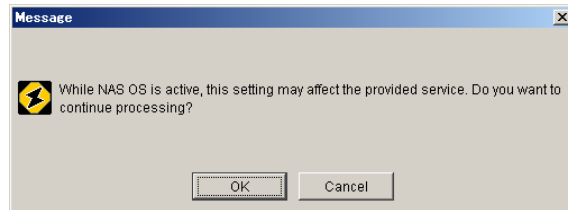
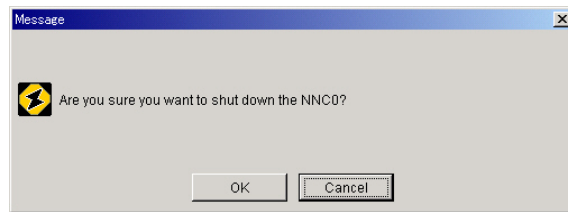
To stop the NAS OS:

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



2. Click the **Shutdown** button at the lower right of the window.

3. The confirmation message is displayed. Click the **OK** button.

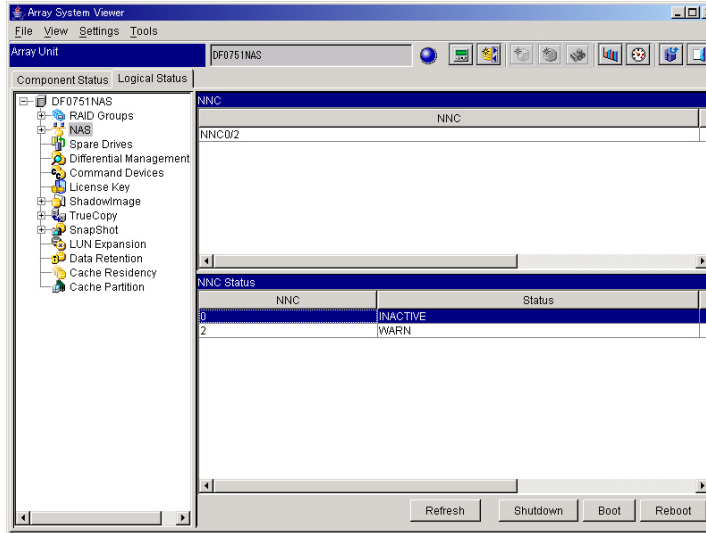


4. Check that **Status** of the NNC (NAS Unit) which stopped the NAS OS is "STOP".

3.1.3.2 Starting NAS OS

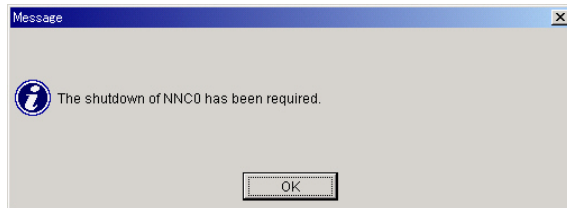
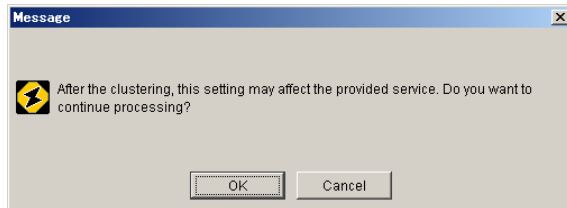
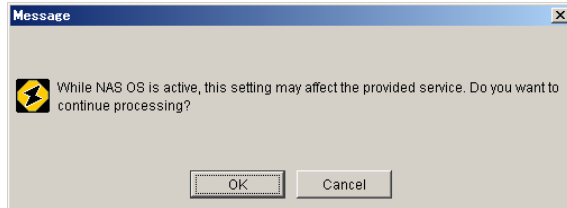
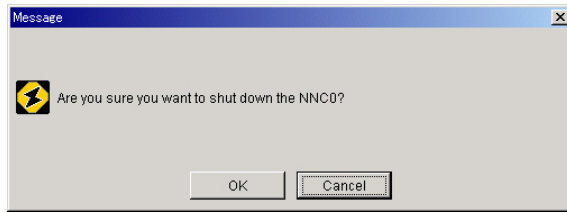
Note: When the status of the NNC (NAS Unit) to start the NAS OS is “NEW”, it cannot start because the NAS OS is not installed. When “Status” is other than “NEW”, “STOP”, and “DOWN”, the NAS OS has already started.

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



2. Click the **Boot** button at the lower right of the window.

3. The start option setting window is displayed. Click the **OK** button.



4. The confirmation message is displayed. Click the **OK** button.
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 NAS OS procedures.

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).

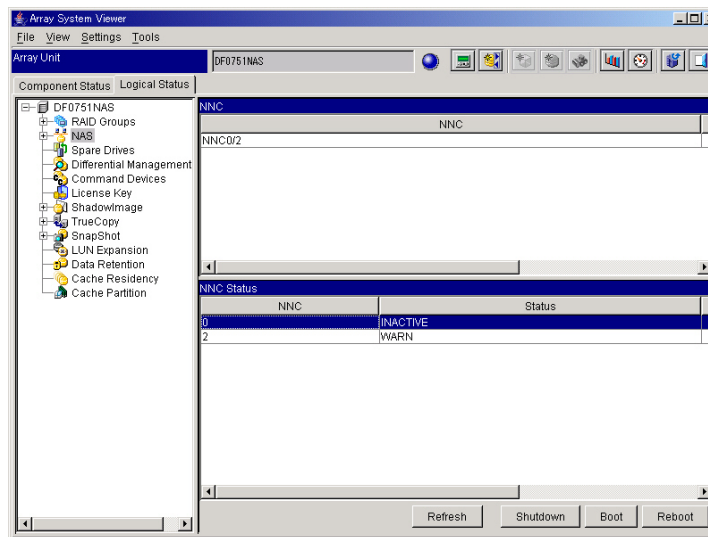
- Immediately after the power supply of the array subsystem was started
- If the NAS cluster was started from NAS Manager Modular

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.

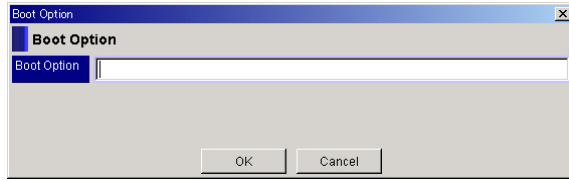
Checking status of the cluster and resource group: The cluster and the resource group are available when the cluster status is “ACTIVE.” The resource group status can be either “Online” or “Offline”).

- 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.

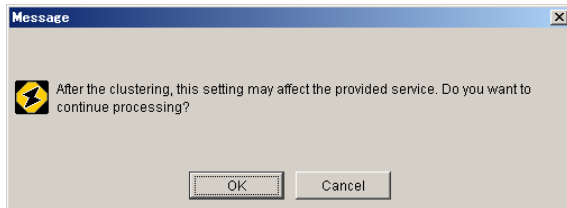
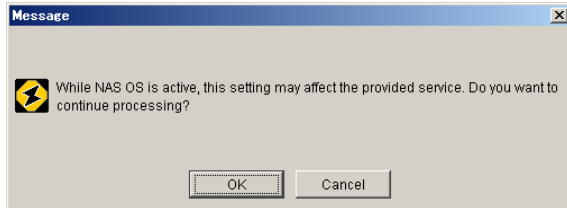
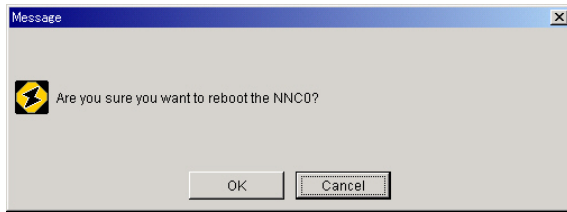
Select the NNC (NAS Unit) to restart the NAS OS from the **NNC Status**.



1. Click the **Reboot** button at the lower right of the window.
2. The start option setting window is displayed. Click the **OK** button.



3. The confirmation message is displayed. Click the **OK** button.



4. 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).

3.2 AMS500 Floor Model

The following steps describe power on/off procedures for the AMS500 floor model.

3.2.1 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. However, it is not a problem if the EALM lamp (red) goes out during this period of time.

1. Verify that the main switch is turned off.
2. Verify that the AC power unit switch of the power unit is turned off.
3. Turn on the AC power unit switch of the power unit on RKAJ/RKAJAT.
4. Turn on the AC power unit switch of the power unit on RKM.
5. Turn on the main switch.
6. Verify that the READY LED (green) lights within five minutes. If the READY LED (green) blinks rapidly, the ENC firmware is downloaded. Even when the READY LED (green) blinks, the subsystem is operational. If the ALARM LED (red) or WARNING LED (orange) lights or blinks slowly, see section 8.1.

Note: The EALM lamp (red) of the control unit (on the rear side of the subsystem) may come on between the powering on of the subsystem and entry into the Ready status.

However, it is not a problem if the EALM lamp (red) goes out until the subsystem enters the Ready status.

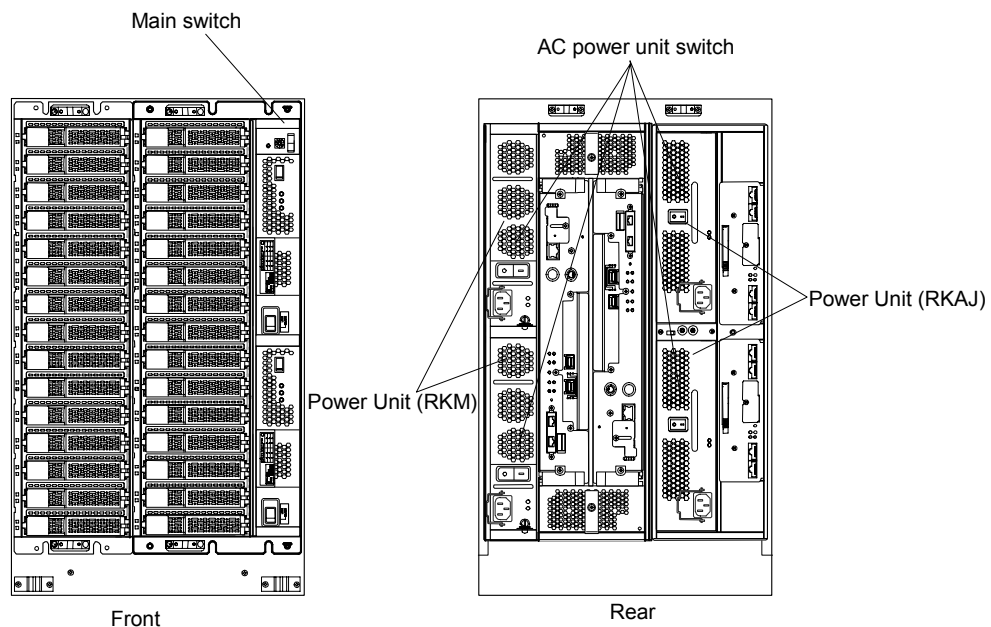


Figure 3-1 Subsystem Power On/Off (Floor [RKM+RKAJ+H2J] Model example)

3.2.2 Storage System Power Off

1. Turn off the main switch.
2. Verify that the POWER LED (green) on the panel is off.
3. Turn off the AC power unit switch of the power unit.

Note: When storing the subsystem without turning on the power for long periods, request that the Customer Engineer turn off the battery of the subsystem. For details on how to store the subsystem, see Chapter 9.

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	4.1.1 AMS500 Rack-Mount Model	○	○/–	○
	4.1.2 AMS500 Floor Model	○	–	○
4.2	Redundant Power Supplies	○	○	○
4.3	Fibre Channel Interface	○	–	–
4.4	NAS Interface	–	○	–
4.5	iSCSI Interface	–	–	○
4.6	4.5.1 AMS500 Rack-Mount Model	○	○	○
	4.5.2 Floor Model	○	–	○
4.6	4.6.1 Front Bezel Component Locations and Functions	○	○	○
	4.6.2 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 block diagrams for the following:

- AMS500 Rack-Mount Model
- AMS500 Floor Model

4.1.1 AMS500 Rack-Mount Model

The configuration block diagrams of the Rack-Mount models are shown below. The RKM can mount up to 15 disk drives. The RKAJ/RKAJAT can mount up to 15 disk drives. (The RKM has a controller that can control up to 225 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.

AMS500 supports 15 hot global spares which can be configured in any location except for slots 0 - 4 in the RKM.

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

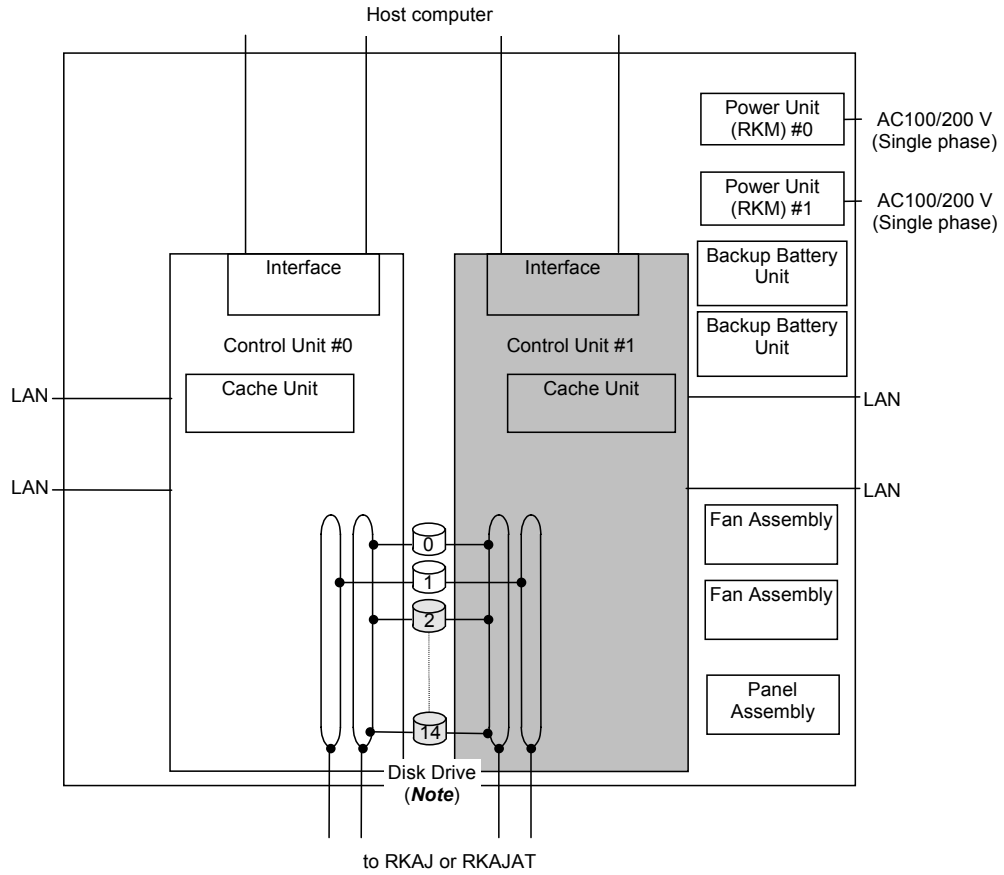


Figure 4-1 RKM Unit System Configuration

Note: Disk drive: DF-F700-AGF72, DF-F700-AGH72, DF-F700-AGF146, DF-F700-AGH146, DF-F700-AGF300, and DF-F700-AGH300

- 1
- : Basic component and indispensable optional part
 - : Option (additional) part

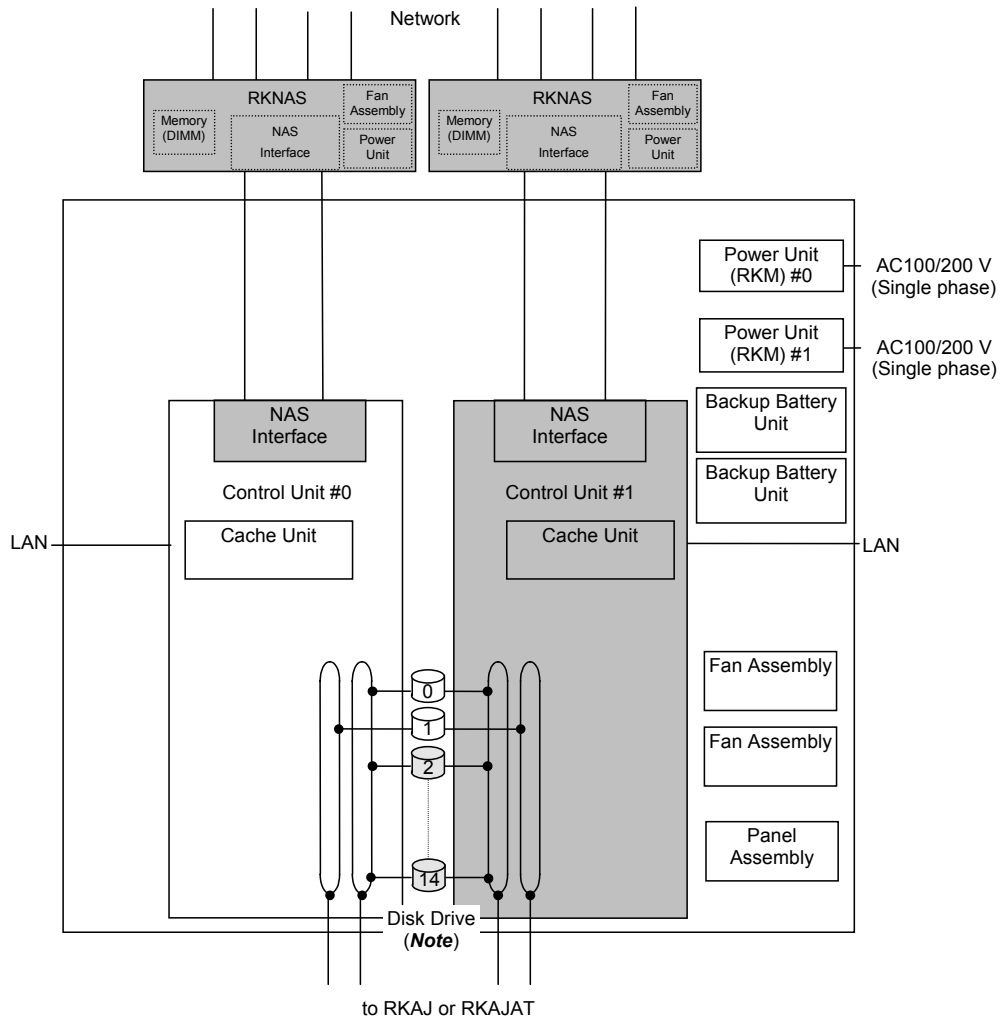


Figure 4-2 RKM and RKNAS Unit System Configuration

Note: Disk drive: DF-F700-AGF72, DF-F700-AGH72, DF-F700-AGF146, DF-F700-AGH146, DF-F700-AGF300, and DF-F700-AGH300

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

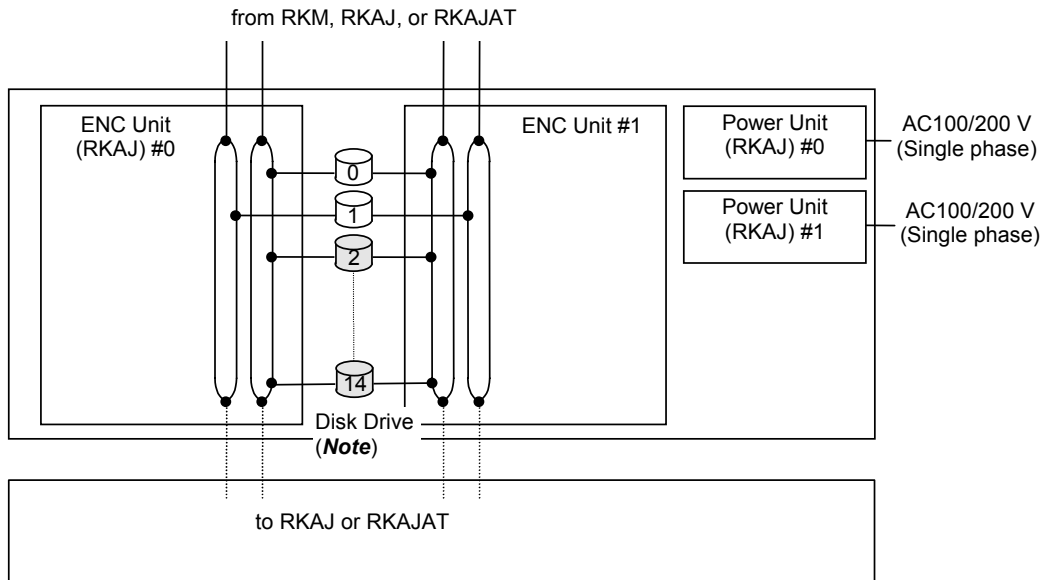


Figure 4-3 RKAJ Unit System Configuration

Note: Disk drive: DF-F700-AGF72, DF-F700-AGH72, DF-F700-AGF146, DF-F700-AGH146, DF-F700-AGF300, and DF-F700-AGH300

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

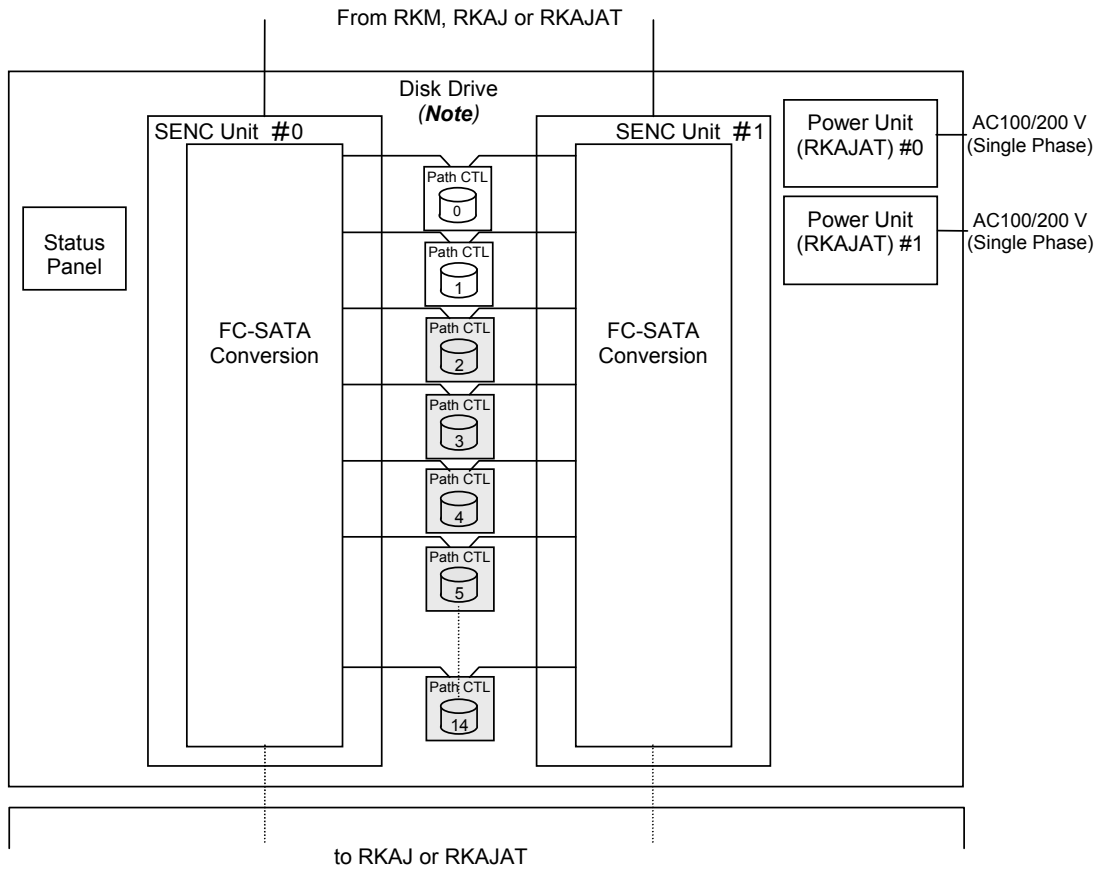


Figure 4-4 RKAJAT Unit System Configuration

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

4.1.2 AMS500 Floor Model

The configuration block diagrams of the Floor (RKM+H1J) Model and Floor (RKM+RKAJ+H2J) Model are shown below.

The Floor (RKM+H1J) Model can mount up to 15 disk drives. The Floor (RKM+RKAJ/RKAJAT+H2J) Model can mount up to 30 disk drives.

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

Up to 15 spare disks (for Floor [RKM+H1J] Model: up to 1) can be mounted in any location within the configuration.

Note: Some disk drive slots cannot be used as a spare disk due to subsystem restrictions. For additional information, contact Hitachi Customer Service.

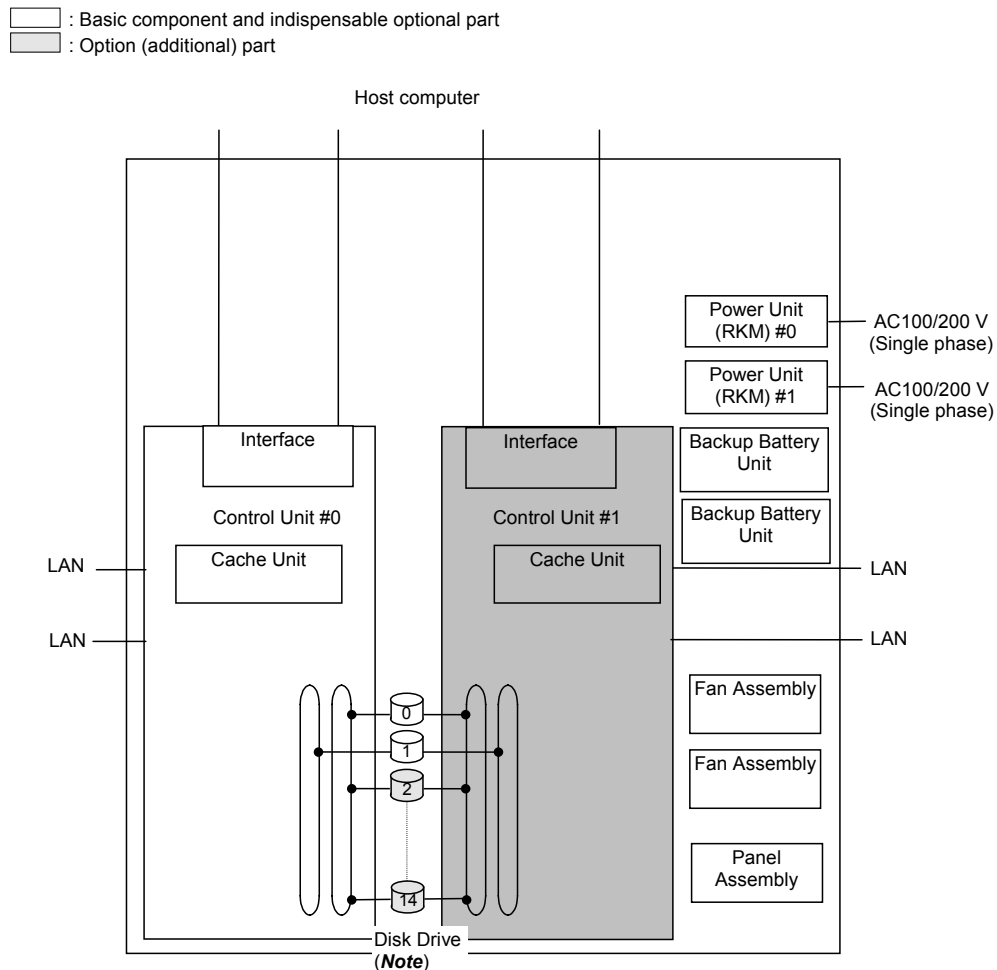


Figure 4-5 Floor (RKM+H1J) Model System Configuration

Note: Disk drive: Disk drive: DF-F700-AGF72, DF-F700-AGH72, DF-F700-AGF146, DF-F700-AGH146, DF-F700-AGF300, and DF-F700-AGH300

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

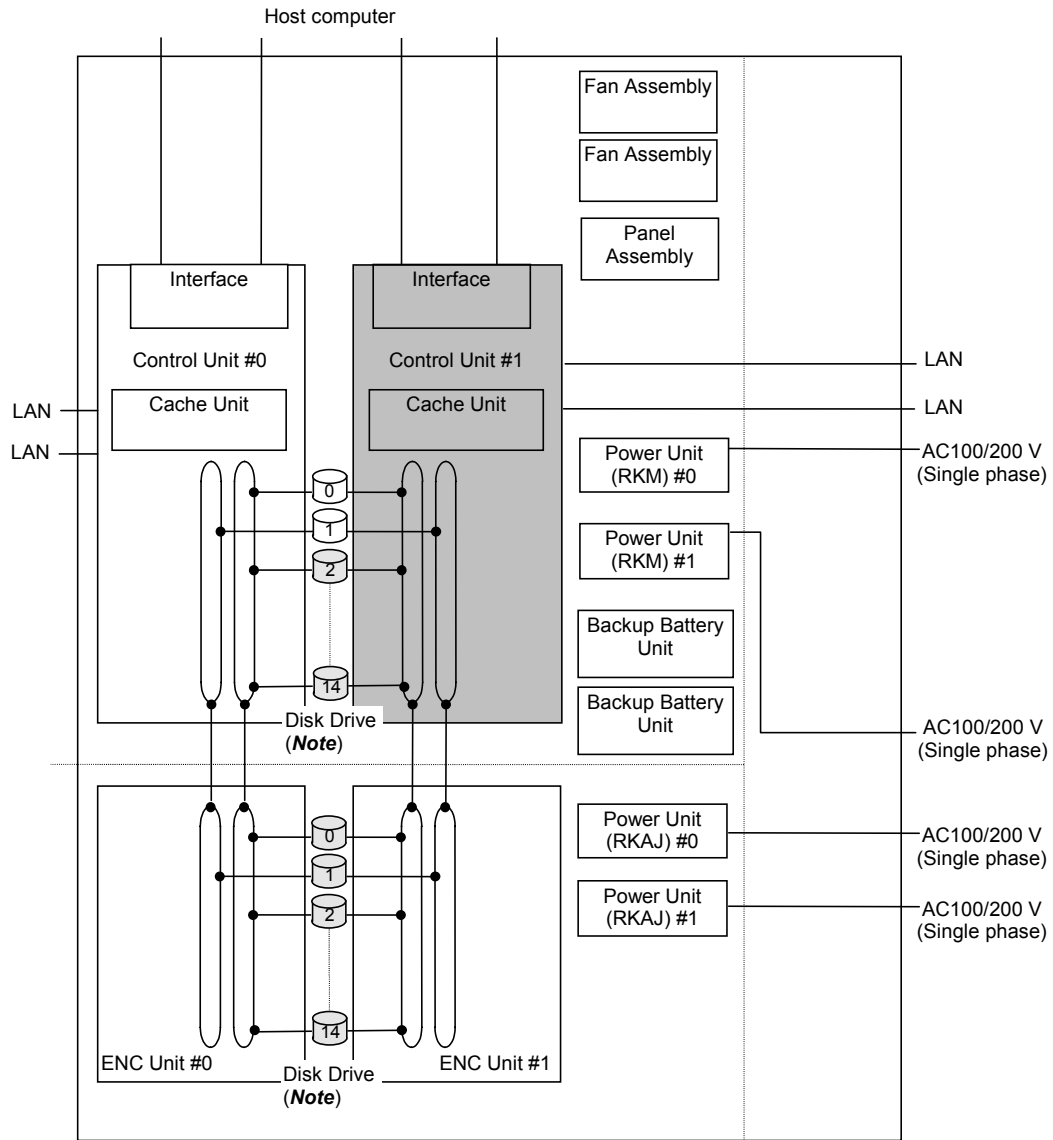


Figure 4-6 Floor (RKM+RKAJ+H2J) Model System Configuration

Note: Disk drive: Disk drive: DF-F700-AGF72, DF-F700-AGH72, DF-F700-AGF146, DF-F700-AGH146, DF-F700-AGF300, and DF-F700-AGH300

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

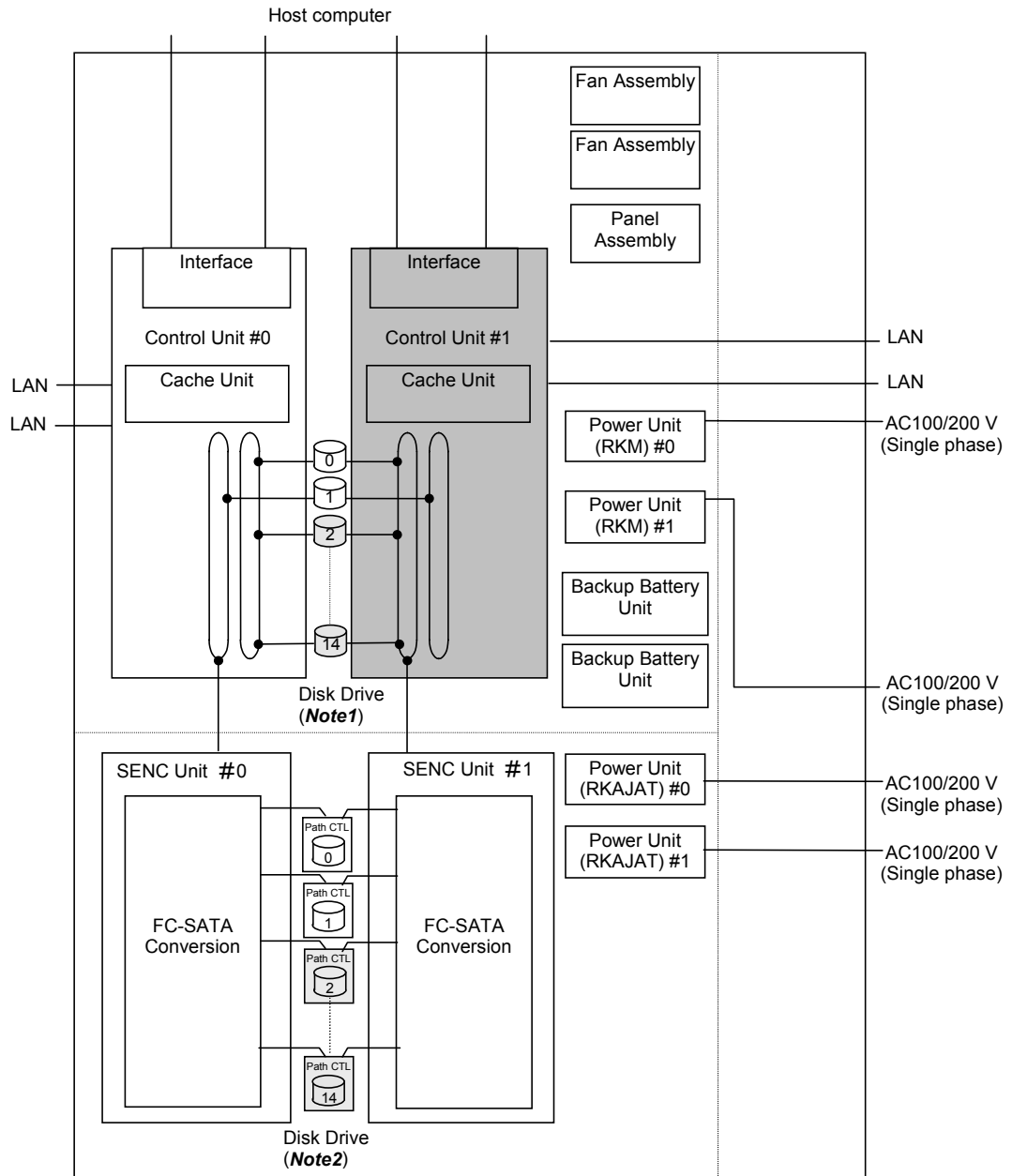


Figure 4-7 Floor (RKM+RKAJAT+H2J) Model System Configuration

Note1: Disk Drive: DF-F700-AGF72, DF-F700-AGH72, DF-F700-AGF146, DF-F700-AGH146, DF-F700-AGF300, and DF-F700-AGH300

Note2: Disk Drive: DF-F700-ATE250R, DF-F700-ATE400R, DF-F700-ATE500R, and DF-F700-ATE750R

4.2 Redundant Power Supplies

Each AMS500 unit is powered by its own set of redundant power supplies, and each power supply is able to provide power for the entire RKM or RKAJ unit, should it become necessary. Because of this redundancy, the AMS500 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 AMS500 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 AMS500 subsystem can continue full operations using power from the alternate source.

RKNAS has no redundancy of power supplies.

4.3 Fibre Channel Interface

The AMS500 subsystem supports open system operations. The AMS500 subsystem supports up to 8 fibre-channel ports. The AMS500 Fibre Channel interface is capable of operating at data transfer speeds of up to 400 MB/sec. The AMS500 supports shortwave multimode optical cables. With these shortwave fibre channel cards, the AMS500 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: Set the "Transfer Rate" of Fibre Channel to the value corresponding to transfer rate of devices connected directly with an array subsystem according to the following table. When the AMS500 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 AMS500 to the fixed transfer rate (the same value for the TagmaStore Universal Storage Platform and the AMS500 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 AMS500 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 AMS500 provides up to 8 LAN ports and supports 1000 BASE-T for Gigabit LAN and 100 Mbps-BASE-TX. The AMS500 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 for the supported conditions of switch and so on in this subsystem.

4.5 iSCSI Interface

The AMS500 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 AMS500 supports Ethernet (1000Base-TX). With the HBA for iSCSI, Generic NIC + Software initiator, and Network Switch, the AMS500 subsystem can be located up to 100 meters.

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

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 AMS500 Fibre Channel.

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

4.6 Array Frames

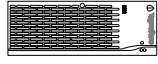
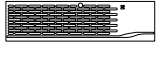


The following array frames are described in this section:

- AMS500 Rack-Mount Model
- AMS500 Floor Model

4.6.1 AMS500 Rack-Mount Model

Each RKM or 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 AMS500 can be configured with 1 RKM and up to 14 RKAJ units for a total of 225 disk drives at a maximum of 60.4 Tbytes RAID5(14D+1P) (using the 287.6 G disk drive). The AMS500 can also be configured with 1 RKM and up to 14 RKAJAT units for a total of 225 disk drives at a maximum of 148.5 Tbytes RAID5(14D+1P) (using the 737.4 G disk drive).

Table 4.2 Basic Specifications of Rack-Mount Model

Item		Rackmount Model				
		RKM	RKAJ	RKAJAT	RKNAS	
Configuration	Configuration	1 RKM	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	Single controller	Fibre Channel: 2 iSCSI: 2 (Note2)	—		
		Dual controller	Fibre Channel: 4 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 3: For information about the global rack-mount model, refer to the *Hitachi Data Systems Global 19-Inch Rack Reference Guide (MK-93DF772)*.

4.6.2 Floor Model

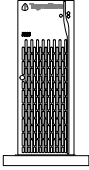
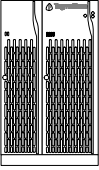
Each floor model contains physical disk drives, including the disk array groups and the dynamic spare disk drives. Additionally, each floor model has dual AC power plugs, which should be attached to two different power sources or power panels.

Floor (RKM+H1J) Model can be configured with 15 disk drives at a maximum of 4.0 Tbytes RAID5 (using the 287.6 GB disk drive).

Floor (RKM+RKAJ+H2J) Model can be configured with 30 disk drives at a maximum of 8.0 Tbytes RAID5 (using the 287.6 GB disk drive).

Floor (RKM+RKAJAT+H2J) Model can be configured with 30 disk drives at a maximum of 14.3 Tbytes RAID5 (using the 287.6 GB (for RKM) and 737.4 GB (for RKAJAT) disk drive).

Table 4.3 Basic Specifications of Floor Model

Item		Floor (RKM+H1J) Model	Floor (RKM+RKAJ+H2J) Model	Floor (RKM+RKAJAT+H2J) Model
Configuration	Configuration	1 RKM+Floor setting kit (DF-F700-H1J)	1 RKM+1 RKAJ+Floor setting kit (DF-F700-H2J)	1 RKM+1 RKAJAT +Floor setting kit (DF-F700-H2J)
	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		RKM: 71.3/143.3/ 287.6 RKAJAT: 245.7/393.4/491.9/ 737.4
	Rotational speed (min ⁻¹)	10,000/15,000		RKM: 10,000 /15,000 RKAJAT: 7,200
	Maximum mountable quantity (unit)	15	30	
Host Interface	Interface type	4 G bps Fibre Channel Optical (Non-OFC) 1 G bps iSCSI (Ethernet) (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	Single controller	Fibre Channel: 2 iSCSI: 2 (Note 2)	
	Dual controller	Fibre Channel: 4 SCSI: 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 (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.

4.7 Component Names, Locations, and Functions

This section includes the following:

- Front Bezel Component Locations and Functions
- RKM, 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.

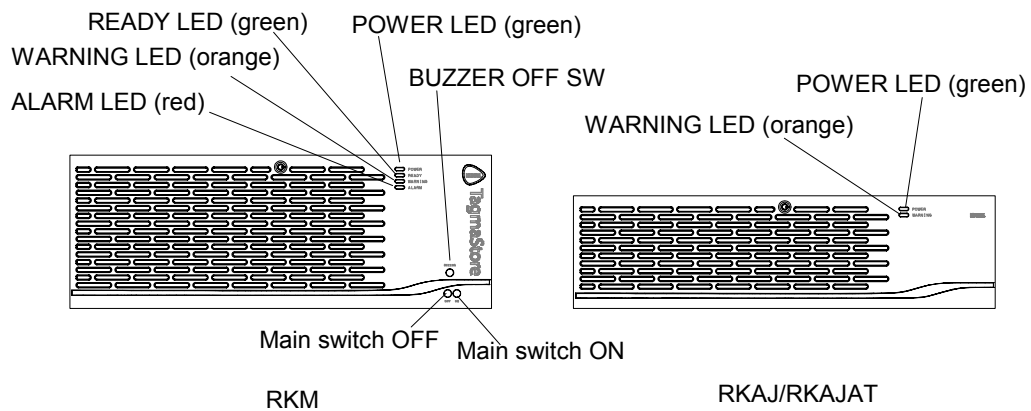
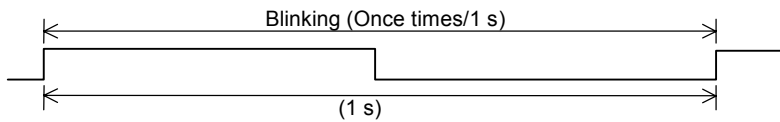


Figure 4-8 RKM, RKAJ, and RKAJAT Front Bezel Component Locations

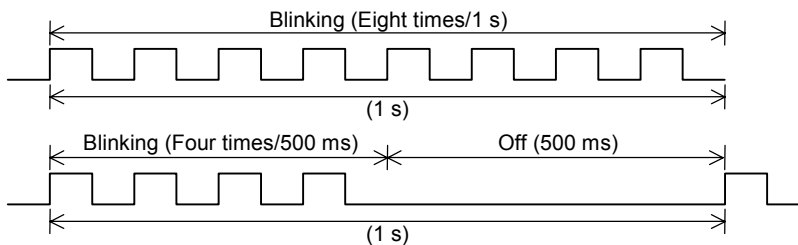
Table 4.4 RKM, RKAJ, and RKAJAT Front Bezel Component Functions

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 is displayed 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.



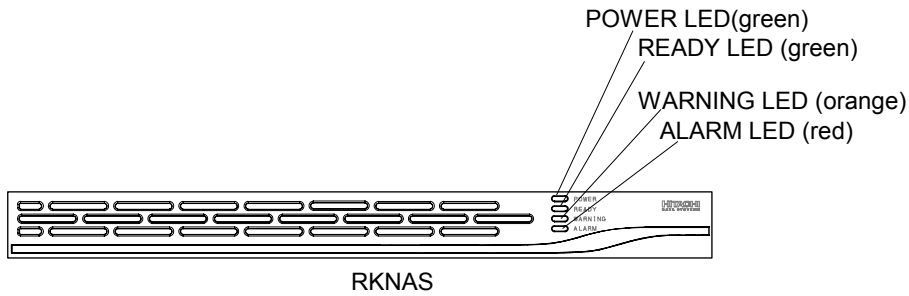


Figure 4-9 RKNAS Front Bezel Component Locations

Table 4.5 RKNAS Front Bezel Component Functions

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 RKM and RKAJ and RKAJAT Component Locations

The locations of the RKM, RKAJ, and RKAJAT components are shown in the following diagram:

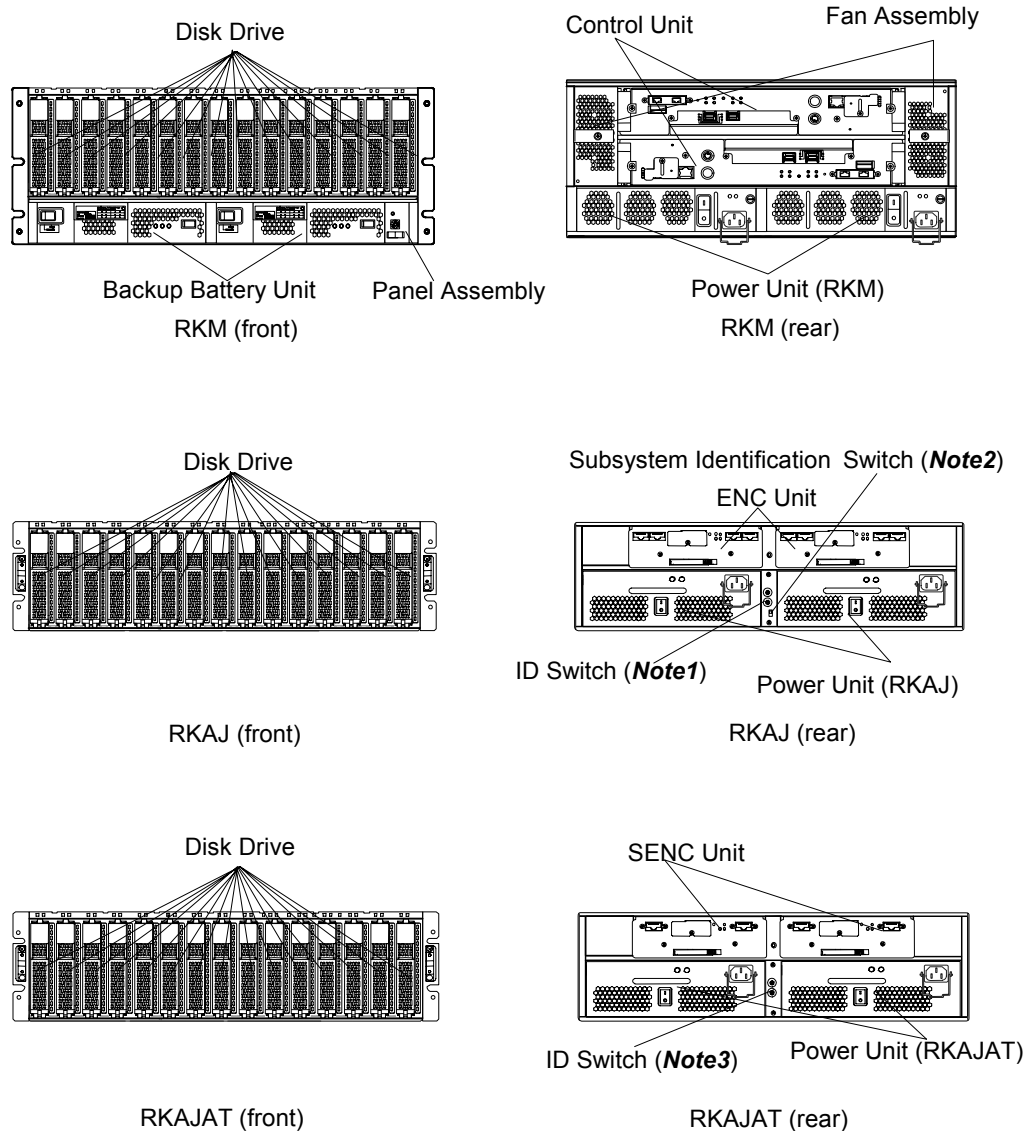


Figure 4-10 RKM, RKAJ, and RKAJAT Component Locations

Notes:

- Sets the device ID of the RKAJ.
- The switch has been set on the M side.
- 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
- Backup Battery Unit
- Power Unit
- RKNAS

4.7.3.1 Panel Assembly

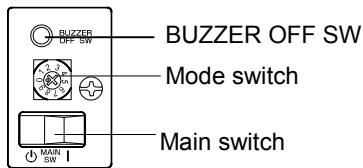


Figure 4-11 Panel Assembly Switch Location

Table 4.6 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

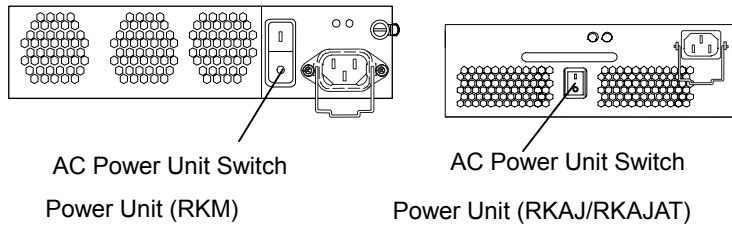


Figure 4-12 Power Unit Switch Locations

Note: Power unit is different between RKAJ and RKAJAT.

Table 4.7 Power Unit Switch Functions

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

4.7.3.3 RKNAS

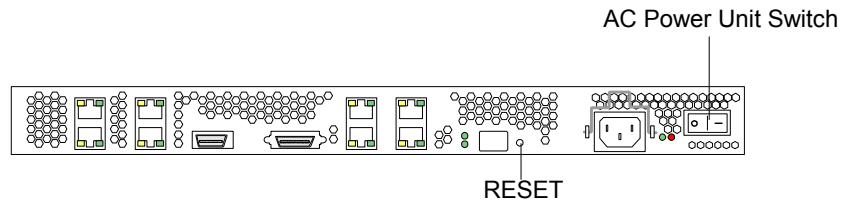


Figure 4-13 RKNAS Switch Locations

Table 4.8 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

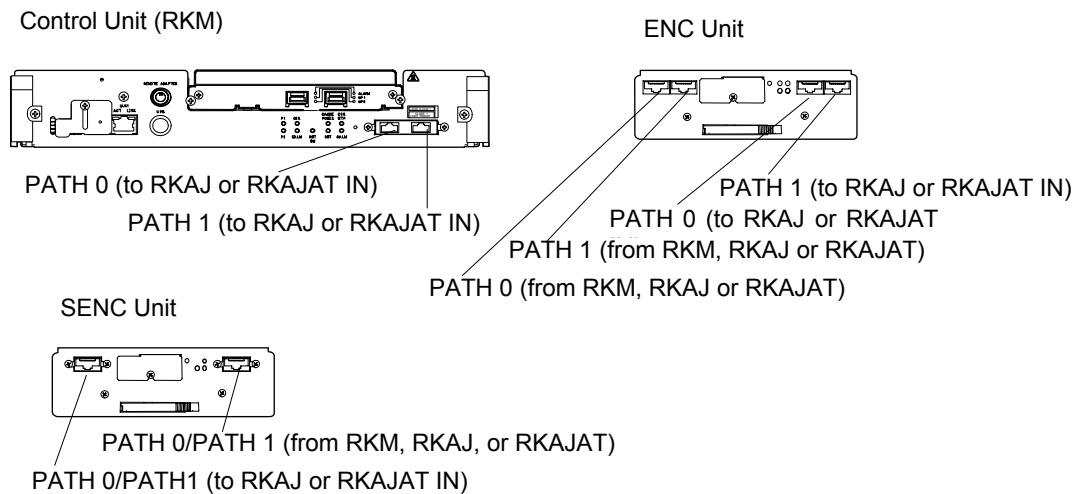


Figure 4-14 Connector Locations for ENC Unit

Table 4.9 Connector Functions for ENC Unit

Connector	Function
PATH 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)
PATH 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)

4.7.4.2 Power Unit

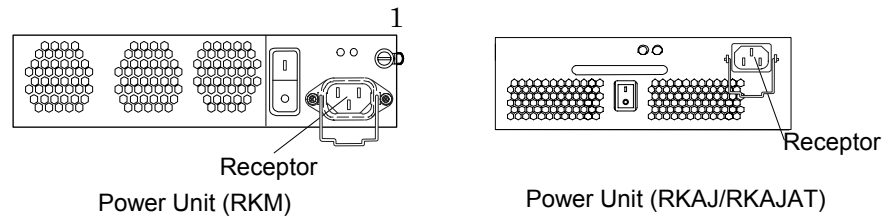


Figure 4-15 Connector Locations for Power Unit

Table 4.10 Connector Functions for Power Unit

Connector	Function
Receptor	Power cable receptacle on the unit side.

4.7.4.3 Control Unit

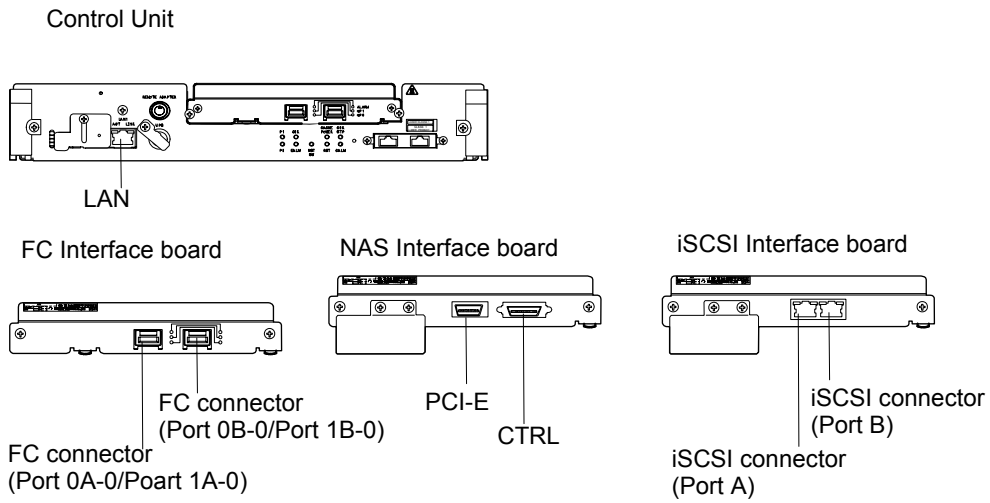


Figure 4-16 Connector Locations for Control Unit

Table 4.11 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

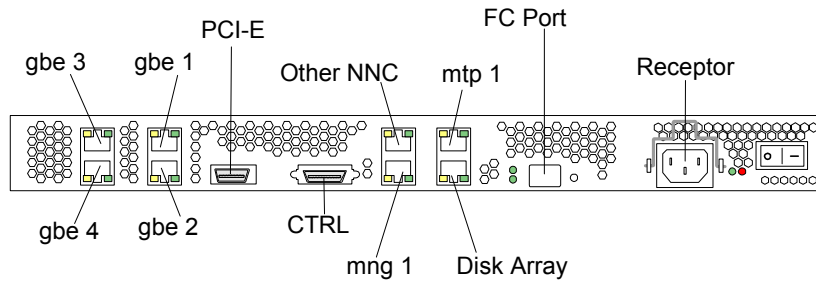


Figure 4-17 Connector Locations for RKNAS

Table 4.12 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 (RKM)

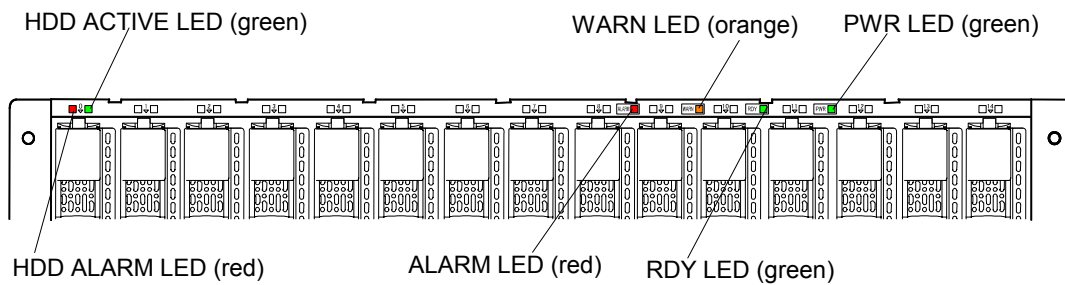
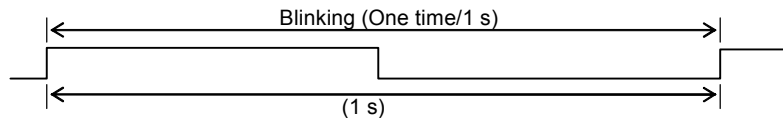


Figure 4-18 LED Locations for Disk Drive Display (RKM,)

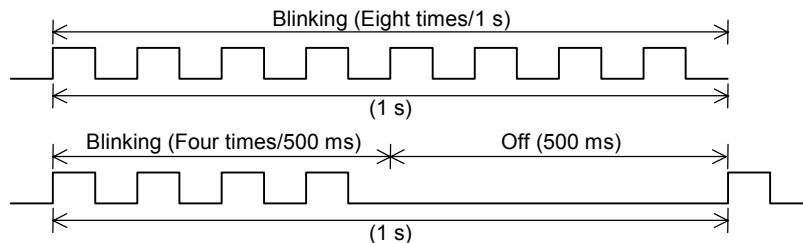
Table 4.13 LED Functions for Disk Drive Display (RKM)

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.
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
RDY LED (green)	Lighting When on, it indicates that the unit is operational. Blinking High-speed blinking (Note 2): Indicates that the download of the ENC/SENC firmware is executed. (The READY LED may blink for up to 15 minutes. Even if the READY LED blinks, the subsystem is operational.) Low-speed blinking (Note 1): Indicates that the offline download processing ended. (It is displayed during the maintenance work.)
WARNING LED (orange)	Lighting Indicates that a failure occurred, but the subsystem is currently operational. Blinking (Only for RKM) 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): In dual configuration, it indicates that the update of the flash program is executed. In single configuration, it indicates that the update of the flash program or the automatic download of the ENC/SENC firmware at the time of powering-on is executed
PWR LED (green)	When on, it indicates that electricity is supplied to the unit.

