HITACHI
Inspire the Next

Hitachi Unified Storage VM Block Module
Hardware User Guide

Hitachi Data Systems

Contents

Preface

This manual provides instructions and information to use the Hitachi Unified Storage VM storage system.

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

This preface includes the following information:

☐ Safety and environmental information

☐ Intended audience

☐ Release notes

☐ Product version

☐ Document revision level

☐ Changes in this revision

☐ Referenced documents

☐ Document conventions

☐ Convention for storage capacity values

☐ Accessing product documentation

☐ Getting help

☐ Comments

Safety and environmental information

> ⚠️ **Caution:** Before operating or working on the Hitachi Unified Storage VM storage system, read the safety and environmental information in Chapter 3, Safety requirements on page 3-1, and Appendix D, Regulatory Compliance on page D-1.

Intended audience

This document is intended for system administrators, Hitachi Data Systems representatives, and authorized service providers who install, configure, and operate the HUS VM storage system.

Readers of this document should be familiar with the following:

- Data processing and RAID storage systems and their basic functions.
- The Hitachi Unified Storage VM storage system and the *Hitachi Unified Storage VM Getting Started Guide*.
- The Storage Navigator software for the Hitachi Unified Storage VM storage system, and the *Hitachi Storage Navigator User Guide*.

Release notes

The Hitachi Unified Storage VM release notes provide information about the HUS VM microcode (DKCMAIN and SVP), including new features and functions and changes. The release notes are available on the Hitachi Data Systems Portal: https://portal.hds.com

Product version

This document revision applies to HUS VM storage system firmware version 73-03-3*x* and later.

Document revision level

Revision	Date	Description
MK-92HM7005-00	September 2012	Initial release
MK-92HM7005-01	September 2012	Supersedes and replaces MK-92HM7005-00
MK-92HM7005-02	December 2012	Supersedes and replaces MK-92HM7005-01
MK-92HM7005-03	May 2013	Supersedes and replaces MK-92HM7005-02
MK-92HM7005-04	October 2013	Supersedes and replaces MK-92HM7005-03
MK-92HM7005-05	November 2013	Supersedes and replaces MK-92HM7005-04
MK-92HM7005-06	March 2015	Supersedes and replaces MK-92HM7005-05

Hitachi Unified Storage VM Block Module Hardware User Guide

Revision	Date	Description
MK-92HM7005-07	October 2016	Supersedes and replaces MK-92HM7005-06

Changes in this revision

- Added information about BNST-free compliant drive models.
- Revised safety certifcation information for Russia to include EurAsian Conformity mark under regulatory compliance.
- Added details of system option mode 901 and updated the details of SOM 896.

Referenced documents

Hitachi Unified Storage VM documentation:

- *Hitachi Storage Navigator User Guide*, MK-92HM7016
- *Hitachi Unified Storage VM Getting Started Guide*, MK-92HM7003
- *Hitachi Unified Storage VM Block Module Provisioning Guide*, MK-92HM7012
- *Hitachi Unified Storage VM Block Module Performance Guide*, MK-92HM7011
- *Hitachi Volume Shredder User Guide*, MK-92HM7021

A complete list of both Hitachi Unified Storage VM Block Module and File Module documentation is located in Appendix A of the *Hitachi Unified Storage VM Getting Started Guide*.

Document conventions

Hitachi Data Systems user manuals use the following typographic conventions as needed to clarify information.

Convention	Description
Bold	Indicates the following: - Text in a window or dialog box, such as menus, menu options, buttons, and labels. Example: In the **Add Pair** dialog box, click **OK**. - Text appearing on screen or entered by the user. Example: The **-split** option. - The name of a directory, folder, or file. Example: The **CacheInfo.csv** file.
Italic	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: copy *source-file target-file*

Convention	Description
	Angle brackets are also used to indicate variables.
Monospace	Indicates text that is displayed on screen or entered by the user. Example: # pairdisplay -g oradb
< > angle brackets	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: # pairdisplay -g <group> Italic is also used to indicate variables.
[ ] square brackets	Indicates optional values. 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: [a | b] indicates that you can choose a, b, or nothing. { a | b } indicates that you must choose either a or b.

Hitachi Data Systems user manuals use the following icons to draw attention to information.

Icon	Meaning	Description
	Tip	Helpful information, guidelines, or suggestions for performing tasks more effectively.
	Note	Information that is important or essential to the completion of a task.
	Caution	Failure to take a specified action can result in adverse conditions or consequences such as damage to the software or hardware
	WARNING	Failure to take a specified action can result in severe conditions or consequences such as in loss of data or serious damage to hardware.
	ELECTRIC SHOCK HAZARD	Failure to take appropriate precautions such as not opening or touching hazardous areas of the equipment could result in injury or death.

Convention for storage capacity values

Physical and logical storage capacities of disk drives in Hitachi Data Systems storage products are calculated based on the following values:

Physical Disk Capacity	
1 KB = 1,000 bytes	1 TB = $1,000^4$ bytes

Physical Disk Capacity	
1 MB = $1,000^2$ bytes	1 PB = $1,000^5$ bytes
1 GB = $1,000^3$ bytes	1 EB = $1,000^6$ bytes

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

Logical Disk Capacity (1 block= 512 bytes)	
1 KB (kilobyte) = 1,024 bytes (2^{10})	1 TB (terabyte) = $1,024^4$ bytes
1 MB (megabyte) = $1,024^2$ bytes	1 PB (petabyte) = $1,024^5$ bytes
1 GB (gigabyte) = $1,024^3$ bytes	1 EB (exabyte) = $1,024^6$ bytes

Accessing product documentation

The Hitachi Unified Storage VM user documentation is available on the Hitachi Data Systems Support Portal: https://Portal.HDS.com. 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 Hitachi Data Systems 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, number, and revision. Please refer to specific sections and paragraphs whenever possible.

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

1

Introduction

This chapter describes the hardware used in The HUS VM storage system.

☐ hardware components

☐ Overview

☐ Controller chassis

☐ Drive trays

☐ Cache memory

☐ Shared memory

hardware components

The following sections describe the HUS VM storage system components.

Overview

The Hitachi Unified Storage VM storage system (HUS VM) is an entry-level enterprise storage system offering the features and functions of a high-end enterprise-class system with the configuration simplicity of a modular system. At a high level, it is comprised of a controller chassis and a variety of drive trays in a one to five rack configuration.

The HUS VM offers an entirely new type of scalable high performance storage, capable of supporting demanding workloads while providing great flexibility. It offers much higher performance, better scalability, higher reliability, and greater flexibility than any competitive offering today.

The controller design is a "compacted logical" implementation of the HiStar design as used in the VSP system, but it uses completely different hardware with some faster, newer generation parts. The HUS VM uses most of the system software from the VSP system. In general, it could be seen as a smaller VSP that provides a lot of I/O power as well as most of the features of a VSP system.

The HiStar based controller supports the SAS cables, DDR3 cache DIMMs, and the front end and back end connectivity modules from the HUS 100 family, as well as the HUS 100 drive trays as described in the following table.

Table 1-1 Supported HUS VM components

Drive tray	Description	Maximum trays / drives per system
CBX / CBXC	5U Controller chassis	1
DBS / DBSC	2U x 24 SFF drives	48 / 1,152
DBL / DBLC	2U x 12 LFF drives	48 / 576
DBF	2U x 12 FMD drives	48 / 576
DBX	4U x 48 LFF drives	24 / 1,152
DB60 / DB60C	4U x 60 LFF drives	20 / 1,152

All system components are mounted in either a standard Hitachi Data Systems 19-inch, 42U rack, or a customer-supplied rack that meets the rack specifications listed in this manual.

Note: The HUS VM is an "open systems" only array. Mainframe systems are not supported.

The following sections provide descriptions and illustrations of the HUS VM storage system and its components.

Introduction

Hitachi Unified Storage VM Block Module Hardware User Guide
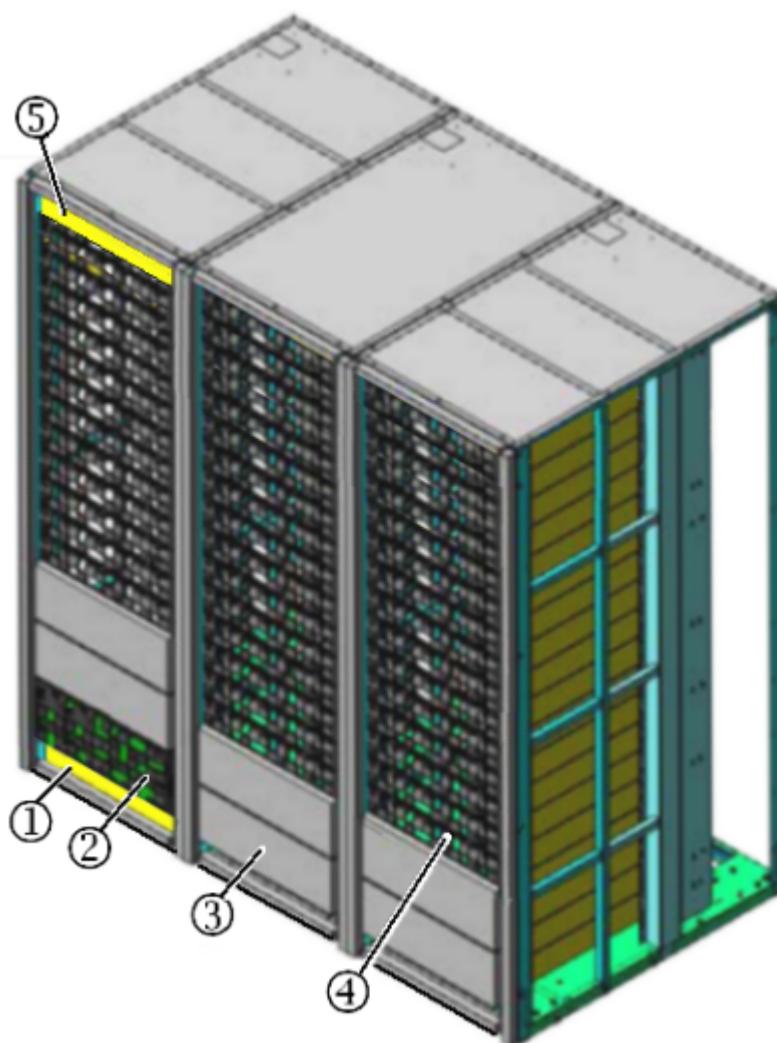
Figure 1-1 HUS VM example storage system

Item	Description	Item	Description
1	Blank space for installation lifter (2U)	2	Controller chassis (CBX)
3	DBX (dense) drive tray (up to 48 LFF drives) or DB60 (dense) drive tray (up to 60 LFF drives)	4	One of the following drives: • DBS drive tray (up to 24 SFF drives each) • DBL drive tray (up to 12 LFF drives each) • DBF drive tray (up to 12 FMD drives each)
5	Blank space (1U)		

Controller chassis

The 5U high controller chassis contains six types of pluggable modules, as shown and described in the following illustrations and tables. The controller provides system logic and control, memory, and monitoring, as well as the interfaces and connections to data drives and host servers.

The following illustrations show 3D views of the front and rear of a controller chassis. It is described in detail on the following pages.
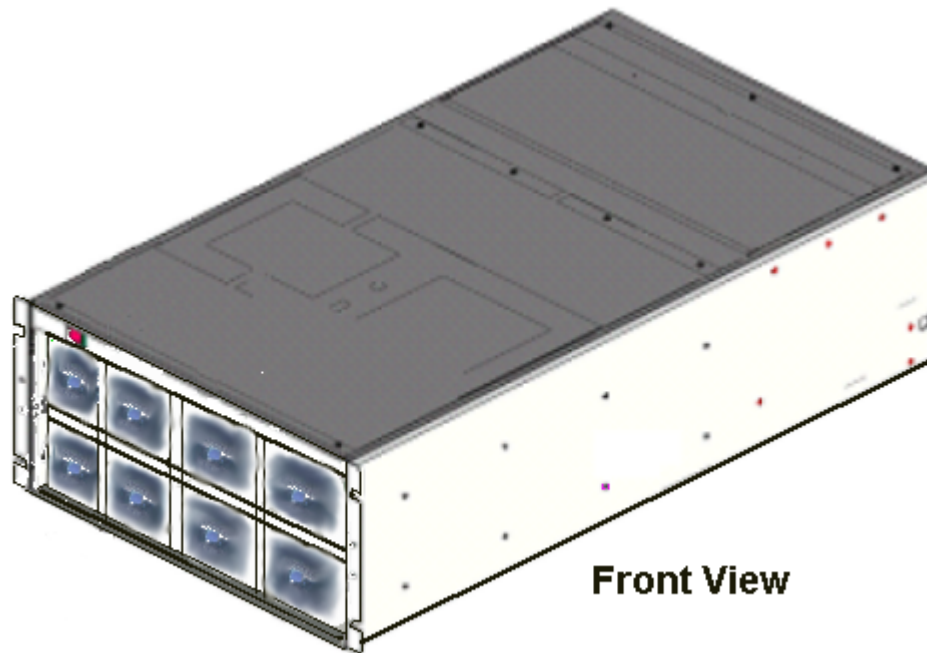
Figure 1-2 Controller chassis - 3D views
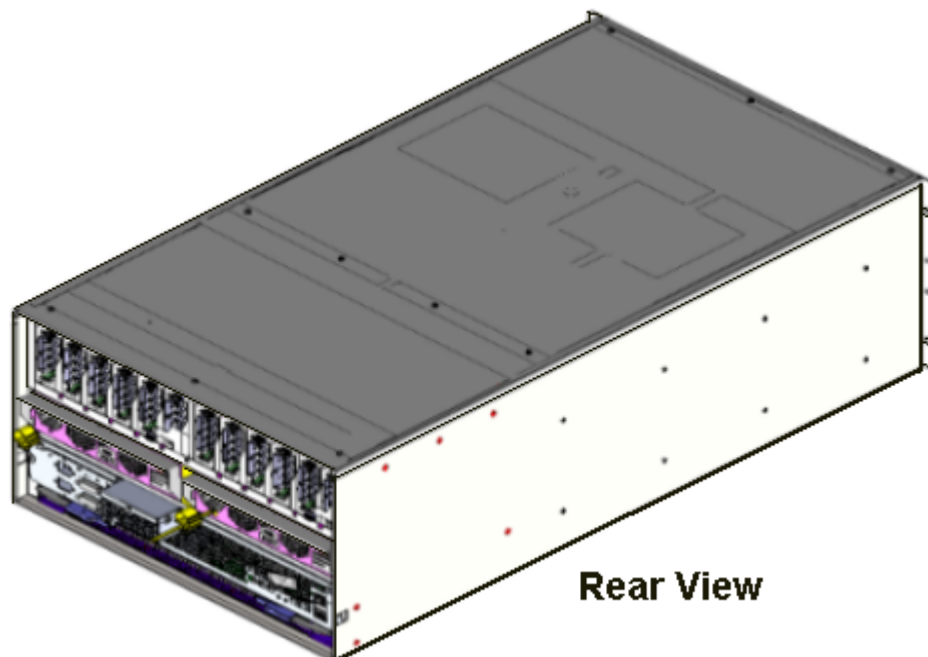
Figure 1-3 Controller chassis - 3D views

Controller configuration and components

The HUS VM controller chassis is vertically divided into two sections called clusters. Each clusters contains a Main blade, a Microprocessor (MP) blade, at

least two host I/O modules and back-end I/O modules, and two redundant power supplies. Both clusters share a single service processor.

The following illustrations show the front and rear views of a controller chassis. The table following the illustrations describes each component.
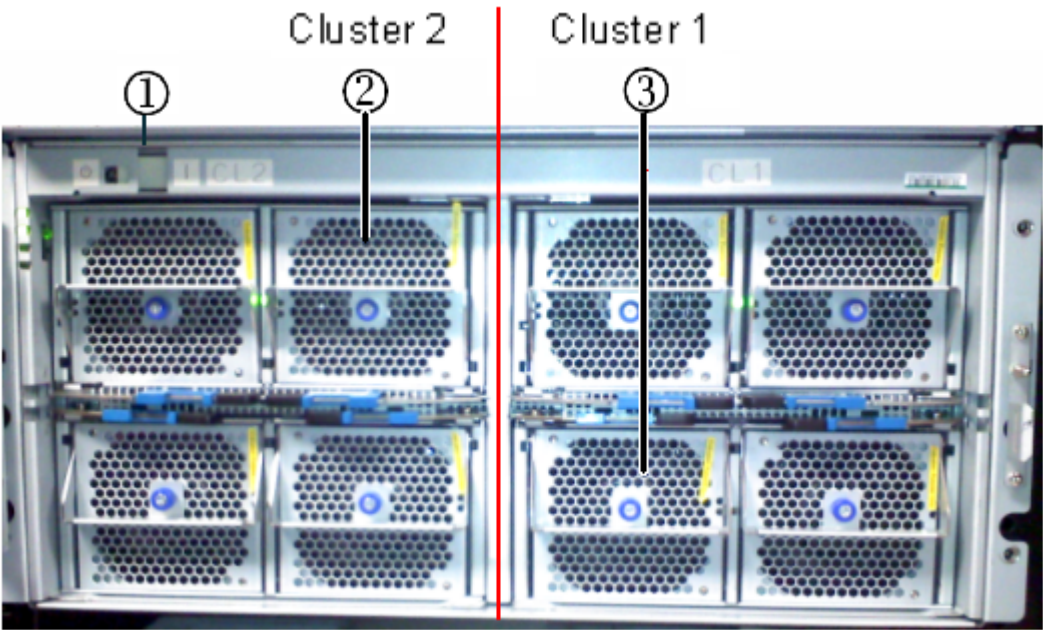
Figure 1-4 Controller chassis - front view
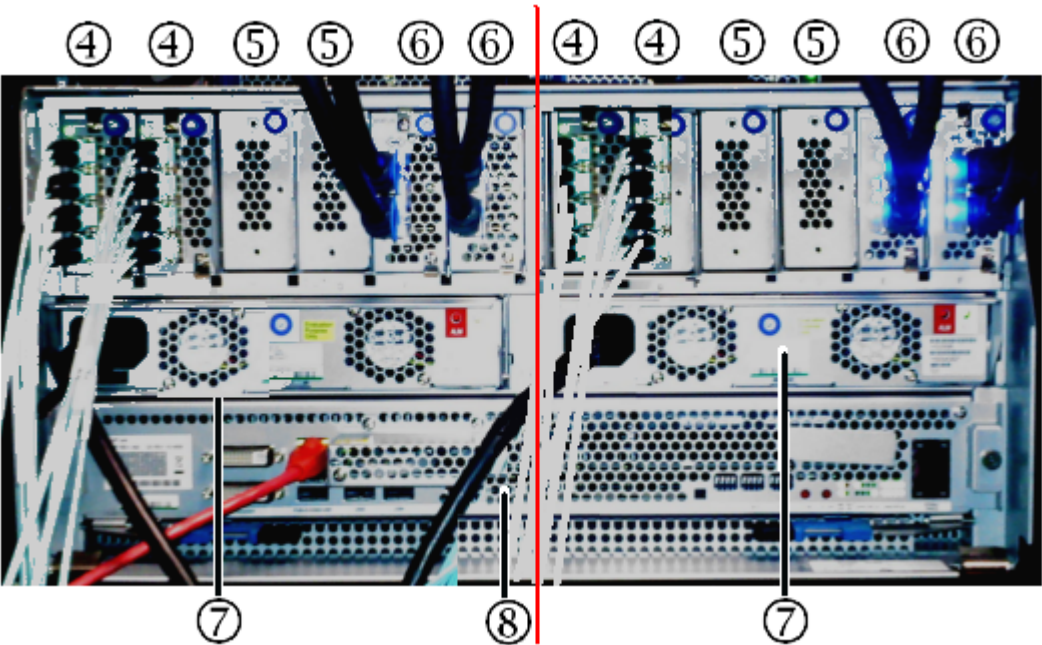
Figure 1-5 Controller chassis - rear view

Hitachi Unified Storage VM Block Module Hardware User Guide

Table 1-2 Controller chassis components

Item Name	Item Min	Item Max	Description
1	Control Panel	1	1	See Power controls and indicators on page 5-2
2	Main Blade (cache memory, cache flash memory, backup battery)	2	4	The main blades contain the cache memory, cache backup (destage) battery, and cache flash memory (SSD). Cache memory is available in 64GB, 128GB and 192GB capacities. If the power fails, the cache is protected from data loss by backup batteries and the cache flash memory, an 80 GB SSD drive. The batteries keep the cache alive for up to 10 minutes while the data is transferred to the flash memory. Each main blade contains two replaceable multispeed cooling fans.
3	MP Blade (microprocessor)	2	2	The MP blades are independent of the back-end I/O modules and host I/O modules and can be shared across them. Each MP blade contains two replaceable multispeed cooling fans.
4	host I/O module	2	8 with drives ---------- 12 for diskless system	A host I/O module is an interface board that provides connection to host servers. Each host I/O module contains an internal processor and 128 bytes of edit buffer memory.
5	Blanking panel which protects the slots for host I/O modules and/or back-end I/O modules			
6	back-end I/O module	0 if diskless ---------- 2 with drives	4	A back-end I/O module provides connection to the HDD, SSD, and FMD data drives. It controls functions for data transfer between data drives and cache. The back-end I/O module contains DRR (Data Recover and Reconstruct), a parity generator circuit. It supports eight FIBRE path and offers 32 KB of buffer for each FIBRE path.
7	Power supply	1	2	200-240 VAC input. Provides power to the controller chassis in a redundant configuration. Each power supply contains two cooling fans to ensure adequate cooling in case one of the fans fails. The system can operate with one power supply if the second one fails.
8	Service Processor	1	1	A custom PC that is used to monitor and control the storage system. It contains the Storage Navigator software that is used to configure nd monitor the system. Connecting the SVP to a service center enables the storage system to be remotely monitored and maintained by the Hitachi Data Systems support team, significantly increasing the level of support.

Flexible host I/O module installation

Host I/O modules can be installed in slots 1A-1D and 2A-2D. Or, slots 1A-1F and 2A-2F for diskless system. The configuration must be symmetric. For example, if slot 1A is populated than slot 2A must also be populated. The order of host I/O module installation is shown in the following table.

Table 1-3 Host I/O module Installation

Installation Order	Installation Slot Location	
	Diskless Mode	Disk-in Model
1	1A/2A (CHB-1A/2A)	1A/2A (CHB-1A/2A)
2	1B/2B (CHB-1B/2B)	1B/2B (CHB-1B/2B)
3	1C/2C (CHB-1C/2C)	1C/2C (CHB-1C/2C)
4	1D/2D (CHB-1D/2D)	1D/2D (CHB-1D/2D)
5	1E/2E (CHB-1E/2E)	
6	1F/2F (CHB-1F/2F)	

Drive trays

The HUS VM supports five different drive tray as described below. All components in the drive trays are configured in redundant pairs to prevent system failure. All components in the drive trays can be added or replaced while the storage system is in operation.

- **DBS** - a 2U high tray containing up to 24 vertically mounted 2-1/2-inch (SFF) HDD or SSD data drives. The DBS drive tray includes two redundant power supplies and two ENC adapter boards that are used to connect the tray to the controller. These connections may be direct via SAS cable or in a daisy-chain fashion through the ENC adapters in other drive trays. See Figure 1-7 DBL drive tray front view on page 1-8.

- **DBL** - a 2U high tray containing up to 12 horizontally mounted 3-1/2-inch (SSF) drives. The DBL drive tray includes two redundant power supplies and two ENC adapter boards that are used to connect the tray to the controller. These connections may be direct via SAS cable or in a daisy-chain fashion through the ENC adapters in other drive trays, See Figure 1-7 DBL drive tray front view on page 1-8.

- **DBF** - a 2U high tray containing up to 12 horizontally mounted 5-1/4-inch Hitachi flash module drives (FMD). In addition to the drives, the tray contains two redundant power supplies and two ENC adapter boards that are used to connect the tray to the controller. The connection to the controller may be direct via ENC cable or via a daisy-chain connection through the ENC adapters in other drive trays, and connecting ENC cables. See Figure 1-10 DBF drive tray on page 1-10.

- **DBX** - a "high-density" 4U high tray containing up to 48 vertically mounted 3-1/2-inch (LFF) drives. This drive tray is functionally divided into two separate drive units (A and B), each containing a maximum of 24

drives. Each drive unit contains two redundant power supplies and two ENC adapter boards that are used to connect the tray to the controller. The connection to the controller may be direct via ENC cable or via a daisy-chain connection through the ENC adapters in other drive trays See Figure 1-13 DBX (dense) drive tray front bezel on page 1-13 and Figure 1-15 DBX (dense) drive tray rear panel on page 1-14.

- **DB60** - a "high-density" 5U high tray containing up to 60 vertically mounted 2-1/2-inch (SFF) drives. This drive tray is functionally divided into two separate drive units (A and B), each containing a maximum of 30 drives. Each drive unit contains two redundant power supplies and two ENC adapter boards that are used to connect the tray to the controller. The connection to the controller may be direct via ENC cable or via a daisy-chain connection through the ENC adapters in other drive trays See Figure 1-13 DBX (dense) drive tray front bezel on page 1-13 and Figure 1-15 DBX (dense) drive tray rear panel on page 1-14.

DBS and DBL drive trays

The illustrations on this page and the next page show the front and rear panels of the DBL and DBS drive trays. The tables following the illustrations describe the main features of each panel.
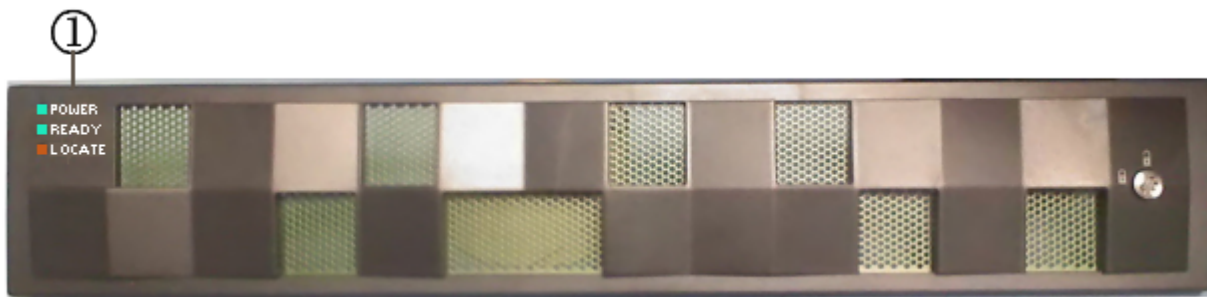
Figure 1-6 DBL, DBS, and DBF drive tray front bezel

Figure 1-7 DBL drive tray front view

Hitachi Unified Storage VM Block Module Hardware User Guide

Figure 1-8 DBS drive tray front view

Item	Name	Color	Description
1	**POWER** LED	Green	OFF - no power is supplied to the system
			ON - Power is supplied to the system
	READY LED	Green	OFF - system is not operational
			ON - normal operation. Storage system is operational.Fast blink - internal processing. Storage system is operational.Slow blink - offline download processing completed (maintenance).
	LOCATE LED	Orange	OFF - normal operation
			ON - nonfatal error. Storage system can remain operating.
			Contact technical support. See Getting help on page xi in the preface of this manual.
2	**ALM** LED (alarm)	Red	OFF - normal operation
			ON - fatal error. Contact technical support. See Getting help on page xi in the preface of this manual.
3	**ACT** LED (Active)	Green	OFF - drive is not being accessed
			Blinks when drive is being accessed.
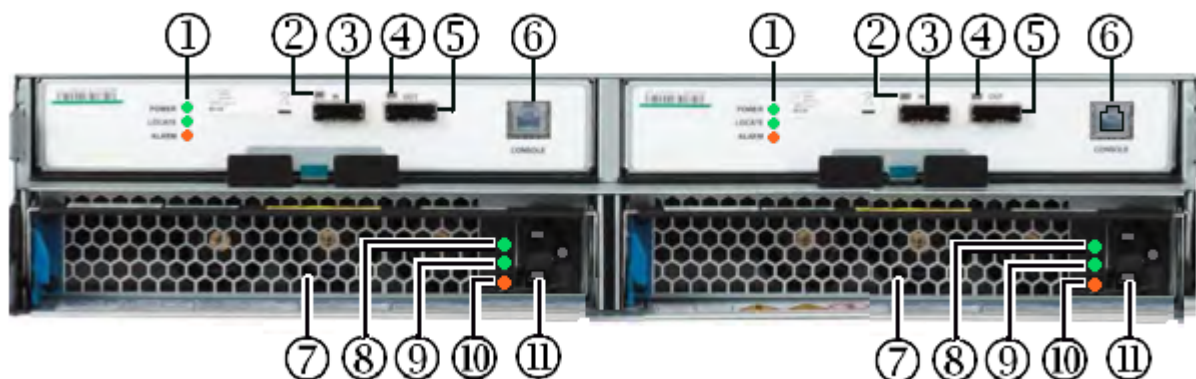
Figure 1-9 DBL and DBS drive tray (rear panel)

Item	Name	Color	Description
1	**POWER** LED	Green	OFF - no power is supplied to the system
			ON - Power is supplied to the system

Item	Name	Color	Description
	READY LED	Green	ON - normal operation. Storage system is operational.Fast blink - internal processing. Storage system is operational.Slow blink - offline download processing completed (maintenance).
	LOCATE LED	Orange	ON - nonfatal error. Storage system can remain operating. Contact technical support. See Getting Help in the preface of this manual.
2	**ENC IN**	-	Connects the drives to the ENC OUT port in the control chassis, either directly, or via another drive tray with daisy chained cables.
3	**ENC IN** LED	Green	ON - Indicates that the port is connected to an OUT port in the controller. This can be directly or indirectly, as described above.
4	**ENC OUT** connector	-	Connects the drives to the ENC IN port in the control chassis, either directly, or via another drive tray with daisy chained cables.
5	**ENC OUT** LED	Green	ON - Indicates that the port is connected to an IN port in the controller. This can be directly or indirectly, as described above.
6	Console port	-	RJ-45 connector, not used
7	Power Supply	-	Converts 200 VAC to the DC voltages used by the drives and the ENC adapters.
8	**RDY** (Ready) LED	Green	OFF - no power is supplied to the system or the power supply has failed. ON - The power supply is operating normally.
9	**AC IN** LED	Green	ON - AC input is normal.
10	**ALM** (Alarm) LED	Red	Power supply has failed. Contact technical support. See Getting help on page xi in the preface of this manual.
11	AC Socket	-	For IEC60320-C14 plug, 200 - 240 VAC +8% - 6% 50/60 Hz

DBF drive tray

The illustrations on this page and the next page show the front and rear panels of the DBF drive tray. The tables following the illustrations describe the main features of the unit.
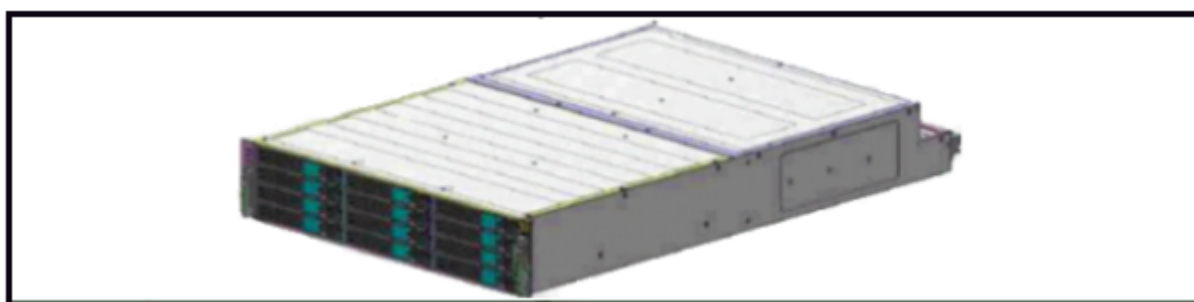
Figure 1-10 DBF drive tray

Item	Description	Item	Description	Ite m	Description
1	Flash module Active LED - lights when activated.Blinks at drive access	2	Flash module Alarm LED - lights when module should be replaced	3	SAS / ENC Module Power LED
4	SAS / ENC Module Alarm LED - indicates fatal error condition	5	SAS / ENC standard IN connector	6	SAS / ENC high performance IN connector
7	ENC adapter - connects the flash modules to the BEDs in the controller.	8	SAS / ENC standard OUT connector	9	SAS / ENC high performance OUT connector
10	Power cord receptacle	11	Power Supply - 220 VAC input, draws approximately 265 watts	12	Power Supply Ready 1 LED - lights when 12 VDC power #1 is ready.
13	Power Supply Ready 2 LED - lights when 12 VDC power #2 is ready.	14	Power Supply alarm LED - lights when power supply has an error.		

