MULTIPLATFORM SECTION

Contents

1 GENERAL

1.1 Product Outline and Features

The multiplatform optional feature can assign a partial or full of disk volume area of the DKC disk subsystem for the Open system hosts by installing FIBRE channel adapter (CHF) packages to the disk controller (hereinafter called DKC). This function enables a use of high reliable and high performance disk subsystem realized by the DKC for a multiplatform or FIBRE system environment. This also provides the customers with a flexible and optimized system construction capability for their system expansion and migration.

Some of the major features of this FIBRE attachment option are listed below.

(1) HMRS (Hitachi Multiplatform Resource Sharing) function and FIBRE interface connectivity

In addition to the conventional Channel interface (asynchronous (ESCON) channels), the SCSI-2, standard interface in the open systems, can be mounted in one controller.
At the same time fibre channel interface can be mounted in one controller. This enables multiplatform system users to share the high reliable and high performance resource realized by the DKC disk subsystem.

The SCSI interface is complied with ANSI SCSI-2, a standard interface for various peripheral devices for open systems. Thus, the DKC can be easily connected to various open-market SCSI host systems (e.g. Workstation servers and PC servers). The DKC can be also connected to open-market FIBRE host systems.

DKC410 can be connected to open system via FIBRE interface by installing Fibre 2/4-port Adapter (DKC-F410I-4GS/8GS/4GL/8GL/8GSE/8GLE/8HSE).
FIBRE connectivity are provided as channel option of DKC410.
FIBRE Adapter can be installed any CHA location of DKC410 and can be co-exist with any other channel adapters.

(2) Fast and concurrent data transmission
Data can be read and written at a maximum speed of 100M bytes/second with use of FIBRE interface (4GS/8GS/4GL/8GL/8GSE/8GLE) and 200 M bytes/second with use of 8HSE.
All of the FIBRE ports can transfer data concurrently too.

(3) All FIBRE configuration
All FIBRE configuration is also allowed either with one CHF pair or two, three or full of four CHF pairs configuration.
These will provide more flexible use of the subsystem for open system environment.

(4) HMDE (Hitachi Multiplatform Data Exchange) support
By installing HMDE mto optional feature, data in the mainframe volumes can be read from open systems and write it into the open system volumes. Another way, by installing HMDE otm optional feature, data can be transferred from open system to mainframe.
This enables faster data transmission of data base files between mainframe and open systems than currently used means such as network transfer.
HMDE mto/otm feature is available through FIBRE adapters.

(5) HMBR (Hitachi Multiplatform Backup/Restore) support
By using HMBR optional feature, data in the open system can be managed by the backup systems and utilities provided in the mainframe systems. This enables a use of rich and high reliable and high performance backup systems of mainframe world to the open system environment.
HMBR feature is available through FIBRE adapters.

(6) Customer assets guarantee (Upgrading paths)
The FIBRE attachment options allows on-site upgrading of already installed channel-type DKC systems owned by customers.

(7) High performance
The DKC has two independent areas of nonvolatile cache memory and this mechanism also applies to the FIBRE attachment option. Thus, compared with a conventional disk array controller used for open systems and not having a cache, this disk subsystem has the following outstanding characteristics:

① Cache data management by LRU control
② Adoption of DFW (DASD Fast Write)
③ Write data duplexing
④ Nonvolatile cache

(8) 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. This concept is also taken over to the FIBRE attachment option, which ensures fault-tolerance against even single point of failure in its components, except the CHF. Fault-tolerance against CHF and FIBRE cable failures depends on the multi-path configuration support of the host system too.

(9) High data reliability
The FIBRE attachment option automatically creates and adds to host data a unique data guarantee code of eight bytes, which is then written together with the data onto the disk. The data guarantee code is checked automatically on the internal data bus of the DKC to prevent the occurrence of data errors due to array-specific data distribution or integration control. Thus, the reliability of the data improves.

(10) HORC (Hitachi Open Remote Copy) Support

HORC is a function to realize the duplication of open system data by connecting the two DKC410 subsystems or inside parts of a single DKC410 using the ESCON.
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.

1.2 Basic Specifications

The basic specifications of the SCSI and FIBRE attachment are shown in Table 1-1.