Note 1: Low-speed blinking.



Note 2: High-speed blinking.



4.7.5.2 Disk Drive Display (RKAJ, RKAJAT)

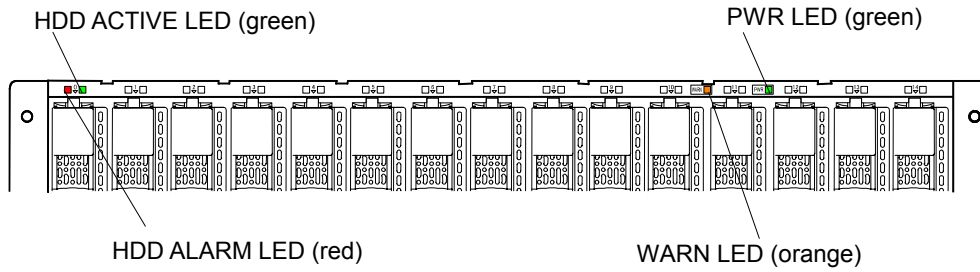


Figure 4-19 LED Locations for Disk Drive Display (RKAJ, RKAJAT)

Table 4.14 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.

4.7.5.3 Battery Backup Unit

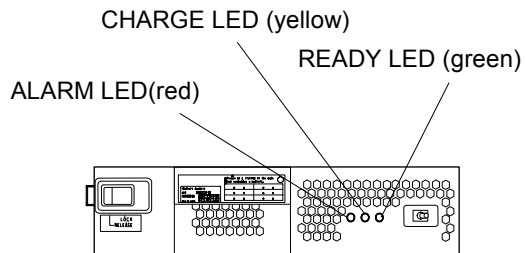


Figure 4-20 LED Locations for Battery Backup Unit

Table 4.15 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

4.7.5.4 ENC Unit

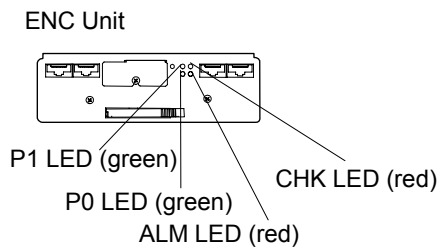
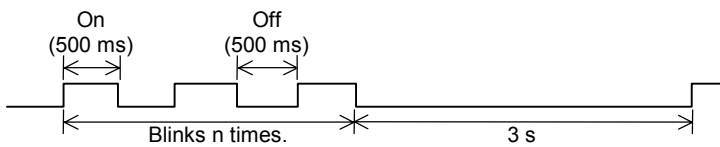


Figure 4-21 LED Locations for ENC Unit

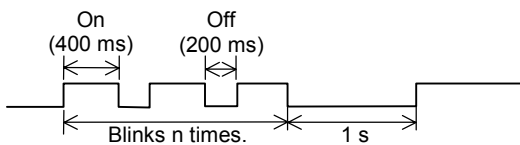
Table 4.16 LED Functions for ENC Unit

LED	Function
P1 LED (green)	When on, it indicates that the link status of FC-AL (loop 1 side) is normal.
P0 LED (green)	When on, it indicates that the link status of FC-AL (loop 0 side) is normal.
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. 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).



4.7.5.5 SENC Unit

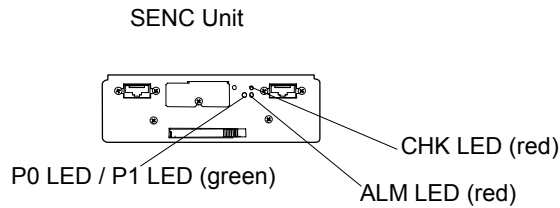
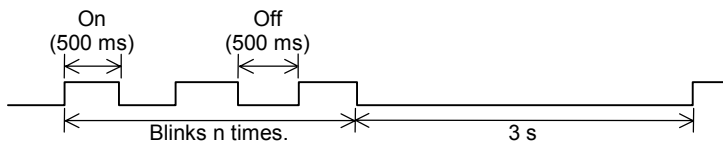


Figure 4-22 LED Locations for SENC Unit

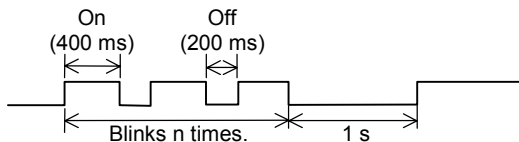
Table 4.17 LED Functions for SENC Unit

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.



4.7.5.6 Power Unit

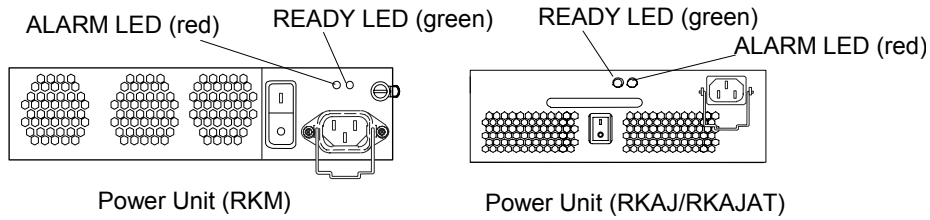


Figure 4-23 LED Locations for Power Unit

Note: Power unit is different between RKAJ and RKAJAT.

Table 4.18 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.

4.7.5.7 Fan Assembly

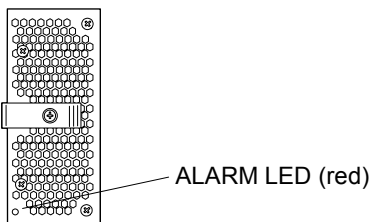


Figure 4-24 LED Locations for Fan Assembly

Table 4.19 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.

4.7.5.8 Control Unit

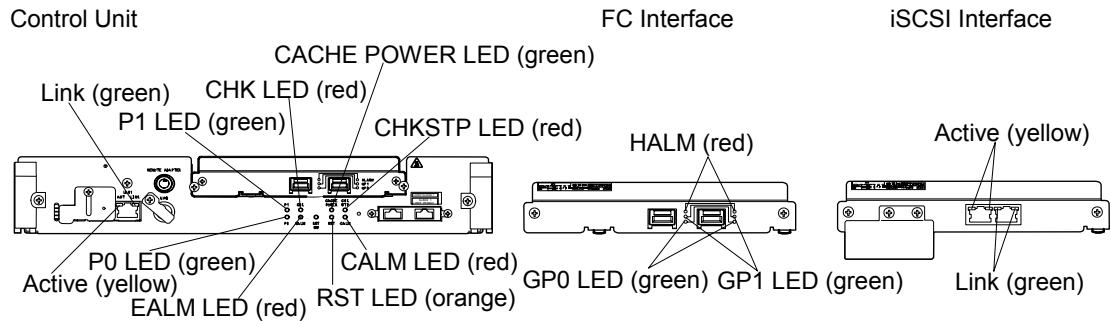


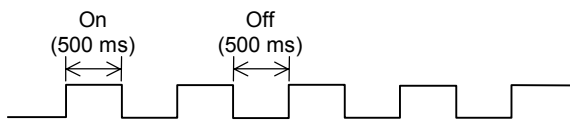
Figure 4-25 LED Locations for Control Unit

Table 4.20 LED Functions for Control Unit

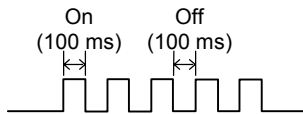
LED	Function
P1 LED (green)	When on, it indicates that the link status of FC-AL (loop 1 side) is normal.
P0 LED (green)	When on, it indicates that the link status of FC-AL (loop 0 side) is normal.
EALM LED (red)	Indicates error factors by the lighting or blinking pattern. Lighting Indicates that a failure 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) Once: Drive +5 V voltage is abnormal. Twice: Drive +12 V voltage is abnormal. Five times: Battery is abnormal. Six times: Voltage on the controller is abnormal. (Reset of the controller is not canceled) Seven times: BS 12 V voltage is abnormal. 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.

LED	Function
GP0 LED (green)	It indicates the status of the interface installed in the controller is normal.
GP1 LED (green)	It indicates the status of the interface installed in the controller is normal..
CHKSTP LED (red)	When on, it indicates that a failure occurred in the controller (CTL side), so the controller is inoperable.
Active (yellow)	When on, it indicates that data is being transferred.
Link (green)	When on, it indicates that the link status is normal.

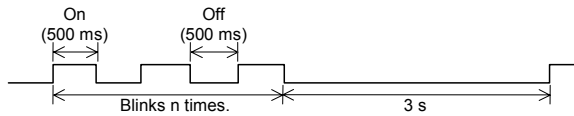
Note 1: Normal blinking.



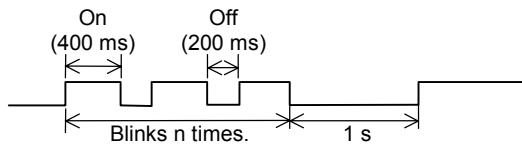
Note 2: High-speed blinking (EALM LED).



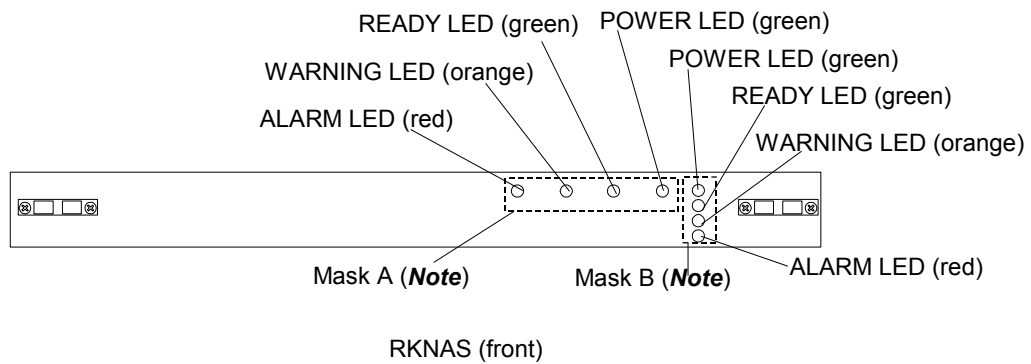
Note 3: Low-speed blinking.



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



4.7.5.9 RKNAS

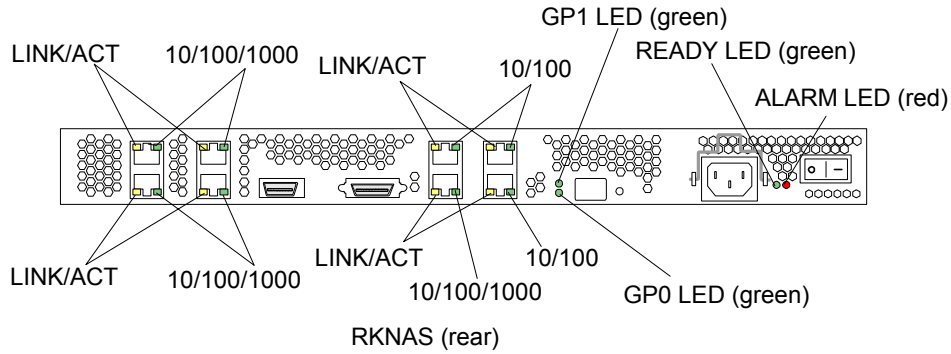


Note: Mask A or Mask B has been affixed.

Figure 4-26 LED Locations for RKNAS (front)

Table 4.21 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 4-27 LED Locations for RKNAS (rear)

Table 4.22 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 AMS500 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)

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 AMS500 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 Extended Distance Function	○	–	–
	5.7.3 ShadowImage In-System Replication Function	○	–	○
	5.7.4 Copy-On-Write Snapshot Function	○	–	○
	5.7.5 Modular Volume Migration Function	○	○	○
	5.7.6 NAS Backup Restore Modular Function	–	○	–
	5.7.7 NAS Sync Image 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	–	–	○

○: An explanation is provided.

–: An explanation is not provided.

5.1 New AMS500 Features and Capabilities

The Hitachi AMS500 subsystem offers the following new or improved features and capabilities, which distinguish the AMS500 subsystem from the 9500V series:

- Up to 15 spare disks installable (Floor [RKM+H1J] Model: up to 1)
- 2,048 LUNs maximum
- Multiple parity groups can be set to one RAID group.
- 45 RAID groups maximum
- The drive interface supports 2 Gbps fibre channel.
- A maximum of 8 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.

5.2 RAID Implementations

The AMS500 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 points failures.

The RAID specifications are shown in the following tables.

Table 5.1 RAID Specifications of Rack-Mount Model

Item		Rack-Mount Model				
		RKM	RKAJ (Range for Setup)	RKAJAT		
RAID specifications	RAID level	0/1/5/1+0			1/5/1+0	
	RAID configuration (unit of addition)	RAID0	2D to 15D	2D to 16D		—
		RAID1	1D+1D			
		RAID5	2D+1P to 14D+1P	2D+1P to 15D+1P	2D+1P to 15D+1P (see Notes)	
		RAID6	2D+2P to 13D+2P	2D+2P to 28D+2P		
RAID1+0	2D+2D to 7D+7D	2D+2D to 8D+8D	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)*.

Table 5.2 RAID Specifications of Floor Model

Item		Floor Model			
		Floor (RKM+H1J) Model	Floor (RKM+RKAJ+H2J) Model	Floor (RKM+RKAJAT+H2J) Model	
RAID specifications	RAID level	0/1/5/1+0		1/5/6/1+0	
	RAID configuration (unit of addition)	RAID0	2D to 15D	2D to 16D	
		RAID1	1D+1D		
		RAID5	2D+1P to 14D+1P	2D+1P to 15D+1P	
		RAID6	2D+2P to 13D+2P	2D+2P to 28D+2P	
RAID1+0	2D+2D to 7D+7D	2D+2D to 8D+8D			

5.3 Cache Management

Cache management features include the following:

- Data is stored in cache when reading and writing; it is dynamically managed, depending on the workload read and write I/O characteristics. A high percent cache hit rate is expected, due to transaction processing (data is updated after it is referenced). System throughput is increased by the reduced data writing time.
- Writing completion is reported to the host at the same time the data is written onto the cache; the write operation onto the disk will be asynchronously performed later. The host can perform the next process without waiting for the write operation onto disk.
- The data written onto the cache is saved in the event of an electric power failure due to the nonvolatile cache. The data is assured for 24 hours on the full charge of a standard configuration.
- One specified logical unit on each controller can be resident in cache. High throughput can be realized for the specified logical unit since a 100% cache percent hit rate is expected when reading and writing from the host.

Cache specifications are shown in the following tables.

Table 5.3 Cache Specifications of Rack-Mount Model

Item		Rack-Mount Model		
		RKM	RKAJ	RKAJAT
Cache specifications	Capacity (M bytes/CTL)	1,024, 2,048, 3,072, 4,096	—	
	Control method	Read LRU/Write after	—	
	Battery backup	Provided	—	
	Backup duration (h)	24 (When cache of 4,096 M bytes/CTL is installed)	—	

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

Table 5.4 Cache Specifications of Floor Model

Item		Floor Model		
		Floor (RKM+H1J) Model	Floor (RKM+RKAJ+H2J) Model	Floor (RKM+RKAJAT+H2J) Model
Cache specifications	Capacity (M bytes/CTL)	1,024, 2,048, 3,072, 4,096	2,048 to 8,192	
	Control method	Read LRU/Write after		
	Battery backup	Provided		
	Backup duration (h)	24 (When cache of 4,096 M bytes/ CTL is installed)		

5.4 Logical Units

The AMS500 supports up to 2,048 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.

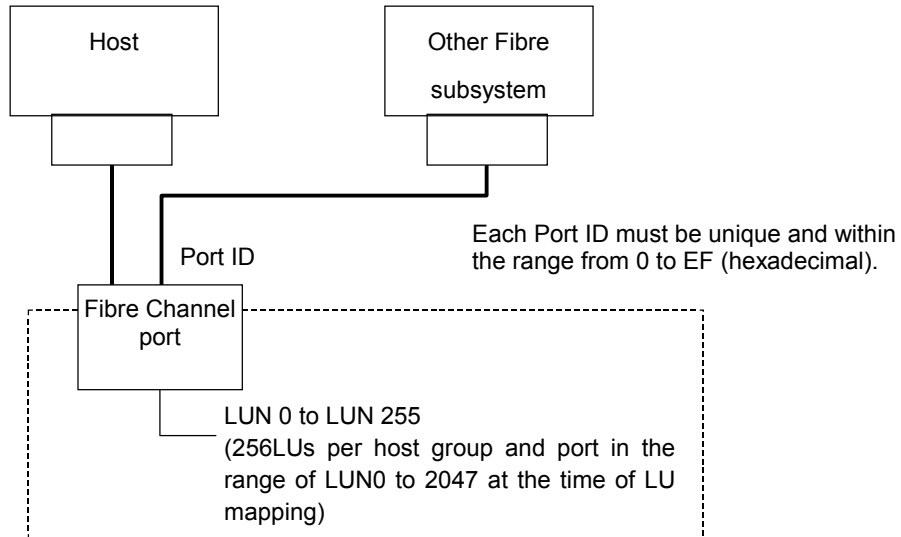


Figure 5-1 Logical Units

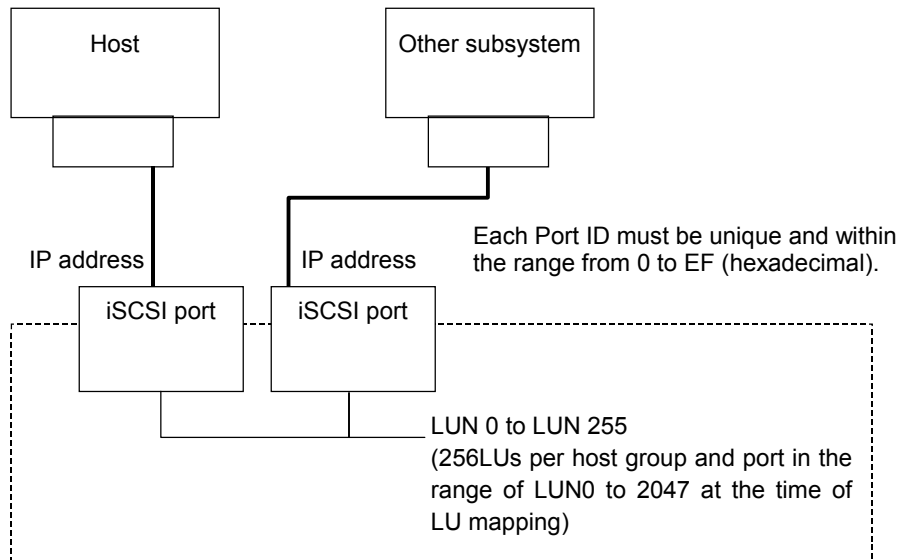


Figure 5-2 Logical Units (when iSCSI interface board is installed to control unit)

When the AMS500 is used as NAS model, 9 logical units need to be assigned as system LU. A maximum of 2,039 logical units can be set for user LU.

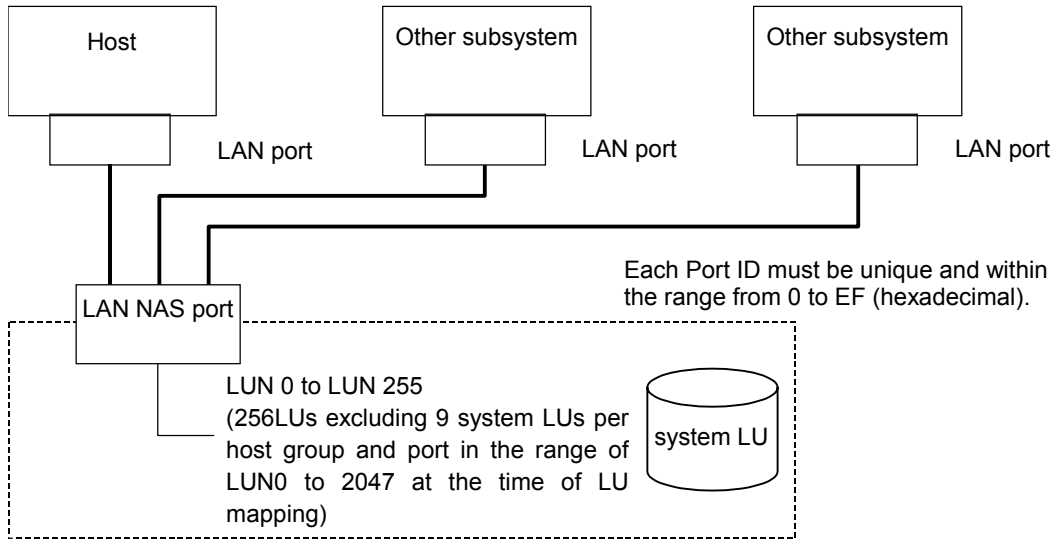


Figure 5-3 Logical Units (NAS Model)

5.5 Open Systems Features and Functions

The AMS500 subsystem offers many features and functions specifically for the open-systems environment. The AMS500 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.

This 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 group 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 AMS500 subsystem provides features and functions which allow you to maintain remote and subsystem internal copies of all user data on the AMS500 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 AMS500 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 AMS500 storage subsystem for purposes such as data backup or duplication. The duplicated volumes are created within the same AMS500 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

NAS Sync Image Modular function creates a snapshot for recovering the data to the state before the change even when the client changed file system data shared in the NAS Modular system mistakenly.

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 is displayed 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 LU.

5.9 NAS Features and Functions

The combination with the AMS500 and RKNAS enabled the different servers connected via LAN to share data easily using the NFS/CIFS protocol of the LAN (GbE) interface. The AMS500 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 5.7.5.

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 AMS500. The AMS500 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 and state change notification on the network easily.

Chapter 6 Configuring the AMS500 Storage System

This chapter includes the following:

- Overview of Configuration (see section 6.1)
- Configuring the LAN Interfaces of the AMS500 Storage System (see section 6.2)
- Configuring the AMS500 Storage System (see section 6.3)
- Registering the AMS500 Storage System for Control by Storage Navigator-Modular (see section 6.4)
- Configuring the AMS500 Storage System for the Desired Application (see section 6.5)
- General Configuration of the AMS500 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	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 the LAN Interfaces Addressing	○	○	○
6.3	Configuring the AMS 500 Storage System	○	○	○
6.4	Registering the AMS 500 Storage System for Control by Storage Navigator – Modular	○	○	○
6.5	Configuring the AMS 500 Storage System for the Desired Application	○	○	○
6.6	General Configuration of the AMS500 Storage System	○	○	○

○: An explanation is provided.

–: An explanation is not provided.

6.1 Overview of Configuration

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 AMS500 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® 2003) as a supported platform. For each open system, installation is required.

- **iSCSI**

The AMS500 uses Linux®, Windows® 2003, Windows® XP as a supported platform. For each open system, installation is required.

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 AMS500 subsystem supports a maximum of 4 fibre-channel ports. Each fibre-channel port is assigned a unique target ID number. The AMS500 can address up to 2,048 LUNs per port. Figure 6-1 illustrates fibre channel port-to-LUN addressing.

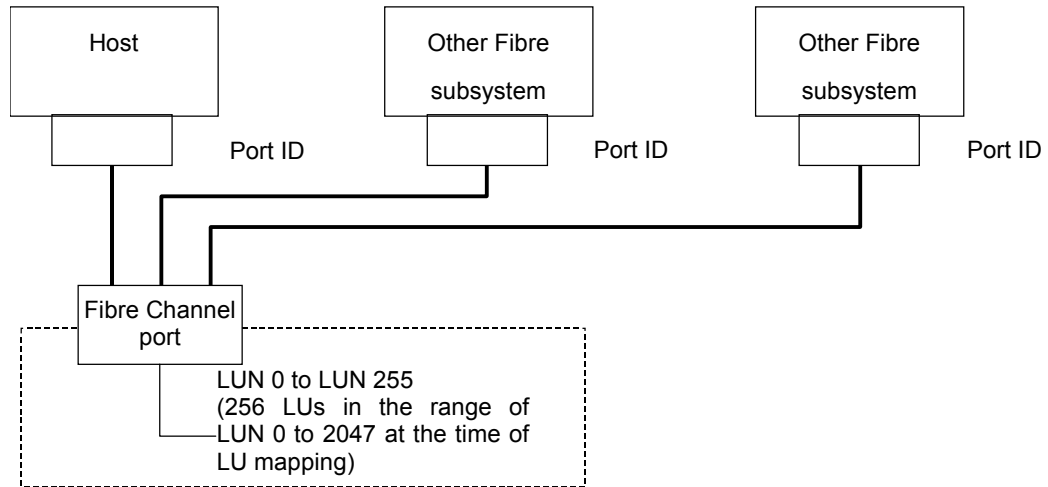


Figure 6-1 Fibre Channel Port-to-LUN Addressing

6.1.4 iSCSI Interface Addressing

The AMS500 supports 4 iSCSI ports by adding iSCSI interface board. The iSCSI port is assigned a target ID by addressing port ID. The AMS500 can address up to 256 logical unit numbers for one port. Host computer accesses to the logical unit with the required logical unit number by identifying the port of disk array subsystem using target ID. Figure 6-2 illustrates iSCSI port addressing and logical unit number assignment.

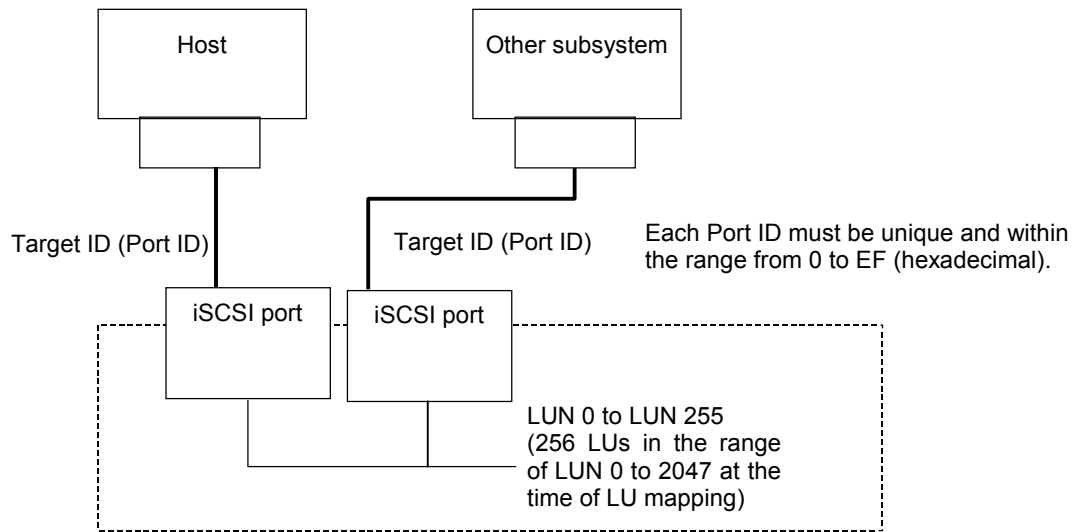


Figure 6-2 iSCSI Port-to-LUN Addressing (when iSCSI interface board is installed)

6.1.5 Alternate Pathing

The user should plan for alternate pathing to ensure the highest data availability. The AMS500 provides up to 4 fibre channel ports or to accommodate alternate pathing for host attachment. The following figures show a sample of alternate pathing.

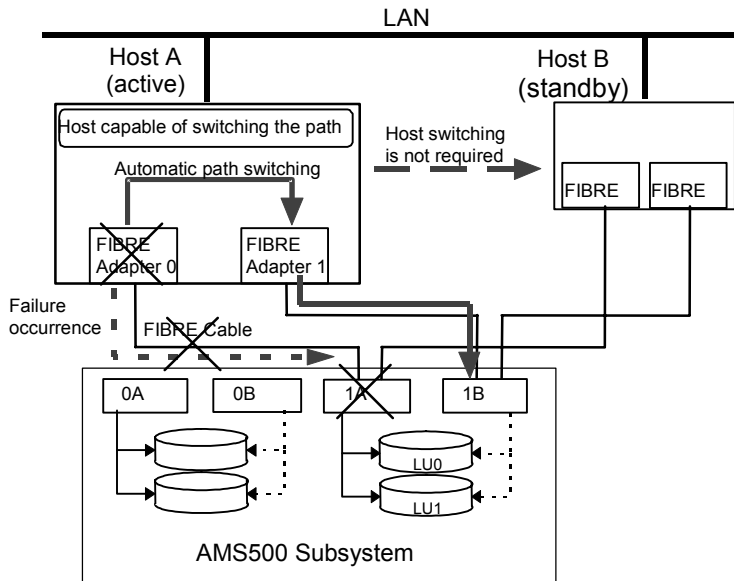


Figure 6-3 Alternate Pathing

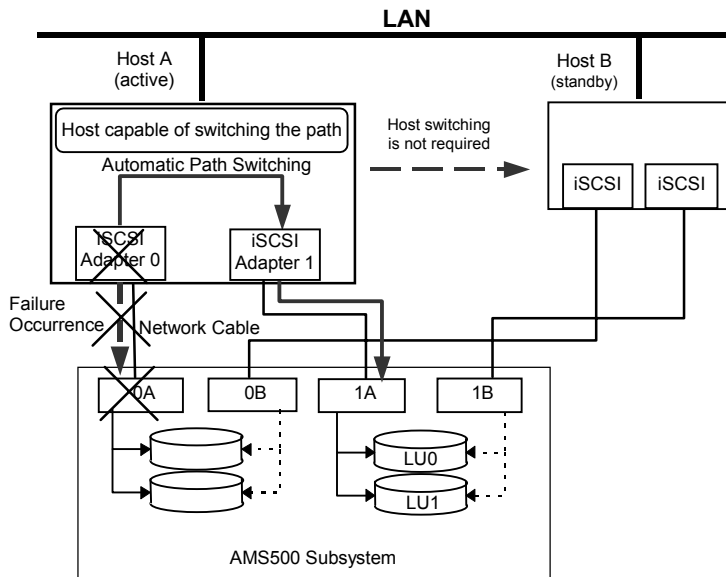


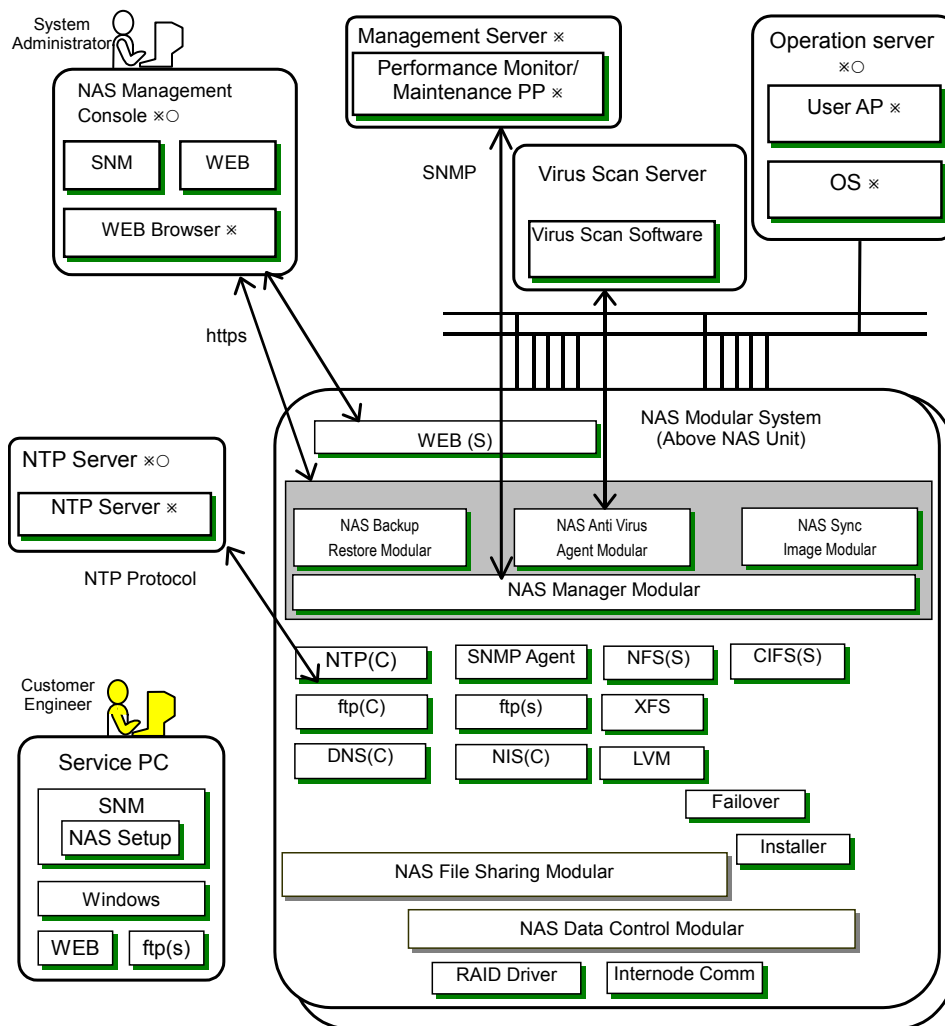
Figure 6-4 Alternate Pathing (when iSCSI Interface board added)

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.



Explanatory notes: (S): Server
(C): Client
*: Indicates a product other than NAS-related products. User needs to prepare the product separately.
○: Indicates a server that is indispensable to the operation.

TagmaStore AMS500

6.2 Configuring LAN Interfaces of AMS500 Storage System

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 8.9.3, and follow the instructions to obtain the LAN port number.

6.3 Configuring the AMS500 Storage System

The following steps must be performed 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.

Refer to the section **Installing Storage Navigator-Modular** for instructions on how to install the program.

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. 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 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 AMS500 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 the **Start** button.
3. The result of the search is displayed.
Select the name that you want to register, and click the  button. The selected array unit is moved from the **Search Results** list to the **Array Units to Add** list.
4. Click the **OK** button.
5. A message displays requesting confirmation to add the subsystems. Click the **OK** button.
6. The **Result** screen is displayed. Click the **Close** button.

6.5 Configuring AMS500 Storage System for Desired Application

Before configuring the AMS500, 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 AMS500 Storage System

Activating Management mode in Storage Navigator-Modular will enable you to do a general configuration of the AMS500 subsystem. Before it is possible to configure the AMS500, management mode must be enabled in Storage Navigator-Modular. Otherwise, it is only possible to monitor the status of the AMS500.

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 the **OK** button.
Specify a password of up to 12 alphanumeric characters.
3. On the **Tools** menu, select **Operation Mode**, and click **Change**. Alternatively, click the **Change Mode** button in the toolbar.
4. When the **password-input** screen appears, input a password and click the **OK** button. **Management Mode** is displayed 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 AMS500 Storage System

The process of configuring storage on the AMS500 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 AMS500 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 9500VFC 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 AMS500 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 Auto Diagnosis Threshold for Fibre Channel Loop	○	○	○
7.15	Changing the IP Address for the Maintenance Port	○	○	○
7.16	Setting the System LU and User LU in the NAS System	—	○	—
7.17	Setting the NNC Management LAN Port Information in the NAS System	—	○	—
7.18	Setting Time Zone	○	○	○
7.19	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: **xxxxxxxx** (x is optional).

7.1.2 System Parameters

System parameters are necessary to start the subsystem (from turning on the main switch of RKM to generation of the RDY LED (green) of RKM. 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)	<p>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.</p> <p>Parameters are backed up to the following:</p> <ul style="list-style-type: none">▪ Fixed part program: Cannot be backed up.▪ Flash 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)	<p>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.)</p> <p>The system area is provided on the disk drives #0 to #4 in the RKM frame. Therefore, the system area has redundancy for disk drives #0 to #4 in the RKM frame.</p>

7.2 Setting Fibre Channel Information

Follow the steps below to set and display 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.)

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 is displayed, select the **Settings** menu in the upper left corner of the screen.
4. In the **Tools** menu, click **Configuration Settings** or click the **Configuration Settings** button on the toolbar.
5. Click the **Fibre Channel** tab.
6. Set a Port Address, Topology Information, and Transfer Rate.

Port Address: Port address is displayed 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 AMS500 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 AMS500 to the fixed transfer rate (the same value for the TagmaStore Universal Storage Platform and the AMS500 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	Auto

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

7.3 Setting iSCSI Information

7.3.1 Setting iSCSI Port Information

To set iSCSI port information, follow these steps:

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

1. Turn on the power supply.
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** 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 **iSCSI** tab.

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

Field	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	00:00:07:86:0B:00
Result	Normal

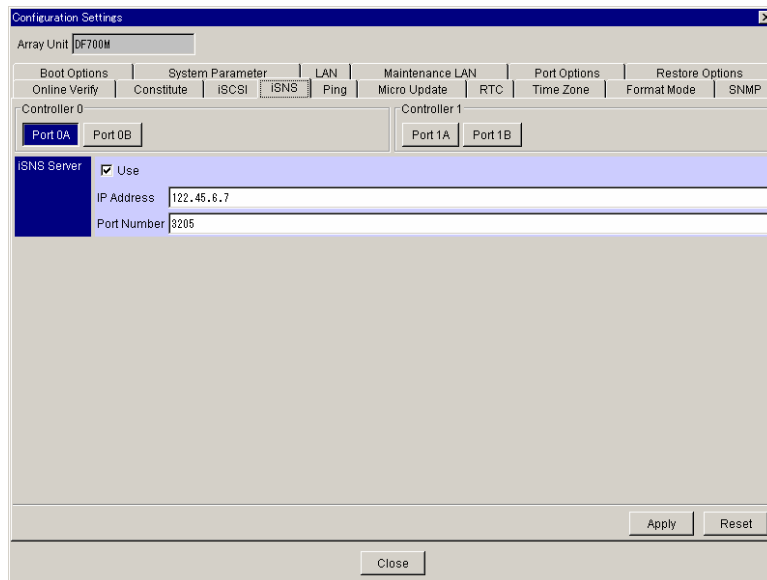
At the bottom of the dialog, there are buttons for 'Refresh', 'Apply', 'Reset', and 'Close'.

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

7.3.2 Setting iSNS Server Information

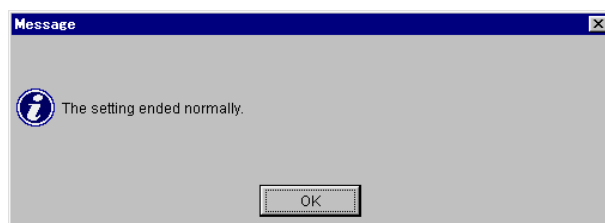
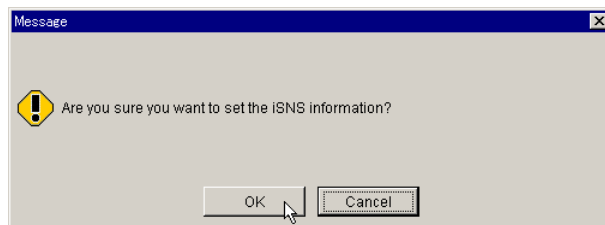
Fabric Switch on the Fibre Channel interface. The iSNS information enables the host as iSCSI initiator to discover the iSCSI Name of the target with the specified IP address. The use of the iSNS is optional for the iSCSI. When using the iSNS, the disk array subsystem registers the iSCSI port information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

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

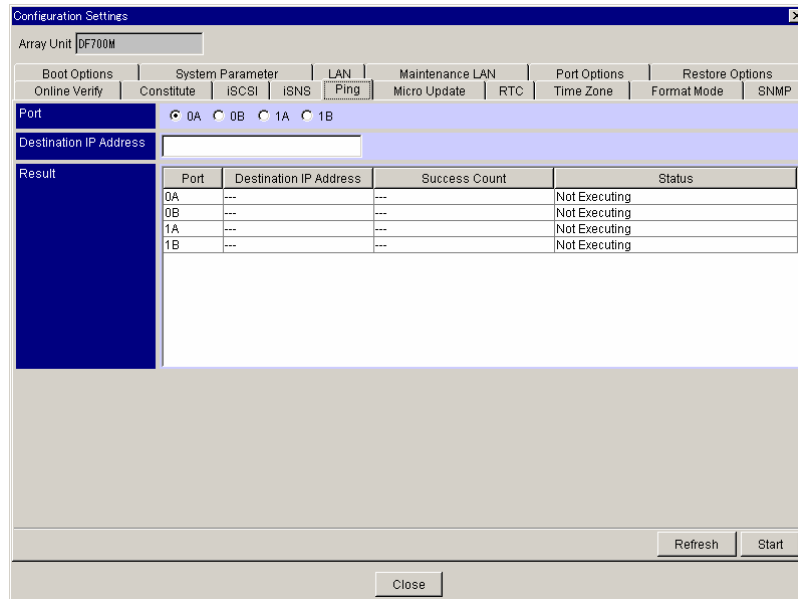
3. Click the **Apply** button.
4. A confirmation message is displayed. Click the **OK** button.



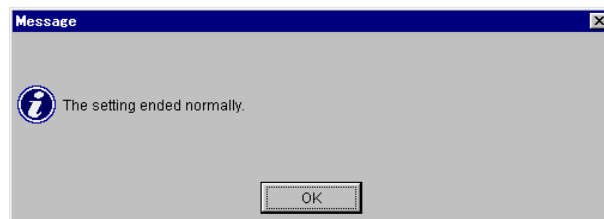
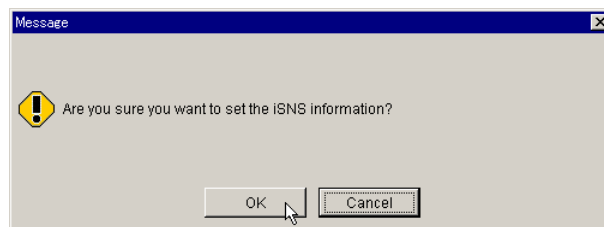
7.3.3 Sending a Ping

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

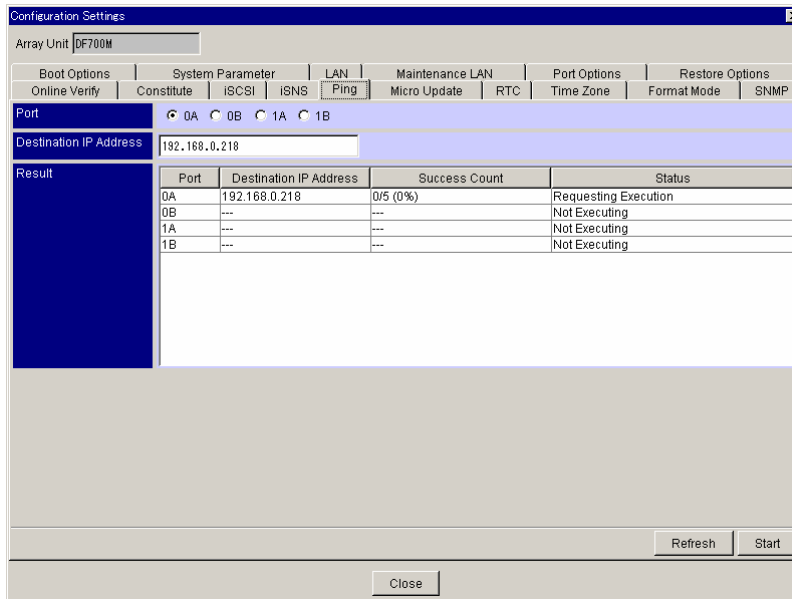
1. On the **Tools** menu, click the **Configuration Settings** or click the **Configuration Settings** button on the toolbar.
2. Click the **Ping** tab.



- **Port:** Select the port to send ping.
 - **Destination IP Address:** Specify the IP Address of the initiator.
3. Click the **Start** button.
 4. The following message appears. Click the **OK** button.



The result is displayed.



5. As necessary, select the **Refresh** button 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).

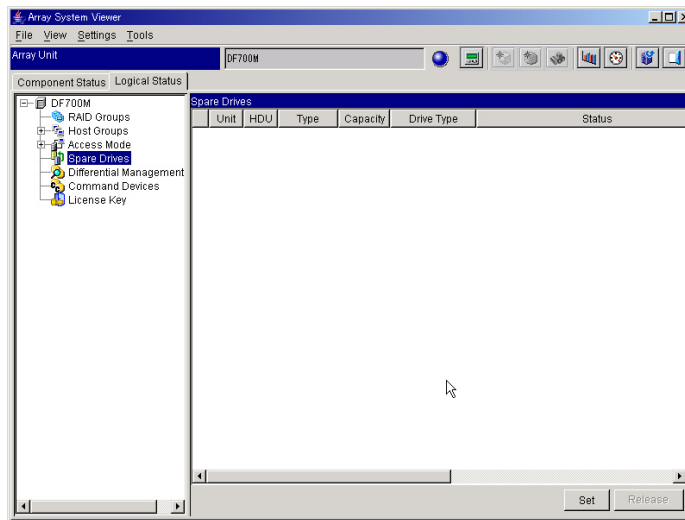
This section includes:

- 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

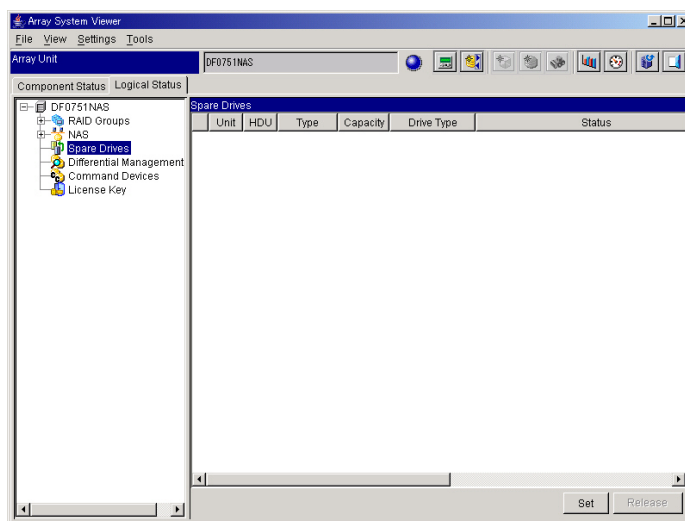
7.4.1 Setting a Spare Disk

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 is displayed, select the **Settings** menu.
4. On the **Settings** menu, select **Display Details** or click the **Display Details** button on the toolbar.
5. Click the **Logical Status** tab on the Unit Window.



(NAS)



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

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

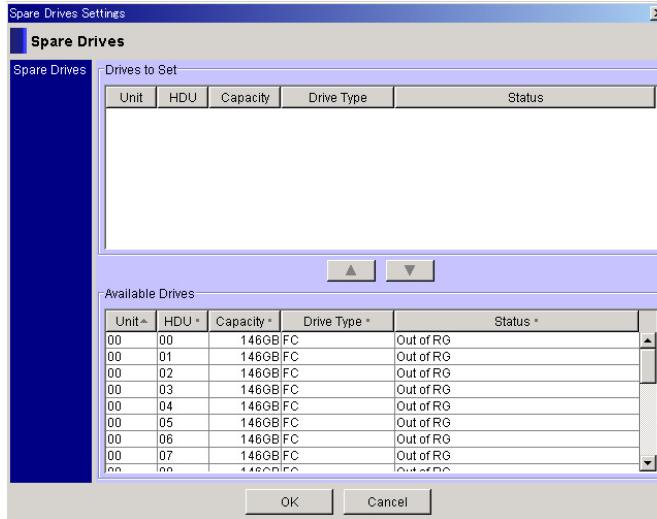



Figure 7-1 Spare Drive Dialog Box (before setting)

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

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

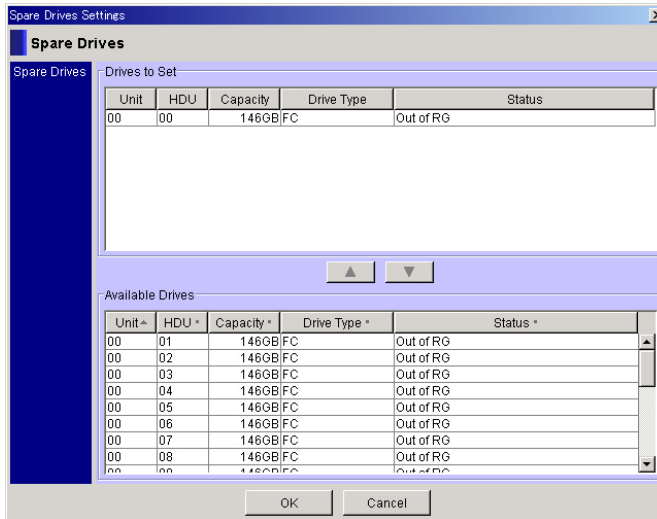
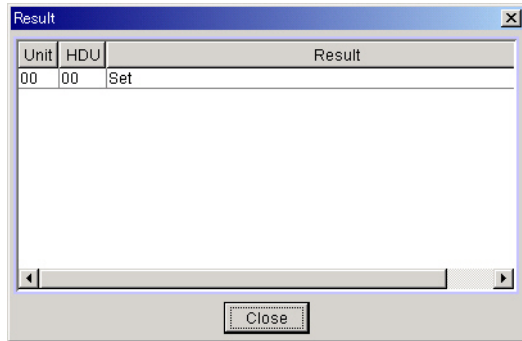
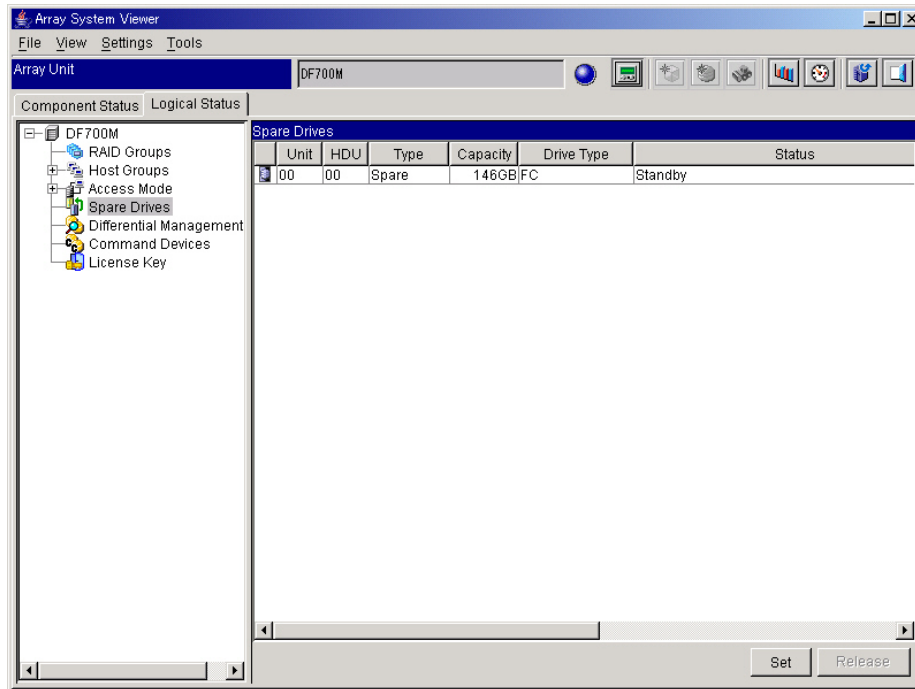


Figure 7-2 Spare Drive Dialog Box (after setting)

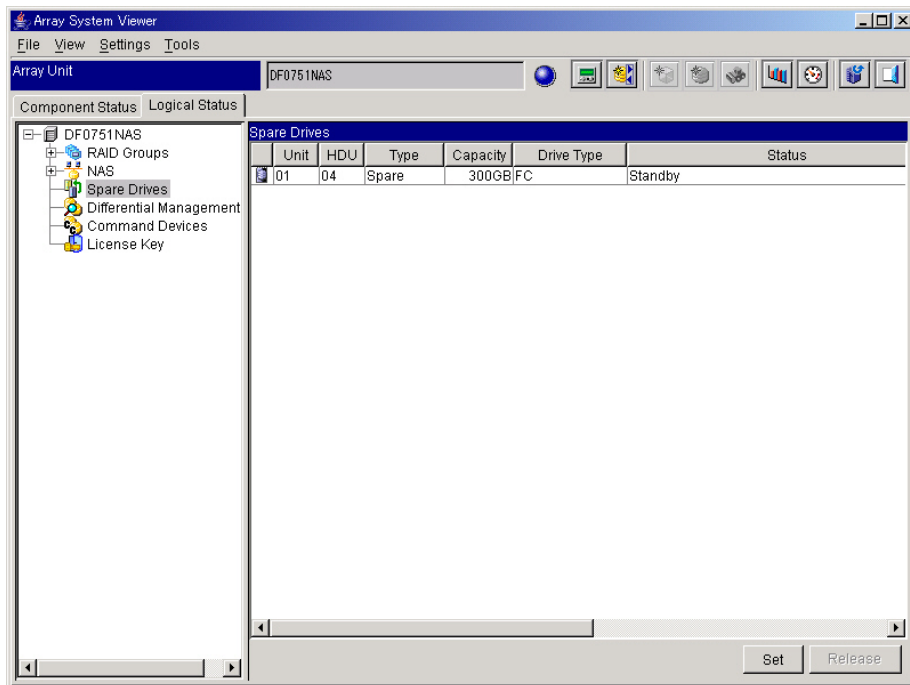
9. Click the **OK** button.
10. A message indicating that the setting is complete is displayed. Click the **OK** button.
11. A **Result** window is displayed, indicating that the setting is completed.
Click the **Close** button.