DBX dense drive tray

The illustrations on this page and the next page show the front and rear panels of the DBX dense drive tray (up to 48 LFF drives). The tables following the illustrations describe the main features of each panel.
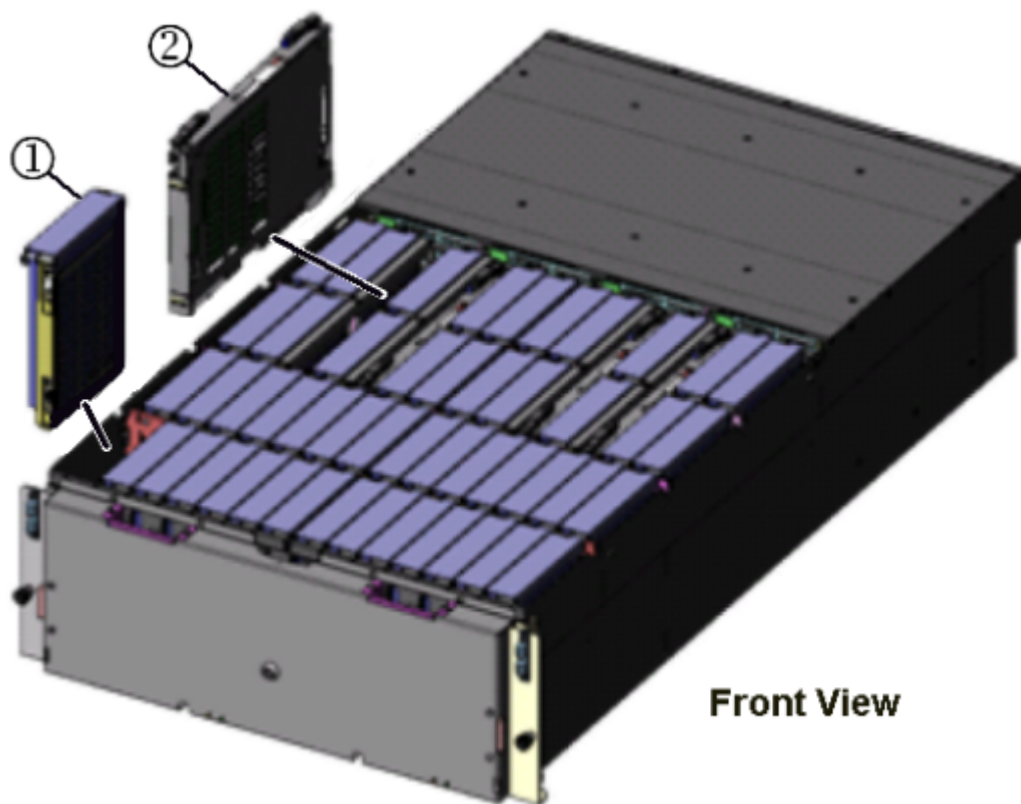
Figure 1-11 DBX (dense) drive tray(front view)
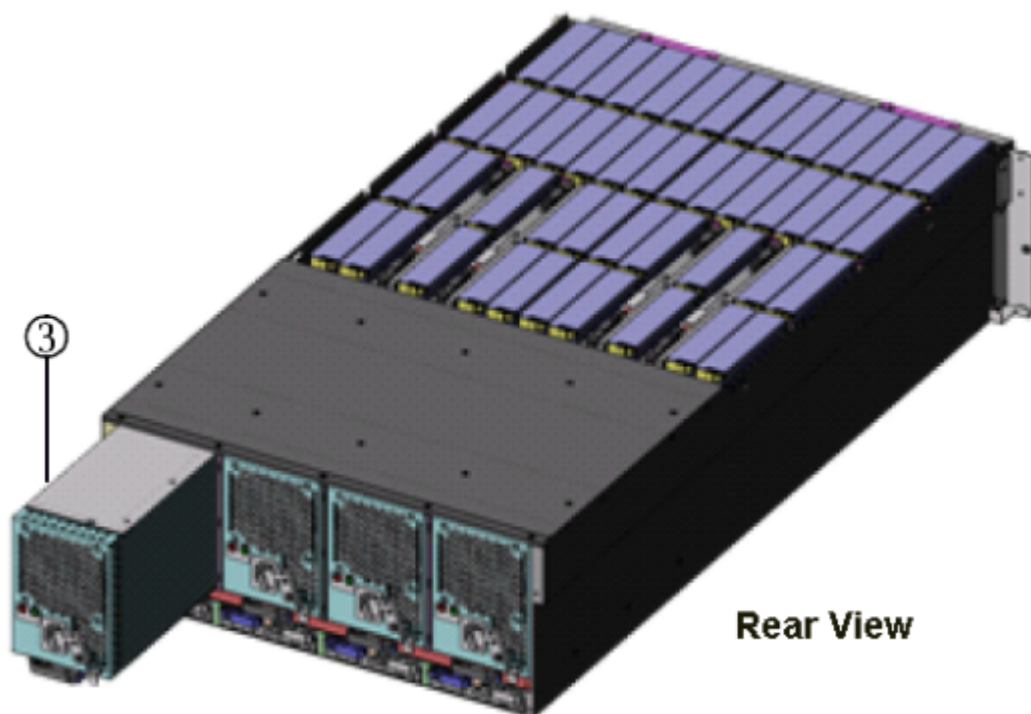
Figure 1-12 DBX (dense) drive tray(rear view)

Item	Description	Item	Description	Item	Description
1	LFF HDD or SSD	2	ENC (adapter) card	3	Power Supply
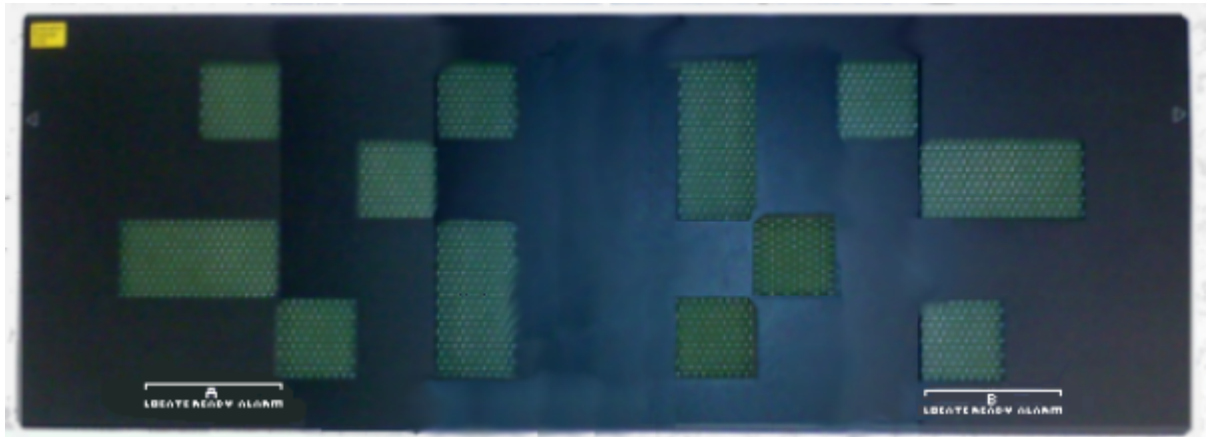
Figure 1-13 DBX (dense) drive tray front bezel
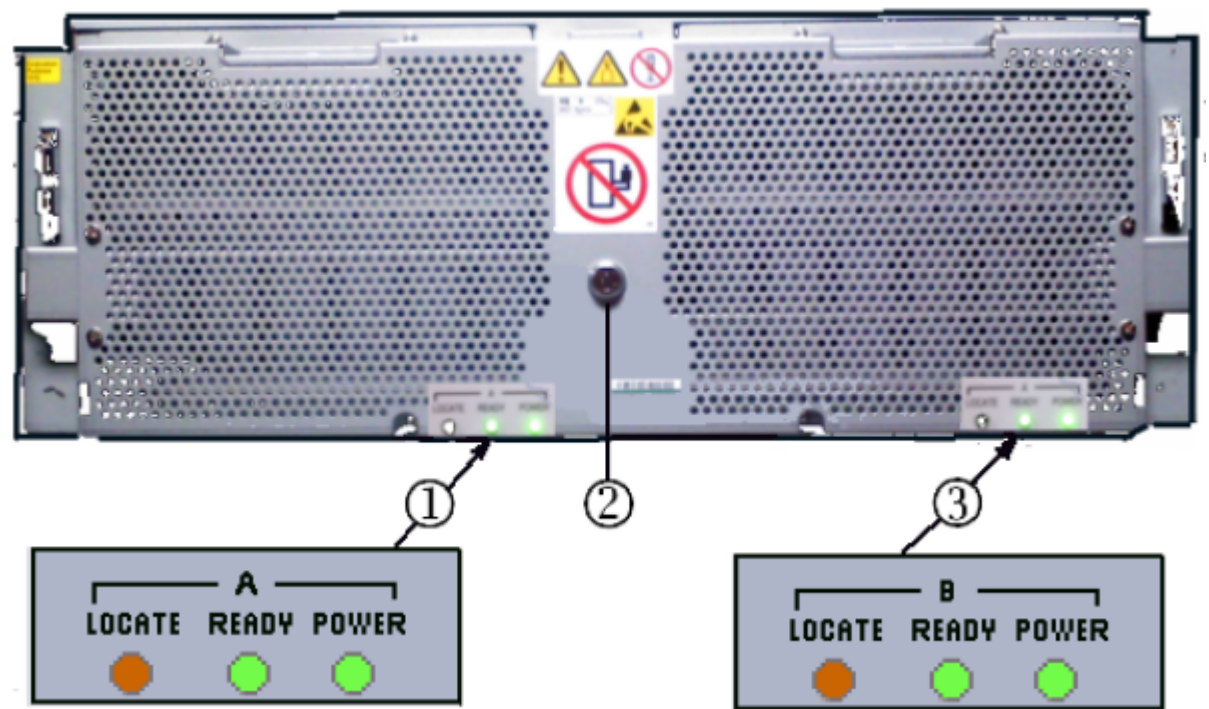
Figure 1-14 DBX (dense) drive tray front panel

Item	Description	Item	Description
1	Unit A Status LEDs	2	Lock
3	Unit B Status LEDs		

Hitachi Unified Storage VM Block Module Hardware User Guide
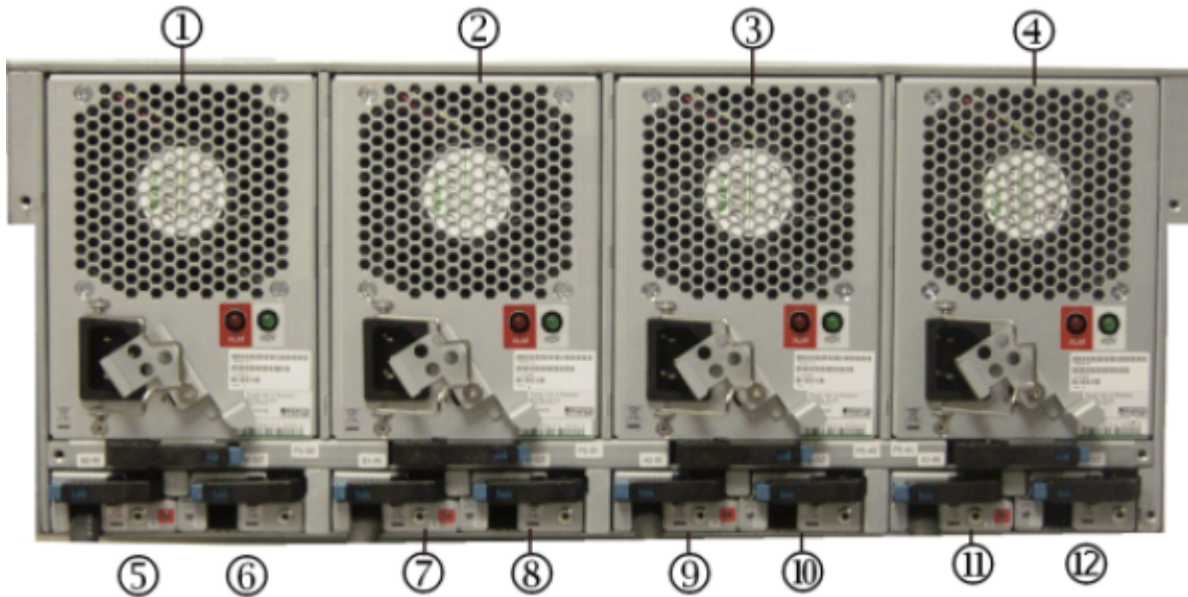
Figure 1-15 DBX (dense) drive tray rear panel

Item	Description	Item	Description
1	Power Supply B1	2	Power Supply B0
3	Power Supply A1	4	Power Supply A0
5	ENC Unit B1 IN	6	ENC Unit B1 OUT
7	ENC Unit B0 IN	8	ENC Unit B0 OUT
9	ENC Unit A1 IN	10	ENC Unit A1 OUT
11	ENC Unit A0 IN	12	ENC Unit A0 OUT

The rear panel of a DBX high-density drive tray includes two redundant power supplies, two ENC-IN ports, and two ENC-OUT ports for each section inthe drive tray. The ports provide the connections to daisy-chain high-density expansion units in the system. The rear panel also includes LEDs that show the status of the ENC units and the power supplies. The following illustration shows the hardware components on the rear panel of a high-density expansion unit.

Dense intermix drive tray

The illustrations on this page and the next page show the front and rear panels of the Dense intermix drive tray (DB60 - up to 60 LFF drives). The tables following the illustrations describe the main features of each panel.

Introduction

Front View
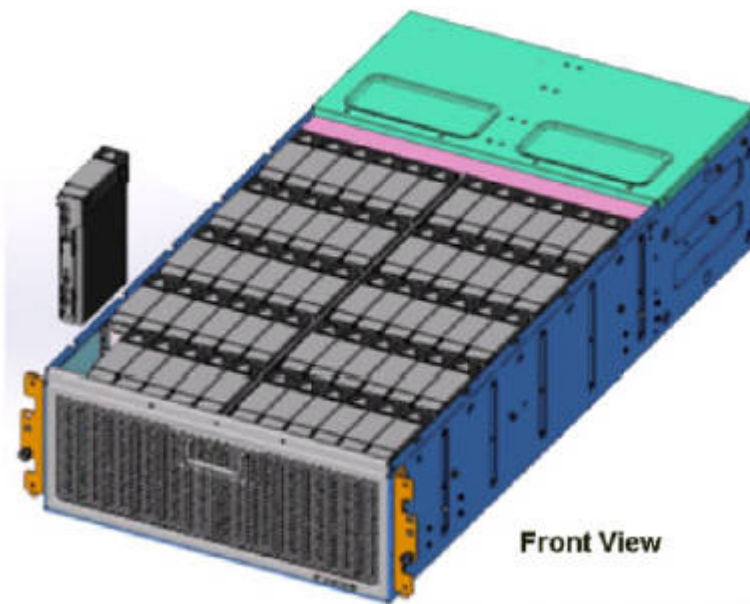
Figure 1-16 DB60 (dense) drive tray

Rear View
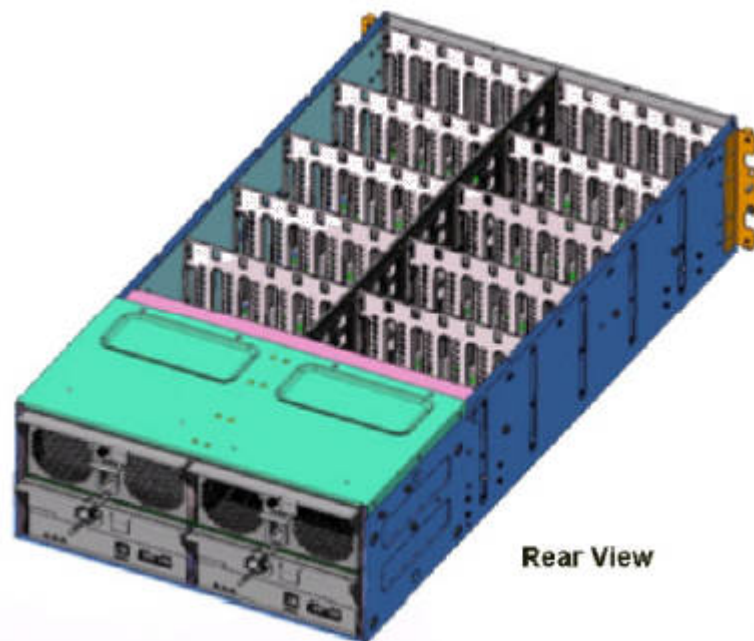
The front panel of the DB60 contains a grille with a built-in air filter. There are no controls on the front panl.

The rear section of a DB60 high-density drive tray contains two redundant power supplies, one ENC-IN port, and one ENC-OUT port for each section in the drive tray. The ports provide the connections to daisy-chain high-density expansion units in the system. The rear panel also includes LEDs that show the status of the ENC units and the power supplies. The following illustration shows the hardware components on the rear panel of a high-density intermix (DB60) expansion unit.
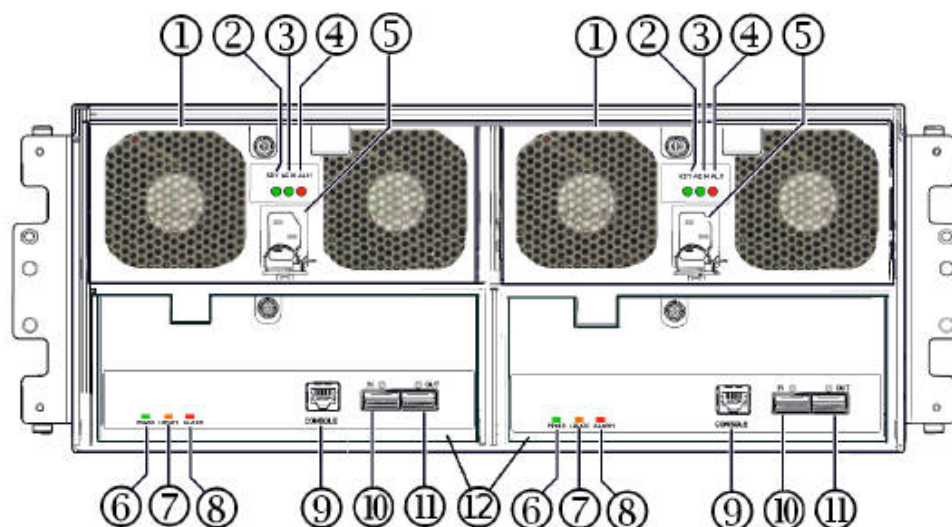
Figure 1-17 DB60

Item	Description	Item	Description
1	Power Supply	2	RDY (Ready) LED, Green. ON when power supply is operating normally
3	AC IN LED, Green. ON when AC is supplied to the power supply.	4	ALM (Alarm) LED. RED. ON when power supply has failed. OK to remove unit.
5	AC receptacle	6	POWER LED Green. ON when power is applied to the ENC Unit
7	LOCATE LED Amber. ON to assist locating the ENC Unit during maintenance operations	8	ALARM LED. RED. ON when the ENC Unit has failed. OK to remove unit.
9	RG45 ethernet connector (LAN)	10	ENC path IN cable connector
11	ENC path OUT cable connector	12	ENC Unit. Interface between the drives and the ENC data/control cable

Cache memory

The HUS VM can be configured with up to 256 GB of cache memory. Each HUS VM system contains two Main blades as shown in the following illustration. Each Main blade contains a single main board with 32, 64, 96, or 128 GB of cache memory. Main blades are installed in pairs and work together to provide cache and shared memory for the system.

Hitachi Unified Storage VM Block Module Hardware User Guide
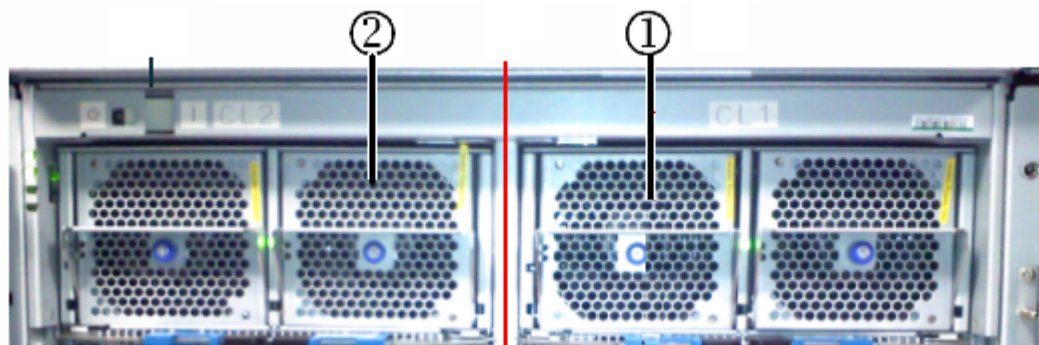
Figure 1-18 Cache memory

Item	Description	Item	Description
1	Main blade / cache cluster 1	2	Main blade / cache cluster 2

Cache capacity

The cache capacity is determined by the RAID level, the number of drives installed in the system, and whether Dynamic Provisioning (DP)/Dynamic Tiering (DT)/Dynamic Cache Residency (DCR)/Universal Volume Manager (UVM) are applied/not applied.The recommended data cache capacity per Cache Logical Partition (CLPR) = (CLPR capacity) - (DCR Extent setting capacity per CLPR)When CLPR is not applied to DP/DT/DCR, install the recommended data cache capacity shown in the following table.

Table 1-4 Recommended data cache capacity when DP, DT, DCR and UVM are not being used

Total logical capacity of External volumes + Internal volumes per CLPR	Recommended data cache capacity per CLPR
Less than 2,900GB	15GB or more
less than 2,900 G	15 GB or more
2,900 GB or more	16 GB or more
11,500 GB or more	22 GB or more
14,400 GB or more	24 GB or more
100,000 GB or more	30 GB or more
128,000 GB or more	32 GB or more
182,000 GB or more	40 GB or more
218,000 GB or more	48 GB or more
254,000 GB or more	56 GB or more
290,000 GB or more	64 GB or more
326,000 GB or more	72 GB or more

Memory operation

The HUS VM places all read and write data in the cache. The amount of fast-write data in cache is dynamically managed by the cache control algorithms to provide the optimum amount of read and write cache, depending on the workload read and write I/O characteristics.

Data Protection

The HUS VM is designed so that it cannot lose data or configuration information from the cache if the power fails. The cache is protected from data loss up for up to ten minutes by the cache destage batteries while the data is copied to the 80 GB cache SSD (flash memory) on the cache boards. This is explained in detail in .

Shared memory

Shared Memory, which holds storage system configuration information, resides in cache. Shared Memory Capacity plus Cache Memory Capacity equals Total Cache Memory Capacity necessary for the storage system.

The following table shows the shared memory capacity needed depending on by the kind of software applications are installed in the system.

Table 1-5 Shared Memory Capacity

Judgment Factor of SM Capacity[3]						
Program Product [1, 2]			SI/VM/DP Extension		TC/UR Extension	SM Capacity
SI/VM2/ DP	TC/UR	DT	1	2		
□	X	X	X	X	X	8 GB
□	□	X	□	X	X	16 GB
□	X	□	X	X	X	16 GB
□	□	□	□	X	X	24 GB
□	□	X	□	□	X	24 GB
□	□	X	□	X	□	24 GB
□	□	□	□	□	□	32 GB
□	□	□	□	□	X	32 GB
□	□	□	□	X	□	32 GB
□	□	□	□	□	□	40 GB
Notes:						
1. DP = Dynamic Provisioning, DT = Dynamic Tiering, SI = ShadowImage, TC = True Copy, UR = Universal Replicator, VM = Volume Migration						
2. Volume Migration is a function in Hitachi Tiered Storage Manager						

Judgment Factor of SM Capacity[3]						
Program Product [1, 2]			**SI/VM/DP Extension**		**TC/UR Extension**	**SM Capacity**
SI/VM2/ DP	**TC/UR**	**DT**	**1**	**2**		
3. Symbol key						
X (N)	Functions and Program Products described in the table are not available as the SM used by the functions and the Program Product is ineffective.					
□ (Y)	Functions and Program Products described in the table are available when the SM used by the functions and Program Products is effective. To use the Program Products, performing installation operation separately is required (see note 4)					
Example	The SM capacity when TC is applied is 16 GB or more.					
	The SM becomes effective regardless of functional necessity of SI/VM/DP, SI/VM/DP Extension1 and UR, and they can be available to use by installation.					
	Functions marked with **X**(No) cannot be used)					
4. For installation, see the *Hitachi Storage Navigator User Guide*.						

Introduction

2

Hardware architecture

This chapter briefly describes the Hitachi Unified Storage VM system architecture, including some of the functional and operational characteristics.

☐ System architecture overview

☐ Hardware architecture

☐ HUS VM RAID implementation

☐ Systems operations

☐ Host Modes and host mode options

☐ Storage Navigator

System architecture overview

This section briefly describes the architecture of the Hitachi Unified Storage VM storage system.

> **Note:** The HUS VM is an "open systems" only array. Mainframe systems are not supported.

Hardware architecture

The basic system architecture is shown in the following diagram.
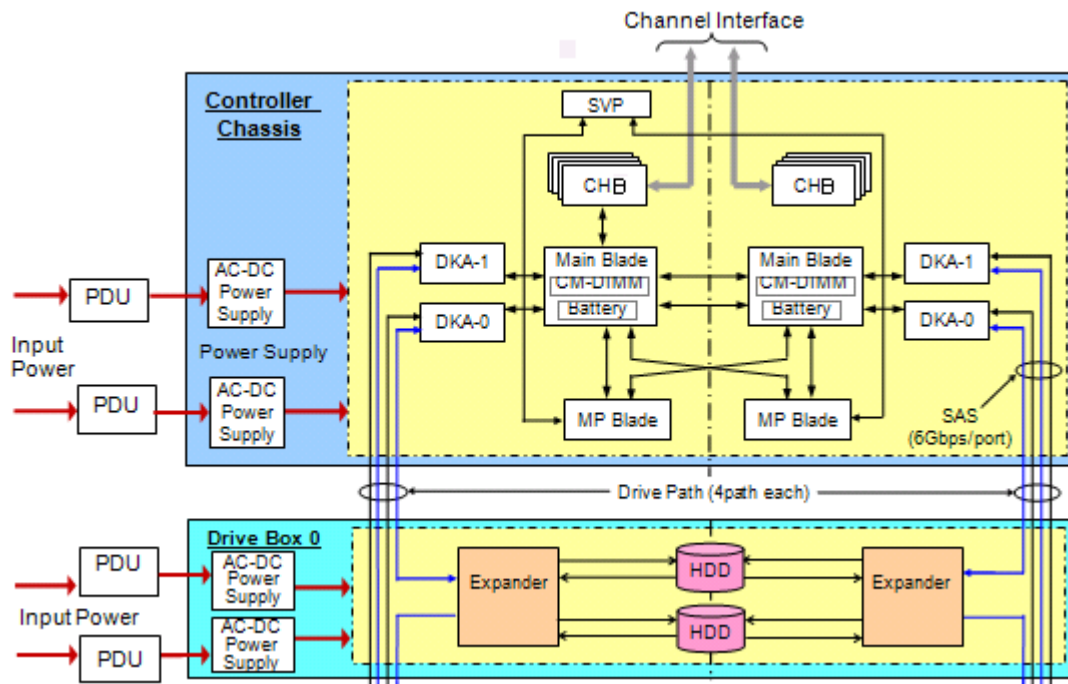
Figure 2-1 HUS VM Architecture Overview

The system consists of two main hardware assemblies:

- A controller chassis that contains the logic and processing components
- One or more drive trays that contains disk drives and/or solid state (flash) drives. Drive trays are not included in diskless systems.

These assemblies are explained briefly in Chapter 1.

HUS VM RAID implementation

This section provides an overview of the implementation of RAID technology used on the Hitachi Unified Storage VM storage system.

The objectives of the RAID technology are the low cost, high reliability, and high I/O performance of disk storage devices. To achieve these objectives, this storage system supports levels 1, 5 and 6 of RAID technologies (in this

section, part of level 3 RAID technology is explained to make the outline of RAID5 more understandable). The features of the levels of RAID technologies are described below.

Array groups and RAID levels

The array group (also called parity group) is the basic unit of storage capacity for the HUS VM storage system. It is a set of four physical drives installed into any disk trays (in any "roaming" order on HUS VM). When a set of one or two such Array Groups (four or eight drives) is formatted using a RAID level, the resulting RAID formatted entity is called a Parity Group. Although technically the term Array Group refers to a group of bare physical drives, and the term Parity Group refers to something that has been formatted as a RAID level and therefore actually has initial parity data (here we consider a RAID-1 mirror copy as parity data), be aware that this technical distinction is often lost. You will see the terms Parity Group and Array Group used interchangeably in the field.

The HUS VM supports the following RAID levels: RAID 1, RAID 5, and RAID 6. RAID 0 is not supported on the HUS VM. When configured in four-drive RAID 5 parity groups (3D+1P), three-fourths of the raw capacity is available to store user data, and one fourth of the raw capacity is used for parity data.

RAID 1

The following two figures illustrate the RAID 1configurations. The tables following the figures describes each configuration.
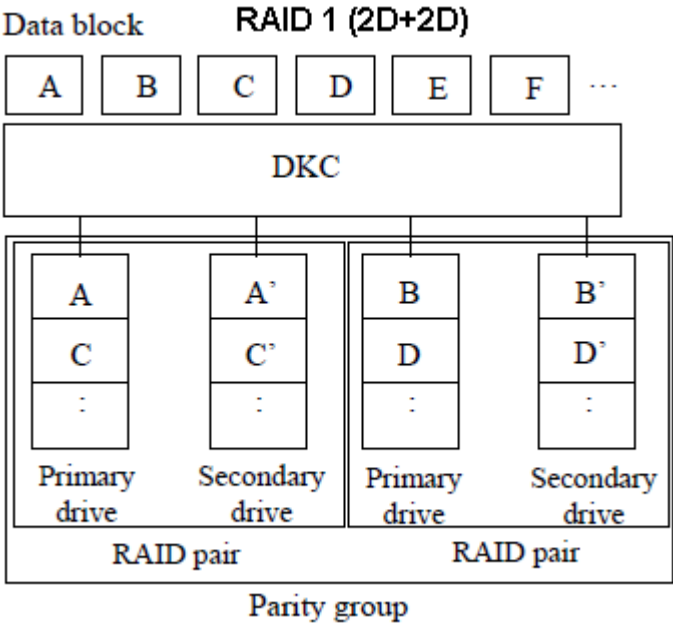
Item	Description
Description	Mirror disks (duplicated writing) Two disk drives, primary and secondary disk drives, compose a RAID pair (mirroring pair) and the

Item	Description
	identical data is written to the primary and secondary disk drives. Further, data is scattered on the two RAID pairs.
Advantage	RAID 1 is highly usable and reliable because of the duplicated data. It has higher performance than ordinary RAID 1 (when it consists of two disk drives) because it consists of the two RAID pairs.
Disadvantage	Requires disk capacity twice as large as the user data.

Data block **RAID 1 (4D+4D)**

| A | B | C | D | E | F | ... |

DKC

A	B	C	D
E	F	G	H
:	:	:	:

RAID pair   RAID pair   RAID pair   RAID pair

NOTE: A RAID pair consists of two disk drives.
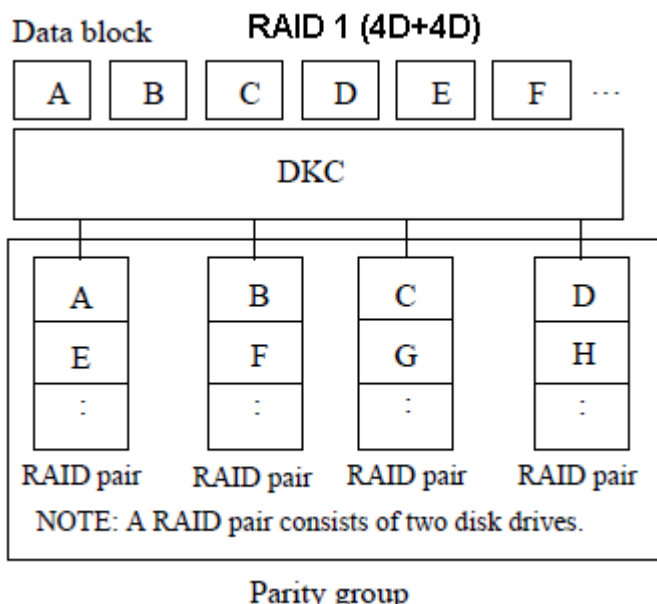
Parity group

Item	Description
Description	Mirror disks (duplicated writing) The two parity groups of RAID 1(2D +2D) are concatenated and data is scattered on them. In the each RAID pair, data is written in duplicate.
Advantage	This configuration is highly usable and reliable because of the duplicated data. It has higher performance than the 2D+2D configuration because it consists of the four RAID pairs.
Disadvantage	Requires disk capacity twice as large as the user data.

The following figure illustrates a sample RAID 1 (2D+2D) layout. a stripe of mirrored pairs. Therefore, when we say RAID-1 in the context of a Hitachi Data Systems enterprise HUS VM system, we mean the same thing as when we say RAID-10 in the context of an AMS modular system. Note that alternative RAID 0+1 used by some vendors is quite different, as it is the very vulnerable mirror of two RAID-10 stripes, where if one disk fails, all protection is lost. In a mirror of stripes, it's not that you lose the data on a single drive failure, because after all, it's still a mirror, but in a mirror of stripes if one drive fails, the entire stripe goes down, and you are very vulnerable to a 2nd drive failure in the other stripe. In Hitachi RAID 1 (RAID 10) where we have a stripe of mirrors, if two drives fail in different mirror pairs, then each mirror pair is still alive within the stripe and thus no data is lost.
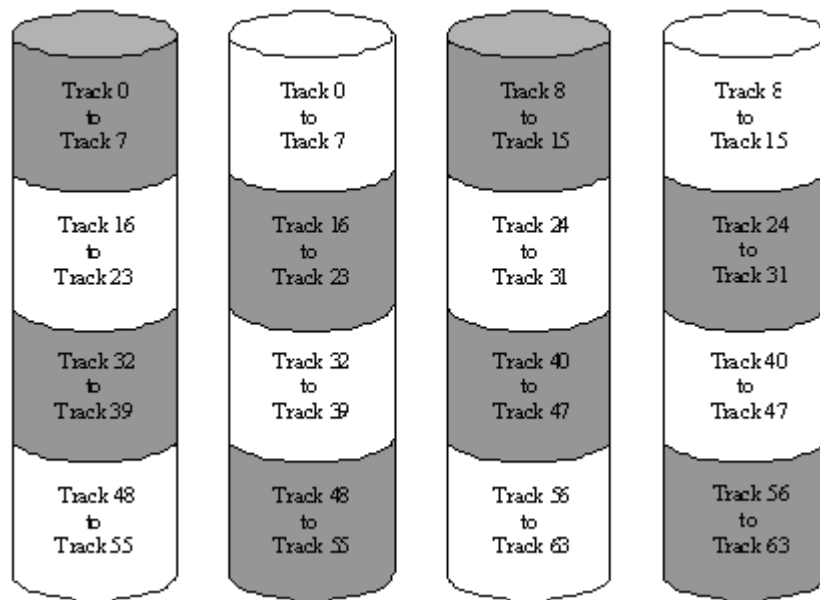
Figure 2-2 Sample RAID 1 (2D + 2D) Layout

RAID 5

A RAID 5 array group consists of four or eight data drives, (3D+1P) or (7D +1P. The data is written across the four (or eight) drives in a stripe that has three (or seven) data chunks and one parity chunk. Each chunk contains 768 logical blocks, because HUS VM supports only open systems. The enhanced RAID 5+ implementation in the HUS VM minimizes the write penalty incurred by standard RAID 5 implementations by keeping write data in cache until an entire stripe can be built and then writing the entire data stripe to the drives. The 7D+1P RAID 5 increases usable capacity and improves performance.

The following two figures illustrate the RAID 5 configurations. The tables following the figures describes each configuration.

Note: There are two configurations of RAID 5: 3D+1P configuration (four disk drives) and 7D+1P configuration (eight disk drives). The following diagram shows the 3D+1P configuration. In the 7D+1P configuration, data is arranged in the same way.

Data block   RAID 5 (3D+1P)

Data disks + Parity disk
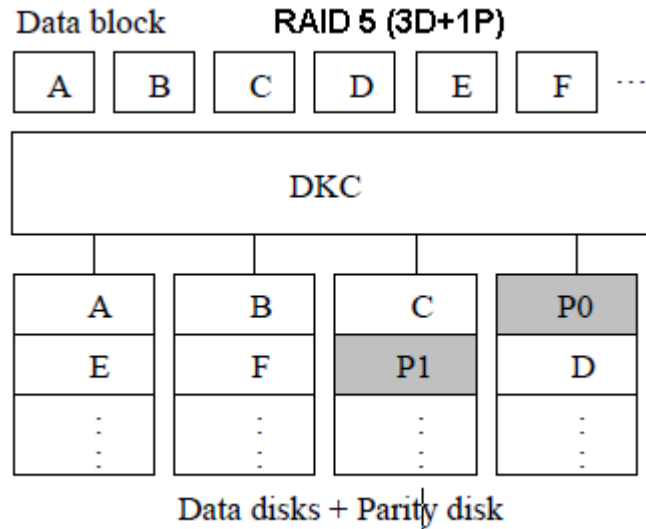
Item	Description
Description	Data is written to multiple disks successively in units of block (orblocks). Parity data is generated from data of multiple blocks and written to optional disk.
Advantage	RAID 5 fits the transaction operation mainly uses small size random access because each disk can receive I/O instructions independently. It can provide high reliability and usability at a comparatively low cost by virtue of the parity data.
Disadvantage	Write penalty of RAID 5 is larger than that of RAID 1 because pre-update data and pre-update parity data must be read internally because the parity data is updated when data is updated.

Data block   RAID 5 (7D+1P)
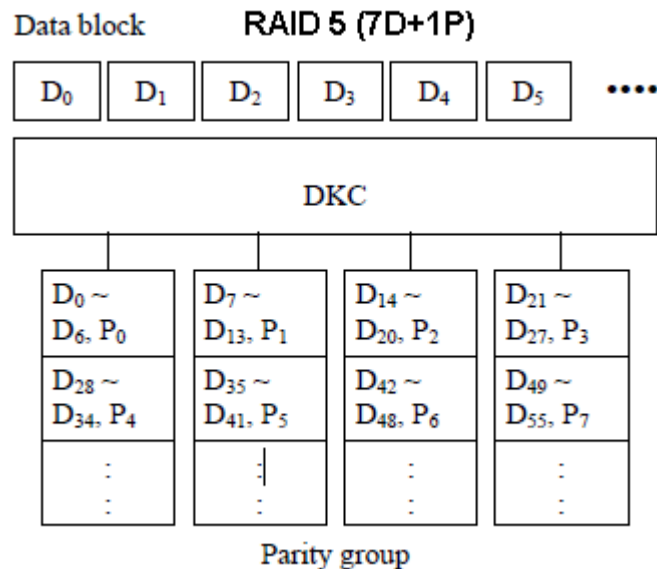
Parity group

Item	Description
Description	In the case of RAID5 (7D+1P), two or four parity groups (eight drives)are concatenated, and the data is distributed and arranged in 16 drives or 32 drives.
Advantage	When the parity group becomes a performance bottleneck, the performance improvement can be attempted because it is configuredwith twice and four times the number of drives in comparison with RAID5 (7D+1P).
Disadvantage	The influence level when two drives are blocked is large because twiceand four times LDEVs are arranged in comparison with RAID5 (7D +1P). However, the probability that the read of the single block in the parity group becomes impossible due to the failure is the same as that of RAID5 (7D+1P).

illustrates RAID 5 data stripes mapped across four physical drives. Data and parity are striped across each of the data drives in the array group (hence the term "parity group"). The logical devices (LDEVs) are evenly dispersed in the array group, so that the performance of each LDEV within the array group is the same. This figure also shows the parity chunks that are the Exclusive OR (EOR) of the data chunks. The parity and data chunks rotate after each stripe. The total data in each stripe is 2304 blocks (768 blocks per chunk) for open-systems data. Each of these array groups can be configured as either 3390-x or OPEN-x logical devices. All LDEVs in the array group must be the same format (3390-x or OPEN-x). For open systems, each LDEV is mapped to a SCSI address, so that it has a TID and logical unit number (LUN).
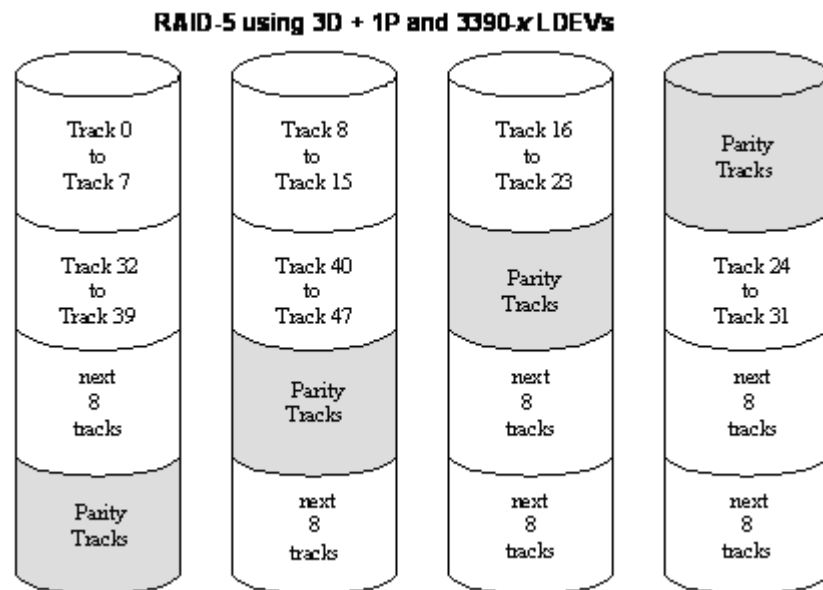
Figure 2-3 Sample RAID 5 3D + 1P Layout (Data Plus Parity Stripe)

RAID 6

A RAID 6 array group consists of eight data drives (6D+2P). The data is written across the eight drives in a stripe that has six data chunks and two parity chunks. Each chunk contains 768 logical blocks..

In RAID 6, data can be assured when up to two drives in an array group fail. Therefore, RAID 6 is the most reliable of the RAID levels.

The following figure illustrates the RAID 5 configuration. The table following the figure describes it.

Note: There are two configurations of RAID 6: 6D+2P configuration (eight disk drives) and 14D+2P configuration (sixteen disk drives). The following diagram shows the 6D+2P configuration.

