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THEORY OF OPERATION SECTION

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NOTICE: Unless otherwise stated, "firmware version" in this section indicates DKCMAIN firmware.

1. Storage System Overview of DW800

This section describes the storage system overview and the operations.
Section 1 describes the overview of the storage systems.
The operations and the related information of the storage systems are described from section 2 and the following sections.

1.1 Overview

DW800 are the 19-inchi rack mount models and they consist of the controller chassis that controls the drive and the drive installed drive box.

Controller chassis is the hardware that plays a vital role in the storage system, and it controls the drive box. 4U chassis has the two clustered controllers and it provides the redundant configuration in which the all major components such as processor, memory and power supply are duplicated.
When a failure occurs on one side of the controllers, a continuous processing can be performed on the other side of the controllers. When a load is concentrated on one side of the controllers, an acceleration of the processing performance is achieved by distributing the processor resource to all CPUs of the both controllers. Furthermore, each component and firmware can minimize the influence from the suspension of the maintenance operation system as they can replace and update while operating the system.
Also, to use as the file storage, installing NAS module on a controller is required.

Four types of the drive boxes are available. Also, the number of drive boxes and the size of the drive box are expandable depending on the usage purpose. Like the controller chassis, the major components of the drive box have the duplicated redundancy configuration.

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1.2 Features of Hardware

DW800 have the following features.

High-performance
- Similar performance to the enterprise class is achieved by implementing the high-speed processor
- Distributing the processing by the cluster configured controller
- High-speed of processing is achieved by large capacity cache memory
- High-speed of I/O processing is achieved by flash disk and FMD
- High-speed data transfer is achieved by 16 Gbps Fibre Channel and 10 Gbs iSCSI interface/NAS

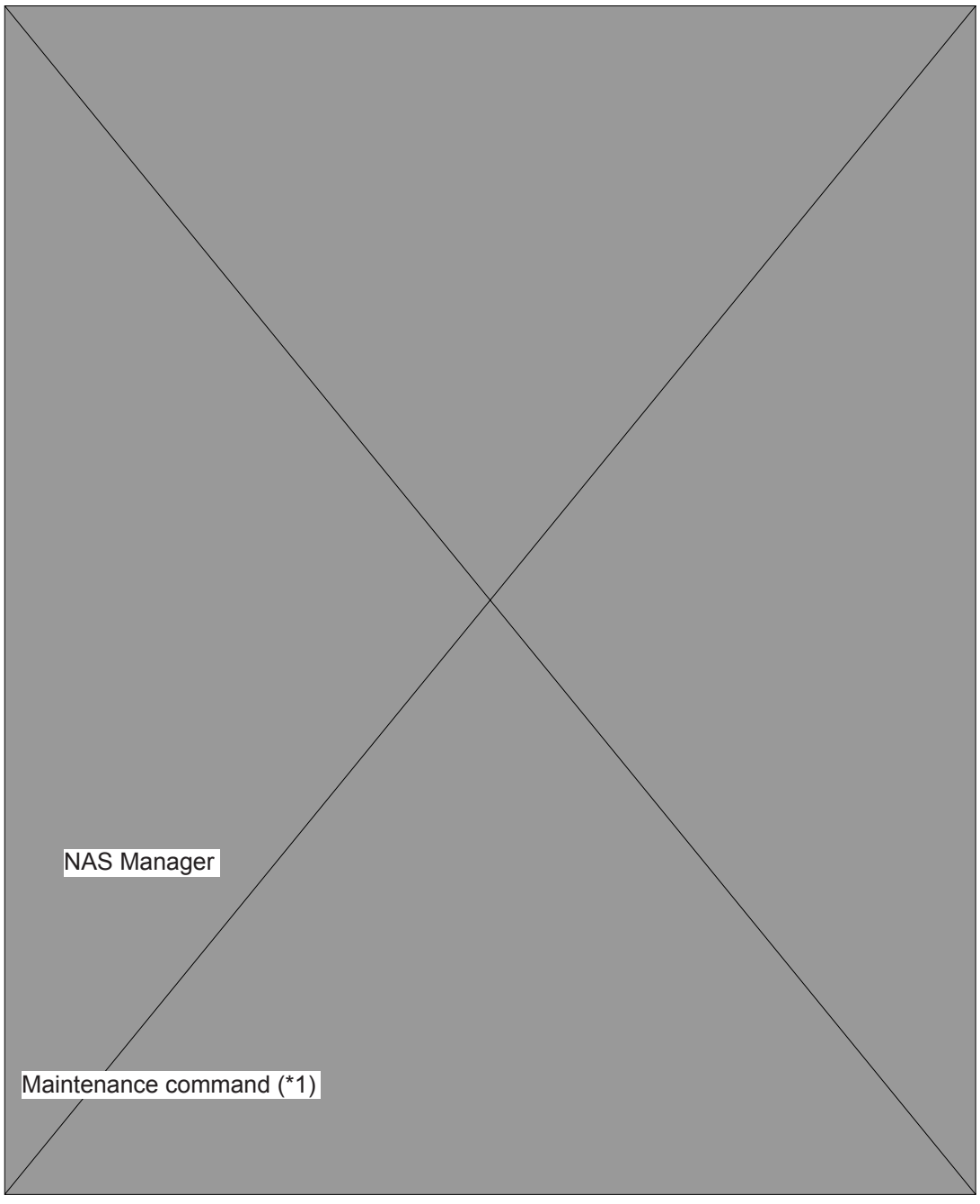
High Availability
- Continuous operation by the duplicated major components
- RAID1/5/6 are supported (RAID 6 supports up to 14D+2P)
- Data is maintained during a power failure by saving data in cash flash memory
- File can be shared between the different types of server

Scalability and Diversity
- Four types of drive box corresponding to SAS drive, flash drive and FMD can be connected
  - DBS: Up to 24 of 2.5 inch SAS drives and flash drives can be installed (2U size)
  - DBL: Up to 12 of 3.5 inch SAS drives and flash drives can be installed (2U size)
  - DB60: Up to 60 of 3.5 inch SAS drives and flash drives can be installed (4U size)
  - DBF: 12 FMD can be installed (2U size)
- High density drive box DB60 in which up to 60 drives can be installed is supported (4U size)
- OS mixed environment such as UNIX, Linux, Windows and VMware is supported

1.3 Storage System Configuration

To configure and operate the Storage System, other than the DW800 hardware, SVP (SuperVisor PC) for the management server is required.
For the storage management and the operation software, use Hitachi Device Manager - Storage Navigator, and for the maintenance software, use Maintenance Utility.
When NAS Modules are installed, use NAS Manger and maintenance command for the software to set and manage NAS.
Figure 1-1 shows the outline of the Storage System configuration.

Figure 1-1 Outline of Storage System Configuration



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1.3.1 Hardware Configuration

A storage system consists of one controller chassis (DKC) and multiple drive boxes (DB) and channel board box (CHBB).
Figure 1-2 shows the hardware configuration of the storage system.

Figure 1-2 Hardware Configuration (Example : VSP Gx00 Model)

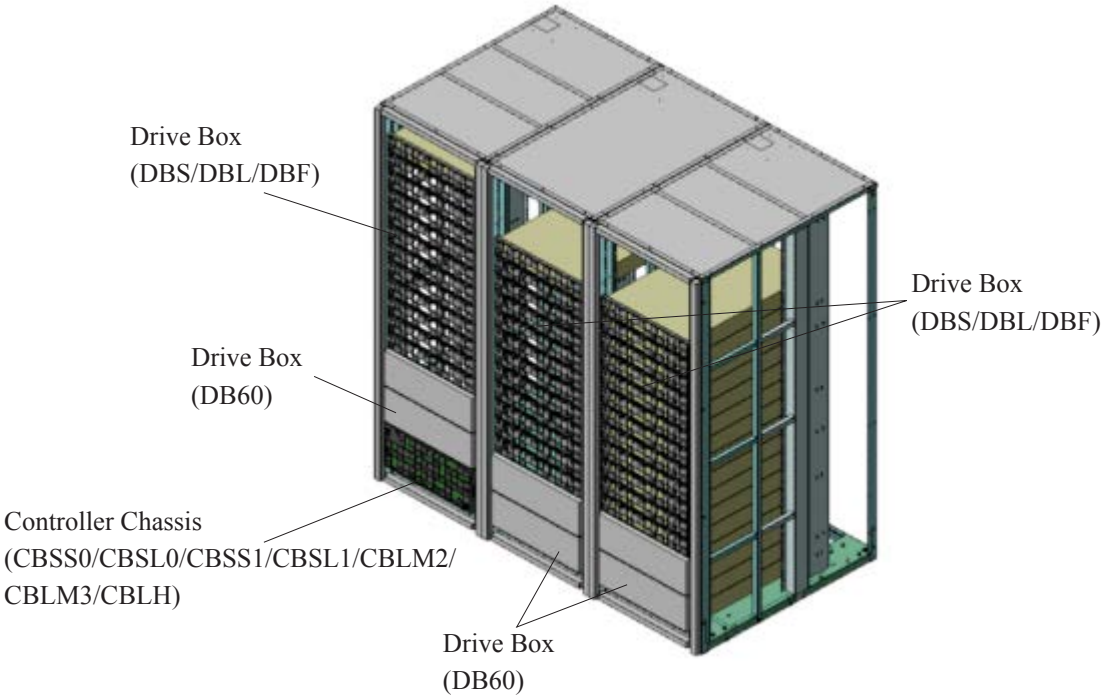
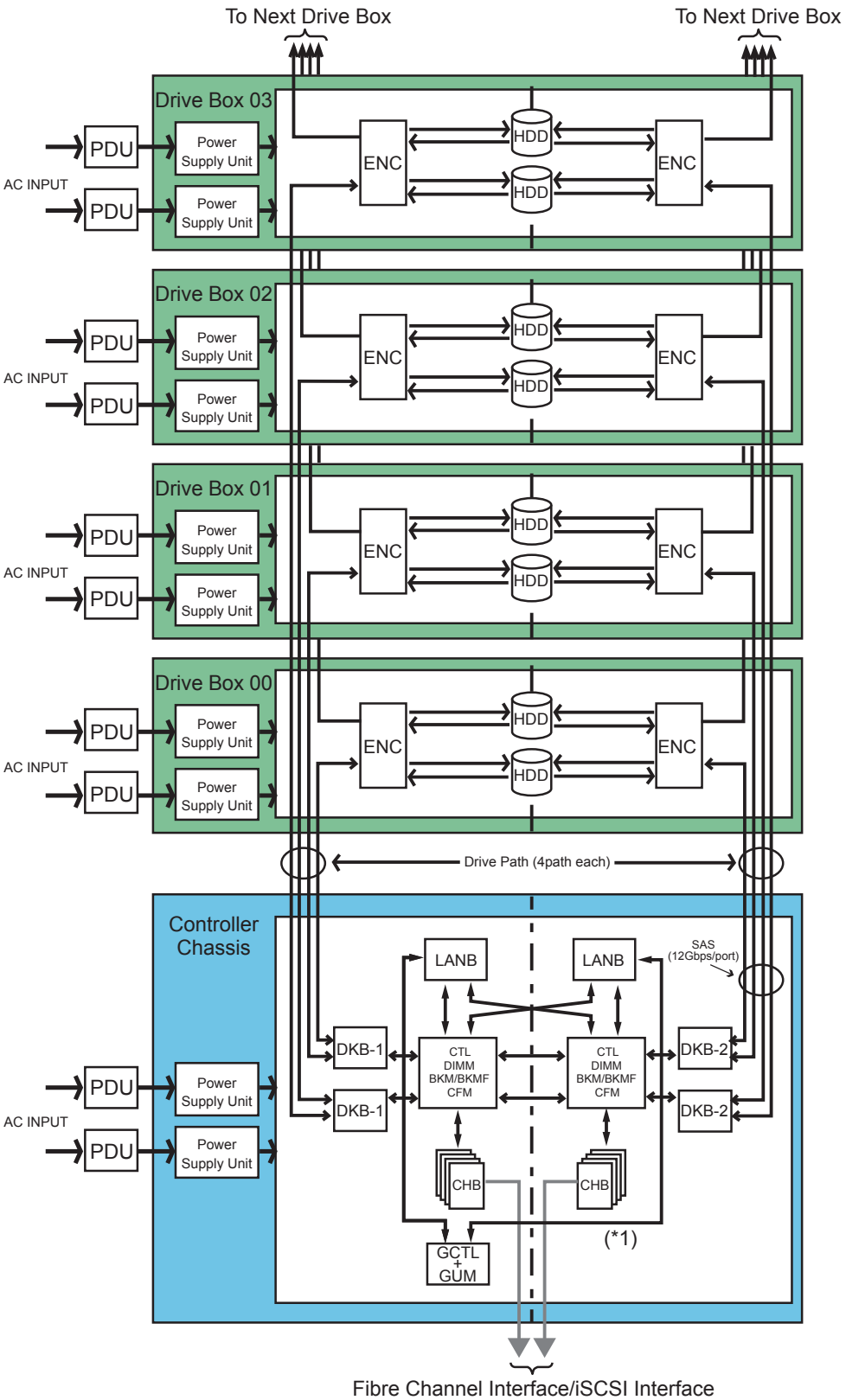


Figure 1-3 shows the system hardware configuration of the storage system.

Figure 1-3 System Hardware Configuration (Back-end)



*1: NAS modules can be installed by using four slots in CHB.

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[Controller Chassis]

It consists of a controller board, a channel board (CHB), a disk board (DKB), NAS modules and a power supply that supplies the power to them.

[Drive Box]

It consists of ENC, drives and the cooling fan integrated power supply.
For the drive boxes, the four types of DBS, DBL, DBF and DB60 are available.

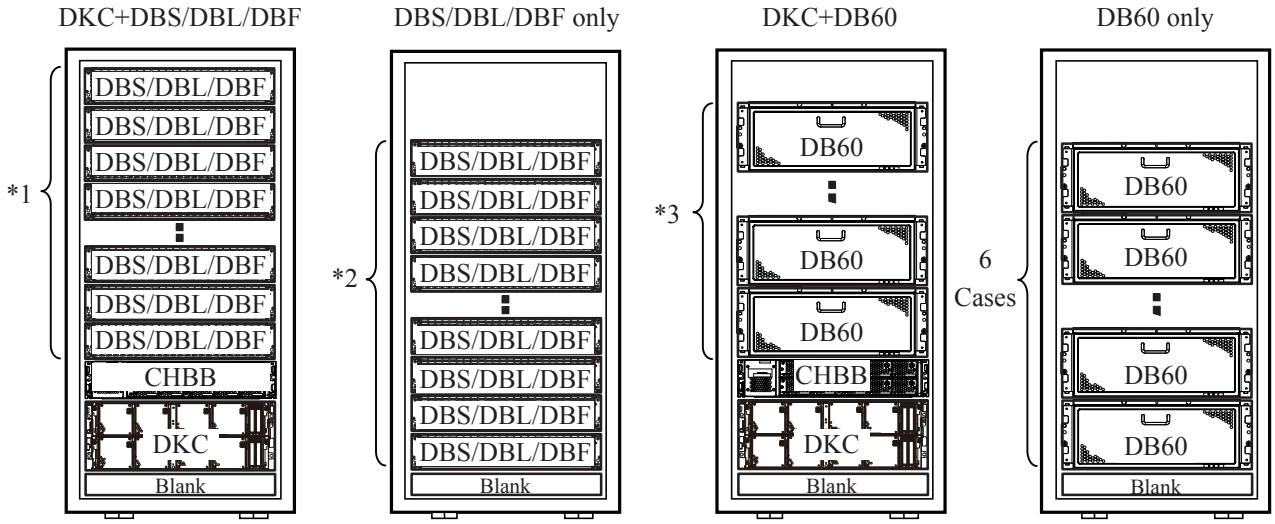
VSP Gx00 models

- DBS (for 2.5 inch)
  One DKC and up to 16 drive boxes can be installed in a rack.
  As the maximum system configuration, a total of 48 drive boxes can be installed.
- DBL (for 3.5 inch)
  One DKC and up to 15 drive boxes can be installed in a rack.
  As the maximum system configuration, a total of 48 drive boxes can be installed.
- DBF (for flash module drive)
  One DKC and up to 12 drive boxes can be installed in a rack.
  As the maximum system configuration, a total of 48 drive boxes can be installed.
- DB60 (for 2.5 inch/3.5 inch)
  One DKC and up to 5 drive boxes can be installed in DB60.
  As the maximum system configuration, a total of 24 drive boxes can be installed.

Figure 1-4 shows the installing configuration in a rack. DBS, DBL, DBF and DB60 can be mixed in the same system.

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Figure 1-4 Installing Configuration in Rack



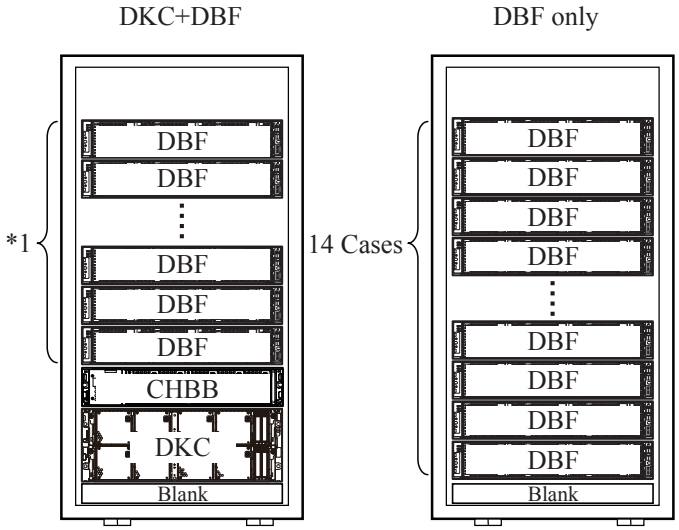
*1: When CHBB is not installed : 16 DBS, 15 DBL and 12 DBF
When CHBB is installed : 14 DBS, 14 DBL and 10 DBF
*2: 19 DBS, 18 DBL and 14 DBF
*3: When CHBB is not installed : 5 DB60
When CHBB is installed : 4 DB60

VSP Fx00 models

- DBF (for flash module drive)
  One DKC and up to 12 drive boxes can be installed in a rack.
  As the maximum system configuration, a total of 48 drive boxes can be installed.

Figure 1-5 shows the installing configuration in a rack.

Figure 1-5 Installing Configuration in Rack



*1: When CHBB is not installed : 12 Cases
When CHBB is installed : 10 Cases

[Channel Board Box]

It consists of a channel board (CHB), a PCIe cable connection package (PCP), a switch package (SWPK) and a power supply (CHBBPS).

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1.3.2 Software Configuration

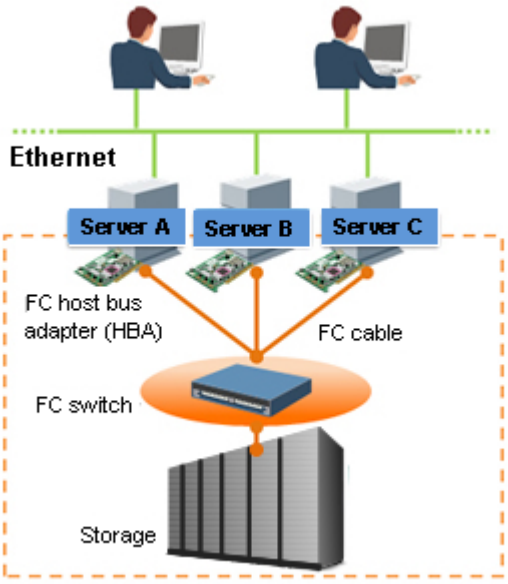
This software configuration section describes the software to perform the data I/O, manage and maintain the storage system.
For the overview of each software, see the subsections from 1.3.2.1 to 1.3.2.3.

1.3.2.1 Software to Perform Data I/O

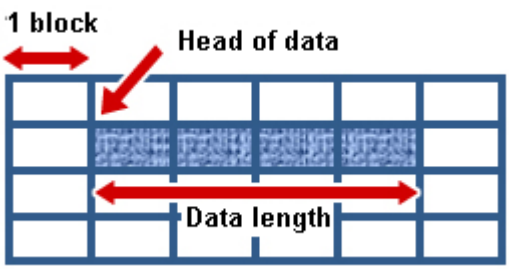
DW800 perform the data I/O in the block storage and the file storage. Overview of the block storage and the file storage are shown below.

1. Block Storage
   It assigns the address to the data for each block in the storage system to write or read the data. For how to access to the block storage, assign the address to the head of the data and access for each block.
   HM firmware is the micro-program to perform the data I/O, hardware failure management and the maintenance function in the block storage.

Figure 1-6 How to Access to Block Storage



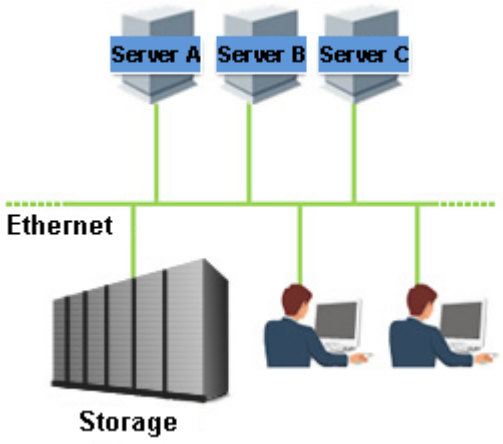
In the block storage, data area is divided by blocks. Access the head of the data that is the address assigned.



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2. File Storage
   It describes the LAN connection file server combined with the server on which the file service specific exclusive OS/FC (file system) installed and the disk system. Each application server and client access files using NFS or CIFS protocol like local files. To access the files, specify the directory name and the file name.
   NAS firmware has BALI that performs I/O in the file storage, NAS module control firmware and the file function.

Figure 1-7 How to Access to File Storage



In the file storage, access the files by specifying the directory name and the file name.



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1.3.2.2 Software to Manage the Storage System

Management and operation of the storage system are performed by the exclusive management software. To access to the management GUI, access from the Web browser and operate on GUI (Graphical User Interface). Management GUI uses Hitachi Device Manager - Storage Navigator (“Storage Navigator” hereinafter). Also, Hitachi Command Suite that can manage the multiple storage systems collectively can be used. If you install NAS modules and use as a file storage, use NAS Manager to manage and operate the file system.

Overview of each software is as follows.

- Storage Navigator
  It is the storage management software to manage the hardware (setting the configuration information, defining the logical device and displaying the status) and the performance management (tuning) of the storage system. Install Storage Navigator in SVP to use. When installing Storage Navigator, StorageDevice List is also installed. Due to the Web application, the storage system can be operated by accessing from the Web browser on the LAN connected PC.

- Hitachi Command Suite
  It is the integrated platform management software that can manage multiple servers and storage systems collectively. Hitachi Command Suite can be used as an option. Install Hitachi Command Suite in the management PC to use. Each storage functions that can be used on Storage Navigator can use from Hitachi Command Suite.

- NAS Manager
  It is the Web application that sets or manages the file storage system. Access from the Web browser to perform the network setting, user information setting and file system setting of NAS modules.
  NAS Manager is provided as the function of NAS firmware.

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1.3.2.3 Software to Maintain the Storage System

Maintenance of the storage system is performed by the exclusive software.
To maintain the hardware and update the firmware, use Maintenance Utility, and to set the file storage, use NAS Manager. Also, the file storage setting and maintenance can be performed by the maintenance command through the communication software.

The overview of each software is as follows.

- Maintenance Utility
  It is the Web application to be used for the failure monitoring of the storage system, parts replacement, an upgrade of the firmware and installation of the program product.
  Maintenance Utility is incorporated into GUM (Gateway for Unified Management) controller that is mounted in the controller chassis. Installation is not required.
  Start up from either Storage Navigator or Hitachi Command Suite. Note that Maintenance Utility can still be accessed even if the power is turned off as GUM is operated as long as the controller chassis is powered on.

- NAS Manager
  It is the Web application that sets or manages the file storage system. Access from the Web browser to perform the network setting, user information setting and file system setting of NAS modules.
  NAS Manager is provided as the function of NAS firmware.

- Maintenance CLI
  It is the maintenance command that performs each setting, information collection and management at the time of installing NAS modules. Because logging in by ssh is required when using the command, install the communication software (such as PuTTY) in the maintenance PCD in advance.
  You can also access to NAS modules directly to operate.
  If NAS Manager cannot be used because of a failure or any, you can maintain by using the maintenance CLI.

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1.4 Specifications by Model

1.4.1 Storage System Specifications

Table 1-1 shows the storage system specifications.

Table 1-1 Storage System Specifications (VSP Gx00 AC Power Model)

Item			Specifications		
			VSP G800	VSP G400, G600	VSP G200
System	Number of HDDs	Minimum	4 (Disk-in model) / 0 (Diskless model)		
		Maximum (When using DB60 with a 3.5-inch HDD)	1,440	720 (VSP G600) / 480 (VSP G400)/	264
	Number of Flash Drives	Minimum	4 (disk-in model) / 0 (diskless model)		
		Maximum	1,440	720 (VSP G600) / 480 (VSP G400)	264
	Number of Flash Module Drives	Minimum	4 (disk-in model)		
		Maximum	576	288 (VSP G600) / 192 (VSP G400)	84
	RAID Level		RAID6/RAID5/RAID1		
	RAID Group Configuration	RAID6	6D+2P, 12D+2P, 14D+2P		
		RAID5	3D+1P, 4D+1P, 6D+1P, 7D+1P		
		RAID1	2D+2D, 4D+4D		
	Maximum Number of Spare Disk Drives		64 (*1)	32 (*1)	16 (*1)
	Maximum Number of Volumes		16,384	4,096	2,048
	Maximum External Configuration Capacity		64 PB (16KLDEV × 4TB)	16 PB (4KLDEV × 4TB)	8 PB (2KLDEV × 4TB)
	Maximum Number of DBs (*6)		DBS/DBL/DBF : 48 DB60 : 24	DBS/DBL/DBF : 24(VSP G600) / 16(VSP G400) DB60 : 12(VSP G600) / 8(VSP G400)	DBS/DBL/DBF : 7 DB60 : 4
Memory	Cache Memory Capacity	NAS Module is not Installed	64 GB/512 GB	64 GB/256 GB (VSP G600) 64 GB/128 GB (VSP G400)	32 GB/64GB
		NAS Module is installed	256 GB/512 GB	256 GB (VSP G600) 128 GB (VSP G400)	—
	NAS Module Memory Capacity		192 GB	192 GB	—
	Cache Flash Memory Type		BM30	BM20/BM30	BM10

(To be continued)

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(Continued from preceding page)

Item			Specifications VSP G800	Specifications VSP G400, G600	Specifications VSP G200
Storage I/F	DKC-DB Interface		SAS/Dual Port		
	Data Transfer Rate		6 Gbps/12 Gbps		
	Maximum Number of HDD per SAS I/F		144		
	Number of DKB PCB		8	2	—
Device I/F	Support Channel Type		Fibre Channel Shortwave (*2)		
			iSCSI (Optic/Copper)		
			NAS (NFS/CIFS)		—
	Data Transfer Rate	Fibre Channel	200 / 400 / 800 / 1600 / 3200 MB/s		
		iSCSI	1000 MB/s (Optic) 100 / 1000 MB/s (Copper)		
		NAS (NFS/CIFS)	1000 MB/s (Optic)		—
	Maximum Number of CHB	CHBB is not Installed	12 (16: When DKB slot is used)	8 (10: When DKB slot is used)	2 (VSP G100) / 4 (VSP G200)
				14 (16: When DKB slot is used) (*7)	—
		CHBB is installed	16 (20: When DKB slot is used)	—	—
		CHBB is not Installed NAS Module is installed	4 (*8)	6 (*8)	—
		CHBB is installed NAS Module is not Installed	8 (*8)	—	—
Acoustic Level	Operating	CBL	60 dB		—
		CBSS/CBSL	—		60 dB
		DBL/DBS/DBF/DB60	60 dB/60 dB/60 dB/71 dB (*3) (*4) (*5)		
	Standby	CBL	55 dB		—
		CBSS/CBSL	—		55 dB
		DBL/DBS/DBF/DB60	55 dB/55 dB/55 dB/71 dB (*3) (*4) (*5)		
Dimension	W × D × H (mm)	19 inch Rack	600 × 1,150 × 2,058.2		
Non-disruptive Maintenance	Control PCB		Supported		
	Cache Memory		Supported		
	Cache Flash Memory		Supported		
	Power Supply, Fan		Supported		
	Microcode		Supported		
	Disk Drive Flash Drive Flash Module Drive		Supported		

*1: Available as spare or data Disks.

*2: By the replacing SFP transceiver of the fibre port on the Channel Board to the DW-F800-1PL8 (SFP for 8 Gbps Longwave) and DW-F800-1PL16 (SFP for 16 Gbps Longwave), the port can be used for the Longwave.
SPF installed in NAS modules are DW-F800-1PS10 (SFP for 10 Gbps Shortwave) only.

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*3: Sound pressure level [LA] changes from 66 dB to 75 dB according to the ambient temperature, Drive configuration and operating status. The maximum could be 79 dB during maintenance procedure for failed ENC or Power Supply.
*4: Acoustic power level [LwA] measured by ISO7779 condition is 7.2 B. And it changes from 7.2 B to 8.1B according to the ambient temperature, Drive configuration and operating status.
*5: Do not work behind DB60 for a long time.
*6: For details, see Table 4-97.
*7: When the firmware version is 83-02-01-x0/xx or later.
*8: When installing NAS module, the HDD-less case is not supported.

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Table 1-2 Storage System specifications (VSP Gx00 DC power supply model)

Item			Specifications
			VSP G200
System	Number of HDDs	Minimum	4 (disk-in model) / 0 (diskless model)
		Maximum	192
	Number of Flash Drives	Minimum	4 (disk-in model) / 0 (diskless model)
		Maximum	192
	RAID Level		RAID6/RAID5/RAID1
	RAID Group Configuration	RAID6	6D+2P, 12D+2P, 14D+2P
		RAID5	3D+1P, 4D+1P, 6D+1P, 7D+1P
		RAID1	2D+2D、4D+4D
	Maximum Number of Spare Disk Drives		16 (*1)
	Maximum Number of Volumes		2,048
	Maximum External Configuration Capacity		8 PB (2K LDEV × 4 TB)
	Maximum Number of DBs (*5)		DBSD/DBLD: 7
Memory	Cache Memory Capacity		32 GB/64GB
	Cache Flash Memory Type		BM10
Storage I/F	DKC-DB Interface		SAS/Dual Port
	Data Transfer Rate		6 Gbps/12 Gbps
	Maximum Number of HDD per SAS I/F		144
	Number of DKB PCB		—
Device I/F	Support Channel Type		Fibre Channel Shortwave (*2)/iSCSi (Optic/ Copper)
	Data Transfer Rate	Fibre Channel	200 / 400 / 800 / 1600 / 3200 MB/s
		iSCSI	1000 MB/s (Optic) 100/1000 MB/s (Copper)
	Maximum Number of CHB		2 (VSP G100) / 4 (VSP G200)
Acoustic Level	Operating	-CBSSD/-CBSLD	60 dB
		-DBLD/DBSD	60 dB (*3)(*4)
	Standby	-CBSSD/-CBSLD	55 dB
		-DBLD/DBSD	55 dB
Dimension	W × D × H (mm)	19 inch Rack	600 × 1,150 × 2,058.2
Non-disruptive Maintenance	Control PCB		Supported
	Cache Memory		Supported
	Cache Flash Memory		Supported
	Power Supply, Fan		Supported
	Microcode		Supported
	Disk Drive Flash Drive		Supported

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*1: Available as spare or data Disks.

*2: By the replacing SFP transceiver of the fibre port on the Channel Board to the DW-F800-1PL8 (SFP for 8 Gbps Longwave) and DW-F800-1PL16 (SFP for 16 Gbps Longwave), the port can be used for the Longwave.

*3: Sound pressure level [LA] changes from 66 dB to 75 dB according to the ambient temperature, Drive configuration and operating status. The maximum could be 79 dB during maintenance procedure for failed ENC or Power Supply.

*4: Acoustic power level [LwA] measured by ISO7779 condition is 7.2 B. And it changes from 7.2 B to 8.1B according to the ambient temperature, Drive configuration and operating status.

*5: For details, see Table 4-98.

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Table 1-3 Storage System Specifications (VSP Fx00 models)

Item			Specifications	
			VSP F800	VSP F400, F600
System	Number of Flash Module Drives	Minimum	4 (Disk-in model)	
		Maximum	576	288 (VSP F600)/ 192 (VSP F400)
	RAID Level		RAID6/RAID5/RAID1	
	RAID Group Configuration	RAID6	6D+2P, 12D+2P, 14D+2P	
		RAID5	3D+1P, 4D+1P, 6D+1P, 7D+1P	
		RAID1	2D+2D, 4D+4D	
	Maximum Number of Spare Disk Drives (*1)		64	32
	Maximum Number of Volumes		16,384	4,096
	Maximum Storage System Capacity (Physical Capacity)		8,106 TB (7,372 TiB)	4,053 TB (3,686 TiB) (VSP F600)/ 2,702 TB (2,457 TiB) (VSP F400)
	Maximum Number of DBs (*5)		DBF : 48	DBF : 24 (VSP F600)/ 16 (VSP F400)
Memory	Cache Memory Capacity	NAS Module is not Installed	64 GB/512 GB	64 GB/256 GB (VSP F600) 64 GB/128 GB (VSP F400)
		NAS Module is installed	256 GB/512 GB	256 GB (VSP F600) 128 GB (VSP F400)
	NAS Module Memory Capacity		192 GB	192 GB
	Cache Flash Memory Type		BM30	BM20/BM30
Storage I/F	DKC-DB Interface		SAS/Dual Port	
	Data Transfer Rate		12 Gbps	
	Maximum Number of drive per SAS I/F		24	
Device I/F	Number of DKB PCB		8	2
	Support Channel Type		Fibre Channel Shortwave (*2)/iSCSI (Optic/Copper)/ NAS (NFS/CIFS)	
	Data Transfer Rate (MB/s)	Fibre Channel	200/400/800/1600/3200 MB/s	
		iSCSI	1000 MB/s (Optic) 100/1000 MB/s (Copper)	—
		NAS (NFS/CIFS)	1000 MB/s (Optic)	
	Maximum Number of CHB	CHBB is not Installed	12 (16: When DKB slot is used)	8 (10: When DKB slot is used)
				14 (16: When DKB slot is used) (*6)
		CHBB is Installed	16 (20: When DKB slot is used)	—
		CHBB is not Installed NAS Module is installed	4	6
		CHBB is installed NAS Module is not Installed	8	—

(To be continued)

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(Continued from preceding page)

Item			Specifications	
			VSP F800	VSP F400, F600
Acoustic Level	Operating	CBL	60 dB	
		DBF	60 dB/60 dB (*3) (*4)	
	Standby	CBL	55 dB	
		DBF	55 dB/55 dB (*3) (*4)	
Dimension	W × D × H (mm)	19 inch Rack	600 × 1,150 × 2,058.2	
Non-disruptive Maintenance	Control PCB		Supported	
	Cache Memory		Supported	
	Cache Flash Memory		Supported	
	Power Supply, Fan		Supported	
	Microcode		Supported	
	Flash Module Drive		Supported	

*1: Available as spare or data Disks.

*2: By the replacing SFP transceiver of the fibre port on the Channel Board to the DW-F800-1PL8 (SFP for 8 Gbps Longwave) and DW-F800-1PL16 (SFP for 16 Gbps Longwave), the port can be used for the Longwave.
SPF installed in NAS modules are DW-F800-1PS10 (SFP for 10 Gbps Shortwave) only.

*3: Sound pressure level [LA] changes from 66 dB to 75 dB according to the ambient temperature, Drive configuration and operating status. The maximum could be 79 dB during maintenance procedure for failed ENC or Power Supply.

*4: Acoustic power level [LwA] measured by ISO7779 condition is 7.2 B. And it changes from 7.2 B to 8.1B according to the ambient temperature, Drive configuration and operating status.

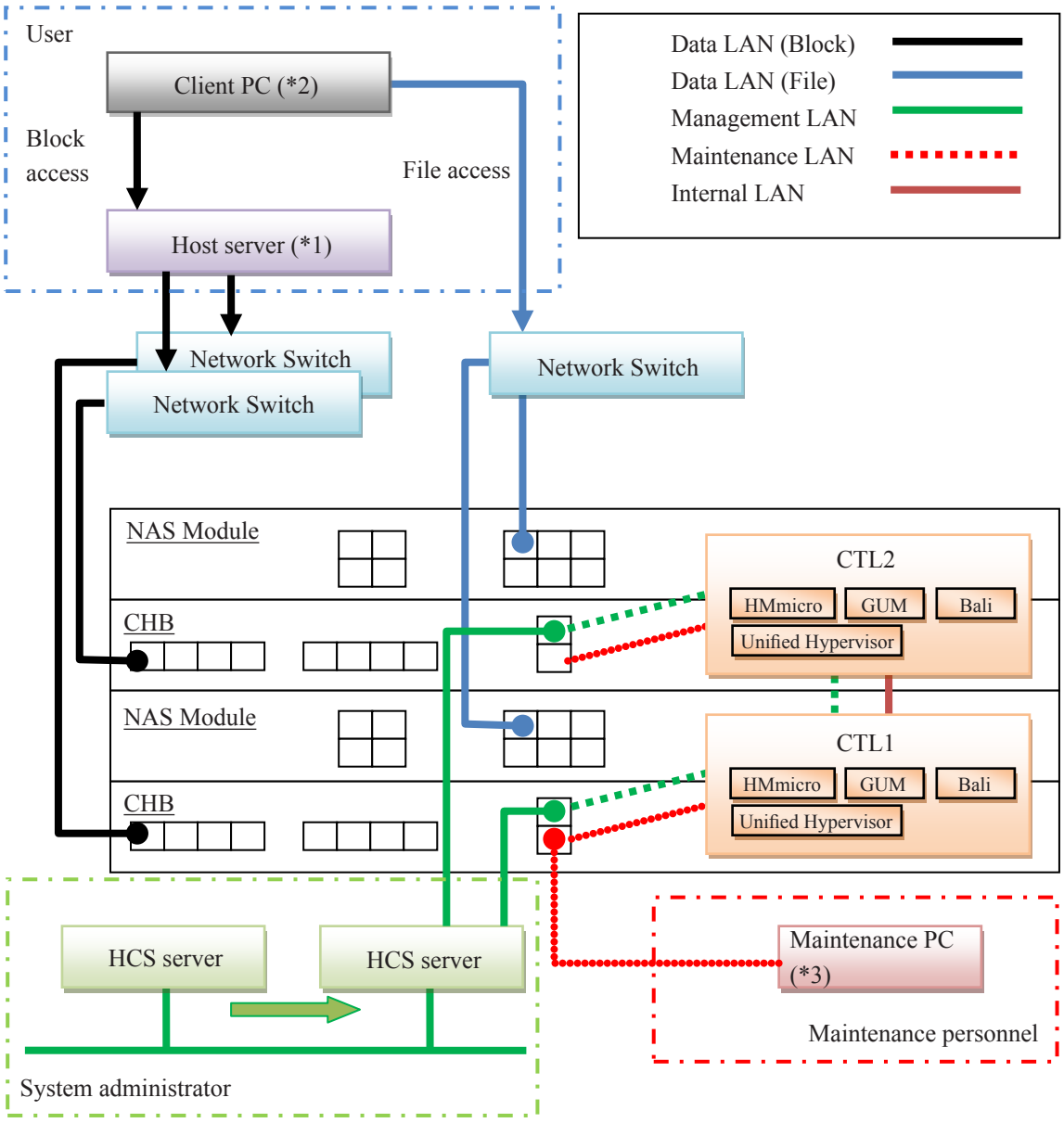
*5: For details, see Table 4-99.

*6: When the firmware version is 83-02-01-x0/xx or later.

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1.5 Network Required by DW800

DW800 construct the network by connecting each hardware to data LAN, management LAN and internal LAN. The access route of each LAN is as shown below.



*1: For the data to be blocked, CHB to be used is determined by the host server.
*2: To access data, client specifies the IP address.
*3: Connect the maintenance PC to the opposite side of the port to be maintained.

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Communication information of each LAN and target are described below.

1. Data LAN (Block)

Information to be communicated	• Communicate the user data (block) between the client PC and the controller.
Target	• User

2. Data LAN (File)

Information to be communicated	• Communicate the user data (file) between the client PC and the controller.
Target	• User

3. Management LAN

Information to be communicated	• Communicate the data that manages Gx00. • When an abnormality is detected in Gx00, report a failure to the management appliance.
Target	• System administrator

4.

Information to be communicated	• Connect between the controller and the maintenance PC to use for the storage system maintenance. • Connect between the management appliance and the maintenance PC to use for the maintenance of the management appliance.
Target	• Maintenance personnel

5. Internal LAN

Information to be communicated	• Use it for communication of the software (Unified Hypervisor, GUM, BALI, HMMicro and HNAS) in Gx00. • The maintenance LAN and the internal LAN use the same wire connection, and network is isolated using the VLAN function.
Target	• Maintenance personnel

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2. Descriptions for the Operations of DW800

2.1 RAID Architecture Overview

The Storage System supports RAID1, RAID5 and RAID6.
The feature of each RAID level is described below.

2.1.1 Overview of RAID Systems

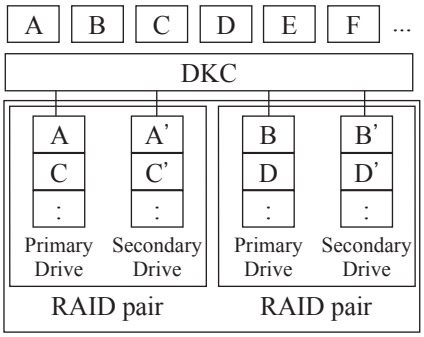
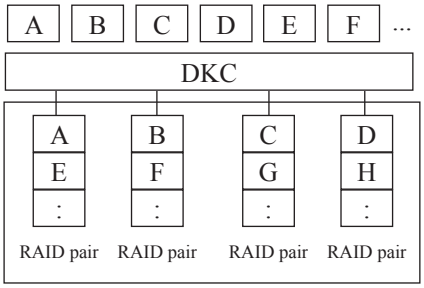
The concept of a Storage System was announced in 1987 by the research group of University of California at Berkeley.
The research group called the Storage System RAID (Redundant Array of Inexpensive Disks: A Storage System that has redundancy by employing multiple inexpensive and small Disk Drives), classified the RAID systems into five levels, that is, RAID 1 to RAID 5, and added RAID 0 and RAID 6 later.
The Storage System supports RAID1, RAID5 and RAID6. The following shows respective methods, advantages and disadvantages.

Table 2-1 RAID Configuration Supported by the Storage System

Level	Configuration
RAID1	2D+2D 4D+4D [Two concatenation of (2D+2D)]
RAID5	3D+1P
	4D+1P
	6D+1P
	7D+1P Two concatenation of (7D+1P) Four concatenation of (7D+1P)
RAID6	6D+2P
	12D+2P
	14D+2P

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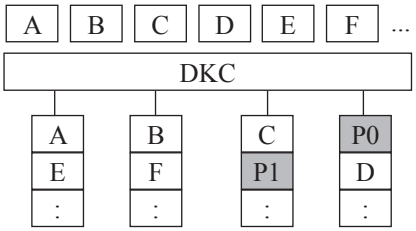
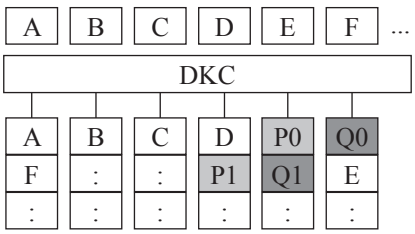
Table 2-2 Overview of RAID Systems

Level	Configuration		Characteristics
RAID 1	Data block  Parity group NOTE: The above diagram shows the (2D+2D) configuration.	Overview	Mirror Disks (Dual write) Two Disk Drives, primary and secondary Disk Drives, compose a RAID pair (mirroring pair) and the identical data is written to the primary and secondary Disk Drives. Further, data is divided into 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	A Disk capacity twice as large as user data capacity is required.
RAID 1 Concatenation configuration	Data block  Parity group NOTE: The above diagram shows the two concatenation configuration of (2D+2D). A RAID pair consists of two Disk Drives.	Overview	Mirror Disks (Dual write) The two parity groups of RAID 1 (2D+2D) are concatenated and data is divided into 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	A Disk capacity twice as large as user data capacity is required.

(To be continued)

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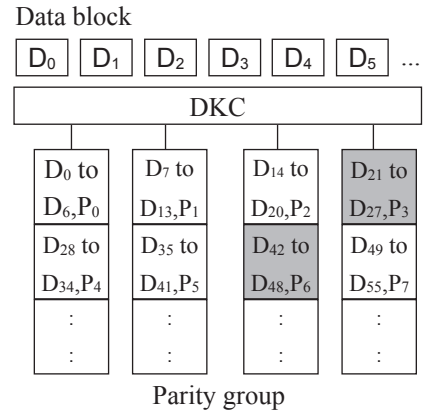
(Continued from preceding page)

Level	Configuration		Characteristics
RAID5	Data block  Data Disks + Parity Disk NOTE: The above diagram shows the 3D+1P configuration.	Overview	Data is written to multiple Disks successively in units of block (or blocks). 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.
RAID6	Data block  Data Disks + Parity Disks P and Q NOTE: The above diagram shows the 4D+2P configuration.	Overview	Data blocks are divided into 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 can restore 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 write is lower than that of RAID 5 in the case where the number of Drives makes a bottleneck.

(To be continued)

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<table>
<tr><th>Level</th><th>Configuration</th><th></th><th>Characteristics</th></tr>
<tr><td rowspan="3">RAID5
Concatenation
configuration</td><td rowspan="3"> 

NOTE:
The above-mentioned figure is four concatenation cofiguration, but it is the same in the case of two concatenation.</td><td>Overview</td><td>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.</td></tr>
<tr><td>Advantage</td><td>When the parity group becomes a performance bottleneck, the performance improvement can be attempted because it is configured with twice and four times the number of Drives in comparison with RAID5 (7D+1P).</td></tr>
<tr><td>Disadvantage</td><td>The influence level when two Drives are blocked is large because twice and 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).</td></tr>
</table>

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2.1.2 Comparison of RAID Levels

1. Space efficiency

   The space efficiency of each RAID level is based on the following contents.

   - RAID1 : The user area is half of the total Drive capacity due to mirroring.
   - RAID5, RAID6 : The data part and the parity part are in the parity group.

     The space efficiency is calculated by the ratio of the data part to the total Drive capacity.

   Table 2-3 shows the space efficiency per RAID level.

Table 2-3 Example of Space Efficiency Comparison

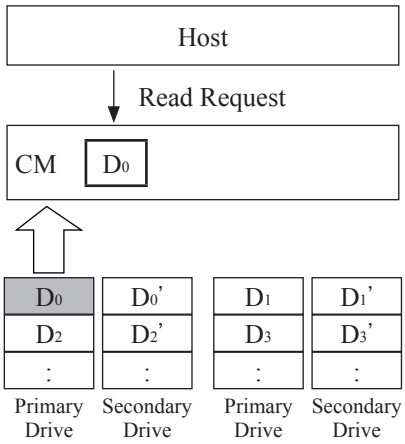
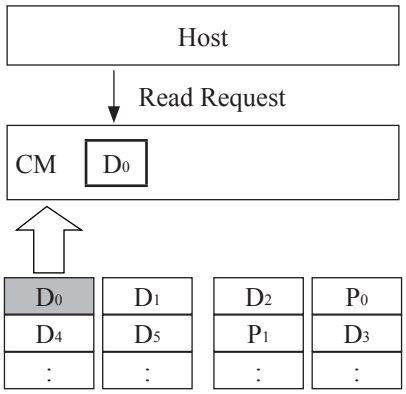
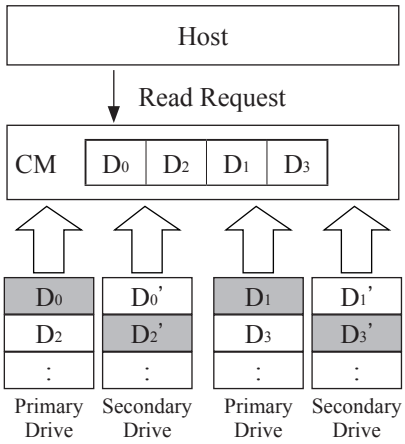
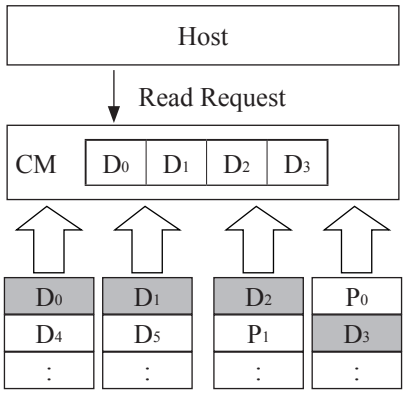
RAID Level	Space Efficiency (User Area/Disk Capacity)	Remarks
RAID1	50.0%	Due to mirroring
RAID5	(N – 1) / N N indicates the number of Drives which configure a parity group	Example: In case of 3D+1P, (4 – 1) / 4 = 0.75 = 75%
RAID6	(N – 2) / N N indicates the number of Drives which configure a parity group	Example: In case of 6D+2D, (8 – 2) / 8 = 0.75 = 75%

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2. I/O processing operation

Table 2-4 shows the overview operation of front-end I/O and back-end I/O in each RAID level.

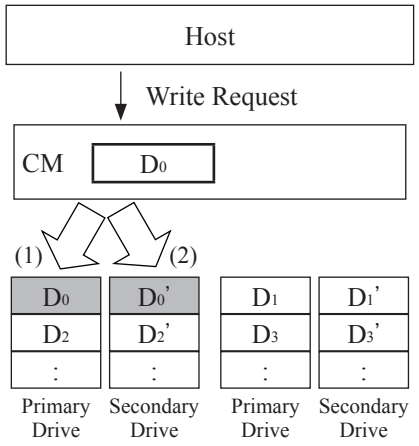
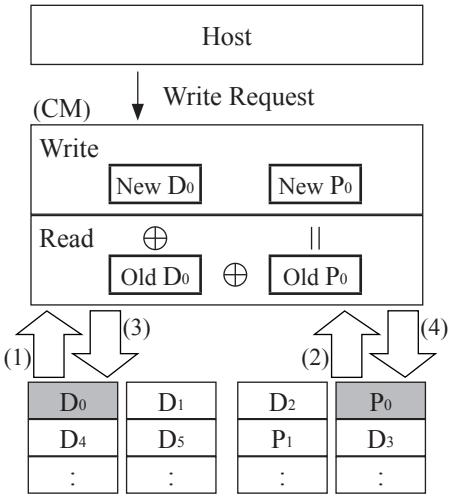
Table 2-4 Example of I/O Operation in Each RAID Level

I/O Type \ RAID Level	RAID1	RAID5, RAID6
Random read	 Perform single Drive read for single read from the host.	 Perform single Drive read for single read from the host.
Sequential read	 Perform Drive read for requests from the host. For the example in the above diagram, perform Drive read four times for four requests of D0 to D3 from the host.	 Perform Drive read for requests from the host. For the example in the above diagram, perform Drive read four times for four requests of D0 to D3 from the host.

(To be continued)

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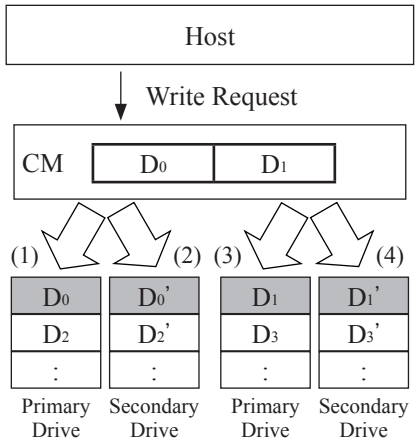
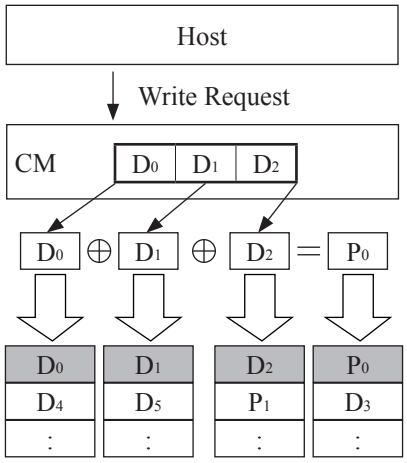
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I/O Type \ RAID Level	RAID1	RAID5, RAID6
Random write	 Perform Drive write twice as shown below for single write by the host. (1) Primary Drive (2) Secondary Drive	 • In case of RAID5: Perform the following read for single write by the host and create a new parity. (1) Read the old data (2) Read the old parity After that, perform the following write. (3) Write new data (4) Write a new parity Operate the I/O four times in total. • In case of RAID6: In addition to the case of RAID5, perform old parity read and new parity write of the second parity. Operate the I/O six times in total.

(To be continued)

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(Continued from preceding page)

RAID Level / I/O Type	RAID1	RAID5, RAID6
Sequential write	 Perform write twice (write to the primary Drive and secondary Drive) for the write requests by the host. For the example in the above diagram, perform Drive write four times for the following two write requests by the host. (1) (3) Primary Drive (2) (4) Secondary Drive	 • In case of RAID5: For write requests by the host, when the crosswise data (from D0 to D2 in the above diagram) is complete, create parity and write the data from the host and the parity to the Drive. For example, in case of 3D+1P, create parity for write of three sets of data by the host and perform Drive write four times combining the data and parity. • In case of RAID6: In addition to the case of RAID5, create the second parity and write the data from the host and two sets of parity to the Drive. For example, in case of 6D+2P, create two sets of parity for write of six sets of data by the host and perform Drive write eight times combining the data and parity.

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3. Limit performance comparison

Table 2-5 shows the performance per RAID level when setting the performance of a Drive to 100. (N indicates the number of Drives which configure a parity group.)

Table 2-5 I/O performance per RAID level

(1) Random Read, Sequential Read

RAID Level	Calculation	Remarks
RAID1	100 × N	Example: In case of 2D+2D, N = 4 results in 400
RAID5	100 × N	Example: In case of 3D+1P, N = 4 results in 400
RAID6	100 × N	Example: In case of 6D+2P, N = 8 results in 800

(2) Random Write

RAID Level	Calculation	Remarks
RAID1	100 × N / 2	Example: In case of 2D+2D, 100 × 4 / 2 = 200
RAID5	100 × N / 4	Example: In case of 7D+1P, 100 × 8 / 4 = 200
RAID6	100 × N / 6	Example: In case of 6D+2P, 100 × 8 / 6 = 133

(3) Sequential Write

RAID Level	Calculation	Remarks
RAID1	100 × N / 2	Example: In case of 2D+2D, 100 × 4 / 2 = 200
RAID5	100 × (N – 1)	Example: In case of 7D+1P, 100 × (8 – 1) = 700
RAID6	100 × (N – 2)	Example: In case of 6D+2P, 100 × (8 – 2) = 600

The above is the theoretical value in case of a Drive neck.
It is not limited to the above in case other parts are performance necks.

4. Reliability

Table 2-6 shows the reliability related to each RAID level.

Table 2-6 Reliability of Each RAID Level

RAID Level	Conditions to Guarantee the Data
RAID1	When a Drive failure occurs in the mirroring pair, recover the data from the Drive on the opposite side. When two Drive failures occur in the mirroring pair, the LDEV is blocked.
RAID5	When a Drive failure occurs in the parity group, recover the data using the parity data. When two Drive failures occur in the parity group, the LDEV is blocked.
RAID6	When one or two Drive failures occur in the parity group, recover the data using the parity data. When three Drive failures occur in the parity group, the LDEV is blocked.

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2.2 Open Platform

NOTE: iSCSI in this Chapter indicates iSCSI (optic/copper) of the Channel Board.
(Model name: DW-F800-2HS10B/2HS10S)
Regarding iSCSI for NAS Module, see "File Service Administration Guide".

2.2.1 Product Overview and Functions

The open platform optional functions can allocate a partial or full of Disk volume area of the DKC for the Open system hosts by installing Channel Board (CHB) to the Disk Controller (hereinafter called DKC). This function enables a use of high reliable and high performance Storage System realized by the DKC for an open platform or Fibre system environment. This also provides the customers with a flexible and optimized system construction capability for their system expansion and migration. In Open system environment, Fibre Channel (FC) and Internet Small Computer System Interface (iSCSI) can be used as a Channel interface.

1. Fibre Channel option (FC) / iSCSI option (iSCSI)
   Available major functions by using the Fibre Channel options are as follows.

   (1) This enables multiplatform system users to share the high reliable and high performance resource realized by the DKC.
   - The SCSI interface is complied with ANSI SCSI-3, a standard interface for various peripheral devices for open systems. Thus, the DKC can be easily connected to various open-market Fibre host systems (e.g. Workstation servers and PC servers).
   - DW800 can be connected to open system via Fibre interface by installing Fibre Channel Board (DW-F800-4HF8/DW-F800-2HF16/DW-F800-4HF32R). Fibre connectivity is provided as Channel option of DW800. Fibre Channel Board can be installed in any CHB location of DW800.
   - The iSCSI interface transmits and receives the block data by SCSI on the IP network. For this reason, you can configure and operate IP-SAN (IP-Storage Area Network) at a low cost using the existing network devices. The iSCSI interface board (DW-F800-2HS10S/DW-F800-2HS10B) can be inserted in an optional place of the DW-F800 CHB slot.

   (2) Fast and concurrent data transmission
   Data can be read and written at a maximum speed of 32 Gbps with use of Fibre interface.
   All of the Fibre ports can transfer data concurrently too.
   You can read/write the data by 10 Gbps using the iSCSI interface.

   (3) All Fibre configuration (only for FC)
   The All Fibre configuration can make a configuration combined with a Channel Board only, 2 Fibre Channels to 4 in the VSP G200, 2 to 14 in the VSP G400, G600 (2 to 16 in HDD-less case) and 2 to 12 in the VSP G800 (2 to 16 in HDD-less case).
   These will provide more flexible use of the Storage System for open system environment.

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(4) High performance

The DKC has two independent areas of Cache Flash Memory and this mechanism also applies to the Fibre attachment / iSCSI option. Thus, compared with a conventional Disk array Controller used for open systems and not having a Cache, this Storage System has the following outstanding characteristics:

- Cache data management by LRU control
- Adoption of DFW (DASD Fast Write)
- Write data duplexing
- Cache Flash Memory

(5) High availability

The DKC is fault-tolerant against even single point of failure in its components and can successively read and write data without stopping the system. Fault-tolerance against path failures depends on the multi-path configuration support of the host system too.

(6) High data reliability

The Fibre attachment option automatically creates a guarantee code of a unique eight byte data, adds it to host data, and writes it onto the Disk as data. The data guarantee code is checked automatically on the internal data bus of the DKC to prevent data errors due to array-specific data distribution or integration control. Thus, the reliability of the data improves.

(7) TrueCopy Support (only for FC)

TrueCopy is a function to realize the duplication of open system data by connecting the two DW800 Storage Systems or inside parts of a single DW800 using the Fibre.
This function enables the construction of a backup system against disasters by means of the duplication of data including those of the host system or the two volumes containing identical data to be used for different purposes.

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2.2.2 Precautions on Maintenance Operations

There are some notices about Fibre maintenance operations.

1. Before LUN path configuration is changed, Fibre I/O on the related Fibre port must be stopped.
2. Before Fibre Channel Board or LDEV is removed, the related LUN path must be removed.
3. Before Fibre Channel Board is replaced, the related Fibre I/O must be stopped.
4. When Fibre-Topology information is changed, pull out a Fibre cable between the port and SWITCH and put it back again. Before a change of Fibre-Topology information, pull out Fibre cable and put it back after completing the change.

The precautions against the iSCSI interface maintenance work are as shown below.

1. Before changing the LUN path definition, the iSCSI interface port I/O needs to be stopped.
2. Before removing the iSCSI interface board or LDEV, the LUN path definition needs to be removed.
3. Before replacing the iSCSI interface board, the I/O needs to be stopped.

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2.2.3 Configuration

2.2.3.1 System Configuration

1. All Fibre Configuration
   The DKC can also have the All Fibre configuration installed only by CHB adapters.
   The all Fibre configuration example is shown below.

Figure 2-1 Minimum system configuration for All Fibre

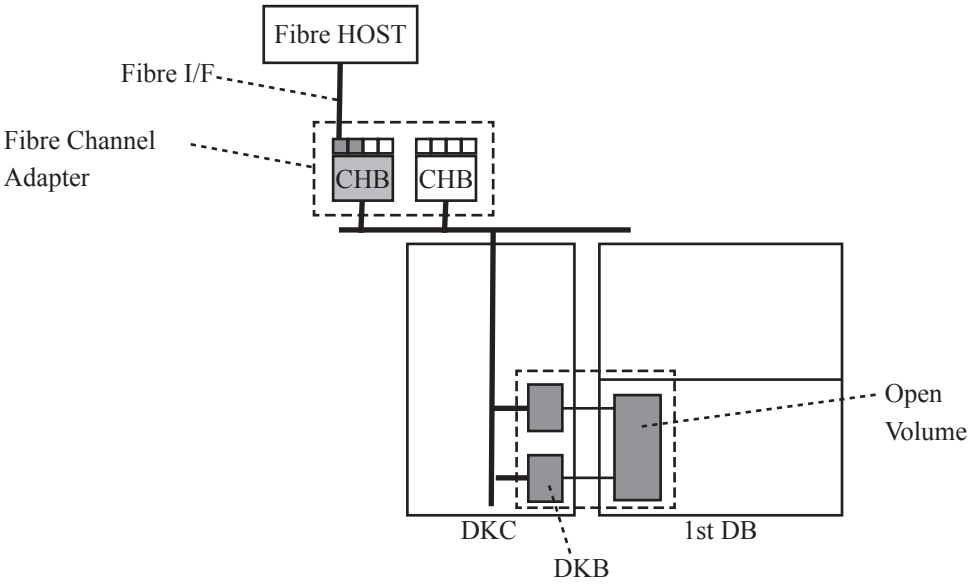
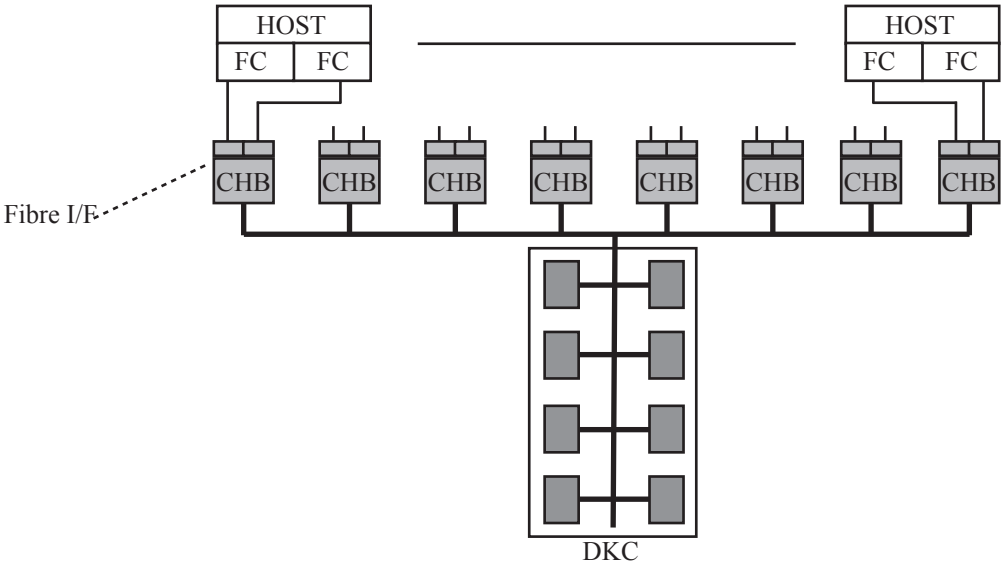


Figure 2-2 Maximum all Fibre Configuration



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2.2.3.2 Channel Configuration

1. Fibre Channel Configuration
   The Fibre Channel Board (CHB) PCBs must be used in sets of 2.
   The DKC can install a maximum of 4 Fibre Channel Board packages (CHBs) in the VSP G200, 14 in the VSP G400, G600 (16 in HDD-less case) and 12 in the VSP G800 (16 in HDD-less case).

2. iSCSI Channel Configuration
   The iSCSI Interface Board PCBs (CHBs) must be configured in sets of 2.
   The DKC can install a maximum of 4 Fibre Channel Board packages (CHBs) in the VSP G200, 14 in the VSP G400, G600 (16 in HDD-less case) and 12 in the VSP G800 (16 in HDD-less case).

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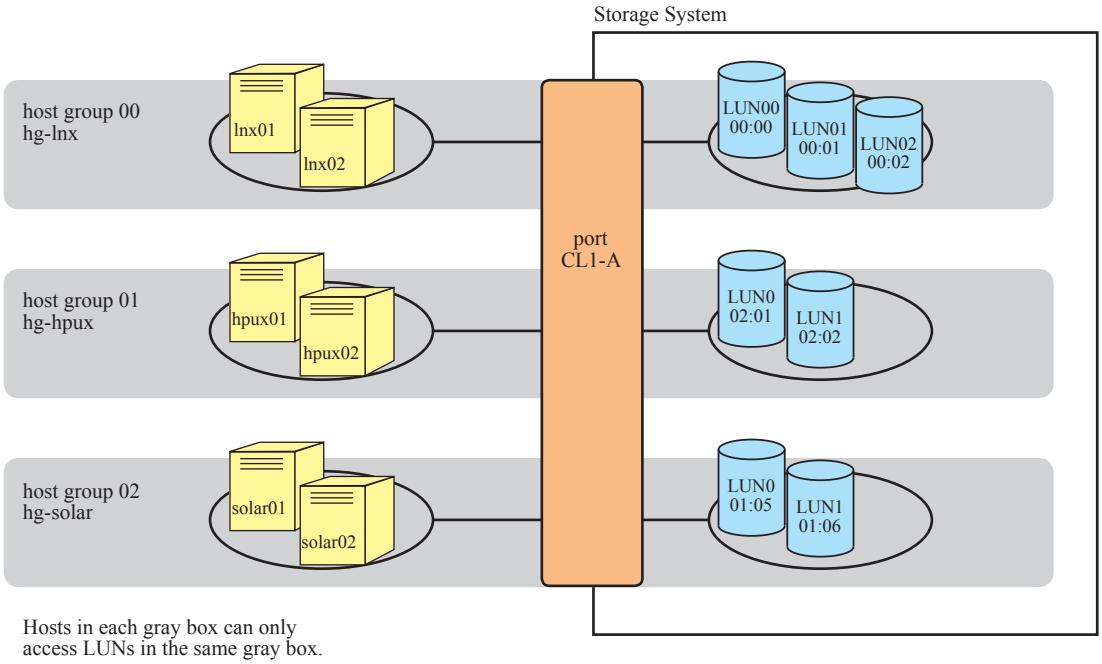
2.2.3.3 Channel Addressing

1. Fibre Channel
   Each Fibre device can set a unique Port-ID number within the range from 1 to EF. An addressing from the Fibre host to the Fibre volume in the DKC can be uniquely defined with a nexus between them.
   The nexus through the Initiator (host) ID, the Target (CHB port) ID, and LUN (Logical Unit Number) defines the addressing and access path.
   The maximum number of LUNs that can be allocated to one port is 2,048.
   The addressing configuration is shown in the Figure 2-4.

   (1) Number of connected Hosts
   For Fibre Channel, the number of connectable hosts is limited to 256 per Fibre port. (FC)
   The number of MCU connections is limited to 16 per RCU Target port. (only for FC)

   (2) Number of Host Groups
   You can define a host group admitted access for the some LU by LUN Security as a Host Group.
   For example, the two hosts in the hg-lnx group can only access the three LUs (00:00, 00:01, and 00:02).
   The two hosts in the hg-hpux group can only access the two LUs (02:01 and 02:02).
   The two hosts in the hg-solar group can only access the two LUs (01:05 and 01:06).

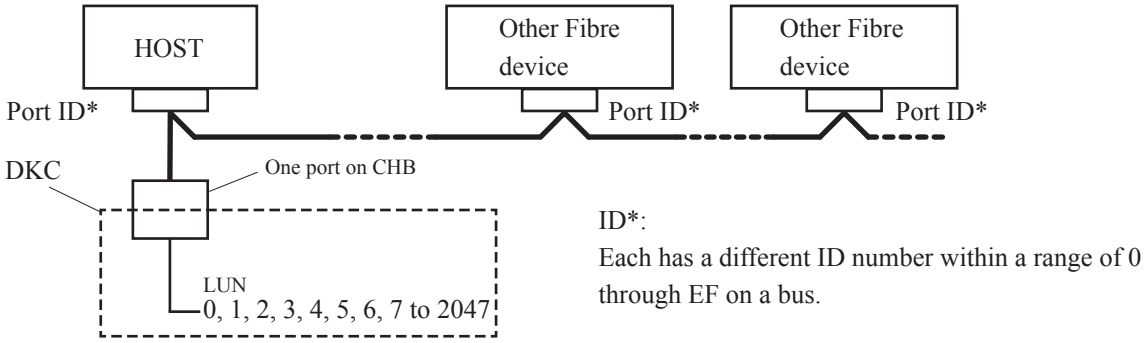
Figure 2-3 Example of Host Group Definition



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(3) LUN (Logical Unit Number)
LUNs can be allocated from 0 to 2,047 to each Fibre Port.

Figure 2-4 Fibre addressing configuration from Host



(4) PORT INFORMATION
A PORT address(AL_PA) and the Topology can be set as PORT INFORMATION.
The port address is selectable from EF to one (loop ID 0 to 125).
Topology information is selected from “Fabric”, “FC-AL” or “Point to point”.

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2. iSCSI interface
   The iSCSI interface specifies an IPv4 address or IPv6 address and connects it to the iSCSI port.
   For the firmware version 83-04-41-x0/xx or later, up to 16 virtual ports can be added to an iSCSI physical port. Use Command Control Interface (CCI) when adding virtual ports.

   (1) The number of connected hosts
   For the iSCSI interface, the number of hosts (Initiators) connectable to a port is up to 255.

   (2) Target number
   Multiple accessible LUNs by the LUN Security function are defined as the target.
   The target is equivalent to the Fibre Channel host group.
   An iSCSI Name is allocated to each target of iSCSI. When connecting from the host by the iSCSI interface, specify a target iSCSI Name in addition to an IP address/TCP port number and connect it.

   (3) LUN (Logical Unit Number)
   The maximum number of LUNs allocatable to each iSCSI interface port is 2048.

   (4) Port information
   Use the iSCSI interface by setting the information related to the following address.
   - IP address: IPV4 or IPv6
   - Subnet mask:
   - Gateway:
   - TCP port number:

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2.2.3.4 Logical Unit

1. Logical Unit Specification
   The specifications of Logical Units supported and accessible from Open system hosts are defined in the Table 2-7.

Table 2-7 LU specification

No	Item		Specification
1	Access right		Read/Write
2	Logical Unit (LU) size	G byte (10^9)	OPEN-V × n
		G byte ($1{,}024^3$)	—
3	Block size		512 Bytes
4	# of blocks		—
5	LDEV emulation name		OPEN-V

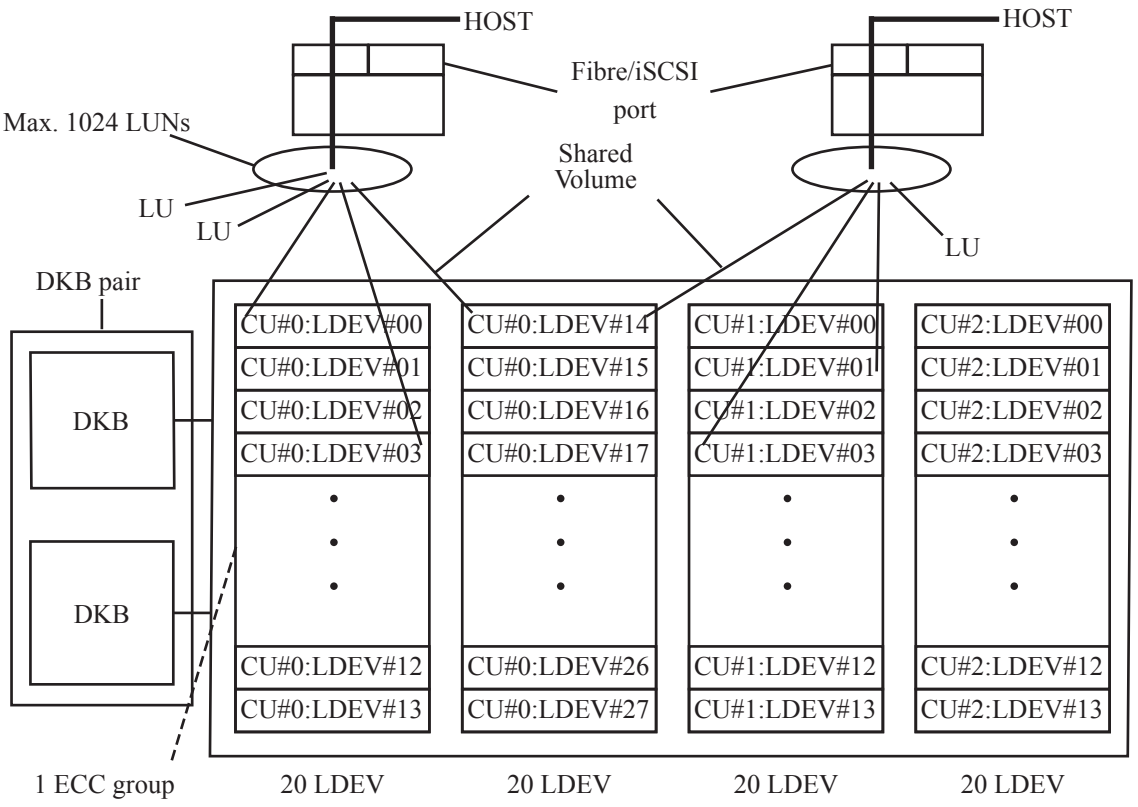
*1: “0” is added to the emulation type of the V-VOLs (e.g. OPEN-0V).

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2. Logical Unit definition
   Each volume name, such as OPEN-V is also used as an emulation type name to be specified for each ECC group. When the emulation type is defined on an ECC group, Logical volumes (LDEVs) are automatically allocated to the ECC group from the specified LDEV#. After creating LDEVs, each LUN of Fibre/iSCSI port will be mapped on any location of LDEV within DKC. This setting is performed by Maintenance PC operation.

   This flexible LU and LDEV mapping scheme enables the same logical volume to be set to multiple paths so that the host system can configure a shared volume configuration such as a High Availability (HA) configuration. In the shared volume environment, however, some lock mechanism need to be provided by the host systems.

Figure 2-5 LDEV and LU mapping for open volume



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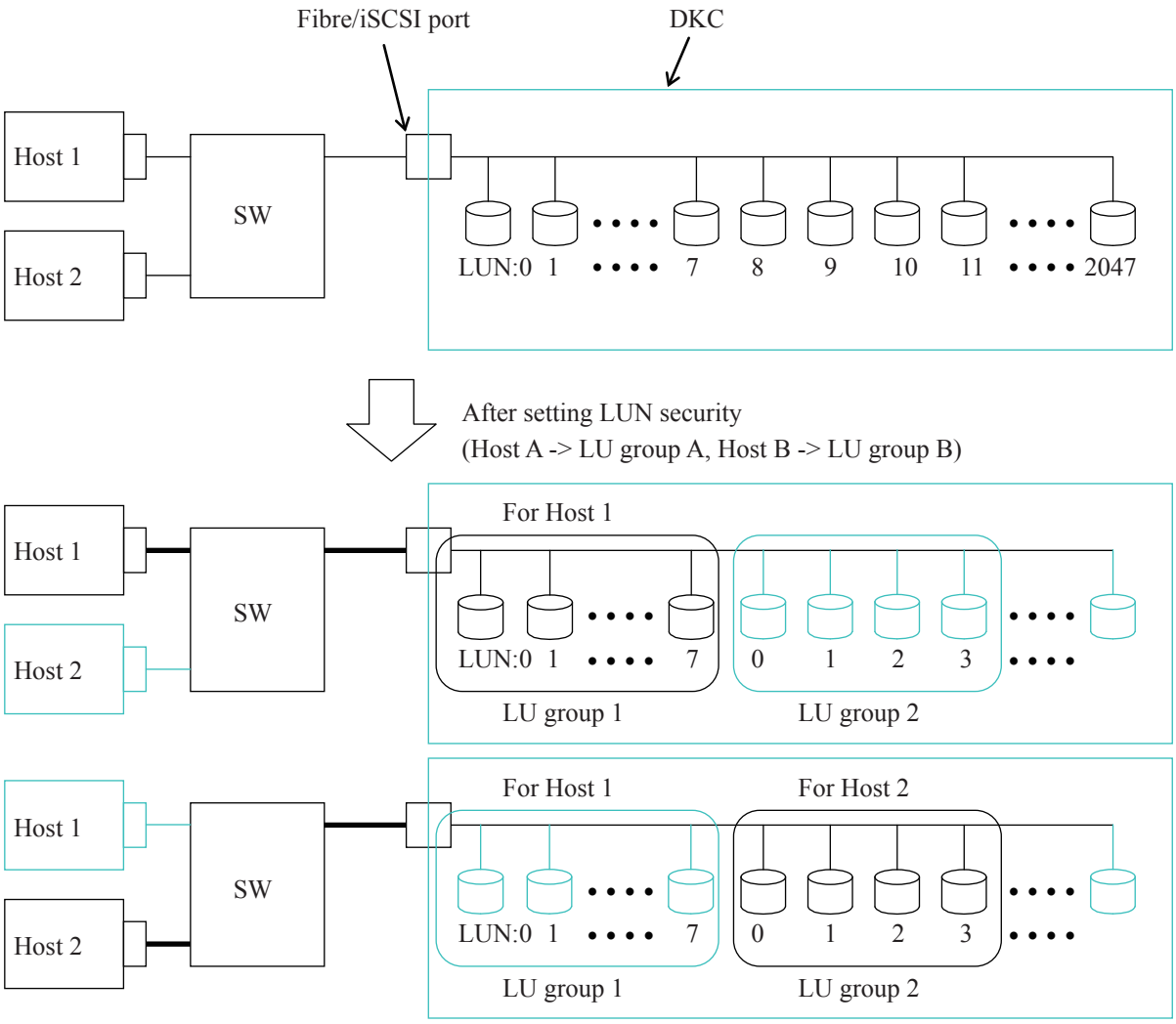
3. LUN Security

(1) Overview

This function connects various types of servers into a segregated, secure environment via the switch in the Fibre/iSCSI port, and thus enables the storage and the server to be used in the SAN environment.

The MCU (initiator) port of TrueCopy does not support this function.

Figure 2-6 LUN Security



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2.2.3.5 Volume Setting

1. Setting of volume space
   The volume setting procedure uses the Maintenance PC function.

2. LUN setting
   - LUN setting:

   • Select the CHB, Fibre port and the LUN, and select the CU# and LDEV# to be allocated to the LUN.
   • Repeat the above procedure as needed.
   The MCU port (Initiator port) of TrueCopy function does not support this setting.

*1: It is possible to refer to the contents which is already set on the Maintenance PC display.

*2: The above setting can be done during on-line.

*3: Duplicated access paths' setting from the different hosts to the same LDEV is allowed. This will provide a means to share the same volume among host computers. It is, however, the host responsibility to manage an exclusive control on the shared volume.

Refer to MAINTENANCE PC SECTION "4.1.3 Allocating the Logical Devices of a Storage System to a Host" for more detailed procedures.

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2.2.3.6 Host Mode Setting

It is necessary to set Host Mode by using Maintenance PC if you want to change a host system.
The meanings of each mode are follows.

*******HDS RAID Controller Models**********
MODE 00 : Standard mode (Linux)
MODE 03 : HP-UX host mode
MODE 04 : Not supported
MODE 05 : OpenVMS host mode
MODE 07 : Tru64 host mode
MODE 08 : Not supported
MODE 09 : Solaris host mode
MODE 0A : NetWare host mode
MODE 0F : AIX host mode
MODE 21 : VMWare host mode (Online LU)
MODE 2C : Windows host mode
MODE 4C : Not supported
others : Reserved
****

Please set the HOST MODE OPTION if required.
For how to set the mode, refer to MAINTENANCE PC SECTION “4.1.4.1 Construct iSCSI Target or Host Group” for changing the host recognition information setting.

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2.2.4 Control Function

2.2.4.1 Cache Specifications (Common to Fibre/iSCSI)

The DKC has two independent areas of Cache Flash Memory for volumes by which high reliability and high performance with the following features can be achieved.

1. Cache data management by LRU control
   Data that has been read out is stored into the Cache and managed under LRU control. For upright transaction processing, therefore, a high Cache hit ratio can be expected and a data-write time is reduced for improved system throughput.

2. Adoption of DFW (DASD Fast Write)
   At the same time that the normal write command writes data into the Cache, it reports the end of the write operations to a host. Data write to the Disk is asynchronous with host access. The host, therefore, can execute the next process without waiting for the end of data write to Disk.

3. Write data duplexing
   The same write data is stored into the two areas of a Cache provided in the DKC. Thus, loss of DFW data can be avoided even one failure occurs in the Cache.

4. Non-volatile Cache
   Batteries and Cache Flash Memories (CFM) are installed in Controller Board in a DKC. Once a data has been written into a Cache, even if a power interruption occurs, it always holds the data because the data is transferred to the CFM.

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2.2.4.2 iSCSI Command Multiprocessing

1. Command Tag Queuing
   The Command Tag Queuing function defined in the SCSI specification is supported.
   This function allows each Fibre/iSCSI port on a CHB to accept multiple iSCSI commands even for the same LUN.
   The DKC can process those queued commands in parallel because a LUN is composed of multiple physical Drives.

2. Concurrent data transfer
   Fibre ports on a CHB can perform the host I/Os and data transfer with maximum 16 Gbps transfer concurrently.
   This is also applied among different CHBs.
   iSCSI ports can perform the host I/Os and data transfer with maximum 10 Gbps transfer concurrently.

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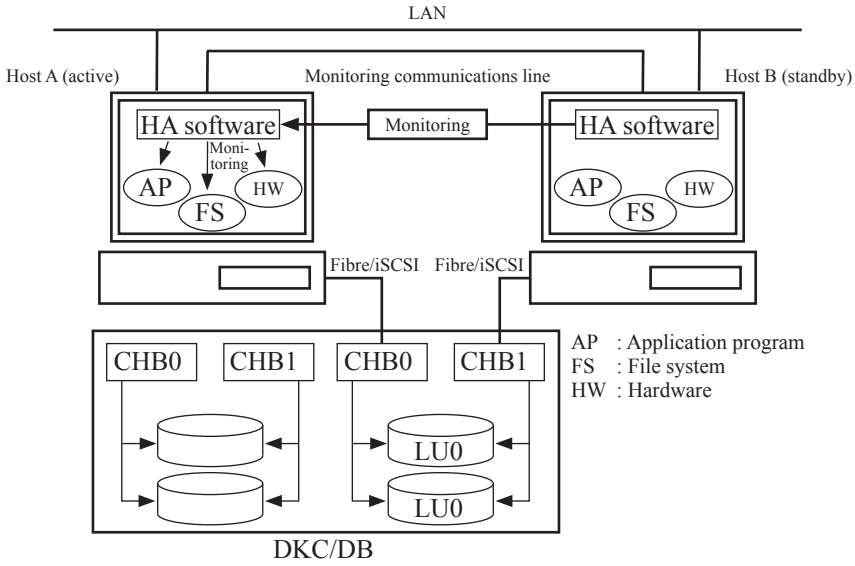
2.2.5 HA Software Linkage Configuration in a Cluster Server Environment

When this Storage System is linked to High-Availability software (HA software) which implements dual-system operation for improved total system fault-tolerance and availability, the open system side can also achieve higher reliability on the system scale.

2.2.5.1 Hot-standby System Configuration

The HA software minimizes system down time in the event of hardware or software failures and allows processing to be restarted or continued. The basic system takes a hot-standby (asymmetric) configuration, in which, as shown in the figure below, two hosts (an active host and a standby host) are connected via a monitoring communication line. In the hot-standby configuration, a complete dual system can be built by connecting the Fibre/iSCSI cables of the active and standby hosts to different CHB Fibre/iSCSI ports.

Figure 2-7 Hot-standby configuration



- The HA software under the hot-standby configuration operates in the following sequence:
  (1) The HA software within the active host monitors the operational status of own system by using a monitoring agent and sends the results to the standby host through the monitoring communication line (this process is referred to as “heart beat transmission”). The HA software within the standby host monitors the operational status of the active host based on the received information.
  (2) If an error message is received from the active host or no message is received, the HA software of the standby host judges that a failure has occurred in the active host. As a result, it transfers management of the IP addresses, Disks, and other common resources, to the standby host (this process is referred to as “fail-over”).
  (3) The HA software starts the application program concerned within the standby host to take over the processing on behalf of the active host.

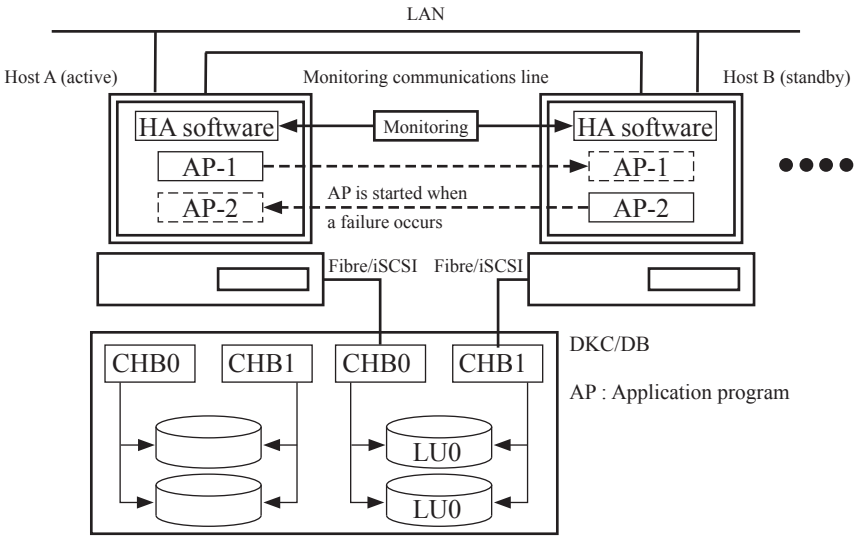
- Use of the HA software allows a processing requirement from a client to be taken over. In the case of some specific application programs, however, it appears to the client as if the host that was processing the task has been rebooted due to the host switching. To ensure continued processing, therefore, a login to the application program within the host or sending of the processing requirement may need to be executed once again.