The spare drive setting is updated and the following window is displayed.



(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 the **Release** button.
4. The confirmation message for spare drive canceled is displayed. Click the **OK** button.
5. A message is displayed, stating that the setting is complete. Click the **Close** button.

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**. Or, click the **Display Details** button in the tool bar.
4. Click the **Logical Status** tab.
5. On the **Settings** menu, select **RAID Group**, and then click the **Settings**. Alternatively, click **RAID Group Settings** button in the tool bar. This operation can also be completed from the context menu of the **RAID 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 the **OK** button. For the **Drives**, select the **Automatic Selection**.
7. A confirmation message appears, click the **OK** button.
8. If the RAID group setting is not successful, delete the affected RAID group, and try creating the RAID group again.

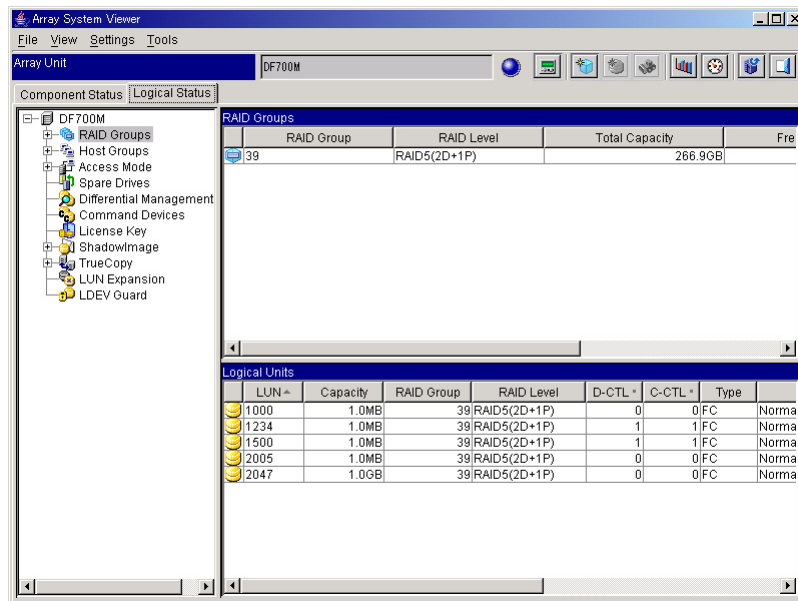


Figure 7-3 Logical Status Tab

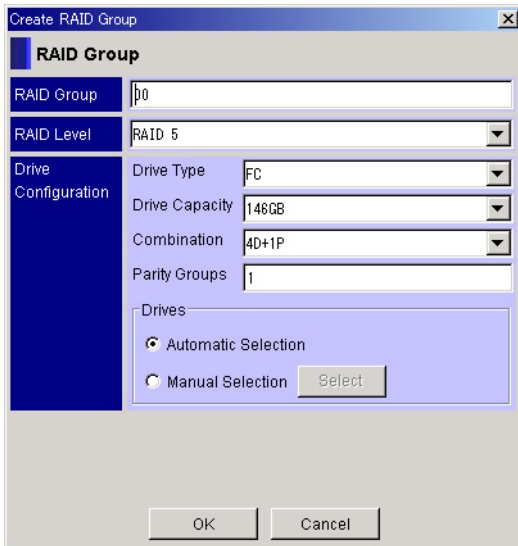


Figure 7-4 RAID Group Dialog

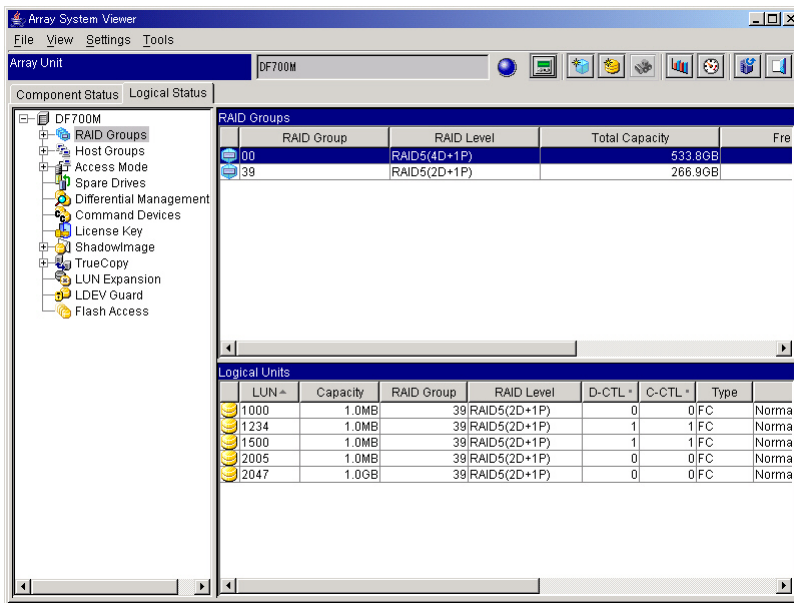
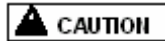


Figure 7-5 Set RAID Group is Updated

7.4.4 Deleting a RAID Group



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.

However, when 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 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 LU that applies to any of the following exists in the RAID group to be deleted:

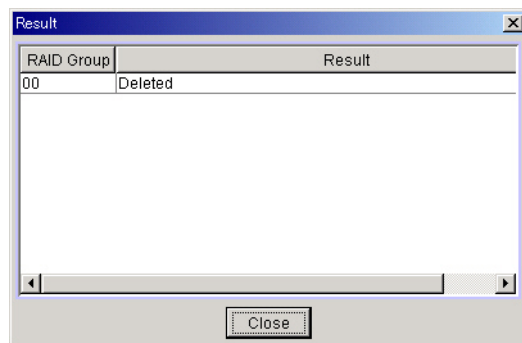
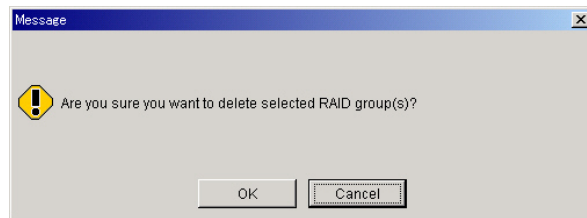
In the Data Retention Utility setting,

- 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)".

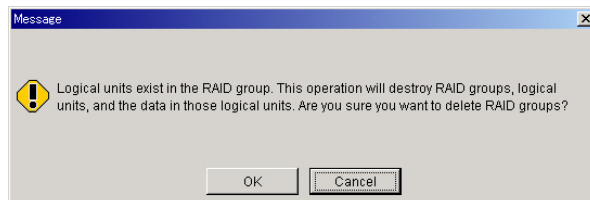
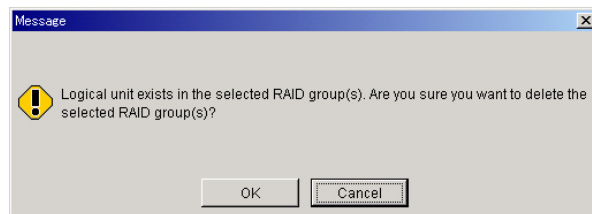
Delete the LU after setting the **Attribute** to "Read/Write", the **S-VOL** to "Enable(the LU can be set to S-VOL)", and the **Mode** to " --- (un-specifying)".

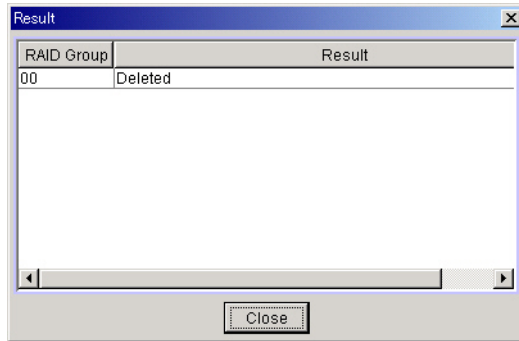
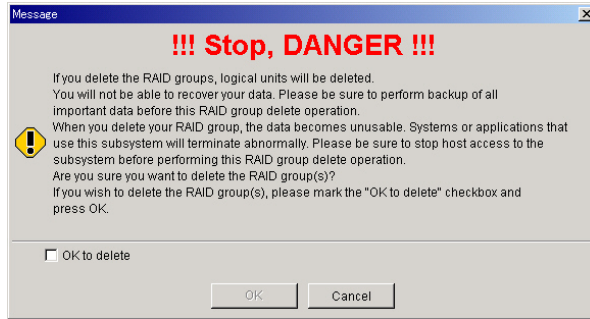
To delete a RAID Group, follow these steps:

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 appears 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 the **OK** button.
 - 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 AMS500 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 back-upping a shared volume	2,537 M bytes (or more)	5,195,776 blocks (or more)	0
9	8	For the volume 2 for back-upping a shared volume	2,537 M bytes (or more)	5,195,776 blocks (or more)	0

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.

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.

Note: When the AMS500 is connected to the NAS, create the system LU and user LU in different RAID groups respectively.

Note: When enabling the ShadowImage I/O switch mode, create the system LU and P-VOL of the ShadowImage at the time of NAS connection to different RAID groups respectively.

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.

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 the **Display Details** button 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** button in the tool bar.

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

6. On the **Logical Unit** dialog, input or select **Logical Unit No.**, **Default Controller**, and **Size**. Click the **OK** button.
7. A created logical unit number is displayed for the **Logical Unit No.** and the RAID group number in which logical units are defined for the **RAID Group**. Additionally, a logical unit capacity that can be created is displayed.

Notes:

- 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.
- 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.

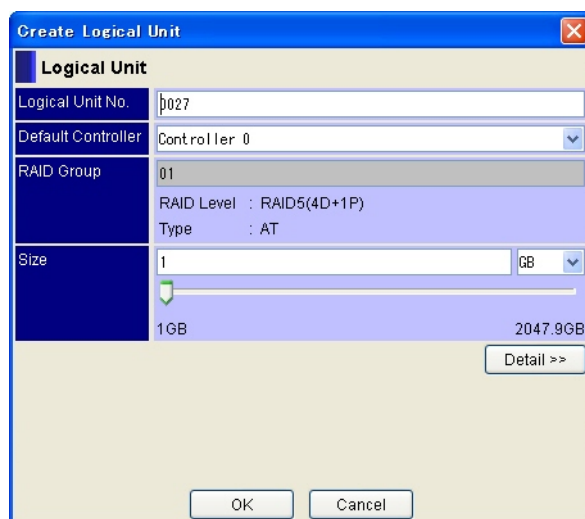


Figure 7-6 Setting the Logical Unit Dialog Box

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 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 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.

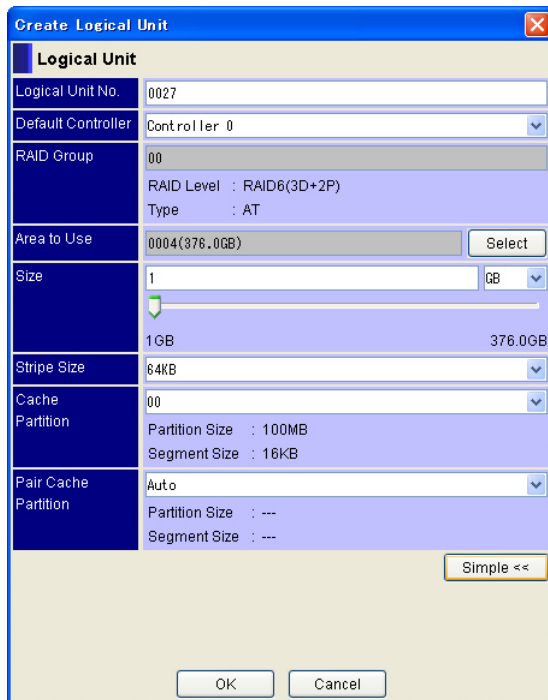


Figure 7-7 Logical Unit Detail Dialog Box

An example of 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.

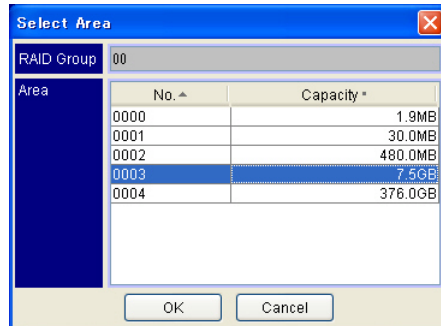


Figure 7-8 Select Area

1. After the setting is complete, click **OK**.
2. The set logical unit information is updated and the window is displayed.
3. When the subsystem is configured with both the Fibre Channel and the NAS interfaces, do LU mapping for the created logical unit. For details on how to do LU mapping, refer to section 7.5.1.

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 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 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)".

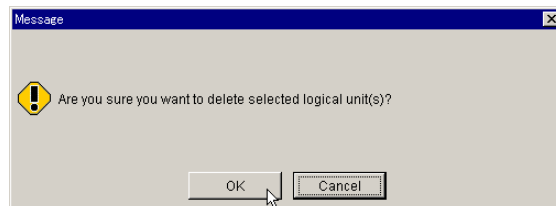
Delete the LU after setting the **Attribute** to "Read/Write", the **S-VOL** to "Enable (the LU can be set to S-VOL)", and the **Mode** to " --- (un-specifying)".

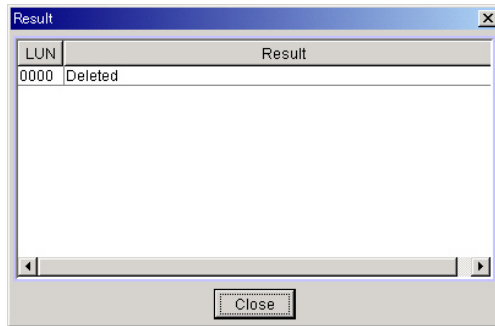
A confirmation message is displayed indicating whether selected logical units should be deleted or not. Depending on whether the logical units to be deleted are formatted or not, the message description is different.

Click the **OK** button.

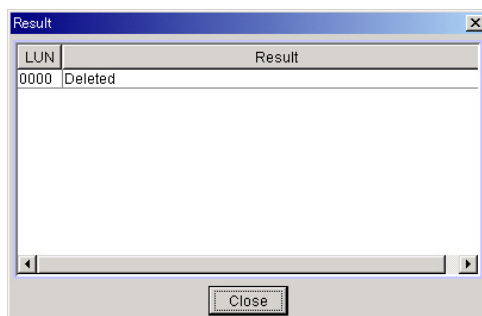
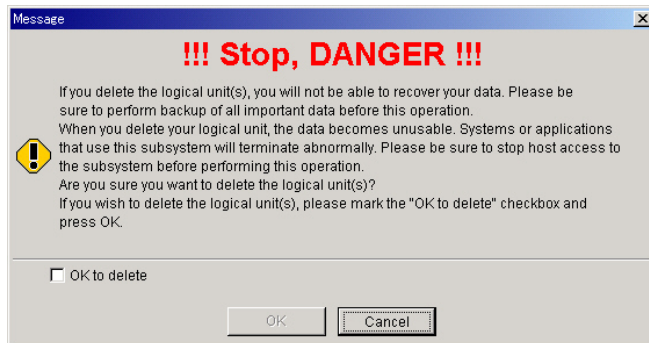
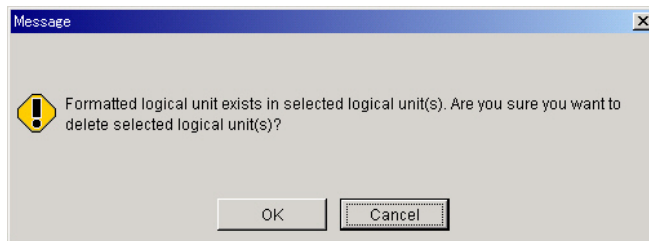
The logical unit information in which the logical unit has been deleted is updated and the window is displayed.

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

Note 4: If an LU is allocated to a NAS system LU that is being used at the time of NAS connection, the user LU cannot be formatted without releasing the allocation.

Note 5: 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 in boot time of the NAS OS.

Note 6: 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.

Note 7: In the following cases, a LU cannot be formatted. When you perform the formatting, follow the way of dealing with 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(Zer)" 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-VOL
 Format 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 120 Terabytes. Therefore, when selecting multiple units for formatting, ensure that their total capacity is less than 120 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 is displayed 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).

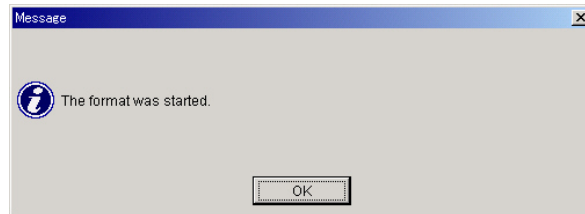
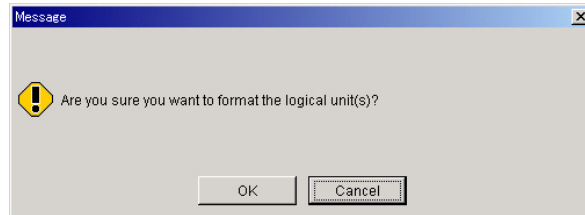
To format a logical unit, follow these steps:

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

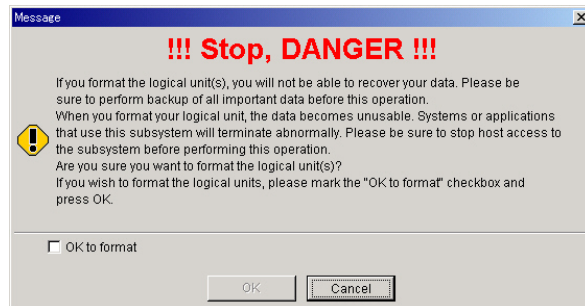
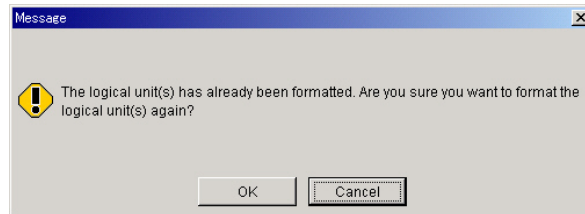
Notes:

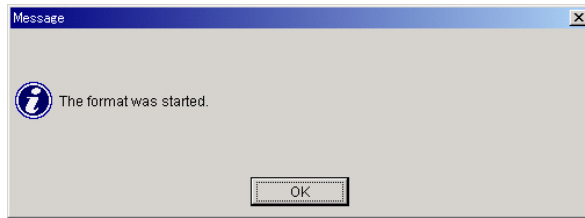
- When you select multiple logical units, hold down the **Ctrl** key and click the icons of the logical units to format.
- When a logical unit is incorrectly specified, press the **Cancel** button and redo processing by selecting a logical unit to be reformatted.

- 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 appears and asks you to confirm whether the selected logical units may be formatted or not. Check the message, and click the OK button. 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:**

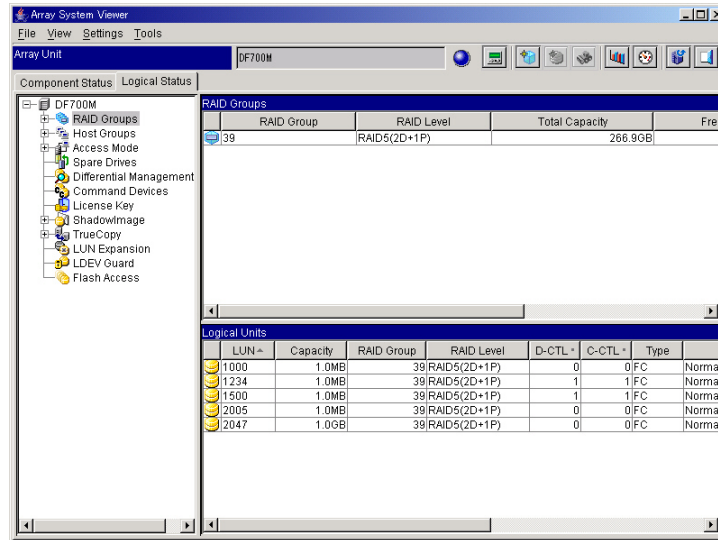


- **When there is a formatted logical unit:**

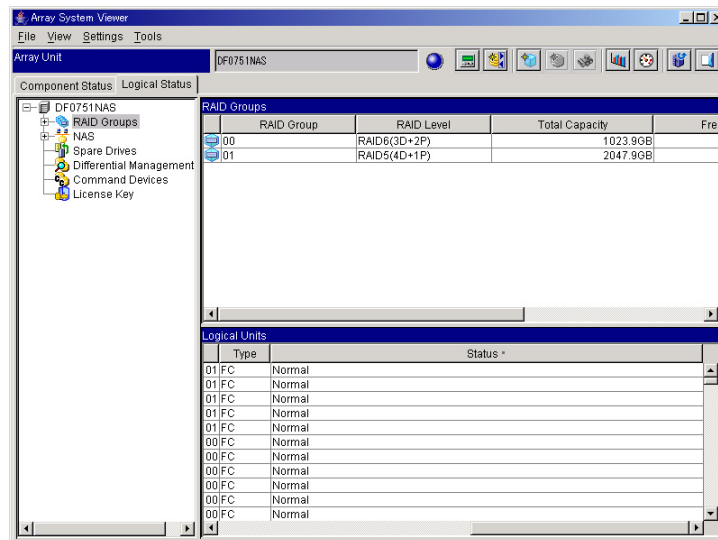




The progress rate of formatting process in the background is displayed in the **Status** box. The progress rate of formatting process is not displayed automatically.



(NAS)



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

- Normal is displayed in the Status box. (When the formatting is in execution, the progress status is displayed.)

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

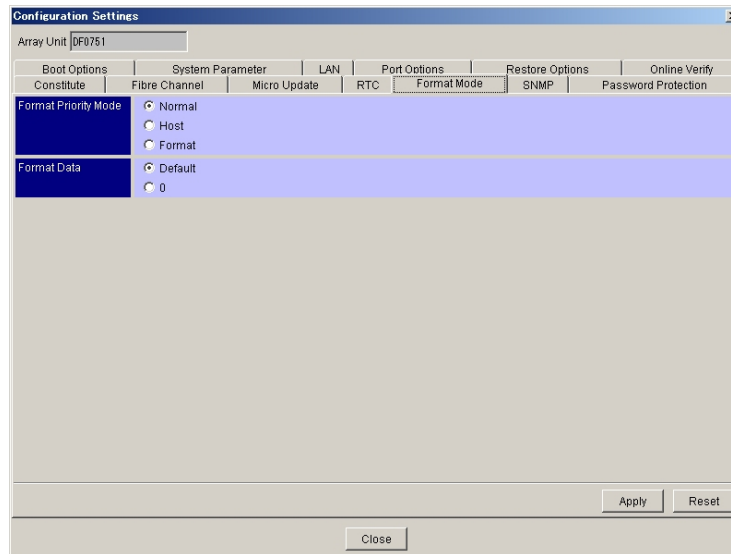
For examples of the messages displayed, see Table 2.1 Fixing AMS500 Formatting Message Errors in *Hitachi TagmaStore® Adaptable Modular Storage (AMS) and Workgroup Modular Storage (WMS) Storage Navigator Modular Error Codes (MK-96DF788)*.

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. On the **Tools** menu, select **Configuration Settings** or click **Configuration Settings** button on the toolbar.
2. Click the **Format Mode** tab.
3. Click the desired radio button from the **Format Priority Mode**.



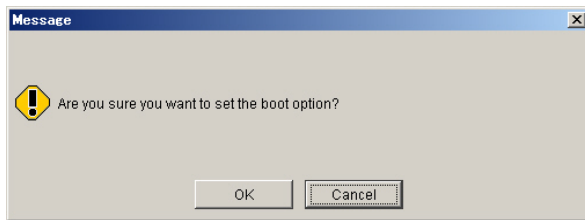
The following provides an explanation for each Format Priority mode.

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 format.ing 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.

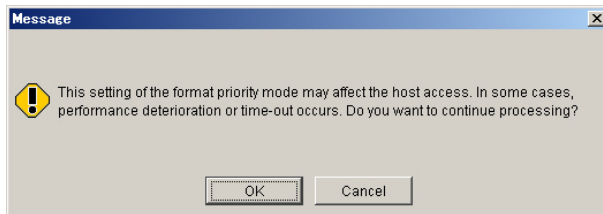
Note: Formatting using the **Format Priority Mode** allows the subsystem to minimize the effects from host access and complete the format promptly, for the online format during the disk drive addition or during the recovery work from the two points disk drive failure. Host access performance may be significantly affected because the **Format of the Format Priority Mode** restricts commands from host.

In the following cases, do not set the **Format Priority Mode** to **Format**; 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 Snapshot
4. When the setting is complete, click **Apply** on the **Configuration Setting** screen. The following message appears, click **OK**.



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



5. A message appears when the setting is complete, click the **OK**. 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) at the time of connecting to TagmaStore USP/TagmaStore NSC.

7.4.9 Changing the Default Controller in Charge of an LU

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

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

1. 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** button 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 appears, requesting confirmation to change the default controller.
7. Click the **OK** button, and the default controller in charge of a logical unit will be changed.
8. A message appears, stating that the setting is complete. Click the **OK** button.

7.5 Setting Host Group Information

In the AMS500, 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.

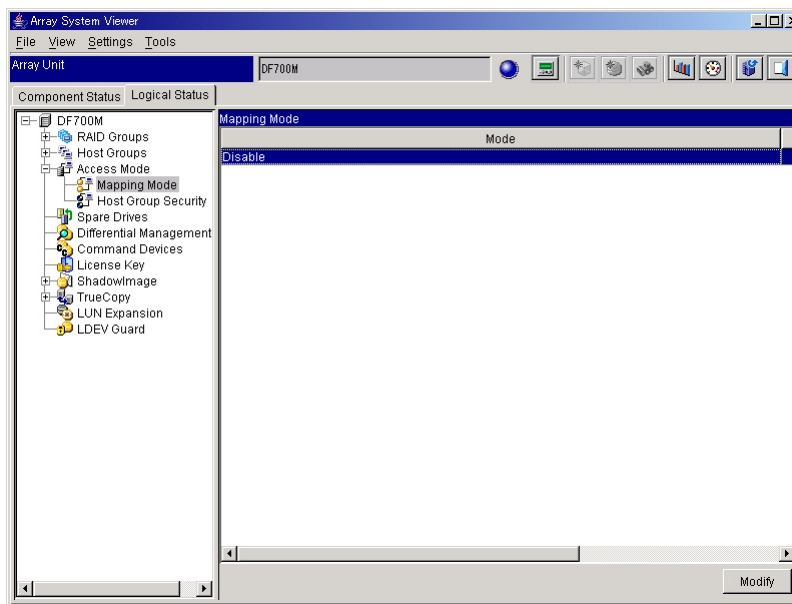
Host groups support only the **000:G000**.

Up to 128 host groups can be set when the LUN Manager (an extra cost optional feature) is used.

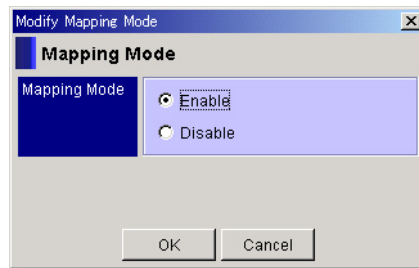
Note: When an array subsystem and a host computer are connected with the Fibre Channel interface, the logical unit of the array subsystem must be set to 0 (zero) or it will not be recognized by the host computer. When using this host computer, create a logical unit set to 0 or map the logical unit to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

7.5.1 Setting Mapping Information

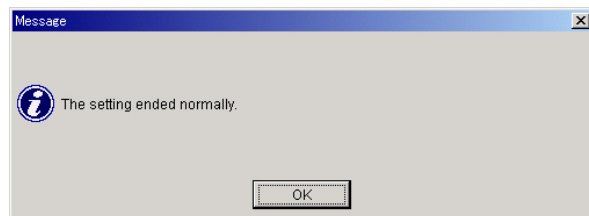
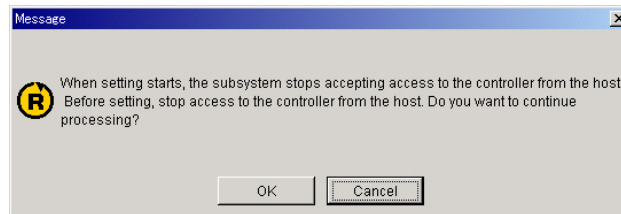
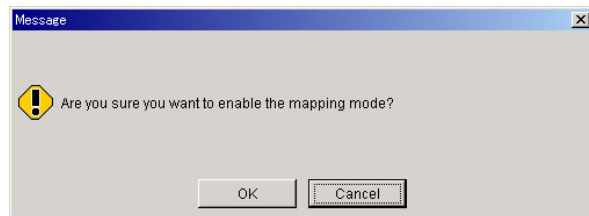
1. In the unit window, click the **Logical Status** tab.
2. Double-click the **Access Mode**, and select the **Mapping Mode**.
3. On the Mode list, select the **Disable**. Click the **Modify** button.



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

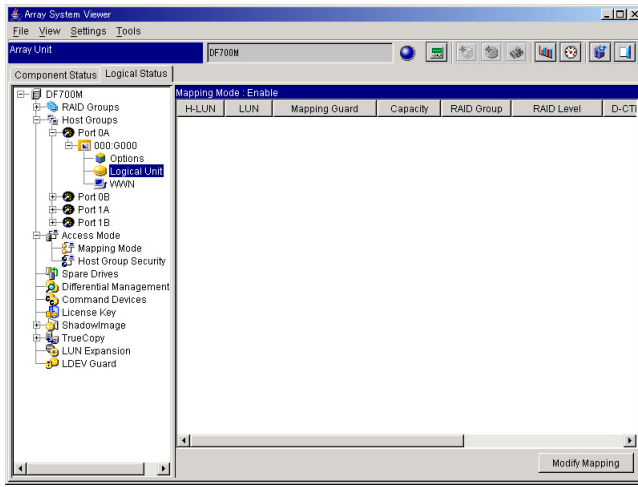


5. A confirmation message appears, click the **OK** button.



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 the **Modify Mapping** button. **Mapping dialog** is displayed.

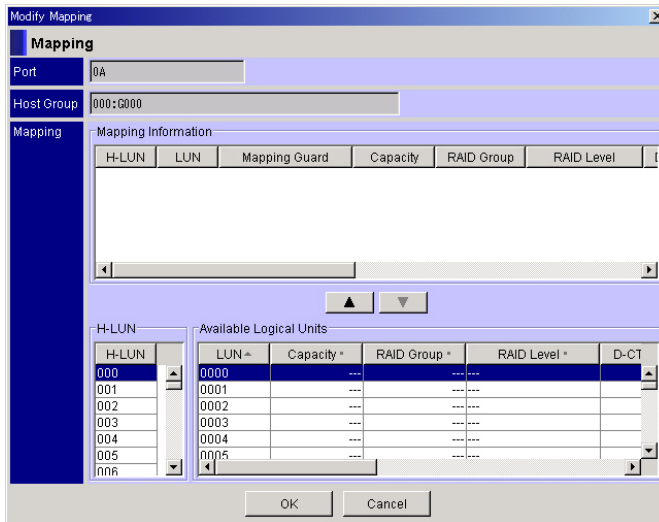

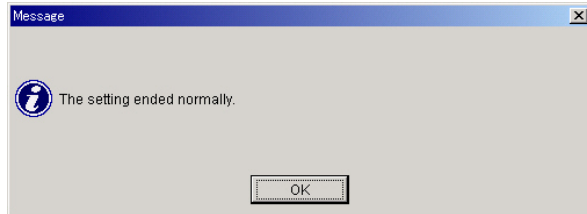
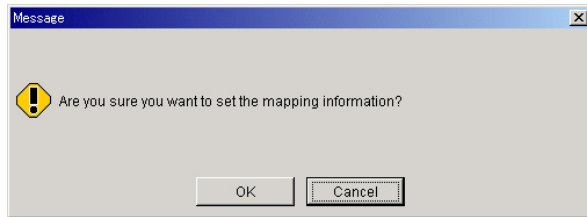


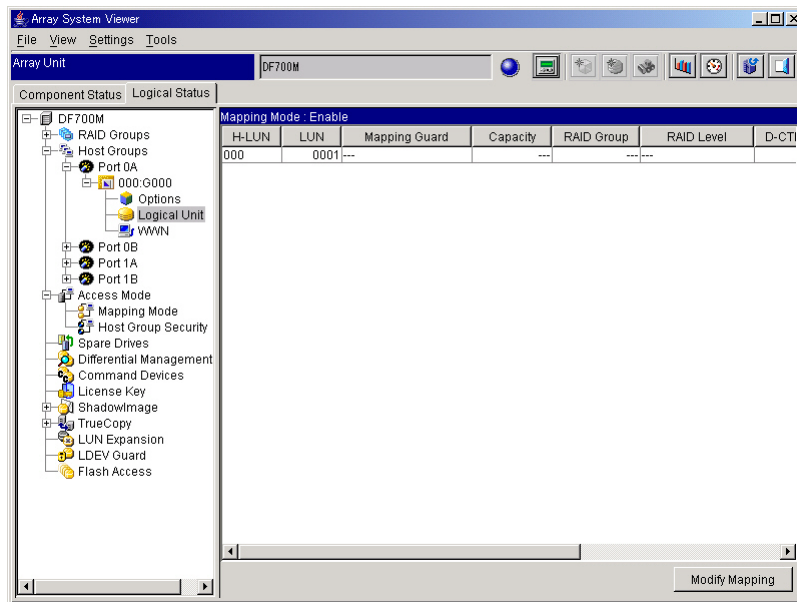
Figure 7-9 Mapping Dialog

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  button.
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 the OK button.

12. A confirmation message appears, click the **OK** button.



The mapping information is updated and the following window is displayed.



7.6 Setting Target Information

In the AMS500, 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.

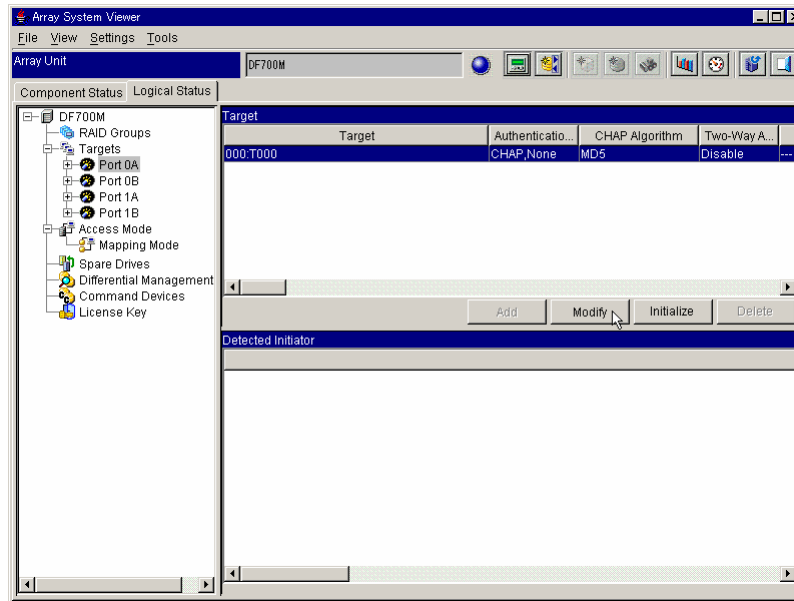
For targets, only the **000:T000** is supported.

Up to 256 targets can be set when the LUN Manager (an extra cost optional feature) is used.

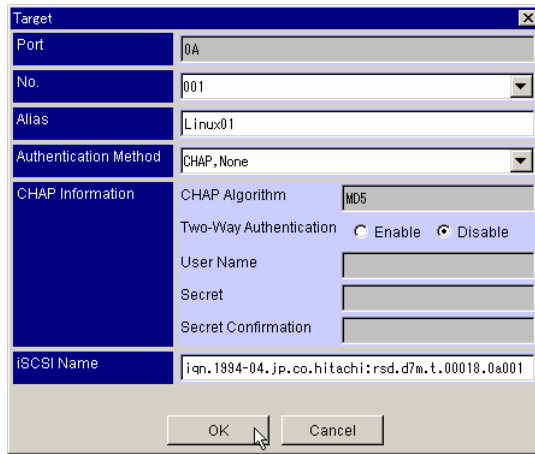
7.6.1 Changing Target Information

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

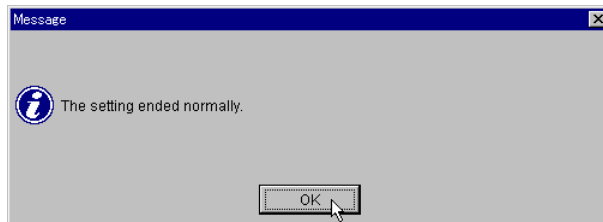
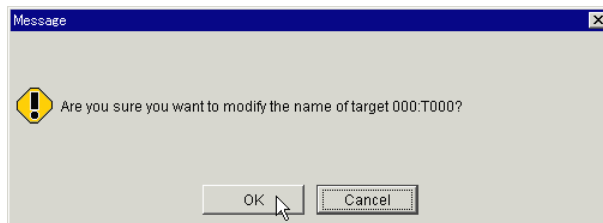
1. Click the **Logical Status** tab on the Unit screen.
2. Click the Port.
3. Select the Target to be changed from the **Target** list.
4. Select the **Modify** button.



The **Target** dialog is displayed.

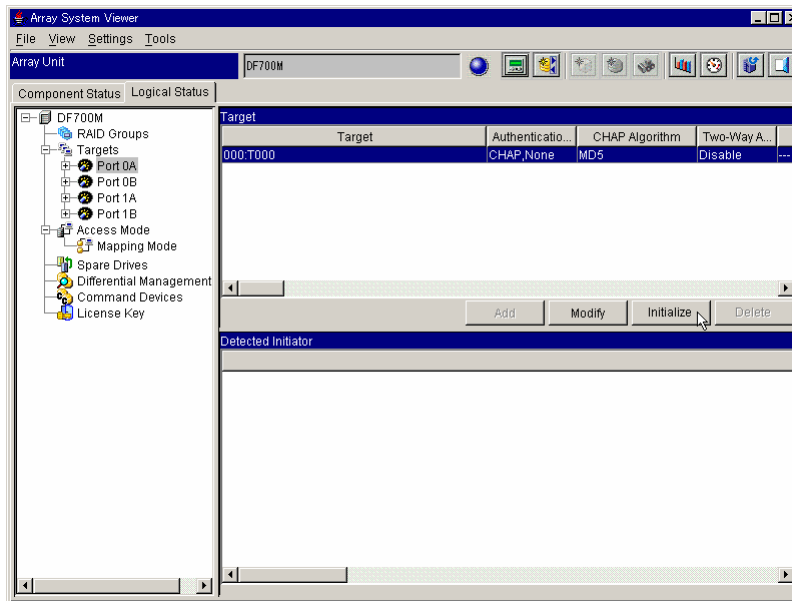


5. In the **Target** dialog, enter the Alias and iSCSI Name.
6. Select the authentication method from the drop-down list.
 - **Alias:** Enter the alias of the Target with 32 or less alphanumeric character.
(Excluding \, /, : , , , ; , * , ? , “ , < , > , | and ‘)
Spaces at the top or end are ignored. 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 the **OK** button.
8. The confirmation message is displayed. Select the **OK** button.

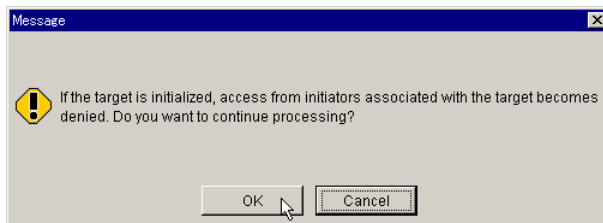
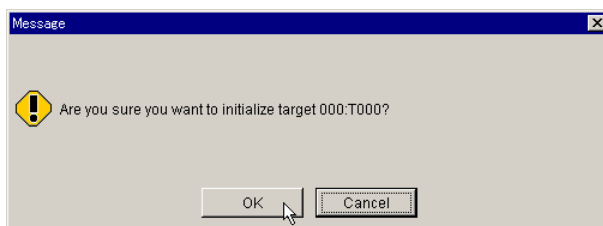


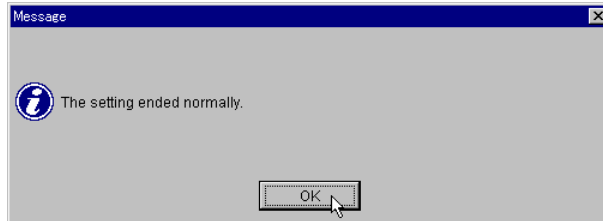
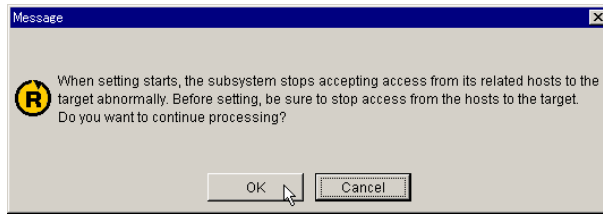
7.6.2 Initializing Target 0

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 the **Initialize** button.



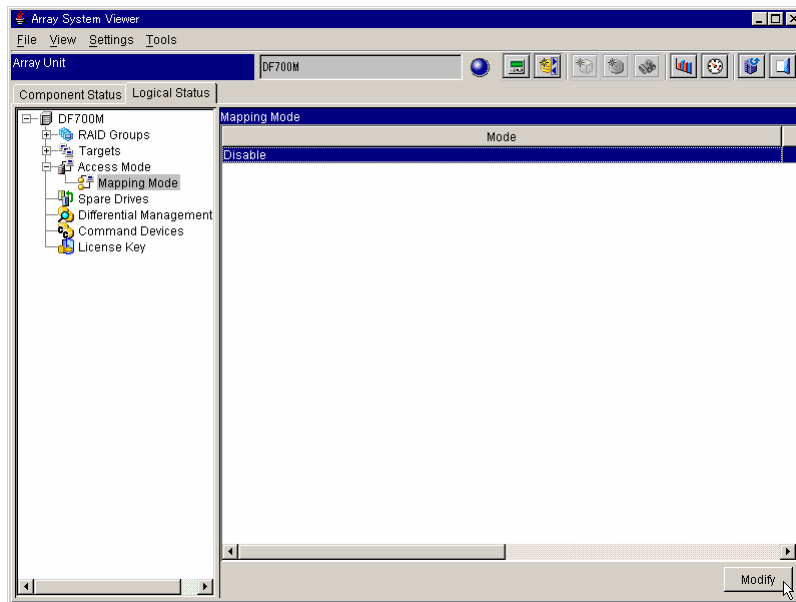
5. The confirmation message is displayed. Select the **OK** button.



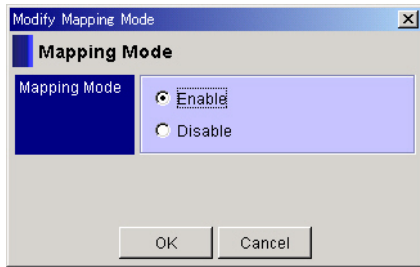


7.6.3 Setting Mapping Information

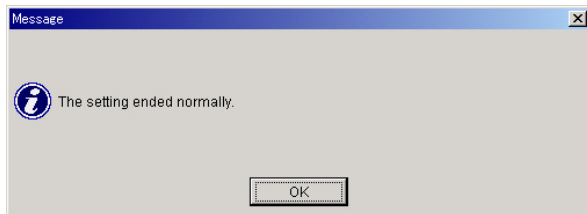
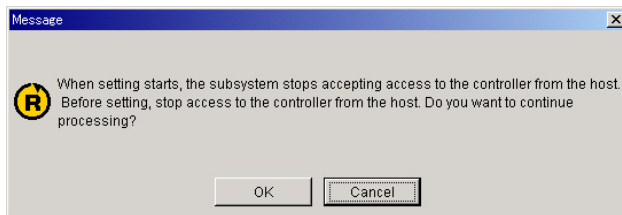
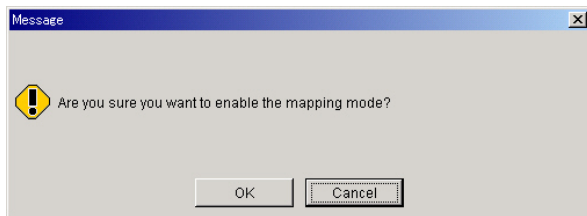
1. Click the **Logical Status** tab on the Unit screen.
2. Double-click the **Access Mode**, and select the **Mapping Mode**.
3. On the **Mode** list, select the **Disable**. Click the **Modify** button.
Mapping Mode dialog box is displayed.



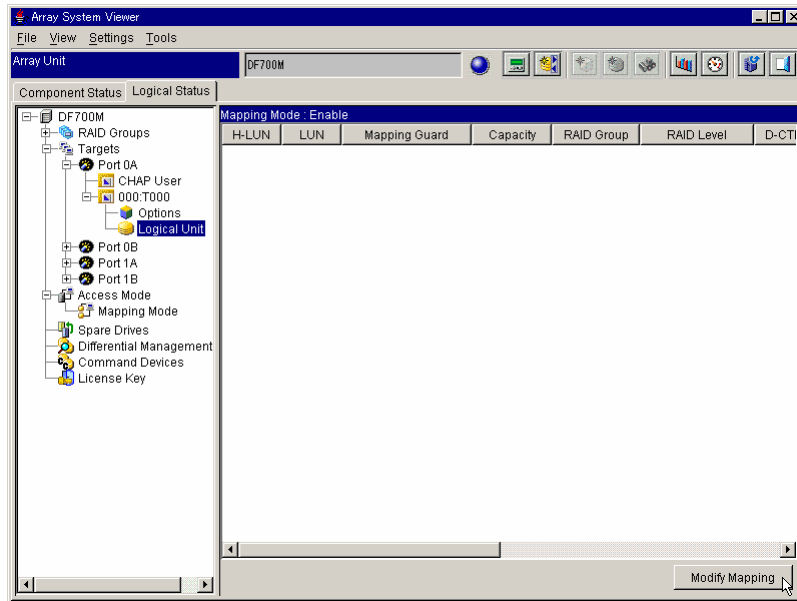
4. On the **Mapping Mode** dialog, click the **Enable** radio button, and click the **OK** button.



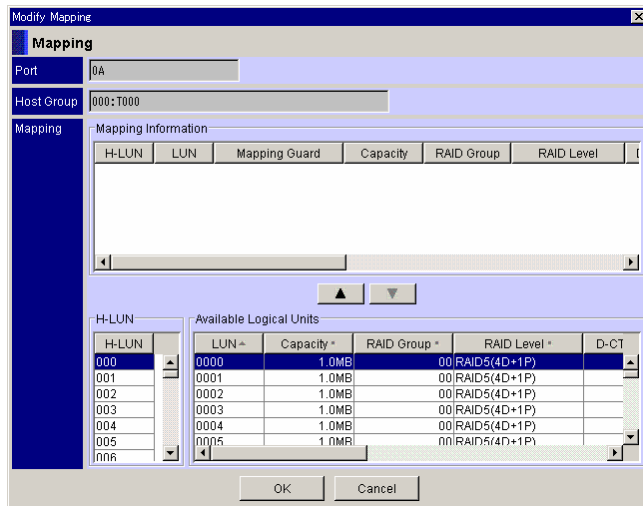
5. A confirmation message appears, click the **OK** button.




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 the **Modify Mapping** button. Mapping dialog is displayed.

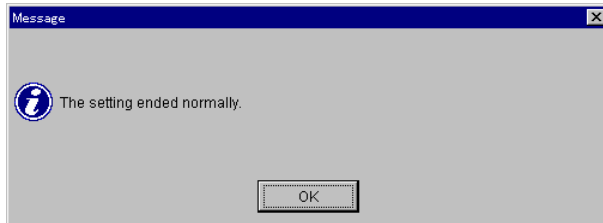
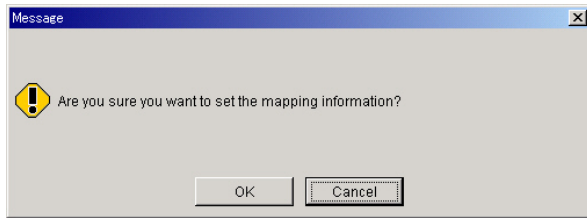


9. Select one H-LUN from the **H-LUN** list, select an LUN that you want to map for the H-LUN from the **Available Logical Units** list, and click  button.

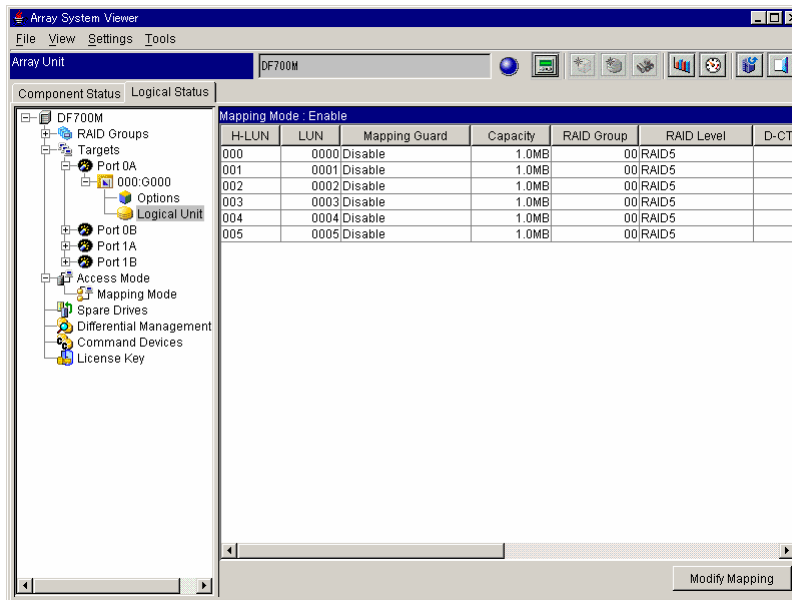
The selected H-LUN and LUN will be moved to the **Mapping Information** list.

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

11. A confirmation message appears, click the **OK** button.



The mapping information is updated and the following window is displayed.



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

7.7 Setting CHAP Authentication

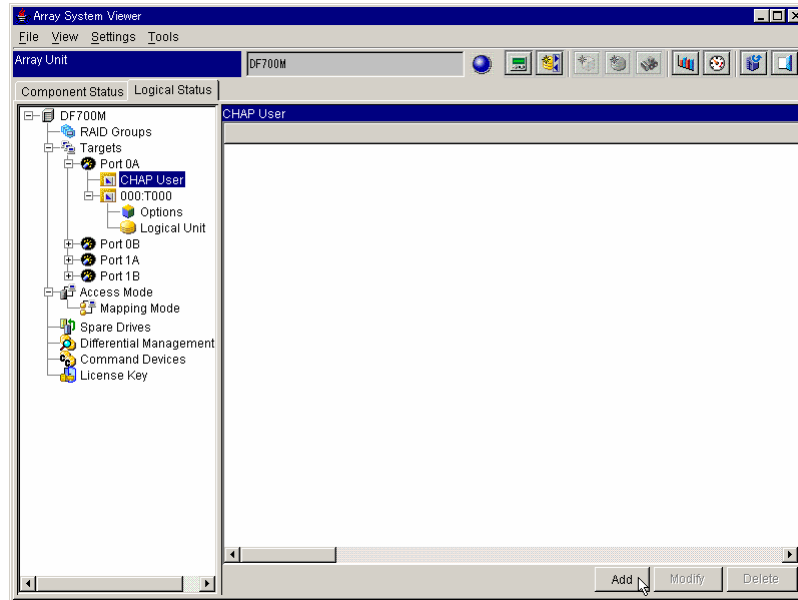
The disk array subsystem can authenticate both the iSCSI User Initiator Authentication and Two-Way Authentication (Target Authentication) with the CHAP (Challenge Handshake Authentication Protocol). This can prevent the unauthorized access from the host (or by the user of the host).

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).

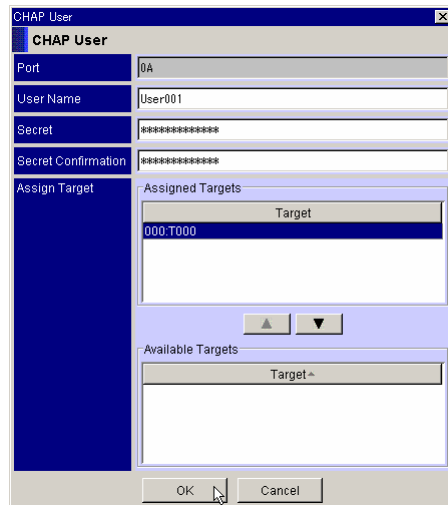
7.7.1 Adding a CHAP User

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. Select the **Add** button.

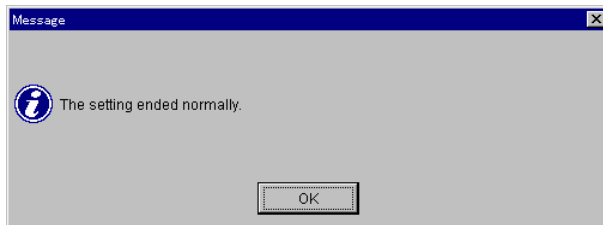


The CHAP User dialog is displayed.



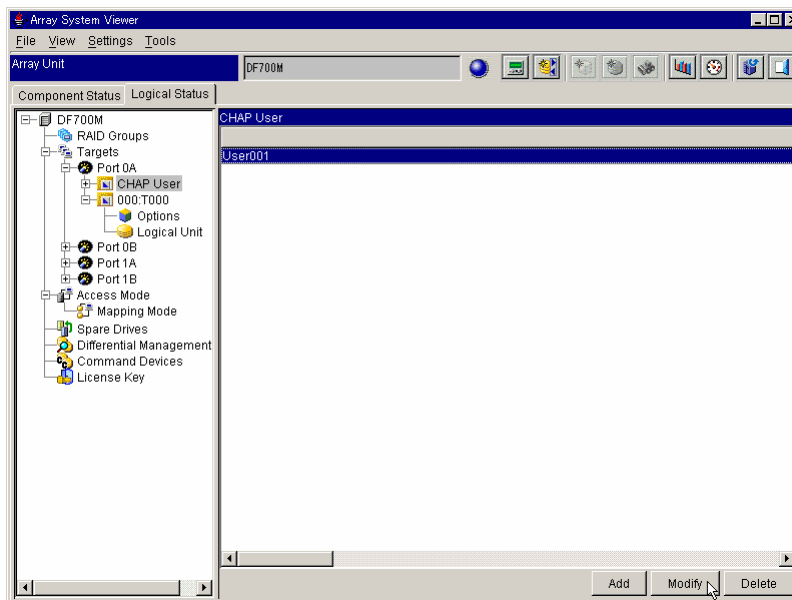
4. In the **CHAP User** dialog, enter the **User Name**, **Secret**, and **Secret Confirmation**.
 - **User Name:** Enter the name of the User with 256 or less alphanumeric character.
The following symbols can be used: (. - + @ _ = : / [] , ~ (space))

- **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 the  button.
 6. Click the **OK** button.
 7. A confirmation message appears. Click the **OK** button.