Data disks + Parity disks P and Q
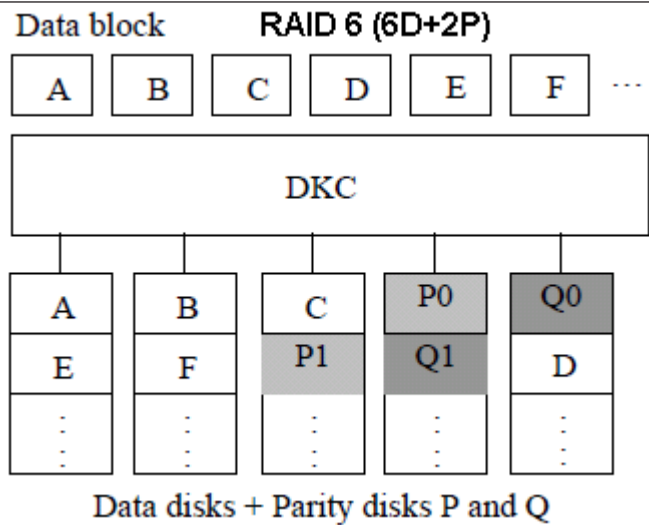
Item	Description
Description	Data blocks are scattered to multiple disks in the same way as RAID 5 and two parity disks, P and Q, are set in each row. Therefore, data can be assured even when failures occur in up to two disk drives in a parity group.
Advantage	RAID 6 is far more reliable than RAID 1 and RAID 5 because it canrestore data even when failures occur in up to two disks in a parity group.
Disadvantage	Because the parity data P and Q must be updated when data is updated, RAID 6 is imposed write penalty heavier than that on RAID 5, performance of the random writing is lower than that of RAID 5 in the case where the number of drives makes a bottleneck.

Sequential data striping

The enhanced RAID 5+ implementation on the HUS VM attempts to keep write data in cache until parity can be generated without referencing old parity or data. This capability to write entire data stripes, which is usually achieved only in sequential processing environments, minimizes the write penalty incurred by standard RAID 5 implementations. The device data and

parity tracks are mapped to specific physical drive locations within each array group. Therefore, each track of an LDEV occupies the same relative physical location within each array group in the storage system.

In a RAID-6 (dual parity) configuration, two parity drives are used to prevent loss of data in the unlikely event of a second failure during a rebuild of a previous failure.

LDEV striping across array groups

In addition to the conventional concatenation of RAID 1 array groups (4D +4D), the HUS VM supports LDEV striping across multiple RAID 5 array groups for improved logical unit performance in open-system environments. The advantages of LDEV striping are:

- Improved performance, especially of an individual logical unit, due to an increase in the number of data drives that constitute an array group.

- Better workload distribution: in the case where the workload of one array group is higher than another array group, you can distribute the workload by combining the array groups, thereby reducing the total workload concentrated on each specific array group.

The supported LDEV striping configurations are:

- LDEV striping across two RAID 5 (7D+1P) array groups. The maximum number of LDEVs in this configuration is 1000. See the following figure.

- LDEV striping across four RAID 5 (7D+1P) array groups. The maximum number of LDEVs in this configuration is 2000. See Figure 2-5 LDEV Striping Across 4 RAID 5 (7D+1P) Array Groups on page 2-10.
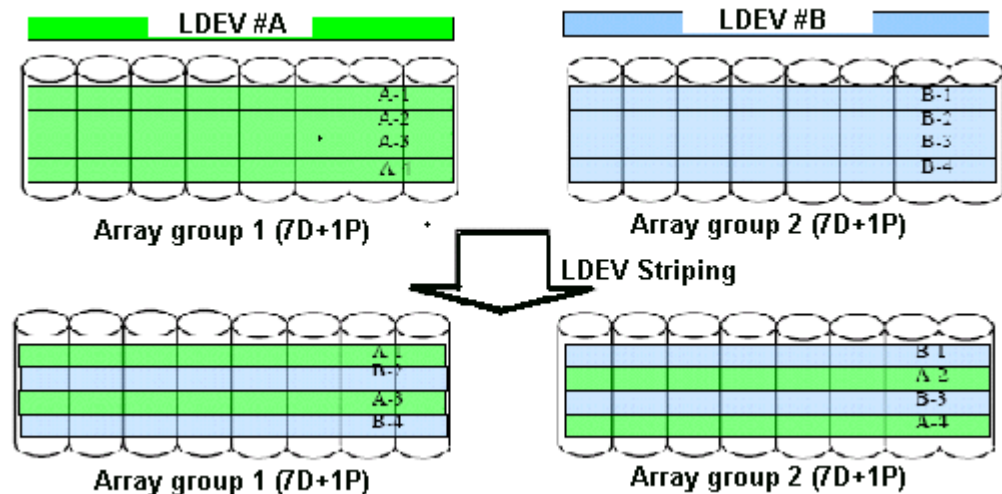
Figure 2-4 LDEV Striping Across 2 RAID 5 (7D+1P) Array Groups
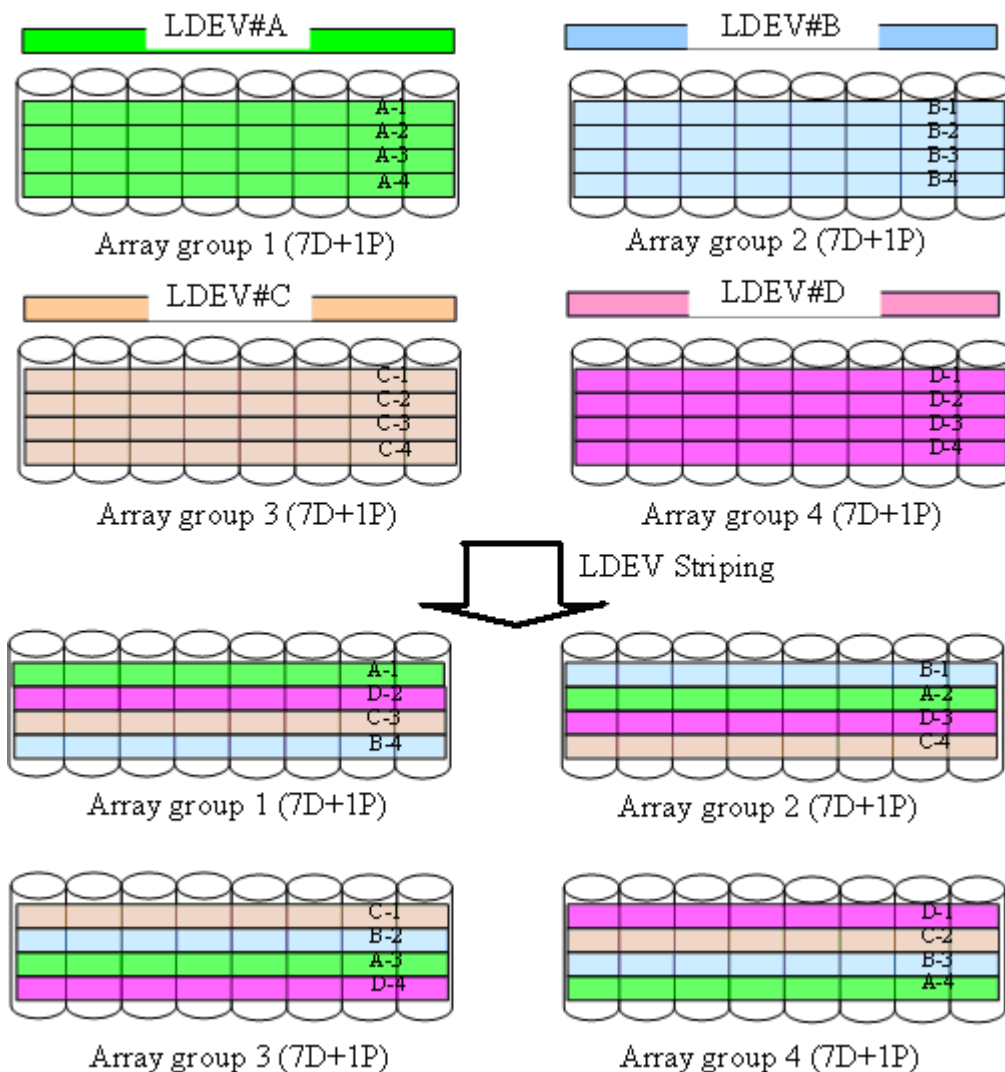
Figure 2-5 LDEV Striping Across 4 RAID 5 (7D+1P) Array Groups

All data drives and device emulation types are supported for LDEV striping. LDEV striping can be used in combination with all HUS VM data management functions.

Systems operations

This section provides high-level descriptions of HUS VM systems compatibility, support, and configuration.

Compatibility and functionality

The HUS VM storage system supports and offers many features and functions for the open-systems environment, including:

- Multi-initiator I/O configurations in which multiple host systems are attached to the same fibre-channel interface

- Fibre-channel arbitrated-loop (FC-AL) and fabric topologies
- Command tag queuing
- Industry-standard failover and logical volume management software
- SNMP remote storage system management

The global cache feature in HUS VM enables any fibre-channel port to have access to any logical unit in the storage system. In the HUS VM, each logical unit can be assigned to multiple fibre-channel ports to provide I/O path failover and/or load balancing (with the appropriate middleware support, such as HGLAM) without sacrificing cache coherency.

The user should plan for path failover (alternate pathing) to ensure the highest data availability. The logical units can be mapped for access from multiple ports and/or multiple target IDs. The number of connected hosts is limited only by the number of FC ports installed and the requirement for alternate pathing within each host. If possible, the primary path and alternate paths should be attached to different channel cards.

Systems host platform support

Hitachi Unified Storage VM supports most major open-system operating systems, such as Microsoft Windows, Oracle Solaris, IBM AIX, Linux, HP-UX, and VMware. For more complete information on the supported operating systems, go to: http://www.hds.com/products/interoperability/index.htm. Each supported platform has a user guide that is included in the HUS VM documentation set. See the Hitachi Unified Storage VM Getting Started Guide for a complete list of HUS VM user guides, including the host configuration guides.

System configuration

After physical installation of the HUS VM has been completed, users can configure the storage system for open-systems operations with assistance as needed from the Hitachi Data Systems representative.

Please refer to the following documents for information and instructions on configuring your HUS VM storage system for open-systems operations:

- The host configuration guides provide information and instructions on configuring the HUS VM storage system and disk devices for attachment to the open-systems hosts.

Note: Queue depth and other parameters may need to be adjusted for the storage system. See the appropriate configuration guide for queue depth and other requirements.

- The *Hitachi Storage Navigator User Guide* provides instructions for installing, configuring, and using Storage Navigator to perform resource and data management operations on the HUS VM .

- The *Hitachi Unified Storage VM Block Module Provisioning Guide* describes and provides instructions for configuring the HUS VM for host operations,

including FC port configuration, LUN mapping, host groups, host modes and host mode options, and LUN Security.

Each fibre-channel port on the HUS VM provides addressing capabilities for up to 2,048 LUNs across as many as 255 host groups, each with its own LUN 0, host mode, and host mode options. Multiple host groups are supported using LUN Security.

- The *Hitachi SNMP Agent User Guide* describes the SNMP API interface for the VSP storage systems and provides instructions for configuring and performing SNMP operations.

- The *Hitachi Unified Storage VM Block Module Provisioning Guide* and Hitachi Volume Shredder User Guide provide instructions for configuring multiple custom volumes (logical units) under single LDEVs on the HUS VM . The *Provisioning Guide for Open Systems* also provides instructions for configuring size-expanded logical units by concatenating multiple logical units to form individual large logical units.

Host Modes and host mode options

HUS VM supports connection of multiple server hosts of different platforms to each of its ports. When your system is configured, the hosts connected to each port are grouped by host group or by target. For example, if Solaris and Windows hosts are connected to a fibre port, a host group is created for the Solaris hosts, another host group is created for the Windows hosts, and the appropriate host mode and host mode options are assigned to each host group. The host modes and host mode options provide enhanced compatibility with supported platforms and environments.

The host groups, host modes, and host mode options are configured using the LUN Manager software on Storage Navigator. For further information on host groups, host modes, and host mode options, refer to the *Hitachi Unified Storage VM Block Module Provisioning Guide*.

Storage Navigator

Storage Navigator is the GUI that accesses the features in the firmware and is used to set up and monitor the storage system. It can be installed on a PC, laptop, or workstation. It communicates via a LAN to the SVP in the HUS VM storage system. The SVP obtains storage system configuration and status information and sends user-initiated commands to the storage system. The Storage Navigator GUI displays detailed storage system information and allows users to configure and perform storage operations on the system.

Storage Navigator is provided as a Java$^®$ applet program that can be executed on any machine that supports a Java Virtual Machine (JVM). A PC hosting the Storage Navigator software is called a remote console. Each time a remote console accesses and logs into the SVP of the desired storage system, the Storage Navigator applet is downloaded from the SVP to the remote console. The following figure illustrates remote console and SVP configuration for Storage Navigator.

For further information about Storage Navigator, see the *Hitachi Storage Navigator User Guide*.
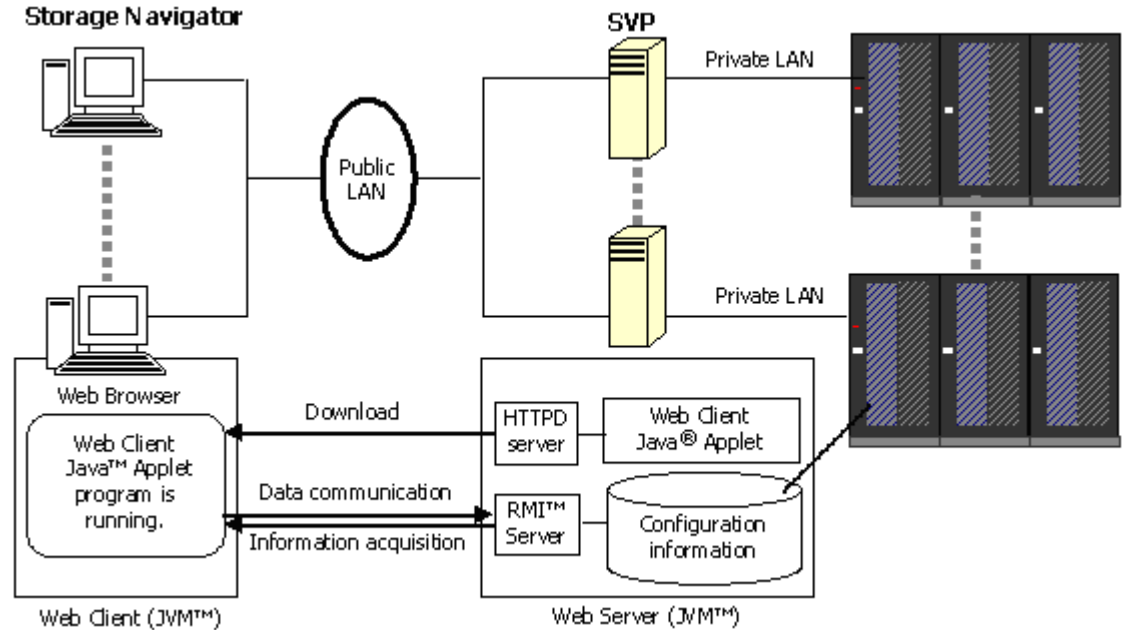
Figure 2-6 Storage Navigator and SVP Configuration

Hardware architecture

3

Safety requirements

Install Hitachi equipment in accordance with the local safety codes and regulations that apply to the facility. This chapter contains additional safety information that may apply to your facility. Read and follow the safety guidelines in this chapter before installing the equipment. The key sections in this chapter are.

☐ General safety guidelines

☐ Work safety guidelines

General safety guidelines

Observe the following general site guidelines:

- **General Requirements:** The data center must comply with all applicable safety regulations, standards, and requirements for installing and operating industrial computer equipment similar to a HUS VM storage system.
- **Fire protection:** The data center must have an operational fire protection system appropriate for use with computer and electrical equipment.
- **Hazards:** The data center must be free of hazards (for example, cables on the floor that block access or that can cause people to trip).
- **Equipment modifications:** Do not make mechanical or electrical modifications to the equipment. Hitachi Data Systems is not responsible for regulatory compliance of a modified Hitachi Data Systems product.
- **Earthquake Safety:** To minimize personal injury in the event of an earthquake, securely fasten the control and drive chassis to a rigid structure extending from the floor to the ceiling or from the walls of the room in which the system is located.
- **Cabling:** Do not block walkways when routing cables. Do not place heavy materials on cables. Do not place cables near any possible source of heat.
- **Warning and safety labels:** Safety warnings, cautions, and instructions in various languages are attached to the VSP storage system components. The safety warnings provide guidelines to follow when working with any equipment. Before working on the storage system, read all safety and warning labels attached to it. If the labels become dirty, damaged, unreadable, or peel off, contact the Hitachi Data Systems support center.
- **Authorized personnel:** Allow only qualified and authorized personnel (for example, a certified electrician) to perform hazardous tasks.

Work safety guidelines

Observe the following site guidelines:

- Do not wear loose clothing that could get caught in the equipment or mounting hardware. Fasten your tie or scarf and roll up your sleeves.
- Wear safety glasses when working under conditions that are hazardous to your eyes.
- Do not perform any action that creates a potential hazard to people or makes the equipment or rack unsafe.
- Keep walkways clear of tools, power cables, and parts to prevent them from being stepped on or causing people to trip and fall over them.
- 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.

- Keep the area clear and dust-free during and after installation.

- Do not block or cover equipment openings. Ensure that all equipment has adequate airflow. Failure to follow these guidelines can cause overheating and affect the system reliability.

- 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.

- The rack is equipped with casters so that you can move it short distances to position it for final installation. Use enough personnel when moving a rack, especially on sloping loading docks and ramps to a raised computer room floor. Move the cabinet slowly and deliberately, and make sure that the floor is free from foreign objects and cables that the cabinet could roll over.

> ⚠️ **WARNING:** To avoid injury, wear protective footwear when moving equipment.

Warning about moving parts

Even though customers do not install or maintain equipment, these guidelines are provided to prevent possible injury when working with authorized service personnel. Observe the following warning related to moving parts:

- Tuck in any loose clothing so that it cannot 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.

Electrical safety guidelines

Even though customers do not install or maintain equipment, these guidelines are provided to prevent possible injury when working with authorized service personnel in the area where equipment is installed. Observe the following electrical safety guidelines:

- Disconnect all power before installation, deinstallation, or moving equipment.

- Ensure that the voltage and frequency of your power source match the voltage and frequency required by the system.

- All 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

- Before starting work, note where the emergency power-off switches are located, and be sure you know how to operate them.

- Before starting work, be sure there are no potential electric hazards in the maintenance area such as insufficient grounding or a wet floor.

Hitachi Unified Storage VM Block Module Hardware User Guide

4

Site preparation

This chapter provides site and system requirements and specifications that are needed to plan a Hitachi Unified Storage VM storage system installation and prepare the site where the system will be installed, so that the equipment installation is efficient and trouble-free.

This chapter may not provide all the information needed for every installation. The installation and maintenance documents used by Hitachi Data Systems personnel contain complete information, including specifications for all possible installations. Contact Hitachi Data Systems support if you need information that is not included in this chapter.

☐ Safety requirements

☐ Responsibilities

☐ Site Preparation checklist

☐ General site requirements

☐ Data center requirements

☐ System specifications and requirements

☐ Service clearance, floor cutout, and floor load rating

☐ Operational requirements

☐ Data cabling

Safety requirements

> ⚠️ **Caution:** Before operating or working on the HUS VM storage system, read the safety and environmental information in <u>Chapter 3, Safety requirements on page 3-1</u>.

Responsibilities

The responsibilities for site planning and preparation are shared by the system users and Hitachi Data Systems support. The required installation planning tasks must be scheduled and completed to ensure successful and efficient installation of the Unified Storage VM storage system.

> 📄 **Note:** The HUS VM storage system must be installed by trained Hitachi Data Systems personnel or trained authorized service providers. The HUS VM storage system is not a customer-installable product.

User responsibilities

You are responsible for performing the following tasks to prepare your site for installation of the HUS VM storage system.

- Understand the applicable safety requirements associated with installing a HUS VM storage system.

- Understand the installation requirements for the HUS VM storage system. You can use the information in this manual to determine the specific requirements for your installation. As needed, review the *Hitachi Unified Storage VM Block Module Hardware User Guide* to familiarize yourself with the components, features, and functions of the HUS VM storage system.

- Verify that the installation site meets all installation requirements. A checklist is included in this section to help you with this task.

- Provide electrical hardware, including cables, connectors and receptacles that are required to connect the HUS VM storage system to site power.

- As needed, work with Hitachi Data Systems support to create an installation plan. Allow enough time to complete any changes to the plan, so your site is ready when the equipment arrives.

Hitachi Data Systems responsibilities

Hitachi Data Systems support is responsible for completing the following tasks:

- Assist you as needed during the installation planning process for your specific site and operational configuration

- Coordinate Hitachi Data Systems resources to ensure a successful installation and configuration of the HUS VM storage system.

Site Preparation checklist

The following checklist can help you ensure that your site meets all requirements to install a Unified Storage VM storage system. You can make copies of this checklist for each installation you perform and check each step after it has been performed. Completing this checklist can help ensure smooth and efficient installation of a HUS VM storage system.

Definition of terms

Equipment: The hardware delivered to the customer site that includes the HUS VM storage system components. The system may be installed in a Hitachi rack when delivered or assembled on site. The delivered equipment may include only the system components if the customer supplies a standard 19-inch rack. Rack specifications are located in Appendix C, Rack information on page C-1.

Location: The specific location in the data center (area or "footprint" on the floor) where the HUS VM storage system will be installed.

User Information	
Company	
Address	
Contact	
Phone	
Mobile	
Email	
Contact	
Phone	
Mobile	
Email	
Hitachi Data Systems Information	
Contact	
Phone	
Mobile	
Email	
Contact	
Phone	
Mobile	
Email	
Notes	.

Preinstallation Checklist	Yes	No
Safety Requirements See Chapter 3, Safety requirements on page 3-1.		
Does the data center provide appropriate fire protection for computer equipment similar to HUS VM storage systems?		
Is the data center free of hazards such as cables that obstruct access to the equipment?		
Delivery Requirements See General site requirements on page 4-5		
Is the receiving area adequate for equipment delivery, unloading and unpacking?		
Are all doors, hallways, elevators, and ramps wide enough and high enough to allow the equipment to be moved from the receiving area to the installation area?		
Can the floors, elevators, and ramps support the weight of the equipment? See Chapter 4 in the *Hitachi Unified Storage VM Block Module Hardware User Guide*.		
Storage Requirements See Storage Requirements on page 4-7.		
If the equipment will be stored after delivery and prior to installation, does the storage location meet the environmental requirements for storing a HUS VM storage system?		
Facilities Requirements See Data center requirements on page 4-7.		
Does the data center have a raised floor?		
Does the location meet the requirements for service clearance and cable routing (for example, floor cutouts)? See Equipment clearances on page 4-5.		
Does the installation site meet the floor load rating requirements?		
Power Requirements See Electrical specifications on page 4-8.		
Does the data center meet the AC input power requirements? See See Electrical specifications on page 4-8, Power connection on page 4-9, and Electrical specifications on page A-5.		
Does the data center meet the circuit breaker and plug requirements? See Data center requirements on page 4-7.		
Is the customer-supplied hardware such as connectors, receptacles, and cables ready for the installation?		
Environmental Requirements See general Environmental specifications on page 4-14 and detailed Environmental specifications on page A-8.		
Does the data center meet the following operational environmental requirements for a HUS VM storage system?		

Site preparation

Preinstallation Checklist		Yes	No
	temperature		
	humidity		
	altitude		
	air flow		
Does the data center provide adequate protection for a HUS VM storage system from the following?			
	electrostatic discharge		
	electrical/radio frequency interference		
.	dust, pollution, and particulate contamination		
Does the data center provide adequate acoustic insulation to operate the Unified Storage VM storage system?			
Operational Requirements See Operational requirements on page 4-16.			
Does the data center provide a LAN for Storage Navigator?			
Does the location meet the cable length requirements for the front-end directors?			
Does the location meet the requirements for attaching external storage?			

General site requirements

The customer site must accommodate the delivery and movement of the equipment from the receiving dock to the installation location in the data center.

Equipment clearances

Receiving area: The receiving dock, storage area, and receiving area must be large enough to allow movement of and access to crated or packed equipment. The dimensions of a shipping crate for a single rack are shown in the following table.

Table 4-1 HUS VM shipping crate dimensions

Item	Height	Width	Depth
Shipping crate, single rack	84 in. / 2134 mm	42 in. / 1067 mm	55 in. / 1397 mm

Other areas: The hallways, doorways, ramps, and elevators must be large enough to allow a single unpacked rack to be moved to the installation

location. Unless the distance between the receiving dock and the data center is very long, HUS VM storage systems are typically unpacked in the receiving area and the individual racks with pre-installed equipment are rolled on their casters to the data center. The following table provides the dimensions of the HUS VM rack.

Table 4-2 HUS VM single A3BF-USP-VM-1 rack dimensions

Item	Height	Width	Depth
Single rack	79 in. / 2010 mm	23.5 in. / 600 mm	43.3 in. /1100 mm

Equipment weight

The floors, elevators, and ramps must be able to support the weight of the delivered equipment as it is moved to the installation location. Spreader plates may be required to distribute the load and protect the floor as the equipment is moved from the receiving area to the installation location. Consult the system bill of materials to establish the approximate weight of the equipment. See the next paragraph for information about calculating the exact weight of the equipment.

The weight for a fully configured storage system can reach **6165** pounds / **2793** kilograms. The exact weight of the equipment depends on the storage system configuration. The following table provides weights of typical system configurations.

Note: The data in the following table was taken from measurements of a system in a controlled environment. To calculate the power draw, current draw, and heat output of a specific system, see Table 4-9 HUS VM component specifications on page 4-12 or (easier) use the Power and Weight calculator at the following URL.
http://www.hds.com/go/weight-and-power-calculator/
Contact technical support if you need assistance using this tool.

Table 4-3 Weight of typical HUS VM system configurations

Dimension		Single Rack	2 racks	3 racks
System Weight	Min (lbs / kg)	467 / 212 (Diskless)	-	-
	Max (lbs / kg)	2166 / 984 (384 LFF drives)	4165 / 1887 (768 LFF drives)	6165 / 2793 (max - 1152 LFF drives)
Rack Weight	(lbs / kg)	286 / 130 w/o panels 343 / 156 w/panels 313 / 142 W&P calc	Rack Weight is included in system weight	

Hitachi Unified Storage VM Block Module Hardware User Guide

Storage Requirements

If the equipment must be stored after delivery and prior to installation, the storage location must meet the storage environmental requirements for the HUS VM storage system. See in this chapter for environmental storage requirements.

Data center requirements

The data center must meet the following general requirements. Detailed mechanical, electrical, and environmental requirements are listed in the tables in the next section.

Table 4-4 Data center requirements

Item	Description
General	The data center must provide appropriate power, air conditioning, cabling, and fire protection.
Temperature	The data center must maintain ambient temperature from 50º F (10ºC) to 104º F (40ºC)
Humidity	The data center must maintain ambient humidity from 20% to 80%, non-condensing
ESD	The data center must provide adequate protection from electrostatic discharge (ESD).
Electrical interference	The data center must provide adequate protection from electrical/radio frequency interference.
Contamination	The data center must provide adequate protection from dust, pollution, and particulate contamination.
Acoustics	The data center must provide adequate acoustic insulation for operating the system.
User-supplied hardware	This includes cables, connectors, and power receptacles that must be available and ready when the system is installed.
User-supplied software	This includes HUS VM supported operating systems on the host and system management console

System specifications and requirements

This section describes the characteristics of a HUS VM storage system, including

Mechanical specifications

Basic system dimensions and configurations of the HUS VM storage system are shown in the following illustration. Detailed specifications follow the illustrations.
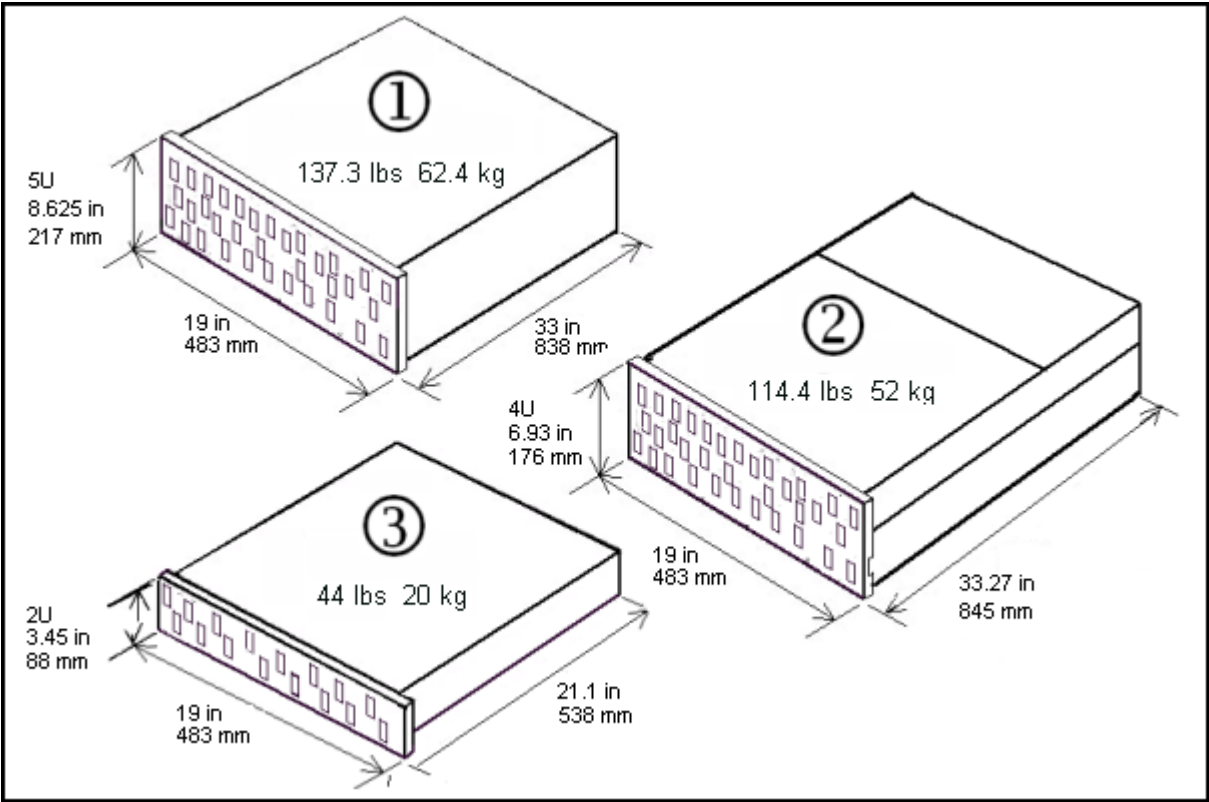
Figure 4-1 HUS VM overview

Table 4-5 HUS VM components

Item	Description	Item	Description	Item	Description
1	Controller Chassis	2	Dense Drive Tray	3	DBS, DBL, and DBF Drive Tray

Table 4-6 HUS VM system dimensions

Dimension (in/mm)	One Rack	Two Racks	Three Racks
Width	23.5 / 600	47 / 1200	70.5 / 1800
Depth	43.3 / 1100	43.3 / 1100	43.3 / 1100
Height	79 / 2100	79 / 2100	79 / 2100

Electrical specifications

Note: The current and power specifications in the following tables were measured on a HUS VM system in a controlled environment. To calculate the

power draw, current draw, and heat output of a specific system, see Table 4-9 HUS VM component specifications on page 4-12 or (easier) use the Power and Weight calculator at the following URL.
http://www.hds.com/go/weight-and-power-calculator/
Contact technical support if you need assistance using this tool.

The following table lists the electric power requirements and approximate power consumption of a typical HUS VM storage system. Detailed electrical specifications are located in Appendix A, Specifications on page A-1.

Table 4-7 HUS VM electric power requirements[1]

Phase	Voltage	Frequency
AC, single phase 2 wire + ground	200 V -8% min 240 V +6% max	50 ±3 Hz 60 ±2 Hz
AC, three phase delta See Table 4-8 PDU plugs, circuit breakers, and receptacles on page 4-10 for connections.	208 V +5/-15%	50/60 Hz
Note 1: See Electrical specifications on page A-5 for detailed voltage and power requirements.		

Grounding

The site and site equipment must meet all of the following three grounding requirements.

- An insulated grounding conductor that is identical in size and insulation material and thickness to the grounded and ungrounded branch-circuit supply conductors. It must be green, with or without yellow stripes, and must be installed as a part of the branch circuit that supplies the unit or system.

- The grounding conductor described above should be connected to earth ground at the service equipment or other acceptable building earth ground. In the case of a high rise steel-frame structure, this can be the steel frame

- The attachment-plug receptacles in the vicinity of the unit or system must include a ground connection. The grounding conductors serving these receptacles must be connected to earth ground at the service equipment or other acceptable building earth ground.

Power connection

The AC power input for the HUS VM storage system has a duplex PDU structure that enables the equipment installed in the entire rack to remain powered on if power is removed from one of the two power distribution panels.

Note: Site power can be connected to the PDUs at either the top or bottom of the racks.

PDU plugs, circuit breakers, and receptacles

The PDU plugs must be appropriate for the power sources at the installation sites. Table 4-8 PDU plugs, circuit breakers, and receptacles on page 4-10 lists the plugs on the end of the PDU power cords. The power distribution panel at the installation site must have receptacles that match these plugs.

Note: Depending on the configuration, the HUS VM storage system may draw considerably less power than the rating of the PDU plugs. Use the weight and power calculator to determine the power draw for a specific system. See the note under Electrical specifications on page 4-8.

Table 4-8 PDU plugs, circuit breakers, and receptacles

Phase	Location	PDU Plug	Operating / Max Voltage Rating	Max Current Rating	No. of CB per PDU	Breaker Rating	Power Supply Receptacle
Single	USA	NEMA L6 30P twistlock 2 pole, 3 wire A + B + gnd	208 VAC / 250 VAC	32 A	2 UL489	16 A, 20 A trip	2 pole, 3 wire 208 VAC A + B + gnd
	Outside USA	IEC 309, blue 2 pole, 3 wire A + B + gnd	230 VAC / 250 VAC	32 A	2 UL489	16 A, 20 A trip	2 pole, 3 wire 208 VAC A + B + gnd
Three	USA	NEMA L15 30P 3 pole, 4 wire A + B + C + gnd	208 VAC / 240 VAC	30 A per phase	3 UL489	15 A 2 pole	2 pole, 3 wire 220 VAC A-B or B-C + gnd
	APAC, EMEA	IEC 309, red 4 pole, 5 wire A + B + C + Neut + gnd	400 VAC / 415 VAC	16 A per phase	6	16 A 2 pole	1 pole, 3 wire 200 VAC A-N or B-N or C-N + gnd
Required number of plugs in each PDU per chassis		Controller chassis		Drive chassis			Same power cord and plug for all power supplies.
		4		4			
Required number of PDUs per rack		Controller rack		Drive rack			Same power cord and plug for all PDPs.
		4		4			
NOTE: The numbers in this table were taken from the PDU manufacturer's specifications. Detailed PDU specifications are located in Appendix C. See PDU specifications on page C-6.							

Power connection diagrams

The following illustrations show the correct way to connect the PDUs to the PDPs. When connected as shown, either of the AC inputs can fail and the system will still operate normally.
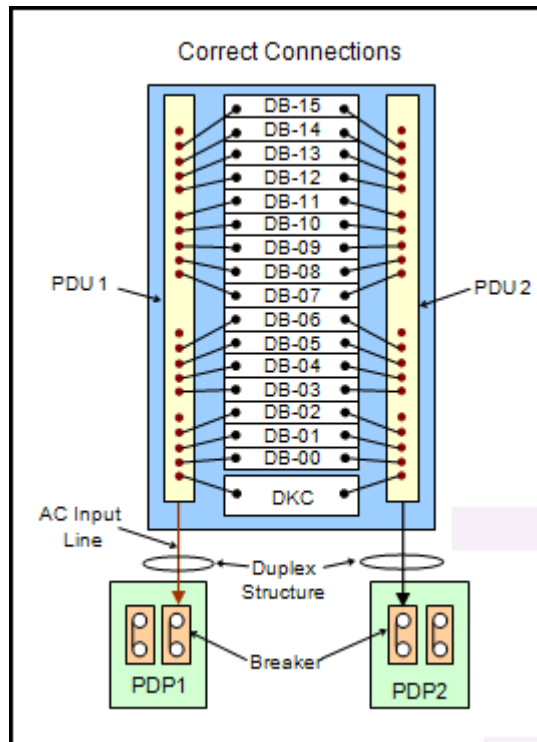
Figure 4-2 PDP Breaker Connections for the control rack

⚠️ **Caution:** When installing a system, do not connect the AC cables as shown in the following illustration. Otherwise, a system failure can occur when either of the AC inputs is interrupted.
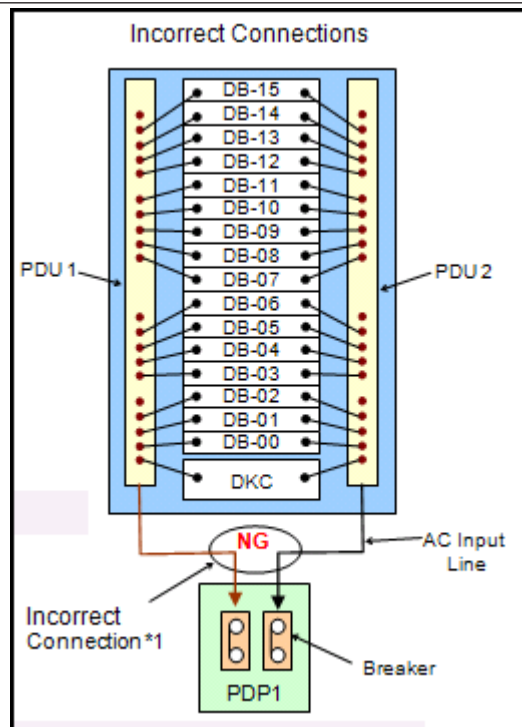
Figure 4-3 Incorrect breaker configurations for the control rack

UPS power connection

The following illustrations show the correct way to connect the PDUs to the PDP when an uninterruptable power supply is used.

Figure 4-4 Breaker configurations when using a UPS

Component weight, heat, airflow, and power consumption

The following table provides physical specifications of the individual HUS VM components.

