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# Hitachi Unified Storage
## Hardware Installation and Configuration Guide

FASTFIND LINKS

Changes in this revision
Changes in this revision
Document organization
Contents

Hitachi Data Systems

MK-91DF8273-27

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## Equipment warranty

The term of guarantee of normal operation of the storage system and free service is one year from date of purchase.

Even when a failure occurs in duplicate only, the storage system may shut off to avoid a serious accident.

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## China RoHS

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| CBXSS/CBXSL/CBSS/CBSL/ CBL/CBLE/CBLD/DBS/DBSD/ DBL/DBLD/DBF/DBX | DBW |
|---|---|
| | |

## Toxic and Hazardous Substances and Elements

| | Lead (Pb) | Mercury (Hg) | Cadmium (Cd) | Hexavalent Chromium (Cr (VI)) | Polybrominated biphenyls (PBB) | Polybrominated diphenyl ethers (PBDE) |
|---|---|---|---|---|---|---|
| CBXSS/ CBXSL/ CBSS/ CBSL/ CBL/ CBLE/ CBLD | x | o | o | o | o | o |
| DBS/ DBSD/ DBL/ DBLD/ DBF/ DBX | x | o | o | o | o | o |
| DBW | x | o | o | o | o | o |

x = 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.

o = 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.

## Backup

Hitachi cannot guarantee against data loss due to failures. Therefore, make backup copies of your data to minimize chances for data loss.

Data backup is also critical when hardware components are added or replaced, since performing such hardware procedures restores parameter settings that can affect how data is managed on the storage systems.

## Disposal

This symbol on the product or on its packaging means that your electrical and electronic equipment should be disposed at the end of life separately from your household wastes.

There are separate collection systems for recycling in EU. For more information, contact the local authority or the dealer where you purchased the product.

## Recycling

A Nickel-hydride battery is used as a battery in the Cache Backup Battery.

A Nickel-hydride battery is a resource that is can be recycled. When you want to replace the Cache Backup Battery, call the service personnel. They will dispose it for you. (This nickel hydride battery, which is designated as a recycling product, needs to be recycled.)

The mark posted on the Cache Backup Battery is a three-arrow mark that means a recyclable part.

**Ni-MH**

## Equipment with Network Equipment-Building System Specifications

In the Hitachi Unified Storage 150 Disk Array System, the CBLD, DBSD or DBLD are the equipment with the Network Equipment-Building System (NEBS) specifications.

The equipment with the NEBS specifications is suitable for use in Telecommunications Facilities.

The equipment with the NEBS specifications is suitable for use in the CBN (Common Bonding Network).

## Open software license

1. This product includes software developed by the OpenSSL project for use in the OpenSSL Toolkit (http://www.openssl.org/).
2. This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).
3. This product includes software written by Tim Hudson (tjh@cryptsoft.com).
4. This product includes the OpenSSL Toolkit software developed under OpenSSL License and Original SSLeay License. OpenSSL License and Original SSLeay License are as follows.

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The OpenSSL toolkit stays under a dual license, i.e. both the conditions of the OpenSSL License and the original SSLeay license apply to the toolkit.

See below for the actual license texts. Actually both licenses are BSD-style Open Source licenses. In case of any license issues related to OpenSSL contact openssl-core@openssl.org.