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2.2.5.2 Mutual Standby System Configuration

In addition to the hot-standby configuration described above, a mutual standby (symmetric) configuration can be used to allow two or more hosts to monitor each other. Since this Storage System has eight Fibre/iSCSI ports, it can, in particular, be applied to a large-scale cluster environment in which more than two hosts exist.

Figure 2-8 Mutual Standby System Configuration



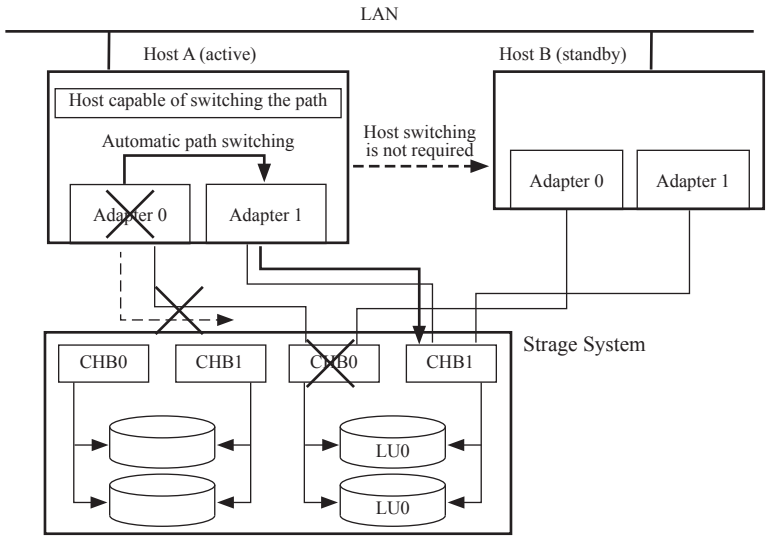
- In the mutual standby configuration, since both hosts operate as the active hosts, no resources exist that become unnecessary during normal processing. On the other hand, however, during a backup operation the disadvantages are caused that performance deteriorated and that the software configuration becomes complex.
- This Storage System is scheduled to support Oracle SUN CLUSTER, Symantec Cluster server, Hewlett-Packard MC/ServiceGuard, and IBM HACMP and so on.

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2.2.5.3 Configuration Using Host Path Switching Function

When the host is linked with the HA software and has a path switching capability, if a failure occurs in the adapter, Fibre/iSCSI cable, or DKC (Fibre/iSCSI ports and the CHB) that is being used, automatic path switching will take place as shown below.

Figure 2-9 Host Path Switching Function Using Configuration



The path switching function enables processing to be continued without host switching in the event of a failure in the adapter, Fibre/iSCSI cable, Storage System or other components.

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2.2.6 LUN Addition

2.2.6.1 Overview

LUN addition function makes it enable to add LUNs to DW800 Fibre ports in the I/O.
Some host operations are required before the added volumes are recognized and become usable from the host operating systems.

2.2.6.2 Specifications

1. General
   (1) LUN addition function supports Fibre interface.
   (2) LUN addition is supported.
   (3) LUN addition can be executed by Maintenance PC or by Web Console.
   (4) Some operating systems require reboot operation to recognize the newly added volumes.
   (5) When new LDEVs should be installed for LUN addition, install the LDEVs by Maintenance PC first. Then add LUNs by LUN addition from Maintenance PC or Web Console.

2. Platform support
   Host Platforms supported for LUN addition are shown in Table 2-8.

Table 2-8 Platform support level

Support level	Platform
(A) LUN addition and LUN recognition.	Solaris, HP-UX, AIX, Windows
(B) LUN addition only. Reboot is required before new LUNs are recognized.	Linux
(C) LUN addition is not supported. Host must be shutdown before installing LUNs and then must be rebooted.	—

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2.2.6.3 Operations

1. Operations
   Step 1: Execute LUN addition from Maintenance PC.
   Step 2: Check whether or not the platform of the Fibre port supports LUN recognition with Table 2-8.
   Support (A) : Execute LUN recognition procedures in Table 2-8.
   Not support (B) : Reboot host and execute normal install procedure.

2. Host operations
   Host operations for LUN recognition are shown in Table 2-9.

Table 2-9 LUN recognition procedures overview for each platform

Platform	LUN recognition procedures
HP-UX	(1) **`ioscan`** (check device added after IPL) (2) **`insf`** (create device files)
Solaris	(1) **`/usr/sbin/drvconfig`** (2) **`/usr/sbin/devlinks`** (3) **`/usr/sbin/Disks`** (4) **`/usr/ucb/ucblinks`**
AIX	(1) **Devices-Install/Configure Devices Added After IPL** By SMIT
Windows	Automatically detected

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2.2.7 LUN Removal

2.2.7.1 Overview

LUN removal function makes it enable to remove LUNs to DW800.

2.2.7.2 Specifications

1. General
   (1) LUN removal can be used only for the ports on which LUNs are already existing.
   (2) LUN removal can be executed by Maintenance PC or by “Web Console”.
   (3) When LUNs should be removed for LUN removal, stop Host I/O of concerned LUNs.
   (4) If necessary, execute backup of concerned LUNs.
   (5) Remove concerned LUNs from HOST.
   (6) In case of AIX, release the reserve of concerned LUNs.
   (7) In case of HP-UX do not remove LUN=0 under existing target ID.

   NOTE: If LUN removal is done without stopping Host I/O, or releasing the reserve, it would fail. Then stop HOST I/O or release the reserve of concerned LUNs and try again. If LUN removal would fail after stopping Host I/O or releasing the reserve, there is a possibility that the health check command from HOST is issued.
   At that time, wait about three minutes and try again.

2. Platform support
   Host platforms supported for LUN removal are shown in Table 2-10.

Table 2-10 Support platform

Platform	OS	Fibre/iSCSI
HP	HP-UX	○
SUN	Solaris	○
RS/6000	AIX	○
PC	Windows	○

(example) ○: supported, ×: not supported

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2.2.7.3 Operations

1. Operations

   Step 1: Confirm whether or not the platform supports LUN removal with Table 2-10.
   Support : Go to Step 2.
   Not support : Go to Step 3.

   Step 2: If HOST MODE of the port is not 00 or 04 or 07 use, go to Step 4.

   Step 3: Stop Host I/O of concerned LUNs.

   Step 4: If necessary, execute backup of concerned LUNs.

   Step 5: Remove concerned LUNs form HOST.

   Step 6: In case AIX, release the reserve of concerned LUNs.
   If not, go to Step 7.

   Step 7: Execute LUN removal from Maintenance PC.

2. Host operations

   Host operations for LUN removal procedures are shown in Table 2-11.

Table 2-11 LUN removal procedures overview for each platform

Platform	LUN removal procedures
HP-UX	mount point:/01, volume group name:vg01 (1) **`umount /01`** (umount) (2) **`vgchange -a n vg01`** (deactive volume groups) (3) **`vgexport /dev/vg01`** (export volume groups)
Solaris	mount point:/01 (1) **`umount /01`** (unmout)
AIX	mount point:/01, volume group name:vg01, device file name:hDisk1 (1) **`umount /01`** (umount) (2) **`rmfs -r" /01`** (delete file systems) (3) **`varyoffvg vg01`** (vary off) (4) **`exportvg vg01`** (export volume groups) (5) **`rmdev -I 'hDisk1' '-d'`** (delete devime files)

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2.2.8 Prioritized Port Control (PPC) Functions

2.2.8.1 Overview

The Prioritized Port Control (PPC) function allows you to use the DKC for both production and development. The assumed system configuration for using the Prioritized Port Control option consists of a single DKC that is connected to multiple production servers and development servers. Using the Prioritized Port Control function under this system configuration allows you to optimize the performance of the development servers without adversely affecting the performance of the production servers.
MCU port (Initiator port) of Fibre Remote Copy function does not support Prioritized Port Control (PPC).

The Prioritized Port Control option has two different control targets: fibre port and open-systems host's World Wide Name (WWN). The fibre ports used on production servers are called prioritized ports, and the fibre ports used on development servers are called non-prioritized ports. Similarly, the WWNs used on production servers are called prioritized WWNs, and the WWNs used on development servers are called non-prioritized WWNs.
The Prioritized Port Control option cannot be used simultaneously for both the ports and WWNs for the same DKC. Up to 176 ports or 2048 WWNs can be controlled for each DKC.

The Prioritized Port Control option monitors I/O rate and transfer rate of the fibre ports or WWNs. The monitored data (I/O rate and transfer rate) is called the performance data, and it can be displayed in graphs. When the PPC function controls a DKC by the port, the maximum number is 16 ports for the VSP G200 model, 64 ports for the VSP G400, G600 model and 128 ports for the VSP G800 model. You can use the performance data to estimate the threshold and upper limit for the ports or WWNs, and optimize the total performance of the DKC.

1. Prioritized Ports and WWNs
   The fibre ports or WWNs used on production servers are called prioritized ports or prioritized WWNs, respectively. Prioritized ports or WWNs can have threshold control set, but are not subject to upper limit control. Threshold control allows the maximum workload of the development server to be set according to the workload of the production server, rather than at an absolute level. To do this, the user specifies whether the current workload of the production server is high or low, so that the value of the threshold control is indexed accordingly.

2. Non-Prioritized Ports and WWNs
   The fibre ports or WWNs used on development servers are called non-prioritized ports or prioritized WWNs, respectively. Non-prioritized ports or WWNs are subject to upper limit control, but not threshold control. Upper limit control makes it possible to set the I/O of the non-prioritized port or WWN within a range that does not affect the performance of the prioritized port or WWN.

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2.2.8.2 Overview of Monitoring Functions

1. Monitoring Function

   Monitoring allows you to collect performance data, so that you can set optimum upper limit and threshold controls. When monitoring the ports, you can collect data on the maximum, minimum and average performance, and select either per port, all prioritized ports, or all non-prioritized ports. When monitoring the WWNs, you can collect data on the average performance only, and select either per WWN, all prioritized WWNs, or all non-prioritized WWNs.
   The performance data can be displayed in graph format either in the real time mode or offline mode. The real time mode displays the performance data of the currently active ports or WWNs. The data is refreshed in every time that you specified between 1 and 15 minutes by minutes, and you can view the varying data in real time. The offline mode displays the stored performance data. Statistics are collected at a user-specified interval between 1 and 15 minutes, and stored between 1 and 15 days.

2. Monitoring and Graph Display Mode

   When you activate the Prioritized Port Control option, the Select Mode panel where you can select either Port Real Time Mode, Port Offline Mode, WWN Real Time Mode, or WWN Offline Mode opens. When you select one of the modes, monitoring starts automatically and continues unless you stop monitoring. However, data can be stored for up to 15 days. To stop the monitoring function, exit the Prioritized Port Control option, and when a message asking if you want to stop monitoring is displayed, select the Yes button.

   (1) The Port/WWN Real Time Mode is recommended if you want to monitor the port or WWN performance for a specific period of time (within 24 hours) of a day to check the performance in real time.
   (2) The Port/WWN Offline Mode is recommended if you want to collect certain amount of the port or WWN performance data (maximum of one week), and check the performance in non-real time.

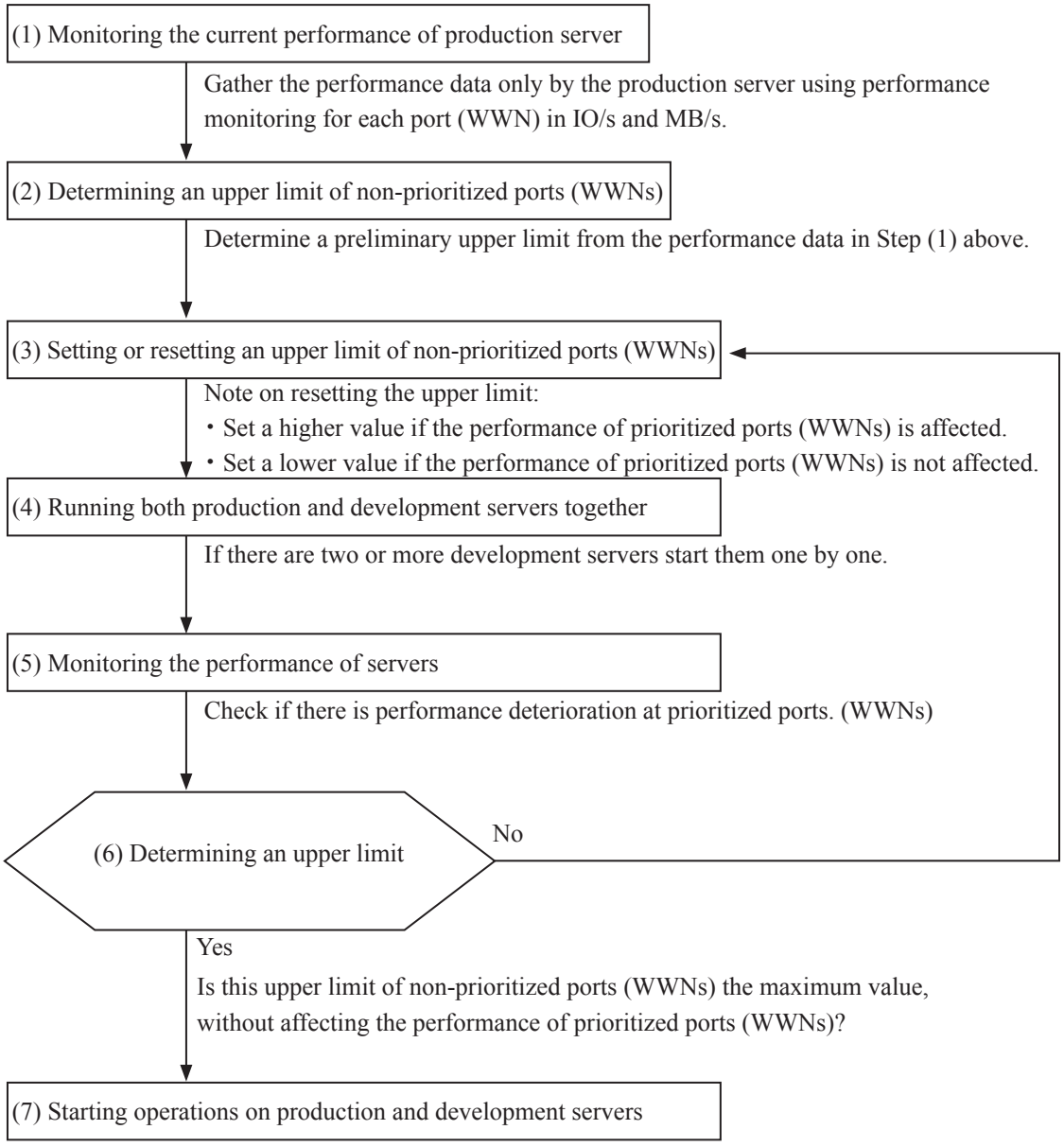
   To determine a preliminary upper limit and threshold, run the development server by using the performance data collected from the production server that was run beforehand and check the changes of performance of a prioritized port. If the performance of the prioritized port does not change, set a value by increasing an upper limit of the non-prioritized port. After that, recollect and analyze the performance data. Repeat these steps to determine the optimized upper limit and threshold.

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2.2.8.3 Procedure (Flow) of Prioritized Port and WWN Control

To perform the prioritized port(WWN) control, determine the upper limit to the non-prioritized port(WWN) by checking that the performance monitoring function does not affect production. Figure 2-10 shows the procedures for prioritized port(WWN) control.

Figure 2-10 Flow of Prioritized Port(WWN) Control



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2.2.9 Replacing Firmware Online

2.2.9.1 Overview

The firmware replacement during I/O is enabled by reducing the offline time of the firmware replacement significantly.
By doing this, the firmware replacement (online replacement) is enabled without stopping I/O of the host connected to the port on the Channel Board even in the system which does not have the path function.

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2.3 Logical Volume Formatting

2.3.1 High-speed Format

2.3.1.1 Overviews

DKC can format two or more ECCs at the same time by providing HDDs with the Logical Volume formatting function. However, when using the encryption function, the high-speed format is unusable.

Table 2-12 Flow of Format

Item No.	Item	Contents
1	Maintenance PC operation	Specify a parity group and execute the LDEV format.
2	Display of execution status	The progress (%) is displayed in the “Task” window or in the summary of the “Parity Group” window and “LDEV” window.
3	Execution result	• Normal: Completed normally • Failed: Terminated abnormally
4	Recovery action when a failure occurs	Same as the conventional one. However, a retry is to be executed in units of ECC. (Because the Logical Volume formatting is terminated abnormally in units of ECC when a failure occurs in the HDD.)
5	Operation of the Maintenance PC which is a high-speed Logical Volume formatting object	When the Logical Volume format for more than one ECCs is instructed, the high-speed processing is carried out(*1).
6	PS/OFF or powering off	The Logical Volume formatting is suspended. No automatic restart is executed.
7	Maintenance PC powering off during execution of an Logical Volume formatting	After the Maintenance PC is rebooted, the indication before the PC powering off is displayed in succession.
8	Execution of a high-speed Logical Volume format in the status that the spare is saved	ECC of HDD which the spare is saved fails the high-speed Logical Volume formatting, and changes to a low-speed format. (Because the low-speed formatting is executed after the high-speed format is completed, the format time becomes long.) After the high-speed Logical Volume formatting is completed, execute the copy back of HDD which the spare is saved from SIM log and restore it.

*1: Normal Format is used for ECC of SSD.

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2.3.1.2 Estimation of Logical Volume Formatting Time

The standard formatting time of the high-speed LDEV format and the low-speed LDEV format for each Drive type is described below.
Note that the Storage System configuration at the time of this measurement is as shown below.

<Storage System Conditions at the Time of Format Measurement>

- The number of the installed DKBs (VSP G200: CTL is directly installed, VSP G400, G600: One per cluster, VSP G800: Two per cluster)
- Without I/O
- Perform the formatting for the single ECC
- Define the number of LDEVs (define a maximum number of 100GB LDEVs for the single ECC)
- Measurement emulation (OPEN-V)

1. HDD
   The formatting time of HDD doesn't depend on number of logical volumes, and be decided by capacity and the rotational speed of HDD.
   (1) High speed LDEV formatting
   The high-speed format time is indicated as follows.
   It is an aim to the last in the standard time required, and the real formatting time may be different by RAID GROUP and a Drive type.

Table 2-13 High-speed format time estimation

HDD Capacity/rotation Speed	Formatting Time (*3)	Monitoring Time (*1)
10 TB / 7.2 krpm	1200 min	1360 min
6.0 TB / 7.2 krpm	770 min	1140 min
4.0 TB / 7.2 krpm	600 min	1010 min
1.8 TB / 10 krpm	170 min	270 min
1.2 TB / 10 krpm	170 min	270 min
600 GB / 10 krpm	85 min	130 min
600 GB / 15 krpm	70 min	115 min
300 GB / 15 krpm	45 min	70 min

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(2) Slow LDEV formatting

The low-speed format time is indicated as follows.

Rough formatting time per 1 TB/1 PG without host I/O is indicated as follows (*2).

Table 2-14 15 krpm

RAID Level		Standard Formatting Time (*3)					
		300 GB			600 GB		
		VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	120 min	105 min	95 min	115 min	95 min	85 min
RAID5	3D+1P	85 min	70 min	65 min	70 min	55 min	50 min
	4D+1P	65 min	55 min	50 min	55 min	40 min	40 min
	6D+1P	50 min	40 min	35 min	40 min	30 min	25 min
	7D+1P	45 min	35 min	30 min	35 min	25 min	25 min
RAID6	6D+2P	45 min	40 min	35 min	40 min	30 min	30 min
	12D+2P	30 min	20 min	20 min	25 min	20 min	15 min
	14D+2P	25 min	20 min	20 min	20 min	15 min	15 min

Table 2-15 10 krpm

RAID Level		Standard Formatting Time (*3)					
		600 GB			1.2 TB		
		VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	150 min	130 min	125 min	170 min	145 min	135 min
RAID5	3D+1P	100 min	80 min	75 min	110 min	100 min	90 min
	4D+1P	80 min	65 min	55 min	85 min	75 min	65 min
	6D+1P	55 min	45 min	40 min	60 min	50 min	45 min
	7D+1P	50 min	40 min	35 min	50 min	40 min	40 min
RAID6	6D+2P	55 min	45 min	40 min	60 min	45 min	45 min
	12D+2P	30 min	25 min	25 min	35 min	25 min	25 min
	14D+2P	30 min	25 min	20 min	30 min	25 min	20 min

RAID Level		Standard Formatting Time (*3)		
		1.8 TB		
		VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	140 min	120 min	115 min
RAID5	3D+1P	80 min	65 min	60 min
	4D+1P	60 min	50 min	45 min
	6D+1P	45 min	35 min	30 min
	7D+1P	40 min	30 min	30 min
RAID6	6D+2P	40 min	30 min	30 min
	12D+2P	25 min	20 min	20 min
	14D+2P	20 min	20 min	15 min

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Table 2-16 7.2 krpm

RAID Level		Standard Formatting Time (*3)					
		4 TB			6 TB		
		VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	235 min	190 min	170 min	225 min	175 min	160 min
RAID5	3D+1P	150 min	110 min	95 min	160 min	125 min	110 min
	4D+1P	115 min	85 min	75 min	125 min	95 min	85 min
	6D+1P	80 min	60 min	55 min	85 min	65 min	55 min
	7D+1P	75 min	50 min	45 min	75 min	55 min	50 min
RAID6	6D+2P	85 min	60 min	50 min	85 min	65 min	55 min
	12D+2P	45 min	35 min	30 min	45 min	35 min	30 min
	14D+2P	40 min	30 min	25 min	40 min	30 min	30 min

RAID Level		Standard Formatting Time (*3)		
		10 TB		
		VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	225 min	175 min	160 min
RAID5	3D+1P	160 min	125 min	110 min
	4D+1P	125 min	95 min	85 min
	6D+1P	85 min	65 min	55 min
	7D+1P	75 min	55 min	50 min
RAID6	6D+2P	85 min	65 min	55 min
	12D+2P	45 min	35 min	30 min
	14D+2P	40 min	30 min	30 min

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2. SSD

SSD doesn't have the self LDEV format function.
LDEV fomatting is performed by slow LDEV format only.
Rough formatting time per 1 TB/1 PG without host I/O is indicated as follows (*2).

Table 2-17 SSD format time estimation

RAID Level		Standard Formatting Time (*3)					
		200 GB			400 GB		
		VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	45 min	35 min	30 min	45 min	35 min	30 min
RAID5	3D+1P	30 min	30 min	25 min	30 min	30 min	25 min
	4D+1P	25 min	25 min	20 min	25 min	25 min	20 min
	6D+1P	20 min	20 min	15 min	20 min	20 min	15 min
	7D+1P	15 min	15 min	15 min	15 min	15 min	15 min
RAID6	6D+2P	20 min	15 min	15 min	20 min	15 min	15 min
	12D+2P	10 min	10 min	10 min	10 min	10 min	10 min
	14D+2P	10 min	10 min	10 min	10 min	10 min	10 min

RAID Level		Standard Formatting Time (*3)				
		480 GB		960 GB		
		VSP G200	VSP G400, G600	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	30 min	25 min	25 min	20 min	15 min
RAID5	3D+1P	25 min	20 min	20 min	15 min	15 min
	4D+1P	20 min	15 min	15 min	15 min	10 min
	6D+1P	10 min	10 min	10 min	10 min	5 min
	7D+1P	10 min	10 min	10 min	10 min	5 min
RAID6	6D+2P	15 min	15 min	10 min	10 min	10 min
	12D+2P	10 min	10 min	10 min	10 min	10 min
	14D+2P	10 min	10 min	10 min	10 min	10 min

RAID Level		Standard Formatting Time (*3)					
		1.9 TB			3.8 TB		
		VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	20 min	20 min	10 min	35 min	35 min	30 min
RAID5	3D+1P	15 min	15 min	10 min	25 min	25 min	25 min
	4D+1P	10 min	10 min	5 min	20 min	20 min	20 min
	6D+1P	10 min	10 min	5 min	15 min	15 min	15 min
	7D+1P	10 min	5 min	5 min	15 min	15 min	15 min
RAID6	6D+2P	10 min	10 min	5 min	15 min	15 min	15 min
	12D+2P	10 min	5 min	5 min	10 min	10 min	10 min
	14D+2P	10 min	5 min	5 min	10 min	10 min	5 min

The formatting time becomes the same in 16 SSDs because the transmission of the format data does not arrive even at the limit of passing.

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3. FMD

The formatting time of FMD doesn't depend on number of ECC, and be decided by capacity of FMD.

(1) High speed LDEV formatting

The high-speed format time is indicated as follows.

It is an aim to the last in the standard time required, and the real formatting time may be different by RAID GROUP and a Drive type.

Table 2-18 FMD High-speed format time estimation (NFxxx-PxxxSS)

FMD Capacity	Formatting Time (*3)	Time Out Value (*1)
1.75 TB (1.6 TiB)	65 min	120 min
3.5 TB (3.2 TiB)	130 min	180 min

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Table 2-19 FMD High-speed format time estimation (NFxxx-QxxxSS)

FMD Capacity	Formatting Time (*3)	Time Out Value (*1)
1.75 TB (1.6 TiB)	5 min	10 min
3.5 TB (3.2 TiB)	5 min	10 min
7 TB (6.4 TiB)	5 min	10 min
14 TB (12.8 TiB)	5 min	10 min

(2) Slow LDEV formatting

The low-speed format time is indicated as follows.

Rough formatting time per 1 TB/1 PG without host I/O is indicated as follows (*2).

Table 2-20 FMD Low-speed format time estimation (NFxxx-PxxxSS)

RAID Level		Standard Formatting Time (*3)					
		1.75 TB (1.6 TiB)			3.5 TB (3.2 TiB)		
		VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	15 min	15 min	15 min	15 min	15 min	15 min
RAID5	3D+1P	15 min	10 min	10 min	15 min	10 min	10 min
	4D+1P	10 min	10 min	10 min	10 min	10 min	10 min
	6D+1P	10 min	5 min	5 min	10 min	5 min	5 min
	7D+1P	10 min	5 min	5 min	10 min	5 min	5 min
RAID6	6D+2P	10 min	10 min	10 min	10 min	10 min	10 min
	12D+2P	10 min	5 min	5 min	10 min	5 min	5 min
	14D+2P	10 min	5 min	5 min	10 min	5 min	5 min

Table 2-21 FMD Low-speed format time estimation (NFxxx-QxxxSS) (When the firmware version is less than 83-03-21-x0/xx.)

RAID Level		Standard Formatting Time (*3)								
		1.75 TB (1.6 TiB)			3.5 TB (3.2 TiB)			7 TB (6.4 TiB)		
		VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	10 min	10 min	10 min	10 min	10 min	10 min	10 min	10 min	10 min
RAID5	3D+1P	10 min	10 min	10 min	10 min	10 min	10 min	10 min	10 min	10 min
	4D+1P	10 min	5 min	5 min	10 min	5 min	5 min	10 min	10 min	5 min
	6D+1P	10 min	5 min	5 min	10 min	5 min	5 min	10 min	10 min	5 min
	7D+1P	10 min	5 min	5 min	10 min	5 min	5 min	10 min	10 min	5 min
RAID6	6D+2P	10 min	5 min	5 min	10 min	5 min	5 min	10 min	5 min	5 min
	12D+2P	10 min	5 min	5 min	10 min	5 min	5 min	10 min	5 min	5 min
	14D+2P	10 min	5 min	5 min	10 min	5 min	5 min	10 min	5 min	5 min

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Table 2-22 FMD Low-speed format time estimation (NFxxx-QxxxSS) (When the firmware version is 83-03-21-x0/xx or later.)

RAID Level		Standard Formatting Time (*3)					
		1.75 TB (1.6 TiB)			3.5 TB (3.2 TiB)		
		VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	3 min	2 min	2 min	3 min	2 min	2 min
RAID5	3D+1P	3 min	1 min	1 min	3 min	1 min	1 min
	4D+1P	2 min	1 min	1 min	2 min	1 min	1 min
	6D+1P	2 min	1 min	1 min	2 min	1 min	1 min
	7D+1P	2 min	1 min	1 min	2 min	1 min	1 min
RAID6	6D+2P	2 min	1 min	1 min	2 min	1 min	1 min
	12D+2P	1 min	1 min	1 min	1 min	1 min	1 min
	14D+2P	1 min	1 min	1 min	1 min	1 min	1 min

RAID Level		Standard Formatting Time (*3)					
		7 TB (6.4 TiB)			14 TB (12.8 TiB)		
		VSP G200	VSP G400, G600	VSP G800	VSP G200	VSP G400, G600	VSP G800
RAID1	2D+2D	3 min	2 min	2 min	3 min	2 min	2 min
RAID5	3D+1P	10 min	10 min	10 min	10 min	10 min	10 min
	4D+1P	10 min	10 min	10 min	10 min	10 min	5 min
	6D+1P	10 min	10 min	5 min	10 min	10 min	5 min
	7D+1P	10 min	5 min	5 min	10 min	5 min	5 min
RAID6	6D+2P	10 min	10 min	5 min	10 min	10 min	5 min
	12D+2P	10 min	5 min	1 min	10 min	5 min	1 min
	14D+2P	10 min	5 min	1 min	10 min	5 min	1 min

*1: After the standard formatting time has elapsed, the display on the Web Console shows 99% until it reaches to the monitoring time. Because Drive itself performs the format, and the progress rate to the total capacity is not understood, the ratio at the elapsed time from the format beginning to the Formatting time required is displayed.

*2: If there is an I/O operation, the minimum formatting time is over 6 times as long as the discrete value, depending on the I/O load.

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*3: The formatting time varies according to the generation of the Drive in standard time distance.

NOTE: The formatting time when mixing the Drive types and the configurations described in "(1) High speed LDEV formatting" and "(2) Slow LDEV formatting" divides into the following cases.

(a) When only the high speed formatting available Drives (1. HDD, 3. FMD) are mixed
The formatting time is the same as the formatting time of Drive types and configurations with the maximum standard time.

(b) When only the low speed formatting available Drives (2. SSD) are mixed
The formatting time is the same as the formatting time of Drive types and configurations with the maximum standard time.

(c) When the high speed formatting available Drives (1. HDD, 3. FMD) and the low speed formatting available Drives (2. SSD) are mixed

(1) The maximum standard time in the high speed formatting available Drive configuration is the maximum high speed formatting time.

(2) The maximum standard time in the low speed formatting available Drive configuration is the maximum low speed formatting time.

The formatting time is the sum of the above formatting time (1) and (2).

When the high speed formatting available Drives and the low speed formatting available Drives are mixed in one formatting process, the low speed formatting starts after the high speed formatting is completed. Even after the high speed formatting is completed, the logical volumes with the completed high speed formatting cannot be used until the low speed formatting is completed.

In all cases of (a), (b) and (c), the time required to start using the logical volumes takes longer than the case that the high speed formatting available Drives and the low speed formatting available Drives are not mixed.
Therefore, when formatting multiple Drive types and the configurations, we recommend dividing the formatting work and starting the work individually from a Drive type and a configuration with the shorter standard time.

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2.3.2 Quick Format

2.3.2.1 Overviews

Quick Format provides the function to format in the background that allows the volumes to be usable without waiting for the completion of the formatting when starting the formatting function.
The support specifications are shown below.

Table 2-23 Quick Format Specifications

Item No.	Item	Contents
1	Support Drive HDD type	All Drive type support
2	Number of parity groups	• Quick Format can be performed on multiple parity groups simultaneously. The number of those parity groups depends on the total of parity group entries. The number of entries is an indicator for controlling the number of parity groups on which Quick Format can be performed. The number of parity group entries depends on the drive capacity configuring each parity group. The number of entries for parity groups is as follows. • Parity group configured with drives of 8 TB or less: 1 entry • Parity group configured with drives of more than 8 TB: 2 entries The maximum number of entries on which Quick Format can be performed is as follows. • VSP G200: 18 entries • VSP G400, G600; VSP F400, F600: 36 entries • VSP G800; VSP F800: 72 entries • The number of volumes does not have a limit if it is less than or equal to the maximum number of entries. • In the case of four concatenations, the number of parity groups is four. In the case of two concatenations, the number of parity groups is two.
3	Combination with various P.P.	It is operable in combination with all P.P.
4	Formatting types	When performing a format from Maintenance PC, Web Console or CLI, you can select either Quick Format or the normal format.
5	Additional start in execution	Additional Quick Format can be executed during Quick Format execution. In this case, the total number of entries during Quick Format and those to be added is limited to the maximum number of entries per model.
6	Preparing Quick Format	• When executing Quick Format, management information is created first. I/O access cannot be executed in the same way as the normal format in this period. • Creating management information takes up to about one minute for one parity group, and up to about 36 minutes in case of 36 parity groups for the preparation.

(To be continued)

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(Continued from the preceding page)

Item No.	Item	Contents
7	Blocking and restoring the volume	• When the volume during Quick Format execution is blocked for maintenance, the status of the volume (during Quick Format execution) is stored in the Storage System. When the volume is restored afterwards, the volume status becomes “Normal (Quick Format)”. Therefore, parity groups in which all volumes during Quick Format are blocked are included in the number of entries during Quick Format. The number of entries for additional Quick Format can be calculated with the following calculating formula: The maximum number of entries per model - X - Y (Legend) X: The number of entries for parity groups during Quick Format. Y: The number of entries for parity groups in which all volumes during Quick Format are blocked.
8	Operation at the time of PS OFF/ON	After P/S ON, Quick Format restarts.
9	Restrictions	• Quick Format cannot be executed to the journal volume of Universal Replicator, external volume, and virtual volume. • Volume Migration and Quick Restore of ShadowImage cannot be executed to a volume during Quick Format. • When the parity group setting is the Accelerated Compression, Quick Format cannot be performed. (If performed, it terminates abnormally)

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2.3.2.2 Volume Data Assurance during Quick Formatting

The Quick Formatting management table is kept on SM. This model can prevent the management table from volatilizing by backing up the SM to an SSD, and assures the data quality during Quick Formatting.

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2.3.2.3 Quick Formatting Time

Quick Format executes the format in background while executing I/O from HOST.
Therefore, the Quick Format time may change significantly depending on the number of I/O from HOST or other conditions.
The following table shows the Quick Format time without I/O.
The Quick Format time with I/O might be twice or three times of the following time.

Table 2-24 Quick Format Time

Drive type	Formatting time
4R0H3M/4R0H3MC/4R0H4M/4R0H4MC (7.2 krpm)	52 h
6R0H9M/6R0HLM (7.2 krpm)	78 h
10RH9M/10RHLM (7.2 krpm)	130 h
600JCM/600JCMC (10 krpm)	8 h
1R2JCM/1R2JCMC/1R2J5M/1R2J5MC/1R2J7M/1R2J7MC (10 krpm)	15 h
1R8JGM/1R8J6M/1R8J8M (10 krpm)	23 h
300KCM/300KCMC (15 krpm)	4 h
600KGM (15 krpm)	8 h
200MEM (SSD)	1 h
400MEM/400M6M/400M8M (SSD)	2 h
480MGM(SSD)	2h
960MGM(SSD)	4h
1R9MEM/1R9MGM (SSD)	8 h
3R8MGM(SSD)	17h
1R6FM (FMD)	8 h
3R2FM (FMD)	16 h
1R6FN (FMD)	8 h
3R2FN (FMD)	16 h
6R4FN (FMD)	32 h
7R0FP (FMD)	32 h
14RFP (FMD)	64 h

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- The time above shows the time when Quick Format is executed to all areas of the parity group, and when Quick Format is executed to a part of LDEV in the parity group, the time will be faster in proportion to the capacity of LDEV.
- The Quick Format time with I/O may be over five times of the time above.
- When Quick Format is executed to multiple parity groups, the time becomes slower than the time above depending on the number of parity groups. The proportion of the time becoming slower is generally two times slower when the number of parity groups are 15, and three times slower when the number of parity groups are 30.
- The time above might be up to four times slower depending on the capacity of Cache Memories and the number of I/F Boards.
- When Quick Format is executed to parity groups with different Drive capacities at the same time, calculate the time with the parity group of the largest capacity.
- When the RAID level is RAID1, the formatting time becomes about half compared with the above-mentioned time.

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2.3.2.4 Performance during Quick Format

Quick Format executes the formatting in background while executing I/O from HOST.
Therefore, it may influence the HOST performance.
The following table shows the proportion of the performance influence.
(However, this is only a rough standard, and it may change depending on the conditions.)

Table 2-25 Performance during Quick Format

I/O types	Performance when the ratio shows 100% at normal condition
Random read	80%
Random write to the unformatted area	20%
Random write to the formatted area	60%
Sequential read	90%
Sequential write	90%

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2.3.2.5 Combination with Other Maintenance

Table 2-26 Combination with Other Maintenance

Item No.	Maintenance Operation	Operation during Quick Format
1	Drive copy / correction copy	The processing is possible as well as the normal volumes, but unformatted area is skipped.
2	LDEV Format (high-speed / low-speed)	The LDEV Format is executable for the volumes that Quick Format is not executed.
3	Volume maintenance block	It is possible to block the volumes instructed by Web Console or CLI for the volumes during Quick Format.
4	Volume forcible restore	If forcible restore is executed after the maintenance block, it returns to Quick Formatting.
5	Verify consistency check	Possible. However, the Verify consistency check for the unformatted area is skipped.
6	PDEV replacement	Possible as usual
7	PK replacement	Possible as usual

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2.3.2.6 SIM Output When Quick Format Completed

After Quick Format is completed, SIM = 0x410100 is output when performing Quick Format. However, SIM is not output when Quick Format is performed by RAID Manager.

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2.4 Ownership Right

2.4.1 Requirements Definition and Sorting Out Issues

Table 2-27 Confirmation and Definitions of Requirement and issues

#	Requirement	Case
1	Maximize system performance by using MPU effectively	Initial set up (Auto-Define-Configuration) Ownership management resources are added.
2		At performance tuning
3	Troubleshoot in the case of problems related to ownership	Troubleshoot
4	Confirm resources allocated to each MPU	Ownership management resources are added. At performance tuning Troubleshoot
5	Maintain performance for resources allocated to specific MPU	Maintain performance for resources allocated to specific MPU

2.4.1.1 Requirement #1

Requirement

Maximize system performance by using MPU effectively.

Issue

Way to distribute resources to balance load of each MPU.

How to realize

(1) User directly allocates resources to each MPU.
(2) User does not allocate resources. Resources are allocated to each MPU automatically.

Case

(A) At the time of initial construction (Auto-Define-Configuration)
Target resource : LDEV
Setting IF : Maintenance PC

(B) Ownership management resources are added.
Target resources : LDEV / External VOL / JNLG
Setting IF : Maintenance PC / Storage Navigator / CLI / RMLib

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2.4.1.2 Requirement #2

Requirement

Maximize system performance by using MPU effectively.

Issue

Way to move resources to balance load of each MPU.

How to realize

User directly requirement s to move resources.

Case

Performance tuning

Target resources : LDEV / E xternal VOL / JNLG

Setting IF : Storage Navigator / CLI / RMLib

2.4.1.3 Requirement #3

Requirement

Troubleshooting in the case of problems related to ownership.

Issue

Way to move resources required for solving problems.

How to realize

Maintenance personnel directly requirement s to move resources.

Case

Troubleshooting

Target resources : LDEV / External VOL / JNLG

Setting IF : Storage Navigator / CLI / RMLib

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2.4.1.4 Requirement #4

Requirement

Confirm resources allocated to each MPU.

Issue

Way to reference resources allocated to each MPU.

How to realize

User directly requirement to reference resources.

Case

(A) Before ownership management resources are added.
Target resources : LDEV / External VOL / JNLG
Referring IF : Storage Navigator / CLI / Report (XPDT) / RMLib

(B) Performance tuning
Target resources : LDEV / External VOL / JNLG
Referring IF : Storage Navigator / CLI / Report (XPDT) / RMLib

(C) Troubleshooting
Target resources : LDEV / External VOL / JNLG
Referring IF : Storage Navigator / CLI / Report (XPDT) / RMLib

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2.4.1.5 Requirement #5

Requirement

Maintain performance for resources allocated to specific MPU.

Issue

Way to move resources allocated to each MPU automatically and, way to prevent movement of resources during addition of MPU.

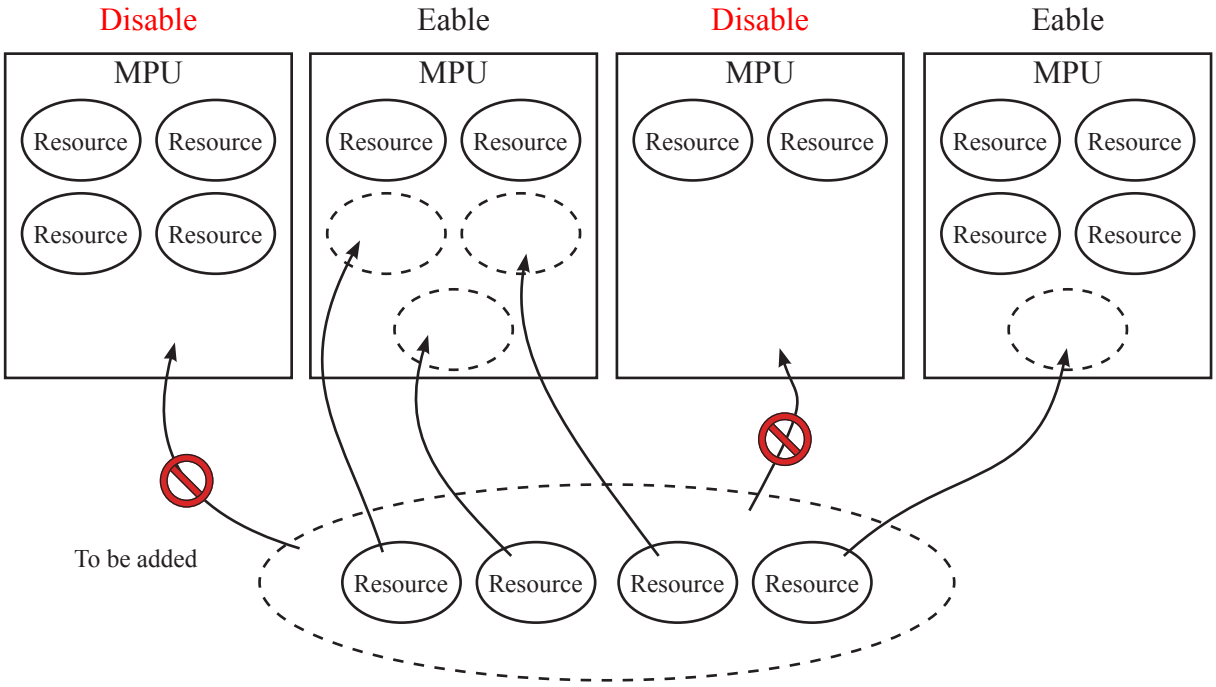
How to realize

Resources are NOT allocated / moved automatically to the MPU that user specified.

Case

(A) When adding ownership management resources, preventing allocation of resources to the Auto Allocation “Disable” MPU.

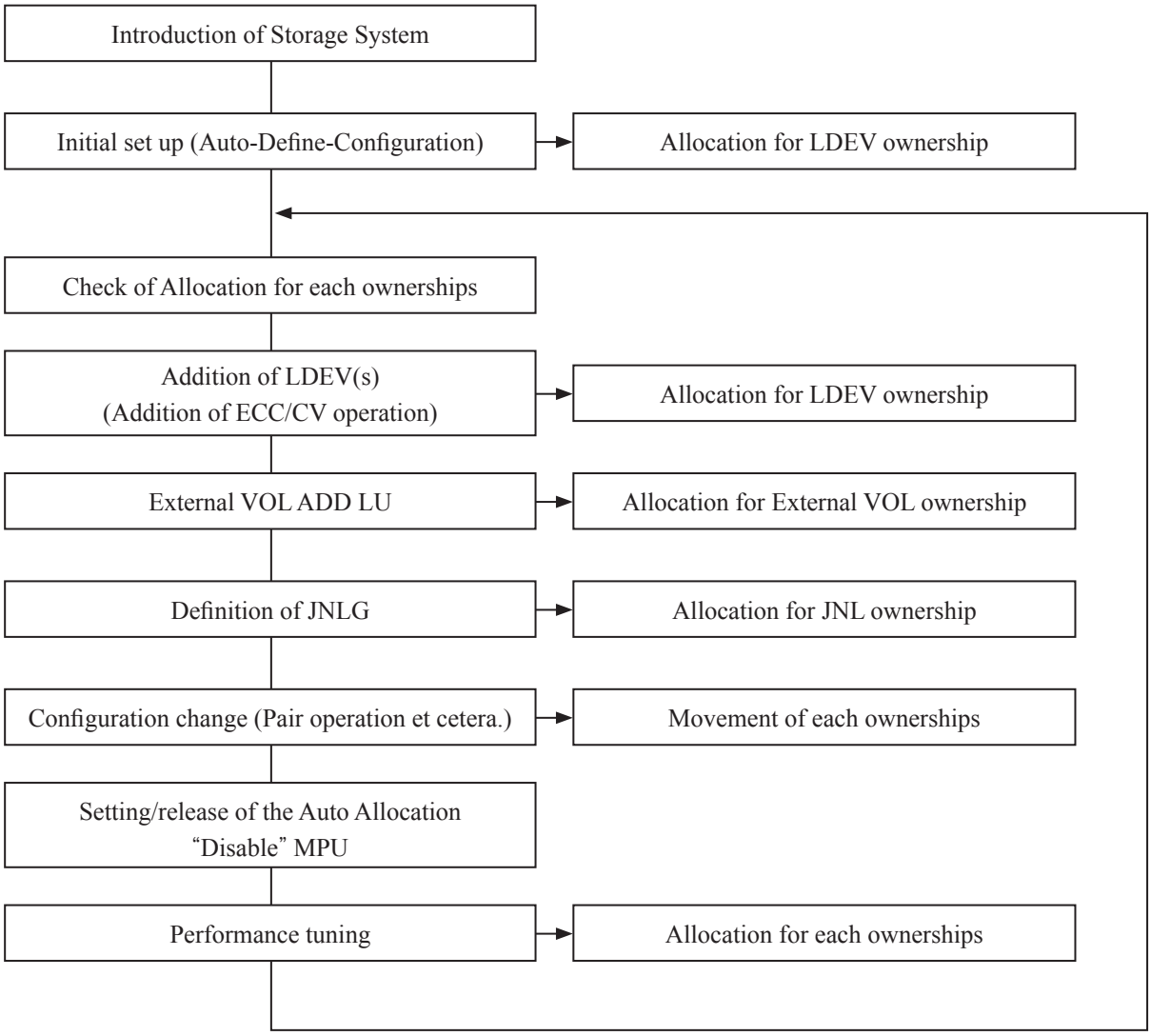
Figure 2-11 Requirement #5 (A)



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2.4.1.6 Process Flow

Figure 2-12 Process flow

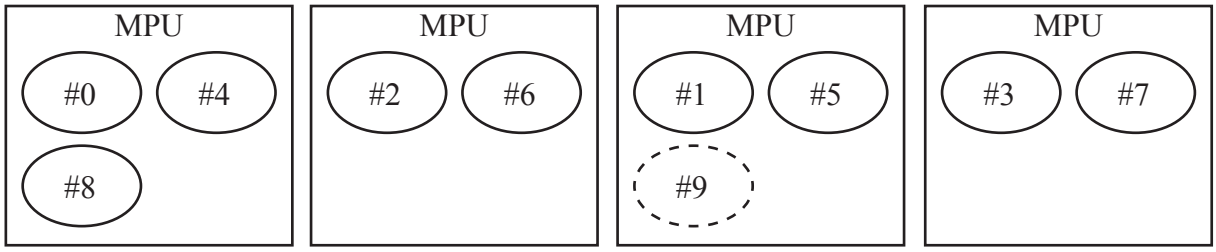


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2.4.2 Resource Allocation Policy

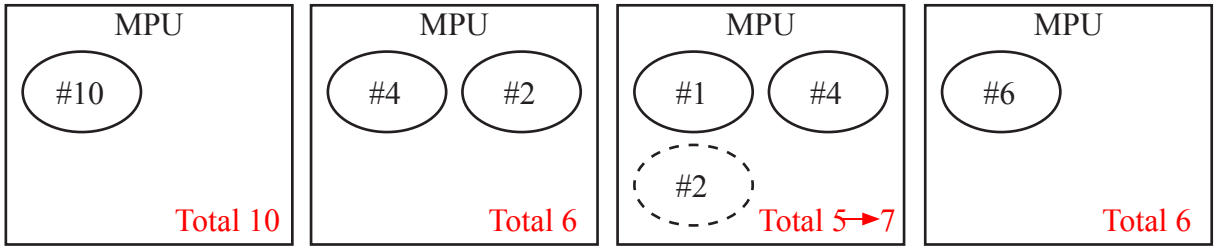
1. Both User-specific and automation allocation are based on the common policy. Allocate resources to each MPU equally.

Figure 2-13 Resource allocation Policy (1)



2. Additionally, user-specific allocation can consider the weight of each device.

Figure 2-14 Resource allocation Policy (2)



But, automation allocation cannot consider the weight of each device.

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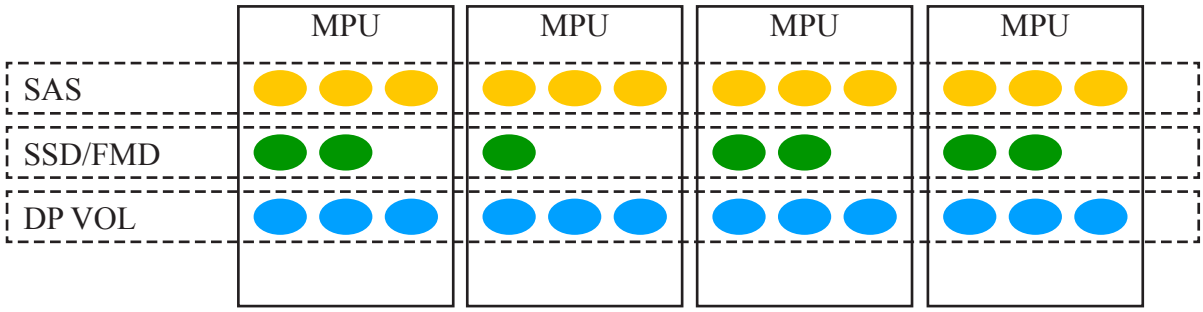
2.4.2.1 Automation Allocation

Allocate resources to each MPU equally independently in each type.

Table 2-28 Automation allocation

Ownership	Device type	Unit	Leveling
LDEV	SAS	ECC Gr.	Number of LDEVs
	SSD/FMD	LDEV	Number of LDEVs
	DP VOL	LDEV	Number of LDEVs
External VOL	—	Ext. VOL	Number of Ext. VOLs
JNLG	—	JNLG	Number of JNLGs.

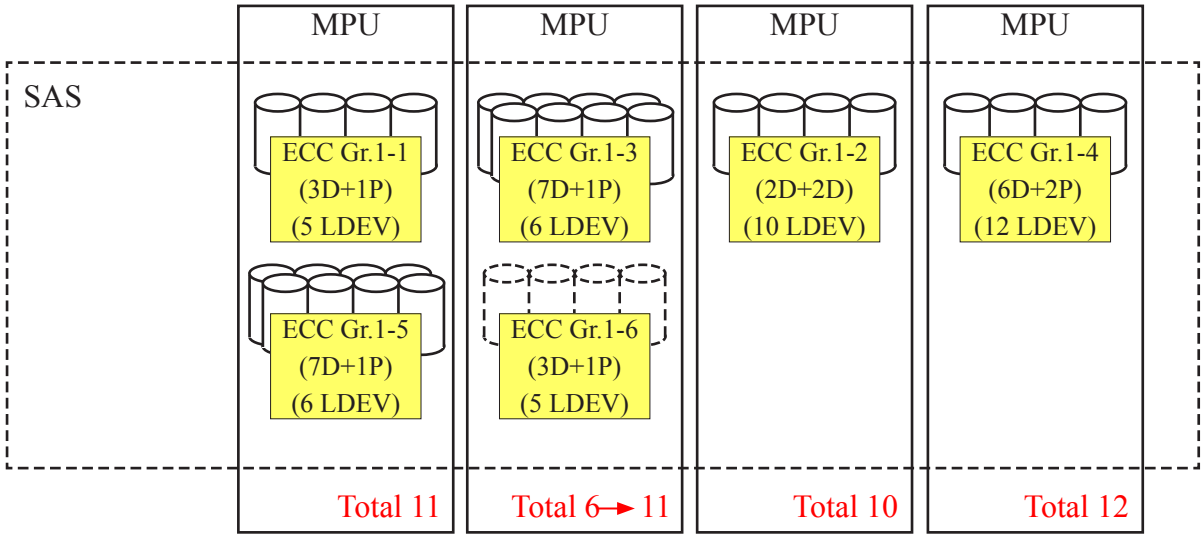
Figure 2-15 Automation allocation



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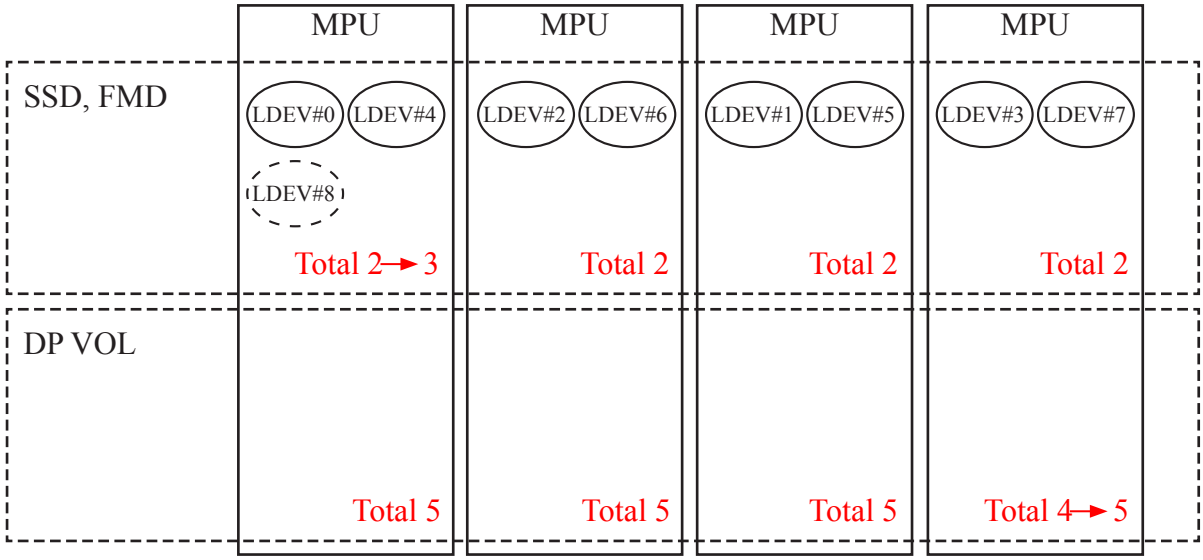
1. Automation allocation (SAS)
   Unit : ECC Gr.
   Leveling : Number of LDEVs

Figure 2-16 Automation allocation (SAS)



2. Automation allocation (SSD, FMD/DP VOL)
   Unit : ECC Gr.
   Leveling : Number of LDEVs

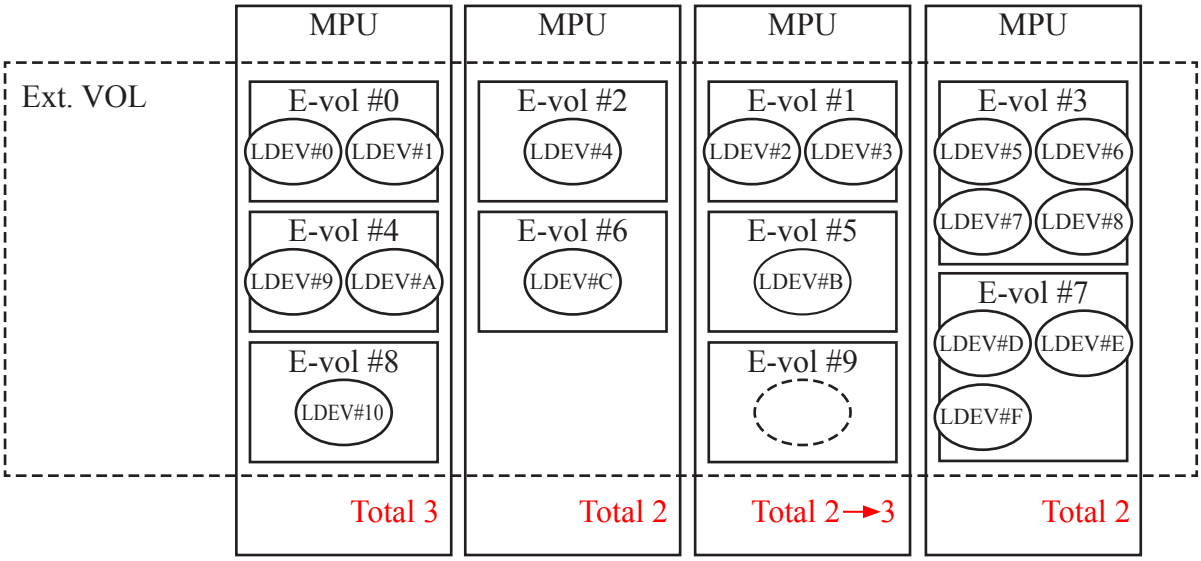
Figure 2-17 Automation allocation (SSD, FMD/DP VOL)



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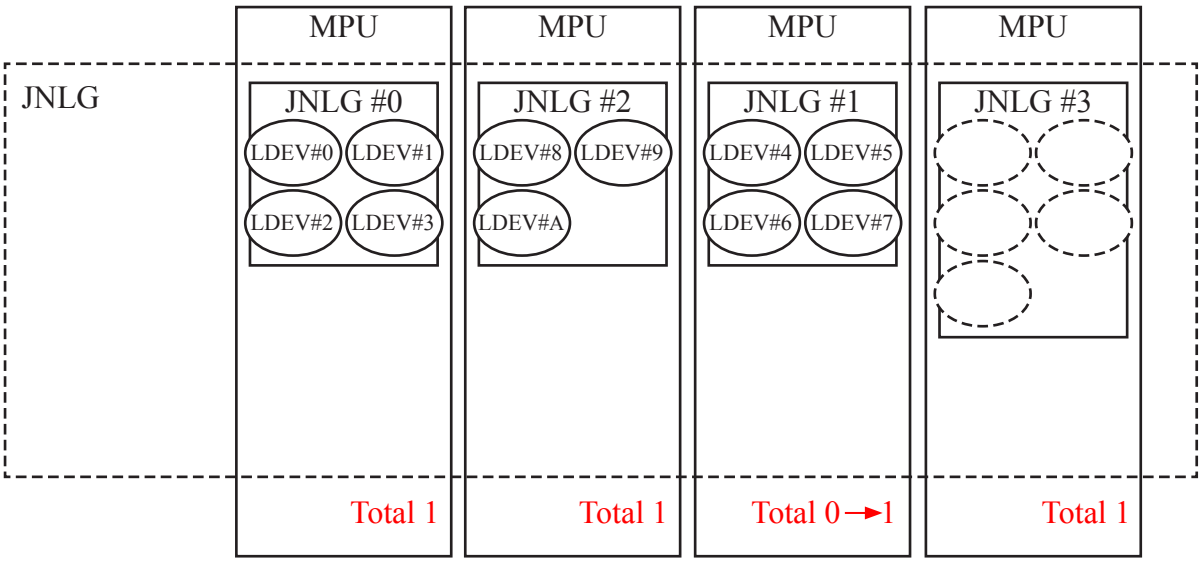
3. Automation allocation (Ext. VOL)
   Unit : Ext. VOL
   Leveling : Number of Ext. VOLs (not Ext. LDEVs)

Figure 2-18 Automation allocation (Ext. VOL)



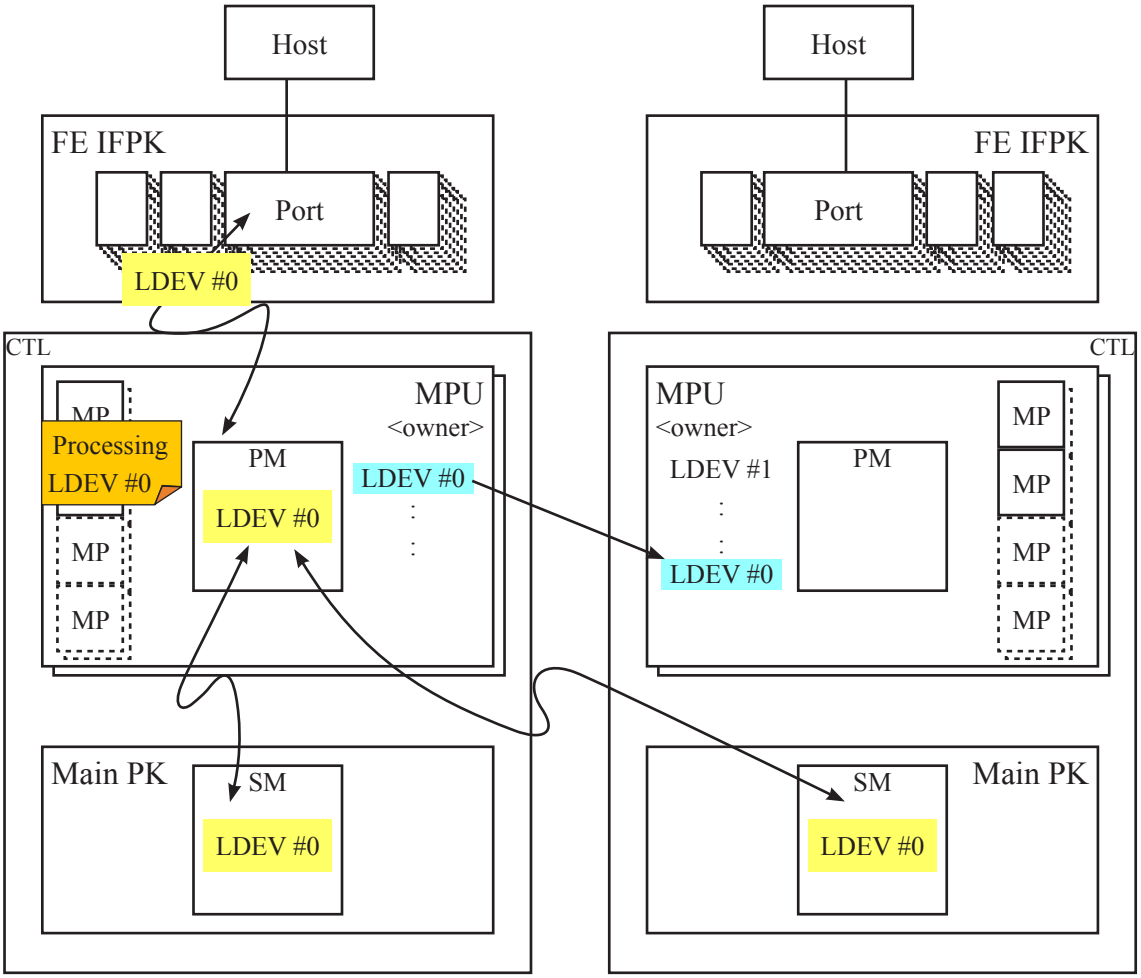
4. Automation allocation (JNLG)
   Unit : JNLG
   Leveling : Number of JNLGs (not JNL VOLs)

Figure 2-19 Automation allocation (JNLG)



2.4.3 MPU Block

Figure 2-20 MPU block

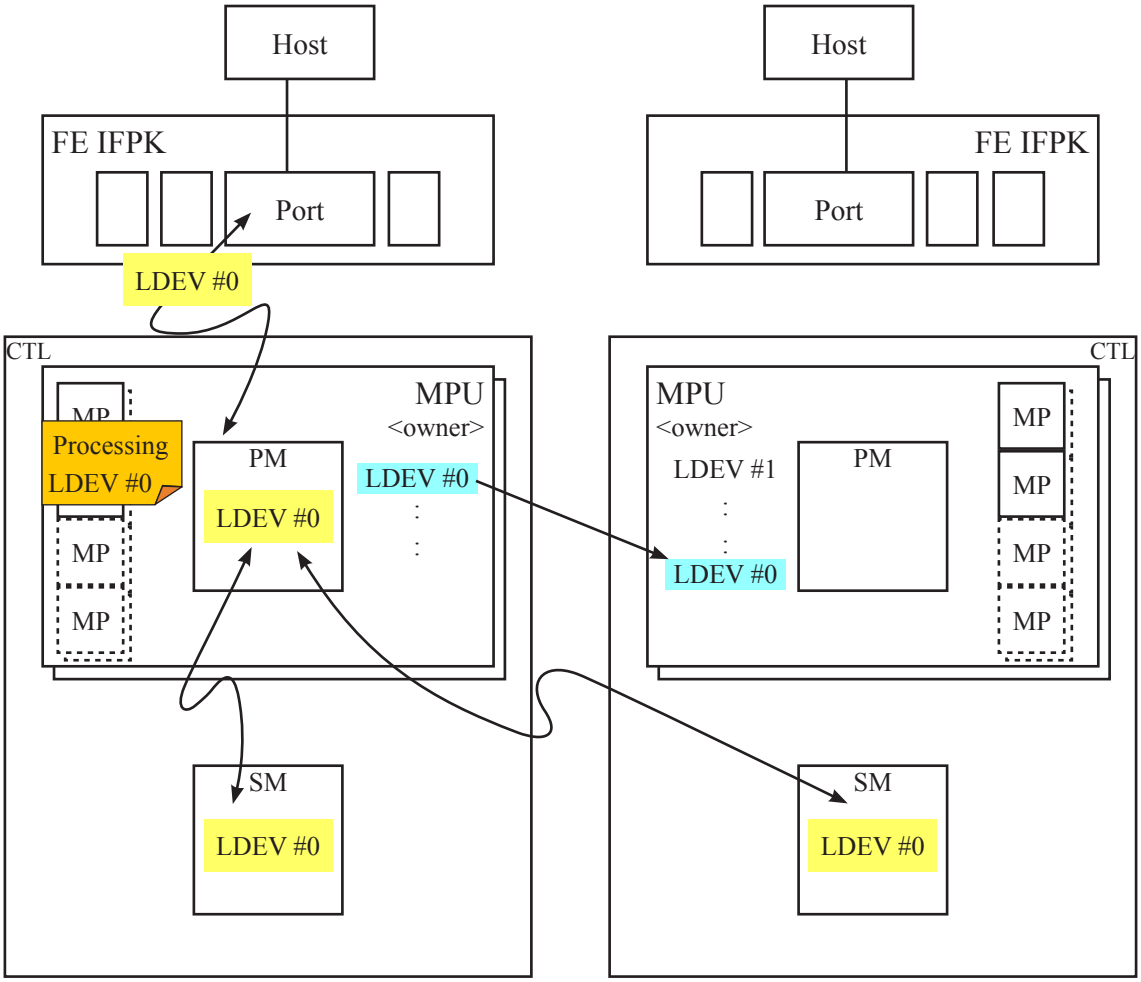


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2.4.3.1 MPU Block for Maintenance

Step1. Make the ownership the moving transient state.

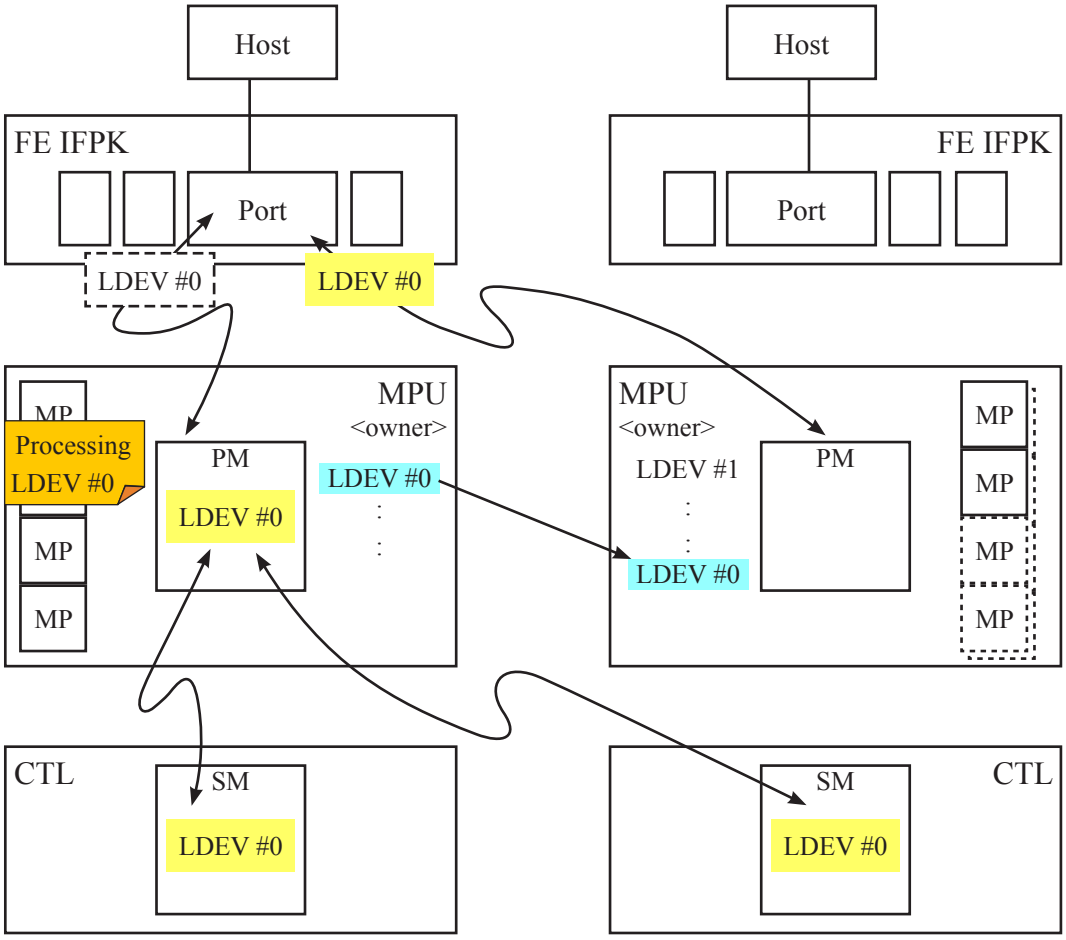
Figure 2-21 MPU block for maintenance (1)



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Step2. Switch MPU, to which I/O is issued, to the target MPU (to which the ownership is moved).

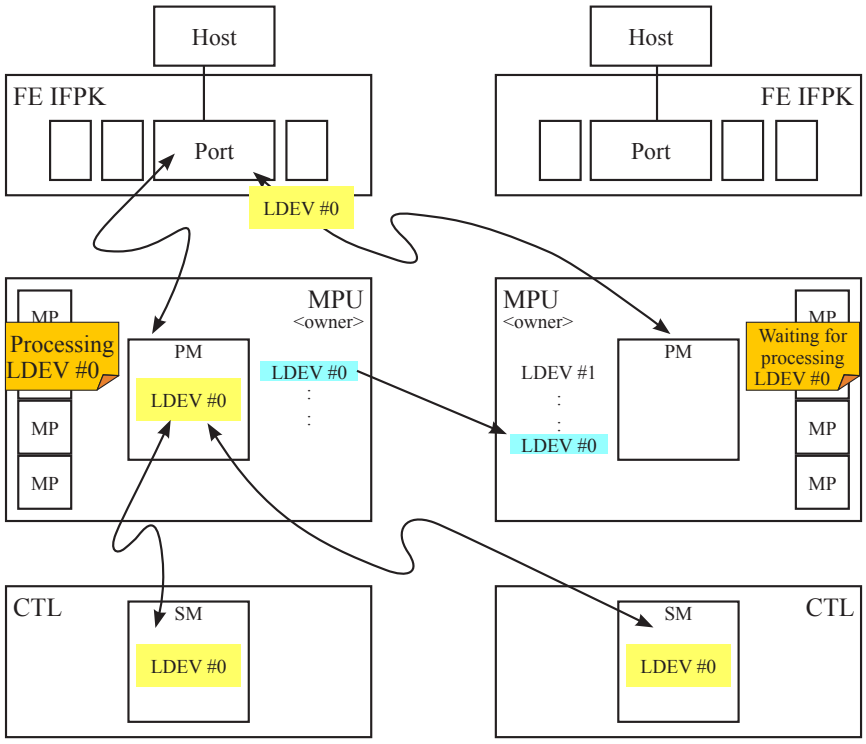
Figure 2-22 MPU block for maintenance (2)



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Step3. Complete the ongoing processing in the source MP whose ownership is moved.
(New processing is not performed in the source MP.)

Figure 2-23 MPU block for maintenance (3)

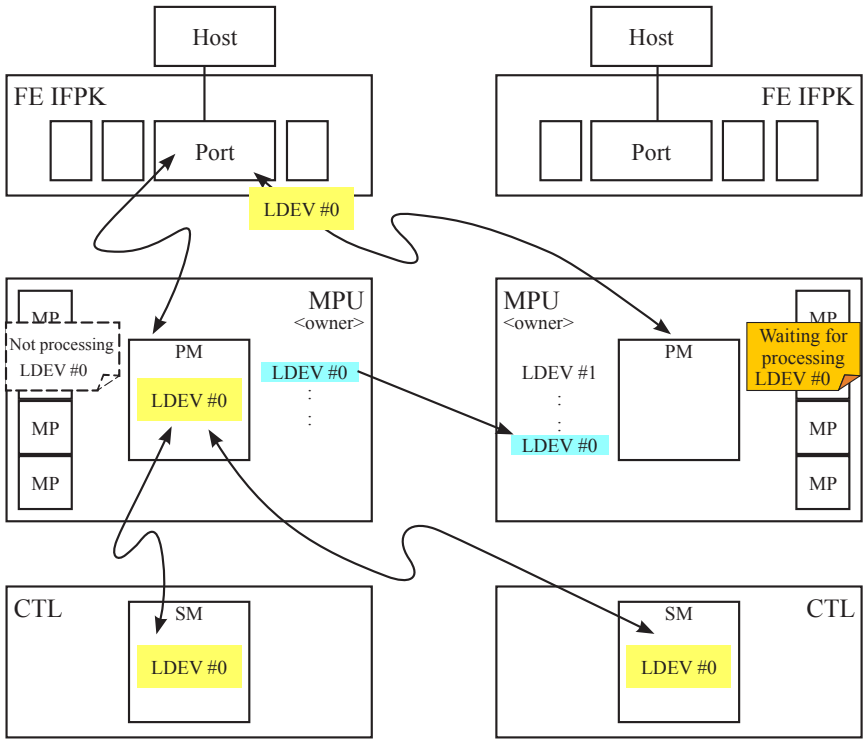


<Target MPU>
- I/O is issued to the target MPU, but processing waits until ownership is completely moved.

<Source MPU>
- Monitor until all ongoing processing is completed. After it is completed. Go on to Step4.
- When Time Out is detected, terminate ongoing processing forcibly.

Step4. Disable PM information in the source MP whose ownership is moved.

Figure 2-24 MPU block for maintenance (4)

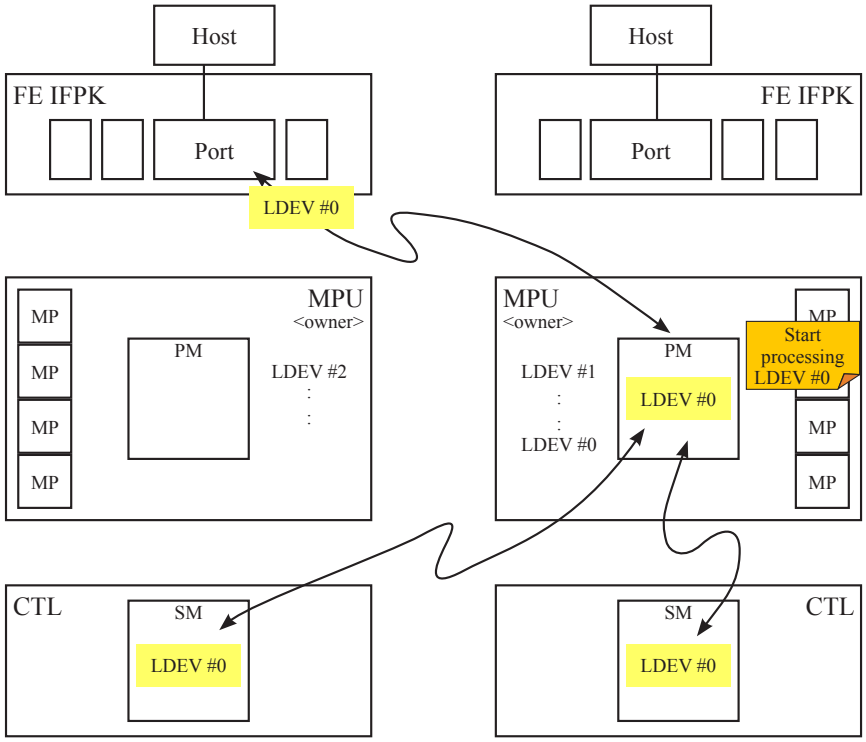


<Source MPU>
- When disabling PM information, only representative info is rewritten, so processing time is less than 1ms.

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Step5. Moving ownership is completed and the processing starts in the target MPU.

Figure 2-25 MPU block for maintenance (5)

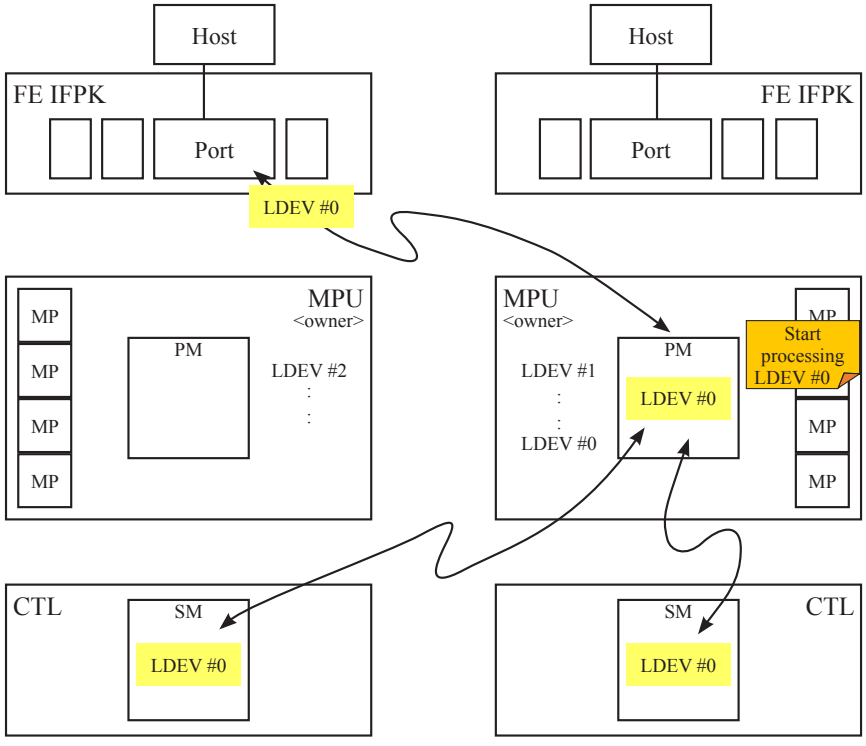


<Target MPU>

- Immediately after processing is started, SM is accessed, so access performance to control info is degraded compared to before moving ownership.
- Along with the progress of the PM information collection, access performance to the control information is improved.

Step6. Perform Step1. to Step5. for all resources under the MPU blocked and after they are completed, block MPU.

Figure 2-26 MPU block for maintenance (6)



<Moving ownership>

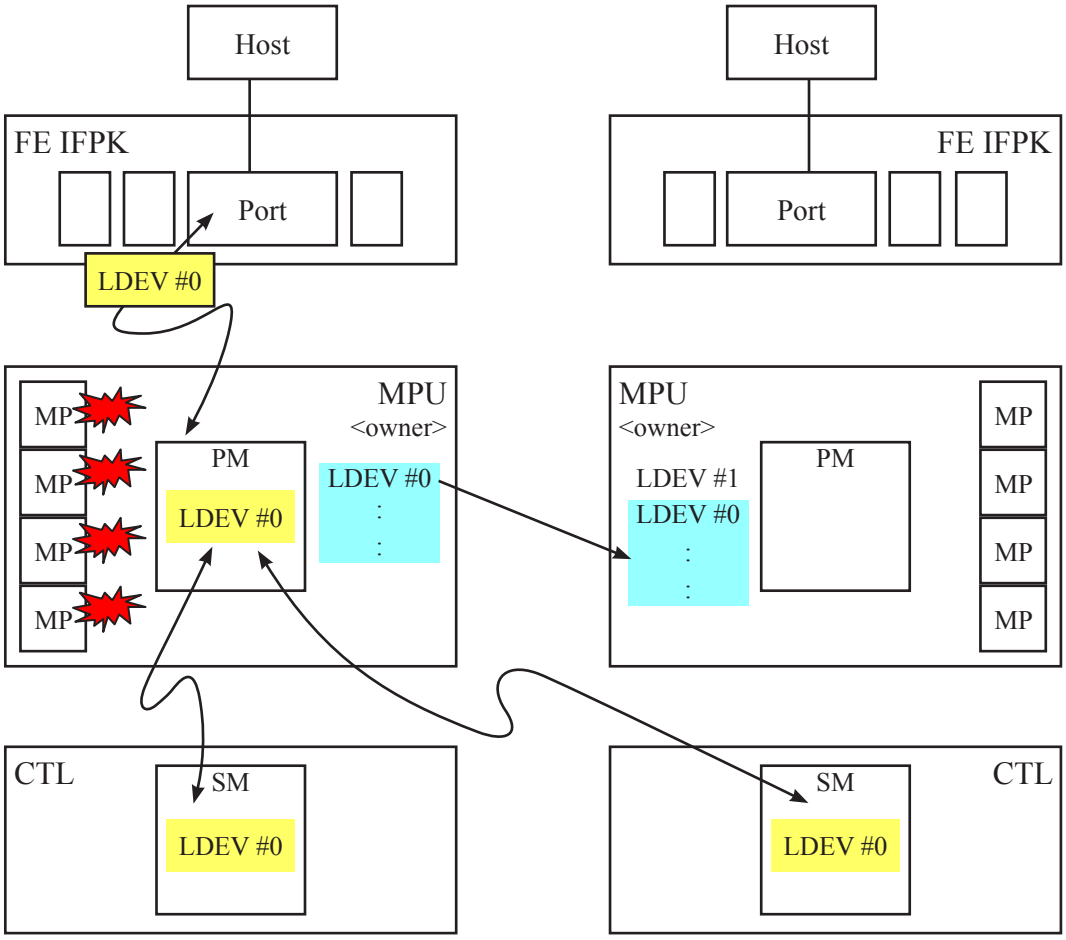
- Move resources that are related to ShadowImage, UR, and TI synchronously.
- If they are moved at a time, performance would be affected significantly, so move them in phase as long as maintenance time is permissible.

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2.4.3.2 MPU Block due to Failure

Step1. Detect that all MPs in the MPU are blocked and decide MPU that takes over the ownership.

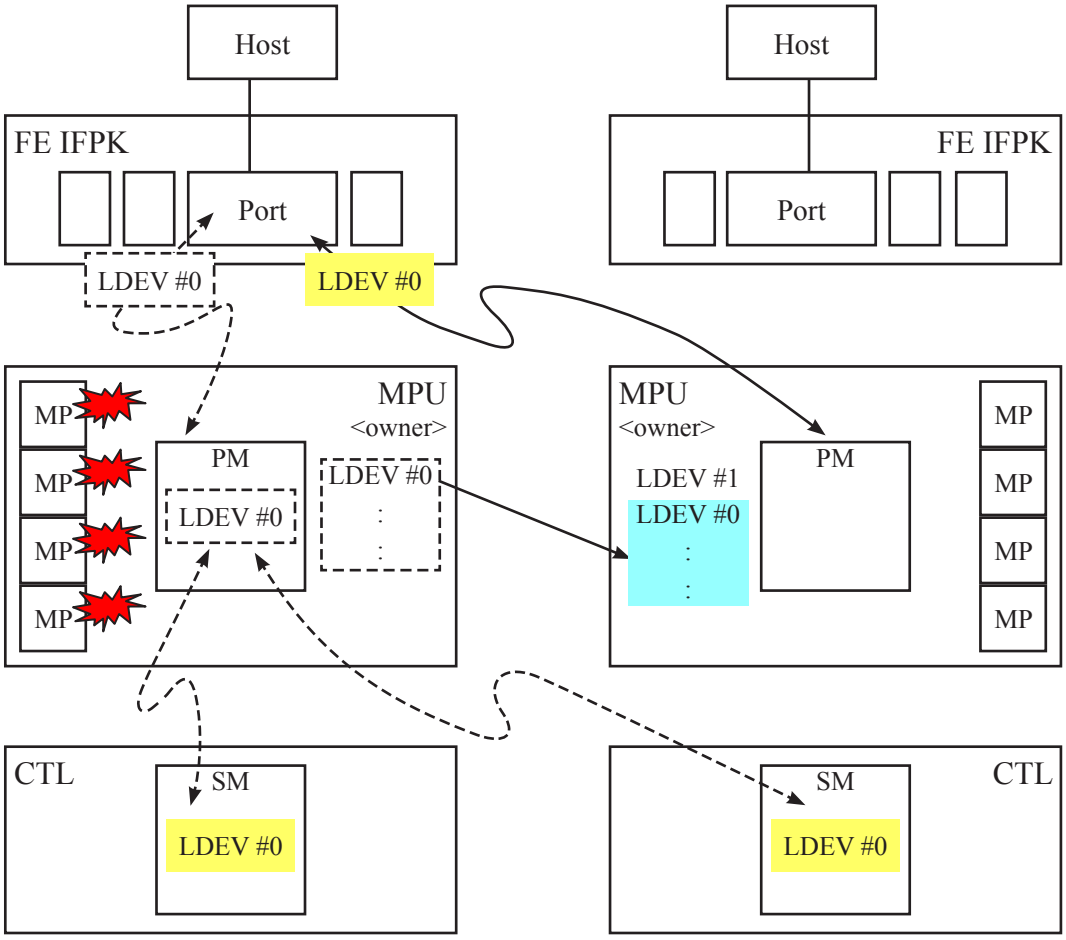
Figure 2-27 MPU blocked due to failure (1)



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Step2. Switch MPU, to which I/O is issued, to MPU that takes over the ownership.