Table 4-9 HUS VM component specifications

Component Name.	Component Model No.	Weight (lb/Kg)	Power Consumption (VA)	Heat Output	Airflow (cubic meters/sec)
Control Chassis	DW700-CBX DW700-CBXC	137.3 /62.4	464[1]	440[1]	3.7
SFF / LFF drive tray	DW-F700-DBS DW-F700-DBSC	44 / 20	156[1]	148[1]	2.2
Dense drive tray	DW-F700-DBX	114.4 / 52	617[1]	586[1]	5.8
Rack Rail for controller	DW-F700-RRCBR	10.6 / 4.8	-	-	-
Rack Rail for SFF and LFF drive tray	DW-F700-RRDB	4.4 / 2.0	-	-	-

Hitachi Unified Storage VM Block Module Hardware User Guide

Component Name.	Component Model No.	Weight (lb/Kg)	Power Consumption (VA)	Heat Output	Airflow (cubic meters/sec)
SAS Cable (1m)	DW-F700-SC1	0.44 / 0.2	-	-	-
SAS Cable (3m)	DW-F700-SC3	1.32 / 0.6	-	-	-
SAS Cable (5m)	DW-F700-SC5	2.2 / 1.0	-	-	-
	DW-F700-BS6G	1.32 / 0.6	21	20	-
FC SFP for 8Gbps Shortwave	DW-F700-1US	0.44 / 0.2	-	-	-
FC SFP for 8Gbps Longwave	DW-F700-1UL	0.44 / 0.2	-	-	-
back-end I/O module	DF-F850-SC3	0.88 / 0.4	-	-	-
back-end I/O module	DF-F850-SC5	1.76 / 0.8	-	-	-
host I/O module (FC 8G)	DF-F850-HF8GR	1.32 / 0.6	11	10	-
Cache Memory (4GB)	DF-F850-4GB	0.44 / 0.2	3	3	-
Cache Memory (8GB)	DF-F850-8GB	0.66 / 0.3	4	4	-
Cache Flash Memory (160 GB)	DW-F700-BM160	0.7 / 0.32	5^2	5^2	
Drive (300GB SAS SFF)	DF-F850-3HGSSH DF-F850-3HGSSHC	0.66 / 0.3	7.9^3	7.9^3	-
Drive (600GB SAS SFF)	DF-F850-6HGSS DF-F850-6HGSSC	0.66 / 0.3	7.8^3	7.8^3	-
Drive (900GB SAS SFF)	DF-F850-9HGSS DF-F850-9HGSSC	0.66 / 0.3	8.4^3	8.4^3	-
Drive (1200GB SAS SFF)	DF-F850-12HGSS DF-F850-12HGSSC	0.66 / 0.3	4.6^3	4.6^3	-
Drive (3TB SAS LFF)	DF-F850-3TNX DF-F850-3TNXC	1.98 / 0.9	$13,4^3$	$13,4^3$	-
Drive (4TB SAS LFF)	DF-F850-4TNV DF-F850-4TNVC	0.9	14.0^3	14.0^3	-
Drive (200GB SAS SSD SFF)	DF-F850-2HGDM	0.55 / 0.25	5.5^3	5.5^3	-
Drive (400GB SAS SSD SFF)	DF-F850-4HGDM	0.55 / 0.25	5.8^3	5.8^3	-
Drive (800GB SAS SSD SFF)	DF-F850-8HGDM	0.13	7.1^3	6.7^3	-
Drive (1.6 TB FMD)	DKC-F710I-1R6FM^3	18	0.017		
Drive (3.2 TB FMD)	DKC-F710I-3R2FM	19	0.018		

Component Name.	Component Model No.	Weight (lb/Kg)	Power Consumption (VA)	Heat Output	Airflow (cubic meters/sec)

Notes:

1. Maximum values with all fans running at maximum speed.

2. Power is consumed during the battery back-up time only. The standby power is included in DW700-CBX.

3. Actual values at a typical I/O condition. (Random Read and Write, 50 IOPSs for HDD, 2500 IOPSs for SSD, Data Length: 8k bytes) These values may increase for future compatible drives.

Environmental specifications

provides the environmental specifications and requirements for the HUS VM storage system.

Table 4-10 HUS VM environmental specifications

Item	Operating	Not Operating	In Storage
Temperature (ºF / ºC)	SFF drive tray 50 to 104 / 10 to 40	-18 - 122 / -10 to -50	-45 - 110 / -30 to 60
Relative Humidity (%)1	20 to 80	8 to 90	5 to 95
Max. Wet Bulb (ºF / ºC)	78.8 / 26	80.6 / 27	84.2 / 29
Temperature deviation per hour) (ºF / ºC)	50 / 10	50 / 10	68 / 20
Temperature (ºF / ºC)	SFF drive tray 50 to 104 / 10 to 40	-18 - 122 / -10 to -50	-45 - 110 / -30 to 60
Guaranteed value to vibration	Less than 2.45m/S2(0.25G)	Less than 3.9m/s2 (0.4G)No critical damage for product function. (Normal operating with part replacement)	-
Guaranteed value to impact	No impact	78.4m/s^2(8.0G) 15ms	-
Guaranteed value to seismic wave	Less than 2.45 sq. meter (0.25 G)(250gal approx.)	Less than 3.9 m/s^2 (0.4G) (400gal)- No critical damage for product function.(Normal operating with part replacement)Below 9.8 m/s^2 (1.0G) (1000gal)- Ensure own safety with fall prevention	-
Dust	Less than 0.15mg per cubic meter of air	-	-
Altitude	-60 m to 3,000 m	-60 m to 12,000 m	

Item	Operating	Not Operating	In Storage

Notes:

1. Environmental specification for operation should be met before the storage system is powered on. Maximum temperature of 90°F / 32°C should be strictly met at air system air inlet.

2. Recommended temperature range is 21 to 24°C

3. Non-operating condition includes both packing and unpacking conditions unless otherwise specified.

4. The system and components should be packed in factory packing for shipping and storing

5. No condensation in and around the drive should be observed under any conditions. No condensation in and around the drive should be observed under any conditions.

6. The above specifications of vibration are applied to all three axes

7. See ASTM D999-01 The Methods for Vibration Testing of Shipping Containers.

8. See ASTM D5277-92 Test Method for Performing Programmed Horizontal Impacts Using an Inclined Impact Tester.

9. See ASTM D6055-96 Test Methods for Mechanical Handling of Unitized Loads and Large Shipping Cases and Crates.

10. Time is 5 seconds or less in case of the testing with device resonance point (6 to 7Hz.

Airflow

The fans in both the control chassis and the drive trays contain fans to circulate air through the units from front to back. Air flows in through the front bezel to the rear of the component and exits through the perforations in the rear door. The racks do not contain fans.

Equipment noise

The acoustic emission values [loudness in dB (A)] for the HUS VM storage system storage system are:

- Front/rear = 65 dB (A)
- Both sides = 65 dB (A)

Service clearance, floor cutout, and floor load rating

This section describes the service clearance requirements for the HUS VM storage system, based on the clearance and required floor cutouts for cabling.

- Make sure that the service clearance for maintenance is available.
- Do not use the clearance space for storage
- The floor cutout area and dimensions correspond to 19-inch rack specifications
- Hitachi Data Systems recommends that you install the grid panel over 450 x 450 mm on the front side of the rack.
- The floor must have a load rating between 660 lbs (300 Kg) and 1,540 lb (700 Kg) per square meter.

> **Note:** For safe and efficient maintenance operations, clearances should be made as large as possible. Actual clearances for installation should be determined after consulting with the site/facilities manager, as the clearances can vary, depending on building conditions.

Single rack configuration

The following figure shows the service clearances for a single rack configuration.
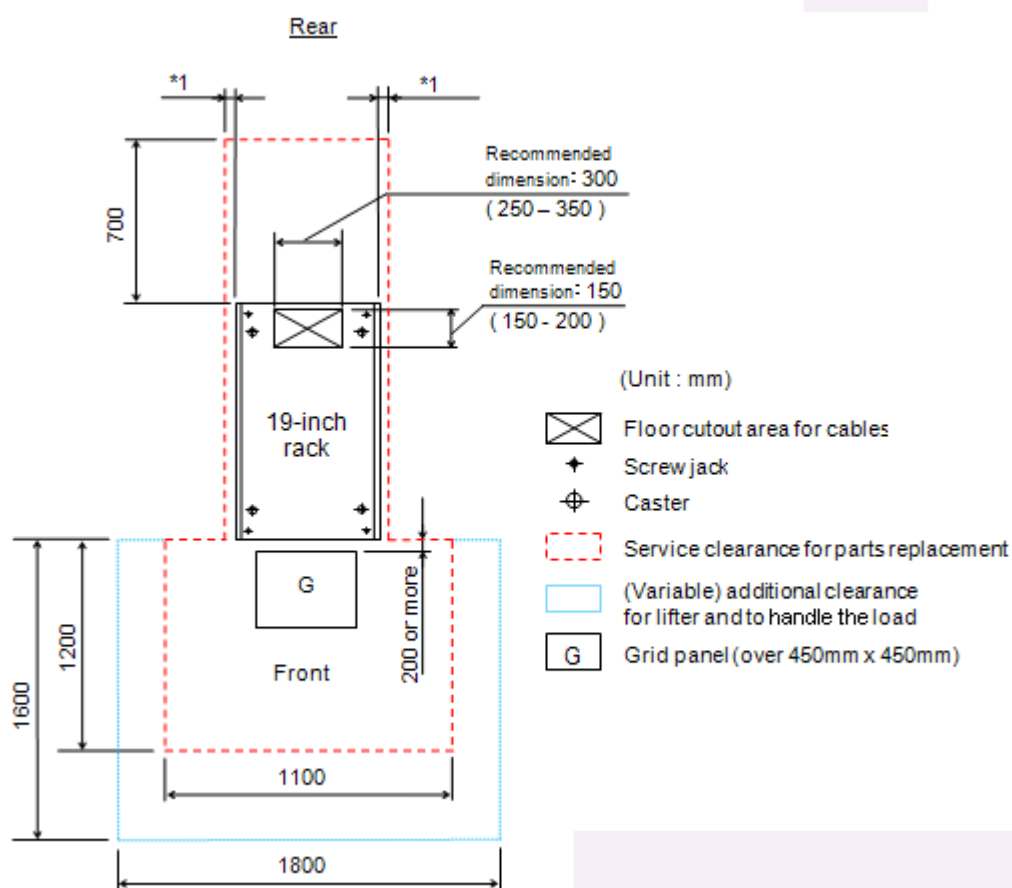
Figure 4-5 Service Clearances, single rack system

Operational requirements

The operational requirements for the HUS VM include:

- **LAN for Storage Navigator**

Storage Navigator communicates with the HUS VM storage system over a LAN to obtain system configuration and status information and send user commands to the storage system. Storage Navigator serves as the integrated interface for all resource manager components.

- **Cable length for host I/O modules**

The following table lists the cable length requirements for the host I/O modules in the HUS VM storage system.

Table 4-11 Maximum cable length (shortwave)

DataTransfer Rate	OM1(62.5/125 f/m multi-mode fiber)	OM2(50/125 f/m multi-mode fiber)	OM3(50/125 f/m laser optimizedmulti-mode fiber)
MB/s	feet / meters	feet / meters	feet / meters
200	492.1 / 150	984.3 / 300	1640.4 / 500
400	229.7 / 70	492.1 / 150	1246.7 / 380
800	68.9 / 21	164 / 50	492.1 / 150

- **External data storage**

If you plan to attach external storage to the HUS VM storage system, be sure to include the appropriate power and space requirements in your planning.

Data cabling

This section provides basic cabling diagrams for connecting ENC (data and control) cables between the control chassis and the drive trays in the block module, and between the controller and HNAS storage in the file module.

Block module

This diagram shows the cabling from the controller to the DBS drive tray (24 SFF drives).
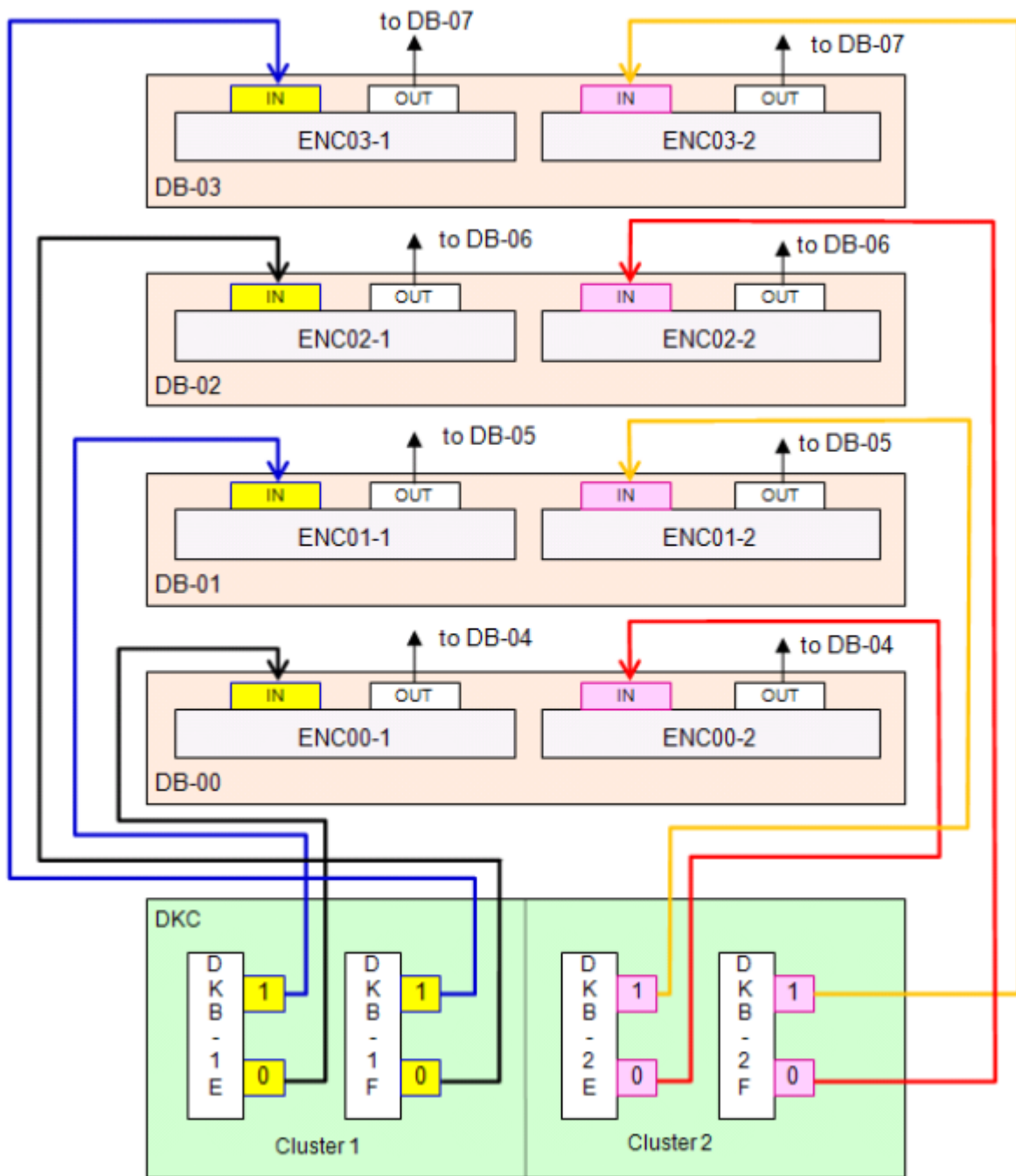
Figure 4-6 Block module ENC cabling for DBS, DBL, and DBF drive trays

This diagram shows the cabling from the controller to the DBX dense drive tray (48 LFF drives).
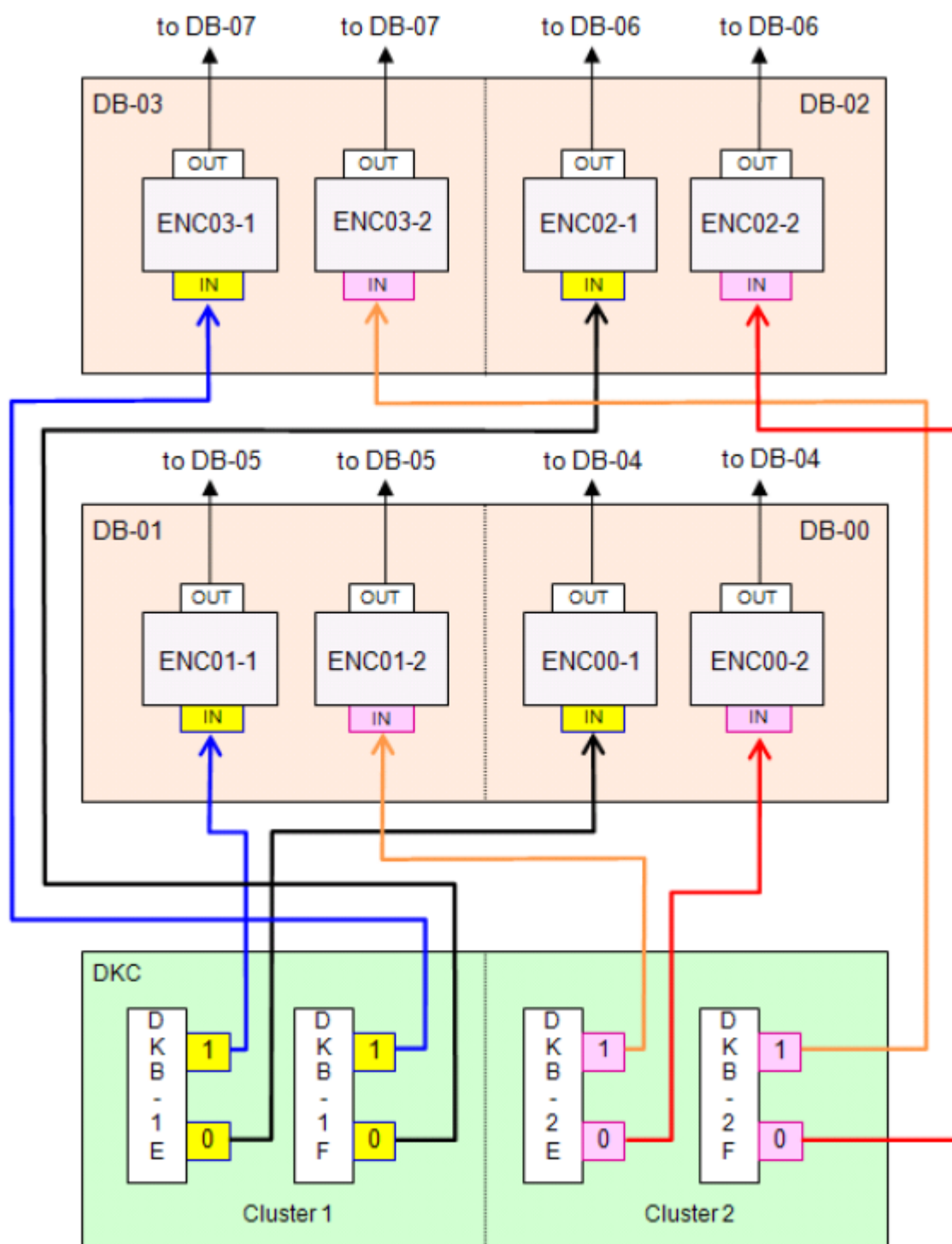
Figure 4-7 Block module ENC cabling for DBX drive trays

File module

This diagram shows the cabling from the controller to HNAS.

Single CHB - Fabric Configuration
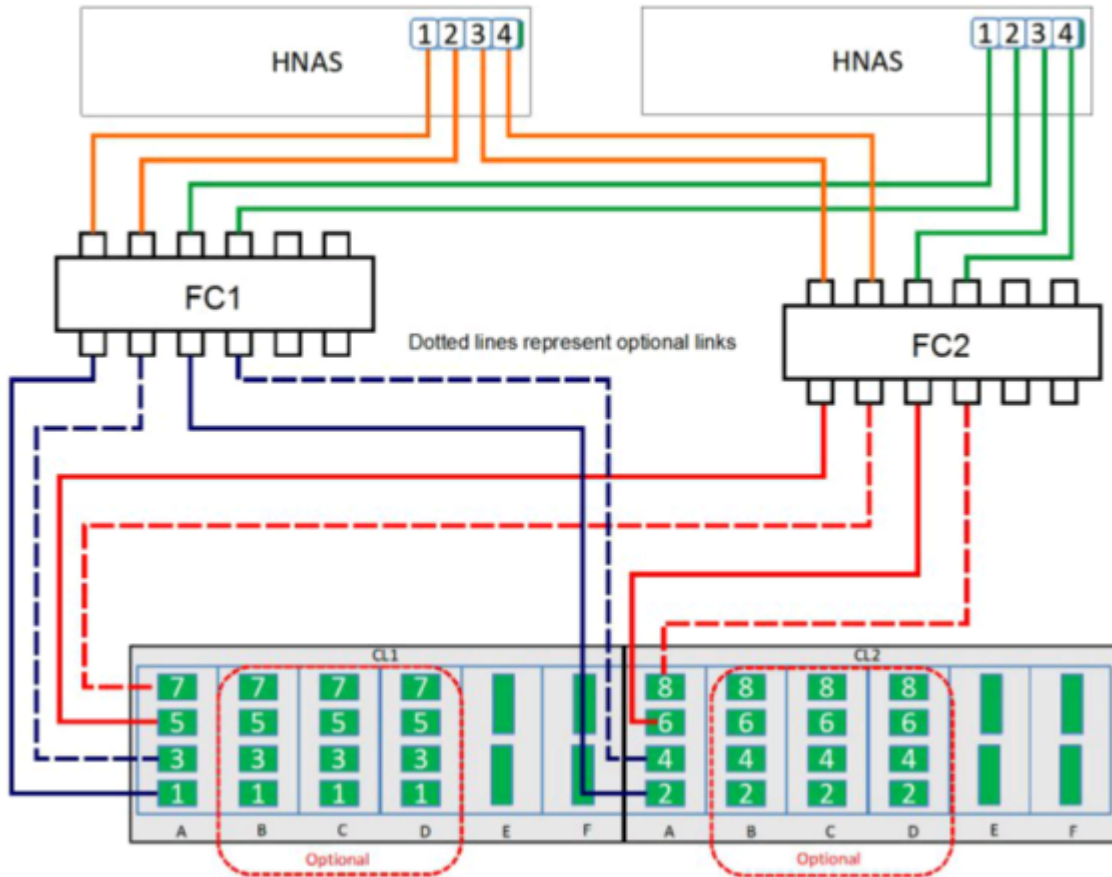
Figure 4-8 File module cabling from controller to HNAS (1 of 4)

Table 4-12 Single CHB - Fabric configuration

HNAS			
1	2	3	4
FC1	FC1	FC2	FC2
FC1			
1	2	3	4
CL1–1A	CL1–3A	CL2–2A	CL1–4A
FC2			
1	2	3	4
CL1–5A	CL1–7A	CL2–6A	CL2–8A
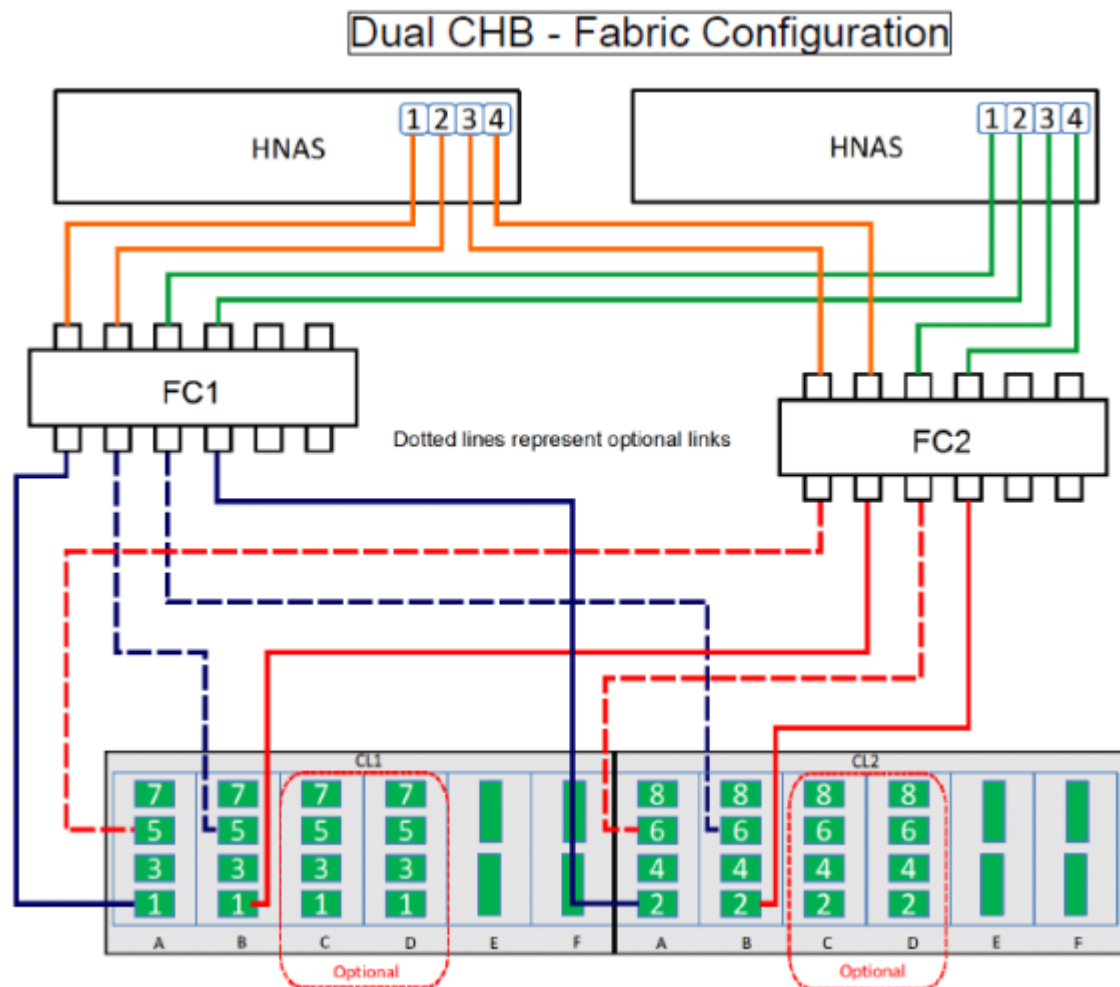
Figure 4-9 File module cabling from controller to HNAS (2 of 4)

Table 4-13 Dual CHB - Fabric configuration

HNAS			
1	2	3	4
FC1	FC1	FC2	FC2
FC1			
1	2	3	4
CL1-1A	CL1-5B	CL2-2A	CL1-6B
FC2			
1	2	3	4
CL1-5A	CL1-1B	CL2-6A	CL2-2B
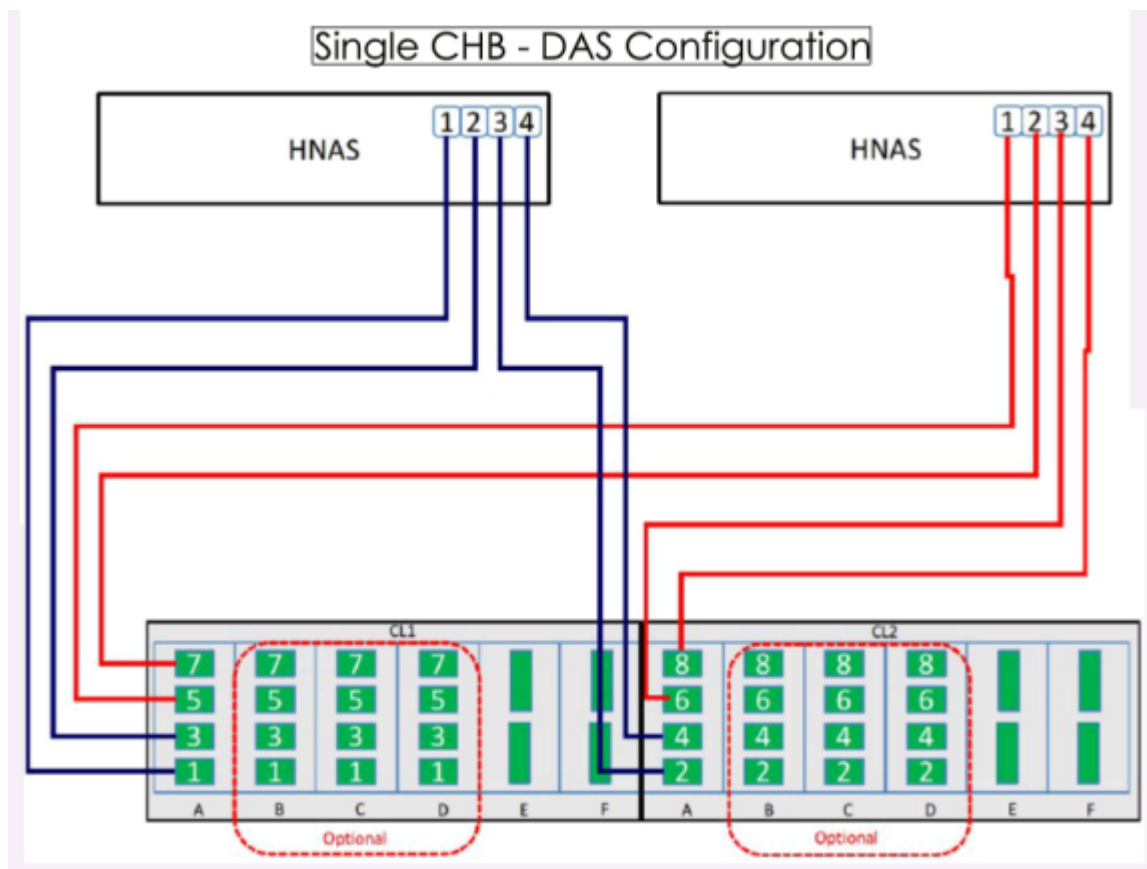
Figure 4-10 File module cabling from controller to HNAS (3 of 4)

Table 4-14 Single CHB - DAS configuration

HNAS1			
1	2	3	4
CL1–1A	CL1–3A	CL2–2A	CL1–4A
HNAS2			
1	2	3	4
CL1–1A	CL1–3A	CL2–2A	CL2–4A
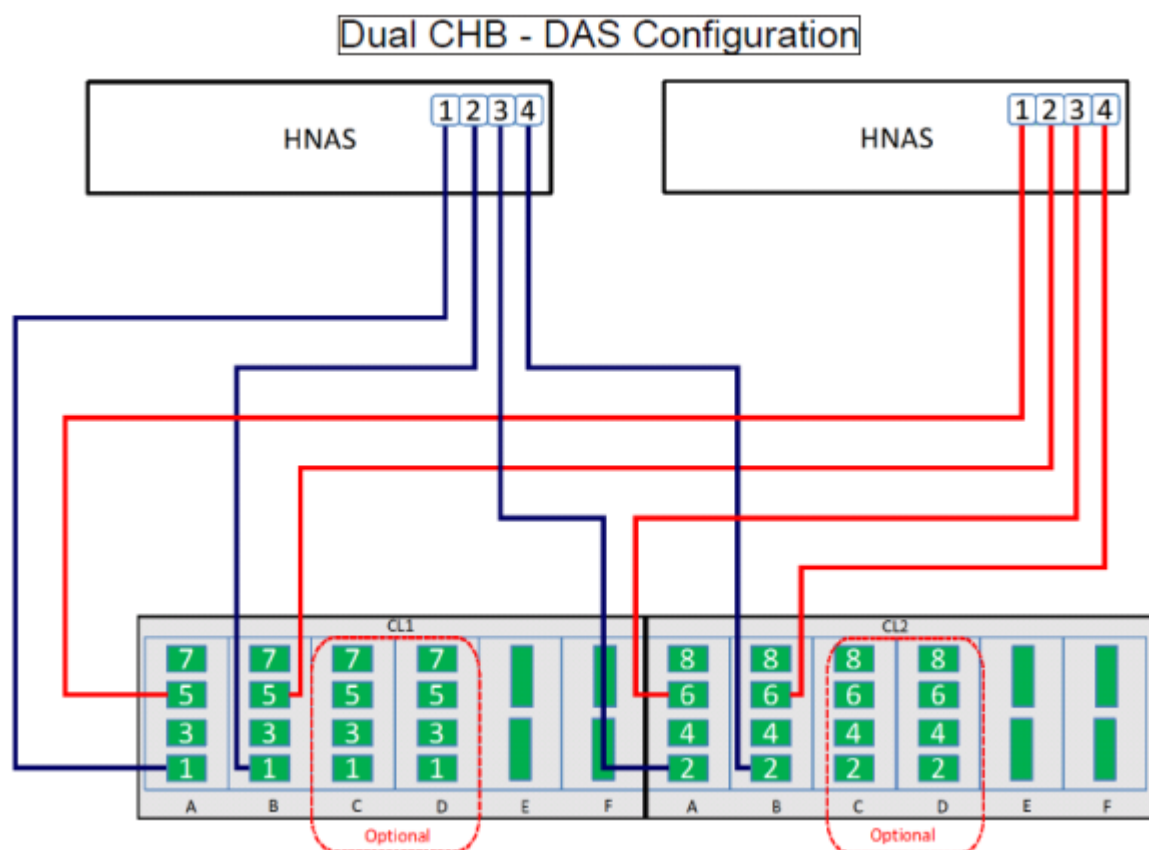
Figure 4-11 File module cabling from controller to HNAS (4 of4)

Table 4-15 Single CHB - DAS configuration

HNAS1			
1	2	3	4
CL1-1A	CL1-1B	CL2-2A	CL2-2B
HNAS2			
1	2	3	4
CL1-5A	CL1-5A	CL2-6A	CL2-6B

Site preparation

5

Power On/Off procedures

This chapter describes the power controls and system status lights, as well as the prerequisites and procedures to turn the HUS VM storage system power on and off. It also describes the procedures to follow in case of a power failure.

Safety and environmental information

> ⚠️ **Caution:** Before operating or working on the HUS VM storage system, read Chapter 3, Safety requirements on page 3-1, and the environmental information in Appendix D, Regulatory Compliance on page D-1 in this manual.

Power controls and indicators

The front panel of the HUS VM storage system controller includes a power ON/OFF switch, and a set of indicator LEDs that show the system status. The are located in the upper left corner of the controller, as shown in the following figure. The table below it describe the controls and indicators.
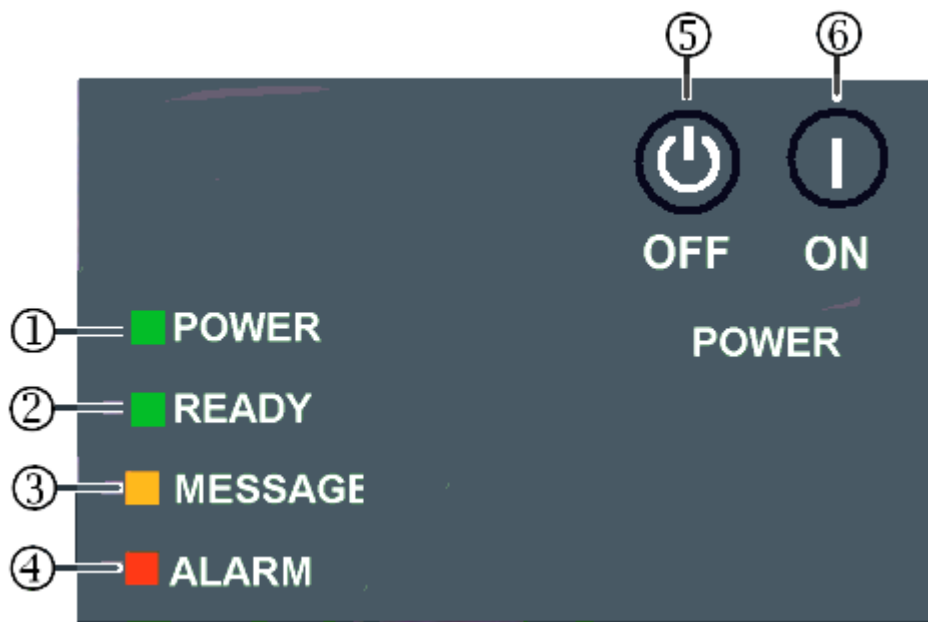
Figure 5-1 Power controls and indicators
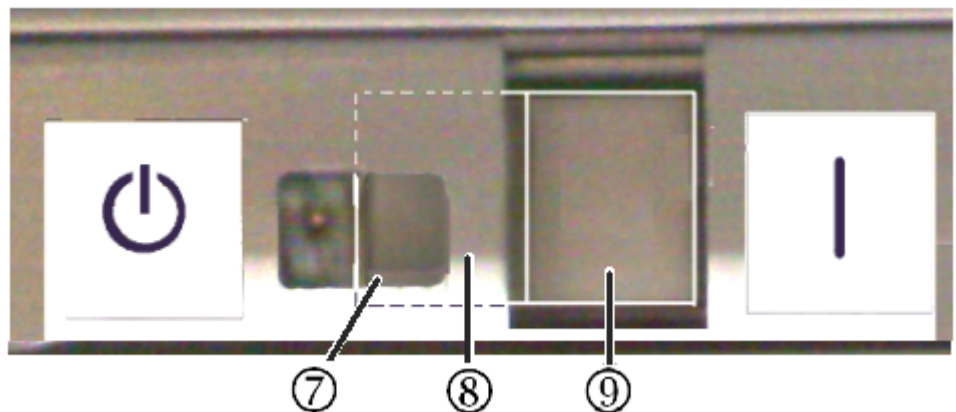
Table 5-1 HUS VM controller, power controls and status indicators

Item	Description	Item	Description	Item	Description
Items 1 - 6 are on the front bezel of the controller chassis.				
1	**POWER LED**- indicates the power status of the system • **Off** when no AC power is applied to the system. • **Amber** when AC power is applied to the system and the system is in standby mode • **Green** when the power switch is ON and the system is running (DC power applied to the system).	2	**READY LED** - indicates the operational status of the system • **Off** when no AC power is applied to the system. • **Amber** when AC power is applied to the system and the system is booting up. • **Green** when the storage system is in operating mode	3	**MESSAGE LED** • **Off** when power is off or when no system generated message is in the queue. • **Amber** * **ON** when a system information message (SIM) is generated by either of the clusters and has been sent to Storage Navigator and to the users that are set up in Storage Navigator to receive them * **Blinking** when a SVP failure has occurred.
4	**ALARM LED** • **Off** when the system is off or when the system is on and operational with no failures . • **Red** when the SVP detects a component failure or other failure condition in the system	5	**POWER OFF** button. Press this button to put the system into standby mode. Note that this does not turn off AC power to the power supplies.	6	**POWER ON** button. Press this button to activate the power supplies, apply DC power to the system components, and start the system POST and boot routines. This takes the system out of Standby mode
Items 7 - 9 are on the front panel of the control chassis (front bezel removed).				
7	**POWER switch**. Press the left side to turn power OFF and put system in Standby mode. See instructions before turning power off.	8	**Metal safety guard** covering most of the OFF side of the POWER switch. This helps to prevent accidental power off.	9	**POWER switch.** Press the right side to turn power ON.