Table 1-1 Basic specifications

Item		Specification
Host Channel	Max. # of Channels	32
	Max. # of concurrent paths	32
Data transfer		100 M bytes/second (4GS/8GS/4GL/8GL/8GSE/8GLE) 200 M bytes/second (8HSE)
RAID level		RAID5/RAID1
RAID configuration		RAID5 (3D+1P: 180 G bytes, 146 G bytes, 72 G bytes, 47 G bytes, 18 G bytes)
		RAID1 (2D+2D: 180 G bytes, 146 G bytes, 72 G bytes, 47 G bytes, 18 G bytes)
DKU		DKU-F405I-18J4 (18 G bytes)
		DKU-F405I-18K4 (18 G bytes)
		DKU-F405I-36K4 (36 G bytes)
		DKU-F405I-47J4 (47 G bytes)
		DKU-F405I-72J4 (72 G bytes)
		DKU-F405I-72K4 (72 G bytes)
		DKU-F405I-146J4 (146 G bytes)
		DKU-F405I-180H4 (180 G bytes)
Cache capacity	minimum	512 M bytes
	maximum	32 G bytes
	additional unit	512 M bytes

*1 : 64 M bytes DRAM

1.3 Terminology

(1) Arbitrated Loop
A configuration that allows multiple ports to be connected serially.

(2) CHA
CHannel Adapter. A hardware package to connect with a channel interface.

(3) CHF
CHannel adapter for FIBRE. A hardware package to connect with FIBRE interface.

(4) Command descriptor block (CDB)
A command block in SCSI interface used to send requests from the initiator to a target.

(5) DKA
DisK Adapter. A hardware package which controls disk drives within a DKC.

(6) DKC
DisK Controller. A disk controller unit consisting of CHA, CHS, CHF, DKA, Cache and other components except DKU.

(7) DKU
DisK Unit. Disk drives units.

(8) Fabric
The entity which interconnects various N-Ports attached to it and is capable of routing frames.

(9) FAL
File Access Library: A program package and provided as a program product for HMDE.

(10) FCU
File Conversion Utility: A program package and provided together with FAL for HMDE.

(11) HMBR
Hitachi Multiplatform Backup/Restore.

(12) HMDE
Hitachi Multiplatform Data Exchange.

(13) HMRS
Hitachi Multiplatform Resource Sharing.

(14) HA configuration
High Availability configuration

(15) Initiator
The SCSI device (usually, a host computer) that requests another SCSI device to operate.

(16) Logical unit (LU)
The logical unit of division of the subsystem data area accessible from SCSI interface.

(17) Logical unit number (LUN)
A three-bit code identifier for a logical unit. LUN0-7 can be assigned.

(18) Logical volume or logical device (LDEV)
The disk pack image, formed on an array disk, that is compatible with that of a 3390-3 in terms of cylinder and track quantities and the track capacity.

(19) Point-to-Point
A configuration that allows two ports to be connected serially.

(20) SCSI device
Collectively refers to the host computer, peripheral control units, and intelligent peripherals that are connected to one SCSI bus.

(21) SCSI address
A unique address assigned to an SCSI device. Eight addresses 0 to 7 (for a WIDE SCSI, 0 to 15) can be assigned.

(22) SCSI ID
A bit definition address for an SCSI address. This bit address is keyed to a data bus bit number.

(23) Target
An SCSI device (usually, the DKC) that operates at the request of the initiator.

(24) VENDOR UNIQUE or VU
A manufacturer- or device-unique definable bit, byte, field, or code value.

(25) Initiator Port
A port-type used for MCU port of Fibre Remote Copy function.

(26) RCU Target Port
A port-type used for RCU port of Fibre Remote Copy function.
This port allows LOGIN of host computers and MCUs.

(27) Target port
A port-type which is different from “Initiator Port” and “RCU Target Port”.
This port is a normal target port which is used without configuration of Fibre Remote Copy.
This “Target port” allows LOGIN of host computers. It does not allow LOGIN of MCUs.

1.4 Notice about maintenance operations

There are some notices about FIBRE maintenance operations.

(1) When SCSI path configuration will be changed, SCSI I/O on the related FIBRE port must be stopped before.
(2) When FIBRE channel adapter or LDEV will be de-installed, the related SCSI path must be de-installed before.
(3) When FIBRE channel adapter will be replaced, the related SCSI I/O must be stopped before.
(4) When micro-program will be changed, all SCSI I/O on the DKC must be stopped before, excepting another operation is instructed with HA configuration or CHF skip mode microprogram exchanging.
(5) When Fibre-Topology information is changed, pull out 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.