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 */
```

/* $NetBSD: vfprintf.c,v 1.50 2006/02/16 23:26:19 christos Exp $
*/
/*-
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*/

## Notes on use

When using the Hitachi Unified Storage 100 Series Disk Array System, be sure to read this guide and understand the operating procedures and instructions described herein thoroughly before starting your operation. Understand, in particular, the descriptions in the Chapter Safety Precautions thoroughly and follow the instructions in this guide.

Windows 95, Windows 98, Windows 2000, Me, XP, and Windows NT Version 4.0 are abbreviated to Windows in the guide.

The array complies with FDA radiation performance standards 21CFR subchapter J.

## 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 another configuration, a user may be requested to take appropriate preventive measures.

- DF850-CBXSS/CBXSL+DBS/DBL(x2)+RK40
- DF850-CBSS+DBS/DBL(x4)+RK40
- DF850-CBL+ DBS/DBL(x4)+RK40
- DF850-CBSS/CBSL+ DBS/DBL(x4)+DBX(x2)+RK40
- DF850-CBL+ DBW(x4)+RK40
- DF850-CBLD+ DBSD/DBLD(x4)+RK40

This product must not be used in residential areas.

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

## Hazard warning statements

When purchasing the AC power cable, make sure that the cable has proper rating and meets the country's safety requirement. Otherwise, an electric shock or machine failure may be caused.

1. ANSI: American National Standards Institute
2. NEMA: National Electrical Manufacturers Association
3. IEC: International Electrotechnical Commission
4. CEE: International Commission on Rules for the Approval of Electrical Equipment
5. BS: British Standard Institution
6. AS: Standards Association of Australia

# Warning labels on equipment

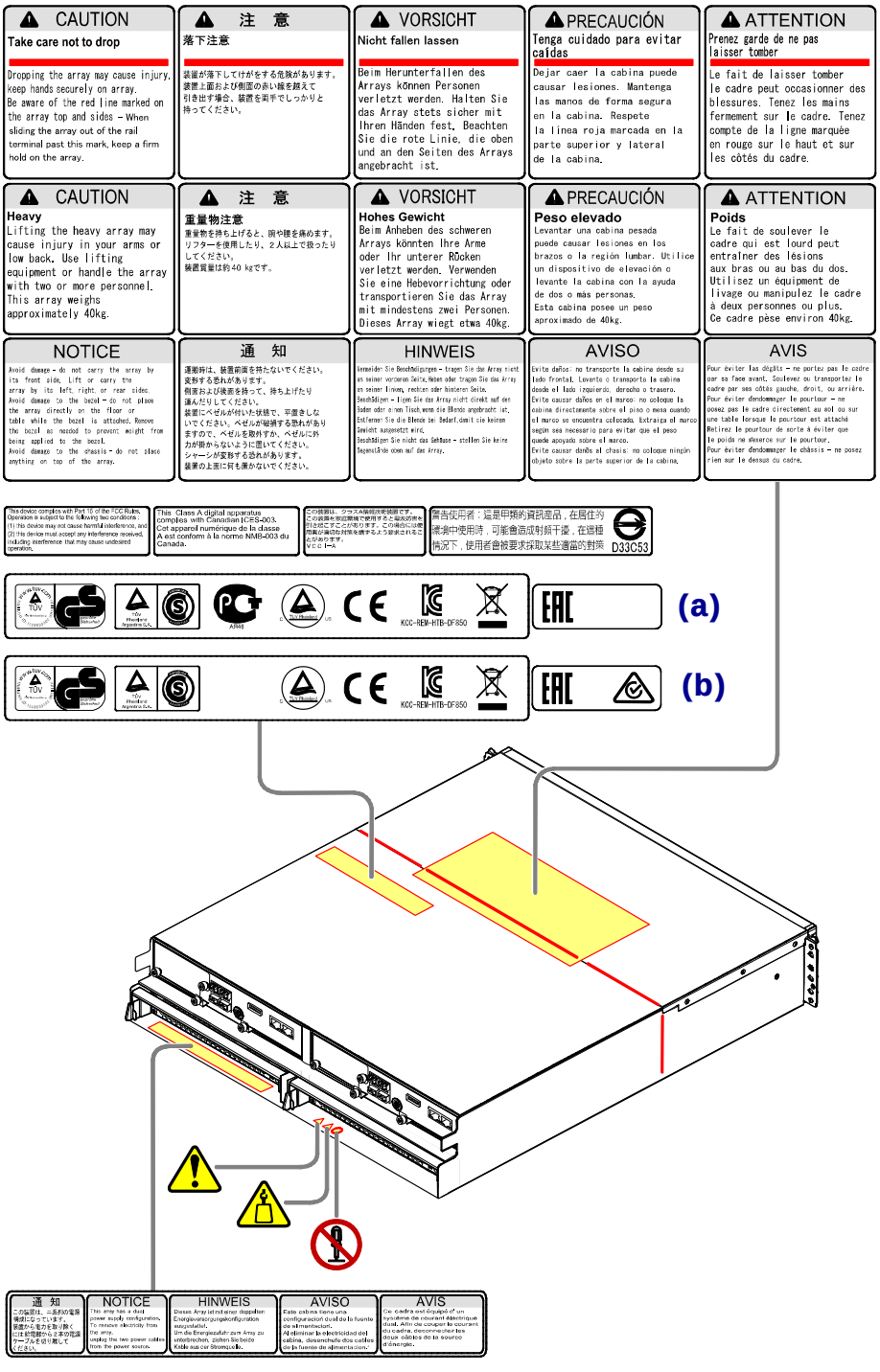
Warning labels are pasted on portions of the equipment where special care is required. These warnings are for service personnel, not customers.

The following table describes the symbols shown in warning labels.

| Label | Description |
|---|---|
| | Do not disassemble the equipment. |
| | Exercise care when handling the heavy equipment. |
| | Handling precautions due to static electricity. |
| | Exercise care to avoid injuring your fingers. |
| | Do not place items on this surface of the storage system. |

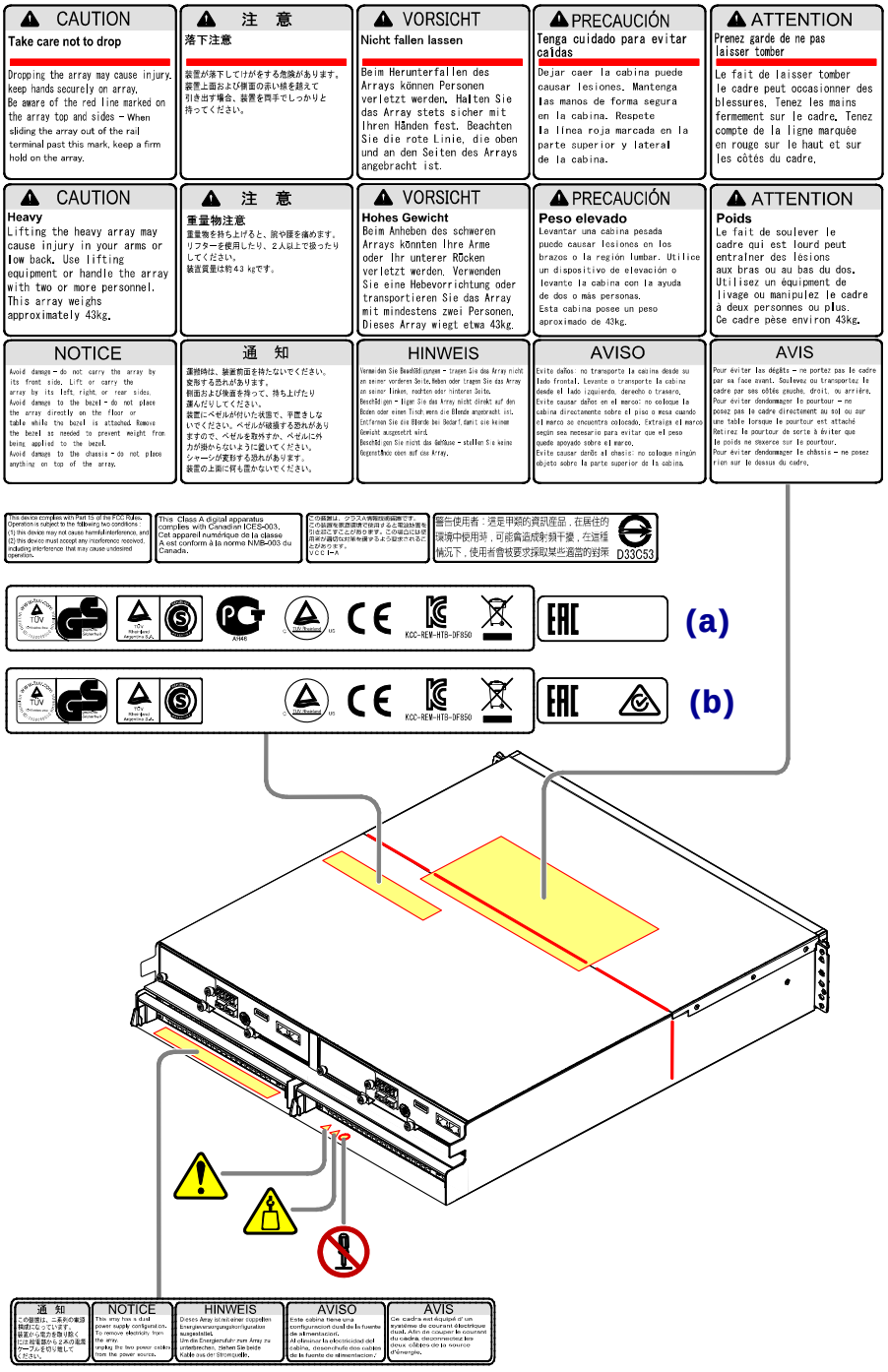
# Labels on the CBXSS

## Either (a) or (b) is affixed.



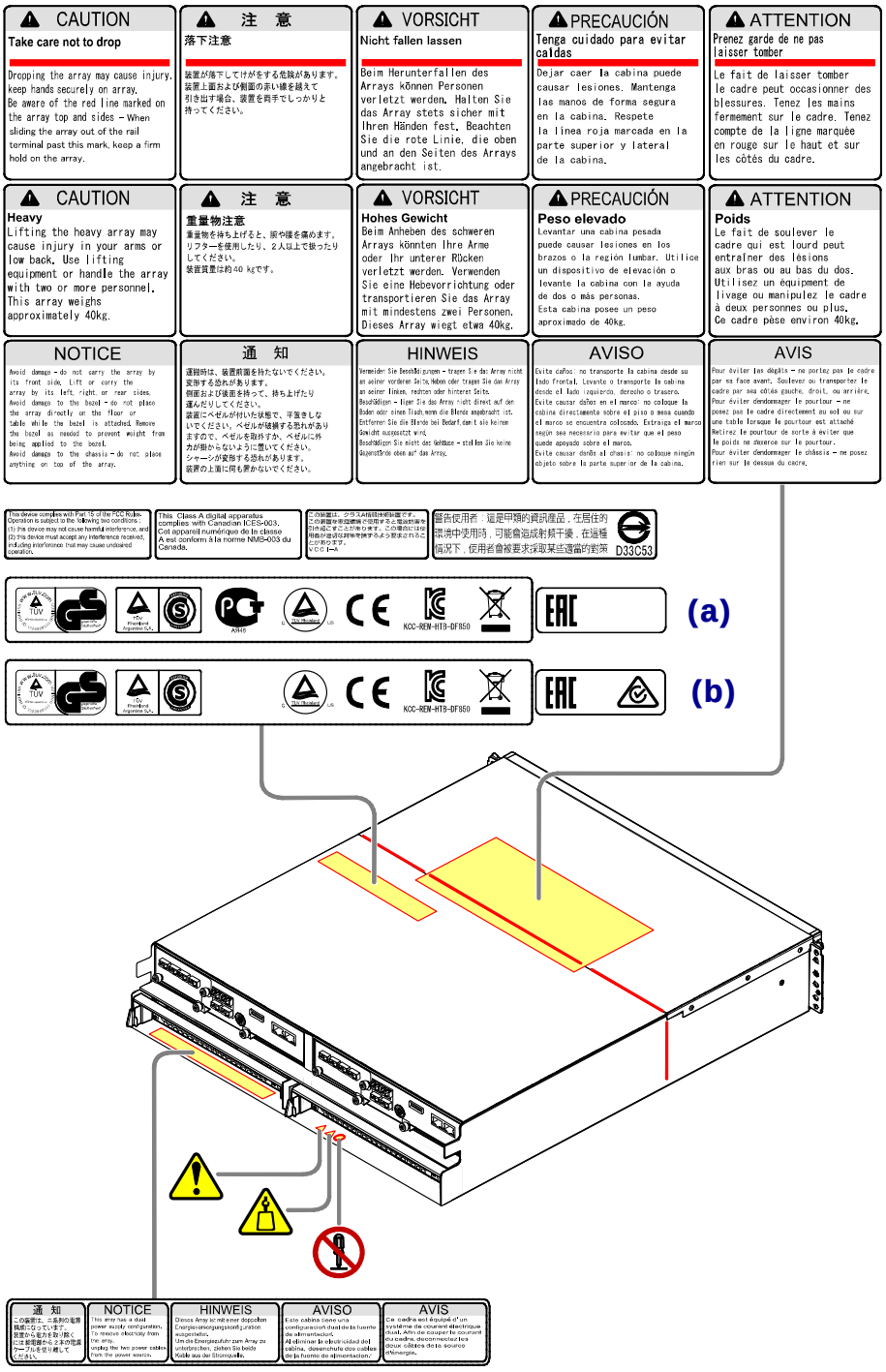
# Labels on the CBXSL

## Either (a) or (b) is affixed.



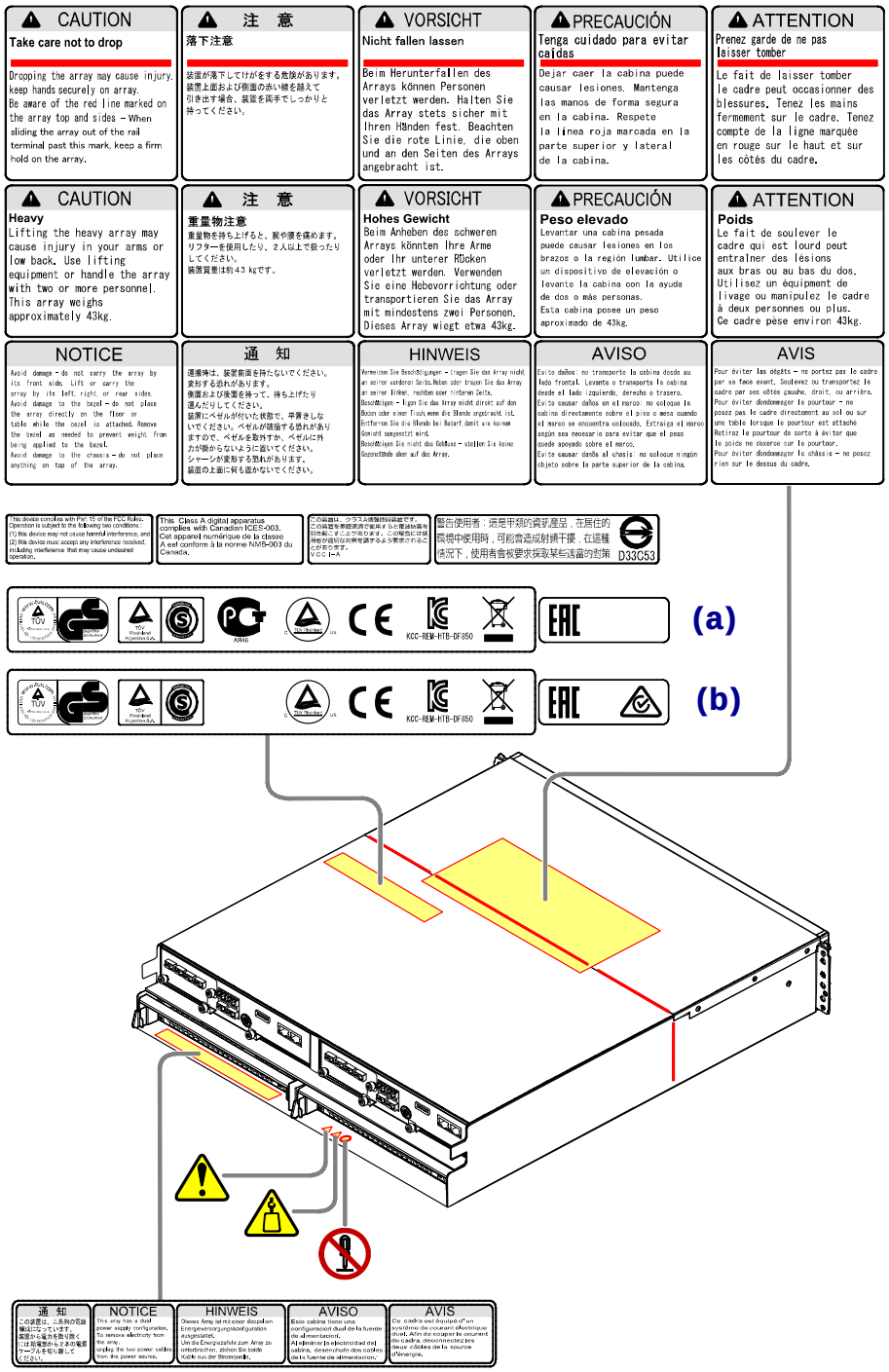
# Labels on the CBSS

## Either (a) or (b) is affixed.



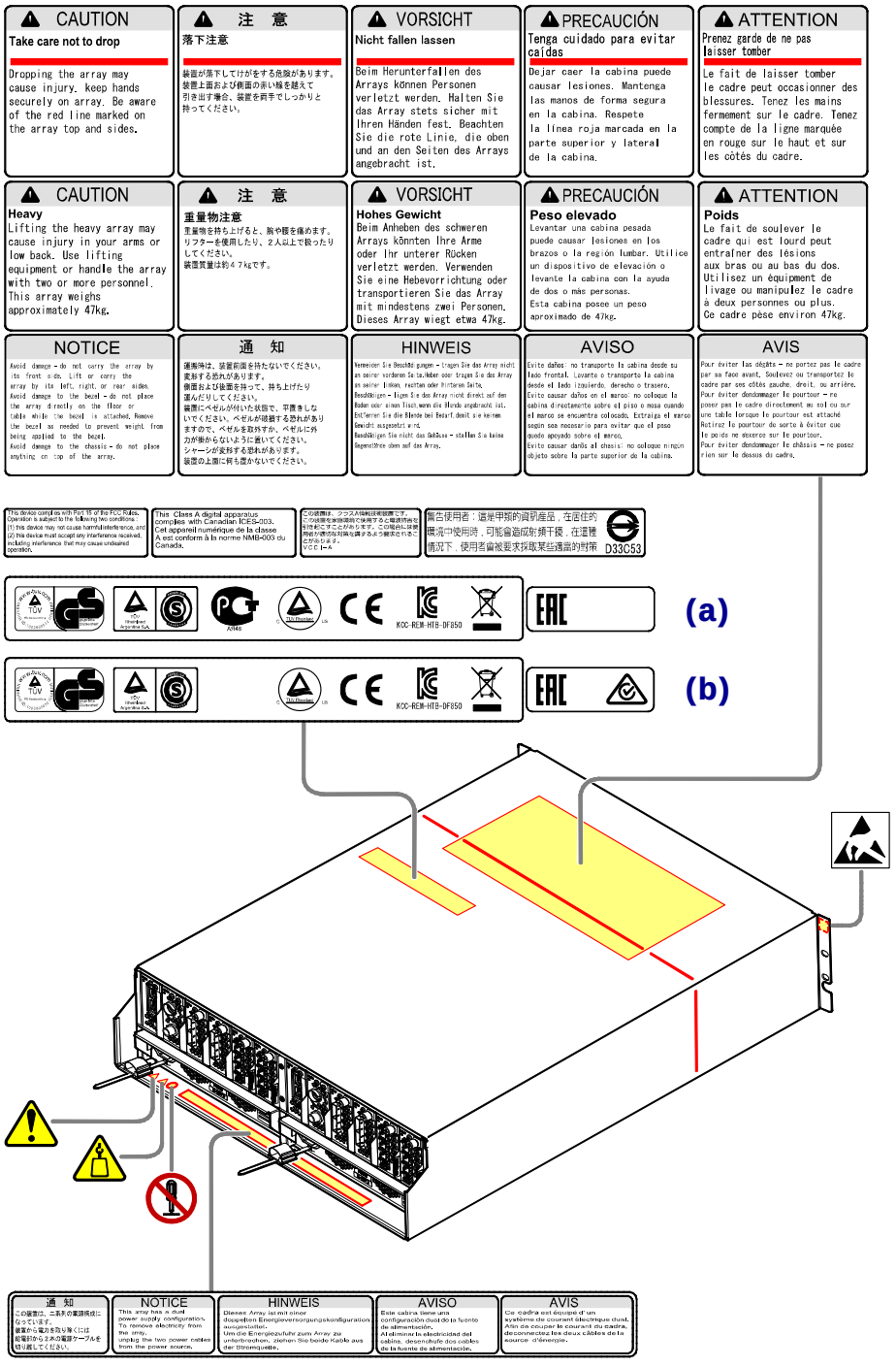
# Labels on the CBSL

## Either (a) or (b) is affixed.



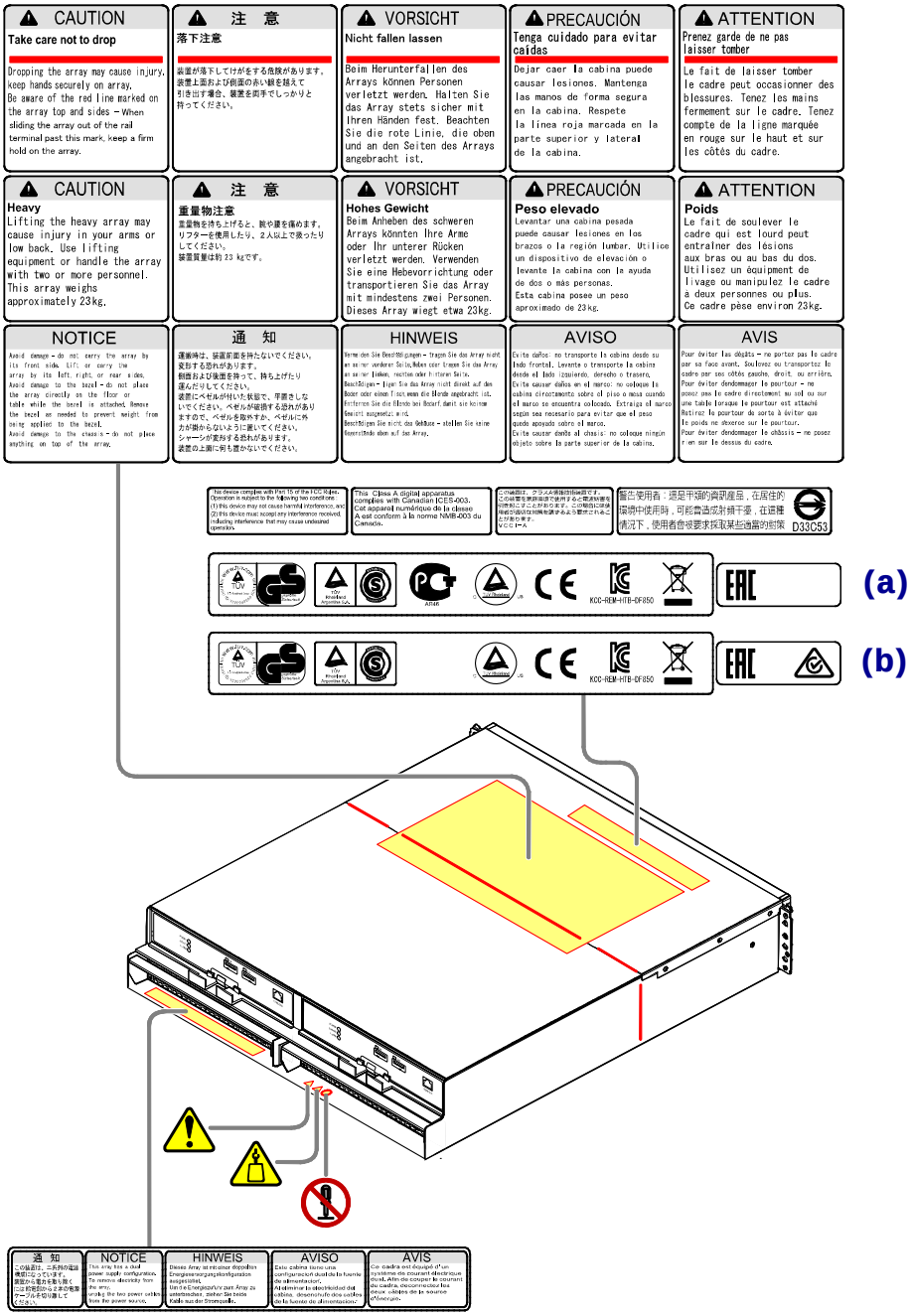
# Labels on the CBL/CBLE/CBLD

## Either (a) or (b) is affixed.



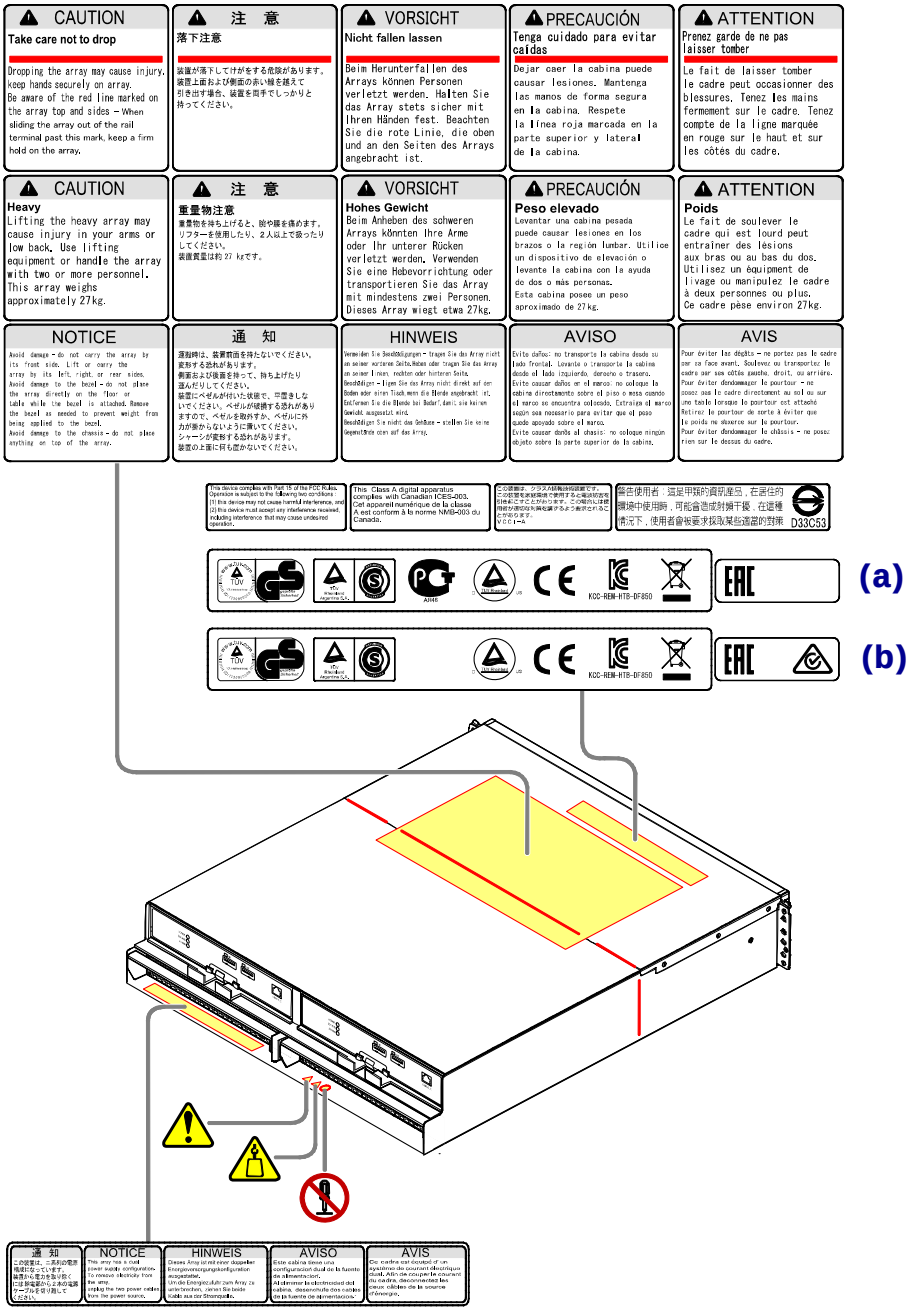
# Labels on the DBS/DBSD

## Either (a) or (b) is affixed.

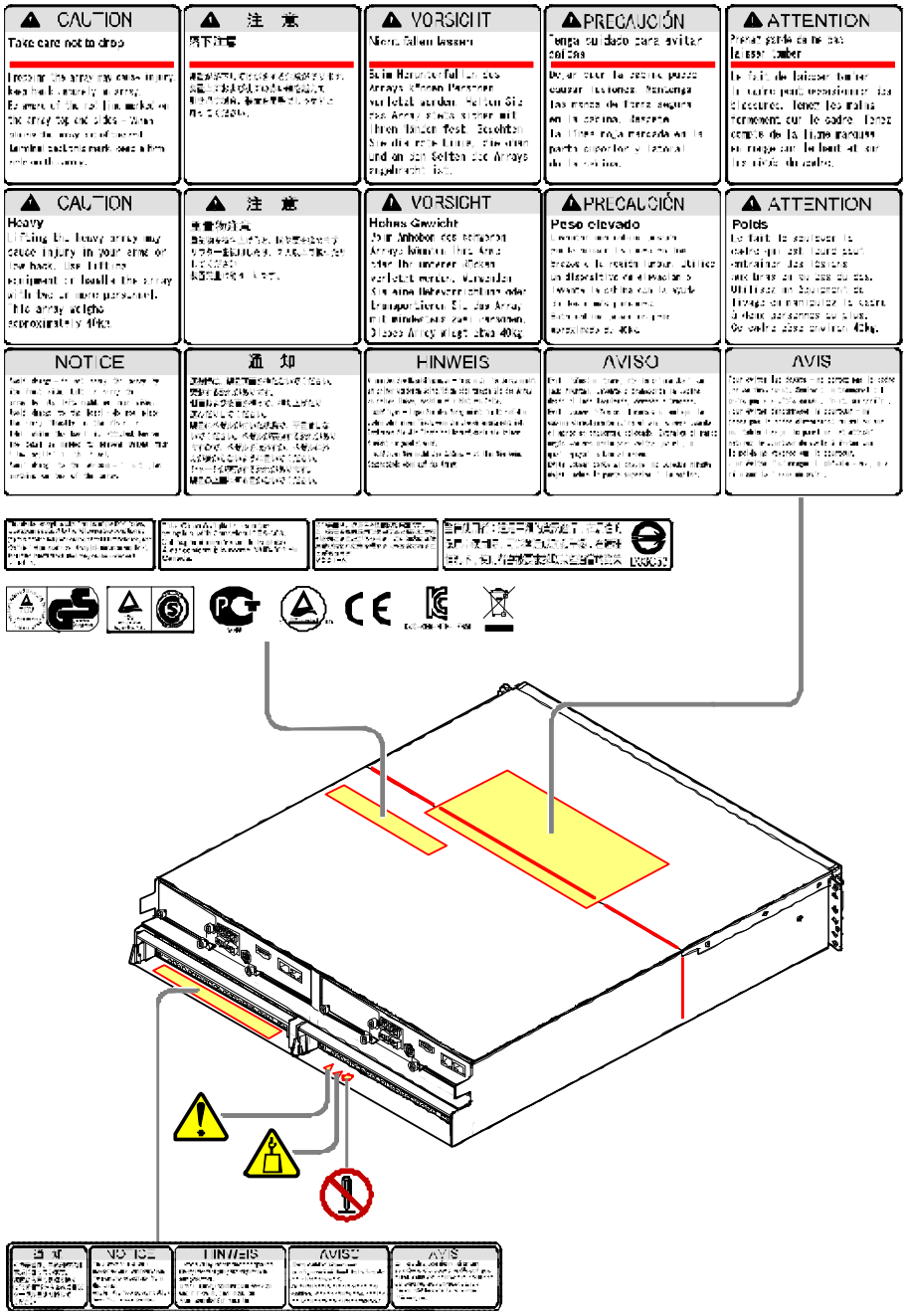


# Labels on the DBL/DBLD

## Either (a) or (b) is affixed.

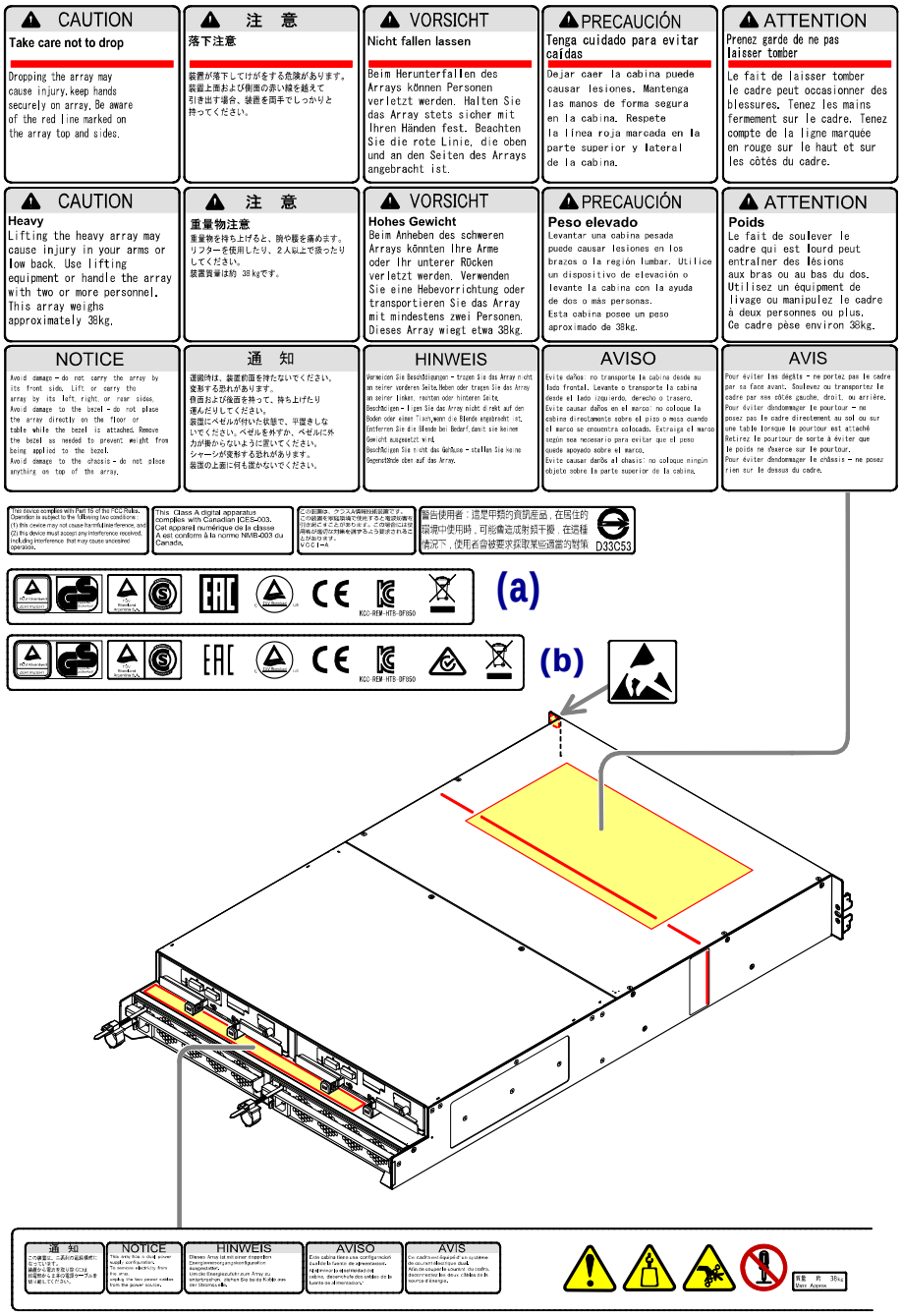


# Labels on the CBXSS



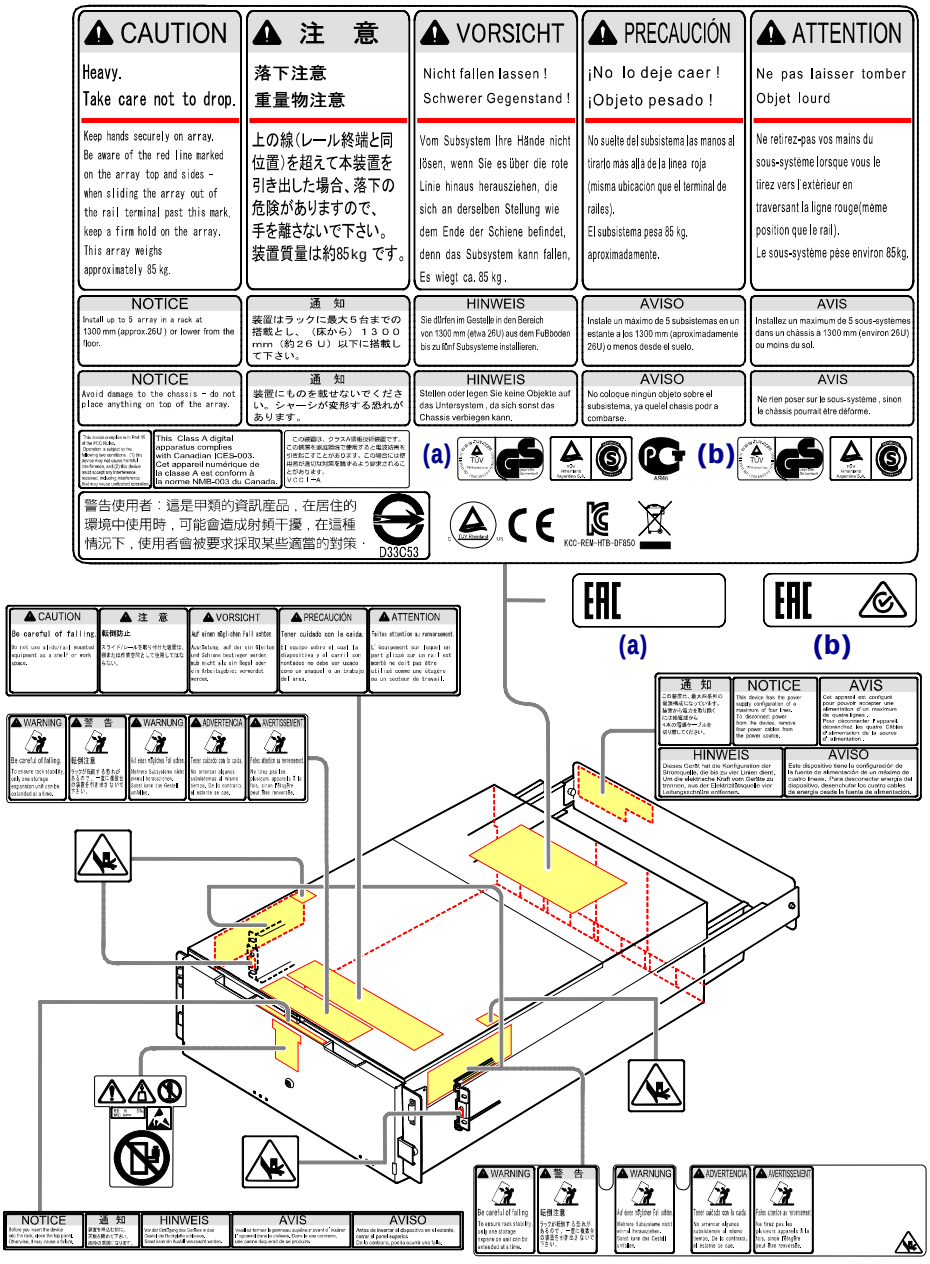
# Labels on the DBF

## Either (a) or (b) is affixed.

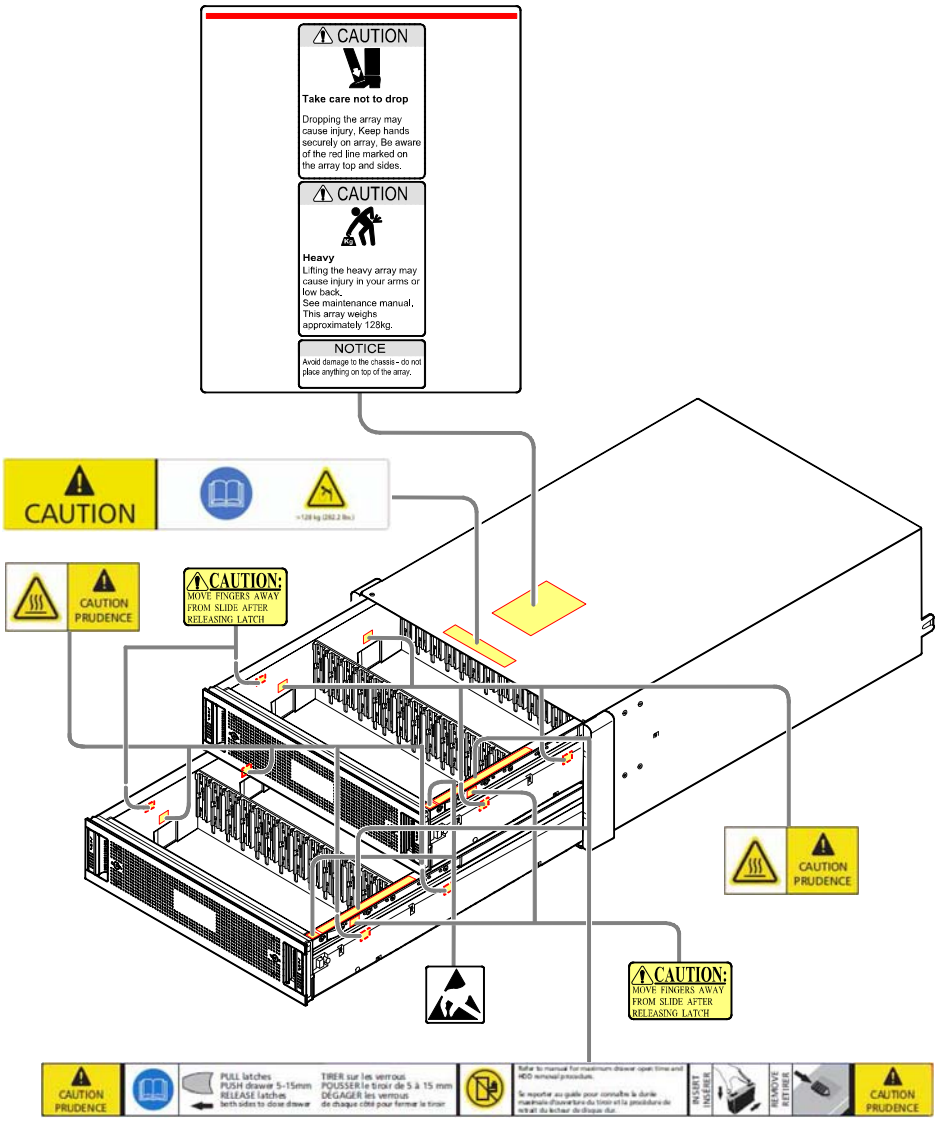


# Labels on the DBX

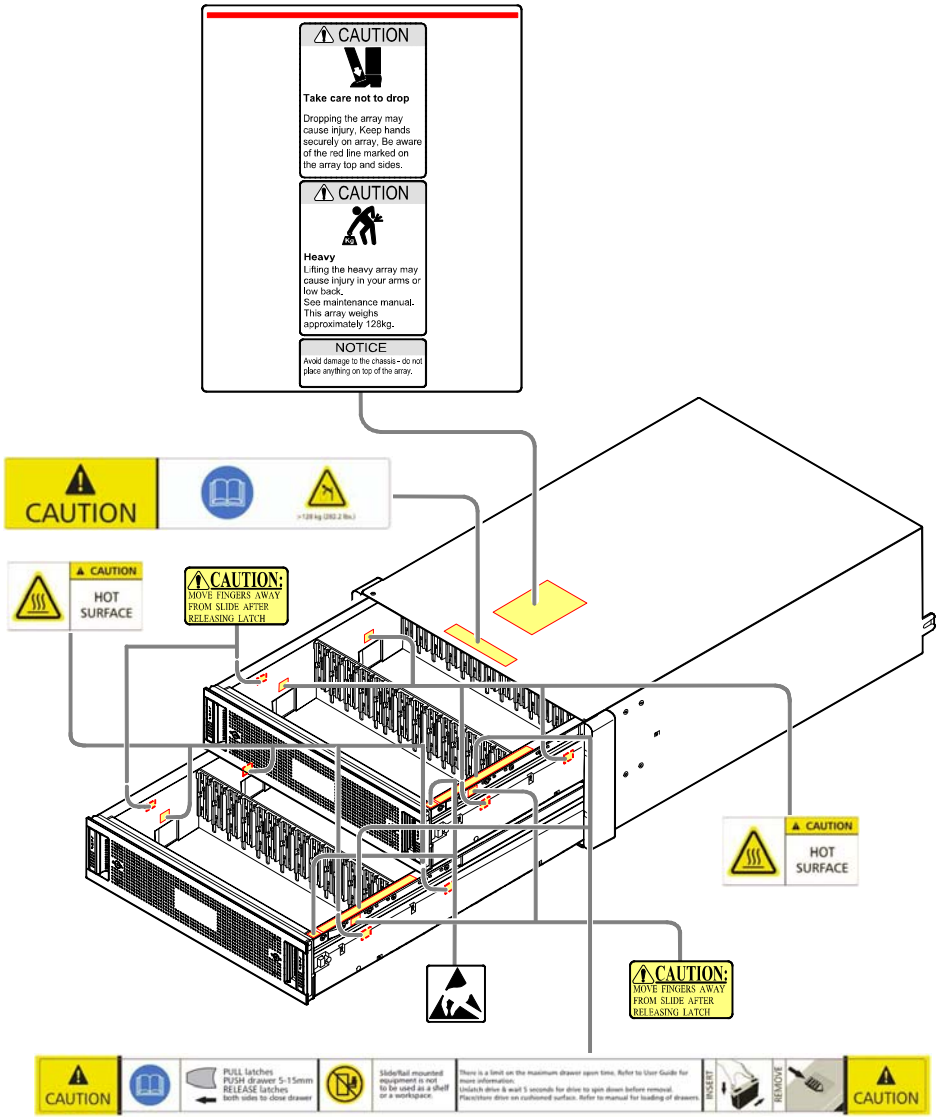
## Either (a) or (b) is affixed.



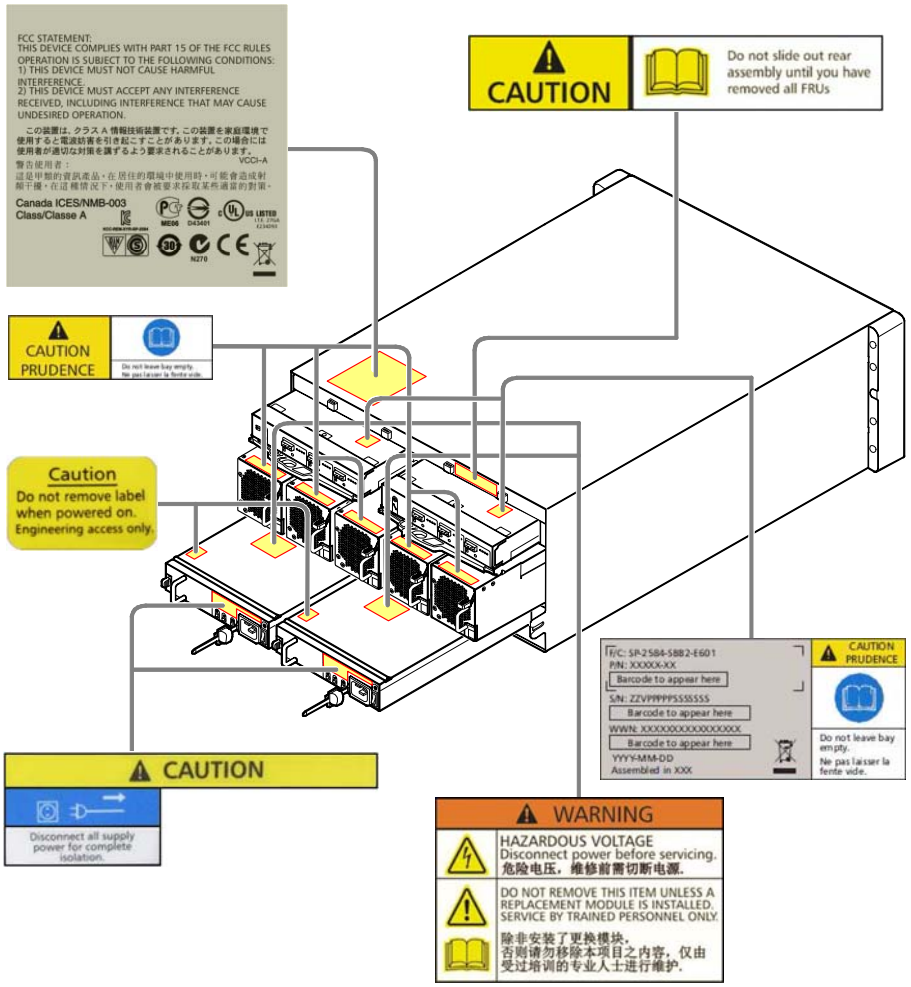
# Labels on front of the DBW (added on April 2014)



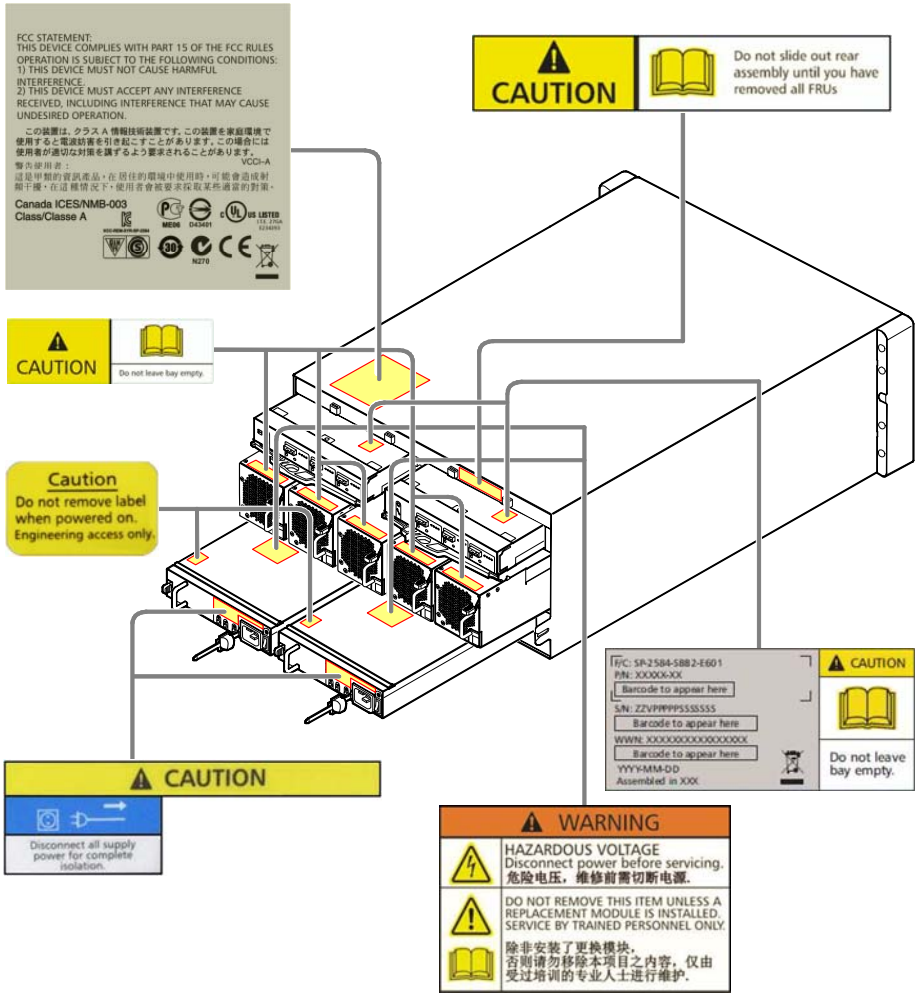
# Labels on front of the DBW (effective until end of March 2014)



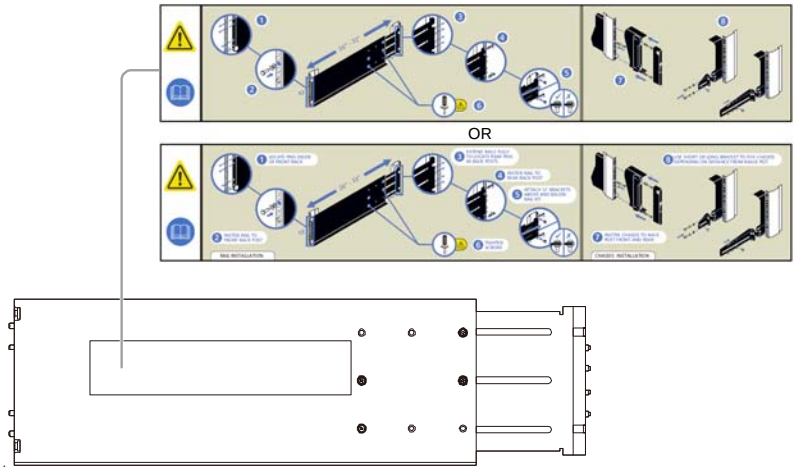
# Labels on rear of the DBW (added on April 2014)



# Labels on rear of the DBW (effective until end of March 2014)

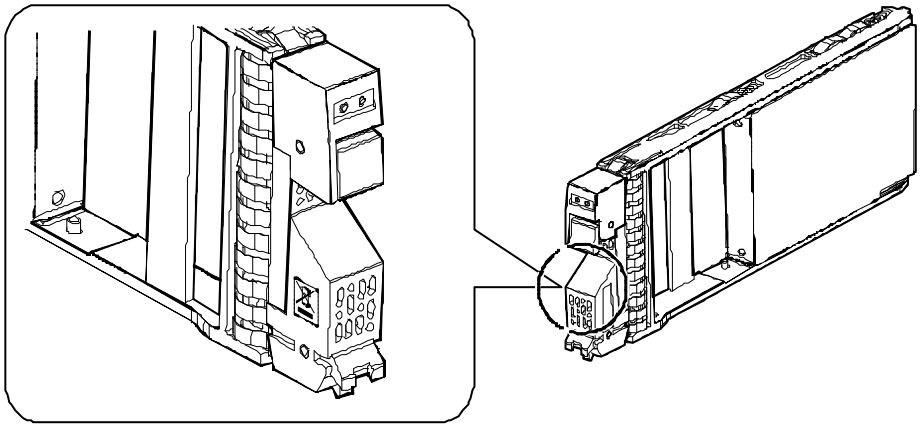



# Label position and contents on DBW rail

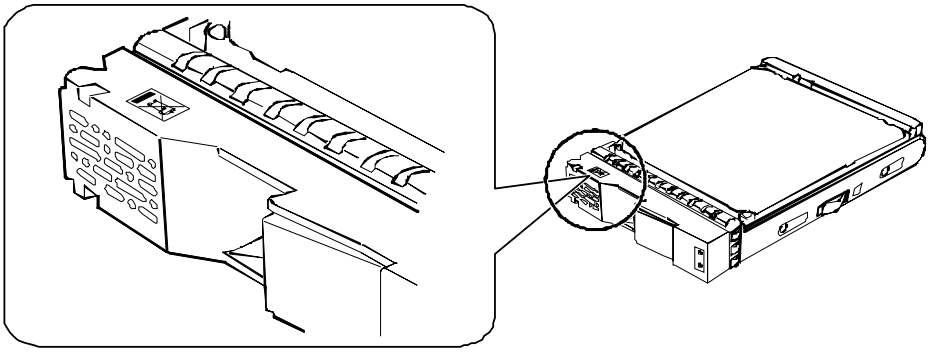


# Labels on the drives

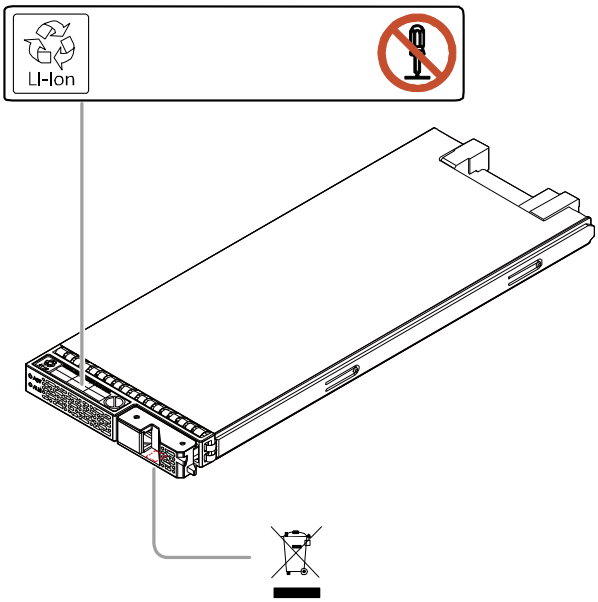
## CBXSS / CBSS / DBS / DBSD



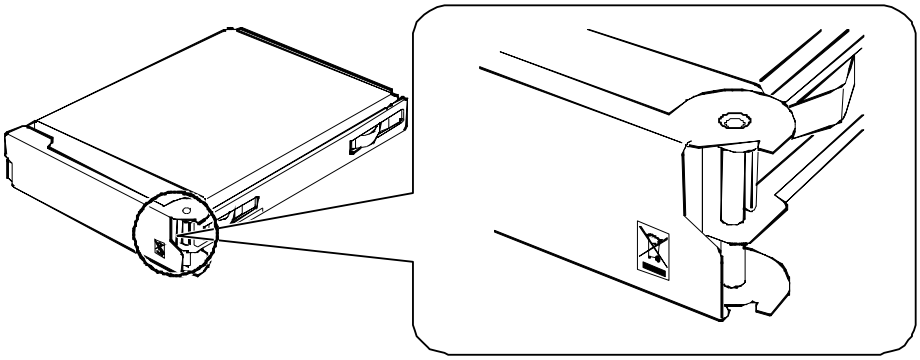
## CBXSL / CBSL / DBL / DBLD



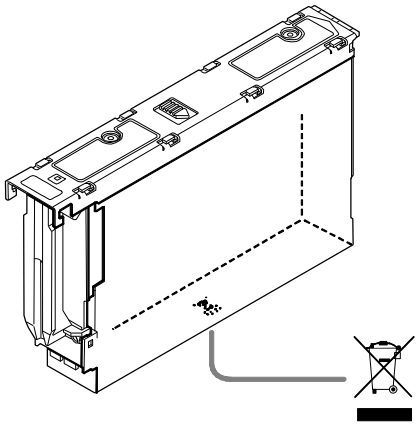
## DBF



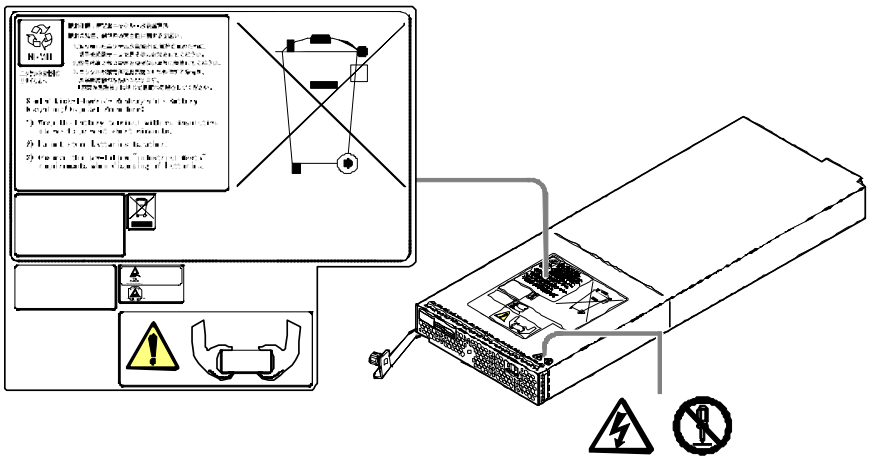
### DBX



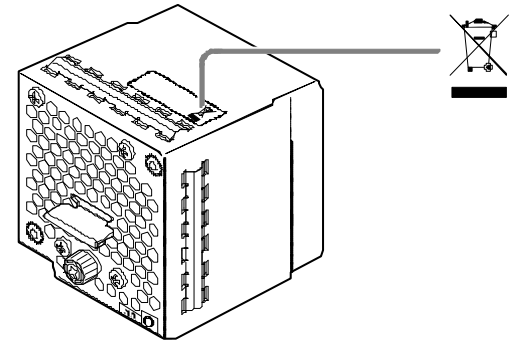
### DBW



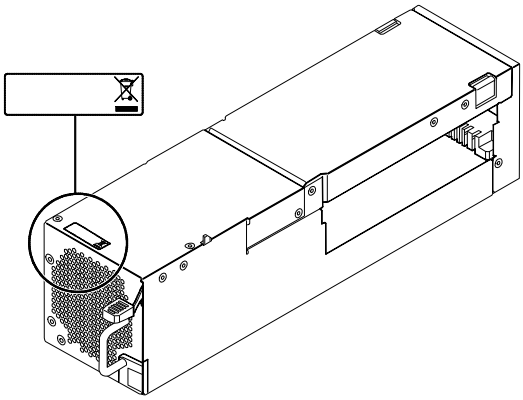
## Labels on cache backup battery (CBL/CBLE/CBLD)



## Labels on fan module (CBL/CBLE/CBLD)

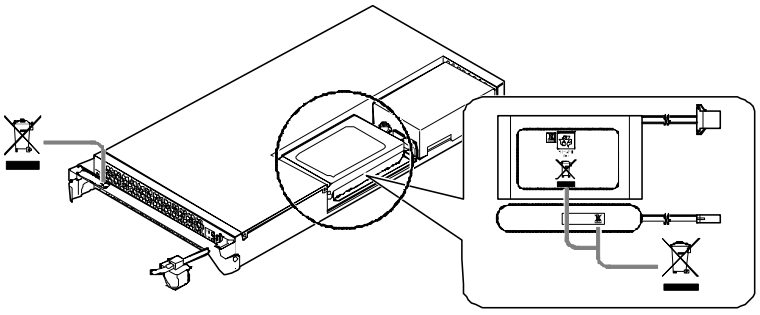


## Labels on DBW

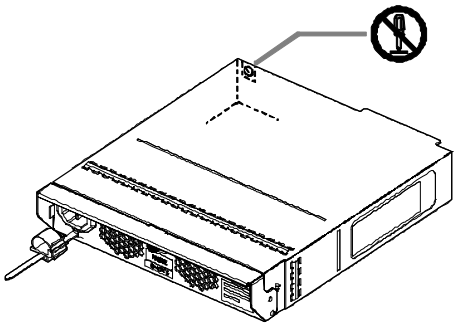


## Labels on the power unit

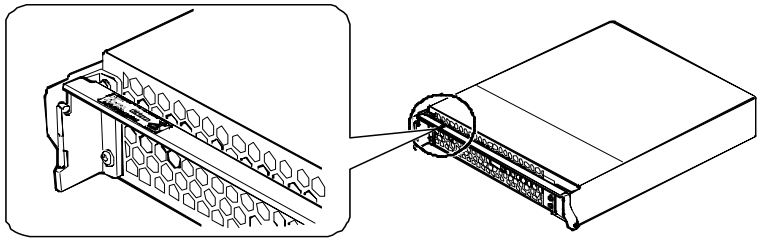
### CBXSS/CBXSL/CBSS/CBSL



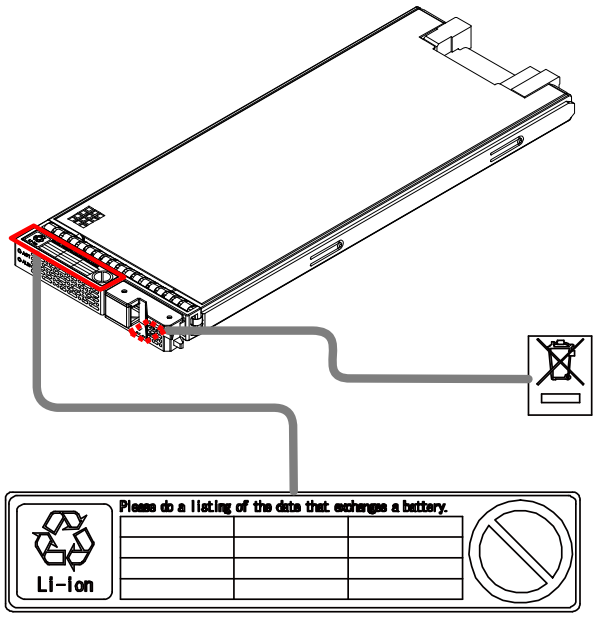
## CBL / CBLE / CBLD



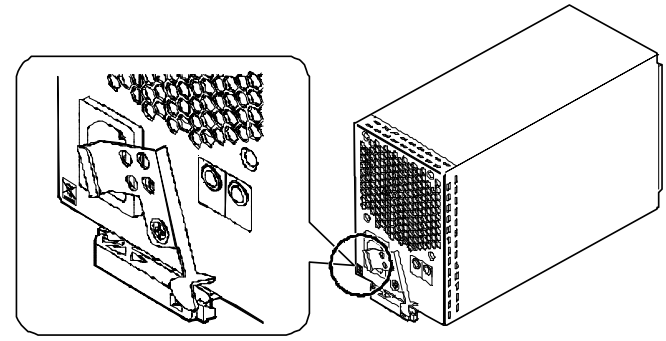
## DBS / DBSD / DBL / DBLD



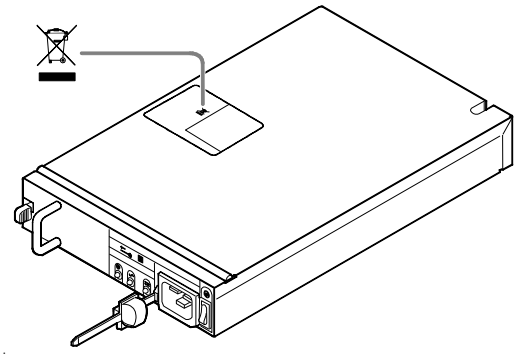
## DBF



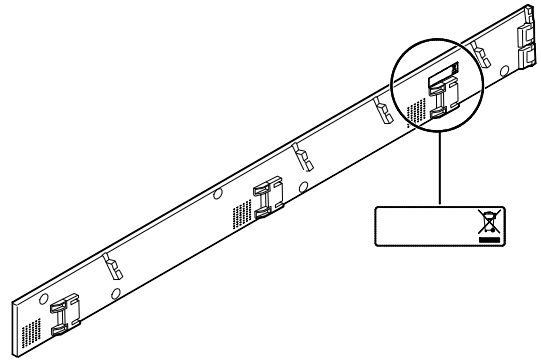
## DBX



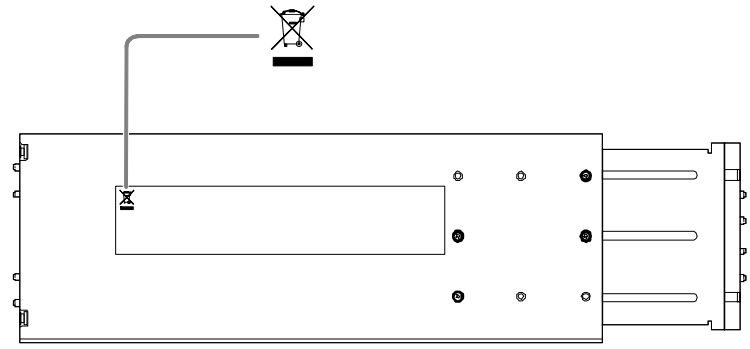
## DBW



## Positions and contents of labels on DBW side card

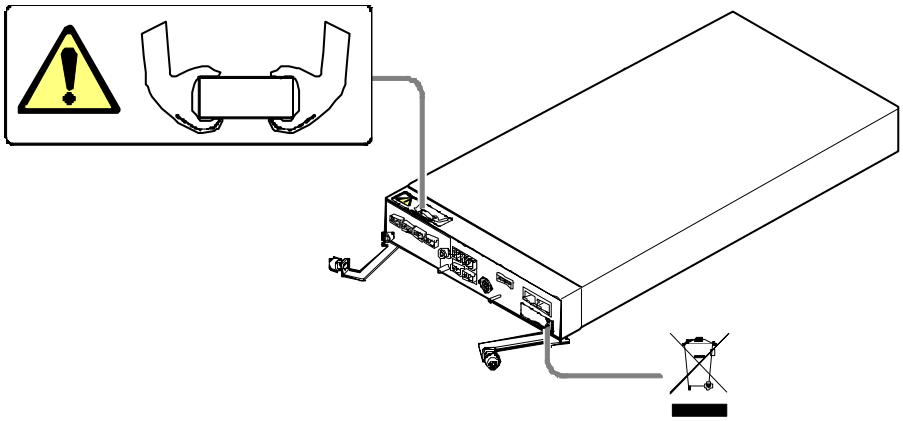


## Positions and Contents of Labels on DBW rail

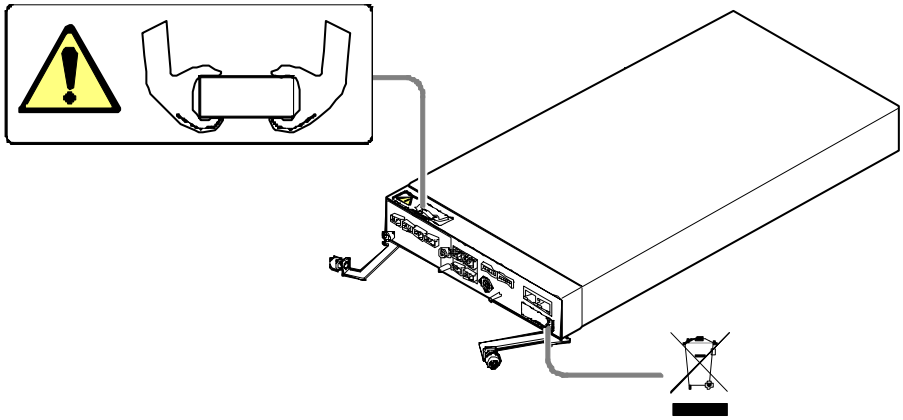


# Labels on the controller

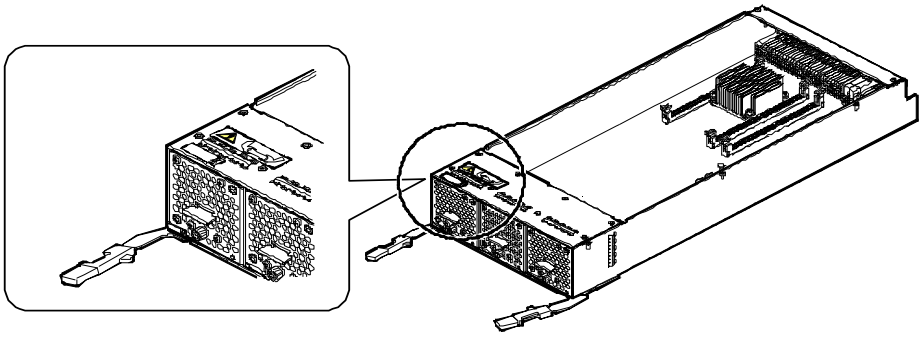
## CBXSS / CBXSL



## CBSS / CBSL

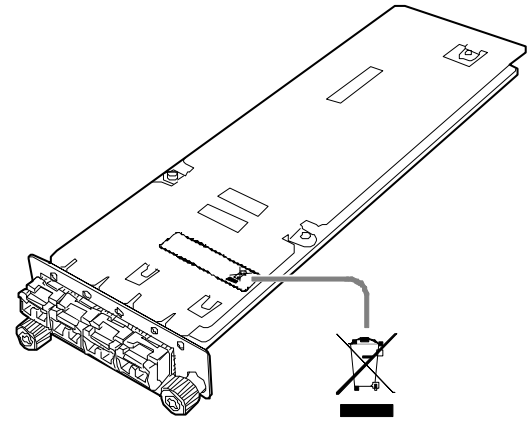


## CBL / CBLE / CBLD



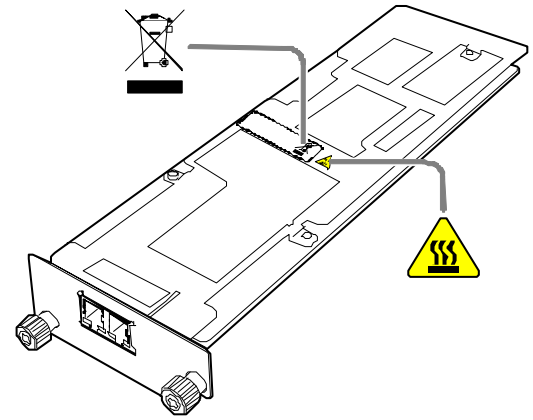
# Labels on Host I/O Boards (CBSS/CBSL)

## Host I/O Board (Fibre Channel)

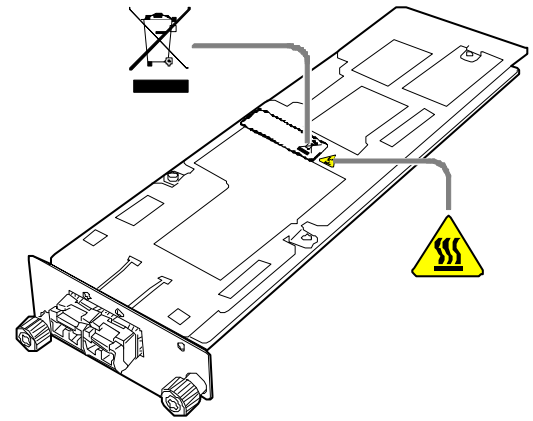


# Labels on Host I/O Boards (CBXSS/CBXSL/CBSS/CBSL)

## 1 Gbps iSCSI

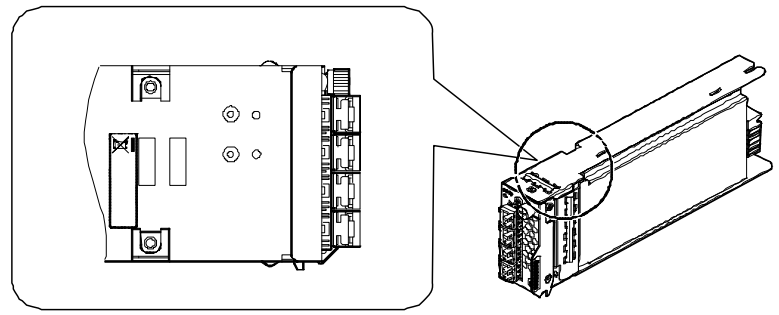


## 10 Gb iSCSI

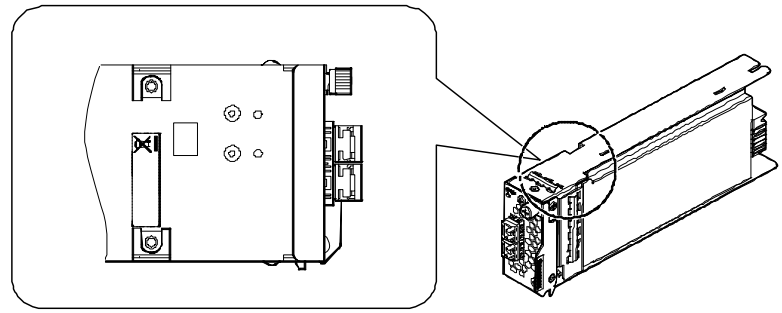


## Labels on Host I/O Module (CBL/CBLE/CBLD)

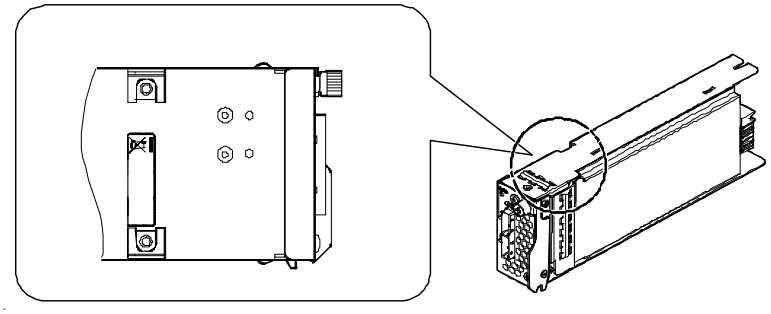
### Fibre Channel



### iSCSI

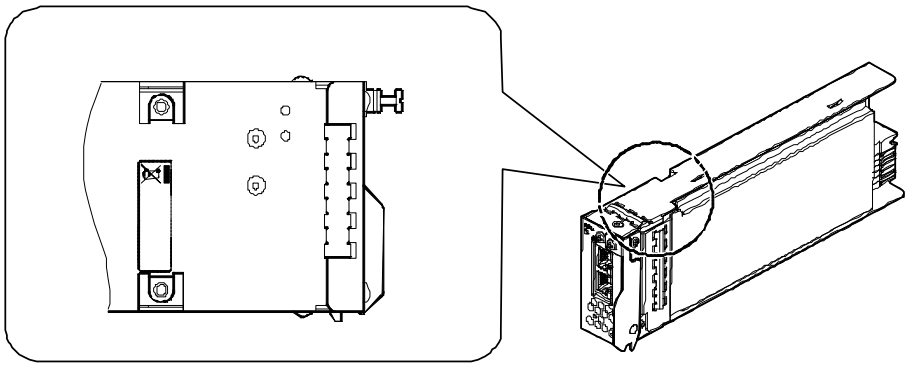


## Labels on Drive I/O Module (CBL/CBLE/CBLD)

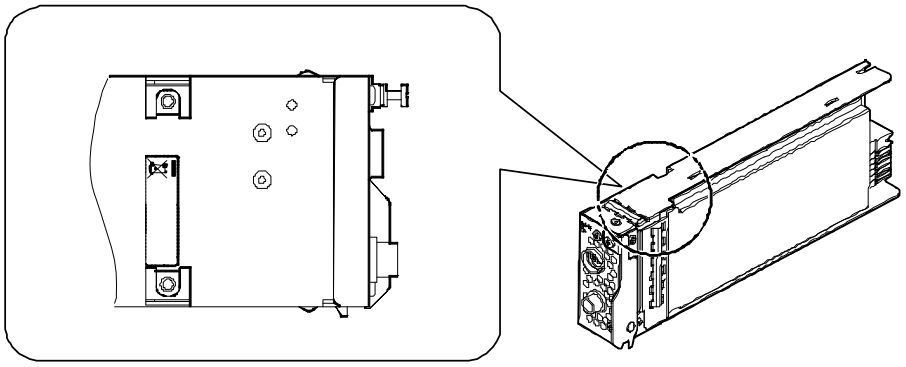


# Labels on Management Module (CBL/CBLE/CBLD)

## LAN

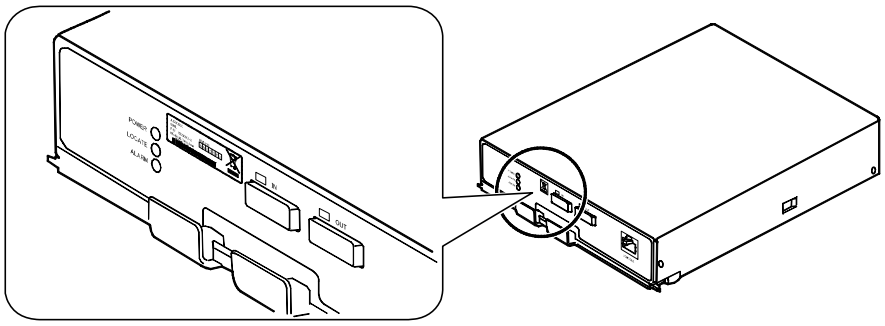


## UPS

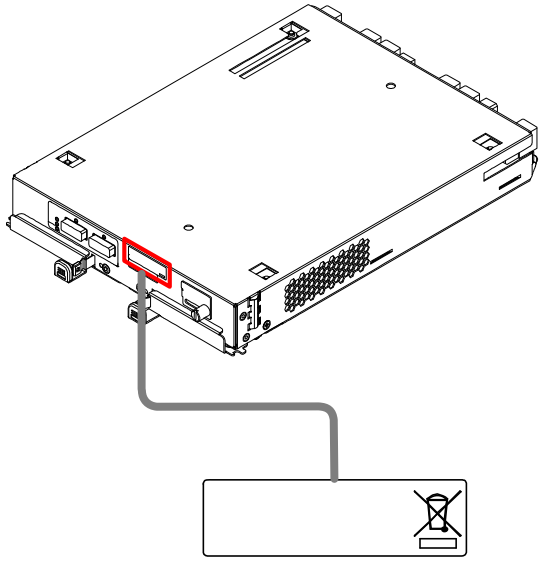


# Labels on I/O Module (ENC)

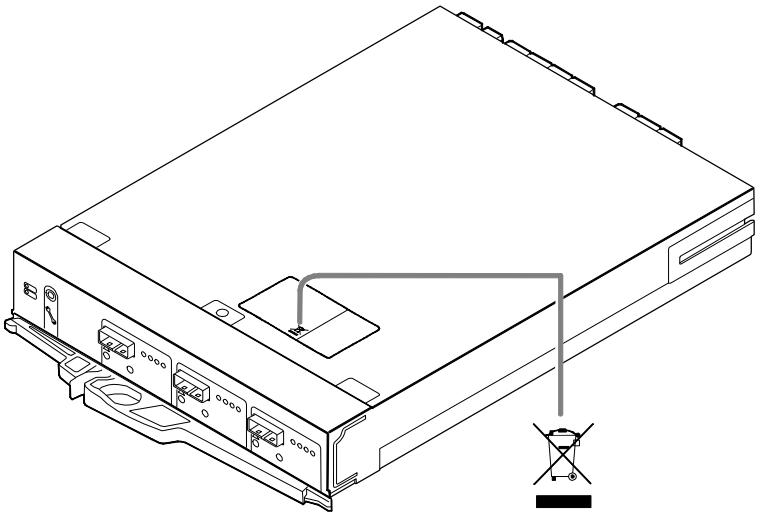
## (DBS/DBSD/DBL/DBLD)



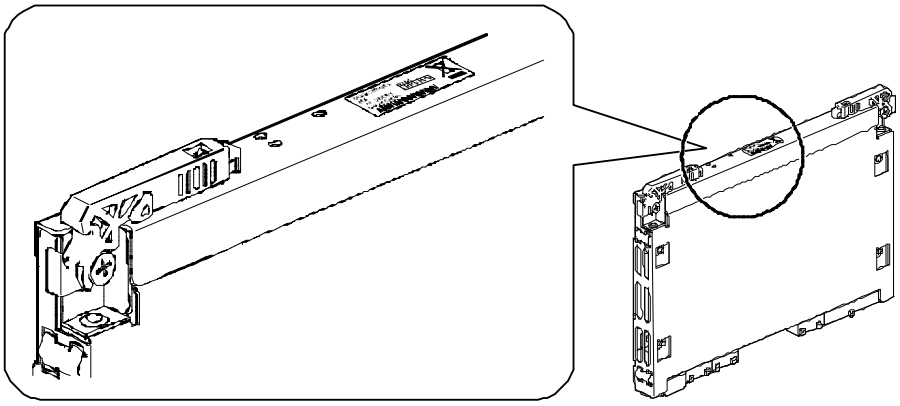
## DBF



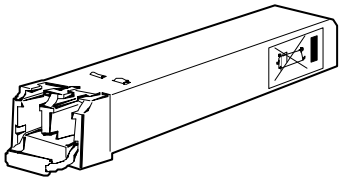
## DBW



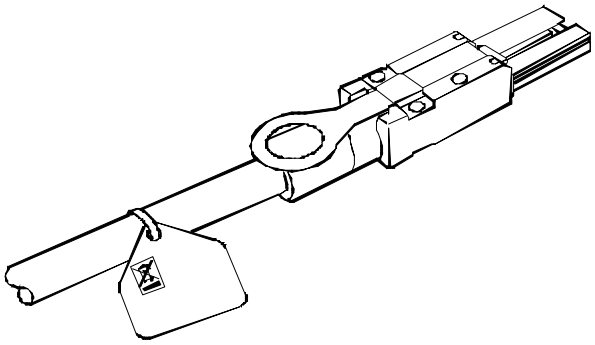
## Labels on I/O Card (ENC) (DBX)



## Labels on Host Connector

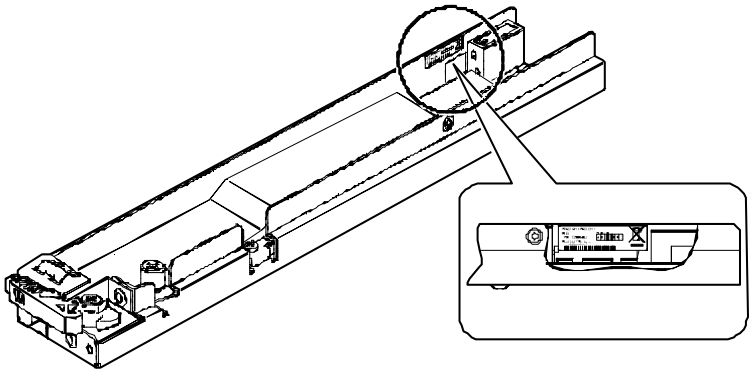


## Labels on SAS (ENC) Cable

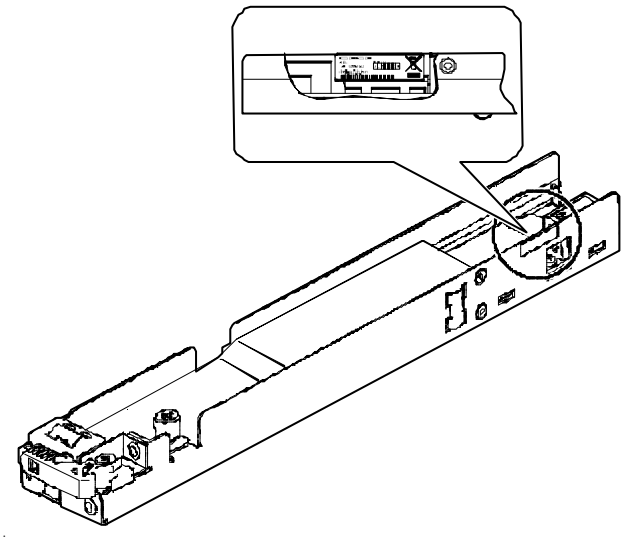


## Labels on cable holder (DBX)

### In



## Out



# Contents


**Preface . . . . . lv**

Intended audience . . . . . lvi
Product version . . . . . lvi
Changes in this revision . . . . . lvi
Document organization . . . . . lvi
Related documents . . . . . lviii
Document conventions . . . . . lix
Convention for storage capacity values . . . . . lx
Accessing product documentation . . . . . lxi
Getting help . . . . . lxi
Comments . . . . . lxi

**1 Introduction . . . . . 1-1**

Hitachi Unified Storage 110 . . . . . 1-2
Hitachi Unified Storage 130 . . . . . 1-3
Hitachi Unified Storage 150 . . . . . 1-4
AC Power Supply Models . . . . . 1-4
DC Power Supply Models . . . . . 1-5
Features . . . . . 1-7
Comparing key features . . . . . 1-7
Scalability . . . . . 1-8
RAID implementations . . . . . 1-13

**2 Hardware description . . . . . 2-1**

Matching Controller Boxes and Drive Boxes . . . . . 2-2
Storage system dimensions . . . . . 2-3
Controller Boxes at a glance . . . . . 2-4
CBXSS Controller Box (DF850-CBSSR) . . . . . 2-5
Front panel bezel . . . . . 2-5
Front panel without bezel . . . . . 2-5
Rear panel . . . . . 2-6

CBXSL Controller Box (DF850-CBSLR) . . . . . 2-7
Front panel bezel . . . . . 2-7
Front panel without bezel . . . . . 2-7
Rear panel . . . . . 2-8
CBSS Controller Box (DF850-CBSSR) . . . . . 2-9
Front panel bezel . . . . . 2-9
Front panel without bezel . . . . . 2-9
Rear panel . . . . . 2-10
CBSL Controller Box (DF850-CBSLR) . . . . . 2-11
Front panel bezel . . . . . 2-11
Front panel without bezel . . . . . 2-11
Rear panel . . . . . 2-12
CBL (DF850-CBLR), CBLE (DF850-CBLR1), and CBLD (DF850-CBLD) Controller Boxes . . . . . 2-13
Front panel bezel . . . . . 2-13
Front panel without bezel . . . . . 2-13
Rear panel . . . . . 2-14
Drive Boxes at a glance . . . . . 2-15
DBS/DBSD Drive Box. . . . . 2-15
Front panel bezel . . . . . 2-15
Front panel without bezel . . . . . 2-15
Rear panel . . . . . 2-16
DBL/DBLD Drive Box. . . . . 2-17
Front panel bezel . . . . . 2-17
Front panel without bezel . . . . . 2-17
Rear panel . . . . . 2-18
DBF Drive Box . . . . . 2-19
Front panel bezel . . . . . 2-19
Front panel without bezel . . . . . 2-19
Rear panel . . . . . 2-20
DBX Drive Box . . . . . 2-21
Front panel bezel . . . . . 2-21
Rear panel . . . . . 2-22
Top view . . . . . 2-23
DBW Drive Box. . . . . 2-24
Front panel bezel . . . . . 2-24
Rear panel . . . . . 2-25
Top view . . . . . 2-25
Hardware descriptions . . . . . 2-26
LED definitions . . . . . 2-26
Front panel LEDs . . . . . 2-26
Drive display LEDs . . . . . 2-30
Controller LEDs. . . . . 2-34
CBXSS/CBXSL controller LEDs . . . . . 2-34

CBSS/CBSL controller LEDs. . . . . .2-34
Data port descriptions . . . . . .2-35
Fibre Channel ports . . . . . .2-35
1 Gb iSCSI ports . . . . . .2-36
Management port . . . . . .2-37
Maintenance port . . . . . .2-37
Host I/O Board and Host I/O Module . . . . . .2-38
Host I/O Boards for CBXSS and CBXSL Controller Boxes . . . . . .2-38
Host I/O Boards for CBSS and CBSL Controller Boxes . . . . . .2-40
I/O Module (ENC) and I/O Card (ENC) . . . . . .2-42
I/O Module (ENC), DBS, DBSD, DBL, and DBLD Drive Boxes . . . . . .2-42
I/O Card (ENC), DBX Drive Box. . . . . .2-43
I/O Module (ENC), DBF Drive Box . . . . . .2-44
Cable Holder (ENC), DBX . . . . . .2-44
Power Unit . . . . . .2-45
Power Unit for CBXSS, CBXSL, CBSS, and CBSL Controller Boxes . . . . . .2-45
Power Unit for DBS and DBL Drive Boxes. . . . . .2-45
Power Unit for DBSD/DBLD Drive Box . . . . . .2-46
Power Unit for DBF Drive Box. . . . . .2-46
Power Unit for CBL/CBLE Controller Box . . . . . .2-46
Power Unit for CBLD Controller Box. . . . . .2-47
Power Unit for DBX Drive Box. . . . . .2-47
CBL/CBLE/CBLD Controller Box. . . . . .2-48
Front of CBL/CBLE/CBLD Controller Box. . . . . .2-48
Rear panel of CBL/CBLE/CBLD Controller Box. . . . . .2-51
Management Module for CBL/CBLE/CBLD Controller Box . . . . . .2-53
Drive I/O Module for CBL/CBLE/CBLD Controller Box . . . . . .2-54
Host I/O Modules for CBL/CBLE/CBLD Controller Box . . . . . .2-55
DBW Drive Box . . . . . .2-57
I/O Module (ENC) for DBW Drive Box . . . . . .2-57
Power Unit for DBW Drive Box . . . . . .2-58
DBW Drive Box drawer . . . . . .2-59
DBW Fan Module. . . . . .2-60

**3 Preparing your site . . . . . .3-1**

Site preparation responsibilities . . . . . 3-2
User responsibilities. . . . . 3-2
Site/installation coordinator responsibilities . . . . . 3-3
Facilities personnel responsibilities . . . . . 3-3
Hitachi responsibilities . . . . . 3-3
Preparing your site. . . . . 3-4
Site considerations . . . . . 3-4
Space requirements. . . . . 3-5

Power considerations . . . . . 3-5
Electrical requirements . . . . . 3-5
Environmental requirements . . . . . 3-6
Floor load ratings . . . . . 3-6
Rack planning . . . . . 3-7
Topology considerations . . . . . 3-9
Safety considerations . . . . . 3-9
Warning about moving parts . . . . . 3-10
Electrical safety . . . . . 3-11
Preventing electric shock . . . . . 3-11
Electrostatic safety . . . . . 3-12
Pre-installation checklist . . . . . 3-13

**4 Installing the storage system . . . . . 4-1**

Installation Roadmap . . . . . 4-2
Unpacking . . . . . 4-3
Required items supplied by the user . . . . . 4-5
Items for all users . . . . . 4-5
Items for Fibre Channel users . . . . . 4-5
Items for 1 Gb iSCSI users . . . . . 4-5
Items for 10 Gb iSCSI users . . . . . 4-6
Items for storage system management . . . . . 4-6
Microsoft Windows server environments . . . . . 4-7
Microsoft Windows client environments . . . . . 4-8
Red Hat Linux environments . . . . . 4-9
Solaris environments . . . . . 4-10
Mounting the storage system . . . . . 4-11
Making data connections . . . . . 4-12
Fibre Channel connections . . . . . 4-12
1 Gb iSCSI connections . . . . . 4-14
10 Gb iSCSI connections . . . . . 4-15
Connecting Drive Boxes . . . . . 4-16
Connection order when installing Drive Boxes . . . . . 4-17
Maximum number of installable Drive Boxes . . . . . 4-19
Installing Drive Boxes . . . . . 4-19
Connecting a CBXSS, CBXSL, CBSS, or CBSL to a DBS, DBSD, DBLD, or DBL Drive Box . . . . . 4-19
Connecting a CBL/CBLE/CBLD to a DBS, DBSD, or DBL Drive Box . . . . . 4-23
Connecting a CBL, CBLE, or CBLD to a DBW Drive Box . . . . . 4-25
Attaching the front panel bezel . . . . . 4-26
Removing the front panel bezel . . . . . 4-29
Connecting power cables and powering on . . . . . 4-31
Powering off the storage system . . . . . 4-33
Restarting the storage system . . . . . 4-34

5 Configuring the storage system . . . . . .5-1
Establishing the management path . . . . . 5-2
Installing and logging in to Storage Navigator Modular 2 . . . . . 5-3
Usage guidelines . . . . . 5-4
Performing basic configuration activities . . . . . 5-6
Registering the storage system . . . . . 5-6
Performing the initial setup . . . . . 5-7
Setting up host ports . . . . . .5-11
Configuring spare drives . . . . . .5-15
Configuring system date and time . . . . . .5-16
Confirming your selections . . . . . .5-17
Creating and mapping volumes . . . . . .5-17
Changing controller IP addresses . . . . . .5-21
Selecting platform-specific settings . . . . . .5-23
Storage systems with Fibre Channel ports . . . . . .5-23
Creating RAID groups . . . . . .5-34
Creating volumes . . . . . .5-36
Completing the basic configuration . . . . . .5-40
Performing routine configuration activities . . . . . .5-41
Managing spares . . . . . .5-42
Guidelines when managing spares . . . . . .5-42
Adding spares . . . . . .5-42
Verifying spares . . . . . .5-44
Deleting spares . . . . . .5-45
Working with RAID groups . . . . . .5-46
Verifying RAID groups . . . . . .5-46
Expanding RAID group capacity . . . . . .5-48
Changing the priority of RAID group expansion . . . . . .5-51
Deleting the RAID Group expansion request . . . . . .5-52
Deleting RAID groups . . . . . .5-53
Managing volumes . . . . . .5-54
Verifying volumes . . . . . .5-55
Changing volume capacity . . . . . .5-56
Unifying volumes . . . . . .5-60
Separating volumes . . . . . .5-62
Formatting volumes . . . . . .5-65
Deleting volumes . . . . . .5-66
Improving I/O response times in small configurations . . . . . .5-67
Changing format mode . . . . . .5-69
Setting the mapping guard . . . . . .5-70
Routine Fibre Channel activities . . . . . .5-72
Changing Fibre Channel settings . . . . . .5-72
Configuring mapping (Fibre Channel) . . . . . .5-73
Releasing volume assignments (Fibre Channel) . . . . . .5-76

Routine iSCSI activities . . . . . 5-79
Changing iSCSI settings . . . . . 5-79
Configuring iSCSI target information . . . . . 5-81
Initializing iSCSI target settings . . . . . 5-83
Configuring mapping (iSCSI) . . . . . 5-84
Releasing volume assignments (iSCSI) . . . . . 5-86
Using CHAP authentication with iSCSI ports . . . . . 5-89
Configuring one-way CHAP . . . . . 5-89
Changing one-way CHAP settings . . . . . 5-90
Deleting a one-way CHAP user . . . . . 5-92
Enabling mutual CHAP . . . . . 5-92
Installing an iSCSI initiator (iSCSI systems only) . . . . . 5-94
Setting the flash drive/FMD write endurance threshold . . . . . 5-95
Setting the FMD Battery Life Threshold . . . . . 5-95
Increasing storage system security on a LAN . . . . . 5-96
Setting the normal port status . . . . . 5-96
Changing the packet filtering . . . . . 5-97
Setting the system date and time . . . . . 5-98
Viewing array system date and time . . . . . 5-99
Setting the array date and time . . . . . 5-99
Setting the array time zone and NTP settings . . . . . 5-101

**6 Fibre Channel host configuration . . . . . 6-1**

Assumptions and requirements . . . . . 6-2
Fibre Channel guidelines . . . . . 6-3
Configurations with multiple hosts . . . . . 6-3
Fault-tolerant topologies . . . . . 6-4
Zoning . . . . . 6-5
Confirming host settings . . . . . 6-5
Fibre Channel Option on the Hitachi Unified Storage 110 . . . . . 6-6
Installing the Fibre Channel Option . . . . . 6-6
Enabling or disabling the Fibre Channel Option . . . . . 6-7
Confirming the installation . . . . . 6-8
Uninstalling the Fibre Channel Option . . . . . 6-9
Microsoft Windows Server 2012 . . . . . 6-11
Queue depth . . . . . 6-11
Device timeout . . . . . 6-11
Verifying and discovering VOLs . . . . . 6-12
Troubleshooting . . . . . 6-14
Microsoft Windows Server 2008 . . . . . 6-15
Queue depth . . . . . 6-15
Device timeout . . . . . 6-15
Verifying and discovering VOLs . . . . . 6-16
Troubleshooting . . . . . 6-16
Microsoft Windows Server 2003 . . . . . 6-17

Queue depth . . . . . 6-17
Device timeout . . . . . 6-17
Verifying and discovering VOLs . . . . . 6-18
Troubleshooting . . . . . 6-21
VMware . . . . . 6-22
Queue depth . . . . . 6-22
Device timeout . . . . . 6-22
Verifying and discovering VOLs . . . . . 6-23
Cooperative computing . . . . . 6-25
Troubleshooting . . . . . 6-27
Solaris . . . . . 6-28
Completing the system and host connection . . . . . 6-28
Queue depth . . . . . 6-28
Device timeout . . . . . 6-30
Verifying and discovering VOLs . . . . . 6-30
Partitioning and labeling the new devices on a SPARC system . . . . . 6-31
Partitioning and labeling the new devices on an x86_64 system . . . . . 6-34
Troubleshooting . . . . . 6-36
Red Hat Enterprise Linux . . . . . 6-37
Device Mapper multipathing . . . . . 6-37
Queue depth . . . . . 6-37
Device timeout . . . . . 6-38
Verifying and discovering VOLs . . . . . 6-38
Troubleshooting . . . . . 6-39
SuSE Linux . . . . . 6-40
Device Mapper multipathing . . . . . 6-40
Queue depth . . . . . 6-40
Device timeout . . . . . 6-41
Verifying and discovering VOLs . . . . . 6-41
Troubleshooting . . . . . 6-42
HP-UX . . . . . 6-43
Queue depth . . . . . 6-43
Device timeout . . . . . 6-43
HP-UX 11.i V1.0/V2.0 . . . . . 6-43
HP-UX 11.i V3.0 . . . . . 6-44
Checking your connection to the storage system . . . . . 6-45
Checking the recognition of Hitachi Unified Storage system . . . . . 6-45
Troubleshooting . . . . . 6-46
AIX . . . . . 6-47
Queue depth . . . . . 6-47
Device timeout . . . . . 6-49
Verifying and discovering VOLs . . . . . 6-49
Troubleshooting . . . . . 6-51
Citrix XenServer . . . . . 6-52
Microsoft Windows and Linux operating systems . . . . . 6-52
Multipath support for Citrix XenServer hosts . . . . . 6-52

Clustering support on Citrix XenServer hosts . . . . . 6-53
SAN Boot . . . . . 6-53
Queue depth . . . . . 6-53
Device timeout . . . . . 6-54
Configuring the Citrix XenServer host . . . . . 6-54
Verifying and discovering VOLs . . . . . 6-54
Troubleshooting . . . . . 6-54

**7 iSCSI host configuration . . . . . 7-1**

Assumptions and requirements . . . . . 7-2
iSCSI overview . . . . . 7-3
What is ISCSI? . . . . . 7-4
iSCSI SAN components . . . . . 7-5
iSCSI under the hood . . . . . 7-6
Determining your iSCSI topology . . . . . 7-7
Interoperability . . . . . 7-11
Reliability and high availability . . . . . 7-12
Check speed settings . . . . . 7-12
Security . . . . . 7-12
Internet Storage Name Service (iSNS) . . . . . 7-14
iSCSI guidelines . . . . . 7-15
Assigning targets and VOLs to hosts . . . . . 7-16
Microsoft Windows Server 2012 . . . . . 7-17
Microsoft iSCSI initiator . . . . . 7-18
Queue depth . . . . . 7-18
Device timeout . . . . . 7-18
Verifying and discovering VOLs . . . . . 7-18
Troubleshooting . . . . . 7-22
Microsoft Windows Server 2008 . . . . . 7-27
Queue depth . . . . . 7-28
Device timeout . . . . . 7-28
Microsoft iSCSI initiator . . . . . 7-28
Multipath Input/Output (MPIO) software . . . . . 7-29
Verifying and discovering VOLs . . . . . 7-29
Troubleshooting . . . . . 7-33
Microsoft Windows Server 2003 . . . . . 7-38
Queue depth . . . . . 7-39
Device timeout . . . . . 7-39
Microsoft iSCSI initiator . . . . . 7-39
Multipath Input/Output (MPIO) software . . . . . 7-40
Verifying and discovering VOLs . . . . . 7-40
Troubleshooting . . . . . 7-43
VMware . . . . . 7-48
Queue depth . . . . . 7-48
Device timeout . . . . . 7-49

Verifying and discovering volumes . . . . . 7-49
Adding and deleting volumes . . . . . 7-51
Cooperative computing . . . . . 7-53
Troubleshooting . . . . . 7-55
Red Hat Enterprise Linux . . . . . 7-57
Configuring the iSCSI initiator . . . . . 7-58
Installing an HBA and HBA driver . . . . . 7-59
Data digest and header digest considerations . . . . . 7-59
CHAP authentication . . . . . 7-60
Keepalive timer . . . . . 7-61
Device Mapper multipathing . . . . . 7-62
Queue depth . . . . . 7-62
Device timeout . . . . . 7-63
Troubleshooting . . . . . 7-63
SuSE Linux . . . . . 7-64
Configuring the iSCSI initiator . . . . . 7-65
Installing an HBA and driver . . . . . 7-65
Data digest and header digest considerations . . . . . 7-65
CHAP authentication . . . . . 7-66
Keepalive timer . . . . . 7-67
Device Mapper multipathing . . . . . 7-68
Queue depth . . . . . 7-69
Device timeout . . . . . 7-69
Troubleshooting . . . . . 7-69
Citrix XenServer . . . . . 7-70
Microsoft Windows and Linux operating systems . . . . . 7-70
Multipath support for Citrix XenServer hosts . . . . . 7-70
Clustering support on Citrix XenServer hosts . . . . . 7-71
SAN Boot . . . . . 7-71
Queue depth . . . . . 7-71
Device timeout . . . . . 7-72
Configuring the Citrix XenServer host . . . . . 7-72
Verifying and discovering VOLs . . . . . 7-72
Troubleshooting . . . . . 7-73

**8 Connecting to Hitachi Virtual Storage Platform . . . . . 8-1**

Operating host servers . . . . . 8-2
Best practices . . . . . 8-2
Performance guidelines . . . . . 8-3
Verifying and discovering VOLs . . . . . 8-4
Troubleshooting . . . . . 8-4

## 9 Connecting to Hitachi Universal Storage Platform V/ Hitachi Universal Storage Platform VM . . . . . 9-1

Operating host servers . . . . . 9-2
Best practices . . . . . 9-2
Performance guidelines . . . . . 9-3
Verifying and discovering VOLs . . . . . 9-4
Troubleshooting . . . . . 9-4

## 10 Troubleshooting . . . . . 10-1

General troubleshooting . . . . . 10-2
Troubleshooting Storage Navigator Modular 2 . . . . . 10-7
Storage Navigator Modular 2 will not run . . . . . 10-7
Storage Navigator Modular 2 cannot connect to the storage system . . . . . 10-9
Troubleshooting iSCSI issues . . . . . 10-11
Working with firewalls . . . . . 10-13
Email alert notifications . . . . . 10-14
Guidelines when using flash drives/FMDs . . . . . 10-14

## 11 Adding optional components . . . . . 11-1

Guidelines when adding optional components. . . . . 11-2
Procedures for adding optional components . . . . . 11-3
Procedures for adding optional components with power applied . . . . . 11-3
Conditions when adding optional components . . . . . 11-5
Conditions when adding Drive Boxes . . . . . 11-5
Optional components that can be added . . . . . 11-6
Adding drives/storage systems. . . . . 11-8
Adding disk drives . . . . . 11-11
Quick summary for adding drives . . . . . 11-13
Adding drives (storage system power is online) . . . . . 11-13
Adding drives (storage system is powered off). . . . . 11-13
Replacing drives to expand storage capacity (storage system power is online) 11-14
Replacing drives to expand storage capacity (storage system is powered off)11-15
Adding drives to a CBXSL/CBSL/DBL . . . . . 11-17
Adding drives to a CBXSS/CBSS/DBS . . . . . 11-18
Replacing drives in a CBXSL/CBSL/DBL . . . . . 11-19
Replacing drives in a CBXSS/CBSS/DBS. . . . . 11-20
Configuring a host to recognize a volume with power on . . . . . 11-21
Adding cache memory . . . . . 11-22
Adding cache memory to a CBSS/CBSL . . . . . 11-22
Adding cache memory to a CBL/CBLE . . . . . 11-25
Adding Fibre Channel Host I/O Modules or Boards . . . . . 11-27

Offline procedure . . . . . 11-27
CBSS/CBSL offline procedure . . . . . 11-27
CBL/CBLE offline procedure . . . . . 11-30
Online procedure (host is operating) . . . . . 11-32
CBSS/CBSL online procedure . . . . . 11-32
CBL/CBLE online procedure . . . . . 11-36
Adding iSCSI Host I/O Modules or Boards . . . . . 11-40
Offline procedure . . . . . 11-40
CBXSS/CBXSL/CBSS/CBSL offline procedure . . . . . 11-40
CBL/CBLE offline procedure . . . . . 11-43
Online procedure (host is operating) . . . . . 11-45
CBXSS/CBXSL/CBSS/CBSL online procedure . . . . . 11-45
CBL/CBLE online procedure . . . . . 11-48
Host I/O replacement for changing host I/O type . . . . . 11-52
Host I/O replacement of host I/O type (host is operating) . . . . . 11-54
Host I/O replacement for changing host I/O type offline procedure . . . 11-62
Adding a Controller . . . . . 11-65
Adding Drive Boxes . . . . . 11-70
Recognizing Drive Boxes . . . . . 11-72

**A Registration, resources, and checklists . . . . . A-1**

Registering your storage system . . . . . A-2
Creating a user account . . . . . A-2
Logging in to the HDS Support Portal . . . . . A-6
Additional resources . . . . . A-10
Product documentation . . . . . A-10
Product interoperability . . . . . A-10
Global Services . . . . . A-10
Hitachi Storage Forums . . . . . A-10
Recording configuration settings . . . . . A-11

**B Upgrading firmware . . . . . B-1**

Firmware upgrade prerequisites . . . . . B-2
Limitations when upgrading firmware . . . . . B-2
Checking firmware version . . . . . B-3
Upgrading firmware on a dual-controller system . . . . . B-4
Upgrading firmware on a single-controller system . . . . . B-5

**C Rack mounting the storage system . . . . . C-1**

Overview . . . . . C-2
Hitachi racks at a glance . . . . . C-3
Hitachi 600 x 1200 mm Universal Racks . . . . . C-3

Hitachi 750 x 1200 mm Universal Racks . . . . . C-4
Hitachi 600 x 1200 mm Universal Racks . . . . . C-5
Corner guide rails . . . . . C-6
Vertical rails . . . . . C-6
Power . . . . . C-7
Anti-tip stabilizers . . . . . C-7
Incline . . . . . C-8
Mobility and inclination . . . . . C-9
Floor load rating . . . . . C-9
Dynamic weight capacity . . . . . C-9
Static weight capacity . . . . . C-9
Weight for maximum configurations . . . . . C-10
Grounding . . . . . C-10
Specifications . . . . . C-11
Hitachi 750 x 1200 mm Universal Racks . . . . . C-13
Corner guide rails . . . . . C-14
Vertical rails . . . . . C-14
Power . . . . . C-15
Anti-tip stabilizers . . . . . C-15
Incline . . . . . C-17
Mobility and inclination . . . . . C-17
Floor load rating . . . . . C-18
Dynamic weight capacity . . . . . C-18
Static weight capacity . . . . . C-18
Weight for maximum configurations . . . . . C-18
Grounding . . . . . C-18
Specifications . . . . . C-20
Hitachi Brazil racks . . . . . C-22
Preparing for installation . . . . . C-25
Planning considerations . . . . . C-25
Safety information . . . . . C-26
General safety instructions . . . . . C-26
Preventing electric shock . . . . . C-26
Preventing electrostatic discharge . . . . . C-27
Fire . . . . . C-28
Working around rotating or moving parts . . . . . C-28
Be aware of all potential hazards . . . . . C-28
Precautions when using the rack-mounted equipment . . . . . C-28
Casters . . . . . C-29
Rack stability . . . . . C-29
Weight and location considerations . . . . . C-29
Height considerations . . . . . C-31
Placing components in the rack . . . . . C-32
Working with racks or components in the rack . . . . . C-33

Air vents and airflow . . . . . C-33
Blanking panels . . . . . C-34
Cable guidelines . . . . . C-34
Power precautions . . . . . C-34
Grounding requirements . . . . . C-35
Environmental specifications . . . . . C-35
Receiving considerations for the rack . . . . . C-36
Tools required . . . . . C-36
Checking the hardware . . . . . C-37
Casters . . . . . C-37
Leveling feet . . . . . C-37
Stabilizing the rack . . . . . C-38
Moving the rack . . . . . C-39
Securing multiple racks together with the baying kit . . . . . C-40
Rear baying instructions . . . . . C-40
Opening and closing the side panels . . . . . C-42
Installing rack equipment . . . . . C-43
Installation steps . . . . . C-43
Installing cage nuts . . . . . C-44
Installing and uninstalling the anti-tip stabilizing plates . . . . . C-44
Installing blanking panels . . . . . C-46
Universal Rail Kit . . . . . C-46
Installing a Universal Rail Kit 19-inch rack-mount rail support kit . . . . . C-47
Mounting the rail assembly . . . . . C-49
Installing the corner guide rails . . . . . C-49
Rack-mounting DBW and DBX Drive Boxes . . . . . C-52
Post-installation considerations . . . . . C-54
Casters . . . . . C-54
Precautions for inspection and cleaning . . . . . C-54
Power Distribution Units . . . . . C-55
PDU information at-a-glance . . . . . C-55
Types of PDU plugs . . . . . C-56
Power cables shipped with the Hitachi Universal Racks . . . . . C-56
Installation overview . . . . . C-58
Reviewing facility requirements . . . . . C-58
Facility power requirements . . . . . C-59
Floor space requirements . . . . . C-59
Circuit breaker capacity and characteristics . . . . . C-59
Grounding requirements . . . . . C-59
Safety considerations . . . . . C-60
PDU information for Hitachi racks . . . . . C-61
PDU specifications . . . . . C-61
PDU-121112F10 . . . . . C-61
PDU-221112F10 . . . . . C-63
PDU-121132F10 . . . . . C-65

PDU-1251120F10 . . . . . C-66
PDU-1561380F10 . . . . . C-68
PDU-1561384F10 . . . . . C-69
PDU-3079354F10 . . . . . C-71
A3CR-6363C4-50 . . . . . C-72
A3CK-123123R4-50 . . . . . C-73
A3B9-123R4-50 . . . . . C-74
A3CR-123294-51 . . . . . C-75
A3CK-123394-51 . . . . . C-76
A3CK-123394-52 . . . . . C-77
A5P0-123394-52 . . . . . C-78

**D Hitachi Modular and Solutions Racks . . . . . D-1**

Hitachi Modular Racks . . . . . D-2
Installation and maintenance clearance areas . . . . . D-5
Power . . . . . D-5
Specifications . . . . . D-6
Hitachi Solutions Racks . . . . . D-7
Installation and maintenance clearance areas . . . . . D-10
Power . . . . . D-11
Floor load rating . . . . . D-11
Specifications . . . . . D-12

**E Specifications . . . . . E-1**

Model lists . . . . . E-2
Hitachi Unified Storage 110 model list . . . . . E-2
Hitachi Unified Storage 130 model list . . . . . E-9
Hitachi Unified Storage 150 model list . . . . . E-16
Replacement parts . . . . . E-25
Mechanical specifications . . . . . E-27
Hitachi Unified Storage 110 mechanical specifications . . . . . E-27
Hitachi Unified Storage 130 mechanical specifications . . . . . E-30
Hitachi Unified Storage 150 mechanical specifications . . . . . E-34
Electrical specifications . . . . . E-41
Environmental specifications . . . . . E-45
RAID specifications . . . . . E-47
iSCSI specifications . . . . . E-48
iSCSI standards . . . . . E-52
Regulatory compliance . . . . . E-53
DBX connection restrictions . . . . . E-55
DBW connection restrictions . . . . . E-55
Storage capacities and corresponding RAID levels . . . . . E-57

F Data and power cables. . . . . F-1
Fibre Channel cables . . . . . F-2
iSCSI cables . . . . . F-4
1 Gb iSCSI cable . . . . . F-4
10 Gb iSCSI cable . . . . . F-5
AC power cables . . . . . F-6
DC power cable . . . . . F-8

G Port address mapping . . . . . G-1

H Using the BECK tool . . . . . H-1
System requirements . . . . . H-2
Supported Drive Boxes . . . . . H-3
Installing the BECK tool . . . . . H-5
BECK tool at a glance . . . . . H-5
Starting the BECK tool . . . . . H-8
BECK tool configuration screen . . . . . H-9
Understanding the BECK tool configuration screen . . . . . H-12
Creating new configurations . . . . . H-15
Creating a configuration automatically. . . . . H-15
Creating a configuration manually. . . . . H-19
Editing the logical configuration figure . . . . . H-25
Assigning units to a path . . . . . H-26
Setting a unit in an empty box in a path . . . . . H-26
Changing or deleting a Drive Box in a path . . . . . H-29
Editing box codes for a Controller Box. . . . . H-31
Moving and exchanging Drive Boxes . . . . . H-33
Editing the physical configuration figure. . . . . H-38
Setting the rack size . . . . . H-39
Setting units to a rack or an empty rack box . . . . . H-42
Setting a Drive Box in an empty rack box . . . . . H-42
Changing or deleting a Drive Box . . . . . H-45
Setting a Controller Box or editing its box code . . . . . H-46
Moving and exchanging units . . . . . H-49
Configuration with 360HDD OFF/ON . . . . . H-51
Creating a configuration with 360HDD OFF selected . . . . . H-51
Creating a configuration with 360HDD ON selected . . . . . H-53
Working with cable figures . . . . . H-57
Sizes . . . . . H-57
Buttons and fields . . . . . H-58
Working with cable figures. . . . . H-60
Working with cable figures in rack boxes. . . . . H-72
Hitachi Unified Storage 110 with single or dual controller. . . . . H-74

Displaying a cable figure of a single controller . . . . . H-74
Displaying a cable figure of a dual controller . . . . . H-77
Expanding a configuration . . . . . H-80
Simple trace default file name . . . . . H-81
Saving and loading a configuration file. . . . . H-88
Saving a configuration file . . . . . H-88
Loading a configuration file . . . . . H-89
BECK tool messages . . . . . H-92
Special guidelines . . . . . H-95
DBX and DBW Drive Box configuration rules . . . . . H-95
Example 1 . . . . . H-95
Example 2 . . . . . H-103
Yellow box in the configuration screen . . . . . H-104
Loading a simple trace when Unit A of a DBX is connected last . . . . . H-106

**I NEBS certification . . . . . I-1**

About NEBS . . . . . I-2
Hitachi Unified Storage NEBS hardware . . . . . I-2
Rack assembly and installation . . . . . I-6
Anchoring the rack . . . . . I-7
Grounding the rack . . . . . I-7
Grounding (battery return) . . . . . I-7
Mounting components in the rack . . . . . I-8
Fasteners. . . . . I-8
Paint-piercing lock washers . . . . . I-8
Wiring and cabling . . . . . I-8
Grounding rack components . . . . . I-9
Other grounding connectors . . . . . I-11
Aligning the front bezels . . . . . I-11
Dust and particles. . . . . I-12
Dual-feed fuse alarm panel. . . . . I-15
Specifications . . . . . I-16
NEBS-3 test results and certification . . . . . I-18
ETSI and telecom test results and certification . . . . . I-21

**Glossary**

**Index**

# Preface

Welcome to the Hitachi Unified Storage Hardware Installation and Configuration Guide.

This document describes how to set up, use, and maintain Hitachi Unified Storage systems. This document includes a full table of contents, index, chapter task lists, and numerous cross-references to help you find specific information.

Read this document carefully to understand how to use this product, and maintain a copy for reference purposes.

This preface includes the following information:


- Intended audience
- Product version
- Changes in this revision
- Document organization
- Related documents
- Document conventions
- Convention for storage capacity values
- Accessing product documentation
- Getting help
- Comments

## Intended audience

This document is intended for system administrators, Hitachi representatives, and authorized service providers who install, configure, and operate Hitachi Unified Storage systems.

This document assumes the user has a background in data processing and understands storage systems and their basic functions, Microsoft Windows and its basic functions, and Web browsers and their basic functions.

## Product version

This document applies to Hitachi Unified Storage firmware version 0982/D or later.

## Changes in this revision

- Under Attaching the front panel bezel (page 4-26), added statement about pressing on the plate of the front bezel.
- Added a note under Releasing volume assignments (Fibre Channel) (page 5-76) and Releasing volume assignments (iSCSI) (page 5-86).

## Document organization

Thumbnail descriptions of the chapters are provided in the following table. Click the chapter title in the first column to go to that chapter. The first page of every chapter or appendix contains links to the contents.

| Chapter/Appendix Title | Description |
|---|---|
| Chapter 1, Introduction | Introduces the Hitachi Unified Storage system models and their features. |
| Chapter 2, Hardware description | Describes the connectors, LEDs, and switches on the Hitachi Unified Storage system hardware. |
| Chapter 3, Preparing your site | Describes the steps to take to prepare for a Hitachi Unified Storage system installation. |
| Chapter 4, Installing the storage system | Provides detailed instructions for installing Hitachi Unified Storage systems. |
| Chapter 5, Configuring the storage system | Describes how to configure Hitachi Unified Storage systems. |
| Chapter 6, Fibre Channel host configuration | Describes how to configure and manage Hitachi Unified Storage systems for use with supported host servers and operating systems in Fibre Channel environments. |
| Chapter 7, iSCSI host configuration | Describes how to configure and manage Hitachi Unified Storage systems for use with supported host servers and operating systems in iSCSI environments. |
| Chapter 8, Connecting to Hitachi Virtual Storage Platform | Provides guidelines when connecting Hitachi Unified Storage systems to Hitachi Virtual Storage. |

| Chapter / Appendix Title | Description |
|---|---|
| Chapter 9, Connecting to Hitachi Universal Storage Platform V/ Hitachi Universal Storage Platform VM | Provides guidelines when connecting Hitachi Unified Storage systems to Hitachi Universal Storage Platform V/ Hitachi Universal Storage Platform VM. |
| Chapter 10, Troubleshooting | Provides troubleshooting suggestions for identifying and resolving problems. |
| Chapter 11, Adding optional components | Describes how to add optional components to Hitachi Unified Storage systems. |
| Appendix A, Registration, resources, and checklists | Provides information for registering your Hitachi Unified Storage systems and additional resources you can use to enhance your experience. A table is also provided for recording configuration settings for future reference. |
| Appendix B, Upgrading firmware | Describes how to upgrade the firmware for Hitachi Unified Storage systems. |
| Appendix C, Rack mounting the storage system | Provides information about the Hitachi racks used with Hitachi Unified Storage systems. |
| Appendix D, Hitachi Modular and Solutions Racks | Contains information about end-of-life racks. |
| Appendix E, Specifications | Lists specifications for Hitachi Unified Storage systems. |
| Appendix F, Data and power cables | Provides reference information about the data and power cables for Hitachi Unified Storage systems. |
| Appendix G, Port address mapping | Provides port addressing information for Hitachi Unified Storage systems. |
| Appendix H, Using the BECK tool | Describes how to use the Backend Configuration Kit to obtain logical and physical views of Hitachi Unified Storage systems for backend configuration and connectivity. |
| Appendix I, NEBS certification | Covers Network Equipment Building System (NEBS) information. |

# Related documents

This Hitachi Unified Storage documentation set consists of the following documents.

*Hitachi Unified Storage Firmware Release Notes*, RN-91DF8304

Contains late-breaking information about the storage system firmware.

*Hitachi Storage Navigator Modular 2 Release Notes*, RN-91DF8305

Contains late-breaking information about the Storage Navigator Modular 2 software.

Read the release notes before installing and using this product. They may contain requirements and restrictions not fully described in this document, along with updates and corrections to this document.

*Hitachi Unified Storage Getting Started Guide*, MK-91DF8303

Describes how to get Hitachi Unified Storage systems up and running in the shortest period of time. For detailed installation and configuration information, refer to the Hitachi Unified Storage Hardware Installation and Configuration Guide.

*Hitachi Unified Storage Hardware Installation and Configuration Guide*, MK-91DF8273 — **this document**

Contains initial site planning and pre-installation information, along with step-by-step procedures for installing and configuring Hitachi Unified Storage systems.

*Hitachi Unified Storage Hardware Service Guide*, MK-91DF8302

Provides removal and replacement procedures for the components in Hitachi Unified Storage systems.

*Hitachi Unified Storage Operations Guide*, MK-91DF8275

Describes the following topics:

- Adopting virtualization with Hitachi Unified Storage systems
- Enforcing security with Account Authentication and Audit Logging
- Creating DP-Vols, standard volumes, Host Groups, provisioning storage, and utilizing spares
- Tuning storage systems by monitoring performance and using cache partitioning
- Monitoring storage systems using email notifications and Hi-Track
- Using SNMP Agent and advanced functions such as data retention and power savings
- Using functions such as data migration, volume expansion and volume shrink, RAID Group expansion, DP pool expansion, and mega VOLs

*Hitachi Unified Storage Replication User Guide*, MK-91DF8274

Describes how to use the four types of Hitachi replication software to meet your needs for data recovery:

- ShadowImage In-system Replication
- Copy-on-Write SnapShot
- TrueCopy Remote Replication
- TrueCopy Extended Distance

*Hitachi Unified Storage Command Control Interface Installation and Configuration Guide*, MK-91DF8306

Describes Command Control Interface installation, operation, and troubleshooting.

*Hitachi Unified Storage Provisioning Configuration Guide*, MK-91DF8277

Describes how to use virtual storage capabilities to simplify storage additions and administration.

*Hitachi Unified Storage Command Line Interface Reference Guide*, MK-91DF8276

Describes how to perform management and replication activities from a command line.

## Document conventions

The following typographic conventions are used in this document.

| Convention | Description |
|---|---|
| **Bold** | Indicates text on a window, other than the window title, including menus, menu options, buttons, fields, and labels. Example: Click **OK**. |
| *Italic* | Indicates a variable, which is a placeholder for actual text provided by you or the system. Example: copy *source-file target-file*<br>Angled brackets (< >) are also used to indicate variables. |
| screen or code | Indicates text that is displayed on screen or entered by you. Example:<br>`# pairdisplay -g oradb` |
| < > angled brackets | Indicates a variable, which is a placeholder for actual text provided by you or the system. Example: `# pairdisplay -g <group>`<br><br>Italic font is also used to indicate variables. |
| [ ] square brackets | Indicates optional values.<br>Example: [ a \| b ] indicates that you can choose a, b, or nothing. |
| { } braces | Indicates required or expected values. Example: { a \| b } indicates that you must choose either a or b. |
| \| vertical bar | Indicates that you have a choice between two or more options or arguments. Examples:<br>[ a \| b ] indicates that you can choose a, b, or nothing.<br>{ a \| b } indicates that you must choose either a or b. |
| underline | Indicates the default value. Example: [ a \| b ] |

This document uses the following symbols to draw attention to important safety and operational information.

| Symbol | Meaning | Description |
|---|---|---|
| | Tip | Tips provide helpful information, guidelines, or suggestions for performing tasks more effectively. |
| | Note | Notes emphasize or supplement important points of the main text. |
| | Caution | Cautions indicate that failure to take a specified action could result in damage to the software or hardware. |
| | WARNING | Warns that failure to take or avoid a specified action could result in severe conditions or consequences (for example, loss of data). |

## Convention for storage capacity values

Physical storage capacity values (for example, disk drive capacity) are calculated based on the following values:

| Physical capacity unit | Value |
|---|---|
| 1 KB | 1,000 bytes |
| 1 MB | 1,000 KB or $1{,}000^2$ bytes |
| 1 GB | 1,000 MB or $1{,}000^3$ bytes |
| 1 TB | 1,000 GB or $1{,}000^4$ bytes |
| 1 PB | 1,000 TB or $1{,}000^5$ bytes |
| 1 EB | 1,000 PB or $1{,}000^6$ bytes |

Logical storage capacity values (for example, logical device capacity) are calculated based on the following values:

| Logical capacity unit | Value |
|---|---|
| 1 block | 512 bytes |
| 1 KB | 1,024 ($2^{10}$) bytes |
| 1 MB | 1,024 KB or $1024^2$ bytes |
| 1 GB | 1,024 MB or $1024^3$ bytes |
| 1 TB | 1,024 GB or $1024^4$ bytes |
| 1 PB | 1,024 TB or $1024^5$ bytes |
| 1 EB | 1,024 PB or $1024^6$ bytes |

## Accessing product documentation

The Hitachi Unified Storage user documentation is available on the HDS Support Portal: https://portal.hds.com. Please check this site for the most current documentation, including important updates that may have been made after the release of the product.

## Getting help

The Hitachi Data Systems customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to the HDS Support Portal for contact information: https://portal.hds.com

## Comments

Please send us your comments on this document: doc.comments@hds.com. Include the document title and number, including the revision level (for example, -07), and refer to specific sections and paragraphs whenever possible. All comments become the property of Hitachi Data Systems.

**Thank you!**

# 1

# Introduction

Hitachi Unified Storage systems are modular, rack-mountable storage arrays. The systems come in three models:

- Hitachi Unified Storage 110 and 130 consist of a Controller Box that contains disk drives for storing data and provides the interface between a data host and the disk drives. Drive Boxes can be added to provide additional storage.
- Hitachi Unified Storage 150 consists of a Controller Box that provides the interface to a data host. Drive Boxes must be added to provide disk drives for storage.

All models have two Controller Boxes (single-controller configurations are available). Each Controller Box has a controller for managing the input/output (I/O) between the volumes and the data host. The controllers have an Ethernet connection for out-of-band management using Hitachi Storage Navigator Modular 2. Because the system contains two controllers, the data path through one controller can fail and the other controller provides a redundant data path to all disk drives. All models allow a defective controller to be replaced.

All models also allow defective drives to be replaced without interruption of data availability to host computers. A hot spare drive can be configured to replace a failed drive automatically, securing the fault-tolerant integrity of the logical drive. Self-contained hardware-based RAID logical drives provide maximum performance in compact external enclosures.

This chapter provides an overview of the Hitachi Unified Storage systems. The following topics are covered in this chapter:


- Hitachi Unified Storage 110
- Hitachi Unified Storage 130
- Hitachi Unified Storage 150
- Features

# Hitachi Unified Storage 110

The Hitachi Unified Storage 110 dual storage controller system consists of:

- A 2U Controller Box that supports either 24 Small Form Factor (SFF) disk drives or 12 Large Form Factor (LFF) disk drives (see Table 1-1)

  AND

- Associated number of Drive Boxes (see Table 1-2)

The dual storage controller supports 120 disk drives using (4) 2.5-inch SFF disk drive trays or (9) 3.5-inch LFF disk drive trays. The disk drives mount in bays in the front of the enclosure. The bays are numbered sequentially from top to bottom or from left to right.

The dual storage controller supports a total of 8 GB of high-speed memory cache (4 GB per controller). Onboard Fibre Channel ports and optional host I/O boards provide the interface between the storage system and the host.

Connectivity options for controller:

| | |
|---|---|
| Standard: | (4) 8 Gb Fibre Channel ports |
| Optional (select one): | (2) 1 Gb iSCSI ports<br>(2) 10 Gb iSCSI ports |

For more information, see Features on page 1-7.

**NOTE:** iSCSI users who want to use the Fibre Channel option require a license. See Fibre Channel Option on the Hitachi Unified Storage 110 on page 6-6.

**Table 1-1: Hitachi Unified Storage 110 Controller Boxes**

| Controller Box | Controller Box model name | Supported drive types | Number of drives supported | Height |
|---|---|---|---|---|
| CBXSS | DF850-CBSSR | 2.5 inch SFF | 24 | 2U (88.4 mm) |
| CBXSL | DF850-CBSLR | 3.5 inch LFF | 12 | 2U (88.4 mm) |

**Table 1-2: Hitachi Unified Storage 110 Drive Boxes**

| Drive Box | Drive Box model name | Supported drive types | Number of drives supported | Height |
|---|---|---|---|---|
| DBS | • DF-F850-DBS AC/DC power supply (contains BNST)<br>• DF-F850-DBSC | 2.5 inch | 24 | 2U (88.4 mm) |
| DBL | DF-F850-DBL<br>• AC/DC power supply (contains BNST)<br>• -DF-F850-DBLC | 3.5 inch LFF | 12 | 2U (88.4 mm) |

# Hitachi Unified Storage 130

The Hitachi Unified Storage 130 dual storage controller system consists of:

- A 2U Controller Box that supports either 24 Small Form Factor (SFF) disk drives or 12 Large Form Factor (LFF) disk drives (see Table 1-3)

  AND

- Associated number of Drive Boxes (see Table 1-4)

The dual storage controller supports 264 disk drives using (10) 2.5-inch SFF disk drive trays or 240 disk drives in (19) 3.5-inch LFF disk drive trays. The disk drives mount in bays in the front of the enclosure. The bays are numbered sequentially from top to bottom or from left to right.

The dual storage controller supports a total of either 16 GB or 32 GB of high-speed memory cache (8 GB or 16 GB per controller). Onboard Fibre Channel ports and optional host I/O boards provide the interface between the storage system and the host.

Connectivity options for controller:

| | |
|---|---|
| Standard: | (4) 8 Gb Fibre Channel ports |
| Optional (select one): | (4) 8 Gb Fibre Channel ports<br>(2) 1 Gb iSCSI ports<br>(2) 10 Gb iSCSI ports |

For more information, see Features on page 1-7.

**Table 1-3: Hitachi Unified Storage 130 Controller Boxes**

| Controller Box | Controller Box model name | Supported drive types | Number of drives supported | Height |
|---|---|---|---|---|
| CBSS | DF850-CBSSR | 2.5 inch SFF | 24 | 2U (88.4 mm) |
| CBSL | DF850-CBSLR | 3.5 inch LFF | 12 | 2U (88.4 mm) |

**Table 1-4: Hitachi Unified Storage 130 Drive Boxes**

| Drive Box | Drive Box model name | Number of drives supported | Supported drive types | Height |
|---|---|---|---|---|
| DBS | • DF-F850-DBS AC/DC power supply (contains BNST)<br>• DF-F850-DBSC | 24 | 2.5 inch SFF | 2U (87.7 mm) |
| DBL | • DF-F850-DBL AC/DC power supply (contains BNST)<br>• DF-F850-DBLC | 12 | 3.5 inch LFF | 2U (87.7 mm) |
| DBX | DF-F850-DBX | 48 | 3.5 inch LFF | 4U (176 mm) |
| DBW | DF-F850-DBW | 84 | 3.5 inch LFF | 5U (220 mm) |

# Hitachi Unified Storage 150

The Hitachi Unified Storage 150 dual storage controller system comes in AC and DC versions. Both versions consist of a 3U Controller Box and associated number of Drive Boxes. The Controller Box contains a controller, but no drives. Drives are supported using Drive Boxes connected to the Controller Box.

**NOTE:** AC-DC intermixing is not allowed. For example, a DC-powered CBLD Controller Box cannot connect to an AC-powered DBL Drive Box.

## AC Power Supply Models

The AC model of the Hitachi Unified Storage 150 storage system is available in a Model CBLE, which supports encryption, and Model CBL, which does not support encryption.

The CBLE/CBL supports 960 disk drives using 2.5-inch SFF disk drives or up to 936 disk drives using 3.5-inch LFF disk drives (see Table 1-12 on page 1-9). The disk drives mount in bays in the front of the Drive Box enclosure. The bays are numbered sequentially from top to bottom or from left to right.

The dual storage controller supports a total of 32 GB of high-speed memory cache (16 GB per controller). Host I/O modules provide the interface between the storage system and the host.

Connectivity options for controller:

| | |
|---|---|
| Optional (select one): | (8) 8 Gb Fibre Channel ports<br>(4) 10 Gb iSCSI ports |

For more information, see Features on page 1-7.

**Table 1-5: Hitachi Unified Storage 150 (AC Model)**

| Controller Box | Controller Box model name | Number of drives supported | Height |
|---|---|---|---|
| CBL | DF850-CBLR | N/A | 3U (129 mm) |
| CBLE | DF850-CBLR1 | N/A | 3U (129 mm) |

**Table 1-6: Hitachi Unified Storage 150 Drive Boxes (AC Model)**

| Drive Box | Drive Box model name | Supported drive types | Number of drives supported | Height |
|---|---|---|---|---|
| DBS | DF-F850-DBS<br>• AC/DC power supply (contains BNST)<br>• DF-F850-DBSC | 2.5 inch SFF | 24 | 2U (87.7 mm) |

**Table 1-6: Hitachi Unified Storage 150 Drive Boxes (AC Model)**

| Drive Box | Drive Box model name | Supported drive types | Number of drives supported | Height |
|---|---|---|---|---|
| DBL | • DF-F850-DBL AC/ DC power supply (contains BNST)<br>• DF-F850-DBLC | 3.5 inch LFF | 12 | 2U (87.7 mm) |
| DBF | DF-F850-DBF | 3.5 inch LFF | 12 | 2U (88.4 mm) |
| DBX | DF-F850-DBX | 3.5 inch LFF | 48 | 4U (176 mm) |
| DBW | DF-F850-DBW | 3.5 inch LFF | 84 | 5U (220 mm) |

**NOTE:** The CBL/CBLE does not contain disk drives and requires at least one of the supported drive types in Table 1-6.

## DC Power Supply Models

The DC model of the Hitachi Unified Storage 150 storage system supports 960 disk drives using 2.5-inch SFF disk drive trays or up to 936 disk drives using 3.5-inch LFF disk drive trays (see Table 1-12 on page 1-9).

The dual storage controller supports a total of 32 GB of high-speed memory cache (16 GB per controller). Host I/O modules provide the interface between the storage system and the host.

Connectivity options for controller:

| | |
|---|---|
| Optional (select one): | (8) 8 Gb Fibre Channel ports<br>(4) 10 Gb iSCSI ports |

For more information about features, see Table 1-9 on page 1-7.

**Table 1-7: Hitachi Unified Storage 150 (DC Model)**

| Controller Box | Controller Box model name | Number of drives supported | Height |
|---|---|---|---|
| CBLD | DF850-CBLD | N/A | 3U (129 mm) |

**Table 1-8: Hitachi Unified Storage 150 Drive Boxes (DC Model)**

| Drive Box | Drive Box model name | Supported drive types | Number of drives supported | Height |
|---|---|---|---|---|
| DBSD | • DF-F850-DBSD AC/DC power supply (contains BNST)<br>• DF-F850-DBSDC | 2.5 inch SFF | 24 | 2U (88.4 mm) |
| DBLD | • DF-F850-DBLD AC/DC power supply (contains BNST)<br>• DF-F850-DBLDC | 3.5 inch LFF | 12 | 2U (88.4 mm) |

**NOTE:** The CBLD does not contain disk drives and requires at least one of the supported drive types in Table 1-8.

# Features

The following list summarizes the key features of Hitachi Unified Storage systems.

- Fully redundant active-active dual controller configuration
- Dynamic load balancing distributes workload across controllers to achieve optimal resource utilization, maximize throughput, minimize response time, and avoid overload
- Hot-swappable drives in a robust 2U or 3U rack-mount chassis with redundant, hot-swappable power and fan modules
- Standard 8 Gbps Fibre Channel, with fallback to 4 and 2 Gbps, and/or 10 Gbps and 1 Gb iSCSI
- Virtualization capabilities for managing storage as a single pool
- Support RAID 0, RAID 1+0, RAID 1, RAID 5, RAID6 or an intermix of RAID configurations for choosing the RAID level best suited to your application needs (see RAID implementations on page 1-13)
- Dynamic sparing maintains full fault-tolerant integrity by automatically rebuilding data from a failed drive to an installed hot spare drive
- Cache support for up to 8 G bytes (Hitachi Unified Storage 110), 32 G bytes (Hitachi Unified Storage 130), and 32 G bytes (Hitachi Unified Storage 150)
- Battery backup for controller cache maintains cache data integrity
- Email notifications sent to recipients in the event of a failure
- 8-byte tuple added to received host data ensures data integrity and avoids data corruption
- Power-savings features spin down drives during periods of inactivity to reduce energy consumption and achieve “green” objectives

## Comparing key features

**Table 1-9: At-a-glance features table**

| Feature | Hitachi Unified Storage models | | |
|---|---|---|---|
| | 110 | 130 | 150 |
| Maximum Cache Supported | 8 G bytes | 32 G bytes | 32 G bytes |
| Maximum Number of Spare Drives | 15 | 30 | 80 |
| Maximum Number of RAID Groups | 50 | 75 | 200 |
| Maximum Volume Size | 128 TB | 128 TB | 128 TB |
| Maximum Volumes/Host Groups | 2048 | 2048 | 2048 |
| Maximum Volumes/RAID Groups | 1024 | 1024 | 1024 |
| Maximum Number of DP Pool Volumes | 2047 | 4095 | 4095 |
| Maximum Number of DP Pools | 50 | 64 | 64 |
| Maximum Number of Fibre Channel Devices via Fibre Channel Switch | 128 | 128 | 128 |
| Maximum Number of iSCSI Hosts via Network Switch | 255 | 255 | 255 |

## Scalability

All Hitachi Unified Storage systems offer pay-as-you-grow scalability by allowing you to hot-add drives as you need them.

For example, you can start with a basic Hitachi Unified Storage 150 storage system that connects a DBS/DBL/DBX/DBW Drive Box to a CBL/CBLE Controller Box and evolve it into a system containing up to 960 drives by adding DBS/DBL/DBX/DBW Drive Boxes.

Table 1-10 lists a few sample configurations.

**Table 1-10: Examples of supported configurations**

| Controller Box | Drive Box | Maximum number of drives supported |
|---|---|---|
| One CBL/CBLE (CBL/CBLE does not contain drives) | DBL | 24 |
| One CBL/CBLE | DBX | 48 |
| One CBL/CBLE | DBW | 84 |
| One CBXSS that contains 24 2.5-inch drives or one CBXSL that contains up to 12 3.5-inch drives | DBS/DBL | 120 |
| One CBSS that contains 24 2.5-inch drives or one CBSL that contains up to 12 3.5-inch drives | DBS/DBL/DBX | 240 |
| One CBSS that contains 24 2.5-inch drives | Five DBXs | 252 |
| One CBSL that contains up to 12 3.5-inch drives | Five DBXs | 264 |

Table 1-11 on page 1-9 and Table 1-12 on page 1-9 list the combination of maximum number of drive boxes and drives supported.

**NOTE:** One or more DBS/DBL/DBX/DBW Drive Boxes must connect to the CBL/CBLE Controller Box for system control. Configurations cannot exceed 240 drive slots per path. For more information, consult your HDS representative.

### Table 1-11: Maximum number of Drive Boxes and drives (Hitachi Unified Storage 110)

| Controller Box | Maximum number of drives controller can recognize | Number of mounted Drive Boxes | | |
|---|---|---|---|---|
| | | DBS | DBL | DBX |
| CBXSS | 120 | 0 | 8 | — |
| | | 4 | 0 | — |
| CBXSL | 120 | 0 | 9 | — |
| | | 4 | 0 | — |

### Table 1-12: Mounted numbers of Drive Boxes and maximum mountable number of drives (DBS, DBL, and DBX)

| Controller Box (one unit) | Number of mounted Drive Boxes (see Note 1) | | Maximum mountable number of drives (see Note 2) |
|---|---|---|---|
| | DBS/DBL | DBX | |
| CBSS | 0/0 | 7 | 360 |
| | 2/4 | 6 | 360 (DBS)/360 (DBL) |
| | 4/8 | 5 | 360 (DBS)/360 (DBL) |
| | 6/11 | 4 | 360 (DBS)/348 (DBL) |
| | 8/13 | 3 | 360 (DBS)/324 (DBL) |
| | 10/15 | 2 | 360 (DBS)/300 (DBL) |
| | 12/17 | 1 | 360 (DBS)/276 (DBL) |
| | 14/19 | 0 | 360 (DBS)/252 (DBL) |
| CBSL | 0/0 | 7 | 348 |
| | 0/1 | 7 | 348 (DBS)/360 (DBL) |
| | 2/5 | 6 | 348 (DBS)/360 (DBL) |
| | 4/9 | 5 | 348 (DBS)/360 (DBL) |
| | 6/11 | 4 | 348 (DBS)/336 (DBL) |
| | 8/13 | 3 | 348 (DBS)/312 (DBL) |
| | 10/15 | 2 | 348 (DBS)/288 (DBL) |
| | 12/17 | 1 | 348 (DBS)/264 (DBL) |
| | 14/19 | 0 | 348 (DBS)/240 (DBL) |

**Table 1-12: Mounted numbers of Drive Boxes and maximum mountable number of drives (DBS, DBL, and DBX) (Continued)**

| Controller Box (one unit) | Number of mounted Drive Boxes (see Note 1) | | Maximum mountable number of drives (see Note 2) |
|---|---|---|---|
| | DBS/DBL | DBX | |
| CBL/CBLE | 0/0 | 20 | 960 |
| | 2/2 | 19 | 960 (DBS)/936 (DBL) |
| | 4/4 | 18 | 960 (DBS)/912 (DBL) |
| | 6/6 | 17 | 960 (DBS)/888 (DBL) |
| | 8/8 | 16 | 960 (DBS)/864 (DBL) |
| | 10/10 | 15 | 960 (DBS)/840 (DBL) |
| | 12/12 | 14 | 960 (DBS)/816 (DBL) |
| | 14/14 | 13 | 960 (DBS)/792 (DBL) |
| | 16/16 | 12 | 960 (DBS)/768 (DBL) |
| | 18/18 | 11 | 960 (DBS)/744 (DBL) |
| | 20/20 | 10 | 960 (DBS)/720 (DBL) |
| | 22/22 | 9 | 960 (DBS)/696 (DBL) |
| | 24/24 | 8 | 960 (DBS)/672 (DBL) |
| | 26/26 | 7 | 960 (DBS)/648 (DBL) |
| | 28/28 | 6 | 960 (DBS)/624 (DBL) |
| | 30/30 | 5 | 960 (DBS)/600 (DBL) |
| | 32/32 | 4 | 960 (DBS)/576 (DBL) |
| | 34/34 | 3 | 960 (DBS)/552 (DBL) |
| | 36/36 | 2 | 960 (DBS)/528 (DBL) |
| | 38/38 | 1 | 960 (DBS)/504 (DBL) |
| | 40/40 | 0 | 960 (DBS)/480 (DBL) |

**NOTE 1:** The maximum number of boxes that can be installed per PATH is 10. The A and B sides of the DBX are counted as one box, respectively. For PATH #0, #1, #2, and #3 of the CBL/CBLE, and PATH #0 and #1 of the CBSL/CBSS, configure an equal number of drives for the A and B sides of the DBX.

**NOTE 2:** The CBSL/CBSS/CBL/CBLE supports up to 240 drives per PATH.

- Up to 15 spare drives (CBXSS/CBXSL), 30 spare drives (CBSS/CBSL), or 80 spare drives (CBL/CBLE) can be set up in any location. For greater efficiency, mount a spare drive in unused drive slots.
- From the host, the storage system can be used as a single-large scale drive, and as a maximum of 2,048 volumes (CBXSS/CBXSL) or 4,096 volumes (CBSS/CBSL/CBL/CBLE).

**Table 1-13: Mounted numbers of Drive Boxes and maximum mountable number of drives (DBS/DBL and DBW)**

| Controller Box (one unit) | Number of mounted Drive Boxes (see Note 1) | | Maximum mountable number of drives (see Note 2) |
|---|---|---|---|
| | DBS/DBL | DBW | |
| CBSS | 0/0 | 4 | 360 (DBS)/360 (DBL) |
| | 3/7 | 3 | 348 (DBS)/360 (DBL) |
| | 7/11 | 2 | 360 (DBS)/324 (DBL) |
| | 10/15 | 1 | 348 (DBS)/288 (DBL) |
| CBSL | 0/1 | 4 | 348 (DBS)/360 (DBL) |
| | 4/7 | 3 | 360 (DBS)/348 (DBL) |
| | 7/11 | 2 | 348 (DBS)/312 (DBL) |
| | 11/15 | 1 | 360 (DBS)/276 (DBL) |
| CBL/CBLE | 0/0 | 12 | 960 (DBS)/936 (DBL) |
| | 1/1 | 11 | 948 (DBS)/936 (DBL) |
| | 2/2 | 10 | 888 (DBS)/864 (DBL) |
| | 3/3 | 9 | 948 (DBS)/768 (DBL) |
| | 12/24 | 8 | 960 (DBS)/960 (DBL) |
| | 15/31 | 7 | 948 (DBS)/960 (DBL) |
| | 19/34 | 6 | 960 (DBS)/812 (DBL) |
| | 22/35 | 5 | 948 (DBS)/840 (DBL) |
| | 26/36 | 4 | 948 (DBS)/768 (DBL) |
| | 29/37 | 3 | 948 (DBS)/696 (DBL) |
| | 33/38 | 2 | 960 (DBS)/624 (DBL) |
| | 36/39 | 1 | 948 (DBS)/552 (DBL) |

**NOTE 1:** The maximum number of boxes that can be installed per PATH is 10. One box of DBWs connected to a CBSS/CBSL counts as four boxes.

**NOTE 2:** The CBSL/CBSS/CBL/CBLE supports up to 240 drives per PATH. If connecting three DBW boxes per PATH for a CBL/CBLE, up to 252 drives can be used per PATH.

**Table 1-14: Mounted numbers of Drive Boxes and maximum mountable number of drives (DBX and DBW)**

| Controller Box (one unit) | Number of mounted Drive Boxes (see Note 1) | | Maximum mountable number of drives (see Note 2) |
|---|---|---|---|
| | DBX | DBW | |
| CBSS | 0 | 4 | 360 |
| | 1 | 3 | 324 |
| | 3 | 2 | 336 |
| | 5 | 1 | 348 |
| CBSL | 0 | 4 | 348 |
| | 2 | 3 | 312 |
| | 7 | 2 | 252 |
| | 5 | 1 | 216 |
| CBL/CBLE | 0 | 12 | 960 |
| | 0 | 11 | 924 |
| | 1 | 10 | 888 |
| | 1 | 9 | 804 |
| | 6 | 8 | 960 |
| | 7 | 7 | 924 |
| | 9 | 6 | 936 |
| | 11 | 5 | 948 |
| | 13 | 4 | 960 |
| | 14 | 3 | 924 |
| | 16 | 2 | 936 |
| | 18 | 1 | 948 |

**NOTE 1:** The maximum number of boxes that can be installed per PATH is 10. The A and B sides of the DBX are counted as one box respectively. For the PATH #0, #1, #2, and #3 of the CBL/CBLE, and the PATH #0 and #1 of the CBSS/CBSL, set the configuration where an equal number of drives is connected in both the A side and the B side of the DBX. One box of the DBW connected to the CBSS/CBSL counts as four boxes.

**NOTE 2:** The CBSL/CBSS/CBL/CBLE supports up to 240 drives per PATH. If connecting three DBW boxes per PATH for a CBL/CBLE, up to 252 drives can be used per PATH.

## RAID implementations

All Hitachi Unified Storage systems support RAID 0, RAID 1+0, RAID 1, RAID 5, RAID6 or an intermix of RAID configurations.

- RAID 6 has two parity drives performing the data striping for superior redundancy that can sustain two points of failure.
- RAID 5 writes complete data blocks to each drive and distributes the parity information to all the drives in the striped storage system.
- RAID 1 consists of at least two drives in a mirrored configuration. Data is fully mirrored to a second drive, providing data availability and fault tolerance.
- RAID 1+0 provides data redundancy similar to RAID 1 by copying all contents of two drives to another pair. Unlike RAID 1, data striping is performed for a maximum of 16 sets of two drives.
- RAID 0 distributes data across all drives in the group to attain higher throughput. This is called “striping” because the data is written in striped that cross the drive spindles. RAID 0 provides no fault tolerance because it does not store parity information.

For RAID specifications, see RAID specifications on page E-47.

If you use a RAID 0 configuration, observe the following guidelines.

- If a drive failure occurs in a RAID 0 configuration, data cannot be restored internally within the storage system because RAID 0 has no data redundancy.
- Unlike with an independent drive, error block management (assignment of alternative block for the independent drive with the Reassign Blocks command) is not performed in a RAID 0 configuration. Therefore, if a RAID 0 drive becomes inaccessible due to a failure, all volumes in the RAID 0 configuration, including the failed drive, become inaccessible. Restoration of user data with backup data is essential after replacing the failed drive.
- Do not allow RAID 0 to coexist with another RAID group. Do not form a group with two or more RAID 0 configurations, such as (4D + 1P) × 2 + 2D.
- Every time a failure occurs in a RAID 0 drive, data that cannot be written to the drive is accumulated in cache. If the amount of accumulated data exceeds a certain value, a write I/O instruction to the other RAID groups will not be accepted and the system will go down. In this case, restoration of user data and resynchronization of a file system using the backup data are required for the entire storage system. The recovery time for this procedure can be significant.

# 2

# Hardware description

This chapter provides a tour of the Hitachi Unified Storage hardware.

The following topics are covered in this chapter:

- Matching Controller Boxes and Drive Boxes
- Storage system dimensions
- Controller Boxes at a glance
- Drive Boxes at a glance
- Hardware descriptions

# Matching Controller Boxes and Drive Boxes

Hardware components on Hitachi Unified Storage systems vary, depending on the Controller Box and Drive Box. To find the hardware components on your Hitachi Unified Storage system, use Table 2-1 to find your storage system's Controller Box and Drive Box(es). Then refer to the page number in the See Page column for information about the hardware components.

A detailed description of the hardware components starts on page 2-26.

**Table 2-1: Matching Controller Boxes and Drive Boxes**

| This Hitachi Unified Storage model | Can use these Controller Boxes | And these Drive Boxes | See page |
|---|---|---|---|
| 110 | CBXSS | | 2-5 |
| | CBXSL | | 2-7 |
| | | DBS | 2-15 |
| | | DBL | 2-17 |
| 130 | CBSS | | 2-9 |
| | CBSL | | 2-11 |
| | | DBS | 2-15 |
| | | DBL | 2-17 |
| | | DBX | 2-21 |
| | | DBW | 2-24 |
| 150 | CBL/CBLE/CBLD | | 2-13 |
| | | DBS/DBSD | 2-15 |
| | | DBL/DBLD | 2-17 |
| | | DBF | 2-19 |
| | | DBX | 2-21 |
| | | DBW | 2-24 |

# Storage system dimensions

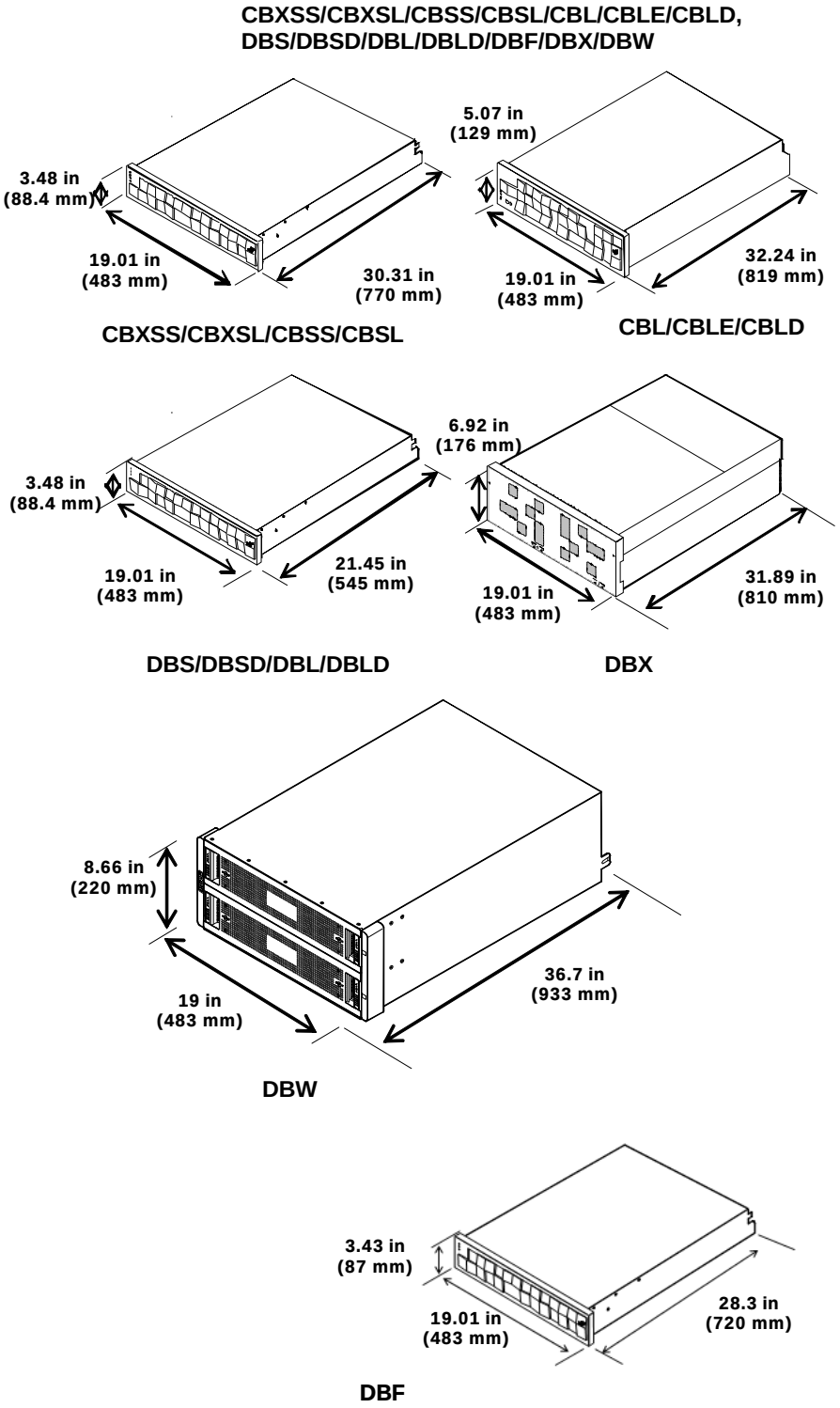



**Figure 2-1: Hitachi Unified Storage system dimensions**

**NOTE:** When rack-mounting a DBX Drive Box, leave at least 6 inches (152 mm) for the required cable guides.

# Controller Boxes at a glance

The following Controller Boxes are described in this section:

- CBXSS Controller Box (DF850-CBSSR) (see the section below)
- CBXSL Controller Box (DF850-CBSLR) on page 2-7
- CBSS Controller Box (DF850-CBSSR) on page 2-9
- CBSL Controller Box (DF850-CBSLR) on page 2-11
- CBL (DF850-CBLR), CBLE (DF850-CBLR1), and CBLD (DF850-CBLD) Controller Boxes on page 2-13

# CBXSS Controller Box (DF850-CBSSR)

## Front panel bezel

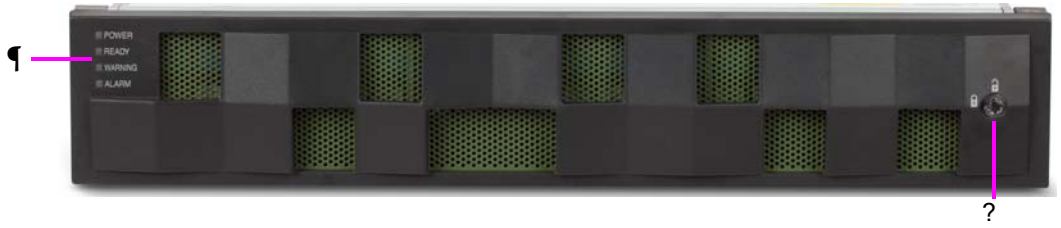



**Figure 2-2: CBXSS Controller Box front panel bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, WARNING, ALARM LEDs**<br>See Table 2-2 on page 2-26. |
| ? | **Lock** |

## Front panel without bezel

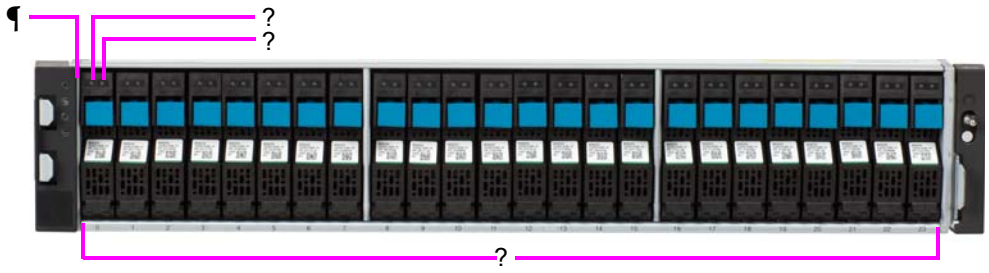



**Figure 2-3: CBXSS Controller Box front panel without bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, WARNING, ALARM LEDs**<br>See Table 2-2 on page 2-26. |
| ? | **ALM LED**<br>Drive display LED above each drive slot. See Table 2-6 on page 2-30. |
| ? | **ACT LED**<br>Drive display LED above each drive slot. See Table 2-6 on page 2-30. |
| ? | **Small Form Factor Drives**<br>24 2.5-inch small form factor drives oriented vertically. Slots are designated 0 - 23 going from left to right. |

## Rear panel

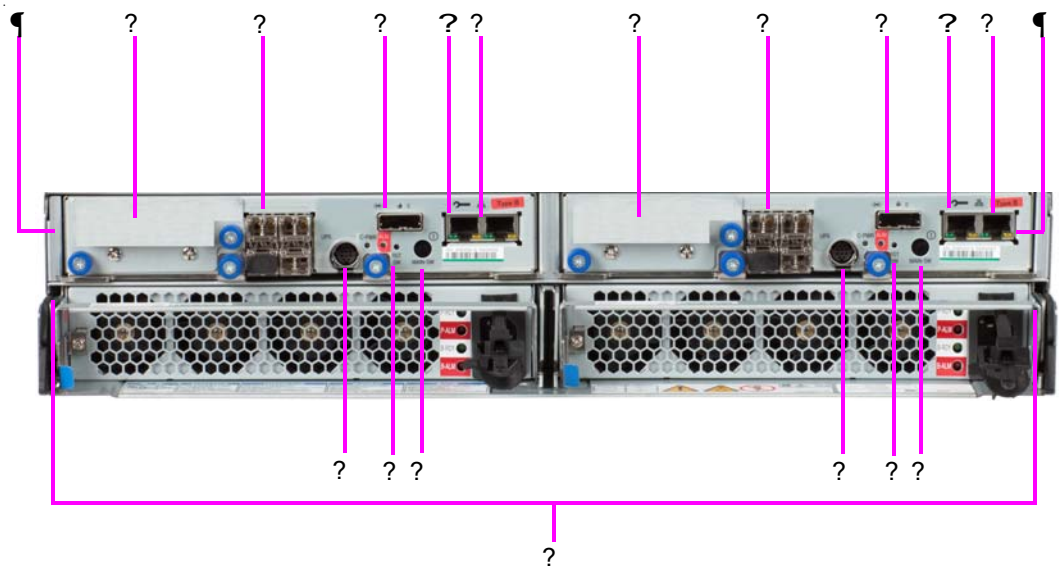


**Figure 2-4: CBXSS Controller Box rear panel**

Legend:

¶ **Two Controllers**
Controller 0 (left) and Controller 1 (right)

? **Host Interface Option**
See Host I/O Boards for CBXSS and CBXSL Controller Boxes on page 2-38.

? **Fibre Channel Ports**
See Fibre Channel ports on page 2-35.

? **PATH 0 Expansion Port**
Connects to a DBS or DBL Drive Box. Do not connect to a DBX Drive Box. LED above port shows when a link is made:
- BLUE ON = Drive Box is connected and link status is normal.
- ORANGE ON = a Hitachi Storage Navigator Modular 2 wizard indicates that a SAS (ENC) cable must to be inserted into the port.

? **LAN 0 Maintenance Port**
- Left LED: Link Status (green)
- Right LED: Port Activity (yellow)

See Maintenance port on page 2-37.

? **LAN 1 Management Port**
- Left LED: Link Status (green)
- Right LED: Port Activity (yellow)

See Management port on page 2-37.

? **Power Unit**
See Power Unit for CBXSS, CBXSL, CBSS, and CBSL Controller Boxes on page 2-45.

? **Main Switch**
Powers the storage system ON and OFF. When power is OFF, turn on power by holding this switch longer than 1 second. When power is ON, turn off power by holding this switch longer than 3 seconds.

? **Reset Switch and Controller LEDs**
Use the Reset switch only when instructed by Hitachi Support. For LEDs, see CBXSS/CBXSL controller LEDs on page 2-34.

? **Uninterruptible Power Supply Port**

# CBXSL Controller Box (DF850-CBSLR)

## Front panel bezel

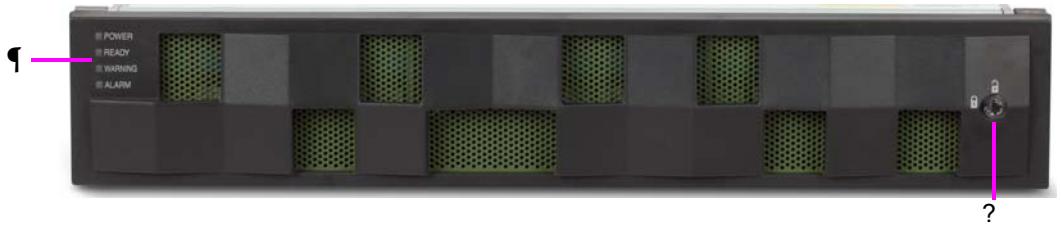



**Figure 2-5: CBXSL Controller Box front panel bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, WARNING, ALARM LEDs**<br>See Table 2-2 on page 2-26. |
| ? | **Lock** |

## Front panel without bezel

**Figure 2-6: CBXSL Controller Box front panel without bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, WARNING, ALARM LEDs**<br>See Table 2-2 on page 2-26. |
| ? | **ACT LED**<br>Drive display LED above each drive slot. See Table 2-7 on page 2-30. |
| ? | **ALM LED**<br>Drive display LED above each drive slot. See Table 2-7 on page 2-30. |
| ? | **Large Form Factor Drives**<br>12 3.5-inch large form factor drives stacked horizontally. Slots are designated in the following way:<br>8 9 10 11<br>4 5 6 7<br>0 1 2 3 |

## Rear panel

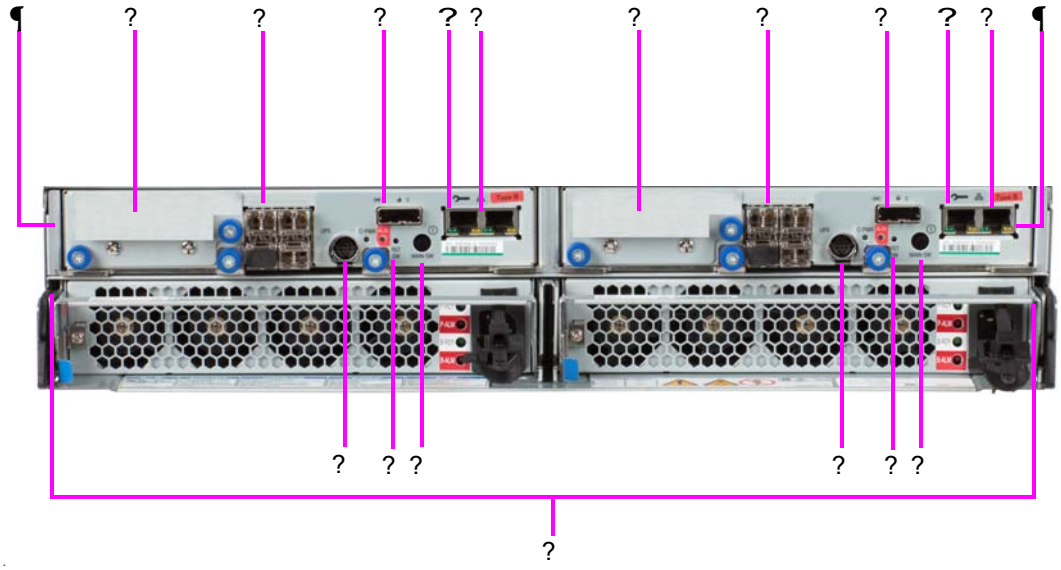


**Figure 2-7: CBXSL Controller Box rear panel**

Legend:

¶ **Two Controllers**
Controller 0 (left) and Controller 1 (right)

? **Host Interface Option**
See Host I/O Boards for CBXSS and CBXSL Controller Boxes on page 2-38.

? **Fibre Channel Ports**
See Fibre Channel ports on page 2-35.

? **PATH 0 Expansion Port**
Connects to a DBS or DBL Drive Box. Do not connect to a DBX Drive Box. LED above port shows when a link is made:
- BLUE ON = Drive Box is connected and link status is normal.
- ORANGE ON = a Storage Navigator Modular 2 wizard indicates that a SAS (ENC) cable must to be inserted into the port.

? **LAN 0 Maintenance Port**
- Left LED: Link Status (green)
- Right LED: Port Activity (yellow)

See Maintenance port on page 2-37.

? **LAN 1 Management Port**
- Left LED: Link Status (green)
- Right LED: Port Activity (yellow)

See Management port on page 2-37.

? **Power Unit**
See Power Unit for CBXSS, CBXSL, CBSS, and CBSL Controller Boxes on page 2-45.

? **Main Switch**
Powers the storage system ON and OFF. When power is OFF, turn on power by holding this switch longer than 1 second. When power is ON, turn off power by holding this switch longer than 3 seconds.

? **Reset Switch and Controller LEDs**
Use the Reset switch only when instructed by Hitachi Support. For LEDs, see CBXSS/CBXSL controller LEDs on page 2-34.

? **Uninterruptible Power Supply Port**

# CBSS Controller Box (DF850-CBSSR)

## Front panel bezel

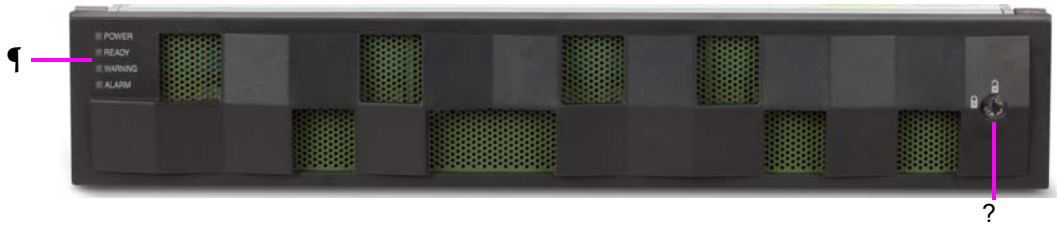



**Figure 2-8: CBSS Controller Box front panel bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, WARNING, ALARM LEDs**<br>See Table 2-2 on page 2-26. |
| ? | **Lock** |

## Front panel without bezel

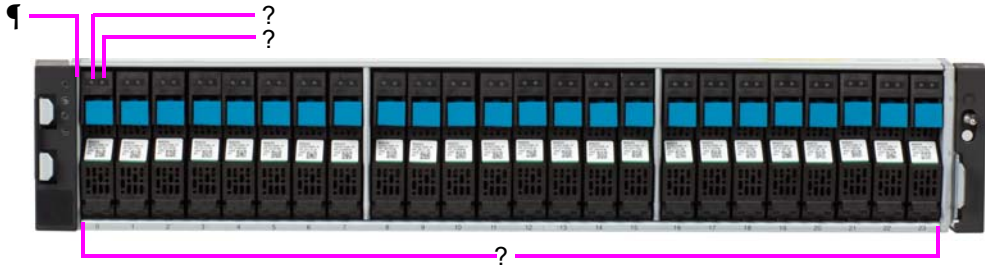



**Figure 2-9: CBSS Controller Box front panel without bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, WARNING, ALARM LEDs**<br>See Table 2-2 on page 2-26. |
| ? | **ALM LED**<br>Drive display LED above each drive slot. See Table 2-6 on page 2-30. |
| ? | **ACT LED**<br>Drive display LED above each drive slot. See Table 2-6 on page 2-30. |
| ? | **Small Form Factor Drives**<br>24 2.5-inch small form factor drives oriented vertically. Slots are designated 0 - 23 going from left to right. |

## Rear panel

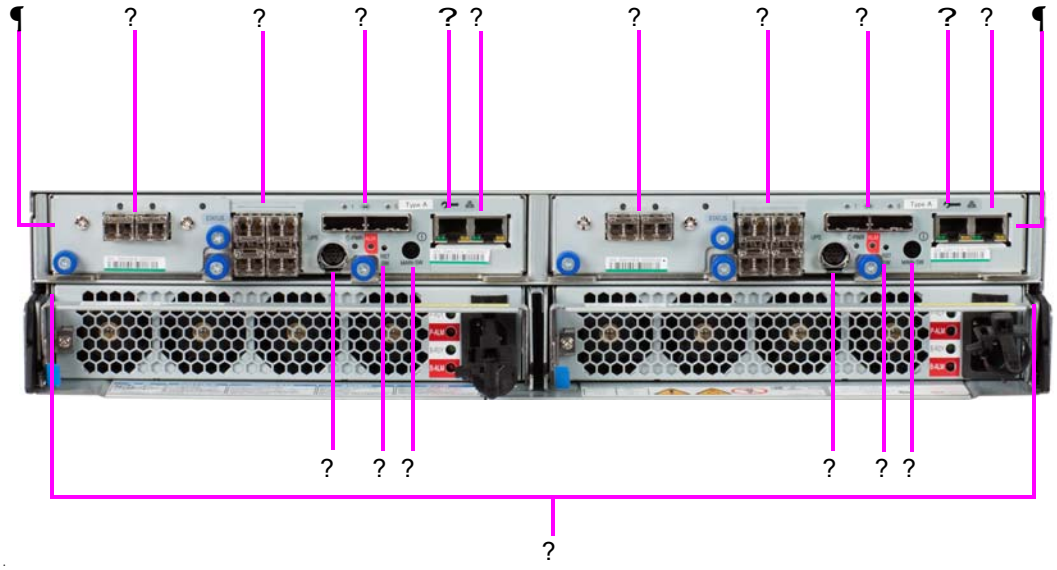


**Figure 2-10: CBSS Controller Box rear panel**

Legend:

¶ **Two Controllers**
Controller 0 (left) and Controller 1 (right)

? **Host Interface Option**
See Host I/O Boards for CBSS and CBSL Controller Boxes on page 2-40.

? **Fibre Channel Ports**
See Fibre Channel ports on page 2-35.

? **PATH 0 (left) and PATH 1 (right) Expansion Ports**
Connect to a DBS, DBL, or DBX Drive Box. LED above each port shows when a link is made:
- BLUE ON = Drive Box is connected and link status is normal.
- ORANGE ON = a Storage Navigator Modular 2 wizard indicates that a SAS (ENC) cable must to be inserted into the port.

? **LAN 0 Maintenance Port**
- Left LED: Link Status (green)
- Right LED: Port Activity (yellow)

See Maintenance port on page 2-37.

? **LAN 1 Management Port**
- Left LED: Link Status (green)
- Right LED: Port Activity (yellow)

See Management port on page 2-37.

? **Power Unit**
See Power Unit for CBXSS, CBXSL, CBSS, and CBSL Controller Boxes on page 2-45.

? **Main Switch**
Powers the storage system ON and OFF. When power is OFF, turn on power by holding this switch longer than 1 second. When power is ON, turn off power by holding this switch longer than 3 seconds.

? **Reset Switch and Controller LEDs**
Use the Reset switch only when instructed by Hitachi Support. For LEDs, see CBSS/CBSL controller LEDs on page 2-34.

? **Uninterruptible Power Supply Port**

# CBSL Controller Box (DF850-CBSLR)

## Front panel bezel

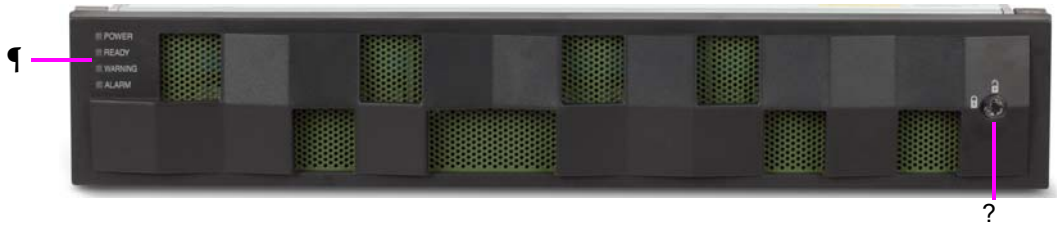



**Figure 2-11: CBSL Controller Box front panel bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, WARNING, ALARM LEDs**<br>See Table 2-2 on page 2-26. |
| ? | **Lock** |

## Front panel without bezel

**Figure 2-12: CBSL Controller Box front panel without bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, WARNING, ALARM LEDs**<br>See Table 2-2 on page 2-26. |
| ? | **ACT LED**<br>Drive display LED above each drive slot. See Table 2-7 on page 2-30. |
| ? | **ALM LED**<br>Drive display LED above each drive slot. See Table 2-7 on page 2-30. |
| ? | **Large Form Factor Drives**<br>12 3.5-inch large form factor drives stacked horizontally. Slots are designated in the following way:<br>8 9 10 11<br>4 5 6 7<br>0 1 2 3 |

## Rear panel

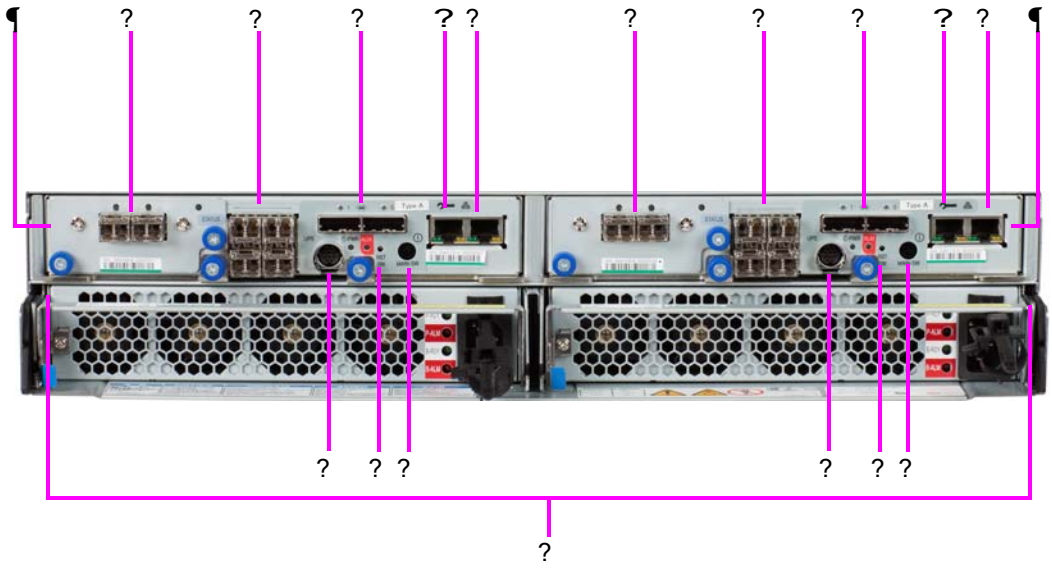


**Figure 2-13: CBSL Controller Box rear panel**

Legend:

¶ **Two Controllers**
Controller 0 (left) and Controller 1 (right)

? **Host Interface Option**
See Host I/O Boards for CBSS and CBSL Controller Boxes on page 2-40.

? **Fibre Channel Ports**
See Fibre Channel ports on page 2-35.

? **PATH 0 (left) and PATH 1 (right) Expansion Ports**
Connect to a DBS, DBL, or DBX Drive Box. LED above each port shows when a link is made:
- BLUE ON = Drive Box is connected and link status is normal.
- ORANGE ON = a Storage Navigator Modular 2 wizard indicates that a SAS (ENC) cable must to be inserted into the port.

? **LAN 0 Maintenance Port**
- Left LED: Link Status (green)
- Right LED: Port Activity (yellow)

See Maintenance port on page 2-37.

? **LAN 1 Management Port**
- Left LED: Link Status (green)
- Right LED: Port Activity (yellow)

See Management port on page 2-37.

? **Power Unit**
See Power Unit for CBXSS, CBXSL, CBSS, and CBSL Controller Boxes on page 2-45.

? **Main Switch**
Powers the storage system ON and OFF. When power is OFF, turn on power by holding this switch longer than 1 second. When power is ON, turn off power by holding this switch longer than 3 seconds.

? **Reset Switch and Controller LEDs**
Use the Reset switch only when instructed by Hitachi Support. For LEDs, see CBSS/CBSL controller LEDs on page 2-34.

? **Uninterruptible Power Supply Port**

# CBL (DF850-CBLR), CBLE (DF850-CBLR1), and CBLD (DF850-CBLD) Controller Boxes

## Front panel bezel

**Figure 2-14: CBL/CBLE / CBLD Controller Box front panel bezel**

Legend:

¶ **POWER, READY, WARNING, ALARM LEDs**
See Table 2-2 on page 2-26.

? **Main Switch**
Powers the storage system ON (right button) or OFF (left button).

? **Lock**

## Front panel without bezel

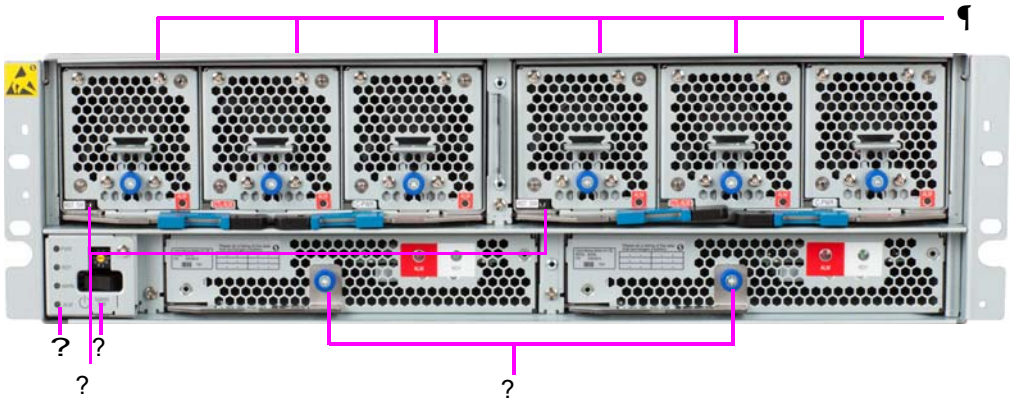



**Figure 2-15: CBL/CBLE / CBLD Controller Box without bezel**

Legend:

¶ **Fan Module**
See Fan Module on page 2-49.

? **Cache Backup Battery**
See Cache backup battery on page 2-50.

? **MAIN SW**

? **Reset Switches**
Use the Reset switches only when instructed by Hitachi Support.

? **PWR, RDY, WARN and ALM LEDs**
See Panel assembly on page 2-49.

## Rear panel

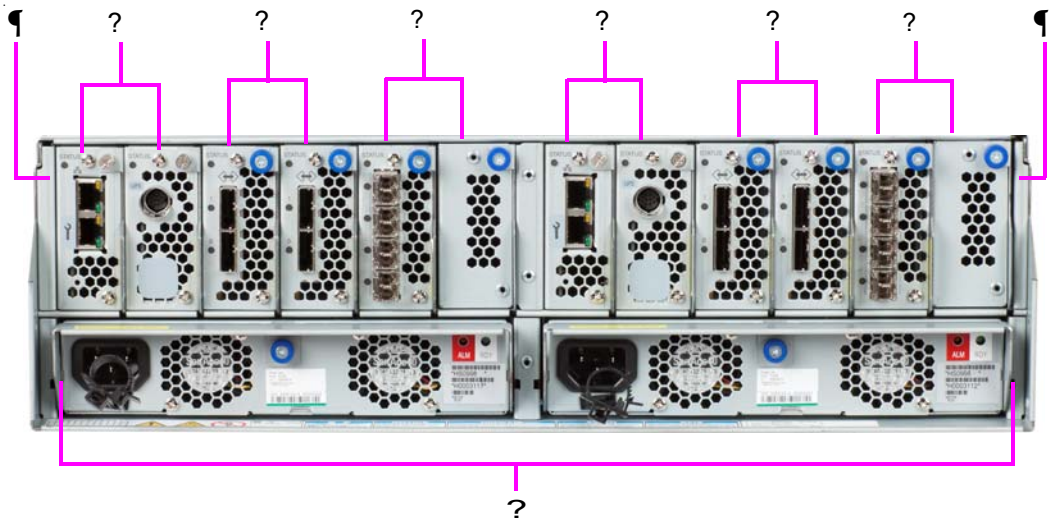



**Figure 2-16: CBL / CBLE / CBLD Controller Box rear panel**

Legend:

| | |
|---|---|
| ¶ | **Two Controllers**<br>Controller 0 (left) and Controller 1 (right) |
| ? | **Management Module**<br>See Management Module for CBL/CBLE/CBLD Controller Box on page 2-53. |
| ? | **Drive I/O Module**<br>See Drive I/O Module for CBL/CBLE/CBLD Controller Box on page 2-54. |
| ? | **Host I/O Modules**<br>See Host I/O Modules for CBL/CBLE/CBLD Controller Box on page 2-55. |
| ? | **Power Unit**<br>See Power Unit for CBL/CBLE Controller Box on page 2-46. |

**NOTE:** The CBLD rear panel is identical to the figure above, except the AC receptacles are replaced by receptacles for accommodating DC power.

# Drive Boxes at a glance

The following Drive Boxes are described in this section

- DBS/DBSD Drive Box, see the section below
- DBL/DBLD Drive Box on page 2-17
- DBF Drive Box on page 2-19
- DBX Drive Box on page 2-21
- DBW Drive Box on page 2-24

## DBS/DBSD Drive Box

### Front panel bezel

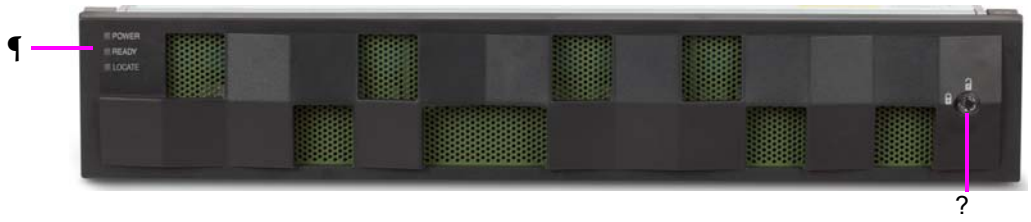



**Figure 2-17: DBS/DBSD front panel bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, LOCATE LEDs**<br>See Table 2-3 on page 2-27. |
| ? | **Lock** |

### Front panel without bezel

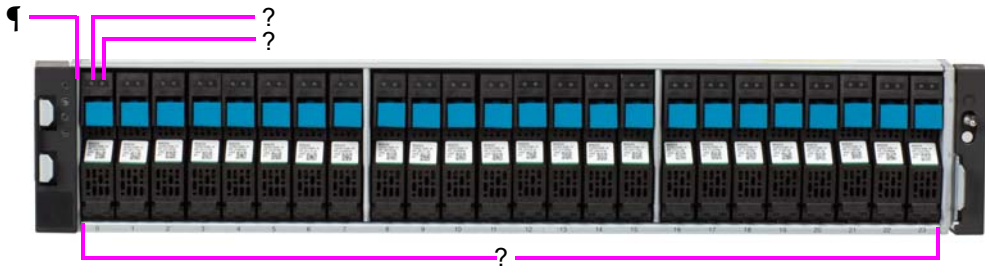



**Figure 2-18: DBS/DBSD front panel without bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, LOCATE LEDs**<br>See Table 2-3 on page 2-27. |
| ? | **ALM LED**<br>Drive display LED above each drive slot. See Table 2-8 on page 2-31. |
| ? | **ACT LED**<br>Drive display LED above each drive slot. See Table 2-8 on page 2-31. |
| ? | **Small Form Factor Drives**<br>24 2.5-inch small form factor drives oriented vertically. Slots are designated 0 - 23 going from left to right. |

## Rear panel

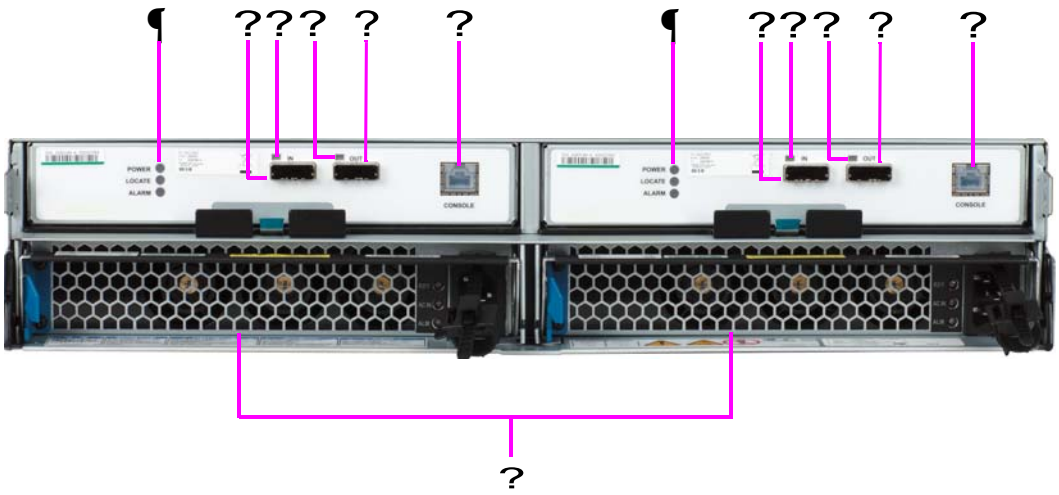



**Figure 2-19: DBS rear panel**

Legend:

| | |
|---|---|
| ¶ | **POWER, LOCATE, ALARM LEDs**<br>See I/O Module (ENC), DBS, DBSD, DBL, and DBLD Drive Boxes on page 2-42. |
| ? | **IN Port**<br>Connects to a CBSS, CBSL, CBL, CBLE, or CBLD Controller Box or a DBS, DBL, DBX, or DBF Drive Box. |
| ? | **IN Port LED**<br>ON when IN port is connected to a CBSS, CBSL, CBL, CBLE, CBLD, DBS, DBSD, DBL, DBLD, DBX, or DBF. |
| ? | **Out Port LED**<br>See I/O Module (ENC), DBS, DBSD, DBL, and DBLD Drive Boxes on page 2-42. |
| ? | **OUT Port**<br>See I/O Module (ENC), DBS, DBSD, DBL, and DBLD Drive Boxes on page 2-42. |
| ? | **Console Port**<br>Not used. |
| ? | **Power Unit**<br>See Power Unit for CBXSS, CBXSL, CBSS, and CBSL Controller Boxes on page 2-45 and Power Unit for DBSD/DBLD Drive Box on page 2-46. |

**NOTE:** The DBSD rear panel is identical to the figure above, except the AC receptacles are replaced by receptacles for accommodating DC power.

# DBL/DBLD Drive Box

## Front panel bezel

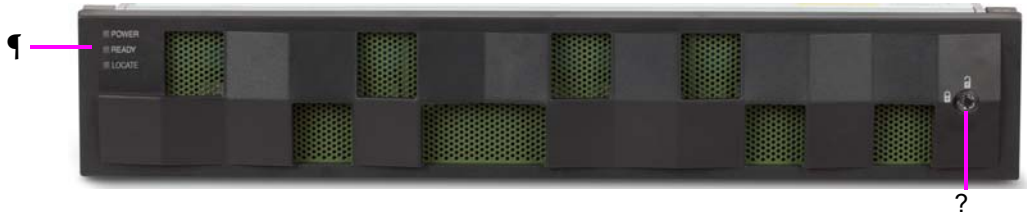



**Figure 2-20: DBL/DBLD front panel bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, LOCATE LEDs**<br>See Table 2-3 on page 2-27. |
| ? | **Lock** |

## Front panel without bezel

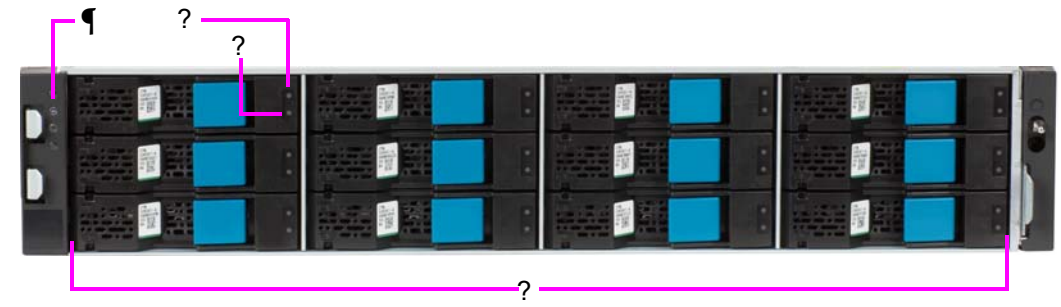



**Figure 2-21: DBL/DBLD front panel without bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, LOCATE LEDs**<br>See Table 2-3 on page 2-27. |
| ? | **ACT LED**<br>Drive display LED above each drive slot. See Table 2-9 on page 2-31. |
| ? | **ALM LED**<br>Drive display LED above each drive slot. See Table 2-9 on page 2-31. |
| ? | **Large Form Factor Drives**<br>12 3.5-inch large form factor drives stacked horizontally. Slots are designated in the following way:<br>8 9 10 11<br>4 5 6 7<br>0 1 2 3 |

## Rear panel

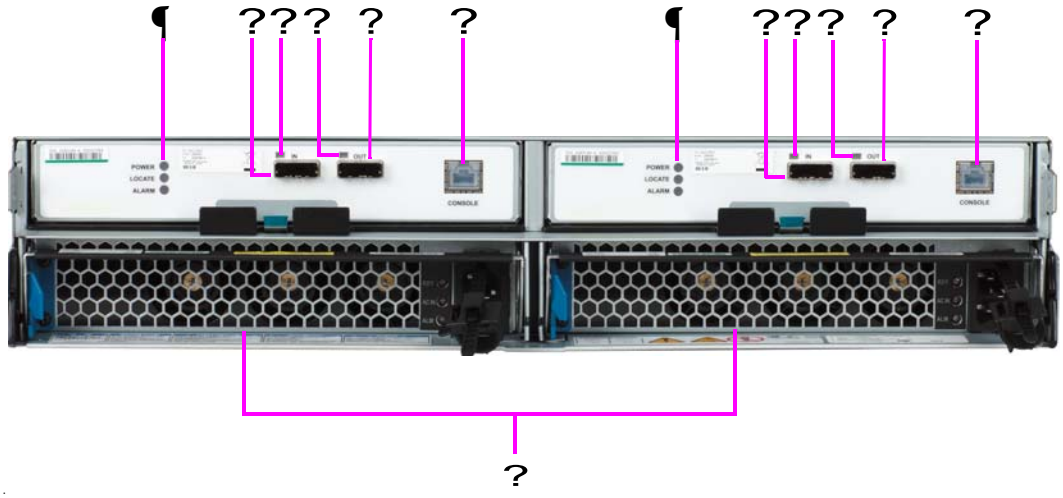


**Figure 2-22: DBL rear panel**

Legend:

| | |
|---|---|
| ¶ | **POWER, LOCATE, ALARM LEDs**<br>See I/O Module (ENC), DBS, DBSD, DBL, and DBLD Drive Boxes on page 2-42. |
| ? | **IN Port**<br>Connects to a CBSS or CBSL Controller Box or a DBS, DBL, or DBX Drive Box. |
| ? | **IN Port LED**<br>ON when IN port is connected to a CBSS, CBSL, DBS, DBL, or DBX. |
| ? | **OUT Port LED**<br>ON when OUT port is connected to a DBS, DBL, or DBX. |
| ? | **OUT Port**<br>Connects to a DBS, DBL, or DBX Drive Box. |
| ? | **Console Port**<br>Not used. |
| ? | **Power Unit**<br>See Power Unit for DBS and DBL Drive Boxes on page 2-45 and Power Unit for DBSD/DBLD Drive Box on page 2-46. |

**NOTE:** The DBLD rear panel is identical to the figure above, except the AC receptacles are replaced by receptacles for accommodating DC power.

# DBF Drive Box

## Front panel bezel

**Figure 2-23: DBF front panel bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, LOCATE LEDs**<br>See Table 2-3 on page 2-27. |
| ? | **Lock** |

## Front panel without bezel

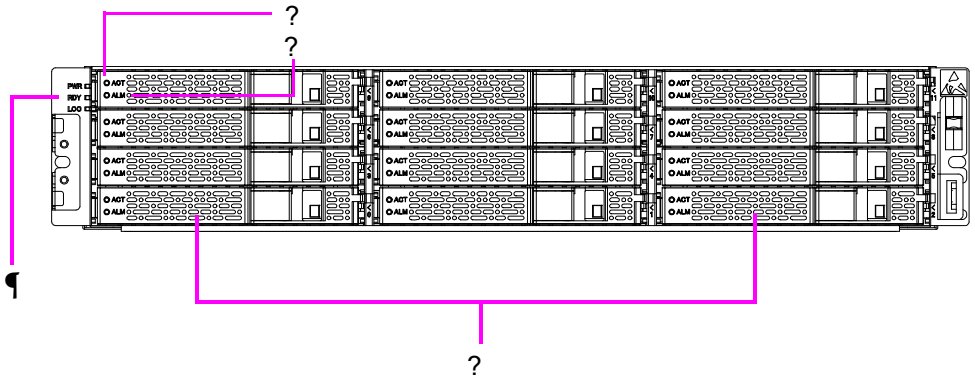



**Figure 2-24: DBF front panel without bezel**

Legend:

| | |
|---|---|
| ¶ | **POWER, READY, LOCATE LEDs**<br>See Table 2-3 on page 2-27. |
| ? | **ALM LED**<br>Drive display LED above each drive slot. See Table 2-10 on page 2-32. |
| ? | **ACT LED**<br>Drive display LED above each drive slot. See Table 2-10 on page 2-32. |
| ? | **Large Form Factor Drives**<br>12 3.5-inch large form factor drives stacked horizontally. Slots are designated in the following way:<br>9 10 11<br>6 7 8<br>3 4 5<br>0 1 2 |

## Rear panel

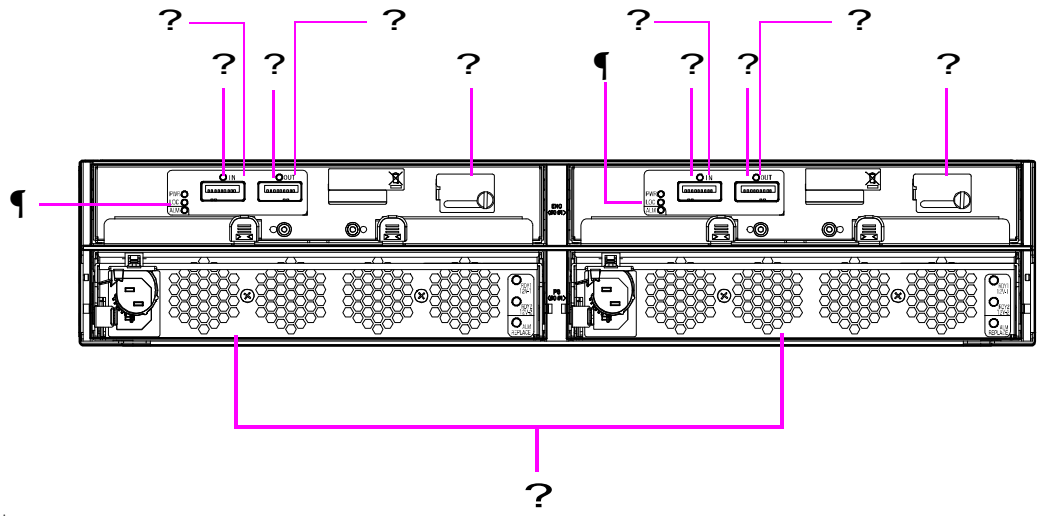


**Figure 2-25: DBF rear panel**

Legend:

¶ **POWER, LOCATE, ALARM LEDs**
See I/O Module (ENC), DBF Drive Box on page 2-44.

? **IN Port**
Connects to a CBSS, CBSL, CBL, CBLE, or CBLD Controller Box or a DBS, DBL, DBX, or DBF Drive Box.

? **IN Port LED**
ON when IN port is connected to a CBSS, CBSL, CBL, CBLE, CBLD, DBS, DBSD, DBL, DBLD, DBX, or DBF.

? **Out Port LED**
See I/O Module (ENC), DBF Drive Box on page 2-44.

? **OUT Port**
See I/O Module (ENC), DBF Drive Box on page 2-44.

? **Console Port**
Not used.

? **Power Unit**
See Power Unit for DBF Drive Box on page 2-46.

# DBX Drive Box

## Front panel bezel

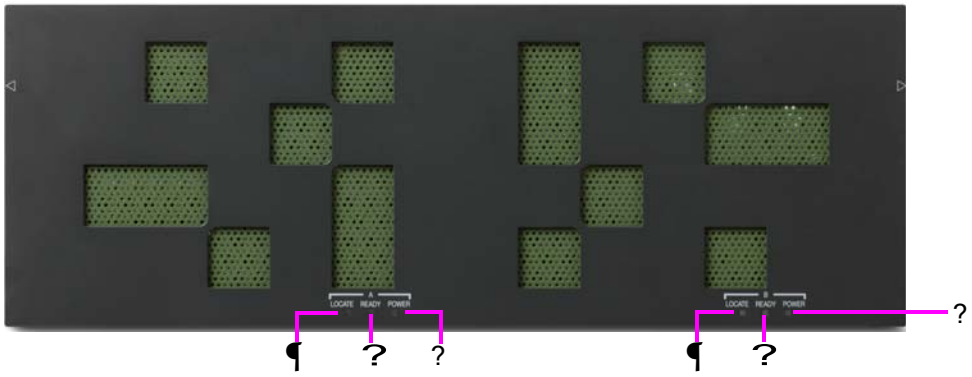



**Figure 2-26: DBX front panel with bezel**

Legend:

| | |
|---|---|
| ¶ | **LOCATE LED**<br>See Table 2-4 on page 2-28. |
| ? | **READY LED**<br>See Table 2-4 on page 2-28. |
| ? | **POWER LED**<br>See Table 2-4 on page 2-28. |

## Rear panel

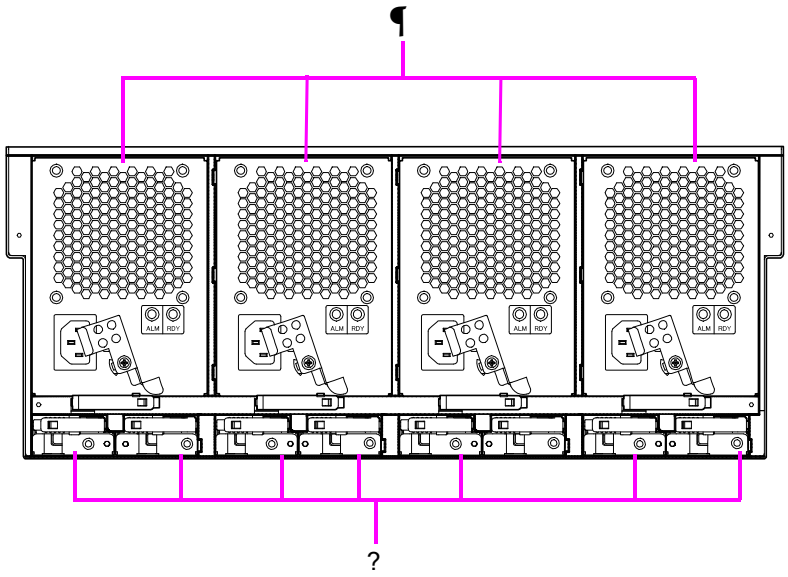



**Figure 2-27: DBX rear panel**

Legend:

| | |
|---|---|
| ¶ | **Power Unit**<br>See Power Unit for DBX Drive Box on page 2-47. |
| ? | **I/O Card (ENC)**<br>See I/O Card (ENC), DBX Drive Box on page 2-43. |

## Top view

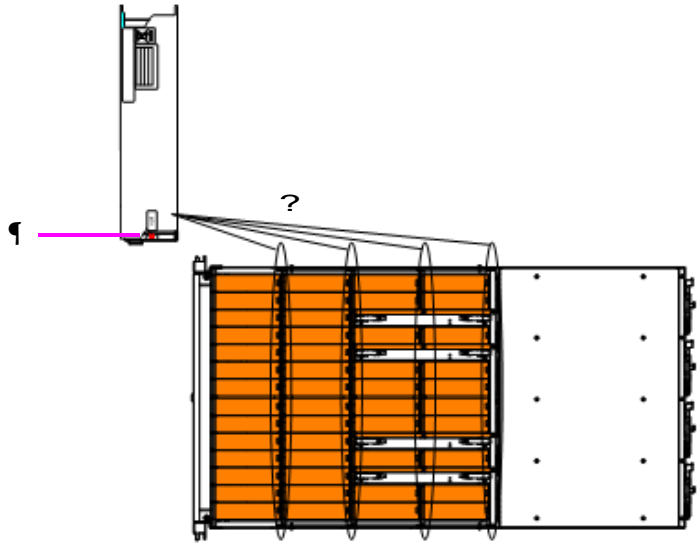



**Figure 2-28: DBX top view**

| Legend: | |
|---|---|
| ¶ | **ALM LED**<br>See Table 2-11 on page 2-32. |
| ? | **Drive Indication** |

# DBW Drive Box

## Front panel bezel

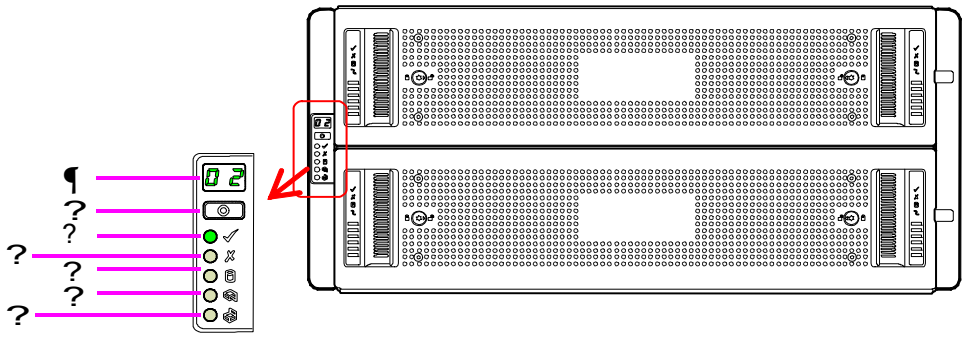


**Figure 2-29: DBW front panel with bezel**

Legend:

¶ **Unit ID Display LED**
Not used. (The displayed number may change when you press the Input Switch. However, it does not affect storage system operations.)

? **Input Switch**
Not used.

? **Power On / Standby LED**
See Table 2-5 on page 2-29.

? **Module WNG LED**
See Table 2-5 on page 2-29.

? **Logical ALM LED**
See Table 2-5 on page 2-29.

? **Drawer 1 ALM LED**
See Table 2-5 on page 2-29 and DBW Drive Box on page 2-57.

? **Drawer 2 ALM LED**
See Table 2-5 on page 2-29 and DBW Drive Box on page 2-57.

## Rear panel

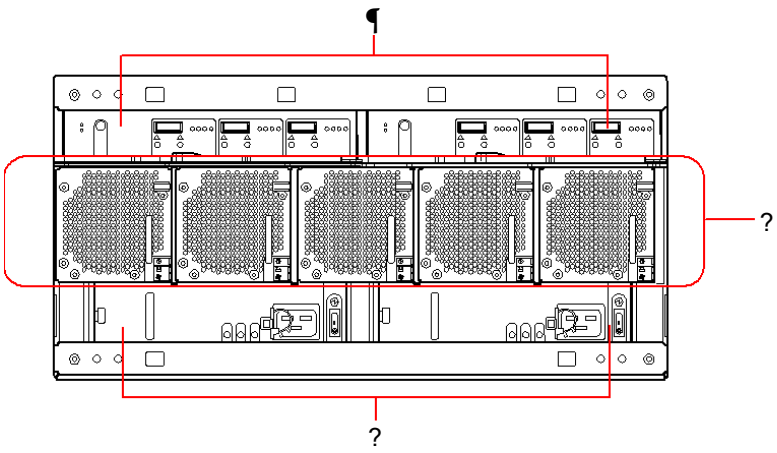



**Figure 2-30: DBW rear panel**

Legend:

¶ **I/O Module (ENC)**
See I/O Module (ENC) for DBW Drive Box on page 2-57.

? **Fan Module**
See DBW Fan Module on page 2-60.

? **Power Unit**
See Power Unit for DBW Drive Box on page 2-58.

## Top view

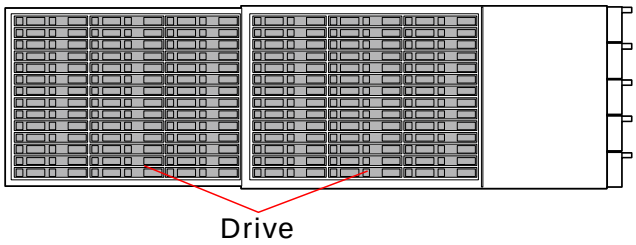


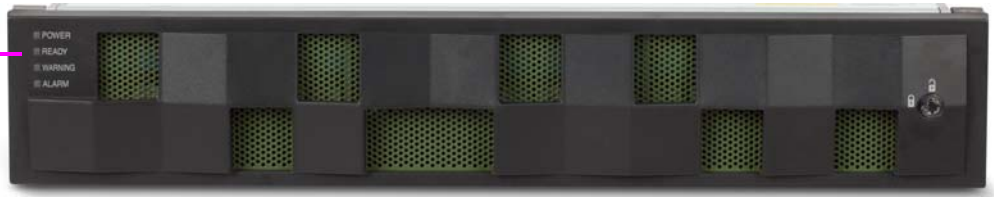

**Figure 2-31: DBW top view**

# Hardware descriptions

## LED definitions

### Front panel LEDs

#### CBXSS, CBXSL, CBSS, and CBSL Controller Boxes



POWER
READY
WARNING
ALARM

#### CBL/CBLE/CBLD Controller Box

POWER
READY
WARNING
ALARM

**Table 2-2: Front panel LEDs**
**(CBXSS, CBXSL, CBSS, CBSL, CBL, CBLE, and CBLD Controller Boxes)**

| LED | Color | Description |
|---|---|---|
| POWER | Green | ON = power-on in progress after main switch has been pushed. Stays ON after system is operational. |
| | Orange | ON = Controller Box power cables are connected and power is supplied. |
| READY | Green | ON = normal operation. Storage system is operational.<br>Fast blink = firmware downloading (do not turn off system).<br>Slow blink = download processing of the ENC firmware completed offline. |
| WARNING | Orange | OFF = normal operation<br>ON or slow blink = failure, but storage system can remain operating.<br>Fast blink = flash is updating. For single-controller storage systems, the system is on, receiving power, and performing internal processing. |
| ALARM | Red | OFF = normal operation<br>ON = failure that prevents the storage system from operating. Visit the HDS Support Portal at portal.hds.com.<br>Slow blink = serious failure. Visit the HDS Support Portal at portal.hds.com. |

**Table 2-3: Front panel LEDs (DBS, DBSD, DBL, DBLD, and DBF Drive Boxes)**

| LED | Color | Description |
|---|---|---|
| POWER | Green | ON = power is being supplied to the storage system. |
| READY | Green | ON = normal operation. Storage system is operational.<br>Fast blink = internal processing. Storage system is operational.<br>Slow blink = offline download processing completed (displayed during maintenance). |
| LOCATE | Orange | ON = nonfatal error. Storage system can remain operating. Visit the HDS Support Portal at portal.hds.com.<br>LED goes ON when adding the chassis with the power turned on (this is not an error) |

## DBX Drive Box

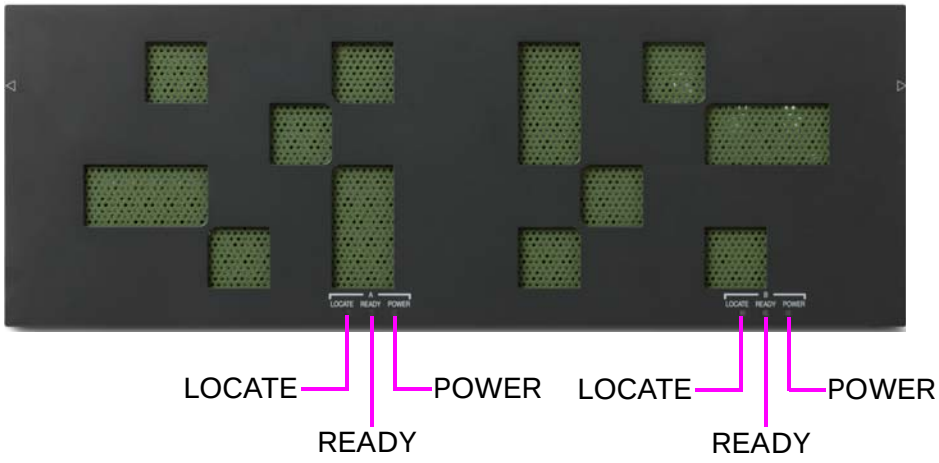



**Table 2-4: Front panel LEDs (DBX Drive Box)**

| LED | Color | Description |
|---|---|---|
| POWER | Green | ON = power is being supplied to the storage system. |
| | Orange | ON = power cables are attached to the rear of the Drive Box and power is being supplied. |
| READY | Green | ON = normal operation. Storage system is operational.<br>Fast blink = internal processing. Storage system is operational.<br>Slow blink = offline download processing completed (displayed during maintenance). |
| LOCATE | Orange | ON = nonfatal error. Storage system can remain operating. Visit the HDS Support Portal at portal.hds.com. If adding a chassis with power ON, LED indicates the addition of the chassis (this is not an error). |

## DBW Drive Box

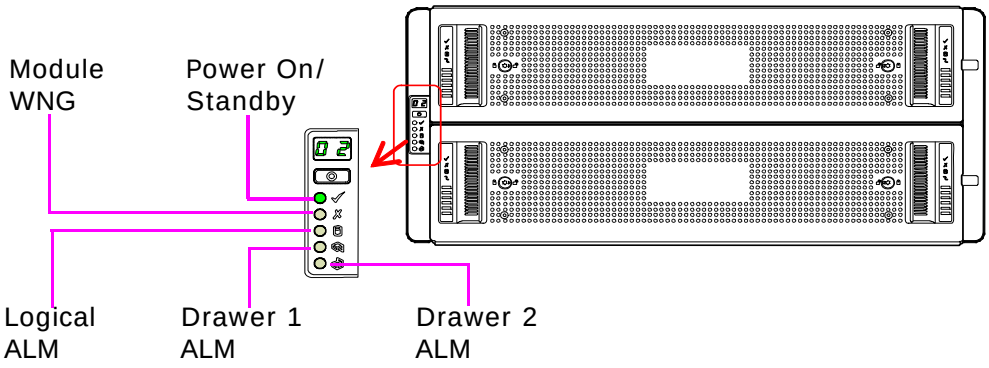



**Table 2-5: Front panel LEDs (DBW Drive Box)**

| LED | Color | Description |
|---|---|---|
| Power On/ Standby | Green | ON = normal Drive Box status. |
| | Orange | ON = abnormal Drive Box status. Visit the HDS Support Portal at portal.hds.com. |
| Module WNG | Orange | ON = abnormal Drive Box condition. Visit the HDS Support Portal at portal.hds.com. |
| Logical ALM | Orange | ON = logical fault has been detected. Visit the HDS Support Portal at portal.hds.com. |
| Drawer 1 ALM | Orange | ON = abnormal top drawer condition. Visit the HDS Support Portal at portal.hds.com. |
| Drawer 2 ALM | Orange | ON = abnormal bottom drawer condition. Visit the HDS Support Portal at portal.hds.com. |

## Drive display LEDs

### CBXSS and CBSS Controller Boxes

**Table 2-6: Drive display LEDs (CBXSS and CBSS Controller Boxes)**

| LED | Color | Description |
|---|---|---|
| ALM | Red | ON = fatal error. Visit the HDS Support Portal at portal.hds.com. |
| ACT | Green | ON or blink = drive is being accessed. |

### CBXSL and CBSL Controller Boxes

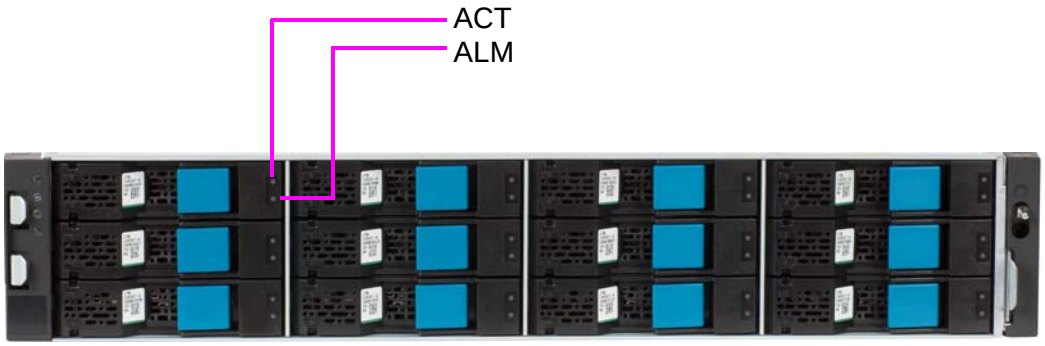



**Table 2-7: Drive display LEDs (CBXSL and CBSL Controller Boxes)**

| LED | Color | Description |
|---|---|---|
| ACT | Green | ON or blink = drive is being accessed. |
| ALM | Red | ON = fatal error. Visit the HDS Support Portal at portal.hds.com. |

## DBS/DBSD Drive Box

**Table 2-8: Drive display LEDs (DBS/DBSD Drive Box)**

| LED | Color | Description |
|---|---|---|
| ALM | Red | ON = fatal error. Visit the HDS Support Portal at portal.hds.com. |
| ACT | Green | ON or blink = drive is being accessed. |

## DBL/DBLD Drive Box

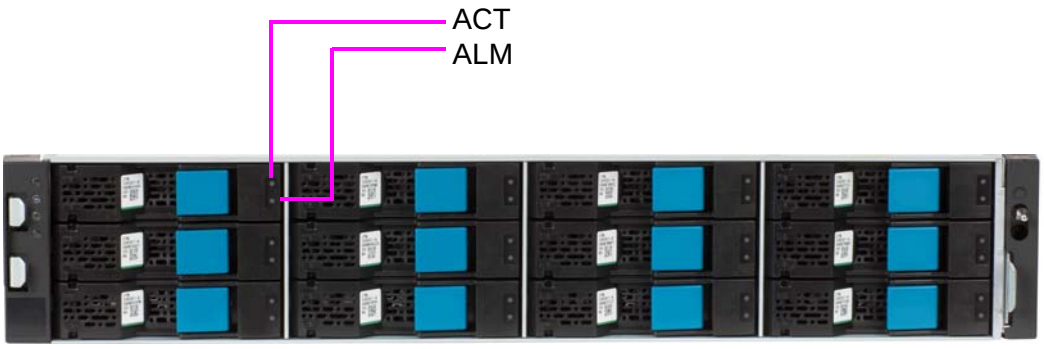



**Table 2-9: Drive display LEDs (DBL/DBLD Drive Box)**

| LED | Color | Description |
|---|---|---|
| ACT | Green | ON or blink = drive is being accessed. |
| ALM | Red | ON = fatal error. Visit the HDS Support Portal at portal.hds.com. |

## DBF Drive Box

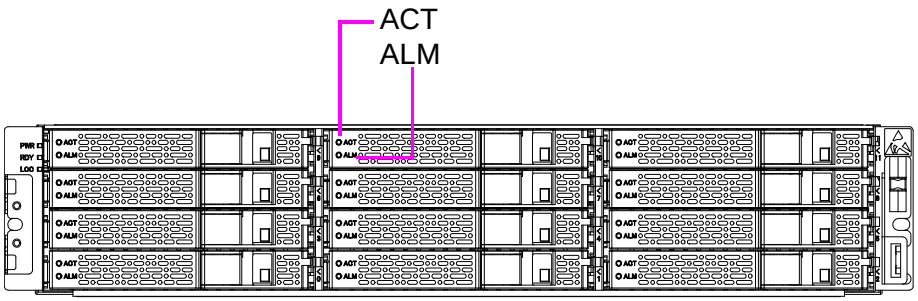



**Table 2-10: Drive display LEDs (DBF Drive Box)**

| LED | Color | Description |
|---|---|---|
| ACT | Green | ON or blink = drive is being accessed. |
| ALM | Red | ON = fatal error. Visit the HDS Support Portal at portal.hds.com. |

## DBX Drive Box

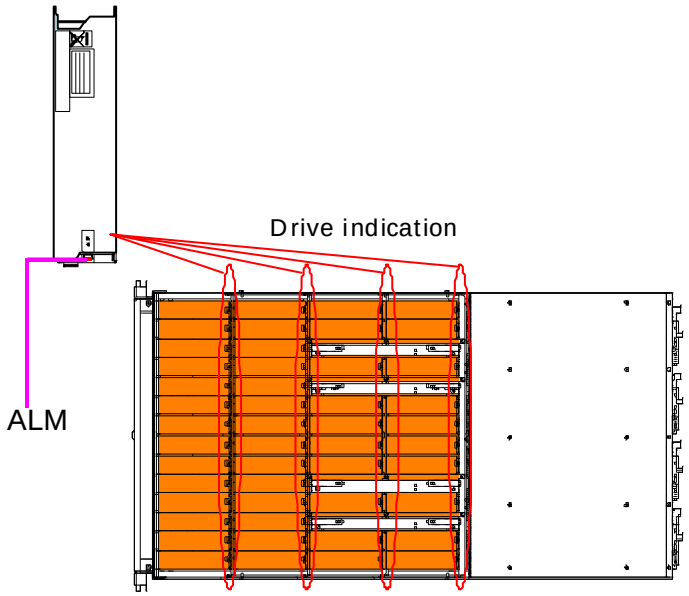



**Table 2-11: Drive display LED (DBX Drive Box)**

| LED | Color | Description |
|---|---|---|
| ALM | Red | ON = fatal error. Visit the HDS Support Portal at portal.hds.com. |

## DBW Drive Box

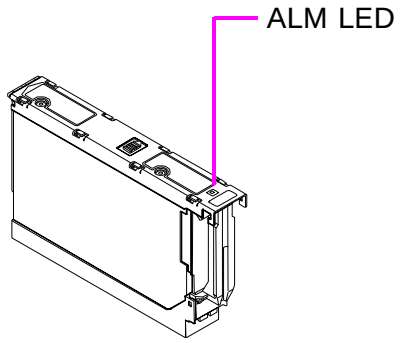



**Table 2-12: Drive display LED (DBW Drive Box)**

| LED | Color | Description |
|---|---|---|
| ALM | Orange | ON = drive is blocked. Visit the HDS Support Portal at portal.hds.com. |

# Controller LEDs

The following LEDs appear on the rear panel of the CBXSS/CBXSL and CBSS/CBSL controllers.

## CBXSS/CBXSL controller LEDs

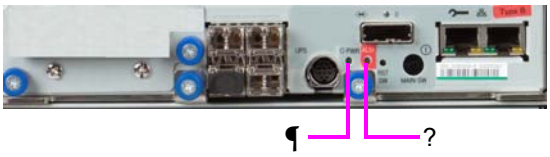



**Table 2-13: CBXSS/CBXSL controller LEDs**

| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | C-PWR | Green | ON = controller status is normal.<br>Blink = data in cache memory is stored in the backup controller. |
| ? | ALM | Red<br><br>Orange | ON = fatal error. Visit the HDS Support Portal at portal.hds.com.<br><br>ON = controller is in reset mode. |

## CBSS/CBSL controller LEDs

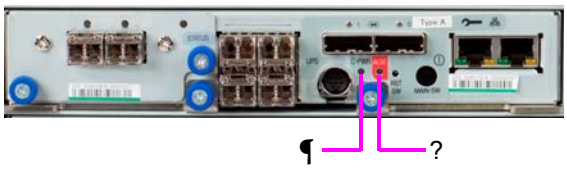



**Table 2-14: CBSS/CBSL controller LEDs**

| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | C-PWR | Green | ON = controller status is normal.<br>Blink = data in cache memory is stored in the backup controller. |
| ? | ALM | Red<br><br>Orange | ON = fatal error. Visit the HDS Support Portal at portal.hds.com.<br><br>ON = controller is in reset mode. |

# Data port descriptions

Hitachi Unified Storage Controller Boxes support the following data port connections:

- Fibre Channel
- 1 Gb iSCSI
- 10 Gb iSCSI

## Fibre Channel ports

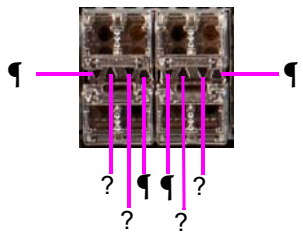
CBXSS, CBXSL, CBSS, and CBSL Controller Boxes have four standard Fibre Channel ports. These Controller Boxes also support a Fibre Channel Host I/O Module that contains four additional Fibre Channel ports (see Host I/O Boards for CBXSS and CBXSL Controller Boxes on page 2-38 and Host I/O Boards for CBSS and CBSL Controller Boxes on page 2-40). The ports are designated in the following way:

| | |
|---|---|
| B | D |
| A | C |

Each Fibre Channel port provides an 8-Gigabit auto-sensing Fibre Channel interface for connecting to storage systems, Fibre Channel switches, Fibre Channel hosts, or other storage networking products. All Fibre Channel ports support fallback speeds of 4 Gigabits and 2 Gigabits.

Each Fibre Channel port has LEDs to indicate its status.

**NOTE:** The CBL/CBLE/CBLD Controller Box provides four Fibre Channel ports as an optional Host I/O Board. See Fibre Channel Host I/O Module on page 2-56.




| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | HALM | Red | Red = Host Connector is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |
| ? | LINK | Blue | ON = normal link status at 8 Gbps. |
| | | Green | ON = normal link status at 2 or 4 Gbps. |

## 1 Gb iSCSI ports

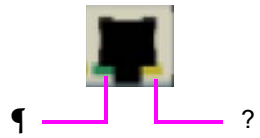
CBXSS and CBXSL Controller Boxes support an optional 1 Gb iSCSI Host/IO Module that contains two 1 Gb iSCSI ports (see Host I/O Boards for CBXSS and CBXSL Controller Boxes on page 2-38). Each port provides a 1-Gigabit Ethernet interface for connecting to IP hosts that require IP access to storage.

Both iSCSI ports support fallback speeds of 100 Mbits and 10 Mbits. The ports are designated in the following way:

| E | F |
|---|---|

Each port uses an RJ-45 port for connection to the port's physical medium. The ports support Auto-MDI/MDIX technology, allowing you to use either standard (straight-through) or crossover Category 5 or better Ethernet cables.

Each 1 Gb iSCSI port has LEDs to indicate its status.

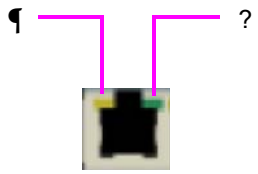



| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | LINK LED | Green | OFF = link status error. Visit the HDS Support Portal at portal.hds.com.<br>ON = link status is normal. |
| ? | ACT LED | Yellow | OFF = data is not being sent or received on the port.<br>ON = data is being sent or received on the port. |

## Management port

All Controller Boxes provide a 10/100/1000 Ethernet RJ-45 management port labeled **LAN 1**. This port is a 10BaseT/100Base-TX/1000BaseT Ethernet management interface that connects to a PC that will be used to configure the storage system using Storage Navigator Modular 2 software.

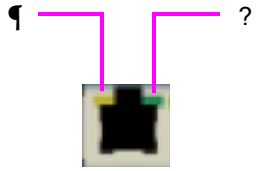
The management port supports Auto-MDI/MDIX technology, allowing you to use either standard (straight-through) or crossover Ethernet cable. It also has port activity and link status LEDs that indicate its status.




| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | ACT LED | Yellow | OFF = data is not being sent or received on the port.<br>ON = data is being sent or received on the port. |
| ? | LINK LED | Green | OFF = link status error. Visit the HDS Support Portal at portal.hds.com.<br>ON = link status is normal. |

## Maintenance port

All Controller Boxes provide a 10/100/1000 Ethernet RJ-45 maintenance port labeled **LAN 0**. This port is used to perform troubleshooting procedures. Do not use this port unless instructed by Hitachi Customer Service. This port has port activity and link status LEDs that indicate its status.




| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | ACT LED | Yellow | OFF = data is not being sent or received on the port.<br>ON = data is being sent or received on the port. |
| ? | LINK LED | Green | OFF = link status error. Visit the HDS Support Portal at portal.hds.com.<br>ON = link status is normal. |

## Host I/O Board and Host I/O Module

The following Host I/O Boards and Host I/O Modules are available for Hitachi Unified Storage systems:

- A Host I/O Board for CBXSS and CBXSL Controller Boxes that comes in two versions (see page 2-38):
  - 1 Gb iSCSI Host I/O Board with two 1 Gb iSCSI ports
  - 10 Gb iSCSI Host I/O Board with two 10 Gb iSCSI ports
- A Host I/O Board for CBSS and CBSL Controller Boxes that comes in three versions (see page 2-40):
  - 1 Gb iSCSI Host I/O Board with two 1 Gb iSCSI ports
  - 10 Gb iSCSI Host I/O Board with two 10 Gb iSCSI ports
  - Fibre Channel Host I/O Board with four Fibre Channel ports
- A Host I/O Module for the CBL/CBLE/CBLD Controller Box that comes in two versions (see page 2-55):
  - 10 Gb iSCSI Host I/O Module with two 10 Gb iSCSI ports
  - Fibre Channel Host I/O Module with four Fibre Channel ports

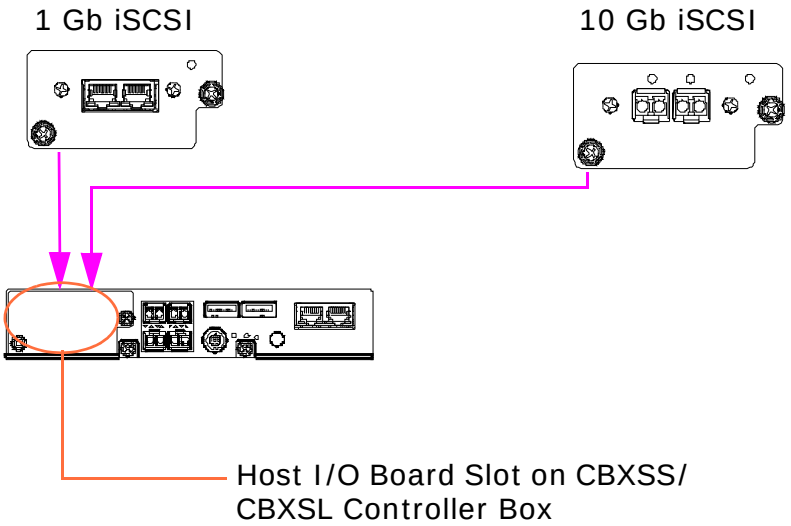
A CBXSS, CBXSL, CBSS, and CBSL Controller Box supports two Host I/O Boards. Facing the rear panel, the ports on the Host I/O Boards can be accessed at the top-left area of the controller.

The CBL/CBLE/CBLD Controller Box supports four Host I/O Modules. Facing the rear panel of the CBL/CBLE/CBLD Controller Box, the ports on the Host I/O Modules are located to the right of the Drive I/O Module.

### Host I/O Boards for CBXSS and CBXSL Controller Boxes

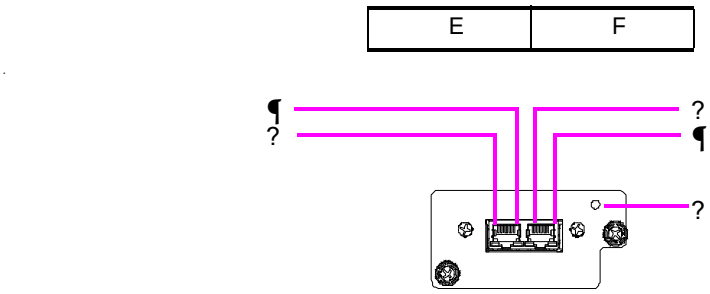
Host I/O Board options for CBXSS and CBXSL Controller Boxes are:

- 1 Gb iSCSI
- 10 Gb iSCSI



## 1 Gb iSCSI Host I/O Board

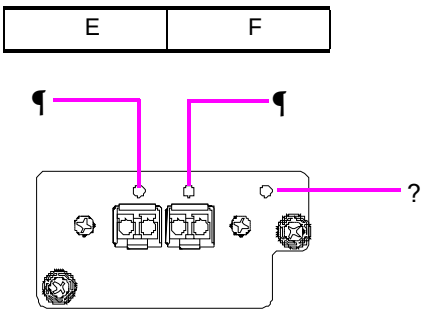
The 1 Gb iSCSI Host I/O Board for CBXSS and CBXSL Controller Boxes has two 1 Gb RJ-45 iSCSI ports. The ports are designated in the following way when the module is installed:




| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | ACT | Yellow | ON = data is being transferred. |
| ? | LINK | Green | ON = link status is normal. |
| ? | STATUS | Green | ON = Host I/O Board is in the power-on status. |
| | | Red | ON = Host I/O Board is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |

## 10 Gb iSCSI Host I/O Board

The 10 Gb iSCSI Host I/O Board for CBXSS and CBXSL Controller Boxes has two 10 Gb optical iSCSI ports. The ports are designated in the following way when the module is installed:

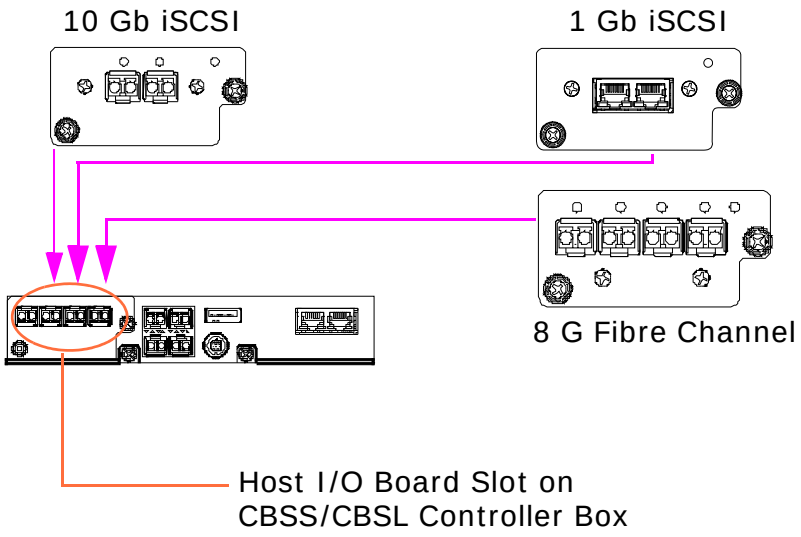



| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | HSTS | Blue | ON = normal link status. |
| | | Red | ON = abnormal operating status. Visit the HDS Support Portal at portal.hds.com. |
| ? | STATUS | Green | ON = Host I/O Board is in the power-on status. |
| | | Red | ON = Host I/O Board is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |

## Host I/O Boards for CBSS and CBSL Controller Boxes

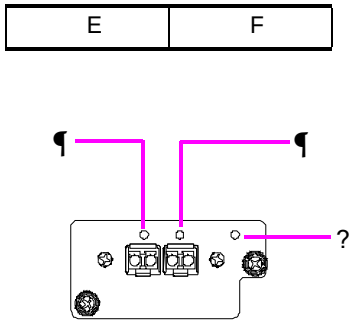
Host I/O Board options for CBSS and CBSL Controller Boxes are:

- 1 Gb iSCSI
- 10 Gb iSCSI
- 8 G Fibre Channel




## 10 Gb iSCSI Host I/O Board

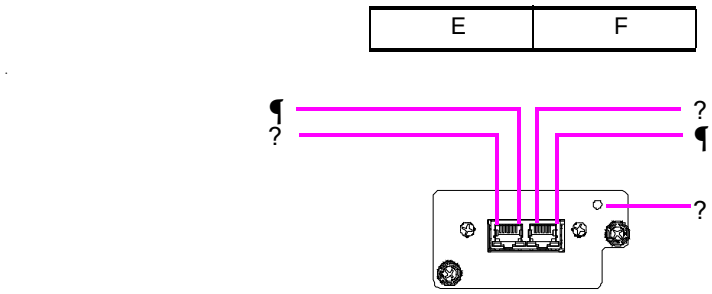
The 10 Gb iSCSI Host I/O Board for CBSS and CBSL Controller Boxes has two 10 Gb iSCSI ports. The ports are designated in the following way when the module is installed:




| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | HSTS | Blue | ON = normal link status. |
| | | Red | ON = abnormal operating status. Visit the HDS Support Portal at portal.hds.com. |
| ? | STATUS | Green | ON = Host I/O Board is in the power-on status. |
| | | Red | ON = Host I/O Board is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |

## 1 Gb iSCSI Host I/O Board

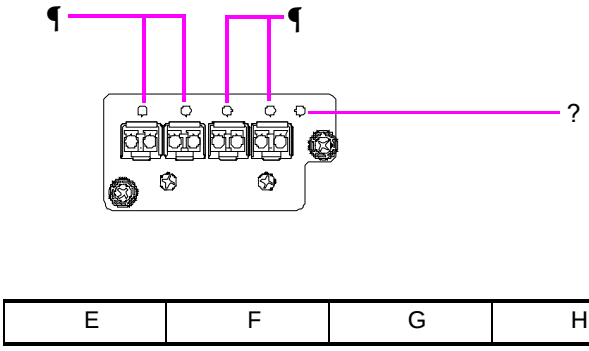
The 1 Gb iSCSI Host I/O Board for CBSS and CBSL Controller Boxes has two 1 G RJ45 iSCSI ports. The ports are designated in the following way when the module is installed:




| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | ACT | Yellow | ON = data is being transferred. |
| ? | LINK | Green | ON = link status is normal. |
| ? | STATUS | Green | ON = Host I/O Board is in the power-on status. |
| | | Red | ON = Host I/O Board is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |

## Fibre Channel Host I/O Board

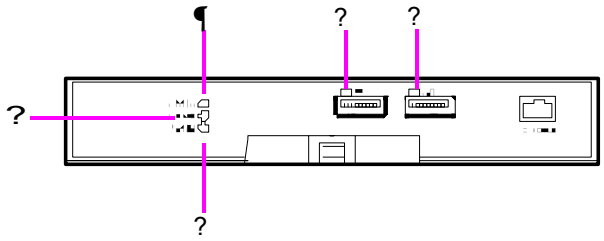
The Fibre Channel Host I/O Board for CBSS and CBSL Controller Boxes has four Fibre Channel ports. The ports support speeds up to 8 Gigabits, and automatically fall back to 4 and 2 Gigabits. The ports are designated in the following way when the module is installed:




| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | HALM | Red | ON = Host Connector is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |
| | | Blue | ON = normal link status at 8 Gbps. |
| | | Green | ON = normal link status at 2 or 4 Gbps. |
| ? | STATUS | Green | ON = Host I/O Board is in the power-on status. |
| | | Red | ON = Host I/O Board is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |

# I/O Module (ENC) and I/O Card (ENC)

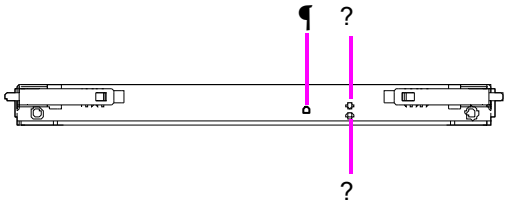
## I/O Module (ENC), DBS, DBSD, DBL, and DBLD Drive Boxes




| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | POWER | Green | ON = AC power is being provided to the I/O Module (ENC). |
| ? | PATH 0 (IN) | Green | ON = IN port is linked as follows:<br>• DBS/DBL connected to CBXSS/CBXSL/ CBSS/CBSL/CBL/CBLE/DBS/DBL/DBX.<br>• DBSD/DBLD connected to CBLD/DBSD/ DBLD. |
| ? | PATH 0 (OUT) | Green | ON = OUT port is linked as follows:<br>• DBS/DBL connected to DBS/DBL/DBX.<br>• DBSD/DBLD connected to DBSD/DBLD. |
| ? | ALM | Red | ON = error with I/O Module (ENC) or I/O Card (ENC), rendering the module or card unusable. Visit the HDS Support Portal at portal.hds.com. |
| ? | LOC | Orange | ON = CUDG, RAM, or I/O configuration error. Visit the HDS Support Portal at portal.hds.com.<br>• Fast blinking 2 times: CUDG error in ENC card.<br>• Fast blinking 3 times: firmware error in flash memory. |

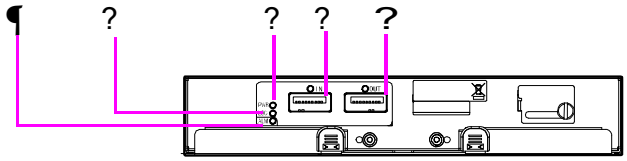
**NOTE:** A CBXSS/CBXSL cannot connect to a DBX/DBW. A CBLD can connect to a DBSD/DBLD only.

## I/O Card (ENC), DBX Drive Box



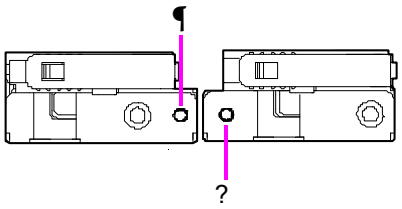

| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | PWR | Green | ON = AC power is being provided to the I/O Card (ENC). |
| ? | LOCATE | Orange | ON when adding chassis with power turned on = chassis is being added. This is not an error.<br>ON = CUDG or RAM error detected by ENC firmware, or ENC error. Visit the HDS Support Portal at portal.hds.com.<br>• Fast blinking 2 times: CUDG error in ENC.<br>• Fast blinking 3 times: firmware error in flash memory. |
| | | Blue | ON = SAS OUT side has made a link. |
| ? | ALARM | Red | ON = error with I/O Module (ENC) or I/O Card (ENC), rendering the module or card unusable. Visit the HDS Support Portal at portal.hds.com. |

## I/O Module (ENC), DBF Drive Box




| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | LOCATE | Orange | ON when adding chassis with power turned on = chassis is being added. This is not an error.<br>ON = CUDG or RAM error detected by ENC firmware, or ENC error. Visit the HDS Support Portal at portal.hds.com.<br>• Fast blinking 2 times: CUDG error in ENC.<br>• Fast blinking 3 times: firmware error in flash memory. |
| ? | ALARM | Red | ON = error with I/O Module (ENC) or I/O Card (ENC), rendering the module or card unusable. Visit the HDS Support Portal at portal.hds.com. |
| ? | PWR | Green | ON = AC power is being provided to the I/O Card (ENC). |
| ? | PATH (IN) | Green | ON = IN port is linked. |
| ? | PATH (OUT) | Green | ON = OUT port is linked. |

## Cable Holder (ENC), DBX

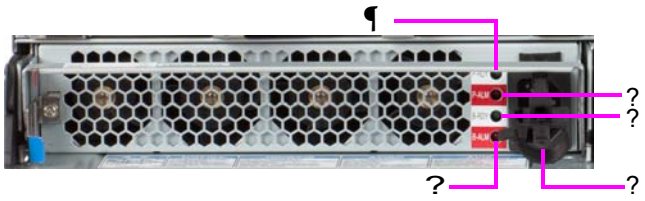



| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | ALM | Red | ON = I/O Card (ENC) error. Visit the HDS Support Portal at portal.hds.com. |
| | | Blue | ON = SAS IN side has made a link. |
| ? | LOCATE | Orange | ON = CUDG, RAM, or I/O configuration error. Visit the HDS Support Portal at portal.hds.com.<br>• High-speed blinking 2 times: CUDG error in ENC card.<br>• High-speed blinking 3 times: firmware error in flash memory. |
| | | Blue | ON = SAS OUT side has made a link. |

# Power Unit

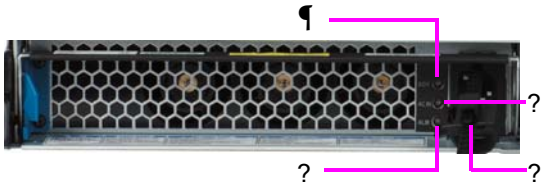
The Power Unit provides the power sockets for connection to an AC power source. The Power Unit also provides LEDs to indicate its status.

## Power Unit for CBXSS, CBXSL, CBSS, and CBSL Controller Boxes



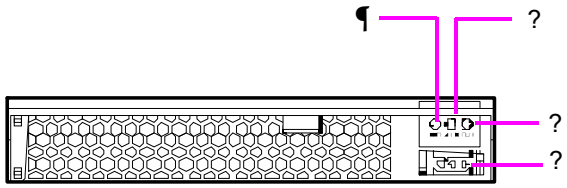

| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | P-RDY | Green | ON = Power Unit is operating normally. |
| ? | P-ALM | Red | ON = Power Unit is experiencing trouble. Visit the HDS Support Portal at portal.hds.com. |
| ? | B-RDY | Green | ON = battery status is normal.<br>Blinking = battery status is charged at start-up.<br>OFF = battery status is abnormal or battery is not installed. If the battery is installed, visit the HDS Support Portal at portal.hds.com. |
| ? | Power Socket | | Connects to AC power source. |
| ? | B-ALM | Red | ON = cache backup battery has failures. Visit the HDS Support Portal at portal.hds.com. |

## Power Unit for DBS and DBL Drive Boxes



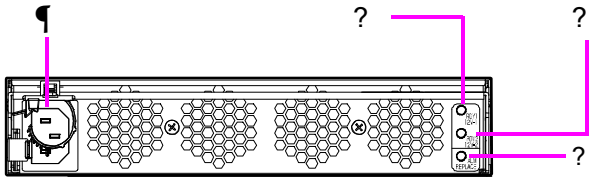

| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | RDY | Green | ON = Power Unit is operating normally. |
| ? | AC IN | Green | ON = AC input is normal. |
| ? | Power Socket | | Connects to AC power source. |
| ? | ALM | Red | ON = Power Unit is experiencing trouble. Visit the HDS Support Portal at portal.hds.com. |

## Power Unit for DBSD/DBLD Drive Box




| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | RDY | Green | ON = Power Unit is operating normally. |
| ? | DC IN | Green | ON = DC input is normal. |
| ? | ALM | Red | ON = Power Unit is experiencing trouble. Visit the HDS Support Portal at portal.hds.com. |
| ? | Power Socket | | Connects to DC power source. |

## Power Unit for DBF Drive Box

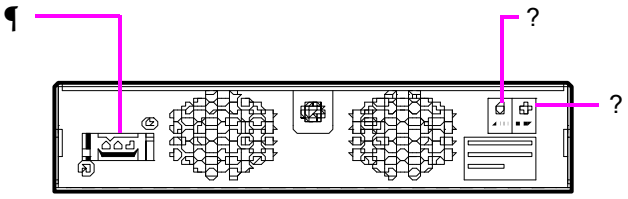



| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | Power Socket | | Connects to AC power source. |
| ? | RDY 1 | Green | ON = Power Unit is operating normally. |
| ? | RDY 2 | Green | ON = Power Unit is operating normally. |
| ? | ALM | Red | ON = Power Unit is experiencing trouble. Visit the HDS Support Portal at portal.hds.com. |

## Power Unit for CBL/CBLE Controller Box

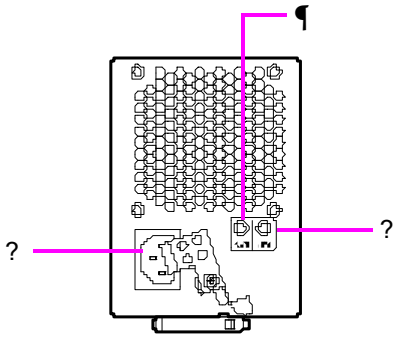
| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | Power Socket | | Connects to AC power source. |
| ? | ALM | Red | ON = Power Unit is experiencing trouble. Visit the HDS Support Portal at portal.hds.com. |
| ? | RDY | Green | ON = Power Unit is operating normally. |

## Power Unit for CBLD Controller Box




| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | Power Socket | | Connects to DC power source. |
| ? | ALM | Red | ON = Power Unit is experiencing trouble. Visit the HDS Support Portal at portal.hds.com. |
| ? | RDY | Green | ON = Power Unit is operating normally. |

## Power Unit for DBX Drive Box




| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | ALM | Red | ON = Power Unit is experiencing trouble. Visit the HDS Support Portal at portal.hds.com. |
| ? | RDY | Green | ON = Power Unit is operating normally. |
| ? | Power Socket | | Connects to AC power source. |

# CBL/CBLE/CBLD Controller Box

The front of the CBL/CBLE/CBLD Controller Box provided access to:

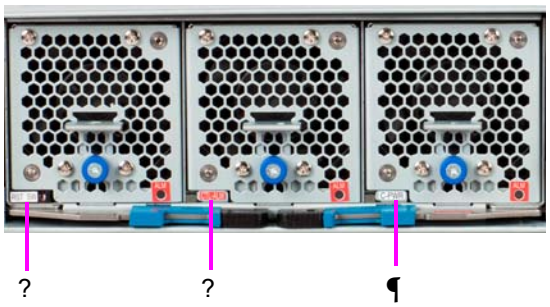
- Controller - see CBL/CBLE/CBLD controller, below
- Fan Module - see Fan Module on page 2-49
- Panel Assembly - see Panel assembly on page 2-49
- Cache backup battery - see Cache backup battery on page 2-50

The rear of the CBL/CBLE/CBLD Controller Box provides access to:

- Management Module — see page 2-53
- Drive I/O Module — see page 2-54
- Host I/O Module — see page 2-55

## Front of CBL/CBLE/CBLD Controller Box

### CBL/CBLE/CBLD controller




| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | C-PWR LED | Green | ON = controller status is normal.<br>Blink = data in cache memory is stored in the backup controller. |
| ? | CTL-ALM LED | Red | ON = fatal error. Visit the HDS Support Portal at portal.hds.com. |
| | | Orange | ON = controller is in the reset status. |
| ? | Reset Switch | | Use the Reset switch only when instructed by Hitachi Support. |

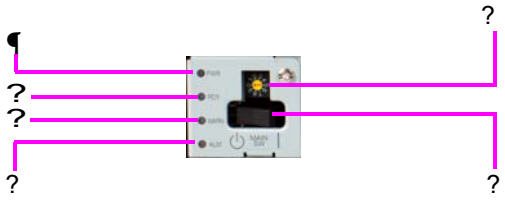
## Fan Module

The CBL/CBLE/CBLD Controller Box has Fan Modules for cooling. Each Fan Module has an **ALM** LED that shows its operating status.

| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | ALM | Red | ON = abnormal operating status. Visit the HDS Support Portal at portal.hds.com.<br>OFF = normal operation. |

## Panel assembly

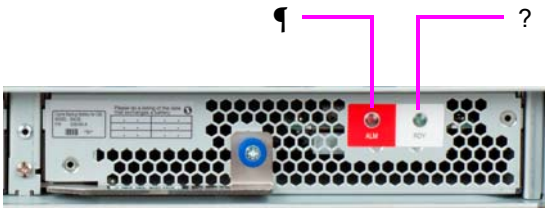
The CBL/CBLE/CBLD panel assembly contains four LEDs and a switch. The switch should be left in its current position and should not be changed.




| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | PWR LED | Green | ON = storage system is receiving AC power. |
| ? | Mode Switch | Not used | |
| ? | Main Switch | Turns power on or off.<br>= power on.<br>= power off. | |
| ? | ALM LED | Red | ON = fatal error. Visit the HDS Support Portal at portal.hds.com. |
| ? | WARN LED | Orange | ON = fatal error. Visit the HDS Support Portal at portal.hds.com. |
| ? | RDY LED | Green | ON = storage system is operational. |

## Cache backup battery

The cache backup battery on the CBL/CBLE/CBLD Controller Box has two LEDs: ALM and RDY.




| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | ALM LED | Red | ON = problem with cache backup battery. Visit the HDS Support Portal at portal.hds.com.<br>OFF = normal operation for cache backup battery. |
| ? | RDY LED | Green | ON = normal condition for battery.<br>Blinking = battery is charging at start-up.<br>OFF = abnormal status due to:<br>Cache backup battery not being installed.<br>Cache backup battery voltage being abnormal.<br>Battery temperature being abnormal.<br>Visit the HDS Support Portal at portal.hds.com. |

## Rear panel of CBL/CBLE/CBLD Controller Box

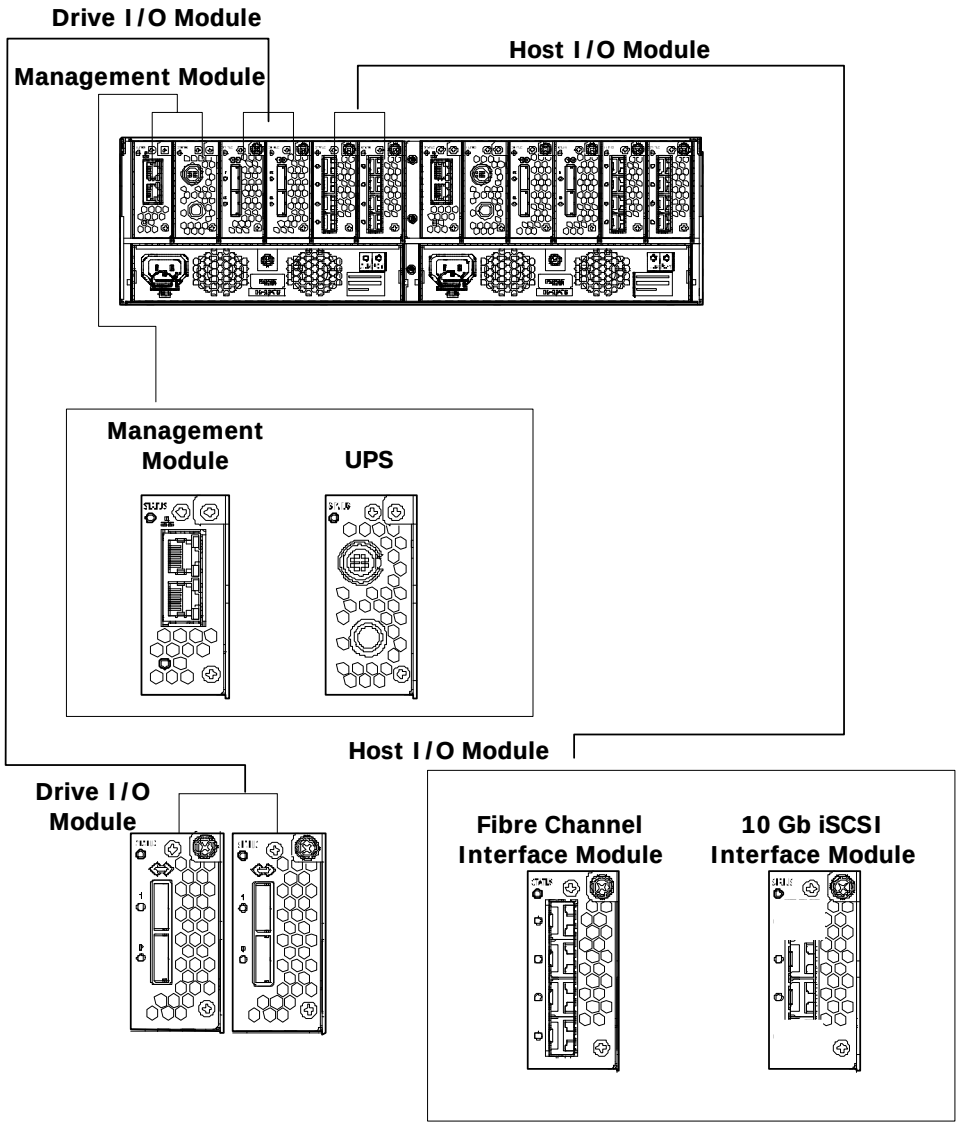



**Figure 2-32: Modules on rear of CBL/CBLE Controller Box**

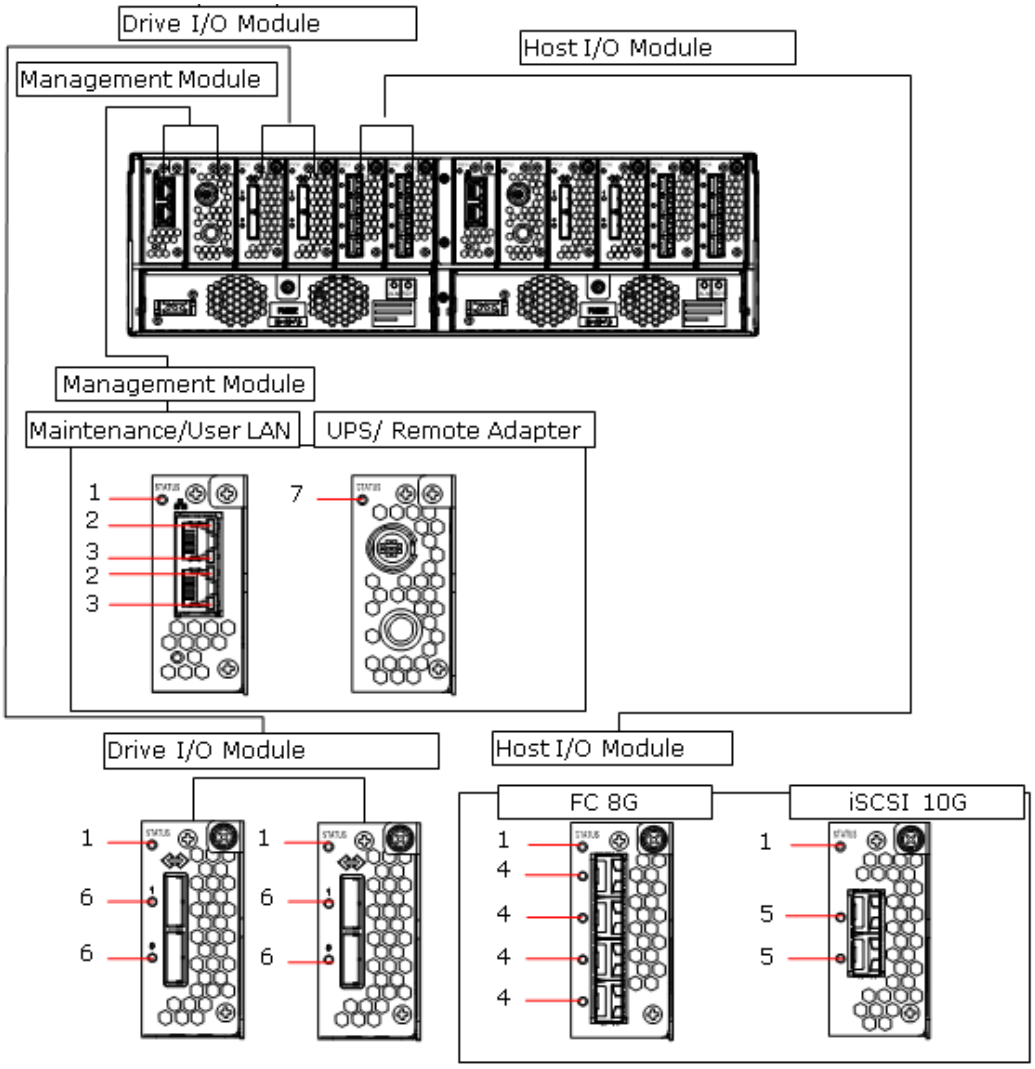



**Figure 2-33: Modules on rear of CBLD Controller Box**

## Management Module for CBL/CBLE/CBLD Controller Box

The Management Module consists of two side-by-side modules. Facing the back of the CBL/CBLE/CBLD Controller Box:

- The left module has a status LED, management port, and maintenance port.
- The right module has a status LED and an uninterruptible power supply port.

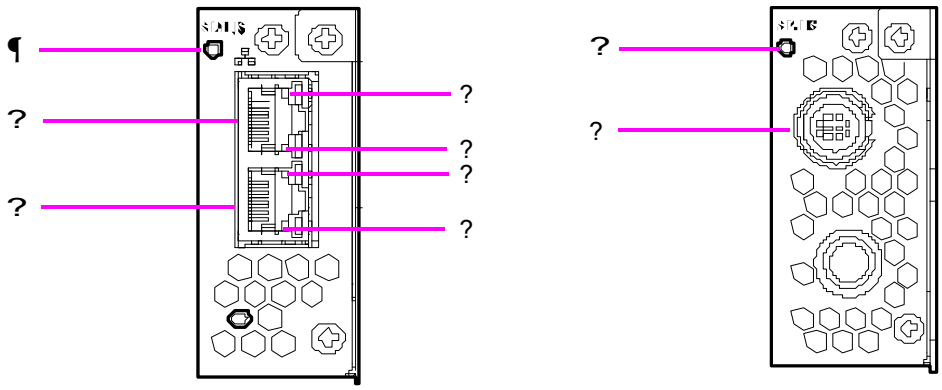



**Figure 2-34: CBL/CBLE/CBLD Management Module**

| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | STATUS LED | Green | ON = power-on status. |
| | | Red | ON = abnormal operating status. Visit the HDS Support Portal at portal.hds.com. |
| ? | ACT LED | Yellow | ON = data is being transferred. |
| ? | LINK LED | Green | ON = link status is normal. |
| ? | **LAN 0 Maintenance Port** See Maintenance port on page 2-37. | | |
| ? | **LAN 1 Management Port** See Management port on page 2-37. | | |
| ? | STATUS LED | Green | ON = power-on status. |
| ? | UPS Connector | — | Connects to an uninterruptible power supply. (This connector is not used on the CBLD Controller.) |

## Drive I/O Module for CBL/CBLE/CBLD Controller Box

The Drive I/O Module consists of two identical modules that each contain a status LED and two connectors for attaching Drive Boxes.

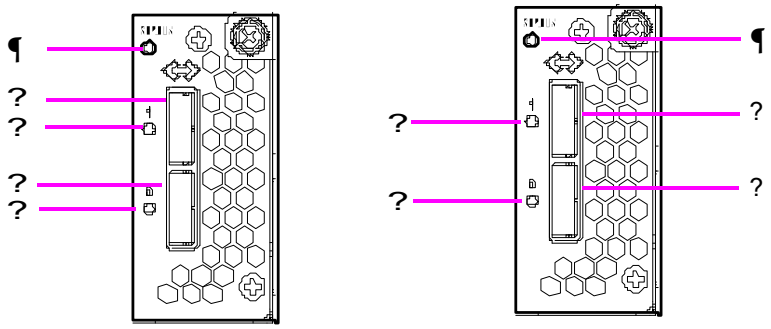



**Figure 2-35: CBL/CBLE/CBLD Drive I/O Module**

| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | Status LED | Green | ON = power-on. |
| | | Red | ON = abnormal operating status. Visit the HDS Support Portal at portal.hds.com. |
| ? | PATH 3 Drive Box Port | | Connector for connecting:<br>• CBL/CBLE to DBS/DBL/DBF/DBX/DBW.<br>• CBLD to DBSD/DBLD. |
| ? | PATH 2 Drive Box Port | | Connector for connecting:<br>• CBL/CBLE to DBS/DBL/DBF/DBX/DBW.<br>• CBLD to DBSD/DBLD. |
| ? | Link/Locate LED | Blue | ON = Drive Box is connected and link status is normal. |
| | | Orange | ON = a Storage Navigator Modular 2 wizard indicates that a SAS (ENC) cable must to be inserted into the port. |
| ? | PATH 1 Drive Box Port | | Connector for connecting:<br>• CBL/CBLE to DBS/DBL/DBF/DBX/DBW.<br>• CBLD to DBSD/DBLD. |
| ? | PATH 0 Drive Box Port | | Connector for connecting:<br>• CBL/CBLE to DBS/DBL/DBF/DBX/DBW.<br>• CBLD to DBSD/DBLD. |

## Host I/O Modules for CBL/CBLE/CBLD Controller Box

Host I/O Modules consist of two side-by-side modules. Each module contains either two 10 Gb iSCSI connectors or four Fibre Channel connectors for interfacing to the storage network.

### 10 Gb iSCSI Host I/O Module

Two 10 Gb iSCSI ports are offered as an optional Host I/O Module. The 10 Gb iSCSI ports are oriented vertically and reside to the right of the Drive I/O Module. The ports are designated in the following way:

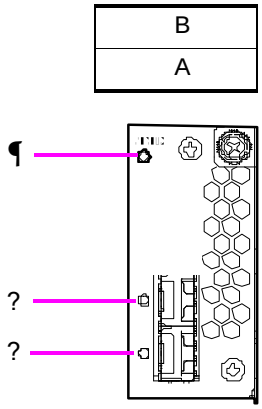



**Figure 2-36: 10 Gb iSCSI Host I/O Module**

| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | STATUS | Green | ON = Host I/O Module is in the power-on status. |
| | | Red | ON = Host I/O Module is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |
| ? | HSTS | Blue | ON = normal link status. |
| | | Red | ON = abnormal operating status. Visit the HDS Support Portal at portal.hds.com. |

## Fibre Channel Host I/O Module

Four Fibre Channel ports are offered as an optional Host I/O Module. The ports support speeds up to 8 Gigabits, and can automatically fall back to 4 and 2 Gigabits.

The Fibre Channel ports are oriented vertically and reside to the right of the Drive I/O Module. The ports are designated in the following way:

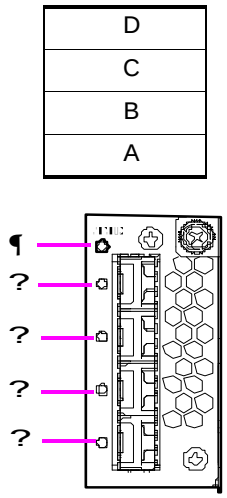



**Figure 2-37: Fibre Channel Host I/O Module**

| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | STATUS | Green | ON = Host I/O Module is in the power-on status. |
| | | Red | ON = Host I/O Module is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |
| ? | HALM | Red | ON = abnormal operating status. Visit the HDS Support Portal at portal.hds.com. |
| | | Blue | ON = normal operation at 8 Gbps. |
| | | Green | ON = normal operation at 2 or 4 Gbps. |

# DBW Drive Box

This section describe the following components on the DBW Drive Box:

- I/O Module ENC — see I/O Module (ENC) for DBW Drive Box, below
- Power Unit — Power Unit for DBW Drive Box on page 2-58
- Drive Box drawer — DBW Drive Box drawer on page 2-59
- Fan Module — DBW Fan Module on page 2-60

## I/O Module (ENC) for DBW Drive Box

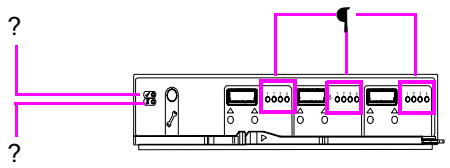



**Figure 2-38: DBW I/O Module (ENC) LEDs**

| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | External Port Activity | Green | ON = port is linked up.<br>Blinking = data is being transferred. |
| ? | ALM | Orange | ON = failure with I/O Module (ENC), rendering the module unusable. Visit the HDS Support Portal at portal.hds.com.<br>Blinking = after an I/O Module (ENC) failure, logs are collected from the failed I/O Module (ENC). During the collection, this LED blinks. When log collection completes, this LED goes ON. |
| ? | RDY | Green | ON = I/O Module is operating normally. |

The DBW I/O Module has a Drive Box with the connectors shown and described in Figure 2-39.

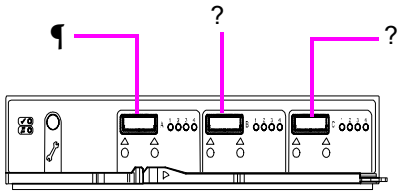



**Figure 2-39: DBW Drive I/O Module connectors**

| Legend | Connector | Description |
|---|---|---|
| ¶ | SAS Port A (IN) | Connects to CBSS, CBSL, CBL, CBLE, DBS, DBL, DBF, DBX, or DBW. |
| ? | SAS Port B (OUT) | Connects to DBS, DBL, DBF, DBX, or DBW. |
| ? | SAS Port C | Not used. |

**NOTE:** A CBXSS/CBXSL Controller Box cannot connect to a DBX/DBW Drive Box

## Power Unit for DBW Drive Box

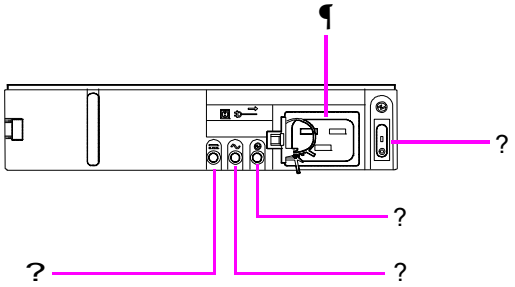



**Figure 2-40: DBW Drive Box Power Unit**

| Legend | Component | Color | Description |
|---|---|---|---|
| ¶ | Receptacle | — | Accommodates power cable. |
| ? | Switch | — | Press ON to apply power to the DBW Drive Box.<br>Press OFF to remove power from the DBW Drive Box. |
| ? | Power OK LED | Green | ON = Power Unit is operating normally. |
| ? | AC ALM LED | Orange | ON = Power Unit is experiencing trouble. Visit the HDS Support Portal at portal.hds.com. |
| ? | PSU ALM LED | Orange | ON = Power Supply Unit is experiencing trouble. Visit the HDS Support Portal at portal.hds.com. |

## DBW Drive Box drawer

The DBW Drive Box has a top drawer and a bottom drawer. Each drawer has the LEDS shown and described in Figure 2-41.

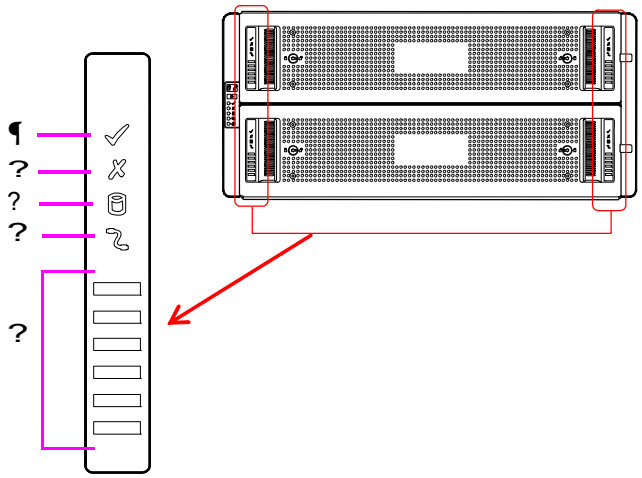



**Figure 2-41: DBW Drive Box drawer**

| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | Sideplane OK/Power Good | Green | ON = normal sideplane operation. |
| ? | Sideplane ALM | Orange | ON = drive failure. Visit the HDS Support Portal at portal.hds.com. |
| ? | Logical ALM | Orange | ON = logical failure. Visit the HDS Support Portal at portal.hds.com. |
| ? | Cable ALM | Orange | ON = cable between the drawer and the I/O Module (ENC) is operating abnormally. Visit the HDS Support Portal at portal.hds.com. |
| ? | Activity Bar Graph | Green | Not used. |

## DBW Fan Module

The DBW Drive Box has Fan Modules for cooling. Each Fan Module has the LEDs shown and described in Figure 2-42.

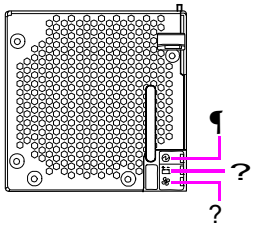



**Figure 2-42: DBW Fan Module LEDs**

| Legend | LED | Color | Description |
|---|---|---|---|
| ¶ | Module OK | Green | ON = normal fan operation. |
| ? | Battery Fault | Orange | Not used. |
| ? | FAN ALM | Orange | ON = fan module is operating abnormally. Visit the HDS Support Portal at portal.hds.com. OFF = fan module is operating normally. |

# 3

# Preparing your site

This chapter describes how to prepare your site before installing a Hitachi Unified Storage system.

The following topics are covered in this chapter:

- Site preparation responsibilities
- Preparing your site
- Pre-installation checklist

# Site preparation responsibilities

The following sections identify the responsibilities of the user and of Hitachi Data Systems when it comes to installing Hitachi storage systems.

## User responsibilities

The user is responsible for performing the following tasks, with assistance as needed from the Hitachi Data Systems account team, to prepare for installation of the Hitachi Unified Storage hardware:

- Reading this document carefully to understand installation requirements. You will use the information in this document to determine the specific requirements for your installation.
- Performing the installation planning tasks described in this document.
- Completing the checklist in Table 3-2 on page 3-13 before equipment delivery to verify that all installation requirements are met. If any requirements are not met, make the changes required to meet the requirements. Be sure to allow enough time to complete the required changes, so that the site is ready when the equipment arrives.
- Providing the customer-supplied hardware that is required for installation and configuration, such as electrical connectors and receptacles (see Required items supplied by the user on page 4-5).
- Observing all applicable safety requirements at all times (see Safety considerations on page 3-9).
- Working with your Hitachi account team during the installation planning process. This step may include:
  - Providing Hitachi with delivery instructions.
  - Unloading the shipping carton.
  - Verifying that neither the carton nor the items in it have been damaged.
  - Confirming that all items on the packing list have been delivered, and that no items are missing.
  - Receiving and inspecting the Hitachi Unified Storage hardware.
  - Transporting the hardware to the installation location.
  - Ensuring there are no obstructions to getting the Hitachi Unified Storage hardware to its final location (narrow doorways, etc.).

## Site / installation coordinator responsibilities

If a site or installation coordinator will be involved, that person should:

- Review this document for safety information and system requirements.
- Coordinate personnel and tasks.
- Order required materials.
- Choose the site.
- Review checklists with the Hitachi representative to verify that the site is prepared properly.
- Schedule the installation and personnel for the installation date.
- Ensure that the site is clear of unnecessary material on the installation day.
- Be available throughout the installation.

## Facilities personnel responsibilities

If facilities personnel will be involved, those individuals should ensure that installation requirements are met for:

- Space at the installation site
- Temperature and humidity
- Ventilation
- Computer
- Safety and installation materials

In addition, facilities personnel should move the Hitachi Unified Storage hardware in its shipping containers to the installation site before the installation date and be available if needed during the installation. See Appendix E for environmental specifications.

## Hitachi responsibilities

Your Hitachi account team will assist you throughout the site planning process. The account team is responsible for:

- Assisting you as needed to plan the installation for your specific site and operational configuration.
- Coordinating Hitachi resources to ensure smooth delivery, installation, and configuration of the Hitachi Unified Storage hardware.

# Preparing your site

Planning the proper location and layout of the Hitachi Unified Storage system is essential for its successful operation. Equipment placed too close together or in an inadequately ventilated area can cause over-temperature conditions. In addition, poor equipment placement can make the rear panel inaccessible.

To ensure normal operation and to avoid unnecessary maintenance, plan your site configuration and prepare your site before installation. The following sections provide guidelines to be observed when preparing your site prior to installing the storage system.

## Site considerations

The following precautions will help you plan an acceptable operating environment for Hitachi Unified Storage systems and will help you avoid environmentally caused equipment failures.

- Select a flat location that is clean, with no dust or exposure to direct sunlight or vibrations. The location should provide a sturdy, level surface that can support the storage system. Avoid locations with inclined floors.
- The location should be fairly cool and dry for the acceptable temperature and humidity ranges. It should not exceed 104°F (40°C); otherwise, the storage system's battery life will be shortened.
- The location should not be prone to variations in temperature and humidity, or be close to strong magnetic fields or a device that generates electric noise.
- For acoustic reasons, we recommend you install DBW Drive Boxes in a room with other machines instead of in an office workplace environment.
- The location should not place the storage system next to, on top off, or below any device that generates heat or will block the fee flow of air through the storage system's ventilation slots.
- Electrical equipment generates heat. Ambient air temperature might not be adequate to cool equipment to acceptable operating temperatures without adequate circulation. Ensure that the room in which the units operate has adequate air circulation.
- Always follow the ESD-prevention procedures described in Electrostatic safety on page 3-12 to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.
- Ensure that the enclosure cover is secure. The enclosure is designed to allow cooling air to flow effectively within it. An open chassis allows air leaks, which may interrupt and redirect the flow of cooling air from internal components.
- The site should have a power outlet within six feet (1.82 meters) of the storage system. The site should allow all system cabinets and racks to be grounded to the CO GRD system, using a 6 AWG (or larger) Copper cable, terminated with listed 2-hole compression lugs.

**NOTE:** For unit dimensions and weight and environmental specifications, see Appendix E, Specifications.

## Space requirements

The installation site requires sufficient space for installation, operation, and servicing the units and sufficient ventilation to provide a free flow of air to the units. To prevent overheating, the Hitachi Unified Storage system has ventilation holes on the front and back of the enclosure. Allow for at least six inches (152.3 mm) of space at the front and back of the storage system for ventilation. There should also be enough space to view LEDs and access drives and interface connectors.

## Power considerations

Hitachi Unified Storage systems have an input power rating of 125V–240V operation. The units come with a set of electrical power cables. A label near the power cord indicates the correct voltage, frequency, current draw, and power dissipation that should be used with the cable. Use the appropriate power cable for your location. Also, check the power at your site to ensure that you are receiving “clean” power (free of spikes and noise). Install a power conditioner if necessary.

**NOTE:** For rack power considerations, see Appendix C.

## Electrical requirements

The Hitachi Unified Storage Controller Box and Drive Box are equipped with two fully redundant wide-ranging power supplies that automatically accommodate voltages to the AC power source. The AC power supplies operate within the range of 100-125 VAC or 200-240 VAC. The power supplies meet standard voltage requirements for both domestic (inside USA) and international (outside USA) operation. When connecting to an AC source, be sure the current does not exceed the rating of the power source circuitry. This includes cabling, power distribution units, filters, and any other components through which the main AC flows.

These requirements must be added to the power demands of any other electrical devices installed in the equipment rack to arrive at a total power consumption figure. In addition, surge currents must be accommodated. Disk drives normally consume twice the amount of current at startup as they do during steady-state operation.

If you purchase the Hitachi Unified Storage Controller Box and Drive Boxes pre-installed in the Hitachi rack, the rack will require four 30 amp, 208 Volt circuits, source power, which use the L630P plug and require L630 connectors.

**NOTE:** If you have the CBLD, DBSD, or DBLD DC power units, see Appendix E for more information.

## Environmental requirements

For information about the environmental conditions that are prerequisite to installing the Hitachi Unified Storage system, see Environmental specifications on page E-45.

## Floor load ratings

The floor space at the installation site must be strong enough to support the combined weight of the:

- Hitachi Unified Storage Controller Box
- Hitachi Unified Storage Drive Boxes
- The rack holding the Hitachi Unified Storage base and Drive Boxes
- All associated equipment

To ensure adequate load-bearing capacity, plan for the maximum configuration. Table 3-1 lists the weight for maximum configurations. The table takes into account a rack that is not sold by Hitachi Data Systems. For rack information, see Appendix C.

The weights below do not include the rack itself, so add the weight of the rack to the values shown below. The maximum allowable weight in the Hitachi rack is 2,000 pounds (907 kg). For more information about the Hitachi rack, see Appendix C, Rack mounting the storage system.

**Table 3-1: Floor load ratings**

| Storage system | Maximum configuration | | Weight |
|---|---|---|---|
| | Controller Box | Drive Boxes | |
| Hitachi Unified Storage 110 | 1 CBXSS unit | 4 DBS units | 781 lbs<br>355 kg |
| | 1 CBXSS unit | 8 DBL units | 1,102.2 lbs<br>501 kg |
| | 1 CBXSL unit | 4 DBS units | 789.8 lbs<br>359 kg |
| | 1 CBXSL unit | 9 DBL units | 1,179.2 lbs<br>536 kg |

**Table 3-1: Floor load ratings (Continued)**

| Storage system | Maximum configuration | | Weight |
|---|---|---|---|
| | Controller Box | Drive Boxes | |
| Hitachi Unified Storage 130 | 1 CBSS unit | 14 DBS units | 1,448.4 lbs<br>657 kg |
| | 1 CBSS unit | 19 DBL units | 2,303.8<br>1,045 kg |
| | 1 CBSL unit | 14 DBS units | 1,441.8 lbs<br>654 kg |
| | 1 CBSL unit | 19 DBL units | 2,347.9 lbs<br>1,065 kg |
| | 1 CBSS unit | 7 DBX units | 2,526.5 lbs<br>1,146 kg |
| | 1 CBSL unit | 7 DBX units | 2,531 lbs<br>1,148 kg |
| | 1 CBSS unit | 4 DBW units | 1,750.4 lbs<br>794 kg |
| | 1 CBSL unit | 4 DBW units | 1,750.5 lbs<br>794 kg |
| Hitachi Unified Storage 150 | 1 CBL/CBLE unit | 40 DBS units | 4,008.4 lbs<br>1,822 kg |
| | 1 CBL/CBLE unit | 40 DBL units | 4,228.4 lbs<br>1,922 kg |
| | 1 CBL/CBLE unit | 40 DBF units | 1,576.3 lbs<br>715 kg |
| | 1 CBL/CBLE unit | 20 DBX units | 6,232 lbs<br>2,827 kg |
| | 1 CBL/CBLE unit | 12 DBW units | 5,026.5 lbs<br>2,280 kg |
| | 1 CBLD unit | 40 DBSD units | 4,016.8 lbs<br>1,822 kg |
| | 1 CBLD unit | 40 DBLD units | 4,237.2 lbs<br>1,922 kg |

## Rack planning

When planning your installation, consider the number of Controller Boxes and Drive Boxes associated with your installation.

For information about the maximum number of Drive Boxes supported by the Hitachi Unified Storage 110, see Table 1-11 on page 1-9. For information about the maximum number of Drive Boxes supported by the DBS, DBL, DBX, and DBW Drive Boxes, see Table 1-11 on page 1-9, Table 1-12 on page 1-9, Table 1-13 on page 1-11, and Table 1-14 on page 1-12.

Unlike the other Hitachi Unified Storage Controller Boxes, the CBL/CBLE/CBLD Controller Box contains no drives. Therefore, these Controller Boxes must be equipped with at least one Drive Box.

For additional information about the Hitachi rack, see Appendix C.

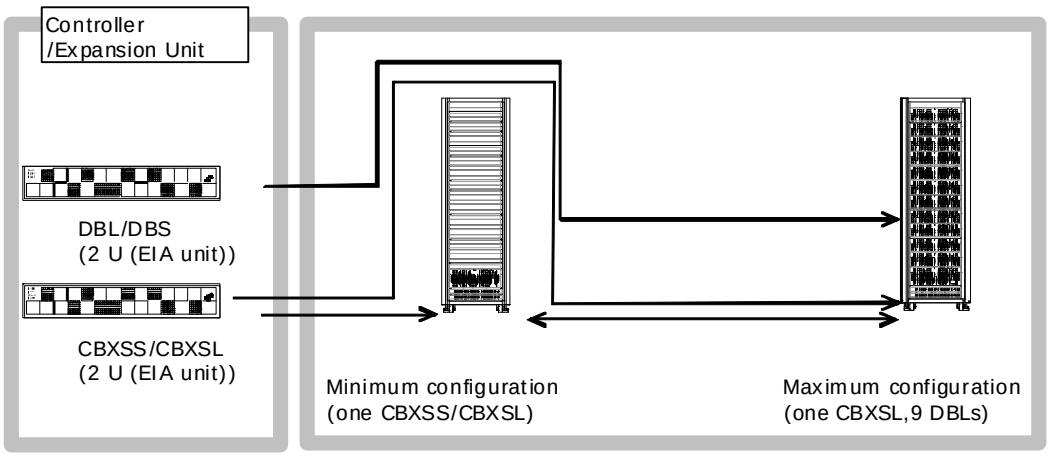



**Figure 3-1: Configuration of CBXSS/CBXSL+DBS/DBL units**

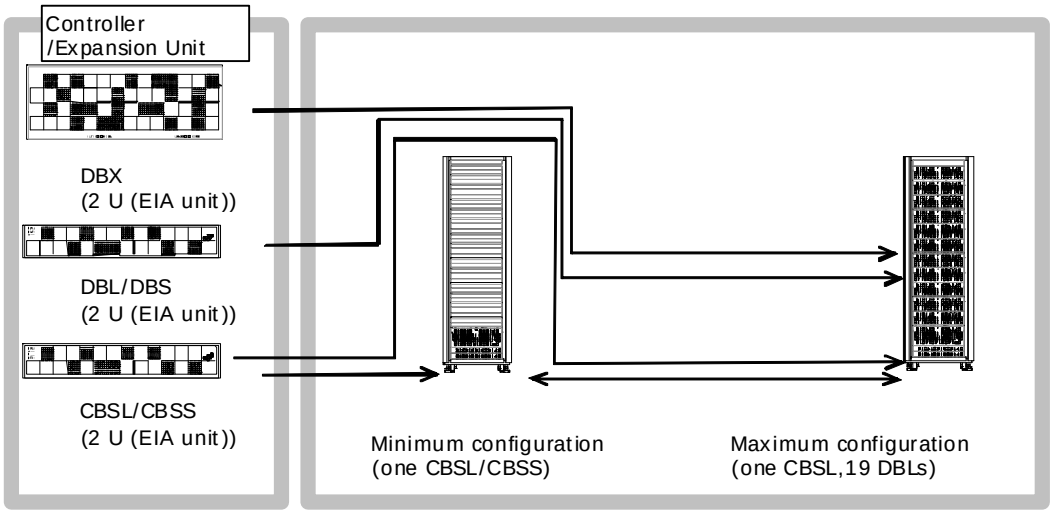



**Figure 3-2: Configuration of CBSS/CBSL+DBS/DBL/DBX units**

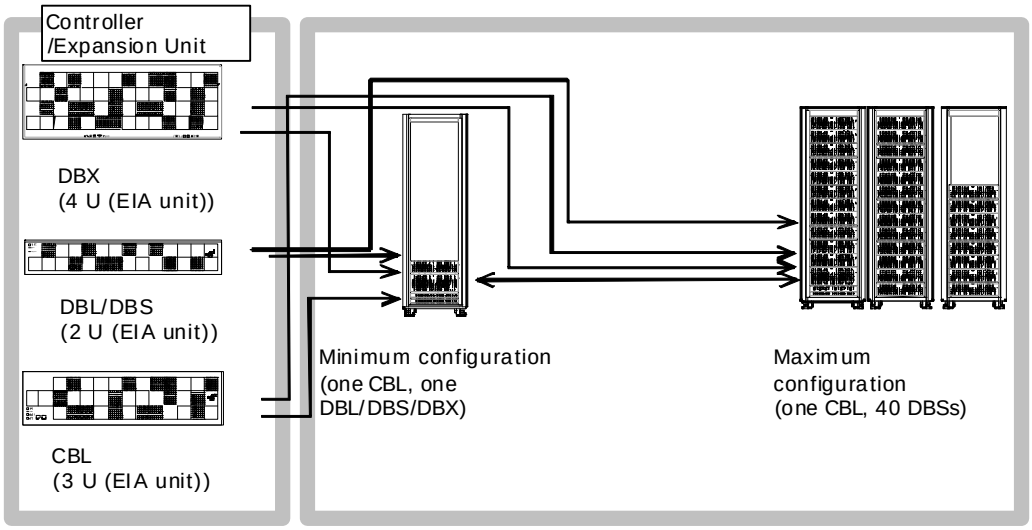



**Figure 3-3: Configuration of CBL+DBS/DBL/DBX units**

## Topology considerations

Plan the topology in which the storage system will be used. Determine whether you want to set up a simple dedicated point-to-point configuration, or include the storage system in a shared and potentially complex switch configuration that requires network expertise and possibly the use of security. A switch topology would be appropriate, for example, if the number of hosts that will connect to the Hitachi Unified Storage system exceeds the number of data ports on the storage system.Server considerations

- The Hitachi Unified Storage system supports a variety of client operating systems (see Items for storage system management on page 4-6).
- For iSCSI storage systems, be sure your server has:
  - An installed iSCSI host bus adapter (HBA) or network-interface card (NIC) with the latest drivers supported by Hitachi Data Systems.
  - An iSCSI initiator supported by Hitachi Data Systems.

  For the latest information about supported iSCSI HBAs, NICs, and iSCSI initiators, refer to the interoperability information at http://www.hds.com/products/interoperability/. Follow the directions for your iSCSI HBA or NIC to install the card and its appropriate driver(s). Install any required updates, such as service packs, hot fixes, or patches, and reboot the server when the installation is complete.
- For Fibre Channel storage systems, be sure your server has an installed Fibre Channel HBA with the latest drivers supported by Hitachi Data Systems. For the latest information about supported HBAs, refer to the interoperability information at http://www.hds.com/products/interoperability/. Follow the directions for your Fibre Channel HBA to install the card and its appropriate driver(s). Install any required updates, such as service packs, hot fixes, or patches, and reboot the server when the installation is complete.

## Safety considerations

Observe the following guidelines to ensure safety. Failure to follow these guidelines could result in bodily injury or damage to the Hitachi Unified Storage system chassis or components.

- When performing any installation, comply with all local health and safety requirements.
- Wear protective footwear when moving Hitachi Unified Storage hardware.
- Do not wear loose clothing that could get caught in the chassis or mounting hardware. Fasten ties and scarves and roll up sleeves.
- Wear safety glasses when working under conditions that are hazardous to your eyes.
- Keep walkways clear of tools, cables, and parts to prevent them from being stepped on or causing people to trip and fall.

- Do not work on the equipment or disconnect cables during a thunderstorm, when wearing a wool sweater or other heavy wool clothing, or when power is applied.
- Keep floors dry to prevent slips and falls.
- Do not use ungrounded power cables.
- Only use the power cables supplied with this product. Do not use power cables for other products. Otherwise, unexpected failures or accidents can occur.
- If you encounter unusual odors, heat generation, or smoke emission, shut off power to the equipment and inform the appropriate personnel Leaving such conditions unattended can cause electric shock or fire.
- Do not use the equipment for any use other than its original purpose.
- Keep the area clear and dust-free during and after installation.
- Do not block or cover the openings of the Hitachi Unified Storage hardware. Never place a unit near a radiator or heat register. Failure to follow these guidelines can cause overheating and affect the unit's reliability.
- Be sure the chassis cover is secure. The chassis is designed to let cooling air flow effectively within it. An open chassis allows air leaks that may interrupt and redirect the flow of cooling air from internal components.
- Disconnect all power before installation.
- Always turn off the storage system and unplug all data and power cables before lifting.
- Do not make mechanical or electrical modifications or repairs to the equipment. Such actions can cause an electric shock or cause the storage system to malfunction. Hitachi is not responsible for regulatory compliance of a modified Hitachi product.
- To minimize personal injury in an earthquake, fasten the Hitachi Unified Storage hardware securely to a rigid structure extending from the floor to the ceiling or from the walls of the room in which the units are located.
- This storage system has a built-in laser diode that meets the laser system standard of class 1. It does not emit the laser beam, which is harmful to a human body, outside the storage system. Operate the storage system according to this manual to avoid. accidents or failures.

## Warning about moving parts

Observe the following warning related to moving parts:

- Tuck in any loose clothing so that it will not be caught by a moving or rotating part such as a fan.
- Tie up long hair.
- Unless otherwise specifically instructed, do not supply power to any device that contains rotating or moving parts that are not properly covered.

- If instructed to supply power to any device with rotating or moving parts whose covers have been removed, work with another person who can immediately turn off the power in an emergency.

## Electrical safety

Observe the following safety guidelines:

- Disconnect all power before installation.
- Electrical equipment generates heat. Ambient air temperature might not be adequate to cool equipment to acceptable operating temperatures without adequate circulation. Ensure that the room in which you operate your system has adequate air circulation.
- Ensure that the voltage and frequency of your power source match the voltage and frequency required by the unit.
- All powered equipment should be properly grounded for proper operation and safety. To reduce the risk of electric shock or damage to equipment, follow proper grounding procedures.

## Preventing electric shock

To prevent electric shock, observe the following guidelines.

- Avoid placing heavy objects, containers with water, or tiny metallic articles such as a paper clips on the storage system.
- Do not place objects on power cables or place cables near devices that generate heat.
- Do not place metallic or combustible material such as paper near the equipment's air vents.
- Do not use the storage system in a moist or dusty location.
- Before starting work, be sure that, unless otherwise specifically instructed, there is no potential electric hazard in the maintenance area such as insufficient grounding or a wet floor. Also, note where emergency power-off switches are located and know how to operate them.
- Unless otherwise specifically instructed, remove all power sources to the storage system before staring work. Switching off power supplies is not enough. When power is fed from a wall or floor outlet, unplug the power supply cord or turn off the switch on the power distribution panel or board.

The following is a portion of 29 CFR 1910.147 "The control of hazardous energy (lockout/tagout)," in the OSHA (Occupational Safety & Health Administration U.S Department of Labor USA) Regulations.

- Lockout device. A device that uses a positive means such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.
- Energy isolating device. A mechanical device that physically prevents the transmission or release of energy, including but not limited to the

following: A manually operated electrical circuit breaker; a disconnect switch, a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

- Do not touch any uninsulated conductor or surface, where so instructed, which remains charged for a limited time after the external power supply to the machine is disconnected.
- When working on a machine which has a grounding terminal, make sure that the terminal is properly connected to the facility's ground.
- When working close to hazardously energized parts, do not work alone. Work with another person who can turn off the power in an emergency.

## Electrostatic safety

Electrostatic discharge (ESD) can damage static-sensitive devices, such as controllers and drives. Observe these guidelines when handling equipment:

- Wear an anti-static wrist strap to help prevent damage to the units due to electrostatic discharge (ESD). Connect the clip on the strap to an unpainted part of the chassis to safely channel any static electricity generated by your body to ground. If no wrist strap is available, ground yourself by touching an unpainted part of the chassis.
- Hold drives using the hand wearing the wrist strap. You can discharge static electricity by touching the frame of the drive.
- When installing or removing ESD-sensitive components such as the motherboard, memory, and other printed-circuit boards, place the components on an antistatic mat.

# Pre-installation checklist

Complete the checklist below (online or hardcopy) to verify that all installation requirements for the Hitachi Unified Storage system have been met. Successful completion of this checklist (Yes is checked for all entries) will ensure smooth and efficient installation of the storage system.

Definition of terms:

- Data center: The room at the customer site in which the units will be installed.
- Equipment: The hardware delivered to the customer site.
- Location: The specific location in the data center (area or “footprint” on the floor) where the units will be installed.

**Table 3-2: Pre-installation checklist**

| **Customer Information** | | **Date:** | |
|---|---|---|---|
| Company: | | | |
| Address: | | | |
| Contact: | | Phone: | |
| | | Mobile: | |
| | | Email: | |
| Contact: | | Phone: | |
| | | Mobile: | |
| | | Email: | |
| **Hitachi Data Systems Information** | | | |
| Contact: | | Phone: | |
| | | Mobile: | |
| | | Email: | |
| Contact: | | Phone: | |
| | | Mobile: | |
| | | Email: | |
| **Notes** | | | |
| | | | |

| Installation and Planning Checklist | Yes | No |
|---|---|---|
| **Safety** | | |
| Is the data center equipped to protect equipment from fire? | | |
| Is the data center free of hazards (for example, cables that obstruct access)? | | |
| **Delivery** | | |
| Is the receiving area adequate for equipment delivery and unloading? | | |
| Does the equipment fit through doors, halls, elevators, and stairs? | | |
| Do the floors, elevators, stairs, and ramps support the weight of the equipment? | | |
| **Storage** | | |
| If the equipment will be stored after delivery and prior to installation, does the storage location meet the environmental requirements for the Hitachi Unified Storage system? | | |
| **Facilities** | | |
| Is the data center fully operational (for example, power, air conditioning, cabling, fire-protection system)? | | |
| Does the data center provide adequate protection from ESD? | | |
| Does the data center provide adequate protection from electrical/radio frequency interference? | | |
| Does the data center provide adequate protection from dust, pollution, and particulate contamination? | | |
| Does the data center provide adequate acoustic insulation for operation of the Hitachi Unified Storage system? | | |
| Is the customer-supplied hardware (for example, connectors, receptacles, cables) ready for the installation? | | |
| **Physical** | | |
| Does the location meet the requirements for service clearance and cable routing (for example, floor cutouts)? | | |
| Does the location meet the requirements for floor load rating? | | |
| **Power** | | |
| Does the data center meet the AC input power requirements? | | |
| Does the data center meet the circuit breaker and plug requirements? | | |
| Does the data center meet the requirements for connection to the Hitachi Unified Storage system? | | |
| **Environmental** | | |
| Does the data center meet the requirements for temperature? | | |
| Does the data center meet the requirements for humidity? | | |
| Does the data center meet the requirements for altitude? | | |
| Does the data center meet the requirements for air flow? | | |
| Does the data center meet the requirements for vibration and shock? | | |
| **Operational** | | |
| Does the data center provide a LAN (or phone line)? | | |
| Does the data center provide a LAN for Hitachi Storage Navigator 2? | | |
| Does the location meet the cable length requirements for the front end directors? | | |
| Does the location meet the requirements for attaching external storage to the Hitachi Unified Storage system? | | |

# 4

# Installing the storage system

This chapter provides detailed instructions for installing Hitachi Unified Storage systems.

The following topics are covered in this chapter:

- Installation Roadmap
- Unpacking
- Required items supplied by the user
- Mounting the storage system
- Making data connections
- Connecting Drive Boxes
- Attaching the front panel bezel
- Removing the front panel bezel
- Connecting power cables and powering on
- Powering off the storage system
- Restarting the storage system

# Installation Roadmap

The Hitachi Unified Storage installation can be organized into the following categories:

- Hardware installation — mount and connect the storage system to your storage network.
- Configuration — configure your storage system
- Post-installation — configure your storage system for connectivity to host operating systems, register your storage system, and download the latest firmware.

Table 4-1 describes the steps to follow when installing your storage system.

**Table 4-1: Installation roadmap**

| Step | Description | See |
|---|---|---|
| | **Hardware installation** | |
| 1. | Unpack the contents in your Hitachi Unified Storage package. | page 4-3 |
| 2. | Gather the items required for the installation. | page 4-5 |
| 3. | Mount the storage system in a rack. | page 4-11 |
| 4. | Make the necessary data connections. | page 4-12 |
| 5. | Attach Drive Boxes. | page 4-16 |
| 6. | Attach the front panel bezel. | page 4-26 |
| 7. | Attach power cables and power-up the storage system. | page 4-31 |
| | **Configuration** | |
| 8. | Install Hitachi Storage Navigator Modular 2, log in, and configure the storage system. | Chapter 5 |
| | **Post installation** | |
| 9. | Register your storage system. | Appendix A |
| 10. | Download the latest firmware. | Appendix B |
| 11. | Configure the storage system for:<br>• Fibre Channel hosts and operating systems<br>• iSCSI hosts and operating systems (iSCSI Host I/O module) | Chapter 6<br>Chapter 7 |

# Unpacking

After receiving the storage system, perform the following steps to ensure that your contents arrived safely.

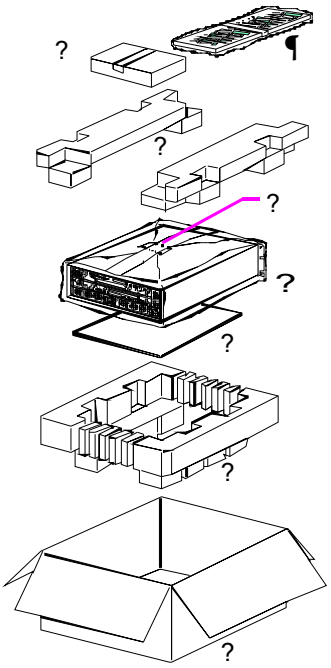
If the storage system arrives in hot or cold weather, do not unpack the storage system until it has been allowed to come to room temperature (one to two hours); otherwise, the storage system might not operate when power is supplied. Immediately exposing the storage system to warm temperature could cause condensation to occur, which could damage the electronics. If you notice any condensation, allow the storage system to stand unattended for one to two hours and then unpack it.

1. Inspect all shipping cartons for signs of damage. If you spot damage, contact the shipper.
2. Loosen the band around the cartons and open all cartons.
3. Compare the items received to the packing list. If an item is missing or damaged, contact your place of purchase.
4. Remove all packing materials, envelopes, and boxes from the cartons. Your carton should include an accessory box located under the packed storage system with rail kits for rack-mounting the storage system.

**WARNING! Unpacking should be done by two or more persons. Approximate weights of the storage system hardware are:**

- **Single CBXSS/CBSS = 88 lbs (40 kg)**
- **CBXSL/CBSL = 94.8 lbs (43 kg)**
- **CBL/CBLE = 103.6 lbs (47 kg)**
- **CBLD = 103.6 lbs (47 kg)**
- **DBF = 83.7 lbs (38 kg)**
- **DBS = 50.7 lbs (23 kg)**
- **DBSD = 50.7 lbs (23 kg)**
- **DBL = 59.5 lbs (27 kg)**
- **DBLD = 59.5 lbs (27 kg)**
- **DBX = approximately 187.3 (85 kg.)**
- **DBW = 281.6 (128 kg)**

5. Open and remove the bag in which the storage system is enclosed.
6. Keep all packing materials and cartons in case you need to transport or ship the storage system.



| Legend: | |
|---|---|
| ¶ | Front Bezel and Key (in polyethylene bag) |
| ? | Accessory Box |
| ? | Buffer Pads |
| ? | Desiccating Agent |
| ? | Storage System |
| ? | Pad |
| ? | Lower Buffer Pad |
| ? | Shipping Box |

# Required items supplied by the user

In addition to the contents supplied with the storage system, the following user-supplied items are required to perform the installation.

**NOTE:** For the latest information about supported operating systems, iSCSI initiators and NICs, and HBAs, see the interoperability matrix at: http://www.hds.com/products/interoperability/

## Items for all users

- A Hitachi or equivalent rack.
- Two AC outlets (100 V to 120/200 V to 240 V) per Controller Box and Drive Box
- Hardware and software required for Storage Navigator Modular 2 (see Items for storage system management)
- A host server configured as described under Items for storage system management
- Internet access via Internet Explorer v7.0 or Internet Explorer v6.0 (Service Pack 1), with pop-up blockers disabled

## Items for Fibre Channel users

- A host server containing an operating system supported by the storage system and one or more HBAs supported by the storage system, with the latest drivers installed.
- A Fibre Channel switch if the storage system will be used in a switch configuration.

**Table 4-2: Fibre Channel cable distances**

| Data transfer rate (MB/s) | Distance from host | | | |
|---|---|---|---|---|
| | 100 | 200 | 400 | 800 |
| Max 62.5/125 µm multimode Fibre (OM1) cable length | 984.25 ft (300 m) | 493 ft (150 m) | 229.6 ft (70 m) | 68.9 ft (21 m) |
| Max 50/125 µ m multimode Fibre (OM2) cable length | 1640.4 ft (500 m) | 984.25 ft (300 m) | 493 ft (150 m) | 164 ft (50 m) |
| Max 50/125 µm multimode Fibre (OM3) cable length | 2821.5 ft (860 m) | 1640.4 ft (500 m) | 1246.7 ft (380 m) | 493 ft (150 m) |

## Items for 1 Gb iSCSI users

- An IP address, subnet mask, gateway (if applicable), and a Category 5e or Category 6 Ethernet cable for each 1 Gb iSCSI data port that will connect to your storage network (see Table 4-3 and 1 Gb iSCSI cable on page F-4).
- A host server containing an operating system supported by the storage system, a 1 Gb iSCSI initiator supported by the storage system and operating system, and one or more 1 Gb NICs or 1 Gb iSCSI HBAs supported by the storage system, with the latest drivers installed.

- A 1 Gb Ethernet switch if the storage system will be used in a switch configuration.

**Table 4-3: 1 Gb iSCSI cable information**

| Cable type | Transmission band | Cable | Connector |
|---|---|---|---|
| Category 6 | 1000BASE-TX | STP<br>You must use STP cables to suppress radio noise.<br>Maximum distance from host: 328 feet (100 m) | RJ-45 |

## Items for 10 Gb iSCSI users

- An IP address, subnet mask, gateway (if applicable), and a 10 G Base-T optical cable for each 10 Gb iSCSI data port that will connect to your storage network (see Table 4-4 and 10 Gb iSCSI cable on page F-5).
- A host server containing an operating system supported by the storage system, a 10 Gb iSCSI initiator supported by the storage system and operating system, and one or more 10 Gb NICs or 10 Gb iSCSI HBAs supported by the storage system, with the latest drivers installed.
- A 10 Gb switch if the storage system will be used in a switch configuration.

**Table 4-4: 10 Gb iSCSI cable information**

| Cable type | Interface | Cable mode | Nominal | | |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| | | | | One side | Other side |
| SC-LC cable | Optical | Equivalent to sumitomo 3M 170AC-AAAA-XXX | 50/125 µm Multimode<br>Wavelength: 300 nm<br>Maximum distance from host:<br>OM3 – 984.25 feet (300 m)<br>OM2 – 269 feet (82 m) | SC connector (JIS C 5973) | LC connector |
| LC-LC cable | | | | LC connector | LC connector |

## Items for storage system management

- An IP address for each storage system management port
- An environment that meets the minimum server and client requirements in the following sections

For a list of supported operating systems and servers, refer to the interoperability matrix at http://www.hds.com/products/interoperability/.

For information about running Storage Navigator Modular 2 from the command-line interface, refer to the *Hitachi Unified Storage Command Line Interface Reference Guide*.

## Microsoft Windows server environments

**Table 4-5: Supported operating systems**

| Microsoft Windows operating systems | Service packs |
|---|---|
| Microsoft Windows XP (x86) | SP2 and SP3 |
| Microsoft Windows Server 2003 (x86) | SP1 and SP2 |
| Microsoft Windows Server 2003 R2 (x86) | None, SP2 |
| Microsoft Windows Server 2003 R2 (x64) | None, SP2 |
| Microsoft Windows Vista (x86) | SP1 |
| Microsoft Windows Server 2008 (x86) | None, SP2 |
| Microsoft Windows Server 2008 (x64) | None, SP2 |
| Microsoft Windows 7 (x86) | None, SP1 |
| Microsoft Windows 7 (x64) | None, SP1 |
| Microsoft Windows Server 2008 R2 (x64) | None, SP1 |

Intel Itanium is not supported. Apply the latest (KB922760 or newer) Windows Update.

Table 4-6 shows the supported Windows guest operating systems for virtual host operating systems.

**Table 4-6: Host and guest operating systems**

| Host operating systems | Guest operating systems |
|---|---|
| VMware ESX Server 3.x | Microsoft Windows XP |
| | Microsoft Windows Server 2003 R2 |
| VMware 4.1 | Microsoft Windows Server 2008 SP2 (x64)<br>Microsoft Windows Server 2008 R2 (x64) |
| Windows Server 2008 R2 (x64) (Hyper-V2) | Windows Server 2008 R2 (x64) |

Table 4-7 shows the minimum hardware requirements for the Storage Navigator Modular 2 server.

**Table 4-7: Minimum hardware requirements**

| Hardware | Minimum requirement |
|---|---|
| Processor | 1 GHz (2 GHz or faster is recommended) |
| Random Access Memory (RAM) | 1 GB or more (2 GB or more is recommended) |
| Available disk space | 1.5 GB or more |

## Microsoft Windows client environments

**Table 4-8: Supported operating systems**

| Microsoft Windows operating systems | Service packs |
|---|---|
| Microsoft Windows XP (x86) | SP2 and SP3<br>Internet Explorer is not supported with SP3 |
| Microsoft Windows Server 2003 (x86) | SP1 and SP2 |
| Microsoft Windows Server 2003 R2 (x86) | None, SP2 |
| Microsoft Windows Server 2003 R2 (x64) | None, SP2 |
| Microsoft Windows Vista (x86) | SP1 |
| Microsoft Windows Server 2008 (x86) | None, SP2 |
| Microsoft Windows Server 2008 (x64) | None, SP2 |
| Microsoft Windows 7 (x86) | None, SP1 |
| Microsoft Windows 7 (x64) | None, SP1 |
| Microsoft Windows Server 2008 R2 (x64) | None, SP1 |

Intel Itanium is not supported. Apply the latest (KB922760 or newer) Windows Update.

Table 4-9 shows the supported Windows guest operating systems for virtual host operating systems.

**Table 4-9: Host and guest operating systems**

| Host operating systems | Guest operating systems |
|---|---|
| VMware ESX Server 3.x | Microsoft Windows XP |
| | Microsoft Windows Server 2003 R2 |
| VMware 4.1 | Microsoft Windows Server 2008 SP2 (x64)<br>Microsoft Windows Server 2008 R2 (x64) |
| Windows Server 2008 R2 (x64) (Hyper-V2) | Windows Server 2008 R2 (x64) |

Table 4-10 shows the minimum requirements for the Storage Navigator Modular 2 client.

**Table 4-10: Minimum requirements**

| Hardware/software | Minimum requirement |
|---|---|
| Browser | Internet Explorer 6.0 (SP1, SP2, SP3) or Internet Explorer 7.0<br>• 64-bit Internet Explorer 6.0 (SP1, SP2, SP3) is supported on Windows Server 2003 R2 (x64) and 64-bit IE7.0 on Windows Server 2008 (x64).<br>• Internet Explorer 8.0 (x86, x64) is supported on Windows 7 and Windows Server 2008 R2. |
| Java Runtime Environment | Download from http://java.com/en/download/. |
| Processor | 1 GHz or faster is recommended |

**Table 4-10: Minimum requirements (Continued)**

| Hardware/software | Minimum requirement |
|---|---|
| Random Access Memory (RAM) | 1 GB or more (2 GB or more is recommended) |
| Available disk space | 100 MB or more |