Standby mode

When the storage system power cables are plugged into the PDUs and the PDU breakers are ON, the storage system is in standby mode. When the storage system is in standby mode:

- The POWER LED is amber. This indicates that AC power is applied to the power supplies but DC power is not supplied to the rest of the system, except as noted below.
- The READY LED is OFF. This indicates that the controller and drive trays are not operational.
- The fans in both the controller chassis and drive trays are running.
- The cache destage batteries are being charged.
- The storage system consumes significantly less power than it does in operating mode. For example, a storage system that draws 100 amps while operating draws only about 70 amps in standby mode. See Table A-4 HUS VM electrical specifications, single phase current on page A-5 and Table A-6 Power consumption, single phase current on page A-7 for power consumption specifications.

To put the storage system into standby mode from the OFF condition:

1. Ensure that power is available to the AC input receptacles and PDUs in all racks in which the HUS VM storage system is installed.
2. Turn all PDU power switches/breakers ON.

To put the storage system into standby mode from a power on condition, complete the steps in Power off procedures on page 5-5.

To completely power down the storage system, complete the power off procedures in this chapter, then turn off all PDU circuit breakers.

WARNING: Make certain that the storage system is powered off normally and in standby mode before turning off the PDU circuit breakers. Otherwise, turning off the PDU circuit breakers can leave the storage system in an abnormal condition.

Normal Power on/off procedures

This section provides general information about power on/off procedures for the HUS VM storage system. If needed, call technical support for assistance.

Power on procedures

Prerequisites:

- Ensure that the storage system is in standby mode. See Standby mode on page 5-3.

Follow this procedure exactly when powering the storage system on. Refer to the illustration of the control panel as needed.

1. If the front bezel is installed, press the Power ON/Off button. If the front bezel is not installed, press the right side of the rocker switch move the **POWER ON/OFF** switch to the **ON** position.

2. Wait for the storage system to complete its power-on self-test and boot-up processes. Depending on the storage system configuration, this may take several minutes.

3. When the READY LED is ON, the storage system boot up operations are complete and the storage system is ready for use.

Note: If the ALARM LED is also on, or if the READY LED is not ON after 20 minutes, contact Technical Support for assistance.

Power off procedures

Prerequisites:

- Ensure that all software-specific shutdown procedures have been completed. Refer to the applicable user manuals for details

- Ensure that the SVP mode is set to "View Only".

- Ensure that all I/O activity to the storage system has stopped. You can vary paths offline and shut down the attached hosts.

- Ensure that all users have logged off.

Follow this procedure exactly when powering the storage system off.

1. Wait for the storage system to complete its shutdown routines. Depending on the storage system configuration and certain MODE settings, it can take up to 20 minutes for the storage system to copy data from cache to the disk drives and for the disk drives to spin down.

Note: If the READY LED does not turn OFF after 20 minutes, contact the support center for assistance.

2. If the front bezel is installed, press the POWER OFF button. If the front bezel is not installed, move the **POWER ON/OFF** switch to the **OFF** position.

Emergency power off/on procedure

This section describes the procedures to follow to shut down the system in case of emergency and how to bring the system back up after an emergency shutdown.

Note: Quick Procedure
Controller: Power PDUs off first.   Power PDUs on last.
Drives: Power PDUs off last.   Power PDUs on first.

Emergency power off procedure

The HUS VM storage system does not have an emergency power off switch as the USP V/VM storage system does.

To shut the system down in an emergency, power off the controller first, then the drive units, as follows.

1. Open the back door of the rack that contains the control unit.

   a. Turn off the circuit breakers in **both** lower PDUs in the rack.

   b. Turn off the circuit breakers in both upper PDUs in the racks with the control unit.

2. Open the back doors of all racks that contain only drive units and turn the circuit breakers off in all the PDUs in any order in those racks.

Power on procedure after emergency power off

To power up the HUS VM storage system after emergency shutdown, reverse the emergency power off procedure.

1. In all system racks, turn on the circuit breakers in the PDUs that power the drive units.

2. In the controller rack, turn on the circuit breakers in the PDUs that power the controller.

3. Follow the instructions in .

Battery backup operations

The HUS VM is designed so that it cannot lose data or configuration information if the power fails. The battery system is designed to provide enough power to completely destage all data in the cache if two consecutive power failures occur and the batteries are fully charged. If the batteries do not contain enough charge to provide sufficient time to destage the cache when a power failure occurs, the cache operates in write through mode. This synchronously writes to HDDs to prevent slow data throughput in the cache. When the battery charge is 50% or more, the cache write protect mode operates normally.

When a power failure occurs and continues for 20 milliseconds or less, the storage system continues normal operation. If the power failure exceeds 20 milliseconds, the storage system uses power from the batteries to back up the cache memory data and storage system configuration data to the cache flash memory on each cache board. This continues for up to ten minutes. The flash memory does not require power to retain the data.

The following illustration shows the timing in the event of a power failure.
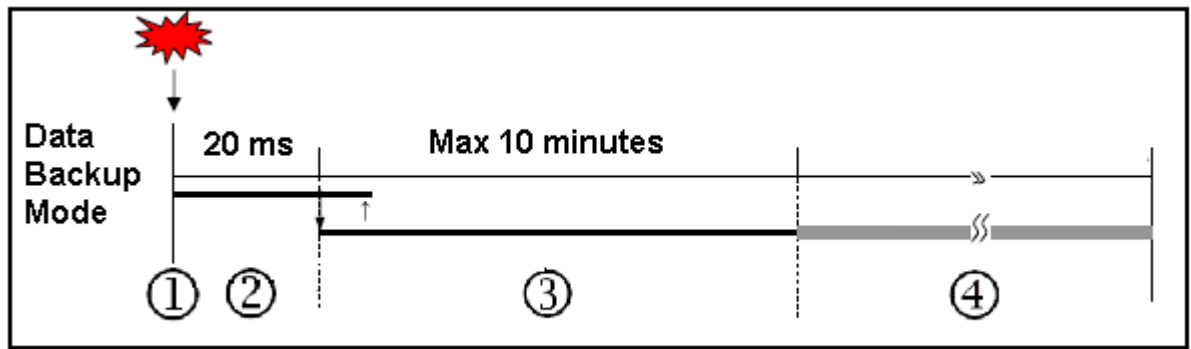
Figure 5-2 Battery backup operations

Item	Description	Item	Description
1	Power failure occurs	2	The storage system continues to operate for 20 milliseconds and detects the power failure.
3	The cache memory data and the storage system configuration are backed up to the cache flash memory on the main boards. The backup continues even if power is restored during the backup.	4	Unrestricted data backup. Data is continuously backed up to the cache flash memory. The cache flash memory consists of two 80 GB SSDs, one on each of the two boards in each main blade.

Cache destage batteries

The environmentally friendly nickel hydride cache destage batteries are used to save storage system configuration and data in the cache in the event of a power failure. The batteries are located on the cache memory boards and are fully charged at the distribution center where the storage system is assembled and tested. Before the system is shipped to a customer site, the batteries are disconnected by a jumper on the cache board. This prevents them from discharging during shipping and storage until the system is installed. At that time, an authorized support person connects the batteries.

Note: The storage system generates a SIM when the cache destage batteries are not connected.

Battery life

The batteries have a lifespan of two years, and will hold a charge for that time when disconnected. When the batteries are connected and power is on, they are charged continuously. This occurs during both normal system operation and while the system is in standby mode.

When the batteries are connected and the power is off, the batteries slowly discharge. They will have a charge of less than 50% after two weeks without power. When fully discharged, the batteries must be connected to power for three hours to fully recharge.

Hitachi Unified Storage VM Block Module Hardware User Guide

> **Note:** The storage system generates a SIM when the cache destage batteries are not charged to at least 50%. The LEDs on the front panel of the cache boards also show the status of the batteries.

Long term array storage

While connected, the cache destage batteries will completely discharge in two to three weeks without power applied. If you do not use a HUS VM for two weeks or more, ask technical support to move the batteries to a storage system that is being used, or turn the storage system on to standby mode for at least 3 hours once every two weeks.

If you store the system for more than two weeks and do not disconnect the cache destage batteries, when you restart the system, the batteries will need to charge for at least 90 minutes before the cache will be protected. To prevent the batteries from discharging during long term storage, call technical support and ask them to disconnect the battery jumpers on the cache boards.

6

Troubleshooting

This chapter provides troubleshooting information for the HUS VM storage system storage system.

☐ Getting help

☐ Solving problems

☐ Service information messages

Getting help

If you have difficulty with any of the procedures included in this chapter, or if a procedure does not provide the answer or results you expect, contact Hitachi Data Systems support. See Getting help on page xi in the preface of this manual.

Solving problems

The HUS VM storage system storage system is highly reliable and is not expected to fail in any way that would prevent access to user data. The READY LED on the control panel must be ON when the storage system is operating online.

The following table lists possible error conditions and provides recommended actions to resolve each condition. If you are unable to resolve an error condition, contact your Hitachi Data Systems representative, or contact Hitachi Data Systems Technical Support for assistance.

Table 6-1 Troubleshooting

Error Condition	Recommended Action
Error message displayed.	Determine the type of error (refer to the SIM codes section. If possible, remove the cause of the error. If you cannot correct the error condition, call the support center for assistance.
General power failure	Turn off all PDU switches and breakers. After the facility power comes back on steady, turn them back on and power the system up. See Chapter 4 for instructions. If needed, call Hitachi Data Systems support for assistance.
Fence message is displayed on the console.	Determine if there is a failed storage path. If so, toggle the RESTART switch, and retry the operation. If the fence message is displayed again, call the support center for assistance.
READY LED does not go on, or there is no power supplied.	Call the support center for assistance.WARNING: Do not open the HUS VM control frame/controller or touch any of the controls.
ALARM LED is on.	If there is a temperature problem in the area, power down the storage system, lower the room temperature to the specified operating range, and power on the storage system. Call the support center if needed for assistance with power off/on operations. If the area temperature is not the cause of the alarm, call the support center for assistance.

Service information messages

The HUS VM generates Service information messages (SIMs) to identify normal operations. For example, TrueCopy pair status change) as well as service requirements and errors or failures. For assistance with SIMs, call the support center.

SIMs can be generated by the host I/O modules and back-end I/O modules and by the SVP. All SIMs generated by the HUS VM are stored on the SVP for use by Hitachi Data Systems personnel, displayed by the Storage Navigator software, and reported over SNMP to the open-system host. The SIM display on Storage Navigator enables users to remotely view the SIMs reported by the attached storage systems. Each time a SIM is generated, the amber Message LED on the control panel turns on. The Hi-Track remote maintenance tool also reports all SIMs to the support center

SIMs are classified according to severity. There are four levels: service, moderate, serious, or acute. The service and moderate SIMs (lowest severity) do not require immediate attention and are addressed during routine maintenance. The serious and acute SIMs (highest severity) are reported to the host system once every eight hours.

Note: If a serious or acute-level SIM is reported, call the support center immediately to ensure that the problem is being addressed.

The following figure illustrates a typical 32-byte SIM from the HUS VM storage system. SIMs are displayed by reference code (RC) and severity. The six-digit RC, which is composed of bytes 22, 23, and 13, identifies the possible error and determines the severity. The SIM type, located in byte 28, indicates which component experienced the error.
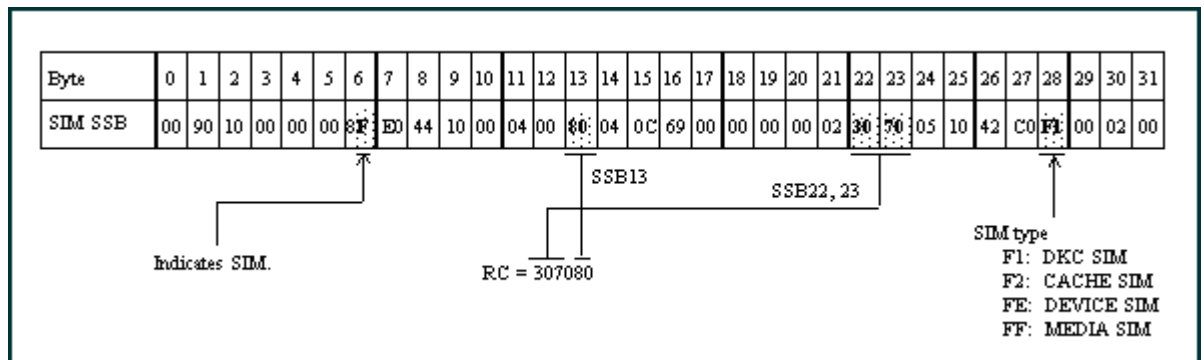
Figure 6-1 Service information message

A

Specifications

This appendix provides the mechanical, electrical, and environmental specifications for the Hitachi Unified Storage VM storage system.

☐ System specifications

☐ Mechanical specifications

☐ Electrical specifications

☐ Environmental specifications

System specifications

The following table lists the system specifications of the HUS VM storage system.

Table A-1 HUS VM system specifications

Item	Specifications	
System	Maximum Storage Capacity	3,383TB (3TB-SAS HDD used)
	Number of Disk Drives	Min: 4 (disk-in model) 0 (diskless model) Max: 1,152
	Maximum Number of Flash Drives	128 *1
	Maximum Number of Spare Drives	64
	Maximum Number of LDEVs / volumes	16,384
	Supported RAID Levels	RAID1, RAID 5, RAID 6
	RAID Group Configuration	RAID1: 2D+2D, 4D+4D RAID5: 3D+1P, 7D+1P RAID6: 6D+2P,14D+2P
	Internal Path	Architecture: Hierarchical Star Net
		Maximum Bandwidth: Cache Path = 128 GB/s Control Path = 64 GB/s
	Back-end Path	SAS 6G: 32 (2WL*6)
Memory	Cache memory capacity	32 GB, 64 GB, 96 GB, 128 GB
	Cache flash memory capacity	160 GB
Number of ports per installation unit	FC 2/4/8 GB	80 (96 *1)/16,8
	FICON 2/4/8 GB	80/16
Device I/F	Controller chassis-drive chassis Interface	SAS/Dual Port
	Data transfer rate	Max. 6 GBps
	Maximum number of HDD per SAS I/F	144
	Number of DKB PCB	4
Channel I/F	Open-systems	2/4/8 GBps Fibre Shortwave: 8UFC/16UFC
	Data Transfer Rate (MB/s, Fibre Channel)	200/400/800
Supported drives	See Table A-2 Drive Specifications on page A-3.	

Item	Specifications	
Management Processor Cores	Quantity	16 cores
MP configuration Minimum/maximum	host I/O modules	2 min, 4 with drives, 8 with no drives max [1]
	back-end I/O modules	0 or 2 / 43
	Cache	2 / 8
	Switches /CSW	2 / 4
Power requirements (see [Table A-4 HUS VM electrical specifications, single phase current on page A-5](#) and [Table A-5 HUS VM electrical specifications, three phase current on page A-6](#) for details)	Single phase to storage system components. Single or three phase to PDU input.	60Hz : 200V to 240V 50Hz : 200V to 240V
Acoustic level	Operating, Controller Chassis	60dB (24ºC or less), 62dB (32ºC)
	Operating, DBS / DBX	54dB (24ºC or less), 60dB (32ºC)
	Standby, Controller Chassis	60dB (24ºC or less), 62dB (32ºC)
	Standby, DBS / DBX	54dB
Notes: 1. When 300 GB is mounted 2. All FED configuration, no BEDs (diskless system) 3. Zero BEDs in a diskless configuration, two BEDs min if drives are installed		

Table A-2 Drive Specifications

Drive Type	Size (inches)[1]	Drive Capacity	Speed (RPM)	
HDD (SAS)	3-1/2	3 TB, 4 TB	7,200	
	2-1/2	600 GB, 900 GB, 1.2 TB	10,000	
	SSD [(MLC SAS) 2] 2-1/2	200 GB and 400 GB		n/a
Flash Module (MLC)	5-1/4	1.6 TB, 3.2 TB	n/a	
Minimum Number of Drives				
Four (two in upper half of drive tray, two in lower half of drive tray). Drives must be added four at a time to create RAID groups, unless they are spare drives.				
Maximum Number of Drives				
Drive Type (inches)	**Drive tray**	Max per drive tray	Max Per system	
HDD, 3-1/2	DBX (dense)	48	1,152	
HDD, 2-1/2	DBS	24	1.152	

Drive Type	Size (inches)[1]	Drive Capacity	Speed (RPM)	
HDD, 3-1/2	DBL	12	1.152	
FMD, 5-1/4	DBF	12	96	
SSD, 2-1/2	128[2]	24 (DBS) or 48 (DBX)	128[3]	
Spare drives[4]	64			
Notes.				
1. the dense drive tray uses only 3-1/2 in. drives. The DBL (LFF) drive tray uses 3-1/2 in. drives. The DBS (SFF) drive tray uses 2-1/2 in. drives.				
2. SSD drives can be mounted all in one drive tray or spread out among all of the drive trays in the storage system.				
3. Recommended maximum number.				
4. Recommended number of spare drives: one spare drive per set of 32 HDDs and one per set of 32 SSDs.				

Mechanical specifications

The following table lists the mechanical specifications of the HUS VM storage system.

Note: The current and power specifications in the following tables were measured on a HUS VM system in a controlled environment. To calculate the power draw, current draw, and heat output of a specific system, see Table 4-9 HUS VM component specifications on page 4-12 or (easier) use the Power and Weight calculator at the following URL.
http://www.hds.com/go/weight-and-power-calculator/
Contact technical support if you need assistance using this tool. See Getting help on page xi in the preface of this manual.

Table A-3 HUS VM mechanical specifications

Dimension		Single Rack	Two racks	Three racks
Width (inches / mm)		23.5 / 600	47 / 1200	70.5 / 1800
Depth (inches / mm)		43.3 / 1100	43.3 / 1100	43.3 / 1100
Height (inches / mm)		79 / 2100	79 / 2100	79 / 2100
System Weight	(lbs / kg)	767 /346 (diskless) 2166 / 984 (384 LFF drives)	4165 / 1887 (768 LFF drives)	6165 / 2793 (max - 1152 LFF drives)
Rack Weight	(lbs / kg)	319.4 / 145.2	Rack Weight is included in system weight	
PDU wright	(lbs / kg)	36 -40 / 79 - 88 (8 - 10 / 17.7 - 22 per PDU)	PDU weight is included in rack weight.	

Specifications

Electrical specifications

The HUS VM storage system can use single phase or three phase AC power.

- lists the single phase specifications.

- lists the three phase power requirements.

- lists the PDU specifications for both single phase and three phase power.

Table A-4 HUS VM electrical specifications, single phase current

Item	Unit	Specification	
Power requirements, system operating [1] Maximum total power consumption for a typical HUS VM storage system during normal operation is TBS amps.	AC, single phase 2 pole + ground	200 V -8% min to 240 V +6% max [1] 50 Hz ±3 Hz, 60 Hz ± 2 Hz	
	Maximum	41.4 KVA	
	Controller chassis power supply	Input Current	3.81 A
		Steady Current	1.91 A
		Leakage Current	0.28 mA
		Inrush current	1st (0-p) 25 A
			2nd (0-p) 20A
			1st (0-p) Time -25%: 150 ms
	DGS and DBL drive tray power supply	Input Current	2.61 A
		Steady Current	1.31 A
		Leakage Current	1.75 mA
		Inrush current	1st (0-p) 25 A
			2nd (0-p) 20A
			1st (0-p) Time (-25%: 150 ms
	Dense drive tray power supply	Input Current	4.03 A
		Steady Current	2.02 A
		Leakage Current	0.87 mA
		Inrush current	1st (0-p) 30A
			2nd (0-p) 30A
			1st (0-p) Time (-25%: 150 ms
Notes 1. 110/120 VAC system is not supported			

Table A-5 HUS VM electrical specifications, three phase current

Item	Unit	Specification	
Power requirements, system operating [1]	AC, three phase [2]	208 V +5/-15%, 50/60 Hz [3]	
	Maximum	41.4 KVA	
	Controller chassis power supply	Input Current	3.81 A
		Steady Current	1.91 A
		Leakage Current	0.28 mA
		Inrush current	1st (0-p) 25 A
			2nd (0-p) 20A
			1st (0-p) Time (-25%: 150 ms
	SFF drive tray power supply	Input Current	2.61 A
		Steady Current	1.31 A
		Leakage Current	1.75 mA
		Inrush current	1st (0-p) 25 A
			2nd (0-p) 20A
			1st (0-p) Time (-25%: 150 ms
	Dense drive tray power supply	Input Current	4.03 A
		Steady Current	2.02 A
		Leakage Current	0.87 mA
		Inrush current	1st (0-p) 30A
			2nd (0-p) 30A
			1st (0-p) Time (-25%: 150 ms

Notes

1. 110/120 VAC system is not supported

2. See Table A-7 PDU plugs, circuit breakers, and receptacles on page A-7 for information about poles and current.

3. The total power consumption of the system is the same whether it uses single phase or three phase power. The difference is that each branch of the three phase input power draws less current than the single phase conductors.

Table A-6 Power consumption, single phase current

Configuration [1]	Max Power Consumption [3, 5]
	Current per rack
R00 controller[4]	
R01 drive 1)[4]	
R02 drive 2)[4]	
Total Power	
Notes: 1. The numbers in this table were calculated with the Weight and Power calculator Depending on the air temperature and actual voltage where the system is installed, current draw can vary as much as + or - 10%. To predict power draw for a specific system, contact technical support for assistance. 2. Idle condition - system is powered on but not being accessed. 2. Max power consumption - all disks are in write mode. 3. R00 is the controller rack with one controller chassis and NNN drive trays. 4. R01and R02 are drive racks with NNN drive chassis each. 5. Configured with the maximum of 2048 146 GB SAS drives.	
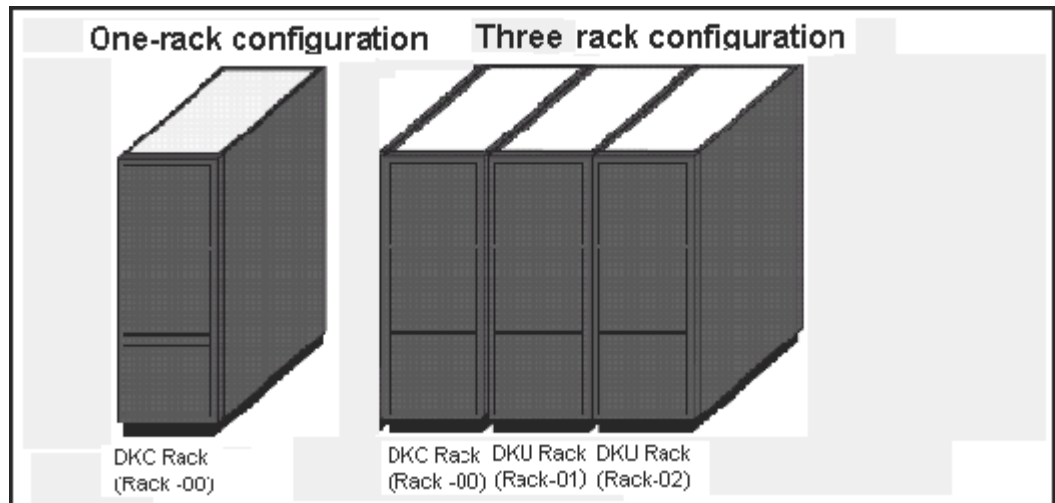
Figure A-1 Rack numbers

Table A-7 PDU plugs, circuit breakers, and receptacles

Phase	Location	PDU Plug	Operating / Max Voltage Rating	Max Current Rating	No. of CB per PDU	Breaker Rating	Power Supply Receptacle
Single	Americas (except Brazil)	NEMA L6 30P twistlock 2 pole, 3 wire	208 VAC / 250 VAC	32 A	2 UL489	16 A, 20 A trip	2 pole, 3 wire 220 VAC A + B + gnd

Phase	Location	PDU Plug	Operating / Max Voltage Rating	Max Current Rating	No. of CB per PDU	Breaker Rating	Power Supply Receptacle
		A + B + gnd					
	EMEA / APAC/ Brazil	IEC 309, blue 2 pole, 3 wire A + B + gnd	230 VAC / 250 VAC	32 A	2 UL489	16 A, 20 A trip	2 pole, 3 wire 220 VAC A + B + gnd
Three	Americas including Brazil	NEMA L15 30P twistlock pole, 4 wire A + B + C + gnd	208 VAC / 240 VAC	30 A per phase	3 UL489	15 A 2 pole	2 pole, 3 wire 220 VAC A-B or B-C + gnd
	APAC/ EMEA	IEC 309, red 4 pole, 5 wire A + B + C + Neut + gnd	400 VAC / 415 VAC	16 A per phase	6	16 A 2 pole	1 pole, 3 wire 200 VAC A-N or B-N or C-N + gnd
Required number of plugs in each PDU for each controller chassis or drive tray		Controller chassis 1		Drive tray 1			Same power cord and plug for all power supplies
Required number of PDUs per rack		Controller rack 4		Drive rack 4			Same power cord and plug for all PDPs
NOTE: The numbers in this table were taken from the PDU manufacturer's specifications.							

Environmental specifications

The following table lists the specifications of the environmental conditions needed to support the HUS VM storage system.

Table A-8 HUS VM environmental specifications

Item	Operating[1,2]	Not Operating[3]	Shipping and Storage[4]
Temperature (°F / °C)	SFF drive tray 50 to 104 / 10 to 40	-18 - 122 / -10 to -50	-45 - 110 / -25 to 60
Relative Humidity (%)[5]	20 to 80	8 to 90	5 to 95
Max. Wet Bulb (°F / °C)	78.8 / 26	80.6 / 27	84.2 / 29
Temperature deviation per hour) (°F / °C)	50 / 10	50 / 10	68 / 20
Temperature (°F / °C)	SFF drive tray 50 to 104 / 10 to 40	-18 - 122 / -10 to -50	-45 - 110 / -30 to 60
Vibration	5 to 10Hz: 0.25mm	5 to 10 Hz: 2.5 mm	Sine Vibration:

Item	Operating[1,2]	Not Operating[3]	Shipping and Storage[4]
to 10Hz: 0.25 mm	10 to 300 Hz 0.49 m/s^2	10 to 70 Hz: 4.9 m/s^2 70 to 99 Hz: 0.05 mm 99 to 300 Hz: 9.8 m/s^2	4.9 m/s^2, 5 min. At the resonant frequency with the highest displacement found between 3 to 100 Hz [6] Random Vibration[7] 0.147 m2/s3 30 min, 5 to 100 Hz
Earthquake resistance (m/s2)	Up to 2.5 [10]	-	-
Shock	-	78.4 m/s^2, 15 ms	Horizontal[8] Incline Impact 1.22 m/s Vertical: Rotational Edge 0.15 m [9]
Acoustic Level DBS DBL DBX DBF	60dB 60dB 62dB 60dB	55dB 55dB 57dB 55dB	n/a
Dust	Less than 0.15mg per cubic meter of air	-	-
Altitude	-60 m to 3,000 m	-60 m to 12,000 m	

Notes:

1. Environmental specification for operation should be met before the storage system is powered on. Maximum temperature of 90°F / 32°C should be strictly met at air system air inlet.

2. Recommended temperature range is 21 to 24°C

3. Non-operating condition includes both packing and unpacking conditions unless otherwise specified.

4. The system and components should be packed in factory packing for shipping and storing

5. No condensation in and around the drive should be observed under any conditions. No condensation in and around the drive should be observed under any conditions.

6. The above specifications of vibration are applied to all three axes

7. See ASTM D999-01 The Methods for Vibration Testing of Shipping Containers.

8. See ASTM D5277-92 Test Method for Performing Programmed Horizontal Impacts Using an Inclined Impact Tester.

9. See ASTM D6055-96 Test Methods for Mechanical Handling of Unitized Loads and Large Shipping Cases and Crates.

10. Time is 5 seconds or less in case of the testing with device resonance point (6 to 7Hz.

Specifications

B

System option modes

This appendix lists and describes the public system option modes.

☐ System option modes

System option modes

To provide greater flexibility and enable the HUS VM to be tailored to unique customer operating requirements, additional operational parameters, or system option modes, are available. At installation, the modes are set to their default values, as shown in the following table. Be sure to discuss these settings with your Hitachi Data Systems team if you think changes should be made. The system option modes can only be changed by a Hitachi Data Systems representative.

The following tables provide information about system option modes and and SVP operations:

The following tables were up to date at the time this manual was published. However, the system option mode information may change in firmware releases that may happen before the next release of this manual. Contact Hitachi Data Systems support for the latest information on the HUS VM system option modes.

The system option mode information includes:

- Mode: Specifies the system option mode number.
- Category: Indicates the functions to which the mode applies.
- Description: Describes the action or function that the mode provides.
- Default: Specifies the default setting (ON or OFF) for the mode.
- MCU/RCU: For remote functions, indicates whether the mode applies to the main control unit (MCU) and/or the remote control unit (RCU).

Table B-1 System option modes

Mode	Category	Description	Default	MCU/RCU
20	Public (Optional)	R-VOL read only function.	OFF	MCU
22	Public	Regarding the correction copy or the drive copy, in case ECCs/LRC PINs are set on the track of copy source HDD, mode 22 can be used to interrupt the copy processing (default) or to create ECCs/LRC PINs on the track of copy target HDD to continue the processing. Mode 22 = ON: If ECCs/LRC PINs (up to 16) have been set on the track of copy source HDD, ECCs/LRC PINs (up to 16) will be created on the track of copy target HDD so that the copy processing will continue.	OFF	-

Mode	Category	Description	Default	MCU/R CU
		If 17 or more ECCs/LRC PINs are created, the corresponding copy processing will be interrupted.		
		Mode 22 = OFF (default):		
		If ECCs/LRC PINs have been set on the track of copy source HDD, the copy processing will be interrupted.		
		(first recover ECCs/LRC PINs by using the PIN recovery flow, and then perform the correction copy or the drive copy again)		
		One of the controlling option for correction/drive copy.		
80	MRCF	ShadowImage	OFF	-
		In response to the Restore instruction from the host, if neither Quick nor Normal is specified, the following operation is performed.		
		Mode 80 = ON: Normal Restore (Reverse Copy) is performed.Mode 80 = OFF (default): Quick Restore is performed.Note.1. This mode is applied when the specification for Restore of ShadowImage is switched between Quick (default) and Normal.2. The performance of Restore differs depending on the Normal or Quick specification.		
87	HOMRCF	Determines whether NormalCopy or QuickResync, if not specified, is performed at the execution of pairresync by CCI.	OFF	-
		Mode 87 = ON: QuickResync is performed.		
		Mode 87 = OFF: NormalCopy is performed.		
122	ShadowImage	For Split or Resync request from the Mainframe host and Storage Navigator.	OFF	-
		Mode 122 = ON:		
		By specifying Split or Resync, Steady/Quick Split or Normal/Quick Resync is respectively executed in accordance with Normal/Quick setting.		
		Mode 122 = OFF (default)?		
		By specifying Split or Resync, Steady/Quick Split or Normal/Quick Resync is respectively executed in accordance with the Normal/Quick setting.		
		For details, see SOM122 sheet.		
		Note:		
		1. For HUS VM, this mode is applied to use scripts etc that are used on RAIrD400 and 450		
		2. 2 Executing the pairresync command from CCI may be related to the SOM087 setting.		
		3. When performing At-Time Split from CCI, Set this mode to OFF or specify the environment variable HORCC_SPLT for Quick. Otherwise, Pairsplit may turn timeout.		
		4. The mode becomes effective after specifying Split/ Resync following the mode setting. The mode function		

Mode	Category	Description	Default	MCU/RCU
		does not work if it is set during the Split/Resync operation		
278	Open	Tru64 (Host Mode 07) and OpenVMS (Host Mode 05) Caution: Host offline: Required	OFF	-
292	HRC	When mode 114 is on and the host is connected with the CNT-made FC switch (FC9000 etc.), and is using TrueCopy S/390 with Open Fibre connection, the Link Incident Report for the host from the FC switch will be deterred when switching the CHT port attribute (including automatic switching when executing CESTPATH and CDELPATH Mode292=ON: When switching the port attribute, issue the OLS (100ms) first, and then reset the Chip. Mode292=OFF (default): When switching the port attribute, reset the Chip without issuing the OLS.	OFF	Both
448	Universal Replicator	ON: (Enabled) If the SVP detects a blocked path, the SVP assumes that an error occurred, and then immediately splits (suspends) the mirror. OFF: (Disabled) If the SVP detects a blocked path and the path does not recover within the specified period of time, the SVP assumes that an error occurred, and then splits (suspends) the mirror.Note: The mode 448 setting takes effect only when mode 449 is set to OFF.	OFF	
449	Universal Replicator	Detecting and monitoring path blockade between MCU and RCU of Universal Replicator<Functionality> - Mode 449 on: Detecting and monitoring of path blockade will NOT be performed.- Mode 449 off (default *) : Detecting and monitoring of the path blockade will be performed.* Newly shipped DKC will have Mode 449 = ON as default.Note: The mode status will not be changed by the microcode exchange.		
454	Virtual Partition Manager	CLPR (Function of Virtual Partition Manager) partitions the cache memory in the disk subsystem into multiple virtual cache and assigns the partitioned virtual cache for each use. If a large amount of cache is required for a specific use, it can minimize the impact on other uses. The CLPR function works as follows depending on whether SOM454 is set to ON or OFF. Mode 454 = OFF (default):The amount of the entire destage processing is periodically determined by using the highest workload of all CLPRs (*a). (The larger the workload is, the larger the amount of the entire destage processing becomes.)*a: (Write Pending capacity of CLPR#x) ÷ (Cache capacity of CLPR#x), x=0 to 31 CLPR whose value above is the highest of all CLPRsBecause the destage processing would be accelerated depending on CLPR with high workload, when the workload in a specific CLPR increases, the risk of host I/O halt would be reduced. Therefore, set Mode 454 to OFF in most cases. Mode 454 = ON:The amount of the entire destage processing is periodically determined by using the workload of the entire system (*b). (The larger the workload is, the larger the amount of the entire	OFF	-

Mode	Category	Description	Default	MCU/RCU
		destage processing becomes.) *b: (Write Pending capacity of the entire system) ÷ (Cache capacity of the entire system) Because the destage processing would not be accelerated even if CLPR has high workload, when the workload in a specific CLPR increases, the risk of host I/O halt would be increased. Therefore, it is limited to set Mode 454 to ON only when a CLPR has constant high workload and it gives priority to I/O		
457	ESM	The high speed LDEV format for external volumes is available by setting System Option Mode 457 to ON. When Mode 457 is ON and you select the external volume group and format an LDEV, any Write processing on the external LUs will be skipped. **Mode 457 = ON:** High speed LDEV format for external volumes is supported . Control Block Write of external LDEVs in Mainframe emulation is supported by Storage Navigator. When the LDEV is not written with data "0" before performing the function, the LDEV format may fail. After the formatting is complete, set System Option Mode 457 to OFF.	OFF	Both
459	ShadowImage	When the secondary volume of an SI/SIz pair is an external volume, the transaction to change the status from SP-PEND to SPLIT is as follows: 1. **Mode 459 = ON** when creating an SI pair: The copy data is created in cache memory. When the write processing on the external storage completes and the data is fixed, the pair status will change to SPLIT. 2. **Mode 459 = OFF** when creating an SI/SIz pair Once the copy data has been created in cache memory, the pair status will change to SPLIT. The external storage data is not fixed (current spec).	OFF	-
466	Universal Replicator	For UR/URz operations it is strongly recommended that the path between main and remote storage systems have a minimum data transfer speed of 100 Mbps. If the data transfer speed falls to 10 Mbps or lower, UR operations cannot be properly processed. As a result, many retries occur and UR pairs may be suspended. Mode 466 is provided to ensure proper system operation for data transfer speeds of at least 10 Mbps. Mode 466 = ON: Data transfer speeds of 10 Mbps and higher are supported. The JNL read is performed with 4-multiplexed read size of 256 KB. Mode 466 = OFF: For conventional operations. Data transfer speeds of 100 Mbps and higher are supported. The JNL read is performed with 32-multiplexed read size of 1 MB by default. **Note:** The data transfer speed can be changed using the Change JNL Group options.	OFF	
467	ShadowImage, ,Compatible	For the following features, the current copy processing slows down when the percentage of "dirty" data is 60% or	ON	