2 Interface Specification

2.1 FIBRE Physical Interface Specification

The physical interface specification supported for FIBRE is shown in Table 2-1 and Table 2-2.

Table 2-1 FIBRE Physical specification

No.	Item		Specification	Remark
1	Host interface	Physical interface	Fibre Channel	FC-PH,FC-AL
		Logical interface	SCSI-3	FCP,FC-PLDA
			Fibre(Arbitrated Loop)	FC-AL
2	data transfer rate	optic fibre cable	100/200 M bytes/second	—
3	cable length	optic single mode fibre	10km	Longwave laser
		optic multi mode fibre	500m	Shortwave laser
4	topology		FC-AL	—
5	service class		3	—
6	protocol		FCP	—
7	transfer code		8B/10B translate	—
8	# of hosts		128/Path	—
9	# of maximum LU		256/Path	—
10	PORT/PCB	2 Port CHF	2 Port (SP Mode*) 1 Port (HP Mode*)	—
		4 Port CHF	4 Port (SP Mode*) 2 Port (HP Mode*)	—

SP Mode : Standard Performance Mode
HP Mode : High Performance Mode

Table 2-2 FC I/F support level

No.	Item	I/F type	DKC410 support level
1	Optic cable type	Optical Type (Longwave)	supported
2		Optical Type(Shortwave)	supported
3		Copper Type	not supported
4	Optic I/F	OFC (Open Fibre Control)	not supported
5		Non-OFC	supported

2.2 Specifications of Fibre Channel High Performance Mode

2.2.1 Standard Performance mode (SP mode)

In the 2-port CHF, processing is performed by the two CHPs for the one port. In the 4-port CHF, the two CHPs operate for the two ports.

2.2.2 High Performance mode

In the 2-port CHF, processing is performed by the four CHPs for the one port to enhance the performance per port. To assign the four CHPs to the one port, a HUB is provided on the PCB and the two fibre channel processors are connected to the one port. In the 4-port CHP, the four CHPs operate for the two ports.

2.2.3 Restrictions of High Performance mode

The following restrictions are placed when using the High Performance mode.

- It looks as if two targets are connected to the one port.
- Number of ports which can be used on the PCB drops.
- To make most of the performance, accesses must be divided equally for the two targets.
- In the following cases, switching from the SP mode to the HP mode cannot be done.
  When the settings of the LUN for the 1st* and 2nd* are duplicated.
  When the settings of the Loop ID (FC-AL) for the 1st* and 2nd* are duplicated.
  When the settings of the Host mode for the 1st* and 2nd* are different.
  When the settings of the topology for the 1st* and 2nd* are unlike.
  When the settings of the topology for the 1st* and 2nd* are Point To Point.
  When the settings of the port-type for the 1st* and 2nd* are different.
  (Ex.) You have to set both port's type same at first when 1st* is "Initiator Port" and 2nd* port is "RCU Target Port".
  After that you can change SP/HP mode.
  *: For the "1st" and "2nd", refer to Table 2-3 on page MULTI02-30.

2.2.4 Restrictions of the change of Standard Performance mode and High Performance mode

- The change of Performance Mode is prohibition during online.
  You must shut the hosts before the change of Performance Mode,
  and reboot the hosts after the change of Performance Mode.
- The hosts recognize already used devices as new one, after the change of Performance Mode.
  Because the device number is changed after the changing Mode.
  You can't continue to use the device over the change of the Performance Mode.
- If a port is configured as "Initiator Port", you have to remove a logical path of Fibre Remote Copy at first.
  On the other hand, if a port is configured as "RCU Target Port", you have to remove R-Vols at first.
  After that you can change SP/HP mode.