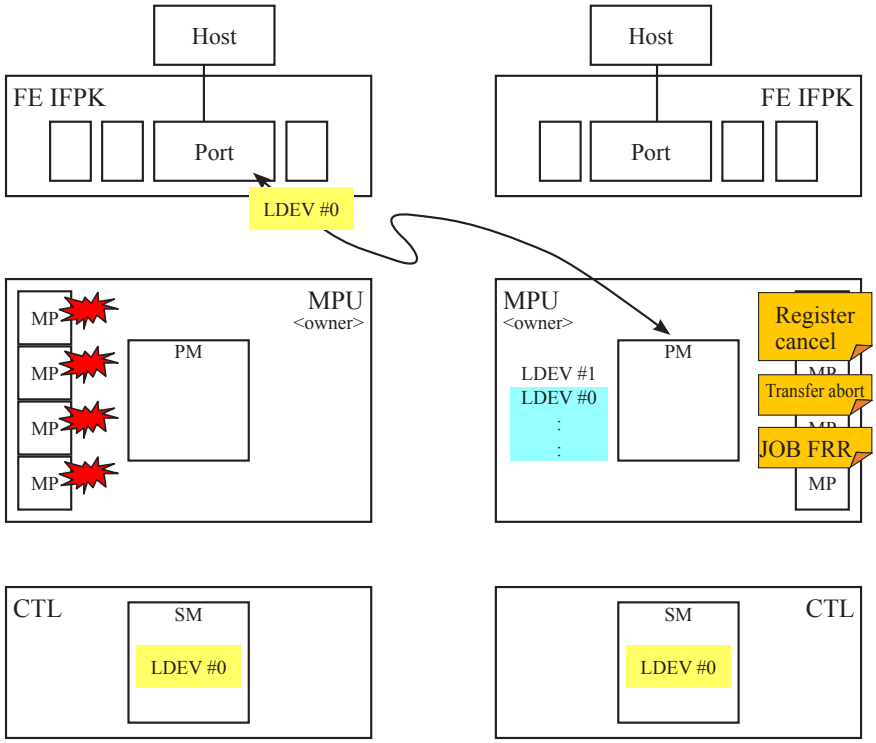
Figure 2-28 MPU blocked due to failure (2)



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Step3. Perform WCHK1 processing at the initiative of MPU that takes over the ownership.

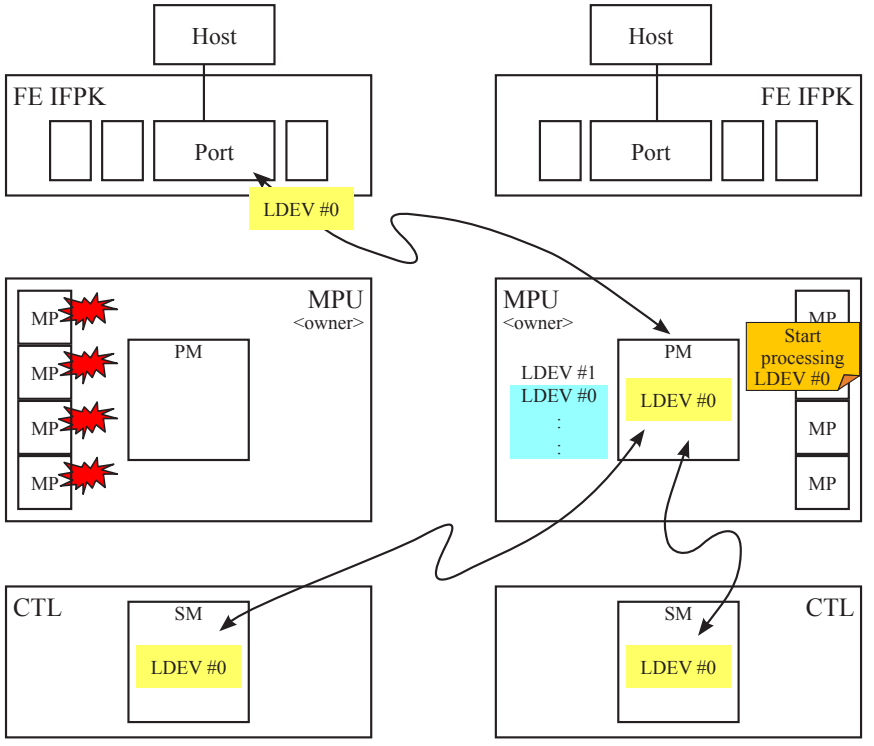
Figure 2-29 MPU blocked due to failure (3)



<WCHK1 processing>
- Issue a requirement for cancelling the requirement for processing received from WCHK1 MPU to all MPs.
- Issue an abort instruction of data transfer started from WCHK1 MPU.
- WCHK1 MPU performs post-processing of ongoing JOB.

Step4. WCHK1 processing is completed, and the processing starts in the target MPU.

Figure 2-30 MPU blocked due to failure (4)



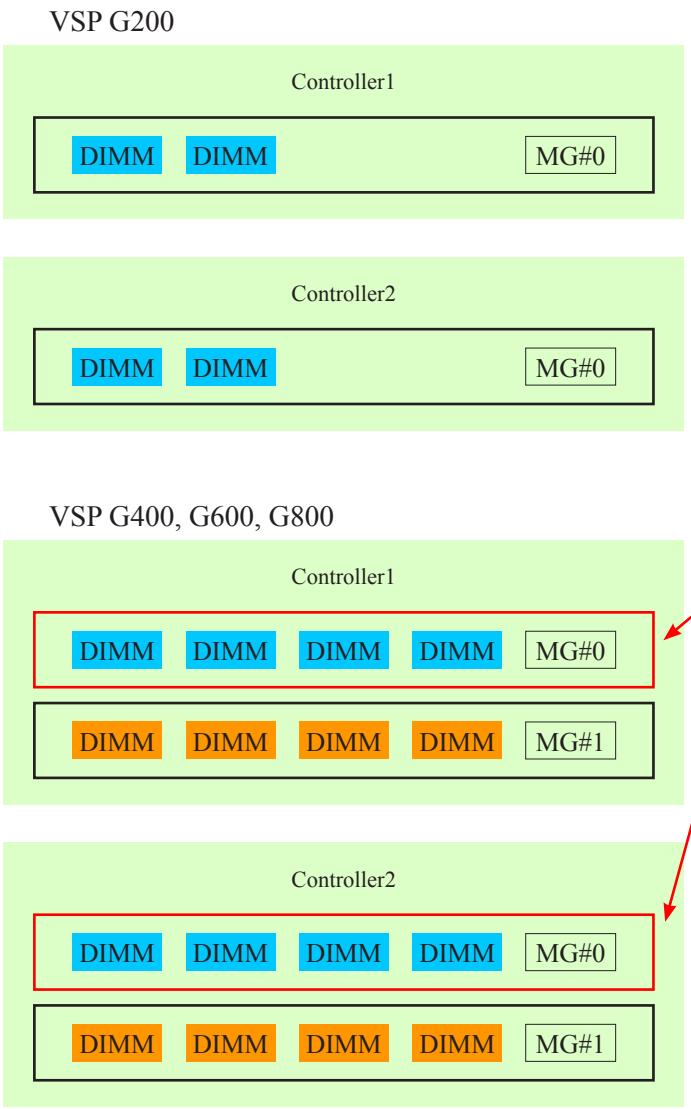
<Target MPU>
- Immediately after processing is started, SM is accessed, so access performance to control information is degraded compared to before moving ownership.
- As processes of importing information in PM progress, access performance to control info is improved.

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2.5 Cache Architecture

2.5.1 Physical Addition of Controller/DIMM

Figure 2-31 Physical addition of Controller/DIMM



DIMM type

Type	GB/ DIMM	GB/MG	GB/DKC
C32G	8	16	32
C64G (VSP G200 only)	16	32	64

DIMM type

Type	GB/ DIMM	GB/MG	GB/DKC
C64G	8	32	128
C128G	16	64	256
C256G	32	128	512

C256G : VSP G800 only

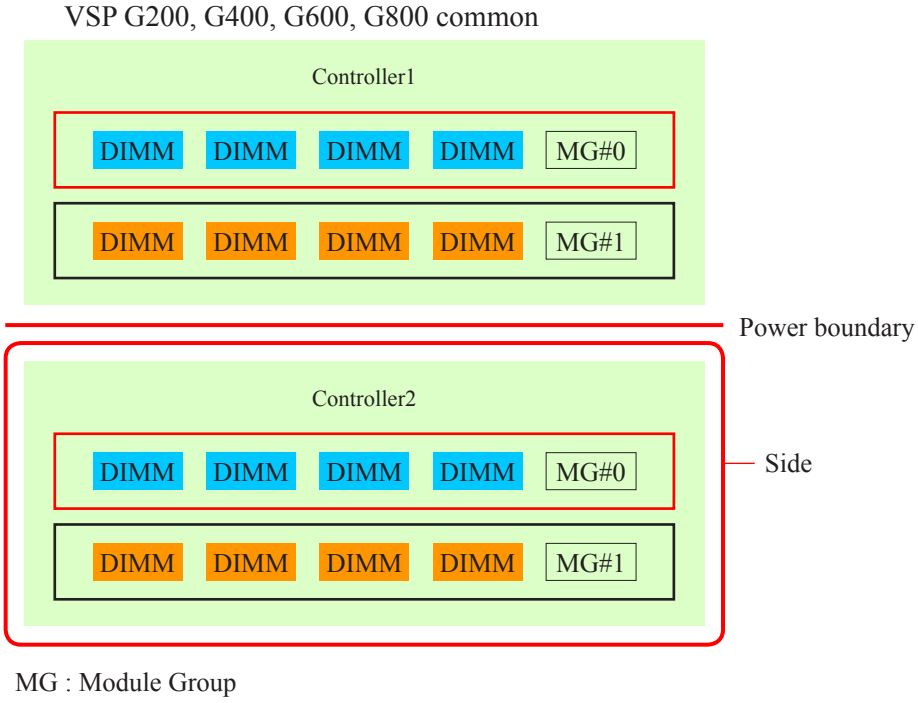
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2.5.2 Maintenance/Failure Blockade Specification

2.5.2.1 Blockade Unit

The block at the time of maintenance/failure is by surface unit and the block management by MG unit is not performed.

Figure 2-32 Blockade Unit

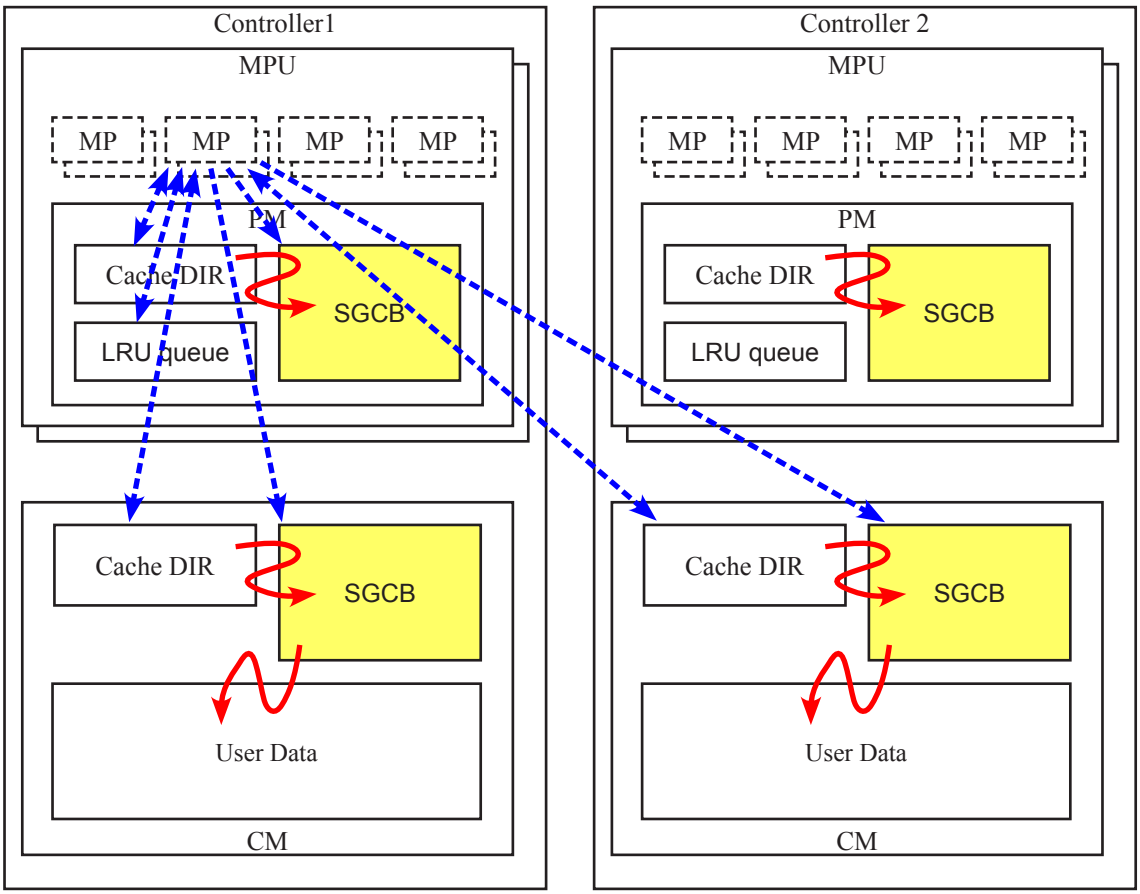


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2.5.3 Cache Control

2.5.3.1 Cache Directory PM Read and PM/SM Write

Figure 2-33 Cache Directory PM read and PM/SM write

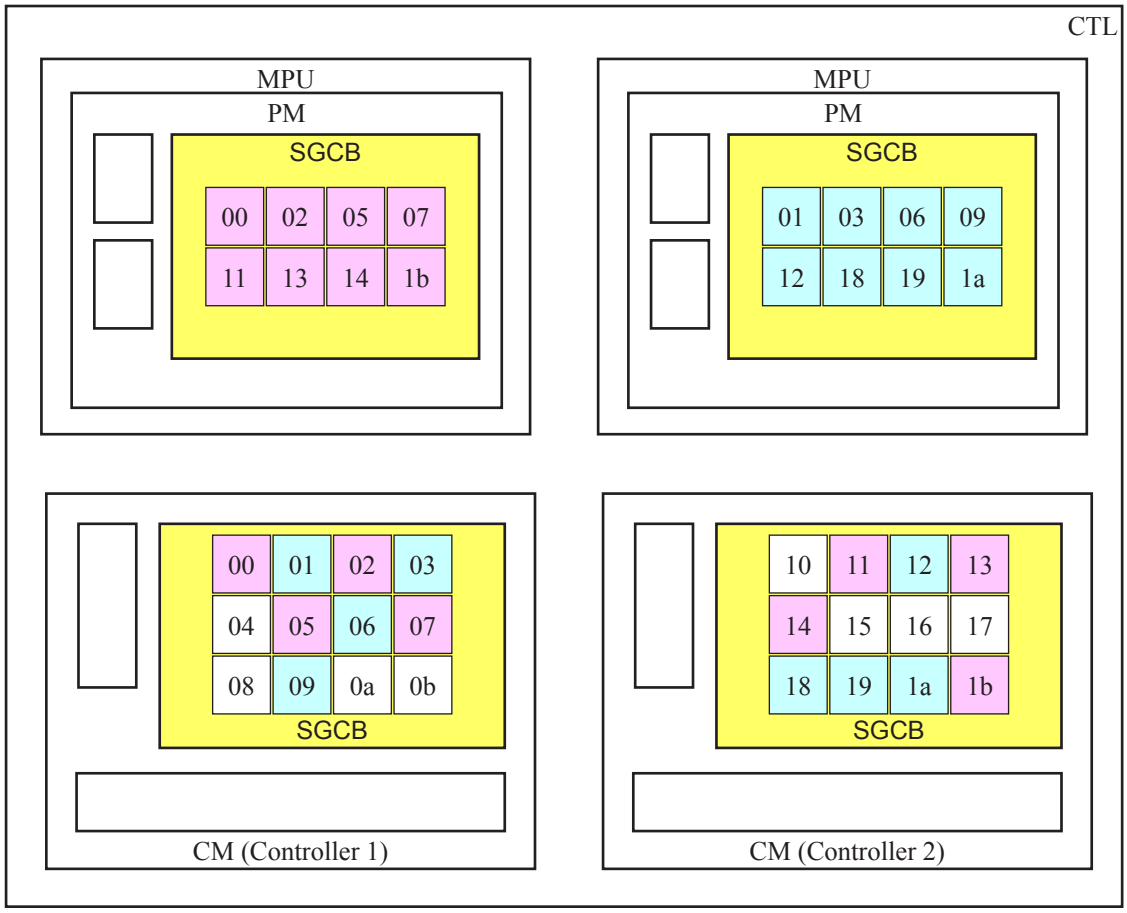


SGCB: SeGment Control Block

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2.5.3.2 Cache Segment Control Image

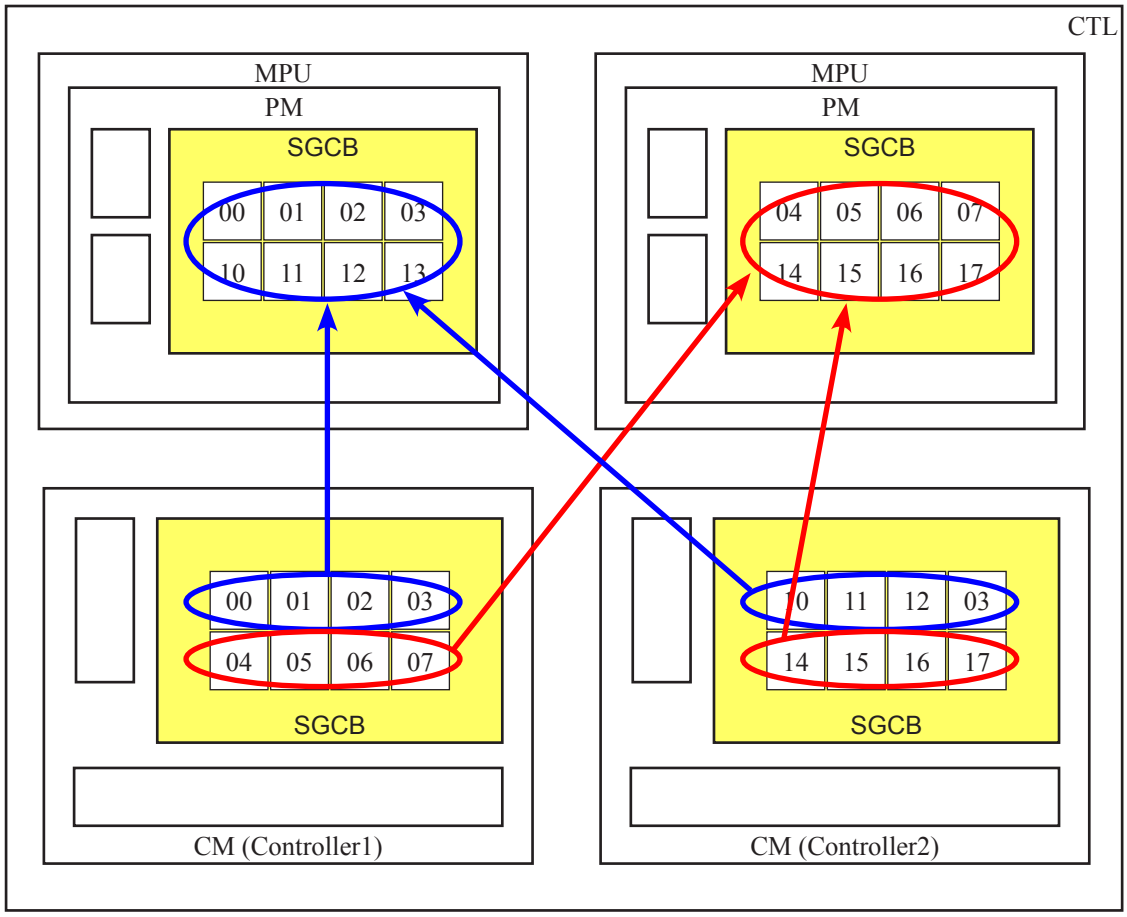
Figure 2-34 Cache Segment Control Image



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2.5.3.3 Initial Setting (Cache Volatilization)

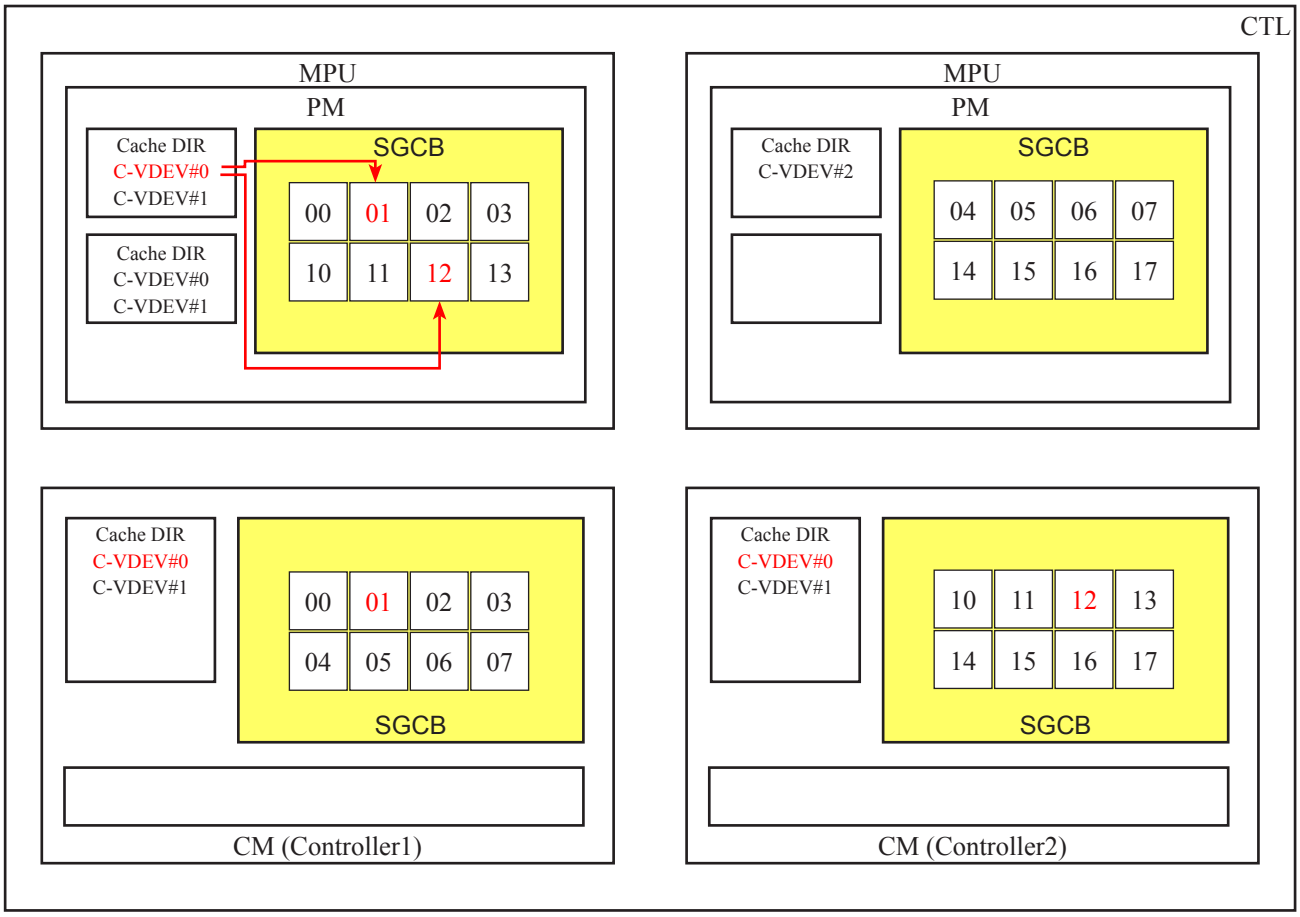
Figure 2-35 Initial Setting (Cache Volatilization)



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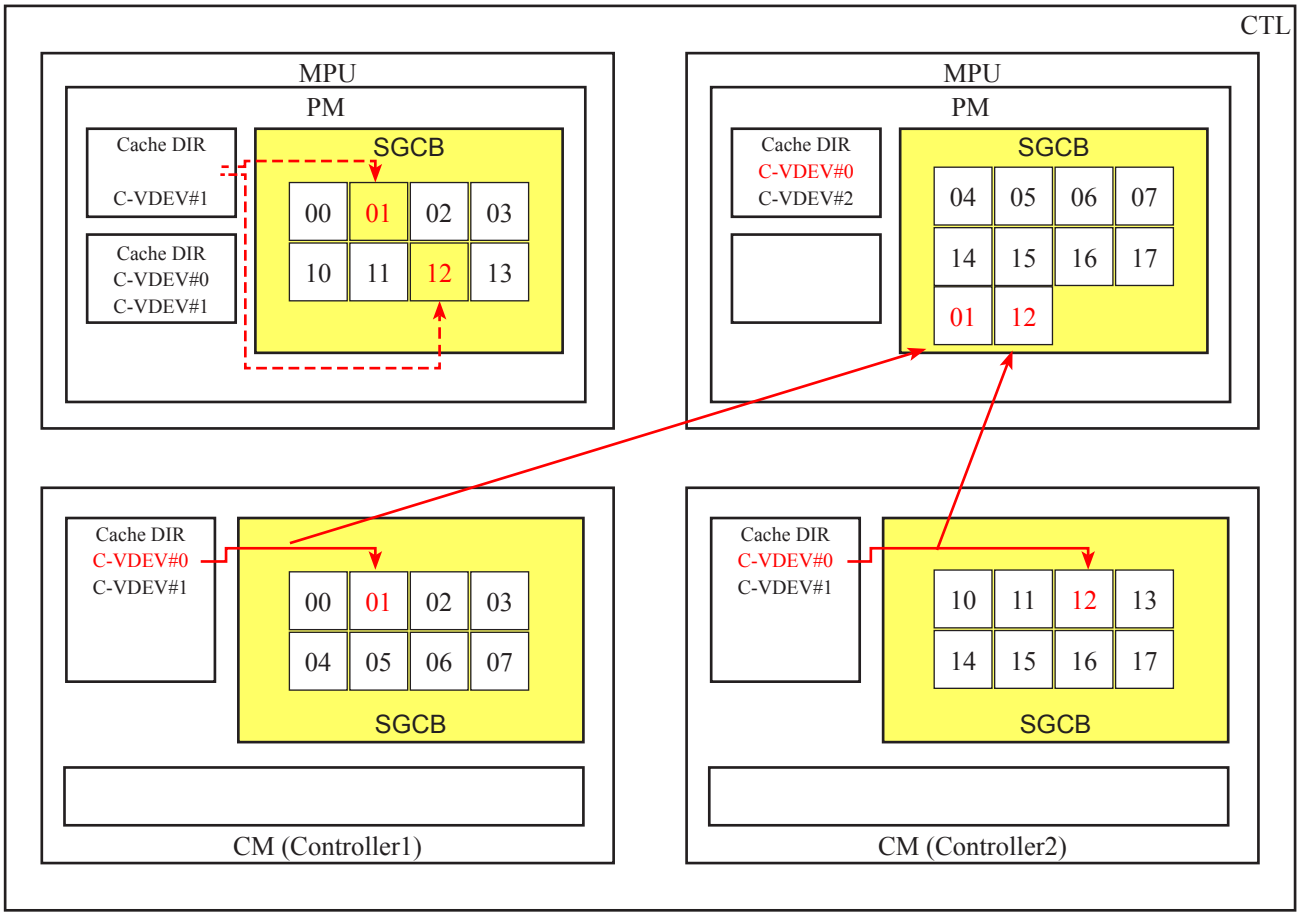
2.5.3.4 Ownership Right Movement

Figure 2-36 Ownership movement (1)



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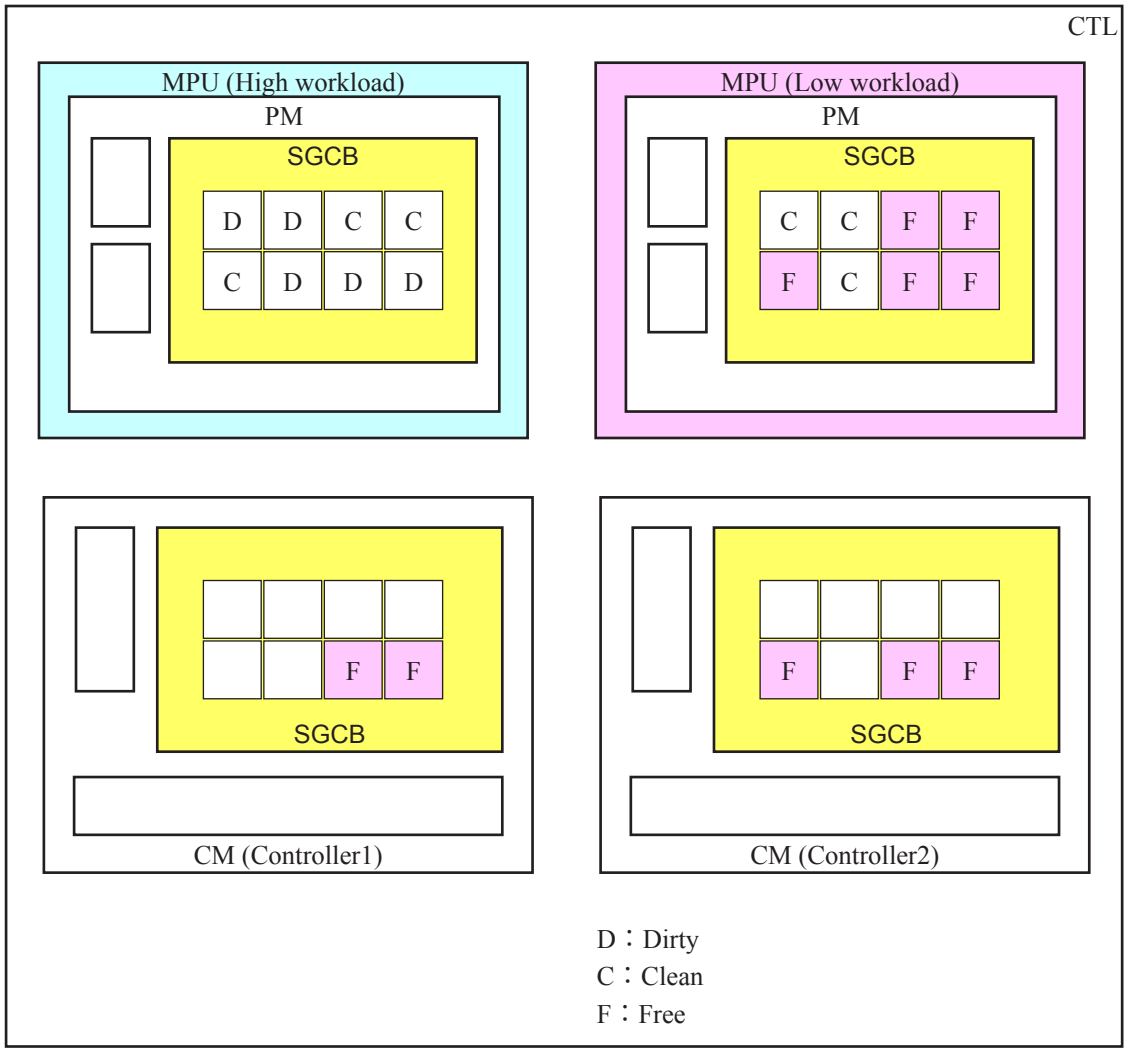
Figure 2-37 Ownership movement (2)



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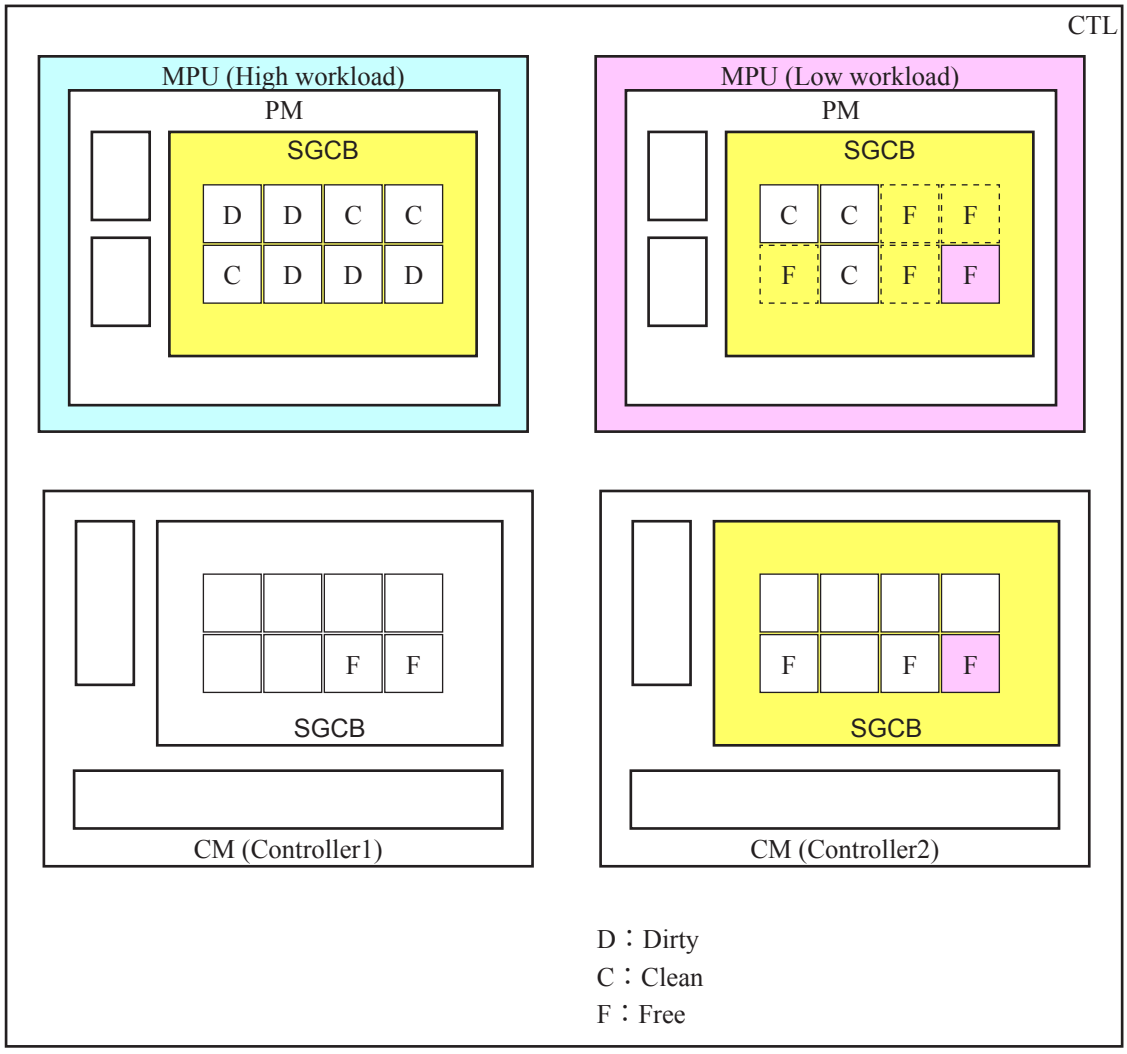
2.5.3.5 Cache Load Balance

Figure 2-38 Cache Load balance (1)



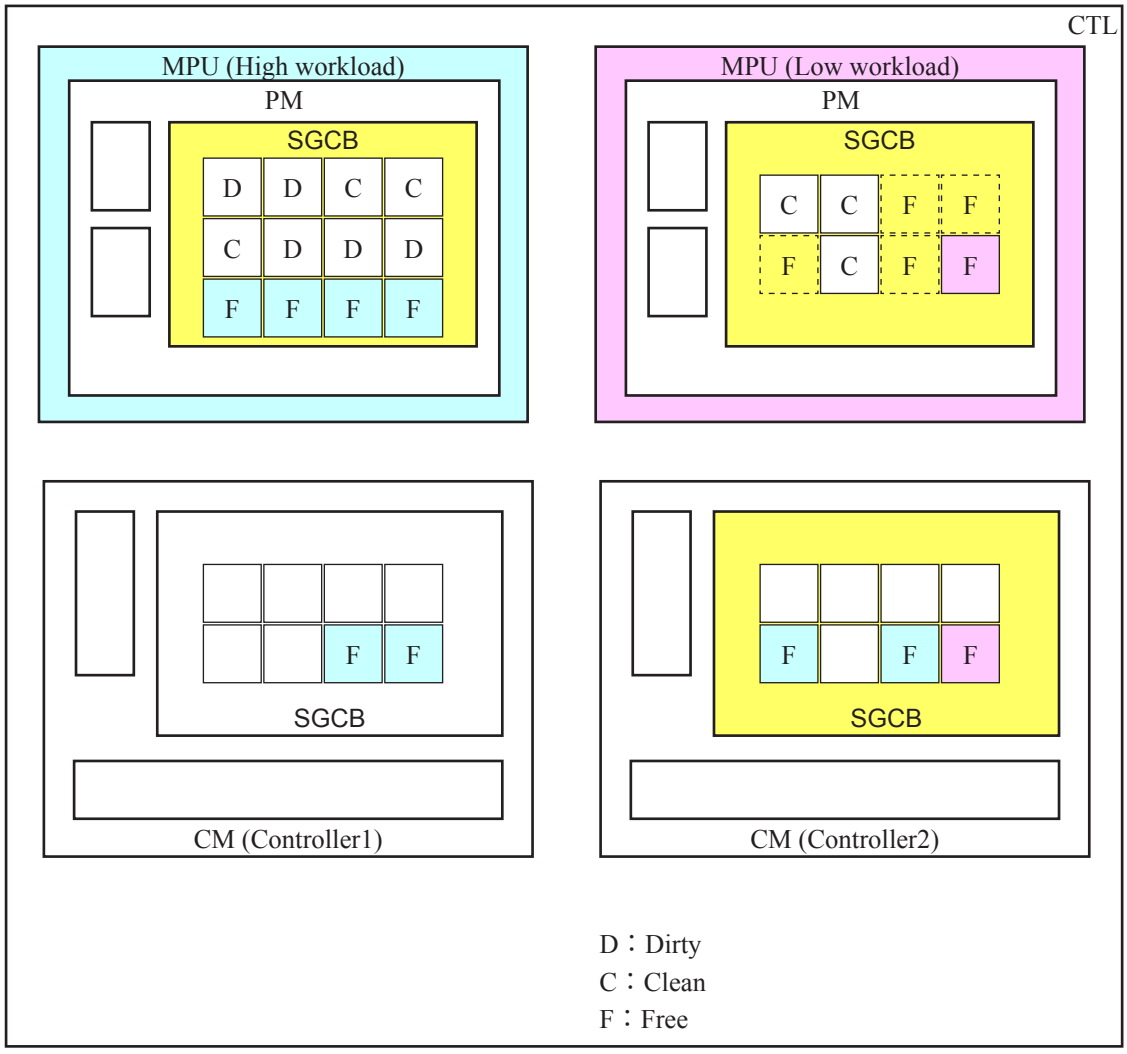
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Figure 2-39 Cache Load balance (2)



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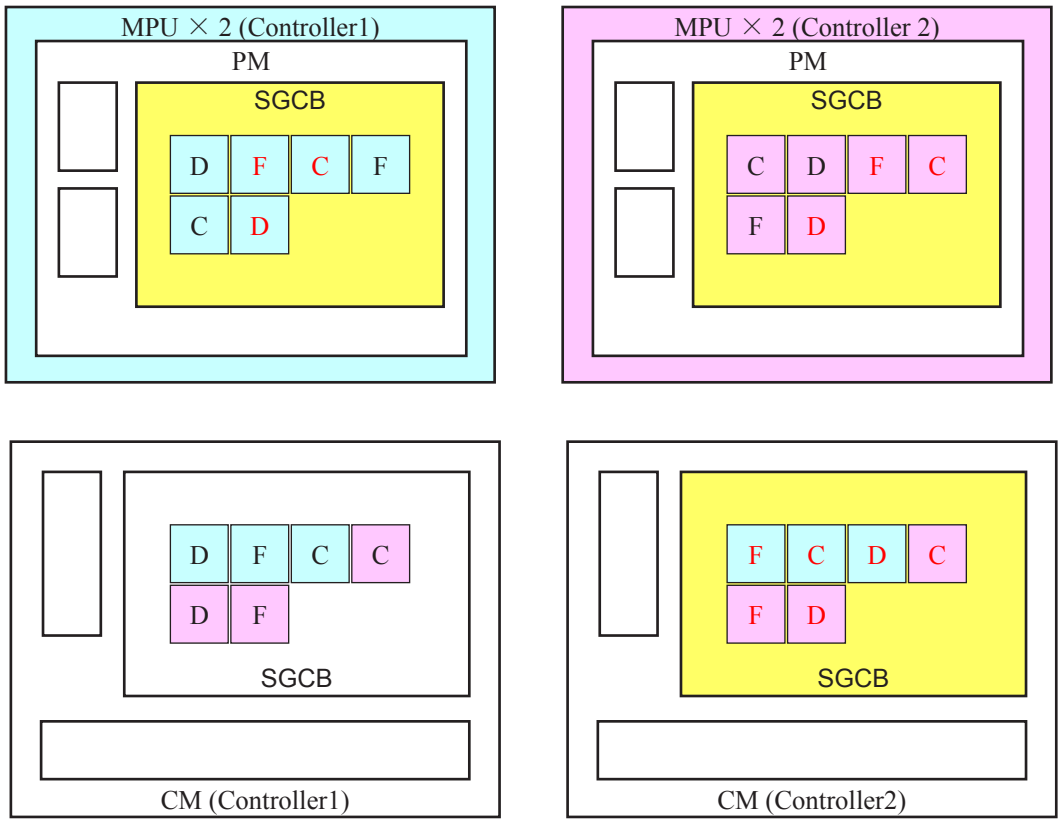
Figure 2-40 Cache Load balance (3)



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2.5.3.6 Controller Replacement

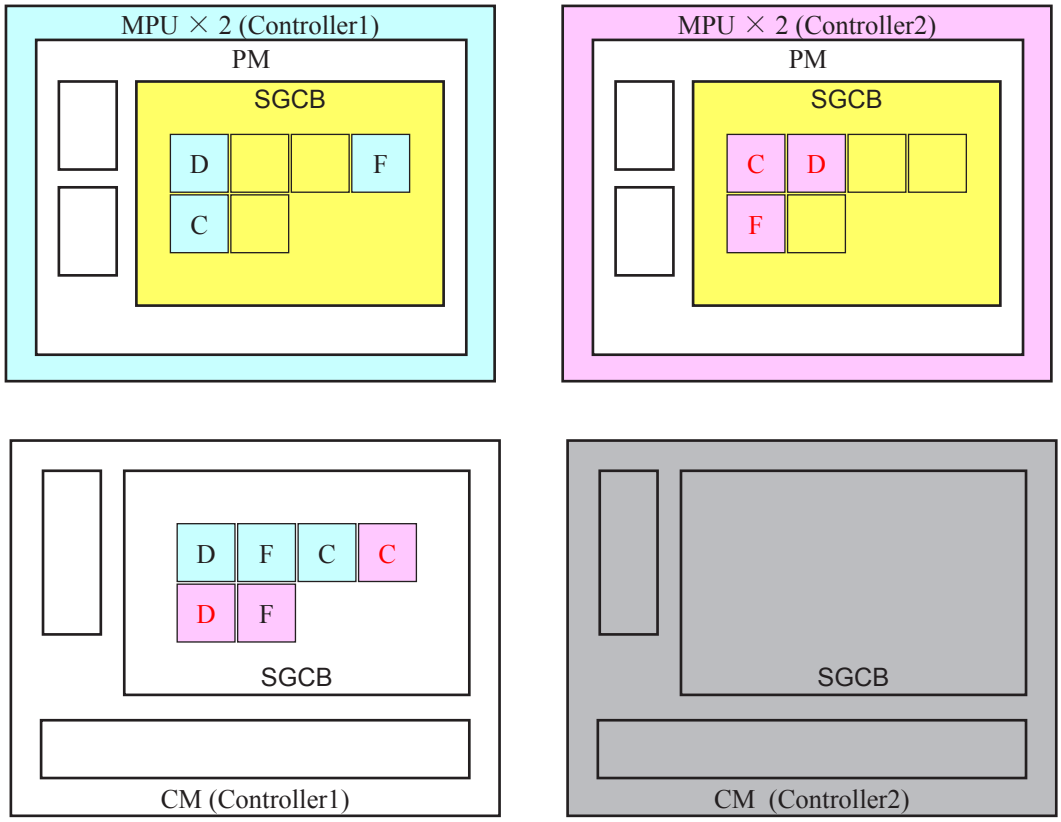
Figure 2-41 Controller Replacement (1)



D：Dirty
C：Clean
F：Free

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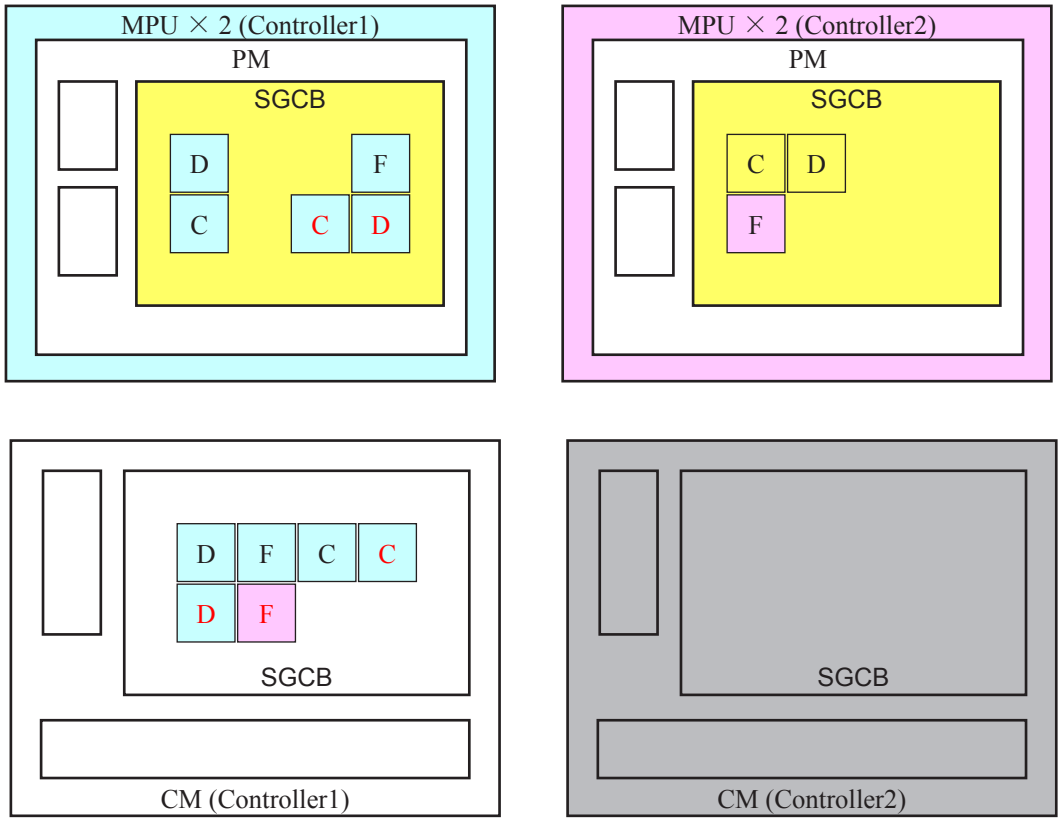
Figure 2-42 Controller Replacement (2)



D：Dirty
C：Clean
F：Free

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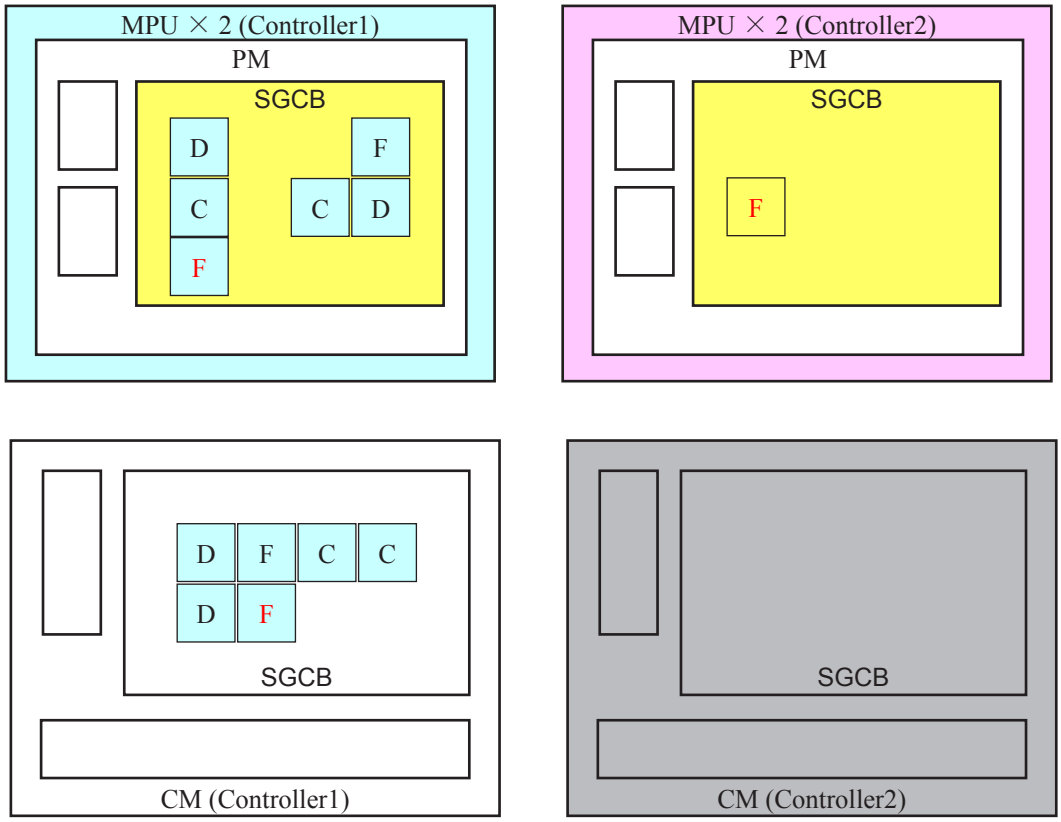
Figure 2-43 Controller Replacement (3)



D：Dirty
C：Clean
F：Free

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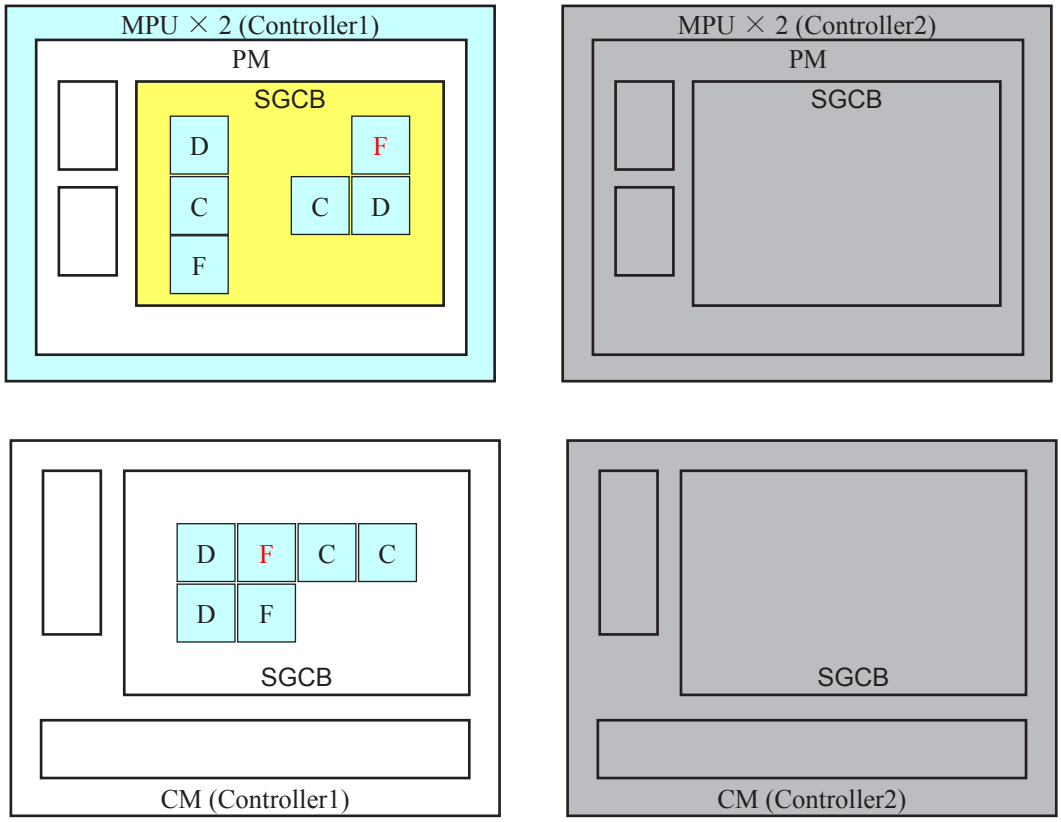
Figure 2-44 Controller Replacement (4)



D：Dirty
C：Clean
F：Free

Copyright © 2015, 2017, Hitachi, Ltd.

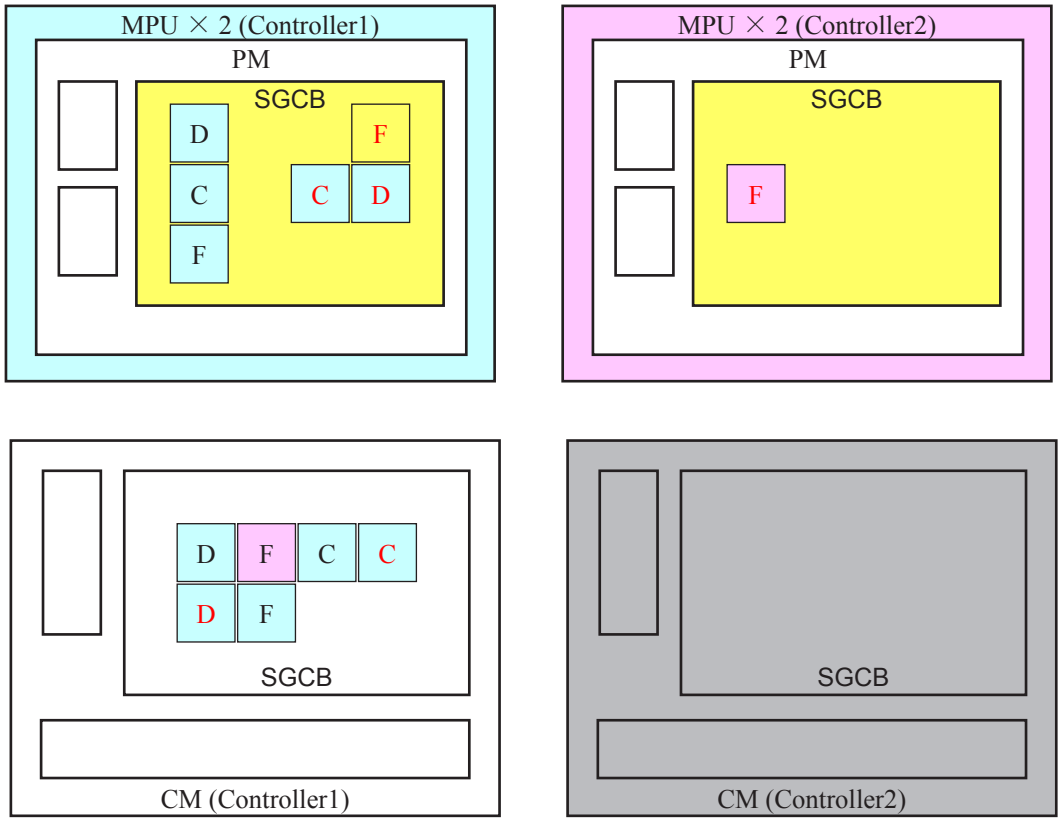
Figure 2-45 Controller Replacement (5)



D：Dirty
C：Clean
F：Free

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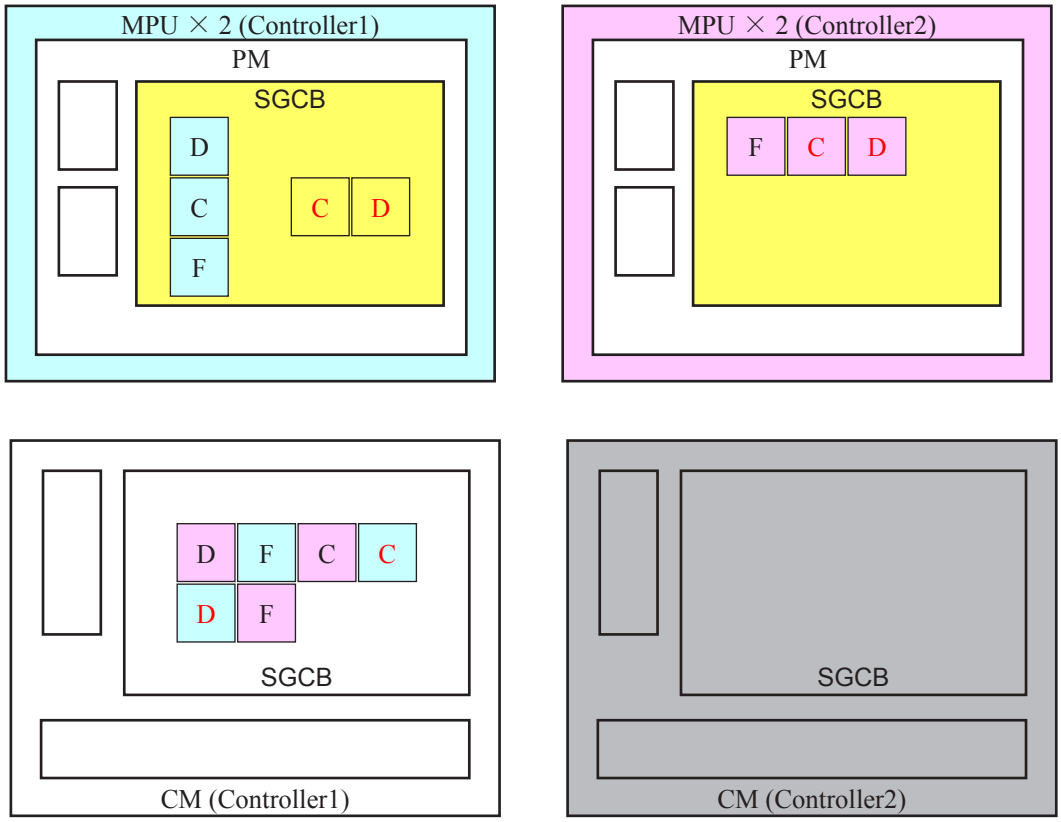
Figure 2-46 Controller Replacement (6)



D：Dirty
C：Clean
F：Free

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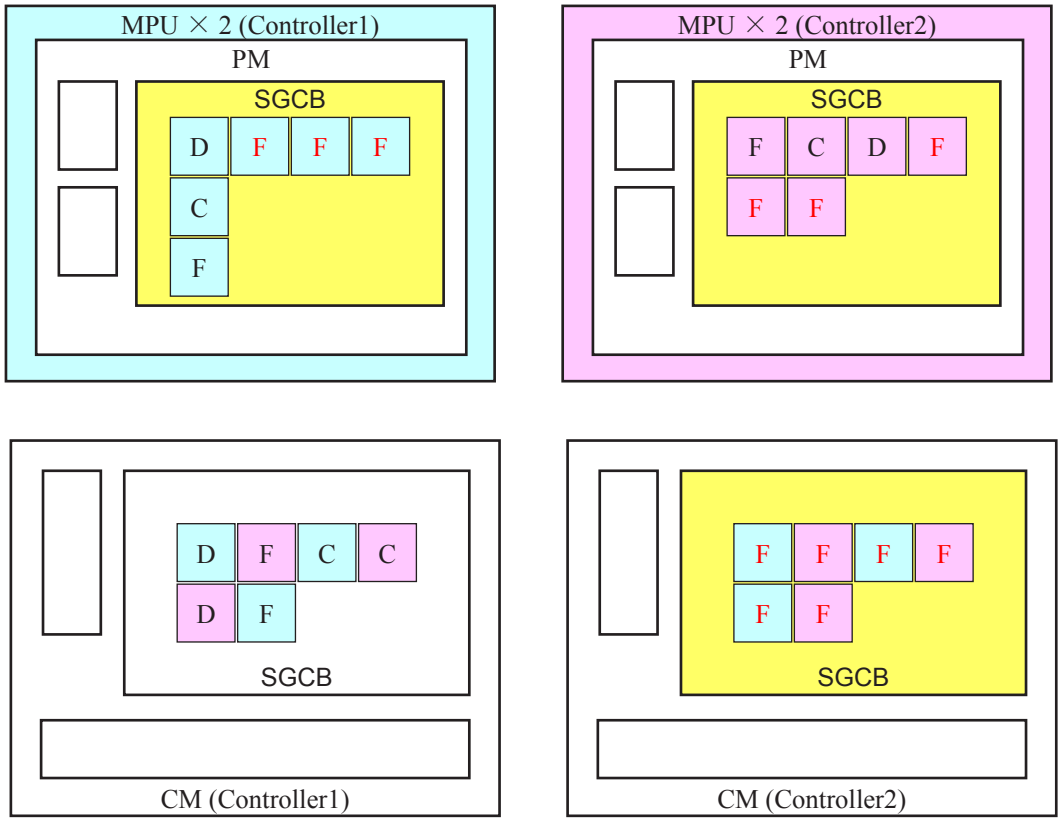
Figure 2-47 Controller Replacement (7)



D：Dirty
C：Clean
F：Free

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Figure 2-48 Controller Replacement (8)

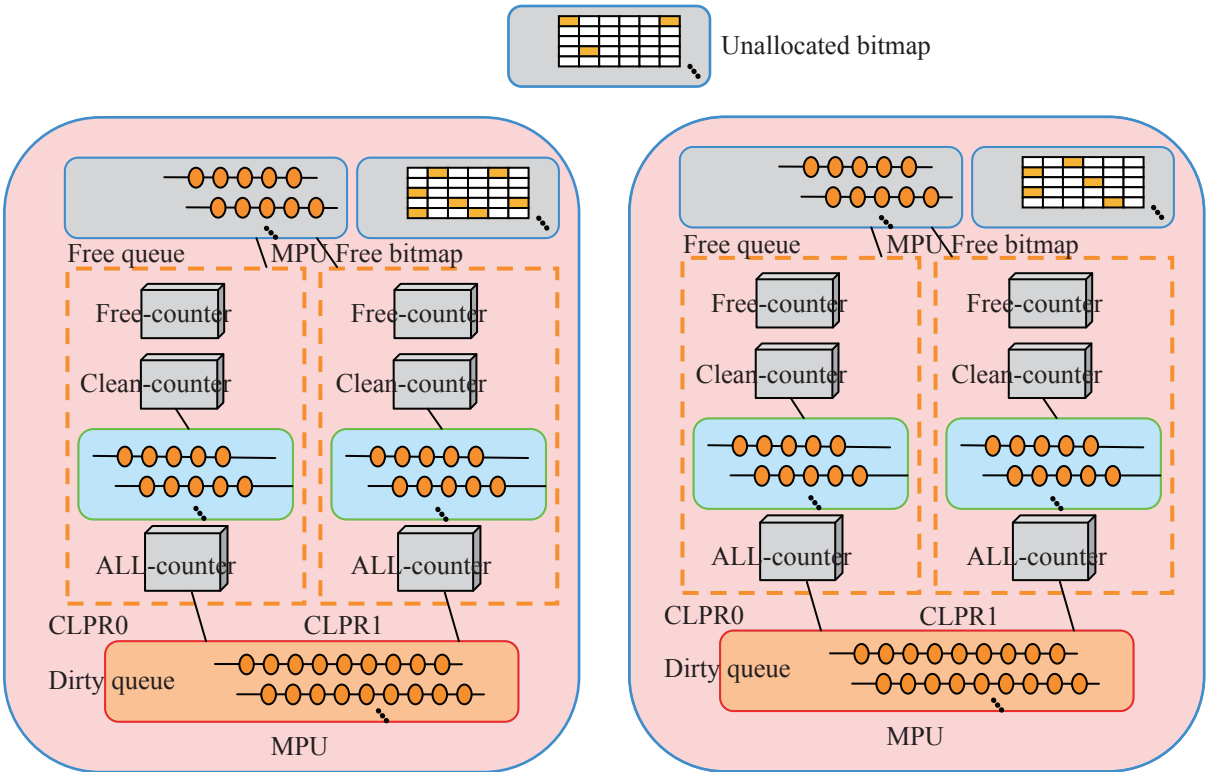


D：Dirty
C：Clean
F：Free

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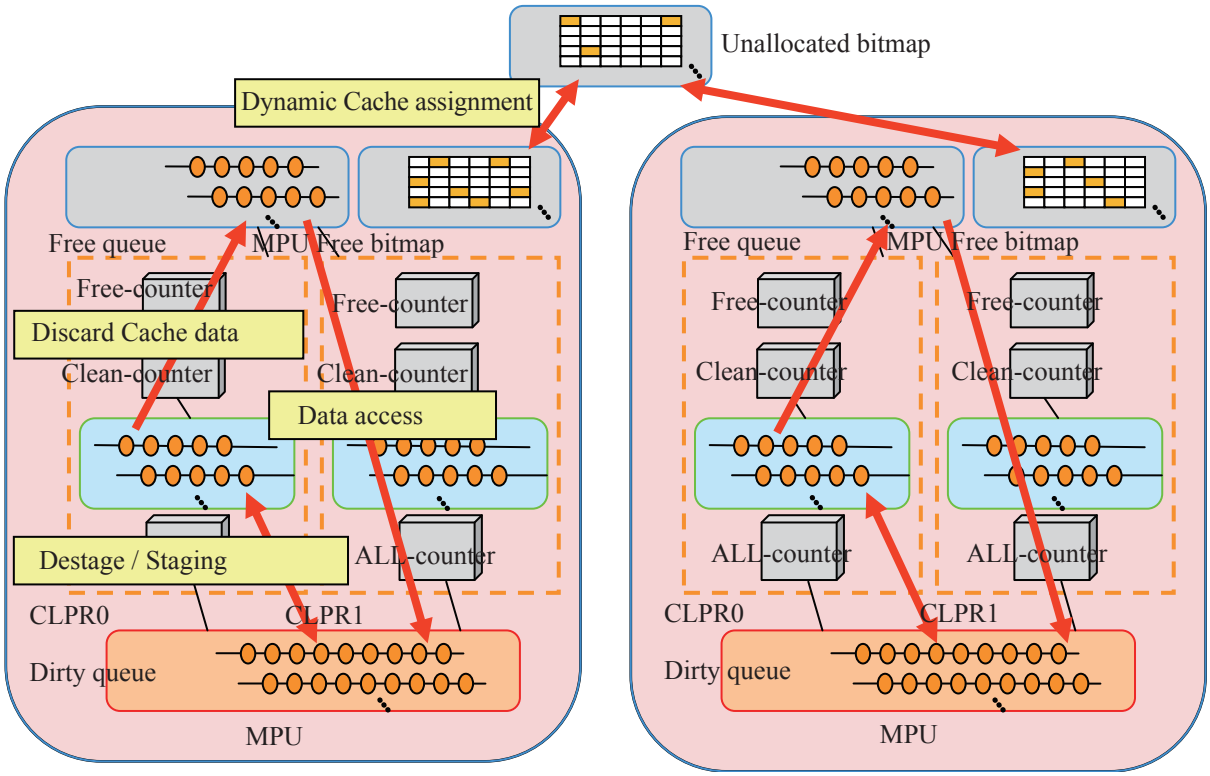
2.5.3.7 Queue/Counter Control

Figure 2-49 Queue/Counter Control (1)



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Figure 2-50 Queue/Counter Control (2)



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2.6 CVS Option Function

2.6.1 Customized Volume Size (CVS) Option

2.6.1.1 Overview

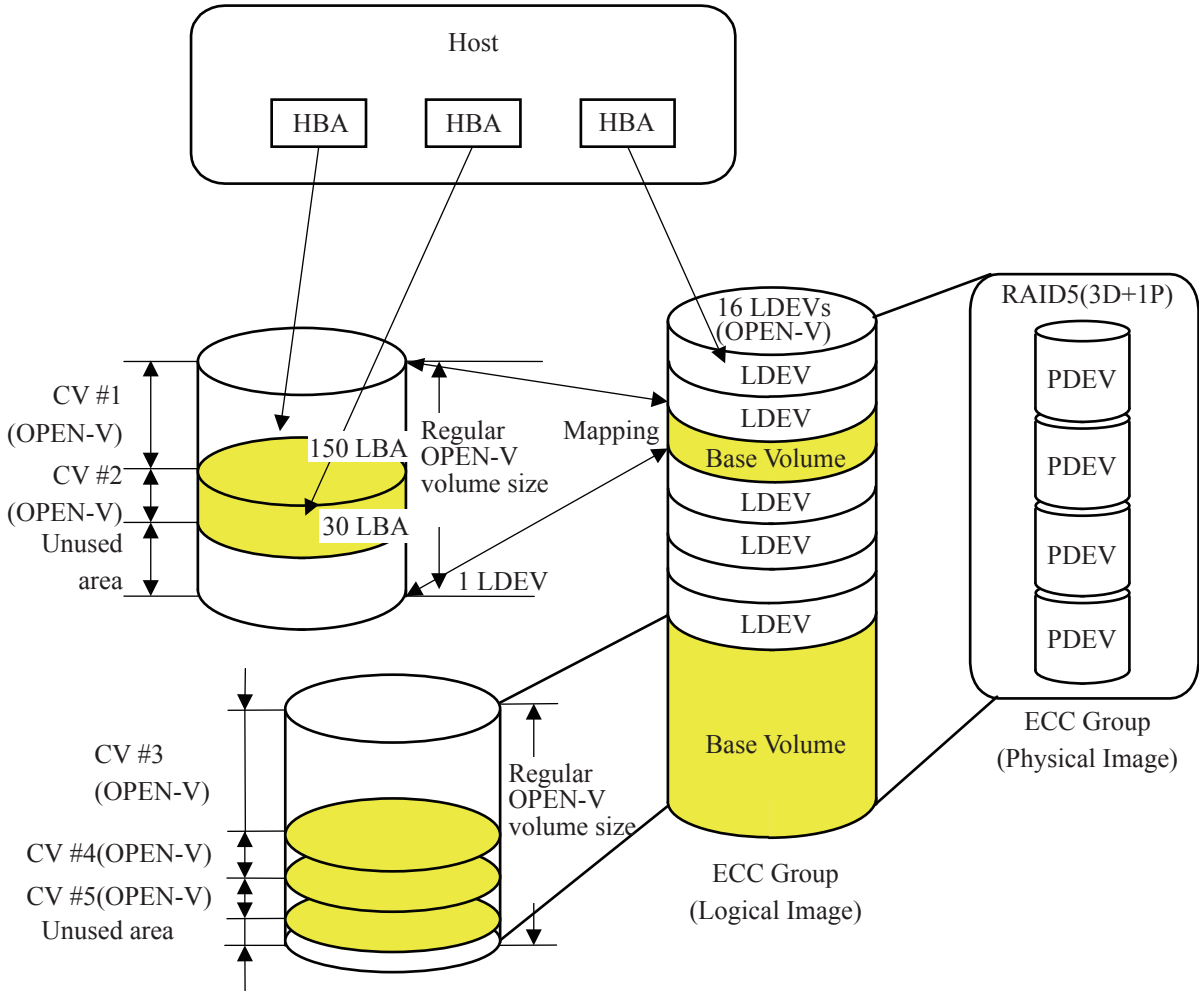
When two or more files to which I/Os are applied frequently exist in the same volume, a contention for the logical volume occurs. If this occurs, the files mentioned above are stored separately in different logical volumes and an action is taken to avoid contention for access. (Or means to prevent I/Os from generation is required.)
However, the work for adjusting the file arrangement giving consideration to the accessing characteristic of the file will be a burden on users of the DKC and it is not welcomed by them.
To solve this problem, the Customized Volume Size (CVS) option is provided. (Hereinafter, it is abbreviated to CVS.)
The CVS provides a function for freely defining the logical volume size.
By doing this, even in a Storage System with the same capacity, the number of volumes can be increased easily. As a result, a file with a high I/O frequency can be easily allocated to an independent volume. That is to say, the trouble to consider a combination of stored files in a volume can be saved.

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2.6.1.2 Features

- The capacity of the ECC group can be fully used.

Figure 2-51 Overview of CVS Option function



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2.6.1.3 Specifications

The CVS option consists of a function to provide variable capacity volumes.

1. Function to provide variable capacity volumes
   This function can create the capacity volume as required by the users.
   You can set the data by Mbytes or Logical Blocks.

Table 2-29 CVS Specifications

Parameter	Content
Track format	OPEN-V
Emulation type	OPEN-V
Maximum number of LDEVs (Base volume and CVS) per VDEV	2,048 for one parity group
Maximum number of LDEVs (Base volume and CVS) per Storage System	VSP G200 : 2,048 VSP G400, G600 : 4,096 VSP G800 : 16,384
Size increment for CV	1 MB
Disk location for CVS Volume	Anywhere

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2.6.1.4 Maintenance Functions

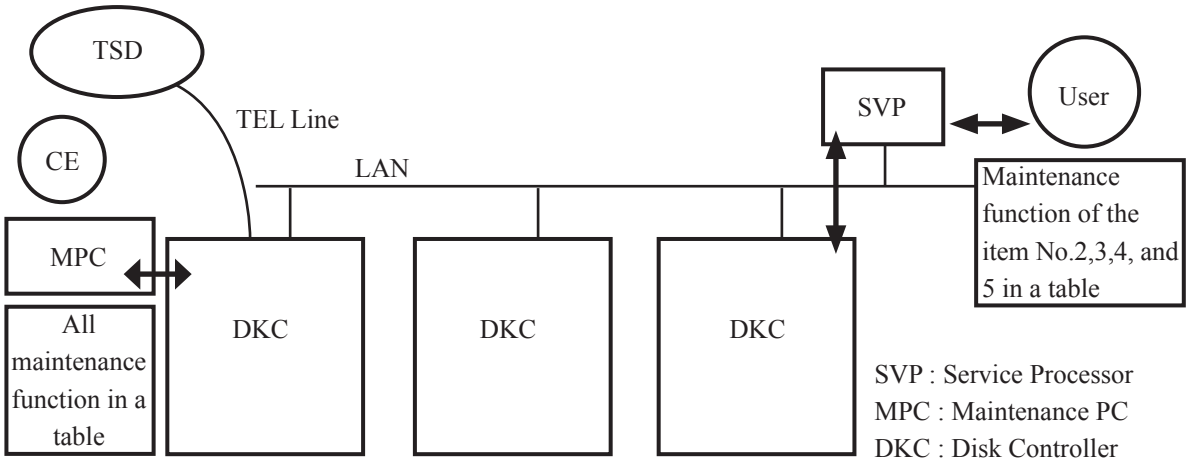
Features of the maintenance functions of the CVS option is that they allow execution of not only the conventional maintenance operations instructed by the Maintenance PC but also the maintenance operations instructed from the Management Appliance Server. (Refer to Item No. 2 to 5 in Table 2-30.)
Unlike the conventional LDEV addition or reduction, the operation for the ECC group is made unnecessary, so that the volumes can be operated from the Management Appliance Server.

Table 2-30 Maintenance Function List

Item No.	Maintenance function	CE	User	Remarks
1	Concurrent addition or deletion of CVs at the time of addition or removal of ECC group	✓	—	Same as the conventional addition or removal of LDEVs. (*2)
2	Addition of CVs only	✓	✓	Addition of CVs in the free area. (*1)
3	Conversion of normal volumes to CV	✓	✓	(*1), (*2)
4	Conversion of CV to normal volumes	✓	✓	(*1), (*2)
5	Deletion of CVs only	✓	✓	No removal of ECC group is involved. (*2)

*1: LDEV format operates as an extension of maintenance.
Since the deleted volume data is lost, the customer's approval is required for execution.
*2: The pending data on the Cache is also discarded with the data on the volume to be deleted.
Same as *1, the customer's approval is required for execution.

Figure 2-52 Maintenance Execution Route when CVS Is Used



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2.7 PDEV Erase

2.7.1 Overview

When the specified system option (*1) is set, the DKC deletes the data of PDEV automatically in the case according Table 2-31.

*1: Please contact to T.S.D.

Table 2-31 Overview

No.	Item	Content
1	Maintenance PC Operation	Select system option from “Install”.
2	Status	DKC only reports on SIM of starting the function. The progress status is not displayed.
3	Result	DKC reports on SIM of normality or abnormal complete.
4	Recovery procedure at failure	Re-Erase of PDEV that terminates abnormally is impossible. Please exchange it for new service parts.
5	P/S off or B/K off	The Erase processing fails. It doesn’t restart after P/S on.
6	How to stop the “PDEV Erase”	Please execute Replace from the Maintenance screen of the Maintenance PC operation, and exchange PDEV that Erase wants to stop for new service parts.
7	Data Erase Pattern	Data Erase Pattern is zero data.

Table 2-32 PDEV Erase execution case

No.	Execution case
1	PDEV is blocked according to Drive Copy completion.

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2.7.2 Rough Estimate of Erase Time

The Erase time is decided by capacity and the rotational speed of PDEV.
Time is indicated as follows. (Time is a standard and it might take the TOV)

Table 2-33 PDEV Erase completion expectation time (1/2)

No.	Type of PDEV	200 GB	300 GB	400 GB	480 GB	600 GB	960 GB	1.2 TB	1.6 TB
1	SAS (7.2krpm)	—	—	—	—	—	—	—	—
2	SAS (10krpm)	—	—	—	—	80 M	—	140 M	—
3	SAS (15krpm)	—	30 M	—	—	50 M	—	—	—
4	Flash Drive	20 M	—	45 M	10 M	—	20 M	—	—
5	Flash Module Drive (NFxxx-PxxxSS)	—	—	—	—	—	—	—	15 M
6	Flash Module Drive (NFxxx-QxxxSS)	—	—	—	—	—	—	—	1 M

Table 2-34 PDEV Erase completion expectation time (2/2)

No.	Type of PDEV	1.8 TB	1.9 TB	3 TB	3.2 TB	3.8 TB	4 TB	6 TB	6.4 TB	10 TB	14 TB
1	SAS (7.2krpm)	—	—	450 M	—	—	480 M	600 M	—	1000 M	—
2	SAS (10krpm)	180 M	—	—	—	—	—	—	—	—	—
3	SAS (15krpm)	—	—	—	—	—	—	—	—	—	—
4	Flash Drive	—	40 M	—	—	80 M	—	—	—	—	—
5	Flash Module Drive (NFxxx-PxxxSS)	—	—	—	30 M	—	—	—	—	—	—
6	Flash Module Drive (NFxxx-QxxxSS)	—	—	—	1 M	—	—	—	1 M	—	1 M

Table 2-35 PDEV Erase TOV (1/2)

No.	Type of PDEV	200 GB	300 GB	400 GB	480 GB	600 GB	960 GB	1.2 TB	1.6 TB
1	SAS (7.2krpm)	—	—	—	—	—	—	—	—
2	SAS (10krpm)	—	—	—	—	200 M	—	320 M	—
3	SAS (15krpm)	—	100 M	—	—	130 M	—	—	—
4	Flash Drive	70 M	—	120 M	60 M	—	75 M	—	—
5	Flash Module Drive (NFxxx-PxxxSS)	—	—	—	—	—	—	—	60 M
6	Flash Module Drive (NFxxx-QxxxSS)	—	—	—	—	—	—	—	9 M

Table 2-36 PDEV Erase TOV (2/2)

No.	Type of PDEV	1.8 TB	1.9 TB	3 TB	3.2 TB	3.8 TB	4 TB	6 TB	6.4 TB	10 TB	14 TB
1	SAS (7.2krpm)	—	—	1000 M	—	—	1230 M	1620 M	—	1830 M	—
2	SAS (10krpm)	3600 M	—	—	—	—	—	—	—	—	—
3	SAS (15krpm)	—	—	—	—	—	—	—	—	—	—
4	Flash Drive	—	110 M	—	—	165 M	—	—	—	—	—
5	Flash Module Drive (NFxxx-PxxxSS)	—	—	—	80 M	—	—	—	—	—	—
6	Flash Module Drive (NFxxx-QxxxSS)	—	—	—	9 M	—	—	—	9 M	—	9 M

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2.7.3 Influence in Combination with Other Maintenance Operation

The influence on the maintenance operation during executing PDEV Erase becomes as follows.

Table 2-37 PDEV Replace

No.	Object part	Influence	Countermeasure
1	Replace from Maintenance PC as for PDEV that does PDEV Erase.	PDEV Erase terminates abnormally.	—
2	Replace from Maintenance PC as for PDEV that does not PDEV Erase.	Nothing	—
3	User Replace	Please do not execute the user replacement during PDEV Erase.	Please execute it after completing PDEV Erase.

Table 2-38 DKB Replace

No.	Object part	Influence	Countermeasure
1	DKB connected with PDEV that is executed PDEV Erase	[SVP4198W] may be displayed. The DKB replacement might fail by [ONL2412E] when the password is entered. (*2)	<SIM4c2xxx/4c3xxx about this PDEV is not reported> Please replace PDEV (to which Erase is done) to new service parts. (*1) The DKB replacement might fail by [ONL2412E] when the password is entered. (*2)
2	DKB other than the above	Nothing	Nothing

Table 2-39 I/F Board Replace/I/F Board Removal

No.	Object part	Influence	Countermeasure
1	I/F Board that is executed PDEV Erase	[SVP4198W] may be displayed. The I/F Board replacement might fail by [ONL2412E] when the password is entered. (*2)	<SIM4c2xxx/4c3xxx about this PDEV is not reported> Please replace PDEV (to which Erase is done) to new service parts. (*1) The I/F Board replacement might fail by [ONL2412E] when the password is entered. (*2)
2	I/F Board other than the above	Nothing	Nothing

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Table 2-40 ENC Replace

No.	Object part	Influence	Countermeasure
1	ENC connected with DKB connected with HDD that does PDEV Erase	[SVP4198W] may be displayed. The ENC replacement might fail by [ONL2788E] [ONL3395E] when the password is entered. (*2)	<SIM4c2xxx/4c3xxx about this PDEV is not reported> Please replace PDEV (to which Erase is done) to new service parts. (*1) The ENC replacement might fail by [ONL2788E][ONL3395E] when the password is entered. (*2)
2	ENC other than the above	Nothing	Nothing

Table 2-41 PDEV Addition/Removal

No.	Object part	Influence	Countermeasure
1	ANY	Addition/Removal might fail by [SVP739W].	Please wait for the Erase completion or replace PDEV (to which Erase is done) to new service parts. (*1)

Table 2-42 Exchanging microcode

No.	Object part	Influence	Countermeasure
1	DKC MAIN	[SVP0732W] may be displayed. Microcode exchanging might fail by [SMT2433E], when the password is entered. (*2)	Please wait for the Erase completion or replace PDEV (to which Erase is done) to new service parts. (*1)
2	HDD	[SVP0732W] may be displayed. Microcode exchanging might fail by [SMT2433E], when the password is entered. (*2)	Please wait for the Erase completion or replace PDEV (to which Erase is done) to new service parts. (*1)

Table 2-43 LDEV Format

No.	Object part	Influence	Countermeasure
1	ANY	There is a possibility that PATH-Inline fails. There is a possibility that the cable connection cannot be checked when the password is entered.	Please wait for the Erase completion or replace PDEV (to which Erase is done) to new service parts. (*1)

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Table 2-44 PATH-Inline

No.	Object part	Influence	Countermeasure
1	DKB connected with PDEV that is executed PDEV Erase	There is a possibility of detecting the trouble by PATH-Inline.	Please wait for the Erase completion or replace PDEV (to which Erase is done) to new service parts. (*1)

Table 2-45 PS/OFF

No.	Object part	Influence	Countermeasure
1	ANY	PDEV Erase terminates abnormally.	<SIM4c2xxx/4c3xxx about this PDEV is not reported> Please wait for the Erase completion or replace PDEV (to which Erase is done) to new service parts. (*1)

*1: When PDEV that stops PDEV Erase is installed into DKC again, it might fail by Spin-up failure.

*2: It is not likely to be able to maintain it when failing because of concerned MSG until PDEV Erase is completed or terminates abnormally.

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2.7.4 Notes of Various Failures

Notes of the failure during PDEV Erase become as follows.