| Video | 800 x 600, 1024 x 768, or more is recommended, 256 color or more |

## Red Hat Linux environments

**Table 4-11: Host requirements**

| Requirement | Description |
|---|---|
| Operating System | • Red Hat Enterprise Linux AS 4.0 (x86), Update 1<br>• Red Hat Enterprise Linux AS 4.0 (x86), Update 5<br>• Red Hat Enterprise Linux 5.3 (x86)<br>• Red Hat Enterprise Linux 5.4 (x86)<br>• Red Hat Enterprise Linux 5.4 (x64)<br>• Red Hat Enterprise Linux 5.5 (x86)<br>• Red Hat Enterprise Linux 5.5 (x64)<br>• Red Hat Enterprise Linux 5.6 (x86)<br>• Red Hat Enterprise Linux 5.6 (x64) |
| Processor | 1 GHz (2 GHz or faster is recommended) |
| Random Access Memory (RAM) | 1 GB or more (2 GB or more is recommended) |
| Available disk space | 800 MB or more |

**Table 4-12: Client requirements**

| Requirement | Description |
|---|---|
| Operating System | • Red Hat Enterprise Linux AS 4.0 (x86), Update 1<br>• Red Hat Enterprise Linux AS 4.0 (x86), Update 5<br>• Red Hat Enterprise Linux 5.3 (x86)<br>• Red Hat Enterprise Linux 5.4 (x86)<br>• Red Hat Enterprise Linux 5.4 (x64)<br>• Red Hat Enterprise Linux 5.5 (x86)<br>• Red Hat Enterprise Linux 5.5 (x64)<br>• Red Hat Enterprise Linux 5.6 (x86)<br>• Red Hat Enterprise Linux 5.6 (x64) |
| Browser | Mozilla 1.7 |
| Java Runtime Environment | Download from http://java.com/en/download/. |
| Processor | 1 GHz or faster is recommended |
| Random Access Memory (RAM) | 1 GB or more (2 GB or more is recommended) |
| Available disk space | 100 MB or more |
| Video | 800 x 600, 1024 x 768, or more is recommended, 256 color or more |

## Solaris environments

**Table 4-13: Host requirements**

| Requirement | Description |
|---|---|
| Operating Systems | • Solaris 8 (SPARC)<br>• Solaris 9 (SPARC)<br>• Solaris 10 (SPARC)<br>• Solaris 10 (x64) |
| Processor | SPARC 1 GHz (2 GHz or faster is recommended)<br>• For Solaris 10 (x64): 1.8 GHz (2 GHz or faster is recommended)<br>• Solaris 10 (x64) is supported using 64 bits kernel mode on Sun Fire x64 server family systems only. Do not change the kernel mode from 64 bits after installing Storage Navigator Modular 2.<br>• x86 processors such as Opteron are not supported. |
| Random Access Memory (RAM) | 1 GB or more (2 GB or more is recommended) |
| Available disk space | 800 MB or more |
| Java Development Kit | JDK1.5.0 is required for Solaris 10 (x64) environments |

**Table 4-14: Client requirements**

| Requirement | Description |
|---|---|
| Operating Systems | • Solaris 8 (SPARC)<br>• Solaris 9 (SPARC)<br>• Solaris 10 (SPARC)<br>• Solaris 10 (x86)<br>• Solaris 10 (x64) |
| Processor | SPARC 1 GHz (2 GHz or faster is recommended)<br>• For Solaris 10 (x64): 1.8 GHz (2 GHz or faster is recommended).<br>• Solaris 10 (x64) is supported using 64 bits kernel mode on Sun Fire x64 server family systems only. Do not change the kernel mode from 64 bits after installing Storage Navigator Modular 2.<br>• x86 processors such as Opteron are not supported. |
| Random Access Memory (RAM) | 1 GB or more (2 GB or more is recommended) |
| Available disk space | 100 MB or more |
| Java Runtime Environment | Download from http://java.com/en/download/. |
| Browsers | Mozilla 1.7, Firefox 2 |

# Mounting the storage system

Hitachi Unified Storage systems are designed to be installed in a Hitachi rack or equivalent. For more information about the Hitachi rack, including specifications, see Appendix C, Rack mounting the storage system.

**NOTE:** Work carefully because the storage system hardware weights are significant (see the Warning on page 4-3).

1. Before mounting the storage system in the rack:
   - Be sure the rack is secure and is in no danger of falling over.
   - Verify that the storage system is turned off, the main switch is in the OFF position, and all power cables are removed from the sockets on all Controller Boxes and Drive Boxes.
   - Install the rack stabilizers before mounting or servicing the storage system in the rack.
2. Adjust the length of the mounting rails as needed.

   The rear rail slides inside the front rail. The rail halves are riveted together and use no adjustment screws.
3. Attach the mounting rail assemblies to the outside of the rack posts, using the attaching screws and flange nuts from your rack system.

   Be sure the front rail support is on the bottom facing inward.

   The alignment pins fit into the rack holes above and below the attaching screws.

   Use the attaching screws and flange nuts from your rack system. Tighten the screws and flange nuts according to your rack system instructions.
4. Place the Controller Box onto the rails.
5. Secure the Controller Box to the rack.

   One screw each side, in the upper hole only. Use the attaching screws and flange nuts from your rack system. Tighten the screws and flange nuts according to your rack system instruction.
6. Place the Drive Box onto the rails.
7. Secure the Drive Box to the rack.

   One screw each side, in the upper hole only. Use the attaching screws and flange nuts from your rack system. Tighten the screws and flange nuts according to your rack system instruction.
8. To mount additional Drive Boxes, repeat steps 6 and 7.

# Making data connections

Examples of Hitachi Unified Storage configurations include:

- Fibre Channel SAN (see Fibre Channel connections, below)
- 1 Gb iSCSI (see 1 Gb iSCSI connections on page 4-14)
- 10 Gb iSCSI (see 10 Gb iSCSI connections on page 4-15)

**NOTE:** For information about data cables, see Appendix F, Data and power cables.

## Fibre Channel connections

CBXSS/CBXSL/CBSS/CBSL Controller Boxes come standard with four Fibre Channel ports. CBSS/CBSL Controller Boxes also support an optional Fibre Channel Host I/O Board that contains four additional Fibre Channel ports.

CBLD Controller Boxes support two optional Fibre Channel Host I/O Modules. Each module has four Fibre Channel ports, for a total of 8 Fibre Channel ports per controller.

A Fibre Channel storage-area network (SAN) requires:

- A Fibre Channel switch
- A Fibre Channel HBA card in each host computer or server

To establish the data path:

1. Connect one of the Fibre Channel data ports on each Hitachi Unified Storage controller to your Fibre Channel switch.
2. Connect your Fibre Channel switch to the Fibre Channel HBA card in each host computer or server.

**NOTE:** Connections to Fibre Channel ports 0B/0D/1B/1D on the CBXSS/CBXSL/CBSS/CBS Controller Boxes are made by turning the Fibre Channel interface cable upside down.

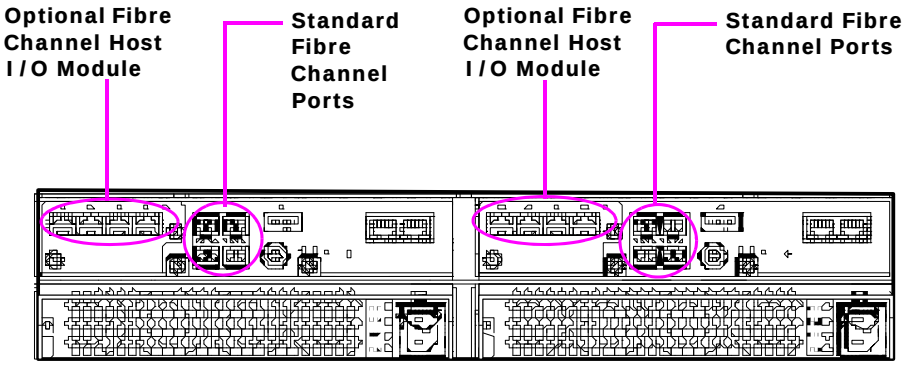



**Figure 4-1: Fibre Channel ports on CBXSS and CBXSL Controller Boxes**

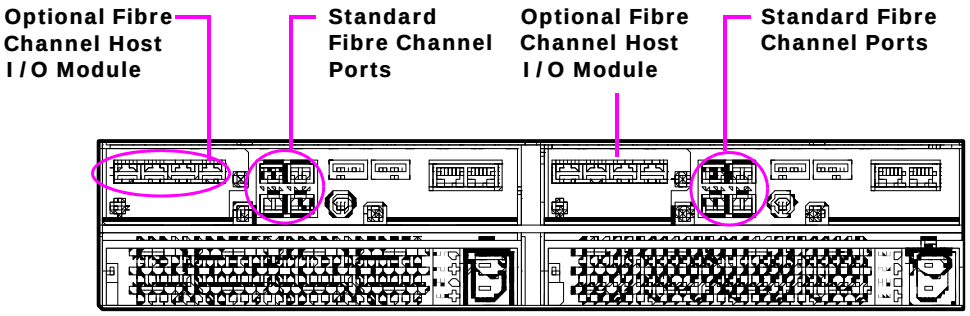



**Figure 4-2: Fibre Channel ports on CBSS and CBSL Controller Boxes**

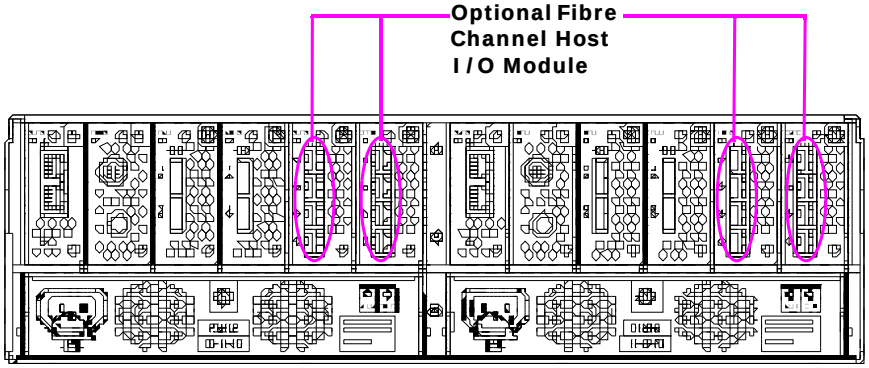



**Figure 4-3: Fibre Channel ports on CBL/CBLE/CBLD Controller Box (CBL is shown)**

## 1 Gb iSCSI connections

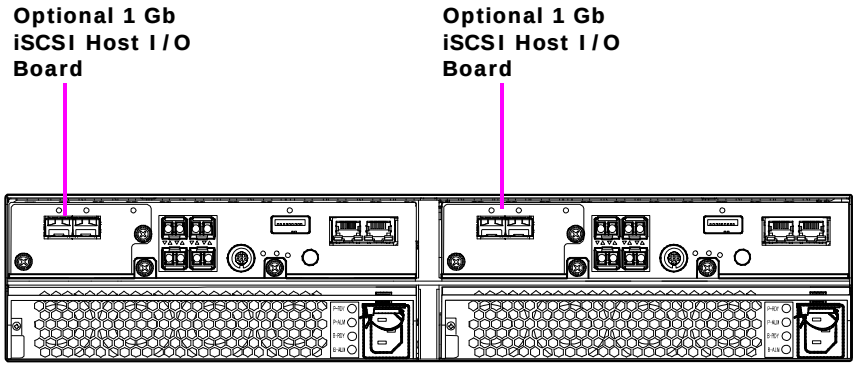
CBSS, CBSL, CBXSS, and CBXSL Controller Boxes support an optional 1 Gb iSCSI Host I/O Board. Each module provide two RJ-45 1 Gb iSCSI data ports. Both data ports support Auto-MDIX, so you can use either a straight-through or crossover cable and have the storage system interface automatically adjust to the cabling used.

A 1 Gb iSCSI SAN requires:

- A Gigabit Ethernet switch
- A 1 Gb NIC or iSCSI HBA card in each host computer or server
- A 1 Gb iSCSI initiator

To establish the data path:

1. Connect one of the 1 Gb iSCSI data ports on each Hitachi Unified Storage controller to your Gigabit Ethernet network switch.
2. Connect your network switch to the NIC or iSCSI HBA card in each host computer or server.




**1 Gb iSCSI ports on CBSS and CBSL Controller Boxes**

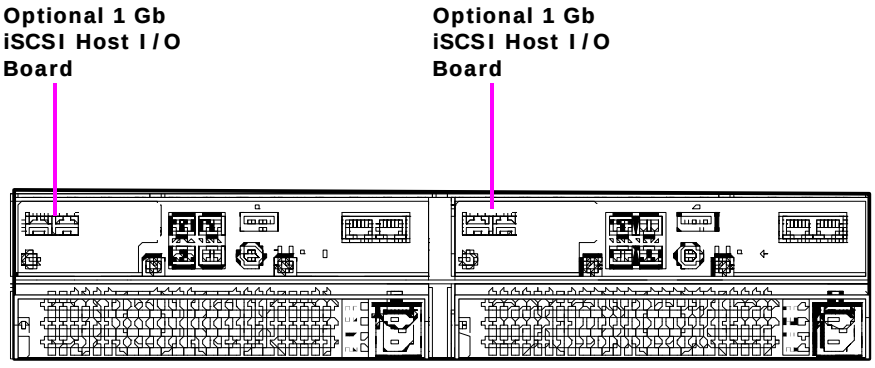



**Figure 4-4: 1 Gb iSCSI ports on CBXSS and CBXSL Controller Boxes**

## 10 Gb iSCSI connections

CBXSS, CBXSL, CBSS, and CBSL Controller Boxes support an optional 10 Gb iSCSI Host I/O Board with two data ports.

A 10 Gb iSCSI SAN requires:

- A 10 Gigabit Ethernet switch
- A 10 Gb NIC or HBA card in each host computer or server
- A 10 Gb iSCSI initiator

To establish the data path:

1. Connect one of the iSCSI data ports on each Hitachi Unified Storage controller to your Gigabit Ethernet network switch.
2. Connect your network switch to the NIC or iSCSI HBA card in each host computer or server.

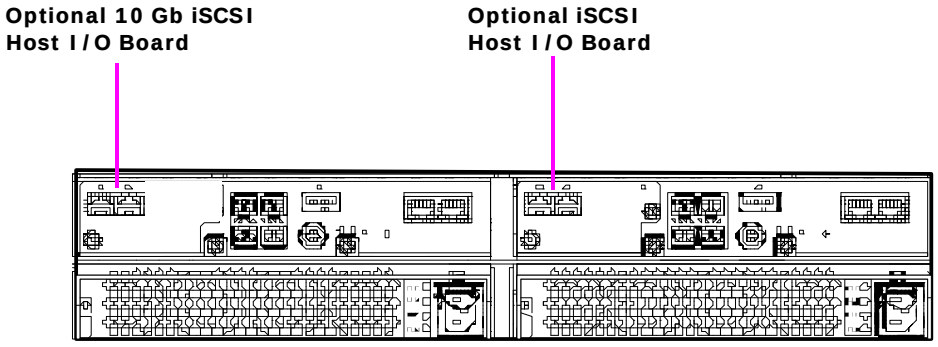



**Figure 4-5: 10 Gb iSCSI ports on CBXSS and CBXSL Controller Boxes**

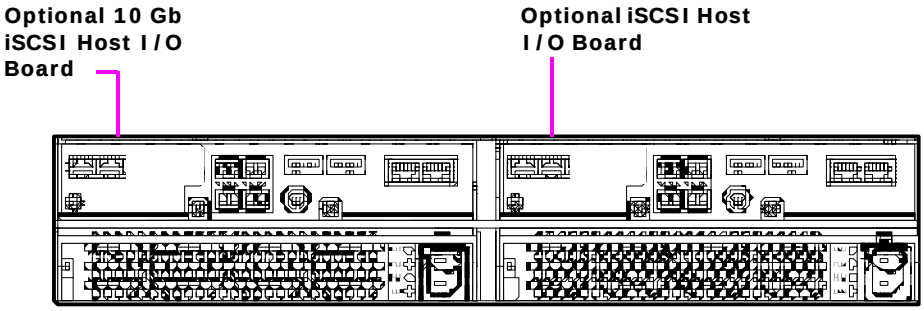



**Figure 4-6: 10 Gb iSCSI ports on CBSS and CBSL Controller Boxes**

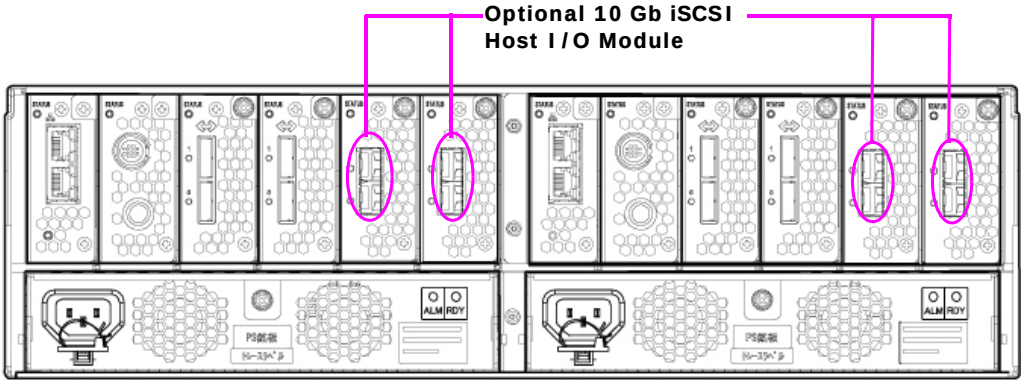



**Figure 4-7: 10 Gb iSCSI ports on CBL/CBLE/CBLD Controller Box (CBL is shown)**

## Connecting Drive Boxes

Drive Boxes let you increase capacity by adding drives to your Hitachi Unified Storage system. An Drive Box contains both physical components (drives, power, and fan modules) and logical components (volumes, host groups, and RAID groups).

Table 4-15 on page 4-16 shows the maximum number of Drive Boxes that can be connected for various configurations. Each Drive Box comes with a SAS cable for connecting to the Controller Box or another Drive Box.

**NOTE:** AC-DC intermixing is not allowed. For example, a DC-powered CBLD Controller Box cannot connect to an AC-powered DBL Drive Box.

**Table 4-15: Maximum Drive Boxes supported**

| Controller Box | Maximum number of drives recognized by controller | Drive Boxes | | | | |
|---|---|---|---|---|---|---|
| | | DBS | DBL | DBF | DBX | DBW |
| CBXSS | 120 | 0 | 8 | — | — | — |
| | | 4 | 0 | — | — | — |
| CBXSL | 120 | 0 | 9 | — | — | — |
| | | 4 | 0 | — | — | — |
| CBSS | 360 | 0 | 19 | — | 0 | — |
| | | 14 | 0 | — | 0 | — |
| | | 0 | 0 | — | 7 | — |
| | | — | — | — | — | 4 |
| CBSL | 360 | 0 | 19 | — | 0 | — |
| | | 14 | 0 | — | 0 | — |
| | | 0 | 0 | — | 7 | — |
| | | — | — | — | — | 4 |

**Table 4-15: Maximum Drive Boxes supported (Continued)**

| Controller Box | Maximum number of drives recognized by controller | Drive Boxes | | | | |
|---|---|---|---|---|---|---|
| | | DBS | DBL | DBF | DBX | DBW |
| CBL/CBLE | 960 | 40 | 0 | — | 0 | 0 |
| | | 0 | 40 | — | 0 | 0 |
| | | 0 | 0 | — | 20 | 0 |
| | | 0 | 0 | 0 | 0 | 12 |
| | | 0 | 0 | 4 | 0 | 0 |

## Connection order when installing Drive Boxes

Drive Boxes are connected using the sequence “Path #0, Path #1,” based on the order in which Controller Box and Drive Boxes are installed in the rack (in order of unit ID number).

The example in Figure 4-8 on page 4-17 shows a connection that follows this ordering rule. In this example, [1], [2], and [3] are connected from left to right in the order shown by the arrow to keep the connection path in sequential order from the bottom to the top of the rack.

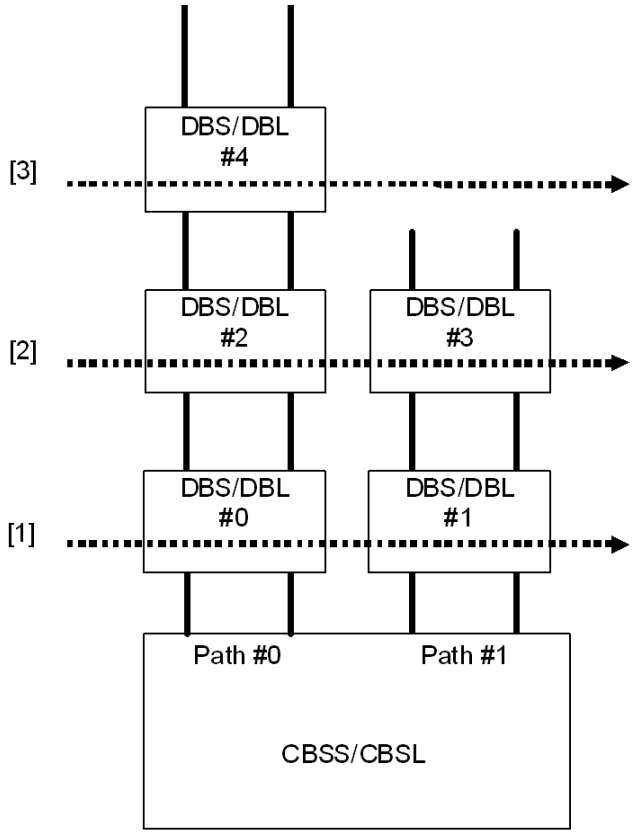



**Figure 4-8: Connecting CBSS/CBSL and DBS/DBSD/DBL/DBLD units according to ordering rules**

Figure 4-9 on page 4-18 shows an example that does not follow the ordering rule. In this example, Path #0 in row [3] is skipped and Path #1 is connected.

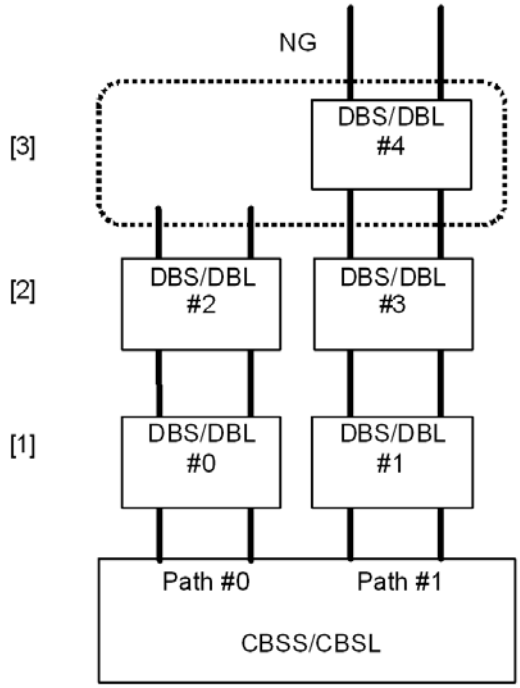



**Figure 4-9: Connecting CBSS/CBSL and DBS/DBSD/DBL/DBLD units against the ordering rules (example 1)**

Figure 4-10 shows another example that does not follow the ordering rule. In this example, Path #1 in row [3] is skipped and Path #0 in the [4] row is connected.

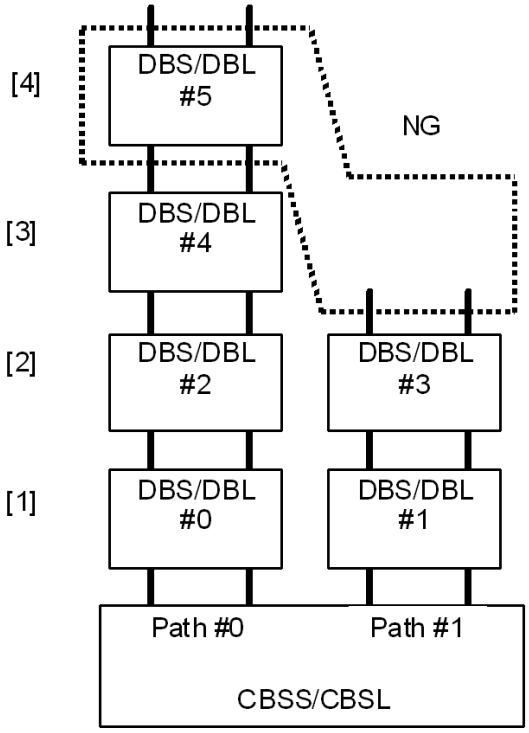



**Figure 4-10: Connecting CBSS/CBSL and DBS/DBSD/DBL/DBLD units against the ordering rules (example 2)**

## Maximum number of installable Drive Boxes

When mounting Drive Boxes, see Table 4-15 on page 4-16 to prevent the maximum number of installed drives from being exceeded.

For CBL, CBLE, and CBLD Controller Boxes, however, some configurations may exceed 240 slots per path. If a drive is inserted into the slot of a configuration that exceeds 240 slots per path, the drive is blocked. Therefore, be sure your configurations do not exceed 240 slots per path.

## Installing Drive Boxes

**NOTE:** The term “slot” means a drive insertion opening. A DBS/DBSD/DBLD Drive Box contains 24 slots, a DBL Drive Box contains 12 slots, and a DBX-A or DBX-B Drive Box contains 24 slots. If a drive is not inserted into slot, the number of slot does not change.

After reviewing the Drive Box guidelines in the previous sections, use the procedures in the following sections to install Drive Boxes.

### Connecting a CBXSS, CBXSL, CBSS, or CBSL to a DBS, DBSD, DBLD, or DBL Drive Box

To connect a CBXSS, CBXSL, CBSS, or CBSL Controller Box to a DBS, DBSD, DBL, or DBLD Drive Box, perform the following procedure and see the following figures.

**NOTE:** You cannot connect a CBXSS or CBXSL Controller Box to a DBX Drive Box.

1. Connect one end of a SAS (ENC) cable to the **PATH 0** expansion port on the rear of a CBXSS, CBXSL, CBSS, or CBSL Controller Box. Connect the other end to the **IN** port on the I/O Module at the rear of the DBS, DBSD, or DBL Drive Box.

**NOTE:** The SAS (ENC) cable connectors are keyed. If you cannot fit a connector into the hardware, use the connector on the other end of the cable. For a single-controller storage system, connect the cable to Controller #0 only. Do not connect the cable to Controller #1.

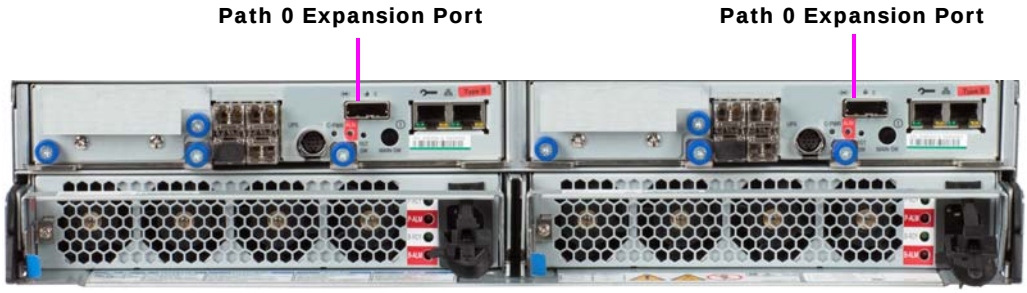



**Figure 4-11: PATH 0 port on CBXSS and CBXSL Controller Boxes**

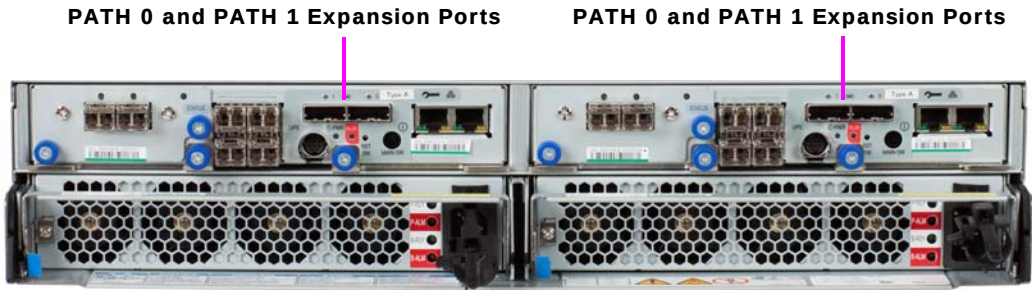



**Figure 4-12: PATH 0 and PATH 1 ports on CBSS and CBSL Controller Boxes**

2. Additional Drive Boxes can be daisy-chained.
   a. To connect a second Drive Box, plug one end of a SAS (ENC) cable to the **PATH 1** expansion port on the rear of the CBXSS, CBXSL, CBSS, or CBSL Controller Box. Connect the other end to the **IN** port on the I/O Module at the rear of the second DBS, DBSD, or DBL Drive Box.
   b. To connect additional Drive Boxes, plug one end of a SAS (ENC) cable to the **OUT** port at the rear of a DBS, DBSD, or DBL Drive Box. Connect the other end to the **IN** port on the next Drive Box.

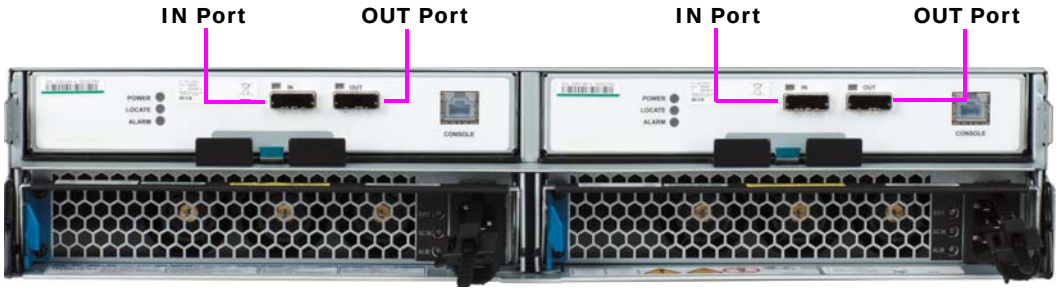



**Figure 4-13: IN and OUT ports on DBS, DBSD, and DBL rear panel (DBS/DBL is shown)**

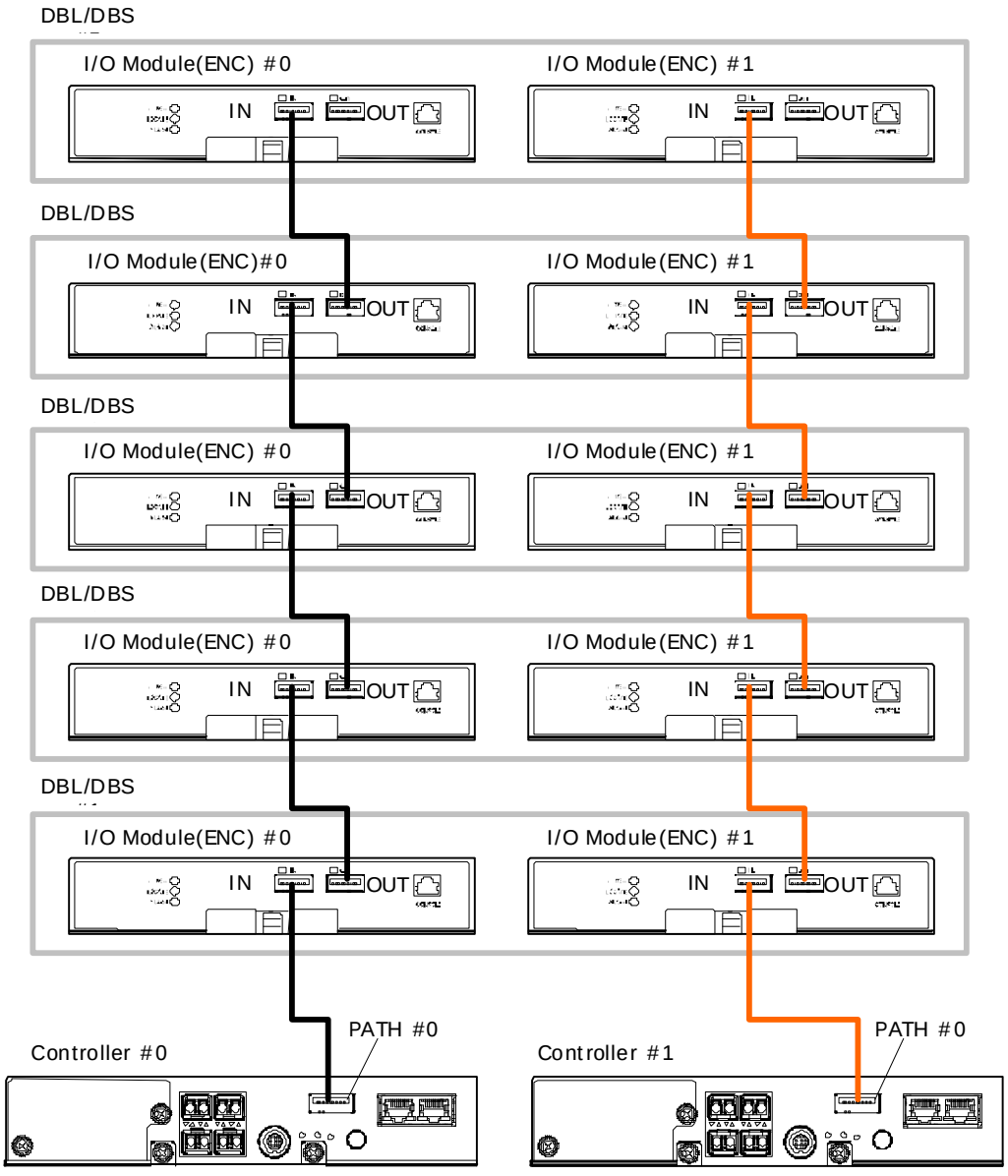



**Figure 4-14: Connecting SAS (ENC) cables (CBXSS/CBXSL+ DBS/DBSD/DBL)**

**NOTE:** Figure 4-14 on page 21 shows a dual-controller configuration. For a single-controller storage system, connect the cable to Controller #0 only. Do not connect the cable to Controller #1.

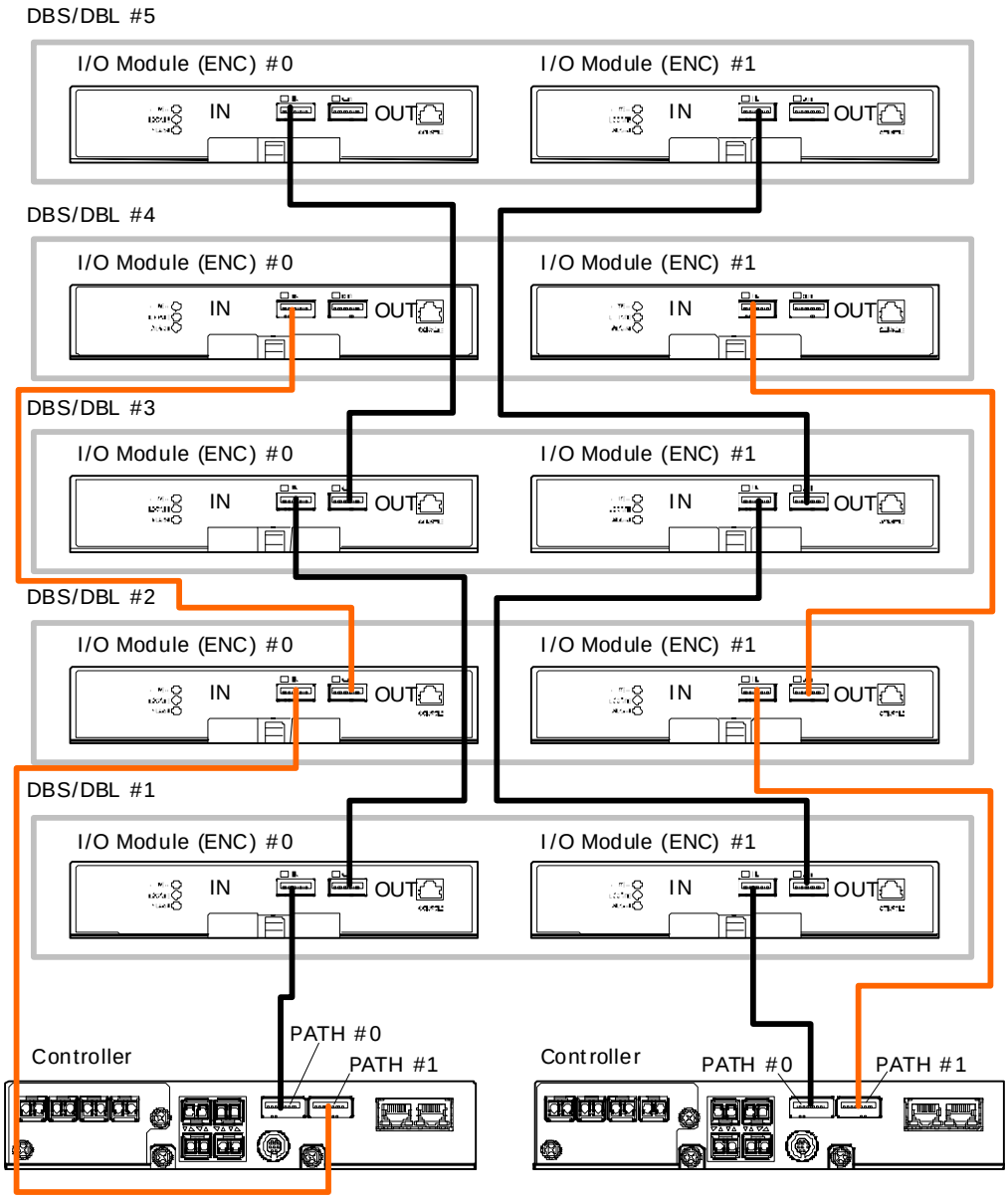



**Figure 4-15: Connecting SAS (ENC) cables (CBSS/CBSL + DBS/DBSD/DBL)**

## Connecting a CBL/CBLE/CBLD to a DBS, DBSD, or DBL Drive Box

To connect a CBL, CBLE, or CBLD Controller Box to a DBS, DBSD, or DBL Drive Box, perform the following procedure and see Figure 4-13 on page 4-21.

**NOTE:** The SAS cable connectors are keyed. If you cannot fit a connector into the hardware, use the connector on the other end of the cable.

1. CBL/CBLE instructions: Connect one end of a supplied SAS cable to the SAS connector on CBL/CBLE Controller 0. Connect the other end of the cable to the **IN** port on Drive I/O Module 0 of the DBS, DBSD, DBL, or DBLD Drive Box.

   Connect one end of a supplied SAS cable to the SAS connector on CBL/CBLE Controller 1. Connect the other end of the cable to the **IN** port on Drive I/O Module 1 of the DBS, DBSD, DBL, or DBLD Drive Box.
2. CBLD instructions: Connect one end of a supplied SAS cable to the SAS connector on CBLD Controller 0. Connect the other end of the cable to the **IN** port on Drive I/O Module 0 of the DBSD or DBLD Drive Box.

   Connect one end of a supplied SAS cable to the SAS connector on CBLD Controller 1. Connect the other end of the cable to the **IN** port on Drive I/O Module 1 of the DBSD or DBLD Drive Box.
3. Additional Drive Boxes can be daisy-chained, as shown in Figure 4-17 on page 4-24.

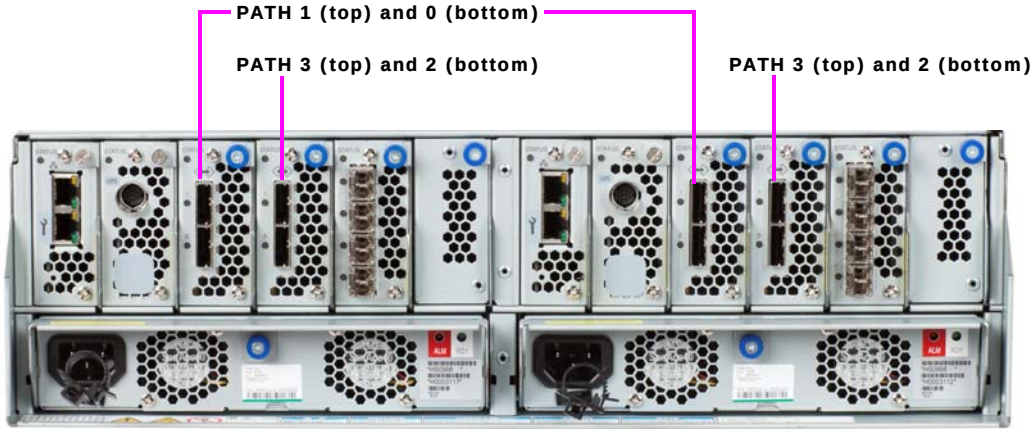



**Figure 4-16: PATH 0, 1, 2, and 3 ports on CBL/CBLE/CBLD Controller Box rear panel (CBL is shown)**

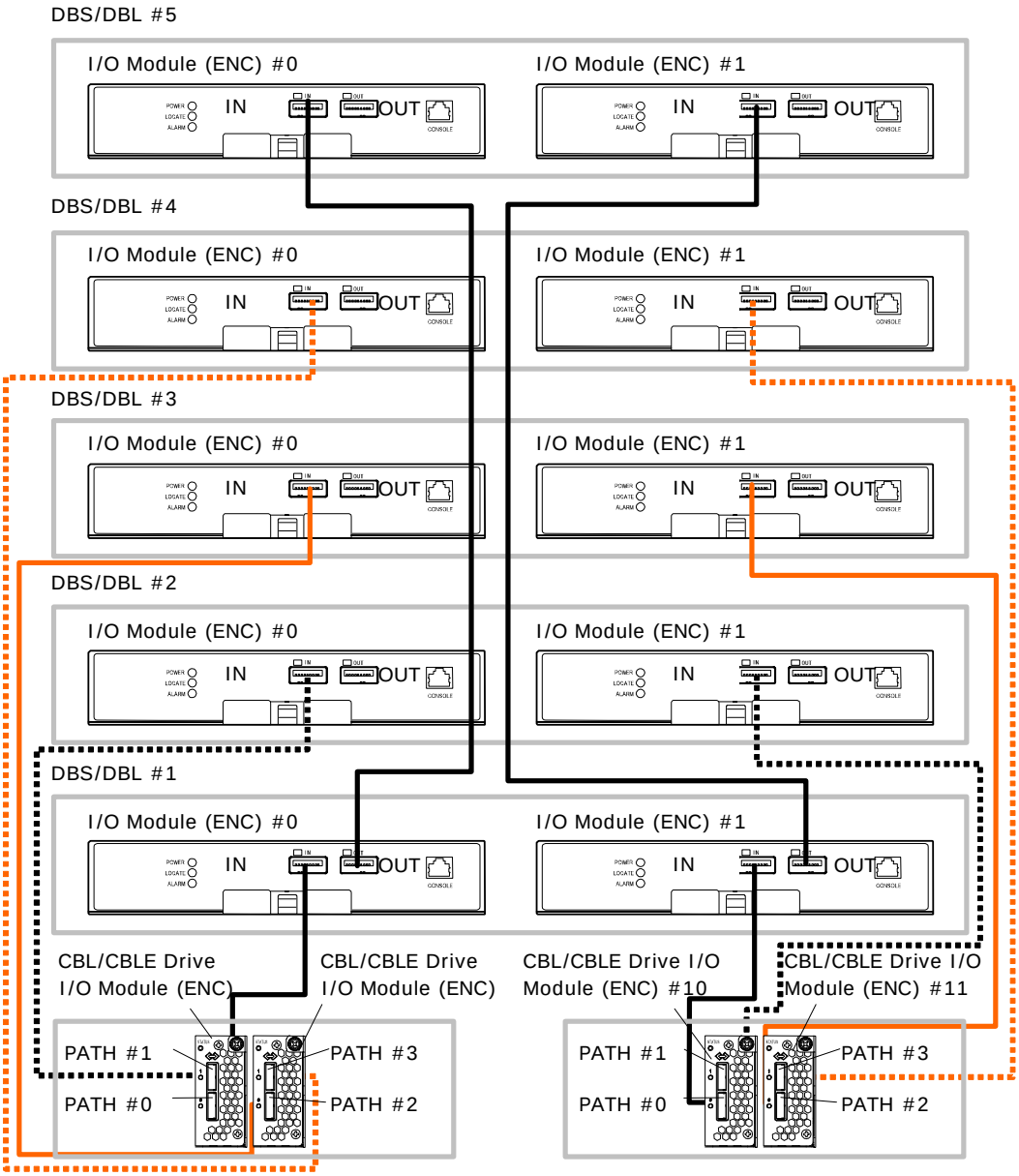



**Figure 4-17: Sample CBL/CBLE connection to DBS/DBL**

## Connecting a CBL, CBLE, or CBLD to a DBW Drive Box

To connect a CBL/CBLE/CBLD to a DBW Drive Box, connect the PATH 0, PATH 1, PATH 2, or PATH 3 port from the CBL/CBLE/CBLD to the **SAS Port A** connector on the DBW Drive Box (see Figure 4-18 and Figure 4-19).

When making these connections:

- Limit the total current to the Drive Box to not exceed 16 amperes.
- Connect the power cables so the load on a PDB does not exceed 24A for the Americas or 25.6A for EMEA and APAC.

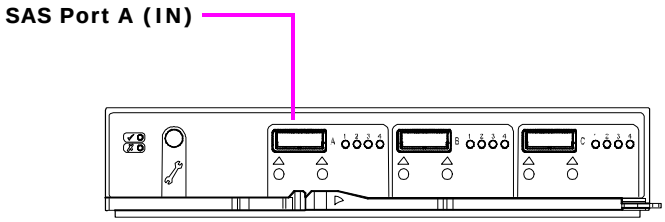



**Figure 4-18: DBW Drive I/O Module connectors**

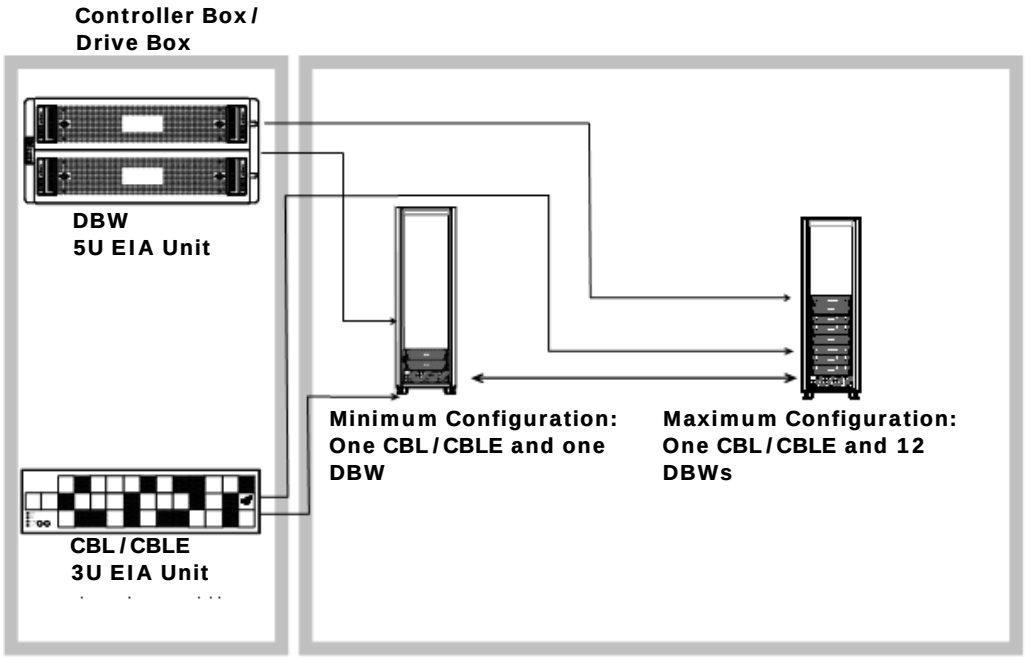


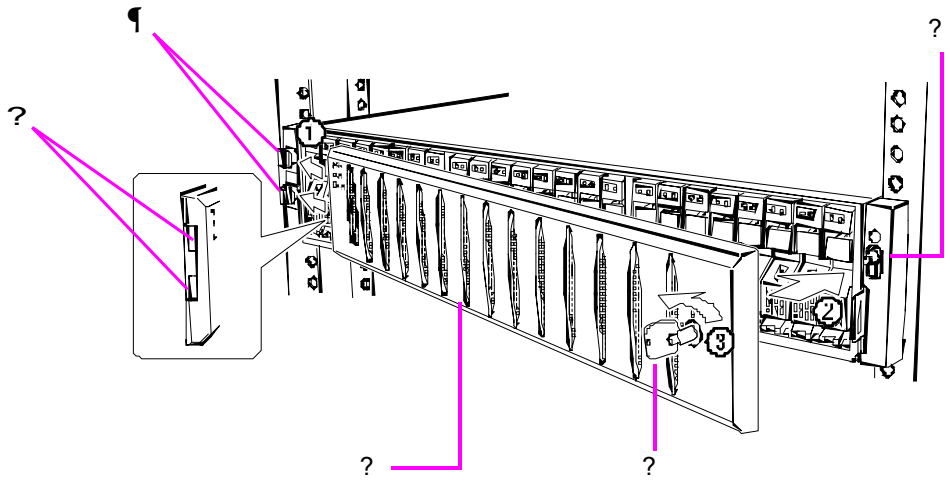

**Figure 4-19: Connecting a CBL/CBLE and DBW**

# Attaching the front panel bezel

Use the following procedure to attach the front panel bezel on the Controller Boxes and Drive Boxes below:

- CBXSS
- CBXSL
- CBSS
- CBSL
- DBS
- DBL
- DBLD
- DBSD

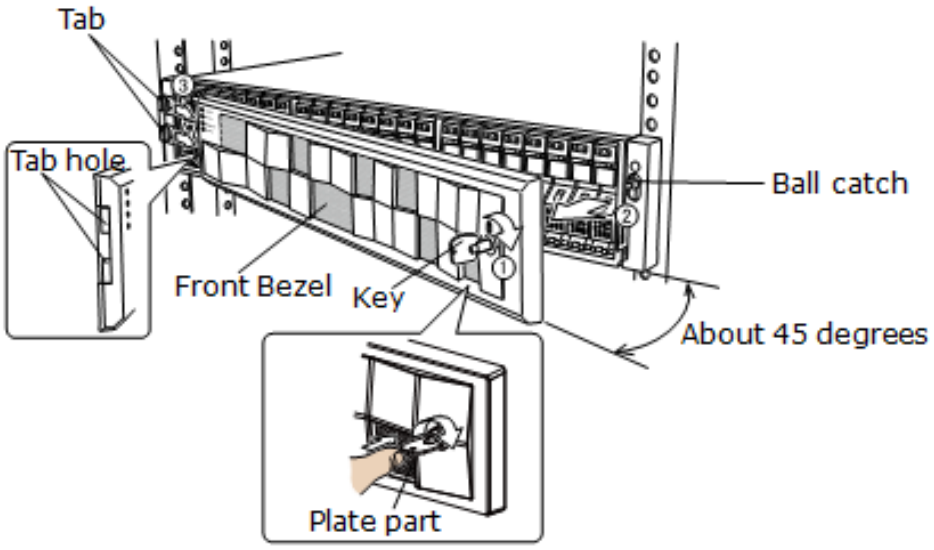
1. Use the supplied key to unlock the front bezel. Hold the key and the bottom of the bezel with both hands, so the front of the bezel is facing you.
2. Insert the tabs on the left-front side of the storage system into the tab holes on the front bezel.
3. Push the right side of the bezel to engage it with the ball catch on the front of the storage system to secure the bezel.
4. Use the supplied key to lock the front bezel.



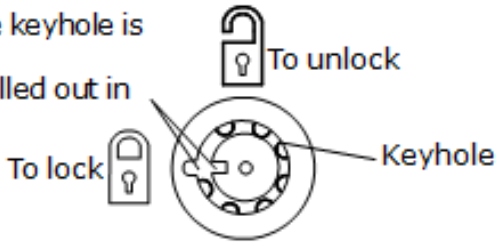

Legend:

| | |
|---|---|
| ¶ | Tabs |
| ? | Ball Catch |
| ? | Key |
| ? | Front of Bezel |
| ? | Tab Holes |

If the lock cannot be released, turn the key while pressing firmly on the plate part of the keyhole (lower left). If you press an area other than the plate, you could a damage the front bezel.

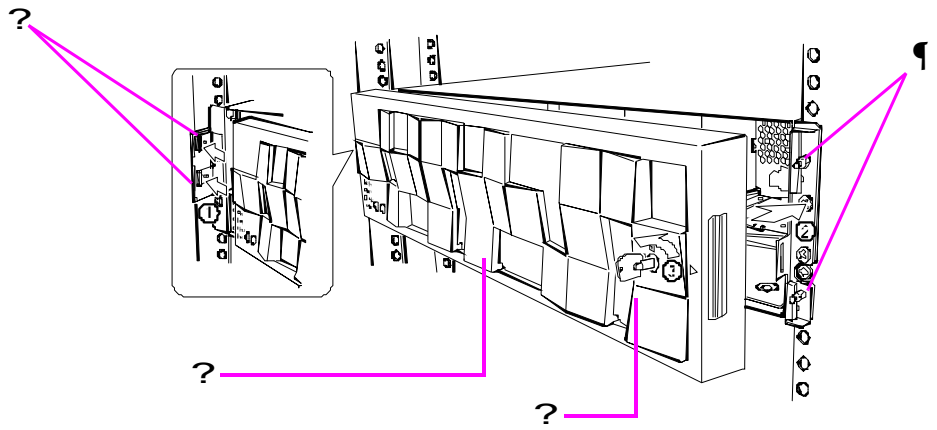



The state in which the slit of the keyhole is aligned with the mark.
(The key can be inserted or pulled out in this state.)



Use the following procedure to attach the front panel bezel on the CBL/CBLE/CBLD Controller Box:

1. Use the supplied key to unlock the front bezel. Hold the bottom of the bezel with both hands, so the front of the bezel is facing you.
2. Insert the tabs on the left-front side of the storage system into the tab holes on the front bezel.
3. Push the right side of the bezel to engage it with the ball catch on the front of the storage system to secure the bezel.
4. Use the supplied key to lock the bezel.




| Legend: | |
|---|---|
| ¶ | Tabs |
| ? | Key |
| ? | Front of Bezel |
| ? | Flange Hole |

# Removing the front panel bezel

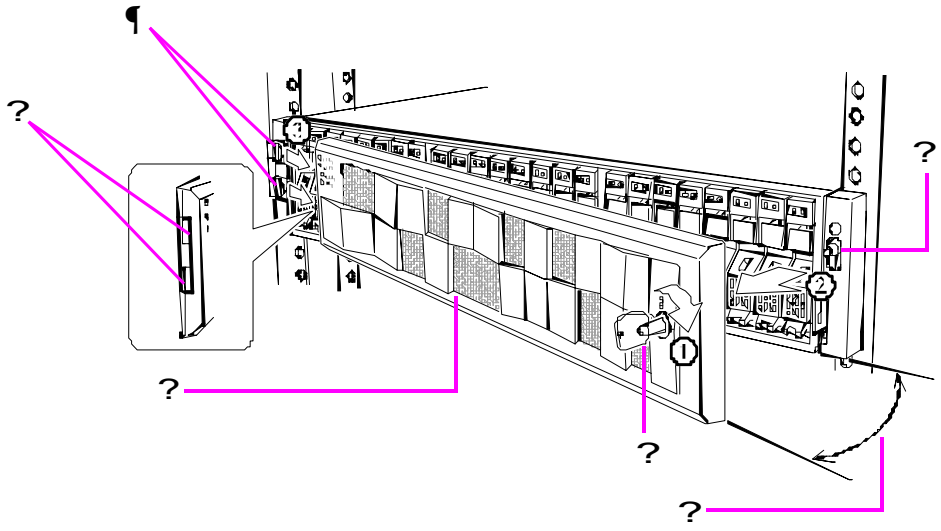
Use this procedure to remove the front panel bezel from the following Controller Boxes and Drive Boxes:

- CBXSS
- CBXSL
- CBSS
- CBSL
- DBS
- DBL
- DBLD
- DBSD

1. Use the supplied key to unlock the bezel.
2. Holding the lower right part of the bezel, gently pull the key toward you and disengage the right side of the bezel from the ball catch.

**NOTE:** When disengaging the front bezel, do not open the bezel more than 45 degrees; otherwise, you can damage the bezel.

3. Disengage the front bezel from the left tabs and then remove the bezel.




Legend:

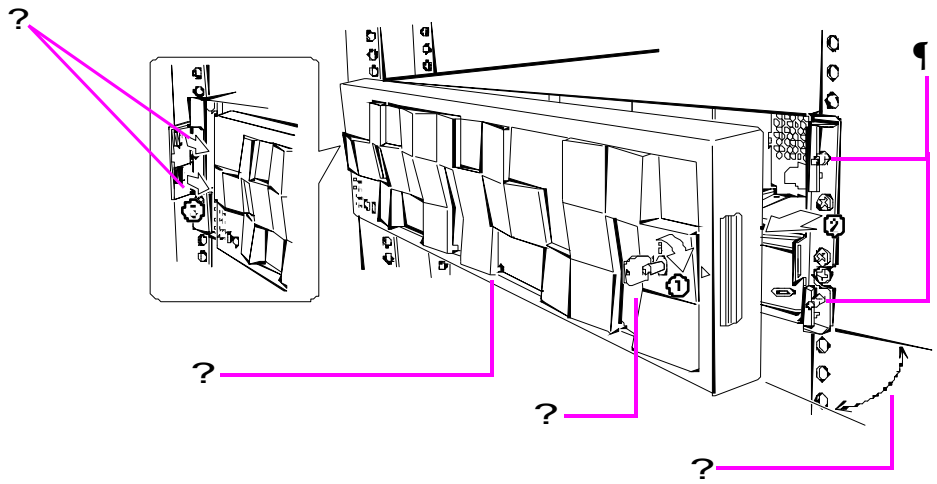
| | |
|---|---|
| ¶ | Tabs |
| ? | Ball Catch |
| ? | Angle About 45 Degrees to Rack |
| ? | Key |
| ? | Front of Bezel |
| ? | Tab Holes |

Use this procedure to remove the front panel bezel from the CBL/CBLE/CBLD Controller Box:

1. Use the supplied key to unlock the bezel.
2. Holding the lower right part of the bezel, gently pull the key toward you and disengage the right side of the bezel from the ball catch.

**NOTE:** When disengaging the front bezel, do not open the bezel more than 45 degrees; otherwise, you can damage the bezel.

3. Disengage the front bezel from the left tabs and then remove the bezel.



| Legend: | |
|---|---|
| ¶ | Tabs |
| ? | Angle Approximately bout 45 Degrees to Rack |
| ? | Key |
| ? | Front of Bezel |
| ? | Flange Hole |

# Connecting power cables and powering on

Plug the power cables to the electrical sockets on all Controller Boxes and Drive Boxes. Then apply power to the Controller Boxes and Drive Boxes. If the green **POWER** LED is ON on the front of the Controller Box, power is turned on and the following steps are not necessary.

**NOTE:** For information about the AC and DC power cables, see Appendix F, Data and power cables.

1. For the CBL/CBLE/CBLD, turn off the main switch.
2. Attach the power cables to the power sockets on all Controller Boxes and Drive Boxes.
3. Route the cables through the cable holders on the rear of the enclosures.
4. Plug the other end of the power cables into an AC power source (or into a DC power source for CBLD, DBSD, and DBLD units).
5. Turn on all PDB breakers.
6. For the DBW Drive Box, turn on the power switch.
7. Power on the CBXSS/CBXSL/CBSS/CBSL Controller Boxes:
   a. Using a pen or key, press the main switch (**MAIN SW**) on either the Controller 0 or Controller 1 rear panel for one second (see Figure 4-20). If the power interlock mode is set to UPS interlock mode1/2/3, connect the UPS interlock cable to the CBXSS/CBXSL/CBSS/CBSL controller. If using one UPS, connect the UPS interlock cable to Controller #0.

**NOTE:** The main switch on each controller powers on the storage system, not the individual controller.

   b. Verify that the green **READY** LED on the front bezel goes ON (usually five-to-seven minutes for the CBXSS/CBXSL or five-to-eight minutes for the CBSS/CBSL). See Figure 4-21.

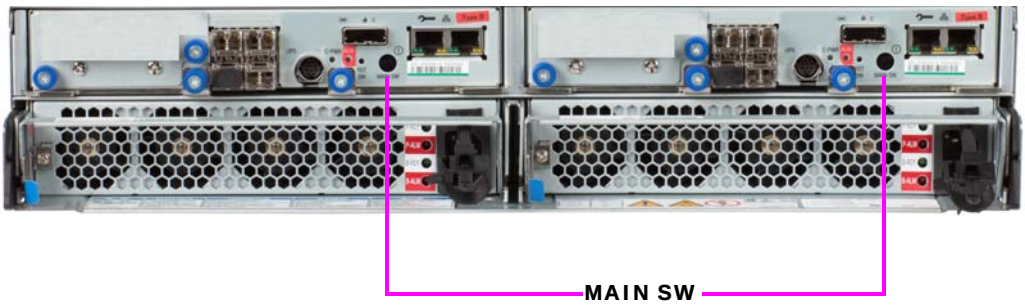



**Figure 4-20: MAIN SW on CBXSS, CBXSL, CBSS, and CBSL rear panel**

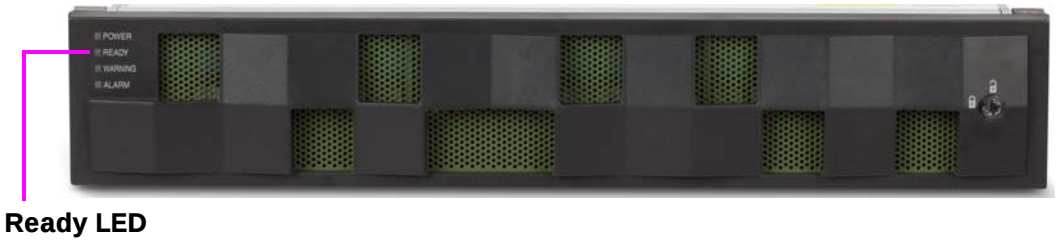



**Figure 4-21: READY LED on CBXSS, CBXSL, CBSS, and CBSL Controller Boxes**

8. Power on the CBL, CBLE, or CBLD Controller Box:
   a. Press the main switch on the front of the Controller Box to the ON position. See Figure 4-22. Turning on the main switch with connected the UPS interlock cable starts the storage system.
   b. Verify that the green **READY** LED on the front bezel goes ON (usually five-to-10 minutes after attaching power cables). See Figure 4-22 on page 32.

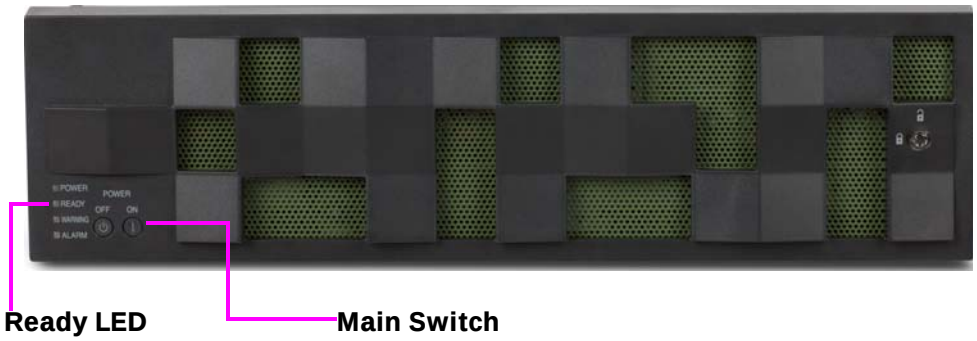



**Figure 4-22: READY LED and main switch on CBL/CBLE/CBLD**

9. Drive Boxes power on when you attach power cables to the Drive Box power socket.

   For DBS/DBSD/DBL/DBLD Drive Boxes, verify that the:
   a. Green **READY** LED on the front bezel goes ON (usually four minutes after attaching power cables). See Figure 4-23.
   b. LED above the rear panel Drive Box Drive Box ports goes ON when the port links up.

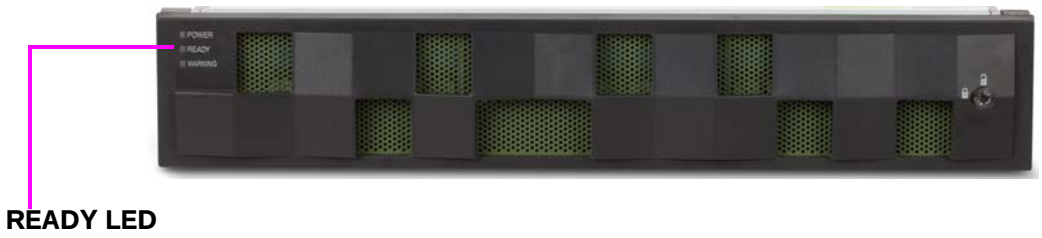



**Figure 4-23: READY LED on DBS/DBSD and DBL/DBLD Drive Boxes**

For DBX Drive Boxes, verify that the:

a. Green **READY** LED on the front bezel goes ON (usually five minutes after attaching power cables). See Figure 4-24.

b. LED above the rear panel Drive Box ports goes ON when the port links up.

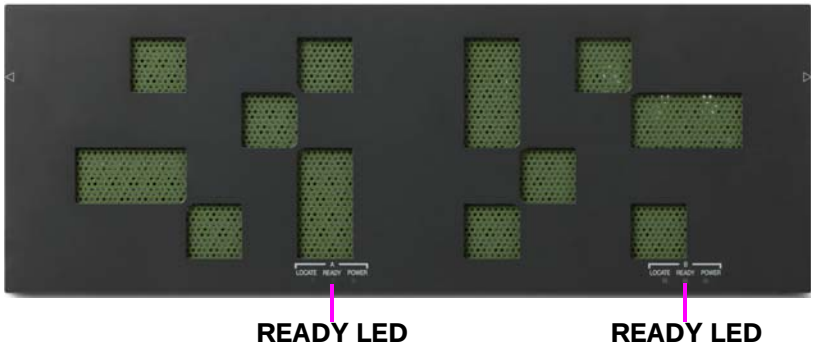



**Figure 4-24: READY LED on DBX Drive Box**

For DBW Drive Boxes, turn on all Power Units and verify the following:

a. Green **Power OK** LED goes ON (see Figure 4-25).

b. DBW Power Unit goes ON.

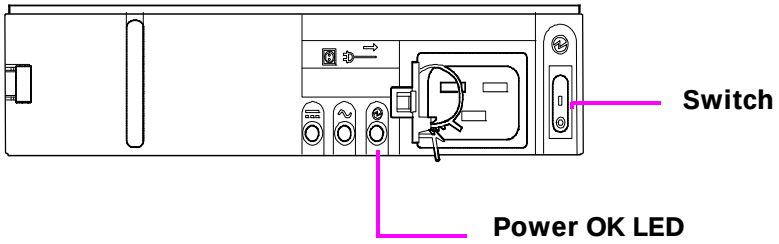



**Figure 4-25: Power OK LED and Switch on DBW Drive Box**

## Powering off the storage system

To power off the storage system:

1. On CBXSS/CBXSL/CBSS/CBSL Controller Boxes, use a pen or key to press the main switch (**MAIN SW**) on either the Controller 0 or Controller 1 front bezel for three seconds. When the main switch is turned off and enabled, the controller's green **C-PWR** LED blinks for three seconds, goes ON, and then goes OFF.
2. For the CBL/CBLE/CBLD, press the main switch on the front of the Controller Box to the OFF position.

**NOTE:** The main switch on each controller powers off the storage system, not the individual controller.

3. On DBW Drive Boxes, turn off the power switch.

4. Verify that the **POWER** LED on the front of the storage system changes from green to orange (it takes up to 10 minutes before the POWER LED turns orange). The green **ACT** LED on the drives might blink after the orange **POWER** LED goes ON; this is normal and does not indicate a problem.
5. Turn off all the breakers for the PDB.
6. Remove the power cord plug from the outlet to stop power to the storage system.

**NOTE:** To stop the power supply completely, remove the power cables from the power units on the Controller Box and Drive Box. If the storage system is connected to a PDB, you can stop the power supply by turning off the PDB breaker.

## Restarting the storage system

If the storage system used in a remote TrueCopy Remote Replication/ TrueCopy Extended Distance configuration restarts with the TrueCopy Remote Replication/TrueCopy Extended Distance status of enabled, the following occur.

- The path used by TrueCopy Remote Replication/TrueCopy Extended Distance becomes blocked. Notifications from the Storage Navigator Modular 2 e-mail alert function, SNMP Agent Support function, and TRAP occur when the path is blocked. Follow the instructions in the notification. The blocked path recovers automatically after restarting the storage system.
- If the TrueCopy Remote Replication/TrueCopy Extended Distance pair status is PAIR or COPY, the pair changes to PSUE. In this case, suspend the pairs before restarting the storage system.
- If a storage system that uses the Power Saving or Power Saving Plus option is restarted before spin-down completes, spin-down might fail. After performing a spin-down and then restart the storage system, confirm that there is no RAID Group whose power saving status is **Normal (command monitoring)**. If the spin-down fails, perform the spin-down again.

5

# Configuring the storage system

Hitachi Unified Storage systems are configured using Hitachi Storage Navigator Modular 2 software.

This chapter starts by describing how to perform basic configuration procedures using Storage Navigator Modular 2. Initially, you perform these procedures after you install your storage system.

After you configure your storage system for the first time, you can perform the basic configuration procedures any time you need to change the storage system's basic configuration settings.

The following topics are covered in this chapter:

- Establishing the management path
- Installing and logging in to Storage Navigator Modular 2
- Performing basic configuration activities
- Performing routine configuration activities
- Routine Fibre Channel activities
- Routine iSCSI activities
- Installing an iSCSI initiator (iSCSI systems only)
- Setting the flash drive/FMD write endurance threshold
- Setting the FMD Battery Life Threshold
- Increasing storage system security on a LAN
- Setting the system date and time

# Establishing the management path

To configure the Hitachi Unified Storage system, establish a management path between the storage system and a personal computer (or "management console") on which the Storage Navigator Modular 2 software will be installed.

**TIP:** To enhance your experience, install Storage Navigator Modular 2 on a new or dedicated PC that will acts as the management console.

1. Connect either end of an Ethernet LAN cable to one of the management ports on the rear panel of a Hitachi Unified Storage controller.
2. Connect the other end of the cable to your network switch or directly to a network-interface card (NIC) installed in your management console.

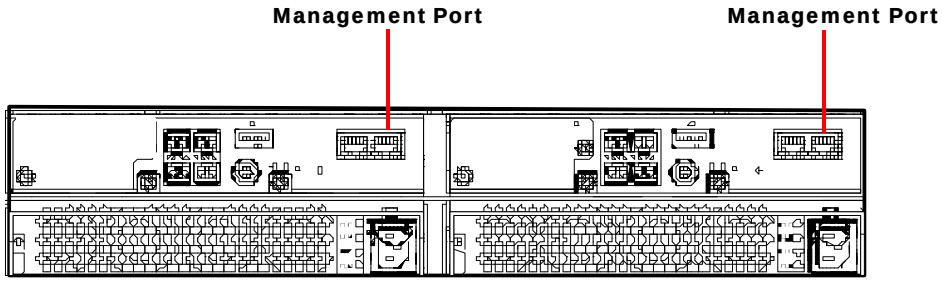



**Figure 5-1: Management port on CBXSS and CBXSL Controller Boxes**

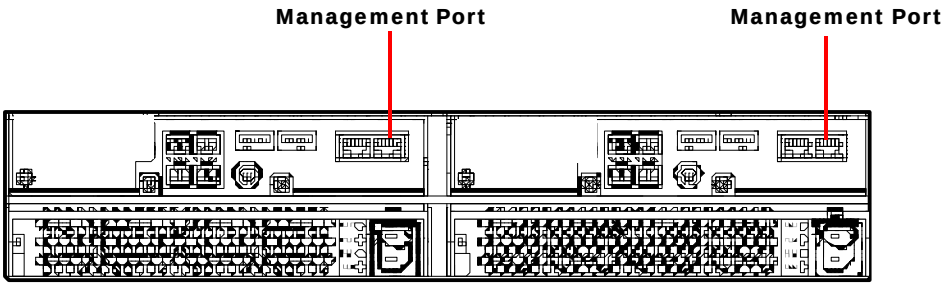



**Figure 5-2: Management port on CBSS and CBSL Controller Boxes**

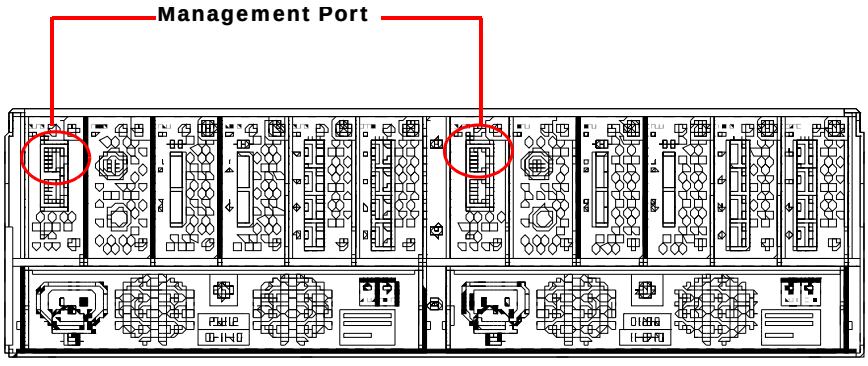



**Figure 5-3: Management port on CBL/CBLE Controller Box**

3. The default physical management port IP addresses are set to:
   - Controller 0: 192.168.0.16
   - Controller 1: 192.168.0.17

   Ascertain the IP address of the management console (for example, using ipconfig). Then change its IP address to 192.168.0.*x* where *x* is a number from 1 to 254, excluding 16 and 17. Write this IP address on a piece of paper. You will be prompted for it during the Storage Navigator Modular 2 installation procedure.
4. Disable pop-up blockers in your Web browser. We also recommend that you disable anti-virus software and proxy settings on the management console when installing the Storage Navigator Modular 2 software.
5. Some operating systems such as Red Hat Enterprise Linux, have additional requirements. For more information, refer to the Storage Navigator Modular 2 online help and *Hitachi Unified Storage Operations Guide*.

## Installing and logging in to Storage Navigator Modular 2

The following procedure describes how to install and log in to Storage Navigator Modular 2.

1. Insert the Storage Navigator Modular 2 DVD in the management console DVD drive and follow the installation wizard.
   - If the DVD does not auto-run, double-click the following file, where *nnnn* is the Storage Navigator Modular 2 version number:

     `\program\hsnm2_win\HSNM2-nnnn-W-GUI.exe`
   - The installation process takes about 15 minutes to complete.
   - During the installation, the progress bar may pause for several seconds. This is normal and does not mean the installation has stopped.
2. After the software installs, launch a browser on the management console and log in to Storage Navigator Modular 2:

   http://<IP *address*>:23015/StorageNavigatorModular/Login

   OR

   https://<*IP address*>:23016/StorageNavigatorModular/Login

   where <*IP address*> is the IP address of the management console.

**NOTE:** If entering an IPv6 address in your Web browser, enter the URL in brackets. Example: http://[xxxx]:23015/StorageNavigatorModular/Login

3. In the login page, type **system** as the default User ID and type **manager** as the default case-sensitive password.

4. Click the **Login** button and go to Registering the storage system on page 5-6.

**NOTE:** For security, change the default Storage Navigator Modular 2 password (refer to the Storage Navigator Modular 2 online help).

## Usage guidelines

Hitachi Storage Navigator Modular 2 does not support the window change function of a Web browser. The following procedures allow Internet Explorer to return to the last-displayed Web window. However, if Hitachi Storage Navigator Modular 2 operates them, the window may not change.

- Press the Backspace key.
- Press the <-key while holding down the Alt key.
- Press the right mouse button and click **Back**.

If you perform any of the above steps on a window that was displayed by clicking **Create** or **Edit** within Hitachi Storage Navigator Modular 2, a Now Loading window appears but the window might not change. In this case, click **X** (close) at the top-right of the window to close the window, and then try again.

Using Hitachi Storage Navigator Modular 2 can cause storage system performance to deteriorate when processing host I/O — especially if multiple users configure settings at the same time. We recommend users perform less than five operations at the same time when the storage system is handling host I/O.

The maximum number of setting/reference operations that a storage system can receive from Hitachi Storage Navigator Modular 2 at one time depends on the firmware installed on the storage system (see the following table.)

| Array firmware | Maximum number of operations that can be received at one time |
|---|---|
| 0980/A or later | 50 operations |
| Less than 0980/A | Less than 5 operations |

If you try to execute the maximum number of operations that can be received at one for one storage system, the following errors may occur:

| Message code | Error code | Message text |
|---|---|---|
| DMEA000006 | 0x00060000 | Failed to connect with the subsystem. Confirm the subsystem status and the LAN environment, and then try again. |
| DMEA000007 | 0x00070000 | An invalid response was received from the subsystem. Confirm the subsystem status and the LAN environment, and then try again. |
| DMEA00000B | 0x00001002 | Failed to transfer data. Confirm the subsystem status and the LAN environment, and then try again. |

# Performing basic configuration activities

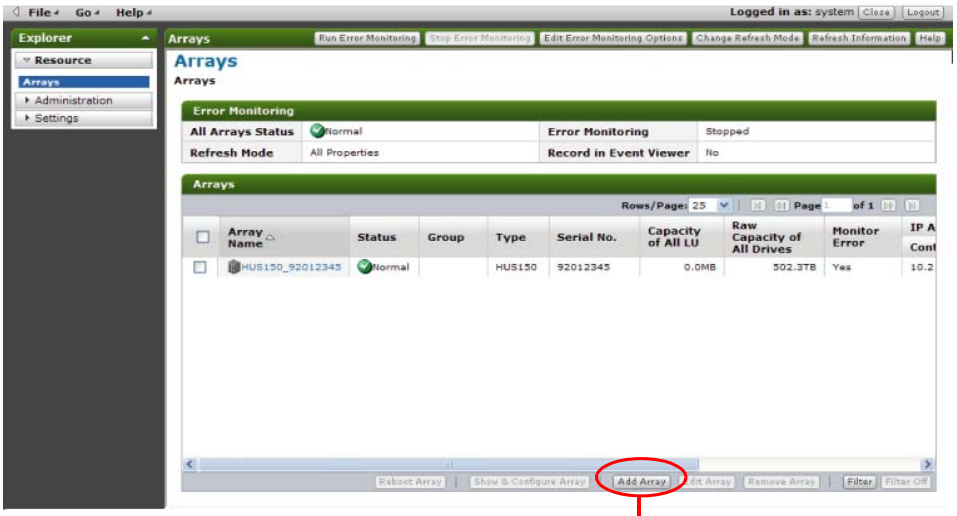
The following sections describe how to configure your Hitachi Unified Storage system for a basic configuration.

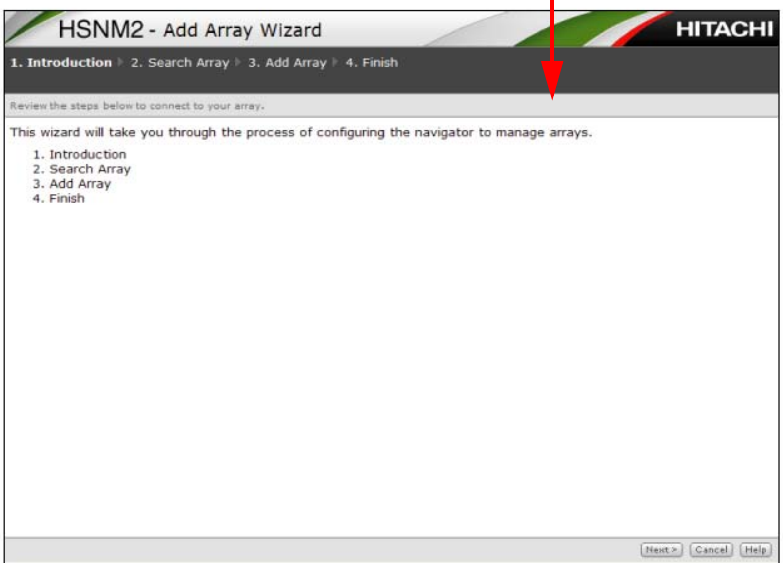
## Registering the storage system

When you start Storage Navigator Modular 2 for the first time on a new Hitachi Unified Storage system, the Add Array wizard starts automatically. Use this wizard to search for and register the storage system you want to configure.

To change these settings in the future, you can run the Add Array wizard manually. If prompted for storage feature license keys during this procedure them, please follow the on-screen instructions.

1. Click the **Add Array** button in the Arrays screen.




2. In the introduction page, click **Next**.

3. In the next page:
   a. Enter the following default IP address in the **Specific IP Address or Array Name** fields for each storage system management port.

      Controller 0: type **192.168.0.16**

      Controller 1: type **192.168.0.17**

**NOTE:** If your management console is directly connected to a management port, enter the default IP address just for that port.

   b. In the **Using Ports** area, select whether the ports are secure, nonsecure, or both.
   c. Click **Next**.
4. In the next page:
   a. Enter a storage system name in the **Array Name** field.
   b. Click **Next**.
   c. Click **Finish**.
5. Go to Performing the initial setup**, below.**

## Performing the initial setup

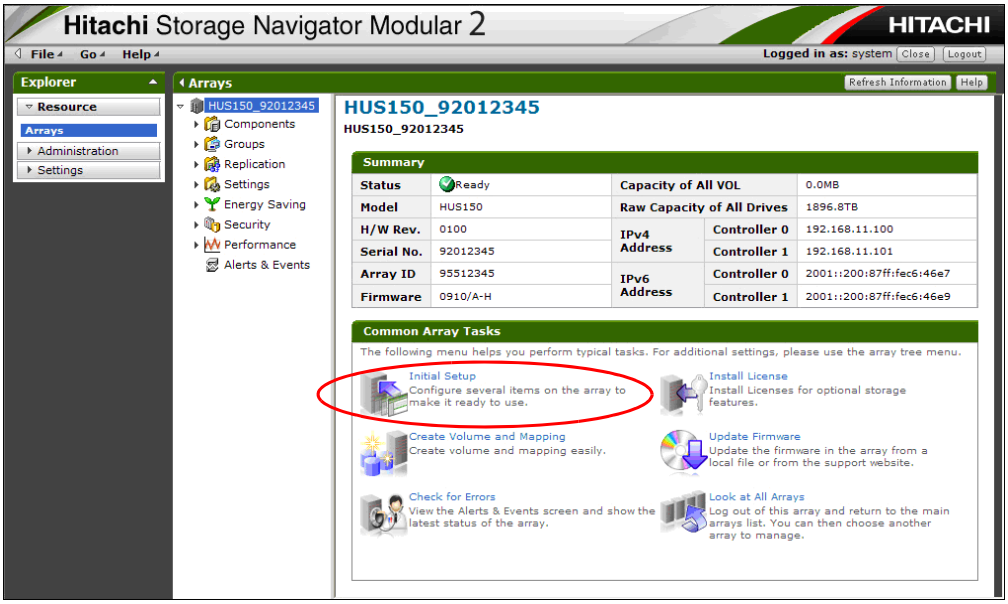
After you run the Add Array wizard, run the Initial Setup wizard to configure the following settings:

- E-mail alerts (to sending e-mail alerts to a service provider, contact the service provider before configuring these)
- Management ports
- Host ports
- Spare drives
- System date and time

After you configure these settings, you can rerun the wizard in the future should you need to change these parameters.

To run the Initial Setup wizard:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click the name of the storage system you want to configure.
2. On the right side of the screen, under **Common Array Tasks**, click **Initial Setup**.




3. In the introductory page, click **Next**.
4. In the Set up Email Alert page, email notifications are disabled by default. To accept this setting, click **Next** to display the Set up Management Ports page and go to step 5.

   To enable email notifications, complete the fields in Figure 5-4 (see Table 5-1 on page 5-9). Then click **Next** and go to step 5.

**NOTE:** This procedure assumes your SMTP server is set up properly to handle email. If desired, you can send a test message to confirm that email notifications work (refer to the Storage Navigator Modular 2 online help).

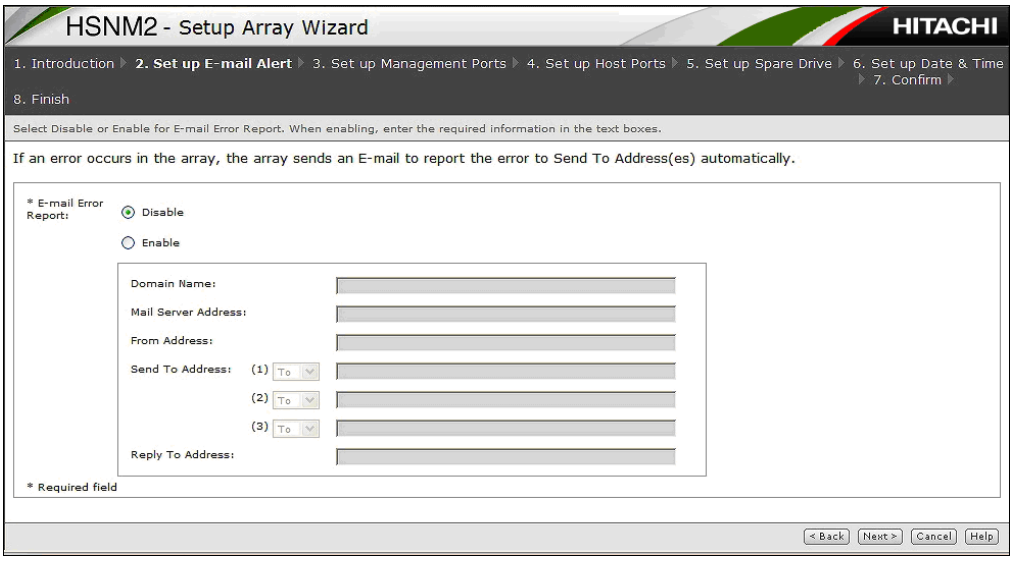



**Figure 5-4: Set up Email Alert page**

**Table 5-1: Enabling email notifications**

| Field | Description |
|---|---|
| Disable/Enable | To enable email notifications, click Enable, complete the remaining fields, and record your settings in Appendix A, Recording configuration settings. |
| Domain Name | Domain appended to addresses that do not contain one. |
| Mail Server Address | Email address or IP address that identifies the Controller Box as the source of the email. |
| From Address | Each email sent by the Controller Box will be identified as being sent from this address. |
| Send to Address | Up to 3 individual email addresses or distribution lists where notifications will be sent or blind copied (Bcc). |
| Reply To Address | Email address where replies can be sent. |

5. Configure the controller management ports manually or automatically (see Figure 5-5 on page 5-9 and Table 5-2 on page 5-10).
6. When you finish, click **Next** and go to Setting up host ports on page 5-11.

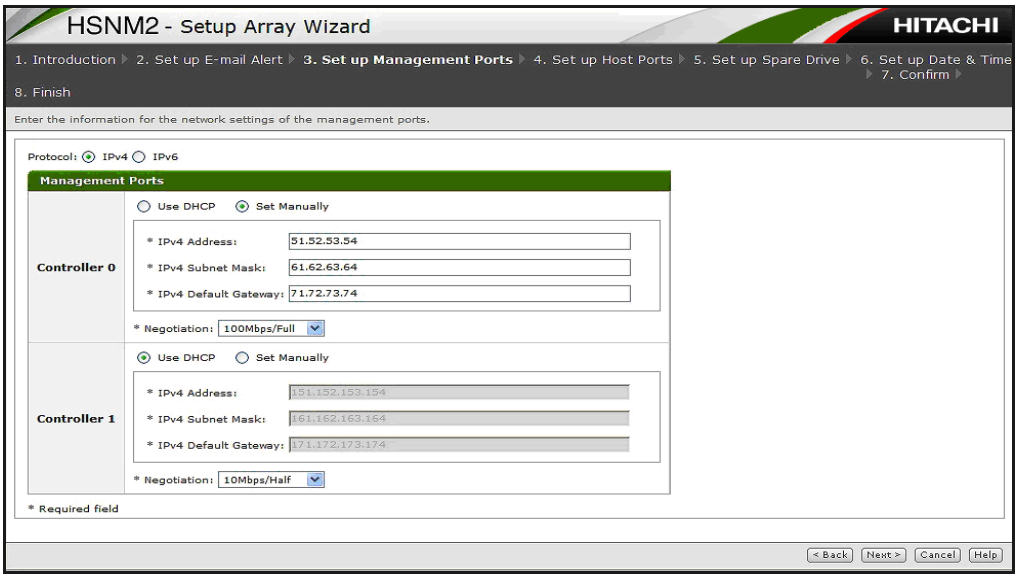



**Figure 5-5: Set up Management Ports page**

**Table 5-2: Configuring management ports**

| Field | Description |
|---|---|
| IPv4/IPv6 | Select the IP addressing method you want to use. |
| Use DHCP/Set Manually | For IPv4, **Use DHCP** configures the management port automatically, but requires a DHCP server.<br>For IPv6, **Set Automatically** configures the management port automatically. |
| Set Manually | Lets you complete the remaining fields to configure the management port manually. If you use IPv6 addresses, note that these addresses are based on Ethernet addresses. If a controller is replaced, the IP address changes. Therefore, we recommend using the manual setting with IPv6. Record your settings in Appendix A, Recording configuration settings. |
| **If you selected the IPv4 protocol in the Set Up Management Ports page:** | |
| IPv4 Address | Static Internet Protocol address that client PCs use to access the Controller Box's management port. |
| IPv4 Subnet Mask | Subnet mask that client PCs use to access the Controller Box's management port. |
| IPv4 Default Gateway | Default gateway that client PCs use to access the Controller Box's management port. |
| Negotiation | Use the default (**Auto**) setting to auto-negotiate speed and duplex mode, or select a fixed speed and duplex setting. |
| **If you selected the IPv6 protocol in the Set Up Management Ports page:** | |
| IPv6 Address | Static Internet Protocol address that client PCs use to access the Controller Box's management port. |
| Subnet Prefix Length | Subnet prefix length that client PCs use to access the Controller Box's management port. |
| IPv6 Default Gateway | Default gateway that client PCs use to access the Controller Box's management port. |
| Negotiation | Use the default (**Auto**) setting to auto-negotiate speed and duplex mode, or select a fixed speed and duplex setting. |

If your:

- Management console is directly connected to a management port on one controller, enter settings only for that controller (you will configure the management port settings for the other controller later).
- Management console is connected using a switch or hub, you can enter settings for both controllers now.

## Setting up host ports

The next part of the wizard lets you configure the Fibre Channel ports on your storage system. If your storage system has iSCSI ports as well, you can configure the settings for the iSCSI ports as well. Fibre Channel and iSCSI settings are configured on separate pages within the wizard.

The first page that appears lets you configure the Fibre Channel ports.

1. In the first Set up Host Ports page, enter configuration information for each Fibre Channel port that will be used.

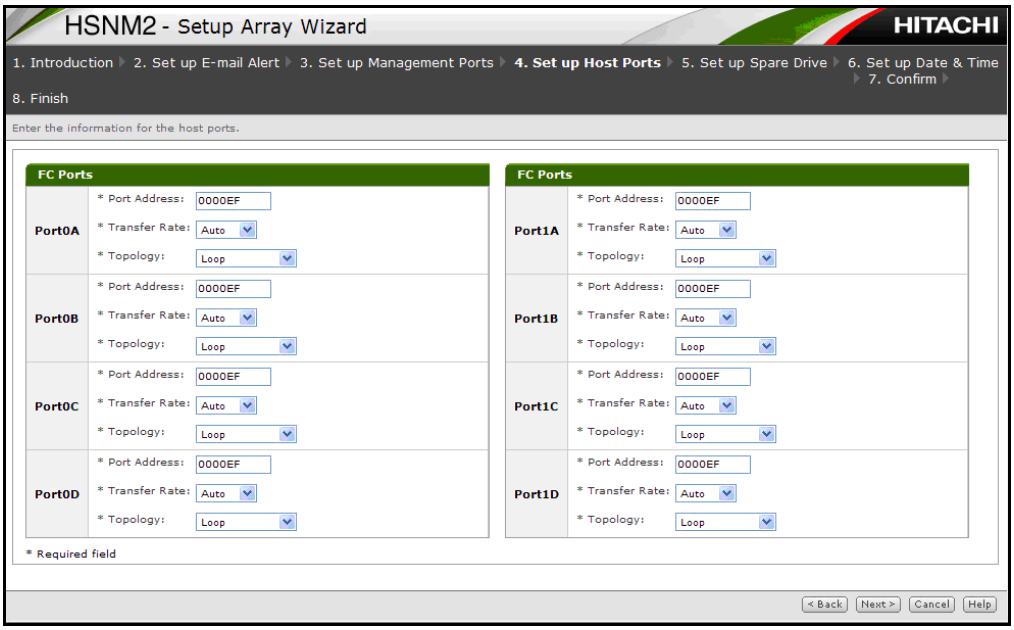



**Figure 5-6: Set Up Host Ports page (Fibre Channel ports)**

**Table 5-3: Configuring Fibre Channel ports**

| Field | Description |
|---|---|
| Port Address | Enter the address for the Fibre Channel port. |
| Transfer Rate | Select the data transfer rate used between the storage system and connected device, such as the server or switch. If you click an option other than **Auto**, select the maximum transfer rate supported by the device connected to the storage system.<br><br>Choices are:<br>• 2 Gbps<br>• 4 Gbps<br>• 8 Gbps<br>• Auto<br><br>For additional considerations, see Transfer rate considerations on page 5-14. |

**Table 5-3: Configuring Fibre Channel ports (Continued)**

| Field | Description |
|---|---|
| Topology | Select the topology in which the port will participate:<br>• Point-to-Point = port will be used with a Fibre Channel switch.<br>• Loop = port is directly connected to the Fibre Channel port of an HBA installed in a server.<br>If you connect a Hitachi Unified Storage system directly to the Hitachi Universal Storage Platform V/Hitachi Universal Storage Platform VM, set the topologies of both devices to **Loop**. |

2. Click **Next**. If your storage system has iSCSI ports, use the next page to configure the settings for each iSCSI port that will be used.

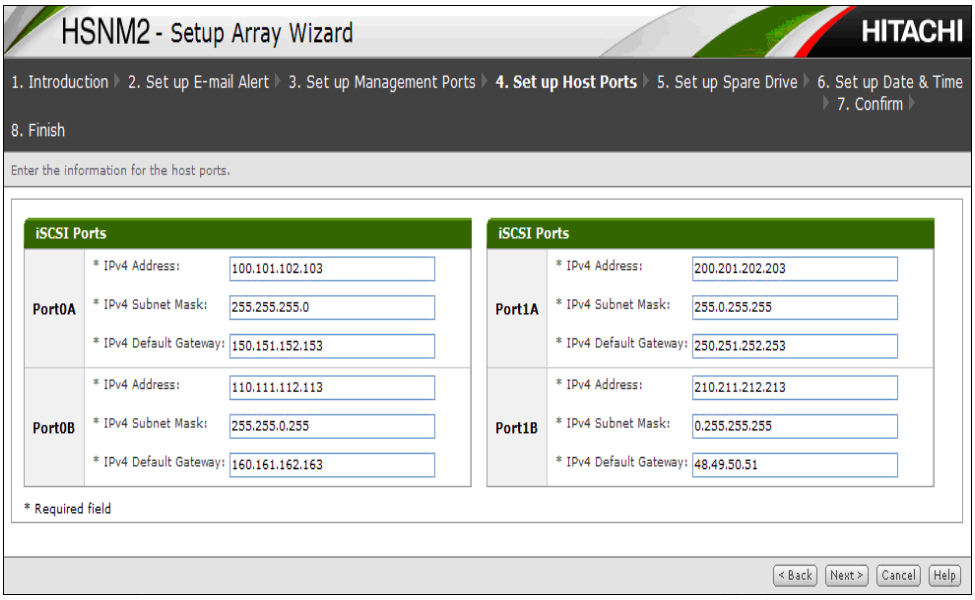



**Figure 5-7: Setup up Host Ports page (iSCSI ports, IPv4)**

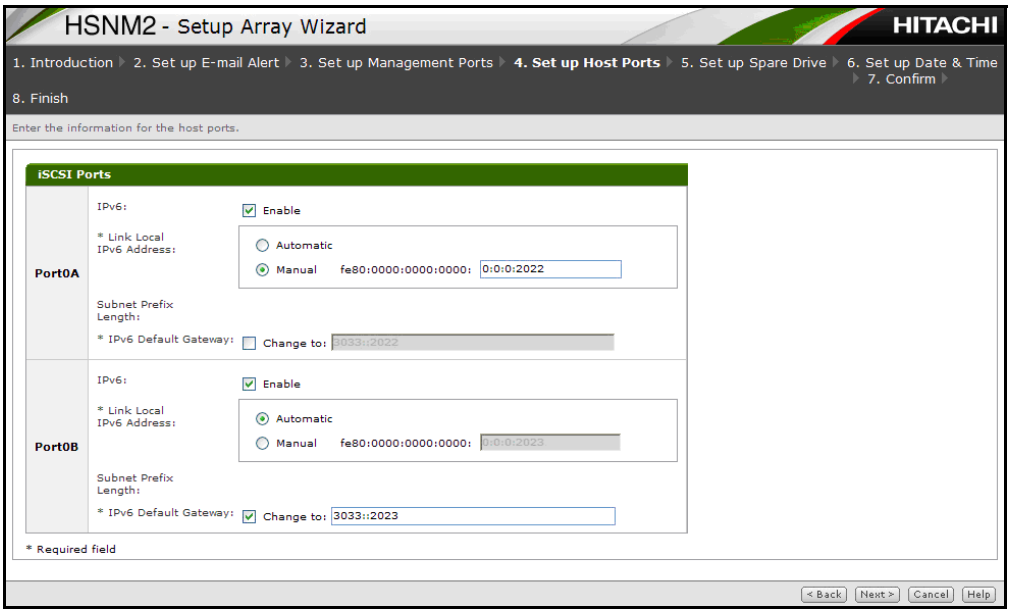



**Figure 5-8: Set up Host Ports page (iSCSI ports, IPv6)**

**Table 5-4: Configuring iSCSI ports**

| Field | | Description |
|---|---|---|
| IPv4 | IP Address | Enter the IPv4 address (dotted-decimal notation). |
| | Subnet Mask | Enter the network subnet mask (dotted-decimal notation). |
| | Default Gateway | Enter the default route. |
| IPv6 | Link Local IP Address | Valid Link local IP address within the same link. |
| | Global IP Address | Unique global IP address that does not overlap other IP addresses. |
| | Subnet PreFix Length | Subnet prefix length. |
| | Default Gateway | Default gateway of the selected iSCSI port. |
| | TCP Port Number | TCP port number used by the storage system. |
| Keep Alive Timer | | Sets the interval, in seconds, for checking communication with the host. If the storage takes longer than 30 seconds, (for example, because of a storage reboot), the operating system is notified about the loss of storage and may require a reboot of the host or a rescan of the target devices. Increasing the Keep Alive Timer value above the 60 second default allows a longer time period for the iSCSI storage to come up without preventing a disconnect. |

**Table 5-4: Configuring iSCSI ports (Continued)**

| Field | | Description |
|---|---|---|
| MTU Size | | Maximum Transmission Unit. MTU enables the automatic detection of large packets between TCP/IP endpoints. Large packets are desirable because of the following factors:<br>• Network – large packets mean fewer packets sent and a reduced number of headers.<br>• Routers – large packets reduce routing decisions.<br>• Clients – large packets mean less protocol processing and device interrupts.<br>To use jumbo frames, all devices in the network path between the storage system and server, including switches, NICs, and HBAs must have jumbo frames enabled. |
| VLAN | | Enables the storage system's Virtual LAN function for use with switches that support VLANs and lets you enter a VLAN identifier from 1 to 4094 to identify the VLAN. |
| MAC Address | | Shows the Media Access Channel (MAC) address of the storage system. |
| Digest | Header Digest | Performs a Cyclic Redundancy Check (CRC) for the header part of the iSCSI Protocol Data Unit (PDU) in the network path. |
| | Data Digest | Performs a CRC check for the data part of iSCSI PDU the in network path. |
| Window Scale | | Allows Window Size to be expanded. |
| Delayed Ack | | Enables the Delayed Ack function. |

3. Click **Next** to display the Set up Spare Drive page.

## Transfer rate considerations

Observe the following considerations when setting the transfer rate.

- Set the **Transfer Rate** to the transfer rate of Fibre Channel devices connected directly to the storage system ports. If the Hitachi Unified Storage system is connected directly to the Hitachi Universal Storage Platform V/ the Hitachi Universal Storage Platform VM, set the port transfer rate of both the Hitachi Universal Storage Platform V/ the Hitachi Universal Storage Platform VM and the Hitachi Unified Storage system to the same transfer rate (2 Gbps, 4 Gbps, or 8 Gbps). See Table 5-5 on page 5-15.

**Table 5-5: Transfer rate per port**

| Transfer rate of devices of each port connected to a storage system | Transfer rate of storage system |
|---|---|
| 2 G bps | 2 G bps |
| 4 G bps | 4 G bps |
| 8 G bps | 8 G bps |
| Auto (Maximum speed 8G bps) | 8 G bps |
| Auto (Maximum speed 4G bps) | 4 G bps |
| Auto (Maximum speed 2G bps) | 2 G bps |

- If a Hitachi Unified Storage system equipped with TrueCopy Remote Replication or TrueCopy Extended Distance is directly connected to the Hitachi Unified Storage system, set the transfer rate to the Fibre Channel transfer rate for the remote path (2 Gbps, 4 Gbps, or 8 Gbps). See Table 5-6 on page 5-15.

**Table 5-6: Transfer rate for direct connections**

| Transfer rate of each port directly connected to a local storage system | Transfer rate of storage system |
|---|---|
| 2 G bps | 2 G bps |
| 4 G bps | 4 G bps |
| 8 G bps | 8 G bps |

- If the transfer rate of a Fibre Channel port on a Hitachi Unified Storage system is set to **Auto**, the storage system auto-negotiates the maximum transfer rate. If you turn off the Hitachi Unified Storage system, HBA, or switch and then turn on the device again, use Storage Navigator Modular 2 to confirm that the maximum transfer rate is configured. If the transfer rate is not the maximum speed, remove the Fibre Channel cable and reinsert it or use Storage Navigator Modular to change the transfer rate.
- If TrueCopy Remote Replication or TrueCopy Extended Distance is installed on a Hitachi Unified Storage system whose remote path becomes blocked frequently, check whether the transfer rate for the storage system's remote path is set to **Auto**. If it is, change the transfer rate to use a fixed transfer rate instead of a rate that is automatically negotiated.
- If you connect the Hitachi Unified Storage system directly to the Hitachi Universal Storage Platform V/Hitachi Universal Storage Platform VM, set the topologies of the both devices to **Loop**.

## Configuring spare drives

The next part of the Setup Array wizard lets you specify the drives you want to use as spares. A spare is a drive that is present in the system, but is normally unused until you need additional capacity or another drive fails. At that time, the drive is substituted for the failed drive.

The Set up Spare Drive page shows all the spares that can be used in your storage system.

1. Select the drives you want to use as spares. If the drives exceed what can be shown in the **Available Drives** area, use the controls at the top of this area to display other pages of drives.

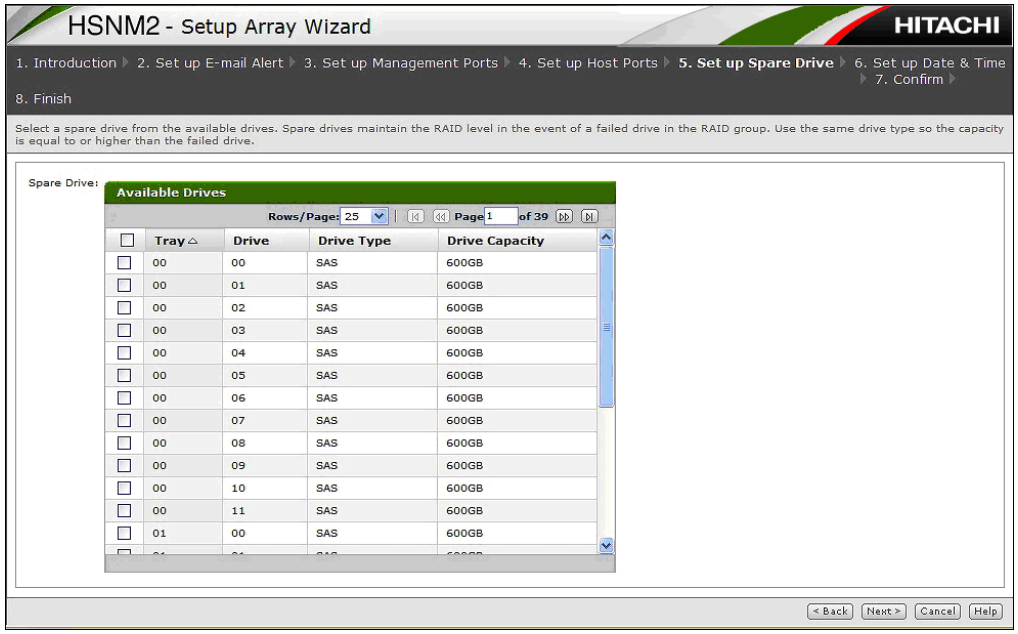



**Figure 5-9: Set up Spare Drive page**

2. Click **Next** to display the Set up Date & Time page.

**NOTE:** To verify and manage spare drives, see Managing spares on page 5-42.

## Configuring system date and time

The next part of the Setup Array wizard lets you configure the storage system date and time (see Figure 5-10 on page 5-17).

**NOTE:** To change the time or synchronize with a Network Protocol Time (NTP) server, use the procedure under Setting the system date and time on page 5-98.

Select whether the date and time are to be set automatically, manually, or to keep the current setting.

3. If you select **Set Manually**, enter the date and time (in 24-hour format) in the fields provided.
4. Click **Next**.

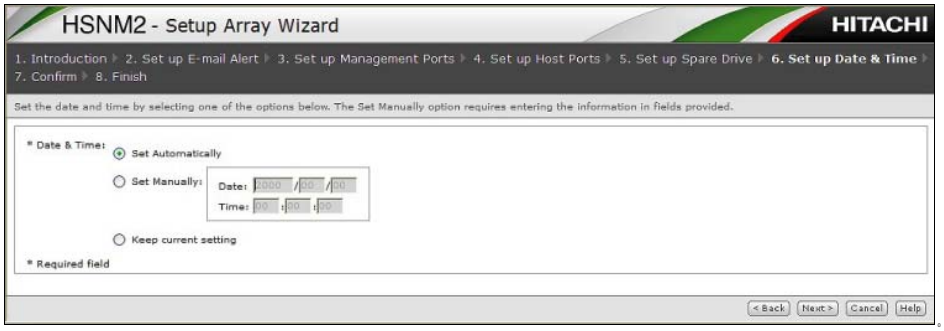



**Figure 5-10: Set up Date & Time page**

## Confirming your selections

1. Review your selections in the next four confirmation pages:
   a. If no changes are required, click **Next**.
   b. To change a selection, click **Back** to return to the appropriate page, make the desired changes, and then click **Next** to return the first confirmation page and verify that the change was made.
   c. In the last confirmation page, click **Confirm** to commit your selections.
2. In the finish page, click **Finish**.
3. When the next page tells you that the initial setup of the storage system was completed successfully, click **Finish**.

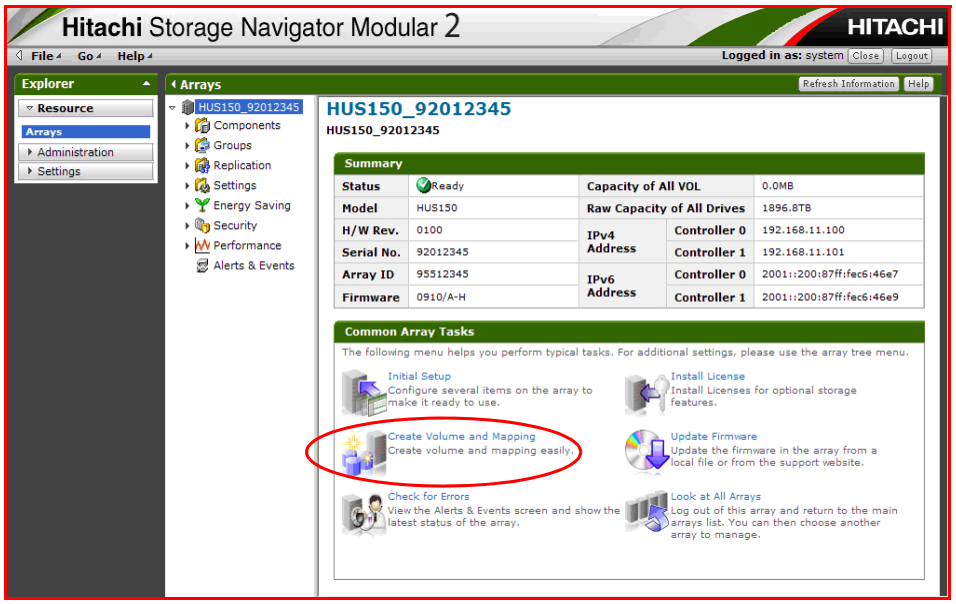
# Creating and mapping volumes

After registering your storage system, use one of the following methods to create volumes.

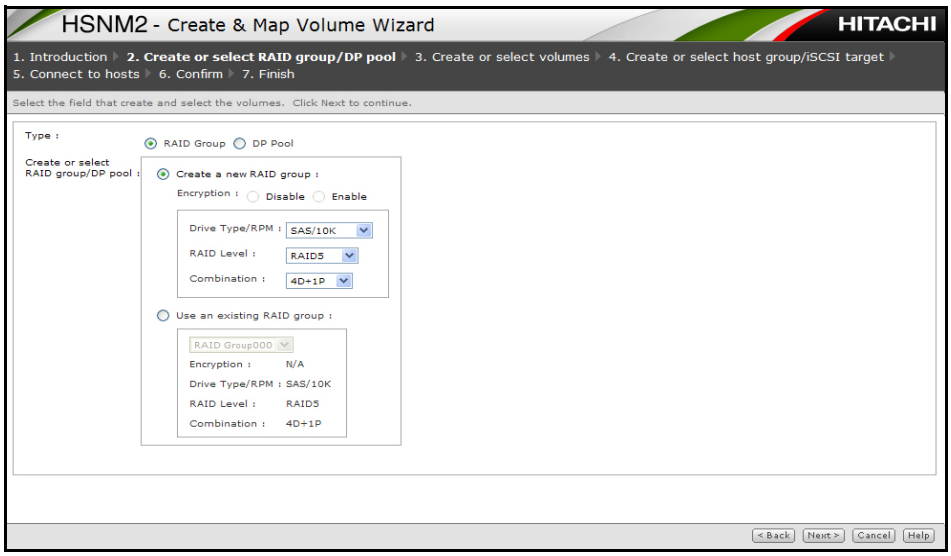
- Using Create and Map Volume wizard, described below.
- Using the manual method, described under Creating volumes on page 5-36.

To use the Create and Map Volume wizard to create volumes, use the following procedure.

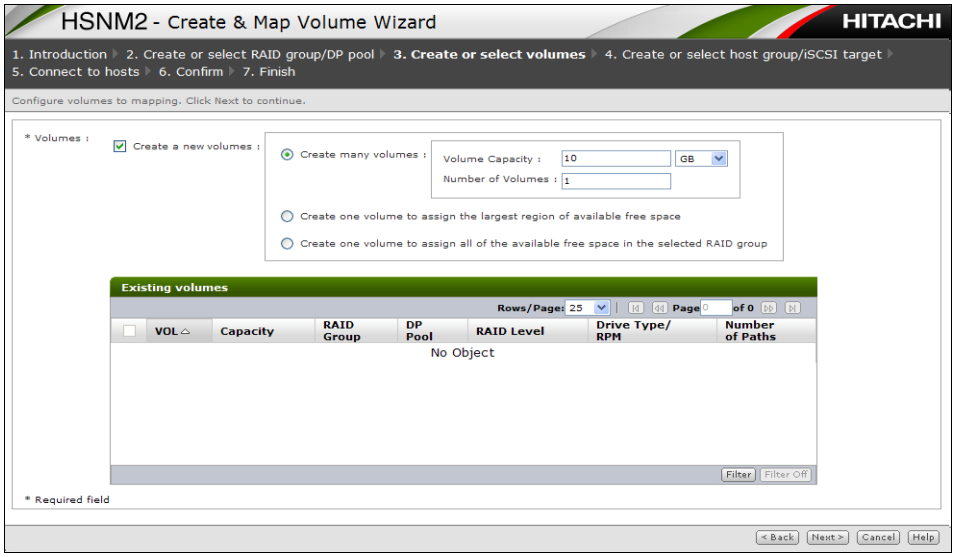
1. Click the **Create Volume and Mapping** in the window.




2. In the next window, click **Next**. Review the steps in this wizard and then click **Next** again.
3. Click **Create or select RAID group/DP pool**, and then click **Next**.

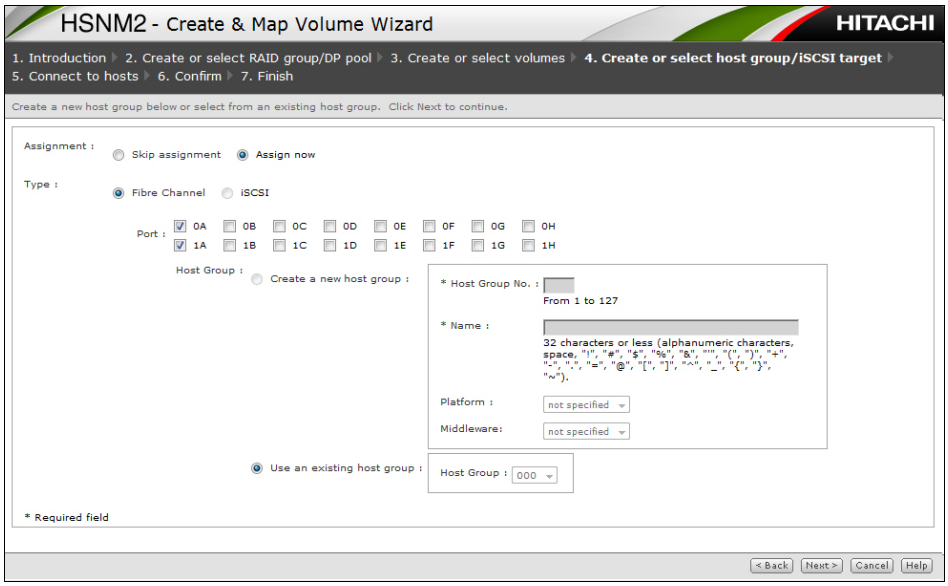



4. Create or select the volumes, and then click **Next**.

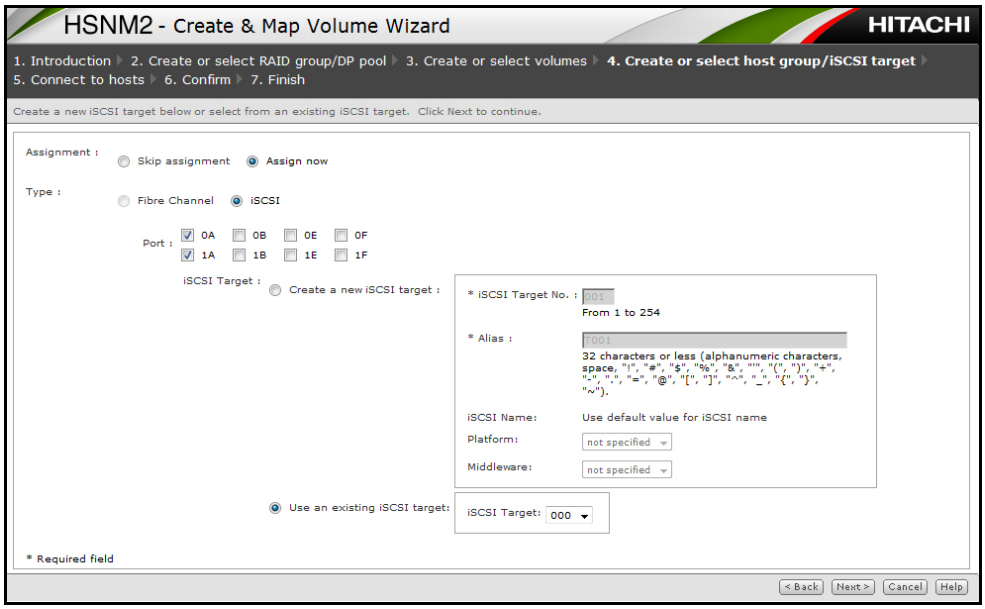



5. Create or select a host group/iSCSI target, and then click **Next**.

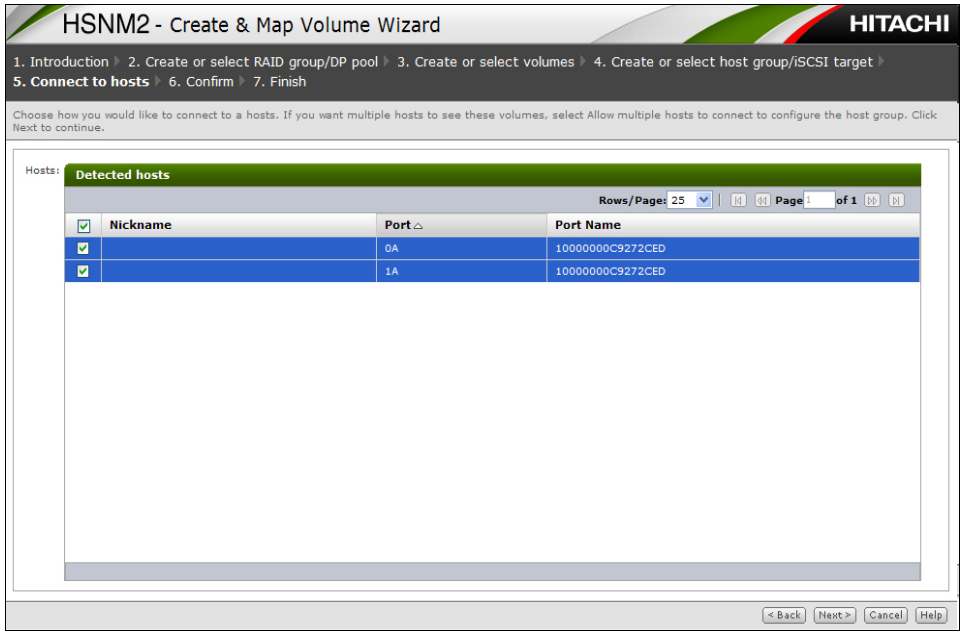
   - The following screen is for Fibre Channel connections:



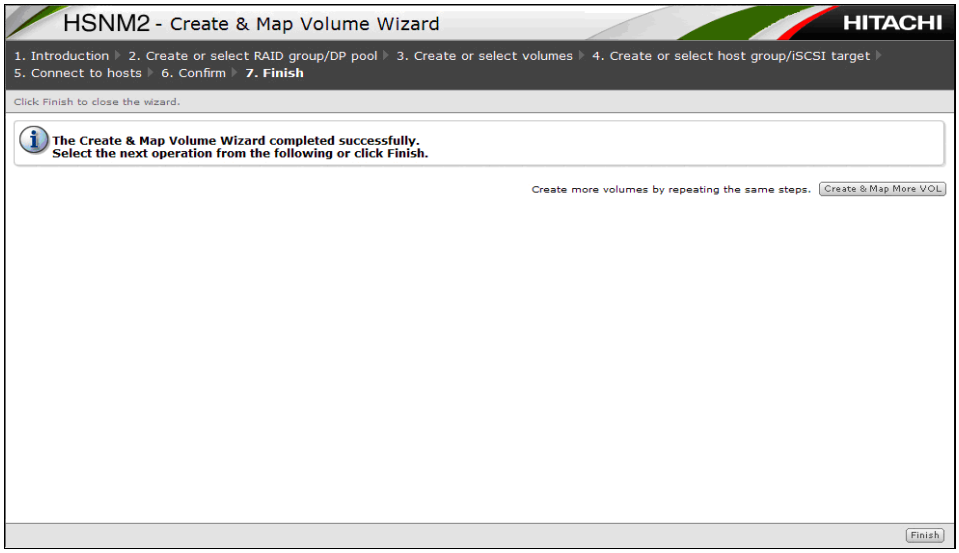

   - The following screen is for iSCSI connections:




6. Click **Connect to hosts**, and then click **Next**.




7. Review your selections in the next two confirmation screens.
   a. If no changes are required, click **Next**.
   b. To change a selection, click **Back** to return to the appropriate page, make the desired changes, and then click **Next** to return the first confirmation page and verify that the change was made.
   c. In the last confirmation page, click **Confirm** to commit your selections.
8. In the finish page, click **Finish**.
9. To add volumes, click **Create & Map More VOL**.




## Changing controller IP addresses

1. If the storage unit was not added to your storage network:
   a. Log out of Storage Navigator Modular 2.
   b. Power-off the storage unit.
   c. Add the storage unit to the network.
   d. Reconnect the management console to the management ports.
   e. Restart your browser and log in to Storage Navigator Modular 2 again.

**NOTE:** Configure the console for the same subnet on which the Controller Box is installed. Otherwise, an error message appears when you try to access Storage Navigator Modular 2.

2. If the Arrays page is not displayed, click **Arrays** in the Explorer pane.
3. In the Arrays page:
   a. Under the **Array Name** column, check the storage system name that you recorded in Appendix A, Recording configuration settings.
   b. Click **Edit Array**. An Edit Array page similar to the one in Figure 5-11 appears.

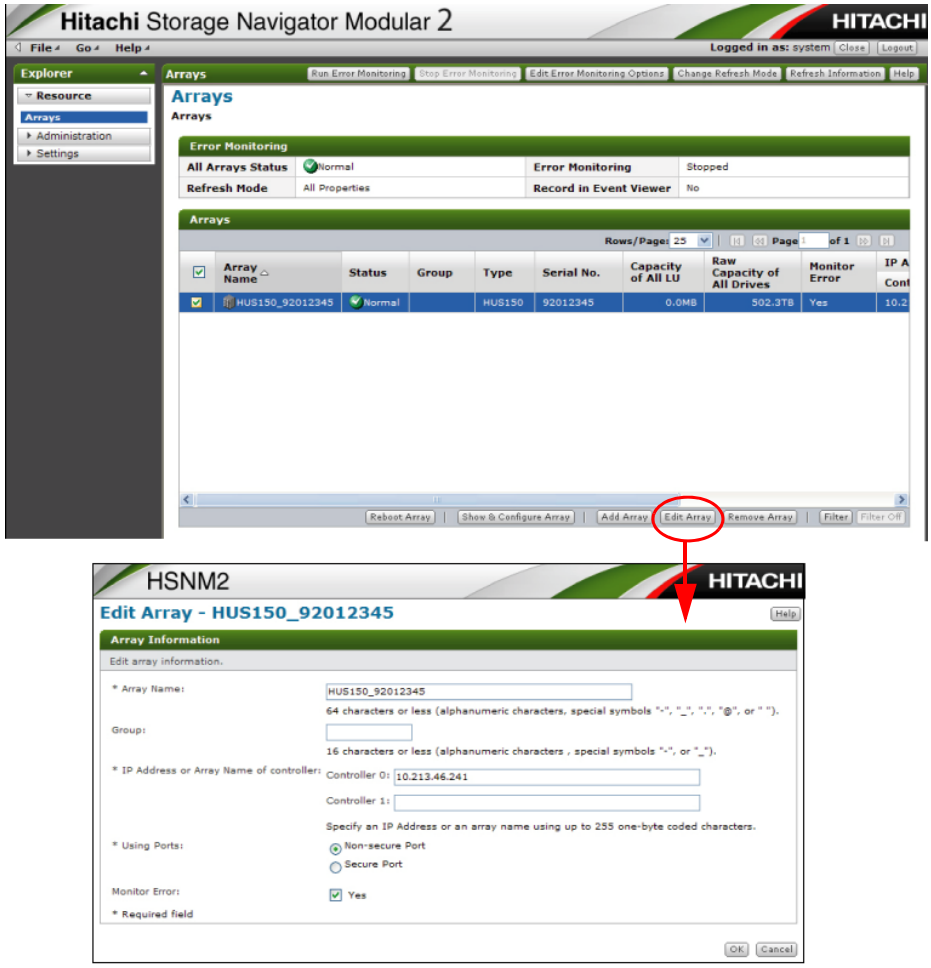



**Figure 5-11: List of arrays and Edit Array window**

4. In the **IP Address or Array Name of controller** field, enter the same controller IP addresses recorded in Appendix A, Recording configuration settings. See the note on page 5-10 about management consoles directly connected to a management port on one controller or connected using a switch or hub.

**NOTE:** If you set the IPv6 address to **Obtain an IP address automatically**, the address is configured automatically. Therefore, after you remove the address from the Arrays window, click **Add Array** in step 3b and perform Search Array to register the address again.

5. Click **OK**.
6. When the page tells you that the storage system information has been edited successfully, click **Close**.

# Selecting platform-specific settings

To connect to hosts running the following host operating systems and clustering solutions, use Storage Navigator Modular 2 to configure the storage system's host groups and iSCSI targets as described in the following procedures.

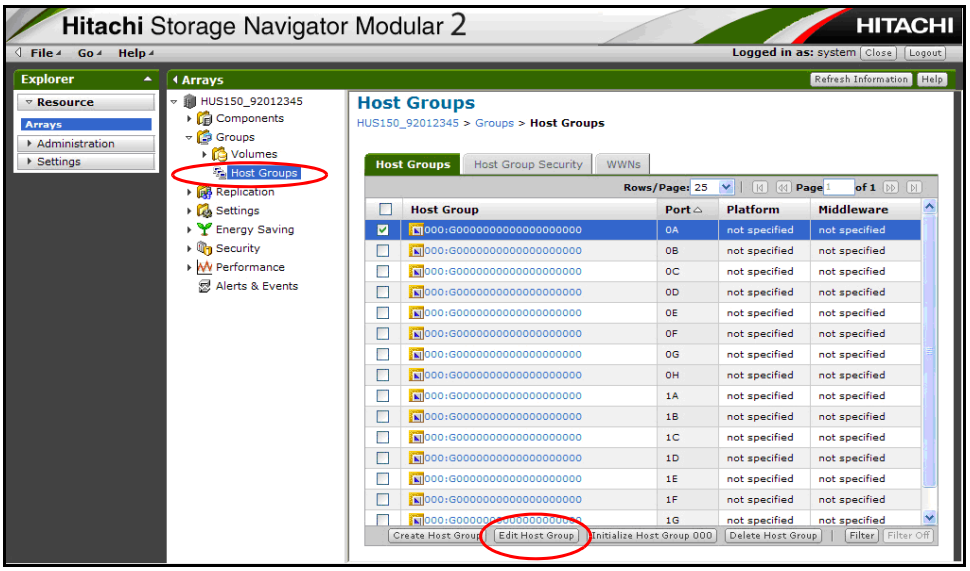
- AIX
- HP-UX
- NetWare
- TruCluster
- Veritas Cluster Server
- Microsoft Windows Server 2003 and 2008
- Red Hat Enterprise Linux
- SUSE Linux Enterprise
- Solaris
- VMware

The following procedure describes how to select platform-specific settings for Fibre Channel host groups (see Storage systems with Fibre Channel ports) and iSCSI targets (see Storage systems with iSCSI ports on page 5-24). A host group is a logical entity of two or more hosts that share access to specific disks on the storage system. The hosts in a host group can run the same or different operating systems. In addition, the hosts in the host group usually have special software, such as clustering software, to manage virtual disk sharing and accessibility.

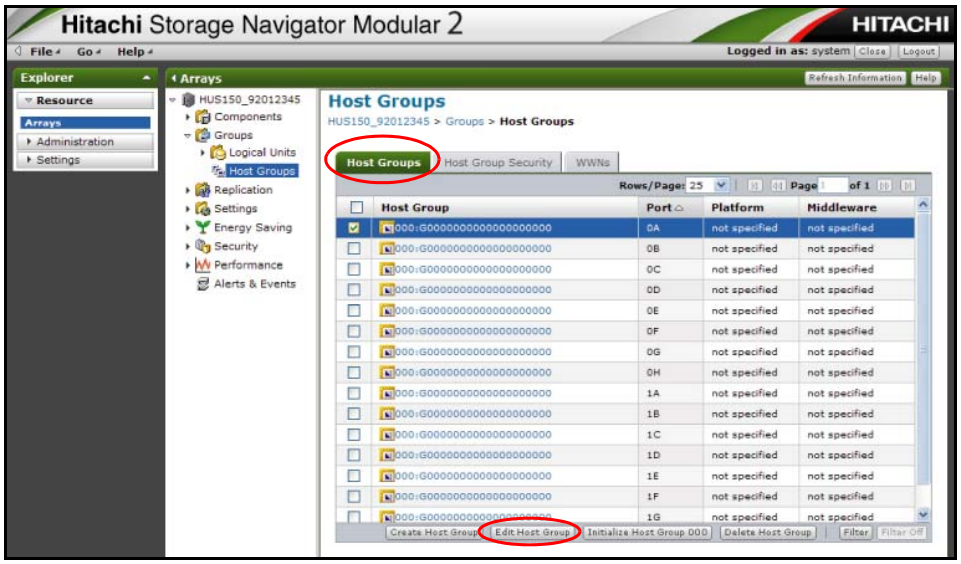
For more information about these settings, see Table 5-9 on page 5-28 and the text preceding the table.

## Storage systems with Fibre Channel ports

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Host Groups**.




2. In the **Host Groups** tab on the right side, check the host group in the **Host Groups** tab and click **Edit Host Group**.



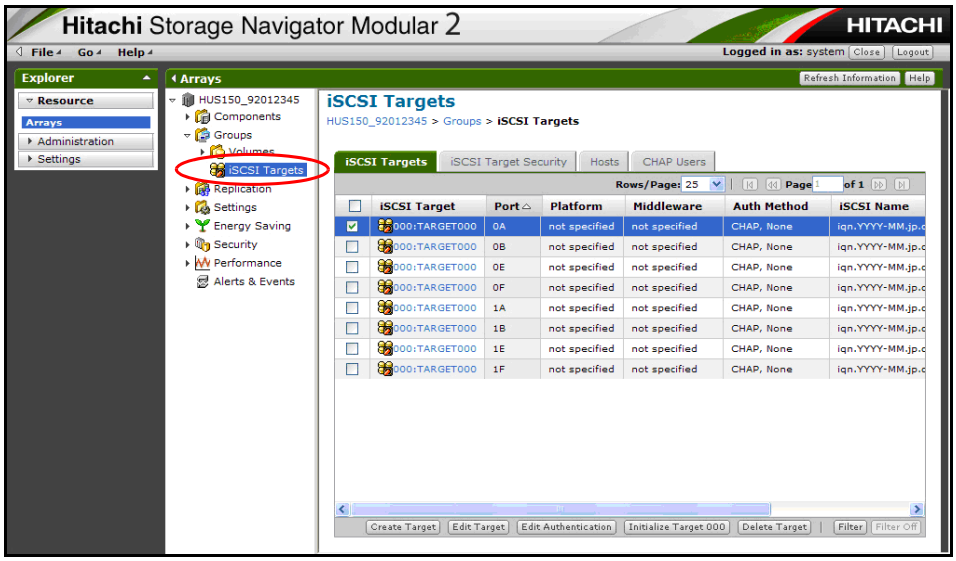

3. In the Edit Host Group page, click the **Volumes** tab.
4. Go to Selecting Platform and Middleware settings on page 5-25.

**NOTE:** If you want to release the volume assignment, see Releasing volume assignments (Fibre Channel) on page 5-76.

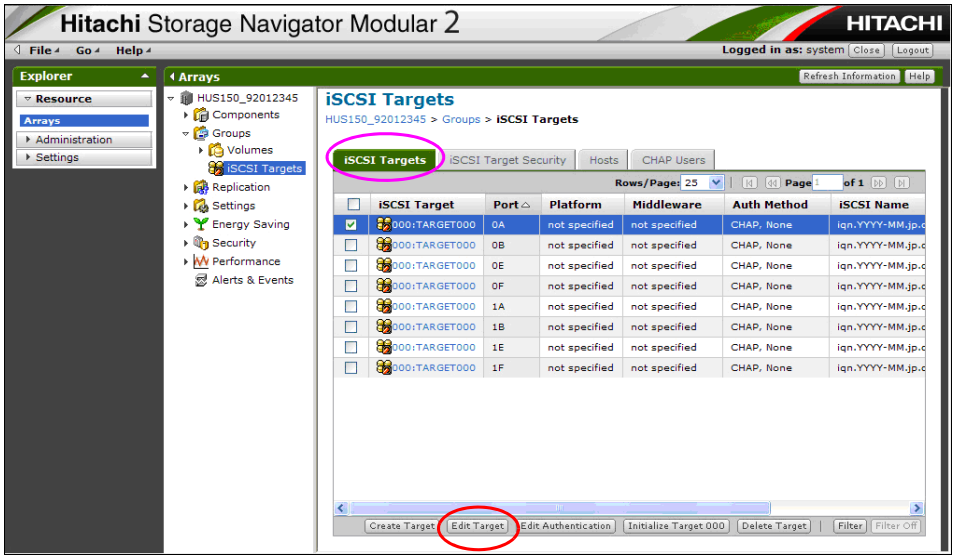
## Storage systems with iSCSI ports

For storage systems with iSCSI ports:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**.




2. In the iSCSI Targets page, check a target in the **iSCSI Targets** tab and click **Edit Target** at the bottom of the page.




3. In the Edit iSCSI Targets page, click the **Options** tab.
4. Go to Selecting Platform and Middleware settings on page 5-25.

## Selecting Platform and Middleware settings

1. Use the **Platform** pull-down list to select a host operating system (see Figure 5-12, Figure 5-13 on page 5-26, and Table 5-7 on page 5-26).

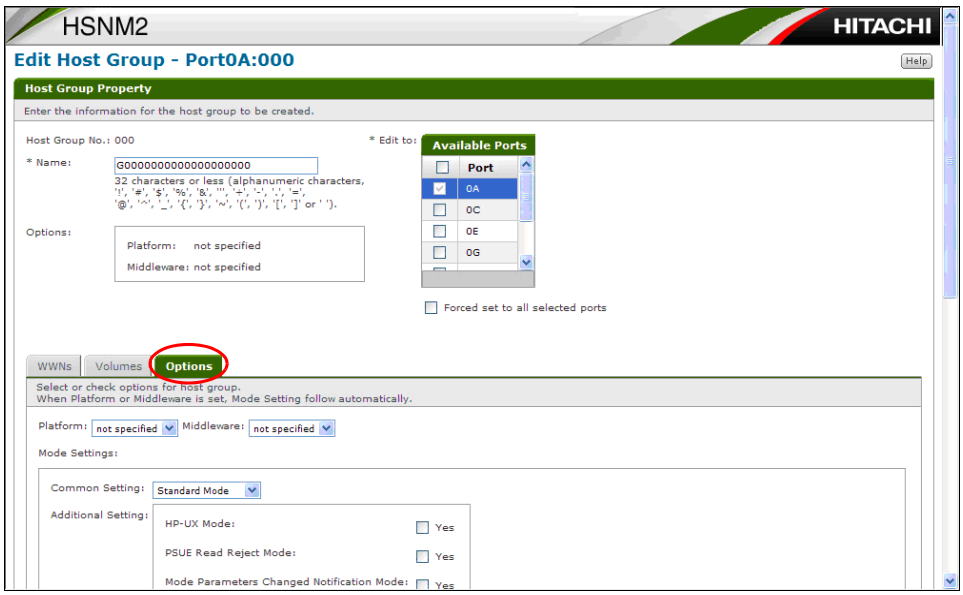



**Figure 5-12: Platform settings for Fibre Channel**

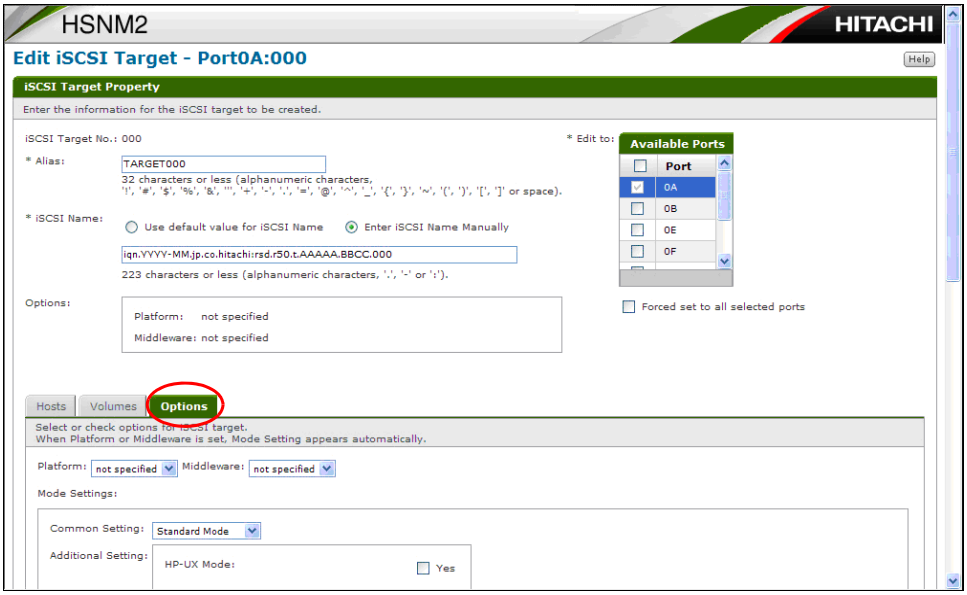



**Figure 5-13: Platform settings for iSCSI**

**Table 5-7: Platform settings**

| For the following operating systems to connect | Select this platform setting |
|---|---|
| Windows 2000 Server, Windows Server 2003 and 2008, Windows XP, and Vista | Windows |
| Red Hat Enterprise Linux, SUSE Linux Enterprise, Asianux | Linux |
| Solaris | Solaris |
| VMware | VMware |
| HP-UX | HP-UX |
| NetWare | NetWare |
| AIX | AIX |
| Tru64 | Not specified<br>(For Tru64, do not select **HP-UX**.) |

When setting multiple ports, select a port number from the **Edit to** list and click **Forced set to all selected ports**. If you selection this option, a prompt asks you to confirm your selection.

If extending the volume capacity on AIX, select AIX as a platform, and then select and enable **Capacity Data Changed Notification Mode** from the **Additional Setting**. This option is enabled for both Fibre Channel and iSCSI. This setting has no impact to platforms other than AIX, even if this setting is selected for non-AIX platforms.

2. When setting multiple ports, select a port number from **Edit to** and check the **Forced set to all selected ports** check box.
3. From the **Middleware** pull-down list, select a middleware setting (see Figure 5-14 on page 5-27, Figure 5-15 on page 5-27, and Table 5-8 on page 5-27). If your configuration is not in the table, select **Not specified** for your **Platform** and **Middleware** settings. For more information, see Table 5-9 on page 5-28 and the text preceding it.

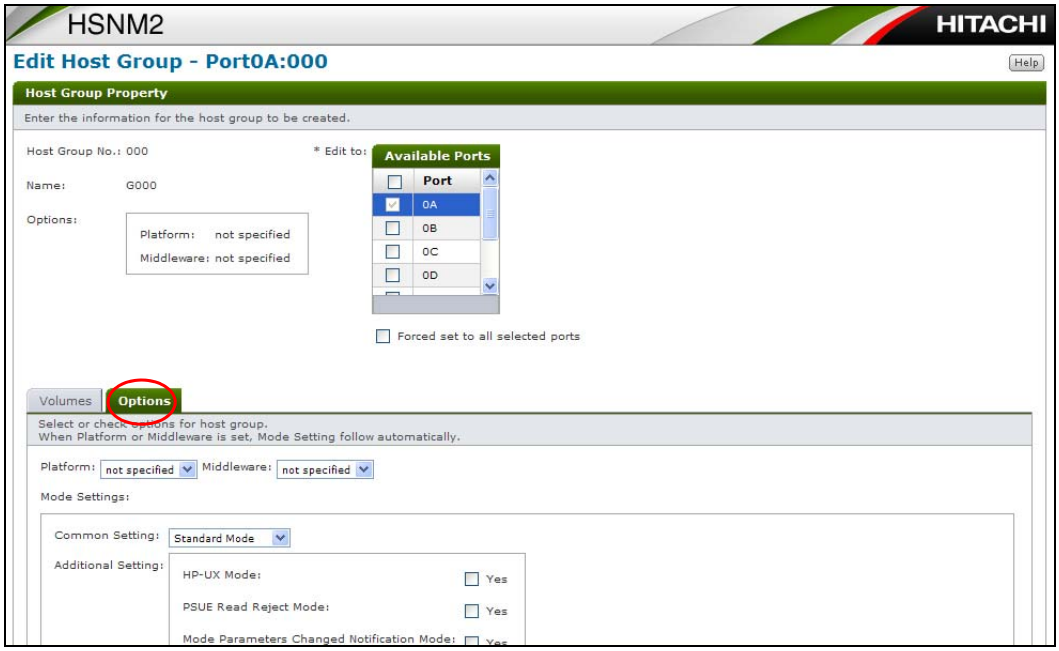



**Figure 5-14: Middleware settings for Fibre Channel**

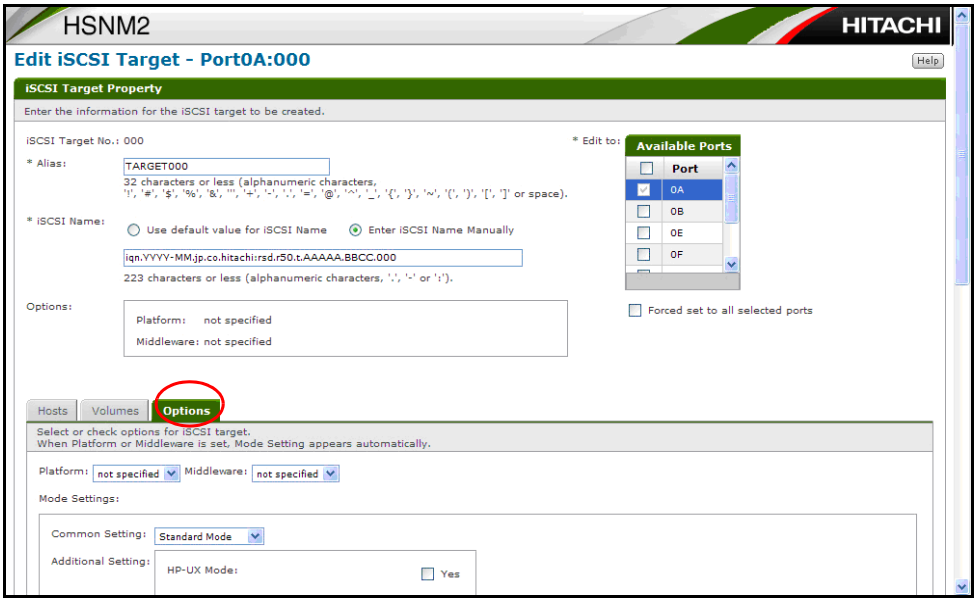



**Figure 5-15: Middleware settings for iSCSI**

**Table 5-8: Middleware settings**

| To use this software | Select this middleware setting |
|---|---|
| Veritas Cluster Server | VCS |
| HP TruCluster Server | TruCluster |
| Other | Not specified |

If you change **Platform** or **Middleware** setting, the selections on the **Additional Settings** list are included automatically and the appropriate setting is redisplayed, even though the drop-down menu changes to inactive.

If you operate other windows with the drop-down list inactive (grayed out), the **Additional Settings** list might not have the desired settings enabled. Therefore, check that the drop-down menu is active and that the appropriate options are selected. In the following table, the symbol • means the parameter is selected automatically by selecting **Platforms** or **Middleware**.

**Table 5-9: Host connection parameter settings**

| Platforms | Windows | Linux | Solaris | HP-UX | AIX | VMware | NetWare | Not Specified | — | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Middleware** | **Not specified** | | | | | | | | **VCS** | **TruCluster** |
| Basic Setting (select one) | | | | | | | | | | |
| Standard Mode | • | • | • | • | • | • | • | • | | |
| Open VMS Mode | | | | | | | | | | |
| Wolfpack Mode | | | | | | | | | | |
| TRESPASS Mode | | | | | | | | | | |
| Detail Setting (multiple selections) | | | | | | | | | | |
| HP-UX Mode | | | | • | | | | | | |
| PSUE Read Reject Mode | | | | • | | | | | | |
| Mode Parameters Changed Notification Mode | | | | | | | | | | |
| NACA Mode | | | | | • | | | | | |
| Capacity Data Changed Notification Mode | | | | | | | | | | |
| Task Management Isolation Mode | | | | | | | | | | |
| Unique Reserve Mode 1 | | | | | | | | | • | |
| Unique Reserve Mode 2 | | | | | | | | | | |
| Port ID Conversion Mode | | | | | | | | | | |
| Tru Cluster Mode | | | | | | | | | | • |
| Product Serial Response Mode | | | | | | | | | | |
| Same Node Name Mode | | | | | | | | | | |
| CCHS Mode | | | | | | | | | | |
| NOP-In Suppress Mode | | | | | | | • | | | |
| S-VOL Disable Advanced Mode | | | | | | | | | | |
| Discovery CHAP Mode | | | | | | • | | | | |
| Unique Extended Copy Mode | | | | | | • | | | | |
| Unique Write Same Mode | | | | | | • | | | | |
| Unique Compare Write Mode | | | | | | • | | | | |
| Standard VAAI Command Mode | | | | | | • | | | | |

## Table 5-9: Host connection parameter settings (Continued)

| Platforms | Windows | Linux | Solaris | HP-UX | AIX | VMware | NetWare | Not Specified | — | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Middleware** | **Not specified** | | | | | | | | **VCS** | **TruCluster** |
| Report iSCSI Full Portal List Mode | | | | | | | | | | |
| DP Depletion Detail Reply Mode | • | • | • | • | • | • | • | • | • | • |
| Unit Attention Change Mode | | | | | | | | | | |
| HNAS Option Mode | | | | | | | | | | |
| Allocation Length Expand Mode | | | | | | | | | | |
| UNMAP Short Length Mode | • | | | | | • | | | | |
| Change Response for Replication Mode | | | | | | | | | | |
| WriteSame Rejection Mode | | • | | | | | | | | |
| WriteSame Rejection Mode | | | | | | | | | | |
| UNMAP Rejection Mode | | | | | | | | | | |

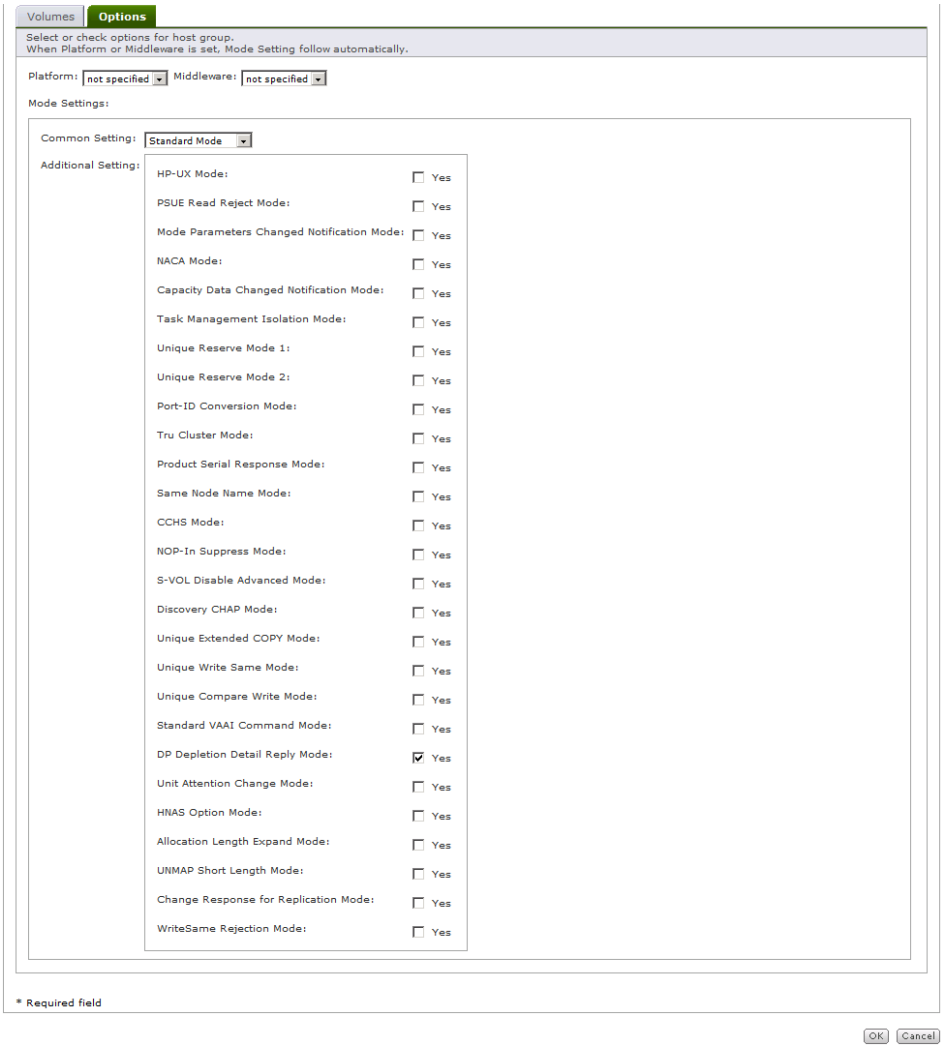



**Figure 5-16: Fibre Channel parameters**

**Figure 5-17: iSCSI parameters**

4. Select any appropriate **Additional Settings**:
   - To support Type7h/8h of the Persistent Reserve command, check **Unique Reserve Mode 2**. This is enabled in both Fibre Channel and iSCSI.
   - When supporting 2-byte Allocation Length of the Inquiry command, check **Allocation Length Expand Mode** from **Additional Setting**. This is enabled in both Fibre Channel and iSCSI configurations.
   - If you use winBoot/i by emBoot, Inc. or Open Enterprise Server by Novell, Inc, check **NOP-In Suppress Mode**.
   - If using Open Enterprise Server from Novell, Inc. for iSCSI connections, check **NOP-In Suppress Mode**.

- If you use VMware CHAP (Discovery session) over an iSCSI connection, check **Enable Discovery CHAP Mode**. Refer to your VMware documentation for additional information. This setting has no effect with Fibre Channel ports, even when checked.
- If you use alternate path (MPIO: Multipath I/O) and clustering (MSCS: Microsoft Cluster Service) configuration using the Microsoft's iSCSI Software Initiator on Windows Server 2003 with the iSCSI connection, the following setting is required.

  Registry setting on the server.
  When downloading the iSCSI Software Initiator from the Microsoft home page, refer to the descriptions of Microsoft Server Cluster (MSCS) in the Microsoft iSCSI Initiator 2.x Users Guide, which is a separate download. Then change the Registry setting for Persistent Reservation as required. Exercise care when setting this value. If set incorrectly, the server may not operate normally.

  Unique Reserve Mode setting on the storage system.
  Check **Unique Reserve Mode 1**.
- If you use an alternate path (MPIO: Multipath I/O) configuration on Windows Server 2008, open MPIO in Windows Control Panel and register **HITACHI DF600F** as an MPIO device.
- **Autodiscover New HG Mode** is checked by default. If a host cannot recognize the added volumes that were added when creating host groups or when adding volumes using LUN Manager, enable (uncheck) **Autodiscover New HG Mode**.

  If either **WWN addition or deletion operation for host group** or **Change operation for the simple setting mode** is enabled with **Autodiscover New HG Mode** enabled, a Linkdown message may be written to a host log for the host group and port.
- The **HNAS Option Mode** can be used when HNAS is connected. When setting this mode, check that the HNAS platform is connected to the relevant host group.
- Hitachi Unified Storage systems that have a large number of VOLs may experience long boot times if the operating system issues PLOGI several times for every VOL. To avoid this, select the **PLOGI Response Quick Mode** in Port Options.
- If you use the storage linkage function to connect to VMware, you must enable **Unique Extended COPY Mode**, **Unique Write Same Mode**, and **Unique Compare Write Mode**. If using the storage linkage function without applying the VAAI plug-in, enable the **Standard VAAI Command Mode** in addition to those mentioned in the previous sentence.
- If using the storage linkage function connecting to VMware, when the clone operation of the virtual machine is executed, the data copy processing is performed using the Extended COPY command. Host I/O performance may deteriorate significantly during the data copy processing. To prioritize host I/O performance, enable the **Extended COPY Low-speed Mode** of the Tuning Parameters; doing so, however, increases the time to complete clone operations. To enable the setting:

Click the target storage system in Hitachi Storage Navigator Modular 2.

Click **Performance > Tuning Parameters > System Tuning**.

Click **Edit System Tuning Parameters** in the System Tuning window.

Enable the **Extended COPY Low-speed Mode** in the Edit System Tuning Parameters window.

Click **OK**.

- If you create a VMFS5 datastore with **Unique Compare Write Mode** or **Standard VAAI Command Mode** enabled, the datastore is set to the ATS-only mode. Commands other than the ATS command cannot lock a datastore in the ATS-only mode. As a result, VMware does not recognize volumes in the ATS-only mode if you disable **Unique Compare Write Mode** or **Standard VAAI Command Mode**. We recommend you do not disable **Unique Compare Write Mode** or **Standard VAAI Command Mode** when you have datastores in ATS-only mode.
- The default status of the port option **UNMAP Short Length Mode** is the port that includes the host group for which the Windows is selected as platform: Enable (selected status). The ports other than the one described above: Disable (unselectable status).
- For Windows Server 2012 connections, enable **UNMAP Short Length Mode**. Otherwise, the UNMAP command can time out and not terminate.
- If ShadowImage In-system replication, Copy-on-Write SnapShot, TrueCopy Remote Replication, TrueCopy Extended Distance, TrueCopy Modular Distributed, and/or Modular Volume Migration are enabled, enable UNMAP Short Length Mode.
- After changing **UNMAP Short Length Mode**, restart the host. Otherwise, the host operation will not change properly. Otherwise, the UNMAP command may time out and not terminate.
- When connecting with the Red Hat Enterprise Linux of the version 6.0 or later, enable WriteSame Rejection Mode. Rejecting the WriteSame command issued by the host prevents the load of the array from rising.

When enabling WriteSame Rejection Mode, a check response is returned for the WriteSame command. In that case, a WriteSame command error may be collected in the host log.

| |
|---|
| Sep 18 20:08:50 localhost kernel: sd 0:0:0:3: [sdh] Discard failure |
| Sep 18 20:08:50 localhost kernel: sd 0:0:0:3: [sdh] Result: hostbyte=DID_OK driverbyte=DRIVER_SENSE |
| Sep 18 20:08:50 localhost kernel: sd 0:0:0:3: [sdh] Sense Key : Illegal Request [current] |
| Sep 18 20:08:50 localhost kernel: sd 0:0:0:3: [sdh] Add. Sense: Invalid command operation code |
| Sep 18 20:08:50 localhost kernel: sd 0:0:0:3: [sdh] CDB: Write same(16): 93 08 00 00 00 00 00 00 08 00 00 40 00 00 00 00 |

**Figure 5-18: Examples of check response logs for the WriteSame command (/var/log/messages)**

- After enabling WriteSame Rejection Mode, if the host restarts, the WriteSame command is not issued. We recommend restarting the host for rejecting the issuance of the WriteSame command.
- Enabling WriteSame Rejection Mode stops the DP pool area release linking to the host processing by using the WriteSame command.
- FullProvisioning Reply Mode replies to a virtual volume as a normal volume. You usually do not have to set this. If you do use it, however, you must restart the host; otherwise, the host will not recognize the change.
- When changing UNMAP Rejection Mode, we recommend you restart the host.

5. Click the **OK** button in the lower right corner of the page.
6. At the confirmation message, click **Confirm**.
7. If you checked **Forced set to all selected ports**, click the check box in the next confirmation and click **Confirm**.
8. Click the **Close** button.

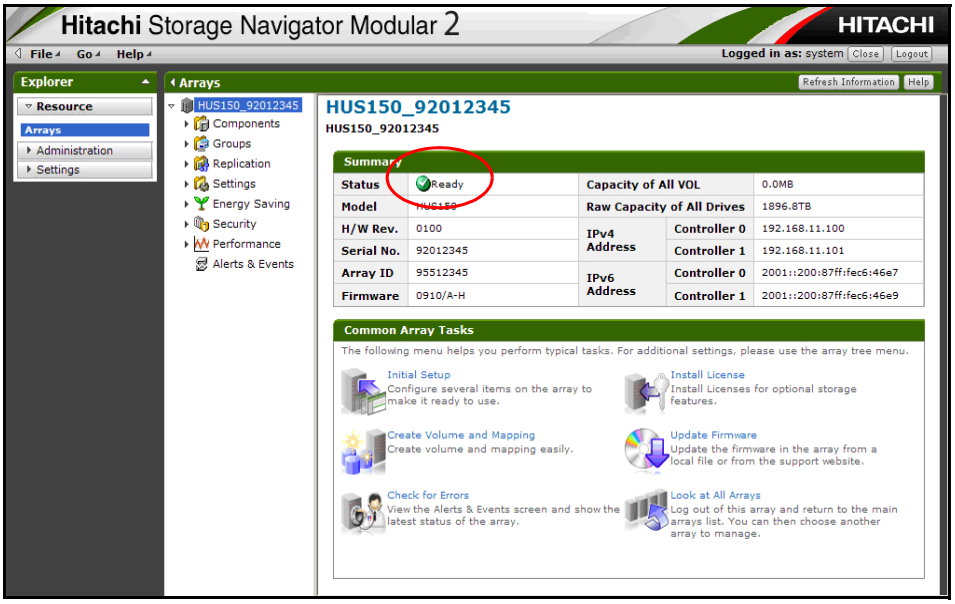
## Creating RAID groups

A RAID group is a set of disks on which you can bind one or more volumes. A volume is a portion of a RAID group that is made available to the client as a logical disk. After you create RAID groups, you can expand them if necessary by adding one or more disks (see Expanding RAID group capacity on page 5-48).

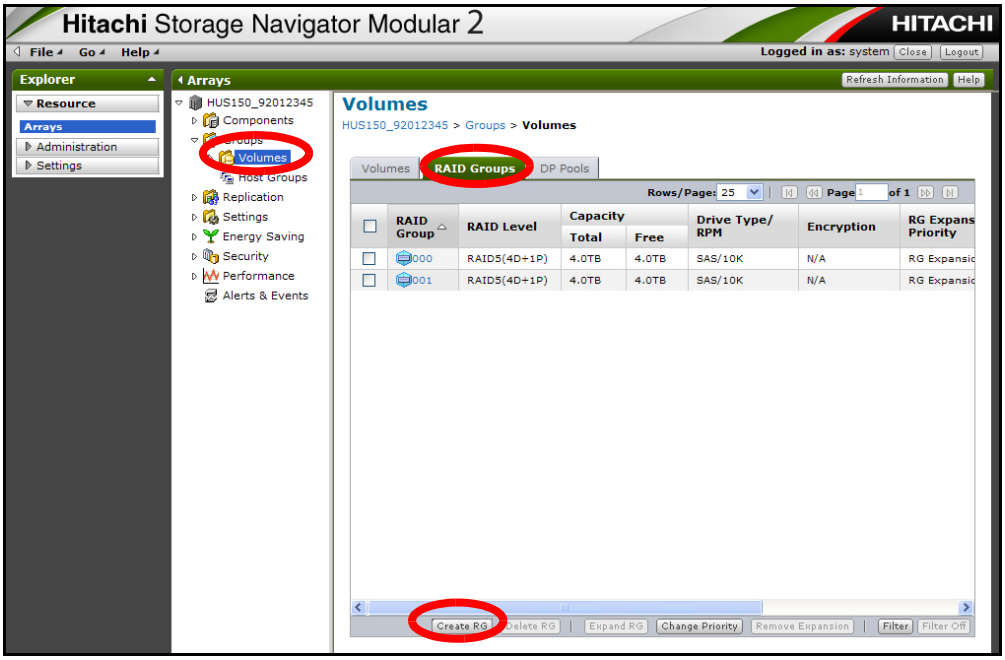
RAID groups can include any of the types of RAID protection described under RAID implementations on page 1-13.

The following procedure describes how to add a RAID group. When you add a RAID group, you can manually select the drives that will belong to the RAID group or have the drives selected for you automatically.

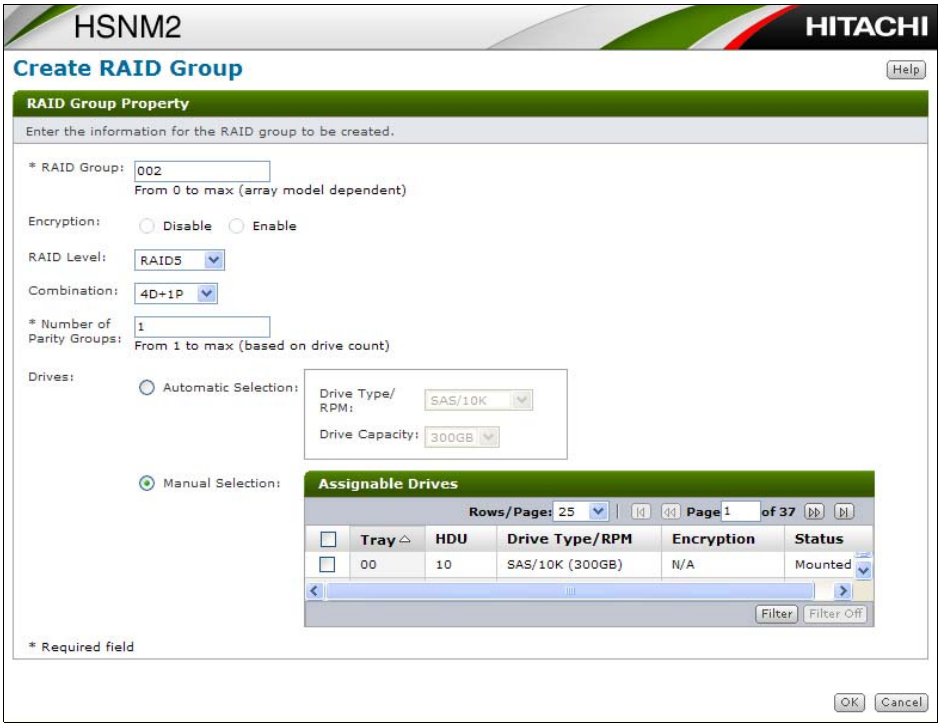
1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click the storage system name, open the Arrays window, and confirm that the storage system status is **Ready**.




2. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**.
3. On the right side of the page, click the **RAID Groups** tab.




4. Click the **Create RG** button at the bottom of the tab.
5. In the Create RAID Group screen, specify the **RAID Group**, **RAID Level**, **Combination**, and **Number of Parity Groups**.




6. Perform one of the following steps for **Drives**:
   - To have the drives for the RAID group selected automatically, click **Automatic Selection**. Then select the drive type/RPM and capacity.
   - To select the drives that will participate in the RAID group, click **Manual Selection**. Then, under **Assignable Drives**, check all the drives you want to participate in the RAID Group.

**NOTE:** If the capacity of a drive exceeds the capacity of a spare in the storage system, an error message appears.

7. Click **OK**.
8. In the confirmation screen, click **Close**. The RAID Groups tab is updated with the new RAID group information.

## Creating volumes

A volume is a device that is addressed by the Fibre Channel or iSCSI protocol. After you create RAID groups in the previous section, create the volumes built on top of these RAID groups. Volumes let you subdivide your RAID groups into convenient sizes. Storage Navigator Modular 2 works at volume level.

There are two ways to create volumes:

- Using the Create and Map Volume wizard (see Creating and mapping volumes on page 5-17).
- Using the procedure in this section to create volumes manually.

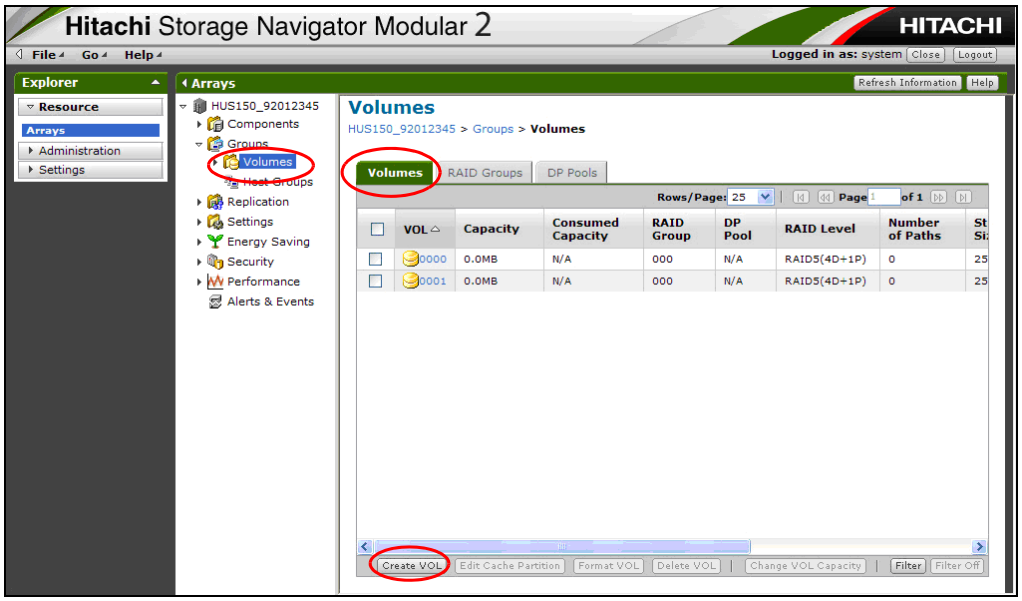
You cannot create volumes when:

- The volumes will be part of a RAID Group that is being expanded. Wait for the RAID group expansion operation to complete before creating volumes in that RAID group.
- The RAID group is configured for Power Saving/Power Saving Plus. Confirm that the power saving instruction is canceled and the power saving status is **Normal (Spinup)** before creating the volume.
- When updating drive firmware.

**NOTE:** If both Fibre Channel and iSCSI interfaces are used, perform volume mapping on all created volumes so that the volumes used by Fibre Channel and iSCSI are mapped exclusively to those interfaces. For more information, see Configuring mapping (Fibre Channel) on page 5-73 and Configuring mapping (iSCSI) on page 5-84.

To create volumes:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**. The volumes defined for the storage system appear in the **Volumes** tab on the right side of the page.
2. In the **Volumes** tab, click the **Create VOL** button at the bottom of the tab.




3. Specify **RAID Group**, **VOL**, **Capacity**, and **Number of Volumes** to set the volume. Specify the **Cache Partition** setting as needed. See Table 5-10 on page 5-38. When you finish, click **OK**.

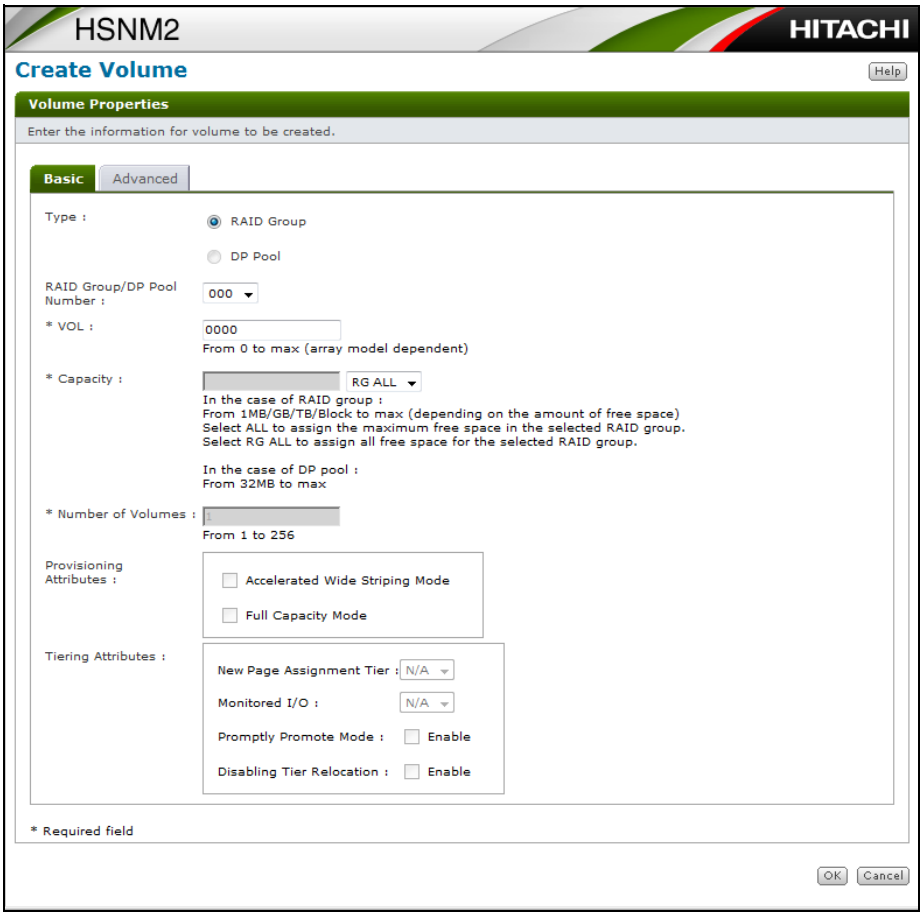
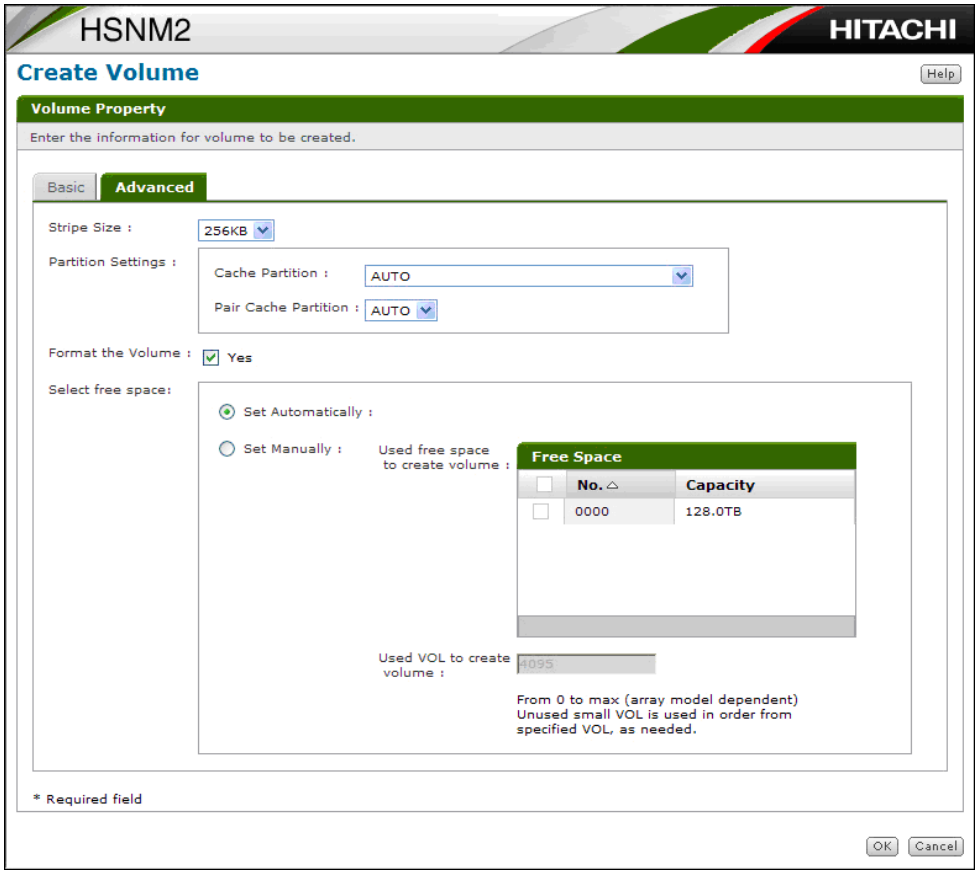



**Table 5-10: Create Volume page**

| Field | Description |
|---|---|
| RAID Group | RAID group defined as the volume. |
| VOL | Enter a number of the volume you want to create. |
| Capacity | Specify the capacity. Choices are:<br>• All<br>• MB<br>• GB<br>• TB<br>• Block |

4. Click the **Advanced** tab, complete the settings on the page (see Table 5-11 on page 5-39), and click **OK**.
5. When finished, click **Close**.




**NOTE:** If both Fibre Channel and iSCSI interfaces are used, perform volume mapping on all created volumes, so the volumes used by Fibre Channel and iSCSI are mapped exclusively to those interfaces. For more information, see Configuring mapping (Fibre Channel) on page 5-73 and Configuring mapping (iSCSI) on page 5-84.

**Table 5-11: Advanced tab**

| Field | Description |
|---|---|
| Stripe Size | Stripe size of volumes. We recommend you accept the default size of 256 k bytes. |
| Partition Settings | Set these values when using Cache Partition.<br>• Cache Partition Manager = default cache partition of volumes.<br>• Pair Cache partition = destination partition for load balancing. |
| Format the Volume | Select whether a format should be performed automatically after creating volumes. |

**Table 5-11: Advanced tab (Continued)**

| | |
|---|---|
| Select free spaces | Lets you define free space automatically or manually.<br>• Automatic = free areas are used as needed from the free area of the Logical Block Address (LBA). When using two or more free areas, the leading volume serves as the volume specified at the time of creation, and other volumes assign the maximum unused volume automatically.<br>• Manual = you specify the free areas used to create volumes. For example, if you set 1000 for the first volume and create four free areas, volumes 998, 999, and 1000 are set for the three volumes created in the free areas, except for the first volume. |

**NOTE:** To verify volumes, see Verifying volumes on page 5-55.

## Completing the basic configuration

To complete the basic configuration:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Arrays**.
2. In the Arrays page on the right, check the storage system you just configured under the **Array Name** column and click **Remove Array**.
3. When the message indicates that the Controller Box was removed successfully, click **Close** to remove the message.
4. In the Arrays page, click **Add Array** to run the Array wizard and click **Next** at the first page.
5. In the Search Array page, enter the IP address for each controller or range of controllers.
6. Click **Next** and **Finish** to complete the wizard. The newly configured controller appears in the Arrays area.

# Performing routine configuration activities

After you set up your storage system for a basic configuration, you can perform the following routine configuration activities.

### General Configuration Activities


- Managing spares on page 5-42
- Working with RAID groups on page 5-46
- Managing volumes on page 5-54
- Improving I/O response times in small configurations on page 5-67
- Changing format mode on page 5-69
- Setting the mapping guard on page 5-70


### Fibre Channel Configuration Activities


- Changing Fibre Channel settings on page 5-72
- Configuring mapping (Fibre Channel) on page 5-73
- Releasing volume assignments (Fibre Channel) on page 5-76


### iSCSI Configuration Activities


- Changing iSCSI settings on page 5-79
- Configuring iSCSI target information on page 5-81
- Initializing iSCSI target settings on page 5-83
- Configuring mapping (iSCSI) on page 5-84
- Releasing volume assignments (iSCSI) on page 5-86
- Using CHAP authentication with iSCSI ports on page 5-89

**NOTE:** For a list of default iSCSI settings, see Table 7-2 on page 7-3.

# Managing spares

As part of the Setup Array wizard, you added spare drives to your Hitachi Unified Storage system. The following sections describe how to add more spares, verify them, and delete them if they are no longer needed.

## Guidelines when managing spares

When managing spares, observe the following guidelines.

If the Power Saving/Power Saving Plus function is installed and enabled, and the spare drive setting is performed with the system drive, the **Copy backless** function (which is the default setting) works with the system drive only during data restoration. This operation is not performed for flash drives and FMDs, even if the Power Saving/Power Saving Plus function is installed and enabled.

If the Power Saving/Power Saving Plus function is installed and enabled, and the spare drive setting is performed with a drive other than the system drive, the **Copy backless** function (which is the default setting) works with drives other than the system drive during data restoration. This operation is not performed for flash drives and FMDs, even if the Power Saving/Power Saving Plus function is installed and enabled.

If drive restoration to a spare drive occurs between the drives of a CBSL/DBL/DBX, and DBW at the same time drive failure restoration of a RAID group is being performed, the power saving instruction of the I/O interlock enables and the copy-back-less function does not operate.

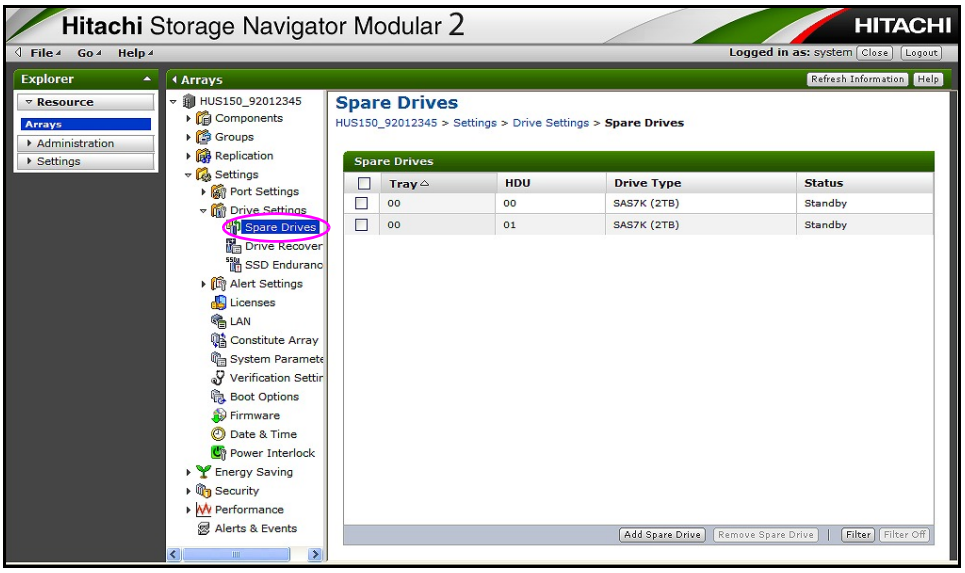
If you enable Power Saving or Power Saving Plus, do not designate the following drives as spares:

- Drives #0 and #4 on a CBXSS/CBXSL/CBSS/CBSL Controller Box.
- Drives #0 to #4 on a DBS/DBL/DBF/DBW or Drive #A0 to #A4 of the DBX corresponding to unit ID #0 connected to the CBL/CBLE.
- Drives #0 to #4 of the DBSD/DBLD corresponding to unit ID #0 connected to the CBLD.

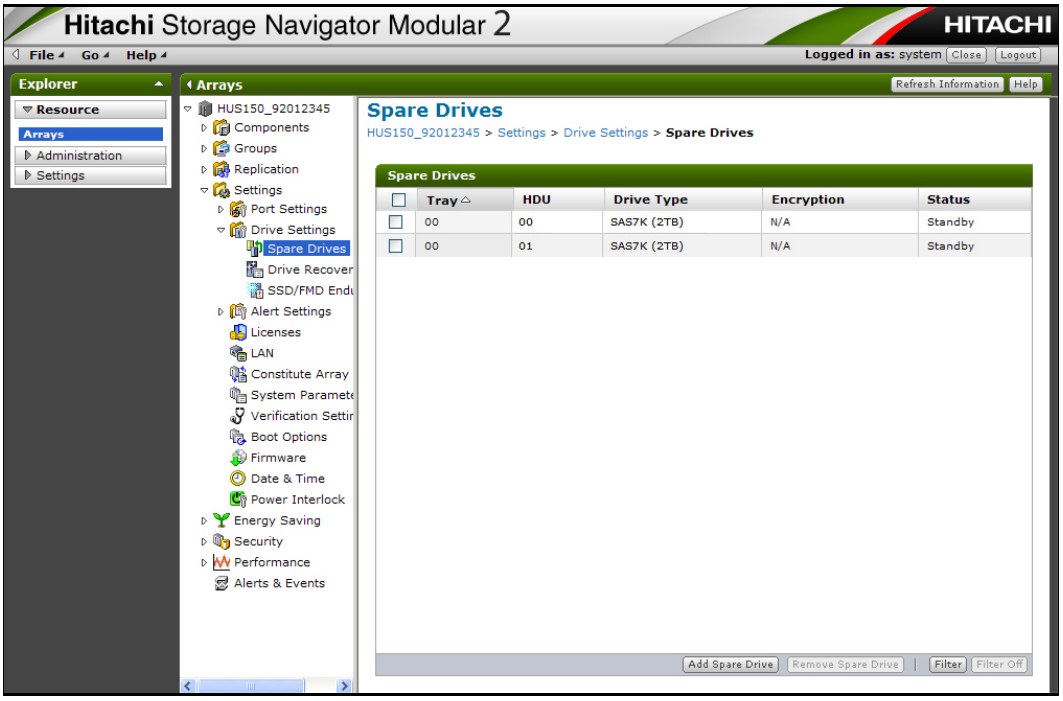
## Adding spares

To add spares:

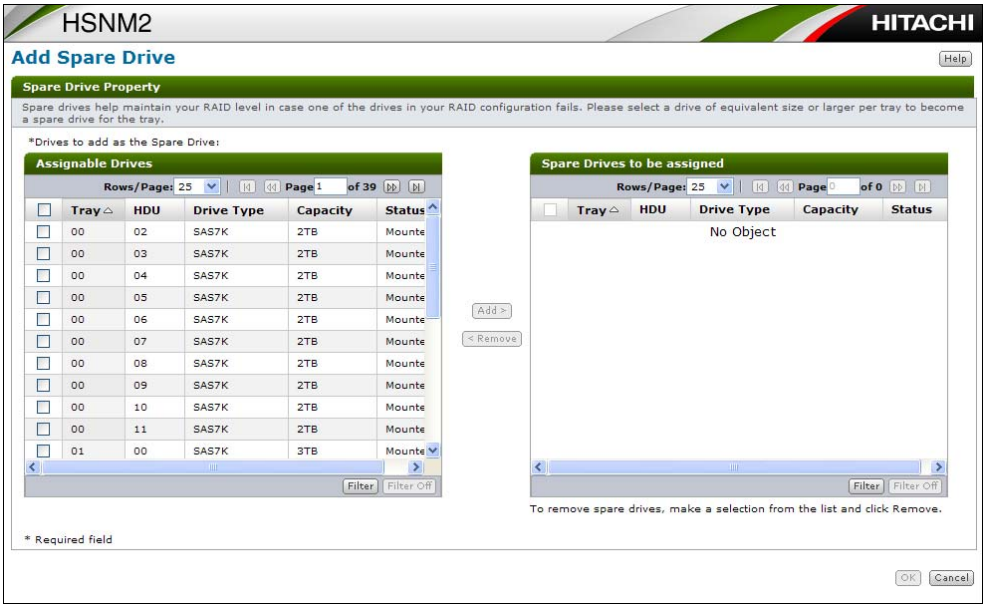
1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Settings > Drive Settings > Spare Drives**.



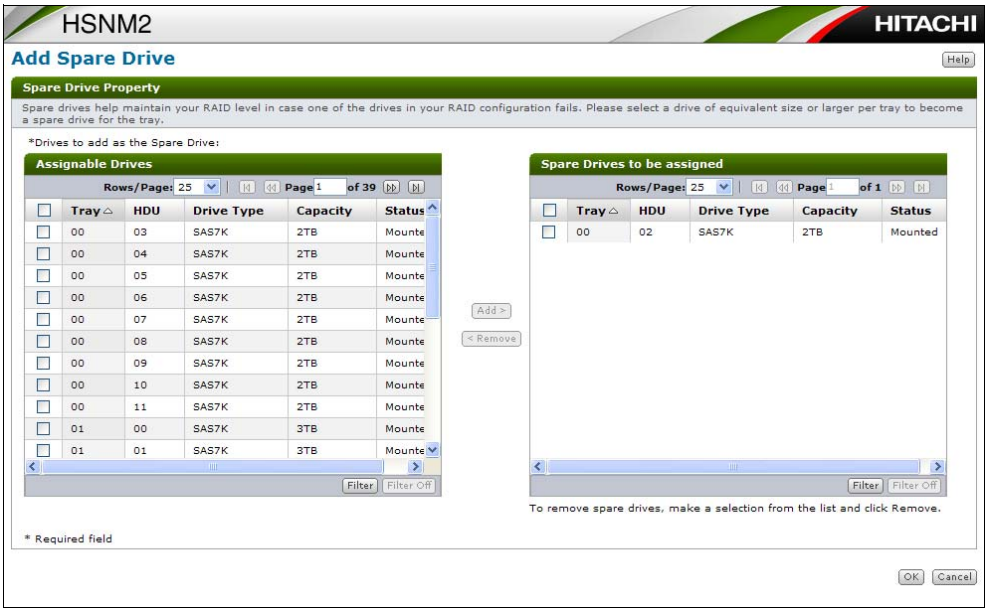

2. Click the **Add Spare Drive** button at the bottom of the screen on the right.




3. In the Add Spare Drive screen, select an HDU you want to specify as a spare drive from the **Assignable Drives** list on the right.




4. Click the **Add** button. Your HDU selection moves to the **Spare Drives to be assigned** list on the right.

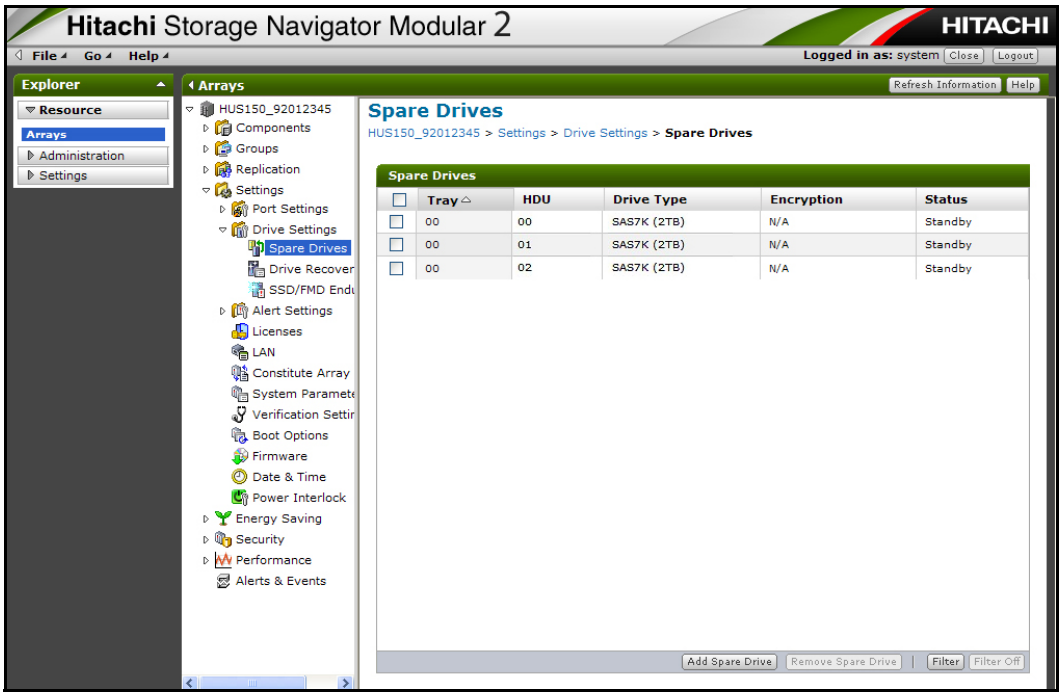



5. Click **OK**.
6. In the Add Spares Drive screen, click **Close**.

## Verifying spares

To verify the spare drives you have configured for the storage system:

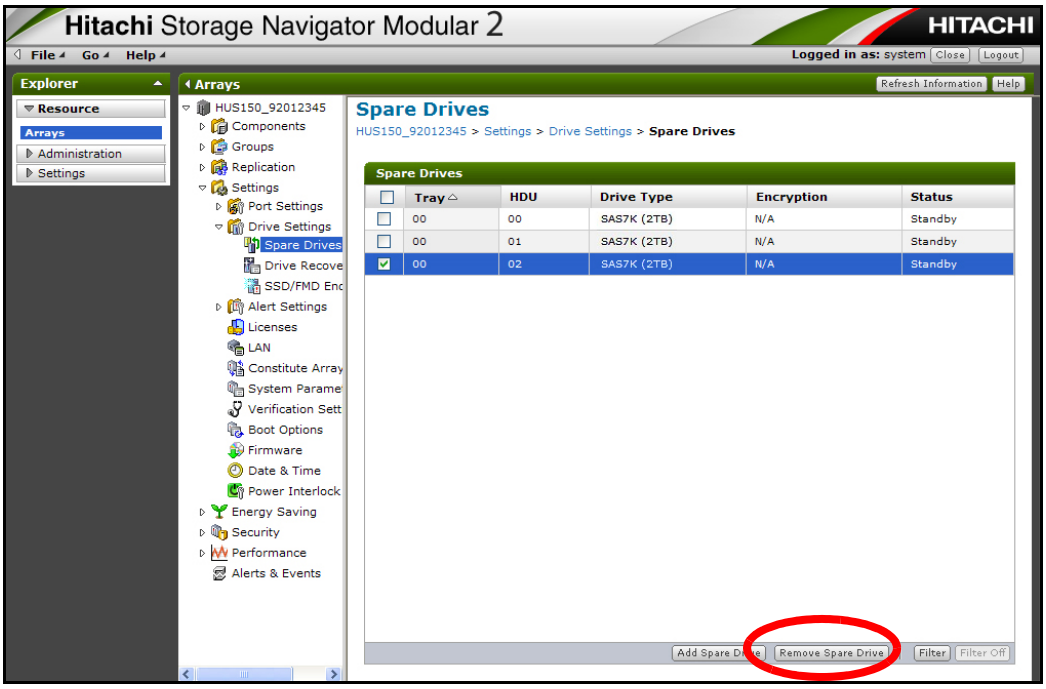
1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Settings > Drive Settings > Spare Drives**. All spare drives you have set up appear in the Spare Drives screen on the right.




## Deleting spares

If you no longer need one or more spares, use the following procedure to delete them. A deleted spare becomes available free space for the storage system to use.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Settings > Drive Settings > Spare Drives**. All spare drives you have set up appear in the Spare Drives screen on the right.
2. In the Spare Drives screen on the right, check each spare you want to remove.
3. Click the **Remove Spare Drive** button at the bottom of the screen.




4. When a message tells you that the selected drives have been released as spare drives, click **Close**.

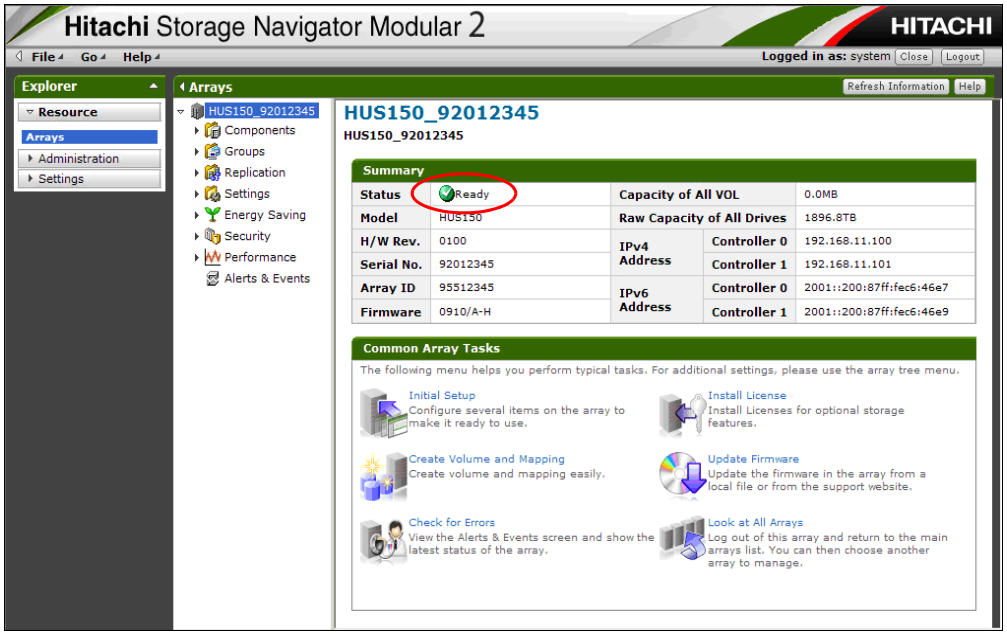
# Working with RAID groups

The procedures in the following sections describe routine operations on RAID groups that you have set up.

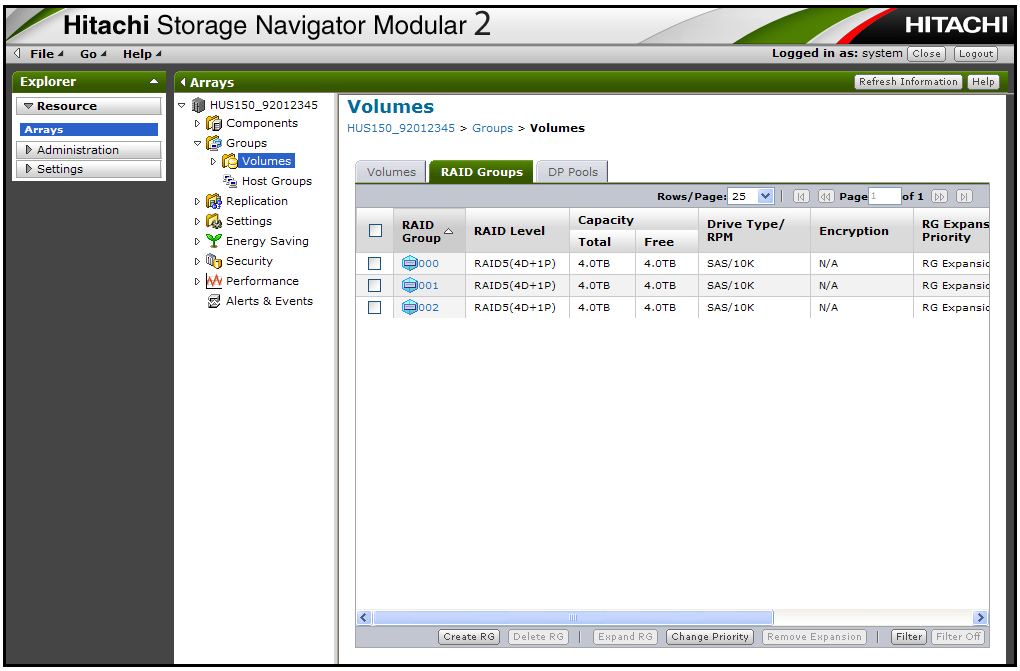
## Verifying RAID groups

To verify the RAID groups you have configured for the storage system:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click the storage system name.
2. Under **Summary** on the right, confirm that the status is **Ready**.




3. In the **Arrays** pane, click **Groups > Volumes**.




4. Click the **RAID Groups** tab on the right. RAID groups and volumes defined for the storage system are displayed. Table 5-12 on page 5-47 describes the information shown.
5. Double-click the icon of the generated RAID group, and then click the **Assigned Drive** tab.

**Table 5-12: Fields in the RAID Groups tab**

| Field | Description |
|---|---|
| RAID Groups | Number of the RAID groups. |
| RAID Level | RAID level specified. |

**Table 5-12: Fields in the RAID Groups tab (Continued)**

| | |
|---|---|
| Total Capacity | Entire capacity of the RAID group. |
| Free Capacity | Available capacity of the RAID group. |
| Drive Type/RPM | Type/RPM of drive assigned to a RAID group. |
| Encryption | Encryption status of a RAID group. |
| RG Expansion Priority | Priority when performing RAID group expansion. |
| Status | Status of the RAID group expansion. |
| Reconstruction Progress | Progress ratio of the RAID group or the number of recoverable drives (HDUs) and volume. |

6. Double-click the icon of the generated RAID group and click the **Assigned Drive** tab.

## Expanding RAID group capacity

You can expand the capacity of RAID groups by adding up to 8 drives to a RAID group. Hitachi Unified Storage systems support “hot” RAID group expansion. This means you can a RAID group online, while one or more hosts access the RAID group.

Observe the following guidelines when expanding a RAID group:

- Host access performance deteriorates when expanding a RAID group. To minimize impact to performance, you can specify whether to prioritize host access or the RAID group expansion (see Changing the priority of RAID group expansion on page 5-51). Nevertheless, we recommend you expand RAID groups when host access to the storage system is minimal.
- Do not turn off the storage system during RAID group expansion.
- In the unlikely event that a cache or power failure occurs when expanding a RAID group, the volume associated with the RAID group being expanded may be unformatted. Therefore, back up your data before expanding a RAID group.
- Although RAID group expansion lets you increase the number of data disks (n of nD+mP) of the RAID group, you cannot change a RAID level (for example, from 4D+1P to 4D+2P). However, you can expand a RAID group from RAID 1 to RAID 1+0. You cannot expand the RAID group of RAID 0.
- Use RAID group expansion only when the number of parity groups is one.
- When adding drives, select drives:
  - Of the same drive type (for example, SAS, SAS 7.2K rpm, or Flash) and rotational speed as the current drives in the RAID group.
  - Whose capacity is the same as or greater than the drive with the lowest capacity in the existing RAID group.
- When expanding a RAID 1 or RAID 1+0 configuration, add drives in multiple number of 2.
- If you perform a dynamic sparing, correction copy, or copy back operation during RAID group expansion, RAID group expansion stops.

When the dynamic sparing, correction copy, or copy back operation completes, RAID group expansion restarts automatically.

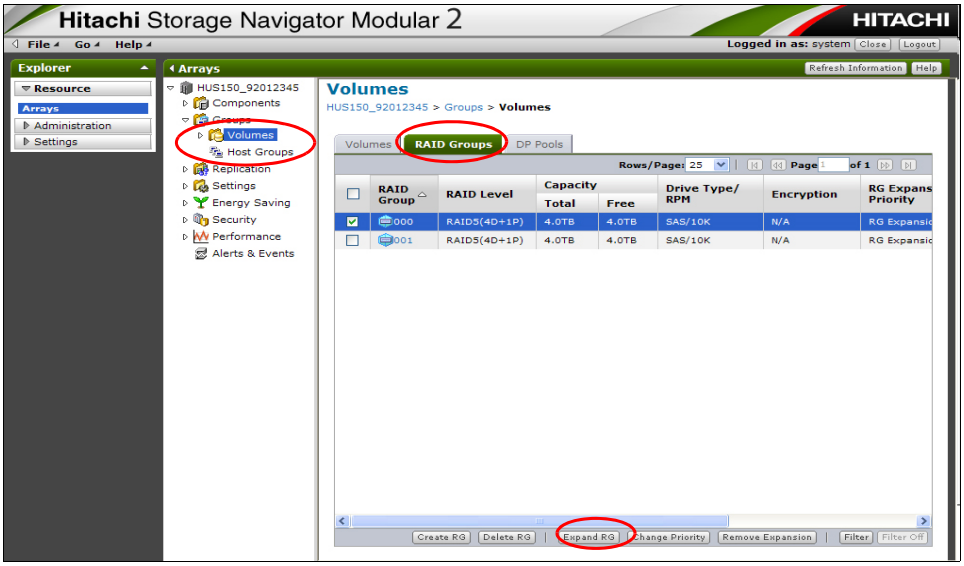
- Host I/O operations on volumes associated with the RAID group expansion may delay the completion of the RAID group expansion operation by as much as 400 seconds.

You cannot expand a RAID group under the following conditions:

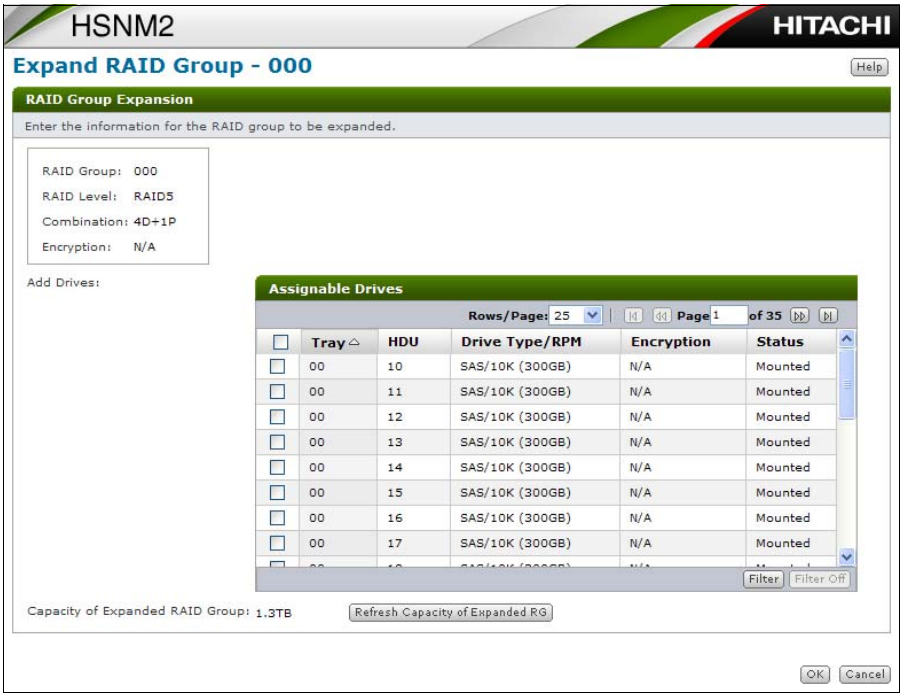
- One of the RAID group's volumes has a forced parity correction status of Correcting, Waiting, Waiting Drive Reconstruction, Unexecuted, Unexecuted 1, or Unexecuted 2. Perform the forced parity correction or skip it to change the volume status to Correction Completed, and then expand the RAID group.
- One of the RAID group's volumes is being formatted. Wait for formatting to complete before expanding the RAID group.
- If the following volumes are in the RAID group of the expansion target. Change the status for these volumes and then expand the RAID group.
  - Volumes set for a pair other than PSUS in ShadowImage In-system Replication
  - Volumes set for a pair other than PAIR in Copy-on-Write SnapShot
  - Volumes set for a pair other than PSUS in TrueCopy Remote Replication
  - Volumes set for a pair other than PSUS in TrueCopy Extended Distance
  - Volumes or a reserve volume in Modular Volume Migration
  - Volumes in which Cache Residency Manager is set
  - DMLU
- If you do not reboot the storage system after setting or changing Cache Partition Manager. Expand the RAID group after rebooting the storage system.
- The RAID group is configured for Power Saving/Power Saving Plus. Confirm that the power saving instruction is canceled and the power saving status is **Normal (Spinup)** before expanding the RAID group.
- During drive degeneration following a drive failure, even after data from the failed drive has copied to the spare. Wait for the drive-restore procedure to complete before expanding the RAID group.
- When upgrading storage system firmware. Expand the RAID group after completing the firmware upgrade.
- When upgrading drive firmware. Expand the RAID group after completing the firmware upgrade.

To expand a RAID group:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**.




2. Click the **RAID Groups** tab on the right. All RAID groups you have set up appear in the tab.
3. Click the **Expand RG** button at the bottom of the tab.
4. In the Expand RAID Group screen, click the drive to add and click **OK**. If there is no drive to add, add a drive to the RAID group and then repeat this procedure.




5. When a message asks whether you want to proceed with the RAID group expansion, check the check box and click **Confirm**.
6. In the next message, click the **Close** button. The **Status** field shows the status of the RAID group expansion. To update the percentage shown, click the **Refresh Information** button at the top left side of the screen. At the end of the formatting, the Volumes screen is updated.

## Changing the priority of RAID group expansion

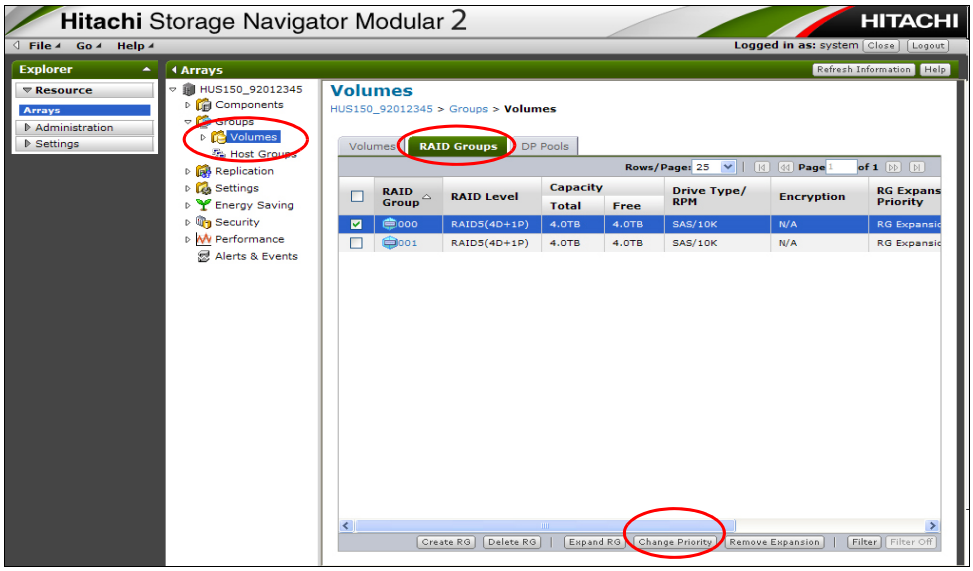
By default, RAID group expansion is performed at regular intervals to minimize impact to host I/O performance. However, you can change this priority to minimize the effect of host access and complete the RAID group expansion as quickly as possible.

Do not change the default setting if you will perform RAID group expansion:

- While using ShadowImage in-system replication, TrueCopy Remote Replication, TrueCopy Extended Distance, or Copy-on-Write SnapShot, with RAID groups involved or not involved with the RAID expansion.
- And perform forced parity correction operations at the same time.
- And perform formatting at the same time.

To change the priority of RAID group expansion:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**.




2. Click the **RAID Groups** tab on the right.
3. Click the **Change Priority** button at the bottom of the tab.
4. In the Change Priority of RAID Group Expansion screen, click the appropriate priority (see Table 5-13 on page 5-52).

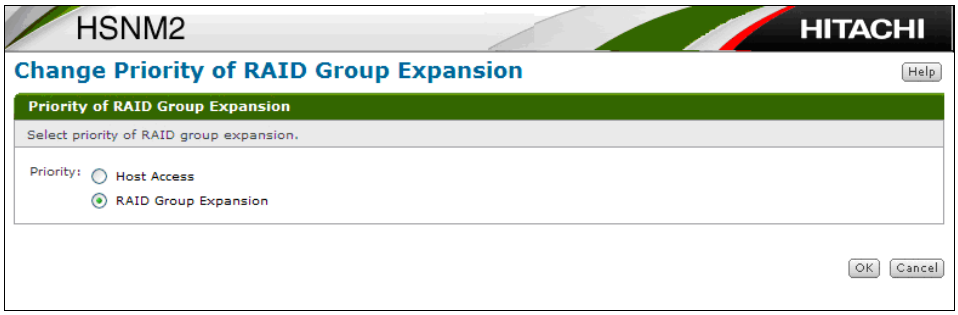


**Table 5-13: Priority settings**

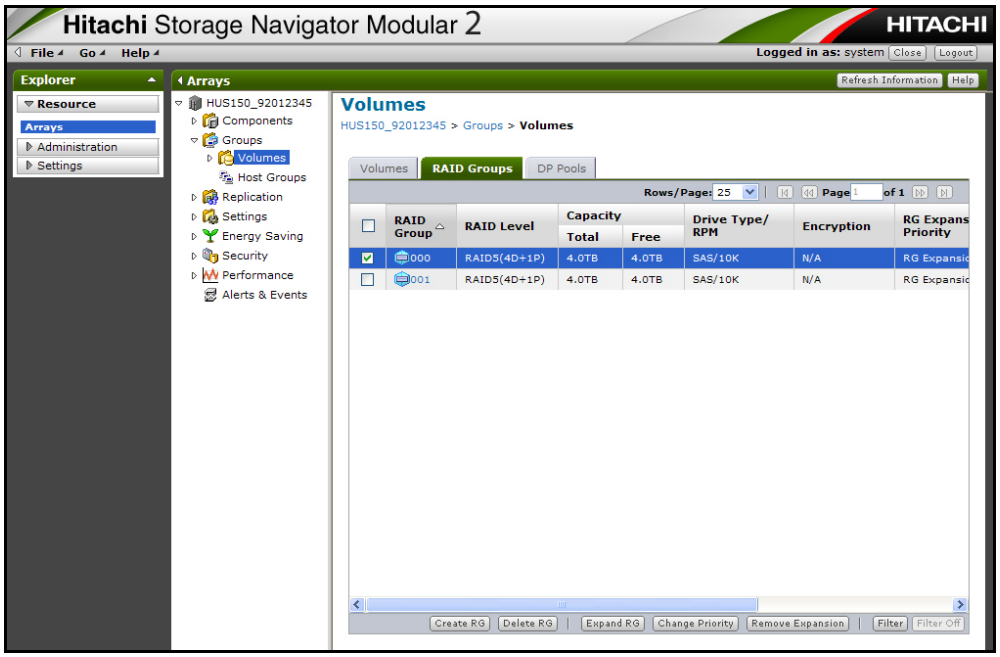
| Field | Description |
|---|---|
| Host Access | RAID group expansion occurs at regular intervals based on the load of the host I/O to minimize impact to host I/O performance. This is the default setting. |
| RAID Group Expansion | Gives priority to RAID group expansion so expansion can be completed as quickly as possible. With this setting, RAID group expansion is performed continuously, regardless of the host I/O load. Host access performance may deteriorate due to a drop in host I/O processing and commands may time out. |

5. Click **OK**.
6. In the confirmation message, click **Confirm**.
7. In the next message, click **Close**.

## Deleting the RAID Group expansion request

The following procedure describes how to delete a request to expand a RAID group.

1. Click the **RAID Groups** tab. Check the RAID group that you want to set.
2. Click **Remove Expansion**.




3. When the result window appears, click **Close**.

## Deleting RAID groups

If you no longer need a RAID group, you can delete it. RAID groups can be deleted even if you have defined volumes in the specified RAID group. However, you cannot delete a RAID group with volumes whose forced parity correction is Correcting, Waiting, Waiting Drive Reconstruction, Uncorrected, Uncorrected 1, or Uncorrected 2. Perform the forced parity correction or skip it to change the volume status to Restored or Skip, and then delete the RAID group that contains the volume.

You cannot delete a RAID group when subvolumes of the unified volume remain in the RAID group to be deleted. For the last-unified subvolume, delete the RAID group after separating the subvolume from the unified volume. For volumes other than the last unified, separate all unified subvolumes from the main volume, and then delete the RAID group.

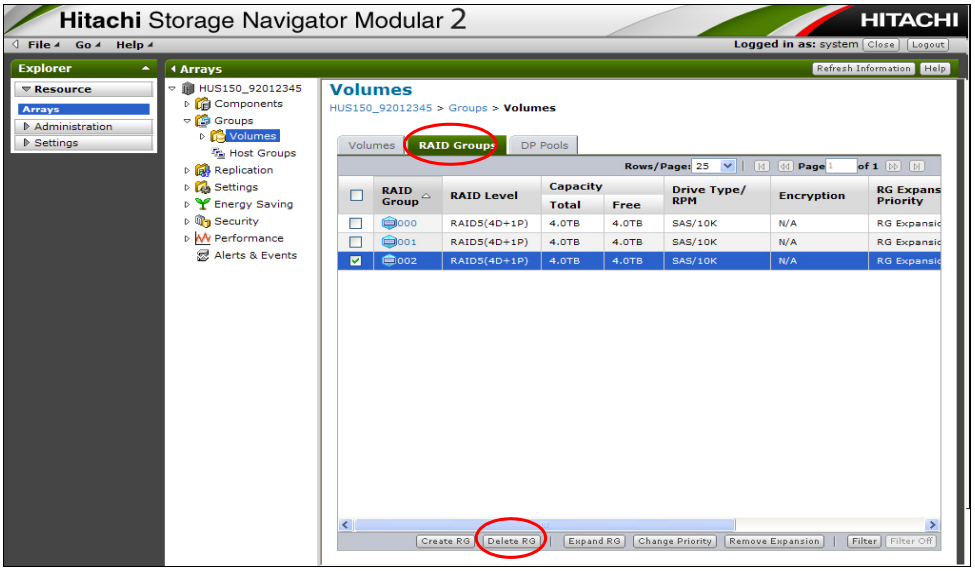
Other conditions that prevent a RAID group from being deleted are when the RAID group contains volumes that:

- Set to a pair in ShadowImage in-System Replication.
- Set to a pair in Copy-on-Write SnapShot.
- Set to a pair in TrueCopy Remote Replication.
- Set to a pair in TrueCopy Extended Distance.
- Set to a command device.
- Are DMLUs.
- Are Reserve volumes of Modular Volume Migration.
- Are registered in a data pool.
- Have a COPY status in Modular Volume Migration. Wait for the pair status to change to PSUS before deleting the RAID group.
- Have a Read Only, Protect, or Can't Guard attribute in Data Retention Utility, have an S-VOL Setting Impossible (disabled), and whose mode is either Read Capacity 0 (Zer) or Inquiry Command Shielding (Zer/Inv). To delete the RAID group, use the Data Retention Utility to set the attribute to Read/Write, the S-VOL setting to Setting Possible (Enabled), and the mode to Unset.
- A RAID group configured for Power Saving/Power Saving Plus cannot be deleted.
- Confirm that the power saving instruction is canceled and the power saving status is **Normal (Spinup)** before deleting a RAID group.

The following procedure describes how to delete a RAID group.

**WARNING. Deleting a RAID group deletes all the data associated with it. Therefore, back up the data associated with a RAID group before deleting it.**

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**.
2. On the right side of the page, click the **RAID Groups** tab. All RAID groups you have configured appear in the tab.




3. In the **RAID Groups** tab, check each RAID group you want to delete.
4. Click the **Delete RG** button at the bottom of the tab.
5. If there is no formatted volume in the RAID group, click **Close** when the confirmation message appears.

   Otherwise, read the warning message about formatted volumes, check the check box at the bottom of the message, and click **Confirm**.
6. When the results page appears, click the **Close** button. The **RAID Groups** tab is updated with the new RAID group information.

## Managing volumes

After you configure volumes (see Creating volumes on page 5-36), you can use the procedures in this section to:

- Verify volumes – see Verifying volumes on page 5-55
- Change volume capacity – see Changing volume capacity on page 5-56
- Unify volume capacity – see Unifying volumes on page 5-60
- Separate volumes – see Separating volumes on page 5-62
- Format volumes – see Formatting volumes on page 5-65
- Delete volumes – see Deleting volumes on page 5-66
-

**NOTE:** A RAID group configured for Power Saving/Power Saving Plus cannot be set. Confirm that the power saving instruction is canceled and the power saving status is **Normal (Spinup)** before setting a volume.

## Verifying volumes

After you create volumes, use the following procedure to verify them.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**. All volumes you have configured appear in the **Volumes** tab. Table 5-14 describes the fields in the tab.

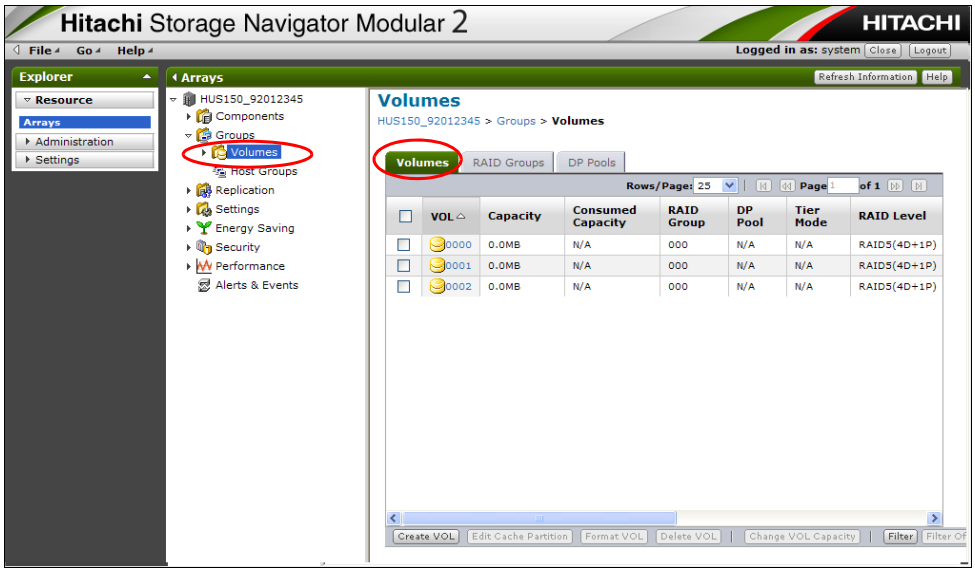
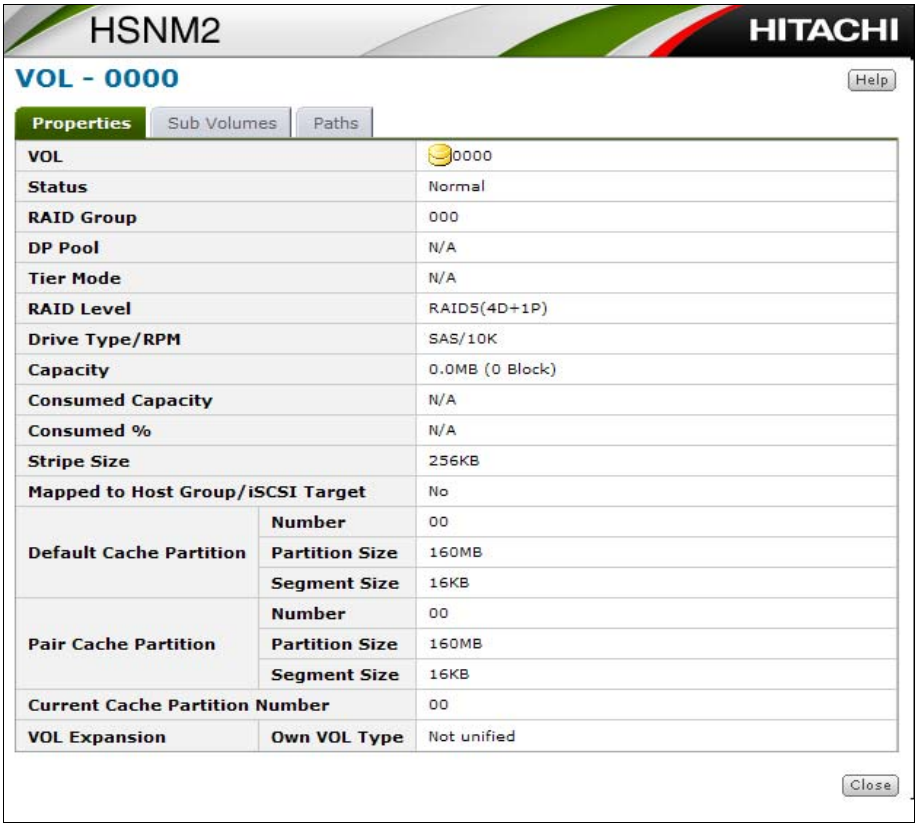



**Table 5-14: Fields in the Volumes tab**

| Field | Description |
|---|---|
| VOL | Volume number. |
| Capacity | Capacity specified for the volume displayed. |
| Consumed Capacity | Amount of capacity that has been used on the volume. |
| RAID Group | RAID group including the current volume. |
| DP Pool | DP pool number including the current volume. |
| Tier Mode | The Tier Mode including the current volume |
| RAID Level | RAID level of the RAID group defined as the volume. |
| Number of Paths | Value mapped to the host group and/or iSCSI target. |
| Stripe Size | Stripe size of the volume. |
| Cache Partition | Cache partition number. |
| Pair Cache Partition | Definition of the pair cache partition. |
| Drive Type/RPM | Type of drive defined as the volume. |
| Status | Status of the volume. |

2. To view the properties for a volume, click the **Volumes** tab, and then click the volume under the **VOL** column.




3. After viewing the properties, click **Close**.

## Changing volume capacity

After you set up a volume, you can expand or reduce its capacity.

Reducing the capacity of a volume physically reduces the capacity. This can prevent file systems and similar data from being written to the volumes. To avoid these situations, refer to the documentation for your operating system and host before reducing volume capacity.

The free areas you can use to expand volumes correspond to the free areas of the RAID group. To use the free areas of another RAID group, use the volume unification feature described under Unifying volumes on page 5-60.

You cannot change the capacity of a volume:

- When it has a forced parity correction status of Correcting, Waiting, Waiting Drive Reconstruction, Unexecuted, Unexecuted 1, or Unexecuted 2. Perform the forced parity correction or skip it to change the volume status to Correction Completed or Skip, and then change the capacity of the volume.
- When it consists of a unified volume with two or more RAID groups. To expand these volumes use the volume unification feature (see Unifying volumes on page 5-60).
- During saving following a drive failure. Wait for the drive-restore procedure to complete before changing the capacity of the volume.

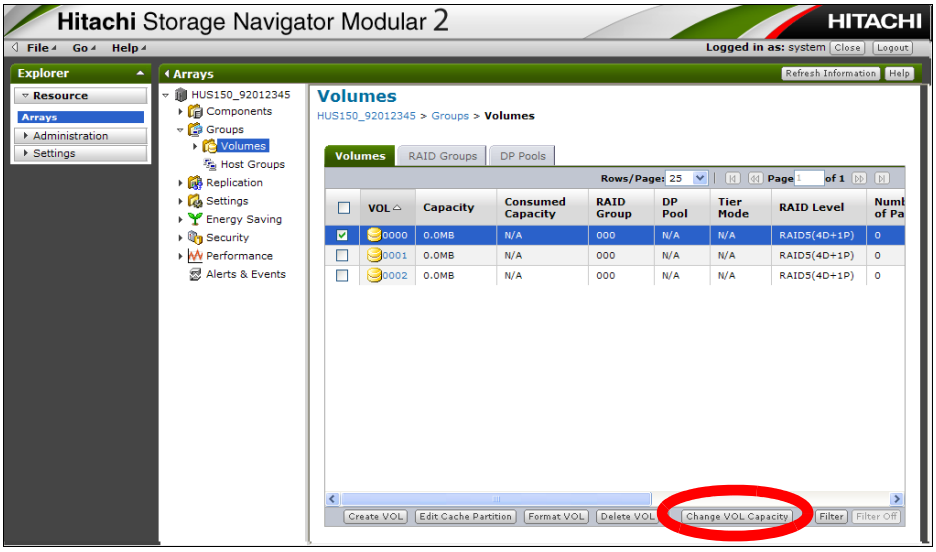
Other conditions that prevent a volume from having its capacity changed are volumes that:

- Are paired in ShadowImage In-system Replication.
- Are paired in Copy-on-Write SnapShot.
- Are paired in TrueCopy Remote Replication.
- Are paired in TrueCopy Extended Distance.
- Are set in Cache Residency Manager.
- Are set to the command device.
- Are DMLUs.
- Are volumes or Reserve volumes of Modular Volume Migration.
- Are registered in a data pool.
- Are being formatted.
- Are in a RAID group that is currently being expanded.
- Have a Read Only, Protect, or Can't Guard attribute set in Data Retention Utility, have an S-VOL Setting Impossible (disabled), and whose mode is either Read Capacity 0 (Zer) or Inquiry Command Shielding (Zer/Inv). To change the capacity of these volumes, use the Data Retention Utility to set the attribute to Read/Write, the S-VOL setting to Setting Possible (Enabled), and the mode to Unset.
- Are used as a Dynamic Disk in Windows Server 2008.

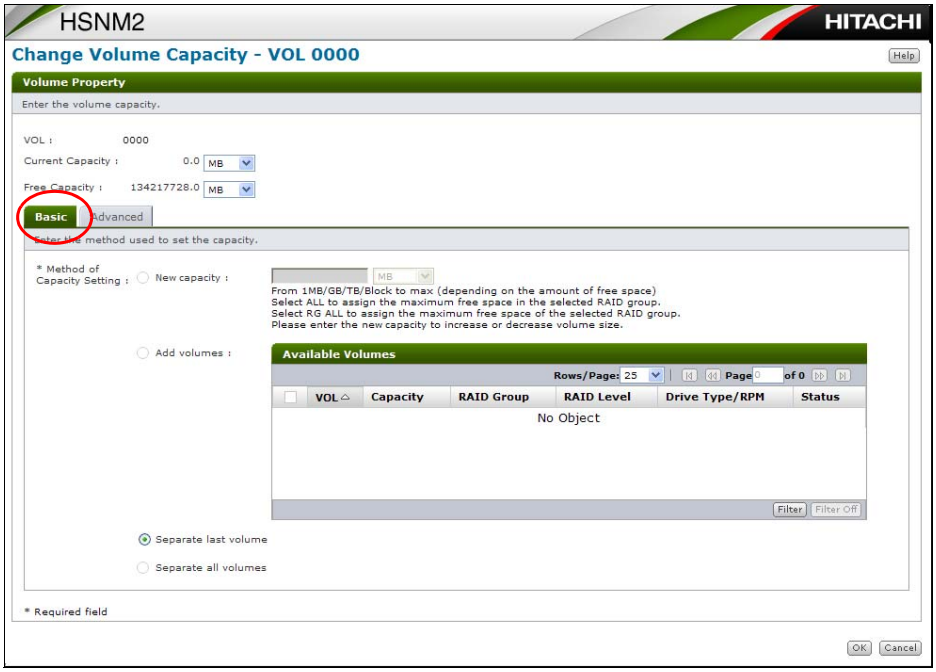
The RAID group that uses Power Saving/Power Saving Plus cannot have its volume capacity changed. Confirm that the power saving instruction is canceled and the power saving status is **Normal (Spinup)** before changing volume capacity.

The following procedure describes how to change the capacity of volumes.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**.
2. In the Volumes screen on the right, check the volume whose capacity you want to change.
3. Click **Change VOL Capacity** at the bottom of the screen.




4. When the Change Volume Capacity window appears, click the **Basic** tab.
5. Next to **Method of Capacity Setting**, click **New capacity** and specify either a larger value (to expand the volume) or smaller value (to shrink the volume).




6. If desired, click the **Advanced** tab to select a free area (see Table 5-9 on page 5-16).

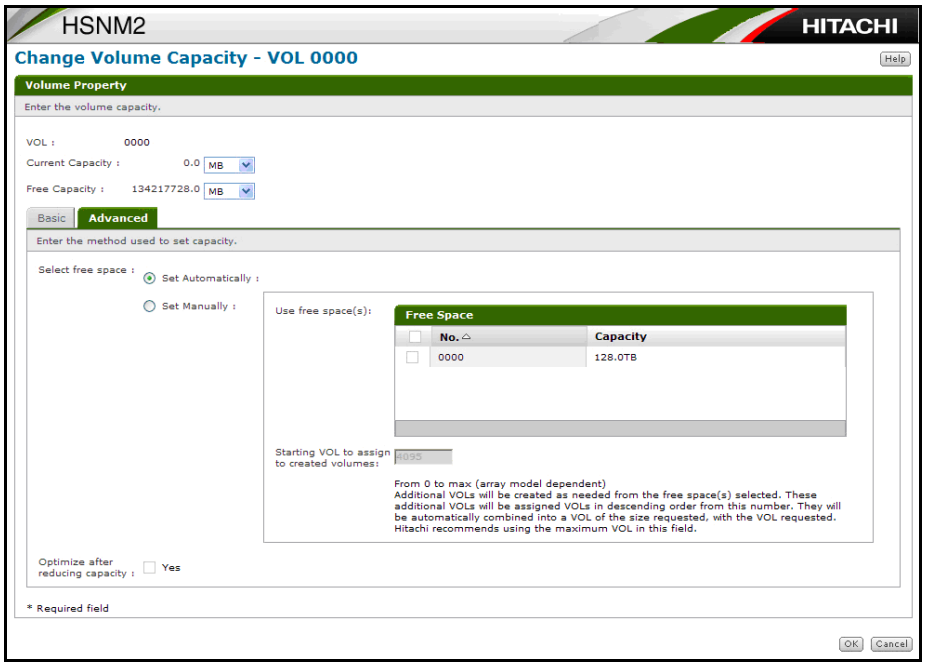



**Table 5-15: Fields on the Input Capacity Options tab**

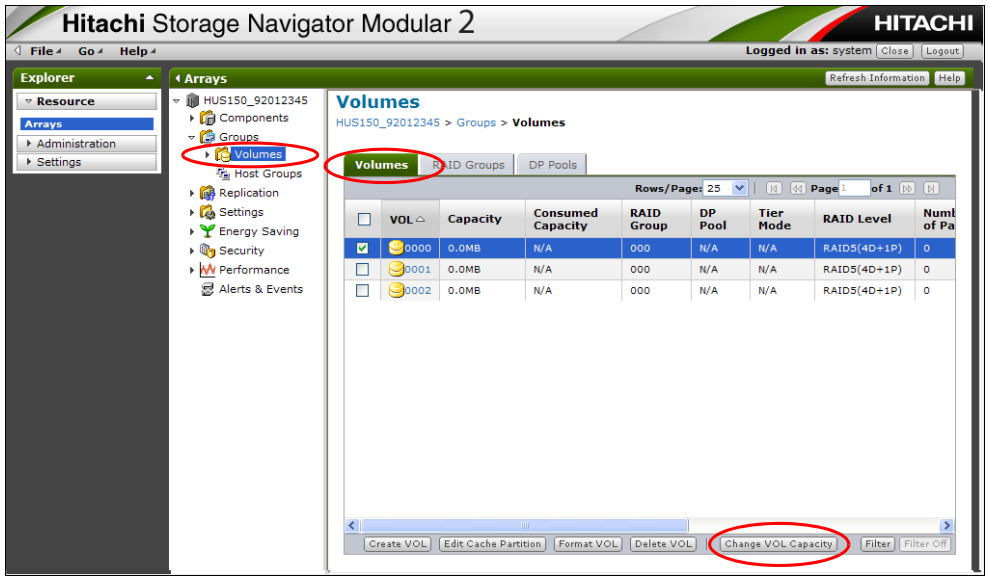
| Field | Description |
|---|---|
| Set Automatically | Free areas from the small LBA are used as needed. Any unused maximum volume is automatically assigned to new volumes created in each free area. This is the default setting. |
| Set Manually | Two options are available:<br>• Use free space(s) = specify two or more free areas used when expanding volumes.<br>• Starting VOL to assign to created volumes = specify the new volume in each free area. For example, if you type 1000 for the first volume and expand the capacity for three free areas, volumes 998, 999, and 1000 are used, respectively, for the three volumes created in the free areas. |

7. Click **OK**.
8. At the confirmation message, click **Confirm**.
9. When the next message states that the volume capacity has changed, click **Close**.

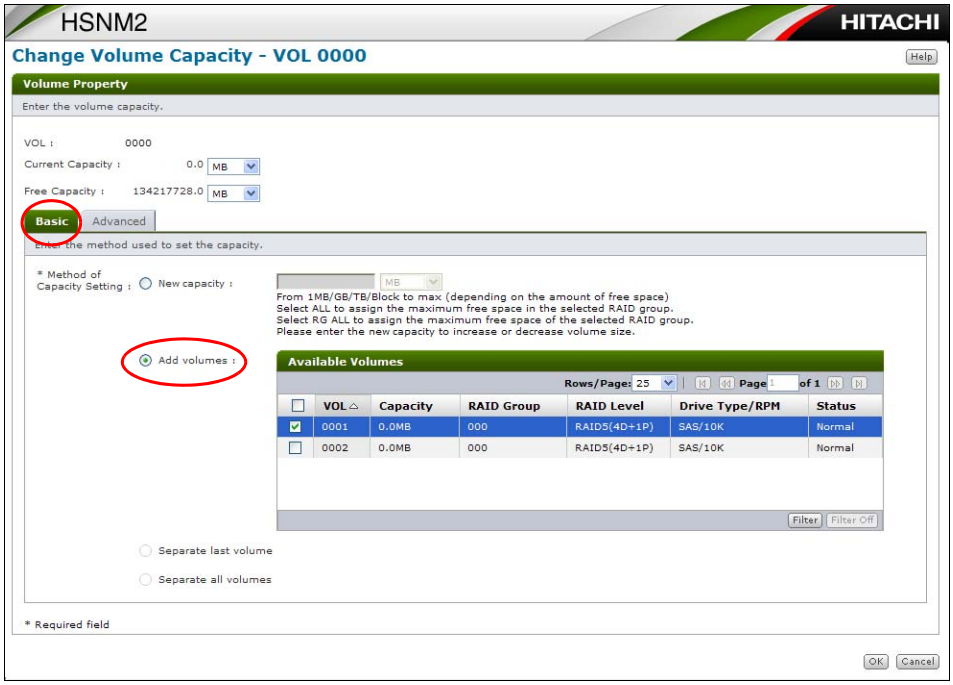
## Unifying volumes

The following procedure describes how to unify volumes. When you unify volumes, you select “subvolumes” that will be used to create a single volume. You cannot use the subvolume after unifying the volume.

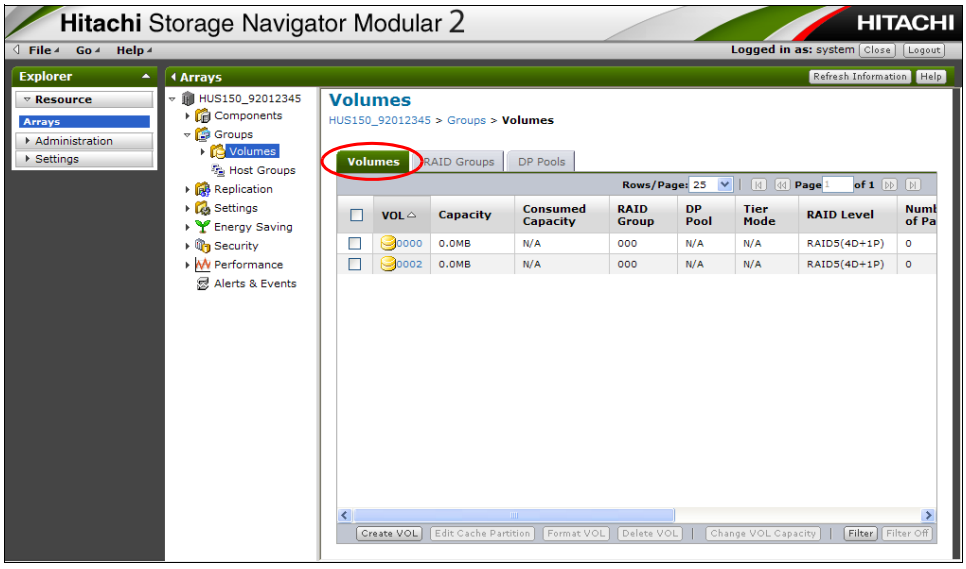
1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**.
2. In the **Volumes** tab on the right, check the volume that will be the source of the unification.
3. Click the **Change VOL Capacity** button at the bottom of the tab.



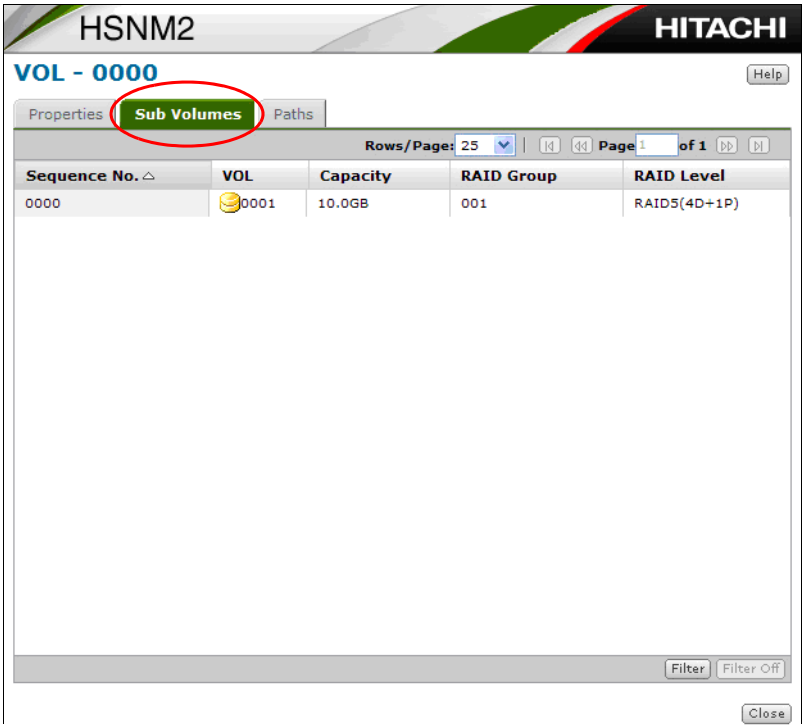

4. When the Change Volume Capacity window appears, click the **Basic** tab.
5. Click **Add volumes**. Then check the volume to be unified from **Available Volumes**.




6. Click the **OK** button.
7. In the confirmation message, check the check box and click **Confirm**.
8. In the next message, click **Close**.
9. To confirm the volume has been unified:
   a. In the **Volumes** tab, click the unified volume.




   b. In the VOL window, click the **Sub Volumes** tab.




c. Confirm that the unified volume is shown.

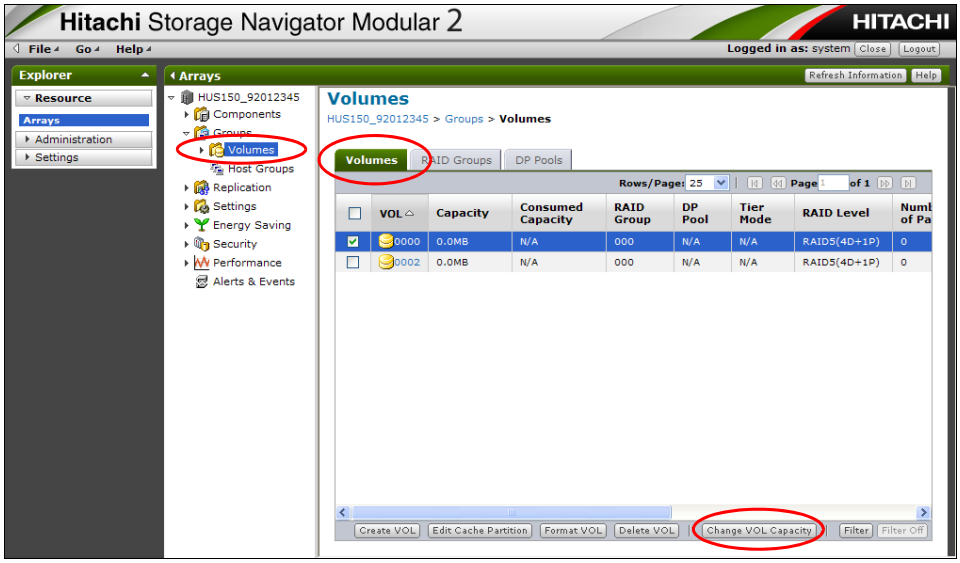
d. Click **Close** to close the window.

## Separating volumes

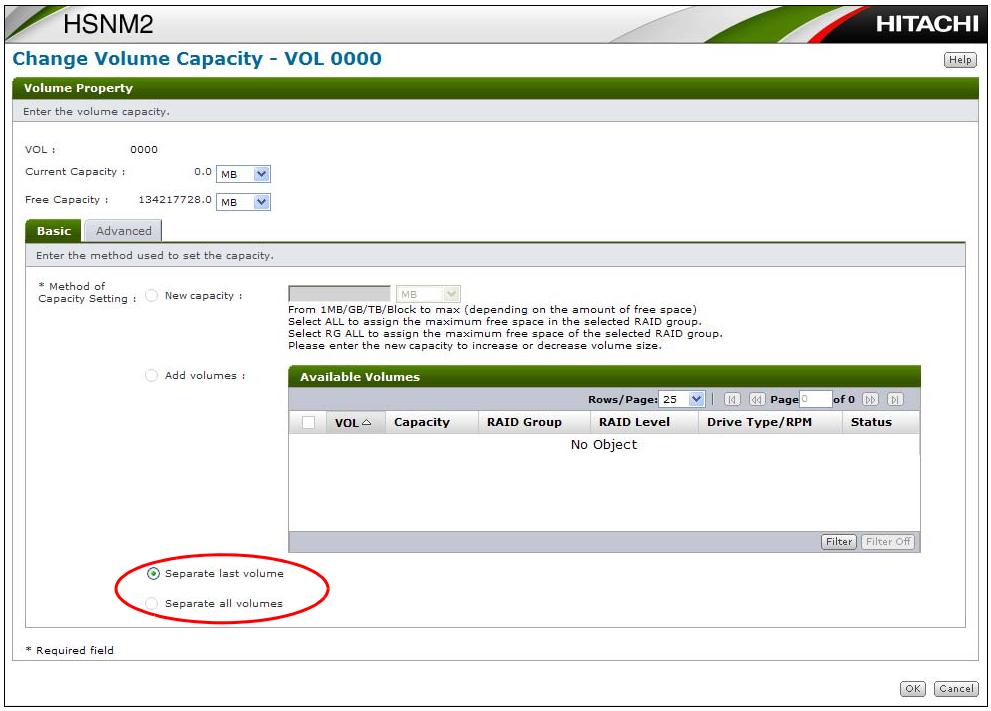
When you separate volumes, you can separate the last volume only or all volumes.

To separate volumes:

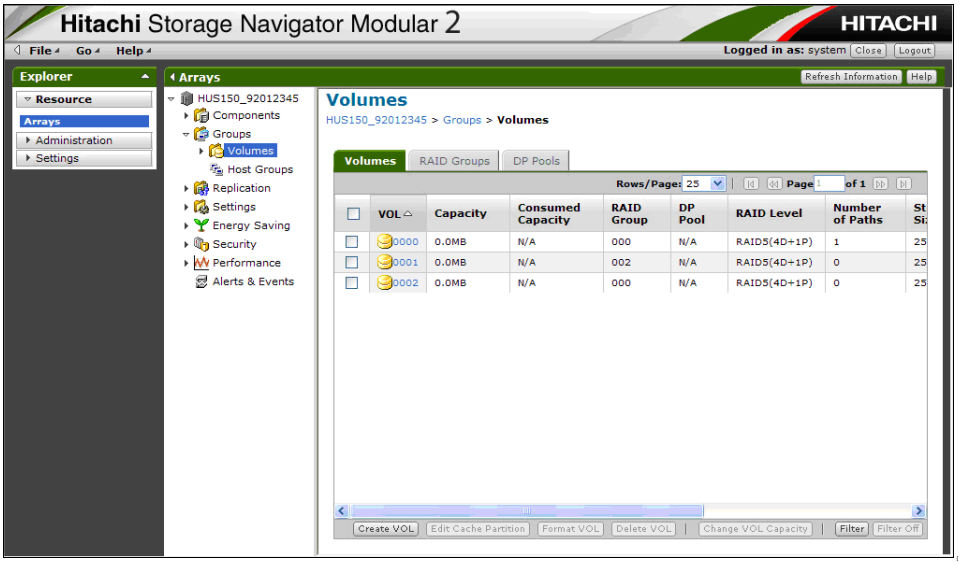
1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**.
2. In the **Volumes** tab on the right side of the page, check the volume you want to separate and click the **Change VOL Capacity** button at the bottom of the tab.



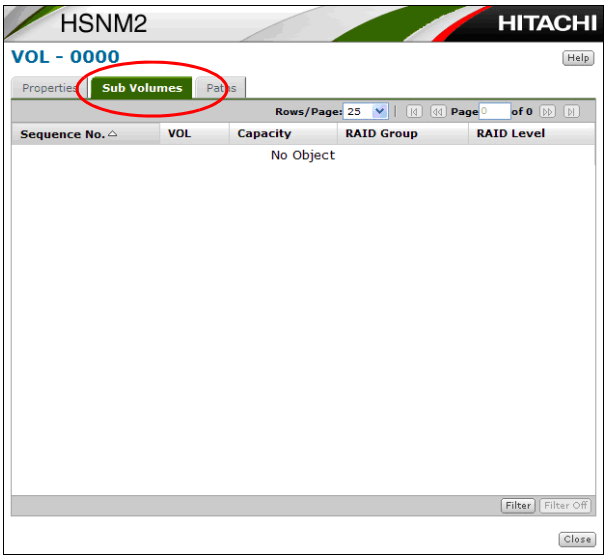

3. In the Change Volume Capacity screen, click the **Basic** tab.
4. Perform one of the following steps under **Method of Capacity Setting**:
   - To separate the last volume only, click **Separate last volume**.
   - To separate every volume, click **Separate all volumes**.




5. Click **OK**.
6. In the confirmation message, check the check box and click **Confirm**.
7. In the next message, click **Close**.
8. To confirm that the **Volumes** tab, and then click the released volume.



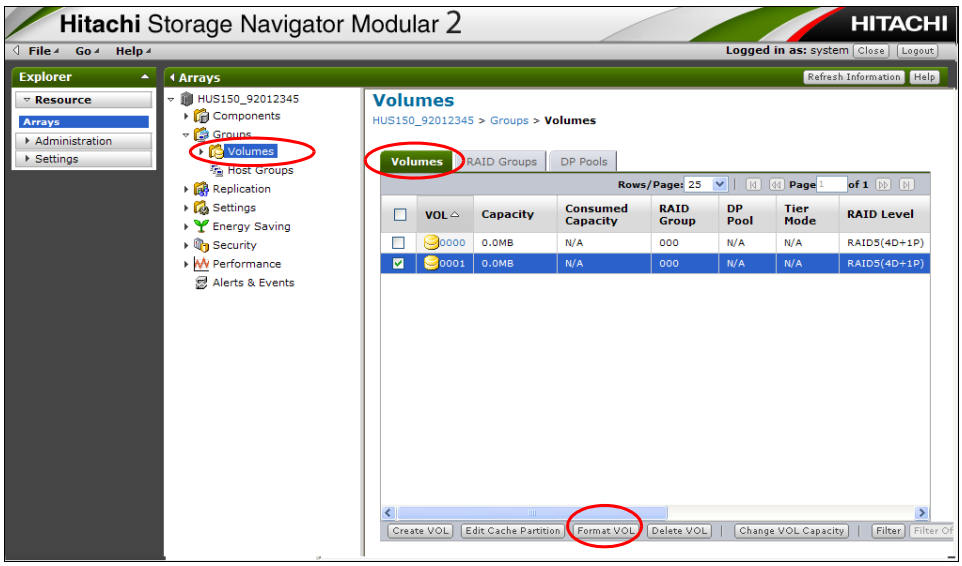

9. When the VOL window appears, click the **Sub Volumes** tab and confirm that the released volume is not shown.
10. Click **Close** to close the window.



## Formatting volumes

To format volumes, use the following procedure.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**.
2. In the **Volumes** tab on the right side of the page, check the volumes you want to format.
3. Click the **Format VOL** button at the bottom of the tab.




4. If there is no formatted volume in the RAID group, click **Close** when the confirmation message appears.

   Otherwise, read the warning message about formatted volumes, check the check box at the bottom of the message, and click **Confirm**. Then, when a message appears about starting volume formatting, click **Close** to start formatting.

   The **Status** field shows the status of the formatting. To update the percentage shown, click the **Refresh Information button** at the top left side of the screen. At the end of the formatting, the window is updated.

---

**NOTE:** If you discover you are formatting the wrong volume, click the **Cancel** button and then select the appropriate volume to be formatted.

---

## Deleting volumes

If you no longer need volumes, you can delete them.

You cannot delete a volume whose forced parity correction is Correcting, Waiting, Waiting Drive Reconstruction, Uncorrected, Uncorrected 1, or Uncorrected 2. Perform the forced parity correction or skip it to change the volume status to Restored or Skip, and then delete the volume.

In addition, a unified volume created configured by subvolumes and two or more RAID Groups cannot be deleted. First separate the unified volumes (see Separating volumes on page 5-62) and then delete the volume.

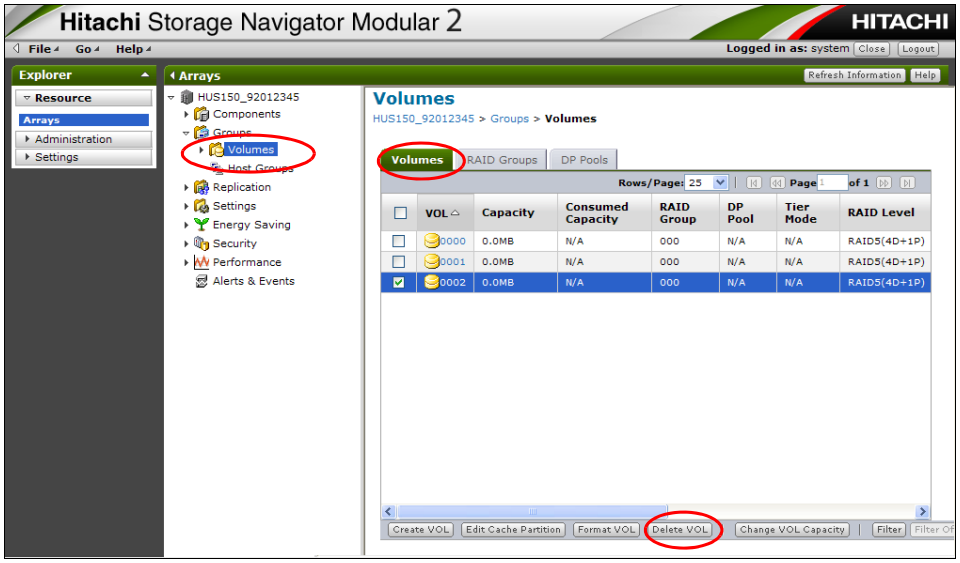
Other conditions that prevent a volume from being deleted are volumes that:

- Are paired in ShadowImage In-system Replication.
- Are paired in Copy-on-Write SnapShot.
- Are paired in TrueCopy Remote Replication.
- Are paired in TrueCopy Extended Distance.
- Are set to the command device.
- Are DMLUs.
- Are Reserve volumes of Modular Volume Migration.
- Are registered in a data pool.
- Have a COPY status in Modular Volume Migration. Wait for the pair status to change to PSUS before deleting the volumes.
- Have a Read Only, Protect, or Can't Guard attribute in Data Retention Utility, have an S-VOL Setting Impossible (disabled), and whose mode is either Read Capacity 0 (Zer) or Inquiry Command Shielding (Zer/Inv). To delete the volumes, use the Data Retention Utility to set the attribute to Read/Write, the S-VOL setting to Setting Possible (Enabled), and the mode to Unset.
- The RAID group is configured for Power Saving/Power Saving Plus. Confirm that the power saving instruction is canceled and the power saving status is **Normal (Spinup)** before deleting the volume.

The following procedure describes how to delete volumes.

**WARNING. Deleting volumes deletes all the data associated with them. Therefore, back up the data associated with volumes before deleting them.**

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes**.
2. In the **Volumes** tab on the right side of the page, check all the volumes you want to delete.
3. Click the **Delete VOL** button at the bottom of the tab.




4. If the volumes are not formatted in the RAID group, click **Close** when the confirmation message appears.

   Otherwise, read the warning message about formatted volumes, check the check box at the bottom of the message, and click **Confirm**, then, when a message states that the volumes have been deleted, click **Close**.

## Improving I/O response times in small configurations

Hitachi Unified Storage systems provide a Response Performance Mode that can improve I/O response times when the number of RAID groups is from 1 to 3 and Write I/O operations are low. This mode stores written data to cache, suppressing I/O operations to drives and improving write I/O response times.

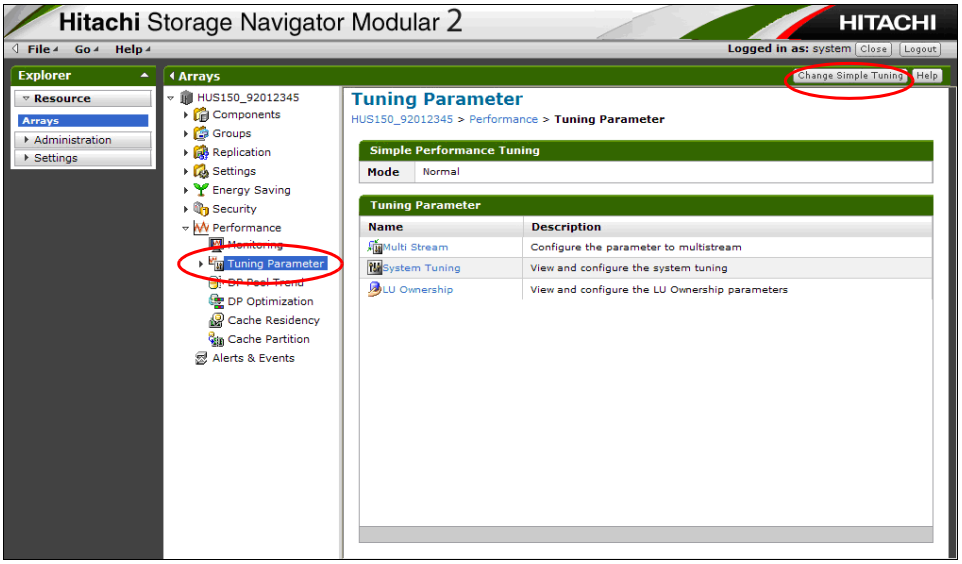
Do not use this mode with applications that write large amounts of data to volumes (that is, data that would exceed what can be held in cache). Otherwise, performance will deteriorate.

Observe the following guidelines when using Response Performance Mode:

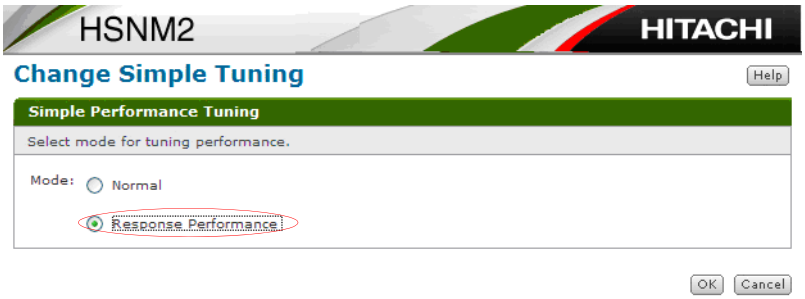
- Response Performance Mode is enabled for segment sizes of 16 KB or less. Exercise care when using this feature with Cache Partition Manager.
- During high I/O operations, you may not be able to switch from Response Performance mode to Normal mode. If an error message appears when you try to switch modes, follow the instructions in the message.
- Processor usage increases in Response Performance mode. This may prevent you from upgrading the storage system firmware. In this case, change to Normal mode and then upgrade firmware.

To enable Response Performance Mode:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Performance > Tuning Parameter**.




2. When the Tuning Parameter screen appears on the right, click the **Change Simple Tuning** button at the top-right side of the screen.
3. When the Change Simple Tuning window appears, click **Response Performance**.




4. Click **OK**.
5. When a message tells you that the tuning performance mode has been changed, click **Close**.

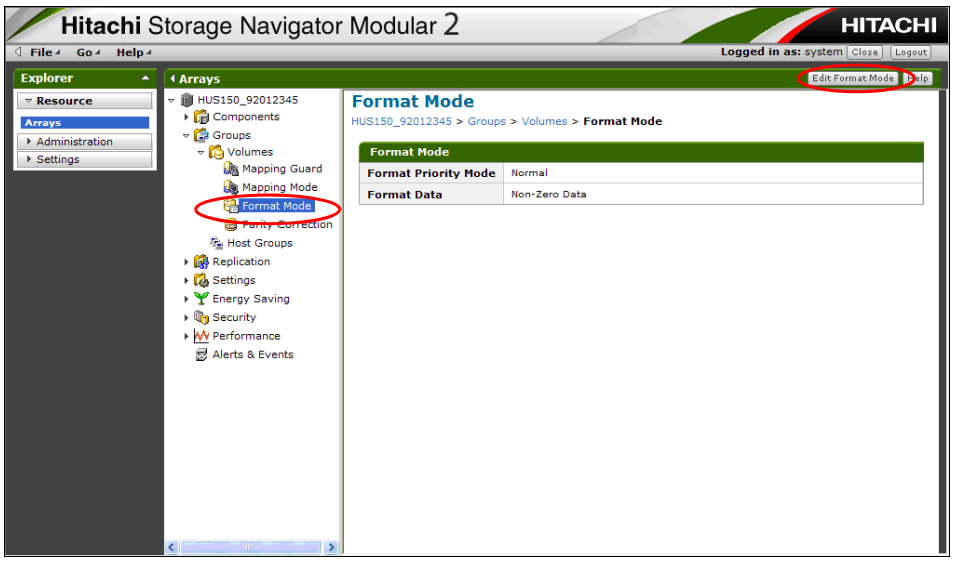
## Changing format mode

By default, Hitachi Unified Storage systems are configured to perform format processing when host I/O loads are low. However, you can change this setting to improve performance if:

- You will perform formatting during copy/restoration operations performed with ShadowImage In-system Replication, TrueCopy Remote Replication, TrueCopy Extended Distance, or Copy-on-Write SnapShot.
- You want the storage system to perform format processing regardless of the host I/O load.

To change the format mode:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes > Format Mode**.




2. Click the **Edit Format Mode** button at the top-right side of the Format Mode screen.
3. In the Edit Format Mode screen, click the appropriate setting for **Format Priority Mode** (see Table 5-16 on page 5-70) and **Format Data** (see Table 5-17 on page 5-70).

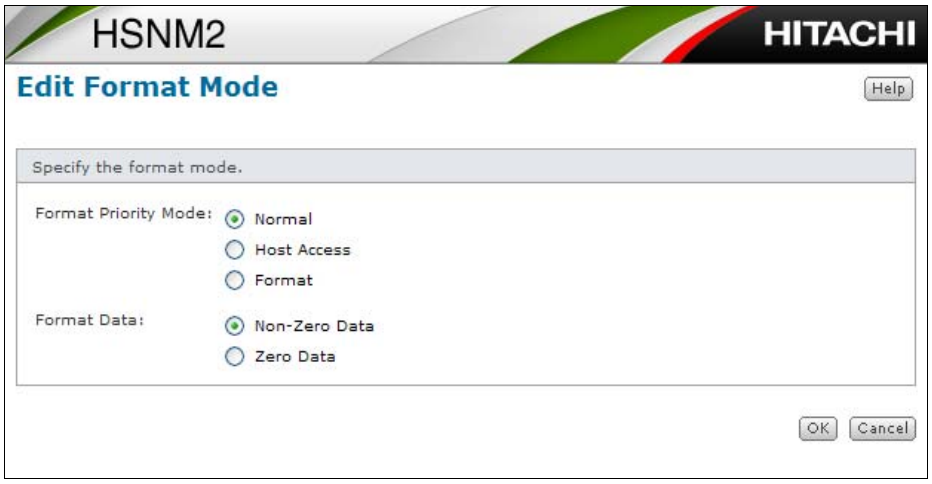


**Table 5-16: Edit Format Mode settings**

| Field | Description |
|---|---|
| Normal | When the host I/O load is low, format processing is performed continuously; if not, it is performed at every constant interval. This is the default setting. |
| Host Access | This mode improves prevents a decrease in performance when formatting is performed during copy/restoration operations using ShadowImage In-system Replication, TrueCopy Remote Replication, TrueCopy Extended Distance, or Copy-on-Write SnapShot. With this selection, format processing occurs according to the host I/O load. |
| Format | With this selection, format processing occurs regardless of host I/O load. This setting gives priority to format processing, but can cause host access performance to decrease significantly. |

**Table 5-17: Format Mode settings**

| Field | Description |
|---|---|
| Non-Zero Data | Formatting is performed when default Data. |
| Zero Data | Formatting is performed when zero. |

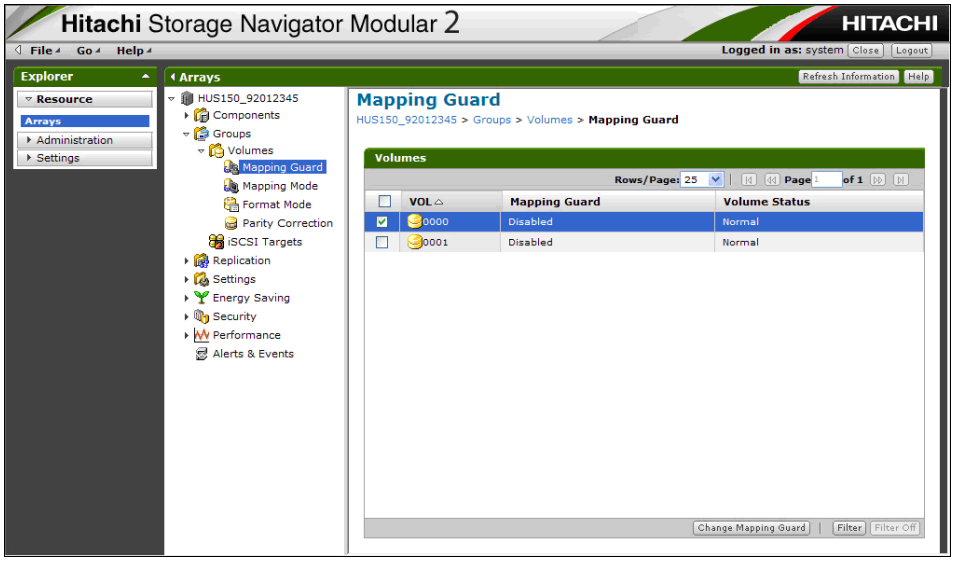
4. Click **OK**.
5. If you selected more than one port, a message with a check box appears. Check the check box and click **Confirm**.
6. In the confirmation message, click **Confirm**.
7. In the next message, click **Close**.

## Setting the mapping guard

Hosts typically have the visibility to see more volumes than they are intended to use. Hitachi Unified Storage systems provide a Mapping Guard function that masks volumes that are not to be used by a host. In this way, enabling Mapping Guard prevents Storage Navigator Modular 2 mapping functions from being performed on “protected” volumes.

To set the mapping guard:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes > Mapping Guard**.




2. In the Mapping Guard screen on the right, check each volume for which you want to enable the mapping guard function.
3. Click the **Change Mapping Guard** button at the bottom of the screen.
4. In the Change Mapping Guard screen, click **Enable** next to **Mapping Guard**.

5. Click **OK**.
6. When a screen tells you that the mapping guard changed successfully, click **Close**.

# Routine Fibre Channel activities

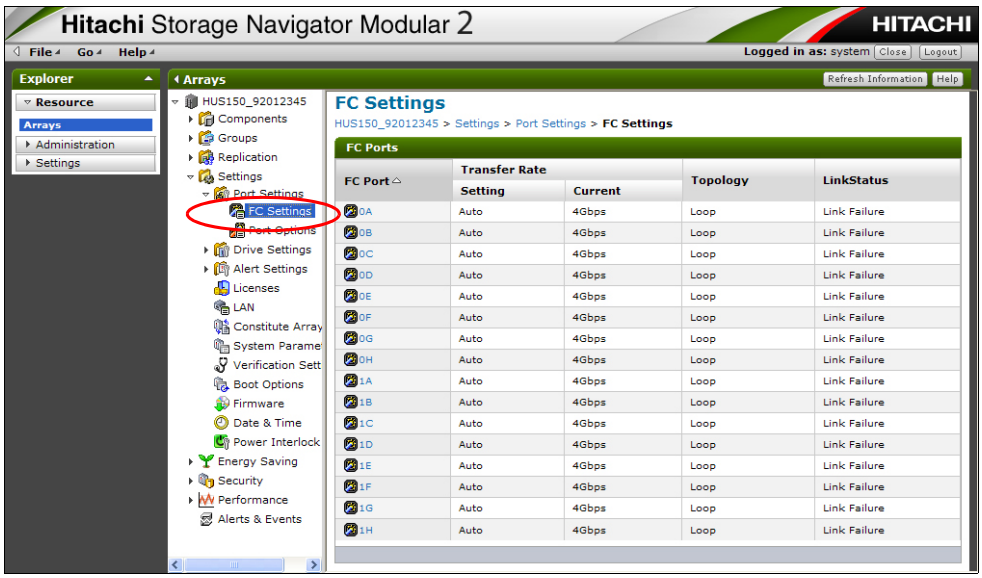
Routine Fibre Channel activities include:

- Changing Fibre Channel settings, below
- Configuring mapping (Fibre Channel) on page 5-73
- Releasing volume assignments (Fibre Channel) on page 5-76configuration screen

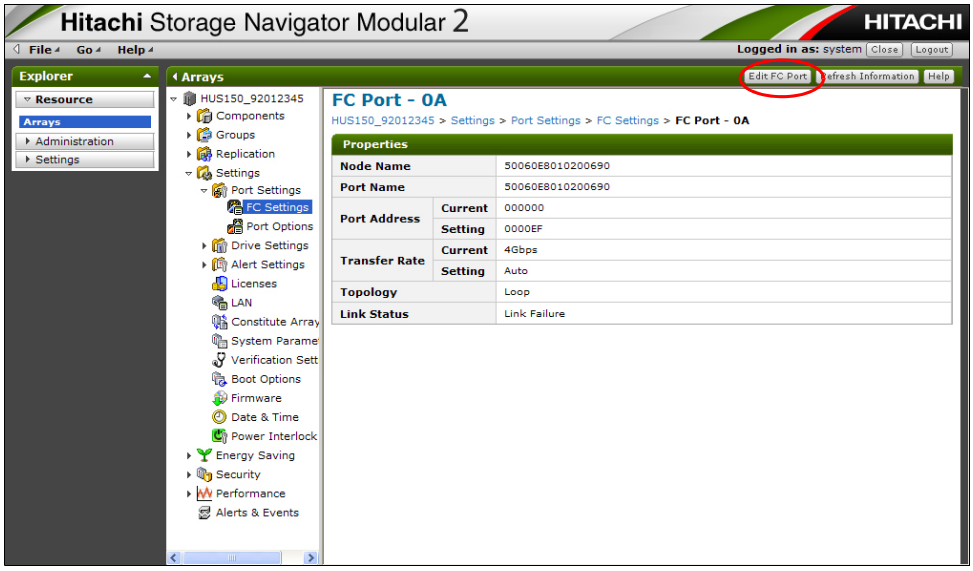
## Changing Fibre Channel settings

As part of the Setup Array wizard, you configured the address, transfer rate, and topology settings for the Fibre Channel ports on your storage system. To change these settings:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Settings** > **Port Settings** > **Host Groups**.




2. In the screen at the right, click a Fibre Channel port in the **FC Port** column.
3. In the top-right side of the screen, click the **Edit FC Port** button.



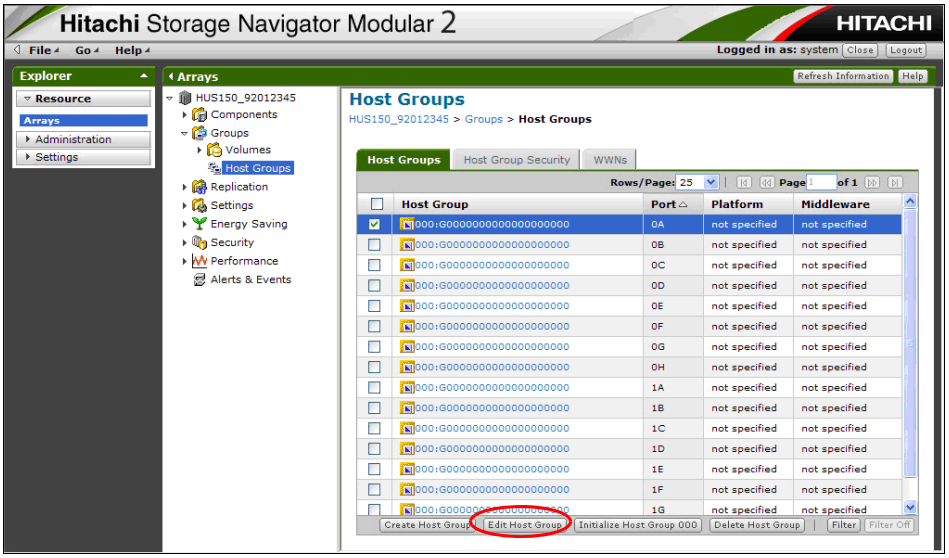

4. Edit the Fibre Channel port information (see Table 5-3 on page 5-11).
5. Click **OK** followed by **Confirm** and **Close**.

## Configuring mapping (Fibre Channel)

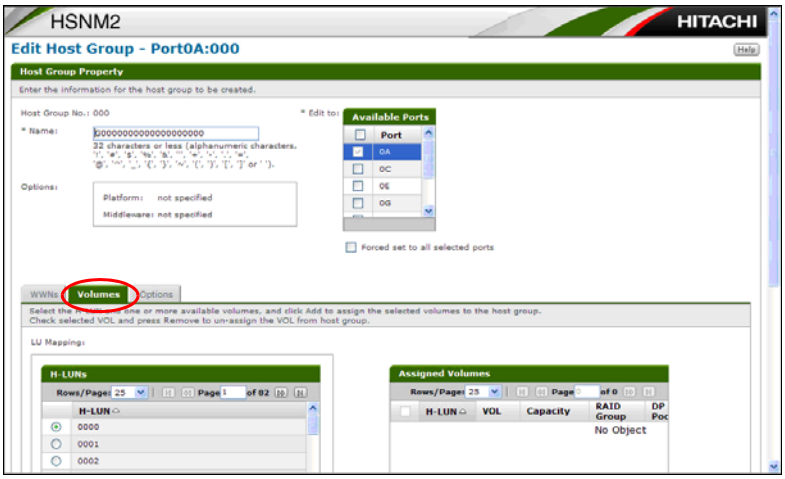
You can map the Port ID and Host LUN (H-LUN) for a volume so they can be used in Fibre Channel host configurations. Mapping settings can be changed while an I/O is using the mapping setting without impacting performance.

If the Hitachi Unified Storage system and host are connected over Fibre Channel, some hosts may not recognize the storage system's volumes, unless the volume 0 is not created at the storage system. When using such hosts, create the volume 0 or map the volume to H-LUN 0.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Host Groups**.
2. In the **Host Groups** tab on the right side of the page, check the host group whose settings you want to change.
3. Click the **Edit Host Group** button at the bottom of the tab.

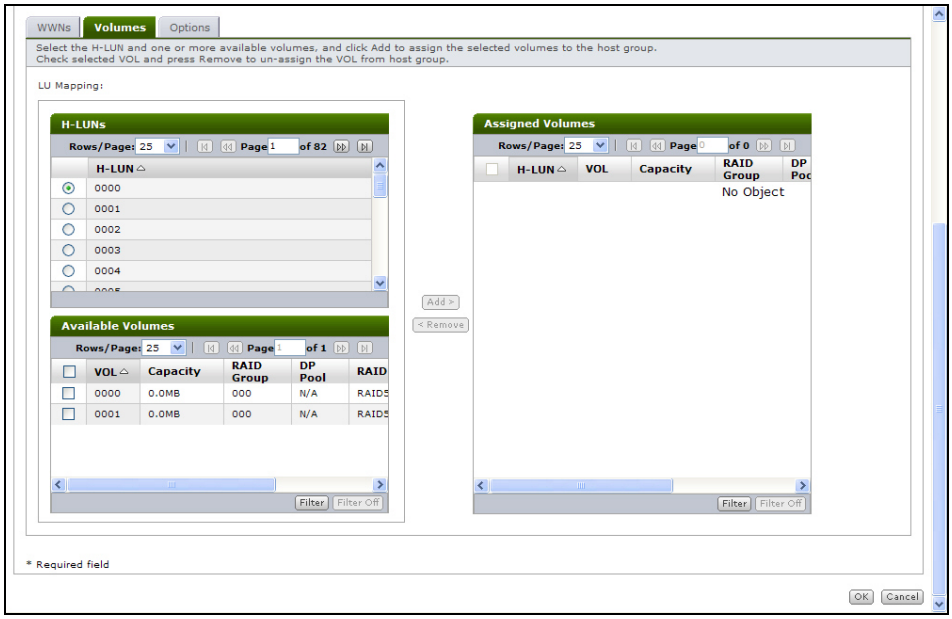



4. In the Edit Host Group screen, click the **Volumes** tab. If you set multiple ports, select a port number at **Edit to** and check **Forced set to all selected ports**. If you did not set multiple ports, go to the next step.

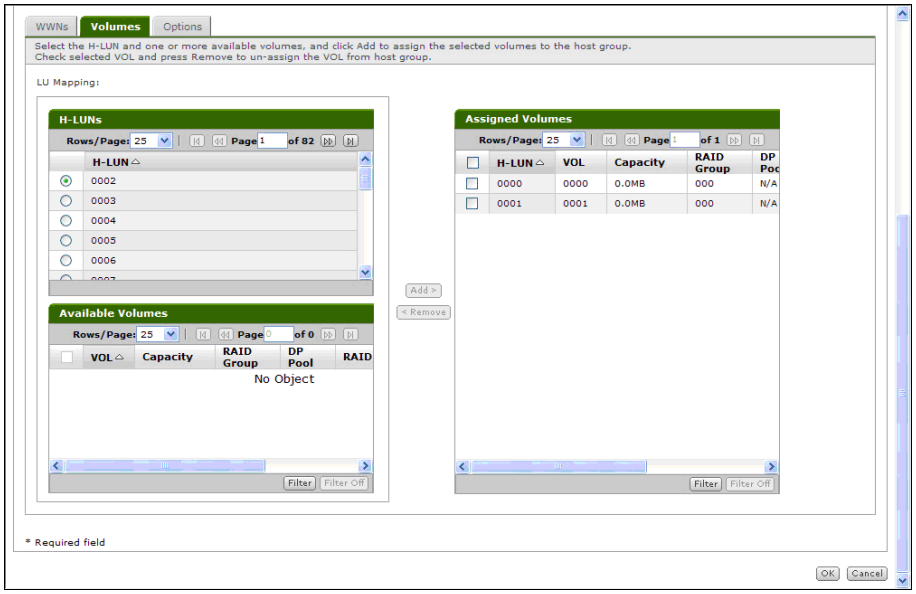



5. Select one H-LUN from the **H-LUNs** list. In the **Assigned Volumes** list, click one volume you want to map on the H-LUN list. Click **Add**. The selected H-LUN and volume move to the **Assigned Volumes** list.

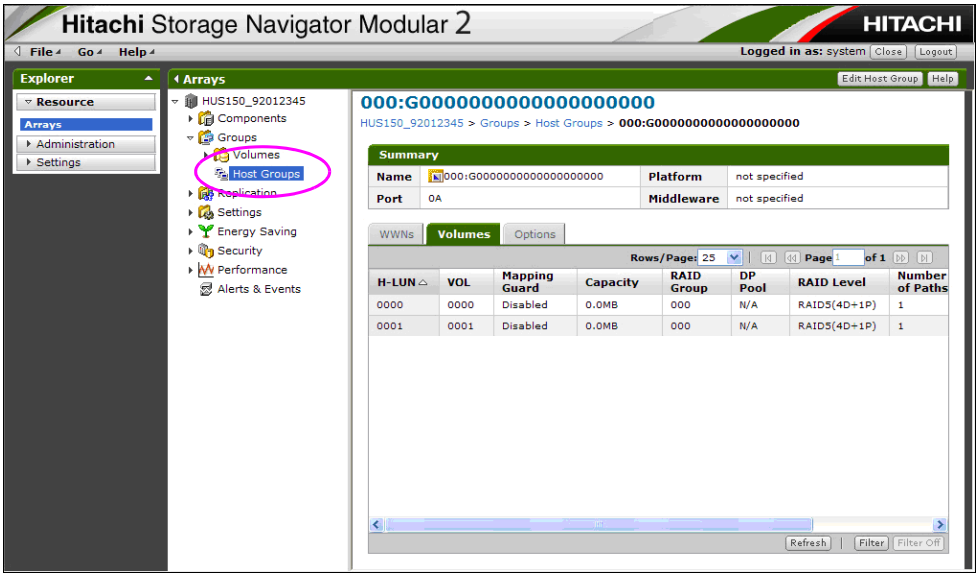
   You can assign H-LUNs sequentially or in ascending order for two or more selected volumes by selecting an H-LUN from the **H-LUNs** list, clicking two or more volumes from the **Assigned Volumes** list, and clicking **Add**. The selected H-LUN and volumes move to the **Assigned Volumes** list.




6. To move more volumes, repeat step 5 until all volumes you want to map appear in the **Assigned Volumes** list.




7. When you finish, click **OK**.
8. If you selected more than one port, a message with a check box appears. Check the check box and click **Confirm**.
9. In the confirmation message, click **Close**.
10. To check the host group, in the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Host Groups**. On the right side of the page, click the **Volumes** tab and confirm that the correct settings are displayed.




## Releasing volume assignments (Fibre Channel)

**NOTE:** Preparing the host side requires (stopping the host I/Os, deleting or removing the logical unit and others) is required in advance. When releasing volume assignments:

Stop all host access for the volume whose assignment is to be released.

Check all active paths for the volume whose assignment is to be released by the path management software on the host side. Then disable the paths.

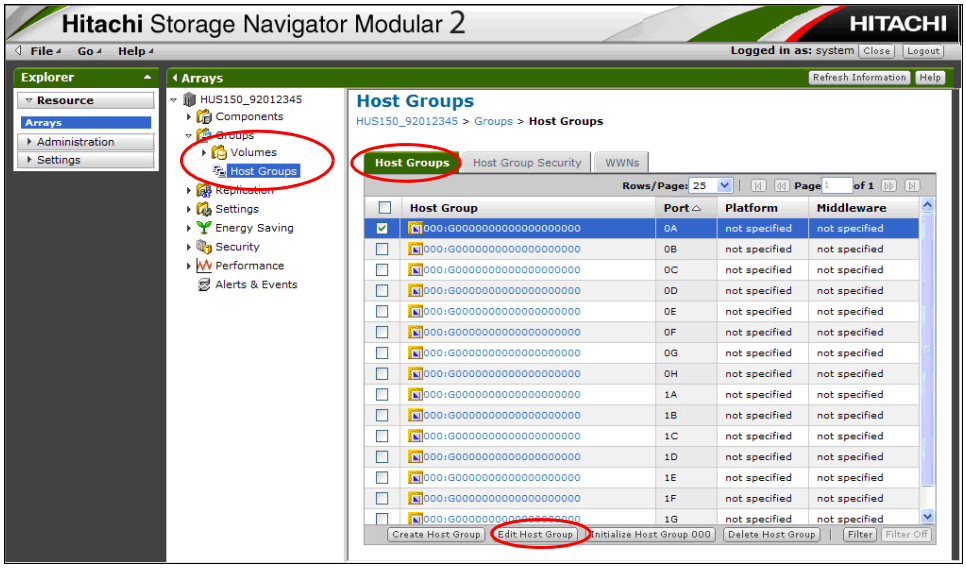
Unmount the volume whose assignment is to be released from the operating system.

Check that the mapping guard of the volume whose assignment is released is not enabled.

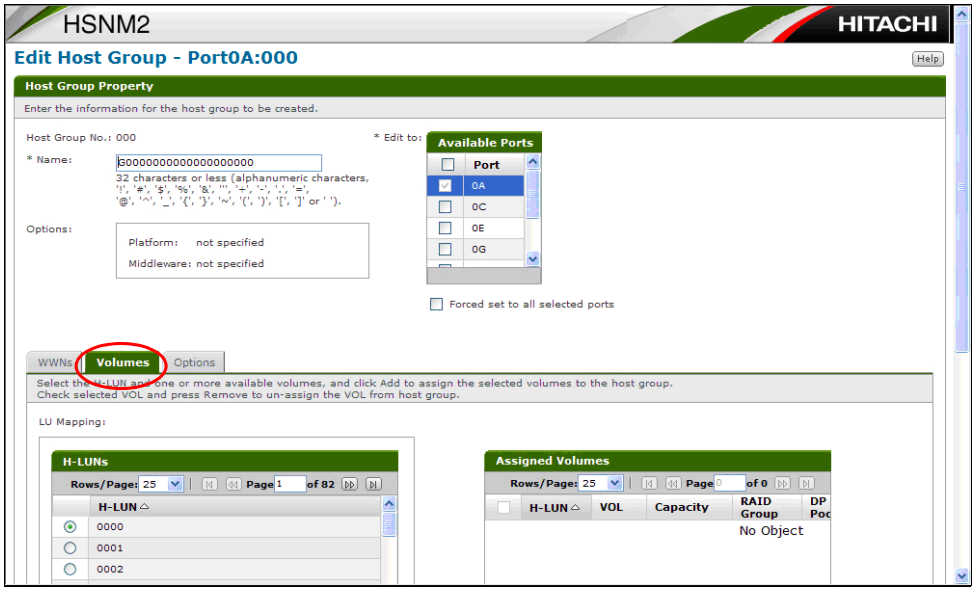
Release the volume assignment from the host group.

To release a volume assignment:

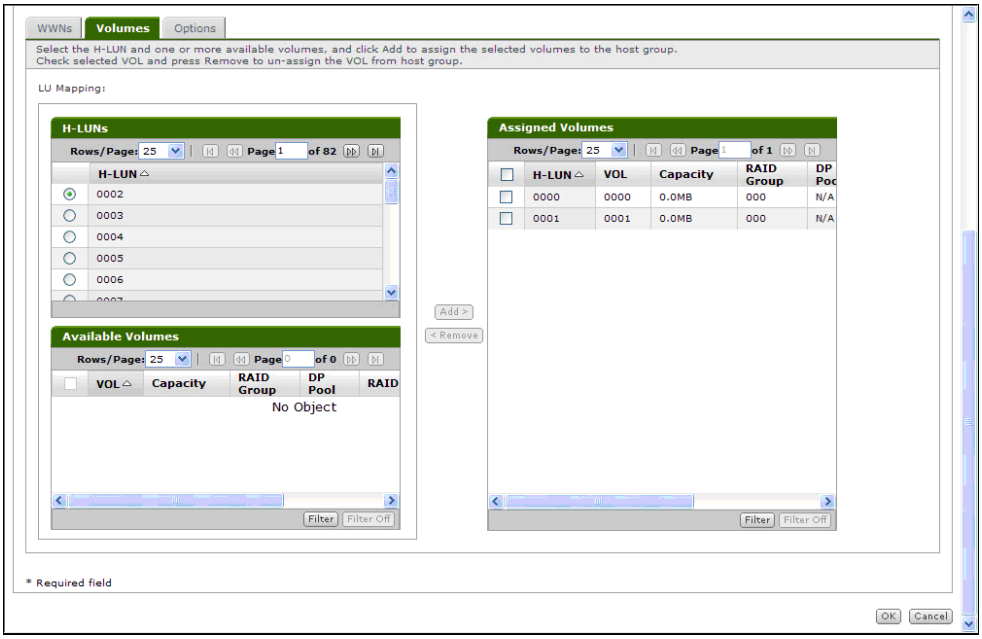
1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > Volumes > Host Groups**.
2. In the **Host Groups** tab on the right side of the page, check the port whose volume assignment you want to release.




3. Click the **Edit Host Group** button at the bottom of the tab. The Edit Host Group page appears.
4. If you set multiple ports, select a port number at **Edit to** and check **Forced set to all selected ports**. If you did not set multiple ports, go to the next step.
5. Click the **Volumes** tab.




6. In the **Assigned Volumes** list, check the check boxes of the volumes you want to release and click the **Remove** button.




7. When you finish, click **OK**.
8. If you selected more than one port, a message with a check box appears. Check the check box and click **Confirm**.
9. In the confirmation window, click **Close**.

# Routine iSCSI activities

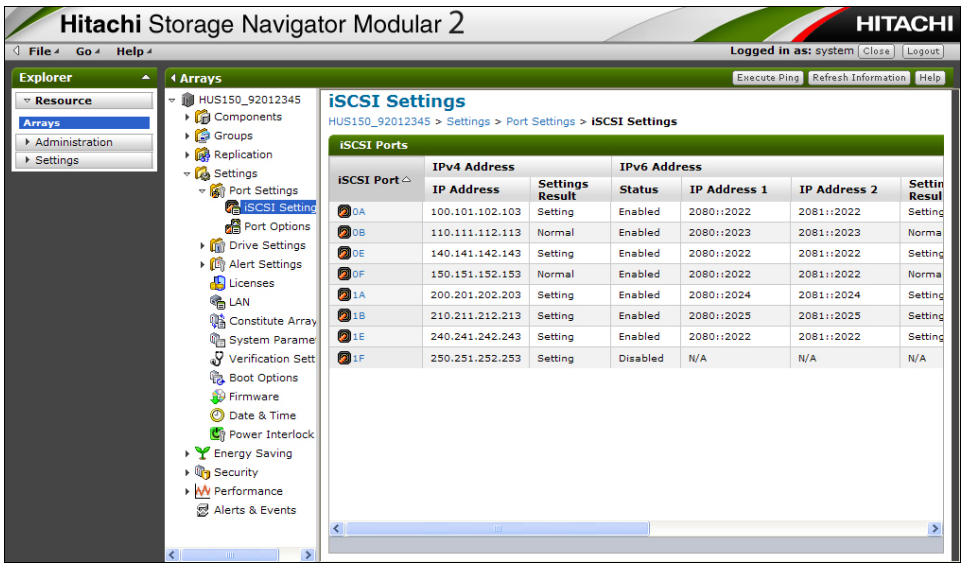
Routine iSCSI activities include:

- Changing iSCSI settings, below
- Configuring iSCSI target information
- Initializing iSCSI target settings
- Configuring mapping (iSCSI)
- Releasing volume assignments (iSCSI)
- Using CHAP authentication with iSCSI ports

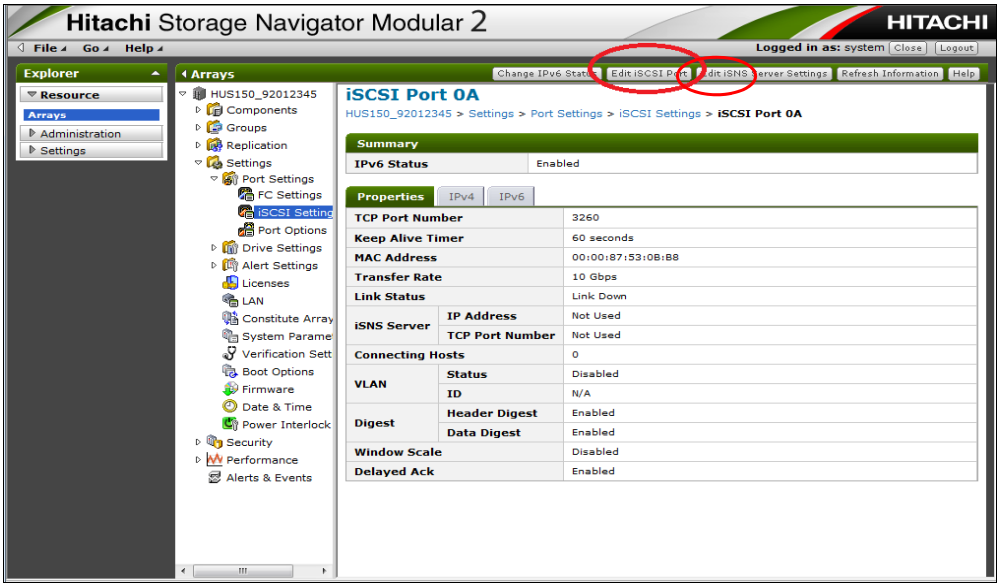
## Changing iSCSI settings

If your Hitachi Unified Storage system has iSCSI ports, you configured the ports during the Setup Array wizard. To change these settings:

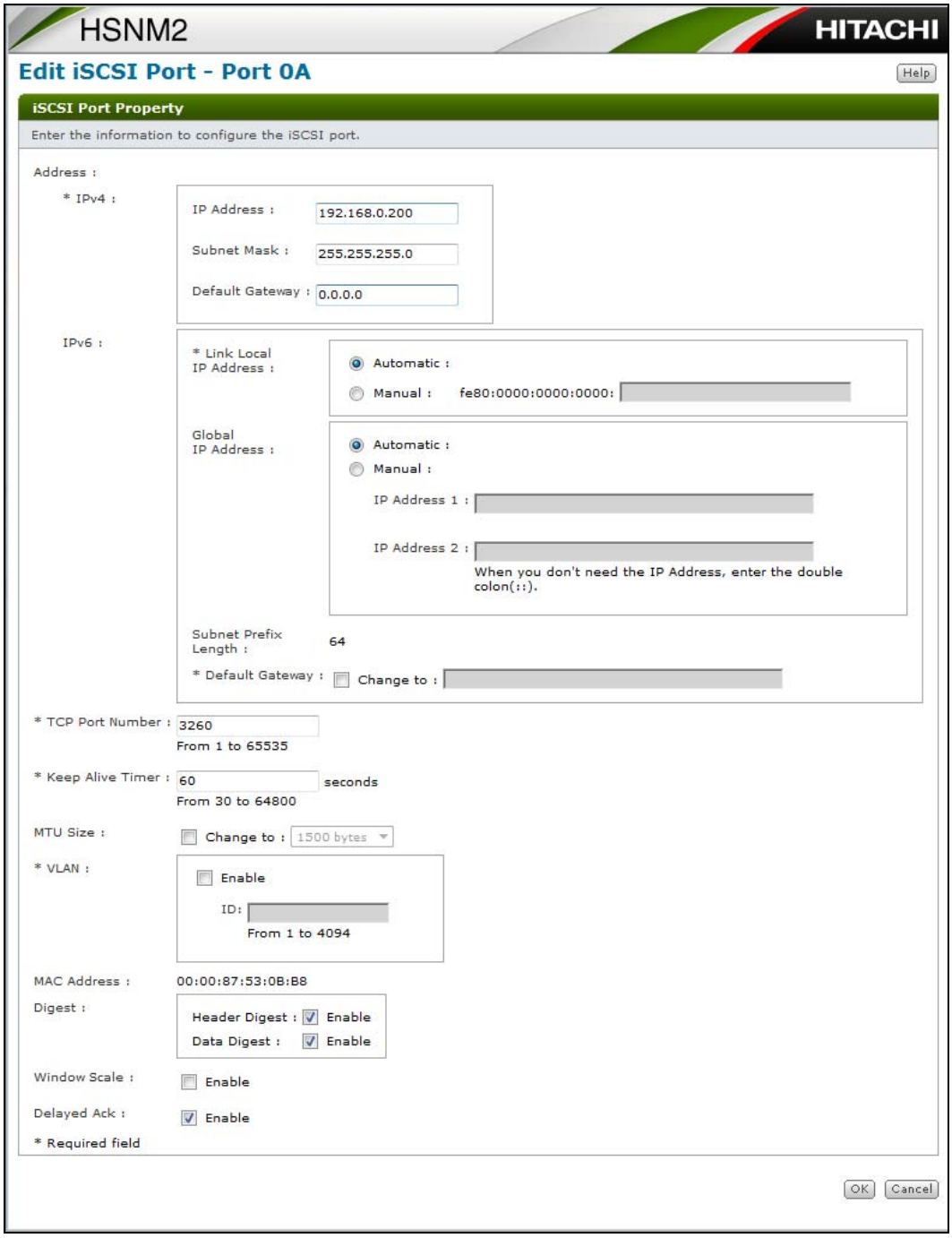
1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Settings > Port Settings > iSCSI Settings**.




2. In the screen at the right, click an iSCSI port in the **Port** column.
3. In the top-right side of the screen, click the **Edit iSCSI Port** button.




4. Edit the iSCSI port information (see Table 5-4 on page 5-13).




5. Click **OK** followed by **Confirm** and **Close**.

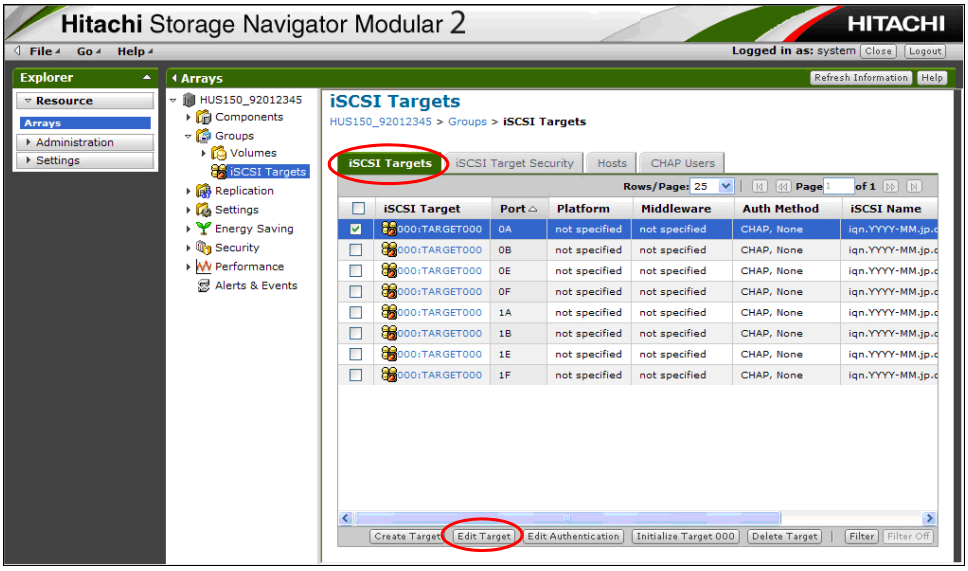
## Configuring iSCSI target information

With iSCSI, the host connection mode, mapping of volumes, and LUN security information are set to targets, not to ports. In this way, you can select the host to which the storage system is connected based on each target

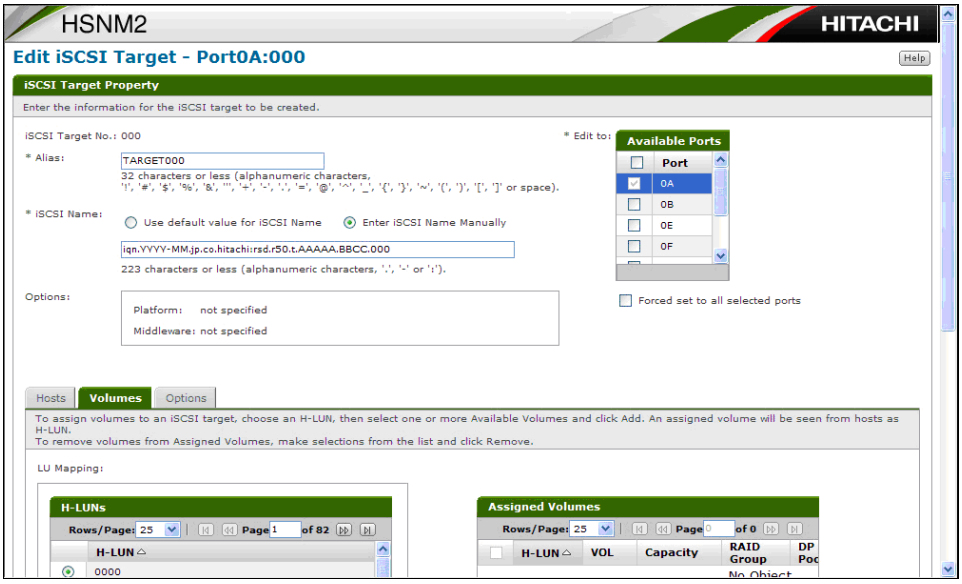
HItachi Unified Storage systems support only the target 000:TARGET000 (or 000:T000). However, you can set up to 255 targets using LUN Manager.

The following procedure describes how to change iSCSI target information. Using this procedure, you can change the iSCSI name and alias for a target.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**.




2. In the **iSCSI Targets** tab on the right, check the port whose iSCSI target information you want to change. Then click the **Edit Target** button at the bottom of the tab.



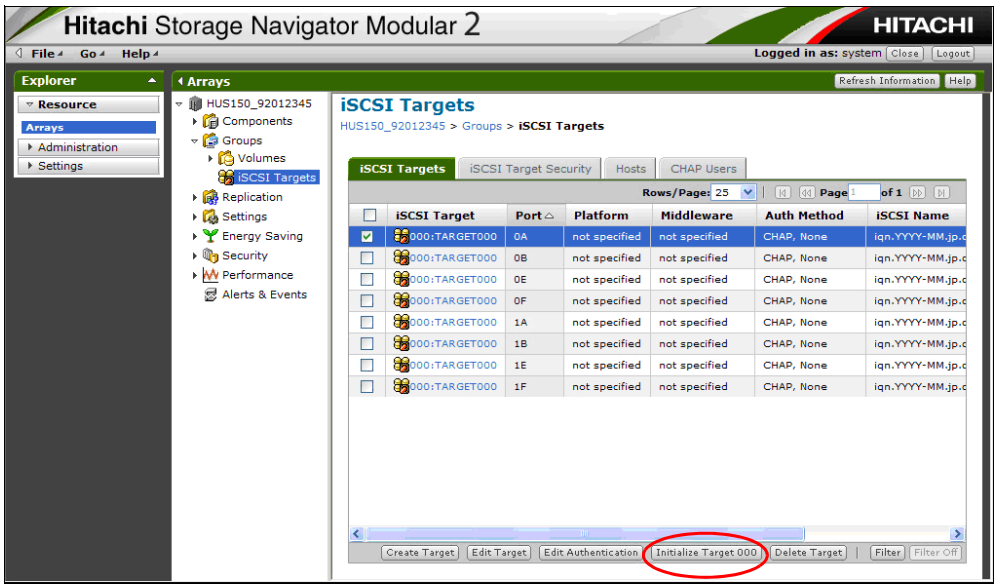

3. In the **Alias** field, enter the iSCSI alias.
4. In the **iSCSI Name** field, enter the iSCSI name.
5. Click **OK**.
6. In the confirmation page, click **Close**.

The iSCSI target information is not used until you use the procedure in the next section to initialize the settings.

# Initializing iSCSI target settings

After you define target information for the iSCSI ports on your Hitachi Unified Storage system, use the following procedure to initialize the target information.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**.
2. In the **iSCSI Targets** tab, check each iSCSI target you want to initialize.

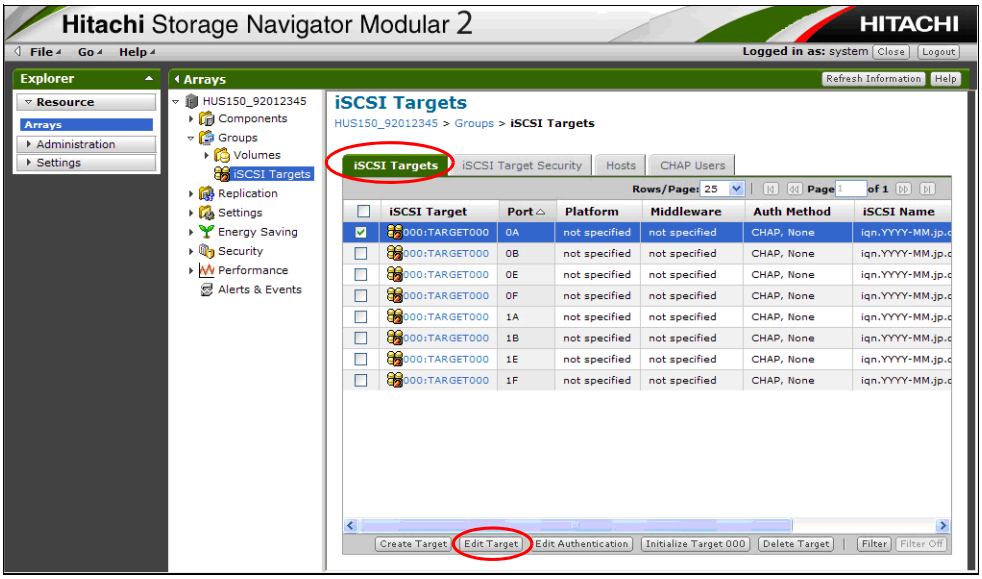



3. Click the **Initialize Target 000** button at the bottom of the tab.
4. In the confirmation message, click **Confirm**.
5. In the next message, click **Close**.

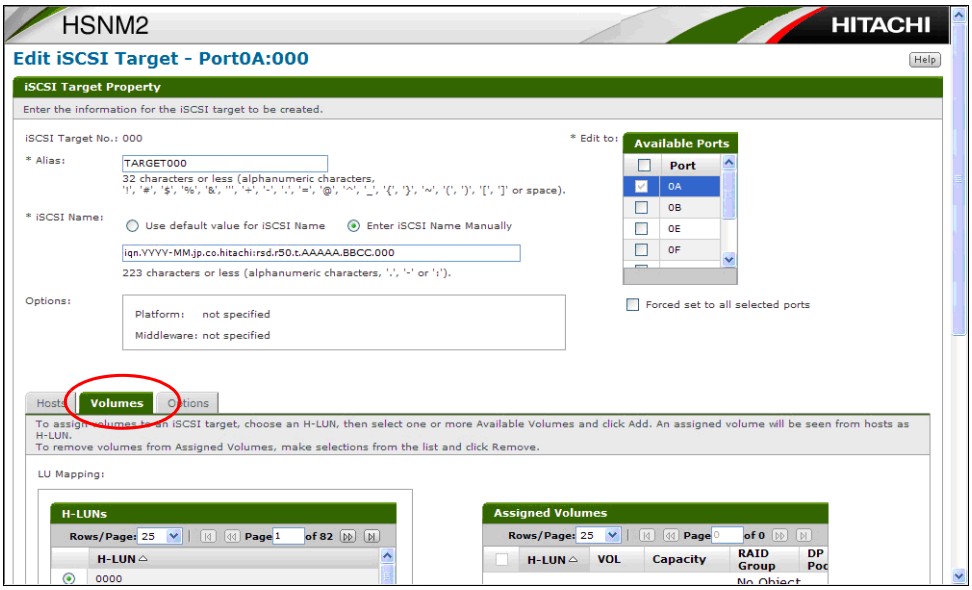
# Configuring mapping (iSCSI)

You can map the Port ID and H-LUN for a volume so they can be used in iSCSI host configurations. Mapping settings can be changed while an I/O is using the mapping setting without impacting performance.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**.
2. In the **iSCSI Targets** tab, check the target whose settings you want to change.
3. Click the **Edit Target** button at the bottom of the tab.

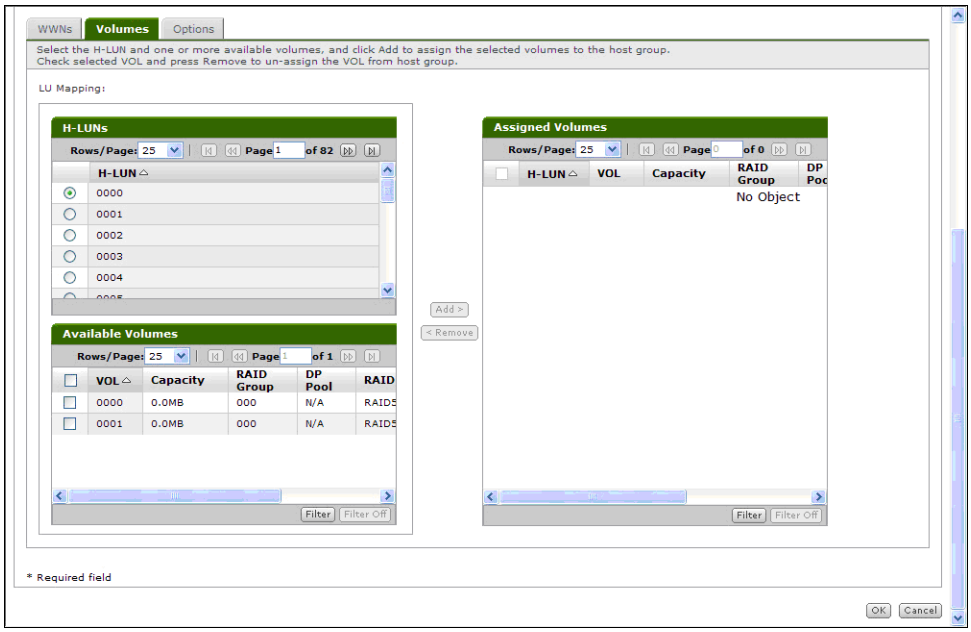



4. In the Edit iSCSI Target screen, click the **Volumes** tab. If you set multiple ports, select a port number at **Edit to** and check **Forced set to all selected ports**. If you do not set multiple ports, go to the next step.

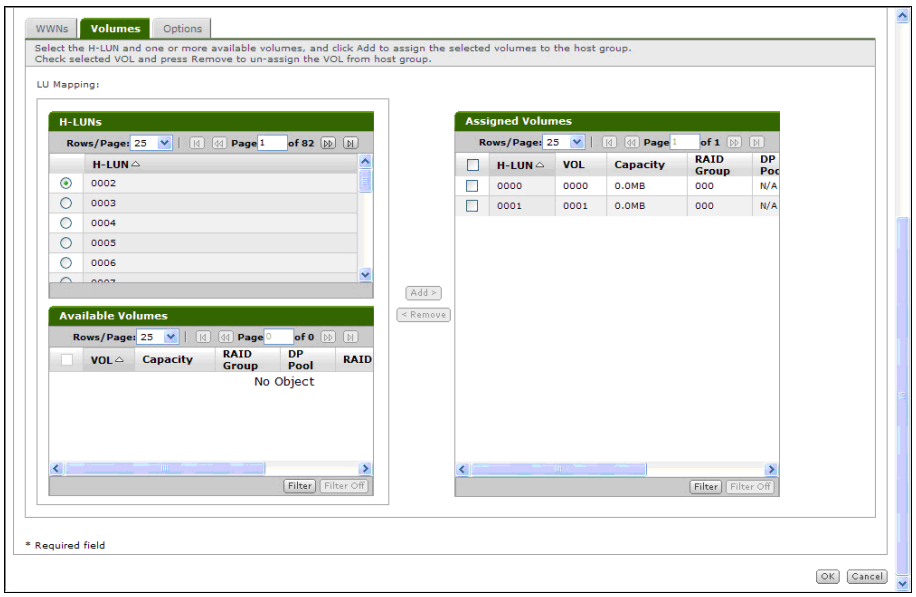



5. Select one H-LUN from the **H-LUNs** list. In the **Assigned Volumes** list, click one volume you want to map on the **H-LUNs** list, and click **Add**. The selected H-LUN and volume move to the **Assigned Volumes** list.

You can assign H-LUNs sequentially or in ascending order for two or more selected volumes by selecting an H-LUN from the **H-LUNs** list, clicking two or more volumes from the **Assigned Volumes** list, and clicking **Add**. The selected H-LUN and volumes move to the **Assigned Volumes** list.

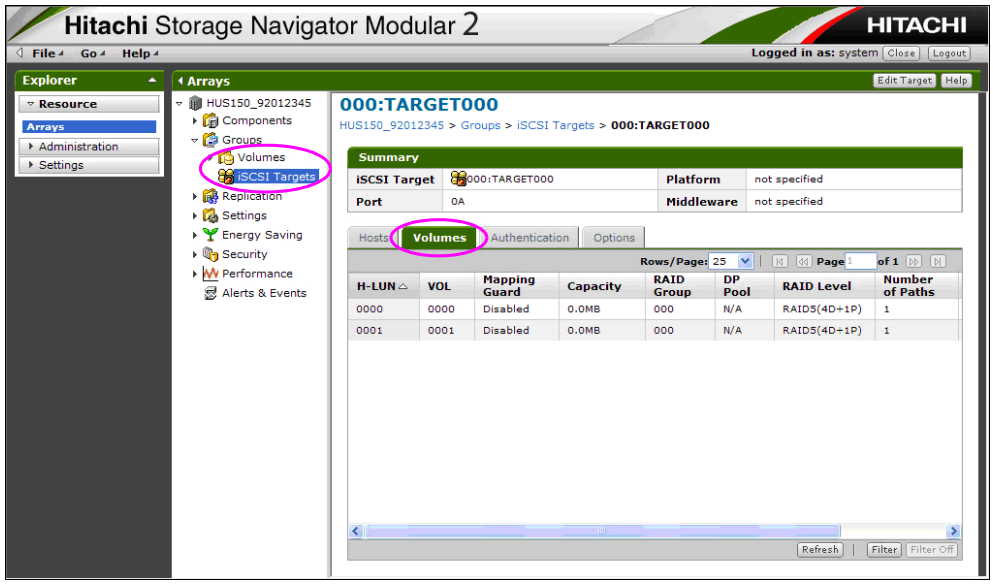



6. To move more volumes, repeat step 5 until all volumes you want to map appear in the **Assigned Volumes** list.




7. When you finish, click **OK**.
8. If you selected more than one port, a message with a check box appears. Check the check box and click **Confirm**.
9. In the confirmation message, click **Close**.

10. To check the host group, in the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**. On the right side of the page, click the port whose settings you want to confirm, and then click the **Volumes** tab. When the settings appear, confirm that they are set properly.




## Releasing volume assignments (iSCSI)

**NOTE:** Preparing the host side requires (stopping the host I/Os, deleting or removing the logical unit and others) is required in advance. When releasing volume assignments:

Stop all hosts access for the volume whose assignment is to be released.

Check all the active paths for the volume whose assignment is to be released by the path management software on the host side. Then, disable the paths.

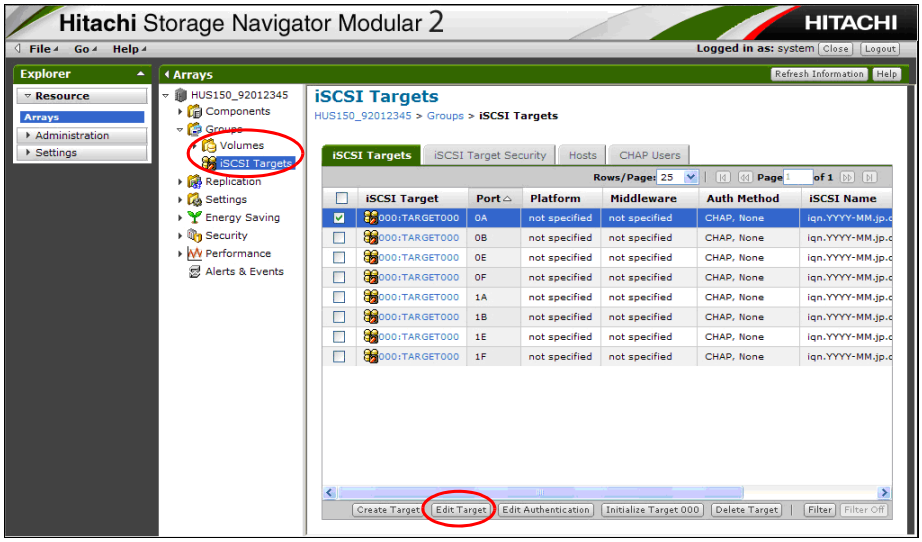
Unmount the volume whose assignment is to be released from the operating system.

Check that the mapping guard of the volume whose assignment is released is not enabled.

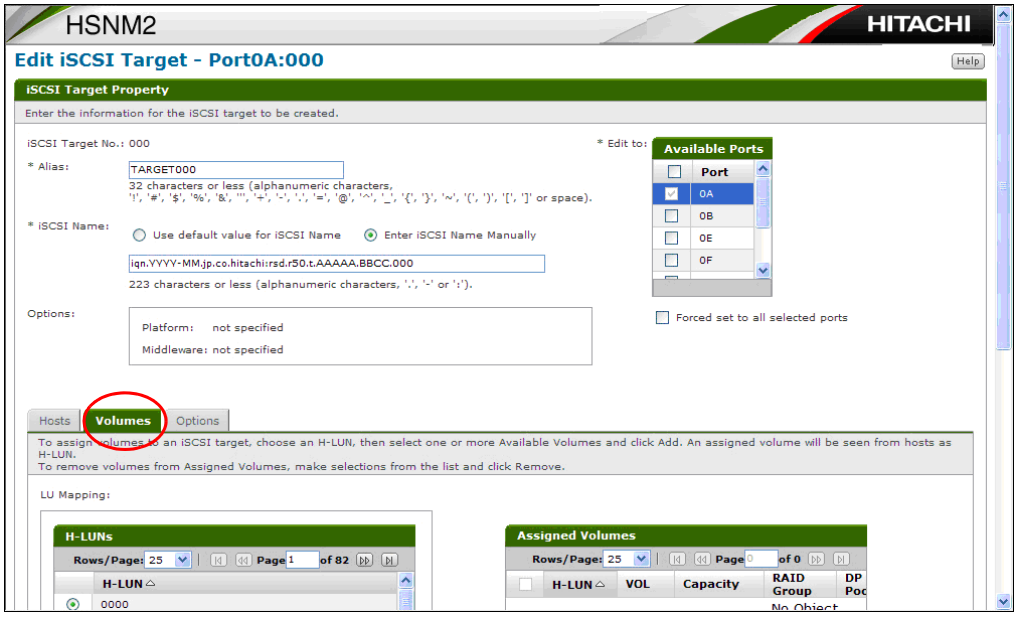
Release the volume assignment from the target.

To release a volume assignment:

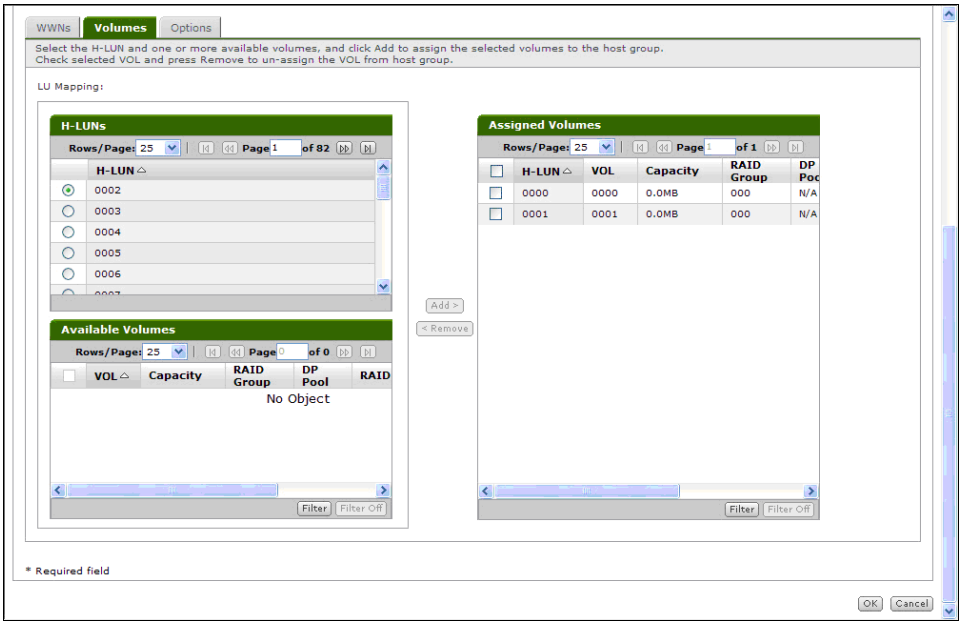
1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**.




2. In the iSCSI **Targets** tab, check the port whose volume assignment you want to release.
3. Click the **Edit Target** button at the bottom of the tab. The Edit iSCSI Target page appears.




4. Click the **Volumes** tab.
5. If you set multiple ports, select a port number at **Edit to** and check **Forced set to all selected ports**. If you did not set multiple ports, go to the next step.
6. In the **Assigned Volumes** list, check the check boxes of the volumes you want to release and click the **Remove** button.




7. Click **OK**.
8. If you selected more than one port, a message with a check box appears. Check the check box and click **Confirm**.
9. In the confirmation window, click **Close**.

## Using CHAP authentication with iSCSI ports

Challenge Handshake Authentication Protocol (CHAP) is an optional iSCSI authentication method where the Hitachi Unified Storage system (target) authenticates iSCSI initiators on the host server.

The storage system uses two types of CHAP authentication:

- One-way CHAP (described below)
- Mutual CHAP (described on page 5-92)

With one-way CHAP, the storage system authenticates all requests for access issued by the iSCSI initiator(s) on the host server via a CHAP secret. To set up one-way CHAP authentication, you enter a CHAP secret on the storage system and then configure each iSCSI initiator on the host server to send that secret each time it tries to access the storage system.

With mutual CHAP, both the storage system and the iSCSI initiator authenticate each other. To set up mutual CHAP, you configure the iSCSI initiator with a CHAP secret that the storage system must send to the host sever to establish a connection. In this 2-way authentication process, both the host server and the storage system are sending information that the other must validate before a connection is allowed.

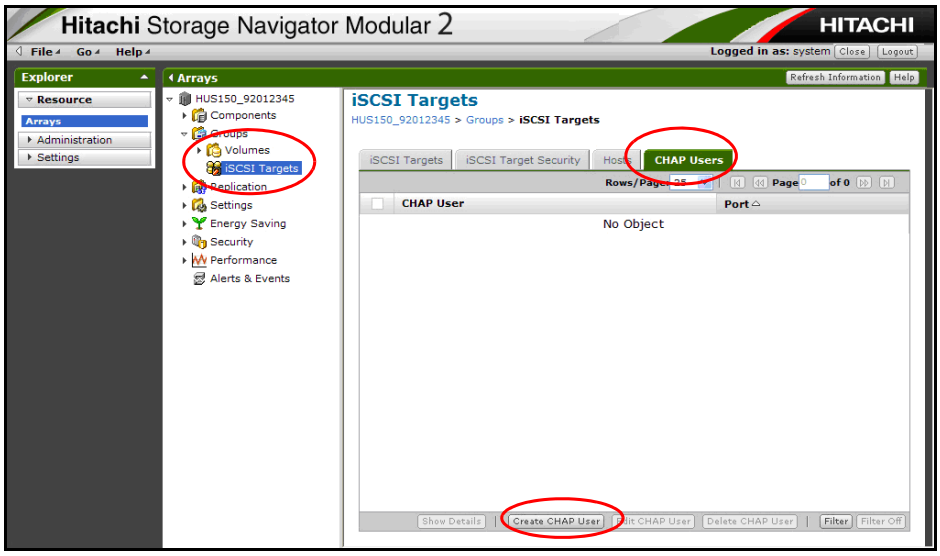
CHAP is an optional feature and is not required to use iSCSI. However, if you do not configure CHAP authentication, any host server connected to the same IP network as the storage system can read from and write to the storage system.

**NOTE:** If you enable CHAP authentication on the Hitachi Unified Storage system, configure it on the host server as well using the iSCSI initiator. If you replace an HBA in an attached host, change the iSCSI Name setting in CHAP. If changing the MTU size, make the change in the storage system (see Table 5-4 on page 5-13) and at the switch/host set.

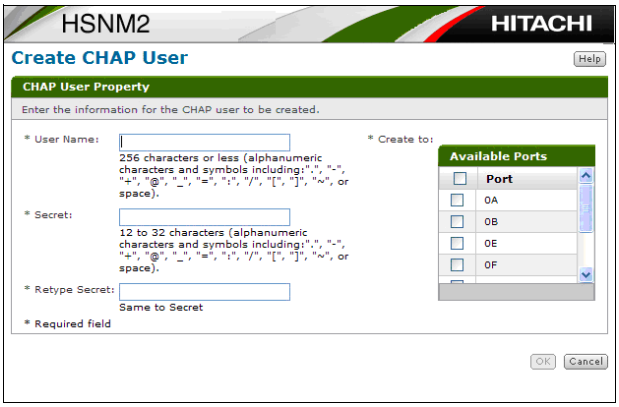
### Configuring one-way CHAP

To set up one-way CHAP on the Hitachi Unified Storage system:

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**.
2. In the iSCSI Targets screen on the right, click the **CHAP Users** tab.




3. Click the **Create CHAP User** button at the bottom of the tab.
4. In the Create CHAP User screen, enter the user name and secret in their respective fields. Retype the case-sensitive secret in the **Retype Secret** field.

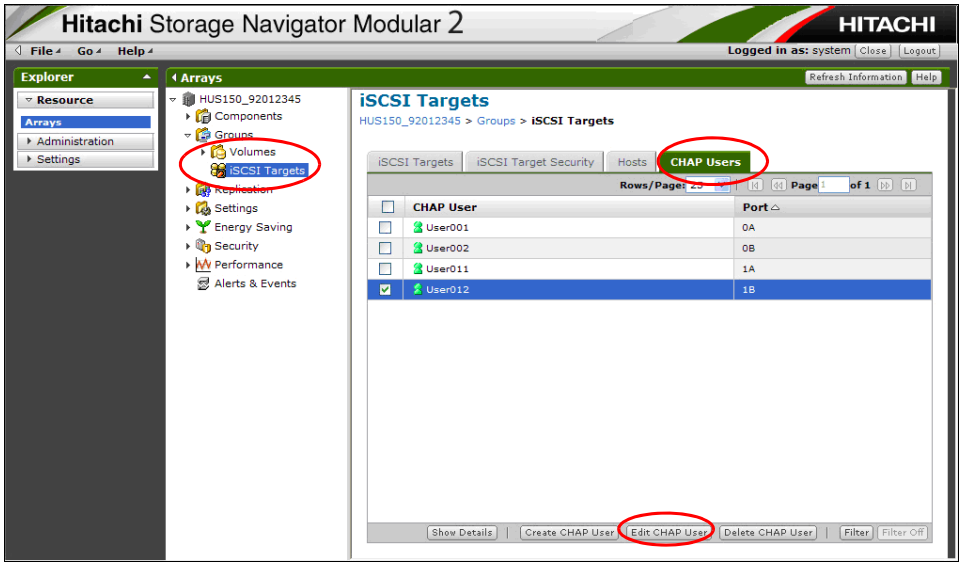



5. Under **Available Ports**, check the port that will use CHAP authentication.
6. Click **OK**.
7. In the confirmation message, click **Close**.

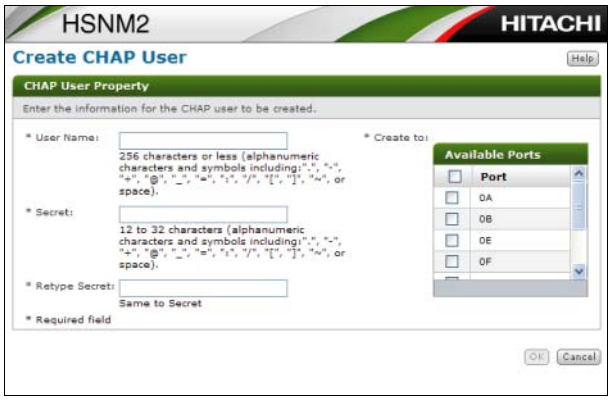
## Changing one-way CHAP settings

To change one-way CHAP settings, use the following procedure.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**.
2. In the **iSCSI Targets** tab on the right, click the **CHAP Users** tab.
3. Check the CHAP user whose settings you want to change.




4. Click the **Edit CHAP User** button at the bottom of the tab.
5. In the Edit CHAP User screen, change the user name and secret, as necessary. If you change the secret, retype the case-sensitive secret in the **Retype Secret** field.

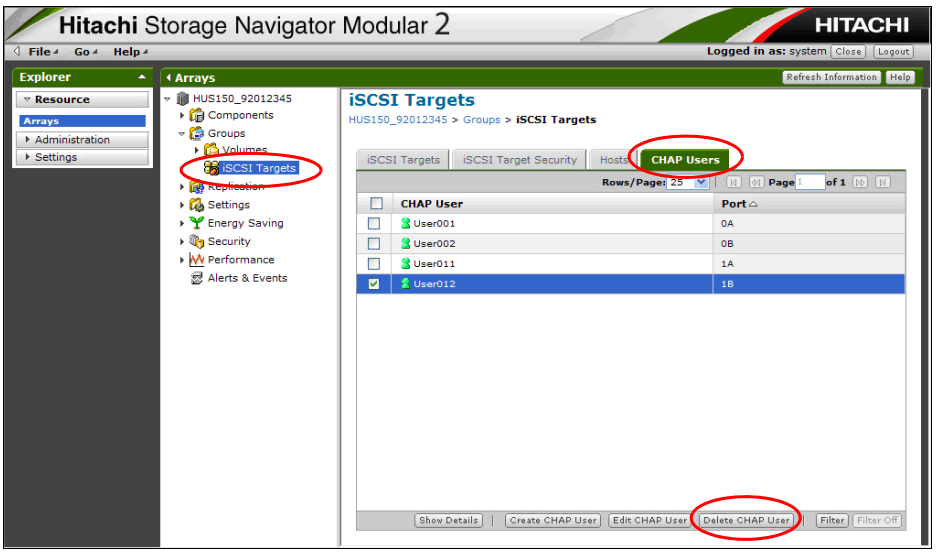



6. Click **OK**.
7. In the confirmation message, click **Close**.

## Deleting a one-way CHAP user

If you no longer need a one-way CHAP user, use the following procedure to delete the CHAP user.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**.
2. In the iSCSI Targets screen on the right, click the **CHAP Users** tab.
3. Check each CHAP user you want to delete.



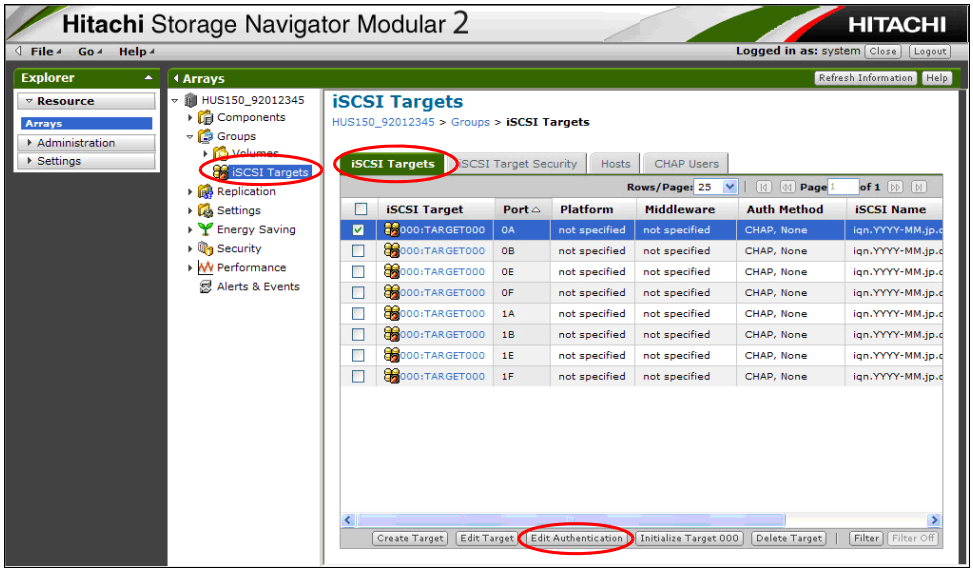

4. Click the **Delete CHAP User** button at the bottom of the tab.
5. In the confirmation message, click **Confirm**.
6. In the next message click **Close**.

## Enabling mutual CHAP

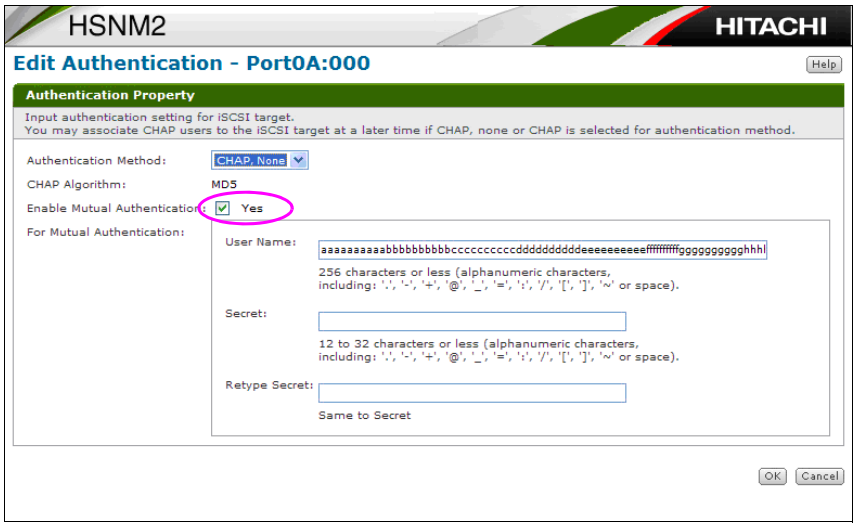
The following procedure describes how to enable mutual CHAP.

**NOTE:** Hitachi Unified Storage systems do not support mutual CHAP authentication with Red Hat Enterprise Linux and SuSE Linux software initiators.

1. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Groups > iSCSI Targets**.
2. In the **iSCSI Targets** tab on the right, check the port for which you want to enable mutual CHAP.




3. Click the **Edit Authentication** button at the bottom of the tab.
4. In the Edit Authentication screen, use the **Authentication Method** drop-down list to select the CHAP authentication method
5. For **Enable Mutual Authentication**, check **Yes** to enable 2-way mutual CHAP. (If this check box is not checked, one-way CHAP is used.)




6. Click **OK**.
7. In the confirmation message, click **Close**.

# Installing an iSCSI initiator (iSCSI systems only)

Hitachi Unified Storage systems containing an iSCSI Host I/O module require an iSCSI initiator. Hitachi Data Systems has qualified a number of iSCSI initiators, network interface cards (NICs), and other devices to interoperate with the storage system. For the latest information about supported versions and models of iSCSI software and hardware products, refer to the interoperability information at http://www.hds.com/products/interoperability/.

Depending on your operating system, you may need to download iSCSI initiator software. For example:

- The iSCSI initiator for Microsoft Windows XP or Windows Server 2003 can be downloaded free of charge from the following site: http://www.microsoft.com/downloads.
- iSCSI initiator software for Microsoft Windows Vista or Windows Server 2008, Solaris, and VMware, on the other hand, are included with these operating systems.

Using the instructions for your iSCSI initiator software:

- Install the iSCSI initiator software on your host.
- Configure the iSCSI initiator to use the same subnet as the Hitachi Unified Storage system iSCSI data ports.

As part of this procedure, you may need to:

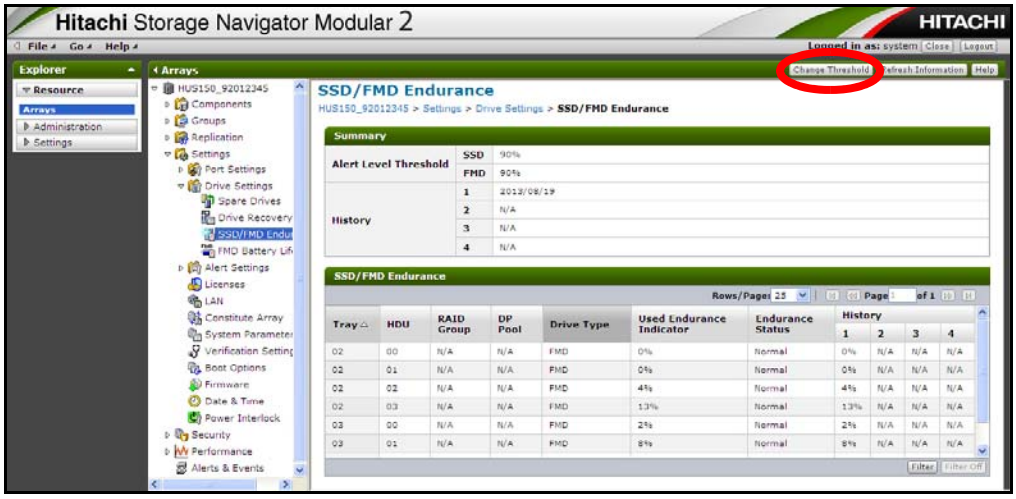
- Add the target to the iSCSI service binding list.
- Initialize new drives.
- Create partitions.
- Format new volumes.

**NOTE:** Microsoft iSCSI Initiator lets you select the Load Balance Policy setting for individual targets. When selecting a Load Balance Policy, choose the default setting Fail Over Only. This failover policy uses one active path and designates all other paths as standby. The standby paths will be tried on a round-robin approach upon failure of the active path until an available path is found. Do not select any other Load Balance Policy for your Hitachi Unified Storage system.

# Setting the flash drive/FMD write endurance threshold

To set the flash drive write endurance threshold:

1. Click **Settings > Drive Settings > SSD/FMD Endurance**. The SSD Endurance page appears, with the current write endurance status displayed.




2. Click **Change Threshold**.
3. When the Change Threshold page appears, specify an Alert Level Threshold, and then click **OK**.
4. When the Change Threshold window appears, click **Close**.

**Table 5-18: SSD endurance status**

| Endurance status | Description |
|---|---|
| [Normal] | Normal (threshold is not reached) |
| [Over] | Excess (threshold is reached) |
| [N/A] | Blocked or 99% of the write endurance limit is reached. |
| [---] | Threshold cannot be obtained. |

# Setting the FMD Battery Life Threshold

To set the FMD battery life threshold:

1. 1.Click **Settings > Drive Settings > FMD Battery Life**. The FMD Battery Life window appears, with the current battery life status displayed.
2. Click **Change Threshold**. The Change Threshold window appears.
3. Specify an Alert Level Threshold, and then click **OK**.
4. When the result window appears, click **Close**.

**Table 5-19: FMD battery threshold**

| Endurance status | Description |
|---|---|
| [Normal] | Normal (threshold is not reached) |
| [Over] | Excess (threshold is reached) |
| [N/A] | 100% of the life limit is reached. |
| [---] | Threshold cannot be obtained. |

# Increasing storage system security on a LAN

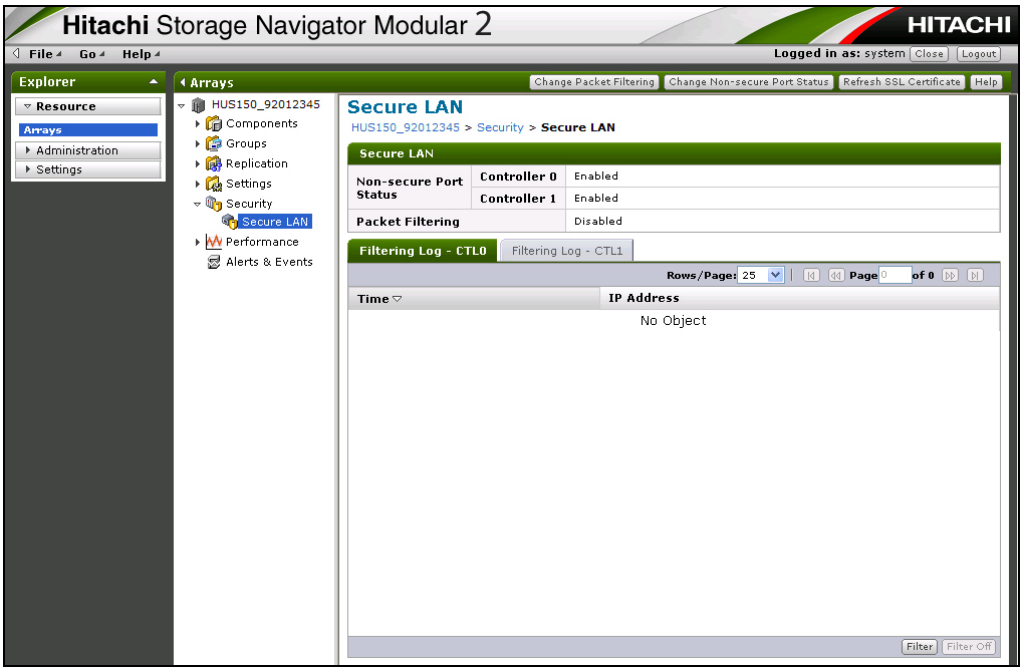
There are two ways to increase security when using the storage system in ar LAN environment.

- Set the normal port status, described below
- Set packet filtering, described on the next page

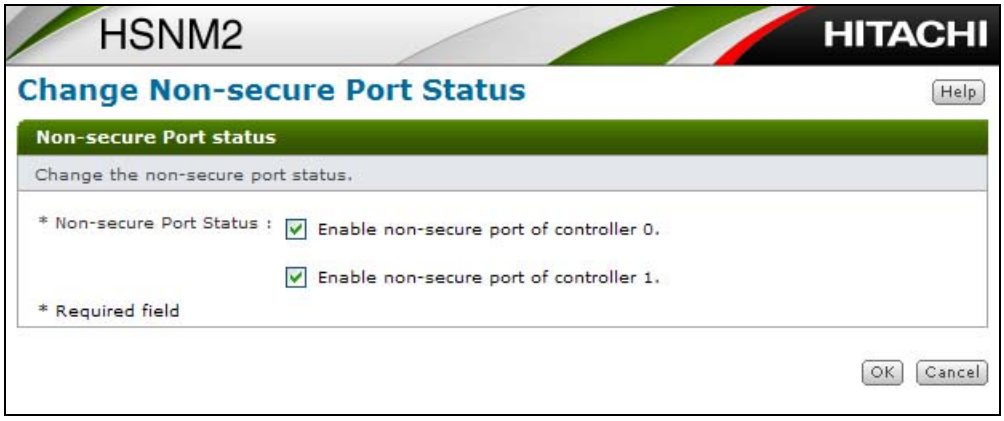
## Setting the normal port status

Hitachi Storage Navigator Modular 2 can communicate with the storage system using the system's normal port and secure port. To increase security, you can connect Hitachi Storage Navigator Modular 2 to the storage system's secure port and disable the normal port.

1. Click **Edit Array** in the Array window and select **Secure Port** from **Using Ports**.
2. Connect to the array from the secure port, and then click **Security > Secure LAN**. The Secure LAN window appears. If the normal port status is **Enabled**, click the **Change Non-secure Port Status**.




3. Disable the normal port and click **OK**.




## Changing the packet filtering

Packet filtering controls the access to the LAN on which the storage system is installed. If illegal access is detected, the storage system blocks the IP address from gaining access to the storage system.

**NOTE:** Since the IP address is blocked, a legitimate server or application using the same IP address will be blocked by the storage system.

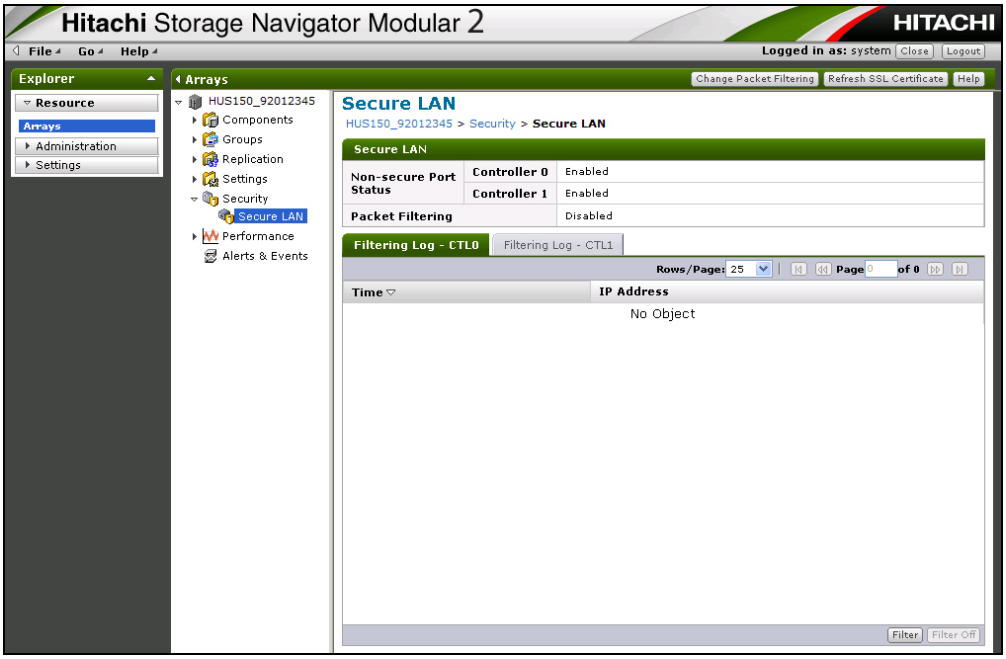
The term “illegal access” refers to:

- Access from outside to unreleased LAN port number
- Receiving huge traffic from outside to the released port number

Packet filtering works with IPv4 addresses. If packet filtering is enabled and you use netstat command with enabling NetBIOS over TCP/IP on Windows environment, access to the packet filtering feature blocks access to the storage system, Disable NetBIOS over TCP/IP or specify the **-n** option to execute the netstat command.

To change packet filtering:

1. Connect to the storage system, and then click **Security > Secure LAN**. The Secure LAN window appears.
2. If **Packet Filtering** is **Disabled**, click **Change Packet Filtering**.




3. Enable **Packet Filtering** and click **OK**.

## Setting the system date and time

Hitachi Unified Storage systems have a clock that is used to time stamp logs. Using Hitachi Storage Navigator Modular 2, you can configure the clock date and time. You can set the clock manually, or synchronize it with either the time of the server in which Hitachi Storage Navigator Modular 2 is installed or up to two NTP servers.

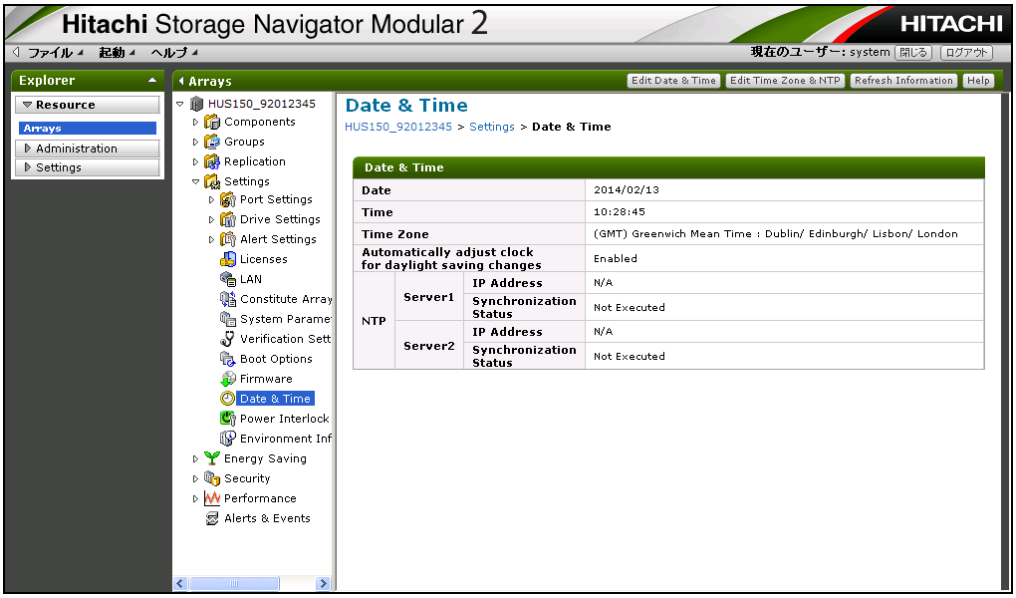
To synchronize with an NTP server, the array's management port must communicate with the NTP server. In this configuration, the array receives Coordinated Universal Time (UTC) information from the NTP server, and calculates time differences and daylight saving time settings for the location in which the system is installed.

Due to local time standards in various countries, gaps may occur between the system time and the actual time in a particular location, even when the array is synchronized to an NTP server. If this occurs, use the Edit Date and Time in as needed. When you perform Edit Date and Time, release the NTP server setting in Hitachi Storage Navigator Modular 2 to adjust the time.

**NOTE:** If you do not synchronize with an NTP server, adjustments to daylight saving time must be performed manually.

## Viewing array system date and time

To view the array's system date and time, click **Settings > Date & Time**. A Date & Time window similar to the following appears.



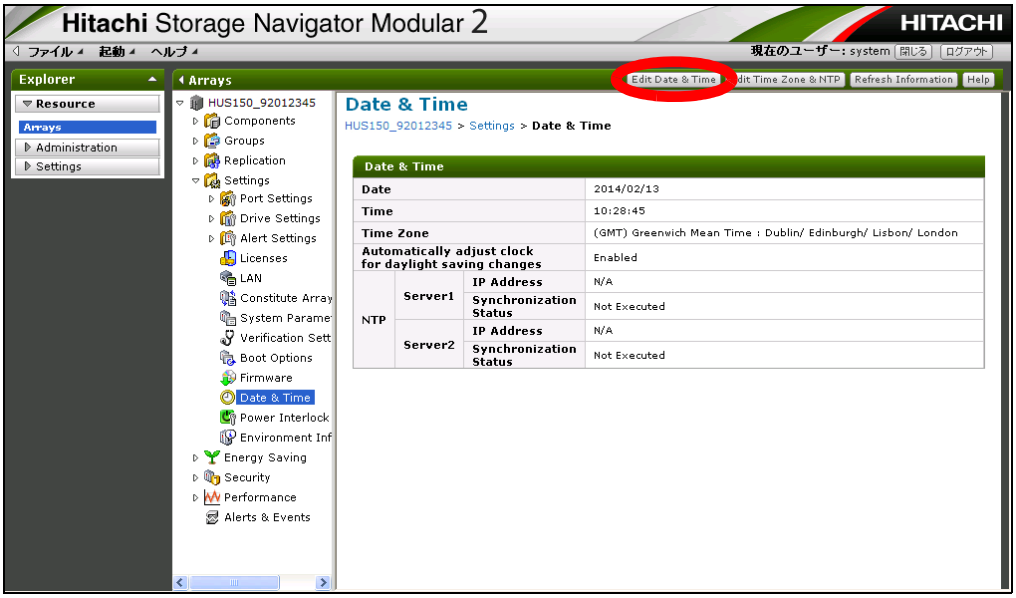

The following table describes the fields in the Date & Time window.

| Field | Description |
|---|---|
| Date | Shows the date of the array clock. |
| Time | Shows the time of the array clock. |
| Time Zone | Shows the time zone set in the array. |
| Automatically adjust clock for daylight saving changes | Shows whether the clock adjusts to daylight savings time automatically. |
| NTP | Shows information about NTP server 1 and NTP server 2. |
| IP Address | Shows the IP address registered for the NTP server. If the IP address is not registered, **N/A** is displayed. |
| Synchronization Status | Shows whether synchronization status with an NTP server succeeded or failed. If the array is not communicating with an NTP server, **Not Executed** is displayed. If the synchronization status fails, check whether the IP address of the NTP server is specified properly and whether there is a valid connection to the NTP server. |

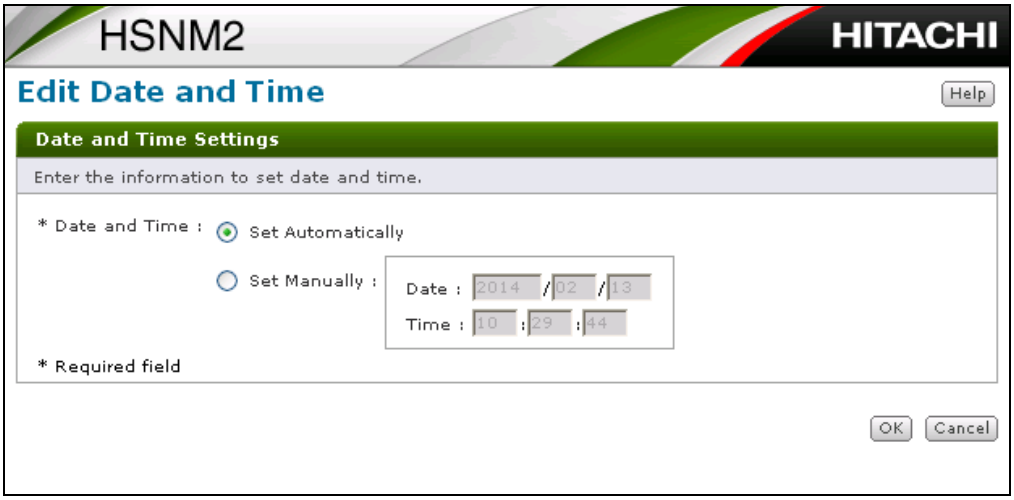
## Setting the array date and time

To set the array date and time:

1. Click **Settings > Date & Time** to display the Date & Time window.
2. Click **Edit Date & Time** in the Date & Time window.




The Edit Date & Time window appears.




3. Set the date and time of the array clock.
   - To set the array time to the time of the server on which Hitachi Storage Navigator 2 is installed, click **Set Automatically**.
   - To enter the date and time manually, click **Set Manually**, and then enter the date and time values in the appropriate fields. (The date and time shown in the fields reflects the date and time when the Edit Date & Time window was displayed.)
4. Click **OK**.

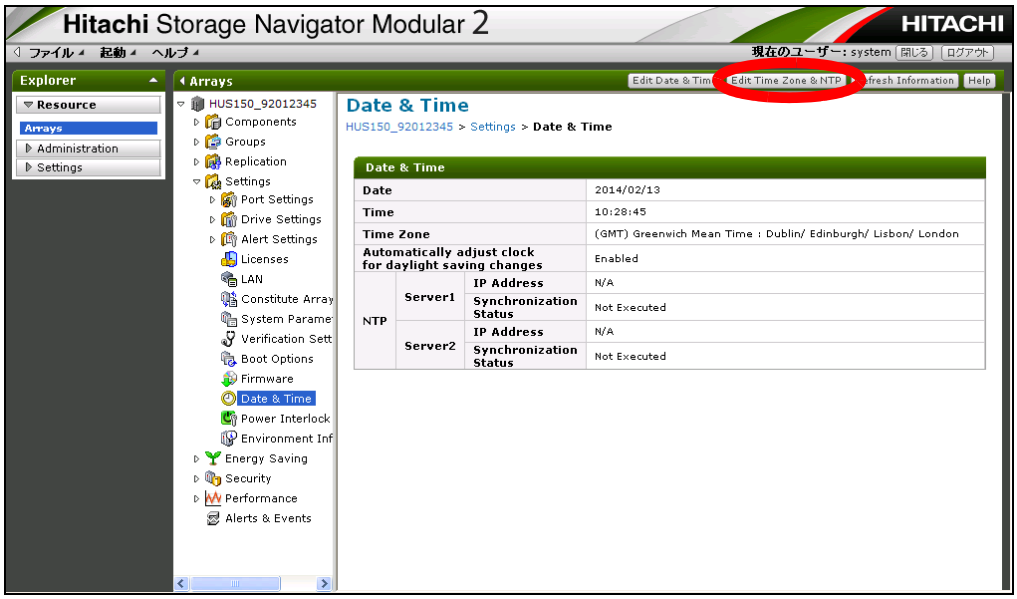
# Setting the array time zone and NTP settings

The following procedure describes how to set the array time zone and NTP settings. When the array clock is configured for use with an NTP server, it synchronizes time with the server under the following conditions:

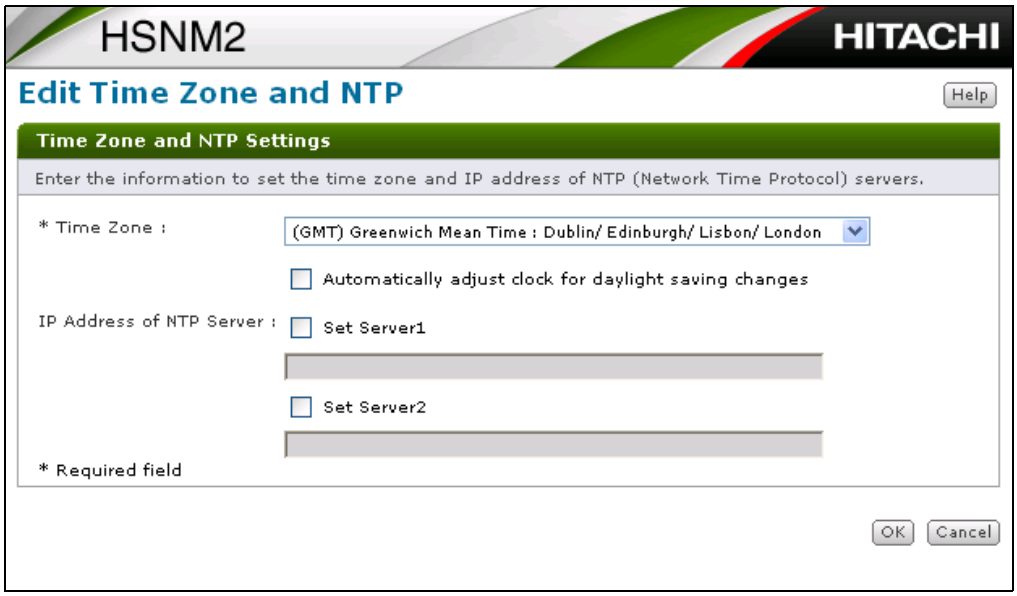
- When you specify or edit the IP address of NTP server in the Date & Time window.
- When you start the array.
- Every 24 hours after initially starting the array.

To set the array time zone and NTP settings:

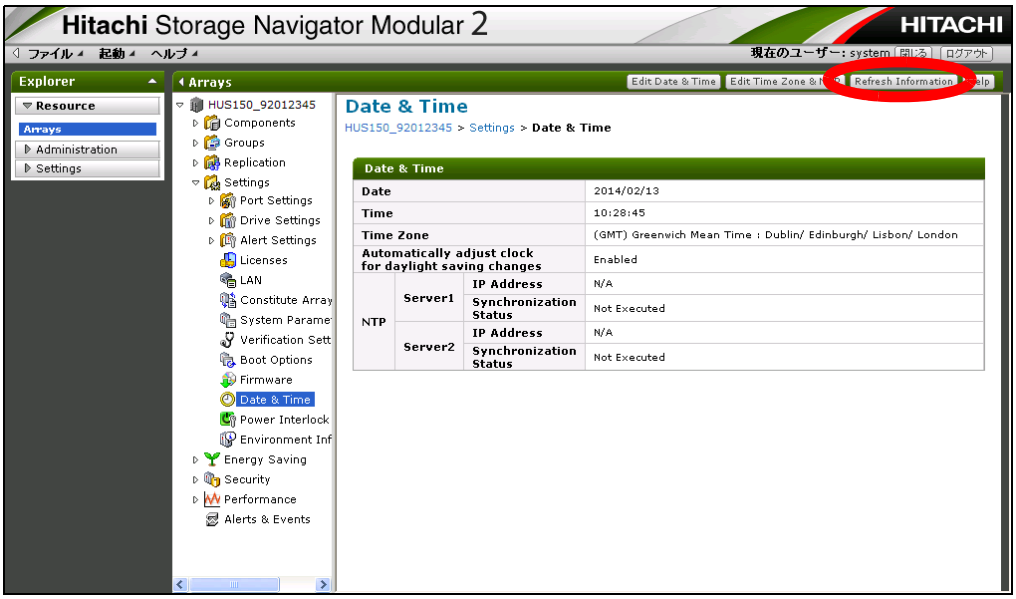
1. Click **Settings > Date & Time** to display the Date & Time window.
2. Click **Edit Time Zone & NTP in the Date & Time** window.




The Edit Time Zone and NTP window appears.



3. Set the time zone manually or synchronize with an NTP server.
   - To set the time zone manually, select a time zone from the **Time Zone** drop-down list. If appropriate, check the check box to adjust the array clock for daylight saving time.
   - To use an NTP server, check the **Set Server** check box and then enter the IP address of the NTP server. You can register up to two NTP servers. The array management port must be able to communicate with the NTP servers. Once a day, the array queries server 1 and adjusts the array clock. If the array cannot communicate with server 1, it queries server 2 and adjusts the array clock.
4. Click **OK**.
5. If you synchronized the time with an NTP server, click **Refresh Information** in the Date & Time window to confirm that the date and time shown are synchronized with the server. If synchronization with an NTP server results in a failure, check that the IP address of the NTP server is correct. If it is, check for network connection problems between the array and the NTP server.



# 6

# Fibre Channel host configuration

After you install and configure your Hitachi Unified Storage system, the next step is to prepare it for use with supported host servers and operating systems.

This chapter describes how to prepare Hitachi Unified Storage systems with Fibre Channel ports for use with Fibre Channel environments. For a list of supported operating systems and servers, see Items for storage system management on page 4-6 and the interoperability matrix at http://www.hds.com/products/interoperability/.

The following topics are covered in this chapter:

- Assumptions and requirements
- Fibre Channel guidelines
- Fibre Channel Option on the Hitachi Unified Storage 110
- Microsoft Windows Server 2012, Microsoft Windows Server 2008, and Microsoft Windows Server 2003
- VMware
- Solaris
- Red Hat Enterprise Linux
- SuSE Linux
- HP-UX
- AIX
- Citrix XenServer

# Assumptions and requirements

The host configuration procedures in this chapter assume that the requirements in Table 6-1 have been met.

**Table 6-1: Host configuration requirements**

| Requirement | See |
|---|---|
| All Hitachi Unified Storage system hardware and cables are connected. | Chapter 4, Installing the storage system. |
| Turn on your Hitachi Unified Storage system and confirm it is behaving properly. | Connecting power cables and powering on on page 4-31 |
| Select the appropriate Platform and Middleware settings. | Selecting Platform and Middleware settings on page 5-25 |
| Install the latest firmware available for the Hitachi Unified Storage system. | Appendix B, Upgrading firmware |
| Perform the required Fibre Channel configuration activities. | Routine Fibre Channel activities on page 5-72 and the Hitachi Storage Navigator Modular 2 online help |
| Configure other appropriate settings for your Hitachi Unified Storage system. | Chapter 5, Configuring the storage system |
| Install the host bus adapter (HBA) in your server. | The documentation for your HBA |
| Turn on your server and networks devices and confirm they are behaving properly. | The documentation for your server and network devices |
| Load the latest drivers and patches for your operating system and the devices on your storage network. | The documentation for your operating system and network devices |
| Cable all HBAs and network devices on your storage network. | The documentation for your network devices |
| Install and configure any clustering and multipathing software for your operating system. | The documentation for your clustering and multipathing software applications |

# Fibre Channel guidelines

The following sections describe general guidelines when connecting Fibre Channel hosts to your Hitachi Unified Storage system.

## Configurations with multiple hosts

If multiple hosts will be accessing the same Fibre Channel port on the Hitachi Unified Storage system:

- Use LUN Manager to add VOLs for each host. As part of this procedure, specify the host's Worldwide Name (WWN), define the volume mapping for each host group, and identify an input/output path between the host and volume. For more information, refer to the *Hitachi Unified Storage Operations Guide*.
- Use Storage Navigator Modular 2 to select the appropriate Platform and Middle settings. See Selecting platform-specific settings on page 5-23.

Multiple hosts connected to the same Hitachi Unified Storage system and which use VOLs within the same RAID group read from and write to the same drive. This competition for resources, which is shown in Figure 6-1, can reduce performance.

To prevent resources from being impacted, configure hosts to use different RAID groups (Figure 6-2 on page 6-4). The number of RAID groups that can be created depends on the number of drives installed and the RAID level of the RAID groups to be created.

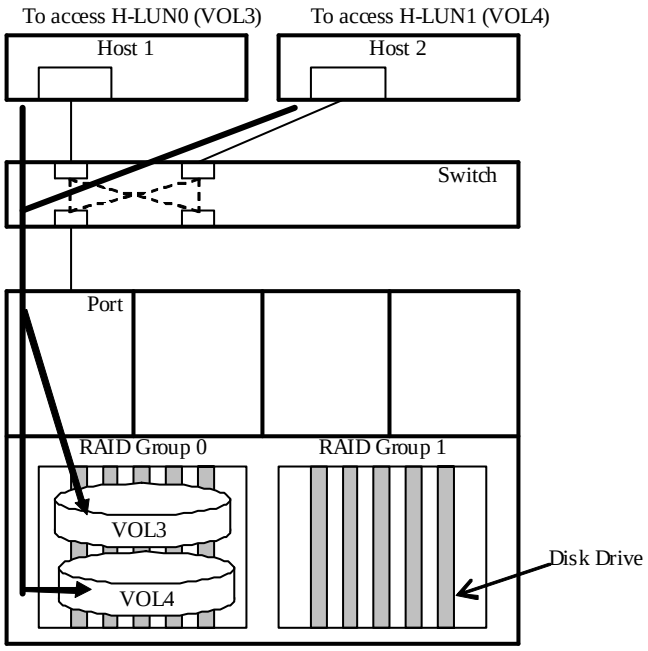



**Figure 6-1: Example of hosts using the same RAID group**

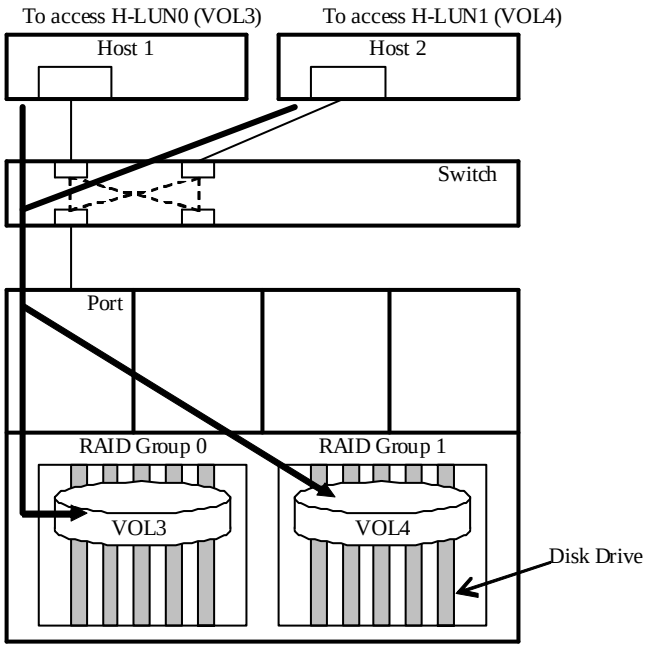



**Figure 6-2: Example of hosts using different RAID groups**

## Fault-tolerant topologies

The ability for the entire SAN environment to sustain and recover from a failure is an essential design goal. To maintain a constant connection between a host and its storage, Hitachi Unified Storage systems support multipathing.

Multipathing is a technique that lets you use more than one physical path to transfer data between the host and storage system. If any element on the storage-area network (SAN) fails, such as an adapter, switch, or cable, the Hitachi Unified Storage system can dynamically switch to another physical path that does not use the failed component. This process of path switching to avoid failed components is known as path failover.

In addition to path failover, multipathing provides load balancing. Load balancing is the process of distributing I/O loads across multiple physical paths. Load balancing reduces or removes potential bottlenecks.

**NOTE:** If you upgrade the Hitachi Unified Storage system firmware in a multipathing environment during periods of high I/O activity, the I/O may time out.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. Depending on the host types and multipath software, spin up may occur automatically from power saving status when a path health check or Read access occurs when recovering from a path failure.

## Zoning

Hosts on a storage network can be grouped into zones. When a SAN is configured in this way, the hosts outside a zone are not visible to hosts inside the zone. In addition, the SAN traffic within each zone is isolated from the other zones.

Within a complex SAN environment, SAN switches provide zoning. This zoning defines and configures the necessary security and access rights for the entire SAN.

Zoning defines which servers can access which volumes to prevent device-sharing conflicts among the servers. Typically, zones are created for each group of servers that access a shared group of storage volumes. There are multiple ways in which zones may be used.

Here are some examples:

- **Zoning by operating system**. If the SAN is being accessed by heterogeneous servers running operating systems such as Windows, VMware, Solaris, or Red Hat Linux, the servers may be grouped by operating system, and SAN zones may be defined for each group of servers. This prevents access of these volumes by other groups or by other classes of servers.
- **Backups**. Zones can also be used to allow common server access for backups. SAN designs often have a servers for backup and recovery processes. These backup servers must be able to access the servers they back up. A SAN zone can be configured for the backup server to access a particular host to perform a backup or recovery process when the backup server is ready to perform backup or recovery processes on that host.
- **Security**. Zoning also provides security. Zones defined for testing can be managed independently within the SAN and do not interfere with the activity going on in the production zones.
- **Multiple Storage Systems**. Zones are also useful when there are multiple storage systems. Through the use of separate zones, each storage system can be managed separately from the others, with no concern for access conflicts between servers.

## Confirming host settings

As the last step before configuring hosts:

- Check that all host, device, and Hitachi Unified Storage system cables are connected properly.
- Confirm that the appropriate LEDs on all devices between the host and Hitachi Unified Storage system are showing normal and linked-up operation.
- If connecting the Hitachi Unified Storage system directly to a HBA, be sure the port address is set correctly and the topology in Storage Navigator Modular 2 is set to Loop. See Selecting platform-specific settings on page 5-23.

- If connecting the Hitachi Unified Storage system to a Fibre Channel switch, be sure the topology in Storage Navigator Modular 2 is set to Point to Point. See Selecting platform-specific settings on page 5-23.
- Check all settings related to the input/output path between the host and volumes. Check that the host WWN, which permits access to host groups when using LUN Manager, and volume mapping are set appropriately.

# Fibre Channel Option on the Hitachi Unified Storage 110

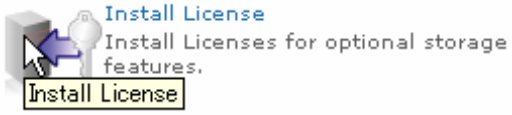
Hitachi Unified Storage 110 systems equipped with the Fibre Channel Option require a license to be installed to enable the Fibre Channel ports. To enable the Fibre Channel ports:

- The Hitachi Unified Storage 110 must be running firmware version 0915/A or later.
- You must use Storage Navigator Modular 2 version 21.50 or later to install the Fibre Channel Option license.
- You must have the key code or key file for enabling the Fibre Channel Option.

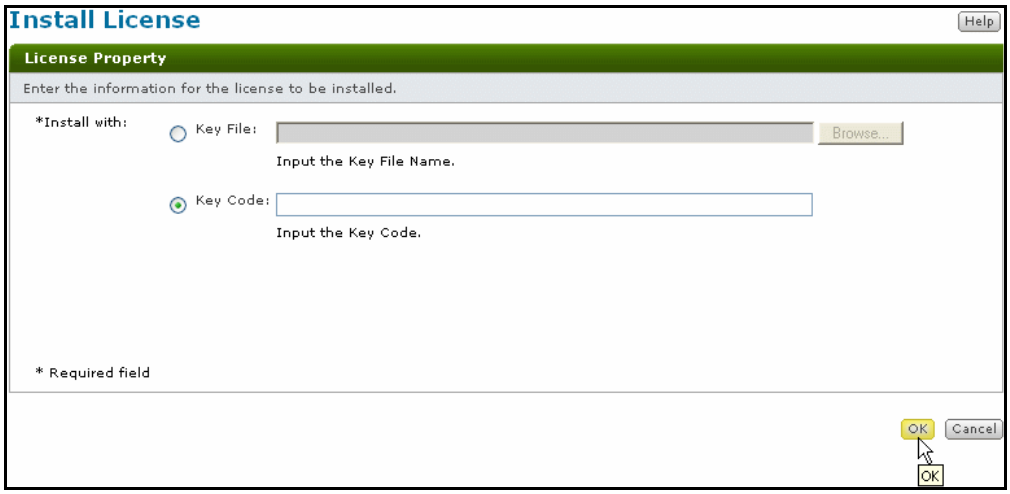
## Installing the Fibre Channel Option

The following procedure describes how to use Storage Navigator Modular 2 to install the Fibre Channel Option on Hitachi Unified Storage 110 systems. You can also install the Fibre Channel Option using a command-line interface; for more information, refer to the *Hitachi Unified Storage Command Line Interface Reference Guide*.

1. Be sure the Hitachi Unified Storage 110 system is operating normally and that there is no condition (such as a failure) that can prevent the installation of the Fibre Channel Option license.
2. Start and log in to Storage Navigator Modular 2 as a registered user.
3. Click the Hitachi Unified Storage 110 system on which you want to install the Fibre Channel Option license.
4. Click **Show & Configure Array**.
5. Click the **Install License** icon in the **Common Array Task**:




The Install License screen appears.

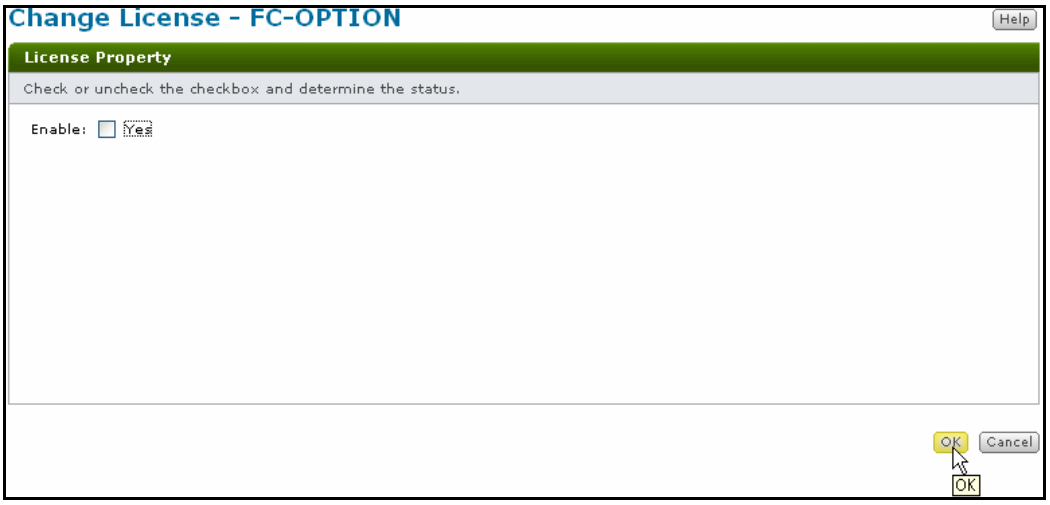



6. Perform one of the following steps:
   - To install the option from a key code, click **Key Code** and enter the supplied key code.
   - To install the option using the key file, click **Key File**. Then either enter the path where the key file resides, or click the **Browse** button to go to the location where the key file resides and double-click the key file.
7. Click **OK**. A message asks you whether you are sure you want to install the license.
8. Click **Confirm**. A message informs you that the license was installed successfully.
9. Click **Close** to close the message.

## Enabling or disabling the Fibre Channel Option

After installing the Fibre Channel Option, use the following procedure to enable it. The following procedure also describes how to disable the Fibre Channel Option if it is enabled.

1. Start and log in to Storage Navigator Modular 2 as a registered user.
2. Click the Hitachi Unified Storage 110 on which you want to enable the Fibre Channel Option.
3. Click **Show & Configure Array**.
4. Click the **Licenses** icon in the **Settings** tree view.
5. Click the **FC-OPTION** in the **Licenses** list.
6. Click **Change Status**. The Change License screen appears.

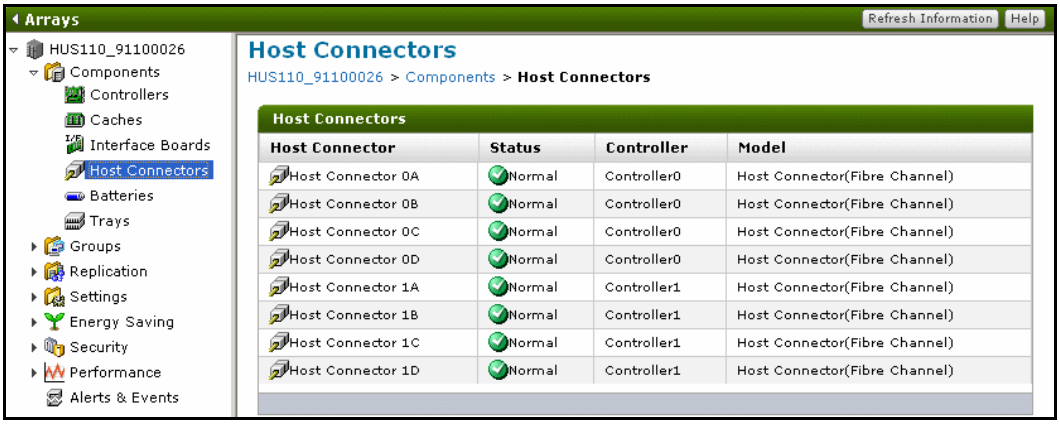



7. Perform one of the following steps:
   - To enable the Fibre Channel Option, check **Yes**.
   - To disable the Fibre Channel Option, uncheck **Yes**.
8. Click **OK**. A confirmation message appears.
9. Click **Confirm**. A message informs you that the change was successful.
10. Click **Close** to close the message.

## Confirming the installation

To confirm the Host Connectors status:

1. Start and log in to Storage Navigator Modular 2 as a registered user.
2. Click the Hitachi Unified Storage 110 system on which you want to confirm the Fibre Channel Option.
3. Click **Show & Configure Array**.
4. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Components > Host Connectors**.

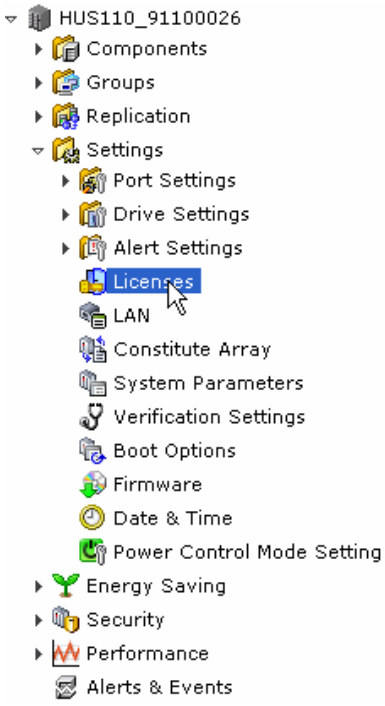



5. Confirm the **Status** of the **Host Connectors**.

## Uninstalling the Fibre Channel Option

If you need to uninstall the Fibre Channel Option, use the following procedure. You can also uninstall the Fibre Channel Option using a command-line interface; for more information, refer to the *Hitachi Unified Storage Command Line Interface Reference Guide*.

1. Start and log in to Storage Navigator Modular 2.
2. Click the Hitachi Unified Storage 110 system on which you want to uninstall the Fibre Channel Option.
3. Click **Show & Configure Array**.
4. In the **Arrays** pane in the middle of the Storage Navigator Modular 2 screen, click **Settings > Licenses**. The Licenses list appears.




5. Click **De-install License**. The De-Install License screen appears.

6. Perform one of the following steps:
   - To uninstall the option from a key code, click **Key Code** and enter the supplied key code.
   - To uninstall the option using the key file, click **Key File**. Then either enter the path where the key file resides, or click the **Browse** button to go to the location where the key file resides and double-click the key file.
7. Click **OK**. A message asks you whether you are sure you want to uninstall the license.
8. Click **Confirm**. A message informs you that the license was uninstalled successfully.
9. Click **Close** to close the message.

# Microsoft Windows Server 2012

This section describes how to attach hosts running the Microsoft Windows Server 2012 operating system to the Hitachi Unified Storage system over a Fibre Channel connection.

Before proceeding, observe the following best practices:

- Obtain the latest vendor versions, related patches, and MPIO multipathing software (if appropriate) for the operating system: www.microsoft.com
- Obtain the latest Microsoft Windows 2012 drivers and related patches for the HBAs and other devices on your storage network.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use Microsoft Windows Server 2012 with multi-path software (Hitachi Dynamic Link Manager), Read access at path health check may cause automatic spin up from the power saving state.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a volume at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of volumes available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

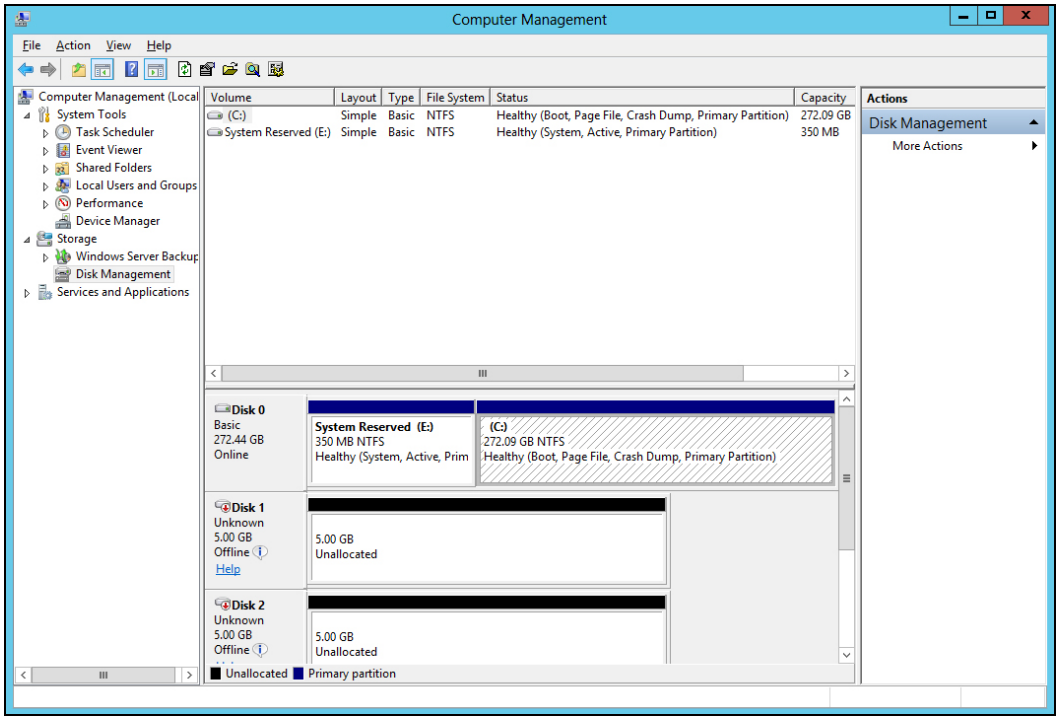
To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

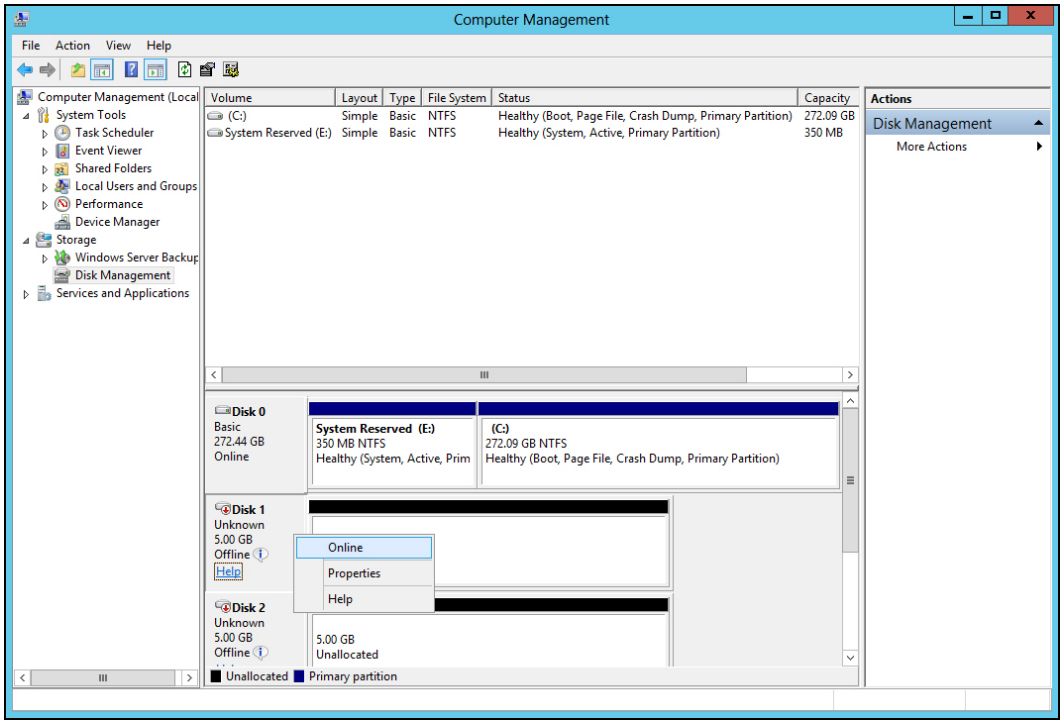
## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host.

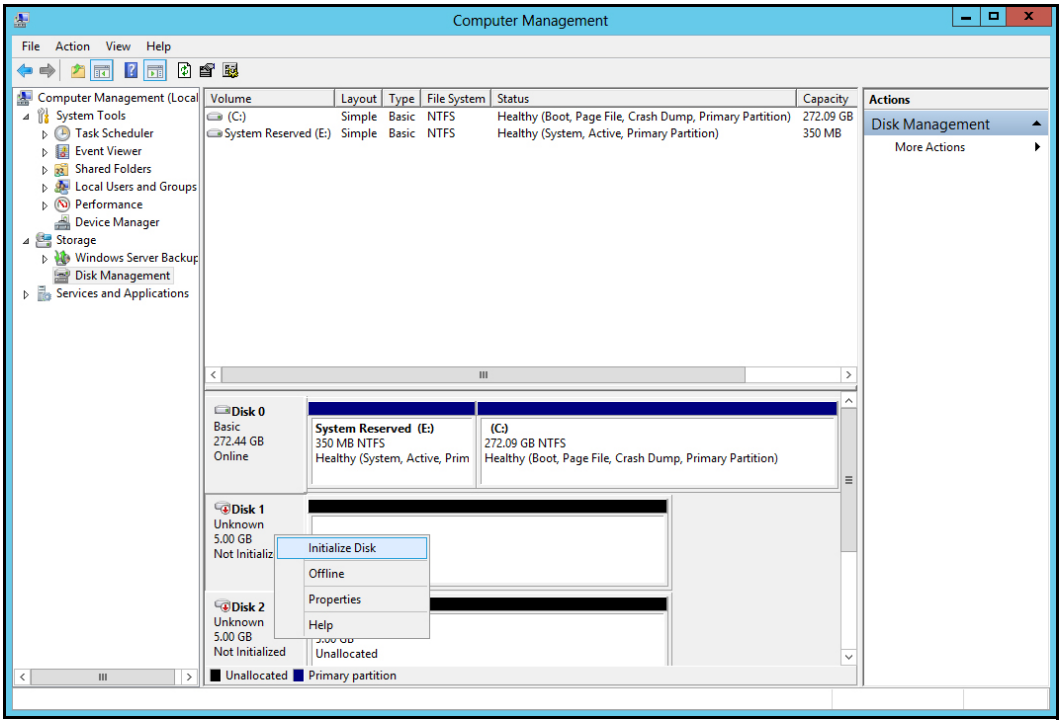
1. Shut down the server, turn off server power, and turn off power to all peripheral devices.
2. Connect the Hitachi Unified Storage system to the server using Fibre Channel cables.
3. Turn on the Hitachi Unified Storage system and check that the **READY** LED is ON.
4. Turn on all peripheral devices. Then turn on the server and log in as Administrator.
5. Click **Start > Control Panel > Management Tool > Computer Management**.
6. Click **Computer Management (Local) > Storage Area > Disk Management**.



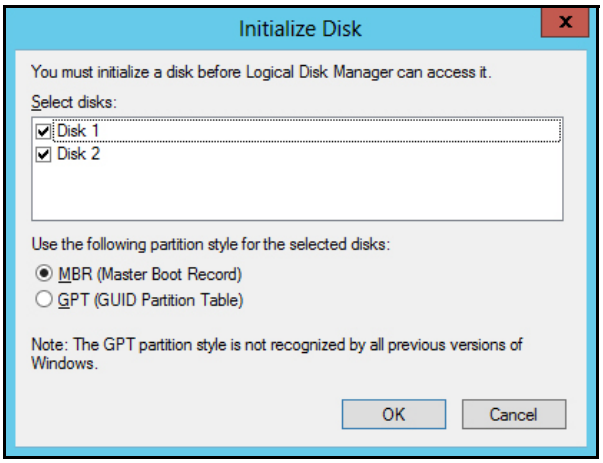

7. Select a target disk and click **Online**.



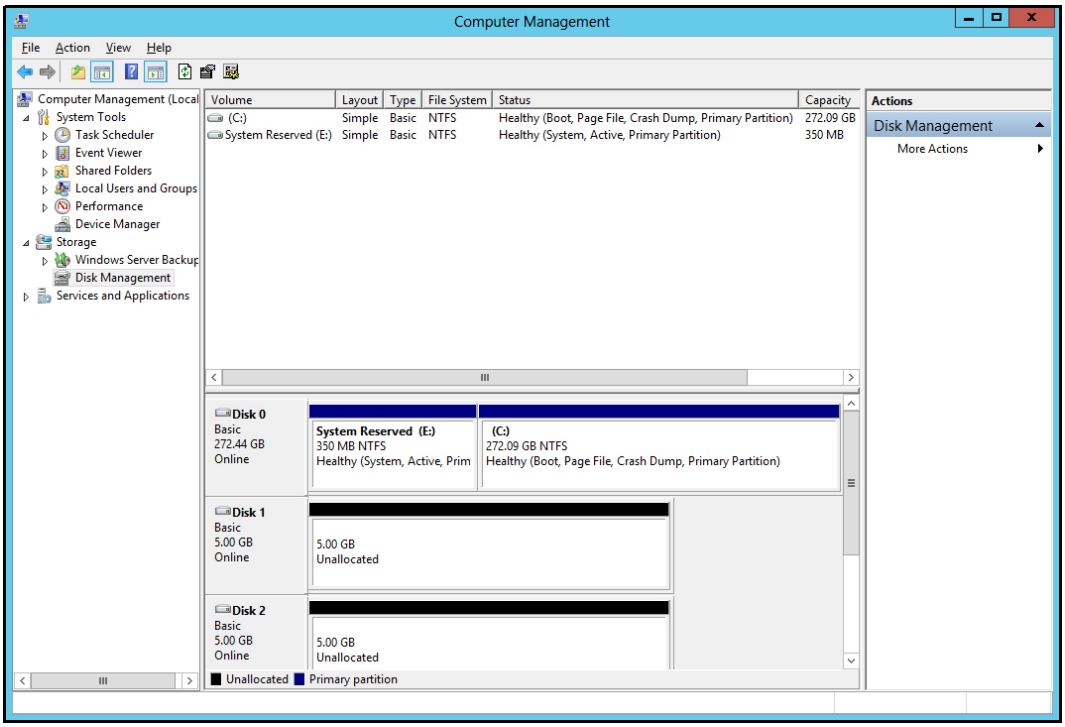

8. Select a disk to initialize and click **Initialize Disk**.




9. Check the check box of the disk to be initialized and click **OK**.




10. Check that this is the Hitachi Unified Storage system by checking the number of volumes and the capacity.




## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system devices are ON.
- Be sure the Fibre Channel cables are installed properly and firmly connected.
- Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

# Microsoft Windows Server 2008

This section describes how to attach hosts running the Microsoft Windows Server 2008 operating system to the Hitachi Unified Storage system over a Fibre Channel connection.

Before proceeding, observe the following best practices:

- Obtain the latest vendor versions, related patches, and MPIO multipathing software (if appropriate) for the operating system: www.microsoft.com
- Obtain the latest Microsoft Windows 2008 drivers and related patches for the HBAs and other devices on your storage network.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use Microsoft Windows Server 2008 with multi-path software (Hitachi Dynamic Link Manager), Read access at path health check may cause automatic spin up from the power saving state.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a volume at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of volumes available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host.

1. Shut down the server, turn off server power, and turn off power to all peripheral devices.
2. Connect the Hitachi Unified Storage system to the server using Fibre Channel cables.
3. Turn on the Hitachi Unified Storage system and check that the **READY** LED is ON.
4. Turn on all peripheral devices. Then turn on the server and log in.
5. Click **Start > Control Panel > Management Tool > Computer Management**.
6. Click **Computer Management (Local) > Storage Area > Disk Management**.
7. Click **Next**.
8. Select a disk to initialize and click **Next**.
9. Check the check box of the disk to be initialized and click **Next**.
10. Click **Complete**.
11. Check that the storage system shown is the Hitachi Unified Storage system based on the number of volumes and capacity displayed.

## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system devices are ON.
- Be sure the Fibre Channel cables are installed properly and firmly connected.
- Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

# Microsoft Windows Server 2003

This section describes how to attach hosts running the Microsoft Windows Server 2003 operating system to the Hitachi Unified Storage system over a Fibre Channel connection.

Before proceeding, observe the following best practices:

- Obtain the latest vendor versions, related patches, and MPIO multipathing software (if appropriate) for the operating system: www.microsoft.com
- Obtain the latest Microsoft Windows 2003 drivers and related patches for the HBAs and other devices on your storage network.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use Microsoft Windows Server 2003 with multi-path software (Hitachi Dynamic Link Manager), Read access at path health check may cause automatic spin up from the power saving state.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

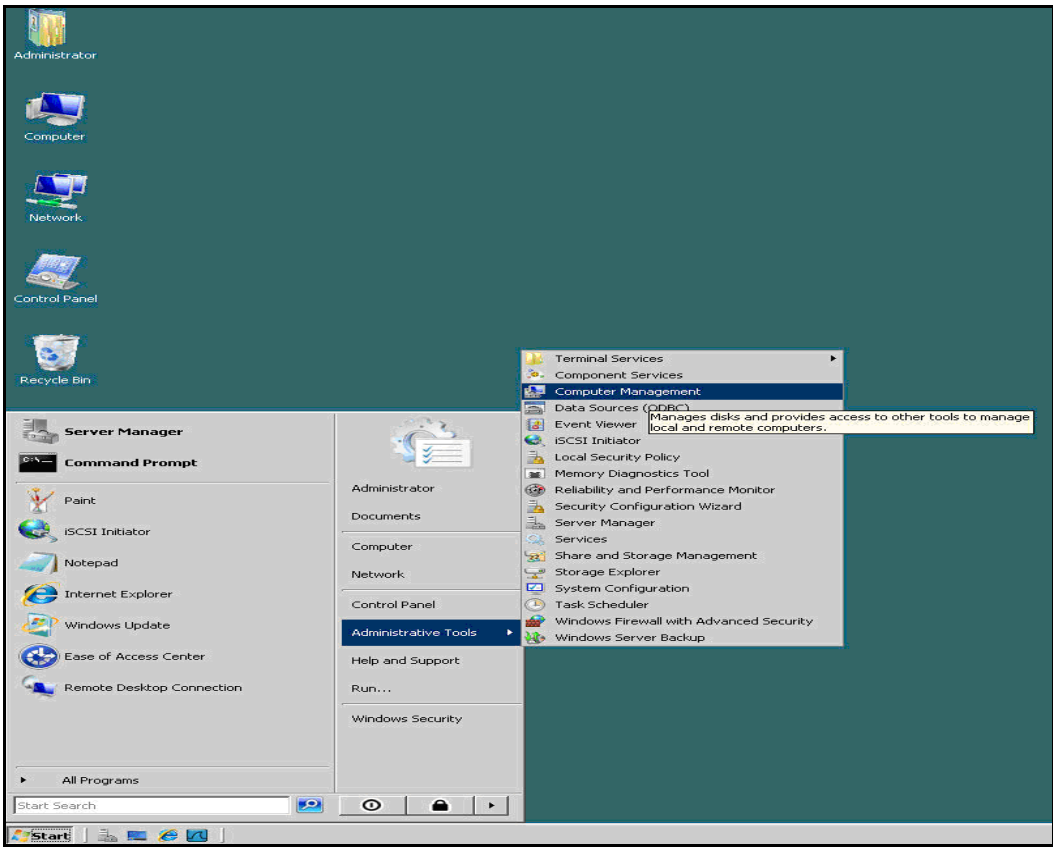
To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

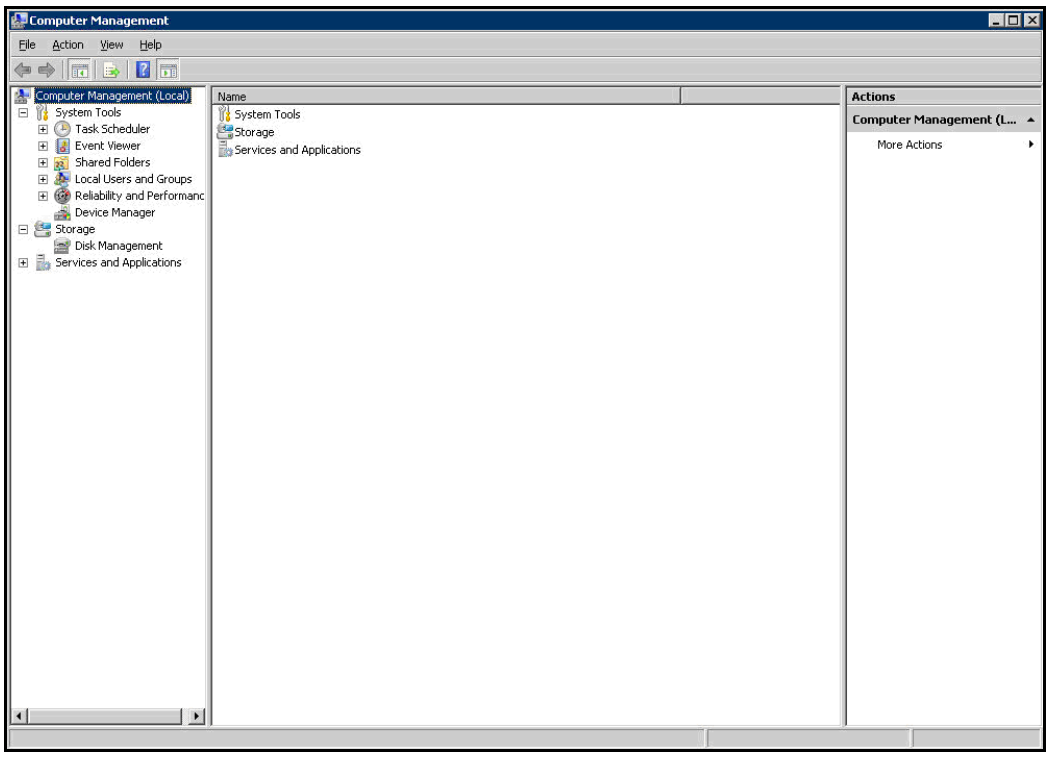
## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host.

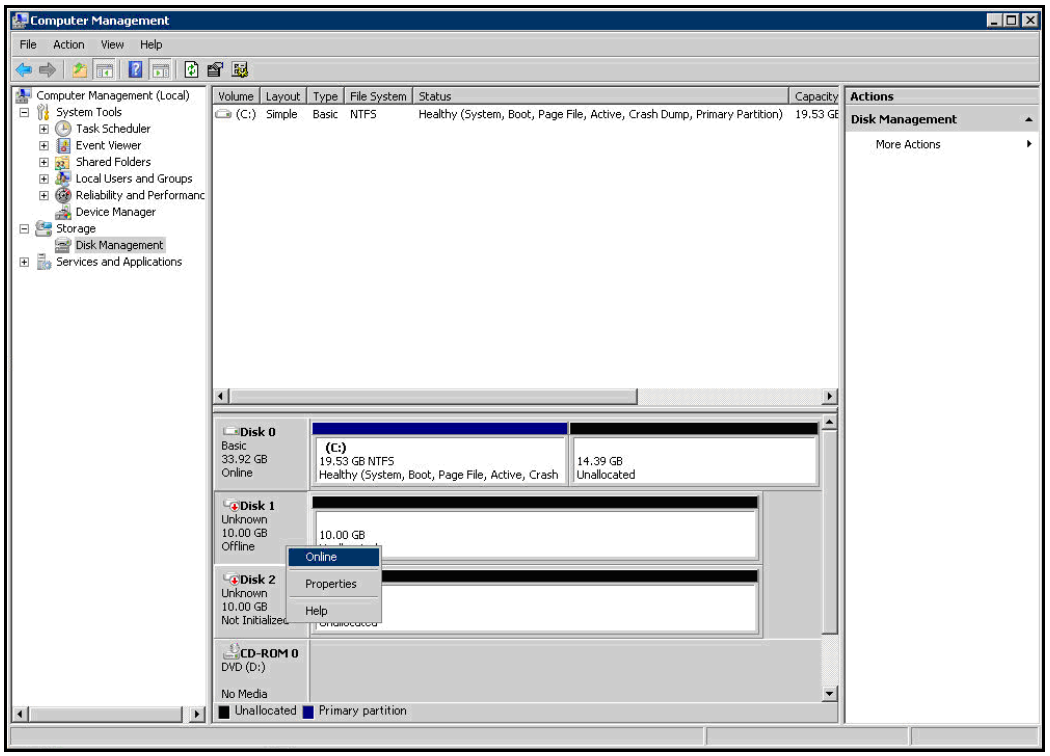
1. Shut down the server, turn off server power, and turn off power to all peripheral devices.
2. Connect the Hitachi Unified Storage system to the server using Fibre Channel cables.
3. Turn on the Hitachi Unified Storage system and check that the **READY** LED is ON.
4. Turn on power to all peripheral devices. Then turn on the server and log in.
5. Click **Start > Control Panel > Administrative Tools > Computer Management**.



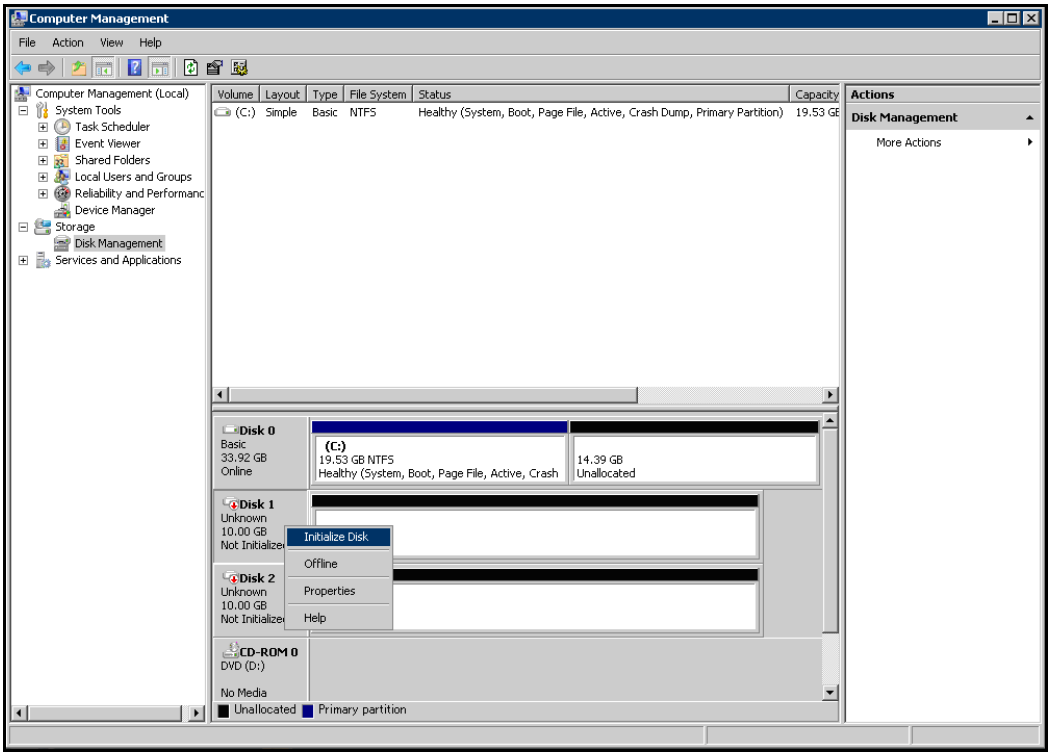
6. Click **Computer Management (Local) > Storage Area > Disk Management**.



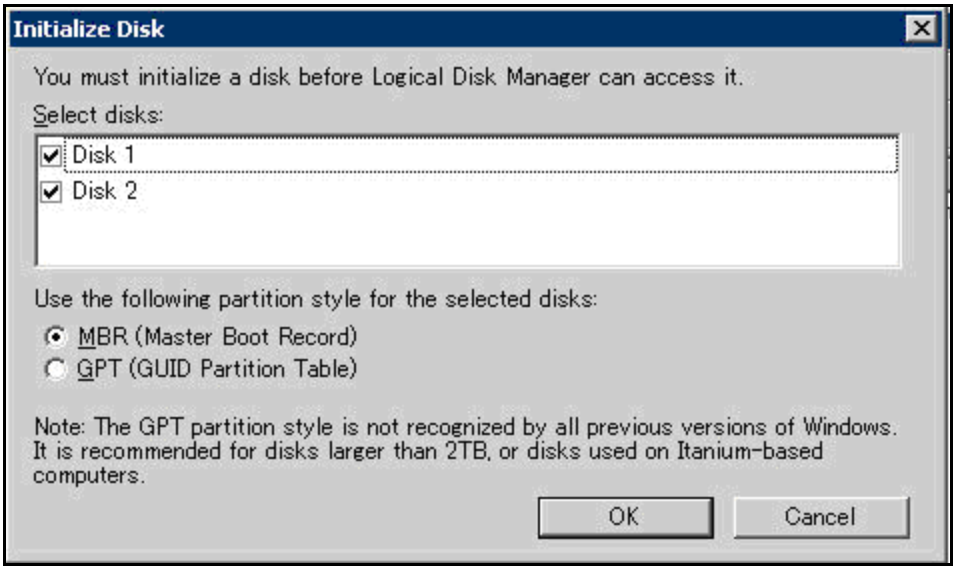

7. Select the targeted disk drive and click **Online (O)**.



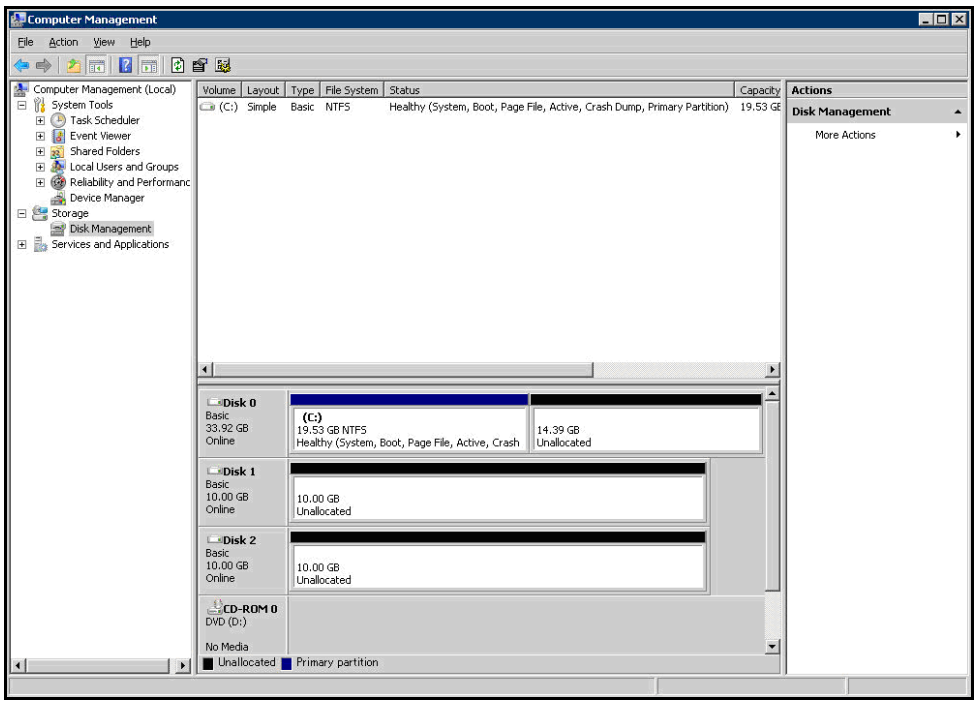
8. Select a disk to initialize and click **Initialize Disk**.




9. Check the check box of the disk to be initialized and click **OK**.



10. Check that the storage system shown is the Hitachi Unified Storage system based on the number of volumes and capacity displayed.




## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system devices are ON.
- Be sure the Fibre Channel cables are installed properly and firmly connected.
- Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

# VMware

This section describes how to attach hosts running VMware to the Hitachi Unified Storage system over a Fibre Channel connection.

Before proceeding, observe the following best practices:

- Obtain the latest vendor versions, related patches, and Fibre Channel drivers for the operating system: www.vmware.com.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.
- Read access operates periodically when a VMware host recognizes volumes, even if there is no host I/O initiated by the user. If the power saving status is changed, it immediately spins up. Therefore, in VMware, the I/O interlock power saving setting for the RAID group using the Power Saving Plus function and the Hitachi Unified Storage power savings configured in Hitachi Unified Storage power savings function are disabled.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

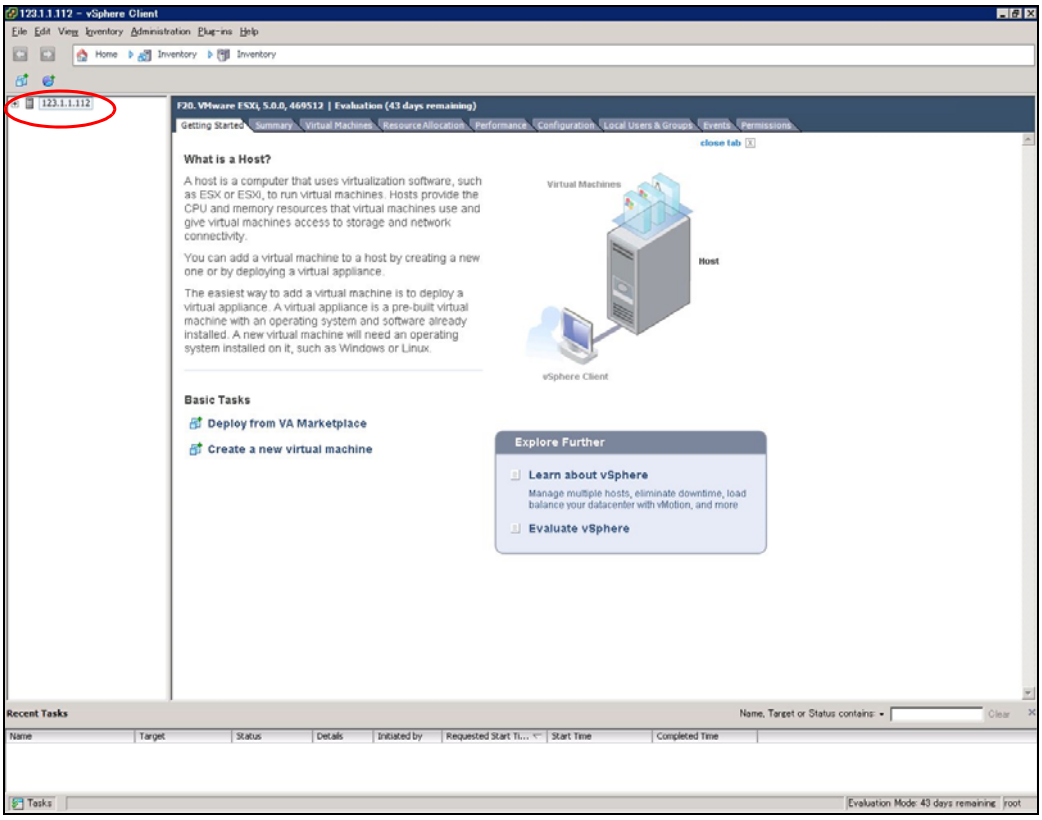
To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

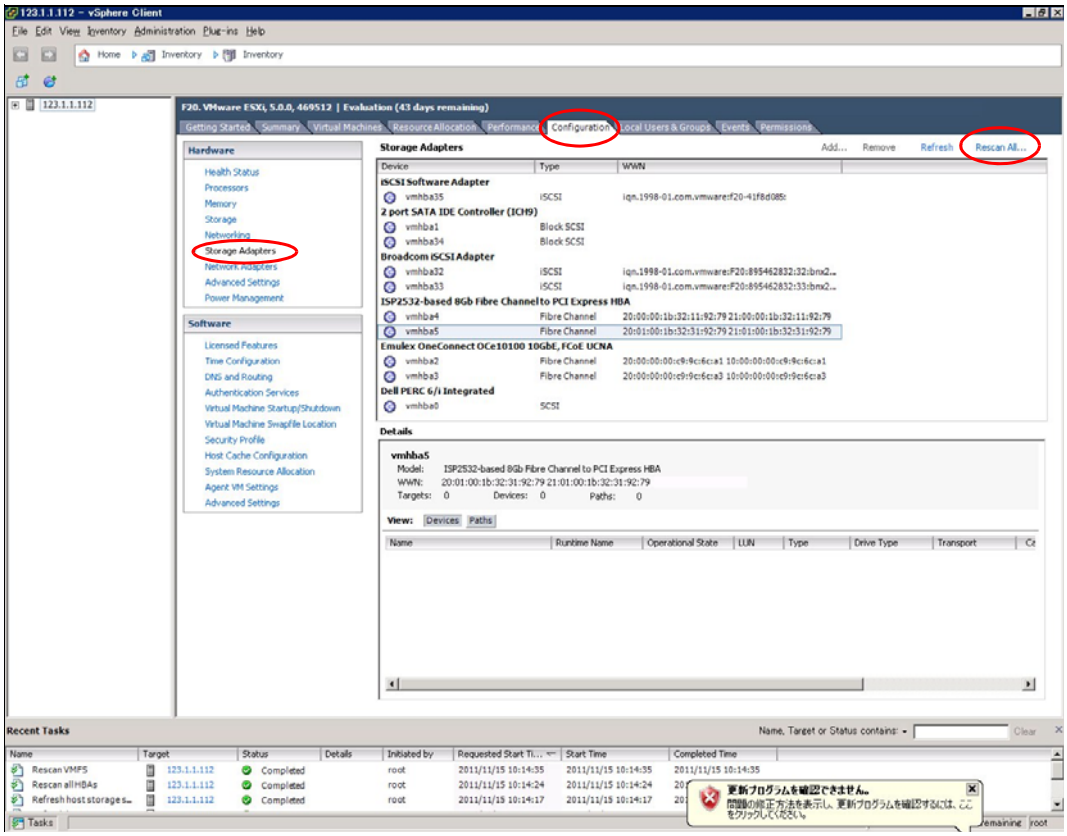
## Verifying and discovering VOLs

The following example describes how to verify and discover VOLs using VMware vSphere ESX 5.0. You must rescan to have VMware vSphere ESX detect the VOL.

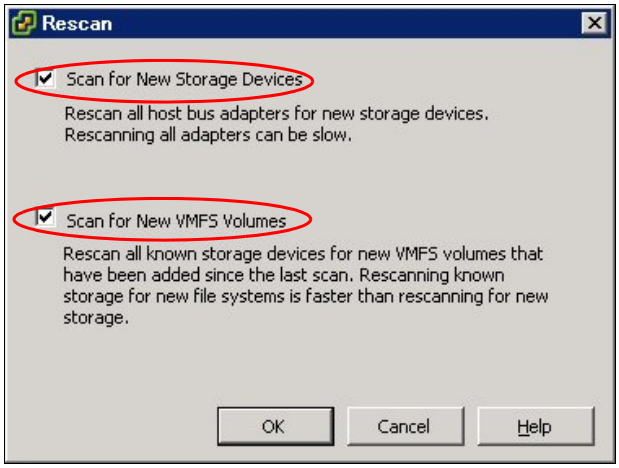
1. Log on the vSphere client and select a server. The hardware configuration page of the server appears.



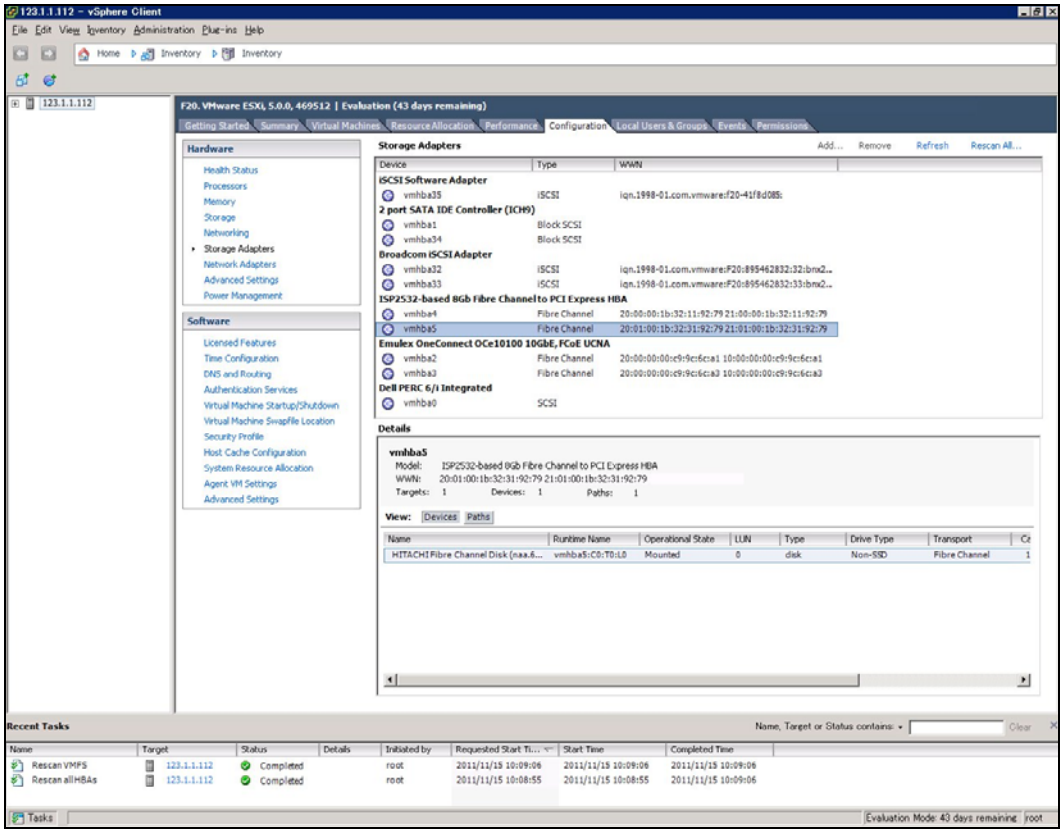

2. Click the **Configuration** tab and click **Storage Adapters**.
3. Click **Rescan All**.




4. Confirm that both checkboxes are checked, and then click **OK**.




5. When a new VOL is detected, it appears on the disk/VOL list.




**NOTE:** The RAID group I/O interlock power saving setting in Power Saving Plus does not work in VMware.

## Cooperative computing

Hitachi Unified Storage systems work with the VMware vStorage API to enhance performance when performing copy and backup operations in a VMware virtual environment.

Figure 6-3 shows how data is copied when the cooperative function is used or not used. Without the function, data is read to VMware and then written to the Hitachi Unified Storage. Using the function copies data inside the Hitachi Unified Storage, without going through VMware; as a result, copy and backup performance, along with resource efficiencies, are increased for both the Hitachi Unified Storage and VMware.

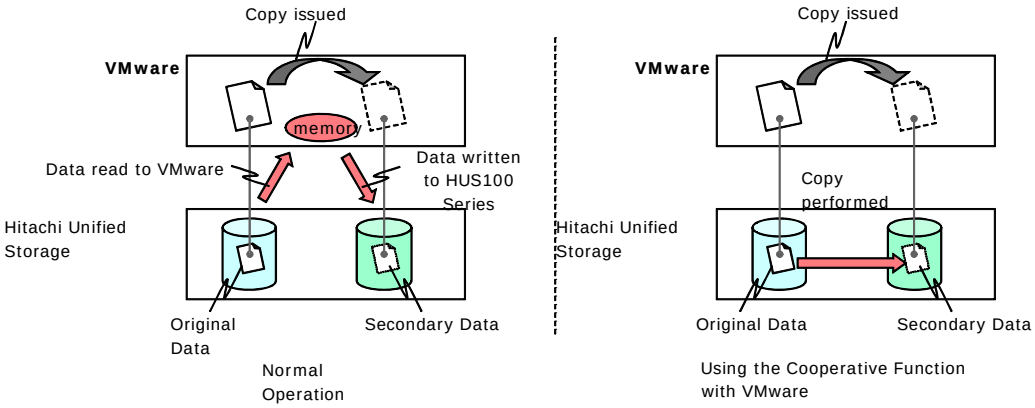



**Figure 6-3: VMware cooperative computing**

To use the function, enable the following host connection parameters. These parameters are enabled automatically if you select VMware as your platform (see Selecting platform-specific settings on page 5-23):

- Unique Extended COPY Mode
- Unique Write Same Mode

Advantages of cooperative computing cannot be achieved under the following conditions and causes VMware to revert to normal operations:

- If the Hitachi Unified Storage system has a battery failure.
- If the Hitachi Unified Storage system has a problem between the disk drives and cache memory.
- The number of data that is unable to be written to disk drives because of some failures exceeds the threshold value.
- When a certain system parameter is set and a problem with related components occurs.
- When the Battery Charging Write Command system parameter is set to Write Through and the Battery capacity is insufficient.
- When the forced write through mode system parameter is valid, and the controller gets blocked or a power unit failure occurs.
- When the Write Unique Response Mode system parameter is enabled.

If the ownership of source and destination volumes differs when the cooperative function is operating, target volume ownership changes to that of the source volume, regardless of the load balancing setting. To avoid ownership changes, set DataMover.HardwareAcceleratedMove to 0 in ESX.

When the cooperative function with VMware is operating, the vmkernel.logmay may contain entries that the 0xfe commands failed. Because the 0xfe command is an internal VMware command, such failures do not impact storage system operations. Below are examples of the 0xfe command failure in the vmkernel.log.