Mode	Category	Description	Default	MCU/RCU
	FlashCopy® V2, Snapshot, Volume Migration, Universal Volume Manager	higher, and it stops when the percentage is 75% or higher. Mode 467 is provided to prevent the percentage from exceeding 60%, so that the host performance is not affected. ShadowImage, , Compatible FlashCopy® V2, Snapshot, Volume Migration, Universal Volume Manager Mode 467 = ON: Copy overload prevention. Copy processing stops when the percentage of "dirty" data reaches 60% or higher. When the percentage falls below 60%, copy processing restarts. Mode 467 = OFF: Normal operation. The copy processing slows down if the dirty percentage is 60% or larger, and it stops if the dirty percentage is 75% or larger. **Caution:** This mode must always be set to ON when using an external volume as the secondary volume of any of the above-mentioned replication products. **Note:** It takes longer to finish the copy processing because it stops for prioritizing the host I/O performance.		
471	Copy-on-Write Snapshot (Earlier than 70-05-0x-00/00) Copy-on-Write Snapshot, Hitachi Thin Image (70-05-0x-00/00 or higher)	Since the SIM-RC 601xxx that are generated when the usage rate of Pool used by Snapshot exceeds the threshold value can be resolved by users, basically they are not reported to the maintenance personnel.This option is used to inform maintenance personnel of these SIMs that are basically not reported to maintenance personnel in case these SIMs must be reported to them. SIMs reported by setting the mode to ON are: • SIM-RC 601xxx (Pool utilization threshold excess) (Earlier than 70-05-0x-00/00) • SIM-RC 601xxx (Pool utilization threshold excess)/ 603000 (SM Space Warning) (70-05-0x-00/00 or higher:) Mode 471 = ON:This kind of SIMs is reported to maintenance personnel.Mode 471 = OFF (default):This kind of SIMs is not reported to maintenance personnel.Note:Set this mode to ON when it is required to inform maintenance personnel of the SIM-RC(*) SIMs reported by setting the mode to ON are: • SIM-RC 601xxx (Pool utilization threshold excess) (Earlier than 70-05-0x-00/00) • SIM-RC 601xxx (Pool utilization threshold excess)/ 603000 (SM Space Warning) (70-05-0x-00/00 or higher:)	OFF	
474	Universal Replicator	UR initial copy performance can be improved by issuing a command from CCI/SI Manager to execute a dedicated script consists of UR initial copy (Nocopy), UR suspend, TC (Sync) initial copy, TC (Sync) delete, and UR resync.Mode 474 = ON:For a suspended UR pair, a TC-Sync pair can be created with the same P-VOL/S-VOL so that UR initial copy time can be reduced by using the dedicated script.Mode 474 = OFF (default):For a suspended UR pair, a TC-Sync pair cannot be created with the same P-VOL/S-	OFF	MCU/RCU

System option modes

Mode	Category	Description	Default	MCU/RCU
		VOL. For this, the dedicated script cannot be used.Note:1. Set this mode for both MCU and RCU.2. When the mode is set to ON; - Execute all of pair operations from CCI/ BCM.- Use a dedicated script.- Initial copy operation is prioritized over update I/O. Therefore, the processing speed of the update I/O slows down by about 15?s per command. 3. If this mode is set to ON, the processing speed of update I/O slows down by about 15?s per command, version downgrade is disabled, and Take Over is not available.		
		4. If the mode is not set to ON for both or either sides, the behavior is as follows.		
		- Without setting on both sides: Normal UR initial copy performance.- With setting on MCU/without setting on RCU: TC Sync pair creation fails.- Without setting on MCU/ with setting on RCU: The update data for P-VOL is copied to the S-VOL in synchronous manner.- While the mode is set to ON, micro-program downgrade is disabled.- While the mode is set to ON, Take Over function is disabled.- The mode cannot be applied to a UR pair that is the 2nd mirror in URxUR multi-target configuration or URxUR cascade configuration. If applied, TC pair creation is rejected with SSB=CBEE output.		
491	ShadowImage	Mode 491 is used to improve the performance of ShadowImage and ShadowImage FCv1.	OFF	-
		Mode 491 = ON: The option (Reserve05) of ShadowImage/ ShadowImage for z/OS is available. If the option is set to ON, the copy of ShadowImage/ ShadowImage for z/OS/ ShadowImage FCv1 will be performed from 64 processes to 128 processes so that the performance will be improved.		
		Mode 491 = OFF (default): The option (Reserve05) of ShadowImage/ ShadowImage for z/OS is unavailable. The copy of ShadowImage/ ShadowImage for z/OS/ ShadowImage FCv1 is performed with 64 processes.		
		Note:		
		• Apply mode 491 when the performance of ShadowImage / ShadowImage FCv1 is important.		
		• Do not apply the mode when the host I/O performance is important.		
		• The mode will be noneffective if 3 or more pairs of BEDs are not mounted.		
		• The mode is noneffective for the NSC model.		
		• Set mode 467 to OFF when using mode 491, since the performance may not improve.		
725	This option determines an action when Not Ready is returned from	OFF	-	

Mode	Category	Description	Default	MCU/RCU
	the external volume.			
	Mode 725 = ON:			
	When Not Ready is returned, the external path is blocked and the path status can be automatically recovered (Not Ready blockade). Note that the two behaviors, automatic recovery and blockade, may be repeated.			
	From version 60-05-06-00/00, the following is added. For the device of Not Ready blockade, the Device Health Check is executed after 30 seconds.			
	Mode 725 = OFF (default):			
	When Not Ready is returned 3 times in 3 minutes, the path is blocked and the path status cannot be automatically recovered (Response error blockade).			
	Note:			
	1. For HM700			
	○ Applying this SOM is prohibi			

System option modes

Hitachi Unified Storage VM Block Module Hardware User Guide

Mode	Category	Description	Default	MCU/RCU
	ted when USP V/VM is used as an external subsystem and its external volume is DP-VOL. ○ Applying this SOM is recommended when the above condition (1) is not met and SUN storage is used as an external storage. ○ Applying this SOM is recommended when the above condition (1) is not met and EMC CX			

Mode	Category	Description	Default	MCU/RCU
	series, VNX series or Fujitsu Fibre CAT CX series is used as an external storage. ○ Applying this SOM is recommended if the above condition (1) is not met and a maintenance operation such as firmware update causing controller reboot is executed on the external storage side while a storage system			

Mode	Category	Description	Default	MCU/RCU
	other than Hitachi product is used as an external subsystem. 2. While USP V/VM is used as an external subsystem and its volume is DP-VOL, if some Pool-VOLs constituting the DP-VOL are blocked, a phenomenon of external path blockade and recovery occurs repeatedly. 3. In the case that a virtual volume mapped by UVM is set to pool-VOL and used as DP-VOL in local subsystem, this SOM can be applied without problem.			
491	ShadowImage	Mode 491 is used for improving the performance of ShadowImage / ShadowImage FCv1.Mode ON: The option (Reserve05) of ShadowImage is available. If the option is set to ON, the copy of ShadowImage / ShadowImage	OFF	.

Mode	Category	Description	Default	MCU/RCU
		FCv1 will be performed from 64 processes to 128 processes so that the performance will be improved.Mode OFF (default): The option (Reserve05) of ShadowImage is unavailable. The copy of ShadowImage/ ShadowImage FCv1 is performed with 64 processes.Note:1. Make sure to apply mode 491 when the performance of ShadowImage / ShadowImage FCv1 is considered to be important.2. Make sure not to apply the mode when the host I/O performance is considered to be important.3. The mode will be noneffective if 3 or more pairs of BEDs are not mounted.4. Make sure to set mode 467 to OFF when using mode 491, since the performance may not improve. 5. The mode is noneffective for the NSC model.		
561	ShadowImage, Universal Volume Manager	Allows Quick Restore for external volumes with different Cache Mode settings. Mode 561 = ON: Quick Restore for external volumes with different Cache Mode settings is prevented. Mode 561 = OFF (default): Quick Restore for external volumes with different Cache Mode settings is allowed.	OFF	MCU/RCU
589	Universal Volume Manager	Turning this option ON changes the frequency of progress updates when disconnecting an external volume. of disconnection is changed. improvement in destaging to the pool by achieving efficient HDD access. Mode 589 = ON: For each external volume, progress is updated only when the progress rate is 100% Mode 589 = OFF (default): Progress is updated when the progress rate exceeds the previous level. **Notes:** 1. Set this option to ON when disconnecting an external volume while the specific host IO operation is online and its performance requirement is severe. 2. Whether the disconnecting status for each external volume is progressed or not cannot be confirmed on Storage Navigator (It indicates "-" until just before the completion and at the last it changes to 100%).	OFF	.
676	Audit Log	This option is used to set whether an audit log is to be stored onto the system disk or not. **Mode 676 = ON:** An audit log is stored onto the system disk. **Mode 676 = OFF (default):** An audit log is not stored onto the system disk. This mode is also enabled/disabled by enabling/disabling Audit Log Buffer on the [Audit Log Setting...] window, which can be opened by selecting [Settings] -> [Security] -> [Audit Log Setting...] in Storage Navigator **Note:** • This option is applied to the sites where the level of importance of an audit log is high.	OFF	.

Mode	Category	Description	Default	MCU/R CU
		• A system disk with available space of more than 130 MB (185 cylinders when the track format is 3380/6586/NF80, and 154 cylinders when the track format is 3390/6588) must exist. (Otherwise, audit log is not stored even this option is ON). • Turn this option on after preparing a normal system disk that meets the condition in (2). If Define Configuration & Install is performed, turn this option on after formatting the system disk.		
690	Universal Replicator	This option is used to prevent Read JNL or JNL Restore when the Write Pending rate on RCU exceeds 60% as follows:- When CLPR of JNL-Volume exceeds 60%, Read JNL is prevented.- When CLPR of Data (secondary)-Volume exceeds 60%, JNL Restore is prevented.Mode 690 = ON:Read JNL or JNL Restore is prevented when the Write Pending rate on RCU exceeds 60%.Mode 690 = OFF (default):Read JNL or JNL Restore is not prevented when the Write Pending rate on RCU exceeds 60% (the same as before).Note: 1. This mode can be set online.2. This mode should be set per customer's requests.3. If the Write Pending status long keeps 60% or more on RCU, it takes extra time for the initial copy to be completed by making up for the prevented copy operation.4. If the Write Pending status long keeps 60% or more on RCU, the pair status may become Suspend due to the JNL-Vol being full.	OFF	.
696	Open	This mode is available to enable or disable the QoS function.Mode 696 = ON:QoS is enabled. (In accordance with the Share value set to SM, I/Os are scheduled. The Share value setting from RMLIB is accepted) Mode 696 = OFF (default):QoS is disabled. (The Share value set to SM is cleared. I/O scheduling is stopped. The Share value setting from host is rejected)Note:1. Set this mode to ON when you want to enable the QoS function.	OFF	.
701	Universal Volume Manager	Issues the Read command at the logical unit discovery operation using UVM. Mode 701 = ON: The Read command is issued at the logical unit discovery operation. Mode 701 = OFF: The Read command is not issued at the logical unit discovery operation. **Notes:** 1. When the Open LDEV Guard attribute (VMA) is defined on an external device, set the system option to ON. 2. When this option is set to ON, it takes longer time to complete the logical unit discovery. The amount of time depends on external storages. 3. With this system option OFF, if searching for external devices with VMA set, the VMA information cannot be read. 4. When the mode is set to ON while the following conditions are met, the external volume is blocked.	OFF	.

Mode	Category	Description	Default	MCU/RCU
		a. RAID700 70-03-3x-00/00 or higher version is used on the storage system.		
		b. An external volume to which Nondisruptive Migration (NDM) attribute is set exists.		
		c. The external volume is reserved by the host		
		5. As the VMA information is USP/NSC specific, this mode does not need to be ON when the external storage is other than USP/NSC.		
		6. Set the mode to OFF when the following conditions are met.		
		a. RAID700 70-03-3x-00/00 or higher version is used on the storage system		
		b. An external volume to which Nondisruptive Migration (NDM) attribute is set exists.		
704	Open	To reduce the chance of MIH, this option can reduce the priority of SI, VM, CoW Snapshot, Flash Copy or Resync copy internal IO requests so that host IO has a higher priority. This mode creates new work queues where these jobs can be assigned with a lower priority.	OFF	.
		Mode 704 = ON: Copy processing requested is registered into a newly created queue so that the processing is scheduled with lower priority than host I/O.		
		Mode 704 = OFF: Copy processing requested is not registered into a newly created queue. Only the existing queue is used.		
		Note: If the PDEV is highly loaded, the priority of Read/Write processing made by SI, VM, Snapshot, Compatible FlashCopy® V2 or Resync may become lower. As a consequence the copy speed may be slower.		
720	Universal Volume Manager (Open)	Supports the Active Path Load Balancing (APLB) mode.	OFF	.
		Mode 720 = ON: The alternate path of EVA (A/A) is used in the APLB mode.		
		Mode 720 = OFF (default): The alternate path of EVA (A/A) is used in the Single mode.		
		Note: Though online setting is available, the setting will not be enabled until Check Paths is performed for the mapped external device.		
721	Open	When a parity group is uninsulated or installed, the following operation is performed according to the setting of mode 721.	OFF	.
		Mode 721 = ON: When a parity group is uninstalled or installed, the LED of the drive for uninstallation is not illuminated, and the instruction message for removing the drive does not appear. Also, the windows other than that of parity group, such as BED or DKU, are unavailable to select.		
		Mode 721 = OFF (default): When a parity group is uninstalled or installed, the operation is as before: the		

Mode	Category	Description	Default	MCU/R CU
		LED of the drive is illuminated, and the drive must be unmounted and remounted. **Note:** • When the RAID level or emulation type is changed for the existing parity group, this option should be applied only if the drive mounted position remains the same at the time of the parity group uninstallation or installation. • After the operation using this option is completed, the mode must be set back to OFF; otherwise, the LED of the drive to be removed will not be illuminated at subsequent parity group uninstalling operations.		
725	Universal Volume Manager	This option determines an action when Not Ready is returned from the external volume. **Mode 725 = ON:** When Not Ready is returned, the external path is blockedand the path status can be automatically recovered (Not Ready blockade). Note that the two behaviors, automatic recovery and blockade, may be repeated. From version 60-05-06-00/00, the following is added. For the device of Not Ready blockade, the Device Health Check is executed after 30 seconds. **Mode 725 = OFF** (default): When Not Ready is returned 3 times in 3 minutes, the path is blocked and the path status cannot be automatically recovered (Response error blockade). **Note:** 1. For R700 70-01-62-00/00 and lower (within 70-01-xx range) a. Applying this SOM is prohibited when USP V/VM is used as an external subsystem and its external volume is DP-VOL. b. Applying this SOM is recommended when the above condition (1) is not met and SUN storage is used as an external storage. c. Applying this SOM is recommended if the above condition (1) is not met and a maintenance operation such as firmware update causing controller reboot is executed on the external storage side while a storage system other than Hitachi product is used as an external subsystem. 2. For R700 70-02-xx-00/00 and higher a. Applying this SOM is prohibited when USP V/VM is used as an external subsystem and its external volume is DP-VOL. b. Applying this SOM is recommended when the above condition (a) is not met and SUN storage is used as an external storage.	OFF	.

Mode	Category	Description	Default	MCU/RCU
		c. Applying this SOM is recommended when the above condition (1) is not met and EMC CX series or Fujitsu Fibre CAT CX series is used as an external storage.(4) Applying this SOM is recommended if the above condition d. Is not met and a maintenance operation such as firmware update causing controller reboot is executed on the external storage side while a storage system other than Hitachi product is used as an external subsystem. *Continued*		
725	Universal Volume Manager Continued	**Notes (continued)** 3. While USP V/VM is used as an external subsystem and its volume is DP-VOL, if some Pool-VOLs constituting the DP-VOL are blocked, a phenomenon of external path blockade and recovery occurs repeatedly. 4. In the case that a virtual volume mapped by UVM is set to pool-VOL and used as DP-VOL in local subsystem, this SOM can be applied without problem.	OFF	
729 up-dated	Dynamic Provisioning	To set the Protect attribute for the target DP-VOL using Data Retention Utility (DRU), when any write operation is requested to the area where the page allocation is not provided at a time when the HDP Pool is full. Mode 729 = ON: To set the Protect attribute for the target DP-VOL using DRU, when any write operation is requested to the area where the page allocation is not provided at a time when the HDP pool is full. (Not to set in the case of Read request.) Mode 729 = OFF (default): Not to set the Protect attribute for the target DP-VOL using DRU, when any write operation is requested to the area where the page allocation is not provided at a time when HDP pool is full. **Notes:** 1. This SOM is applied when: - The threshold of pool is high (e.g., 95%) and the pool may be full. - File system is used. - Data Retention Utility is installed. 2. Since the Protect attribute is set for V-VOL, the Read operation cannot be allowed as well. 3. When Data Retention Utility is not installed, the desired effect is not achieved. 4. Protect attribute can be released from the Data Retention window of Storage Navigator after releasing the full status of the pool by adding a Pool-VOL.	OFF	.
733	Volume Migration	This option enables to suspend Volume Migration or Quick Restore operation during LDEV-related maintenance.RAID600:Mode 733 = ON:Volume Migration	OFF	.

Mode	Category	Description	Default	MCU/RCU
		or Quick Restore operation during LDEV-related maintenance is suspended.Mode 733 = OFF (default):Volume Migration or Quick Restore operation during LDEV-related maintenance is not suspended.RAID700:Mode 733 = ON:Volume Migration or Quick Restore operation during LDEV-related maintenance is not suspendedMode 733 = OFF (default):Volume Migration or Quick Restore operation during LDEV-related maintenance is suspendedNote:1. This option should be applied when Volume Migration or Quick Restore operation can be suspended during LDEV-related maintenance. 2. Set mode 733 to ON if you want to perform any LDEV-related maintenance activities and you do not want these operations to fail when Volume Migration or Quick Restore is active.3. This option is recommended as functional improvement to avoid maintenance failures. In some cases of a failure in LDEV-related maintenance without setting the option, Storage Navigator operations may be unavailable.4. There is the potential for LDEV-related maintenance activities to fail when Volume Migration and Quick Restore is active without setting the option.		
734	Dynamic Provisioning	When exceeding the pool threshold, the SIM is reported as follows: Mode 734 = ON: The SIM is reported at the time when exceeding the pool threshold. If the pool usage rate continues to exceed the pool threshold, the SIM is repeatedly reported every eight (8) hours. Once the pool usage rate falls below the pool threshold, and then exceeds again, the SIM is reported. Mode 734 = OFF (default): The SIM is reported at the time when exceeding the pool threshold. The SIM is not reported while the pool usage rate continues to exceed the pool threshold. Once the pool usage rate falls below the pool threshold and then exceeds again, the SIM is reported. **Notes:** 1. This option is turned ON to prevent the write I/O operation from being unavailable due to pool full. 2. If the exceeding pool threshold SIM occurs frequently, other SIMs may not be reported. 3. Though turning on this option can increase the warning effect, if measures such as adding a pool fail to be done in time so that the pool becomes full, MODE 729 can be used to prevent file systems from being destroyed. 4. Turning on MODE 741 can provide the SIM report to not only the users but also the service personnel.	OFF	.
741	Dynamic Provisioning	The option enables to switch over whether to report the following SIM for users to the service personnel: SIM-RC 625000 (DP pool usage rate continues to exceed the threshold) Mode 741 = ON: SIM is reported to the service personnel	OFF	-

Mode	Category	Description	Default	MCU/R CU
		Mode 741 = OFF (default): SIM is not reported to the service personnel		
		Note:		
		1. This option is set to ON to have SIM for users reported to the service personnel:		
		- For the system where SNMP and E-mail notification are not set.		
		- If Storage Navigator is not periodically activated.		
		2. When MODE 734 is turned OFF, SIM-RC625000 is not reported; accordingly the SIM is not reported to the service personnel even though this option is ON.		
745	Universal Volume Manager	Enables to change the area where the information is obtained as the Characteristic1 item from SYMMETRIX.	OFF	-
		Mode 745 = ON:		
		• The area where the information is obtained as the Characteristic1 item from SYMMETRIX is changed.		
		• When CheckPaths or Device Health Check (1/hour) is performed, the information of an already-mapped external volume is updated to the one after change.		
		Mode 745 = OFF (default):		
		• The area where the information is obtained as the Characteristic1 item from SYMMTRIX is set to the default.		
		• When CheckPaths or Device Health Check (1/hour) is performed, the information of an already-mapped external volume is updated to the default.		
		Notes:		
		1. This option is applied when the Characteristic1 item is displayed in symbols while the EMC SYMMETRIX is connected using UVM.		
		2. Enable the setting of EMC SCSI Flag SC3 for the port of the SYMMETRIX connected with HUS VM. If the setting of EMC SCSI Flag SC3 is not enabled, the effect of this mode may not be achieved.		
		3. If you want to enable this mode immediately after setting, perform Check Paths on each path one by one for all the external ports connected to the SYMMETRIX. Without doing Check Paths, the display of Characteristic1 can be changed automatically by the Device Health Check performed once per hour. If SSB=AD02 occurs and a path is blocked, perform Check Paths on this path again.		
		4. If Check Paths is performed while ShadowImage for Mainframe pair and Compatible FlashCopy® V2 Mirror pair are defined in the specified volume, the Check Paths operation is rejected with a message "605 2518". If ShadowImage for Mainframe pair and Compatible FlashCopy® V2 Mirror pair are defined in the specified volume, do not perform Check Paths and wait until the display is automatically changed.		

Mode	Category	Description	Default	MCU/R CU
749	Dynamic Provisioning	Disables the Dynamic Provisioning Rebalance function that allows the HDDs of all ECC Groups in the pool to share the load. Mode 749 = ON: The Dynamic Provisioning Rebalance function is disabled. Mode 749 = OFF (default): The Dynamic Provisioning Rebalance function is activated. **Notes:** 1. This option is applied when no change in performance characteristic is desired. 2. All Dynamic Provisioning pools are subject to the DP Rebalance function. 3. When a pool is newly installed, the load may be concentrated on the installed pool volumes. 4. When 0 data discarding is executed, load may be unbalanced among pool volumes.	OFF	.
757	Open	Enables/disables output of in-band audit logs. Mode 757 = ON: Output is disabled. Mode 776 = OFF (default): output is enabled. **Notes:** 1. Mode 757 applies to the sites where outputting the In-band audit logs is not needed. 2. When this option is set to ON - There is no access to SM for the In-band audit logs, which can avoid the corresponding performance degradation. - SM is not used for the In-band audit logs. 3. If outputting the In-band audit log is desired, set this mode to OFF.	OFF	MCU/RC U
803	Dynamic Provisioning, Data Retention Utility	While a DP pool VOL is blocked, if a read or write I/O is issued to the blocked pool VOL, this mode can enable the Protect attribute of DRU for the target DP-VOL. Mode 803 = ON:While a DP pool VOL is blocked, if a read or write I/O is issued to the blocked pool VOL, the DRU attribute is set to Protect. Mode 803 = OFF (default):While a DP pool VOL is blocked, if a read or write I/O is issued to the blocked pool VOL, the DRU attribute is not set to Protect. Note:1. This mode is applied when - a file system using DP pool VOLs is used.- Data Retention Utility is installed. 2. Because the DRU attribute is set to Protect for the V-VOL, a read I/O is also disabled. 3. If Data Retention Utility is not installed, the expected effect cannot be achieved. 4. The Protect attribute of DRU for the HDP V-VOL can be released on the Data Retention window of Storage Navigator after recovering the blocked pool VOL.	OFF	.
855	ShadowImage, Volume Migration	By switching the mode to ON/OFF when ShadowImage is used with SOM 467 set to ON, copy processing is continued or stopped as follows.		

Mode	Category	Description	Default	MCU/R CU
		Mode 855 = ON:		
		When the amount of dirty data is within the range from 58% to 63%, the next copy processing is continued after the dirty data created in the previous copy is cleared to prevent the amount of dirty data from increasing (copy after destaging). If the amount of dirty data exceeds 63%, the copy processing is stopped.		
		Mode 855 = OFF (default):		
		The copy processing is stopped when the amount of dirty data is over 60%.		
		Note:		
		1. This mode is applied when all the following conditions are met		
		○ ShadowImage is used with SOM 467 set to ON.		
		○ Write pending rate of an MP blade that has LDEV ownership of the copy target is high		
		○ Usage rate of a parity group to which the copy target LDEV belongs is low.		
		○ ShadowImage copy progress is delayed.		
		2. This mode is available only when SOM467 is set to ON.		
		3. If workload of the copy target parity group is high, the copy processing may not be improved even if this mode is set to ON		
857	OPEN	This mode enables or disables to limit the cache allocation capacity per MPB to within 128GB except for cache residency.Mode 857 = ON:The cache allocation capacity is limited to within 128GB.Mode 857 = OFF (default):The cache allocation capacity is not limited to within 128GB.	OFF	-
		Note:This mode is applied when downgrading the micro-program from V02 (70-02-02-00/00) or higher to a version earlier than V02 (70-02-02-00/00) while over 128GB is allocated.		
867	Dynamic Provisioning	All-page reclamation (discarding all mapping information between DP pool and DP volumes) is executed in DP-VOL LDEV format. This new method is enabled or disabled by setting the mode to ON or OFF. Mode 867 = ON:LDEV format of the DP-VOL is performed with page reclamation.Mode 867 = OFF (default):LDEV format of the HDP-VOL is performed with 0 data writing.Note:1. This mode is applied at recovery after a pool failure.2. Do not change the setting of the mode during DP-VOL format.3. If the setting of the mode is changed during DP-VOL format, the change is not reflected to the format of the DP-VOL being executed but the format continues in the same method.	OFF	.
872	Universal Volume Manager	When the mode is applied, the order of data transfer slots is guaranteed at the destaging from VSP to an external storage.Mode 872 = ON:The order of data transfer slots from VSP to an external storage is guaranteed.Mode 872	OFF	.

Mode	Category	Description	Default	MCU/R CU
		= OFF (default):The order of data transfer slots from VSP to an external storage is not guaranteed.In V03 and later versions, the mode is set to ON before shipment. If the micro-program is exchanged to a supported version (V03 or later), the setting is OFF as default and needs to be set to ON manually.Note:1. This mode is applied when performance improvement at sequential write in UVM configuration is required.		
896	Dynamic Provisioning, Dynamic Tiering	The mode enables or disables the background format function performed on an unformatted area of a DP/DT pool. For information about the operating conditions, refer to the *Hitachi Unified Storage VM Block Module Provisioning Guide*. Mode 896 = ON: The background format function is disabled. Mode 896 = OFF (default): The background format function is enabled. Note: 1. The mode is applied when a customer requires the background format for a DP/DT pool in the environment where new page allocation (for example, when system files are created from a host for newly created multiple DP VOLs), frequently occurs and the write performance degrades because of an increase in write pending rate. 2. When the mode is set to ON, because up to 42MB/s of ECCG performance is used, local copy performance may degrade by about 10%. Therefore, confirm whether the 10% performance degradation is acceptable or not before setting the mode to ON. 3. When a Dynamic Provisioning VOL that is used as an external VOL is used as a pool VOL, if the external pool becomes full due to the background format, the external VOL may be blocked. If the external pool capacity is smaller than the external VOL (Dynamic Provisioning VOL), do not set the mode to ON.	OFF	.
897	Dynamic Tiering	By the combination of SOM897 and 898 setting, the expansion width of Tier Range upper I/O value (IOPH) can be changed as follows. **Mode 897 = ON:** **SOM898 is OFF:** 110%+0IO **SOM898 is ON:** 110%+2IO **Mode 897 = OFF** (Default) **SOM898 is OFF:** 110%+5IO (Default) **SOM898 is ON:** 110%+1IO	OFF	.

Mode	Category	Description	Default	MCU/R CU
		By setting the SOMs to ON to lower the upper limit for each tier, the gray zone between other tiers becomes narrow and the frequency of page allocation increases. **Note:** 1. Apply the mode when the usage of upper tier is low and that of lower tier is high. 2. The mode must be used with SOM898. 3. Narrowing the gray zone increases the number of pages to migrate between tiers per relocation. 4. When Tier1 is SSD while SOM901 is set to ON, the effect of SOM897 and 898 to the gray zone of Tire1 and Tier2 is disabled and the SOM901 setting is enabled instead. In addition, the settings of SOM897 and 898 are effective for Tire2 and Tier3. Please also see spreadsheet "SOM897_898_901" for more details about the relations between SOM897, 898 and 901.		
899	Volume Migration	In combination with the SOM900 setting, whether to execute and when to start the I/O synchronous copy change as follows. **Mode 899 = ON:** **SOM900 is ON:** I/O synchronous copy starts without retrying Volume Migration. **SOM900 is OFF:** I/O synchronous copy starts when the threshold of Volume Migration retry is exceeded. (Recommended) **Mode 899 = OFF** (default): SOM900 is ON: I/O synchronous copy starts when the number of retries reaches half of the threshold of Volume Migration retry. SOM900 is OFF: Volume Migration is retired and I/O synchronous copy is not executed. **Note:** 1. This mode is applied when improvement of Volume Migration success rate is desired under the condition that there are many updates to a migration source volume of Volume Migration. 2. During I/O synchronous copy, host I/O performance degrades.	OFF	.
900	Volume Migration	In combination with the SOM8 99 setting, whether to execute and when to start the I/O synchronous copy change as follows. **Mode 900= ON:** **SOM 899 is ON:** I/O synchronous copy starts without retrying Volume Migration. **SOM900 is OFF:** I/O synchronous copy starts when the threshold of Volume Migration retry is exceeded. (Recommended)	OFF	.

Mode	Category	Description	Default	MCU/R CU
		Mode 899 = OFF (default):		
		SOM900 is ON: I/O synchronous copy starts when the number of retries reaches half of the threshold of Volume Migration retry.		
		SOM900 is OFF: Volume Migration is retired and I/O synchronous copy is not executed.		
		Note:		
		1. This mode is applied when improvement of Volume Migration success rate is desired under the condition that there are many updates to a migration source volume of Volume Migration.		
		2. During I/O synchronous copy, host I/O performance degrades.		
901	Dynamic Tiering	By setting the mode to ON or OFF, the page allocation method of Tier Level ALL when the drive type of tier1 is SSD changes as follows.	OFF	
		Mode 901 = ON:		
		For tier1 (drive type is SSD), pages are allocated until the capacity reaches the limit. (Without consideration of performance limitation exceedance, allocation is done from highly loaded pages until reaching the capacity limit.		
		When the capacity of the tier1 reaches the threshold value, the minimum value of the tier range is set to the starting value of the lower IOPH zone, and the maximum value of the lower tier range is set to the boundary value.		
		Mode 901 = OFF (default):		
		For tier1 (drive type is SSD), page allocation is performed based on performance potential limitation. (With consideration of performance limitation exceedance, allocation is done from highly loaded pages but at the point when the performance limitation is reached, pages are not allocated any more even there is free space) When the capacity of the tier1 reaches the threshold value, the minimum value of the tier range is set to the boundary value, and the maximum value of the lower tier range is set to a value of boundary value x 110% + 5 [IOPH].		
		Note:		
		1. This mode is applied when pages with the maximum capacity need to be allocated to tier1 (drive type is SSD) with DT or DTz.		
		2. When Tier1 is SSD while SOM901 is set to ON, the effect of SOM897 and 898 to the gray zone of Tire1 and Tier2 is disabled and the SOM901 setting is enabled instead. In addition, the settings of SOM897 and 898 are effective for Tire2 and Tier3.		
		3. The following is recommended when applying SOM901. The actual I/O value (total number of I/Os of all tiering policies) < the performance potential value of Tier 1*1 x 0.6 *1: The performance potential value of Tier 1 displayed on Monitor information by using Dx-ray. Please		

Mode	Category	Description	Default	MCU/R CU
		also see spreadsheet "SOM897_898_901" for more details about the relations between SOM897, 898 and 901.		
908	Universal Replicator	The mode can change CM capacity allocated to MPBs with different workload. **Mode 908 = ON:** The difference in CM allocation capacity among MPBs with different workload is large. **Mode 908 = OFF (default):** Difference in CM allocation capacity among MPBs with different workload is small. (Existing operation) **Note:** 1. If a CLPR is used by only some MPBs among all the installed MPBs, set the mode to ON for the CLPR to increase CM capacity allocated to the MPBs that use the CLPR. Example: (a) A CLPR only for UR JNLG (b) A configuration where MPBs and CLPRs are separately used for open systems. 2, Since CM capacity allocated to MPBs with low load is small, the performance is affected by a sudden increase in load 3. This mode is effective for a CLPR. Therefore, when setting the mode to ON/OFF, select target "LPRXX (XX=00 to 31)". For example, even when CLPR0 is defined (any of CLPR1 to 31 are not defined), select "LPR00" first and then set the mode to ON/OFF. 4. SOM908 cannot be used with SOM 933. When SOM 933 is set to ON, the function of SOM908 is canceled even though SOM908 is ON.	OFF	.
917	Dynamic Provisioning, Dynamic Tiering	The mode is used to switch the method to migrate data at rebalancing. **Mode 917 = ON (default):** Page usage rate is averaged among parity groups or external volume groups where pool volumes are defined. **Mode 917 = OFF:** Page usage rate is averaged among pool volumes without considering parity groups or external volume groups. **Note:** 1. The mode is applied when multiple LDEVs are created in a parity group or in an external volume group. 2. If the mode setting is changed during pool shrink, the shrink processing may fail. 3. When the mode is set to OFF, the processing to the average page usage rate among pool volumes in a parity group or in an external volume group works; therefore, the drive workload becomes high because	ON	.

Mode	Category	Description	Default	MCU/RCU
		the migration source and target are in the same parity group or external volume group. 4. When pool shrink is performed per pool VOL from a parity group with multiple pool VOLs defined (or from an external volume group) while the mode is set to ON, the pool shrink takes longer than when the mode is set to OFF.		

930	Dynamic Provisioning, Hitachi Thin Image	When the mode is set to ON, all of the zero data page reclamation operations in processing are stopped. (Also the zero data page reclamation cannot be started.)
		
		* Zero data page reclamation by WriteSame and UNMAP functions, and IO synchronous page reclamation are not disabled.
		
		Mode 930 = ON:
		
		All of the zero data page reclamation operations in processing are stopped at once. (Also the zero data reclamation cannot be newly started.)
		
		Mode 930 = OFF (default):
		
		The zero data page reclamation is performed.
		
		See sheet "SOM930" for relationship with SOM755 and SOM859.
		
		Note:
		
		1. The mode is applied when stopping or disabling zero data page reclamation by user request is required.
		
		2. When the mode is set to ON, the zero data page reclamation does not work at all.
		
		    ○ Zero data page reclamation by Write Same and UNMAP, and IO synchronous page reclamation can work.
		
		3. When downgrading micro-program to a version that does not support the mode while the mode is set to ON, set the mode to OFF after the downgrade
		
		    ○ Because the zero data page reclamation does not work at all while the mode is set to ON.
		
		4. The mode is related to SOM755 and SOM859.		

Table B-2 Mode 269: Storage Navigator Operations

Operation	Target of Operation	Mode 269 ON	Mode 269 OFF
VLL (CVS)	All LDEVs in a PG	No format	No format
VLL (CVS)	Some LDEVs in a PG	No format	No format
Format	PG is specified	No operation	No operation
Format	All LDEVs in a PG	Low speed	Low speed
Format	Some LDEVs in a PG	Low speed	Low speed

Table B-3 Mode 269: SVP Operations

Operation	Target of Operation	Mode 269 ON	Mode 269 OFF
PDEV Addition	-	High speed	High speed
VLL (CVS)	All LDEVs in a PG	No format	No format
VLL (CVS)	Some LDEVs in a PG	No format	No format
Format	PG is specified	High speed	High speed
Format	All LDEVs in a PG	High speed	Low speed
Format	Some LDEVs in a PG	Low speed	Low speed
PDEV Addition	-	High speed	High speed

Hitachi Unified Storage VM Block Module Hardware User Guide

Rack information

This appendix provides the specifications for the Hitachi standard 19-inch "Universal" rack and the specifications that a customer-supplied rack must meet to support a Hitachi Unified Storage VM storage system.

☐ About the Hitachi Universal rack

☐ Before installing a rack or equipment

☐ Installation safety

☐ Working with racks or components in the rack

☐ Preparing for installation

☐ Installing a Hitachi Universal rack

☐ Post-installation considerations

About the Hitachi Universal rack

Hitachi Universal racks and can be used to mount a Hitachi Unified Storage VM system controller and one or more drive trays. The following figure shows views of the Hitachi rack. Table C-1 Hitachi Universal rack basic specifications on page C-3provides the basic specifications of the rack. Table C-2 Hitachi Universal rack specifications on page C-3provides detailed specifications of the rack. Additional figures and specifications showing and describing the rack and the required PDUs are included also in this appendix.

Note: Customer-supplied racks with the same specifications as the Hitachi Universal rack can also be used to mount a Hitachi Unified Storage VM storage system.