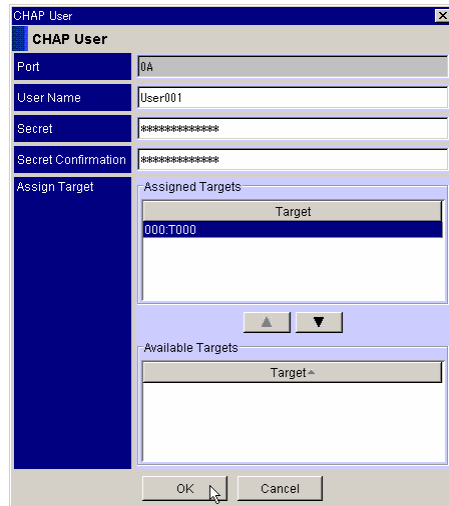


7.7.2 Changing the CHAP User

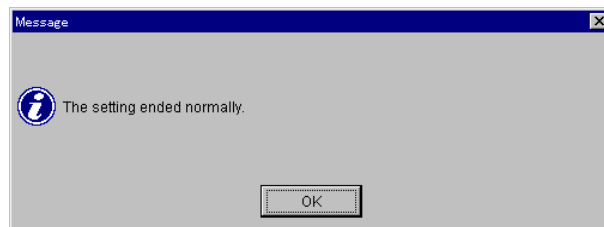
1. Click the **Logical Status** tab on the Unit screen.
2. Double-click the **Port** of which you want to change the CHAP User, and then select the **CHAP User**.
3. Select the **CHAP User** to be changed from the **CHAP User** list.
4. Select the **Modify** button.



The CHAP User dialog is displayed.

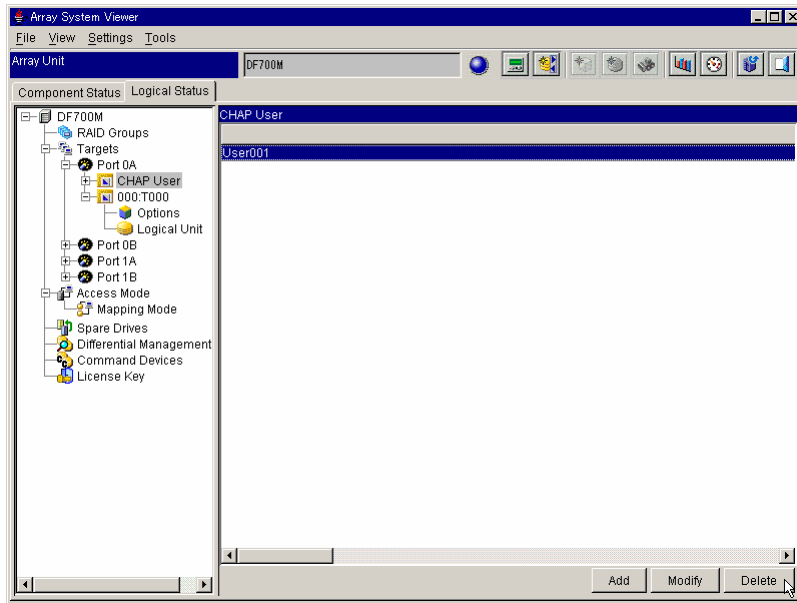


5. As necessary, enter the **User Name**, **Secret**, and **Secret Confirmation**.
6. As necessary, change the assigned Target, and then select the **OK** button.
7. The confirmation message is displayed. Select the **OK** button.

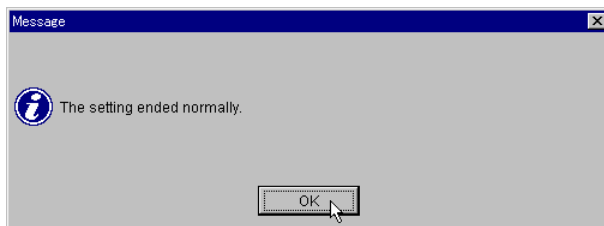
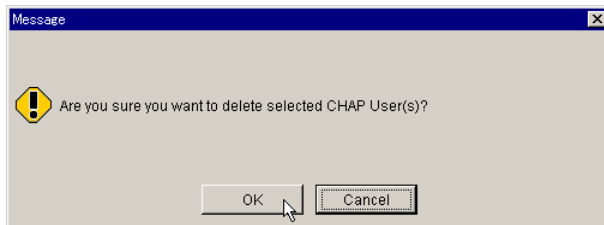


7.7.3 Deleting the CHAP User

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. Select the **Delete** button.

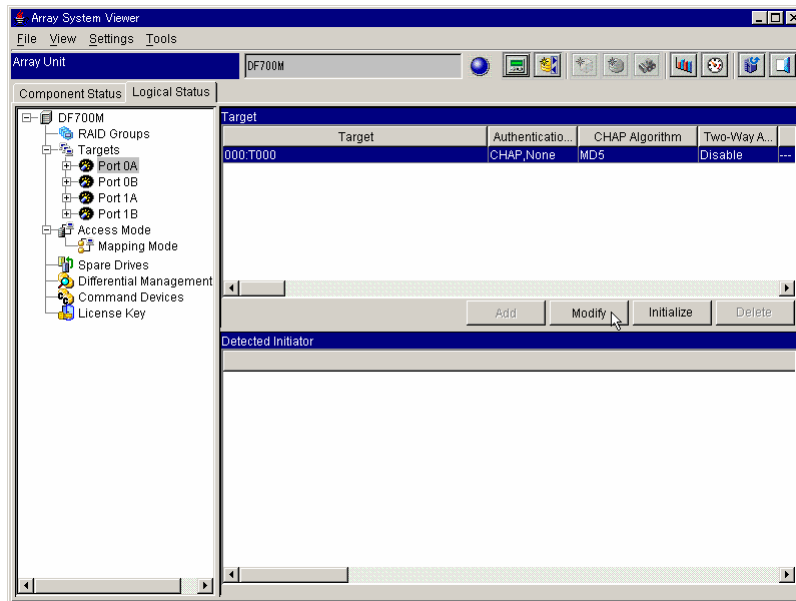


5. The confirmation message is displayed. Select the **OK** button.

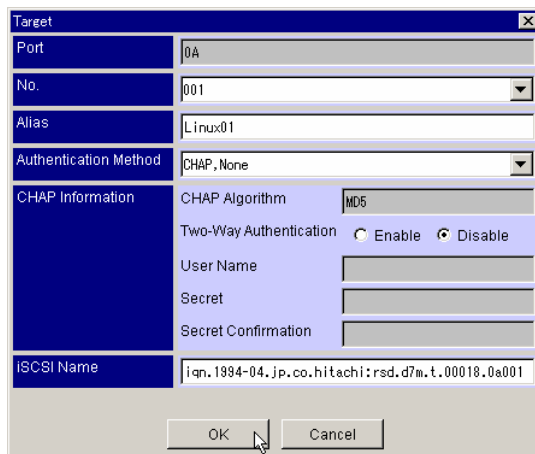


7.7.4 Changing Two-Way Authentication Information

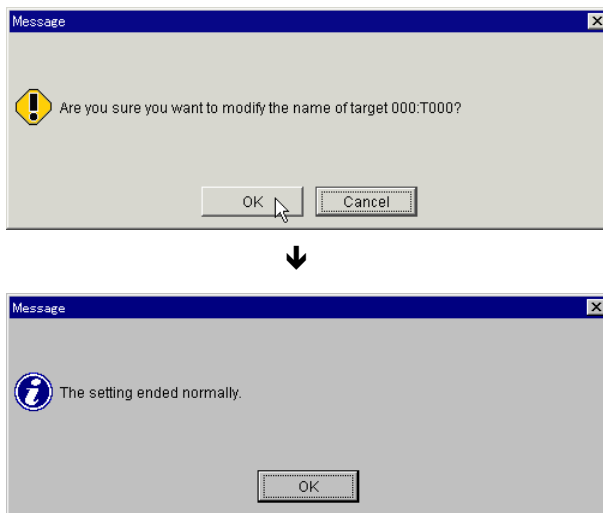
1. Click the **Logical Status** tab on the Unit screen.
2. Click the **Port**.
3. Select the **Target** to be changed about Two-Way Authentication from the **Target** list.
4. Select the **Modify** button.



The **Target** dialog is displayed.



5. In the **Target** dialog, 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))
 - **Secret:** Enter the Secret from 12 through 32 alphanumeric characters. The following symbols can be used. 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.
6. Select the **OK** button.
7. The confirmation message is displayed. Select the **OK** button.



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. 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 and 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:

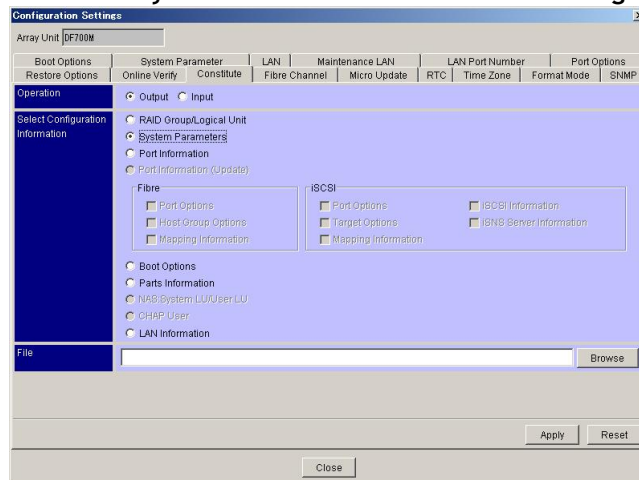
- System Parameter Information
- RAID Group/LU Information
- Port/Host Group Information

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:

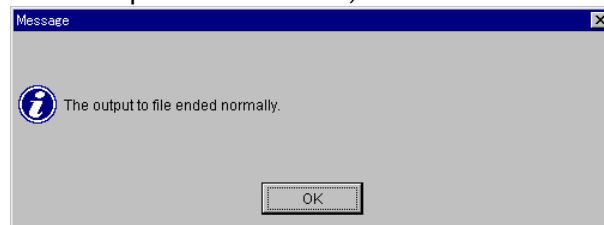
1. On the **Tools** menu, select **Configuration Settings** or click **Configuration Settings** button on the toolbar.
2. Click the **Constitute** tab.

Check the **System Parameters** in the **Select Configuration Information** box.



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

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

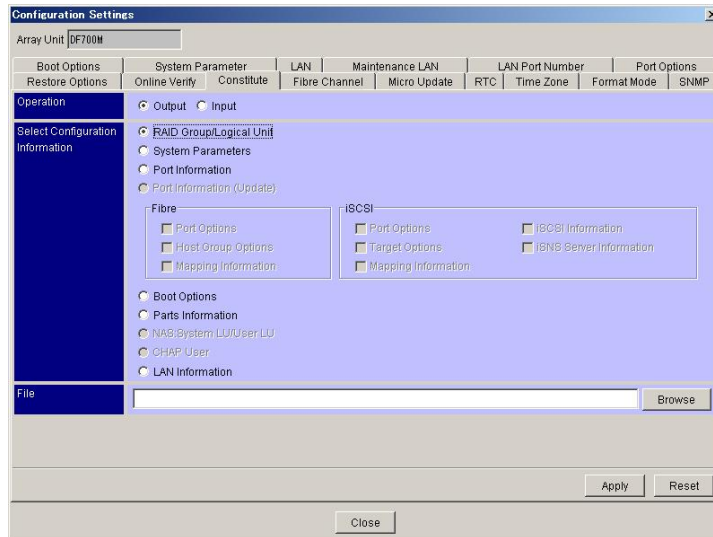


System parameter information is saved in the form of a text file with the specified file name.

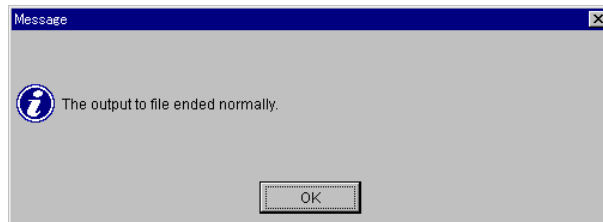
7.9.2 RAID Group/LU Information

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

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



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



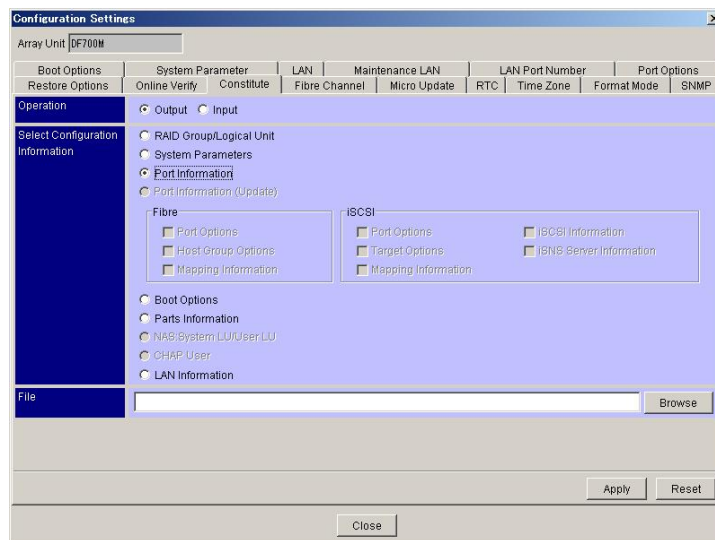
RAID group/LU information is saved in the form of a text file with the specified file name.

7.9.3 Port/Host Group Information

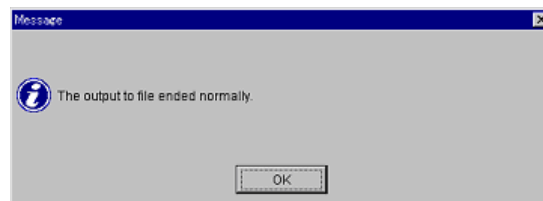
This setting is not required for the NAS system.

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** button on the toolbar.
2. Click the **Constitute** tab.
3. Check the **Port Information** radio button 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.



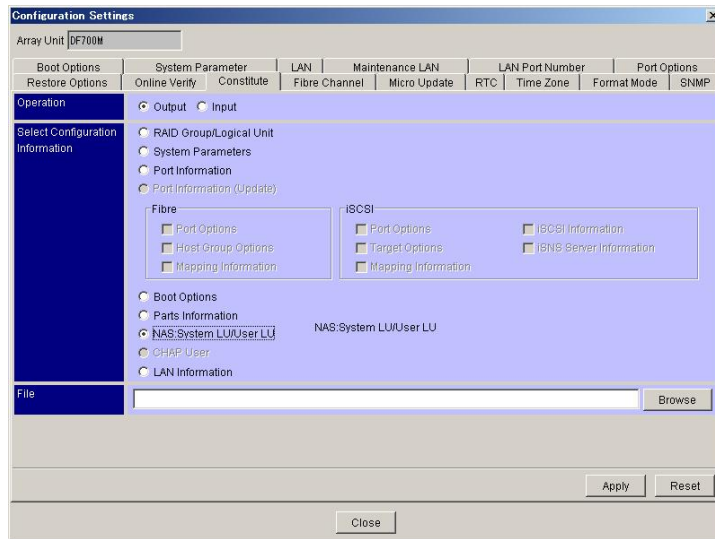
Port/Host group information is saved in the form of a text file with the specified file name.

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 the **Configuration Settings** button on the toolbar.
2. Click the **Constitute** tab.
3. Check the **NAS: System LU/User LU** in the **Select Configuration Information** box.



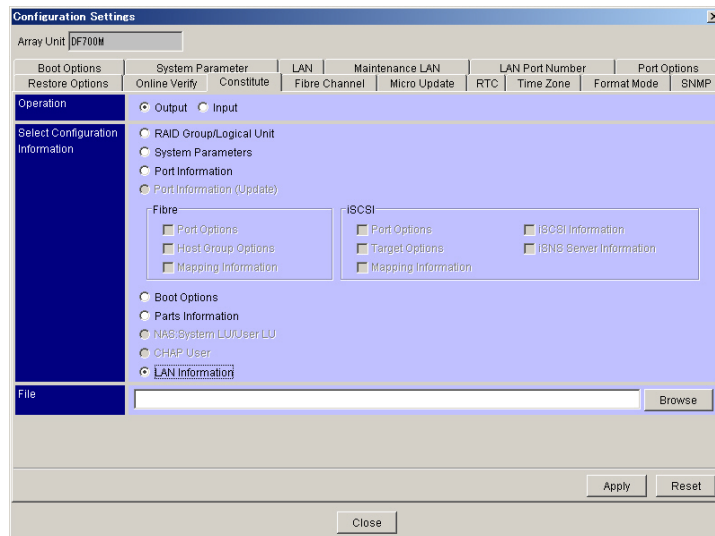
4. Click the **Browse** button, and specify the directory and file name to output the file of the configuration for the **File**.
5. Click the **Apply** button.
6. A message appears, confirming that the system parameter information is output with the specified file name. Click the **OK** button.

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

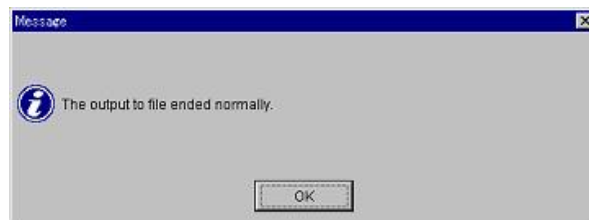
7.9.5 LAN information

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 another AMS500 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, 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 the **Configuration Settings** button on the toolbar.
3. Click the **Constitute** tab.
4. Click the **Input** radio button in the **Operation** box.
5. Click the **System Parameter** radio button in the **Select Configuration Information** box.
6. Click the **Browse** button, and specify the directory and file name of the file that describes the system parameters edited in 1. The specified file name will be shown in the textbox.
7. Click the **Apply** button.

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

7.10.2 RAID Group/Logical Unit



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 the **Configuration Settings** button on the toolbar.
3. Click the **Constitute** tab.
4. Click the **Input** radio button in the **Operation** box.
5. Click the **RAID Group/Logical Unit** radio button in the **Select Configuration Information** box.
6. Click the **Browse** button, and specify the directory and name of the file that describes the RAID group definition and logical unit definition edited in step 1. The specified file name will be shown in the textbox.
7. Click the **Apply** button.

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

7.10.3 Port/Host Group

This setting is not required for the NAS system.

1. On the **Tools** menu, select **Configuration Settings**, or click the **Configuration Settings** button 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 the **Browse** button, and specify the directory and name of the file to which the Port/Host Group information is input for the **File** box.
7. Click the **Apply** button.

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**

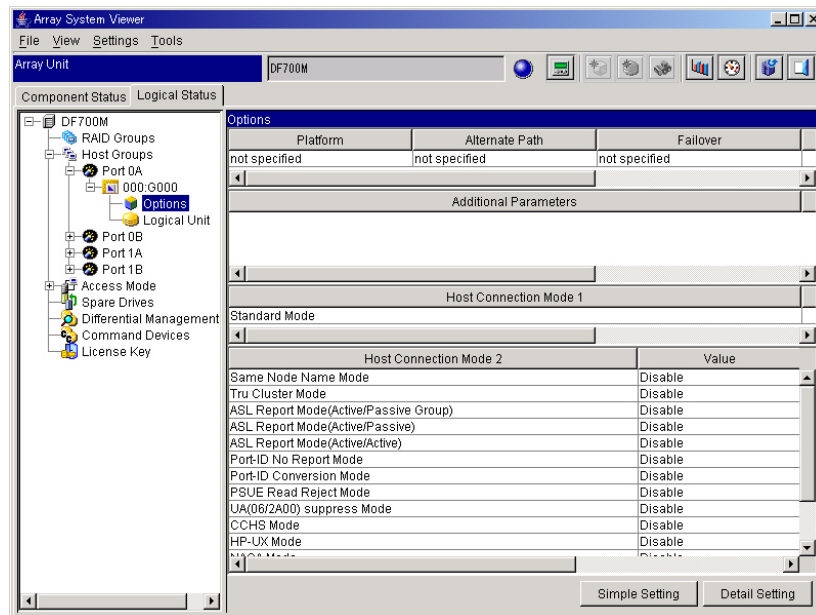
When using the detail setting, directly set the necessary host group options (host connection mode 1 and 2) in the same way as the conventional one.

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



4. Click the Simple Setting button.
5. The **Options (Simple)** dialog box is opened.

Select **Platform**, **Alternative Path**, and **Fail-Over** according to an environment of the host to be connected.

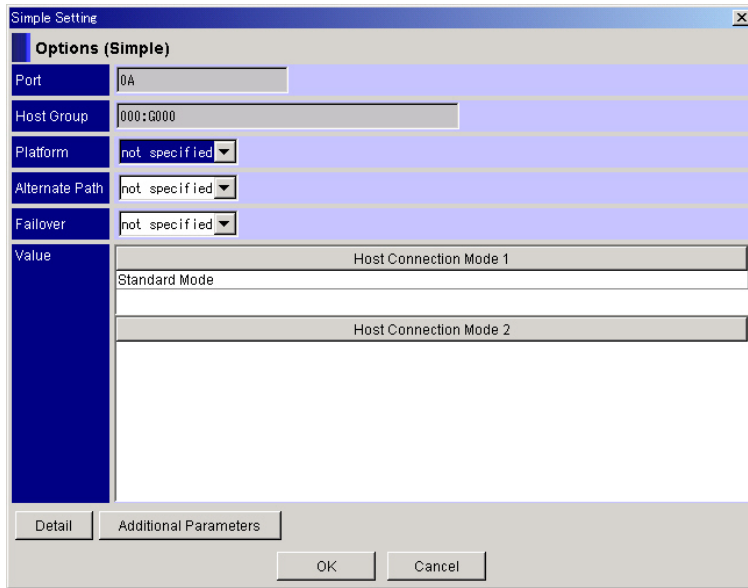


Figure 7-10 Options (Simple) Dialog Box

Table 7.2 Simple Setting Item List

No.	Menu Item	Description		Factory Setting
		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		

- Click the **Additional Parameters** button. The Additional Parameters Property is opened. Select the **Item** as occasion demands, and click the **OK** button. (The screen returns to Figure 7-10)

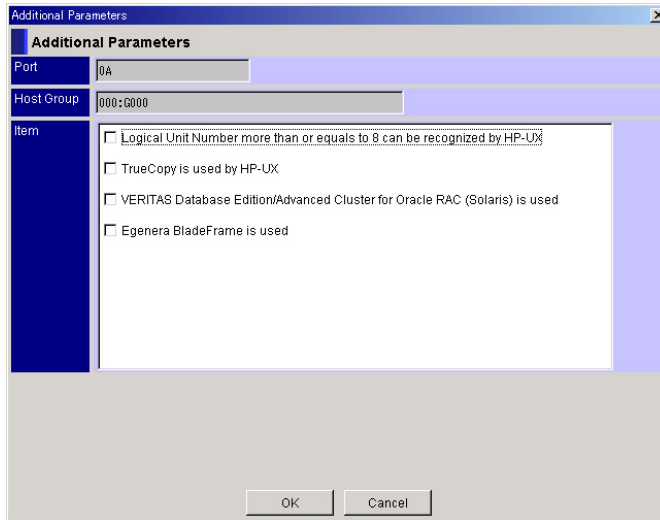


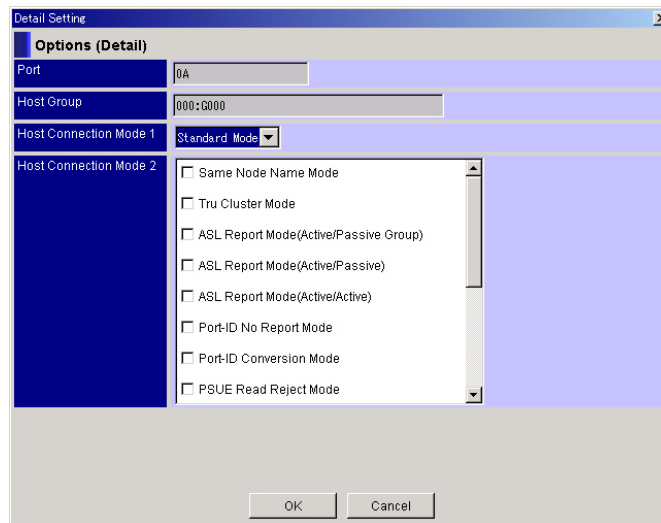
Figure 7-11 Additional Parameters Property

Table 7.3 List of Additional Parameter Setting Items

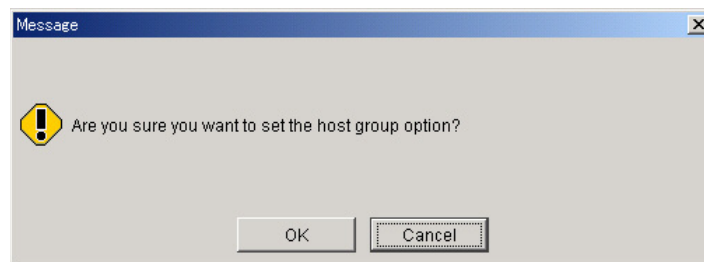
No.	Menu Item	Description		Factory Setting
		Parameters	Selection Method	
1	Additional Parameter	Logical Unit Numbers more than or equal to 8 can be recognized by HP-UX	Selection	Not selected
		TrueCopy (Note) is used by HP-UX	Selection	Not selected
		VERITAS® Database Edition/Advanced Cluster for Oracle®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

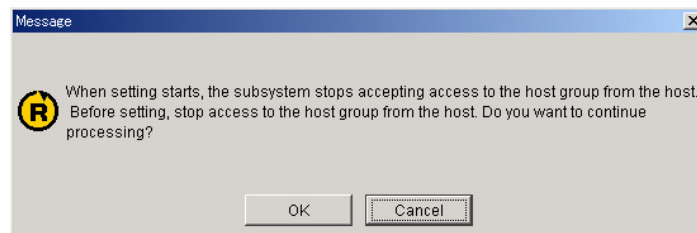
Click the **Detail** button as needed. Select **Host Connection Mode 1** and **Host Connection Mode 2**, and click the **OK** button. (The screen returns to Figure 7-10.)



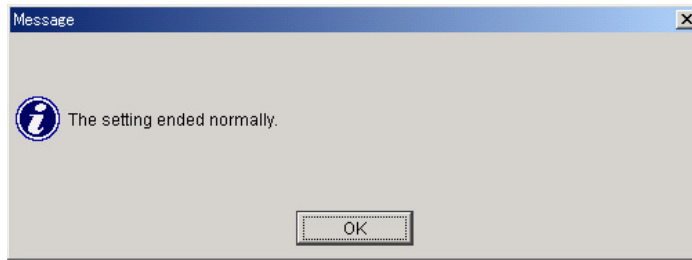
7. Click the **OK** button in the **Option (Simple)** dialog box.
8. A confirmation message appears. Click the **OK** button.



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

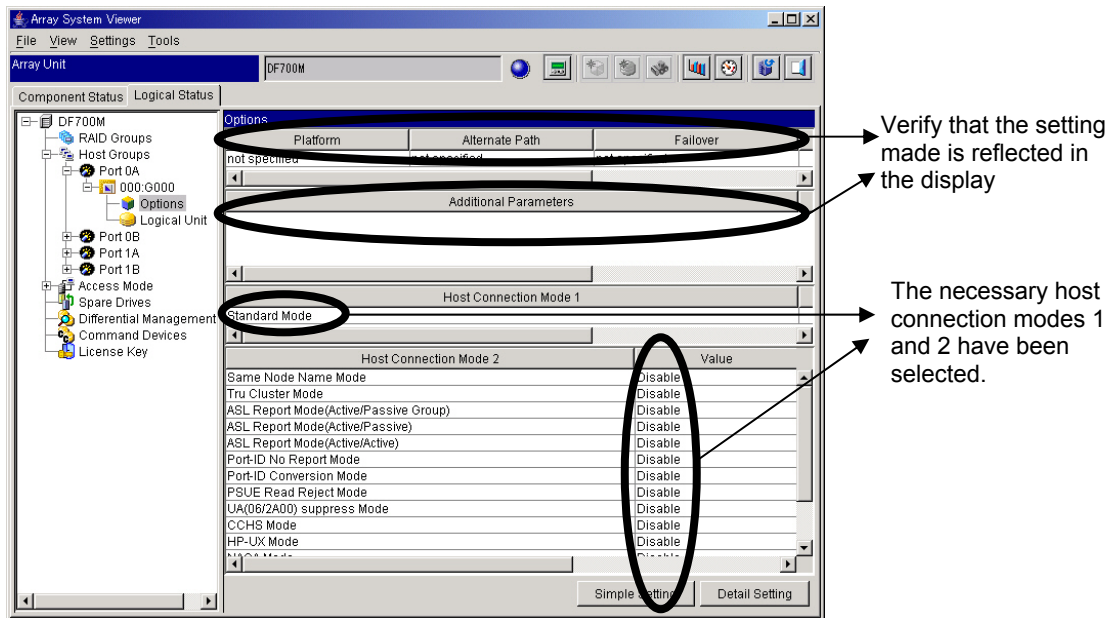


10. A message appears, stating that the setting is complete. Click the **OK** button.



11. The setting is displayed.

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.

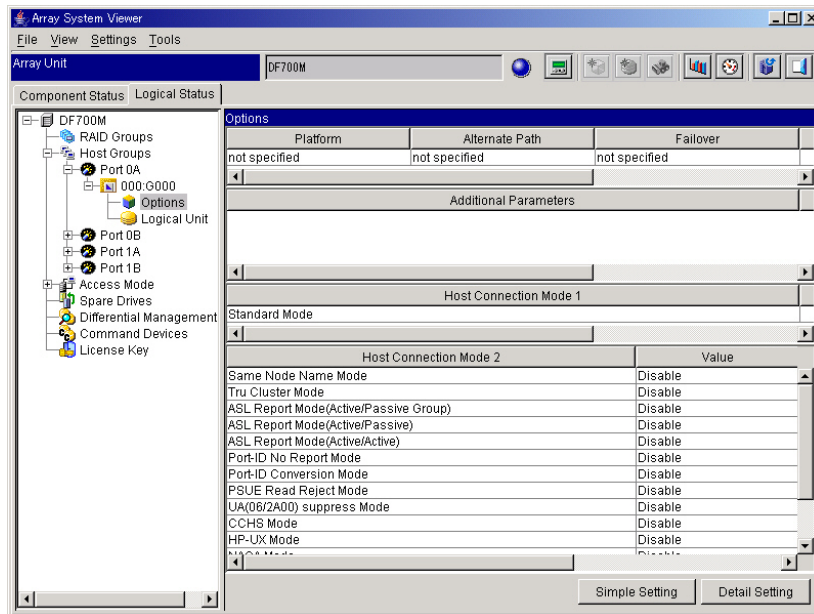
The following describes the procedure for setting a subsystem offline when the host group option setting is required for a combination that simple setting does not have.

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 the **Detail Setting** button.



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.

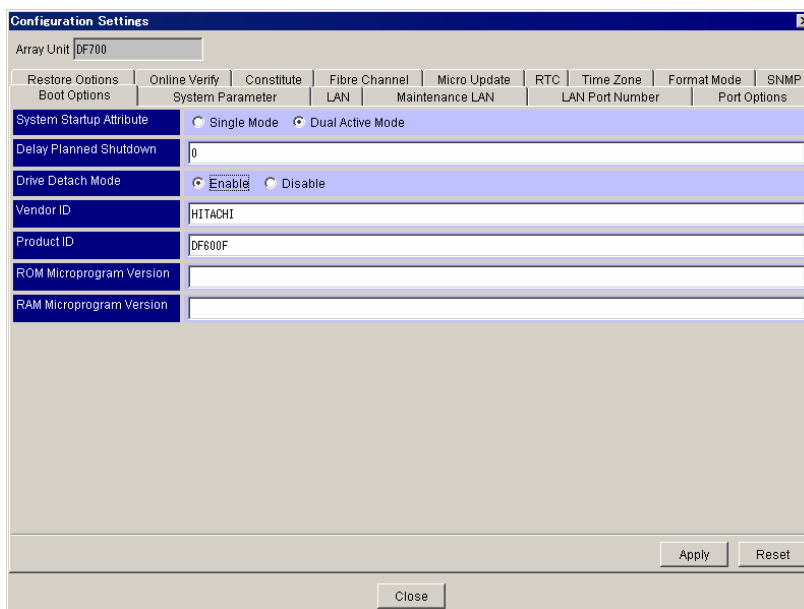
Note: If the subsystem is configured when the disk array subsystem is used as the remote side of TrueCopy Remote Replication/TrueCopy Extended Distance, the following occurs:

- 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 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.

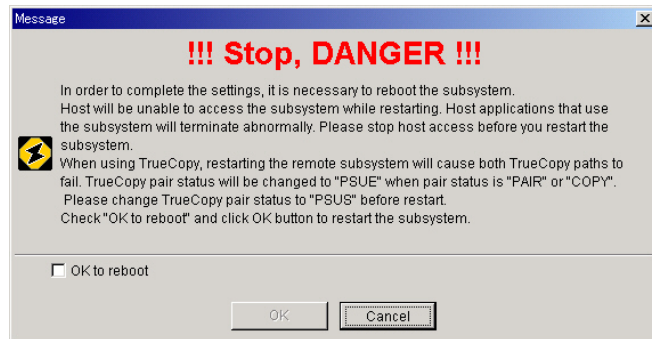
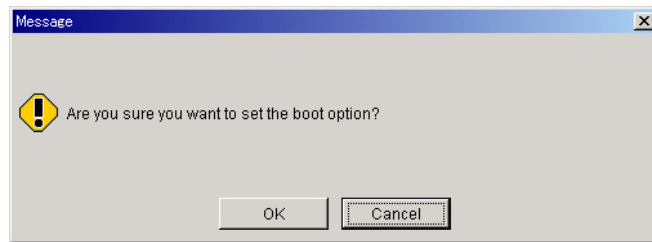
When the disk array subsystem must be configured, transmit the pair status of TrueCopy Remote Replication/TrueCopy Extended Distance to PSUS, and then configure the subsystem.

Note: If the 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.

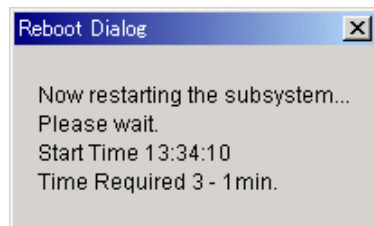
1. On the **Tools** menu, select **Configuration Settings**. Or, click the **Configuration Settings** button in the tool bar.
2. Click the **Boot Option** tab.
3. For the **Drive Detach Mode**, select the **Enable** radio button.



4. Click the **Apply** button.
5. A confirmation message appears. Click the **OK** button.



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

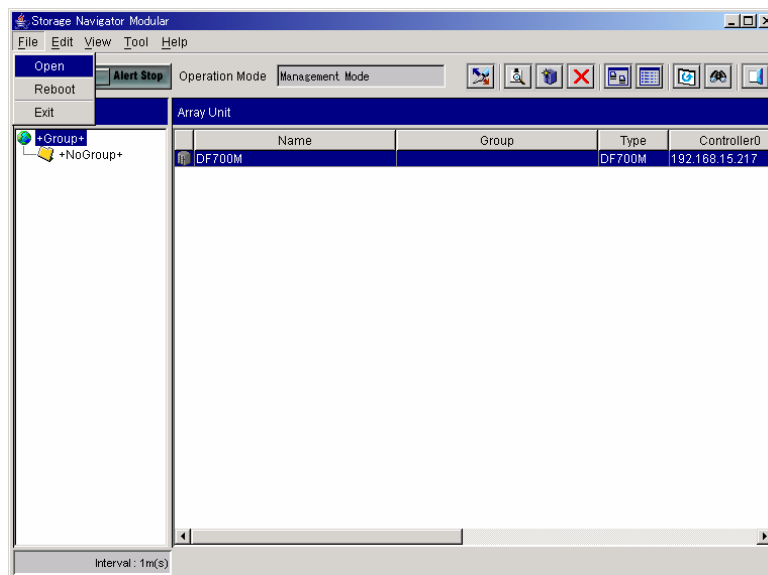
Set a network parameter from the Storage Navigator-Modular.

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.)

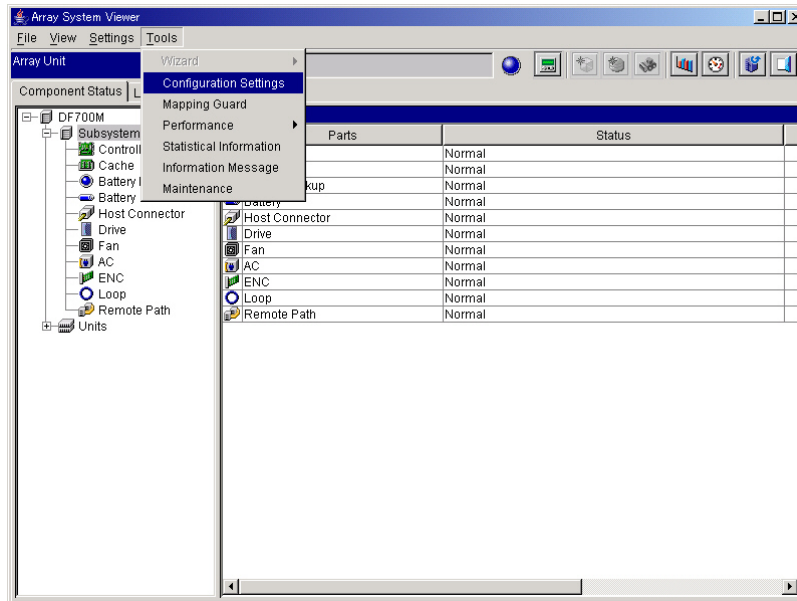
Note: When the LAN access such as the Storage Navigator Modular, WEB and SNMP is provided for the user-managed port of the control unit to be set, the LAN setting cannot be performed.

Perform the LAN setting after stopping the LAN access to the user-managed port to be set.

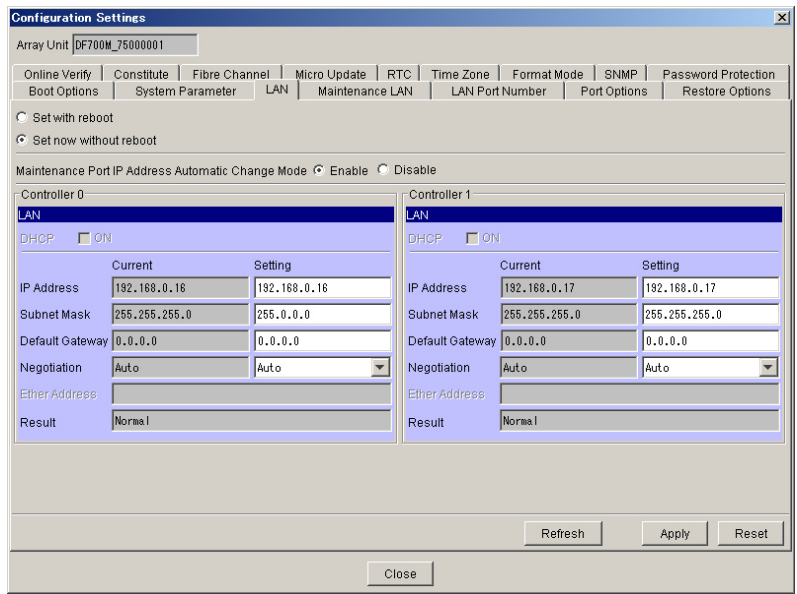
1. Turn on the power supply.
2. Start the Storage Navigator Modular and set the operation mode in the Management Mode (Refer to the Storage Navigator Modular (for GUI) User's Guide).
3. Click the icon of an array unit on the Main window and select the File menu. Click the Open or click the Display Details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



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



- 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. 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.

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 the IP address of user management port as follows. If the maintenance port is used, change the IP address of maintenance port 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

For the 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 when the IP process is changed, the IP address of maintenance port may be set temporarily. Verify that the 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.

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.

Note3: 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

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

If the connection does not occur 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 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 the Refresh button again to refresh the display.

		<p>When the "---" is displayed no matter how many times the update is repeated, make the setting again.</p> <p>If the same information is displayed in spite of the above operation, contact the maintenance personnel.</p>
2	Setting in progress	<p>The setting is being changed.</p> <p>Wait for about 5 minutes, and then press the Refresh button again to refresh the display.</p> <p>If the same information is displayed no matter how many times the update is repeated, contact the maintenance personnel.</p>
3	Abnormal (Time-out of the waiting for the connection)	<p>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.</p> <p>In cases other than the above case, make the setting again.</p> <p>If the same information is displayed in spite of the above operation, contact the maintenance personnel.</p>
4	Abnormal (Occurrence of a DF internal failure.)	<p>The setting could not be changed because the processing could not continue inside the subsystem.</p> <p>When a failure occurs in the subsystem, contact the maintenance personnel.</p> <p>When no failure occurs in the subsystem, make the setting again.</p> <p>If the same information is displayed in spite of the above operation, contact the maintenance personnel.</p>