```
2012-11-20T14:22:52.801Z cpu0:2052)ScsiDeviceIO: 2309: Cmd(0x41240077ad40) 0xfe,
CmdSN 0x171e5 from world 249512 to dev "naa.60060e8010311a60057d55d60000002c" failed
H:0x0 D:0x2 P:0x5
Possible sense data: 0x2 0x3a 0x1
```

When using the linkage function, setting the array's host group option setting is required.

The VMware linkage function offloads operations from VMware ESX and puts them on the storage system. Execute the clone operation and others that the VMware linkage function operates in the low-load status, as the processor use rate of the array is approximately 30%. When the array has a high-load, if the VMware linkage function is used, the storage system operates in high-load status, which can affect the performance of other host I/Os. If the VMware linkage function affects the performance, stop the VMware linkage function or change the tuning parameter setting. When stopping the VMware linkage function, specify 0 for DataMover.HardwareAcceleraterdMove.

VMware ESX has a Space Reclamation function that releases the Thin Provisioning area that is no longer used in the datastore. Storage system CPU utilization becomes high when a large amount of Thin Provisioning area is released by the Space Reclamation function. Processing time associated with the Space Reclamation function are lengthy and can affect guest OS or VMware ESX operation in configurations where the number of data drives in the target volume is small or copy pairs are created. Considering the impact to performance, we recommend you use the Space Reclamation function when storage system CPU utilization is as low as 30%.

If a copy operation initiated by the XCOPY command times-out, the array returns Medium Error (03) to the VMware host. The VMware host the receiving Medium Error (03) may determine the volume to be inaccessible and stop accessing it. In such cases, enabling the Change Response for Replication Mode makes the array return an Aborted Command (0B) to the VMware host. When the VMware host receives Aborted Command (0B), it retries the XCOPY command and the operation continues.

## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system devices are ON.
- Be sure the Fibre Channel cables are installed properly and firmly connected.
- Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

If a VOL of 2 TB or more in the Hitachi Unified Storage system cannot be recognized by the ESX Server 3.5, create a VOL smaller than 2 TB.

# Solaris

This section describes how to attach hosts running the Solaris operating system to the Hitachi Unified Storage system over a Fibre Channel connection.

Before proceeding, observe the following best practices:

- Obtain the latest vendor versions and related patches for the operating system: www.oracle.com.
- Obtain the latest Solaris drivers and related patches for the HBAs and other devices on your storage network.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use Solaris with multi-path software (Veritas Dynamic Multipathing, Veritas Volume Manager), Read access at path health check may cause automatic spin up from the power saving state.

## Completing the system and host connection

After connecting the Hitachi Unified Storage system to the host system, perform the following procedure before rebooting the host.

1. Edit `/etc/system` to show the appropriate timeout and the maximum throttle value.
2. Edit `/kernel/drv/sd.conf` to have the VOL recognized.
3. Configure the host Fibre Channel adapter.
4. Ensure that the Hitachi Unified Storage system is powered on and the Fibre Channel port are configured. Then turn on power to all peripheral devices.

**NOTE:** If the storage system Fibre Channel port is configured after turning on the host system, restart the system to recognize the new device.

5. Confirm that the **READY** LEDs on the Hitachi Unified Storage system devices are ON.
6. Turn on the host system.
7. Log in the Hitachi Unified Storage system from Solaris.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

The Hitachi Unified Storage system reports the Queue Full status when it receives a command with Queue Depth exceeding an allowable limit. A Queue Full condition can occur if there is a large number of VOLs to use and a big value is set for multiplicity. Therefore, set the appropriate value for your environment, especially when adding drives.

To connect to the Hitachi Unified Storage system, edit the `/etc/system` file as shown below and set the command multiplex number.

```
# cp-ipr/etc/systemr/etc/system.standard ↵
# vir/etc/system ↵
# sync ↵
# sync ↵
# sync ↵
# reboot ↵
```

```
# cpr-ipr/etc/systemr/etc/system.standard ↵  <-- Create a backup file.
#
# vir/etc/system ↵
:
setsd:sd_max_throttle = 16'MM      <--Add the command multiplex number to the last row.

:wq!  ↵                            <-- Save the edit and terminate it.
#
# sync ↵
# sync ↵
# sync ↵
#
# reboot ↵                          <-- Restart the server.
```

**Figure 6-4: Example of setting the command number in Solaris (Oracle/Sun-authorized HBA)**

```
# cpr-ipr/etc/systemr/etc/system.standard ↵  <-- Create a backup file.
#
# vir/etc/system ↵
:
setssd:ssd_max_throttle = 16       <-- Add the command multiplex number to the last row.

:wq! ↵                               <-- Save the edit and terminate it.
#
# sync ↵
# sync ↵
# sync ↵
#
# reboot ↵                             <-- Restart the server.
```

**Figure 6-5: Example of setting the command number in Solaris (Sun-authorized HBA)**

**NOTE:** The default value of the command multiplex number is set to 256 per volume.

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host.

1. Shut down the server.
2. Turn off the server and turn off all peripheral devices.
3. Connect the Hitachi Unified Storage system to the server using Fibre Channel cables.
4. Turn on the Hitachi Unified Storage system and check that it is Ready.
5. Turn on all peripheral devices. Then turn on the server after checking that it is Ready.
6. Log in as super user (`root`).
7. Check that Hitachi storage system is recognized.

   `# cfgadm -la ↵`

```
# cfgadm -la
c18                      fc-private   connected    configured   unknown?Topology connection
c18::50060e80100005a1    disk         connected    configured   unknown?WWW connection
c19                      fc-fabric    connected    configured   unknown
c19::50060e80100005a9    disk         connected    configured   unknown
```

**Figure 6-6: Recognizing the Hitachi Unified Storage system in Solaris**

## Partitioning and labeling the new devices on a SPARC system

After Solaris recognizes the new devices, use the `format` command to set the partitions and labels to all new devices. The following procedures describe how to partition and label the new devices using a SPARC system.

If you will not be changing partition settings when labeling the new devices:

1. Issue the `format` command from the `root` prompt (see Figure 6-7).
   - Check all the new devices. If there is no new device, terminate the command with `quit` or ctl-d.)
   - The character device name (for example, clt2d0) is assigned to the new device. This information is necessary for creating the file system and using it as the RAW device.
2. Select the devices to attach the labels from the list of the new devices, and enter the numbers of the devices.
3. Type **y** to indicate Yes for attaching the labels of the disks.

```
# format                                                  <-- Start format Utility.
AVAILABLE DISK SELECTIONS:

c1t1d0 <SUN36G cyl 24620 alt 2 hd 27 sec 107>
   /pci@1c,600000/scsi@2/sd@1,0
c4t0d0 <HITACHI-DF600F-0000 cyl 52 alt 2 hd 50 sec 768>   <-- Not yet labeled.
   /pci@1e,600000/SUNW,qlc@2/fp@0,0/ssd@w50060e8010200497,0

Specify disk (enter its number):   <-- Select disk
Disk not labeled.  Label it now?   <-- Select "y"
```

**Figure 6-7: Recognizing new devices for disk partitioning**

If you will be changing partition settings when labeling the new devices:

1. Issue the `format` command from the `root` prompt (see Figure 6-8 on page 6-32).
   - Check all the new devices. If there is no new device, terminate the command with `quit` or ctl-d.
   - The character device name (for example, clt2d0) is assigned to the new device. This information is necessary for creating the file system and using it as the RAW device.
2. Select the devices to attach the partitions and labels from the list of the new devices, and enter the numbers of the devices.
3. Type **n** to indicate No for not attaching the labels. Type **n** to indicate No so that no labels attached at this time.
4. Type `partition` from the format menu.
5. Perform the following steps on the partition of the selected device:
   - Enter the partition number and partition parameter according to Figure 6-9 on page 6-33.
   - Type `print` to display the current partition table by the prompt of the partition.
6. For the selected device, type `label` after setting the partition and enter `y` to attach the label to the device (see Figure 6-10 on page 6-34).
7. Type `quit` to exit the partition tool and return to the format command.

8. At the *Format* > prompt, type `disk` to display the enabled disk. The original disk type name and parameter are displayed.
9. Repeat steps 1 through 8 for the new device to which the partition and label are attached. After defining the disk type, you can define the device label of the same size without reentering the parameter.
10. When you finish partitioning and labeling, check the label and terminate the format command with `quit` or Ctrl-d.