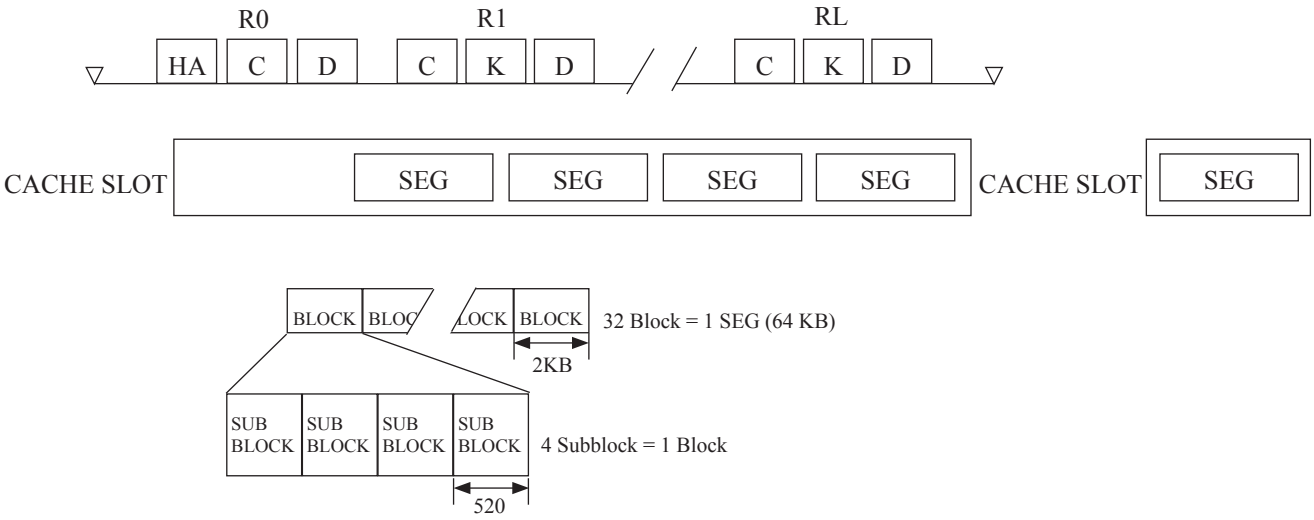
No.	Failure	Object part	Notice	Countermeasure
1	B/K OFF/ Black Out	Drive BOX (DB)	There is a possibility that PDEV Erase fails due to the failure.	Please replace PDEV of the Erase object to new service parts after P/S on.
2		DKC	Because monitor JOB of Erase disappears, it is not possible to report on normality/abnormal termination SIM of Erase.	Please replace PDEV of the Erase object to new service parts after P/S on.
3	MP failure	I/F Board	[E/C 9470 is reported at the MP failure] JOB of the Erase monitor is reported on E/C 9470 when Abort is done due to the MP failure and completes processing. In this case, it is not possible to report on normality/abnormal termination SIM of Erase.	Please replace PDEV of the Erase object to new service parts after the recovery of MP failure.
4			[E/C 9470 is not reported at the MP failure] It becomes impossible to communicate with the Controller who is doing Erase due to the MP failure. In this case, it becomes TOV of monitor JOB with E/C 9450, and reports abnormal SIM.	Please replace PDEV to new service parts after judging the Erase success or failure after it waits while TOV of PDEV Erase after the recovery of MP.

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2.8 Cache Management

Since the DKC requires no through operation, its Cache system is implemented by two memory areas called Cache A and Cache B so that write data can be duplexed.
To prevent data loss due to power failures, Cache is made non-volatile by storing SSD on Cache PCB. This dispenses with the need for the conventional NVS.
The minimum unit of Cache is the segment. Cache is destaged in segment units.
Emulation Disk type at one or four segments make up one slot.
The read and write slots are always controlled in pair.
Cache data is enqueued and dequeued usually in slot units.
In real practice, the segments of the same slot are not always stored in a contiguous area in Cache, but are stored in discreet areas. These segments are controlled suin-g CACHE-SLCB and CACHE-SGCB so that the segments belonging to the same slot are seemingly stored in a contiguous area in Cache.

Figure 2-53 Cache Data Structure



For increased directory search efficiency, a single virtual device (VDEV) is divided into 16-slot groups which are controlled using VDEV-GRPP and CACHE-GRPT.

1 Cache segment = 32 blocks = 128 subblocks = 64 KB

1 slot = 1 stripe = 4 segments = 256 KB

The directories VDEV-GRPP, CACHE-GRPT, CACHE-SLCB, and CACHE-SGCB are used to identify the Cache hit and miss conditions. These control tables are stored in the shared memory.

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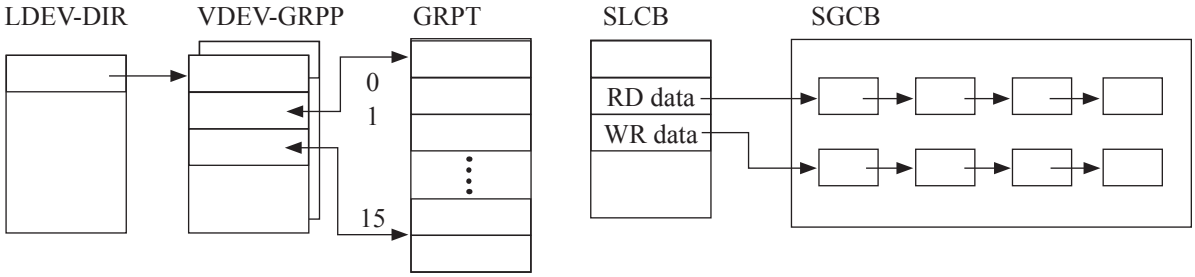
In addition to the Cache hit and miss control, the shared memory is used to classify and control the data in Cache according to its attributes. Queues are something like boxes that are used to classify data according to its attributes.

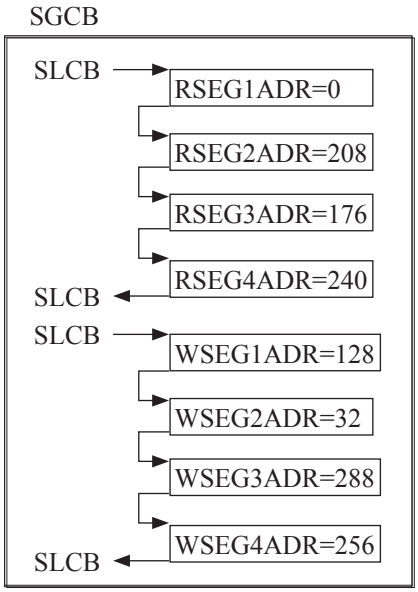
Basically, queues are controlled in slot units (some queues are controlled in segment units). Like SLCB-SGCB, queues are controlled using a queue control table so that queue data of the seemingly same attribute can be controlled as a single data group. These control tables are briefly described below.

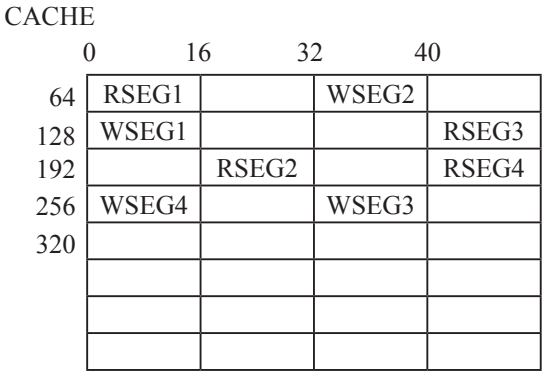
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1. Cache control tables (directories)

Figure 2-54







\

LDEV-DIR (Logical DEV-directory):

Contains the shared memory addresses of VDEV-GRPPs for an LDEV. LDEV-DIR is located in the local memory in the CHB.

VDEV-GRPP (Virtual DEV-group Pointer):

Contains the shared memory addresses of the GRPTs associated with the group numbers in the VDEV.

GRPT (Group Table):

A table that contains the shared memory address of the SLCBs for 16 slots in the group. Slots are grouped to facilitate slot search and to reduce the space for the directory area.

SLCB (Slot Control Block):

Contains the shared memory addresses of the starting and completing SGCBs in the slot. One or more SGCBs are chained. The SLCB also stores slot status and points to the queue that is connected to the slot. The status transitions of clean and dirty queues occur in slot units. The processing tasks reserve and release Cache areas in this unit.

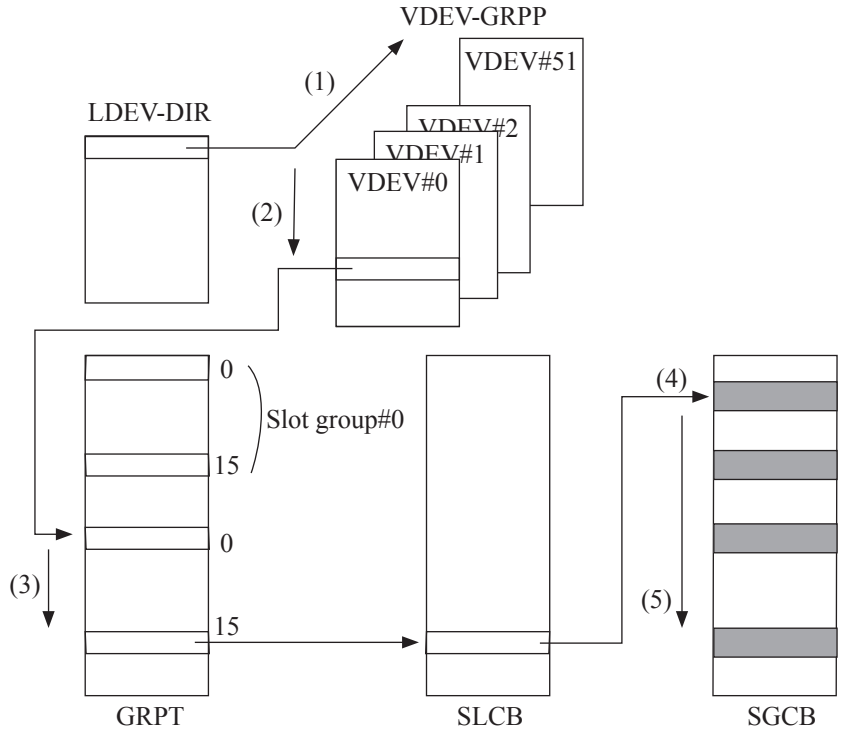
SGCB (Segment Control Block):

Contains the control information about a Cache segment. It contains the Cache address of the segment. It is used to control the staged subblock bit map, dirty subblock bitmap and other information. The status transitions of only free queues occur in segment units.

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2. Cache control table access method (hit/miss identification procedure)

Figure 2-55 Overview of Cache Control Table Access



(1) The current VDEV-GRPP is referenced through the LDEV-DIR to determine the hit/miss condition of the VDEV-groups.
(2) If a VDEV-group hits, CACHE-GRPT is referenced to determine the hit/miss condition of the slots.
(3) If a slot hits, CACHE-SLCB is referenced to determine the hit/miss condition of the segments.
(4) If a segment hits, CACHE-SGCB is referenced to access the data in Cache.

If a search miss occurs during the searches from 1. through 4., the target data causes a Cache miss.

Definition of VDEV number
Since the host processor recognizes addresses only by LDEV, it is unaware of the device address of the parity device. Accordingly, the RAID system is provided with a VDEV address which identifies the parity device associated with an LDEV. Since VDEVs are used to control data devices and parity devices systematically, their address can be computed using the following formulas:
Data VDEV number = LDEV number
Parity VDEV number = 1024 + LDEV number

From the above formulas, the VDEV number ranges from 0 to 2047.

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3. Queue structures
   The DKC and DB uses 10 types of queues to control data in Cache segments according to its attributes. These queues are described below.

   - CACHE-GRPT free queue
     This queue is used to control segments that are currently not used by CACHE-GRPT (free segments) on an FIFO (First-In, First-Out) basis. When a new table is added to CACHE-GRPT, the segment that is located by the head pointer of the queue is used.
   - CACHE-SLCB free queue
     This queue is used to control segments that are currently not used by CACHE-SLCB (free segments) on an FIFO basis. When a new slot is added to CACHE-SLCB, the segment that is located by the head pointer of the queue is used.
   - CACHE-SGCB free queue
     This queue is used to control segments that are currently not used by CACHE-SGCB (free segments) on an FIFO basis. When a new segment is added to CACHE-SGCB, the segment that is located by the head pointer of the queue is used.
   - Clean queue
     This queue is used to control the segments that are reflected on the Drive on an LRU basis.
   - Bind queue
     This queue is defined when the bind mode is specified and used to control the segments of the bind attribute on an LRU basis.
   - Error queue
     This queue controls the segments that are no longer reflected on the Drive due to some error (pinned data) on an LRU basis.
   - Parity in-creation queue
     This queue controls the slots (segments) that are creating parity on an LRU basis.
   - DFW queue (host dirty queue)
     This queue controls the segments that are not reflected on the Drive in the DFW mode on an LRU basis.
   - CFW queue (host dirty queue)
     This queue controls the segments that are not reflected on the Drive in the CFW mode on an LRU basis.
   - PDEV queue (physical dirty queue)
     This queue controls the data (segments) that are not reflected on the Drive and that occur after a parity is generated. Data is destaged from this queue onto the physical DEV. There are 32 PDEV queues per physical DEV.

     The control table for these queues is located in the shared memory and points to the head and tail segments of the queues.

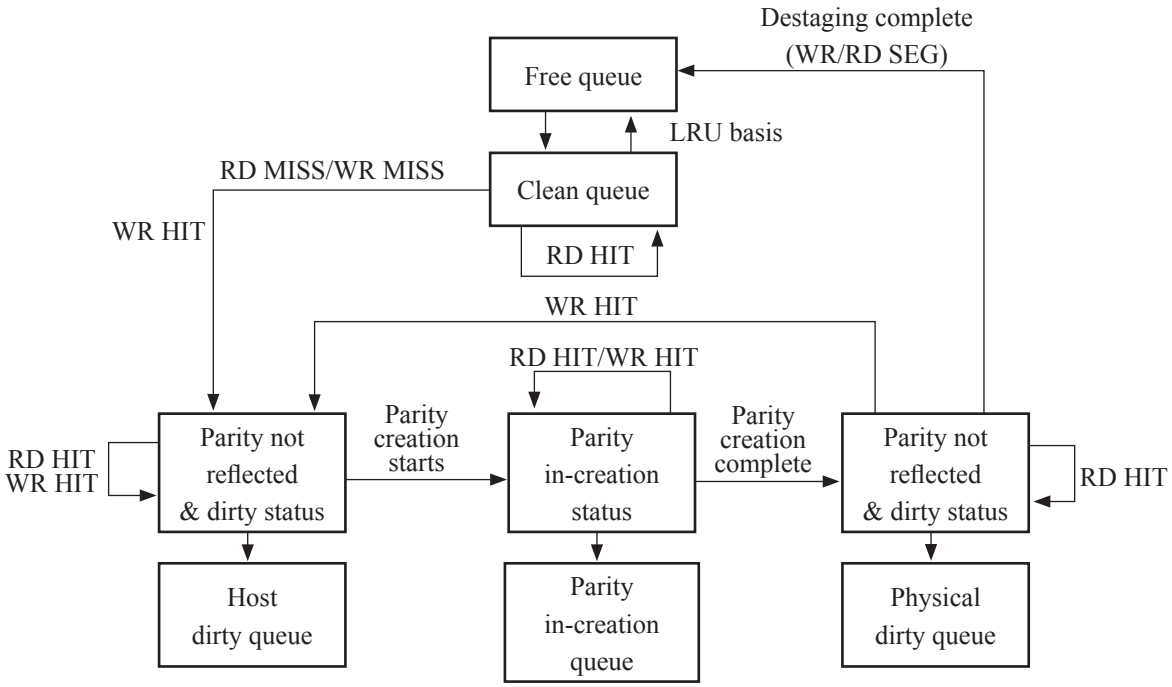
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4. Queue status transitions

Figure 2-56 shows the status transitions of the queues used in. A brief description of the queue status transitions follows.

- Status transition from a free queue
  When a read miss occurs, the pertinent segment is staged and enqueued to a clean queue. When a write miss occurs, the pertinent segment is temporarily staged and enqueued to a host dirty queue.
- Status transition from a clean queue
  When a write hit occurs, the segment is enqueued to a host dirty queue. Transition from clean to free queues is performed on an LRU basis.
- Status transition from a host dirty queue
  The host dirty queue contains data that reflects no parity. When parity generation is started, a status transition occurs to the parity in-creation queue.
- Status transition from the parity in-creation queue
  The parity in-creation queue contains parity in-creation data. When parity generation is completed, a transition to a physical dirty queue occurs.
- Status transition from a physical dirty queue
  When a write hit occurs in the data segment that is enqueued in a physical dirty queue, the segment is enqueued into the host dirty queue again. When destaging of the data segment is completed, the segment is enqueued into a queue (destaging of data segments occur asynchronously on an LRU basis).

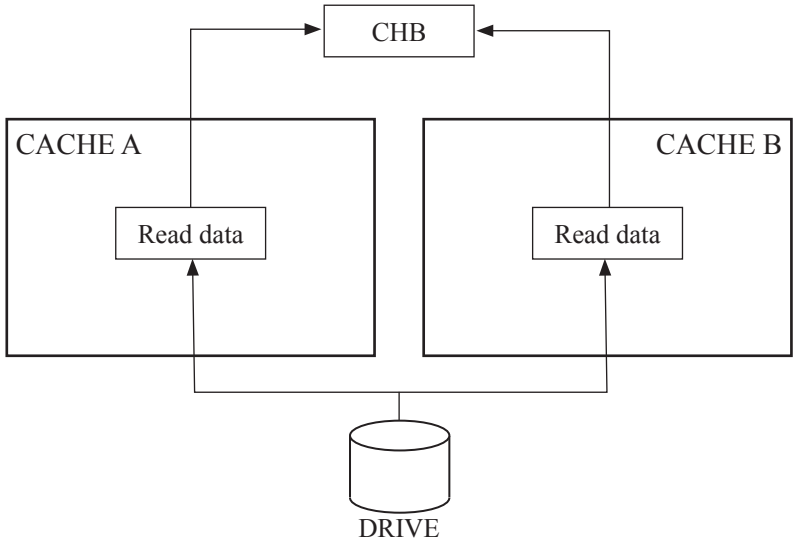
Figure 2-56 Queue Segment Status Transition Diagram



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5. Cache usage in the read mode

Figure 2-57 Cache Usage in the Read Mode



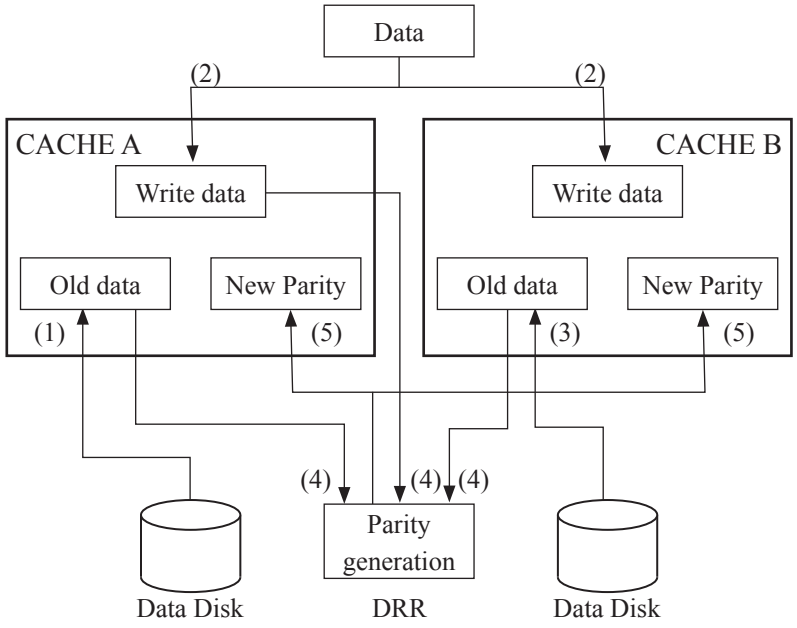
The Cache area to be used for destaging read data is determined depending on whether the result of evaluating the following expression is odd or even:
(CYL# x 15 + HD#) / 16
The read data is destaged into area A if the result is even and into area B if the result is odd.

Read data is not duplexed and its destaging Cache area is determined by the formula shown in Figure 2-57. Staging is performed not only on the segments containing the pertinent block but also on the subsequent segments up to the end of track (for increased hit ratio). Consequently, one track equivalence of data is prefetched starting at the target block. This formula is introduced so that the Cache activity ratios for areas A and B are even. The staged Cache area is called the Cache area and the other area NVS area.

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6. Cache usage in the write mode

Figure 2-58 Cache Usage in the Write Mode



This system handles write data (new data) and read data (old data) in separate segments as shown in Figure 2-58 (not overwritten as in the conventional systems), whereby compensating for the write penalty.

(1) If the write data in question causes a Cache miss, the data from the block containing the target record up to the end of the track is staged into a read data slot.
(2) In parallel with Step (1), the write data is transferred when the block in question is established in the read data slot.
(3) The parity data for the block in question is checked for a hit or miss condition and, if a Cache miss condition is detected, the old parity is staged into a read parity slot.
(4) When all data necessary for generating new parity is established, create the Parity in the DRR processing of the CPU.
(5) When the new parity is completed, the DRR transfers it into the write parity slots for Cache A and Cache B (the new parity is handled in the same manner as the write data).

The reason for write the write data into both Cache areas is that data will be lost if a Cache error occurs when it is not yet written on the Disk.

Although two Cache areas are used as described above, the read data (including parity) is staged into either Cache A or Cache B simply by duplexing only the write data (including parity) (in the same manner as in the read mode).

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7. CFW-inhibited write-operation (with Cache single-side error)
   The non RAID-type Disk systems write data directly onto Disk storage in the form of Cache through, without performing a DFW, when a Cache error occurs. In this system, Cache must always be passed, which fact disables the through operation. Consequently, the write data is duplexed, and a CFW-inhibited write-operation is performed; that is, when one Cache Storage System goes down, the end of processing status is not reported until the data write in the other Cache Storage System is completed. This process is called CFW-inhibited write-operation.

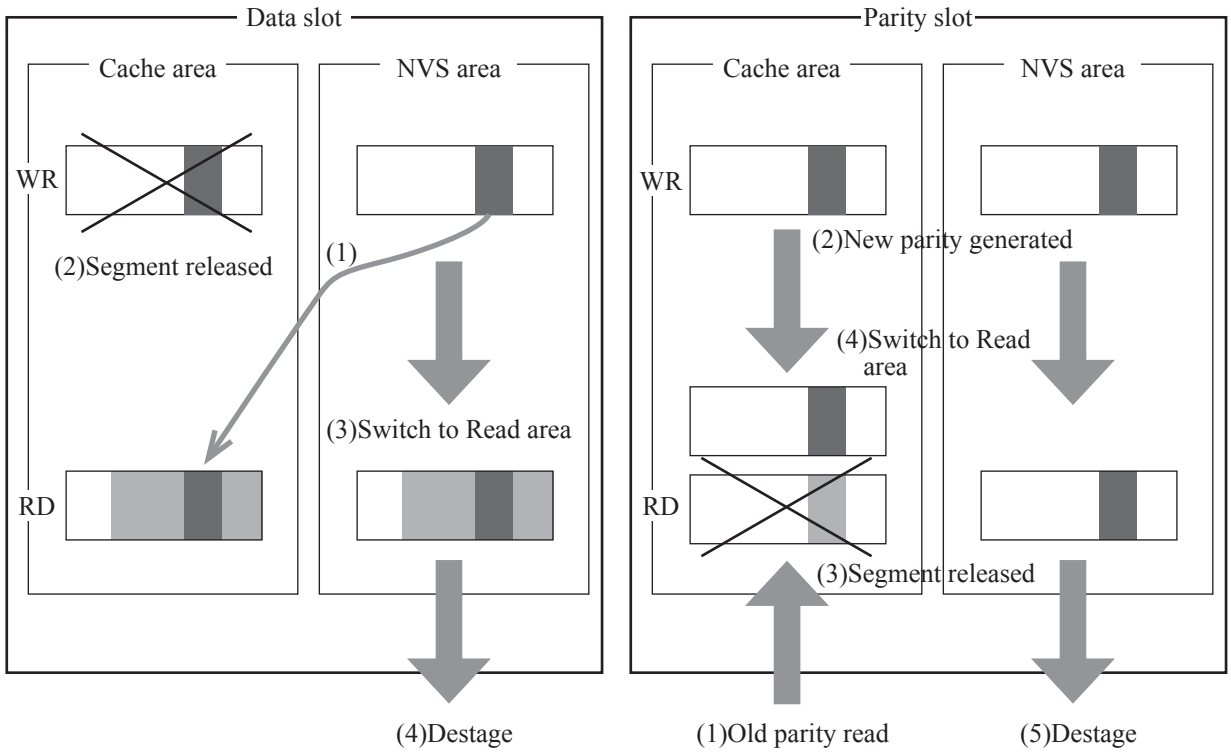
   The control information necessary for controlling Cache is stored in the shared memory.

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2.9 Destaging Operations

1. Cache management in the destage mode (RAID5)
   Destaging onto a Drive is deferred until parity generation is completed. Data and parity slot transitions in the destage mode occur as shown in Figure 2-59.

Figure 2-59 Cache Operation in the Destage Mode



(1) The write data is copied from the NVS area into the read area.
(2) The write segment in the Cache area is released.
(3) Simultaneously, the segment in the NVS area is switched from write to read segment.
(4) Destaging.
(5) The read segment in the NVS area is released.

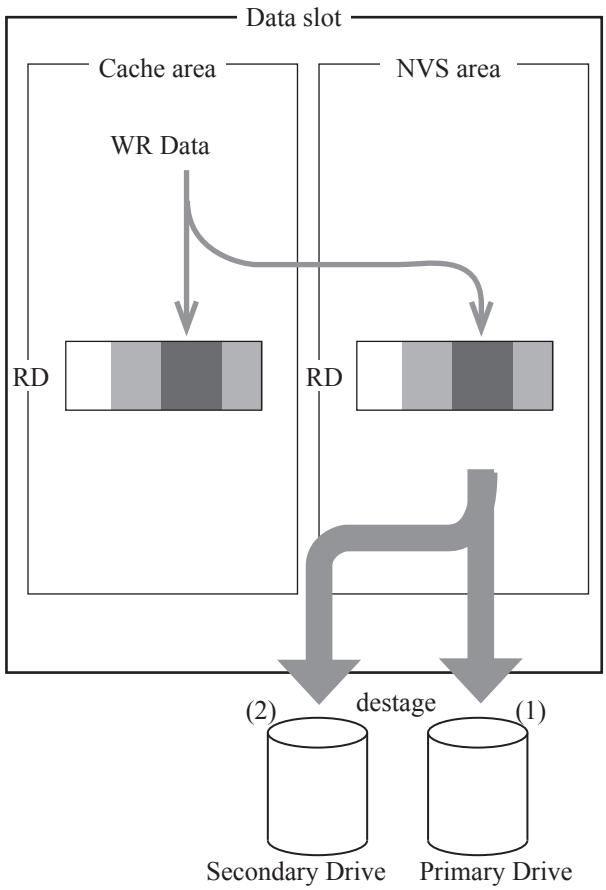
(1) Parity generation correction read (old parity) occurs.
(2) New parity is generated.
(3) The old parity in the read segment is released.
(4) The segments in the Cache and NVS areas are switched from write to read segment.
(5) Destaging.
(6) The read segment in the NVS area is released.

Write data is stored in write segments before parity is generated but stored in read segments after parity is generated. When Drive data is stored, therefore, the data from the read segment is transferred.

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2. Cache management in the destage mode (RAID1)
   Data slot is destaged to primary/secondary Drive.

Figure 2-60 RAID1 asynchronous destage



(1) Destage to primary Drive.
(2) Destage to secondary Drive.
(3) The data read segment in the NVS area is released.

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3. Blocked data write
   The purpose of blocked data write is to reduce the number of accesses to the Drive during destaging, whereby increasing the Storage System performance. There are three modes of blocked data write: single-stripe blocking, multiple-stripe blocking and Drive blocking. These modes are briefly described below.

   - Single-stripe blocking
     Two or more dirty segments in a stripe are combined into a single dirty data block. Contiguous dirty blocks are placed in a single area. If an unloaded block exists between dirty blocks, the system destages the dirty blocks separately at the unloaded block. If a clean block exists between dirty blocks, the system destages the blocks including the clean block.
   - Multiple-stripe blocking
     The sequence of stripes in a parity group are blocked to reduce the number of write penalties. This mode is useful for sequential data transfer.
   - Drive blocking
     In the Drive blocking mode, blocks to be destaged are written in a block with a single Drive command if they are contiguous when viewed from a physical Drive to shorten the Drive's latency time.

   The single- and multiple-stripe blocking modes are also called in-Cache blocking modes. The DMP determines which mode to use. The Drive blocking mode is identified by the DSP.

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2.10 Power-on Sequences

2.10.1 IMPL Sequence

The IMPL sequence, which is executed when power is turned on, is comprises of the following four modules:

1. BIOS
   The BIOS starts other MP cores after a ROM boot. Subsequently, the BIOS expands the OS loader from the flash memory into the local memory and OS loader is executed.

2. OS loader
   The OS loader performs the minimum necessary amount of initializations, tests the hardware resources, then loads the Real Time OS modules into the local memory and the Real Time OS is executed.

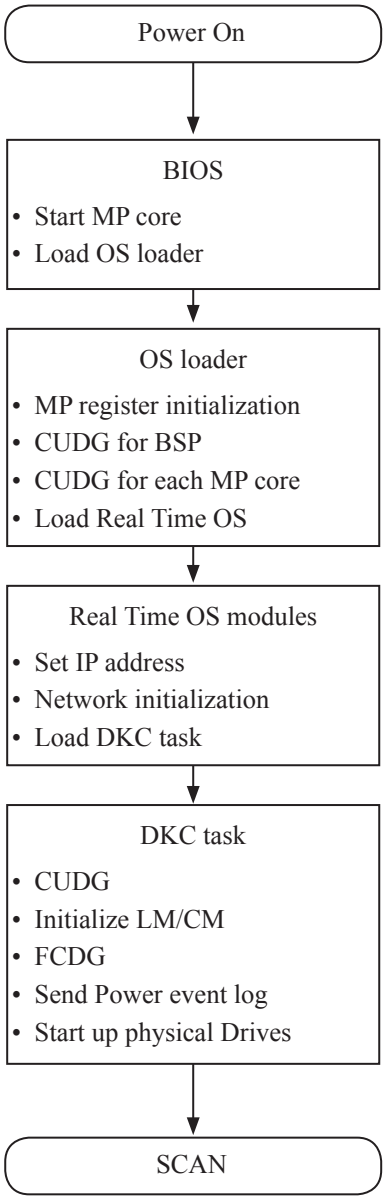
3. Real Time OS modules
   Real Time OS is a root task that initializes the tables in the local memory that are used for intertask communications. Real Time OS also initializes network environment and create the DKC task.

4. DKC task
   When the DKC task is created, it executes initialization routines. Initialization routines initialize the most part of the environment that the DKC task uses. When the environment is established so that the DKC task can start scanning, the DKC task notifies the Maintenance PC of a power event log. Subsequently, the DKC task turns on the power for the physical Drives and, when the logical Drives become ready, The DKC task notifies the host processor of an NRTR.

The control flow of IMPL processing is shown in Figure 2-61.

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Figure 2-61 IMPL Sequence

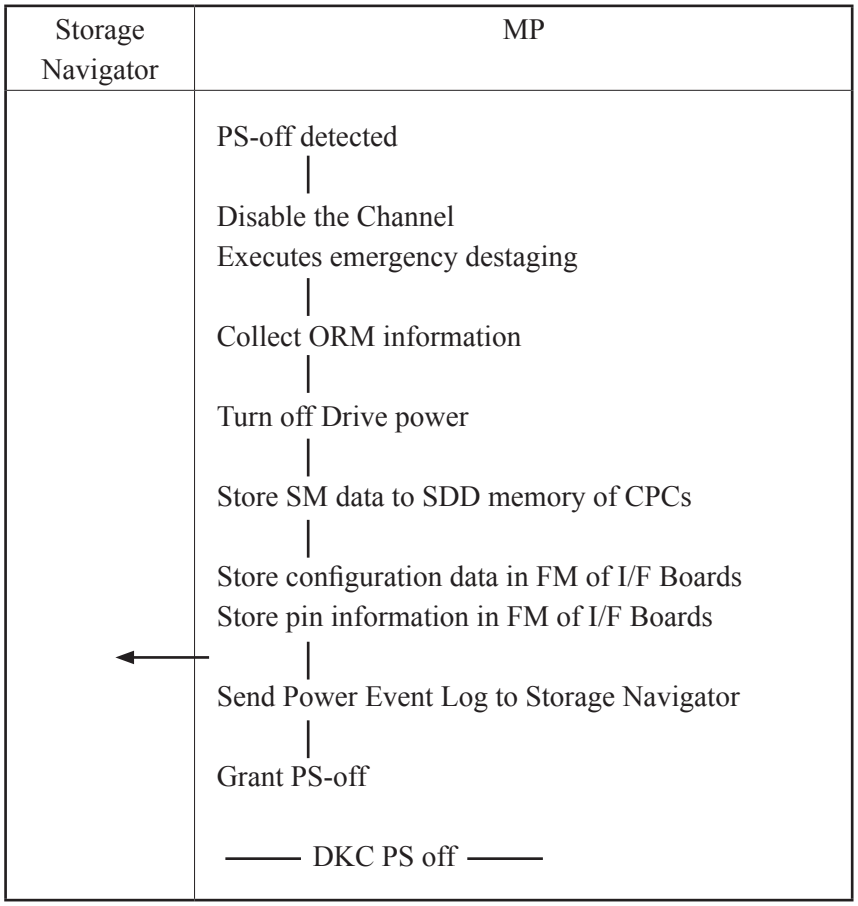


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2.10.2 Planned Power Off

When a power-off is specified by a maintenance personnel, this Storage System checks for termination of tasks that are blocked or running on all logical devices. When all the tasks are terminated, this Storage System disables the CHL and executes emergency destaging. If a track for which destaging fails (pinned track) occurs, this Storage System stores the pin information in shared memory.
Subsequently, this Storage System saves the configuration data and the pin information(which is used as hand-over information) in flash memory of I/F Boards, save all SM data (which is used as none-volatile power on) in SSD memory of CPCs. Then, sends Power Event Log to the Maintenance PC, notifies the hardware of the grant to turn off the power.

The hardware turns off main power when power-off grants for all processors are presented.



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2.11 Data Guarantee

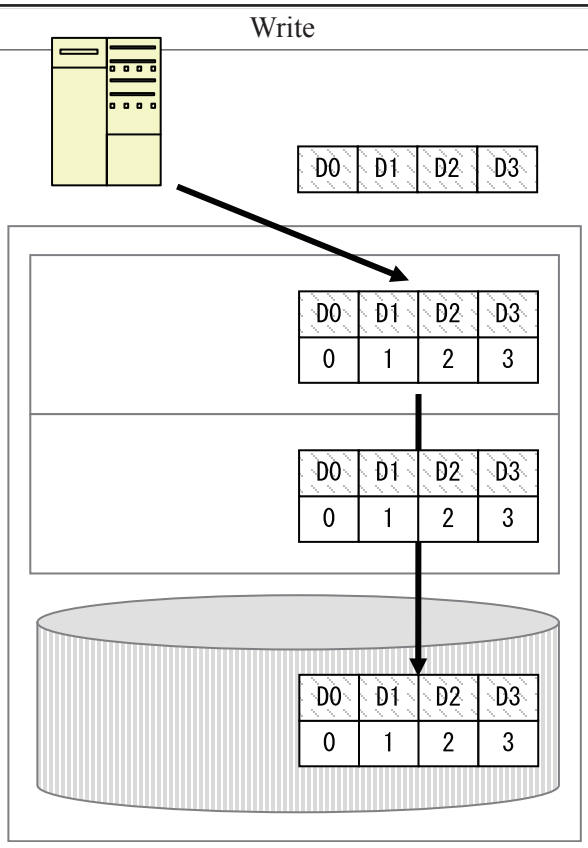
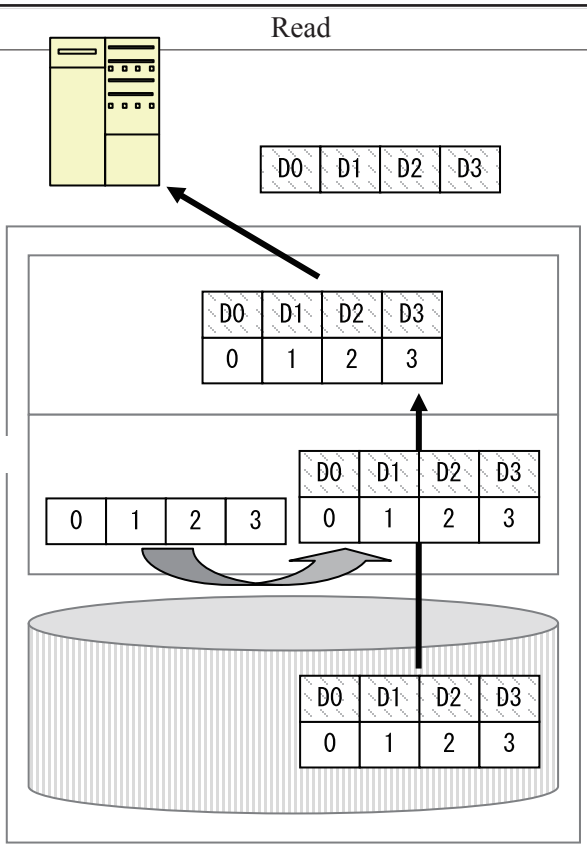
DW800 makes unique reliability improvements and performs unique preventive maintenance.

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2.11.1 Data Check Using LA (Logical Address) (LA Check) (Common to SAS Drives and SSD)

When data is transferred, the LA value of the target BLK (LA expectation value) and the LA value of the actual transferred data (Read LA value) are compared to guarantee data. This data guarantee is called “LA check”.
With the LA check, it is possible to check whether data is read from the correct BLK location.

Table 2-46 LA check method

Write	Read
	
1. Receive Write requirement from Host. 2. CHB stores data on Cache and adds the LA value and, at the same time, adds an LA value, which is a check code, to each BLK. (LA value is calculated based on the logical address of each BLK) 3. DKB stores data on HDD.	1. DKB calculates the LA expectation value based on the logical address of the BLK to read. 2. Perform read from HDD. 3. Check whether the LA expectation value and the LA value of the read data are consistent. (When the LBA to read is wrong, the LA values would be inconsistent, and the error can be detected. In such a case, a correction read is performed to restore data.) 4. CHB transfers data to Host by removing the LA field.

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2.12 Encryption License Key

2.12.1 Overview of Encryption

You are able to encrypt data stored in volumes in the Storage System by using Encryption License Key. By encrypting data, you can prevent data from being leaked when you replace the Storage System or hard Disks in the Storage System or when these are stolen.

2.12.2 Specifications of Encryption

Table 2-47 shows the specifications of encryption with Encryption License Key.

Table 2-47 Specifications of encryption with Encryption License Key

Item		Specifications
Hardware spec	Encryption algorithm	AES 256 bit
Volume to encrypt	Volume type	Open volumes
	Emulation type	OPEN-V
Encryption key management	Unit of creating encryption key	HDD
	Number of encryption keys	VSP G200 : 512 (*1) VSP G400, G600 : 1,024 VSP G800 : 2,048
	Unit of setting encryption	RAID group
Converting non-encrypted data/ encrypted data	Encryption of existing data	Convert non-encrypted data/encrypted data for RAID group in which encryption is set by using the existing function (Volume Migration, ShadowImage et cetera.).

*1: When the firmware version is 83-03-01-x0/xx or later.

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2.12.3 Notes on Using Encryption License Key

Please note the following when using Encryption License Key.

Table 2-48 Notes on Encryption License Key

#	Item	Content
1	Volumes to encrypt	Only internal volumes in the Storage System can be encrypted with Encryption License Key. External volumes cannot be encrypted.
2	LDEV format	You cannot perform high-speed format (Drive format) for Disks under RAID group in which encryption is set. Time required for LDEV format performed for the RAID group in which encryption is set depends on the number of RAID groups.
3	Encryption/ non-encryption status of volumes	When encrypting user data, set encryption for all volumes in which the data is stored in order to prevent the data from being leaked. Example: • In the case a copy function is used, and when encryption is set for P-VOL, set it also for S-VOL. When encryption is set for P-VOL, and non-encryption is set for S-VOL (or vice versa), you cannot prevent data on the non-encrypted volume from being leaked.
4	Switch encryption setting	When you switch the encryption setting of RAID group, you need to perform LDEV format again. To switch the encryption setting, back up data as necessary.
5	[Protect the Key Encryption Key at the Key Management Server] Check Box	When you select [Protect the Key Encryption Key at the Key Management Server] Check Box, the KEK (Key Encryption Key) is stored in the key management server. Registration of 2 key management servers is required for this operation. When you perform PS-ON for the DKC, the Maintenance PC gets the key from the key management server. Therefore, the communication between the SVP and the key management server should be available. Before you perform PS-ON for the DKC, make sure that the communication between the SVP and the key management server is available.

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2.12.4 Creation of Encryption Key

An encryption key is used for data encryption and decryption. Encryption keys can be created in the Storage System up to 512 for the VSP G200, 1,024 for the VSP G400, G600 and 2,048 for the VSP G800.
Only customer security administrators are able to create encryption keys.

In the following cases, however, creation of encryption key is inhibited to avoid data corruption.

- Due to a failure in the Storage System, the Storage System does not have any encryption key but it has a RAID group in which encryption is set.
  In this case, restore the backed up encryption key.

2.12.5 Backup of Encryption Key

There are two types of encryption key backup; backup within the Storage System and backup outside the subsystem. In the case of backup within the subsystem, the encryption key is backed up in the Cache Flash Memory in the the Storage System. In the case of backup outside the subsystem, it is backed up in the SVP.

- Backup within the subsystem
  Encryption key created on SM is backed up in the Cache Flash Memory in the Storage System.
  Encryption key is automatically backed up within the subsystem at the time it is created, deletion, a status are changed.

- Backup outside the subsystem
  Encryption key created on SM is backed up in the SVP. Backup outside the subsystem is performed when requested by the user from Storage Navigator.

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2.12.6 Restoration of Encryption Key

There are two types of encryption key restoration; restoration from backup within the subsystem and restoration from backup outside the subsystem.

- Restoration from backup within the subsystem
  When the encryption key on SM cannot be used, the encryption key backed up within the subsystem is restored.
  Restoration from backup within the subsystem is automatically performed in the the Storage System.

- Restoration from backup outside the subsystem
  When encryption keys including the encryption key backed up within the subsystem cannot be used in the Storage System, the encryption key backed up outside the subsystem is restored.
  Restoration from backup outside the subsystem is performed when requested by the security administrator from Storage Navigator.

2.12.7 Setting and Releasing Encryption

You can set and release encryption by specifying a RAID group. Set and release encryption in the Parity Group list window in Storage Navigator.

NOTE:
- Encryption can be set and released only when all volumes that belong to the RAID group are blocked, or when there is no volume in the RAID group.
  When the RAID group contains at least one volume that is not blocked, you cannot set and release encryption.
- When you switch the encryption setting, you need to perform LDEV format again. Therefore set encryption before formatting the entire RAID group when installing RAID groups et cetera.

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2.12.8 Encryption Format

To format a RAID group in which encryption is set, format the entire Disk area by write encrypted 0 data in the entire Disk area. This is called Encryption format.
When encryption is set for a RAID group, encryption format is needed before user data is written. When encryption is released, normal format is needed before user data is written.

NOTE: Encryption format can be performed only when all volumes in the RAID group can be formatted. When at least one volume cannot be formatted, encryption format cannot be performed.

2.12.9 Converting Non-encrypted Data/Encrypted Data

To encrypt existing data, create a RAID group in which encryption is set in advance and use a copy Program Product, such as Volume Migration, and ShadowImage, to convert data. Data conversion is performed per LDEV.
The specifications of converting non-encrypted data/encrypted data comply with the specifications of the copy function (Volume Migration, ShadowImage et cetera.) used for conversion.

2.12.10 Deleting Encryption Keys

Only customer security administrators are able to delete encryption keys. You cannot delete the encryption key which is allocated to HDDs or DKBs. You can delete the encryption key whose attribute is Free key.

2.12.11 Reference of Encryption Setting

You can check the encryption setting (Encryption: Enable/Disable) per RAID group from Parity Groups screen of Storage Navigator.

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2.13 NAS Module

A Storage System can store data in unit of directory and file in addition to a block unit by installing NAS Modules in DW800.
This section describes the following overviews of the Storage System in which NAS Modules are installed.

Table 2-49 List of overviews of NAS Modules

#	Item	Description
1	Maintenance Tool Access Path	Describes the overview of the startup and the behaviors of the software to be used for the maintenance.
2	Logical System Connection	Describes the overview of the network path followed by the software to be used for the maintenance.
3	Cluster and EVS Migration	Describes the overview of the EVS migration operation in the cluster configuration.

2.13.1 Maintenance Tool Access Path

Figure 2-62is a schematic view of the software to be used for the maintenance by the maintenance personnel and the software startup in the Storage System in which NAS Modules are installed in DW800.
The following shows the overview of the behaviors in the figure.
Table 2-50 and Table 2-51 describe the software in the figure.

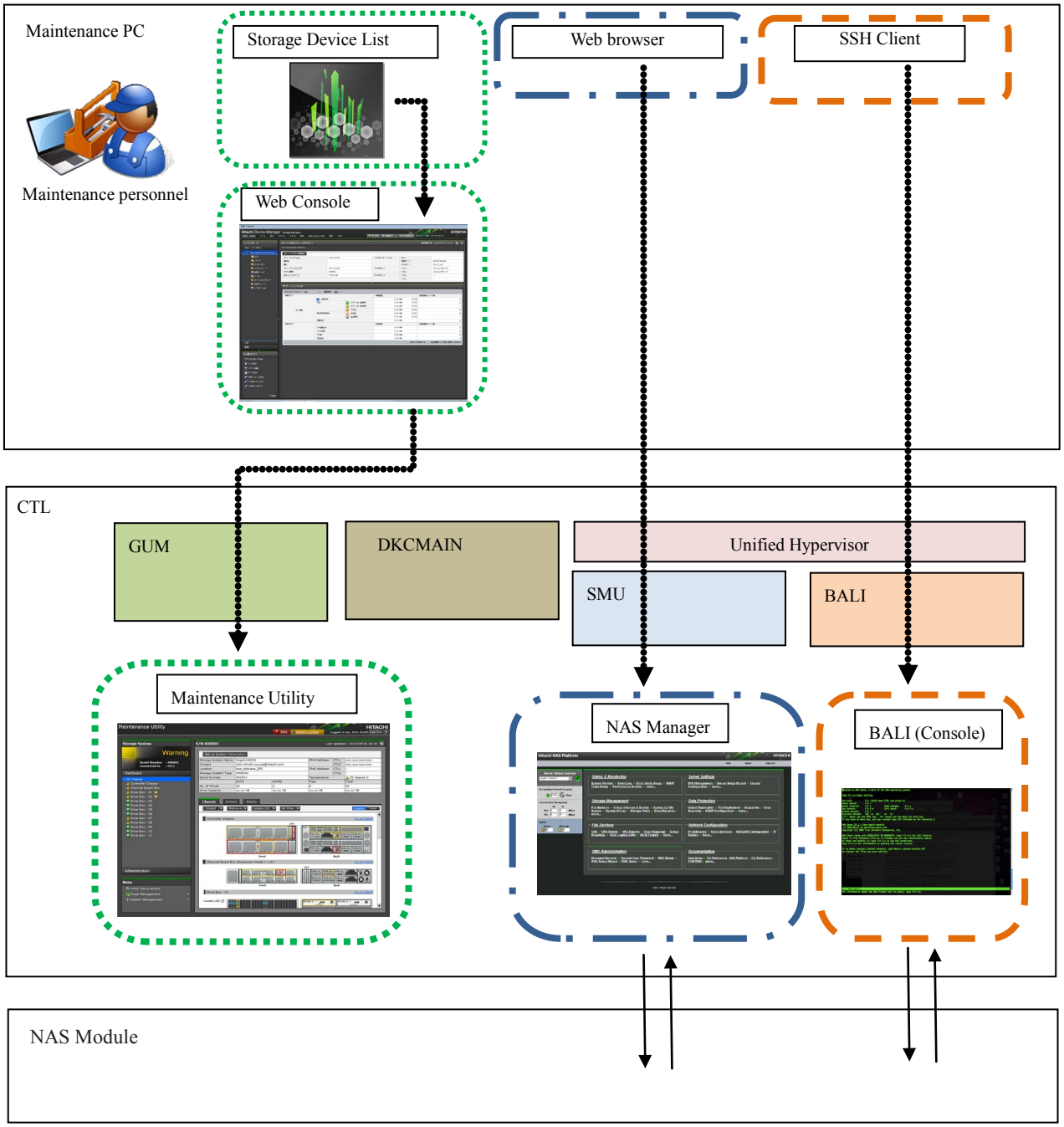
1. To access Maintenance Utility, select the access target Storage System from Storage Device List in the Maintenance PC to start Web Console and access GUM.

2. When investigating failures in the NAS Modules in details or operating EVS, launch NAS Manager from the Web browser and operate the NAS Modules through NAS Manager.

3. To use a special maintenance command for NAS Modules, log into BALI using SSH Client and operate the NAS Modules through BALI.

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Figure 2-62 Schematic View of Maintenance Related Software



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Table 2-50 List of Maintenance PC software

#	Software	Overview
1	Storage Device List	This is a program to provide the function equivalent to Storage Navigator. It registers multiple Storage Systems to be maintained and manages the Storage Systems collectively.
2	Web Console	If a specific Storage Systems is selected from Storage Device List, Web Console starts up and provides the functions to set the Storage System configuration, create RAID groups and create logical units.
3	SSH Client	This is a program for maintenance by running CLI of BALI (Console). An SSH client needs to support SSH2 and PuTTY or Tera Term is recommended.

Table 2-51 List of NAS Module Related Software

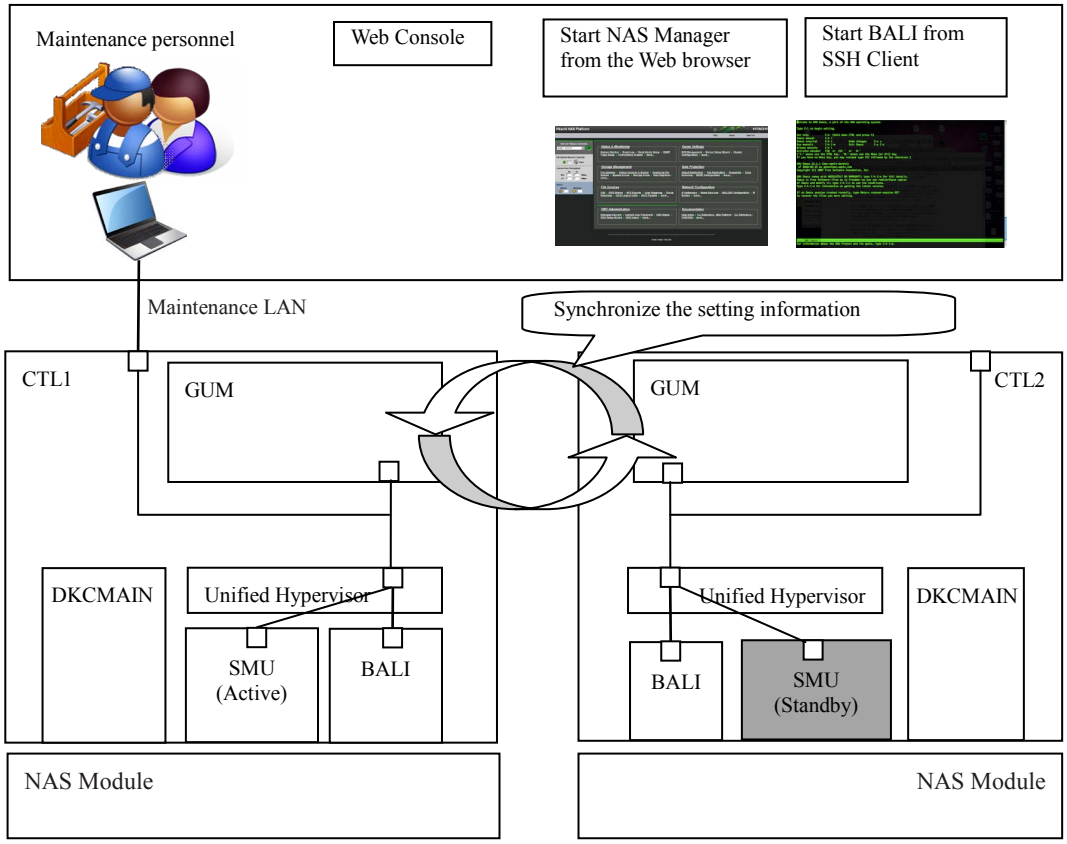
#	Term	Meaning
1	BALI	This is an abbreviation of BlueArcOS and Linux Incorporated. BALI provides NAS unique functions such as operating EVS by controlling NAS modules and realizing the cluster system by communicating with SMU and remote nodes. Maintenance personnel can operate NAS modules by issuing the command to BALI through CLI.
2	SMU	This is an abbreviation of System Management Unit. SMU manages clusters and has functions such as EVS migration. SMU provides GUI “NAS Manager” to manage NAS. SMU can monitor the NAS system and migrate EVS by operating NAS Manager.
3	NAS Manager	This is GUI for management of the browser base operated on SMU. NAS Manager prepares the interface to manage clusters, nodes and file systems and can operate network settings, user information settings and file system settings.
4	Unified Hypervisor	This is a virtual program to operate DKCMAIN and other OS at the same time. Unified Hypervisor controls management maintenance function and each LPAR operated under Unified Hypervisor through DKCMAIN.
5	EVS	This indicates the virtual server operated by BALI and processes I/O requests from clients. DW800 in which NAS modules and NAS Unified Firmware are installed can operate multiple EVS (up to 64).

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2.13.2 Logical System Connection

Figure 2-63 is a schematic view indicating which network path the software used by maintenance personnel passes through in the Storage System in which NAS Modules are installed in DW800.
The maintenance operation usually starts by connecting LAN cables to maintenance ports. When using Web Console and the related programs, access GUM through the maintenance LAN of CTL.
When using Web Console, either Web Console can be used because the setting information of CTL1 and CTL2 is synchronized。
When using NAS Manager, use the one on the CTL1 side usually. SMU (Standby) (*1) on the CTL2 side cannot be used unless SMU (Active) is stopped because SMU (Standby) is an alternate function of SMU on CTL1.
When using BALI, connect the LAN cable to the maintenance port of CLT on the side to which you want to log in. You cannot log into BALI of CTL on the side where the LAN cable is disconnected.

Figure 2-63 Network Path



*1: SMU (Standby) is an alternate SMU of SMU (Active). When the CTL2 side has SMU (Active), the CTL1 side has SMU (Standby).

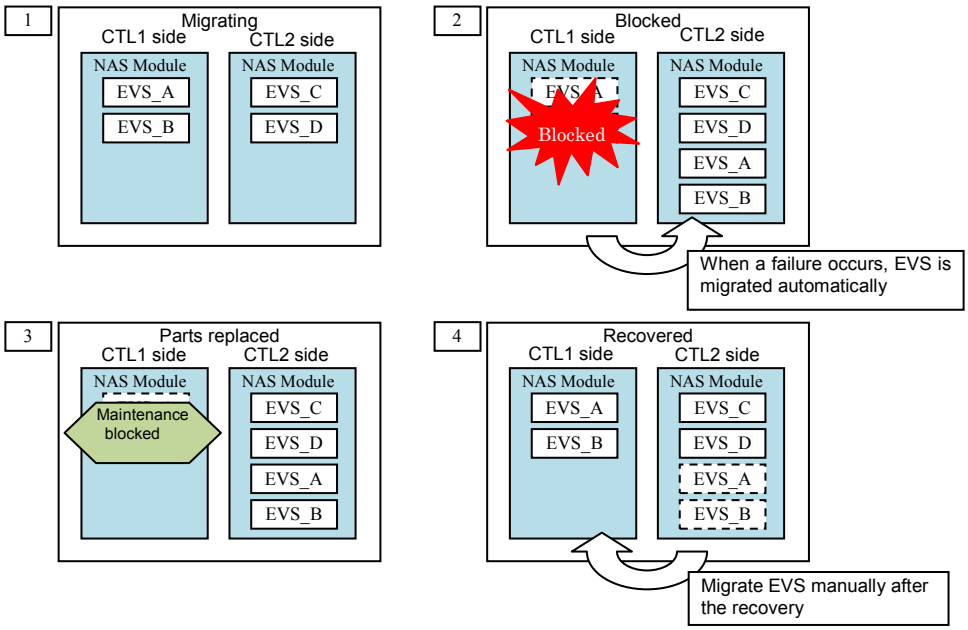
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2.13.3 Cluster and EVS Migration

The Controller Chassis (DKC) consists of the two clusters (CTL1 and CTL2). When a failure occurs in one of the clusters, the other cluster continues services.

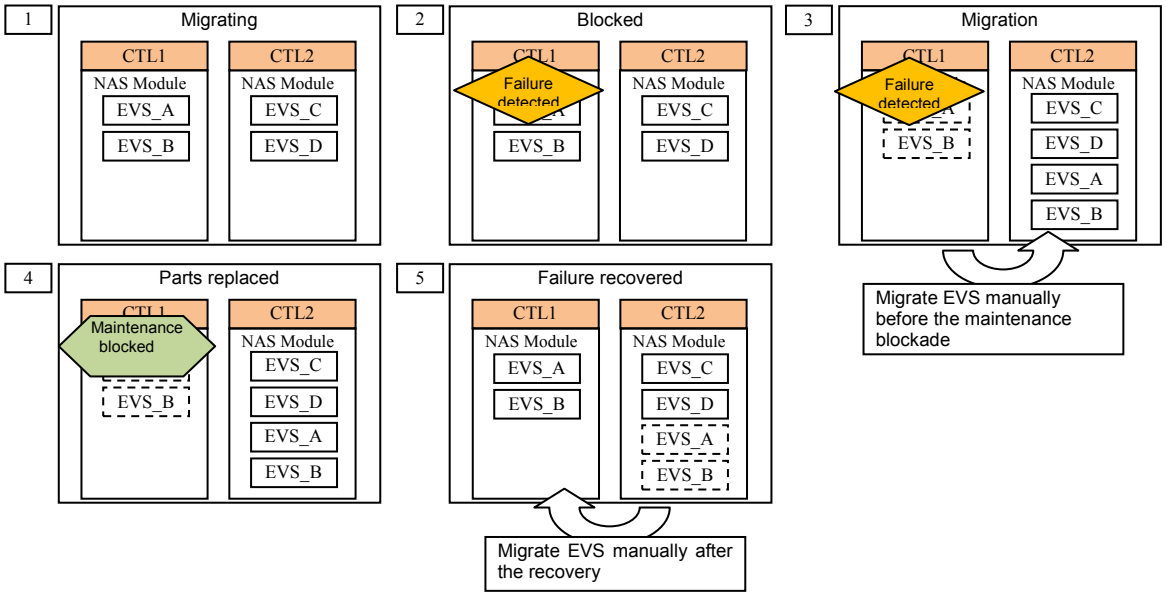
The Storage System with NAS Modules and NAS Unified Firmware installed in DW800 accepts the Read/Write request from the client with the virtual server (EVS). Therefore, if a failure occurs in one of the clusters, EVS is migrated to the other cluster automatically to continue the services. Taking over the processing in this manner is called “EVS migration”.
Migrating EVS by the system administrator or service personnel using the management GUI such as NAS Manager is called “Manual EVS migration”.

Figure 2-64 EVS Migration (Automatic)



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Figure 2-65 Manual EVS migration



After the cluster in which a failure occurred recovers, restore EVS to the original cluster.
Since EVS is migrated either automatically or manually depending on the timing when the migration is required, the EVS migration case-by-case method is shown in Table 2-52.

Table 2-52 List of EVS migration

#	EVS migration timing	EVS migration	EVS restoration to original cluster
1	Firmware update	EVS migration	EVS migration
2	Cluster failure	EVS migration	Manual EVS migration
3	Parts replacement in cluster	Manual EVS migration	Manual EVS migration

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2.13.4 NAS iSCSI

DW800 can access data I/O of block storage and file storage.
The block data is accessed by Fibre Channel Channel Board (CHB) and iSCSI Channel Board (CHB). The file data is accessed by a NAS Module.
As described above, different Channel Boards need to be used depending on the block data and the file data. In the NAS Module, however, if the NAS iSCSI protocol is used, the block data can be accessed through iSCSI. NAS iSCSI enables the data access to both file and block data only by the NAS Module.
For the details of NAS iSCSI, see “File Service Administration Guide”.

Table 2-53 Access to Block and File Data

I/O Module	Interface to be used	How to access
Channel Board	Fibre Channel	Block data access
	iSCSI	
NAS Module	NAS	File data access
	NAS iSCSI	Block data access

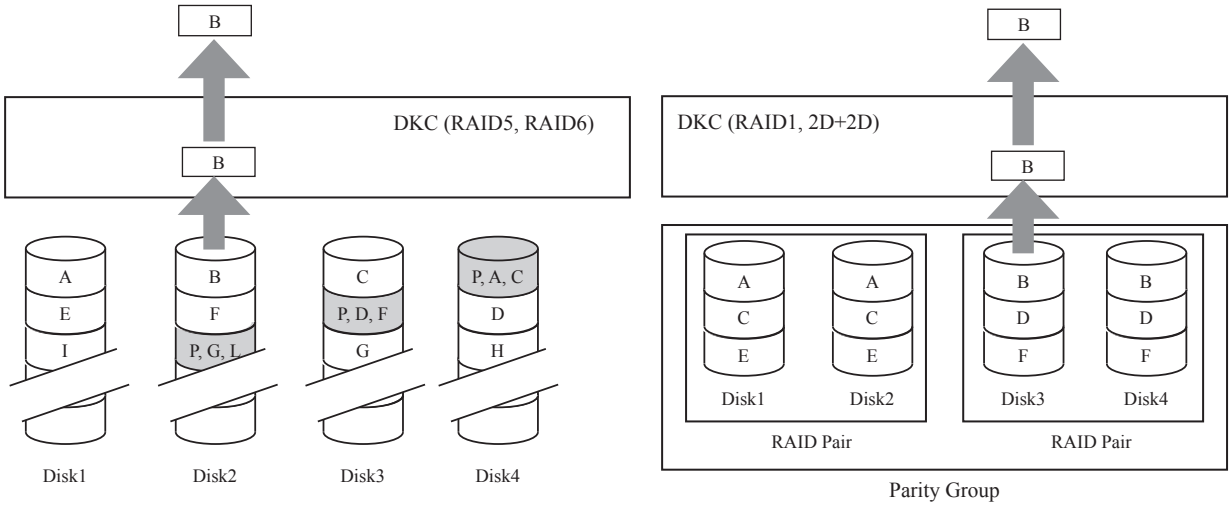
2.14 Operations Performed when Drive Errors Occur

2.14.1 I/O Operations Performed when Drive Failures Occur

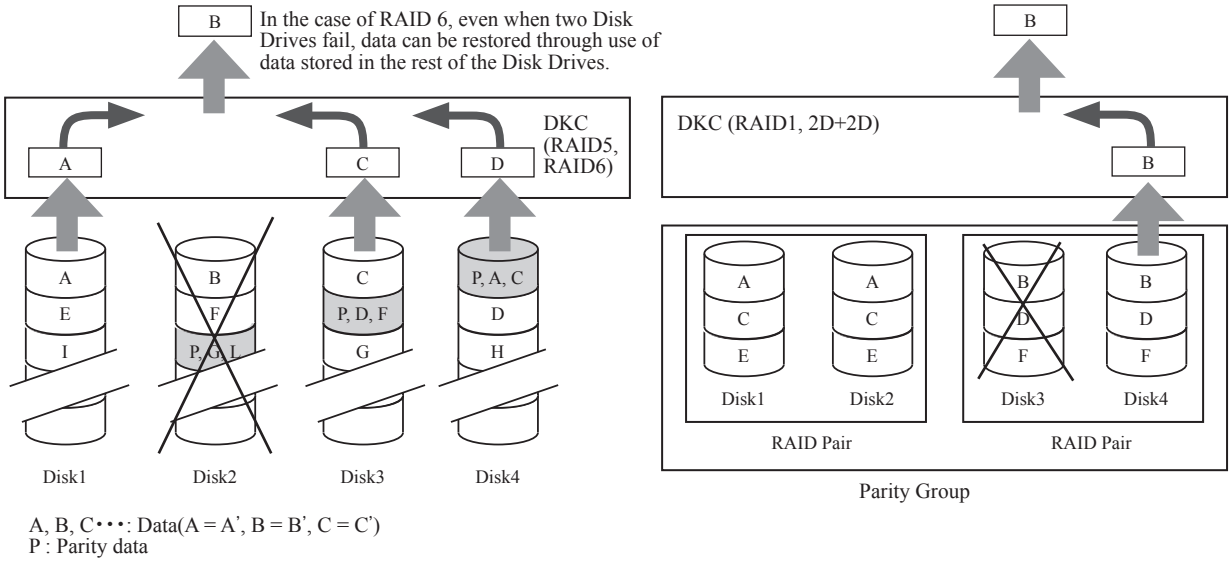
This system can recover target data using parity data and data stored on normal Disk storage even when it cannot read data due to failures occurring on physical Drives. This feature ensures non-disruptive processing of applications in case of Drive failures. This system can also continue processing for the same reason in case failures occur on physical Drives while processing write requirements.
Figure 2-66 shows the overview of data read processing in case a Drive failure occurs.

Figure 2-66 Overview of Data Read Processing (Requirement for read data B)

1. Normal time



2. When a Disk failure occurs



A, B, C・・・: Data(A = A', B = B', C = C')
P : Parity data

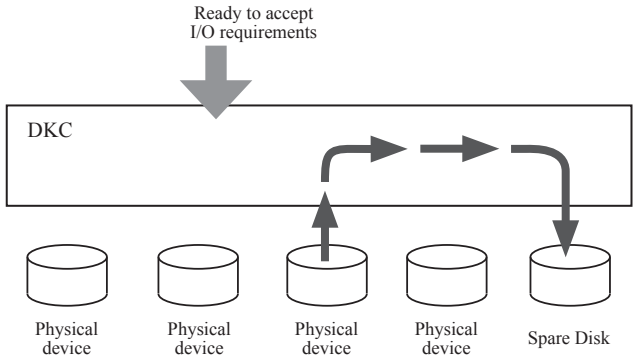
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2.14.2 Data Guarantee at the Time of Drive Failures

This system uses spare Disk Drives and reconfigures any Drives that are blocked due to failures or Drives whose failure count exceeds a specified limit value using spare Disks. (Drives belonging to a Parity Group with no LDEVs defined are not reconfigured.)
Since this processing is executed on the host in the background, this system can continue to accept I/O requirements. The data saved on spare Disks are copied into the original location after the failure Drives are replaced with new ones. But when the copy back mode is set to “No Copy Back”, and when copying to the same capacity spare Disk, the copy back is not performed.

1. Dynamic sparing
   This system keeps track of the number of failures that occurred, for each Drive, when it executes normal read or write processing. If the number of failures occurring on a certain Drive exceeds a predetermined value, this system considers that the Drive is likely to cause unrecoverable failures and automatically copies data from that Drive to a spare Disk. This function is called dynamic sparing. In RAID1 method, this system is same as RAID5 dynamic sparing.

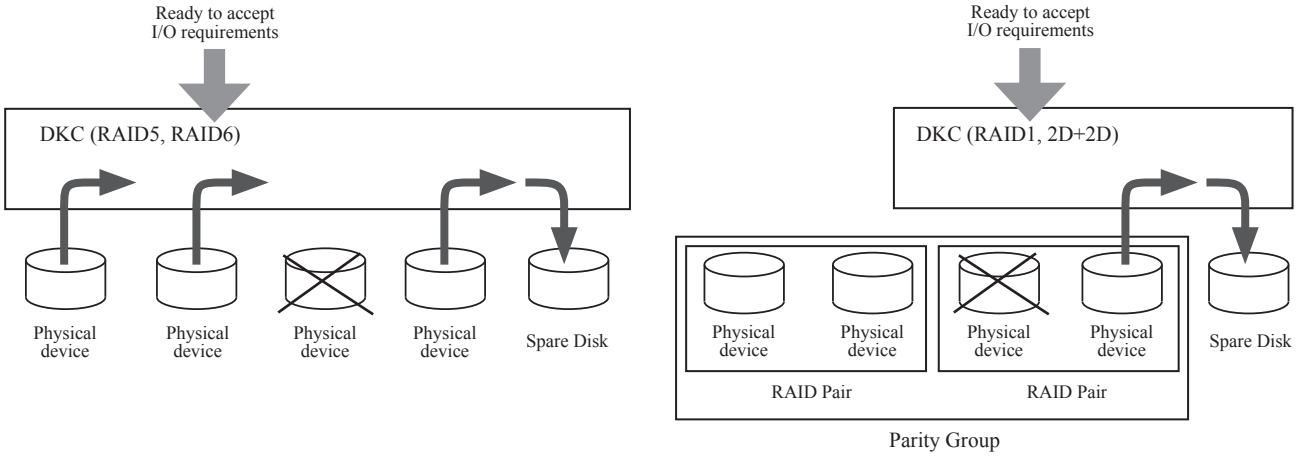
Figure 2-67 Overview of the Dynamic Sparing Overview



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2. Correction copy
   When this system cannot read or write data from or to a Drive due to an failure occurring on that Drive, it regenerates the original data for that Drive using data from the other Drives and the parity data and copies it onto a spare Disk.
   - In RAID1 method, this system copies data from the another Drive to a spare Disk.
   - In the case of RAID 6, the correction copy can be made to up to two Disk Drives in a parity group.

Figure 2-68 Overview of the Correction Copy Overview



3. Allowable number of copying operations

Table 2-54 Allowable number of copying operations

RAID level	Allowable number of copying operations
RAID1	Either the dynamic sparing or correction copy can be executed within a RAID pair.
RAID5	Either the dynamic sparing or correction copy can be executed within a parity group.
RAID6	The dynamic sparing and/or correction copy can be executed up to a total of twice within a parity group.

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2.15 Data Guarantee at the Time of a Power Outage due to Power Outage and Others

If a power failure due to power outage and others occurs, refer to "5. Battery" of "4.6.4 Hardware Component".

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2.16 Overview of DKC Compression

2.16.1 Capacity Saving and Accelerated Compression

The following two functions are available for using the capacity of virtual volumes effectively.

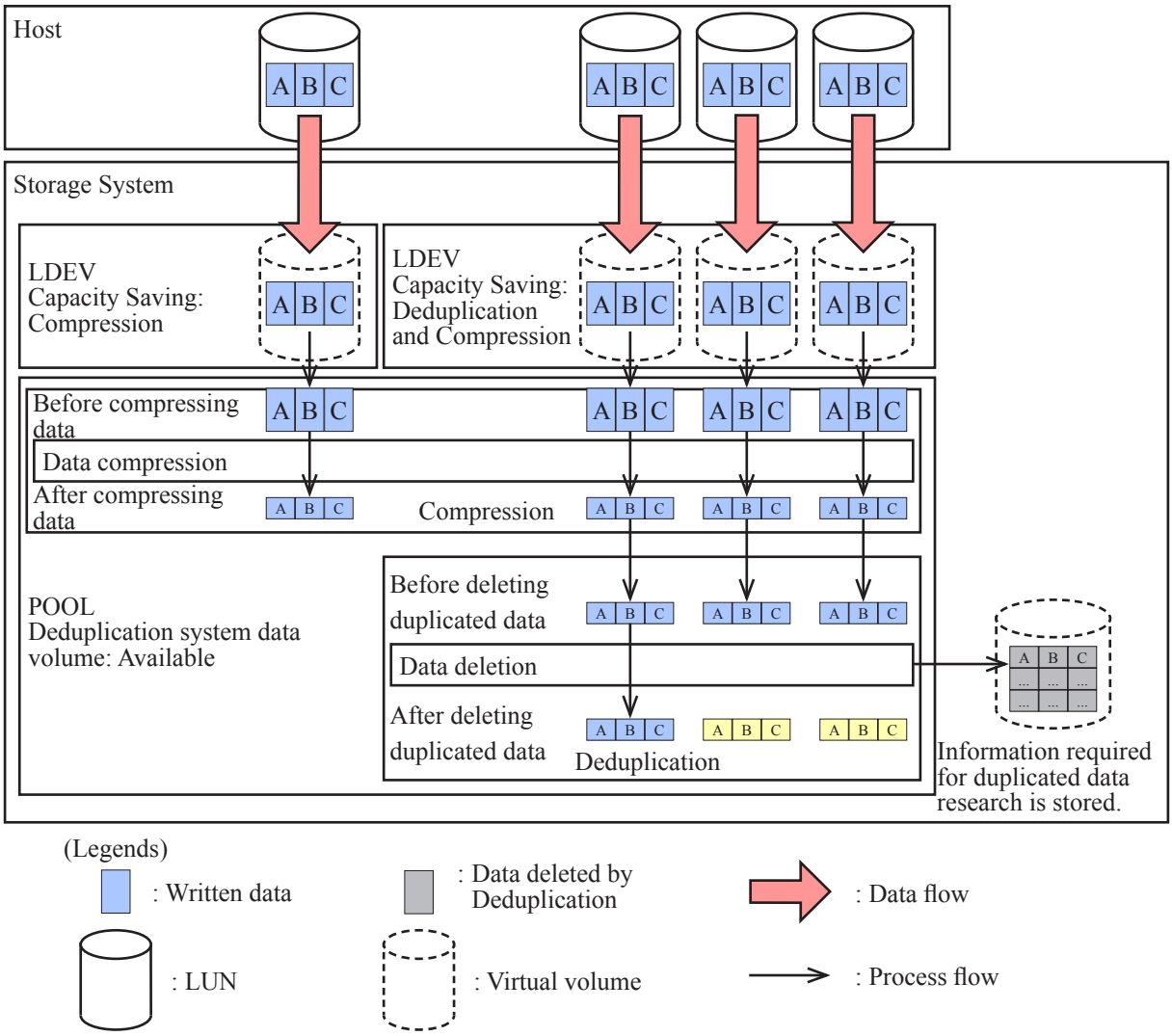
- Capacity Saving (Compression and Deduplication)
  Capacity Saving is a function to reduce the bit-cost by the data compression (Compression) and data deduplication (Deduplication) performed by the storage system controller to compress the stored data. The post process mode or the inline mode can be selected as the mode for writing new data.
- Accelerated Compression
  Accelerated Compression is a function to expand the drive capacity and reduce the bit-cost while maintaining the high data access of the storage system by using Compression on the FMC

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2.16.2 Capacity Saving

Capacity Saving is a function to perform Compression and Deduplication of stored data by using the storage system controller. This function can be used in the Dynamic Provisioning pool. Capacity Saving allows data more than the size of drives on the system to be stored. Capacity Saving is available for all types of drives and can be used with encryption.
The Capacity Saving function operates in the post process mode or the inline mode. For these modes, refer to the Provisioning Guide “Capacity saving function: data deduplication and compression”.

The following describes each function.



When the Capacity Saving function is enabled, the pool capacity is consumed because the entire capacity of metadata and garbage data is stored. The capacity to be consumed is equivalent to the physical capacity of about 10% of the LDEV capacity that is processed by Capacity Saving. The pool capacity is dynamically consumed according to usage of the Capacity Saving process. When the amount of data writes from the host increases, the consumed capacity might exceed 10% of the pool capacity temporarily. When the amount of data writes decreases, the used capacity becomes about 10% of the pool capacity due to the garbage collection operation.

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2.16.2.1 Compression

Compression is a function to convert a data size to a different smaller data size by encryption without reducing the amount of information. LZ4 is used for Compression as the data compression algorithm. Set this function to each virtual volume for Dynamic Provisioning.

2.16.2.2 Deduplication

Deduplication is a function to retain data on a single address and delete the duplicated data on other addresses if the same data is written on different addresses in the same pool. Set Deduplication to each pool and virtual volume for Dynamic Provisioning. When Deduplication is enabled, duplicated data among virtual volumes associated with a pool is deleted. When a pool with Deduplication enabled is created, a system data volume is created for Deduplication, which stores a table to search for duplicated data among data stored in the pool. A system data volume is created per pool.

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3. Specifications for the Operations of DW800

3.1 Precautions When Stopping the Storage System

Pay attention to the following instructions concerning the operation when the Storage System stops immediately after turning on the PDU breaker and completing the power off of the Storage System.

3.1.1 Precautions in a Power-off Mode

- Even if the PDU breaker is immediately after turning on, or the Storage System is in the status of the power off after the process of the power off is completed, the Storage System is in a standby mode.
- In this standby mode, the AC input is supplied to the Power Supply in the Storage System, and this supplies the Power Supply to the FANs, the Cache Memory modules and some boards (I/F Boards, Controller Boards, ENCs or the like).
- Please execute the following process when the standby electricity must be controlled, because the standby electricity exists in the Storage System under this condition. See Table 3-1 for standby electricity.

1. When the Storage System is powered on
   Turn on the breaker of each PDU just before the power on processing.

2. When the Storage System is powered off
   After the power off processing is completed, turn each PDU breaker off.
   - When turning each PDU breaker off, make sure the power off processing is completed in advance.
   - When the breaker is turned off during the power off processing, the battery power is burned and the power on time may take little longer at the next power on processing depending on to the battery charge, because the Storage System shifts to the emergency SSD transfer processing of the data with the battery.
   - Moreover, in advance of the turning each PDU breaker off, make sure the AC cables of the other Storage System are not connected to the PDU that is turned off.
   - The management information stored in the memory is transferred to the Cache Flash Memory (CFM) in the Controller Board during the power off process, therefore, leaving the breaker of the PDUs on is needless for the data retention.

Table 3-1 Maximum Standby Electricity per Controller Chassis and Drive Box

Controller Chassis/Drive Box etc	Maximum Standby Electricity [VA]
DBS (SFF Drive Box)	200
DBL (LFF Drive Box)	140
DB60 (3.5-inch Drive Box)	560
DBF (Flash Module Drive Box)	320
CBL (Controller Chassis)	230
CBSS (Controller Chassis)	370
CBSL (Controller Chassis)	310
CHBB (Channel Board Box)	180

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3.1.2 Operations When a Distribution Board Is Turned off

When the distribution board breaker or the PDU breaker is turned off, execute the operation after making sure that the Power Supply of the Storage System was normally turned off, by confirming the PS was normally turned off according to the Power OFF Event Log (Refer to "1.5.2 Storage System Power Off (Sequential Shutdown)" in INSTALLATION SECTION.) of Maintenance PC.

When the Power OFF Event Log confirmation is impossible, suspend the operation and requirement customers to restart the Storage System to confirm that the PS is normally turned off.

NOTICE: Requirement the thoroughness in the following operations to the customer if the distribution board breaker or the PDU is impossible to keep the on-status after the power of the Storage System is turned off.

1. Point to be checked before turning the breaker off
   Requirement the customer to make sure that the power off processing of the Storage System is completed (READY lamp and ALARM lamp are turned off) before turning off the breaker.

2. Operation when breaker is turned off for two weeks or more
   A built-in battery spontaneously becomes a status of discharge when the distribution board breaker or PDU breaker is turned off after the Storage System is powered off. Therefore, when the breaker is turned off for two weeks or more, charging the built-in battery to full will take a maximum of 4.5 hours. Accordingly, requirement the customer to charge the battery prior to the restarting of the Storage System.

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3.2 Precautions When Installing of Flash Drive and Flash Module Drive Addition

For precautions when installing of Flash Drive and Flash Module Drive, refer to INSTALLATION SECTION "1.3.4 Notes for Installing Flash Drives (SSD)" and "1.3.5 Notes for Installing Flash Module Drive Boxes".

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3.3 Notes on Maintenance during LDEV Format/Drive Copy Operations

This section describes whether maintenance operations can be performed when Dynamic Sparing, Correction Copy, Copy Back, Correction Access or LDEV Format is running or when data copying to a spare Disk is complete.

If Correction Copy runs due to a Drive failure or Dynamic Sparing runs due to preventive maintenance on large-capacity Disk Drives or Flash Drives, it may take long to copy data. In the case of low-speed LDEV Format performed due to volume addition, it may take time depending on the I/O frequency because host I/Os are prioritized. In such a case, it is recommended to perform operations, such as replacement, addition, and removal, after Dynamic Sparing, LDEV Format et cetera. is completed, based on the basic maintenance policy, but the following maintenance operations are available.

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Table 3-2 Correlation List of Storage System Statuses and Maintenance Available Parts

Maintenance operation		Storage System status					
		Dynamic Sparing	Correction Copy	Copy Back	Correction Access	Copied to spare Disk	LDEV Format
Replacement	CTL	Possible	Possible	Possible	Possible (*1) (*8)	Possible	Impossible (*6)
	LANB	Possible	Possible	Possible	Possible (*1) (*8)	Possible	Impossible (*6)
	CHB	Possible	Possible	Possible	Possible (*1) (*8)	Possible	Impossible (*6)
	Power supply	Possible	Possible	Possible	Possible	Possible	Possible (*16)
	SVP	Possible	Possible	Possible	Possible	Possible	Possible
	ENC	Possible	Possible	Possible	Possible (*1) (*8)	Possible	Impossible (*6)
	DKB	Possible	Possible	Possible	Possible (*1) (*8)	Possible	Impossible (*6)
	PDEV	Possible (*15)	Possible (*15)	Possible (*15)	Possible (*1) (*8)	Possible	Possible (*4)
Addition/ Removal	CM/SM	Impossible (*7)	Impossible (*7)	Impossible (*7)	Possible (*1) (*8)	Possible	Impossible (*6)
	LANB	Impossible (*7)	Impossible (*7)	Impossible (*7)	Possible (*1) (*8)	Possible	Impossible (*6)
	CHB	Impossible (*7)	Impossible (*7)	Impossible (*7)	Possible (*1) (*8)	Possible	Impossible (*6)
	SVP	Possible	Possible	Possible	Possible	Possible	Possible
	DKB	Impossible (*7)	Impossible (*7)	Impossible (*7)	Possible (*1) (*8)	Possible	Impossible (*6)
	PDEV	Impossible (*7)	Impossible (*7)	Impossible (*7)	Possible (*1) (*8)	Possible (*2)	Impossible (*6)
Firmware exchange	Online	Possible (*3)	Possible (*3)	Possible (*3)	Possible (*1) (*8)	Possible (*1) (*3) (*9)	Impossible (*6)
	Offline	Impossible (*7)	Impossible (*7)	Impossible (*7)	Impossible (*8)	Possible	Impossible (*6)(*16)
	SVP only	Possible	Possible	Possible	Possible	Possible	Possible
LDEV maintenance	Blockade	Possible (*5) (*9) (*10)	Possible (*5) (*9) (*10)	Possible (*5) (*9) (*10)	Possible (*5)	Possible	Possible (*9) (*10)
	Restore	Possible (*5) (*9) (*11)	Possible (*5) (*9) (*11)	Possible (*5) (*9) (*11)	Possible (*5)	Possible	Possible (*9) (*11)
	Format	Possible (*5)	Possible (*5)	Possible (*5)	Possible (*5) (*9) (*13)	Possible	Impossible (*12)
	Verify	Impossible (*10)	Impossible (*10)	Impossible (*10)	Possible (*9) (*14)	Possible	Impossible (*10)

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*1: It is prevented with the message. However, it is possible to perform it by checking the checkbox of "Perform forcibly without safety check".

*2: It is impossible to remove a RAID group in which data is migrated to a spare Disk and the spare Disk.

*3: Firmware-program exchange can be performed if HDD firmware-program exchange is not included.

*4: It is impossible when high-speed LDEV Format is running. When low-speed LDEV Format is running, it is possible to replace PDEV in a RAID group in which LDEV Format is not running.

*5: It is possible to perform LDEV maintenance for LDEV defined in a RAID group in which Dynamic Sparing, Correction Copy, Copy Back or Correction Access is not running.

*6: It is prevented with message [30762-208158]. However, a different message might be displayed depending on the occurrence timing of the state regarded as a prevention condition.

*7: It is prevented with message [30762-208159]. However, a different message might be displayed depending on the occurrence timing of the state regarded as a prevention condition.

*8: It is prevented with message [33361-203503:33462-200046]. However, a different message might be displayed depending on the occurrence timing of the state regarded as a prevention condition.

*9: It is prevented with the message. However, it is possible to perform it from "Forcible task without safety check".

*10: It is prevented with message [03005-002095]. However, a different message might be displayed depending on the occurrence timing of the state regarded as a prevention condition.

*11: It is prevented with message [03005-202002]. However, a different message might be displayed depending on the occurrence timing of the state regarded as a prevention condition.

*12: It is prevented with message [03005-202001]. However, a different message might be displayed depending on the occurrence timing of the state regarded as a prevention condition.

*13: It is prevented with message [03005-202005]. However, a different message might be displayed depending on the occurrence timing of the state regarded as a prevention condition.

*14: It is prevented with message [03005-002011]]. However, a different message might be displayed depending on the occurrence timing of the state regarded as a prevention condition.

*15:It is prevented with message [30762-208159].

- When the RAID group to which the maintenance target PDEV belongs and the RAID group whose Dynamic Sparing / Correction Copy / Copy Back is operating are not identical, it is possible to perform it by checking the checkbox of "Perform forcibly without safety check".
- When the RAID group to which the maintenance target PDEV belongs and the RAID group whose Dynamic Sparing / Correction Copy / Copy Back is operating are identical and the RAID level is RAID 6, it is possible to perform it by checking the checkbox of "Perform forcibly without safety check" depending on the status of the PDEV other than the maintenance target.

However, a different message might be displayed depending on the occurrence timing of the state regarded as a prevention condition.

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*16: If you perform power-on, or offline firmware update after interrupting the LDEV format on the storage system with Capacity Saving (Dedupe and Compression) used, check the state of all DP-VOLs with Capacity Saving enabled after performing the operation. For the check procedure, refer to [Virtual Volumes] tab in [Pools: Volume] tabs or “Logical Devices” window in “Provisioning Guide”. If the DP-VOLs with Capacity Saving enabled are blocked, perform the LDEV format on the DP-VOLs. (See TRBL21-70.)

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3.4 Inter Mix of Drives

Table 3-3 shows permitted coexistence of RAID levels and HDD types respectively.