2.2.5 Indication format of port

Table 2-3 Indication Format of Port

	8GS/8GSE/8GL/8GLE/8HSE Fibre (Standard)	4GS/4GL Fibre (Standard)	High Performance Mode
CL1-A	1A	1A	1A (1A-1st)
CL1-B	1B	–	1B (1B-1st) (–)
CL1-C	1C	1C	1C (1A-2nd)
CL1-D	1D	–	1D (1B-2nd) (–)
CL1-E	1E	1E	1E (1E-1st)
CL1-F	1F	–	1F (1F-1st) (–)
CL1-G	1G	1G	1G (1E-2nd)
CL1-H	1H	–	1H (1F-2nd) (–)
CL1-J	1J	1J	1J (1J-1st)
CL1-K	1K	–	1K (1K-1st) (–)
CL1-L	1L	1L	1L (1J-2nd)
CL1-M	1M	–	1M (1K-2nd) (–)
CL1-N	1N	1N	1N (1N-1st)
CL1-P	1P	–	1P (1P-1st) (–)
CL1-Q	1Q	1Q	1Q (1N-2nd)
CL1-R	1R	–	1R (1P-2nd) (–)
CL2-A	2A	2A	2A (2A-1st)
CL2-B	2B	–	2B (2B-1st) (–)
CL2-C	2C	2C	2C (2A-2nd)
CL2-D	2D	–	2D (2B-2nd) (–)
CL2-E	2E	2E	2E (2E-1st)
CL2-F	2F	–	2F (2F-1st) (–)
CL2-G	2G	2G	2G (2E-2nd)
CL2-H	2H	–	2H (2F-2nd) (–)
CL2-J	2J	2J	2J (2J-1st)
CL2-K	2K	–	2K (2K-1st) (–)
CL2-L	2L	2L	2L (2J-2nd)
CL2-M	2M	–	2M (2K-2nd) (–)
CL2-N	2N	2N	2N (2N-1st)
CL2-P	2P	–	2P (2P-1st) (–)
CL2-Q	2Q	2Q	2Q (2N-2nd)
CL2-R	2R	–	2R (2P-2nd) (–)

– : Unsupported port

(–): Uninstalled port in the case of the 4GS/4GL PCB

3 CONFIGURATION

3.1 System Configurations

3.1.1 Multiplatform Configuration

The DKC can be connected to the FIBRE cable as one of the devices and can exchange data with host via the FIBRE cable. The conventional Channel host systems can also be connected simultaneously with FIBRE cable. The possible system configurations with the FIBRE attachment are shown below.