```
# format                                                    <-- Start format Utility.
AVAILABLE DISK SELECTIONS:

c1t1d0 <SUN36G cyl 24620 alt 2 hd 27 sec 107>
   /pci@1c,600000/scsi@2/sd@1,0
c4t0d0 <HITACHI-DF600F-0000 cyl 52 alt 2 hd 50 sec 768>   <-- Not yet labeled.
   /pci@1e,600000/SUNW,qlc@2/fp@0,0/ssd@w50060e8010200497,0

Specify disk (enter its number):     <-- Select disk
Disk not labeled.  Label it now? n   <-- Select "n".
```

**Figure 6-8: Recognizing new devices for disk partitioning**

```
FORMAT MENU:
        disk      - select a disk
        type      - select (define) a disk type
        partition - select (define) a partition table
        current   - describe the current disk
        format    - format and analyze the disk
        repair    - repair a defective sector
        label     - write label to the disk
        analyze   - surface analysis
        defect    - defect list management
        backup    - search for backup labels
        verify    - read and display labels
        save      - save new disk/partition definitions
        inquiry   - show vendor, product and revision
        volname   - set 8-character volume name
        <cmd>     - execute <cmd>, then return
        quit
format> partition                    <-- Display partition menu

PARTITION MENU
       0      - change '0' partition
       1      - change '1' partition
       2      - change '2' partition
       3      - change '3' partition
       4      - change '4' partition
       5      - change '5' partition
       6      - change '6' partition
       7      - change '7' partition
       select - select a predefined table
       modify - modify a predefined partition table
       name   - name the current table
       print  - display the current table
       label  - write partition map and label to the disk
       quit
partition> 0                                          <-- Select partition number.
Part      Tag     Flag      Cylinders     Size       Blocks
  0       root    wm         0 -  1       37.50MB    (2/0/0)    76800

Enter partition id tag [root]:                         <-- Return by default value
Enter partition permission flags [wm]:                 <-- Return by default value
Enter new starting cyl [0]:                            <-- Return by default value
Enter partition size [76800b, 2c, 1e, 37.50mb, 0.04gb]: 51c <-- Enter size
partition> print                                       <-- Display partition table
:
Current partition table (unnamed):
Total disk cylinders available: 52 + 2 (reserved cylinders)

Part      Tag    Flag     Cylinders      Size            Blocks
  0       root    wm       0 - 50      956.25MB    (51/0/0) 1958400
  1       swap    wu       2 -  5       75.00MB    (4/0/0)   153600
  2     backup    wu       0 - 51      975.00MB    (52/0/0) 1996800
  3 unassigned    wm       0             0         (0/0/0)        0
  4 unassigned    wm       0             0         (0/0/0)        0
  5 unassigned    wm       0             0         (0/0/0)        0
  6        usr    wm       6 - 51      862.50MB    (46/0/0) 1766400
  7 unassigned    wm       0             0         (0/0/0)        0
```

**Figure 6-9: Setting partitions**

```
PARTITION MENU
       0      - change '0' partition
       1      - change '1' partition
       2      - change '2' partition
       3      - change '3' partition
       4      - change '4' partition
       5      - change '5' partition
       6      - change '6' partition
       7      - change '7' partition
       select - select a predefined table
       modify - modify a predefined partition table
       name   - name the current table
       print  - display the current table
       label  - write partition map and label to the disk
       quit
partition> label                                          <-- Label the disk
Ready to label disk, continue? Y                          <-- Select "y"
  * (see Note, below)
partition> quit                                           <-- Return to format menu.
format> disk                                              <-- Select the disk

AVAILABLE DISK SELECTIONS
       0. c1t1d0 <SUN36G cyl 24620 alt 2 hd 27 sec 107>
          /pci@1c,600000/scsi@2/sd@1,0
       1. c4t0d0 <HITACHI DF600F cyl 52 alt 2 hd 50 sec 768>
>        Ð Verify disk label.
          /pci@1e,600000/SUNW,qlc@2/fp@0,0/ssd@w50060e8010200497,0
       2. c4t0d1 <HITACHI-DF600F-0000 cyl 107 alt 2 hd 50 sec 768> <-- Not yet labeled.
          /pci@1e,600000/SUNW,qlc@2/fp@0,0/ssd@w50060e8010200497,1
       3. c4t0d2 <HITACHI-DF600F-0000 cyl 161 alt 2 hd 50 sec 768> <-- Not yet labeled.
          /pci@1e,600000/SUNW,qlc@2/fp@0,0/ssd@w50060e8010200497,2
       4. c4t0d3 <HITACHI-DF600F-0000 cyl 216 alt 2 hd 50 sec 768> <-- Not yet labeled.
          /pci@1e,600000/SUNW,qlc@2/fp@0,0/ssd@w50060e8010200497,3
Specify disk (enter its number): 2         <-- Select next disk or press Ctrl-d to quit.
```

**Figure 6-10: Labeling the disk and verifying the disk label**

## Partitioning and labeling the new devices on an x86_64 system

After Solaris recognizes the new devices, use the `format` command to set the partitions and labels to all new devices. The following procedures describe how to partition and label the new devices using an x86_64 system.

1. Issue the `format` command at the `root` prompt.
   - Check all the new devices. If there is no new device, terminate the command with `quit` or ctl-d.
   - The character device name (for example, c7t60060E801040070004F27B3000000008d0) is assigned to the new device (see Figure 6-11 on page 6-35). This information is necessary for creating the file system and using it as the RAW device.
2. Select the devices to attach the partitions and labels from the list of new devices and enter the numbers of the devices.
3. Type `fdisk` from the format menu and create an LU (see Figure 6-12 on page 6-35).
4. Type `partition` from the format menu and set the partition (see Figure 6-13 on page 6-35).
5. Type `modify` from the partition prompt and set the capacity value (see Figure 6-14 on page 6-36).
6. Enable the labeling for the setting (see Figure 6-15 on page 6-36).

```
8. c7t60060E801040070004F27B3000000008d0 <DEFAULT cyl 2557 alt 2 hd 128 sec 32>  <-- Not yet
labeled.
      Devices name of MPxIO                    <-- In the format output on the system, a
disk does not display its product name. (Only Solaris10 is displayed in DEFAULT.)
          /scsi_vhci/disk@g60060e801040070004f27b3000000008    <-- MPxIO is enabled
```

**Figure 6-11: Recognizing new devices for disk partitioning**

```
FORMAT MENU:
        disk        - select a disk
        type        - select (define) a disk type
        partition   - select (define) a partition table
        current     - describe the current disk
        format      - format and analyze the disk
        fdisk       - run the fdisk program
        repair      - repair a defective sector
        label       - write label to the disk
        analyze     - surface analysis
        defect      - defect list management
        backup      - search for backup labels
        verify      - read and display labels
        save        - save new disk/partition definitions
        inquiry     - show vendor, product and revision
        volname     - set 8-character volume name
        !<cmd>      - execute <cmd>, then return
        quit
format> fdisk                                   <-- Enter fdisk.
No fdisk table exists. The default partition for the disk is:

  a 100% "SOLARIS System" partition

Type "y" to accept the default partition,  otherwise type "n" to edit the
 partition table.
y       <-- Select "y".
```

**Figure 6-12: Creating an LU for disk partitioning**

```
format> partition                               <-- Display partition menu
PARTITION MENU:
        0      - change `0' partition
        1      - change `1' partition
        2      - change `2' partition
        3      - change `3' partition
        4      - change `4' partition
        5      - change `5' partition
        6      - change `6' partition
        7      - change `7' partition
        select - select a predefined table
        modify - modify a predefined partition table
        name   - name the current table
        print  - display the current table
        label  - write partition map and label to the disk
        !<cmd> - execute <cmd>, then return
        quit
partition> print                                <-- Display partition table.
Current partition table (original):
Total disk cylinders available: 2556 + 2 (reserved cylinders)

Part      Tag    Flag     Cylinders        Size            Blocks
  0 unassigned    wm       0               0         (0/0/0)           0
  1 unassigned    wm       0               0         (0/0/0)           0
  2     backup    wu       0 - 2555        4.99GB    (2556/0/0) 10469376
  3 unassigned    wm       0               0         (0/0/0)           0
  4 unassigned    wm       0               0         (0/0/0)           0
  5 unassigned    wm       0               0         (0/0/0)           0
  6 unassigned    wm       0               0         (0/0/0)           0
  7 unassigned    wm       0               0         (0/0/0)           0
  8       boot    wu       0 -    0        2.00MB    (1/0/0)        4096
  9 unassigned    wm       0               0         (0/0/0)           0
```

**Figure 6-13: Setting disk partitioning (1 of 2)**

```
partition> modify            <-- Enter Modify.
Select partitioning base:
        0. Current partition table (original)
        1. All Free Hog
Choose base (enter number) [0]? 1       <-- Select 1.
Part      Tag    Flag     Cylinders        Size            Blocks
  0       root    wm       0               0         (0/0/0)           0
  1       swap    wu       0               0         (0/0/0)           0
  2     backup    wu       0 - 2555        4.99GB    (2556/0/0) 10469376
  3 unassigned    wm       0               0         (0/0/0)           0
  4 unassigned    wm       0               0         (0/0/0)           0
  5 unassigned    wm       0               0         (0/0/0)           0
  6        usr    wm       0               0         (0/0/0)           0
  7 unassigned    wm       0               0         (0/0/0)           0
  8       boot    wu       0 -    0        2.00MB    (1/0/0)        4096
  9 alternates    wm       0               0         (0/0/0)           0
Do you wish to continue creating a new partition
table based on above table[yes]?        <-- Return by default value.
Free Hog partition[6]?                  <-- Return by default value.
Enter size of partition '0' [0b, 0c, 0.00mb, 0.00gb]:
Enter size of partition '1' [0b, 0c, 0.00mb, 0.00gb]:
Enter size of partition '3' [0b, 0c, 0.00mb, 0.00gb]:
Enter size of partition '4' [0b, 0c, 0.00mb, 0.00gb]:
Enter size of partition '5' [0b, 0c, 0.00mb, 0.00gb]:
Enter size of partition '7' [0b, 0c, 0.00mb, 0.00gb]:
Part      Tag    Flag     Cylinders        Size            Blocks
  0       root    wm       0               0         (0/0/0)           0
  1       swap    wu       0               0         (0/0/0)           0
  2     backup    wu       0 - 2555        4.99GB    (2556/0/0) 10469376
  3 unassigned    wm       0               0         (0/0/0)           0
  4 unassigned    wm       0               0         (0/0/0)           0
  5 unassigned    wm       0               0         (0/0/0)           0
  6      usr      wm       1 - 2555        4.99GB    (2555/0/0) 10465280  <---Assign all capacity.
  7 unassigned    wm       0               0         (0/0/0)           0
  8       boot    wu       0 -    0        2.00MB    (1/0/0)        4096
  9 alternates    wm       0               0         (0/0/0)           0

Okay to make this the current partition table[yes]?       <-- Return by default.
Enter table name (remember quotes): usr                   <-- Type usr.
```

**Figure 6-14: Setting disk partitioning (2 of 2)**

```
Ready to label disk, continue? y      <-- Select "y"
```

**Figure 6-15: Enabling labeling**

## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system are ON.
- Be sure the Fibre Channel cables are installed properly and firmly connected.
- Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

# Red Hat Enterprise Linux

This section describes how to attach hosts running the Red Hat Enterprise Linux operating system to the Hitachi Unified Storage system over a Fibre Channel connection.

Before proceeding, observe the following best practices:

- Obtain the latest vendor versions, related patches, and Device Mapper multipathing software (if appropriate) for the operating system: www.redhat.com/rhel/
- Obtain the latest Red Hat Enterprise Linux drivers and related patches for the HBAs and other devices on your storage network.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use Red Hat Enterprise Linux with multi-path software (Device Mapper Multipath, Veritas Volume Manager), Read access at path health check may cause automatic spin up from the power saving state.

## Device Mapper multipathing

Your Hitachi Unified Storage system is compatible with Device Mapper, a multipathing software application bundled with Red Hat Enterprise Linux. If the path between a Red Hat Linux host and the Hitachi Unified Storage system fails, Device Mapper reroutes the I/O over other available paths.

For information about installing and configuring Device Mapper, refer to the Device Mapper documentation. Some Device Mapper release level documentation can be obtained from:

http://www.redhat.com/docs/en-US/Red_Hat_Enterprise_Linux/5.4/html/DM_Multipath/queueifnopath_issues.html

To ensure Active/Active I/O activity between the host Linux I/O and the Hitachi Unified Storage system, confirm that the following minimum parameters are set in the file /etc/multipath.conf:

- Vendor: Hitachi
- Product: DF600F
- Path_grouping _policy: Multibus
- prio: const

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

The Hitachi Unified Storage system reports the Queue Full status when it receives a command with Queue Depth exceeding an allowable limit. A Queue Full condition can occur if there is a large number of VOLs to use and a big value is set for multiplicity. Therefore, set the appropriate value for your environment, especially when adding drives.

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host.

1. Shut down the server.
2. Stop all the peripheral devices.
3. Connect the Hitachi Unified Storage system to the server using Fibre Channel cables.
4. Start the Hitachi Unified Storage system and check that it is in the Ready status.
5. Start all the peripheral devices, check that they are in the Ready status, and then start the server.
6. Log in as super user (`root`).
7. Issue the following command to check whether the Hitachi Unified Storage system is recognized:

   ```
   # dmesg ↵
   ```

```
# dmesg ↵ | more.
:
:
scsi1 : ioc1: LSI53C1030, FwRev=01032700h, Ports=1, MaxQ=255, IRQ=209
      Emulex LightPulse Fibre Channel SCSI driver 8.1.10.3
      Copyright(c) 2004-2006 Emulex.  All rights reserved.

scsi : 1 host.
Vendor: HITACHI       Model: DF600F          Rev: 0000
Type:   Direct-Access                 ANSI SCSI revision: 04  --> You will find
sd 0:0:0:0: Attached scsi disk sda          that the Hitachi system is connected.
   scsi ID0/channel 0/ID 0/lun 0    Device file name = /dev/sda

Vendor: HITACHI       Model: DF600F          Rev: 0000
Type:   Direct-Access                 ANSI SCSI revision: 04
sd 0:0:0:1: Attached scsi disk sdb
:
:
```

**Figure 6-16: Recognizing the Hitachi Unified Storage system in Linux**

```
# ls -l /dev | more
:
brw-rw----   1 root    disk    8,  0 Oct  30  2007 sda   ←Device file name =
sda
```

**Figure 6-17: Recognizing the Hitachi Unified Storage system in Linux**

## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system are ON.
- Be sure the Fibre Channel cables are installed properly and firmly connected.
- Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

# SuSE Linux

This section describes how to attach hosts running the SuSE Linux operating system to the Hitachi Unified Storage system over a Fibre Channel connection.

Before proceeding, observe the following best practices:

- Obtain the latest vendor versions, related patches, and Device Mapper multipathing software (if appropriate) for the operating system: www.novell.com
- Obtain the latest SuSE Linux drivers and related patches for the HBAs and other devices on your storage network.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.

## Device Mapper multipathing

Your Hitachi Unified Storage system is compatible with Device Mapper, a multipathing software application bundled with SuSE Linux. If the path between a SuSE Linux host and the Hitachi Unified Storage system fails, Device Mapper reroutes the I/O over other available paths.

For information about installing and configuring Device Mapper, refer to the Device Mapper documentation. Some Device Mapper release level documentation can be obtained from:

http://www.novell.com/products/linuxpackages/desktop10/i386/device-mapper.html

To ensure Active/Active I/O activity by the host Linux I/O to the Hitachi Unified Storage system, confirm that the following minimum parameters are set in the file /etc/multipath.conf:

- Vendor: Hitachi
- Product: DF600F
- Path_grouping _policy: Multibus
- prio: const

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands**

**per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

The Hitachi Unified Storage system reports the Queue Full status when it receives a command with Queue Depth exceeding an allowable limit. A Queue Full condition can occur if there is a large number of VOLs to use and a big value is set for multiplicity. Therefore, set the appropriate value for your environment, especially when adding drives.

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

The Hitachi Unified Storage system reports the Queue Full status when it receives a command with Queue Depth exceeding an allowable limit. A Queue Full condition can occur if there is a large number of VOLs to use and a big value is set for multiplicity. Therefore, set the appropriate value for your environment, especially when adding drives.

## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host.

1. Shut down the server.
2. Stop all the peripheral devices.
3. Connect the Hitachi Unified Storage system to the server using Fibre Channel cables.
4. Start the Hitachi Unified Storage system and check that it is in the Ready status.
5. Start all the peripheral devices, check that they are in the Ready status, and then start the server.
6. Log in as super user (`root`).
7. Issue the following command to check whether the Hitachi Unified Storage system is recognized:

   ```
   # dmesg ↵
   ```

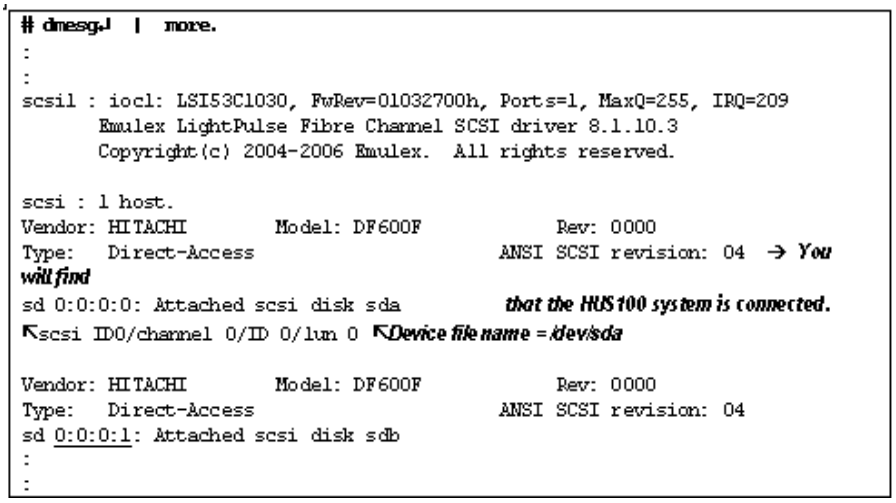



**Figure 6-18: Recognizing the Hitachi Unified Storage system in Linux**

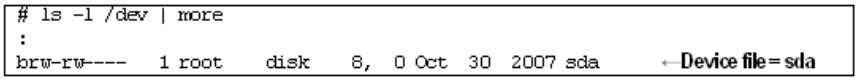



**Figure 6-19: Recognizing the storage system in Linux**

## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system are ON.
- Be sure the Fibre Channel cables are installed properly and firmly connected.
- Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

# HP-UX

This section describes how to attach hosts running the HP-UX operating system to the Hitachi Unified Storage system over a Fibre Channel connection.

Before proceeding, observe the following best practices:

- Obtain the latest vendor versions and related patches for the operating system: www.hp.com
- Obtain the latest HP-UX drivers and related patches for the HBAs and other devices on your storage network.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use HP-UX with multi-path software (PV-Link, VERITAS Volume Manager, Native Multipathing Plugin), Read access at path health check may cause automatic spin up from the power saving state.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

### HP-UX 11.i V1.0/V2.0

To account for time that an I/O may take to complete, set the device timeout value for volumes to 30 seconds or more.

1. Use the pvdisplay command to confirm the IO timeout value (shown in **bold** in the following figure).

```
# pvdisplay /dev/dsk/c211t0d0
--- Physical volumes ---
PV Name                  /dev/dsk/c211t0d0
VG Name                  /dev/vg02
PV Status                available
Allocatable              yes
VGDA                     2
Cur LV                   4
PE Size (Mbytes)         4
Total PE                 1023
Free PE                  23
Allocated PE             1000
Stale PE                 0
IO Timeout (Seconds)     default
Autoswitch               On
```

2. Use the pvchange-t command to change the IO timeout value to 30 seconds.

```
# pvchange -t 30 /dev/dsk/c211t0d0
Physical volume "/dev/dsk/c211t0d0" has been successfully changed.
Volume Group configuration for /dev/vg02 has been saved in /etc/lvmconf/vg02.conf
```

3. Confirm the IO timeout value using the pvdisplay command.

```
# pvdisplay /dev/dsk/c211t0d0
--- Physical volumes ---
PV Name                  /dev/dsk/c211t0d0
VG Name                  /dev/vg02
PV Status                available
Allocatable              yes
VGDA                     2
Cur LV                   4
PE Size (Mbytes)         4
Total PE                 1023
Free PE                  23
Allocated PE             1000
Stale PE                 0
IO Timeout (Seconds)     30
Autoswitch               On
```

4. Perform steps 1 through 3 for the Hitachi Unified Storage system volumes.

## HP-UX 11.i V3.0

To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Checking your connection to the storage system

To check your HP-UX connection to the Hitachi Unified Storage system:

1. Check that all necessary OS patches have been installed.
2. Issue the following command to check the driver version.

```
# swlist | grep Fibre ↵          <-- Check the driver version
  FibrChanl-00B.11.11.09     PCI/HSC FibreChannel;Supptd
HW=A6684A,A6685A,A5158A,A6795A
  b_PHKL_277511.0           (PHKL_27751) Fibre Channel Mass Storage Patch
#
```

## Checking the recognition of Hitachi Unified Storage system

The final step when installing and configuring your Hitachi Unified Storage system is to connect it to the HP-UX server.

1. Shut down the server.
2. Turn off power to the server and all peripheral devices.
3. Connect the Hitachi Unified Storage system to the server using Fibre Channel cables.
4. Start the Hitachi Unified Storage system and check that it is in the Ready status.
5. Start all the peripheral devices, check that they are in the Ready status, and then start the server.
6. Log in as the super user (root).
7. If you are using HP-UX11.i V1.0 or HP-UX V2.0, issue the following command and check that the Hitachi Unified Storage system is recognized.

   ```
   # ioscan -nfC disk ↵
   ```

```
# ioscan -fn <-- Check the recognition of Hitachi Disk Array System.
Class     I   H/W Path    Driver         S/W State H/W Type  Description
==========================================================
bc        0                       root    CLAIMED  BUS_NEXUS
bc        1   8                   bc      CLAIMED  BUS_NEXUS Bus Converter
fc        0   8/12                fcT1    CLAIMED  INTERFACE HP Fibre Channel Mass Storage
fcp       0   8/12.8              fcp     CLAIMED  INTERFACE FCP Protocol Adapter
ext_bus   2   8/12.8.0.255.0      fcpdev  CLAIMED  INTERFACE FCP Device Interface
target    7   8/12.8.0.255.0.6    tgt     CLAIMED  DEVICE
disk      3   8/12.8.8.255.0.6.0  sdisk   CLAIMED  DEVICE    HITACHI DF600F <-- Hitachi Disk
              /dev/dsk/c2t6d0   /dev/rdsk/c2t6d0
disk      4   8/12.8.8.255.0.6.1  sdisk   CLAIMED  DEVICE    HITACHI DF600F <-- Hitachi Disk
              /dev/dsk/c2t6d1   /dev/rdsk/c2t6d1
#
```

**Figure 6-20: Recognizing storage (11.i V1.0 and HP-UX V2.0) (Hitachi disks are bold)**

The sample in Figure 6-20 on page 6-45 shows the following new Hitachi Unified Storage devices recognized.

- HITACHI DF600F device:bus number = 8/12, bus instance = 8, target ID = 6, LUN = 0, driver = sdisk.
- HITACHI DF600F device:bus number = 8/12, bus instance = 8, target ID = 6, LUN = 1, driver = sdisk.

8. If you are using HP-UX11.31, issue the following command and check that the Hitachi Unified Storage system is recognized.

   ```
   # ioscan -nfC disk ↵
   ```

```
# ioscan -nkf    <-- Check the recognition of Hitachi Disk Array System.
Class     I  H/W Path             Driver     S/W State  H/W Type   Description
============================================================================
slot      0  0/2/1                pci_slot   CLAIMED    SLOT       PCI Slot
fc        0  0/2/1/0              fcd        CLAIMED    INTERFACE  HP A6826-60001 2Gb
             /dev/fcd0
fcp       7  0/2/1/0.1            fcd_fcp    CLAIMED    INTERFACE  FCP Domain
ext_bus  32  0/2/1/0.1.0.0.0      fcd_vbus   CLAIMED    INTERFACE  FCP Array Interface
target    1  0/2/1/0.1.0.0.0.0    tgt        CLAIMED    DEVICE
disk    306  0/2/1/0.1.0.0.0.0.0  sdisk     CLAIMED    DEVICE     HITACHI DF600F <-- Hitachi Disk
             /dev/dsk/c32t0d0   /dev/rdsk/c32t0d0
slot      5  0/6/1                pci_slot   CLAIMED    SLOT       PCI Slot
fc        6  0/6/1/0              fcd        CLAIMED    INTERFACE  HP A6826-60001 2Gb
             /dev/fcd6
fcp       3  0/6/1/0.8            fcd_fcp    CLAIMED    INTERFACE  FCP Protocol Adapter
ext_bus  11  0/6/1/0.8.0.2.0      fcd_vbus   CLAIMED    INTERFACE  FCP Array Interface
target   11  0/6/1/0.8.0.2.0.0    tgt        CLAIMED    DEVICE
disk     33  0/6/1/0.8.0.2.0.0.0  sdisk     CLAIMED    DEVICE     HITACHI DF600F <-- Hitachi Disk
             /dev/dsk/c11t0d0   /dev/rdsk/c11t0d0
```

**Figure 6-21: Recognizing storage (11.i V3.0, legacy DSF format) (Hitachi disks are bold)**

```
# ioscan -nfkN    <-- Check the recognition of Hitachi Disk Array System.
Class     I  H/W Path     Driver    S/W State   H/W Type   Description
============================================================================
fc        0  0/2/1/0      fcd       CLAIMED     INTERFACE  HP A6826-60001 2Gb
             /dev/fcd0
tgtpath   4  0/2/1/0.0x50060e8010227240                     estp         CLAIMED
             TGT_PATH     fibre_channel target served by fcd driver
lunpath   4  0/2/1/0.0x50060e8010227240.0x0                 eslpt        CLAIMED
             LUN_PATH     LUN path for ctl19
lunpath   5  0/2/1/0.0x50060e8010227240.0x4000000000000000  eslpt        CLAIMED
             LUN_PATH     LUN path for disk322
fc        6  0/6/1/0      fcd       CLAIMED    INTERFACE  HP A6826-60001 2Gb
             /dev/fcd6
tgtpath   7  0/6/1/0.0x50060e8010227242                     estp         CLAIMED
             TGT_PATH     fibre_channel target served by fcd driver
lunpath  34  0/6/1/0.0x50060e8010227242.0x0                 eslpt        CLAIMED
             LUN_PATH     LUN path for ctl19
lunpath  35  0/6/1/0.0x50060e8010227242.0x4000000000000000  eslpt        CLAIMED
             LUN_PATH     LUN path for disk322
esvroot   0  64000/0xfa00       esvroot  CLAIMED    VIRTBUS    Escsi virtual root
ctl      19  64000/0xfa00/0x18  esctl    CLAIMED    DEVICE     HITACHI DF600F <-- Hitachi Disk
             /dev/pt/pt19
disk    322  64000/0xfa00/0x19  esdisk   CLAIMED    DEVICE     HITACHI DF600F <-- Hitachi Disk
             /dev/disk/disk322   /dev/rdisk/disk322
```

**Figure 6-22: Device recognition of storage in HP-UX (persistent format) (Hitachi disks are bold)**

## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system are ON.
- Be sure the Fibre Channel cables are installed properly and firmly connected.
- Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

# AIX

This section describes how to attach hosts running the AIX operating system to the Hitachi Unified Storage system over a Fibre Channel connection.

Before proceeding, observe the following best practices:

- Obtain the latest vendor versions and related patches for the operating system: www.ibm.com
- Obtain the latest AIX drivers and related patches for the HBAs and other devices on your storage network.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.
- The RAID group using the Power Saving Plus function and instructing the I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O.
- Read access operates periodically when an AIX host recognizes volumes, even if there is no host I/O initiated by the user. If the power saving status is changed, it immediately spins up. Therefore, in AIX, the I/O interlock power saving setting for the RAID group using the Power Saving Plus function and the Hitachi Unified Storage power savings configured in Hitachi Unified Storage power savings function are disabled.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

The Hitachi Unified Storage system reports the Queue Full status when it receives a command with Queue Depth exceeding an allowable limit. A Queue Full condition can occur if there is a large number of VOLs to use and a big value is set for multiplicity. Therefore, set the appropriate value for your environment, especially when adding drives.

For Hitachi Unified Storage systems, create a volume group that will correspond to the physical volume to change belongs be non-activated in advance.

```
# chdev -l [physical volume (hdiskX)] -a queue_depth=[queue_depth] ↵
# lsattr -El [physical volume (hdiskX)] ↵
```

```
# chdevr-lrhdisk4r-arqueue_depth=16 ↵
The hdisk4 was changed.
# lsattrr-Elrhdisk4 ↵
clr_q                        no                Device CLEARS its Queue on error    True
location                                       Location Label                      True
lun_id                      0x0                Logical Unit Number ID              False
max_transfer                0x40000            Maximum TRANSFER Size               True
node_name                   0x50060e8010111bc0 FC Node Name                        False
pvid                        none               Physical volume identifier          False
q_err                       yes                Use QERR bit                        True
q_type                      simple             Queuing TYPE                        True
queue_depth                 16                 Queue DEPTH                         True
reassign_to                 120                REASSIGN time out value             True
rw_timeout                  30                 READ/WRITE time out value           True
scsi_id                     0xef               SCSI ID                             False
start_timeout               60                 START unit time out value           True
ww_name                     0x50060e8010111bc0 FC World Wide Name                  False
```

**Figure 6-23: Setting the command multiplex number in AIX (1 of 4)**

```
# cfgmgr ↵

# lsdevr-Ccrdisk ↵
hdisk0                usable        01-08-00        SAS Disk Drive
hdisk1                usable        01-08-00        SAS Disk Drive
hdisk2                usable        01-08-00        SAS Disk Drive
hdisk3                usable        01-08-00        SAS Disk Drive
hdisk4                usable        04-00-02        Other FC SCSI Disk Drive
hdisk5                usable        04-00-02        Other FC SCSI Disk Drive
```

**Figure 6-24: Setting the command multiplex number in AIX (2 of 4)**

```
# lsattrr-Elrhdisk4 ↵
clr_q                no                Device CLEARS its Queue on error       True
location                               Location Label                         True
lun_id              0x0                Logical Unit Number ID                 False
max_transfer        0x40000            Maximum TRANSFER Size                  True
node_name           0x50060e8010111bc0 FC Node Name                           False
pvid                none               Physical volume identifier             False
q_err               yes                Use QERR bit                           True
q_type              simple             Queuing TYPE                           True
queue_depth         1                  Queue DEPTH                            True
reassign_to         120                REASSIGN time out value                True
rw_timeout          30                 READ/WRITE time out value              True
scsi_id             0xef               SCSI ID                                False
start_timeout       60                 START unit time out value              True
ww_name             0x50060e8010111bc0 FC World Wide Name                     False
```

**Figure 6-25: Setting the command multiplex number in AIX (3 of 4)**

```
# cfgmgr ↵

# lsdevr-Ccrdisk ↵
hdisk0                usable        01-08-00        SAS Disk Drive
hdisk1                usable        01-08-00        SAS Disk Drive
hdisk2                usable        01-08-00        SAS Disk Drive
hdisk3                usable        01-08-00        SAS Disk Drive
hdisk4                usable        04-00-02        Other FC SCSI Disk Drive
hdisk5                usable        04-00-02        Other FC SCSI Disk Drive

# lsattrr-Elrhdisk4 ↵
clr_q         no                      Device CLEARS its Queue on error          True
location                              Location Label                            True
lun_id        0x0                     Logical Unit Number ID                    False
max_transfer  0x40000                 Maximum TRANSFER Size                     True
node_name     0x50060e8010111bc0      FC Node Name                              False
pvid          none                    Physical volume identifier                False
q_err         yes                     Use QERR bit                              True
q_type        simple                  Queuing TYPE                              True
queue_depth   1                       Queue DEPTH                               True
reassign_to   120                     REASSIGN time out value                   True
rw_timeout     30                     READ/WRITE time out value                 True
scsi_id       0xef                    SCSI ID                                   False
start_timeout 60                      START unit time out value                 True
ww_name       0x50060e8010111bc0      FC World Wide Name                        False
```

**Figure 6-26: Setting the command multiplex number in AIX (4 of 4)**

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** The RAID group I/O interlock power saving setting in Power Saving Plus does not work in AIX.

## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host.

1. Shut down the server.
2. Stop all the peripheral devices.
3. Connect the Hitachi Unified Storage system to the server using Fibre Channel cables.
4. Start the Hitachi Unified Storage system and check that it is in the Ready status.
5. Start all the peripheral devices, check that they are in the Ready status, and then start the server.
6. Log in as super user (`root`).
7. Issue the following command to check whether the Hitachi Unified Storage system is recognized:

   ```
   # lsdev -Cc disk ↵
   ```

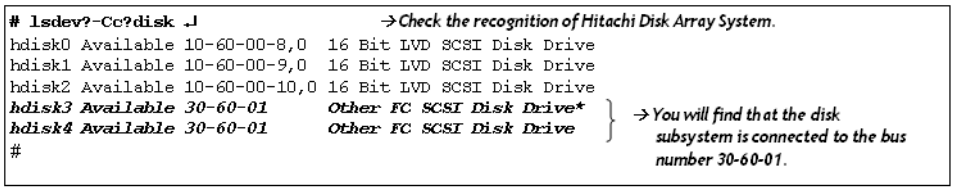



**Figure 6-27: Recognizing Hitachi Unified Storage in AIX (1 of 2)**

8. Confirm that the Hitachi Unified Storage system by the target ID (scsi_id), volume (lun_id), and WWN (ww_name) of each port in the Hitachi Unified Storage system.

   # lsattr -El [physical volume (hdiskX) ↵

   If Object Data Manager (ODM) is installed, it is recognized as a Hitachi FCSCSI disk drive.

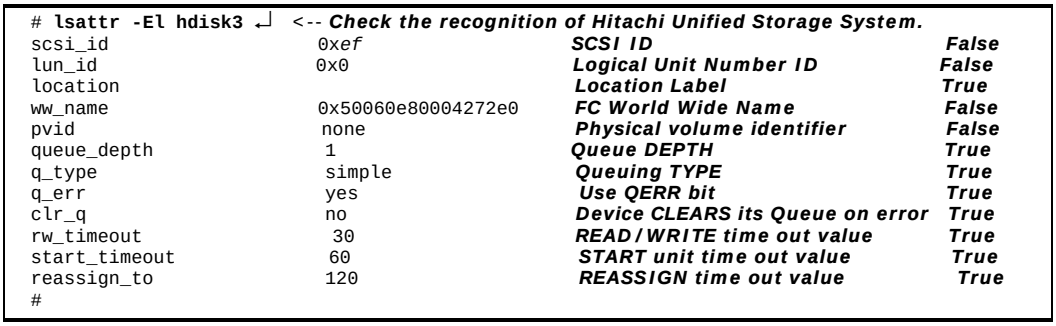


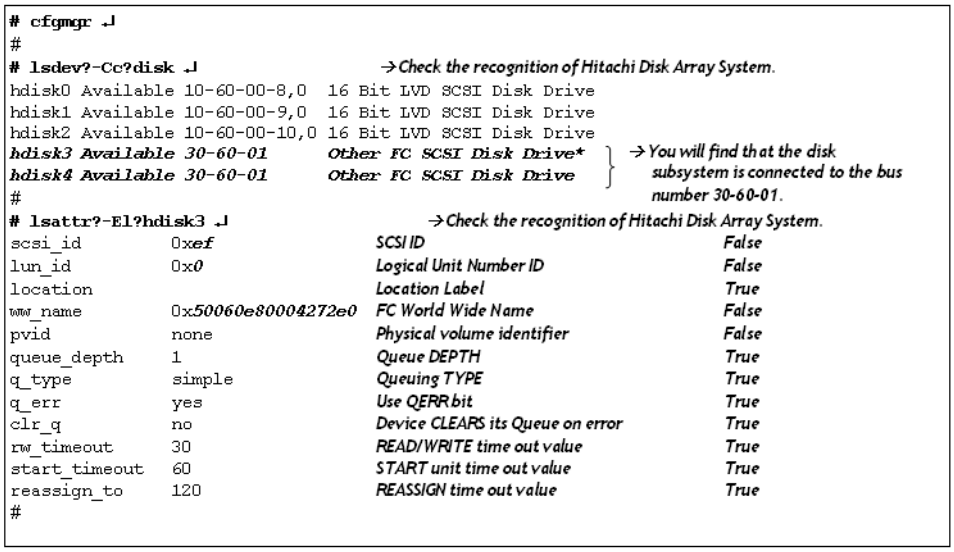

**Figure 6-28: Recognizing Hitachi Unified Storage in AIX (2 of 2)**

9. When your Hitachi Unified Storage system is installed and configured for the first time, or when volumes are added, issue the following commands to recognize the device as shown below.

   # cfgmgr ↵

   # lsdev -Cc disk ↵

   # lsattr -El [physical volume (hdiskX)] ↵



## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system devices are ON.
- Be sure the Fibre Channel cables are installed properly and firmly connected.
- Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

# Citrix XenServer

This section describes how to attach hosts running the Citrix XenServer virtualization platform to the Hitachi Unified Storage system over a Fibre Channel connection.

XenServer hosts support Fibre Channel SANs using an HBA. Logical unit numbers (LUNs) are mapped to the XenServer host as disk devices `/dev/sdx` just like physical disks would be.

Fibre Channel storage is implemented based on LVHD, a technology that combines the Logical Volume Manager (LVM) and Virtual Hard Disk (VHD) standards. Virtual machine VDIs are stored on a LUN created on the Hitachi Unified Storage system.

Before proceeding, observe the following best practices:

- Obtain the documentation for your host system.
- Install a supported Citrix XenServer version. The following Web site describes the system requirements for Citrix XenServer hosts:

  www.citrix.com
- Obtain the appropriate HBAs, drivers, and firmware for your Citrix XenServer host(s).

## Microsoft Windows and Linux operating systems

Citrix XenServer supports on-demand deployment of Windows and Linux virtual machines (VMs).

- Windows VMs are always supported as hardware-based virtual machines (HVMs), with paravirtualized drivers for storage and network.
  - The drivers are installed from the Citrix XenServer installation media.
  - To use Windows VMs running under Citrix XenServer, the server processors must have hardware virtualization support, such as Intel Virtualization Technology (VT)-based processors or AMD-V-based processors.
- Linux VMs are always supported in a paravirtualized mode.

## Multipath support for Citrix XenServer hosts

XenServer 5.0 introduced Active/Active multipathing for I/O data paths over Fibre Channel. Dynamic multipathing uses a round-robin load-balancing algorithm that directs active traffic to both routes during normal operations. Multipathing can be enabled via XenCenter or on the command line.

The multipath driver is installed as part of the Citrix XenServer software. For an overview of multipathing on Citrix XenServer 5.0, refer to:

http://support.citrix.com/article/CTX118791

## Clustering support on Citrix XenServer hosts

Clustering of Citrix XenServer hosts, or clustering for guest operating systems within or across Citrix XenServer hosts, is not supported.

## SAN Boot

If your Fibre Channel HBA supports boot from LUN, perform all boot operations from the LUN set up before installing the XenServer Host. During installation, select the remote LUNs as if they were local disk drives. After you complete the installation and reboot, the system boots from the remote LUN.

Fibre Channel LUNs appear on the host as SCSI devices. Each SCSI device is symbolically linked (symlinked) under the directory `/dev/disk/by_id` using its unique `scsi_id`. If you are not sure which `scsi_id` corresponds to which device, query a device with the `sginfo` command followed by the path. For example:

```
sginfo /dev/disk/by_id/ {scsi_id}
```

Always reference Fibre Channel disks by this path, since it provides persistent device identification, regardless of the core device name assigned by the host which may change (for example, across host reboots).

If you add an HBA to the XenServer Host after installation, edit the file `/etc/modprobe.conf` according to the instructions in your HBA documentation. For complete compatibility details, go to the online interoperability matrix at http://www.hds.com/products/interoperability/.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Configuring the Citrix XenServer host

You must configure the Citrix XenServer host before you can use the host with the Hitachi Unified Storage system. Typical configuration steps include:

1. Installing and configuring the HBA on each host. Refer to your HBA documentation.
2. Configuring the Fibre Channel ports as targets/
3. Retrieving the HBA's WWPN using XenCenter. Refer to the XenServer documentation and to the following Web site: www.citrix.com
4. Creating the LUN on the storage. See Configuring mapping (Fibre Channel) on page 5-73.
5. Creating a Storage repository using XenCenter. Refer to the XenServer documentation and to the following Web site: www.citrix.com
6. For a multipath installation, refer to the XenServer Installation Guide.
7. Verifying and discovering VOLs. See Verifying and discovering VOLs below.

## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to verify and discover VOLs at the host. This step assumes you have configured zones in your switches for hosts and your storage ports.

1. Leave the server running.
2. Stop all the peripheral devices.
3. Use XenServer to discover new Storage Repositories.

## Troubleshooting

Observe the following troubleshooting guidelines.

- If you run Citrix XenServer EE 5 Update 2 on a Windows 2008 EE SP1 (x84-64) virtual machine, you can experience the Windows stop message if you configured more than one vCPU.
- If you run multiple Citrix XenServer hosts as part of a shared resource pool, one of the hosts can become unresponsive when you perform Hitachi Unified Storage system activities, such as adding, removing, or resetting nodes.

- If the system does not recognize the VOL devices on the Hitachi Unified Storage system:
  - Confirm that the **READY** LEDs on the Hitachi Unified Storage system devices are ON.
  - Be sure the Fibre Channel cables are installed properly and firmly connected.
  - Check that the ports on the HBA, switch, and Hitachi Unified Storage system are linked up.

7

# iSCSI host configuration

After you install and configure your Hitachi Unified Storage system, the next step is to prepare it for use with supported host servers and operating systems.

This chapter describes how to prepare Hitachi Unified Storage systems with iSCSI ports for use with iSCSI environments. For a list of supported operating systems and servers, see Items for storage system management on page 4-6 and the interoperability matrix at http://www.hds.com/products/interoperability/.

The following topics are covered in this chapter:


- Assumptions and requirements
- iSCSI overview
- Microsoft Windows Server 2012
- Microsoft Windows Server 2008
- Microsoft Windows Server 2003
- VMware
- Red Hat Enterprise Linux
- SuSE Linux
- Citrix XenServer

# Assumptions and requirements

The host configuration procedures in this chapter assume that the requirements in Table 7-1 have been met.

**Table 7-1: Host configuration requirements**

| Requirement | See |
|---|---|
| All Hitachi Unified Storage system hardware and cables are connected. | Chapter 4, Installing the storage system. |
| Turn on your Hitachi Unified Storage system and confirm it is behaving properly. | Connecting power cables and powering on on page 4-31 |
| Select the appropriate Platform and Middleware settings. | Selecting Platform and Middleware settings on page 5-25 |
| Install the latest firmware available for the Hitachi Unified Storage system. | Appendix B, Upgrading firmware |
| Perform the required iSCSI configuration activities. | Routine iSCSI activities on page 5-79 and the Hitachi Storage Navigator Modular 2 online help |
| Configure other appropriate settings for your Hitachi Unified Storage system. | Chapter 5, Configuring the storage system |
| Install the network-interface card (NIC) or iSCSI host bus adapter (HBA) in your server. | The documentation for your NIC or iSCSI HBA |
| Turn on your server and networks devices and confirm they are behaving properly. | The documentation for your server and network devices |
| Load the latest drivers and patches for your operating system and the devices on your storage network. | The documentation for your operating system and network devices |
| Cable all NIC, iSCSI HBAs, and network devices on your storage network. | The documentation for your network devices |
| Install and configure any clustering and multipathing software for your operating system. | The documentation for your clustering and multipathing software applications |

# iSCSI overview

The Internet Small Computer Systems Interface (iSCSI) is a SCSI mass storage transport that operates between the Transport Control Protocol (TCP) and the SCSI Protocol Layers. The iSCSI protocol is defined in RFC 3720 (iSCSI), which was finalized by the Internet Engineering Task Force (IETF) in April, 2004.[1] A mandate of the iSCSI protocol design required no modifications to the existing SCSI or TCP/IP protocols.

Hitachi Unified Storage iSCSI target port responses to iSCSI host initiators requests comply with the iSCSI communication protocol defined in RFC 3720. HUS iSCSI target ports do not support iSCSI initiators that do not comply with iSCSI (RFC 3270).

Table 7-2 lists the storage system's default iSCSI settings. You can change these settings using Storage Navigator Modular 2.

**Table 7-2: Hitachi Unified Storage iSCSI settings**

| Item | Description |
|---|---|
| Target | • iSCSI initiator in host logs-in to an iSCSI target on a Hitachi Unified Storage system with iSCSI ports.<br>• Target 0 (zero) is set as default.<br>• Up to 255 targets can be set for each port using LUN Manager. |
| Setting/deleting a target | • LUN Manager, targets 1 through 254 can be set or deleted.<br>• Target 0 (zero) cannot be deleted. To delete iSCSI name, options, and LU mapping of target 0, initialize target 0. |
| Target alias | • You must set a target alias when the target is created.<br>• the target alias can also be changed. |
| iSCSI name | • Used to identify initiators and targets. iSCSI name needs a World Wide Unique value.<br>• iqn and eui are supported.<br>• iSCSI name of a target is automatically set as a World Wide Unique when initializing the target. The value can be changed using LUN Manager, however, you must ensure the World Wide Uniqueness of the new iSCSI name. |
| iSCSI user name | • Identifies an initiator or a user who uses the initiator to perform CHAP authentication.<br>• Up to 255 iSCSI user names accessing iSCSI targets can be set for an iSCSI port.<br>• The same iSCSI user name cannot be set to the other target of the same port with another Secret. |
| iSNS | • If the IP address of an iSNS server is set, iSNS can be used for discovery. |

1.Internet Small Computer Systems Interface, Internet Engineering Task Force, http://www.ietf.org/rfc/rfc3720.txt?number=3720.

**Table 7-2: Hitachi Unified Storage iSCSI settings (Continued)**

| Item | Description |
|---|---|
| Login authentication | • None, CHAP is supported.<br>None: always no authentication.<br>CHAP: always CHAP authentication is executed.<br>None, CHAP: Follows to the host setting. When the host also presents “None, CHAP” in login, CHAP authentication is executed.<br>• Mutual authentication is supported, except with VMWare connections, which support single-direction authentication. |
| LU mapping | • LU mapping can be set per target.<br>• Up to 2048 LU mappings can be set for a target. LU mappings can also be set for a port. However, the maximum number should not exceed the maximum number of volumes per ports.<br>• By mapping the same VOLs to several targets, you can map up to 16384VOL/ports inside one port. |
| Concurrent use of LUN Manager | • Up to 255 targets can be set using LAN Manager. |

## What is ISCSI?

iSCSI is a protocol that unites IP networking and storage by enabling the transport of block-level storage traffic over IP networks.

iSCSI builds on two widely used technologies — SCSI commands for storage and IP protocols for networking — to create an end-to-end protocol for moving data from server to storage using standard and ubiquitous Ethernet switches and routers. With iSCSI, IP and Ethernet infrastructures can be used to expand access to storage and extend connectivity across any distance. Unlike other network storage protocols, such as fibre channel (which is used with many SANs), iSCSI requires only the simple and ubiquitous Ethernet interface (or any other TCP/IP-capable network) to operate.

Putting drives directly onto the Ethernet network and making them IP-addressable yield a number of benefits. For example, the use of switched Ethernet breaks the limitation of internal buses and loops of the conventional storage systems. In addition, small, medium, and large companies can extend and expand their switched network easily and quickly while enjoying the price/performance improvement trends of Ethernet using standard, low-cost networking equipment such as Gigabit Ethernet switches, routers, and NICs. Given these advantages, along with the additional benefits described in this guide, iSCSI empowers businesses of all sizes and budgets to deploy SAN technology that may have been cost prohibitive previously, while enabling enterprises to add a complementary storage tier for secondary servers or expand existing networked storage to include workgroups and departments to consolidate storage assets.

From the network's perspective, iSCSI is just another service that runs over TCP/IP. It can use the same networking stack as other applications, with clients requesting data from servers. The main difference is that its function is more specialized. While other layer-7 protocols such as Simple Mail

Transfer Protocol (SMTP) are not concerned with the technologies used at their endpoints, iSCSI is designed as a way to extend an existing storage technology across IP networks.

## iSCSI SAN components

The iSCSI protocol is conceptually similar to the TCP/IP client/server model. Every iSCSI configuration involves an iSCSI initiator and target. In this arrangement, the initiator acts as a client and the target acts as a server (see Figure 7-1 on page 7-6).

- The iSCSI initiator is the client or host. The iSCSI initiator connects to an IP network, initiates requests, and receives responses from an iSCSI target. Each iSCSI host is identified by a unique iSCSI qualified name (IQN), which is similar to the World Wide Name in a fibre channel setup.
- The iSCSI target is a storage device, such as a storage array, tape device, or optical storage device.

The initiator issues requests to read data from and write data to the iSCSI target. The initiator's iSCSI stack packs these requests, in the form of SCSI commands, and data into IP packets, which are transmitted to and unpacked by the target for processing as if they had originated locally.

To transport SCSI block commands over the IP network, an iSCSI driver must be installed on the iSCSI host. iSCSI initiators are available as hardware and software implementations:

- A hardware initiator is installed in each client computer that wants to communicate with the target. Examples of hardware initiators include:
  - Standard NICs with an iSCSI driver
  - HBAs designed for iSCSI (iSCSI HBAs typically are available from vendors that manufacture Fibre Channel HBAs)
  - TCP offload engine (TOE) NICs with an iSCSI driver
- Software initiators are applications installed on the client operating system. Examples include:
  - Microsoft iSCSI Software Initiator
  - iSCSI initiators provided with other operating systems, such as VMware, Solaris, HP-UX, AIX, and many Linux distributions

The target's local resources (usually disk volumes) are assigned to a volume that can be accessed through the iSCSI protocol. The volume represents dedicated storage allocated from the available disk storage on the target system. Typically, the volume is assigned to one initiator at a time. In a clustering environment, however, each node of the cluster can access a volume containing data.

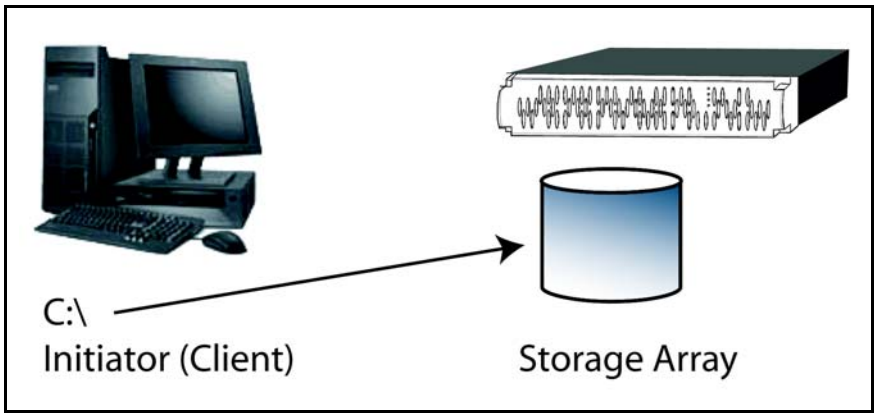



**Figure 7-1: Example of an iSCSI target and initiator**

The iSCSI protocol makes it possible for the initiator to connect to the storage target anywhere on an Internet Protocol (IP) network, whether through a LAN or Wide Area Network (WAN) connection (see Figure 7-2).

In the example in Figure 7-2, each host and storage resource support an Ethernet interface and an iSCSI protocol stack, with IP routers and Ethernet switches providing the network connections. This arrangement enables storage devices to connect directly to the switches and routers, and appear as any other IP entity on the network.

When an operating system receives a request, it generates an SCSI command and sends an IP packet over an Ethernet connection. At the receiving end, the SCSI commands are separated from the request, and the SCSI commands and data are sent to the iSCSI target storage device. The section that starts on the next page describes what goes on “behind the scenes” during this sequence.

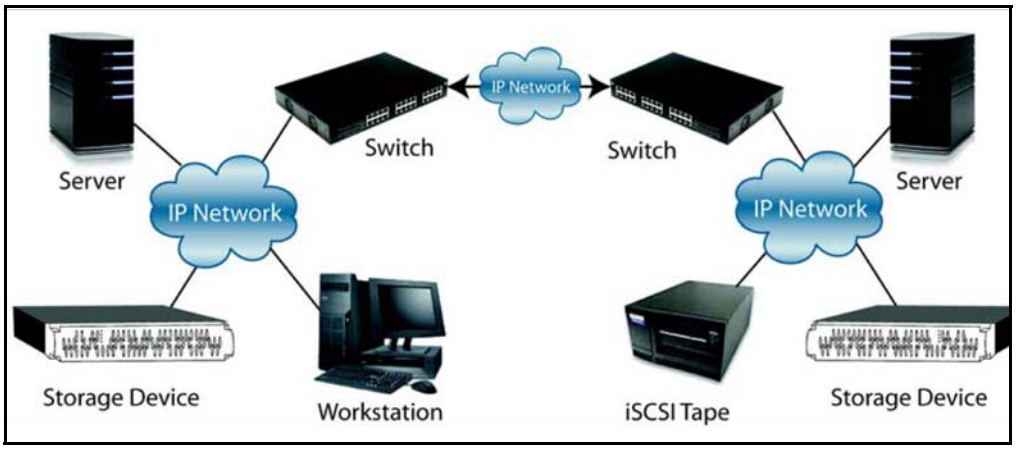



**Figure 7-2: Example of initiators and targets in an iSCSI network**

## iSCSI under the hood

The iSCSI protocol controls and monitors all block data transfers, and confirms completion of I/O operations. These events occur over one or more TCP/IP connections between the initiator and target. Figure 7-3 shows the model of the iSCSI protocol levels, including the encapsulation order of SCSI commands for delivery through a physical carrier.

At the top of the model is a SCSI driver. The driver or a subordinate protocol engine encapsulates raw SCSI commands and data into iSCSI messages, maps the local drive assignment to remote devices, and is responsible for related tasks such as authentication. Further down, iSCSI messages are sent from the initiator to the target over TCP/IP sessions, which may involve services such as error detection and encryption. At the bottom, the host interface manages low-level network link functions.

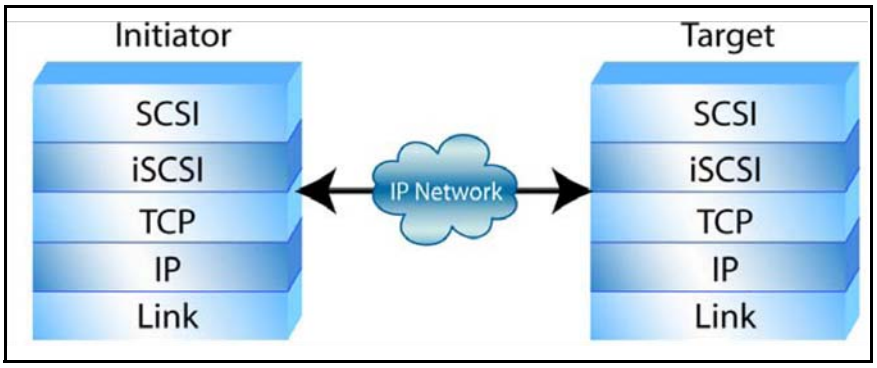



**Figure 7-3: iSCSI protocol levels**

## Determining your iSCSI topology

Hitachi Unified Storage systems support direct attached and network switch connections. The storage systems also support redundant path for multipathing and failover.

The following figures show examples of supported iSCSI topologies. In each figure:

- 0E, 0F, 1E, 1F = iSCSI ports on the Hitachi Unified Storage system
- 1/10 Gb = Gigabit Ethernet link
- L2 switch = Layer 2 network switch
- L3 switch = Layer 3 network switch
- Dashed line = standby path.

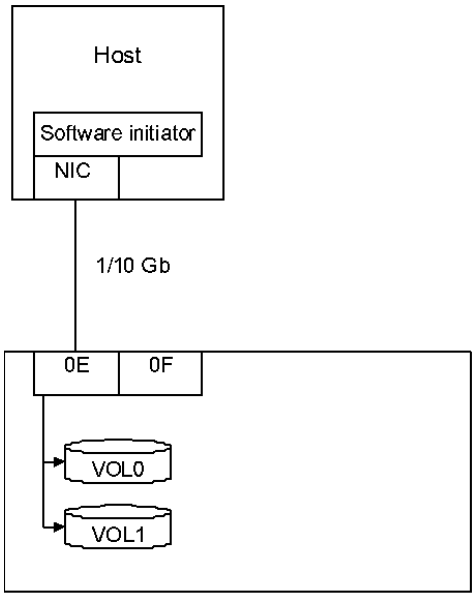



**Figure 7-4: Sample direct connect topology (1 of 5)**

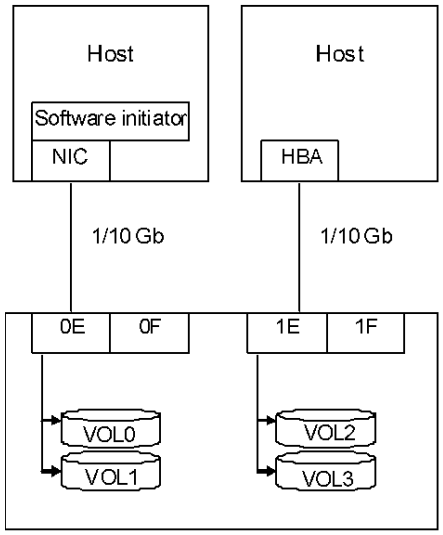



**Figure 7-5: Sample direct connect topology (2 of 5)**

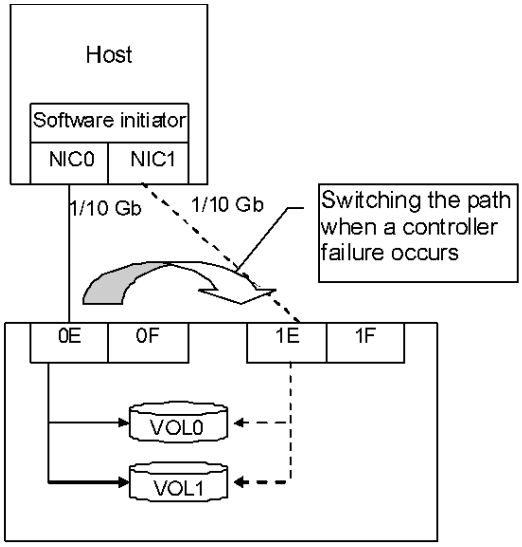



**Figure 7-6: Sample direct connect topology (3 of 5)**

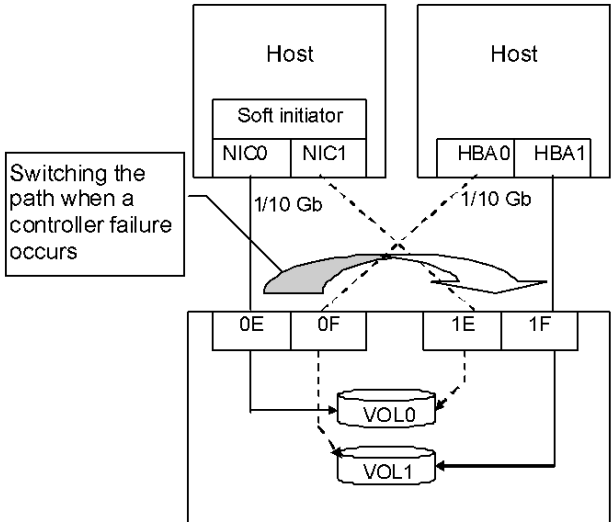



**Figure 7-7: Sample direct connect topology (4 of 5)**

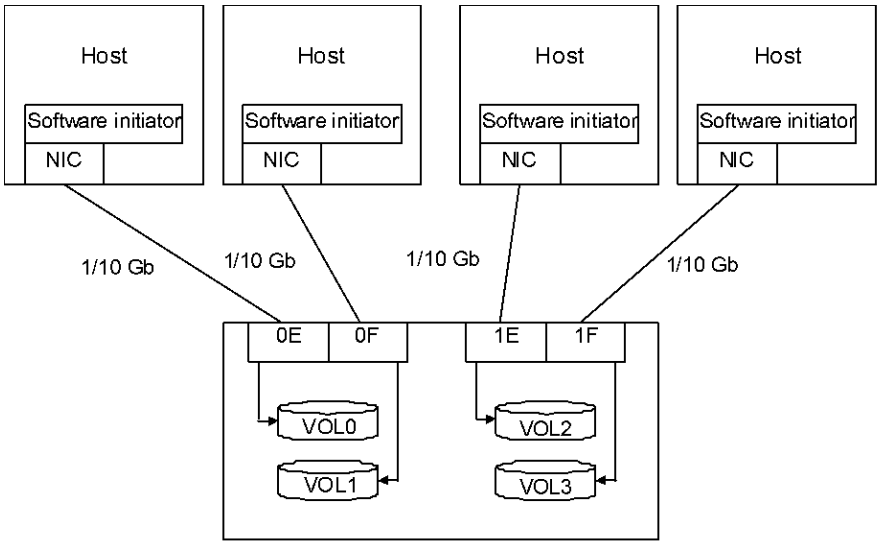



**Figure 7-8: Sample direct connect topology (5 of 5)**

The following figures show examples of topologies using a network switch.

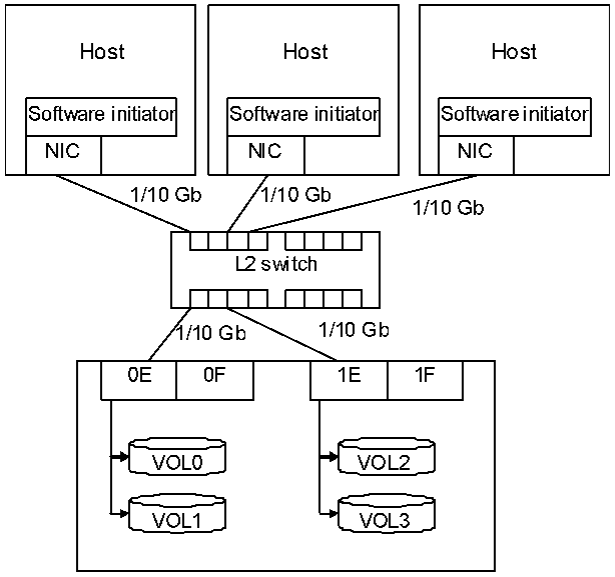



**Figure 7-9: Sample switch topology (1 of 3)**

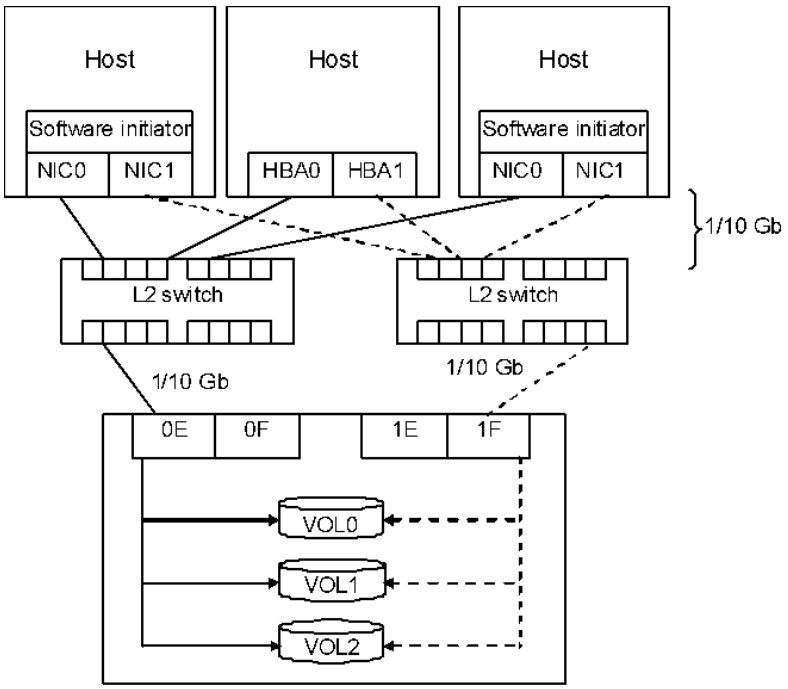



**Figure 7-10: Sample switch topology (2 of 3)**

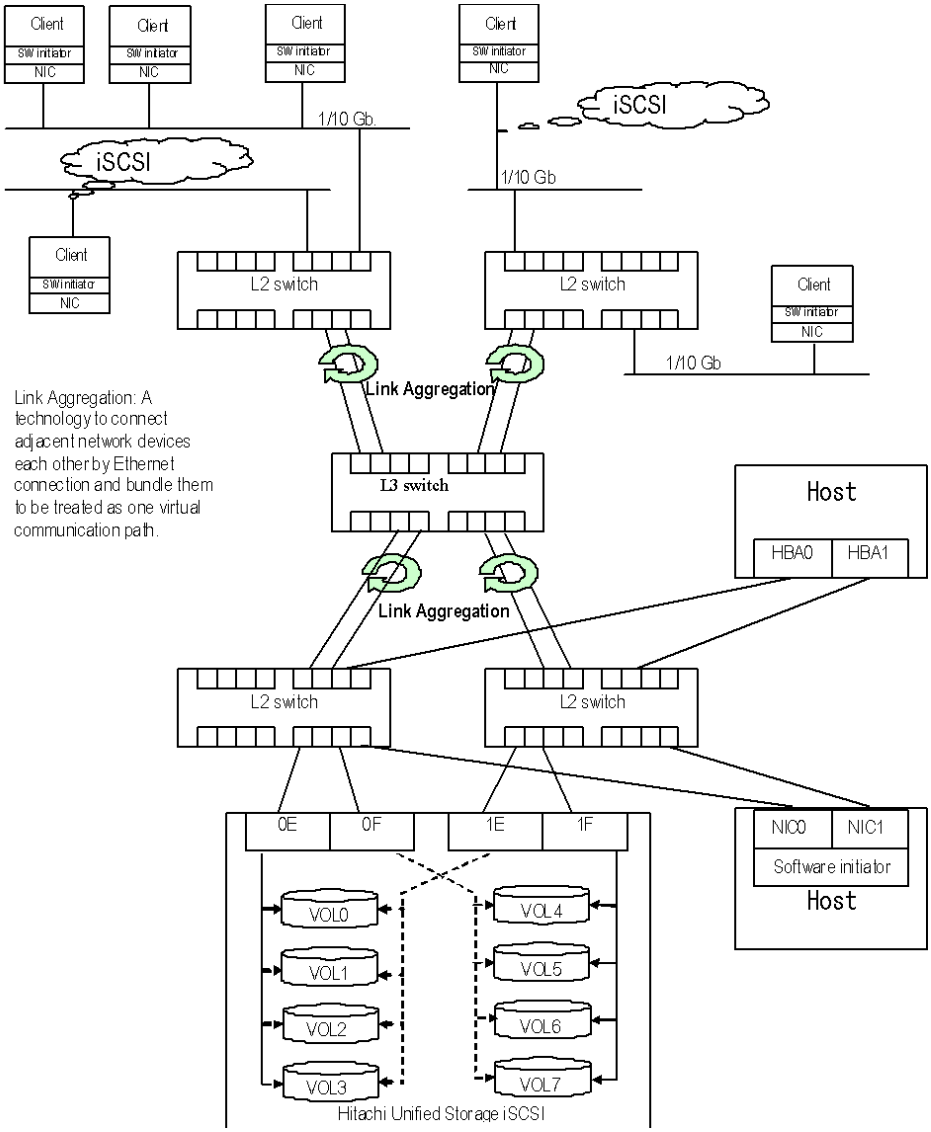



**Figure 7-11: Sample switch topology (3 of 3)**

## Interoperability

Since iSCSI products leverage mature Ethernet technology, interoperability issues encountered during deployments are rare. iSCSI has a login stage during which parameters and features — such as unsolicited data usage, number of connections per session, and maximum size of packet data units (PDUs) — are negotiated. The outcome from these negotiations determine the features that are used for the iSCSI session. markers and any other vendor specific features. If an iSCSI product does not support all of the parameters and features negotiated, the negotiation may result in a successful session that is less than optimal. Therefore, it is critical for individuals intent on deploying an iSCSI network to compare and choose their iSCSI products carefully, with an eye toward must-have features that meet their requirements.

## Reliability and high availability

Because an iSCSI target often serves mission-critical functions, reliability is critical. High in the reliability pecking order are a storage server's ability to never lose or corrupt data. Equally as important is keeping the system as available as possible. Hardware with redundant power supplies and field-installable spare drives are designed with high availability in mind. Not as immediately evident, but equally important, is the target's management software and its resistance to crashing.

In the end, targets are mechanical devices that are always prone to crashing. Therefore, another factor to consider is the time it takes a target to restart following a crash. Since most initiators try to reconnect and recover the session after losing a TCP connection, a target crash can be transparent to the application if the target can restart during the time when the initiator tries to recover the session. The retransmission mechanism in TCP usually allows an iSCSI session to survive a brief loss of network connectivity such as a switch reboot. Session timeout, reconnect, and recovery times are not covered by the iSCSI specification, so these tolerances vary by initiator.

High availability targets are equipped with two or more redundant controllers. If one controller fails, another can take over its load.

## Check speed settings

Check whether the NICs, iSCSI HBAs, and switches in your deployment are configured for auto-negotiation. (Auto-negotiation is the default setting for the Hitachi Unified Storage system iSCSI ports and Storage Navigator Modular 2 management ports. It is often the default setting for these devices as well.) Auto-negotiation allows a device to automatically negotiate data transmission speed, without requiring user intervention.

If auto-negotiation is used, the NIC, iSCSI HBA, and switch may settle on a speed that is well below network capacity. You should be able to reset the negotiated speed manually using the configuration software for the NIC and switch. The documentation for the NIC, iSCSI HBA, and switch should describe this procedure.

## Security

Since iSCSI provides block-level access to storage, it is accessed by the host operating system as if it were a directly attached (local) storage device. This means that an iSCSI target has no way of knowing which user on the host system is requesting access to storage. It is up to the administrator or root user on the host operating system to configure and initiate access. So, like a fibre-channel SAN, all user-level authentication and authorization for access to data within the VOL must be delegated to the host operating system.

The iSCSI protocol specifies a variety of security capabilities for preventing unauthorized access to data on iSCSI target drives, including use of the Challenge Handshake Authentication Protocol (CHAP) during the initial

iSCSI login. CHAP authenticates the peer of a connection to restrict access to targets. It is based on the peers sharing a secret — a security key that is similar to a password.

iSCSI devices can support CHAP as a one-way or mutual implementation:

- With one-way CHAP, only the target authenticates the initiator. The secret is set for the target. All initiators that want to access that target must use the same secret to start a logon session with the target.
- With mutual CHAP, the target and initiator authenticate each other. A separate secret is set for each target and for each initiator in the SAN.

iSCSI standards mandate support for CHAP in iSCSI products. However, not all iSCSI products support both CHAP implementations. Therefore, it is up to each organization to determine whether one-way or mutual CHAP meets its security concerns and then select the appropriate iSCSI devices.

Regardless of the CHAP implementation chosen, the iSCSI specification recommends that administrators select random CHAP secrets up to 16 bytes long. If privacy is not a concern, the iSCSI standard recommends using randomly generated CHAP secrets at least 12 bytes long.

For additional security, LUN Manager can be used to define, configure, add, delete, expand, revise. and reassign VOLs to specific paths, without having to reboot the storage system. Consider the following example. If you assign VOL3 to Host 1 and VOL4 to Host 2, both hosts can access the same VOL if LU mapping is set (see Figure 7-12 on page 7-14). When LUN Manager and CHAP are used together, host (iSCSI Name) access to each VOL can be distinguished, even at the same port, as shown in Figure 7-13 on page 7-14.

**NOTE:** If you use security software that allows **IPv6 is intercepted** to be set to firewall, disable this setting when using IPv6 addressing.

Power Saving

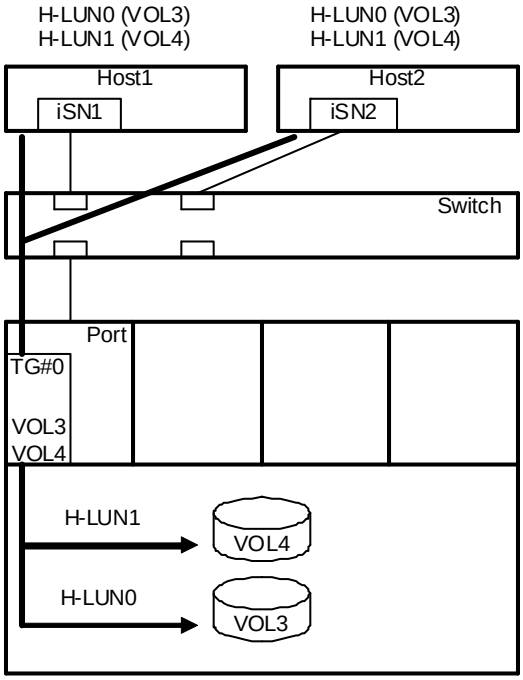



**Figure 7-12: Example Using LU mapping only**

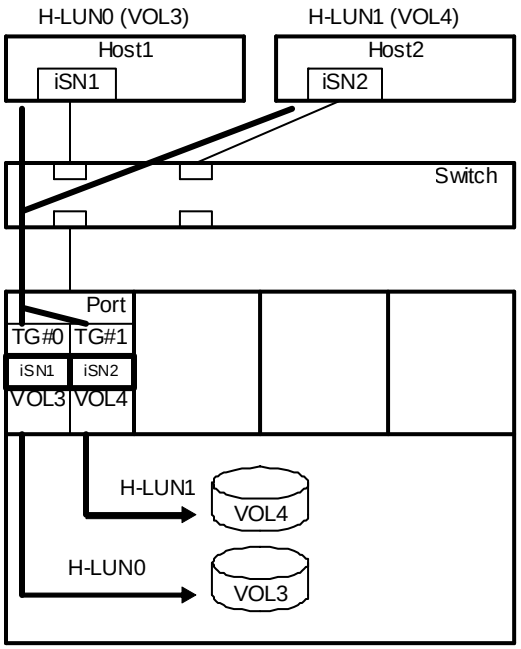



**Figure 7-13: Example of using LUN Manager and CHAP authentication**

## Internet Storage Name Service (iSNS)

In any storage network, servers (or initiators) need to know which storage resources (or targets) they can access. One way to accomplish this is for an administrator to configure each initiator manually with its own list of authorized targets and configure each target with a list of authorized

initiators and access controls. This process is time-consuming and error-prone, and accidentally configuring multiple servers to access the same storage resources could be disastrous.

A better alternative is to use the Internet Storage Name Service (iSNS) protocol. iSNS lets servers automatically identify and connect to authorized storage resources. Letting the servers dynamically adapt to changing storage resource membership and availability without human intervention results in greater accuracy and efficiency.

All Hitachi Unified Storage systems support iSNS.

## iSCSI guidelines

Observe the following considerations when using the Hitachi Unified Storage system in an iSCSI configuration.

- Hitachi Unified Storage systems support up to 224 iSCSI hosts and are intended for use as storage systems only. They should not be used as a network boot device.
- Hitachi Unified Storage systems do not support link aggregation.
- If a host contains multiple NICs, the NICs should have IP addresses belonging to different network segments. A host with two NICs, for example, might have one NIC configured to use the IP address 172.16.0.221 and the other NIC configured for 17.16.1.222.
- For 1 Gb iSCSI connections, use a 16-port L2 switch supporting 1000BASE-T (full duplex). For 10 Gb iSCSI connections, use a L3 switch that supports 10 Gb SFP+.
- Hitachi Unified Storage systems support iSCSI Header digest and iSCSI Data digest.
  - The Header digest increases data integrity by performing a checksum of each iSCSI Protocol Data Unit's (PDU's) header part using the CRC32C algorithm.
  - The Data digest works similarly to the Header digest. However, for each PDU data part, a checksum is performed using the CRC32C algorithm as well.

  To enhance data integrity on the network, Header digest and Data digest should be used in all iSCSI connection configurations, Using these features may decrease performance slightly (approximately 10%), although the decrease may be more significant with older HBAs. These features should be used with L3 switches and routers.

  If a network switch connected directly to a Hitachi Unified Storage system port supports Spanning Tree, disable this feature on the switch (refer to the documentation for your switch); otherwise, it could disrupt communications between the host and the storage system.
- Maximum Transmission Unit (MTU) refers to the number of frames required to transfer Ethernet packets in a TCP/IP network. The higher the MTU, the more efficient the network, as it will take fewer packets and fewer routing decisions to transfer data. For maximum performance, use Storage Navigator Modular 2 to configure the storage system to use an MTU size of 4500 (see Setting up host ports on page

5-11). The same MTU value must be configured at the NIC or switch connected to the storage system.

- With Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if it has been requested to be in the I/O-linked power saving mode. Depending on the combination of the host type and multi-path software, Read access at path health check, recovery from a path failure, and similar activities may cause automatic spin up from the power saving state.

## Assigning targets and VOLs to hosts

Groups of VOL that can be accessed by certain hosts are associated to a target using LU mapping. To apply CHAP authentication, the required username-secret combination can be set on a per-target basis. Up to 255 targets can be defined for an iSCSI port.

Up to 2048 LU mappings can be configured for a target. The host recognizes VOLs between H-LUN0 and H-LUN2047.

A host computer specifies a target by iSCSI name and accesses VOLs that are mapped to the target. Figure 7-14 shows an example of address setting, target setting, and LUN mapping for an iSCSI port. By mapping the same VOLs to several targets, you can map up to 16384 VOL/port combinations for each physical port.

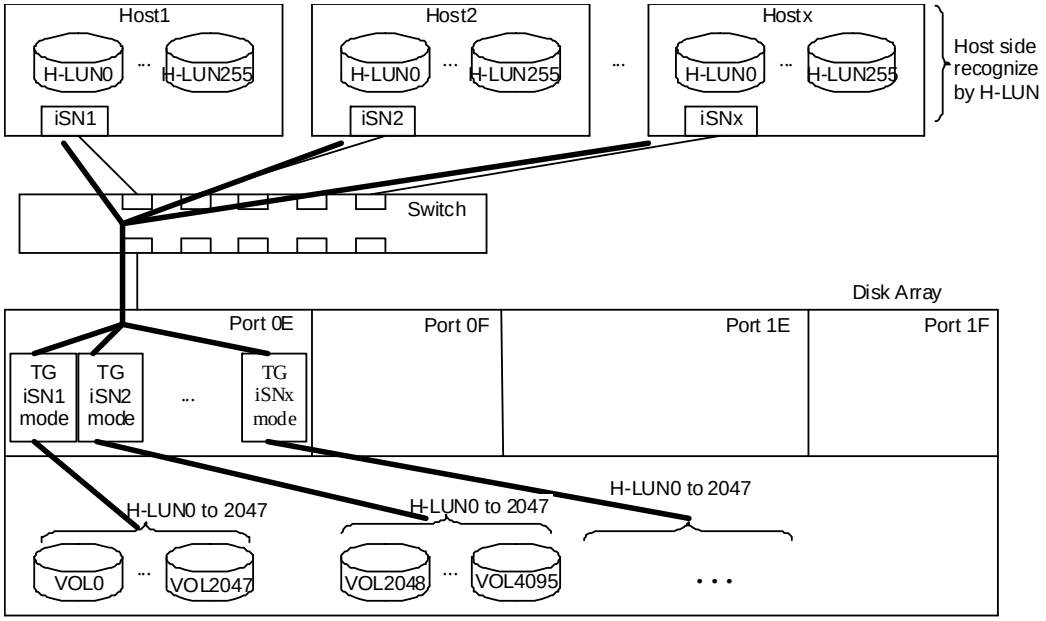



**Figure 7-14: LU mappings that can be set for targets**

# Microsoft Windows Server 2012

This section describes how to attach hosts running the Microsoft Windows Server 2012 operating system to the Hitachi Unified Storage system over an iSCSI connection.

Before proceeding, observe the following best practices:

- Directly connect the NIC, iSCSI HBA, and Ethernet switch directly to the Hitachi Unified Storage system iSCSI port. These devices must support Institute of Electrical and Electronics Engineers (IEEE) 802.3ab 1000Base-T, full-duplex operations. The storage system's optical interface is used for 10 G bps iSCSI operations.

**TIP:** We recommend you use Microsoft-approved NICs that have the Microsoft logo.

- Use an optical fibre cable (OM2/OM3) for 10 G bps iSCSI operations.
- Use a host with an iSCSI interface that is either a network port on the host motherboard or a NIC that is recommended by the vendor of the host. Use Microsoft-approved NICs that have the Microsoft logo.
- Obtain the latest vendor versions, related patches, iSCSI initiator, and MPIO multipathing software (if appropriate) for the operating system: www.microsoft.com
- To use the Hitachi Unified Storage system as an iSNS client, install Microsoft iSNS Server 3.0 or later on the same IP-SAN.
- Configure VOL 0 on the Hitachi Unified Storage system port connected to the Windows host server.
- Do not change the Challenge Handshake Authentication Protocol (CHAP) authentication settings that correspond to hosts that will be logging in to the Hitachi Unified Storage system. If you disable CHAP authentication for the Hitachi Unified Storage system while it is communicating with a Microsoft iSCSI software initiator using CHAP authentication, the host will not be able to access the target device without rebooting.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.
- If the delay Ack at the host side is enabled and the MPIO policy is set to round robin, host I/O delays might occur during packet retransmissions. To avoid host I/O delays, change the MPIO policy to the Failover setting.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use Microsoft Windows Server 2012 with multi-path software (Hitachi Dynamic Link Manager), Read access at path health check may cause automatic spin up from the power saving state.

## Microsoft iSCSI initiator

An iSCSI initiator is the software component residing on a server that is installed and configured to connect to an iSCSI target. By using an iSCSI initiator, target-based volumes can be mounted and managed on a server as if they were local volumes. Refer to the Microsoft documentation to install the Microsoft iSCSI initiator for Windows Server 2012.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All NICs and iSCSI HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0937/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value on hosts to 30 seconds or more.

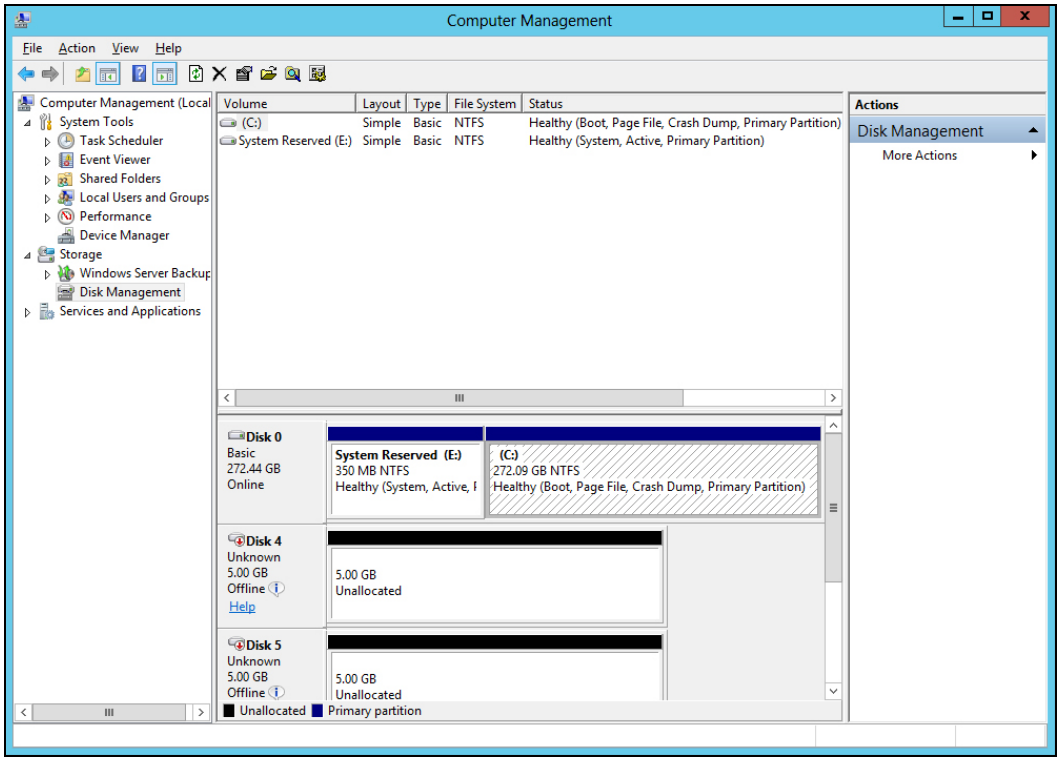
**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Verifying and discovering VOLs

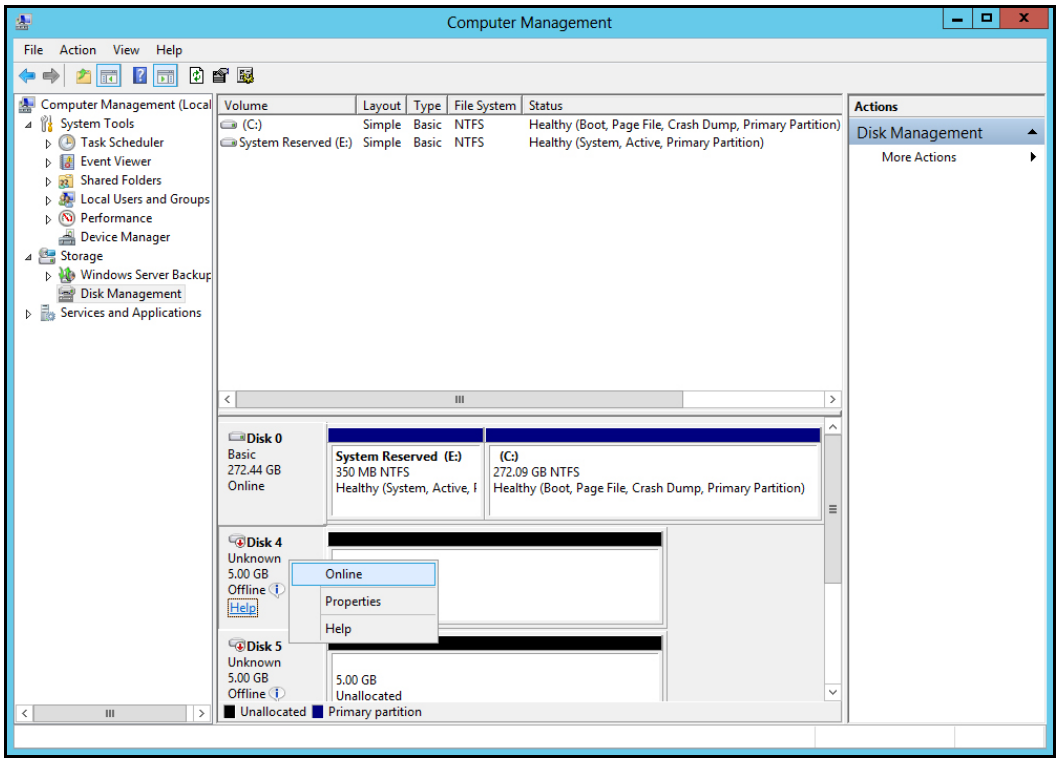
The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host. This procedure assumes you have installed Microsoft iSCSI initiator.

1. Shut down the server, turn off server power, and turn off power to all peripheral devices.
2. Connect the Hitachi Unified Storage system to the server using iSCSI cables.
3. Turn on the Hitachi Unified Storage system and check that the **READY** LED is ON.

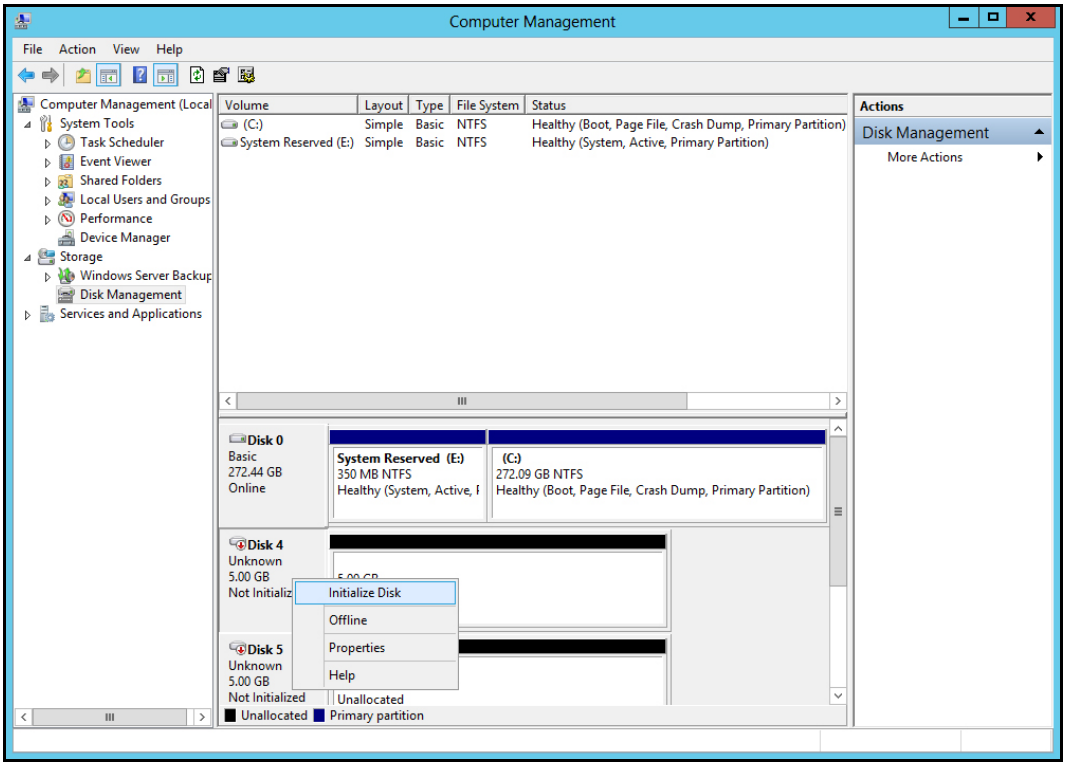
4. Turn on all peripheral devices. Then turn on the server and log in as Administrator.
5. Click **Start > Control Panel > Management Tool > Computer Management**.
6. Click **Computer Management (Local) > Storage Area > Disk Management**.



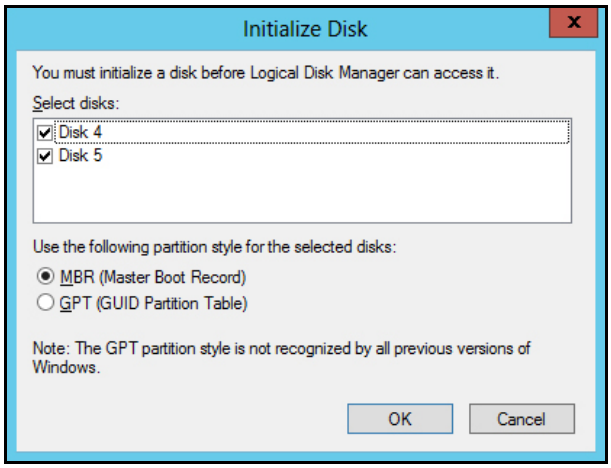

7. Select a target disk and click **Online**.



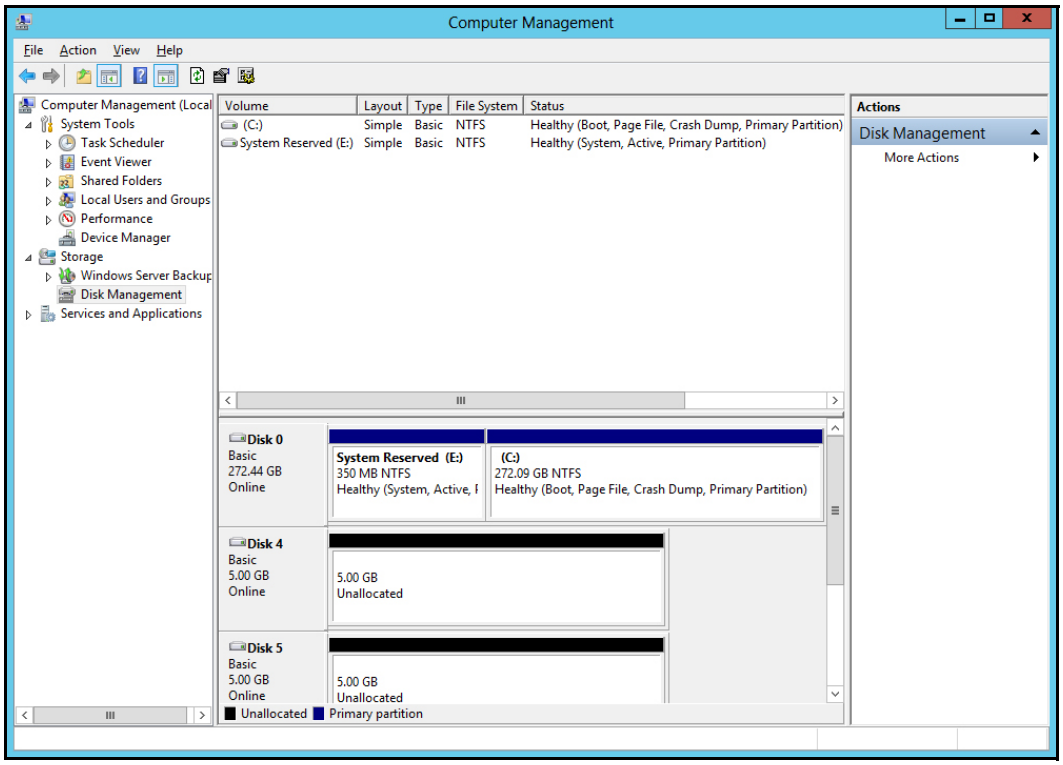

8. Select a disk to initialize and click **Initialize Disk**.



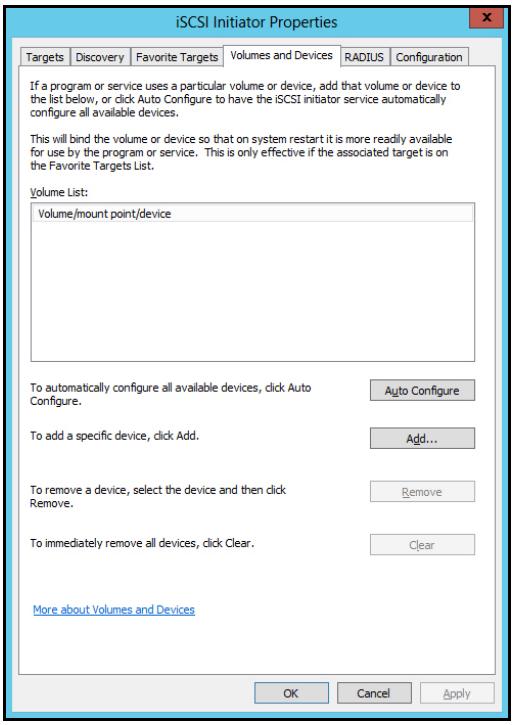

9. Check the check box of the disk to be initialized and click **OK**.



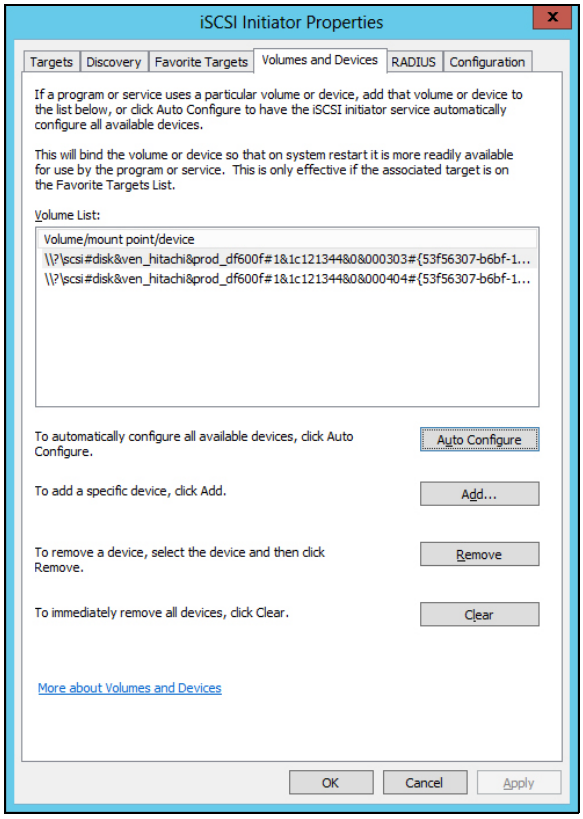

10. Check that this is the Hitachi Unified Storage system by checking the number of volumes and the capacity.




11. Start Microsoft iSCSI Software Initiator, click the **Volumes & Devices** tab, and click **Auto Configure**. (Perform this step after the VOL configuration changes.)




12. Click **OK**.




## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system are ON.
- Be sure the iSCSI cables are correctly installed and firmly connected.

The following tables provide additional troubleshooting suggestions.

**Table 7-3: Server errors with Microsoft iSCSI initiator**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| When adding a target after executing iSCSI initiator (Add Target Portals window), an error occurs and you cannot add a target. | Authorization Failure | iSCSI target security is enabled in the iSCSI security setting of Hitachi Unified Storage system. | Click **Group > iSCSI Target** in Storage Navigator Modular 2, select the iSCSI target security tab in the iSCSI target window on the right side, and change the iSCSI target security of the appropriate iSCSI port to **No** by clicking the iSCSI target security change button. |
| | Connection Failed | The host interface cable is not connected, or the IP address or port value that was specified is illegal. | Confirm that the host interface cable is connected correctly. Check whether the IP address set as "IP address or DNS name" is a correct value. The storage system's default values are: |
| | Control Unit #0 (Port A): 192.168.0.200<br>Control Unit #0 (Port B): 192.168.0.201<br>Control Unit #1 (Port A): 192.168.0.208<br>Control Unit #1 (Port B): 192.168.0.209 | | |
| | | | Check whether a correct value is set for "Port". The storage system's default value is 3260. |
| | Authentication Failure | CHAP at Discovery is not supported. | In the iSCSI initiator, click the **Advanced** button in the Add Target Portals window and Uncheck the check box **CHAP Logon information** on the **General** tab. |
| When logging on to a target (Log On to Target window), an error occurs and you cannot log on to the target. | Authentication Failure | The CHAP setting was not performed properly. | Check whether the following settings are configured properly. |

**Table 7-3: Server errors with Microsoft iSCSI initiator (Continued)**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| | **1. Forward direction setting**<br>In the Log On to Target window, click the **Advanced** button in the Log On to Target window and check that the CHAP logon information check box is checked. Also, check that User name, Target secret is the same value set in #2 below. If not, set it again.<br><br>**2. Setting CHAP user**<br>In Storage Navigator Modular 2, select the target you want to check as CHAP user and click the **CHAP User Edit** button on the **CHAP User** tab. Check that the user name, secret is the same value set in step #1 above. If not, set it again. Also, check the bidirectional setting.<br><br>**3. Setting iSCSI initiator at logon**<br>Check the CHAP logon information check box in the Advanced Settings window, click the **Advanced** button in the Log On to Target window, click the **Advanced** button, and check that the **Perform mutual authentication** check box is checked. Also, check that **Initiator Node Name**, **CHAP secret** on the **General** tab is the same value set in step 4. If not, set it again.<br><br>**4. Setting iSCSI target**<br>In Storage Navigator Modular 2, select the target whose authentication information you want to check and click the authentication setting **Edit** button. Check that the authentication method, bidirectional authentication validity, and bidirectional authentication setting are configured properly. If not, set them again. | | |
| | Authentication Failure | The same secret is set for one-way CHAP and bidirectional CHAP. | When connecting with Windows, using the same secret for one-way CHAP and bidirectional CAP prevents you from logging in from Windows. Change the secrets so they are not the same. |

**Table 7-4: Device not recognized from Disk Management**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| You cannot recognize the expected device from Disk Management. | — | LU mapping is not configured properly. | Using Storage Navigator Modular 2, select the target whose LU mapping you want to check. Click the **Target Edit** button. Click the **Volume** tab in the Target Edit dialog box and check that LU mapping is set properly. |

### Table 7-5: Device not recognized during operation

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| The host recognized the device initially and then failed. | <Windows event log><br>• Connection to the target was lost. The initiator will attempt to retry the connection.<br>• Initiator could not send an iSCSI PDU. Error status is given in the dump data.<br>• Initiator failed to connect to the target. Target IP address and TCP port number are specified in dump data. | Host interface cable was disconnected. | Check that the host interface cable is connected correctly and securely. |

### Table 7-6: VOL recognition delays or activation is released after restarting the operating system

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| After using the disk as the dynamic disk from Windows and setting activation, the activation is cancelled after restarting Windows. | — | The network common service is starting before the Microsoft iSCSI initiator service starts (before finding the disk). | Link the services so the Microsoft initiator service starts before the network common service starts. |

**Table 7-7: Host has two or more LAN connectors**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| When adding a target after executing iSCSI initiator (Add Target Portals window), an error occurs and you cannot add a target. | Connection Failed. | A network of two or more hosts and the Hitachi Unified Storage system are on different subnets. | Check that the network hosts and Hitachi Unified Storage system are on the same subnet. To achieve this, the first three octets in the IP address of the host and Hitachi Unified Storage system controller must be the same.<br><br>Examples:<br><br>Host LAN 1: 192.168.0.100<br><br>Hitachi Controller #0: 192.168.0.200<br><br>Host LAN 2: 192.168.1.100<br><br>Hitachi Controller #1: 192.168.1.209 |

# Microsoft Windows Server 2008

This section describes how to attach hosts running the Microsoft Windows Server 2008 operating system to the Hitachi Unified Storage system over an iSCSI connection.

Before proceeding, observe the following best practices:

- Directly connect the NIC, iSCSI HBA, and Ethernet switch directly to the Hitachi Unified Storage system iSCSI port. These devices must support Institute of Electrical and Electronics Engineers (IEEE) 802.3ab 1000Base-T, full-duplex operations.

**TIP:** We recommend you use Microsoft-approved NICs that have the Microsoft logo.

- Use a Category 5e (enhanced Category 5) or Category 6 network cable for each 1 Gb iSCSI connection. Use an optical fibre cable (OM2/OM3) for each 10 Gb iSCSI connections.
- Use a host with an iSCSI interface that is either a network port on the host motherboard or a NIC that is recommended by the vendor of the host.
- Obtain the latest vendor versions, related patches, iSCSI initiator, and MPIO multipathing software (if appropriate) for the operating system: www.microsoft.com
- Obtain the latest Microsoft Windows Server 2008 drivers and related patches for the NICs, iSCSI HBAs, and other devices on your storage network.
- Install Microsoft iSNS Server 3.0 or later on the same IP-SAN as the storage system if using the Hitachi Unified Storage system as an iSNS client.
- Configure VOL 0 on the Hitachi Unified Storage system port connected to the Windows host server.
- Hitachi Unified Storage systems do not support CHAP authentication in the discovery session. Disk drive authentication and formatting for iSCSI are the same as drives connected via fibre-channel.
- Do not change the Challenge Handshake Authentication Protocol (CHAP) authentication settings that correspond to hosts that will be logging in to the Hitachi Unified Storage system. If you disable CHAP authentication for the Hitachi Unified Storage system while it is communicating with a Microsoft iSCSI software initiator using CHAP authentication, the host will not be able to access the target device without rebooting.
- Enabling Header digest may decrease performance significantly, depending on network configuration, host performance, and host applications. iSCSI Data digest and Header digest should be used with an L3 switch or router that is in the path of the hosts and Hitachi Unified Storage system iSCSI port.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.

- If the delay Ack at the host side is enabled and the MPIO policy is set to round robin, host I/O delays might occur during packet retransmissions. To avoid host I/O delays, change the MPIO policy to the Failover setting.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use Microsoft Windows Server 2008 with multi-path software (Hitachi Dynamic Link Manager), Read access at path health check may cause automatic spin up from the power saving state.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All NICs and iSCSI HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0937/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value on hosts to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Microsoft iSCSI initiator

An iSCSI initiator is the software component residing on a server that is installed and configured to connect to an iSCSI target. By using an iSCSI initiator, target-based volumes can be mounted and managed on a server as if they were local volumes.

Microsoft iSCSI Initiator is included with the Microsoft Windows 2008 Server operating system. Refer to the Microsoft documentation to install the initiator.

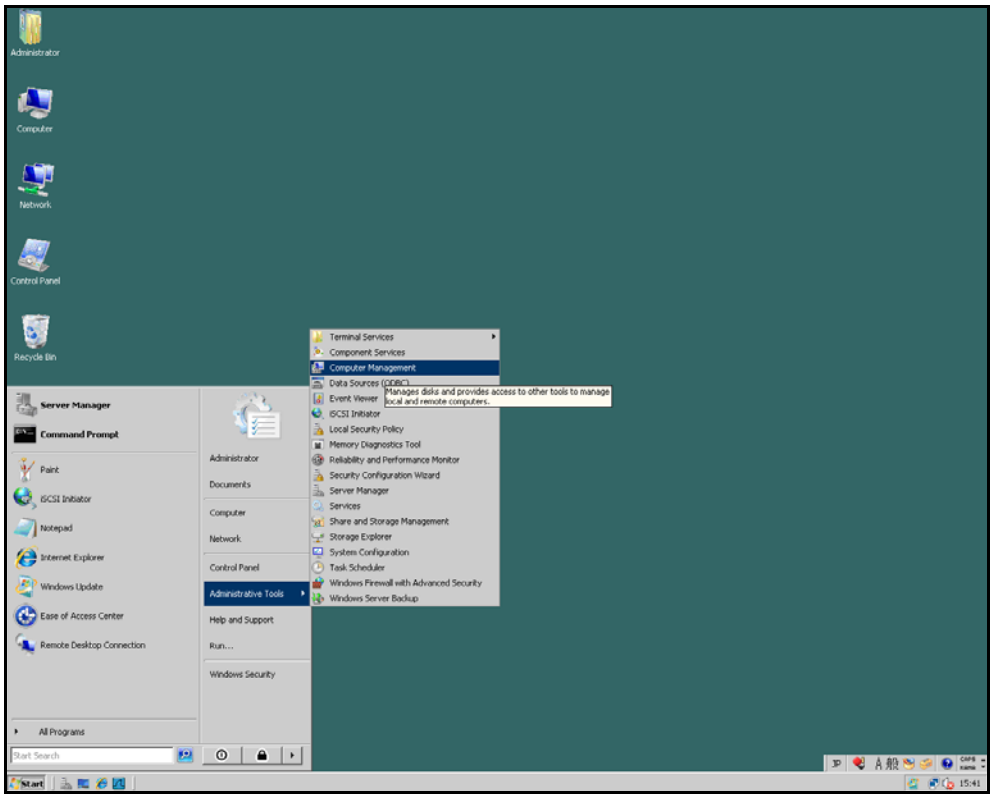
## Multipath Input/Output (MPIO) software

The Microsoft MPIO framework provides support for multiple data paths from a Windows server to your Hitachi Unified Storage system, improving fault tolerance of data connections to storage. The multiple data paths can also be aggregated to increase bandwidth for applications that require high performance. For information about dowloading, installing, and configuring MPIO, refer to the Microsoft Web site at www.microsoft.com.

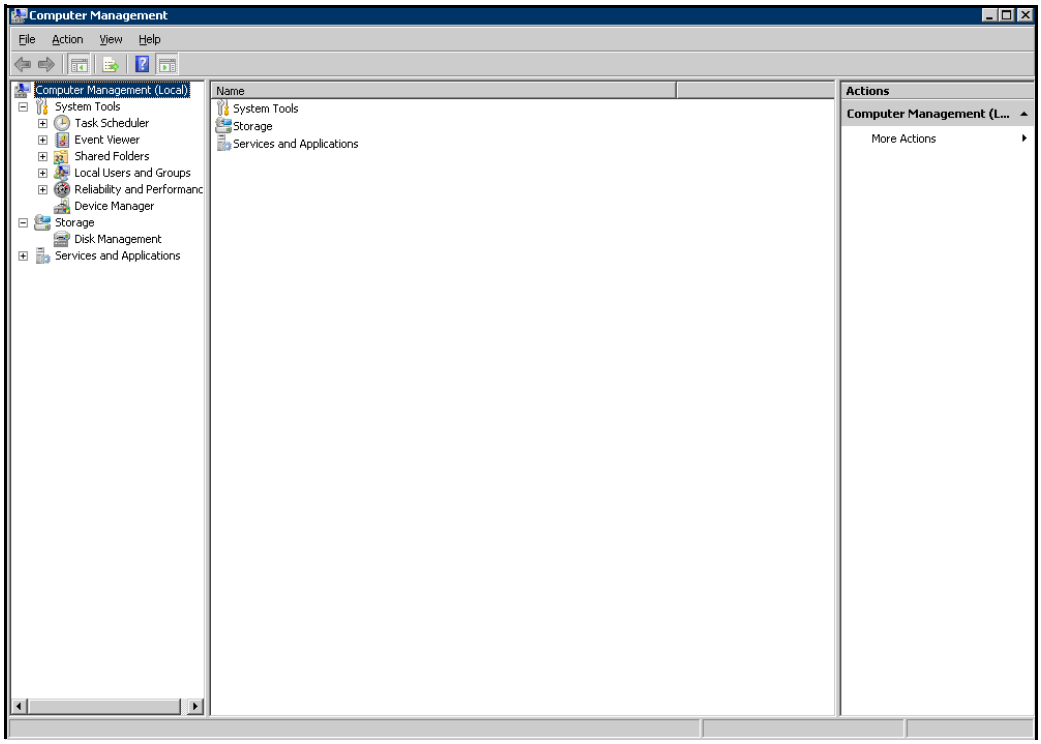
## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host. This procedure assumes you have installed Microsoft iSCSI initiator.

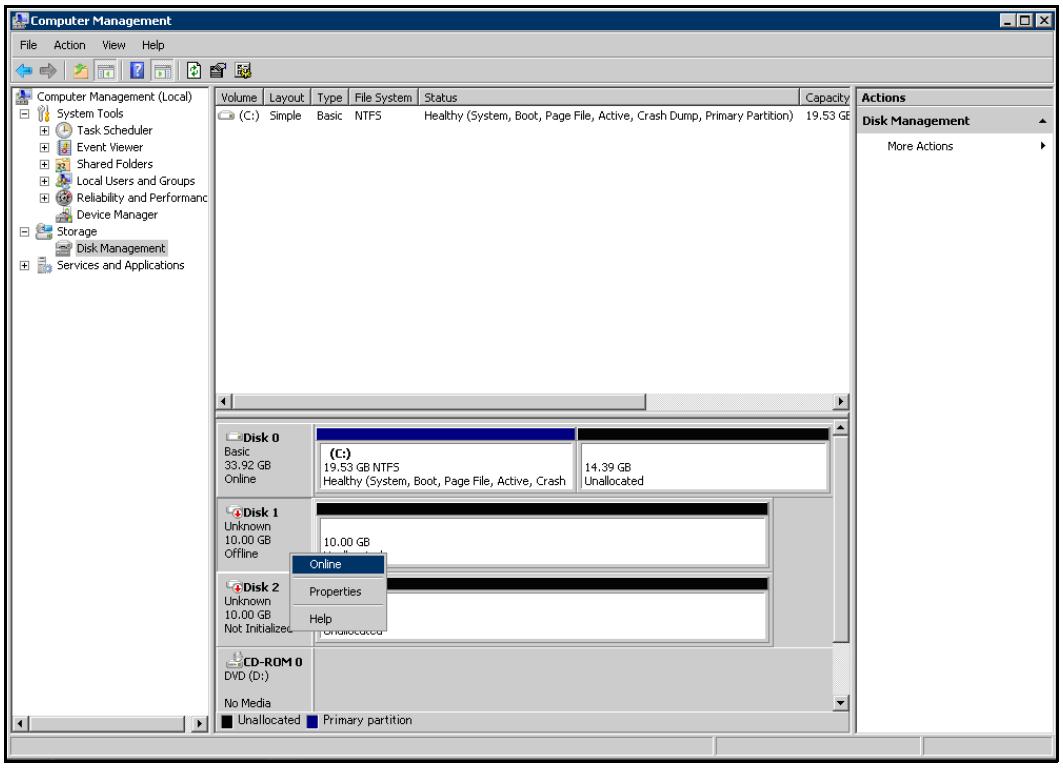
1. Shut down the server, turn off server power, and turn off power to all peripheral devices.
2. Connect the Hitachi Unified Storage system to the server using iSCSI cables.
3. Turn on the Hitachi Unified Storage system and check that the **READY** LED is ON.
4. Turn on all peripheral devices. Then turn on the server and log in as Administrator.
5. Click **Start > Control Panel > Management Tool > Computer Management**.



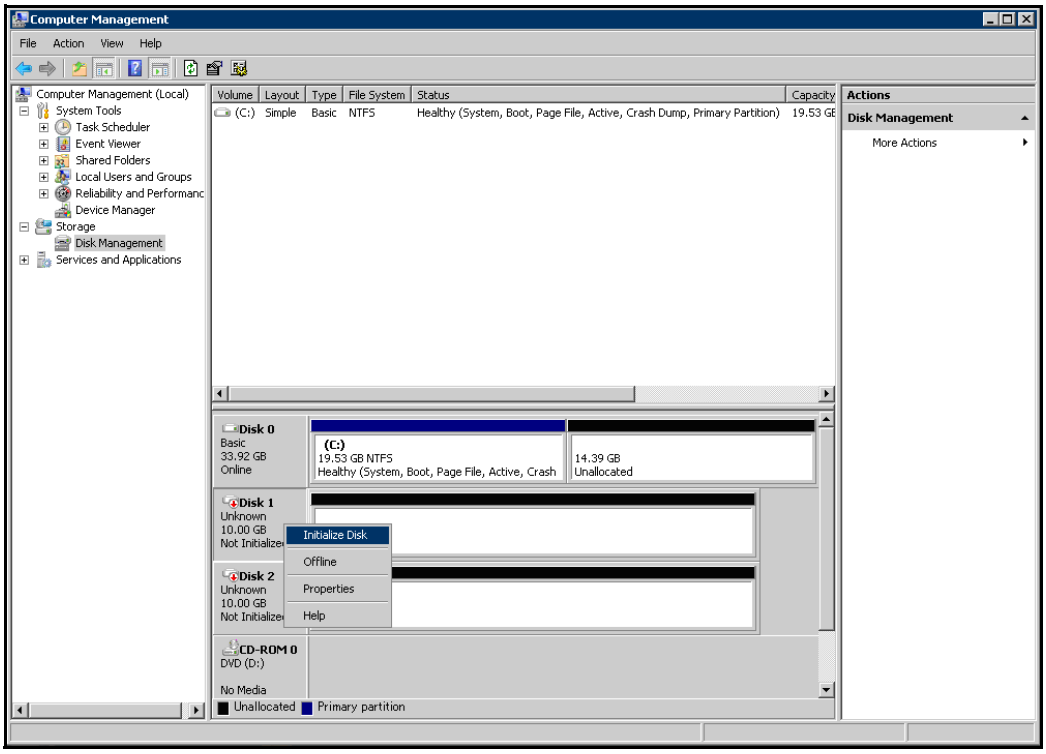

6. Click **Computer Management (Local) > Storage Area > Disk Management**.



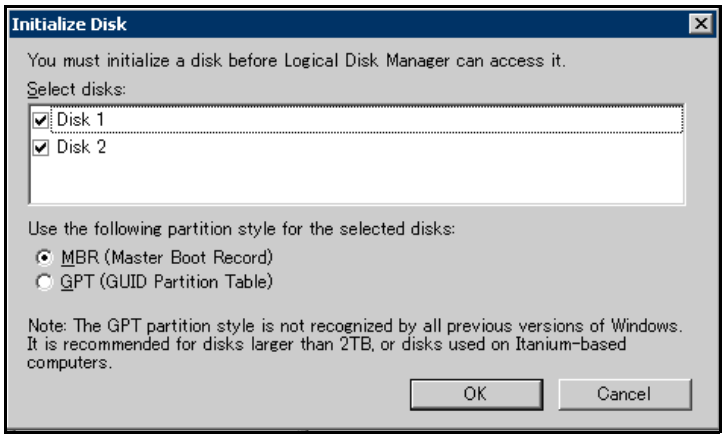

7. Select a target disk and click **Online**.



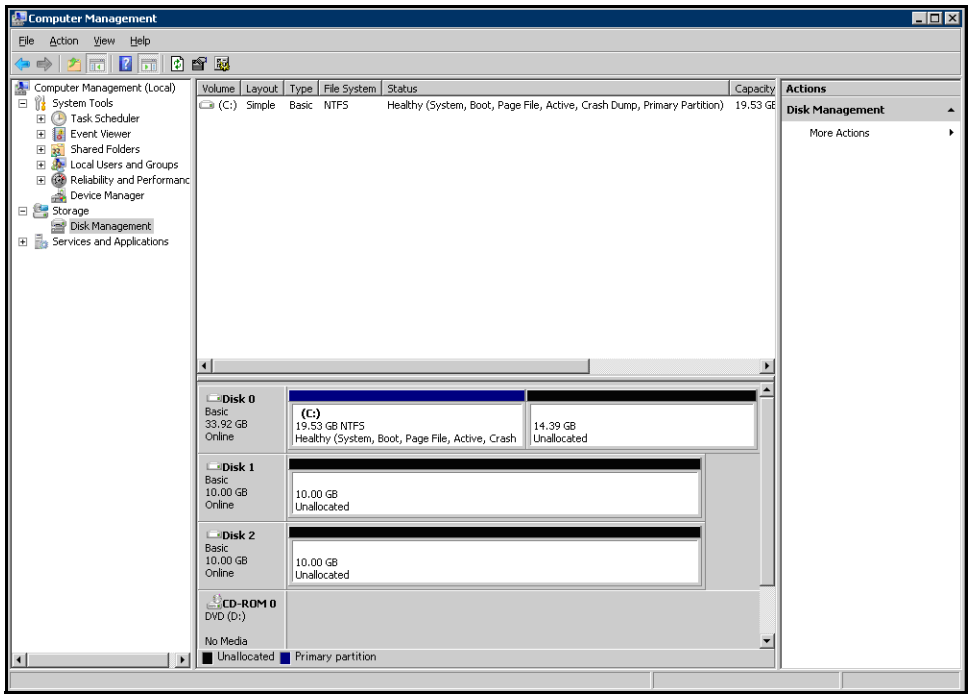

8. Select a disk to initialize and click **Initialize Disk**.



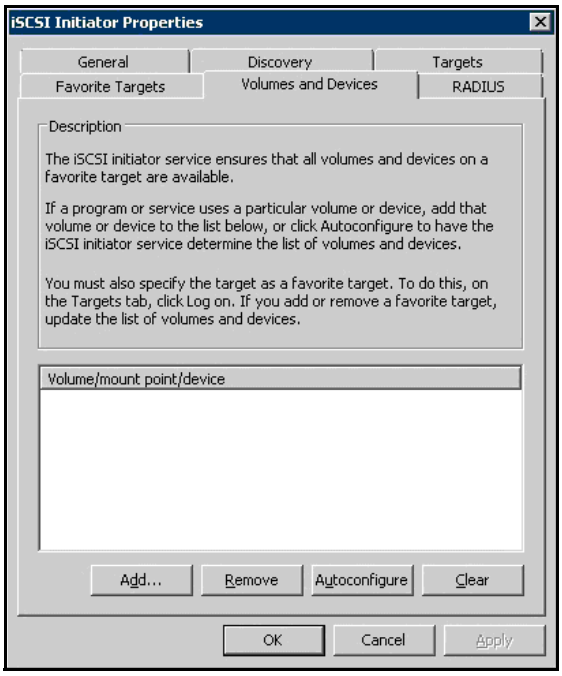

9. Check the check box of the disk to be initialized and click **OK**.



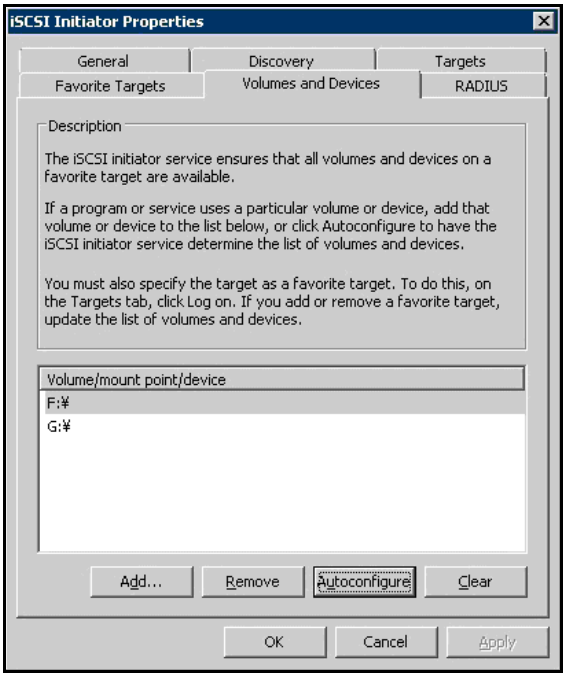

10. Check that this is the Hitachi Unified Storage system by checking the number of volumes and the capacity.




11. Start Microsoft iSCSI Software Initiator, click the **Volumes & Devices** tab, and click **Automatic Configuration**. (Perform this step after the VOL configuration changes.)




12. Click **OK**.




## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system are ON.
- Be sure the iSCSI cables are correctly installed and firmly connected.

The following tables provide additional troubleshooting suggestions.

**Table 7-8: Server errors with Microsoft iSCSI initiator**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| When adding a target after executing iSCSI initiator (Add Target Portals window), an error occurs and you cannot add a target. | Authorization Failure | iSCSI target security is enabled in the iSCSI security setting of Hitachi Unified Storage system. | Click **Group > iSCSI Target** in Storage Navigator Modular 2, select the iSCSI target security tab in the iSCSI target window on the right side, and change the iSCSI target security of the appropriate iSCSI port to **No** by clicking the iSCSI target security change button. |
| | Connection Failed | The host interface cable is not connected, or the IP address or port value that was specified is illegal. | Confirm that the host interface cable is connected correctly. Check whether the IP address set as "IP address or DNS name" is a correct value. The storage system's default values are: |
| | Control Unit #0 (Port A): 192.168.0.200<br>Control Unit #0 (Port B): 192.168.0.201<br>Control Unit #1 (Port A): 192.168.0.208<br>Control Unit #1 (Port B): 192.168.0.209 | | |
| | | | Check whether a correct value is set for "Port". The storage system's default value is 3260. |
| | Authentication Failure | CHAP at Discovery is not supported. | In the iSCSI initiator, click the **Advanced** button in the Add Target Portals window and Uncheck the check box **CHAP Logon information** on the **General** tab. |
| When logging on to a target (Log On to Target window), an error occurs and you cannot log on to the target. | Authentication Failure | The CHAP setting was not performed properly. | Check whether the following settings are configured properly. |

**Table 7-8: Server errors with Microsoft iSCSI initiator (Continued)**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| | **1. Forward direction setting**<br>In the Log On to Target window, click the **Advanced** button in the Log On to Target window and check that the CHAP logon information check box is checked. Also, check that User name, Target secret is the same value set in #2 below. If not, set it again.<br><br>**2. Setting CHAP user**<br>In Storage Navigator Modular 2, select the target you want to check as CHAP user and click the **CHAP User Edit** button on the **CHAP User** tab. Check that the user name, secret is the same value set in step #1 above. If not, set it again.<br><br>**3. Setting iSCSI initiator at logon**<br>Check the CHAP logon information check box in the Advanced Settings window, click the **Advanced** button in the Log On to Target window, click the **Advanced** button, and check that the **Perform mutual authentication** check box is checked. Also, check that **Initiator Node Name**, **CHAP secret** on the **General** tab is the same value set in step 1 above. If not, set it again.<br><br>**4. Setting iSCSI target**<br>In Storage Navigator Modular 2, select the target whose authentication information you want to check and click the authentication setting **Edit** button. Check that the authentication method, bidirectional authentication validity, and bidirectional authentication setting are configured properly. If not, set them again. | | |
| | Authentication Failure | The same secret is set for one-way CHAP and bidirectional CHAP. | When connecting with Windows, using the same secret for one-way CHAP and bidirectional CAP prevents you from logging in from Windows. Change the secrets so they are not the same. |

**Table 7-9: Device not recognized from Disk Management**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| You cannot recognize the expected device from Disk Management. | — | LU mapping is not configured properly. | Using Storage Navigator Modular 2, select the target whose LU mapping you want to check. Click the **Target Edit** button. Click the **Volume** tab in the Target Edit dialog box and check that LU mapping is set properly. |

**Table 7-10: Device not recognized during operation**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| The host recognized the device initially and then failed. | <Windows event log><br>• Connection to the target was lost. The initiator will attempt to retry the connection.<br>• Initiator could not send an iSCSI PDU. Error status is given in the dump data.<br>• Initiator failed to connect to the target. Target IP address and TCP port number are specified in dump data. | Host interface cable was disconnected. | Check that the host interface cable is connected correctly and securely. |

**Table 7-11: VOL recognition delays or activation is released after restarting the operating system**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| After using the disk as the dynamic disk from Windows and setting activation, the activation is cancelled after restarting Windows. | — | The network common service is starting before the Microsoft iSCSI initiator service starts (before finding the disk). | Link the services so the Microsoft initiator service starts before the network common service starts. |

**Table 7-12: Host has two or more LAN connectors**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| When adding a target after executing iSCSI initiator (Add Target Portals window), an error occurs and you cannot add a target. | Connection Failed. | A network of two or more hosts and the Hitachi Unified Storage system are on different subnets. | Check that the network hosts and Hitachi Unified Storage system are on the same subnet. To achieve this, the first three octets in the IP address of the host and Hitachi Unified Storage system controller must be the same.<br><br>Examples:<br><br>Host LAN 1: 192.168.0.100<br><br>Hitachi Controller #0: 192.168.0.200<br><br>Host LAN 2: 192.168.1.100<br><br>Hitachi Controller #1: 192.168.1.209 |

# Microsoft Windows Server 2003

This section describes how to attach hosts running the Microsoft Windows Server 2003 operating system to the Hitachi Unified Storage system over an iSCSI connection.

Before proceeding, observe the following best practices:

- Directly connect the NIC, iSCSI HBA, and Ethernet switch directly to the Hitachi Unified Storage system iSCSI port. These devices must support IEEE 802.3ab 1000Base-T, full-duplex operations.

**TIP:** We recommend you use Microsoft-approved NICs that have the Microsoft logo.

- Use a Category 5e (enhanced Category 5) or Category 6 network cable for each 1 Gb iSCSI connection. Use an optical fibre cable (OM2/OM3) for each 10 Gb iSCSI connections.
- Use a host with an iSCSI interface that is either a network port on the host motherboard or a NIC that is recommended by the vendor of the host.
- Obtain the latest vendor versions, related patches, iSCSI initiator, and MPIO multipathing software (if appropriate) for the operating system: www.microsoft.com
- Obtain the latest Microsoft Windows Server 2003 drivers and related patches for the NICs, iSCSI HBAs, and other devices on your storage network.
- Install Microsoft iSNS Server 3.0 or later on the same IP-SAN as the storage system if using the Hitachi Unified Storage system as an iSNS client.
- Configure VOL 0 on the Hitachi Unified Storage system port connected to the Windows host server.
- Hitachi Unified Storage systems do not support CHAP authentication in the discovery session. Disk drive authentication and formatting for iSCSI are the same as drives connected via fibre-channel.
- Do not change the Challenge Handshake Authentication Protocol (CHAP) authentication settings that correspond to hosts that will be logging in to the Hitachi Unified Storage system. If you disable CHAP authentication for the Hitachi Unified Storage system while it is communicating with a Microsoft iSCSI software initiator using CHAP authentication, the host will not be able to access the target device without rebooting.
- Enabling Header digest may decrease performance significantly, depending on network configuration, host performance, and host applications. iSCSI Data digest and Header digest should be used with an L3 switch or router that is in the path of the hosts and Hitachi Unified Storage system iSCSI port.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.

- If the delay Ack at the host side is enabled and the MPIO policy is set to round robin, host I/O delays might occur during packet retransmissions. To avoid host I/O delays, change the MPIO policy to the Failover setting.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use Microsoft Windows Server 2003 with multi-path software (Hitachi Dynamic Link Manager), Read access at path health check may cause automatic spin up from the power saving state.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All NICs and iSCSI HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0937/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value on hosts to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Microsoft iSCSI initiator

An iSCSI initiator is the software component residing on a server that is installed and configured to connect to an iSCSI target. By using an iSCSI initiator, target-based volumes can be mounted and managed on a server as if they were local volumes.

For Microsoft 2003 Server, use Microsoft iSCSI Initiator, which can be downloaded from the Microsoft Web site at www.microsoft.com.

Be sure to download the initiator that is designed for your operating system. Microsoft provides builds for both 32-bit and 64-bit Windows. In the 64-bit category, versions are available for both x64-based processors and Itanium-based processors.

After downloading the initiator, refer to the Microsoft documentation to install the initiator.

## Multipath Input/Output (MPIO) software

The Microsoft MPIO framework provides support for multiple data paths from a Windows server to your Hitachi Unified Storage system, improving fault tolerance of data connections to storage. The multiple data paths can also be aggregated to increase bandwidth for applications that require high performance. For information about dowloading, installing, and configuring MPIO, refer to the Microsoft Web site at www.microsoft.com.

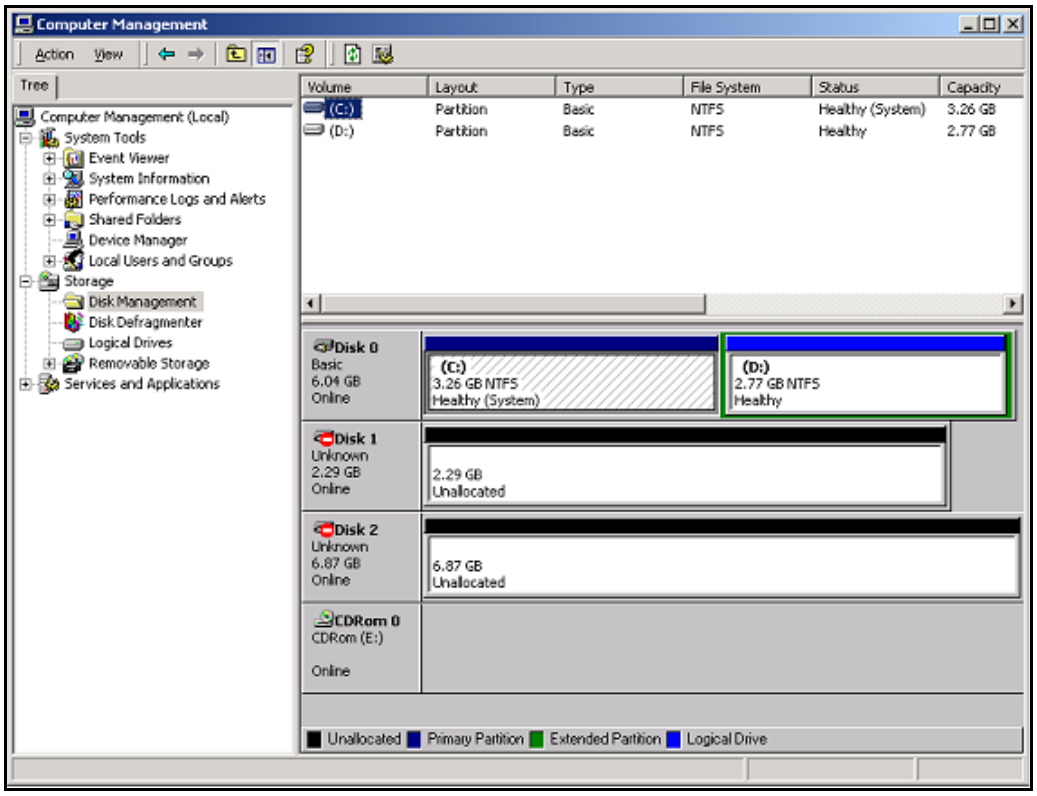
## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to confirm that you can verify and discover VOLs at the host.

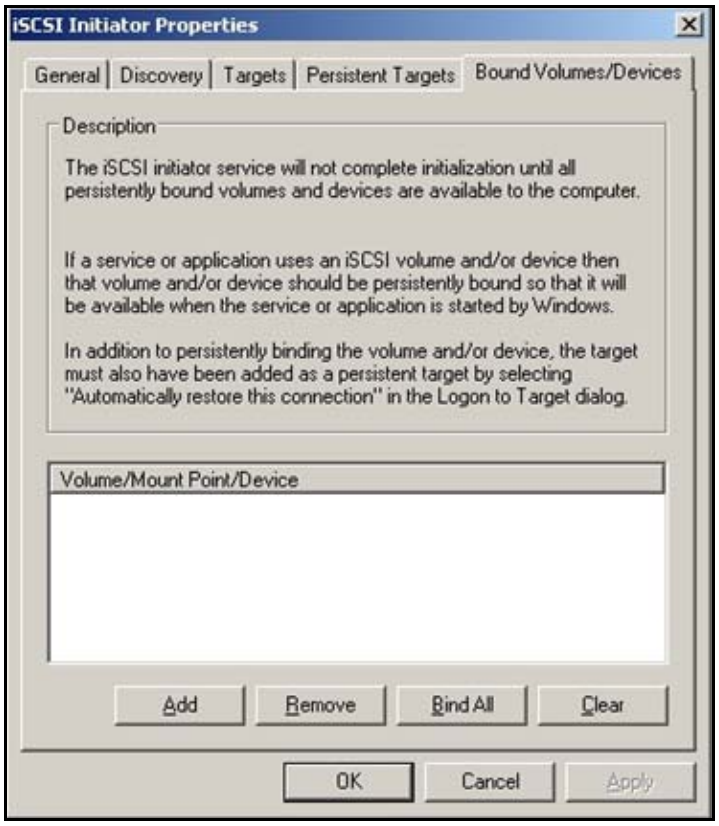
If the Hitachi Unified Storage system, Windows operating system, and HBA drivers and software are installed and working properly, VOL discovery occurs automatically.

Windows 2003 Server assigns disk numbers sequentially, starting with the local disks, and then assigns them by adapter and by TID/VOL.

- If the Hitachi Unified Storage system is attached to the first adapter (displayed first during system start-up), the disk numbers for the new devices start at 1 (the local disk is 0).
- If the Hitachi Unified Storage system is not attached to the first adapter, the disk numbers for the new devices start at the next available disk number. If 40 disks are attached to the first adapter (disks 1-40) and the Hitachi Unified Storage system is attached to the second adapter, for example, the disk numbers for the Hitachi Unified Storage system start at 41.

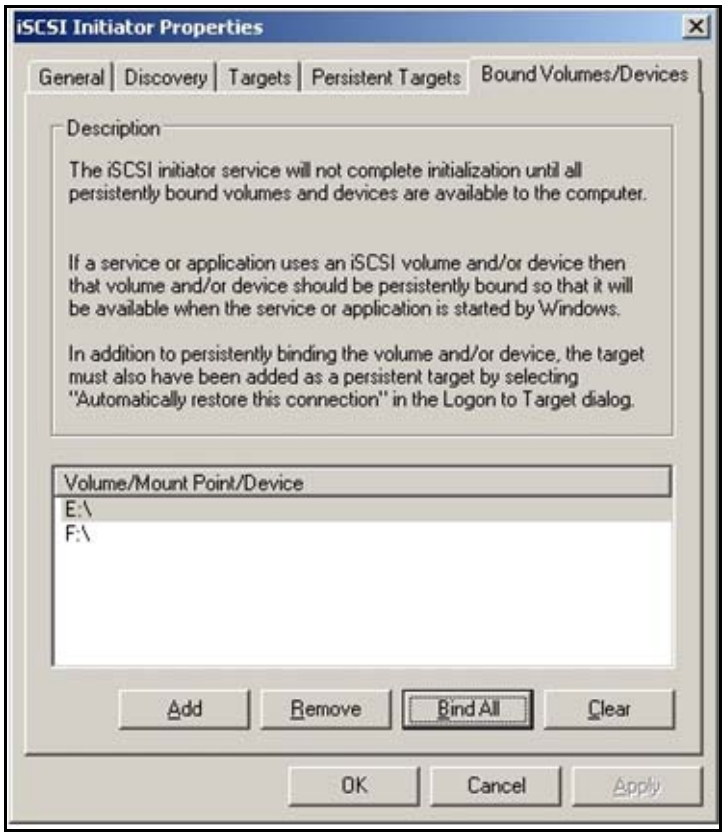



1. Start Microsoft iSCSI Software Initiator.
2. Click the **Bound Volumes/Devices** tab and click **Bind All**.




3. Click **OK**.

**NOTE:** You may want to reboot your system after adding new devices.




## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the Hitachi Unified Storage system are ON.
- Be sure the iSCSI cables are correctly installed and firmly connected.

The following tables provide additional troubleshooting suggestions.

**Table 7-13: Server errors with Microsoft iSCSI initiator**

| Problem | Message | Description | Corrective action |
|---|---|---|---|

**Table 7-13: Server errors with Microsoft iSCSI initiator (Continued)**

| | | | |
|---|---|---|---|
| When adding a target after executing iSCSI initiator (Add Target Portals window), an error occurs and you cannot add a target. | Microsoft iSCSI initiator service has not started. | When installing Microsoft iSCSI Software Initiator, you unchecked the **Initiator Service** check box in Installation Options. | Uninstall Microsoft iSCSI Software Initiator from (Add/Delete Programs in Control Panel), restart the server, and install Microsoft iSCSI Software Initiator again with the **Initiator Service** check box checked. |
| | Initiator Instance Does Not Exist. | When installing Microsoft iSCSI Software Initiator, you unchecked the **Software Initiator** check box in Installation Options. | Uninstall Microsoft iSCSI Software Initiator from (Add/Delete Programs in Control Panel), restart the server, and install Microsoft iSCSI Software Initiator again with the **Software Initiator** check box checked. |
| | Authorization Failure | iSCSI target security is enabled in the iSCSI security setting for the Hitachi Unified Storage system. | Click **Group > iSCSI Target** in Storage Navigator Modular 2, select the iSCSI target security tab in the iSCSI target window on the right side, and change the iSCSI target security of the appropriate iSCSI port to **No** by clicking the iSCSI target security change button. |
| | Connection Failed | The host interface cable is not connected, or the IP address or port value is illegal. | Check whether the host interface cable is connected correctly. Check whether the IP address set as “IP address or DNS name” is a correct value. The storage system’s default values are. |
| | Control Unit #0 (Port A): 192.168.0.200<br>Control Unit #0 (Port B): 192.168.0.201<br>Control Unit #1 (Port A): 192.168.0.208<br>Control Unit #1 (Port B): 192.168.0.209 | | |
| | | | Check whether a correct value is set for “Port”. The storage system’s default value is 3260. |

**Table 7-8: Server errors with Microsoft iSCSI initiator (Continued)**

<table>
<tr><th>Problem</th><th>Message</th><th>Description</th><th>Corrective action</th></tr>
<tr><td>When adding a target after executing iSCSI initiator (Add Target Portals window), an error occurs and you cannot add a target.</td><td>Authentication Failure</td><td>CHAP at Discovery is not supported.</td><td>In the iSCSI initiator, click the Advanced button in the Add Target Portals window and Uncheck the check box CHAP Logon information on the General tab.</td></tr>
<tr><td rowspan="3">When logging on to a target (Log On to Target window), an error occurs and you cannot log on to the target.</td><td>Authentication Failure</td><td>The CHAP setting was not performed properly.</td><td>When logging on to a target (Log On to Target window), an error occurs and you cannot log on to the target.</td></tr>
<tr><td colspan="3">1. Forward direction setting<br>In the Log On to Target window, click the Advanced button in the Log On to Target window and check that the CHAP logon information check box is checked. Also, check that User name, Target secret is the same value set in #2 below. If not, set it again.<br><br>2. Setting CHAP user<br>In Storage Navigator Modular 2, select the target you want to check as CHAP user and click the CHAP User Edit button on the CHAP User tab. Check that the user name, secret is the same value set in step #1 above. If not, set it again.<br><br>3. Setting iSCSI initiator at logon<br>Check the CHAP logon information check box in the Advanced Settings window, click the Advanced button in the Log On to Target window, click the Advanced button, and check that the Perform mutual authentication check box is checked. Also, check that Initiator Node Name, CHAP secret on the General tab is the same value set in step 1 above. If not, set it again.<br><br>4. Setting iSCSI target<br>In Storage Navigator Modular 2, select the target whose authentication information you want to check and click the authentication setting Edit button. Check that the authentication method, bidirectional authentication validity, and bidirectional authentication setting are configured properly. If not, set them again.</td></tr>
<tr><td>Authentication Failure</td><td>The same secret is set for one-way CHAP and bidirectional CHAP.</td><td>When connecting with Windows, using the same secret for one-way CHAP and bidirectional CAP prevents you from logging in from Windows. Change the secrets so they are not the same.</td></tr>
</table>

**Table 7-9: Device not recognized from Disk Management**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| You cannot recognize the expected device from Disk Management. | — | LU mapping is not configured properly. | Using Storage Navigator Modular 2, select the target whose LU mapping you want to check. Click the **Target Edit** button. Click the **Volume** tab in the Target Edit dialog box and check that LU mapping is set properly. |

**Table 7-10: Device not recognized during operation**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| The host recognized the device initially and then failed. | <Windows event log><br>• Connection to the target was lost. The initiator will attempt to retry the connection.<br>• Initiator could not send an iSCSI PDU. Error status is given in the dump data.<br>• Initiator failed to connect to the target. Target IP address and TCP port number are specified in dump data. | Host interface cable was disconnected. | Check that the host interface cable is connected correctly and securely. |

**Table 7-11: VOL recognition delays or activation is released after restarting the operating system**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| After using the disk as the dynamic disk from Windows and setting activation, the activation is cancelled after restarting Windows. | — | The network common service is starting before the Microsoft iSCSI initiator service starts (before finding the disk). | Link the services so the Microsoft initiator service starts before the network common service starts. |

**Table 7-12: Host has two or more LAN connectors**

| Problem | Message | Description | Corrective action |
|---|---|---|---|
| When adding a target after executing iSCSI initiator (Add Target Portals window), an error occurs and you cannot add a target. | Connection Failed. | A network of two or more hosts and the Hitachi Unified Storage system are on different subnets. | Check that the network hosts and Hitachi Unified Storage system are on the same subnet. To achieve this, the first three octets in the IP address of the host and Hitachi Unified Storage system controller must be the same.<br><br>Examples:<br><br>Host LAN 1: 192.168.0.100<br><br>Hitachi Controller #0: 192.168.0.200<br><br>Host LAN 2: 192.168.1.100<br><br>Hitachi Controller #1: 192.168.1.209 |

# VMware

This section describes how to attach hosts running VMware to the Hitachi Unified Storage system over an iSCSI connection.

Before proceeding, observe the following best practices:

- Directly connect the NIC, iSCSI HBA, and Ethernet switch directly to the Hitachi Unified Storage system iSCSI port. These devices must support IEEE 802.3ab 1000Base-T, full-duplex operations.
- Reboot the VMware server and configure the iSCSI l adapter(s) connected to your Hitachi Unified Storage system. Refer to the documentation for your adapters.
- Configure different iSCSI names for the target of each I/O path if using multipathing software and set the discovery (IP) addresses of the iSCSI target appropriately.
- If you use the Hitachi Unified Storage system as an iSNS client, install Microsoft iSNS Server 3.0 or later on the same IP-SAN.
- Be sure all users are experienced and trained on iSCSI driver installations.
- Do not change the Challenge Handshake Authentication Protocol (CHAP) authentication settings that correspond to hosts that are logging in to the Hitachi Unified Storage system. If you disable CHAP authentication while the Hitachi Unified Storage system communicates with a Linux iSCSI software initiator using CHAP authentication, the host will not be able to access the target device without rebooting.
- Obtain the latest versions and patches for your operating system and NIC drivers.
- To eliminate extraneous operations and reduce server loads, we recommend you stop all other services that are not being used.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All NICs and iSCSI HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0937/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value on hosts to 30 seconds or more.

**NOTE:** The RAID group I/O interlock power saving setting in Power Saving Plus does not work in VMware.

## Verifying and discovering volumes

The following procedure describes how to verify that VMware recognizes the new devices. You can also verify VOL discovery and path failover using the VMware Management Interface under submenu Option/Storage Management/Disks and volumes, and Option/Storage/Management/ Failover Paths (refer to your VMware documentation).

1. Display the device information using the `ls` and `cat` commands on the VMware vSphere ESX service console.
2. Verify that the VMware vSphere ESX recognizes the devices.
3. Record each `vmhba` number and SCSI target ID (TID) for storage port to be used when you perform VMware volume creation, labeling, and Guest OS volume assignments.

   Figure 7-15 on page 7-50 shows sample output of the `ls` command used to verify discovered volumes of the storage attached to a `vmhba` (i.e., `vmhba2`). Table 7-13 on page 7-51 shows a sample worksheet for recording the `vmhba` number, storage target SCSI ID assignment, and volume numbers.
4. Restart the VMware vSphere ESX connected to the storage port. After rebooting, the VMware vSphere ESX scans each HBA port attached to each storage port and assigns the appropriate `vmhba` number and SCSI TID. Entry for each discovered volume is placed under the directory `/proc/VMware/scsci/vmhbax`, where X is the `vmhba` number assigned for each HBA iSCSI port.
5. After the VMware vSphere ESX reboots, log in to the VMware vSphere ESX and verify HBA log in and volume discovering.
6. Verify that the log-in (green) LED is ON at the back of the two HBAs.
7. Verify that each HBA and internal SCSI controller is discovered as a VMware HBA with a SCSI ID number. For example, issue the command `cd /proc/VMware/scsi` and verify:

```
vmhba0    vmhba1    vmhba2    vmhba3    vmhba4    vmhba5 ……
```

8. Assuming that vmhba0 and vmhba1 correspond to the internal SCSI controllers, verify that the primary iSCSI HBA, vmhba2, discovers all volumes assigned to it. Issue `ls /proc/VMware/scsi/vmhba2` and verify the following reply:

   `x:0  x:1  x:2  x:3  x:4 ……..`

   where x is the target SCSI ID number for a target port attached to an HBA (vmhba2). 0,1,2,3,4 are the volume number assigned to that target port. Set the parameter Disk.MaxLUN from the Advanced Setting on the Options tab of the VMware Interface Management to an appropriate number if the discovered volume is greater than Lun7. Rebooting VMware vSphere ESX may be necessary to have the change take effect.

9. Assuming that vmhba2 is the primary and vmhba3 is the secondary path of the VMware multipath function, issue `ls /proc/VMware/scsi/vmhba3` to discover any volume entries. The display should be:

   `stats`

10. Verify that each volume has two paths. Issue `cat/proc/VMware/scsi/vmhba2/0:0` on the primary path vmhba2 for Lun0 of SCSI TID 0. Verify volume paths in the form of:

    `vmhba2:x:0  on*#`

    `vmhba3:y:0  on`

    where x is the target SCSI ID for the primary path vmhba2 and y is the secondary path vmhba3. Repeat the command and verify both paths for every discovered volume.

**NOTE:** The cat command on the volume of the secondary path vmhba3 should only return “No such file or directory.”

```
[root@VM4 root] ls /proc/VMware/scsi/vmhba2
0:0  0:2  0:4  0:6  0:8
0:1  0:3  0:5  0:7  0:9
0:10
[root@VM4 root] ls /proc/VMware/scsi/vmhba4
1:0  1:2  1:4  1:6  1:8
1:1  1:3  1:5  1:7  1:9
1:10
[root@VM4 root] cat /proc/VMware/scsi/vmhba2/0:0
Paths:fixed
vmhba2:0:0 on*#
vmhba3:0:0 on
```

**Figure 7-15: Verifying new device recognition**

**Table 7-13: Sample SCSI target ID worksheet**

| Physical HBA | VMHBA# (path) | SCSI target ID (iSCSI port) | LDEV:volume# | VMware SCSI ID assignment |
|---|---|---|---|---|
| 1st QLA2342 port 1 | 2 (Primary) | 0 (port 0A) | 0:0 | Vmhba2:0:0 |
| | | | 0:1 | Vmhba2:0:1 |
| | | | 0:2 | Vmhba2:0:2 |
| | | | ... | ... |
| 1st QLA2342 port 2 | 3 (Secondary) | 0 (port 1A) | 0:0 | Vmhba3:0:0 |
| | | | 0:1 | Vmhba3:0:1 |
| | | | 0:2 | Vmhba3:0:2 |
| | | | 0:3 | Vmhba3:0:3 |
| | | | ... | ... |
| 2nd QLA2342 port 1 | 4 (Primary) | 1 (port 0B) | 2:0 | Vmhba4:0:0 |
| | | | 2:1 | Vmhba4:0:1 |
| | | | 2:2 | Vmhba4:0:2 |
| | | | 2:3 | Vmhba4:0:3 |
| | | | ... | ... |
| 2nd QLA2342 port 2 | 5 (Secondary) | 1 (port 1B) | 2:0 | Vmhba5:0:0 |
| | | | 2:1 | Vmhba5:0:1 |
| | | | 2:2 | Vmhba5:0:2 |
| | | | 2:3 | Vmhba5:0:3 |
| and so on... | | | ... | |

**NOTE:** In Table 7-13, ports 0A and 1A share the same volumes, and ports 0B and 1B share the same volumes. In addition, the SCSI TID for ports 0B/1B can be changed to from 1 to 0.

## Adding and deleting volumes

VMware vSphere ESX supports online volume addition and deletion for Hitachi Unified Storage systems.

To add or delete volumes to both paths:

1. 1.Issue the `ls` command to verify all volumes on the primary and secondary paths.

```
[… root]# ls /proc/VMware/scsi/vmhba2
0:0  0:2  0:4  0:6  0:8
0:1  0:3  0:5  0:7  0:9
0:10
[… root]# ls /proc/VMware/scsi/vmhba3

stats

[… root]# cat /proc/VMware/scsi/vmhba2/0:0

Paths:fixed
vmhba2:0:0 on*#
vmhba3:0:0 on
```

**Figure 7-16: Volume display**

2. Issue the `vmkfstools -s` command at the vSphere ESX service console for each vmhba for vSphere ESX to scan for the newly added volumes on both primary and secondary paths.

```
[… root]# vmkfstools -s vmhba2
[… root]# vmkfstools -s vmhba3
[… root]# cos-rescan.sh vmhba2
[… root]# cos-rescan.sh vmhba3
…
```

**Figure 7-17: Using VMKFSTOOLS to scan for added/deleted devices**

3. The vSphere ESX should discover the newly added or deleted volumes. Issuing the `ls` and `cat` commands may verify this. However, newly added or deleted volumes may not appear to the VMware Management Interface until you rescan the SAN:
   a. From the Disks and volumes submenu of the Storage Management, click **rescan SAN**. Repeat the scan if necessary.
   b. Display volumes again at the service console to verify the newly added or deleted volumes.
4. From the **Disks and volumes** tab or **Failover Paths of the Storage Management**, verify newly added volumes. At any time, you can issue the `ls` and `cat` commands to verify that the volumes have been added or deleted volumes.
5. Repeat steps 1 through 4 as necessary.

**TIP:** You can use the `vmkmultipath -q | more` command instead of `cat` to quickly display multiple volume entries. You can also use the cursor key to repeat the previous command on the service console.

```
[… root]# ls /proc/VMware/scsi/vmhba2
0:0  0:2  0:6
0:1  0:3  0:7
0:10 0:4  0:8
0:11 0:5  0:9

[… root]# ls /proc/VMware/scsi/vmhba3

stats

[… root]# cat /proc/VMware/scsi/vmhba2/0:11

Paths:fixed
vmhba2:0:11 on*#
vmhba3:0:11 on
```

## Cooperative computing

Hitachi Unified Storage systems work with the VMware vStorage API to enhance performance when performing copy and backup operations in a VMware virtual environment.

Figure 7-18 shows how data is copied when the cooperative function is used or not used. Without the function, data is read to VMware and then written to the Hitachi Unified Storage. Using the function copies data inside the Hitachi Unified Storage, without going through VMware; as a result, copy and backup performance, along with resource efficiencies, are increased for both the Hitachi Unified Storage and VMware.

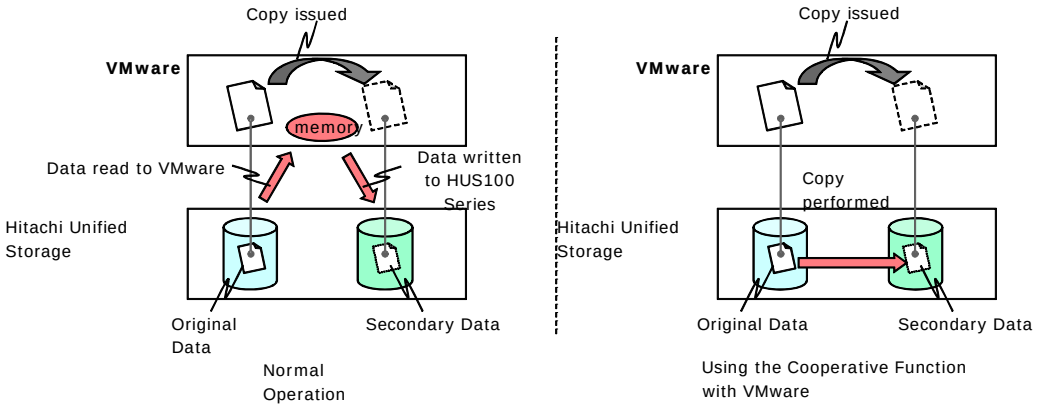



**Figure 7-18: VMware cooperative computing**

To use the function, enable the following host connection parameters. These parameters are enabled automatically if you select VMware as your platform (see Selecting platform-specific settings on page 5-23):

- Unique Extended COPY Mode
- Unique Write Same Mode

Advantages of cooperative computing cannot be achieved under the following conditions and causes VMware to revert to normal operations:

- If the Hitachi Unified Storage system has a battery failure.
- If the Hitachi Unified Storage system has a problem between the disk drives and cache memory.
- The number of data that is unable to be written to disk drives because of some failures exceeds the threshold value.
- When a certain system parameter is set and a problem with related components occurs.
- When the Battery Charging Write Command system parameter is set to Write Through and the Battery capacity is insufficient.
- When the forced write through mode system parameter is valid, and the controller gets blocked or a power unit failure occurs.
- When the Write Unique Response Mode system parameter is enabled.

If the ownership of source and destination volumes differs when the cooperative function is operating, target volume ownership changes to that of the source volume, regardless of the load balancing setting. To avoid ownership changes, set DataMover.HardwareAcceleratedMove to 0 in ESX.

When the cooperative function with VMware is operating, the vmkernel.logmay may contain entries that the 0xfe commands failed. Because the 0xfe command is an internal VMware command, such failures do not impact storage system operations. Below are examples of the 0xfe command failure in the vmkernel.log.

```
2012-11-20T14:22:52.801Z cpu0:2052)ScsiDeviceIO: 2309: Cmd(0x41240077ad40) 0xfe,
CmdSN 0x171e5 from world 249512 to dev "naa.60060e8010311a60057d55d60000002c" failed
H:0x0 D:0x2 P:0x5
Possible sense data: 0x2 0x3a 0x1
```

When using the linkage function, setting the array's host group option setting is required.

The VMware linkage function offloads operations from VMware ESX and puts them on the storage system. Execute the clone operation and others that the VMware linkage function operates in the low-load status, as the processor use rate of the array is approximately 30%. When the array has a high-load, if the VMware linkage function is used, the storage system operates in high-load status, which can affect the performance of other host I/Os. If the VMware linkage function affects the performance, stop the VMware linkage function or change the tuning parameter setting. When stopping the VMware linkage function, specify 0 for DataMover.HardwareAcceleraterdMove.

VMware ESX has a Space Reclamation function that releases the Thin Provisioning area that is no longer used in the datastore. Storage system CPU utilization becomes high when a large amount of Thin Provisioning area is released by the Space Reclamation function. Processing time associated with the Space Reclamation function are lengthy and can affect guest OS or VMware ESX operation in configurations where the number of data drives in the target volume is small or copy pairs are created. Considering the impact to performance, we recommend you use the Space Reclamation function when storage system CPU utilization is as low as 30%.

If a copy operation initiated by the XCOPY command times-out, the array returns Medium Error (03) to the VMware host. The VMware host the receiving Medium Error (03) may determine the volume to be inaccessible and stop accessing it. In such cases, enabling the Change Response for Replication Mode makes the array return an Aborted Command (0B) to the VMware host. When the VMware host receives Aborted Command (0B), it retries the XCOPY command and the operation continues.

## Troubleshooting

If you encounter problems configuring VMware hosts, refer to Table 7-14 for troubleshooting suggestions.

**Table 7-14: VMware troubleshooting**

| Problem | Corrective action |
|---|---|
| VMware Management Interface fails to access VMware vSphere ESX log-on screen | Be sure there is IP communication between the VMware Management Interface and the vSphere ESX.<br><br>Httpd service may not have been started. Verify by typing `ps -ef \|more` at the service console to check for httpd services. If not started, gracefully reboot vSphere ESX by typing `shutdown -h now`. |
| 511 Error | One of the following may have occurred:<br>• There is a SCSI device error timing-out. Check for error messages in the log file.<br>• The GUI timed out. Restart the GUI and restart the operation. |
| Cannot format an NTFS or mkfs a device successfully | You may have an intermittent cabling problem or a bad storage port. |
| Virtual Machine HBA does not see Lun8 and greater. | Verify cabling, storage volume, switch and storage security, and volume masking. Check that the Disk.MaxLUN parameter in the Advance Settings of the VMware Management Interface is greater than 8. |
| Vmkfstools -s does not add volume online. | Perform the following steps:<br>• Delete the volume. Select and add another volume and retry the process.<br>• Repeat the command and/or perform the Rescan SAN using Storage Management in the VMware Management Interface and display again. |
| Service console discovers online volume addition, but the Disks and volumes does not. | Rescan SAN and refresh. |
| VMware vSphere ESX crashes during booting. | Check for on-screen error message. The server may contain different types of HBA that are causing interoperability problems. |
| VMware does not show * for failover or failback device. | There is no I/O to the device. A rescan and refresh with the Failover Paths of the Storage Management may update the display status. |

**Table 7-14: VMware troubleshooting (Continued)**

| Problem | Corrective action |
|---|---|
| Creating VMFS-2 file shows vmfs-2.11. | ESX Server 2.5 still uses VMFS-2.11. |
| Guest OS virtual machine booting up, but not installing the OS | There is an existing corrupted vmdk file (usually due to a previous incomplete installation). Delete the vmdk file from File Manager and remove it from the Guest OS. Add a new device for the Guest OS and recreate a new vmdk image file. |
| Cannot add Meta Data File for raw device. | The Meta Data File for the raw device may have existed. Selected the existing Meta Data File, or delete the old Meta Data File and create a new one. |
| Cannot create vmdk mapping file for raw device. | Be sure the vmkfs file system is vmkfs2.11 and the raw device is attached to a non-shared (dedicated) vmhba. |
| Volume label is not successful. | Limit the number of characters to 30. |
| mkfs -t ext3 does not create ext3 file system for Linux 2.1. | Use mkfs -j for Linux 2.1. |
| Cannot delete a VMFS file. | There is an active swap file on the same extended partition.<br>• Manually turn off the swap device using the vmkfstools command from the service console and try again.<br>• Relocate the swap file to another disk. |
| Guest OS cannot communicate with the server or outside network. | Be sure a virtual switch is created and bound to a connected network adapter. |

# Red Hat Enterprise Linux

This section describes how to attach hosts running the Red Hat Enterprise Linux operating system to the Hitachi Unified Storage system over an iSCSI connection.

Before proceeding, observe the following best practices:

- Directly connect the NIC, iSCSI HBA, and Ethernet switch directly to the Hitachi Unified Storage system iSCSI port. These devices must support IEEE 802.3ab 1000Base-T, full-duplex operations.
- Use a Category 5e (enhanced Category 5) or Category 6 network cable for each 1 Gb iSCSI connection.
- Use an optical fibre cable (OM2/OM3) for each 10 Gb iSCSI connections.
- Use a host with an iSCSI interface that is either a network port on the host motherboard or a NIC that is recommended by the vendor of the host.
- Obtain the latest vendor versions, related patches, iSCSI initiator, and Device Mapper multipathing software (if appropriate) for the operating system: www.redhat.com
- Obtain the latest Red Hat Enterprise Linux drivers and related patches for the NICs, iSCSI HBAs, and other devices on your storage network.
- Install Microsoft iSNS Server 3.0 or later on the same IP-SAN as the storage system if using the Hitachi Unified Storage system as an iSNS client.
- Do not change the Challenge Handshake Authentication Protocol (CHAP) authentication settings that correspond to hosts that will be logging in to the Hitachi Unified Storage system. If you disable CHAP authentication for the Hitachi Unified Storage system while it is communicating with a Microsoft iSCSI software initiator using CHAP authentication, the host will not be able to access the target device without rebooting.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.
- When using Power Saving Plus, a RAID group automatically spins up from the power saving state according to host I/O if configured to be in the I/O-linked power saving mode. If you use Red Hat Enterprise Linux with multi-path software (Device Mapper Multipath, Veritas Volume Manager), Read access at path health check may cause automatic spin up from the power saving state.
- Linux software initiator versions less than RH5.0 establish two connections to communicate with a target. Hitachi Unified Storage 100 systems can establish up to 255 connections at the same time per iSCSI port and communicate with up to 255 hosts. However, the maximum number of hosts decreases when Linux software initiator versions less than RH5.0 are included in the hosts. For instance, if all hosts use Linux software initiator versions less than RH5.0) Hitachi Unified Storage 100 systems iSCSI can communicate with 127 hosts or less per iSCSI port.

## Configuring the iSCSI initiator

The following example uses Red Hat Enterprise Linux 6.1. Replace the IP address and iSCSI name shown with the values of the iSCSI data ports on the Hitachi Unified Storage system.

1. If the iSCSI service started, stop it.

```
# service iscsi stop
Stopping iSCSI daemon: /etc/init.d/iscsid stop
```

2. Send a ping to the target to check that the IP address is set properly.

```
# ping 192.168.0.200
PING 192.168.70.200 (192.168.0.200) 56(84) bytes of data
64 bytes from 192.168.70.200: icmp_seq=1 ttl=64 time=1.75 ms
64 bytes from 192.168.70.200: icmp_seq=2 ttl=64 time=0.196 ms
....
```

3. Register the target in /etc/iscis.conf. Specify the IP address and iSCSI name of the target in the following command. You can find the iSCSI name assigned to the port using Storage Navigator Modular 2 (refer to the Storage Navigator Modular 2 online help).

```
DiscoveryAddress = 192.168.0.200
TargetName = iqn.1994-04.jp.co.hitachi:rsd.d8s.t.12345.0a000
```

4. Start the ISCSI service.

```
# service iscsi start
"iscsid" (pid 2087 2086) is being executed...
The iSCSi target is being set: iscsiadm: No records found!  [  OK  ]
```

5. Check whether the Hitachi Unified Storage system VOL is recognized by Red Hat Enterprise Linux.

```
# dmesg
# cat /proc/scsi/scsi
```

**NOTE:** If you use IPv6 addressing with an iSCSI connection to a Linux system, select the IPv6 setting Global Address. If you select Link Local Address of IPv6, the Linux system will not recognize VOLs. If IPv6 Global Address is set to two or more interfaces on a Linux system, set the IPv6 address with a different prefix.

## Installing an HBA and HBA driver

To use a Red Hat Linux host with an iSCSI HBA to communicate with the Hitachi Unified Storage system, confirm that the iSCSI HBA is supported by the storage system. The following procedure provides general steps when using a QLogic iSCSI HBA. If you use a different iSCSI HBA, follow the steps in the documentation for that HBA.

1. Install the QLogic iSCSI HBA driver (refer to the HBA documentation).
2. Install the SANsurfer iSCSI HBA Manager for the HBA and Solaris operating system (refer to the vendor documentation).
3. Issue the following command to start SANsurfer:

```
/opt/QLogic_Corporation/SANsurfer/SANsurfer
```

4. Use SANsurfer to set the following target connection settings, as described in the SANsurfer documentation:
   - Port Option: IP address and subnet mask
   - Target Settings: IP address, subnet mask, and iSCSI name

## Data digest and header digest considerations

The parameter `DataDigest` enables DataDigest in Red Hat Enterprise Linux. The procedure for setting and confirming the DataDigest value are shown in Table 7-15. To set this value, delete the default comment mark "#" for the setting you want to configure (for example, `#DataDigest=always`).

Data reliability improves when DataDigest used; however, performance can deteriorate, depending on factors such as the host environment and network (transfer performance can deteriorate by 10%).

When using an Layer 3 switch between the host and Hitachi Unified Storage system, we recommend you select **Always**. However, when connecting the host and Hitachi Unified Storage system directly or via an L2 switch, we recommend you select **Never**.

**Table 7-15: Setting data digest, data digest values**

| Parameter | Description | Negotiation value on iSCSI login |
|---|---|---|
| Always | Always enable digest | CRC32C |
| Never | Always disable digest | None |
| Prefer-on | Prioritize enabling over disabling | CR232C or None (CRC32C is given priority) |
| Prefer-off | Prioritize disabling over enabling | None or CRC32C (None is given priority) |

The parameter HeaderDigest enables HeaderDigest in Red Hat Enterprise Linux. The procedure for setting and confirming the DataDigest value are shown in Table 7-16. To set this value, delete the default comment mark "#" for the setting you want to configure (for example, #HeaderDigest=always),

Data reliability improves when HeaderDigest used; however, performance can deteriorate, depending on factors such as the host environment and network (transfer performance can deteriorate by 10%)

When using an Layer 3 switch between the host and Hitachi Unified Storage system, we recommend you select **Always**. However, when connecting the host and Hitachi Unified Storage system directly or via an L2 switch, we recommend you select **Never**.

**Table 7-16: Setting data digest and header digest values**

| Parameter | Description | Negotiation value on iSCSI login |
|---|---|---|
| Always | Always enable digest | CRC32C |
| Never | Always disable digest | None |
| Prefer-on | Prioritize enabling over disabling | CR232C or None (CRC32C is given priority) |
| Prefer-off | Prioritize disabling over enabling | None or CRC32C (None is given priority) |

## CHAP authentication

Table 7-17 lists the CHAP authentication settings for Red Hat Enterprise Linux. Set the same value at the host and target; otherwise, the authentication fails and you cannot log in.

**Table 7-17: CHAP authentication values**

| Parameter | Description | Corresponding setting of su iSCSI |
|---|---|---|
| OutgoingUsername | Username for authentication of initiator | Username of CHAP user |
| OutgoingPasword | Password for authentication of initiator | Secret of CHAP user |
| IncomingUsername (see Note below) | Username for authentication of target | Username of target |
| IncomingPassword (see Note below) | Password for authentication of target | Secret of target |

**NOTE:** Hitachi Unified Storage systems do not support mutual CHAP authentication with a Red Hat Enterprise Linux software initiator.

```
DiscoveryAddress=192.168.0.200
  OutgoingUsername=fred
```

**Figure 7-19: Example of CHAP setting**

## Keepalive timer

Table 7-18 lists the keepalive timer values for Red Hat Enterprise Linux.

**Table 7-18: KeepAlive timer values**

| Parameter | Unit | Description | Default value | Detail |
|---|---|---|---|---|
| IdleTimeout | Seconds | Keep Alive Timer specification | 60 | Time until the host transmits NOP-Out when there is no response from the target in the “Connection” established status. |
| ActiveTimeout | Seconds | Active Timeout time specification | — | — |
| PingTimeout | Seconds | Ping Timeout time specification | 6 | Time until the host transmits FIN when there is no response from the target for NOP-OUT sent by the host. Set this value to 60 when connecting to Hitachi Unified Storage systems. |

With the KeepAliveTimer, if there is no response from the target in the “Connection” established status after the initiator sends a request, the initiator sends a FIN and disconnects the “Connection.”

- IdleTimeout — if there is no response from the target (Hitachi DF50 storage system) for the request from the initiator in the “Connection” established status that is greater than or equal to the value specified by IdleTimeout, the host sends NOP-Out and checks the “Connection” status.
- Ping Timeout — if there is no response from the target for NOP-IN that is greater than or equal to the PingTimeout value during the KeepAliveTimer monitoring, the host sends FIN and disconnects the connection (see Figure 7-20).

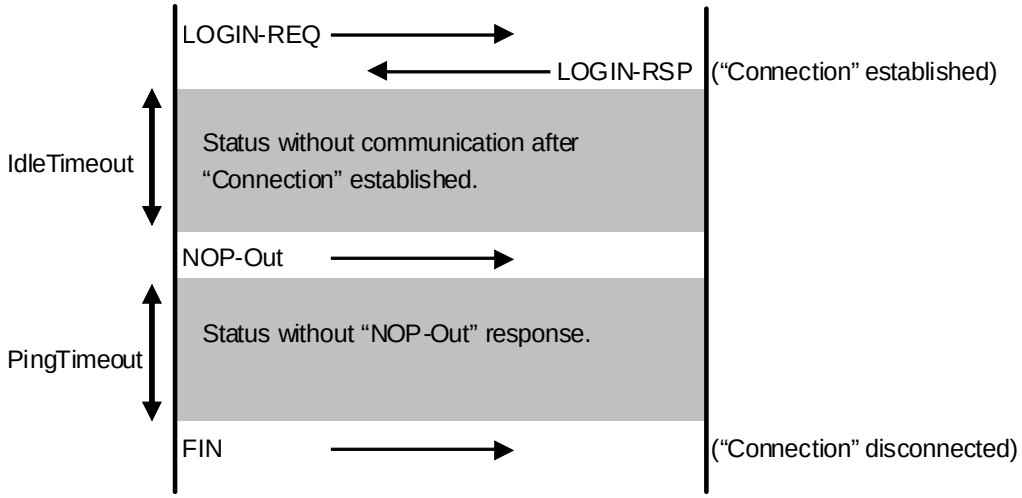



**Figure 7-20: Relation between IdleTimeout and PingTimeout in the KeepAliveTimer monitoring of Red Hat Enterprise Linux**

To configure the parameters in Figure 7-20 on page 7-61, specify a value, in seconds for <*number*> and enable them by removing the comment mark "#" written by default:

- #IdleTimeout=<*number*>
- #ActiveTimeout=<*number*>
- #PingTimeout=<*number*>

## Device Mapper multipathing

Your Hitachi Unified Storage system is compatible with Device Mapper, a multipathing software application bundled with Red Hat Enterprise Linux. If the path between a Red Hat Linux host and the Hitachi Unified Storage system fails, Device Mapper reroutes the I/O over other available paths.

For information about installing and configuring Device Mapper, refer to the Device Mapper documentation. Some Device Mapper release level documentation can be obtained from:

http://www.redhat.com/docs/en-US/Red_Hat_Enterprise_Linux/5.4/html/DM_Multipath/queueifnopath_issues.html

To ensure Active/Active I/O activity between the host Linux I/O and the Hitachi Unified Storage system, confirm that the following minimum parameters are set in the file /etc/multipath.conf:

- Vendor: Hitachi
- Product: DF600F
- Path_grouping _policy: Multibus
- prio: const

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All NICs and iSCSI HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0937/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value on hosts to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the storage system devices are ON.
- Be sure the iSCSI cables are installed properly and firmly connected.

# SuSE Linux

This section describes how to attach hosts running the SuSE Linux operating system to the Hitachi Unified Storage system over an iSCSI connection.

Before proceeding, observe the following best practices:

- Directly connect the NIC, iSCSI HBA, and Ethernet switch directly to the Hitachi Unified Storage system iSCSI port. These devices must support IEEE 802.3ab 1000Base-T, full-duplex operations.
- Use a Category 5e (enhanced Category 5) or Category 6 network cable for each 1 Gb iSCSI connection.
- Use an optical fibre cable (OM2/OM3) for each 10 Gb iSCSI connections.
- Use a host with an iSCSI interface that is either a network port on the host motherboard or a NIC that is recommended by the vendor of the host.
- Obtain the latest vendor versions, related patches, iSCSI initiator, and Device Mapper multipathing software (if appropriate) for the operating system: www.novell.com
- Obtain the latest SuSE Linux drivers and related patches for the NICs, iSCSI HBAs, and other devices on your storage network.
- Install Microsoft iSNS Server 3.0 or later on the same IP-SAN as the storage system if using the Hitachi Unified Storage system as an iSNS client.
- Do not change the Challenge Handshake Authentication Protocol (CHAP) authentication settings that correspond to hosts that will be logging in to the Hitachi Unified Storage system. If you disable CHAP authentication for the Hitachi Unified Storage system while it is communicating with a Microsoft iSCSI software initiator using CHAP authentication, the host will not be able to access the target device without rebooting.
- Stop all other services and applications that are not being used to eliminate extraneous operations and reduce server loads.

## Configuring the iSCSI initiator

Table 7-19 provides examples of SUSE Linux Enterprise Server 11 sp1.

**Table 7-19: Setting iSCSI initiator for SuSE Linux**

| Step | To perform this step | Issue these commands |
|---|---|---|
| 1. | Start the iSCSI service. | # service open-iscsi start |
| 2. | Log in to the target and discover the VOL. | # iscsiadm -m discovery<br># # iscsiadm -m node<br># iscsiadm -m node -L<br># cat /proc/scsi/scsi |
| | Stop the iSCSI service. | # service open-iscsi stop |
| | Enabling auto-login. | Edit the /etc/iscsi.conf file |
| 3. | Start the iSCSI service. | # service open-iscsi start |
| 4. | Discover the target and VOL. | # # iscsiadm -m node<br># cat /proc/scsi/scsi |

**NOTE:** If you use IPv6 addressing with an iSCSI connection to a Linux system, select the IPv6 setting Global Address. If you select Link Local Address of IPv6, the Linux system will not recognize VOLs. If IPv6 Global Address is set to two or more interfaces on a Linux system.

## Installing an HBA and driver

To use a SuSE Linux host with an iSCSI HBA to communicate with the Hitachi Unified Storage system, confirm that the iSCSI HBA is supported by the storage system. The following procedure provides general steps when using a QLogic iSCSI HBA. If you use a different iSCSI HBA, follow the steps in the documentation for that HBA.

1. Install the QLogic iSCSI HBA driver (refer to the HBA documentation).
2. Install the SANsurfer iSCSI HBA Manager for the HBA and Solaris operating system (refer to the vendor documentation).
3. Issue the following command to start SANsurfer:

```
/opt/QLogic_Corporation/SANsurfer/SANsurfer
```

4. Use SANsurfer to set the following target connection settings, as described in the SANsurfer documentation:
   - Port Option: IP address and subnet mask
   - Target Settings: IP address, subnet mask, and iSCSI name

## Data digest and header digest considerations

The parameter `DataDigest` enables DataDigest in Red Hat Linux. The procedure for setting and confirming the DataDigest value are shown in Table 7-20 on page 7-66. To set this value, delete the default comment mark "#" for the setting you want to configure (for example, `#DataDigest=always`).

Data reliability improves when DataDigest used; however, performance can deteriorate, depending on factors such as the host environment and network (transfer performance can deteriorate by 10%).

When using an Layer 3 switch between the host and Hitachi Unified Storage system, we recommend you select **Always**. However, when connecting the host and Hitachi Unified Storage system directly or via an L2 switch, we recommend you select **Never**.

**Table 7-20: Setting data digest, data digest values**

| Parameter | Description | Negotiation value on iSCSI login |
|---|---|---|
| Always | Always enable digest | CRC32C |
| Never | Always disable digest | None |
| Prefer-on | Prioritize enabling over disabling | CR232C or None (CRC32C is given priority) |
| Prefer-off | Prioritize disabling over enabling | None or CRC32C (None is given priority) |

The parameter `HeaderDigest` enables HeaderDigest in Red Hat Linux. The procedure for setting and confirming the DataDigest value are shown in Table 7-21. To set this value, delete the default comment mark "#" for the setting you want to configure (for example, `#HeaderDigest=always`),

Data reliability improves when HeaderDigest used; however, performance can deteriorate, depending on factors such as the host environment and network (transfer performance can deteriorate by 10%)

When using an Layer 3 switch between the host and Hitachi Unified Storage system, we recommend you select **Always**. However, when connecting the host and Hitachi Unified Storage system directly or via an L2 switch, we recommend you select **Never**.

**Table 7-21: Setting data digest and header digest values**

| Parameter | Description | Negotiation value on iSCSI login |
|---|---|---|
| Always | Always enable digest | CRC32C |
| Never | Always disable digest | None |
| Prefer-on | Prioritize enabling over disabling | CR232C or None (CRC32C is given priority) |
| Prefer-off | Prioritize disabling over enabling | None or CRC32C (None is given priority) |

## CHAP authentication

Table 7-22 on page 7-67 lists the CHAP authentication settings for SuSE Linux. Set the same value at the host and target; otherwise, the authentication fails and you cannot log in.

**Table 7-22: CHAP authentication values**

| Parameter | Description | Corresponding setting of su iSCSI |
|---|---|---|
| OutgoingUsername | Username for authentication of initiator | Username of CHAP user |
| OutgoingPasword | Password for authentication of initiator | Secret of CHAP user |
| IncomingUsername (see the Note below) | Username for authentication of target | Username of target |
| IncomingPassword (see the Note below) | Password for authentication of target | Secret of target |

**NOTE:** Hitachi Unified Storage systems do not support mutual CHAP authentication with SuSE Linux software initiator.

```
DiscoveryAddress=192.168.0.200
  OutgoingUsername=fred
```

**Figure 7-21: Example of CHAP setting**

## Keepalive timer

Table 7-23 lists the keepalive timer values for SuSE Linux.

**Table 7-23: KeepAlive Timer values**

| Parameter | Unit | Description | Default value | Detail |
|---|---|---|---|---|
| IdleTimeout | Seconds | Keep Alive Timer specification | 60 | Time until the host transmits NOP-Out when there is no response from the target in the “Connection” established status. |
| ActiveTimeout | Seconds | Active Timeout time specification | — | — |
| PingTimeout | Seconds | Ping Timeout time specification | 6 | Time until the host transmits FIN when there is no response from the target for NOP-OUT sent by the host. Set this value to 60 when connecting to Hitachi Unified Storage systems. |

With the KeepAliveTimer, if there is no response from the target in the “Connection” established status after the initiator sends a request, the initiator sends a FIN and disconnects the “Connection.”

- IdleTimeout — if there is no response from the target (Hitachi DF50 storage system) for the request from the initiator in the “Connection” established status that is greater than or equal to the value specified by

IdleTimeout, the host sends NOP-Out and checks the “Connection” status.

- Ping Timeout — if there is no response from the target for NOP-IN that is greater than or equal to the PingTimeout value during the KeepAliveTime monitoring, the host sends FIN and disconnects the connection (see Figure 7-22).

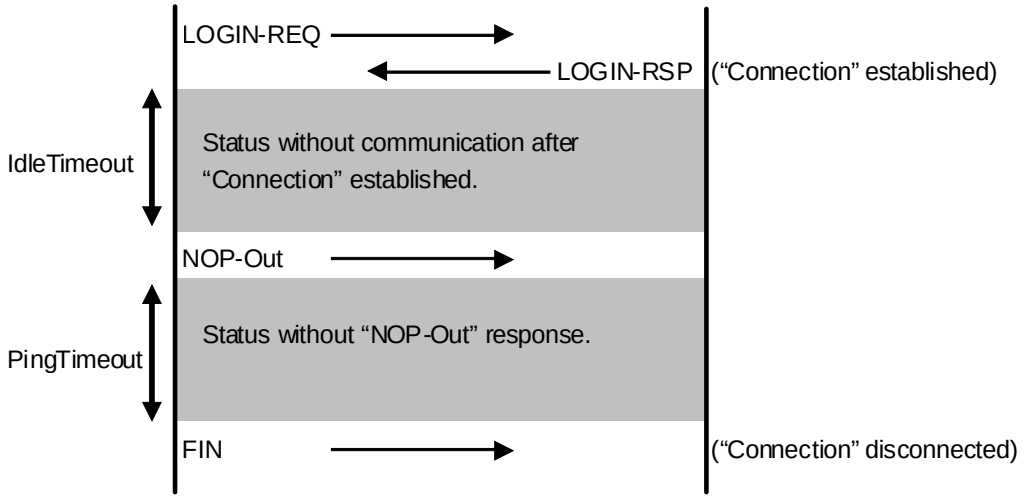



**Figure 7-22: Relation between IdleTimeout and PingTimeout in the KeepAliveTimer monitoring of SuSE Linux**

To configure the parameters in Figure 7-20 on page 7-61, specify a value, in seconds for <*number*> and enable them by removing the comment mark “#” written by default:

- #IdleTimeout=<*number*>
- #ActiveTimeout=<*number*>
- #PingTimeout=<*number*>

## Device Mapper multipathing

Your Hitachi Unified Storage system is compatible with Device Mapper, a multipathing software application bundled with SuSE Linux. If the path between a SuSE Linux host and the Hitachi Unified Storage system fails, Device Mapper reroutes the I/O over other available paths.

For information about installing and configuring Device Mapper, refer to the Device Mapper documentation. Some Device Mapper release level documentation can be obtained from:

http://www.novell.com/products/linuxpackages/desktop10/i386/device-mapper.html

To ensure Active/Active I/O activity between the host Linux I/O and the Hitachi Unified Storage system, confirm that the following minimum parameters are set in the file /etc/multipath.conf:

- Vendor: Hitachi
- Product: DF600F
- Path_grouping _policy: Multibus

- prio: const

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All NICs and iSCSI HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0937/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value on hosts to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Troubleshooting

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the storage system devices are ON.
- Be sure the iSCSI cables are installed properly and firmly connected.

# Citrix XenServer

This section describes how to attach hosts running the Citrix XenServer virtualization platform to the Hitachi Unified Storage system over an iSCSI connection.

XenServer hosts support iSCSI SANs using the openiSCSI software iSCSI initiator or a supported iSCSI HBA.

iSCSI storage is implemented based on LVHD, a technology that combines the Logical Volume Manager (LVM) and Virtual Hard Disk (VHD) standards. Virtual machine VDIs are stored on a LUN created on the Hitachi Unified Storage system.

Before proceeding, observe the following best practices:

- Obtain the documentation for your host system.
- Install a supported Citrix XenServer version. The following Web site describes the system requirements for Citrix XenServer hosts:

  www.citrix.com
- Obtain the appropriate HBAs, drivers, and firmware for your Citrix XenServer host(s).

## Microsoft Windows and Linux operating systems

Citrix XenServer supports on-demand deployment of Windows and Linux virtual machines (VMs).

- Windows VMs are always supported as hardware-based virtual machines (HVMs), with paravirtualized drivers for storage and network.
  - The drivers are installed from the Citrix XenServer installation media.
  - To use Windows VMs running under Citrix XenServer, the server processors must have hardware virtualization support, such as Intel Virtualization Technology (VT)-based processors or AMD-V-based processors.
- Linux VMs are always supported in a paravirtualized mode.

## Multipath support for Citrix XenServer hosts

XenServer 5.0 introduced Active/Active multipathing for I/O data paths over iSCSI. Dynamic multipathing uses a round-robin load-balancing algorithm that directs active traffic to both routes during normal operations. Multipathing can be enabled via XenCenter or on the command line.

The multipath driver is installed as part of the Citrix XenServer software. For an overview of multipathing on Citrix XenServer 5.0, refer to:

http://support.citrix.com/article/CTX118791

## Clustering support on Citrix XenServer hosts

Clustering of Citrix XenServer hosts, or clustering for guest operating systems within or across Citrix XenServer hosts, is not supported.

## SAN Boot

If your iSCSI HBA supports boot from LUN, perform all boot operations from the LUN set up before installing the XenServer Host. During installation, select the remote LUNs as if they were local disk drives. After you complete the installation and reboot, the system boots from the remote LUN.

Each SCSI device is symbolically linked (symlinked) under the directory `/dev/disk/by_id` using its unique `scsi_id`. If you are not sure which `scsi_id` corresponds to which device, query a device with the `sginfo` command followed by the path. For example:

```
sginfo /dev/disk/by_id/ {scsi_id}
```

Always reference iSCSI disks by this path, since it provides persistent device identification, regardless of the core device name assigned by the host which may change (for example, across host reboots).

If you add an HBA to the XenServer Host after installation, edit the file `/etc/modprobe.conf` according to the instructions in your HBA documentation. For complete compatibility details, go to the online interoperability matrix at http://www.hds.com/products/interoperability/.

## Queue depth

On your Hitachi Unified Storage system, queue depth refers to the physical limit of exchanges that can be open on a storage port at any one time. The queue depth setting specifies how many exchanges can be sent to a VOL at one time. To prevent a storage port from being overrun, consider both the number of servers that are connecting to a storage port and the number of VOLs available on that port. By knowing the number of exchanges that are pending at any one time, you can manage the storage queue depth.

To properly manage queue depths, consider both the configuration settings at the HBA in a server and the physical limits of the Hitachi Unified Storage system. **Hitachi Unified Storage systems support up to 32 commands per volume and up to 512 commands per port** (see the note below)**.** All HBAs that access a storage port must be configured with these limits in mind.

**NOTE:** For firmware version 0935/A or later, the number of commands can be extended to 1024 per port using the port option setting **Command Queue Expansion Mode** (see Selecting platform-specific settings on page 5-23).

## Device timeout

To account for time that an I/O may take to complete, set the device timeout value for the VOL to 30 seconds or more.

**NOTE:** A RAID group using the Power Saving Plus function and I/O interlock power saving spins up automatically from the power saving status interlocking with the host I/O. The spin-up from the power saving status takes from 20-to-125 seconds. If a device time-out occurs during this time, reset the device time-out value setting.

## Configuring the Citrix XenServer host

You must configure the Citrix XenServer host before you can use the host with the Hitachi Unified Storage system. Typical configuration steps include:

1. Installing and configuring the HBA on each host. This step can include one or more of the following activities (refer to your HBA documentation).
   a. Set the IP networking configuration for each port on the HBA.
   b. Add a persistent iSCSI target to each port of the HBA.
   c. Rescan the HBA controller to display the available LUNs. Record the IQN for the HBA. If an IQN is not already set on the HBA, you might need to configure an IQN for the HBA using the information in your HBA documentation.
2. Installing the XenServer iSCSI initiator.
3. Creating Storage Repositories. Refer to the XenServer documentation and to the following Web site: www.citrix.com
4. Creating an initiator group.
5. Creating a new LUN specifying the HBA iSCSI Qualified Names (IQNs) for each host in the pool. See Configuring mapping (iSCSI) on page 5-84.
6. Creating the HBA Storage Repository.
7. For a multipath installation, refer to the XenServer Installation Guide.
8. Verifying and discovering VOLs. See Verifying and discovering VOLs below.

## Verifying and discovering VOLs

The final step when installing and configuring your Hitachi Unified Storage system is to verify and discover VOLs at the host. This step assumes you have configured zones in your switches for hosts and your storage ports.

1. Leave the server running.
2. Stop all the peripheral devices.
3. Connect the Hitachi Unified Storage system to the server using iSCSI cables.
4. Start the Hitachi Unified Storage system and check that it is in the Ready status.

5. Start all the peripheral devices, check that they are in the Ready status.
6. Use XenServer to discover new Storage Repositories.

## Troubleshooting

Observe the following troubleshooting guidelines.

- If you run Citrix XenServer EE 5 Update 2 on a Windows 2008 EE SP1 (x84-64) virtual machine, you can experience the Windows stop message if you configured more than one vCPU.
- If you run multiple Citrix XenServer hosts as part of a shared resource pool, one of the hosts can become unresponsive when you perform Hitachi Unified Storage system activities, such as adding, removing, or resetting nodes.

If the system does not recognize the VOL devices on the Hitachi Unified Storage system:

- Confirm that the **READY** LEDs on the storage system devices are ON.
- Be sure the iSCSI cables are installed properly and firmly connected

# 8

# Connecting to Hitachi Virtual Storage Platform

The Hitachi Virtual Storage Platform is a 3D scaling storage platform that moves block, file, and content data dynamically across virtual storage tiers. It supports host-transparent migration with storage virtualization and reduces outage windows.

This appendix contains guidelines to follow when connecting Hitachi Unified Storage systems to the Hitachi Virtual Storage Platform.

The following topics are covered in this appendix:

- Operating host servers
- Best practices
- Performance guidelines
- Verifying and discovering VOLs
- Troubleshooting

## Operating host servers

For information about operating host servers, refer to the *Hitachi Universal Volume Manager User's Guide*.

## Best practices

Observe the following guidelines when using the Hitachi Virtual Storage Platform with Hitachi Unified Storage systems.

- Limit the queue depth on the Hitachi Virtual Storage Platform. Queue depth values can be configured using the World Wide Name (WWN) parameter on the Hitachi Virtual Storage.
- Total command multiplicity to a Hitachi Unified Storage system should be less than 500. To calculate this value, use the following formula:

  QueueDepth × Number of paths for each external volume × Number of external volumes accessed simultaneously < 500
- The number of received command tags for each volume of a Hitachi Unified Storage system can be ascertained using Performance Monitor on the Hitachi Unified Storage system by selecting **Volume > Tag count** in Hitachi Storage Navigator Modular 2.
- Use volume mapping on the Hitachi Unified Storage system to configure no more than two paths for each external volume. To maintain redundancy, assign each path to separate ports on each Hitachi Unified Storage system controller.
- If you use Hitachi Unified Storage external volumes with Hitachi Virtual Storage Platform Copy functions, configure or schedule copy operations of the copy pairs on the external volumes into multiple RAID groups on the Hitachi Unified Storage.
- In the unlikely event that a Hitachi Unified Storage controller becomes blocked and causes a time-out for at least 40 seconds, all paths to the Hitachi Virtual Storage may become blocked. To prevent the paths from becoming blocked, change the timer values to the values in Table 8-1.

**Table 8-1: Timer values**

| Timer | Default value | Change to this value |
|---|---|---|
| I/O TOV | 15 seconds | 25 seconds |
| Path Watch | 10 seconds | 35 seconds |
| Server time-out | I/O TOV × 2 margin (10 seconds) | Greater than 60 seconds |

# Performance guidelines

To avoid performance degradation caused by Hitachi Unified Storage failures, observe the following performance guidelines.

- Hitachi Unified Storage controller failures can reduce Read/Write performance by half. To ensure the Hitachi Virtual Storage Platform's average CPU utilization is less than 50%, conduct a thorough performance review.
- Hitachi Unified Storage backend failures can reduce Read/Write performance by half. Ensure that backend failures will not occur to avoid such performance degradation.
- Hitachi Unified Storage drive failures can reduce Read operations by half and Write operations by approximately one-third. To avoid these failures, take all steps and best practices to ensure that optimum system performance can be sustained even when problems occur.
- The activities in Table 8-2 can require high CPU utilization or significant drive I/O, which can have an adverse effect on the performance of the external connection. Consider performing CPU and disk-intensive activities during non-peak hours.

**Table 8-2: Activities requiring high CPU and drive I/O resources**

| Activity | Operation and status | Affects the performance of... |
|---|---|---|
| Volume format | Volume format operation to normal volume | CPU and RAID group operation of the volume |
| Online microcode update | Run online microcode update | CPU |
| RAID group extension | Run RAID group extension | CPU and RAID group |
| Hitachi Dynamic Provisioning Pool operation | Create | CPU and RAID group operation of the affected pool |
| | Extension | |
| | Reinitialize | |
| | Shrink | |
| Hitachi Dynamic Provisioning DP Vol operation | Create | CPU and RAID group of the affected DP Vol |
| | Shrink | |
| | Reduction | |
| | Delete | |
| | Pool rebalance | |
| | Format | |
| | Full Capacity | |
| ShadowImage in-system replication copy operations | Except SMPL, PSUS | CPU and RAID group operation of the affected pair. Do not use Hitachi Unified Storage copy functions for external volumes. Separate RAID groups between those for external volume and those for the copy pair. |
| Copy-on-write SnapShot copy operations | Except SMPL | |
| TrueCopy remote replication and TrueCopy Extended Distance copy operations | Except SMPL, PSUS | |
| Online force parity recovery | Recovery | CPU and RAID group operation of the affected volume |
| Modular Volume Migration operation | Start | CPU and RAID group operation of the affected pair |

## Verifying and discovering VOLs

After volumes have been verified and discovered, refer to the *Hitachi Universal Volume Manager User's Guide* for information about VOLs.

**NOTE:** SAS 7.2K rpm drives deliver higher capacity and higher performance than SATA drives. On the Hitachi Virtual Storage Platform, **External VOL Information** is used to differentiate SAS 7.2K rpm drives from SATA drives. To identify SAS 7.2K rpm drives on the Hitachi Unified Storage, use Hitachi Storage Navigator Modular 2.

## Troubleshooting

If you encounter a problem when attaching a host to the Hitachi Unified Storage system, see Chapter 10, Troubleshooting. For information about Hitachi Virtual Storage Platform. refer to the *Hitachi Universal Volume Manager User's Guide*.

9

# Connecting to Hitachi Universal Storage Platform V/ Hitachi Universal Storage Platform VM

Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM are high-performance, highly reliable enterprise-class storage system. Both systems offer advanced virtualization of externally attached storage, logical partitioning, thin provisioning, and universal replication.

This appendix contains guidelines to follow when connecting Hitachi Unified Storage systems to Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM.

The following topics are covered in this appendix:


- Operating host servers
- Best practices
- Performance guidelines
- Verifying and discovering VOLs
- Troubleshooting

## Operating host servers

For information about operating host servers, refer to the *Hitachi Universal Volume Manager User's Guide*.

## Best practices

Observe the following guidelines when operating Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM with Hitachi Unified Storage systems.

- Limit the queue depth on the Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM. Queue depth values can be configured using the World Wide Name (WWN) parameter on the Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM.
- Total command multiplicity to a Hitachi Unified Storage system should be less than 500. To calculate this value, use the following formula:

  QueueDepth × Number of paths for each external volume × Number of external volumes accessed simultaneously < 500
- The number of received command tags for each volume of a Hitachi Unified Storage system can be ascertained using Performance Monitor on the Hitachi Unified Storage system by selecting **Logical Unit > Tag count** in Hitachi Storage Navigator Modular 2.
- To determine the number of received command tags for each Hitachi Unified Storage volume, start Hitachi Storage Navigator Modular 2 at the Hitachi Unified Storage system, and then start Performance Monitor and select **Volume > Tag count**.
- Use volume mapping on the Hitachi Unified Storage system to configure no more than two paths for each external volume. To maintain redundancy, assign each path to separate ports on each Hitachi Unified Storage system controller.
- If you use Hitachi Unified Storage external volumes with the Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM Copy functions, configure or schedule copy operations of the copy pairs on the external volumes into multiple RAID groups on the Hitachi Unified Storage.
- In the unlikely event that a Hitachi Unified Storage controller becomes blocked and causes a time-out for at least 40 seconds, all paths to the Hitachi Virtual Storage may become blocked. To prevent the paths from becoming blocked, change the timer values to the values in Table 9-1.

**Table 9-1: Timer values**

| Timer | Default value | Change to this value |
|---|---|---|
| I/O TOV | 15 seconds | 25 seconds |
| Path Watch | 10 seconds | 35 seconds |
| Server time-out | I/O TOV × 2 margin (10 seconds) | Greater than 60 seconds |

# Performance guidelines

To avoid performance degradation caused by Hitachi Unified Storage failures, observe the following performance guidelines.

- Hitachi Unified Storage controller failures can reduce Read/Write performance by half. To ensure the Hitachi Universal Storage Platform V's and Hitachi Universal Storage Platform VM's average CPU utilization is less than 50%, conduct a thorough performance review.
- Hitachi Unified Storage backend failures can reduce Read/Write performance by half. Ensure that backend failures will not occur to avoid such performance degradation.
- Hitachi Unified Storage drive failures can reduce Read operations by half and Write operations by approximately one-third. To avoid these failures, take all steps and best practices to ensure that optimum system performance can be sustained even when problems occur.
- The activities in Table 9-2 can require high CPU utilization or significant drive I/O, which can have an adverse effect on the performance of the external connection. Consider performing CPU and disk-intensive activities during non-peak hours.

**Table 9-2: Activities requiring high CPU and drive I/O resources**

| Activity | Operation and status | Affects the performance of... |
|---|---|---|
| Volume format | Volume format operation to normal volume | CPU and RAID group operation of the volume |
| Online microcode update | Run online microcode update | CPU |
| RAID group extension | Run RAID group extension | CPU and RAID group |
| Hitachi Dynamic Provisioning operation | Create | CPU and RAID group operation of the affected pool |
| | Extension | |
| | Reinitialize | |
| | Shrink | |
| Hitachi Dynamic Provisioning DP | Create | CPU and RAID group of the affected DP Vol |
| | Reduction | |
| | Delete | |
| | Pool rebalance | |
| | Format | |
| | Full Capacity | |
| ShadowImage in-system replication copy operations | Except SMPL, PSUS | CPU and RAID group operation of the affected pair. Do not use Hitachi Unified Storage copy functions for external volumes. Separate RAID groups between those for external volume and those for the copy pair. |
| Copy-on-write SnapShot copy operations | Except SMPL | |
| TrueCopy remote replication and TrueCopy Extended Distance copy operations | Except SMPL, PSUS | |
| Online force parity recovery | Recovery | CPU and RAID group operation of the affected volume |
| Modular Volume Migration operation | Start | CPU and RAID group operation of the affected pair |

## Verifying and discovering VOLs

After volumes have been verified and discovered, refer to the *Hitachi Universal Volume Manager User's Guide* for information about VOLs.

**NOTE:** SAS 7.2K rpm drives deliver higher capacity and higher performance than SATA drives. On the Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM, **External VOL Information** is used to differentiate SAS 7.2K rpm drives from SATA drives. To identify SAS 7.2K rpm drives on the Hitachi Unified Storage, use Hitachi Storage Navigator Modular 2.

## Troubleshooting

If you encounter a problem when attaching a host to the Hitachi Unified Storage system, see Chapter 10, Troubleshooting.

# 10

# Troubleshooting

In the unlikely event you encounter a problem with your Hitachi Unified Storage system, refer to the information in this chapter to identify and resolve the problem.

The topics covered in this chapter are:

- General troubleshooting
- Troubleshooting Storage Navigator Modular 2
- Working with firewalls
- Email alert notifications
- Guidelines when using flash drives/FMDs

# General troubleshooting

Table 10-1 provides general troubleshooting information.

**Table 10-1: General troubleshooting**

| Problem | Corrective action |
|---|---|
| Missing or damaged parts | If any of the contents included with the storage system are missing or damaged, contact your place of purchase immediately. |
| Host cannot access storage | 1. Verify that the port activity LED on the used data port is ON. If not, try a different data port.<br>2. Check that all data port cables are connected securely at both ends.<br>3. Send a ping command from the host to the storage system. If the ping fails, verify that the host is communicating with the storage system at the appropriate IP address.<br>4. Check whether other devices in your network, such as a router or switch, are the cause of the problem.<br>5. If these steps do not fix the problem, contact HDS Support at portal.hds.com. |
| Switches and other devices cannot communicate with the storage system. | Check whether the negotiation setting for the storage system is correct. The default value for the negotiation is Auto.<br><br>If you are using fixed (static) negotiation settings with the storage system, be sure the same settings are used on the devices trying to connect to it (see Table 10-2 on page 10-6). |
| Are the correct values set for the storage system IP address, subnet mask, and default gateway? | Set appropriate value IP address, subnet mask, and default gateway settings for the storage system for the customer environment.<br><br>[IPv4 default value]<br>controller #0:<br>IP Address:192.168.0.16<br>Subnet Mask:255.255.255.0<br>default gateway:0.0.0.0<br>controller #1:<br>IP Address:192.168.0.17<br>Subnet Mask:255.255.255.0<br>default gateway:0.0.0.0<br><br>[IPv6 default value]<br>controller #0:<br>IP Address: Auto<br>controller #1:<br>IP Address: Auto |

**Table 10-1: General troubleshooting (Continued)**

| Problem | Corrective action |
|---|---|
| Is the storage system configured for DHCPv4? | If the storage system is configured to use DHCPv4, connect with the IP address assigned by the DHCP v4 server. When using DHCP v4 server, configure the storage system to use a static IP address.<br><br>If the storage system does not receive an IP address from a DHCP server when it is configured for DHCP, Hitachi Storage Navigator Modular 2 cannot connect to the storage system. Contact your network administrator, and review the DHCP v4 server settings.<br><br>[default value]<br>DHCP v4:Off (Static IP Address) |
| Is the storage system's IP address being used by other storage systems or hosts? | If the storage system us using the same IP address use by other devices, Storage Navigator Modular 2 cannot connect to the storage system. Assign an IP address to the storage system that is not used by another device. |
| Have the correct IP address, subnet mask, and default gateway settings been configured for the host? | Use Storage Navigator Modular 2 to set the IP address, subnet mask, and default gateway that the host can use to communicate with the storage system. |
| Is the TCP/UDP port filtering being performed on the network switch? | The default TCP port number for Storage Navigator Modular 2 is 2000.<br><br>[default port umber]:2000(standard)<br>28355(secure)<br><br>Change the default port number in environments where the Cisco SIP Phone is used. |
| Is IPv6 Search Array being performed across IPv6 routers? | The IPv6 Auto Search Array uses link-local scope multicast. An IPv6 router cannot transfer this multicast to other local links, so the IPv6 router is unable to search the storage system across an IPv6 router. For situations involving different local links, register the storage system by searching static IP addresses. |
| Is packet filtering enabled? | There may be a condition when a host cannot connect to the storage system temporarily. In this case, wait at least one minute and try connecting to the storage system.<br><br>If you use the netstat command with NetBIOS over TCP/IP enabled in a Windows environment, the packet filtering feature blocks access to the storage system. Disable NetBIOS over TCP/IP or specify -n option to execute the netstat command. |

**Table 10-1: General troubleshooting (Continued)**

| Problem | Corrective action |
|---|---|
| Storage Navigator Modular 2 will not start | 1. Be sure the computer acting as the management console meets the minimum requirements described in Required items supplied by the user on page 4-5.<br>2. Check the settings of your Web browser.<br>3. Verify that the Storage Navigator Modular 2 server is working.<br>4. Verify that your host has Java Runtime Environment (JRE) version 1.6 (update 2) installed. This is a free download from http://java.sun.com/javase/downloads/index.jsp.<br>5. Verify that the correct IP address was entered in the Web browser address bar.<br>6. If these steps do not fix the problem, you may need to reinstall the Storage Navigator Modular 2 software.<br>7. See Storage Navigator Modular 2 will not run on page 10-7. |

**Table 10-1: General troubleshooting (Continued)**

| Problem | Corrective action |
|---|---|
| Storage Navigator Modular 2 cannot communicate with the storage system | 1. Check that both power cables are connected to the storage system and to working AC outlets, and that the **Power** LEDs above each receptacle on the rear Panel are blinking.<br>2. Check that the main switch on both controllers is in the ON position.<br>3. Check that the front panel **Power** LED on both controllers are ON.<br>4. Check whether other devices in your network, such as a router or switch, is the cause of the problem.<br>5. Turn off the storage system. Verify that the front panel **POWER** LED goes OFF. If it is ON, disconnect both power cables and verify that the front panel **POWER** LED is OFF.<br>6. Turn on the storage system and verify that the **READY** LED goes ON.<br>7. Repeat steps 4 and 5 again.<br>8. Attach a LAN cable to the storage system management port and see whether you can log in to Storage Navigator Modular 2.<br>9. Be sure you are using the correct IP address and subnet to access the storage system. The default IPv4 settings for management port 0 are:<br>• IP address: 192.168.0.16<br>• Subnet mask: 255.255.255.0<br>• Default gateway: 0.0.0.0<br>The default IPv4 settings for management port 1 are:<br>• IP address: 192.168.0.17<br>• Subnet mask: 255.255.255.0<br>• Default gateway: 0.0.0.0<br>[IPv6 default value]<br>• Controller #0:<br>• IP Address: Auto<br>• Controller #1:<br>• IP Address: Auto<br>10. See Storage Navigator Modular 2 cannot connect to the storage system on page 10-9. |
| You are not able to upgrade firmware. | Processor usage may be high due to Response Performance Mode being enabled. Switch to Normal mode (see Improving I/O response times in small configurations on page 5-67) and try to upgrade the firmware again. |
| A host cannot recognize volumes that were added when creating host groups or when using LUN Manager. | Disable (uncheck) Autodiscover New HG Mode (see Selecting platform-specific settings on page 5-23). |

**Table 10-2: Negotiation settings**

| Storage system setting | Customer device | | | | | |
|---|---|---|---|---|---|---|
| | Auto | 10 Mbps half-duplex | 10 Mbps duplex | 100 Mbps half-duplex | 100 Mbps full-duplex | 1000 Mbps full-duplex |
| Auto (default) | YES | NO | NO | NO | NO | NO |
| 10 Mbps Half-duplex | NO | YES | NO | NO | NO | NO |
| 10 Mbps Full-duplex | NO | NO | YES | NO | NO | NO |
| 100 Mbps Half-duplex | NO | NO | NO | YES | NO | NO |
| 100 Mbps Full-duplex | NO | NO | NO | NO | YES | NO |
| 1000 Mbps Full-duplex | NO | NO | NO | NO | NO | YES |

In the table above:

- YES means the storage system and customer device can negotiate and communicate with each other.
- NO means the storage system and customer device cannot negotiate and communicate with each other.

# Troubleshooting Storage Navigator Modular 2

## Storage Navigator Modular 2 will not run

In the unlikely event that Storage Navigator Modular 2 will not run, it may be due to a communication failure between Storage Navigator Modular 2 and the host or because Storage Navigator Modular 2 may not be activated normally. Consult Figure 10-1 on page 10-8 for troubleshooting suggestions.

In this figure:

- Note 1: HSNM2 = Storage Navigator Modular 2
- Note 2: See Required items supplied by the user on page 4-5.

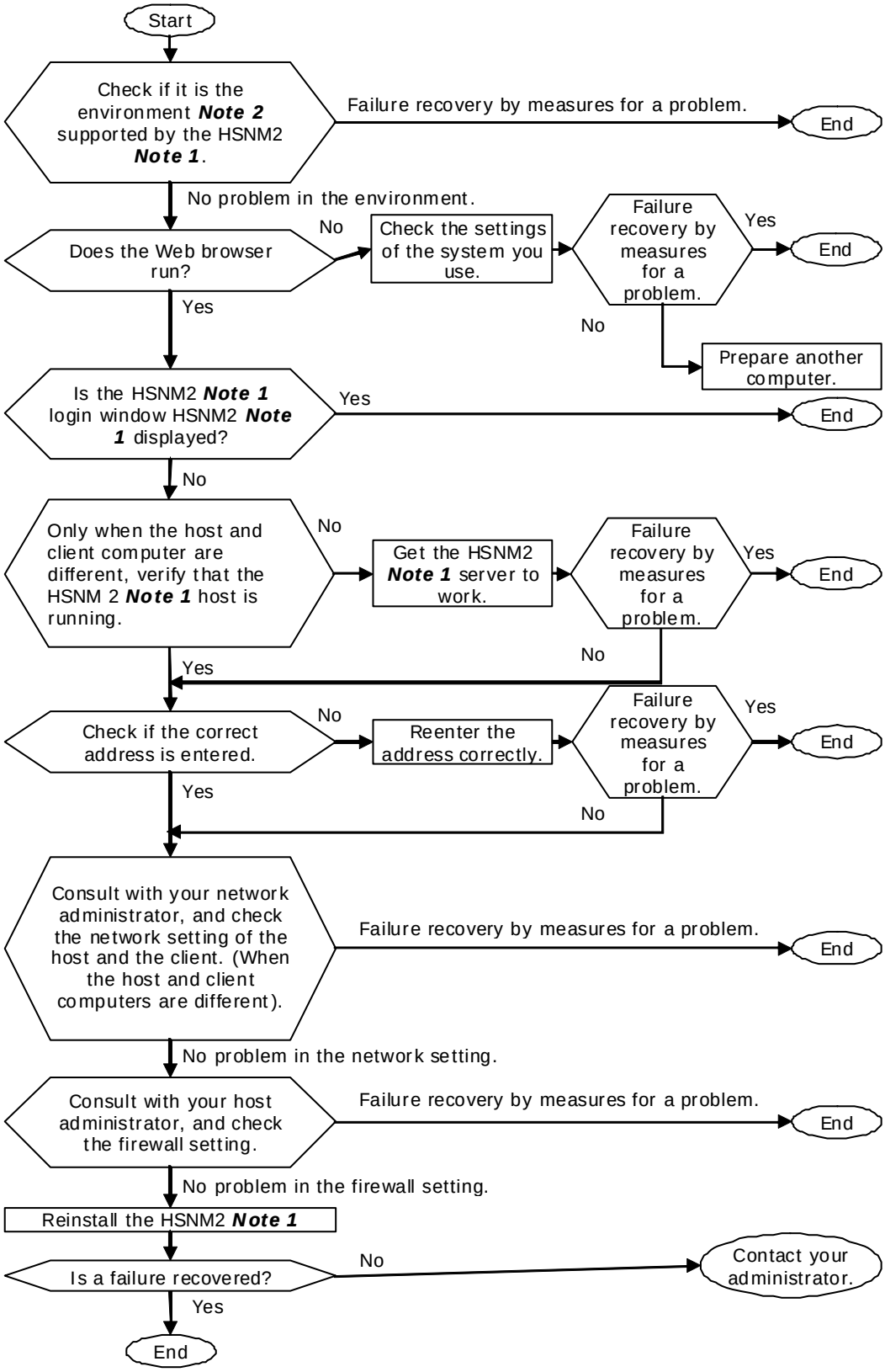



**Figure 10-1: Storage Navigator Modular 2 will not run**

## Storage Navigator Modular 2 cannot connect to the storage system

In the unlikely event Storage Navigator Modular 2 cannot connect to the Hitachi Unified Storage system, see Figure 10-2 on page 10-10 and then consult the storage system LEDs to determine the problem (refer to the *Hitachi Unified Storage Service Guide*).

In this figure:

- Note 1 HSNM2 = Storage Navigator Modular 2
- Notes 2: The **READY** LED goes ON about five-to-seven minutes after starting the CBXSS/CBXSL, five-to-eight minutes after starting the CBSS/CBSL, and five-to-10 minutes after starting the CBL/CBLE/CBLD. If the **READY** LED does not go ON after waiting 20 minutes, check whether the **POWER** LED is ON. If **POWER** is OFF, confirm that the power cables are connected security to the storage system an a known working AC power source.
- Notes 3: The storage system may not have powered off properly. Turn on the main switch and then turn it off again.

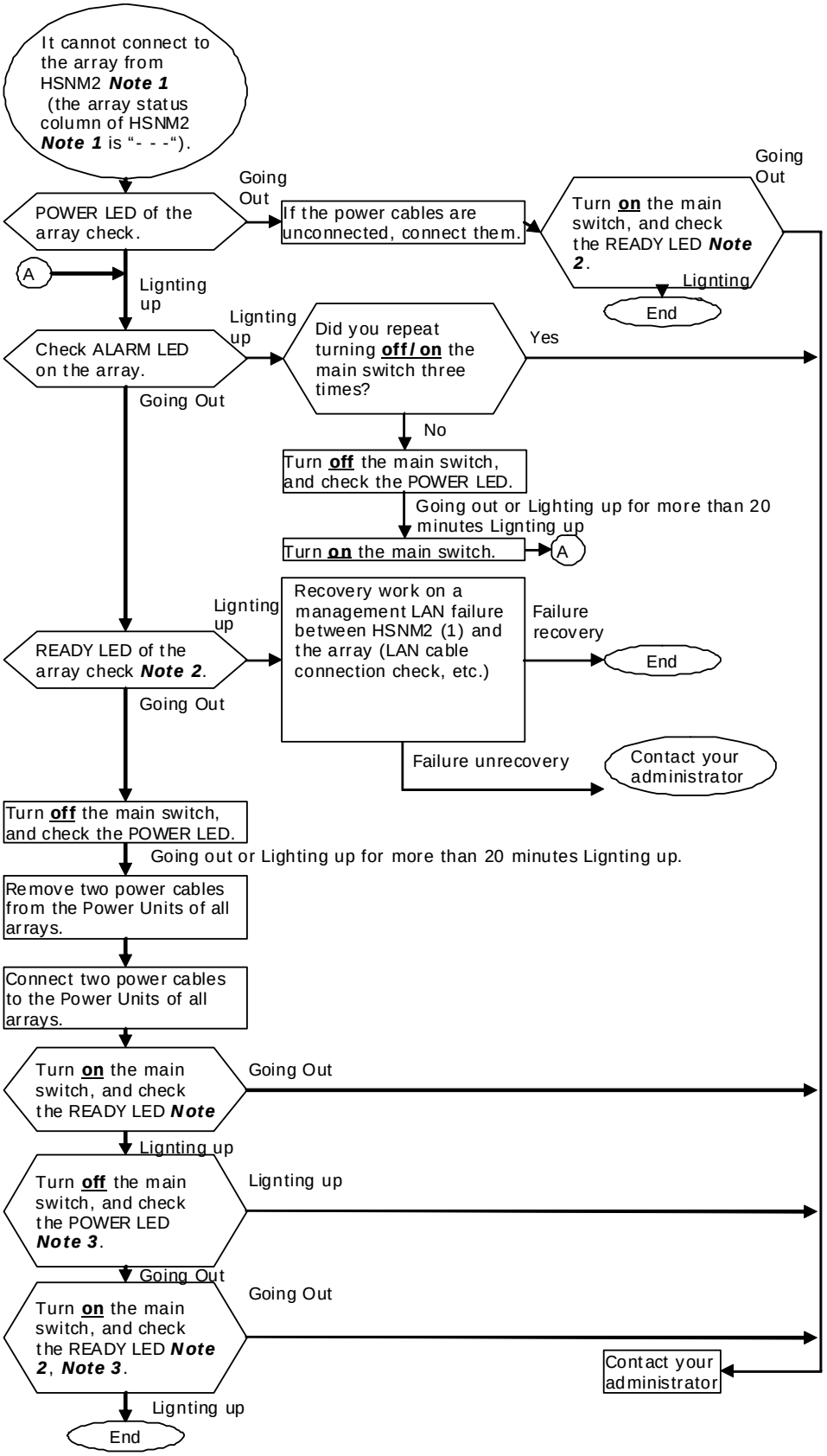



**Figure 10-2: Storage Navigator Modular 2 cannot connect to storage system**

# Troubleshooting iSCSI issues

The following list summarizes issues associated with iSCSI configurations.

- Is the link status of the host LAN port normal?
- Check the power status of the network peripherals (switches, routers, NICs, and other devices) between the storage system and host.
- Is power being supplied to devices, are the devices turned on, and are all cables to devices connected securely to the appropriate connectors?
- If the LAN cable is connected loosely, secure it.
- Does the port transfer speed of the HBA, switch, or NIC connected to the storage system match the transfer speed of the storage system configured in Storage Navigator Modular 2?
- Match the transfer speeds between the storage system (configured in Storage Navigator Modular 2) and the customer device.
- Check the following:
  - VLANs
  - Firewall settings
  - Level 3 switches and routers
  - Installing and configuring host iSCSI drivers
- Check that IPsec is turned OFF at the host storage system port. This setting must be turned OFF for the storage system port.
- Are the IP address, subnet mask, default gateway, and MTU value for each storage system and host set properly for the network over which they communicate? The MTU value must be the same as all the devices (hosts, switches, storage systems, and so on) in the LAN environment.

  When connecting using an IPv6 address, check whether the IPv6 address, subnet mask, default gateway, and MTU value are configured appropriately for the network? Check the address status of the IPv6 address (see Table 10-3 on page 10-12).
- Does the host recognize the iSCSI driver? Can the host log into the target using the appropriate IP address and iSCSI name?
- Is the storage system TCP port number set correctly for the host?
- Are discovery and login performed by the host?
- If using an iSNS server, is the IP address of the iSNS server set correctly for the host and storage system? Can the iSNS server register the IP address, iSCSI name, and other information for new iSCSI devices?
- If using CHAP authentication, is the CHAP user (initiator) registered for the storage system port? If not, register them.
- If using initiator authentication (part of CHAP authentication), is the target name (for example, [000:T000]) registered on the storage system for the CHAP user? If not, use Storage Navigator Modular 2 to assign a target name to the CHAP user of the initiator.
- If using bidirectional CHAP authentication, are the user name and target secret set appropriately for the host?

- If using target security by unlocking the LUN Manager function, does the HBA iSCSI name appear in the list of iSCSI initiators assigned to the storage system target? If not, use Storage Navigator Modular 2 to assign the HBA iSCSI name to the target.

**Table 10-3: iSCSI IPv6 troubleshooting**

| Check these items | | Description |
|---|---|---|
| Are the values of the IPv6 address and the default gateway address of the iSCSI port to be connected set correctly? | | The IPv6 address and default gateway of the iSCSI Port are generated automatically. When set manually, select a suitable value for the environment. |
| Display the address status of the IPv6 address for the iSCSI port. | Confirming | IPv6 is checking whether other hosts and addresses in the network connection are not duplicated. Confirm the transition. |
| | Enabled | The IPv6 address of the iSCSI port is not duplicated and set correctly. The address is in normal status. |
| | Disabled | The iSCSI port is in Link Down status. When using an IPv6 address with an iSCSI port, check that the cable is connected correctly. |
| | Duplicated | The IPv6 address for the iSCSI port is the same as the address of other hosts in the network connection. Set the unassigned IPv6 address manually. |
| | Not confirmed | The IPv6 address of the iSCSI port is the same as other addresses on the same iSCSI port. Set the unassigned IPv6 address on the iSCSI port manually. |
| Is the value of the MTU size set correctly? | | The IPv6 Link MTU size shows the MTU size current value on the network.<br>If the Link MTU size and the MTU size for an iSCSI port are different, the MTU size of the host or the router/switch is different from the array. Set the MTU sizes to the same value. |
| Is the IPv6 address of the remote pass setting on the IPv6 address set correctly? | | Set the IPv6 address to the appropriate setting at the local and remote paths of the iSCSI port. |
| Is the prefix set as IPv6 Global Address in a server correct? | | When IPv6 Global Address is set to two or more interfaces in a Linux system, set the IPv6 address with different prefix. |

# Working with firewalls

A firewall's main purpose is to block incoming unsolicited connection attempts to your network. If the storage system is used within an environment that uses a firewall, there will be times when the storage system's outbound connections will need to traverse the firewall.

The storage system's incoming indication ports are ephemeral, with the system randomly selecting the first available open port that is not being used by another TCP application. To permit outbound connections from the storage system, you must either disable the firewall or create or revise a source-based firewall rule (not a port-based rule) so that items coming from the storage system are allowed to traverse the firewall.

A firewall can also interfere when upgrading the storage system software. Software upgrades on the storage system are FTP connections, where the host computer acts as a server and the software acts as the client. In these roles, the host listens for a storage system's software upgrade request on an FTP socket and then makes an incoming connection to the storage system. The firewall must permit this incoming socket for the upgrade to succeed.

Table 10-4 lists the ports used by the storage system and Storage Navigator Modular 2. We suggest you create or revise your source-based firewall rules/policies to accommodate outbound connections to the storage system via these ports.

**Table 10-4: Hitachi Unified Storage system ports**

| Port | Description |
|---|---|
| 2000 | TCP (Storage Navigator Modular 2: Nonsecure)<br>Cisco Skinny Client Control Protocol (SCCP) uses port 2000 for TCP. If you use Storage Navigator Modular 2 in a network with SCCP, change the TCP port that Storage Navigator Modular 2 uses (refer to the Storage Navigator Modular 2 online help). |
| 28355 | TCP (Storage Navigator Modular 2: Secure) |
| 161 | UDP (SNMP uses this port to send traps from the storage system) |
| 23015 | Web Browser |
| 23016 | Web Browser using SSL |
| 10995 | TCP (Storage Navigator Modular 2 and Hitachi suite components) |

**NOTE:** For outgoing traffic from the storage system's management port, there are no fixed port numbers (ports are ephemeral), so all ports should be open for traffic from the storage system management port. The storage system iSCSI data ports only use port 3260 (standard iSCSI port).

# Email alert notifications

Hitachi Storage Navigator Modular 2 can be configured to send email alert notifications for the following storage system failures:

- Power Unit or drive failure
- DP pool consumed capacity depletion alert
- Flash drive write count limit alert

The email contains critical information for identifying and resolving the problem, including the date and time of the failure, the name of the storage system, and a failure message.

When an email notification is generated, a message is entered into the Hitachi Storage Navigator Modular 2 Event Log. The Event Log message contains failure and status information (up to 50 messages) that the storage system detected when the email notification was sent.

Figure 10-3 shows an example of an email alert notification. For information about configuring your storage system to send email alert notifications, see Performing the initial setup on page 5-7 and refer to the Hitachi Storage Navigator Modular 2 online help.

```
Tue, Jun. 21 15:44:35 2012/StorageSystem//ARRAY Controller Detached.
Tue, Jun. 21 15:44:35 2012/StorageSystem//ARRAY DeviceType 01.