Table 3-3 pecifications for Coexistence of Elements

<table>
<tr><th>Item</th><th>Specification</th><th>Remarks</th></tr>
<tr><td>Coexistence of RAID levels</td><td>RAID1 (2D+2D, 4D+4D), RAID5 (3D+1P, 4D+1P, 6D+1P, 7D+1P), RAID6 (6D+2P, 12D+2P, 14D+2P) can exist in the system.</td><td></td></tr>
<tr><td>Drive type</td><td>Different drive types can be mixed for each parity group.</td><td></td></tr>
<tr><td>Spare drive</td><td>When the following conditions 1 and 2 are met, the drives can be used as spare drives.
1. Capacity of the spare drives is the same as or larger than the drives in operation.
2. The type of the drives in operation and the type of the spare drives fulfill the following conditions.

<table><tr><th>Type of Drive in Operation</th><th>Type of Usable Spare Drive</th></tr><tr><td>HDD (7.2 krpm)</td><td>HDD (7.2 krpm)</td></tr><tr><td>HDD (10 krpm)</td><td>HDD (10 krpm)</td></tr><tr><td>HDD (15 krpm)</td><td>HDD (15 krpm)</td></tr><tr><td>SSD</td><td>SSD</td></tr><tr><td>FMD (xRyFM)</td><td>FMD (xRyFM)</td></tr><tr><td>FMD (xRyFN)</td><td>FMD (xRyFN, xRyFP)</td></tr><tr><td>FMD (xRyFP)</td><td>FMD (xRyFP)</td></tr></table>
NOTE: “x” and “y” are an arbitrary number. Some drives do not contain the number of “y” (e.g. 14RFP).
The numbers (x, y) of Type of Drive in Operation need not be the same as those of Type of Usable Spare Drive.
For example, when the drives in operation are 1R6FN, the drives of 1R6FN, 7R0FP, etc. can be used as spare drives.</td><td></td></tr>
</table>

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4. Appendixes

4.1 DB Number - C/R Number Matrix

NOTE: In case of a CBSS/CBSL/CBSSD/CBSLD, it includes DB-00.

Table 4-1 DB Number - C/R Number Matrix (DB-00)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-00	HDD00-00	00/00	000
	HDD00-01	00/01	001
	HDD00-02	00/02	002
	HDD00-03	00/03	003
	HDD00-04	00/04	004
	HDD00-05	00/05	005
	HDD00-06	00/06	006
	HDD00-07	00/07	007
	HDD00-08	00/08	008
	HDD00-09	00/09	009
	HDD00-10	00/0A	00A
	HDD00-11	00/0B	00B
	HDD00-12	00/0C	00C
	HDD00-13	00/0D	00D
	HDD00-14	00/0E	00E
	HDD00-15	00/0F	00F
	HDD00-16	00/10	010
	HDD00-17	00/11	011
	HDD00-18	00/12	012
	HDD00-19	00/13	013
	HDD00-20	00/14	014
	HDD00-21	00/15	015
	HDD00-22	00/16	016
	HDD00-23	00/17	017

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-00	HDD00-24	00/18	018
	HDD00-25	00/19	019
	HDD00-26	00/1A	01A
	HDD00-27	00/1B	01B
	HDD00-28	00/1C	01C
	HDD00-29	00/1D	01D
	HDD00-30	00/1E	01E
	HDD00-31	00/1F	01F
	HDD00-32	00/20	020
	HDD00-33	00/21	021
	HDD00-34	00/22	022
	HDD00-35	00/23	023
	HDD00-36	00/24	024
	HDD00-37	00/25	025
	HDD00-38	00/26	026
	HDD00-39	00/27	027
	HDD00-40	00/28	028
	HDD00-41	00/29	029
	HDD00-42	00/2A	02A
	HDD00-43	00/2B	02B
	HDD00-44	00/2C	02C
	HDD00-45	00/2D	02D
	HDD00-46	00/2E	02E
	HDD00-47	00/2F	02F
	HDD00-48	00/30	030
	HDD00-49	00/31	031
	HDD00-50	00/32	032
	HDD00-51	00/33	033
	HDD00-52	00/34	034
	HDD00-53	00/35	035
	HDD00-54	00/36	036
	HDD00-55	00/37	037
	HDD00-56	00/38	038
	HDD00-57	00/39	039
	HDD00-58	00/3A	03A
	HDD00-59	00/3B	03B

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Table 4-2 DB Number - C/R Number Matrix (DB-01)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-01	HDD01-00	01/00	040
	HDD01-01	01/01	041
	HDD01-02	01/02	042
	HDD01-03	01/03	043
	HDD01-04	01/04	044
	HDD01-05	01/05	045
	HDD01-06	01/06	046
	HDD01-07	01/07	047
	HDD01-08	01/08	048
	HDD01-09	01/09	049
	HDD01-10	01/0A	04A
	HDD01-11	01/0B	04B
	HDD01-12	01/0C	04C
	HDD01-13	01/0D	04D
	HDD01-14	01/0E	04E
	HDD01-15	01/0F	04F
	HDD01-16	01/10	050
	HDD01-17	01/11	051
	HDD01-18	01/12	052
	HDD01-19	01/13	053
	HDD01-20	01/14	054
	HDD01-21	01/15	055
	HDD01-22	01/16	056
	HDD01-23	01/17	057

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-01	HDD01-24	01/18	058
	HDD01-25	01/19	059
	HDD01-26	01/1A	05A
	HDD01-27	01/1B	05B
	HDD01-28	01/1C	05C
	HDD01-29	01/1D	05D
	HDD01-30	01/1E	05E
	HDD01-31	01/1F	05F
	HDD01-32	01/20	060
	HDD01-33	01/21	061
	HDD01-34	01/22	062
	HDD01-35	01/23	063
	HDD01-36	01/24	064
	HDD01-37	01/25	065
	HDD01-38	01/26	066
	HDD01-39	01/27	067
	HDD01-40	01/28	068
	HDD01-41	01/29	069
	HDD01-42	01/2A	06A
	HDD01-43	01/2B	06B
	HDD01-44	01/2C	06C
	HDD01-45	01/2D	06D
	HDD01-46	01/2E	06E
	HDD01-47	01/2F	06F
	HDD01-48	01/30	070
	HDD01-49	01/31	071
	HDD01-50	01/32	072
	HDD01-51	01/33	073
	HDD01-52	01/34	074
	HDD01-53	01/35	075
	HDD01-54	01/36	076
	HDD01-55	01/37	077
	HDD01-56	01/38	078
	HDD01-57	01/39	079
	HDD01-58	01/3A	07A
	HDD01-59	01/3B	07B

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Table 4-3 DB Number - C/R Number Matrix (DB-02)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-02	HDD02-00	02/00	080
	HDD02-01	02/01	081
	HDD02-02	02/02	082
	HDD02-03	02/03	083
	HDD02-04	02/04	084
	HDD02-05	02/05	085
	HDD02-06	02/06	086
	HDD02-07	02/07	087
	HDD02-08	02/08	088
	HDD02-09	02/09	089
	HDD02-10	02/0A	08A
	HDD02-11	02/0B	08B
	HDD02-12	02/0C	08C
	HDD02-13	02/0D	08D
	HDD02-14	02/0E	08E
	HDD02-15	02/0F	08F
	HDD02-16	02/10	090
	HDD02-17	02/11	091
	HDD02-18	02/12	092
	HDD02-19	02/13	093
	HDD02-20	02/14	094
	HDD02-21	02/15	095
	HDD02-22	02/16	096
	HDD02-23	02/17	097

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-02	HDD02-24	02/18	098
	HDD02-25	02/19	099
	HDD02-26	02/1A	09A
	HDD02-27	02/1B	09B
	HDD02-28	02/1C	09C
	HDD02-29	02/1D	09D
	HDD02-30	02/1E	09E
	HDD02-31	02/1F	09F
	HDD02-32	02/20	0A0
	HDD02-33	02/21	0A1
	HDD02-34	02/22	0A2
	HDD02-35	02/23	0A3
	HDD02-36	02/24	0A4
	HDD02-37	02/25	0A5
	HDD02-38	02/26	0A6
	HDD02-39	02/27	0A7
	HDD02-40	02/28	0A8
	HDD02-41	02/29	0A9
	HDD02-42	02/2A	0AA
	HDD02-43	02/2B	0AB
	HDD02-44	02/2C	0AC
	HDD02-45	02/2D	0AD
	HDD02-46	02/2E	0AE
	HDD02-47	02/2F	0AF
	HDD02-48	02/30	0B0
	HDD02-49	02/31	0B1
	HDD02-50	02/32	0B2
	HDD02-51	02/33	0B3
	HDD02-52	02/34	0B4
	HDD02-53	02/35	0B5
	HDD02-54	02/36	0B6
	HDD02-55	02/37	0B7
	HDD02-56	02/38	0B8
	HDD02-57	02/39	0B9
	HDD02-58	02/3A	0BA
	HDD02-59	02/3B	0BB

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Table 4-4 DB Number - C/R Number Matrix (DB-03)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-03	HDD03-00	03/00	0C0
	HDD03-01	03/01	0C1
	HDD03-02	03/02	0C2
	HDD03-03	03/03	0C3
	HDD03-04	03/04	0C4
	HDD03-05	03/05	0C5
	HDD03-06	03/06	0C6
	HDD03-07	03/07	0C7
	HDD03-08	03/08	0C8
	HDD03-09	03/09	0C9
	HDD03-10	03/0A	0CA
	HDD03-11	03/0B	0CB
	HDD03-12	03/0C	0CC
	HDD03-13	03/0D	0CD
	HDD03-14	03/0E	0CE
	HDD03-15	03/0F	0CF
	HDD03-16	03/10	0D0
	HDD03-17	03/11	0D1
	HDD03-18	03/12	0D2
	HDD03-19	03/13	0D3
	HDD03-20	03/14	0D4
	HDD03-21	03/15	0D5
	HDD03-22	03/16	0D6
	HDD03-23	03/17	0D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-03	HDD03-24	03/18	0D8
	HDD03-25	03/19	0D9
	HDD03-26	03/1A	0DA
	HDD03-27	03/1B	0DB
	HDD03-28	03/1C	0DC
	HDD03-29	03/1D	0DD
	HDD03-30	03/1E	0DE
	HDD03-31	03/1F	0DF
	HDD03-32	03/20	0E0
	HDD03-33	03/21	0E1
	HDD03-34	03/22	0E2
	HDD03-35	03/23	0E3
	HDD03-36	03/24	0E4
	HDD03-37	03/25	0E5
	HDD03-38	03/26	0E6
	HDD03-39	03/27	0E7
	HDD03-40	03/28	0E8
	HDD03-41	03/29	0E9
	HDD03-42	03/2A	0EA
	HDD03-43	03/2B	0EB
	HDD03-44	03/2C	0EC
	HDD03-45	03/2D	0ED
	HDD03-46	03/2E	0EE
	HDD03-47	03/2F	0EF
	HDD03-48	03/30	0F0
	HDD03-49	03/31	0F1
	HDD03-50	03/32	0F2
	HDD03-51	03/33	0F3
	HDD03-52	03/34	0F4
	HDD03-53	03/35	0F5
	HDD03-54	03/36	0F6
	HDD03-55	03/37	0F7
	HDD03-56	03/38	0F8
	HDD03-57	03/39	0F9
	HDD03-58	03/3A	0FA
	HDD03-59	03/3B	0FB

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Table 4-5 DB Number - C/R Number Matrix (DB-04)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-04	HDD04-00	04/00	100
	HDD04-01	04/01	101
	HDD04-02	04/02	102
	HDD04-03	04/03	103
	HDD04-04	04/04	104
	HDD04-05	04/05	105
	HDD04-06	04/06	106
	HDD04-07	04/07	107
	HDD04-08	04/08	108
	HDD04-09	04/09	109
	HDD04-10	04/0A	10A
	HDD04-11	04/0B	10B
	HDD04-12	04/0C	10C
	HDD04-13	04/0D	10D
	HDD04-14	04/0E	10E
	HDD04-15	04/0F	10F
	HDD04-16	04/10	110
	HDD04-17	04/11	111
	HDD04-18	04/12	112
	HDD04-19	04/13	113
	HDD04-20	04/14	114
	HDD04-21	04/15	115
	HDD04-22	04/16	116
	HDD04-23	04/17	117

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-04	HDD04-24	04/18	118
	HDD04-25	04/19	119
	HDD04-26	04/1A	11A
	HDD04-27	04/1B	11B
	HDD04-28	04/1C	11C
	HDD04-29	04/1D	11D
	HDD04-30	04/1E	11E
	HDD04-31	04/1F	11F
	HDD04-32	04/20	120
	HDD04-33	04/21	121
	HDD04-34	04/22	122
	HDD04-35	04/23	123
	HDD04-36	04/24	124
	HDD04-37	04/25	125
	HDD04-38	04/26	126
	HDD04-39	04/27	127
	HDD04-40	04/28	128
	HDD04-41	04/29	129
	HDD04-42	04/2A	12A
	HDD04-43	04/2B	12B
	HDD04-44	04/2C	12C
	HDD04-45	04/2D	12D
	HDD04-46	04/2E	12E
	HDD04-47	04/2F	12F
	HDD04-48	04/30	130
	HDD04-49	04/31	131
	HDD04-50	04/32	132
	HDD04-51	04/33	133
	HDD04-52	04/34	134
	HDD04-53	04/35	135
	HDD04-54	04/36	136
	HDD04-55	04/37	137
	HDD04-56	04/38	138
	HDD04-57	04/39	139
	HDD04-58	04/3A	13A
	HDD04-59	04/3B	13B

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Table 4-6 DB Number - C/R Number Matrix (DB-05)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-05	HDD05-00	05/00	140
	HDD05-01	05/01	141
	HDD05-02	05/02	142
	HDD05-03	05/03	143
	HDD05-04	05/04	144
	HDD05-05	05/05	145
	HDD05-06	05/06	146
	HDD05-07	05/07	147
	HDD05-08	05/08	148
	HDD05-09	05/09	149
	HDD05-10	05/0A	14A
	HDD05-11	05/0B	14B
	HDD05-12	05/0C	14C
	HDD05-13	05/0D	14D
	HDD05-14	05/0E	14E
	HDD05-15	05/0F	14F
	HDD05-16	05/10	150
	HDD05-17	05/11	151
	HDD05-18	05/12	152
	HDD05-19	05/13	153
	HDD05-20	05/14	154
	HDD05-21	05/15	155
	HDD05-22	05/16	156
	HDD05-23	05/17	157

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-05	HDD05-24	05/18	158
	HDD05-25	05/19	159
	HDD05-26	05/1A	15A
	HDD05-27	05/1B	15B
	HDD05-28	05/1C	15C
	HDD05-29	05/1D	15D
	HDD05-30	05/1E	15E
	HDD05-31	05/1F	15F
	HDD05-32	05/20	160
	HDD05-33	05/21	161
	HDD05-34	05/22	162
	HDD05-35	05/23	163
	HDD05-36	05/24	164
	HDD05-37	05/25	165
	HDD05-38	05/26	166
	HDD05-39	05/27	167
	HDD05-40	05/28	168
	HDD05-41	05/29	169
	HDD05-42	05/2A	16A
	HDD05-43	05/2B	16B
	HDD05-44	05/2C	16C
	HDD05-45	05/2D	16D
	HDD05-46	05/2E	16E
	HDD05-47	05/2F	16F
	HDD05-48	05/30	170
	HDD05-49	05/31	171
	HDD05-50	05/32	172
	HDD05-51	05/33	173
	HDD05-52	05/34	174
	HDD05-53	05/35	175
	HDD05-54	05/36	176
	HDD05-55	05/37	177
	HDD05-56	05/38	178
	HDD05-57	05/39	179
	HDD05-58	05/3A	17A
	HDD05-59	05/3B	17B

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Table 4-7 DB Number - C/R Number Matrix (DB-06)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-06	HDD06-00	06/00	180
	HDD06-01	06/01	181
	HDD06-02	06/02	182
	HDD06-03	06/03	183
	HDD06-04	06/04	184
	HDD06-05	06/05	185
	HDD06-06	06/06	186
	HDD06-07	06/07	187
	HDD06-08	06/08	188
	HDD06-09	06/09	189
	HDD06-10	06/0A	18A
	HDD06-11	06/0B	18B
	HDD06-12	06/0C	18C
	HDD06-13	06/0D	18D
	HDD06-14	06/0E	18E
	HDD06-15	06/0F	18F
	HDD06-16	06/10	190
	HDD06-17	06/11	191
	HDD06-18	06/12	192
	HDD06-19	06/13	193
	HDD06-20	06/14	194
	HDD06-21	06/15	195
	HDD06-22	06/16	196
	HDD06-23	06/17	197

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-06	HDD06-24	06/18	198
	HDD06-25	06/19	199
	HDD06-26	06/1A	19A
	HDD06-27	06/1B	19B
	HDD06-28	06/1C	19C
	HDD06-29	06/1D	19D
	HDD06-30	06/1E	19E
	HDD06-31	06/1F	19F
	HDD06-32	06/20	1A0
	HDD06-33	06/21	1A1
	HDD06-34	06/22	1A2
	HDD06-35	06/23	1A3
	HDD06-36	06/24	1A4
	HDD06-37	06/25	1A5
	HDD06-38	06/26	1A6
	HDD06-39	06/27	1A7
	HDD06-40	06/28	1A8
	HDD06-41	06/29	1A9
	HDD06-42	06/2A	1AA
	HDD06-43	06/2B	1AB
	HDD06-44	06/2C	1AC
	HDD06-45	06/2D	1AD
	HDD06-46	06/2E	1AE
	HDD06-47	06/2F	1AF
	HDD06-48	06/30	1B0
	HDD06-49	06/31	1B1
	HDD06-50	06/32	1B2
	HDD06-51	06/33	1B3
	HDD06-52	06/34	1B4
	HDD06-53	06/35	1B5
	HDD06-54	06/36	1B6
	HDD06-55	06/37	1B7
	HDD06-56	06/38	1B8
	HDD06-57	06/39	1B9
	HDD06-58	06/3A	1BA
	HDD06-59	06/3B	1BB

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Table 4-8 DB Number - C/R Number Matrix (DB-07)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-07	HDD07-00	07/00	1C0
	HDD07-01	07/01	1C1
	HDD07-02	07/02	1C2
	HDD07-03	07/03	1C3
	HDD07-04	07/04	1C4
	HDD07-05	07/05	1C5
	HDD07-06	07/06	1C6
	HDD07-07	07/07	1C7
	HDD07-08	07/08	1C8
	HDD07-09	07/09	1C9
	HDD07-10	07/0A	1CA
	HDD07-11	07/0B	1CB
	HDD07-12	07/0C	1CC
	HDD07-13	07/0D	1CD
	HDD07-14	07/0E	1CE
	HDD07-15	07/0F	1CF
	HDD07-16	07/10	1D0
	HDD07-17	07/11	1D1
	HDD07-18	07/12	1D2
	HDD07-19	07/13	1D3
	HDD07-20	07/14	1D4
	HDD07-21	07/15	1D5
	HDD07-22	07/16	1D6
	HDD07-23	07/17	1D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-07	HDD07-24	07/18	1D8
	HDD07-25	07/19	1D9
	HDD07-26	07/1A	1DA
	HDD07-27	07/1B	1DB
	HDD07-28	07/1C	1DC
	HDD07-29	07/1D	1DD
	HDD07-30	07/1E	1DE
	HDD07-31	07/1F	1DF
	HDD07-32	07/20	1E0
	HDD07-33	07/21	1E1
	HDD07-34	07/22	1E2
	HDD07-35	07/23	1E3
	HDD07-36	07/24	1E4
	HDD07-37	07/25	1E5
	HDD07-38	07/26	1E6
	HDD07-39	07/27	1E7
	HDD07-40	07/28	1E8
	HDD07-41	07/29	1E9
	HDD07-42	07/2A	1EA
	HDD07-43	07/2B	1EB
	HDD07-44	07/2C	1EC
	HDD07-45	07/2D	1ED
	HDD07-46	07/2E	1EE
	HDD07-47	07/2F	1EF
	HDD07-48	07/30	1F0
	HDD07-49	07/31	1F1
	HDD07-50	07/32	1F2
	HDD07-51	07/33	1F3
	HDD07-52	07/34	1F4
	HDD07-53	07/35	1F5
	HDD07-54	07/36	1F6
	HDD07-55	07/37	1F7
	HDD07-56	07/38	1F8
	HDD07-57	07/39	1F9
	HDD07-58	07/3A	1FA
	HDD07-59	07/3B	1FB

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Table 4-9 DB Number - C/R Number Matrix (DB-08)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-08	HDD08-00	08/00	200
	HDD08-01	08/01	201
	HDD08-02	08/02	202
	HDD08-03	08/03	203
	HDD08-04	08/04	204
	HDD08-05	08/05	205
	HDD08-06	08/06	206
	HDD08-07	08/07	207
	HDD08-08	08/08	208
	HDD08-09	08/09	209
	HDD08-10	08/0A	20A
	HDD08-11	08/0B	20B
	HDD08-12	08/0C	20C
	HDD08-13	08/0D	20D
	HDD08-14	08/0E	20E
	HDD08-15	08/0F	20F
	HDD08-16	08/10	210
	HDD08-17	08/11	211
	HDD08-18	08/12	212
	HDD08-19	08/13	213
	HDD08-20	08/14	214
	HDD08-21	08/15	215
	HDD08-22	08/16	216
	HDD08-23	08/17	217

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-08	HDD08-24	08/18	218
	HDD08-25	08/19	219
	HDD08-26	08/1A	21A
	HDD08-27	08/1B	21B
	HDD08-28	08/1C	21C
	HDD08-29	08/1D	21D
	HDD08-30	08/1E	21E
	HDD08-31	08/1F	21F
	HDD08-32	08/20	220
	HDD08-33	08/21	221
	HDD08-34	08/22	222
	HDD08-35	08/23	223
	HDD08-36	08/24	224
	HDD08-37	08/25	225
	HDD08-38	08/26	226
	HDD08-39	08/27	227
	HDD08-40	08/28	228
	HDD08-41	08/29	229
	HDD08-42	08/2A	22A
	HDD08-43	08/2B	22B
	HDD08-44	08/2C	22C
	HDD08-45	08/2D	22D
	HDD08-46	08/2E	22E
	HDD08-47	08/2F	22F
	HDD08-48	08/30	230
	HDD08-49	08/31	231
	HDD08-50	08/32	232
	HDD08-51	08/33	233
	HDD08-52	08/34	234
	HDD08-53	08/35	235
	HDD08-54	08/36	236
	HDD08-55	08/37	237
	HDD08-56	08/38	238
	HDD08-57	08/39	239
	HDD08-58	08/3A	23A
	HDD08-59	08/3B	23B

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Table 4-10 DB Number - C/R Number Matrix (DB-09)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-09	HDD09-00	09/00	240
	HDD09-01	09/01	241
	HDD09-02	09/02	242
	HDD09-03	09/03	243
	HDD09-04	09/04	244
	HDD09-05	09/05	245
	HDD09-06	09/06	246
	HDD09-07	09/07	247
	HDD09-08	09/08	248
	HDD09-09	09/09	249
	HDD09-10	09/0A	24A
	HDD09-11	09/0B	24B
	HDD09-12	09/0C	24C
	HDD09-13	09/0D	24D
	HDD09-14	09/0E	24E
	HDD09-15	09/0F	24F
	HDD09-16	09/10	250
	HDD09-17	09/11	251
	HDD09-18	09/12	252
	HDD09-19	09/13	253
	HDD09-20	09/14	254
	HDD09-21	09/15	255
	HDD09-22	09/16	256
	HDD09-23	09/17	257

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-09	HDD09-24	09/18	258
	HDD09-25	09/19	259
	HDD09-26	09/1A	25A
	HDD09-27	09/1B	25B
	HDD09-28	09/1C	25C
	HDD09-29	09/1D	25D
	HDD09-30	09/1E	25E
	HDD09-31	09/1F	25F
	HDD09-32	09/20	260
	HDD09-33	09/21	261
	HDD09-34	09/22	262
	HDD09-35	09/23	263
	HDD09-36	09/24	264
	HDD09-37	09/25	265
	HDD09-38	09/26	266
	HDD09-39	09/27	267
	HDD09-40	09/28	268
	HDD09-41	09/29	269
	HDD09-42	09/2A	26A
	HDD09-43	09/2B	26B
	HDD09-44	09/2C	26C
	HDD09-45	09/2D	26D
	HDD09-46	09/2E	26E
	HDD09-47	09/2F	26F
	HDD09-48	09/30	270
	HDD09-49	09/31	271
	HDD09-50	09/32	272
	HDD09-51	09/33	273
	HDD09-52	09/34	274
	HDD09-53	09/35	275
	HDD09-54	09/36	276
	HDD09-55	09/37	277
	HDD09-56	09/38	278
	HDD09-57	09/39	279
	HDD09-58	09/3A	27A
	HDD09-59	09/3B	27B

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Table 4-11 DB Number - C/R Number Matrix (DB-10)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-10	HDD10-00	0A/00	280
	HDD10-01	0A/01	281
	HDD10-02	0A/02	282
	HDD10-03	0A/03	283
	HDD10-04	0A/04	284
	HDD10-05	0A/05	285
	HDD10-06	0A/06	286
	HDD10-07	0A/07	287
	HDD10-08	0A/08	288
	HDD10-09	0A/09	289
	HDD10-10	0A/0A	28A
	HDD10-11	0A/0B	28B
	HDD10-12	0A/0C	28C
	HDD10-13	0A/0D	28D
	HDD10-14	0A/0E	28E
	HDD10-15	0A/0F	28F
	HDD10-16	0A/10	290
	HDD10-17	0A/11	291
	HDD10-18	0A/12	292
	HDD10-19	0A/13	293
	HDD10-20	0A/14	294
	HDD10-21	0A/15	295
	HDD10-22	0A/16	296
	HDD10-23	0A/17	297

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-10	HDD10-24	0A/18	298
	HDD10-25	0A/19	299
	HDD10-26	0A/1A	29A
	HDD10-27	0A/1B	29B
	HDD10-28	0A/1C	29C
	HDD10-29	0A/1D	29D
	HDD10-30	0A/1E	29E
	HDD10-31	0A/1F	29F
	HDD10-32	0A/20	2A0
	HDD10-33	0A/21	2A1
	HDD10-34	0A/22	2A2
	HDD10-35	0A/23	2A3
	HDD10-36	0A/24	2A4
	HDD10-37	0A/25	2A5
	HDD10-38	0A/26	2A6
	HDD10-39	0A/27	2A7
	HDD10-40	0A/28	2A8
	HDD10-41	0A/29	2A9
	HDD10-42	0A/2A	2AA
	HDD10-43	0A/2B	2AB
	HDD10-44	0A/2C	2AC
	HDD10-45	0A/2D	2AD
	HDD10-46	0A/2E	2AE
	HDD10-47	0A/2F	2AF
	HDD10-48	0A/30	2B0
	HDD10-49	0A/31	2B1
	HDD10-50	0A/32	2B2
	HDD10-51	0A/33	2B3
	HDD10-52	0A/34	2B4
	HDD10-53	0A/35	2B5
	HDD10-54	0A/36	2B6
	HDD10-55	0A/37	2B7
	HDD10-56	0A/38	2B8
	HDD10-57	0A/39	2B9
	HDD10-58	0A/3A	2BA
	HDD10-59	0A/3B	2BB

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Table 4-12 DB Number - C/R Number Matrix (DB-11)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-11	HDD11-00	0B/00	2C0
	HDD11-01	0B/01	2C1
	HDD11-02	0B/02	2C2
	HDD11-03	0B/03	2C3
	HDD11-04	0B/04	2C4
	HDD11-05	0B/05	2C5
	HDD11-06	0B/06	2C6
	HDD11-07	0B/07	2C7
	HDD11-08	0B/08	2C8
	HDD11-09	0B/09	2C9
	HDD11-10	0B/0A	2CA
	HDD11-11	0B/0B	2CB
	HDD11-12	0B/0C	2CC
	HDD11-13	0B/0D	2CD
	HDD11-14	0B/0E	2CE
	HDD11-15	0B/0F	2CF
	HDD11-16	0B/10	2D0
	HDD11-17	0B/11	2D1
	HDD11-18	0B/12	2D2
	HDD11-19	0B/13	2D3
	HDD11-20	0B/14	2D4
	HDD11-21	0B/15	2D5
	HDD11-22	0B/16	2D6
	HDD11-23	0B/17	2D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-11	HDD11-24	0B/18	2D8
	HDD11-25	0B/19	2D9
	HDD11-26	0B/1A	2DA
	HDD11-27	0B/1B	2DB
	HDD11-28	0B/1C	2DC
	HDD11-29	0B/1D	2DD
	HDD11-30	0B/1E	2DE
	HDD11-31	0B/1F	2DF
	HDD11-32	0B/20	2E0
	HDD11-33	0B/21	2E1
	HDD11-34	0B/22	2E2
	HDD11-35	0B/23	2E3
	HDD11-36	0B/24	2E4
	HDD11-37	0B/25	2E5
	HDD11-38	0B/26	2E6
	HDD11-39	0B/27	2E7
	HDD11-40	0B/28	2E8
	HDD11-41	0B/29	2E9
	HDD11-42	0B/2A	2EA
	HDD11-43	0B/2B	2EB
	HDD11-44	0B/2C	2EC
	HDD11-45	0B/2D	2ED
	HDD11-46	0B/2E	2EE
	HDD11-47	0B/2F	2EF
	HDD11-48	0B/30	2F0
	HDD11-49	0B/31	2F1
	HDD11-50	0B/32	2F2
	HDD11-51	0B/33	2F3
	HDD11-52	0B/34	2F4
	HDD11-53	0B/35	2F5
	HDD11-54	0B/36	2F6
	HDD11-55	0B/37	2F7
	HDD11-56	0B/38	2F8
	HDD11-57	0B/39	2F9
	HDD11-58	0B/3A	2FA
	HDD11-59	0B/3B	2FB

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Table 4-13 DB Number - C/R Number Matrix (DB-12)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-12	HDD12-00	0C/00	300
	HDD12-01	0C/01	301
	HDD12-02	0C/02	302
	HDD12-03	0C/03	303
	HDD12-04	0C/04	304
	HDD12-05	0C/05	305
	HDD12-06	0C/06	306
	HDD12-07	0C/07	307
	HDD12-08	0C/08	308
	HDD12-09	0C/09	309
	HDD12-10	0C/0A	30A
	HDD12-11	0C/0B	30B
	HDD12-12	0C/0C	30C
	HDD12-13	0C/0D	30D
	HDD12-14	0C/0E	30E
	HDD12-15	0C/0F	30F
	HDD12-16	0C/10	310
	HDD12-17	0C/11	311
	HDD12-18	0C/12	312
	HDD12-19	0C/13	313
	HDD12-20	0C/14	314
	HDD12-21	0C/15	315
	HDD12-22	0C/16	316
	HDD12-23	0C/17	317

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-12	HDD12-24	0C/18	318
	HDD12-25	0C/19	319
	HDD12-26	0C/1A	31A
	HDD12-27	0C/1B	31B
	HDD12-28	0C/1C	31C
	HDD12-29	0C/1D	31D
	HDD12-30	0C/1E	31E
	HDD12-31	0C/1F	31F
	HDD12-32	0C/20	320
	HDD12-33	0C/21	321
	HDD12-34	0C/22	322
	HDD12-35	0C/23	323
	HDD12-36	0C/24	324
	HDD12-37	0C/25	325
	HDD12-38	0C/26	326
	HDD12-39	0C/27	327
	HDD12-40	0C/28	328
	HDD12-41	0C/29	329
	HDD12-42	0C/2A	32A
	HDD12-43	0C/2B	32B
	HDD12-44	0C/2C	32C
	HDD12-45	0C/2D	32D
	HDD12-46	0C/2E	32E
	HDD12-47	0C/2F	32F
	HDD12-48	0C/30	330
	HDD12-49	0C/31	331
	HDD12-50	0C/32	332
	HDD12-51	0C/33	333
	HDD12-52	0C/34	334
	HDD12-53	0C/35	335
	HDD12-54	0C/36	336
	HDD12-55	0C/37	337
	HDD12-56	0C/38	338
	HDD12-57	0C/39	339
	HDD12-58	0C/3A	33A
	HDD12-59	0C/3B	33B

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Table 4-14 DB Number - C/R Number Matrix (DB-13)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-13	HDD13-00	0D/00	340
	HDD13-01	0D/01	341
	HDD13-02	0D/02	342
	HDD13-03	0D/03	343
	HDD13-04	0D/04	344
	HDD13-05	0D/05	345
	HDD13-06	0D/06	346
	HDD13-07	0D/07	347
	HDD13-08	0D/08	348
	HDD13-09	0D/09	349
	HDD13-10	0D/0A	34A
	HDD13-11	0D/0B	34B
	HDD13-12	0D/0C	34C
	HDD13-13	0D/0D	34D
	HDD13-14	0D/0E	34E
	HDD13-15	0D/0F	34F
	HDD13-16	0D/10	350
	HDD13-17	0D/11	351
	HDD13-18	0D/12	352
	HDD13-19	0D/13	353
	HDD13-20	0D/14	354
	HDD13-21	0D/15	355
	HDD13-22	0D/16	356
	HDD13-23	0D/17	357

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-13	HDD13-24	0D/18	358
	HDD13-25	0D/19	359
	HDD13-26	0D/1A	35A
	HDD13-27	0D/1B	35B
	HDD13-28	0D/1C	35C
	HDD13-29	0D/1D	35D
	HDD13-30	0D/1E	35E
	HDD13-31	0D/1F	35F
	HDD13-32	0D/20	360
	HDD13-33	0D/21	361
	HDD13-34	0D/22	362
	HDD13-35	0D/23	363
	HDD13-36	0D/24	364
	HDD13-37	0D/25	365
	HDD13-38	0D/26	366
	HDD13-39	0D/27	367
	HDD13-40	0D/28	368
	HDD13-41	0D/29	369
	HDD13-42	0D/2A	36A
	HDD13-43	0D/2B	36B
	HDD13-44	0D/2C	36C
	HDD13-45	0D/2D	36D
	HDD13-46	0D/2E	36E
	HDD13-47	0D/2F	36F
	HDD13-48	0D/30	370
	HDD13-49	0D/31	371
	HDD13-50	0D/32	372
	HDD13-51	0D/33	373
	HDD13-52	0D/34	374
	HDD13-53	0D/35	375
	HDD13-54	0D/36	376
	HDD13-55	0D/37	377
	HDD13-56	0D/38	378
	HDD13-57	0D/39	379
	HDD13-58	0D/3A	37A
	HDD13-59	0D/3B	37B

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Table 4-15 DB Number - C/R Number Matrix (DB-14)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-14	HDD14-00	0E/00	380
	HDD14-01	0E/01	381
	HDD14-02	0E/02	382
	HDD14-03	0E/03	383
	HDD14-04	0E/04	384
	HDD14-05	0E/05	385
	HDD14-06	0E/06	386
	HDD14-07	0E/07	387
	HDD14-08	0E/08	388
	HDD14-09	0E/09	389
	HDD14-10	0E/0A	38A
	HDD14-11	0E/0B	38B
	HDD14-12	0E/0C	38C
	HDD14-13	0E/0D	38D
	HDD14-14	0E/0E	38E
	HDD14-15	0E/0F	38F
	HDD14-16	0E/10	390
	HDD14-17	0E/11	391
	HDD14-18	0E/12	392
	HDD14-19	0E/13	393
	HDD14-20	0E/14	394
	HDD14-21	0E/15	395
	HDD14-22	0E/16	396
	HDD14-23	0E/17	397

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-14	HDD14-24	0E/18	398
	HDD14-25	0E/19	399
	HDD14-26	0E/1A	39A
	HDD14-27	0E/1B	39B
	HDD14-28	0E/1C	39C
	HDD14-29	0E/1D	39D
	HDD14-30	0E/1E	39E
	HDD14-31	0E/1F	39F
	HDD14-32	0E/20	3A0
	HDD14-33	0E/21	3A1
	HDD14-34	0E/22	3A2
	HDD14-35	0E/23	3A3
	HDD14-36	0E/24	3A4
	HDD14-37	0E/25	3A5
	HDD14-38	0E/26	3A6
	HDD14-39	0E/27	3A7
	HDD14-40	0E/28	3A8
	HDD14-41	0E/29	3A9
	HDD14-42	0E/2A	3AA
	HDD14-43	0E/2B	3AB
	HDD14-44	0E/2C	3AC
	HDD14-45	0E/2D	3AD
	HDD14-46	0E/2E	3AE
	HDD14-47	0E/2F	3AF
	HDD14-48	0E/30	3B0
	HDD14-49	0E/31	3B1
	HDD14-50	0E/32	3B2
	HDD14-51	0E/33	3B3
	HDD14-52	0E/34	3B4
	HDD14-53	0E/35	3B5
	HDD14-54	0E/36	3B6
	HDD14-55	0E/37	3B7
	HDD14-56	0E/38	3B8
	HDD14-57	0E/39	3B9
	HDD14-58	0E/3A	3BA
	HDD14-59	0E/3B	3BB

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Table 4-16 DB Number - C/R Number Matrix (DB-15)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-15	HDD15-00	0F/00	3C0
	HDD15-01	0F/01	3C1
	HDD15-02	0F/02	3C2
	HDD15-03	0F/03	3C3
	HDD15-04	0F/04	3C4
	HDD15-05	0F/05	3C5
	HDD15-06	0F/06	3C6
	HDD15-07	0F/07	3C7
	HDD15-08	0F/08	3C8
	HDD15-09	0F/09	3C9
	HDD15-10	0F/0A	3CA
	HDD15-11	0F/0B	3CB
	HDD15-12	0F/0C	3CC
	HDD15-13	0F/0D	3CD
	HDD15-14	0F/0E	3CE
	HDD15-15	0F/0F	3CF
	HDD15-16	0F/10	3D0
	HDD15-17	0F/11	3D1
	HDD15-18	0F/12	3D2
	HDD15-19	0F/13	3D3
	HDD15-20	0F/14	3D4
	HDD15-21	0F/15	3D5
	HDD15-22	0F/16	3D6
	HDD15-23	0F/17	3D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-15	HDD15-24	0F/18	3D8
	HDD15-25	0F/19	3D9
	HDD15-26	0F/1A	3DA
	HDD15-27	0F/1B	3DB
	HDD15-28	0F/1C	3DC
	HDD15-29	0F/1D	3DD
	HDD15-30	0F/1E	3DE
	HDD15-31	0F/1F	3DF
	HDD15-32	0F/20	3E0
	HDD15-33	0F/21	3E1
	HDD15-34	0F/22	3E2
	HDD15-35	0F/23	3E3
	HDD15-36	0F/24	3E4
	HDD15-37	0F/25	3E5
	HDD15-38	0F/26	3E6
	HDD15-39	0F/27	3E7
	HDD15-40	0F/28	3E8
	HDD15-41	0F/29	3E9
	HDD15-42	0F/2A	3EA
	HDD15-43	0F/2B	3EB
	HDD15-44	0F/2C	3EC
	HDD15-45	0F/2D	3ED
	HDD15-46	0F/2E	3EE
	HDD15-47	0F/2F	3EF
	HDD15-48	0F/30	3F0
	HDD15-49	0F/31	3F1
	HDD15-50	0F/32	3F2
	HDD15-51	0F/33	3F3
	HDD15-52	0F/34	3F4
	HDD15-53	0F/35	3F5
	HDD15-54	0F/36	3F6
	HDD15-55	0F/37	3F7
	HDD15-56	0F/38	3F8
	HDD15-57	0F/39	3F9
	HDD15-58	0F/3A	3FA
	HDD15-59	0F/3B	3FB

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Table 4-17 DB Number - C/R Number Matrix (DB-16)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-16	HDD16-00	10/00	400
	HDD16-01	10/01	401
	HDD16-02	10/02	402
	HDD16-03	10/03	403
	HDD16-04	10/04	404
	HDD16-05	10/05	405
	HDD16-06	10/06	406
	HDD16-07	10/07	407
	HDD16-08	10/08	408
	HDD16-09	10/09	409
	HDD16-10	10/0A	40A
	HDD16-11	10/0B	40B
	HDD16-12	10/0C	40C
	HDD16-13	10/0D	40D
	HDD16-14	10/0E	40E
	HDD16-15	10/0F	40F
	HDD16-16	10/10	410
	HDD16-17	10/11	411
	HDD16-18	10/12	412
	HDD16-19	10/13	413
	HDD16-20	10/14	414
	HDD16-21	10/15	415
	HDD16-22	10/16	416
	HDD16-23	10/17	417

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-16	HDD16-24	10/18	418
	HDD16-25	10/19	419
	HDD16-26	10/1A	41A
	HDD16-27	10/1B	41B
	HDD16-28	10/1C	41C
	HDD16-29	10/1D	41D
	HDD16-30	10/1E	41E
	HDD16-31	10/1F	41F
	HDD16-32	10/20	420
	HDD16-33	10/21	421
	HDD16-34	10/22	422
	HDD16-35	10/23	423
	HDD16-36	10/24	424
	HDD16-37	10/25	425
	HDD16-38	10/26	426
	HDD16-39	10/27	427
	HDD16-40	10/28	428
	HDD16-41	10/29	429
	HDD16-42	10/2A	42A
	HDD16-43	10/2B	42B
	HDD16-44	10/2C	42C
	HDD16-45	10/2D	42D
	HDD16-46	10/2E	42E
	HDD16-47	10/2F	42F
	HDD16-48	10/30	430
	HDD16-49	10/31	431
	HDD16-50	10/32	432
	HDD16-51	10/33	433
	HDD16-52	10/34	434
	HDD16-53	10/35	435
	HDD16-54	10/36	436
	HDD16-55	10/37	437
	HDD16-56	10/38	438
	HDD16-57	10/39	439
	HDD16-58	10/3A	43A
	HDD16-59	10/3B	43B

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Table 4-18 DB Number - C/R Number Matrix (DB-17)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-17	HDD17-00	11/00	440
	HDD17-01	11/01	441
	HDD17-02	11/02	442
	HDD17-03	11/03	443
	HDD17-04	11/04	444
	HDD17-05	11/05	445
	HDD17-06	11/06	446
	HDD17-07	11/07	447
	HDD17-08	11/08	448
	HDD17-09	11/09	449
	HDD17-10	11/0A	44A
	HDD17-11	11/0B	44B
	HDD17-12	11/0C	44C
	HDD17-13	11/0D	44D
	HDD17-14	11/0E	44E
	HDD17-15	11/0F	44F
	HDD17-16	11/10	450
	HDD17-17	11/11	451
	HDD17-18	11/12	452
	HDD17-19	11/13	453
	HDD17-20	11/14	454
	HDD17-21	11/15	455
	HDD17-22	11/16	456
	HDD17-23	11/17	457

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-17	HDD17-24	11/18	458
	HDD17-25	11/19	459
	HDD17-26	11/1A	45A
	HDD17-27	11/1B	45B
	HDD17-28	11/1C	45C
	HDD17-29	11/1D	45D
	HDD17-30	11/1E	45E
	HDD17-31	11/1F	45F
	HDD17-32	11/20	460
	HDD17-33	11/21	461
	HDD17-34	11/22	462
	HDD17-35	11/23	463
	HDD17-36	11/24	464
	HDD17-37	11/25	465
	HDD17-38	11/26	466
	HDD17-39	11/27	467
	HDD17-40	11/28	468
	HDD17-41	11/29	469
	HDD17-42	11/2A	46A
	HDD17-43	11/2B	46B
	HDD17-44	11/2C	46C
	HDD17-45	11/2D	46D
	HDD17-46	11/2E	46E
	HDD17-47	11/2F	46F
	HDD17-48	11/30	470
	HDD17-49	11/31	471
	HDD17-50	11/32	472
	HDD17-51	11/33	473
	HDD17-52	11/34	474
	HDD17-53	11/35	475
	HDD17-54	11/36	476
	HDD17-55	11/37	477
	HDD17-56	11/38	478
	HDD17-57	11/39	479
	HDD17-58	11/3A	47A
	HDD17-59	11/3B	47B

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Table 4-19 DB Number - C/R Number Matrix (DB-18)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-18	HDD18-00	12/00	480
	HDD18-01	12/01	481
	HDD18-02	12/02	482
	HDD18-03	12/03	483
	HDD18-04	12/04	484
	HDD18-05	12/05	485
	HDD18-06	12/06	486
	HDD18-07	12/07	487
	HDD18-08	12/08	488
	HDD18-09	12/09	489
	HDD18-10	12/0A	48A
	HDD18-11	12/0B	48B
	HDD18-12	12/0C	48C
	HDD18-13	12/0D	48D
	HDD18-14	12/0E	48E
	HDD18-15	12/0F	48F
	HDD18-16	12/10	490
	HDD18-17	12/11	491
	HDD18-18	12/12	492
	HDD18-19	12/13	493
	HDD18-20	12/14	494
	HDD18-21	12/15	495
	HDD18-22	12/16	496
	HDD18-23	12/17	497

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-18	HDD18-24	12/18	498
	HDD18-25	12/19	499
	HDD18-26	12/1A	49A
	HDD18-27	12/1B	49B
	HDD18-28	12/1C	49C
	HDD18-29	12/1D	49D
	HDD18-30	12/1E	49E
	HDD18-31	12/1F	49F
	HDD18-32	12/20	4A0
	HDD18-33	12/21	4A1
	HDD18-34	12/22	4A2
	HDD18-35	12/23	4A3
	HDD18-36	12/24	4A4
	HDD18-37	12/25	4A5
	HDD18-38	12/26	4A6
	HDD18-39	12/27	4A7
	HDD18-40	12/28	4A8
	HDD18-41	12/29	4A9
	HDD18-42	12/2A	4AA
	HDD18-43	12/2B	4AB
	HDD18-44	12/2C	4AC
	HDD18-45	12/2D	4AD
	HDD18-46	12/2E	4AE
	HDD18-47	12/2F	4AF
	HDD18-48	12/30	4B0
	HDD18-49	12/31	4B1
	HDD18-50	12/32	4B2
	HDD18-51	12/33	4B3
	HDD18-52	12/34	4B4
	HDD18-53	12/35	4B5
	HDD18-54	12/36	4B6
	HDD18-55	12/37	4B7
	HDD18-56	12/38	4B8
	HDD18-57	12/39	4B9
	HDD18-58	12/3A	4BA
	HDD18-59	12/3B	4BB

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Table 4-20 DB Number - C/R Number Matrix (DB-19)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-19	HDD19-00	13/00	4C0
	HDD19-01	13/01	4C1
	HDD19-02	13/02	4C2
	HDD19-03	13/03	4C3
	HDD19-04	13/04	4C4
	HDD19-05	13/05	4C5
	HDD19-06	13/06	4C6
	HDD19-07	13/07	4C7
	HDD19-08	13/08	4C8
	HDD19-09	13/09	4C9
	HDD19-10	13/0A	4CA
	HDD19-11	13/0B	4CB
	HDD19-12	13/0C	4CC
	HDD19-13	13/0D	4CD
	HDD19-14	13/0E	4CE
	HDD19-15	13/0F	4CF
	HDD19-16	13/10	4D0
	HDD19-17	13/11	4D1
	HDD19-18	13/12	4D2
	HDD19-19	13/13	4D3
	HDD19-20	13/14	4D4
	HDD19-21	13/15	4D5
	HDD19-22	13/16	4D6
	HDD19-23	13/17	4D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-19	HDD19-24	13/18	4D8
	HDD19-25	13/19	4D9
	HDD19-26	13/1A	4DA
	HDD19-27	13/1B	4DB
	HDD19-28	13/1C	4DC
	HDD19-29	13/1D	4DD
	HDD19-30	13/1E	4DE
	HDD19-31	13/1F	4DF
	HDD19-32	13/20	4E0
	HDD19-33	13/21	4E1
	HDD19-34	13/22	4E2
	HDD19-35	13/23	4E3
	HDD19-36	13/24	4E4
	HDD19-37	13/25	4E5
	HDD19-38	13/26	4E6
	HDD19-39	13/27	4E7
	HDD19-40	13/28	4E8
	HDD19-41	13/29	4E9
	HDD19-42	13/2A	4EA
	HDD19-43	13/2B	4EB
	HDD19-44	13/2C	4EC
	HDD19-45	13/2D	4ED
	HDD19-46	13/2E	4EE
	HDD19-47	13/2F	4EF
	HDD19-48	13/30	4F0
	HDD19-49	13/31	4F1
	HDD19-50	13/32	4F2
	HDD19-51	13/33	4F3
	HDD19-52	13/34	4F4
	HDD19-53	13/35	4F5
	HDD19-54	13/36	4F6
	HDD19-55	13/37	4F7
	HDD19-56	13/38	4F8
	HDD19-57	13/39	4F9
	HDD19-58	13/3A	4FA
	HDD19-59	13/3B	4FB

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Table 4-21 DB Number - C/R Number Matrix (DB-20)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-20	HDD20-00	14/00	500
	HDD20-01	14/01	501
	HDD20-02	14/02	502
	HDD20-03	14/03	503
	HDD20-04	14/04	504
	HDD20-05	14/05	505
	HDD20-06	14/06	506
	HDD20-07	14/07	507
	HDD20-08	14/08	508
	HDD20-09	14/09	509
	HDD20-10	14/0A	50A
	HDD20-11	14/0B	50B
	HDD20-12	14/0C	50C
	HDD20-13	14/0D	50D
	HDD20-14	14/0E	50E
	HDD20-15	14/0F	50F
	HDD20-16	14/10	510
	HDD20-17	14/11	511
	HDD20-18	14/12	512
	HDD20-19	14/13	513
	HDD20-20	14/14	514
	HDD20-21	14/15	515
	HDD20-22	14/16	516
	HDD20-23	14/17	517

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-20	HDD20-24	14/18	518
	HDD20-25	14/19	519
	HDD20-26	14/1A	51A
	HDD20-27	14/1B	51B
	HDD20-28	14/1C	51C
	HDD20-29	14/1D	51D
	HDD20-30	14/1E	51E
	HDD20-31	14/1F	51F
	HDD20-32	14/20	520
	HDD20-33	14/21	521
	HDD20-34	14/22	522
	HDD20-35	14/23	523
	HDD20-36	14/24	524
	HDD20-37	14/25	525
	HDD20-38	14/26	526
	HDD20-39	14/27	527
	HDD20-40	14/28	528
	HDD20-41	14/29	529
	HDD20-42	14/2A	52A
	HDD20-43	14/2B	52B
	HDD20-44	14/2C	52C
	HDD20-45	14/2D	52D
	HDD20-46	14/2E	52E
	HDD20-47	14/2F	52F
	HDD20-48	14/30	530
	HDD20-49	14/31	531
	HDD20-50	14/32	532
	HDD20-51	14/33	533
	HDD20-52	14/34	534
	HDD20-53	14/35	535
	HDD20-54	14/36	536
	HDD20-55	14/37	537
	HDD20-56	14/38	538
	HDD20-57	14/39	539
	HDD20-58	14/3A	53A
	HDD20-59	14/3B	53B

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Table 4-22 DB Number - C/R Number Matrix (DB-21)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-21	HDD21-00	15/00	540
	HDD21-01	15/01	541
	HDD21-02	15/02	542
	HDD21-03	15/03	543
	HDD21-04	15/04	544
	HDD21-05	15/05	545
	HDD21-06	15/06	546
	HDD21-07	15/07	547
	HDD21-08	15/08	548
	HDD21-09	15/09	549
	HDD21-10	15/0A	54A
	HDD21-11	15/0B	54B
	HDD21-12	15/0C	54C
	HDD21-13	15/0D	54D
	HDD21-14	15/0E	54E
	HDD21-15	15/0F	54F
	HDD21-16	15/10	550
	HDD21-17	15/11	551
	HDD21-18	15/12	552
	HDD21-19	15/13	553
	HDD21-20	15/14	554
	HDD21-21	15/15	555
	HDD21-22	15/16	556
	HDD21-23	15/17	557

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-21	HDD21-24	15/18	558
	HDD21-25	15/19	559
	HDD21-26	15/1A	55A
	HDD21-27	15/1B	55B
	HDD21-28	15/1C	55C
	HDD21-29	15/1D	55D
	HDD21-30	15/1E	55E
	HDD21-31	15/1F	55F
	HDD21-32	15/20	560
	HDD21-33	15/21	561
	HDD21-34	15/22	562
	HDD21-35	15/23	563
	HDD21-36	15/24	564
	HDD21-37	15/25	565
	HDD21-38	15/26	566
	HDD21-39	15/27	567
	HDD21-40	15/28	568
	HDD21-41	15/29	569
	HDD21-42	15/2A	56A
	HDD21-43	15/2B	56B
	HDD21-44	15/2C	56C
	HDD21-45	15/2D	56D
	HDD21-46	15/2E	56E
	HDD21-47	15/2F	56F
	HDD21-48	15/30	570
	HDD21-49	15/31	571
	HDD21-50	15/32	572
	HDD21-51	15/33	573
	HDD21-52	15/34	574
	HDD21-53	15/35	575
	HDD21-54	15/36	576
	HDD21-55	15/37	577
	HDD21-56	15/38	578
	HDD21-57	15/39	579
	HDD21-58	15/3A	57A
	HDD21-59	15/3B	57B

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Table 4-23 DB Number - C/R Number Matrix (DB-22)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-22	HDD22-00	16/00	580
	HDD22-01	16/01	581
	HDD22-02	16/02	582
	HDD22-03	16/03	583
	HDD22-04	16/04	584
	HDD22-05	16/05	585
	HDD22-06	16/06	586
	HDD22-07	16/07	587
	HDD22-08	16/08	588
	HDD22-09	16/09	589
	HDD22-10	16/0A	58A
	HDD22-11	16/0B	58B
	HDD22-12	16/0C	58C
	HDD22-13	16/0D	58D
	HDD22-14	16/0E	58E
	HDD22-15	16/0F	58F
	HDD22-16	16/10	590
	HDD22-17	16/11	591
	HDD22-18	16/12	592
	HDD22-19	16/13	593
	HDD22-20	16/14	594
	HDD22-21	16/15	595
	HDD22-22	16/16	596
	HDD22-23	16/17	597

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-22	HDD22-24	16/18	598
	HDD22-25	16/19	599
	HDD22-26	16/1A	59A
	HDD22-27	16/1B	59B
	HDD22-28	16/1C	59C
	HDD22-29	16/1D	59D
	HDD22-30	16/1E	59E
	HDD22-31	16/1F	59F
	HDD22-32	16/20	5A0
	HDD22-33	16/21	5A1
	HDD22-34	16/22	5A2
	HDD22-35	16/23	5A3
	HDD22-36	16/24	5A4
	HDD22-37	16/25	5A5
	HDD22-38	16/26	5A6
	HDD22-39	16/27	5A7
	HDD22-40	16/28	5A8
	HDD22-41	16/29	5A9
	HDD22-42	16/2A	5AA
	HDD22-43	16/2B	5AB
	HDD22-44	16/2C	5AC
	HDD22-45	16/2D	5AD
	HDD22-46	16/2E	5AE
	HDD22-47	16/2F	5AF
	HDD22-48	16/30	5B0
	HDD22-49	16/31	5B1
	HDD22-50	16/32	5B2
	HDD22-51	16/33	5B3
	HDD22-52	16/34	5B4
	HDD22-53	16/35	5B5
	HDD22-54	16/36	5B6
	HDD22-55	16/37	5B7
	HDD22-56	16/38	5B8
	HDD22-57	16/39	5B9
	HDD22-58	16/3A	5BA
	HDD22-59	16/3B	5BB

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Table 4-24 DB Number - C/R Number Matrix (DB-23)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-23	HDD23-00	17/00	5C0
	HDD23-01	17/01	5C1
	HDD23-02	17/02	5C2
	HDD23-03	17/03	5C3
	HDD23-04	17/04	5C4
	HDD23-05	17/05	5C5
	HDD23-06	17/06	5C6
	HDD23-07	17/07	5C7
	HDD23-08	17/08	5C8
	HDD23-09	17/09	5C9
	HDD23-10	17/0A	5CA
	HDD23-11	17/0B	5CB
	HDD23-12	17/0C	5CC
	HDD23-13	17/0D	5CD
	HDD23-14	17/0E	5CE
	HDD23-15	17/0F	5CF
	HDD23-16	17/10	5D0
	HDD23-17	17/11	5D1
	HDD23-18	17/12	5D2
	HDD23-19	17/13	5D3
	HDD23-20	17/14	5D4
	HDD23-21	17/15	5D5
	HDD23-22	17/16	5D6
	HDD23-23	17/17	5D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-23	HDD23-24	17/18	5D8
	HDD23-25	17/19	5D9
	HDD23-26	17/1A	5DA
	HDD23-27	17/1B	5DB
	HDD23-28	17/1C	5DC
	HDD23-29	17/1D	5DD
	HDD23-30	17/1E	5DE
	HDD23-31	17/1F	5DF
	HDD23-32	17/20	5E0
	HDD23-33	17/21	5E1
	HDD23-34	17/22	5E2
	HDD23-35	17/23	5E3
	HDD23-36	17/24	5E4
	HDD23-37	17/25	5E5
	HDD23-38	17/26	5E6
	HDD23-39	17/27	5E7
	HDD23-40	17/28	5E8
	HDD23-41	17/29	5E9
	HDD23-42	17/2A	5EA
	HDD23-43	17/2B	5EB
	HDD23-44	17/2C	5EC
	HDD23-45	17/2D	5ED
	HDD23-46	17/2E	5EE
	HDD23-47	17/2F	5EF
	HDD23-48	17/30	5F0
	HDD23-49	17/31	5F1
	HDD23-50	17/32	5F2
	HDD23-51	17/33	5F3
	HDD23-52	17/34	5F4
	HDD23-53	17/35	5F5
	HDD23-54	17/36	5F6
	HDD23-55	17/37	5F7
	HDD23-56	17/38	5F8
	HDD23-57	17/39	5F9
	HDD23-58	17/3A	5FA
	HDD23-59	17/3B	5FB

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Table 4-25 DB Number - C/R Number Matrix (DB-24)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-24	HDD24-00	18/00	600
	HDD24-01	18/01	601
	HDD24-02	18/02	602
	HDD24-03	18/03	603
	HDD24-04	18/04	604
	HDD24-05	18/05	605
	HDD24-06	18/06	606
	HDD24-07	18/07	607
	HDD24-08	18/08	608
	HDD24-09	18/09	609
	HDD24-10	18/0A	60A
	HDD24-11	18/0B	60B
	HDD24-12	18/0C	60C
	HDD24-13	18/0D	60D
	HDD24-14	18/0E	60E
	HDD24-15	18/0F	60F
	HDD24-16	18/10	610
	HDD24-17	18/11	611
	HDD24-18	18/12	612
	HDD24-19	18/13	613
	HDD24-20	18/14	614
	HDD24-21	18/15	615
	HDD24-22	18/16	616
	HDD24-23	18/17	617

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-24	HDD24-24	18/18	618
	HDD24-25	18/19	619
	HDD24-26	18/1A	61A
	HDD24-27	18/1B	61B
	HDD24-28	18/1C	61C
	HDD24-29	18/1D	61D
	HDD24-30	18/1E	61E
	HDD24-31	18/1F	61F
	HDD24-32	18/20	620
	HDD24-33	18/21	621
	HDD24-34	18/22	622
	HDD24-35	18/23	623
	HDD24-36	18/24	624
	HDD24-37	18/25	625
	HDD24-38	18/26	626
	HDD24-39	18/27	627
	HDD24-40	18/28	628
	HDD24-41	18/29	629
	HDD24-42	18/2A	62A
	HDD24-43	18/2B	62B
	HDD24-44	18/2C	62C
	HDD24-45	18/2D	62D
	HDD24-46	18/2E	62E
	HDD24-47	18/2F	62F
	HDD24-48	18/30	630
	HDD24-49	18/31	631
	HDD24-50	18/32	632
	HDD24-51	18/33	633
	HDD24-52	18/34	634
	HDD24-53	18/35	635
	HDD24-54	18/36	636
	HDD24-55	18/37	637
	HDD24-56	18/38	638
	HDD24-57	18/39	639
	HDD24-58	18/3A	63A
	HDD24-59	18/3B	63B

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Table 4-26 DB Number - C/R Number Matrix (DB-25)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-25	HDD25-00	19/00	640
	HDD25-01	19/01	641
	HDD25-02	19/02	642
	HDD25-03	19/03	643
	HDD25-04	19/04	644
	HDD25-05	19/05	645
	HDD25-06	19/06	646
	HDD25-07	19/07	647
	HDD25-08	19/08	648
	HDD25-09	19/09	649
	HDD25-10	19/0A	64A
	HDD25-11	19/0B	64B
	HDD25-12	19/0C	64C
	HDD25-13	19/0D	64D
	HDD25-14	19/0E	64E
	HDD25-15	19/0F	64F
	HDD25-16	19/10	650
	HDD25-17	19/11	651
	HDD25-18	19/12	652
	HDD25-19	19/13	653
	HDD25-20	19/14	654
	HDD25-21	19/15	655
	HDD25-22	19/16	656
	HDD25-23	19/17	657

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-25	HDD25-24	19/18	658
	HDD25-25	19/19	659
	HDD25-26	19/1A	65A
	HDD25-27	19/1B	65B
	HDD25-28	19/1C	65C
	HDD25-29	19/1D	65D
	HDD25-30	19/1E	65E
	HDD25-31	19/1F	65F
	HDD25-32	19/20	660
	HDD25-33	19/21	661
	HDD25-34	19/22	662
	HDD25-35	19/23	663
	HDD25-36	19/24	664
	HDD25-37	19/25	665
	HDD25-38	19/26	666
	HDD25-39	19/27	667
	HDD25-40	19/28	668
	HDD25-41	19/29	669
	HDD25-42	19/2A	66A
	HDD25-43	19/2B	66B
	HDD25-44	19/2C	66C
	HDD25-45	19/2D	66D
	HDD25-46	19/2E	66E
	HDD25-47	19/2F	66F
	HDD25-48	19/30	670
	HDD25-49	19/31	671
	HDD25-50	19/32	672
	HDD25-51	19/33	673
	HDD25-52	19/34	674
	HDD25-53	19/35	675
	HDD25-54	19/36	676
	HDD25-55	19/37	677
	HDD25-56	19/38	678
	HDD25-57	19/39	679
	HDD25-58	19/3A	67A
	HDD25-59	19/3B	67B

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Table 4-27 DB Number - C/R Number Matrix (DB-26)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-26	HDD26-00	1A/00	680
	HDD26-01	1A/01	681
	HDD26-02	1A/02	682
	HDD26-03	1A/03	683
	HDD26-04	1A/04	684
	HDD26-05	1A/05	685
	HDD26-06	1A/06	686
	HDD26-07	1A/07	687
	HDD26-08	1A/08	688
	HDD26-09	1A/09	689
	HDD26-10	1A/0A	68A
	HDD26-11	1A/0B	68B
	HDD26-12	1A/0C	68C
	HDD26-13	1A/0D	68D
	HDD26-14	1A/0E	68E
	HDD26-15	1A/0F	68F
	HDD26-16	1A/10	690
	HDD26-17	1A/11	691
	HDD26-18	1A/12	692
	HDD26-19	1A/13	693
	HDD26-20	1A/14	694
	HDD26-21	1A/15	695
	HDD26-22	1A/16	696
	HDD26-23	1A/17	697

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-26	HDD26-24	1A/18	698
	HDD26-25	1A/19	699
	HDD26-26	1A/1A	69A
	HDD26-27	1A/1B	69B
	HDD26-28	1A/1C	69C
	HDD26-29	1A/1D	69D
	HDD26-30	1A/1E	69E
	HDD26-31	1A/1F	69F
	HDD26-32	1A/20	6A0
	HDD26-33	1A/21	6A1
	HDD26-34	1A/22	6A2
	HDD26-35	1A/23	6A3
	HDD26-36	1A/24	6A4
	HDD26-37	1A/25	6A5
	HDD26-38	1A/26	6A6
	HDD26-39	1A/27	6A7
	HDD26-40	1A/28	6A8
	HDD26-41	1A/29	6A9
	HDD26-42	1A/2A	6AA
	HDD26-43	1A/2B	6AB
	HDD26-44	1A/2C	6AC
	HDD26-45	1A/2D	6AD
	HDD26-46	1A/2E	6AE
	HDD26-47	1A/2F	6AF
	HDD26-48	1A/30	6B0
	HDD26-49	1A/31	6B1
	HDD26-50	1A/32	6B2
	HDD26-51	1A/33	6B3
	HDD26-52	1A/34	6B4
	HDD26-53	1A/35	6B5
	HDD26-54	1A/36	6B6
	HDD26-55	1A/37	6B7
	HDD26-56	1A/38	6B8
	HDD26-57	1A/39	6B9
	HDD26-58	1A/3A	6BA
	HDD26-59	1A/3B	6BB

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Table 4-28 DB Number - C/R Number Matrix (DB-27)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-27	HDD27-00	1B/00	6C0
	HDD27-01	1B/01	6C1
	HDD27-02	1B/02	6C2
	HDD27-03	1B/03	6C3
	HDD27-04	1B/04	6C4
	HDD27-05	1B/05	6C5
	HDD27-06	1B/06	6C6
	HDD27-07	1B/07	6C7
	HDD27-08	1B/08	6C8
	HDD27-09	1B/09	6C9
	HDD27-10	1B/0A	6CA
	HDD27-11	1B/0B	6CB
	HDD27-12	1B/0C	6CC
	HDD27-13	1B/0D	6CD
	HDD27-14	1B/0E	6CE
	HDD27-15	1B/0F	6CF
	HDD27-16	1B/10	6D0
	HDD27-17	1B/11	6D1
	HDD27-18	1B/12	6D2
	HDD27-19	1B/13	6D3
	HDD27-20	1B/14	6D4
	HDD27-21	1B/15	6D5
	HDD27-22	1B/16	6D6
	HDD27-23	1B/17	6D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-27	HDD27-24	1B/18	6D8
	HDD27-25	1B/19	6D9
	HDD27-26	1B/1A	6DA
	HDD27-27	1B/1B	6DB
	HDD27-28	1B/1C	6DC
	HDD27-29	1B/1D	6DD
	HDD27-30	1B/1E	6DE
	HDD27-31	1B/1F	6DF
	HDD27-32	1B/20	6E0
	HDD27-33	1B/21	6E1
	HDD27-34	1B/22	6E2
	HDD27-35	1B/23	6E3
	HDD27-36	1B/24	6E4
	HDD27-37	1B/25	6E5
	HDD27-38	1B/26	6E6
	HDD27-39	1B/27	6E7
	HDD27-40	1B/28	6E8
	HDD27-41	1B/29	6E9
	HDD27-42	1B/2A	6EA
	HDD27-43	1B/2B	6EB
	HDD27-44	1B/2C	6EC
	HDD27-45	1B/2D	6ED
	HDD27-46	1B/2E	6EE
	HDD27-47	1B/2F	6EF
	HDD27-48	1B/30	6F0
	HDD27-49	1B/31	6F1
	HDD27-50	1B/32	6F2
	HDD27-51	1B/33	6F3
	HDD27-52	1B/34	6F4
	HDD27-53	1B/35	6F5
	HDD27-54	1B/36	6F6
	HDD27-55	1B/37	6F7
	HDD27-56	1B/38	6F8
	HDD27-57	1B/39	6F9
	HDD27-58	1B/3A	6FA
	HDD27-59	1B/3B	6FB

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Table 4-29 DB Number - C/R Number Matrix (DB-28)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-28	HDD28-00	1C/00	700
	HDD28-01	1C/01	701
	HDD28-02	1C/02	702
	HDD28-03	1C/03	703
	HDD28-04	1C/04	704
	HDD28-05	1C/05	705
	HDD28-06	1C/06	706
	HDD28-07	1C/07	707
	HDD28-08	1C/08	708
	HDD28-09	1C/09	709
	HDD28-10	1C/0A	70A
	HDD28-11	1C/0B	70B
	HDD28-12	1C/0C	70C
	HDD28-13	1C/0D	70D
	HDD28-14	1C/0E	70E
	HDD28-15	1C/0F	70F
	HDD28-16	1C/10	710
	HDD28-17	1C/11	711
	HDD28-18	1C/12	712
	HDD28-19	1C/13	713
	HDD28-20	1C/14	714
	HDD28-21	1C/15	715
	HDD28-22	1C/16	716
	HDD28-23	1C/17	717

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-28	HDD28-24	1C/18	718
	HDD28-25	1C/19	719
	HDD28-26	1C/1A	71A
	HDD28-27	1C/1B	71B
	HDD28-28	1C/1C	71C
	HDD28-29	1C/1D	71D
	HDD28-30	1C/1E	71E
	HDD28-31	1C/1F	71F
	HDD28-32	1C/20	720
	HDD28-33	1C/21	721
	HDD28-34	1C/22	722
	HDD28-35	1C/23	723
	HDD28-36	1C/24	724
	HDD28-37	1C/25	725
	HDD28-38	1C/26	726
	HDD28-39	1C/27	727
	HDD28-40	1C/28	728
	HDD28-41	1C/29	729
	HDD28-42	1C/2A	72A
	HDD28-43	1C/2B	72B
	HDD28-44	1C/2C	72C
	HDD28-45	1C/2D	72D
	HDD28-46	1C/2E	72E
	HDD28-47	1C/2F	72F
	HDD28-48	1C/30	730
	HDD28-49	1C/31	731
	HDD28-50	1C/32	732
	HDD28-51	1C/33	733
	HDD28-52	1C/34	734
	HDD28-53	1C/35	735
	HDD28-54	1C/36	736
	HDD28-55	1C/37	737
	HDD28-56	1C/38	738
	HDD28-57	1C/39	739
	HDD28-58	1C/3A	73A
	HDD28-59	1C/3B	73B

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Table 4-30 DB Number - C/R Number Matrix (DB-29)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-29	HDD29-00	1D/00	740
	HDD29-01	1D/01	741
	HDD29-02	1D/02	742
	HDD29-03	1D/03	743
	HDD29-04	1D/04	744
	HDD29-05	1D/05	745
	HDD29-06	1D/06	746
	HDD29-07	1D/07	747
	HDD29-08	1D/08	748
	HDD29-09	1D/09	749
	HDD29-10	1D/0A	74A
	HDD29-11	1D/0B	74B
	HDD29-12	1D/0C	74C
	HDD29-13	1D/0D	74D
	HDD29-14	1D/0E	74E
	HDD29-15	1D/0F	74F
	HDD29-16	1D/10	750
	HDD29-17	1D/11	751
	HDD29-18	1D/12	752
	HDD29-19	1D/13	753
	HDD29-20	1D/14	754
	HDD29-21	1D/15	755
	HDD29-22	1D/16	756
	HDD29-23	1D/17	757

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-29	HDD29-24	1D/18	758
	HDD29-25	1D/19	759
	HDD29-26	1D/1A	75A
	HDD29-27	1D/1B	75B
	HDD29-28	1D/1C	75C
	HDD29-29	1D/1D	75D
	HDD29-30	1D/1E	75E
	HDD29-31	1D/1F	75F
	HDD29-32	1D/20	760
	HDD29-33	1D/21	761
	HDD29-34	1D/22	762
	HDD29-35	1D/23	763
	HDD29-36	1D/24	764
	HDD29-37	1D/25	765
	HDD29-38	1D/26	766
	HDD29-39	1D/27	767
	HDD29-40	1D/28	768
	HDD29-41	1D/29	769
	HDD29-42	1D/2A	76A
	HDD29-43	1D/2B	76B
	HDD29-44	1D/2C	76C
	HDD29-45	1D/2D	76D
	HDD29-46	1D/2E	76E
	HDD29-47	1D/2F	76F
	HDD29-48	1D/30	770
	HDD29-49	1D/31	771
	HDD29-50	1D/32	772
	HDD29-51	1D/33	773
	HDD29-52	1D/34	774
	HDD29-53	1D/35	775
	HDD29-54	1D/36	776
	HDD29-55	1D/37	777
	HDD29-56	1D/38	778
	HDD29-57	1D/39	779
	HDD29-58	1D/3A	77A
	HDD29-59	1D/3B	77B

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Table 4-31 DB Number - C/R Number Matrix (DB-30)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-30	HDD30-00	1E/00	780
	HDD30-01	1E/01	781
	HDD30-02	1E/02	782
	HDD30-03	1E/03	783
	HDD30-04	1E/04	784
	HDD30-05	1E/05	785
	HDD30-06	1E/06	786
	HDD30-07	1E/07	787
	HDD30-08	1E/08	788
	HDD30-09	1E/09	789
	HDD30-10	1E/0A	78A
	HDD30-11	1E/0B	78B
	HDD30-12	1E/0C	78C
	HDD30-13	1E/0D	78D
	HDD30-14	1E/0E	78E
	HDD30-15	1E/0F	78F
	HDD30-16	1E/10	790
	HDD30-17	1E/11	791
	HDD30-18	1E/12	792
	HDD30-19	1E/13	793
	HDD30-20	1E/14	794
	HDD30-21	1E/15	795
	HDD30-22	1E/16	796
	HDD30-23	1E/17	797

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-30	HDD30-24	1E/18	798
	HDD30-25	1E/19	799
	HDD30-26	1E/1A	79A
	HDD30-27	1E/1B	79B
	HDD30-28	1E/1C	79C
	HDD30-29	1E/1D	79D
	HDD30-30	1E/1E	79E
	HDD30-31	1E/1F	79F
	HDD30-32	1E/20	7A0
	HDD30-33	1E/21	7A1
	HDD30-34	1E/22	7A2
	HDD30-35	1E/23	7A3
	HDD30-36	1E/24	7A4
	HDD30-37	1E/25	7A5
	HDD30-38	1E/26	7A6
	HDD30-39	1E/27	7A7
	HDD30-40	1E/28	7A8
	HDD30-41	1E/29	7A9
	HDD30-42	1E/2A	7AA
	HDD30-43	1E/2B	7AB
	HDD30-44	1E/2C	7AC
	HDD30-45	1E/2D	7AD
	HDD30-46	1E/2E	7AE
	HDD30-47	1E/2F	7AF
	HDD30-48	1E/30	7B0
	HDD30-49	1E/31	7B1
	HDD30-50	1E/32	7B2
	HDD30-51	1E/33	7B3
	HDD30-52	1E/34	7B4
	HDD30-53	1E/35	7B5
	HDD30-54	1E/36	7B6
	HDD30-55	1E/37	7B7
	HDD30-56	1E/38	7B8
	HDD30-57	1E/39	7B9
	HDD30-58	1E/3A	7BA
	HDD30-59	1E/3B	7BB

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Table 4-32 DB Number - C/R Number Matrix (DB-31)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-31	HDD31-00	1F/00	7C0
	HDD31-01	1F/01	7C1
	HDD31-02	1F/02	7C2
	HDD31-03	1F/03	7C3
	HDD31-04	1F/04	7C4
	HDD31-05	1F/05	7C5
	HDD31-06	1F/06	7C6
	HDD31-07	1F/07	7C7
	HDD31-08	1F/08	7C8
	HDD31-09	1F/09	7C9
	HDD31-10	1F/0A	7CA
	HDD31-11	1F/0B	7CB
	HDD31-12	1F/0C	7CC
	HDD31-13	1F/0D	7CD
	HDD31-14	1F/0E	7CE
	HDD31-15	1F/0F	7CF
	HDD31-16	1F/10	7D0
	HDD31-17	1F/11	7D1
	HDD31-18	1F/12	7D2
	HDD31-19	1F/13	7D3
	HDD31-20	1F/14	7D4
	HDD31-21	1F/15	7D5
	HDD31-22	1F/16	7D6
	HDD31-23	1F/17	7D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-31	HDD31-24	1F/18	7D8
	HDD31-25	1F/19	7D9
	HDD31-26	1F/1A	7DA
	HDD31-27	1F/1B	7DB
	HDD31-28	1F/1C	7DC
	HDD31-29	1F/1D	7DD
	HDD31-30	1F/1E	7DE
	HDD31-31	1F/1F	7DF
	HDD31-32	1F/20	7E0
	HDD31-33	1F/21	7E1
	HDD31-34	1F/22	7E2
	HDD31-35	1F/23	7E3
	HDD31-36	1F/24	7E4
	HDD31-37	1F/25	7E5
	HDD31-38	1F/26	7E6
	HDD31-39	1F/27	7E7
	HDD31-40	1F/28	7E8
	HDD31-41	1F/29	7E9
	HDD31-42	1F/2A	7EA
	HDD31-43	1F/2B	7EB
	HDD31-44	1F/2C	7EC
	HDD31-45	1F/2D	7ED
	HDD31-46	1F/2E	7EE
	HDD31-47	1F/2F	7EF
	HDD31-48	1F/30	7F0
	HDD31-49	1F/31	7F1
	HDD31-50	1F/32	7F2
	HDD31-51	1F/33	7F3
	HDD31-52	1F/34	7F4
	HDD31-53	1F/35	7F5
	HDD31-54	1F/36	7F6
	HDD31-55	1F/37	7F7
	HDD31-56	1F/38	7F8
	HDD31-57	1F/39	7F9
	HDD31-58	1F/3A	7FA
	HDD31-59	1F/3B	7FB

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Table 4-33 DB Number - C/R Number Matrix (DB-32)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-32	HDD32-00	20/00	800
	HDD32-01	20/01	801
	HDD32-02	20/02	802
	HDD32-03	20/03	803
	HDD32-04	20/04	804
	HDD32-05	20/05	805
	HDD32-06	20/06	806
	HDD32-07	20/07	807
	HDD32-08	20/08	808
	HDD32-09	20/09	809
	HDD32-10	20/0A	80A
	HDD32-11	20/0B	80B
	HDD32-12	20/0C	80C
	HDD32-13	20/0D	80D
	HDD32-14	20/0E	80E
	HDD32-15	20/0F	80F
	HDD32-16	20/10	810
	HDD32-17	20/11	811
	HDD32-18	20/12	812
	HDD32-19	20/13	813
	HDD32-20	20/14	814
	HDD32-21	20/15	815
	HDD32-22	20/16	816
	HDD32-23	20/17	817

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-32	HDD32-24	20/18	818
	HDD32-25	20/19	819
	HDD32-26	20/1A	81A
	HDD32-27	20/1B	81B
	HDD32-28	20/1C	81C
	HDD32-29	20/1D	81D
	HDD32-30	20/1E	81E
	HDD32-31	20/1F	81F
	HDD32-32	20/20	820
	HDD32-33	20/21	821
	HDD32-34	20/22	822
	HDD32-35	20/23	823
	HDD32-36	20/24	824
	HDD32-37	20/25	825
	HDD32-38	20/26	826
	HDD32-39	20/27	827
	HDD32-40	20/28	828
	HDD32-41	20/29	829
	HDD32-42	20/2A	82A
	HDD32-43	20/2B	82B
	HDD32-44	20/2C	82C
	HDD32-45	20/2D	82D
	HDD32-46	20/2E	82E
	HDD32-47	20/2F	82F
	HDD32-48	20/30	830
	HDD32-49	20/31	831
	HDD32-50	20/32	832
	HDD32-51	20/33	833
	HDD32-52	20/34	834
	HDD32-53	20/35	835
	HDD32-54	20/36	836
	HDD32-55	20/37	837
	HDD32-56	20/38	838
	HDD32-57	20/39	839
	HDD32-58	20/3A	83A
	HDD32-59	20/3B	83B

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Table 4-34 DB Number - C/R Number Matrix (DB-33)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-33	HDD33-00	21/00	840
	HDD33-01	21/01	841
	HDD33-02	21/02	842
	HDD33-03	21/03	843
	HDD33-04	21/04	844
	HDD33-05	21/05	845
	HDD33-06	21/06	846
	HDD33-07	21/07	847
	HDD33-08	21/08	848
	HDD33-09	21/09	849
	HDD33-10	21/0A	84A
	HDD33-11	21/0B	84B
	HDD33-12	21/0C	84C
	HDD33-13	21/0D	84D
	HDD33-14	21/0E	84E
	HDD33-15	21/0F	84F
	HDD33-16	21/10	850
	HDD33-17	21/11	851
	HDD33-18	21/12	852
	HDD33-19	21/13	853
	HDD33-20	21/14	854
	HDD33-21	21/15	855
	HDD33-22	21/16	856
	HDD33-23	21/17	857

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-33	HDD33-24	21/18	858
	HDD33-25	21/19	859
	HDD33-26	21/1A	85A
	HDD33-27	21/1B	85B
	HDD33-28	21/1C	85C
	HDD33-29	21/1D	85D
	HDD33-30	21/1E	85E
	HDD33-31	21/1F	85F
	HDD33-32	21/20	860
	HDD33-33	21/21	861
	HDD33-34	21/22	862
	HDD33-35	21/23	863
	HDD33-36	21/24	864
	HDD33-37	21/25	865
	HDD33-38	21/26	866
	HDD33-39	21/27	867
	HDD33-40	21/28	868
	HDD33-41	21/29	869
	HDD33-42	21/2A	86A
	HDD33-43	21/2B	86B
	HDD33-44	21/2C	86C
	HDD33-45	21/2D	86D
	HDD33-46	21/2E	86E
	HDD33-47	21/2F	86F
	HDD33-48	21/30	870
	HDD33-49	21/31	871
	HDD33-50	21/32	872
	HDD33-51	21/33	873
	HDD33-52	21/34	874
	HDD33-53	21/35	875
	HDD33-54	21/36	876
	HDD33-55	21/37	877
	HDD33-56	21/38	878
	HDD33-57	21/39	879
	HDD33-58	21/3A	87A
	HDD33-59	21/3B	87B

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Table 4-35 DB Number - C/R Number Matrix (DB-34)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-34	HDD34-00	22/00	880
	HDD34-01	22/01	881
	HDD34-02	22/02	882
	HDD34-03	22/03	883
	HDD34-04	22/04	884
	HDD34-05	22/05	885
	HDD34-06	22/06	886
	HDD34-07	22/07	887
	HDD34-08	22/08	888
	HDD34-09	22/09	889
	HDD34-10	22/0A	88A
	HDD34-11	22/0B	88B
	HDD34-12	22/0C	88C
	HDD34-13	22/0D	88D
	HDD34-14	22/0E	88E
	HDD34-15	22/0F	88F
	HDD34-16	22/10	890
	HDD34-17	22/11	891
	HDD34-18	22/12	892
	HDD34-19	22/13	893
	HDD34-20	22/14	894
	HDD34-21	22/15	895
	HDD34-22	22/16	896
	HDD34-23	22/17	897

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-34	HDD34-24	22/18	898
	HDD34-25	22/19	899
	HDD34-26	22/1A	89A
	HDD34-27	22/1B	89B
	HDD34-28	22/1C	89C
	HDD34-29	22/1D	89D
	HDD34-30	22/1E	89E
	HDD34-31	22/1F	89F
	HDD34-32	22/20	8A0
	HDD34-33	22/21	8A1
	HDD34-34	22/22	8A2
	HDD34-35	22/23	8A3
	HDD34-36	22/24	8A4
	HDD34-37	22/25	8A5
	HDD34-38	22/26	8A6
	HDD34-39	22/27	8A7
	HDD34-40	22/28	8A8
	HDD34-41	22/29	8A9
	HDD34-42	22/2A	8AA
	HDD34-43	22/2B	8AB
	HDD34-44	22/2C	8AC
	HDD34-45	22/2D	8AD
	HDD34-46	22/2E	8AE
	HDD34-47	22/2F	8AF
	HDD34-48	22/30	8B0
	HDD34-49	22/31	8B1
	HDD34-50	22/32	8B2
	HDD34-51	22/33	8B3
	HDD34-52	22/34	8B4
	HDD34-53	22/35	8B5
	HDD34-54	22/36	8B6
	HDD34-55	22/37	8B7
	HDD34-56	22/38	8B8
	HDD34-57	22/39	8B9
	HDD34-58	22/3A	8BA
	HDD34-59	22/3B	8BB

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Table 4-36 DB Number - C/R Number Matrix (DB-35)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-35	HDD35-00	23/00	8C0
	HDD35-01	23/01	8C1
	HDD35-02	23/02	8C2
	HDD35-03	23/03	8C3
	HDD35-04	23/04	8C4
	HDD35-05	23/05	8C5
	HDD35-06	23/06	8C6
	HDD35-07	23/07	8C7
	HDD35-08	23/08	8C8
	HDD35-09	23/09	8C9
	HDD35-10	23/0A	8CA
	HDD35-11	23/0B	8CB
	HDD35-12	23/0C	8CC
	HDD35-13	23/0D	8CD
	HDD35-14	23/0E	8CE
	HDD35-15	23/0F	8CF
	HDD35-16	23/10	8D0
	HDD35-17	23/11	8D1
	HDD35-18	23/12	8D2
	HDD35-19	23/13	8D3
	HDD35-20	23/14	8D4
	HDD35-21	23/15	8D5
	HDD35-22	23/16	8D6
	HDD35-23	23/17	8D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-35	HDD35-24	23/18	8D8
	HDD35-25	23/19	8D9
	HDD35-26	23/1A	8DA
	HDD35-27	23/1B	8DB
	HDD35-28	23/1C	8DC
	HDD35-29	23/1D	8DD
	HDD35-30	23/1E	8DE
	HDD35-31	23/1F	8DF
	HDD35-32	23/20	8E0
	HDD35-33	23/21	8E1
	HDD35-34	23/22	8E2
	HDD35-35	23/23	8E3
	HDD35-36	23/24	8E4
	HDD35-37	23/25	8E5
	HDD35-38	23/26	8E6
	HDD35-39	23/27	8E7
	HDD35-40	23/28	8E8
	HDD35-41	23/29	8E9
	HDD35-42	23/2A	8EA
	HDD35-43	23/2B	8EB
	HDD35-44	23/2C	8EC
	HDD35-45	23/2D	8ED
	HDD35-46	23/2E	8EE
	HDD35-47	23/2F	8EF
	HDD35-48	23/30	8F0
	HDD35-49	23/31	8F1
	HDD35-50	23/32	8F2
	HDD35-51	23/33	8F3
	HDD35-52	23/34	8F4
	HDD35-53	23/35	8F5
	HDD35-54	23/36	8F6
	HDD35-55	23/37	8F7
	HDD35-56	23/38	8F8
	HDD35-57	23/39	8F9
	HDD35-58	23/3A	8FA
	HDD35-59	23/3B	8FB