Figure C-1 Hitachi Universal rack (shown without doors or side panels)

Table C-1 Hitachi Universal rack basic specifications

Product Code	Description
A3BF-600-1200	Black Front Bezel/Lock Back Door External Dimensions (with panels) Width: 600 mm (1ft 11-1/2 in) Depth: 1200 mm (3 ft 11-1/4 in) Height: 2010 mm (6 ft 7 in) Mounting height for stroage equipment: 42U Rail kits, PDUs, and power cords with an accessory kit not included

Table C-2 Hitachi Universal rack specifications

Item	Specification
P-code	A3BF-600-1200
Dimensions (H x W x D)	2010 x 600 x 1200 mm (6.59 x 1.96 x 3.9 ft)
Frame	Height: 42U (2010 mm) Finished black RAL 9011 1 x Logo Hitachi 1 x ground cables - set 2 x mounting depth post - depth: 1000 mm
Base	1 x Base legs, adjustable, set of 4 1 x Construction for rollers (front) 1 x Construction for casters (back) 1 x Plinth front/rear in combination with castors: (W) 600 mm - RAL9011 (front) 1 x Base, plinth side in combination with castors: 1200 mm (D) (left) (left) 1 x Base, plinth side in combination with castors - 1200 mm (D) (right)
Roof	1 x Top, blank, 3 cut-outs F/R: W X D = 600 x 1200 mm 1 x Cable entry brush (front) 1 x Cable entry brush (rear)
Profiles	1 x Profiles, 19-inch, set of 4 - 42U (h mounted at 130mm from front, mounted at 740 mm from profiles front side 4 x Number-strip for 19 inch profile 1 - 42 Umounted at 19" rear profiles, 01 at the bottom 2 x Site plate front side 1 x Top plate front side 21 x Front panel 1U ABS without Logo 2 x Cable tray zinced - 75mm x 42U (w x h)

Item	Specification
Rear	1 x Door, 65% ventilated - 600 mm x 42U (W x H) 3 x Hinged on the right side 1 x Swivel handle, 2-points Fix Easy lock 1 x Lock, for swivel handle, EK-333
Left Side	1 x Side panel - 1000 mm x 42U (D x H) RAL 9011 2 x Cylinder lock
Right Side	1 x Side panel - 1000 mm x 42U (D x H) RAL 9011 2 x Cylinder lock
Accessories	1 x Accessories (set) delivered separately in a box. The set includes: • 1 x Cabinet stabilizer- 600mm (w) • 1 x Universal key for leveling • 10 x Velcro strap (including mounting material) • 100 x Cage nuts M5 • 100 x Screws M5 (black) • 1 x Nylon strap (including mounting material) • 8 x Mounting bracket PDU (including mounting material) • 2 x Plinth front/rear - 600mm (w) • 4 x Baying kit (including mounting material)
Miscellaneous	1 x Packaging
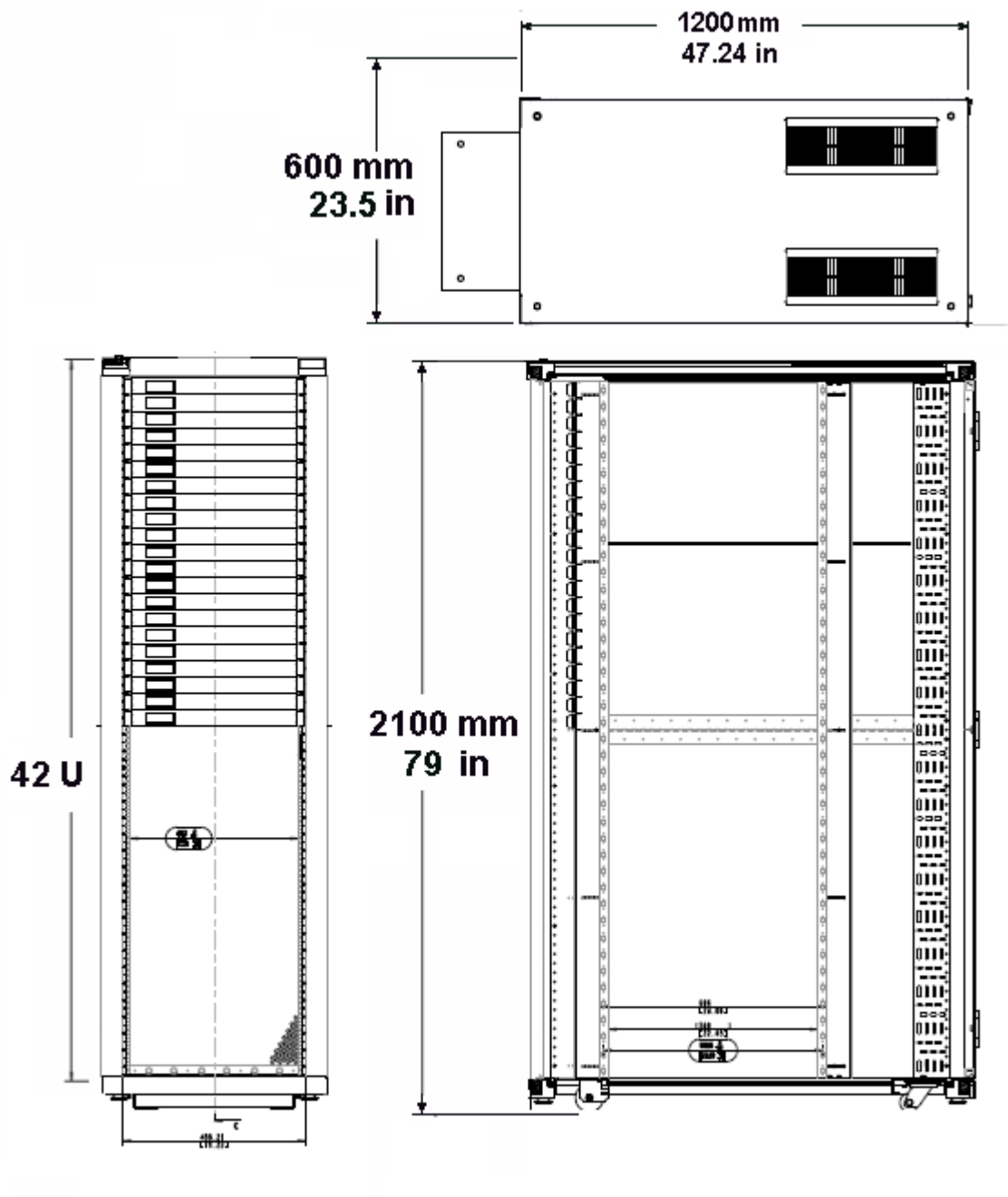
Figure C-2 Hitachi Universal rack dimensions

Power considerations

The Hitachi rack is wired for 200-240V with four PDUs.

• The Americas version of the rack (PDU-121112F10) comes with four preinstalled 30-amp Nema PDUs and a 10-foot power cord. The PDUs are rated for 208VAC, 50/60 Hz, 30 amps, derated to 80% for continued use (24 amps).

- The APAC version of the rack (0FTQ-123C4-50) comes with four preinstalled 32-amp IEC PDUs and a 10-foot power cord.

Maximum current load. When connecting devices to the PDUs, do not exceed 12 amps per bank of four receptacles, and do not exceed 24 amps per PDU. Follow the guidelines for PDU load as specified in the appropriate Hitachi Data Systems installation documentation.

To ensure maximum system availability, each PDU requires a dedicated 30A circuit. For example, a system with four PDUs, each with a 30A L630P plug, requires four 30A circuits.

Before installing third-party components in the rack, determine the current draw of each component and compare that with the allowable current load on each PDU to determine if the component can be plugged into a PDU.

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 current load between available PDUs.
- The current 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 uninterruptable power supply (UPS) is used, the load should not exceed 80% of the UPS devices marked electrical current rating.

PDU specifications

The following illustration shows the Hitachi rack PDU that is used in the Hitachi Data Systems Universal rack in the USA. The tables following the illustration provide the specifications of the PDUs for the USA, APAC, and EMEA.
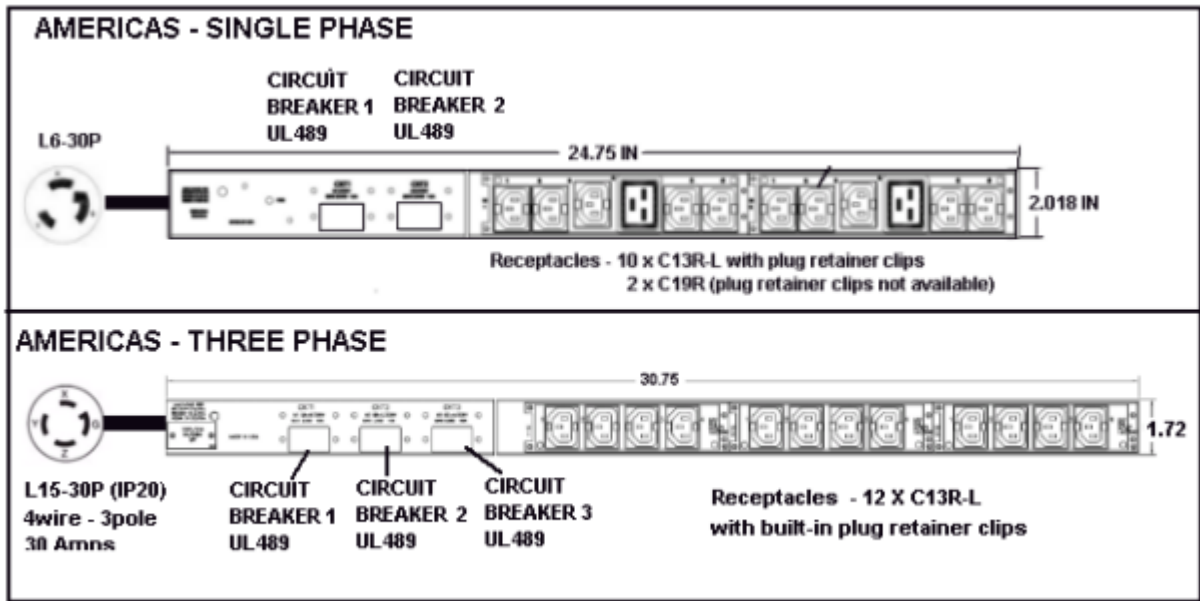
Figure C-3 Hitachi rack Single Phase PDU

Table C-3 PDU specifications

Product Code	Description	Usable in Universal rack?
Americas	Americas region	
Single phase PDU-1251120F10 (sourced by Methode)	12 outlet, 30A, 208V NEMA L6-30P connector, 10-foot power cable	**Single phase** PDU-1251120F10 (sourced by Methode)
Three phase PDU-121132F10 (sourced by Methode)	12 outlet, 30A, 208V NEMA L15-30P connector, 10-foot power cable	**Three phase** PDU-121132F10 (sourced by Methode)
EMEA and APAC	EMEA and APAC region	EMEA and APAC
Single phase A3CR-1239214-51(sourced by Minkels)	12 outlet, 32A, 230V, single phase, IEC-309 blue connector, 10-foot power cable	**Single phase** A3CR-1239214-51(sourced by Minkels)
Three phase A3B9-12394-52(sourced by Minkels)	12 outlet, 16A, 400V, 3-phase, IEC-309 red connector, 10-foot power cable	**Three phase** A3B9-12394-52(sourced by Minkels)

Table C-4 PDU specifications (details)

Item	Americas[1]	International
P-code	See Table C-3 PDU specifications on page C-7	See Table C-3 PDU specifications on page C-7

Item	Americas[1]	International
Input Specifications		
Voltage	208 VAC[2]	208 VAC/400 VAC
Frequency	50/60 Hz	50/60 Hz
Line Current	30A Max	32A Max
Load Capacity	6.90 KVA	7.36KVA
Overload Protection: Circuit Breaker	(2) 2P/15A UL489	(2) 2P/16A UL489
Power Cord: 10' (3m), #10AWG/3C	Yes	Yes
Connector	NEMA L6-30P	56P332 Plug
Indicators: Power-on, LED	Yes	Yes
Output Specifications		
Voltage	208 VAC	200 - 250 VAC
Current (Total Combined Load)	30A	30A
Outlets: 2x 12 IEC C13	Yes	Yes
Mechanical Specifications		
Material: CRS	Yes	Yes
Finish: Powder Coat, Black, Fine Texture	Yes	Yes
Lettering: Silk-Screen, White/Epoxy	Yes	Yes
Storage Temp.: -13° to 149°F (-25° to 65°C)	Yes	Yes
Operating Specifications		
Temperature: 32° to 122°F (0° to 50°C)	Yes	Yes
Relative Humidity: 0 - 95% (non-condensing)	Yes	Yes
Elevation: 0 - 10,000FT (0 - 3000 m)	Yes	Yes
Regulatory Specifications		
Safety Agency: UL/cUL, UL60950-1, CE	Yes	Yes
RoHS: Compliant to Directive 2002/95/EC	Yes	Yes

Notes:

1. North and South America except Brazil, which has its own rack.

2, This is the PDU voltage rating. See Electrical specifications on page A-5 for system voltage ratings.

Types of PDU plugs

The following figure shows the PDU plug types that are used with the Hitachi rack.

- The plug on the left is for single phase used in Canada, United States, and the Americas (L6-30P)

- The plug in the center is for three phase used in Canada, United States, and the Americas (L15-30P)
- The plug on the right is used in Asia-Pacific and Europe-Middle East-Africa Rack Models (IEC 309)

Figure C-4 PDU power plugs

Power jumper cables

The following figure shows the power jumper cables (043-100210-01) shipped with the Hitachi rack. Table C-3 describes the cable. The cable is used to connect HUS VM systems to the PDU.

Table C-4 summarizes the rack Power Distribution Unit (PDU) information for the rack.
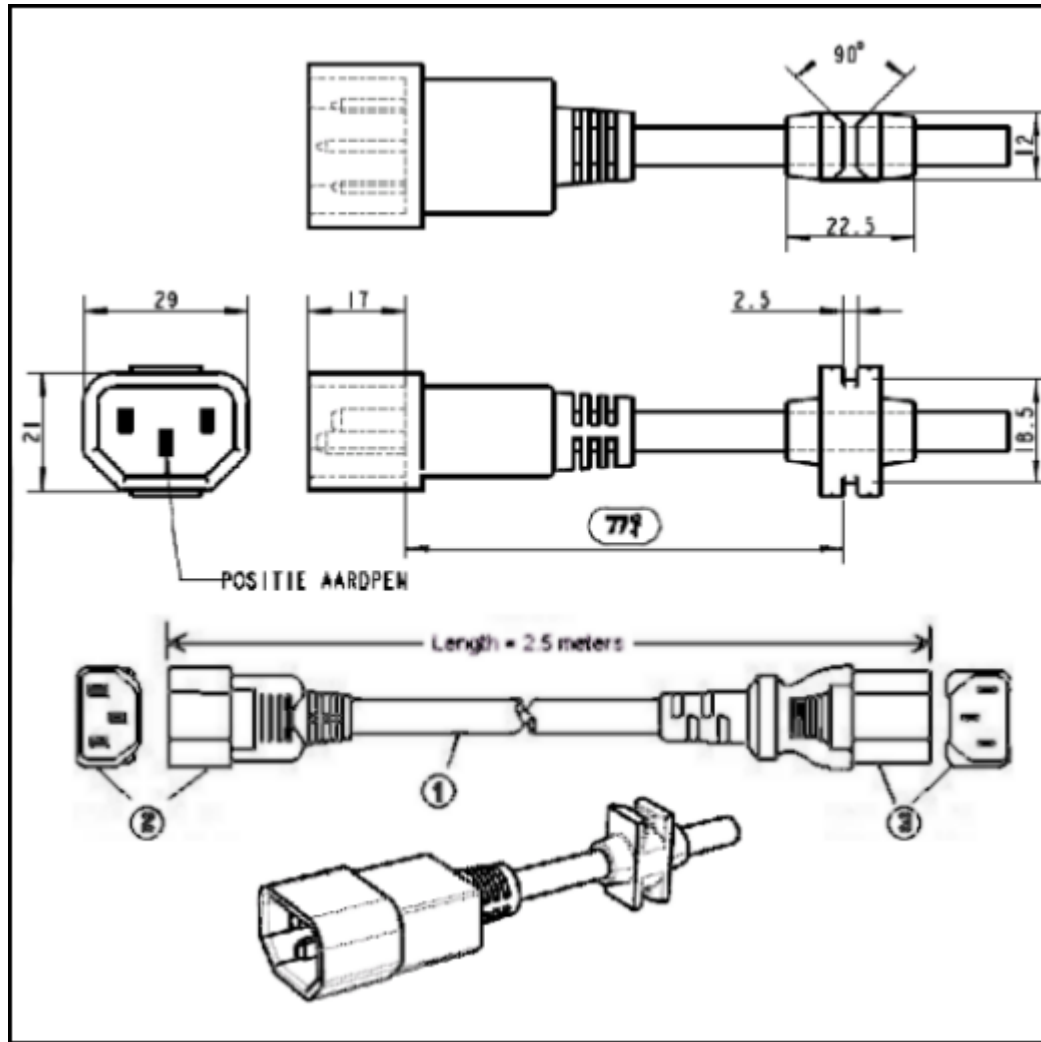
Figure C-5 Power jumper cable (250 VAC 10A IEC320-C14)

Item	Description	Quantity	Model	Applicable Safety Standard / Rating
1	Cable	—	PVC code	UL and CSA
2	Connector A	1	EN60324-C14	For 250 VAC (10 A)
3	Connector B	1	EN60324-C13	For rack frame

Floor load ratings

The floor load rating must be sufficient to support a fully loaded Hitachi rack. The total weight of a storage system in the maximum configuration is approximately 6165 lbs (2793 kg.) including the rack. Hitachi Data Systems recommend that you place the rack over a sufficient number of floor tiles to distribute the weight evenly.

Note: The data in the following table was taken from measurements of a system in a controlled environment. To calculate the power draw, current draw, and heat output of a specific system, see Table 4-9 HUS VM component specifications on page 4-12, or (easier) use the Power and Weight calculator at the following URL.
http://www.hds.com/go/weight-and-power-calculator/
Contact technical support if you need assistance using this tool. See Getting help on page xi in the preface of this manual.

Universal Rail Kit

Hitachi Data Systems offers the following third-party Universal Rail Kit 19-inch rack-mount rail support kits for rack mounting devices in third-party racks:

- Corner Rail kits for use with 2U trays - Minkels A3BF-HK-GL-740-LR (Rev. D) - Corner Guide Rail

- Uinversal rail kits for use with 3U and 4U trays - Minkels A34V-445-900-UNI33

The contents of the kits are:

- Inner rail assembly left
- Inner rail assembly right
- Four M5 flat-head screws
- Four M5 cage nuts

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)

The following procedure describes how to install a Universal Rail Kit 19-inch rack-mount rail support kit (see Figure C-6 Installing the t rail kit on page C-12). When using a third-party rack, ensure that the rack meets or exceeds the specifications of the Hitachi rack described in this chapter.

1. Install the first inner rail assembly (either the left or right):

2. Loosen the hex nuts at the rear of the support rail kit to adjust for the depth of the storage component to be rack mounted.

3. Orient and insert the caged nuts into the square EIA rail flanges (one front and one rear per side).

4. Align the support rail flange holes with the caged nuts and install the front screw to secure the assembly in place.

5. Install the M5 screw at the rear of the cabinet and tighten to 1.0 N-m / 8.85 in-lbs. If a torque wrench is not available, tighten the screw to hold the rail firmly in place. Be careful not to overtighten.

6. Install another M5 screw at the front of the cabinet and tighten to 1.0 N-m / 8.85 in-lbs.

7. Repeat the previous step to install the rail kit on the opposite side. The following four illustrations show various views of the installed rack-mount rail support installation kit.

The following figures show the left side of the rail assembly and views of the rack-mount rail support installation kit.
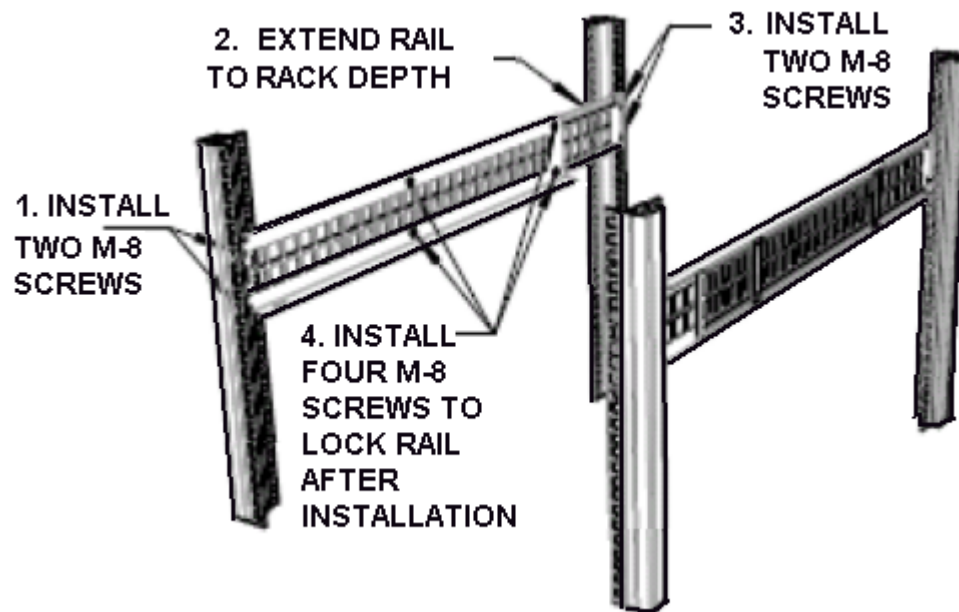
2. EXTEND RAIL TO RACK DEPTH

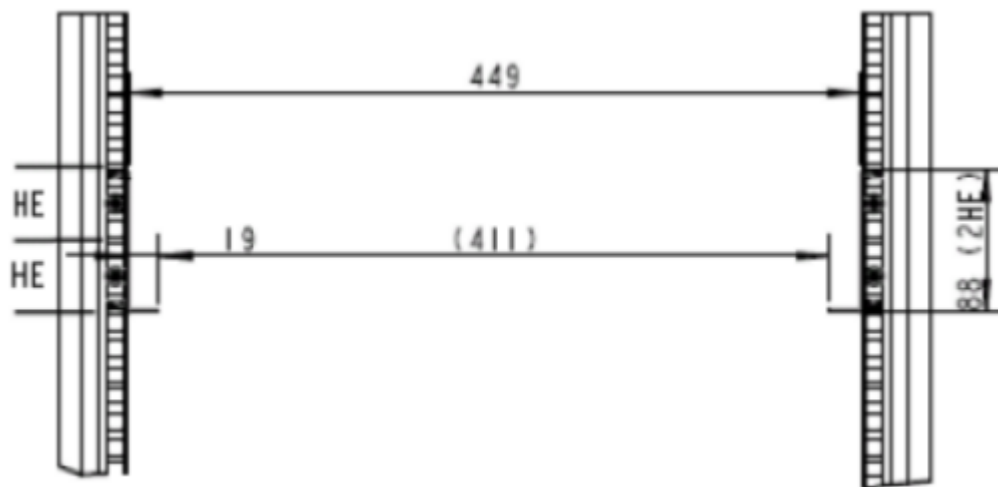**3. INSTALL TWO M-8 SCREWS**

1. INSTALL TWO M-8 SCREWS

4. INSTALL FOUR M-8 SCREWS TO LOCK RAIL AFTER INSTALLATION

Figure C-6 Installing the t rail kit

449

HE

19   (411)

HE

88 (2HE)

Figure C-7 Rail Assembly
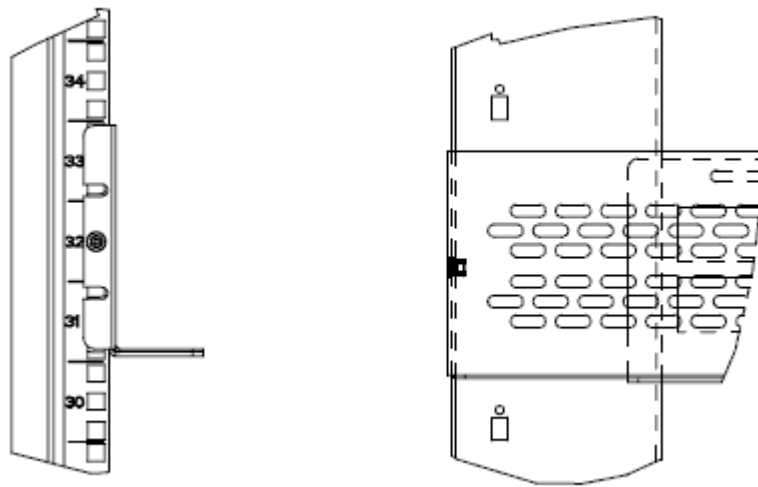
Figure C-8 Front and side views after installation

Installation and maintenance clearance area

The following shows the installation and maintenance clearance areas for the Hitachi rack.

Symbols

———————	:Outline of the rack frame
·······━━━━	Maintenance area boundary
··················	Swinging door
▲	Front side of the rack frame
•	Leveling bolt
+	Caster

Dimensions	Inches	Millimeters
a	41.9	1064.4
b	39.4	1000.0
c	5.9	150.0
d	36.0	914.4
e	18.9	479.6
f	1.3	33.5
g	4.4	110.7
w	23.1	586.5
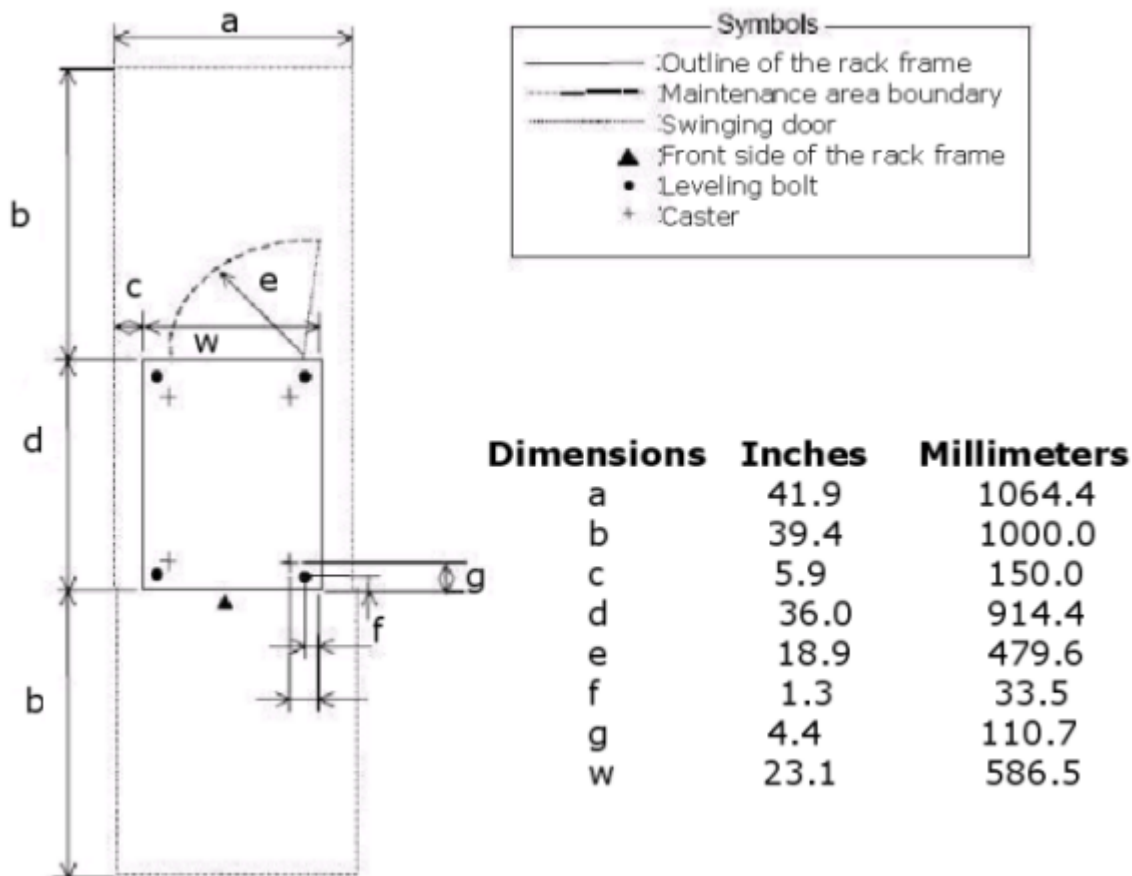
Figure C-9 Hitachi rack clearance area

Before installing a rack or equipment

Before unpacking, moving, or installing a rack or any equipment in it, read the following safety information. If yo have any questions, contact appropriate personnel within your company and as needed, contact Hitachi Data Systems Technical Support.

Safety precautions

To prevent bodily injury when mounting or servicing the storage system in the rack, take special precautions to ensure that the storage system racks and equipment remains stable.

⚠️ **WARNING:** The Hitachi Unified Storage VM storage system equipment is very heavy. Use a mechanical lifter to lift, move, install, and remove storage system equipment in a rack. If a piece of equipment falls, it could cause serious personal injury. Be careful when lifting, handling, positioning, and fastening equipment in a rack.

• Do not do anything that creates a potential hazard to people or that makes the equipment or rack unsafe.

- Mount the storage system starting from the bottom of the rack. If the rack will be partially filled, mount the heaviest component at the bottom of the rack. If the storage system is mounted only near the top of the rack, the rack may become unstable and fall

- Adjust the position of the storage system components so that they are mounted horizontally in the center of the rack frame. Shift the storage system onto the rails in the rack frame. When shifting the storage system, push it in to the end gently.

- The Hitachi rack is equipped with wheels for moving. Use enough personnel when moving the cabinet, especially on sloping loading docks and ramps to raised computer room floors. Move the cabinet slowly and deliberately. Be sure the floor is free from foreign objects and cables that the cabinet could roll over.

Electrical and environmental requirements

The following are basic data center requirements for installing and operating a Hitachi Unified Storage VMstorage system in a Hitachi rack. Detailed specifications and requirements are listed in Appendix A, Specifications on page A-1.

- The AC supply circuit for rack-mounted equipment must supply the total current specified on all the labels of the rack-mounted equipment and as specified in this guide.

- All AC power supply connections to the rack must be properly grounded. To ensure the integrity of the ground connection, special attention must be given to connections that are not directly connected to the branch circuit (for example, power strips).

- The operating ambient temperature of rack-mounted equipment must not exceed the maximum rated ambient temperature indicated in this guide.

- Air flow clearances specified in this guide must be maintained within the rack.

Installation safety

- 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.

Precautions when using rack-mounted equipment

This section explains precautions for:

- Casters — see Casters on page C-16
- Rack stability — see Rack stability on page C-16
- Component weight and location — see Component weight and location on page C-17
- Height considerations — see Height considerations on page C-18
- Placing components in the rack — see Placing components in the rack on page C-18
- Working with racks or components — see Working with racks or components in the rack on page C-19
- Air vents and airflow — see Air vents and airflow on page C-19
- Blanking panels — see Blanking panels on page C-20
- Cable Guidelines — see Cable guidelines on page C-20

Casters

Hitachi racks have casters that enable the rack to be rolled 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 to support the full weight of the rack on a long-term basis. As soon as the rack is in its final position, adjust the leveling feet so that they support the full weight of the rack. Otherwise, the casters may be damaged.

Rack stability

To reduce the risk of injury to persons or equipment, follow these guidelines:

- Be sure the front anti-tip stabilizing plate is installed before extending any equipment to the front. See Stabilizing the rack on page C-30 and Installing side stabilizer plates.

shows an example of how to install the side stabilizer plates. See the example of Installing the Side Stabilizer Plates.

- Install anti-tip stabilizing plates at the bottom left and right sides to increases rack stability.

- If extending equipment out of the rack, extend only one tray at a time. Extending two or more trays at a time may cause the rack to become unstable and possibly fall.

- Always use common sense and safety precautions.

Component weight and location

The Hitachi racks allow many components to be mounted. 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, follow the safety guidelines and stabilize the rack as described in this manual.

Note: 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. The location of the HUS VM controller and drive trays, 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.

Caution: If a controller or drive tray falls, it can cause personal injury. When lifting a unit, be sure you have at least two people, and up to 4 people and a mechanical lift device, depending on the weight of the storage unit being installed. Controller and drive tray positioning, fastening, or other handling should be performed very carefully.

- Fully configured HUS VM base and drive trays 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 HUS VM base and drive trays. The direction of airflow is front/input to rear/output.

- 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 rack is a 42U rack.

Note: Hitachi racks have a maximum mountable space of 42U. 2U is reserved at the base of the rack. The HUS VM base and drive trays are mounted starting from that point in the rack.

To reduce the risk of injury to persons or damage to the storage system, review the following guidelines prior to installing the HUS VM system into the Hitachi rack.

- Install the anti-tip stabilizing plate to provide added stability during installation. See Stabilizing the rack on page C-30 and Installing side stabilizer plates. Figure C-20 Installing and Uninstalling the Anti-Tip Stabilizing Plate (2) on page C-35 shows an example of how to install the side stabilizer plates.

- 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 HUS VM system has crossed the front of the rail kit. Otherwise, the HUS VM system 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 HUS VM system, 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.

Placing components in the rack

If mounting more than one HUS VM Drive Tray, spread the storage system ratio evenly and to avoid a top-heavy installation. The following illustration shows an example of such a ratio.

Smallest	1 Full Rack	Spanning Racks

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 HUS VM base and drive trays.
- 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 guidelines

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 uninterruptable 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.

Hitachi Unified Storage VM Block Module Hardware User Guide

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.

Note: 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 requirements

Table C-5 Rack internal environmental specifications[1] on page C-21 below lists the environmental specifications for the HUS VM systems when mounted in a Hitachi Data Systems rack. These specifications must be observed to ensure the proper operating and storage environment for the storage equipment 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 a magnet close to the rack or the HUS VM 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 the following table.

Table C-5 Rack internal environmental specifications[1]

Item	Specification	
Temperature	In operation	10 to 40° C
	Not-operating	-10 to 50° C
	In transport/storage	-30 to 60 °C
	Temperature change rate	10° C or less per hour
Humidity	In operation	8 to 80%
	In non-operation	8 to 90%
	Maximum wet bulb temp.	29° C (non condensing)

Item	Specification	
Altitude	In operation	-300 to 3,000 m
	In non-operation	-300 to 12,000 m
Note 1. Also see the system Environmental specifications on page A-8.		

Preparing for installation

This section covers preinstallation guidelines to observe before installing the equipment in a Hitachi rack.

Planning considerations

The following information will help you plan an acceptable equipment rack configuration.

To ensure personal safety, maintain a low center of gravity, and reduce the chance of instability, install the storage system controller and drive trays from the bottom of the rack upwards.

To ensure that internal heat build up is dissipated, do not restrict air flow

Be sure no vents are blocked, and that the HUS VM controller and drive trays are away from a solid surface such as a wall or partition. Air flows through the units from front to rear.

Note: In the Hitachi rack, 2U is reserved at the base of the rack. This leaves 40U of mountable space in the rack. Storage system units are mounted starting from that point in the rack.

- 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. Provide adequate ventilation for equipment at the bottom of the rack.

- Baffles can help 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. For information about the weight of an example storage controller and drive trays, see Floor load ratings on page C-10.

Receiving the rack from the shipping carrier

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 transporting the rack to upper and lower floors.
- Do not lay the rack down because the sheet metal may twist or distort.
- If the rack already has storage system components mounted in it, it may be heavy (250 lbs. to approximately 1000 lbs).

Tools required for installation

The following tools are required for securing products to the rack-mounting holes on a Hitachi rack:

- Adjustable wrench
- Cage nut tool
- Phillips screwdriver

All necessary screws, washers, cage nuts, and a cage nut too are suppled with the rack. When installing equipment, be sure to:

- Install the front anti-tip stabilizing plate to provide greater stability and safety. See Stabilizing the rack on page C-24 and Installing side stabilizer plates on page C-26. Figure C-12 Hitachi Univesal Rack with Side Stabilizer Plates Installed on page C-28 shows an how to install the stabilizer plates.
- Mount heavier storage equipment such as the controller chassis at the bottom of the rack first. Then install 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 enable 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, adjust the leveling feet so that the full weight of the rack is supported by them.

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 the following figure.
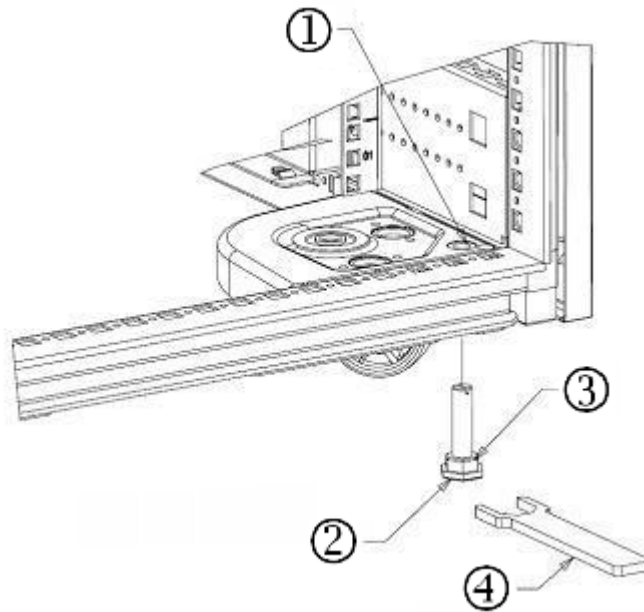
Figure C-10 Example of Leveling Feet

Item	Description
1	Access to leveling foot to allow manual adjustment with flat-tip screwdriver
2	1" (25 mm) Hex Foot Pad
3	Jam Nut
4	Wrench (not supplied with cabinet)

If access is available to the top of the leveling foot from the inside of the cabinet, a flat blade screwdriver may be used to drop the leveler down. Alternatively, you can loosen the leveler by turning it clockwise with a wrench to fit into the 1 inch hex pad. 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 drive trays 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 and side stabilizer plates must be installed on racks with storage system drive trays.

Always follow safety precautions and common sense. The following figure shows an example of how to stabilize a rack by lowering the leveling feet.

Left   Right   Front   Rear

Turn the leveling bolts clockwise
(viewed from top) to extend the
bolt and raise the rack. Approx
2-1/2 mm per turn or 10 turns
per inch.

0±2 mm   0±2 mm

Leveling bolts
(four each)

Approx
2.5 mm

Floor   Caster
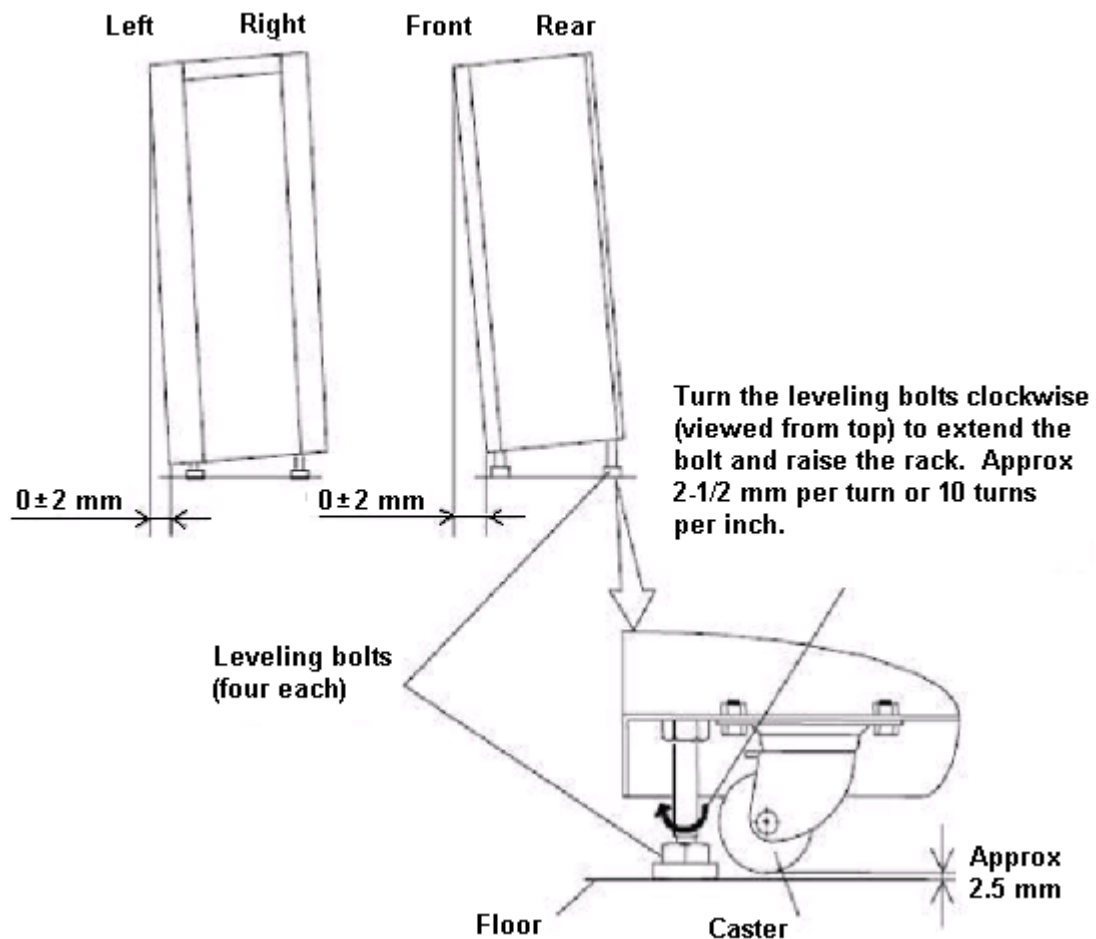
Figure C-11 Example of Lowering the Leveling Feet

Installing a Hitachi Universal rack

The following sections provides procedures to install a Hitachi rack and to install storage system components in the rack.