Timezone : (GMT+09:00) Osaka/ Sapporo/ Tokyo
Hardware serial number : 92000030
Micro program version : Controller 0 = 1910/A-H, Controller 1 = 1910/A-H
Hardware serial number for controller/tray : 92000030
Failed part revision : --
Failed Drive information : --
Drive operation time : --
Drive failed factor information : --
------------------------------------------------------------------
```

**Figure 10-3: Sample email alert notification**

# Guidelines when using flash drives/FMDs

Like all drives, flash drives and FMDs have a life span. Life spans vary, depending on how the flash drive/FMD is used. If the flash drive/FMD reaches its write count limit, the drive must be replaced.

You can configure Hitachi Storage Navigator Modular 2 to send email notifications when a flash drive/FMD reaches approximately 90% of its life span. For information about configuring the flash drive/FMD write endurance threshold, see Setting the flash drive/FMD write endurance threshold on page 5-95.

At 95%-to-98% of its lifespan, the message appears with each 1% increase. If the flash drive/FMD reaches 99% of its life span, dynamic sparing copies data from the flash drive/FMD to a spare drive automatically.

Example: When the write endurance threshold is set, a message appears when the following endurance rate is reached.

| Threshold | Write endurance rate at which the message is generated |
|---|---|
| 50% | 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 96, 97, 98 |
| 83% | 83, 85, 90, 95, 96, 97, 98 |
| 90% | 90, 95, 96, 97, 98 |
| 97% | 97, 98 |

FMDs have batteries built-in. The battery life is affected by the array specification environment.

You can configure Hitachi Storage Navigator Module 2 to generate a message that the FMD battery must be replaced when the FMD battery life reaches 90% of its life span (see Setting the FMD Battery Life Threshold on page 5-95). When the battery life span reaches between 95% and 98%, the message is generated at every 1% increase.

Example: When the write endurance threshold is set as follows, the message is generated when the following endurance rates are reached.

| Threshold | Write endurance rate at which the message is generated |
|---|---|
| 50% | 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 96, 97, 98, 99, 100 |
| 83% | 83, 85, 90, 95, 96, 97, 98, 99, 100 |
| 90% | 90, 95, 96, 97, 98, 99, 100 |
| 97% | 97, 98, 99, 100 |
| 98% | 99, 100 |
| 99% | 100 |

As writing capacity of a flash drive/FMD increases, the data retention period is reduced at power down (either when the Controller Box/Drive Box with a flash drive/FMD installed is powered down or when the flash drive/FMD itself is powered down).

Power up flash drive/FMDs using power from the storage system at least once every three months.

When a FMD or DBF has not been used for a long period, power on the DBF and charge the FMD battery. When battery charge is required, the green **ACT** LED on the FMD blinks. The LED goes OFF when the charge is completed.

# 11

# Adding optional components

This chapter describes how to add optional components to the following Hitachi Unified Storage system components:

- CBXSS and CBXSL
- CBSS and CBSL
- CBL/CBLE
- DBS and DBL

The topics covered in this chapter are:


- Guidelines when adding optional components
- Procedures for adding optional components
- Conditions when adding optional components
- Adding disk drives
- Adding cache memory
- Adding Fibre Channel Host I/O Modules or Boards
- Adding iSCSI Host I/O Modules or Boards
- Adding a Controller
- Adding Drive Boxes


**NOTE:** Although this chapter contains procedures for adding optional components to all Hitachi Unified Storage systems, Hitachi supports customer servicing of Hitachi Unified Storage 110 systems only. Procedures for adding optional components to Hitachi Unified Storage 130 and 150 systems are provided in this chapter for reference purposes only; to service these systems, please contact the Hitachi Global Solutions Center.

# Guidelines when adding optional components

Observe the following guidelines before adding optional components to Hitachi Unified Storage systems.

- To avoid the chance of losing data in the event you make a mistake while adding an optional component, back up all user data at the host before performing the procedures in this chapter.
- The procedures in this chapter assume that all work will be performed at the storage system location.
- When performing the procedures in this chapter, confirm whether the activity can be performed with storage system power on or off. The host can remain on or off, regardless of whether the storage system is turned on or off during these procedures.
- When adding optional components, you will need to change the storage system's configuration settings using a service personal computer (PC) connected via a LAN. Therefore, prepare a PC that has an installed version of Hitachi Storage Navigator Modular 2. The PC will be used on the LAN side of the storage system.
- Ascertain whether the storage system is operable via a LAN.
- If a replacement part is exposed to high or low temperature during transport, it might not operate properly when installed in the storage system.
- When a procedure involves replacing a dummy drive, performing this procedure with the storage system power on, requires the procedure to be completed within 10 minutes.
- Do not perform the procedures in this chapter if the green **READY** LED on the front of the Controller Box is blinking quickly. When this LED blinks quickly, the storage system is performing internal processing. Wait for the green **READY** LED on the front of the Controller Box to go ON after waiting up to 50 minutes, up to 60 minutes for the CBL/CBLE, or up to 180 minutes if the DBW is connected to the CBL/CBLE.
- Do not perform the procedures in this chapter if the orange **WARNING** LED on the front of the Controller Box is blinking quickly. When this LED blinks quickly after turning on power in a single-controller storage system, the storage system is updating flash or conducting internal processing. Wait for the orange **WARNING** LED on the front of the Controller Box to go OFF and for the green **READY** LED to go ON (this can take up to 85 minutes).
- Do not add optional components while the storage system is being started. After starting the storage system is being started, wait for the storage system to enter Ready status before adding optional components.
- Some procedures in this chapter require you to install firmware.
- Before performing the procedures in this chapter, collect simple trace information (refer to the *Hitachi Unified Storage Service Guide*) if the storage system will be returned to the original state after the optional the adding work.

# Procedures for adding optional components

The following sections summarize the procedures for adding optional components to Hitachi Unified Storage systems. You can add optional components to Hitachi Unified Storage systems with the storage system power turned on or off.

## Procedures for adding optional components with power applied

Table 11-1 summarizes the steps associated with adding optional components when power is applied to the Hitachi Unified Storage system.

**Table 11-1: Adding components with storage system turned on**

| Step | Procedure | For more information, see... |
|---|---|---|
| 1. | Unpack the optional components. | Unpacking on page 4-3 |
| 2. | If drives are to be added, add them at this step. | Adding disk drives on page 11-11 |
| 3. | Mount the storage system on a rack. | Mounting the storage system on page 4-11 |
| 4. | Connect cables. | Connecting power cables and powering on on page 4-31 |
| 5. | Connect a service PC to the storage system. | Establishing the management path on page 5-2 |
| 6. | Use the service PC to:<br>• Check restoration of system information<br>• Set a spare drive<br>• Set RAID and volume(s)<br>• Set volume recognition<br>The system copy takes approximately 1.5 minutes to complete for each drive. | Chapter 5, Configuring the storage system |
| 7. | Prepare the uninteruptible power supply (UPS), if required. | The documentation for the UPS |
| 8. | If Host I/O Modules or Boards are to be added, add them at this step. | Adding Fibre Channel Host I/O Modules or Boards on page 11-27<br><br>Adding iSCSI Host I/O Modules or Boards on page 11-40 |
| 9. | Install the host. | The documentation for each host. |
| 10. | Close the front bezel after the operation. | Attaching the front panel bezel on page 4-26 |

Table 11-2 summarizes the steps associated with adding optional components when power is removed from the Hitachi Unified Storage system.

**Table 11-2: Adding components with storage system turned off**

| Step | Procedure | For more information, see... |
|---|---|---|
| 1. | Unpack the optional components. | Unpacking on page 4-3 |
| 2. | Power off the storage system. | Powering off the storage system on page 4-33 |
| 3. | Mount the storage system on a rack. | Mounting the storage system on page 4-11 |
| 4. | Add the following optional components:<br>Controller<br>Drives<br>Cache memory<br>If Host I/O Modules or Boards are to be added, add them at this step. | <br>Adding a Controller on page 11-65<br>Adding disk drives on page 11-11<br>Adding cache memory on page 11-22<br>Adding Fibre Channel Host I/O Modules or Boards on page 11-27<br>Adding iSCSI Host I/O Modules or Boards on page 11-40 |
| 5. | Connect cables. | Connecting power cables and powering on on page 4-31 |
| 6. | Power on the storage system. | Connecting power cables and powering on on page 4-31 |
| 7. | Connect a service PC to the storage system. | Establishing the management path on page 5-2 |
| 8. | Configure the storage system. | Chapter 5, Configuring the storage system |
| 9. | Power off the storage system. | Powering off the storage system on page 4-33 |
| 10. | Restart the storage system. | Connecting power cables and powering on on page 4-31 |
| 11. | Power off the storage system. | Powering off the storage system on page 4-33 |
| 12. | Prepare the uninteruptible power supply (UPS), if required. | The documentation for the UPS |
| 13. | Close the front bezel after the operation. | Attaching the front panel bezel on page 4-26 |

# Conditions when adding optional components

Observe the conditions in the following sections when adding optional components.

## Conditions when adding Drive Boxes

**Table 11-3: Conditions when adding Drive Boxes**

| Component | Model name | Specification | Minimum Requirements | Condition | |
|---|---|---|---|---|---|
| | | | | Power online and host is operating (see note) | Storage system is powered off |
| Drive Box | DF-F850-DBS | A storage system and basic accessories to be mounted on a rack | Two drives and the following Drive Boxes:<br>• CBXSL: up to 4 DBS Drive Boxes<br>• CBXSS: up to 4 DBS Drive Boxes<br>• CBSL: up to 9 DBS Drive Boxes<br>• CBSS: up to 9 DBS Drive Boxes<br>• CBL/CBLE: up to 40 DBS Drive Boxes | Supported (see Adding Drive Boxes on page 11-70) | Supported (see Adding Drive Boxes on page 11-70) |
| | DF-F850-DBL | A storage system and basic accessories to be mounted on a rack | Two drives and the following Drive Boxes:<br>• CBXSL: up to 9 DBL Drive Boxes<br>• CBXSS: up to 8 DBL Drive Boxes<br>• CBSL: up to 19 DBL Drive Boxes<br>• CBSS: up to 18 DBL Drive Boxes<br>• CBL/CBLE: up to 40 DBL Drive Boxes | Supported (see Adding Drive Boxes on page 11-70) | Supported (see Adding Drive Boxes on page 11-70) |

**NOTE:** Data is exchanged between a host and the storage system.

# Optional components that can be added

**Table 11-4: Optional components that can be added**

| Component | Model name | Specification | Requirements | Condition | |
|---|---|---|---|---|---|
| | | | | Power online and host is operating (see Note 1) | Storage system is powered off |
| Controller | DF-F850-CTLXSR | Array controller for duplicating (for CBXSS/CBXSL) | Make the configuration the same as installed Controller #0. | Not supported | Supported (see Adding a Controller on page 11-65) |

## Table 11-4: Optional components that can be added (Continued)

| Component | Model name | Specification | Requirements | Condition | |
|---|---|---|---|---|---|
| | | | | Power online and host is operating (see Note 1) | Storage system is powered off |
| Drive (see Note 2), including spare drive | DF-F850-3HGSS | 2.5-inch drive 287.62 G bytes<br>Disk rotational speed: 10,000 min-1 | Select from the drives shown on the left according to the intended total capacity of the array.<br><br>Spare drives can be set up as follows:<br>• CBXSS/CBXSL: 15<br>• CBSS/CBSL: 30<br>• CBL/CBLE: 80 | Varies, depending on the storage system to be added (see Adding disk drives on page 11-11) | |
| | DF-F850-3HGSSC | 2.5-inch Drive (287.62 G bytes)<br>Disk rotational speed: 10,000 min-1.<br>BNST-free. | | | |
| | DF-F850-3HGSSH | 2.5-inch drive 287.62 G bytes<br>Disk rotational speed: 15,000 min-1 | | | |
| | DF-F850-3HGSSHC | 2.5-inch drive 287.62 G bytes<br>Disk rotational speed: 15,000 min-1.<br>BNST-free. | | | |
| | DF-F850-6HGSS | 2.5-inch drive 575.30 G bytes<br>Disk rotational speed: 10,000 min-1 | | | |
| | DF-F850-6HGSSC | 2.5-inch drive 575.30 G bytes<br>Disk rotational speed: 10,000 min-1.<br>BNST-free. | | | |
| | DF-F850-9HGSS | 2.5-inch drive 879.98 G bytes<br>Disk rotational speed: 10,000 min-1 | | | |
| | DF-F850-9HGSSC | 2.5-inch drive 879.98 G bytes<br>Disk rotational speed: 10,000 min-1.<br>BNST-free. | | | |
| | DF-F850-12HGSS | 2.5-inch Drive (1173.71 G bytes)<br>Disk rotational speed: 10,000 min-1 | | | |
| | DF-F850-12HGSSC | 2.5-inch Drive (1173.71 G bytes)<br>Disk rotational speed: 10,000 min-1 | | | |
| | DF-F850-2TNL | 3.5-inch Drive 1,956.94 G bytes<br>Disk rotational speed: 7,200 min-1 | | | |
| | DF-F850-2TNLC | 3.5-inch Drive 1,956.94 G bytes<br>Disk rotational speed: 7,200 min-1.<br>BNST-free. | | | |
| | DF-F850-3TNL | 3.5-inch Drive 2,935.96 G bytes<br>Disk rotational speed: 7,200 min-1 | | | |
| | DF-F850-3TNLC | 3.5-inch Drive 2,935.96 G bytes<br>Disk rotational speed: 7,200 min-1.<br>BNST-free. | | | |
| | DF-F850-4TNL | 3.5-inch Drive 3,915.01 G bytes<br>Disk rotational speed: 7,200 min-1 | | | |
| | DF-F850-4TNLC | 3.5-inch Drive 3,915.01 G bytes<br>Disk rotational speed: 7,200 min-1.<br>BNST-free. | | | |
| | DF-F850-2HGDM | 2.5-inch Flash drive<br>195.82 G bytes | | | |
| | DF-F850-4HGDM | 2.5-inch flash drive<br>392.73 G bytes | | | |
| | DF-F850-8HGDM | 2.5-inch Flash Drive (786.59 G bytes) | | | |
| | DF-F850-2HGDML | 3.5-inch Flash Drive (195.82 G bytes) | | | |
| | DF-F850-4HGDML | 3.5-inch Flash Drive (392.73 G bytes) | | | |
| | DF-F850-3HGSLH | 3.5-inch Drive (287.62 G bytes)<br>Disk rotational speed: 15,000 min-1 | | | |
| | DF-F850-3HGSLHC | 3.5-inch Drive (287.62 G bytes)<br>Disk rotational speed: 15,000 min-1.<br>BNST-free. | | | |
| | DF-F850-9HGSL | 3.5-inch Drive (879.98 G bytes)<br>Disk rotational speed: 10,000 min-1 | | | |
| | DF-F850-9HGSLC | 3.5-inch Drive (879.98 G bytes)<br>Disk rotational speed: 10,000 min-1.<br>BNST-free. | | | |

**Table 11-4: Optional components that can be added (Continued)**

| Component | Model name | Specification | Requirements | Condition | |
|---|---|---|---|---|---|
| | | | | Power online and host is operating (see Note 1) | Storage system is powered off |
| Cache memory | DF-F850-CMM8 (CBSS/CBSL) | Cache memory 8,192 M bytes | Install the Cache Memory of the same capacity in Controller #0 and #1. | Not supported | Supported (see Adding cache memory on page 11-22) |
| | DF-F850-8GB (CBL/CBLE) | | | | |
| Fibre Channel I/O Module or Board | DF-F850-HBF84R | 8G bps Fibre Channel Host I/O Board, including host connectors (4) | • Install the Host I/O Board/Module after removing the dummy (Board/Module) from the Controller.<br>• Host I/O Module/Board type must correspond to the slot type. | Supported (see Adding Fibre Channel Host I/O Modules or Boards on page 11-27) | |
| | DF-F850-HF8GR | 8G bps Fibre Channel Host I/O Module, including host connectors (4) | | | |
| iSCSI I/O Module or Board | DF-F850-HBS12 | 1G bps iSCSI Host I/O Board | • Install the Host I/O Board/Module after removing the dummy board/module from the Controller.<br>• Host I/O Module/Board type correspond to the slot type. | Supported (see Adding iSCSI Host I/O Modules or Boards on page 11-40) | |
| | DF-F850-HBS102 | 10G bps iSCSI Host I/O Board, including host connectors (2) | | | |
| | DF-F850-HS10G | 10G bps iSCSI Host I/O Module, including host connectors (2) | | | |

**NOTE 1:** Data is exchanged between a host and the storage system.

**NOTE 2:** Drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different than the calculation 1 k byte =1,024 bytes. The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

## Adding drives/storage systems

**Table 11-5: Adding drives to expand storage capacity**

| Number | Unit addition | Component to be added | Power online and host is operating (see Note 1) | Storage system is powered off |
|---|---|---|---|---|
| 1. | Storage system | DBS/DBL | Supported for last DBL/DBS only (see Note 2) | |
| | | | See Adding Drive Boxes on page 11-70 | |

**Table 11-5: Adding drives to expand storage capacity**

| Number | Unit addition | Component to be added | Power online and host is operating (see Note 1) | Storage system is powered off |
|---|---|---|---|---|
| 2. | Drive | CBXSS/CBXSL/CBSS/ CBSL: Drives #0 to 4 | Supported (see Note 3) | Not supported |
| | | DBS/DBL corresponding to unit #0 connected to the CBL/CBLE: Drive #0 to 4 | See Adding drives (storage system power is online) on page 11-13 | — |
| 3. | | CBXSS/CBXSL/CBSS/ CBSL: Drive #5 or more | Supported | Supported |
| | | DBS/DBL corresponding to the unit #0 connected to the CBL/CBLE: Drive #5 or more | See Adding drives (storage system power is online) on page 11-13 | See Adding drives (storage system is powered off) on page 11-13 |

**NOTE 1:** Data is exchanged between a host and the storage system.

**NOTE 2:** The Drive Box can be added at the end of the configuration, but not in the middle of the configuration.

**NOTE 3:** When adding drives #0 through #4 in the CBXSS/CBSS or the first DBS connected to the CBL/CBLE, a mix of SAS and flash drives cannot be installed. When adding or replacing drives #0 through #4 in a CBXSL/ CBXSS/CBSL/CBSS or the first DBL/DBS to be connected to the CBL/CBLE, perform the task with storage system power turned on, and check that the system copy starts automatically with the newly added drives and completes successfully. The system copy is completed in approximately 1.5 minute for each drive.

**Table 11-6: Replacing drives with drives of larger capacity**

| Number | Unit addition | Component to be added | Power online and host is operating (see Note 1) | Storage system is powered off |
|---|---|---|---|---|
| 1. | Storage system | DBS/DBL | See Note 2 | |
| | | | — | — |

**Table 11-6: Replacing drives with drives of larger capacity**

| Number | Unit addition | Component to be added | Power online and host is operating (see Note 1) | Storage system is powered off |
|---|---|---|---|---|
| 2. | Drive | CBXSS/CBXSL/CBSS/ CBSL: Drive #0 to 4 | Supported (see Note 3) | Not supported |
| | | DBS/DBL corresponding to unit #0 connected to the CBL/CBLE: Drive #0 to 4 | See Replacing drives in a CBXSL/CBSL/DBL on page 11-19 | — |
| 3. | | CBXSS/CBXSL/CBSS/ CBSL: Drive #5 or more | Supported | Supported |
| | | DBS/DBL corresponding to the unit #0 connected to the CBL/CBLE: Drive #5 or more | See Replacing drives in a CBXSS/CBSS/DBS on page 11-20 | See Replacing drives in a CBXSS/CBSS/ DBS on page 11-20 |

**NOTE 1:** Data is exchanged between a host and the storage system.

**NOTE 2:** When performing a replacement procedure to expand storage capacity. you can simply replace drives installed in the storage system. There is no need to replace the storage system itself.

**NOTE 3:** When adding drives #0 through #4 in the CBXSS/CBSS or the first DBS connected to the CBL/CBLE, a mix of SAS and flash drives cannot be installed. When adding or replacing drives #0 through #4 in a CBXSL/ CBXSS/CBSL/CBSS or the first DBL/DBS to be connected to the CBL/CBLE, perform the task with storage system power turned on, and check that the system copy starts automatically with the newly added drives and completes successfully. The system copy is completed in approximately 1.5 minute for each drive.

# Adding disk drives

The procedure you use to add drives depends on the drive's location and whether the storage system is powered on or off.

Exercise care to use the appropriate procedure; otherwise, user data could be lost.

**Table 11-7: Adding different types of drives to expand capacity**

| Number | Unit addition | Component to be added | Power online and host is operating (see Note 1) | Storage system is powered off |
|---|---|---|---|---|
| 1. | Drive | CBXSS/CBXSL/CBSS/ CBSL: Drive #0 to 4 | Supported (see Note 2) | Not supported |
| | | DBS/DBL corresponding to unit #0 connected to the CBL/CBLE: Drive #0 to 4 | See Adding drives (storage system power is online) on page 11-13 | — |
| 2. | | CBXSS/CBXSL/CBSS/ CBSL: Drive #5 or more | Supported | Supported |
| | | DBS/DBL corresponding to the unit #0 connected to the CBL/CBLE: Drive #5 or more | See Adding drives (storage system power is online) on page 11-13 | See Adding drives (storage system is powered off) on page 11-13 |
| 3. | | DBS/DBL corresponding to unit #1 or more | Supported | Supported |
| | | | See Adding drives (storage system power is online) on page 11-13 | See Adding drives (storage system is powered off) on page 11-13 |

**NOTE 1:** Data is exchanged between a host and the storage system.

**NOTE 2:** When adding drives #0 through #4 in the CBXSS/CBSS or the first DBS connected to the CBL/CBLE, a mix of SAS and flash drives cannot be installed. When adding or replacing drives #0 through #4 in a CBXSL/ CBXSS/CBSL/CBSS or the first DBL/DBS to be connected to the CBL/CBLE, perform the task with storage system power turned on, and check that the system copy starts automatically with the newly added drives and completes successfully. The system copy is completed in approximately 1.5 minute for each drive.

**Table 11-8: Replacing with different types of drives to expand capacity**

| Number | Unit addition | Component to be added | Power online and host is operating (see Note 1) | Storage system is powered off |
|---|---|---|---|---|
| 1. | Drive | CBXSS/CBXSL/CBSS/ CBSL: Drive #0 to 4 | Supported (see Note 2) | Not supported |
| | | DBS/DBL corresponding to unit #0 connected to the CBL/CBLE: Drive #0 to 4 | See Replacing drives to expand storage capacity (storage system power is online) on page 11-14 | — |
| 2. | | CBXSS/CBXSL/CBSS/ CBSL: Drive #5 or more | Supported | Supported |
| | | DBS/DBL corresponding to the unit #0 connected to the CBL/CBLE: Drive #5 or more | See Replacing drives to expand storage capacity (storage system power is online) on page 11-14 | See Replacing drives to expand storage capacity (storage system is powered off) on page 11-15 |
| 3. | | DBS/DBL corresponding to unit #1 or more | Supported | Supported |
| | | | See Replacing drives to expand storage capacity (storage system power is online) on page 11-14 | See Replacing drives to expand storage capacity (storage system is powered off) on page 11-15 |

**NOTE 1:** Data is exchanged between a host and the storage system.

**NOTE 2:** When adding drives #0 through #4 in the CBXSS/CBSS or the first DBS connected to the CBL/CBLE, a mix of SAS and flash drives cannot be installed. When adding or replacing drives #0 through #4 in a CBXSL/ CBXSS/CBSL/CBSS or the first DBL/DBS to be connected to the CBL/CBLE, perform the task with storage system power turned on, and check that the system copy starts automatically with the newly added drives and completes successfully. The system copy is completed in approximately 1.5 minute for each drive.

## Quick summary for adding drives

To expand storage capacity, drives can be added with the Hitachi Unified Storage system online or offline. However, adding drives in drive slots 0 – 4 of the CBXSL/CBXSS/CBSS/CBSL or drive slots 0 through 4 of the DBS/DBL can only be performed with the storage system online.

### Adding drives (storage system power is online)

1. Unpack the new drive.
2. Remove the front bezel of the Hitachi Unified Storage system.
   - See Removing the front panel bezel on page 4-29.
3. Remove the dummy drive.
4. Install the new drive(s).
   - See Adding drives to a CBXSL/CBSL/DBL on page 11-17.
   - See Adding drives to a CBXSS/CBSS/DBS on page 11-18.
5. If you inserted new drives in drive slots 0 – 4 of the CBXSL/CBXSS/CBSS/CBSL or drive slots 0 – 4 of the DBS/DBL, check that the system copy started and completed automatically for the drives you added. This procedure takes about 1.5 minutes per drive.
6. Attach the front bezel.
   - See Attaching the front panel bezel.
7. Configure the following system information using the procedures in Chapter 5, Configuring the storage system:
   - Set a RAID/volume
   - Format a volume
   - Set a spare drive
   - Set Logical Unit mapping
8. Have the host recognize a volume on the Hitachi Unified Storage system.
   - See Configuring a host to recognize a volume with power on on page 11-21.
   - Refer to the host documentation.

### Adding drives (storage system is powered off)

1. Unpack the new drive.
2. Power off the Hitachi Unified Storage system.
3. Remove the front bezel of the Hitachi Unified Storage system.
   - See Removing the front panel bezel on page 4-29.
4. Install the new drive(s).
   - See Adding drives to a CBXSL/CBSL/DBL on page 11-17 or Adding drives to a CBXSS/CBSS/DBS on page 11-18.
5. Power on the Hitachi Unified Storage system.

6. Configure the following system information using the procedures in Chapter 5, Configuring the storage system:
   - Set a RAID/volume
   - Format a volume
   - Set a spare drive
   - Set Logical Unit mapping
7. Power off the Hitachi Unified Storage system again.
8. Attach the front bezel.
   - See Attaching the front panel bezel.
9. Have the host recognize a volume on the Hitachi Unified Storage system.
   - See Configuring a host to recognize a volume with power on on page 11-21.
   - Refer to the host documentation.

## Replacing drives to expand storage capacity (storage system power is online)

1. Connect a service PC to the storage system.
   - See Establishing the management path on page 5-2.
2. Check the drive(s) to be replaced.
3. Unpack the replacement drive(s).
4. Back up user data.
5. Delete all volumes associated with the RAID group that includes the drive to be replaced.
   - See Chapter 5, Configuring the storage system.
6. Delete the RAID group that includes the drive to be replaced.
   - See Chapter 5, Configuring the storage system.
7. If the drive to be replaced is assigned to a spare drive, cancel the assignment.
   - See Configuring spare drives on page 5-15.
8. Remove the front bezel of the Hitachi Unified Storage system.
   - See Removing the front panel bezel on page 4-29.
9. Remove the drive(s) to be replaced and install the replacement drive(s).
   - See Replacing drives in a CBXSL/CBSL/DBL on page 11-19.
   - See Replacing drives in a CBXSS/CBSS/DBS on page 11-20.
10. If you replaced drives #0 through #4 of the CBXSL/CBXSS/CBSS/CBSL or drives #0 through #4 of the DBS/DBL corresponding to unit ID #0 connected to the CBL/CBLE, confirm that this procedure is performed with storage system power turned on and that the system copy starts automatically for the newly added drives and completes.
11. Attach the front bezel.
    - See Attaching the front panel bezel.

12. Configure the following system information using the procedures in Chapter 5, Configuring the storage system:
    - Set a RAID/volume
    - Format a volume
    - Set a spare drive
    - Set Logical Unit mapping
13. Have the host recognize a volume on the Hitachi Unified Storage system.
    - See Configuring a host to recognize a volume with power on on page 11-21.
    - Refer to the host documentation.

**NOTE:** When replacing two or more drives, check system restoration at step 10 for each unit and install drives one by one.

## Replacing drives to expand storage capacity (storage system is powered off)

1. Connect a service PC to the storage system.
    - See Establishing the management path on page 5-2.
2. Check the drive(s) to be replaced.
3. Unpack the replacement drive(s).
4. Back up user data.
5. Delete all volumes associated with the RAID group that includes the drive to be replaced.
    - See Chapter 5, Configuring the storage system.
6. Delete the RAID group that includes the drive to be replaced.
    - See Chapter 5, Configuring the storage system.
7. If the drive to be replaced is assigned to a spare drive, cancel the assignment.
    - See Configuring spare drives on page 5-15.
8. Power off the storage system.
    - See Powering off the storage system on page 4-33.
9. Remove the front bezel of the Hitachi Unified Storage system.
    - See Removing the front panel bezel on page 4-29.
10. Remove the drive(s) to be replaced and install the replacement drive(s).
    - See Replacing drives in a CBXSL/CBSL/DBL on page 11-19.
    - See Replacing drives in a CBXSS/CBSS/DBS on page 11-20.
11. Power on the storage system.
    - See Connecting power cables and powering on on page 4-31.
12. Configure the following system information using the procedures in Chapter 5, Configuring the storage system:
    - Set a RAID/volume

- Format a volume
- Set a spare drive
- Set Logical Unit mapping

13. Power off the storage system.
    - See Powering off the storage system on page 4-33.
14. Attach the front bezel.
    - See Attaching the front panel bezel.
15. Power on the storage system.
    - See Connecting power cables and powering on on page 4-31.
16. Have the host recognize a volume on the Hitachi Unified Storage system.
    - See Configuring a host to recognize a volume with power on on page 11-21.
    - Refer to the host documentation.

## Adding drives to a CBXSL/CBSL/DBL

To add drives to a CBXSL or CBSL Controller Box or DBL Drive Box, perform the following procedure and see Figure 11-1.

1. Press the latch on the left side of the dummy drive in the direction shown by the arrow.
2. Hold the right side of the dummy drive, pull it out, and then remove it.
3. Install the new drive. When handling the drive, hold the rail side to avoid breaking or damaging components on the drive.
   a. Open the handle fully and fit the drive into the guide rail of the array and slide it in the direction shown by the arrow.
   b. Push in the drive until a hook on the handle enters the square hole on the frame.
   c. Pull the stopper lightly, close the handle, and then engage the lock by pressing the stopper.

**NOTE:** If the handle is raised so that hook cannot enter into the square hole, the drive meets the frame of the storage system and cannot be installed correctly.

   d. Pull the handle lightly to confirm that the drive cannot be pulled out.
4. If the drive has been added while the storage system power is on, confirm that the **ALARM** LED on the drive goes OFF.

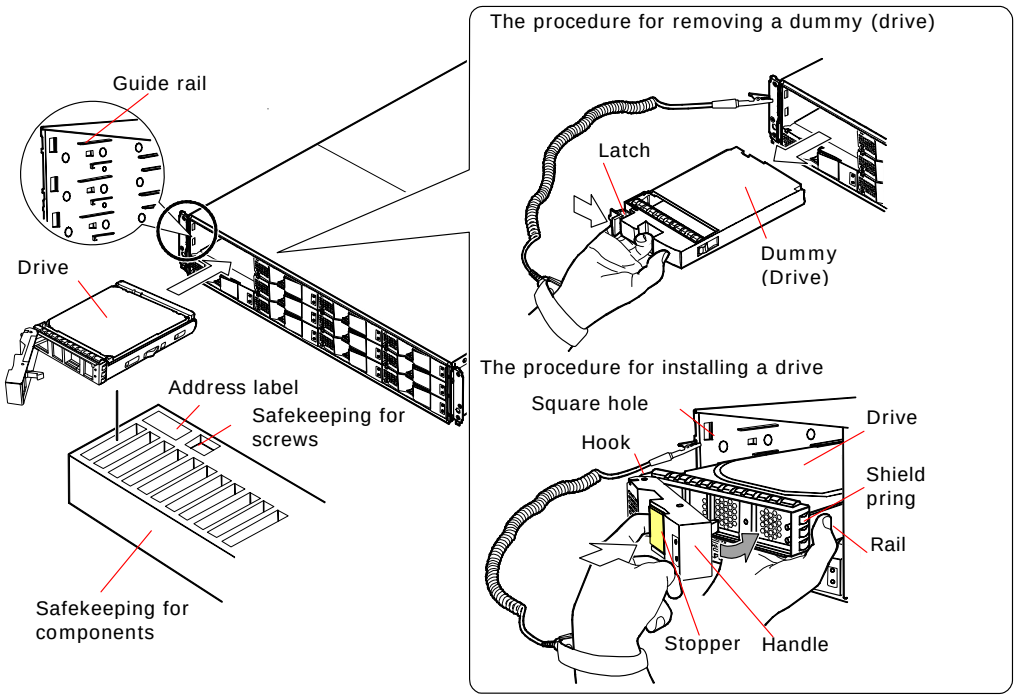



**Figure 11-1: Removing a dummy drive and installing a drive (CBXSL/CBSL/DBL)**

## Adding drives to a CBXSS/CBSS/DBS

To add drives to a CBXSS or CBSS Controller Box or DBS Drive Box, perform the following procedure and see Figure 11-2.

1. Press the latch at the lower part of the dummy drive in the direction shown by the arrow.
2. Hold the upper part of the drive, pull it out, and then remove it.
3. Install the new drive.
   a. Fit the drive in the guide rail of the array and slide it in the direction shown by the arrow(①).
   b. Push in the drive until a hook on the handle enters the square hole on the frame(?).
   c. With the stoppper titled toward you, raise the stopper and then press the stopper to lock the drive (?).

**NOTE:** If the handle is raised so that hook cannot enter into the square hole, the drive meets the frame of the storage system and cannot be installed correctly.

4. If the drive has been added while the storage system power is on, confirm that the **ALARM** LED on the drive goes OFF.

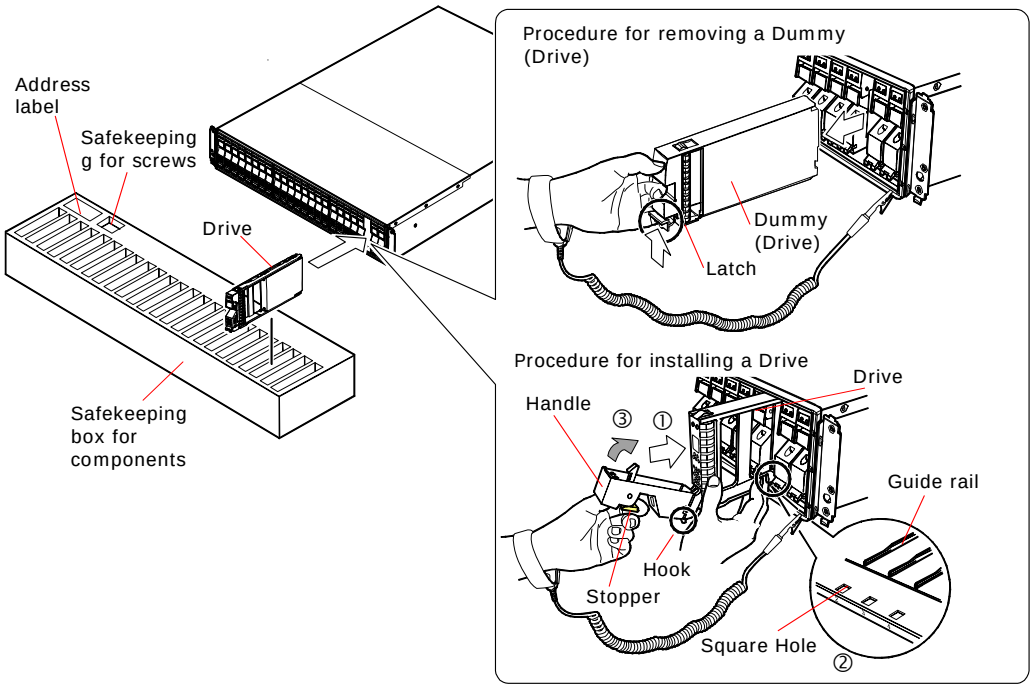



**Figure 11-2: Removing a dummy drive and installing a drive (CBXSS/CBSS/DBS)**

## Replacing drives in a CBXSL/CBSL/DBL

To replace drives in a CBXSL or CBSL Controller Box or DBL Drive Box, perform the following procedure for each drive to be replaced and see Figure 11-3.

1. Pull the stopper of the handle toward you to disengage the lock, tilt the handle toward you, and then remove the drive by pulling it out taking care not to apply a shock to it.

   If the drive you removed will be used in another Hitachi Unified Storage system, keep it near with its handle returned to its original state (locked by the stopper).

2. Install the replacement drive. When handling the drive, hold the rail side to avoid breaking or damaging components on the drive.
   a. Open the handle fully and fit the drive into the guide rail of the array and slide it in the direction shown by the arrow.
   b. Push in the drive until a hook on the handle enters the square hole on the frame.
   c. Pull the stopper lightly, close the handle, and then engage the lock by pressing the stopper.

**NOTE:** If the handle is raised so that hook cannot enter into the square hole, the drive meets the frame of the storage system and cannot be installed correctly.

   d. Pull the handle lightly to confirm that the drive cannot be pulled out.

3. If the drive has been replaced while the storage system power is on, confirm that the **ALARM** LED on the drive goes OFF.

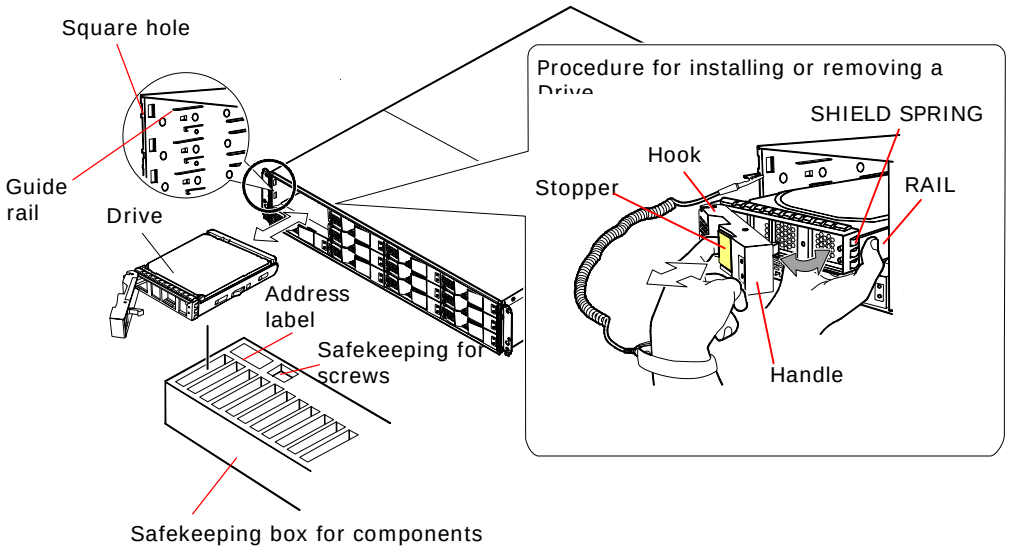



**Figure 11-3: Replacing a drive (CBXSL/CBSL/DBL)**

## Replacing drives in a CBXSS/CBSS/DBS

To replace drives in a CBXSS or CBSS Controller Box or DBS Drive Box, perform the following procedure for each drive to be replaced and see Figure 11-4.

1. Pull the stopper of the handle toward you to disengage the lock, tilt the handle toward you, and then remove the drive by pulling it out taking care not to apply a shock to it.

   If the drive you removed will be used in another Hitachi Unified Storage system, keep it near with its handle returned to its original state (locked by the stopper).

2. Install the replacement drive. When handling the drive, hold the rail side to avoid breaking or damaging components on the drive.
   a. Fit the drive in the guide rail of the array and slide it in the direction shown by the arrow (①).
   b. Push in the drive until a hook on the handle enters the square hole on the frame (②).
   c. With the stopper tilted toward you, raise the stopper and then engage the lock by pressing the stopper (②).

**NOTE:** If the handle is raised so that hook cannot enter into the square hole, the drive meets the frame of the storage system and cannot be installed correctly.

3. If the drive has been replaced while the storage system power is on, confirm that the **ALARM** LED on the drive goes OFF.

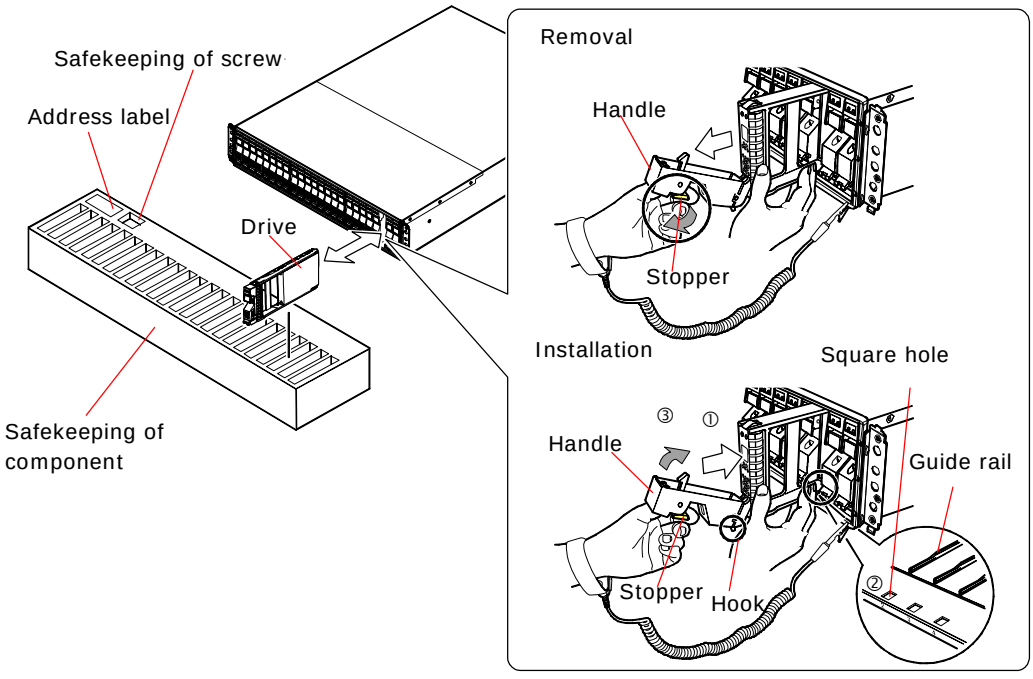
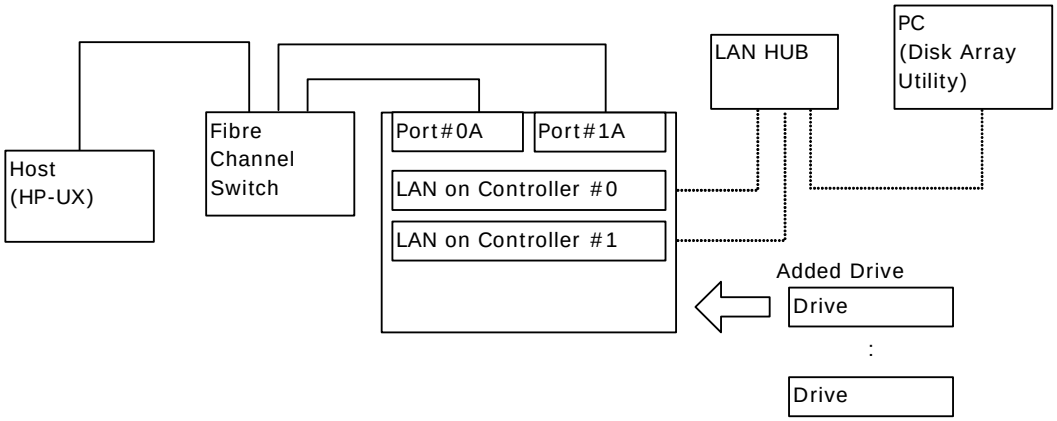



**Figure 11-4: Replacing a drive (CBXSS/CBSS/DBS)**

## Configuring a host to recognize a volume with power on

The following example describes how an HP-UX host recognizes a newly added drive that has been added to a Hitachi Unified Storage system with array power on. In the following figure, the PC connected to the LAN has an installed version of Hitachi Storage Navigator Modular 2.




Be sure the host and Hitachi Unified Storage system are in the Ready state, then perform the procedure below. Administrators who use network operating systems other than HP-UX will follow a different procedure, although they might find the steps below a helpful reference.

1. Create a new RAID group for the installed drives.
2. Create one or more new volumes for the RAID group created in the previous step.
3. Format the volumes created in the previous step.
4. From the host, issue the command `ioscan -nfC disk` to verify that the host recognizes the Hitachi Unified Storage system. The status of the newly added volume appears as **NO-NW**.
5. From the host:
   a. Issue the command `insf -e` to create a device file for the new volumes.
   b. Issue the command `ioscan -nfC disk` to verify that the host recognizes the Hitachi Unified Storage system. The status of the new volume appears as **CLAIMED**.
   c. Create a file system by creating the volume group and logical volume for the newly added volume.

The host can now use the new volumes.

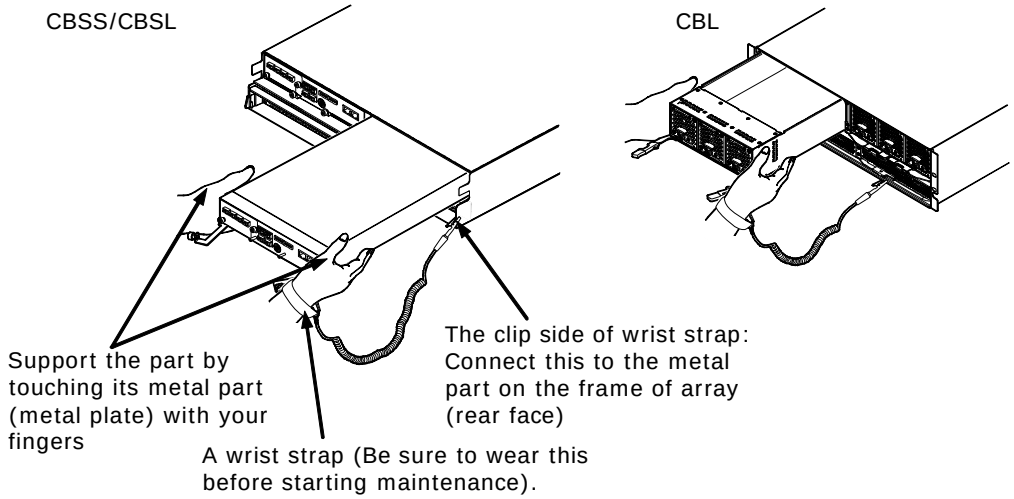
# Adding cache memory

The following sections describe how to add cache memory to the following Hitachi Unified Storage systems:

- CBSS and CBSL Controller Boxes — see Adding cache memory to a CBSS/CBSL below.
- CBL/CBLE Controller Boxes — see Adding cache memory to a CBL/CBLE on page 11-25.

## Adding cache memory to a CBSS/CBSL

The following procedure describes how to add cache memory to a CBSS or CBSL Controller Box. These Controller Boxes use different types of cache memory, so be sure to use the appropriate cache memory. if you add cache memory to both Controller Boxes in a dual-Controller system, be sure to return the Controller Boxes to the original locations.




When performing this procedure, see Figure 11-5 on page 11-24 and Figure 11-6 on page 11-25.

1. Turn off the main switch:
   - Press the main switch on Controller 0 or Controller 1 for at least three seconds.
   - Wait for the **POWER** LED on the front bezel to change from green to orange (approximately 10 minutes). If you cannot turn off the power, contact HDS Support at portal.hds.com.

     If the green **C-PWR** LED on the Controller blinks, some cache memory data has not been written to the drive. Wait until the **C-PWR** LED to go OFF.

     If the Controller is removed from the array when the **C-PWR** LED blinks, user data may be lost.
2. Remove the power cables from the two Power Units.
3. Remove the Controller:
   a. Loosen the blue right and left screws.

b. Open the right and left levers forward.

c. When the levers open completely, the Controller moves forward.

d. Remove all the connected cables to the Controller. If the Drive Box is connected, remove the SAS (ENC) cable.

**NOTE:** If cables cannot be removed easily, do not pull it by force; otherwise, you can damage the cable. When removing Fibre Channel cables, pull the cables completely out of the host connectors; if the cables are inserted halfway into the host connectors, the Controller detects Fibre Channel failures and I/O processing might deteriorate.

**WARNING:** Do not touch heat sinks or integrated circuits (ICs); otherwise, you could get burned.

e. Slide the Controller forward and then remove it.

4. Add cache memory:

   a. Place the Controller with its module-revision label facing down, loosen the blue two screws at the rear of the Controller, slide the cover in the direction shown by the arrow (⟶) and remove the cover.

   b. To remove the cache memory on the Controller, push the slot levers that secure the cache memory, and then hold both ends of the cache memory and gently pull up to remove the cache memory.

   c. Place the cache memory you removed in a static-free area.

   d. Install the additional cache memory in the Controller.

   e. Hold both ends of the additional cache memory and insert it into the slot in the Controller until the slot levers are completely closed

**NOTE:** The same capacity of cache memory must be installed in slot #0 and slot #1, and in Controller #0 and Controller #1.

   f. Slide and install the cover of the Controller, then secure using the two blue screws at the rear of the Controller.

5. Install the Controller:

   a. Orient the Controller with its module-revision label facing up, with its left and right levers open completely. Then insert and push the Controller all the way into the slot, with its right and left levers open completely. Exercise care to avoid catching cables.

   b. Close the levers and tighten using the right and left blue screws to secure the Controller.

6. Repeat steps 3 through 5 for the other Controller.

7. Connect all cables you removed form the Controller. Be sure Fibre Channel cables are connected securely; otherwise, the Controller detects Fibre Channel failures and I/O processing might deteriorate.

8. Connect the two power cables to the Controller Box.

9. Turn on the main switch.

10. Check that the green **READY** LED on the front of the Controller Box is ON, and the red **ALARM** LED and orange **WARNING** LED are OFF.

**NOTE:** Before the **READY** LED Box goes ON, it might blink quickly for up to 50 minutes and the **WARNING** LED may blink quickly for up to 85 minutes. However, if the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

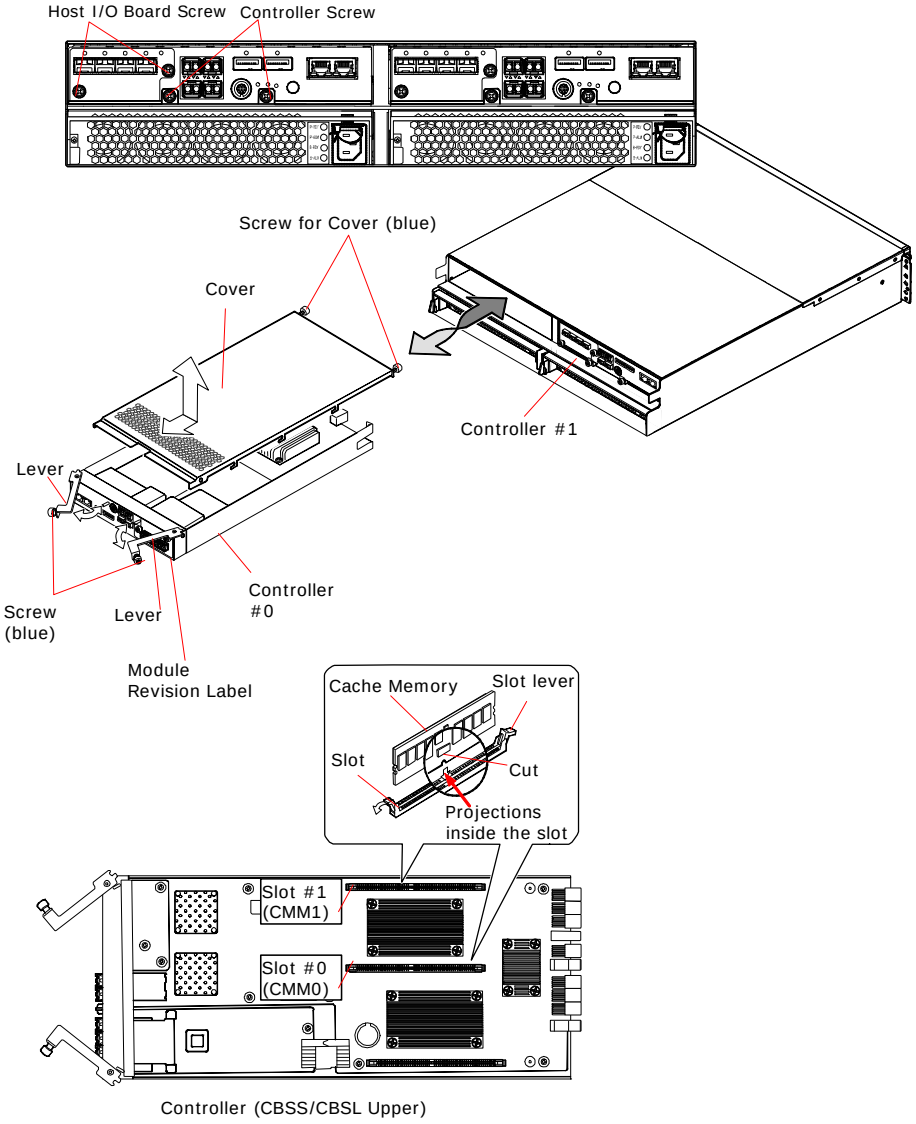



**Figure 11-5: Adding cache memory to a CBSS/CBSL**

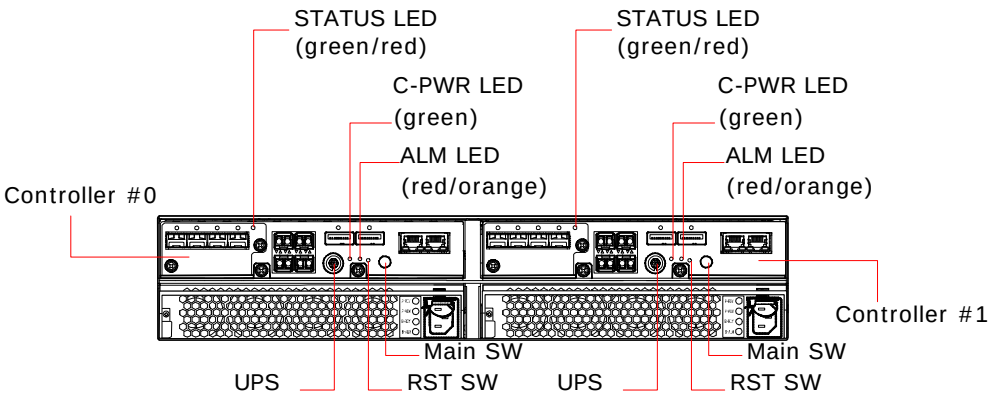



**Figure 11-6: Controller LEDs (CBSS/CBSL)**

## Adding cache memory to a CBL/CBLE

The following procedure describes how to add cache memory to a CBL/CBLE Controller Box. The CBL/CBLE Controller Box uses a different type of cache memory than the CBSS and CBSL Controller Boxes. Therefore, if you have more than one type of Controller Box, use the appropriate cache memory. If you add cache memory to both Controller Boxes in a dual-Controller system, be sure to return the Controller Boxes to the original locations.

When performing this procedure, see Figure 11-7 on page 11-26 and Figure 11-8 on page 11-26.

1. Turn off the main switch.
2. Remove the power cables from the two Power Units.
3. Remove the Controller:
   a. Slide the right blue right and latches, and then open the levers.
   b. Pull the right and left levers open. When the levers are opened completely, the Controller moves forward.
   c. Slide the Controller forward and then remove it.
4. Add the cache memory:
   a. To remove the cache memory on the Controller, push the slot levers that secure the cache memory, hold both sides of the cache memory, and gently pull up.
   b. Place the cache memory you removed in a static-free area.
   c. Hold both ends of the additional cache memory and insert it into the slot in the Controller until the slot levers are completely closed.

**NOTE:** The same capacity of cache memory must be installed in slot #0 and slot #1, and in Controller #0 and Controller #1.

5. Install the Controller:
   a. Insert and push the Controller all the way into the slot, with its right and left levers opened completely. Exercise care to avoid catching cables.

b. Close the levers and tighten using the right and left blue screws to secure the Controller.

6. Repeat steps 3 through 5 for the other Controller.
7. Connect the two power cables to the Controller Box.
8. Turn on the main switch.
9. Check that the green **READY** LED on the front of the Controller Box is ON, and the red **ALARM** LED and orange **WARNING** LED are OFF.

**NOTE:** Before the **READY** LED Box goes ON, it might blink quickly for up to 60 minutes or up to 180 minutes if the DBW is connected to the CBL/CBLE, and the **WARNING** LED may blink quickly for up to 85 minutes. However, if the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

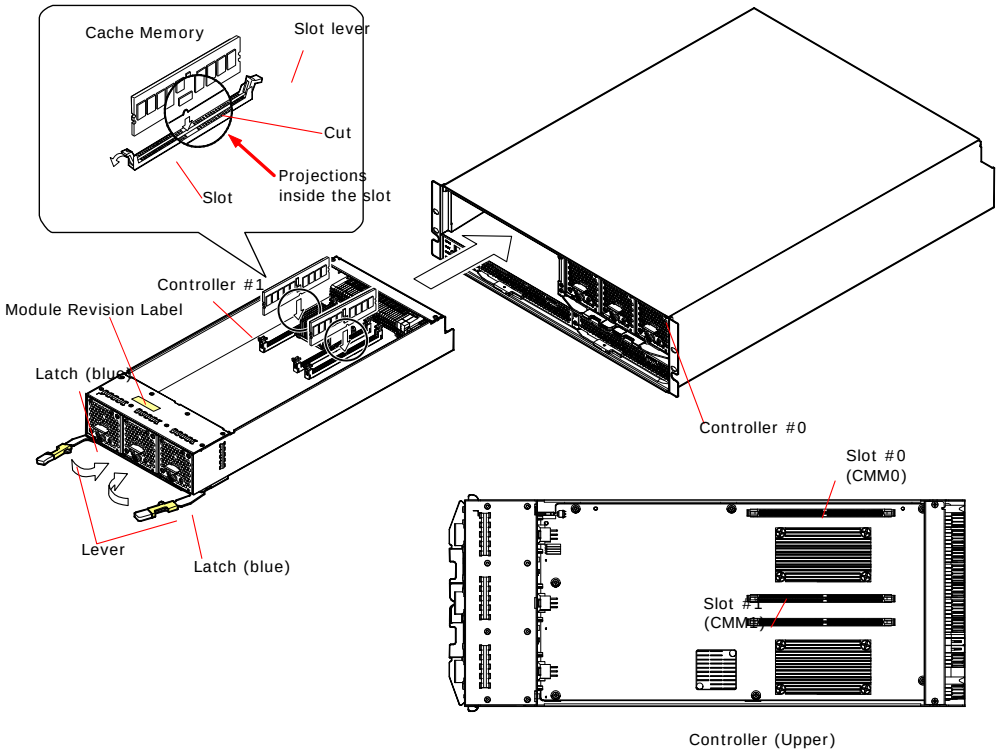



**Figure 11-7: Adding cache memory to a CBL/CBLE**

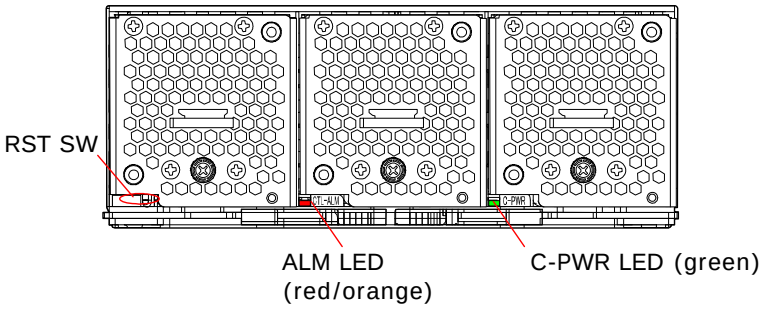



**Figure 11-8: Controller LEDs (CBL/CBLE)**

# Adding Fibre Channel Host I/O Modules or Boards

Fibre Channel Host I/O Modules and Boards can be added to Hitachi Unified Storage systems with the storage system offline (power is removed) or online (power is applied).

- For offline procedures — see Offline procedure below.
- For online procedures, see Online procedure (host is operating) on page 11-32.

## Offline procedure

The following sections describe how to add Fibre Channel Host I/O Boards to Hitachi Unified Storage systems with array power turned off.

- For CBSS and CBSL Controller Boxes — see CBSS/CBSL offline procedure below.
- For CBL/CBLE Controller Boxes — see CBL/CBLE offline procedure on page 11-30.

**NOTE:** For single-Controller configurations, add the Fibre Channel Module or Board for Controller #0 only.

### CBSS/CBSL offline procedure

The following procedure describes how to add a Fibre Channel Host I/O Board to a CBSS or CBSL Controller Box with power to the storage system turned off. When performing this procedure, see Figure 11-9 on page 11-29 and Figure 11-10 on page 11-29.

1. Collect a simple trace (refer to the *Hitachi Unified Storage Service Guide*).

**NOTE:** If you add a Host I/O Board to the location where a different type of Host I/O Board was installed, the following information is cleared. Therefore, perform the simple trace to collect and then back up configuration information before adding the Host I/O Board.

- Host group and target information
- Host group and target options
- Mapping information
- Fibre Channel port settings

2. Turn off the main switch:
   - Press the main switch on Controller 0 or Controller 1 for at least three seconds.
   - Wait for the **POWER** LED on the front bezel to change from green to orange (approximately 10 minutes). If you cannot turn off the power, contact HDS Support at portal.hds.com.

     If the green **C-PWR** LED on the Controller blinks, some cache memory data has not been written to the drive. Wait until the **C-PWR** LED to go OFF.

If the Controller is removed from the array when the **C-PWR** LED blinks, user data may be lost.

3. Remove the power cables from the two Power Units.
4. Remove the Host I/O Board or dummy board installed in the Controller:

**WARNING:** Do not touch heat sinks or ICs; otherwise, you could get burned.

   a. Loosen the two blue screws securing the Host I/O Board.
   b. Pull out and remove the Host I/O Board.
   c. Place the Host I/O Board you removed in a static-free area.
5. Install the Fibre Channel Host I/O Board in the Controller:
   a. Remove the Host Connector installed on the additional Host I/O Board.
   b. Insert and push the additional Fibre Channel Host I/O Board into the slot on the Controller.

**NOTE:** Install the same type of Host I/O Boards in the same position of Controller #0 and #1.

   c. Tighten the two screws to secure the Fibre Channel Host I/O Board.
   d. Install the Host Connector in the Host I/O Board.
6. Repeat steps 3 and 4 for the other Controller.
7. Connect the power cables to the Power Units.
8. Turn on the main switch.
9. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF. The **WARNING** LED might blink quickly for up to 85 minutes.

**NOTE:** If the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

10. Check that the green **READY** LED on the front of the Controller Box is ON. The **READY** LED might blink quickly for up to 50 minutes.
11. Configure the host group and Fibre Channel port setting for the port on the Fibre Channel Host I/O Board you added (see Chapter 5, Configuring the storage system).

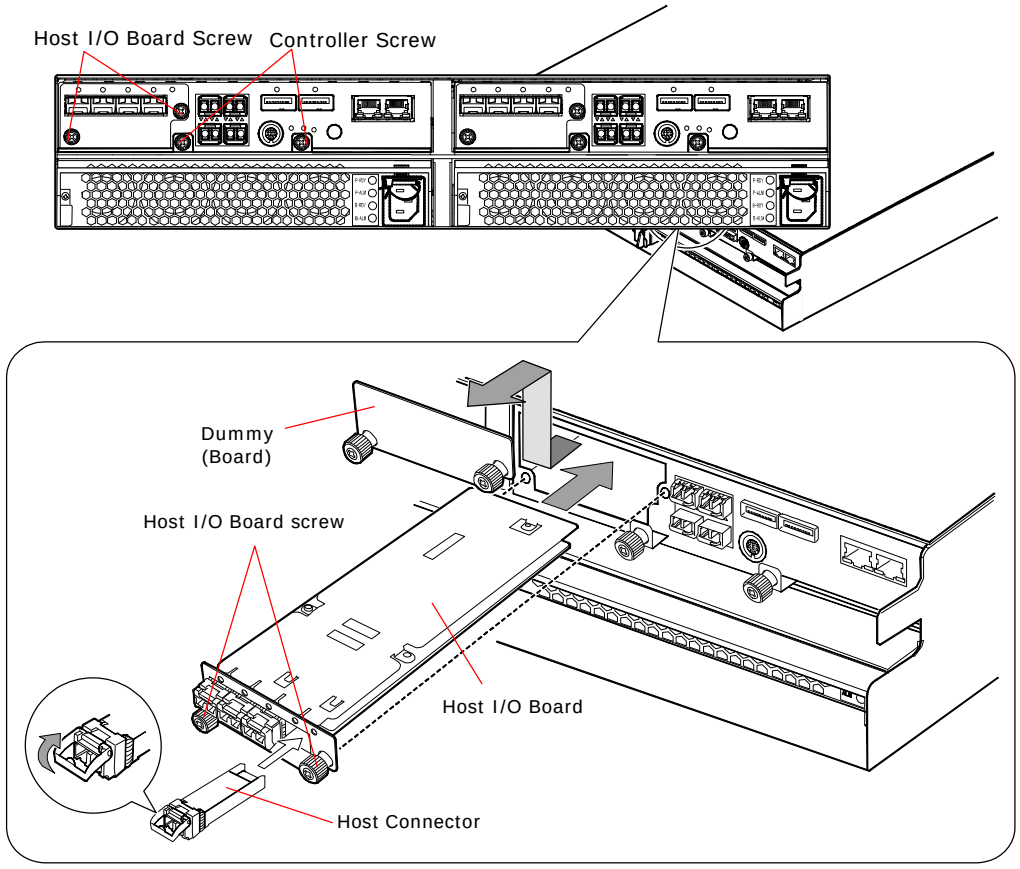



**Figure 11-9: Adding a Fibre Channel Host I/O Board (CBSS/CBSL)**

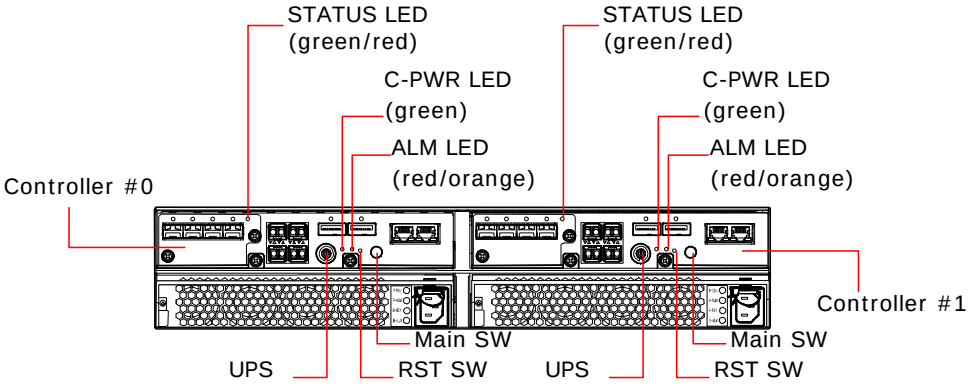



**Figure 11-10: LED Locations on the Controller (CBSS/CBSL)**

## CBL/CBLE offline procedure

The following procedure describes how to add a Fibre Channel Host I/O Module or Board to a CBL/CBLE Controller Box with power to the storage system turned off. When performing this procedure, see Figure 11-11 on page 11-31 and Figure 11-12 on page 11-32.

1. Collect a simple trace (refer to the *Hitachi Unified Storage Service Guide*).

**NOTE:** If you add a Host I/O Module to the location where a different type of Host I/O Module was installed, the following information is cleared. Therefore, perform the simple trace to collect and then back up configuration information before adding the Host I/O Module.

- Host group and target information
- Host group and target options
- Mapping information
- Fibre Channel port settings

2. Turn off the main switch:
   - Be sure the **POWER** LED on the front bezel changes from green to orange. If you cannot turn off the power, contact HDS Support at portal.hds.com.

     If the green **C-PWR** LED on the Controller blinks, some cache memory data has not been written to the drive. Wait until the **C-PWR** LED to go OFF.

     If the Controller is removed from the array when the **C-PWR** LED blinks, user data may be lost.
3. Remove the power cables from the two Power Units.
4. Remove the interface cables from the additional Host I/O Module.

**NOTE:** If cables cannot be removed easily, do not pull it by force; otherwise, you can damage the cable. If the interface cables are inserted halfway into the host connectors, the Controller detects failures and I/O processing might deteriorate.

5. Remove the Host I/O Module or the dummy Module installed in the Controller:

**WARNING:** Do not touch heat sinks or ICs; otherwise, you could get burned.

   a. Loosen the blue screw securing the Host I/O Module or dummy Module, and then tilt the lever toward you. When the lever is completely tilted, the Host I/O Module or dummy Module moves forward.

   b. Pull out and remove the Host I/O Module or dummy Module. Place the Module you removed in a static-free area.

6. Insert the Host I/O Module:
   a. Insert and push the additional Host I/O Module (FC) with its lever open completely.

**NOTE:** Install Host I/O Modules of the same type in the same position of Controller #0 and #1.

   b. Close the lever and tighten the blue screw to secure the Host I/O Module.
7. Repeat steps 4 through 6 for the other Controller.
8. Connect the interface cables to the Host I/O Module. Be sure Fibre Channel cables are connected securely; otherwise, the Controller detects Fibre Channel failures and I/O processing might deteriorate.
9. Connect the power cables to the Power Units.
10. Turn on the main switch.
11. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF. The **WARNING** LED might blink quickly for up to 85 minutes.

**NOTE:** If the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

12. Check that the green **READY** LED on the front of the Controller Box is ON. The **READY** LED might blink quickly for up to 60 minutes or up to 180 minutes if the DBW is connected to the CBL/CBLE.
13. Configure the host group and Fibre Channel port setting for the port on the Fibre Channel Host I/O Module you added (see Chapter 5, Configuring the storage system).

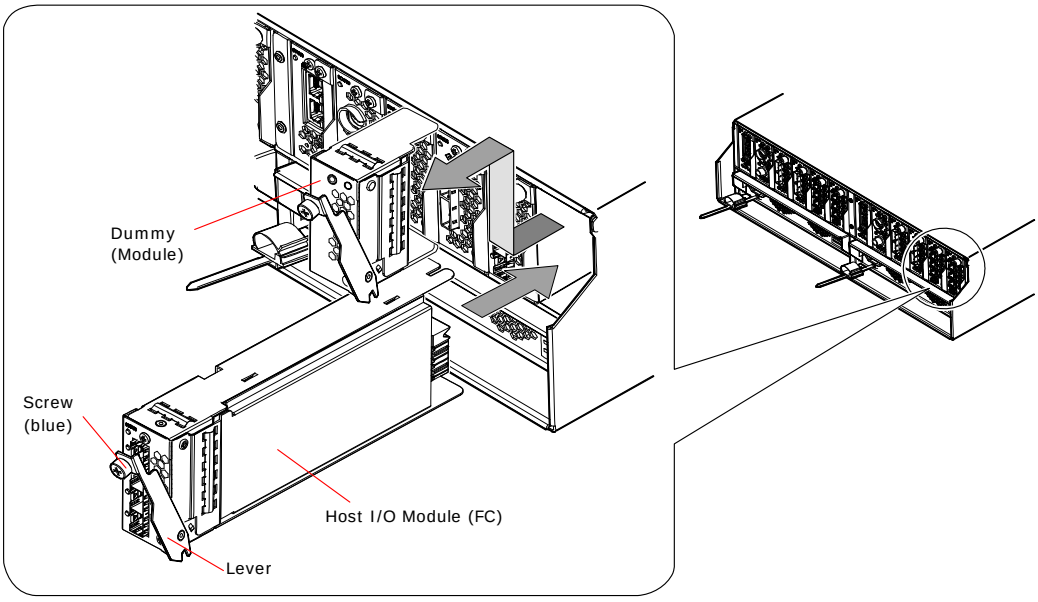



**Figure 11-11: Adding a Fibre Channel Host I/O Board (CBL/CBLE)**

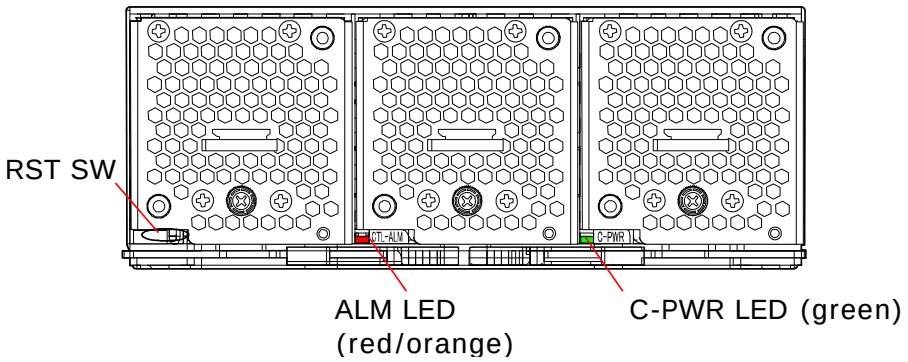



**Figure 11-12: LED Locations on the Controller (CBL/CBLE)**

## Online procedure (host is operating)

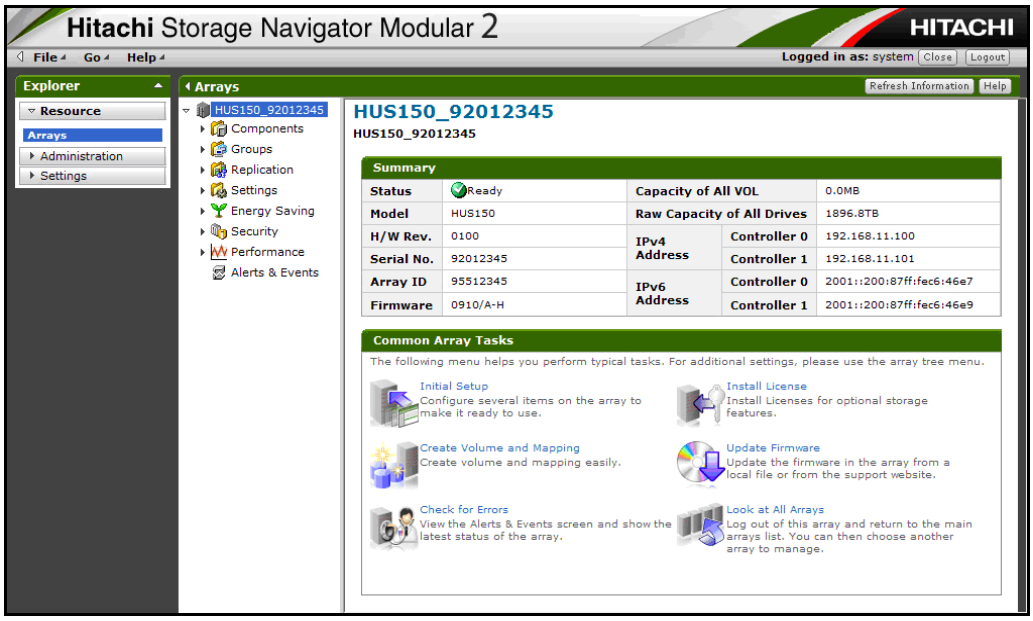
The following sections describe how to add Fibre Channel Host I/O Module or Board to Hitachi Unified Storage systems with array power turned off and the host remaining operational.

- For CBSS, CBSL, and CBL/CBLE Controller Boxes — see CBXSS/CBXSL/CBSS/CBSL online procedure below.
- For CBL/CBLE Controller Boxes — see CBL/CBLE online procedure on page 11-36.

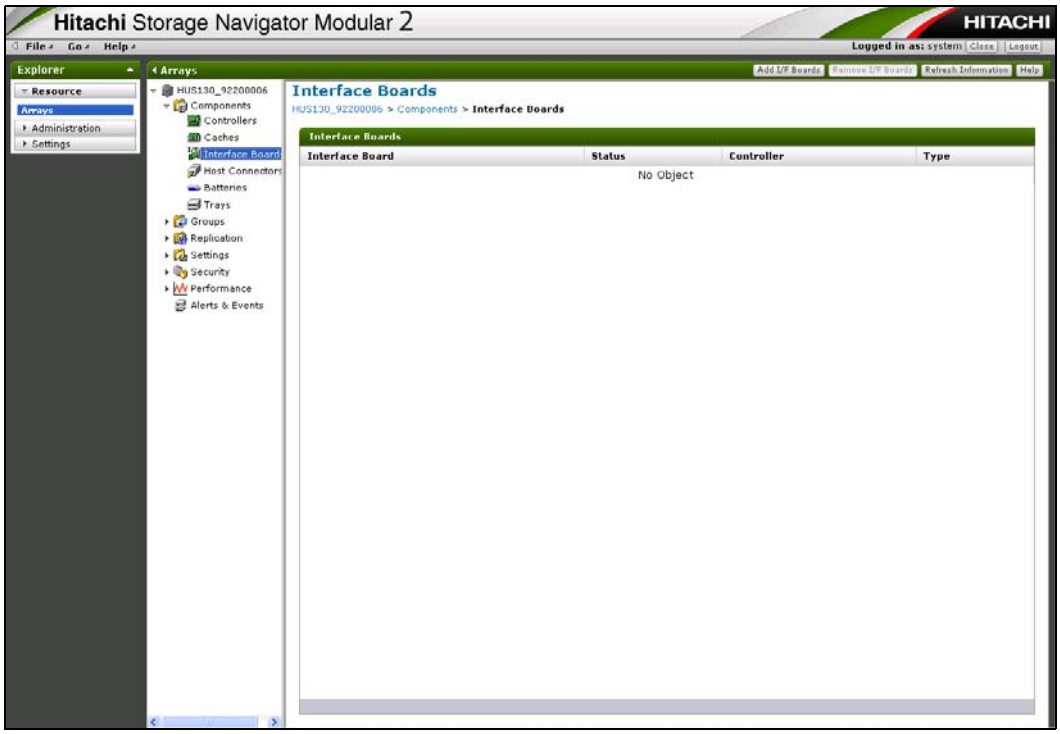
### CBSS/CBSL online procedure

The following procedure describes how to add a Fibre Channel Host I/O Board to a CBSS or CBSL Controller Box with power to the storage system turned on and the host remaining operational. When performing this procedure, see Figure 11-11 on page 11-31 and Figure 11-12 on page 11-32.

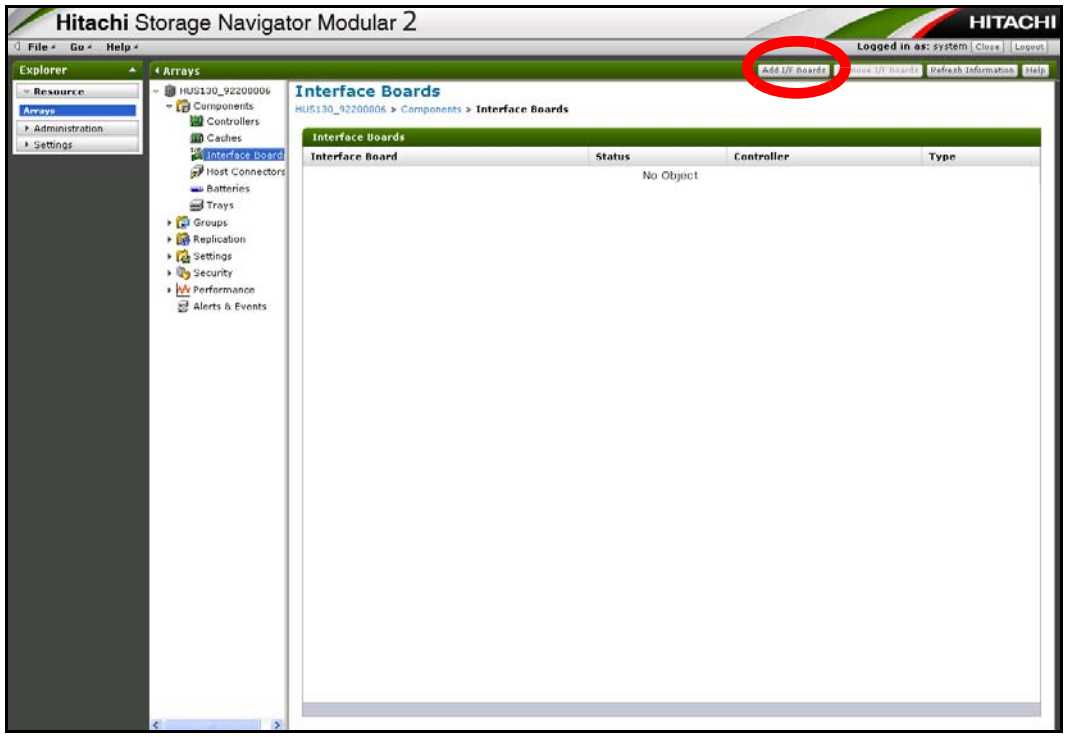
1. Check that the storage system is a dual-Controller configuration.
2. Confirm that the slot where you want to add the Host I/O Board is empty. If you change the type of the Host I/O Board, contact HDS Support at portal.hds.com.
3. Start Hitachi Storage Navigator Modular 2 and log in:
   a. Click the array name to display the unit window. If the unit window is not displayed, check that the LAN port number has not changed. If it has, repeat this step using the LAN port number shown.




b. Click **Components > Interface Boards**. The Interface Boards window appears.

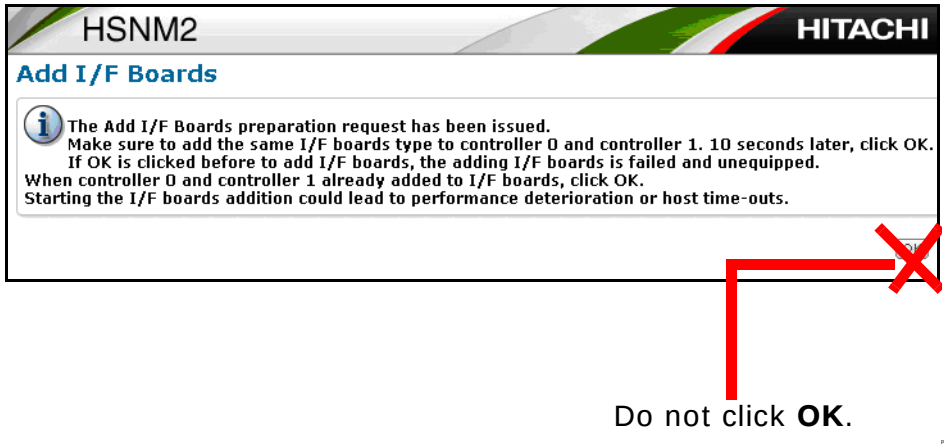



c. Click **Add I/F Boards**.




d. When the Add I/F Boards confirmation message appears, click **Confirm**.

e. At the next screen, DO NOT CLICK **OK**.

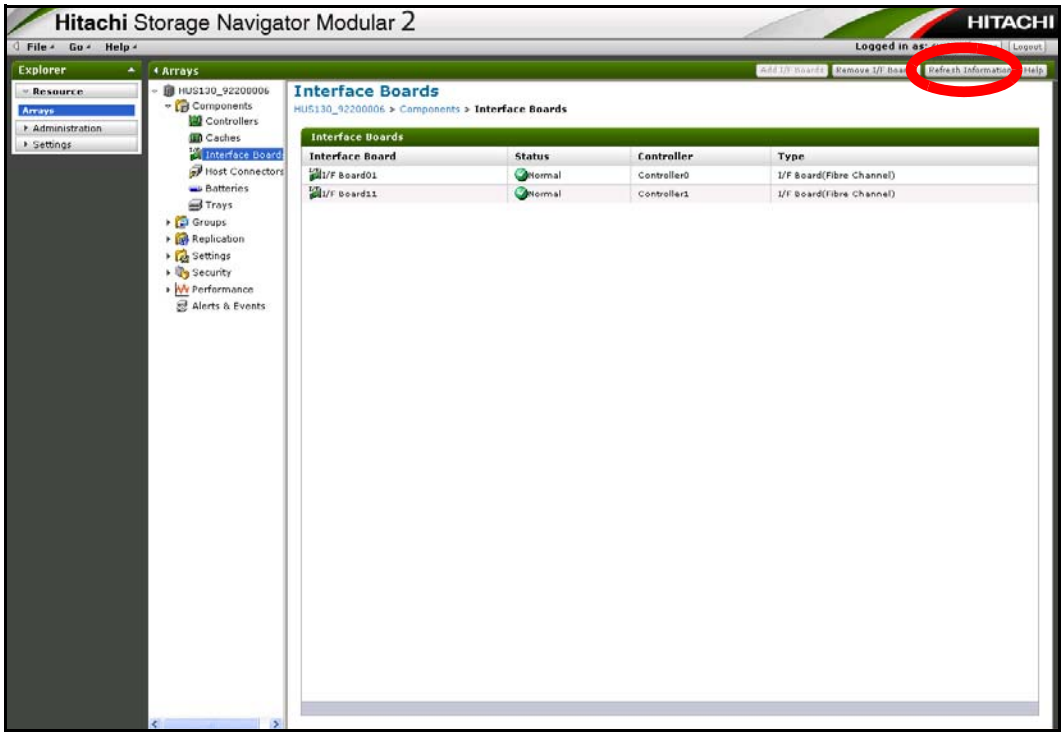



4. Remove the dummy Board:
   a. Loosen the two screws securing the dummy Board.
   b. Pull out and remove the dummy Board.
5. Install a Fibre Channel Host I/O Board.

6. Remove the Host Connector installed on the additional Host I/O Board.
7. Insert and push the additional Fibre Channel Host I/O Board into the slot in the Controller.

**NOTE:** Install the same type of Host I/O Board in the same position of Controller #0 and Controller #1.

8. In Hitachi Storage Navigator Modular 2, click **OK** in the Add I/F Boards screen within 10 seconds after you install the Fibre Channel Host I/O Board.
9. At the next message, click **Close**.
10. In Hitachi Storage Navigator Modular 2, click **Refresh Information** to update the window and check that the status of the Interface Board is **Normal**.




11. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF.

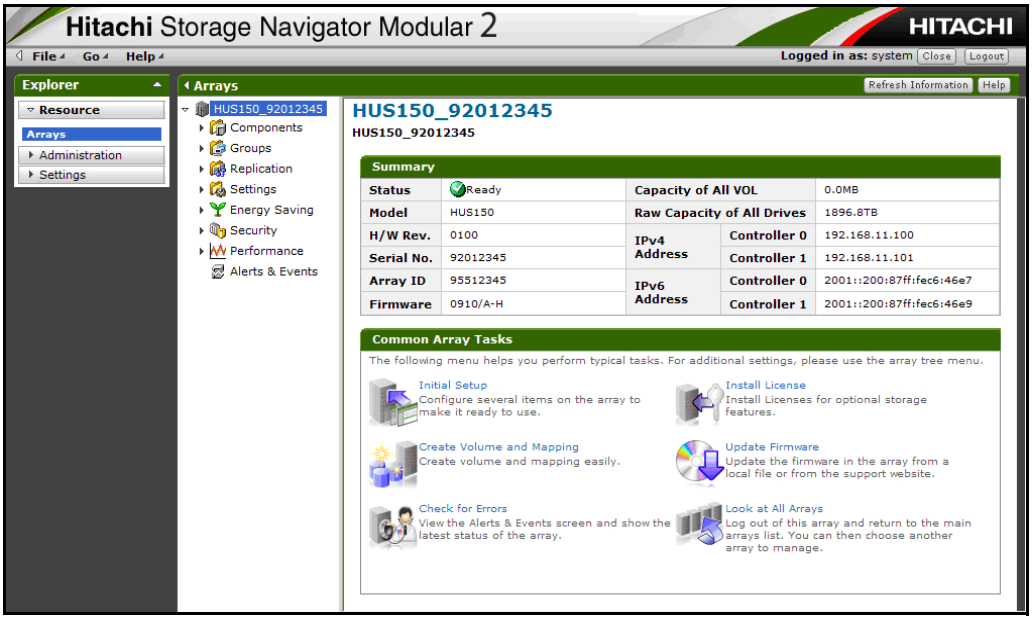
**NOTE:** If the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

12. Check that the green **READY** LED on the front of the Controller Box is ON.
13. Connect the interface cables to the Host I/O Board you added. When connecting Fibre Channel cables, be sure the cables are connected securely; otherwise, the Controller detects Fibre Channel failures and I/O processing might deteriorate.
14. Configure the host group and Fibre Channel port setting for the port on the Fibre Channel Host I/O Board you added (see Chapter 5, Configuring the storage system).

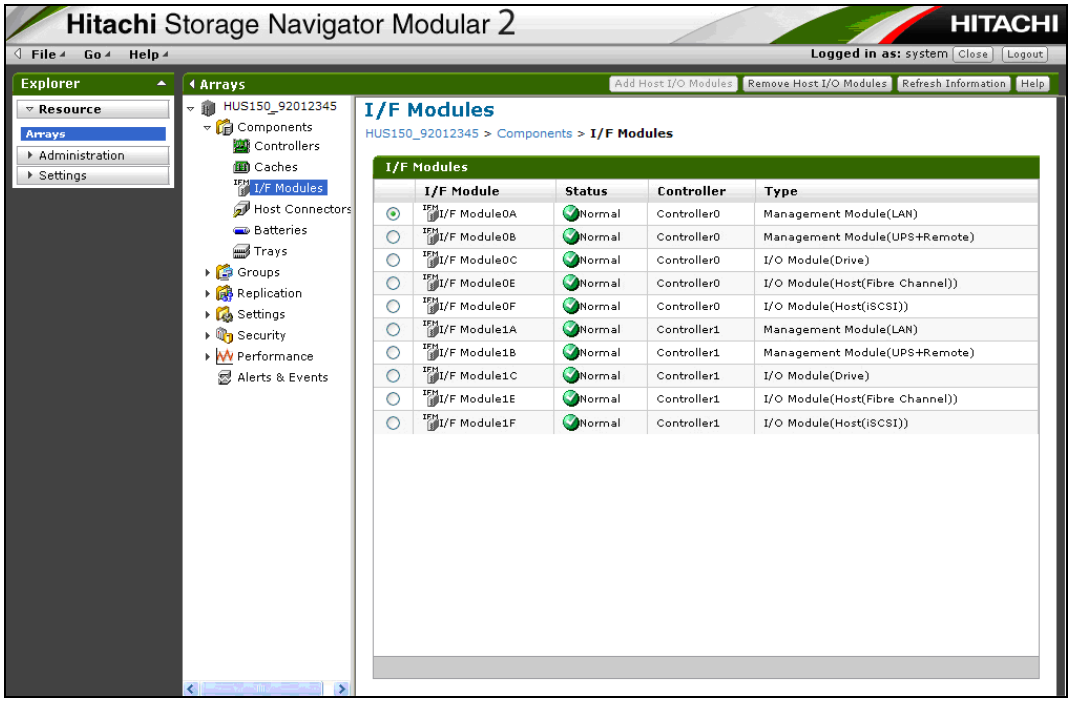
## CBL/CBLE online procedure

The following procedure describes how to add a Fibre Channel Host I/O Module to a CBL/CBLE Controller Box with power to the storage system turned on and the host remaining operational. When performing this procedure, see Figure 11-11 on page 11-31 and Figure 11-12 on page 11-32.

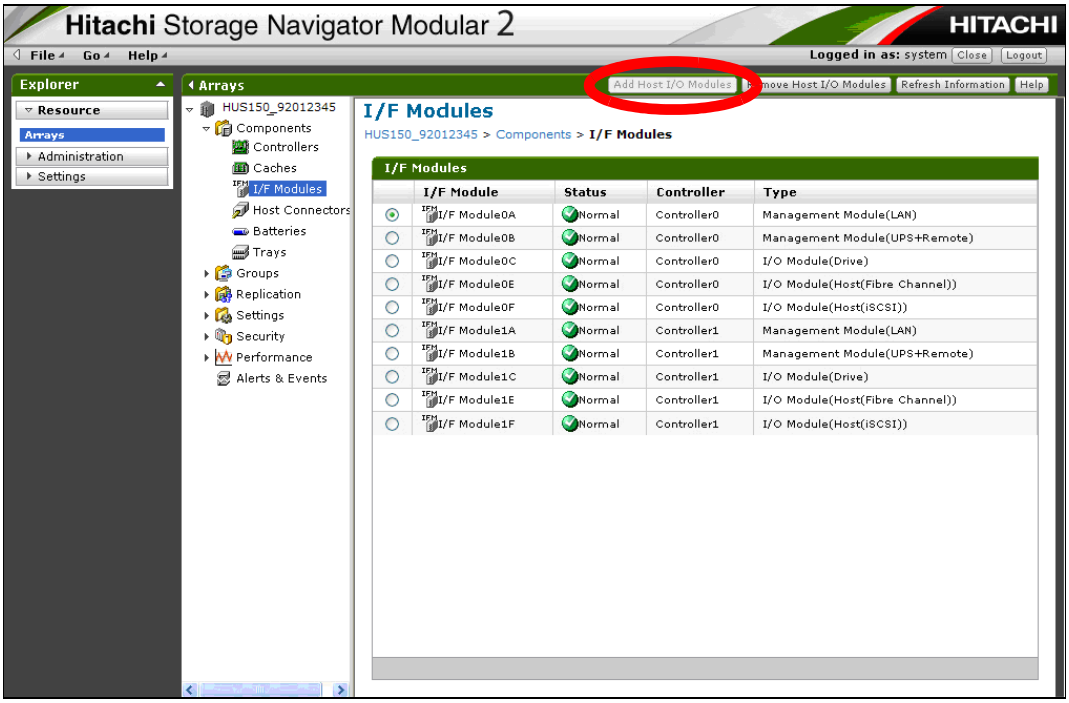
1. Check that the storage system is a dual-Controller configuration.
2. Confirm that the slot where you want to add the Host I/O Module is empty. If you change the type of the Host I/O Module, contact HDS Support at portal.hds.com.
3. Start Hitachi Storage Navigator Modular 2 and log in:
   a. Click the array name to display the unit window. If the unit window is not displayed, check that the LAN port number has not changed. If it has, repeat this step using the LAN port number shown.



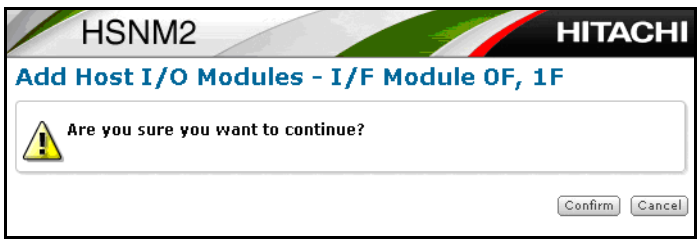

   b. Click **Components > IF Modules**. The IF Modules window appears.



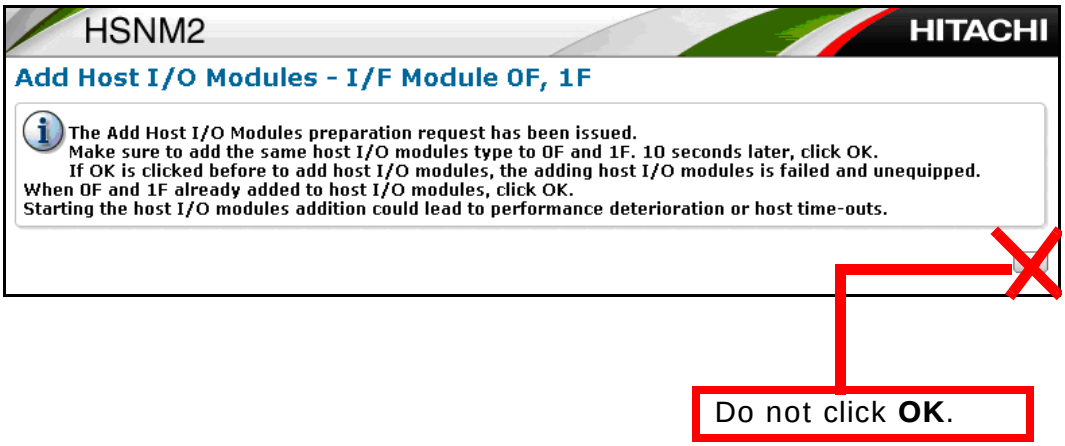

c. Click **Add Host I/O Modules**.




d. When the Host I/O Module confirmation message appears, click **Confirm**.



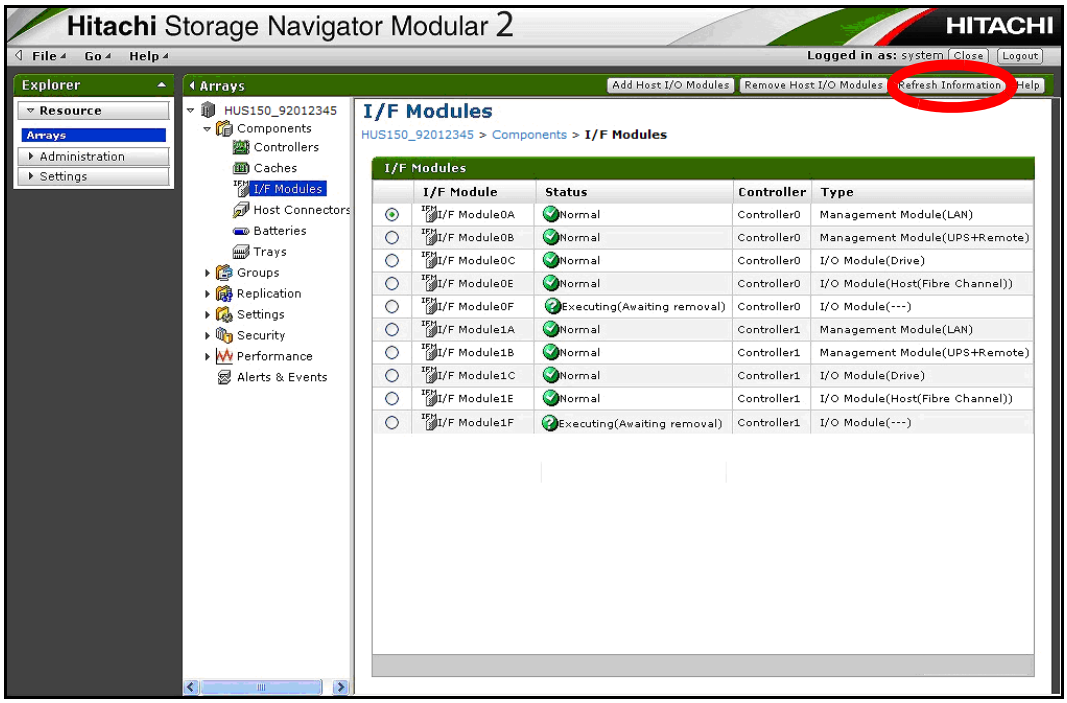
e. At the next screen, DO NOT CLICK **OK**.




4. Remove the dummy Module:
   a. Loosen the blue screw securing the dummy Module to pull the lever. If you pull the lever, the dummy Module sticks out.
   b. Pull out and remove the dummy Module.
5. Install a Fibre Channel Host I/O Module.
6. Insert and push the additional Fibre Channel Host I/O Module with its lever opened completely.
7. Close the lever and tighten using the blue crew to secure the Host I/O Module.

**NOTE:** Install the same type of Host I/O Module in the same position of Controller #0 and Controller #1.

8. In Hitachi Storage Navigator Modular 2, click **OK** in the Add Host I/O Modules screen within 10 seconds after you install the Fibre Channel Host I/O Module.
9. At the next message, click **Close**.
10. In Hitachi Storage Navigator Modular 2, click **Refresh Information** to update the window and check that the status of the Interface Module is **Normal**.




11. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF.

**NOTE:** If the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

12. Check that the green **READY** LED on the front of the Controller Box is ON.
13. Connect the interface cables to the Host I/O Module you added. When connecting Fibre Channel cables, be sure the cables are connected securely; otherwise, the Controller detects Fibre Channel failures and I/O processing might deteriorate.
14. Configure the host group and Fibre Channel port setting for the port on the Fibre Channel Host I/O Module you added (see Chapter 5, Configuring the storage system).

# Adding iSCSI Host I/O Modules or Boards

iSCSI Host I/O Modules and Boards can be added to Hitachi Unified Storage systems with the storage system offline (power is removed) or online (power is applied).

- For offline procedures — see Offline procedure below.
- For online procedures, see Online procedure (host is operating) on page 11-45.

## Offline procedure

The following sections describe how to add iSCSI Host I/O Module or Board to Hitachi Unified Storage systems with array power turned off.

- For CBXSS, CBXSL, CBSS, and CBSL Controller Boxes — see CBXSS/CBXSL/CBSS/CBSL offline procedure below.
- For CBL/CBLE Controller Boxes — see CBL/CBLE offline procedure on page 11-43.

**NOTE:** For single-Controller configurations, add the iSCSI Module or Board for Controller #0 only.

### CBXSS/CBXSL/CBSS/CBSL offline procedure

The following procedure describes how to add an iSCSI Host I/O Module or Board to a CBXSS, CBXSL, CBSS, or CBSL Controller Box with power to the storage system turned off. When performing this procedure, see Figure 11-13 on page 11-42 and Figure 11-14 on page 11-42.

1. Collect a simple trace (refer to the *Hitachi Unified Storage Service Guide*).

**NOTE:** If you add a Host I/O Board to the location where a different type of Host I/O Board was installed, the following information is cleared. Therefore, perform the simple trace to collect and then back up configuration information before adding the Host I/O Board.

- Host group and target information
- Host group and target options
- Mapping information
- iSCSI port settings
- CHAP security information

2. Turn off the main switch:
   - Press the main switch on Controller 0 or Controller 1 for at least three seconds.
   - Wait for the **POWER** LED on the front bezel to change from green to orange (approximately 10 minutes). If you cannot turn off the power, contact HDS Support at portal.hds.com.

If the green **C-PWR** LED on the Controller blinks, some cache memory data has not been written to the drive. Wait until the **C-PWR** LED to go OFF.

If the Controller is removed from the array when the **C-PWR** LED blinks, user data may be lost.

3. Remove the power cables from the two Power Units.
4. Remove the Host I/O Board or dummy board installed in the Controller:

**WARNING:** Do not touch heat sinks or ICs; otherwise, you could get burned.

   a. Loosen the two blue screws securing the Host I/O Board.
   b. Pull out and remove the Host I/O Board.
   c. Place the Host I/O Board you removed in a static-free area.
5. Install the iSCSI Host I/O Board in the Controller:
   a. Insert and push the additional iSCSI Host I/O Board into the slot on the Controller.

**NOTE:** Install the same type of Host I/O Boards in the same position of Controller #0 and #1.

   b. Tighten the two screws to secure the iSCSI Host I/O Board.
6. Repeat steps 4 and 5 for the other Controller.
7. Connect the power cables to the Power Units.
8. Turn on the main switch.
9. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF. The **WARNING** LED might blink quickly for up to 85 minutes.

**NOTE:** If the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

10. Check that the green **READY** LED on the front of the Controller Box is ON. The **READY** LED might blink quickly for up to 50 minutes.
11. Configure the host group and iSCSI port setting for the port on the iSCSI Host I/O Board you added (see Chapter 5, Configuring the storage system).

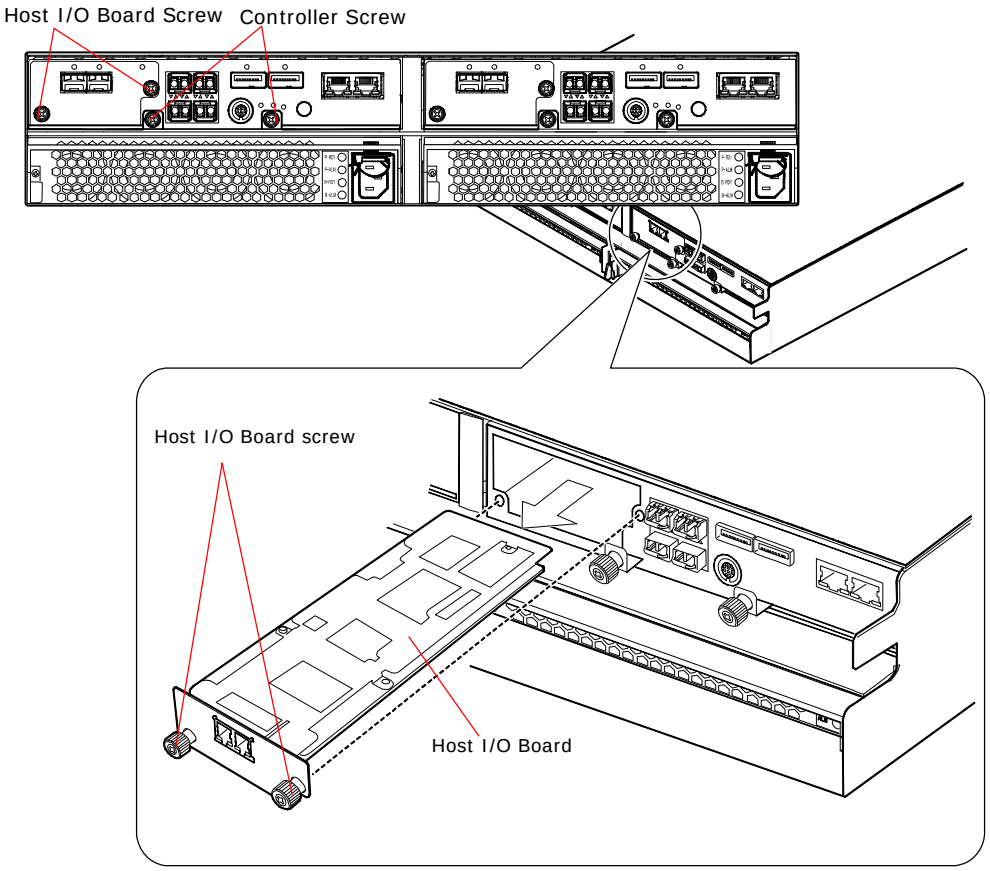



**Figure 11-13: Adding an iSCSI Host I/O Board (CBXSS/CBXSL/CBSS/CBSL)**

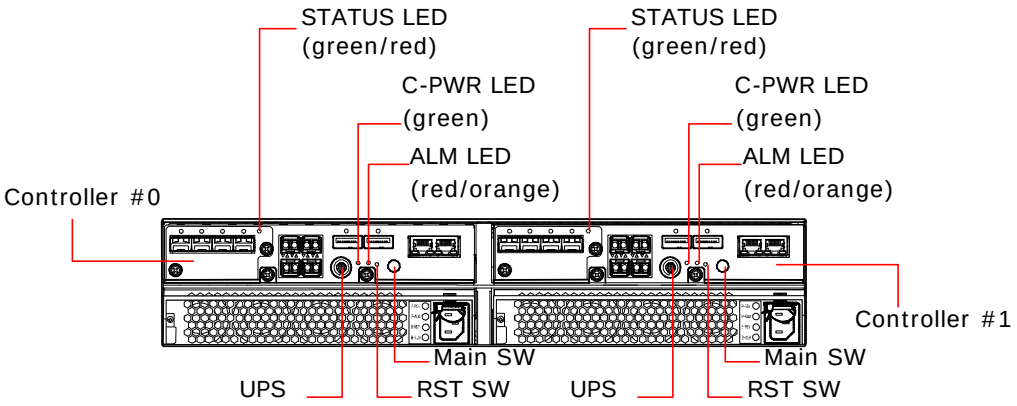



**Figure 11-14: LED Locations on the Controller (CBXSS/CBXSL/CBSS/CBSL)**

## CBL/CBLE offline procedure

The following procedure describes how to add an iSCSI Host I/O Module or Board to a CBL/CBLE Controller Box with power to the storage system turned off. When performing this procedure, see Figure 11-13 on page 11-42 and Figure 11-14 on page 11-42.

1. Collect a simple trace (refer to the *Hitachi Unified Storage Service Guide*.

**NOTE:** If you add a Host I/O Module to the location where a different type of Host I/O Module was installed, the following information is cleared. Therefore, perform the simple trace to collect and then back up configuration information before adding the Host I/O Module.

- Host group and target information
- Host group and target options
- Mapping information
- iSCSI port settings
- CHAP security information

2. Turn off the main switch:
   - Be sure the **POWER** LED on the front bezel changes from green to orange. If you cannot turn off the power, contact HDS Support at portal.hds.com.

     If the green **C-PWR** LED on the Controller blinks, some cache memory data has not been written to the drive. Wait until the **C-PWR** LED to go OFF.

     If the Controller is removed from the array when the **C-PWR** LED blinks, user data may be lost.
3. Remove the power cables from the two Power Units.
4. Remove the interface cables from the additional Host I/O Module.

**NOTE:** If cables cannot be removed easily, do not pull it by force; otherwise, you can damage the cable. If the interface cables are inserted halfway into the host connectors, the Controller detects failures and I/O processing might deteriorate.

5. Remove the Host I/O Module or the dummy Module installed in the Controller:

**WARNING:** Do not touch heat sinks or ICs; otherwise, you could get burned.

   a. Loosen the blue screw securing the Host I/O Module or dummy Module, and then tilt the lever toward you. When the lever is completely tilted, the Host I/O Module or dummy Module moves forward.
   b. Pull out and remove the Host I/O Module or dummy Module. Place the Module you removed in a static-free area.

6. Insert the Host I/O Module:
   a. Insert and push the additional Host I/O Module (FC) with its lever open completely.

**NOTE:** Install Host I/O Modules of the same type in the same position of Controller #0 and #1.

7. If Controller #0 has an iSCSI Host I/O Module, install the iSCSI Host I/O Module in Controller #1. Otherwise, skip to step 8.
   a. Loosen the two screws securing the dummy Module, pull out the dummy Module, and remove it.
   b. Insert and push the iSCSI Host I/O Module into the slot in Controller #1.
   c. Tighten the two screws to secure the iSCSI Host I/O Module.
8. Insert Controller #1:
   a. Insert and push the Controller all the way into the slot, with its right and left levers opened completely. Exercise care to avoid catching cables.
   b. Close the levers and tighten using the right and left blue screws to secure the Controller
9. Connect the interface cables, LAN cables, and SAS (ENC) cables to the Controller.
   - When connecting a SAS (ENC) cable, bend it at least 30 mm to avoid stress on the cable and its connector.
   - When connecting a Fibre Channel cable, be sure it is connected securely; otherwise, the Controller detects Fibre Channel failures and I/O processing might deteriorate.
10. Connect the power cables to the Power Units.
11. Press the main switch on Controller #0 for at least one second.
12. Check that the green **READY** LED on the front of the Controller Box is ON. The **READY** LED might blink quickly for up to 60 minutes or up to 180 minutes if the DBW is connected to the CBL/CBLE.
13. Connect the interface cables to the Host I/O Module you added. When connecting Fibre Channel cables, be sure the cables are connected securely; otherwise, the Controller detects Fibre Channel failures and I/O processing might deteriorate.
14. Configure the host group and Fibre Channel port settings for the port on the Fibre Channel Host I/O Module you added (see Chapter 5, Configuring the storage system).

# Online procedure (host is operating)

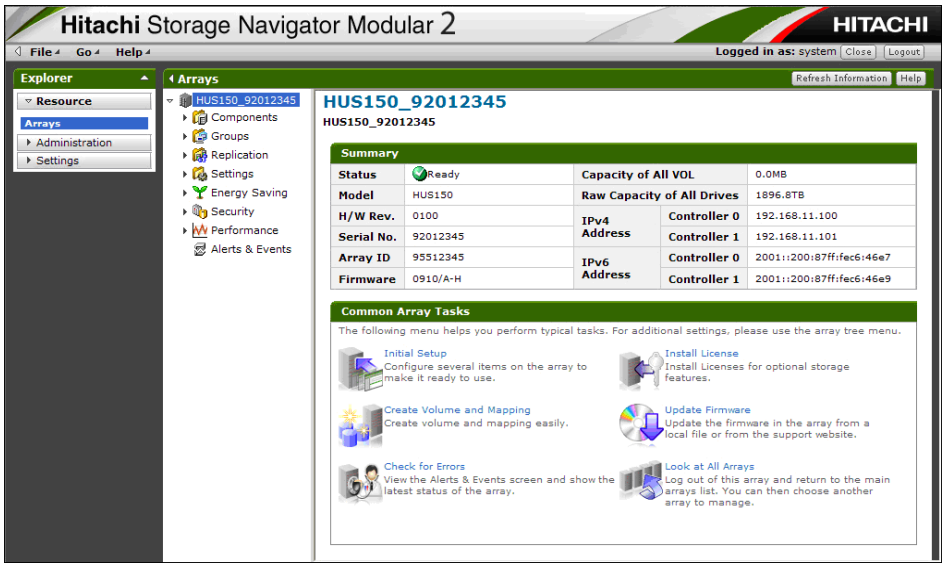
The following sections describe how to add iSCSI Host I/O Module or Board to Hitachi Unified Storage systems with array power turned on and the host remaining operational.

- For CBXSS, CBXSL, CBSS, and CBSL Controller Boxes — see CBXSS/CBXSL/CBSS/CBSL online procedure below.
- For CBL/CBLE Controller Boxes — see CBL/CBLE online procedure on page 11-48.

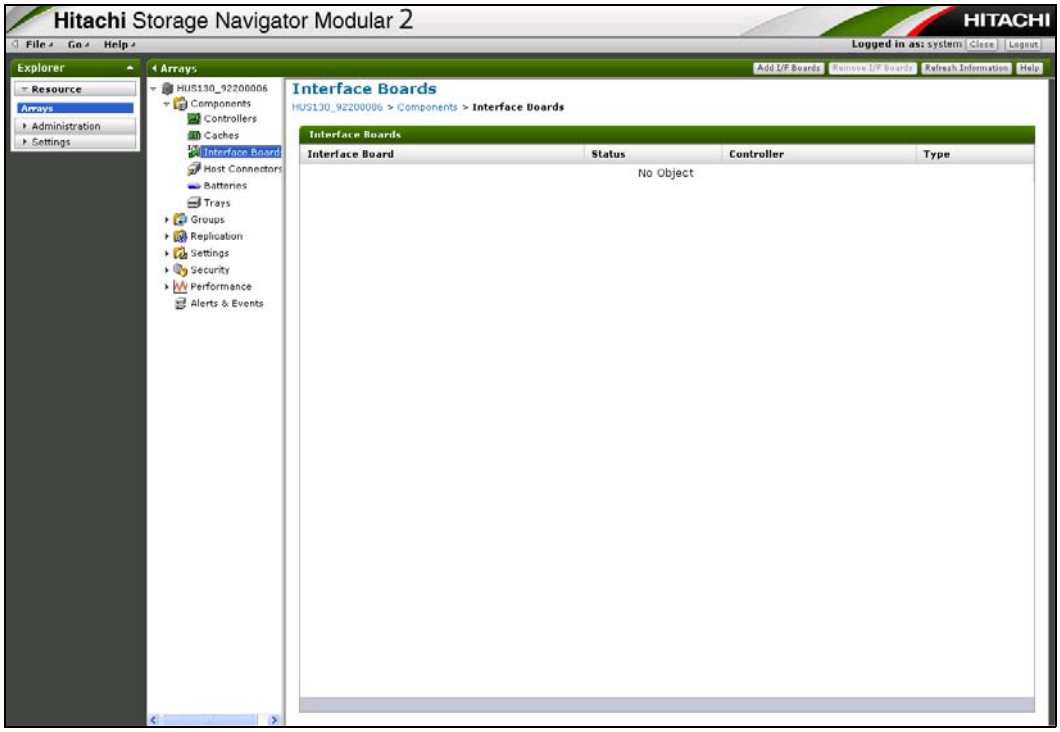
## CBXSS/CBXSL/CBSS/CBSL online procedure

The following procedure describes how to add an iSCSI Host I/O Board to a CBXSS, CBXSL, CBSS, or CBSL Controller Box with power to the storage system turned on and the host remaining operational. When performing this procedure, see Figure 11-13 on page 11-42 and Figure 11-14 on page 11-42.

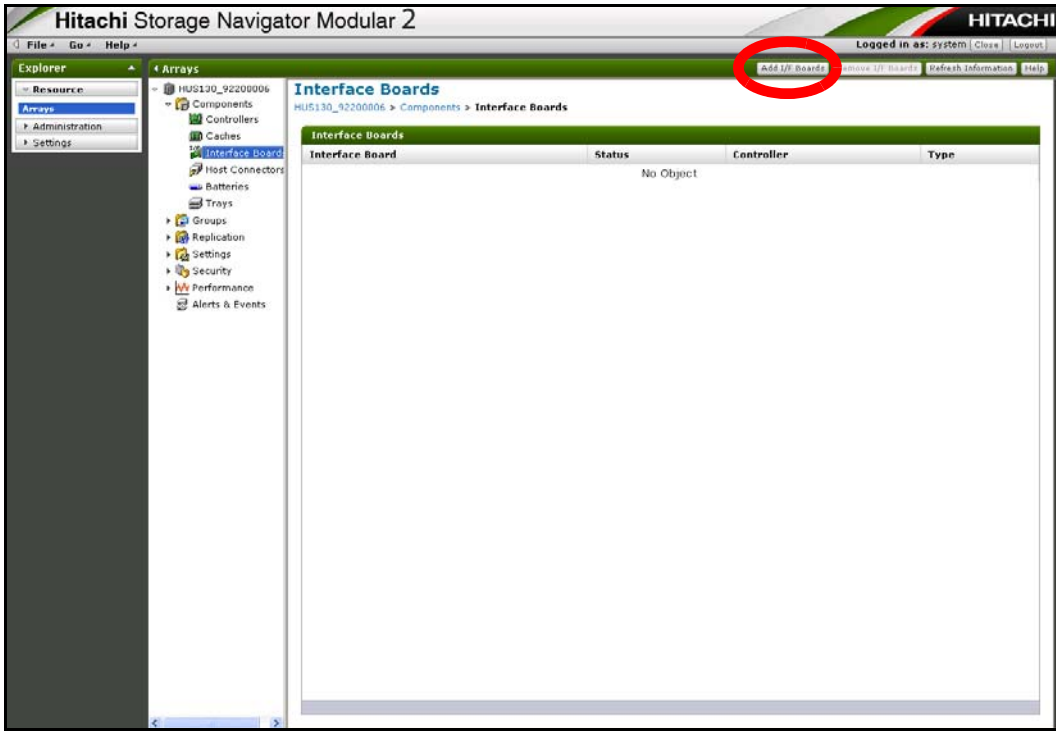
1. Check that the storage system is a dual-Controller configuration.
2. Confirm that the slot where you want to add the Host I/O Board is empty. If you change the type of the Host I/O Board, contact HDS Support at portal.hds.com.
3. Start Hitachi Storage Navigator Modular 2 and log in:
   a. Click the array name to display the unit window. If the unit window is not displayed, check that the LAN port number has not changed. If it has, repeat this step using the LAN port number shown.



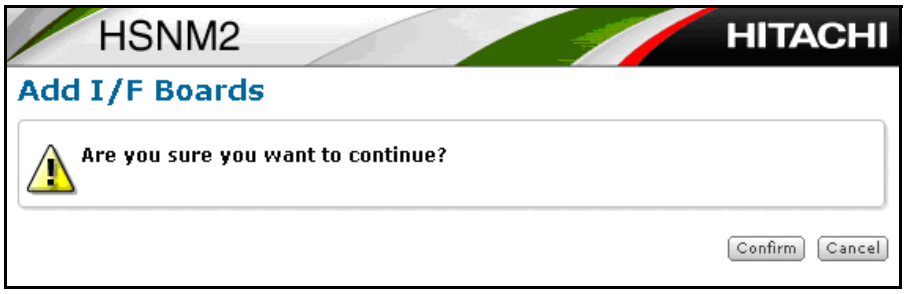

   b. Click **Components > Interface Boards**. The Interface Boards window appears.



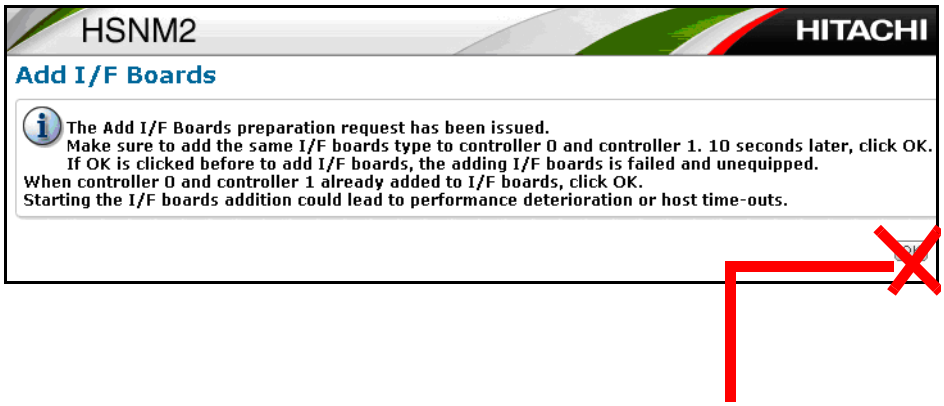

c. Click **Add I/F Boards**.




d. When the Add I/F Boards confirmation message appears, click **Confirm**.




e. At the next screen, DO NOT CLICK **OK**.

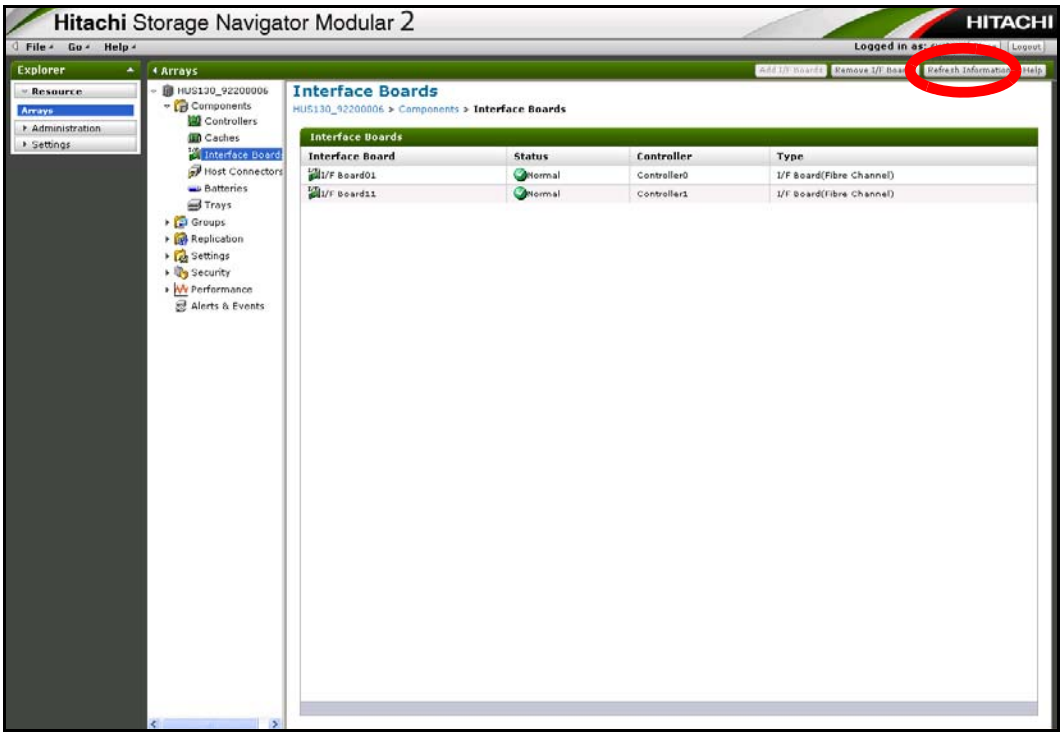



Do not click **OK**.

4. Remove the dummy Board:
   a. Loosen the two screws securing the dummy Board.
   b. Pull out and remove the dummy Board.
5. Install an iSCSI Host I/O Board.
6. Remove the Host Connector installed on the additional Host I/O Board.
7. Insert and push the additional iSCSI Host I/O Board into the slot in the Controller.

**NOTE:** Install the same type of Host I/O Board in the same position of Controller #0 and Controller #1.

8. In Hitachi Storage Navigator Modular 2, click **OK** in the Add I/F Boards screen within 10 seconds after you install the iSCSI Host I/O Board.
9. At the next message, click **Close**.
10. In Hitachi Storage Navigator Modular 2, click **Refresh Information** to update the window and check that the status of the Interface Board is **Normal**.




11. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF.

**NOTE:** If the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

12. Check that the green **READY** LED on the front of the Controller Box is ON.
13. Connect the interface cables to the Host I/O Board you added.

**NOTE:** When connecting iSCSI cables, be sure the cables are connected securely; otherwise, the Controller detects iSCSI failures and I/O processing might deteriorate.

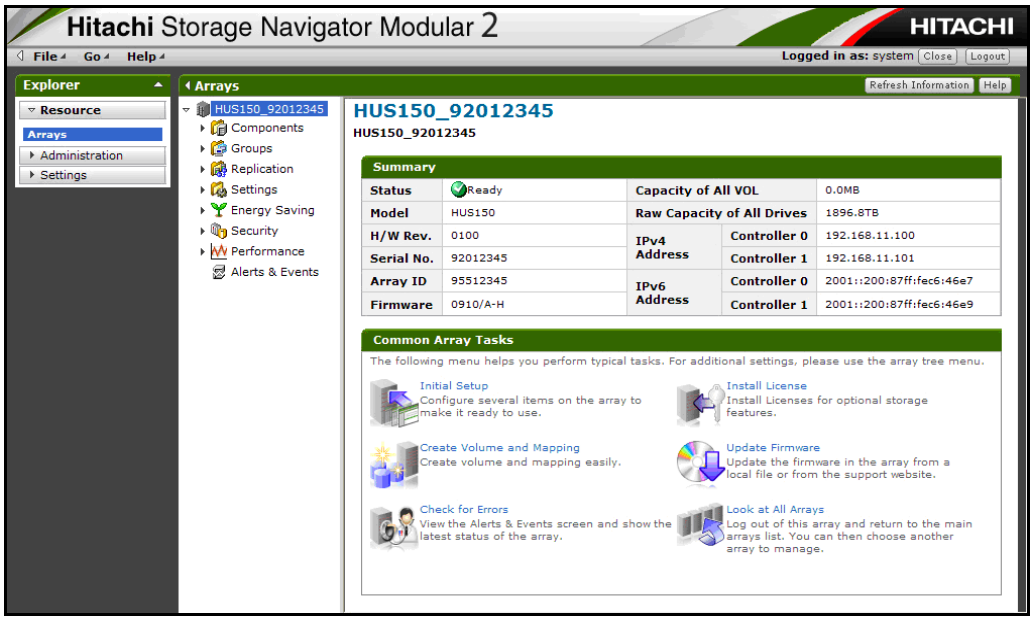
14. Configure the host group and iSCSI port setting for the port on the iSCSI Host I/O Board you added (see Chapter 5, Configuring the storage system).

## CBL/CBLE online procedure

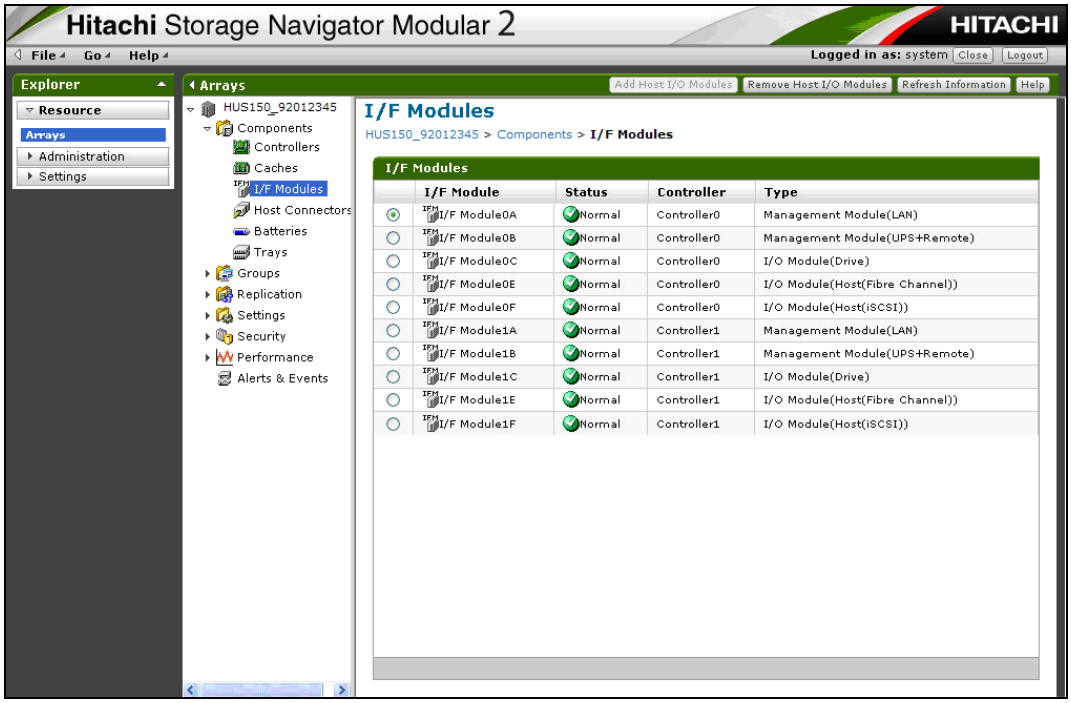
The following procedure describes how to add an iSCSI Host I/O Module to a CBL/CBLE Controller Box with power to the storage system turned on and the host remaining operational. When performing this procedure, see Figure 11-13 on page 11-42 and Figure 11-14 on page 11-42.

1. Check that the storage system is a dual-Controller configuration.
2. Confirm that the slot where you want to add the Host I/O Module is empty. If you change the type of the Host I/O Module, contact HDS Support at portal.hds.com.

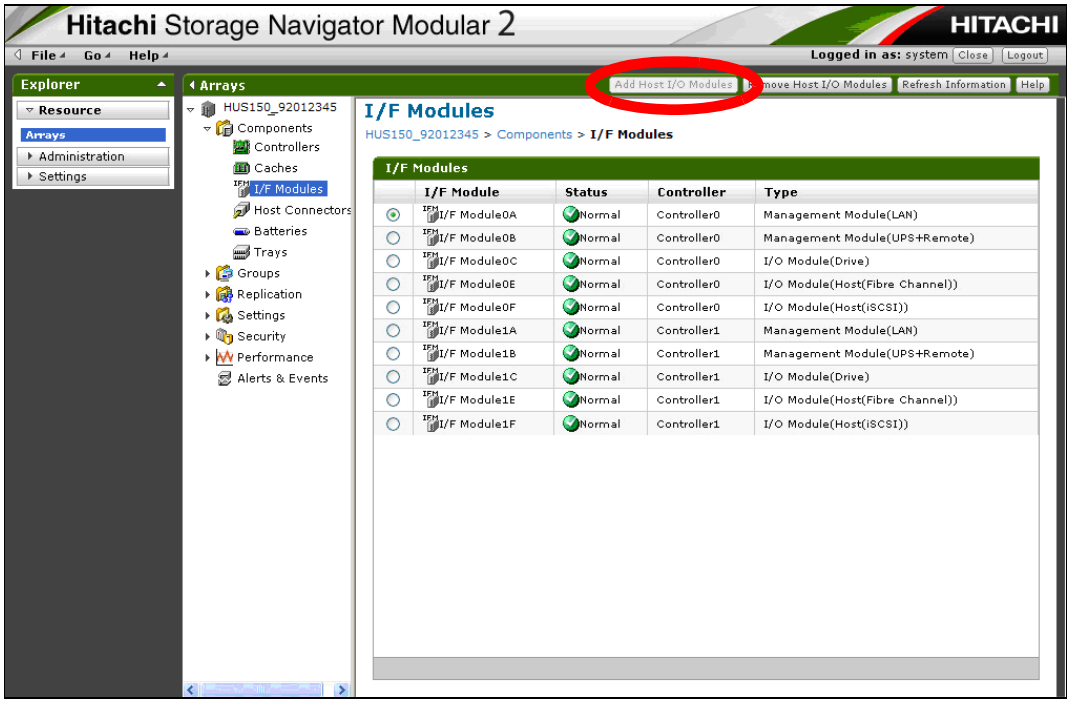
3. Start Hitachi Storage Navigator Modular 2 and log in:
   a. Click the array name to display the unit window. If the unit window is not displayed, check that the LAN port number has not changed. If it has, repeat this step using the LAN port number shown.



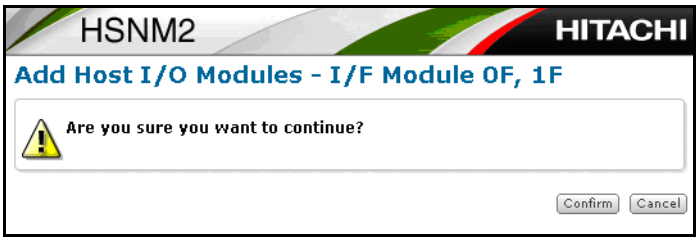

   b. Click **Components > IF Modules**. The IF Modules window appears.



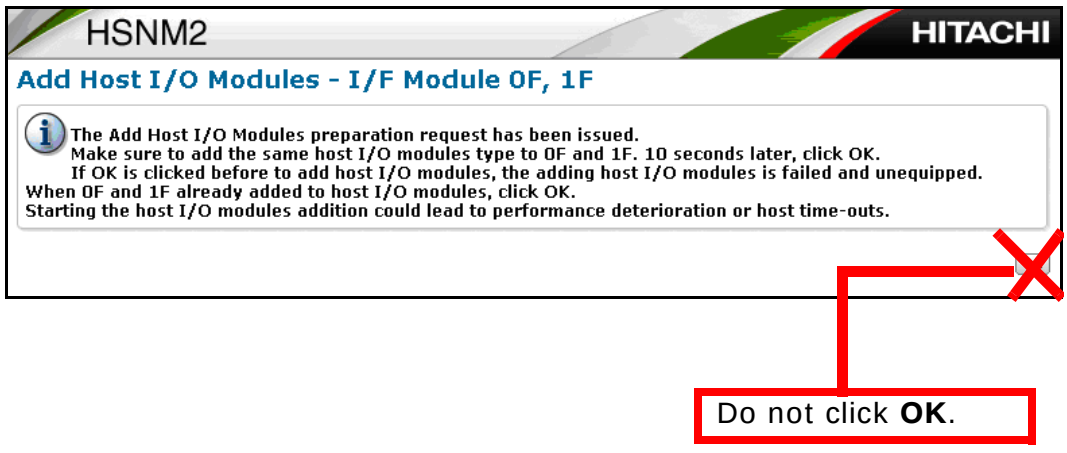

   c. Click **Add Host I/O Modules**.




d. When the Host I/O Module confirmation message appears, click **Confirm**.




e. At the next screen, DO NOT CLICK **OK**.




Remove the dummy Module:

f. Loosen the blue screw securing the dummy Module to pull the lever. If you pull the lever, the dummy Module sticks out.

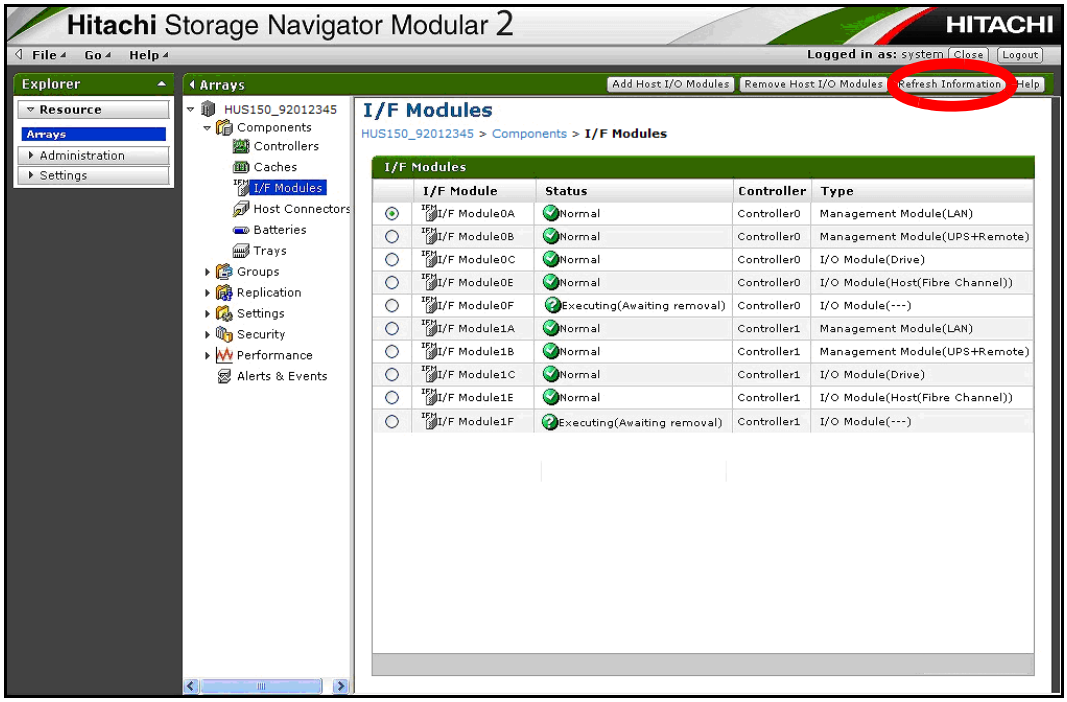
g. Pull out and remove the dummy Module.

4. Install an iSCSI Host I/O Module.
5. Insert and push the additional iSCSI Host I/O Module with its lever opened completely.

6. Close the lever and tighten using the blue crew to secure the Host I/O Module.

**NOTE:** Install the same type of Host I/O Module in the same position of Controller #0 and Controller #1.

7. In Hitachi Storage Navigator Modular 2, click **OK** in the Add Host I/O Modules screen within 10 seconds after you install the iSCSI Host I/O Module.
8. At the next message, click **Close**.
9. In Hitachi Storage Navigator Modular 2, click **Refresh Information** to update the window and check that the status of the Interface Module is **Normal**.




10. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF.

**NOTE:** If the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

11. Check that the green **READY** LED on the front of the Controller Box is ON.
12. Connect the interface cables to the Host I/O Module you added.
13. Configure the host group and iSCSI port setting for the port on the iSCSI Host I/O Module you added (see Chapter 5, Configuring the storage system).

## Host I/O replacement for changing host I/O type

Table 11-9 describes the types of Host I/O Board/Module that can be replaced.

**Table 11-9: Types of Host I/O Board/Module**

| Controller Box | 1 Gbps iSCSI | 10 Gbps iSCSI | Fibre Channel |
|---|---|---|---|
| CBXSS/CBXSL | Host I/O Board (DF-F850-HBS12) | Host I/O Board (DF-F850-HBS102) | — |
| CBSS/CBSL | Host I/O Board (DF-F850-HBS12) | Host I/O Board (DF-F850-HBS102) | Host I/O Board (DF-F850-HBF84R) |
| CBL/CBLE | — | Host I/O Module (DF-F850-HS10G) | Host I/O Module (DF-F850-HF8GR) |

Before replacing Host I/O Board or Module, perform the following steps to guard against unexpected accidents.

1. Back up user data in the storage system from the host side.
2. The procedures for replacing a Host I/O Board or Module require you to change storage system settings using a service PC connected via a local-area network (LAN). Prepare a PC that has an installed version of Hitachi Storage Navigator Modular 2. The PC will be used in the LAN environment. Confirm that the Hitachi Unified Storage system can operate over a LAN.
3. Do not perform the work when the green **READY** LED on the front of the Controller Box blinks fast. Fast blinking indicates that internal processing is occurring. Wait for the **READY** LED to stay ON for up to 50 minutes, 60 minutes for the CBL/CBLE, or 180 minutes if the DBW is connected to the CBL/CBLE before performing these procedures.
4. Do not perform the work when the orange **WARNING** LED on the front of the Controller Box blinks fast. Fast blinking indicates that the flash program or internal processing is occurring at a single controller. Wait for the **WARNING** LED and green **READY** LED to stay ON for up to 85 minutes before performing these procedures.
5. Do not perform the work while the storage system is being started. When the storage system is being started, perform the work after the storage system enters the Ready status.
6. Before performing these procedures, collect a simple trace (refer to the Hitachi Unified Storage Hardware Service Guide). This will allow you to return the storage system to its original configuration if necessary.
7. The following setting information may be deleted or maintained. depending on the types to be replaced.
   - Host Group Option/Target Option setting
   - Volume Mapping setting
   - Fibre Channel/iSCSI setting
   - Port option setting

   If necessary, configure the settings after performing the replacement procedure and see Table 11-10 on page 11-53.

**Table 11-10: Host I/O Board and Module replacement settings**

| Controller Box | Types before replacement | | Types after replacement (Note 1) | | Necessary/ Unnecessary? |
|---|---|---|---|---|---|
| | Item | Model Name | Item | Model Name | |
| CBXSS/CBXSL | 1 Gbps iSCSI Host I/O Board | DF-F850-HBS12 | 10 Gbps iSCSI Host I/O Board including host connectors (2) | DF-F850-HBS102 | Unnecessary (see note 4) |
| | 10 Gbps iSCSI Host I/O Board including host connectors (2) | DF-F850-HBS102 | 1 Gbps iSCSI Host I/O Board | DF-F850-HBS12 | Unnecessary (see note 4) |
| CBSS/CBSL | 1 Gbps iSCSI Host I/O Board | DF-F850-HBS12 | 10 Gbps iSCSI Host I/O Board including host connectors (2) | DF-F850-HBS102 | Unnecessary (see note 4) |
| | 1 Gbps iSCSI Host I/O Board | DF-F850-HBS12 | 8 Gbps Fibre Channel Host I/O Board including host connectors (4) | DF-F850-HBF84R | Necessary (see note 2) |
| | 10 Gbps iSCSI Host I/O Board including host connectors (2) | DF-F850-HBS102 | 1 Gbps iSCSI Host I/O Board | DF-F850-HBS12 | Unnecessary (see note 4) |
| | 10 Gbps iSCSI Host I/O Board including host connectors (2) | DF-F850-HBS102 | 8 Gbps Fibre Channel Host I/O Board including host connectors (4) | DF-F850-HBF84R | Necessary (see note 2) |
| | 8 Gbps Fibre Channel Host I/O Board including host connectors (4) | DF-F850-HBF84R | 1 Gbps iSCSI Host I/O Board | DF-F850-HBS12 | Necessary (see note 3) |
| | 8 Gbps Fibre Channel Host I/O Board including host connectors (4) | DF-F850-HBF84R | 10 Gbps iSCSI Host I/O Board including host connectors (2) | DF-F850-HBS102 | Necessary (see note 3) |
| CBL/CBLE | Host I/O Module (iSCSI 10 Gbps) | DF-F850-HS10G | Host I/O Module (FC 8 Gbps) including host connectors (4) | DF-F850-HF8GR | Necessary (see note 2) |
| | Host I/O Module (FC 8 Gbps) including host connectors (4) | DF-F850-HF8GR | Host I/O Module (iSCSI 10 Gbps) | DF-F850-HS10G | Necessary (see note 3) |

**NOTE 1:** Install the same types of Host I/O Boards/Modules in the same slots in both controllers.

**NOTE 2:** The iSCSI interface setting used to recognize the storage system at the host is not supported. Configure this setting Perform the connection setting using the procedures under Changing Fibre Channel settings on page 5-72 and Configuring mapping (Fibre Channel) on page 5-73.

**NOTE 3:** The Fibre Channel (FC) interface setting used to recognize the storage system at the host is not supported. Configure this setting using the procedures under Changing iSCSI settings on page 5-79 and Configuring iSCSI target information on page 5-81.

**NOTE 4:** The iSCSI interface setting used to recognize the storage system at the host takes over after the replacement procedure is completed.

The following sections describe the host I/O procedures for changing host I/O type.

- Host I/O replacement of host I/O type (host is operating) below
- Host I/O replacement for changing host I/O type offline procedure on page 11-62

When performing these procedures:

- Avoid touching heat sinks or ICs. Handle all components with care.
- To prevent part failures caused by static electrical charge, wear a wrist strap connected to the chassis before starting and do not remove it until you finish.
- Wear a wrist strap connected to the chassis whenever you unpack parts from a case. Otherwise, the static electrical charge on your body may damage the parts.
- When you install Host I/O Board/Module, support its metal part with the hand that has the wrist strap. To discharge static electricity, touch the metal plate.

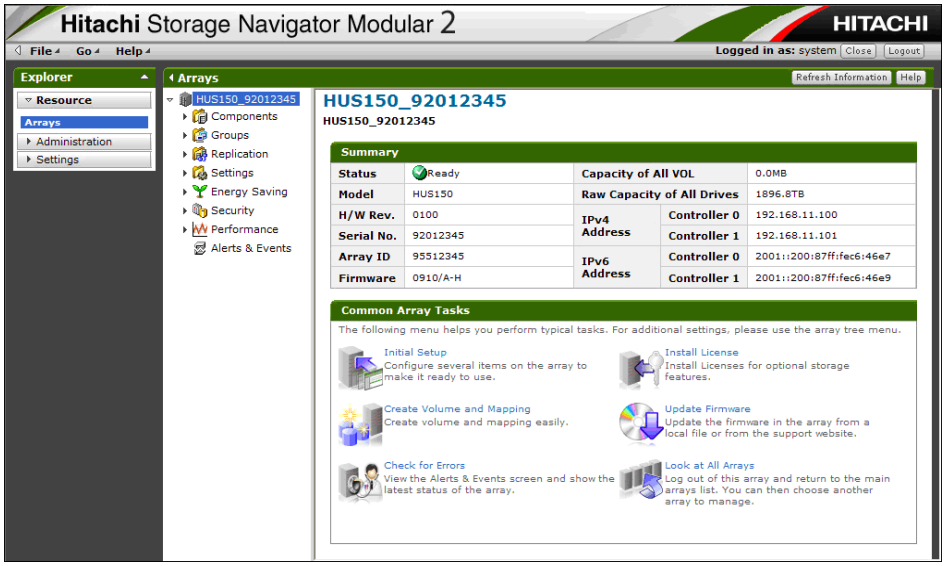
## Host I/O replacement of host I/O type (host is operating)

The following procedure describes the host I/O replacement of host I/O type while the host is operational.

1. Check the following items:
   - Ensure that the Controller is a dual configuration.

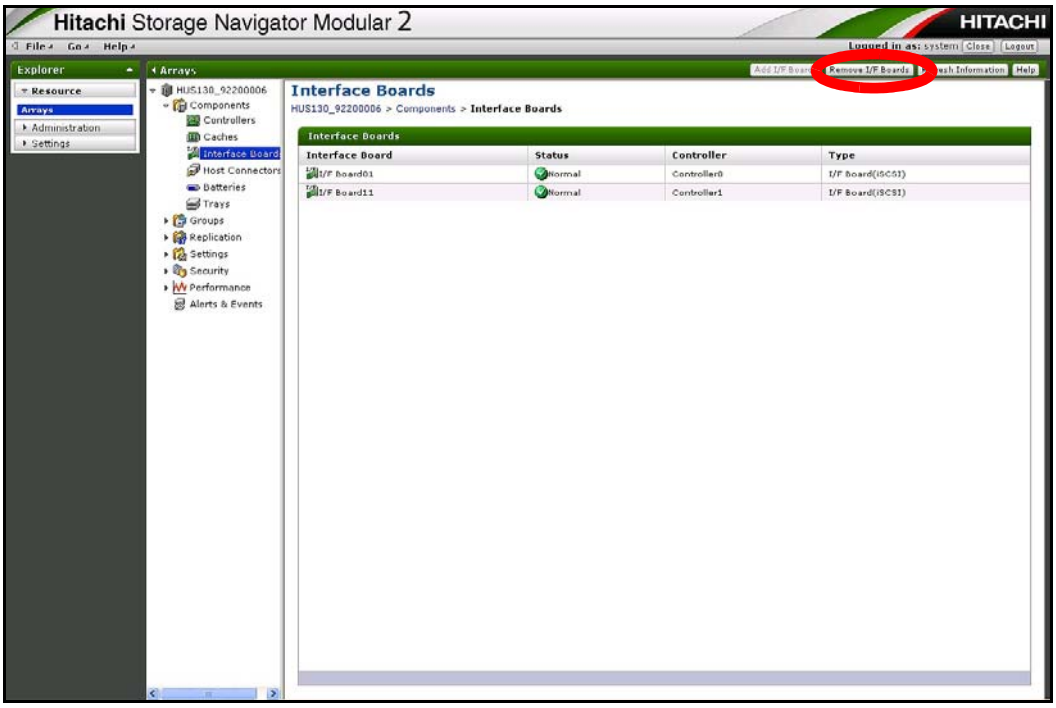
- Confirm that the remote path of TrueCopy remote replication, TrueCopy Extended Distance, and TrueCopy Modular Distributed functions are not set for the Host I/O Board/Module to be replaced from the Controller Box.
- Check that there is no access from the host to the Host I/O Board/ Module to be replaced.

2. Start Hitachi Storage Navigator Modular 2 and log in:
   a. Click the array name to display the unit window. If the unit window is not displayed, check that the LAN port number has not changed. If it has, repeat this step using the LAN port number shown.

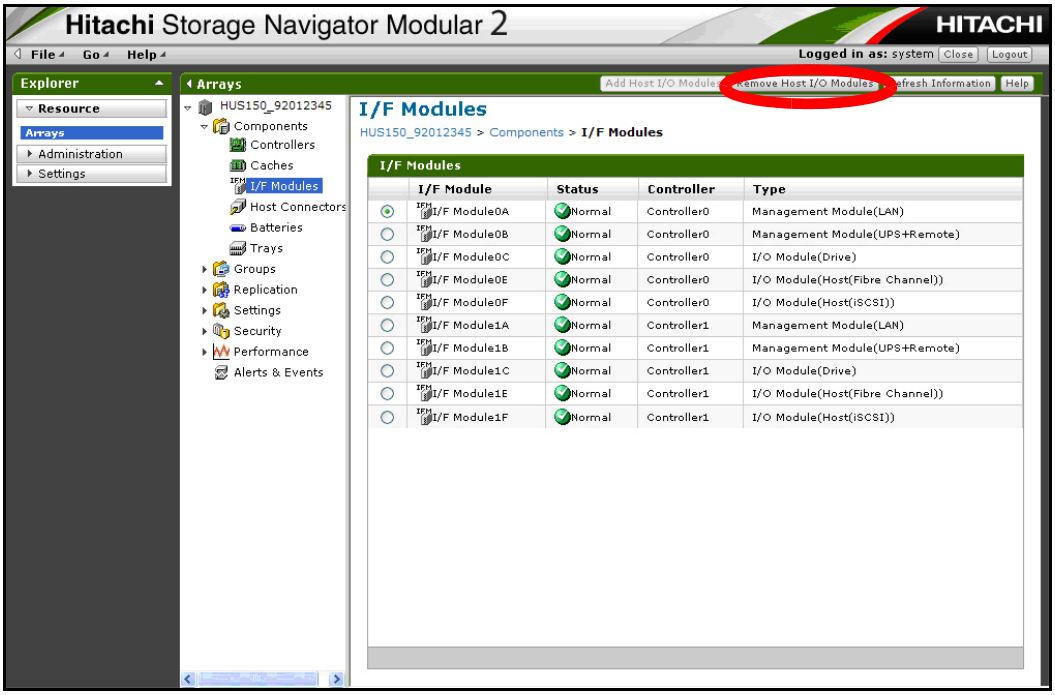



   b. Perform one of the following steps:

- For the CBXSS/CBXSL/CBSS/CBSL: Click **Components > Interface Boards**. When the Interface Boards window appears, click **Remove IF Boards**.




- For the CBL/CBLE, click **Components > IF Modules**. When the IF Modules window appears, click **Remove Host I/O Modules**. Then click the Host I/O Module to be removed.




3. At the confirmation message, click **Confirm**, and then click **Close**.
4. Remove the Host I/O Board/Module whose red **STATUS** LED is ON. When removal is complete, click **Refresh Information** to update the status of the Interface Boards or I/F Modules.
   a. Loosen the two screws securing the dummy Board.
   b. Pull out and remove the dummy Board.

5. For the CBSS/CBXSS/CBXSL/CBSS/CBSL:
   - For a Fibre Channel FC Host I/O Board, remove the installed Host Connector.
   - Loosen the two screws securing the Host I/O Board.
   - Pull out and remove the Host I/O Board and place it in a static-free area.
   - Remove the Host I/O Board on Controllers #0 and #1.
6. For the CBL/CBLE:
   - Loosen one blue screw securing the Host I/O Module and then tilt the lever toward you. When the lever is completely tilted, the Host I/O Module moves forward.
   - Pull out and remove the Host I/O Module and place it in a static-free area.
   - Remove the Host I/O Modules on Controllers #0 and #1.
7. When the removal is completed, the display of the removed Host I/O Board/Module disappears from the Interface Boards or I/F Modules window. Check that the removed Host I/O Boards/Modules of Controllers #0 and #1 are not shown.

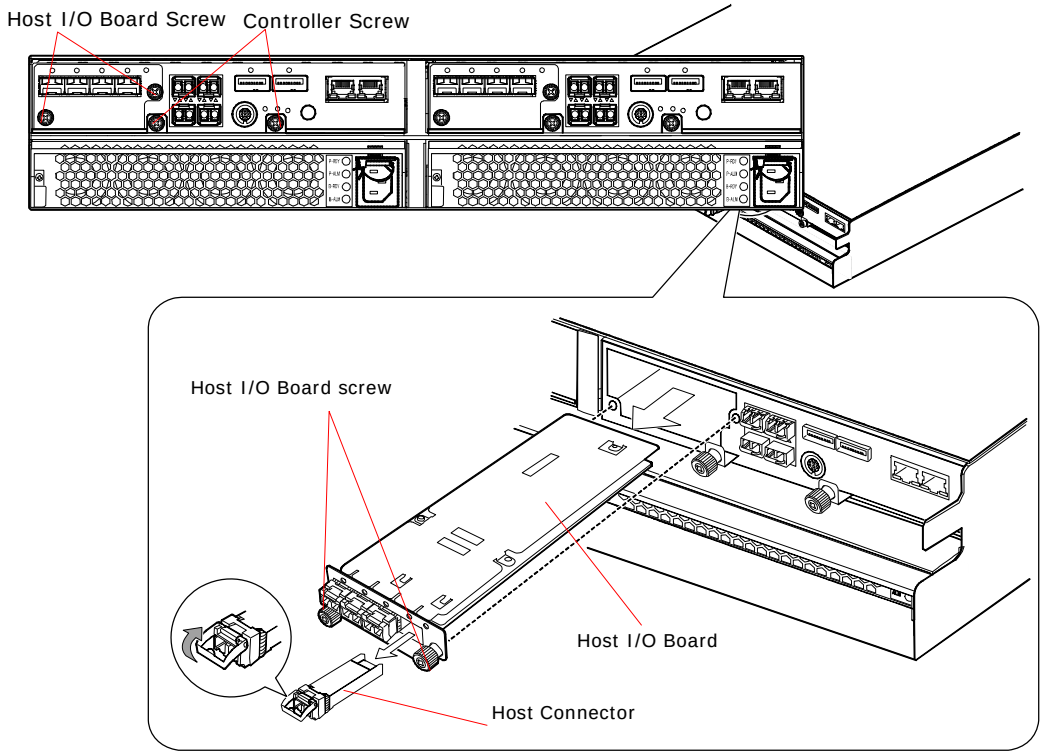



**Figure 11-15: Replacing Fibre Channel Host I/O Board (CBXSS/CBXSL/CBSS/CBSL)**

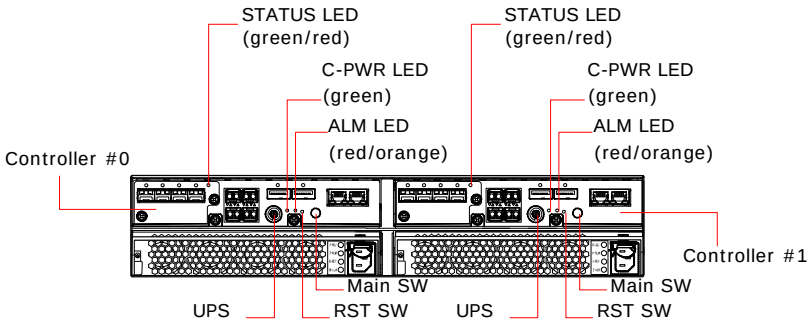



**Figure 11-16: LEDs on CBXSS/CBXSL/CBSS/CBSL**

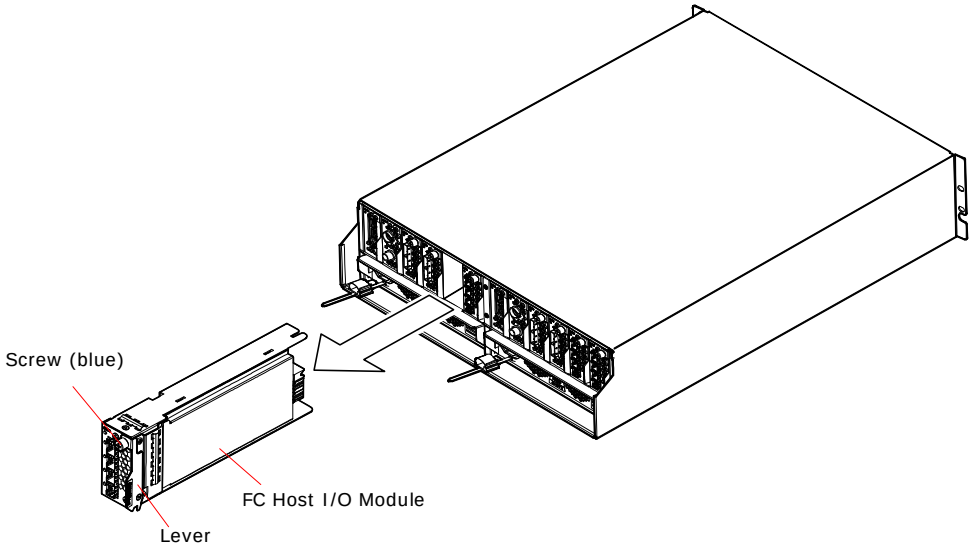



**Figure 11-17: Replacing a Fibre Channel Host I/O Module (CBL/CBLE)**

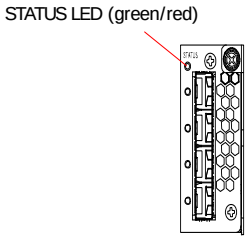
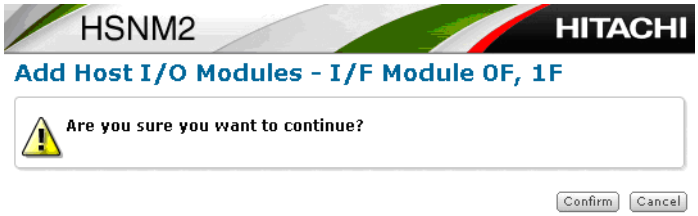


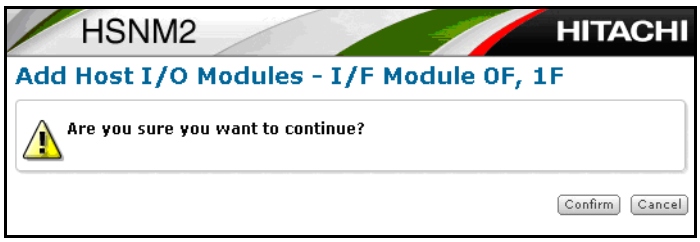

**Figure 11-18: LED Location on Host I/O Module (CBL/CBLE)**

8. Install the Host I/O Board or Host I/O Module.
   a. For the CBXSS/CBXSL/CBSS/CBSL: Click **Components > Interface Boards**. When the Interface Boards window appears, click **Add IF Boards**.
   b. For the CBL/CBLE, click **Components > IF Modules**. When the IF Modules window appears, click **Add Host I/O Modules**.
9. When the confirmation message appears, click **Confirm**.

   The following screen appears for the CBXSS/CBXSL/CBSS/CBSL:

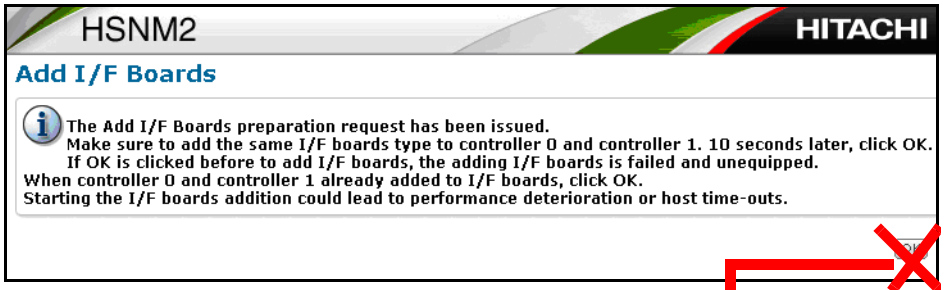



The following screen appears for the CBL/CBLE:



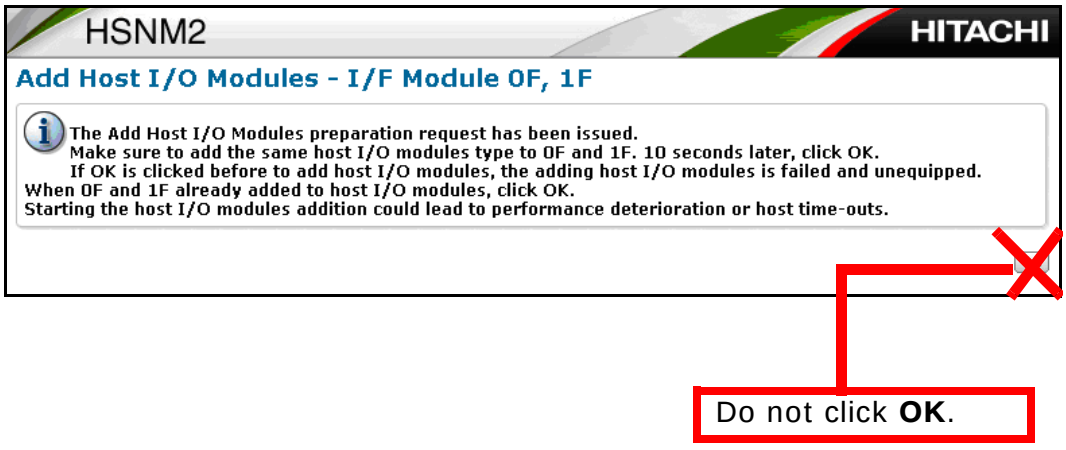

c. At the next confirmation screen, DO NOT CLICK **OK**.

The following screen appears for the CBXSS/CBXSL/CBSS/CBSL:




Do not click **OK**.

The following screen appears for the CBL/CBLE:




Do not click **OK**.

Remove the dummy Module:

10. Install a Host I/O Board/Module.

- For a Fibre Channel Host I/O Board in a CBXSS/CBXSL/CBSS/CBSL:

a. Remove the Host Connector installed in the Host I/O Board.

b. Insert and push the Host I/O Board into the slot in the Controller.

c. Install the same Host I/O Board type in the same position to the Controller #0 and Controller #1.

d. Tighten the two screws to secure the Host I/O Board.

e. Install the Host Connector in the Host I/O Board.

- For a CBL/CBLE:

a. Insert and push the Host I/O Module with its lever completely opened. Install the same Host I/O Module type in the same position to the Controller #0 and Controller #1.

b. Close the lever and tighten one blue screw to secure the Host I/O Module.

11. Click **OK** in the confirmation screen shown on the previous page within 10 seconds after the Host I/O Board/Module is inserted correctly.
12. Click **Close**.
13. Click **Refresh Information** to update the window and check that the status of the Interface Board is **Normal**.
14. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF.

**NOTE:** If the **WARNING** LED blinks slowly, contact HDS Support at portal.hds.com.

15. Check that the green **READY** LED on the front of the Controller Box is ON.
16. Connect the interface cables to the host connectors.

**NOTE:** When connecting cables, be sure the cables are connected securely; otherwise, the Controller detects failures and I/O processing might deteriorate.

17. Configure the host group and port settings (see Table 11-10 on page 11-53 and Chapter 5, Configuring the storage system).

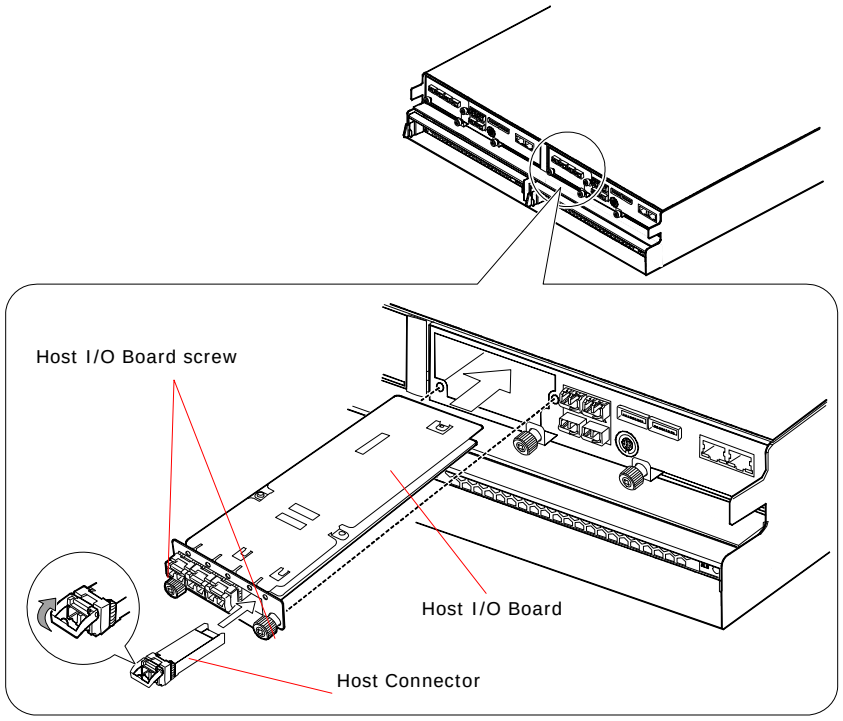



**Figure 11-19: Replacing Fibre Channel Host I/O Board (CBXSS/CBXSL/CBSS/CBSL)**

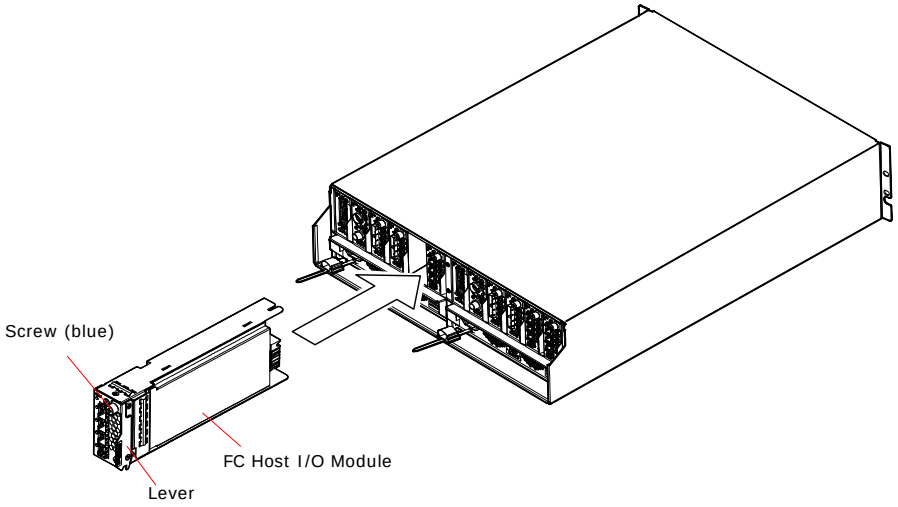



**Figure 11-20: Replacing Fibre Channel Host I/O Module (CBL/CBLE)**

## Host I/O replacement for changing host I/O type offline procedure

The following procedure describes how to change a host I/O controller type.

- For CBXSS/CBXSL/CBSS/CBSL Controller Boxes, see the procedure below.
- For the CBL/CBLE Controller Box, see CBL/CBLE procedures on page 11-63

### CBXSS/CBXSL/CBSS/CBSL procedures

The following procedure describes how I/O replacement procedures for changing host I/O type offline on CBXSS/CBXSL/CBSS/CBSL Controller Boxes.

1. Collect a simple trace (refer to the Hitachi Unified Storage Hardware Service Guide).

**NOTE:** When the installation position of the Host I/O Board changed, or the Host I/O Board of a different type is installed in the location where the Host I/O Board was installed, the following configuration information is cleared. Performing a simple trace records these settings, so you can reconfigure them after the replacement procedure is completed.

- Host Group Information/Target Information
- Host Group Option/Target Option
- Mapping Information
- Fibre Channel Information Port Setting Information/iSCSI port setting information
- CHAP security information (iSCSI)

2. Press the main switch on Controller #0 or Controller #1 for at least three seconds to turn off the main switch. Be sure the **POWER** LED on the front bezel changes from green to orange. If you cannot turn off the power, contact HDS Support at portal.hds.com.

   If the green **C-PWR** LED on the Controller blinks, some cache memory data may not have written into the drive. Wait for the **C-PWR** LED to go OFF.

**CAUTION!** If the Controller is removed from the storage system when the **C-PWR LED** blinks, user data may be lost.

3. Remove the power cables from two Power Units. If the replacement is performed without removing the power cable, the array cannot recover properly.
4. Remove the Host I/O Board installed in the Controller.

**CAUTION! Touching heat sinks or ICs may cause you to get burned. Handle all components with care.**

5. For a Fibre Channel Host I/O Board:
   a. Remove the installed Host Connector.

b. Loosen the two screws securing the Host I/O Board.

c. Pull out and remove the Host I/O Board and place it in a static-free area.

d. Install the Host I/O Board in the Controller.

e. Remove the Host Connector installed in the installed Host I/O Board.

f. Insert and push the Host I/O Board into the slot in the Controller. In a dual-controller configuration, install the Host I/O Boards of the same type in the same location in Controllers #0 and #1.

g. Tighten the two screws to secure the Host I/O Board.

h. Install the Host Connector in the Host I/O Board. In a dual-controller configuration, repeat this step for the other Controller.

6. Connect the power cables to the Power Units.
7. Turn on the main switch.
8. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF. The **WARNING** LED may blink quickly for up to 85 minutes. If it blinks slowly, contact HDS Support at portal.hds.com.
9. Check that the green **READY** LED on the front of the Controller Box goes ON. The **READY** LED may blink quickly for up to 50 minutes.
10. Configure the and port settings (see Table 11-10 on page 11-53 and Chapter 5, Configuring the storage system).

## CBL/CBLE procedures

The following procedure describes how I/O replacement procedures for changing host I/O type offline on CBL/CBLE Controller Boxes.

1. Collect a simple trace (refer to the Hitachi Unified Storage Hardware Service Guide).

**NOTE:** When the installation position of the Host I/O Board changed, or the Host I/O Board of a different type is installed in the location where the Host I/O Board was installed, the following configuration information is cleared. Performing a simple trace records these settings, so you can reconfigure them after the replacement procedure is completed.

- Host Group Information/Target Information
- Host Group Option/Target Option
- Mapping Information
- Fibre Channel Information Port Setting Information/iSCSI port setting information
- CHAP security information (iSCSI)

2. Turn off the main switch. Be sure the **POWER** LED on the front bezel changes from green to orange. If you cannot turn off the power, contact HDS Support at portal.hds.com.

   If the green **C-PWR** LED on the Controller blinks, some cache memory data may not have written into the drive. Wait for the **C-PWR** LED to go OFF.

**CAUTION!** If the Controller is removed from the storage system when the **C-PWR LED** blinks, user data may be lost.

3. Remove the power cables from two Power Units. If the replacement is performed without removing the power cable, the array cannot recover properly.
4. Remove all interface cables from the Host I/O Module.

**NOTE:** If cables cannot be removed easily, do not pull it by force; otherwise, you can damage the cable. If the interface cables are inserted halfway into the host connectors, the Controller detects failures and I/O processing might deteriorate.

5. Remove the Host I/O Module.

**CAUTION! Touching heat sinks or ICs may cause you to get burned. Handle all components with care.**

   a. Loosen the one blue screw securing the Host I/O Module and then tilt the lever toward you. When the lever is completely tilted, the Host I/O Module moves forward.
   a. Pull out and remove the Host I/O Module, and place it in a static-free area.

6. Install the Host I/O Board in the Controller.
   a. Insert and push the Host I/O Module with its lever completely opened.
   b. Close the lever. Tighten the one blue screw to secure the Host I/O Module.
   c. In a dual-controller configuration, repeat this step with the other Controller.
7. Connect the interface cable to the Host I/O Module.

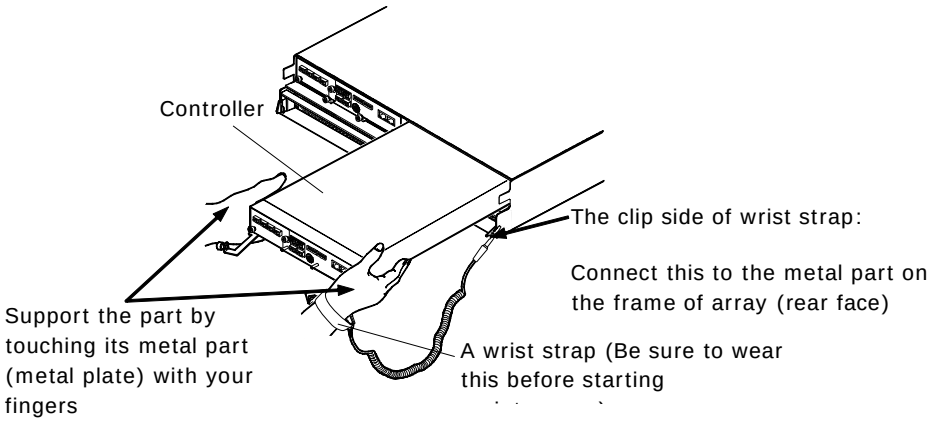
**NOTE:** When connecting cables, be sure the cables are connected securely; otherwise, the Controller detects failures and I/O processing might deteriorate.

8. Connect the power cables to the Power Units.
9. Turn on the main switch.
10. Check that the orange **WARNING** LED on the front of the Controller Box goes OFF. The **WARNING** LED may blink quickly for up to 85 minutes. If it blinks slowly, contact HDS Support at portal.hds.com.
11. Check that the green **READY** LED on the front of the Controller Box goes ON. The **READY** LED may blink quickly for up to 50 minutes.
12. Configure the port settings (see Table 11-10 on page 11-53 and Chapter 5, Configuring the storage system).

# Adding a Controller

The following procedure describes how to add a Controller to a CBXSS or CBXSL Controller Box. When performing this procedure, see Figure 11-21 on page 11-68 and Figure 11-22 on page 11-69.

Before unpacking and adding a Controller, wear a wrist strap connected to ground, such as the metal part of the enclosure. When you insert a Controller into the array, touch the metal part of the Controller with the hand wearing the wrist strap.




**WARNING:** Do not touch heat sinks or ICs; otherwise, you could get burned.

1. Collect a simple trace (refer to the *Hitachi Unified Storage Service Guide*).

**NOTE:** If you add a Host I/O Board to the location where a different type of Host I/O Board was installed, the following information is cleared. Therefore, perform the simple trace to collect and then back up configuration information before adding the Host I/O Board.

- Host group and target information
- Host group and target options
- Mapping information
- Fibre Channel and iSCSI port settings
- CHAP security information (iSCSI)

2. Turn off the main switch:
   - The green **C-PWR LED** on the Controller blinks for three seconds, and then goes ON and goes OFF.
   - Be sure the **POWER** LED on the front bezel changes from green to orange. If you cannot turn off the power, contact HDS Support at portal.hds.com.

     If the green **C-PWR** LED on the Controller blinks, some cache memory data has not been written to the drive. Wait until the **C-PWR** LED to go OFF.

If the Controller is removed from the array when the **C-PWR** LED blinks, user data may be lost.

3. Remove the power cables from the two Power Units.
4. Loosen the blue right and left screws securing the dummy Controller, open the lever toward you, and remove the dummy Controller.
5. Add Controller #1.
6. Insert cache memory on Controller #1:
   a. Orient the Controller with its module-revision label facing down, loosen the blue two screws at the rear of the Controller, slide the cover in the direction shown by the arrow (⟶) and remove the cover.
   b. Hold both ends of the cache memory and insert it into the slot in the Controller until the slot levers are completely closed.
   c. Slide and install the Controller cover, and then secure using the two blue screws at the rear of the Controller.

**NOTE:** The same capacity of cache memory must be installed in slot #0 and slot #1, and in Controller #0 and Controller #1.

   d. Close the lever and tighten the blue screw to secure the Host I/O Module.
7. If the iSCSI Host I/O Board is installed in Controller #0, perform the following steps to install the iSCSI Host I/O Board in Controller #1. If the iSCSI Host I/O Board is not installed in the Controller #0, go to the next step.
   a. Loosen two screws fixing the dummy (board), pull out the dummy (Board), and remove it.
   b. Insert and push the iSCSI Host I/O Board into the slot in the newly added Controller #1.
   c. Tighten the two screws to secure the iSCSI Host I/O Board.
8. Orient the new Controller #1 with its module-revision label facing up. Then insert and push the new Controller all tall the way into the slot, with its right and left levers open completely. Exercise care not to catch a SAS (ENC) cable when inserting the Controller.
9. Close the levers, and tighten the blue right and left screws to secure Controller #1.
10. Connect the interface cables, LAN cables, or SAS (ENC) cables to the Controller.
    - Bend the SAS (ENC) cable at least 30 mm to avoid stress on the cable and its connector.
    - When connecting Fibre Channel cables, insert the Fibre Channel interface cables until they are secure with the host connectors. If the cables are inserted halfway into the host connectors, the Controller detect the Fibre Channel failures, and I/O processing of the Controller may deteriorate.
11. Connect the power cables to the Power Units.

12. Turn on the main switch.
13. Check that the green **READY** LED on the front of the Controller Box is ON. The **READY** LED might blink quickly for up to 60 minutes.
14. Start Hitachi Storage Navigator Modular 2 and log in.
15. Configure the **System Startup Attribute Boot Options** to **Dual Active Mode**.
16. After the system parameters have been set, the following message appears. Click the check box, and then click **Confirm**.

17. Click **OK**.
18. Turn off the main switch:
    a. Press the main switch on Controller #0 for at least three seconds.
    b. Confirm that the Controller's green **C-PWR** LED blinks for three seconds, and then goes ON and goes OFF.
    c. Be sure the **POWER** LED on the front bezel changes from green to orange. If you cannot turn off the power, contact HDS Support at portal.hds.com.
19. Wait more than one minute, and then turn on the main switch.
20. Confirm that the green **READY** LED on the front of the Controller Box goes ON.
21. Remove the LAN cross-over cable from Controller #0, and connect it to Controller #1.
22. Because the array configuration was changed from single Controller to dual Controller, delete the target array in which the Hitachi Storage Navigator Modular 2 is registered and register the IP address of Controller #1 in the storage system after.
23. Reset the configuration for Controller #1.

**NOTE:** You must set up Controller #1 for a dual-controller configuration.

24. Turn off the main switch:
    a. Press the main switch on either Controller #0 or Controller #1 for at least three seconds. When the main switch is turned off and it is enabled, the Controller's green **C-PWR** LED goes ON after blinking for three seconds, and then goes OFF

b. Be sure the **POWER** LED on the front bezel changes from green to orange. If you cannot turn off the power, contact HDS Support at portal.hds.com.

25. Remove the LAN cross-over cable from the Controller #1.

26. Turn on the main switch.:

a. Press the main switch on either Controller #0 or Controller #1 for at least one second.

b. Confirm that the green **READY** LED on the front of the Controller Box goes ON.

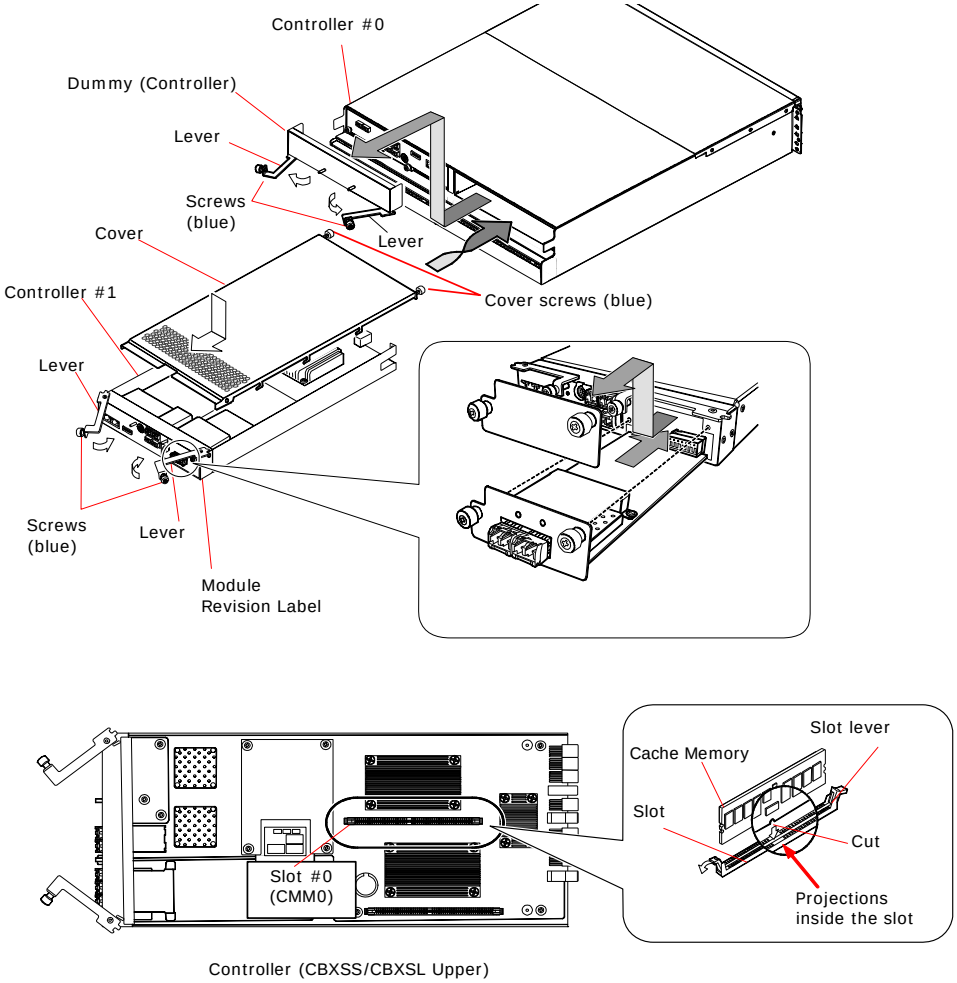



**Figure 11-21: Adding a Controller (CBXSS/CBXSL)**

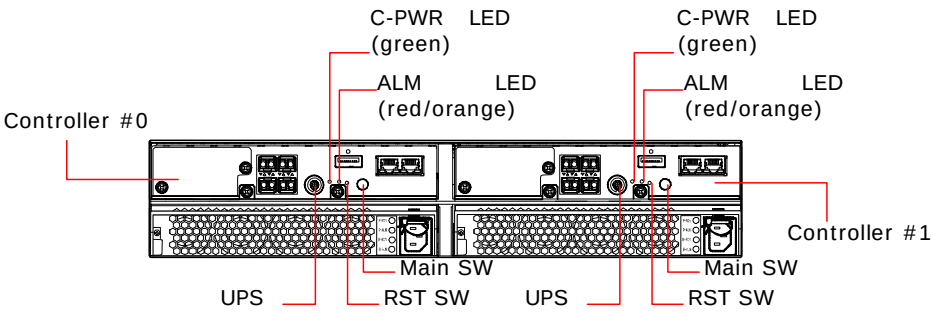



**Figure 11-22: LED Locations on the Controller (CBSS/CBSL)**

# Adding Drive Boxes

Drives Boxes are added to the rack in which a Hitachi Unified Storage system is installed.

Observe the following guidelines when adding Drive Boxes:

- Add Drive Boxes when the LEDs on the Hitachi Unified Storage system are as follows:
  - Orange **WARNING** LED and red **ALARM** LED = OFF.
  - Green **POWER** LED and green **READY** LED = ON.
- Do not add Drive Boxes if the green **READY** LED on the front of the Controller Box is blinking quickly. This LED status indicates that the storage system is conducting internal processing. Wait for the **READY** LED to go ON (this can take up to 50 minutes or up to 60 minutes for the CBL/CBLE or up to 180 minutes if the DBW is connected to the CBL/CBLE).
- If the orange **WARNING** LED on the front of the Controller Box is blinking quickly, do not add the Drive Box. Wait for the **WARNING** LED to go OFF and for the green **READY** LED to go ON (this can take up to 85 minutes).
- Use SAS (ENC) cables to connect Controller and Drive Boxes.
- The number of Drive Boxes that can be added depends on the Controller Box (see Table 11-11). Do not exceed the maximum number of Drive Box that can be mounted.

**Table 11-11: Number of Supported Drives Boxes**

| Controller | Maximum Number of Mountable Drive Boxes |
|---|---|
| CBXSS | DBS: 4<br>DBL: 8 |
| CBXSL | DBS: 4<br>DBL: 9 |
| CBSS | DBS: 9<br>DBL: 18<br>DBX: 5 |
| CBSL | DBS: 9<br>DBL: 19<br>DBX: 5 |
| CBXSL | DBS: 40<br>DBL: 40<br>DBX: 20 |

- If a mix of DBS, DBL, DBX, and DBW Drive Boxes is installed, the mountable number of Drive Boxes is different. For the mountable number of each Drive Box when a mix of DBS, DBL DBX, and DBW is installed, see Table 1-11 on page 1-9, Table 1-12 on page 1-9, Table 1-13 on page 1-11, and Table 1-14 on page 1-12.
- If a failure occurs in a Drive Box when adding it to a Hitachi Unified Storage system, contact HDS Support at portal.hds.com.

- When adding Drive Boxes with the storage system power turned off, install all the drives that are to be added, connect the enclosures using SAS (ENC) cables, and turn on the array power.
- Do not add FRUs while the storage system is starting. FRUs can be added after the storage system starts and reaches Ready status.

Drive Boxes can be added when the storage system is offline or online.

**Adding Drive Boxes online (storage system is powered on):**

1. Install the rails in the rack.
2. Unpack the Drive Box.
3. Mount the Drive Box on the rack.
4. Fasten the DBS/DBL Drive Box.
5. Install drives and other components.
6. Connect the Drive Box to the Controller Box, attach power cables to the Drive Box, and ensure the Controller recognizes the Drive Box.
7. Attach the front bezel to the Drive Box.
8. Configure the following system settings as required:
   - Set RAID/volumes
   - Format volumes
   - Set spare drives
   - Set Logical Unit mapping

**Adding Drive Boxes offline storage system is powered off):**

1. Power off the storage system.
2. Wait for the green **C-PWR** LED on the Controller to go OFF.
3. Remove the front bezel.
4. Install the rails in the rack.
5. Unpack the Drive Box.
6. Mount the Drive Box on the rack.
7. Fasten the DBS/DBL Drive Box.
8. Install drives and other components.
9. Connect the Drive Box to the Controller Box and attach power cables to the Drive Box.
10. Power on the storage system.
11. Configure the following system settings as required:
    - Set RAID/volumes
    - Format volumes
    - Set spare drives
    - Set Logical Unit mapping
12. Attach the front bezel to the Drive Box.

## Recognizing Drive Boxes

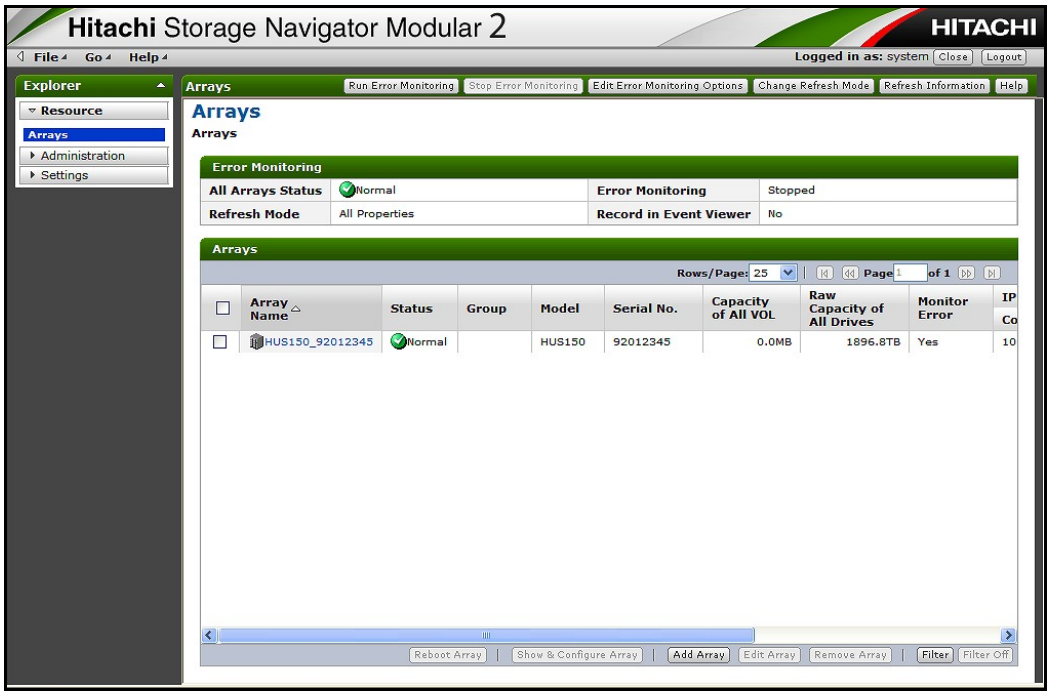
After Drives Boxes are installed, they must be recognized by the Hitachi Unified Storage system using Hitachi Storage Navigator Modular 2. The following steps describe this procedure.

1. Before recognizing the Drive Boxes, check the items in Table 11-12.

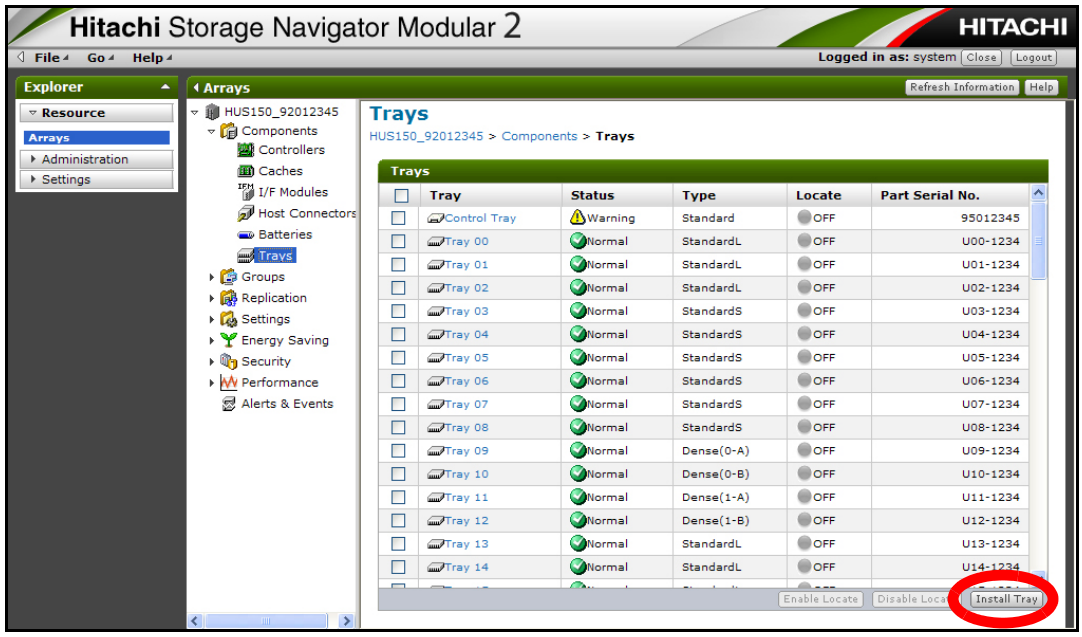
**Table 11-12: Checklist prior to recognizing Drive Boxes**

| Item to be Checked | | Action to Take |
|---|---|---|
| I/O Module (ENC) | The I/O Module (ENC) must be installed in the array to be added. DBS/DBL: two units | Check that the Module was installed when shipped. |
| Power Unit | The two units must be installed in the Controller Box to be added. | |
| **WARNING** LED on the Controller Box | No orange **WARNING** LED on the front of the Controller Box must be ON or blinking. | Check that the **WARNING** LED is OFF after completing maintenance. |
| **ALARM** LED on the Controller Box | No red **ALARM** LED on the front of the Controller Box is ON or blinking. | Check that the **ALARM** LED is OFF after completing maintenance. |
| **READY** LED on the front of the Controller Box | The green **READY** LED on the front of the Controller Box should be ON. | • If the **READY** LED is blinking quickly, internal processing is occurring. Check whether the orange **WARNING** LED on the front of the Controller Box goes OFF (up to 50 minutes, up to 60 minutes for the CBL/CBLE, or up to 180 minutes if the DBW is connected to the CBL/CBLE), the **READY** LED goes ON.<br>• If the **READY** LED continues blinking, contact HDS Support at portal.hds.com. |
| Other maintenance work | No other maintenance work must be in progress. | Complete all the maintenance work in progress. |

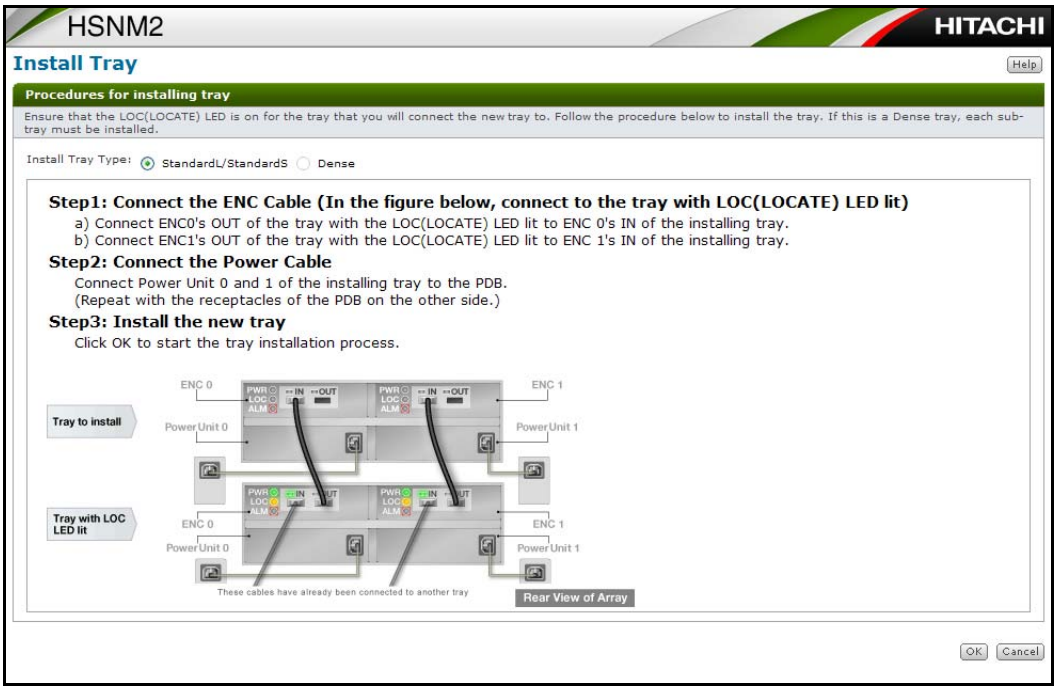
2. Start Hitachi Storage Navigator Modular 2 and log in.
3. Click the array name to be added in the Arrays window.




4. In the middle pane, click **Trays**.
5. When the Trays screen appears, click the **Install Tray** button.




A screen similar to the following appears.




The Drive Box might be connected to a Controller Box or to another Drive Box.

When connecting the SAS cable, see Connecting Drive Boxes on page 4-16.

When connecting a power cable to PDU, if the PDU breaker is on, connect the power cable to the PDU without turning off the PDU breaker. If the PDU breaker is off, connect a power cable and then turn on the PDU breaker.

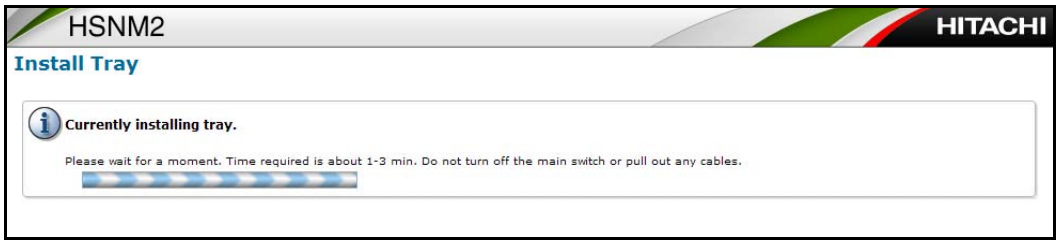
If you did not check the addition completed window because you closed the dialog box while adding the Drive Box, wait about three minutes and repeat steps 2 through 4 to display the Trays window again in Hitachi Storage Navigator Modular 2.

If the Drive Box under addition is displayed, the addition is completed. Otherwise, remove the cables connected to the Drive Box you added and then reconnect them to the Drive Box again.

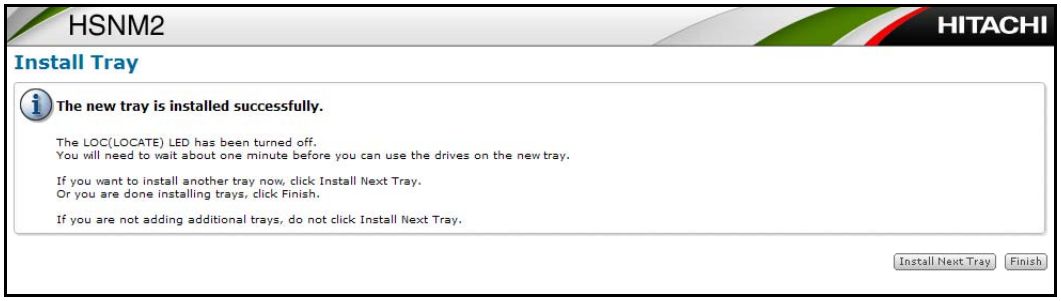
If you connected power cables to the Power Unit of the newly added Drive Box, the red **ALARM** LED on the I/O Module (ENC) goes ON. This is normal. The LED will go OFF when you complete the addition procedure.

If you click the **Cancel** button in the Install Tray screen, the window closes, but the **LOC** LED remains ON. Click the **Refresh Information** button in the Trays list screen to update the window contents, click the tray on which the position column is displayed as ON, and click the **Disable Locate** button to turn off the **LOC** LED.

The following screen appears during the tray installation procedure.




6. When the addition is completed, the following window appears.




7. To continue adding more Drive Boxes, click the **Install Next Tray** button and repeat this procedure from step 5. To complete the addition, click the **Finish** button.
8. If Drive Box connection and recognition fails, the following window appears.

   Click the **Close** button to close the window, remove the Drive Box power cables and ENC cables between the existing storage system and the Drive Box, and repeat this procedure from step 5.

   If you stop the addition procedure, the **LOC** LED remains ON. Click the **Refresh Information** button in the Trays list screen to update the window contents, click the tray on which the position column is displayed as ON, and click the **Disable Locate** button to turn off the **LOC** LED.
9. Check the added chassis in the Trays list screen.
10. Check that the green **READY** LED on the front of the Controller Box is ON and the orange **WARNING** LED is OFF. If the **WARNING** LED goes ON or blinks slowly, contact HDS Support at portal.hds.com.

# A

# Registration, resources, and checklists

This appendix contains instructions for registering your Hitachi Unified Storage system and information about the available resources you can use to enhance your experience with your Hitachi Unified Storage system. Also, included is a table where you can record your configuration settings for future reference.

The following topics are covered in this chapter:

- Registering your storage system
- Additional resources
- Recording configuration settings

# Registering your storage system

Before you start using your Hitachi Unified Storage system for the first time, use the HDS Support Portal to register your storage system. As part of this procedure, you will create a new user account if you do not already have one.

If you already have a user account, skip to Logging in to the HDS Support Portal on page A-6.

**NOTE:** If you encounter a problem, visit https://portal.hds.com/index.php/contact-us or contact the Hitachi Global Contact Center (GCC):

- From the US: (800) 446-0744
- Outside the US: (858) 547-4526
- Web: portal.support@hds.com
- EMEA assistance: hdsservicerequests@hds.com or call +44 1753 216064.

When calling the GCC, please have the following information available:

- Customer site ID
- Product model and serial number
- Contact name, phone number, and e-mail address

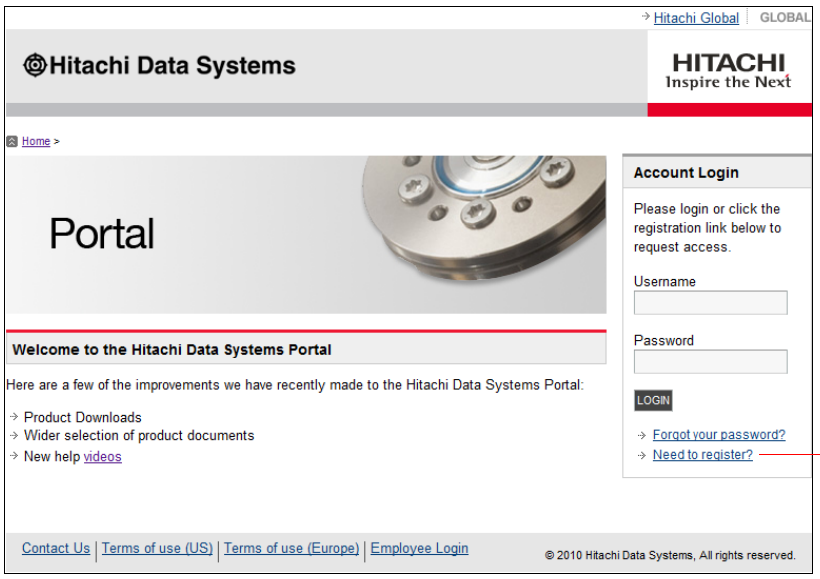
## Creating a user account

The first time you log in to the HDS Support Portal, you must create a user account before you register your Hitachi storage system. The following procedure describes how to create a user account.

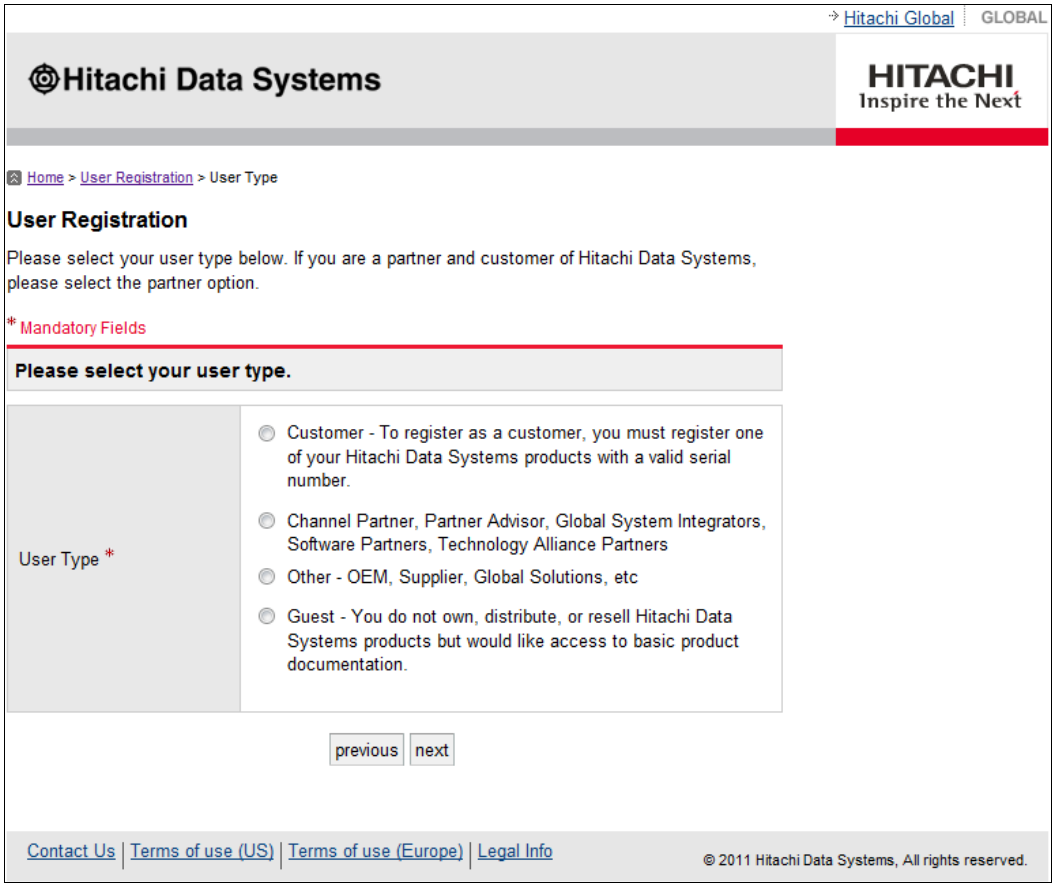
1. Launch a browser and go to the HDS Support Portal:

   https://portal.hds.com

2. When the Landing page appears, click **Need to register?** under **Login** at the bottom-right area of the page.



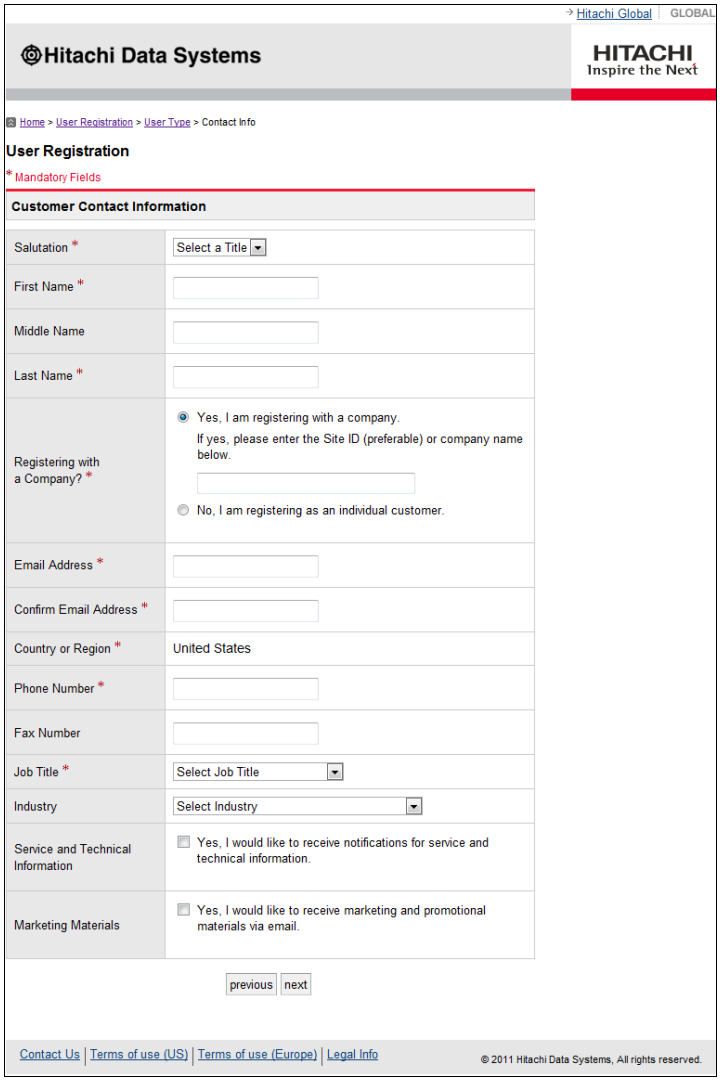
3. At the User Registration page, click your country or region, and then click **submit**.
4. At the Global Personal Data Protection & Privacy Policy page, read the policy. When you finish, click **I accept**. You must accept the policy to continue with the registration process.
5. At the User Type page, select a user type.



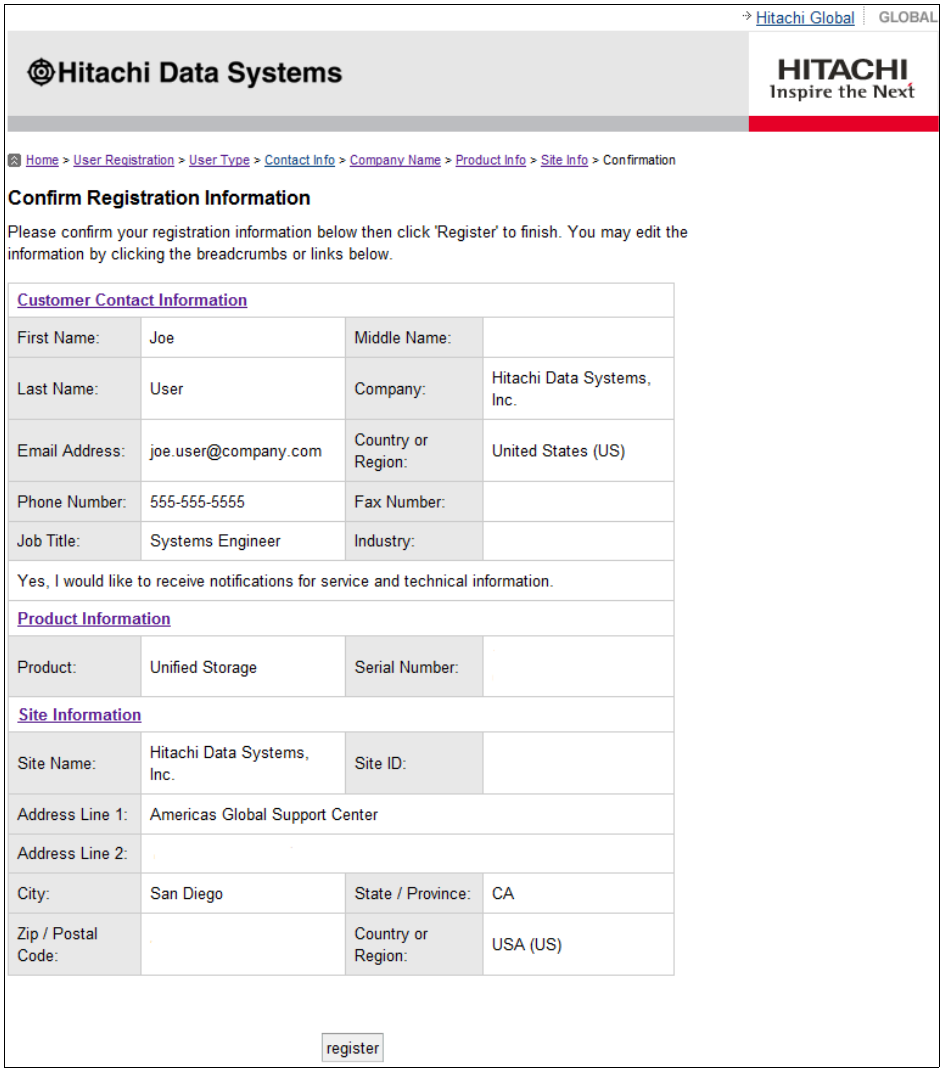

6. Click **next**.
7. At the Contact Info page, enter your customer contact information.

**NOTE:** In the **Registering with a Company** field, enter your company's Site ID to ensure accurate user to site matching.

8. When you finish, click **next**.




9. Follow the remaining on-screen instructions.
10. At the Confirmation page, confirm that the information shown is correct. If you need to change it:
    a. Click the appropriate topic link in the bread crumbs at the top of the page or in the body of the page.
    b. Edit the information.
    c. Click **next** until the Confirm page appears.
11. Click **register**. The storage system is registered, the Landing page appears, and a login password is sent to the email address you specified during product registration. You can use the email address and password to log in to the HDS Support Portal using the instructions in Logging in to the HDS Support Portal on page A-6.



Hitachi Global GLOBAL

Hitachi Data Systems

HITACHI
Inspire the Next

Home > User Registration > User Type > Contact Info > Company Name > Product Info > Site Info > Confirmation

**Confirm Registration Information**

Please confirm your registration information below then click 'Register' to finish. You may edit the information by clicking the breadcrumbs or links below.

| Customer Contact Information | | | |
|---|---|---|---|
| First Name: | Joe | Middle Name: | |
| Last Name: | User | Company: | Hitachi Data Systems, Inc. |
| Email Address: | joe.user@company.com | Country or Region: | United States (US) |
| Phone Number: | 555-555-5555 | Fax Number: | |
| Job Title: | Systems Engineer | Industry: | |
| Yes, I would like to receive notifications for service and technical information. | | | |
| **Product Information** | | | |
| Product: | Unified Storage | Serial Number: | |
| **Site Information** | | | |
| Site Name: | Hitachi Data Systems, Inc. | Site ID: | |
| Address Line 1: | Americas Global Support Center | | |
| Address Line 2: | | | |
| City: | San Diego | State / Province: | CA |
| Zip / Postal Code: | | Country or Region: | USA (US) |

register

## Logging in to the HDS Support Portal

After you create a user account in the HDS Support Portal and receive a password for logging in to the HDS Support Portal, you can log in to the Portal to register additional Hitachi storage systems.

The HDS Support Portal also provides the following support tools:

- Knowledge Base
- Case management
- Downloads
- Product Interoperability
- Technical bulletins
- Product documents

To log in to the HDS Support Portal:

1. At the Login page, enter you log in credentials:
   - **Username** = enter the email address you specified when you created your user account.
   - **Password** = enter the case-sensitive password you received by email when you created your user account. For security, each typed password character is masked with a dot (•).
2. Click **LOGIN**.

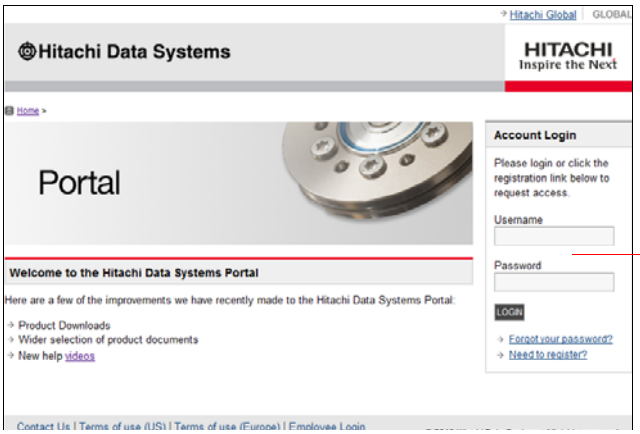
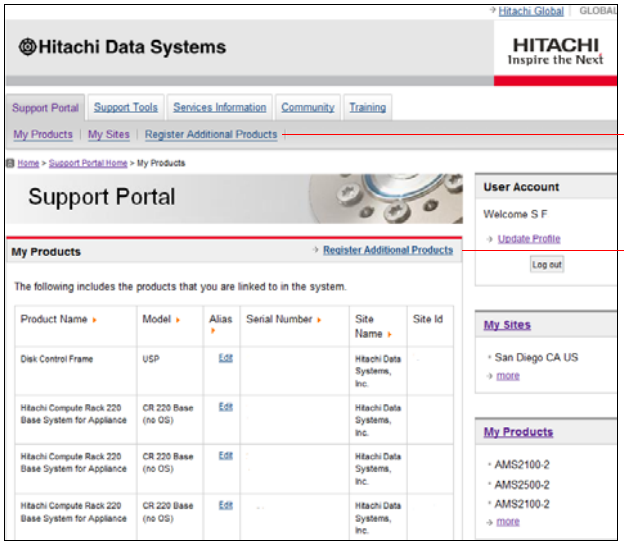



**Figure A-1: Login page**

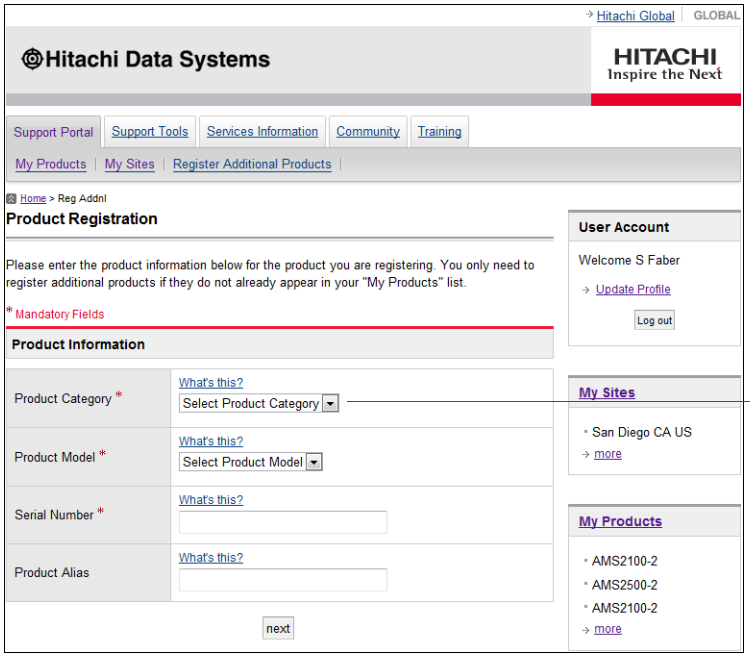
3. Confirm that all of your products are registered by clicking the **My Products** link at the top of the page or at the bottom-right area of the page.
4. If all of your products are shown under **My Products** for all of your sites, your Hitachi storage systems are registered.

   Otherwise, perform the following steps:

   a. Click the **Register Additional Product** link at the top of the page or the **Register Additional Products** link at the bottom-right area of the page, and then go to the next step.




b. At the Product Registration page, under **Product Information**, click the **Product Category** drop-down list and select the product category for the product you are registering.

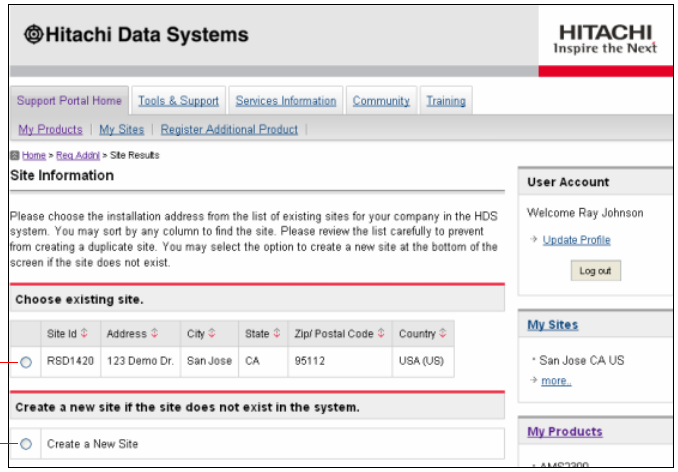



c. Click the **Product Model** drop-down list and select the product you are registering.

d. Click in the **Serial Number** field and enter the serial number for your product. For convenience, Hitachi Unified Storage system models 110 and 130 provide a **serial # label** on the top of the enclosure, as shown in the example in the following figure.

e. Optionally, click in the **Alias** field and enter a “friendly” name for the product you are registering.

f. Click the **next** button at the bottom of the page.

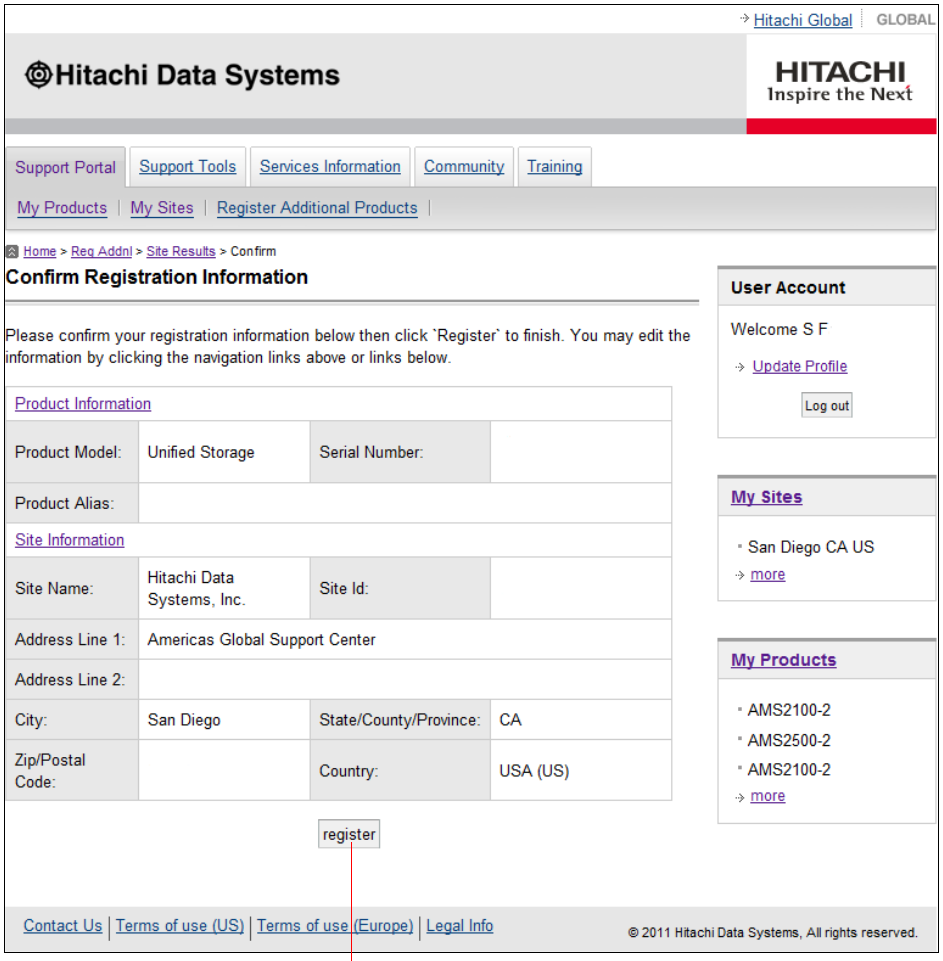



g. At the Site Information page, click the site where the product is installed. If the site does not exist, create a new site. Click **Next**.

   If you clicked an existing site, go to the next step.

   If you clicked **Create a New Site**, complete the on-screen site information. When you finish, go to the next step.

h. At the Confirm Registration page, click **register** at the bottom of the page.




register
Button

i. Wait 15 minutes, and then go to the My Products page link and confirm that the storage systems is registered.

# Additional resources

Hitachi provides a number of resources for maximizing your experience.

## Product documentation

Refer to Related documents on page lviii and the supplied documentation CD, or visit the site:

http://www.hds.com/corporate/resources/

## Product interoperability

For convenience, Hitachi Data Systems provides an interoperability matrix that can be accessed from the HDS Support Portal and the Hitachi Web site:

HDS Support Portal: Log in to the Portal and click the **Product Interoperability** link

Hitachi Web site: http://www.hds.com/products/interoperability/

## Global Services

Hitachi Data Systems Global Services can increase the value of IT to your business with carefully applied technologies for reducing risk, accelerating ROI, lowering costs, and managing your storage infrastructure successfully.

http://www.hds.com/services/

For a list of in-country toll-free phone numbers, go to:

https://portal.hds.com/index.php/contact-us/in-country-toll-free-numbers

## Hitachi Storage Forums

Hitachi Storage Forums let you exchange information and questions comments about Hitachi Data Systems products, services, and support.

http://forums.hds.com

# Recording configuration settings

We recommend that you make a copy of the following table and record your configuration settings for future reference.

**Table A-1: Recording configuration settings**

| Field | Description |
|---|---|
| Storage system Name | |
| **Email Notifications** | |
| Email Notifications | ? Disabled<br>? Enabled (record your settings below) |
| Domain Name | |
| Mail Server Address | |
| From Address | |
| Send to Address<br>Address 1:<br>Address 2:<br>Address 3: | |
| Reply To Address | |
| **Management Port Settings** | |
| Controller 0 | |
| Configuration | ? Automatic (Use DHCP)<br>? Manual (record your settings below) |
| IP Address | |
| Subnet Mask | |
| Default Gateway | |
| Controller 1 | |
| Configuration | ? Automatic (Use DHCP)<br>? Manual (record your settings below) |
| IP Address | |
| Subnet Mask | |
| Default Gateway | |
| **Host Port Settings** | |
| Fibre Channel Port:_____ | Port Address:<br>Transfer Rate:<br>Topology: |
| Fibre Channel Port:_____ | Port Address:<br>Transfer Rate:<br>Topology: |

**Table A-1: Recording configuration settings (Continued)**

| Field | Description |
|---|---|
| Fibre Channel Port:_____ | Port Address:<br>Transfer Rate:<br>Topology: |
| Fibre Channel Port:_____ | Port Address:<br>Transfer Rate:<br>Topology: |
| Fibre Channel Port:_____ | Port Address:<br>Transfer Rate:<br>Topology: |
| Fibre Channel Port:_____ | Port Address:<br>Transfer Rate:<br>Topology: |
| Fibre Channel Port:_____ | Port Address:<br>Transfer Rate:<br>Topology: |
| Fibre Channel Port:_____ | Port Address:<br>Transfer Rate:<br>Topology: |
| iSCSI Port:_____ | IP Address:<br>Subnet Mask:<br>Default Gateway: |
| iSCSI Port:_____ | IP Address:<br>Subnet Mask:<br>Default Gateway: |
| iSCSI Port:_____ | IP Address:<br>Subnet Mask:<br>Default Gateway: |
| iSCSI Port:_____ | IP Address:<br>Subnet Mask:<br>Default Gateway: |
| **VOLUME Settings** | |
| RAID Group | |
| Free Space | |
| VOL | |
| Capacity | |
| Stripe Size | |
| Format the VOL | ? Yes<br>? No |

B

# Upgrading firmware

Hitachi works hard to constantly improve the operation and performance of the Hitachi Unified Storage systems. When improvements are available, they are offered to customers as upgraded firmware releases.

We recommend you check that your storage system has the latest firmware after you install and configure the storage system. Thereafter, check for firmware releases and install them as they become available.

The following topics are covered in this appendix:


- Firmware upgrade prerequisites
- Limitations when upgrading firmware
- Checking firmware version
- Upgrading firmware on a dual-controller system
- Upgrading firmware on a single-controller system

## Firmware upgrade prerequisites

Before upgrading the firmware on a Hitachi Unified Storage system, observe the following prerequisites:

- Firmware upgrades on a Hitachi Unified Storage system with two controllers can cause a single controller to handle all host I/O. Therefore, we recommend you upgrade firmware when host I/O is low, such as during non-peak hours or on weekends or holidays.
- If the Hitachi Unified Storage system and the computer that will be used during the upgrade are connected directly, check that the storage system LAN port is linked up. If they are connected using a switch, check that the LAN port on the switch is linked up.
- Confirm that other applications (JP1/HiCommand Device Manager, other Hitachi Storage Navigator Modular 2 operations, and so on) that access the storage system over a network are not operating.
- If you use the Power Saving/Power Saving Plus option, check that there is no RAID group with a power saving status of Normal (command monitoring), indicating the spin-down is not being performed.
- Do not upgrade firmware when TrueCopy Remote Replication or TrueCopy Extended Distance is used.

## Limitations when upgrading firmware

Fibre Channel hosts connected to a Hitachi Unified Storage system whose firmware is being upgraded may suffer I/O timeouts during periods of peak activity.

iSCSI hosts connected to a Hitachi Unified Storage system whose firmware is being upgraded may encounter the following conditions:

- Windows 2003 and Windows 2008

  I/O under execution may pause up to 30 seconds before and after firmware is upgraded. If a host is connected to the Hitachi Unified Storage 100 system using a host bus adapter (HBA) and switch, firmware can only be upgraded for the redundant path.
- Red Hat Enterprise Linux

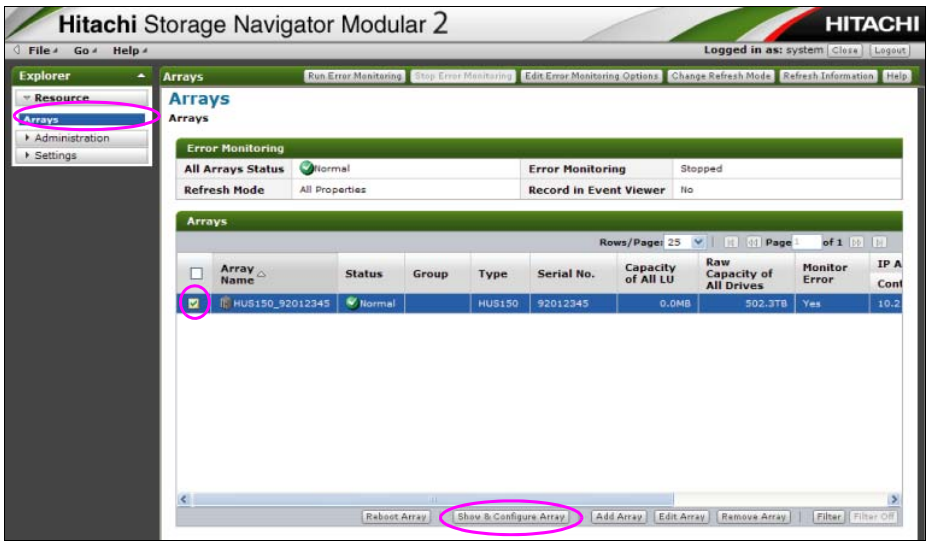
  I/O under execution may pause up to 30 seconds before and after firmware is upgraded. For 10 Gb iSCSI interfaces, upgraded the firmware in a configuration where 128 hosts or more are connected to one iSCSI port, set the login time-out time to 60 seconds or more. If a host is connected to the Hitachi Unified Storage 100 system using an HBA and switch, firmware can only be upgraded for the redundant path.
- AIX, HP-UX, Solaris, and VMware

  I/O under execution may pause up to 30 seconds before and after firmware is upgraded.

# Checking firmware version

Use the following procedure to determine whether your storage system is using the most recent firmware version.

1. Prepare the Hitachi Storage Navigator Modular 2 management console (see Performing basic configuration activities on page 5-6).
2. Start Hitachi Storage Navigator Modular 2 and log in.
3. In the Explorer pane, click **Arrays**.
4. In the Arrays screen on the right, check the storage system whose firmware you want to upgrade.




5. Click **Show & Configure Array** at the bottom of the Arrays window.
6. Go to the HDS Support Portal:

   https://portal.hds.com/

7. Log in to the Support Portal with your username and password.
   - **Username** = enter the email address you specified when you created your user account.
   - **Password** = enter the case-sensitive password you received by email when you created your user account. For security, each typed password character is masked with a dot (•).

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If you are logging on for the first time, see Registering your storage system on page A-2**.**

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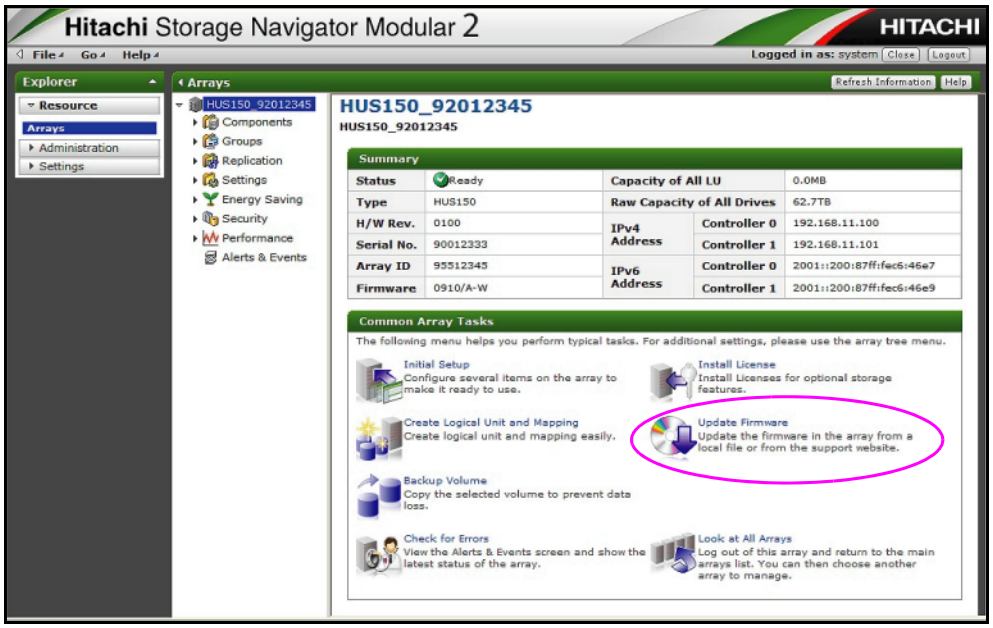
8. At the bottom-left side of the page, under **Tools & Support**, click **Downloads**.
9. At the Downloads page, select your product, and then click **Search**.
1. At the Software and Firmware page, look at the latest firmware available for your storage system. If this firmware version is later than the one shown in the **Summary** area of Storage Navigator Modular 2, click the firmware version you want to download. Then, at the File Download prompt, save the WinZip file containing the firmware to the C: drive of your maintenance computer.

# Upgrading firmware on a dual-controller system

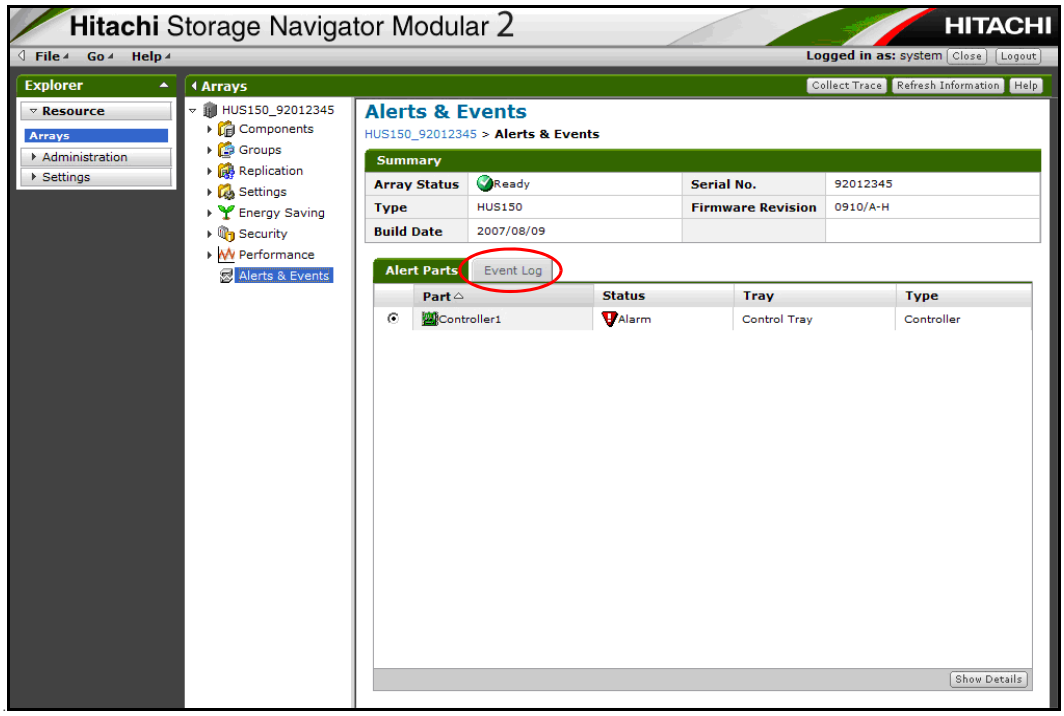
After downloading the latest firmware file from the Portal, use the following procedure to upgrade the storage system firmware on a Hitachi Unified Storage system that has two controllers.

1. In Hitachi Storage Navigator Modular 2, under **Common Array Tasks** on the right, click **Update Firmware** and follow the on-screen instructions.




2. Click the **Browse** button.
3. In the Open dialog box, go to the location where you downloaded the firmware WinZip file, click the file, and click **Open**.
4. At the Update Firmware page, confirm that the firmware version shown in **Current version** is an earlier version than the one shown in **Local file revision**.
   - If it is, check the check box and click **Confirm**.
   - If it is not, click **Cancel** to cancel without upgrading firmware.
5. After the firmware upgrade completes. use the following procedure to confirm that the upgrade was successful:
   a. In Storage Navigator Modular 2, under **Common Array Task**, click **Check for Errors**.
   b. In the center pane, click **Alerts & Events**.
   c. In the Alerts & Events page, click the **Event Log** tab.

**NOTE:** If the firmware upgrade fails, it may be due to processor usage being high because Response Performance Mode is enabled. Switch to Normal mode (see Improving I/O response times in small configurations on page 5-67) and try upgrading the firmware again.



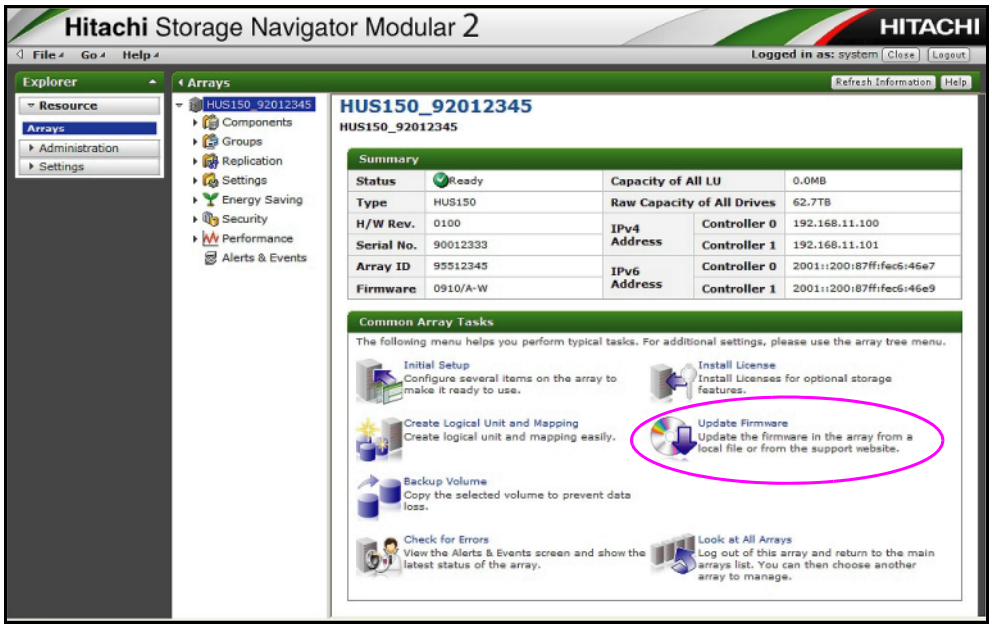

d. In the **Event Log** tab, look for the entry **I19000 Online micro-update completed**. This entry indicates that the firmware upgrade was successful.

## Upgrading firmware on a single-controller system

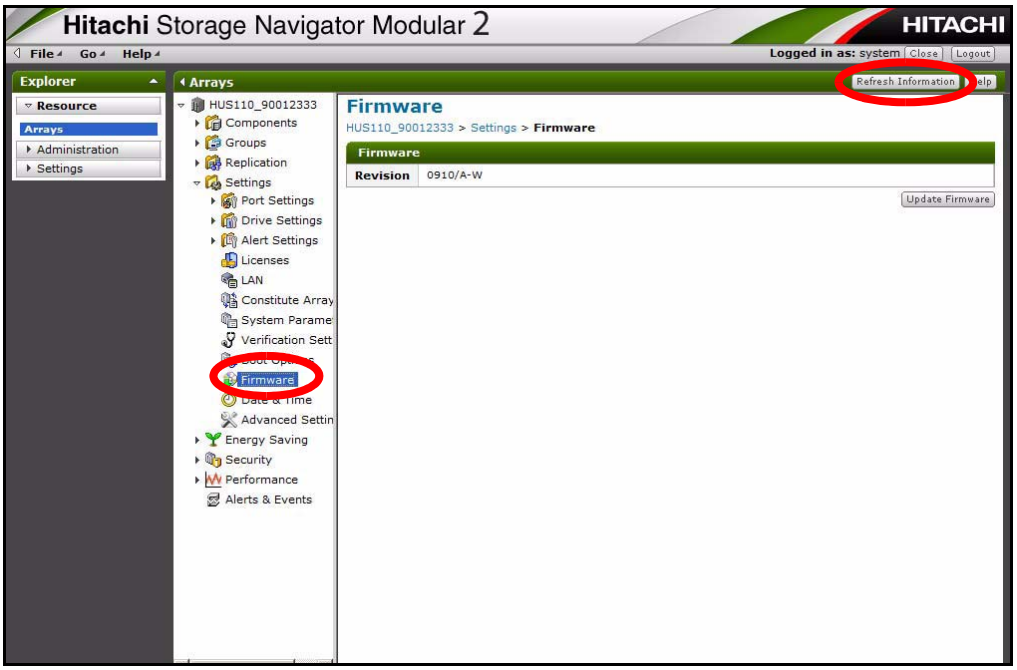
After downloading the latest firmware file from the Portal, use the following procedure to upgrade the storage system firmware on a Hitachi Unified Storage system that has a single controller.

**CAUTION! This procedure requires you to turn off the Hitachi Unified Storage system. Therefore, perform this procedure when there is no I/O activity, such as at night or over a weekend or holiday. If users will be accessing the storage system, alert them in advance that storage will be unavailable temporarily while firmware is being upgraded.**

1. In Hitachi Storage Navigator Modular 2, under **Common Array Tasks** on the right, click **Update Firmware** and follow the on-screen instructions.




2. Click the **Browse** button.
3. In the Open dialog box, go to the location where you downloaded the firmware WinZip file, click the file, and click **Open**.
4. At the Update Firmware page, confirm that the firmware version shown in **Current version** is an earlier version than the one shown in **Local file revision**.
   - If it is, check the check box and click **Confirm**.
   - If it is not, click **Cancel** to cancel without upgrading firmware.
5. After the firmware upgrade completes, turn off the main switch.
6. Wait at least one minute after the **POWER** LED goes OFF, and then turn on the main switch. Confirm that the green **READY** LED on the front of Controller Box is ON. If the orange **WARNING** LED on the front of Controller Box blinks quickly, the **READY** LED on the front of Controller Box goes ON after the **WARNING** LED blinks quickly for up to 85 minutes.
7. In the middle pane, click **Settings > Firmware**.
8. At the top-right area of the Firmware page click the **Refresh Information** button.




9. Confirm that the version of the firmware that was replaced appears next to **Revision**.

C

# Rack mounting the storage system

This chapter provides guidelines for Hitachi racks that can be used to mount Hitachi Unified Storage systems.

The key topics in this chapter include:

- Overview
- Hitachi racks at a glance
- Hitachi 600 x 1200 mm Universal Racks
- Hitachi 750 x 1200 mm Universal Racks
- Hitachi Brazil racks
- Preparing for installation
- Installing rack equipment
- Universal Rail Kit
- Rack-mounting DBW and DBX Drive Boxes
- Post-installation considerations
- Power Distribution Units

# Overview

Hitachi Data Systems provides the racks in Table C-1 for mounting Hitachi Unified Storage systems. For more information about a rack, see the page number in the "See" column. For information about rack mounting DBX Drive Boxes in a Hitachi 600 x 1200 mm Universal Rack, see Rack-mounting DBW and DBX Drive Boxes on page C-52.

**Table C-1: Hitachi Racks**

| Rack | Usage | See |
|---|---|---|
| Hitachi 600 x 1200 mm Universal | Designed to hold Hitachi Unified Storage 110, 130, and 150 systems and related components.<br><br>Alternatively, equivalent racks can be used to hold these Hitachi storage systems so long as they:<br>• Meet Hitachi Data Systems' specifications (see Table C-4 on page C-11 and Table C-5 on page C-20).<br>• For DBX Drive Boxes, use Hitachi-supplied rails.<br>• For DBW Drive Boxes, use the Hitachi 750 x 1200 mm Universal Rack or equivalent (see Table C-5 on page C-20). | page C-5 |
| Hitachi 750 x 1200 mm Universal Rack | Designed for mounting Hitachi Unified Storage Model 110, 130, and 150 systems.<br>• Highly recommended for mounting Hitachi Unified Storage 130 or 150 systems equipped with one or more DBX Drive Boxes.<br>• Required for mounting Hitachi Unified Storage 150 equipped with one or more DBW Drive Boxes.<br>• For DBX and DBW Drive Boxes, use Hitachi-supplied rails. | page C-13 |

Hitachi racks are installed at the customer site in one of two configurations:

- In a stand-alone installation, where the rack has sufficient clearance to permanently attach stabilization plates.
- In a bayed installation, where the rack is installed in a row with other racks.

Front stabilizing plates are required for all stand-alone installations. Front stabilization or bayed installations are required when using DBX Drive Boxes with a Hitachi Unified Storage system. Front stabilizing plates (p-code A3BF-STABILISATOR) come with the rack. Hitachi Data Systems stabilization plates have anchoring holes. Hitachi Data Systems recommends that stand-alone racks be anchored whenever possible.

All bay-type installations require baying/interconnecting kits (p-code A17C-EXTERN-9011) to attach a rack to an adjacent rack and front stabilizing plates. For more information, see Securing multiple racks together with the baying kit on page C-40.

Hitachi racks are UL listed, with UL labels applied to the racks. All system cabinets and racks must be grounded to the CO GRD system, using a 6 AWG Rack information at-a-glance

# Hitachi racks at a glance

## Hitachi 600 x 1200 mm Universal Racks

Hitachi 600 x 1200 mm Universal Racks are available in one version worldwide (see Table C-2). For more information, see Hitachi 600 x 1200 mm Universal Racks on page C-5.

**Table C-2: Hitachi 600 x 1200 mm Universal Rack**

| Specification | Description |
|---|---|
| Product Codes: | • Rack without side panels: A3BF-600-1200 (side panels are always ordered separately and installed at DC)<br>• Side panel (quantity 1): A3FB-Z-PAN-1200 (order 2 per rack)<br>• Optional front door with install kit for DC: A3BF-DR |
| Doors: | • Optional locking front door<br>• Locking back door |
| External Dimensions (with Panels): | • Width: 600 mm (1.97 ft)<br>• Depth: 1200 mm (3.94 ft)<br>• Height: 2008.25 mm (6.59 ft) |
| Rail Kits, PDUs, and Power Cords: | Ordered separately |

Hitachi Unified Storage systems equipped with a DBW Drive Box are installed in 750 x 1200 mm Universal Racks. Configure the DBX in the 750 mm-wide rack. Otherwise, there is limited space for managing cables and power distribution units (PDUs).

PDUs and hot-swappable components will be hard to remove on-site without downtime. Hitachi Unified Storage non-dense trays should also be configured in 750 mm Universal Racks if you plan to upgrade to DBX and DBW Drive Trays.

**NOTE:** For DBW and DBX dense trays, the Hitachi 750 x 1200 mm Universal Rack is recommended (see Hitachi 750 x 1200 mm Universal Racks on page C-13).

## Hitachi 750 x 1200 mm Universal Racks

Hitachi 750 x 1200 mm Universal Racks are available in one version worldwide (see Table C-3). For more information, see Hitachi 750 x 1200 mm Universal Racks on page C-13.

**Table C-3: Hitachi 750 x 1200 mm Universal Rack**

| Specification | Description |
|---|---|
| Product Codes: | • Rack without side panels: A3BF-750-1200 (side panels are always ordered separately and installed at DC)<br>• Side panel (quantity 1): A3FB-Z-PAN-1200 (order 2 per rack)<br>• Optional front door with install kit for DC: A3BF-DR-750 |
| Doors: | • Optional locking front door<br>• Locking back door |
| External Dimensions (with Panels): | • Width: 750 mm (2.46 ft)<br>• Depth: 1200 mm (3.94 ft)<br>• Height: 2008.25 mm (6.59 ft) |
| Rail Kits, PDUs, and Power Cords: | Ordered separately |

Alternatively, if a 600 mm-wide rack is required, you can install Hitachi Unified Storage systems equipped with a DBX Drive Box in Hitachi 600 x 1200 mm Universal Racks.

# Hitachi 600 x 1200 mm Universal Racks

Hitachi 600 x 1200 mm Universal Racks can be used to mount Hitachi Unified Storage 110, 130, and 150 systems.

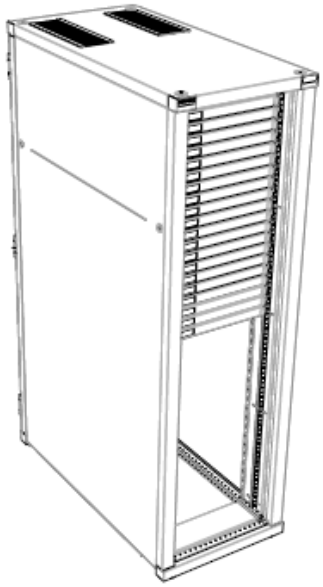


**Figure C-1: 600 x 1200 mm Universal Rack (front view)**

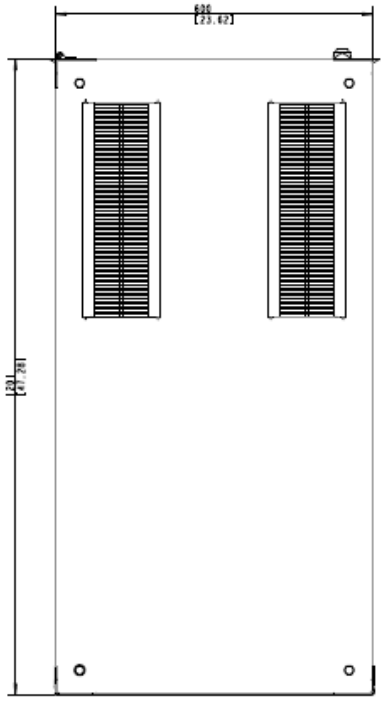
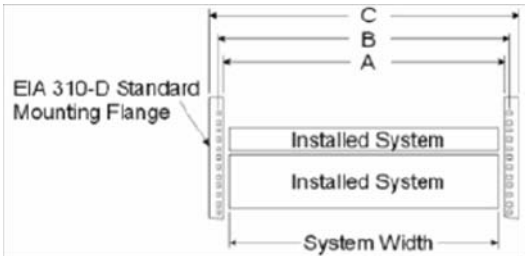


**Figure C-2: 600 x 1200 mm Universal Rack (top view)**




Dimension A = 17.717 inches (450 mm)
Dimension B= 18.307 inches (465 mm)
Dimension C = 19.031 inches (483.3 mm)

**Figure C-3: EIA 310-D standard for mounting flanges of vertical rails**

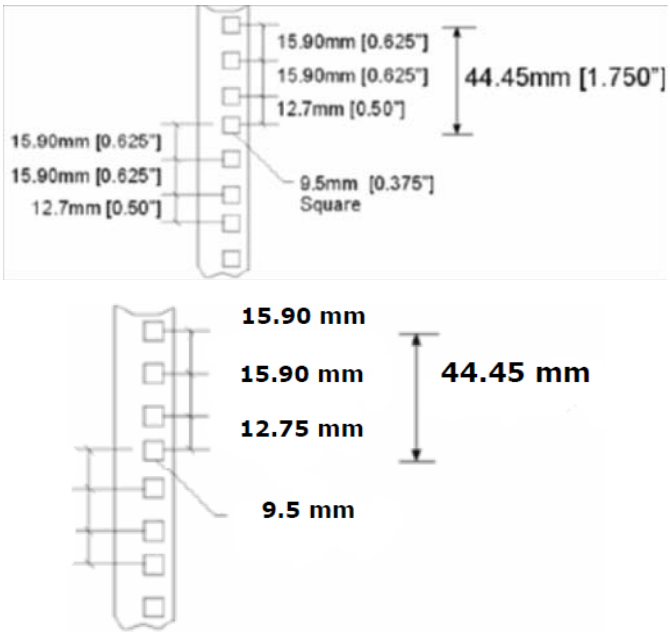



**Figure C-4: EIA 310-D standard for U spacing and square hole dimensions and placement**

## Corner guide rails

See Installing the corner guide rails on page C-49.

## Vertical rails

Hitachi 600 x 1200 mm Universal Racks have four vertical EIA-310-D compliant adjustable rails, with “U” markings. The rails are adjustable and can be placed at different points along the front to rear axis, on the left and right sides of the rack, depending on the items being installed in the rack.

The vertical EIA rails are designed for use with cage nuts. The vertical rails have a solid ground contact with the frame of the cabinet for proper ESD grounding. There is no ESD grounding point on the front and rear of the cabinet attached to the cabinet frame or vertical rails.

**Figure C-5: Vertical rails**

## Power

See Power Distribution Units on page C-55.

## Anti-tip stabilizers

The Accessory Kit includes one L-shaped anti-tip stabilizer. The anti-tip stabilizer is installed on the rack to prevent the rack from tipping when installing or uninstalling equipment from the front of the rack, especially above the mid-point of the rack.

Figure C-6 shows a basic configuration (including side panels and rear door, with the adjusting-feet extended, stabilizer mounted, and cabinet horizontal leveled.

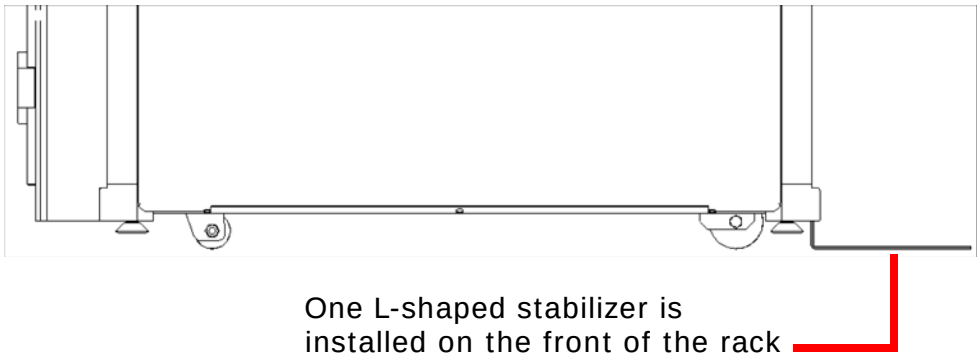



**Figure C-6: Anti-tip stabilizer**

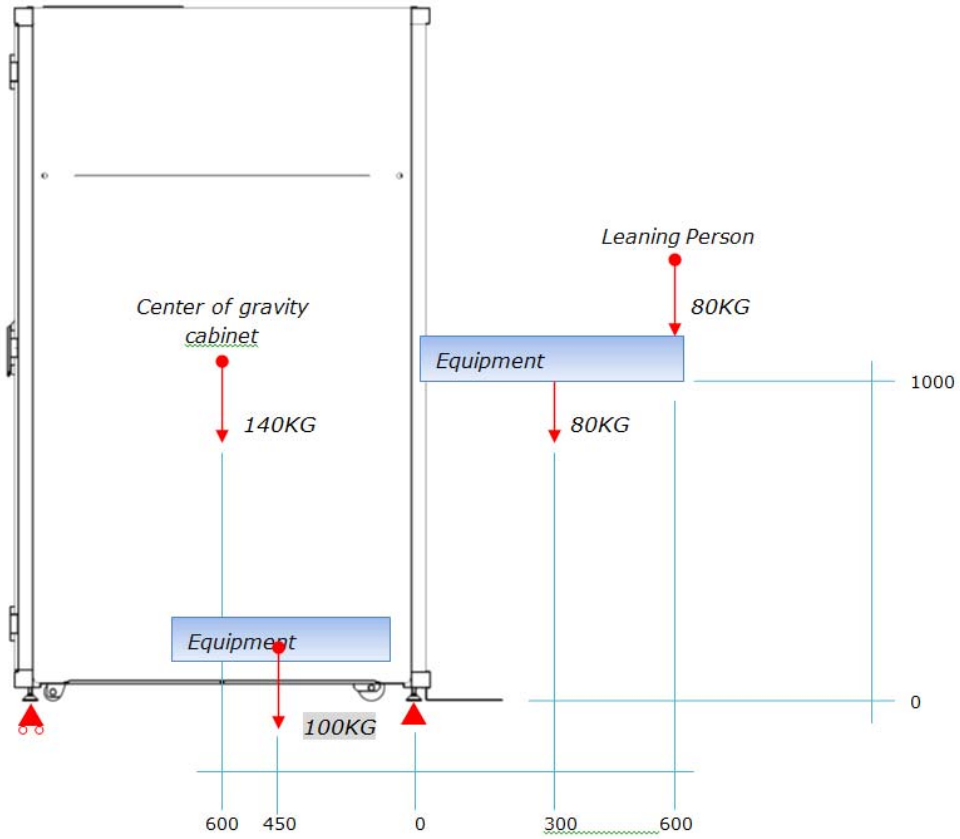
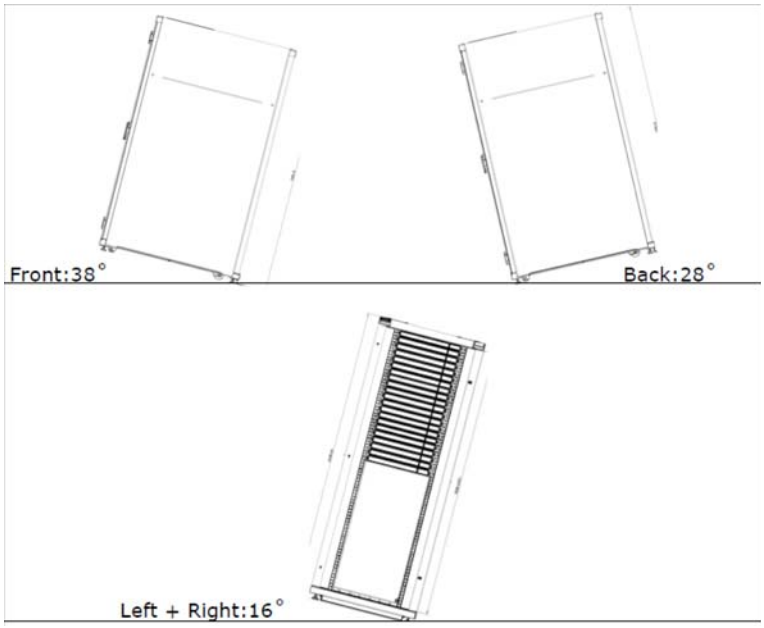



**Figure C-7: Hitachi 600 x 1200 mm Universal Rack**

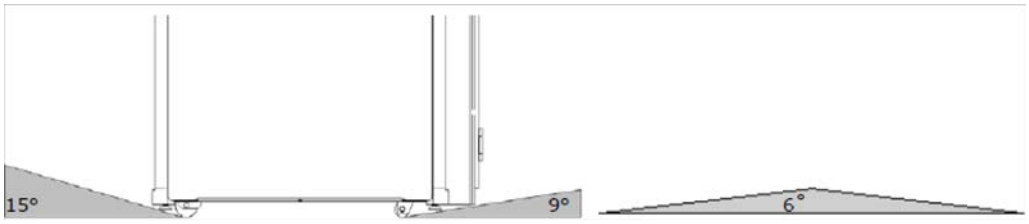
## Incline

- Minimum 10 degrees in transportation
- Minimum 15 degrees in installed situation



### Mobility and inclination

The Hitachi 600 x 1200 mm Universal Rack, when fully configured with integrated Hitachi Unified Storage systems, should have a reasonable method of moving the system up and down ramps (i.e., the base should not catch or hit against ramps having reasonable degrees of inclination). Similarly, the rack should be able to sustain the static & dynamic weight requirements.




The securing of the supports to the rack should not interfere with the vertical rails and front and rear mounting points on the vertical rails.

Equipment mounted on the supports should have their bottom plane aligned with the bottom of an EIA unit.

## Floor load rating

The floor space at the installation site must be strong enough to support the maximum combined weight of:

- The Hitachi Unified Storage Controller Box
- The Hitachi Unified Storage Drive Boxes
- The rack holding the Hitachi Unified Storage Controller Boxes and Drive Boxes
- All associated equipment

### Dynamic weight capacity

The following values show the maximum weight the rack can support while being shipped or moved with equipment installed:

- Maximum 1,102 lbs. (500 kg.)
- Meets a safety factor of 1.5 times the minimum stated above

### Static weight capacity

Maximum weight the empty rack can support after it is leveled and installed properly (i.e., fitted with stabilizers or secured to other equipment):

- Maximum 1,984 lbs. (900 kg.)
- Meets a safety factor of 1.5 times the minimum state above

## Weight for maximum configurations

To ensure adequate load-bearing capacity, plan for the maximum configuration. Unpacking on page 4-3 lists weights for the storage system hardware.

# Grounding

The Hitachi 600 x 1200 mm Universal Rack has proper grounding for the entire rack, with all pre-installed equipment, including but not limited to PDUs, fan, and so on). Resistance is <100mΩ.

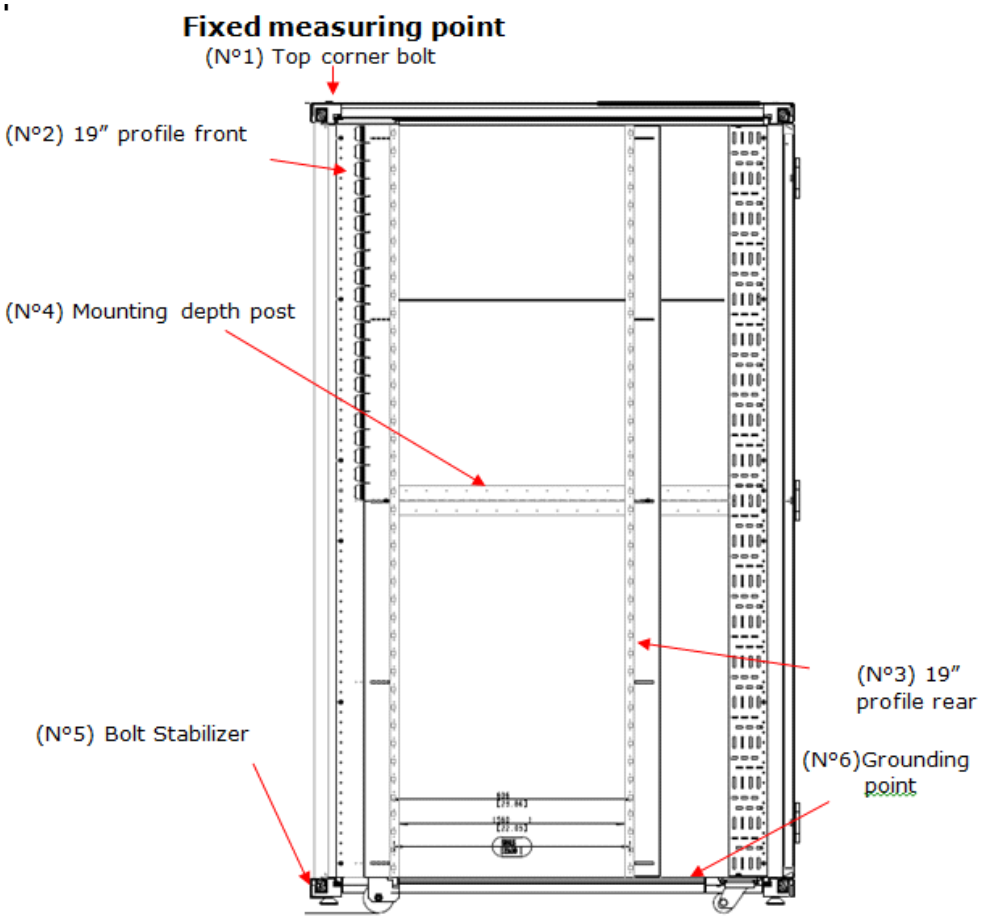



**Figure C-8: Grounding**

Measurement settings: Max 10A

- (N°1) Top corner bolt ->(N°2) 19" profile front: 10A - 10mΩ
- (N°1) Top corner bolt ->(N°3) 19" profile rear: 10A - 9m
- (N°1) Top corner bolt ->(N°4) mounting depth post: 10A - 10mΩ
- (N°1) Top corner bolt ->(N°5) bolt stabilizer: 10A - 11μΩ
- (N°1) Top corner bolt ->(N°6) grounding point: 10A - 10mΩ

## Specifications

**Table C-4: Hitachi 600 x 1200 mm Universal Rack specifications**

| Item | Specification |
|---|---|
| P-code | • Rack without side panels: A3BF-600-1200<br>• Side panels (quantity 1): A3BF-Z-PAN-1200 (order 2 per rack)<br>• Optional front door: A3BF-DR |
| Dimensions (H x W x D) | 6.59 x 2.46 x 3.94 ft<br>(2008.25 x 600 x 1200 mm) |
| Weight (empty) | 308.6 lbs<br>(140 kg) |
| Frame | • 1 x Frame – 600 x 1200 x 2010mm (42u) = (w x d x h)<br>• Finished black RAL 9011<br>• 1 x Logo Hitachi, top left<br>• 1 x Earthing, earthing cables - set<br>• 2 x Mounting depth post - depth 1200mm<br>• 1 x Label Hitachi, on top inside the roof<br>• 1 x Cover set front (Left, Right and Bottom) |
| Base | • 1 x Base legs, adjustable, set of 4<br>• 1 x Construction for rollers (front)<br>• 1 x Construction for casters (back)<br>• 1 x Base, plinth side (in combination with castors) - 1200mm (d) (left)<br>• 1 x Base, plinth side (in combination with castors) - 1200mm (d) (right) |
| Roof | • 1 x Top, blank, 2 cut-outs F/R - 600 x 1200mm (w x d)<br>• 1 x Cable entry brush (front)<br>• 1 x Cable entry brush (rear) |
| Profiles | • 1 x Profiles, 19-inch, set of 4 - 42U (h)<br>• mounted at 130mm from front, mounted at 740 mm from profiles front side<br>• 4 x Number-strip for 19 inch profile 1 - 42 U<br>• mounted at 19" rear profiles, 01 at the bottom<br>• 2 x Site plate front side<br>• 1 x Top plate front side<br>• 21 x Front panel 1U ABS without Logo<br>• 2 x Cable tray zinced - 75mm x 42U (w x h) |
| Front | • 1 x Door, 65% ventilated - 600 mm x 42U (w x h) RAL 9011<br>• 3 x Hinging - on the right side<br>• 1 x Swivel handle, 2-points Fix Easy lock<br>• 1 x Lock, for swivel handle, EK-1333 |
| Rear | • 1 x Door, 65% ventilated - 600mm x 42U (w x h)<br>• 3 x Hinging - on the right side<br>• 1 x Swivel handle, 2-points Fix Easy lock<br>• 1 x Lock, for swivel handle, Z-Snap EK-1333 (keys delivered in zip bag on 19” profiles) |

**Table C-4: Hitachi 600 x 1200 mm Universal Rack specifications (Continued) (Continued)**

| Item | Specification |
|---|---|
| Accessories (separate box) | • 1 x Cabinet stabilizer- 600mm (w)<br>• 1 x Universal key for leveling<br>• 10 x Velcro strap (including mounting material)<br>• 100 x T-wrap 360 x 4,8 mm (black)<br>• 100 x Cage nuts M5<br>• 100 x Screws M5 (black)<br>• 8 x Screws 4.8 x 10 (spare parts)<br>• 8 x Screws M6 x 12 (spare parts)<br>• 1 x Nylon strap (including mounting material)<br>• 8 x Mounting bracket PDU (including mounting material)<br>• 2 x Plinth front/rear - 600mm (w)<br>• 4 x Baying kit (including mounting material) |

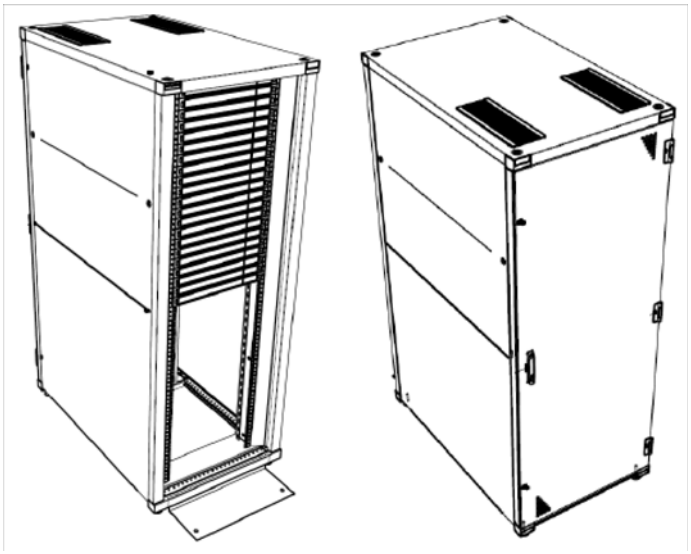
# Hitachi 750 x 1200 mm Universal Racks

Hitachi 750 x 1200 mm Universal Racks can be used to mount Hitachi Unified Storage Model 110, 130, and 150 systems.

Hitachi 750 x 1200 mm Universal Racks are:

- Required for mounting DBW Drive Boxes and intelligent PDUs.
- Highly recommended for mounting DBX Drive Boxes.

For more information about installing DBW and DBX Drive Boxes, see Rack-mounting DBW and DBX Drive Boxes on page C-52.



Front View Rear View

**Figure C-9: Hitachi 750 x 1200 mm Universal Racks**

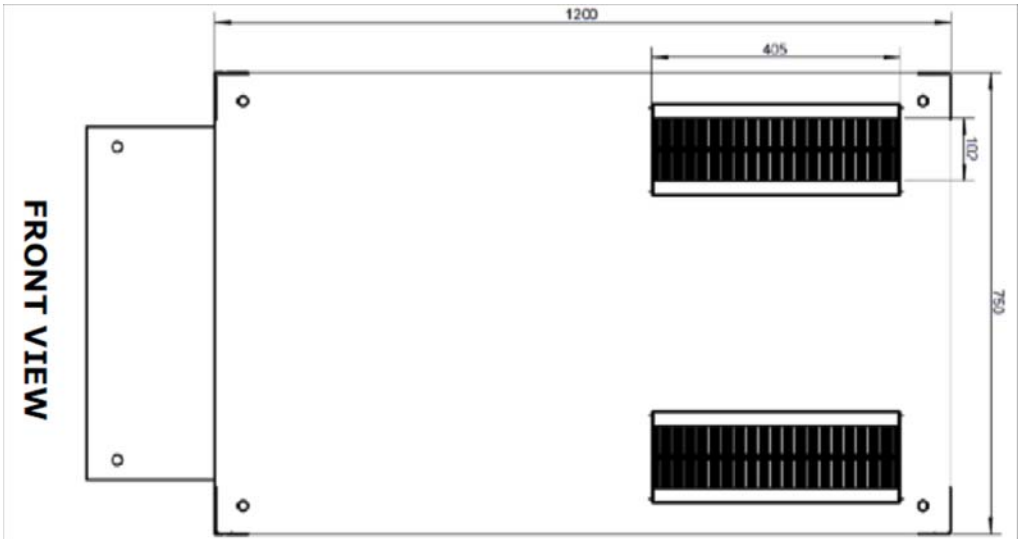
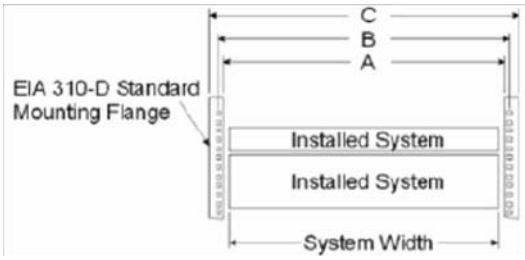



**Figure C-10: Front view**




Dimension A = 17.717 inches (450 mm)
Dimension B= 18.307 inches (465 mm)
Dimension C = 19.031 inches (483.3 mm)

**Figure C-11: EIA 310-D standard for mounting flanges of vertical rails**

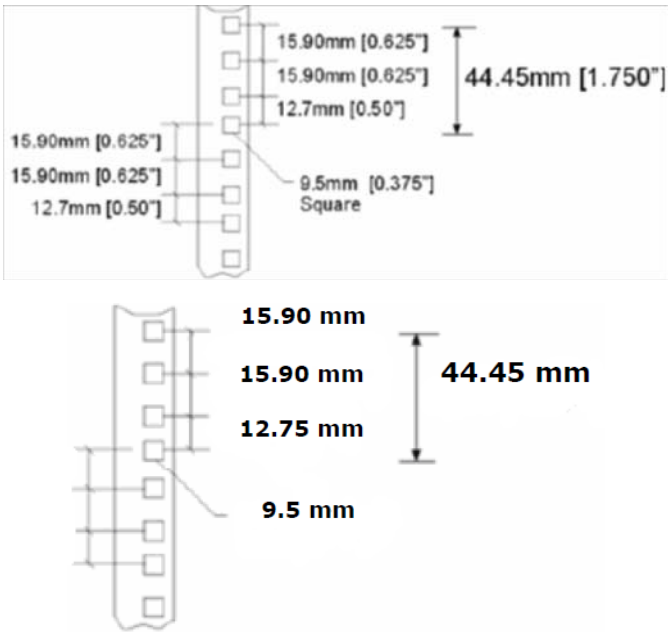



**Figure C-12: EIA 310-D standard for U spacing and square hole dimensions and placement**

## Corner guide rails

See Installing the corner guide rails on page C-49.

## Vertical rails

Hitachi 750 x 1200 mm Universal Racks have four vertical EIA-310-D compliant adjustable rails, with “U” markings. The rails are adjustable and can be placed at different points along the front to rear axis, on the left and right sides of the rack, depending on the items being installed in the rack.

The vertical EIA rails are designed for use with cage nuts. The vertical rails have a solid ground contact with the frame of the cabinet for proper ESD grounding. There is no ESD grounding point on the front and rear of the cabinet attached to the cabinet frame or vertical rails.

**Figure C-13: Vertical rails**

## Power

See Power Distribution Units on page C-55.

## Anti-tip stabilizers

The Accessory Kit includes one L-shaped anti-tip stabilizer. The anti-tip stabilizer is installed on the rack to prevent the rack from tipping when installing or uninstalling equipment from the front of the rack, especially above the mid-point of the rack.

Figure C-14 shows a basic configuration (including side panels and rear door, with the adjusting-feet extended, stabilizer mounted, and cabinet horizontal leveled.

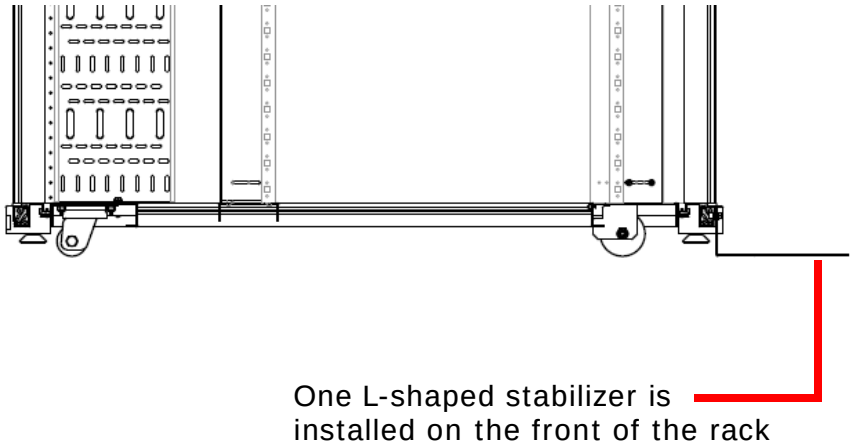



**Figure C-14: Anti-tip stabilizer**

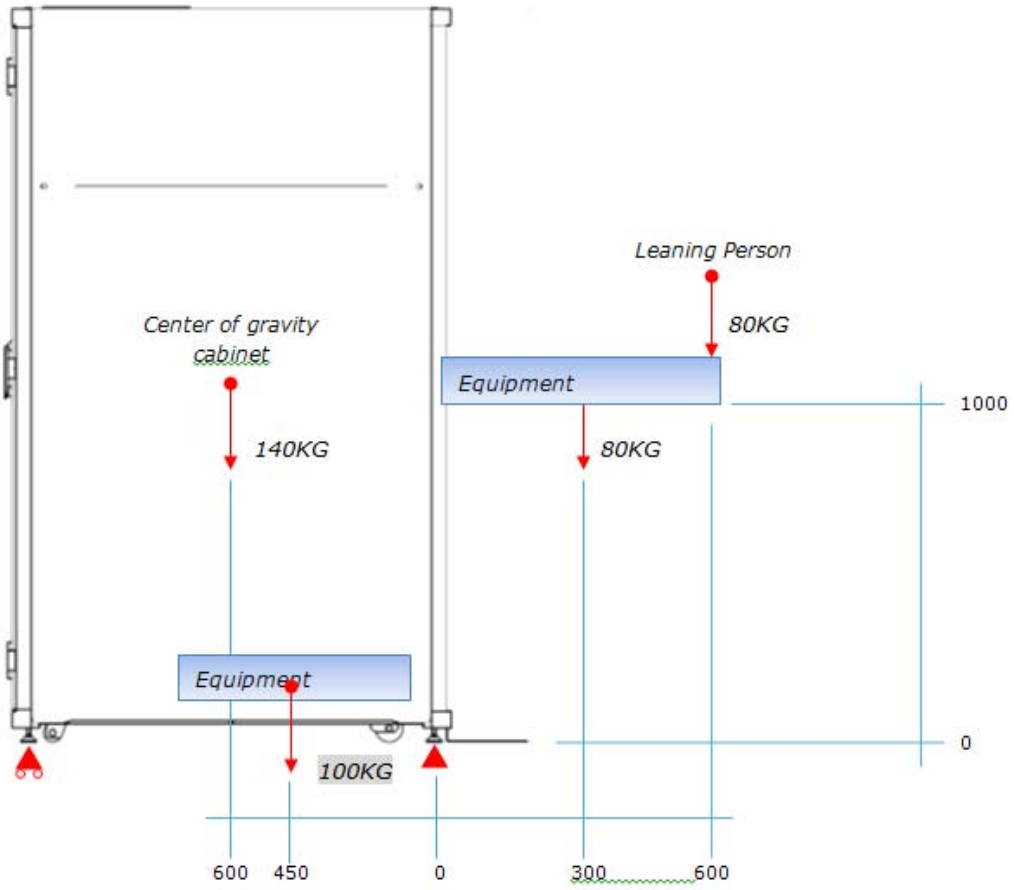
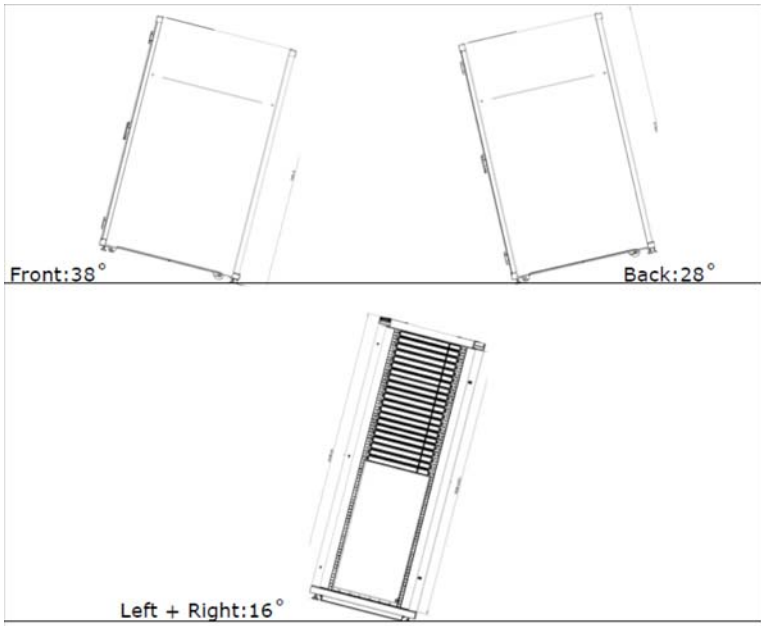



**Figure C-15: Hitachi 750 x 1200 mm Universal Rack**

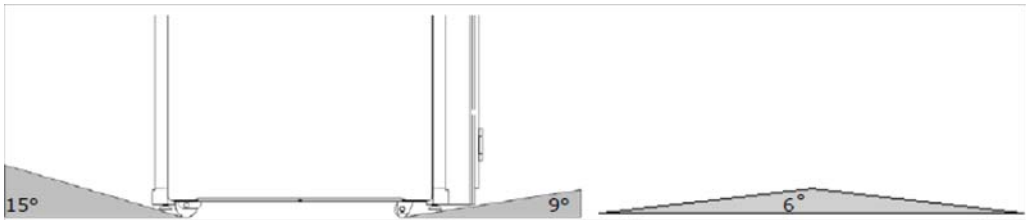
## Incline

- Minimum 10 degrees in transportation
- Minimum 15 degrees in installed situation




## Mobility and inclination

The Hitachi 750 x 1200 mm Universal Rack, when fully configured with integrated Hitachi Unified Storage systems, should have a reasonable method of moving the system up and down ramps (i.e., the base should not catch or hit against ramps having reasonable degrees of inclination). Similarly, the rack should be able to sustain the static & dynamic weight requirements.




The securing of the supports to the rack should not interfere with the vertical rails and front and rear mounting points on the vertical rails.

Equipment mounted on the supports should have their bottom plane aligned with the bottom of an EIA unit.

## Floor load rating

The floor space at the installation site must be strong enough to support the combined weight of the:

- Hitachi Unified Storage Controller Box
- Hitachi Unified Storage Drive Boxes
- The rack holding the Hitachi Unified Storage Controller Boxes and Drive Boxes
- All associated equipment

### Dynamic weight capacity

Maximum weight the rack can support while being shipped or moved with equipment installed:

- Maximum 1,102 lbs (500 kg)
- Meets a safety factor of 1.5 times the minimum stated above

### Static weight capacity

Maximum weight the empty rack can support after it is leveled and installed properly (i.e., fitted with stabilizers or secured to other equipment):

- Maximum 1,984 lbs (900 kg)
- Meets a safety factor of 1.5 times the minimum state above

### Weight for maximum configurations

To ensure adequate load-bearing capacity, plan for the maximum configuration. Unpacking on page 4-3 lists weights for the storage system hardware.

## Grounding

The Hitachi 750 x 1200 mm Universal Rack has proper grounding for the entire rack, with all pre-installed equipment, including but not limited to PDUs, fan, and so on). Resistance is <100mΩ.

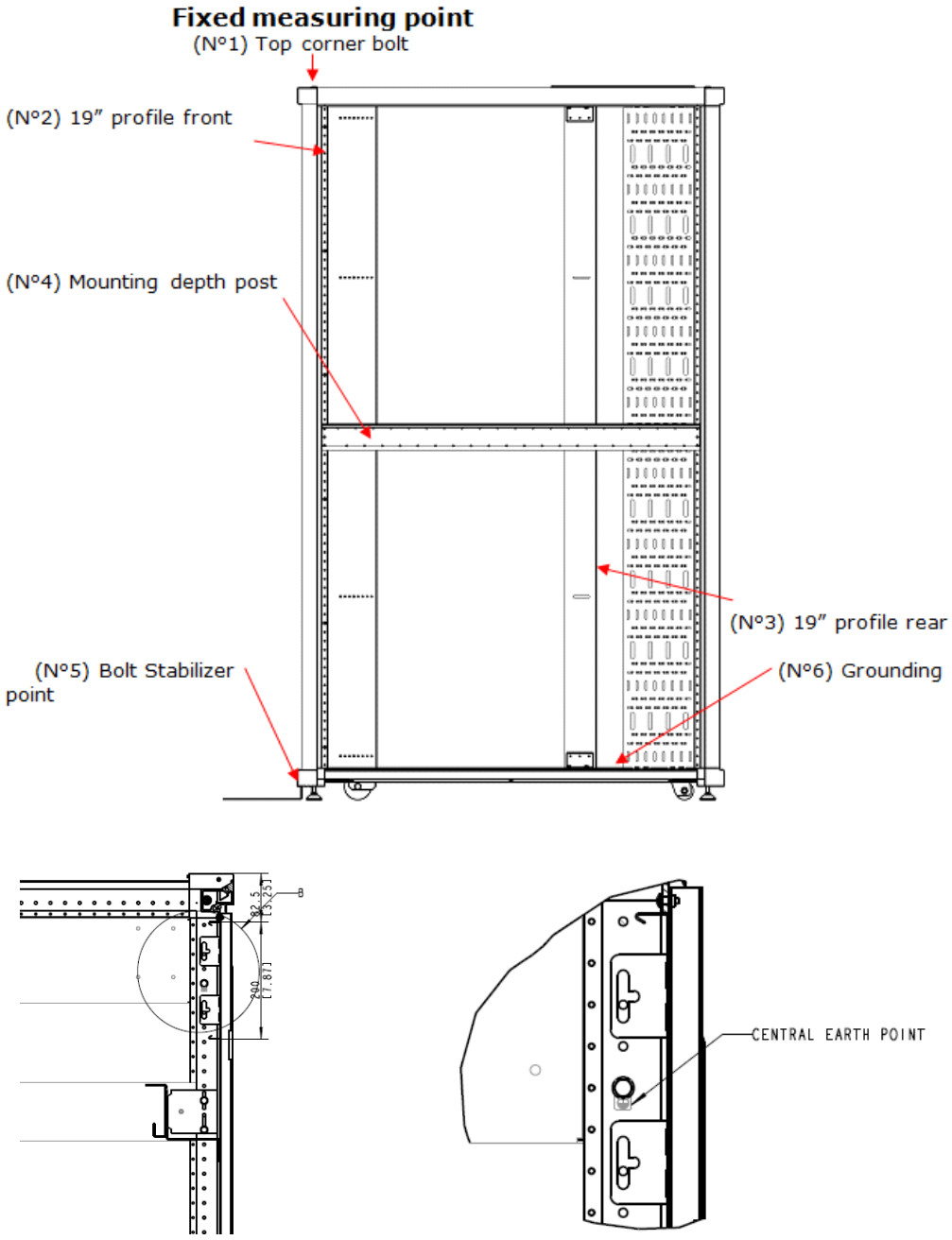



**Figure C-16: Grounding**

Measurement settings: Max 10A

- (N°1) Top corner bolt ->(N°2) 19" profile front: 10A - 10mΩ
- (N°1) Top corner bolt ->(N°3) 19" profile rear: 10A - 9m
- (N°1) Top corner bolt ->(N°4) mounting depth post: 10A - 10mΩ
- (N°1) Top corner bolt ->(N°5) bolt stabilizer: 10A - 11μΩ
- (N°1) Top corner bolt ->(N°6) grounding point: 10A - 10mΩ

## Specifications

**Table C-5: Hitachi 750 x 1200 mm Universal Rack specifications**

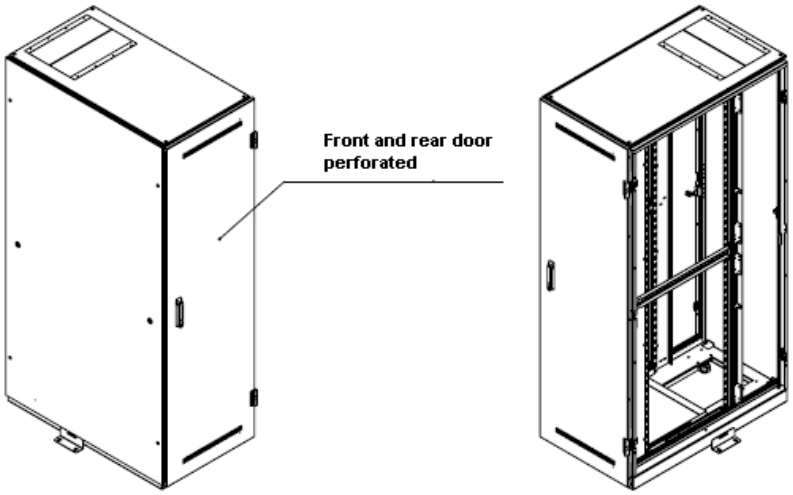
| Item | Specification |
|---|---|
| P-code | • Rack without side panels: A3BF-750-1200<br>• Side panels (quantity 1): A3BF-Z-PAN-1200 (order 2 per rack)<br>• Optional front door: A3BF-DR-750 |
| Dimensions (H x W x D) | 6.59 x 2.46 x 3.94 ft<br>(2008.25 x 750 x 1200 mm) |
| Weight (empty) | 308.6 lbs<br>(140 kg) |
| Frame | • 1 x Frame – 750 x 1200 x 2010mm (42u) = (w x d x h)<br>• Finished black RAL 9011<br>• 1 x Logo Hitachi, top left<br>• 1 x Earthing, earthing cables - set<br>• 2 x Mounting depth post - depth 1200mm<br>• 1 x Label Hitachi, on top inside the roof<br>• 1 x Cover set front (Left, Right and Bottom) |
| Base | • 1 x Base legs, adjustable, set of 4<br>• 1 x Construction for rollers (front)<br>• 1 x Construction for casters (back)<br>• 1 x Base, plinth side (in combination with castors) - 1200mm (d) (left)<br>• 1 x Base, plinth side (in combination with castors) - 1200mm (d) (right) |
| Roof | • 1 x Top, blank, 2 cut-outs L/R - 750 x 1200mm (w x d)<br>• 1 x Cable entry brush (left)<br>• 1 x Cable entry brush (right) |
| Profiles | • 1 x Profiles, 19-inch, set of 4 - 42U (h)<br>• mounted at 100mm from front, mounted at 740 mm from profiles front side<br>• 4 x Number-strip for 19 inch profile 1 - 42 U<br>• mounted at 19" rear profiles, 01 at the bottom<br>• 2 x Site plate front side<br>• 1 x Top plate front side<br>• 21 x Front panel 1U ABS without Logo from 22U-42U<br>• 2 x Cable tray zinced - 200mm x 42U (w x h) |
| Rear | • 1 x Door, 65% ventilated - 750mm x 42U (w x h)<br>• 3 x Hinging - on the right side<br>• 1 x Swivel handle, 2-points Fix Easy lock<br>• 1 x Lock, for swivel handle, EK-1333 (keys delivered in zip bag on 19” profiles) |

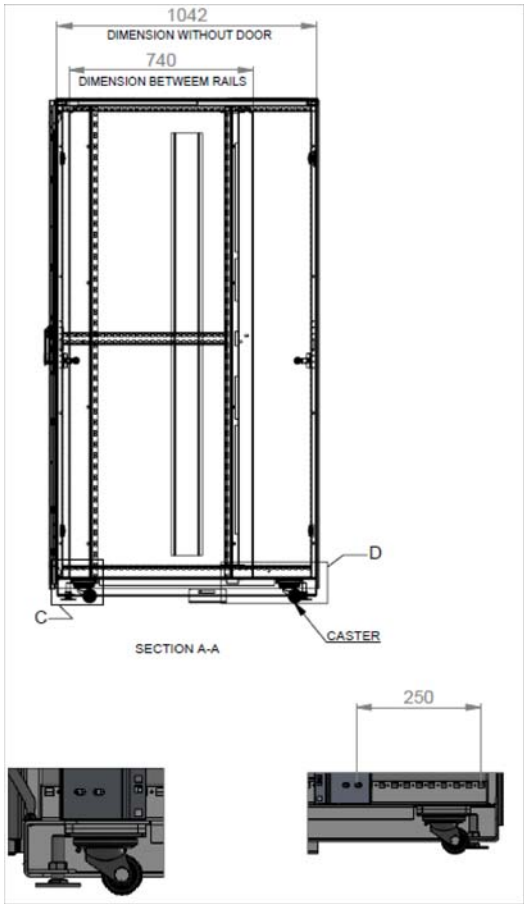
**Table C-5: Hitachi 750 x 1200 mm Universal Rack specifications (Continued)**

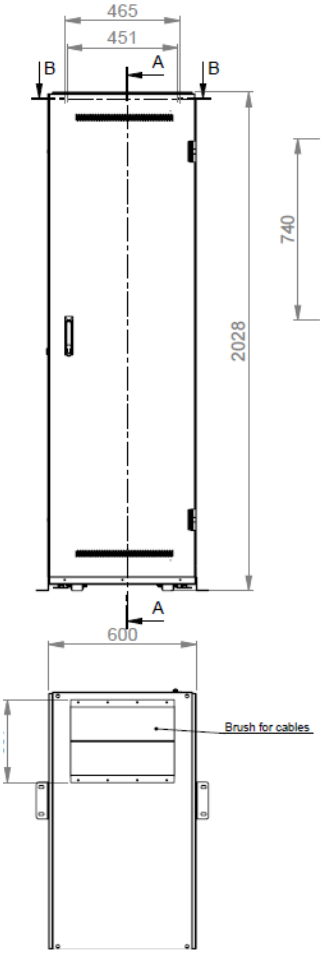
| Item | Specification |
|---|---|
| Accessories (separate box) | • 1 x Cabinet stabilizer- 750mm (w)<br>• 1 x Universal key for leveling<br>• 10 x Velcro strap (including mounting material)<br>• 100 x T-wrap 360 x 4,8 mm (black)<br>• 100 x Cage nuts M5<br>• 100 x Screws M5 (black)<br>• 8 x Screws 4.8 x 10 (spare parts)<br>• 8 x Screws M6 x 12 (spare parts)<br>• 1 x Nylon strap (including mounting material)<br>• 8 x Mounting bracket PDU (including mounting material)<br>• 2 x Plinth front/rear - 750mm (w)<br>• 4 x Baying kit (including mounting material) |

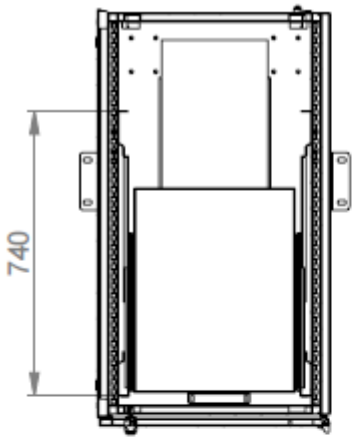
# Hitachi Brazil racks

The Hitachi Brazil rack is similar to the Hitachi 600 x 1200 mm Universal Rack, but has the specifications shown in Table C-6 on page C-24. For more information about this rack other than specifications, see Hitachi 600 x 1200 mm Universal Racks on page C-5.

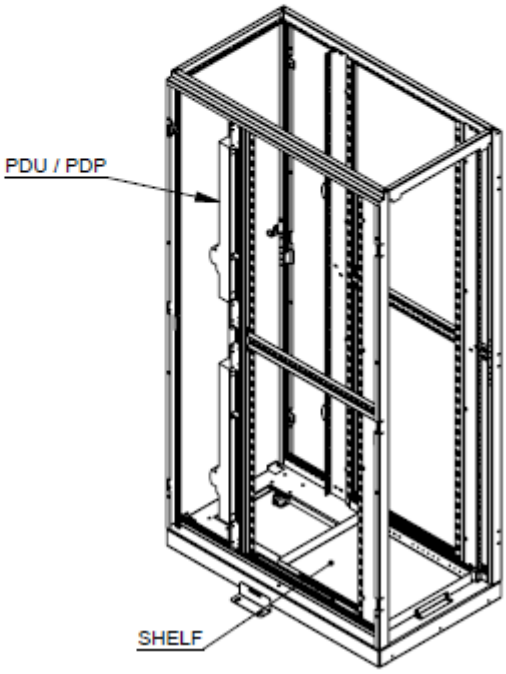





SECTION B-B



## Table C-6: Hitachi Brazil rack specifications

| Item | Specification |
|---|---|
| P-code | E11282901 |
| Dimensions (H x W x D) | 2028 x 600 x 1100 mm<br>(6.65 x 1.96 x 3.60 ft) |
| Frame | 1 x Logo Hitachi<br>1 x Earthing cables - set |
| Base | 1 x Bottom construction including castors<br>2 x Set castors (2 x fixed 2 x manoeuvrable)<br>1 x Base legs, adjustable, set of 4<br>1 x Plinth 25 mm front/rear, blank - 600 mm (W) RAL 9011(front)<br>1 x Plinth side, blank - 1000 mm (d) RAL 9011 (left)<br>1 x Plinth side, blank - 1000 mm (d) RAL 9011(right) |
| Roof | 1 x Bottom construction including castors<br>2 x Set castors (2 x fixed 2 x maneuverable)<br>1 x Base legs, adjustable, set of 4<br>1 x Plinth 25 mm front/rear, blank - 600 mm (W) RAL 9011(front)<br>1 x Plinth side, blank - 1000 mm (d) RAL 9011 (left)<br>1 x Plinth side, blank - 1000 mm (d) RAL 9011(right) |
| Profiles | 1 x Profiles, 19-inch, set of 2 - 42U (h) mounted at 100 mm from front<br>1 x Profiles, 19-inch, set of 2 - 42U (h) mounted at 735 mm from profiles front side<br>2 x Site plate front side<br>4 x Number-strip for 19 inch profile 1 - 42 U mounted at 19" rear profiles, 01 at the bottom |
| Front | 1 x Door (optional), 65% ventilated - 600 mm x 42U (W X H) RAL 9011<br>2x Hinging - on the right side<br>1 x Swivel handle, 2-points Fix Easy lock<br>1 x Lock, for swivel handle |
| Rear | 1 x Door, 65% ventilated - 600 mm x 42U (W x H) RAL 9011<br>2 x Hinging - on the right side<br>1 x Swivel handle, 2-points Fix Easy lock<br>1 x Lock, for swivel handle |
| Left Side | 1 x Side panel - 1100 mm x 42U (D X H) RAL 9011<br>2 x Lock with cylinder |
| Right Side | 1 x Side panel - 1100 mm x 42U (D x H) RAL 9011<br>2 x Lock with cylinder |
| Accessories | Assembled:<br>• 3 x Front panel 4U Metal without Logo<br>• 8 x Front panel 1U Metal without Logo<br>• 1 x Label Hitachi<br>Separately Packaged:<br>• 1 x Cabinet stabilizer (with mounting material)<br>• 100 x Cage nuts M5<br>• 100 x Screws M5 |
| PDU | See Power Distribution Units on page C-55. |
| Miscellaneous | 1 x Packaging |

# Preparing for installation

This section covers preinstallation guidelines to observe before installing equipment in Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks.

## Planning considerations

The following information will help you plan an acceptable equipment rack configuration.

- To maintain a low center of gravity and reduce the likelihood of instability, the Hitachi Unified Storage Controller Boxes and Drive Boxes should be installed from the bottom of the rack upwards. This is recommended to ensure personal safety.

**NOTE:** 1U is reserved at the bottom of Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks for airflow and cabling. This leaves 40U of mountable space in the racks. Hitachi Unified Storage Controller Boxes and Drive Boxes are mounted starting from that point in the racks.

- To ensure that the internal heat build up is adequately dissipated into the room environment, air flow should not be restricted. It is essential that no vents are blocked, and that the Hitachi Unified Storage Controller Boxes and Drive Boxes are away from a solid surface such as a wall or partition. Air flow through the units is from front to rear.
- Enclosed racks must have adequate ventilation. Ensure that the rack is not overly congested, because each unit generates heat. An enclosed rack should have louvered sides and a fan to provide cooling air.
- In an enclosed rack with a ventilation fan in the top, excessive heat generated by equipment near the bottom of the rack can be drawn upward and into the intake ports of the equipment above it in the rack. Ensure that you provide adequate ventilation for equipment at the bottom of the rack.
- Baffles can help to isolate exhaust air from intake air, which also helps to draw cooling air through the chassis. The best placement of the baffles depends on the airflow patterns in the rack, which can be found by experimenting with different arrangements.

Consideration should be given to the floor ratings of the site where the rack and units will be installed.

- An unpopulated Hitachi 600 x 1200 mm Universal Rack weighs 355 lbs (161 kgs).
- An unpopulated Hitachi 750 x 1200 mm Universal Rack weighs 360 lbs (163 kgs).

## Safety information

The following safety information applies to Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks. Please read and follow the safety guidelines and procedures in this section as well as in the manuals for any products you install in the racks before installing any components in the racks.

The following hazard warnings are provided in this section and on rack-mounted products to prevent or reduce the risk of personal injury and product damage.

- **Danger** indicates an imminently hazardous situation which, if not avoided, may result in death or serious injury.
- **Warning** indicates an imminently hazardous situation which, if not avoided, may result in death or serious injury.
- **Caution** indicates a potentially hazardous situation which, if not avoided, may result in injury or damage to product.