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Table 4-37 DB Number - C/R Number Matrix (DB-36)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-36	HDD36-00	24/00	900
	HDD36-01	24/01	901
	HDD36-02	24/02	902
	HDD36-03	24/03	903
	HDD36-04	24/04	904
	HDD36-05	24/05	905
	HDD36-06	24/06	906
	HDD36-07	24/07	907
	HDD36-08	24/08	908
	HDD36-09	24/09	909
	HDD36-10	24/0A	90A
	HDD36-11	24/0B	90B
	HDD36-12	24/0C	90C
	HDD36-13	24/0D	90D
	HDD36-14	24/0E	90E
	HDD36-15	24/0F	90F
	HDD36-16	24/10	910
	HDD36-17	24/11	911
	HDD36-18	24/12	912
	HDD36-19	24/13	913
	HDD36-20	24/14	914
	HDD36-21	24/15	915
	HDD36-22	24/16	916
	HDD36-23	24/17	917

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-36	HDD36-24	24/18	918
	HDD36-25	24/19	919
	HDD36-26	24/1A	91A
	HDD36-27	24/1B	91B
	HDD36-28	24/1C	91C
	HDD36-29	24/1D	91D
	HDD36-30	24/1E	91E
	HDD36-31	24/1F	91F
	HDD36-32	24/20	920
	HDD36-33	24/21	921
	HDD36-34	24/22	922
	HDD36-35	24/23	923
	HDD36-36	24/24	924
	HDD36-37	24/25	925
	HDD36-38	24/26	926
	HDD36-39	24/27	927
	HDD36-40	24/28	928
	HDD36-41	24/29	929
	HDD36-42	24/2A	92A
	HDD36-43	24/2B	92B
	HDD36-44	24/2C	92C
	HDD36-45	24/2D	92D
	HDD36-46	24/2E	92E
	HDD36-47	24/2F	92F
	HDD36-48	24/30	930
	HDD36-49	24/31	931
	HDD36-50	24/32	932
	HDD36-51	24/33	933
	HDD36-52	24/34	934
	HDD36-53	24/35	935
	HDD36-54	24/36	936
	HDD36-55	24/37	937
	HDD36-56	24/38	938
	HDD36-57	24/39	939
	HDD36-58	24/3A	93A
	HDD36-59	24/3B	93B

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Table 4-38 DB Number - C/R Number Matrix (DB-37)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-37	HDD37-00	25/00	940
	HDD37-01	25/01	941
	HDD37-02	25/02	942
	HDD37-03	25/03	943
	HDD37-04	25/04	944
	HDD37-05	25/05	945
	HDD37-06	25/06	946
	HDD37-07	25/07	947
	HDD37-08	25/08	948
	HDD37-09	25/09	949
	HDD37-10	25/0A	94A
	HDD37-11	25/0B	94B
	HDD37-12	25/0C	94C
	HDD37-13	25/0D	94D
	HDD37-14	25/0E	94E
	HDD37-15	25/0F	94F
	HDD37-16	25/10	950
	HDD37-17	25/11	951
	HDD37-18	25/12	952
	HDD37-19	25/13	953
	HDD37-20	25/14	954
	HDD37-21	25/15	955
	HDD37-22	25/16	956
	HDD37-23	25/17	957

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-37	HDD37-24	25/18	958
	HDD37-25	25/19	959
	HDD37-26	25/1A	95A
	HDD37-27	25/1B	95B
	HDD37-28	25/1C	95C
	HDD37-29	25/1D	95D
	HDD37-30	25/1E	95E
	HDD37-31	25/1F	95F
	HDD37-32	25/20	960
	HDD37-33	25/21	961
	HDD37-34	25/22	962
	HDD37-35	25/23	963
	HDD37-36	25/24	964
	HDD37-37	25/25	965
	HDD37-38	25/26	966
	HDD37-39	25/27	967
	HDD37-40	25/28	968
	HDD37-41	25/29	969
	HDD37-42	25/2A	96A
	HDD37-43	25/2B	96B
	HDD37-44	25/2C	96C
	HDD37-45	25/2D	96D
	HDD37-46	25/2E	96E
	HDD37-47	25/2F	96F
	HDD37-48	25/30	970
	HDD37-49	25/31	971
	HDD37-50	25/32	972
	HDD37-51	25/33	973
	HDD37-52	25/34	974
	HDD37-53	25/35	975
	HDD37-54	25/36	976
	HDD37-55	25/37	977
	HDD37-56	25/38	978
	HDD37-57	25/39	979
	HDD37-58	25/3A	97A
	HDD37-59	25/3B	97B

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Table 4-39 DB Number - C/R Number Matrix (DB-38)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-38	HDD38-00	26/00	980
	HDD38-01	26/01	981
	HDD38-02	26/02	982
	HDD38-03	26/03	983
	HDD38-04	26/04	984
	HDD38-05	26/05	985
	HDD38-06	26/06	986
	HDD38-07	26/07	987
	HDD38-08	26/08	988
	HDD38-09	26/09	989
	HDD38-10	26/0A	98A
	HDD38-11	26/0B	98B
	HDD38-12	26/0C	98C
	HDD38-13	26/0D	98D
	HDD38-14	26/0E	98E
	HDD38-15	26/0F	98F
	HDD38-16	26/10	990
	HDD38-17	26/11	991
	HDD38-18	26/12	992
	HDD38-19	26/13	993
	HDD38-20	26/14	994
	HDD38-21	26/15	995
	HDD38-22	26/16	996
	HDD38-23	26/17	997

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-38	HDD38-24	26/18	998
	HDD38-25	26/19	999
	HDD38-26	26/1A	99A
	HDD38-27	26/1B	99B
	HDD38-28	26/1C	99C
	HDD38-29	26/1D	99D
	HDD38-30	26/1E	99E
	HDD38-31	26/1F	99F
	HDD38-32	26/20	9A0
	HDD38-33	26/21	9A1
	HDD38-34	26/22	9A2
	HDD38-35	26/23	9A3
	HDD38-36	26/24	9A4
	HDD38-37	26/25	9A5
	HDD38-38	26/26	9A6
	HDD38-39	26/27	9A7
	HDD38-40	26/28	9A8
	HDD38-41	26/29	9A9
	HDD38-42	26/2A	9AA
	HDD38-43	26/2B	9AB
	HDD38-44	26/2C	9AC
	HDD38-45	26/2D	9AD
	HDD38-46	26/2E	9AE
	HDD38-47	26/2F	9AF
	HDD38-48	26/30	9B0
	HDD38-49	26/31	9B1
	HDD38-50	26/32	9B2
	HDD38-51	26/33	9B3
	HDD38-52	26/34	9B4
	HDD38-53	26/35	9B5
	HDD38-54	26/36	9B6
	HDD38-55	26/37	9B7
	HDD38-56	26/38	9B8
	HDD38-57	26/39	9B9
	HDD38-58	26/3A	9BA
	HDD38-59	26/3B	9BB

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Table 4-40 DB Number - C/R Number Matrix (DB-39)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-39	HDD39-00	27/00	9C0
	HDD39-01	27/01	9C1
	HDD39-02	27/02	9C2
	HDD39-03	27/03	9C3
	HDD39-04	27/04	9C4
	HDD39-05	27/05	9C5
	HDD39-06	27/06	9C6
	HDD39-07	27/07	9C7
	HDD39-08	27/08	9C8
	HDD39-09	27/09	9C9
	HDD39-10	27/0A	9CA
	HDD39-11	27/0B	9CB
	HDD39-12	27/0C	9CC
	HDD39-13	27/0D	9CD
	HDD39-14	27/0E	9CE
	HDD39-15	27/0F	9CF
	HDD39-16	27/10	9D0
	HDD39-17	27/11	9D1
	HDD39-18	27/12	9D2
	HDD39-19	27/13	9D3
	HDD39-20	27/14	9D4
	HDD39-21	27/15	9D5
	HDD39-22	27/16	9D6
	HDD39-23	27/17	9D7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-39	HDD39-24	27/18	9D8
	HDD39-25	27/19	9D9
	HDD39-26	27/1A	9DA
	HDD39-27	27/1B	9DB
	HDD39-28	27/1C	9DC
	HDD39-29	27/1D	9DD
	HDD39-30	27/1E	9DE
	HDD39-31	27/1F	9DF
	HDD39-32	27/20	9E0
	HDD39-33	27/21	9E1
	HDD39-34	27/22	9E2
	HDD39-35	27/23	9E3
	HDD39-36	27/24	9E4
	HDD39-37	27/25	9E5
	HDD39-38	27/26	9E6
	HDD39-39	27/27	9E7
	HDD39-40	27/28	9E8
	HDD39-41	27/29	9E9
	HDD39-42	27/2A	9EA
	HDD39-43	27/2B	9EB
	HDD39-44	27/2C	9EC
	HDD39-45	27/2D	9ED
	HDD39-46	27/2E	9EE
	HDD39-47	27/2F	9EF
	HDD39-48	27/30	9F0
	HDD39-49	27/31	9F1
	HDD39-50	27/32	9F2
	HDD39-51	27/33	9F3
	HDD39-52	27/34	9F4
	HDD39-53	27/35	9F5
	HDD39-54	27/36	9F6
	HDD39-55	27/37	9F7
	HDD39-56	27/38	9F8
	HDD39-57	27/39	9F9
	HDD39-58	27/3A	9FA
	HDD39-59	27/3B	9FB

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Table 4-41 DB Number - C/R Number Matrix (DB-40)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-40	HDD40-00	28/00	A00
	HDD40-01	28/01	A01
	HDD40-02	28/02	A02
	HDD40-03	28/03	A03
	HDD40-04	28/04	A04
	HDD40-05	28/05	A05
	HDD40-06	28/06	A06
	HDD40-07	28/07	A07
	HDD40-08	28/08	A08
	HDD40-09	28/09	A09
	HDD40-10	28/0A	A0A
	HDD40-11	28/0B	A0B
	HDD40-12	28/0C	A0C
	HDD40-13	28/0D	A0D
	HDD40-14	28/0E	A0E
	HDD40-15	28/0F	A0F
	HDD40-16	28/10	A10
	HDD40-17	28/11	A11
	HDD40-18	28/12	A12
	HDD40-19	28/13	A13
	HDD40-20	28/14	A14
	HDD40-21	28/15	A15
	HDD40-22	28/16	A16
	HDD40-23	28/17	A17

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-40	HDD40-24	28/18	A18
	HDD40-25	28/19	A19
	HDD40-26	28/1A	A1A
	HDD40-27	28/1B	A1B
	HDD40-28	28/1C	A1C
	HDD40-29	28/1D	A1D
	HDD40-30	28/1E	A1E
	HDD40-31	28/1F	A1F
	HDD40-32	28/20	A20
	HDD40-33	28/21	A21
	HDD40-34	28/22	A22
	HDD40-35	28/23	A23
	HDD40-36	28/24	A24
	HDD40-37	28/25	A25
	HDD40-38	28/26	A26
	HDD40-39	28/27	A27
	HDD40-40	28/28	A28
	HDD40-41	28/29	A29
	HDD40-42	28/2A	A2A
	HDD40-43	28/2B	A2B
	HDD40-44	28/2C	A2C
	HDD40-45	28/2D	A2D
	HDD40-46	28/2E	A2E
	HDD40-47	28/2F	A2F
	HDD40-48	28/30	A30
	HDD40-49	28/31	A31
	HDD40-50	28/32	A32
	HDD40-51	28/33	A33
	HDD40-52	28/34	A34
	HDD40-53	28/35	A35
	HDD40-54	28/36	A36
	HDD40-55	28/37	A37
	HDD40-56	28/38	A38
	HDD40-57	28/39	A39
	HDD40-58	28/3A	A3A
	HDD40-59	28/3B	A3B

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Table 4-42 DB Number - C/R Number Matrix (DB-41)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-41	HDD41-00	29/00	A40
	HDD41-01	29/01	A41
	HDD41-02	29/02	A42
	HDD41-03	29/03	A43
	HDD41-04	29/04	A44
	HDD41-05	29/05	A45
	HDD41-06	29/06	A46
	HDD41-07	29/07	A47
	HDD41-08	29/08	A48
	HDD41-09	29/09	A49
	HDD41-10	29/0A	A4A
	HDD41-11	29/0B	A4B
	HDD41-12	29/0C	A4C
	HDD41-13	29/0D	A4D
	HDD41-14	29/0E	A4E
	HDD41-15	29/0F	A4F
	HDD41-16	29/10	A50
	HDD41-17	29/11	A51
	HDD41-18	29/12	A52
	HDD41-19	29/13	A53
	HDD41-20	29/14	A54
	HDD41-21	29/15	A55
	HDD41-22	29/16	A56
	HDD41-23	29/17	A57

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-41	HDD41-24	29/18	A58
	HDD41-25	29/19	A59
	HDD41-26	29/1A	A5A
	HDD41-27	29/1B	A5B
	HDD41-28	29/1C	A5C
	HDD41-29	29/1D	A5D
	HDD41-30	29/1E	A5E
	HDD41-31	29/1F	A5F
	HDD41-32	29/20	A60
	HDD41-33	29/21	A61
	HDD41-34	29/22	A62
	HDD41-35	29/23	A63
	HDD41-36	29/24	A64
	HDD41-37	29/25	A65
	HDD41-38	29/26	A66
	HDD41-39	29/27	A67
	HDD41-40	29/28	A68
	HDD41-41	29/29	A69
	HDD41-42	29/2A	A6A
	HDD41-43	29/2B	A6B
	HDD41-44	29/2C	A6C
	HDD41-45	29/2D	A6D
	HDD41-46	29/2E	A6E
	HDD41-47	29/2F	A6F
	HDD41-48	29/30	A70
	HDD41-49	29/31	A71
	HDD41-50	29/32	A72
	HDD41-51	29/33	A73
	HDD41-52	29/34	A74
	HDD41-53	29/35	A75
	HDD41-54	29/36	A76
	HDD41-55	29/37	A77
	HDD41-56	29/38	A78
	HDD41-57	29/39	A79
	HDD41-58	29/3A	A7A
	HDD41-59	29/3B	A7B

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Table 4-43 DB Number - C/R Number Matrix (DB-42)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-42	HDD42-00	2A/00	A80
	HDD42-01	2A/01	A81
	HDD42-02	2A/02	A82
	HDD42-03	2A/03	A83
	HDD42-04	2A/04	A84
	HDD42-05	2A/05	A85
	HDD42-06	2A/06	A86
	HDD42-07	2A/07	A87
	HDD42-08	2A/08	A88
	HDD42-09	2A/09	A89
	HDD42-10	2A/0A	A8A
	HDD42-11	2A/0B	A8B
	HDD42-12	2A/0C	A8C
	HDD42-13	2A/0D	A8D
	HDD42-14	2A/0E	A8E
	HDD42-15	2A/0F	A8F
	HDD42-16	2A/10	A90
	HDD42-17	2A/11	A91
	HDD42-18	2A/12	A92
	HDD42-19	2A/13	A93
	HDD42-20	2A/14	A94
	HDD42-21	2A/15	A95
	HDD42-22	2A/16	A96
	HDD42-23	2A/17	A97

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-42	HDD42-24	2A/18	A98
	HDD42-25	2A/19	A99
	HDD42-26	2A/1A	A9A
	HDD42-27	2A/1B	A9B
	HDD42-28	2A/1C	A9C
	HDD42-29	2A/1D	A9D
	HDD42-30	2A/1E	A9E
	HDD42-31	2A/1F	A9F
	HDD42-32	2A/20	AA0
	HDD42-33	2A/21	AA1
	HDD42-34	2A/22	AA2
	HDD42-35	2A/23	AA3
	HDD42-36	2A/24	AA4
	HDD42-37	2A/25	AA5
	HDD42-38	2A/26	AA6
	HDD42-39	2A/27	AA7
	HDD42-40	2A/28	AA8
	HDD42-41	2A/29	AA9
	HDD42-42	2A/2A	AAA
	HDD42-43	2A/2B	AAB
	HDD42-44	2A/2C	AAC
	HDD42-45	2A/2D	AAD
	HDD42-46	2A/2E	AAE
	HDD42-47	2A/2F	AAF
	HDD42-48	2A/30	AB0
	HDD42-49	2A/31	AB1
	HDD42-50	2A/32	AB2
	HDD42-51	2A/33	AB3
	HDD42-52	2A/34	AB4
	HDD42-53	2A/35	AB5
	HDD42-54	2A/36	AB6
	HDD42-55	2A/37	AB7
	HDD42-56	2A/38	AB8
	HDD42-57	2A/39	AB9
	HDD42-58	2A/3A	ABA
	HDD42-59	2A/3B	ABB

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Table 4-44 DB Number - C/R Number Matrix (DB-43)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-43	HDD43-00	2B/00	AC0
	HDD43-01	2B/01	AC1
	HDD43-02	2B/02	AC2
	HDD43-03	2B/03	AC3
	HDD43-04	2B/04	AC4
	HDD43-05	2B/05	AC5
	HDD43-06	2B/06	AC6
	HDD43-07	2B/07	AC7
	HDD43-08	2B/08	AC8
	HDD43-09	2B/09	AC9
	HDD43-10	2B/0A	ACA
	HDD43-11	2B/0B	ACB
	HDD43-12	2B/0C	ACC
	HDD43-13	2B/0D	ACD
	HDD43-14	2B/0E	ACE
	HDD43-15	2B/0F	ACF
	HDD43-16	2B/10	AD0
	HDD43-17	2B/11	AD1
	HDD43-18	2B/12	AD2
	HDD43-19	2B/13	AD3
	HDD43-20	2B/14	AD4
	HDD43-21	2B/15	AD5
	HDD43-22	2B/16	AD6
	HDD43-23	2B/17	AD7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-43	HDD43-24	2B/18	AD8
	HDD43-25	2B/19	AD9
	HDD43-26	2B/1A	ADA
	HDD43-27	2B/1B	ADB
	HDD43-28	2B/1C	ADC
	HDD43-29	2B/1D	ADD
	HDD43-30	2B/1E	ADE
	HDD43-31	2B/1F	ADF
	HDD43-32	2B/20	AE0
	HDD43-33	2B/21	AE1
	HDD43-34	2B/22	AE2
	HDD43-35	2B/23	AE3
	HDD43-36	2B/24	AE4
	HDD43-37	2B/25	AE5
	HDD43-38	2B/26	AE6
	HDD43-39	2B/27	AE7
	HDD43-40	2B/28	AE8
	HDD43-41	2B/29	AE9
	HDD43-42	2B/2A	AEA
	HDD43-43	2B/2B	AEB
	HDD43-44	2B/2C	AEC
	HDD43-45	2B/2D	AED
	HDD43-46	2B/2E	AEE
	HDD43-47	2B/2F	AEF
	HDD43-48	2B/30	AF0
	HDD43-49	2B/31	AF1
	HDD43-50	2B/32	AF2
	HDD43-51	2B/33	AF3
	HDD43-52	2B/34	AF4
	HDD43-53	2B/35	AF5
	HDD43-54	2B/36	AF6
	HDD43-55	2B/37	AF7
	HDD43-56	2B/38	AF8
	HDD43-57	2B/39	AF9
	HDD43-58	2B/3A	AFA
	HDD43-59	2B/3B	AFB

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Table 4-45 DB Number - C/R Number Matrix (DB-44)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-44	HDD44-00	2C/00	B00
	HDD44-01	2C/01	B01
	HDD44-02	2C/02	B02
	HDD44-03	2C/03	B03
	HDD44-04	2C/04	B04
	HDD44-05	2C/05	B05
	HDD44-06	2C/06	B06
	HDD44-07	2C/07	B07
	HDD44-08	2C/08	B08
	HDD44-09	2C/09	B09
	HDD44-10	2C/0A	B0A
	HDD44-11	2C/0B	B0B
	HDD44-12	2C/0C	B0C
	HDD44-13	2C/0D	B0D
	HDD44-14	2C/0E	B0E
	HDD44-15	2C/0F	B0F
	HDD44-16	2C/10	B10
	HDD44-17	2C/11	B11
	HDD44-18	2C/12	B12
	HDD44-19	2C/13	B13
	HDD44-20	2C/14	B14
	HDD44-21	2C/15	B15
	HDD44-22	2C/16	B16
	HDD44-23	2C/17	B17

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-44	HDD44-24	2C/18	B18
	HDD44-25	2C/19	B19
	HDD44-26	2C/1A	B1A
	HDD44-27	2C/1B	B1B
	HDD44-28	2C/1C	B1C
	HDD44-29	2C/1D	B1D
	HDD44-30	2C/1E	B1E
	HDD44-31	2C/1F	B1F
	HDD44-32	2C/20	B20
	HDD44-33	2C/21	B21
	HDD44-34	2C/22	B22
	HDD44-35	2C/23	B23
	HDD44-36	2C/24	B24
	HDD44-37	2C/25	B25
	HDD44-38	2C/26	B26
	HDD44-39	2C/27	B27
	HDD44-40	2C/28	B28
	HDD44-41	2C/29	B29
	HDD44-42	2C/2A	B2A
	HDD44-43	2C/2B	B2B
	HDD44-44	2C/2C	B2C
	HDD44-45	2C/2D	B2D
	HDD44-46	2C/2E	B2E
	HDD44-47	2C/2F	B2F
	HDD44-48	2C/30	B30
	HDD44-49	2C/31	B31
	HDD44-50	2C/32	B32
	HDD44-51	2C/33	B33
	HDD44-52	2C/34	B34
	HDD44-53	2C/35	B35
	HDD44-54	2C/36	B36
	HDD44-55	2C/37	B37
	HDD44-56	2C/38	B38
	HDD44-57	2C/39	B39
	HDD44-58	2C/3A	B3A
	HDD44-59	2C/3B	B3B

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Table 4-46 DB Number - C/R Number Matrix (DB-45)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-45	HDD45-00	2D/00	B40
	HDD45-01	2D/01	B41
	HDD45-02	2D/02	B42
	HDD45-03	2D/03	B43
	HDD45-04	2D/04	B44
	HDD45-05	2D/05	B45
	HDD45-06	2D/06	B46
	HDD45-07	2D/07	B47
	HDD45-08	2D/08	B48
	HDD45-09	2D/09	B49
	HDD45-10	2D/0A	B4A
	HDD45-11	2D/0B	B4B
	HDD45-12	2D/0C	B4C
	HDD45-13	2D/0D	B4D
	HDD45-14	2D/0E	B4E
	HDD45-15	2D/0F	B4F
	HDD45-16	2D/10	B50
	HDD45-17	2D/11	B51
	HDD45-18	2D/12	B52
	HDD45-19	2D/13	B53
	HDD45-20	2D/14	B54
	HDD45-21	2D/15	B55
	HDD45-22	2D/16	B56
	HDD45-23	2D/17	B57

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-45	HDD45-24	2D/18	B58
	HDD45-25	2D/19	B59
	HDD45-26	2D/1A	B5A
	HDD45-27	2D/1B	B5B
	HDD45-28	2D/1C	B5C
	HDD45-29	2D/1D	B5D
	HDD45-30	2D/1E	B5E
	HDD45-31	2D/1F	B5F
	HDD45-32	2D/20	B60
	HDD45-33	2D/21	B61
	HDD45-34	2D/22	B62
	HDD45-35	2D/23	B63
	HDD45-36	2D/24	B64
	HDD45-37	2D/25	B65
	HDD45-38	2D/26	B66
	HDD45-39	2D/27	B67
	HDD45-40	2D/28	B68
	HDD45-41	2D/29	B69
	HDD45-42	2D/2A	B6A
	HDD45-43	2D/2B	B6B
	HDD45-44	2D/2C	B6C
	HDD45-45	2D/2D	B6D
	HDD45-46	2D/2E	B6E
	HDD45-47	2D/2F	B6F
	HDD45-48	2D/30	B70
	HDD45-49	2D/31	B71
	HDD45-50	2D/32	B72
	HDD45-51	2D/33	B73
	HDD45-52	2D/34	B74
	HDD45-53	2D/35	B75
	HDD45-54	2D/36	B76
	HDD45-55	2D/37	B77
	HDD45-56	2D/38	B78
	HDD45-57	2D/39	B79
	HDD45-58	2D/3A	B7A
	HDD45-59	2D/3B	B7B

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Table 4-47 DB Number - C/R Number Matrix (DB-46)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-46	HDD46-00	2E/00	B80
	HDD46-01	2E/01	B81
	HDD46-02	2E/02	B82
	HDD46-03	2E/03	B83
	HDD46-04	2E/04	B84
	HDD46-05	2E/05	B85
	HDD46-06	2E/06	B86
	HDD46-07	2E/07	B87
	HDD46-08	2E/08	B88
	HDD46-09	2E/09	B89
	HDD46-10	2E/0A	B8A
	HDD46-11	2E/0B	B8B
	HDD46-12	2E/0C	B8C
	HDD46-13	2E/0D	B8D
	HDD46-14	2E/0E	B8E
	HDD46-15	2E/0F	B8F
	HDD46-16	2E/10	B90
	HDD46-17	2E/11	B91
	HDD46-18	2E/12	B92
	HDD46-19	2E/13	B93
	HDD46-20	2E/14	B94
	HDD46-21	2E/15	B95
	HDD46-22	2E/16	B96
	HDD46-23	2E/17	B97

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-46	HDD46-24	2E/18	B98
	HDD46-25	2E/19	B99
	HDD46-26	2E/1A	B9A
	HDD46-27	2E/1B	B9B
	HDD46-28	2E/1C	B9C
	HDD46-29	2E/1D	B9D
	HDD46-30	2E/1E	B9E
	HDD46-31	2E/1F	B9F
	HDD46-32	2E/20	BA0
	HDD46-33	2E/21	BA1
	HDD46-34	2E/22	BA2
	HDD46-35	2E/23	BA3
	HDD46-36	2E/24	BA4
	HDD46-37	2E/25	BA5
	HDD46-38	2E/26	BA6
	HDD46-39	2E/27	BA7
	HDD46-40	2E/28	BA8
	HDD46-41	2E/29	BA9
	HDD46-42	2E/2A	BAA
	HDD46-43	2E/2B	BAB
	HDD46-44	2E/2C	BAC
	HDD46-45	2E/2D	BAD
	HDD46-46	2E/2E	BAE
	HDD46-47	2E/2F	BAF
	HDD46-48	2E/30	BB0
	HDD46-49	2E/31	BB1
	HDD46-50	2E/32	BB2
	HDD46-51	2E/33	BB3
	HDD46-52	2E/34	BB4
	HDD46-53	2E/35	BB5
	HDD46-54	2E/36	BB6
	HDD46-55	2E/37	BB7
	HDD46-56	2E/38	BB8
	HDD46-57	2E/39	BB9
	HDD46-58	2E/3A	BBA
	HDD46-59	2E/3B	BBB

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Table 4-48 DB Number - C/R Number Matrix (DB-47)

Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-47	HDD47-00	2F/00	BC0
	HDD47-01	2F/01	BC1
	HDD47-02	2F/02	BC2
	HDD47-03	2F/03	BC3
	HDD47-04	2F/04	BC4
	HDD47-05	2F/05	BC5
	HDD47-06	2F/06	BC6
	HDD47-07	2F/07	BC7
	HDD47-08	2F/08	BC8
	HDD47-09	2F/09	BC9
	HDD47-10	2F/0A	BCA
	HDD47-11	2F/0B	BCB
	HDD47-12	2F/0C	BCC
	HDD47-13	2F/0D	BCD
	HDD47-14	2F/0E	BCE
	HDD47-15	2F/0F	BCF
	HDD47-16	2F/10	BD0
	HDD47-17	2F/11	BD1
	HDD47-18	2F/12	BD2
	HDD47-19	2F/13	BD3
	HDD47-20	2F/14	BD4
	HDD47-21	2F/15	BD5
	HDD47-22	2F/16	BD6
	HDD47-23	2F/17	BD7

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Drive Box Number	Disk Drive Number	C#/R#	Reference Code C#/R#(3-digit Display)
DB-47	HDD47-24	2F/18	BD8
	HDD47-25	2F/19	BD9
	HDD47-26	2F/1A	BDA
	HDD47-27	2F/1B	BDB
	HDD47-28	2F/1C	BDC
	HDD47-29	2F/1D	BDD
	HDD47-30	2F/1E	BDE
	HDD47-31	2F/1F	BDF
	HDD47-32	2F/20	BE0
	HDD47-33	2F/21	BE1
	HDD47-34	2F/22	BE2
	HDD47-35	2F/23	BE3
	HDD47-36	2F/24	BE4
	HDD47-37	2F/25	BE5
	HDD47-38	2F/26	BE6
	HDD47-39	2F/27	BE7
	HDD47-40	2F/28	BE8
	HDD47-41	2F/29	BE9
	HDD47-42	2F/2A	BEA
	HDD47-43	2F/2B	BEB
	HDD47-44	2F/2C	BEC
	HDD47-45	2F/2D	BED
	HDD47-46	2F/2E	BEE
	HDD47-47	2F/2F	BEF
	HDD47-48	2F/30	BF0
	HDD47-49	2F/31	BF1
	HDD47-50	2F/32	BF2
	HDD47-51	2F/33	BF3
	HDD47-52	2F/34	BF4
	HDD47-53	2F/35	BF5
	HDD47-54	2F/36	BF6
	HDD47-55	2F/37	BF7
	HDD47-56	2F/38	BF8
	HDD47-57	2F/39	BF9
	HDD47-58	2F/3A	BFA
	HDD47-59	2F/3B	BFB

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4.2 Comparison of Pair Status on Storage Navigator, RAID Manager

Table 4-49 Comparison of Pair Status on Storage Navigator, RAID Manager

No.	Event	Status on RAID Manager	Status on Storage Navigator
1	Simplex Volume	P-VOL: SMPL S-VOL: SMPL	P-VOL: SMPL S-VOL: SMPL
2	Copying LU Volume Partly completed (SYNC only)	P-VOL: PDUB S-VOL: PDUB	P-VOL: PDUB S-VOL: PDUB
3	Copying Volume	P-VOL: COPY S-VOL: COPY	P-VOL: COPY S-VOL: COPY
4	Pair volume	P-VOL: PAIR S-VOL: PAIR	P-VOL: PAIR S-VOL: PAIR
5	Pairsplit operation to P-VOL	P-VOL: PSUS S-VOL: SSUS	P-VOL: PSUS (S-VOL by operator) S-VOL: PSUS (S-VOL by operator)/ SSUS
6	Pairsplit operation to S-VOL	P-VOL: PSUS S-VOL: PSUS	P-VOL: PSUS (S-VOL by operator) S-VOL: PSUS (S-VOL by operator)
7	Pairsplit -P operation (*1) (P-VOL failure, SYNC only)	P-VOL: PSUS S-VOL: SSUS	P-VOL: PSUS (P-VOL by operator) S-VOL: PSUS (by MCU)/SSUS
8	Pairsplit -R operation (*1)	P-VOL: PSUS S-VOL: SMPL	P-VOL: PSUS(Delete pair to RCU) S-VOL: SMPL
9	P-VOL Suspend (failure)	P-VOL: PSUE S-VOL: SSUS	P-VOL: PSUE (S-VOL failure) S-VOL: PSUE (S-VOL failure)/ SSUS
10	S-VOL Suspend (failure)	P-VOL: PSUE S-VOL: PSUE	P-VOL: PSUE (S-VOL failure) S-VOL: PSUE (S-VOL failure)
11	PS ON failure	P-VOL: PSUE S-VOL: —	P-VOL: PSUE (MCU IMPL) S-VOL: —
12	Copy failure (P-VOL failure)	P-VOL: PSUE S-VOL: SSUS	P-VOL: PSUE (Initial copy failed) S-VOL: PSUE (Initial copy failed)/ SSUS
13	Copy failure (S-VOL failure)	P-VOL: PSUE S-VOL: PSUE	P-VOL: PSUE (Initial copy failed) S-VOL: PSUE (Initial copy failed)
14	RCU accepted the notification of MCU's P/S-OFF	P-VOL: — S-VOL: SSUS	P-VOL: — S-VOL: PSUE (MCU P/S OFF)/ SSUS
15	MCU detected the failure of RCU	P-VOL: PSUE S-VOL: PSUE	P-VOL: PSUS (by RCU)/PSUE S-VOL: PSUE (S-VOL failure)

*1: Operation on RAID Manager

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4.3 Parts Number of Correspondence Table

Table 4-50 Relationship between Cluster # and CTL #

Cluster	CTL Location Name	Cluster# (HEX)	CTL# (HEX)
Cluster-1	CTL1	0x00	0x00
Cluster-2	CTL2	0x01	0x01

Table 4-51 Relationship between Cluster # and MPU#, MP#

Cluster	CTL Location Name	MPU# (HEX)	VSP G200 MP# (HEX)	VSP G400, G600 MP# (HEX)	VSP G800 MP# (HEX)
Cluster-1	CTL1	0x00	0x00 to 0x01	0x00 to 0x03	0x00 to 0x07
		0x01	0x02 to 0x03	0x04 to 0x07	0x08 to 0x0F
Cluster-2	CTL2	0x02	0x04 to 0x05	0x08 to 0x0B	0x10 to 0x17
		0x03	0x06 to 0x07	0x0C to 0x0F	0x18 to 0x1F

Table 4-52 Correspondence Table of Cluster # and MP # of VSP G200 and a Variety of Numbering

Cluster	CTL Location Name	MP#		PK#			
		Hardware	Internal Part	MPU#	MP in MP#	MPPK#	MPPK in MP#
Cluster-1	CTL1	0x00	0x00	0x00	0x00	0x00	0x00
		0x01	0x01		0x01		0x01
		0x02	0x02	0x01	0x00		0x02
		0x03	0x03		0x01		0x03
Cluster-2	CTL2	0x04	0x04	0x02	0x00	0x01	0x00
		0x05	0x05		0x01		0x01
		0x06	0x06	0x03	0x00		0x02
		0x07	0x07		0x01		0x03

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Table 4-53 Correspondence Table of Cluster # and MP # of VSP G400, G600 and a Variety of Numbering

Cluster	CTL Location Name	MP#		PK#			
		Hardware	Internal Part	MPU#	MP in MP#	MPPK#	MPPK in MP#
Cluster-1	CTL1	0x00	0x00	0x00	0x00	0x00	0x00
		0x01	0x01		0x01		0x01
		0x02	0x02		0x02		0x02
		0x03	0x03		0x03		0x03
		0x04	0x04	0x01	0x00		0x04
		0x05	0x05		0x01		0x05
		0x06	0x06		0x02		0x06
		0x07	0x07		0x03		0x07
Cluster-2	CTL2	0x08	0x08	0x02	0x00	0x01	0x00
		0x09	0x09		0x01		0x01
		0x0A	0x0A		0x02		0x02
		0x0B	0x0B		0x03		0x03
		0x0C	0x0C	0x03	0x00		0x04
		0x0D	0x0D		0x01		0x05
		0x0E	0x0E		0x02		0x06
		0x0F	0x0F		0x03		0x07

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Table 4-54 Correspondence Table of Cluster # and MP # of VSP G800 and a Variety of Numbering

Cluster	CTL Location Name	MP#		PK#			
		Hardware	Internal Part	MPU#	MP in MP#	MPPK#	MPPK in MP#
Cluster-1	CTL1	0x00	0x00	0x00	0x00	0x00	0x00
		0x01	0x01		0x01		0x01
		0x02	0x02		0x02		0x02
		0x03	0x03		0x03		0x03
		0x04	0x04		0x04		0x04
		0x05	0x05		0x05		0x05
		0x06	0x06		0x06		0x06
		0x07	0x07		0x07		0x07
		0x08	0x08	0x01	0x00		0x08
		0x09	0x09		0x01		0x09
		0x0A	0x0A		0x02		0x0A
		0x0B	0x0B		0x03		0x0B
		0x0C	0x0C		0x04		0x0C
		0x0D	0x0D		0x05		0x0D
		0x0E	0x0E		0x06		0x0E
		0x0F	0x0F		0x07		0x0F
Cluster-2	CTL2	0x10	0x10	0x02	0x00	0x01	0x10
		0x11	0x11		0x01		0x11
		0x12	0x12		0x02		0x12
		0x13	0x13		0x03		0x13
		0x14	0x14		0x04		0x14
		0x15	0x15		0x05		0x15
		0x16	0x16		0x06		0x16
		0x17	0x17		0x07		0x17
		0x18	0x18	0x03	0x00		0x18
		0x19	0x19		0x01		0x19
		0x1A	0x1A		0x02		0x1A
		0x1B	0x1B		0x03		0x1B
		0x1C	0x1C		0x04		0x1C
		0x1D	0x1D		0x05		0x1D
		0x1E	0x1E		0x06		0x1E
		0x1F	0x1F		0x07		0x1F

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Table 4-55 Relationship between Cluster # and CHB#, DKB#

Cluster	CHB/DKB Location Name	VSP G200		VSP G400, G600		VSP G800	
		CHB#	DKB#	CHB#	DKB#	CHB#	DKB#
Cluster-1	CHB-1A / DKB-1A	0x00	—	0x00	—	0x00	—
	CHB-1B / DKB-1B	0x01	—	0x01	—	0x01	—
	CHB-1C / DKB-1C	—	0x00	0x02	—	0x02	—
	CHB-1D	—	—	0x03	—	0x03	—
	CHB-1E / DKB-1E	—	—	0x04 (*1)	—	0x04	0x02
	CHB-1F / DKB-1F	—	—	0x05 (*1)	—	0x05	0x03
	CHB-1G / DKB-1G	—	—	0x06 (*1)	—	0x06	0x00
	CHB-1H / DKB-1H	—	—	0x07	0x00	0x07	0x01
	CHB-1J	—	—	—	—	0x08 (*2)	—
	CHB-1K	—	—	—	—	0x09 (*2)	—
	CHB-1L	—	—	—	—	0x0A (*2)	—
	CHB-1M	—	—	—	—	0x0B (*2)	—
Cluster-2	CHB-2A / DKB-2A	0x02	—	0x08	—	0x10	—
	CHB-2B / DKB-2B	0x03	—	0x09	—	0x11	—
	CHB-2C / DKB-2C	—	0x01	0x0A	—	0x12	—
	CHB-2D	—	—	0x0B	—	0x13	—
	CHB-2E / DKB-2E	—	—	0x0C (*1)	—	0x14	0x06
	CHB-2F / DKB-2F	—	—	0x0D (*1)	—	0x15	0x07
	CHB-2G / DKB-2G	—	—	0x0E (*1)	—	0x16	0x04
	CHB-2H / DKB-2H	—	—	0x0F	0x01	0x17	0x05
	CHB-2J	—	—	—	—	0x18 (*2)	—
	CHB-2K	—	—	—	—	0x19 (*2)	—
	CHB-2L	—	—	—	—	0x1A (*2)	—
	CHB-2M	—	—	—	—	0x1B (*2)	—

*1: When the firmware version is 83-02-01-x0/xx or later.

*2: When the firmware version is 83-02-01-x0/xx or later and the Channel Board Box is mounted.

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Table 4-56 Relationship between Cluster # and Channel Port#

Cluster	CHB Location Name	VSP G200 Channel Port# (HEX)	VSP G400, G600 Channel Port# (HEX)	VSP G800 Channel Port# (HEX)
Cluster-1	CHB-1A	0x00 to 0x03	0x00 to 0x03	0x00 to 0x03
	CHB-1B	0x04 to 0x07	0x04 to 0x07	0x04 to 0x07
	CHB-1C	—	0x08 to 0x0B	0x08 to 0x0B
	CHB-1D	—	0x0C to 0x0F	0x0C to 0x0F
	CHB-1E	—	0x10 to 0x13 (*1)	0x10 to 0x13
	CHB-1F	—	0x14 to 0x17 (*1)	0x14 to 0x17
	CHB-1G	—	0x18 to 0x1B (*1)	0x18 to 0x1B
	CHB-1H	—	0x1C to 0x1F	0x1C to 0x1F
	CHB-1J	—	—	0x20 to 0x23 (*2)
	CHB-1K	—	—	0x24 to 0x27 (*2)
	CHB-1L	—	—	0x28 to 0x2B (*2)
	CHB-1M	—	—	0x2C to 0x2F (*2)
Cluster-2	CHB-2A	0x08 to 0x0B	0x20 to 0x23	0x40 to 0x43
	CHB-2B	0x0C to 0x0F	0x24 to 0x27	0x44 to 0x47
	CHB-2C	—	0x28 to 0x2B	0x48 to 0x4B
	CHB-2D	—	0x2C to 0x2F	0x4C to 0x4F
	CHB-2E	—	0x30 to 0x33 (*1)	0x50 to 0x53
	CHB-2F	—	0x34 to 0x37 (*1)	0x54 to 0x57
	CHB-2G	—	0x38 to 0x3B (*1)	0x58 to 0x5B
	CHB-2H	—	0x3C to 0x3F	0x5C to 0x5F
	CHB-2J	—	—	0x60 to 0x63 (*2)
	CHB-2K	—	—	0x64 to 0x67 (*2)
	CHB-2L	—	—	0x68 to 0x6B (*2)
	CHB-2M	—	—	0x6C to 0x6F (*2)

*1: When the firmware version is 83-02-01-x0/xx or later.

*2: When the firmware version is 83-02-01-x0/xx or later and the Channel Board Box is mounted.

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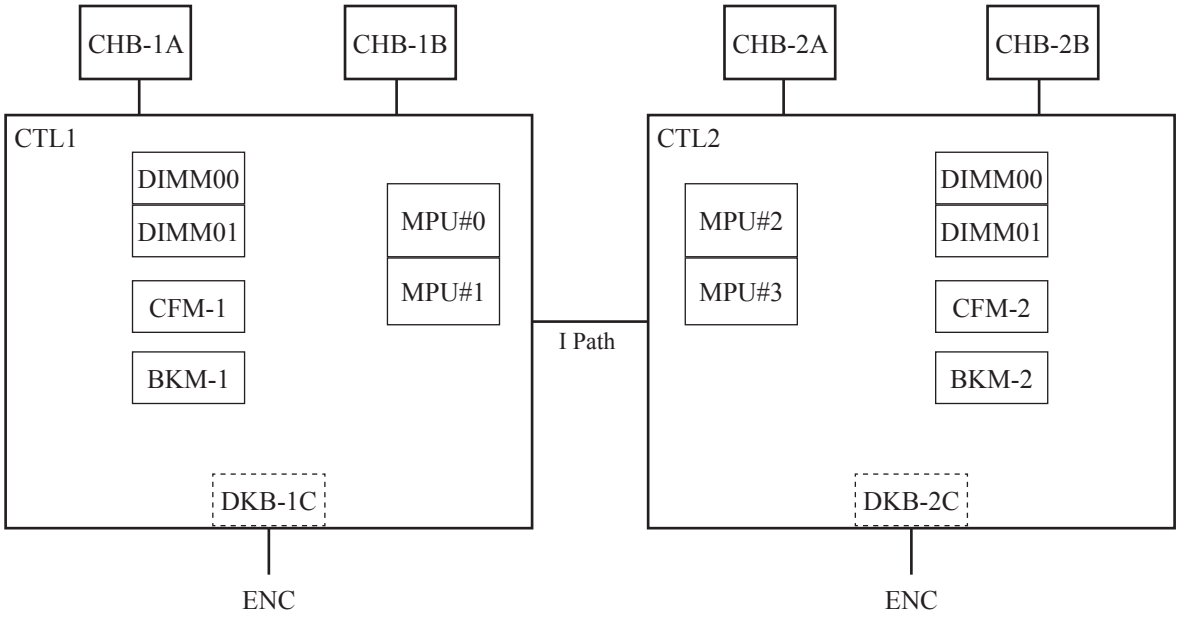
Table 4-57 Relationship between Cluster # and SASCTL#, SAS Port#

Cluster	CHB/DKB Location Name	VSP G200		VSP G400, G600		VSP G800	
		SASCTL#	SASPort#	SASCTL#	SASPort#	SASCTL#	SASPort#
Cluster-1	DKB-1C	0x00	0x00 to 0x01	—	—	—	—
	DKB-1E	—	—	—	—	0x02	0x04 to 0x05
	DKB-1F	—	—	—	—	0x03	0x06 to 0x07
	DKB-1G	—	—	—	—	0x00	0x00 to 0x01
	DKB-1H	—	—	0x00	0x00 to 0x01	0x01	0x02 to 0x03
Cluster-2	DKB-2C	0x01	0x02 to 0x03	—	—	—	—
	DKB-2E	—	—	—	—	0x06	0x0C to 0x0D
	DKB-2F	—	—	—	—	0x07	0x0E to 0x0F
	DKB-2G	—	—	—	—	0x04	0x08 to 0x09
	DKB-2H	—	—	0x01	0x02 to 0x03	0x05	0x0A to 0x0B

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4.4 Connection Diagram of DKC

Figure 4-1 VSP G200



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Figure 4-2 VSP G400, G600

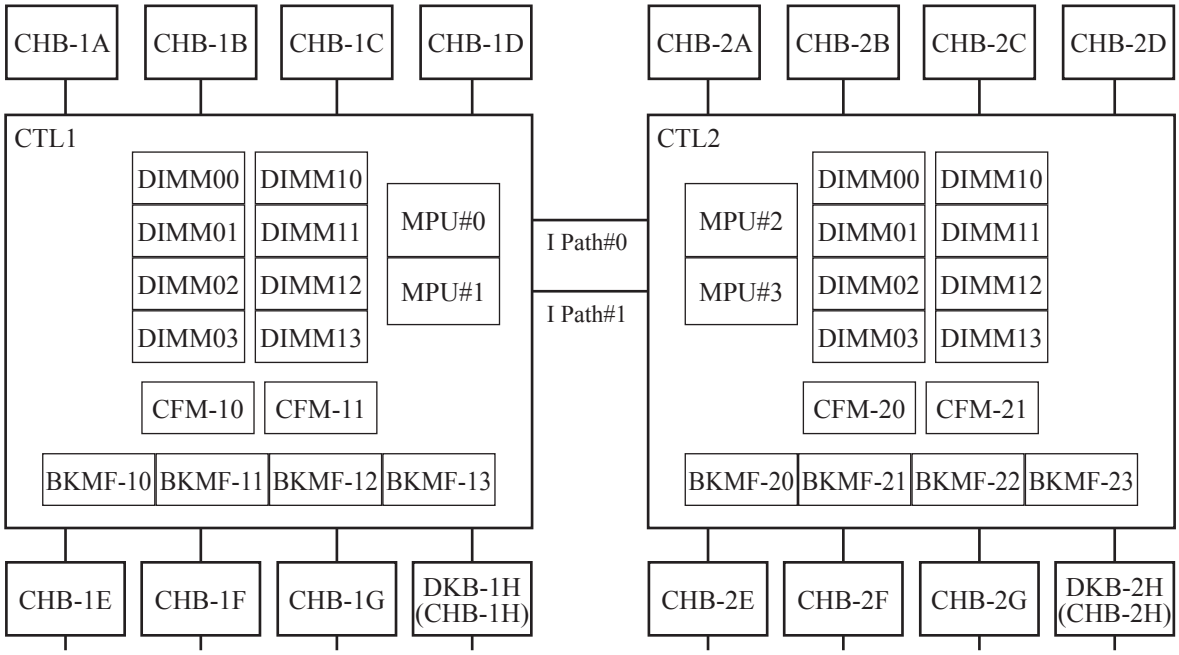
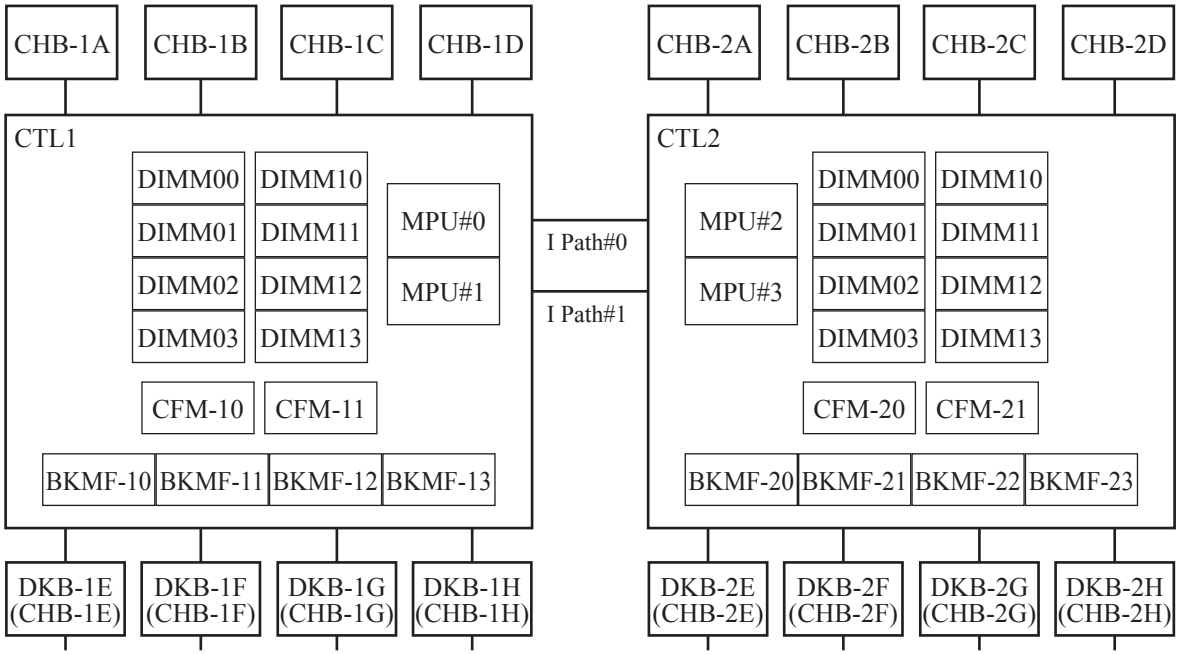


Figure 4-3 VSP G800



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4.5 Channel Interface (Fiber and iSCSI)

NOTE: iSCSI in this Chapter indicates iSCSI (optic/copper) of the Channel Board.
(Model name: DW-F800-2HS10B/2HS10S)
Regarding iSCSI for NAS Module, see "File Service Administration Guide".

4.5.1 Basic Functions

The basic specifications of the Fibre Channel Board and iSCSI Interface board are shown in Table 4-58.

Table 4-58 Basic specifications

Item		Specification	
		FC	iSCSI
Host Channel	Max. # of Ports	VSP G200 : 16 VSP G400, G600 : 32 (HDD less : 40) 56 (HDD less : 64) (*1) VSP G800 : 48 (HDD less : 64) 64 (HDD less : 80) (*2)	VSP G200 : 8 VSP G400, G600 : 16 (HDD less : 20) 28 (HDD less : 32) (*1) VSP G800 : 24 (HDD less : 32) 32 (HDD less : 40) (*2)
	Max. # of concurrent paths/Port	256	255
Data transfer		DW-F800-4HF8: 2, 4, 8 Gbps DW-F800-2HF16: 4, 8, 16 Gbps DW-F800-4HF32R: 4, 8, 16, 32 Gbps (*3)	DW-F800-2HS10S: 10 Gbps DW-F800-2HS10B: 1, 10 Gbps
RAID level		RAID6/RAID5/RAID1	
RAID configuration		RAID6	
		RAID5	
		RAID1	
Cache capacity	minimum	32 G byte/System	
	maximum	256 G byte/System	
	additional unit	32 G byte	

*1: When the firmware version is 83-02-01-x0/xx or later.
*2: When the firmware version is 83-02-01-x0/xx or later and the Channel Board Box is mounted.
*3: When the firmware version is 83-04-01-x0/xx or later.

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4.5.2 Glossary

- iSCSI(Internet Small Computer Systems Interface)
  This is a technology to transmit and receives the block data by SCSI on the IP network.

- iSNS(Internet Storage Name Service)
  This is a technology to detect the iSCSI device on the IP network.

- NIC(Network Interface Card)
  This is an interface card for network communication to be installed in the server or PC.
  It is also called a network card, LAN card or LAN board. It includes a port installed on the motherboard in the server or PC.

- CNA(Converged Network Adapter)
  This is an integrated network adapter which supports LAN (TCP/IP) and iSCSI at a 10 Gbps Ethernet speed.

- IPv4(Internet Protocol version 4)
  This is an IP address of 32-bit address length.

- IPv6(Internet Protocol version 6)
  This is an IP address of 128-bit address length.

- VLAN(Virtual LAN)
  This is a technology to create a virtual LAN segment.

- CHAP(Challenge Handshake Authentication Protocol)
  This is a user authentication method of handshakes by encoding a user name and secret.
  In the [CHAP] authentication, the iSCSI target authenticates the iSCSI initiator.
  Furthermore, in the bidirectional CHAP authentication, the iSCSI target and the iSCSI initiator authenticate each other.

- iSCSI Digest
  iSCSI Header Digest and iSCSI Data Digest exist and checks the data consistency end to end.

- iSCSI Name
  The iSCSI node has an iSCSI name consisting of a maximum of 223 characters for node identification.

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4.5.3 Interface Specifications

4.5.3.1 Fibre Channel Physical Interface Specifications

The physical interface specification supported for Fibre Channel (FC) is shown in Table 4-59 to Table 4-60.

Table 4-59 Fibre Channel Physical specification

No.	Item		Specification	Remarks
1	Host interface	Physical interface	Fibre Channel	FC-PH,FC-AL
		Logical interface	SCSI-3	FCP,FC-PLDA
			Fibre	FC-AL
2	Data Transfer Rate	Optic Fibre cable	2, 4, 8, 16, 32 (*1) Gbps	—
3	Cable Length	Optic single mode Fibre	10km	Longwave laser
		Optic multi mode Fibre	500 m/400 m/190 m/125m/ 100 m (*1)	Shortwave laser
4	Connector Type		LC	—
5	Topology		NL-Port (FC-AL) F-Port FL-Port	—
6	Service class		3	—
7	Protocol		FCP	—
8	Transfer code		2, 4, 8 Gbps : 8B/10B translate 16, 32 Gbps : 64B/66B translate	—
9	Number of hosts		255/Path	—
10	Number of host groups		255/Path	—
11	Maximum number of LUs		2048/Path	—
12	PORT/PCB		4 Port	—

*1: See Table 4-85.

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Table 4-60 Fibre Channel Port name

Cluster	CHB/DKB Location	VSP G200		VSP G400, G600		VSP G800	
		CHB#	DKB#	CHB#	DKB#	CHB#	DKB#
Cluster-1	CHB-1A / DKB-1A	0x00	—	0x00	—	0x00	—
	CHB-1B / DKB-1B	0x01	—	0x01	—	0x01	—
	CHB-1C / DKB-1C	—	0x00	0x02	—	0x02	—
	CHB-1D	—	—	0x03	—	0x03	—
	CHB-1E / DKB-1E	—	—	0x04 (*1)	—	0x04	0x02
	CHB-1F / DKB-1F	—	—	0x05 (*1)	—	0x05	0x03
	CHB-1G / DKB-1G	—	—	0x06 (*1)	—	0x06	0x00
	CHB-1H / DKB-1H	—	—	0x07	0x00	0x07	0x01
	CHB-1J	—	—	—	—	0x08 (*2)	—
	CHB-1K	—	—	—	—	0x09 (*2)	—
	CHB-1L	—	—	—	—	0x0A (*2)	—
	CHB-1M	—	—	—	—	0x0B (*2)	—
Cluster-2	CHB-2A / DKB-2A	0x02	—	0x08	—	0x10	—
	CHB-2B / DKB-2B	0x03	—	0x09	—	0x11	—
	CHB-2C / DKB-2C	—	0x01	0x0A	—	0x12	—
	CHB-2D	—	—	0x0B	—	0x13	—
	CHB-2E / DKB-2E	—	—	0x0C (*1)	—	0x14	0x06
	CHB-2F / DKB-2F	—	—	0x0D (*1)	—	0x15	0x07
	CHB-2G / DKB-2G	—	—	0x0E (*1)	—	0x16	0x04
	CHB-2H / DKB-2H	—	—	0x0F	0x01	0x17	0x05
	CHB-2J	—	—	—	—	0x18 (*2)	—
	CHB-2K	—	—	—	—	0x19 (*2)	—
	CHB-2L	—	—	—	—	0x1A (*2)	—
	CHB-2M	—	—	—	—	0x1B (*2)	—

*1: When the firmware version is 83-02-01-x0/xx or later.

*2: When the firmware version is 83-02-01-x0/xx or later and the Channel Board Box is mounted.

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4.5.3.2 iSCSI Physical Interface Specifications

The physical interface specification supported for iSCSI is shown in Table 4-61 to Table 4-62.

Table 4-61 iSCSI Physical specification

No.	Item		Specification	Remarks
1	Host interface	Physical interface	10Gbps : 10Gbps SFP+	—
		Logical interface	RFC3720	—
2	Data Transfer Rate	Optic Fibre cable	10Gbps	—
3	Cable Length	Optic single mode Fibre	(Not supported)	—
		Optic multi mode Fibre	OM2:82m, OM3:100m	—
4	Connector Type	Optic	LC	—
5	Topology		—	—
6	Service class		—	—
7	Protocol		TCP/IP, iSCSI	—
8	Transfer code		—	—
9	Number of hosts		255/Port	—
10	Number of host groups		255/Port	A target in case of iSCSI
11	Maximum number of LUs		2048/Path	(Same as Fibre)
12	PORT/PCB		2 Port	—

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The iSCSI port is a 2-port/CHB and a configuration without 5x, 7x, 6x and 8x installed for the Fibre Channel port.

Table 4-62 CHB/DKB Location Name and Corresponding CHB/DKB #

Cluster	CHB/DKB Location	VSP G200		VSP G400, G600		VSP G800	
		CHB#	DKB#	CHB#	DKB#	CHB#	DKB#
Cluster-1	CHB-1A / DKB-1A	0x00	—	0x00	—	0x00	—
	CHB-1B / DKB-1B	0x01	—	0x01	—	0x01	—
	CHB-1C / DKB-1C	—	0x00	0x02	—	0x02	—
	CHB-1D	—	—	0x03	—	0x03	—
	CHB-1E / DKB-1E	—	—	0x04 (*1)	—	0x04	0x02
	CHB-1F / DKB-1F	—	—	0x05 (*1)	—	0x05	0x03
	CHB-1G / DKB-1G	—	—	0x06 (*1)	—	0x06	0x00
	CHB-1H / DKB-1H	—	—	0x07	0x00	0x07	0x01
	CHB-1J	—	—	—	—	0x08 (*2)	—
	CHB-1K	—	—	—	—	0x09 (*2)	—
	CHB-1L	—	—	—	—	0x0A (*2)	—
	CHB-1M	—	—	—	—	0x0B (*2)	—
Cluster-2	CHB-2A / DKB-2A	0x02	—	0x08	—	0x10	—
	CHB-2B / DKB-2B	0x03	—	0x09	—	0x11	—
	CHB-2C / DKB-2C	—	0x01	0x0A	—	0x12	—
	CHB-2D	—	—	0x0B	—	0x13	—
	CHB-2E / DKB-2E	—	—	0x0C (*1)	—	0x14	0x06
	CHB-2F / DKB-2F	—	—	0x0D (*1)	—	0x15	0x07
	CHB-2G / DKB-2G	—	—	0x0E (*1)	—	0x16	0x04
	CHB-2H / DKB-2H	—	—	0x0F	0x01	0x17	0x05
	CHB-2J	—	—	—	—	0x18 (*2)	—
	CHB-2K	—	—	—	—	0x19 (*2)	—
	CHB-2L	—	—	—	—	0x1A (*2)	—
	CHB-2M	—	—	—	—	0x1B (*2)	—

*1: When the firmware version is 83-02-01-x0/xx or later.

*2: When the firmware version is 83-02-01-x0/xx or later and the Channel Board Box is mounted.

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4.5.4 Volume Specification (Common to Fibre/iSCSI)

1. Volume Specification
   Model Number of Disk Drive and supported RAID Level are shown in Table 4-63.

Table 4-63 List of DW800 Model number

Model Number	Disk Drive model (type name displayed in MPC window) (*1)	RAID Level
DKC-F810I-600JCM (*2)/ DKC-F810I-600JCMC	DKR5D-J600SS/DKS5E-J600SS/ DKR5G-J600SS/DKS5H-J600SS	RAID1 (2D+2D/4D+4D) RAID5 (3D+1P/4D+1P/6D+1P/7D+1P) RAID6 (6D+2P/12D+2P/14D+2P)
DKC-F810I-600KGM	DKR5C-K600SS/DKS5D-K600SS/ DKS5E-K600SS	
DKC-F810I-1R2JCM (*2)/ DKC-F810I-1R2JCMC	DKR5E-J1R2SS/DKS5F-J1R2SS/ DKR5G-J1R2SS/DKS5H-J1R2SS	
DKC-F810I-1R2J5M (*2)/ DKC-F810I-1R2J5MC	DKR5E-J1R2SS/DKS5F-J1R2SS/ DKR5G-J1R2SS	
DKC-F810I-1R2J7M (*2)/ DKC-F810I-1R2J7MC	DKR5E-J1R2SS/DKS5F-J1R2SS/ DKR5G-J1R2SS/DKS5H-J1R2SS	
DKC-F810I-300KCM (*2)/ DKC-F810I-300KCMC	DKS5C-K300SS/DKR5C-K300SS/ DKS5D-K300SS/DKS5E-K300SS	
DKC-F810I-4R0H3M (*2)/ DKC-F810I-4R0H3MC	DKR2E-H4R0SS/DKS2E-H4R0SS/ DKR2G-H4R0SS/DKS2H-H4R0SS	
DKC-F810I-4R0H4M (*2)/ DKC-F810I-4R0H4MC	DKR2E-H4R0SS/DKS2E-H4R0SS/ DKR2G-H4R0SS/DKS2H-H4R0SS	
DKC-F810I-200MEM	SLB5B-M200SS/SLR5D-M200SS/ SLB5C-M200SS/SLB5E-M200SS	
DKC-F810I-400MEM	SLB5B-M400SS/SLR5D-M400SS/ SLB5C-M400SS/SLB5E-M400SS	
DKC-F810I-400M6M	SLB5B-M400SS/SLB5C-M400SS	
DKC-F810I-400M8M	SLB5B-M400SS/SLB5C-M400SS/ SLB5E-M400SS	
DKC-F810I-480MGM	SLB5F-M480SS	
DKC-F810I-960MGM	SLB5F-M960SS	
DKC-F810I-1R9MEM	SLB5D-M1R9SS/SLB5E-M1R9SS	
DKC-F810I-1R9MGM	SLB5E-M1R9SS	
DKC-F810I-3R8MGM	SLB5F-M3R8SS	
DKC-F710I-1R6FM	NFH1A-P1R6SS/NFH1C-P1R6SS/ NFH1D-P1R6SS	
DKC-F810I-1R6FN	NFHAE-Q1R6SS	
DKC-F710I-3R2FM	NFH1B-P3R2SS/NFH1C-P3R2SS/ NFH1D-P3R2SS	
DKC-F810I-3R2FN	NFHAE-Q3R2SS	
DKC-F810I-6R4FN	NFHAE-Q6R4SS	
DKC-F810I-7R0FP	NFHAF-Q6R4SS	
DKC-F810I-14RFP	NFHAF-Q13RSS	
DKC-F810I-6R0H9M (*2)/ DKC-F810I-6R0HLM (*2)	DKS2F-H6R0SS/DKR2G-H6R0SS/ DKS2H-H6R0SS	

(To be continued)

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(Continued from the preceding page)

Model Number	Disk Drive model (type name displayed in MPC window) (*1)	RAID Level
DKC-F810I-10RH9M DKC-F810I-10RHLM	DKR2H-H10RSS	RAID1 (2D+2D/4D+4D) RAID5 (3D+1P/4D+1P/6D+1P/7D+1P) RAID6 (6D+2P/12D+2P/14D+2P)
DKC-F810I-1R8JGM	DKR5G-J1R8SS/DKS5H-J1R8SS	
DKC-F810I-1R8J6M	DKR5G-J1R8SS	
DKC-F810I-1R8J8M	DKR5G-J1R8SS/DKS5H-J1R8SS	

*1: The disk drive type name displayed in the MPC window might differ from the one on the drive. In such a case, refer to INSTALLATION SECTION "1.2.2 Disk Drive Model".

*2: Contains BNST

NOTE:
- As for RAID1, the concatenation of two parity groups is possible (8HDDs).
  In this case the number of volumes required is doubled.
  Two concatenation and four concatenation (16HDDs and 32HDDs) of the RAID Groups are possible for RAID5 (7D+1P).
  In this case, the number of volumes becomes twice or four times.
  When OPEN-V is set in the parity group of the above-mentioned connection configuration, the maximum volume size becomes the parity cycle size of the source (2D+2D) or (7D+1P). It does not become twice or four times.
- The Storage System capacity is different from one of Maintenance PC, because of 1GB=1000Mbyte calculation.

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2. List of emulation types

NOTE: In the Accelerated Compression enabled RAID group, a logical volume that has more than or equal to the drive capacity can be created depending on the compression rate of the data to be stored. For the details, see “Provisioning Guide”.

(1) VSP G800 and VSP F800

Table 4-64 List of emulation types (VSP G800)

RAID Level / Storage capacity (GB/volume)			2D+2D (RAID1)	3D+1P (RAID5)	4D+1P (RAID5)	6D+1P (RAID5)
DBS	300KCM(*1)/ 300KCMC	PG	1 - 287	1 - 287	1 - 229	1 - 164
		Capacity	576.3 - 165,398.1	864.5 - 248,111.5	1,152.7 - 264,429.4	1,729.1 - 282,831.4
	600KGM/ 600JCM(*1)/ 600JCMC	PG	1 - 287	1 - 287	1 - 229	1 - 164
		Capacity	1,152.7 - 330,824.9	1,729.1 - 496,251.7	2,305.5 - 528,881.7	3,458.3 - 565,679.1
	1R2JCM(*1)/ 1R2JCMC	PG	1 - 287	1 - 287	1 - 229	1 - 164
		Capacity	2,305.5 - 661,678.5	3,458.3 - 992,532.1	4,611.1 - 1,057,786.3	6,916.7 - 1,131,374.5
	200MEM	PG	1 - 287	1 - 287	1 - 229	1 - 164
		Capacity	393.8 - 113,020.6	590.7 - 169,530.9	787.6 - 180,675.4	1,181.5 - 193,259.6
	400MEM	PG	1 - 287	1 - 287	1 - 229	1 - 164
		Capacity	787.6 - 226,041.2	1,181.5 - 339,090.5	1,575.3 - 361,373.8	2,363.0 - 386,519.3
	960MGM	PG	1 - 287	1 - 287	1 - 229	1 - 164
		Capacity	1,890.4 - 542,544.8	2,835.6 - 813,817.2	3,780.9 - 867,338.5	5,671.3 - 927,662.6
	1R8JGM	PG	1 - 287	1 - 287	1 - 229	1 - 164
		Capacity	3,458.5 - 992,589.5	5,187.8 -1,488,898.6	6,917.1 - 1,586,782.7	10,375.7 - 1,697,168.1
	1R9MEM/ 1R9MGM	PG	1 - 287	1 - 287	1 - 229	1 - 164
		Capacity	3,780.9 - 1,085,118.3	5,671.3 - 1,627,663.1	7,561.8 - 1,734,676.9	11,342.7 - 1,855,341.6
	3R8MGM	PG	1 - 287	1 - 287	1 - 229	1 - 164
		Capacity	7,561.8 - 2,170,236.6	11,342.7 - 3,255,354.9	15,123.6 - 3,469,353.8	22,685.5 - 3,710,699.6
DBL	1R2J5M(*1)/ 1R2J5MC	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	2,305.5 - 329,686.5	3,458.3 - 494,536.9	4,611.1 - 526,587.6	6,916.7 - 562,228.9
	4R0H3M(*1)/ 4R0H3MC	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	7,832.2 - 1,120,004.6	11,748.4 - 1,680,021.2	15,664.5 - 1,788,885.9	23,496.8 - 1,909,954.2
	6R0H9M	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	11,748.4 - 1,680,021.2	17,622.6 - 2,520,031.8	23,496.8 - 2,683,334.6	35,245.2 - 2,864,931.3
	10RH9M	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	19,580.7 - 2,800,040.1	29,371.0 - 4,200,053.0	39,161.4 - 4,472,231.9	58,742.1 - 4,774,893.6
	400M6M	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	787.6 - 112,626.8	1,181.5 - 168,954.5	1,575.3 - 179,899.3	2,363.0 - 192,078.1
	1R8J6M	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	3,458.5 - 494,565.5	5,187.8 - 741,855.4	6,917.1 - 789,932.8	10,375.7 - 843,396.2
DB60	1R2J7M(*1)/ 1R2J7MC	PG	1 - 359	1 - 359	1 - 287	1 - 205
		Capacity	2,305.5 - 827,674.5	3,458.3 - 1,241,529.7	4,611.1 - 1,323,385.7	6,916.7 - 1,415,947.3
	4R0H4M(*1)/ 4R0H4MC	PG	1 - 359	1 - 359	1 - 287	1 - 205
		Capacity	7,832.2 - 2,811,759.8	11,748.4 - 4,217,675.6	15,664.5 - 4,495,711.5	23,496.8 - 4,810,130.6
	6R0HLM	PG	1 - 359	1 - 359	1 - 287	1 - 205
		Capacity	11,748.4 - 4,217,675.6	17,622.6 - 6,326,513.4	23,496.8 - 6,743,581.6	35,245.2 - 7,215,195.9
	10RHLM	PG	1 - 359	1 - 359	1 - 287	1 - 205
		Capacity	19,580.7 - 7,029,471.3	29,371.0 - 10,544,189.0	39,161.4 - 1,239,321.8	58,742.1 - 2,025,347.0
	400M8M	PG	1 - 359	1 - 359	1 - 287	1 - 205
		Capacity	787.6 - 282,748.4	1,181.5 - 424,158.5	1,575.3 - 452,111.1	2,363.0 - 483,739.9
	1R8J8M	PG	1 - 359	1 - 359	1 - 287	1 - 205
		Capacity	3,458.5 - 1,241,601.5	5,187.8 - 1,862,420.2	6,917.1 - 1,985,207.7	10,375.7 - 2,124,054.0
DBF	1R6FM/ 1R6FN	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	3,518.4 - 503,131.2	5,277.6 - 754,696.8	7,036.8 - 803,602.6	10,555.3 - 857,995.1
	3R2FM/ 3R2FN	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	7,036.8 - 1,006,262.4	10,555.3 - 1,509,407.9	14,073.7 - 1,607,216.5	21,110.6 - 1,715,990.2
	6R4FN/ 7R0FP	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	14,073.7 - 2,012,546.0	21,110.6 - 3,018,815.8	28,147.4 - 3,214,433.1	42,221.2 - 3,431,980.4
	14RFP	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	28,147.5 - 4,025,091.9	42,221.2 - 6,037,631.6	56,294.9 - 6,428,877.6	84,442.4 - 6,863,960.8

(To be continued)

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RAID Level / Storage capacity (GB/volume)			7D+1P (RAID5)	6D+2P (RAID6)	12D+2P (RAID6)	14D+2P (RAID6)
DBS	300KCM(*1)/ 300KCMC	PG	1 - 143	1 - 143	1 - 81	1 - 71
		Capacity	2,017.3 - 288,473.9	1,729.1 - 247,261.3	3,458.3 - 281,110.4	4,034.7 - 286,463.7
	600KGM/ 600JCM(*1)/ 600JCMC	PG	1 - 143	1 - 143	1 - 81	1 - 71
		Capacity	4,034.7 - 576,962.1	3,458.3 - 494,536.9	6,916.7 - 562,228.9	8,069.5 - 572,934.5
	1R2JCM(*1)/ 1R2JCMC	PG	1 - 143	1 - 143	1 - 81	1 - 71
		Capacity	8,069.5 - 1,153,938.5	6,916.7 - 989,088.1	13,833.4 - 1,124,457.8	16,139.0 - 1,145,869.0
	200MEM	PG	1 - 143	1 - 143	1 - 81	1 - 71
		Capacity	1,378.4 - 197,111.2	1,181.5 - 168,954.5	2,363.0 - 192,078.1	2,756.9 - 195,739.9
	400MEM	PG	1 - 143	1 - 143	1 - 81	1 - 71
		Capacity	2,756.9 - 394,236.7	2,363.0 - 337,909.0	4,726.1 - 384,164.4	5,513.8 - 391,479.8
	960MGM	PG	1 - 143	1 - 143	1 - 81	1 - 71
		Capacity	6,616.6 - 946,173.8	5,671.3 - 810,995.9	11,342.7 - 921,999.5	13,233.2 - 939,557.2
	1R8JGM	PG	1 - 143	1 - 143	1 - 81	1 - 71
		Capacity	12,105.0 - 1,731,015.0	10,375.7 - 1,483,725.1	20,751.4 - 1,686,792.4	24,210.0 - 1,718,910.0
	1R9MEM/ 1R9MGM	PG	1 - 143	1 - 143	1 - 81	1 - 71
		Capacity	13,233.2 - 1,892,347.6	11,342.7 - 1,622,006.1	22,685.5 - 1,844,007.1	26,466.4 - 1,879,114.4
	3R8MGM	PG	1 - 143	1 - 143	1 - 81	1 - 71
		Capacity	26,466.4 - 3,784,695.2	22,685.5 - 3,244,026.5	45,371.0 - 3,688,014.1	52,932.9 - 3,758,235.9
DBL	1R2J5M(*1)/ 1R2J5MC	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	8,069.5 - 572,934.5	6,916.7 - 491,085.7	13,833.4 - 555,312.2	16,139.0 - 564,865.0
	4R0H3M(*1)/ 4R0H3MC	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	27,413.0 - 1,946,323.0	23,496.8 - 1,668,272.8	46,993.7 - 1,886,461.4	54,826.0 - 1,918,910.0
	6R0H9M	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	41,119.5 - 2,919,484.5	35,245.2 - 2,502,409.2	70,490.5 - 2,829,690.1	82,239.0 - 2,878,365.0
	10RH9M	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	68,532.5 - 4,865,807.5	58,742.1 - 4,170,689.1	117,484.3 - 4,716,155.5	137,065.0 - 4,797,275.0
	400M6M	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	2,756.9 - 195,739.9	2,363.0 - 167,773.0	4,726.1 - 189,719.2	5,513.8 - 192,983.0
	1R8J6M	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	12,105.0 - 859,455.0	10,375.7 - 736,674.7	20,751.4 - 833,020.5	24,210.0 - 847,350.0
DB60	1R2J7M(*1)/ 1R2J7MC	PG	1 - 179	1 - 179	1 - 102	1 - 89
		Capacity	8,069.5 - 1,444,440.5	6,916.7 - 1,238,089.3	13,833.4 - 1,409,030.6	16,139.0 - 1,436,371.0
	4R0H4M(*1)/ 4R0H4MC	PG	1 - 179	1 - 179	1 - 102	1 - 89
		Capacity	27,413.0 - 4,906,927.0	23,496.8 - 4,205,927.2	46,993.7 - 4,786,644.0	54,826.0 - 4,879,514.0
	6R0HLM	PG	1 - 179	1 - 179	1 - 102	1 - 89
		Capacity	41,119.5 - 7,360,390.5	35,245.2 - 6,308,890.8	70,490.5 - 7,179,960.9	82,239.0 - 7,319,271.0
	10RHLM	PG	1 - 179	1 - 179	1 - 102	1 - 89
		Capacity	68,532.5 - 12,267,317.5	58,742.1 - 10,514,835.9	117,484.3 - 11,966,615.1	137,065.0 - 12,198,785.0
	400M8M	PG	1 - 179	1 - 179	1 - 102	1 - 89
		Capacity	2,756.9 - 493,485.1	2,363.0 - 422,977.0	4,726.1 - 481,387.0	5,513.8 - 490,728.2
	1R8J8M	PG	1 - 179	1 - 179	1 - 102	1 - 89
		Capacity	12,105.0 - 2,166,795.0	10,375.7 - 1,857,250.3	20,751.4 - 2,113,678.3	24,210.0 - 2,154,690.0
DBF	1R6FM/ 1R6FN	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	12,314.5 - 874,329.5	10,555.3 - 749,426.3	21,110.6 - 847,439.8	24,629.0 - 862,015.0
	3R2FM/ 3R2FN	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	24,629.0 - 1,748,659.0	21,110.6 - 1,498,852.6	42,221.2 - 1,694,879.6	49,258.1 - 1,724,033.5
	6R4FN/ 7R0FP	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	49,258.1 - 3,497,325.1	42,221.2 - 2,997,705.2	84,442.4 - 3,389,759.2	98,516.2 - 3,448,067.0
	14RFP	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	98,516.2 - 6,994,650.2	84,442.4 - 5,995,410.4	168,884.9 - 6,779,522.4	197,032.4 - 6,896,134.0

*1: Contains BNST

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Table 4-65 List of emulation types (VSP F800)

RAID Level / Storage capacity (GB/volume)			2D+2D (RAID1)	3D+1P (RAID5)	4D+1P (RAID5)	6D+1P (RAID5)
DBF	1R6FM/ 1R6FN	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	3,518.4 - 503,131.2	5,277.6 - 754,696.8	7,036.8 - 803,602.6	10,555.3 - 857,995.1
	3R2FM/ 3R2FN	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	7,036.8 - 1,006,262.4	10,555.3 - 1,509,407.9	14,073.7 - 1,607,216.5	21,110.6 - 1,715,990.2
	6R4FN/ 7R0FP	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	14,073.7 - 2,012,546.0	21,110.6 - 3,018,815.8	28,147.4 - 3,214,433.1	42,221.2 - 3,431,980.4
	14RFP	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	28,147.5 - 4,025,091.9	42,221.2 - 6,037,631.6	56,294.9 - 6,428,877.6	84,442.4 - 6,863,960.8

RAID Level / Storage capacity (GB/volume)			7D+1P (RAID5)	6D+2P (RAID6)	12D+2P (RAID6)	14D+2P (RAID6)
DBF	1R6FM/ 1R6FN	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	12,314.5 - 874,329.5	10,555.3 - 749,426.3	21,110.6 - 847,439.8	24,629.0 - 862,015.0
	3R2FM/ 3R2FN	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	24,629.0 - 1,748,659.0	21,110.6 - 1,498,852.6	42,221.2 - 1,694,879.6	49,258.1 - 1,724,033.5
	6R4FN/ 7R0FP	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	49,258.1 - 3,497,325.1	42,221.2 - 2,997,705.2	84,442.4 - 3,389,759.2	98,516.2 - 3,448,067.0
	14RFP	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	98,516.2 - 6,994,650.2	84,442.4 - 5,995,410.4	168,884.9 - 6,779,522.4	197,032.4 - 6,896,134.0

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(2) VSP G600 and VSP F600

Table 4-66 List of emulation types (VSP G600)

RAID Level / Storage capacity (GB/volume)			2D+2D (RAID1)	3D+1P (RAID5)	4D+1P (RAID5)	6D+1P (RAID5)
DBS	300KCM(*1)/ 300KCMC	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	576.3 - 82,410.9	864.5 - 123,623.5	1,152.7 - 131,638.3	1,729.1 - 140,551.1
	600KGM/ 600JCM(*1)/ 600JCMC	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	1,152.7 - 164,836.1	1,729.1 - 247,261.3	2,305.5 - 263,288.1	3,458.3 - 281,110.4
	1R2JCM(*1)/ 1R2JCMC	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	2,305.5 - 329,686.5	3,458.3 - 494,536.9	4,611.1 - 526,587.6	6,916.7 - 562,228.9
	200MEM	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	393.8 - 56,313.4	590.7 - 84,470.1	787.6 - 89,943.9	1,181.5 - 96,039.1
	400MEM	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	787.6 - 112,626.8	1,181.5 - 168,954.5	1,575.3 - 179,899.3	2,363.0 - 192,078.1
	480MGM	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	945.2 - 135,163.6	1,417.8 - 202,745.4	1,890.4 - 215,883.7	2,835.6 - 230,493.8
	960MGM	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	1,890.4 - 270,327.2	2,835.6 - 405,490.8	3,780.9 - 431,778.8	5,671.3 - 460,995.7
	1R8JGM	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	3,458.5 - 494,565.5	5,187.8 - 741,855.4	6,917.1 - 789,932.8	10,375.7 - 843,396.2
	1R9MEM/ 1R9MGM	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	3,780.9 - 540,668.7	5,671.3 - 810,995.9	7,561.8 - 863,557.6	11,342.7 - 921,999.5
	3R8MGM	PG	1 - 143	1 - 143	1 - 114	1 - 81
		Capacity	7,561.8 - 1,081,337.4	11,342.7 - 1,622,006.1	15,123.6 - 1,727,115.1	22,685.5 - 1,844,007.1
DBL	1R2J5M(*1)/ 1R2J5MC	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	2,305.5 - 163,690.5	3,458.3 - 245,539.3	4,611.1 - 260,988.3	6,916.7 - 277,656.1
	4R0H3M(*1)/ 4R0H3MC	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	7,832.2 - 556,086.2	11,748.4 - 834,136.4	15,664.5 - 886,610.7	23,496.8 - 943,228.7
	6R0H9M	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	11,748.4 - 834,136.4	17,622.6 - 1,251,204.6	23,496.8 - 1,329,918.9	35,245.2 - 1,414,843.0
	10RH9M	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	19,580.7 - 1,390,229.7	29,371.0 - 2,085,341.0	39,161.4 - 2,216,535.2	58,742.1 - 2,358,075.7
	400M6M	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	787.6 - 55,919.6	1,181.5 - 83,886.5	1,575.3 - 89,162.0	2,363.0 - 94,857.6
	1R8J6M	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	3,458.5 - 245,553.5	5,187.8 - 368,333.8	6,917.1 - 391,507.9	10,375.7 - 416,510.2
DB60	1R2J7M(*1)/ 1R2J7MC	PG	1 - 179	1 - 179	1 - 143	1 - 102
		Capacity	2,305.5 - 412,684.5	3,458.3 - 619,035.7	4,611.1 - 659,387.3	6,916.7 - 704,515.3
	4R0H4M(*1)/ 4R0H4MC	PG	1 - 179	1 - 179	1 - 143	1 - 102
		Capacity	7,832.2 - 1,401,963.8	11,748.4 - 2,102,963.6	15,664.5 - 2,240,023.5	23,496.8 - 2,393,316.9
	6R0HLM	PG	1 - 179	1 - 179	1 - 143	1 - 102
		Capacity	11,748.4 - 2,102,963.6	17,622.6 - 3,154,445.4	23,496.8 - 3,360,042.4	35,245.2 - 3,589,975.4
	10RHLM	PG	1 - 179	1 - 179	1 - 143	1 - 102
		Capacity	19,580.7 - 3,504,945.3	29,371.0 - 5,257,409.0	39,161.4 - 5,600,080.2	58,742.1 - 5,983,302.5
	400M8M	PG	1 - 179	1 - 179	1 - 143	1 - 102
		Capacity	787.6 - 140,980.4	1,181.5 - 211,488.5	1,575.3 - 225,267.9	2,363.0 - 240,688.4
	1R8J8M	PG	1 - 179	1 - 179	1 - 143	1 - 102
		Capacity	3,458.5 - 619,071.5	5,187.8 - 928,616.2	6,917.1 - 989,145.3	10,375.7 - 1,056,839.2
DBF	1R6FM/ 1R6FN	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	3,518.4 - 249,806.4	5,277.6 - 374,709.6	7,036.8 - 398,282.9	10,555.3 - 423,719.9
	3R2FM/ 3R2FN	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	7,036.8 - 499,612.8	10,555.3 - 749,426.3	14,073.7 - 796,571.4	21,110.6 - 847,439.8
	6R4FN/ 7R0FP	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	14,073.7 - 999,236.1	21,110.6 - 1,498,852.6	28,147.4 - 1,593,142.8	42,221.2 - 1,694,879.6
	14RFP	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	28,147.5 - 1,998,472.2	42,221.2 - 2,997,705.2	56,294.9 - 3,186,291.3	84,442.4 - 3,389,759.2

*1: Contains BNST

(To be continued)

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RAID Level / Storage capacity (GB/volume)			7D+1P (RAID5)	6D+2P (RAID6)	12D+2P (RAID6)	14D+2P (RAID6)
DBS	300KCM(*1)/ 300KCMC	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	2,017.3 - 143,228.3	1,729.1 - 122,766.1	3,458.3 - 138,826.0	4,034.7 - 141,214.5
	600KGM/ 600JCM(*1)/ 600JCMC	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	4,034.7 - 286,463.7	3,458.3 - 245,539.3	6,916.7 - 277,656.1	8,069.5 - 282,432.5
	1R2JCM(*1)/ 1R2JCMC	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	8,069.5 - 572,934.5	6,916.7 - 491,085.7	13,833.4 - 555,312.2	16,139.0 - 564,865.0
	200MEM	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	1,378.4 - 97,866.4	1,181.5 - 83,886.5	2,363.0 - 94,857.6	2,756.9 - 96,491.5
	400MEM	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	2,756.9 - 195,739.9	2,363.0 - 167,773.0	4,726.1 - 189,719.2	5,513.8 - 192,983.0
	480MGM	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	3,308.3 - 234,889.3	2,835.6 - 201,327.6	5,671.3 - 227,662.2	6,616.6 - 231,581.0
	960MGM	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	6,616.6 - 469,778.6	5,671.3 - 402,662.3	11,342.7 - 455,328.4	13,233.2 - 463,162.0
	1R8JGM	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	12,105.0 - 859,455.0	10,375.7 - 736,674.7	20,751.4 - 833,020.5	24,210.0 - 847,350.0
	1R9MEM/ 1R9MGM	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	13,233.2 - 939,557.2	11,342.7 - 805,331.7	22,685.5 - 910,660.8	26,466.4 - 926,324.0
	3R8MGM	PG	1 - 71	1 - 71	1 - 40	1 - 35
		Capacity	26,466.4 - 1,879,114.4	22,685.5 - 1,610,670.5	45,371.0 - 1,821,321.6	52,932.9 - 1,852,651.5
DBL	1R2J5M(*1)/ 1R2J5MC	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	8,069.5 - 282,432.5	6,916.7 - 242,084.5	13,833.4 - 270,739.4	16,139.0 - 274,363.0
	4R0H3M(*1)/ 4R0H3MC	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	27,413.0 - 959,455.0	23,496.8 - 822,388.0	46,993.7 - 919,733.8	54,826.0 - 932,042.0
	6R0H9M	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	41,119.5 - 1,439,182.5	35,245.2 - 1,233,582.0	70,490.5 - 1,379,599.8	82,239.0 - 1,398,063.0
	10RH9M	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	68,532.5 - 2,398,637.5	58,742.1 - 2,055,973.5	117,484.3 - 2,299,335.6	137,065.0 - 2,330,105.0
	400M6M	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	2,756.9 - 96,491.5	2,363.0 - 82,705.0	4,726.1 - 92,496.5	5,513.8 - 93,734.6
	1R8J6M	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	12,105.0 - 423,675.0	10,375.7 - 363,149.5	20,751.4 - 406,134.5	24,210.0 - 411,570.0
DB60	1R2J7M(*1)/ 1R2J7MC	PG	1 - 89	1 - 89	1 - 50	1 - 44
		Capacity	8,069.5 - 718,185.5	6,916.7 - 615,586.3	13,833.4 - 697,598.6	16,139.0 - 710,116.0
	4R0H4M(*1)/ 4R0H4MC	PG	1 - 89	1 - 89	1 - 50	1 - 44
		Capacity	27,413.0 - 2,439,757.0	23,496.8 - 2,091,215.2	46,993.7 - 2,369,825.2	54,826.0 - 2,412,344.0
	6R0HLM	PG	1 - 89	1 - 89	1 - 50	1 - 44
		Capacity	41,119.5 - 3,659,635.5	35,245.2 - 3,136,822.8	70,490.5 - 3,554,735.2	82,239.0 - 3,618,516.0
	10RHLM	PG	1 - 89	1 - 89	1 - 50	1 - 44
		Capacity	68,532.5 - 6,099,392.5	58,742.1 - 5,228,046.9	117,484.3 - 5,924,565.4	137,065.0 - 6,030,860.0
	400M8M	PG	1 - 89	1 - 89	1 - 50	1 - 44
		Capacity	2,756.9 - 245,364.1	2,363.0 - 210,307.0	4,726.1 - 238,330.5	5,513.8 - 242,607.2
	1R8J8M	PG	1 - 89	1 - 89	1 - 50	1 - 44
		Capacity	12,105.0 - 1,077,345.0	10,375.7 - 923,437.3	20,751.4 - 1,046,463.5	24,210.0 - 1,065,240.0
DBF	1R6FM/ 1R6FN	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	12,314.5 - 431,007.5	10,555.3 - 369,435.5	21,110.6 - 413,164.6	24,629.0 - 418,693.0
	3R2FM/ 3R2FN	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	24,629.0 - 862,015.0	21,110.6 - 738,871.0	42,221.2 - 826,329.2	49,258.1 - 837,387.7
	6R4FN/ 7R0FP	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	49,258.1 - 1,724,033.5	42,221.2 - 1,477,742.0	84,442.4 - 1,652,658.4	98,516.2 - 1,674,775.4
	14RFP	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	98,516.2 - 3,448,067.0	84,442.4 - 2,955,484.0	168,884.9 - 3,305,318.8	197,032.4 - 3,349,550.8