When the **Apply** button is clicked although there is the 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.

```

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

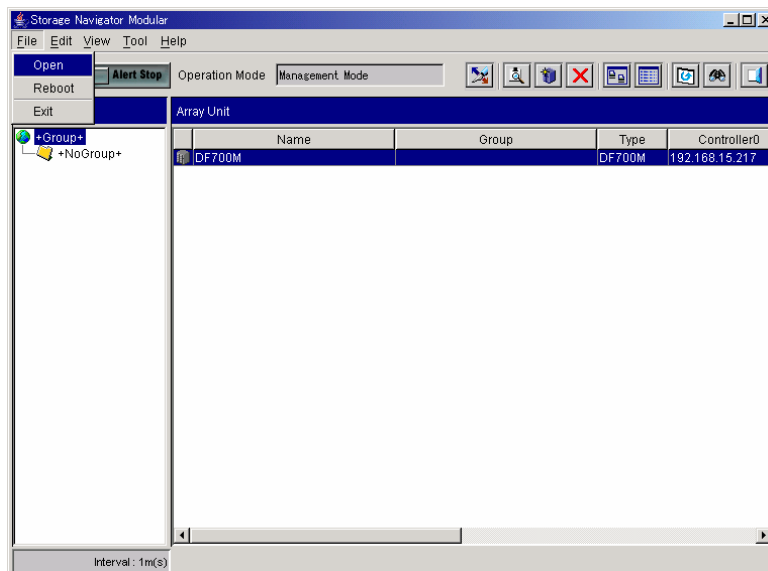
- 0:CLOSE : There are no connections
- 2:SYN_SENT : Waiting for reply of connection request
- 3:SYN_RCVD : Waiting for confirmation of connection reply
- 4:ESTABLISHED : Establishing connection
- 5:CLOSE_WAIT : Waiting for request of connection termination from application
- 6:FIN_WAIT_1 : Waiting for 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

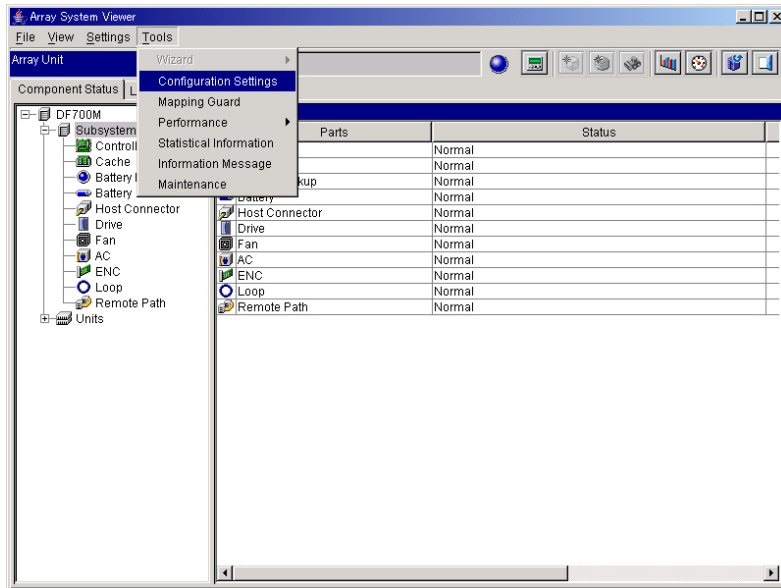
The auto diagnosis threshold for Fibre Channel loop on the drive side of the subsystem can be changed to any number within a range from 1 to 255. The default value is "10". However, this threshold is not normally changed.

This operation is performed using Storage Navigator-Modular.

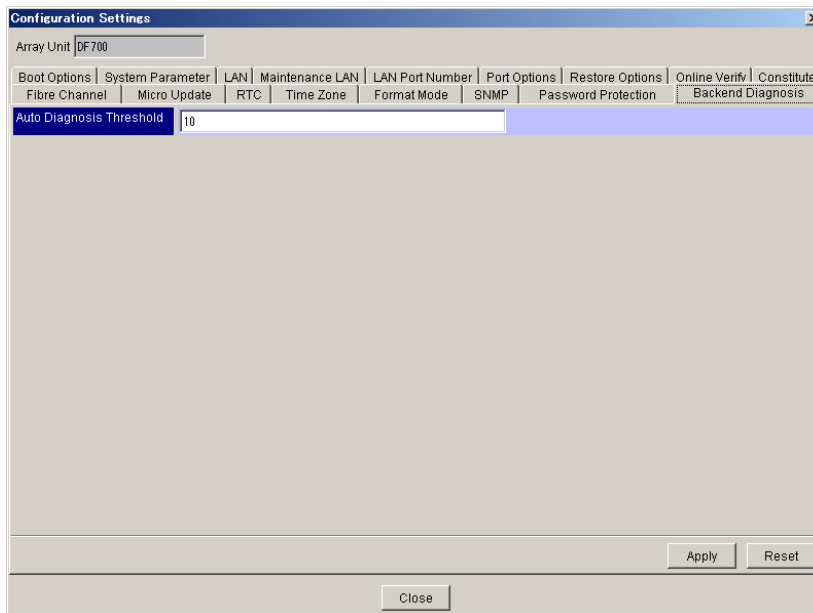
1. Turn on the power supply.
2. Start the Storage Navigator Modular and set the operation mode in **Management Mode**. Refer to the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User's Guide (MK-95DF711)*.
3. Click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



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

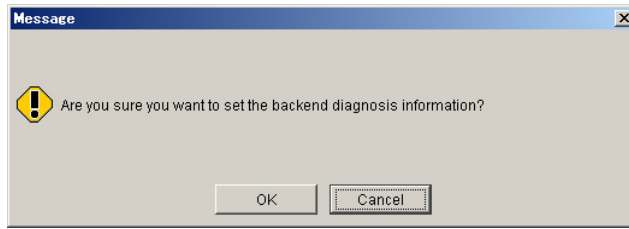


5. Click the **Backend Diagnosis** tab on the **Parameter** screen.

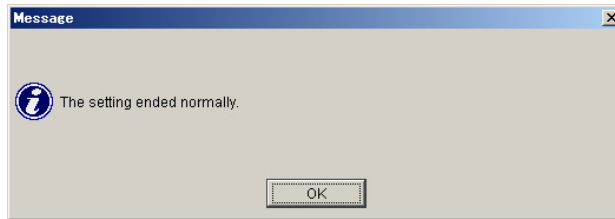


6. Set the **Auto Diagnosis Threshold** within a range from 1 to 255.
7. After completing the above settings, click **Apply**.

A confirmation message appears. Click **OK**.



8. A message indicating the completion of changing the Auto Diagnosis Threshold is displayed. Click the **OK** button.



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

7.15 Changing the Maintenance Port IP Address

This operation is performed using the Storage Navigator Modular.

Note: 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 needed.

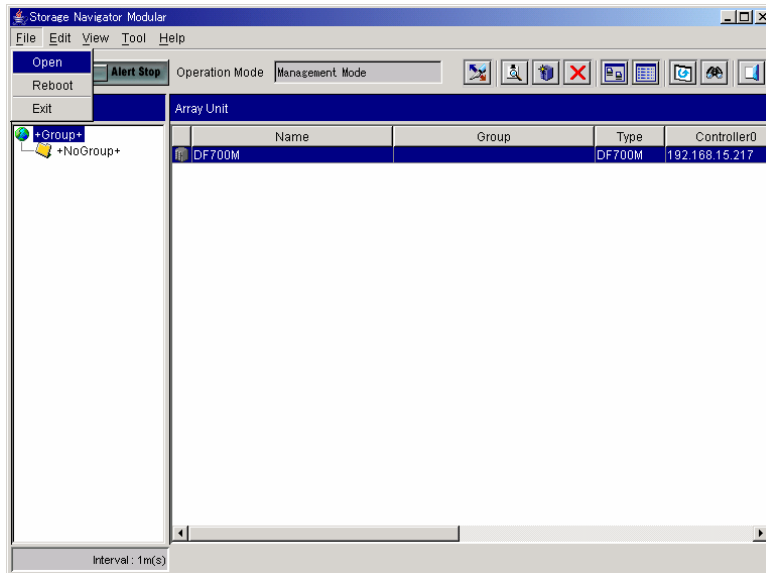
Note: If the user management port is incorrectly set, the setting of maintenance port will fail, and an error may be displayed. Set the value of user management port according to error message. (Refer to section 7.13.)

Note: 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.)

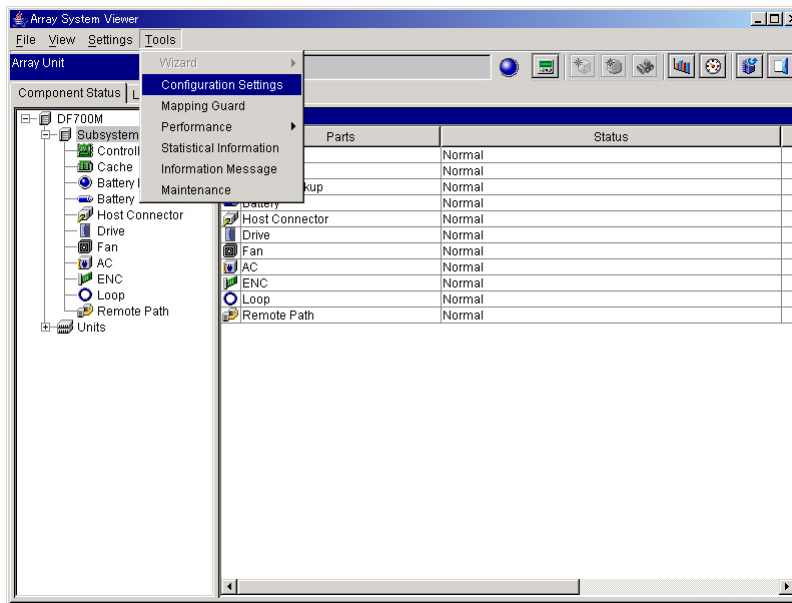
To change the IP address for the maintenance port, follow these steps:

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).

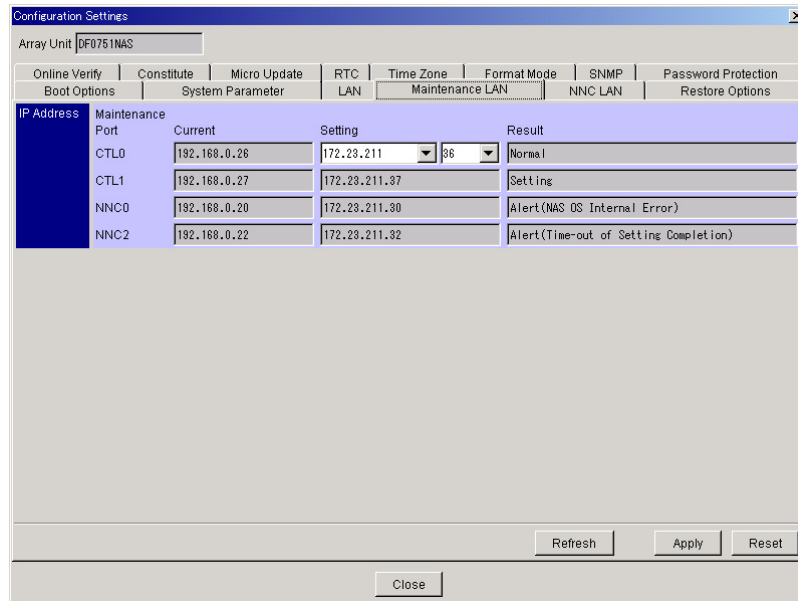
- Click the icon of an array unit on the Main window, and then select the **File** menu. Click **Open**. Alternatively, click the **Display Details** button in the tool bar.



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



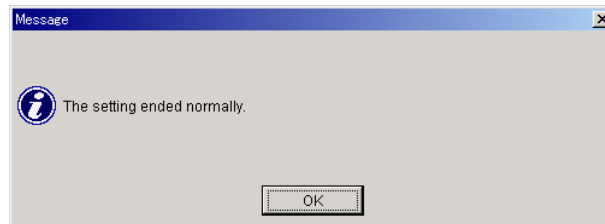
- Click the **Maintenance LAN** tab on the **Configuration Settings** screen.



- 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. When the network parameter of the maintenance port, the user-managed port or the NNC management port is changed, the setting of the user-managed port network parameter cannot be changed. An error occurs when **Apply** is clicked on the **Parameter** screen during the setting change.

- Click the **Apply** button on the **Configuration Settings** screen after the setting is completed.
- A confirmation message appears, click the **OK** button.



- When all the **Current** values are the same as the set value on the **Configuration Settings** screen, and the **Normal** is displayed on the **Result**, the setting is completed. If the **Setting** is displayed 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 2.2 Fixing AMS500 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 Capacity Restriction of System LU

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)

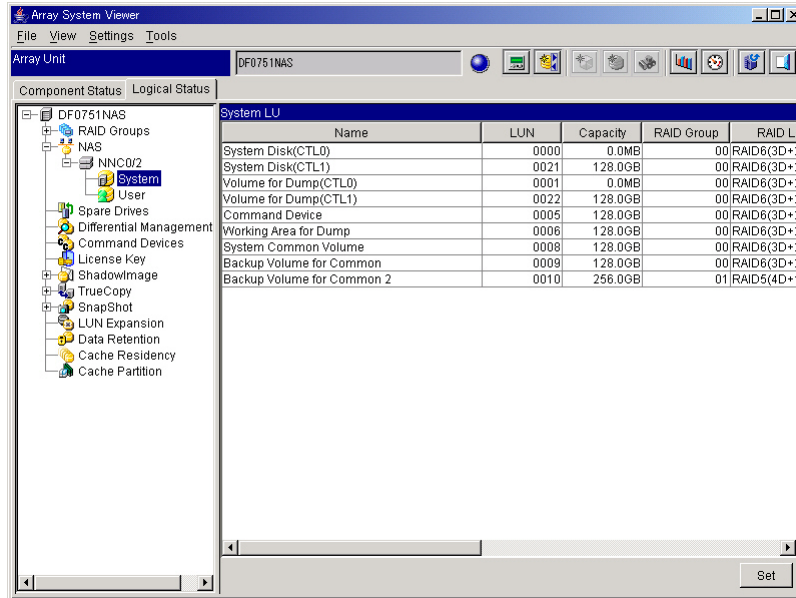
Note: ShadowImage In-System Replication Copy-on-write SnapShot, TrueCopy Remote Replication, TrueCopy Extended Distance, and Backup Restore are required.

7.16.1 Setting the System LU

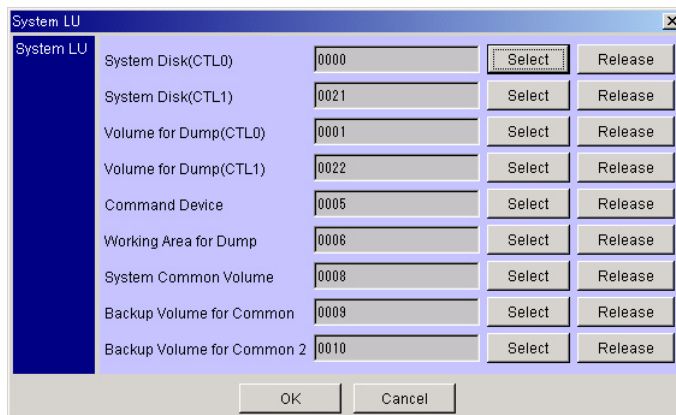
To set the System LU:

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

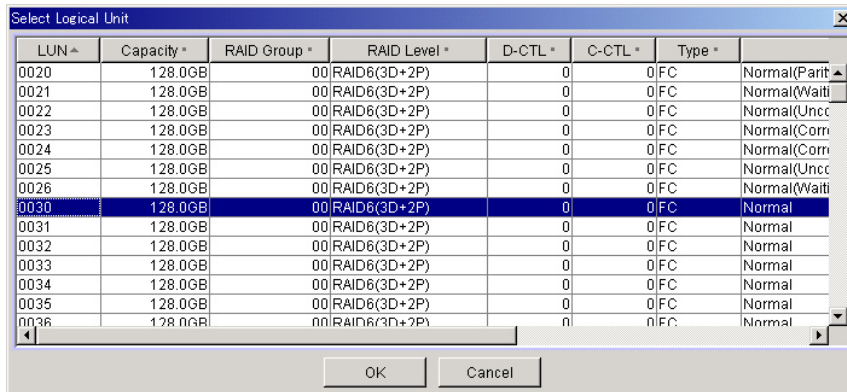
Display the **System** and **User** by double-clicking the **NNC0/2**, and select the **System**. A list of system LU is displayed.



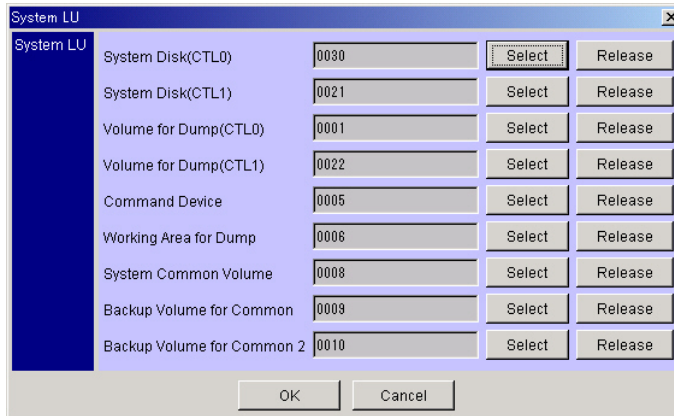
3. Click the **Set** button in the lower right portion of the screen. The **System LU** dialog box is displayed.
4. Click the **Select** button for the system LU that you want to set. The **Select Logical Unit** dialog box is displayed.



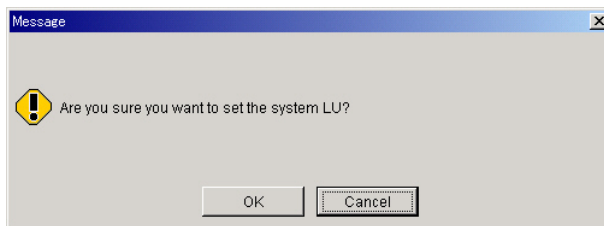
5. Select the LUNs to be assigned, click the **OK** button.



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



7. A confirmation message appears, click the **OK** button.



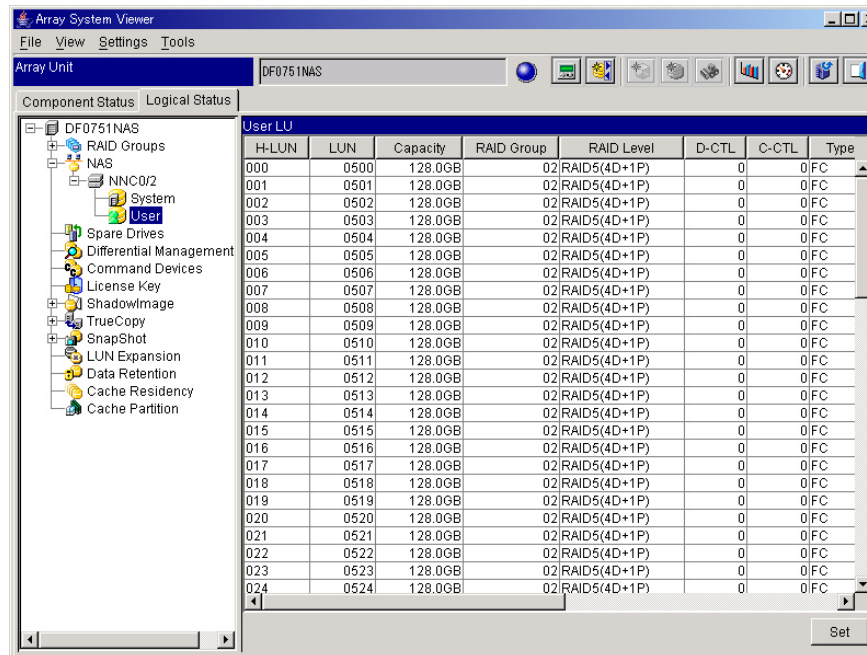
7.16.2 Setting User LU

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:

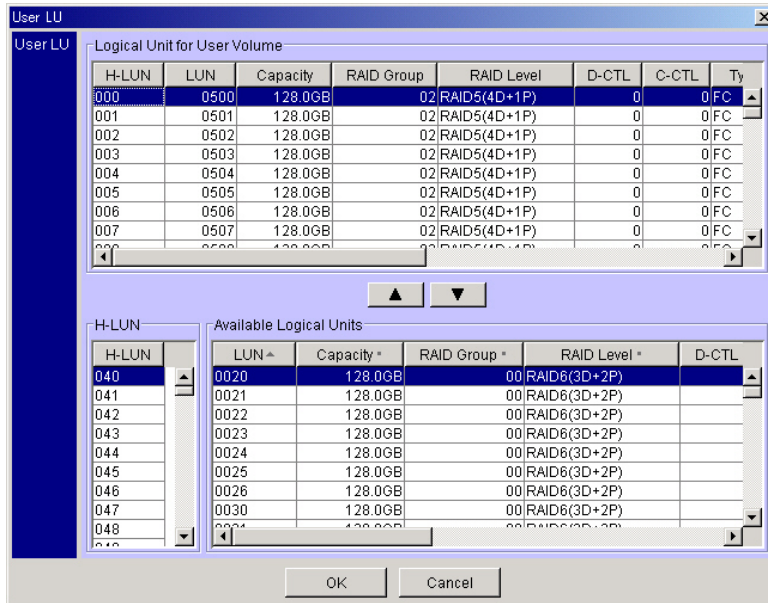
1. On the Unit screen, click the **Logical Status** tab.
2. Display the **NNC0/2** by double-clicking the **NAS**.
3. Display the **System** and **User** by double-clicking the **NNC0/2**, and select the **User**.

A list of system LU is displayed.



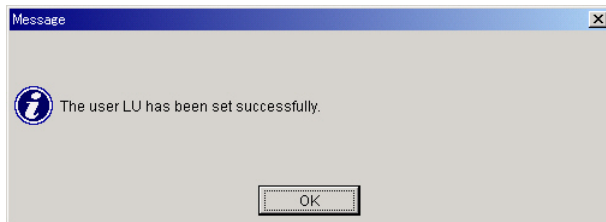
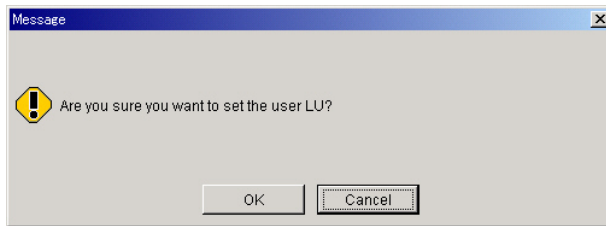
4. Click the **Set** button in the lower right portion of the screen.
The **User LU** dialog box is displayed.

5. 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  button.



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

6. Repeat step 4 until all the LUNs that you want to assign are moved to the **Logical Unit for User Volume**, click the **OK** button.
7. A confirmation message appears, click the **OK** button.



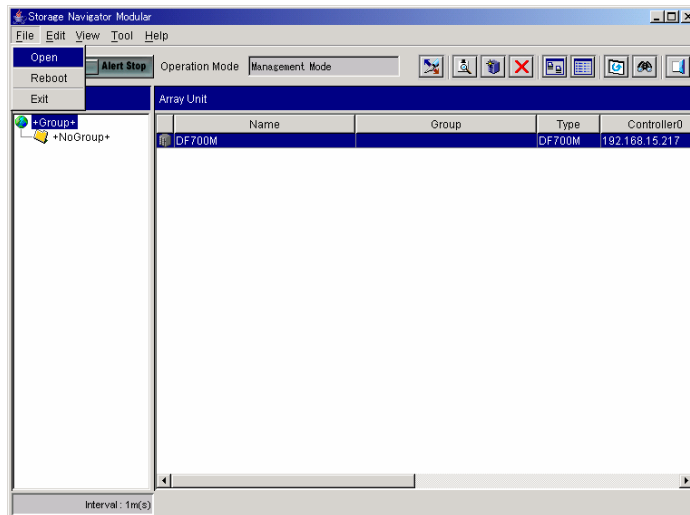
7.17 Setting NNC Management LAN Port Information in NAS System

This operation is performed using the Storage Navigator Modular.

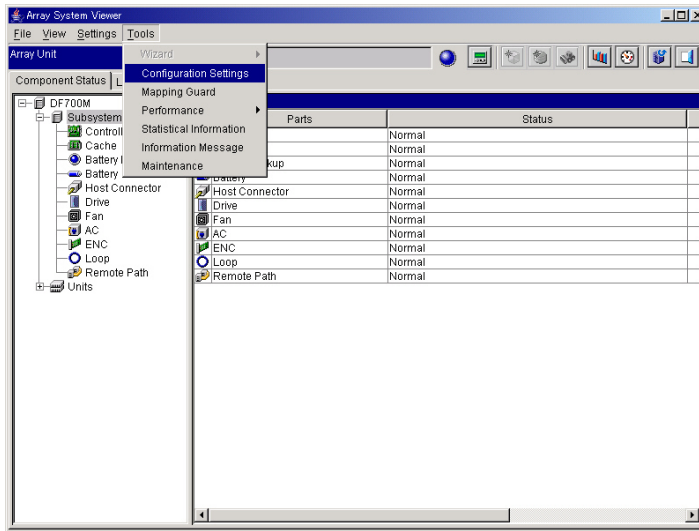
To set the NNC management port in the network, follow these steps:

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

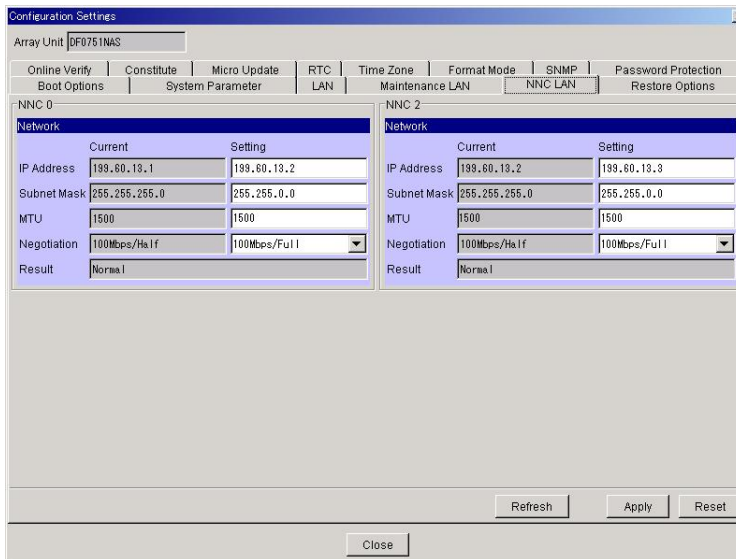
1. Turn on the power supply.
2. When the node in the cluster is "ACTIVE", stop the cluster, and make the cluster "INACTIVE".
3. Start the Storage Navigator Modular and set the operation mode in the **Management Mode** (Refer to the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular 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 the **Display Details** button 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.



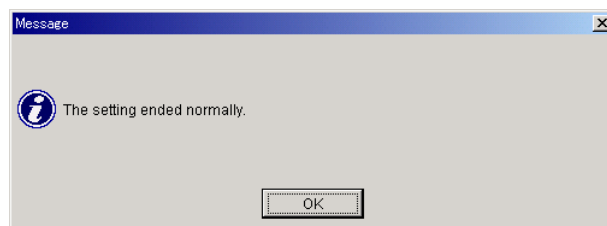
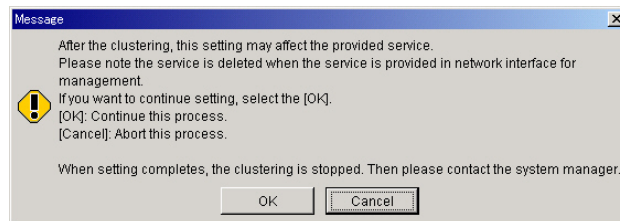
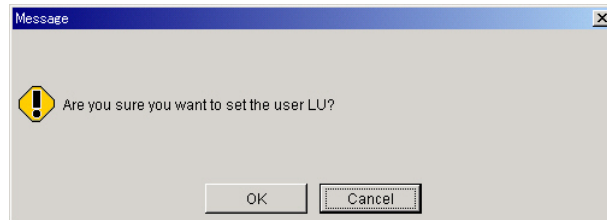
7. Set the **LAN Information**.

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

9. A confirmation message appears, click the **OK** button.



- When all the **Current** values are the same as the set value on the **Configuration Settings** screen, and the **Normal** is displayed on the **Result**, the setting is completed.

If the **Setting** is displayed 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 2.3 Fixing AMS500 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.

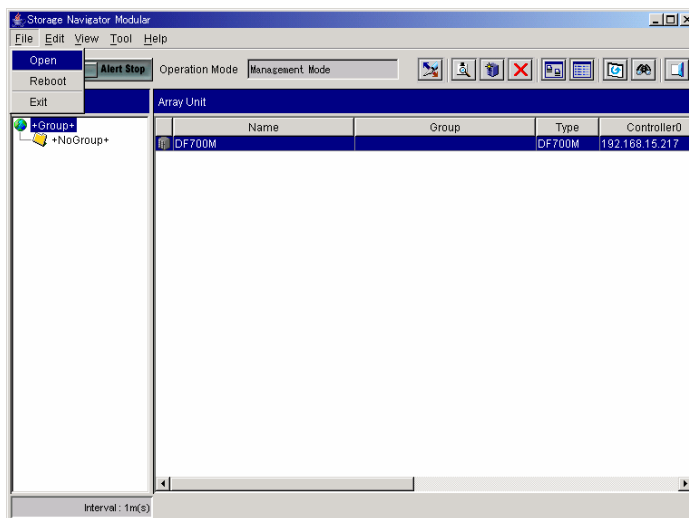
7.18 Setting Time Zone

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:

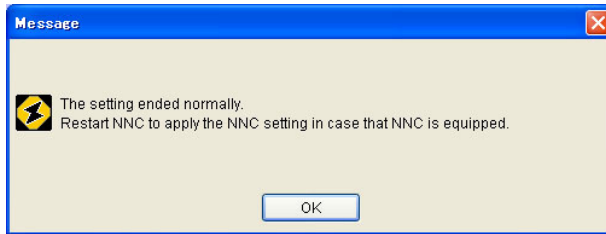
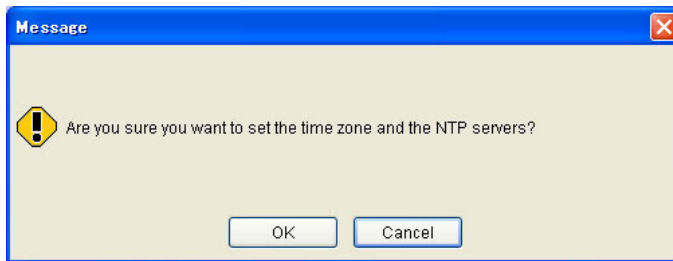
- Turn on the power supply.
- Start the Storage Navigator Modular and set the operation mode in **Management Mode**. Refer to the *Hitachi TagmaStore® Adaptable Modular Storage and Workgroup Modular Storage Storage Navigator Modular Graphical User Interface (GUI) User's Guide (MK-95DF711)*.
- Click the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



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

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

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



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 AMS500 can be connected with the Thunder 9500V FC additional unit (DF600-RKA). To add the DF600-RKA to the TagmaStore AMS500, order the addition support kit (type name: DF-F700-K1BUP).

The disk drives of the DF600-RKA in 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. However, this setting does not apply to 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:

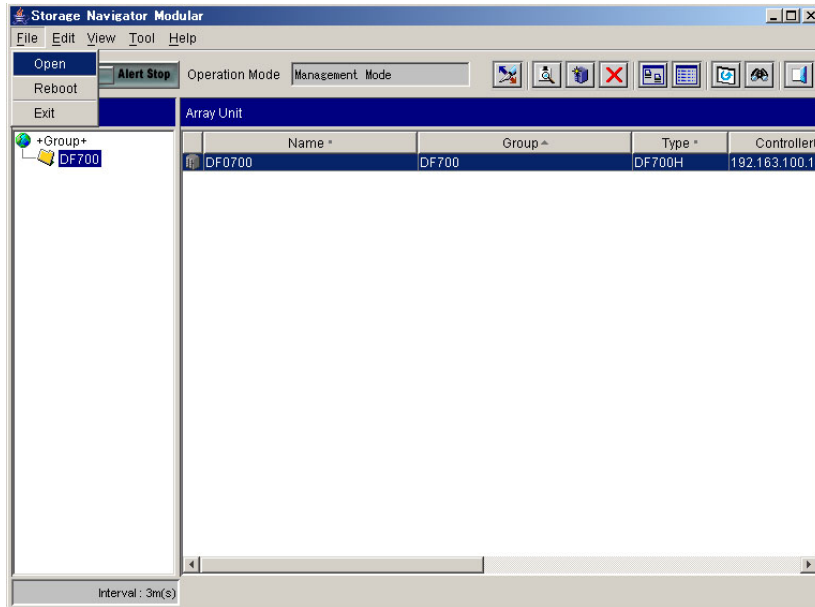
- I/O performance
- copy system function of the options (ShadowImage in-system replication, etc.)
- the format performance,
- disk drive restoration performance have no problems.

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.

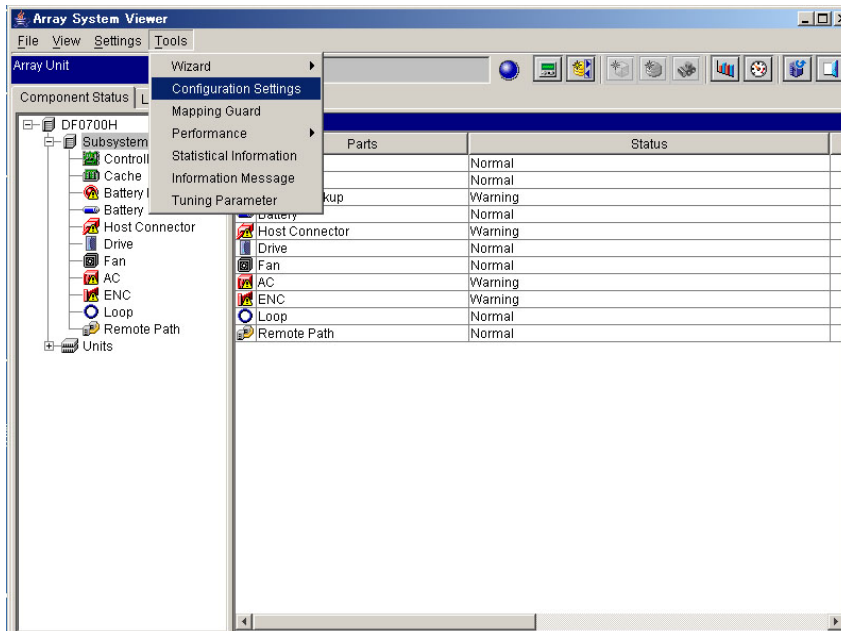
Note 2: When the dynamic sparing or the correction copy that was a result of disk drive blockage is completed, if the capacity of the data disk drive and the spare disk drive which recovered the data are the same, even if the failed disk drive is replaced, the copy backless does not operates because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

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

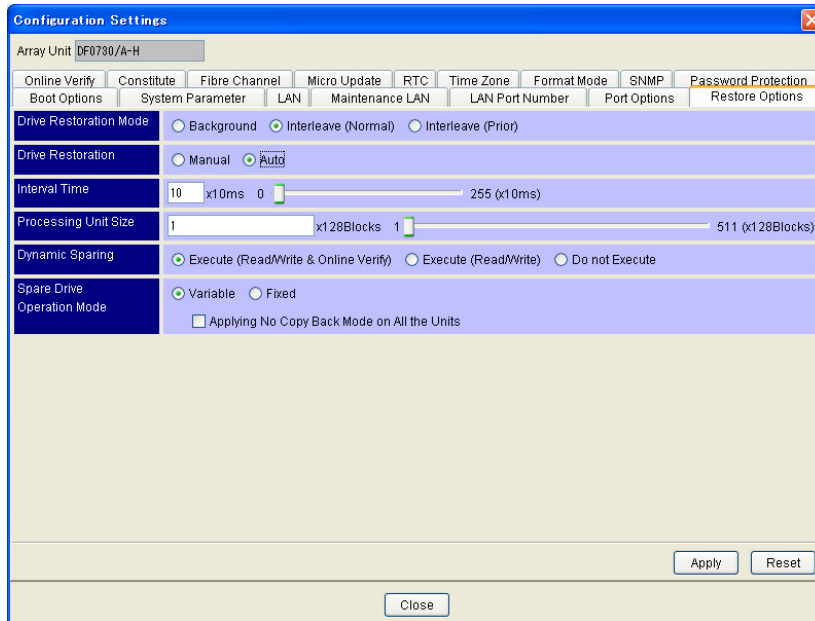
1. Turn on the power supply.
2. Start the Storage Navigator Modular and set the operation mode in the **Management Mode** (Refer to the **Storage Navigator Modular (for GUI) User's Guide**)
3. Click the icon of an array unit on the Main window and select the **File** menu. Click the **Open** or click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



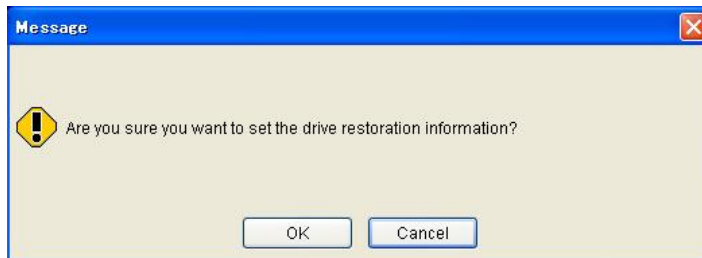
4. On the **Tools** menu, click **Configuration Settings** or click the **Configuration Settings** button on the toolbar.



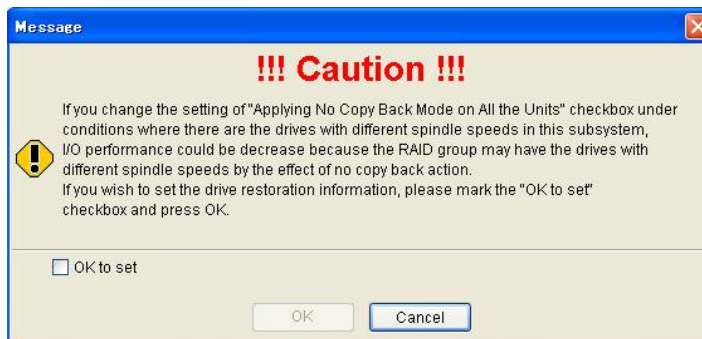
5. Click the **Restore Options** tab.



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 problem, and according to the message, 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 Network Side in the 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.

Sections		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 Network Side in the 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 RKM turned on?
Yes: Go to step 11.
No: Power-on the host computer.
3. Has the POWER LED on the RKM turned on?
Yes: Go to step 11.
No: Set the main switch to off; set the AC power unit switch 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 RKM 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. Has the READY LED on the RKM (and RKNAS) 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: 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?
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. Verify that the AC cable is correctly connected to the plug socket.
3. Set the main switch to off, then set all the AC power unit switches to off.
4. After waiting for more than one minute, set all the AC power unit switches to on, then set the main switch to on.
5. Has the POWER LED on the RKM turned on?

Yes: Go to step 7.

No: Set the main switch to off, then set the AC power unit switch to off.

6. Call your Customer Engineer. Go to step 9.
7. Has the READY LED on the RKM 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.**

8. 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 9.

9. 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 RKM 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 RKM on?

Yes: Refer to **ALARM LED Has Turned on.**

No: Go to step 3.

3. Is the RKNAS connected?

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 5.

No:

- If the POWER LED on the RKNAS is not on, go to step 4 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 READY LED (green) on the RKM blink at high speed?

Yes: Wait for up to 30 to 50 minutes until the READY LED (green) on the RKM lights because the automatic download of the ENC/SENC firmware is executed. Even when the READY LED (green) blinks, the subsystem is operational.

No:

- If your AMS500 is configured with dual controllers, go to step 6.
- If your AMS500 is configured with single controller, go to step 7.

6. In dual controller configuration, does the WARNING LED (orange) blink at high speed?

Yes: Wait until the WARNING LED (orange) on the RKM is off, and the READY LED (green) on the RKM lights because the update of the flash program is executed.

No: Go to step 8.

7. In single controller configuration, does the WARNING LED (orange) on the RKM blink at high speed?

Yes: Wait until the WARNING LED (orange) on the RKM is off, and the READY LED (green) on the RKM lights because the update of the flash program or the automatic download of the ENC/SENC firmware at the time of powering-on is executed. When the automatic download of the ENC/SENC is in operation, the WARNING LED (orange) blinks for up to 30 to 85 minutes, and then the READY LED (green) lights.

No: Go to step 8.

8. Turn off the main switch.
9. After waiting for more than one minute, set the AC power unit switch to on, then set the main switch to on.
10. Has the READY LED on the RKM turned on?
Yes: Continue to use the equipment in its current operational state. When the READY LED (green) on the RKM blinks continuously, the download of the ENC/SENC firmware is executed. The subsystem is operational even though the READY LED (green) on the RKM is blinking.
Go to step 15.
No: Go to step 11.
11. Set the main switch to off, then set the AC power unit switch to off.
12. Is the RKINAS connected?
Yes: Go to step 13.
No: Go to step 14.
13. Is the READY LED on the RKNAS on?
Yes: Go to step 15.
No: Set the AC power unit switch of the RKNAS to off.
14. Call your Customer Engineer.
15. 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 components whose LEDs indicate their respective failures.
2. Set the main switch to off, then set the AC power unit switch to off.
3. Call your Customer Engineer and do not disturb the equipment.

8.1.5 Warning LED has Turned On or Blinks

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

1. Is your AMS500 configured with dual controllers?
Yes: Go to step 2.
No: Go to step 3.
2. In dual controller configuration, does the WARNING LED (orange) blink at high speed?
Yes: Wait until the WARNING LED (orange) on the RKM is off and the READY LED (green) on the RKM lights; the flash program is updated.
No: Go to step 3.
3. In single controller configuration, does the WARNING LED (orange) on the RKM blink at high speed?
Yes: Wait until the WARNING LED (orange) on the RKM is off. The READY LED (green) on the RKM lights because the flash program is updated or when powering on, the ENC/SENC firmware is automatically downloaded. When the ENC/SENC is automatically downloaded, the WARNING LED (orange) blinks for up to 30 to 85 minutes, then the READY LED (green) lights.
No: Go to step 3.
4. Does the WARNING LED on the RKM blink slowly?
Yes: Call your Customer Engineer. Go to step 13.
No: Go to step 5.
5. Is the RKNAS connected?
Yes: Go to step 6.
No: Go to step 7.
6. Does the WARNING LED on the RKNAS blink?
Yes: Call your Customer Engineer. Go to step 13.
No: Go to step 7.

7. Is the READY LED on the RKM on?
Yes: Go to step 8.
No: Refer to section 8.1.3.
8. Is the RKNAS connected?
Yes: Go to step 9.
No: Go to step 10.
9. Is the READY LED on the RKNAS on?
Yes: Go to step 10.
No: Refer to section 8.1.3.
10. Identify in which components a failure resides in the RKM.
Note: Refer to section 4.7.5 to identify failed components whose LEDs indicate their respective failures.
11. Is the RKNAS connected?
Yes: Identify in which components a failure resides in the RKNAS.
No: Go to step 12.
12. Continue to use the equipment, and contact the Customer Engineer.
13. End of procedure.

8.2 Web Overview

This section includes the following:

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

8.2.1 Operational Environment

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

Table 8.1 Web Operational Environment

No.	Item	Description
1	OS	Microsoft® Windows® 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 AMS500 Web Function Support Browser/Version

No.	Platform	OS	Ver.	Browser	Ver. (Notes)	Supported/Not Supported	Java Applet Supported/Not Supported (Notes)
1	WS	IRIX®	6.5	Netscape Navigator	4.76	○	×
			2.6	Netscape Navigator	4.76	○	×
		AIX	8	Netscape Navigator	4.76	○	×
			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 the **Custom Level** button.
3. Specify **Medium** or **lower** for **Custom Setting Reset**, then click the **Reset** button.
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 is displayed by Netscape, the succeeding operation in Refresh mode may not be completed normally. In this situation, display the page again by clicking the Re-Display button.
- 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 the close button on the upper right corner of the sub-screen to close the sub-screen after 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.
- When collecting memory dump (Full Dump) using Netscape Navigator 4.7x, pay attention to free space on the PC because information to be downloaded will not be compressed.

8.2.2 Characteristics of Network Functions 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 AMS500 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 (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 Figure 8-1.

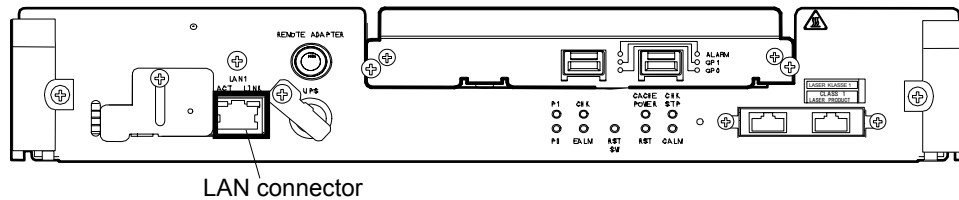


Figure 8-1 LAN Connector Location

3. Enter **Normal Mode** to change the IP Address of the controller set up to Address of Web browser.
4. Set the IP Address of the controller connected with the network as a dual system configuration.

The status of the devices (both controllers) can be monitored from one controller.

8.3.2 Screen Outlines

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

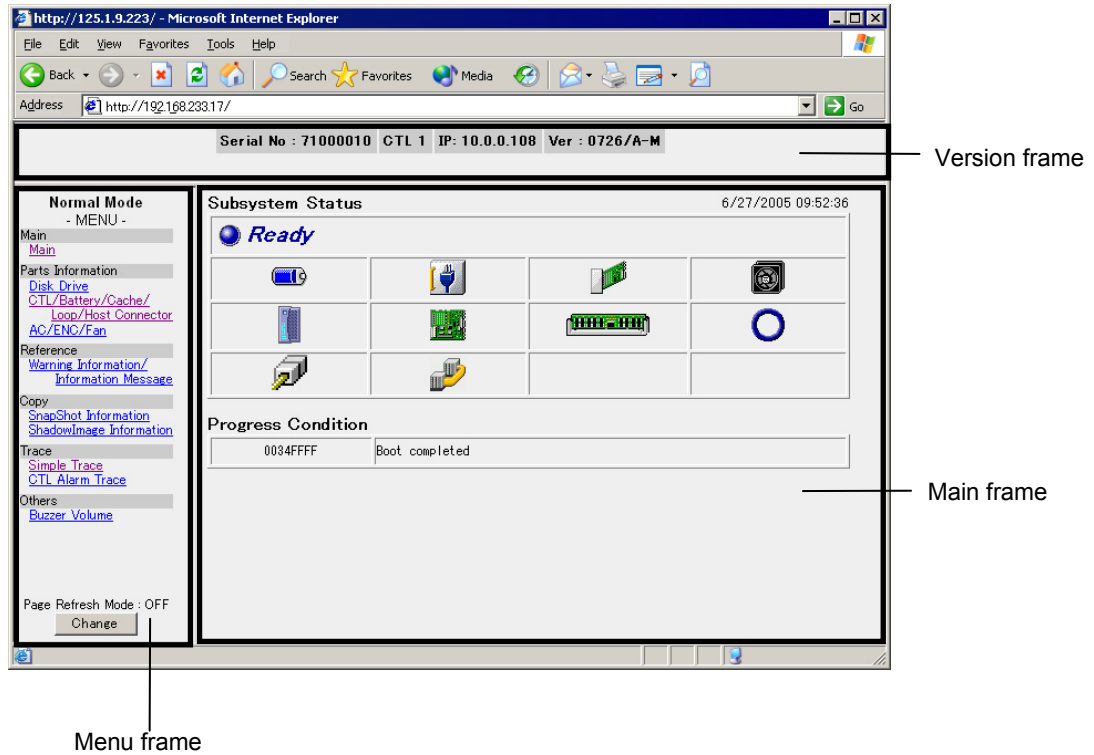


Figure 8-2 Main Screen Outline

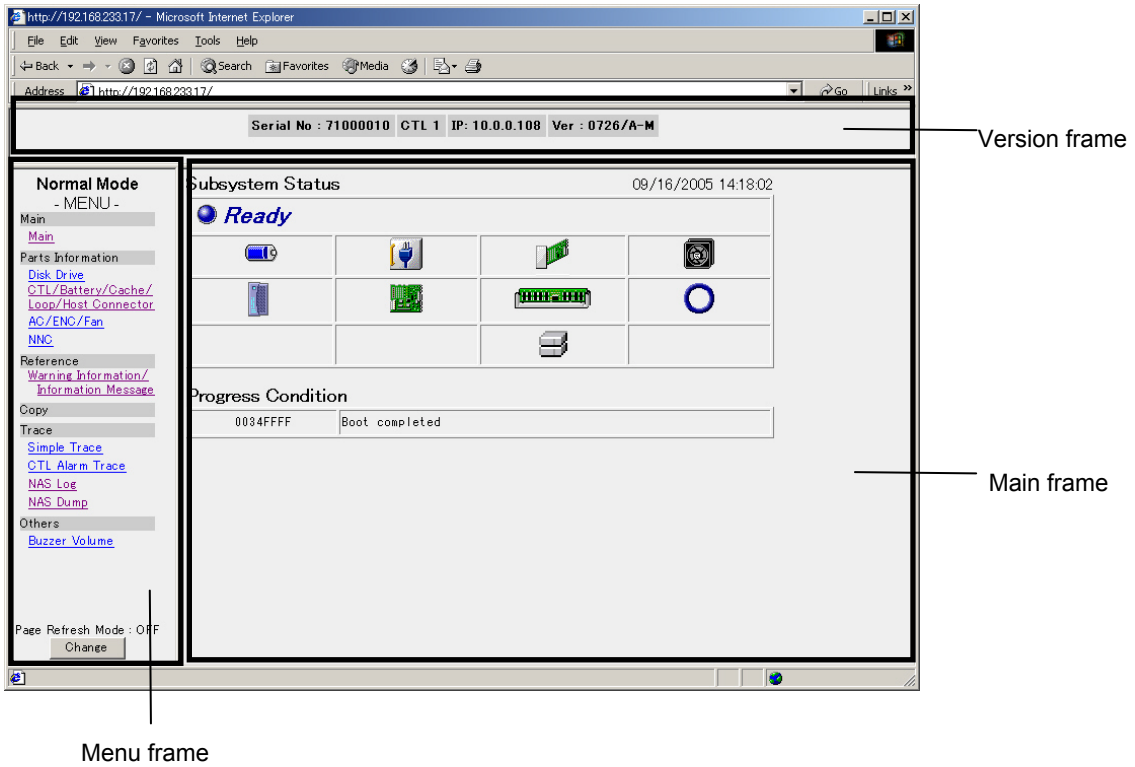


Figure 8-3 Main Screen Outline (NAS)

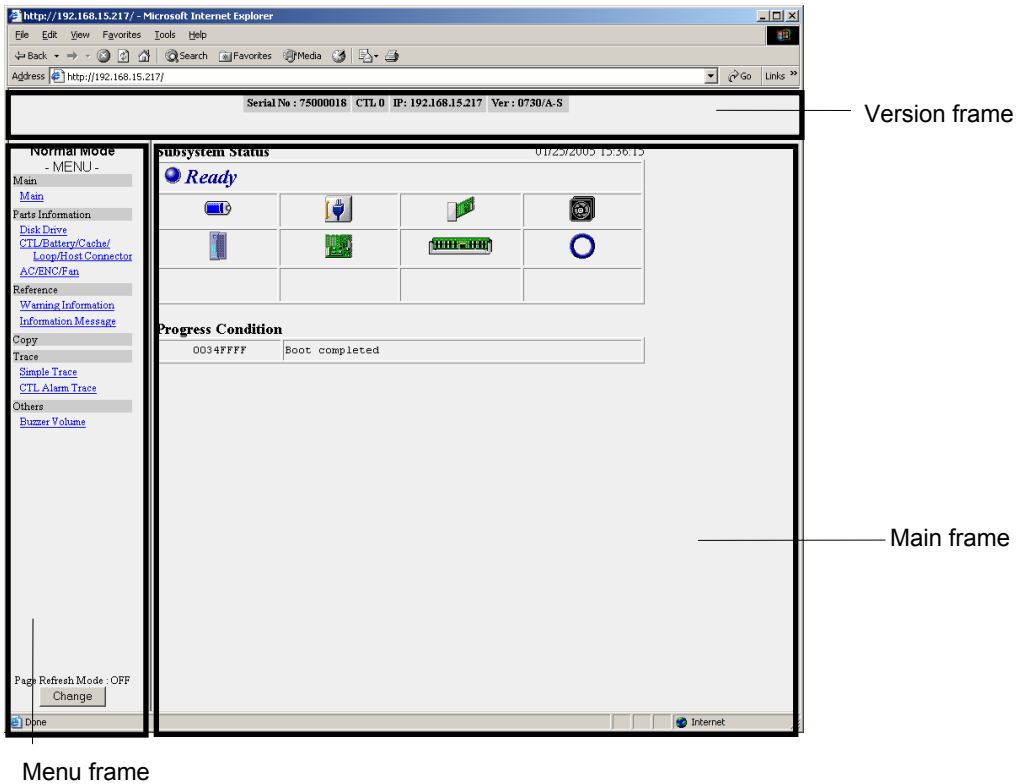


Figure 8-4 Main Screen Outline (iSCSI)

This section includes the following:

- Menu Frame
- Main Frame
- Version Frame

8.3.2.1 Menu Frame

If the Normal Mode is displayed 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 is displayed.

- **Parts Information**

Disk Drive: The status of disk drives is displayed.

CTL/Battery/Cache/Loop/Host Connector: The status of controllers, cache, loop, and host connector is displayed.

AC/ENC/Fan: The status of the power supply unit, ENC/SENC unit, and fan assembly is displayed.

- **Reference**

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

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

- **Trace**

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

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

- **Others**

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

- **Page Refresh Mode**

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

OFF display: This is not refreshed.

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

8.3.2.3 Version Frame

The version frame displays the following information:

- **Web title:** The Web title set by a user is displayed. When it is not set, nothing is displayed.
- **Serial No:** The subsystem serial number is displayed.
- **CTL:** The connected controller number is shown.
- **IP:** The connected IP Address of the controller is shown.
- **Rev:** The device version of the microprogram is shown.

8.3.3 Main Screen in Normal Mode

The main screen of normal mode consists of the following:

- Patrol Lamp
- Summary of Exchange Parts Status
- Progress Condition Display
- Page Refresh Button

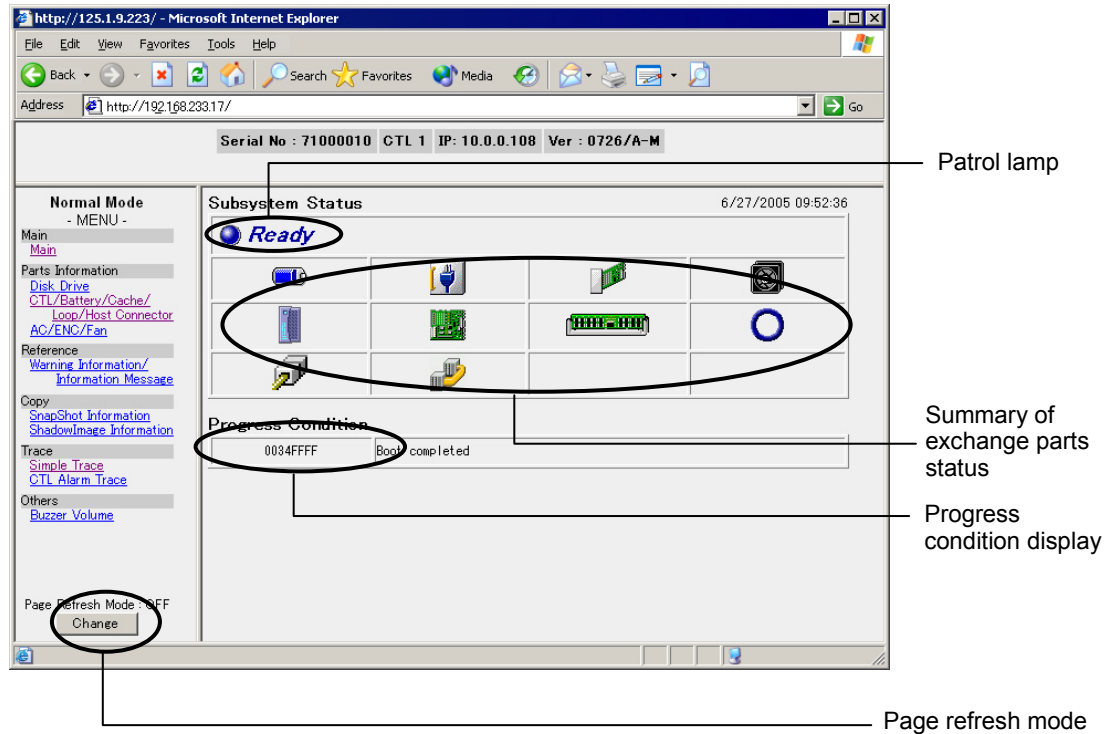


Figure 8-5 Subsystem Condition Display

8.3.3.1 Patrol Lamp

While monitoring the device, the status is displayed.


















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 is displayed 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	—













Parts	Image		Notes
	Normal	Abnormal	
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, is displayed in the progress condition display box.

8.3.3.4 Page Refresh Button

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

OFF display: The screen is not refreshed.

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

8.3.4 Status Display of Replaceable Components

The status display screen of replaceable components displays the status of the Disk Drive, Control Unit, Cache Unit, 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 is displayed.

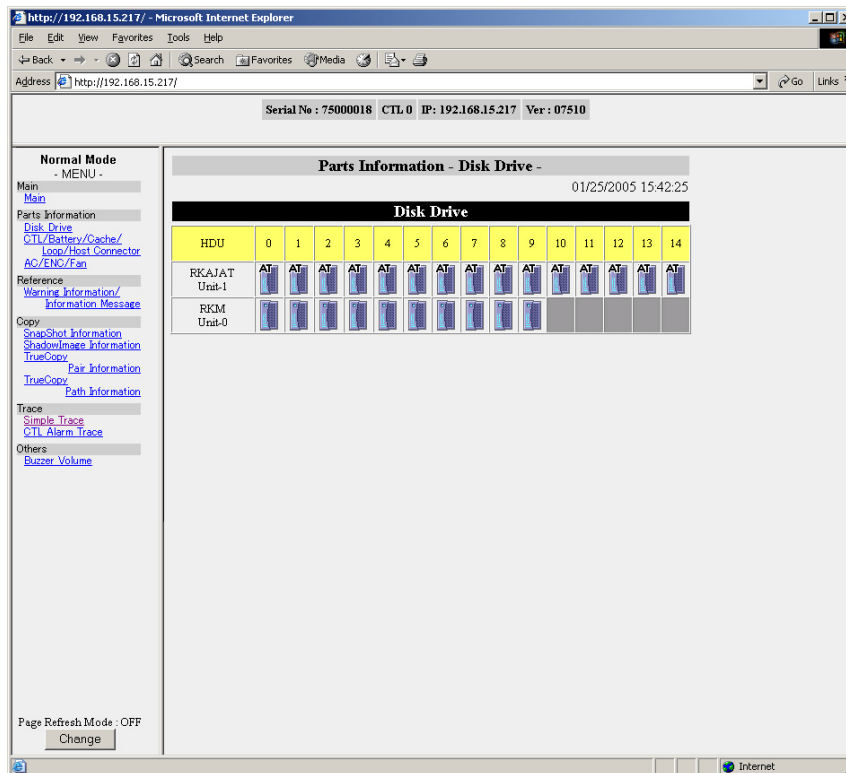


Figure 8-8 Component Status Screen (Disk Drive)

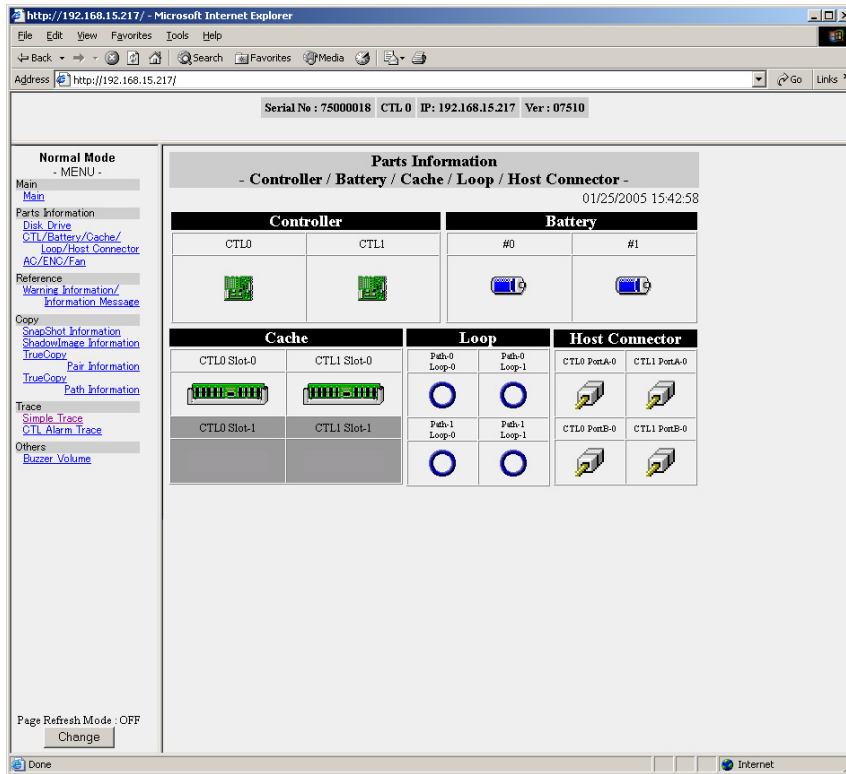


Figure 8-9 Component Status Screen (Controller/Battery/Cache/Loop/Host Computer)

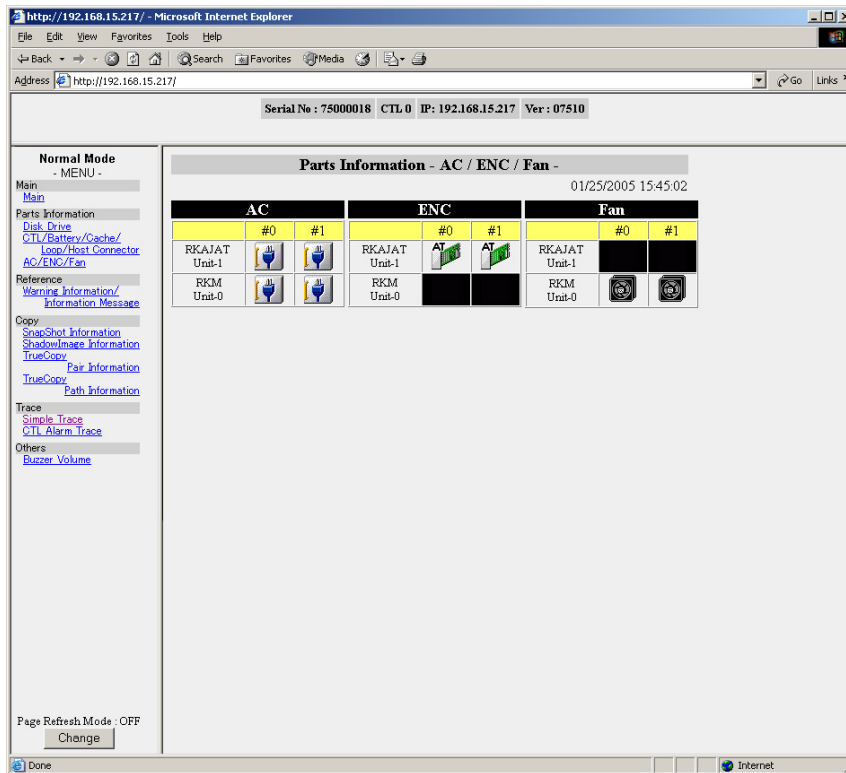


Figure 8-10 Component Status Screen (AC/ENC/FAN)

Serial No : 75010003 CTL 0 IP: 192.168.1.16 Ver : 0750/A-M

[NNC0](#) [NNC2](#)

Normal Mode

- MENU -

Main
[Main](#)

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

Reference
[Warning Information/Information Message](#)

Copy

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







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

Page Refresh Mode : OFF

Normal

INACTIVE

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




Done Internet

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)

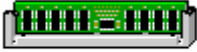

Disk Drive (S-ATA):

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
No display	The fault has not occurred without being implemented with the setting of a single system configuration



Cache Unit:

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



Battery Backup Unit:

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



Fan Assembly:

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



Power Unit/Power Unit (DC):

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



ENC Unit:

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



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 is displayed.



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 is displayed.

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 PS:

Image	Status
 blue	Normal
 red	Fault



NNC DIMM:

Image	Status
 green	Normal
 red	Fault

NNC FAN:

Image	Status
 black	Normal
 red	Fault

NNC 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.

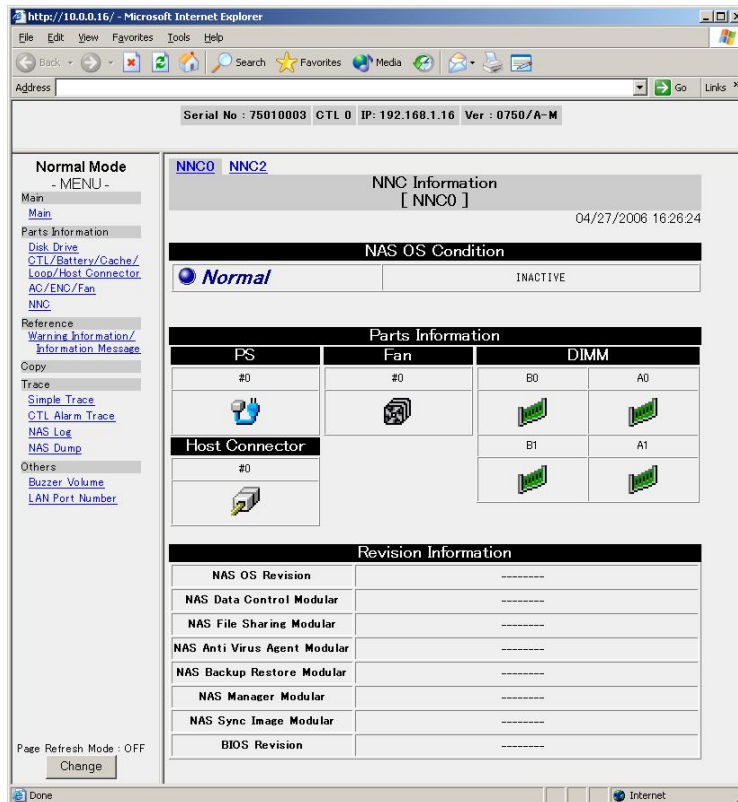


Figure 8-12 Revision Information Screen

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

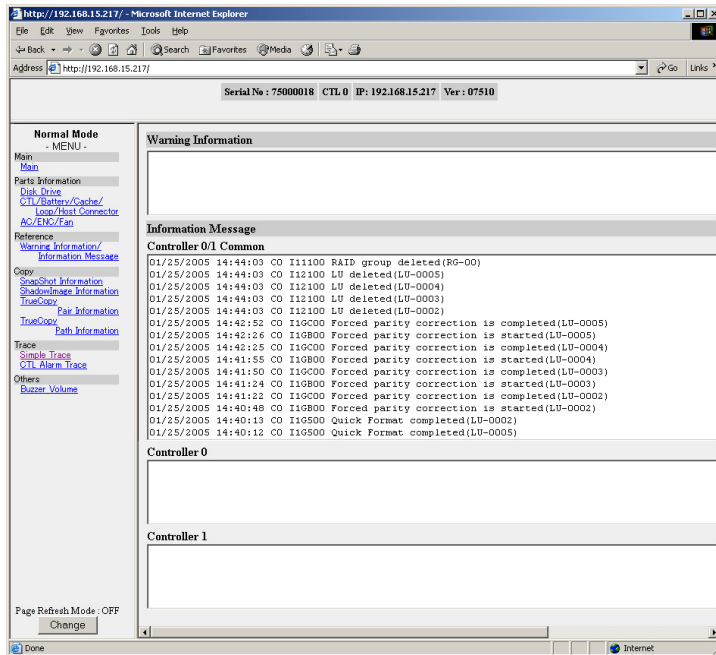


Figure 8-13 Warning Information Screen

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.

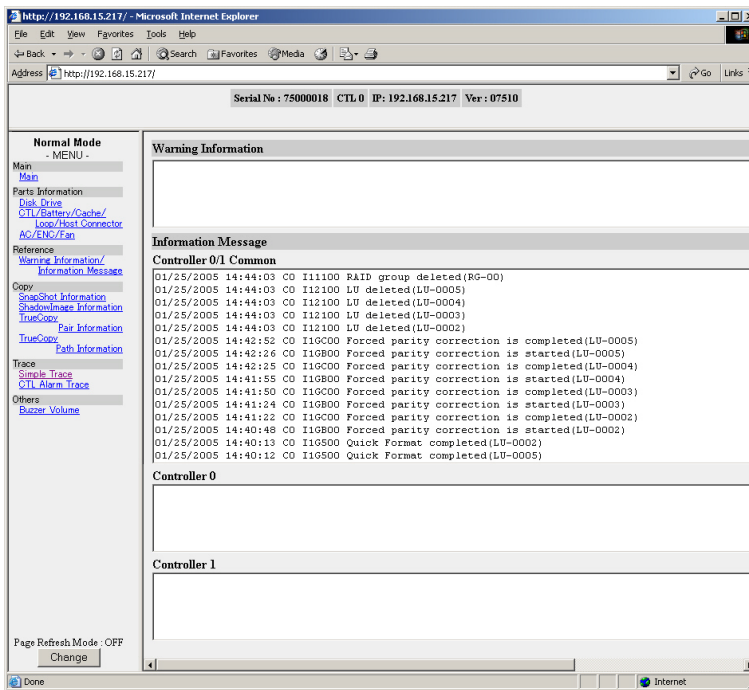


Figure 8-14 Information Message Screen

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 the **Buzzer Volume** of the menu frame to enter into the buzzer volume-setting screen. If the buzzer volume is designated with the radio button and the **OK** button is clicked, the buzzer volume is changed.

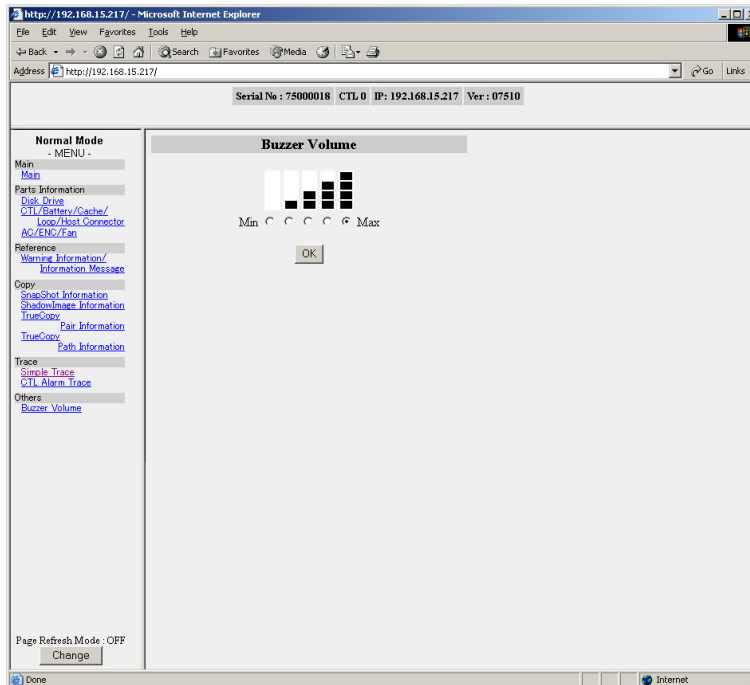


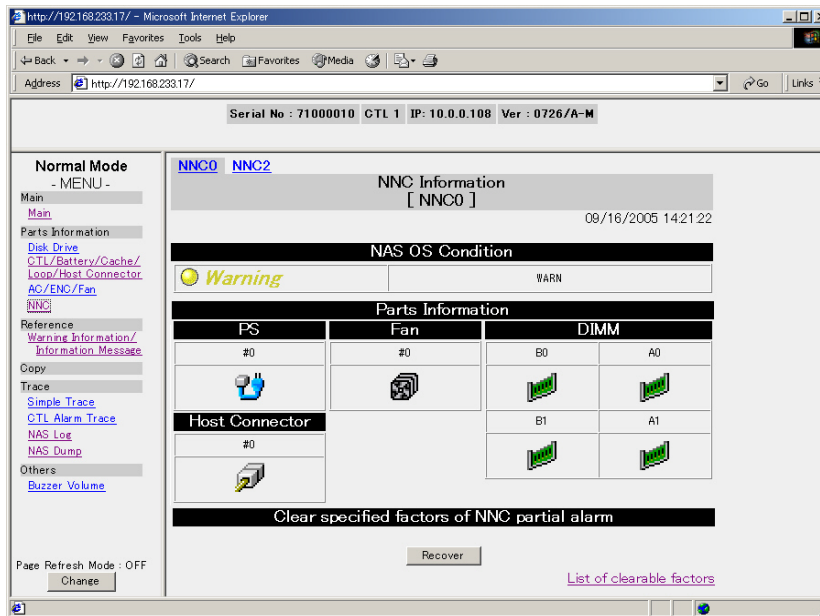
Figure 8-15 Buzzer Volume Screen

8.3.7 Clear Specified Factors of NNC Partial Alarm

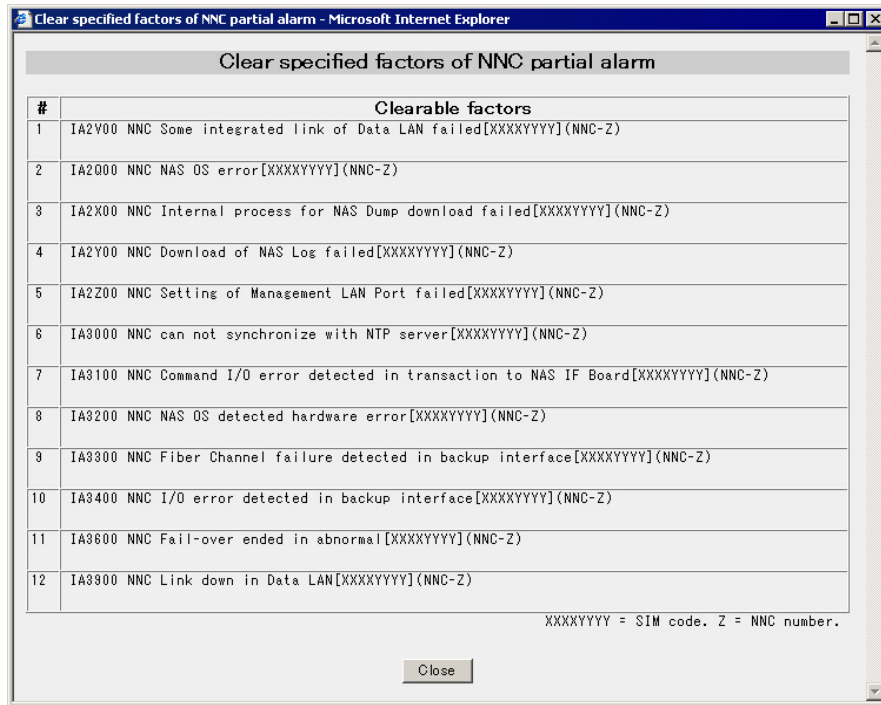
The Warning status of the control unit may not be released when the WARNING LEDs on the array subsystem and the NAS unit are lighting up even though the recovery works for some specific NNC partial alarms.

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.

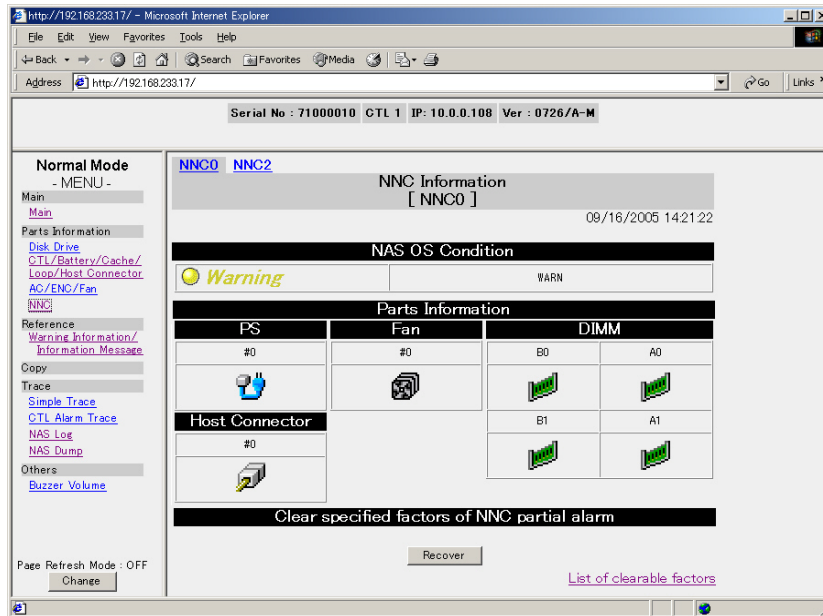
1. Before operating “Clear specified factors of NNC partial alarm”.
2. Click the List of clearable factors.



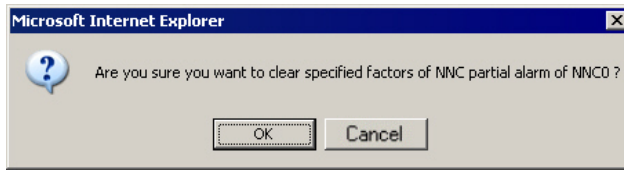
- Verify that either of the lists where the failure factors are displayed.



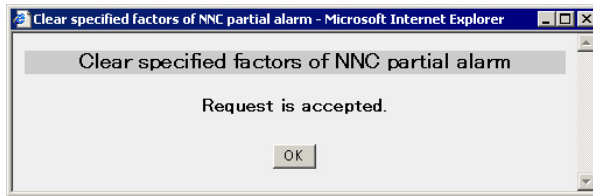
- Clear specified factors of NNC partial alarm.
- Click the **Recovery** button.



6. A message appears asking you to verify the setting is displayed. Click the **OK** button.

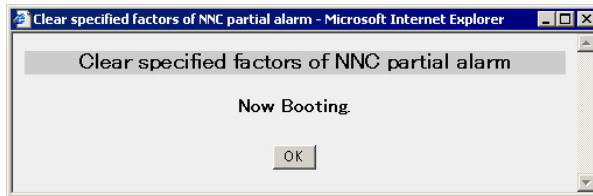


7. Check the NNC partial alarm recovery. When the “Clear specified factors of NNC partial alarm” is completed normally.



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

If the array subsystem was booting at the time of clicking the **Recovery** button:



10. Click the **OK** button. Execute this again after the array subsystem is in the **READY** status.

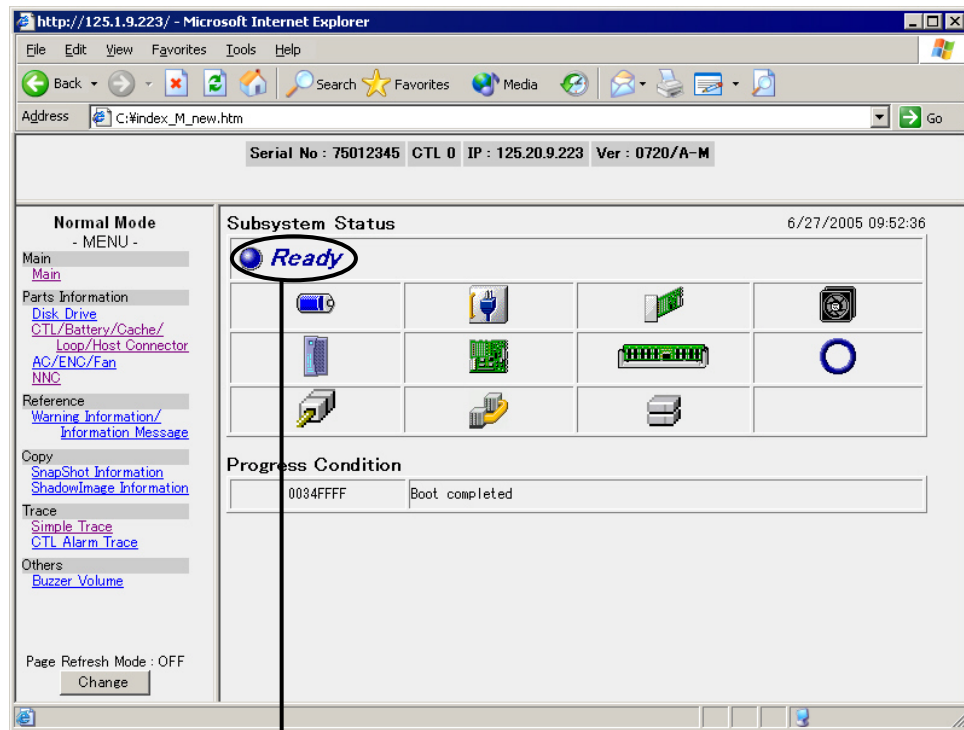
8.4 Troubleshooting Using a Web Connection

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.



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 the **ON** button).

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

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

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

If the start-up operation is completed, **Boot completed** is indicated in this part.

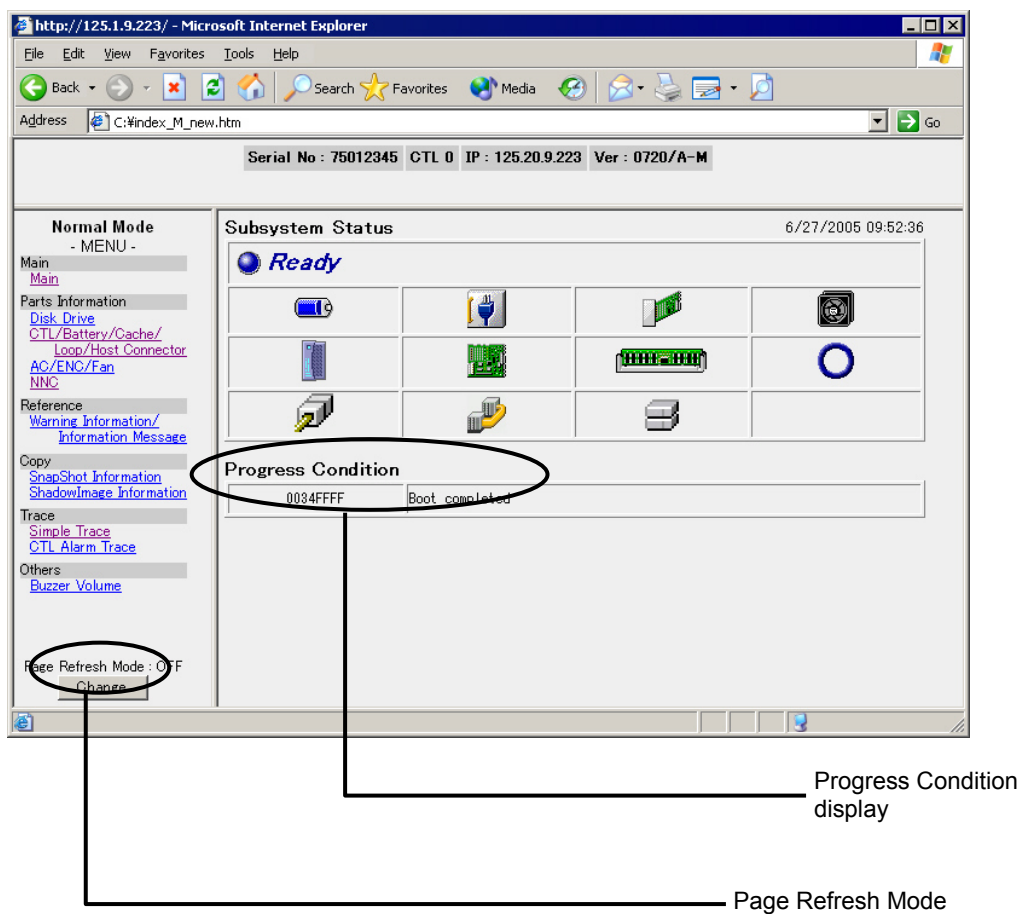


Figure 8-17 Progress Condition Display

8.4.3 Checking Component Status

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

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

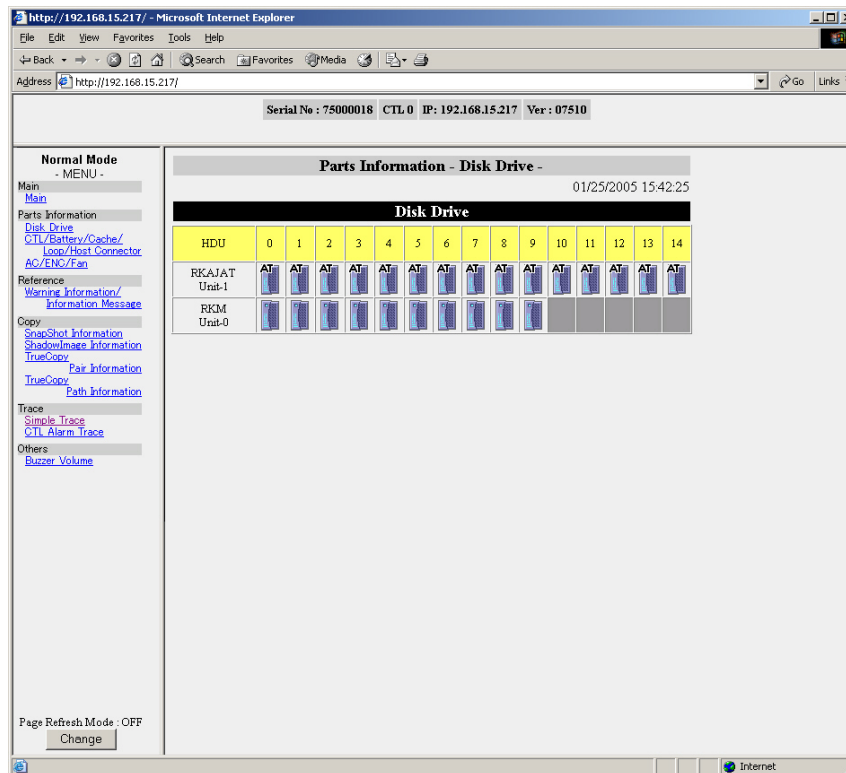


Figure 8-18 Replace Part Summary Screen (HDD)

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

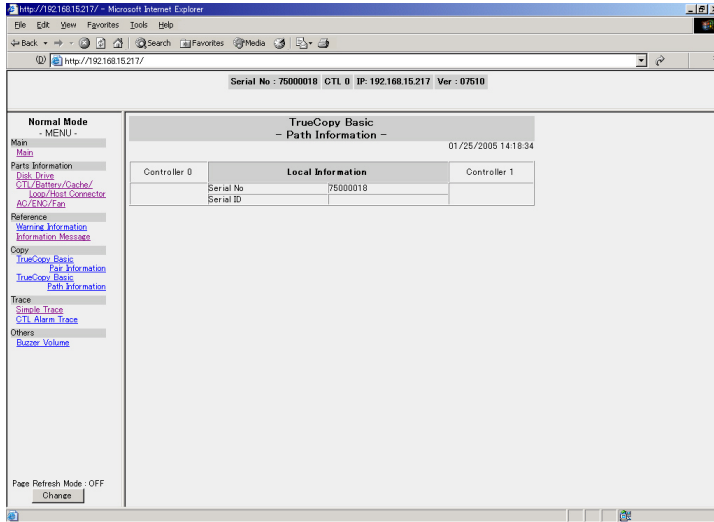


Figure 8-19 Path Information Screen

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

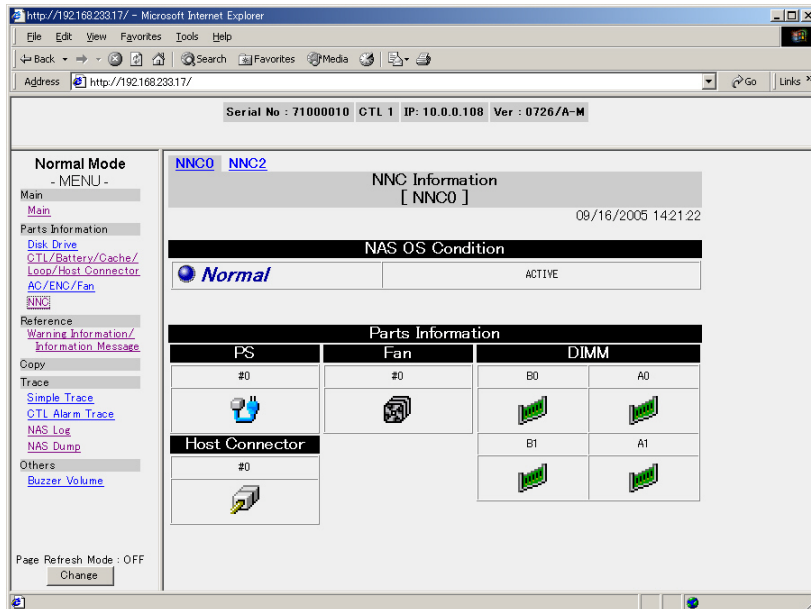


Figure 8-20 NNC Information Screen

8.4.4 Checking Log Messages

To check log messages:

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

The Information Message window displays.

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

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

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

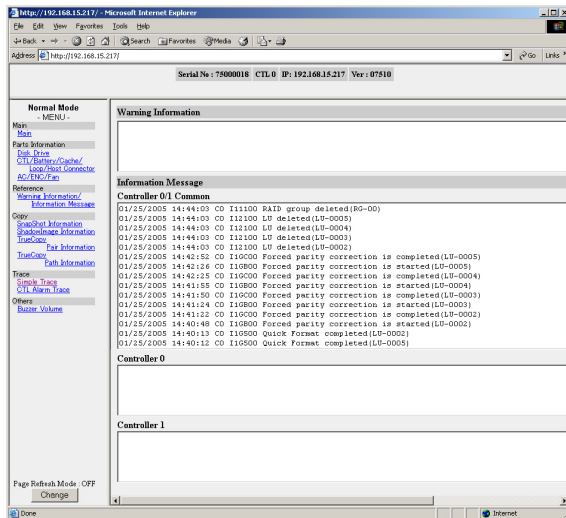


Figure 8-21 Information Message Screen

- **Flash/RAM Micro Detection Message**

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

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

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

Example:

```
MM/DD/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, **Ixxxxx:** Progress messages, **Wxxxxx:** Warning messages, **Hxxxxx:** Failure messages)

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

■■■■■■: Recovery measures code

◆◆◆: Collecting failure information code

8.4.5 Troubleshooting using Messages

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

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

Table 8.4 Message Code Types

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

8.4.5.1 Errors Detected by CUDG

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

8.4.5.2 Flash Detected Messages

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

Table 8.5 Flash Detected Messages

Message Code	Message Text	Recovery Measures
RA00xx	Microprogram error [FLS]	Restarting the equipment
RA7000	Microprogram revision mismatch	
RB0000	Upload system error	Check the microprogram you want to install and install it over again.
RB0600	No micro program	Perform the new installation upgrade.
RB0A00	Upload file SUM check error	A sum check error occurred in a read file during a upload. Check the microprogram you want to install and install it over again.
RB0E00	Up grade check NG	The upgrade check of the microprogram failed. (An upgrade version of a microprogram does not conform to the microprogram being upgraded.) Do a new install of the microprogram.
RB3000	File size error	Check the microprogram you wish to install.
RB3100	File open error	

RB3200	File read error	
RB3500	Bad block ID	
RB3600	Bad LBA in START 600 DAT	
RB7000	Program size too large	
RB8000	Old microprogram exists	If the installation can be continued, the RAID group and LU deformation are initialized. (In this case, all the data in the disk drive are deleted. When the data in the disk drive need to be saved, stop the work and perform the update installation.
RB8300	Empty system retry full install	The update installation cannot be executed because a system does not exist in the disk drive. Execute a new installation.
RBA000	Down grade check NG	The present microprogram version cannot be updated to a specified microprogram version. Check the work procedure. Execute a new installation.

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

8.4.5.3 Progress Messages

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

Table 8.6 Progress Messages (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# (RKM=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 (continues on the next page)

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)

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: 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 8.7 Warning Messages

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

Note: When a Progress message other than those shown above is displayed, inform 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 8.8 Failure Messages

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

Note: When a Progress message other than those shown above is displayed, inform 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 8.9 How to Read Failure Information

No.	Description	Failure detected messages		Failure recovery messages	
		Failure code	Failure description	Recovery code	Recovery description
1	Controller error/recovery	W00100	CTL alarm (CTL-x)	I0010x	CTL recovered (CTL-x)
2	Battery error/recovery	W03000 W0300x	Battery alarm	I00300	Battery recovered
		W03100 W0310x	Battery removed	I0030x	Battery recovered (Battery-x)
		W03200 W0320x	Battery SW off		
		W03300 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	FAN alarm (Unit-x, FAN-y)	I005xy	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	PS alarm (Unit-x, PS-y)	I006xy	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)	I00600	PS recovered (CTL-Unit, FAN-x)

No.	Description	Failure detected messages		Failure recovery messages	
6	Disk Drive error/recovery	W060AT	SATA HDU alarm (Unit-x, HDU-y)	I007xy	HDU recovered (Unit-x, HDU-y)
		W060xy	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	Spare HDU recovered (Unit-x, HDU-y)
		W061xy	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)
9	ENC Unit error/SENC Unit error/recovery	W090AT	SENC alarm (Unit-x, ENC-y)	I00Bxy	ENC recovered (Unit-x, ENC-y)
		W090xy	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)

No.	Description	Failure detected messages		Failure recovery messages	
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)

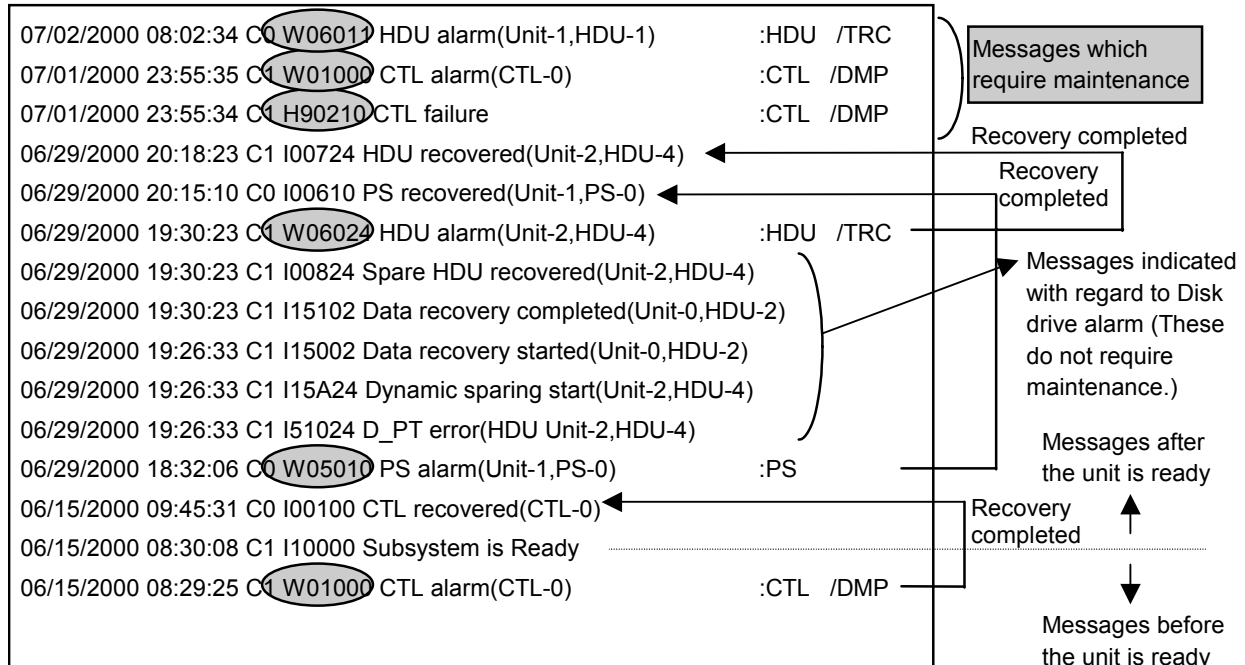
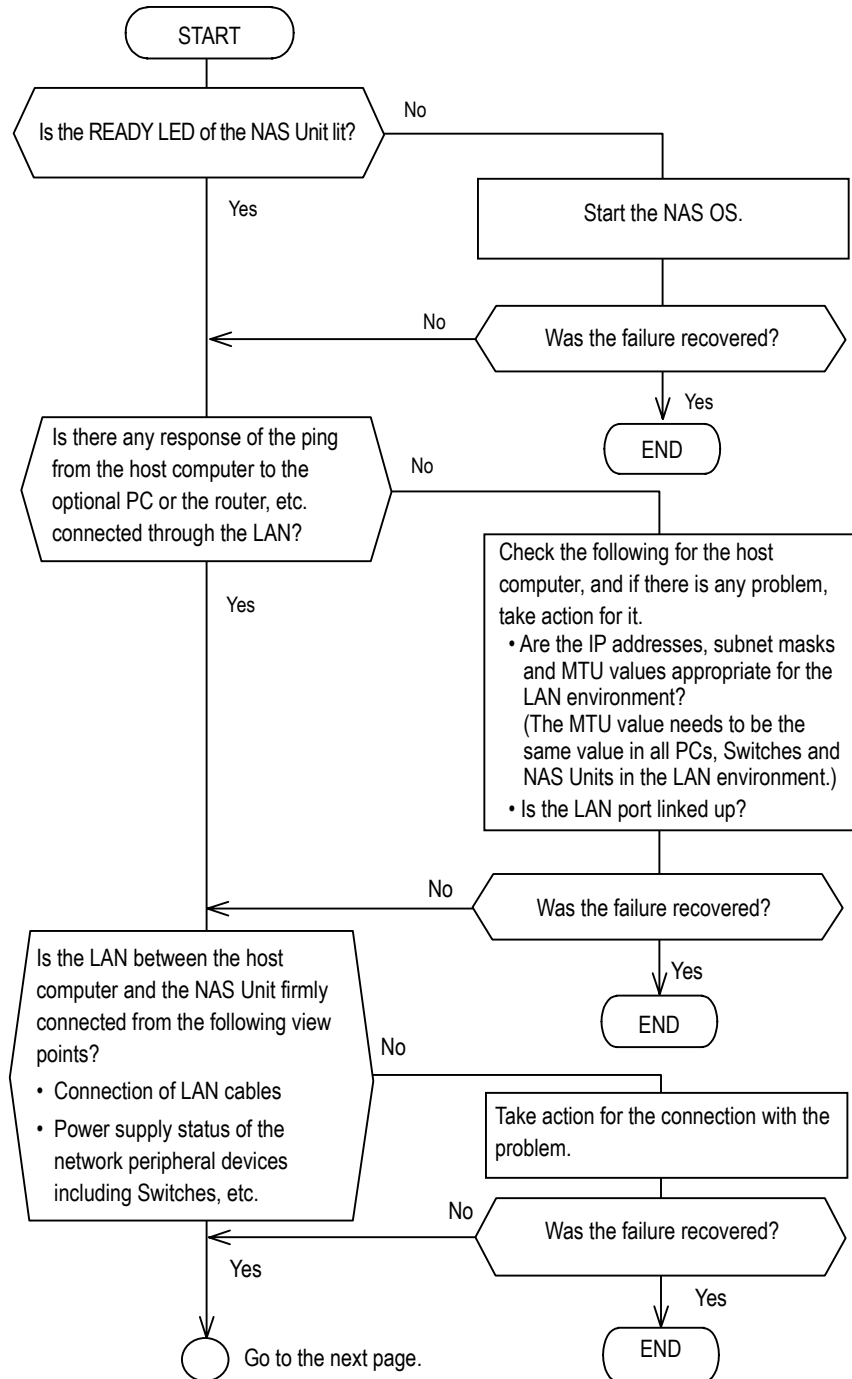
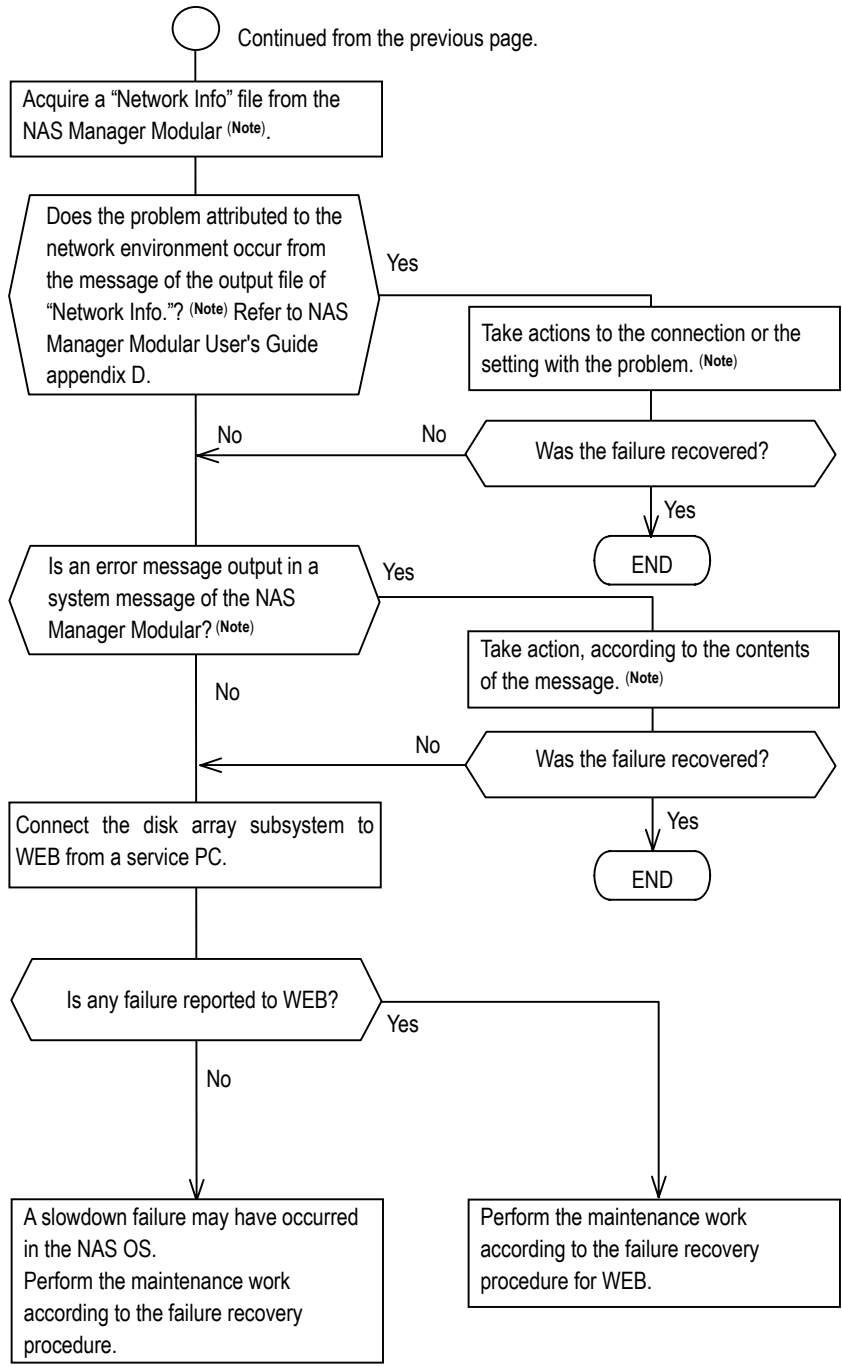


Figure 8-22 Message Analysis Example

8.5 Determining Failure of Network Side 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.



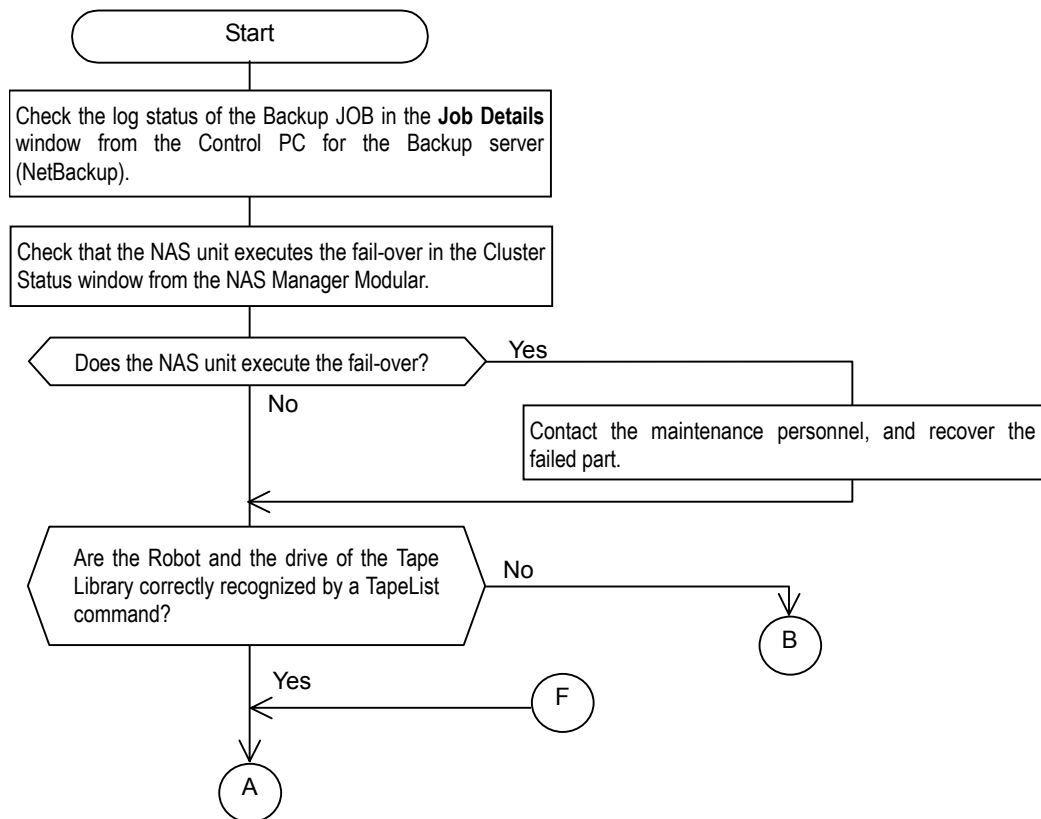
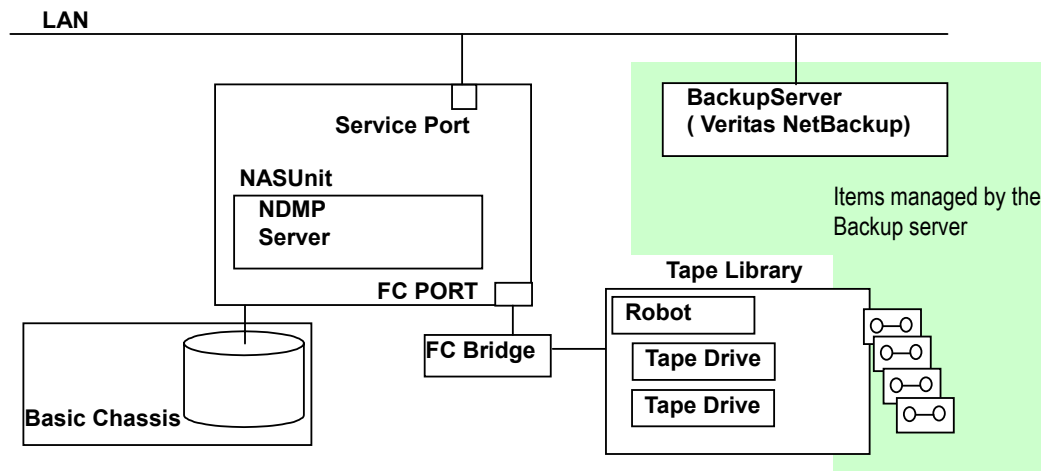


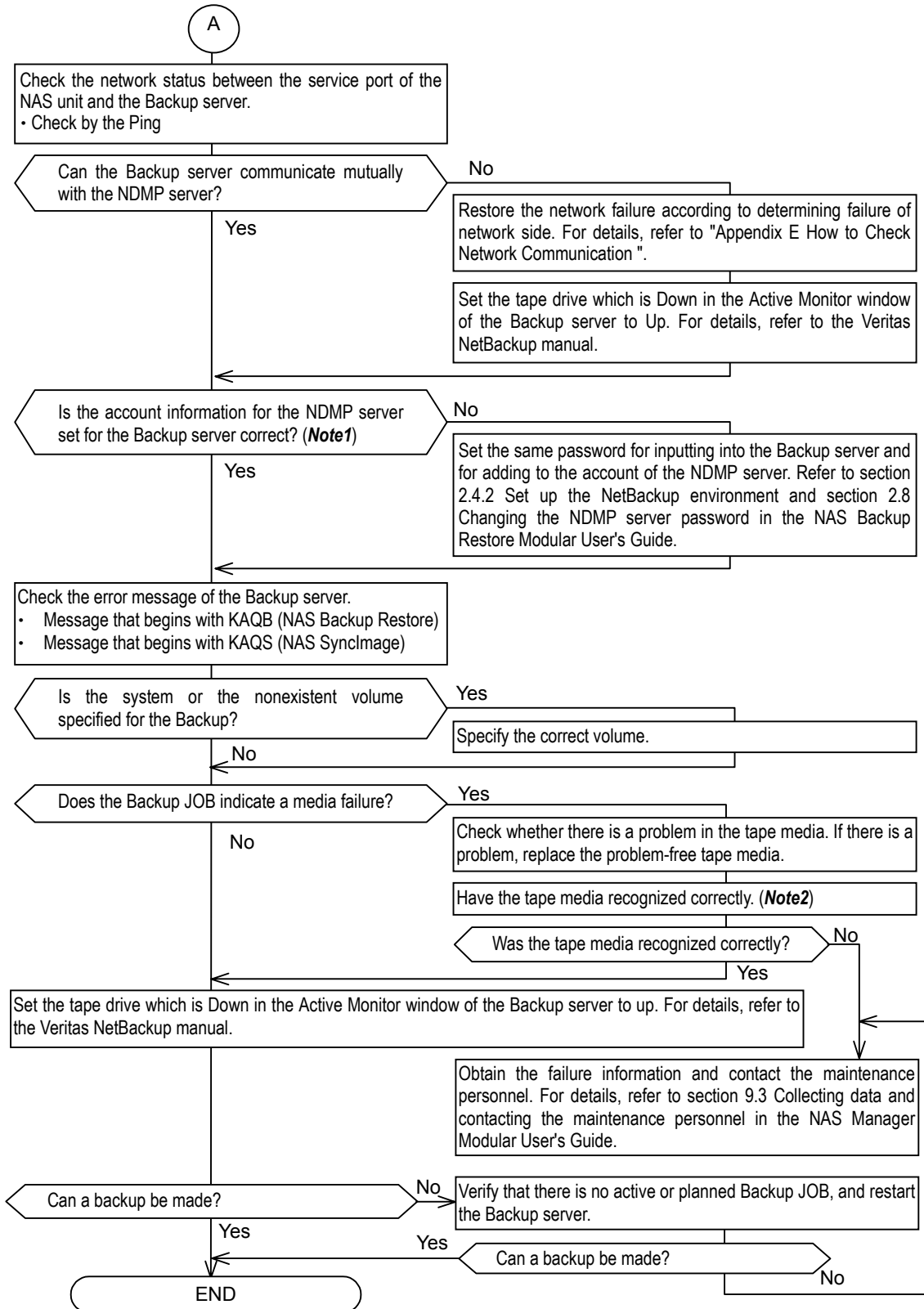
Note : Work to use NAS Manager Modular becomes charge of the system administrator.
The system administrator must cooperate with the maintenance member.

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.

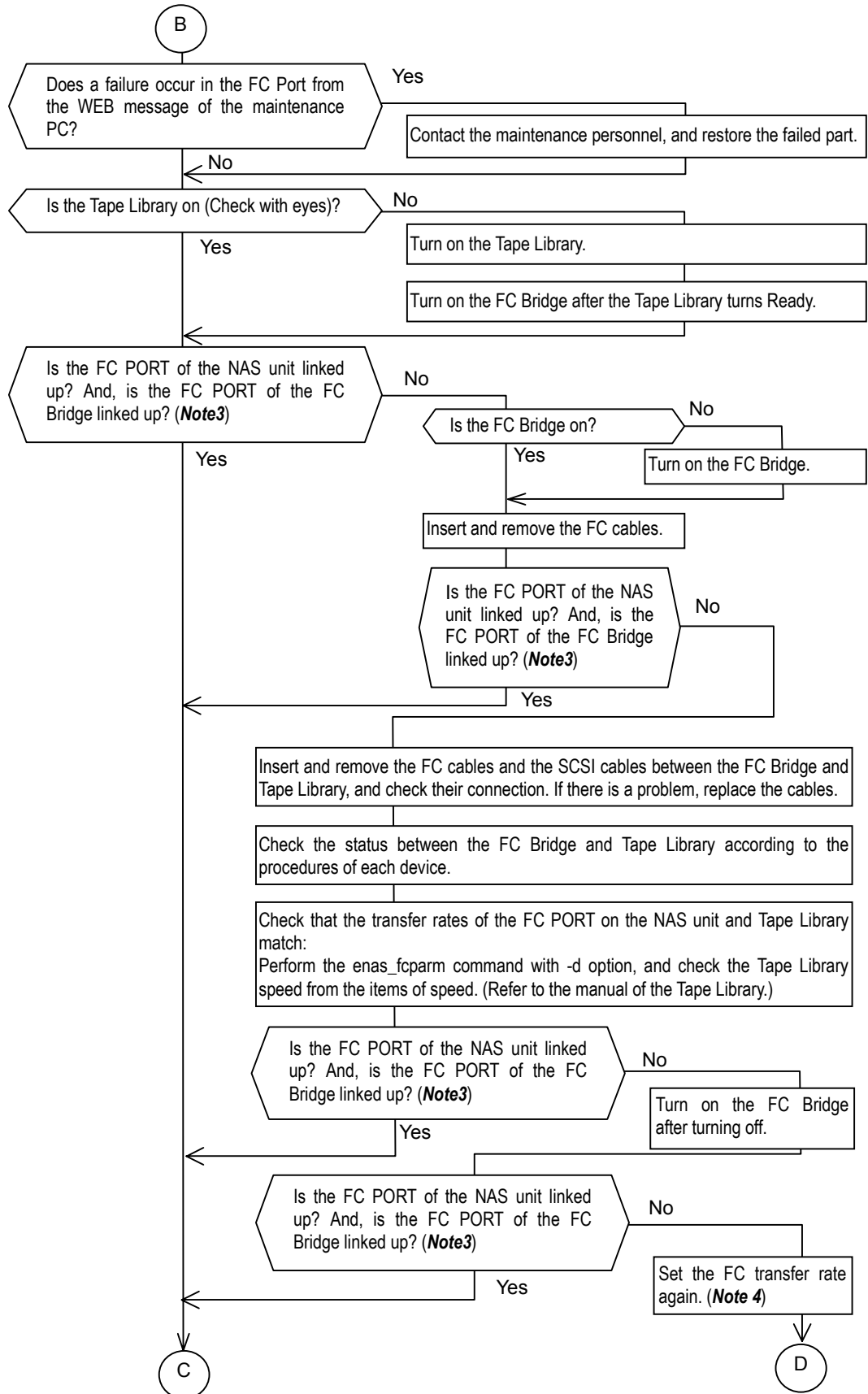
Figure 8-23 Configuration Diagram

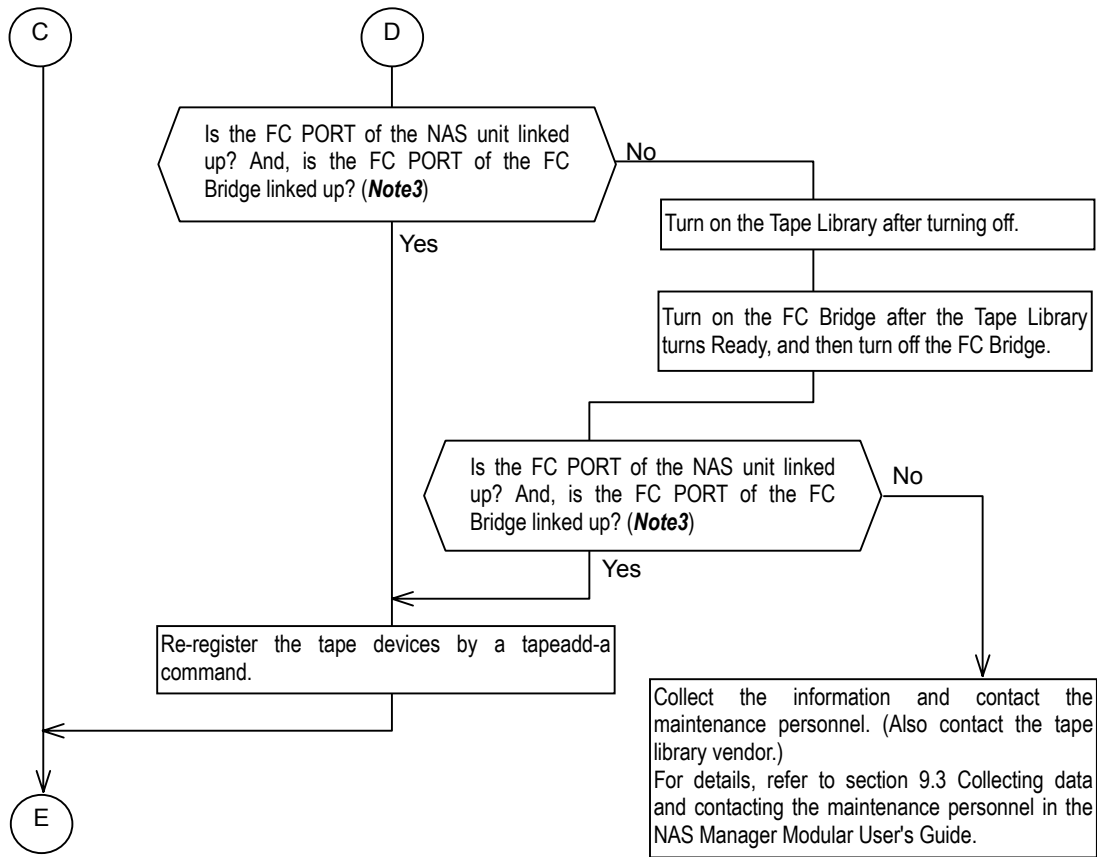




Note 1: In the CLI operation of the NetBackup, perform the `set_ndmp_attr-verify<NDMP server name>`. If "Login was successful" is displayed, the account information is correct.

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



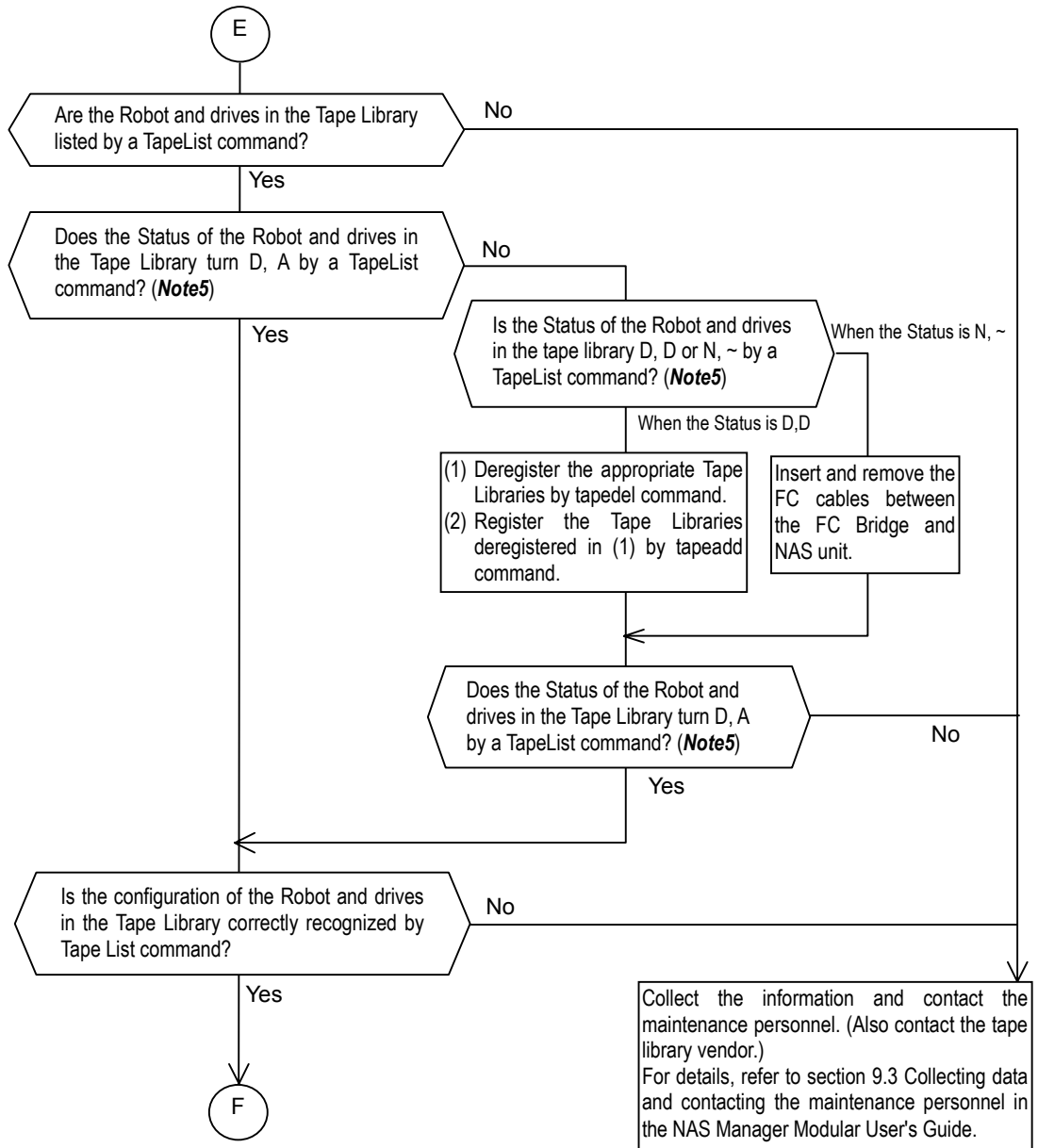


Note3: The conditions that the FC link is correct are the following (1) and (2).