Note: The HUS VM storage system must be installed by trained Hitachi Data Systems personnel or trained authorized service providers. The HUS VM storage system is not a customer-installable product.

Installing side stabilizer plates

The following figure shows an example of how to install the side stabilizer plates. Example of Installing the Side Stabilizer Plates (Detail A)

Scale 0.100

(6) Flat Washer for M8 screw
6 M8 x 16 screw

Hex tool

Scale: 0.300

These 4x bolts and 4x washers to be no less than M12 (1/2-130 thread diameter, by installer)
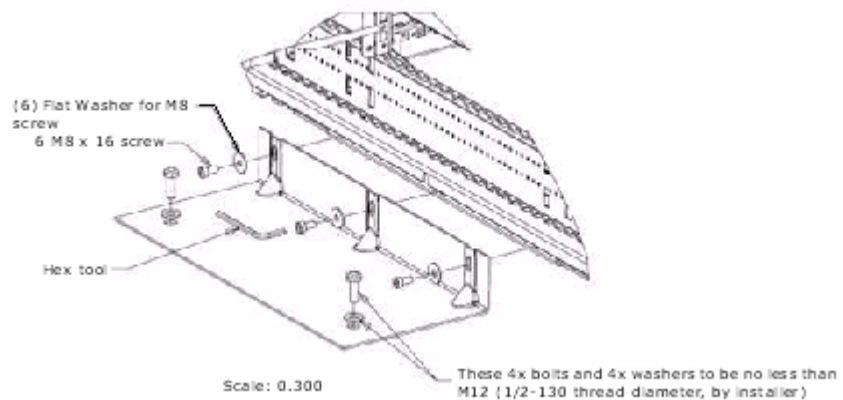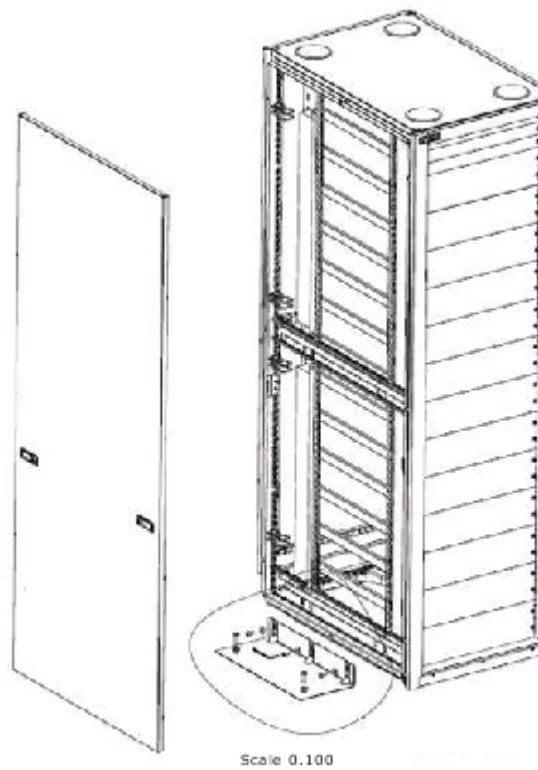
The following procedure describes how to install the side stabilizer plates. Installing side stabilizer plates is required only when the rack is installed as a stand-alone rack system with no equipment mounted in it. The side plates keep the rack from tipping on its sides. If equipment is mounted in the rack, the use of these side stabilizer plates is optional.

1. Remove side stabilizer plates from cabinet. The side panels are grounded inside the cabinet. To remove them, unlock the latches and then pull panel out and up.

2. Place the stabilizer plate as shown above so it can mate against the bracket at the bottom sides of frame and align with the holes.

3. Using the hardware supplied, attach both plates as shown in using the included hex tool.

4. Reinstall the side stabilizer plates.

5. Using the holes on the flat plate's surface, install bolts and washers to anchor the cabinet to the floor. This hardware is not included in the kit. The following figure shows the final view after everything is installed.

Scale: 0.100
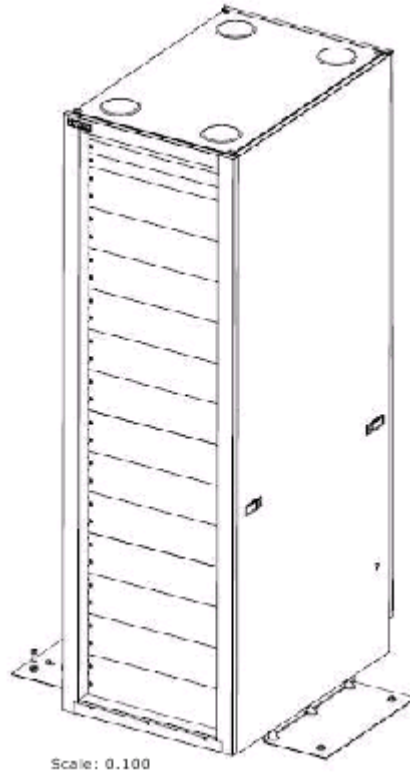
Figure C-12 Hitachi Univesal Rack with Side Stabilizer Plates Installed

Moving the rack

The maximum allowable inclination angle for the Hitachi rack is eight degrees (8°). When moving the rack across steep slopes or different floor levels, use a ramp as shown in the following figure to form a slope with an inclination angle (slope) of less than eight 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.

If you need to move the rack with the mounted components in it, use the pallet on which the rack was shipped to you. Be careful when loading the rack onto the pallet. Secure the rack on the pallet as it was shipped and received.
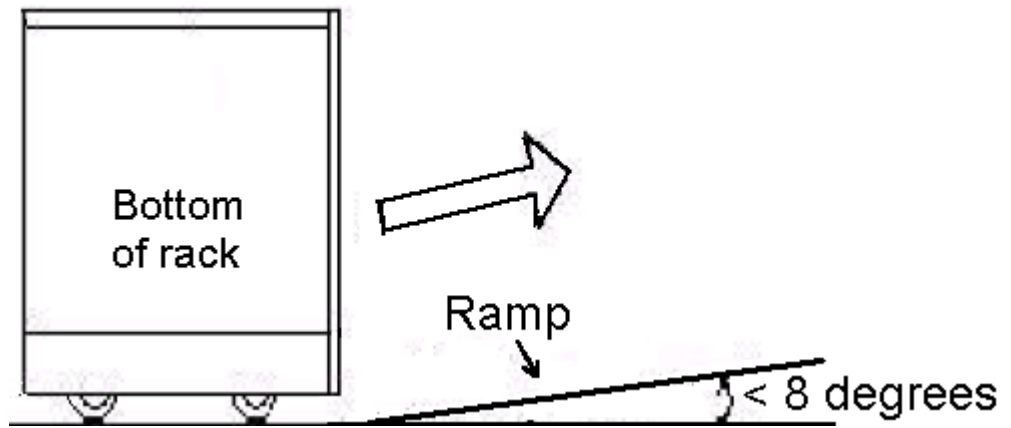
Figure C-13 Maximum Incline for moving a fully loaded rack

Securing multiple racks together with a baying kit

Baying kits are used to secure multiple racks together. To secure multiple racks, use the following procedure.

1. Remove side panels from the cabinets that are to be bayed together.
2. Open the contents of the baying kit.
3. Place the cabinets side by side until they touch.
4. After the cabinets are leveled, remove the two front-center roof installation screws using the TORX® tip tool supplied.
5. Place the baying plate on top (aligning the holes), and then reinstall the roof installation screws into both holes to connect the cabinets (see Detail A).
6. For the baying connection at the front bottom, the M12 bolts must be started by hand into the holes at the bottom of the frame until they are high enough to clear the TORX tool for final tightening).
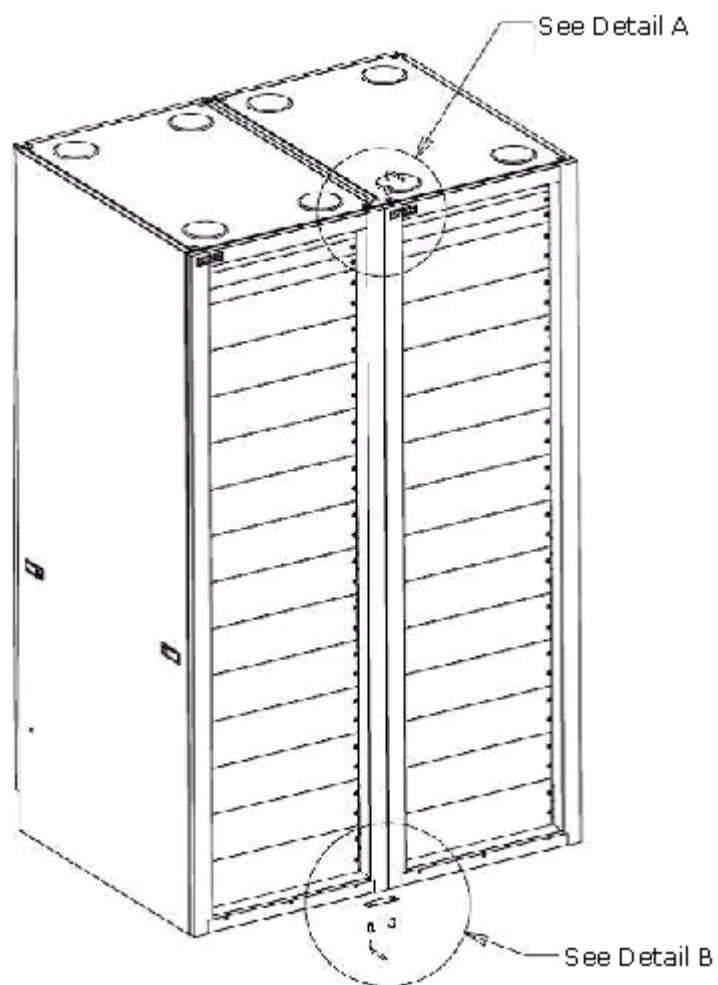
Figure C-14 Baying kit (also see details A and B)
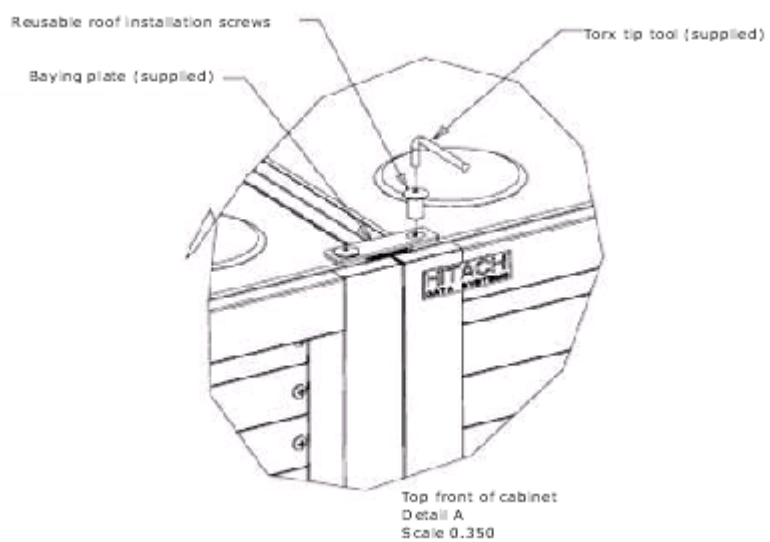
Figure C-15 Baying kit (detail A)

Reusable roof installation screws

Baying plate (supplied)

Torx tip tool (supplied)

Top front of cabinet
Detail A
Scale 0.350
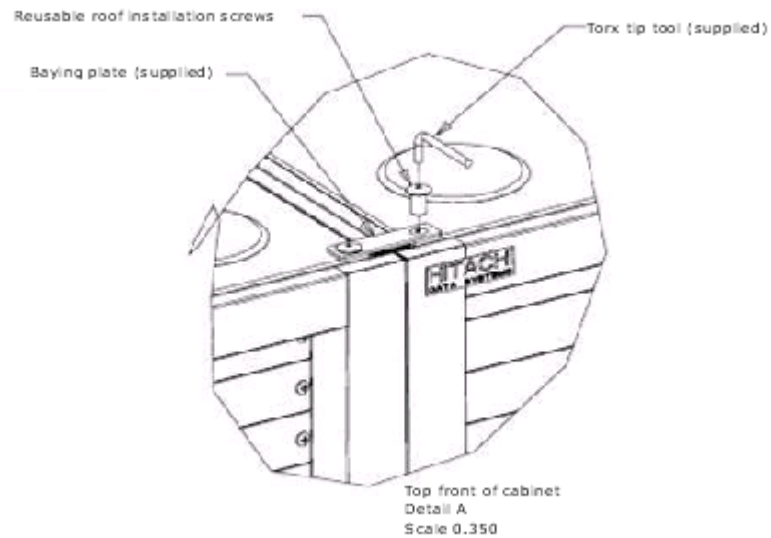
Figure C-16 Baying kit (detail B)

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).
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.
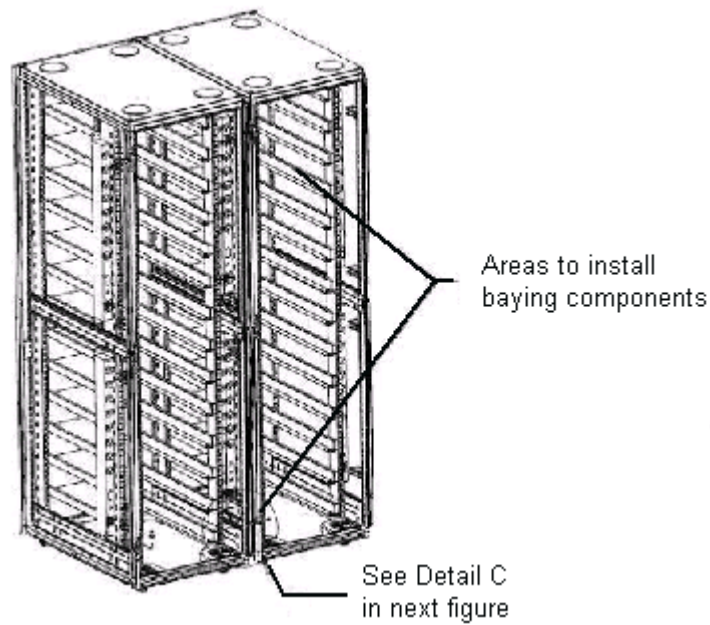
Figure C-17 Baying kit
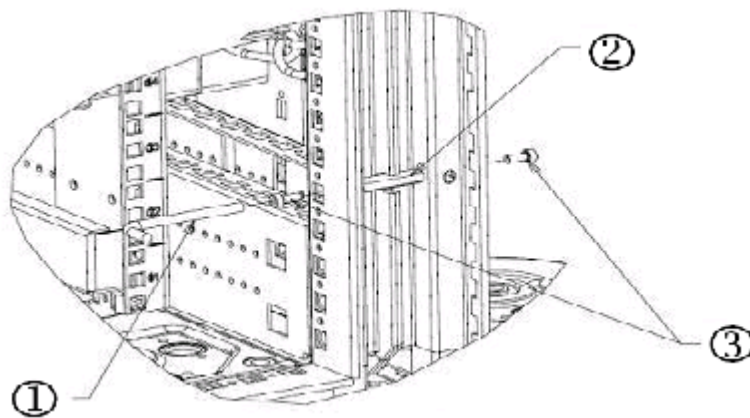
Figure C-18 Baying kit

Item	Description
1	4MM hex tool (not supplied) Magnetic type recommended
2	Hex connecting busing (supplied)
3	M6 bolts (supplied)

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 equipment in a rack

This section describes how to install equipment in the Hitachi rack. The topics covered in this section are:

Before installing equipment, read the safety information on page C-19. 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-30 and Installing side stabilizer plates. Figure C-19 Installing and Uninstalling the Anti-Tip Stabilizing Plate on page C-35 shows an example of how to install the side stabilizer plates. Example of Installing the Side Stabilizer Plates (Detail A) on page C-32.

- 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.

Installation tasks

Most installations of equipment in the rack involve the following steps:

1. Determine location in the rack where the components will be mounted.
2. Remove side panels or rear door of rack (not necessary but may make installation easier).
3. Install rail kits or mounting hardware on which that equipment will rest in the rack.
4. Prepare the mounting hardware.
5. Insert the applicable cage nuts in the rack to which the rail kits will be secured.
6. Install the rail kits/mounting hardware into the rack.
7. Install the front anti-tip stabilizing plate to provide greater stability and safety. See Stabilizing the rack on page C-30 and Installing side stabilizer plates.
   Figure C-19 Installing and Uninstalling the Anti-Tip Stabilizing Plate on page C-35 shows an example of how to install the side stabilizer plates.

Install the equipment into the rack as follows:

1. Determine what mounting holes will be used for securing the equipment to the rack, and install cage nuts at these locations.

2. Insert equipment into the rack using the previously installed railkits/ mounting hardware.

3. 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 rail kits or securing equipment to the rack, insert the cage nuts into the square holes. Then insert cage screws to secure the rail kits and equipment to the rack.

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 here.
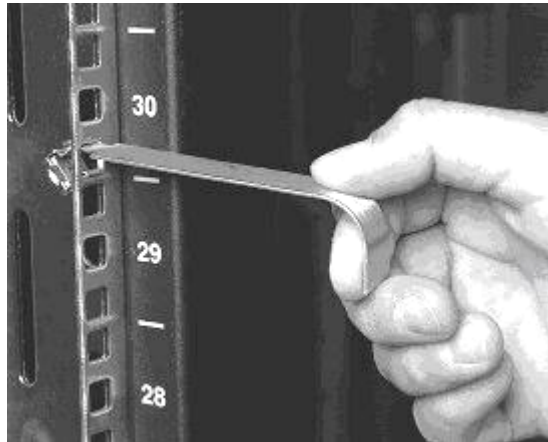
Installing and uninstalling the anti-tip stabilizing plates

Install anti-tip stabilizing plates to provide further stability to the rack. This extra stability is especially important when installing equipment into the rack or when removing equipment from it. Figure C-19 Installing and Uninstalling the Anti-Tip Stabilizing Plate on page C-35 shows the installation of the anti-tip stabilizing plate. Reverse these actions for uninstalling the anti-tip stabilizing plate.
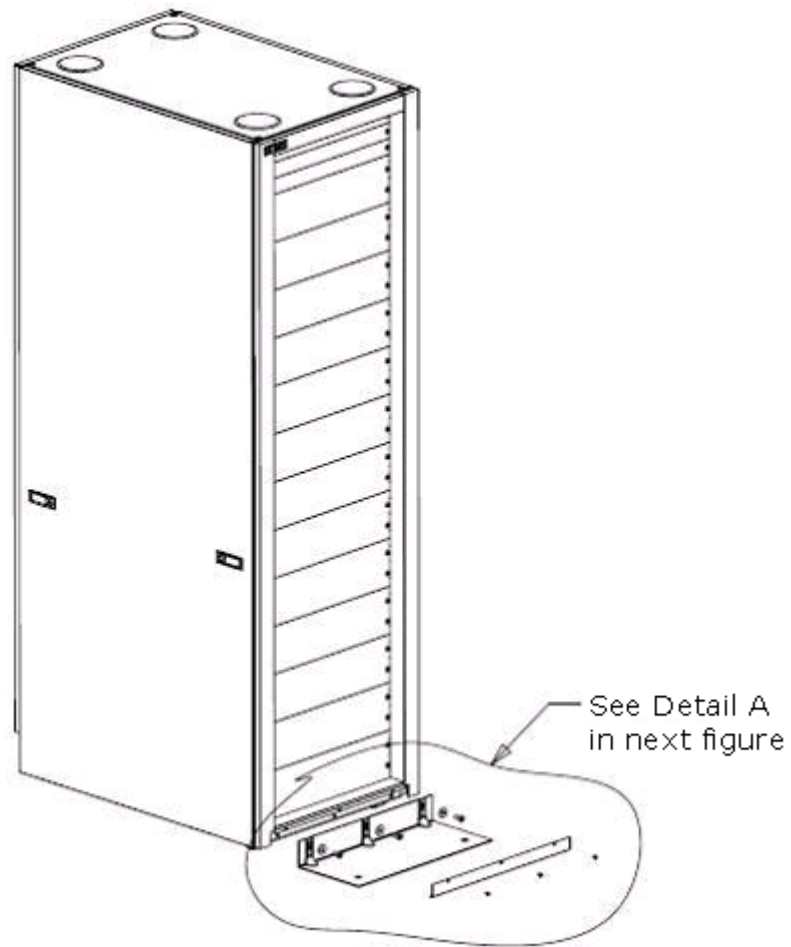
Hitachi Unified Storage VM Block Module Hardware User Guide

See Detail A
in next figure

Figure C-19 Installing and Uninstalling the Anti-Tip Stabilizing Plate

(3) flat washer F. M8 screw

(3) M8 x 16 screw

(3) M4 x 10 flathead screw

Stabilizer plate

Hex tool

Trim cover plate (bezel)

Detail A
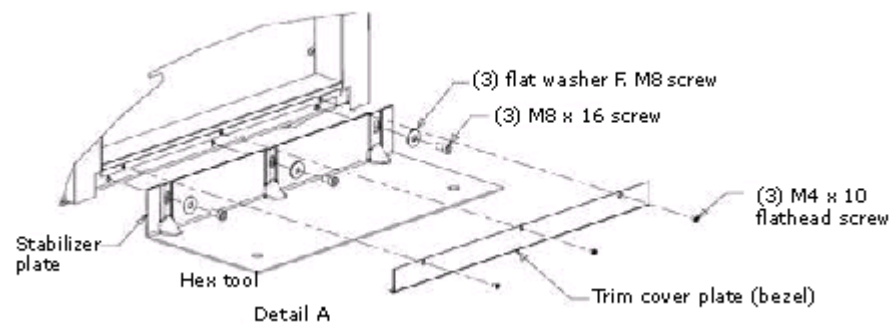
Figure C-20 Installing and Uninstalling the Anti-Tip Stabilizing Plate (2)

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 the bottom of the frame. Using the washers, M8 screws, and tool in the kit, secure the plate to the frame.

4. 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.

Post-installation considerations

The following sections provide guidelines to consider after you install equipment in the Hitachi rack.

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.

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 , 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.

Rack information

D

Regulatory Compliance

This appendix includes a comprehensive set of specifications for the HUS VM storage system storage system described in this manual. The Regulatory Compliance section includes a table of regulatory specifications that are met by the HUS VM storage system. Following the tables are individual regulatory statements that explain the requirements of various countries.

☐ Regulatory compliance

☐ US FCC Notice

☐ European Declaration of Conformity

☐ Notice of export controls

☐ Hazardous and toxic substances

☐ Disposal

☐ Recycling

☐ Electronic emissions certificates

Regulatory compliance

This equipment has been tested and is certified to meet the following standards:

Table D-1 HUS VM Certifications

Standard	Specification	Mark on the product	Country
Electronic emission control	FCC Part 15 Subpart B Class A	Yes (FCC)	U.S.A
Electronic emission control	FCC Part 15 Subpart B Class A:2010, Class A ICES-003 Issue 4 Class A	Yes (UL)	Japan
Safety certification	TUV Safety Report and TUV-NRTL Certification, FCC Verification Report	Yes (TUV)	EU, North America
Electronic emission certifications	TUV Safety Report, EMC Report, TUV GS License, EMC Certificate, CE Mark	Yes (CE Mark)	European Union
Electronic emission control	CB Report and Certificate	Yes (TUV)	Worldwide
Electronic emission control	Test Report for C-Tick Approval	Yes	Australia andNew Zealand
VCCI Registration for Product and Accessories	VCCI Class A	Yes (VCCI)	Japan
Safety certification	EAC EurAsian Conformity mark	Yes (EAC)	Russia
Electronic emission control	BSMI Approval for Product and Accessories	Yes (BSMI)	Taiwan
Electronic emission control	RRL Approval and KTL Safety Approval	Yes (RRL)	Korea
Safety certification	IRAM Approval	Yes	Argentina
Electronic emission control	CCC Approval for Switching Power Supply	Yes (IRAM)	China

Table D-2 HUS VM Certifications, by Region

Region	Regulatory	Standard	Certificate No. and Report No.	
CB	IEC60950-1 :2005	Certificate No.	JPTUV-033033 JPTUV-033033-M1	

Region	Regulatory	Standard	Certificate No. and Report No.	
			Worldwide	Report No.	12020365-001 12020365-002
				Photo Documentation No.	12020365-001
Safety	North America	cTUVus	UL60950-1:2007CSA-C22.2 No.60950-1-07	Certificate No.	CU 72100030
	European Union	TUV GS	EN60950-1:2006 +A11	Certificate No.	S1 50183813
	Argentina	IRAM	IEC60950-1:2005	Certificate No.	RA 3082130 E
Safety EMC	Russia	EAC	TP TC 004/2011, TP TC 020/2011	Certificate No.	RU C-JP.AЯ46.B.66763
North America	FCC	FCC Part15 SubpartA: 2010	Test Report No.	29HE0209-YK-B 30HE0216-SH-B 30KE0010-SH-B	
	European Union	EN	EN55022:2006+A1EN61000-3-2:2006EN61000-3-3:2008EN55024:1998+A1+A2	Test Report No.	12606815-001
EMC	Australia andNew Zealand	C-Tick	AS/NZS CISPR22:2009	Test Report No.	29HE0209-YK-C 30HE0216-SH-C
	Taiwan	BSMI	CNS13438:2006IEC60950-1:2005	Declaration of Conformity	Declaration of Conformity
	South Korea	KCC	KN22KN24	Certificate No.	HTB-DKC710ICBXFBX(A)
	Region	Regulatory	Standard	Parts	Certificate No.
SafetyEMC	China	CCC	GB4943-2001GB9254-2008GB17625.1-2003	SVP HJ-4230-xyyyy	2009010911374023
				HUB HJ-4230-HUB	2009010911378891
				SWPSHS1502	2010010907425306

US FCC Notice

FCC Notice

Federal Communications Commission

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 to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

Electronic emissions testing

EMI testing was done with shielded cables. Therefore, in order to comply with the FCC regulations, you must use shielded cables with your installation.

The EMI tests were done in the following configurations:

DKC710I-CBX+DKC+F710I-SBX

DKC710I-CBX+DKC+F710I-SBX+DKC-F710I-UBX

Copies of the Underwriters Laboratories EMI compliance certificates are located at the end of this chapter.

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

European Declaration of Conformity

Warning This equipment complies with the requirements relating to electromagnetic compatibility, EN 55022 class A for ITE, the essential protection requirement of Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility.

"EINE LEICHT ZUGÄNGLICHE TRENN-VORRICHTUNG, MIT EINER KONTAKT-ÖFFNUNGSWEITE VON MINDESTENS 3mm IST IN DER UNMITTELBAREN NÄHE DER VERBRAUCHERANLAGE ANZUORDEN (4-POLIGE ABSCHALTUNG)."

Maschinen lärm informations verordnung 3. GSGV, 18.01.1991: Der "höchste" Schalldruckpegel beträt 70 db (A) oder weniger gemäß ISO 7779

CLASS 1 LASER PRODUCT

WARNING: 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.

WARNING: Dies ist ein Produkt der Klasse A. In nichtgewerblichen Umgebungen können von dem Gerät Funkstörungen ausgehen, zu deren Beseitigung vom Benutzer geeignete Maßnahmen zu ergreifen sind.

Notice of export controls

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

(-20 symbol)	This symbol displays requirements for controlling pollution caused by electronic information products.

Hazardous and toxic substances

Table D-3 Hazardous and toxic substances

Toxic and Hazardous Substances and Elements					
Unit	Lead (PB)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chronium (Cr (VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Controller chassis	X	O	O	O	O	O
Drive chassis	X	O	O	O	O	O
The Symbol O indicates that this toxic or hazardous substances contained in all of the homogeneous materials for this part is below this limit requirement in SJ/T 11363-2006.						
The symbol X indicates that this toxic or hazardous substances contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T 11363-2006.						

Disposal

(crossed-out wheeled bin symbol)	**NOTE**: 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 household wastes. There are separate collection systems for recycling EU and many cities in the USA. For more information, contact the local authority or the dealer where you purchased the product.

Recycling

The cache backup battery unit includes a nickel-hydride battery. A nickel-hydride battery should be recycled when it is no longer usable. When you replace the battery unit, do not dispose of the old one in the trash. recycle the battery instead. The mark posted on the battery unit is a three-arrow mark that means a recyclable part.

Electronic emissions certificates

Copies of the Underwriters Laboratories EMI compliance certificates are located on the following pages. Contact Hitachi Data Systems support for detailed information if needed.

.

Underwriters Laboratories

EMI TEST REPORT

Test Report No.:30HE0216-SH-B

Applicant	:	Hitachi Ltd.
Type of Equipment	:	Disk Subsystem
Model No.	:	DKC710I-CBX+DKC-F710I-SBX +DKC-F710I-UBX
Test regulation	:	FCC Part15 Subpart A: 2010, Class A ICES-003 Issue 4 Class A
Test result	:	Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

Date of test:
June 10, 11, 15, 16 and July 7, 2010

Tested by:

Makoto Hosaka
Engineer of EMC Service

Akihiro Oda
Engineer of EMC Service

Approved by:

Ichiro Isozaki
Leader of EMC Service

JAB
Testing
RTL02010

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

UL Japan, Inc.
Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone:	+81 463 50 6400
Facsimile:	+81 463 50 6401

MF06404 706 08.09?

Figure D-1 UL EMI compliance certificate (1 of 3)

EMI TEST REPORT

Test Report No.:30KE0010-SH-B

Applicant	:	Hitachi Ltd.
Type of Equipment	:	Disk Subsystem
Model No.	:	DKC710I-CBX+DKC-F710I-SBX +DKC-F710I-UBX
Test regulation	:	FCC Part15 Subpart A: 2010, Class A ICES-003 Issue 4 Class A (Radiated Emission test only)
Test result	:	Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

Date of test:

July 17, 2010

Tested by:

Akio Hayashi
Engineer of EMC Service

Approved by:

Ichiro Isozaki
Leader of EMC Service

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

JAB
Testing
RT100818

Figure D-2 UL EMI compliance certificate (2 of 3)

EMI TEST REPORT

Test Report No.:29HF0209-YK-B

Applicant	:	Hitachi Ltd.
Type of Equipment	:	Disk Subsystem
Model No.	:	DKC710I-CBX~DKC-F710I-SBX
Test regulation	:	FCC Part15 Subpart A: 2010, Class A ICES-003 Issue 4 Class A
Test result	:	Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

Date of test:

March 3- 5, 2010

Tested by:

Makoto Hosaka
Engineer of EMC Service

Akihiro Ieta
Engineer of EMC Service

Approved by:

Ichiro Isozaki
Leader of EMC Service

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

UL Japan, Inc.
Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Karagawa-ken, 259-1220   JAPAN

MF060d (06.03.29)

Telephone: +81 463 50 6400
Facsimile: +81 463 50 6401

Figure D-3 UL IMI compliance certificate (1 of 3)

Regulatory Compliance

Hitachi Unified Storage VM Block Module Hardware User Guide

Glossary

This glossary defines the special terms used in this document.

A

array
See disk array.

B

back-end I/O module
The hardware component that controls the transfer of data between the drives and cache. A back-end I/O module feature consists of a pair of boards.

C

controller chassis
The hardware assembly that contains the logic and processing components of the HUS VM storage system, including the front-end directors, virtual storage directors, cache memory, switches, and back-end directors. The HUS VM storage system can be configured with one or two control chassis.

D

disk array
Disk array, or just array, is a complete storage system, including the control and logic devices, drives, connecting cables, and racks.

drive tray
The hardware component of the HUS VM that houses disk drives and/or flash drives.

dynamic provisioning
An approach to managing storage. Instead of "reserving" a fixed amount of storage, it removes capacity from the available pool when data is actually written to disk. Also called thin provisioning.

F

flash drive
A data drive that uses a solid-state memory device instead of a rotating hard disk drive to store information.

free capacity
The amount of storage space (in bytes) that is available for use by the host systems.

H

host I/O module
The hardware component that processes channel commands from hosts and manages host access to cache. A host I/O module is also referred to as a channel adapter (CHA).

J

JRE
Java Runtime Environment

JVM
Java Virtual Machine

K

kVA
kilovolt-ampere

L

LDEV
logical device

license key
A specific set of characters that unlocks an application and allows it to be used.

logical device (LDEV)
An individual logical data volume (on multiple drives in a RAID configuration) in the storage system. An LDEV may or may not contain any data and may or may not be defined to any hosts. Each LDEV has a unique identifier or "address" within the storage system composed of the logical disk controller (LDKC) number, control unit (CU) number, and LDEV number. The LDEV IDs within a storage system do not change.An LDEV formatted for use by open-system hosts is called a logical unit (LU).

logical volume
See *volume*.

LUN
logical unit number. Sometimes used in place of LU, logical unit.

LUSE
LUN Size Expansion

P

pair
Two logical volumes in a replication relationship in which one volume contains original data to be copied and the other volume contains the copy of the original data. The copy operations can be synchronous or asynchronous, and the pair volumes can be located in the same storage system (in-system replication) or in different storage systems (remote replication).

pair status
Indicates the condition of a copy pair. A pair must have a specific status for specific operations. When an operation completes, the status of the pair changes to the new status.

PDB
power distribution box

PDP
power distribution panel

PDU
   power distribution unit

pool
   A set of volumes that are reserved for storing Copy-on-Write Snapshot data or Dynamic
   Provisioning write data.

R

RAID
   redundant array of independent disks. A disk array in which part of the physical storage
   space is used to store user data and parity information, and another part is used to
   store a duplicate set of user data and parity information. This redundant configuration
   prevents data loss in case a disk drive within the RAID configuration fails, and enables
   regeneration of user data in the event that one of the array's member disks or the
   access path to it fails.

RAID group
   A set of RAID disks that have the same capacity and are treated as one group for data
   storage and recovery. A RAID group contains both user data and parity information.
   This allows user data to be accessed in the event that one or more of the drives within
   the RAID group are not available. The RAID level of a RAID group determines the
   number of data drives and parity drives and how the data is "striped" across the drives.
   For RAID1, user data is duplicated within the RAID group, so there is no parity data for
   RAID1 RAID groups.
   A RAID group can also be called an array group or a parity group.

RAID level
   The type of RAID implementation. The HUS VM system supports RAID levels RAID1,
   RAID5 and RAID6.

S

SAS
   serial-attached SCSI

SATA
   serial Advanced Technology Attachment

service information message (SIM)
   SIMs are generated by a storage system when it detects an error or service
   requirement. SIMs are reported to hosts and displayed on Storage Navigator.

Hitachi Unified Storage VM Block Module Hardware User Guide

service processor (SVP)
The computer in a HUS VMstorage system that hosts the Storage Navigator software and is used to configure and maintain the storage system.

SIM
service information message

SOM
system option mode

SSD
solid state drive. See *flash drive.*

SVP
See *service processor (SVP)*.

system disk
The volume from which an open-systems host boots.

system option mode (SOM)
Additional operational parameters for the RAID storage systems that enable the storage system to be tailored to unique customer operating requirements. SOMs are set on the service processor.

V

volume
A logical device (LDEV), or a set of concatenated LDEVs in the case of LUSE, that has been defined to one or more hosts as a single data storage unit. An open-systems volume is called a logical unit. (LU).

Index

O

operations
  battery backup   5-6
option modes
  system   B-2

P

procedures
  power off   5-5
  power on   5-4

R

RAID groups   2-3
RAID implementation   2-2
requirements   4-7
  airflow   4-12
  cable length   4-17
  circuit breakers   4-10
  data center   4-7
  delivery   4-4
  facilities   4-4
  general   3-2
  grounding   4-9
  installation   4-1, 4-2
  LAN   4-16
  operational   4-5, 4-16
  plugs   4-10
  power   4-4
  power connection   4-9
  safety   3-1, 4-2, 4-4
  service clearance   4-15
  site   4-5
  storage   4-4, 4-7
responsibilities
  support team   4-2
respopnsibilities
  user   4-2

S

safety   5-2
specifications   4-7
  drive   A-3
  electrical   4-9
  environmental   4-14, A-8

  equipment noise   4-15
  heat output   4-12
  load rating   4-15
  mechanical   A-2, A-4
switches
  power   5-4

Index-2

Hitachi Data Systems

Corporate Headquarters
2845 Lafayette Street
Santa Clara, California 95050-2639
U.S.A.
www.hds.com

Regional Contact Information

Americas
+1 408 970 1000
info@hds.com

Europe, Middle East, and Africa
+44 (0)1753 618000
info.emea@hds.com

Asia Pacific
+852 3189 7900
hds.marketing.apac@hds.com

@Hitachi Data Systems

MK-92HM7005-07