*1: Contains BNST

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Table 4-67 List of emulation types (VSP F600)

RAID Level / Storage capacity (GB/volume)			2D+2D (RAID1)	3D+1P (RAID5)	4D+1P (RAID5)	6D+1P (RAID5)
DBF	1R6FM/ 1R6FN	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	3,518.4 - 249,806.4	5,277.6 - 374,709.6	7,036.8 - 398,282.9	10,555.3 - 423,719.9
	3R2FM/ 3R2FN	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	7,036.8 - 499,612.8	10,555.3 - 749,426.3	14,073.7 - 796,571.4	21,110.6 - 847,439.8
	6R4FN/ 7R0FP	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	14,073.7 - 999,236.1	21,110.6 - 1,498,852.6	28,147.4 - 1,593,142.8	42,221.2 - 1,694,879.6
	14RFP	PG	1 - 71	1 - 71	1 - 57	1 - 40
		Capacity	28,147.5 - 1,998,472.2	42,221.2 - 2,997,705.2	56,294.9 - 3,186,291.3	84,442.4 - 3,389,759.2

RAID Level / Storage capacity (GB/volume)			7D+1P (RAID5)	6D+2P (RAID6)	12D+2P (RAID6)	14D+2P (RAID6)
DBF	1R6FM/ 1R6FN	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	12,314.5 - 431,007.5	10,555.3 - 369,435.5	21,110.6 - 413,164.6	24,629.0 - 418,693.0
	3R2FM/ 3R2FN	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	24,629.0 - 862,015.0	21,110.6 - 738,871.0	42,221.2 - 826,329.2	49,258.1 - 837,387.7
	6R4FN/ 7R0FP	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	49,258.1 - 1,724,033.5	42,221.2 - 1,477,742.0	84,442.4 - 1,652,658.4	98,516.2 - 1,674,775.4
	14RFP	PG	1 - 35	1 - 35	1 - 20	1 - 17
		Capacity	98,516.2 - 3,448,067.0	84,442.4 - 2,955,484.0	168,884.9 - 3,305,318.8	197,032.4 - 3,349,550.8

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(3) VSP G400 and VSP F400

Table 4-68 List of emulation types (VSP G400)

RAID Level / Storage capacity (GB/volume)			2D+2D (RAID1)	3D+1P (RAID5)	4D+1P (RAID5)	6D+1P (RAID5)
DBS	300KCM(*1)/ 300KCMC	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	576.3 - 54,748.5	864.5 - 82,127.5	1,152.7 - 87,374.7	1,729.1 - 93,124.4
	600KGM/ 600JCM(*1)/ 600JCMC	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	1,152.7 - 109,506.5	1,729.1 - 164,264.5	2,305.5 - 174,756.9	3,458.3 - 186,254.2
	1R2JCM(*1)/ 1R2JCMC	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	2,305.5 - 219,022.5	3,458.3 - 328,538.5	4,611.1 - 349,521.4	6,916.7 - 372,513.7
	200MEM	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	393.8 - 37,411.0	590.7 - 56,116.5	787.6 - 59,700.1	1,181.5 - 63,632.2
	400MEM	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	787.6 - 74,822.0	1,181.5 - 112,242.5	1,575.3 - 119,407.7	2,363.0 - 127,264.4
	480MGM	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	945.2 - 89,794.0	1,417.8 - 134,691.0	1,890.4 - 143,292.3	2,835.6 - 152,717.3
	960MGM	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	1,890.4 - 179,588.0	2,835.6 - 269,382.0	3,780.9 - 286,592.2	5,671.3 - 305,440.0
	1R8JGM	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	3,458.5 - 328,557.5	5,187.8 - 492,841.0	6,917.1 - 524,316.2	10,375.7 - 558,805.6
	1R9MEM/ 1R9MGM	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	3,780.9 - 359,185.5	5,671.3 - 538,773.5	7,561.8 - 573,184.4	11,342.7 - 610,885.4
	3R8MGM	PG	1 - 95	1 - 95	1 - 76	1 - 54
		Capacity	7,561.8 - 718,371.0	11,342.7 - 1,077,556.5	15,123.6 - 1,146,368.9	22,685.5 - 1,221,776.2
DBL	1R2J5M(*1)/ 1R2J5MC	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	2,305.5 - 108,358.5	3,458.3 - 162,540.1	4,611.1 - 172,455.1	6,916.7 - 182,798.5
	4R0H3M(*1)/ 4R0H3MC	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	7,832.2 - 368,113.4	11,748.4 - 552,174.8	15,664.5 - 585,852.3	23,496.8 - 620,986.9
	6R0H9M	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	11,748.4 - 552,174.8	17,622.6 - 828,262.2	23,496.8 - 878,780.3	35,245.2 - 931,480.3
	10RH9M	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	19,580.7 - 920,292.9	29,371.0 - 1,380,437.0	39,161.4 - 1,464,636.4	58,742.1 - 1,552,469.8
	400M6M	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	787.6 - 37,017.2	1,181.5 - 55,530.5	1,575.3 - 58,916.2	2,363.0 - 62,450.7
	1R8J6M	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	3,458.5 - 162,549.5	5,187.8 - 243,826.6	6,917.1 - 258,699.5	10,375.7 - 274,214.9
DB60	1R2J7M(*1)/ 1R2J7MC	PG	1 - 119	1 - 119	1 - 95	1 - 68
		Capacity	2,305.5 - 274,354.5	3,458.3 - 411,537.7	4,611.1 - 438,054.5	6,916.7 - 467,371.3
	4R0H4M(*1)/ 4R0H4MC	PG	1 - 119	1 - 119	1 - 95	1 - 68
		Capacity	7,832.2 - 932,031.8	11,748.4 - 1,398,059.6	15,664.5 - 1,488,127.5	23,496.8 - 1,587,712.3
	6R0HLM	PG	1 - 119	1 - 119	1 - 95	1 - 68
		Capacity	11,748.4 - 1,398,059.6	17,622.6 - 2,097,089.4	23,496.8 - 2,232,196.0	35,245.2 - 2,381,568.5
	10RHLM	PG	1 - 119	1 - 119	1 - 95	1 - 68
		Capacity	19,580.7 - 2,330,103.3	29,371.0 - 3,495,149.0	39,161.4 - 3,720,333.0	58,742.1 - 3,969,287.6
	400M8M	PG	1 - 119	1 - 119	1 - 95	1 - 68
		Capacity	787.6 - 93,724.4	1,181.5 - 140,598.5	1,575.3 - 149,653.5	2,363.0 - 159,671.3
	1R8J8M	PG	1 - 119	1 - 119	1 - 95	1 - 68
		Capacity	3,458.5 - 411,561.5	5,187.8 - 617,348.2	6,917.1 - 657,124.5	10,375.7 - 701,100.9
DBF	1R6FM/ 1R6FN	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	3,518.4 - 165,364.8	5,277.6 - 248,047.2	7,036.8 - 263,176.3	10,555.3 - 278,961.5
	3R2FM/ 3R2FN	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	7,036.8 - 330,729.6	10,555.3 - 496,099.1	14,073.7 - 526,356.4	21,110.6 - 557,923.0
	6R4FN/ 7R0FP	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	14,073.7 - 661,466.2	21,110.6 - 992,198.2	28,147.4 - 1,052,712.8	42,221.2 - 1,115,846.0
	14RFP	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	28,147.5 - 1,322,932.3	42,221.2 - 1,984,396.4	56,294.9 - 2,105,429.3	84,442.4 - 2,231,692.0

*1: Contains BNST

(To be continued)

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RAID Level / Storage capacity (GB/volume)			7D+1P (RAID5)	6D+2P (RAID6)	12D+2P (RAID6)	14D+2P (RAID6)
DBS	300KCM(*1)/ 300KCMC	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	2,017.3 - 94,813.1	1,729.1 - 81,267.7	3,458.3 - 91,397.9	4,034.7 - 92,798.1
	600KGM/ 600JCM(*1)/ 600JCMC	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	4,034.7 - 189,630.9	3,458.3 - 162,540.1	6,916.7 - 182,798.5	8,069.5 - 185,598.5
	1R2JCM(*1)/ 1R2JCMC	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	8,069.5 - 379,266.5	6,916.7 - 325,084.9	13,833.4 - 365,597.0	16,139.0 - 371,197.0
	200MEM	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	1,378.4 - 64,784.8	1,181.5 - 55,530.5	2,363.0 - 62,450.7	2,756.9 - 63,408.7
	400MEM	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	2,756.9 - 129,574.3	2,363.0 - 111,061.0	4,726.1 - 124,904.1	5,513.8 - 126,817.4
	480MGM	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	3,308.3 - 155,490.1	2,835.6 - 133,273.2	5,671.3 - 149,884.4	6,616.6 - 152,181.8
	960MGM	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	6,616.6 - 310,980.2	5,671.3 - 266,551.1	11,342.7 - 299,771.4	13,233.2 - 304,363.6
	1R8JGM	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	12,105.0 - 568,935.0	10,375.7 - 487,657.9	20,751.4 - 548,429.9	24,210.0 - 556,830.0
	1R9MEM/ 1R9MGM	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	13,233.2 - 621,960.4	11,342.7 - 533,106.9	22,685.5 - 599,545.4	26,466.4 - 608,727.2
	3R8MGM	PG	1 - 47	1 - 47	1 - 26	1 - 23
		Capacity	26,466.4 - 1,243,920.8	22,685.5 - 1,066,218.5	45,371.0 - 1,199,090.7	52,932.9 - 1,217,456.7
DBL	1R2J5M(*1)/ 1R2J5MC	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	8,069.5 - 185,598.5	6,916.7 - 159,084.1	13,833.4 - 175,881.8	16,139.0 - 177,529.0
	4R0H3M(*1)/ 4R0H3MC	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	27,413.0 - 630,499.0	23,496.8 - 540,426.4	46,993.7 - 597,491.3	54,826.0 - 603,086.0
	6R0H9M	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	41,119.5 - 945,748.5	35,245.2 - 810,639.6	70,490.5 - 896,236.4	82,239.0 - 904,629.0
	10RH9M	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	68,532.5 - 1,576,247.5	58,742.1 - 1,351,068.3	117,484.3 - 1,493,729.0	137,065.0 - 1,507,715.0
	400M6M	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	2,756.9 - 63,408.7	2,363.0 - 54,349.0	4,726.1 - 60,089.0	5,513.8 - 60,651.8
	1R8J6M	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	12,105.0 - 278,415.0	10,375.7 - 238,641.1	20,751.4 - 263,839.2	24,210.0 - 266,310.0
DB60	1R2J7M(*1)/ 1R2J7MC	PG	1 - 59	1 - 59	1 - 33	1 - 29
		Capacity	8,069.5 - 476,100.5	6,916.7 - 408,085.3	13,833.4 - 460,454.6	16,139.0 - 468,031.0
	4R0H4M(*1)/ 4R0H4MC	PG	1 - 59	1 - 59	1 - 33	1 - 29
		Capacity	27,413.0 - 1,617,367.0	23,496.8 - 1,386,311.2	46,993.7 - 1,564,218.9	54,826.0 - 1,589,954.0
	6R0HLM	PG	1 - 59	1 - 59	1 - 33	1 - 29
		Capacity	41,119.5 - 2,426,050.5	35,245.2 - 2,079,466.8	70,490.5 - 2,346,326.6	82,239.0 - 2,384,931.0
	10RHLM	PG	1 - 59	1 - 59	1 - 33	1 - 29
		Capacity	68,532.5 - 4,043,417.5	58,742.1 - 3,465,783.9	117,484.3 - 3,910,548.8	137,065.0 - 3,974,885.0
	400M8M	PG	1 - 59	1 - 59	1 - 33	1 - 29
		Capacity	2,756.9 - 162,657.1	2,363.0 - 139,417.0	4,726.1 - 157,311.6	5,513.8 - 159,900.2
	1R8J8M	PG	1 - 59	1 - 59	1 - 33	1 - 29
		Capacity	12,105.0 - 714,195.0	10,375.7 - 612,166.3	20,751.4 - 690,725.2	24,210.0 - 702,090.0
DBF	1R6FM/ 1R6FN	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	12,314.5 - 283,233.5	10,555.3 - 242,771.9	21,110.6 - 268,406.2	24,629.0 - 270,919.0
	3R2FM/ 3R2FN	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	24,629.0 - 566,467.0	21,110.6 - 485,543.8	42,221.2 - 536,812.4	49,258.1 - 541,839.1
	6R4FN/ 7R0FP	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	49,258.1 - 1,132,936.3	42,221.2 - 971,087.6	84,442.4 - 1,073,624.8	98,516.2 - 1,083,678.2
	14RFP	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	98,516.2 - 2,265,872.6	84,442.4 - 1,942,175.2	168,884.9 - 2,147,250.9	197,032.4 - 2,167,356.4

*1: Contains BNST

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Table 4-69 List of emulation types (VSP F400)

RAID Level / Storage capacity (GB/volume)			2D+2D (RAID1)	3D+1P (RAID5)	4D+1P (RAID5)	6D+1P (RAID5)
DBF	1R6FM/ 1R6FN	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	3,518.4 - 165,364.8	5,277.6 - 248,047.2	7,036.8 - 263,176.3	10,555.3 - 278,961.5
	3R2FM/ 3R2FN	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	7,036.8 - 330,729.6	10,555.3 - 496,099.1	14,073.7 - 526,356.4	21,110.6 - 557,923.0
	6R4FN/ 7R0FP	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	14,073.7 - 661,466.2	21,110.6 - 992,198.2	28,147.4 - 1,052,712.8	42,221.2 - 1,115,846.0
	14RFP	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	28,147.5 - 1,322,932.3	42,221.2 - 1,984,396.4	56,294.9 - 2,105,429.3	84,442.4 - 2,231,692.0

RAID Level / Storage capacity (GB/volume)			7D+1P (RAID5)	6D+2P (RAID6)	12D+2P (RAID6)	14D+2P (RAID6)
DBF	1R6FM/ 1R6FN	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	12,314.5 - 283,233.5	10,555.3 - 242,771.9	21,110.6 - 268,406.2	24,629.0 - 270,919.0
	3R2FM/ 3R2FN	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	24,629.0 - 566,467.0	21,110.6 - 485,543.8	42,221.2 - 536,812.4	49,258.1 - 541,839.1
	6R4FN/ 7R0FP	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	49,258.1 - 1,132,936.3	42,221.2 - 971,087.6	84,442.4 - 1,073,624.8	98,516.2 - 1,083,678.2
	14RFP	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	98,516.2 - 2,265,872.6	84,442.4 - 1,942,175.2	168,884.9 - 2,147,250.9	197,032.4 - 2,167,356.4

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(4) VSP G200

Table 4-70 List of emulation types (VSP G200)

RAID Level / Storage capacity (GB/volume)			2D+2D (RAID1)	3D+1P (RAID5)	4D+1P (RAID5)	6D+1P (RAID5)
DBS (*2)	300KCM(*1)/ 300KCMC	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	576.3 - 27,086.1	864.5 - 40,631.5	1,152.7 - 43,111.0	1,729.1 - 45,697.6
	600KGM/ 600JCM(*1)/ 600JCMC	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	1,152.7 - 54,176.9	1,729.1 - 81,267.7	2,305.5 - 86,225.7	3,458.3 - 91,397.9
	1R2JCM(*1)/ 1R2JCMC	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	2,305.5 - 108,358.5	3,458.3 - 162,540.1	4,611.1 - 172,455.1	6,916.7 - 182,798.5
	200MEM	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	393.8 - 18,508.6	590.7 - 27,762.9	787.6 - 29,456.2	1,181.5 - 31,225.4
	400MEM	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	787.6 - 37,017.2	1,181.5 - 55,530.5	1,575.3 - 58,916.2	2,363.0 - 62,450.7
	480MGM	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	945.2 - 44,424.4	1,417.8 - 66,636.6	1,890.4 - 70,701.0	2,835.6 - 74,940.9
	960MGM	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	1,890.4 - 88,848.8	2,835.6 - 133,273.2	3,780.9 - 141,405.7	5,671.3 - 149,884.4
	1R8JGM	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	3,458.5 - 162,549.5	5,187.8 - 243,826.6	6,917.1 - 258,699.5	10,375.7 - 274,214.9
	1R9MEM/ 1R9MGM	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	3,780.9 - 177,702.3	5,671.3 - 266,551.1	7,561.8 - 282,811.3	11,342.7 - 299,771.4
	3R8MGM	PG	1 - 47	1 - 47	1 - 37	1 - 26
		Capacity	7,561.8 - 355,404.6	11,342.7 - 533,106.9	15,123.6 - 565,622.6	22,685.5 - 599,545.4
DBL (*3)	1R2J5M(*1)/ 1R2J5MC	PG	1 - 23	1 - 23	1 - 18	1 - 13
		Capacity	2,305.5 - 53,026.5	3,458.3 - 79,540.9	4,611.1 - 83,922.0	6,916.7 - 87,940.9
	4R0H3M(*1)/ 4R0H3MC	PG	1 - 23	1 - 23	1 - 18	1 - 13
		Capacity	7,832.2 - 180,140.6	11,748.4 - 270,213.2	15,664.5 - 285,093.9	23,496.8 - 298,745.0
	6R0H9M	PG	1 - 23	1 - 23	1 - 18	1 - 13
		Capacity	11,748.4 - 270,213.2	17,622.6 - 405,319.8	23,496.8 - 427,641.8	35,245.2 - 448,117.5
	10RH9M	PG	1 - 23	1 - 23	1 - 18	1 - 13
		Capacity	19,580.7 - 450,356.1	29,371.0 - 675,533.0	39,161.4 - 712,737.5	58,742.1 - 746,863.8
	400M6M	PG	1 - 23	1 - 23	1 - 18	1 - 13
		Capacity	787.6 - 18,114.8	1,181.5 - 27,174.5	1,575.3 - 28,670.5	2,363.0 - 30,043.9
	1R8J6M	PG	1 - 23	1 - 23	1 - 18	1 - 13
		Capacity	3,458.5 - 79,545.5	5,187.8 - 119,319.4	6,917.1 - 125,891.2	10,375.7 - 131,919.6
DB60	1R2J7M(*1)/ 1R2J7MC	PG	1 - 59	1 - 59	1 - 47	1 - 33
		Capacity	2,305.5 - 136,024.5	3,458.3 - 204,039.7	4,611.1 - 216,721.7	6,916.7 - 230,227.3
	4R0H4M(*1)/ 4R0H4MC	PG	1 - 59	1 - 59	1 - 47	1 - 33
		Capacity	7,832.2 - 462,099.8	11,748.4 - 693,155.6	15,664.5 - 736,231.5	23,496.8 - 782,107.8
	6R0HLM	PG	1 - 59	1 - 59	1 - 47	1 - 33
		Capacity	11,748.4 - 693,155.6	17,622.6 - 1,039,733.4	23,496.8 - 1,104,349.6	35,245.2 - 1,173,161.7
	10RHLM	PG	1 - 59	1 - 59	1 - 47	1 - 33
		Capacity	19,580.7 - 1,155,261.3	29,371.0 - 1,732,889.0	39,161.4 - 1,840,585.8	58,742.1 - 1,955,272.8
	400M8M	PG	1 - 59	1 - 59	1 - 47	1 - 33
		Capacity	787.6 - 46,468.4	1,181.5 - 69,708.5	1,575.3 - 74,039.1	2,363.0 - 78,654.1
	1R8J8M	PG	1 - 59	1 - 59	1 - 47	1 - 33
		Capacity	3,458.5 - 204,051.5	5,187.8 - 306,080.2	6,917.1 - 325,103.7	10,375.7 - 345,362.6
DBF	1R6FM/ 1R6FN	PG	1 - 20	1 - 20	1 - 16	1 - 11
		Capacity	3,518.4 - 70,368.0	5,277.6 - 105,552.0	7,036.8 - 111,181.4	10,555.3 - 116,108.3
	3R2FM/ 3R2FN	PG	1 - 20	1 - 20	1 - 16	1 - 11
		Capacity	7,036.8 - 140,736.0	10,555.3 - 211,106.0	14,073.7 - 222,364.5	21,110.6 - 232,216.6
	6R4FN/ 7R0FP	PG	1 - 20	1 - 20	1 - 16	1 - 11
		Capacity	14,073.7 - 281,475.0	21,110.6 - 422,212.0	28,147.4 - 444,728.9	42,221.2 - 464,433.2
	14RFP	PG	1 - 20	1 - 20	1 - 16	1 - 11
		Capacity	28,147.5 - 562,949.9	42,221.2 - 844,424.0	56,294.9 - 889,459.4	84,442.4 - 928,866.4

*1: Contains BNST

*2: The number of parity groups includes the Disk Drives installed in the Controller Chassis (VSP G200 (CBSS1)).

*3: The number of parity groups includes the Disk Drives installed in the Controller Chassis (VSP G200 (CBSL1)).

(To be continued)

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(Continued from the preceding page)

RAID Level / Storage capacity (GB/volume)			7D+1P (RAID5)	6D+2P (RAID6)	12D+2P (RAID6)	14D+2P (RAID6)
DBS (*2)	300KCM(*1)/ 300KCMC	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	2,017.3 - 46,397.9	1,729.1 - 39,769.3	3,458.3 - 43,969.8	4,034.7 - 44,381.7
	600KGM/ 600JCM(*1)/ 600JCMC	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	4,034.7 - 92,798.1	3,458.3 - 79,540.9	6,916.7 - 87,940.9	8,069.5 - 88,764.5
	1R2JCM(*1)/ 1R2JCMC	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	8,069.5 - 185,598.5	6,916.7 - 159,084.1	13,833.4 - 175,881.8	16,139.0 - 177,529.0
	200MEM	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	1,378.4 - 31,703.2	1,181.5 - 27,174.5	2,363.0 - 30,043.9	2,756.9 - 30,325.9
	400MEM	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	2,756.9 - 63,408.7	2,363.0 - 54,349.0	4,726.1 - 60,089.0	5,513.8 - 60,651.8
	480MGM	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	3,308.3 - 76,090.9	2,835.6 - 65,218.8	5,671.3 - 72,106.5	6,616.6 - 72,782.6
	960MGM	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	6,616.6 - 152,181.8	5,671.3 - 130,439.9	11,342.7 - 144,214.3	13,233.2 - 145,565.2
	1R8JGM	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	12,105.0 - 278,415.0	10,375.7 - 238,641.1	20,751.4 - 263,839.2	24,210.0 - 266,310.0
	1R9MEM/ 1R9MGM	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	13,233.2 - 304,363.6	11,342.7 - 260,882.1	22,685.5 - 288,429.9	26,466.4 - 291,130.4
	3R8MGM	PG	1 - 23	1 - 23	1 - 13	1 - 11
		Capacity	26,466.4 - 608,727.2	22,685.5 - 521,766.5	45,371.0 - 576,859.9	52,932.9 - 582,261.9
DBL (*3)	1R2J5M(*1)/ 1R2J5MC	PG	1 - 11	1 - 11	1 - 6	1 - 5
		Capacity	8,069.5 - 88,764.5	6,916.7 - 76,083.7	13,833.4 - 81,024.2	16,139.0 - 80,695.0
	4R0H3M(*1)/ 4R0H3MC	PG	1 - 11	1 - 11	1 - 6	1 - 5
		Capacity	27,413.0 - 301,543.0	23,496.8 - 258,464.8	46,993.7 - 275,248.8	54,826.0 - 274,130.0
	6R0H9M	PG	1 - 11	1 - 11	1 - 6	1 - 5
		Capacity	41,119.5 - 452,314.5	35,245.2 - 387,697.2	70,490.5 - 412,872.9	82,239.0 - 411,195.0
	10RH9M	PG	1 - 11	1 - 11	1 - 6	1 - 5
		Capacity	68,532.5 - 753,857.5	58,742.1 - 646,163.1	117,484.3 - 688,122.3	137,065.0 - 685,325.0
	400M6M	PG	1 - 11	1 - 11	1 - 6	1 - 5
		Capacity	2,756.9 - 30,325.9	2,363.0 - 25,993.0	4,726.1 - 27,681.4	5,513.8 - 27,569.0
	1R8J6M	PG	1 - 11	1 - 11	1 - 6	1 - 5
		Capacity	12,105.0 - 133,155.0	10,375.7 - 114,132.7	20,751.4 - 121,543.9	24,210.0 - 121,050.0
DB60	1R2J7M(*1)/ 1R2J7MC	PG	1 - 29	1 - 29	1 - 16	1 - 14
		Capacity	8,069.5 - 234,015.5	6,916.7 - 200,584.3	13,833.4 - 223,310.6	16,139.0 - 225,946.0
	4R0H4M(*1)/ 4R0H4MC	PG	1 - 29	1 - 29	1 - 16	1 - 14
		Capacity	27,413.0 - 794,977.0	23,496.8 - 681,407.2	46,993.7 - 758,612.6	54,826.0 - 767,564.0
	6R0HLM	PG	1 - 29	1 - 29	1 - 16	1 - 14
		Capacity	41,119.5 - 1,192,465.5	35,245.2 - 1,022,110.8	70,490.5 - 1,137,918.1	82,239.0 - 1,151,346.0
	10RHLM	PG	1 - 29	1 - 29	1 - 16	1 - 14
		Capacity	68,532.5 - 1,987,442.5	58,742.1 - 1,703,520.9	117,484.3 - 1,896,532.3	137,065.0 - 1,918,910.0
	400M8M	PG	1 - 29	1 - 29	1 - 16	1 - 14
		Capacity	2,756.9 - 79,950.1	2,363.0 - 68,527.0	4,726.1 - 76,292.8	5,513.8 - 77,193.2
	1R8J8M	PG	1 - 29	1 - 29	1 - 16	1 - 14
		Capacity	12,105.0 - 351,045.0	10,375.7 - 300,895.3	20,751.4 - 334,986.9	24,210.0 - 338,940.0
DBF	1R6FM/ 1R6FN	PG	1 - 10	1 - 10	1 - 5	1 - 4
		Capacity	12,314.5 - 116,987.8	10,555.3 - 100,275.4	21,110.6 - 105,553.0	24,629.0 - 104,673.3
	3R2FM/ 3R2FN	PG	1 - 10	1 - 10	1 - 5	1 - 4
		Capacity	24,629.0 - 233,975.5	21,110.6 - 200,550.7	42,221.2 - 211,106.0	49,258.1 - 209,346.9
	6R4FN/ 7R0FP	PG	1 - 10	1 - 10	1 - 5	1 - 4
		Capacity	49,258.1 - 467,952.0	42,221.2 - 401,101.4	84,442.4 - 422,212.0	98,516.2 - 418,693.9
	14RFP	PG	1 - 10	1 - 10	1 - 5	1 - 4
		Capacity	98,516.2 - 935,903.9	84,442.4 - 802,202.8	168,884.9 - 844,424.5	197,032.4 - 837,387.7

*1: Contains BNST

*2: The number of parity groups includes the Disk Drives installed in the Controller Chassis (VSP G200 (CBSS1)).

*3: The number of parity groups includes the Disk Drives installed in the Controller Chassis (VSP G200 (CBSL1)).

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3. The number of Drives and blocks for each RAID level

Table 4-71 The number of Drives and blocks for each RAID level

RAID Levcel		Drive Type	Capacity	
			MB	Logical Block
RAID1	2D+2D	DKS5x-K300SS/DKR5x-K300SS	549,692	1,125,768,192
		DKR5x-K600SS/DKS5x-K600SS	1,099,383	2,251,536,384
		DKR5x-J600SS/DKS5x-J600SS	1,099,383	2,251,536,384
		DKR5x-J1R2SS/DKS5x-J1R2SS	2,198,767	4,503,073,792
		DKR5x-J1R8SS/DKS5x-J1R8SS	3,298,352	6,755,024,896
		DKR2x-H4R0SS/DKS2x-H4R0SS	7,469,451	15,297,435,648
		DKS2x-H6R0SS/DKR2x-H6R0SS	11,204,177	22,946,153,472
		DKR2x-H10RSS	18,673,627	38,243,589,120
		SLB5x-M200SS/SLR5x-M200SS	375,601	769,229,824
		SLB5x-M400SS/SLR5x-M400SS	751,202	1,538,460,672
		SLB5x-M480SS	901,442	1,846,153,216
		SLB5x-M960SS	1,802,884	3,692,307,456
		SLB5x-M1R9SS	3,605,769	7,384,614,912
		SLB5x-M3R8SS	7,211,538	14,769,230,848
		NFH1A-P1R6SS/NFH1C-P1R6SS/ NFH1D-P1R6SS/NFHAE-Q1R6SS	3,355,440	6,871,940,096
		NFH1B-P3R2SS/NFH1C-P3R2SS/ NFH1D-P3R2SS/NFHAE-Q3R2SS	6,710,884	13,743,889,408
		NFHAE-Q6R4SS/NFHAF-Q6R4SS	13,421,772	27,487,788,032
		NFHAF-Q13RSS	26,843,543	54,975,577,088
RAID5	3D+1P	DKS5x-K300SS/DKR5x-K300SS	824,537	1,688,652,288
		DKR5x-K600SS/DKS5x-K600SS	1,649,075	3,377,304,576
		DKR5x-J600SS/DKS5x-J600SS	1,649,075	3,377,304,576
		DKR5x-J1R2SS/DKS5x-J1R2SS	3,298,150	6,754,610,688
		DKR5x-J1R8SS/DKS5x-J1R8SS	4,947,528	10,132,537,344
		DKR2x-H4R0SS/DKS2x-H4R0SS	11,204,177	22,946,153,472
		DKS2x-H6R0SS/DKR2x-H6R0SS	16,806,265	34,419,230,208
		DKR2x-H10RSS	28,010,441	57,365,383,680
		SLB5x-M200SS/SLR5x-M200SS	563,401	1,153,844,736
		SLB5x-M400SS/SLR5x-M400SS	1,126,802	2,307,691,008
		SLB5x-M480SS	1,352,163	2,769,229,824
		SLB5x-M960SS	2,704,326	5,538,461,184
		SLB5x-M1R9SS	5,408,653	11,076,922,368
		SLB5x-M3R8SS	10,817,307	22,153,846,272
		NFH1A-P1R6SS/NFH1C-P1R6SS/ NFH1D-P1R6SS/NFHAE-Q1R6SS	5,033,159	10,307,910,144
		NFH1B-P3R2SS/NFH1C-P3R2SS/ NFH1D-P3R2SS/NFHAE-Q3R2SS	10,066,325	20,615,834,112
		NFHAE-Q6R4SS/NFHAF-Q6R4SS	20,132,657	41,231,682,048
		NFHAF-Q13RSS	40,265,315	82,463,365,632

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RAID Levcel		Drive Type	Capacity	
			MB	Logical Block
RAID5	4D+1P	DKS5x-K300SS/DKR5x-K300SS	1,099,383	2,251,536,384
		DKR5x-K600SS/DKS5x-K600SS	2,198,766	4,503,072,768
		DKR5x-J600SS/DKS5x-J600SS	2,198,766	4,503,072,768
		DKR5x-J1R2SS/DKS5x-J1R2SS	4,397,533	9,006,147,584
		DKR5x-J1R8SS/DKS5x-J1R8SS	6,596,704	13,510,049,792
		DKR2x-H4R0SS/DKS2x-H4R0SS	14,938,902	30,594,871,296
		DKS2x-H6R0SS/DKR2x-H6R0SS	22,408,353	45,892,306,944
		DKR2x-H10RSS	37,347,255	76,487,178,240
		SLB5x-M200SS/SLR5x-M200SS	751,201	1,538,459,648
		SLB5x-M400SS/SLR5x-M400SS	1,502,403	3,076,921,344
		SLB5x-M480SS	1,802,884	3,692,306,432
		SLB5x-M960SS	3,605,769	7,384,614,912
		SLB5x-M1R9SS	7,211,538	14,769,229,824
		SLB5x-M3R8SS	14,423,077	29,538,461,696
		NFH1A-P1R6SS/NFH1C-P1R6SS/ NFH1D-P1R6SS/NFHAE-Q1R6SS	6,710,879	13,743,880,192
		NFH1B-P3R2SS/NFH1C-P3R2SS/ NFH1D-P3R2SS/NFHAE-Q3R2SS	13,421,767	27,487,778,816
		NFHAE-Q6R4SS/NFHAF-Q6R4SS	26,843,543	54,975,576,064
		NFHAF-Q13RSS	53,687,087	109,951,154,176
	6D+1P	DKS5x-K300SS/DKR5x-K300SS	1,649,075	3,377,304,576
		DKR5x-K600SS/DKS5x-K600SS	3,298,149	6,754,609,152
		DKR5x-J600SS/DKS5x-J600SS	3,298,149	6,754,609,152
		DKR5x-J1R2SS/DKS5x-J1R2SS	6,596,300	13,509,221,376
		DKR5x-J1R8SS/DKS5x-J1R8SS	9,895,056	20,265,074,688
		DKR2x-H4R0SS/DKS2x-H4R0SS	22,408,353	45,892,306,944
		DKS2x-H6R0SS/DKR2x-H6R0SS	33,612,530	68,838,460,416
		DKR2x-H10RSS	56,020,882	114,730,767,360
		SLB5x-M200SS/SLR5x-M200SS	1,126,802	2,307,689,472
		SLB5x-M400SS/SLR5x-M400SS	2,253,605	4,615,382,016
		SLB5x-M480SS	2,704,326	5,538,459,648
		SLB5x-M960SS	5,408,653	11,076,922,368
		SLB5x-M1R9SS	10,817,307	22,153,844,736
		SLB5x-M3R8SS	21,634,615	44,307,692,544
		NFH1A-P1R6SS/NFH1C-P1R6SS/ NFH1D-P1R6SS/NFHAE-Q1R6SS	10,066,319	20,615,820,288
		NFH1B-P3R2SS/NFH1C-P3R2SS/ NFH1D-P3R2SS/NFHAE-Q3R2SS	20,132,651	41,231,668,224
		NFHAE-Q6R4SS/NFHAF-Q6R4SS	40,265,315	82,463,364,096
		NFHAF-Q13RSS	80,530,630	164,926,731,264

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RAID Levcel		Drive Type	Capacity	
			MB	Logical Block
RAID5	7D+1P	DKS5x-K300SS/DKR5x-K300SS	1,923,920	3,940,188,672
		DKR5x-K600SS/DKS5x-K600SS	3,847,841	7,880,377,344
		DKR5x-J600SS/DKS5x-J600SS	3,847,841	7,880,377,344
		DKR5x-J1R2SS/DKS5x-J1R2SS	7,695,683	15,760,758,272
		DKR5x-J1R8SS/DKS5x-J1R8SS	11,544,232	23,642,587,136
		DKR2x-H4R0SS/DKS2x-H4R0SS	26,143,079	53,541,024,768
		DKS2x-H6R0SS/DKR2x-H6R0SS	39,214,618	80,311,537,152
		DKR2x-H10RSS	65,357,696	133,852,561,920
		SLB5x-M200SS/SLR5x-M200SS	1,314,602	2,692,304,384
		SLB5x-M400SS/SLR5x-M400SS	2,629,205	5,384,612,352
		SLB5x-M480SS	3,155,047	6,461,536,256
		SLB5x-M960SS	6,310,095	12,923,076,096
		SLB5x-M1R9SS	12,620,191	25,846,152,192
		SLB5x-M3R8SS	25,240,384	51,692,307,968
		NFH1A-P1R6SS/NFH1C-P1R6SS/ NFH1D-P1R6SS/NFHAE-Q1R6SS	11,744,038	24,051,790,336
		NFH1B-P3R2SS/NFH1C-P3R2SS/ NFH1D-P3R2SS/NFHAE-Q3R2SS	23,488,092	48,103,612,928
		NFHAE-Q6R4SS/NFHAF-Q6R4SS	46,976,200	96,207,258,112
		NFHAF-Q13RSS	93,952,402	192,414,519,808
RAID6	6D+2P	DKS5x-K300SS/DKR5x-K300SS	1,649,075	3,377,304,576
		DKR5x-K600SS/DKS5x-K600SS	3,298,149	6,754,609,152
		DKR5x-J600SS/DKS5x-J600SS	3,298,149	6,754,609,152
		DKR5x-J1R2SS/DKS5x-J1R2SS	6,596,300	13,509,221,376
		DKR5x-J1R8SS/DKS5x-J1R8SS	9,895,056	20,265,074,688
		DKR2x-H4R0SS/DKS2x-H4R0SS	22,408,353	45,892,306,944
		DKS2x-H6R0SS/DKR2x-H6R0SS	33,612,530	68,838,460,416
		DKR2x-H10RSS	56,020,882	114,730,767,360
		SLB5x-M200SS/SLR5x-M200SS	1,126,802	2,307,689,472
		SLB5x-M400SS/SLR5x-M400SS	2,253,605	4,615,382,016
		SLB5x-M480SS	2,704,326	5,538,459,648
		SLB5x-M960SS	5,408,653	11,076,922,368
		SLB5x-M1R9SS	10,817,307	22,153,844,736
		SLB5x-M3R8SS	21,634,615	44,307,692,544
		NFH1A-P1R6SS/NFH1C-P1R6SS/ NFH1D-P1R6SS/NFHAE-Q1R6SS	10,066,319	20,615,820,288
		NFH1B-P3R2SS/NFH1C-P3R2SS/ NFH1D-P3R2SS/NFHAE-Q3R2SS	20,132,651	41,231,668,224
		NFHAE-Q6R4SS/NFHAF-Q6R4SS	40,265,315	82,463,364,096
		NFHAF-Q13RSS	80,530,630	164,926,731,264

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(To be continued)

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(Continued from the preceding page)

RAID Levcel		Drive Type	Capacity	
			MB	Logical Block
RAID6	12D+2P	DKS5x-K300SS/DKR5x-K300SS	3,298,149	6,754,609,152
		DKR5x-K600SS/DKS5x-K600SS	6,596,298	13,509,218,304
		DKR5x-J600SS/DKS5x-J600SS	6,596,298	13,509,218,304
		DKR5x-J1R2SS/DKS5x-J1R2SS	13,192,599	27,018,442,752
		DKR5x-J1R8SS/DKS5x-J1R8SS	19,790,112	40,530,149,376
		DKR2x-H4R0SS/DKS2x-H4R0SS	44,816,706	91,784,613,888
		DKS2x-H6R0SS/DKR2x-H6R0SS	67,225,059	137,676,920,832
		DKR2x-H10RSS	112,041,765	229,461,534,720
		SLB5x-M200SS/SLR5x-M200SS	2,253,603	4,615,378,944
		SLB5x-M400SS/SLR5x-M400SS	4,507,209	9,230,764,032
		SLB5x-M480SS	5,408,652	11,076,919,296
		SLB5x-M960SS	10,817,307	22,153,844,736
		SLB5x-M1R9SS	21,634,614	44,307,689,472
		SLB5x-M3R8SS	43,269,231	88,615,385,088
		NFH1A-P1R6SS/NFH1C-P1R6SS/ NFH1D-P1R6SS/NFHAE-Q1R6SS	20,132,637	41,231,640,576
		NFH1B-P3R2SS/NFH1C-P3R2SS/ NFH1D-P3R2SS/NFHAE-Q3R2SS	40,265,301	82,463,336,448
		NFHAE-Q6R4SS/NFHAF-Q6R4SS	80,530,629	164,926,728,192
		NFHAF-Q13RSS	161,061,261	329,853,462,528
	14D+2P	DKS5x-K300SS/DKR5x-K300SS	3,847,841	7,880,377,344
		DKR5x-K600SS/DKS5x-K600SS	7,695,681	15,760,754,688
		DKR5x-J600SS/DKS5x-J600SS	7,695,681	15,760,754,688
		DKR5x-J1R2SS/DKS5x-J1R2SS	15,391,366	31,521,516,544
		DKR5x-J1R8SS/DKS5x-J1R8SS	23,088,464	47,285,174,272
		DKR2x-H4R0SS/DKS2x-H4R0SS	52,286,157	107,082,049,536
		DKS2x-H6R0SS/DKR2x-H6R0SS	78,429,236	160,623,074,304
		DKR2x-H10RSS	130,715,392	267,705,123,840
		SLB5x-M200SS/SLR5x-M200SS	2,629,204	5,384,608,768
		SLB5x-M400SS/SLR5x-M400SS	5,258,411	10,769,224,704
		SLB5x-M480SS	6,310,094	12,923,072,512
		SLB5x-M960SS	12,620,191	25,846,152,192
		SLB5x-M1R9SS	25,240,383	51,692,304,384
		SLB5x-M3R8SS	50,480,769	103,384,615,936
		NFH1A-P1R6SS/NFH1C-P1R6SS/ NFH1D-P1R6SS/NFHAE-Q1R6SS	23,488,077	48,103,580,672
		NFH1B-P3R2SS/NFH1C-P3R2SS/ NFH1D-P3R2SS/NFHAE-Q3R2SS	46,976,185	96,207,225,856
		NFHAE-Q6R4SS/NFHAF-Q6R4SS	93,952,401	192,414,516,224
		NFHAF-Q13RSS	187,904,804	384,829,039,616

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4.5.5 SCSI Commands

4.5.5.1 Common to Fibre/iSCSI

The DASD commands defined under the SCSI-3 standards and those supported by the DKC are listed in Table 4-72.

Table 4-72 SCSI-3 DASD commands and DKC-supported commands

Group	Op Code	Name of Command	Type	○:Supported	Remarks
0 (00H -1FH)	00H	Test Unit Ready	CTL/SNS	○	—
	01H	Rezero Unit	CTL/SNS	Nop	—
	03H	Requirement Sense	CTL/SNS	○	—
	04H	Format Unit	DIAG	Nop	—
	07H	Reassign Blocks	DIAG	Nop	—
	08H	Read (6)	RD/WR	○	—
	0AH	Write (6)	RD/WR	○	—
	0BH	Seek (6)	CTL/SNS	Nop	—
	12H	Inquiry	CTL/SNS	○	—
	15H	Mode Select (6)	CTL/SNS	○	—
	16H	Reserve	CTL/SNS	○	—
	17H	Release	CTL/SNS	○	—
	1AH	Mode Sense (6)	CTL/SNS	○	—
	1BH	Start/Stop Unit	CTL/SNS	Nop	—
	1CH	Receive Diagnostic Results	DIAG	—	—
	1DH	Send Diagnostic	DIAG	Nop	Supported only for self-test.
1 (20H -3FH)	25H	Read Capacity (10)	CTL/SNS	○	—
	28H	Read (10)	RD/WR	○	—
	2AH	Write (10)	RD/WR	○	—
	2BH	Seek (10)	CTL/SNS	Nop	—
	2EH	Write And Verify (10)	RD/WR	○	Supported only Write.
	2FH	Verify (10)	RD/WR	Nop	—
	35H	Synchronize Cache (10)	CTL/SNS	Nop	—
	37H	Read Defect Data (10)	DIAG	—	No defect always reported.
	3BH	Write Buffer	DIAG	○	—
	3CH	Read Buffer	DIAG	○	—
2 (40H -5FH)	42H	Unmap	CTL/SNS	○	—
	4DH	Log Sense	CTL/SNS	○	—
	55H	Mode Select (10)	CTL/SNS	○	—
	56H	Reserve (10)	CTL/SNS	○	—
	57H	Release (10)	CTL/SNS	○	—
	5AH	Mode Sense (10)	CTL/SNS	○	—
	5EH	Persistent Reserve IN	CTL/SNS	○	—
	5FH	Persistent Reserve OUT	CTL/SNS	○	—

(To be continued)

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(Continued from preceding page)

Group	Op Code	Name of Command	Type	○:Supported	Remarks
3 (80_H -$9F_H$)	$83_H/00_H$	Extended Copy	CTL/SNS	○	—
	$83_H/11_H$	Write Using Token	CTL/SNS	○	—
	$84_H/03_H$	Receive Copy Result	CTL/SNS	○	—
	$84_H/07_H$	Receive ROD Token Information	CTL/SNS	○	—
	88_H	Read (16)	RD/WR	○	—
	89_H	Compare and Write	RD/WR	○	—
	$8A_H$	Write (16)	RD/WR	○	—
	$8E_H$	Write And Verify (16)	RD/WR	○	Supported only Write.
	$8F_H$	Verify (16)	RD/WR	Nop	—
	91_H	Synchronized Cache (16)	CTL/SNS	Nop	—
	93_H	Write Same (16)	CTL/SNS	○	—
	$9E/10_H$	Read Capacity (16)	CTL/SNS	○	—
	$9E/12_H$	Get LBA Status	CTL/SNS	○	—
4 ($A0_H$ -BF_H)	$A0_H$	Report LUN	CTL/SNS	○	—
	$A3_H/05_H$	Report Device Identifier	CTL/SNS	○	—
	$A3_H/0A_H$	Report Target Port Groups	CTL/SNS	—	—
	$A3_H/0B_H$	Report Aliases	CTL/SNS	—	—
	$A3_H/0C_H$	Report Supported Operation Codes	CTL/SNS	—	—
	$A3_H/0D_H$	Report Supported Task Management Functions	CTL/SNS	—	—
	$A3_H/0E_H$	Report Priority	CTL/SNS	—	—
	$A3_H/0F_H$	Report Timestamp	CTL/SNS	—	—
	$A4_H/XX_H$	Maintenance OUT	CTL/SNS	—	—
	$A4_H/06_H$	Set Device Identifier	CTL/SNS	—	—
	$A4_H/0A_H$	Set Target Port Groups	CTL/SNS	○	—
	$A4_H/0B_H$	Change Aliases	CTL/SNS	—	—
	$A4_H/0E_H$	Set Priority	CTL/SNS	—	—
	$A4_H/0F_H$	Set Timestamp	CTL/SNS	—	—
	$A8_H$	Read (12)	RD/WR	○	—
	AA_H	Write (12)	RD/WR	○	—
	AE_H	Write And Verify (12)	RD/WR	○	However, only the Write operation.
	AF_H	Verify (12)	RD/WR	Nop	—
	$B7_H$	Read Defect Data (12)	CTL/SNS	○	It always reports on No defect.
5 ($E0_H$ -FF_H)	$E8_H$	Read With Skip Mask (IBM-unique)	CTL/SNS	—	—
	EA_H	Write With Skip Mask (IBM-unique)	CTL/SNS	—	—

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4.6 Outline of Hardware

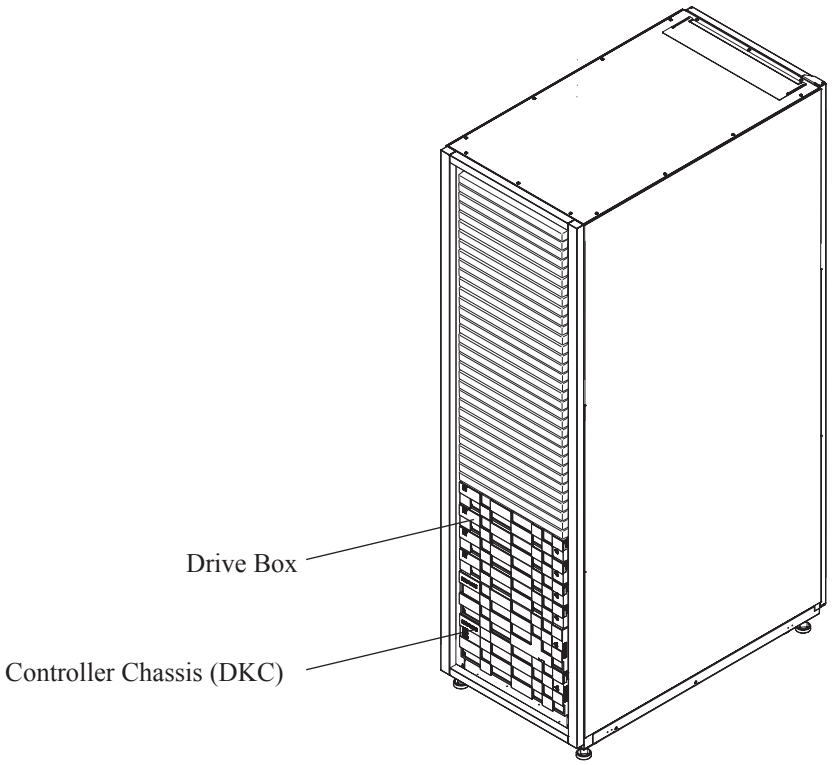
DW800 is a new Storage System of a high midrange-class that offers high performance of the enterprise-class.
DW800 consists of the Controller Chassis and the Drive Box as well as the Storage System of the midrange-class, and they are installed in a 19-inch rack.

The Drives are installable in the Controller Chassis and the Drive Box.
A maximum number of installable Drives is as shown below.

- VSP G200 : 192 (252 with DB60 connected (When using DB60 with a 3.5-inch HDD))
- VSP G400 : 384 (480 with DB60 connected (When using DB60 with a 3.5-inch HDD))
- VSP F400 : 192
- VSP G600 : 576 (720 with DB60 connected (When using DB60 with a 3.5-inch HDD))
- VSP F600 : 288
- VSP G800 : 1,152 (1,440 with DB60 connected (When using DB60 with a 3.5-inch HDD))
- VSP F800 : 576

Dual Controller configuration is adopted in the controller part that is installed in the Controller Chassis.
The Channel I/F supports only the open system and the mainframe is not supported.
The Power Supply is single phase AC100V/200V for the VSP G200 model and single phase AC200V for the VSP G400, G600, G800 models and DB60.

Figure 4-4 DW800 Storage System



For information about the service processor used with HDS VSP storage systems, refer to the Hitachi Virtual Storage Platform G200, G400, G600 Service Processor Technical Reference (FE-94HM8036).

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4.6.1 Outlines Features

1. Scalability
   DW800 provides variations of the Storage System configuration according to the types and the numbers of selected options: Channel Boards, Cache Memory, NAS Modules,Disk Drive, Flash Drive and Flash Module Drive (FMD).
   - Number of installed Channel options: 0 to 6
     (Number of installed Channel options is zero only when NAS Modules are installed
     Up to 8 when the DKB slot is used)
   - Capacity of Cache Memory: 16 GB to 256 GB (VSP G800 model : 512 GB)
   - Number of HDDs (VSP G800) : DBL : Up to 576
     DBS : Up to 1,152
     DB60 : Up to 1,440
     DBF : Up to 576
     (VSP F800) : DBF : Up to 576

2. High-performance
   - DW800 supports three types of high-speed Disk Drives at the speed of 7,200 min^{-1}, 10,000 min^{-1} and 15,000 min^{-1}.
   - DW800 supports Flash Drives with ultra high-speed response.
   - DW800 supports Flash Module Drive (FMD) with ultra high-speed response and high capacity.
   - The high-speed data transfer between DKB and HDDs at a rate of 6/12 Gbps with the SAS interface is achieved.
   - DW800 uses Intel processor with brand new technology which performs as excellent as that of the enterprise device DKC710I.

3. Large Capacity
   - DW800 supports Disk Drives with capacities of 300 GB, 600 GB, 1.2 TB, 1.8 TB, 4 TB, 6 TB and 10 TB.
   - DW800 supports Flash Drives with capacities of 200 GB, 400 GB, 480 GB, 960 GB, 1.9 TB and 3.8 TB.
   - DW800 supports Flash Module Drive (FMD) with capacities of 1.75 TB (1.6 TiB), 3.5 TB(3.2 TiB), 7 TB(6.4 TiB) and 14 TB (12.8 TiB).
   - DW800 controls up to 16,384 logical volumes and up to 1,440 Disk Drives and provides a physical Disk capacity of approximately 14,098 TB per Storage System.

4. Flash Module Drive (FMD)
   The FMD is a Flash Drive with large capacity which has been accomplished by adopting the Hitachi original package.
   Its interface is 12 Gbps SAS same as that of the HDD/SDD.
   The FMD uses MLC-NAND Flash Memory and high performance, long service life and superior cost performance by virtue of its original control methods.

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5. Connectivity
   DW800 supports OS's for various UNIX servers and PC servers, so that it conforms to heterogeneous system environment in which those various OS's coexist.
   The platforms that can be connected are shown in the following table.

Table 4-73 Support OS Type

Manufacturer	OS
HPE	HP-UX
	Tru64
	OpenVMS
Oracle	Solaris
IBM	AIX 5L
Microsoft	Windows
NOVELL	NetWare
	SUSE Linux
Red Hat	Red Hat Linux
VMware	ESX Server

A Channel interface supported by the DW800 is shown below.
- Fibre Channel
- iSCSI

6. High reliability
   - DW800 supports RAID6 (6D+2P/12D+2P/14D+2P), RAID5 (3D+1P, 4D+1P, 6D+1P, 7D+1P) and RAID1 (2D+2D/4D+4D).
   - Main components are implemented with a duplex or redundant configuration, so even when single point of the component failure has occurred, the Storage System can continue the operation.
   - However, when the failure of the Controller Board with the Cache Memory is maintained, the Channel ports and the Drive ports of the cluster concerned are blocked.

7. Non-disruptive maintenance
   - Main components can be added, removed and replaced without shutting down a device while the Storage System is in operation.
     However, when the additional addition of the Cache Memory is executed, the Channel ports and the Drive ports of the cluster concerned are blocked.
   - The firmware can be upgraded without shutting down the Storage System.

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4.6.2 External View of Hardware

DW800 consists of the Controller Chassis installed with Control Boards and the Drive Box to be installed with various types of HDDs. The Controller Chassis and the Drive Box are mounted in a 19-inch rack.

1. VSP Gx00 models
   There are four types of Drive Boxes.
   - The Drive Box (DBS) can be installed with up to 24 2.5-inch HDDs.
   - The Drive Box (DBL) can be installed with up to 12 3.5-inch HDDs.
   - The Drive Box (DB60) can be installed with up to 60 3.5-inch HDDs.
   - The Drive Box (DBF) can be installed with up to 12 FMDs.

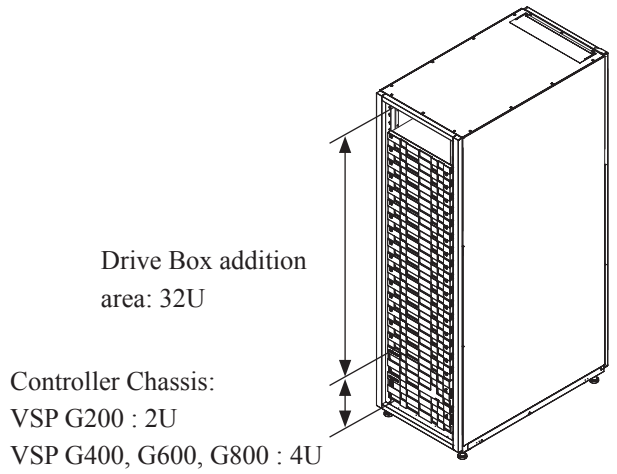
   The Controller Chassis controls is as shown below.
   - Drive Box (DBS/DBL) : up to 48
   - Drive Box (DB60) : up to 24
   - Drive Box (DBF) : up to 48

   - The Drive Box (DBS), the Drive Box (DBL), the Drive Box (DB60) and the Drive Box (DBF) can be mixed in the Storage System.
   - The number of installable Drives changes depending on the Storage System models and Drive Boxes.

   The size of each unit is as shown below.
   - VSP G200 Controller Chassis : 2U
   - VSP G400, G600, G800 Controller Chassis : 4U
   - Drive Boxes (DBS/DBL/DBF) : 2U
   - Drive Box (DB60) : 4U

   - The minimum configuration of the Storage System consists of one Controller Chassis and one Drive Box because DW800 allows free allocation of HDDs to make a RAID group. However, to configure the Storage System with super performance, it is recommended to install or add the Drive Box (DBS/DBL/DBF) in units of four at a time or the Drive Box (DB60) in units of two at a time per Controller Chassis.

Figure 4-5 DW800 Configuration



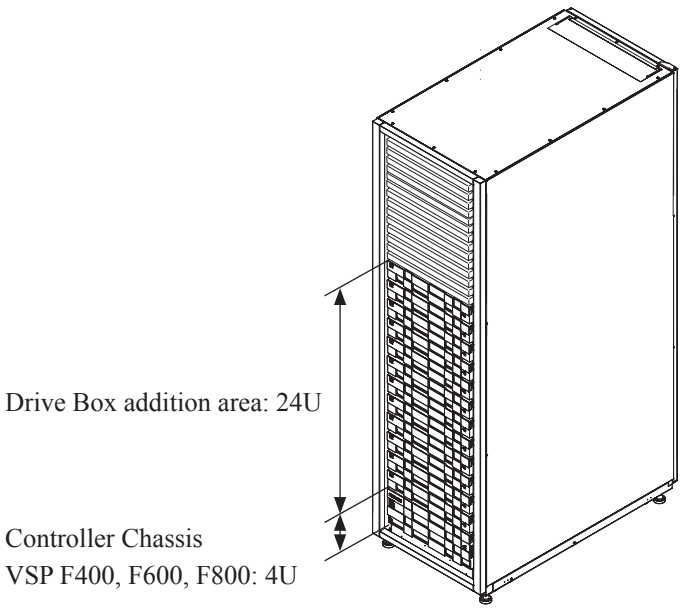
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2. VSP Fx00 models
   There is one type of Drive Box.
   - The Drive Box (DBF) can be installed with up to 12 FMDs.

   The Controller Chassis controls is as shown below.
   - Drive Box (DBF) : up to 48
   - The number of installable Drives changes depending on the Storage System models and Drive Boxes.

   The size of each unit is as shown below.
   - Controller Chassis : 4U
   - Drive Boxes (DBF) : 2U
   - The minimum configuration of the Storage System consists of one Controller Chassis and one Drive Box because DW800 allows free allocation of drives to make a RAID group.

Figure 4-6 DW800 Configuration



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4.6.3 Hardware Architecture

1. Controller Chassis (DKC)
   - The VSP G200 Controller Chassis (DKC) consists of a Controller Board (CTL), Channel Board (CHB), Power Supply (DKCPS), Backup Module (BKM), Cache Flash Memory (CFM) and Drives.
   - The VSP G400, G600, G800 Controller Chassis (DKC) consists of a Controller Board (CTL), Channel Board (CHB), Disk Board (DKB), NAS Modules, Power Supply (DKCPS), Backup Module (BKMF) and Cache Flash Memory (CFM).
   - The Cache Memory is installed in the Controller Boards and NAS Modules.
   - The Battery and the Cache Flash Memory are also installed in the Controller Boards to prevent data loss by the occurrence of power outage or the like.
   - The Storage System continues to operate when a single point of failure occurred, by adopting a duplexed configuration for each Controller Board (CTL, LANB, CHB, DKB, NAS Modyles) and the Power Supply Unit, and a redundant configuration for the Power Supply Unit and the cooling fan. The addition and the replacement of the components and the upgrading of the firmware can be processed while the Storage System is in operation. However, when performing the maintenance and replacement of the Controller Boards, the Channel Board of the cluster, the Disk Board and the NAS Module are blocked.

2. Drive Box (DBS)
   - The Drive Box (DBS) is a chassis to install the 2.5-inch Disk Drives and the 2.5-inch Flash Drives, and it consists of ENC and the integrated cooling fan power supply.
   - The duplex configuration is adopted in ENC and Power Supply Unit, and the redundant configuration is adopted in Power Supply Unit and the cooling fan. All the components can be replaced and added while the Storage System is in operation.

3. Drive Box (DBL)
   - The Drive Box (DBL) is a chassis to install the 2.5/3.5-inch Disk Drives and the 2.5-inch Flash Drives, and it consists of ENC and the integrated cooling fan power supply.
   - The duplex configuration is adopted in ENC and Power Supply Unit, and the redundant configuration is adopted in Power Supply Unit and the cooling fan. All the components can be replaced and added while the Storage System is in operation.

4. Drive Box (DB60)
   - The Drive Box (DB60) is a chassis to install the 2.5/3.5-inch Disk Drives and the 2.5-inch Flash Drives, and it consists of ENC and the integrated cooling fan power supply.
   - The duplex configuration is adopted in ENC and Power Supply Unit, and the redundant configuration is adopted in Power Supply Unit and the cooling fan. All the components can be replaced and added while the Storage System is in operation.

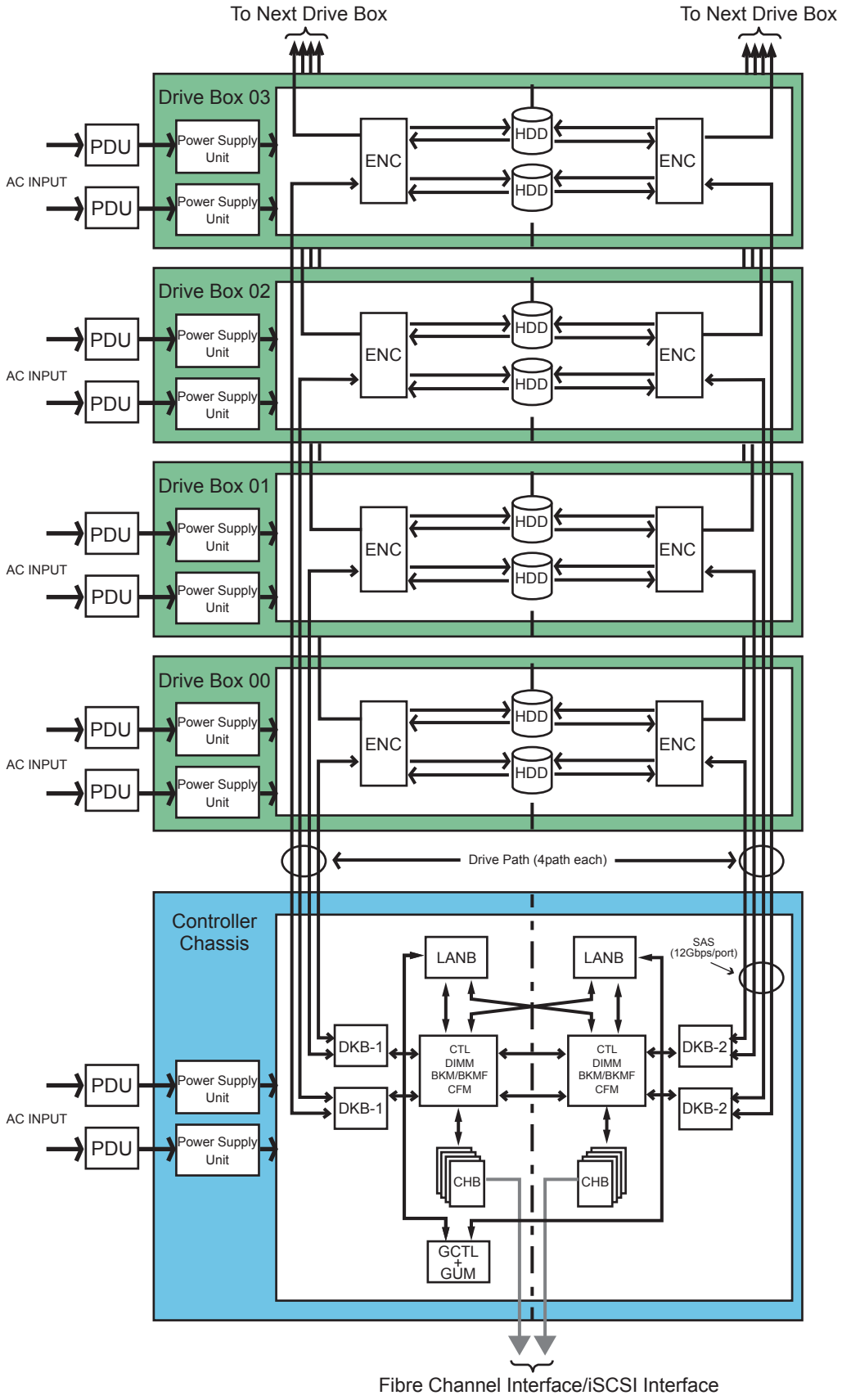
5. Drive Box (DBF)
   - The Drive Box (DBF) is a chassis to install the Flash Module Drives (FMD), and consists of ENC, and it consists of ENC and the integrated cooling fan power supply.
   - The duplex configuration is adopted in ENC and Power Supply Unit, and the redundant configuration is adopted in Power Supply Unit and the cooling fan. All the components can be replaced and added while the Storage System is in operation.

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6. Channel Board Box (CHBB)
   - The Channel Board Box (CHBB) is a chassis to install the channel options, and consists of PCIe-cable Connecting Package (PCP), Power Supply and Switch Package (SWPK).
   - Channel Board Box (CHBB) can connect only with VSP G800 model.
   - The duplex configuration is adopted in SWPK and Power Supply Unit, and the redundant configuration is adopted in Power Supply Unit. All the components can be replaced and added while the storage system is in operation.

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Figure 4-7 DW800 Hardware Configuration Overviews



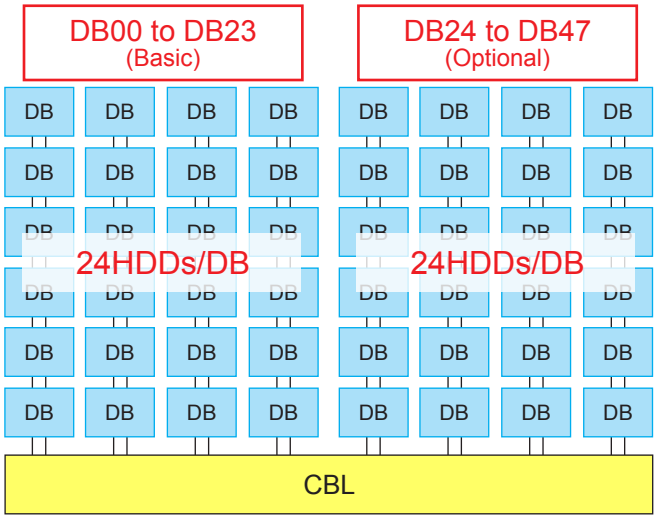
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7. Drive Path

(1) When using 2.5-inch HDD (SFF)

DW800 controls 1,152 HDDs with eight paths.

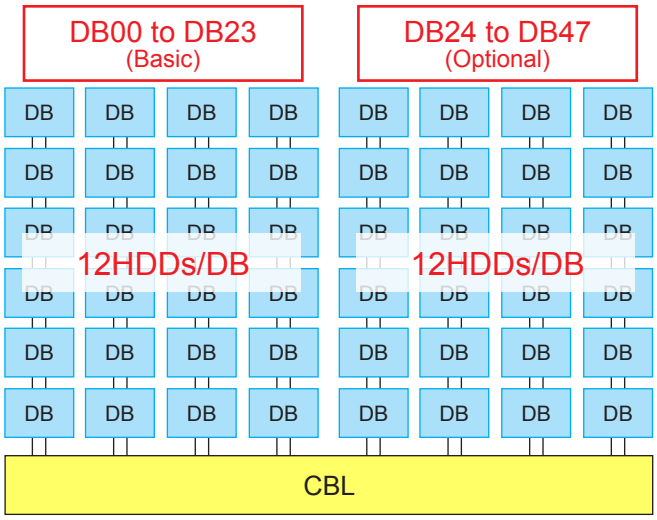
Figure 4-8 Drive Path Connection Overviews when using 2.5-inch Drives



(2) When using 3.5-inch HDD (LFF)

DW800 controls 576 HDDs with eight paths.

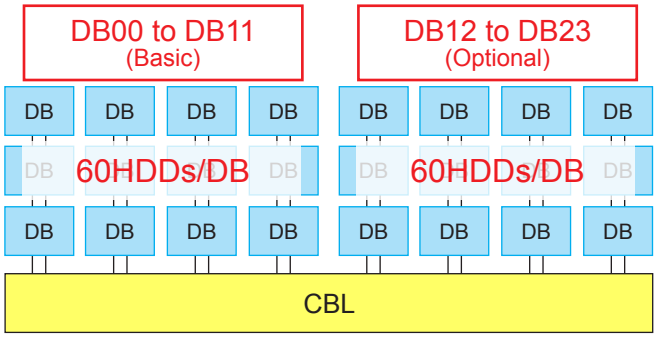
Figure 4-9 Drive Path Connection Overviews when using 3.5-inch Drives



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(3) When using 3.5-inch HDD
DW800 controls 1,440 HDDs with eight paths.

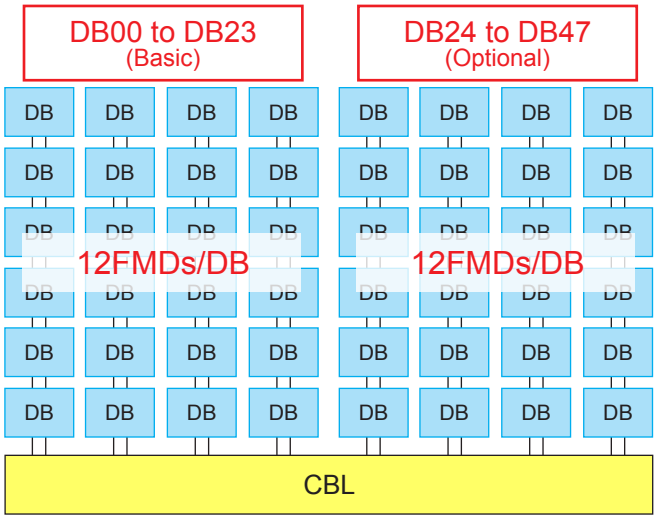
Figure 4-10 Drive Path Connection Overviews when using 3.5-inch Drives



NOTICE: Up to six DB60 can be installed in a rack. Up to five DB60 can be installed in a rack when a DKC (H model) is installed there.
Install the DB60 at a height of 1,300 mm or less above the ground (at a range between 2U and 26U).

(4) When using Flash Module Drive (FMD) (DBF)
DW800 controls 576 FMDs with eight paths.

Figure 4-11 Drive Path Connection Overviews when using FMDs (DBF)



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4.6.4 Hardware Component

1. Controller Chassis (DKC)
   (1) VSP G200 Model
   The Controller Chassis for the VSP G200 model has a Controller Board (CTL), Channel Board (CHB), Power Supply (PS), Cache Flash Memories (CFMs) and Disk Drives.
   - Channel Boards (CHB) is installed two or more. The addition unit of Channel Boards (CHB) is two. A maximum of four Channel Boards is installable.

Figure 4-12 Controller Chassis (CBSS0/CBSS1/CBSS0D/CBSS1D)

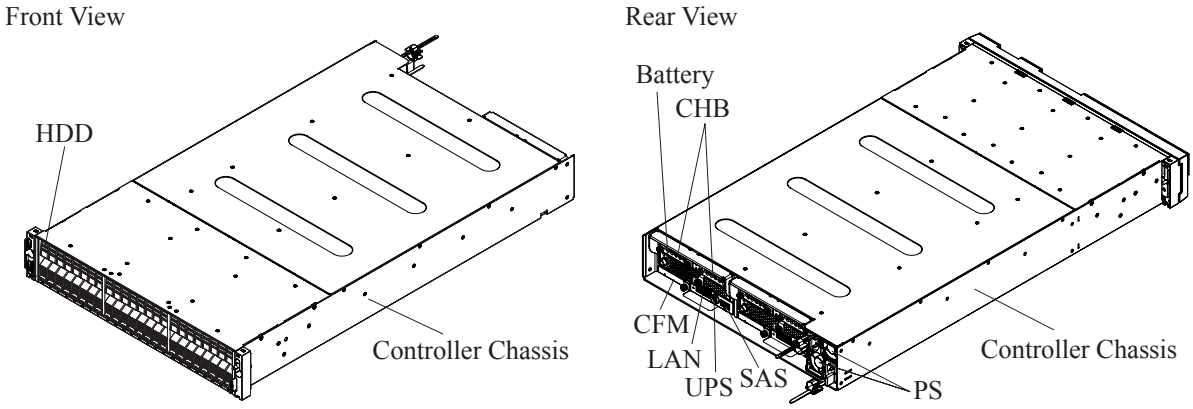
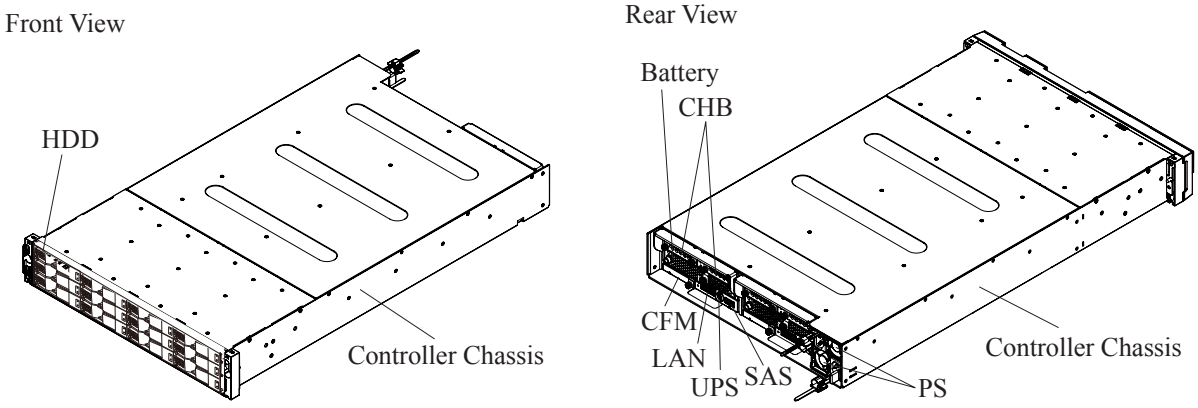


Figure 4-13 Controller Chassis (CBSL0/CBSL1/CBSL0D/CBSL1D)



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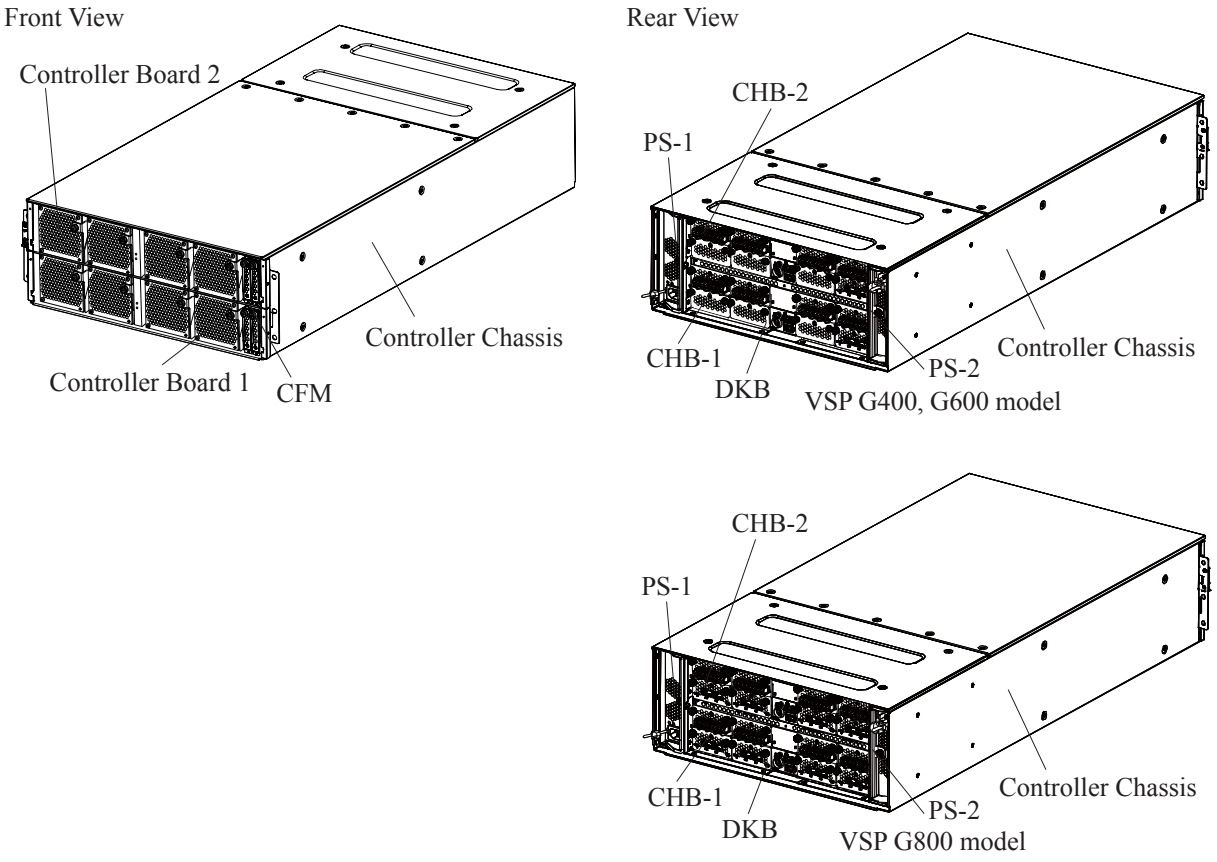
(2) VSP G400, G600, G800 Model

(a) NAS Module non-installed configuration

The Controller Chassis of the VSP G400, G600, G800 model (NAS Module non-installed configuration) installs a Controller Board (CTL), Channel Board (CHB), Power Supply (PS) and Cache Flash Memories (CFMs).

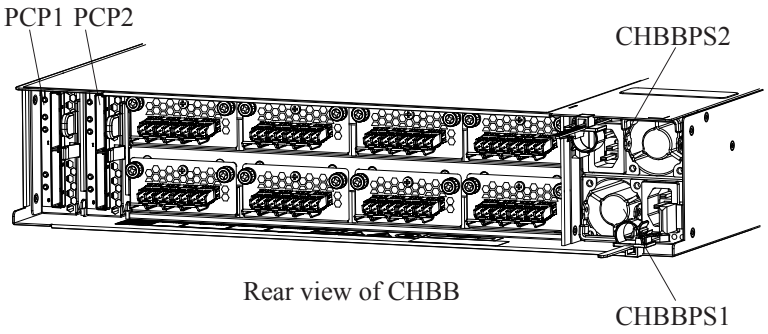
- When installing Disk Drives (HDD) in the VSP G400, G600, G800 model (NAS Module non-installed configuration), a Disk Board (DKB) needs to be installed in the Controller Chassis. In a Disk Drive (HDD)-less case, Disk Boards (DKB) are not required.
- Maximum two Disk Boards (DKBs) can be inserted into the Disk Board slots in the VSP G400 and G600 models and maximum eight in the VSP G800 model. In the VSP G800 model, you can add up to two Controller Boards (up to four Controller Chassis).
- In the configuration using Channel Boards (CHB), the VSP G400, G600 model can install a maximum of 14 Disk Drives and the VSP G800 model 12. In the Disk Drive (HDD)-less configuration, the VSP G400, G600, G800 model can install a maximum of 16 Disk Drives (The Channel Board Box can mount 20 Channel Boards).

Figure 4-14 Controller Chassis (VSP G400, G600, G800 model (NAS Module non-installed configuration))



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Figure 4-15 Channel Board Box (CHBB)



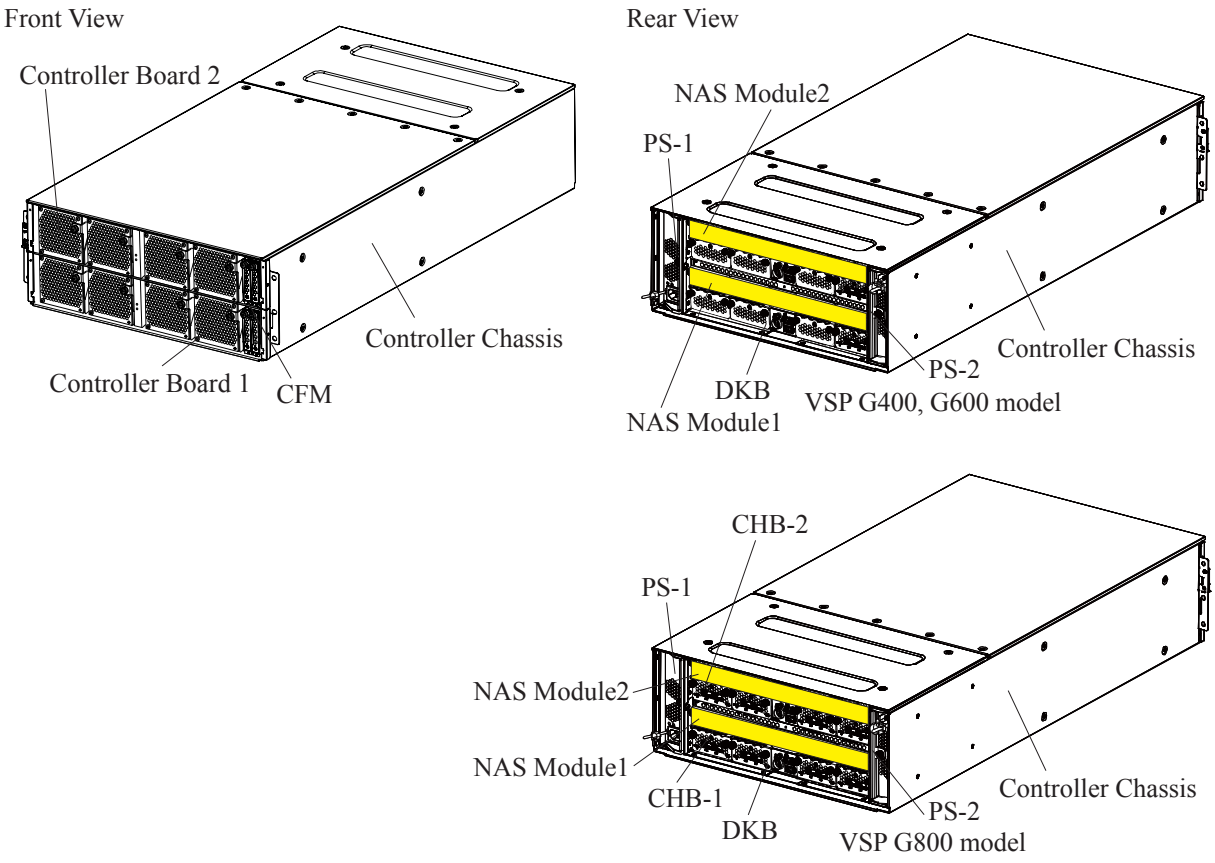
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(b) NAS Module installed configuration

The Controller Chassis of the VSP G400, G600, G800 model (NAS Module installed configuration) has a Controller Board (CTL), Channel Board (CHB), Power Supply (PS) and Cache Flash Memories (CFMs).

- When installing Disk Drives (HDD) in the VSP G400, G600, G800 model (NAS Module installed configuration), a Disk Board (DKB) needs to be installed in the Controller Chassis. The NAS Module installed configuration does not support a Disk Drive (HDD)-less case.
- Two Disk Boards (DKBs) can be inserted into the Disk Board slots for the VSP G400 and G600 models and up to eight for the VSP 800 model. For the VSP G800 model, you can add up to two Controller Boards (up to four Controller Chassis).
- Six Channels Boards (CHB) can be installed for the VSP G400 and G600 models and up to four for the VSP G800 model. The NAS Module installed configuration does not support a Disk Drive (HDD)-less case.