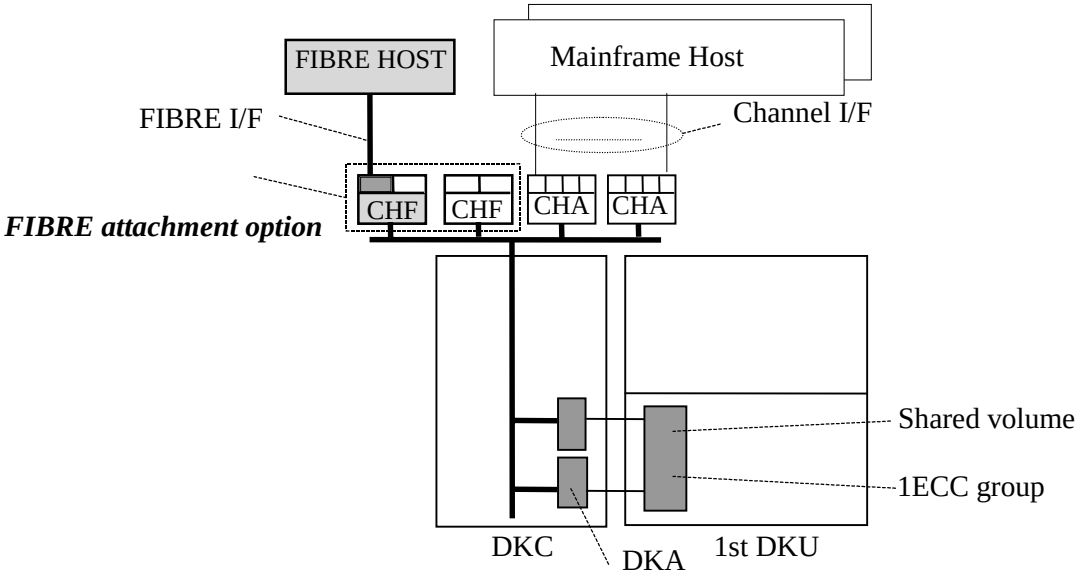


Figure 3-1 multiplatform configuration example

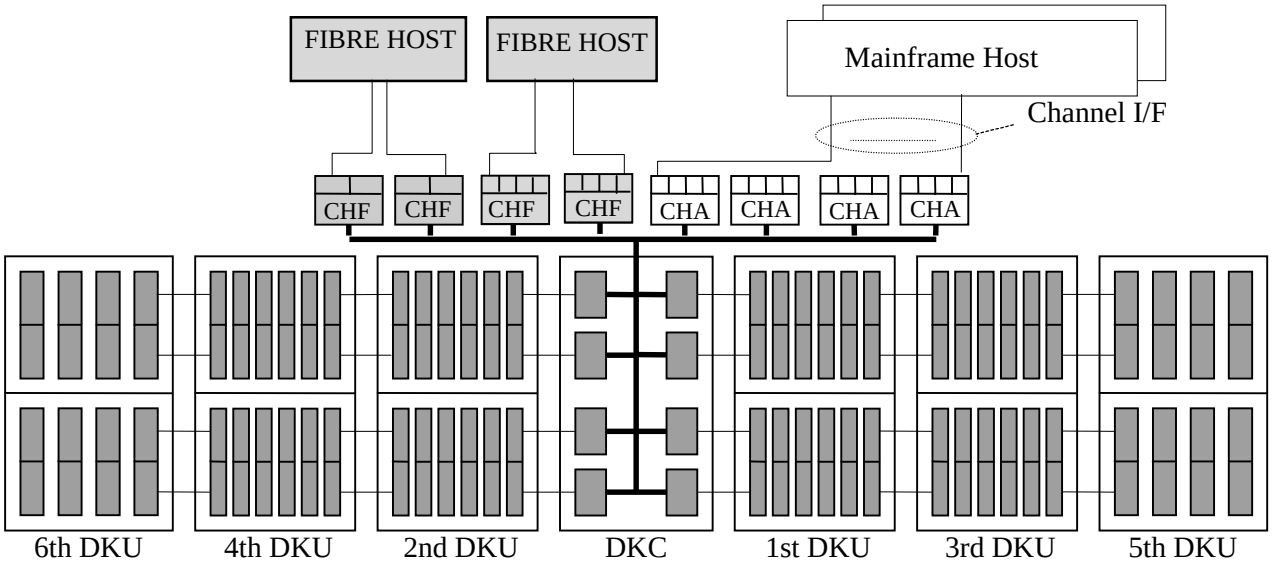


Figure 3-2 multiplatform configuration example

3.1.2 All FIBRE Configuration

The DKC can also be configured as the all FIBRE interface equipment by installing only CHF adapters on it. The possible system configurations for the all FIBRE configuration are shown below.