- (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:~$
  
```

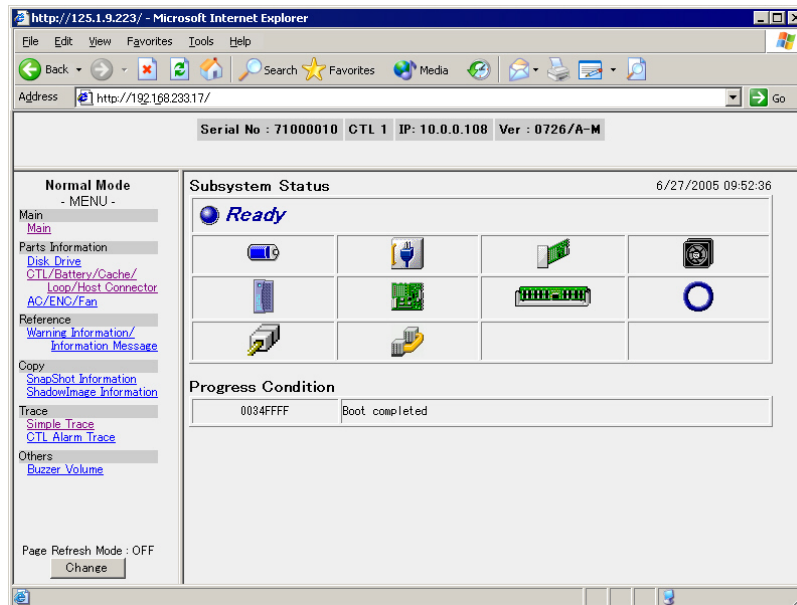
8.7 Connecting Failure in Connection with the Web

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.



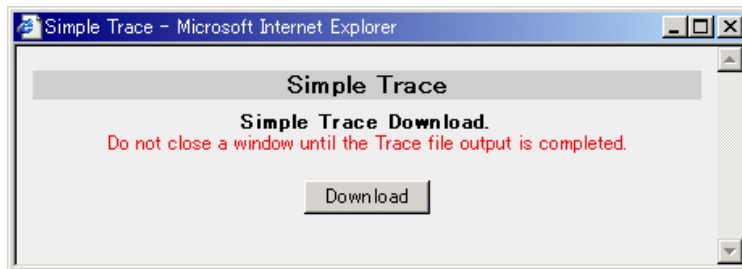
2. When the **Simple Trace** is clicked, the following window is displayed.



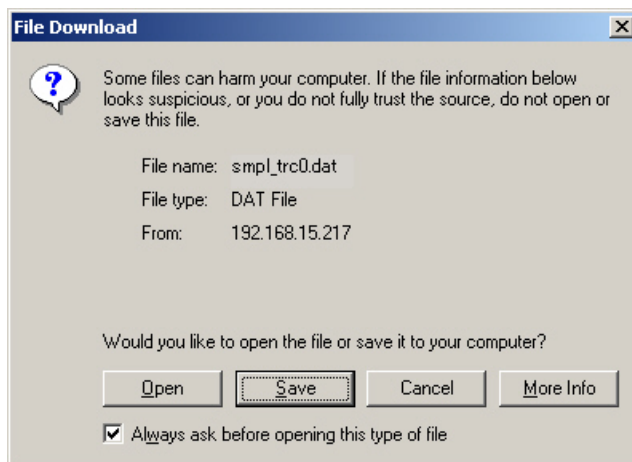
3. When the **OK** button is clicked, the following window is displayed.



4. The following window is displayed. Click the **Download** button.



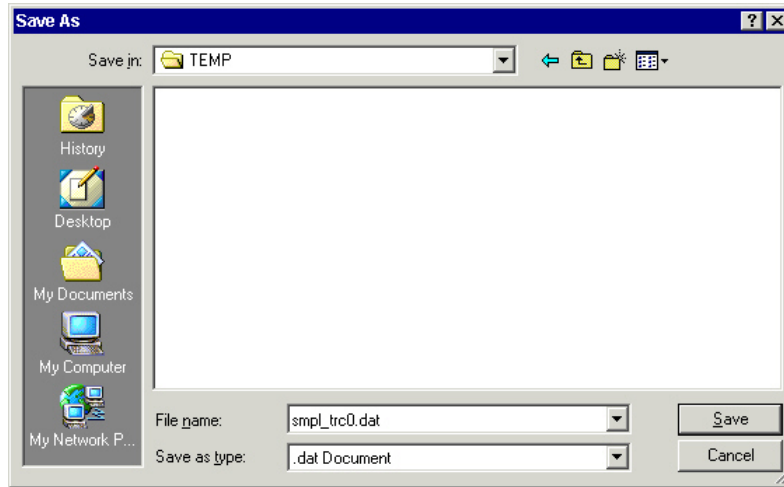
5. Click **Save**, if it is continued. Click **Cancel**, if it is stopped.



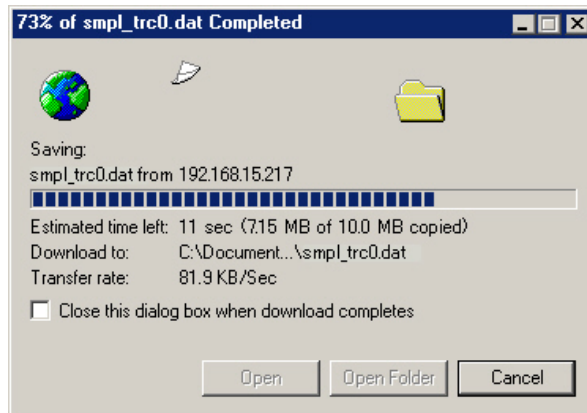
6. If the following window is displayed. Click **Save** after file name is setting, if it is continued. Click **Cancel**, if it is stopped.

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.

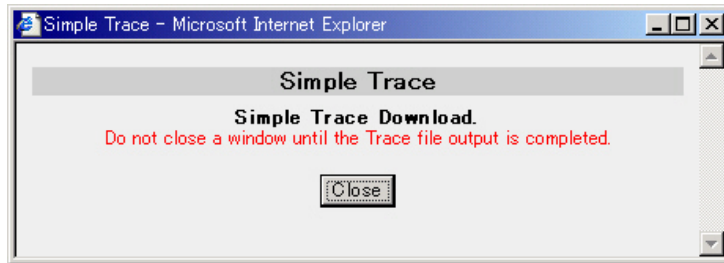
Click **Cancel**, if it is stopped.



7. The following window is displayed during execution download.



8. The progress message window is closed when the download is completed.
9. Click the **Close** button.



8.7.2 NAS Log Collection

This function downloads the log information on the present NAS OS. The free capacity of approximately 4 MB in Normal Mode, 12 MB in Detail Mode and 150 MB in 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.

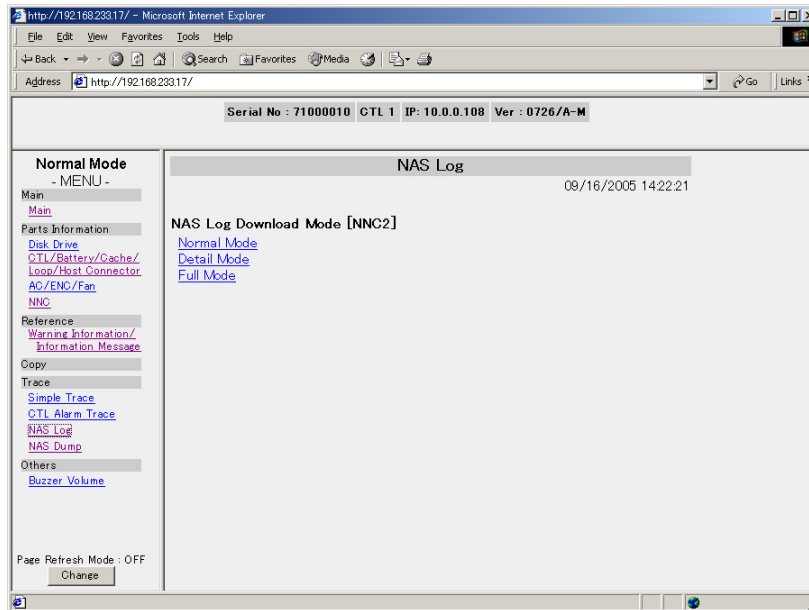
Table 8.10 Collection Mode

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

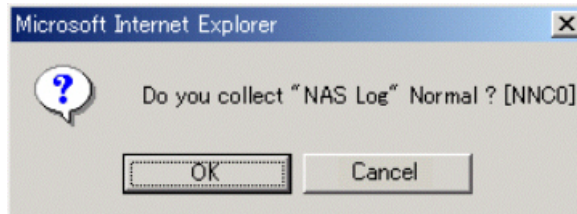
Notes:

- 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.)

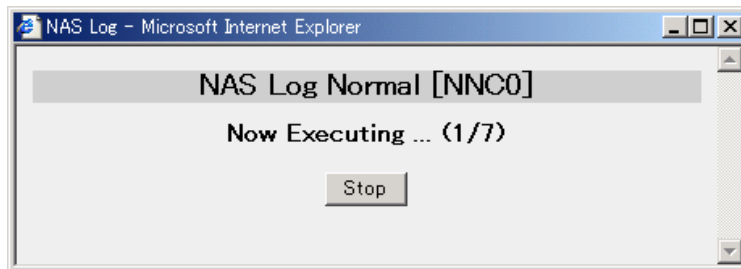
1. Click **NAS Log** in **Trace** of the menu frame.
2. Select the collection mode in **NAS Log**, and click it.



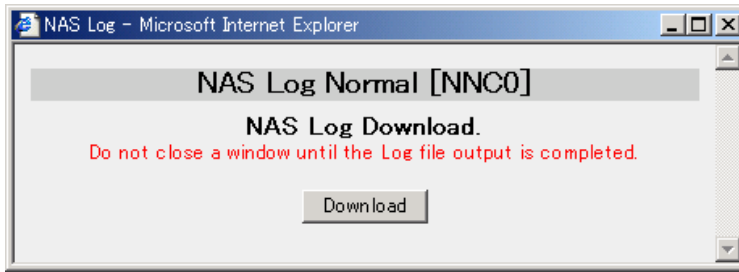
3. The confirmation message is displayed. Click the **OK** button.



The following dialog is displayed.

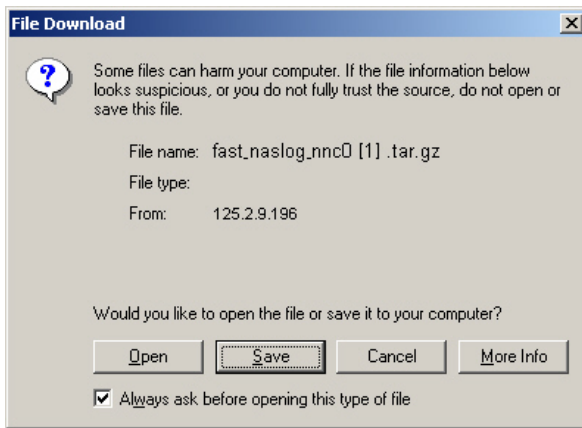


- The following dialog is displayed when ending. Click the **Download** button.



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 is displayed. Click **Save**.

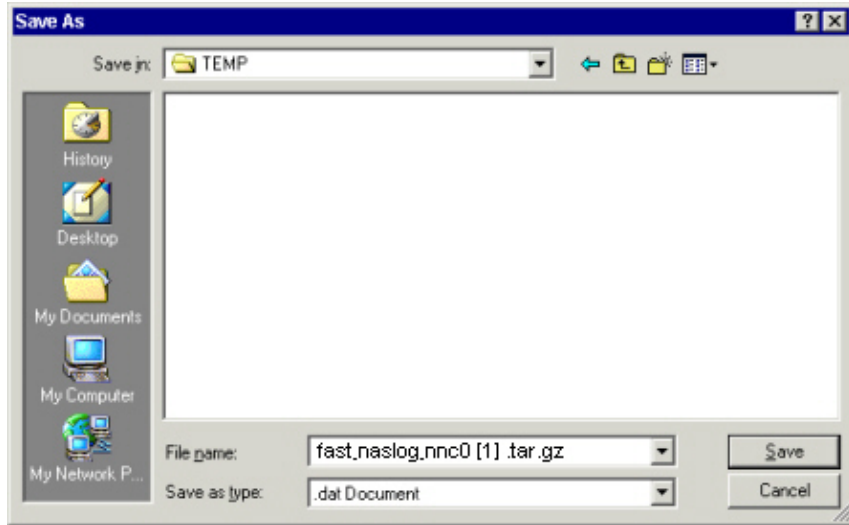


- Specify the storage location of the file and the file name, and click **Save**.

A file name can be changed to “optional file name.tar.gz”.

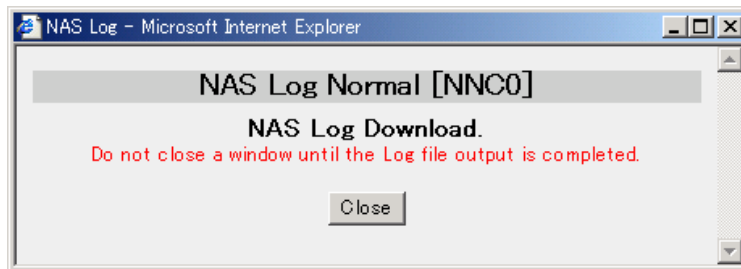
A default file name is as follows in the collection mode.

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
NNC 2	fast_naslog_nnc2[1].tar.gz	naslog_nnc2[1].tar.gz	full_naslog_nnc2[1].tar.gz



The downloading is started and the progress indicating message window is displayed. When the downloading completes, click **Close** button.

7. Click **Close** button.

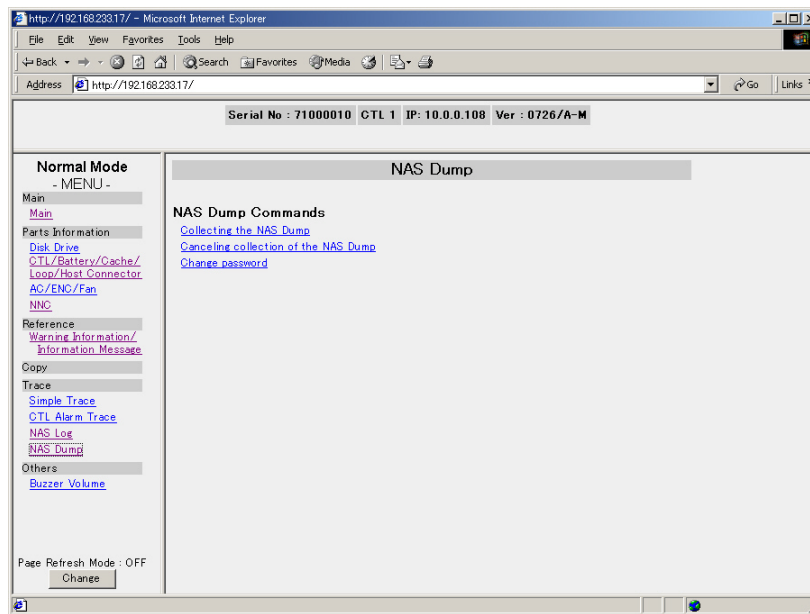


8.7.3 NAS Dump Generation

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

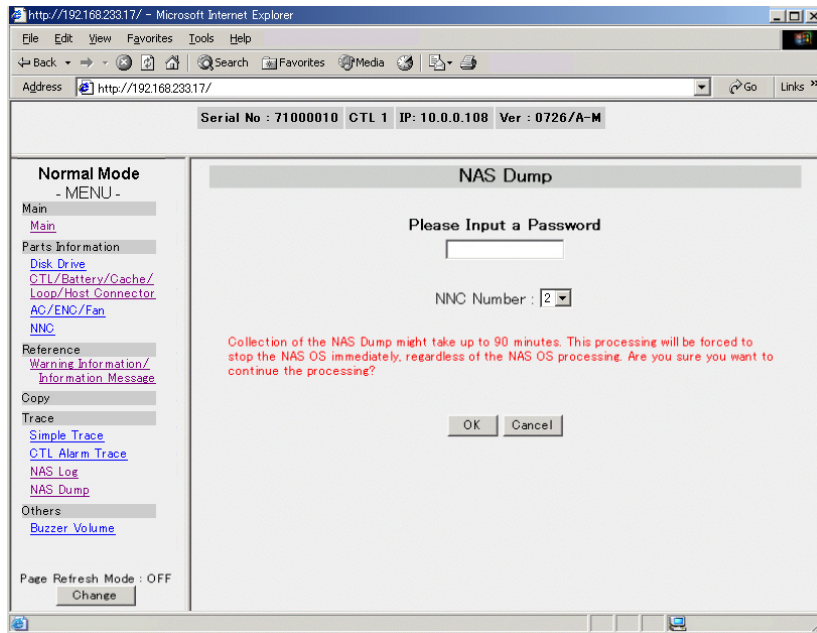
1. Click **NAS Dump** in **Trace** of the menu frame.
2. Select the **Collecting the NAS Dump**.



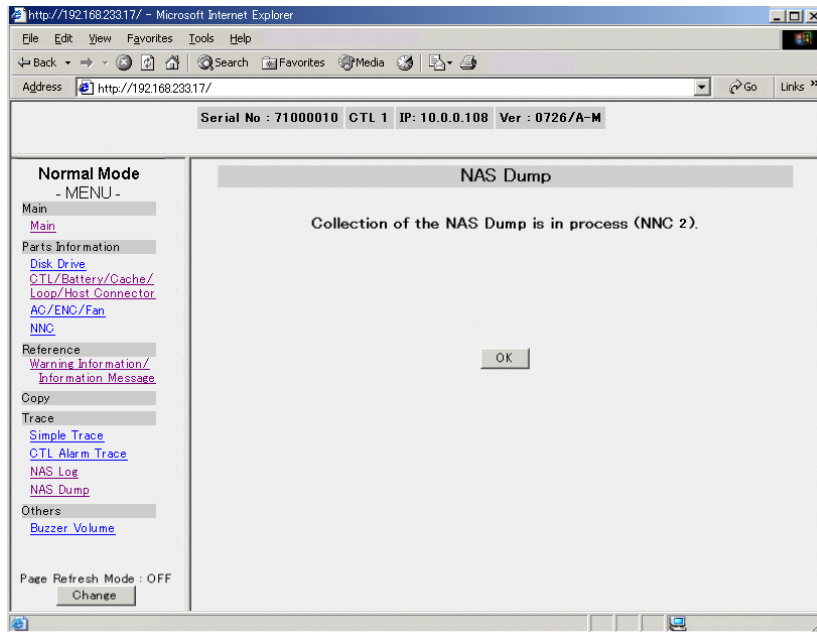
3. The confirmation message is displayed. Click the **OK** button.



4. Input the registered password, and click the **OK** button. (The default password is “user=NAS”)

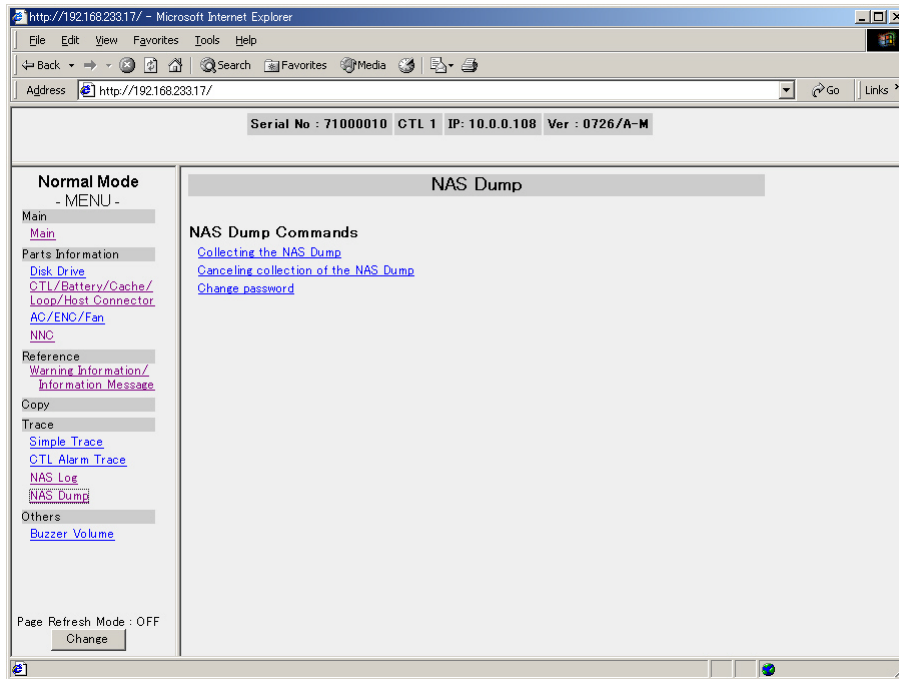


5. The following window is displayed. Click the **OK** button.

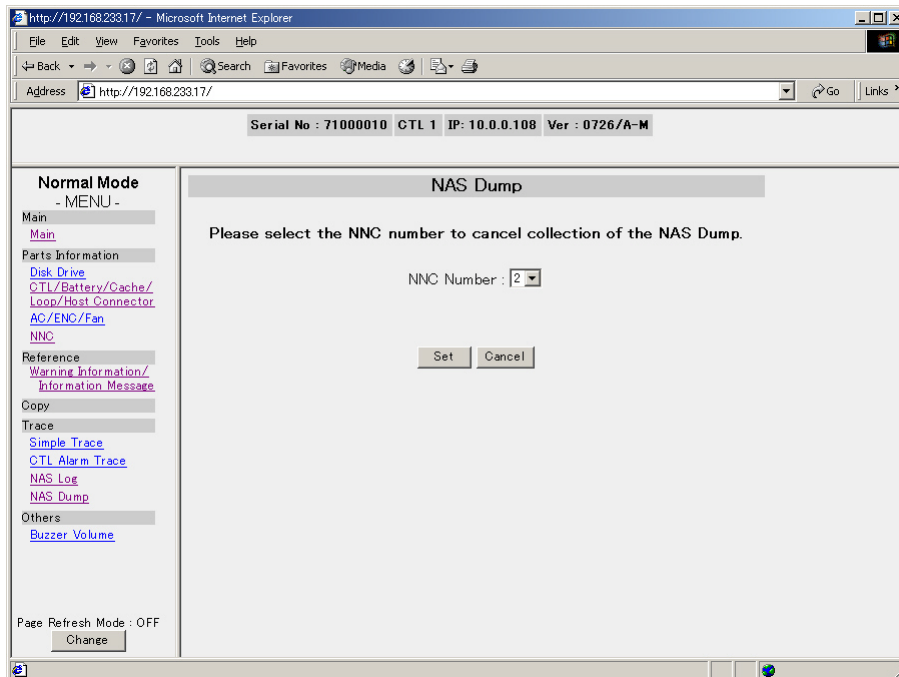


8.7.3.2 Suspension of NAS Dump Generation

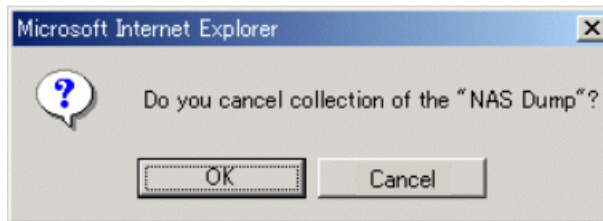
1. Select the Canceling collection of the NAS Dump.



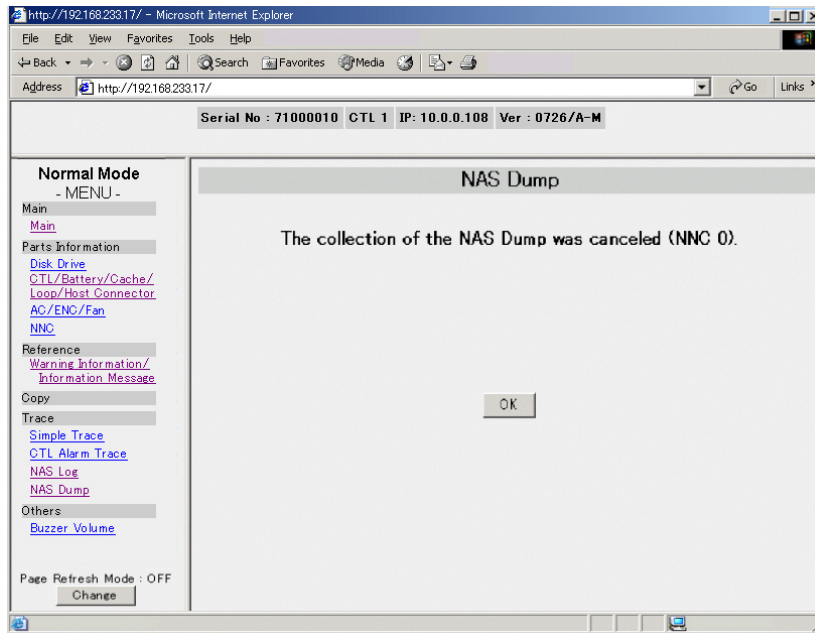
2. Specify the NNC (NAS Unit), which suspends the NAS Dump flushing, as “NNC Number”, and click the Set button.



3. The confirmation message is displayed. Click the **OK** button.

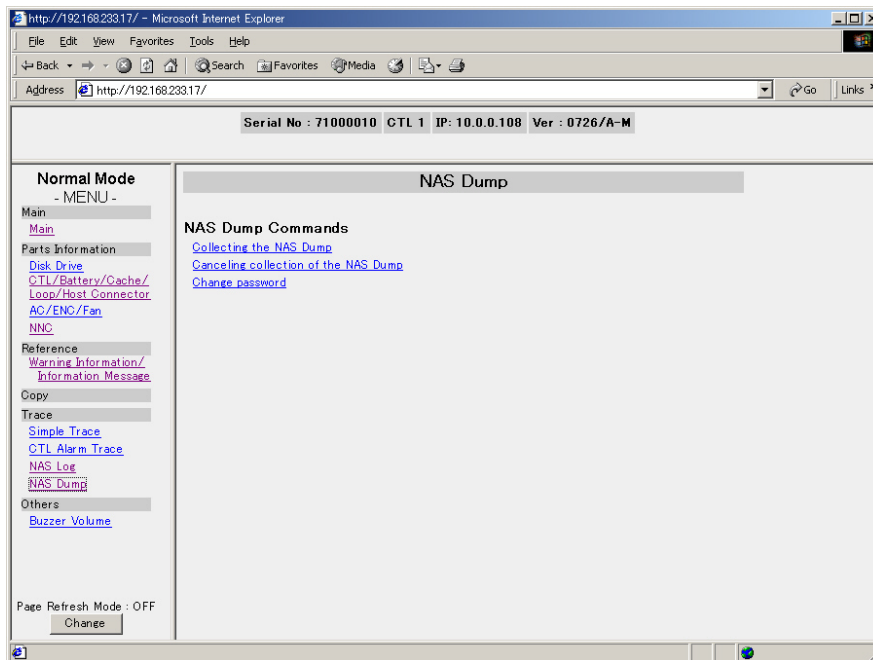


4. A suspension completion window is displayed. Click the **OK** button.

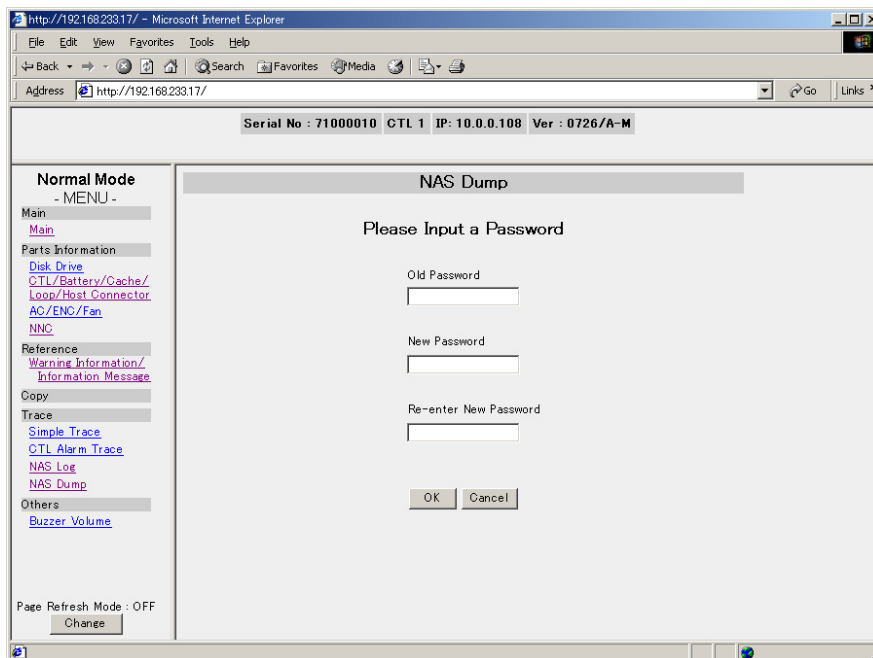


8.7.3.3 Registration and Changing the Password

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 the OK button.



3. The window, indicating the completion of the password registration, is displayed. Click the OK button.

8.8 Determining Failure on Network Side of an 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 AMS500 subsystem, determine whether there is a failure in the AMS500 subsystem according to the following flow diagram.

8.9 Changing the 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 Changing the 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:

- Microprogram Version 0726/E or later.
- Storage Navigator Modular Version 2.61 or later. The CLI is not supported in this version.
- 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 returning the microprogram version to the Version 0726/E or earlier after changing the LAN port number to the number other than 2000, return the LAN port number to 2000, and then return the microprogram version to the Version 0726/E or earlier.
- When returning the Storage Navigator Modular version to the Version 2.61 or earlier after changing the LAN port number to the number other than 2000, return the LAN port number to 2000, and then return the Storage Navigator Modular version to the Version 2.61 or earlier.
- 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 the LAN Port Number

1. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** button in the tool bar.
2. Click the **LAN Port Number** tab.

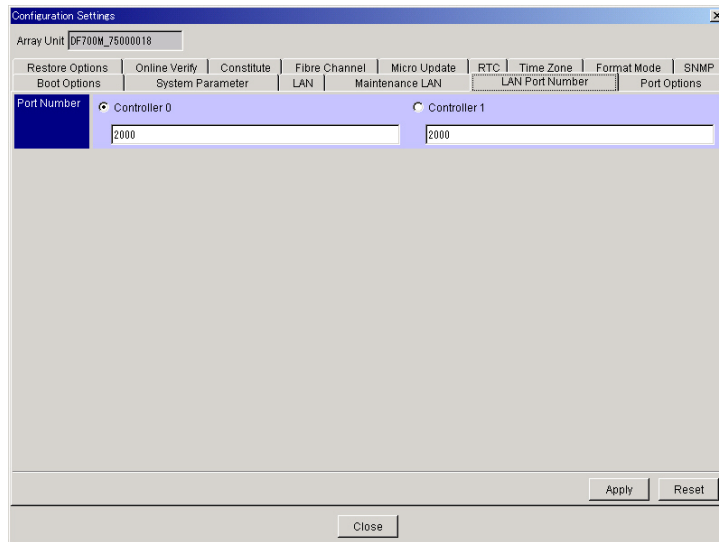
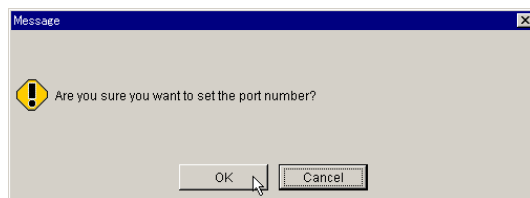
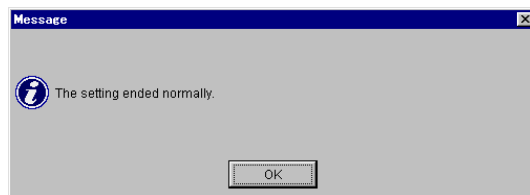


Figure 8-24 LAN Port Number Setting

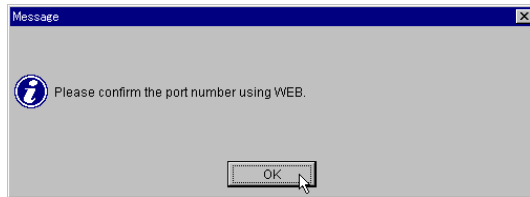
3. Click the **Controller 1** radio button, enter the port number to be set for the text field. Use the port number that is not used for the OS which activates the Storage Navigator Modular or other applications.
4. Click the **Apply** button.
5. A confirmation message appears, click the **OK** button.



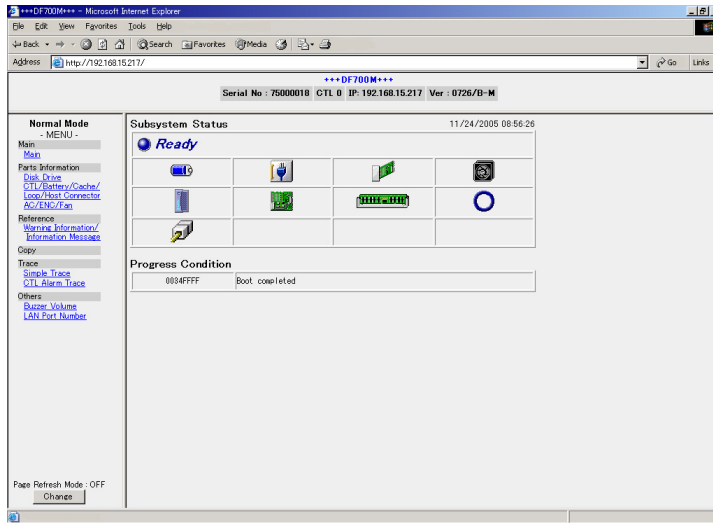
6. A message indicating completion of setting is displayed. Click the **OK** button.



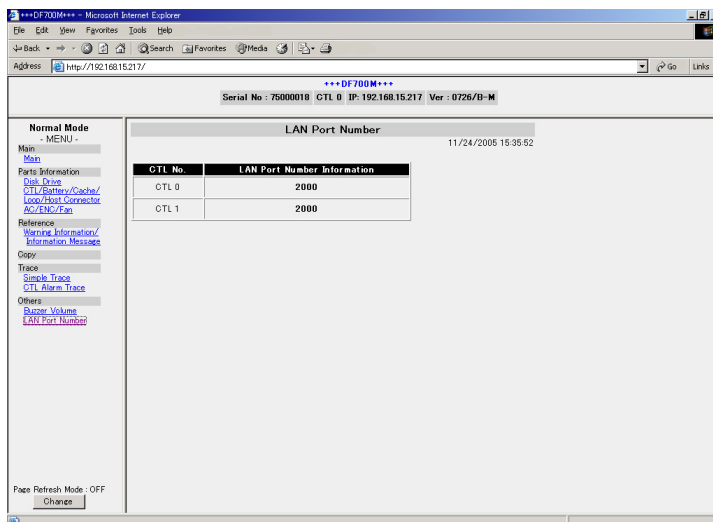
7. A confirmation message is displayed. Check that the LAN port number set in the Web browser is correct. Click the **OK** button.



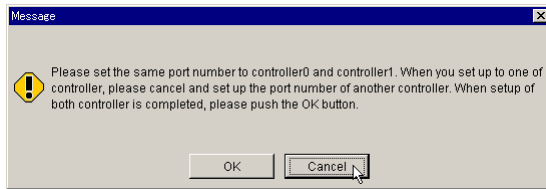
- Confirming the LAN Port Number with Web:
 - a) Enter the IP address of the array subsystem in the Web browser.
 - b) Click the LAN Port Number.



- c) Check that it corresponds with the set LAN port number.

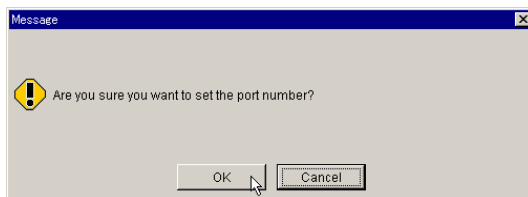


8. A confirmation message appears, click the **Cancel** button.

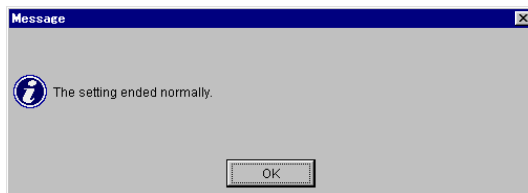


9. Click the **Controller 0** radio button, enter the port number to be set for the text field. Enter the value set for the **Controller1**.

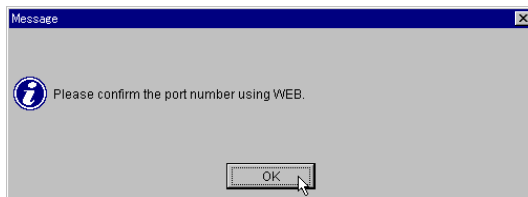
10. A confirmation message appears, click the **OK** button.



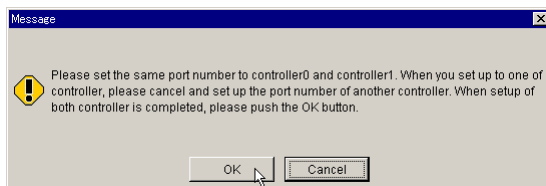
11. A message indicating completion of setting is displayed. Click the **OK** button.



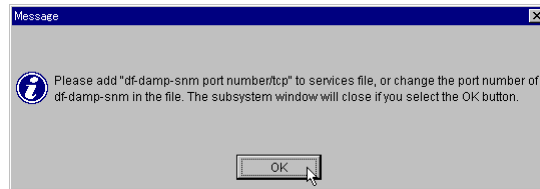
12. A confirmation message is displayed. Check that the LAN port number set in the Web browser is correct.



13. A confirmation message appears, click the **OK** button.



14. A confirmation message appears, click the **OK** button.
Unit screen will be closed by clicking the **OK** button.



15. 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 Windows® 2000: C:\WINNT\system32\drivers\etc\services, For Windows® XP: C:\WINDOWS\system32\drivers\etc\services) with a text editor such as Widows 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
```

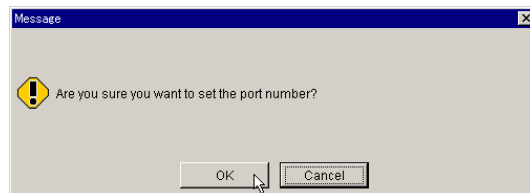
8.9.3 Troubleshooting

When a problem occurs during the LAN port number change work, recover it according to the following procedure.

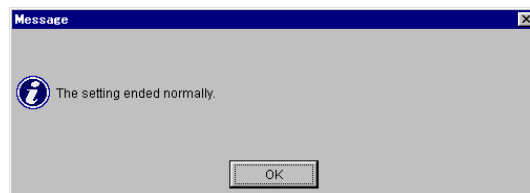
When the either control unit failed (Or, when the LAN port number for every control unit):

In this case, perform the LAN port number setting change connecting a LAN cable only to the control unit to be set.

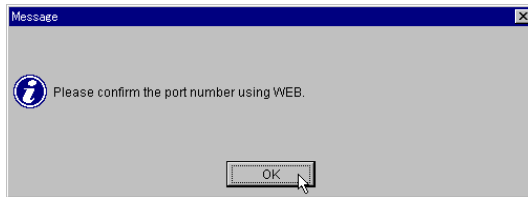
1. Set the LAN port number of the control unit to be set to the services file.
If it is unknown, check it using the Web browser.
2. Connect a LAN cable only to the control unit to be set, and register it in the Storage Navigator Modular with the IP address of the control concerned.
3. Start the Storage Navigator Modular.
4. On the **Settings** menu, select **Configuration Settings** or click **Configuration Settings** button 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 the **Apply** button.
8. A confirmation message appears, click the **OK** button.



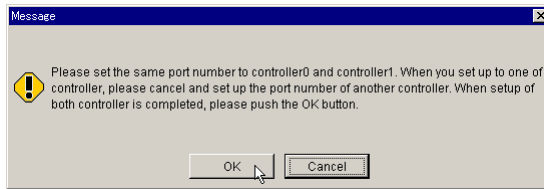
9. A message indicating completion of setting is displayed. Click the **OK** button.



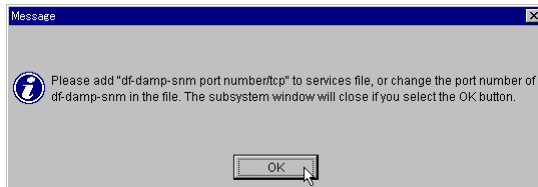
10. A confirmation message is displayed. Check that the LAN port number set in the Web browser is correct.



11. A confirmation message appears, click the **OK** button.



12. A confirmation message appears, click the **OK** button.
Unit screen will be closed by clicking the **OK** button.



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

If the subsystem is not energized for more than three months, the battery may over-discharge and unrecoverable damage may result. In this situation, the battery must be energized more than 6 hours at least once every three months or, 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 6 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	Glossary	○	○	○
Appendix B	System Parameter Setting List	○	—	○
Appendix C	Basic Specifications of the Storage System	○	○	○
Appendix D	D.1 Fibre Channel Connection Specifications	○	—	○
	D.2 Ethernet Connection Specifications	—	○	—
Appendix E	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
DAMP	Disk Array Management Program
D-CNT	default (owner) controller
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
FDN	Freedom Data Networks

Gbps	gigabit per second
GUI	graphical user interface
HA	high availability
HACMP	high availability cluster multi-processing
HBA	host bus adapter
HDLM	Hitachi Dynamic Link Manager
H-LUN	host logical unit
HORCM	Hitachi Open Remote Copy Manager
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
LU	logical unit
LUN	logical unit number
LUSE	LU size expansion
LVI	logical volume image
LVM	logical volume manager
MCU	main control unit
MDB	master directory block
MIB	message information block
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)
NDMP	Network Data Management Protocol
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 AMS500 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					
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 (Note 1)		VxVM (Note 2)		MpxIO (Note 5)		
Fail Over	None	Sun™ Cluster	VCS (Note 3)	None	Sun™ Cluster	None	VCS (Note 3)	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										
	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 6)					Not Selected					
VERITAS® Database Edition/Advanced Cluster for Oracle® RAC (Solaris™) is used					Not Selected	Unique Reserve Mode 1 (Note 7)	Not Selected	Unique Reserve Mode 1 (Note 7)	Not Selected	
Egenera® BladeFrame® Is used										

✓: 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 the items shown on gray backgrounds. Only when using the combination not described in the simple setting, select the required parameter from detail settings.

- When using Hitachi Dynamic Link Manager (HDLM), take notice of the following:
 - Vendor ID: If this text is changed, it cannot be managed by HDLM. Do not change this text.
 - Serial Number: When the multiple storages of same types exist, a different Serial Number needs to be allocated for each disk array subsystem.
- When using VERITAS® Volume Manager (VxVM), Array Support Library (ASL) for AMS Series is required. Please download from the Web screen of VERITAS®.
- VERITAS® Cluster Server.
- 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.
- SUN Multi Path (MPxIO).
- TrueCopy displayed on parameter means TrueCopy Remote Replication and TrueCopy Extended Distance.
- 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 Edition/Advanced 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:
 - 1) Vendor ID: If this text is changed, it cannot be managed by HDLM. Do not change this text.
 - 2) 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 (Note1)		VxVM (Note2)			
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 (Note3)	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:
 - 1) Vendor ID: If this text is changed, it cannot be managed by HDLM. Do not change this text.
 - 2) 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									

Host Group Option									
Simple Setting									
	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.

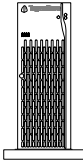
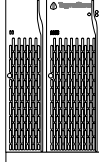
1. When using VERITAS® Volume Manager (VxVM), Array Support Library (ASL) for AMS Series is required. Please download from the Web screen of VERITAS®.
2. VERITAS® Cluster Server.
3. TrueCopy displayed on parameter means TrueCopy Remote Replication and TrueCopy Extended Distance.
4. When using VERITAS® 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 AMS500 Storage System Basic Specifications

Basic specifications of AMS500 are shown in this chapter.

The basic specifications of floor model and rackmount model are listed and described in Table C.1 and Table C.2, and the basic specifications of the RKNAS are listed and described in Table C.3.

Table C.1 Basic Specifications of AMS500 Floor Model

Item		Model	Floor Model	
			Floor (RKM+H1J) Model	Floor (RKM+RKAJ+H2J) Model
Configuration	Subsystem appearance			
Disk Drive	Disk drive size (W×D×H) (mm)	101.6×146.1×25.4		
	Data capacity (GB) (Note 1)	71.3/143.3/287.6		RKM: 71.3/143.3/287.6 RKAJAT: 245.7/393.4/ 491.9/737.4
	Rotational speed (min ⁻¹)	10,000/15,000		RKM: 10,000/15,000 RKAJAT: 7,200
	Maximum mountable quantity (unit)	15	30	
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	Single controller	Fibre Channel: 2iSCSI: 2 (Note 2)	
		Dual controller	Fibre Channel: 4iSCSI: 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 of when iSCSI interface board is added to the control unit.

Table C.1 Basic Specifications of AMS500 Floor Model (Continued)

Item	Model		Floor Model			
			Floor (RKM+H1J) Model	Floor (RKM+RKAJ+H2J) Model	Floor (RKM+RKAJAT+H2J) Model	
RAID Specifications (<i>Note 1</i>)	RAID Level (<i>Note 2</i>)		0/1/5/6/1+0	1/5/6/1+0		
	RAID Configuration (Unit of addition)	RAID 0	2D to 15D	2D to 16D	-	
		RAID 1	1D+1D			
		RAID 5	2D+1P to 14D+1P	2D+1P to 15D+1P		
		RAID 6	2D+2P to 13D+2P	2D+2P to 28D+2P		
		RAID 1+0	2D+2D to 7D+7D	2D+2D to 8D+8D		
Internal Logic Specifications	Control CPU		Power PC7447A (1.0 G Hz)			
	Control memory		Flash memory: 16 M bytes L2Cache memory: 512 k 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 (<i>Note 8</i>)			
	Chassis size (W×D×H) (mm)		260×737×540	309×737×540		
	Mass (kg) (<i>Note 3</i>)		70 approx.	115 approx.		
	Acoustic noise (dB) (<i>Note 7</i>)		56 approx.	59 approx.		
	Require height (EIA unit)		-			
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)(<i>Note 5</i>) (<i>Note 6</i>)		4.2×2/2.1×2	4.2×2+2.6×2/2.1×2+1.3×2	4.2×2+2.4×2/2.1×2+1.2×2	
	Breaking current (A)		16.0			
	Heat value (kJ/h)		3,025 or less	4,900 or less	4,755 or less	
	Required power (<i>Note 4</i>)	Steady State (VA)	840 or less	1,360 or less	1,320 or less	
Starting state (VA)		840 or less	1,400 or less	1,320 or less		

Notes:

1. D: Data disk, P: Parity disk
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.
3. Value of maximum configuration (in the case where all the mountable Disk drives and Controller are mounted).
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 AMS500 is “0.90 - 0.96”. The manual incorrectly states the value as “1”.
5. Power current of N×2 described in this table is required for operation by a single power supply unit.
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.
7. A noise emitted at the time of start is not included.
8. The start-up time may be longer than three minutes depending on the configuration.




Table C.1 Basic Specifications of AMS500 Floor Model (Continued)

Item		Floor Model		
		Floor (RKM+H1J) Model	Floor (RKM+RKAJ+H2J) Model	Floor (RKM+RKAJAT+H2J) Model
Cache Specifications	Capacity (M bytes/CTL)	1,024, 2,048, 3,072, 4,096		
	Control method	Read LRU/Write after		
	Battery backup	Provided		
	Backup duration (h) (Note)	24 (When cache of 4,096 M bytes/CTL)		
Maintenance Specifications/ Antifault Specifications	Spare disk	Up to fifteen of mounted Disk drives can be set to Spare disks		
	Display function	Status LEDs (POWER, READY, WARNING, and ALARM), LED of maintenance part		
Insulation Performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)	AC 1,500 V (100 mA, 1 min)	
	Insulation resistance	DC 500 V, 10 M W 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 three months, over-discharging of the battery occurs and can result in unrecoverable damage. The battery must be energized more than 6 hours at least once a month, or the subsystem must be stored with the switch of the battery turned off. Even with the switch turned off, the battery discharges naturally. In this case, charge the battery once per six months for longer than 6 hours.

Table C.2 Basic Specifications of AMS500 Rackmount Model

Item		Model	Rackmount Model		
			RKM	RKAJ	RKAJAT
Configuration	Configuration		1 RKM	1 RKAJ	1 RKAJAT
	Subsystem appearance				
Disk Drive	Disk drive size (W×D×H) (mm)	101.6×146.1×25.4			
	Data capacity (GB) (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 Gbps Fibre Channel Optical (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	Single controller	Fibre Channel: 2iSCSI: 2 (Note 2)	-	
		Dual controller	Fibre Channel: 4iSCSI: 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 of when iSCSI interface board is added to the control unit.

Table C.2 Basic Specifications of AMS500 Rackmount Model (Continued)

Item	Model		Rackmount Model		
			RKM	RKAJ	RKAJAT
RAID Specifications (<i>Note 1</i>)	RAID level (<i>Note 2</i>)		0/1/5/6/1+0		1/5/6/1+0
	RAID configuration (Unit of addition)	RAID 0	2D to 15D	2D to 16D	-
		RAID 1	1D+1D		
		RAID 5	2D+1P to 14D+1P	2D+1P to 15D+1P	
		RAID 6	2D+2P to 13D+2P	2D+2P to 28D+2P	
		RAID 1+0	2D+2D to 7D+7D	2D+2D to 8D+8D	
Internal Logic Specifications	Control CPU		Power PC7447A (1.0 G Hz)	-	
	Control memory		Flash memory: 16 M bytes L2 Cache memory: 512 k 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 (<i>Note 8</i>)	-	
	Chassis size (W×D×H) (mm)		483×650×174	483×650×129	
	Mass (kg) (<i>Note 3</i>)		58 approx.	40 approx.	
	Acoustic noise (dB) (<i>Note 7</i>)		57 approx.	60 approx.	
	Require height (EIA unit)		4	3	
Input Power Specifications	Input voltage (v)		AC 100/200 (100 to 120/200 to 240)		
	Frequency (Hz)		50/60 ±1		
	Number of phases, cabling		Single-phase with protective grounding		
	Steady-state current (A) (<i>Note 5</i>) (<i>Note 6</i>)		4.2×2/2.1×2	2.6×2/1.3×2	2.4×2/1.2×2
	Breaking current (A)		16.0	10.0	
	Heat value (kJ/h)		3,025 or less	1,875 or less	1,730 or less
	Required power (<i>Note 4</i>)	Starting state (VA)	840 or less	520 or less	480 or less
		Steady State (VA)	840 or less	560 or less	480 or less

Notes:

1. D: Data disk, P: Parity disk
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.
3. Value of maximum configuration (in the case where all the mountable Disk drives and Controller are mounted).
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 AMS500 is "0.90 - 0.96". The manual incorrectly states the value as "1".

5. Power current of N×2 described in this table is required for operation by a single power supply unit.
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.
7. A noise emitted at the time of start is not included.
8. The start-up time may be longer than three minutes depending on the configuration.

Table C.2 Basic Specifications of AMS500 Rackmount Model (Continued)

Item	Model	Rackmount Model		
		RKM	RKAJ	RKAJAT
Cache Specifications	Capacity(M bytes/CTL)	1,024, 2,048, 3,072, 4,096	-	
	Control method	Read LRU/Write after	-	
	Battery backup	Provided	-	
	Backup duration(h) (Note)	24 (When cache of 4,096 M bytes/CTL)	-	
Maintenance Specifications/ Antifault Specifications	Spare disk	Up to fifteen of mounted Disk drives can be set to Spare disks		
	Display function	Status LEDs (POWER, READY, WARNING, and ALARM), LED of maintenance part		
Insulation Performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		
	Insulation resistance	DC 500 V, 10 M W 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 three months, over-discharging of the battery occurs and can result in unrecoverable damage. The battery must be energized more than 6 hours at least once a month, or the subsystem must be stored with the switch of the battery turned off. Even with the switch turned off, the battery discharges naturally. In this case, charge the battery once per six months for longer than 6 hours.

The following table lists and describes the basic specifications of RKNAS.

Table C.3 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 (Note 3)	Steady state (VA)
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 AMS500 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 AMS500, 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.

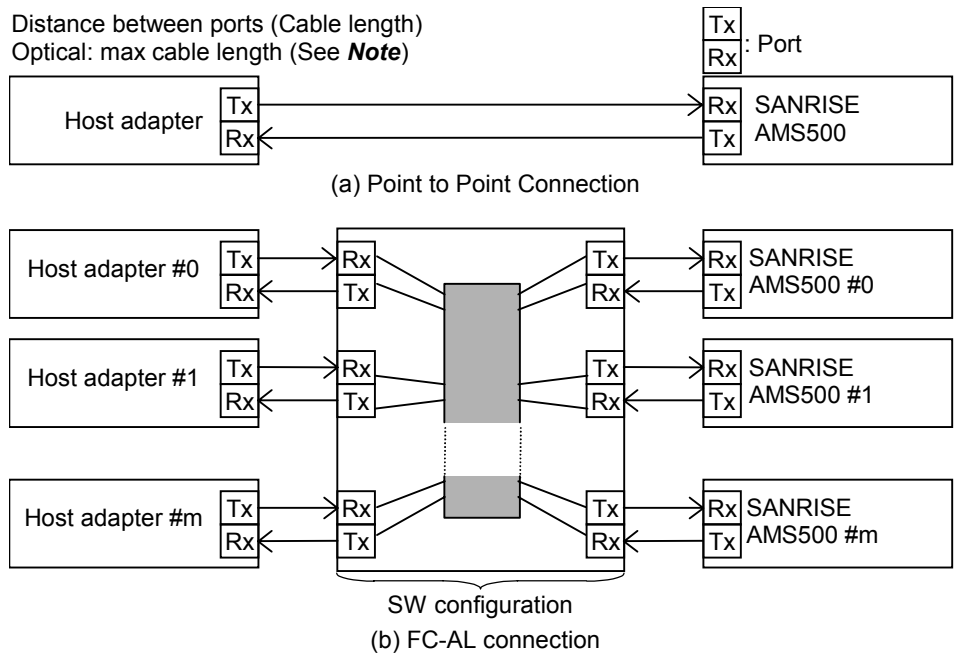


Figure D.1 Fibre Channel Connection Specifications

Note:

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

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

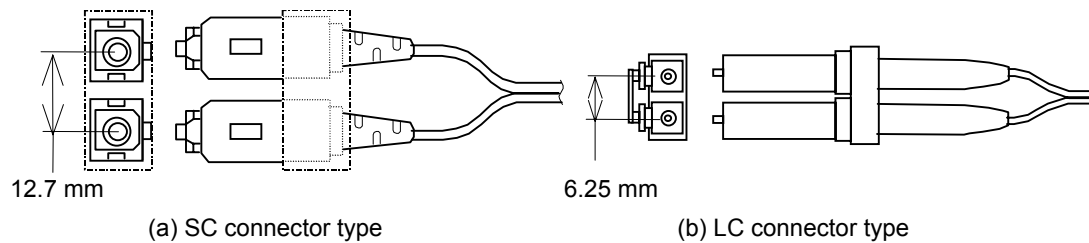


Figure D.2 Cable Side Connector

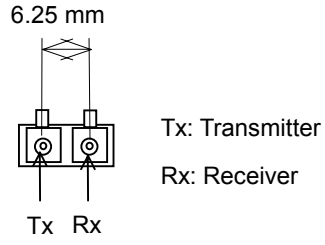
D.1.3 Storage System Side Connector

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 Connector Shape

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 AMS500 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 Field	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 (**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 optional 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 AMS500 is shown in Table D.7.

Table D.7 Frame Format

No.	Name	Usage	Treatment with 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 AMS500 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 AMS500. If the Optional Headers are added in the Data frames sent to the subsystem, correct operation in the AMS500 is not guaranteed.

■ **Link Control Frames**

Table D.8 displays the defined Link Control frames (FT-0) and supports Link Control frames. The AMS500 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 AMS500.

Table D.9 Link Service Frames Supported by the AMS500

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**

The AMS500 supports 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
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.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

- **CP_LUN:**
The FCP_LUN field specifies the Logical Unit Number in which the issued SCSI Command is executed.

Table D.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 AMS500.

- **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 AMS500.

- **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 AMS500.
(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 AMS500 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 the Table D.15.

At the beginning, the AMS500 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 AMS500 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 AMS500 transmits LIP first. When LIP is detected by the AMS500, the array controller transmits LISM. When the same LISM as the AMS500 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 AMS500 does not become a Loop Master, the transmission of LIFA, LIHA, LISA, LIRP, and LILP are initiated by the Loop Master. The AMS500 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:

<AMS500>	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:

<AMS500>	Direction	
LIP, LIP	----->	
	<-----	LIP, LIP
LISM, LISM	----->	
	<-----	LISM, LISM
	<-----	ARB (F0), ARB (F0)
ARB (F0), ARB (F0)	----->	
	<-----	LIFA
LIFA	----->	
	<-----	LIPA
LIPA	----->	
	<-----	LIHA
LIHA	----->	
	<-----	LISA
LISA	----->	
	<-----	LIRP
LIRP	----->	
	<-----	LILP
LILP	----->	
	<-----	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	<AMS500>
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
		FS_ACC	→		as the N/NL.
6	<Fabric Controller>		←	SCR	Receives and registers the RSCN.
		ACC	→		(=3: Full Registration)
7	<Fabric Controller>		←	RSCN	Requires a host computer for an issue of RSCN again. (ADR format = 0
		ACC	→		Affected N_Port ID = Own port address)

- **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: HDS recommends that you use an STP cable that suppresses radio noise.

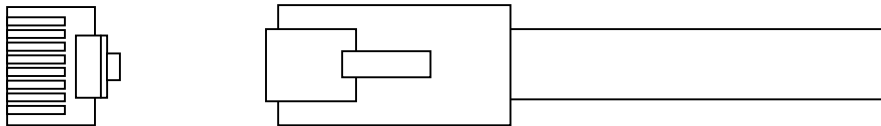


Figure D.4 Connector Type on Cable Side

- Connector Type on the Subsystem Side
Figure D.5 shows the connector type for the LAN interface on the subsystem side.