### General safety instructions

Observe the following safety instructions.

- If you notice unusual heat generation, odors, or smoke emission, shut off the power feed to the equipment and contact a maintenance engineer. Leaving such conditions unattended may result in hazardous physical conditions and equipment failure.
- Avoid physical disruption to the equipment. This may result in hazardous physical conditions and equipment failure.
- Avoid using the equipment for any use other than its original purpose; otherwise, an injury or equipment failure may result.
- If using a lift, do not move it away from the rack frame or lower the platform until the component you are mounting is fully inserted into the rack. Otherwise, the component may fall.
- If warning labels become dirty or start peeling off, replace them.

**WARNING!** The rack allows many components to be mounted vertically. The weight and location of the components in the rack must be planned to place the center of mass as much as possible below the mid-point of the rack. To reduce the risk of danger to persons or equipment, please follow the safety guidelines and stabilize the rack as described in this chapter.

If installing a single (stand-alone) rack, be sure the rack is level and has been stabilized before installing the components. If an unstable rack is loaded with components, it may become unbalanced and tip over.

### Preventing electric shock

To prevent electric shock, observe the following guidelines.

**WARNING!** In case of electric shock, remain calm, and take immediate and appropriate action according to your company's first-aid and safety procedures.

- Before starting work, be sure there are no potential electric hazards in the maintenance area such as insufficient grounding or a wet floor.
- Before starting work, note where the emergency power-off switches are located, and be sure you know how to operate them.
- Unless otherwise specifically instructed, cut off all power sources to the rack or the rack-mounted components before staring maintenance. Just switching off the rack-mounted components is usually not enough. When power is fed from a wall or floor outlet, unplug the power supply cord, or turn off the switch on the power distribution panel or board.
- Attach a notice on the panel or board prohibiting the use of the switch. If the rack-mounted components have already had their power turned off, be sure these conditions are satisfied.
- Do not touch any uninsulated conductor or surface which may remain charged for a limited time after the external power supply to a rack-mounted component is disconnected.
- If working on a rack-mounted component that has a grounding terminal, be sure the terminal is properly connected to the facility's ground.
- If working near a hazardously energized part, do not work alone. Work with another person who can immediately turn off the power in an emergency.
- Do not wear any metallic item such as a wristwatch with a metallic surface or metallic accessories. If you wear eyeglasses with a metallic frame, do not allow the frame to touch an uninsulated surface.
- Be sure your hands and arms are dry.
- Unless otherwise specifically instructed, use only one hand when it is necessary to work near an exposed live electric circuit. This prevents the completion of the circuit through both hands even if you accidentally touch the circuit.
- Do not use a dental mirror near an exposed live electric circuit. The mirror surface is conductive and can become hazardous even if it is made of plastic.
- Unless otherwise specifically instructed, do not supply power to any subassembly such as a power supply unit or a motor while it is removed from its main product.

## Preventing electrostatic discharge

To prevent damage to equipment mounted in the rack, take necessary precautions during maintenance activities (storage, switches, PDU, etc.). A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices.

Follow the recommended handling procedures that accompany the equipment you are mounting or handling.

Use one of the following methods for grounding when handling or installing electrostatic-sensitive parts in the rack:

- Use a wrist strap connected by a ground cord to the grounded aluminum bar or to the chassis of mounted equipment that is grounded. For proper grounding, wear the strap snug against the skin.
- If you do not have any of the suggested equipment for proper grounding, have Hitachi Data Systems technical support install the part.

### Fire

Shut off all the power to the machine using the emergency power-off switch. If the fire continues to burn after power is shut off, take suitable actions immediately, such as using a fire extinguisher and calling the fire department.

### Working around rotating or moving parts

Observe the following precautions when working around rotating or moving parts.

- Tuck in your tie, scarf, shirt, or any other loose clothing so that it will not be caught by a rotating or moving part.
- Tie up long hair.
- Unless otherwise specifically instructed, do not supply power to any device with rotating or moving parts that are not properly covered.
- When instructed to supply power to any device with rotating or moving parts whose covers have been removed, work with another person who can immediately turn off the power in an emergency.

### Be aware of all potential hazards

It is not possible to describe every hazard that may exist with this equipment. Be aware of all possible hazards, and work safely.

## Precautions when using the rack-mounted equipment

This section explains precautions for:

- Casters — see page C-29
- Rack stability — see page C-29
- Weight and location considerations — see page C-29
- Height considerations — see page C-31
- Placing components in the rack — see page C-32
- Working with racks or components — see page C-33
- Air vents and airflow — see page C-33

- Blanking panels — see page C-34
- Cable Guidelines — see page C-34

## Casters

Hitachi racks have casters that facilitate movement of the rack across short distances to position it for final installation. Although the casters can support the weight of the rack with installed components, they are not designed for supporting the full weight of the rack on a long-term basis. As soon as the rack is in its final position for installation, be sure the full weight of the rack is supported by the stabilizing feet; otherwise, the casters may be damaged.

## Rack stability

To reduce the risk of injury to persons or equipment, observe the following guidelines:

- Stabilize the rack frame on-site by adjusting the leveling feet.
- The full weight of the rack should be resting on the levelers, not on the casters.
- Be sure the front anti-tip stabilizing plate is installed before extending any equipment to the front (see Stabilizing the rack on page C-38). Using anti-tip stabilizing plates installed at the bottom left and right sides increases rack stability.
- If extending equipment out of the rack, extend only one tray at a time. Extending two or more at a time may cause the rack to be unstable and pose unnecessary risk or danger.
- Always follow common sense and safety precautions.

## Weight and location considerations

Hitachi racks allow many components to be mounted vertically. The weight and location of the components in the rack must be planned to ensure that the center of mass is as much as possible below the mid-point of the rack. To reduce the risk of danger to persons or equipment, please follow the safety guidelines and stabilize the rack as described in this manual.

- For single (stand-alone) racks, be sure the rack is level and has been stabilized before installing components. If an unstable rack is loaded with components, it may become unbalanced and tip over.
- Start mounting hardware from the bottom of the rack. If the hardware is mounted at the top of the rack, the rack may become unstable and fall.

**WARNING! If a unit falls, it can cause personal injury. When lifting the unit, be sure you have at least 3 or 4 people and a mechanical lift device. Unit positioning, fastening, or other handling should be performed very carefully.**

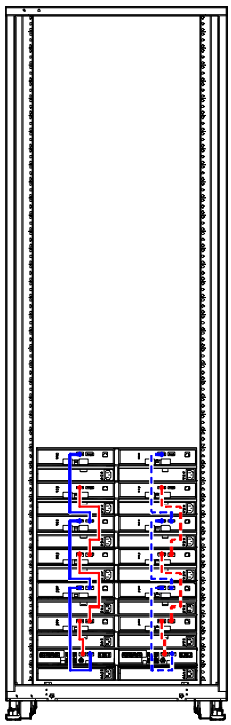


**Figure C-17: Example of Hitachi Unified Storage at bottom of a rack**

- The location of the Hitachi Unified Storage Controller Boxes and Drive Boxes, along with the layout of your equipment rack and its wiring, are extremely important for proper system operation. Equipment placed too closely together can cause inadequate ventilation and inaccessible panels. These can cause system malfunctions and shutdowns, and can make system maintenance difficult.
- Fully configured Hitachi Unified Storage Controller Boxes and Drive Boxes can weigh hundreds of pounds (see Floor load ratings on page 3-6). Ensure that all surfaces over which this system will travel can withstand this load.
- Enclosed racks must have adequate ventilation. Be sure not to block the air vents on the front and back of the Hitachi Unified Storage Controller Boxes and Drive Boxes. The direction of airflow is front/input to rear/output on the Controller Boxes and Drive Boxes.
- When mounting a chassis in an open rack, ensure that the rack frame does not block the airflow from either the intake or the exhaust ports. If the chassis is installed on slides, check the position of the chassis when it is seated all the way in the rack.
- In an enclosed rack with a ventilation fan in the top, excessive heat generated by equipment near the bottom of the rack can be drawn upward and into the intake ports of the equipment above it in the rack. Ensure that you provide adequate ventilation for equipment at the bottom of the rack.

## Height considerations

Rack-mount storage (or server) chassis (devices) are measured in “U's,” which is short for “units” and refers to a standard for measuring the height of a device when installed into a rack. A 1U server, for example, is very thin, measuring only 1.75" high, while 2U is 3.5", exactly double the height of 1U. The Hitachi Universal Racks are 42U racks.

Be sure the rack has sufficient space to accommodate the Hitachi Unified Storage Controller Boxes and Drive Boxes (see Table C-7).

**Table C-7: Height of Controller Boxes and Drive Boxes**

| Hitachi Unified Storage model | Controller Box | Drive Box | Height |
|---|---|---|---|
| 110 | CBXSS | | 2U (88.4 mm) |
| | CBXSL | | 2U (88.4 mm) |
| | | DBS | 2U (87.7 mm) |
| | | DBL | 2U (87.7 mm) |
| 130 | CBSS | | 2U (88.4 mm) |
| | CBSL | | 2U (88.4 mm) |
| | | DBS | 2U (87.7 mm) |
| | | DBL | 2U (87.7 mm) |
| | | DBX | 4U (176 mm) |
| 150 | CBL/CBLE | | 3U (129.9 mm) |
| | | DBS | 2U (87.7 mm) |
| | | DBL | 2U (87.7 mm) |
| | | DBX | 4U (176 mm) |
| | | DBW | 5U |

When planning the number of Hitachi Unified Storage Controller Boxes and Drive Boxes to install in a rack, observe the guidelines in Table C-8.

**Table C-8: Tray guidelines**

| Hitachi Unified Storage model | Maximum number of drive trays |
|---|---|
| 110 | Mix up to 120 SSD, SAS, and NL-SAS |
| | Maximum 4 standard 2.5-inch trays |
| | Maximum 9 standard 3.5-inch trays |
| 130 | Mix up to 264 SSD, SAS, and NL-SAS |
| | Maximum 10 standard 2.5-inch trays |
| | Maximum 19 standard 3.5-inch trays |

**Table C-8: Tray guidelines**

| Hitachi Unified Storage model | Maximum number of drive trays |
|---|---|
| 150 | Mix up to 960 SSD, SAS, and NL-SAS |
| | Maximum 40 standard 2.5-inch trays |
| | Maximum 40 standard 3.5-inch trays |
| | Maximum 20 DBW 3.5-inch trays |

Hitachi Universal Racks have a maximum mountable space of 42U. The bottom of the racks have 1U reserved for airflow and cabling.

## Placing components in the rack

To reduce the risk of injury to persons or damage to equipment, review the following guidelines prior to installing Hitachi Unified Storage systems into Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks.

- Install the anti-tip stabilizing plate to provide added stability during installation. See Stabilizing the rack on page C-38.
- Obtain assistance to lift and stabilize the product during installation or removal, especially when the product is not yet fastened to the rails.
- Use stable mechanical lift equipment that can handle the weight and that can lift components to the highest levels of the rack (70-80 inches).
- When using a mechanical lift device, do not move it away from the rack frame or lower the platform until the red line on the label affixed to the Hitachi Unified Storage has crossed the front of the rail kit. Otherwise, the Hitachi Unified Storage may fall.
- Install equipment with at least one other person.
- Remove all pluggable power supplies and modules to reduce total product weight before lifting it.
- Observe local occupational health and safety requirements and guidelines for manual material handling.
- The handles may be used when raising the Hitachi Unified Storage, but it is preferable to hold it by the front and rear portions made of sheet metal.
- Be sure that there are no scratches or flaws on the power cables. These defects may cause electric shock or a fire.
- Be sure the storage units are connected to a properly grounded power source to prevent electric shock.
- When mounting the heaviest equipment at the bottom of a Hitachi rack and the lightest equipment at the top, keep the center of mass at or below the 20 U line.

- If mounting more than one Hitachi Unified Storage Controller Box or Drive Box, spread the storage system ratio evenly. Avoid a top-heavy installation. Figure C-18 on page C-33 shows an example of this ratio.

| | | |
|---|---|---|
| Smallest | 1 Full Rack | Spanning Racks |

**Figure C-18: Sample configuration types**

## Working with racks or components in the rack

Observe the following guidelines when working with racks or components in a rack.

- For all procedures, follow the given methods and sequence of steps.
- Use tools and parts for maintenance specified in the manual; otherwise, personal injury or damage of the rack, as well as deterioration of the product's quality, may result.
- Use only the special tools and instruments specified in this manual or use appropriate commercially available tools and instruments.
- Keep the maintenance area clean.
- Put away parts, materials, or tools when not in use.
- Wear eye protection where liquid may splash or objects may fly about.
- When lifting anything heavy, lift it using your legs with your back kept erect to prevent injury to your back or spine. When lifting, use a proper lifting tool, or ask somebody to assist you.
- Before finishing your work, be sure the rack and any products mounted in it are returned to their original state. Be sure all parts removed during maintenance have been installed back in their original positions in the rack or products mounted in it.
- Be sure that no tool or foreign material is left in the rack.
- Do not repair, remodel, or disassemble the rack and related components. Such actions can injure you and damage the equipment.

## Air vents and airflow

Observe the following air vent and airflow guidelines.

- Be sure the air vents on the rack are free of obstruction and are inspected periodically. To prevent electric shock or fire, do not place metallic material such as paper clips or any combustible material such as paper into or near the air vents.
- The direction of airflow is front/input to rear/output on the Hitachi Unified Storage Controller Boxes and Drive Boxes.
- Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks have a rear door and an optional front door. The ventilated door in the back allows the system to draw air through the front and exhaust air through the back. Do not block the front of mounted components or the rear-ventilated door.

- 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.
- Air flows through the rack from front to back. An optional rear-mounted fan tray is available to further maintain the airflow.

## Blanking panels

If all the vertical mounting space in a rack is not occupied by rack-mounted products, cover the empty space with blanking panels. Otherwise, the empty gaps between the components can cause airflow changes that may adversely affect cooling within the rack.

## Cable guidelines

- Be sure all cables are correctly and fully connected.
- Do not obstruct 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. If that happens, the cable jacket could be damaged and could break, resulting in an electric shock, fire, or loss of data.
- Be sure all electrical and signal cables are clean before connecting them. Any dirt on a connector should be removed before inserting the connector into a socket.

## Power precautions

Review the appropriate section in this appendix for information about the power precautions for your Hitachi rack:

- For the Hitachi 600 x 1200 mm Universal Rack, see page C-5.
- For the Hitachi 750 x 1200 mm Universal Rack, see page C-13.

If installing third-party components in the rack, identify the component's amperage load, and check the current amperage load on the PDUs to determine whether the component can be plugged into a PDU.

To reduce the risk of injury, fire, or damage to persons or equipment:

- Do not overload the AC supply branch circuit that provides power to the rack. Consult the electrical authority having jurisdiction over your facility wiring and installation requirements.
- When planning for power distribution and requirements for your rack configuration:
  - Balance the power load between available AC supply branch circuits.
  - The overall system AC current load must not exceed 80% of the branch circuit AC current rating.

- If an uninterruptible power supply (UPS) is used, the load should not exceed 80% of the UPS' marked electrical current rating.

To reduce the risk of damage to the equipment:

- Verify that all AC voltage selector switches are set correctly to match your local AC line voltage (230V). If the AC voltage selector switch is not properly set, your components may be damaged when power is applied.
- The installation of rack and mounted components must comply with local and regional electrical regulations governing the installation of Information Technology Equipment by licensed electricians. For electrical power ratings on components, refer to their product rating label or user documentation supplied.

## Grounding requirements

All powered equipment should be properly grounded for operation and safety. Ground integrity should be maintained for each connection made in a reliably grounded outlet, such as with the PDUs in the rack.

All system cabinets and racks must be grounded to the CO GRD system, using a 6 AWG (or larger) Copper cable, terminated with listed 2-hole compression lugs.

**DANGER!** To reduce the risk of electric shock or damage to equipment, follow proper grounding procedures and do not tamper with the pre-installed PDUs. The rack connects to a grounded (earth) power outlet.

## Environmental specifications

Table C-9 on page C-36 lists the environmental specifications for the Hitachi Unified Storage when mounted in a Hitachi Data Systems rack. These specifications must be observed to ensure the proper operating and storage environment for the storage solution in the rack. The following environmental conditions may damage or decrease the life of the storage system:

- Exposure to direct sunlight
- Rapid change in temperature or humidity (such as being near an air-conditioner)
- Proximity (near) to a device which generates electrical noise, such as the ungrounded motor of an air conditioner or washing machine
- Proximity (near) to a device that generates a strong magnetic field (Do not bring any magnet close to the rack or the Hitachi Unified Storage system
- Exposure to dust, dirt, or vibration

**NOTE:** To reduce the risk of damage to equipment during installation, do not impede airflow to products already mounted in the rack and do not exceed internal rack specifications listed in Table C-9 on page C-36.

**Table C-9: 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 temp. (°C) | 29 (non condensing) |
| Altitude | In operation (m) | -300 to 3,000 |
| | In non-operation (m) | -300 to 12,000 |

## Receiving considerations for the rack

To receive a fully integrated and configured Hitachi rack, consider the following:

- The dock door at the receiving site must accommodate the height and width of the rack.
- An appropriate freight elevator must be available for deliveries to upper and lower floors.
- Do not lay the rack down because the sheet metal may twist or distort.
- If the rack already has components mounted in it, it may be heavy (250 lbs. ~ 1000 lbs. if a Hitachi Unified Storage system is already installed in it).

## Tools required

The following tools are required for securing products to the rack-mounting holes on a Hitachi rack:

- Adjustable wrench
- Cage nuts
- Cage nut tool
- Phillips screwdriver
- Screws
- Washers

The racks come with all necessary screws, washers, cage nuts, and cage nut tool. When installing equipment, be sure to:

- Install the front anti-tip stabilizing plate when installing or removing equipment to provide greater stability and safety. See Stabilizing the rack on page C-38.
- Mount the heavier equipment at the bottom of the rack first, prior to installing equipment in the upper half of the rack.

## Checking the hardware

If the rack is ordered empty, it should come with all components. If additional features or options were ordered, or if the rack was ordered with Hitachi Data Systems products pre-installed, verify that all items have been received.

## Casters

The casters facilitate movement of the rack across short distances in order to position it for final installation. As soon as the rack is in its final position for installation, make sure that the full weight of the rack is supported by the leveling feet.

The casters can only support the weight of the rack with installed components for short periods of time and not designed to support the full weight of the rack on a long-term basis. If this occurs, the casters may be damaged.

## Leveling feet

The leveling feet, located beside each caster on the Hitachi rack, unscrew and extend to the floor. These feet support the rack and help compensate for uneven surfaces as shown in Figure C-19.

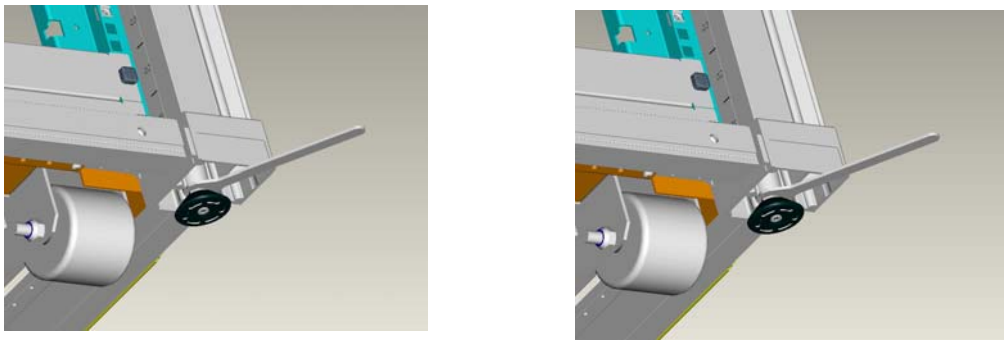


**Figure C-19: Example of leveling feet**

If access is available to the top of the leveling foot from the inside of the cabinet, a flat tip screwdriver may be used to drop the leveler down. Alternatively, you can loosen the leveler by turning it clockwise using the wrench supplied in the accessory kit. Once leveled, the jaw nuts can be used to secure the leveler in place.

The leveling feet are screwed in at the factory and tightened to avoid loosening during shipment. If you have difficulty loosening up the levelers from top, use the wrench to break them loose from the bottom.

## Stabilizing the rack

Hitachi racks allow many components to be installed vertically. Plan the weight and location of the components to place the center of mass as much as possible below the mid-point of the rack. To reduce the risk of danger to persons or equipment, follow the safety guidelines and stabilize the rack as described in the following paragraphs.

If you are installing a single (stand-alone) rack, be sure the rack is level and that it has been stabilized before installing the components. If an unstable rack is loaded with components, it may become unbalanced and fall over.

If installing DBS, DBL, DBX, and DBW Drive Boxes in adjacent racks, bay the racks together and be sure both racks are level and stabilized before installing components in the rack.

To stabilize the rack, observe the following guidelines:

- Stabilize the rack frame at its final installation location by adjusting the leveling feet.
- Using an adjustable wrench, turn each leveling foot clockwise until the clearance between the caster and the floor is 2.5 mm. The full weight of the rack should be resting on the leveling feet, and not on the casters.
- Adjust the leveling feet so that the tilt of the rack (forwards, backwards, left or right) becomes 0.0 ± 2 mm.
- When extending equipment out of the rack, be sure the front stabilizer plate is installed and extend only one item at a time. Extending two or more items of equipment at a time may cause the rack to become unstable and tip over.
- Front stabilizer plate must be installed on racks with DBS, DBL, DBX, and DBW Drive Boxes.
- Always follow safety precautions and common sense.

Figure C-20 shows an example of how to stabilize a rack by lowering the leveling feet.

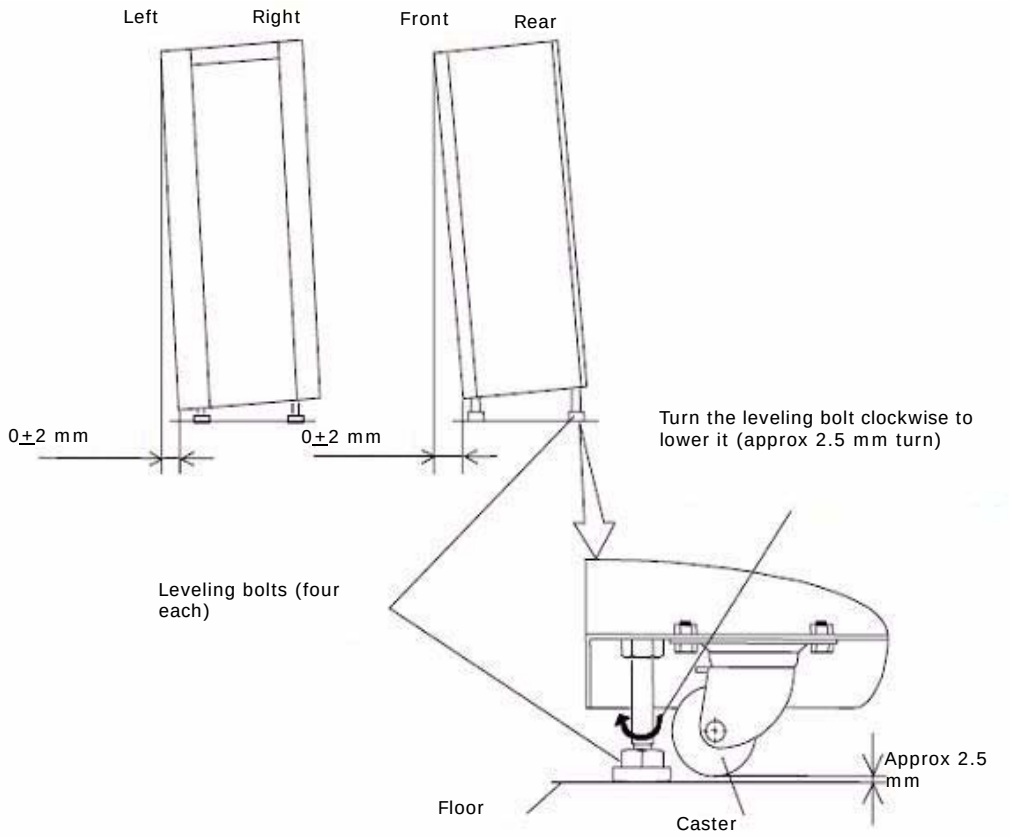



**Figure C-20: Example of lowering the leveling feet**

## Moving the rack

The maximum allowable inclination angle for the Hitachi rack is 10 degrees (10°). When moving the rack across steep slopes or different floor levels, use a gangway as shown in Figure C-21 on page C-40 to form a slope with an inclination angle (slope) of less than 10 degrees.

To reduce the risk of injury to persons or damage to equipment, it is recommended that all equipment be removed from the rack, in order from top to bottom. Transport the rack and the components individually to the desired location.

To move the rack with the mounted components in it, it is recommended to transport on the same pallet on which the rack was shipped. Take necessary precautions when loading onto the pallet. Package and secure the rack on the pallet as it was shipped and received.

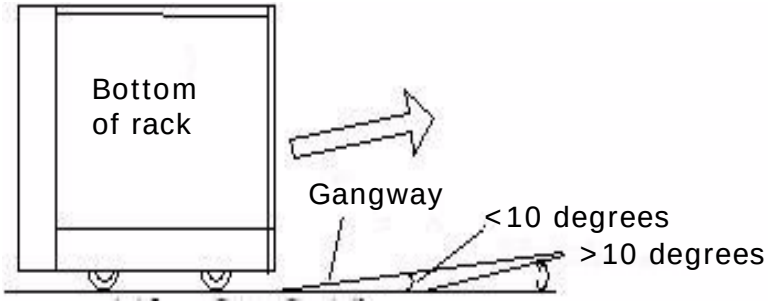



**Figure C-21: Maximum incline (slope) for moving the rack**

## Securing multiple racks together with the baying kit

The baying kit is used to secure multiple racks together. The baying kit is required for all configurations that use dense trays. The baying kit is included with the Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks, and does not need to be ordered separately.

To secure multiple racks, use the following procedure.

1. Open the contents of the baying kit.
2. Place the cabinets side by side until they touch.
3. After the cabinets are leveled, place the bracket on the frame profile and secure it with the delivered screws,
4. Use two brackets for the front and two brackets for the rear of the rack.

### Rear baying instructions

1. Remove rear doors to access cabinet frames.
2. Look for a common notch in frames where the baying connection will be made (one at bottom and one at the top). See Figure C-22 on page C-41 and Figure C-23 on page C-42.
3. When the cabinets are even, place the hex connecting bushing. Use a 4mm hex Allen tool to put an M6 cap screw through the frame open square. This will align the internal slot to reach the hex bushing. (A magnetic tool is recommended because screws may fall off inside the frame cavity.)
4. Repeat step 3 with the rest of the screws and the bushing installation.

**Figure C-22: Baying kit (1 of 2)**

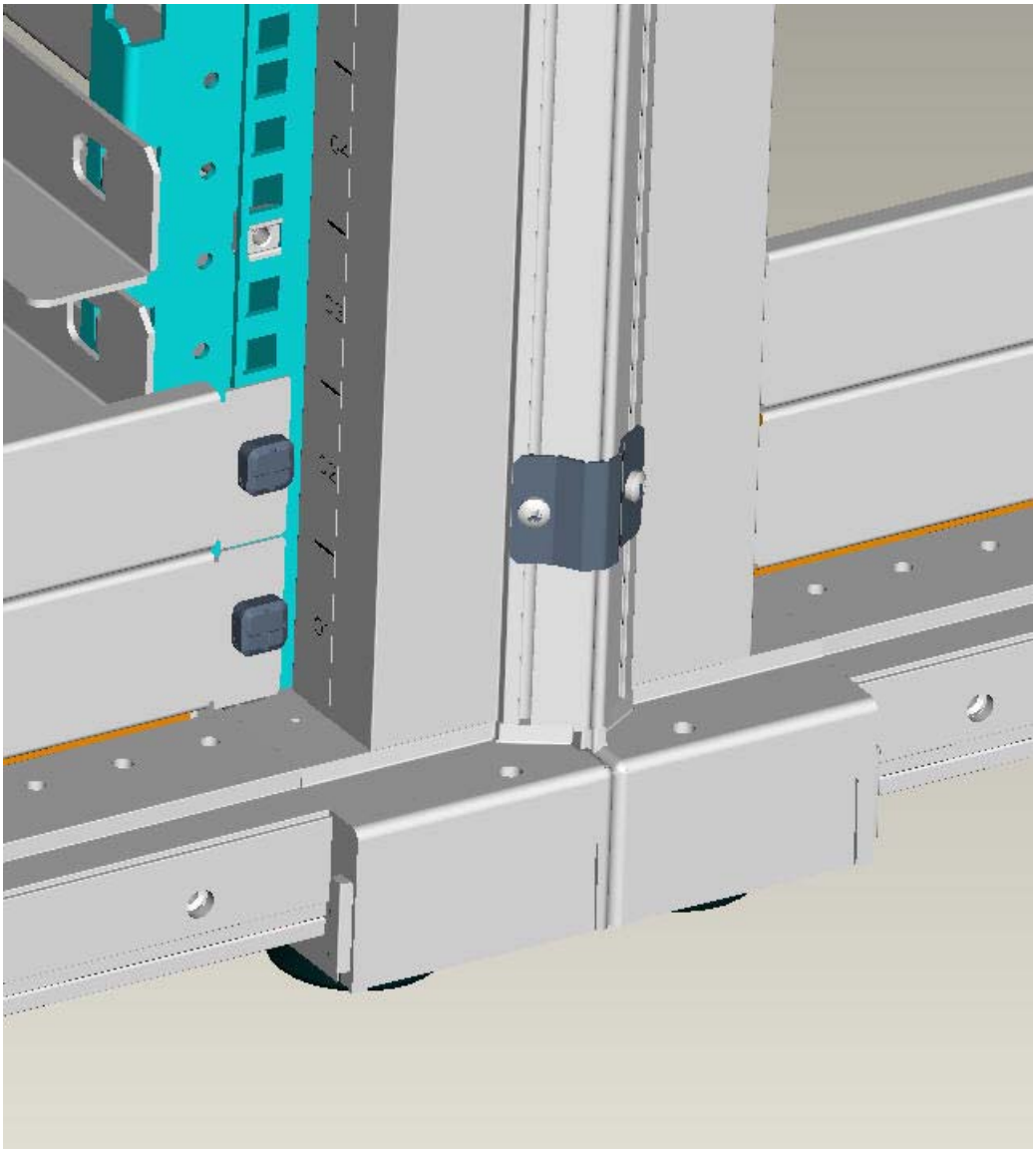


**Figure C-23: Baying kit (2 of 2)**

## Opening and closing the side panels

The side panels can be locked and unlocked with keys supplied with the rack. Once unlocked, press the release levers inward and pull the panel outwards and lift to remove. Reverse these procedures when reinstalling the side panels.

# Installing rack equipment

This section describes how to install equipment in Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks. The topics covered in this section are:

- Installation steps, below
- Installing cage nuts on page C-44
- Installing and uninstalling the anti-tip stabilizing plates on page C-44
- Installing blanking panels on page C-46

Before installing equipment, read the safety information in Safety information on page C-26 and install required PDUs (see Power Distribution Units on page C-55).

When installing equipment, be sure to:

- Install equipment in the rack in a way that does not compromise the amount of air flow required for the safe operation of the equipment.
- Mount equipment in the rack in such a way that prevents a hazardous condition due to uneven mechanical loading.
- Install the front anti-tip stabilizing plate when installing or removing equipment to provide greater stability and safety. See Stabilizing the rack on page C-38.
- Mount the heavier equipment at the bottom of the rack prior to installing equipment in the upper half of the rack.
- Refer to the specific instructions included with the equipment you will mount.

For instructions about mounting a specific Hitachi Unified Storage system into the rack, refer to the appropriate Hitachi Data Systems installation and user guides.

## Installation steps

Most installations of equipment in the rack involve the following steps:

1. Determine location in the rack where the components will be mounted.

**TIP:** Removing the side panels or rear door of the rack may make installation easier.

2. Install the railkits or mounting hardware on which the equipment will rest in the rack as follows:
   a. Prepare the mounting hardware.
   b. Insert the applicable cage nuts in the rack to which the railkits will be secured.
   c. Install the railkits/mounting hardware into the rack.

d. Install the front anti-tip stabilizing plate to provide greater stability and safety. See Stabilizing the rack on page C-38.

3. Install the equipment into the rack as follows:
   a. Determine what mounting holes will be used for securing the equipment to the rack, and install cage nuts at these locations.
   b. Insert equipment into the rack using the previously installed railkits/ mounting hardware.
   c. Secure the equipment to the rack with screws that secure to the cage nuts as determined in Step 3.
4. When the rack is in its final destination, keep the bar bolted to the rack for maintenance and safety purposes.
5. Identify the correct power source (220V) which the equipment will be connected to, and then connect to power.
6. Install the blanking panels.
7. Reattach the side panels and rear door (if they have been removed).

## Installing cage nuts

When installing railkits or securing equipment to the rack, cage nuts are inserted into the square holes. Screws can then attach to the cage nut for securing the railkits or equipment.

To install cage nuts, insert one curved edge into the square hole, and use the cage nut tool to pull the other end through the square hole as shown in Figure C-24.

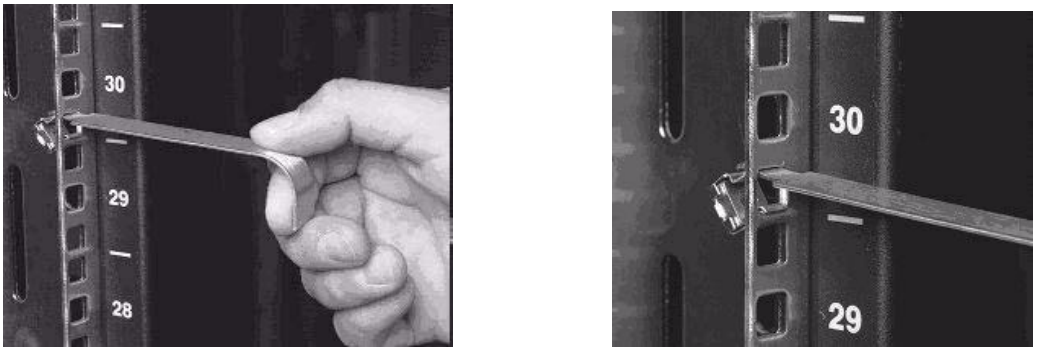



**Figure C-24: Installing the cage nuts**

## Installing and uninstalling the anti-tip stabilizing plates

Install anti-tip stabilizing plates with Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks to provide further stability to the rack. Front anti-tip plates are mandatory when installing Hitachi Unified Storage DBX and DBW Drive Boxes. This extra stability is especially important when installing equipment into the rack or when removing equipment from it.

Figure C-25 on page C-45 shows the installation of the anti-tip stabilizing plate. Reverse these actions for uninstalling the anti-tip stabilizing plate.

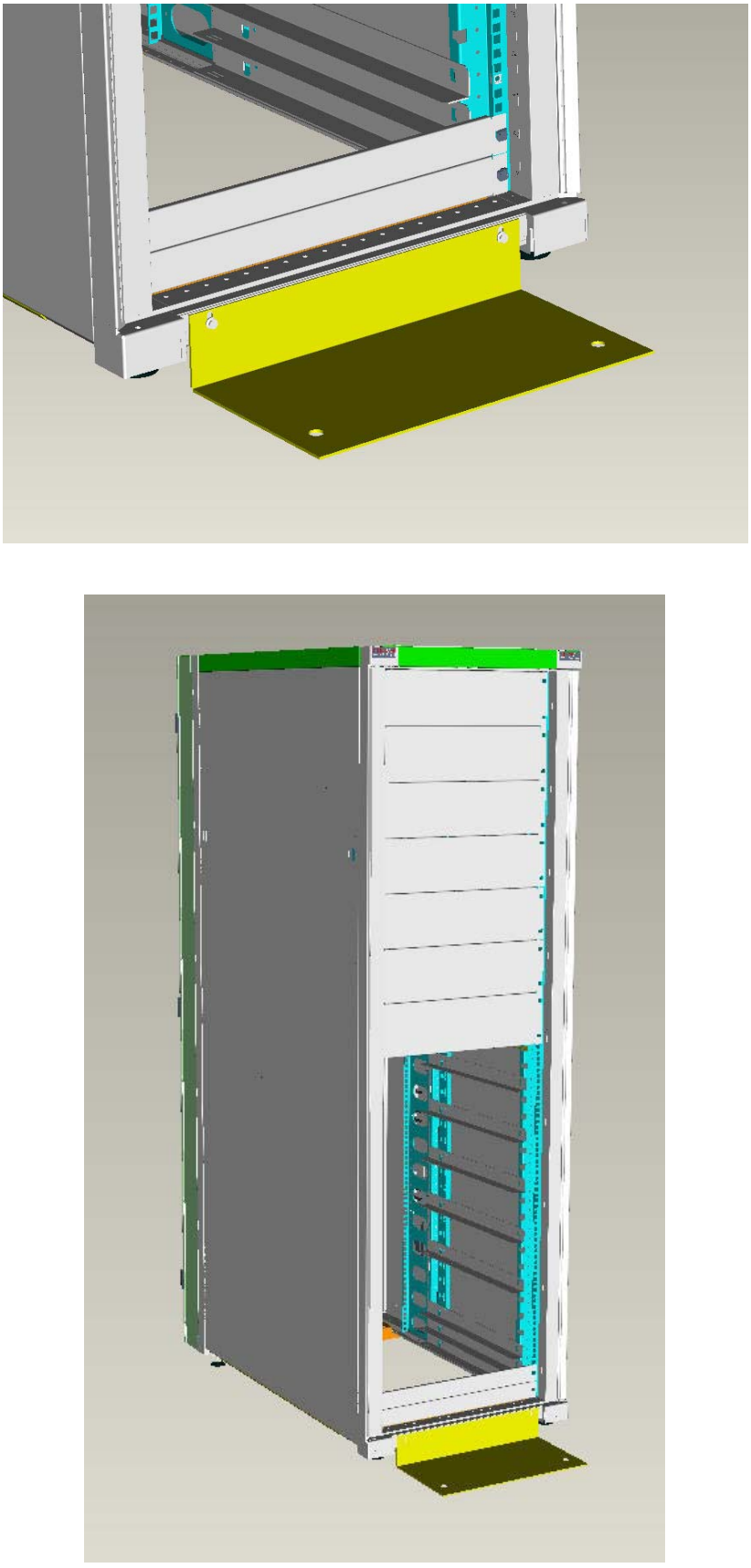


**Figure C-25: Installing and uninstalling the anti-tip stabilizing plate**

To install the stabilizer plate:

1. Remove the trim cover plate from bottom of bezel and set it aside for reinstallation later.
2. Unpack the stabilizer plate kit.
3. Place the stabilizer plate as shown to mate with bracket at bottom of frame.

**NOTE:** The plate may have to be tucked in at a slight angle to clear the bezel bottom flange. Rest the large flat surface fully on the floor surface.

4. Using the washers, M8 screws, and tool in the kit, secure the plate to the frame.
5. Reinstall the trim cover plate with the M4 flat head screws you removed in step 1.

## Installing blanking panels

Blanking panels should be installed to cover any empty space at the front of the rack. This will ensure adequate airflow to the equipment in the rack if the rack is not completely filled.

When installing blanking panels, follow these steps:

1. Place the blanking panel on the rack as a template to determine which holes will require cage nuts.
2. Insert the cage nuts.
3. Secure the panels to the rack by screwing them onto the rack at the cage nut locations.

# Universal Rail Kit

Hitachi Data Systems offers third-party Universal Rail Kit 19-inch rack-mount rail support kits for rack mounting devices in Hitachi 600 x 1200 mm Rack, Hitachi 750 x 1200 mm Universal Racks, and third-party racks.

The configuration rules for the Universal Rail Kit are the following:

- Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks: A fixed corner guide rail kit (item code A3BF-HK-GL-740-L and A3BF-HK-GL-740-R) is configured 1:1, with all Controller Boxes and non-dense Drive Boxes. The Universal Rail Kit (A34V-900-445-UNI33) is not required.
- Installation into third-party racks: The Universal Rail Kit (UNI33) is configured 1:1, with all Controller Boxes and non-dense Drive Boxes.
- Upgrade orders. The Universal Rail Kit (A34V-900-445-UNI33) is configured 1:1, with all Controller Boxes and non-dense Drive Boxes.

**NOTE:** DBX and DBW Drive Boxes are already equipped with specialized rail kits included in the product BOM. The Universal Rail Kit (A34V-900-445-UNI33) is not required.

The previous version of the Universal Rail Kit (item code A34V-900-445-UNI) has been replaced with A34V-900-445-UNI33. The new rail kit was introduced to solve a mounting issue with the non-dense trays and Controller Boxes.

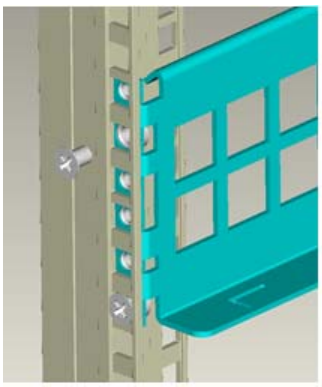
The kit contents consist of a set of Universal guiding rails, with a horizontal plane of 29 mm. The kits offer the following adjustability and load-bearing limit:

- Minimum depth adjustability:23.8 inches (606 mm)
- Maximum depth adjustability:33.1 inches (842 mm)
- Load-bearing limit: 150 lbs (68 kg)

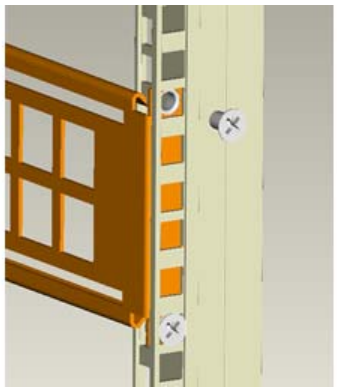
## Installing a Universal Rail Kit 19-inch rack-mount rail support kit

The following figure shows how to install a 19-inch rack-mount rail support kit. Facing the front of the cabinet, you will mount the profile with the “L” mark on the left side of the cabinet.

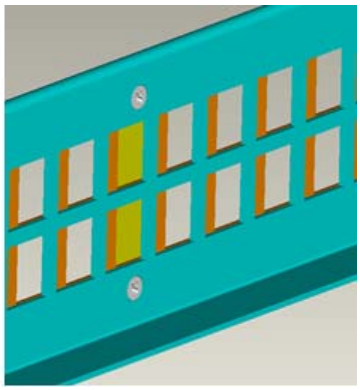
1. Assemble front part guide rail with 2 screws M6*10 (counter sunk).
2. Extend rear part to rear 19"profile and fixate the part with 2 screws M6*10.
3. Secure the four screws on the rail to stabilize.



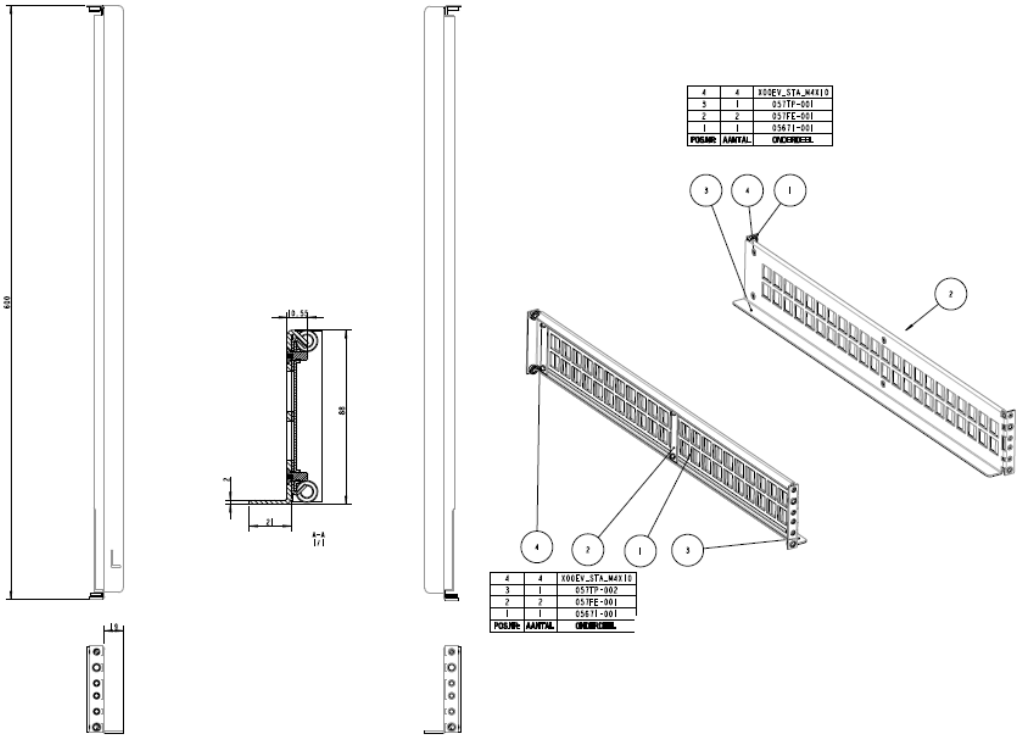
**Step 1**



**Step 2**



**Step 3**



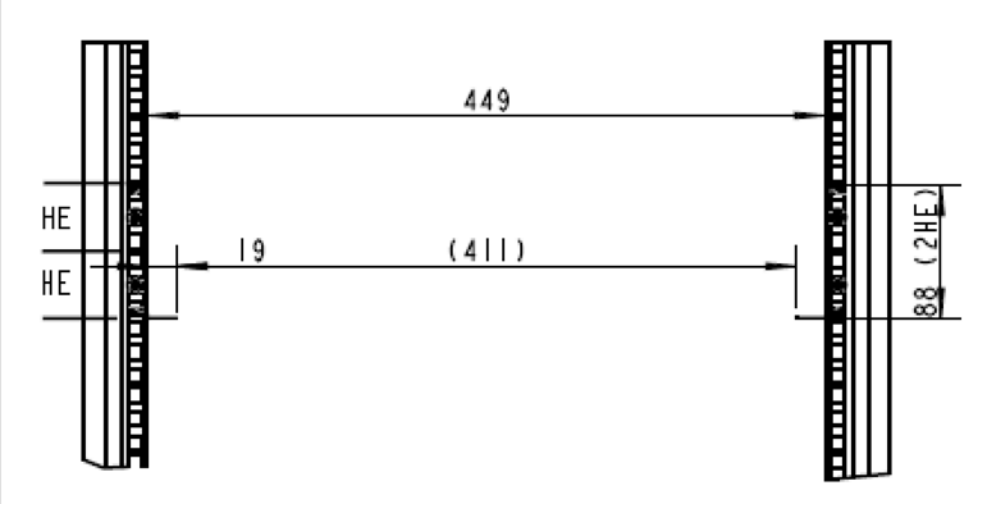



**Figure C-26: Profile view**

## Mounting the rail assembly

The following procedure describes how to mount the rail assembly. Mount the profile with the “L” mark on the cabinet. Figure C-27 shows the left side of the assembly viewed from the front of the cabinet.

1. Assemble front part guide rail with 2 screws M6*10.
2. Extend rear part to rear 19"profile and fixate the part with 2 screws M6*10.
3. Fix the 4 screws on the rail to stabilize.

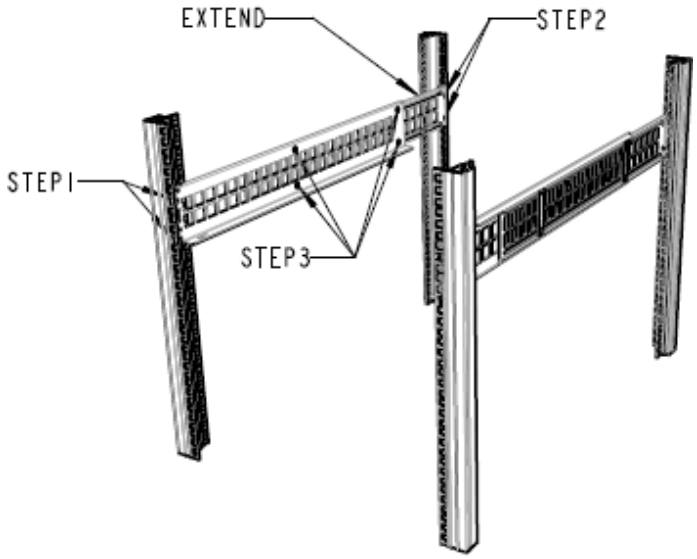



**Figure C-27: Left view of rail assembly**

## Installing the corner guide rails

Hitachi 600 x 1200 mm and 750 x 1200 mm Universal Racks use the following corner guide rails:

- Product Code: A3BF-HK-GL-740-L (left rail) and A3BF-HK-GL-740-R (right rail)
- Description: Corner Guide Rail 740 mm depth

The corner guide rails are configured 1:1 with Hitachi Unified Storage 110, 130, and 150 controllers and all non-dense Drive Boxes.

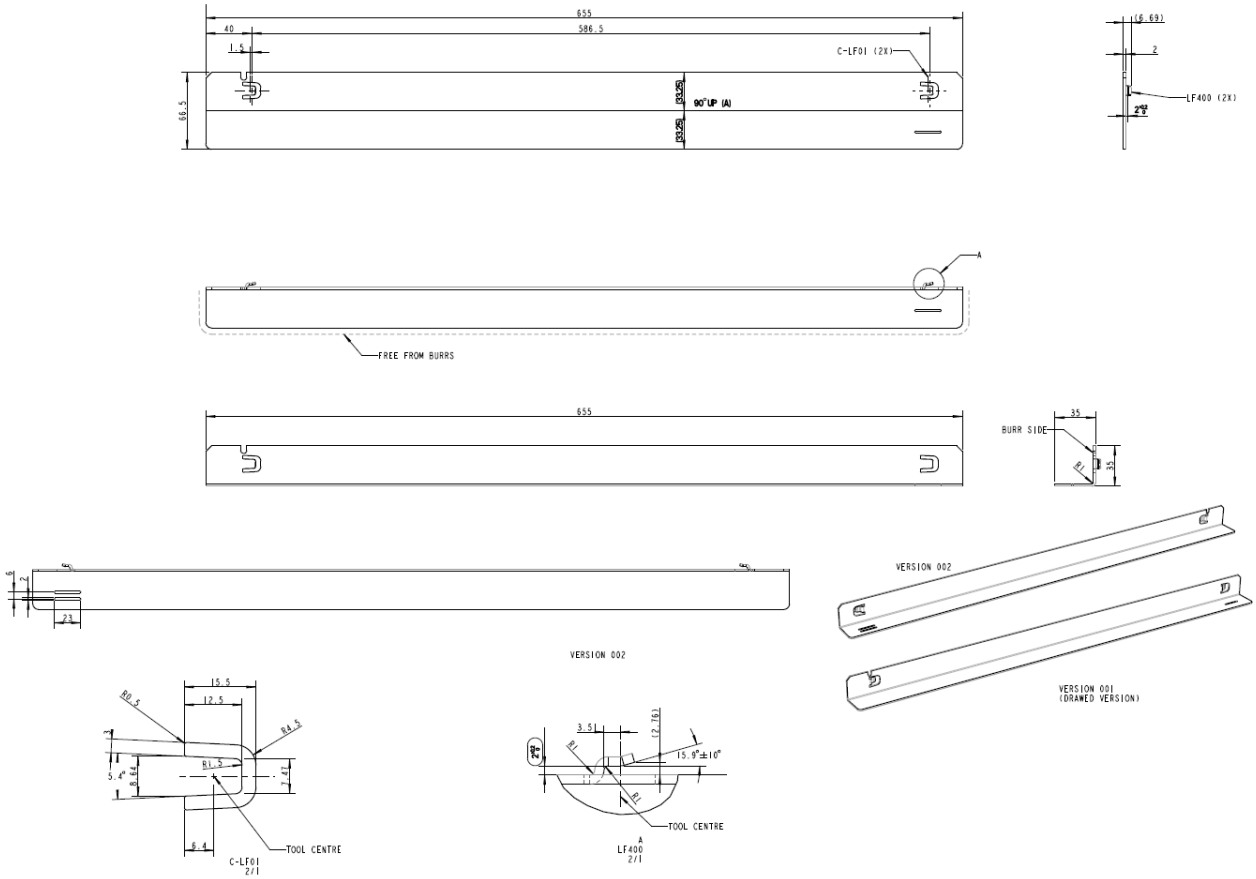
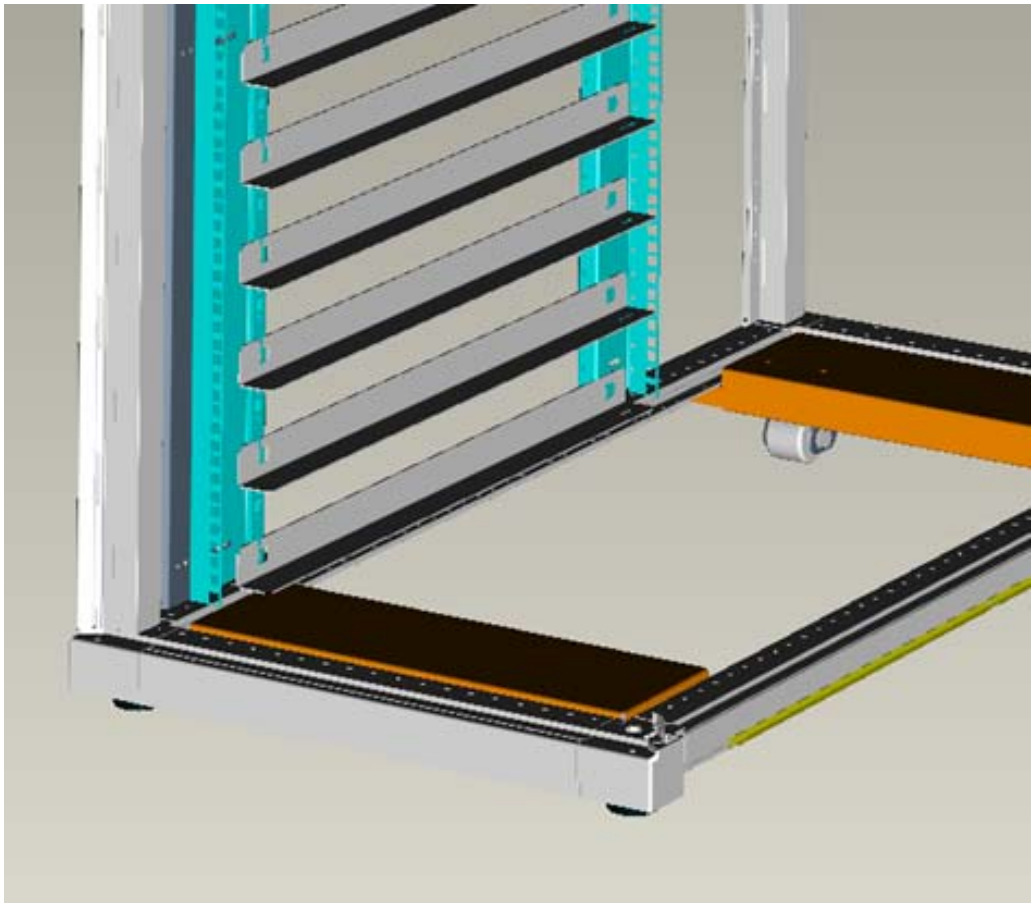
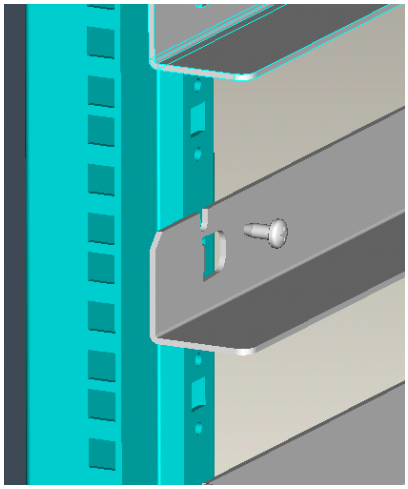



**Figure C-28: Corner guide rails**

The following figures show how to install the corner guide rails.





# Rack-mounting DBW and DBX Drive Boxes

The maximum number of DBW and DBX Drive Boxes that can be shipped in a rack is sufficient to populate half of the rack. However, you may need to install additional DBW and DBX Drive Boxes at the customer site. Due to the extremely heavy weight of these units, do not try to move a rack that contains more than four DBW or DBX Drive Boxes.

Observe the following guidelines when installing DBX Drive Boxes units in Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks.

- The maximum number of:
  - DBX Drive Boxes that can be shipped in a rack is four.
  - DBX Drive Boxes that can be installed in a rack is nine.
  - DBW Drive Boxes that can be installed in a rack is six.

  Therefore, you may need to install up to five additional DBX units or two additional DBW units at the customer site. Due to the extremely heavy weight of these units, do not try to move a rack that contains more than four high-density expansion units.
- To maintain a low center of gravity and maximize rack stability, place all DBX Drive1 Boxes at the lowest point possible in the rack.
- To ensure a safe experience, installation requires using a mechanical lift device, with at least the capacity and capabilities of the Genie Lift GL-8. The GL-8 with GL-LP platform or compatible lift device is required to install high-density expansion units. This can be ordered from HDS Logistics if unavailable from the customer site. Order the following part number well in advance of the install and allow 5 days for delivery. The GL-8 can be raised to 8’ 3” and load rating is 400 lbs.
  - IP-2000-2.x — GL-8, lift only
  - IP-2500-2.x —includes GL-8 lift and (2) step ladders (see below)

**NOTE:** For installations in the UK and Europe, a Transport/Logistic company provides the physical installation of the high-density expansion units into the rack. For more information, see http://www.genielift.com/en/products/new-equipment/material-lifts/genie-lift/.

- When rack-mounting a DBX, leave at least 6 inches (152 mm) for the required cable guides.
- Installation must be performed by at least two service personnel, even when installing an empty DBX Drive Box.
- To reduce the weight of DBX and DBW Drive Boxes significantly, remove the disk drives and power supplies prior to installing these Drive Boxes into the rack.
- To replace a drive, withdraw the unit from the rack. Since the high-density expansion units have no drawer interlock system, it is possible to withdraw more than one unit at a time, risking unbalancing the rack that could cause the rack to topple over.

**WARNING!** To avoid the risk of tipping, no more than one high-density expansion unit should ever be extended on rails within the rack during installation or service.

- A small step ladder is required to service five or more high-density expansion units, or when units are mounted at a height of 26U or higher. The ladder is required to service the drive trays, as maintenance access is from the top and rear. This can be ordered from HDS Logistics. Please order:

  (IP-2001-1.x) Step-Ladder – Qnty. (1)
- Ensure that the IDC/EDC removed all plastic cut-outs at the top of the rack to ensure proper airflow for heat dissipation.
- Ensure that the rack casters are lined up straight (front to rear).
- Lower the front and back rack leveler feet to the floor prior to installing the Anti-tip Plate both front and sides A standard Crescent wrench / spanner is required to lower leveler feet.
- When you receive the rack from IDC/EDC, mount the high-density expansion unit drive trays according to the “Serial Form” sheet found on top of the individual DBX/DBW Drive Boxes in the shipping carton. The sheet is also mounted on the rear rack door.
- If servicing power supplies or ENC expanders at the rear of the rack, uncable and pull back the Cable Routing arms from the rail mounting. Plan for a significant amount of time when servicing from the rear and use plastic tie wraps to complete this recabling task as necessary. Plan for at least 30min. to recable a single DBS/DBL drive tray.
- To maximize service personnel effectiveness, rails are pre-installed.
- Upgrade installations into an existing rack require high-density expansion unit trays to be installed as far toward the bottom of the rack as possible to keep the center of gravity low. This may require an “offline” upgrade and shifting of all the trays and rail kits in the rack to accommodate.
- To minimize weight, drives and power supplies should be removed before installing the tray. Two service personnel are still required to perform the installation, even if drives and power supplies are removed.
- In DBX Drive Boxes, installed drives and ENC cards are serviced from the top. In DBW Drive Boxes, installed drives are serviced from the top and installed ENC cards installed from the rear. As a result, the units should be mounted on extending rails to permit access from the top. To ensure rack stability, service personnel must extend a single tray at a time. In addition, a mechanical lift device must be used to minimize weight on the extended rails and maintain stability.
- Servicing DBX and DBW Drive Boxes installed higher than 26U in the rack requires the use of a small step ladder (2-to-3 steps).
- Equivalent racks can be used to hold DBX/DBW Drive Boxes, so long as the racks meet Hitachi Data Systems’ specifications (see Power Distribution Units on page C-55) and use Hitachi-supplied rails.

# Post-installation considerations

The following sections provide guidelines to consider after you install equipment in Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks.

## Casters

The casters facilitate movement of the rack across short distances in order to position it for final installation. As soon as the rack is in its final position for installation, make sure that the full weight of the rack is supported by the leveling feet.

The casters can only support the weight of the rack with installed components for short periods of time and not designed to support the full weight of the rack on a long-term basis. If this occurs, the casters may be damaged.

## Precautions for inspection and cleaning

Observe the following precautions when inspecting and cleaning the rack.

- If the equipment must be powered off, perform the power-off sequence described in the storage solution user's guide before proceeding with maintenance.
- Do not work on the equipment or rack in a damp or flooded environment.
- Do not obstruct access to the rack with parts or tools.
- If the rack has a door, before 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 does not become tangled in moving components.
- There are high-voltage parts in the equipment. Observe the cautionary statements in this chapter to make sure that high-voltage components are not touched during maintenance. Another person should be on alert in case the power feed to the equipment needs to be quickly turned off.
- After the power feed to the equipment is shut off, electricity remains in the equipment for a period of time. Do not touch any components other than those indicated in this chapter.
- The equipment can become extremely hot. Do not touch any parts other than those indicated in this chapter.
- When working with the door open, wear cotton gloves to prevent your hands from touching sharp objects.

# Power Distribution Units

The power distribution units (PDUs) described in this section are designed exclusively for the Hitachi family of racks. Install the PDUs into the racks before installing other equipment.

## PDU information at-a-glance

Table C-10 and Table C-11 on page C-56 summarize PDU information. All Hitachi Unified Storage tray configurations require four PDUs per rack. For more information about a PDU, see the page number in the "See" column. For PDU availability, refer to the Hitachi Insight Configurator when configuring your order.

**NOTE:** The amperage load on each PDU must not exceed 80% of the PDU current rating (that is, the maximum amperage is 80% of the 30 amp PDUs, allowing for a maximum of 24 usable amps per PDU).

**Table C-10: PDU information for Americas, EMEA, and APAC**

| Product code | Description | Usable in... | | See |
|---|---|---|---|---|
| | | 600 x 1200 mm Universal Rack? | 750 x 1200 mm Universal Rack? | |
| **Americas** | **Americas region** | | | |
| PDU-121112F10 | PDU 0RU 12xC13<br>1 Phase 208V 30A NEMA L6-30P | Yes | Yes | page C-61 |
| PDU-221112F10 | PDU 0RU 22xC13<br>1 Phase 208V 30A NEMA L6-30P | Yes | Yes | page C-63 |
| PDU-121132F10 | PDU 0RU 12xC13<br>3 Phase 208V 30A NEMA L15-30P | Yes | Yes | page C-65 |
| PDU-1251120F10 | PDU 0RU 10xC13 2xC19<br>1 Phase 208V 30A NEMA L6-30P | Yes (default) | Yes (default) | page C-66 |
| PDU-1561380F10 | PDU 0RU 12xC13 3xC19<br>3 Phase 208V 30A NEMA L15-30P | No | Yes (default for DBW) | page C-68 |
| PDU-1561384F10 | iPDU 0RU 12xC13 3xC19<br>3 Phase 208V 30A NEMA L15-30P | No | Yes | page C-69 |
| PDU-3079354F10 | iPDU 0RU 24xC13 6xC19<br>3 Phase 208V 60A IEC 60309P | No | Yes | page C-71 |
| **EMEA/APAC** | **EMEA/APAC region** | | | |
| A3CR-6363C4-50 | PDU 0RU 12xC13<br>1 Phase 230V 32A 2P+E | Yes | Yes | page C-72 |
| A3CK-123123R4-50 | PDU 0RU 24xC13<br>1 Phase 230V 32A 2P+E | Yes | Yes | page C-73 |
| A3B9-123R4-50 | PDU 0RU 12xC13<br>3 Phase 230V 16A 3P+N+E | Yes | Yes | page C-74 |
| A3CR-123294-51 | PDU 0RU 12xC13 2xC19<br>1 Phase 230V 32A 2P+E | Yes (default) | Yes (default) | page C-75 |
| A3CK-123394-51 | PDU 0RU 12xC13 3xC19<br>3 Phase 400V 32A 3P+N+E | No | Yes (default for DBW) | page C-76 |
| A3CK-123394-52 | PDU 0RU 12xC13 3xC19<br>3 Phase 400V 32A 3P+N+E | Yes | Yes | page C-77 |
| A5P0-123394-52 | iPDU 0RU 12xC13 3xC19<br>3 Phase 400V 16A 3P+N+E | No | Yes | page C-78 |

**Table C-11: PDU information for Brazil**

| Product code | Description | Usable in... | | | | See |
|---|---|---|---|---|---|---|
| | | 600 x 1200 mm Universal Rack? | 600 x 1200 mm Universal Rack? | 750 mm rack? | Brazil rack? | |
| **Brazil** | **Brazil region** | | | | | |
| A3CR-123294-51 | PDU 0RU 12xC13 2xC19<br>1 Phase 230V 32A 2P+E | N/A | N/A | N/A | Yes<br>(default 1-ph) | page C-75 |
| PDU-121132F10 | PDU 0RU 12xC13<br>3 Phase 208V 30A NEMA L15-30P | N/A | N/A | N/A | Yes<br>(default 3-ph) | page C-65 |
| PDU-1561380F10 | PDU ORU 12xC13 3xC19<br>3 Phase 208V 30A NEMA L15-30P | N/A | N/A | N/A | Yes<br>(default 3-ph for DBW) | page C-68 |

## Types of PDU plugs

Figure C-29 and Figure C-30 show the PDU plug types per world region.

**Figure C-29: Plug type for Canada, United States, and Americas (L6-30P)**

**Figure C-30: Plug type for Asia-Pacific and Europe-Middle East-Africa Rack models (IEC 309)**

## Power cables shipped with the Hitachi Universal Racks

Hitachi 600 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks come with power cables for connecting the storage system chassis to the PDU within the rack.

For racked configurations, all Hitachi Unified Storage components, except DBW Drive boxes, require the 250 VAC 10A IEC320-C14 to IEC320-C13 power cable (see Figure C-31 on page C-57 and Table C-12 on page C-57).

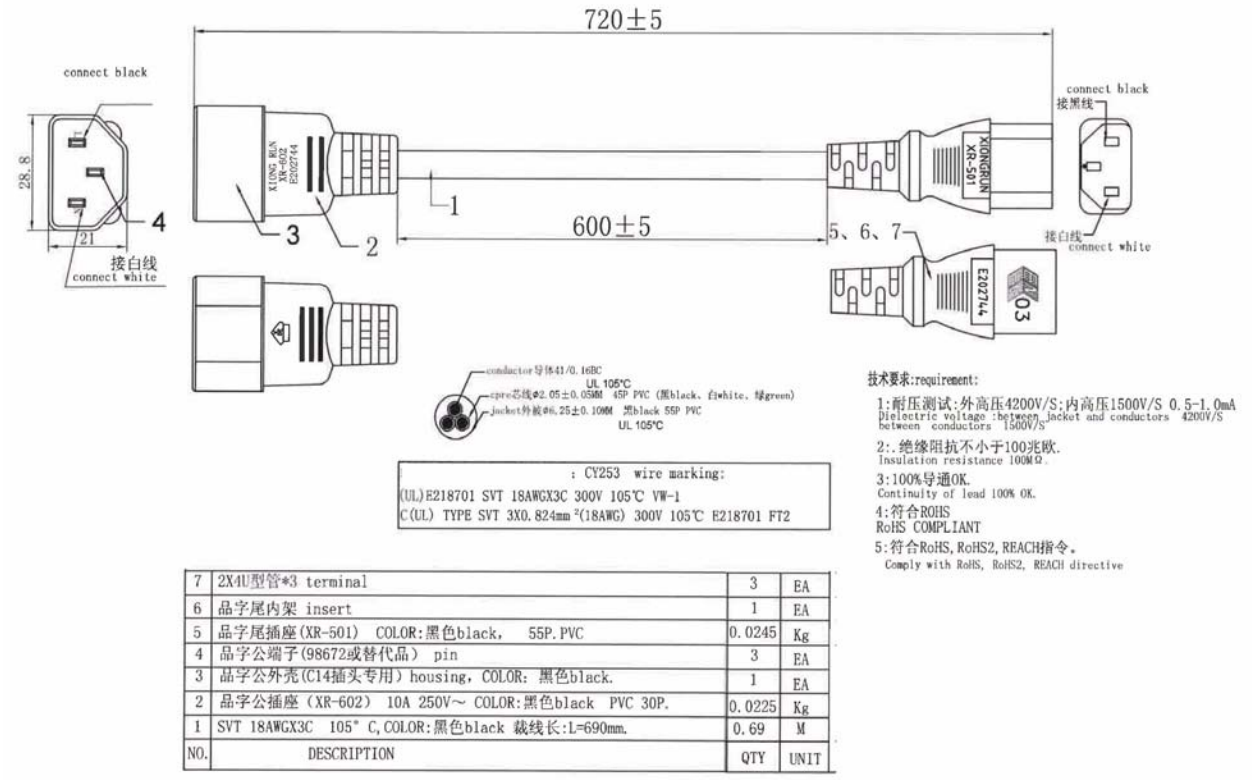



**Figure C-31: 250 VAC 10A IEC320-C14 to IEC320-C13 power cable**

**Table C-12: 250 VAC 10A IEC320-C14 to IEC320-C13 power cable**

| Name | Quantity | Model |
|---|---|---|
| Connector A | 1 | EN60324-C14 for 250 VAC (10 A) |
| Connector B | 1 | EN60324-C13 for rack frame |

For racked configurations, DBW Drive Boxes connect to 200 V PDUs installed in the rack using the 250 VAC 16A IEC320-C20 to IEC320-C19 power cable (see Figure C-32 on page C-58 and Table C-13 on page C-58). Do not connect DBW Drive Boxes to a wall outlet.

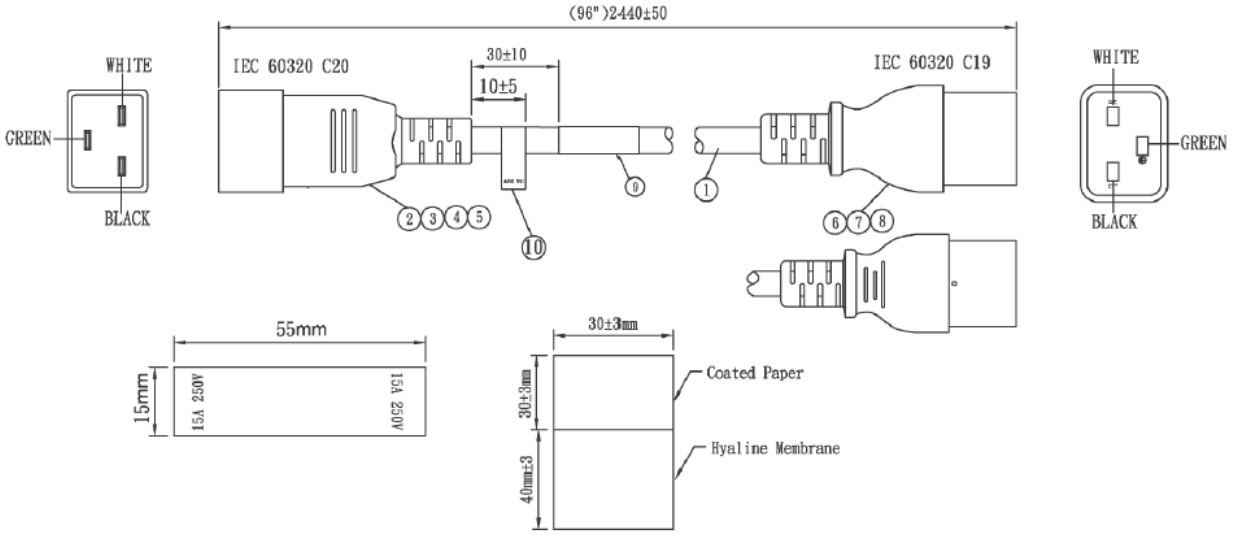



**Figure C-32: IEC320-C20 to IEC320-C19 power cable**

**Table C-13: 250 VAC 16A IEC320-C20 to IEC320-C19 power cable**

| Name | Quantity | Model |
|---|---|---|
| Connector A | 1 | EN60324-C20 for 250 VAC (16 A) |
| Connector B | 1 | EN60324-C19 for rack frame |

**NOTE:** For non-racked installations, power cables depend on the country where the Hitachi Unified Storage system is installed.

## Installation overview

The following steps describes the procedure for installing a power distribution unit into a Hitachi rack.

1. Review the facility power, capacity, and grounding requirements.
2. Review the PDU specifications in the following sections.
3. Install the PDU(s) into the rack.
4. Connect the PDU power input cables to the facility's main AC power source.

## Reviewing facility requirements

Review the power, circuit breaker, and grounding requirements of your facility, and review all safety notices, prior to installing and cabling the PDU.

## Facility power requirements

To prevent catastrophic failures, design your input power sources to ensure that adequate power is provided to the power distribution units. Use dedicated AC breaker panels for all power circuits that supply power to the PDU.

Portions of the PDU power cords will be routed within the rack. Therefore, the installation site's AC power receptacle must be close enough to be reached with the PDU power cords.

Electrical work and installations must comply with applicable local, state, and national electrical codes. Contact your facilities manager or a qualified electrician to determine what type of power is supplied to your building.

When planning for power distribution requirements for installed rack equipment:

- Balance the power load between available AC supply branch circuits.
- In the United States and Canada, ensure that the overall system AC input current load does not exceed 80% of the branch circuit AC current rating.

## Floor space requirements

The floor space at the installation site must be strong enough to support the combined weight of the:

- Hitachi Unified Storage Controller Box
- Hitachi Unified Storage Drive Boxes
- The rack holding the Hitachi Unified Storage Controller Boxes and Drive Boxes
- All associated equipment

To ensure adequate load-bearing capacity, plan for the maximum configuration. Unpacking on page 4-3 lists weights for the storage system hardware.

## Circuit breaker capacity and characteristics

Each Hitachi rack requires its own customer-supplied circuit breaker and AC receptacle for each power input cord. Provide a stable power source, such as an uninterruptible power system (UPS), to reduce the possibility of component failures.

If the computer equipment is subjected to repeated power interruptions and fluctuations, it is susceptible to a higher component failure rate than it would be with a stable power source.

## Grounding requirements

Always connect the PDU input power cords into grounded power outlets.

## Safety considerations

Observe the following PDU safety considerations.

- To reduce the risk of electric shock or damage to installed equipment, never disable the grounding plug on any power cord or receptacle.
- PDU installation and configuration must be performed by qualified personnel with experience installing similar hardware.
- Before installing and using the PDU, check it for any external damage. If the PDU is damaged, do not install or operate the PDU, and contact your service representative.
- Do not use the PDU in damp rooms. If a liquid spills on the PDU, or if the PDU becomes damp from condensation, immediately disconnect the power input lead connector from the AC power supply. Contact your service representative before using the PDU again. You might need to return it for inspection.
- Confirm the maximum permitted fuse/circuit breaker load in the building. Observe all national and local regulations, safety provisions, and fuse load variations.
- Never bend, or rest any object, on a PDU's power input lead.
- Be sure the total power consumed by all of the connected equipment does not exceed the respective nominal power rating of the PDU.
- Always provide an easily accessible safety disconnect for units with fixed connections.
- When connecting equipment to the PDU, ensure that you install the most symmetrical load to all of the phases as possible.
- If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment might be greater than the room ambient. Therefore, consider installing the equipment in an environment compatible with the maximum ambient temperature (Tma) specified by the manufacturer.
- When connecting equipment to the PDU, consider the damaging effect that overloading the circuits might have on overcurrent protection and supply wiring. Always review the equipment nameplate ratings when considering circuit overloading issues.
- Always maintain reliable earthing of rack-mounted equipment. Give particular attention to supply connections other than direct connections to the branch circuit (for example, when using power strips).
- If installing third-party components in the rack, identify the component's amperage load and check the current amperage load on the PDUs to determine if the component can be plugged into a PDU.
- Hitachi Unified Storage Controller Boxes and Drive Boxes have two fully redundant power supplies that provide auto-switching between 110VAC and 230VAC.
- To reduce the risk of injury, fire, or damage to persons or equipment, do not exceed the maximum usable amperage per PDU. Consult the electrical authority having jurisdiction over your facility's wiring and

installation requirements. When planning for power distribution and requirements for your rack configuration, note the following:

- Balance the amperage load between available PDUs.
- The amperage load on each PDU must not exceed 80% of the PDU current rating (that is, the maximum amperage is 80% of the 30 amp PDUs, allowing for a maximum of 24 usable amps per PDU).
- If an uninterruptible power supply (UPS) is used, the load should not exceed 80% of the UPS's marked electrical current rating.

## PDU information for Hitachi racks

Hitachi racks are 220 V solutions that provide the electrical scalability needed for Hitachi Unified Storage Systems. The racks have space for 4 PDUs. No PDUs are preinstalled. See Table C-10 on page C-55 and Table C-11 on page C-56 for compatible PDUs.

Hitachi racks provide the ability to mount vertical power strips, in the rear (side panels) of the rack in a “0U” fashion, along left and right sides, without interfering with the area between vertical rails (left and right), which must remain accessible for maintenance purposes.

To ensure maximum system availability, each PDU requires a dedicated circuit pertaining to the current rating for that PDU. For example, a system with four PDUs, each with a 30A L6-30P plug requires four 30A circuits.

## PDU specifications

The following sections describe the specifications for the PDUs supported with the Hitachi 500 x 1200 mm and Hitachi 750 x 1200 mm Universal Racks.

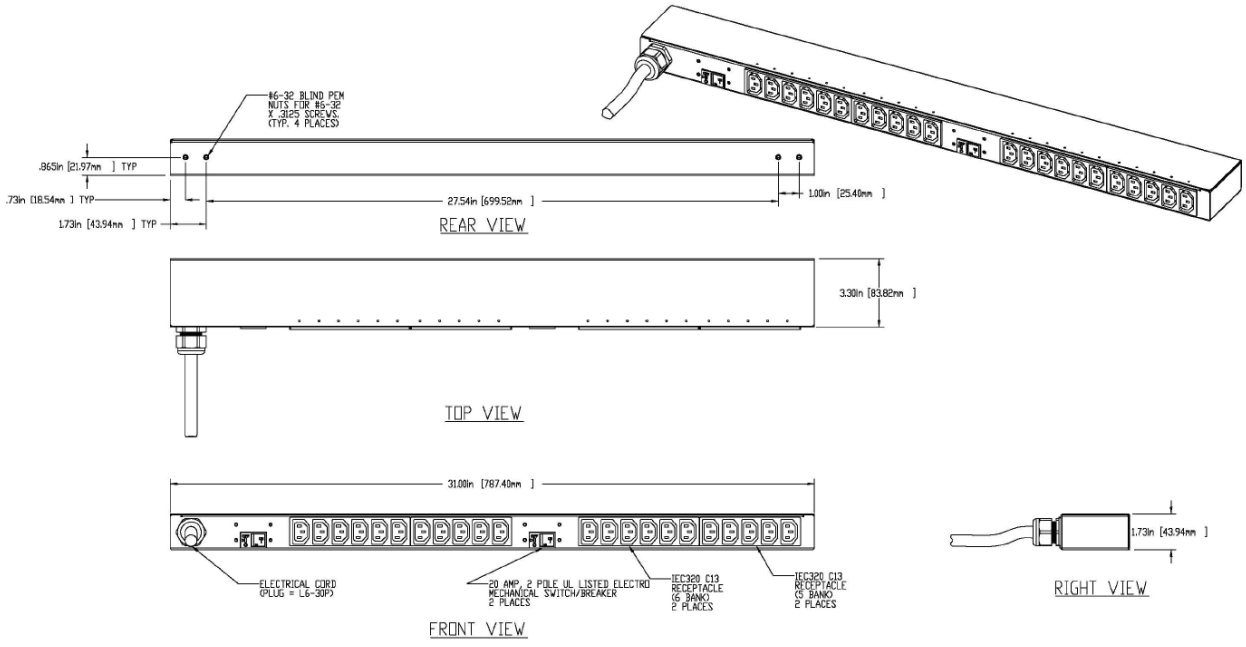
### PDU-121112F10

| Item | Description |
|---|---|
| 12-outlet single-phase NEMA | |
| Shipping: | 1 unit per box |
| Box labels | Each box has one label that displays the serial number of the unit inside. |
| Labels on PDU: | ETL and serial number labels |
| Mounting brackets: | One set of Universal brackets per unit |
| Plug retainer clips: | Built in (12 x C13R-L) |
| Cord color: | Black |
| Cord length: | 10 foot<br>(3048 mm) |
| Plug color: | Black |
| Plug type: | L6-30P (IP20) (3-wire - 2-pole) |
| Case color: | Aluminum |

| Item | Description |
|---|---|
| Amperage: | 30 Amps |
| Voltage: | 208 Volts |
| Dimensions: | 26.82 inches x 3.25 inches x 1.72 inches<br>(681.228 mm x 82.55 mm x 43.68 mm) |
| Circuit breaker specifications: | UL489 |
| Phase: | Single (1) |

## PDU-221112F10

| Item | Description |
|---|---|
| Shipping: | 1 unit per box |
| Box labels | See labeling instructions provided. |
| Labels on PDU: | UL and serial number labels |
| Mounting brackets: | None |
| Receptacles: | IEC C-13 x 22 |
| Cord color: | Black |
| Cord length | 10 foot<br>(3048 mm) |
| Plug color: | Black |
| Plug type: | L6-30P (NEMA twist-lock plug) |
| Case color: | Black |
| Amperage: | 30 Amps |
| Voltage: | 208 Volts |
| Dimensions: | 31.00 inches x 1.73 inches x 3.3 inches (L x W x D)<br>(787.4 mm x 44 mm x 84 mm) |
| Circuit breaker specifications: | UL489 |
| Phase: | Single |

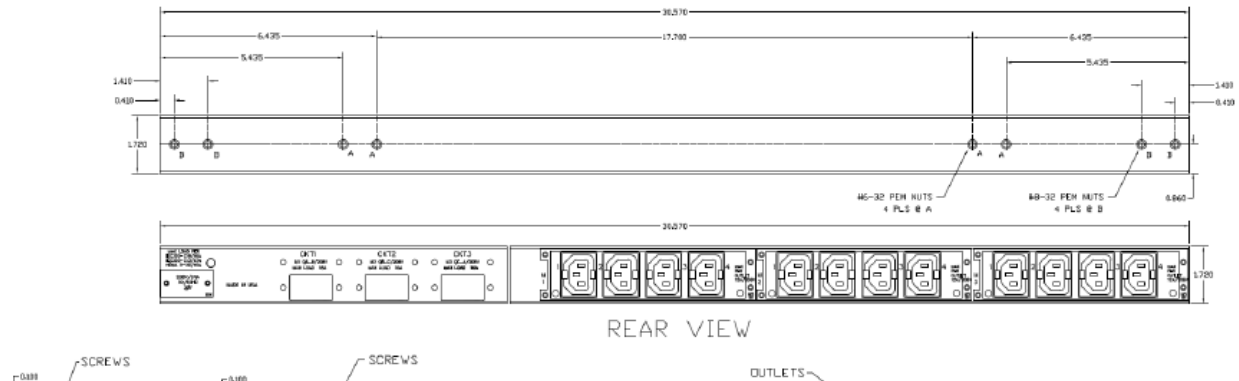



**NOTE:** PDU Bracket (900-1121-A) is required to install the Americas Solutions PDU (PDU-221112F10) in Universal Racks (see Figure C-33 on page C-64).

**Figure C-33: 22-Outlet PDU Bracket (900-1121-A)**
**(Required for Americas Solutions PDU (PDU-221112F10) in Universal Racks)**

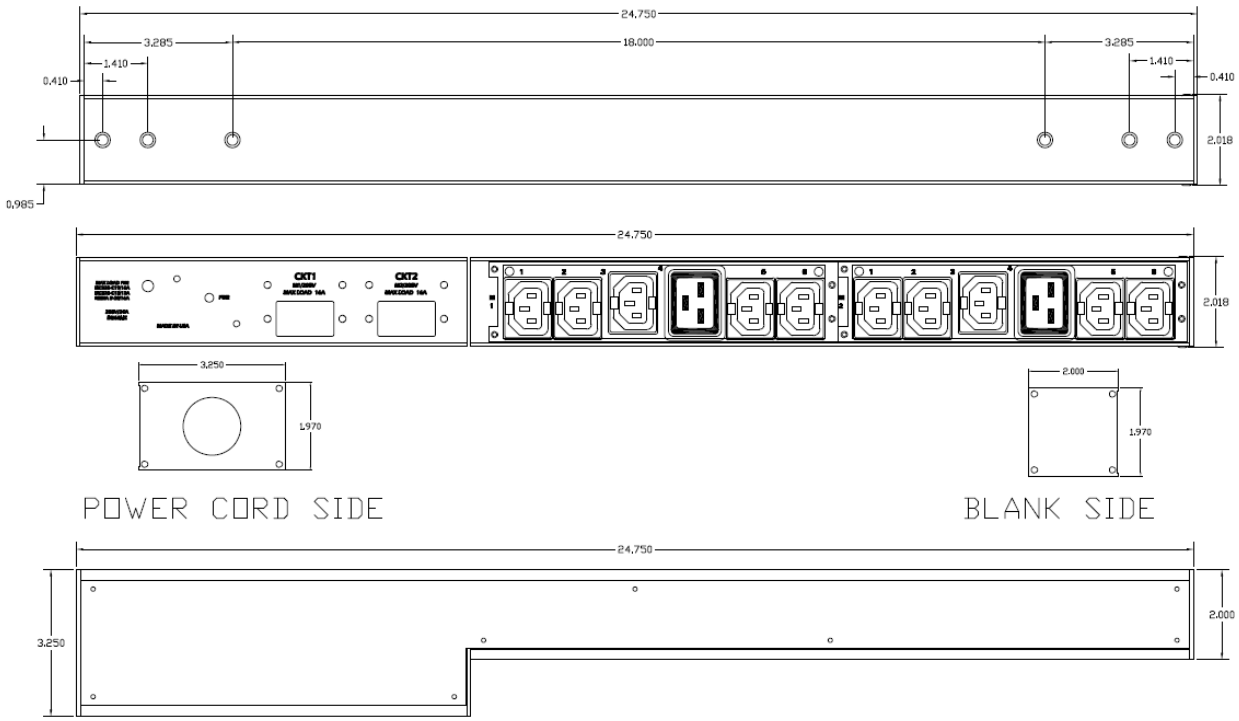
## PDU-121132F10

| Item | Description |
|---|---|
| 12-outlet three-phase NEMA | |
| Shipping: | 1 unit per box |
| Box labels: | Each box has one label that displays the serial number of the unit inside. |
| Labels on PDU: | ETL and serial number labels |
| Mounting brackets: | One set of Universal brackets per unit |
| Plug retainer clips: | Yes (built in) (12 x C13R-L) |
| Cord color: | Black |
| Cord length: | 10 foot<br>(3048 mm) |
| Plug color: | Black |
| Plug type: | L15 - 30P (IP20) (4-wire — 3-pole) |
| Case color: | Aluminum |
| Amperage: | 30 Amps |
| Voltage: | 208 Volts |
| Dimensions: | 30.57 inches x 3.25 inches x 1.72 inches<br>(77.64 mm x 8.26 mm x 4.36 mm) |
| Circuit breaker specifications: | UL489 |
| Phase: | Three (3) |



## PDU-1251120F10

| Item | Description |
|---|---|
| Shipping: | 1 unit per box |
| Box labels: | Each box has one label that displays the serial number of the unit inside. |
| Labels on PDU: | • ETL and serial number labels<br>• Circuits are color coded on both sides of PDU |
| Mounting brackets: | One set of Universal brackets per unit |
| Receptacles: | • 10 x C13R-L with plug retainer clips<br>• 2 x C19R (plug retainer clips not available) |
| Cord color: | Black |
| Cord length: | 10 foot |
| Plug color: | Black |
| Plug type: | L6-30P (3-wire — 2-pole) |
| Case color: | Aluminum |
| Amperage: | 30 Amps (UL de-rated to 24) |
| Voltage: | 208 Volts |
| Dimensions: | 24.75 inches x 2.00/3.25 inches x 2.018 inches<br>(628.65 mm x 50.8/82.55 mm x 51.26 mm) |
| Circuit breaker specifications: | UL489 |
| Phase: | Single (1) |
| Shipping weight: | 10 pounds<br>(4.53 kgs) |


24.750
3.285
18.000
3.285
1.410
1.410
0.410
0.410
2.018
0.985
24.750
CKT1
CKT2
2.018
3.250
1.970
2.000
1.970
POWER CORD SIDE
BLANK SIDE
24.750
3.250
2.000

## PDU-1561380F10

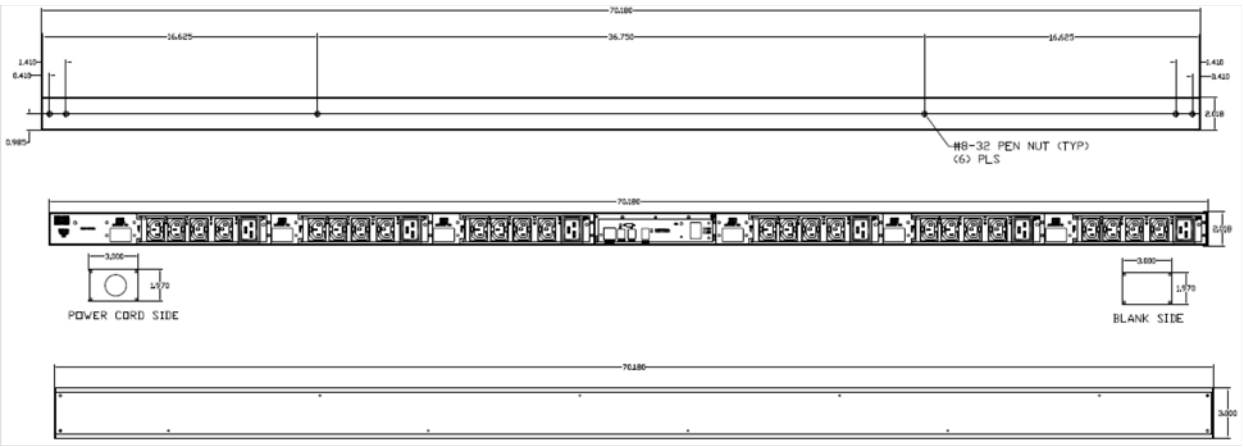
| Item | Description |
|---|---|
| Shipping: | 1 unit per box |
| Box labels: | Each box has one label that displays the serial number of the unit inside. |
| Labels on PDU: | • ETL and serial number labels<br>• Circuits are color coded on both sides of PDU |
| Mounting brackets: | One set of Universal brackets per unit |
| Receptacles: | • 12 x C13R-L with plug retainer clips<br>• 3 x C19R (plug retainer clips not available) |
| Cord color: | Black |
| Cord length: | 10 foot |
| Plug color: | Black/White |
| Plug type: | L15-30P (4-wire — 3-pole) |
| Case color: | Aluminum |
| Amperage: | 30 Amps (UL de-rated to 24) |
| Voltage: | 208 Volts |
| Dimensions: | 34.00 inches x 2.00/3.25 inches x 2.018 inches<br>(863.6 mm x 50.8/82.55 mm x 51.26 mm) |
| Circuit breaker specifications: | UL489 |
| Phase: | Three (3) |
| Shipping weight: | 13 pounds<br>(5.89 kgs) |

## PDU-1561384F10

| Item | Description |
|---|---|
| Shipping: | 1 unit per box |
| Box labels: | Each box has one label that displays the serial number of the unit inside. |
| Labels on PDU: | ETL and serial number labels |
| Mounting brackets: | One set of Universal brackets per unit |
| Receptacles: | • 12 x C13R-L with plug retainer clips<br>• 3 x C19R (plug retainer clips not available) |
| Cord color: | Black |
| Cord length: | 10 foot |
| Plug color: | Black/White |
| Plug type: | L15-30P (4-wire - 3-pole) |
| Case color: | Aluminum |
| Amperage: | 30 Amps (UL de-rated to 24) |
| Voltage: | 208 Volts |
| Dimensions: | 40.50 inches x 3.00 inches x 2.018 inches<br>(1028.7 mm x 76.2 mm x 51.26 mm) |
| Circuit breaker specifications: | UL489 |
| Phase: | Three (3) |
| Additional features: | • Vertical, LCD Display<br>• Interface: RS-232/Direct IP/ Metered outlet/Outlet control |
| Shipping weight: | 18 pounds<br>(8.16 kg) |

## PDU-3079354F10

| Item | Description |
|---|---|
| Shipping: | 1 unit per box |
| Box labels: | Each box has one label that displays the serial number of the unit inside. |
| Labels on PDU: | • ETL and serial number labels<br>• Circuits are color coded on both sides of PDU |
| Mounting brackets: | One set of Universal brackets per unit |
| Receptacles: | • 24 x C13R-L with plug retainer clips<br>• 6 x C19R (plug retainer clips not available) |
| Cord color: | Black |
| Cord length: | 10 foot |
| Plug color: | Black/Blue |
| Plug type: | IEC60309P (4-wire — 3-pole) |
| Case color: | Aluminum |
| Amperage: | 60 Amps (UL de-rated to 48) |
| Voltage: | 208 Volts |
| Dimensions: | 70.18 inches x 3.00 inches x 2.018 inches<br>(1782.5 mm x 76.2 mm x 51.26 mm) |
| Circuit breaker specifications: | UL489 |
| Phase: | Three (3) |
| Additional features: | • Vertical, LCD Display<br>• Interface: RS-232/Direct IP/ Metered outlet/Outlet control |
| Shipping weight: | 25 pounds<br>(11.34 kg) |




p

## A3CR-6363C4-50

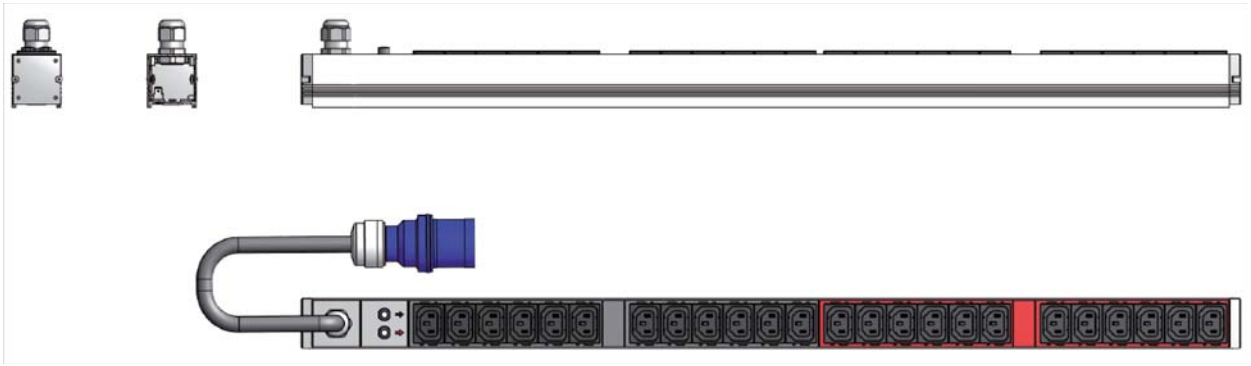
Description:

- Power strip single phase 230V
- PDU 12xC13, CEEform
- 1 phase (2P+N+E), non-intelligent, 4.5m cable

| Item | Description |
|---|---|
| 12 IEC C13 sockets 2-phases with each LS C16A 1-pole | |
| Sockets: | IEC320 C13:<br>• 2-poles, grounded<br>• 10 A/2500 W, AC250 V, IP20<br>• Phases with different colors |
| Input: | • Non-rewireable<br>• Connection 4.5 m Olflex 3G4 mm with CEE-plug 32 A 3-poles<br>• 230 V max. 32 A 50Hz |
| Profile: | 1HE, ALU, anodized; 659 mm |
| Plastic material: | RAL7035, PA6 GF 30 V1, Glow wire resistant up to 850° C |
| Holding flanges: | No flanges |
| 2x fuse: | • 1-pole, charakteristic C; 10k A<br>• With protection cap |
| Packing: | Blank carton |
| Extent of delivery: | 1 x socket outlet |

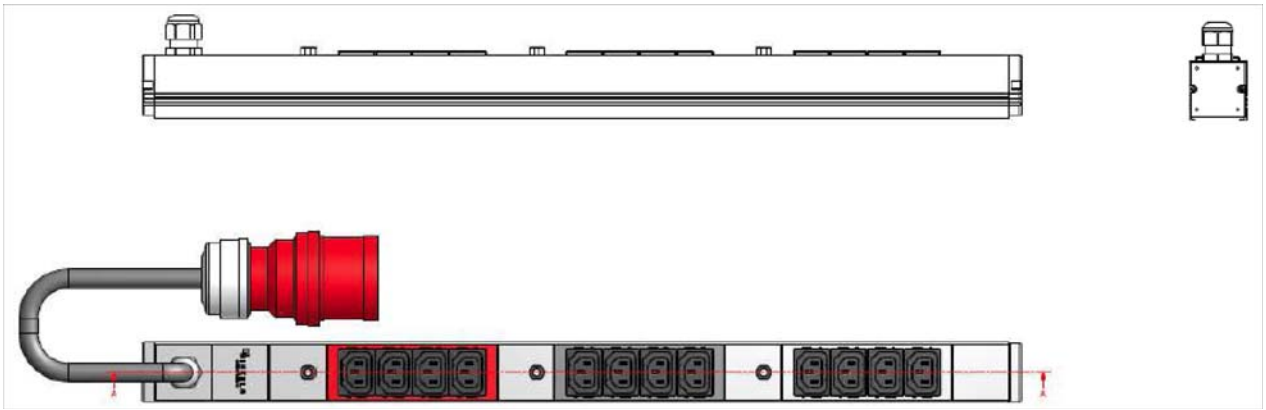
## A3CK-123123R4-50

| Item | Description |
|---|---|
| 24 IEC C13 sockets | |
| Sockets: | IEC320 C13:<br>• 2-poles, grounded<br>• 10 A/2500 W, AC250 V, IP20<br>• Split on two blocks with different colors, each 12 sockets |
| Input: | • Non-rewireable<br>• Connection 3.0 m Olflex 3G4 mm with CEE-plug 32 A 3-poles<br>• 230 V max. 32 A 50Hz |
| Profile: | 1HE, ALU, anodized; 832 mm |
| Plastic material: | RAL7035, PA6 GF 30 V1, Glow wire resistant up to 850° C |
| Holding flanges: | No flanges |
| Fuse: | 2xFuse 16 A resettable |
| Packing: | Blank carton |
| Extent of delivery: | 1 x socket outlet |



## A3B9-123R4-50

| Item | Description |
|---|---|
| 12 IEC C13 sockets, 3 phases with each ETA 16 A | |
| Sockets: | IEC320 C13:<br>• 2-poles, grounded<br>• 10 A/2500 W, AC250 V, IP20<br>• Phases with different colors |
| Input: | • Non-rewireable<br>• Connection 4.5 m H05VV-F5G2.5 mm with CEE-plug 16 A 5-poles<br>• 400 V 3~ max. 3 x 16 A 50 Hz |
| Profile: | 1HE, ALU, anodized; 657 mm |
| Plastic material: | RAL7035, PA6 GF 30 V1, Glow wire resistant up to 850° C |
| Holding flanges: | No flanges |
| Fuse: | 3xFuse 16 A resettable |
| Packing: | Blank carton |
| Extent of delivery: | 1 x socket outlet |



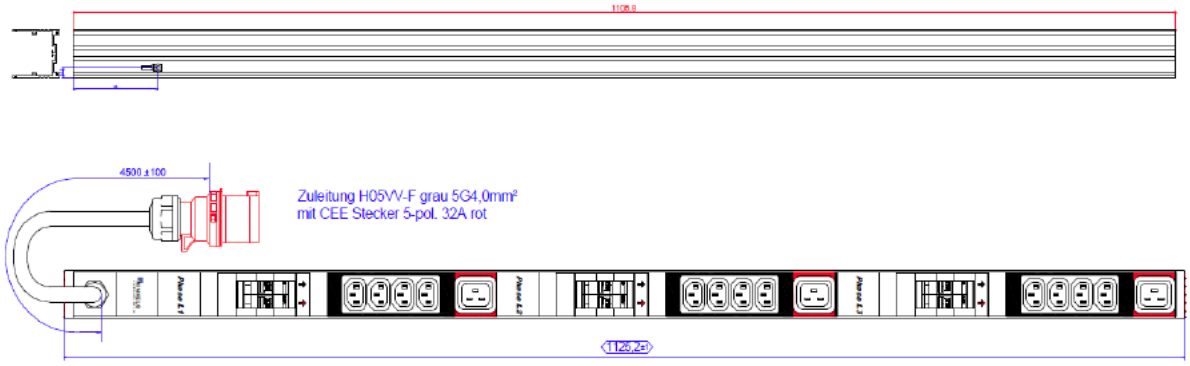
| Item | Description |
|---|---|
| 12 IEC C13 + 2 IEC C19 sockets 2-phases with each LS C16A 1-pole | |
| Sockets: | IEC320 C13:<br>• 2-poles, grounded<br>• 10A/2500W, AC250V, IP20<br>• Phases with different colors<br>IEC 320 C19:<br>• 2-pole with earthing contact<br>• 16A/3680W, AC250V, IP20<br>• Phases with different colors |
| Input: | • Non rewireable<br>• IEC60309 BLUE 2P+E<br>• Connection 4,5m H05VV-F 3G4mm2 with CEE-plug 32A 3-poles<br>• 230V max. 32A 50Hz |
| Profile: | 1HE, ALU, anodized; 659 mm |
| Plastic material: | RAL7035, PA6 GF 30 V1, Glow wire resistant up to 850° C |
| Holding flanges: | Without flanges |
| 2 x Fuse: | • 1 pole, characteristic CI 10kA<br>• With protection cap |
| Packing: | Blank carton |
| Extent of delivery: | 1 x socket outlet |

## A3CK-123394-51

Description:

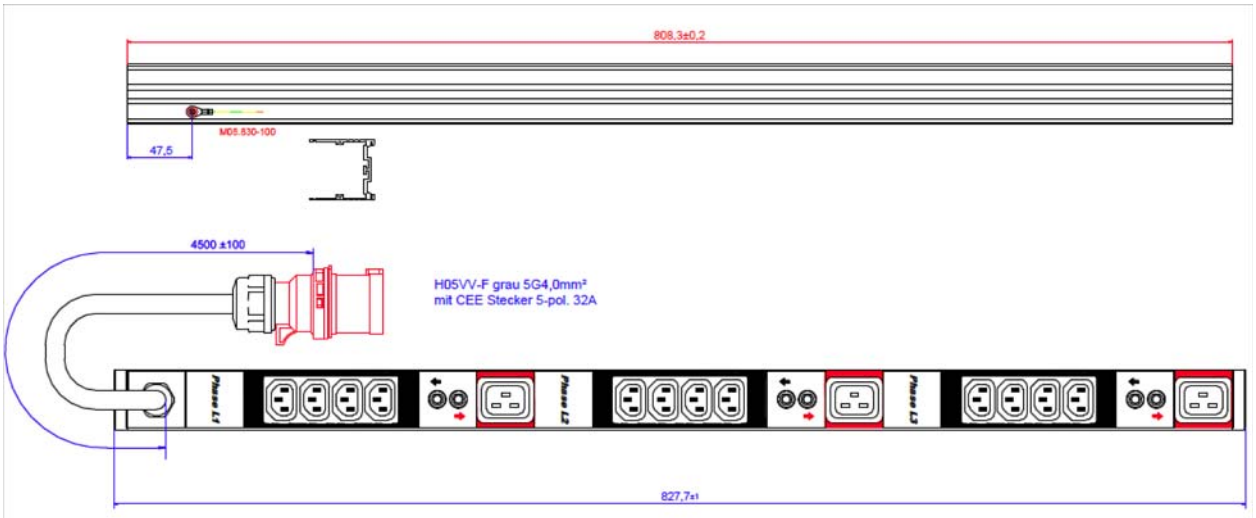
- Power strip Three Phase 400V
- PDU 12 x C13, 3 x C19, CEEform
- 3phase (3P+N+E), non-intelligent, 4.5m cable

| Item | Description |
|---|---|
| 12 IEC C13 + 3 IEC C19 sockets 3-phases with each LS C16A 1-pole | |
| Sockets: | IEC320 C13:<br>• 2-poles, grounded<br>• 10 A/2500 W, AC250V, IP20<br>• Phases with different colors<br>IEC 320 C19:<br>• 2-pole with earth contact<br>• 16A/3680W, AC250V, IP20<br>• Phases with different colors |
| Input: | • Non-rewireable<br>• IEC60309 RED 3P+N+E<br>• Connection 4.5m H05VV-F 3G4mm with CEE-plug 32A 5-poles<br>• 400V max. 3 x 32A 50Hz |
| Profile: | 1HE, ALU, anodized; 827,7mm |
| Plastic material: | RAL7035, PA6 GF 30 V1, Glow wire resistant up to 850° C |
| Holding flanges: | Without flanges |
| 6x fuse: | ETA Thermal Fuse 16A |
| Packing: | Blank carton |
| Extent of delivery: | 1 x socket outlet |



## A3CK-123394-52

| Item | Description |
|---|---|
| 12 IEC C13 + 3 IEC C19 sockets 3-phases with each 16A Thermal Fuse | |
| Sockets: | IEC320 C13:<br>• 2-poles, grounded<br>• 10A/2500W, AC250V, IP20<br>• Phases with different colors<br>IEC 320 C19:<br>• 2-pole with earthing contact<br>• 16A/3680W, AC250V, IP20<br>• Phases with different colors |
| Input: | • Non rewireable<br>• IEC60309 RED 3P+N+E<br>• Connection 4,5m H05VV-F 5G4mm with CEE-plug 32A 5-poles<br>• 400V max. 3x 32A 50Hz |
| Profile: | 1HE, Aluminum, anodized; 827.7 mm |
| Plastic material: | RAL7035, PA6 GF 30 V1, Glow wire resistant up to 850° C |
| Holding flanges: | No flanges |
| 6xFuse: | ETA Thermal Fuse 16 A |
| Packing: | Blank carton |
| Extent of delivery: | 1 x socket outlet |



## A5P0-123394-52

Description:

- Vertical PDU, Three Phase, 16A, input measuring, output measuring and switching
- 15-outlet PDU
- Vertical mounting (0H)
- 3 phase
- 16 Amps

| Item | Description |
|---|---|
| Input: | • CEE-plug, 3 phase, 16A, 5-poles male<br>• RED 3P+N+E<br>• 400V max. 3x 32A 50Hz<br>• 4.5m power lead 5G2,5 H07 (black)<br>• Input measuring, 3 phase w/ display w/ sensor port |
| Output: Module for 9 fold individual measuring and switching | |
| | Phase 1:<br>• C13 10A chassis outlet (dual)<br>• C19 16A power adapter<br>Phase 2:<br>• C13 10A chassis outlet (dual)<br>• C19 16A power adapter<br>Phase 3:<br>• C13 10A chassis outlet (dual)<br>• C19 16A power adapter |
| Output: Module for 9 fold individual measuring and switching | |
| | Phase 1:<br>• C13 10A chassis outlet (dual)<br>Phase 2:<br>• C13 10A chassis outlet (dual)<br>Phase 3:<br>• C13 10A chassis outlet (dual) |
| Profile: | Aluminium, anodized, black; 1119 mm |
| Packing: | Blank carton |

D

# Hitachi Modular and Solutions Racks

This chapter describes Hitachi Solutions Racks and Hitachi Modular Racks, which reached end-of-life (EOL) in the third quarter of 2013 and can no longer be ordered.

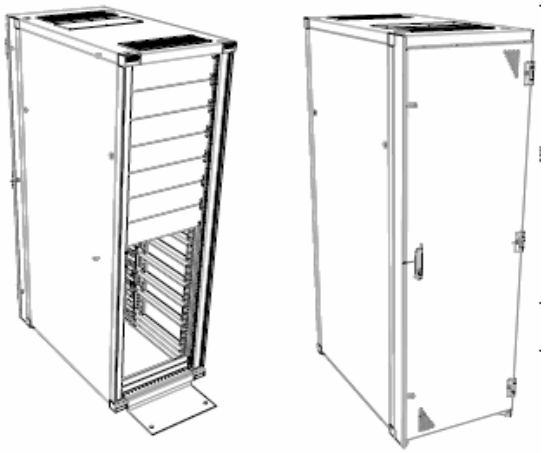
The key topics in this chapter include:

- Hitachi Modular Racks
- Hitachi Solutions Racks

# Hitachi Modular Racks

Hitachi Modular Racks are designed to hold a Hitachi Unified Storage 110, 130, and 150 consisting of a Controller Box and one or more DBS and DBL Drive Boxes. All Hitachi Data Systems Modular Racks are 42U high X 1.96 ft (600 mm) wide X 3.60 ft (1100 mm) deep 19-inch cabinets capable of containing all components required for a full installation of the Hitachi Unified Storage system.

Hitachi Data Systems also offers a third-party Universal Rail Kit 19-inch rack for rack mounting devices in third-party racks. Depth is adjustable to facilitate rack mounting. All hardware is included. For more information, see Appendix D, Hitachi Modular and Solutions Racks.



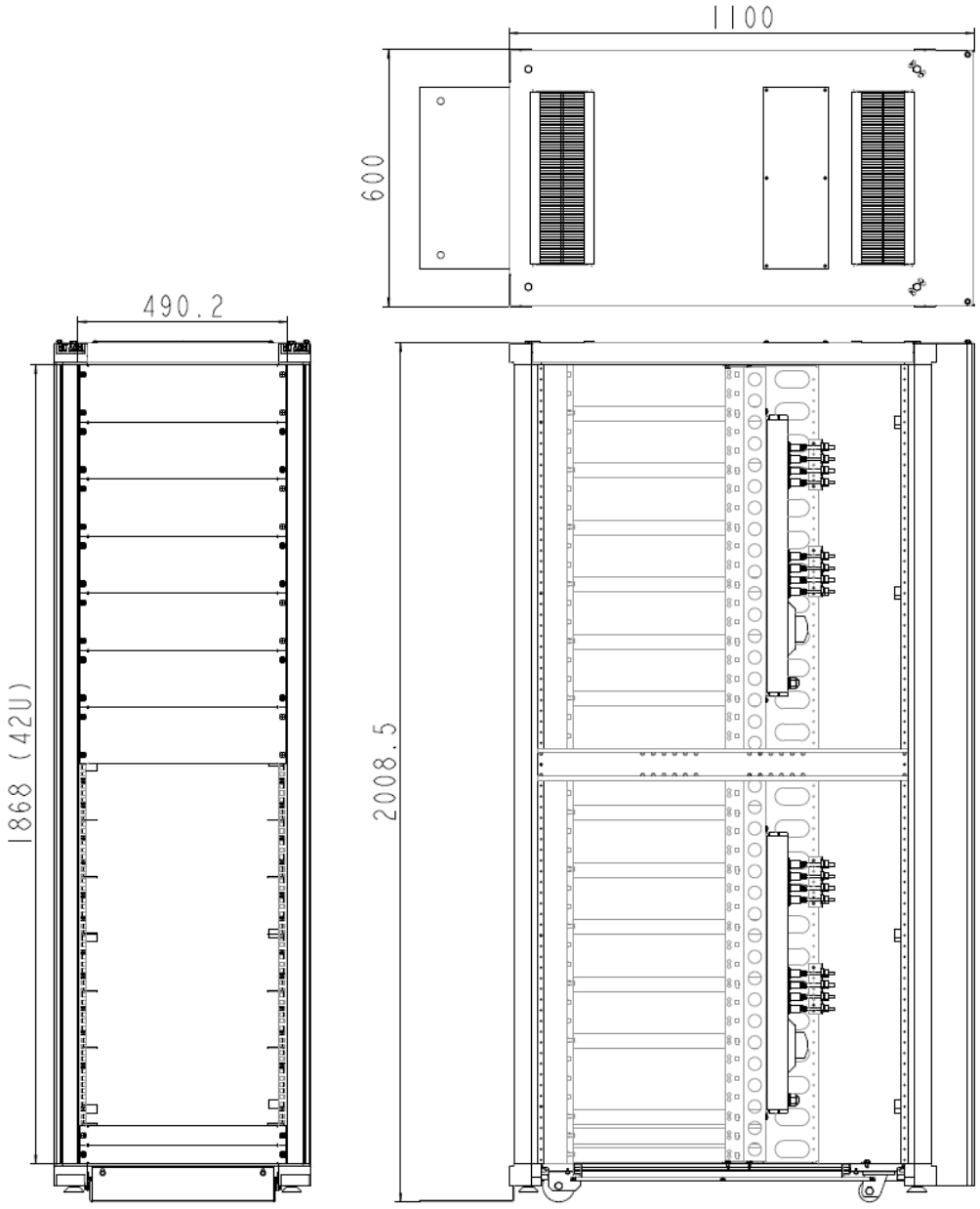



**Figure D-1: Hitachi Modular Rack (1 of 3)**

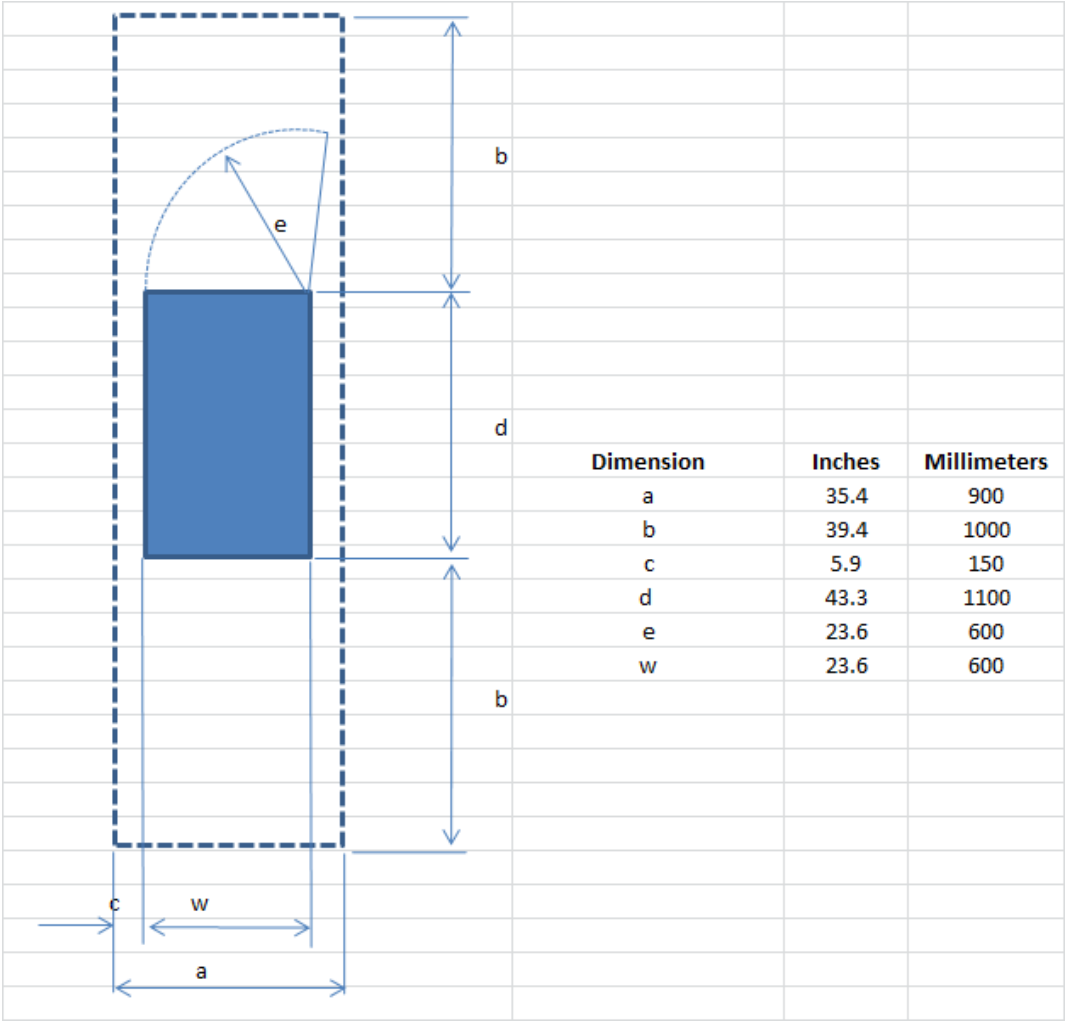
Front View Rear View

**Figure D-2: Hitachi Modular Rack (2 of 3)**

**Figure D-3: Hitachi Modular Rack (3 of 3)**

## Installation and maintenance clearance areas

Figure D-4 shows the installation and maintenance clearance areas for the Hitachi Modular Rack.




| Dimension | Inches | Millimeters |
|---|---|---|
| a | 35.4 | 900 |
| b | 39.4 | 1000 |
| c | 5.9 | 150 |
| d | 43.3 | 1100 |
| e | 23.6 | 600 |
| w | 23.6 | 600 |

**Figure D-4: Installation and maintenance areas**

## Power

See Appendix D, Hitachi Modular and Solutions Racks.

# Specifications

**Table D-1: Modular Rack specifications**

| Item | Specification |
|---|---|
| P-code | Americas:<br>Rack with side panels: A3BF-AMS-US<br>Rack without side panels: A3BF-AMS-P-US<br>EMEA / APAC:<br>Rack with side panels: A3BF-AMS-1<br>Rack without side panels: A3BF-AMS-P-1 |
| Dimensions (H x W x D) | 2010 x 600 x 1100 mm<br>(6.59 x 1.96 x 3.60 ft) |
| Frame | 42U (2010 mm)<br>Finished black RAL 9011<br>1 x Logo Hitachi<br>1 x Earthing, earthing cables - set<br>2 x Mounting depth post - depth: 1000 mm |
| Base | 1 x Base legs, adjustable, set of 4<br>1 x Construction for rollers (front)<br>1 x Construction for casters (back)<br>1 x Plinth front/rear in combination with castors: (W) 600 mm - RAL9011 (front)<br>1 x Base, plinth side in combination with castors: 1000 mm (D) (left) (left)<br>1 x Base, plinth side in combination with castors - 1000 mm (D) (right) |
| Roof | 1 x Top, blank, 3 cut-outs F/R: W X D = 600 x 1100 mm<br>1 x Cable entry brush (front)<br>1 x Cover plate RAL 9011 (middle)<br>1 x Cable entry brush (rear) |
| Profiles | 1 x Profiles, 19-inch, set of 4 - 42U (h)<br>2 x Profiles, number strip for 19-inch profile 46U (H) mounted at 19" profiles, 01 at the bottom<br>1 x Label with product information HDS<br>21 x Corner guide rails (set)<br>21 x Front panel, MFE - 19-inch x 1 mm x 1U (W x D x H) RAL 9011<br>2 x Shunting panel<br>1 x Cage nuts M6 (50pcs.)<br>Americas: 4 x Power strip 30A 6*C13 (2*)<br>EMEA/APAC: 4 x Power strip 32A 6*C13 (2*) |
| Rear | 1 x Door, 65% ventilated - 600 mm x 42U (W x H) RAL 9011<br>3 x Hinging right<br>1 x Swivel handle, 2-points Fix Easy lock<br>1 x Lock, for swivel handle, EK-333 |
| Left Side | 1 x Side panel - 1000 mm x 42U (D x H) RAL 9011<br>2 x Cylinder lock |
| Right Side | 1 x Side panel - 1000 mm x 42U (D x H) RAL 9011<br>2 x Cylinder lock |
| Accessories | 1 x Accessories (set) delivered separately in a box<br>• 42 x cable IEC 0.6m - UL<br>• Universal key<br>• Stabilizer |
| Miscellaneous | 1 x Packaging |

# Hitachi Solutions Racks

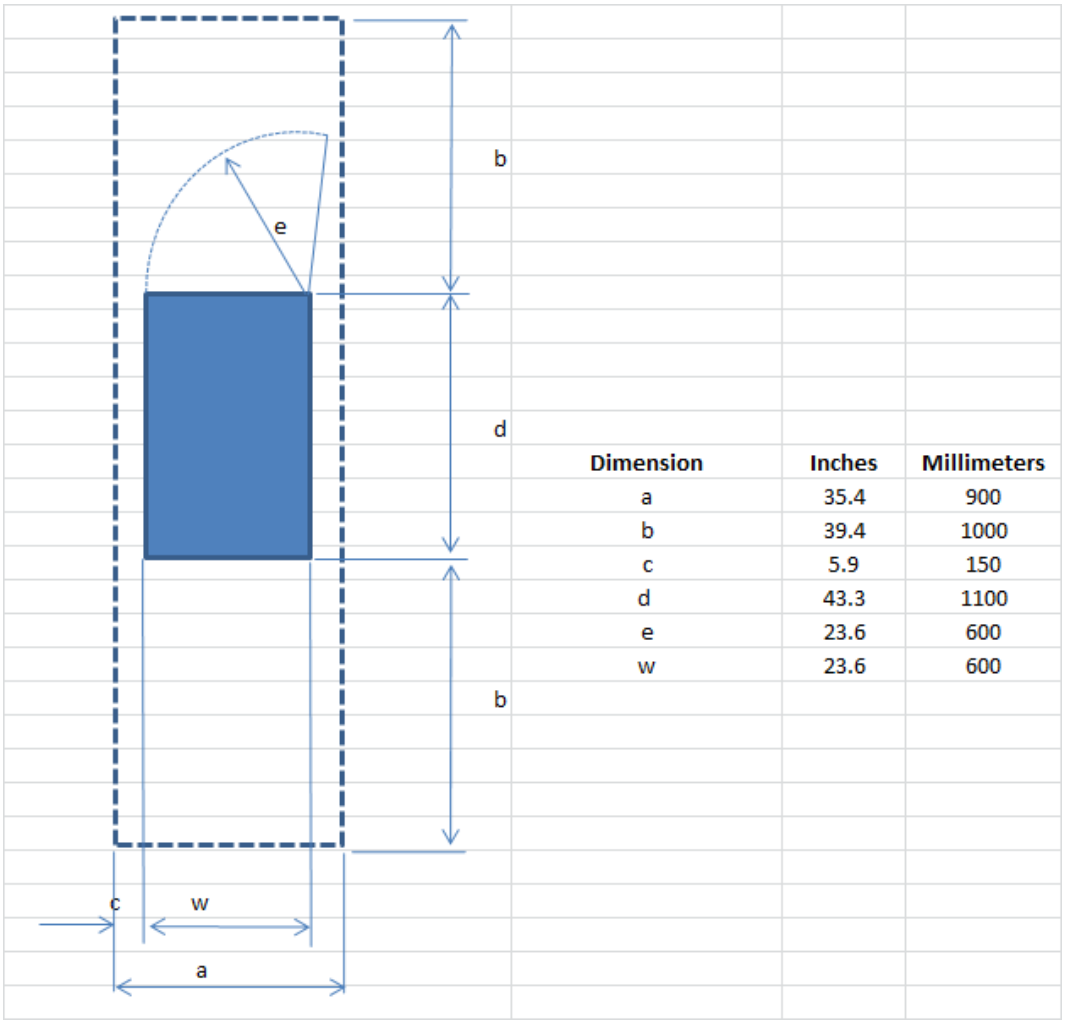
Hitachi Solutions Rack are configured for:

- Hitachi Unified Storage 130 or 150 that are used with DBX Drive Boxes.
- Hitachi Unified Storage 110, 130, and 150 that are not used with DBX Drive Boxes.

**Front View** **Rear View**

## Installation and maintenance clearance areas

Figure D-5 shows the installation and maintenance clearance areas for the Hitachi Modular Rack.




| Dimension | Inches | Millimeters |
|---|---|---|
| a | 35.4 | 900 |
| b | 39.4 | 1000 |
| c | 5.9 | 150 |
| d | 43.3 | 1100 |
| e | 23.6 | 600 |
| w | 23.6 | 600 |

**Figure D-5: Installation and maintenance areas**

## Power

See Appendix C, Rack mounting the storage system.

## Floor load rating

The floor space at the installation site must be strong enough to support the combined weight of the:

- Hitachi Unified Storage Controller Box
- Hitachi Unified Storage Drive Boxes
- The rack holding the Hitachi Unified Storage Controller Boxes and Drive Boxes
- All associated equipment

To ensure adequate load-bearing capacity, plan for the maximum configuration. Appendix C, Rack mounting the storage system lists weights for the storage system hardware.

## Specifications

**Table D-2: Hitachi Solutions Rack specifications**

| Item | Specification |
|---|---|
| P-code | Rack with side panels: A3BF-SOLUTION<br>Rack without side panels: A3BF-SOLUTION-P |
| Dimensions (H x W x D) | 2010 x 600 x 1100 mm<br>(6.59 x 1.96 x 3.60 ft) |
| Frame | 1 x Logo Hitachi<br>1 x Earthing cables - set<br>2 x Mounting depth post |
| Base | 1 x Bottom construction including castors<br>2 x Set castors (2 x fixed 2 x manoeuvrable)<br>1 x Base legs, adjustable, set of 4<br>1 x Plinth 25mm front/rear, blank - 600mm (W) RAL 9011(front)<br>1 x Plinth side, blank - 1000 mm (d) RAL 9011 (left)<br>1 x Plinth side, blank - 1000 mm (d) RAL 9011(right) |
| Roof | 1 x Bottom construction including castors<br>2 x Set castors (2 x fixed 2 x maneuverable)<br>1 x Base legs, adjustable, set of 4<br>1 x Plinth 25mm front/rear, blank - 600 mm (W) RAL 9011(front)<br>1 x Plinth side, blank - 1000mm (d) RAL 9011 (left)<br>1 x Plinth side, blank - 1000mm (d) RAL 9011(right) |
| Profiles | 1 x Profiles, 19-inch, set of 2 - 42U (h) mounted at 100mm from front<br>1 x Profiles, 19-inch, set of 2 - 42U (h) mounted at 735 mm from profiles front side<br>2 x Site plate front side<br>4 x Number-strip for 19 inch profile 1 - 42 U mounted at 19" rear profiles, 01 at the bottom |
| Front | 1 x Door, 65% ventilated - 600 mm x 42U (W X H) RAL 9011<br>3 x Hinging - on the right side<br>1 x Swivel handle, 2-points Fix Easy lock<br>1 x Lock, for swivel handle, Z-Snap EK-1333 |
| Rear | 1 x Door, 65% ventilated - 600 mm x 42U (W x H) RAL 9011<br>3 x Hinging - on the right side<br>1 x Swivel handle, 2-points Fix Easy lock<br>1 x Lock, for swivel handle, Z-Snap EK-1333 |
| Left Side | 1 x Side panel - 1100 mm x 42U (D X H) RAL 9011<br>2 x Lock with cylinder |
| Right Side | 1 x Side panel - 1100mm x 42U (D x H) RAL 9011<br>2 x Lock with cylinder |

**Table D-2: Hitachi Solutions Rack specifications (Continued)**

| Item | Specification |
|---|---|
| Accessories | Assembled:<br>• 42 x Front panel 1U ABS without Logo<br>• 2 x Cable guiding by Velcro strap (5) including fixation strip and pull relief (cables)<br>• 1 x Label Hitachi<br>• 2 x Mounting bracket for PDU in the extension set<br>Separately Packaged:<br>• 1 x Cabinet stabilizer (with mounting material)<br>• 2 x Velcro strap<br>• 100 x T-wrap 360 x 4,8 mm (black)<br>• 60 x Cage nuts M5<br>• 60 x Screws M5<br>• 1 x set (4) Bracket for PDU type 002 including mounting material<br>• 1 x set (4) Bracket for PDU type 003 including mounting material<br>• 12 x Screws 4.8 x 10<br>• 1 x Nylon strap |
| PDU | For EMEA, reference A0CK-123123R4-50 |
| Miscellaneous | 1 x Packaging |

# Specifications

This appendix contains specification for Hitachi Unified Storage systems.

The specifications covered in this appendix are:

- Model lists
- Replacement parts
- Mechanical specifications
- Electrical specifications
- Environmental specifications
- RAID specifications
- iSCSI standards
- Regulatory compliance
- DBX connection restrictions
- DBW connection restrictions
- Storage capacities and corresponding RAID levels

# Model lists

## Hitachi Unified Storage 110 model list

**Table E-1: Hitachi Unified Storage 110 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| CBXSS Controller Box | Components | DF850-CBSSR (RoHS compliant) | 2U Box | 1 |
| | | | Power Unit | 2 |
| | | | Cache Backup Battery | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | 200 V PS Cable | 2 |
| | | DF-F850-CTLXSR | Controller | 1-2 |
| | Options | DF-F850-CTLXSR | Controller | 1 |
| | | DF-F850-HBS102 | Host I/O Board (8 G Fibre Channel) | 0-2 |
| | | DF-F850-HBS12 | Host I/O Board (1 G iSCSI) | 0-2 |
| | | DF-F850-3HGSS | Drive (300 GB, SAS, 2.5 inch); see Note on page E-6. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSC | Drive (300GB, SAS, 2.5 inch);; see Note on page E-6. BNST-free | 2-24 |
| | | DF-F850-3HGSSH | Drive (300GB, SAS, 2.5 inch); see Note on page E-6. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSHC | Drive (300GB, SAS, 2.5 inch); see Note on page E-6. | 2-24 |
| | | DF-F850-6HGSS | Drive (600 GB, SAS, 2.5 inch); see Note on page E-6. Contains BNST. | 2-24 |
| | | DF-F850-6HGSSC | Drive (600 GB, SAS, 2.5 inch); see Note on page E-6. | 2-24 |
| | | DF-F850-9HGSS | Drive (900 GB, SAS, 2.5 inch); see Note on page E-8. Contains BNST. | 2-24 |
| | | DF-F850-9HGSSC | Drive (900 GB, SAS, 2.5 inch); see Note on page E-8. | 2-24 |
| | | DF-F850-12HGSS | Drive (1.2 TB, SAS, 2.5 inch); see Note on page E-8. Contains BNST. | 2-24 |
| | | DF-F850-12HGSSC | Drive (1.2 TB, SAS, 2.5 inch); see Note on page E-8. BNST-free | 2-24 |
| | | DF-F850-2HGDM | Drive (200 GB, Flash, 2.5 inch); see Note on page E-6 | 2-24 |
| | | DF-F850-4HGDM | Drive (400 GB, Flash, 2.5 inch); see Note on page E-6 | 2-24 |
| | | DF-F850-CMM4 | Cache Memory (4 GB) | 1 |

## Table E-1: Hitachi Unified Storage 110 Controller Box, Drive Box model list

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| CBXSL Controller Box | Components | DF850-CBSLR (RoHS compliant) | 2U Box | 1 |
| | | | Power Unit | 2 |
| | | | Cache Backup Battery | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | 200 V PS Cable | 2 |
| | | DF-F850-CTLXSR | Controller | 1-2 |
| | Options | DF-F850-CTLXSR | Controller | 1 |
| | | DF-F850-HBF84 | Host I/O Board (8 G Fibre Channel) | 0-2 |
| | | DF-F850-3HGSSH | Drive (300GB, SAS, 2.5 inch) | 2-24 |
| | | DF-F850-HBS102 | Host I/O Board (10 Gb iSCSI) | 0-2 |
| | | DF-F850-HBS12 | Host I/O Board (1 G iSCSI) | 0-2 |
| | | DF-F850-2TNL | Drive (2 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. Contains BNST. | 2-12 |
| | | DF-F850-2TNLC | Drive (2 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. | 2-12 |
| | | DF-F850-3TNL | Drive (3 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. Contains BNST. | 2-12 |
| | | DF-F850-3TNLC | Drive (3 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. | 2-12 |
| | | DF-F850-4TNL | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. Contains BNST. | 2-12 |
| | | DF-F850-4TNLC | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. BNST-free | 2-12 |
| | | DF-F850-2HGDML | Drive (200 GB, Flash, 3.5 inch) see Note on page E-6 | 2-12 |
| | | DF-F850-4HGDML | Drive (400 GB, Flash, 3.5 inch) see Note on page E-6 | 2-12 |
| | | DF-F850-3HGSLH | Drive (300 GB, SAS, 3.5 inch) see Note on page E-6 | 2-12 |
| | | DF-F850-9HGSL | Drive (900 GB, SAS, 3.5 inch) see Note on page E-6 | 2-12 |
| | | DF-F850-CMM4 | Cache Memory (4 GB) | 2 |

**Table E-1: Hitachi Unified Storage 110 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBS Drive Box | Components | DF-F850-DBS | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit. Contains BNST. | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m) | 2 |
| | | DF-F850-DBSC | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m) | 2 |
| | Options | DF-F850-3HGSS | Drive (300 GB, SAS, 2.5 inch); see Note on page E-6. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSC | Drive (300 GB, SAS, 2.5 inch); see Note on page E-6. | 2-24 |
| | | DF-F850-3HGSSH | Drive (300GB, SAS, 2.5 inch); see Note on page E-6. Contains BNST. | 2-24 |
| | | DF-F850-6HGSS | Drive (600 GB, SAS, 2.5 inch); see Note on page E-8. Contains BNST. | 2-24 |
| | | DF-F850-6HGSSC | Drive (600 GB, SAS, 2.5 inch); see Note on page E-8. | 2-24 |
| | | DF-F850-9HGSS | Drive (900 GB, SAS, 2.5 inch); see Note on page E-6. Contains BNST. | 2-24 |
| | | DF-F850-9HGSSC | Drive (900 GB, SAS, 2.5 inch); see Note on page E-6. | 2-24 |
| | | DF-F850-12HGSS | Drive (1.2 TB, SAS, 2.5 inch); see Note on page E-6. . Contains BNST. | 2-24 |
| | | DF-F850-12HGSSC | Drive (1.2 TB, SAS, 2.5 inch); see Note on page E-6. | 2-24 |
| | | DF-F850-2HGDM | Drive (200 GB, Flash, 2.5 inch); see Note on page E-6 | 2-24 |
| | | DF-F850-4HGDM | Drive (400 GB, Flash, 2.5 inch); see Note on page E-6 | 2-24 |
| | | DF-F850-8HGDM | Drive (800 GB, Flash, 2.5 inch); see Note on page E-6 | 2-24 |

## Table E-1: Hitachi Unified Storage 110 Controller Box, Drive Box model list

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBL Drive Box | Components | DF-F850-DBL | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit. Contains BNST. | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m) | 2 |
| | | DF-F850-DBLC | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m) | 2 |
| | Options | DF-F850-2TNL | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note on page E-6. Contains BNST. | 2-12 |
| | | DF-F850-2TNLC | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note on page E-6 | 2-12 |
| | | DF-F850-3TNL | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note on page E-6. Contains BNST. | 2-12 |
| | | DF-F850-3TNLC | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note on page E-6 | 2-12 |
| | | DF-F850-4TNL | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-6. Contains BNST. | 2-12 |
| | | DF-F850-4TNLC | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-6. | 2-12 |
| | | DF-F850-2HGDML | Drive (200 GB, Flash, 3.5 inch; see Note on page E-6 | 2-12 |
| | | DF-F850-4HGDML | Drive (400 GB, Flash, 3.5 inch); see Note on page E-6 | 2-12 |
| | | DF-F850-3HGSLH | Drive (300 GB, SAS, 3.5 inch); see Note on page E-6. Contains BNST. | 2-12 |
| | | DF-F850-3HGSLHC | Drive (300 GB, SAS, 3.5 inch); see Note on page E-6. | 2-12 |
| | | DF-F850-9HGSL | Drive (900 GB, SAS, 3.5 inch); see Note on page E-6. Contains BNST. | 2-12 |
| | | DF-F850-9HGSLC | Drive (900 GB, SAS, 3.5 inch); see Note on page E-6. | 2-12 |

**NOTE:** In the above table, drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which appear on personal computers. The RAID group capacity values displayed in Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

## Table E-2: Hitachi Unified Storage 110 additional model list

| Name | Model | Specification |
|---|---|---|
| Power Cable | DF-F850-J1H | 2.5 m, 2-pole power cable with grounding terminal (AC 125 V, 13 A or 15 A) |
| | DF-F850-J2H | 2.5 m, 2-pole power cable with grounding terminal (AC 250 V, 13 A or 15 A) |
| | DF-F850-J2H5 | 5.0 m, 2-pole power cable with grounding terminal (AC 200 V, 13 A or 15 A) |
| | DF-F850-J2H10 | 10.0 m, 2-pole power cable with grounding terminal (AC 200 V, 13 A or 15 A) |
| SAS (ENC) Cable | DF-F850-SC3 | SAS (ENC) Cable 3 m (1) |
| | DF-F850-SC5 | SAS (ENC) Cable 5 m (1) |
| Fibre Channel Cable | A-6515-GM10S | LC-SC Fibre Channel Cable for Optical (10 m) |
| | A-6515-GM20S | LC-SC Fibre Channel Cable for Optical (20 m) |
| | A-6515-GM30S | LC-SC Fibre Channel Cable for Optical (30 m) |
| | A-6515-GM50S | LC-SC Fibre Channel Cable for Optical (50 m) |
| | A-6515-GM1JS | LC-SC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM2S | LC-SC Fibre Channel Cable for Optical (2 m) |
| | A-6515-HM5S | LC-SC Fibre Channel Cable for Optical (5 m) |
| | A-6515-HM10S | LC-SC Fibre Channel Cable for Optical (10 m) |
| | A-6515-HM20S | LC-SC Fibre Channel Cable for Optical (20 m) |
| | A-6515-HM30S | LC-SC Fibre Channel Cable for Optical (30 m) |
| | A-6515-HM40S | LC-SC Fibre Channel Cable for Optical (40 m) |
| | A-6515-HM50S | LC-SC Fibre Channel Cable for Optical (50 m) |
| | A-6515-HM60S | LC-SC Fibre Channel Cable for Optical (60 m) |
| | A-6515-HM70S | LC-SC Fibre Channel Cable for Optical (70 m) |
| | A-6515-HM80S | LC-SC Fibre Channel Cable for Optical (80 m) |
| | A-6515-HM90S | LC-SC Fibre Channel Cable for Optical (90 m) |
| | A-6515-HM100S | LC-SC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM150S | LC-SC Fibre Channel Cable for Optical (150 m) |
| | A-6515-HM200S | LC-SC Fibre Channel Cable for Optical (200 m) |
| | A-6515-HM300S | LC-SC Fibre Channel Cable for Optical (300 m) |
| | A-6515-GM5L | LC-LC Fibre Channel Cable for Optical (5 m) |
| | A-6515-GM10L | LC-LC Fibre Channel Cable for Optical (10 m) |
| | A-6515-GM20L | LC-LC Fibre Channel Cable for Optical (20 m) |
| | A-6515-GM30L | LC-LC Fibre Channel Cable for Optical (30 m) |
| | A-6515-GM50L | LC-LC Fibre Channel Cable for Optical (50 m) |
| | A-6515-GM1JL | LC-LC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM2L | LC-LC Fibre Channel Cable for Optical (2 m) |
| | A-6515-HM5L | LC-LC Fibre Channel Cable for Optical (5 m) |

**Table E-2: Hitachi Unified Storage 110 additional model list (Continued)**

| Name | Model | Specification |
|---|---|---|
| | A-6515-HM10L | LC-LC Fibre Channel Cable for Optical (10 m) |
| | A-6515-HM20L | LC-LC Fibre Channel Cable for Optical (20 m) |
| | A-6515-HM30L | LC-LC Fibre Channel Cable for Optical (30 m) |
| | A-6515-HM40L | LC-LC Fibre Channel Cable for Optical (40 m) |
| | A-6515-HM50L | LC-LC Fibre Channel Cable for Optical (50 m) |
| | A-6515-HM60L | LC-LC Fibre Channel Cable for Optical (60 m) |
| | A-6515-HM70L | LC-LC Fibre Channel Cable for Optical (70 m) |
| | A-6515-HM80L | LC-LC Fibre Channel Cable for Optical (80 m) |
| | A-6515-HM90L | LC-LC Fibre Channel Cable for Optical (90 m) |
| | A-6515-HM100L | LC-LC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM150L | LC-LC Fibre Channel Cable for Optical (150 m) |
| | A-6515-HM200L | LC-LC Fibre Channel Cable for Optical (200 m) |
| | A-6515-HM300L | LC-LC Fibre Channel Cable for Optical (300 m) |

**NOTE:** In the above table, numbers in parentheses show quantities of the components.

# Hitachi Unified Storage 130 model list

**Table E-3: Hitachi Unified Storage 130 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| CBSS Controller Box | Components | DF850-CBSSR (RoHS compliant) | 2U Box | 1 |
| | | | Power Unit | 2 |
| | | | Cache Backup Battery | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | 200 V PS Cable | 2 |
| | | DF-F850-CTLSR | Controller | 2 |
| | Options | DF-F850-HBF84R | Host I/O Board (8 G Fibre Channel) | 0-2 |
| | | DF-F850-HBS102 | Host I/O Board (10 Gb iSCSI) | 0-2 |
| | | DF-F850-HBS12 | Host I/O Board (1 Gb iSCSI) | 0-2 |
| | | DF-F850-3HGSS | Drive (300 GB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSC | Drive (300 GB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-3HGSSH | Drive (300GB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSHC | Drive (300GB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-6HGSS | Drive (600 GB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-6HGSSC | Drive (600 GB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-9HGSS | Drive (900 GB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-9HGSSC | Drive (900 GB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-12HGSS | Drive (1.2 TB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-12HGSSC | Drive (1.2 TB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-2HGDM | Drive (200 GB, Flash, 2.5 inch); see Note 1 on page E-14 | 2-24 |
| | | DF-F850-4HGDM | Drive (400 GB, Flash, 2.5 inch); see Note 1 on page E-14 | 2-24 |
| | | DF-F850-CMM4 | Cache Memory (4 GB) | 4 |
| | | DF-F850-CMM8 | Cache Memory (8GB) | 4 |

## Table E-3: Hitachi Unified Storage 130 Controller Box, Drive Box model list

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| CBSL Controller Box | Components | DF850-CBSLR (RoHS compliant) | 2U Box | 1 |
| | | | Power Unit | 2 |
| | | | Cache Backup Battery | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | 200 V PS Cable | 2 |
| | | DF-F850-CTLSR | Controller | 1-2 |
| | Options | DF-F850-HBF84R | Host I/O Board (8G-FC) | 0-2 |
| | | DF-F850-HBS102 | Host I/O Board (10 Gb iSCSI) | 0-2 |
| | | DF-F850-HBS12 | Host I/O Board (1 Gb iSCSI) | 0-2 |
| | | DF-F850-2TNL | Drive (2 TB, SAS 7.2 K, 3.5 inch); see Note 1 on page E-14. Contains BNST. | 2-12 |
| | | DF-F850-2TNLC | Drive (2 TB, SAS 7.2 K, 3.5 inch); see Note 1 on page E-14. | 2-12 |
| | | DF-F850-3TNL | Drive (3 TB, SAS 7.2 K, 3.5 inch); see Note 1 on page E-14. Contains BNST. | 2-12 |
| | | DF-F850-3TNLC | Drive (3 TB, SAS 7.2 K, 3.5 inch); see Note 1 on page E-14. | 2-12 |
| | | DF-F850-CMM4 | Cache Memory (4 GB) | 4 |
| | | DF-F850-4TNL | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. Contains BNST. | 2-12 |
| | | DF-F850-4TNLC | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. | 2-12 |
| | | DF-F850-2HGDML | Drive (200 GB, Flash, 3.5 inch) see Note on page E-14 | 2-12 |
| | | DF-F850-3HGSLH | Drive (300 GB, SAS, 3.5 inch); see Note 1 on page E-14. Contains BNST. | 2-12 |
| | | DF-F850-3HGSLHC | Drive (300 GB, SAS, 3.5 inch); see Note 1 on page E-14. | 2-12 |
| | | DF-F850-9HGSL | Drive (900 GB, SAS, 3.5 inch); see Note 1 on page E-14. Contains BNST. | 2-12 |
| | | DF-F850-9HGSLC | Drive (900 GB, SAS, 3.5 inch); see Note 1 on page E-14. | 2-12 |
| | | DF-F850-4HGDML | Drive (400 GB, Flash, 3.5 inch) see Note on page E-14 | 2-12 |
| | | DF-F850-CMM4 | Cache Memory (4 GB) | 4 |
| | | DF-F850-CMM8 | Cache Memory (8 GB) | 4 |

**Table E-3: Hitachi Unified Storage 130 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBS Drive Box | Components | DF-F850-DBS | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit. Contains BNST. | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-14 | 2 |
| | | DF-F850-DBSC | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-14 | 2 |
| | Options | DF-F850-3HGSS | Drive (300 GB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSC | Drive (300 GB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-3HGSSH | Drive (300GB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSHC | Drive (300GB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-6HGSS | Drive (600 GB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-6HGSSC | Drive (600 GB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-9HGSS | Drive (900 GB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-9HGSSC | Drive (900 GB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-12HGSS | Drive (1.2 TB, SAS, 2.5 inch); see Note 1 on page E-14. Contains BNST. | 2-24 |
| | | DF-F850-12HGSSC | Drive (1.2 TB, SAS, 2.5 inch); see Note 1 on page E-14. | 2-24 |
| | | DF-F850-2HGDM | Drive (200 GB, Flash, 2.5 inch); see Note 1 on page E-14 | 2-24 |
| | | DF-F850-4HGDM | Drive (400 GB, Flash, 2.5 inch); see Note 1 on page E-14 | 2-24 |

**Table E-3: Hitachi Unified Storage 130 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBL Drive Box | Components | DF-F850-DBL | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit. Contains BNST. | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-14 | 2 |
| | | DF-F850-DBLC | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-14 | 2 |
| | Options | DF-F850-2TNL | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-14. Contains BNST. | 2-12 |
| | | DF-F850-2TNLC | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-14. | 2-12 |
| | | DF-F850-3TNL | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-14. Contains BNST. | 2-12 |
| | | DF-F850-3TNLC | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-14. | 2-12 |
| | | DF-F850-4TNL | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-14. Contains BNST. | 2-12 |
| | | DF-F850-4TNLC | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-14. | 2-12 |
| | | DF-F850-2HGDML | Drive (200 GB, Flash, 3.5 inch); see Note 1 on page E-14 | 2-12 |
| | | DF-F850-4HGDML | Drive (400 GB, Flash, 3.5 inch); see Note 1 on page E-14 | 2-12 |
| | | DF-F850-3HGSLH | Drive (300 GB, SAS, 3.5 inch); see Note 1 on page E-14. Contains BNST. | 2-12 |
| | | DF-F850-3HGSLHC | Drive (300 GB, SAS, 3.5 inch); see Note 1 on page E-14. | 2-12 |
| | | DF-F850-9HGSL | Drive (900 GB, SAS, 3.5 inch); see Note 1 on page E-14. Contains BNST. | 2-12 |
| | | DF-F850-9HGSLC | Drive (900 GB, SAS, 3.5 inch); see Note 1 on page E-14. | 2-12 |

**Table E-3: Hitachi Unified Storage 130 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBX Drive Box | Components | DF-F850-DBX | 4U Box | 1 |
| | | | I/O Module (ENC) | 4 |
| | | | Power Unit | 4 |
| | | | Cable Holder (IN) | 4 |
| | | | Cable Holder (OUT) | 4 |
| | | | 200 V PS Cable | 4 |
| | | | Front Bezel (DBX) | 1 |
| | | | SAS (ENC) Cable (3 m); see Note 2 below | 4 |
| | Options | DF-F850-2TNX | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1. Contains BNST. | 2-48 |
| | | DF-F850-3TNX | Drive (3 TB, SAS 7.2K rpm, 3.5 inch). Contains BNST. | 2-48 |
| | | DF-F850-3TNXC | Drive (3 TB, SAS 7.2K rpm, 3.5 inch). | 2-48 |
| | | DF-F850-4TNX | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 below. Contains BNST. | 2-48 |
| | | DF-F850-4TNXC | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 below. | 2-48 |
| DBW Drive Box | Components | DF-F850-DBW | 5U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit | 2 |
| | | | Side Card-A | 2 |
| | | | Side Card-B | 2 |
| | | | 200 V PS Cable | 2 |
| | | | SAS (ENC) Cable (3 m) | 2 |
| | | | FAN Module | 5 |
| | Options | DF-F850-3TNW | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 below. Contains BNST. | 84 |
| | | DF-F850-3TNWC | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 below. | 84 |
| | | DF-F850-4TNW | Drive (4 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 below. Contains BNST. | 84 |
| | | DF-F850-4TNWC | Drive (4 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 below. | 84 |

**NOTE 1:** In the above table, drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which appear on personal computers. The RAID group capacity values displayed in Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

**NOTE 2:** If the system is configured with a mix of DBS, DBL, and DBX units, DF-F850-SC3 or DF-F850-SC5 SAS (ENC) cables must be purchased separately.

**Table E-4: Hitachi Unified Storage 130 additional model list**

| Name | Model | Specification |
|---|---|---|
| Power Cable | DF-F850-J1H | 2.5 m, 2-pole power cable with grounding terminal (AC 125 V, 13 A or 15 A) |
| | DF-F850-J2H | 2.5 m, 2-pole power cable with grounding terminal (AC 250 V, 13 A or 15 A) |
| | DF-F850-J2H5 | 5.0 m, 2-pole power cable with grounding terminal (AC 200 V, 13 A or 15 A) |
| | DF-F850-J2H10 | 10.0 m, 2-pole power cable with grounding terminal (AC 200 V, 13 A or 15 A) |
| SAS (ENC) Cable | DF-F850-SC3 | SAS (ENC) Cable 3 m (1) |
| | DF-F850-SC5 | SAS (ENC) Cable 5 m (1) |
| Fibre Channel Cable | A-6515-GM10S | LC-SC Fibre Channel Cable for Optical (10 m) |
| | A-6515-GM20S | LC-SC Fibre Channel Cable for Optical (20 m) |
| | A-6515-GM30S | LC-SC Fibre Channel Cable for Optical (30 m) |
| | A-6515-GM50S | LC-SC Fibre Channel Cable for Optical (50 m) |
| | A-6515-GM1JS | LC-SC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM2S | LC-SC Fibre Channel Cable for Optical (2 m) |
| | A-6515-HM5S | LC-SC Fibre Channel Cable for Optical (5 m) |
| | A-6515-HM10S | LC-SC Fibre Channel Cable for Optical (10 m) |
| | A-6515-HM20S | LC-SC Fibre Channel Cable for Optical (20 m) |
| | A-6515-HM30S | LC-SC Fibre Channel Cable for Optical (30 m) |
| | A-6515-HM40S | LC-SC Fibre Channel Cable for Optical (40 m) |
| | A-6515-HM50S | LC-SC Fibre Channel Cable for Optical (50 m) |
| | A-6515-HM60S | LC-SC Fibre Channel Cable for Optical (60 m) |
| | A-6515-HM70S | LC-SC Fibre Channel Cable for Optical (70 m) |
| | A-6515-HM80S | LC-SC Fibre Channel Cable for Optical (80 m) |
| | A-6515-HM90S | LC-SC Fibre Channel Cable for Optical (90 m) |
| | A-6515-HM100S | LC-SC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM150S | LC-SC Fibre Channel Cable for Optical (150 m) |

**Table E-4: Hitachi Unified Storage 130 additional model list (Continued)**

| Name | Model | Specification |
|---|---|---|
| | A-6515-HM200S | LC-SC Fibre Channel Cable for Optical (200 m) |
| | A-6515-HM300S | LC-SC Fibre Channel Cable for Optical (300 m) |
| | A-6515-GM5L | LC-LC Fibre Channel Cable for Optical (5 m) |
| | A-6515-GM10L | LC-LC Fibre Channel Cable for Optical (10 m) |
| | A-6515-GM20L | LC-LC Fibre Channel Cable for Optical (20 m) |
| | A-6515-GM30L | LC-LC Fibre Channel Cable for Optical (30 m) |
| | A-6515-GM50L | LC-LC Fibre Channel Cable for Optical (50 m) |
| | A-6515-GM1JL | LC-LC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM2L | LC-LC Fibre Channel Cable for Optical (2 m) |
| | A-6515-HM5L | LC-LC Fibre Channel Cable for Optical (5 m) |
| | A-6515-HM10L | LC-LC Fibre Channel Cable for Optical (10 m) |
| | A-6515-HM20L | LC-LC Fibre Channel Cable for Optical (20 m) |
| | A-6515-HM30L | LC-LC Fibre Channel Cable for Optical (30 m) |
| | A-6515-HM40L | LC-LC Fibre Channel Cable for Optical (40 m) |
| | A-6515-HM50L | LC-LC Fibre Channel Cable for Optical (50 m) |
| | A-6515-HM60L | LC-LC Fibre Channel Cable for Optical (60 m) |
| | A-6515-HM70L | LC-LC Fibre Channel Cable for Optical (70 m) |
| | A-6515-HM80L | LC-LC Fibre Channel Cable for Optical (80 m) |
| | A-6515-HM90L | LC-LC Fibre Channel Cable for Optical (90 m) |
| | A-6515-HM100L | LC-LC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM150L | LC-LC Fibre Channel Cable for Optical (150 m) |
| | A-6515-HM200L | LC-LC Fibre Channel Cable for Optical (200 m) |
| | A-6515-HM300L | LC-LC Fibre Channel Cable for Optical (300 m) |

**NOTE:** In the above table, numbers in parentheses show quantities of the components.

# Hitachi Unified Storage 150 model list

**Table E-5: Hitachi Unified Storage 150 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| CBL Controller Box | Components | DF850-CBLR (RoHS compliant) | 3U Box | 1 |
| | | | Drive I/O Module | 4 |
| | | | Cache Backup Battery | 2 |
| | | | Power Unit (AC power supply) | 2 |
| | | | Management Module (LAN) | 2 |
| | | | Management Module (UPS) | 2 |
| | | | Front Bezel (CBL) | 1 |
| | | | 200 V PS Cable | 2 |
| | | DF-F850-CTLL | Controller | 2 |
| | | | Fan Module | (3x2) |
| | Options | DF-F850-4GB | Cache Memory (4 GB) | 4 |
| | | DF-F850-8GB | Cache Memory (8 GB) | 4 |
| | | DF-F850-HF8GR | Host I/O Module (8 G Fibre Channel) | 2-4 |
| | | DF-F850-HS10G | Host I/O Module (10 Gb iSCSI) | 2-4 |
| CBL Controller | Components | DF850-CBLR1 (RoHS compliant) | 3U Box | 1 |
| | | | Cache Backup Battery | 2 |
| | | | Power Unit (AC power supply) | 2 |
| | | | Management Module (LAN) | 2 |
| | | | Management Module (UPS) | 2 |
| | | | Front Bezel (CBL) | 1 |
| | | | 200 V PS Cable | 2 |
| | | DF-F850-CTLL | Controller | 2 |
| | | | Fan Module | (3x2) |
| | Options | DF-F850-4GB | Cache Memory (4 GB) | 4 |
| | | DF-F850-8GB | Cache Memory (8 GB) | 4 |
| | | DF-F850-HF8GR | Host I/O Module (8 G Fibre Channel) | 2-4 |
| | | DF-F850-HS10G | Host I/O Module (10 Gb iSCSI) | 2-4 |
| | | DW-F700-BS6G | Drive I/O Module | 4 |

## Table E-5: Hitachi Unified Storage 150 Controller Box, Drive Box model list

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| CBLE Controller | Components | DF850-CBLR1 (RoHS compliant) | 3U Box | 1 |
| | | | Cache Backup Battery | 2 |
| | | | Power Unit (AC power supply) | 2 |
| | | | Management Module (LAN) | 2 |
| | | | Management Module (UPS) | 2 |
| | | | Front Bezel (CBL) | 1 |
| | | | 200 V PS Cable | 2 |
| | | DF-F850-CTLL | Controller | 2 |
| | | | Fan Module | (3x2) |
| | Options | DF-F850-4GB | Cache Memory (4 GB) | 4 |
| | | DF-F850-8GB | Cache Memory (8 GB) | 4 |
| | | DF-F850-HF8GR | Host I/O Module (8 G Fibre Channel) | 2-4 |
| | | DF-F850-HS10G | Host I/O Module (10 Gb iSCSI) | 2-4 |
| | | DW-F700-BS6G | Drive I/O Module | 4 |
| | | DW-F700-BS6GE | Drive I/O Module (Encryption) | 4 |
| CBLD Controller Box | Components | DF850-CBLD (RoHS compliant) | 3U Box | 1 |
| | | | Drive I/O Module | 4 |
| | | | Cache Backup Battery | 2 |
| | | | Power Unit (DC power supply) | 2 |
| | | | Management Module (LAN) | 2 |
| | | | Management Module (UPS) | 2 |
| | | | Front Bezel (CBLD) | 1 |
| | | DF-F850-CTLL | Controller | 2 |
| | | | Fan Module | (3x2) |
| | Options | DF-F850-4GB | Cache Memory (4 GB) | 4 |
| | | DF-F850-8GB | Cache Memory (8 GB) | 4 |
| | | DF-F850-HF8GR | Host I/O Module (8 G Fibre Channel) | 2-4 |
| | | DF-F850-HS10G | Host I/O Module (10 Gb iSCSI) | 2-4 |

**Table E-5: Hitachi Unified Storage 150 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBS Drive Box | Components | DF-F850-DBS | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit (AC power supply). Contains BNST. | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | DF-F850-DBSC | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit (AC power supply) | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | Options | DF-F850-3HGSS | Drive (300 GB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSC | Drive (300 GB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-3HGSSH | Drive (300GB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSHC | Drive (300GB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-6HGSS | Drive (600 GB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-6HGSSC | Drive (600 GB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-9HGSS | Drive (900 GB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-9HGSSC | Drive (900 GB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-12HGSS | Drive (1.2 TB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-12HGSSC | Drive (1.2 TB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-2HGDM | Drive (200 GB, Flash, 2.5 inch); see Note 1 on page E-23 | 2-24 |
| | | DF-F850-4HGDM | Drive (400 GB, Flash, 2.5 inch); see Note 1 on page E-23 | 2-24 |

## Table E-5: Hitachi Unified Storage 150 Controller Box, Drive Box model list

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBSD Drive Box | Components | DF-F850-DBSD | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit (DC power supply). Contains BNST. | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-23 | 2 |
| | | DF-F850-DBSDC | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit (DC power supply). Contains BNST. | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-23 | 2 |
| | Options | DF-F850-3HGSS | Drive (300 GB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSC | Drive (300 GB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-3HGSSH | Drive (300GB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-3HGSSHX | Drive (300GB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-6HGSS | Drive (600 GB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-6HGSSC | Drive (600 GB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-9HGSS | Drive (900 GB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-9HGSSC | Drive (900 GB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-12HGSS | Drive (1.2 TB, SAS, 2.5 inch); see Note 1 on page E-23. Contains BNST. | 2-24 |
| | | DF-F850-12HGSSC | Drive (1.2 TB, SAS, 2.5 inch); see Note 1 on page E-23. | 2-24 |
| | | DF-F850-2HGDM | Drive (200 GB, Flash, 2.5 inch); see Note 1 on page E-23 | 2-24 |
| | | DF-F850-4HGDM | Drive (400 GB, Flash, 2.5 inch); see Note 1 on page E-23 | 2-24 |
| | | DF-F850-8HGDM | Drive (800 GB, Flash, 2.5 inch); see Note 1 on page E-23 | 2-24 |

**Table E-5: Hitachi Unified Storage 150 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBL Drive Box | Components | DF-F850-DBL | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit (AC power supply). Contains BNST. | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-23 | 2 |
| | | DF-F850-DBLC | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit (AC power supply) | 2 |
| | | | 200 V PS Cable | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-23 | 2 |
| | Options | DF-F850-2TNL | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-12 |
| | | DF-F850-2TNLC | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. | 2-12 |
| | | DF-F850-3TNL | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-12 |
| | | DF-F850-3TNLC | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. | 2-12 |
| | | DF-F850-4TNL | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. Contains BNST. | 2-12 |
| | | DF-F850-4TNLC | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. | 2-12 |
| | | DF-F850-2HGDML | Drive (200 GB, Flash, 3.5 inch); see Note 1 on page E-23 | 2-12 |
| | | DF-F850-4HGDML | Drive (400 GB, Flash, 3.5 inch); see Note 1 on page E-23 | 2-12 |
| | | DF-F850-3HGSLH | Drive (300 GB, SAS, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-12 |
| | | DF-F850-3HGSLHC | Drive (300 GB, SAS, 3.5 inch); see Note 1 on page E-23. | 2-12 |
| | | DF-F850-9HGSL | Drive (900 GB, SAS, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-12 |
| | | DF-F850-9HGSLC | Drive (900 GB, SAS, 3.5 inch); see Note 1 on page E-23. | 2-12 |

## Table E-5: Hitachi Unified Storage 150 Controller Box, Drive Box model list

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBLD Drive Box | Components | DF-F850-DBLD | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit (DC power supply). Contains BNST. | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-23 | 2 |
| | | DF-F850-DBLDC | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit (DC power supply). Contains BNST. | 2 |
| | | | Front Bezel (2U) | 1 |
| | Options | DF-F850-2TNL | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-12 |
| | | DF-F850-2TNLC | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. | 2-12 |
| | | DF-F850-3TNL | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-12 |
| | | DF-F850-3TNLC | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. | 2-12 |
| | | DF-F850-4TNL | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. Contains BNST. | 2-12 |
| | | DF-F850-4TNLC | Drive (4 TB, SAS 7.2 K, 3.5 inch); see Note on page E-8. | 2-12 |
| | | DF-F850-2HGDML | Drive (200 GB, Flash, 3.5 inch); see Note 1 on page E-23 | 2-12 |
| | | DF-F850-4HGDML | Drive (400 GB, Flash, 3.5 inch); see Note 1 on page E-23 | 2-12 |
| | | DF-F850-3HGSLH | Drive (300 GB, SAS, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-12 |
| | | DF-F850-3HGSLHC | Drive (300 GB, SAS, 3.5 inch); see Note 1 on page E-23. | 2-12 |
| | | DF-F850-9HGSL | Drive (900 GB, SAS, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-12 |
| | | DF-F850-9HGSLC | Drive (900 GB, SAS, 3.5 inch); see Note 1 on page E-23. | 2-12 |

## Table E-5: Hitachi Unified Storage 150 Controller Box, Drive Box model list

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBF Drive Box | Components | DF-F850-DBF | 2U Box | 1 |
| | | | I/O Module (ENC) | 2 |
| | | | Power Unit (AC power supply) | 2 |
| | | | Front Bezel (2U) | 1 |
| | | | SAS (ENC) Cable (1 m); see Note 2 on page E-23 | 2 |
| | Options | DKC-F170I-1R6FM | Drive (1.6 TB, Flash [FMD]) | 2-12 |
| DBX Drive Box | Components | DF-F850-DBX | 4U Box | 1 |
| | | | I/O Module (ENC) | 4 |
| | | | Power Unit | 4 |
| | | | Cable Holder (IN) | 4 |
| | | | Cable Holder (OUT) | 4 |
| | | | 200 V PS Cable | 4 |
| | | | Front Bezel (DBX) | 1 |
| | | | SAS (ENC) Cable (3 m); see Note 2 on page E-23 | 4 |
| | Options | DF-F850-2TNX | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-48 |
| | | DF-F850-3TNX | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-48 |
| | | DF-F850-3TNXC | Drive (3 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23 | 2-48 |
| | | DF-F850-4TNX | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 2-48 |
| | | DF-F850-4TNXC | Drive (2 TB, SAS 7.2K rpm, 3.5 inch); see Note 1 on page E-23. | 2-48 |

**Table E-5: Hitachi Unified Storage 150 Controller Box, Drive Box model list**

| Name | Model | | Part name | Quantity |
|---|---|---|---|---|
| DBW Drive Box | Components | DF-F850-DBW | 5U Box | 1 |
| | | | SAS (ENC) Cable (1m) | 2 |
| | | | Power Unit | 2 |
| | | | Fan Module | 5 |
| | | | I/O Module (ENC) | 2 |
| | | | Side Card-A | 2 |
| | | | Side Card-B | 2 |
| | | | 200VPS Cable | 2 |
| | | | Rail Kit | 1 |
| | | | SAS (ENC) Cable (3m) | 2 |
| | Options | DF-F850-3TNW | Drive (3 TB, SAS7.2K, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 84 |
| | | DF-F850-3TNWC | Drive (3 TB, SAS7.2K, 3.5 inch); see Note 1 on page E-23. | 84 |
| | | DF-F850-4TNW | Drive (4 TB, SAS7.2K, 3.5 inch); see Note 1 on page E-23. Contains BNST. | 84 |
| | | DF-F850-4TNWC | Drive (4 TB, SAS7.2K, 3.5 inch); see Note 1 on page E-23. | 84 |

**NOTE 1:** In the above table, drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which appear on personal computers. The RAID group capacity values displayed in Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

**NOTE 2:** If a system is configured with a mix of DBS, DBL, and DBX Drive Boxes, DF-F850-SC3 or DF-F850-SC5 SAS (ENC) cables must be used (these cables are purchased separately from the storage system).

## Table E-6: Hitachi Unified Storage 150 additional model list

| Name | Model | Specification |
|---|---|---|
| Power Cable | DF-F850-J1H | 2.5 m, 2-pole power cable with grounding terminal (AC 125 V, 13 A or 15 A) |
| | DF-F850-J2H | 2.5 m, 2-pole power cable with grounding terminal (AC 250 V, 13 A or 15 A) |
| | DF-F850-J2H5 | 5.0 m, 2-pole power cable with grounding terminal (AC 200 V, 13 A or 15 A) |
| | DF-F850-J2H10 | 10.0 m, 2-pole power cable with grounding terminal (AC 200 V, 13 A or 15 A) |
| | A-F6516-P620 | Power cable for PDB (1) |
| | A-F6516-P630 | Power cable for PDB (1) |
| | DF-F850-J4DC | Power cable for DC Power Unit (1.5 m) |
| | DF-F850-J4DC3 | Power cable for DC Power Unit (3.0 m) |
| SAS (ENC) Cable | DF-F850-SC3 | SAS (ENC) Cable 3 m (1) |
| | DF-F850-SC5 | SAS (ENC) Cable 5 m (1) |
| Fibre Channel Cable | A-6515-GM10S | LC-SC Fibre Channel Cable for Optical (10 m) |
| | A-6515-GM20S | LC-SC Fibre Channel Cable for Optical (20 m) |
| | A-6515-GM30S | LC-SC Fibre Channel Cable for Optical (30 m) |
| | A-6515-GM50S | LC-SC Fibre Channel Cable for Optical (50 m) |
| | A-6515-GM1JS | LC-SC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM2S | LC-SC Fibre Channel Cable for Optical (2 m) |
| | A-6515-HM5S | LC-SC Fibre Channel Cable for Optical (5 m) |
| | A-6515-HM10S | LC-SC Fibre Channel Cable for Optical (10 m) |
| | A-6515-HM20S | LC-SC Fibre Channel Cable for Optical (20 m) |
| | A-6515-HM30S | LC-SC Fibre Channel Cable for Optical (30 m) |
| | A-6515-HM40S | LC-SC Fibre Channel Cable for Optical (40 m) |
| | A-6515-HM50S | LC-SC Fibre Channel Cable for Optical (50 m) |
| | A-6515-HM60S | LC-SC Fibre Channel Cable for Optical (60 m) |
| | A-6515-HM70S | LC-SC Fibre Channel Cable for Optical (70 m) |
| | A-6515-HM80S | LC-SC Fibre Channel Cable for Optical (80 m) |
| | A-6515-HM90S | LC-SC Fibre Channel Cable for Optical (90 m) |
| | A-6515-HM100S | LC-SC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM150S | LC-SC Fibre Channel Cable for Optical (150 m) |
| | A-6515-HM200S | LC-SC Fibre Channel Cable for Optical (200 m) |
| | A-6515-HM300S | LC-SC Fibre Channel Cable for Optical (300 m) |
| | A-6515-GM5L | LC-LC Fibre Channel Cable for Optical (5 m) |
| | A-6515-GM10L | LC-LC Fibre Channel Cable for Optical (10 m) |
| | A-6515-GM20L | LC-LC Fibre Channel Cable for Optical (20 m) |
| | A-6515-GM30L | LC-LC Fibre Channel Cable for Optical (30 m) |
| | A-6515-GM50L | LC-LC Fibre Channel Cable for Optical (50 m) |
| | A-6515-GM1JL | LC-LC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM2L | LC-LC Fibre Channel Cable for Optical (2 m) |

**Table E-6: Hitachi Unified Storage 150 additional model list (Continued)**

| Name | Model | Specification |
|---|---|---|
| | A-6515-HM5L | LC-LC Fibre Channel Cable for Optical (5 m) |
| | A-6515-HM10L | LC-LC Fibre Channel Cable for Optical (10 m) |
| | A-6515-HM20L | LC-LC Fibre Channel Cable for Optical (20 m) |
| | A-6515-HM30L | LC-LC Fibre Channel Cable for Optical (30 m) |
| | A-6515-HM40L | LC-LC Fibre Channel Cable for Optical (40 m) |
| | A-6515-HM50L | LC-LC Fibre Channel Cable for Optical (50 m) |
| | A-6515-HM60L | LC-LC Fibre Channel Cable for Optical (60 m) |
| | A-6515-HM70L | LC-LC Fibre Channel Cable for Optical (70 m) |
| | A-6515-HM80L | LC-LC Fibre Channel Cable for Optical (80 m) |
| | A-6515-HM90L | LC-LC Fibre Channel Cable for Optical (90 m) |
| | A-6515-HM100L | LC-LC Fibre Channel Cable for Optical (100 m) |
| | A-6515-HM150L | LC-LC Fibre Channel Cable for Optical (150 m) |
| | A-6515-HM200L | LC-LC Fibre Channel Cable for Optical (200 m) |
| | A-6515-HM300L | LC-LC Fibre Channel Cable for Optical (300 m) |

**NOTE:** In the above table, numbers in parentheses show quantities of the components.

## Replacement parts

Hitachi Unified Storage systems use replaceable parts. An example of a replaceable part is the battery mounted in the storage system.

Part replacement is required to maintain high-quality operation performance. Replacement of parts is covered by the maintenance service contract. Otherwise, customers are requested to purchase genuine replacement parts periodically and to replace the parts by them selves.

**Table E-7: Replaceable parts**

| Classification | Part names | Replacement period | Treatment |
|---|---|---|---|
| Replacement part | Battery unit | Five years | Periodic replacement is required. Use the array in a place where the ambient temperature is at $30^{o}$ or less in average.<br><br>When the maintenance service contract is made, the periodical replacement is performed as a part of maintenance service.<br><br>If not, the periodical replacement must be performed basically by the user. The genuine parts must be used.<br><br>Follow the given procedure to dispose of the used battery.<br><br>This battery is designed to protect the data in the Cache Memory in an emergency such as a sudden power failure, etc. When executing the sequential shutdown of the system, make sure to follow the regular procedure. If not, the battery may reach its life-span earlier, therefore may become unusable within five years. |
| | Air filter (see Note) | One year | Contact service personnel, to request replacement of air filter. |

**NOTE:** The air filter is used for the front bezel of the Network Equipment-Building System (NEBS) specification.

# Mechanical specifications

## Hitachi Unified Storage 110 mechanical specifications

**Table E-8: Hitachi Unified Storage 110 mechanical specifications**

| Item | | CBXSS/CBXSL | DBS/DBL |
|---|---|---|---|
| Configuration | | 1 CBXSS<br>1 CBXSL | 1 DBS<br>1 DBL |
| Drive | Drive size (W D H) (mm) | CBXSS/DBS: 81.6x205.7x18.7 (2.5 type)<br><br>CBXSL/DBL: 101.6x147.0x26.1 (3.5 type) | |
| | Data capacity (G byte); see Note 1 on page E-28 | CBXSS/DBS: 195.82/287.62/392.73/575.30/879.98/1173.71 (2.5 type)<br><br>CBXSL/DBL: 195.82/287.62/392.73/879.98/1956.94/2935.96/3915.01 (3.5 Type) | |
| | Rotational speed ($min^{-1}$) | CBXSS/DBS: 287.62/575.30/879.98/1173.71 G bytes:10000 (2.5 type)<br>287.62 G bytes:15000 (2.5 type)<br>195.82/392.73 G bytes: Flash Drive (2.5 inch)<br><br>CBXSL/DBL: 1956.94/2935.96/3915.01 G bytes:7200 (3.5 Type)<br>879.98 G bytes:10000 (3.5Type)<br>287.62 G bytes:15000 (3.5Type)<br>195.82/392.73 G bytes: Flash Drive (3.5 inch) | |
| | Maximum mountable quantity (unit) | CBXSS: 24<br>CBXSL: 12 | DBS: 24<br>DBL: 12 |
| Host Interface | Interface Type | 8 Gbps Fibre Channel Optical<br><br>1 G bps iSCSI (1000 Base-T)/10 G bps (Optical) iSCSI | — |
| | Data Transfer Speed (i.e., maximum speed for transfer to host) | 800 M bytes/s (Fibre Channel)<br><br>1000 M bytes/s (iSCSI) | — |
| | Number of Ports | Single controller:<br>Fibre Channel: 4<br>Fibre Channel: 4 + iSCSI: 2 | — |
| | | Dual controllers:<br>Fibre Channel: 4 x 2<br>Fibre Channel: 4 x 2 + iSCSI: 2 x 2 | — |
| | Transferred Block Size (bytes) | 512 | |

**Table E-8: Hitachi Unified Storage 110 mechanical specifications (Continued)**

| Item | | CBXSS/CBXSL | DBS/DBL |
|---|---|---|---|
| RAID Specifications (see Note 2 on page E-28) | RAID Level (see Note 3 on page E-29) | SAS/SAS 7.2K rpm/Flash drives mounted: 0/1/5/6/1+0 | |
| | RAID 0 | SAS/SAS 7.2K rpm/Flash drives mounted: 2D to 16D | |
| | RAID 1 | 1D + 1D | |
| | RAID 5 | 2D+1P to 15D+1P | |
| | RAID 6 | 2D+2P to 28D+2P | |
| | RAID 1 + 0 | 2D+2D to 8D+8D | |
| Internal Logic Specifications | Control Memory | Flash memory: 32 M bytes<br><br>L3 Cache memory:2 M bytes<br><br>SDRAM: 1 G bytes | — |
| | Data Assurance Method | Data bus: Parity<br>Cache memory:<br><br>ECC (1 bit for correction, 2 bits for detection)<br><br>Drive: Data assurance code | — |
| Physical Specifications | Start-up Time (min) | Standard: 5 to 7 (see Note 4 on page E-29) | |
| | Chassis Size (W D H) (mm) | 483x770x88.4 | DBS/DBL: 483x545x 88.4 |
| | Mass (approx.); see Note 5 on page E-29 | CBBS: 88.1 lbs (40 kg)<br>CBXSL: 94.8 lbs (43 kg) | DBS: 50.7 lbs (23 kg)<br>DBL: 59.5 lbs (27 kg) |
| | Required height (EIA unit) | 2 | 2 |
| Cache Specifications | Capacity (M bytes/CTL) | 4,096 | — |
| | Control Method | Read LRU/Write after | — |
| | Battery Backup | Provided | — |
| | Backup Duration (see Note 6 on page E-29) | Unrestricted (saving to nonvolatile memory) | — |
| Insulation Performance | Insulation Withstand Voltage | AC 1,500 V (10 mA, 1 min) | |
| | Insulation Resistance | DC 500 V, 10 M Ω or more | |

**NOTE 1:** The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using. The RAID group capacity values displayed in the Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

**NOTE 2:** Data drive, P: Parity drive

**NOTE 3:** Although the storage system 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 or hardware/software of the storage system itself. Therefore, users are requested to back up all data for restoration in case where the original data is lost.

RAID 0+1 is described in place of RAID 1+0 in some places, however, it has the same meaning as RAID 1+0.

**NOTE 4:** The start-up time may be longer in proportion to the number of Drive Boxes connected. With a maximum configuration of 1 Controller Box and 9 Drive Boxes, start-up time is approximately 7 minutes.

**NOTE 5:** Value of maximum configuration when all mountable drives and controller are mounted.

**NOTE 6:**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 Drives by turning off the power normally, and prevents the battery charge from being wasted.

When the storage system enters Cache Backup mode, the orange **WARNING** LED goes ON to alert you to a battery voltage drop when the storage system starts. This warning indicates that the remaining battery capacity is not sufficient and the storage system operates with the Write Cache function disabled.

When the battery is charged, the warning indication disappears, and the storage system continues the operation in Write Cache function.

The warning indication disappears within six hours. Even when the warning is shown, normal operation is assured in Write-Through. Read/Write performance is lowered because the Write Cache function is disabled.

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

If the storage system is not charged for more than six months, the battery may become overdischarged and suffer from unrecoverable damage. To avoid this situation, charge the battery more than 3 hours every six months.

# Hitachi Unified Storage 130 mechanical specifications

**Table E-9: Hitachi Unified Storage 130 mechanical specifications**

| Item | | CBSS/CBSL | DBS/DBL/DBX/DBW |
|---|---|---|---|
| Configuration | | 1 CBSS<br>1 CBSL | 1 DBS<br>1 DBL<br>1 DBX<br>1 DBW |
| Drive | Drive size (W D H) (mm) | CBSS/DBS: 81.6x205.7x18.7 (2.5 type)<br><br>CBSL/DBL/DBX/DBW: 101.6x147.0x26.1 (3.5 type) | |
| | Data capacity (G byte); see Note 1 on page E-32 | CBSS/DBS: 195.82/287.62/392.73/575.30/879.98/1173.71 (2.5 type)<br><br>CBSL/DBL/DBX/DBW (see Note 2 on page E-32 and Note 9 on page E-33): 195.82/287.62/392.73/879.98/1956.94/2935.96/3915.01 (3.5 Type) | |
| | Rotational speed ($min^{-1}$) | CBSS/DBS: (see Note 7 on page E-32): 287.62/575.30/879.98/1173.71 G bytes:10000 (2.5 type)<br>287.62 G bytes:15000 (2.5 type)<br>195.82/392.73 G bytes: Flash Drive (2.5 inch)<br><br>CBSL/DBL/DBX/DBW: (see Note 2 on page E-32 and and Note 9 on page E-33): 1956.94/2935.96/3915.01 G bytes:7200 (3.5 Type)<br>879.98 G bytes:10000 (3.5Type)<br>287.62 G bytes:15000 (3.5Type)<br>195.82/392.73 G bytes: Flash Drive (3.5 inch) | |
| | Maximum mountable quantity (unit) | CBSS: 24<br>CBSL: 12 | DBS: 24<br>DBL: 12<br>DBX: 48<br>DBW: 84 |
| Host Interface | Interface Type | 8 Gbps Fibre Channel Optical<br><br>1 G bps iSCSI (1000 Base-T)/10 G bps (Optical) iSCSI | — |
| | Data Transfer Speed (i.e., maximum speed for transfer to host) | 800 M bytes/s (Fibre Channel)<br><br>1000 M bytes/s (iSCSI) | — |
| | Number of Ports | Fibre Channel: 16<br>Fibre Channel: 8 + iSCSI: 4 | — |
| | Transferred Block Size (bytes) | 512 | |

## Table E-9: Hitachi Unified Storage 130 mechanical specifications

| Item | | CBSS/CBSL | DBS/DBL/DBX/ DBW |
|---|---|---|---|
| RAID Specifications (see Note 3 on page E-32) | RAID Level (see Note 4 on page E-32) | SAS/SAS 7.2K rpm/Flash drives mounted: 0/1/5/ 6/1+0 | |
| | RAID 0 | SAS/SAS 7.2K rpm/Flash drives mounted: 2D to 16D | |
| | RAID 1 | 1D + 1D | |
| | RAID 5 | 2D+1P to 15D+1P | |
| | RAID 6 | 2D+2P to 28D+2P | |
| | RAID 1 + 0 | 2D+2D to 8D+8D | |
| Internal Logic Specifications | Control Memory | Flash memory: 32 M bytes<br><br>L3 Cache memory:2 M bytes<br><br>SDRAM: 1 G bytes | — |
| | Data Assurance Method | Data bus: Parity<br>Cache memory:<br><br>ECC (1 bit for correction, 2 bits for detection)<br><br>Drive: Data assurance code | — |
| Physical Specifications | Start-up Time (min) | CBSS/CBSL, DBS/DBL, DBX/DBW: Standard: 5 to 8 (see Note 5 on page E-32) | |
| | Chassis Size (W D H) (mm) | 483x770x88.4 | DBS/DBL: 483x545x 88.4<br>DBX: 483x840x176<br>DBW: 483x933x220 |
| | Mass (approx.); see Note 6 on page E-32 | CBBS: 88.1 lbs (40 kg)<br>CBXSL: 94.8 lbs (43 kg) | DBS: 50.7 lbs (23 kg)<br>DBL: 59.5 lbs (27 kg)<br>DBX: 187.3 lbs (85 kg)<br>DBW: 128 approx |
| | Required height (EIA unit) | 2 | DBS: 2<br>DBL: 2<br>DBX: 4<br>DBW: 5 |
| Cache Specifications | Capacity (M bytes/CTL) | 8,192, 16,384 | — |
| | Control Method | Read LRU/Write after | — |
| | Battery Backup | Provided | — |
| | Backup Duration (see Note 7 on page E-33) | Unrestricted (saving to nonvolatile memory) | — |

**Table E-9: Hitachi Unified Storage 130 mechanical specifications**

| Item | | CBSS/CBSL | DBS/DBL/DBX/ DBW |
|---|---|---|---|
| Insulation Performance | Insulation Withstand Voltage | AC 1,500 V (10 mA, 1 min) | |
| | Insulation Resistance | DC 500 V, 10 M Ω or more | |

**NOTE 1:** The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using. The RAID group capacity values displayed in the Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

**NOTE 2:** When mounting storage systems mixing DBS, DBL, DBX, and DBW Drive Boxes, the maximum mountable quantity (unit) varies. For more information, see Scalability on page 1-8.

**NOTE 3:** Data drive, P: Parity drive

**NOTE 4:** Although the storage system 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 or hardware/software of the storage system itself. Therefore, users are requested to back up all data for restoration in case where the original data is lost.

RAID 0+1 is described in place of RAID 1+0 in some places, however, it has the same meaning as RAID 1+0.

**NOTE 5:** The start-up time may be longer in proportion to the number of Drive Boxes connected. With a maximum configuration of 1 Controller Box and 19 Drive Boxes, start-up time is approximately 8 minutes.

**NOTE 6:** Value of maximum configuration (in the case where all the mountable drives and controller are mounted).

**NOTE 7:** The DBW supports a SAS7.2K drive (2935.96 and 3915.01 G bytes).

**NOTE 8:** 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 Drives by turning off the power normally, and prevents the battery charge from being wasted.

When the storage system enters Cache Backup mode, the orange **WARNING** LED goes ON to alert you to a battery voltage drop when the storage system starts. This warning indicates that the remaining battery capacity is not sufficient and the storage system operates with the Write Cache function disabled.

When the battery is charged, the warning indication disappears, and the storage system continues the operation in Write Cache function.

The warning indication disappears within six hours. Even when the warning is shown, normal operation is assured in Write-Through. Read/Write performance is lowered because the Write Cache function is disabled.

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

If the storage system is not charged for more than six months, the battery may become overdischarged and suffer from unrecoverable damage. To avoid this situation, charge the battery more than 3 hours every six months.

**NOTE 9:** The DBW Drive Box supports SAS7.2K drives (2935.96 G bytes). The DBX or DBW Drive Box does not support Flash Drive.

# Hitachi Unified Storage 150 mechanical specifications

**Table E-10: Hitachi Unified Storage 150 mechanical specifications - AC power supply model**

| Item | | CBL/CBLE | DBS/DBL/DBF/ DBX/DBW |
|---|---|---|---|
| Configuration | | 1 CBL/CBLE | 1 DBS<br>1 DBL<br>1 DBF<br>1 DBX<br>1 DBW |
| Drive | Drive size (W D H) (mm) | DBS: 81.6x205.7x18.7 (2.5 type)<br><br>DBL/DBX/DBW: 101.6x147.0x26.1 (3.5 type)<br><br>DBF: 146 x 366.8 x 19.8 (Flash Drive [FMD]) | |
| | Data capacity (G byte); see Note 1 on page E-36 | DBS: 195.82/287.62/392.73/575.30/879.98/ 1173.71 (2.5 type)<br><br>DBL/DBX/DBW (see Note 2 on page E-36): 195.82/287.62/392.73/879.98/1956.94/2935.96/ 3915.01 (3.5 type) (see Note 8 on page E-37)<br><br>DBF: 1758.12 (Flash Drive [FMD]) | |
| | Rotational speed ($min^{-1}$) | DBS: 287.62/575.30/879.98/1173.71 G bytes:10000 (2.5 type)<br>287.62 G bytes:15000 (2.5 type)<br>195.82/392.73 G bytes: Flash Drive (3.5 inch)<br><br>DBL/DBX/DBW (see Note 2 on page E-36): 1956.94/2935.96/3915.01 G bytes:7200 (3.5 type) (see Note 8 on page E-37)<br>879.98 G bytes:10000 (3.5Type)<br>287.62 G bytes:15000 (3.5Type)<br>195.82/392.73 G bytes: Flash Drive (3.5 inch)<br><br>DBF: 1758.12 (Flash Drive [FMD]) | |
| | Maximum mountable quantity (unit) | — | DBS: 24<br>DBL: 12<br>DBF: 12<br>DBX: 48<br>DBW: 84 |

## Table E-10: Hitachi Unified Storage 150 mechanical specifications - AC power supply model (Continued)

| Item | | CBL/CBLE | DBS/DBL/DBF/ DBX/DBW |
|---|---|---|---|
| Host Interface | Interface Type | 8 Gbps Fibre Channel Optical<br><br>10 Gbps Optical iSCSI (1000Base-T) | — |
| | Data Transfer Speed (i.e., maximum speed for transfer to host) | 800 M bytes/s (Fibre Channel)<br><br>1000 M bytes/s (iSCSI) | — |
| | Number of Ports | Fibre Channel: 16<br>iSCSI: 8 | — |
| | Transferred Block Size (bytes) | 512 | |
| RAID Specifications (Note 3 on page E-36) | RAID Level (see Note 4 on page E-37) | — | SAS/SAS 7.2K rpm/ Flash drives mounted: 0/1/5/6/ 1+0 |
| | RAID 0 | — | SAS/SAS 7.2K rpm/ Flash drives mounted: 2D to 16D |
| | RAID 1 | — | 1D + 1D |
| | RAID 5 | — | 2D+1P to 15D+1P |
| | RAID 6 | — | 2D+2P to 28D+2P |
| | RAID 1 + 0 | — | 2D+2D to 8D+8D |
| Internal Logic Specifications | Control Memory | Flash memory: 32 M bytes<br><br>L2 Cache memory:4 M bytes<br><br>SDRAM: 1 G bytes | — |
| | Data Assurance Method | Data bus: Parity<br>Cache memory:<br><br>ECC (1 bit for correction, 2 bits for detection)<br><br>Drive: Data assurance code | — |

**Table E-10: Hitachi Unified Storage 150 mechanical specifications - AC power supply model (Continued)**

| Item | | CBL/CBLE | DBS/DBL/DBF/ DBX/DBW |
|---|---|---|---|
| Physical Specifications | Start-up Time (min) | CBL.CBLE, DBS/DBL/DBF, DBX/DBW: Standard: 5 to 10 (see Note 5 on page E-37) | |
| | Chassis Size (W D H) (mm) | 483x819x129 | DBS/DBL: 483x545x 88.4<br>DBF: 483x755x87<br>DBX: 483x840x176<br>DBW: 483x933x220 |
| | Mass (approx.); see Note 6 on page E-37 | 103.4 lbs (47 kg) | DBS: 50.7 lbs (23 kg)<br>DBL: 59.5 lbs (27 kg)<br>DBF: 83.7 lbs (38 kg)<br>DBX:187.4 lbs (85 kg)<br>DBW: 281.6 lbs (128 kg) |
| | Required height (EIA unit) | 3 | DBS: 2<br>DBL: 2<br>DBF: 2<br>DBX: 4<br>DBW: 5 |
| Cache Specifications | Capacity (M bytes/CTL) | 8,192 to 16,384 | — |
| | Control Method | Read LRU/Write after | — |
| | Battery Backup | Provided | — |
| | Backup Duration (see Note 7 on page E-37) | Unrestricted (saving to nonvolatile memory) | — |
| Insulation Performance | Insulation Withstand Voltage | AC 1,500 V (10 mA, 1 min) | |
| | Insulation Resistance | DC 500 V, 10 M Ω or more | |

**NOTE 1:** The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using. The RAID group capacity values displayed in the Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

**NOTE 2:** When installing DBS, DBL, DBX, and DBW Drive Boxes together, the number of drives to be installed depends on the combination of the Drive Boxes. For more information, see Scalability on page 1-8.

**NOTE 3:** Data drive, P: Parity drive

**NOTE 4:** Although the storage system 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 or hardware/software of the storage system itself. Therefore, users are requested to back up all data for restoration in case where the original data is lost.

The DBF Drive Box does not support RAID 0.

**NOTE 5:** The start-up time may be longer in proportion to the number of Drive Boxes connected. With a maximum configuration of 1 Controller Box and 20 Drive Boxes, start-up time is approximately 10 minutes.

**NOTE 6:** Value of maximum configuration (in the case where all the mountable drives and controller are mounted).

**NOTE 7:** 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 Drives by turning off the power normally, and prevents the battery charge from being wasted.

When the storage system enters Cache Backup mode, the orange **WARNING** LED goes ON to alert you to a battery voltage drop when the storage system starts. This warning indicates that the remaining battery capacity is not sufficient and the storage system operates with the Write Cache function disabled.

When the battery is charged, the warning indication disappears, and the storage system continues the operation in Write Cache function.

The warning indication disappears within six hours. Even when the warning is shown, normal operation is assured in Write-Through. Read/Write performance is lowered because the Write Cache function is disabled.

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

If the storage system is not charged for more than six months, the battery may become overdischarged and suffer from unrecoverable damage. To avoid this situation, charge the battery more than 3 hours every six months.

**NOTE 8:** The DBX and DBW Drive Box do not support Flash Drives. The DBW Drive Box supports the SAS7.2K drive (2935.96, 3915.01 G bytes).

## Table E-11: Hitachi Unified Storage 150 mechanical specifications - DC power supply model

| Item | | CBLD | DBSD/DBLD |
|---|---|---|---|
| Configuration | | 1 CBLD | 1 DBSD<br>1 DBLD |
| Drive | Drive size<br>(W D H) (mm) | DBSD: 81.6x205.7x18.7 (2.5 type)<br><br>DBLD: 101.6x147.0x26.1 (3.5 type) | |
| | Data capacity<br>(G byte); see Note 1 on page E-39 | DBSD: 195.82/287.62/392.73/575.30/879.98/ 1173.71 (2.5Type)<br><br>DBLD: 195.82//287.62/392.73/879.98/1956.94/ 2935.96/3915.01 (3.5 Type) | |
| | Rotational speed<br>($min^{-1}$) | DBSD: 287.62/575.30/879.98/1173.71 G bytes:10000 (2.5Type)<br>287.62 G bytes:15000 (2.5Type)<br>195.82/392.73 G bytes: Flash Drive (2.5 inch)<br><br>DBLD: 1956.94/2935.96 G bytes:7200 (3.5 Type)<br>879.98 G bytes:10000 (3.5Type)<br>287.62 G bytes:15000 (3.5Type)<br>195.82/392.73 G bytes: Flash Drive (3.5 inch) | |
| | Maximum mountable quantity (unit) | — | DBSD: 24<br>DBLD: 12 |
| Host Interface | Interface Type | 8 Gbps Fibre Channel Optical<br><br>10 Gbps Optical iSCSI (1000Base-T) | — |
| | Data Transfer Speed<br>(i.e., maximum speed for transfer to host) | 800 M bytes/s<br>(Fibre Channel)<br><br>1000 M bytes/s<br>(iSCSI) | — |
| | Number of Ports | Fibre Channel: 16<br>iSCSI: 8 | — |
| | Transferred Block Size (bytes) | 512 | |
| RAID Specifications (Note 2 on page E-39) | RAID Level<br>(see Note 3 on page E-40) | — | SAS/SAS 7.2K rpm/ Flash drives mounted: 0/1/5/6/ 1+0 |
| | RAID 0 | — | SAS/SAS 7.2K rpm/ Flash drives mounted: 2D to 16D |
| | RAID 1 | — | 1D + 1D |
| | RAID 5 | — | 2D+1P to 15D+1P |
| | RAID 6 | — | 2D+2P to 28D+2P |
| | RAID 1 + 0 | — | 2D+2D to 8D+8D |

**Table E-11: Hitachi Unified Storage 150 mechanical specifications - DC power supply model (Continued)**

| Item | | CBLD | DBSD/DBLD |
|---|---|---|---|
| Internal Logic Specifications | Control Memory | Flash memory: 32 M bytes<br><br>L2 Cache memory:4 M bytes<br><br>SDRAM: 1 G bytes | — |
| | Data Assurance Method | Data bus: Parity<br>Cache memory:<br><br>ECC (1 bit for correction, 2 bits for detection)<br><br>Drive: Data assurance code | — |
| Physical Specifications | Start-up Time (min) | CBLD, DBSD/DBLD: Standard: 5 to 10 (see Note 4 on page E-40) | |
| | Chassis Size (W D H) (mm) | 483x819x129 | 483x545x 88.4 |
| | Mass (approx.); see Note 5 on page E-40 | 103.4 lbs (47 kg) | DBSD: 50.7 lbs (23 kg)<br>DBLD: 59.5 lbs (27 kg) |
| | Required height (EIA unit) | 3 | 2 |
| Cache Specifications | Capacity (M bytes/CTL) | 8,192 to 16,384 | — |
| | Control Method | Read LRU/Write after | — |
| | Battery Backup | Provided | — |
| | Backup Duration (see Note 6 on page E-40) | Unrestricted (saving to nonvolatile memory) | — |
| Insulation Performance | Insulation Withstand Voltage | DC 1,000 V (100 mA, 1 min) | |
| | Insulation Resistance | DC 500 V, 10 M Ω or more | |

**NOTE 1:** The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using. The RAID group capacity values displayed in the Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

**NOTE 2:** Data drive, P: Parity drive

**NOTE 3:** Although the storage system 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 or hardware/software of the storage system itself. Therefore, users are requested to back up all data for restoration in case where the original data is lost.

RAID 0+1 is described in place of RAID 1+0 in some places, however, it has the same meaning as RAID 1+0.

**NOTE 4:** The start-up time may be longer in proportion to the number of Drive Boxes connected. With a maximum configuration of 1 Controller Box and 20 Drive Boxes, start-up time is approximately 10 minutes.

**NOTE 5:** Value of maximum configuration (in the case where all the mountable drives and controller are mounted).

**NOTE 6:** Nonvolatile data in cache memory is protected against events such as power failures. To conserve battery power, cached data transfers to drives with power turned off.

When the storage system enters the Cache Backup mode, an orange LED indicates that battery voltage has dropped when the storage system is started. This indication shows that remaining battery capacity is not sufficient and, in this state, the storage system operates with the Write Cache function disabled automatically.

When the battery is charged, the warning indication disappears and the storage system operates with the Write Cache function enabled.

The warning indication disappears within six hours. When the warning is shown, normal operations can continue, even though Write-Through mode and Read/Write performance is lowered because the Write Cache function is disabled.

The battery is subject to environmental temperatures. Avoid using a battery continuously in an environment exposed to high temperatures.

If the storage system is not powered for more than six months, the battery can become over-discharged, resulting in unrecoverable damage to the battery. To avoid this situation, charge the battery more than three hours at least once six months.

# Electrical specifications

**Table E-12: Hitachi Unified Storage 110 electrical specifications**

| Item | | CBXSS/CBXSL | DBS/DBL |
|---|---|---|---|
| Input Power | Input voltage (Operable voltage range) (v) | AC 100-120/200-240 +6%/-11% | |
| | Frequency (Hz) | 50/60 ±1 | |
| | Number of phases, cabling | Single-phase with protective grounding | |
| | Steady-state current 100V/200V (A) (see Notes 1 and 2 on page E-41) | CBXSS: 4.1×2/2.1×2<br>CBXSL: 3.5×2/1.8×2 | DBS: 2.4×2/1.2×2<br>DBL: 1.9 2/1.0×2 |
| | Current rating of Breaker/ Fuse (A) | 16.0 | 16.0 |
| | Heat value (normal) (kJ/h) | CBXSS: 2,780 or less<br>CBXSL: 2,340 or less | DBS: 1,660 or less<br>DBL: 1,260 or less |
| | Steady-state power (VA/W) (see Note 3 on page E-41) | CBXSS: 820/770 or less<br>CBXSL: 700/650 or less | DBS: 480/460 or less<br>DBL: 380/350 or less |
| | Power consumption (VA/W) | CBXSS: 590/550 or less<br>CBXSL: 540/500 or less | DBS: 320/310 or less<br>DBL: 280/260 or less |

**NOTE 1:** The power current of Nx2 described in this table is required for operation by a single power unit.

**NOTE 2:** If one power unit fails, another power unit requires electric current for the two power units. Therefore, plan the power supply facility so the current carrying capacity of one power unit can provide a total capacity of the two power units.

**NOTE 3:** Power requirement for the maximum configuration is shown. Value at 100 V/200 V is shown. The actual required power may exceed the value shown in the table when the tolerance is included.

**Table E-13: Hitachi Unified Storage 130 electrical specifications**

| Item | | CBSS/CBSL | DBS/DBL/DBX/DBW |
|---|---|---|---|
| Input Power | Input voltage (Operable voltage range) (v) | AC 100-120/200-240 +6%/-11% | DBS/DBL/DBX: AC 100-120/200-240 +6%/-11%<br>DBW: AC 200-240 +6%/-11% |
| | Frequency (Hz) | 50/60 ±1 | |
| | Number of phases, cabling | Single-phase with protective grounding | |
| | Steady-state current 100V/200V (A) (see Notes 1 and 2 on page E-42) | CBSS: 4.1×2/2.1×2<br>CBSL: 3.5×2/1.8×2 | DBS: 2.4×2/1.2×2<br>DBL: 1.9×2/1.0×2<br>DBX: 3.7×4/1.9×4<br>DBW: -/8 2 |
| | Current rating of Breaker/ Fuse (A) | 16.0 | 16.0 |
| | Heat value (normal) (kJ/h) | CBSS: 2,780 or less<br>CBSL: 2,340 or less | DBS: 1,660 or less<br>DBL: 1,260 or less<br>DBX: 5,220 or less<br>DBW: 10,370 or less |
| | Steady-state power (VA/W) (see Note 3 on page E-42) | CBSS: 820/770 or less<br>CBSL: 700/650 or less | DBS: 480/460 or less<br>DBL: 380/350 or less<br>DBX: 1,480/1,450 or less<br>DBW: 3,200/2,880 or less |
| | Power consumption (VA/W) | CBSS: 620/580 or less<br>CBSL: 570/530 or less | DBS: 320/310 or less<br>DBL: 280/260 or less<br>DBX: 1,000/980 or less<br>DBW: 1,400/1,330 or less |

**NOTE 1:** The power current of Nx2 described in this table is required for operation by a single power unit.

**NOTE 2:** If one power unit fails, another power unit requires electric current for the two power units. Therefore, plan the power supply facility so the current carrying capacity of one power unit can provide a total capacity of the two power units.

**NOTE 3:** Power requirement for the maximum configuration is shown. Value at 100 V/200 V is shown. The actual required power may exceed the value shown in the table when the tolerance is included.

## Table E-14: Hitachi Unified Storage 150 electrical specifications - AC power supply model

| Item | | CBL/CBLE | DBS/DBL/DBF/DBX/DBW |
|---|---|---|---|
| Input Power | Input voltage (Operable voltage range) (v) | AC 100-120/200-240 +6%/-11% | DBS/DBL/DBF/DBX: AC 100-120/200-240 +6%/-11%<br>DBW: AC 200-240 +6%/-11% |
| | Frequency (Hz) | 50/60 ±1 | |
| | Number of phases, cabling | Single-phase with protective grounding | |
| | Steady-state current 100V/200V (A) (see Notes 1 and 2 on page E-43) | 2.5×2/1.3×2 | DBS: 2.4×2/1.2×2<br>DBL: 1.9×2/1.0×2<br>DBF: 2.6 x 2/1.3 x 2<br>DBX: 3.7×4/1.9×4<br>DBW: -/8x2 |
| | Current rating of Breaker/ Fuse (A) | 16.0 | 16.0 |
| | Heat value (normal) (kJ/h) | 1,620 or less | DBS: 1,660 or less<br>DBL: 1,260 or less<br>DBF: 1,700 or less<br>DBX: 5,220 or less<br>DBW: 10,370 or less |
| | Steady-state power (VA/W) (kJ/h) (see Note 3 on page E-43) | 500/450 or less | DBS: 480/460 or less<br>DBL: 380/350 or less<br>DBF: 520/470 or less<br>DBX: 1,480/1,450 or less<br>DBW: 3,200/2,880 or less |
| | Power consumption (VA/W) | 410/370 or less | DBS: 320/310 or less<br>DBL: 280/260 or less<br>DBF: 450/410 or less<br>DBX: 1,000/980 or less<br>DBW: 1,400/1,330 or less |

**NOTE 1:** The power current of Nx2 described in this table is required for operation by a single power unit.

**NOTE 2:** If one power unit fails, another power unit requires electric current for the two power units. Therefore, plan the power supply facility so the current carrying capacity of one power unit can provide a total capacity of the two power units. Power requirement for the maximum configuration is shown. Value at 100 V/200 V is shown. The actual required power may exceed the value shown in the table when the tolerance is included.

**NOTE 3:** Power requirement for a maximum configuration is shown. Value at 100 V/200 V is shown. The actual required power may exceed the value shown in the table when the tolerance is included.

**Table E-15: Hitachi Unified Storage 150 electrical specifications - DC power supply model**

| Item | | CBLD | DBSD/DBLD |
|---|---|---|---|
| Input Power | Input voltage (Operable voltage range) (v) | DC -48 to -60 (-40 to -72) | DC -48 to -60 (-40 to -72) |
| | Steady-state current (see Notes 1 and 2 on page E-44) | 4.7 x 2 | 4.8 x 2/3.7 x 2 |
| | Current rating of Breaker/ Fuse (A) | 16.0 | 16.0 |
| | Heat value (normal) (kJ/h) | 1,620 or less | DBSD: 1,660 or less<br>DBLD: 1,260 or less |
| | Steady-state power (VA/W) | 450/450 or less | DBSD: 480/460 or less<br>DBLD: 350/350 or less |
| | Power consumption (VA/W) | 370/370 or less | DBSD: 310/310 or less<br>DBLD: 260/260 or less |

**NOTE 1:** The power current of Nx2 described in this table is required for operation by a single power unit.

**NOTE 2:** If one power unit fails, another power unit requires electric current for the two power units. Therefore, plan the power supply facility so the current carrying capacity of one power unit can provide a total capacity of the two power units. Power requirement for the maximum configuration is shown. Value at -48 V is shown. The actual required power may exceed the value shown in the table when the tolerance is included.

# Environmental specifications

**Table E-16: Hitachi Unified Storage environmental specifications**

| Item | | CBXSS/CBXSL/CBSS/CBSL/CBL/CBLE/CBLD | DBS/DBSD/DBL/DBLD | DBX | DBW | DBF |
|---|---|---|---|---|---|---|
| Temperature | Operating | 50° to 104° F (10° to 40° C) (see Note 4) | | 50° to 95° F (10° to 35° C) | 41° to 95° F (5° to 35° C) | 50° to 104° F (10° to 40° C) |
| | Non-operating | 14° to 122° F (-10° to 50° C) | | | | -14° to 95° F (-10° to 35° C) |
| | Transport/Storage | -22° to 140° F (-30° to 60° C) | | | | -22° to 122° F (-30° to 50° C) |
| | Temperature change rate (°C/h) | 10 or less | | | | |
| Humidity | Operating | 8 to 80 (see Note 5) | | | | |
| | Non-operating | 8 to 90 (see Note 6) | | | | |
| | Maximum wet bulb temperature (°C) | 29 (non-condensing) | | | | |
| Vibration | Operating (m/s2) | 2.5 or less<br>Within 5 seconds (Resonance point:10Hz or less) | | | | |
| | Non-operating (m/s2) | 5.0 or less<br>Within 5 seconds (Resonance point:10Hz or less) | | | | |
| | Transport (packed) (m/s2) | 5.0 or less | | | | |
| Impact | Operating (m/s2) | 20 or less | | | | |
| | Non-operating (m/s2) | 50 or less | | | | |
| | Transport (packed) (m/s2) | 80 or less | | | | |
| Angle at which the storage system turns over | | 15 or less | | | | |
| Altitude | Operating (m) | -60 to 3,000<br>Ambient temperature: 50° to 104°F (10°C to 40°C)<br>See Note 7 | | | | |
| | Non-operating (m) | -60 to 12,000 | | | | |
| Atmosphere | | No corrosive gas and salty air must be found. | | | | |
| Acoustic Noise (dB) | | 60 (Environmental temperature 32°C or less). See Note 1. | | 65 (Environmental temperature 32°C or less). See Note 1. | 75 (Environmental temperature 32°C or less). See Notes 1 and 2. | 60 (Environmental temperature 32°C or less). See Note 1. |

**NOTE 1:** The system's internal temperature controls the rotating speed of the FAN Module. Therefore, this standard value might be exceeded if the maximum load continues under high-temperature environment or if a failure occurs in the system.

**NOTE 2:** For one DBW, 80 dB at the temperature of 32°C, the maximum level is 85 dB. Do not work on the DBW for a prolonged period of time.

**NOTE 3:** 79 dB (environmental temperature is 28°C or less) when DBW is mounted.

**NOTE 4:** NEBS specification: 10°C (14°F)-to-55°C (131° F).

**NOTE 5:** NEBS specification: 5% to 85%.

**NOTE 6:** NEBS specification: 5% to 100%.

**NOTE 7:** NEBS specification:
Above sea level: -60 m to 3000 m (ambient temperature: 5°C to 40°C)

# RAID specifications

**Table E-17: Hitachi Unified Storage 110 / Hitachi Unified Storage 130 RAID specifications**

| Item | | CBXSS/CBXSL/CBSS/CBSL | DBS/DBL/DBX/DBW (Note 1) (range for setup) |
|---|---|---|---|
| RAID Level | | SAS/SAS 7.2K rpm (see Note 2) /Flash drives mounted:0/ 1/5/6/1+0 | |
| RAID Configuration (unit of addition) | RAID 0 | 2D to 16D | |
| | RAID 1 | 1D+1D | |
| | RAID 5 | 2D+1P to 15D+1P | |
| | RAID 6 | 2D+2P to 28D+2P | |
| | RAID 1+0 | 2D+2D to 8D+8D | |

**Table E-18: Hitachi Unified Storage 150 RAID specifications**

| Item | | CBL/ CBLE/ CBLD (Note 3) | DBS/DBSD/DBL/DBLD/DBF/DBX/DBW (range for setup) |
|---|---|---|---|
| RAID Level | | — | SAS/SAS 7.2K rpm/Flash drives mounted:0/1/ 5/6/1+0 (DBW supports SAS7.2K drives) |
| RAID Configuration (unit of addition) | RAID 0 | — | 2D to 16D |
| | RAID 1 | — | 1D+1D |
| | RAID 5 | — | 2D+1P to 15D+1P |
| | RAID 6 | — | 2D+2P to 28D+2P |
| | RAID 1+0 | — | 2D+2D to 8D+8D |

**NOTE 1:** The DBW supports only Hitachi Unified Storage 130.

**NOTE 2:** The DBW supports only SAS7.2K drives.

**NOTE 3:** The CBLD can connect to a DBSD/DBLD only.

**NOTE 4:** The DBF does not support RAID 0.

# iSCSI specifications

**Table E-19: 1G iSCSI specifications**

| Item | Hitachi Unified Storage system | Comments |
|---|---|---|
| iSCSI Target Function: | Supported | |
| iSCSI Target Function: | Supported | TrueCopy or TrueCopy Extended only |
| iSCSI Ports: | 2 per interface board | Hitachi Unified Storage 110 and 130: 2 per controller (4 per storage system max.) |
| Host Connections: | 255 (maximum per iSCSI port) | With Linux software initiator, the maximum number will decrease. |
| Path Failover | HDLM (see Note 1 on page E-51) | Supports Microsoft MPIO (Multi Path IO). |
| Link: | 1000BASE-T | Only 1000BASE-T (full-duplex) is available to the directly connected port. |
| Transfer Speed: | 1 Gbps | |
| Connector Type: | RJ-45 | |
| Cable: | Category 5e or 6 (copper) | |
| Network Switch: | L2 or L3 switch | Should comply with IEEE802.3ae. |
| Switch Cascading: | Maximum: 5 or less recommended | Minimum number of cascading is recommended. |
| MAC Address: | Per port (fixed value) | Factory setting: World Wide Unique value. Cannot be changed. |
| Max Transfer Unit (MTU): | 1500/4500/9000 bytes (Ethernet frame) | Jumbo frame (MTU size greater than 1500) |
| Link Aggregation: | Not supported | |
| Tagged VLAN: | Supported | |
| IPv4: | Supported | |
| IPv6: | Supported | |
| Subnet Mask: | Supported | |
| Gateway Address: | Supported | |
| DHCP: | Not available | |
| DNS: | Not available | |
| Ping (ICMP ECHO) Transmit/Receive: | Supported | |
| IPsec (see Note 2 on page E-51) | Not available | |
| TCP Port Number: | 3260 | Changeable among 1 to 65,535. Observe the following if changing values:<br>• The setting of the corresponding host should be also changed to login the new port number.<br>• The new port number might conflict other network communication or be filtered on some network equipment, preventing the storage system from communicating through the new port number. |
| iSCSI Name: | Both iqn (see Note 3 on page E-51) and eui (see Note 4 on page E-51) types are supported | iqn value, which is World Wide Unique, is automatically set when a target is made. iSCSI name is configurable. |