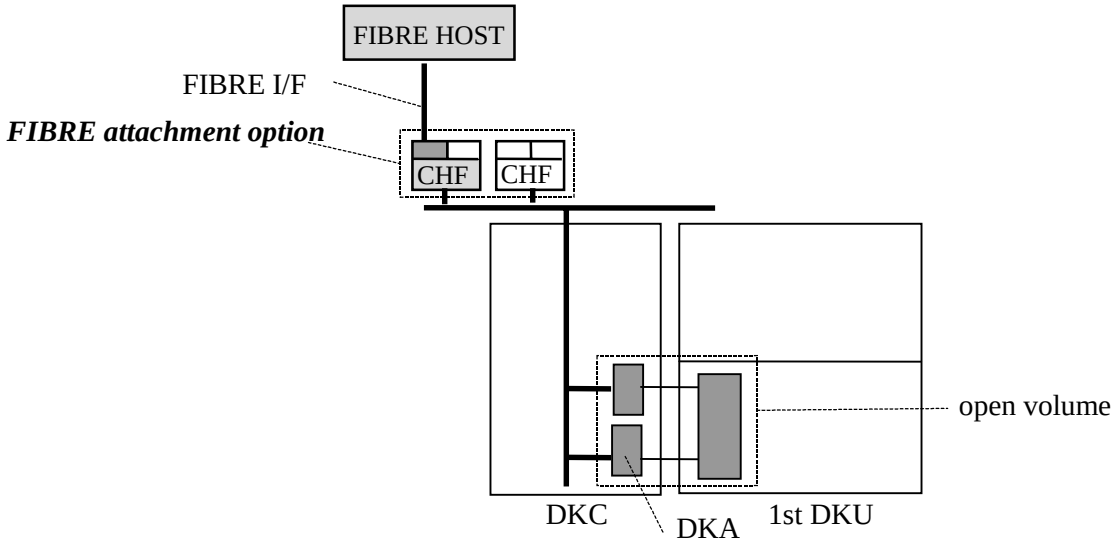


Figure 3-3 Minimum system configuration for All FIBRE

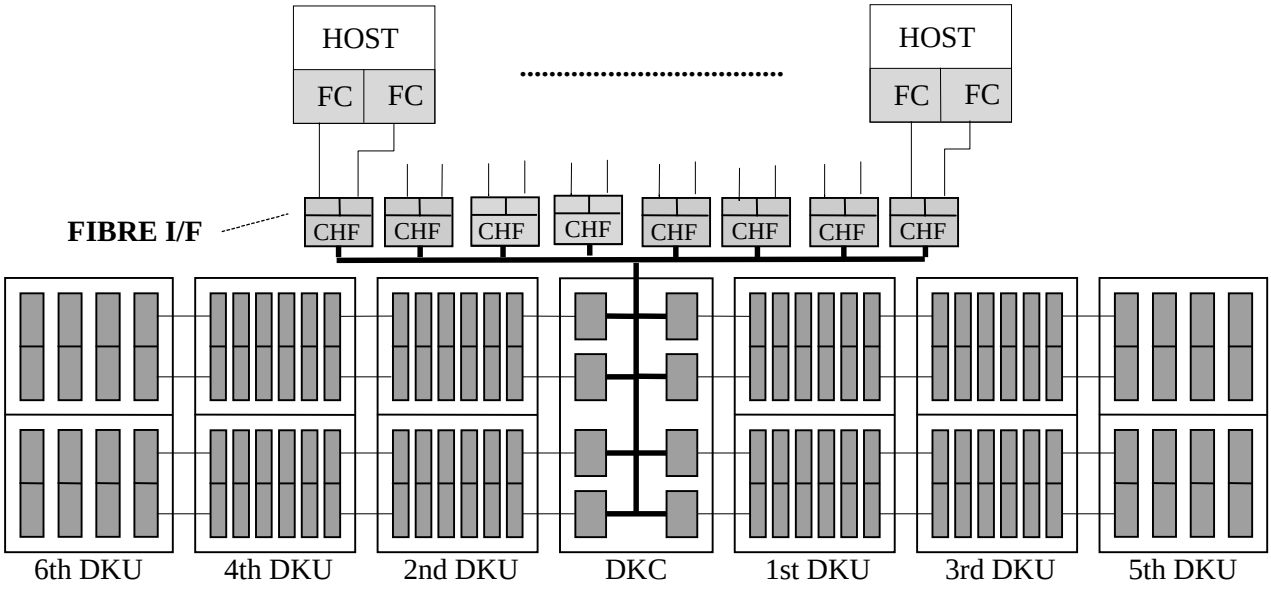


Figure 3-4 Maximum system configuration example for All FIBRE

3.2 Channel Configuration

The FIBRE attachment adapter (CHF) package must be mounted in two-package unit too.
A maximum eight packages including CHA and CHF can be installed in the DKC.
All CHF (I.e. all FIBRE) configuration is also allowed.
Four FIBRE ports or two FIBRE ports are mounted on a single CHF package.
The Example of available channel configuration is shown in Table 3-1.

Table 3-1 Example of available channel configuration

No.	Basic	Additional 1	Additional 2	Additional 3	Remark
1	CHA	CHF	-	-	Minimum multiplatform (FIBRE)
2	CHF	-	-	-	Minimum All FIBRE
3	CHF	CHF	CHF	CHF	Maximum All FIBRE

CHF:FIBRE adapter,CHA:ESCON,-:empty

3.3 FIBRE Addressing

Each FIBRE device can be 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 (CHF port) ID, and LUN (Logical Unit Number) define the addressing and access path. The maximum number of LUNs assigned to a single Target SCSI-ID is limited to maximum 256.

The addressing configuration is shown in the Figure 3-11.

3.3.1 Number of Hosts

The number of FIBRE channel hosts able to connecting, are limited to 128 per FIBRE port.
For RCU Target port of Fibre Remote Copy function, this limitation is the following.
The number of FIBRE channel host connections is limited to 128 and the number of MCU connections is limited to 16 per RCU Target port.