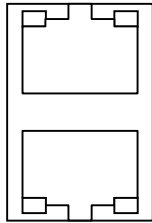


Figure D.5 Connector Type on Subsystem Side

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	Input voltage (V)	AC 100-120/200-240	
specifications	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

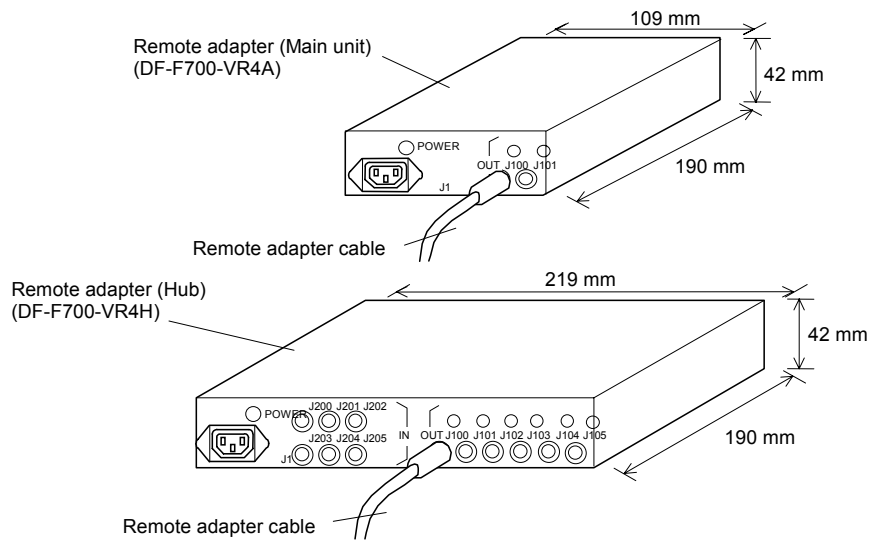


Figure E.1 Information Message Screen

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	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
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	105 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.2 List of Capacities Corresponding to RAID1 (72 GB)

Disk capacity	71.3 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
1D+1D	2	14	30	44	60	74	90	104	120	134	150	164	180	194	210	224
	71.31	499.17	1069.66	1568.84	2139.33	2638.51	3209.00	3708.18	4278.67	4777.85	5348.34	5847.52	6418.01	6917.19	7487.68	7986.86

Table F.3 List of Capacities Corresponding to RAID5 (72 GB)

Disk capacity	71.3 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
2D+1P	3	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
	142.62	713.11	1426.22	2139.33	2852.45	3565.56	4278.67	4991.78	5704.90	6418.01	7131.12	7844.23	8557.35	9270.46	9983.57	10696.68
3D+1P	4	12	28	44	60	72	88	104	120	132	148	164	180	192	208	224
	213.93	641.80	1497.53	2353.27	3209.00	3850.80	4706.54	5562.27	6418.01	7059.81	7915.54	8771.28	9627.01	10268.82	11124.55	11980.29
4D+1P	5	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
	285.24	855.73	1711.47	2567.20	3422.94	4278.67	5134.41	5990.14	6845.88	7701.61	8557.35	9413.08	10268.82	11124.55	11980.29	12836.02
5D+1P	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210	222
	356.55	713.11	1782.78	2495.89	3565.56	4278.67	5348.34	6061.45	7131.12	7844.23	8913.90	9627.01	10696.68	11409.80	12479.47	13192.58
6D+1P	7	14	28	42	56	70	84	105	119	133	147	161	175	189	210	224
	427.86	855.73	1711.47	2567.20	3422.94	4278.67	5134.41	6418.01	7273.74	8129.48	8985.21	9840.95	10696.68	11552.42	12836.02	13691.76
7D+1P	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208	224
	499.17	499.17	1497.53	2495.89	3494.25	4492.60	5490.96	6489.32	7487.68	7986.86	8985.21	9983.57	10981.93	11980.29	12978.64	13977.00
8D+1P	9	9	27	45	54	72	90	99	117	135	144	162	180	189	207	225
	570.49	570.49	1711.47	2852.45	3422.94	4563.92	5704.90	6275.39	7416.37	8557.35	9127.84	10268.82	11409.80	11980.29	13121.27	14262.25
9D+1P	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210	220
	641.80	641.80	1925.40	2567.20	3850.80	4492.60	5776.21	6418.01	7701.61	8343.41	9627.01	10268.82	11552.42	12194.22	13477.82	14119.62
10D+1P	11	11	22	44	55	66	88	99	110	132	143	165	176	187	209	220
	713.11	713.11	1426.22	2852.45	3565.56	4278.67	5704.90	6418.01	7131.12	8557.35	9270.46	10696.68	11409.80	12122.91	13549.13	14262.25
11D+1P	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204	216
	784.42	784.42	1568.84	2353.27	3922.11	4706.54	5490.96	6275.39	7844.23	8628.66	9413.08	10197.50	11766.35	12550.78	13335.20	14119.62
12D+1P	13	13	26	39	52	65	78	104	117	130	143	156	169	195	208	221
	855.73	855.73	1711.47	2567.20	3422.94	4278.67	5134.41	6845.88	7701.61	8557.35	9413.08	10268.82	11124.55	12836.02	13691.76	14547.49
13D+1P	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210	224
	927.04	927.04	1854.09	2781.13	3708.18	4635.23	5562.27	6489.32	7416.37	8343.41	9270.46	10197.50	11124.55	12051.60	13905.69	14832.74
14D+1P	15	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
	998.35	998.35	1996.71	2995.07	3993.43	4991.78	5990.14	6988.50	7986.86	8985.21	9983.57	10981.93	11980.29	12978.64	13977.00	14975.36
15D+1P	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208	224
	0.00	0.00	1069.66	2139.33	3209.00	4278.67	5348.34	6418.01	7487.68	8557.35	9627.01	10696.68	11766.35	12836.02	13905.69	14975.36

Table F.4 List of Capacities Corresponding to RAID6 (72 GB)

Disk capacity	71.3 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
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	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	108 6845.88	126 7986.86	144 9127.84	162 10268.82	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 4769.16	95 6061.45	114 7273.74	133 8486.03	152 9698.33	171 10910.62	190 12122.91	209 13335.20	228 14568.40		
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 9085.21	160 10268.82	180 11552.42	200 12836.02	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	126 8129.48	147 9484.39	168 10839.31	189 12194.22	210 13549.13	231 15074.13			
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	154 9983.57	176 11409.80	198 12836.02	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	184 11980.29	207 13477.82	220 14777.82				
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	192 12550.78	216 14119.62					
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	200 13121.27	225 14761.43					
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	208 13691.76	234 15372.72					
25D+2P	0 0.00	0 0.00	27 1782.78	54 3565.56	81 5348.34	108 6713.12	135 8913.90	162 10696.68	189 12479.47	216 14262.25						
26D+2P	0 0.00	0 0.00	28 1854.09	56 3708.18	84 4562.27	112 6716.37	140 8557.35	168 10268.82	196 11980.29	224 14832.74						
27D+2P	0 0.00	0 0.00	29 1925.40	58 3850.80	87 5776.21	116 7701.61	145 9627.01	174 11552.42	203 13477.82	231 15074.13						
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							

Table F.5 List of Capacities Corresponding to RAID1+0 (72 GB)

Disk capacity		71.3 G bytes															
Component unit		RKM		RKAJ													
Range		1	2	3	4	5	6	7	8	9	10	11	12	13	14		
Total range of Disk drives		Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
2D+2D	4	12	28	44	60	72	88	104	120	132	148	164	180	192	208	224	
	142.62	427.86	998.35	1568.84	2139.33	2567.20	3137.69	3708.18	4278.67	4706.54	5277.03	5847.52	6418.01	6845.88	7416.37	7986.86	
3D+3D	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210	222	
	213.93	427.86	1069.66	1497.53	2139.33	2567.20	3209.00	3636.87	4278.67	4706.54	5348.34	5776.21	6418.01	6845.88	7487.68	7915.54	
4D+4D	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208	224	
	285.24	285.24	855.73	1426.22	1996.71	2567.20	3137.69	3708.18	4278.67	4563.92	5134.41	5704.90	6275.39	6845.88	7416.37	7986.86	
5D+5D	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210	220	
	356.55	356.55	1069.66	1426.22	2139.33	2495.89	3209.00	3565.56	4278.67	4635.23	5348.34	5704.90	6418.01	6774.56	7487.68	7844.23	
6D+6D	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204	216	
	427.86	427.86	855.73	1283.60	2139.33	2567.20	2995.07	3422.94	4278.67	4706.54	5134.41	5562.27	6418.01	6845.88	7273.74	7701.61	
7D+7D	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210	224	
	499.17	499.17	998.35	1497.53	1996.71	2495.89	2995.07	3494.25	3993.43	4492.60	4991.78	5490.96	5990.14	6489.32	7487.68	7986.86	
8D+8D	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	
	0.00	0.00	570.49	1140.98	1711.47	2281.96	2852.45	3422.94	3993.43	4563.92	5134.41	5704.90	6275.39	6845.88	7416.37	7986.86	

Table F.6 List of Capacities Corresponding to RAID0 (146 GB)

Disk capacity		143.3 G bytes															
Component unit		RKM		RKAJ													
Range		1	2	3	4	5	6	7	8	9	10	11	12	13	14		
Total range of Disk drives		Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
2D	2	14	30	44	60	74	90	104	120	134	150	164	180	194	210	224	
	286.61	2006.29	4299.19	6305.49	8598.39	10604.69	12897.59	14903.88	17196.79	19203.08	21495.99	23502.28	25795.19	27801.48	30094.39	32100.68	
3D	3	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	
	429.91	2149.59	4299.19	6448.79	8598.39	10747.99	12897.59	15047.19	17196.79	19346.39	21495.99	23645.59	25795.19	27944.79	30094.39	32243.99	
4D	4	12	28	44	60	72	88	104	120	132	148	164	180	192	208	224	
	573.22	1719.67	4012.58	6305.49	8598.39	10318.07	12610.98	14903.88	17196.79	18916.47	21209.38	23502.28	25795.19	27514.87	29807.77	32100.68	
5D	5	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	
	716.53	2149.59	4299.19	6448.79	8598.39	10747.99	12897.59	15047.19	17196.79	19346.39	21495.99	23645.59	25795.19	27944.79	30094.39	32243.99	
6D	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210	222	
	859.83	1719.67	4299.19	6018.87	8598.39	10318.07	12897.59	14617.27	17196.79	18916.47	21495.99	23215.67	25795.19	27514.87	30094.39	31814.07	
7D	7	14	28	42	56	70	84	105	119	133	147	161	175	189	210	224	
	1003.14	2006.29	4012.58	6018.87	8025.17	10031.46	12037.75	15047.19	17053.48	19059.78	21066.07	23072.36	25078.65	27084.95	30094.39	32100.68	
8D	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208	224	
	1146.45	1146.45	3439.35	5732.26	8025.17	10318.07	12610.98	14903.88	17196.79	18343.24	20636.15	22929.06	25221.96	27514.87	29807.77	32100.68	
9D	9	9	27	45	54	72	90	99	117	135	144	162	180	189	207	225	
	1289.75	1289.75	3869.27	6448.79	7738.55	10318.07	12897.59	14187.35	16766.87	19346.39	20636.15	23215.67	25795.19	27084.95	29664.47	32243.99	
10D	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210	220	
	1433.06	1433.06	4299.19	5732.26	8598.39	10031.46	12897.59	14330.66	17196.79	18629.86	21495.99	22929.06	25795.19	27228.25	30094.39	31527.45	
11D	11	11	22	44	55	66	88	99	110	132	143	165	176	187	209	220	
	1576.37	1576.37	3152.74	6305.49	7881.86	9458.23	12610.98	14187.35	15763.72	18916.47	20492.84	23645.59	25221.96	26798.33	29951.08	31527.45	
12D	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204	216	
	1719.67	1719.67	3439.35	5159.03	8598.39	10318.07	12037.75	13757.43	17196.79	18916.47	20636.15	22355.83	25795.19	27514.87	29234.55	30954.23	
13D	13	13	26	39	52	65	78	104	117	130	143	156	169	195	208	221	
	1862.98	1862.98	3725.97	5588.95	7451.94	9314.93	11177.91	14903.88	16766.87	18629.86	20492.84	22355.83	24218.81	27944.79	29807.77	31670.76	
14D	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210	224	
	2006.29	2006.29	4012.58	6018.87	8025.17	10031.46	12037.75	14044.04	16050.34	18056.63	20062.92	22069.22	24075.51	26081.80	30094.39	32100.68	
15D	15	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	
	2149.59	2149.59	4299.19	6448.79	8598.39	10747.99	12897.59	15047.19	17196.79	19346.39	21495.99	23645.59	25795.19	27944.79	30094.39	32243.99	
16D	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	
	0.00	0.00	2292.90	4585.81	6878.71	9171.62	11464.53	13757.43	16050.34	18343.24	20636.15	22929.06	25221.96	27514.87	29807.77	32100.68	

Table F.7 List of Capacities Corresponding to RAID1 (146 GB)

Disk capacity	143.3 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
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

Table F.8 List of Capacities Corresponding to RAID5 (146 GB)

Disk capacity	143.3 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
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.9 List of Capacities Corresponding to RAID6 (146 GB)

Disk capacity		143.3 G bytes														
Component unit	RKM		RKAJ													
	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Range	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
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 20662.92	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 14903.88	130 15763.72	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 20662.92	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	169 21495.99	186 23645.59	204 25795.19	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 13757.43	126 16050.34	144 18343.24	162 20636.15	180 22929.06	198 25221.96	216 27514.87		
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		
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 25795.19	220 28374.71			
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			
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 19346.39	176 21495.99	198 23645.59	220 25795.19	220 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 18056.63	161 21066.07	184 24075.51	207 27084.95	207 27084.95				
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 22069.22	192 25221.96	216 28374.71					
23D+2P	0 0.00	0 0.00	25 3296.05	50 6592.10	75 9888.15	100 13184.20	125 16480.26	150 19776.31	175 23072.36	200 26368.41	225 29664.47					
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 23072.36	208 26368.41	224 28374.71					
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 25078.65	216 28661.32						
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 25078.65	224 28661.32						
27D+2P	0 0.00	0 0.00	29 3869.27	58 7738.55	87 11607.83	116 14903.88	145 18629.86	174 22355.83	203 25078.65	231 28661.32						
28D+2P	0 0.00	0 0.00	30 4012.58	60 8025.17	90 12037.75	120 15763.72	150 19346.39	180 23215.67	210 27084.95	240 30161.80						

Table F.10 List of Capacities Corresponding to RAID1+0 (146 GB)

Disk capacity	143.3 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
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	60 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

Table F.11 List of Capacities Corresponding to RAID0 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
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	90 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	70 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.12 List of Capacities Corresponding to RAID1 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
1D+1D	2	14	30	44	60	74	90	104	120	134	150	164	180	194	210	224
	287.62	2013.40	4314.42	6327.82	8628.85	10642.25	12943.28	14956.68	17257.71	19271.11	21572.14	23585.54	25886.57	27899.97	30201.00	32214.40

Table F.13 List of Capacities Corresponding to RAID5 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
2D+1P	3	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
	575.25	2876.28	5752.57	8628.85	11505.14	14381.42	17257.71	20134.00	23010.28	25886.57	28762.85	31639.14	34515.43	37391.71	40268.00	43144.28
3D+1P	4	12	28	44	60	72	88	104	120	132	148	164	180	192	208	224
	862.88	2588.65	6040.20	9491.74	12943.28	15531.94	18983.48	22435.03	25886.57	28475.23	31926.77	35378.31	38829.85	41418.51	44870.06	48321.60
4D+1P	5	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
	1150.51	3451.54	6903.08	10354.62	13806.17	17257.71	20709.25	24160.80	27612.34	31063.88	34515.43	37966.97	41418.51	44870.06	48321.60	51773.14
5D+1P	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210	222
	1438.14	2876.28	7190.71	10067.00	14381.42	17257.71	21572.14	24448.43	28762.85	31639.14	35953.57	38829.85	43144.28	46020.57	50335.00	53211.28
6D+1P	7	14	28	42	56	70	84	105	119	133	147	161	175	189	210	224
	1725.77	3451.54	6903.08	10354.62	13806.17	17257.71	20709.25	25886.57	29338.11	32789.65	36241.20	39692.74	43144.28	46595.83	51773.14	55224.68
7D+1P	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208	224
	2013.40	2013.40	6040.20	10067.00	14093.80	18120.60	22147.40	26174.20	30201.00	32214.40	36241.20	40268.00	44294.80	48321.60	52348.40	56375.20
8D+1P	9	9	27	45	54	72	90	99	117	135	144	162	180	189	207	225
	2301.02	2301.02	6903.08	11505.14	13806.17	18408.22	23010.28	25311.31	29913.37	34515.43	36816.45	41418.51	46020.57	48321.60	52923.66	57525.71
9D+1P	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210	220
	2588.65	2588.65	7765.97	10354.62	15531.94	18120.60	23297.91	25886.57	31063.88	33652.54	38829.85	41418.51	46595.83	49184.48	54361.80	56950.46
10D+1P	11	11	22	44	55	66	88	99	110	132	143	165	176	187	209	220
	2876.28	2876.28	5752.57	11505.14	14381.42	17257.71	23010.28	25886.57	28762.85	34515.43	37391.71	43144.28	46020.57	48896.86	54649.43	57525.71
11D+1P	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204	216
	3163.91	3163.91	6327.82	9491.74	15819.57	18983.48	22147.40	25311.31	31639.14	34803.05	37966.97	41130.88	47458.71	50622.63	53786.54	56950.46
12D+1P	13	13	26	39	52	65	78	104	117	130	143	156	169	195	208	221
	3451.54	3451.54	6903.08	10354.62	13806.17	17257.71	20709.25	27612.34	31063.88	34515.43	37966.97	41418.51	44870.06	51773.14	55224.68	58676.23
13D+1P	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210	224
	3739.17	3739.17	7478.34	11217.51	14956.68	18695.85	22435.03	26174.20	29913.37	33652.54	37391.71	41130.88	44870.06	48609.23	56087.57	59826.74
14D+1P	15	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
	4026.80	4026.80	8053.60	12080.40	16107.20	20134.00	24160.80	28187.60	32214.40	36241.20	40268.00	44294.80	48321.60	52348.40	56375.20	60402.00
15D+1P	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208	224
	0.00	0.00	4314.42	8628.85	12943.28	17257.71	21572.14	25886.57	30201.00	34515.43	38829.85	43144.28	47458.71	51773.14	56087.57	60402.00

Table F.14 List of Capacities Corresponding to RAID6 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKM		RKAJ													
Range	1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total range of Disk drives	Min.	15 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max)
2D+2P	4	12	28	44	60	72	88	104	120	132	148	164	180	192	208	224
	575.25	1725.77	4026.80	6327.82	8628.85	10354.62	12655.65	14956.68	17257.71	18983.48	21284.51	23585.54	25886.57	27612.34	29913.37	32214.40
3D+2P	5	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
	862.88	2588.65	5177.31	7765.97	10354.62	12943.28	15531.94	18120.60	20709.25	23297.91	25886.57	28475.23	31063.88	33652.54	36241.20	38829.85
4D+2P	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210	222
	1150.51	2301.02	5752.57	8053.60	11505.14	13806.17	17257.71	19558.74	23010.28	25311.31	28762.85	31063.88	34515.43	36816.45	40268.00	42569.03
5D+2P	7	14	28	42	56	70	84	105	119	133	147	161	175	189	210	224
	1438.14	2876.28	5752.57	8628.85	11505.14	14381.42	17257.71	21572.14	24448.43	27324.71	30201.00	33077.28	35953.57	38829.85	43144.28	46020.57
6D+2P	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208	224
	1725.77	1725.77	5177.31	8628.85	12080.40	15531.94	18983.48	22435.03	25886.57	27612.34	31063.88	34515.43	37966.97	41418.51	44870.06	48321.60
7D+2P	9	9	27	45	54	72	90	99	117	135	144	162	180	189	207	225
	2013.40	2013.40	6040.20	10067.00	12080.40	16107.20	20134.00	22147.40	26174.20	30201.00	32214.40	36241.20	40268.00	42281.40	46308.20	50335.00
8D+2P	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210	220
	2301.02	2301.02	6903.08	9204.11	13806.17	16107.20	20709.25	23010.28	27612.34	29913.37	34515.43	36816.45	41418.51	43719.54	48321.60	50622.63
9D+2P	11	11	22	44	55	66	88	99	110	132	143	165	176	187	209	220
	2588.65	2588.65	5177.31	10354.62	12943.28	15531.94	20709.25	23297.91	25886.57	31063.88	33652.54	38829.85	41418.51	44007.17	49184.48	51773.14
10D+2P	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204	216
	2876.28	2876.28	5752.57	8628.85	14381.42	17257.71	20134.00	23010.28	28762.85	31639.14	34515.43	37391.71	43144.28	46020.57	48896.86	51773.14
11D+2P	13	13	26	39	52	65	78	104	117	130	143	156	169	195	208	221
	3163.91	3163.91	6327.82	9491.74	12655.65	15819.57	18983.48	25311.31	28475.23	31639.14	34803.05	37966.97	41130.88	47458.71	50622.63	53786.54
12D+2P	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210	224
	3451.54	3451.54	6903.08	10354.62	13806.17	17257.71	20709.25	24160.80	27612.34	31063.88	34515.43	37966.97	41418.51	44870.06	51773.14	55224.68
13D+2P	15	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225
	3739.17	3739.17	7478.34	11217.51	14956.68	18695.85	22435.03	26174.20	29913.37	33652.54	37391.71	41130.88	44870.06	48609.23	52348.40	56087.57
14D+2P	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208	224
	0.00	0.00	4026.80	8053.60	12080.40	16107.20	20134.00	24160.80	28187.60	32214.40	36241.20	40268.00	44294.80	48321.60	52348.40	56375.20
15D+2P	0	0	17	34	51	68	85	102	119	136	153	170	187	204	221	
	0.00	0.00	4314.42	8628.85	12943.28	17257.71	21572.14	25886.57	30201.00	30201.00	34515.43	38829.85	43144.28	47458.71	51773.14	56087.57
16D+2P	0	0	18	36	54	72	90	90	108	126	144	162	180	180	198	216
	0.00	0.00	4602.05	9204.11	13806.17	18408.22	23010.28	23010.28	27612.34	32214.40	36816.45	41418.51	46020.57	46020.57	50622.63	55224.68
17D+2P	0	0	19	38	57	76	95	114	133	133	152	171	190	209	209	
	0.00	0.00	4889.68	9779.37	14669.05	14669.05	19558.74	24448.43	29338.11	34227.80	34227.80	39117.48	44007.17	48896.86	53786.54	53786.54
18D+2P	0	0	20	40	60	80	100	100	120	140	160	180	180	200	220	
	0.00	0.00	5177.31	10354.62	15531.94	15531.94	20709.25	25886.57	31063.88	31063.88	36241.20	41418.51	46595.83	46595.83	51773.14	56950.46
19D+2P	0	0	21	42	63	84	105	105	126	147	147	168	189	210	210	
	0.00	0.00	5464.94	10929.88	16394.82	21859.77	27324.71	27324.71	32789.65	38254.60	38254.60	43719.54	49184.48	54649.43	54649.43	
20D+2P	0	0	22	44	66	88	88	110	132	132	154	176	176	198	220	
	0.00	0.00	5752.57	11505.14	11505.14	17257.71	23010.28	23010.28	28762.85	34515.43	34515.43	40268.00	46020.57	46020.57	51773.14	57525.71
21D+2P	0	0	23	46	69	92	115	115	138	161	161	184	207	207		
	0.00	0.00	6040.20	12080.40	18120.60	18120.60	24160.80	30201.00	30201.00	36241.20	42281.40	42281.40	48321.60	54361.80	54361.80	
22D+2P	0	0	24	48	72	96	120	120	144	144	168	182	192	216	216	
	0.00	0.00	6327.82	12655.65	18983.48	18983.48	25311.31	31639.14	31639.14	37966.97	37966.97	44294.80	50622.63	50622.63	56950.46	
23D+2P	0	0	25	50	75	100	100	125	150	150	175	175	200	225	225	
	0.00	0.00	6615.45	13230.91	19846.37	19846.37	26461.83	26461.83	33077.28	39692.74	39692.74	46308.20	46308.20	52923.66	59539.11	
24D+2P	0	0	26	52	78	104	104	130	156	156	182	208	208	224	224	
	0.00	0.00	6903.08	13806.17	13806.17	20709.25	27612.34	27612.34	34515.43	34515.43	41418.51	41418.51	48321.60	55224.68	55224.68	
25D+2P	0	0	27	54	81	108	135	135	162	162	189	189	216	216	216	
	0.00	0.00	7190.71	14381.42	14381.42	21572.14	21572.14	28762.85	35953.57	35953.57	43144.28	43144.28	50335.00	50335.00	57525.71	
26D+2P	0	0	28	56	84	112	112	140	168	168	196	196	224	224	224	
	0.00	0.00	7478.34	14956.68	14956.68	22435.03	22435.03	29913.37	29913.37	37391.71	37391.71	44870.06	44870.06	52348.40	59826.74	
27D+2P	0	0	29	58	87	116	116	145	174	174	203	203	230	230	230	
	0.00	0.00	7765.97	15531.94	15531.94	23297.91	23297.91	31063.88	31063.88	38829.85	38829.85	46595.83	46595.83	54361.80	54361.80	
28D+2P	0	0	30	60	90	120	120	150	180	180	210	210	240	240	240	
	0.00	0.00	8053.60	16107.20	16107.20	24160.80	24160.80	32214.40	32214.40	40268.00	40268.00	48321.60	48321.60	56375.20	56375.20	

Table F.15 List of Capacities Corresponding to RAID1+0 (300 GB)

Disk capacity	287.6 G bytes															
Component unit	RKM		RKAJ													
Range	1		2	3	4	5	6	7	8	9	10	11	12	13	14	
Total range of Disk drives	Min.	15 (Max.)	30	45	60	75	90	105	120	135	150	165	180	195	210	225 (Max.)
2D+2D	4	12	28	44	60	72	88	104	120	132	148	164	180	192	208	224
	575.25	1725.77	4026.80	6327.82	8628.85	10354.62	12655.65	14956.68	17257.71	18983.48	21284.51	23585.54	25886.57	27612.34	29913.37	32214.40
3D+3D	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210	222
	862.88	1725.77	4314.42	6040.20	8628.85	10354.62	12943.28	14669.05	17257.71	18983.48	21572.14	23297.91	25886.57	27612.34	30201.00	31926.77
4D+4D	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208	224
	1150.51	1150.51	3451.54	5752.57	8053.60	10354.62	12655.65	14956.68	17257.71	18408.22	20709.25	23010.28	25311.31	27612.34	29913.37	32214.40
5D+5D	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210	220
	1438.14	1438.14	4314.42	5752.57	8628.85	10067.00	12943.28	14381.42	17257.71	18695.85	21572.14	23010.28	25886.57	27324.71	30201.00	31639.14
6D+6D	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204	216
	1725.77	1725.77	3451.54	5177.31	8628.85	10354.62	12080.40	13806.17	17257.71	18983.48	20709.25	22435.03	25886.57	27612.34	29338.11	31063.88
7D+7D	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210	224
	2013.40	2013.40	4026.80	6040.20	8053.60	10067.00	12080.40	14093.80	16107.20	18120.60	20134.00	22147.40	24160.80	26174.20	30201.00	32214.40
8D+8D	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208	224
	0.00	0.00	2301.02	4602.05	6903.08	9204.11	11505.14	13806.17	16107.20	18408.22	20709.25	23010.28	25311.31	27612.34	29913.37	32214.40

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 (Max.)	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	

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 (Max.)	30	45	60	75	90	105	120	135	150	165	180	195	210
2D+1P	3 491.49	15 2457.45	30 4914.91	45 7372.37	60 9829.83	75 12287.29	90 14744.75	105 17202.21	120 19659.67	135 22117.13	150 24574.59	165 27032.05	180 29489.51	195 31946.97	210 34404.43
3D+1P	4 737.23	12 2211.71	28 5160.66	44 8109.61	60 11058.56	72 13270.28	88 16219.23	104 19168.18	120 22117.13	132 24328.84	148 27277.79	164 30226.75	180 33175.70	192 35387.41	208 38336.36
4D+1P	5 982.98	15 2948.95	30 5897.90	45 8846.85	60 11795.80	75 14744.75	90 17693.70	105 20642.65	120 23591.61	135 26540.56	150 29489.51	165 32438.46	180 35387.41	195 38336.36	210 41285.31
5D+1P	6 1228.72	12 2457.45	30 6143.64	42 8601.10	60 12287.29	72 14744.75	90 18430.94	102 20888.40	120 24574.59	132 27032.05	150 30718.24	162 33175.70	180 36861.89	192 39319.35	210 43005.54
6D+1P	7 1474.47	14 2948.95	28 5897.90	42 8846.85	56 11795.80	70 14744.75	84 17693.70	105 22117.13	119 25066.08	133 28015.03	147 30963.98	161 33912.94	175 36861.89	189 39810.84	210 44234.27
7D+1P	8 1720.22	8 1720.22	24 5160.66	40 8601.10	56 12041.55	72 15481.99	88 18922.43	104 22362.88	120 25803.32	128 27523.54	144 30963.98	160 34404.43	176 37844.87	192 41285.31	208 44725.76
8D+1P	9 1965.96	9 1965.96	27 5897.90	45 9829.83	54 11795.80	72 15727.74	90 19659.67	99 21625.64	117 25557.57	135 29489.51	144 31455.48	162 35387.41	180 39319.35	189 41285.31	207 45217.25
9D+1P	10 2211.71	10 2211.71	30 6635.14	40 8846.85	60 13270.28	70 15481.99	90 19905.42	100 22117.13	120 26540.56	130 28752.27	150 33175.70	160 35387.41	180 39810.84	190 42022.55	210 46445.98
10D+1P	11 2457.45	11 2457.45	22 4914.91	44 9829.83	55 12287.29	66 14744.75	88 19659.67	99 22117.13	110 24574.59	132 29489.51	143 31946.97	165 36861.89	176 39319.35	187 41776.81	209 46691.72
11D+1P	12 2703.20	12 2703.20	24 5406.41	36 8109.61	60 13516.02	72 16219.23	84 18922.43	96 21625.64	120 27032.05	132 29735.25	144 32438.46	156 35141.67	180 40548.08	192 43251.28	204 45954.49
12D+1P	13 2948.95	13 2948.95	26 5897.90	39 8846.85	52 11795.80	65 14744.75	78 17693.70	104 23591.61	117 26540.56	130 29489.51	143 32438.46	156 35387.41	169 38336.36	195 44234.27	208 47183.22
13D+1P	14 3194.69	14 3194.69	28 6389.39	42 9584.09	56 12778.78	70 15973.48	84 19168.18	98 22362.88	112 25557.57	126 28752.27	140 31946.97	154 35141.67	168 38336.36	182 41531.06	210 47920.45
14D+1P	15 3440.44	15 3440.44	30 6880.88	45 10321.32	60 13761.77	75 17202.21	90 20642.65	105 24083.10	120 27523.54	135 30963.98	150 34404.43	165 37844.87	180 41285.31	195 44725.76	210 48166.20
15D+1P	0 0.00	0 0.00	16 3686.18	32 7372.37	48 11058.56	64 14744.75	80 18430.94	96 22117.13	112 25803.32	128 29489.51	144 33175.70	160 36861.89	176 40548.08	192 44234.27	208 47920.45

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 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210 (Max)
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 39565.09
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 25803.32	153 29489.51	170 33175.70	187 36861.89	204 40548.08	210 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	90 19659.67	108 23591.61	126 27523.54	144 31455.48	162 35387.41	180 39319.35	198 43251.28	210 46961.72
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	210 46961.72	210 46961.72
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	210 46961.72	210 46961.72	210 46961.72
19D+2P	0 0.00	0 0.00	21 4669.17	42 9338.34	63 14007.51	84 18676.69	105 23345.86	126 28015.03	147 32684.21	168 36861.89	189 42022.55	210 46961.72	210 46961.72	210 46961.72	210 46961.72
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	210 46961.72	210 46961.72	210 46961.72	210 46961.72
21D+2P	0 0.00	0 0.00	23 5160.66	46 9584.09	69 13761.77	92 15481.99	115 19659.67	138 25803.32	161 31455.48	184 37599.12	207 43251.28	210 46961.72	210 46961.72	210 46961.72	210 46961.72
22D+2P	0 0.00	0 0.00	24 5406.41	48 10812.82	72 16219.23	96 21625.64	120 27032.05	144 32438.46	168 37844.87	192 43251.28	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72
23D+2P	0 0.00	0 0.00	25 5652.15	50 11304.31	75 16956.47	100 22608.62	125 28260.78	150 33912.94	175 39565.09	200 45217.25	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72
24D+2P	0 0.00	0 0.00	26 5897.90	52 11795.80	78 17693.70	104 23591.61	130 29489.51	156 35387.41	182 41285.31	208 47183.22	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72
25D+2P	0 0.00	0 0.00	27 6143.64	54 12287.29	81 12287.29	108 18430.94	135 24574.59	162 30718.24	189 43005.54	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72
26D+2P	0 0.00	0 0.00	28 6389.39	56 12778.78	84 12778.78	112 19168.18	140 25557.57	168 31946.97	196 38336.36	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72
27D+2P	0 0.00	0 0.00	29 6635.14	58 13270.28	87 13270.28	116 19905.42	145 26540.56	174 33175.70	203 46445.98	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72
28D+2P	0 0.00	0 0.00	30 6880.88	60 13761.77	90 13761.77	120 20642.65	150 26426.65	180 32752.35	210 40404.43	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72	210 46961.72

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 (Max.)	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	16 1965.96	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

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 (Max.)	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

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 (Max.)	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 35444.03	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	210 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	16 5901.88	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.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 (Max)	30	45	60	75	90	105	120	135	150	165	180	195	210 (Max)
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	180 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	16 5508.42	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	17 5901.88	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	18 6295.34	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	19 6688.80	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	20 7082.26	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	21 7475.72	0 0.00	21 7475.72	42 14951.45	63 19902.90	84 22427.17	105 2902.90	126 37378.63	147 44854.35	168 52330.08	189 59805.80	210 67281.53			
20D+2P	22 7869.18	0 0.00	22 7869.18	44 15738.37	66 23607.55	88 31476.74	110 37772.08	132 45247.81	154 54297.37	176 63346.94	198 72396.50				
21D+2P	23 8262.64	0 0.00	23 8262.64	46 16525.28	69 24787.93	92 24787.93	115 33050.57	138 41313.22	161 49575.86	184 57838.51	207 66101.15				
22D+2P	24 8656.10	0 0.00	24 8656.10	48 17312.20	72 25968.31	96 34624.41	120 43280.51	144 51936.62	168 59018.89	192 66101.15	216 74363.80				
23D+2P	25 9049.56	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	26 9443.02	0 0.00	26 9443.02	52 18886.04	78 28329.06	104 37772.08	130 47215.11	156 56658.13	182 66101.15	208 75544.17					
25D+2P	27 9836.48	0 0.00	27 9836.48	54 19672.96	81 29509.44	108 39345.92	135 49182.40	162 59018.89	189 68855.37	216 77118.01					
26D+2P	28 10229.94	0 0.00	28 10229.94	56 20459.88	84 30689.82	112 40919.76	140 51149.70	168 61379.64	196 71609.58						
27D+2P	29 10623.40	0 0.00	29 10623.40	58 21246.80	87 31870.20	116 42493.60	145 53117.00	174 63740.40	203 74363.80						
28D+2P	30 11016.85	0 0.00	30 11016.85	60 22033.71	90 33050.57	120 44067.43	150 55084.29	180 66101.15	210 77118.01						

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 (Max.)	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	16 3147.67	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	

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	2 491.94	14 3443.59	30 7379.12	44 10822.71	60 14758.24	74 18201.83	90 22137.36	104 25580.95	120 29516.49	134 32960.08	150 36895.61	164 40339.20	180 44274.73	194 47718.32	210 51653.86	

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	3 983.88	15 4919.41	30 9838.83	45 14758.24	60 19677.66	75 24597.07	90 29516.49	105 34435.90	120 39355.32	135 44274.73	150 49194.15	165 54113.56	180 59032.98	195 63952.39	210 68871.81	
3D+1P	4 1475.82	12 4427.47	28 10330.77	44 16234.07	60 22137.36	72 26564.84	90 32468.14	104 38371.43	120 44274.73	132 48702.21	148 54605.50	164 60508.80	180 66412.10	192 70839.57	208 76742.87	
4D+1P	5 1967.76	15 5903.29	30 11806.59	45 17709.89	60 23613.19	75 29516.49	90 35419.78	105 41323.08	120 47226.38	135 53129.68	150 59032.98	165 64936.28	180 70839.57	195 76742.87	210 82646.17	
5D+1P	6 2459.70	12 4919.41	28 12298.53	42 17217.95	60 24597.07	72 29516.49	90 36895.61	104 41815.02	120 49194.15	132 54113.56	150 61492.69	162 66412.10	180 73791.22	192 78710.64	210 86089.76	
6D+1P	7 2951.64	14 5903.29	28 11806.59	42 17709.89	56 23613.19	70 29516.49	84 35419.78	105 44274.73	119 50178.03	133 56081.33	147 61984.63	161 67887.93	175 73791.22	189 79694.52	210 88549.47	
7D+1P	8 3443.59	8 3443.59	24 10330.77	40 17217.95	56 24105.13	72 30992.31	88 37879.49	104 44766.67	120 51653.86	128 55097.45	144 61984.63	160 68871.81	176 75758.99	192 82646.17	208 89533.35	
8D+1P	9 3935.53	9 3935.53	27 11806.59	45 19677.66	54 23613.19	72 31484.25	90 39355.32	99 43290.85	117 51161.91	135 59032.98	144 62968.51	162 70839.57	180 78710.64	189 82646.17	207 90517.24	
9D+1P	10 4427.47	10 4427.47	30 13282.42	40 17709.89	60 26564.84	70 30992.31	90 39847.26	100 44274.73	120 53129.68	130 57557.15	150 66412.10	160 70839.57	180 79694.52	190 84122.00	210 92976.94	
10D+1P	11 4919.41	11 4919.41	22 9838.83	44 19677.66	55 24597.07	66 29516.49	88 39355.32	99 44274.73	110 49194.15	132 59032.98	143 63952.39	165 73791.22	176 78710.64	187 83630.05	209 93468.89	
11D+1P	12 5411.35	12 5411.35	24 10822.71	36 16234.07	60 27056.78	72 32468.14	84 37879.49	96 43290.85	120 54113.56	132 59524.92	144 64936.28	156 70347.63	180 81170.35	192 86581.70	204 91993.06	
12D+1P	13 5903.29	13 5903.29	26 11806.59	39 17709.89	52 23613.19	65 29516.49	78 35419.78	104 47226.38	117 53129.68	130 59032.98	143 64936.28	156 70839.57	169 76742.87	195 88549.47	208 94452.77	
13D+1P	14 6395.23	14 6395.23	28 12790.47	42 19185.71	56 25580.95	70 31976.19	84 38371.43	98 44766.67	112 51161.91	126 57557.15	140 63952.39	154 70347.63	168 76742.87	182 83138.11	210 95928.59	
14D+1P	15 6887.18	15 6887.18	30 13774.36	45 20661.54	60 27548.72	75 34435.90	90 41323.08	105 48210.26	120 55097.45	135 61984.63	150 68871.81	165 75758.99	180 82646.17	195 89533.35	210 96420.53	
15D+1P	0 0.00	0 0.00	16 7379.12	32 14758.24	48 22137.36	64 29516.49	80 36895.61	96 44274.73	112 51653.86	128 59032.98	144 66412.10	160 73791.22	176 81170.35	192 88549.47	208 95928.59	

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	30 9838.83	42 13774.36	60 19677.66	72 23613.19	90 29516.49	102 33452.02	120 39355.32	132 43290.85	150 49194.15	162 53129.68	180 59032.98	192 62968.51	210 68871.81	
5D+2P	7 2459.70	14 4919.41	28 9838.83	42 14758.24	56 19677.66	70 24597.07	84 29516.49	105 36895.61	119 41815.02	133 46734.44	147 51653.86	161 56573.27	175 61492.69	189 66412.10	210 73791.22	
6D+2P	8 2951.64	8 2951.64	24 8854.94	40 14758.24	56 20661.54	72 26564.84	88 32468.14	104 38371.43	120 44274.73	128 47226.38	144 53129.68	160 59032.98	176 64936.28	192 70839.57	208 76742.87	
7D+2P	9 3443.59	9 3443.59	27 10330.77	45 17217.95	54 20661.54	72 27548.72	90 34435.90	99 37879.49	117 44766.67	135 51653.86	144 55097.45	162 61984.63	180 68871.81	189 72315.40	207 79202.58	
8D+2P	10 3935.53	10 3935.53	30 11806.59	40 15742.12	60 23613.19	70 27548.72	90 35419.78	100 39355.32	120 47226.38	130 51161.91	150 59032.98	160 62968.51	180 70839.57	190 74775.11	210 82646.17	
9D+2P	11 4427.47	11 4427.47	22 8854.94	44 17709.89	55 22137.36	66 26564.84	88 35419.78	99 39847.26	110 44274.73	132 53129.68	143 57557.15	165 66412.10	176 70839.57	187 75267.05	209 84122.00	
10D+2P	12 4919.41	12 4919.41	24 9838.83	36 14758.24	60 24597.07	72 29516.49	84 34435.90	96 39355.32	120 49194.15	132 54113.56	144 59032.98	156 63952.39	180 73791.22	192 78710.64	204 83630.05	
11D+2P	13 5411.35	13 5411.35	26 10822.71	39 16234.07	52 21645.42	65 27056.78	78 32468.14	104 43290.85	117 48702.21	130 54113.56	143 59524.92	156 64936.28	169 70347.63	195 81170.35	208 86581.70	
12D+2P	14 5903.29	14 5903.29	28 11806.59	42 17709.89	56 23613.19	70 29516.49	84 35419.78	98 41323.08	112 47226.38	126 53129.68	140 59032.98	154 64936.28	168 70839.57	182 76742.87	210 88549.47	
13D+2P	15 6395.23	15 6395.23	30 12790.47	45 19185.71	60 25580.95	75 31976.19	90 38371.43	105 44766.67	120 51161.91	135 57557.15	150 63952.39	165 70347.63	180 76742.87	195 83138.11	210 89533.35	
14D+2P	0 0.00	0 0.00	16 6887.18	32 13774.36	48 20661.54	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 29516.49	85 36895.61	102 44274.73	119 51653.86	136 59032.98	153 66412.10	170 73791.22	187 81170.35	204 88549.47		
16D+2P	0 0.00	0 0.00	18 7871.06	36 15742.12	54 23613.19	72 31484.25	90 39355.32	108 47226.38	126 55097.45	144 62968.51	162 70839.57	180 78710.64	198 86581.70			
17D+2P	0 0.00	0 0.00	19 8363.00	38 16726.01	57 25089.01	76 31976.19	95 38371.43	114 46766.67	133 51161.91	152 57557.15	171 63952.39	190 70347.63	209 76742.87	210 83138.11		
18D+2P	0 0.00	0 0.00	20 8854.94	40 17709.89	60 26564.84	80 32468.14	100 35419.78	120 41323.08	140 48702.21	160 54113.56	180 59524.92	200 64936.28	210 70839.57	210 76964.52	210 83630.05	210 91993.06
19D+2P	0 0.00	0 0.00	21 9346.88	42 18693.77	63 28040.66	84 33943.96	105 37387.55	126 46734.44	147 46734.44	168 56081.33	189 65428.22	210 74775.11	210 84122.00	210 93468.89		
20D+2P	0 0.00	0 0.00	22 9838.83	44 19677.66	66 29516.49	88 33955.32	110 39355.32	132 49194.15	154 59032.98	176 68871.81	198 78710.64	210 88549.47				
21D+2P	0 0.00	0 0.00	23 10330.77	46 20661.54	69 30992.31	92 39992.31	115 41323.08	138 51653.86	161 51653.86	184 61984.63	207 72315.40	210 72315.40	210 82646.17	210 92976.94		
22D+2P	0 0.00	0 0.00	24 10822.71	48 21645.42	72 32468.14	96 32468.14	120 43290.85	144 54113.56	168 54113.56	192 64936.28	210 64936.28	210 64936.28	210 75758.99	210 86581.70		
23D+2P	0 0.00	0 0.00	25 11314.65	50 22629.31	75 33943.96	100 33943.96	125 45258.62	150 45258.62	175 56573.27	200 67887.93	210 67887.93	210 79202.58	210 79202.58	210 90517.24		
24D+2P	0 0.00	0 0.00	26 11806.59	52 23613.19	78 23613.19	104 35419.78	130 47226.38	156 59032.98	182 70839.57	208 80839.57	210 80839.57	210 80839.57	210 82646.17	210 94452.77		
25D+2P	0 0.00	0 0.00	27 12298.53	54 24597.07	81 24597.07	108 36895.61	135 36895.61	162 49194.15	189 61492.69	216 61492.69	210 73791.22	210 73791.22	210 86089.76	210 86089.76		
26D+2P	0 0.00	0 0.00	28 12790.47	56 25580.95	84 25580.95	112 38371.43	140 38371.43	168 51161.91	196 51161.91	224 63952.39	210 63952.39	210 76742.87	210 76742.87	210 89533.35		
27D+2P	0 0.00	0 0.00	29 13282.42	58 26564.84	87 26564.84	116 39847.26	145 39847.26	174 53129.68	203 53129.68	232 66412.10	210 66412.10	210 79694.52	210 79694.52	210 92976.94		
28D+2P	0 0.00	0 0.00	30 13774.36	60 27548.72	90 27548.72	120 41323.08	150 41323.08	180 55097.45	210 55097.45	240 68871.81	210 68871.81	210 82646.17	210 82646.17	210 96420.53		

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	12	28	44	60	72	88	104	120	132	148	164	180	192	208
	983.88	2951.64	6887.18	10822.71	14758.24	17709.89	21645.42	25580.95	29516.49	32468.14	36403.67	40339.20	44274.73	47226.38	51161.91
3D+3D	6	12	30	42	60	72	90	102	120	132	150	162	180	192	210
	1475.82	2951.64	7379.12	10330.77	14758.24	17709.89	22137.36	25089.01	29516.49	32468.14	36895.61	39847.26	44274.73	47226.38	51653.86
4D+4D	8	8	24	40	56	72	88	104	120	128	144	160	176	192	208
	1967.76	1967.76	5903.29	9838.83	13774.36	17709.89	21645.42	25580.95	29516.49	31484.25	35419.78	39355.32	43290.85	47226.38	51161.91
5D+5D	10	10	30	40	60	70	90	100	120	130	150	160	180	190	210
	2459.70	2459.70	7379.12	9838.83	14758.24	17217.95	22137.36	24597.07	29516.49	31976.19	36895.61	39355.32	44274.73	46734.44	51653.86
6D+6D	12	12	24	36	60	72	84	96	120	132	144	156	180	192	204
	2951.64	2951.64	5903.29	8854.94	14758.24	17709.89	20661.54	23613.19	29516.49	32468.14	35419.78	38371.43	44274.73	47226.38	50178.03
7D+7D	14	14	28	42	56	70	84	98	112	126	140	154	168	182	210
	3443.59	3443.59	6887.18	10330.77	13774.36	17217.95	20661.54	24105.13	27548.72	30992.31	34435.90	37879.49	41323.08	44766.67	51653.86
8D+8D	0	0	16	32	48	64	80	96	112	128	144	160	176	192	208
	0.00	0.00	3935.53	7871.06	11806.59	15742.12	19677.66	23613.19	27548.72	31484.25	35419.78	39355.32	43290.85	47226.38	51161.91

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

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.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 44249.57	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 110623.92
6D+2P	8 4424.95	16 8849.90	32 13274.87	48 22124.78	64 30974.70	80 39824.61	96 48674.52	112 57524.44	128 66374.35	144 70799.31	160 79649.22	176 88499.14	192 97349.05	208 106198.97	224 115048.88
7D+2P	9 5162.45	18 15624.90	36 15487.35	54 25812.25	72 30974.70	90 41299.60	108 51624.50	126 61949.40	144 72274.30	162 82599.20	180 92924.10	200 103249.00	220 113573.90	240 123898.80	260 134223.70
8D+2P	10 5899.94	20 31249.80	40 17699.82	60 23599.77	80 35399.65	100 41299.60	120 53099.48	140 64899.37	160 76699.25	180 88499.14	200 94399.08	220 106198.97	240 117998.85	260 129798.74	280 142598.62
9D+2P	11 6637.43	22 13274.87	44 26549.74	66 33187.17	88 39824.61	110 46462.05	132 53099.48	154 59736.92	176 66374.35	198 73749.28	220 81124.21	242 88499.14	264 95874.07	286 103249.00	308 110623.92
10D+2P	12 7374.92	24 14749.85	48 22124.78	72 36874.64	96 44249.57	120 51624.50	144 58999.42	168 67849.34	192 77436.75	216 87616.65	240 98286.66	264 109561.53	288 121686.32	312 133686.22	336 145686.12
11D+2P	13 8112.42	26 16224.84	52 24337.26	78 32449.68	104 40562.10	130 48674.52	156 56899.37	182 64899.37	208 73011.79	234 81124.21	260 89236.63	286 97349.05	312 105461.47	338 112686.32	364 129798.74
12D+2P	14 8849.91	28 17699.82	56 26549.74	84 35399.65	112 44249.57	140 53099.48	168 61949.40	196 70799.31	224 79649.22	252 88499.14	280 97349.05	308 106198.97	336 115048.88	364 123748.71	392 132748.71
13D+2P	15 9587.40	30 19174.81	60 28762.22	90 38349.62	120 47937.03	150 57524.44	180 67111.85	210 76699.25	240 86286.66	270 95874.07	300 105461.47	330 115048.88	360 124636.29	390 134223.70	420 142898.50
14D+2P	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	224 144683.60
15D+2P	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 143800.10	238 154913.50
16D+2P	0 0.00	18 11799.88	36 23599.77	54 35399.65	72 47199.54	90 58999.42	108 67099.31	126 76699.25	144 86286.66	162 95874.07	180 105461.47	198 115048.88	216 124636.29	234 134223.70	252 143800.10
17D+2P	0 0.00	19 12537.37	38 25074.75	57 37612.13	76 49762.13	95 61949.40	114 74367.50	133 87616.65	152 100299.02	171 112686.32	190 125373.78	209 137911.16	228 150627.54	247 163880.90	266 177392.70
18D+2P	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 149593.42	240 167263.00	260 185572.58	280 203951.74
19D+2P	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 155195.00	252 170898.12	273 188299.18	294 207614.34
20D+2P	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 149593.42	242 167263.00	264 185572.58	286 203951.74	308 222640.90
21D+2P	0 0.00	23 15487.35	46 30974.70	69 46462.05	92 59736.92	115 74367.50	138 89236.63	161 105461.47	184 121686.32	207 137911.16	230 154913.50	253 173184.66	276 190895.12	299 209916.18	322 227947.70
22D+2P	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 146913.50	240 164263.00	264 182572.58	288 200292.10	312 218961.16	336 235650.70
23D+2P	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 136593.00	225 153463.50	250 170195.00	275 186897.50	300 203692.00	325 221396.50	350 240991.00
24D+2P	0 0.00	26 17699.82	52 35399.65	78 53099.48	104 70799.31	130 88499.14	156 106198.97	182 123748.71	208 141298.22	234 157897.74	260 174997.26	286 192696.80	312 209496.34	338 226195.82	364 242695.30
25D+2P	0 0.00	27 18437.32	54 36874.64	81 55311.96	108 73749.28	135 92186.60	162 109561.53	189 127060.60	216 144913.50	243 162663.00	270 179215.00	297 195869.50	324 213674.00	351 230685.00	378 247690.00
26D+2P	0 0.00	28 19174.81	56 38349.62	84 57524.44	112 76699.25	140 95874.07	168 112686.32	196 129798.74	224 149593.42	252 167263.00	280 185572.58	308 203951.74	336 222640.90	364 240991.00	392 258000.00
27D+2P	0 0.00	29 19912.30	58 39824.61	87 59736.92	116 79649.22	145 99561.53	174 119473.84	203 137911.16	232 156913.50	261 175463.00	290 193963.00	319 212913.00	348 230863.00	377 248813.00	406 265763.00
28D+2P	0 0.00	30 20649.80	60 41299.60	90 61949.40	120 82599.20	150 103249.00	180 123898.80	210 144683.60	240 165173.20	270 186658.40	300 208138.00	330 230612.00	360 253066.00	390 275490.00	420 299810.00

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

Appendix G Port Address Mapping Table

Fibre channel physical addresses are converted to target IDs (TIDs) using a conversion table. The following table shows the current limits for TIDs on various operating systems.

Table 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

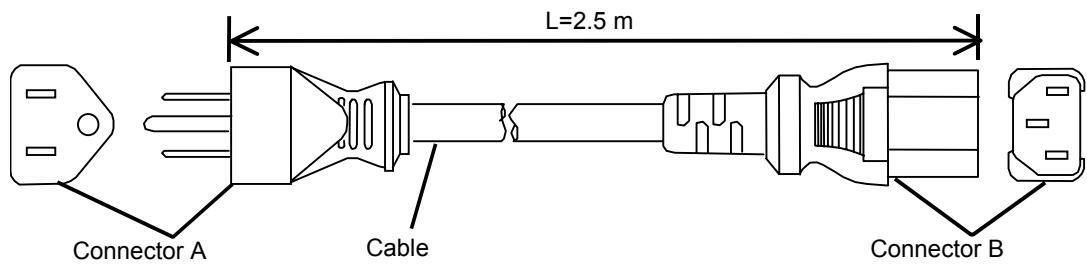


Figure H.1 J1H Power Cable

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

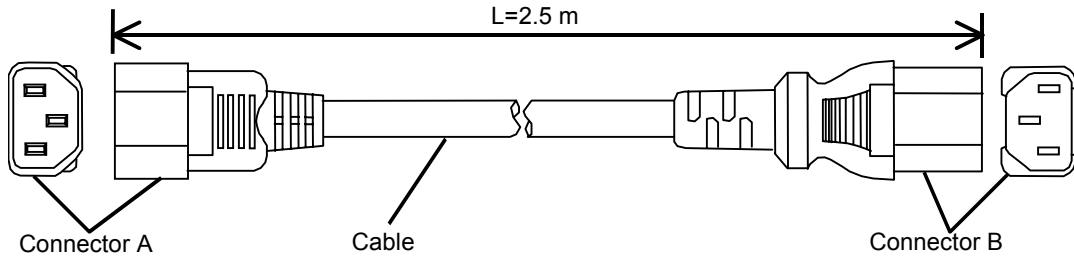


Figure H.2 J2H Power Cable

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

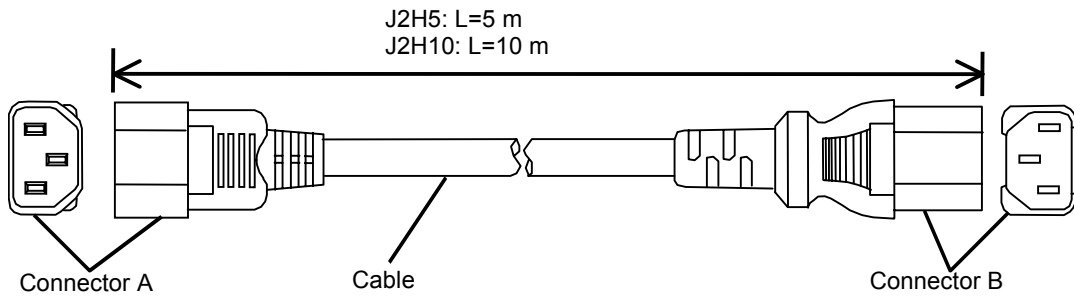


Figure H.3 J2H5 and J2H10 Power Cables

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

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

The number of logical blocks for one parity group is shown below.

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
	(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

Disk drive capacity		71.3 G bytes	143.3 G bytes	245.7 G bytes	292 G bytes	393.4 G bytes	491.9 G bytes	737.4 G bytes
RAID configuration								
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	
RAID1+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.