**Table E-19: 1G iSCSI specifications (Continued)**

| Item | Hitachi Unified Storage system | Comments |
|---|---|---|
| Error Recovery Level: | 0 (zero) | Error recovery by retrying from host. Does not support Level 1, 2. |
| Header Digest: | Supported | Detects header error or data error with iSCSI communications. The Hitachi Unified Storage system follows the host's digest setting. If digest is enabled, the performance degrades. Amount of the degradation depends on factors such as host performance of host and transaction pattern. |
| Data Digest: | Supported | |
| Maximum iSCSI Connections at One TIme: | 255 per iSCSI port | |
| CHAP: | Supported | Authentication: login request is sent properly from host to storage. CHAP is not supported during discovery session. |
| Mutual (2-way) CHAP: | Supported (not available if connected to Linux software initiator) | Authentication: login request is sent properly from host to storage. |
| CHAP User Registration: | Max 512 users per iSCSI port | |
| iSNS | Supported | With iSNS (Name service), a host can discover a target without knowing the target's IP address. |

## Table E-20: 10G iSCSI Specifications

| Item | Hitachi Unified Storage system | Comments |
|---|---|---|
| iSCSI Target Function: | Supported | |
| iSCSI Target Function: | Supported | TrueCopy or TrueCopy Extended only |
| iSCSI Ports: | 2 per interface board | Hitachi Unified Storage 110, 130, and 150: 2 per controller (4 per storage system max.) |
| Host Connections: | 255 (maximum per iSCSI port) | |
| Path Failover | HDLM (see Note 1 on page E-51) | Supports Microsoft MPIO (Multi Path IO). |
| Link: | 10 Gbps SFP+ | |
| Transfer Speed: | 10 Gbps | |
| Connector Type: | LC | |
| Cable: | Optical OM3/OM2 MMF cable | |
| Network Switch: | L2 or L3 switch | Should comply with IEEE802.3ae. |
| Switch Cascading: | Maximum: 5 or less recommended | Minimum number of cascading is recommended. |
| MAC Address: | Per port (fixed value) | Factory setting: World Wide Unique value. Cannot be changed. |
| Max Transfer Unit (MTU): | 1500/4500/9000 bytes (Ethernet frame) | Jumbo frame (MTU size greater than 1500) |
| Link Aggregation: | Not supported | |
| Tagged VLAN: | Supported | |
| IPv4: | Supported | |
| IPv6: | Supported | |
| Subnet Mask: | Supported | |
| Gateway Address: | Supported | |
| DHCP: | Not available | |
| DNS: | Not available | |
| Ping (ICMP ECHO) Transmit/Receive: | Supported | |
| IPsec (see Note 2 on page E-51) | Not available | |
| TCP Port Number: | 3260 | Changeable among 1 to 65,535. Observe the following if changing values:<br>• The setting of the corresponding host should be also changed to login the new port number.<br>• The new port number might conflict other network communication or be filtered on some network equipment, preventing the storage system from communicating through the new port number. |
| iSCSI Name: | Both iqn (see Note 3 on page E-51) and eui (see Note 4 on page E-51) types are supported | iqn value, which is World Wide Unique, is automatically set when a target is made. iSCSI name is configurable. |
| Error Recovery Level: | 0 (zero) | Error recovery by retrying from host. Does not support Level 1, 2. |

**Table E-20: 10G iSCSI Specifications (Continued)**

| Item | Hitachi Unified Storage system | Comments |
|---|---|---|
| Header Digest: | Supported | Detects header error or data error with iSCSI communications. The Hitachi Unified Storage system follows the host's digest setting. If digest is enabled, the performance degrades. Amount of the degradation depends on factors such as host performance of host and transaction pattern. |
| Data Digest: | Supported | |
| Maximum iSCSI Connections at One TIme: | 255 per iSCSI port | |
| CHAP: | Supported | Authentication: login request is sent properly from host to storage. CHAP is not supported during discovery session. |
| Mutual (2-way) CHAP: | Supported (not available if connected to Linux software initiator) | Authentication: login request is sent properly from host to storage. |
| CHAP User Registration: | Max 512 users per iSCSI port | |
| iSNS | Supported | With iSNS (Name service), a host can discover a target without knowing the target's IP address. |

**NOTE 1:** JP1/HiCommand Dynamic Link Manager. Pass switching is achieved. Not supported on Microsoft Windows Vista and Windows 7 operating systems.

**NOTE 2:** IP Security. Authentication and encryption of IP packets. The storage system does not support IPsec.

**NOTE 3:** iqn: iSCSI Qualified Name. The iqn consists of a type identifier, "iqn", a date of domain acquisition, a domain name, and a character string given by a person who acquired the domain. Example: iqn.1994-04.jp.co.hitachi:rsd.d7m.t.10020.1b000.Tar

**NOTE 4:** eui: 64-bit Extended Unique Identifier. The eui consists of a type identifier, "eui", and an ASCII-coded hexadecimal EUI-64 identifier. Example: eui.0123456789abcdef

# iSCSI standards

The following standards apply to the management, maintenance, and iSCSI data ports. To configure this system, use switches that comply 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
- IEEE 802.3ae 10 Gigabit Ethernet (for 10 Gb iSCSI connections)
- 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

# Regulatory compliance

**Table E-21: Regulatory compliance**

| Standard | Specification | Mark on the product | Country regulation |
|---|---|---|---|
| Radio interference voluntary control | VCCI Class A (see Note) | VCCI | Japan |
| Limits for harmonic current emissions (see note 2 on page E-54) | JIS C61000-3-2 (see Note after table) | None | Japan |
| Electronic emission control | FCC Part15 Subpart B Class A | FCC | USA |
| Electronic emission control | ICES-003 Class A | ICES-003 | Canada |
| Electronic emission control | AS/NZS CISPR 22:2006 Class A | None | Australia |
| Electronic emissions certification | EN 55022:2006/A1:2007 | CE marking | EU |
| | EN 61000-3-2:2006/ A1:2009/A2:2009 | | |
| | EN 61000-3-3:2008 | | |
| | EN 55024:1998/A1:2001/ A2:2003 | | |
| | EN 61000-4-2:1995/ A1:1998/A2:2001 | | |
| | EN 61000-4-3:2006 | | |
| | EN 61000-4-4:1995/ A1:2000/A2:2001 | | |
| | EN 61000-4-5:1995A1:2001 | | |
| | EN 61000-4-6:1996/ A1:2001 | | |
| | EN 61000-4-8:1993/ A1:2001 | | |
| | EN 61000-4-11:1994/ A1:2001 | | |
| Electronic emission control | CNS 13438 (95) Class A | BSMI | Taiwan |
| | CNS 14336-1 (99) | | |
| Electronic emission control | KN22 | KCC | Korea |
| | KN24 | | |
| Safety certification | UL 60950-1: 2007 | TUV | EU / USA |
| | CAN/CSA-C22.2 No.60950-1-07 | | |
| Safety certification | EN 60950-1:2006/A11:2009 | GS (see note 2 on page E-54) | EU |

**Table E-21: Regulatory compliance (Continued)**

| Standard | Specification | Mark on the product | Country regulation |
|---|---|---|---|
| Safety certification | GOST R60950-1-2009 | GOST | Russia |
| | GOST R51318.22-99 | | |
| | GOST R51318.24-99 | | |
| | GOST R51317.3.2-2006 | | |
| | GOST R51317.3.3-2008 | | |
| | TP TC 004/2011 | Yes (EAC) | Russia, Kazakhstan, Belarus |
| | TP TC 020/2011 | | |
| Safety certification | IEC 60950-1:2005 | IRAM | Argentina |
| NEBS Level 3 | GR-63-CORE Issue 4 | None | U.S.A |
| | GR-1089-CORE Issue 6 | | |

**NOTE 1:** The DBW Drive Box does not support this standard.

**NOTE 2:** DBW Drive Box: none

# DBX connection restrictions

When considering the number of mounted Drive Boxes, see Table 1-13 on page 1-11 and Table 1-14 on page 1-12.

For CBL/CBLE Controller Boxes, if a drive is inserted into a slot when the installed number of drives exceeds 240 slots per path, the drive will be blocked. Therefore, do not exceed 240 slots per path.

# DBW connection restrictions

When considering the number of mounted Drive Boxes, see Table 1-13 on page 1-11 and Table 1-14 on page 1-12.

The number of Drive Boxes connected in the same path below a DBW is limited to within two. Therefore, the number of installable Drive Boxes supported after installing the DBW is within 11 for a CBL/CBLE and five for a CBSS/CBSL.

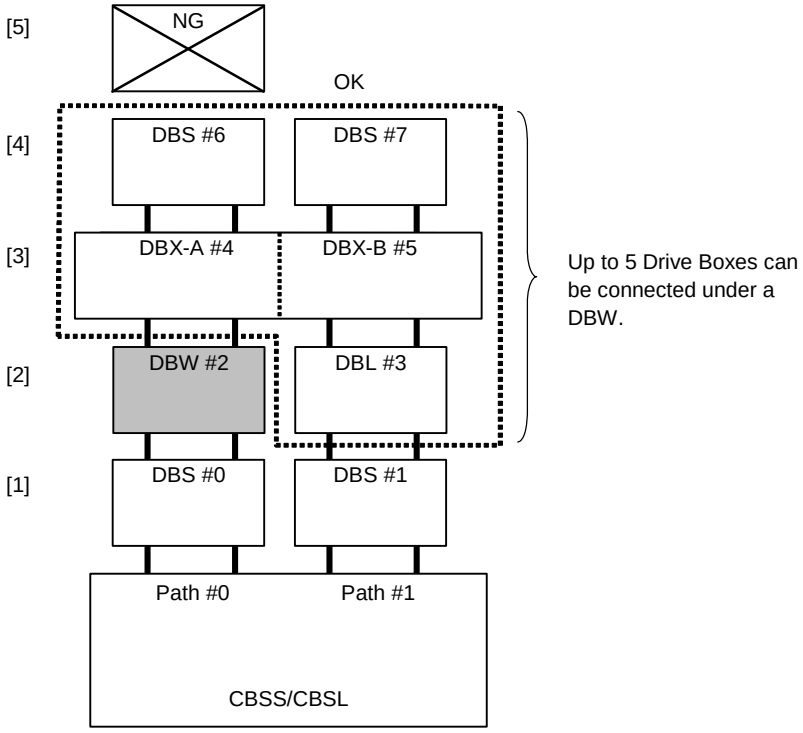



**Figure E-1: Restriction on a DBW connection configuration (CBSS/CBSL)**

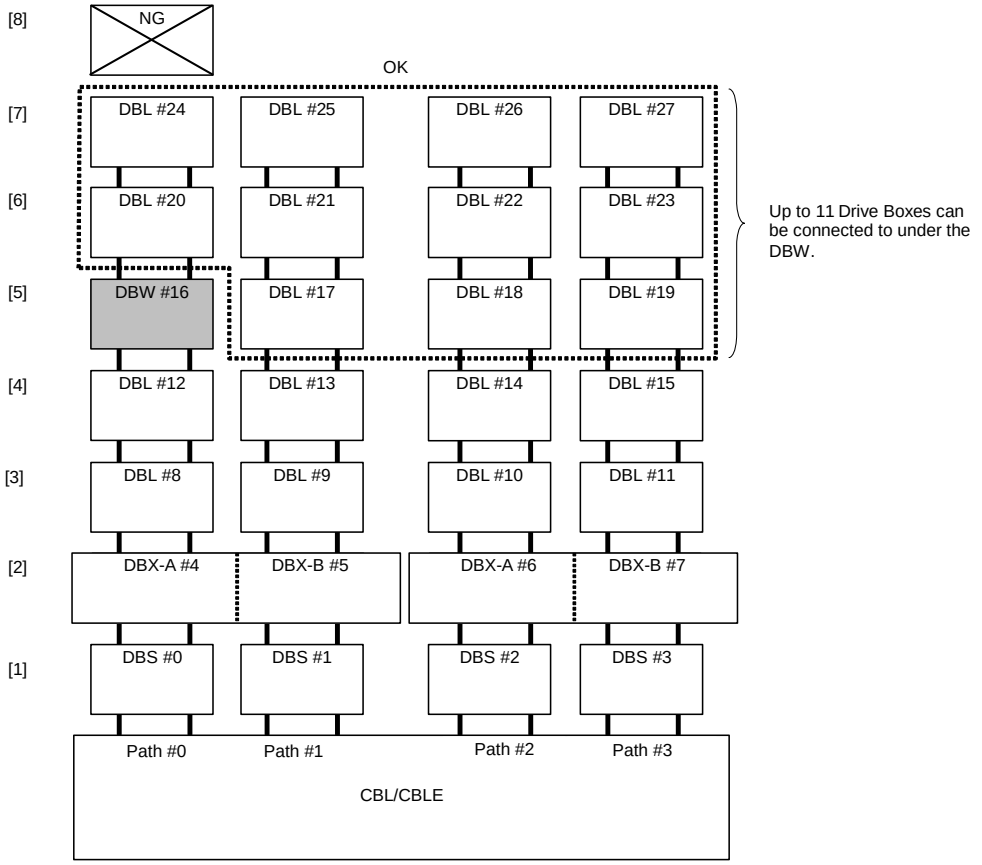



**Figure E-2: Restriction on a DBW connection configuration (CBL/CBLE)**

# Storage capacities and corresponding RAID levels

The following tables show the capacity for drives supported by Hitachi Unified Storage. The values shown correspond to the capacity of one RAID group. When calculating usage capacity, use *n* times based on the number of drives.

Example: RAID5 (2D + 1P) when configured with 6 drives

The capacity of (2D+1P) in RAID5 x *n* (*n* = 2)

Drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different than the one calculated as 1 k byte =1,024 bytes, which are actually displayed on personal computers. The RAID group capacity values displayed in Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

In these tables:

- D = data drive
- P = parity drive

DBF does not support RAID 0.

**Table E-22: Storage capacities and corresponding RAID levels (RAID 0)**

| RAID 0 | Drives | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SAS | | | | SAS7.2K | | | Flash | | |
| | 300 GB | 600 GB | 900 GB | 1200 GB | 2000 GB | 3000 GB | 4000 GB | 200 GB | 400 GB | 1600 GB |
| 2D | 575.1 | 1150.4 | 1759.8 | 2347.2 | 3913.7 | 5871.7 | 7829.8 | 391.5 | 785.3 | — |
| 3D | 826.6 | 1725.7 | 2639.7 | 3520.9 | 5870.6 | 8807.6 | 11744.8 | 587.2 | 1178 | — |
| 4D | 1150.2 | 2300.9 | 3519.6 | 4694.5 | 7827.5 | 11743.5 | 15659.7 | 783 | 1570.6 | — |
| 5D | 1437.8 | 2876.1 | 4399.5 | 5868.2 | 9784.3 | 14679.4 | 19574.7 | 978.7 | 1963.3 | — |
| 6D | 1725.3 | 3451.4 | 5279.4 | 7041.8 | 11741.2 | 17615.3 | 23489.6 | 1174.5 | 2356 | — |
| 7D | 2012.9 | 4026.6 | 6159.3 | 8215.5 | 13698.1 | 20551.2 | 27404.6 | 1370.2 | 2748.6 | — |
| 8D | 2300.4 | 4601.8 | 7039.3 | 9389.1 | 15655 | 23487.1 | 31319.5 | 1566 | 3141.3 | — |
| 9D | 2588 | 5177.1 | 7919.2 | 10562.8 | 17611.8 | 26423 | 35234.5 | 1761.7 | 3534 | — |
| 10D | 2875.6 | 5752.3 | 8799.1 | 11736.4 | 19568.7 | 29358.9 | 39149.4 | 1957.5 | 3926.6 | — |
| 11D | 3163.1 | 6327.5 | 9679 | 12910.1 | 21525.6 | 32294.8 | 43064.4 | 2153.2 | 4319.3 | — |
| 12D | 3450.7 | 6902.8 | 10558.9 | 14083.7 | 23482.5 | 35230.7 | 46979.3 | 2349 | 4712 | — |
| 13D | 3738.2 | 7478 | 11438.8 | 15257.4 | 25439.3 | 38166.6 | 50894.2 | 2544.8 | 5104.7 | — |
| 14D | 4025.8 | 8053.2 | 12318.7 | 16431.0 | 27396.2 | 41102.5 | 54809.2 | 2740.5 | 5497.3 | — |
| 15D | 4313.4 | 8628.5 | 13198.7 | 17604.7 | 29353.1 | 44038.4 | 58724.1 | 2936.3 | 5890 | — |
| 16D | 4600.9 | 9203.7 | 14078.6 | 18778.3 | 31310 | 46974.3 | 62639.1 | 3132 | 6282.7 | — |

## Table E-23: Storage capacities and corresponding RAID levels (RAID 1)

| RAID 1 | Drives | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SAS | | | | SAS7.2K | | | Flash | | |
| | 300 GB | 600 GB | 900 GB | 1200 GB | 2000 GB | 3000 GB | 4000 GB | 200 GB | 400 GB | 1600 GB |
| 1D +1D | 287.5 | 575.2 | 879.9 | 1173.6 | 1956.8 | 2935.8 | 3914.9 | 195.7 | 392.6 | 1,758.0 |

## Table E-24: Storage capacities and corresponding RAID levels (RAID 5)

| RAID 5 | Drives | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SAS | | | | SAS7.2K | | | Flash | | |
| | 300 GB | 600 GB | 900 GB | 1200 GB | 2000 GB | 3000 GB | 4000 GB | 200 GB | 400 GB | 1600 GB |
| 2D +1P | 575.1 | 1150.4 | 1759.8 | 2347.2 | 3913.7 | 5871.7 | 7829.8 | 391.5 | 785.3 | 3,5161.1 |
| 3D+1P | 862.6 | 1725.7 | 2639.7 | 3520.9 | 5870.6 | 8807.6 | 11744.8 | 587.2 | 1178 | 5,274.1 |
| 4D+1P | 1150.2 | 2300.9 | 3519.6 | 4694.5 | 7827.5 | 11743.5 | 15659.7 | 783 | 1570.6 | 7,032.2 |
| 5D+1P | 1437.8 | 2876.1 | 4399.5 | 5682.2 | 9784.3 | 14679.4 | 19574.7 | 978.7 | 1963.3 | 8,790.2 |
| 6D+1P | 1725.3 | 3451.4 | 5279.4 | 7041.8 | 11741.2 | 17615.3 | 23489.6 | 1174.5 | 2356 | 10,548.3 |
| 7D+1P | 2012.9 | 4026.6 | 6159.3 | 8215.5 | 13698.1 | 20551.2 | 27404.6 | 1370.2 | 2748.6 | 12,306.4 |
| 8D+1P | 2300.4 | 4601.8 | 7039.3 | 9389.1 | 15655 | 23487.1 | 31319.5 | 1566 | 3141.3 | 14,064.4 |
| 9D+1P | 2588 | 5177.1 | 7919.2 | 10562.8 | 17611.8 | 26423 | 35234.5 | 1761.7 | 3534 | 15.822.5 |
| 10D+1P | 2875.6 | 5752.3 | 8799.1 | 11736.4 | 19568.7 | 29389.9 | 39149.4 | 1957.5 | 3926.6 | 17,580.5 |
| 11D+1P | 3163.1 | 6327.5 | 9679 | 12910.1 | 21525.6 | 32294.8 | 43064.4 | 2153.2 | 4319.3 | 19,338.6 |
| 12D+1P | 3450.7 | 6902.8 | 10558.9 | 14083.7 | 23482.5 | 35230.7 | 46979.3 | 2349 | 4712 | 21,096.6 |
| 13D+1P | 3738.2 | 7478 | 11438.8 | 15257.4 | 25439.3 | 38166.6 | 50894.2 | 2544.8 | 5104.7 | 22,854.7 |
| 14D+1P | 4025.8 | 8053.2 | 12318.7 | 16431.0 | 27396.2 | 41102.5 | 54809.2 | 2740.5 | 5497.3 | 24,612.8 |
| 15D+1P | 4313.4 | 8628.5 | 13198.7 | 17604.7 | 29353.1 | 44038.4 | 58724.1 | 2936.3 | 5890 | 26,370.8 |

## Table E-25: Storage capacities and corresponding RAID levels (RAID 6)

| RAID 6 | Drives | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SAS | | | | SAS7.2K | | | Flash | | |
| | 300 GB | 600 GB | 900 GB | 1200 GB | 2000 GB | 3000 GB | 4000 GB | 200 GB | 400 GB | 1600 GB |
| 2D +2P | 575.1 | 1150.4 | 1759.8 | 2347.2 | 3913.7 | 5817.7 | 7829.8 | 391.5 | 785.3 | 3516.1 |
| 3D+2P | 862.6 | 1725.7 | 2639.7 | 3520.9 | 5870.6 | 8807.6 | 11744.8 | 587.2 | 1178 | 5274.1 |
| 4D+2P | 1150.2 | 2300.9 | 3519.6 | 4694.5 | 7827.5 | 11743.5 | 15659.7 | 783 | 1570.6 | 7,032.2 |
| 5D+2P | 1437.8 | 2876.1 | 4399.5 | 5868.2 | 9784.3 | 14679.4 | 15659.7 | 783 | 1570.6 | 8,790.2 |
| 6D+2P | 1725.3 | 3451.4 | 5279.4 | 7041.8 | 11741.2 | 17615.3 | 23489.6 | 1174.5 | 2356 | 10,548.3 |
| 7D+2P | 2012.9 | 4026.6 | 6159.3 | 8215.5 | 13698.1 | 20551.2 | 27404.6 | 1370.2 | 2748.6 | 12,306.4 |

## Table E-25: Storage capacities and corresponding RAID levels (RAID 6) (Continued)

| RAID 6 | Drives | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SAS | | | | SAS7.2K | | | Flash | | |
| | 300 GB | 600 GB | 900 GB | 1200 GB | 2000 GB | 3000 GB | 4000 GB | 200 GB | 400 GB | 1600 GB |
| 8D+2P | 2300.4 | 4601.8 | 7039.3 | 9389.1 | 15655 | 23487.1 | 31319.5 | 1566 | 3141.3 | 14,064.4 |
| 9D+2P | 2588 | 5177.1 | 7919.2 | 10562.8 | 17611.8 | 26423 | 35234.5 | 1761.7 | 3534 | 15,822.5 |
| 10D+2P | 2875.6 | 5752.3 | 8799.1 | 11736.4 | 19568.7 | 29357.9 | 39149.4 | 1957.5 | 3926.6 | 17,580.5 |
| 11D+2P | 3163.1 | 6327.5 | 9679 | 12910.1 | 21525.6 | 32294.8 | 43064.4 | 2153.2 | 4319.3 | 19,338.6 |
| 12D+2P | 3450.7 | 6902.8 | 10558.9 | 14083.7 | 23482.5 | 35230.7 | 46979.3 | 2349 | 4712 | 21,096.6 |
| 13D+2P | 3738.2 | 7478 | 11438.8 | 15257.4 | 25439.3 | 38166.6 | 50894.2 | 2544.8 | 5104.7 | 22,854.7 |
| 14D+2P | 4025.8 | 8053.2 | 12318.7 | 15431.0 | 27396.2 | 41102.5 | 54809.2 | 2740.5 | 5497.3 | 24,612.8 |
| 15D+2P | 4313.4 | 8268.5 | 13198.7 | 17604.7 | 29353.1 | 44038.4 | 58724.1 | 2936.3 | 5890 | 26,370.8 |
| 16D+2P | 4600.9 | 9203.7 | 14078.6 | 18778.3 | 31310 | 46974.3 | 62639.1 | 3132 | 6282.7 | 28,128.9 |
| 17D+2P | 4888.5 | 9778.9 | 14958.5 | 19952.0 | 33266.9 | 49910.2 | 66554 | 3327.8 | 6675.3 | 29,886.9 |
| 18D+2P | 5176 | 10354.2 | 15838.4 | 21125.6 | 35223.7 | 52846 | 70469 | 3523.5 | 7068 | 31,645.0 |
| 19D+2P | 5436.6 | 10929.2 | 16718.3 | 22299.3 | 37180.6 | 55781.9 | 74383.9 | 3719.3 | 7460.7 | 33,403.1 |
| 20D+2P | 5751.2 | 11504.6 | 17598.2 | 23472.9 | 39137.5 | 58717.8 | 78298.9 | 3915 | 7853.3 | 36,161.1 |
| 21D+2P | 6038.7 | 12079.9 | 18478.1 | 24646.6 | 41094.4 | 61653.7 | 82213.8 | 4110.8 | 8246 | 36,919.2 |
| 22D+2P | 6326.3 | 12655.1 | 19358 | 25820.2 | 43015.2 | 64589.6 | 86128.8 | 4306.5 | 8638.7 | 38,677.2 |
| 23D+2P | 6613.8 | 13230.3 | 20238 | 26993.9 | 45008.1 | 67525.5 | 90043.7 | 4502.3 | 9031.4 | 40,435.3 |
| 24D+2P | 6901.4 | 13805.6 | 21117.9 | 28167.5 | 46965 | 70461.4 | 93958.6 | 4698.1 | 9424 | 42,193.3 |
| 25D+2P | 7189 | 14380.8 | 21997.8 | 29341.2 | 48921.9 | 73397.3 | 97873.6 | 4893.8 | 9816.7 | 43,951.4 |
| 26D+2P | 7476.5 | 14956 | 22877.7 | 30514.8 | 50878.7 | 76333.2 | 101788.5 | 5089.6 | 10209.4 | 45,709.5 |
| 27D+2P | 7764.1 | 15531.3 | 23757.6 | 31688.5 | 52835.6 | 79269.1 | 105703.5 | 5285.3 | 10602 | 47,467.5 |
| 28D+2P | 8051.6 | 16106.5 | 24637.5 | 32862.1 | 54792.5 | 82205 | 109168.4 | 5481.1 | 10994.7 | 49,225.6 |

## Table E-26: Storage capacities and corresponding RAID levels (RAID 1+0)

| RAID 1+0 | Drives | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SAS | | | | SAS7.2K | | | Flash | | |
| | 300 GB | 600 GB | 900 GB | 1200 GB | 2000 GB | 3000 GB | 4000 GB | 200 GB | 400 GB | 1600 GB |
| 2D+2D | 575.1 | 1150.4 | 1759.8 | 2347.2 | 3913.7 | 5871.7 | 7829.8 | 391.5 | 785.3 | 3516.1 |
| 3D+3D | 862.6 | 1725.7 | 2639.7 | 3520.9 | 5870.6 | 8807.6 | 11744.8 | 587.2 | 1178 | 5,274.1 |
| 4D+4D | 1150.2 | 2300.9 | 3519.6 | 4694.5 | 7827.5 | 11743.5 | 15659.7 | 783 | 1570.6 | 7,032.2 |
| 5D+5D | 1437.8 | 2786.1 | 4399.5 | 5868.2 | 9784.3 | 14679.4 | 19574.7 | 978.7 | 1963.3 | 8,790.2 |
| 6D+6D | 1725.3 | 3451.4 | 5279.4 | 7041.8 | 11741.2 | 17615.3 | 23489.6 | 1174.5 | 2356 | 10,548.3 |
| 7D+7D | 2012.9 | 4026.6 | 6159.3 | 8215.5 | 13698.1 | 20551.2 | 27404.6 | 1370.2 | 2748.6 | 12,306.4 |
| 8D+8D | 2300.4 | 4601.8 | 7039.3 | 9389.1 | 15655 | 23487.1 | 31319.5 | 1566 | 3141.3 | 14,064.4 |

# Data and power cables

This appendix describes the data and power cables used with Hitachi Unified Storage systems.

This appendix covers the following topics:

- Fibre Channel cables
- iSCSI cables
- AC power cables
- DC power cable

# Fibre Channel cables

Fibre Channel connections deliver high-speed serial data transfers. To ensure optimum performance, use high-quality Fibre Channel cables that conform to the FC-PH standard.

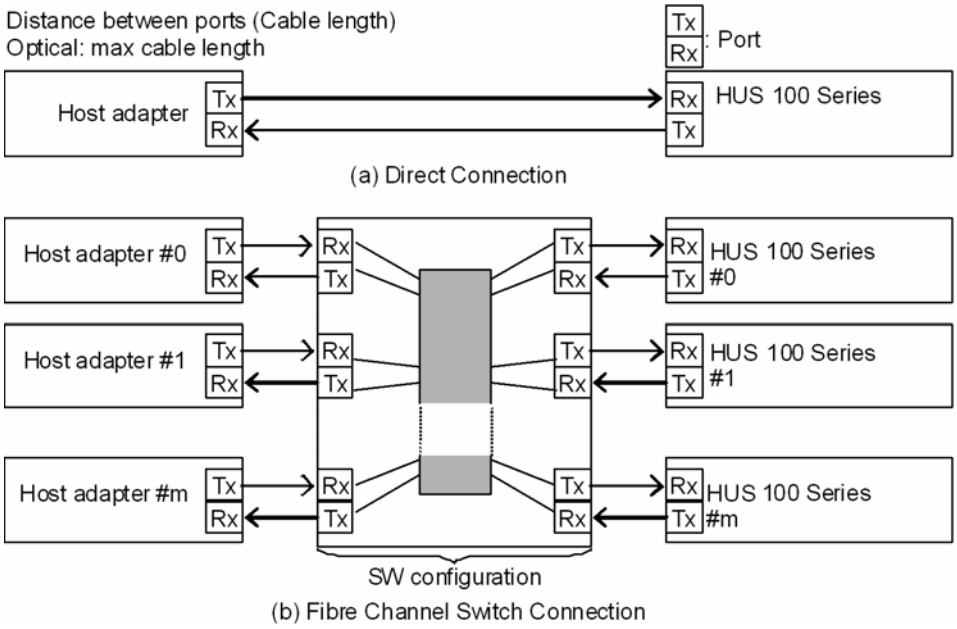



**Table F-1: Fibre Channel cable distances**

| Data transfer rate (MB/s) | Distance from host | | | |
|---|---|---|---|---|
| | 100 | 200 | 400 | 800 |
| Max 62.5/125 µm multimode Fibre (OM1) cable length | 984.25 ft (300 m) | 493 ft (150 m) | 229.6 ft (70 m) | 68.9 ft (21 m) |
| Max 50/125 µm multimode Fibre (OM2) cable length | 1640.4 ft (500 m) | 984.25 ft (300 m) | 493 ft (150 m) | 164 ft (50 m) |
| Max 50/125 µm multimode Fibre (OM3) cable length | 2821.5 ft (860 m) | 1640.4 ft (500 m) | 1246.7 ft (380 m) | 493 ft (150 m) |

Table F-2 lists specifications of the Fibre Channel interface cable. Figure F-1 on page F-3 shows the connector used for optical interfaces.

**Table F-2: Fibre Channel cable specifications**

| Cable type | Interface | 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 Wavelength: 850 nm | SC connector (JIS C 5973) | LC connector |
| LC-LC cable | | | | LC connector | LC connector |

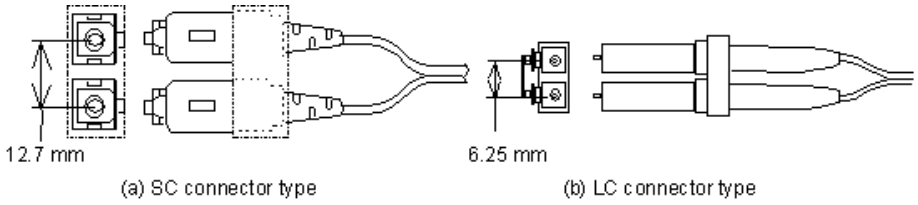



**Figure F-1: Fibre Channel connector (cable side shown)**

Figure F-2 shows the type of optical connector that connects to Hitachi Unified Storage Fibre Channel ports.

- LC connector type
- Connector type: LC duplex receptacle connector
- Interval: 6.25 mm flat type, two rows

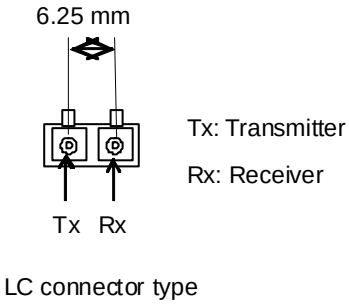



**Figure F-2: Fibre Channel connector (storage system end shown)**

# iSCSI cables

## 1 Gb iSCSI cable

Table F-3 lists 1 Gb iSCSI cable specifications.

**Table F-3: Cable specifications for 1 Gb iSCSI interface**

| Cable Type | Transmission band | Cable | Connector |
|---|---|---|---|
| Category 6 | 1000BASE-TX | STP<br>You must use STP cables to suppress radio noise. | RJ-45 |

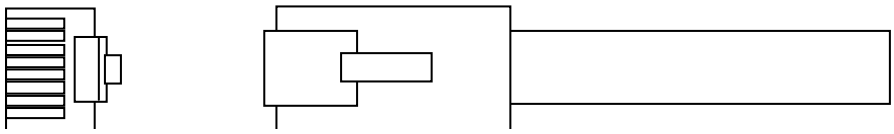


**Figure F-3: 1 Gb iSCSI cable**

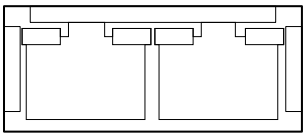


**Figure F-4: 1 Gb iSCSI cable interface connector**

- Connector type for 10 G bps iSCSI interface on the storage system side
- LC connector type
- Connector type: LC duplex receptacle connector
- Interval: 6.25 mm flat type, two rows

## 10 Gb iSCSI cable

Table F-4 lists 10 Gb iSCSI cable specifications.

**Table F-4: Cable specifications for 10 Gb iSCSI interface**

| Cable type | Interface | Cable mode | 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 Wavelength: 850 nm | SC connector (JIS C 5973) | LC connector |
| LC-LC cable | | | | LC connector | LC connector |

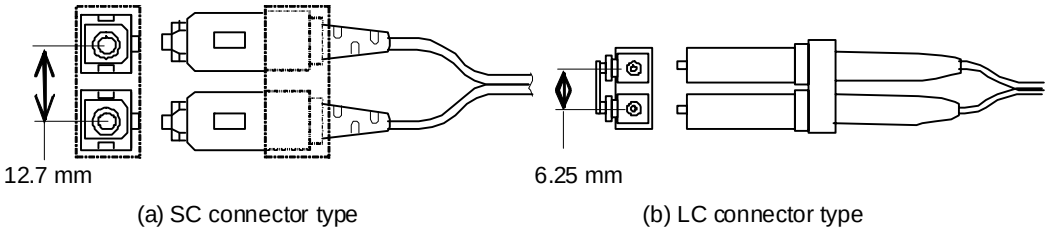



**Figure F-5: 10 Gb iSCSI cable**

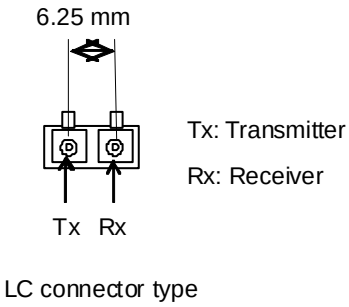



**Figure F-6: 10 Gb iSCSI cable interface connector**

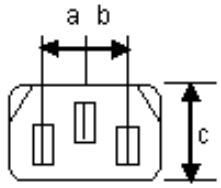
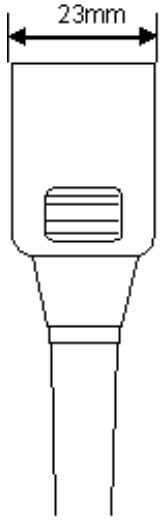
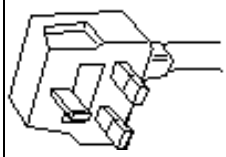
# AC power cables

AC power cables should be used that meet the safety requirements of countries where the monitor is used. This section describes common power cables.

When purchasing AC power cables, be sure they have the proper rating and meet the country's safety requirement. Otherwise, an electric shock or machine failure can occur.

- ANSI: American National Standards Institute
- NEMA: National Electrical Manufacture's Association
- IEC: International Electrotechnical Commission
- CEE: International Commission on Rules for the Approval of Electrical Equipment
- BS: British Standard Institution
- AS: Standards Association of Australia

**Table F-5: Power cable and plug identification**

| Input rating | Plug configuration | Reference standards | Cable and connector |
|---|---|---|---|
| 100V-120V (standard attachment) | North America | 1 ANSI C73.11<br>2 NEMA 5-15P<br>3 IEC 83 |  <br>a=7± 0.05mm<br>b=7± 0.05mm<br>c=15.8mm<br>Three-wire power cable with a two-pole, three-terminal grounding-type connector.<br>  |
| 200V-240V | North America | 1 ANSI C73.11<br>2 NEMA 6-15P<br>3 IEC 83 | |
| | Universal Euro | 4 CEE (7)<br>II, IV, VII<br>3 IEC 83 | |
| |  United Kingdom | 5 BS 1365<br>3 IEC 83 | |
| | Australia | 6 AS C112 | |

# DC power cable

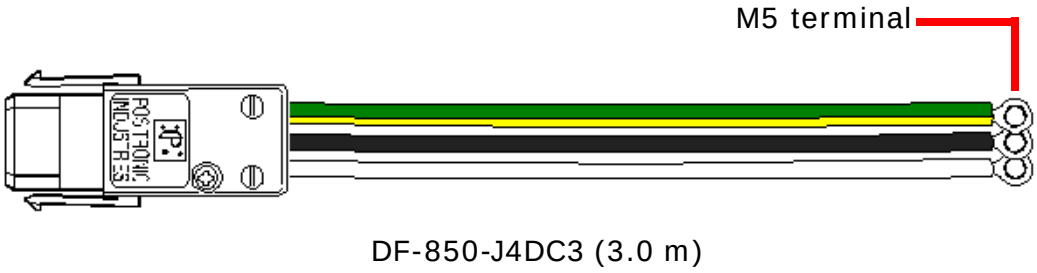



**Figure F-7: DC cable termination at the storage system**

G

# Port address mapping

For the port address (AL_PA) of each Fibre Channel port of the Hitachi Unified Storage, “EF” is set (see Setting Fibre Channel Information on page 6-19). You do not have to change the AL_PA because the storage array port can connect to the host bus adapter (HBA) with the current setting.

To change the AL_PA, select the value described in the following table.

When setting a value not described in the following table, or when setting a value already used by the HBA, the host might not be able to recognize the VOL. If this problem or other problems occur, restore the value to the default value of “EF.”

**Table G-1: Port addressing**

| AL_PA | | | | | | | |
|---|---|---|---|---|---|---|---|
| EF (Note) | CD | B2 | 98 | 72 | 55 | 3A | 25 |
| E8 | CC | B1 | 67 | 7 | 64 | 39 | 23 |
| E4 | CB | AE | 90 | 6E | 53 | 36 | 1F |
| E2 | CA | AD | 8F | 6D | 52 | 35 | 1E |
| E1 | C9 | AC | 88 | 6C | 51 | 34 | 1D |
| E0 | C7 | AB | 84 | 6B | 4E | 33 | 1B |
| DC | C6 | AA | 82 | 6A | 4D | 32 | 18 |
| DA | C5 | A9 | 81 | 69 | 4C | 31 | 17 |
| D9 | C3 | A7 | 80 | 67 | 4B | 2E | 10 |
| D6 | BC | A6 | 7C | 66 | 4A | 2D | 0F |
| D5 | BA | A5 | 7A | 65 | 49 | 2C | 08 |
| D4 | B9 | A3 | 79 | 63 | 47 | 2B | 04 |
| D3 | B6 | 9F | 76 | 5C | 46 | 2A | 02 |
| D2 | B5 | 9E | 75 | 5A | 45 | 29 | 01 |
| D1 | B4 | 9D | 74 | 59 | 43 | 27 | |
| CE | B3 | 9B | 73 | 56 | 3C | 26 | |

**NOTE:** A value set as the default value.

# Using the BECK tool

This appendix describes how to use the Backend Configuration Kit (BECK) tool. The BECK tool is a graphic application for checking cabling among paths of Controller and Drive Boxes for initial and existing configurations. The BECK tool is supplied on the Hitachi Storage Navigator Modular 2 DVD. The following topics are covered in this appendix:

- System requirements
- Supported Drive Boxes
- Installing the BECK tool
- Starting the BECK tool
- BECK tool configuration screen
- Creating new configurations
- Editing the logical configuration figure
- Editing the physical configuration figure
- Configuration with 360HDD OFF/ON
- Working with cable figures
- Hitachi Unified Storage 110 with single or dual controller
- Expanding a configuration
- Saving and loading a configuration file
- BECK tool messages
- Special guidelines

# System requirements

To use the BECK tool, confirm the following system requirements.

**Table H-1: BECK tool system requirements**

| Item | Description |
|---|---|
| Operating System | Microsoft Windows XP (x86), Windows Vista (x86), or Windows 7 (x86) |
| Available Disk Space | 5 M or more for installation.<br>At least 100 M if the simple trace function will be used. |
| Memory | 1 G or more is recommended.<br>We recommend you close memory-intensive programs before using the BECK tool. |
| Related File | To use the simple trace function, place the file `UNLHA32.DLL` in the Windows system folder. |
| Screen Resolution | 1280 x 700 DPI (96 DPI or less is recommended).<br>For Windows XP (x86) English version, the screen resolution of 1280x1024 or more is recommended. |

# Supported Drive Boxes

Table H-2 lists the Drive Boxes supported by the BECK tool. for the various Controller Boxes.

**Table H-2: Supported Drive Boxes**

| Hitachi Unified Storage Model | | Drive count in Controller Box | Unit size (U) | Path | Max Drive Box Connection | | | | | Max. drive count (Note 1) | Max. drive count per path |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | DBL | DBS | DBX | DBW | DBF | | |
| 110 | 2.5-inch | 24 | 2 | 1 | 8 | 4 | — | — | — | 120 | 120 |
| | 3.5-inch | 12 | 2 | 1 | 9 | 4 (5 Note 7) | — | — | — | 120 | 120 |
| 130 (360 HDD OFF Note 5) | 2.5-inch | 24 | 2 | 2 | 17 | 9 | 5 | — | — | 240 Note2 (264 Note3) | 120 (144 Note4) |
| | 3.5-inch | 12 | 2 | 2 | 19 | 9 | 5 | — | — | 240 (252 Note3) | 120 (132 Note4) |
| 130 (360 HDD ON Note 6) | 2.5-inch | 24 | 2 | 2 | 19 | 14 | 7 | 4 | — | 360 | 240 |
| | 3.5-inch | 12 | 2 | 2 | 19 | 14 (15 Note 7) | 7 | 4 | 4 | 360 | 240 |
| 150 | | — | 3 | 4 | 40 | 40 | 20 | 12 (Note 8) | 40 | 960 | 240 252 (Note 9) |

**NOTE 1:** Maximum drive count may be limited, depending on the mounting pattern that is followed when DBL, DBS, DBX, or DBF Drive Boxes are used together.

**NOTE 2:** A maximum of 240 drives are supported. Because a path supports 120 drives, some Drive Box configurations might reduce the maximum number of drives that can be supported in some installations.

**NOTE 3:** Five DBX Drive Boxes (only DBXs are used).

**NOTE 4:** When only DBX Drive Boxes are used, Hitachi Unified Storage 130 systems can connect to a maximum of 144 2.5-inch drives per path and 132 3.5-inch drive per path.

**NOTE 5:** These value apply to a storage system when **360 HDD OFF** is selected in the configuration screen for the Hitachi Unified Storage 130 system. In this case, the storage system firmware version is assumed to be earlier than 0937/A (see Configuration with 360HDD OFF/ON on page H-51).

**NOTE 6:** These values apply to a storage system when **360 HDD ON** is selected in the configuration screen for the Hitachi Unified Storage 130 system. In this case, the storage system firmware version is assumed to be 0937/A or later (see Configuration with 360HDD OFF/ON on page H-51).

**NOTE 7:** A Drive Box that is added last appears in yellow. Some of the slots that have larger drive numbers cannot be used by the **Over** value. For this reason, we recommend you do not add the box (see Yellow box in the configuration screen on page H-104).

**NOTE 8:** If 12 DBW Drive Boxes are connected to the Hitachi Unified Storage 150, the total number of drive slots becomes 1008, exceeding the maximum number of 960 drives to be connected when the 12th DBW is added. This causes the 12th DBW to appear yellow (see Yellow box in the configuration screen on page H-104).

**NOTE 9:** For a Hitachi Unified Storage 150, up to 252 drives can be connected per path only if 3 DBW Drive Boxes are connected in 1 path.

**Table H-3: Drive Box specifications**

| Model | Drive count | Unit size [U] | Path |
|---|---|---|---|
| DBL | 12 | 2U | 1 |
| DBS | 24 | 2U | 1 |
| DBX (Note 1) | 48 | 4U | 2 (Note 2) |
| DBW (Note 3) | 84 | 5U | 1 |
| DBF | 12 | 2 | 1 |

**NOTE 1:** DBX is considered one unit comprising unit A (24 drives) and unit B (24 drives).

**NOTE 2:** Unit A and unit B use one path, respectively.

**NOTE 3:** The number of installable drive boxes after installing a DBW is within 11 for the Hitachi Unified Storage 150 and 5 for the Hitachi Unified Storage 130 (360HDD is ON).
If DBW is connected to the storage system, the number of Drive Boxes that can be added is limited as follows:
- Hitachi Unified Storage 150: 11
- Hitachi Unified Storage 130: 5

If a DBW is connected to Hitachi Unified Storage 130 (360HDD ON) the following limitations also apply:
- If one DBW is connected to a path, the number of non-DBW Drive Boxes must be six or less in the path where the DBW is connected.
- If two DBWs are connected to a path, the number of non-DBW Drive Boxes must be two or less in the path where the DBWs are connected.

**Table H-4: DBW connection limitation to a path in a Hitachi Unified Storage 130 (360HDD ON)**

| Number of DBW Drive Boxes | Maximum number of non-DBW Drive Boxes to be added |
|---|---|
| 0 | 10 |
| 1 | 6 |
| 2 | 2 |

# Installing the BECK tool

To install the BECK tool.

1. In a new (empty) folder, place the file BECK _Tool_*wxyz*.zip, where *wxyz* represents the BECK version number.
2. Double-click the zip file. A BECK_Tool_wxyz subfolder is created automatically within the folder where the zip file is located, and BECK Tool.exe and initialization (INI) files are displayed in the folder.

**NOTE:** Do not move the INI file from the folder or change the INI file name and INI file contents.

3. To verify that the BECK tool is installed, double-click the executable file BECK_Tool.exe in the BECK_Tool_wxyz folder to start BECK tool. Then confirm that the Language dialog box appears.

To uninstall the BECK tool:

1. Confirm that the computer is operating normally.
2. If the BECK tool is running, stop it.
3. If there are files in the BECK_Tool_wxyz subfolder that you want to keep, copy them to another folder. Then delete the BECK_Tool_wxyz subfolder containing the BECK_Tool.exe and INI files.

# BECK tool at a glance

The steps below and Figure H-1 on page H-7 summarize BECK tool usage.

1. Select a language from the Language dialog box (English or Japanese).
2. At the Array Unit Type dialog box, click an array unit type or enter a box code of up to 8 alphanumeric characters. (You can enter the serial unit number and an optional name as the box code.) A configuration screen appears that corresponds to the array type selected in the Array Unit Type dialog box.

3. Create logical/physical configuration figures automatically by specifying the number of units or manually by entering values in supplied fields. Configurations can be expanded after you create them.

   You can also expand a configuration loaded from simple trace in step 2. At the Array Unit Type screen, select a storage array unit type and load an existing configuration.

   Configurations in the configuration file for the BECK tool can also be loaded and saved.

4. A cable figure appears based on the logical and physical configuration figures.

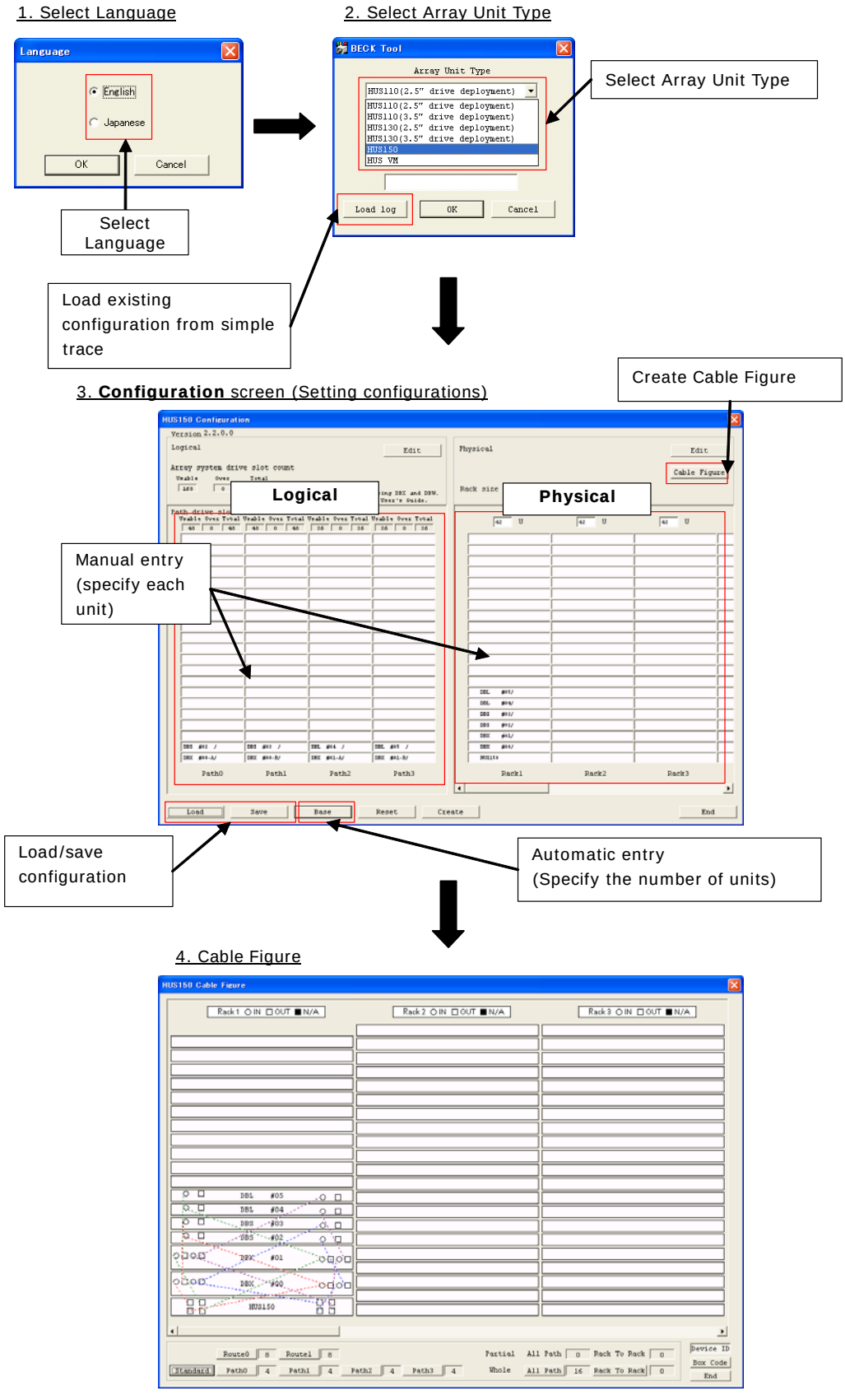



**Figure H-1: BECK tool at a glance**

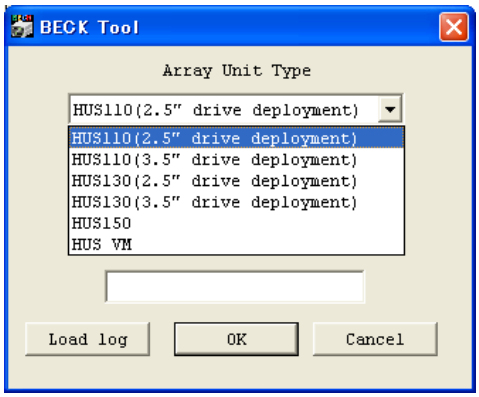
# Starting the BECK tool

To start the BECK tool:

1. Store the executable file on your computer's desktop.
2. In the BECK_Tool_wxyz folder, run the BECK executable file BECK_Tool.exe.

3. At the Language dialog box, click a language, and then click **OK**. The selected language will be used in the subsequent screens.

4. At the Array Unit Type dialog box, perform one of the following steps:
   - Click a storage system from the drop-down menu.
   - Enter the system's box code, up to 8 alphanumeric characters. Or enter the system's serial unit number and optional name as the box code.
5. Click **OK**.




The configuration screen appears.

# BECK tool configuration screen

The configuration screen consists of **Logical** and **Physical** areas:

- **Logical** at the left side shows logical path information about the storage system. To activate this area, click any of the fields in the path columns. When the message asks whether the physical configuration should be initialized, click **OK**.
- **Physical** at the right side shows rack information about the storage system. To activate this area, click any field in the rack columns. When the message asks whether the logical configuration should be initialized, click **OK**.

Only one side, **Logical** or **Physical**, can be active at a time. The background of the **Logical** or **Physical** area turns light green to show it is activated.

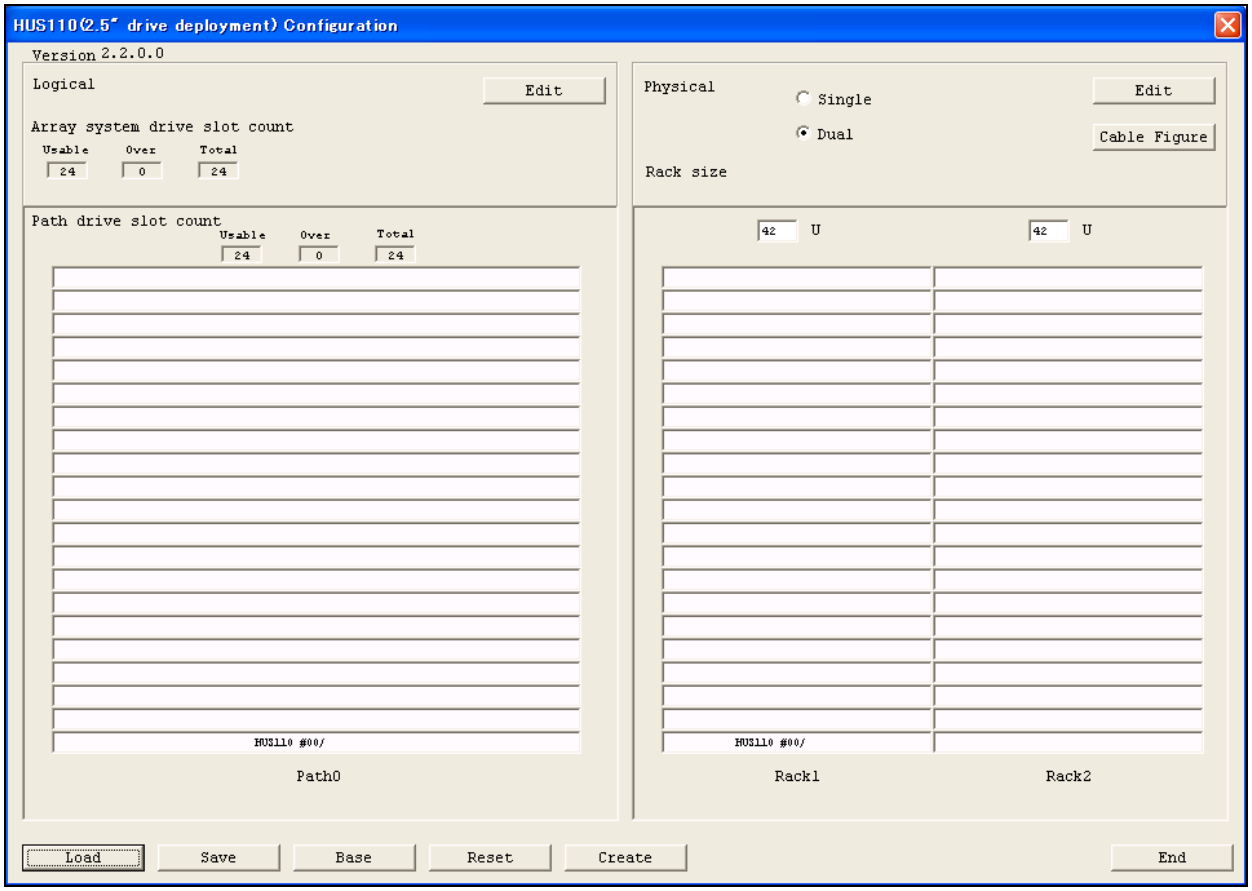



**Figure H-2: Sample Hitachi Unified Storage 110 Configuration Screen**

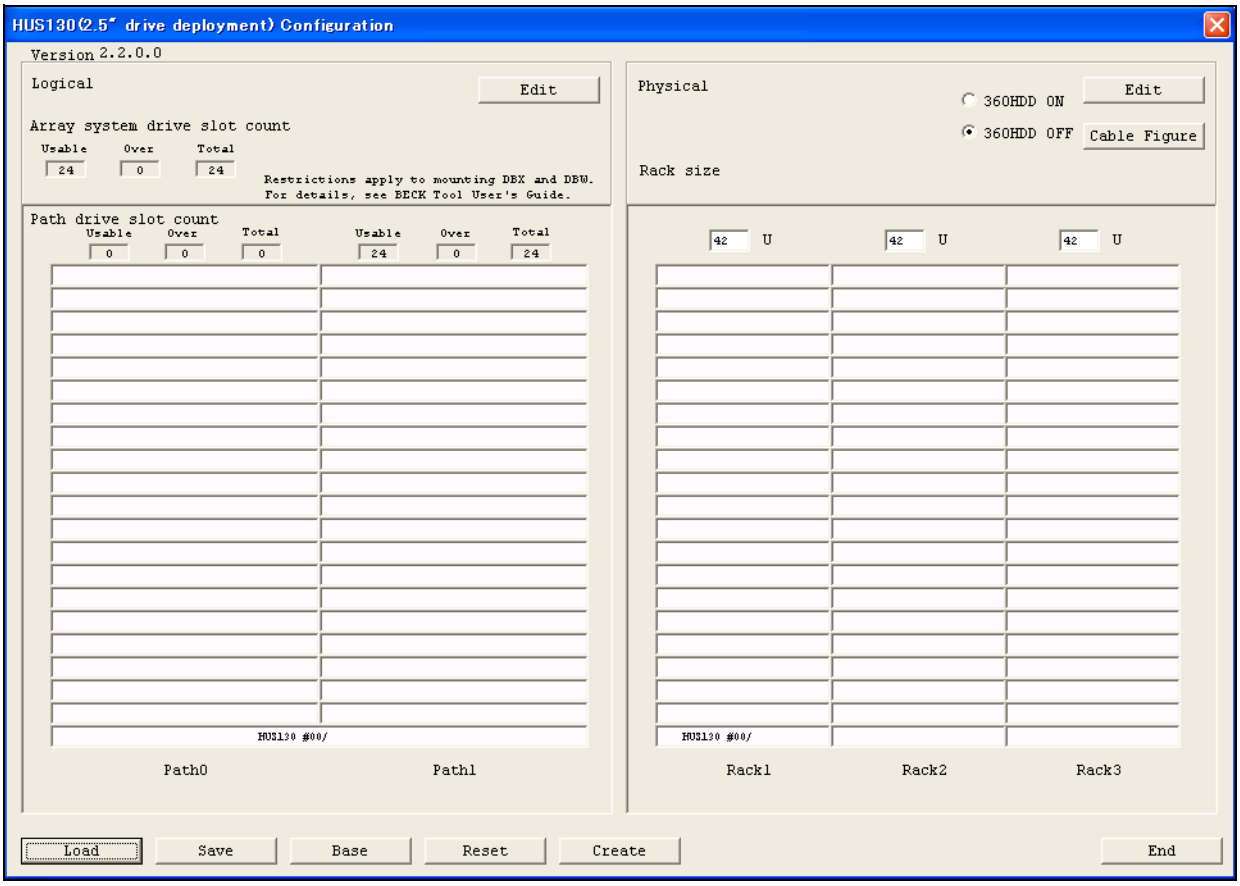



**Figure H-3: Sample Hitachi Unified Storage 130 Configuration Screen**

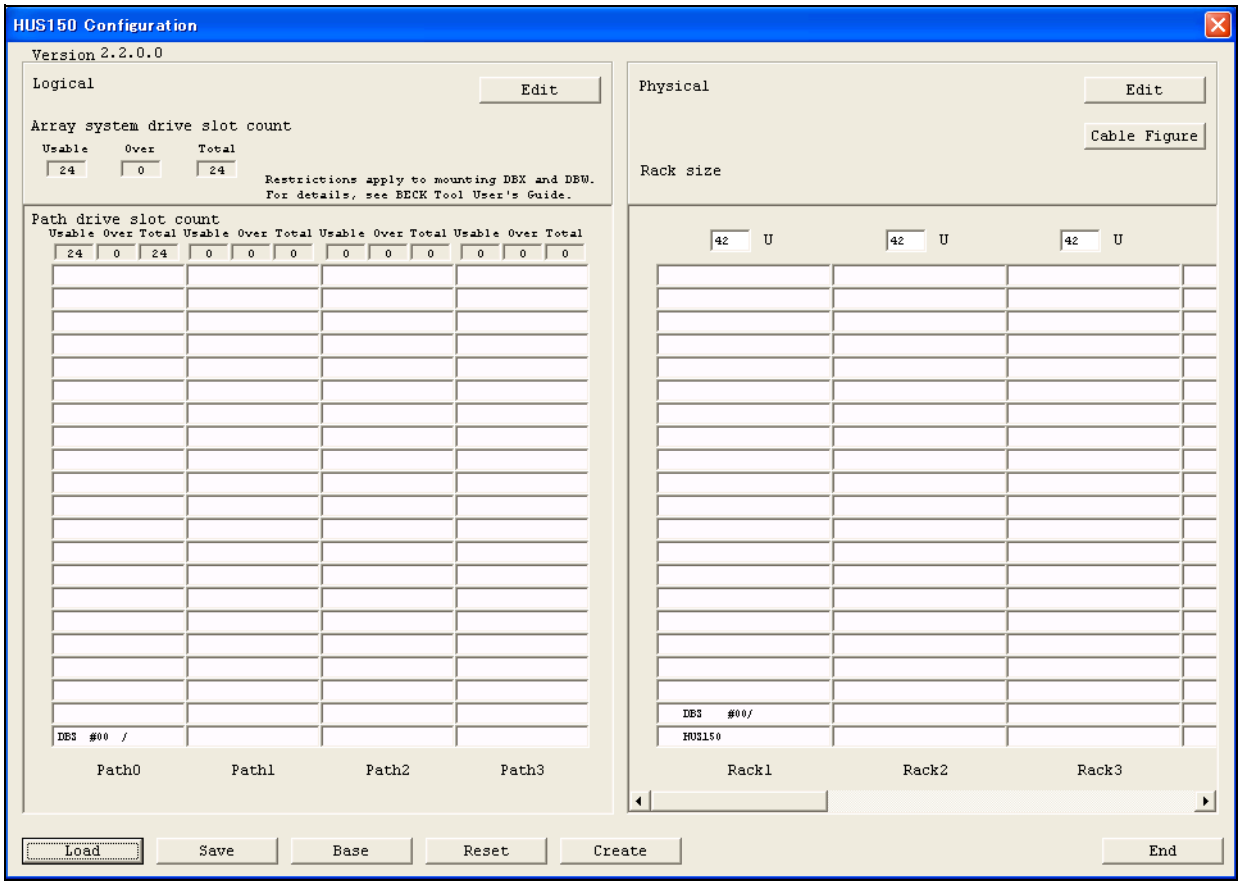



**Figure H-4: Sample Hitachi Unified Storage 150 Configuration Screen**

# Understanding the BECK tool configuration screen

Figure H-5 and Figure H-6 on page H-12 show the key areas of the configuration screen and Table H-5 on page H-13 describes them.

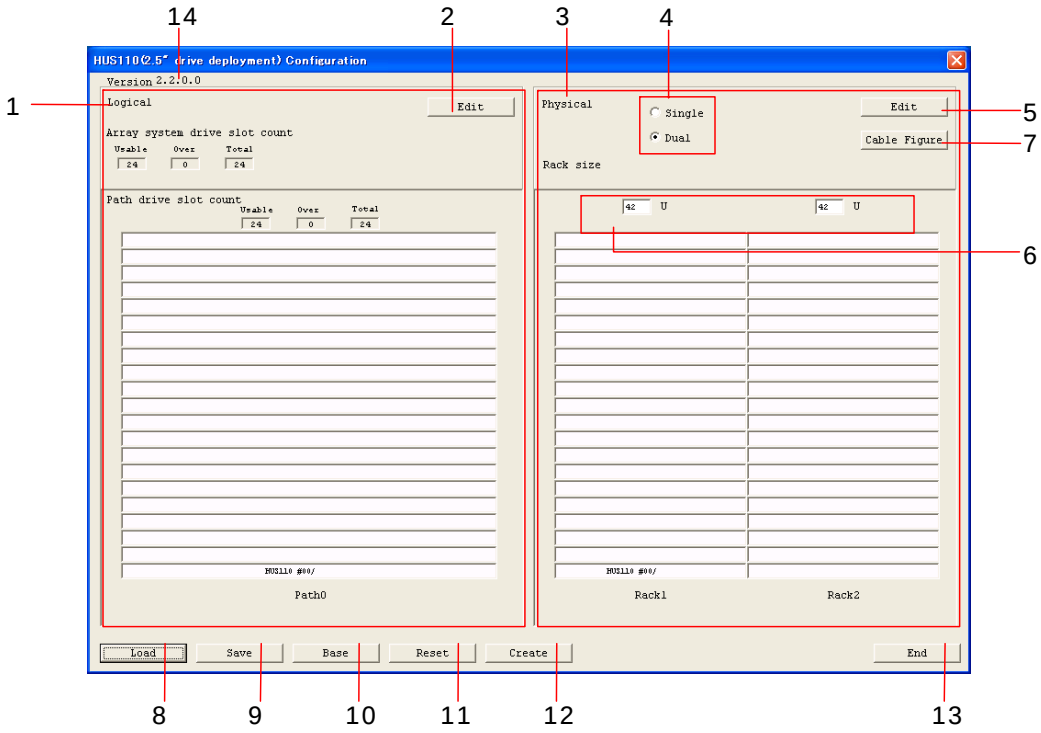



**Figure H-5: BECK tool configuration screen (Hitachi Unified Storage 110)**

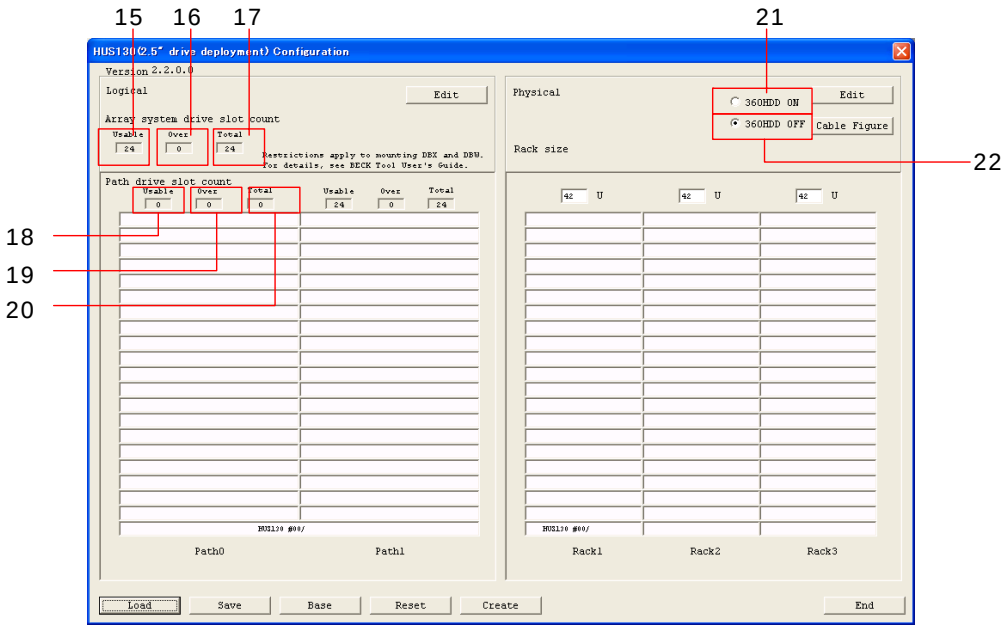



**Figure H-6: BECK tool configuration screen (Hitachi Unified Storage 130)**

**Table H-5: Main areas in the BECK tool configuration screen**

| Number | Name | Description |
|---|---|---|
| 1 | Logical | Displays units, unit IDs, and box codes in each path. Controller Box is also displayed for Hitachi Unified Storage 110 and 130. |
| 2 | Edit button (Logical) | Click this button to edit the logical configuration figure manually. |
| 3 | Physical | Displays units, unit IDs, and box codes in each rack. The number of racks vary, depending on the Controller Box:<br>• Hitachi Unified Storage 110: 2<br>• Hitachi Unified Storage 130: 3<br>• Hitachi Unified Storage 150: 10 |
| 4 | Single/Dual buttons | Applies to Hitachi Unified Storage 110 only: lets you select a single or dual controller (default is dual). |
| 5 | Edit (Physical) | Lets you edit the physical configuration figure manually. |
| 6 | Rack Size | Size of each rack, specified in 0 to 42 U. |
| 7 | Cable figure button | Displays the SAS (ENC) cable figure. |
| 8 | Load button | Loads configuration information from a CSV file. |
| 9 | Save button | Saves configuration information to a CSV file. |
| 10 | Base button | Displays units and unit IDs in the Logical and Physical configuration figures automatically created after entering number of DBL, DBS, DBX, DBW, and DBF Drive Boxes. (DBW is supported only on Hitachi Unified Storage 130 (360HDD ON) and 150.) |
| 11 | Reset button | Resets the created configuration (units, unit IDs, and box codes) If you load a simple trace, clicking this button redisplays the configuration screen that was shown after the simple trace was loaded. If loading a configuration information file, the configuration screen displayed after the configuration information file was loaded is redisplayed. |
| 12 | Create button | Creates the configuration edited in the logical and physical configuration figures. Displays units, unit IDs, and box codes in the logical and physical configuration figures. |
| 13 | End button | Closes the configuration screen. |
| 14 | Version | Shows the BECK tool version. |
| 15 | Usable<br>(Array system drive slot count) | Number of drive slots that can be used in the array. The number is updated after a configuration is created. |
| 16 | Over<br>(Array system drive slot count) | Number of drive slots that can not be used in the array. This number is displayed if some of the drive slots cannot be used in an added Drive Box, which is displayed in pale yellow. The number is updated after a configuration is created. |
| 17 | Total<br>(Array system drive slot count) | Total number of Usable and Over drive slots in the array. The number is updated after a configuration is created. |

**Table H-5: Main areas in the BECK tool configuration screen**

| Number | Name | Description |
|---|---|---|
| 18 | Usable<br>(Path drive slot count) | Number of drive slots that can be used in the path. The number is updated after a configuration is created. |
| 19 | Over<br>(Path drive slot count | Number of drive slots that cannot be used in the path. This number is displayed if some of the drive slots cannot be used in an added Drive Box, which is displayed in pale yellow. The number is updated after a configuration is created. |
| 20 | Total<br>(Path drive slot count) | Total number of Usable and Over drive slots in the path. The number is updated after a configuration is created. |
| 21 | 360HDD ON | 360HDD ON is selected in the Hitachi Unified Storage 130 configuration screen. In this case, its firmware version is assumed to be 0937/A or later (see Configuration with 360HDD OFF/ON on page H-51). The number is updated after a configuration is created. |
| 22 | 360HDD OFF | 360HDD OFF is selected in the Hitachi Unified Storage configuration screen. In this case, its firmware version is assumed to be earlier than 0937/A. By default, the 360HDD OFF is selected (see Configuration with 360HDD OFF/ON on page H-51). The number is updated after a configuration is created. |

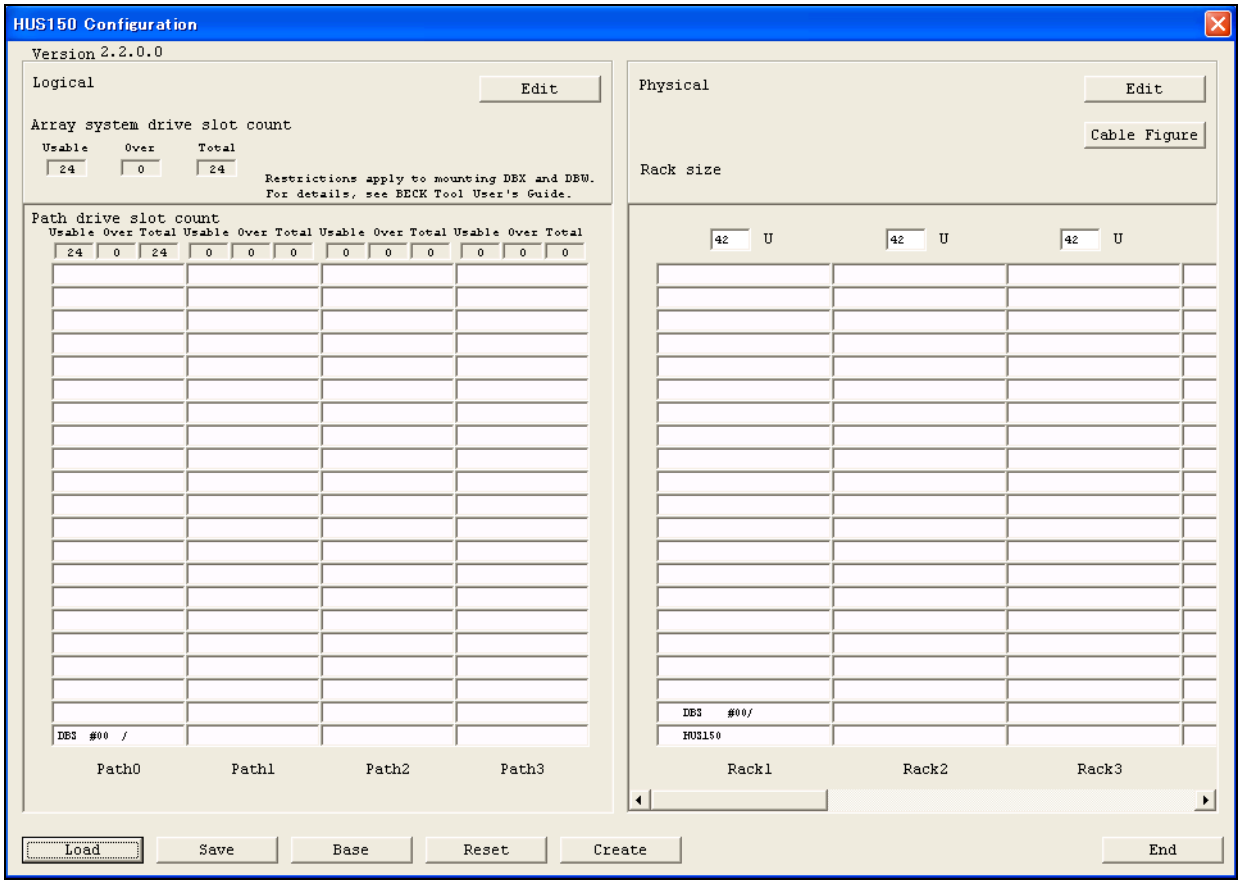
# Creating new configurations

Using the BECK tool, you can create new configuration diagrams automatically (described below) or manually (described on page H-19).

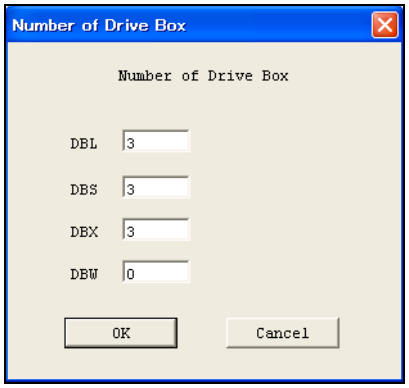
## Creating a configuration automatically

You can use the BECK tool to create a configuration automatically by entering a Drive Box value.

1. In the configuration screen, click **Base**.




2. At the Number of Drive Box dialog box, change the default values shown to the number of DBL, DBS, DBX, DBW, and DBF Drive Boxes. The **DBS** field has the default value 1 for Hitachi Unified Storage 150 systems.

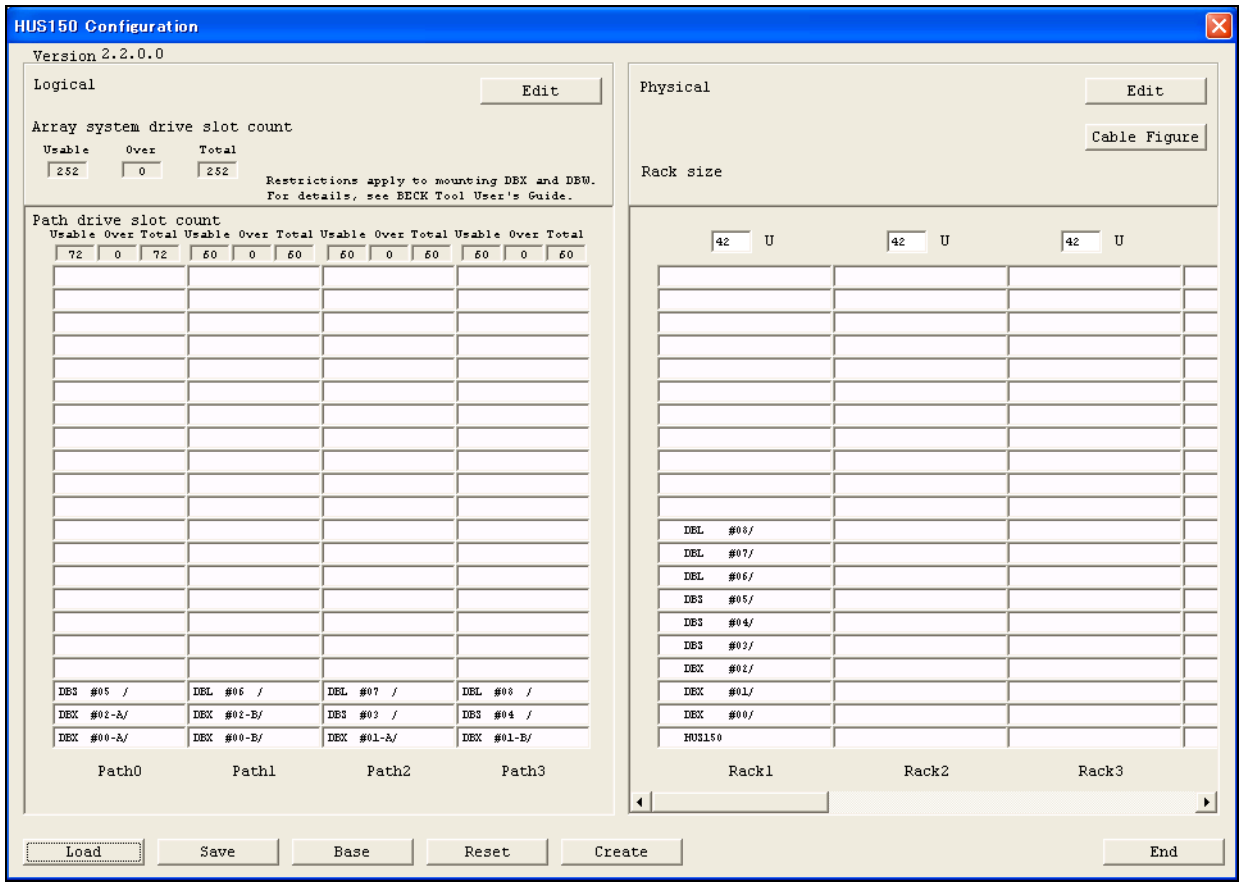


3. Click **OK**. Using the entered values, the BECK tool generates logical and physical configuration figures. Drive Boxes are added to a path and rack for each storage system in the following order.

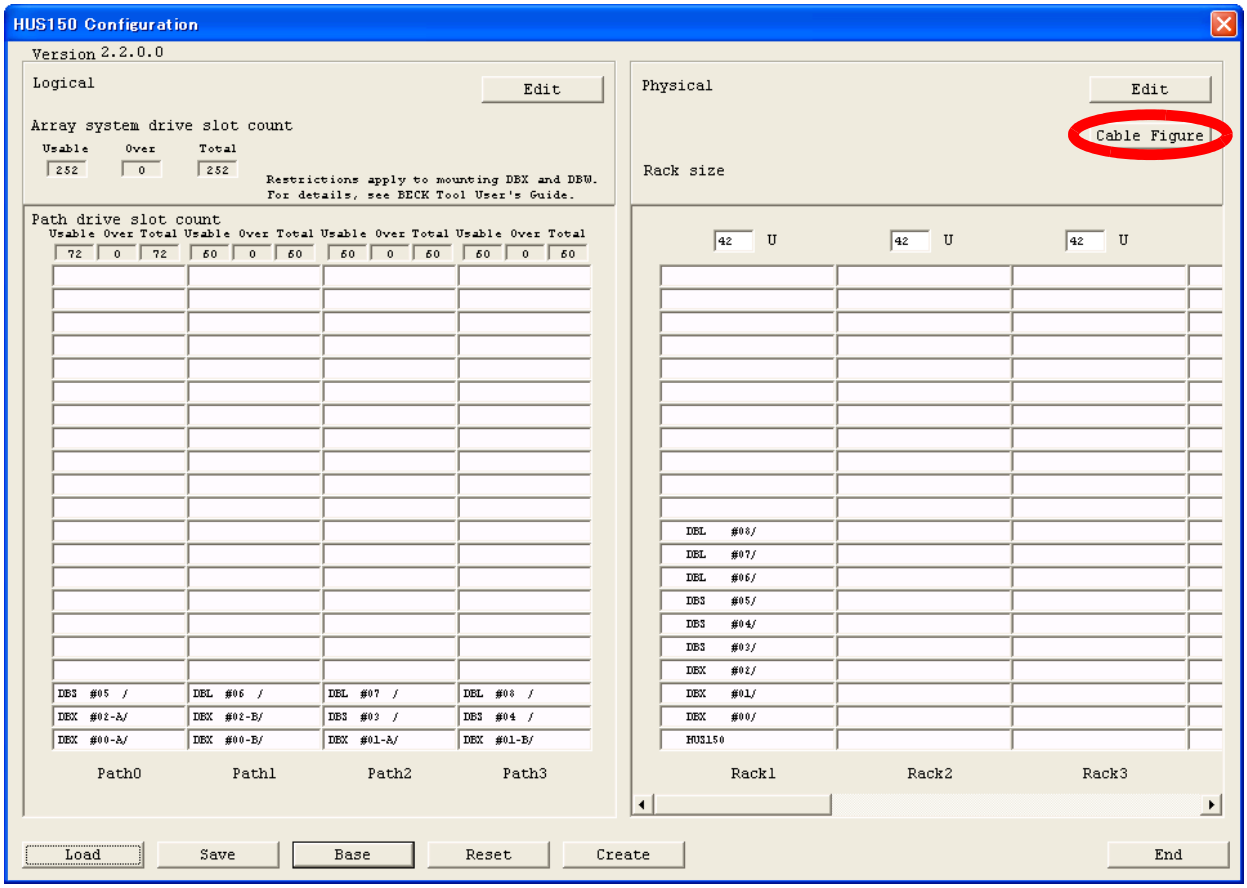
   - Hitachi Unified Storage 110: DBS to DBL
   - Hitachi Unified Storage 130/150: DBF, DBW, DBX, DBS, and to DBL

   Unit IDs are assigned to the Hitachi Unified Storage 110 and 130 Controller Box and Drive Boxes automatically. Unit IDs range between #00 and #47, and are assigned in ascending path and rack order, starting with the smallest number. DBX unit A and B share the same unit ID.

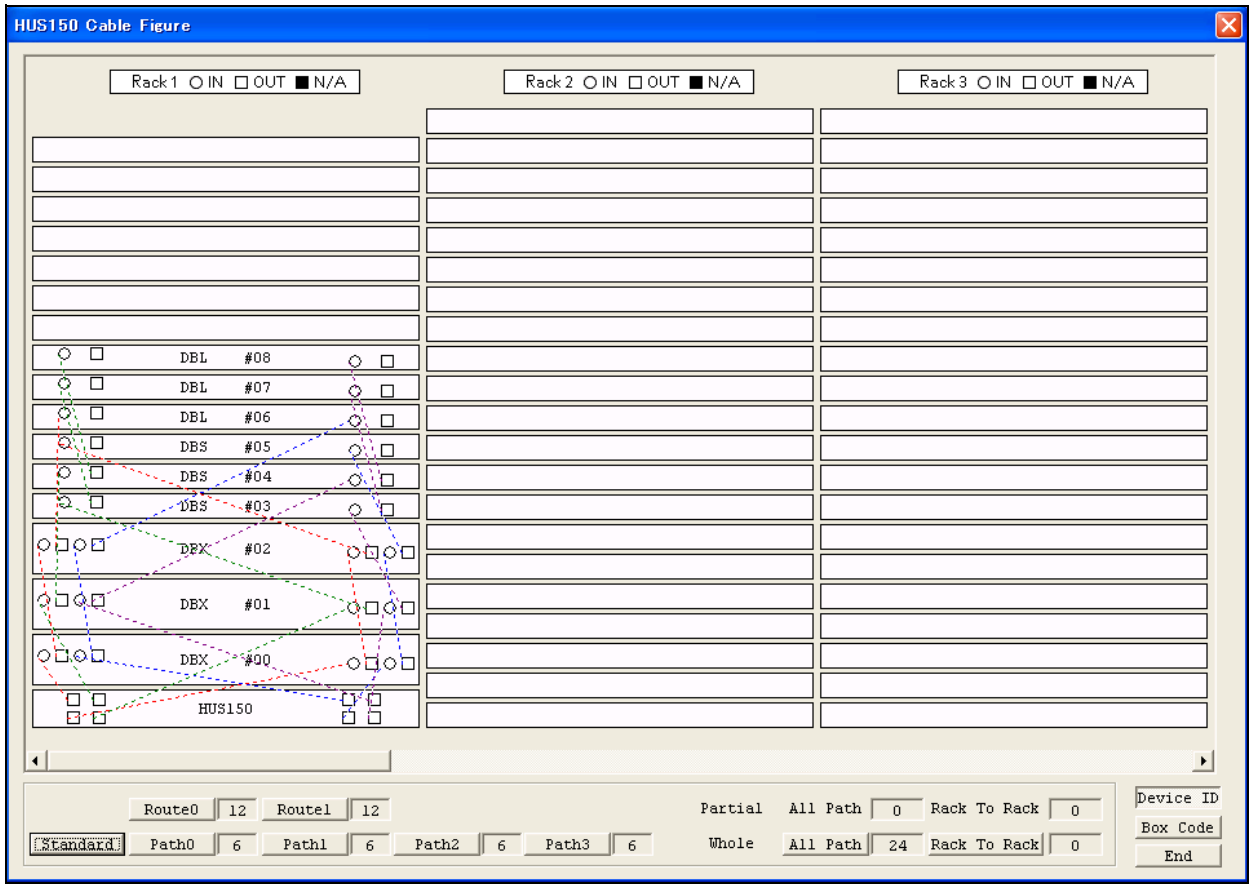
   Example: If DBX is installed in the top, unit IDs **DBX #00-A** and **DBX #00-B** are assigned for the Hitachi Unified Storage 150.




4. Click **Cable Figure**.



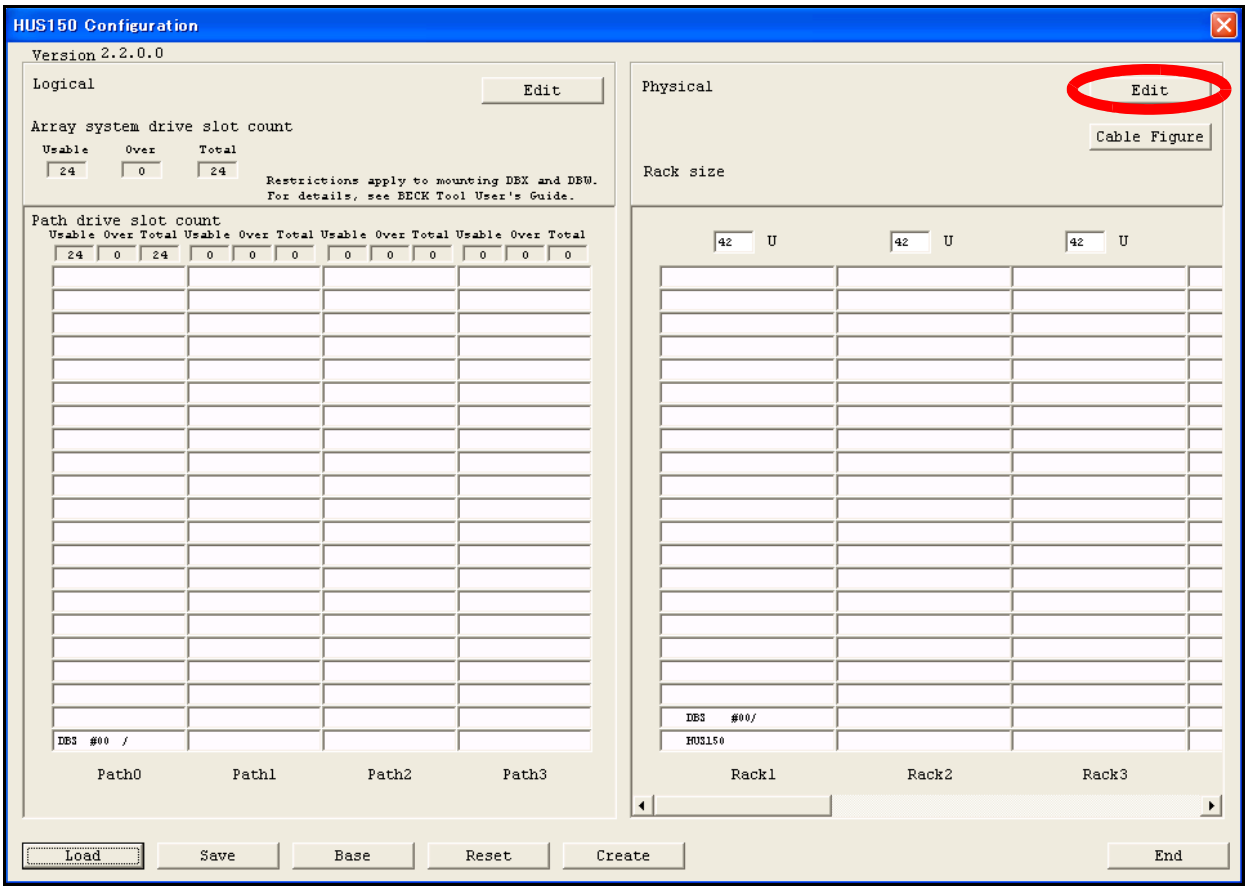

A cable figure similar to the following is displayed based on the logical and physical configuration.


HUS150 Cable Figure
Rack 1 ○ IN □ OUT ■ N/A
Rack 2 ○ IN □ OUT ■ N/A
Rack 3 ○ IN □ OUT ■ N/A
DBL #08
DBL #07
DBL #06
DBS #05
DBS #04
DBS #03
DBX #02
DBX #01
DBX #00
HUS150
Route0 12
Route1 12
Standard
Path0 6
Path1 6
Path2 6
Path3 6
Partial
All Path 0
Rack To Rack 0
Whole
All Path 24
Rack To Rack 0
Device ID
Box Code
End

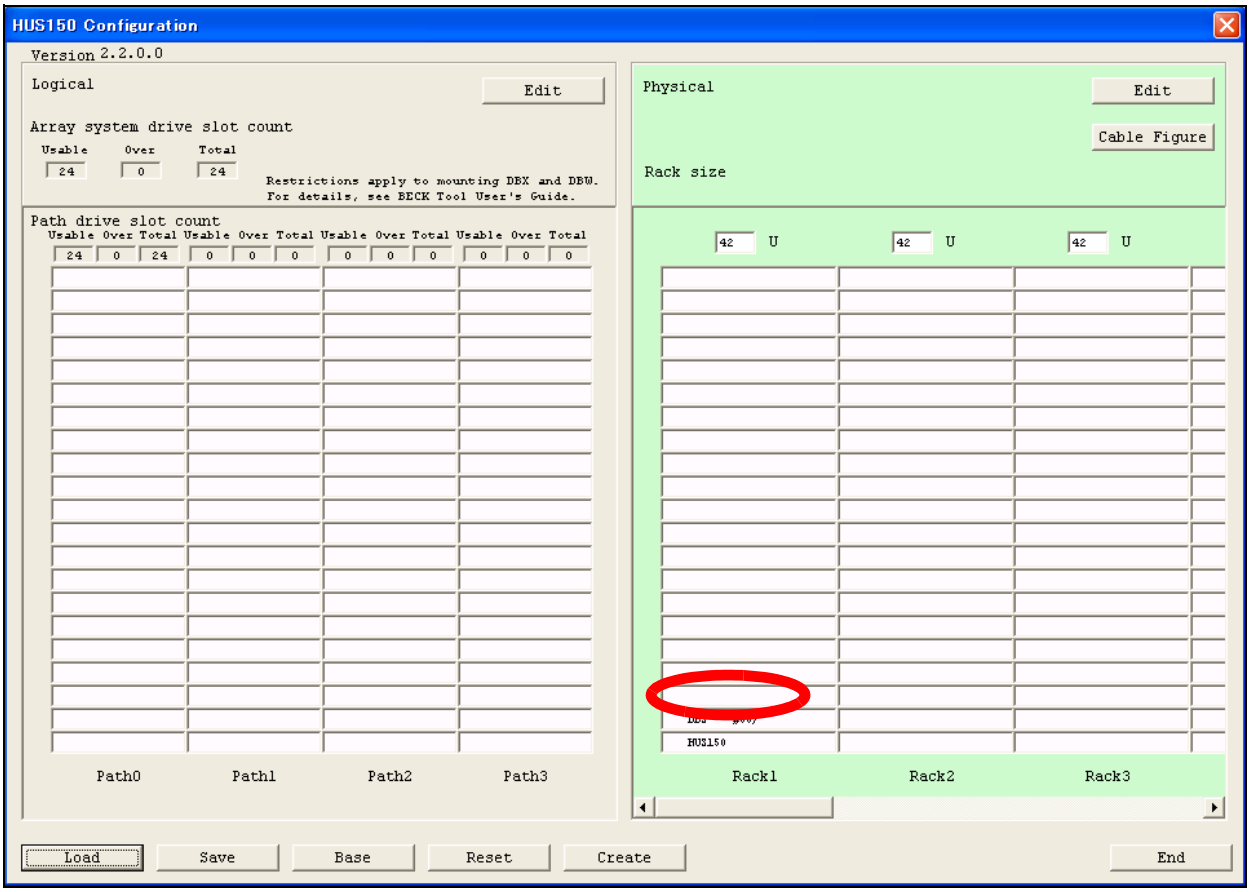
## Creating a configuration manually

An alternative to creating a configuration automatically is to create a configuration manually by entering the Drive Boxes in the logical or physical configuration figure.

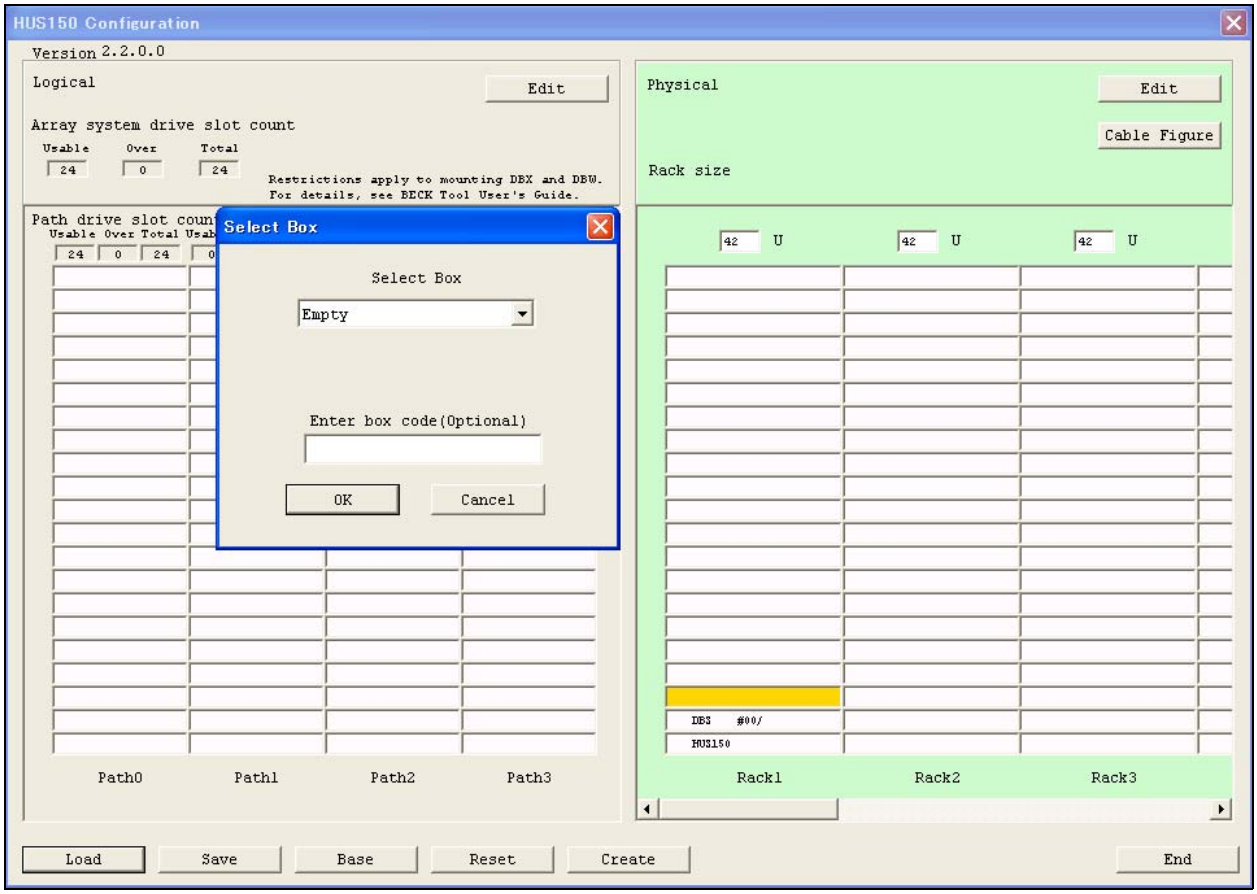
1. In the logical or physical figure of the configuration screen, click the **Edit** button or left-click the areas of the logical or physical configuration figure (see Editing the logical configuration figure on page H-25 and Editing the physical configuration figure on page H-38).




2. If you clicked **Edit** in the physical figure, the message **May logical configuration figure be initialized?** appears. Click **OK** to remove the message.
3. All the units, unit IDs, and box codes in the logical configuration figure are cleared and the physical configuration figure is highlighted in light green. Right-click an empty box in a rack.



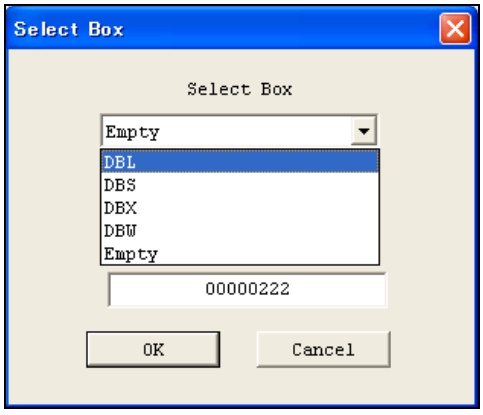

The clicked box is highlighted in orange and the Select Box dialog box appears.



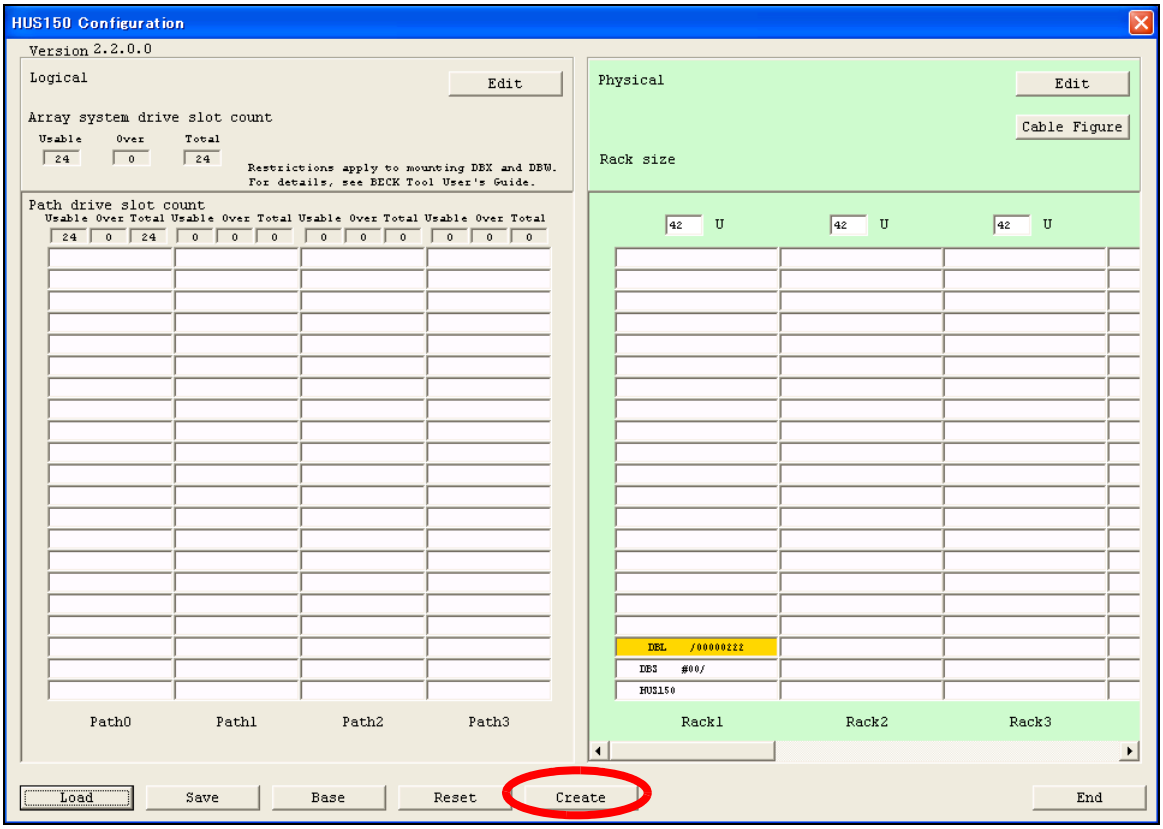

4. In the Select Box dialog box, click the desired Drive Box.

   You can optionally enter a box code for the selected Drive Box in the **Enter box code (optional)** field.

   For the DBW Drive Box, you can optionally enter up to 15 alphanumeric characters. If you enter 9 characters or more, they appear as 5 upper-case characters followed by dashes (**---**).

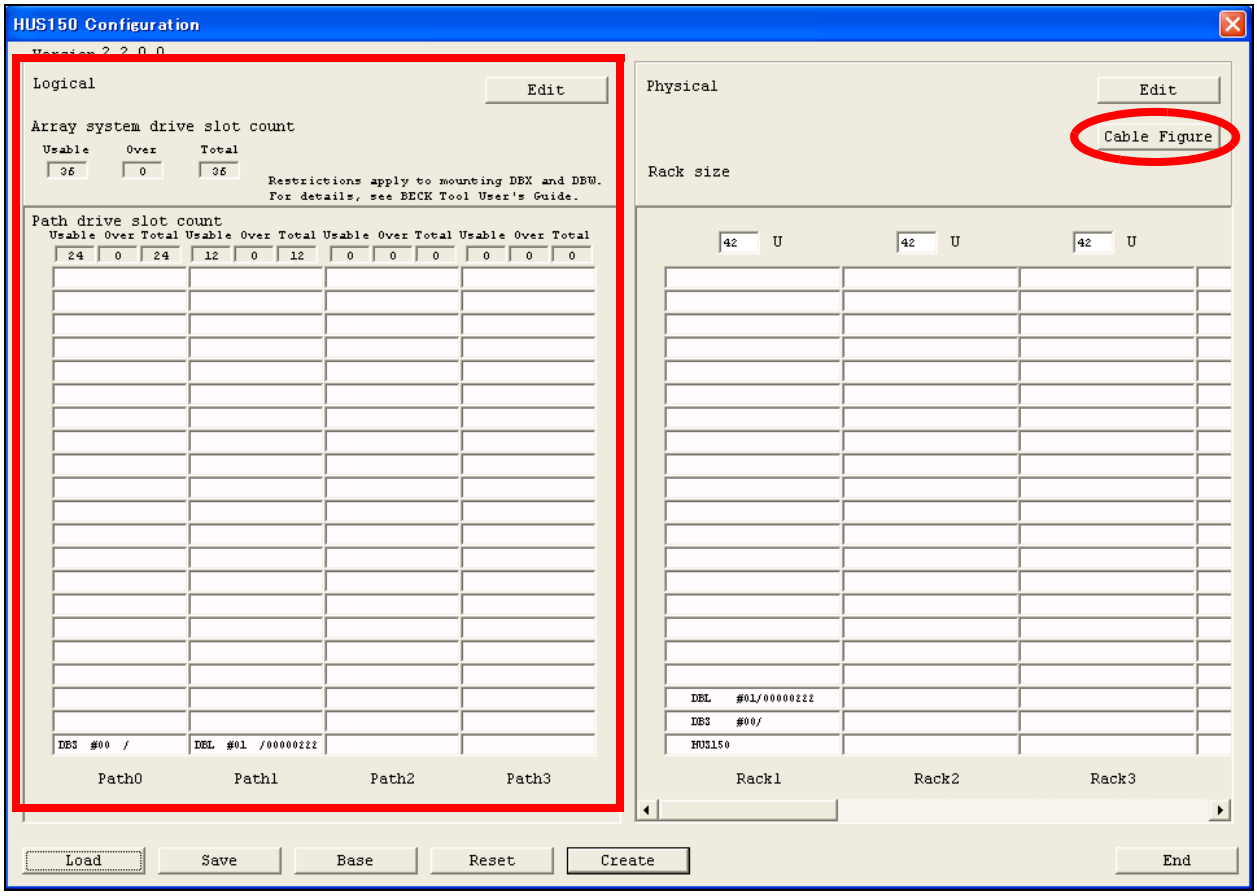



5. Click **OK**. The selected Drive Box appears in the box you clicked in the physical configuration figure.
6. Click **Create**.

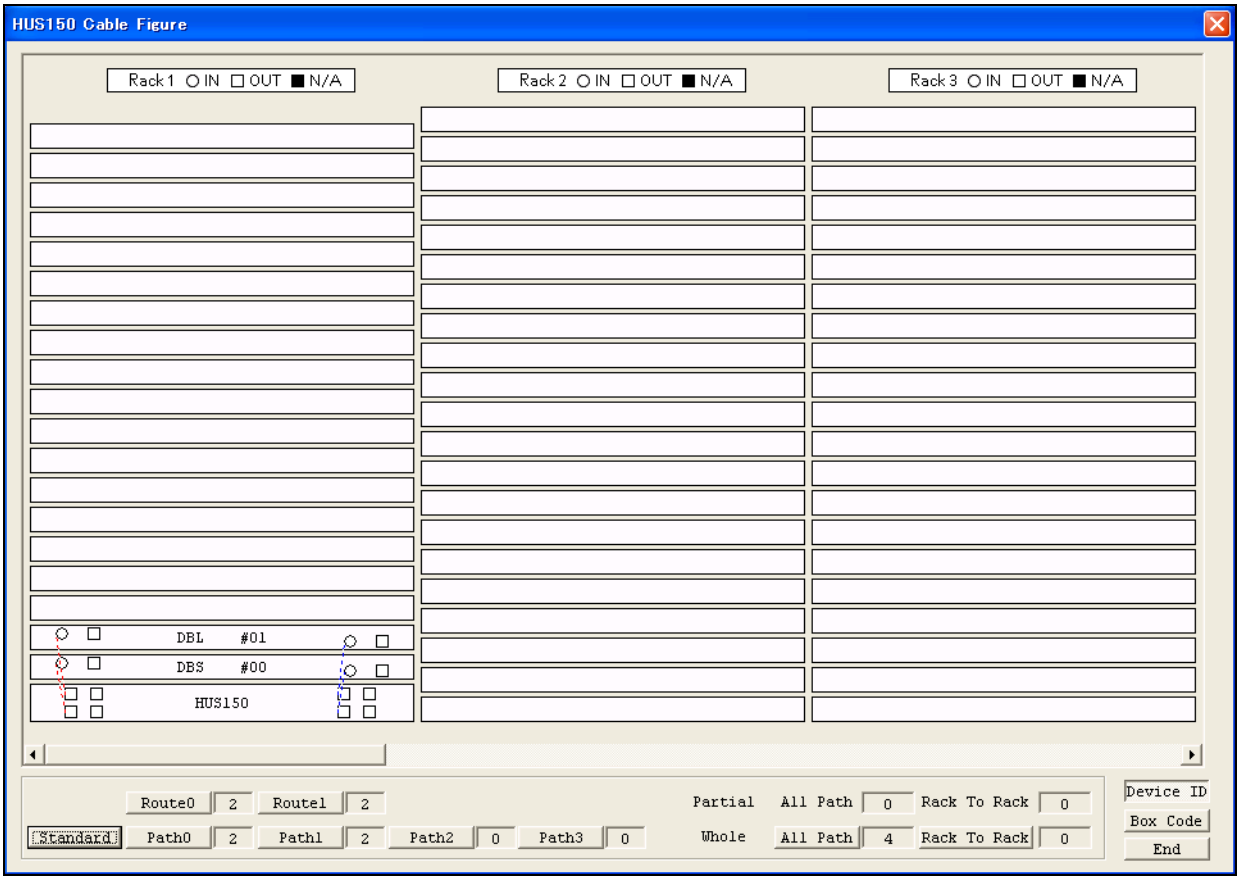



The logical configuration figure is updated based on the changes made. Unit IDs are assigned automatically.

7. Click **Cable Figure**.



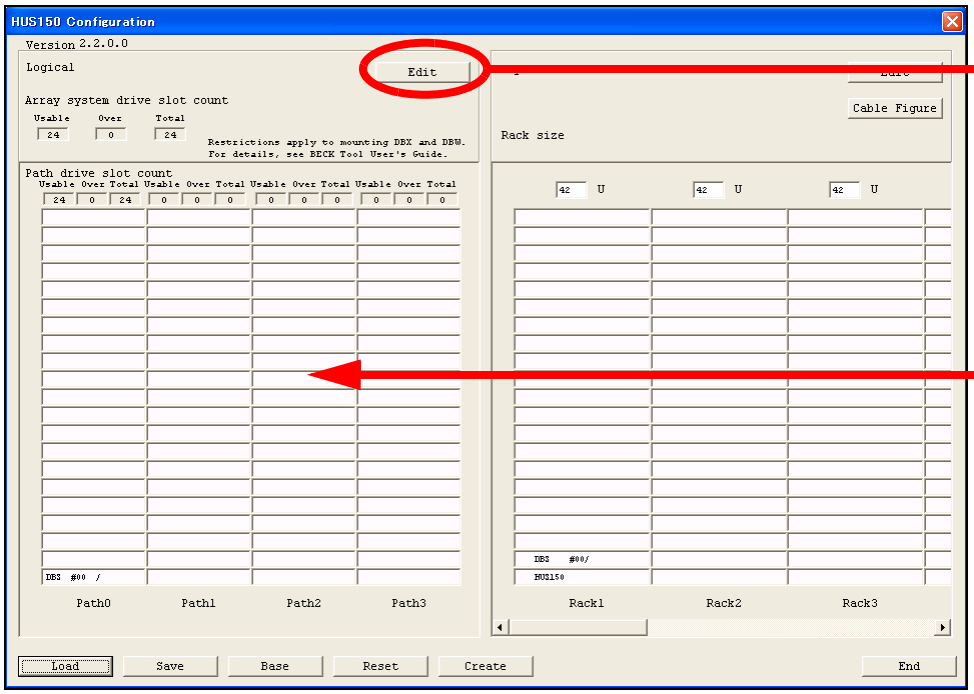

The BECK tool creates and displays a cable figure similar to the following, based on the logical and physical configuration figure.


HUS150 Cable Figure
Rack 1 ○ IN □ OUT ■ N/A
Rack 2 ○ IN □ OUT ■ N/A
Rack 3 ○ IN □ OUT ■ N/A
DBL #01
DBS #00
HUS150
Route0 2
Route1 2
Standard
Path0 2
Path1 2
Path2 0
Path3 0
Partial All Path 0 Rack To Rack 0
Whole All Path 4 Rack To Rack 0
Device ID
Box Code
End

# Editing the logical configuration figure

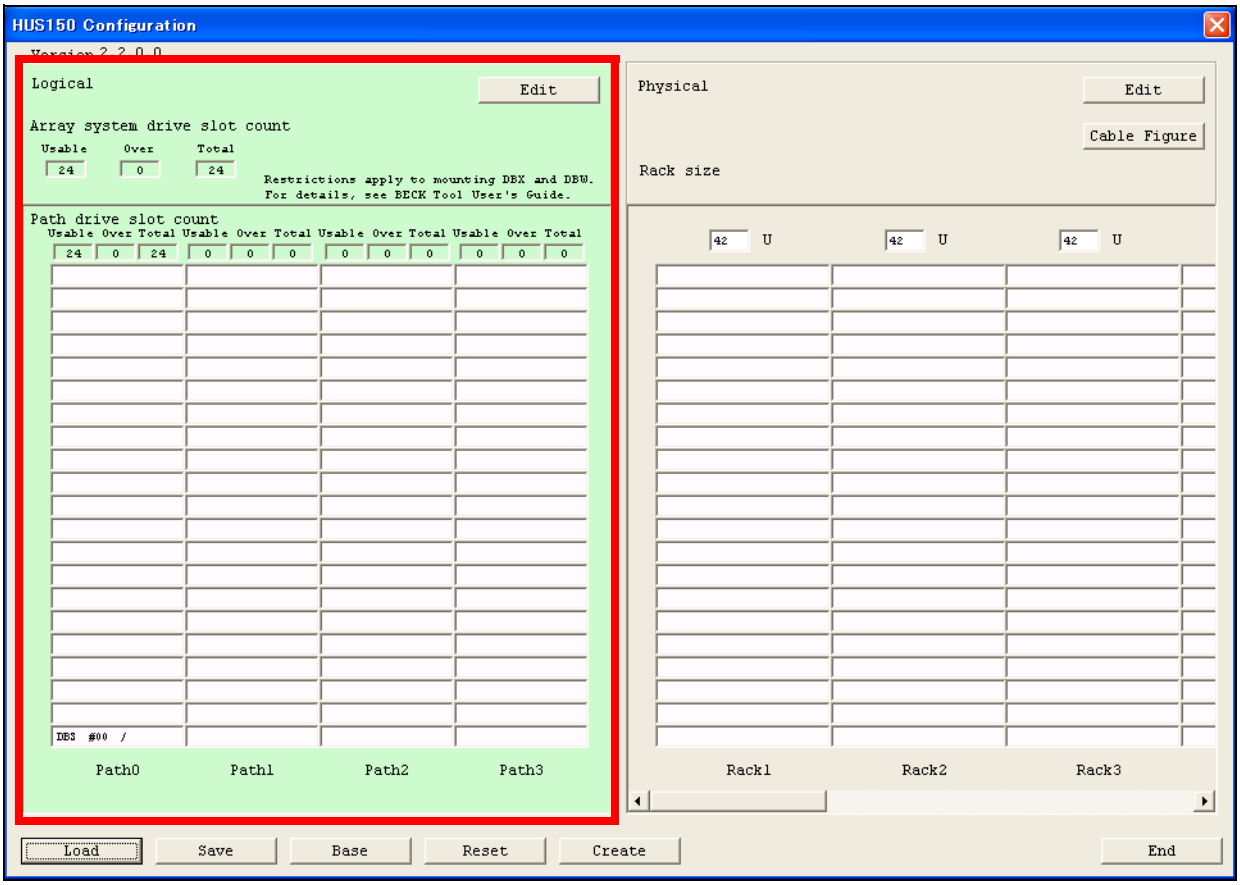
To edit the logical configuration figure:

1. In the logical configuration figure, click **Edit**, or click the area in the logical configuration figure.




2. When the message **May physical configuration figure be initialized?** appears, click **OK** to remove the message.

   All the units, unit IDs, and box codes in the physical configuration figure are cleared, and the logical configuration figure is highlighted in light green.




From this screen, you can:

- Assign units to a path — see Assigning units to a path, below.
- Move and exchange Drive Boxes — see Moving and exchanging Drive Boxes on page H-33.

## Assigning units to a path

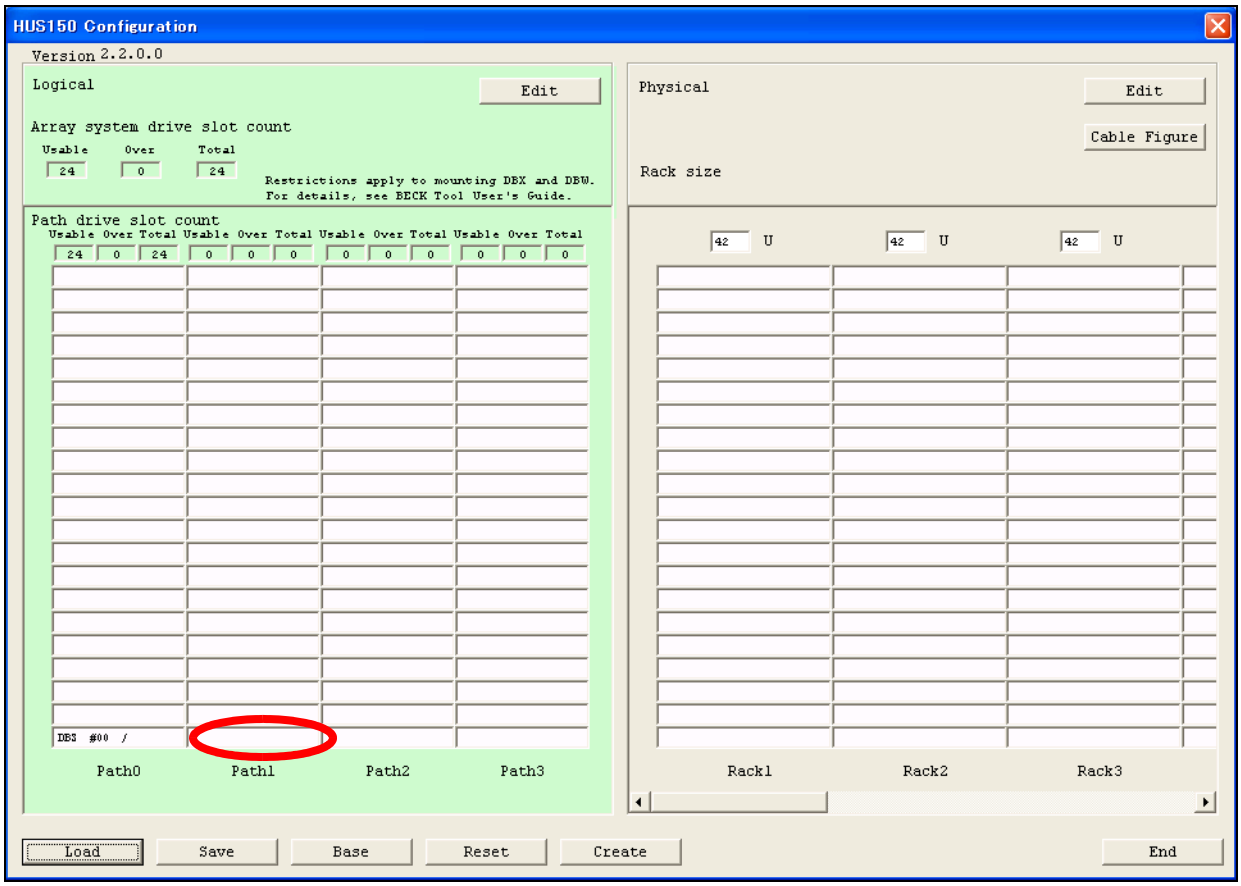
When you assign units to a path in the logical configuration figure, you can:

- Set a unit in an empty box in a path (described below).
- Change or delete a Drive Box in the path (see page H-29).
- Set Hitachi Unified Storage 110 and 130 Controller Boxes and edit their box codes see page H-31).

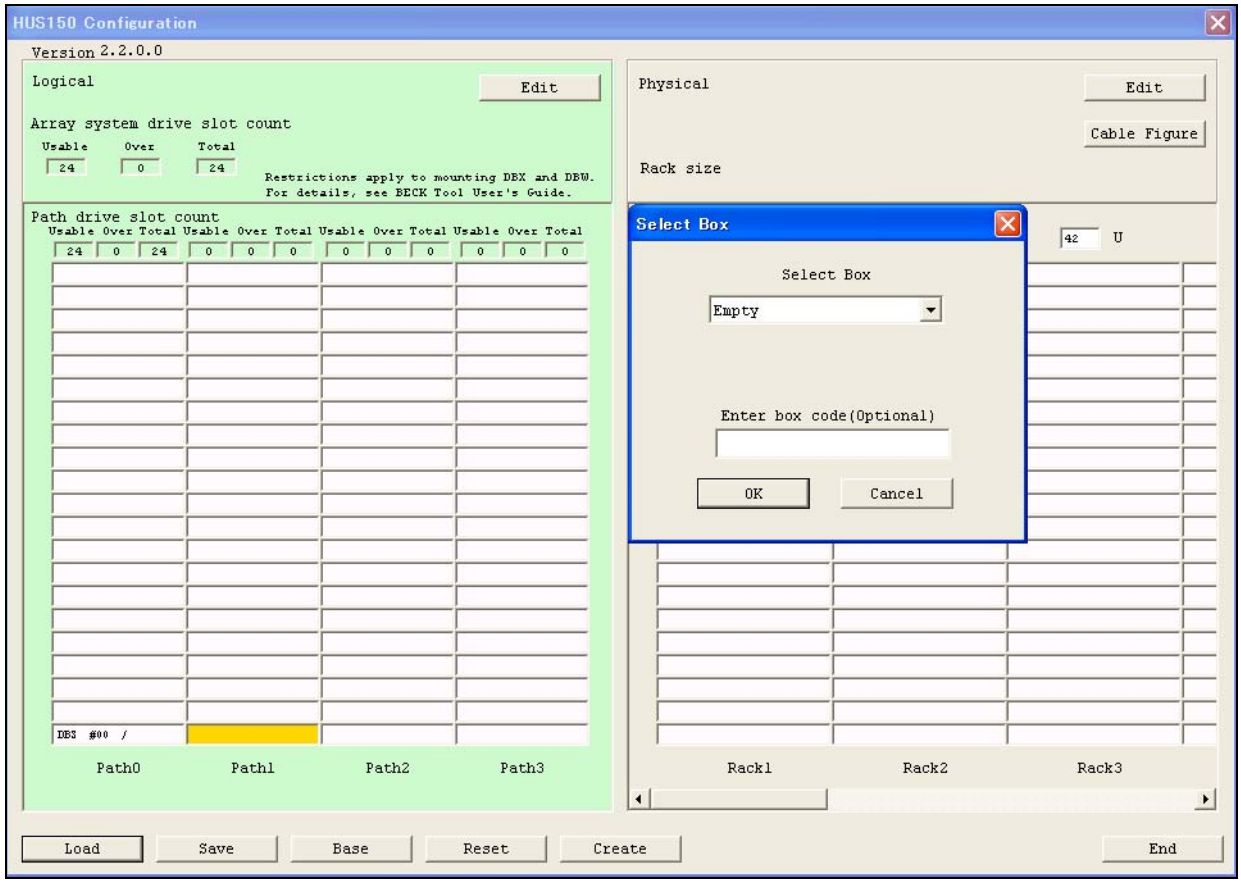
### Setting a unit in an empty box in a path

To set a unit in an empty box in a path:

1. Right-click an empty box in a path when the logical configuration figure can be edited.



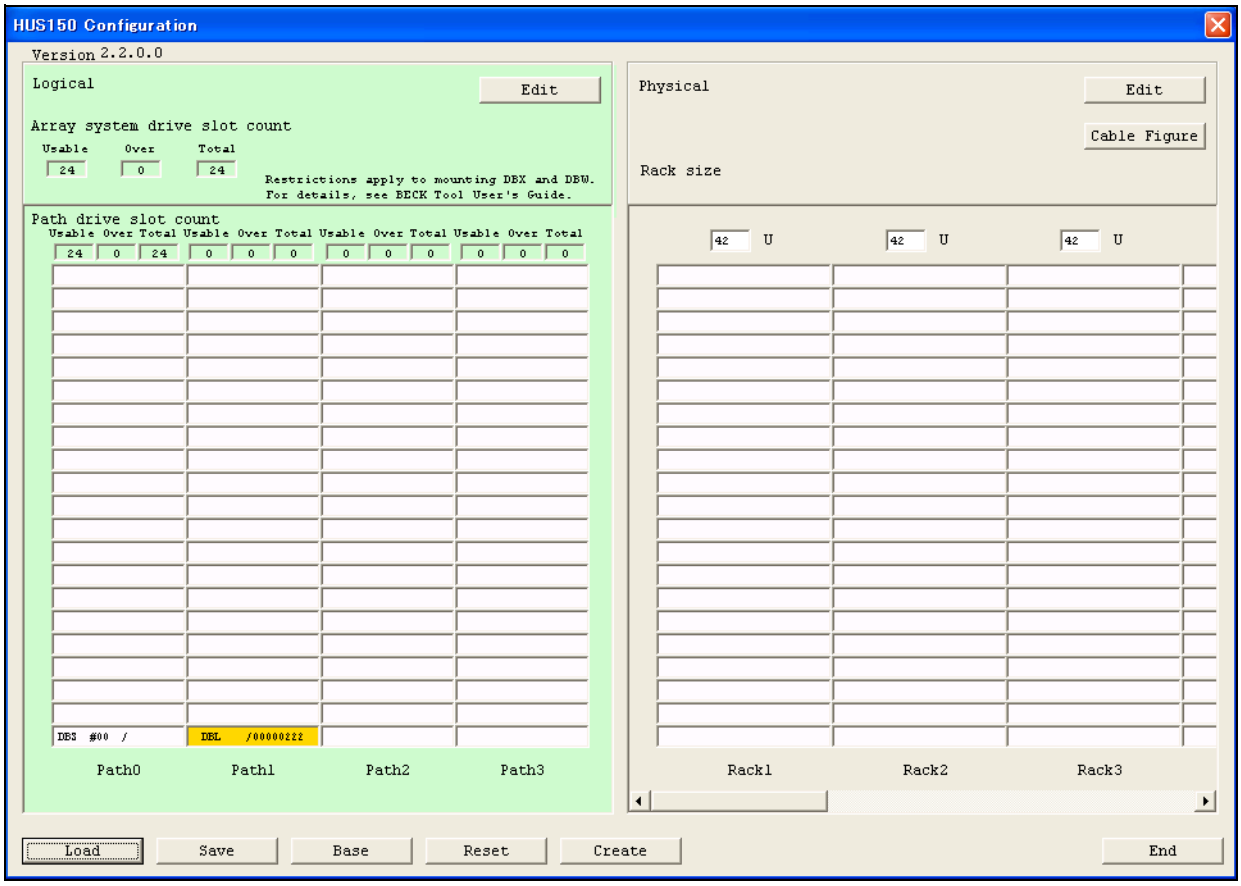

The clicked box is highlighted in orange and the Select Box dialog box appears.




2. In the Select Box dialog box, click the desired Drive Box. You can optionally enter the box code for the selected Drive Box in the **Enter box code (optional)** field.

   For the DBW Drive Box, you can optionally enter up to 15 alphanumeric characters. If you enter 9 characters or more, they appear as 5 upper-case characters followed by dashes (**---**).

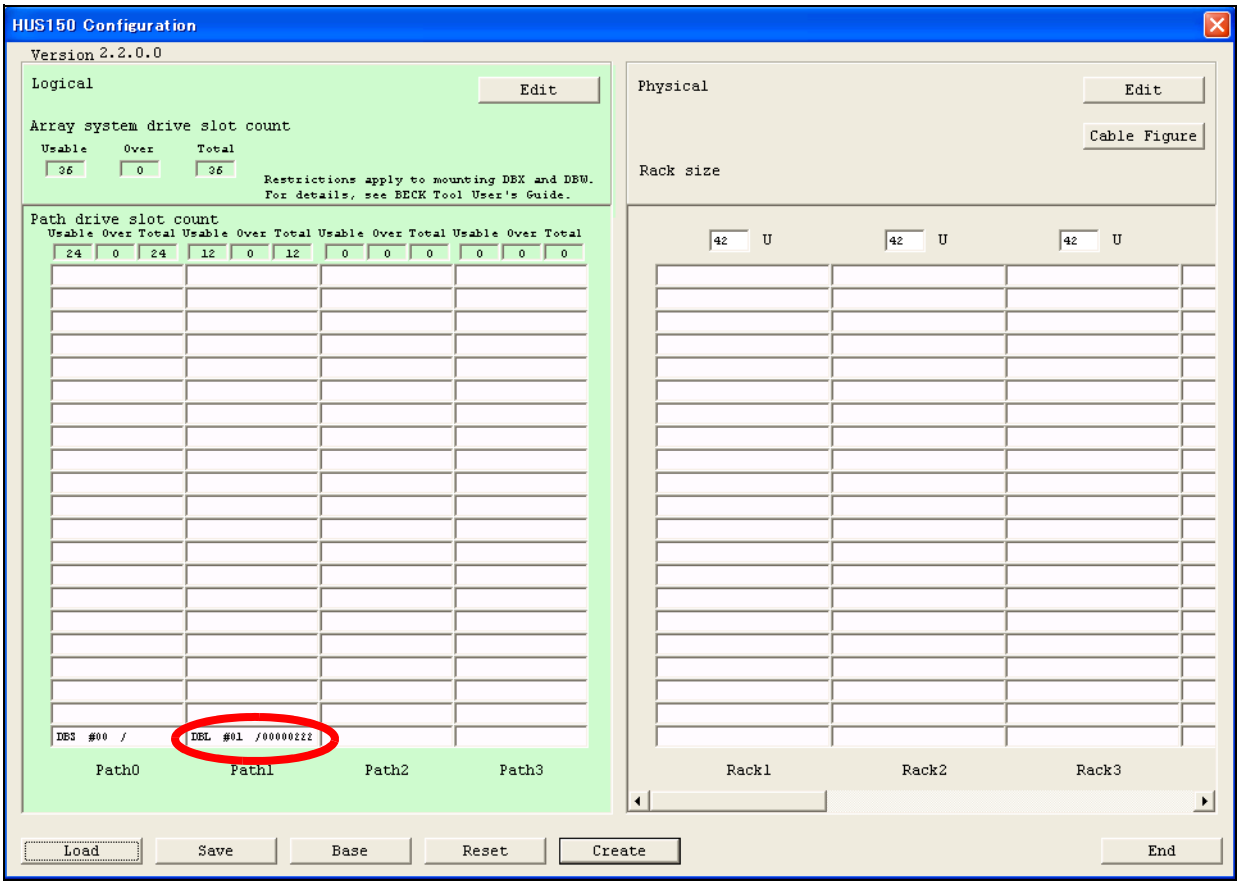
3. Click **OK**. The selected drive box appears in the box in the logical configuration figure.




## Changing or deleting a Drive Box in a path

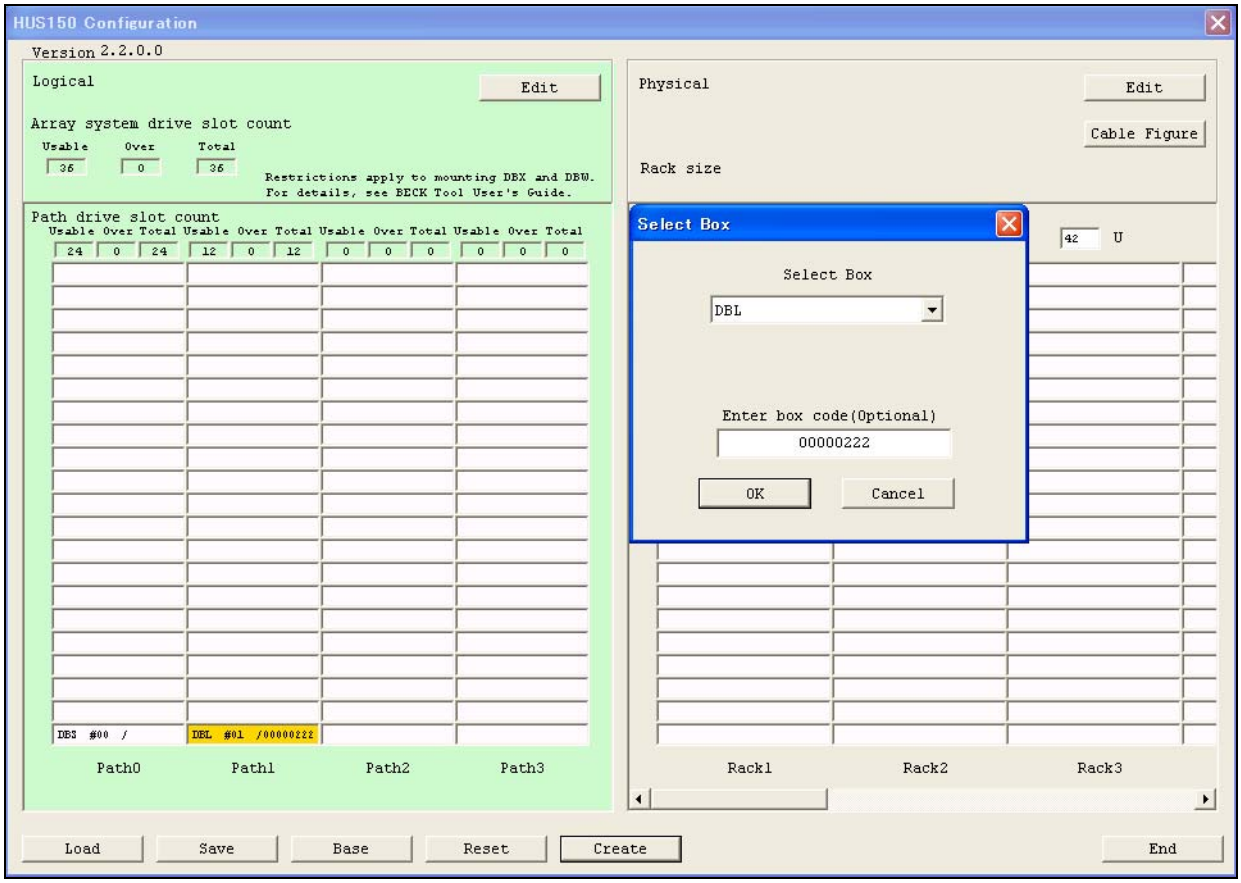
To change or delete a Drive Box in a path:

1. Right-click a drive box in the path.




The selected Drive Box is highlighted in orange and the Select Box dialog box appears. The Select Box dialog box shows the selected Drive Box. A Box Code is also displayed if you registered the system.

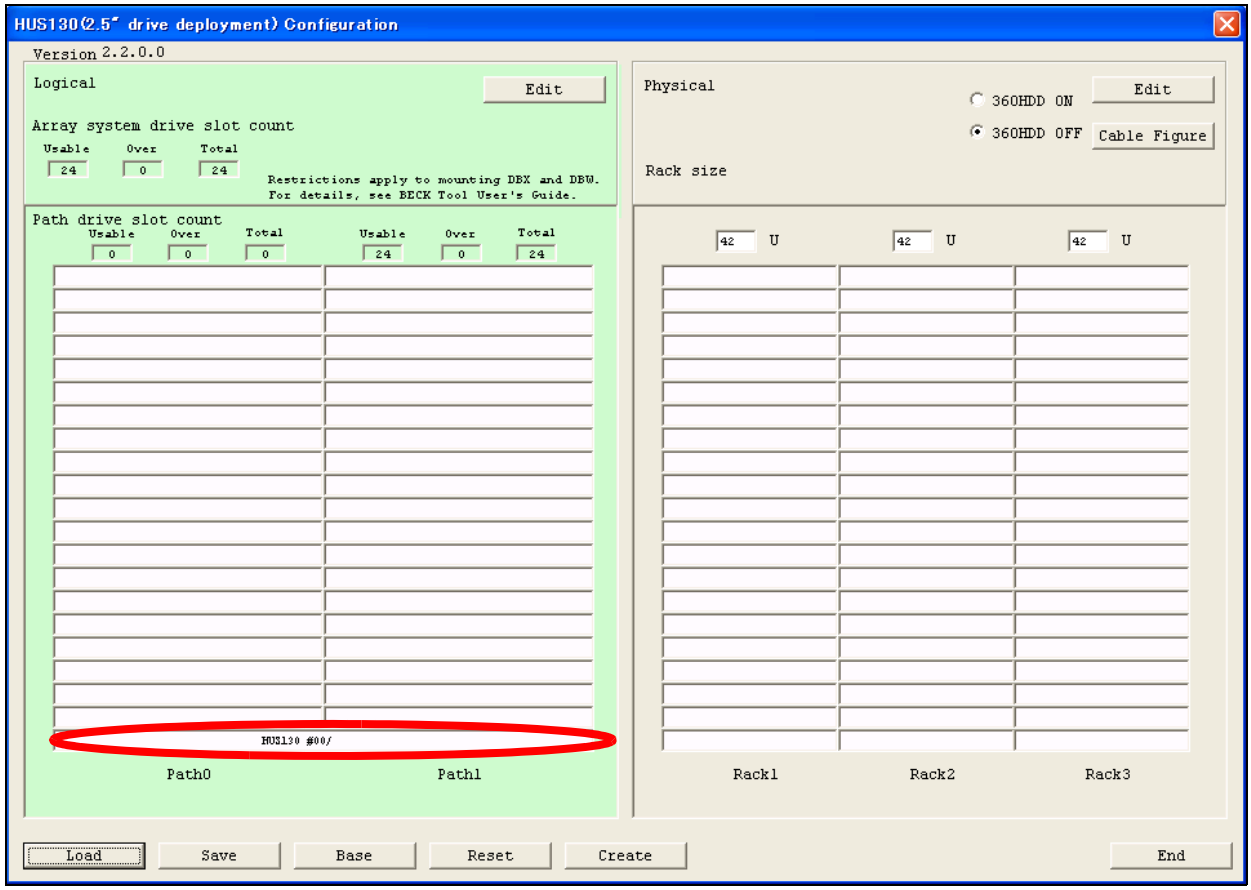
If you change the type of Drive Box type, the existing Drive Box is changed or deleted. You can also edit the box code.




## Editing box codes for a Controller Box

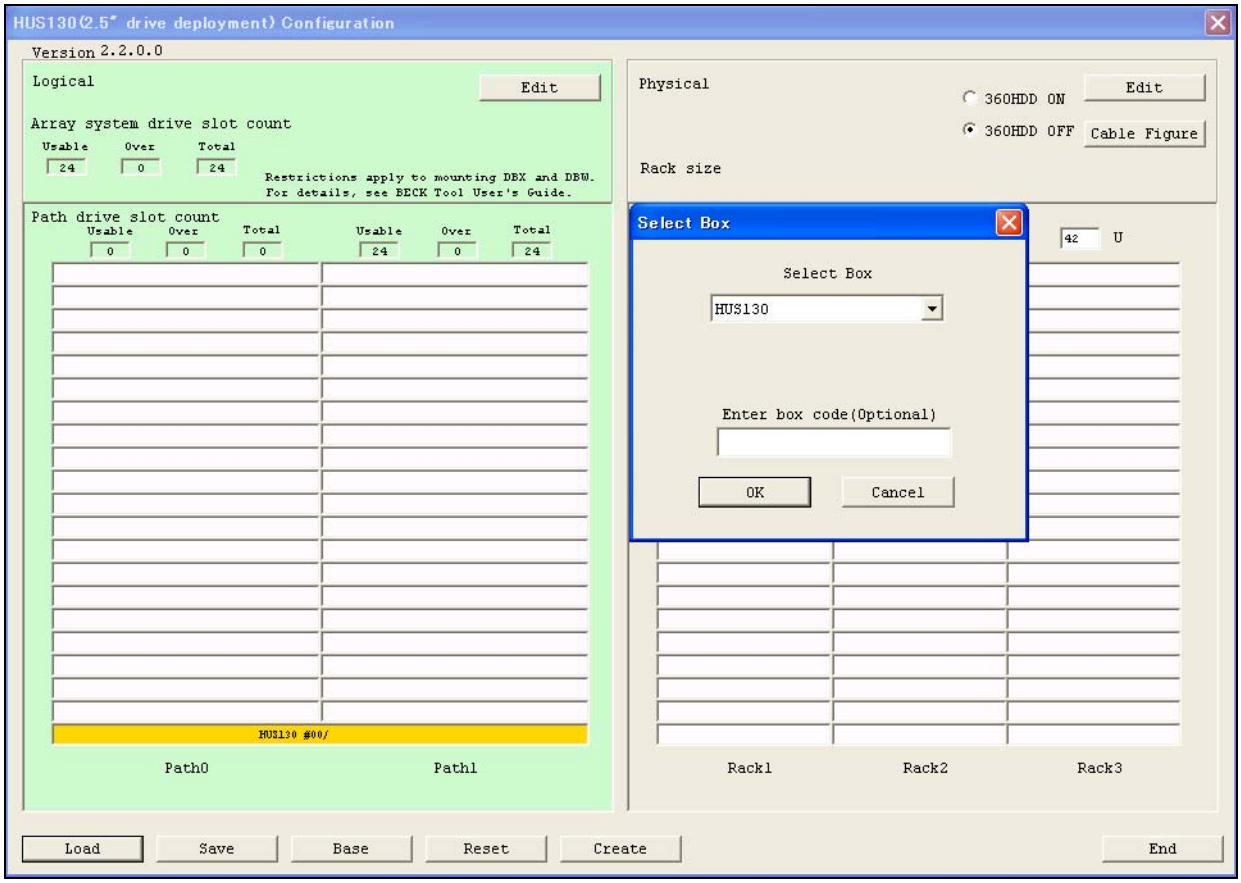
The following procedure describes how to set Controller Boxes and edit their box codes on Hitachi Unified Storage 110 and 130 systems.

1. In the logical configuration figure, right-click a Controller Box in the path or a box where you want to set a Controller Box (bottom box of the logical configuration figure).




2. The box is highlighted in orange and the Select Box dialog box appears, with a Controller Box and box code displayed. If you registered the Drive Box, the displayed box code can be edited.

   If no Controller Box appears in the configuration screen, click **OK** to add a Controller Box to the configuration screen.




3. From here, you can:
   - Assign a unit in an empty box in a path (see Setting a unit in an empty box in a path on page H-26).
   - Change or delete a Drive Box in a path (see Changing or deleting a Drive Box in a path on page H-29).
   - Assign Controller Boxes and edit their box codes (see Editing box codes for a Controller Box on page H-31).

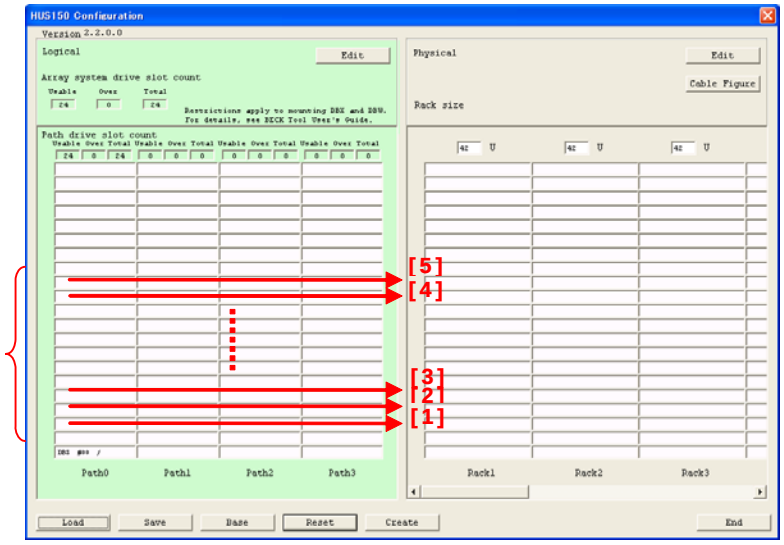
**NOTE:** If you click **Cable Figure** after creating configuration figures, the cable figure appears. You can also display the cable figure by clicking **Cable Figure** without first creating configuration figures.

## Moving and exchanging Drive Boxes

When editing the logical configuration figure, you can move and exchange units by dragging and dropping them in the logical configuration figure in ascending order in paths. The following figure shows an example.

Set Drive Boxes in [1], [2], [3], [4], [5] order.

(Path 0, Path 1, Path 2, Path 3, Path 0, Path 1...)



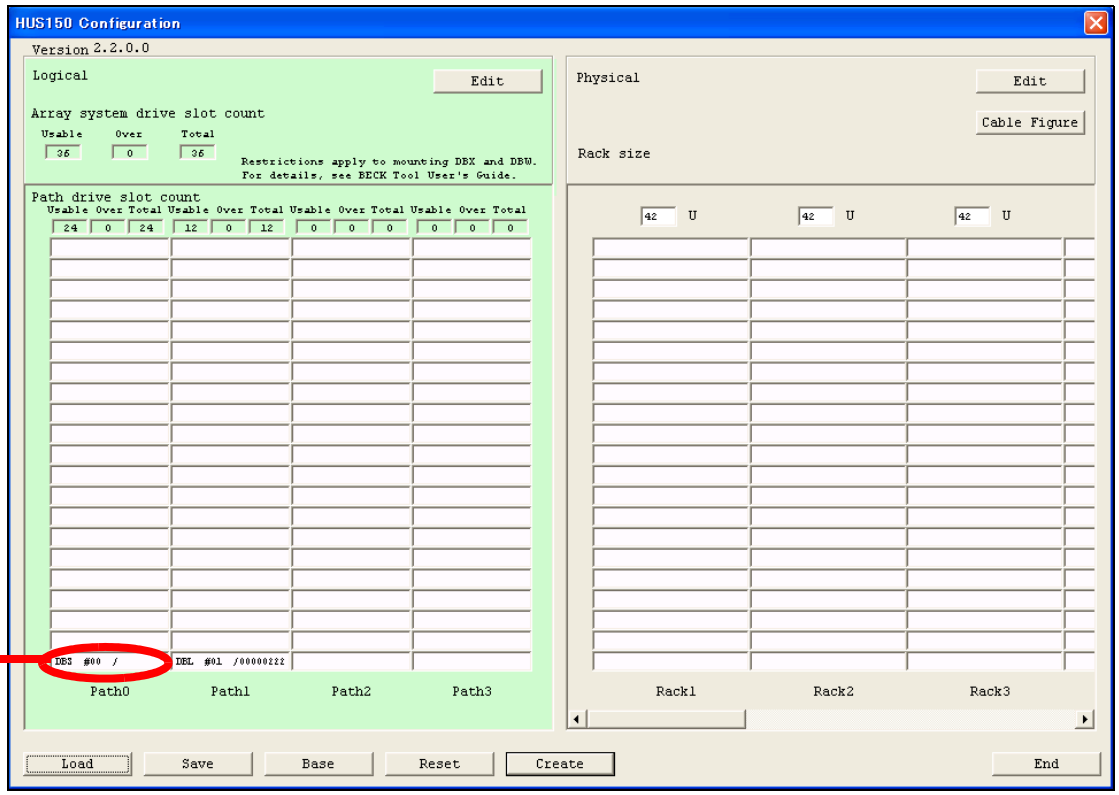

Before you move and exchange DBX Drive Boxes, observe the following guidelines:

- A DBX Drive Box consists of unit A and unit B.
- When you select unit A or unit B, only the unit selected is highlighted in orange.
- Unit A and unit B work as a pair. After you drag unit A, unit B follows when you drop it.

  For example, assume you want to exchange DBX #01 (DBX #01-A and DBX #01-B) and DBX #02 (DBX #02-A and DBX #02-B). If you drag DBX #01-A and drop it on DBX #02-B, DBX #01-A, DBX #02-A, DBX #01-B, and DBX #02-B are exchanged.
- You cannot exchange a DBX Drive Box for a DBL or DBS Drive Box in the logical configuration figure.
- Two empty boxes are required to exchange DBX and empty boxes.

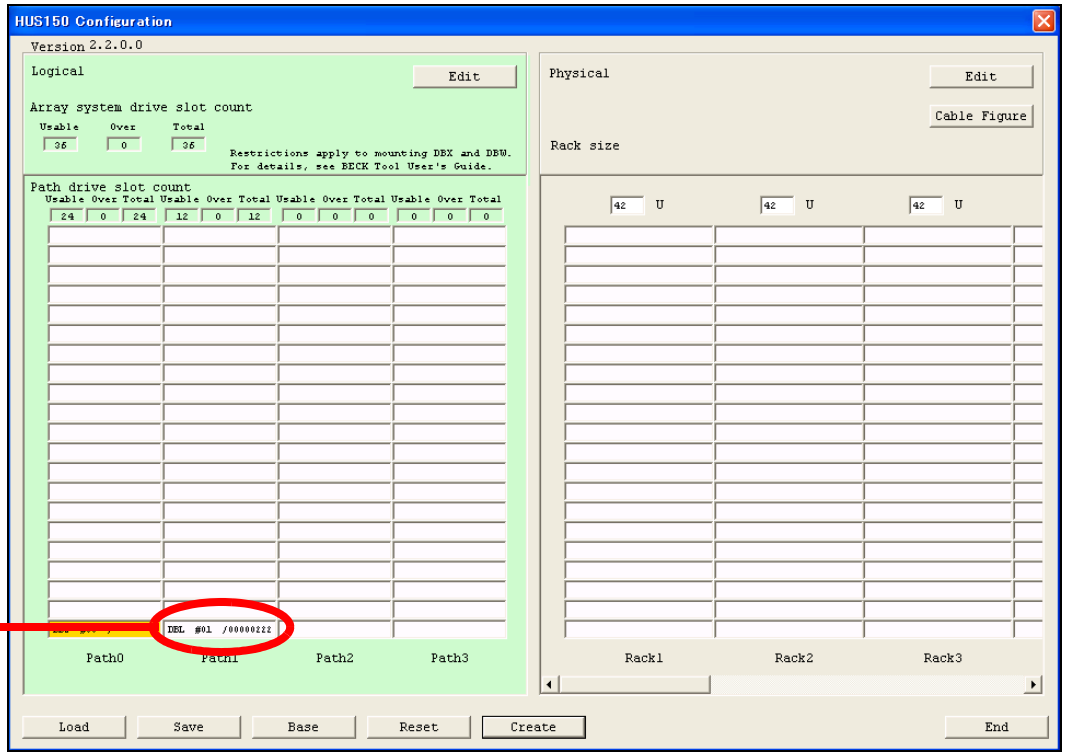
To move and exchange Drive Boxes:

1. Click an existing Drive Box in the path. The existing Drive Box is highlighted in orange.



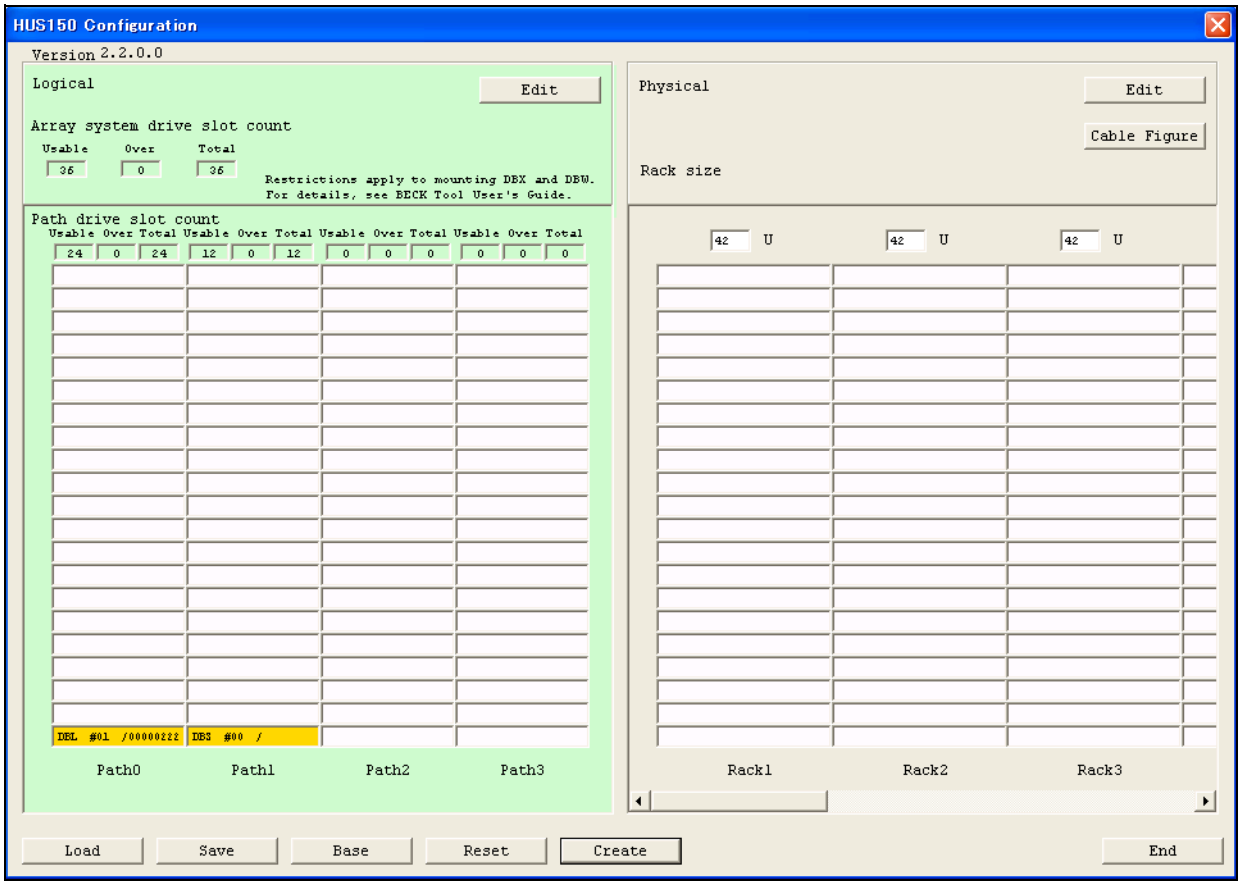

Click the existing Drive Box.

2. Drag the existing Drive Box to the destination Drive Box. Empty boxes can be the destination; however, you cannot specify Controller Box and empty boxes for Controller Box as the destination,




Drag here.

Drive Boxes are exchanged, the box is highlighted in orange, and the unit ID and box code are exchanged accordingly.



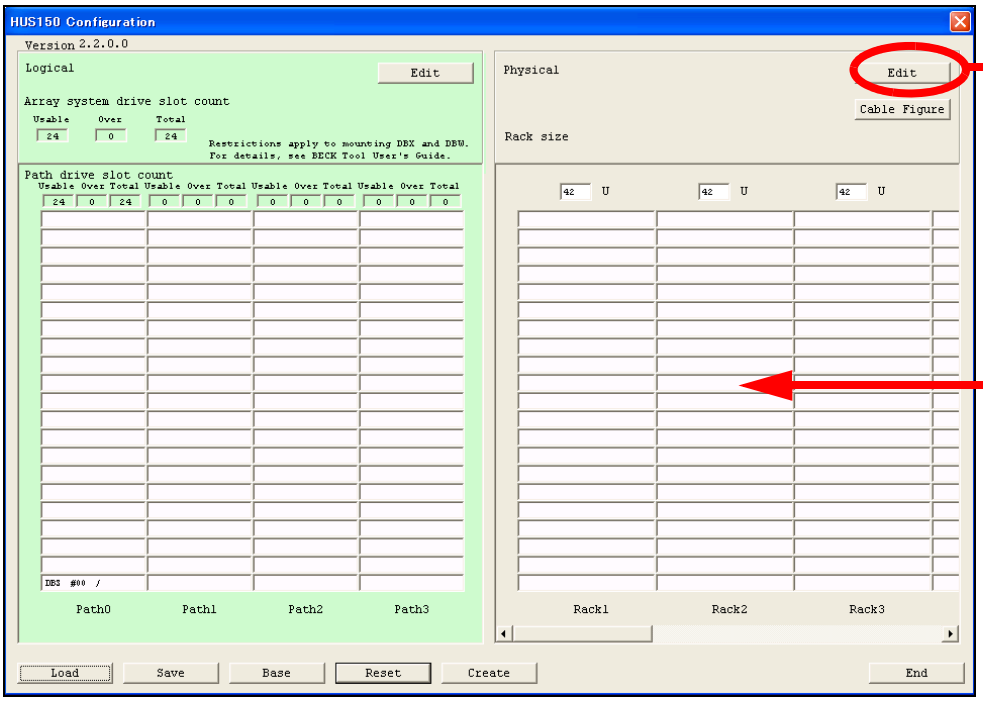

3. After moving and exchanging units by dragging and dropping them, click **Cable Figure** to display the cable figure.

**TIP: Cable Figure** also lets you display the cable figure without first creating configuration figures.

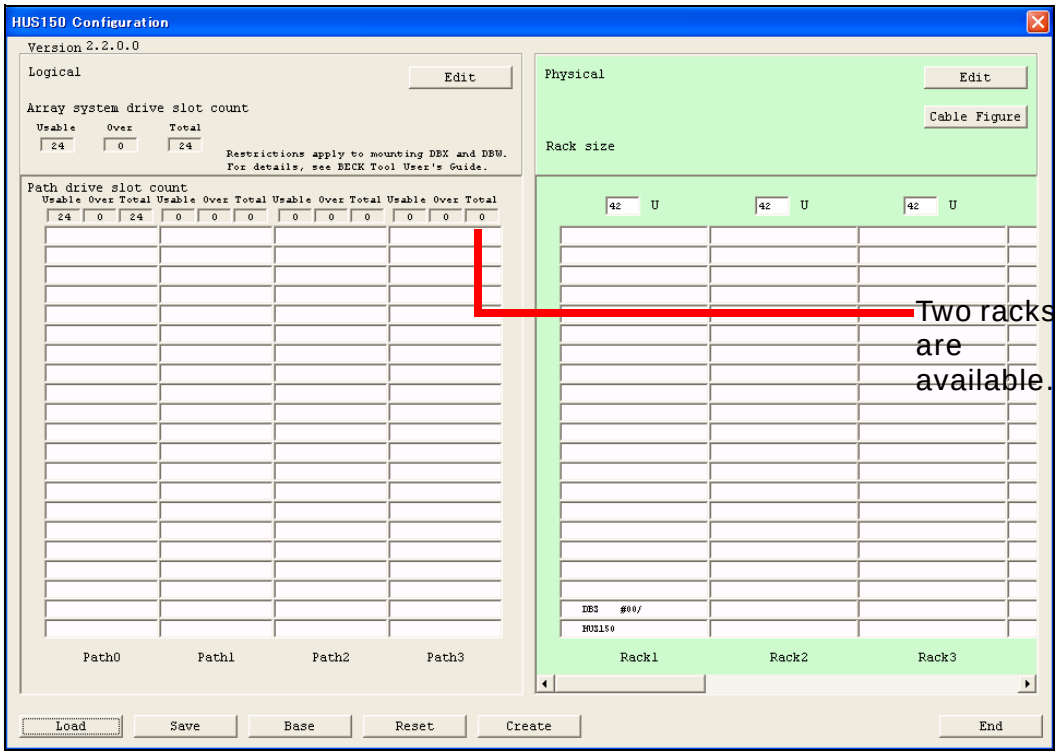
# Editing the physical configuration figure

To edit the configuration shown in the physical configuration figure:

1. In the physical configuration figure, click **Edit** or click the physical configuration figure.




2. When the message **May logical configuration figure be initialized?** appears, click **OK** to remove the message. All the units, unit IDs, and box codes in the logical configuration figure are cleared. The physical configuration figure is highlighted in light green.




From this screen, you can:

- Set rack size — see Setting the rack size, below.
- Assign units to a rack or set up an empty rack box — see Setting units to a rack or an empty rack box on page H-42.
- Move and exchange units — see Moving and exchanging units on page H-49.

## Setting the rack size

You can specify the rack size in the physical configuration figure. Rack sizes are specified in 0 to 42 U. The default setting is 42 U. You can also set the rack size when you are not editing the physical configuration figure.

The following figures show examples of Hitachi Unified Storage racks displayed in the BECK tool. The following sizes are represented by a box in the physical configuration figure:

- Hitachi Unified Storage 150: 3[U]
- Hitachi Unified Storage 110 and 130: 2[U]
- DBL, DBS, and DBF Drive Boxes: 2[U]
- DBX Drive Box: 4[U]
- DBW Drive Box: 5[U]
- Empty: 2[U]

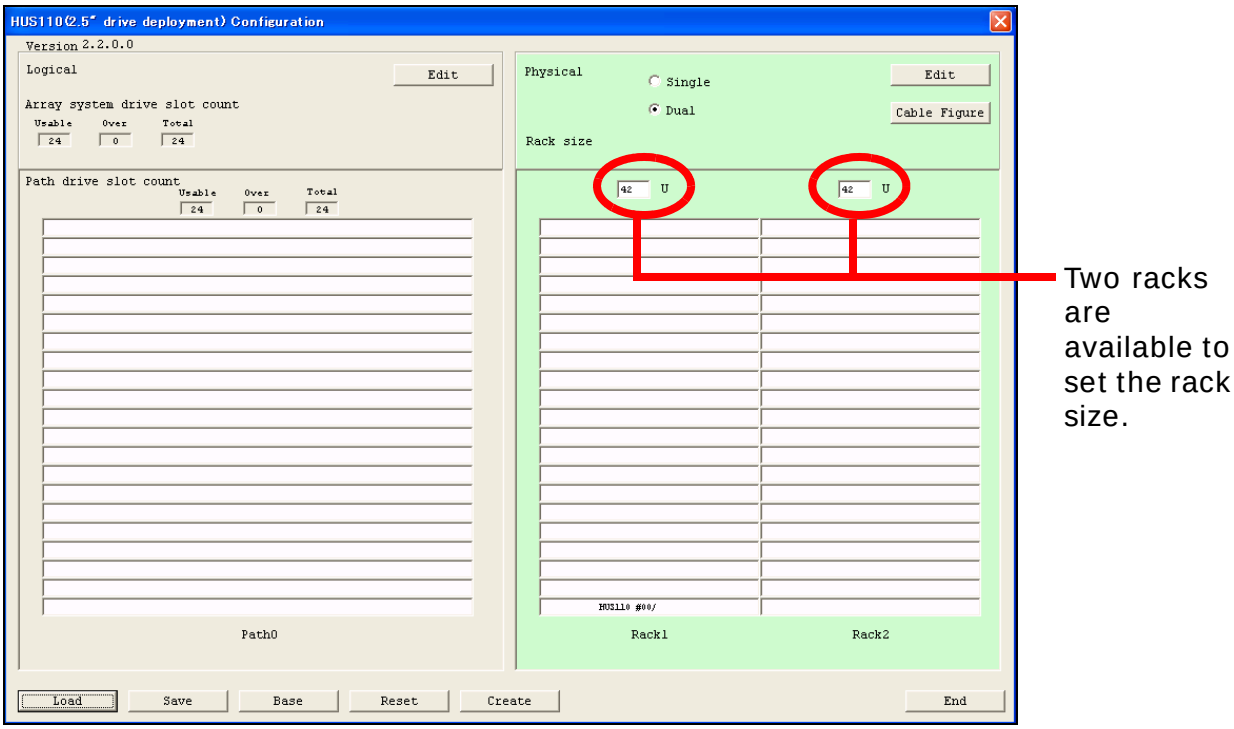



**Figure H-7: Example of Rack Size for Hitachi Unified Storage 110**

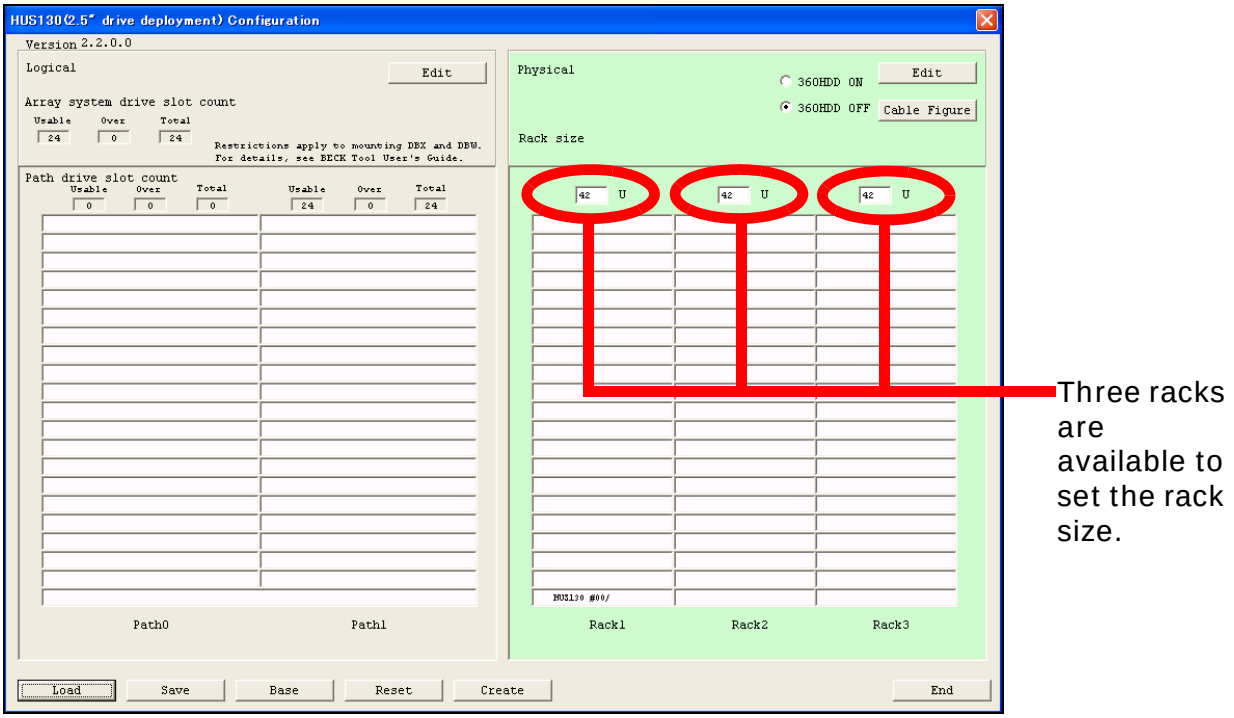



**Figure H-8: Example of Rack Size for Hitachi Unified Storage 130**

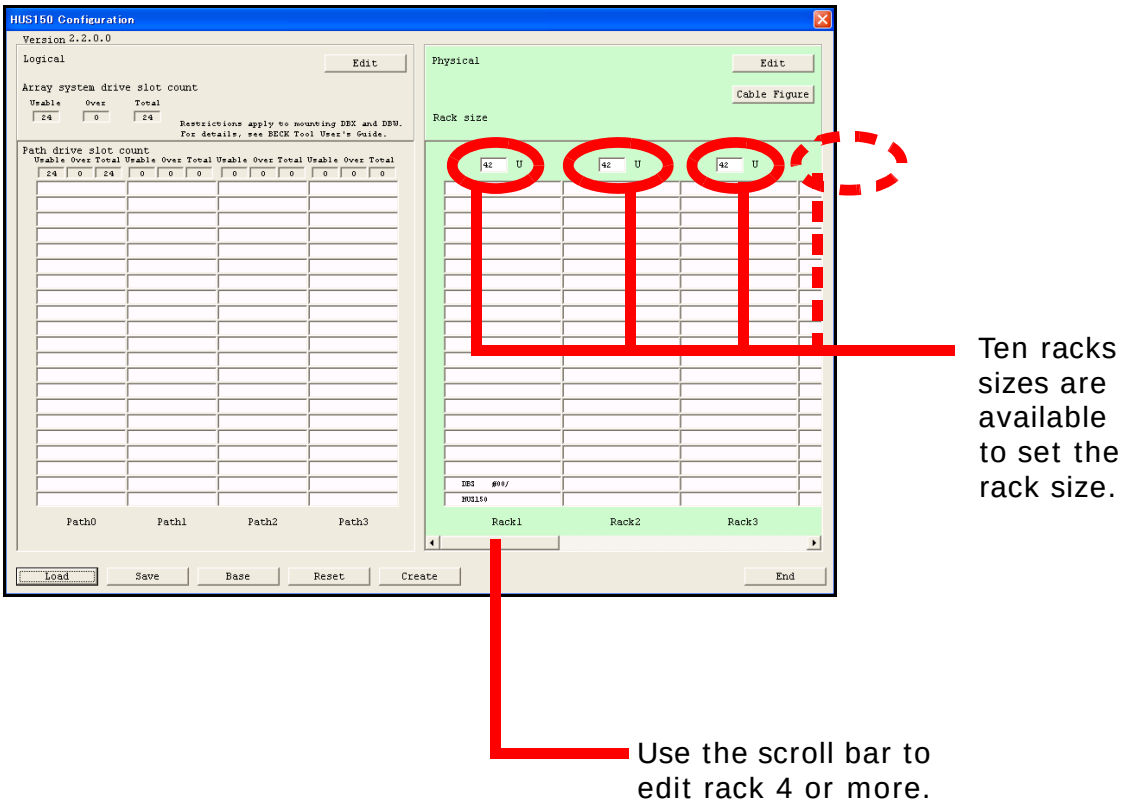



**Figure H-9: Example of Rack Size for Hitachi Unified Storage 150**

## Setting units to a rack or an empty rack box

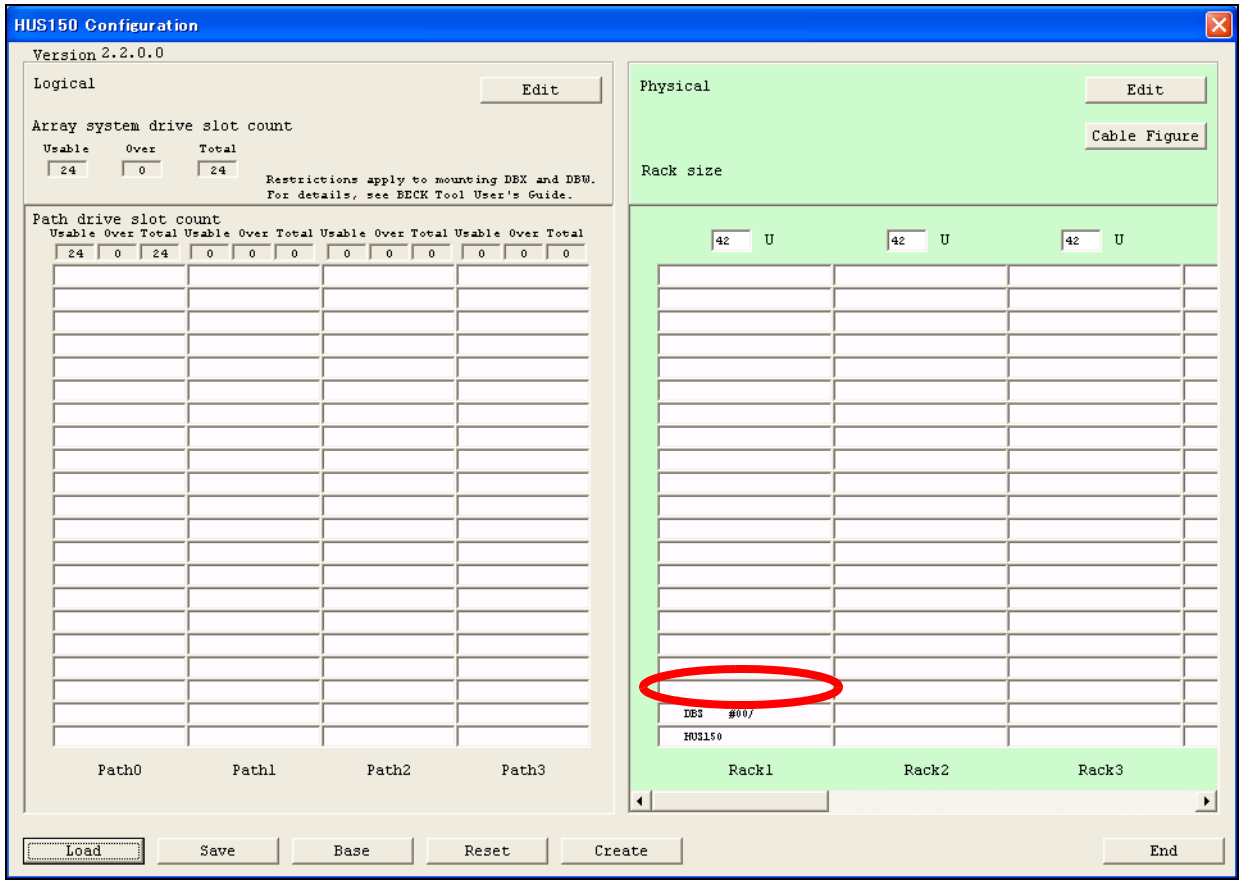
Setting units to a rack or an empty rack box in Physical, you can:

- To set drive box in an empty rack box — see Setting a Drive Box in an empty rack box, below
- To change/delete a drive box — see Changing or deleting a Drive Box on page H-45
- To set a controller box or edit its box code — see Setting a Controller Box or editing its box code on page H-46

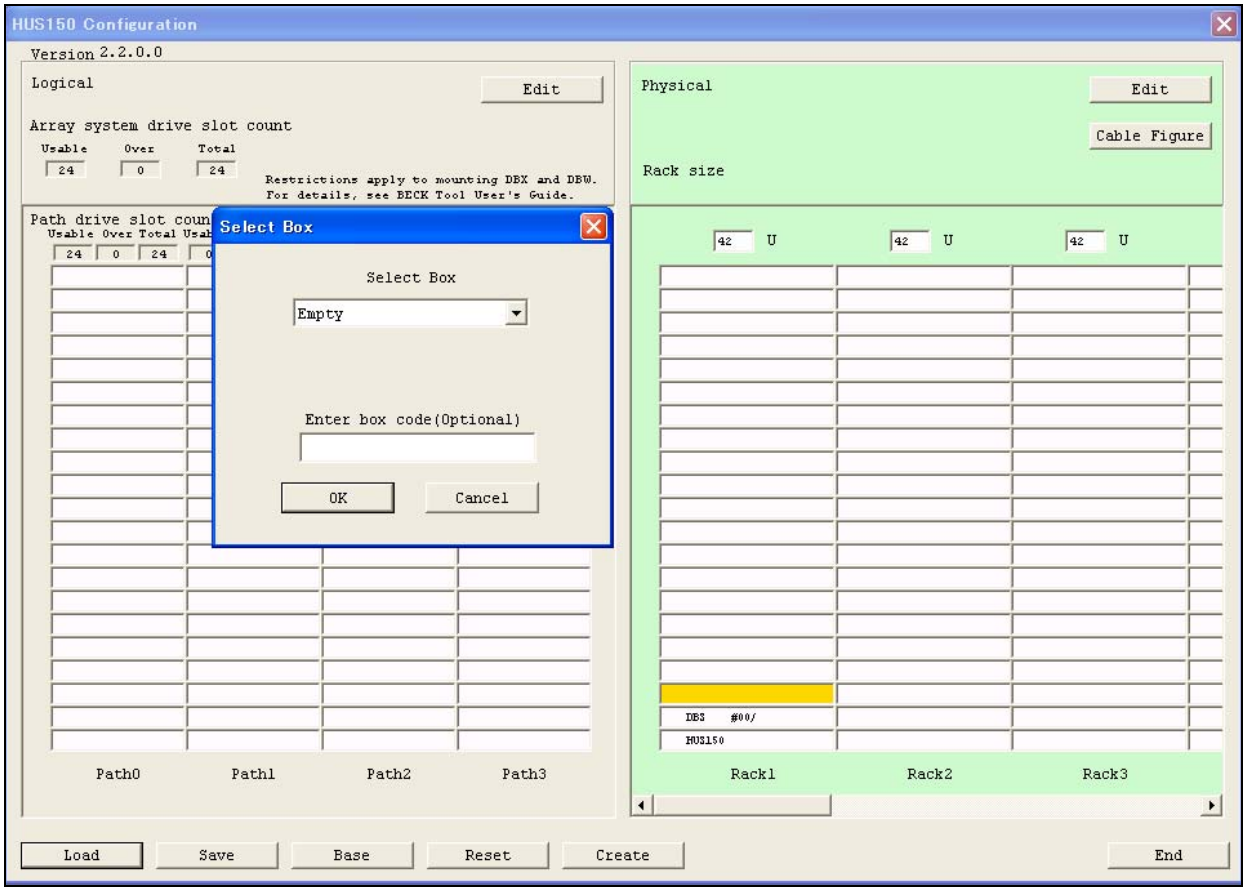
### Setting a Drive Box in an empty rack box

To set drive box in an empty rack box:

1. Right-click an empty box for racks when the physical configuration figure can be edited.



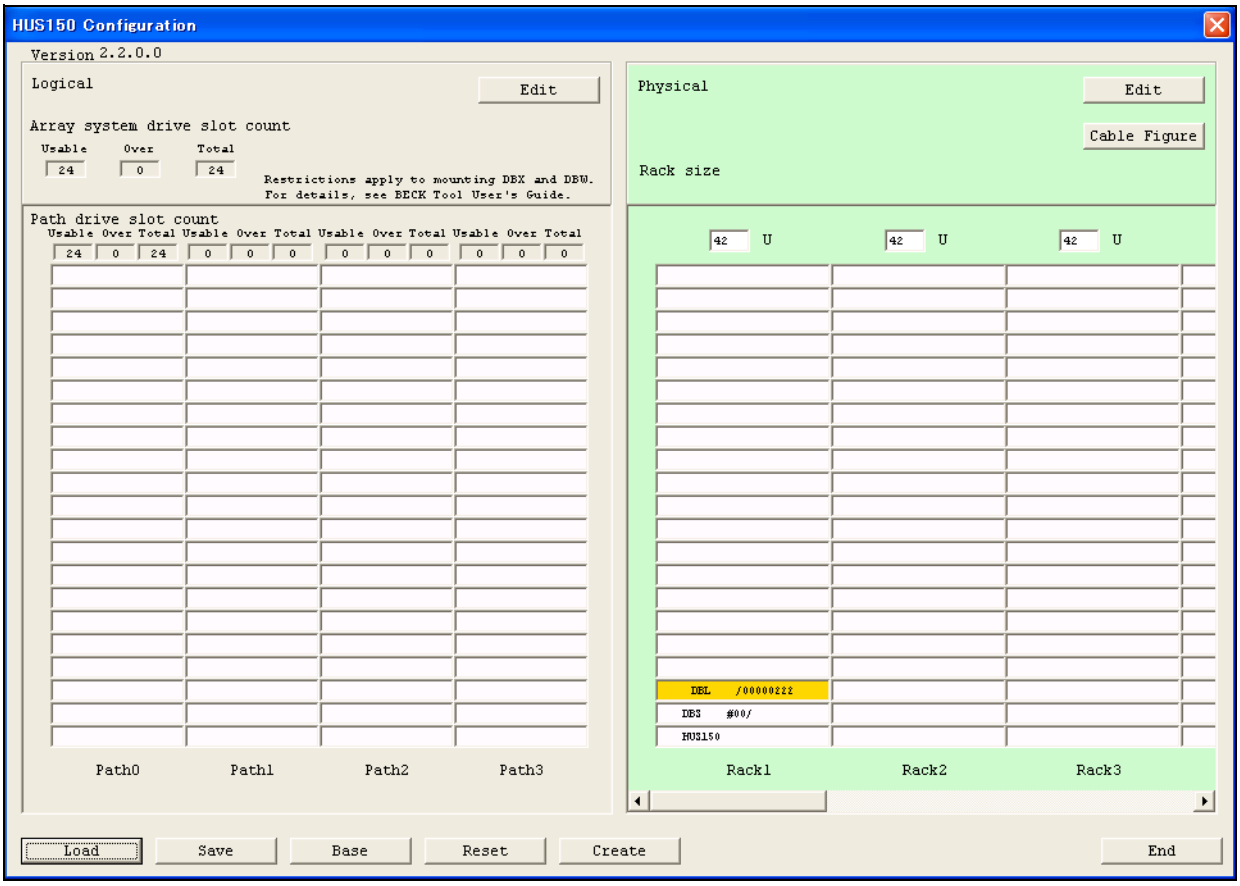

The selected box is highlighted in orange and the Select Box dialog box appears.




2. In the Select Box dialog box, click the desired Drive Box. You can optionally enter a box code for the selected Drive Box in the **Enter box code (optional)** field.

   For the DBW Drive Box, you can optionally enter up to 15 alphanumeric characters. If you enter 9 characters or more, they appear as 5 upper-case characters followed by dashes (**---**).

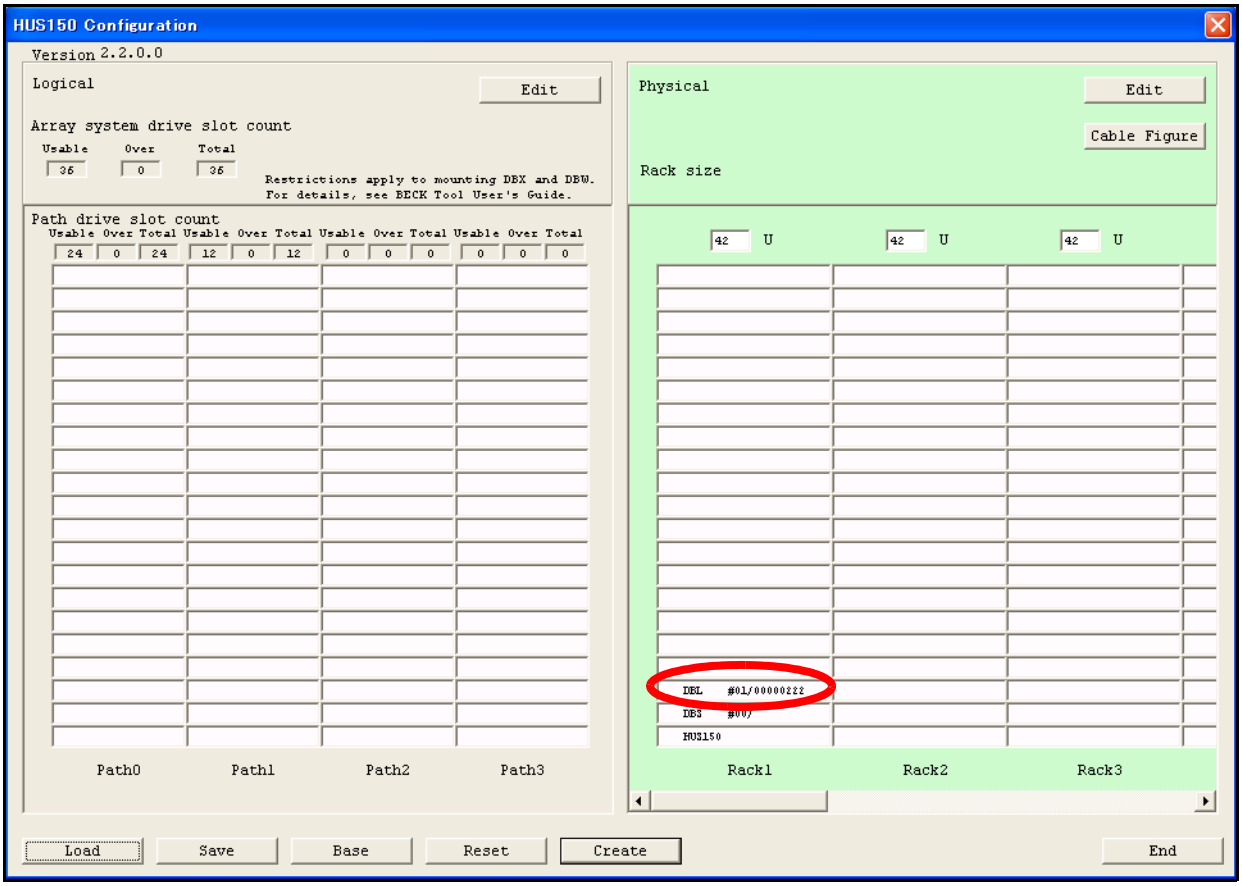
3. Click **OK**. The selected Drive Box appears in the box.


HUS150 Configuration
Version 2.2.0.0
Logical
Edit
Array system drive slot count
Usable
Over
Total
24
0
24
Restrictions apply to mounting DBX and DBW.
For details, see BECK Tool User's Guide.
Path drive slot count
Usable Over Total Usable Over Total Usable Over Total Usable Over Total
24 0 24 0 0 0 0 0 0 0 0 0
Path0
Path1
Path2
Path3
Physical
Edit
Cable Figure
Rack size
42 U
42 U
42 U
DBL /00000222
DBS #00/
HUS150
Rack1
Rack2
Rack3
Load
Save
Base
Reset
Create
End

## Changing or deleting a Drive Box

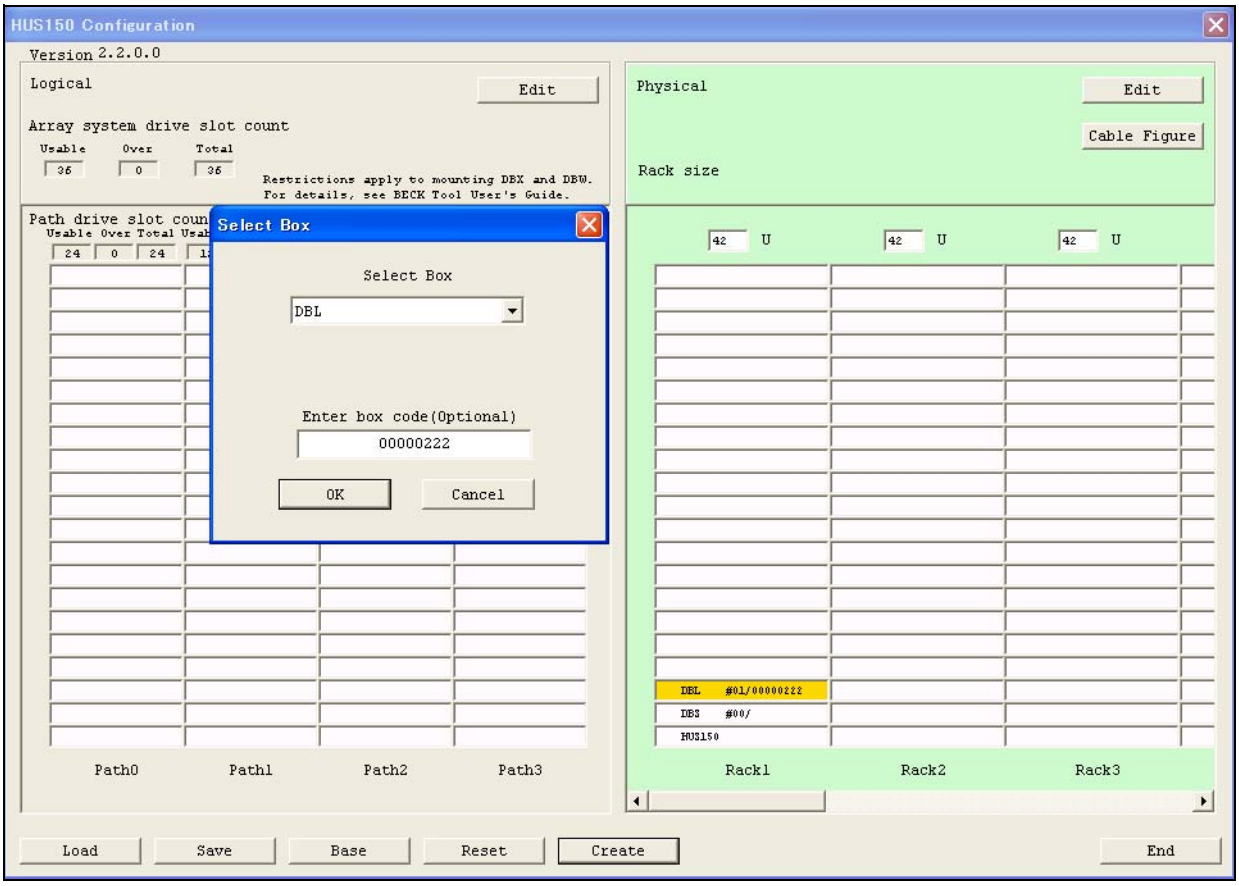
To change or delete a Drive Box:

1. Right-click a Drive Box in the rack.




2. The selected Drive Box is highlighted in orange and the Select Box dialog box appears. The button of the Drive Box corresponds to the Drive Box type you selected. If you registered the Drive Box, a box code is also displayed.

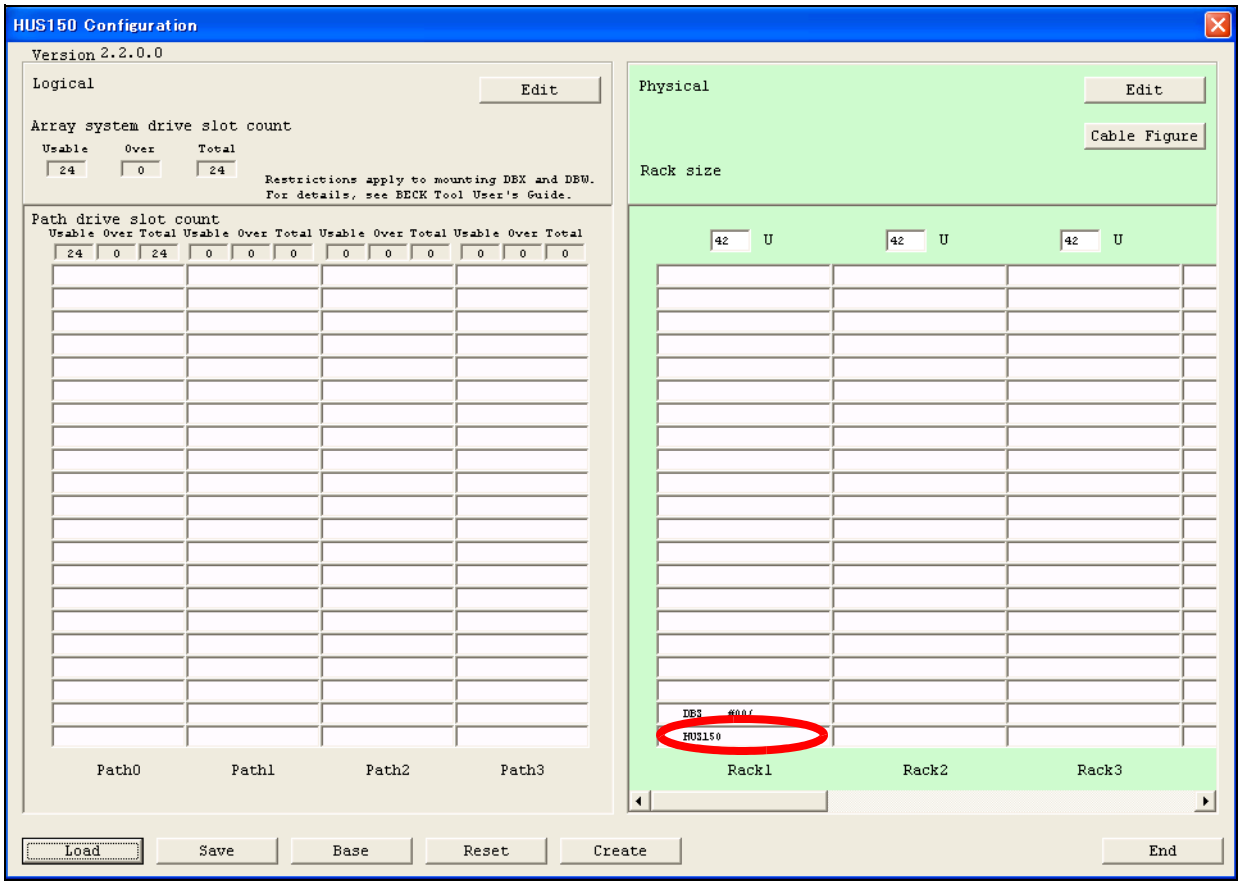
   If you change the Drive Box type, the Drive Box is changed or deleted. You can also edit the box code.



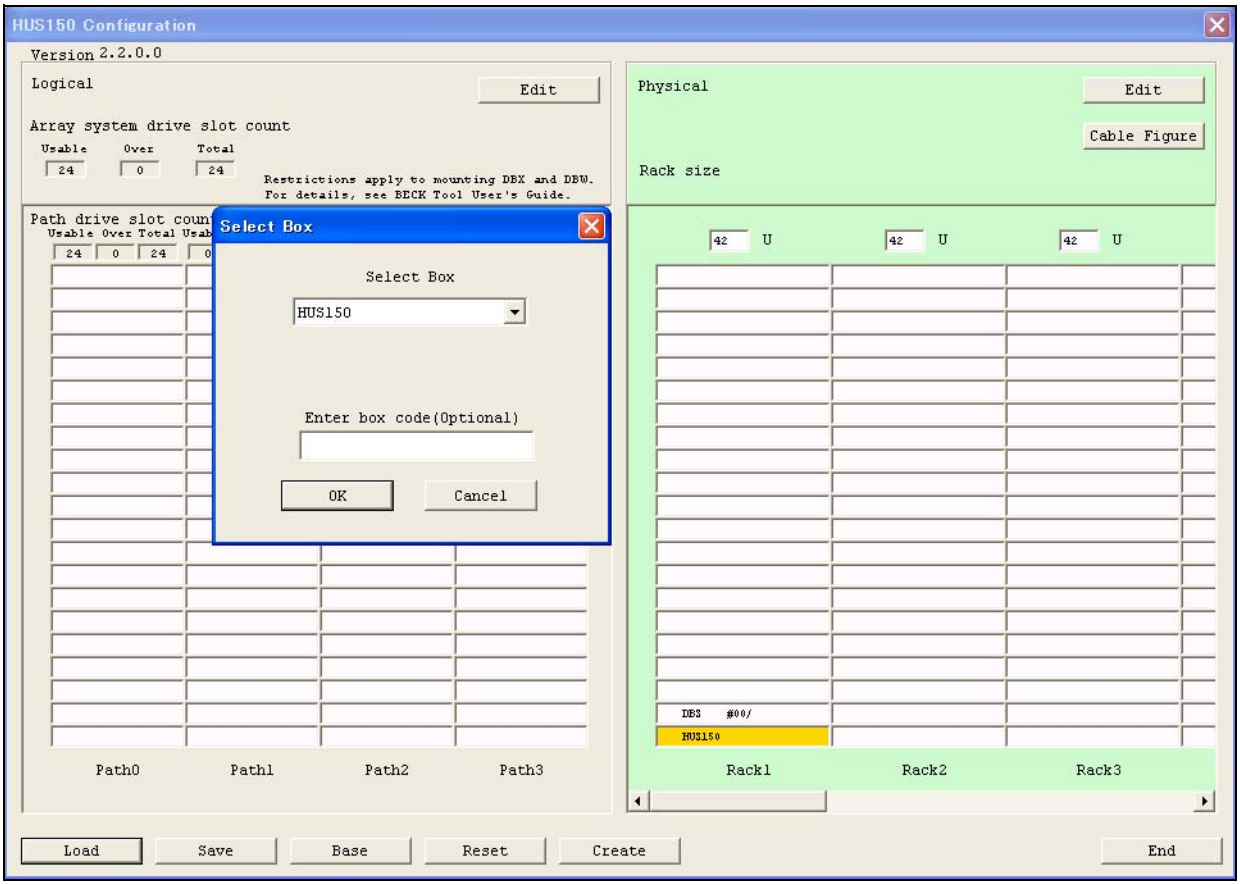

## Setting a Controller Box or editing its box code

To set a controller box or edit its box code, use the following procedure. In this procedure, screens for a Hitachi Unified Storage 150 are used.

1. Right-click a Controller Box in Rack 1 or right-click an empty box in the Rack area if no Controller Box is displayed.




The box is highlighted in orange and the Select Box dialog box appears, with the Controller Box and its box code is displayed. If you registered the Controller Box, a box code is displayed and can be edited. If the configuration screen does not display a Controller Box, click **OK** to add a Controller Box to the configuration screen. Controller Box can be added only in the Rack 1.




From this screen, you can:

- Set a drive box in an empty rack box — see Setting a Drive Box in an empty rack box on page H-42
- Change or delete a Drive Box — see Changing or deleting a Drive Box on page H-45
- Set a Controller Box or edit its box code — see Setting a Controller Box or editing its box code on page H-46

If you click **Cable Figure** after creating configuration figures, the cable figure is displayed. You cannot add a Drive Box below the Controller Box.

**TIP: Cable Figure** also lets you display the cable figure without first creating configuration figures.

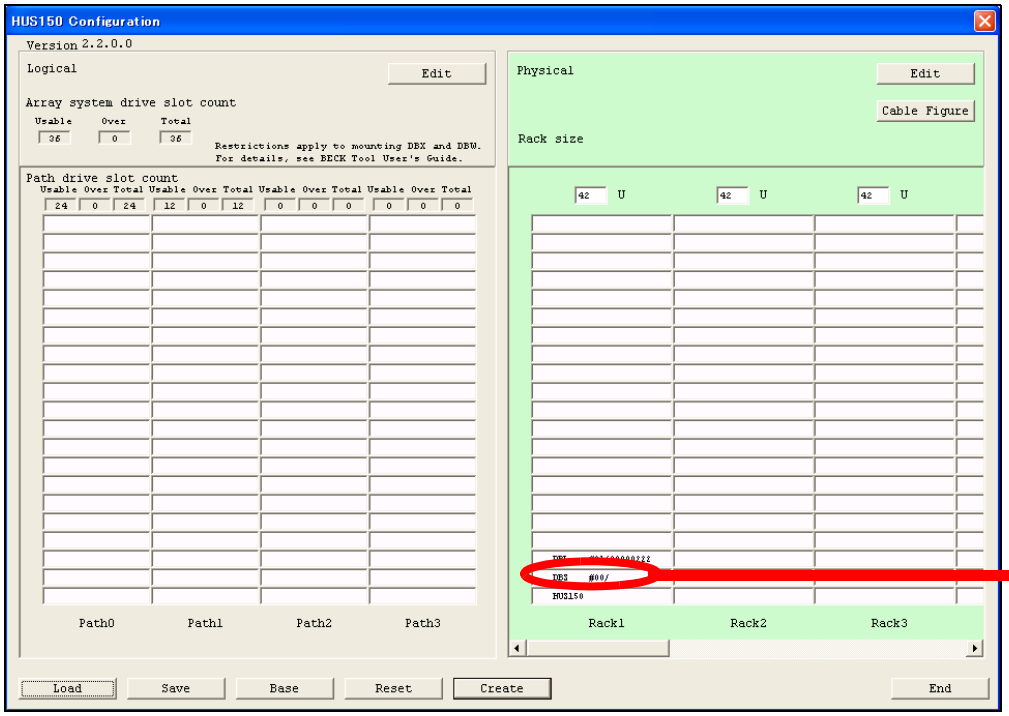
## Moving and exchanging units

You move and exchange units by dragging and dropping them in the physical configuration figure. The following sizes are represented by a box in the physical configuration figure.

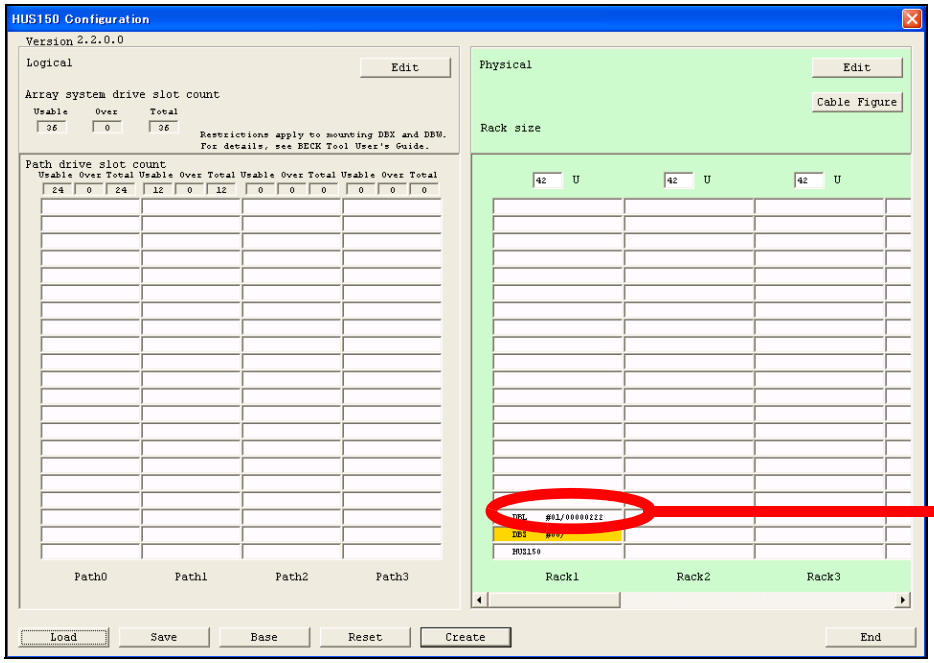
- Hitachi Unified Storage 150: 3[U]
- Hitachi Unified Storage 110 and 130: 2[U]
- DBL, DBS, and DBF Drive Boxes: 2[U]
- DBX Drive Box: 4[U]
- DBW Drive Box: 5[U]
- Empty: 2[U]

To move and exchange units:

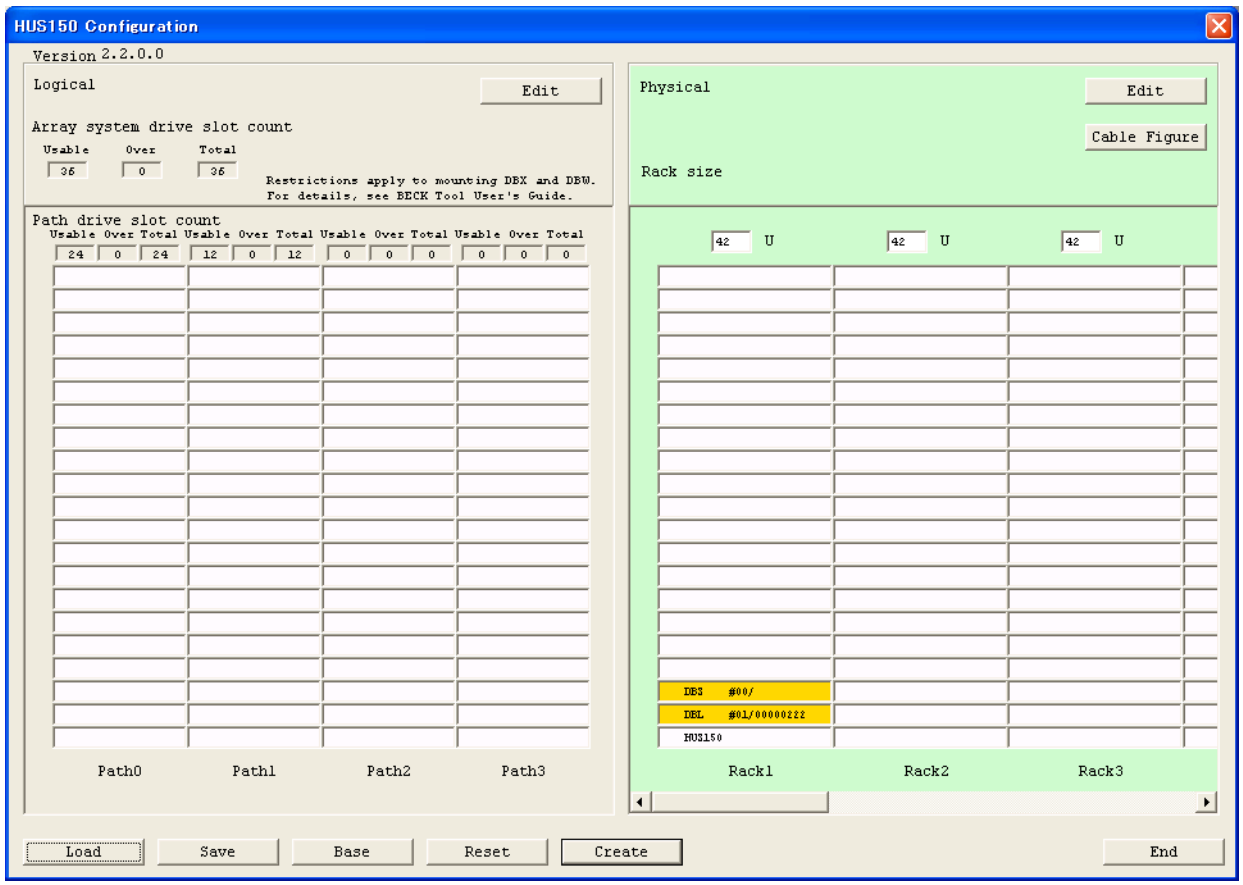
1. Click an existing Drive Box in the rack. The existing Drive Box is highlighted in orange.




2. Drag the existing Drive Box to the destination Drive Box. Empty boxes can be the destination, but you cannot specify a Controller Box and empty boxes for the Controller Box as the destination. You can also drag one to an empty box or a Controller Box in Rack 1 only.




Drive Boxes are exchanged and the box is highlighted in orange. The unit ID and the box codes are exchanged accordingly.



After moving and exchanging units by dragging and dropping them, click **Cable Figure** to display the cable figure. You can also display it by clicking **Cable Figure** without creating the configuration figure. You cannot add Drive Boxes below the Controller Box.

# Configuration with 360HDD OFF/ON

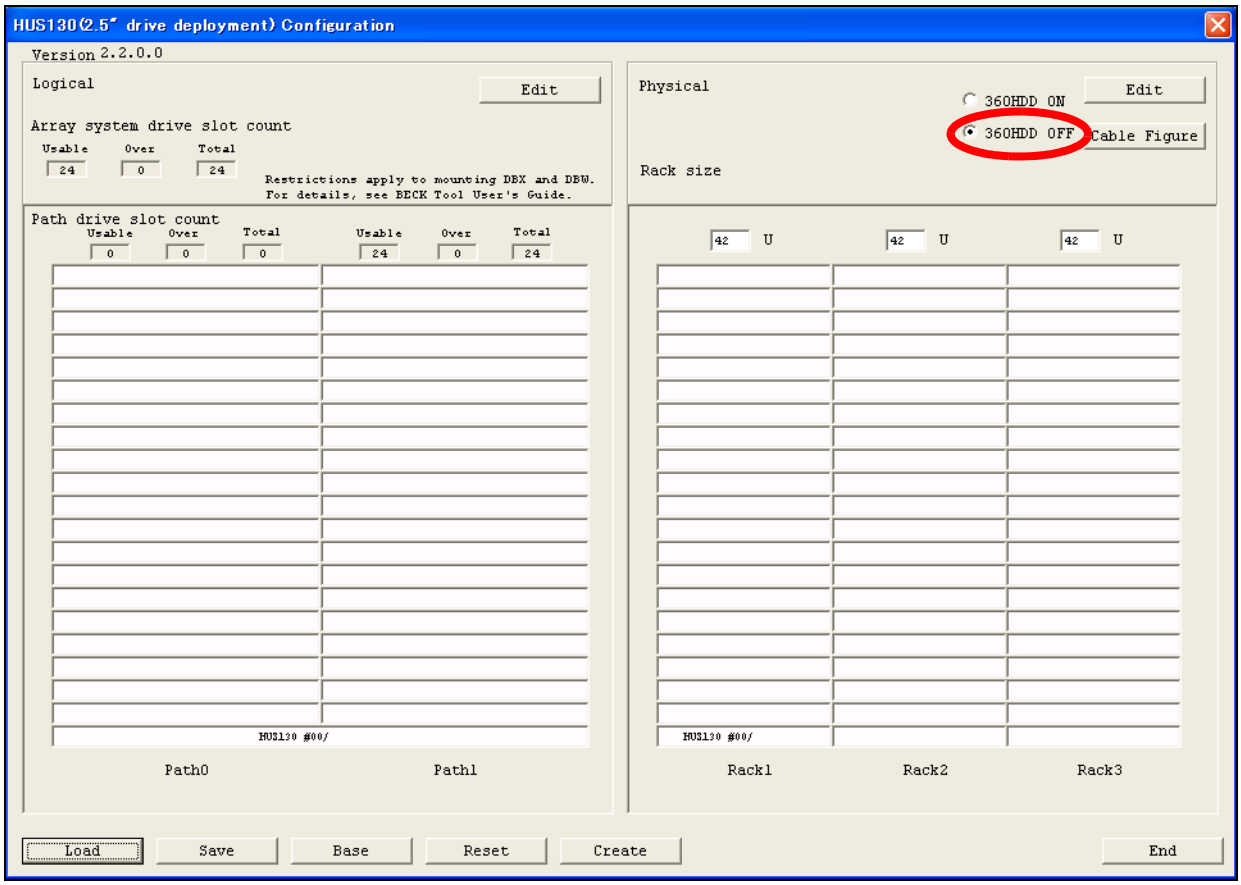
If you select as a Controller Box a Hitachi Unified Storage 130 system with 2.5-inch or 3.5-inch drives, the **360HDD OFF** and **360HDD ON** buttons appear in **Physical** area of the configuration screen.

If **360HDD OFF** is selected, you can create a configuration with a storage system whose firmware version is earlier than 0937/A. Alternatively, you can select **360HDD ON** to create a configuration with a storage system whose firmware version is 0937/A or later.

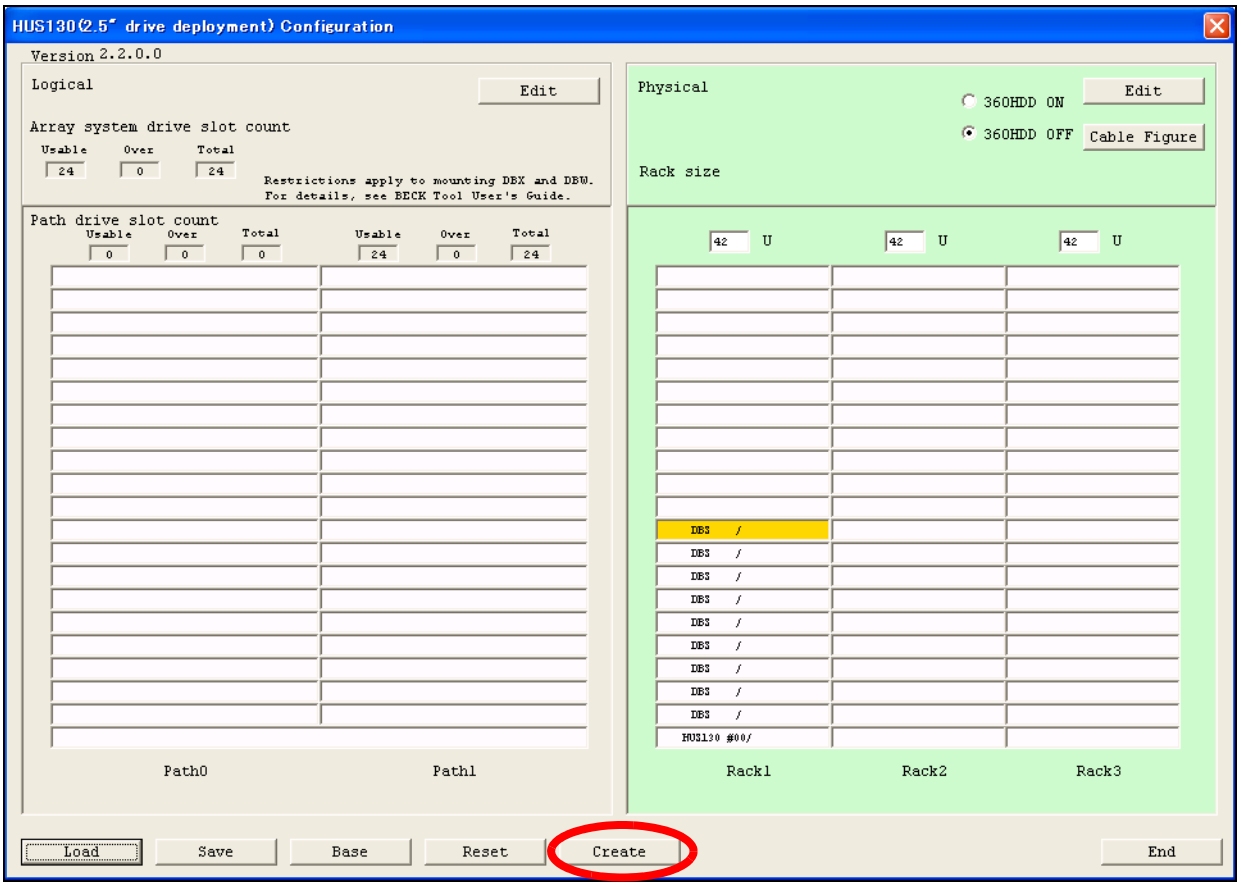
The following sections describe how to create a configuration in the **Physical** area using the **360HDD OFF** and **360HDD ON** options.

## Creating a configuration with 360HDD OFF selected

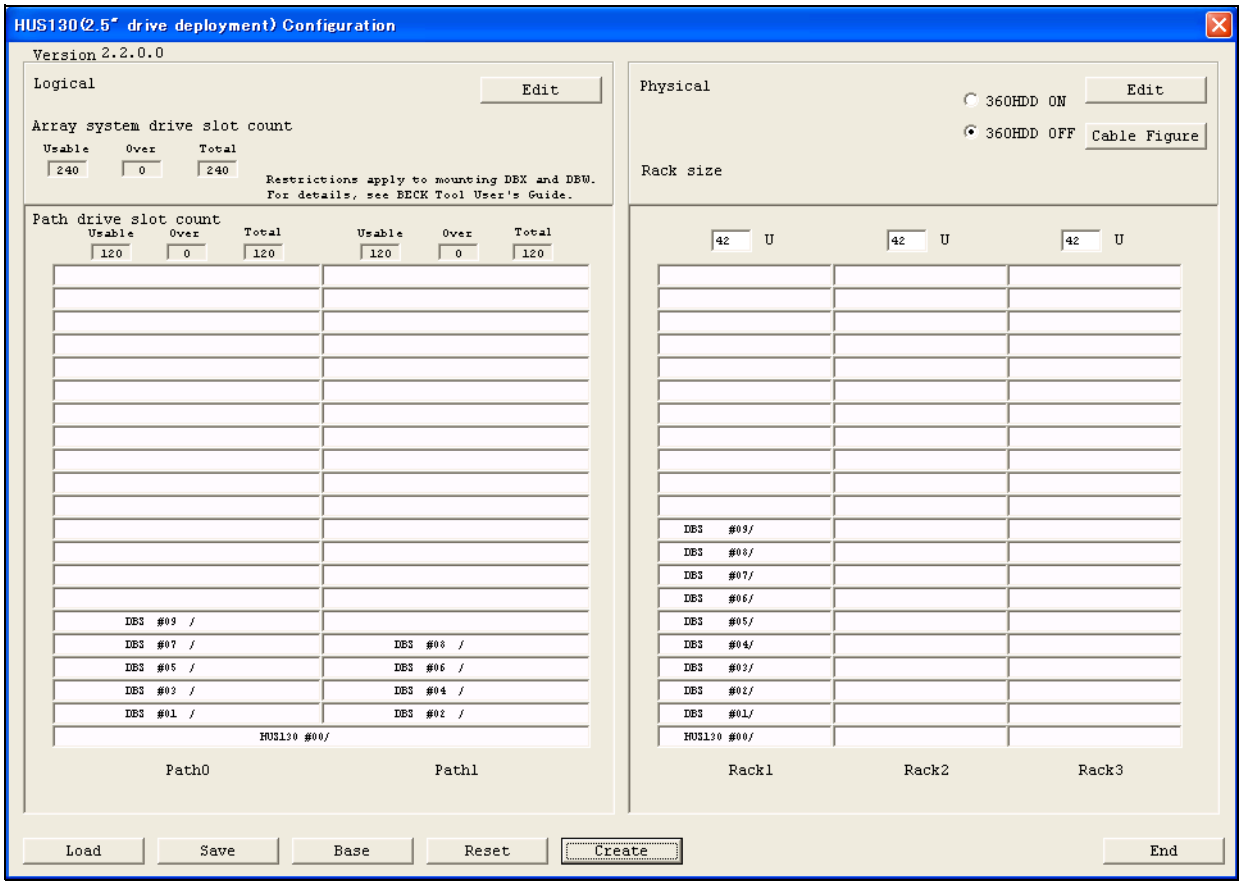
1. In the configuration screen, select **360HDD OFF**. In this example, a Hitachi Unified Storage 130 with 2.5-inch drives is selected as a the storage system.



2. In the **Physical** area, add a Controller Box in a Rack in Physical. In this example, DBS units are added to 9, which is the maximum number of DBS units that can be connected when only DBS units are used with **360HDD OFF** selected (firmware version is earlier than 0937/A).

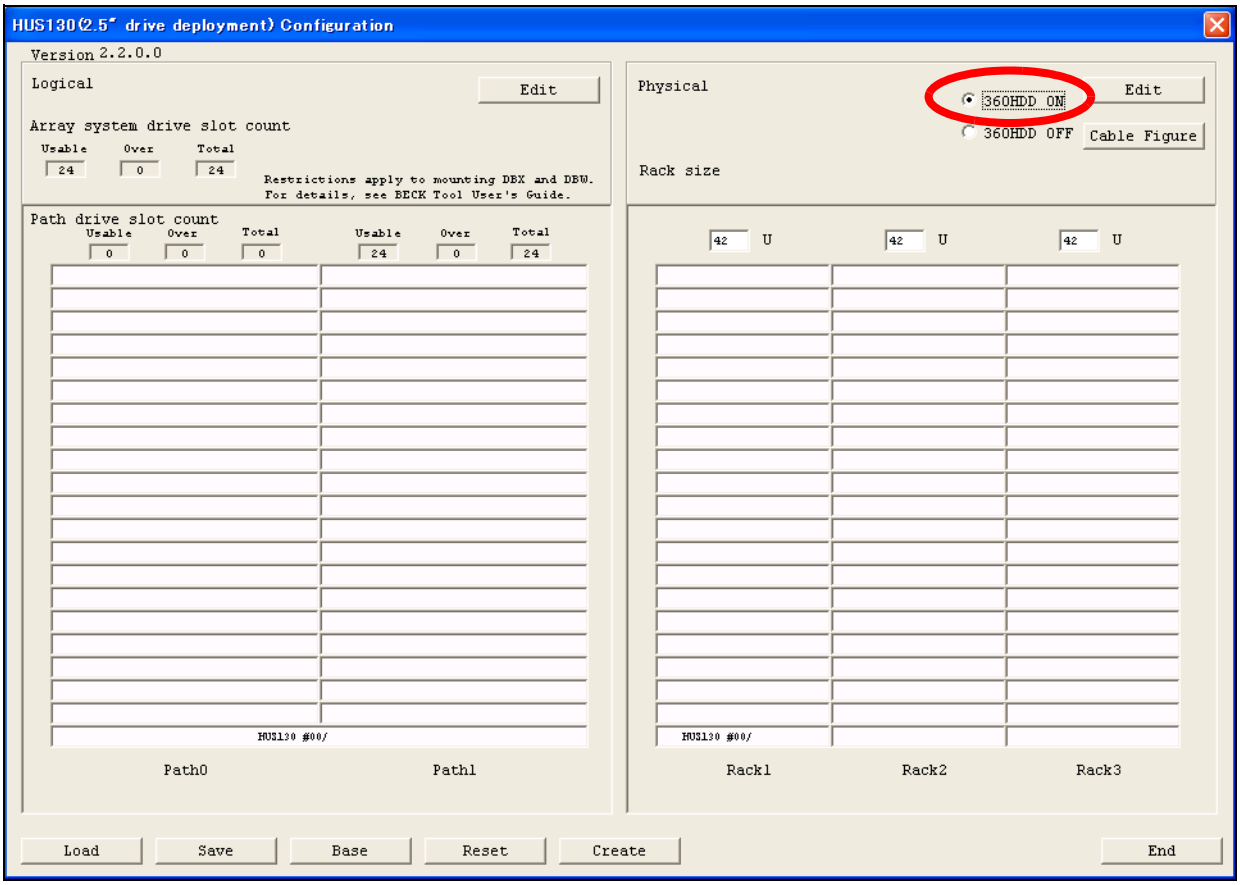



3. In the configuration screen, click **Create**. The configuration is displayed.

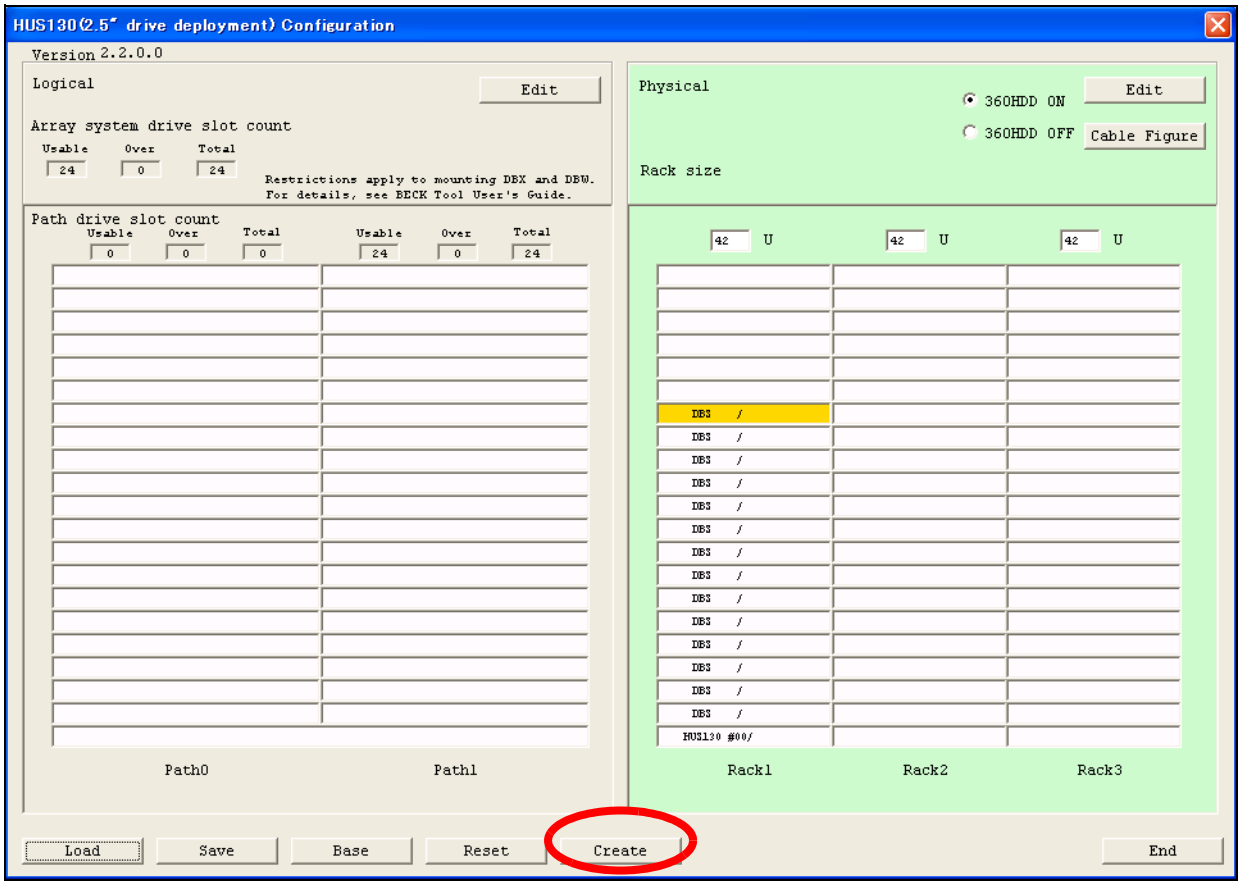



## Creating a configuration with 360HDD ON selected

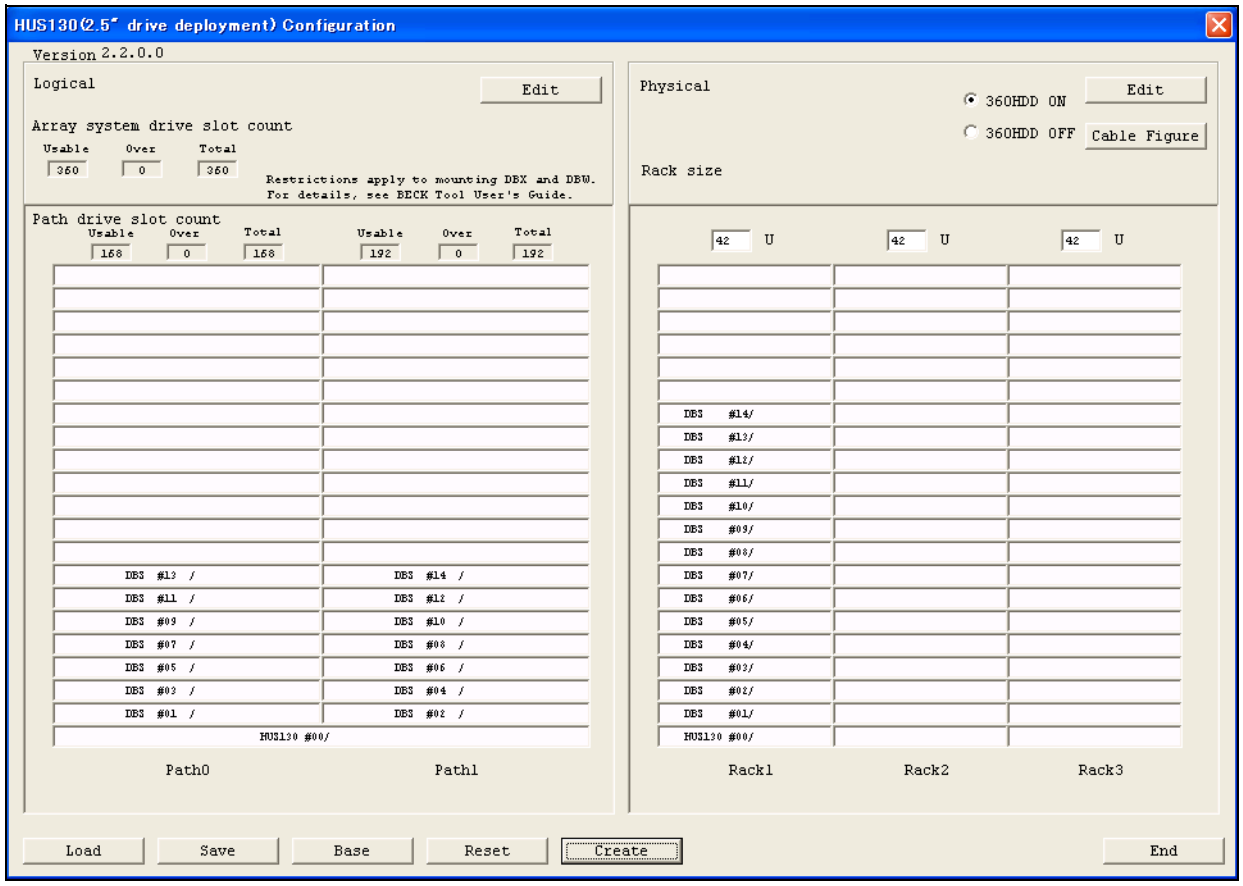
1. In the configuration screen, select **360HDD ON**. In this example, a Hitachi Unified Storage 130 with 2.5-inch drives is selected as the storage system.




2. In the **Physical** area, add a Controller Box in a rack. In this example, DBS units are added to 14, which is the maximum number of DBS units that can be connected when only DBS units are used with **360HDD ON** selected (firmware version is 0937/A or later).




3. In the configuration screen, click **Create**. The configuration is displayed.




As described above, you can use more Drive Boxes in a configuration when **360HDD ON** is selected than when **360HDD OFF** is selected. For details such as the number of maximum drives and Drive Boxes to be added when **360HDD ON** or **360HDD OFF** is selected, see Supported Drive Boxes on page H-3.

# Working with cable figures

The Cable Figure screen shows logical and physical configuration figures.

The total number of racks that can be shown are:

- Hitachi Unified Storage 110: 2
- Hitachi Unified Storage 130: 3
- Hitachi Unified Storage 150: 10 (use the scroll bar to display rack 4 or more)

## Sizes

The following sizes are represented by a box for a rack in the Cable Figure screen.

- Hitachi Unified Storage 150: 3[U]
- Hitachi Unified Storage 110 and 130: 2[U]
- DBL, DBS, and DBF Drive Boxes: 2[U]
- DBX Drive Box: 4[U]
- DBW Drive Box: 5[U]
- Empty: 2[U]

Figure H-10 shows an example for a Hitachi Unified Storage 150 system.

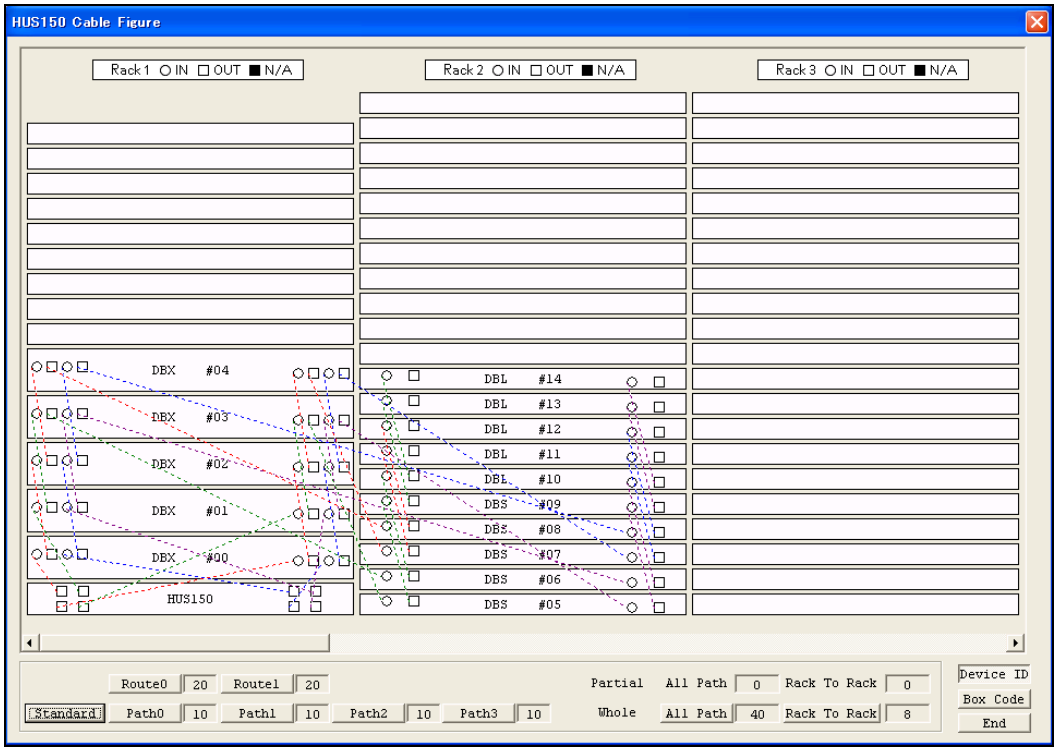



**Figure H-10: Example of cable figure for Hitachi Unified Storage 150**

## Buttons and fields

Figure H-11 shows the buttons in the Cable Figure screen and Table H-6 describes them.

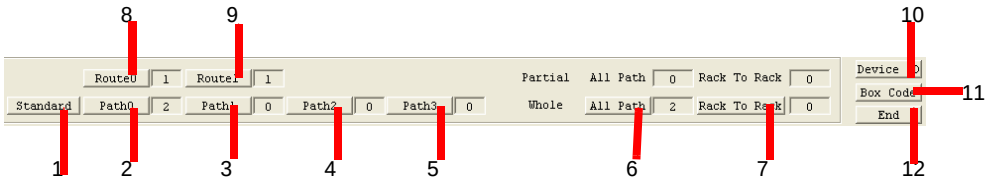



**Figure H-11: Buttons in the Cable Figure screen**

**Table H-6: Buttons for the cable figure**

| Number | Name | Description |
|---|---|---|
| 1 | Standard | Clears all highlighted SAS (ENC) cables in the Cable Figure screen. |
| 2 | Path0 | Highlights SAS (ENC) cables connected to Path0. |
| 3 | Path1 | Highlights SAS (ENC) cables connected to Path1 on a Hitachi Unified Storage 130 or 150 system. |
| 4 | Path2 | Highlights SAS (ENC) cables connected to Path2 on a Hitachi Unified Storage 150 system. |
| 5 | Path3 | Highlights SAS (ENC) cables connected to Path3 on a Hitachi Unified Storage 150 system. |
| 6 | All Path | Highlights SAS (ENC) cables connected to all the paths. |
| 7 | Rack to Rack | Highlights SAS (ENC) cables connected between racks. |
| 8 | Route0 | Highlights of SAS (ENC) cables connected to the unit of controller 0. |
| 9 | Route1 | Highlights of SAS (ENC) cables connected to the unit of controller 1. |
| 10 | unit ID | Shows or hides unit IDs. (Default: ON) |
| 11 | Box Code | If box codes are assigned to units, clicking this button shows or hides the box codes. |
| 12 | End | Closes the Cable Figure screen. |

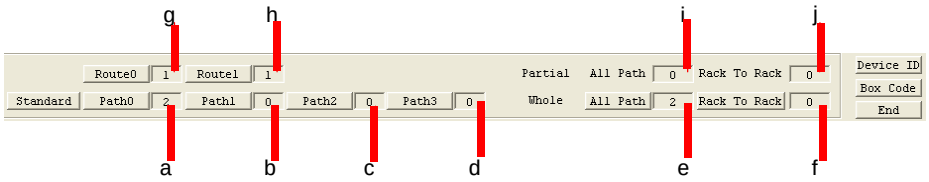



**Figure H-12: Fields in the Cable Figure screen**

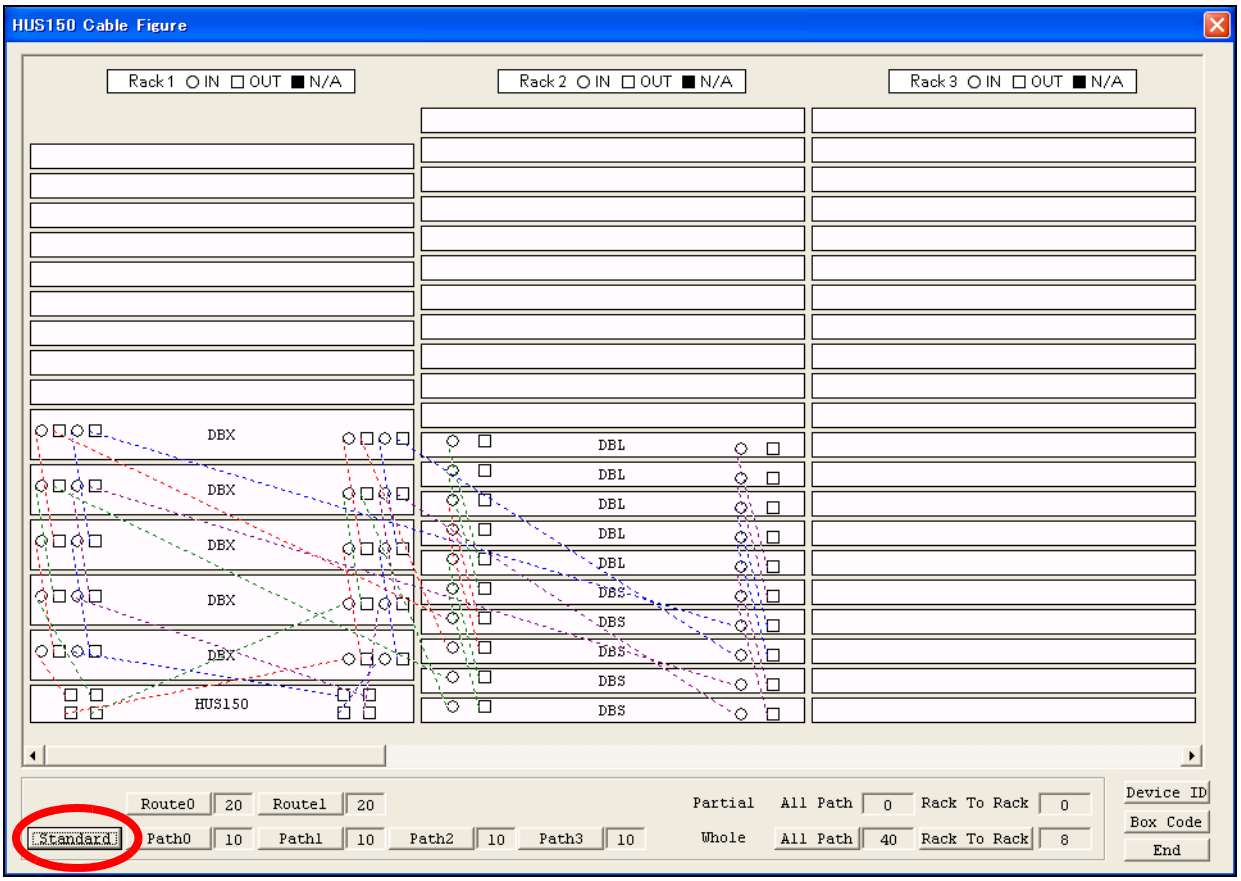
**Table H-7: Fields in the Cable Figure screen**

| Field | Description |
|---|---|
| a | Number of SAS (ENC) cables connected to path0. |
| b | Number of SAS (ENC) cables connected to path1 on a Hitachi Unified Storage 130 or 150 system. |
| c | Number of SAS (ENC) cables connected to path2 on a Hitachi Unified Storage 150 system. |
| d | Number of SAS (ENC) cables connected to path3 on a Hitachi Unified Storage 150 system. |
| e | Total number of SAS (ENC) cables. |
| f | Number of SAS (ENC) cables connected between racks. |
| g | Number of SAS (ENC) cables connected to controller0. |
| h | Number of SAS (ENC) cables connected to controller1. |
| i | Number of SAS (ENC) cables connected to the selected unit. |
| j | Number of SAS (ENC) cables connected spanning the selected unit. |

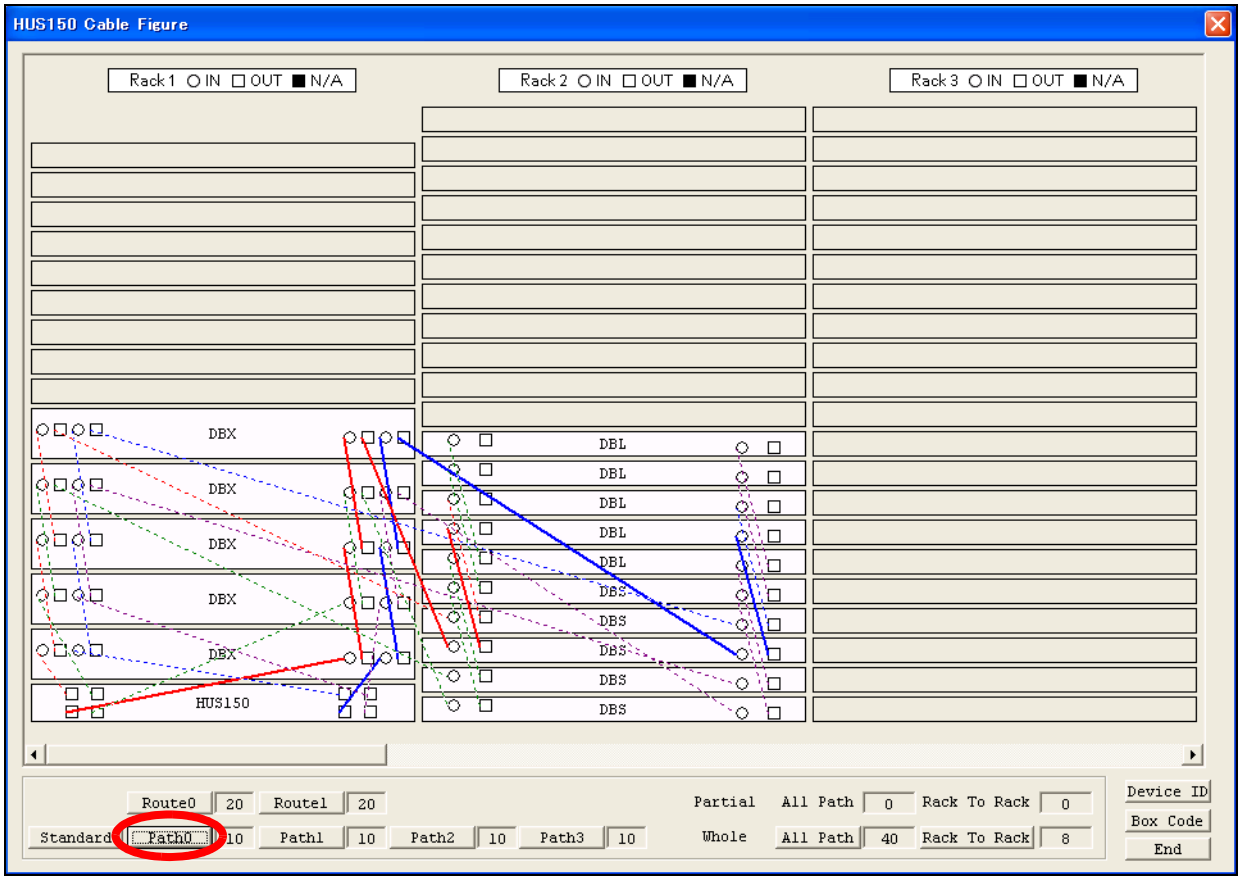
## Working with cable figures

The following procedure describes how to use the buttons with cable figures.

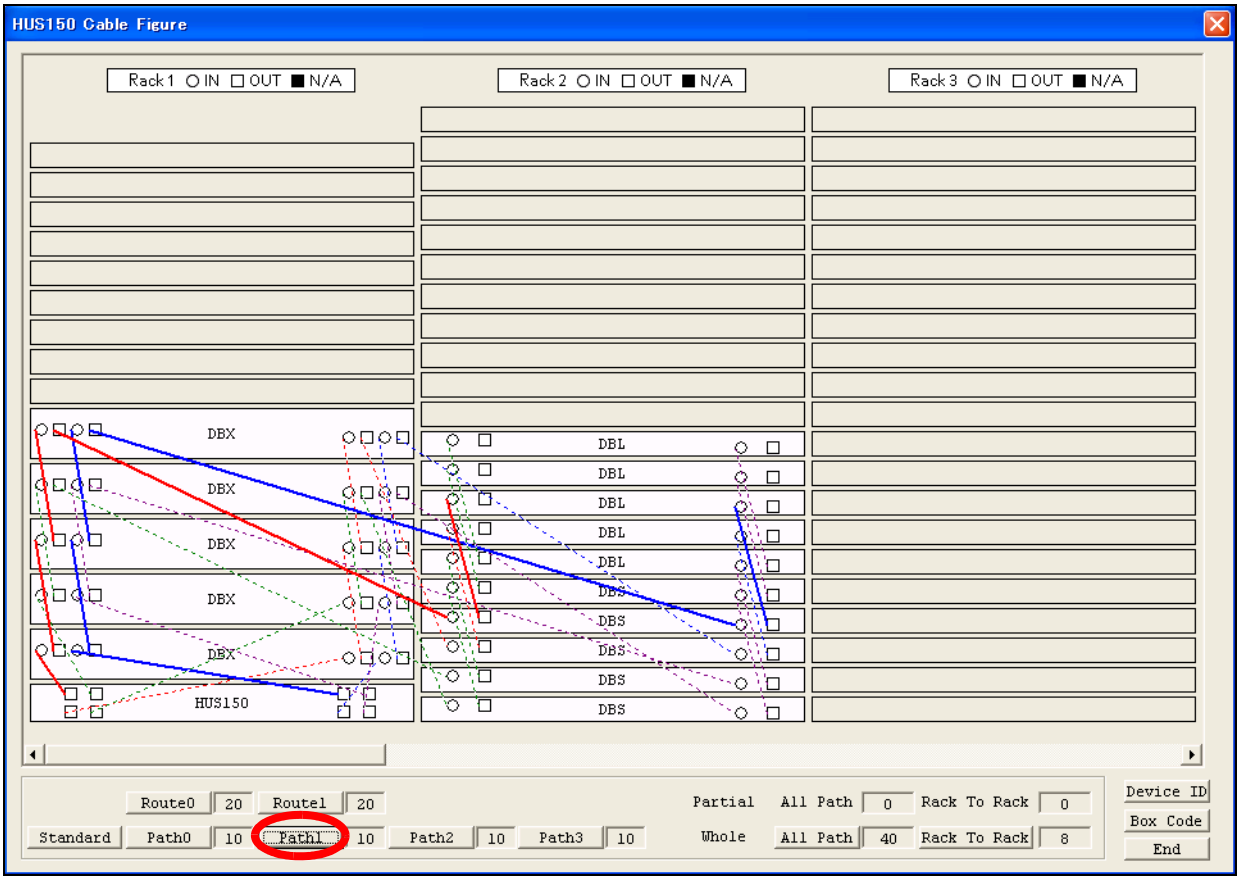
1. Click **Standard** to remove highlights from the SAS (ENC) cables.



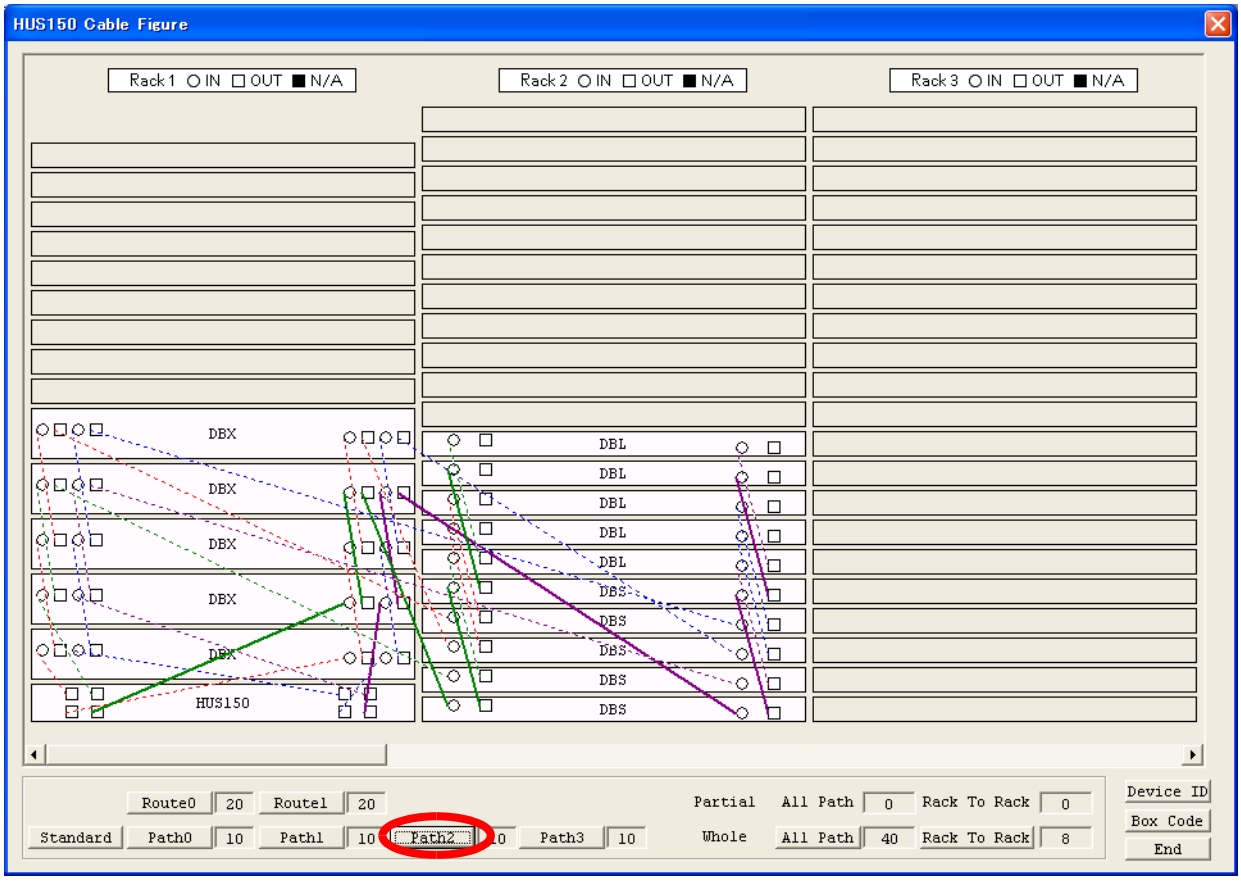
2. To highlight SAS (ENC) cables of the unit connected to Path0, click **Path0**.



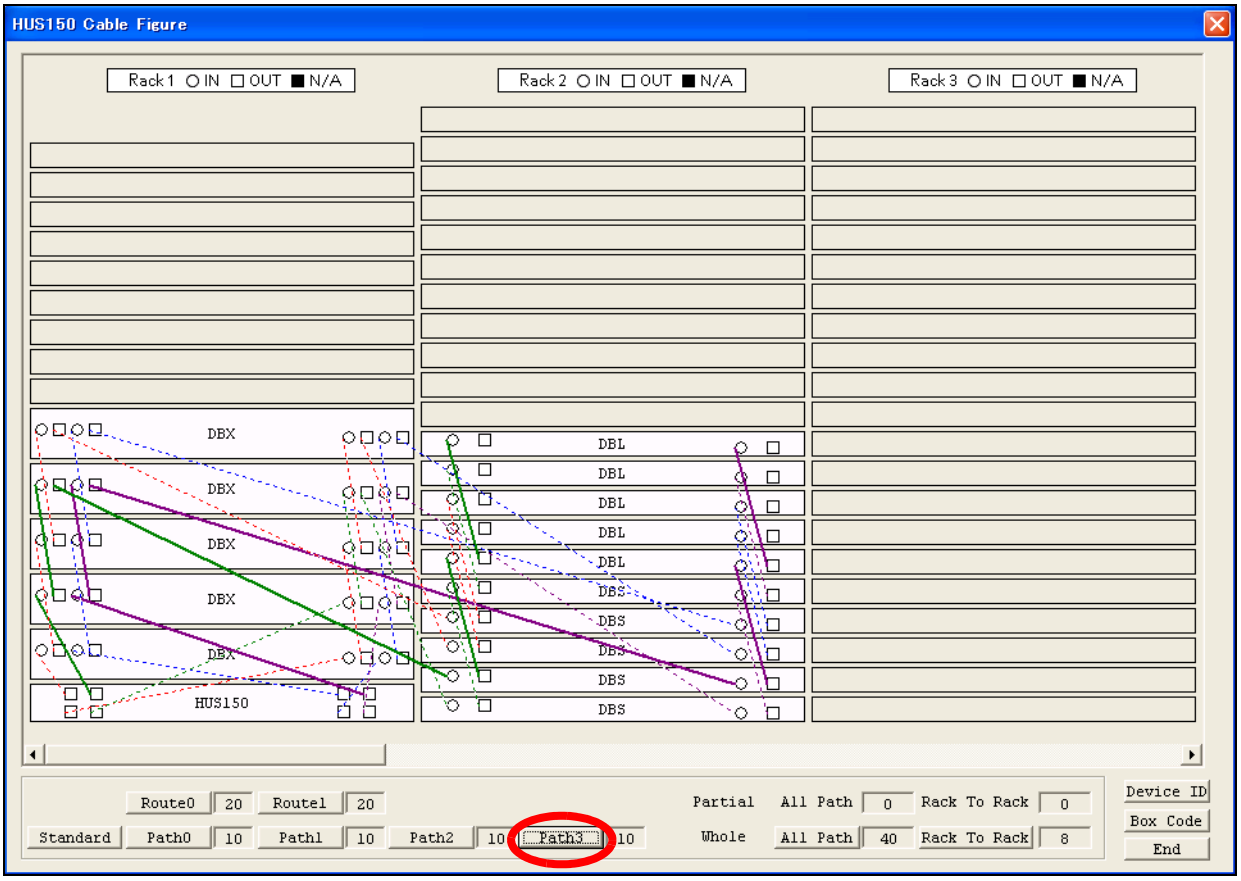
3. To highlight SAS (ENC) cables of the unit connected to Path1, click **[Path1]**.



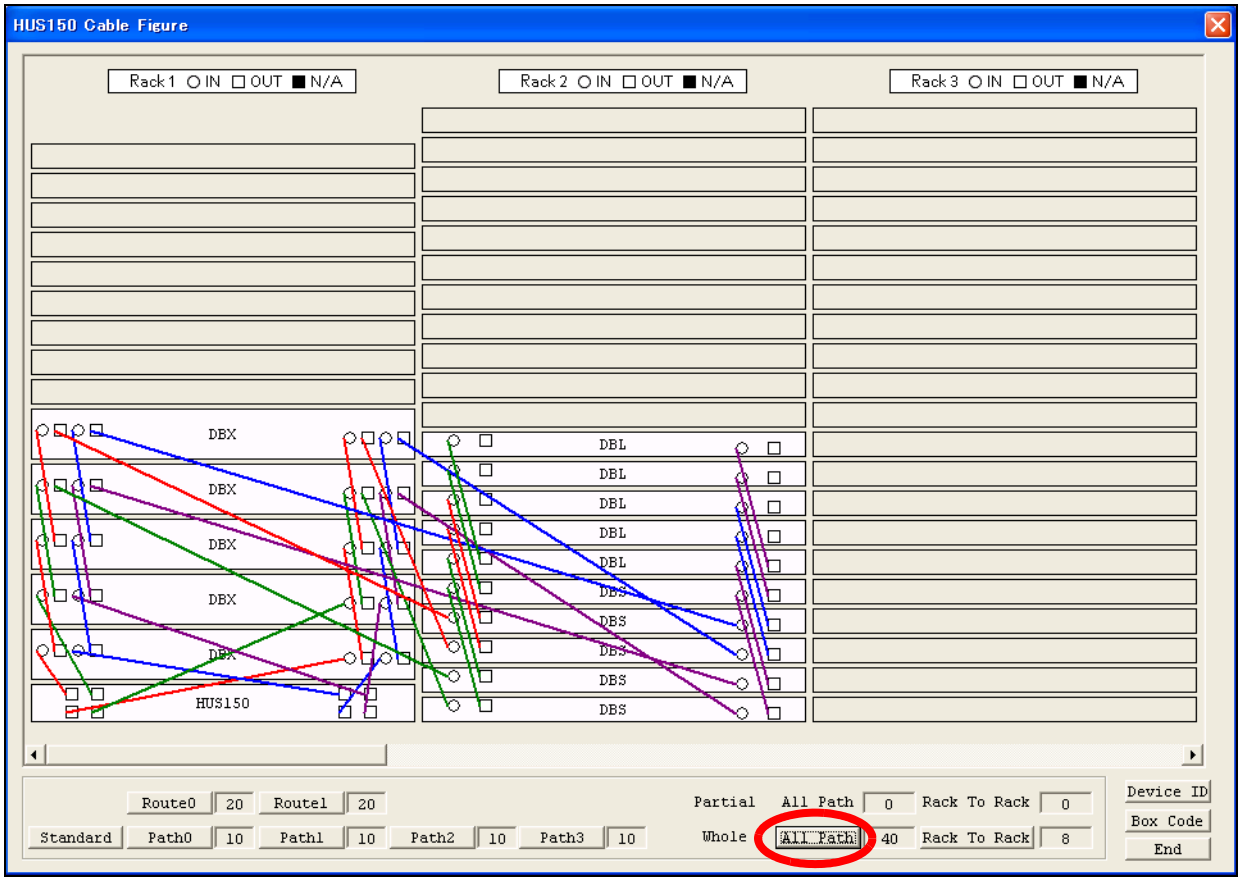
4. To highlight SAS (ENC) cables of the unit connected to Path2, click **Path2**.



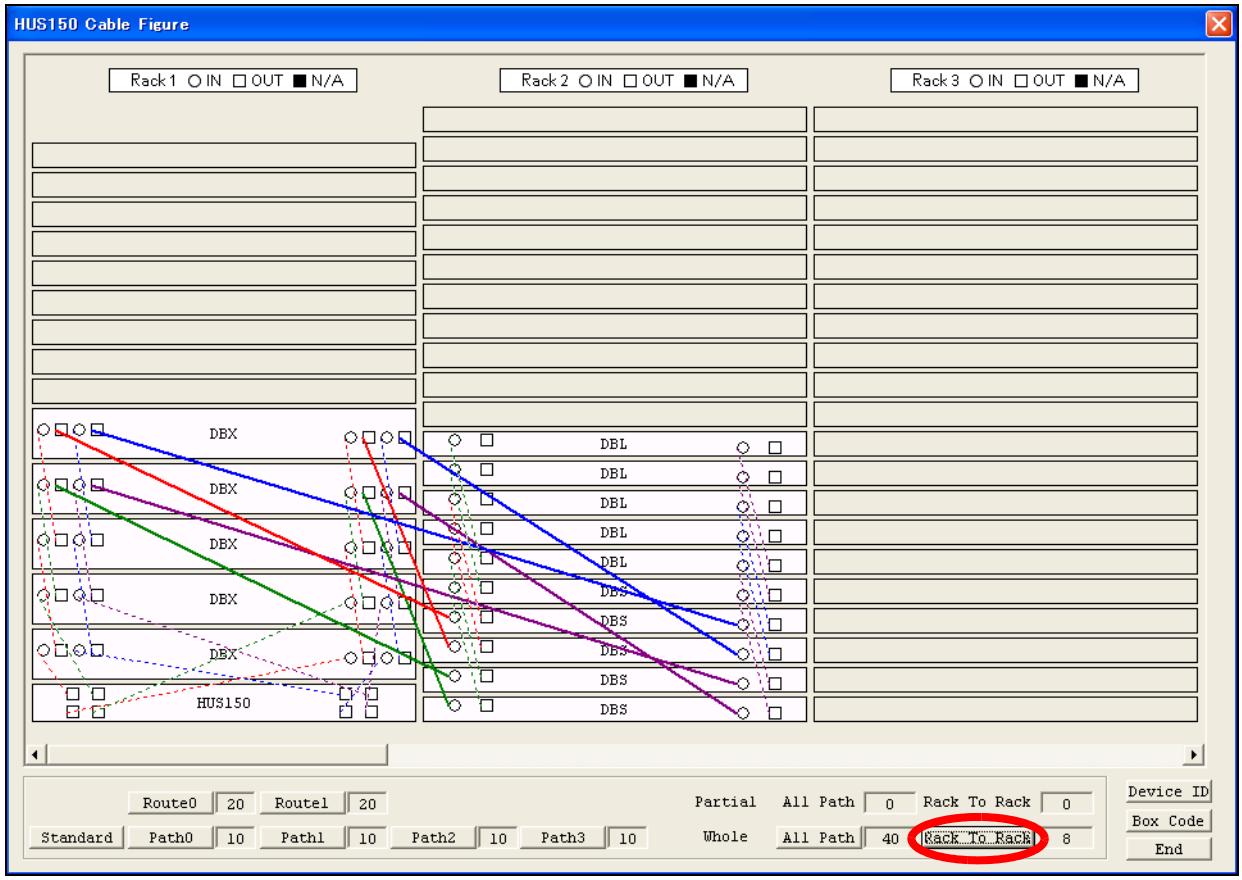
5. To highlight SAS (ENC) cables of the unit connected to path3, click **Path3**.



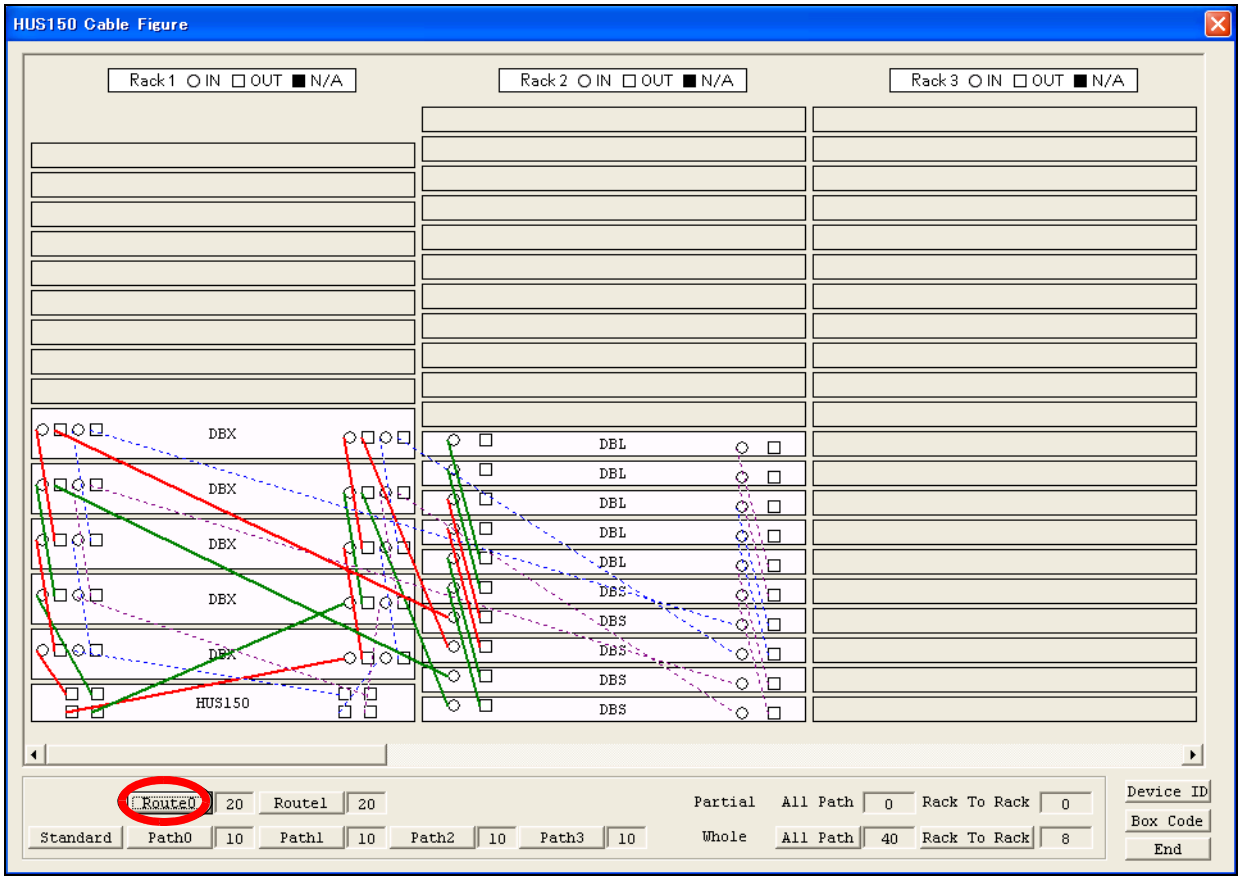
6. To highlight SAS (ENC) cables connected to all paths, click **All Path**.



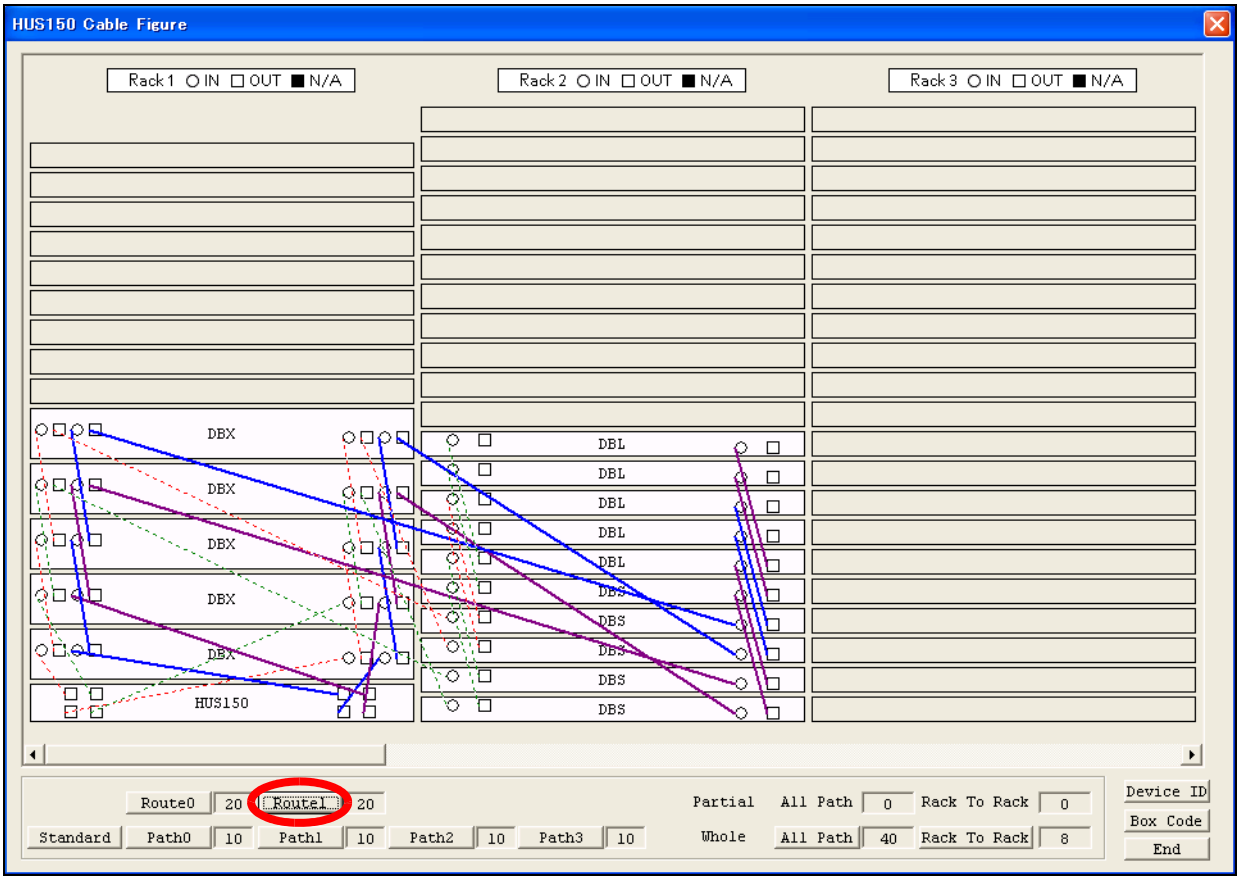
7. To highlight the SAS (ENC) cables connected between racks, click **Rack To Rack**.



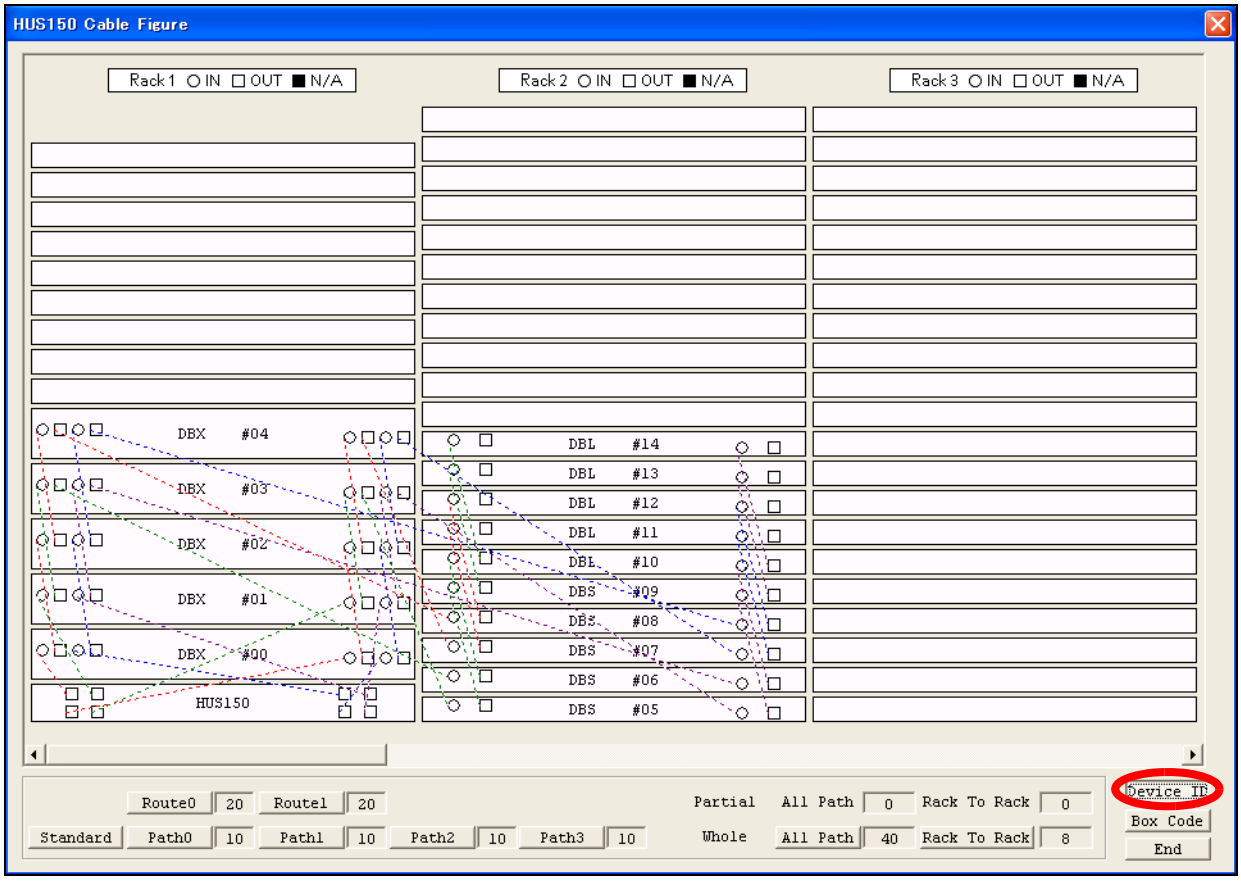
8. To highlight the SAS (ENC) cables of the unit connected to the contoller0, click **Route0**.



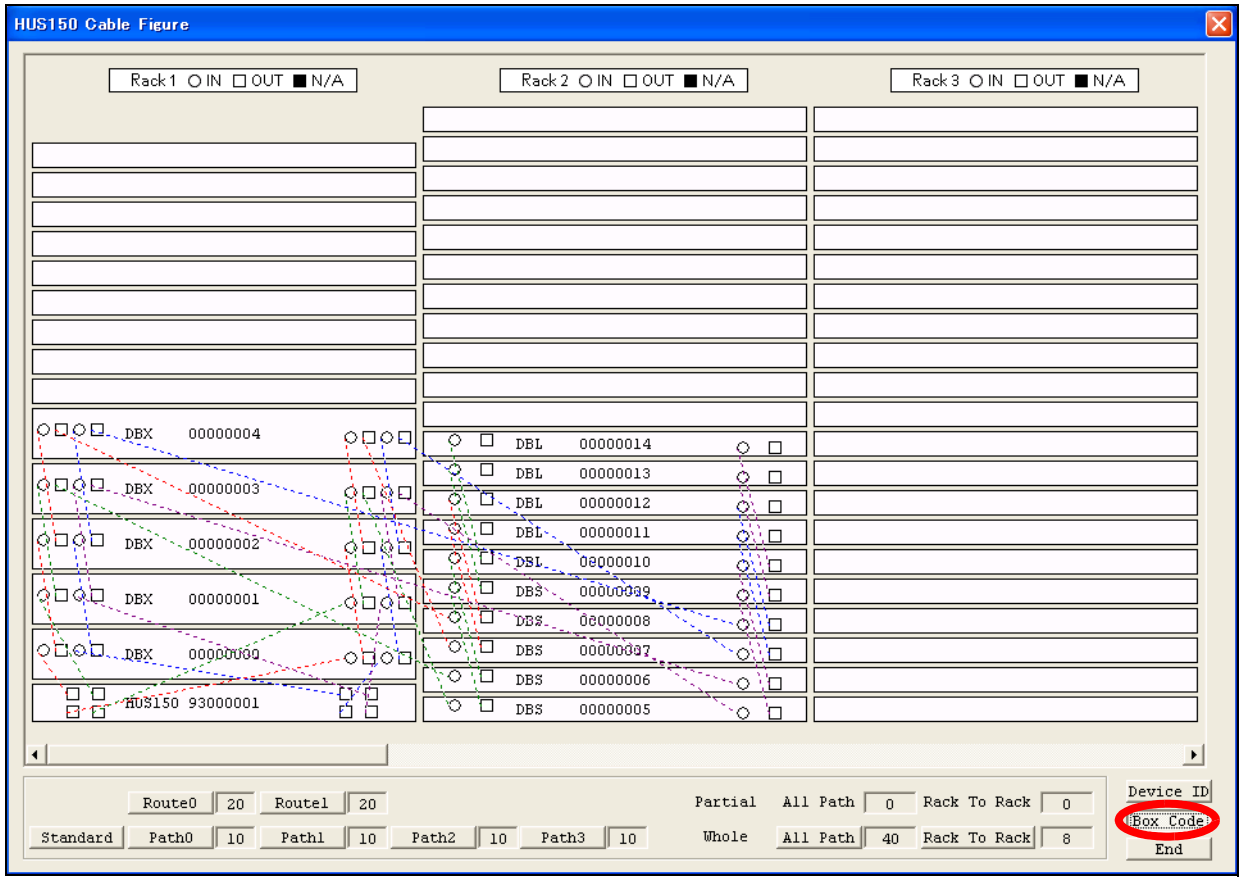
9. To highlight the SAS (ENC) cables of the unit connected to controller1, click **Route1**.



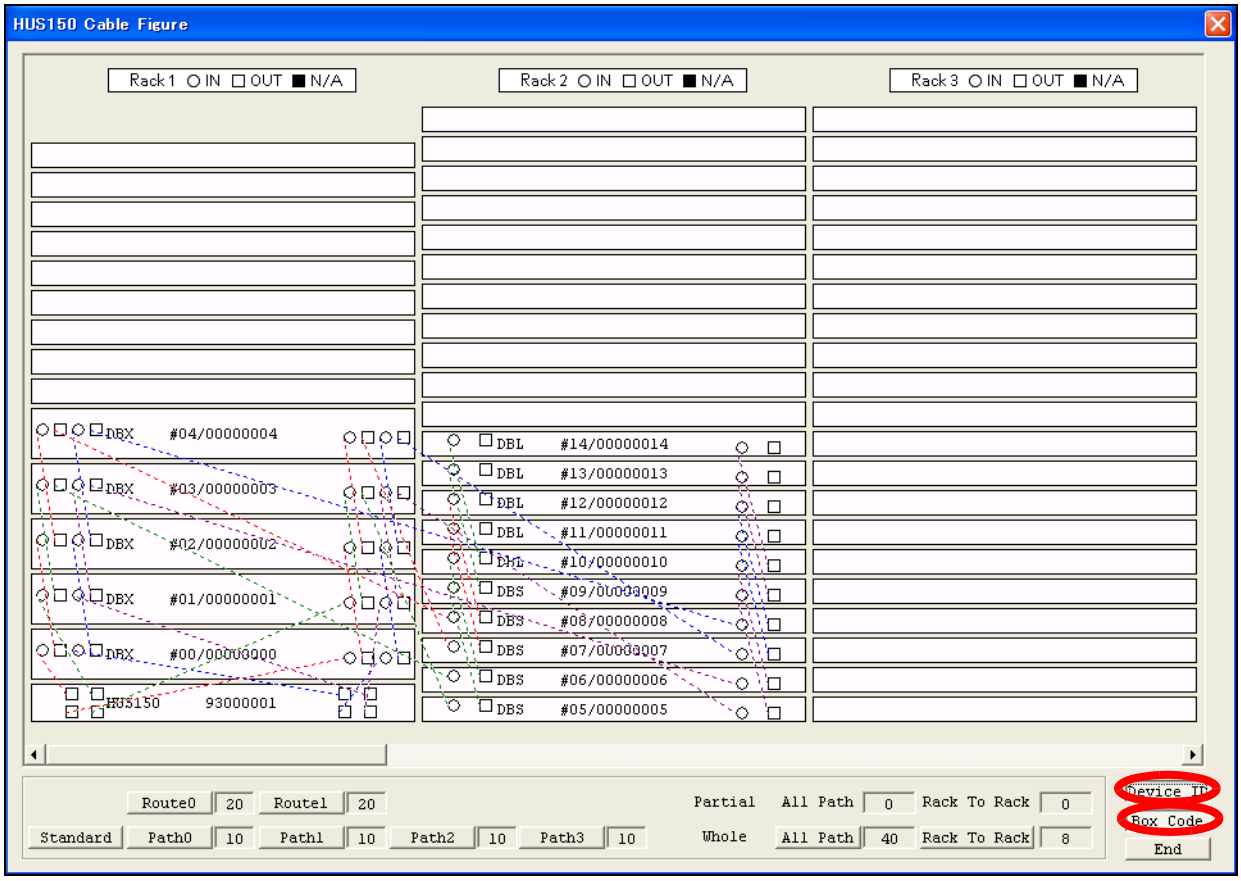
10. To display unit IDs, click **Device ID**. Use this toggle button to show or hide unit IDs. The box code can be used regardless of this setting.



11. If the box codes are registered, click **Box Code** to display the box codes. Use this toggle button to show or hide box codes. You can use the **Device ID** button regardless of whether box codes are shown or hidden.



12. If both the **Device ID** and **Box Code** are ON, unit IDs and their box codes are displayed

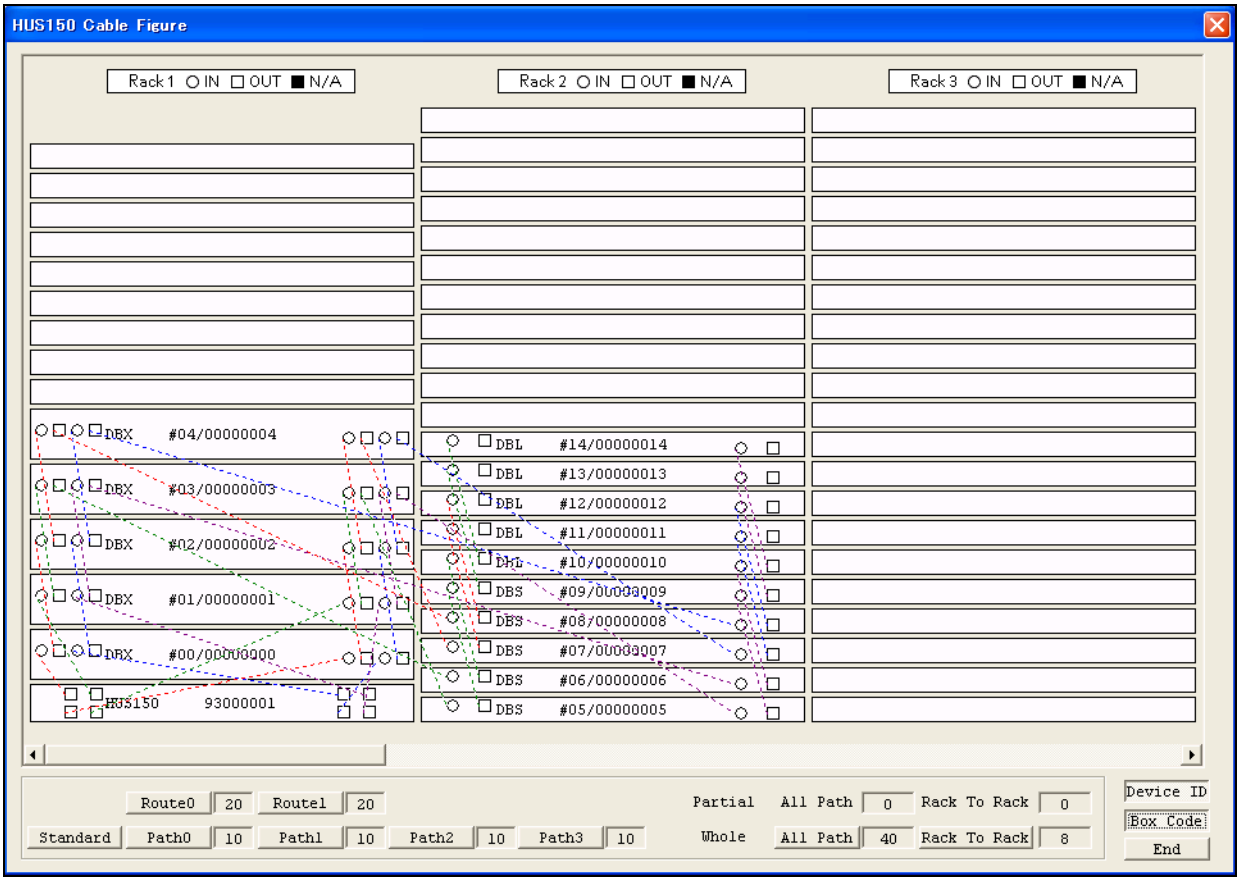



13. Click **End** to close the Cable Figure screen.

## Working with cable figures in rack boxes

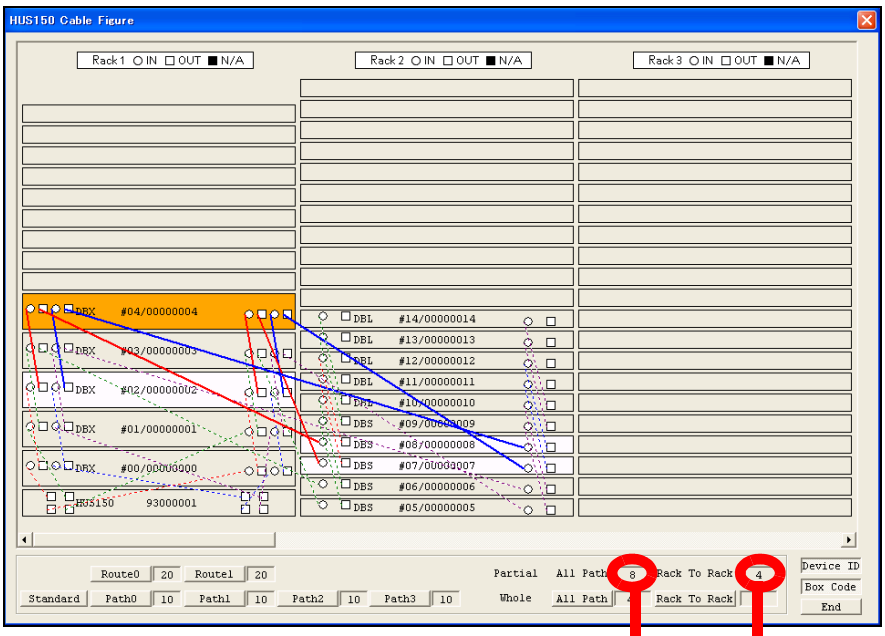
To work with rack boxes shown in the cable figure screen:

1. Click a Drive Box in a rack box.




2. The selected unit is highlighted in orange and units connected to the selected unit are displayed in white. SAS (ENC) cables connected the selected unit are highlighted.

   **All Path of Partial** indicates the number of SAS (ENC) cables connected to the selected unit. **Rack To Rack** indicates the number of SAS (ENC) cables connected to the selected unit spanning between racks.




Number of total SAS (ENC) cables connected to the selected unit.

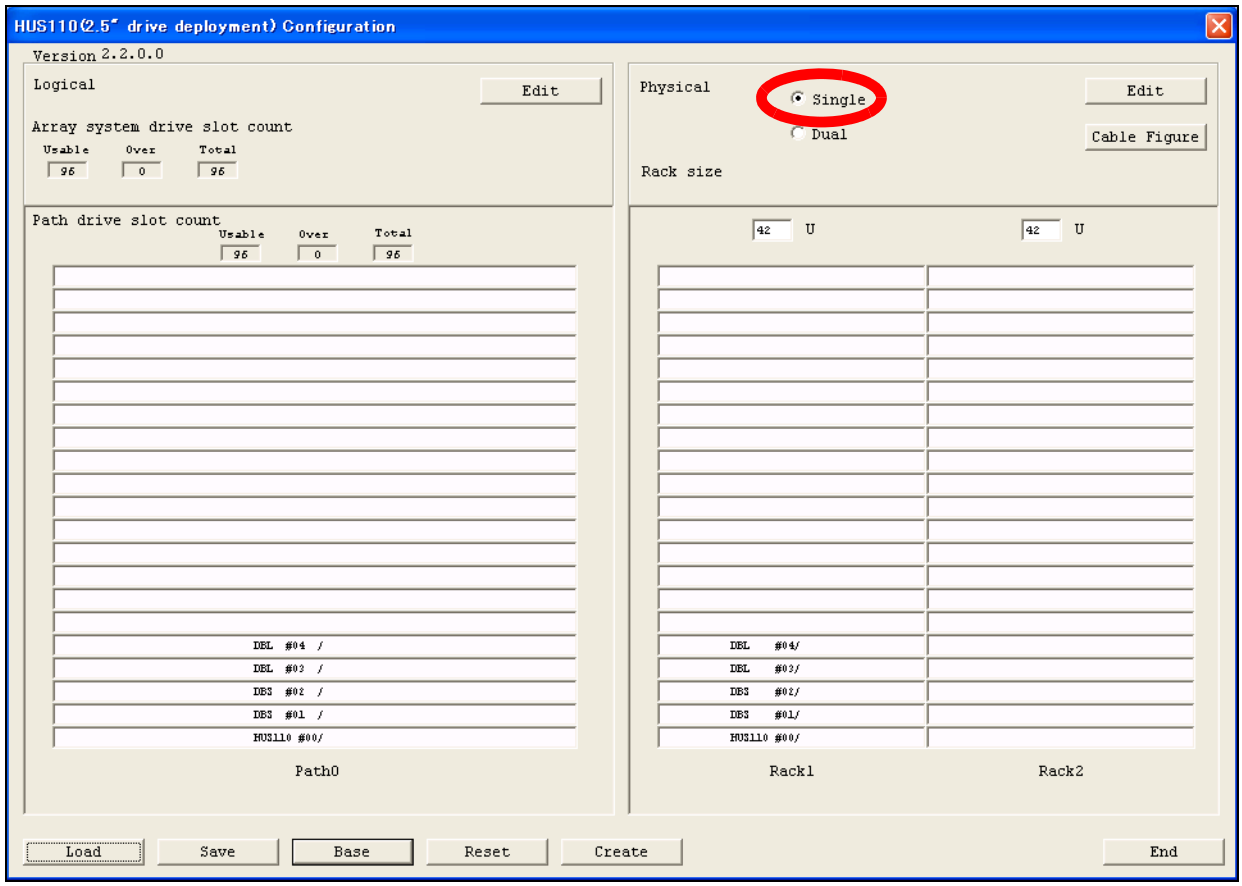
Number of total SAS (ENC) cables connected to the selected unit spanning between racks.

# Hitachi Unified Storage 110 with single or dual controller

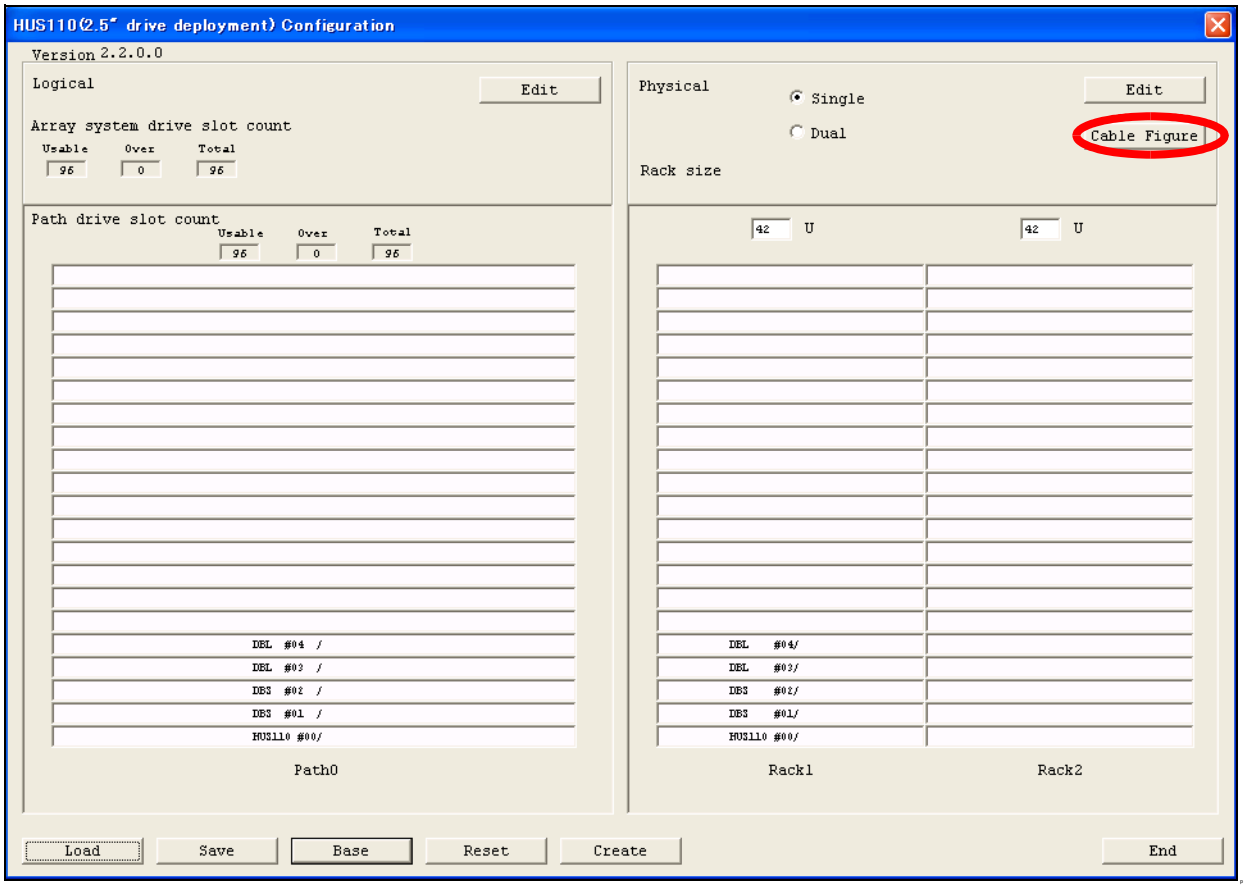
When selecting a Hitachi Unified Storage 110 system with 2.5- or 3.5-inch drives as a Controller Box, you can use the **Single** or **Dual** button to display a cable figure screen that shows a single-controller or dual-controller configuration.

## Displaying a cable figure of a single controller

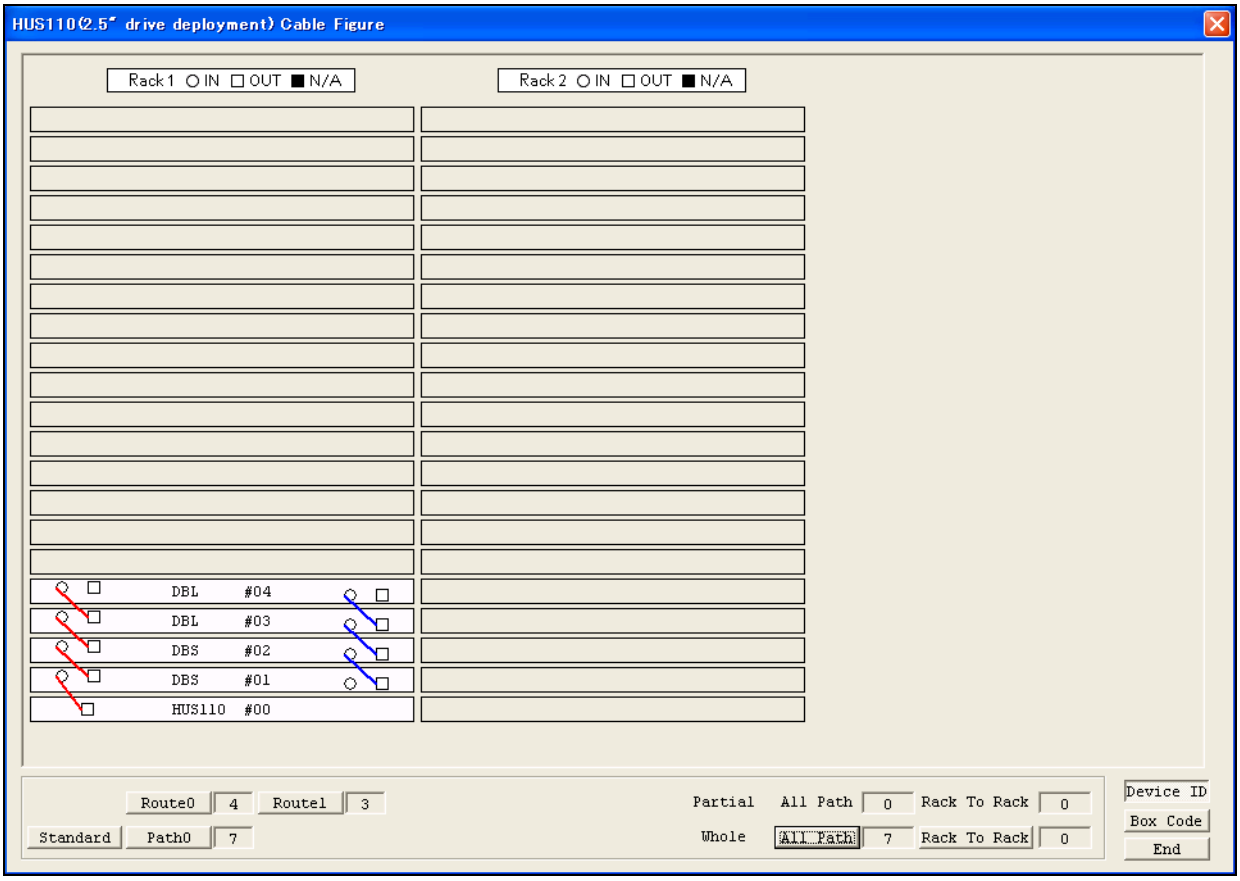
1. In the Hitachi Unified Storage 110 configuration screen, click **Single**.




2. Click **Cable Figure**.

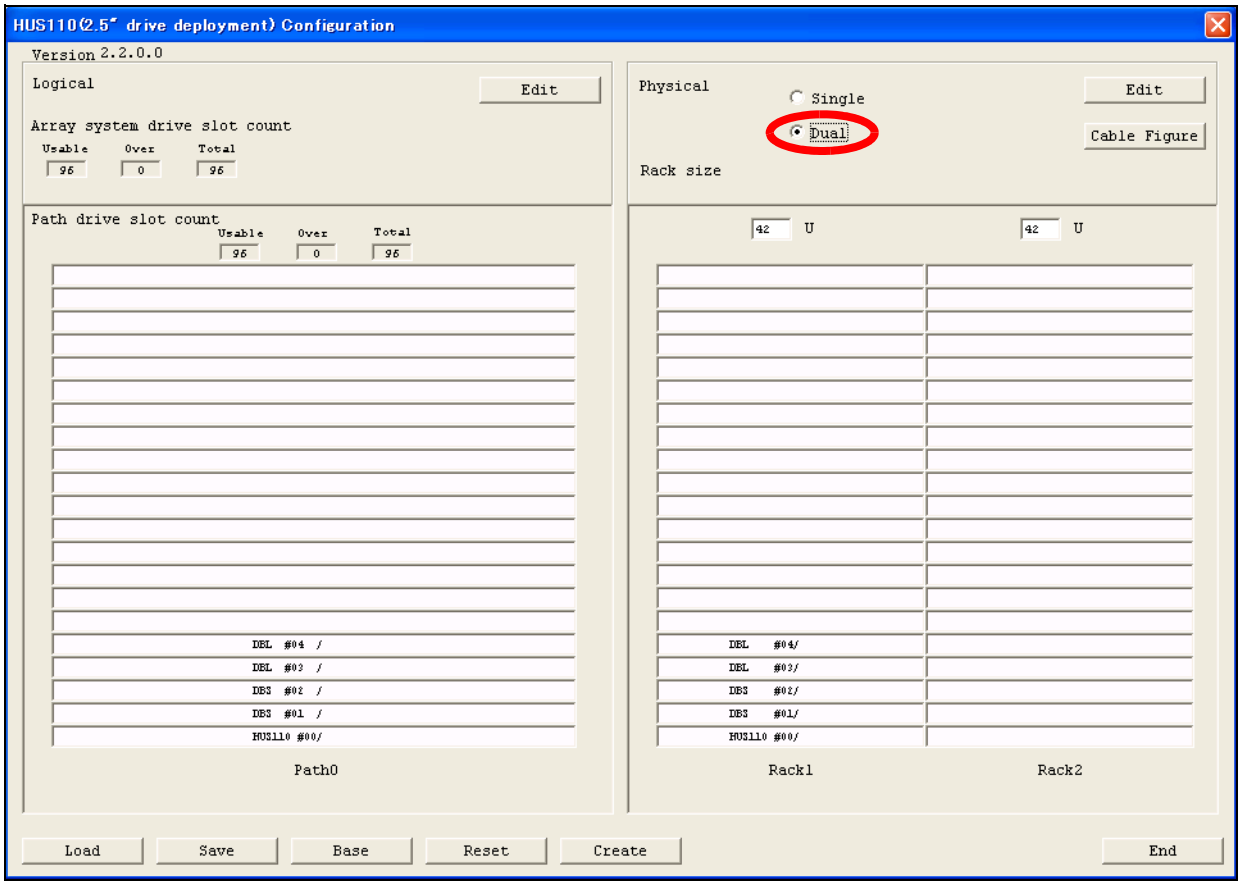



3. The cable figure screen of the single-controller configuration is displayed. To view unit IDs, click **Device ID**. To highlight the SAS (ENC) cables between the units, click **All Path**.

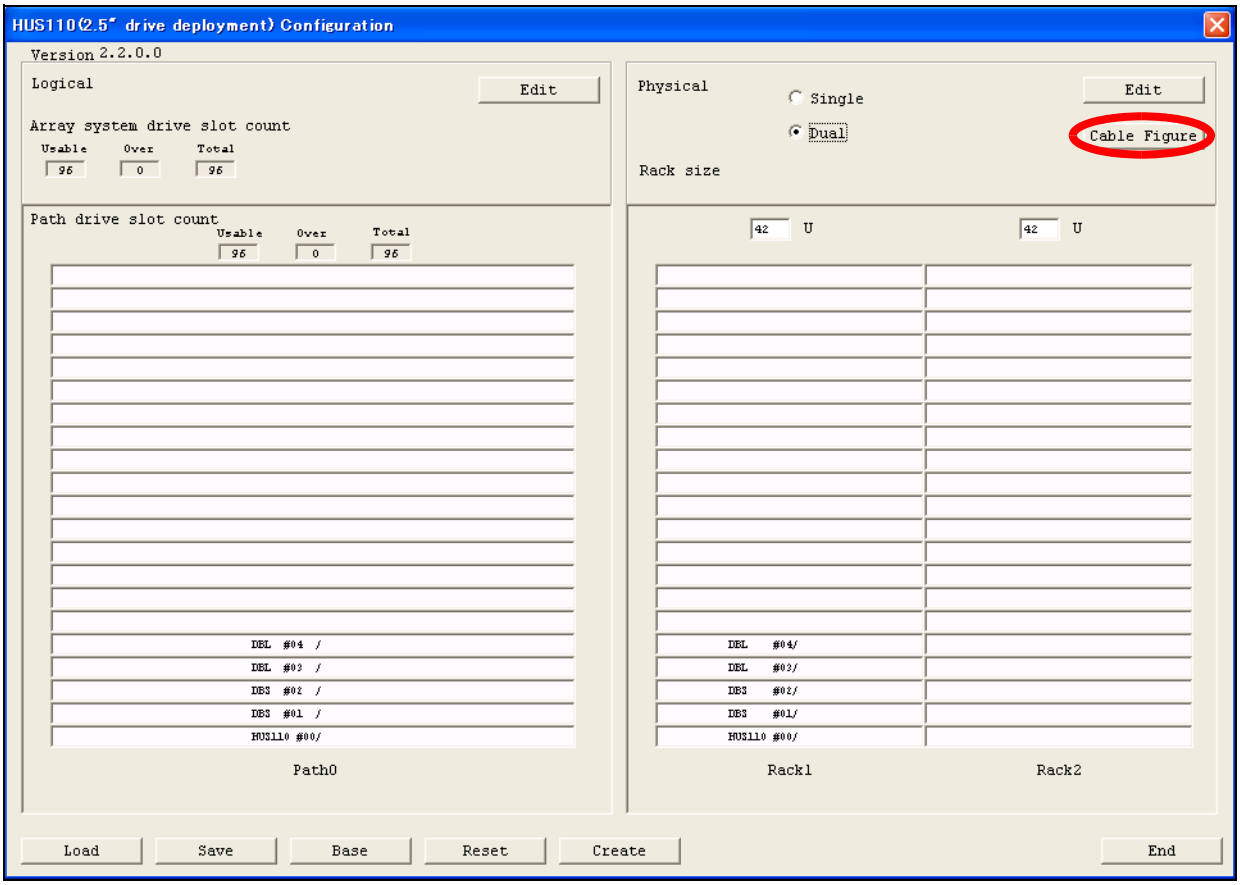

HUS110(2.5" drive deployment) Cable Figure
Rack1 ○IN □OUT ■N/A
Rack2 ○IN □OUT ■N/A
DBL #04
DBL #03
DBS #02
DBS #01
HUS110 #00
Route0 4
Route1 3
Standard
Path0 7
Partial
All Path 0
Rack To Rack 0
Whole
All Path 7
Rack To Rack 0
Device ID
Box Code
End

## Displaying a cable figure of a dual controller

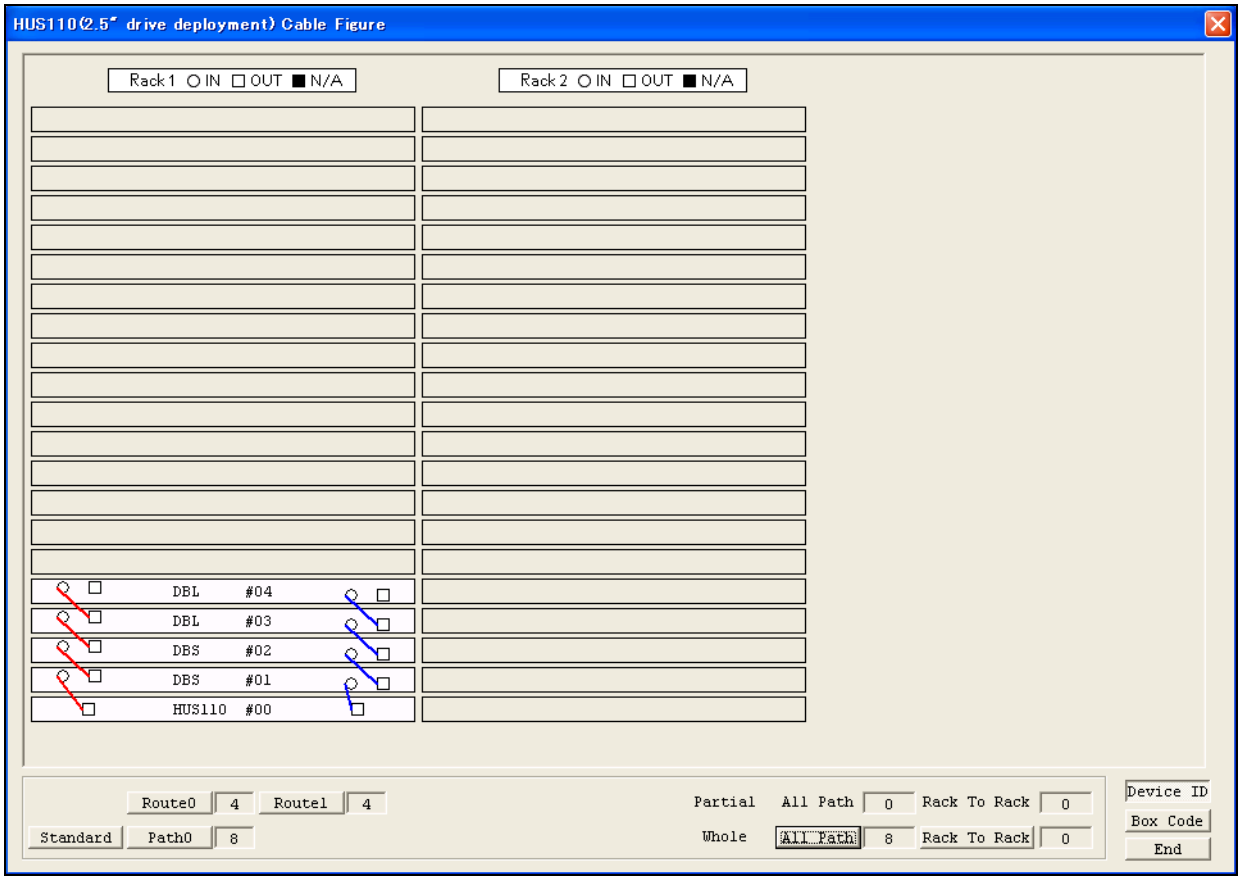
1. In the Hitachi Unified Storage 110 configuration screen, click **Dual**.




2. Click **Cable Figure**.




3. The cable figure screen of the dual-controller configuration is displayed. To view unit IDs, click **Device ID**. To highlight the SAS (ENC) cables between the units, click **All Path**.

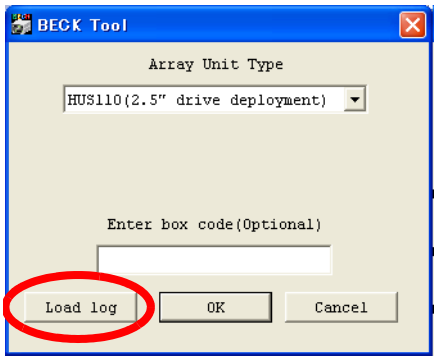

HUS110(2.5" drive deployment) Cable Figure
Rack 1 ○ IN □ OUT ■ N/A
Rack 2 ○ IN □ OUT ■ N/A
DBL #04
DBL #03
DBS #02
DBS #01
HUS110 #00
Route0 4
Route1 4
Standard
Path0 8
Partial
All Path 0
Rack To Rack 0
Whole
All Path 8
Rack To Rack 0
Device ID
Box Code
End

# Expanding a configuration

using the BECK tool, you can expand a configuration by loading a simple trace (refer to the *Hitachi Unified Storage Service Guide*) obtained in a array to display the existing configuration and adding Drive Boxes. To load simple traces, place the `UNLHA32.dll` file in the Windows system folder.

To expand the configuration:

1. Perform steps 1 through 3 under Starting the BECK tool on page H-8.
2. At the Array Unit Type dialog box, click the **Load Log** button.

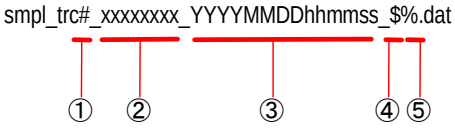



3. In the Open dialog box, select the simple trace file (dat file format).
   - If the trace file is stored in another directory, select the trace file belonging to the storage destination.
   - If one simple trace file is collected for an array, select the trace file of the load target.
   - If the trace file resides in another directory, When one simple trace file is collected in the array, select the trace file of the load target.
   - If there are multiple simple trace files, selecting an optional trace file loads the other trace file automatically. If the other simple trace file resides in the same directory, a load error occurs.

**NOTE:** The trace file can be renamed, but its contents must not be changed.

## Simple trace default file name

A simple trace default file uses the following naming convention:

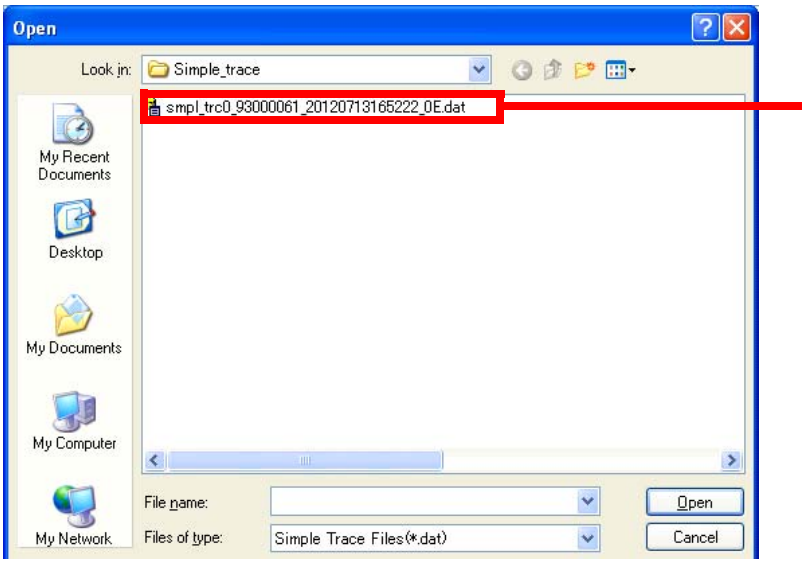



| Number | Description | |
|---|---|---|
| ① | # | Controller number for trace target (0 or 1) |
| ② | xxxxxxxx | Serial unit number |
| ③ | YYYYMMDDhhmmss | Trace collecting start time (year, month, date, hour, minute, second) |
| ④ | $ | Trace file serial number (0, 1, 2...) |
| ⑤ | % | Trace file split discriminator:<br>• S = start file<br>• C = center file<br>• E = end file |

### Single trace file example

If single trace files have been collected on controller 0 in a Hitachi Unified Storage 150 system, the file name resembles the following:

`smpl_trc0_93000061_20120713165222_0E.dat`




Select the simple trace file of the target.

## Multiple trace file example

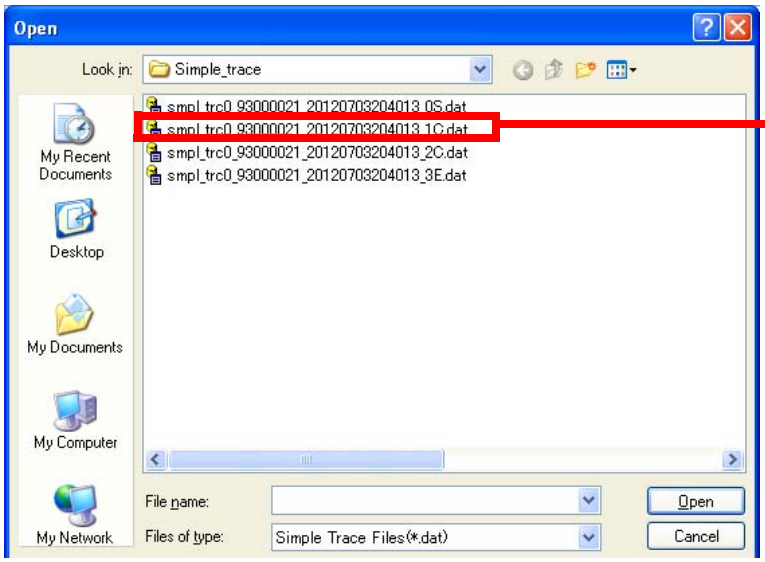
The following example shows the names of four trace files collected on controller 0 in a Hitachi Unified Storage 150 system:

Start file: `smpl_trc0_93000021_20120703204013_`**`0S`**`.dat`

Middle file: `smpl_trc0_93000021_20120703204013_`**`1C`**`.dat`

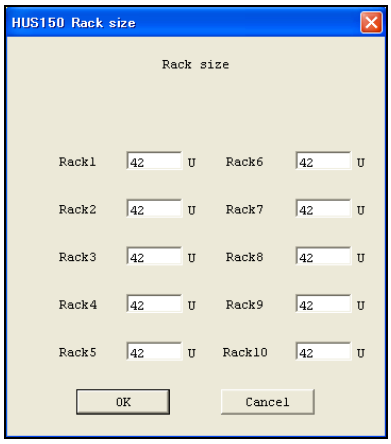
Middle file: `smpl_trc0_93000021_20120703204013_`**`2C`**`.dat`

End file: `smpl_trc0_93000021_20120703204013_`**`3E`**`.dat`

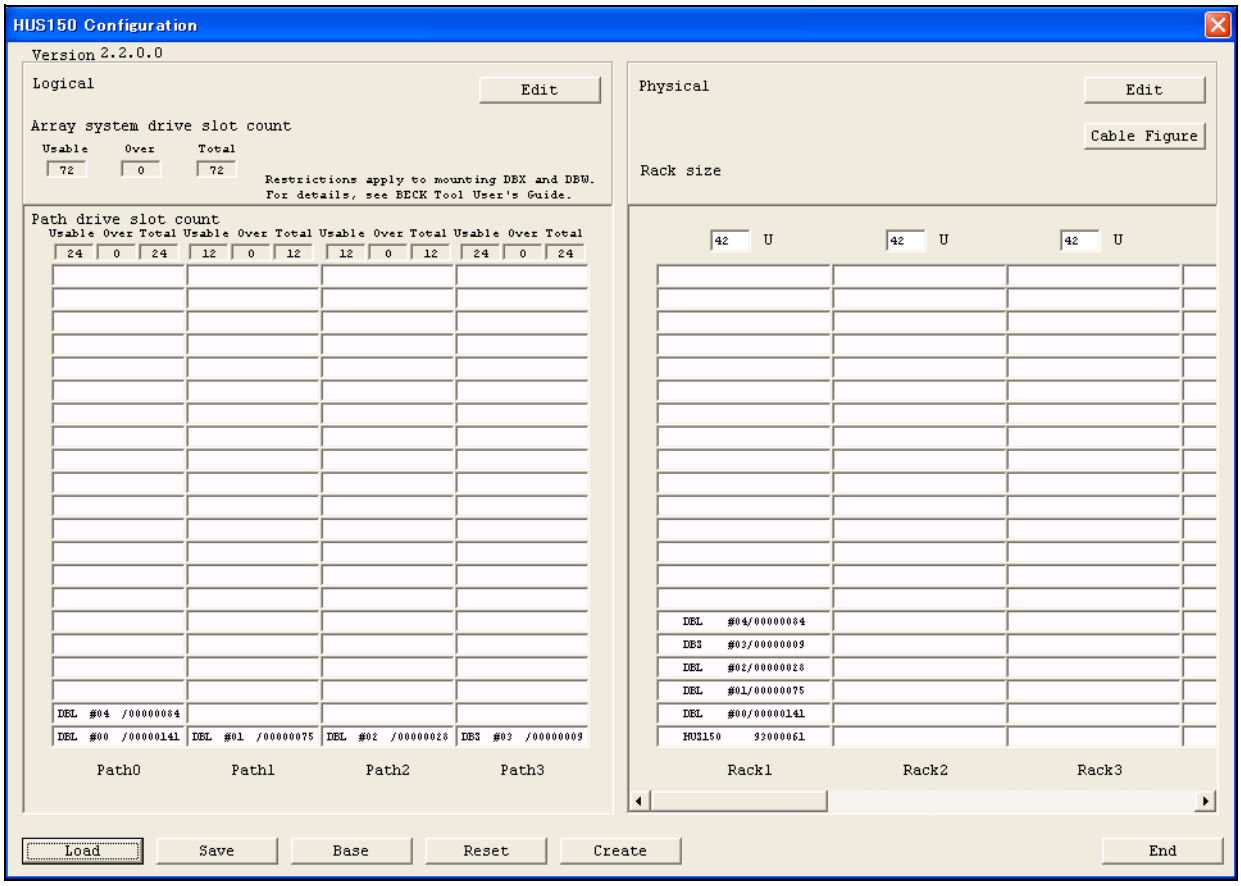



Select one optional simple trace file.

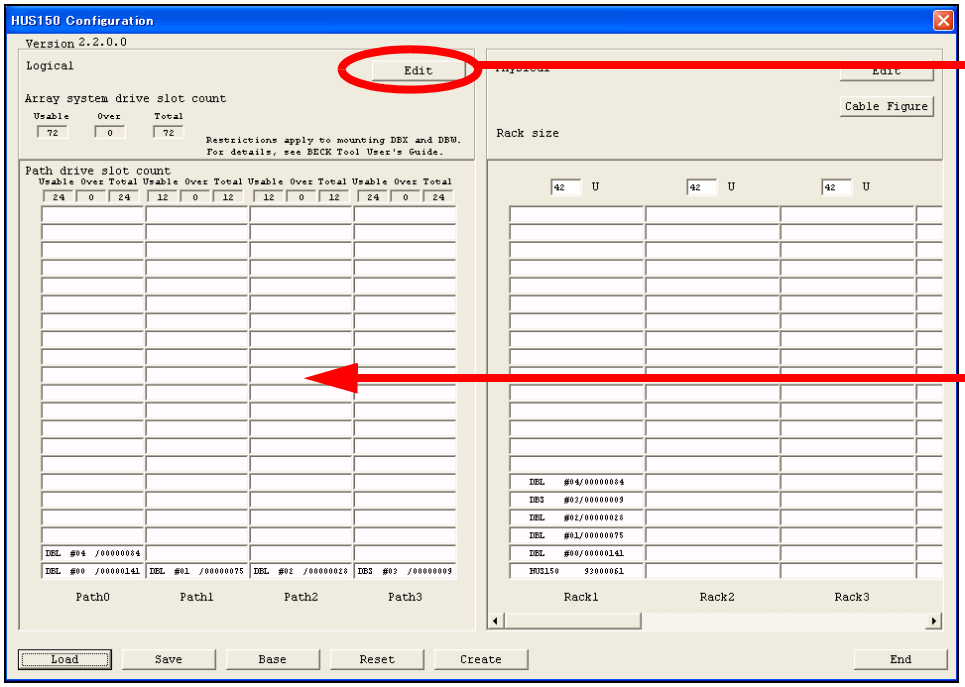
4. When a Rack size dialog box similar to the following for the Hitachi Unified Storage 150 appears, enter the size of each rack (default is 42 U) and click **OK** (or click **Cancel** to cancel loading of the simple trace file).



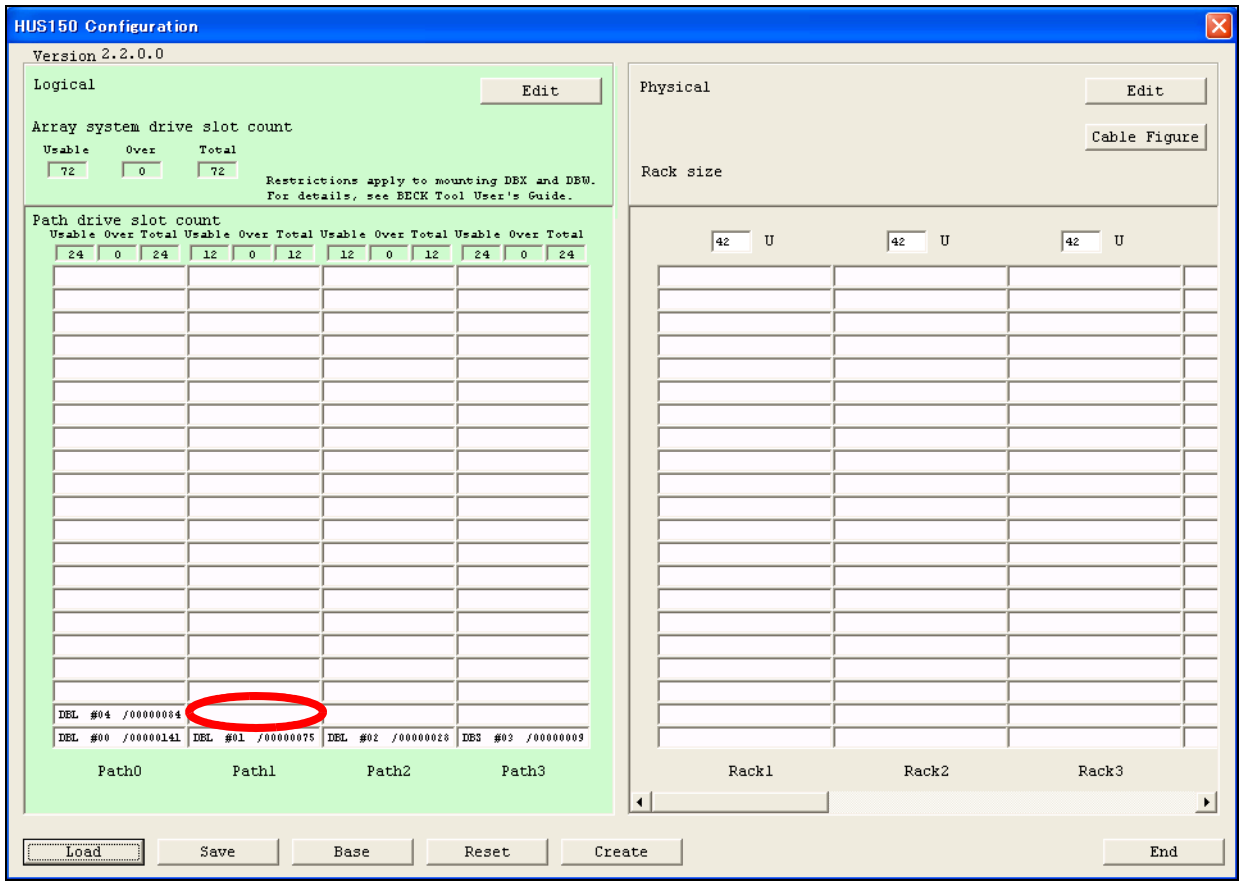

If the simple trace loads successfully, the existing configuration appears in the logical and physical configuration figures, along with the unit IDs and box codes.



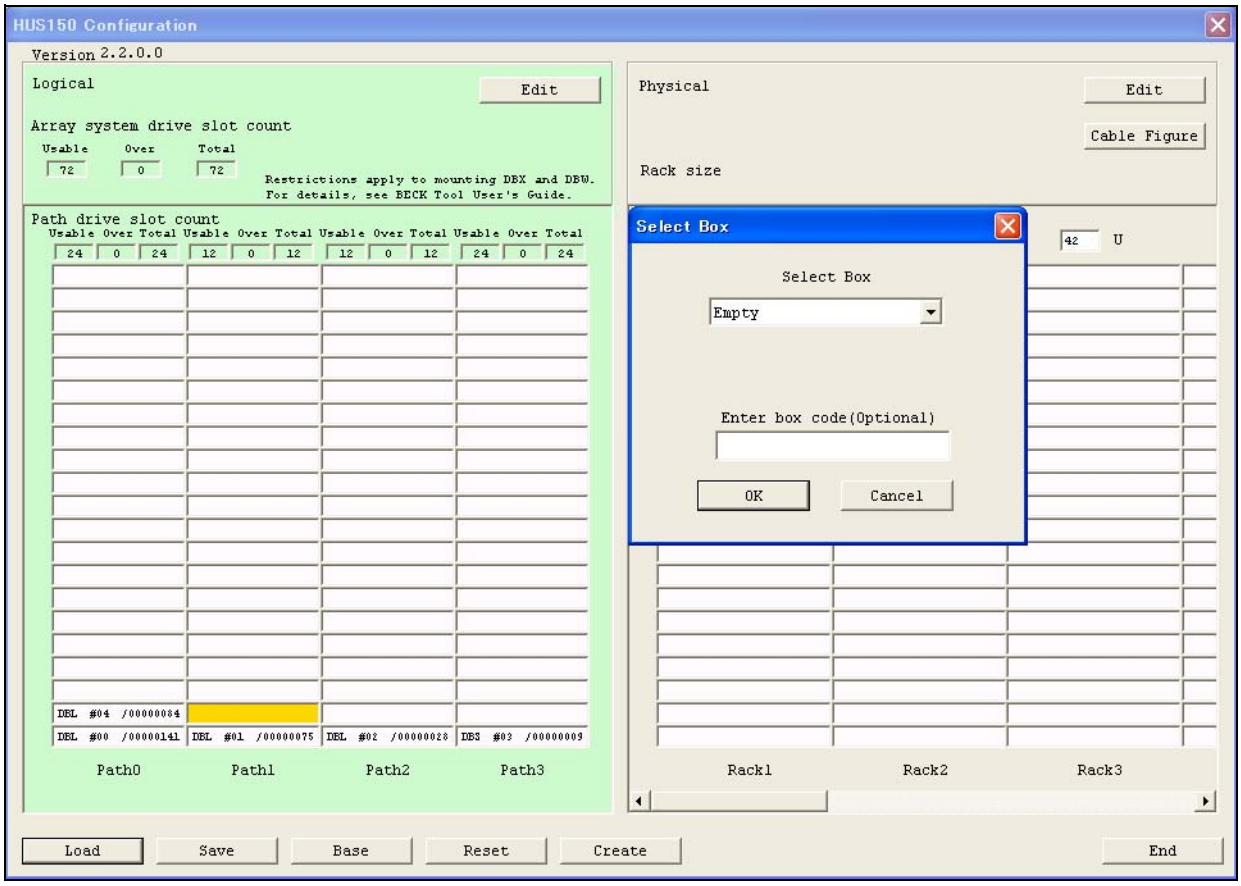

5. Expand the existing configuration. Edit the logical or physical configuration figure in the configuration screen (the logical configuration figure is shown in the following example). Click **Edit** in the logical configuration figure or click in the logical configuration figure.



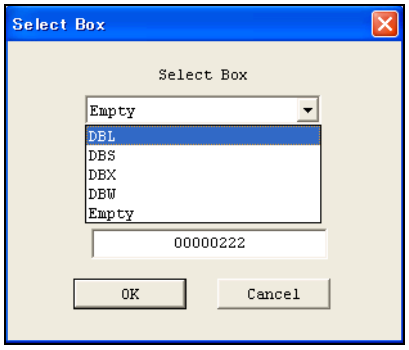
6. At the message **May physical configuration figure be initialized?**, click **OK**. All the units, unit IDs, and box codes in the physical configuration figure are cleared and the logical configuration figure is highlighted in light green.
7. Right-click an empty box in a path.



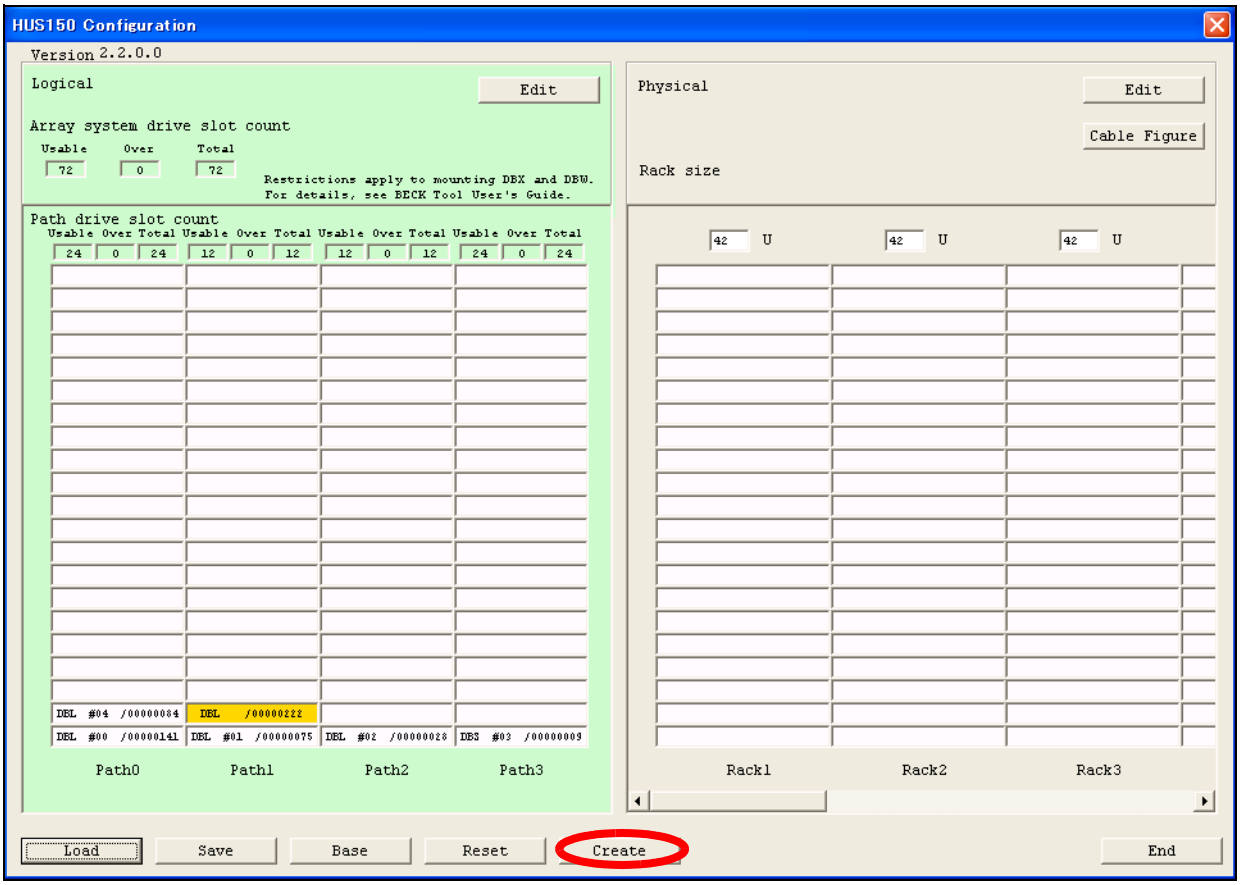

The selected box is highlighted in orange and the Select Box dialog box appears.




8. In the Select Box dialog box, click the desired Drive Box. You can optionally enter the box code for the selected Drive Box.

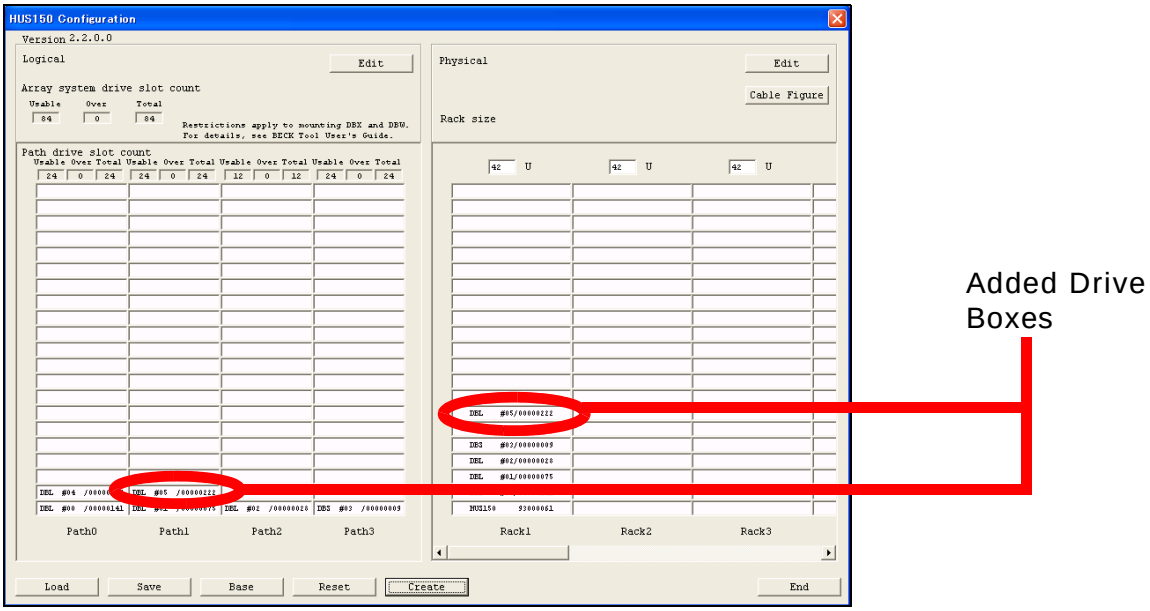



9. Click **OK**.The selected drive box is displayed in the box in the logical configuration figure.
10. Click **Create**.




Changes made are displayed in the physical configuration figure. Unit IDs are assigned automatically.

11. Click **Cable Figure** to display the cable figure based on the expansion.




This completes the procedure for expanding a configuration.

**NOTE:** If you click **Reset** after editing the loaded configuration, the Configuration screen immediately after it was loaded is recovered. After loading a Hitachi Unified Storage 110 simple trace, **Single** is selected for a single-controller configuration and **Dual** is selected for a dual-controller configuration, depending on the contents of the trace file.

By default, **360HDD OFF** is selected if a Hitachi Unified Storage 130 simple trace file was collected from a storage system whose firmware version is earlier than 0937/A, or **360HDD ON** is selected for firmware version 0937/A or later.

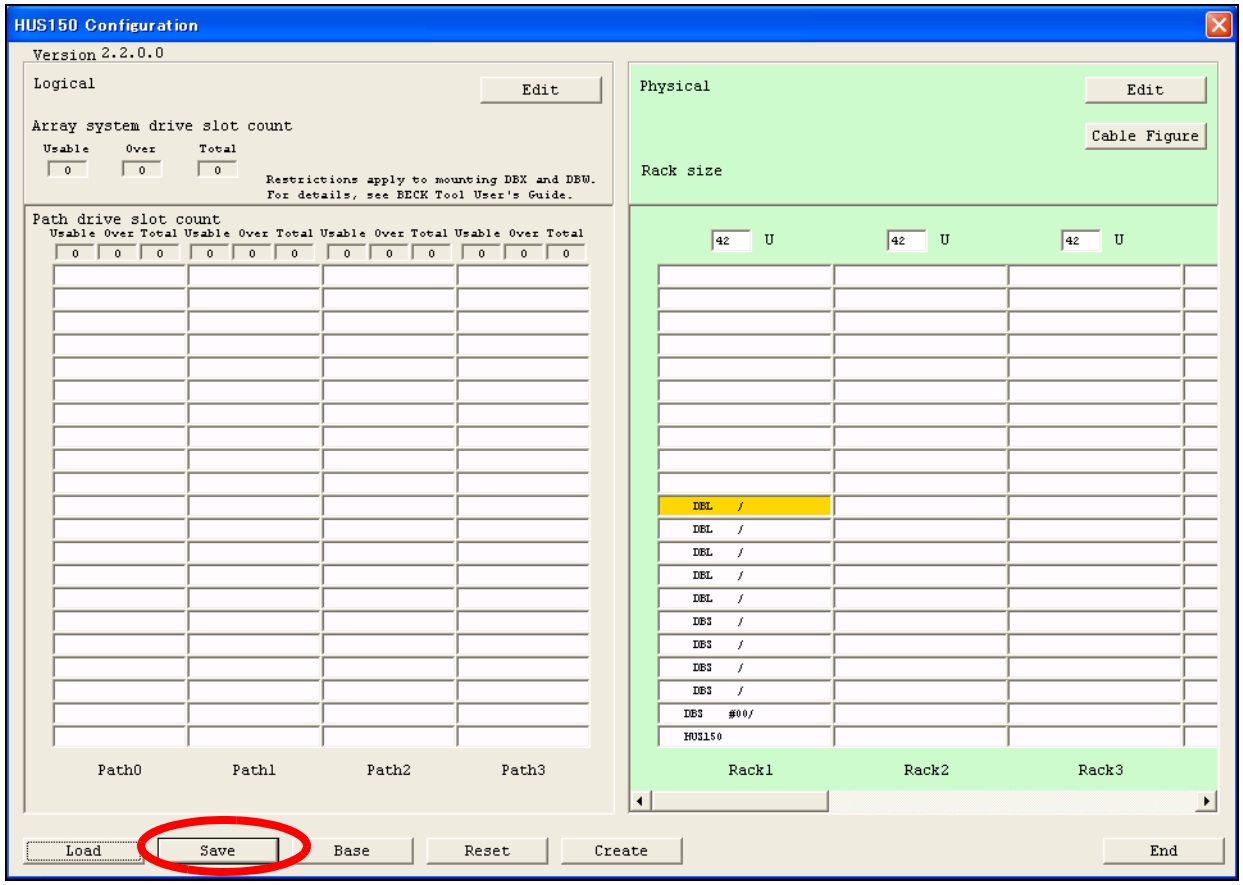
# Saving and loading a configuration file

Using the BECK tool, you can save the configuration as a CSV file. After you save a configuration file, you can load it when you want to use the data contained in the file.

## Saving a configuration file

The following procedure describes how to save a configuration file. If you save the configuration information file while editing the configuration, the file is saved with the array unit configuration unchanged.

1. In the configuration screen, click **Save**.




The Save As dialog box appears.

2. In the Save As dialog box, select a folder where you want to save the file. The default name for the configuration file is the Controller Box name selected in the Select Array Unit dialog box for the Hitachi Unified Storage 110, 130, or 150 system followed by the extension .csv. The data is saved in comma-separated value (CSV) format.
3. Click **Save** to save the file.

The configuration information file is stored with the following default file name:

- If the box code is not entered, the file name consists of the Controller Box name selected in the Array Unit Type dialog box + .csv

- When the box code is entered, the file name consists of the Controller Box name selected in the Array Unit Type dialog box + "_" + box code (up to eight alphanumeric characters) + .csv

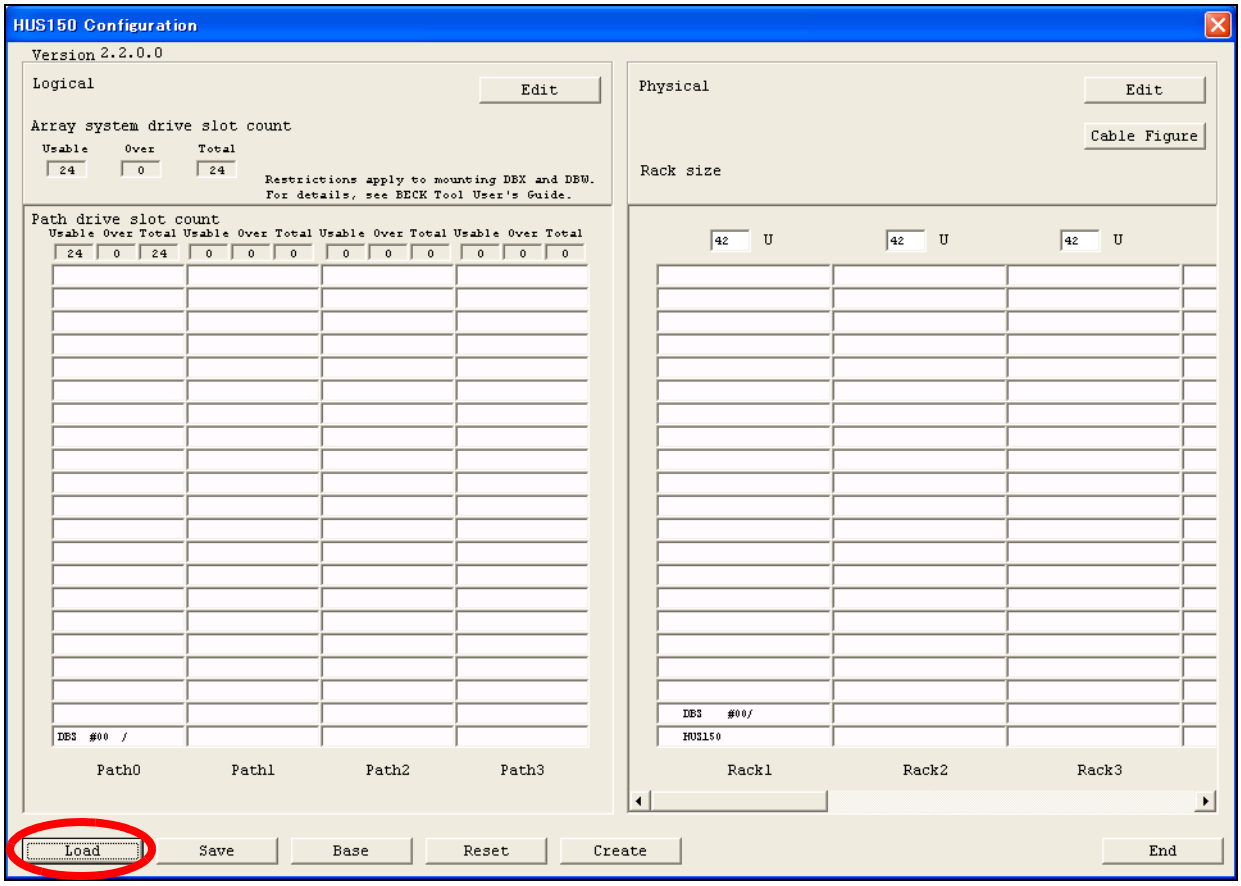
Observe the following guidelines when saving a configuration file:

- When **360HDD OFF** is selected in the Hitachi Unified Storage 130 configuration screen, its firmware version is assumed to be earlier than 0937/A. If you create a configuration that exceeds the unit connection support specifications of **360HDD OFF**, the configuration information file cannot be saved. However, if a Logical and Physical configuration figures are being edited, you can save the configuration information file.
- If you save the configuration information file while editing the configuration in the Logical or Physical configuration figure, the file is saved with the array unit configuration unchanged.

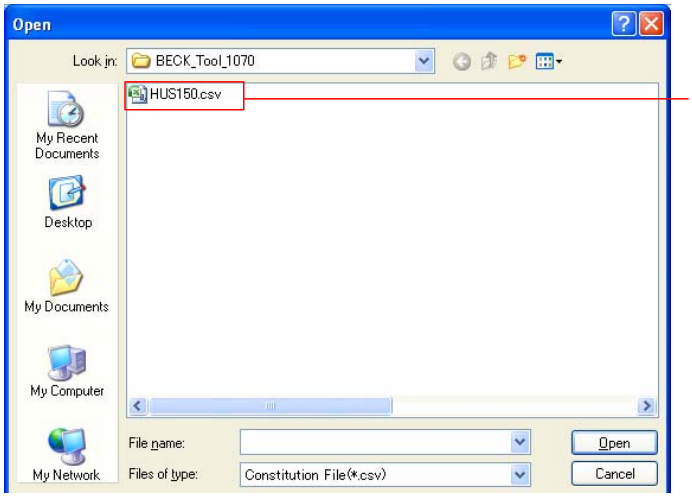
## Loading a configuration file

After you save a configuration file, use the following procedure to load it.

1. In the configuration screen, click **Load**. The Open dialog box appears.




2. In the Open dialog box, go to the folder that contains the configuration file you want to load.




3. Click the configuration file, and then click **Open**. The configuration information contained in the file is displayed in the BECK tool.

Figure H-13 on page H-91 shows an example of a configuration information file saved while the physical configuration figure for a Hitachi Unified Storage 150 was loaded.

Observe the following guidelines when loading a configuration file:

- If you click **Reset** after editing a loaded configuration information file, the previous configuration figure screen is recovered.
- After loading a configuration file, **Single** is selected for a single-controller configuration and **Dual** is selected for a dual-controller configuration, depending on the contents of the configuration file.
- After a Hitachi Unified Storage 130 configuration information file is loaded, the **360HDD OFF** or **360HDD ON** button selected is the same one that was selected when the file was saved.
- If you load the configuration information file that was saved while editing the configuration in the Logical or Physical configuration figure, the array unit configuration displayed in the Logical or Physical configuration figure is unchanged.

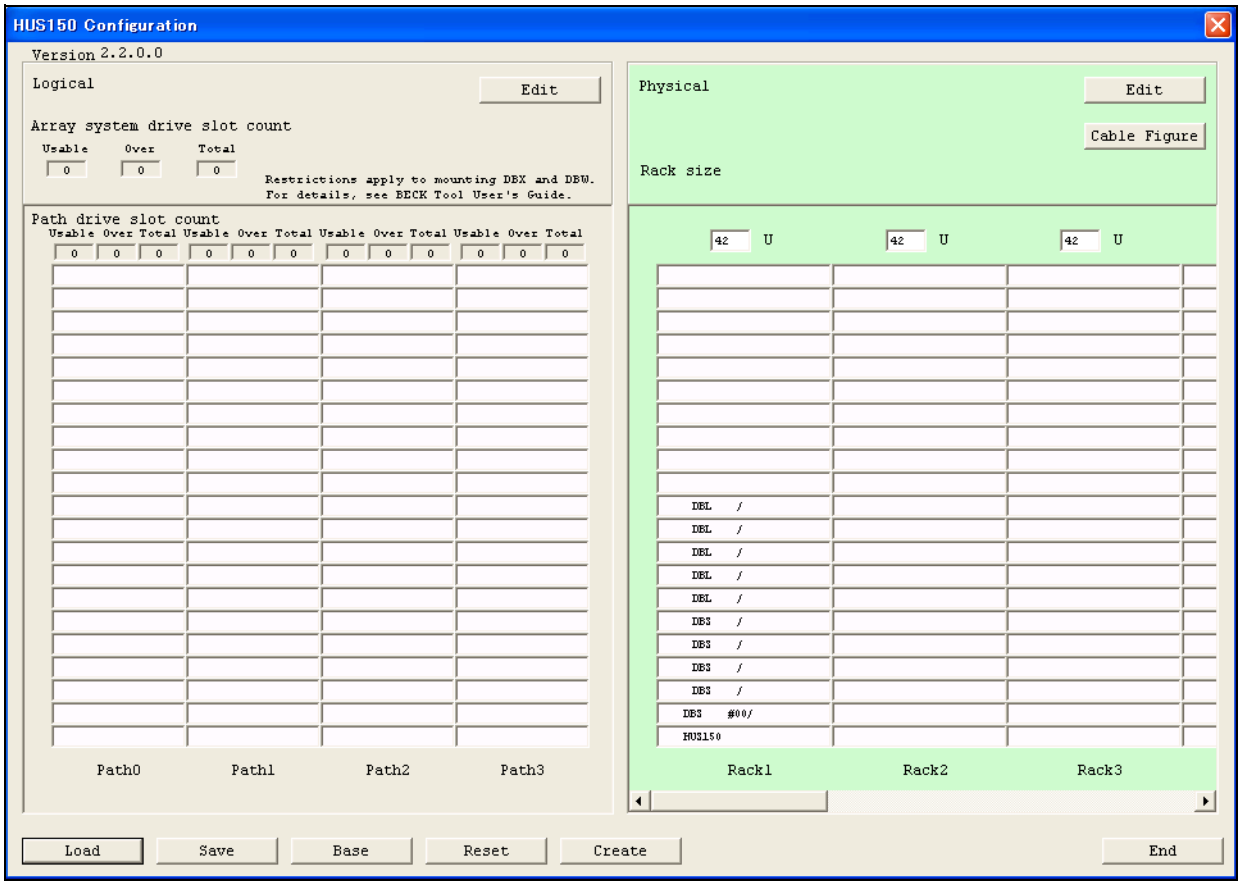



**Figure H-13: Loading a previously saved configuration file**

# BECK tool messages

Table H-8 lists the messages associated with the BECK tool and the actions to take.

**Table H-8: BECK tool messages**

| Number | Message | Corrective action |
|---|---|---|
| 1. | DBL has more rack-mountable numbers than allowed. | Re-examine the unit configuration. Display the Select Box dialog box and delete the DBL. |
| 2. | DBS has more rack-mountable numbers than allowed. | Re-examine the unit configuration. Display the Select Box dialog box and delete the DBS. |
| 3. | DBX has more rack-mountable numbers than allowed. | Display Select Box dialog box and delete the DBX. |
| 4. | DBW has more rack-mountable numbers than allowed. | Re-examine the unit configuration. Display the Select Box dialog box and delete the DBW. |
| 5. | DBF has more rack-mountable numbers than allowed. | Re-examine the unit configuration. Display the Select Box dialog box and delete the DBF. |
| 6. | DB60 has more rack-mountable numbers than allowed. | Re-examine the unit configuration. Display the Select Box dialog box and delete the DB60. |
| 7. | No more DBWs can be added. | Re-examine the unit configuration. Delete the DBW using the Select Box dialog box. |
| 8. | Unable to set DBW. | Click the [360HDD ON] option button before setting DBW. |
| 9. | Unable to set DBW with other types of drive boxes. | You cannot set DBW with other types of drive boxes. |
| 10. | The total number of drive boxes mountable exceeds its maximum numbers allowed. | Re-examine the unit configuration. Reduce the total number of Drive Boxes within the limit maximum numbers on the Select Box dialog box. |
| 11. | The number of installable drive boxes exceed its maximum numbers allowed. | Re-examine the unit configuration. Reduce the total number of drives within the limit maximum numbers on the Select Box dialog box. |
| 12. | Maximum drive box count per path was exceeded. | Re-examine the unit configuration. Specify the Drive Box count per path within the upper limit in the Select Box dialog box. |
| 13. | Rack-mountable drive numbers per path are exceeded. | Re-examine the unit configuration. Reduce the total number of drives per path within the limit of maximum drive numbers on the Select Box dialog box. |
| 14. | The number of Drive Boxes after DBW is over the limit. | Reduce the number of Drive Boxes. The number of installable Drive Boxes after installing the DBW is within 11 for Hitachi Unified Storage 150 and 5 for Hitachi Unified Storage 130 (360HDD ON). |
| 15. | Select one or more drive boxes. | In the Select Box dialog box, set any input value to more than 1. |
| 16. | More units are set to path 1 than path 0. | In the Logical configuration figure, set the same number of units to path 0 and path 1, or set one more unit to path 0 than path 1. |

**Table H-8: BECK tool messages (Continued)**

| Number | Message | Corrective action |
|---|---|---|
| 17. | More units are set to path 2 than path 1. | In the Logical configuration figure, set the same number of units to path 1 and path 2, or set one more unit to path 1 than path 2. |
| 18. | More units are set to path 3 than path 2. | In the Logical configuration figure, set the same number of units to path 2 and path 2, or set one more unit to path 2 than path 3. |
| 19. | Two or more units are set to path 0 than path 1. | In the Logical configuration figure, set the same number of units to path 0 and path 1, or set one more unit to path 0 than path 1. |
| 20. | Two or more units are set to path 1 than path 2. | In the Logical configuration figure, set the same number of units to path 1 and path 2, or set one more unit to path 1 than path 2. |
| 21. | Two or more units are set to path 2 than path 3. | In the Logical configuration figure, set the same number of units to path 2 and path 3, or set one more unit to path 2 than path 3. |
| 22. | Unit of path 0 side skips one or more units. | In the Logical configuration figure, do not have space between the units in path 0. |
| 23. | Unit of path 1 side skips one or more units. | In the Logical configuration figure, do not have space between the units in path 1. |
| 24. | Unit of path 2 side skips one or more units. | In the Logical configuration figure, do not have space between the units in path 2. |
| 25. | Unit of path 3 side skips one or more units. | In the Logical configuration figure, do not have space between the units in path 3. |
| 26. | The total size of mounted units exceeds the rack size. | Re-examine the size of each rack or reallocate the units to fit the allowed size of each rack. |
| 27. | The controller box location cannot be changed. | The Controller Box location is nontransferable. Do not click there. |
| 28. | Log file loading has failed. | • Provide sufficient space for storing the trace file.<br>• Check access authorization to the folder.<br>• Check whether another application is trying to access the folder that contains the trace file. |
| 29. | Log file contains inaccurate information. | • Confirm whether there are trace files other than the input file in the folder.<br>• Trace file may be corrupt. Re-examine the trace file.<br>• Confirm that the trace file is from a Hitachi Unified Storage system. |
| 30. | Configuration information file loading has failed. | • Re-examine the configuration file.<br>• Provide sufficient space for storing the configuration file.<br>• Check access authorization to the folder where the configuration file is located.<br>• Check whether another application is trying to access the folder that contains the configuration file. |

**Table H-8: BECK tool messages (Continued)**

| Number | Message | Corrective action |
|---|---|---|
| 31. | Configuration information file saving has failed. | • Provide sufficient space for storing the configuration file.<br>• Check the access authorization to the folder where the configuration file is located.<br>• Check whether another application is trying to access the folder that contains the configuration file.<br>• Check whether the configuration exceeds unit connection support specification 360HDD OFF. |
| 32. | Set the controller box. | Set a Controller Box to the logical or physical configuration figure. |
| 33. | The rack size exceeds the maximum value 42. | Set the rack size to 42 or below. |
| 34. | The size of rack 1 is insufficient. | Set the size of rack 1 as follows:<br>• Hitachi Unified Storage 150: 3 or more<br>• Hitachi Unified Storage110/130: 2 or more |
| 35. | Set the Drive Box. | Set one or more Drive Boxes. |
| 36. | Unable to set the drive box below the controller box. | Set a Drive Box above a Controller Box. |
| 37. | Rack height is insufficient. | Operate it again at the size shown in the maximum unit size screen. |
| 38. | Non-exchangeable because of the exchange not between the DBX's. | If the unit of exchange destination is not a DBX or blank, move the unit to a different location and then re-execute. |
| 39. | Unable to set at the specified location. | • If DBX-A is selected, do not set it to the highest place of maximum path in the logical configuration figure.<br>• If DBX-B is selected, do not set it to the lowest place of the smallest path in the logical configuration figure.<br>• Set a Controller Box only in Rack 1. |
| 40. | Unable to select because unit exists on right side of the unit. | • Move the unit on the right side of the exchange destination to a different location, and then re-execute.<br>• If DBX is specified in the Select Box dialog box, be sure the cell on the right side is blank. |
| 41. | Unable to select because unit exists on left side of the unit. | Move the unit on the left side of the exchange destination to a different location, and then re-execute. |
| 42. | Enter box code within 8-alphanumeric characters | Enter the box code, up to eight alphanumeric characters. |
| 43. | Enter box code within 15 alphanumeric characters. | Enter the Box code within 15 alphanumeric characters. |
| 44. | Install UNLHA32.dll in the Windows system folder. | Click the **Load Log** button after storing the file `UNLHA32.dll` in the Windows system folder. |

**Table H-8: BECK tool messages (Continued)**

| Number | Message | Corrective action |
|---|---|---|
| 45. | ini file has not stored in program folder, or ini file loading has failed. | • Store the INI file in the BECK_Tool_wxyz folder.<br>• Exchange the INI file or the BECK Tool.exe file. |
| 46. | More than one ini files are stored in program folder. | Store only one INI file in the BECK_Tool_wxyz folder. |
| 47. | One or more setting values in ini file are incorrect. | The INI file may be corrupt. Exchange the INI file. |
| 48. | BECK tool is already running. | Confirm whether the BECK tool is not running. |
| 49. | System error has occurred. Exit the tool and execute it once again. | Unexpected error occurred. Close the BECK tool and then start it again. |
| 50. | May physical configuration figure be initialized? | Click **OK** or **Cancel**. |
| 51. | May logical configuration figure be initialized? | Click **OK** or **Cancel**. |
| 52. | May physical configuration and logical configuration figure be initialized? | Click **OK** or **Cancel**. |
| 53. | Current configuration figure will be discarded if the screen is closed without saving. Continue to close the screen? | Click **OK** or **Cancel**. |
| 54. | Specified file already exists. Overwrite? | Click **OK** or **Cancel**. |
| 55 | Cancel to read Log file? | Click **OK** or **Cancel**. |
| 56 | Unit is set in path 7 from path 4. | Set a unit from path 0 to path 3. |

# Special guidelines

The following sections describe the following guidelines to observe when using BECK.


- DBX and DBW Drive Box configuration rules on page H-95
- Yellow box in the configuration screen on page H-104
- Loading a simple trace when Unit A of a DBX is connected last on page H-106

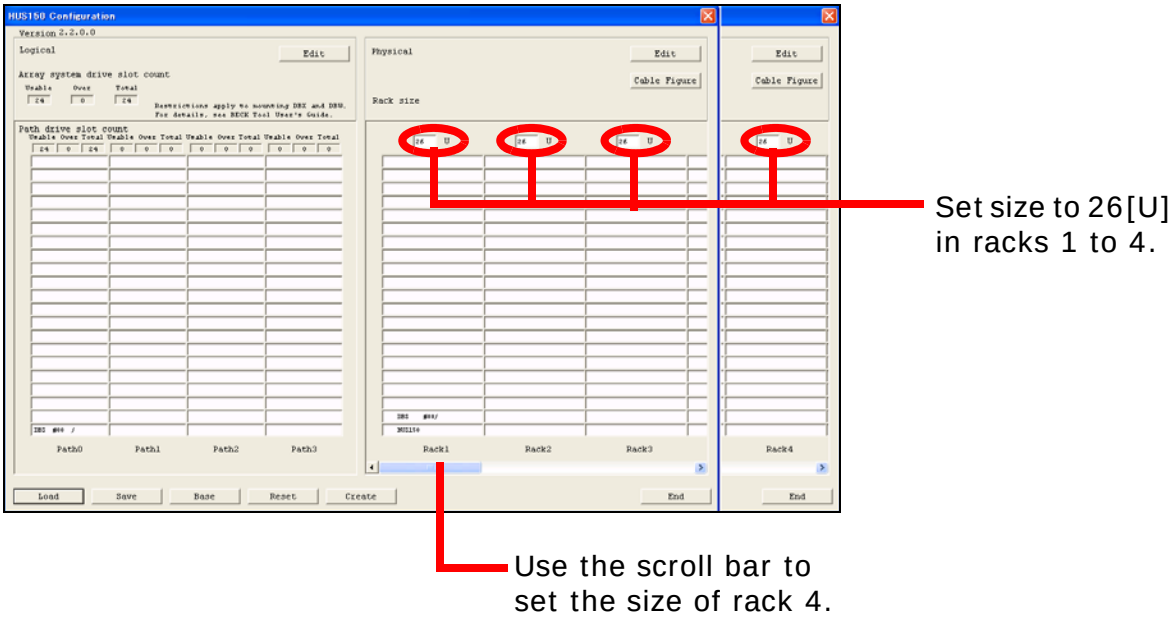

## DBX and DBW Drive Box configuration rules

When setting a DBX Drive Box in a rack, the rack size must be between 3U and 26U. When setting a DBW Drive Box in a rack, the rack size must be between 3U and 22U.

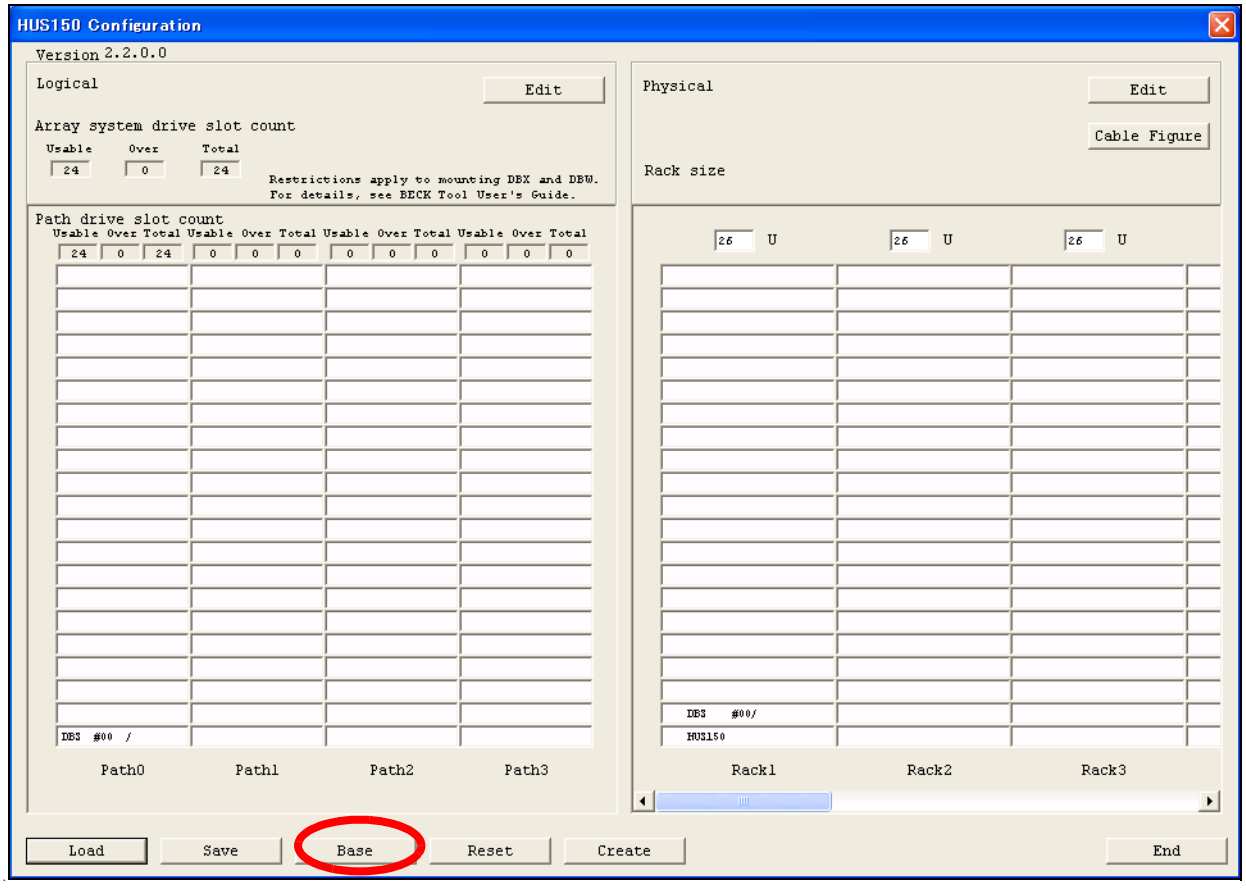
### Example 1

The following example shows how to use the BECK tool to create a DBX and DBW configuration. In this example, 20 DBX Drive Boxes will be set in a Hitachi Unified Storage 150.

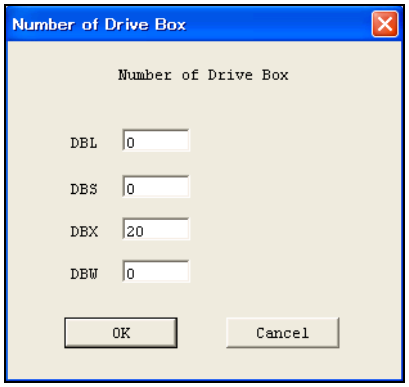
1. In the physical configuration figure, set the size of racks 1 to 4 to 26 [U].




2. In the configuration screen, click **Base**.

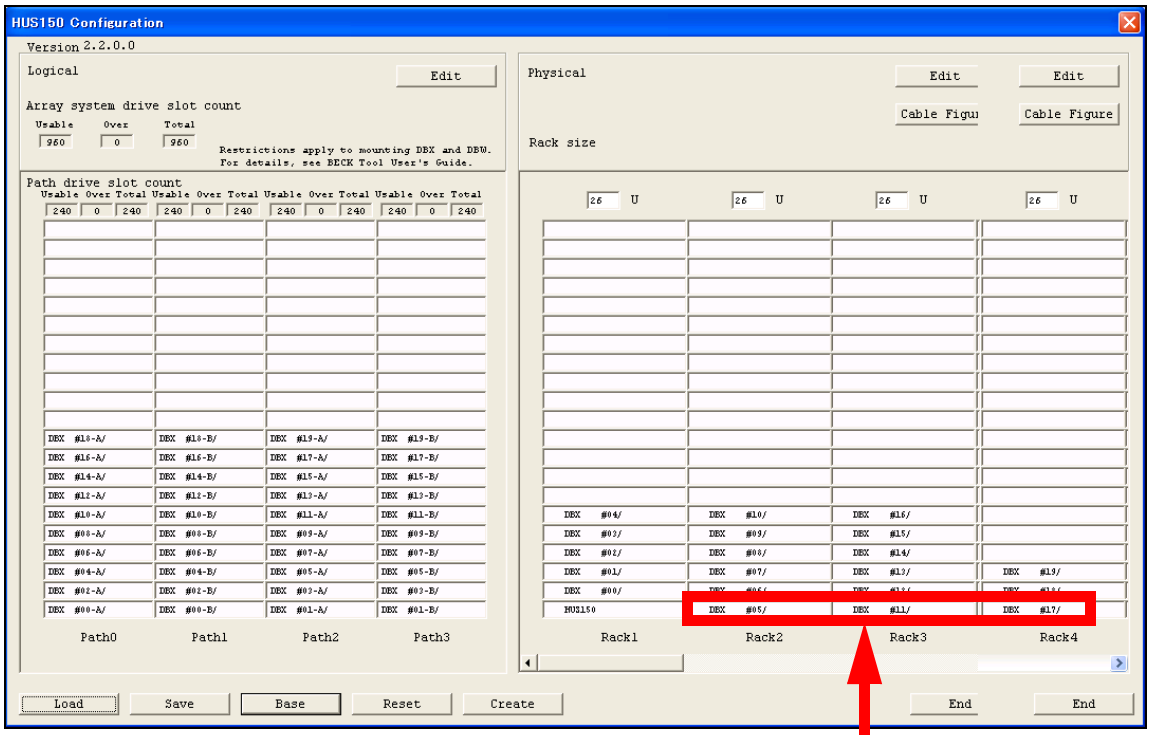



3. At the Number of Drive Box dialog box, type **20** in the **DBX** field.



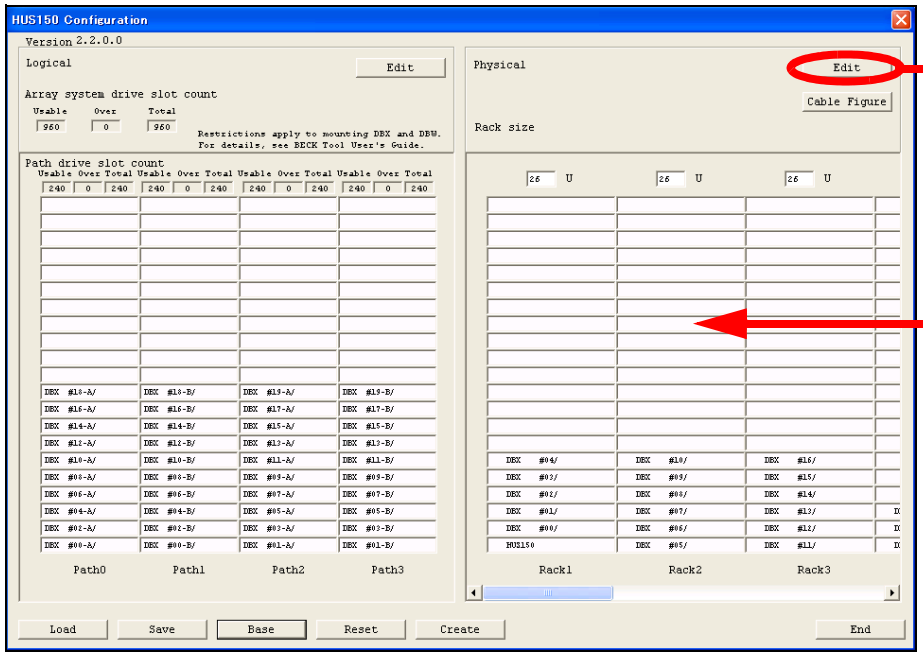

4. Click **OK**. The configurations are automatically created on the logical and physical configuration figures in the configuration screen. Drive Boxes appear in the paths in DBF, DBW, DBX, DBS, and DBL order.

   In this example, DBX Drive Boxes are located at the bottom of the racks, violating the DBX setup rules of 3 to 26 U. To resolve this issue, perform the remaining steps to drag and drop the DBX Drive Boxes to appropriate locations in the rack.



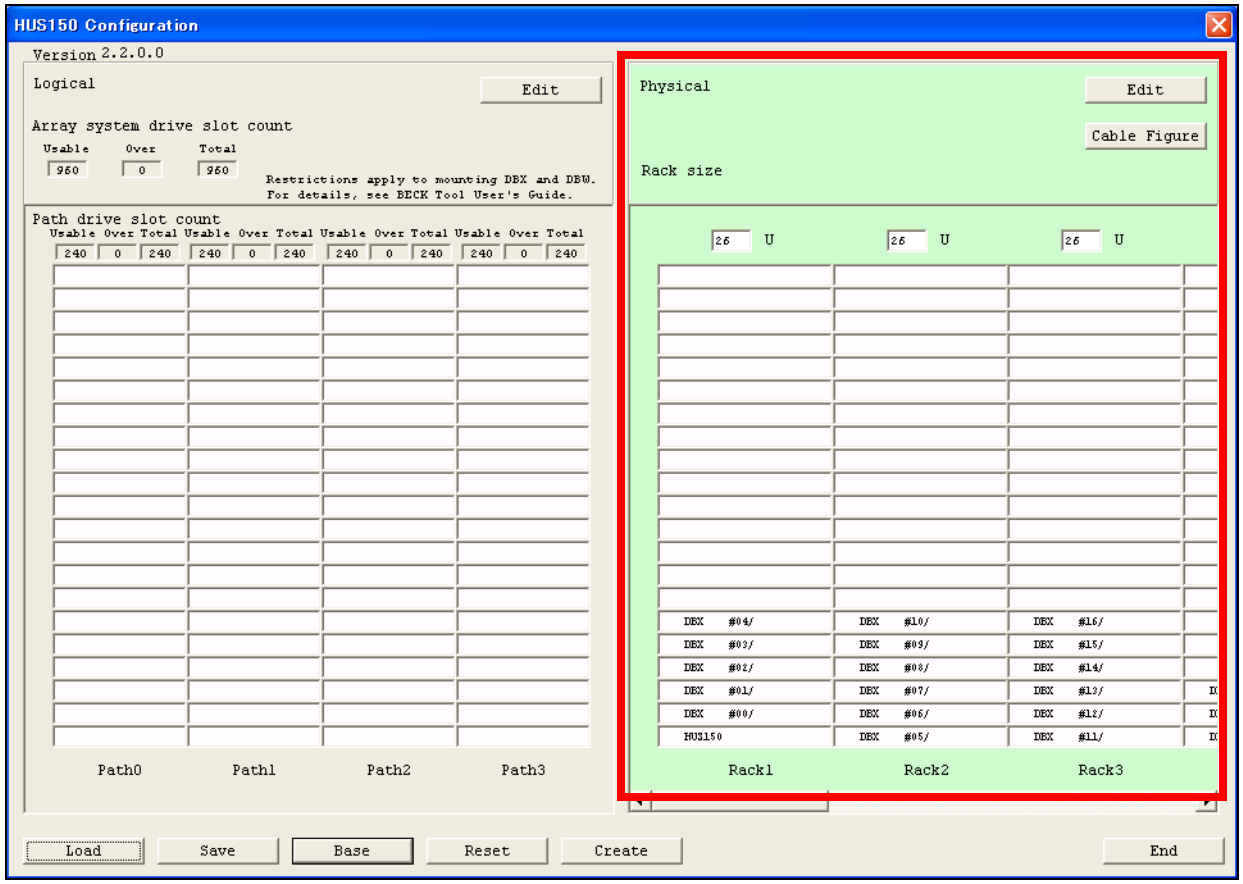

DBX units in the bottom of the racks should be moved.

5. Click **Edit** in the physical configuration figure or click the physical configuration figure.

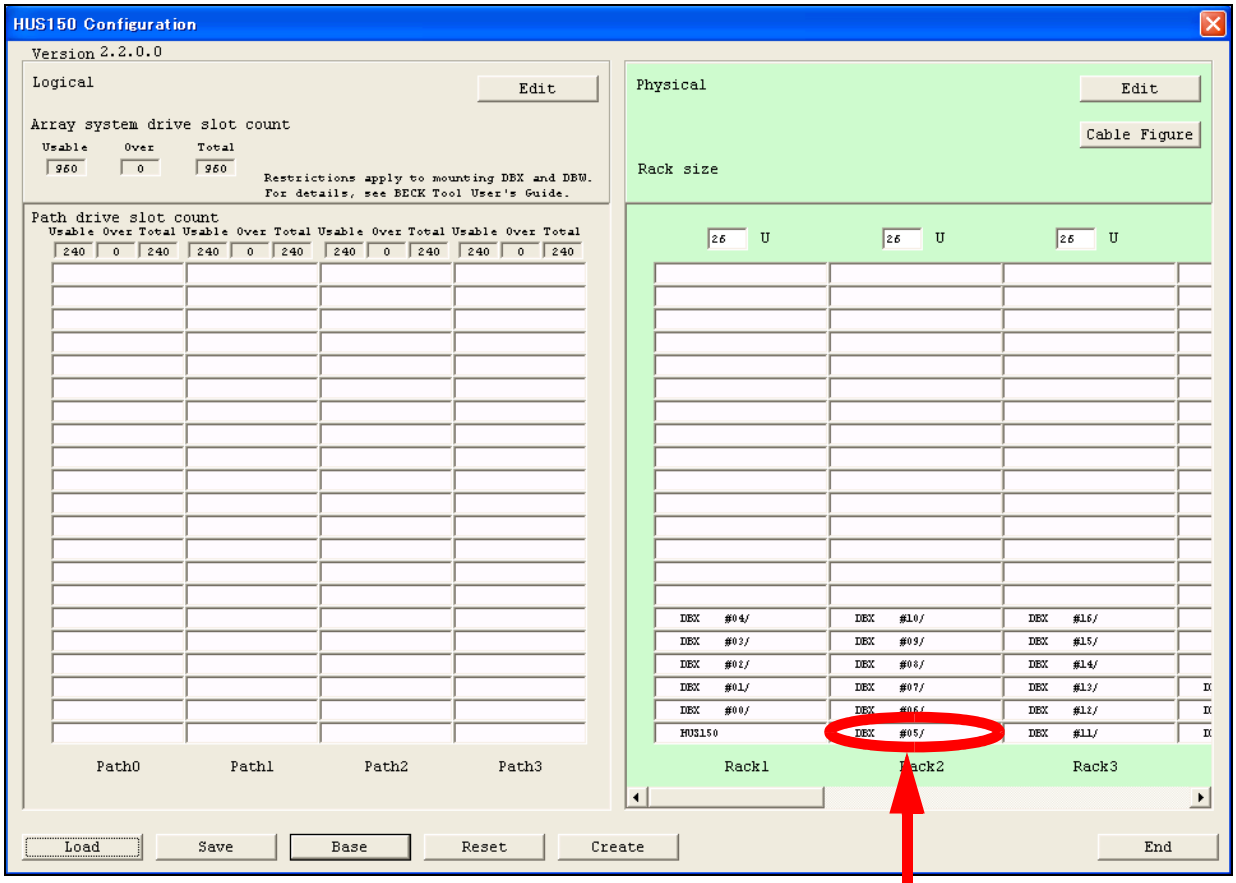



6. At the message **May logical configuration figure be initialized?**, click **OK**.

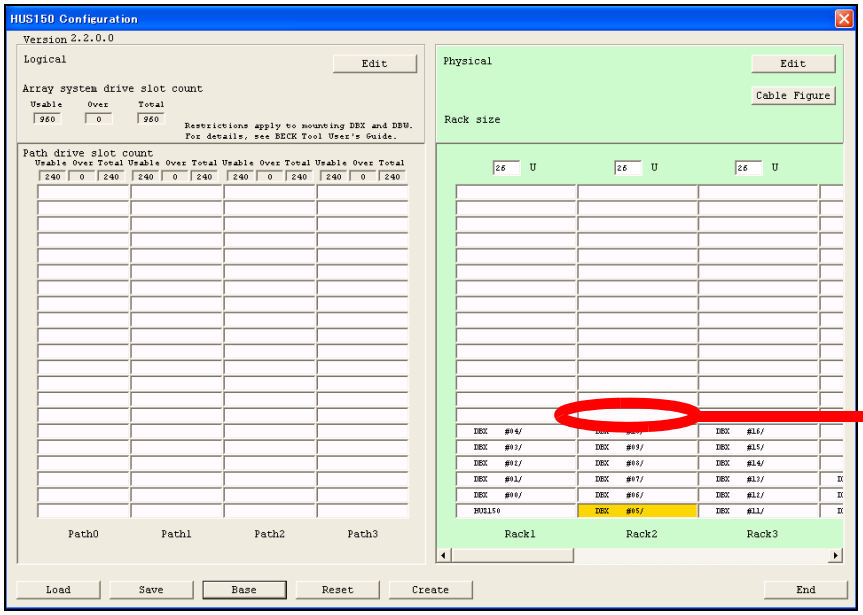
   All units, unit IDs, and serial unit numbers in the logical configuration figure are cleared and the physical configuration figure is highlighted in light green.



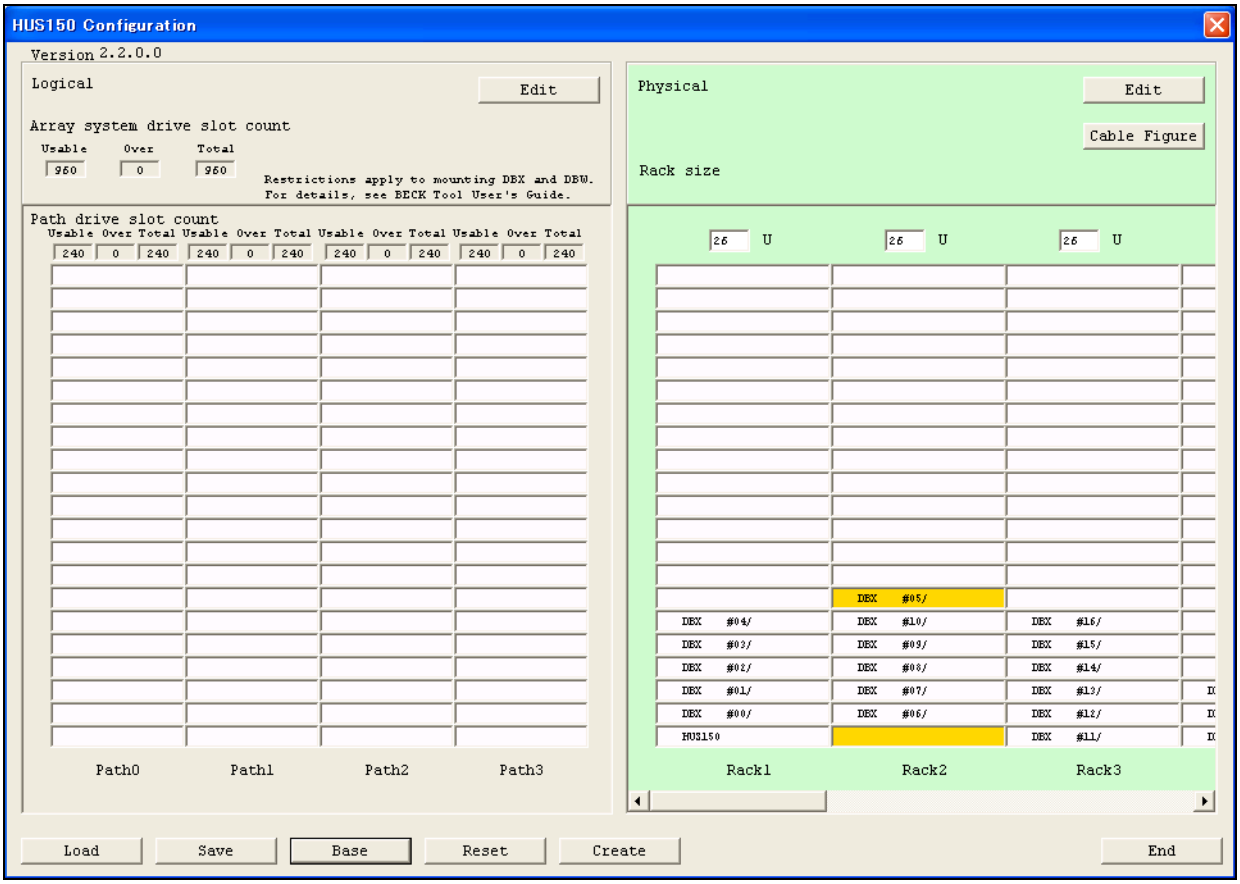

7. Click the DBX Drive Box at the bottom of the rack.



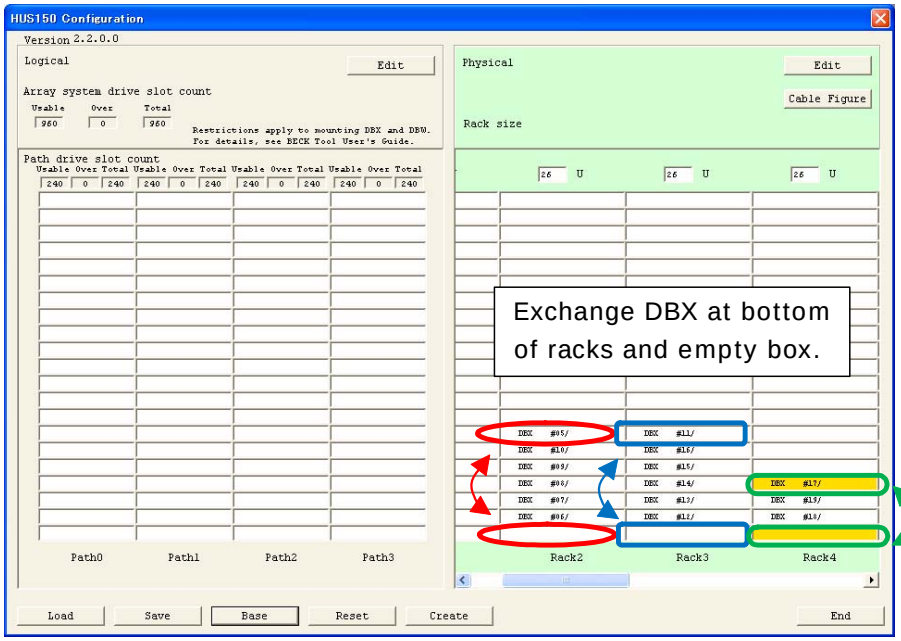

8. With the DBX Drive Box highlighted in orange, drag it to an empty box, and then release the mouse button over the desired box.



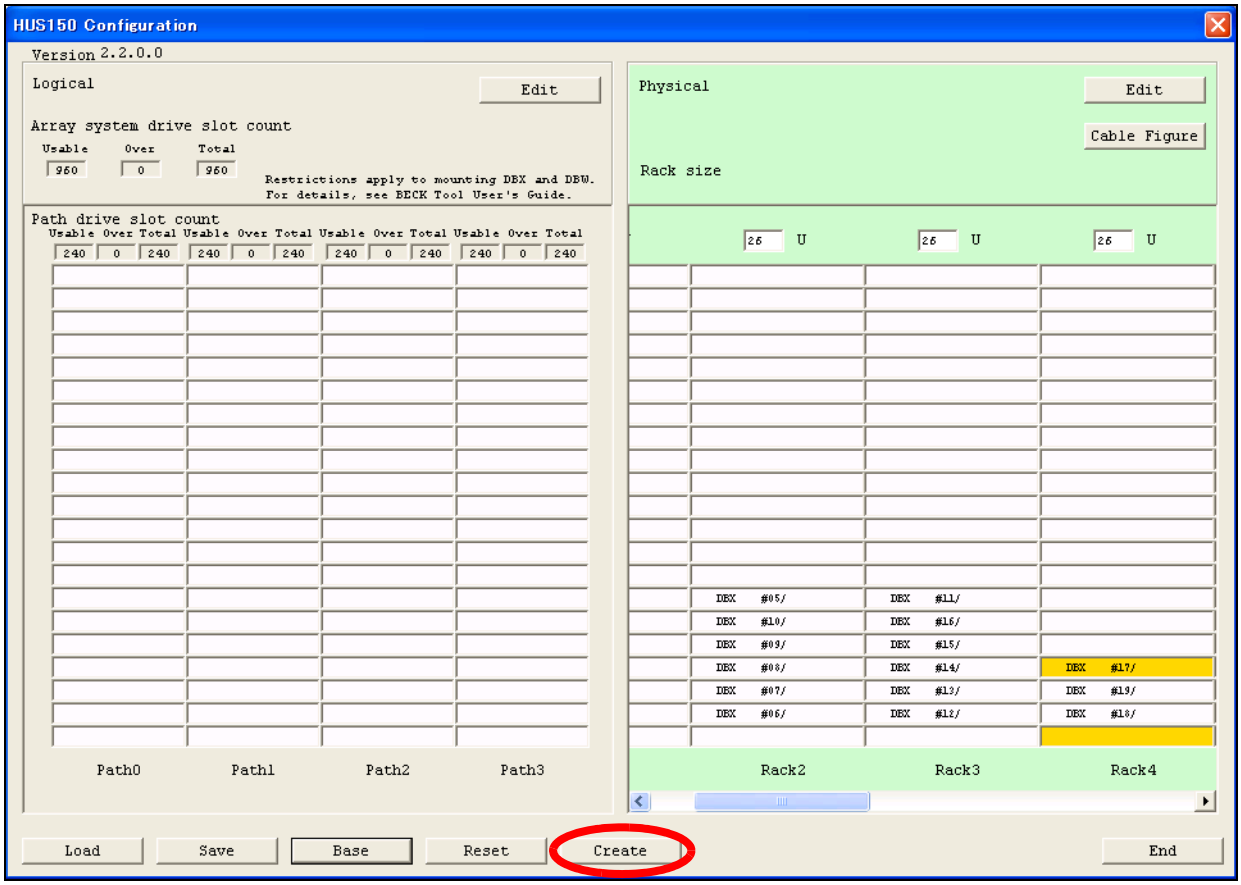
The DBX and empty box are exchanged, and the box is highlighted in orange. The unit ID and serial unit number are also exchanged if they have been registered.




9. Drag and drop the DBX at the bottom of the rack to an empty box in another rack.

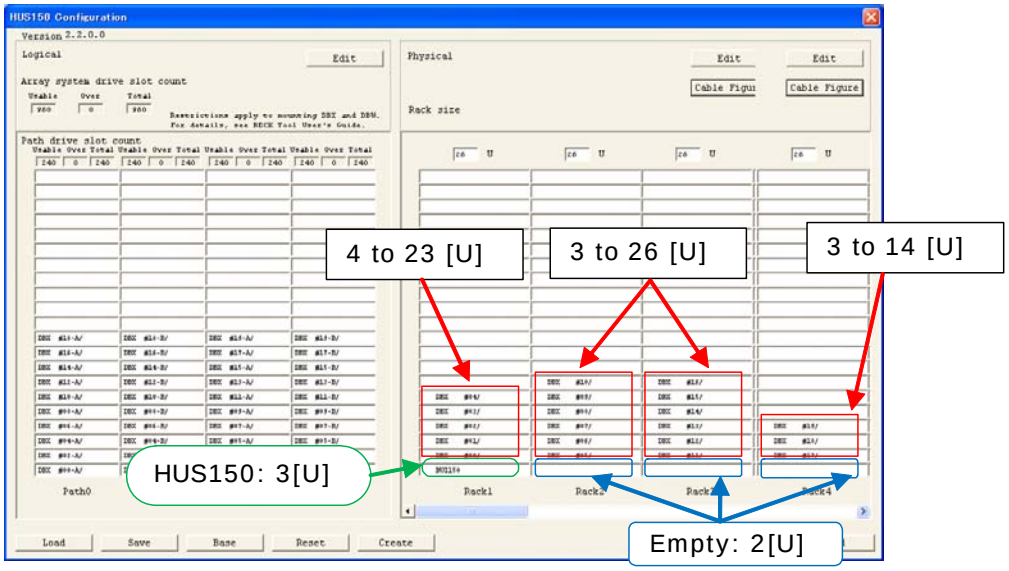


10. Click **Create**.




Changes made are displayed in the logical configuration figure and unit IDs are assigned automatically.

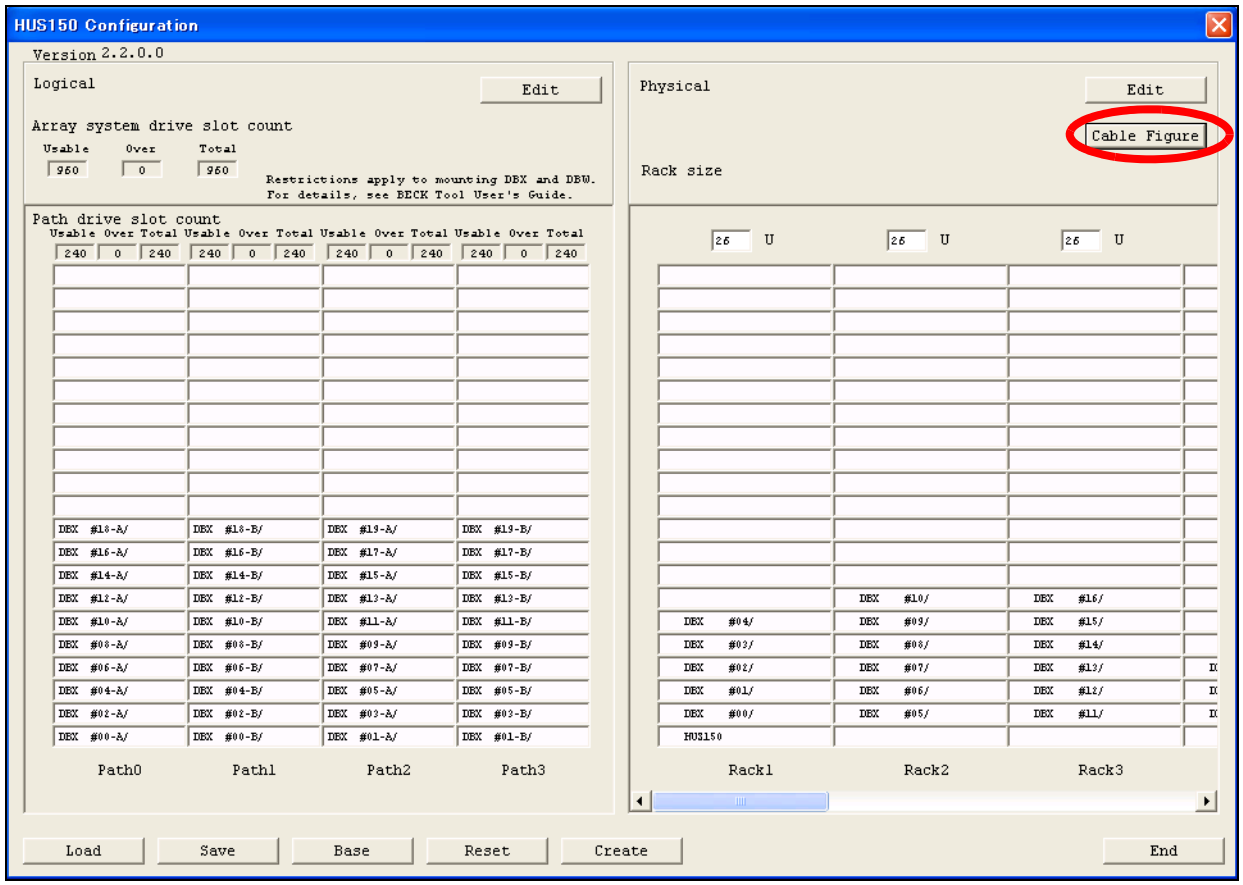
This completes the steps for creating a configuration that complies with the setup rules for DBX Drive Boxes. Perform the remaining steps to complete the procedure.



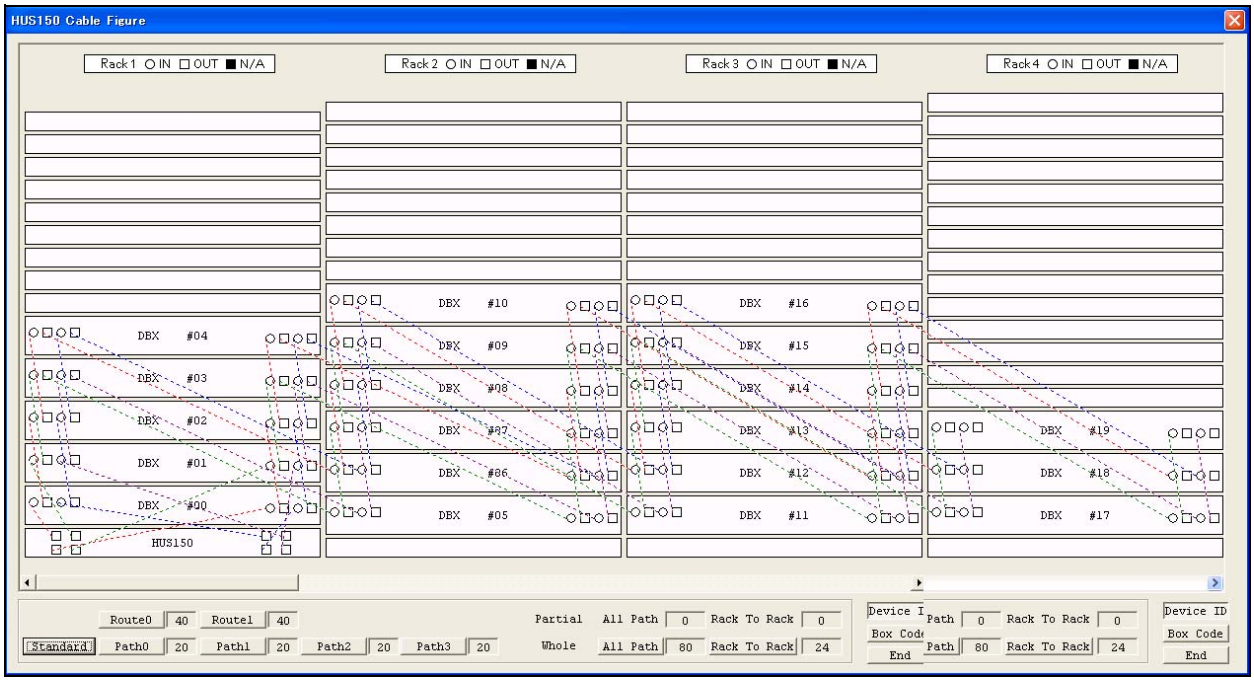
The following sizes are represented by a rack box in the physical configuration figure.

- Hitachi Unified Storage 150: 3 [U]
- Hitachi Unified Storage 110 and 130: 2 [U]
- DBL, DBS, and DBF Drive Boxes: 2 [U]
- DBX Drive Box: 4 [U]
- DBW Drive Box: 5 [U]
- Empty: 2 [U]

11. Click **Cable Figure** to display the cable figure based on the setup rules for the DBX Drive Box.




The BECK tool displays the cable figure based on the setup rules for the DBX Drive Box. In this example, 20 DBX Drive Boxes are set. Set the rack size to 26 [U] according to the number of DBX Drive Boxes to be set.

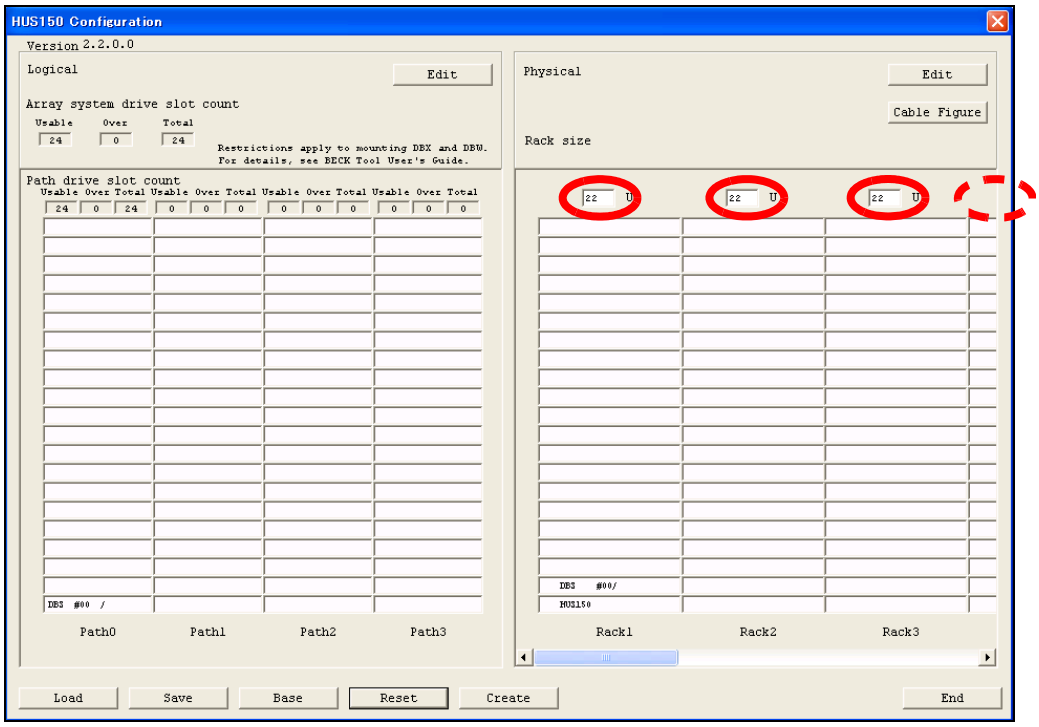



## Example 2

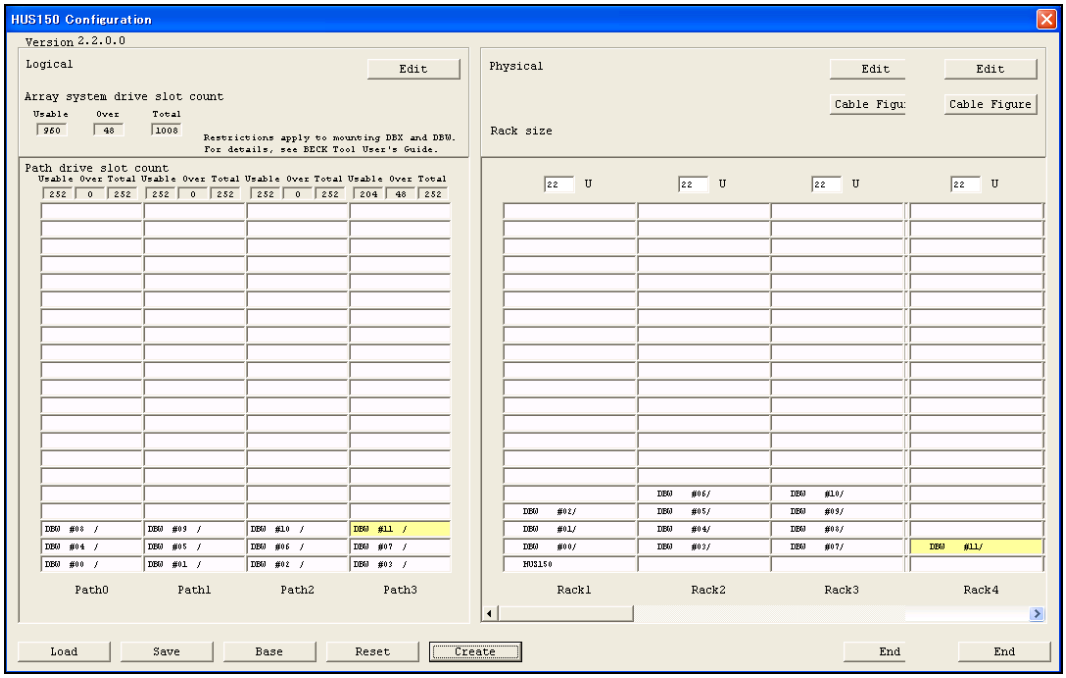
In this example, 20 DBXs are set. Set each rack size to 26[U] according to the number of DBX Drive Boxes to be set.

If you use a DBW Drive Box, set each rack size to 22[U] according to the number of DBW Drive Boxes to be set. This example uses a configuration with a DBW Drive Box.

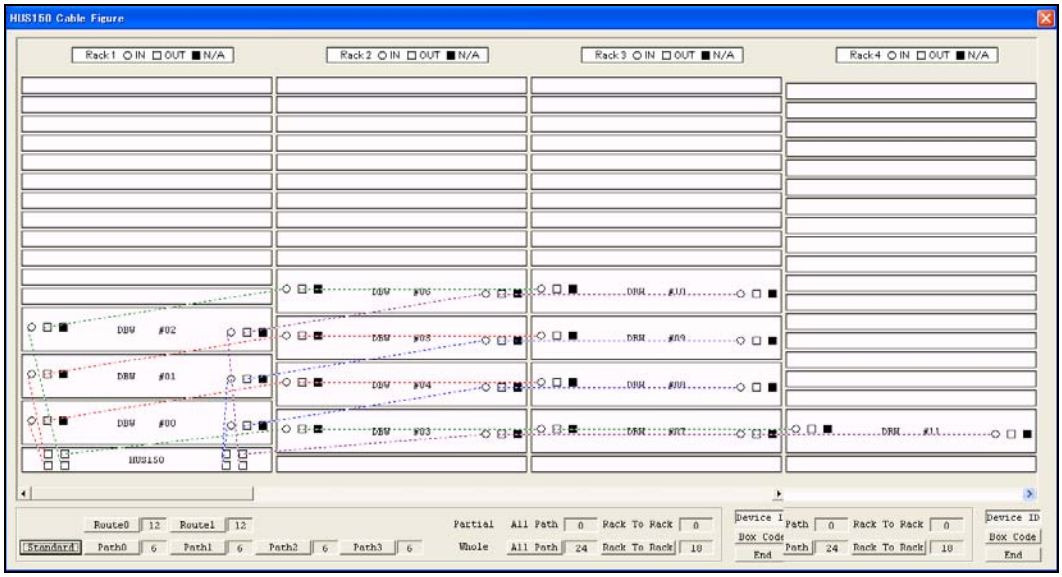
1. Set the rack size to 22[U] in racks 1 to 4 in the Physical configuration figure of the **Configuration** screen for Hitachi Unified Storage 150.



2. As described in example 1, create a configuration according to DBW mounting rules.



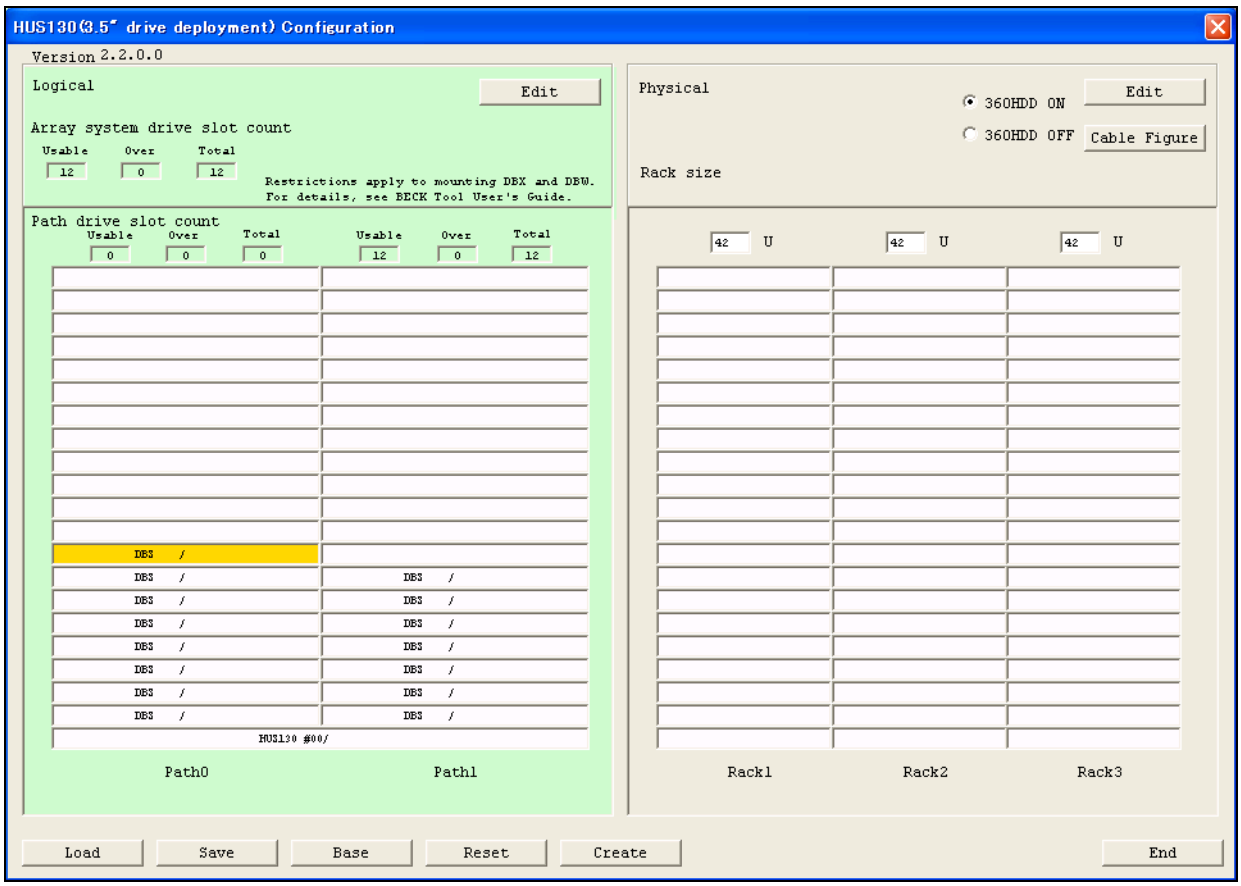

3. Click **Cable Figure** to display a cable figure according to DBW mounting rules.



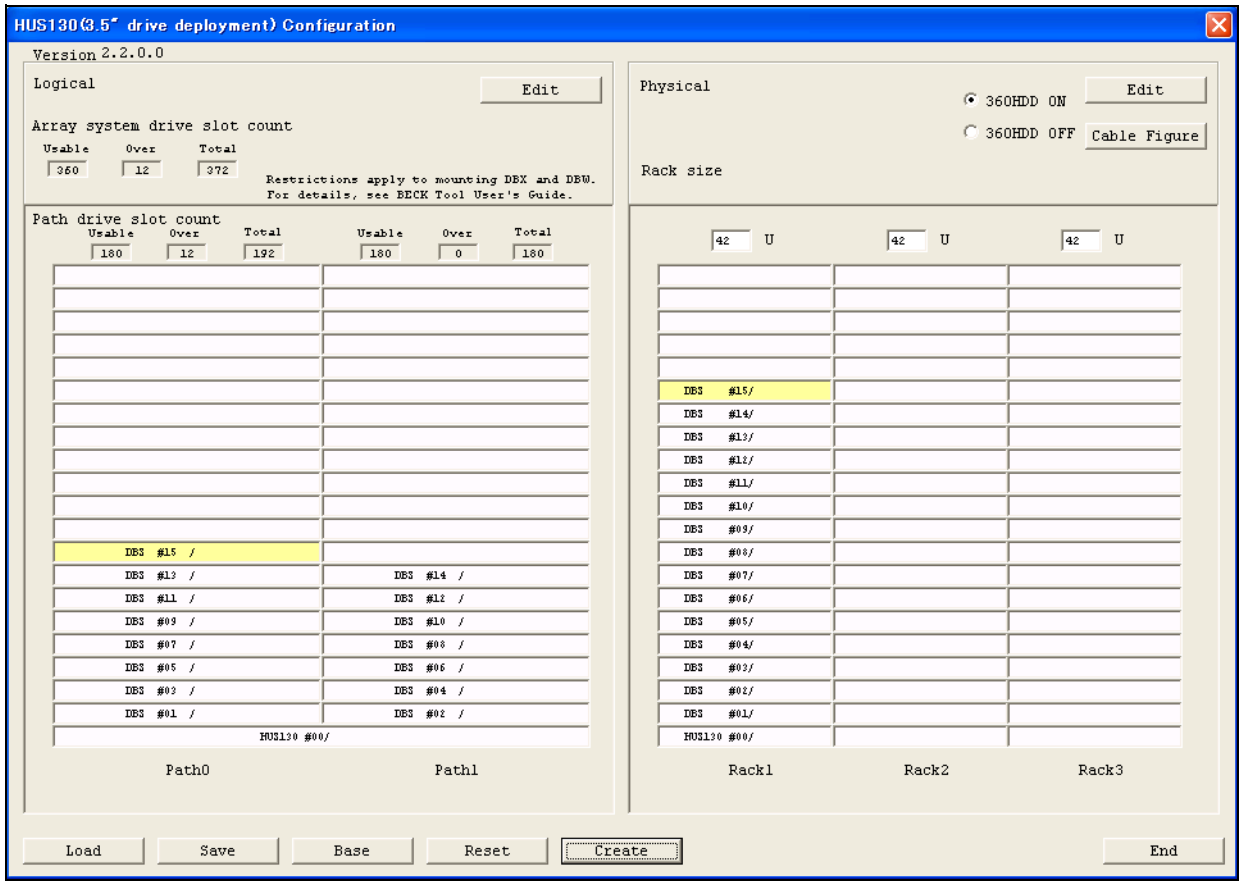

## Yellow box in the configuration screen

A yellow box displayed in the Physical or Logical configuration figure of the **Configuration** screen indicates drive slots in the box cannot be used by the number indicated at **Over in Array system drive slot count / Path drive slot count**. Drive slots that have larger drive numbers in the box cannot be used by the number indicated at **Over**. This section describes the steps to take if you see these boxes.

1. In the **Configuration** screen, create a configuration. In this example, a Hitachi Unified Storage 130 with 3.5-inch drives is selected and 15 boxes of DBS units are added.




2. In the configuration screen, the yellow box shows drive slots that cannot be used. The number of drive slots appears at **Over** in **Array system drive slot count** / **Path drive slot count**. In this example, a drive slot count of **12** is displayed at **Over**. This means 12 slots that have larger drive numbers cannot be used in the DBS displayed in pale yellow. Twelve slots that have smaller drive numbers can be used.




As described above, a yellow box appears when there are drive slots that cannot be used in the box. In this case, we recommend you do not add the box.

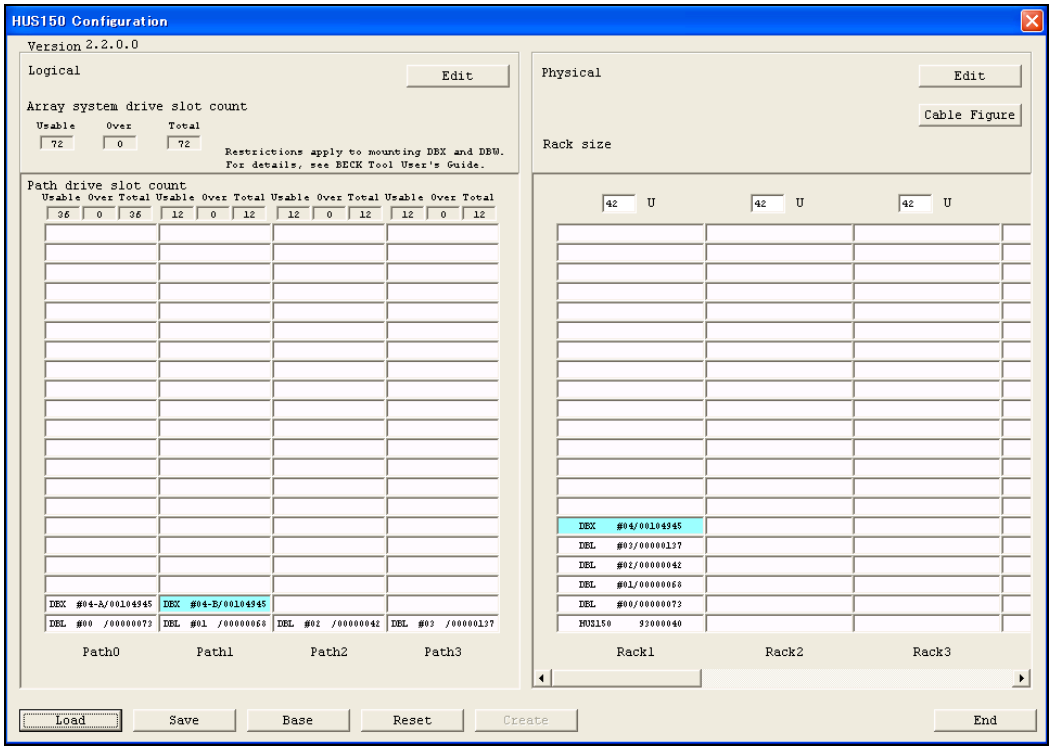
## Loading a simple trace when Unit A of a DBX is connected last

If you collect a simple trace file when Unit A of a DBX Drive Box is connected last in the configuration, Unit B of the DBX in the **Logical** configuration figure and DBX in the **Physical** configuration figure are displayed in cyan in the Configuration screen. This indicates Unit B is not connected because the unit connected last is Unit A of the DBX, which consists of Unit A and Unit B. You can reference the cable figure where only Unit A of the DBX is connected.

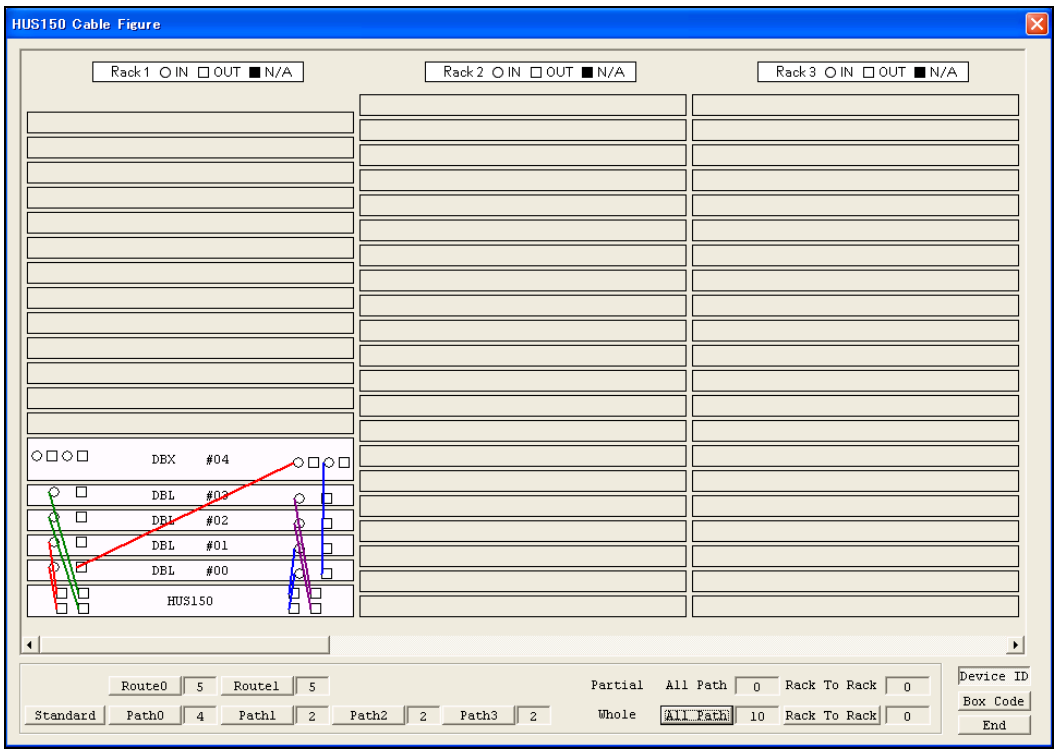
The following procedure provides details of a DBX displayed in cyan and the cable figure.

1. In the Array Unit Type dialog box, click **Load log** to load a simple trace of the configuration, where Unit A of a DBX is connected last. After it is loaded, Unit B of the DBX in Logical configuration figure and the DBX in Physical configuration figure are shown in cyan.

   The number of drive slots in Unit B of the DBX is not reflected in the **Array system drive slot count** and **Path drive slot count** because Unit B of the DBX is not connected.




2. Click **Cable Figure** to display the cable figure. No SAS (ENC) cable is connected to Unit B of the DBX because the Unit A of the DBX is connected last.




If you collect a simple trace file when Unit A of a DBX Drive Box is connected last in the configuration, you cannot click **Create** on the configuration screen. When the Logical/Physical configuration figure can be edited, Unit B of a DBX is not displayed in cyan and **Create** can be clicked.

# NEBS certification

This appendix is intended for customers who will use Network Equipment Building System (NEBS)-compliant equipment with the Hitachi Unified Storage. This appendix contains information for achieving NEBS compliance.


- About NEBS
- Hitachi Unified Storage NEBS hardware
- Rack assembly and installation
- Mounting components in the rack
- Dual-feed fuse alarm panel
- NEBS-3 test results and certification
- ETSI and telecom test results and certification

# About NEBS

"NEBS Level 3" is a term from Bellcore special report, SR-3580, and means the equipment meets all of the requirements of GR-63-CORE and GR-1089-CORE. NEBS Level 3 has strict specifications for:

- Fire suppression
- Thermal margin testing
- Vibration resistance (earthquakes)
- Airflow patterns
- Acoustic limits

NEBS-3 also requires that equipment pass a set of operational and non-operational tests. These tests consist of high and low temperatures, high humidity, drop, rain, and other requirements and objectives. For specific details, see NEBS-3 test results and certification on page I-18.

# Hitachi Unified Storage NEBS hardware

To accommodate NEBS requirements, Hitachi Data Systems offers Hitachi Unified Storage customers the NEBS Level 3-certified equipment in Table I-1 on page I-3.

All of the NEBS tests described under NEBS-3 test results and certification on page I-18 and ETSI/telecom tests described under ETSI and telecom test results and certification on page I-21 were performed on the Hitachi Unified Storage equipment. The equipment passed all the tests.

**NOTE:** The CBLD, DBLD, and DBSD are functionally equivalent to their AC-powered counterparts. Therefore, the configuration, operation, and troubleshooting procedures for these components are the same as the AC-powered units described in the other chapters and appendixes in this manual.

**WARNING! The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.**

**Table I-1: NEBS-certified components**

| Component | Description | See |
|---|---|---|
| DC power supply | Provides DC power to the Hitachi Unified Storage 150 | Table E-11 on page E-38 |
| Dual-feed fuse alarm panel | Routes DC power to the Hitachi Unified Storage system in a seismic rack and provides power protection for installed equipment | Dual-feed fuse alarm panel on page I-15 |
| CBLD | DC-powered 3U Controller Box | • DC Power Supply Models on page 1-5<br>• CBL (DF850-CBLR), CBLE (DF850-CBLR1), and CBLD (DF850-CBLD) Controller Boxes on page 2-13 |
| DBLD | DC-powered 2U Drive Box for large form-factor (LFF) drives | • DC Power Supply Models on page 1-5<br>• DBL/DBLD Drive Box on page 2-17 |
| DBSD | DC-powered 2U Drive Box for small form-factor (SFF) drives | • DC Power Supply Models on page 1-5<br>• DBS/DBSD Drive Box on page 2-15 |

The following figures show DC-powered Hitachi Unified Storage components.

**Figure I-1: Hitachi Unified Storage DBL Drive Box (Front View)**

**Figure I-2: Hitachi Unified Storage DBS Drive Box (Rear View)**

**Figure I-3: Drive Box Power Supply (Front View)**

**Figure I-4: Drive Box Power Supply (Rear View)**

**Figure I-5: EUT Frame (Front View)**

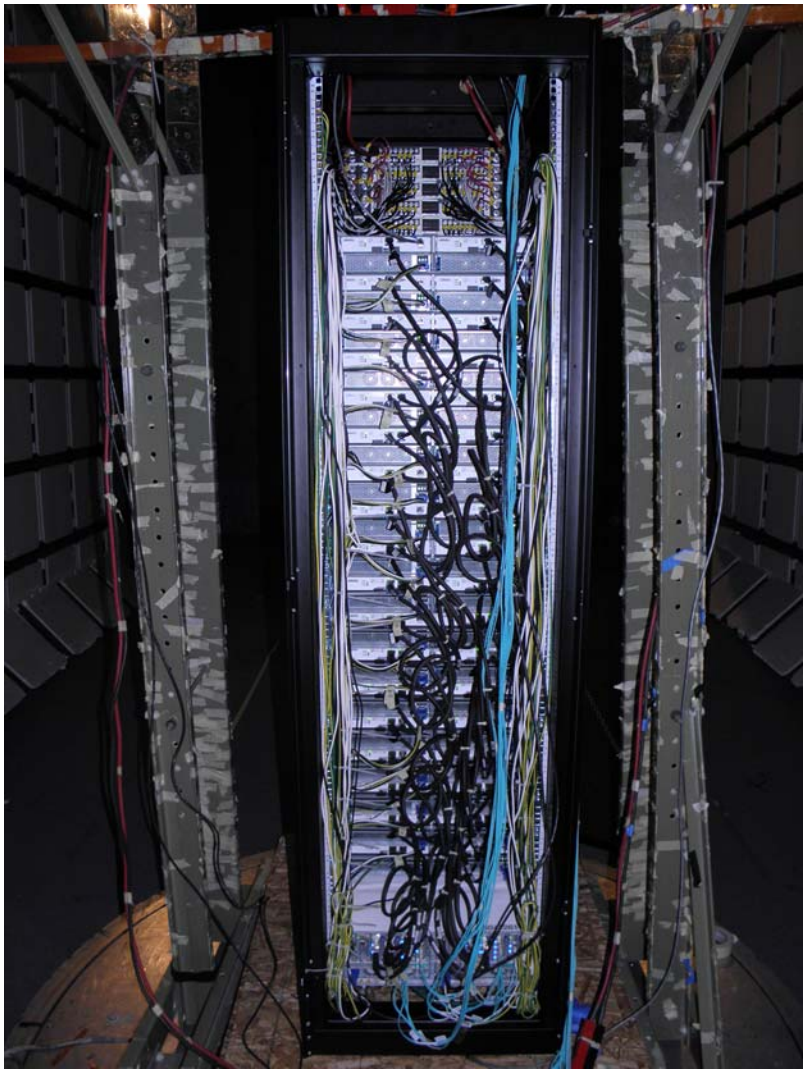


**Figure I-6: EUT Frame (Rear View)**

**NOTE:** The EUT shall be installed in Common Bonding Network or Isolated Bonding Network. (Typically Common Bonding Network).

## Rack assembly and installation

This section complies with NEBS-3 Section 9.6 Equipment Unit Bonding and Grounding. NEBS-3 requires that you complete the following steps when building a rack.

**NOTE:** Testing was based upon the EUT being Installed in a Network Telecommunications Facility or Central Office Locations.

1. Clean all parts to be joined before assembly.
2. Apply anti-oxidant compounds to the surfaces to be joined before assembly.

3. Fasten the internal rack structures together with thread forming screws and paint-piercing star lock washers, and apply antioxidants during assembly.

It is the customer's responsibility to place and anchor the rack, and then connect it to earth ground and the DC power grid. After the rack is installed, Hitachi Data Systems personnel will install the Hitachi Unified Storage components in the rack, and configure and test the system.

## Anchoring the rack

The rack must be anchored to the concrete floor with anchoring bolts that meet NEBS-3 specifications. Rack anchoring must be completed by an experienced installer who is familiar with seismic installations that meet local building codes and can obtain the appropriate anchor bolts.

For more information, refer to the documentation for the anchoring kit.

## Grounding the rack

The rack is grounded to a vertical rail and to an external earth grounding source. Figure I-7 on page I-7 shows an example of these grounding connections. All grounding hardware and conductors are made of copper.

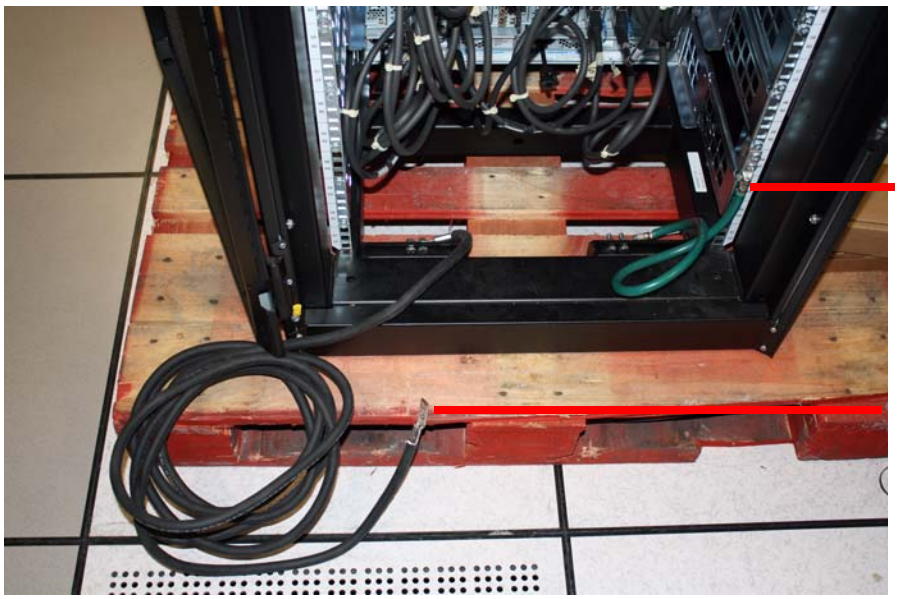



**Figure I-7: Example of grounding to vertical rail and grounding source**

### Grounding (battery return)

The seismic rack should use an Isolated DC return (DC-I) for battery return. DC-I means that the DC return terminal or conductor is not connected to the equipment frame or the grounding means of the equipment. All grounding hardware and conductors are made of copper.

# Mounting components in the rack

After the rack is assembled and installed, observe the following NEBS guidelines when installing components in the rack.

## Fasteners

To meet the NEBS-3 code, use screws that form their own threads in the rack, ensuring good electrical contact with the rack as well as a tight mechanical bond. These are sheet-metal screws and are shown in the following illustration and on the detailed drawings at the end of this appendix.

## Paint-piercing lock washers

In addition to the fasteners described above, use lock washers that pierce the paint or other finish (alodine, etc.) on the installed units and the rack to ensure that the units are securely grounded to the rack. A star washer usually fills this requirement. A star washer has internal or external teeth that lock the fastener to the unit as well as pierce the finish and contact the metal underneath. The fastener, in turn, is grounded to the rack via the threads in the rack.

Table I-2 on page I-8 shows internal and external tooth star washers and Figure I-17 on page I-15 shows an example of an installation.

**Table I-2: Fasteners and star washers**

| | | |
|---|---|---|
| Internal Tooth Star Washer | External Tooth Star Washer | Installed Fastener with Star Washer |
| Captive 1/4-20 stud for ground terminals. See Table I-3 above. | Thread forming screw: 10-32 x 3/8 pan head philips drive steel zinc finish. | |

## Wiring and cabling

To meet NEBS-3 requirements, you must use shielded, twisted-pair (STP) Ethernet cables for connecting to the Hitachi Unified Storage management ports. The shield must be grounded at both ends of the cable. This is a REQUIREMENT for installation. For more information, see DC power cable on page F-8.

## Grounding rack components

**NOTE:** The following grounding information complies with NEBS-3 Sections 9.9.2 and 9.9.3, Connectors, and Section 9.7.1, Connectors and Connection Methods for Equipment Unit Assemblies.

Grounding cables between rack components are constructed with two-hole compression lugs at both ends of the cable (see Figure I-8 on page I-9). The two-hole compression lug or grounding lugs used must be UL listed or approved.

**Figure I-8: Seismic rack ground connection**

To connect the lug to the rack:

1. Remove any paint overspray from the area where the lug will attach to the rack.
2. Clean the rack surface where the ground lug will be attached and remove any residue and paint particles.

**NOTE:** To meet NEBS-3 requirements, the surface where the ground lug attaches to the rack must be cleaned and polished to a bright finish and anti-oxidant applied to the area before the ground lug is attached to the rack. The two-hole compression lug or grounding lugs used must be UL listed or approved.

3. Clean the connector lug.
4. Apply anti-oxidant compound to both the area where the lug will attach to the rack and to the side of the connector lug that will contact the rack.
5. Fasten the grounding lug to the rack with two thread-forming screws or use captive bolts if they are installed in the rack. Install star lock washers above *and below* the compression lug. If the lug is installed with captive bolts (nominally 1/4 inch diameter, carbon steel) tighten the nuts as specified in Table I-3.

**Table I-3: Ground Lug Torque Specifications**

| Bolt Size | Torque - foot lbs. |
|---|---|
| 1/4-20 | 6 |
| 1/4-28 | 7 |

**Table I-3: Ground Lug Torque Specifications**

| Bolt Size | Torque - foot lbs. |
|---|---|
| Torque values are for SAE Grade 5 (medium strength) steel bolts, dry lubricated, using SAE Grade 5 nuts | |

When grounding rack components, observe the following guidelines:

- Each ground lead must be secured with its own bolt or thread-forming screw.
- Bolt assembly size and torque specifications for securing the two hole compression lugs to the rack must be followed when installing the rack.
- Procedures for cleaning and treating the surface areas surrounding the compression lugs during installation must followed when installing the rack.
- DC power cords require grounding directly to the rack (see Figure I-9).
- All grounding hardware and conductors are made of copper.

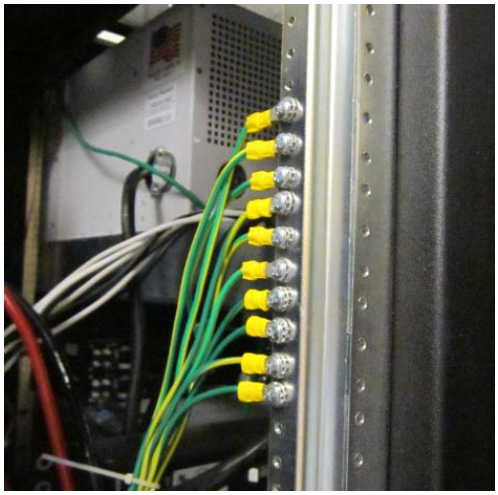


**Figure I-9: Example of rack grounding**

**NOTE:** To install Hitachi Unified Storage DC components in a non-NEBS rack, you may have to drill holes for additional grounding points (see Figure I-10).

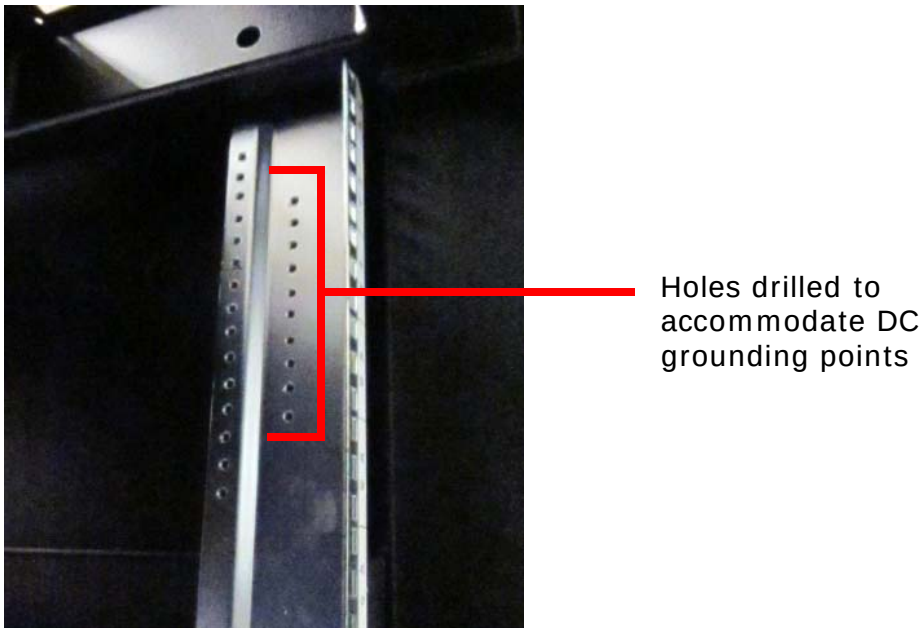



**Figure I-10: Example of drilling additional grounding points in the rack**

## Other grounding connectors

Bare conductors must be cleaned and antioxidant materials applied before crimp connections during installation.

Install a crimp-type lug on each grounding conductor. Fasten the lug to the chassis or rack with a thread forming screw. Install paint-piercing star lock washers on both sides of the lug to ensure positive ground and thread locking.

Each grounding conductor must be attached to the chassis or rack with a separate screw or bolt. Do not connect multiple ground wires to a chassis or to the rack with a single screw or bolt.

## Aligning the front bezels

Be sure the front bezel bracket of the Hitachi Unified Storage hardware components is flush-mounted with the rack vertical rail.

When affixing the rail kit to the rack vertical rail, avoid using screws that are larger than the screw holes; otherwise, the bracket cannot be installed flush against the rack's vertical rail, which can result in noncompliance with NEBS grounding guidelines. The screws in Figure I-11, for example are M6 screws that are larger than the holes used to accommodate them, thereby preventing the bracket from installing flush with the rack vertical rail.

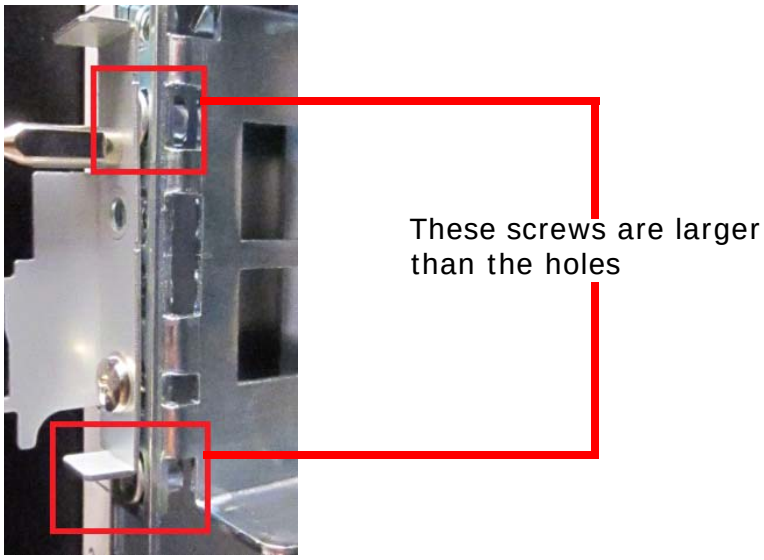



**Figure I-11: Examples of screws that are not flush with rack rails**

Figure I-12 on page I-12 shows an example where a large screw was replaced with a small screw with an M5 head to allow the bracket to be installed flush with the rack vertical rail.

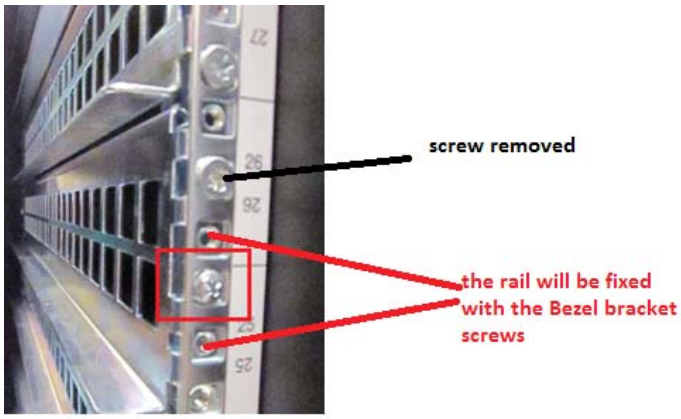



**Figure I-12: Using a smaller-size screw to secure front bezel bracket**

For additional pictures and descriptions about the front bezels, see Chapter 2, Hardware description.

## Dust and particles

**NOTE:** Verizon and AT&T do not follow NEBS Level 3 or SR-3580. They use their own NEBS checklists. Both accept the TCG checklist that can be found on their web sites.

Fans cool power supplies and system components by drawing in room temperature air and exhausting heated air out through various openings in the chassis. However, fans also ingest dust and other particles, causing contaminant buildup in the system and increased internal chassis

temperature. A clean operating environment can greatly reduce the negative effects of dust and other particles, which act as insulators and interfere with the mechanical components in the system.

The NEBS GR-63-CORE standard provides guidelines for acceptable working environments and acceptable levels of suspended particulate matter. The Hitachi Unified Storage system complies with this standard in the following ways.

| | |
|---|---|
| Dust arrestance of filters:<br>2U models (DBL,DBS):<br>3U models (CBL): | <br>More than 63%<br>More than 83% |
| Fire rating of filters: | UL94 HF-1 for 2U and 3U and base and expansion units. |
| Filter use: | Single use (eliminates cleaning in place) |
| Alarm indication when filter needs to be replaced: | When the filter needs to be replaced, the following message appears in the Hitachi Storage Navigator Modular 2 Event Log window:<br><br>*I55300 Please replace the Air Filter of Bezel Collecting Error Information*<br><br>Although this message is not displayed to users, it appears in email notifications from Hitachi Storage Navigator Modular 2 if users have configured their system to send email notifications. |
| Individuals responsible for changing filters: | Hitachi maintenance personnel |
| Environmental characteristics: | Filters are recyclable and material is polyurethane foams. |

To meet NEBS-3 requirements, the front bezels on all Hitachi Unified Storage DC components, including the CBLD Controller Box and DBLD and DBSD Drive Boxes, contain filters. These filters must be changed at least every six months to meet NEBS-3 requirements.

Filters are provided in two sizes: 2U (see Figure I-13) and 3U (see Figure I-14).

**Figure I-13: 2U filter**

**Figure I-14: 3U filter**

# Dual-feed fuse alarm panel

A Dual Feed DC PDU 200A 4/5 TPA/GMT Fuse Panel (p-code 009-8005-0404) is offered as an option. The panel is used to route DC power to a racked Hitachi Unified Storage system and provides power protection for installed equipment.

The panel includes 8 TPA output fuse holders (4 per side) and 10 GMT fuse holders (5 per side). Sides A and B are electronically independent, except for the replaceable alarm card, which contains power and alarm LEDs for both feeds. Also included are fuse alarm and power-fail relay terminal for external indicators.

Figure I-15 and Figure I-16 show the front and rear views of the fuse alarm panel.

**Figure I-15: DC power distribution unit (Front View)**

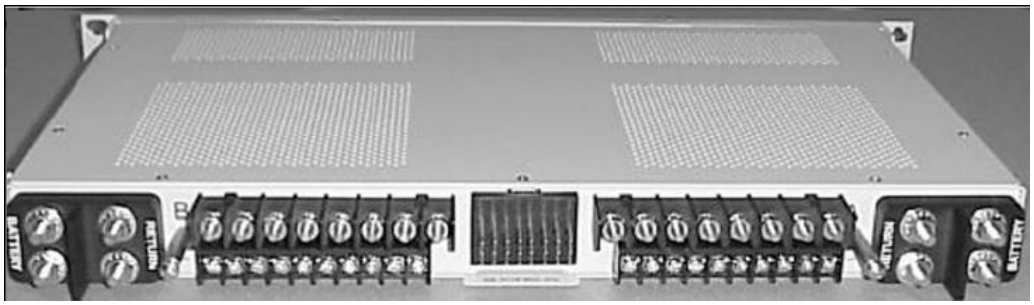



**Figure I-16: DC power distribution unit (Rear View)**

Figure I-17 shows a close-up view of the dual-feed fuse alarm panel mounted in a rack using external tooth star washers.

**Figure I-17: Example or mounted dual-feed fuse alarm panel**

**WARNING! If a breaker trips, do not turn on the breaker back until you determine what tripped the breaker and fix the problem.**

## Specifications

**Table I-4: Dual-Feed Alarm Panel Inputs**

| Inputs | Description |
|---|---|
| Voltage and Range: | ±24 Vdc, ±20 V to ±30 V<br>-48 Vdc, - 40 V to - 60 V |
| Maximum Input Load Rating: | 200 A per side |
| Nominal Power Loss at Full Load: | 70 W per side @9600 W full load per side (200 A x 48 V) |
| Percentage of Full Load Power Dissipation at Nominal Voltage: | Less than 1% |
| Maximum Input Interrupt Device: | 200 A |
| Input Terminal Studs (with split ring lock washers and nuts) for Dual-Hole Compression Lugs: | Two pairs of 1/4 - 20 studs on 3.4-inch centers. Torque nut (using 7/16-inch or 12 mm socket) to ~45 inch lb. (~5 N•m) |
| Input Wire Size: | #8-to-#4/0 AWG (depends on input interrupt device); 1-inch lug width |

**Table I-5: TPA Outputs**

| TPA Outputs | Description |
|---|---|
| Maximum TPA Output Fuse (ea.): | 50 A |
| Maximum TPA Output Load (ea.) – continuous: | 40 A |
| Maximum Total TPA Output Load: | 160 A per side |
| TPA Output Terminal Studs with Nuts: | 16, single, #8 - 36 studs (max. lug width of 0.46 in. (1.17 cm). Torque nut (using 5/16 in. or 8 mm socket) to -15 inches -lb. (~1.75 N•m) |
| TPA Output Wire Size: | #18-to-#6 AWG (depends on output fuse rating) |

**Table I-6: GMT Outputs**

| GMT Outputs | Description |
|---|---|
| Maximum GMT Output Fuse (ea.): | 15 A |
| Maximum GMT Output Load (ea.) – continuous: | 12 A |
| Maximum Total GMT Output Load: | 65 A per side |
| GMT Output Terminal (Wire Binding): | 20, #6 panhead screws (maximum lug width of .32 in., [.81 cm.]) |
| GMT Output Wire Size: | #24-to-#14 AWG (depends on output fuse rating) |

### Table I-7: Grounding

| Grounding | Description |
|---|---|
| Earth GND Terminal Studs (with split-ring lock washers and hex nuts) for Dual-Hole Compression Lug: | Two pair 1/4 - 20 threaded holes on 5/8 in. (1.59 cm) centers. Torque-supplied bolt (using 7/16 in. or 12 mm socket) to 45 in. -lb (5.42 N•m) |
| Ground Wire Size: | Up to #4 AWG (depends on input interrupt device) |

### Table I-8: Alarms

| Alarms | Description |
|---|---|
| Alarm Relay Contacts: | 2 A @ 30 Vdc<br>0.6 A @ 60 Vdc |
| Maximum Alarm Card Power Rating: | @20 V: 85 mA (1.70 W)<br>@24 V: 103 mA (2.47 W)<br>@27 V: 109 mA (2.9 W)<br>@30 V: 112 mA (3.36 W)<br>@42 V: 123 mA (5.17 W)<br>@48 V: 128 mA (6.14 W)<br>@56 V: 135 mA (7.56 W)<br>@60 V: 139 mA (8.34 W) |
| Alarm Wire Size: | #24 AWG, typ. (#26-to-#20 AWG) |

### Table I-9: Indicators

| Indicators | Description |
|---|---|
| Input Power LEDs (green): | Lights when power is applied to that feed. |
| Fuse Alarm LED (red): | Lights if any GMT fuse blows. |

### Table I-10: Dimensions

| Dimensions | Description |
|---|---|
| Nominal without Brackets: | Width: 17.4 in. (44.2 cm)<br>Height: 3.5 in (9 cm)<br>Depth: 12 in. (30.5 cm) |

### Table I-11: Weight

| Weight | Description |
|---|---|
| Weight (without packaging): | 18 lb (8.7 kg) |
| Weight (shipping): | -23 lb (-10.5 kg) |

**Table I-12: Environment**

| Environment | Description |
|---|---|
| Operating Temperature Range: | 10°C (14°F)-to-55°C (131° F) |

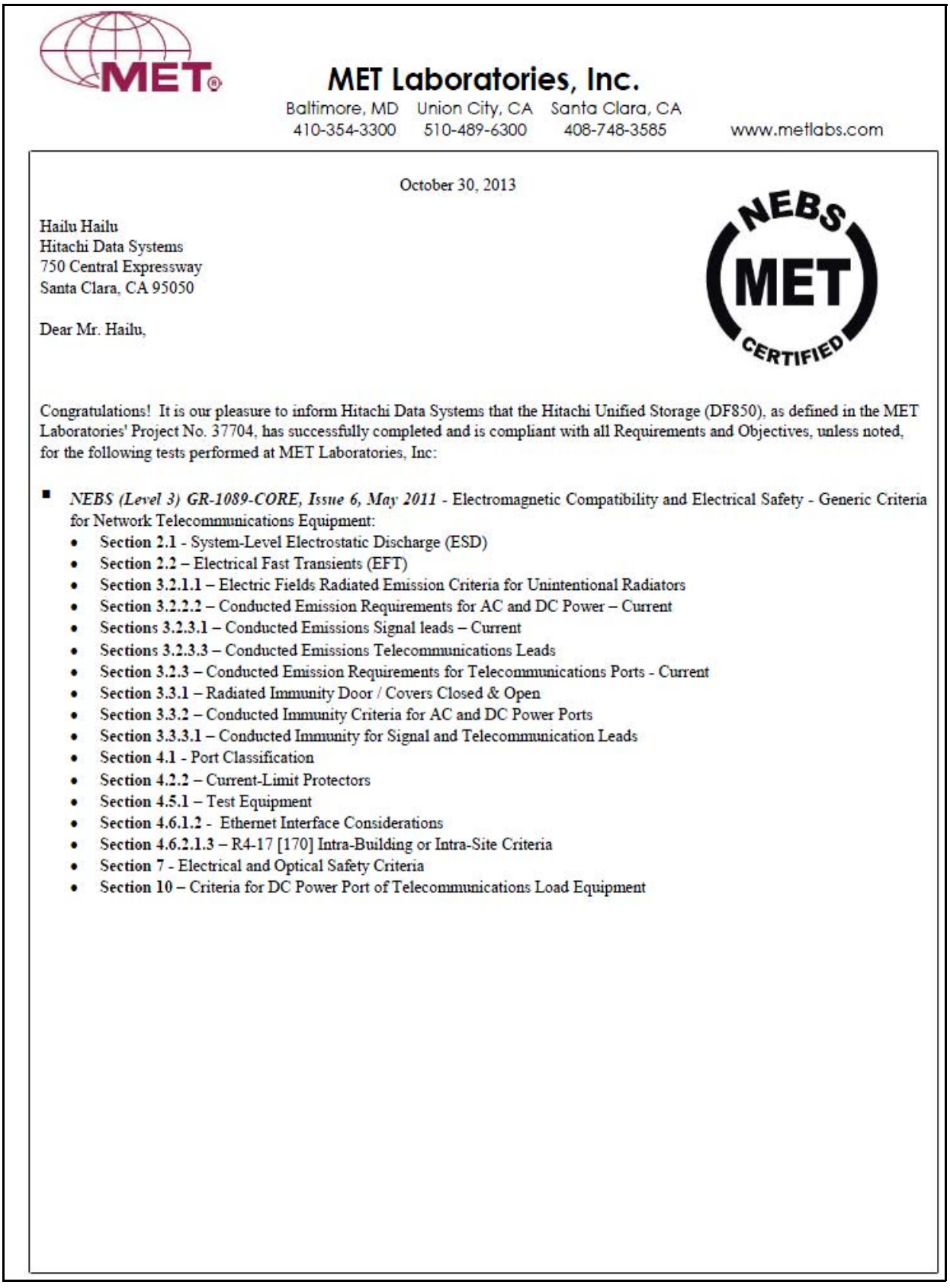
# NEBS-3 test results and certification

NEBS-3 testing was completed at the following facility:

MET Laboratories, Inc.
33439 Western Ave.
Union City, CA 94587
510-489-6300
http://www.metlabs.com

**The Hitachi Unified Storage DC-powered system described in this appendix passed NEBS-3 test requirements and is certified for NEBS-3 installations as of April 26, 2013.**

Figure I-18 on page I-19 and Figure I-19 on page I-20 show the test results and certificates.



MET Laboratories, Inc.

Baltimore, MD 410-354-3300 Union City, CA 510-489-6300 Santa Clara, CA 408-748-3585 www.metlabs.com

October 30, 2013

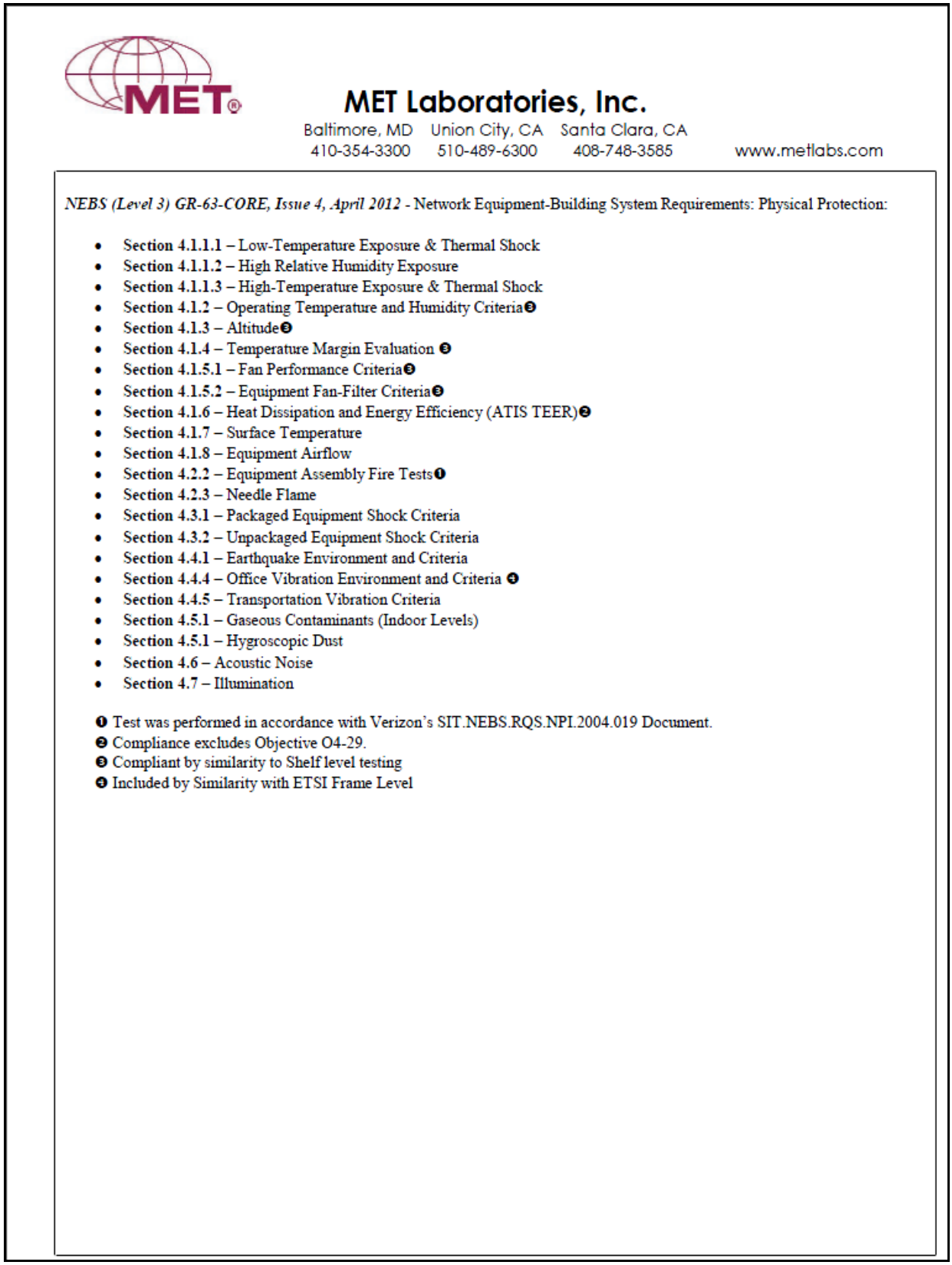
Hailu Hailu
Hitachi Data Systems
750 Central Expressway
Santa Clara, CA 95050

Dear Mr. Hailu,

Congratulations! It is our pleasure to inform Hitachi Data Systems that the Hitachi Unified Storage (DF850), as defined in the MET Laboratories' Project No. 37704, has successfully completed and is compliant with all Requirements and Objectives, unless noted, for the following tests performed at MET Laboratories, Inc:

- *NEBS (Level 3) GR-1089-CORE, Issue 6, May 2011* - Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment:
  - **Section 2.1** - System-Level Electrostatic Discharge (ESD)
  - **Section 2.2** – Electrical Fast Transients (EFT)
  - **Section 3.2.1.1** – Electric Fields Radiated Emission Criteria for Unintentional Radiators
  - **Section 3.2.2.2** – Conducted Emission Requirements for AC and DC Power – Current
  - **Sections 3.2.3.1** – Conducted Emissions Signal leads – Current
  - **Sections 3.2.3.3** – Conducted Emissions Telecommunications Leads
  - **Section 3.2.3** – Conducted Emission Requirements for Telecommunications Ports - Current
  - **Section 3.3.1** – Radiated Immunity Door / Covers Closed & Open
  - **Section 3.3.2** – Conducted Immunity Criteria for AC and DC Power Ports
  - **Section 3.3.3.1** – Conducted Immunity for Signal and Telecommunication Leads
  - **Section 4.1** - Port Classification
  - **Section 4.2.2** – Current-Limit Protectors
  - **Section 4.5.1** – Test Equipment
  - **Section 4.6.1.2** - Ethernet Interface Considerations
  - **Section 4.6.2.1.3** – R4-17 [170] Intra-Building or Intra-Site Criteria
  - **Section 7** - Electrical and Optical Safety Criteria
  - **Section 10** – Criteria for DC Power Port of Telecommunications Load Equipment

**Figure I-18: NEBS compliance (1 of 2)**



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*NEBS (Level 3) GR-63-CORE, Issue 4, April 2012* - Network Equipment-Building System Requirements: Physical Protection:

- **Section 4.1.1.1** – Low-Temperature Exposure & Thermal Shock
- **Section 4.1.1.2** – High Relative Humidity Exposure
- **Section 4.1.1.3** – High-Temperature Exposure & Thermal Shock
- **Section 4.1.2** – Operating Temperature and Humidity Criteria❷
- **Section 4.1.3** – Altitude❷
- **Section 4.1.4** – Temperature Margin Evaluation ❸
- **Section 4.1.5.1** – Fan Performance Criteria❸
- **Section 4.1.5.2** – Equipment Fan-Filter Criteria❸
- **Section 4.1.6** – Heat Dissipation and Energy Efficiency (ATIS TEER)❷
- **Section 4.1.7** – Surface Temperature
- **Section 4.1.8** – Equipment Airflow
- **Section 4.2.2** – Equipment Assembly Fire Tests❶
- **Section 4.2.3** – Needle Flame
- **Section 4.3.1** – Packaged Equipment Shock Criteria
- **Section 4.3.2** – Unpackaged Equipment Shock Criteria
- **Section 4.4.1** – Earthquake Environment and Criteria
- **Section 4.4.4** – Office Vibration Environment and Criteria ❹
- **Section 4.4.5** – Transportation Vibration Criteria
- **Section 4.5.1** – Gaseous Contaminants (Indoor Levels)
- **Section 4.5.1** – Hygroscopic Dust
- **Section 4.6** – Acoustic Noise
- **Section 4.7** – Illumination

❶ Test was performed in accordance with Verizon's SIT.NEBS.RQS.NPI.2004.019 Document.
❷ Compliance excludes Objective O4-29.
❸ Compliant by similarity to Shelf level testing
❹ Included by Similarity with ETSI Frame Level

**Figure I-19: NEBS compliance (2 of 2)**

# ETSI and telecom test results and certification

In addition to NEBS-3 testing, the DC-powered Hitachi Unified Storage system was also tested at MET Laboratories for compliance with the specifications set forth by the European Telecommunications Standards Institute (ETSI), as well as the following telecom tests for equipment installed in telecommunications facilities:

- Verizon Technical Purchasing Requirements (VZ.TPR.9305)
- ATT-TP-76200 (IEER)

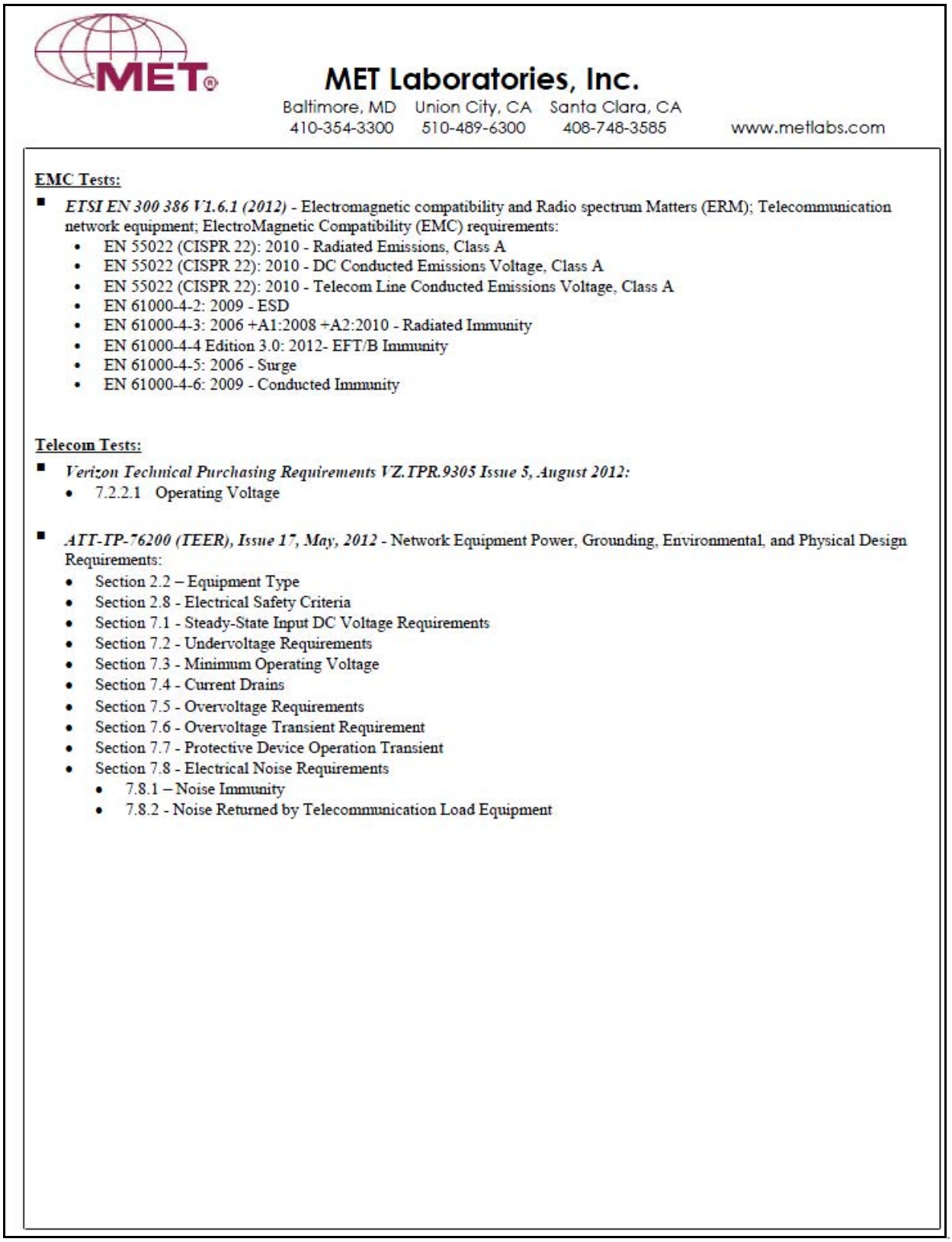
**NOTE:** The European Telecommunications Standards Institute is a non-profit organization that establishes telecommunications standards for Europe. ETSI guidelines are voluntary and almost always comply with standards produced by international bodies.

All testing was completed at the following facility:

MET Laboratories, Inc.
33439 Western Ave.
Union City, CA 94587
510-489-6300
http://www.metlabs.com

**The Hitachi Unified Storage DC-powered system described in this appendix passed NEBS-3 test requirements and is certified for ETSI installations as of April 26, 2013.**

Figure I-20 on page I-22 and Figure I-21 on page I-23 show the certificates and test results.



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**EMC Tests:**

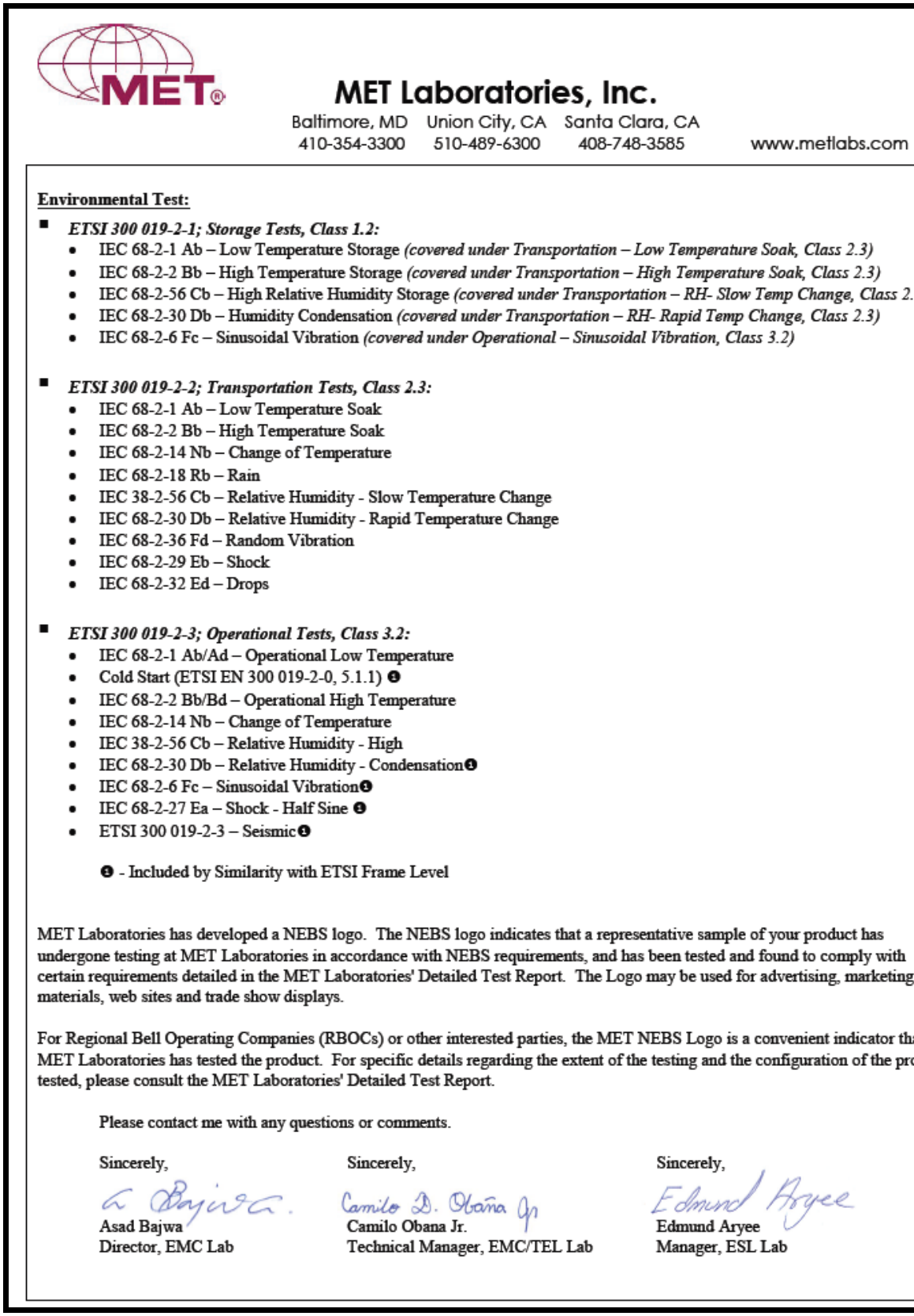
- *ETSI EN 300 386 V1.6.1 (2012)* - Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements:
  - EN 55022 (CISPR 22): 2010 - Radiated Emissions, Class A
  - EN 55022 (CISPR 22): 2010 - DC Conducted Emissions Voltage, Class A
  - EN 55022 (CISPR 22): 2010 - Telecom Line Conducted Emissions Voltage, Class A
  - EN 61000-4-2: 2009 - ESD
  - EN 61000-4-3: 2006 +A1:2008 +A2:2010 - Radiated Immunity
  - EN 61000-4-4 Edition 3.0: 2012- EFT/B Immunity
  - EN 61000-4-5: 2006 - Surge
  - EN 61000-4-6: 2009 - Conducted Immunity

**Telecom Tests:**

- *Verizon Technical Purchasing Requirements VZ.TPR.9305 Issue 5, August 2012:*
  - 7.2.2.1 Operating Voltage

- *ATT-TP-76200 (TEER), Issue 17, May, 2012* - Network Equipment Power, Grounding, Environmental, and Physical Design Requirements:
  - Section 2.2 – Equipment Type
  - Section 2.8 - Electrical Safety Criteria
  - Section 7.1 - Steady-State Input DC Voltage Requirements
  - Section 7.2 - Undervoltage Requirements
  - Section 7.3 - Minimum Operating Voltage
  - Section 7.4 - Current Drains
  - Section 7.5 - Overvoltage Requirements
  - Section 7.6 - Overvoltage Transient Requirement
  - Section 7.7 - Protective Device Operation Transient
  - Section 7.8 - Electrical Noise Requirements
    - 7.8.1 – Noise Immunity
    - 7.8.2 - Noise Returned by Telecommunication Load Equipment

**Figure I-20: ETSI and telecom test compliance (1 of 2)**



MET Laboratories, Inc.

Baltimore, MD 410-354-3300 | Union City, CA 510-489-6300 | Santa Clara, CA 408-748-3585 | www.metlabs.com

**Environmental Test:**

- ***ETSI 300 019-2-1; Storage Tests, Class 1.2:***
  - IEC 68-2-1 Ab – Low Temperature Storage *(covered under Transportation – Low Temperature Soak, Class 2.3)*
  - IEC 68-2-2 Bb – High Temperature Storage *(covered under Transportation – High Temperature Soak, Class 2.3)*
  - IEC 68-2-56 Cb – High Relative Humidity Storage *(covered under Transportation – RH- Slow Temp Change, Class 2.3)*
  - IEC 68-2-30 Db – Humidity Condensation *(covered under Transportation – RH- Rapid Temp Change, Class 2.3)*
  - IEC 68-2-6 Fc – Sinusoidal Vibration *(covered under Operational – Sinusoidal Vibration, Class 3.2)*

- ***ETSI 300 019-2-2; Transportation Tests, Class 2.3:***
  - IEC 68-2-1 Ab – Low Temperature Soak
  - IEC 68-2-2 Bb – High Temperature Soak
  - IEC 68-2-14 Nb – Change of Temperature
  - IEC 68-2-18 Rb – Rain
  - IEC 38-2-56 Cb – Relative Humidity - Slow Temperature Change
  - IEC 68-2-30 Db – Relative Humidity - Rapid Temperature Change
  - IEC 68-2-36 Fd – Random Vibration
  - IEC 68-2-29 Eb – Shock
  - IEC 68-2-32 Ed – Drops

- ***ETSI 300 019-2-3; Operational Tests, Class 3.2:***
  - IEC 68-2-1 Ab/Ad – Operational Low Temperature
  - Cold Start (ETSI EN 300 019-2-0, 5.1.1) ❶
  - IEC 68-2-2 Bb/Bd – Operational High Temperature
  - IEC 68-2-14 Nb – Change of Temperature
  - IEC 38-2-56 Cb – Relative Humidity - High
  - IEC 68-2-30 Db – Relative Humidity - Condensation❶
  - IEC 68-2-6 Fc – Sinusoidal Vibration❶
  - IEC 68-2-27 Ea – Shock - Half Sine ❶
  - ETSI 300 019-2-3 – Seismic❶

❶ - Included by Similarity with ETSI Frame Level

MET Laboratories has developed a NEBS logo. The NEBS logo indicates that a representative sample of your product has undergone testing at MET Laboratories in accordance with NEBS requirements, and has been tested and found to comply with certain requirements detailed in the MET Laboratories' Detailed Test Report. The Logo may be used for advertising, marketing materials, web sites and trade show displays.

For Regional Bell Operating Companies (RBOCs) or other interested parties, the MET NEBS Logo is a convenient indicator that MET Laboratories has tested the product. For specific details regarding the extent of the testing and the configuration of the product tested, please consult the MET Laboratories' Detailed Test Report.

Please contact me with any questions or comments.

Sincerely,
Asad Bajwa
Director, EMC Lab

Sincerely,
Camilo Obana Jr.
Technical Manager, EMC/TEL Lab

Sincerely,
Edmund Aryee
Manager, ESL Lab

**Figure I-21: ETSI and telecom test compliance (2 of 2)**

# Glossary

This glossary provides definitions for replication terms as well as terms related to the technology that supports your Hitachi storage system. Click the letter of the glossary section to display the related page.


| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

# A

### Arbitrated loop

A Fibre Channel topology that requires no Fibre Channel switches. Devices are connected in a one-way loop fashion. Also referred to as FC-AL.

### Array

A set of hard disks mounted in a single enclosure and grouped logically together to function as one contiguous storage space.

# B

### bps

Bits per second. The standard measure of data transmission speeds.

# C

### Cache

A temporary, high-speed storage mechanism. It is a reserved section of main memory or an independent high-speed storage device. Two types of caching are found in computers: memory caching and disk caching. Memory caches are built into the architecture of microprocessors and often computers have external cache memory. Disk caching works like memory caching; however, it uses slower, conventional main memory that on some devices is called a memory buffer.

### Capacity

The amount of information (usually expressed in megabytes) that can be stored on a disk drive. It is the measure of the potential contents of a device. In communications, capacity refers to the maximum possible data transfer rate of a communications channel under ideal conditions.

### CCI

See command control interface.

### Challenge Handshake Authentication Protocol

An authentication technique for confirming the identity of one computer to another. Described in RFC 1994.

### Controller Box

The enclosure that contains the storage system controller. For some models, disk drives may be included as well. Controller Boxes come in 2U and 3U versions.

- CBL: AC-powered 3U Controller Box.

- CBLE: AC-powered 3U Controller Box with support for encryption.
- CBLD: DC-powered 3U Controller Box.
- CBLE: 3U Controller Box that supports encryption.
- CBSL Controller Box: A 3U Controller Box that can contain a maximum of 12 3.5-inch drives.
- CBSS Controller Box: A 2U Controller Box that can contain a maximum of 24 2.5-inch drives.
- CBXSL Controller Box: A 3U Controller Box that can contain a maximum of 12 3.5-inch drives.
- CBXSS Controller Box: A 2U Controller Box that can contain a maximum of 24 2.5-inch drives.

### CHAP

See Challenge Handshake Authentication Protocol.

### CLI

See command line interface.

### Cluster

A group of disk sectors. The operating system assigns a unique number to each cluster and then keeps track of files according to which clusters they use.

### Cluster capacity

The total amount of disk space in a cluster, excluding the space required for system overhead and the operating system. Cluster capacity is the amount of space available for all archive data, including original file data, metadata, and redundant data.

### Command devices

Dedicated logical volumes that are used only by management software such as CCI, to interface with the storage systems. Command devices are not used by ordinary applications. Command devices can be shared between several hosts.

### Command line interface (CLI)

A method of interacting with an operating system or software using a command line interpreter. With Hitachi Storage Navigator Modular Command Line Interface, CLI is used to interact with and manage Hitachi storage and replication systems.

### Controller Box

The enclosure that contains the storage system controller. Some Controller

Boxes also include drives. Controller Boxes come in 2U and 3U versions.

### CRC

Cyclic Redundancy Check. An error-correcting code designed to detect accidental changes to raw computer data.

## D

### Disaster recovery

A set of procedures to recover critical application data and processing after a disaster or other failure. Disaster recovery processes include failover and failback procedures.

### DMLU

See Differential Management-Logical Unit.

### Drive Box

Chassis for mounting drives that connect to the Controller Box.

- Drive Boxes with AC power supply:

  DBS, DBL, DBF: Drive Box (2U)

  DBX: Drive Box (4U)

  DBW: Drive Box (5U)
- Drive Boxes with DC power supply:

  DBSD Drive Box (2U)

  DBLD: Drive Box (2U)

### Drive I/O Module

I/O module for the CBL/CBLE that has drive interfaces.

### Duplex

The transmission of data in either one or two directions. Duplex modes are full-duplex and half-duplex. Full-duplex is the simultaneous transmission of data in two direction. For example, a telephone is a full-duplex device, because both parties can talk at once. In contrast, a walkie-talkie is a half-duplex device because only one party can transmit at a time.

## E

### Ethernet

A computer networking technology for local-area networks.

### Extent

A contiguous area of storage in a computer file system that is reserved for writing or storing a file.

## F

### Fabric

Hardware that connects workstations and servers to storage devices in a Storage-Area Network (SAN)N. The SAN fabric enables any-server-to-any-storage device connectivity through the use of Fibre Channel switching technology.

### Failover

The automatic substitution of a functionally equivalent system component for a failed one. The term failover is most often applied to intelligent controllers connected to the same storage devices and host computers. If one of the controllers fails, failover occurs, and the survivor takes over its I/O load.

### Fallback

Refers to the process of restarting business operations at a local site using the P-VOL. It takes place after the storage systems have been recovered.

### Fault tolerance

A system with the ability to continue operating, possibly at a reduced level, rather than failing completely, when some part of the system fails.

### FC

See Fibre Channel.

### FC-AL

See Arbitrated Loop.

### FCOE

See Fibre Channel over Ethernet.

### Fibre Channel

A gigabit-speed network technology primarily used for storage networking.

### Fibre Channel over Ethernet

A way to send Fiber Channel commands over an Ethernet network by encapsulating Fiber Channel calls in TCP packets.

### Firmware

Software embedded into a storage device. It may also be referred to as Microcode.

### FMD

Flash Module Drive. A large-capacity flash drive that delivers very high performance.

### Full-duplex

Transmission of data in two directions simultaneously. For example, a telephone is a full-duplex device because both parties can talk at the same time.

## G

### Gbps

Gigabit per second.

### Gigabit Ethernet

A version of Ethernet that supports data transfer speeds of 1 gigabit per second. The cables and equipment are very similar to previous Ethernet standards.

### GUI

Graphical user interface.

## H

### HA

High availability.

### Half-duplex

Transmission of data in just one direction at a time. For example, a walkie-talkie is a half-duplex device because only one party can talk at a time.

### HBA

See Host bus adapter.

### Host

A server connected to the storage system via Fibre Channel or iSCSI ports.

### Host bus adapter

An I/O adapter located between the host computer's bus and the Fibre Channel loop that manages the transfer of information between the two channels. To minimize the impact on host processor performance, the host bus adapter performs many low-level interface functions automatically or with minimal processor involvement.

### Host I/O Module

I/O Module for the CBL/CBLE/CBLD. The Host I/O Module provides interface functions for the host.

## I

### IEEE

Institute of Electrical and Electronics Engineers (read “I-Triple-E”). A non-profit professional association best known for developing standards for the computer and electronics industry. In particular, the IEEE 802 standards for local-area networks are widely followed.

### I/O

Input/output.

### I/O Card (ENC)

The I/O Card (ENC) is installed in a DBX. It provides interface functions for the Controller Box or Drive Box.

### I/O Module (ENC)

The I/O Module (ENC) is installed in a DBS/DBSD/DBL/DBLD/DBF/DBW. It provides interface functions for the Controller Box or Drive Box.

### IOPS

Input/output per second. A measurement of hard disk performance.

### initiator

See iSCSI initiator.

### IOPS

I/O per second.

### iSCSI

Internet-Small Computer Systems Interface. A TCP/IP protocol for carrying SCSI commands over IP networks.

### iSCSI initiator

iSCSI-specific software installed on the host server that controls communications between the host server and the storage system.

### iSNS

Internet Storage Naming Service. An automated discovery, management and configuration tool used by some iSCSI devices. iSNS eliminates the need to manually configure each individual storage system with a specific list of initiators and target IP addresses. Instead, iSNS automatically discovers, manages, and configures all iSCSI devices in your environment.

## L

### LAN

Local-area network. A computer network that spans a relatively small area, such as a single building or group of buildings.

### Load

In UNIX computing, the system load is a measure of the amount of work that a computer system is doing.

### Logical

Describes a user's view of the way data or systems are organized. The opposite of logical is physical, which refers to the real organization of a system. A logical description of a file is that it is a quantity of data collected together in one place. The file appears this way to users. Physically, the elements of the file could live in segments across a disk.

## M

### Microcode

The lowest-level instructions directly controlling a microprocessor. Microcode is generally hardwired and cannot be modified. It is also referred to as firmware embedded in a storage subsystem.

### Microsoft Cluster Server

Microsoft Cluster Server is a clustering technology that supports clustering of two NT servers to provide a single fault-tolerant server.

## P

### Pair

Refers to two volumes that are associated with each other for data management purposes (for example, replication, migration). A pair is

usually composed of a primary or source volume and a secondary or target volume as defined by you.

### Pair status

Internal status assigned to a volume pair before or after pair operations. Pair status transitions occur when pair operations are performed or as a result of failures. Pair statuses are used to monitor copy operations and detect system failures.

### Parity

The technique of checking whether data has been lost or corrupted when it's transferred from one place to another, such as between storage units or between computers. It is an error detection scheme that uses an extra checking bit, called the parity bit, to allow the receiver to verify that the data is error free. Parity data in a RAID array is data stored on member disks that can be used for regenerating any user data that becomes inaccessible.

### Parity groups

RAID groups can contain single or multiple parity groups where the parity group acts as a partition of that container.

### Point-to-Point

A topology where two points communicate.

### Port

An access point in a device where a link attaches.

### Primary or local site

The host computer where the primary data of a remote copy pair (primary and secondary data) resides. The term “primary site” is also used for host failover operations. In that case, the primary site is the host computer where the production applications are running, and the secondary site is where the backup applications run when the applications on the primary site fail, or where the primary site itself fails.

## R

### RAID

Redundant Array of Independent Disks. A storage system in which part of the physical storage capacity is used to store redundant information about user data stored on the remainder of the storage capacity. The redundant information enables regeneration of user data in the event that one of the storage system's member disks or the access path to it fails.

### RAID group

A set of disks on which you can bind one or more volumes.

### Remote path

A route connecting identical ports on the local storage system and the remote storage system. Two remote paths must be set up for each storage system (one path for each of the two controllers built in the storage system).

## S

### SAN

See Storage-Area Network

### SAS

Serial Attached SCSI. An evolution of parallel SCSI into a point-to-point serial peripheral interface in which controllers are linked directly to disk drives. SAS delivers improved performance over traditional SCSI because SAS enables up to 128 devices of different sizes and types to be connected simultaneously.

### SAS (ENC) Cable

Cable for connecting a controller box and drive box.

### Secure Sockets Layer (SSL)

A protocol for transmitting private documents via the Internet. SSL uses a cryptographic system that uses two keys to encrypt data - a public key known to everyone and a private or secret key known only to the recipient of the message.

### Snapshot

A term used to denote a copy of the data and data-file organization on a node in a disk file system. A snapshot is a replica of the data as it existed at a particular point in time.

### SNM2

See Storage Navigator Modular 2.

### Storage-Area Network

A dedicated, high-speed network that establishes a direct connection between storage systems and servers.

### Storage Navigator Modular 2

A multi-featured scalable storage management application that is used to configure and manage the storage functions of Hitachi storage systems.

### Striping

A way of writing data across drive spindles.

## T

### Target

The receiving end of an iSCSI conversation, typically a device such as a disk drive.

### TCP

Transmission Control Protocol. A common Internet protocol that ensures packets arrive at the end point in order, acknowledged, and error-free. Usually combined with IP in the phrase TCP/IP.

### 10 Gb

10 gigabit Ethernet computer networking standard, with a nominal data rate of 10 Gbit/s, 10 times as fast as gigabit Ethernet

## U

### URL

Uniform Resource Locator. A standard way of writing an Internet address that describes both the location of the resource, and its type.

## W

### World Wide Name

A unique identifier that identifies a particular Fibre Channel target.

## Z

### Zoning

A logical separation of traffic between host and resources. By breaking up into zones, processing activity is distributed evenly.

# Index

## Numerics


1 Gb iSCSI connections 4-14
1 Gb iSCSI ports 2-36
10 Gb iSCSI connections 4-15


## A


AC power cables F-6
Add Array wizard 5-7
Adding
  cache memory
    CBL 11-25
    CBSL, CBSS 11-22
  drives
    CBXSL, CBSL, DBL 11-17
    CBXSS, CBSS, DBS 11-18
  Fibre Channel I/O Board offline
    CBL 11-30
    CBLE 11-30
    CBSS/CBSL 11-27
  Fibre Channel I/O Board online
    CBL 11-36
    CBLE 11-36
    CBSS/CBSL 11-32
  iSCSI I/O Board offline
    CBL 11-43
    CBLE 11-43
    CBSS/CBSL 11-40, 11-54
    CBXSS/CBXSL 11-40
  iSCSI I/O Board online
    CBL 11-48
    CBLE 11-48
    CBSS/CBSL 11-45
    CBXSS/CBXSL 11-45
Adding optional components
  cache memory 11-22
  Controller 11-65
  Drive Boxes 11-70
  Fibre Channel Host I/O Board/Module 11-27
  iSCSI Host I/O Board/Module 11-40
Adding spare drives 5-15, 5-42
AIX
  host configuration
    Fibre Channel 6-47


## B


Backend Configuration Kit tool H-1
Base units at a glance 2-4
BECK tool H-1


## C


Cables
  1 Gb iSCSI F-4
  10 Gb iSCSI F-5
  AC power F-6
  Fibre Channel F-2
Cache backup battery
  CBL 2-50
  CBLD 2-50
  CBLE 2-50
Cache memory, adding 11-22
Capacity
  RAID units 5-48
  volumes 5-56
CBL
  1 Gb iSCSI ports 2-36
  adding cache memory 11-25
  adding Fibre Channel I/O Board 11-30, 11-36
  adding iSCSI I/O Board 11-43
  adding iSCSI I/O Board online 11-48
  cache backup battery 2-50
  Controller Box 2-48
  Drive I/O Module 2-54
  electrical specifications E-45
  Fan Module 2-49
  Fibre Channel ports 2-35
  Host I/O Modules 2-55
  Host I/O replacement for changing host I/O type 11-63
  maintenance port 2-37
  Management Module 2-53
  management port 2-37

panel assembly 2-49
Power Unit 2-46
RAID specifications E-47
rear panel 2-14, 2-51
CBLD
cache backup battery 2-50
Controller Box 2-48
Drive I/O Module 2-54
Fan Module 2-49
Host I/O Modules 2-55
Management Module 2-53
panel assembly 2-49
Power Unit 2-47
rear panel 2-14, 2-51
CBLE 2-53
adding cache memory 11-25
adding Fibre Channel I/O Board 11-30, 11-36
adding iSCSI I/O Board 11-43
adding iSCSI I/O Board online 11-48
cache backup battery 2-50
Controller Box 2-48
Drive I/O Module 2-54
Fan Module 2-49
Host I/O Modules 2-55
Host I/O replacement for changing host I/O type 11-63
Management Modules 2-53
panel assembly 2-49
Power Unit 2-46
rear panel 2-14, 2-51
CBSL
1 Gb iSCSI ports 2-36
10 Gb iSCSI connections 4-15
adding cache memory 11-22
adding drives 11-17
adding Fibre Channel I/O Board 11-27, 11-32
adding iSCSI I/O Board 11-40, 11-45, 11-54
dimensions 2-3
electrical specifications E-45
Fibre Channel ports 2-35
front panel 2-11
Host I/O Boards 2-40
Host I/O replacement for changing host I/O type 11-62
maintenance port 2-37
management port 2-37
Power Unit 2-45
RAID specifications E-47
rear panel 2-12
replacing drives 11-19
CBSS
1 Gb iSCSI ports 2-36
10 Gb iSCSI connections 4-15
adding cache memory 11-22
adding drives 11-18
adding Fibre Channel I/O Board offline 11-27
adding Fibre Channel I/O Board online 11-32
adding iSCSI I/O Board offline 11-40, 11-54
adding iSCSI I/O Board online 11-45
electrical specifications E-45
Fibre Channel ports 2-35
front panel 2-9
Host I/O Boards 2-40
Host I/O replacement for changing host I/O type 11-62
maintenance port 2-37
management port 2-37
Power Unit 2-45
RAID specifications E-47
rear panel 2-10
replacing drives 11-20
CBXSL
1 Gb iSCSI connections 4-14
1 Gb iSCSI ports 2-36
10 Gb iSCSI connections 4-15
adding drives 11-17
adding iSCSI I/O Board 11-45
adding iSCSI I/O Board offline 11-40
dimensions 2-3
electrical specifications E-45
Fibre Channel ports 2-35
front panel 2-7
Host I/O Boards 2-38
Host I/O replacement for changing host I/O type 11-62
maintenance port 2-37
management port 2-37
Power Unit 2-45
RAID specifications E-47
rear panel 2-8
replacing drives 11-19
CBXSS
1 Gb iSCSI connections 4-14
1 Gb iSCSI ports 2-36
10 Gb iSCSI connections 4-15
adding drives 11-18
adding iSCSI I/O Board 11-40
adding iSCSI I/O Board online 11-45
dimensions 2-3
electrical specifications E-45
Fibre Channel ports 2-35
front panel 2-5
Host I/O Boards 2-38
Host I/O replacement for changing host I/O type 11-62
maintenance port 2-37
management port 2-37
Power Unit 2-45
RAID specifications E-47
rear panel 2-6
replacing drives 11-20

Changing
priority of RAID group expansion 5-51
volume capacity 5-56
CHAP authentication
mutual 5-92
one-way
changing 5-90
configuring 5-89
deleting 5-92
Checklist for pre-installation 3-13
Citrix XenServer host configuration
Fibre Channel 6-52, 7-70
Configuration
adding spare drives 5-15, 5-42
changing priority of RAID group expansion 5-51
changing volume capacity 5-56
creating RAID groups 5-34
creating volumes 5-36
date and time 5-16, 5-98
deleting RAID group expansion 5-52
deleting RAID groups 5-53
deleting spare drives 5-45
deleting volumes 5-66
email notifications 5-9
expanding RAID groups 5-48
Fibre Channel ports 5-11, 5-72
format mode 5-69
formatting volumes 5-65
initial setup 5-7
iSCSI ports 5-13, 5-79
iSCSI target 5-81
iSCSI target initialization 5-83
management port 5-10
mapping guard 5-70
middleware 5-23
mutual CHAP 5-92
one-way CHAP
changing 5-90
configuring 5-89
deleting 5-92
platform 5-23
recording settings A-11
Response Performance Mode 5-67
separating volumes 5-62
verifying RAID groups 5-46
verifying spare drives 5-44
verifying volumes 5-55
Configurations, supported 1-8
Connection restrictions
DBW E-55
DBX E-55
Connections
1 Gb iSCSI 4-14
10 Gb iSCSI 4-15
expansion unit 4-16
management path 5-2
order for expansion units 4-17
power cables 4-31
Cooperative computing 6-25
Corner guide rails C-38
Creating
RAID groups 5-34
volumes 5-36

## D

Date and time 5-16, 5-98
DBF
front panel 2-19
I/O Module 2-44
Power Unit 2-46
rear panel 2-20
DBL
adding drives 11-17
dimensions 2-3
electrical specifications E-45
front panel 2-17
I/O Module and I/O Card (ENC) 2-42
maximum number of drives 1-9
Power Unit 2-45
RAID specifications E-47
rear panel 2-18
replacing drives 11-19
DBLD
front panel 2-17
I/O Module and I/O Card (ENC) 2-42
Power Unit 2-46
rear panel 2-18
DBS
adding drives 11-18
dimensions 2-3
electrical specifications E-45
front panel 2-15
I/O Module and I/O Card (Enc) 2-42
maximum number of drives 1-9
Power Unit 2-45
RAID specifications E-47
rear panel 2-16
replacing drives 11-20
DBSD
front panel 2-15
Power Unit 2-46
rear panel 2-16
DBW 2-57
connection restrictions E-55
Fan Module 2-60
front panel 2-24
I/O Module 2-57
Power Unit 2-58
DBW Drive Box 2-24, 2-29, 2-57
DBX
connection restrictions E-55
dimensions 2-3
electrical specifications E-45
front panel 2-21
I/O Card 2-43
maximum number of drives 1-9
Power Unit 2-47, 2-58

RAID specifications E-47
rear panel 2-22, 2-25
top view 2-23, 2-25
Deleting
RAID group expansion 5-52
RAID groups 5-53
spare drives 5-45
volumes 5-66
Device Mapper multipathing 7-62, 7-68
Dimensions 2-3
Drive
adding to CBXSL, CBSL, DBL 11-17
adding to CBXSS, CBSS, DBS 11-18
display LEDs 2-30
maximum number 1-9
replacing to CBXSL, CBSL, DBL 11-19
replacing to CBXSS, CBSS, DBS 11-20
Drive Boxes, adding 11-70
Drive I/O Module
CBL 2-54
CBLD 2-54
CBLE 2-54
Duplex settings 10-6

## E

Electrical
safety 3-11
specifications E-41, E-45
Electrostatic safety 3-12
Email alert notifications 10-14
Email notifications 5-9
Environmental specifications E-45
Expanding RAID groups 5-48
Expansion units
connection order 4-17
connections 4-16
installing 4-19
maximum number 3-7, 4-19

## F

Facilities personnel responsibilities 3-3
Fan Module
CBL 2-49
CBLD 2-49
CBLE 2-49
DBW 2-60
Features 1-7
Fibre Channel
cables F-2
mapping port IDs 5-73
port configuration 2-35, 5-11, 5-72
Fibre Channel Host I/O Board/Module
adding 11-27
Fibre Channel Option
confirming installation 6-8
disabling 6-7
enabling 6-7
installing 6-6
uninstalling 6-9
Firewalls 10-13
Firmware upgrade B-1
Flash drive guidelines 10-14
Flash Drive write endurance threshold 5-95
Format mode 5-69
Formatting
volumes 5-65
Forums A-10
Front bezel
CBL 2-13
CBLD 2-13
CBLE 2-13
CBSL 2-11
CBSS 2-9
CBXSL 2-7
CBXSS 2-5
DBF 2-19
DBL 2-17
DBLD 2-17
DBS 2-15
DBSD 2-15
DBX 2-21
installation 4-26
removal 4-29
Front panel
CBSL 2-11
CBSS 2-9
CBXSL 2-7
CBXSS 2-5
DBF 2-19
DBL 2-17
DBLD 2-17
DBS 2-15
DBSD 2-15
DBW 2-24
DBX 2-21
Front panel LEDs 2-26

## G

General troubleshooting 10-2
Guard for mapping 5-70

## H

HDS Support Portal, logging in A-6
Hitachi
Global Services A-10
site preparation responsibilities 3-3
Storage Forums A-10
Hitachi 600 x 1200 mm Universal Racks C-5
Hitachi 750 x 1200 mm Universal Racks C-13
Hitachi Brazil racks C-22
Hitachi Modular Racks D-2
Hitachi Solutions Racks D-7
Hitachi Storage Navigator Modular 2
installation 5-3
log in 5-3
registering storage systems 5-6
troubleshooting 10-7
Hitachi Unified Storage

dimensions 2-3
features 1-7
iSCSI standards E-52
LED definitions 2-26
ports 2-35
power off 4-33
power on 4-31
registering with Hitachi Storage Navigator Modular 2 5-6
regulatory compliance E-53
specifications E-1
supported configurations 1-8
unpacking 4-3
Hitachi Unified Storage 110 1-2
Fibre Channel Option 6-6
mechanical specifications E-27
model list E-2
power requirements E-41
Hitachi Unified Storage 130 1-3
mechanical specifications E-30
model list E-9
power requirements E-42
Hitachi Unified Storage 150 1-4
mechanical specifications E-34
model list E-16
power requirements E-43, E-44
Hitachi Universal Storage Platform V 9-1, 9-4
Hitachi Universal Storage Platform VM 9-1, 9-4
Hitachi Virtual Storage 8-1
Host configuration
Fibre Channel
AIX 6-47
Citrix XenServer 6-52, 7-70
HP-UX 6-43
Microsoft Windows 2003 Server 6-17
Microsoft Windows 2008 Server 6-15
Microsoft Windows 2012 Server 6-11
Red Hat Enterprise Linux 6-37
Solaris 6-28
SuSE Linux 6-40
VMware 6-22
iSCSI
Microsoft Windows 2003 7-38
Microsoft Windows 2008 Server 7-27
Microsoft Windows 2012 Server 7-17
Red Hat Enterprise Linux 7-57
SuSE Linux 7-64
VMware 7-48
Host I/O Boards
CBSS and CBSL 2-40
CBXSS and CBXSL 2-38
Host I/O Modules
CBL 2-55
CBLD 2-55
CBLE 2-55
Host I/O replacement for changing host I/O type 11-52
CBL and CBLE 11-63
Host LUNs
iSCSI 5-84
HP-UX
host configuration
Fibre Channel 6-43


## I


I/O Module 2-57
I/O Module or I/O Card (ENC) 2-42
I/O response time, improving 5-67
Implementations of RAID 1-13
Improving I/O response time 5-67
Initial setup 5-7
Initializing iSCSI targets 5-83
Installation
expansion units 4-19
Fibre Channel Option (Hitachi Unified Storage 110) 6-6
front bezel 4-26
Hitachi Storage Navigator Modular 2 5-3
summary 4-2
Installation coordinator responsibilities 3-3
Internet Storage Name Service 7-14
iSCSI
1 Gb port configuration 2-36, 5-13
10 Gb port configuration 5-13
cables for 1 Gb F-4
cables for 10 Gb F-5
guidelines 7-15
initiator software 5-94
mapping port IDs and host LUNs 5-84
mutual CHAP authentication 5-92
one-way CHAP authentication
changing 5-90
configuring 5-89
deleting 5-92
overview 7-3
port configuration 5-13, 5-79
SAN components 7-5
specifications E-48
standards E-52
topology 7-7
troubleshooting 10-11
under the hood 7-6
iSCSI Host I/O Board/Module
adding 11-40
iSCSI target 5-81
initialization 5-83


## L


LED definitions 2-26
LEDs
drive display 2-30
front panel 2-26
Logging in to
HDS Support Portal A-6
Hitachi Storage Navigator Modular 2 5-3

## M


Maintenance port 2-37
Management Module 2-53
  CBL 2-53
  CBLD 2-53
Management path 5-2
Management port 2-37
  configuration 5-10
Mapping guard 5-70
Mapping port IDs
  Fibre Channel 5-73
  iSCSI 5-84
Matching base and expansion units 2-2
Maximum number
  drives 1-9
  expansion units 4-19
Maximum number of expansion units 3-7
Mechanical specifications
  Hitachi Unified Storage 110 E-27
  Hitachi Unified Storage 130 E-30
  Hitachi Unified Storage 150 E-34
Microsoft iSCSI initiator 7-18, 7-28, 7-39
Microsoft Windows 2003
  host configuration
    iSCSI 7-38
Microsoft Windows 2003 Server
  host configuration
    Fibre Channel 6-17
Microsoft Windows 2008 Server
  host configuration
    Fibre Channel 6-15
    iSCSI 7-27
Microsoft Windows 2012 Server
  host configuration
    Fibre Channel 6-11
    iSCSI 7-17
Middleware settings 5-23
Mode
  Format 5-69
  Response Performance 5-67
Model list
  Hitachi Unified Storage 110 E-2
  Hitachi Unified Storage 130 E-9
  Hitachi Unified Storage 150 E-16
Models
  Hitachi Unified Storage 110 1-2
  Hitachi Unified Storage 130 1-3
  Hitachi Unified Storage 150 1-4
Multipath Input/Output (MPIO) software 7-29, 7-40
Mutual CHAP authentication 5-92


## N


Negotiation settings 10-6
Network Protocol Time servers 5-101
Normal port status 5-96


## O


One-way CHAP authentication 5-89


## P


Packet filtering 5-97
Panel assembly
  CBL 2-49
  CBLD 2-49
  CBLE 2-49
Parts, replacement E-25
Performance mode 5-67
Platform settings 5-23
Ports
  1 Gb iSCSI 2-36
  Fibre Channel 2-35
  maintenance 2-37
  management 2-37
Power cables 4-31
  AC F-6
Power distribution units C-55
Power off 4-33
Power on 4-31
Power requirements
  Hitachi Unified Storage 110 E-41
  Hitachi Unified Storage 130 E-42
  Hitachi Unified Storage 150 E-43, E-44
Power Unit
  CBL 2-46
  CBLD 2-47
  CBLE 2-46
  CBXSS, CBXSL, CBSS, and CBSL 2-45
  DBF 2-46
  DBLD 2-46
  DBS and DBL 2-45
  DBSD 2-46
  DBW 2-58
  DBX 2-47, 2-58
Pre-installation
  checklist 3-13
Preparing
  site 3-4


## R


Racks
  at-a-glance C-3
  DBW Drive Boxes C-52
  DBX Drive Boxes C-52
  Hitachi 600 x 1200 mm Universal C-5
  Hitachi 750 x 1200 mm Universal C-13
  Hitachi Brazil C-22
  Hitachi Modular D-2
  Hitachi Solutions D-7
  installing C-43
  moving C-39
  post-installation C-54
  preparing for installation C-25
  safety information C-26
RAID

implementations 1-13
specifications E-47
RAID group expansion, deleting 5-52
RAID groups
changing priority of expansion 5-51
creating 5-34
deleting 5-53
expanding 5-48
verifying 5-46
RAID levels and corresponding storage capacities E-57
Rear panel
CBL 2-14, 2-51
CBLD 2-14, 2-51
CBLE 2-14, 2-51
CBSL 2-12
CBSS 2-10
CBXSL 2-8
CBXSS 2-6
DBF 2-20
DBL 2-18
DBLD 2-18
DBS 2-16
DBSD 2-16
DBX 2-22, 2-25
Recording configuration settings A-11
Red Hat Enterprise Linux
host configuration
Fibre Channel 6-37
iSCSI 7-57
Registering storage system
with Hitachi Storage Navigator Modular 2 5-6
Regulatory compliance E-53
Removing
front bezel 4-29
Replacement parts E-25
Replacing
drives
CBXSL, CBSL, DBL 11-19
CBXSS, CBSS, DBS 11-20
Response time, improving 5-67

## S

Safety 3-9
electrical 3-11
electrostatic 3-12
Secure LAN 5-96
Separating volumes 5-62
Server considerations 3-9
Site
coordinator responsibilities 3-3
preparation 3-4
Site preparation
facilities personnel responsibilities 3-3
Hitachi responsibilities 3-3
installation coordinator responsibilities 3-3
site coordinator responsibilities 3-3
user responsibilities 3-2
Solaris
host configuration
Fibre Channel 6-28
Spare drives
adding 5-15, 5-42
deleting 5-45
verifying 5-44
Specifications
electrical E-41, E-45
environmental E-45
iSCSI E-48
mechanical E-27
RAIS E-47
Standards
iSCSI E-52
Storage capacities and corresponding RAID levels E-57
Storage Forums A-10
Supported configurations 1-8
SuSE Linux
host configuration
Fibre Channel 6-40
iSCSI 7-64
System date and time 5-16, 5-98

## T

Target for iSCSI 5-81
initialization 5-83
Time 5-16, 5-98
Time zone 5-101
Topology 3-9
Troubleshooting 10-1
email alert notifications 10-14
general 10-2
iSCSI 10-11
Storage Navigator Modular 2 10-7

## U

Unifying volumes 5-60
Universal Rail Kit C-46
Unpacking
storage system 4-3
Upgrading firmware B-1
User responsibilities 3-2
User-supplied items 4-5

## V

Verifying
RAID groups 5-46
spare drives 5-44
volumes 5-55
VMware
cooperative computing 6-25
host configuration
Fibre Channel 6-22
iSCSI 7-48
Volumes
changing capacity 5-56

creating 5-36
deleting 5-66
formatting 5-65
separating 5-62
unifying 5-60
verifying 5-55

## W

Write endurance threshold 5-95

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