Figure 4-16 Controller Chassis (VSP G400, G600, G800 model) (NAS Module installed configuration)



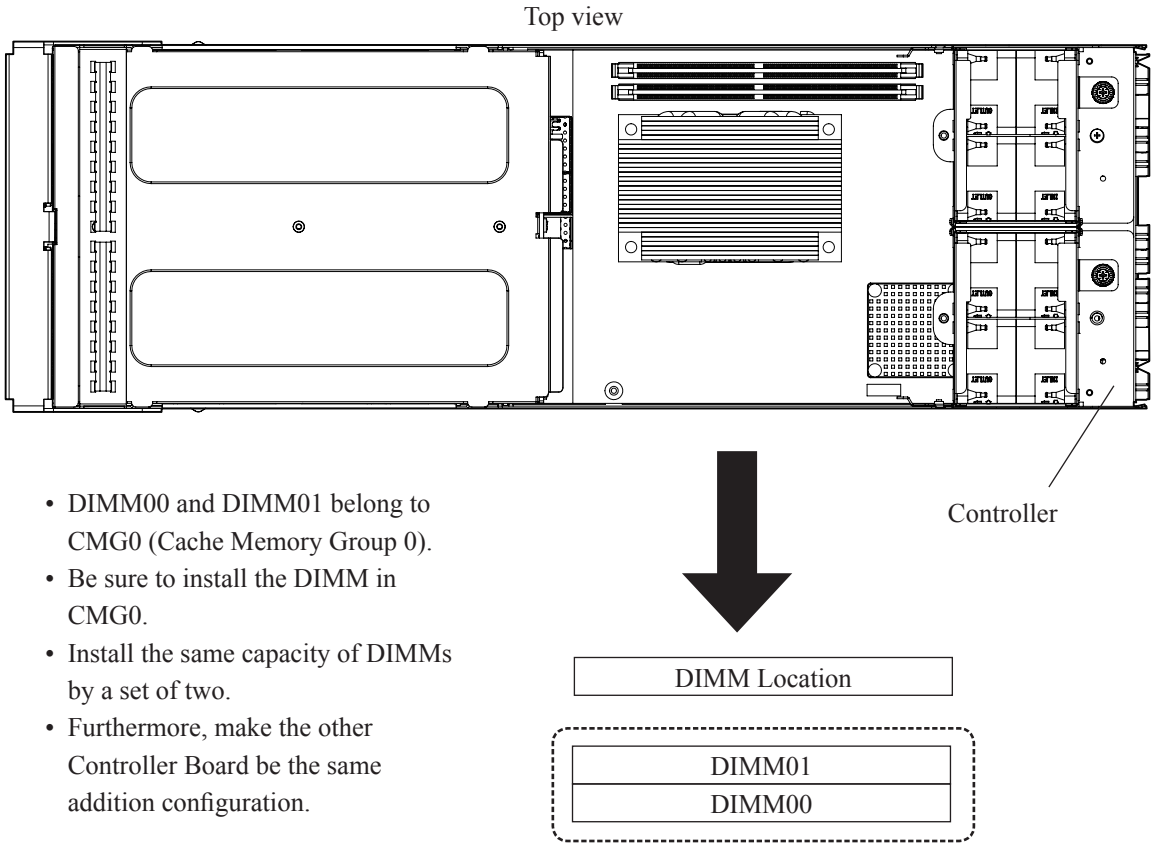
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2. Controller Boards (CTL)
   The Controller Board has Cache Memories (DIMMs) and Cache Flash Memories (CFMs).

Table 4-74 Controller Boards Specifications

PCB Name	Controller Board of VSP G200 model DW-F800-CTLS/ DW-F800-CTLSE	Controller Board of VSP G400, G600 model DW-F800-CTLM	Controller Board of VSP G800 model DW-F800-CTLH
Number of PCB	1		
Necessary number of PCB per Controller Chassis	2		
Number of DIMM slot	2	8	
Cache Memory Capacity	16 to 32GB	(VSP G400) : 32 to 64GB (VSP G600) : 32 to 128GB	32 to 256GB

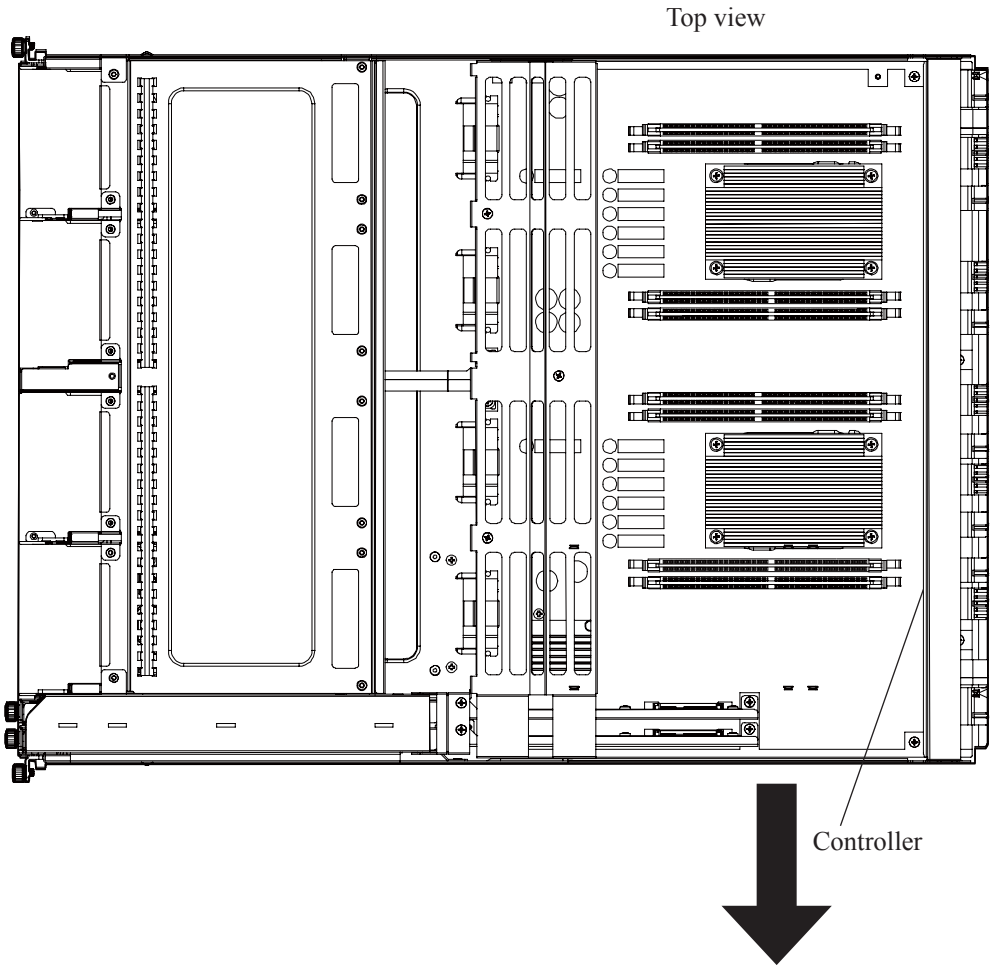
Figure 4-17 Top of Controller Board (VSP G200 Model)



- DIMM00 and DIMM01 belong to CMG0 (Cache Memory Group 0).
- Be sure to install the DIMM in CMG0.
- Install the same capacity of DIMMs by a set of two.
- Furthermore, make the other Controller Board be the same addition configuration.

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Figure 4-18 Top of Controller Board (VSP G400, G600, G800 Model)



- The DIMM with the DIMM location number DIMM0x belongs to CMG0 (Cache Memory Group 0) and the DIMM with DIMM1x belongs to CMG1 (Cache Memory Group 1).
- Be sure to install the DIMM in CMG0.
- Install the same capacity of DIMMs by a set of four.
- CMG1 is a slot for adding DIMMs.
- Furthermore, make the other Controller Board be the same addition configuration.

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CFM/Battery addition of the VSP G400, G600, G800 model is as shown below.

- VSP G400, G600 model :
  For DIMM capacity of 64 GB or more, add CFM to CFM-11/21.
  For DIMM capacity of 128 GB/CTL or more, add Option batteries to all BKMFs.
  When installing NAS Modules, add batteries to BKMF-10/20.
- VSP G800 model :
  For DIMM capacity of 128 GB or more, add CFM to CFM-11/21.
  For DIMM capacity of 256 GB/CTL or more, add Option batteries to all BKMFs.
  When installing NAS Modules, add batteries to BKMF-10/20.

The installable CFMs by model are as shown below.

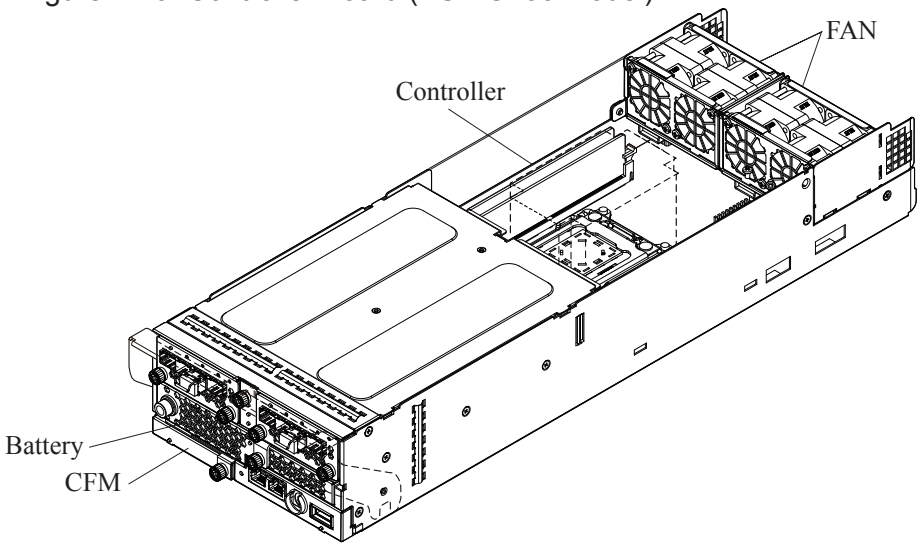
- VSP G200 model : BM10
- VSP G400, G600 model : BM20 or BM30
- VSP 800 model : BM30

NOTE :
- It is necessary to match the type (model name) of CFM-10/20 and CFM-11/21 (addition side).
  When adding Cache Memories, check the model name of CFM-10/20 and add the same model.
- When replacing Cache Flash Memories, it is necessary to match the type (model name) defined in the configuration information.
  Example: When the configuration information is defined as BM20, replacing to BM30 is impossible.

Table 4-75 Correspondence List of DIMM Capacity and CFM, BKM (VSP G200 model)

Model	DIMM Capacity (GB)	DIMM Installed Number/CTL	DIMM Capacity (GB)/ CTL	DIMM Capacity (GB)/System	Types of CFM installed in CFM-1/2	Number of Batteries Installed in System(BATT1/2)
VSP G200	16	2	32	64	BM10	2
	8	2	16	32	BM10	2

Figure 4-19 Controller Board (VSP G200 Model)



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Table 4-76 Correspondence List of DIMM Capacity and CFM, BKMF (VSP G400, G600, G800 model) (NAS Module non-installed configuration)

Model	DIMM Capacity (GB)	DIMM Installed Number / CTL	DIMM Capacity (GB) / CTL	DIMM Capacity (GB) / System	Types of CFM installed in CFM-10/20	Types of CFM installed in CFM-11/21	Number of Basic Batteries Installed in System (*1)	Number of Option Batteries Installed in System (*1)
VSP G800	32	8	256	512	BM30	BM30	6	6
		4	128	256	BM30	BM30	6	-
	16	8	128	256	BM30	BM30	6	-
		4	64	128	BM30	-	6	-
	8	8	64	128	BM30	-	6	-
		4	32	64	BM30	-	6	-
VSP G600	16	8	128	256	BM30/BM20	BM30/BM20(*2)	6	6
		4	64	128	BM30/BM20	BM30/BM20(*2)	6	-
	8	8	64	128	BM30/BM20	BM30/BM20(*2)	6	-
		4	32	64	BM30/BM20	-	6	-
VSP G400	16	4	64	128	BM30/BM20	BM30/BM20(*2)	6	-
	8	4	32	64	BM30/BM20	-	6	-

*1 : (BKMF-x1/x2/x3)

*2 : • It is necessary to match the type (model name) of CFM-10/20 and CFM-11/21 (addition side). When adding Cache Memories, check the model name of CFM-10/20 and add the same model.
• When replacing Cache Memories, it is necessary to match the type (model name) defined in the configuration information.
Example: When the configuration information is defined as BM20, replacing to BM30 is impossible.

NOTICE: Adding a battery for BKMF-10 and BKMF-20 is impossible.

Table 4-77 Correspondence List of DIMM Capacity and CFM, BKMF (VSP G400, G600, G800 model) (NAS Module installed configuration)

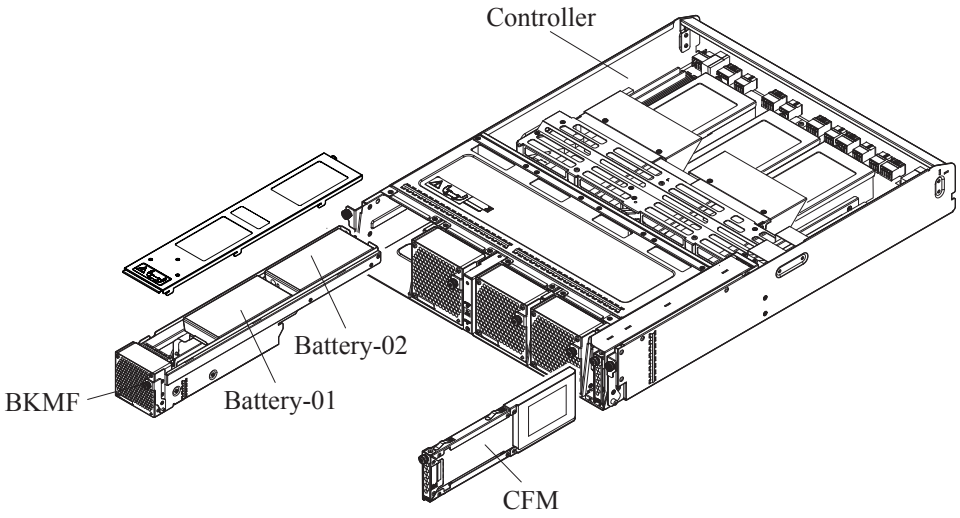
Model	DIMM Capacity (GB)	DIMM Installed Number / CTL	DIMM Capacity (GB) / CTL	DIMM Capacity (GB) / System	Types of CFM installed in CFM-10/20	Types of CFM installed in CFM-11/21	Number of Basic Batteries Installed in System (*3)	Number of Option Batteries Installed in System (*3)	Number of Batteries for NAS Installed in System (*4)
VSP G800	32	8	256	512	BM30	BM30	6	6	2
	16	8	128	256	BM30	BM30	6	-	2
VSP G600	16	8	128	256	BM20	BM20	6	6	2
VSP G400	16	4	64	128	BM20	BM20	6	-	2

*3: (BKMF-x1/x2/x3)

*4: (BKMF-10/20)

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Figure 4-20 Controller Board (VSP G400, G600, G800 Model)



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3. Cache Memory (DIMM)
   DW800 can be used the three types of DIMM capacity.

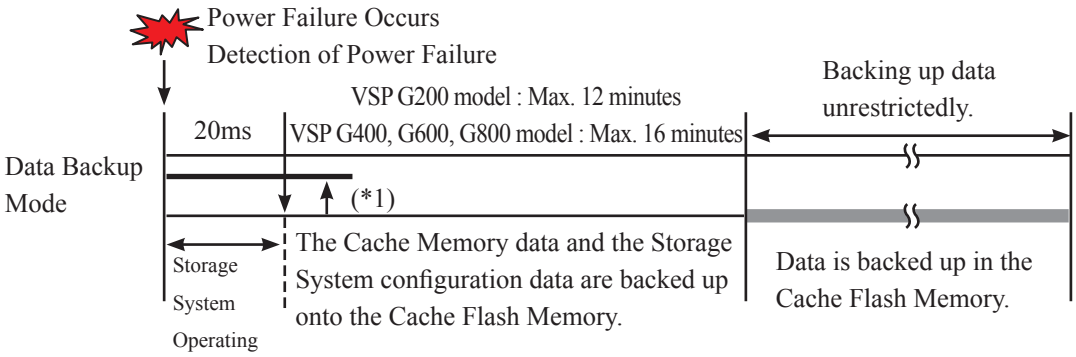
Table 4-78 Cache Memory Specifications

Model Number	Capacity	Component
DKC-F810I-CM8G	8GB	8GB DIMM × 1
DKC-F810I-CM16G	16GB	16GB DIMM × 1
DKC-F810I-CM32G	32GB	32GB DIMM × 1

4. Cache Flash Memory (CFM)
   The Cache Flash Memory saves the Cache Memory data when a power failure occurs.

5. Battery
   (1) The battery for the data saving is installed on each Controller Board in DW800.
   - When the power failure continues more than 20 milliseconds, the Storage System uses power from the batteries to backup the Cache Memory data and the Storage System configuration data onto the Cache Flash Memory.
   - Environmentally friendly nickel hydride battery is used for the Storage System.

Figure 4-21 Data Backup Process



*1: The data backup processing is continued when the power outage recovered while the data is being backed up.

(2) Installation Location of Battery

The Storage System has the Batteries shown in Figure 4-22 and Figure 4-23.

Figure 4-22 Battery Location (CBLM/CBLH)

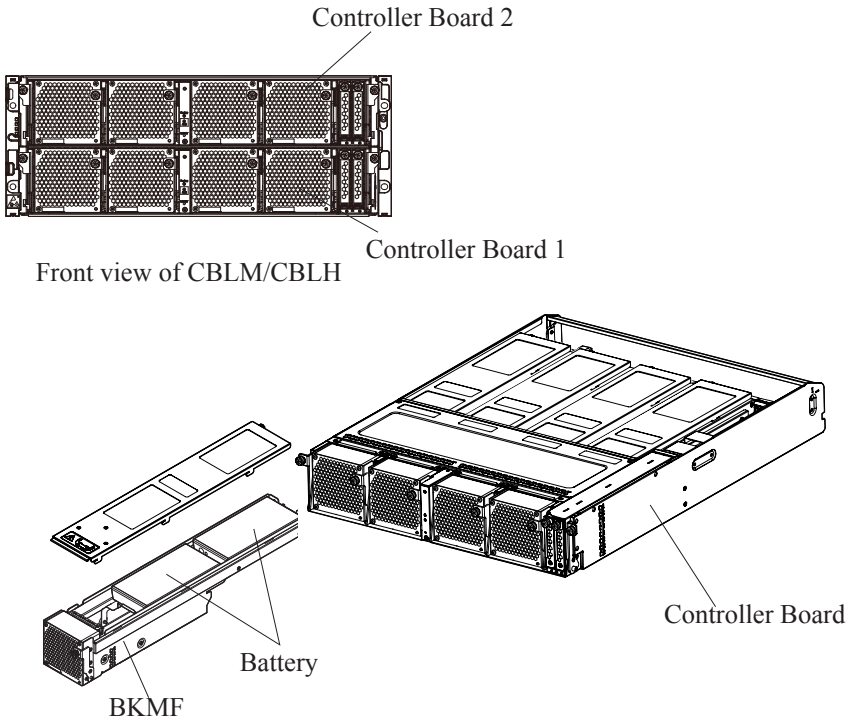
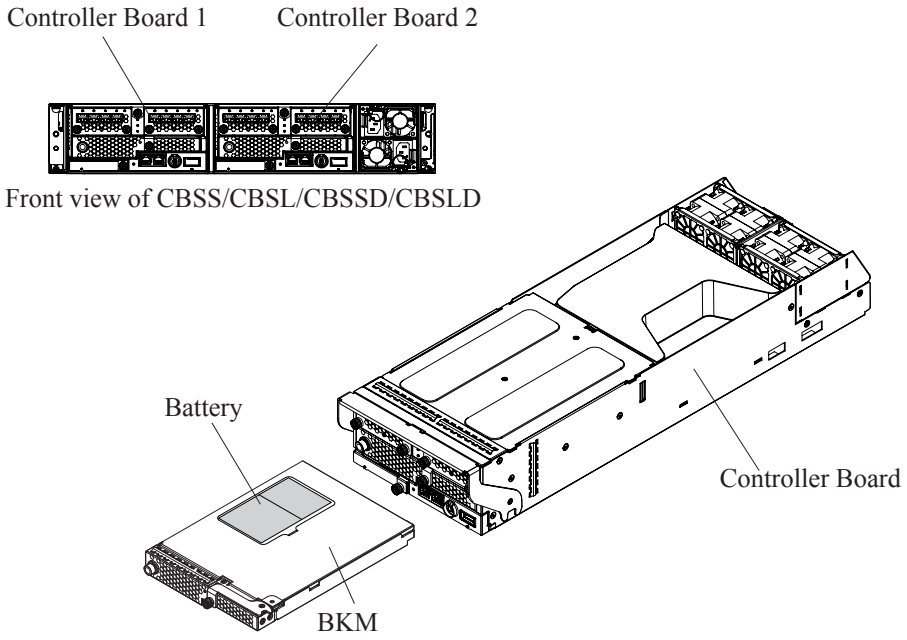


Figure 4-23 Battery Location (CBSS/CBSL/CBSSD/CBSLD)



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(3) Battery lifetime

The battery life time is affected by the battery temperature. The battery temperature changes depending on the intake temperature and height of the Storage System, the configuration and operation of the Controllers and Drives (VSP G200 only), charge-discharge count, variation in parts and others, the battery lifetime will be two to five years.

The battery lifetime (expected value) in the standard environment is as shown below.

Storage System Intake Temperature	CBLM/CBLH	CBSS/CBSSD	CBSL/CBSLD
Up to 24 degrees Celsius	5 years	5 years	5 years
Up to 30 degrees Celsius	5 years	5 years	4 years
Up to 34 degrees Celsius	4 years	4 years	3 years
Up to 40 degrees Celsius	3 years	3 years	2 years

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(4) Relation between Battery Charge Level and System Startup Action

No.	Power Status	Battery Charge Level	System Startup Action
1	PS ON	<Case1> The battery charge level of both the Controller Boards is below 30%.	The system does not start up until the battery charge level of both the Controller Boards becomes 30% or more in either or both of the clusters. (It takes a maximum of 90 minutes (*2).) (*1)
2		<Case2> The battery charge level of both the Controller Boards is below 50%. (In the case other than Case1)	SIM that shows the lack of battery charge is reported and the system starts up. I/O is executed by the pseudo through operation until the battery charge level of either or both of the Controller Boards becomes 50% or more. (It takes a maximum of 50 minutes (*2).)
3		<Case3> Other than <Case1>, <Case2>. (The battery charge level of either or both of the Controller Boards is 50% or more.)	The system starts up normally. If the condition changed from Case2 to Case3 during startup, SIM that shows the completion of battery charge is reported.

*1: Action when System Option Mode 837 is off (default setting).
*2: Battery charge time: 4.5 hours to charge from 0% to 100%.

(5) Relation between Power Status and SM/CM Data Backup Methods

No.	Power Status		SM/CM Data Backup Methods	Data Restore Methods during Restart
1	PS OFF (planned power off)		SM data (including CM directory information) is stored in CFM before PS OFF is completed. If PIN data exists, all the CM data including PIN data is also stored.	SM data is restored from CFM. If CM data was stored, CM data is also restored from CFM.
2	When power outage occurs	Instant power outage	If power is recovered in a moment, SM/CM data remains in memory and is not stored in CFM.	SM/CM data in memory is used.
3		Power outage while the system is in operation	All the SM/CM data is stored in CFM. If a power outage occurred after the system started up in the condition of Case2 (the battery charge level of both the Controller Boards had been below 50%), only SM data is stored.	All the SM/CM data is restored from CFM. If CM data was not stored, only CM data is volatilized and the system starts up.
4		Power outage while the system is starting up	Data storing in CFM is not done. (The latest backup data that was successfully stored remains.)	The data that was stored in the latest power off operation or power outage is restored from CFM.

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(6) Action When CFM Error Occurs

No.	DKC Status	Description of Error	Action When Error Occurs
1	In operation	CFM error or data comparing error was detected at the time of CFM health check (*1).	• CFM warning SIMRC = 30750x (Environmental error: CFM Warning) is output.
2	Planed power off or power outage	CFM error was detected, and moreover, retry failed four times during data storing. • Data storing error is managed in a per module group (MG) basis and is classified into data storing error only in the MG concerned and data storing error in all the MG depending on the location of the failed memory.	• DKC power off process is executed. • Blockage occurs in Controller Board or CMG in Controller Board depending on the location of the failed memory. For details, refer to "2.5.2 Maintenance/ Failure Blockade Specification".
3	When powered on -1 (In the case that data storing was successfully done in No.2)	CFM error or protection cord (*2) error occurred during data restoring.	• Blockage occurs in Controller Board or CMG in Controller Board depending on the location of the failed memory. • If the failed memory is in CMG0, the Controller Board concerned becomes blocked. If the failed memory is in CMG1, the CACHE concerned is volatilized and the system starts up. (If data in the other Controller Board can be restored, the data is not lost.)
4	When powered on -2 (In the case that data storing failed in No.2)	—	• Blockage occurs in Controller Board or CMG in Controller Board depending on the location of data storing error. (Same as described in No.2.)

*1: CFM health check: Function that executes the test of read and write of a certain amount of data at specified intervals to CFM while the DKC is in operation.

*2: Protection code: The protection code (CRC) is generated and saved onto CFM at the time of data storing in CFM and is checked at the time of data restoring.

NOTE: CFM handles only the data in the Controller Board in which it is installed.

e.g.: Cache data in CTL1 is not stored in CFM which is installed in CTL2.
Similarly, CFM data in the CTL1 is not restored to Cache Memory in CTL2.

(7) Notes during Planned Power Off (PS OFF)

Removing the Controller Board when the system is off and the breakers on the PDU are on may result in <Case1> of (1) because of the lack of battery charge.
Therefore, to remove the board and the battery, replace them when the system is on, or remove them after the breakers on the PDU are powered off.

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6. Disk Board (DKB)
   The Disk Board (DKB) controls data transfer between the Drive and Cache Memory. Controller 1 and 2 should be in the same configuration on the Disk Board.

Table 4-79 Disk Board Specifications

Model Number	DW-F800-BS12G	DW-F800-BS12GE
Number of PCB	1	1
Necessary number of PCB per Controller Chassis	1	1
Data Encryption	Not Supported	Supported
Performance of SAS Port	12 Gbps	12 Gbps

Table 4-80 The Number of Installed DKBs and SAS Ports by Model

Item	VSP G200	VSP G400, G600	VSP G800
Number of DKB	Built into CTL	1 piece / cluster (2 piece / system)	2, 4 piece / cluster (4, 8 piece / system)
Number of SAS Port	1 port / cluster (2 port / system)	2 port / cluster (4 port / system)	4, 8 port / cluster (8, 16 port / system)

The VSP G400, G600, G800 model also supports the HDD-less configuration without DKB installed.

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7. Channel Board (CHB)
The Channel Board controls data transfer between the upper host and the Cache Memory.
It supports the following CHBs. The addition is common to the VSP G200, G400, G600, G800 models.
The number of CHBs and CHB types needs to be in the same configuration between clusters.

Table 4-81 Types CHB

Type	Option Name
8G 4Port FC	DW-F800-4HF8
16G 2Port FC	DW-F800-2HF16
32G 4Port FC	DW-F800-4HF32R
10G 2Port iSCSI (Optic)	DW-F800-2HS10S
10G 2Port iSCSI (Copper)	DW-F800-2HS10B

The number of installable CHBs is shown below.

Table 4-82 The Number of Installable CHBs by Model (VSP G200)

Item	VSP G200
Minimum installable number	1 piece/cluster (2 piece/system)
Maximum installable number (HDD)	2 piece/cluster (4 piece/system)
Maximum installable number (HDD less)	2 piece/cluster (4 piece/system)

Table 4-83 The Number of Installable CHBs by Model (VSP G400, G600)

Item	VSP G400, G600	
	NAS Module is not installed	NAS Module is installed
Minimum installable number	1 piece/cluster (2 piece/system)	0 piece/cluster (0 piece/system)
Maximum installable number (HDD)	4 piece/cluster (8 piece/system)	0 piece/cluster (0 piece/system)
	7 piece/cluster (14 piece/system) (*1)	3 piece/cluster (6 piece/system) (*1)
Maximum installable number (HDD less)	5 piece/cluster (10 piece/system) (*2)	- (*3)
	8 piece/cluster (16 piece/system) (*1)	- (*3)

*1: When the firmware version is 83-02-01-x0/xx or later, you can mount CHBs to the slots of E to G. When CHBs are mounted to the slots of E to G, you cannot downgrade the firmware version to less than 83-02-01-x0/xx.
*2: Installed in five slots; A to D of I/O slots and H shared with BE.
*3: When installing NAS module, the HDD-less case is not supported.

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Table 4-84 The Number of Installable CHBs by Model (VSP G800)

Item	VSP G800			
	CHBB is not installed		CHBB is installed (*3)	
	NAS Module is not installed	NAS Module is installed	NAS Module is not installed	NAS Module is installed
Minimum installable number	1 piece/cluster (2 piece/system)	0 piece/cluster (0 piece/system)	2 piece/cluster (4 piece/system)	0 piece/cluster (0 piece/system)
Maximum installable number (HDD)	4 piece/cluster (8 piece/system) (*1)	0 piece/cluster (0 piece/system) (*1)	6 piece/cluster (12 piece/system) (*1)	4 piece/cluster (8 piece/system)
	6 piece/cluster (12 piece/system)	2 piece/cluster (4 piece/system)	8 piece/cluster (16 piece/system)	
Maximum installable number (HDD less)	8 piece/cluster (16 piece/system)	- (*2)	10 piece/cluster (20 piece/system)	- (*2)

*1: When installing four DKBs per cluster.

*2: When installing NAS module, the HDD-less case is not supported.

*3: When the firmware version is 83-02-01-x0/xx or later, you can mount the Channel Board Box (CHBB). When the Channel Board Box (CHBB) is mounted, you cannot downgrade the firmware version to less than 83-02-01-x0/xx.

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The CHB for Fibre Channel connection can correspond to Shortwave or Longwave by port unit by selecting a transceiver to be installed in each port.
Note that a port of each CHB installs a transceiver for Shortwave as standard.
When changing to a Longwave supported port, addition of DKC-F810I-1PL8 (SFP for 8Gbps Longwave) or DKC-F810I-1PL16 (SFP for 16Gbps Longwave) is required.

Table 4-85 Maximum cable length (Fibre Channel, Shortwave)

Item	Maximum cable length		
Data Transfer Rate	OM2 (50 / 125µm multi-mode fibre)	OM3 (50 / 125µm laser optimized multi-mode fibre)	OM4 (50 / 125µm laser optimized multi-mode fibre)
200 MB/s	300 m	500 m	-
400 MB/s	150 m	380 m	400 m
800 MB/s	50 m	150 m	190 m
1600 MB/s	35 m	100 m	125 m
3200 MB/s	20 m	70 m	100 m

Table 4-86 Maximum cable length (iSCSI, Shortwave)

Item	Maximum cable length		
Data Transfer Rate	OM2 (50/125µm multi-mode fibre	OM3 (50/125µm laser optimized multi-mode fibre)	OM4 (50/125µm laser optimized multi-mode fibre)
1000 MB/s	82 m	300 m	550 m

Table 4-87 Maximum cable length (iSCSI (Copper))

Item	Maximum cable length	
Data Transfer Rate	Cable type : Category 5e LAN cable Corresponding Transmission Band : 1000 BASE-T	Cable type : Category 6a LAN cable Corresponding Transmission Band : 10G BASE-T
100 MB/s	100 m	100 m
1000 MB/s	-	50 m

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8. NAS Module

The NAS Module controls data transfer between the client and the Cache Memory.
The number of NAS Modules needs to be the same configuration between clusters.
The NAS Module has 12 Cache Memories for each cluster by default.

Table 4-88 NAS Module Types

Type	Option Name
NAS Module Cache Memory (for NAS)	DW-F800-NAS

The number of installable NAS Modules is shown below.

Table 4-89 The Number of Installable NAS Modules by Model

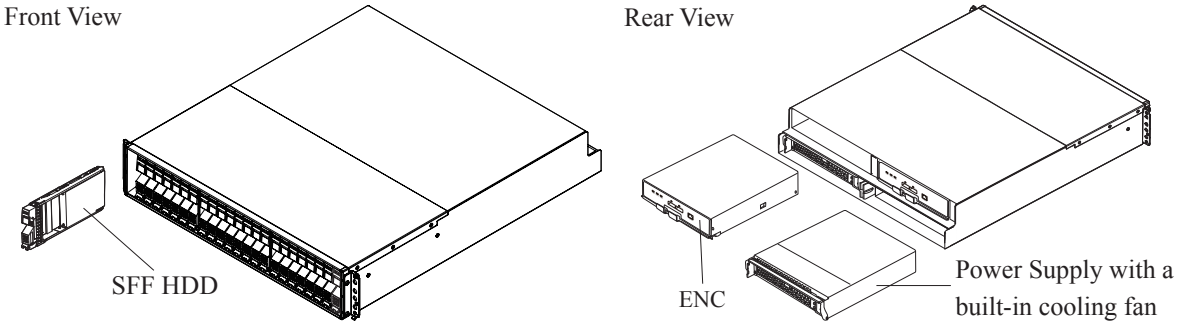
Item	VSP G400, G600(*1)	VSP G800 (*1)
Minimum installable number	0 piece/cluster(*2) (0 piece/system) (*2)	0 piece/cluster(*2) (0 piece/system) (*2)
Maximum installable number (HDD)(*3)	1 piece/cluster (2 piece/system)	1 piece/cluster (2 piece/system)

*1: VSP G200 cannot install NAS Modules.
*2: The minimum number for the block dedicated configuration.
*3: The disk-less configuration is not supported.

9. Drive Box (DBS/DBSD)

The Drive Box (DBS/DBSD) is a chassis to install the 2.5-inch Disk Drives and the 2.5-inch Flash Drives, and consists of two ENCs and two Power Supplies with a built-in cooling fan.

Figure 4-24 Drive Box (DBS/DBSD)



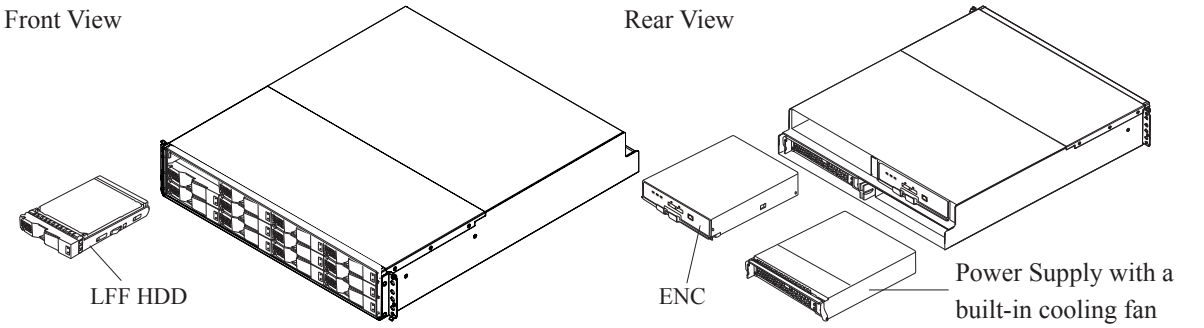
24 SFF HDDs can be installed.

ENC and Power Supply are a duplex configuration.

10. Drive Box (DBL/DBLD)

The Drive Box (DBL/DBLD) is a chassis to install the 2.5/3.5-inch Disk Drives and the 2.5-inch Flash Drives, and consists of two ENCs and two Power Supplies with a built-in cooling fan.

Figure 4-25 Drive Box (DBL/DBLD)



12 LFF HDDs can be installed.

ENC and Power Supply are a duplex configuration.

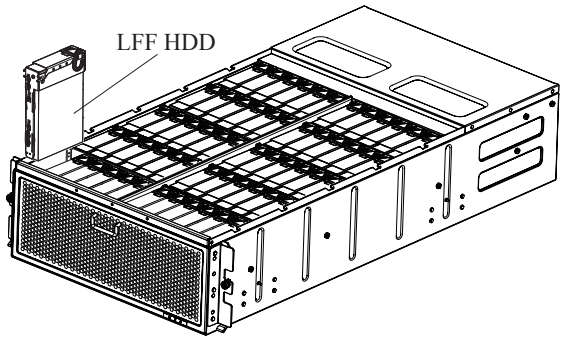
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11. Drive Box (DB60)

The Drive Box (DB60) is a chassis to install the 2.5/3.5-inch Disk Drives and 2.5-inch Flash Drives consists of two ENCs and two Power Supplies with a built-in cooling fan.

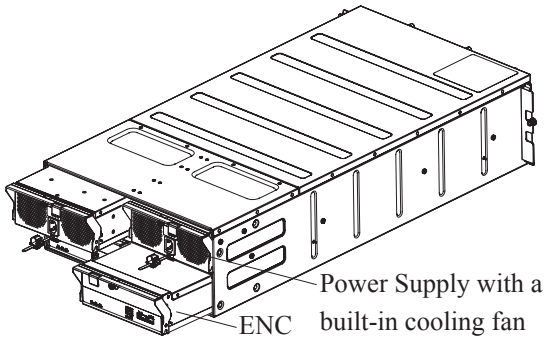
Figure 4-26 Drive Box (DB60)

Front View



60 LFF HDDs can be installed.

Rear View



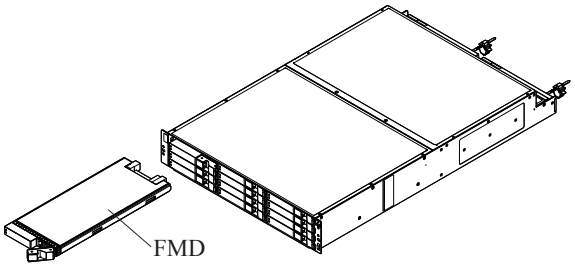
ENC and Power Supply are a duplex configuration.

12. Drive Box (DBF)

The Drive Box (DBF) is a chassis to install the Flash Module Drives (FMD), and consists of two ENCs and two Power Supplies with a built-in cooling fan.

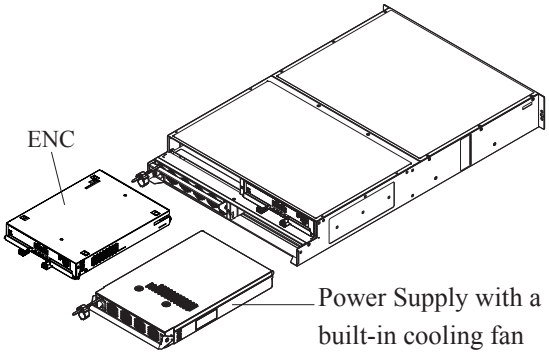
Figure 4-27 Drive Box (DBF)

Front View



12 FMDs can be installed.

Rear View



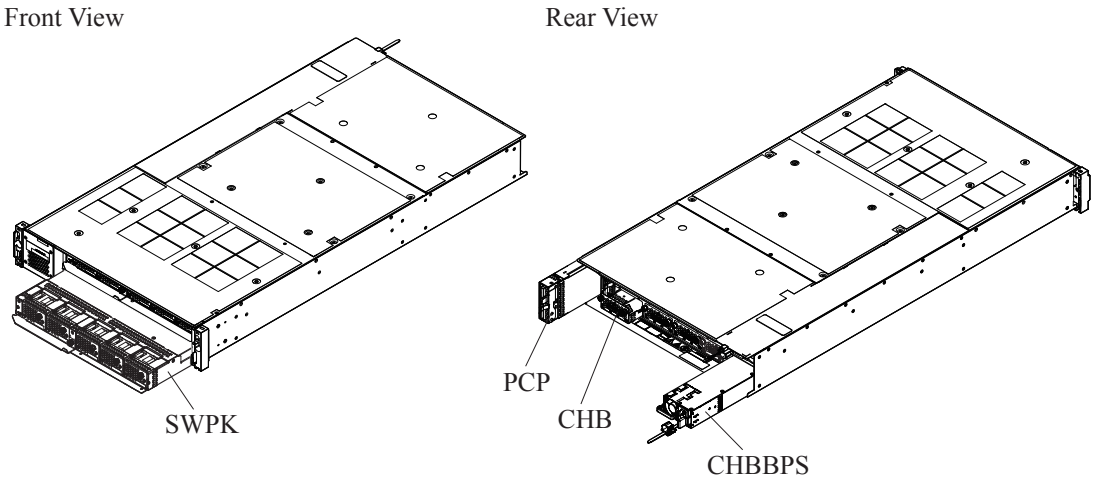
ENC and Power Supply are a duplex configuration.

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13. Channel Board Box (CHBB)

The Channel Board Box (CHBB) is a chassis to install the Channel Board (CHB), and consists of two PCIe-cable Connecting Packages (PCP), two power supplies and two Switch Packages (SWPK).

Figure 4-28 Channel Board Box (CHBB)



8 CHBs can be installed.

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14. Disk Drive, Flash Drive and Flash Module Drive

The Disk Drives and Flash Drives supported by DW800 are shown below.

Table 4-90 Disk Drive and Flash Drive Support Type

Group	I/F	Size (inch)	Maximum Transfer Rate (Gbps)	Revolution Speed (min^{-1}) or Flash Memory Type	Capacity
Disk Drive (HDD)	SAS	2.5 (SFF)	6	10,000	600 GB, 1.2 TB
			12	10,000	600 GB, 1.2 TB, 1.8 TB
			6	15,000	300 GB
			12	15,000	300 GB, 600 GB
	SAS	3.5 (LFF)	6	10,000	1.2 TB
			12	10,000	1.8 TB
			6	7,200	4 TB
			12	7,200	4 TB
			12	7,200	6 TB
			12	7,200	10 TB
Flash Drive (SSD)	SAS	2.5 (SFF)	12	MLC	200 GB, 400 GB, 480 GB, 960 GB, 1.9 TB, 3.8 TB
	SAS	3.5 (LFF)	12	MLC	400 GB
Flash Module Drive (FMD)	SAS	—	6	MLC	1.75 TB (1.6 TiB), 3.5 TB (3.2 TiB)
			12	MLC	1.75 TB (1.6 TiB), 3.5 TB (3.2 TiB), 7 TB (6.4 TiB), 14 TB (12.8 TiB)

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Table 4-91 LFF Disk Drive Specifications

Item		DKC-F810I-1R2J5M(*2)/ DKC-F810I-1R2J5MC/ DKC-F810I-1R2J7M(*2)/ DKC-F810I-1R2J7MC	DKC-F810I-4R0H3M(*2)/ DKC-F810I-4R0H3MC/ DKC-F810I-4R0H4M(*2)/ DKC-F810I-4R0H4MC	DKC-F810I-6R0H9M/ DKC-F810I-6R0HLM	DKC-F810I-1R8J6M/ DKC-F810I-1R8J8M
Disk Drive Model Name	Seagate	DKS5F-J1R2SS/ DKS5H-J1R2SS	DKS2E-H4R0SS/ DKS2H-H4R0SS	DKS2F-H6R0SS/ DKS2H-H6R0SS	DKS5H-J1R8SS
	HGST	DKR5E-J1R2SS/ DKR5G-J1R2SS	DKR2E-H4R0SS/ DKR2G-H4R0SS	DKR2G-H6R0SS	DKR5G-J1R8SS
User Capacity		1152.79 GB	3916.14 GB	5874.22 GB	1729.29 GB
Number of heads		DKS5F : 8 DKS5H : 6 DKR5E : 8 DKR5G : 6	DKS2E : 10 DKS2H : 10 DKR2E : 10 DKR2G : 8	DKS2F : 12 DKS2H : 10 DKR2G : 10	8
Number of Disks		DKS5F : 4 DKS5H : 3 DKR5E : 4 DKR5G : 3	DKS2E : 5 DKS2H : 5 DKR2E : 5 DKR2G : 4	DKS2F : 6 DKS2H : 5 DKR2G : 5	4
Seek Time (ms) (Read/Write)	Average (*1)	DKS5F : 3.7/4.3 DKS5H : 4.4/4.8 DKR5E : 4.6/5.0 DKR5G : 3.5/4.2	DKS2E : 7.8/8.5 DKS2H : 8.5/9.5 DKR2E : 8.2/8.2 DKR2G : 7.6/8.0	DKS2F : 8.5/9.5 DKS2H : 8.5/9.5 DKR2G : 7.6/8.0	DKS5H : 4.4/.4.8 DKR5G : 3.7/4.4
Average latency time (ms)		DKS5F : 3.0 DKS5H : 2.9 DKR5E : 3.0 DKR5G : 2.85	DKS2E : 4.16 DKS2H : 4.16 DKR2E : 4.2 DKR2G : 4.2	DKS2F : 4.16 DKS2H : 4.16 DKR2G : 4.2	DKS5H : 2.9 DKR5G : 2.85
Revolution speed (min^{-1})		10,000	7,200	7,200	10,000
Data transfer rate (Gbps)		DKS5F : 6 DKS5H : 12 DKR5E : 6 DKR5G : 12	DKS2E : 6 DKS2H : 12 DKR2E : 6 DKR2G : 12	12	12
Internal data transfer rate (MB/s)		DKS5F : Max. 293.8 DKS5H : - DKR5E : Max. 279 DKR5G : Max. 357.4	DKS2E : Max. 276 DKS2H : Max. 304 DKR2E : Max. 203 DKR2G : Max. 270	DKS2F : Max. 226 DKS2H : Max. 304 DKR2G : Max. 270	DKS5H : - DKR5G : Max. 357.4

*1: The Controller Board overhead is excluded.

*2: Contains BNST

(To be continued)

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(Continued from preceding page)

Item		DKC-F810I-10RH9M/ DKC-F810I-10RHLM
Disk Drive Model Name	Seagate	—
	HGST	DKR2H-H10RSS
User Capacity		9790.36 GB
Number of heads		14
Number of Disks		7
Seek Time (ms) (Read/Write)	Average (*1)	8.0/8.6
Average latency time (ms)		4.16
Revolution speed (min^{-1})		7,200
Data transfer rate (Gbps)		12
Internal data transfer rate (MB/s)		Max. 277.75

*1: The Controller Board overhead is excluded.

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Table 4-92 LFF Flash Drive Specifications

Item		DKC-F810I-400M6M/DKC-F810I-400M8M
Flash Drive Model Name	Toshiba	SLB5B-M400SS/SLB5C-M400SS/SLB5E-M400SD
	HGST	—
Form Factor		3.5 inch
User Capacity		393.85 GB
Flash memory type		MLC
Data transfer rate (Gbps)		12

Table 4-93 SFF Disk Drive Specifications

Item		DKC-F810I-300KCM(*2)/ DKC-F810I-300KCMC	DKC-F810I-600JCM(*2)/ DKC-F810I-600JCMC	DKC-F810I-600KGM	DKC-F810I-1R2JCM(*2)/ DKC-F810I-1R2JCMC
Disk Drive Model Name	Seagate	DKS5C-K300SS/ DKS5D-K300SS/ DKS5E-K300SS	DKS5E-J600SS/ DKS5H-J600SS	DKS5D-K600SS/ DKS5E-K600SS	DKS5F-J1R2SS/ DKS5H-J1R2SS
	HGST	DKR5C-K300SS	DKR5D-J600SS/ DKR5G-J600SS	DKR5C-K600SS	DKR5E-J1R2SS/ DKR5G-J1R2SS
User Capacity		288.20 GB	576.39 GB	576.39 GB	1152.79 GB
Number of heads		DKS5C : 4 DKS5D : 4 DKS5E : 2 DKR5C : 3	DKS5E : 4 DKS5H : 3 DKR5D : 4 DKR5G : 3	DKS5D : 6 DKS5E : 4 DKR5C : 6	DKS5F : 8 DKS5H : 6 DKR5E : 8 DKR5G : 6
Number of Disks		DKS5C : 2 DKS5D : 2 DKS5E : 1 DKR5C : 2	2	DKS5D : 3 DKS5E : 2 DKR5C : 3	DKS5F : 4 DKS5H : 3 DKR5E : 4 DKR5G : 3
Seek Time (ms) (Read/ Write)	Average (*1)	DKS5C : 2.7/3.1 DKS5D : 2.9/3.3 DKS5E : 2.9/3.3 DKR5C : 2.9/3.1	DKS5E : 3.6/4.1 DKS5H : 4.2/4.6 DKR5D : 3.8/4.2 DKR5G : 3.3/3.8	DKS5D : 2.9/3.3 DKS5E : 2.9/3.3 DKR5C : 2.9/3.1	DKS5F : 3.7/4.3 DKS5H : 4.4/4.8 DKR5E : 4.6/5.0 DKR5G : 3.5/4.2
Average latency time (ms)		2.0	DKS5E : 2.9 DKS5H : 2.9 DKR5D : 3.0 DKR5G : 2.85	2.0	DKS5F : 3.0 DKS5H : 2.9 DKR5E : 3.0 DKR5G : 2.85
Revolution speed (min-1)		15,000	10,000	15,000	10,000
Interface data transfer rate (Gbps)		DKS5C : 6 DKS5D: 12 DKS5E : 12 DKR5C : 12	DKS5E : 6 DKS5H : 12 DKR5D : 6 DKR5G : 12	12	DKS5F : 6 DKS5H : 12 DKR5E : 6 DKR5G : 12
Internal data transfer rate (MB/s)		DKS5C : Max. 283.4 DKS5D : - DKS5E : - DKR5C : Max. 399.7	DKS5E : Max. 293.8 DKS5H : - DKR5D : Max. 279 DKR5G : Max. 357.4	DKS5D : - DKS5E : - DKR5C : Max. 399.7	DKS5F : Max. 293.8 DKS5H : - DKR5E : Max. 279 DKR5G : Max. 357.4

*1: The Controller Board overhead is excluded.

*2: Contains BNST

(To be continued)

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(Continued from preceding page)

Item		DKC-F810I-1R8JGM
Disk Drive Model Name	Seagate	DKS5H-J1R8SS
	HGST	DKR5G-J1R8SS
User Capacity		1729.29 GB
Number of heads		8
Number of Disks		4
Seek Time (ms) (Read/Write)	Average (*1)	DKS5H : 4.4/.4.8 DKR5G : 3.7/4.4
Average latency time (ms)		DKS5H : 2.9 DKR5G : 2.85
Revolution speed (min-1)		10,000
Interface data transfer rate (Gbps)		12
Internal data transfer rate (MB/s)		DKS5H : - DKR5G : Max. 357.4

*1: The Controller Board overhead is excluded.

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Table 4-94 SFF Flash Drive Specifications

Item		DKC-F810I-200MEM	DKC-F810I-400MEM	DKC-F810I-480MGM	DKC-F810I-960MGM
Flash Drive Model Name	Toshiba	SLB5B-M200SS/ SLB5C-M200SS/ SLB5E-M200SD	SLB5B-M400SS/ SLB5C-M400SS/ SLB5E-M400SD	SLB5F-M480SD	SLB5F-M960SD
	HGST	SLR5D-M200SS	SLR5D-M400SS	—	—
Form Factor		2.5 inch	2.5 inch	2.5 inch	2.5 inch
User Capacity		196.92 GB	393.85 GB	472.61 GB	945.23 GB
Flash memory type		MLC	MLC	MLC	MLC
Interface data transfer rate (Gbps)		12	12	12	12

Item		DKC-F810I-1R9MEM	DKC-F810I-1R9MGM	DKC-F810I-3R8MGM
Flash Drive Model Name	Toshiba	SLB5D-M1R9SD/ SLB5E-M1R9SD	SLB5E-M1R9SD	SLB5F-M3R8SS
	HGST	—	—	—
Form Factor		2.5 inch	2.5 inch	2.5 inch
User Capacity		1890.46 GB	1890.46 GB	3780.92 GB
Flash memory type		MLC	MLC	MLC
Interface data transfer rate (Gbps)		12	12	12

Table 4-95 Flash Module Drive Specifications (1/2)

Item	DKC-F710I-1R6FM	DKC-F710I-3R2FM
Flash Module Drive Model Name	NFH1A-P1R6SS/ NFH1C-P1R6SS/ NFH1D-P1R6SS	NFH1B-P3R2SS/ NFH1C-P3R2SS/ NFH1D-P3R2SS
Form Factor	—	—
User Capacity	1759.21 GB	3,518.43 GB
Flash memory type	MLC	MLC
Interface data transfer rate (Gbps)	6	6

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Table 4-96 Flash Module Drive Specifications (2/2)

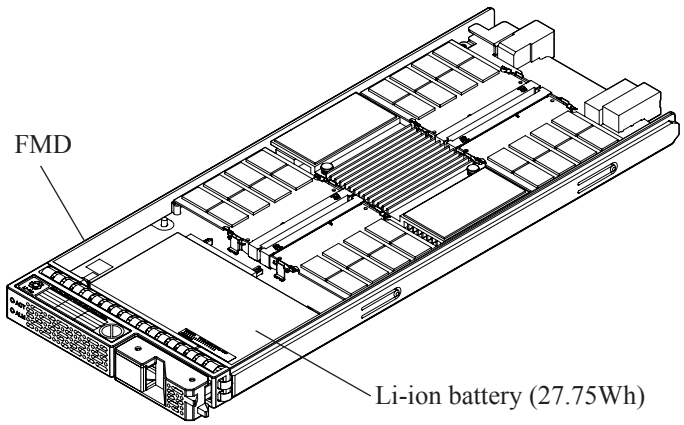
Item	DKC-F810I-1R6FN	DKC-F810I-3R2FN	DKC-F810I-6R4FN
Flash Module Drive Model Name	NFHAE-Q1R6SS	NFHAE-Q3R2SS	NFHAE-Q6R4SS
Form Factor	—	—	—
User Capacity	1759.21 GB	3518.43 GB	7036.87 GB
Flash memory type	MLC	MLC	MLC
Interface data transfer rate (Gbps)	12	12	12

Item	DKC-F810I-7R0FP	DKC-F810I-14RFP
Flash Module Drive Model Name	NFHAF-Q6R4SS	NFHAF-Q13RSS
Form Factor	—	—
User Capacity	7036.87 GB	14073.74 GB
Flash memory type	MLC	MLC
Interface data transfer rate (Gbps)	12	12

15. FMD

FMD has 27.75Wh Li-ion battery in it.

Figure 4-29 Location of Li-ion Battery



Package with over 100Wh battery should be handled as DG (Dangerous Goods) in IATA regulation when it is transported by airplane. DG freight requires additional freight fee. So, if you ship multiple FMDs installed in DBF, it will be handled as DG.
In order not to be handled as DG, please transport FMD in single module package.
If you ship FMDs installed in DBF as DG, you have to display “DG Mark label” below in outer package.
And the package must be the one specified by U. N, but the present package does not satisfy it.

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Figure 4-30 DG Mark label



Even if it is the case that multiple single module packages are put into one exterior package and it is transported by air, you have to display “Battery label” below in outer package.

Figure 4-31 Battery label



However, the interpretation of IATA regulation is a little different by each airline companies. So, although it depends on the number of FMDs, even if FMDs are installed in DBF, when using the airline which does not treat as a DG article, then the treatment in this clause is unnecessary.
Also, even if multiple single module packages are put into one exterior package, when using the airline which does not treat the package as “Battery label” necessary article, then the treatment in this clause is unnecessary.

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4.7 Mounted Numbers of Drive Box and the Maximum Mountable Number of Drive

Table 4-97 Mounted numbers of Drive Box and the maximum mountable number of drive (VSP Gx00 AC Power Supply Model)

Model name	Number of mounted Drive Box (*1)		Maximum mountable number of drives (*2)	
	DBS/DBL/DBF	DB60	DBS+DB60	DBL/DBF+DB60
VSP G200 (CBSS)	7	0	192	108
	5	1	204	144
	3	2	216	180
	1	3	228	216
	0	4	264	264
VSP G200 (CBSL)	7	0	180	96
	5	1	192	132
	3	2	204	168
	1	3	216	204
	0	4	252	252
VSP G400	16	0	384	192
	13	1	372	216
	12	2	408	264
	9	3	396	288
	8	4	432	336
	5	5	420	360
	4	6	456	408
	1	7	444	432
	0	8	480	480
VSP G600	24	0	576	288
	21	1	564	312
	20	2	600	360
	17	3	588	384
	16	4	624	432
	13	5	612	456
	12	6	648	504
	9	7	636	528
	8	8	672	576
	5	9	660	600
	4	10	696	648
	1	11	684	672
	0	12	720	720

(To be continued)

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Model name	Number of mounted Drive Box (*1)		Maximum mountable number of drives (*2)	
	DBS/DBL/DBF	DB60	DBS+DB60	DBL/DBF+DB60
VSP G800	48	0	1152	576
	45	1	1140	600
	44	2	1176	648
	41	3	1164	672
	40	4	1200	720
	37	5	1188	744
	36	6	1224	792
	33	7	1212	816
	32	8	1248	864
	29	9	1236	888
	28	10	1272	936
	25	11	1260	960
	24	12	1296	1008
	21	13	1284	1032
	20	14	1320	1080
	17	15	1308	1104
	16	16	1344	1152
	13	17	1332	1176
	12	18	1368	1224
	9	19	1356	1248
	8	20	1392	1296
	5	21	1380	1320
	4	22	1416	1368
	1	23	1404	1392
	0	24	1440	1440

*1: The maximum number of boxes that can be installed per PATH
VSP G200 : 7
VSP G400 : 8
VSP G600 : 12
VSP G800 : 6

*2: VSP G200 includes the drive to be installed in Controller Chassis.

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Table 4-98 Mounted numbers of Drive Box and the maximum mountable number of drive (VSP Gx00 DC Power Supply Model)

Model name	Number of mounted Drive Box (*1)		Maximum mountable number of drives (*2)
	DBSD	DBLD	
VSP G200 (CBSS1D)	7	0	192
	5	2	168
	3	4	144
	1	6	120
	0	7	108
VSP G200 (CBSL1D)	7	0	180
	5	2	156
	3	4	132
	1	6	108
	0	7	96

*1: The maximum number of boxes that can be installed per PATH
VSP G200 : 7

*2: VSP G200 includes the drive to be installed in Controller Chassis.

Table 4-99 Mounted numbers of Drive Box and the maximum mountable number of drive (VSP Fx00 models)

Model name	Number of mounted Drive Box (*1)	Maximum mountable number of drives
	DBF	FMD
VSP F400	16	192
VSP F600	24	288
VSP F800	48	576

*1: The maximum number of boxes that can be installed per PATH
VSP F400 : 8
VSP F600 : 12
VSP F800 : 6

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4.8 Storage System Physical Specifications

Table 4-100 Storage System Physical Specifications

#	Model Number	Weight (kg)	Heat Output (W)	Power Consumption (VA) (*1)	Dimension (mm)			Air Flow (m^3/min)
					Width	Depth	Height	
1	DW800-CBL (VSP G800)	32.8	453	493	483.0	891.7	174.3	6.0
2	DW800-CBL (VSP G400, G600)	32.8	338	363	483.0	891.7	174.3	6.0
3	DW800-CBSS	16.1	218	226	483.0	813.0	88.0	4.0
4	DW800-CBSSD	16.1	218	226	483.0	813.0	88.0	4.0
5	DW800-CBSL	15.9	192	200	483.0	813.0	88.0	3.5
6	DW800-CBSLD	15.9	192	200	483.0	813.0	88.0	3.5
7	DW-F800-DBS/ DW-F800-DBSC(*2)	17.0	116	126	482.0	565.0	88.2	2.2
8	DW-F800-DBSD	17.0	116	126	482.0	565.0	88.2	2.2
9	DW-F800-DBL/ DW-F800-DBLC(*2)	17.4	124	144	482.0	565.0	88.2	2.2
10	DW-F800-DBLD	17.4	124	144	482.0	565.0	88.2	2.2
11	DW-F800-DB60/ DW-F800-DB60C(*2)	36.0	184	191	482.0	1029.0	176.0	5.1
12	DW-F800-DBF	19.3	120	130	483.0	762.0	87.0	1.6
13	DW-F800-CHBB	33.2	222	230	483.0	891.7	88.0	2.0
14	DW-F800-1HP8	0.5	8.3	8.8	—	—	—	—
15	DW-F800-PC1F	1.0	—	—	—	—	—	—
16	DW-F800-SCQ1	0.2	—	—	—	—	—	—
17	DW-F800-SCQ1F	0.2	—	—	—	—	—	—
18	DW-F800-SCQ3	0.45	—	—	—	—	—	—
19	DW-F800-SCQ5	0.6	—	—	—	—	—	—
20	DW-F800-SCQ10A	0.2	—	—	—	—	—	—
21	DW-F800-SCQ30A	0.4	—	—	—	—	—	—
22	DW-F800-SCQ1HA	1.0	—	—	—	—	—	—
23	DW-F800-BS12G	0.5	16	17.2	—	—	—	—
24	DW-F800-BS12GE	0.5	16	17.2	—	—	—	—
25	DKC-F810I-CM8G	0.018	4	4.2	—	—	—	—
26	DKC-F810I-CM16G	0.022	4	4.2	—	—	—	—
27	DKC-F810I-CM32G	0.054	7	7.3	—	—	—	—
28	DW-F800-BM10	0.15	5	5.2	—	—	—	—
29	DW-F800-BM20	0.15	5	5.2	—	—	—	—
30	DW-F800-BM30	0.15	5	5.2	—	—	—	—
31	DW-F800-BAT	0.6	24.4	25.7	—	—	—	—

(To be continued)

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(Continued from preceding page)

#	Model Number	Weight (kg)	Heat Output (W)	Power Consumption (VA) (*1)	Dimension (mm)			Air Flow (m^3/min)
					Width	Depth	Height	
32	DW-F800-4HF8	0.45	12.3	12.9	—	—	—	—
33	DW-F800-2HF16	0.45	13.5	14.2	—	—	—	—
34	DW-F800-4HF32R	0.5	22.4	24.9	—	—	—	—
35	DW-F800-2HS10S	0.5	18.0	18.9	—	—	—	—
36	DW-F800-2HS10B	0.5	28.5	30.0	—	—	—	—
37	DW-F800-NAS	2.3	110	120	337.9	228.4	46	—
38	DKC-F810I-1PL8	0.02	—	—	—	—	—	—
39	DKC-F810I-1PS8	0.02	—	—	—	—	—	—
40	DKC-F810I-1PL16	0.02	—	—	—	—	—	—
41	DKC-F810I-1PS16	0.02	—	—	—	—	—	—
42	DKC-F810I-1PS32	0.02	—	—	—	—	—	—
43	DW-F800-1PS10	0.02	—	—	—	—	—	—
44	DW-F800-J4DC	0.3	—	—	—	—	—	—
45	DW-F800-J4DC3	0.6	—	—	—	—	—	—
46	DKC-F810I-600JCM(*2)/ DKC-F810I-600JCMC	0.3	8.0	8.4	—	—	—	—
47	DKC-F810I-600KGM	0.3	8.0	8.4	—	—	—	—
48	DKC-F810I-1R2JCM(*2)/ DKC-F810I-1R2JCMC	0.3	8.3	8.7	—	—	—	—
49	DKC-F810I-1R2J5M(*2)/ DKC-F810I-1R2J5MC	0.8	8.3	8.7	—	—	—	—
50	DKC-F810I-1R2J7M(*2)/ DKC-F810I-1R2J7MC	0.4	8.3	8.7	—	—	—	—
51	DKC-F810I-1R8JGM	0.3	8.3	8.7	—	—	—	—
52	DKC-F810I-1R8J6M	0.8	8.3	8.7	—	—	—	—
53	DKC-F810I-1R8J8M	0.4	8.3	8.7	—	—	—	—
54	DKC-F810I-300KCM(*2)/ DKC-F810I-300KCMC	0.3	8.6	9.0	—	—	—	—
55	DKC-F810I-4R0H3M(*2)/ DKC-F810I-4R0H3MC	0.78	12.9	13.5	—	—	—	—
56	DKC-F810I-4R0H4M(*2)/ DKC-F810I-4R0H4MC	0.9	12.9	13.5	—	—	—	—
57	DKC-F810I-200MEM	0.23	6.7	7.0	—	—	—	—
58	DKC-F810I-400MEM	0.23	6.7	7.0	—	—	—	—
59	DKC-F810I-480MGM	0.23	6.7	7.0	—	—	—	—
60	DKC-F810I-960MGM	0.23	6.7	7.0	—	—	—	—
61	DKC-F810I-1R9MEM	0.23	6.7	7.0	—	—	—	—
62	DKC-F810I-1R9MGM	0.23	6.7	7.0	—	—	—	—
63	DKC-F810I-3R8MGM	0.23	6.7	7.0	—	—	—	—
64	DKC-F810I-400M6M	0.8	6.7	7.0	—	—	—	—
65	DKC-F810I-400M8M	0.3	6.7	7.0	—	—	—	—
66	DKC-F710I-1R6FM	1.4	17.0	18.0	—	—	—	—
67	DKC-F810I-1R6FN	1.4	25.0	26.0	—	—	—	—

(To be continued)

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(Continued from preceding page)

#	Model Number	Weight (kg)	Heat Output (W)	Power Consumption (VA) (*1)	Dimension (mm)			Air Flow (m^3/min)
					Width	Depth	Height	
68	DKC-F710I-3R2FM	1.4	18.0	19.0	—	—	—	—
69	DKC-F810I-3R2FN	1.4	25.0	26.0	—	—	—	—
70	DKC-F810I-6R4FN	1.4	25.0	26.0	—	—	—	—
71	DKC-F810I-7R0FP	1.4	25.0	26.0	—	—	—	—
72	DKC-F810I-14RFP	1.4	25.0	26.0	—	—	—	—
73	DKC-F810I-6R0HLM	0.96	12.9	13.5	—	—	—	—
74	DKC-F810I-6R0H9M	0.85	12.9	13.5	—	—	—	—
75	DKC-F810I-10RH9M	0.73	12.9	13.5	—	—	—	—
76	DKC-F810I-10RHLM	0.84	12.9	13.5	—	—	—	—

*1: Actual values at a typical I/O condition. (Random Read and Write, 50 IOPSs for HDD, 2500 IOPSs for SSD, Data Length: 8 kbytes. All fans rotate at normal.) These values may increase for future compatible drives.

*2: Contains BNST

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4.8.1 Environmental Specifications

The environmental specifications are shown in the following table.

1. Environmental Conditions

Table 4-101 Usage Environment Conditions

Item	Condition			
	Operating (*1)(*5)			
Model Name	CBL/ CBSS1/CBSL1/ CBSS0/CBSL0/ CHBB	DBS/DBL	DBF	DB60
Temperature range (ºC)	10 to 40	10 to 40	10 to 40 (*6)	10 to 35
Relative humidity (%) (*4)	8 to 80	8 to 80	8 to 80	8 to 80
Maximum wet-bulb temperature (ºC)	29	29	29	29
Temperature gradient (ºC/hour)	10	10	10	10
Dust (mg/m3)	0.15 or less	0.15 or less	0.15 or less	0.15 or less
Gaseous contaminants (*11)	G1 classification levels			
Altitude (m) (Ambient temperature)	3,000 (10ºC to 32ºC) 900 (10ºC to 40ºC)	3,000 (10ºC to 32ºC) 900 (10ºC to 40ºC)	3,000 (10ºC to 32ºC) 900 (10ºC to 40ºC) (*7)	3,000 (10ºC to 28ºC) 1000 (10ºC to 35ºC)
Noise Level (*10) (Recommended)	80 dB or less			

Item	Condition			
	Non-Operating (*2)			
Model Name	CBL/ CBSS1/CBSL1/ CBSS0/CBSL0/ CHBB	DBS/DBL	DBF	DB60
Temperature range (ºC)	-10 to 50	-10 to 50	-10 to 50 (*8)	-10 to 50
Relative humidity (%) (*4)	8 to 90	8 to 90	8 to 90	8 to 90
Maximum wet-bulb temperature (ºC)	29	29	29	29
Temperature gradient (ºC/hour)	10	10	10	10
Dust (mg/m^3)	—	—	—	—
Gaseous contaminants (*11)	G1 classification levels			
Altitude (m)	-60 to 12,000	-60 to 12,000	-60 to 12,000	-60 to 12,000

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Item	Condition			
	Transportation, Storage (*3)			
Model Name	CBL/ CBSS1/CBSL1/ CBSS0/CBSL0/ CHBB	DBS/DBL	DBF	DB60
Temperature range (ºC)	-30 to 60	-30 to 60	-30 to 60 (*9)	-30 to 60
Relative humidity (%) (*4)	5 to 95	5 to 95	5 to 95	5 to 95
Maximum wet-bulb temperature (ºC)	29	29	29	29
Temperature gradient (ºC/hour)	10	10	10	10
Dust (mg/m^3)	—	—	—	—
Gaseous contaminants (*11)	—			
Altitude (m)	-60 to 12,000	-60 to 12,000	-60 to 12,000	-60 to 12,000

*1: Environmental conditions of operation should be completed before switch on a system.
*2: “Non-operation” includes conditions of both packing and unpacking.
*3: Transportation and storage should be conducted in the packing of initial shipping.
*4: No dew condensation.
*5: The system monitors the intake temperature and the internal temperature of the Controller and the Power Supply. It executes the following operations in accordance with the temperatures.
*6: When FMDs (DKC-F710I-1R6FM/3R2FM) are installed, the value becomes 10 to 35 ºC.
*7: When FMDs (DKC-F710I-1R6FM/3R2FM) are installed, the value becomes 10 to 35 ºC.
*8: When FMDs (DKC-F710I-1R6FM/3R2FM) are installed, the value becomes -10 to 35 ºC.
*9: When FMDs (DKC-F710I-1R6FM/3R2FM) are installed, the value becomes -10 to 50 ºC.
*10: Noise may cause an error in the storage system.
Locate the storage system as far as possible from noise sources such as emergency bells and fire extinguishing nozzles.
Doing so can reduce the occurrence of an error of the storage system when noise is generated.
Noise Level shows the recommended value instead of the guaranteed value.
For example, the noise level of an emergency bell thet generates noise of 93 dB will be :
- Approximately 80 dB at 6 meters distance from the emergency bell.
- Approximately 70 dB at 15 meters distance from the emergency bell.
*11: See ANSI/ISA-71.04-2013 Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants.

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(1) VSP G200
- If the use environment temperature rises to 43 degrees C or higher, the external temperature warning (SIM-RC = af110x) is notified.
- If the use environment temperature rises to 58 degrees C or higher or the Controller Board internal temperature rises to 96 degrees C or higher, the external temperature alarm (SIM-RC = af120x) is notified.
  If both Controller Boards are alarmed, the system executes the power-off processing (planned power off) automatically.
- If the use environment temperature is 5 degrees C or lower, the external temperature warning (SIM-RC = af110x) is notified.
- If the temperature of the CPU exceeds its operation guarantee value, the MP temperature abnormality warning (SIM-RC = af100x) is notified.
- If the temperature of the Controller Board exceeds its operation guarantee value, the thermal monitor warning (SIM-RC = af130x) is notified.

(2) VSP G400, G600, G800
- If the use environment temperature rises to 43 degrees C or higher (When the firmware version is 83-01-21-x0/xx or earlier: 48 degrees C or higher), the external temperature warning (SIM-RC = af110x) is notified.
- If the use environment temperature rises to 50 degrees C or higher or the Controller Board internal temperature rises to 69 degrees C or higher (When the firmware version is 83-01-21-x0/xx or earlier: 60 degrees C or higher), the external temperature alarm (SIM-RC = af120x) is notified.
  If both Controller Boards are alarmed, the system executes the power-off processing (planned power off) automatically.
- If the use environment temperature is 5 degrees C or lower, the external temperature warning (SIM-RC = af110x) is notified.
- If the temperature of the CPU exceeds its operation guarantee value, the MP temperature abnormality warning (SIM-RC = af100x) is notified.
- If the temperature of the Controller Board exceeds its operation guarantee value, the thermal monitor warning (SIM-RC = af130x) is notified.

(3) DBS/DBL
- If the internal temperature of the Power Supply rises to 55 degrees C or higher, the DB external temperature warning (SIM-RC = af7000) is notified.
- If the internal temperature of the Power Supply rises to 64.5 degrees C or higher, the DB external temperature alarm (SIM-RC = af7100) is notified.

(4) DBF
- If the internal temperature of the Power Supply rises to 62 degrees C or higher, the DB external temperature warning (SIM-RC = af7000) is notified.
- If the internal temperature of the Power Supply rises to 78 degrees C or higher, the DB external temperature alarm (SIM-RC = af7100) is notified.

(5) DB60
- If the internal temperature of the Power Supply rises to 60 degrees C or higher, the DB external temperature warning (SIM-RC = af7000) is notified.
- If the internal temperature of the Power Supply rises to 70 degrees C or higher, the DB external temperature alarm (SIM-RC = af7100) is notified.

(6) CHBB
- If the use environment temperature rises to 43 degrees C or higher, the CHBB temperature warning (SIM-RC = af46xx) is notified.

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2. Mechanical Environmental Conditions

Table 4-102 Mechanical Environmental Conditions

Item	In operating	In non-operating
Guaranteed value to vibration	2.45 m/s^2 or less (0.25 G)	5.0 m/s^2 (0.4 G) or less : No critical damage for product function. (Normal operating with part replacement)
		9.8 m/s^2 (1.0 G) or less : Ensure own safety with fall prevention.
Guaranteed value to impact	No impact	78.4 m/s^2 (8.0 G), 15 ms :
Guaranteed value to seismic wave	2.45 m/s^2 or less (0.25 G) (250 gal approx.) :	3.9 m/s^2 (0.4 G) (400gal) or less : No critical damage for product function. (Normal operating with part replacement) 9.8 m/s^2 (1.0 G) (1000 gal) or less : Ensure own safety with fall prevention.

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4.9 Power Specifications

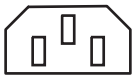
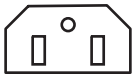
4.9.1 Storage System Current

DW800 input power specifications are shown below.

Model	Rated Power
CBL (VSP G400, G600, G800)	1600 VA
CBSS/CBSL	800 VA
DBS	480 VA
DBL	380 VA
DB60	1200 VA
DBF	520 VA
DBSD	460 VA
DBLD	350 VA
CBSSD/CBSLD	760 VA
CHBB	560 VA

DW800 input current are shown as each Power Supply.

Table 4-103 Input Power Specifications

Item	Input Power	Input Current (*1)	Rated Current (*2)	Leakage Current	Inrush Current			Power Cord Plug Type
					1st (0-p)	2nd (0-p)	1st (0-p) Time (-25%)	
DKC(VSP G400, G600, G800) PS	Single phase, AC200V to AC240V	8.0 A	4.0 A	1.75 mA	30 A	20 A	25 ms	
DKC(VSP G200) PS		4.0 A	2.0 A	1.75 mA	30 A	28 A	25 ms	
DBS/DBL PS		2.4 A	1.2 A	1.75 mA	30 A	25 A	25 ms	
DB60 PS		6.0 A	3.0 A	1.75 mA	45 A	35 A	25 ms	
DBF PS		2.6 A	1.3 A	1.75 mA	20 A	15 A	80 ms	
CHBB PS		4.0 A	2.0 A	1.75 mA	30 A	28 A	25 ms	
DKC(VSP G200) PS	Single phase, AC100V to AC120V	8.0 A	4.0 A	1.75 mA	30 A	28 A	25 ms	
DBS/DBL PS		4.8 A	2.4 A	1.75 mA	30 A	25 A	25 ms	
DB60 PS		—	—	—	—	—	—	
DBF PS		5.2 A	2.6 A	1.75 mA	20 A	15 A	80 ms	
CBSSD/CBSLD	-48V to -60V	16.0 A	8.0 A	—	30 A	25 A	25 ms	
DBSD/DBLD		9.6 A	4.8 A	—	30 A	25 A	25 ms	

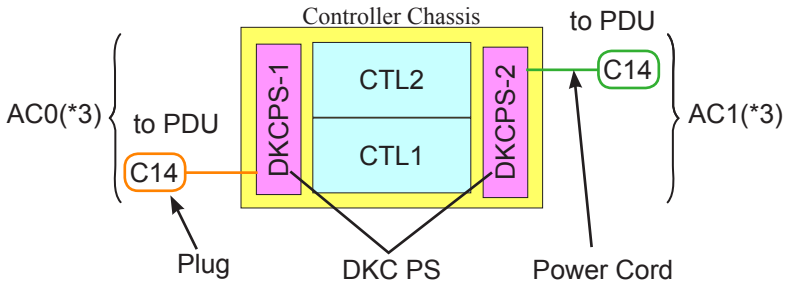
*1: The maximum current in case AC input is not a redundant configuration.

*2: The maximum current in case AC input is a redundant configuration.

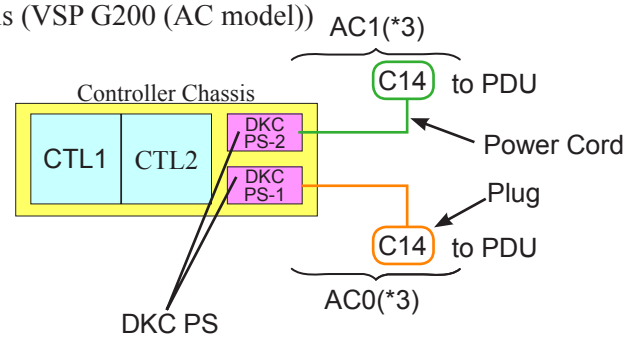
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Figure 4-32 Power Supply Locations

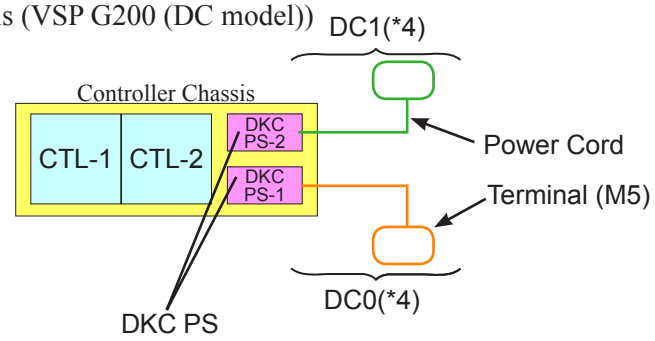
1. Controller Chassis (VSP G400, G600, G800)



2. Controller Chassis (VSP G200 (AC model))



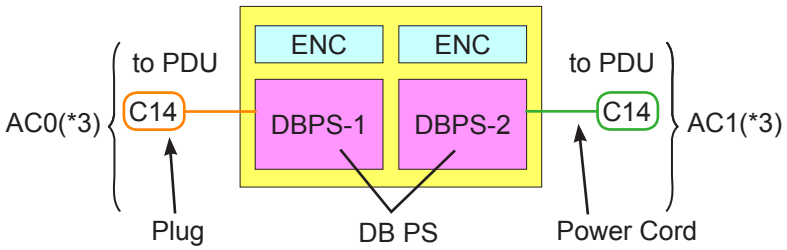
Controller Chassis (VSP G200 (DC model))



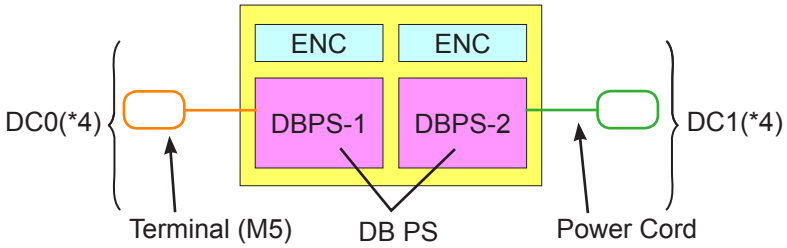
*3: It is necessary to separate AC0 and AC1 for AC redundant.
*4: It is necessary to separate DC0 and DC1 for DC redundant.

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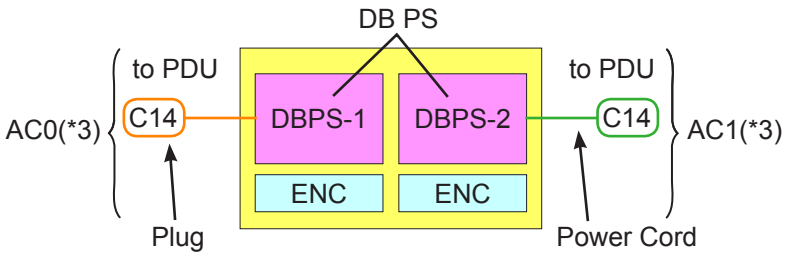
3. Drive Box (DBS/DBL/DBF (AC model))



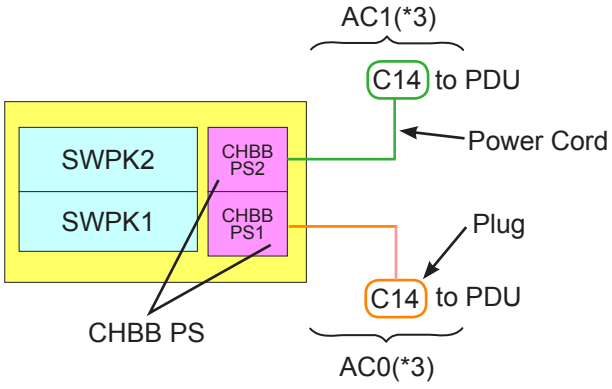
Drive Box (DBSD/DBLD (DC model))



4. Drive Box (DB60)



5. Channel Board Box(CHBB)



*3: It is necessary to separate AC0 and AC1 for AC redundant.
*4: It is necessary to separate DC0 and DC1 for DC redundant.

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4.9.2 Input Voltage and Frequency

The following shows the electric power system specifications for feeding to the Storage System.

1. Input Voltage and Frequency
   The following shows the input voltage and frequency to be supported.

   • CBLM2/CBLM3/CBLH/DB60

Input Voltage	Voltage Tolerance	Frequency	Wire Connection
200V to 240V	+10% or -11%	50Hz ± 2Hz 60Hz ± 2Hz	1 Phase 2 Wire + Ground

   • CBSS0/CBSL0/CBSS1/CBSL1/DBS/DBL/DBF/CHBB

Input Voltage (AC)	Voltage Tolerance	Frequency	Wire Connection
100V to 120V/ 200V to 240V	+10% or -11%	50Hz ± 2Hz 60Hz ± 2Hz	1 Phase 2 Wire + Ground

   • CBSSD/CBSLD/DBSD/DBLD

Input Voltage (DC)	Voltage Tolerance	Frequency	Wire Connection
-48V to -60V	+10% or -11%	—	2 Wire + Ground(+, -)

2. PDU specifications
   The two types of the PDU (Power Distribution Unit) are a vertical PDU mounted on a rack frame post and a horizontal PDU of 1U size. Order the required number of PDUs together with the PDU AC cables in accordance with the configuration of the device to be mounted on the rack frame.

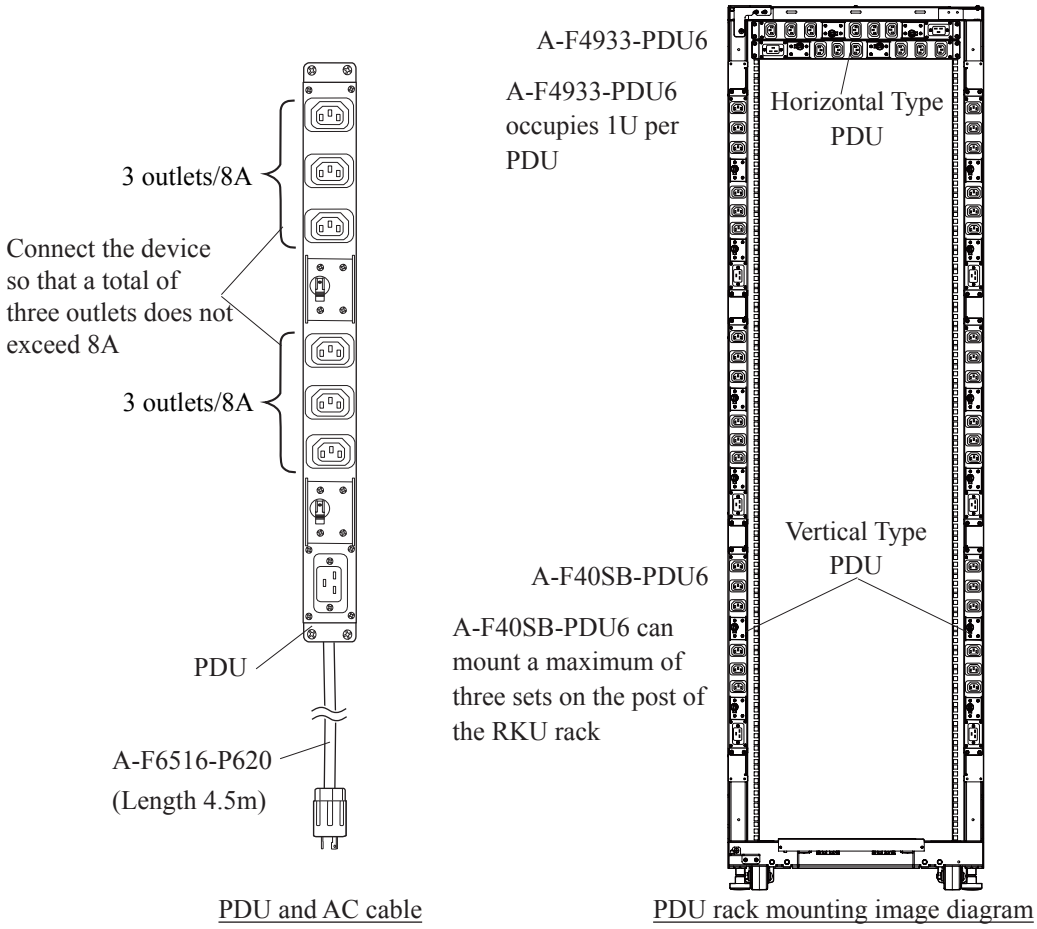
Table 4-104 PDU Device Specifications

Item		Vertical Type	Horizontal Type
Model Name	PDU	A-F40SB-PDU6	A-F4933-PDU6
	AC cable	A-F6516-P620	
AC Input		AC200V	
PDU Output		6 outlets: A circuit breaker is available for every three outlets (8 rated amperes)	
Remarks		Two-set configuration per model name for both PDU/AC cable options	

For information about the Hitachi Universal V2 rack used with HDS VSP storage systems, refer to the Hitachi Universal V2 Rack Reference Guide (MK-94HM8035).

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Figure 4-33 PDU Specifications



PDU and AC cable　　PDU rack mounting image diagram

When using AC100V, request the customer to prepare the PDU.

The following shows the specifications of the PDU power codes and connectors.
The available cable lengths of the PDU power codes differ according to the installation location of the PDU.

PDU Location	Available Cable Length(*1)	Plug			Receptacle	
		Rating	Manufacturer	Parts No.	Manufacturer	Parts No.
Upper PDU	2.7 m	20A	AMERICAN DENKI CO.,LTD.	L6-20P	—	L6-20R (*2)
Mid PDU	3.2 m					
Lower PDU	3.7 m					

*1 : This is a length outside the rack chassis.
*2 : When the receptacle is L6-30R, select P630 as an option.