3.3.2 LUN (Logical Unit Number)

LUNs from 0 to 255 can be assigned to each FIBRE Port.

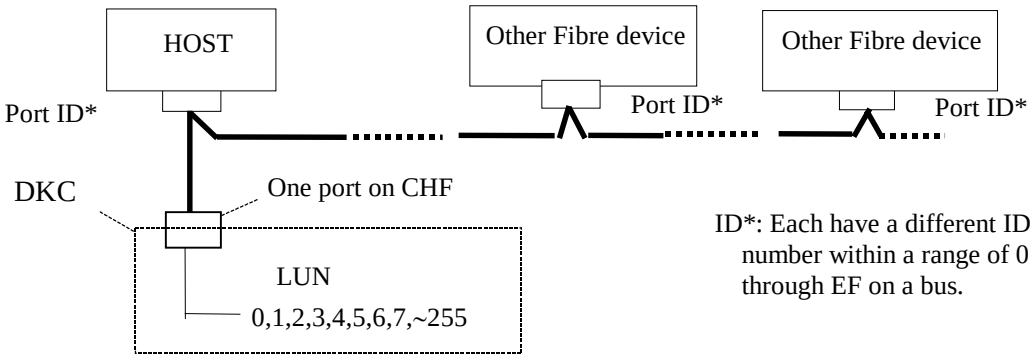


Figure 3-5 FIBRE addressing configuration from Host

3.3.3 PORT INFORMATION

A PORT address and the Topology can be set as PORT INFORMATION. The value of PORT address is EF and can be changed by user. Topology information is selected from “Fabric”, “FC-AL” or “Point to point”.

3.4 Logical Unit

3.4.1 Logical Unit Specification

The specifications of Logical Units supported and accessible from Open system hosts are defined in the Table 3-2.

Table 3-2 LU specification (1/4)

No	Item		Specification				
1	Volume name		OPEN-3	OPEN-8	OPEN-9	OPEN-E	OPEN-L
2	Volume attribute		- OPEN volume - HMBR volume	- OPEN volume - HMBR volume	- OPEN volume - HMBR volume	- SCSI volume	- SCSI volume
3	Access right	FIBRE host	Read/Write	Read/Write	Read/Write	Read/Write	Read/Write
		M/F host	Read/Write (need HMBR option)	Read/Write (need HMBR option)	Read/Write (need HMBR option)	—	—
4	Logical Unit (LU) size	GB (10^9)	2.4 GB	7.3 GB	7.3 GB	14.5 GB	36.4 GB
		GB ($1,024^3$)	2.29 GB	6.84 GB	6.88 GB	13.56 GB	33.94 GB
5	Block size		512 Bytes	512 Bytes	512 Bytes	512 Bytes	512 Bytes
6	# of blocks		4,806,720	14,351,040	14,423,040	28,452,960	71,192,160
7	LDEV emulation name		OPEN-3	OPEN-8	OPEN-9	OPEN-E	OPEN-L
8	LDEV size : LU size		1 : 1	1 : 1	1 : 1	1 : 1	1 : 1

Table 3-2 LU specification (2/4)

No	Item		Specification				
1	Volume name		OPEN-M	3390-3A	3390-3B	3380-KA	3380-KB
2	Volume attribute		- SCSI volume	- M/F volume - HMDE volume	- M/F volume - HMDE volume	- M/F volume - HMDE volume	- M/F volume - HMDE volume
3	Access right	FIBRE host	Read/Write	Read/Write (need HMDE otm/mto option)	Read only (need HMDE mto option)	Read/Write (need HMDE otm/mto option)	Read only (need HMDE mto option)
		M/F host	—	Read/Write	Read/Write	Read/Write	Read/Write
4	Logical Unit (LU) size	GB (10^9)	47.1 GB	—	—	—	—
		GB ($1,024^3$)	43.94 GB	—	—	—	—
5	Block size		512 Bytes	512 Bytes	512 Bytes	512 Bytes	512 Bytes
6	# of blocks		92,158,560	5,825,520	5,822,040	3,836,160	3,833,280
7	LDEV emulation name		OPEN-M	3390-3A	3390-3B	3380-KA	3380-KB
8	LDEV size : LU size		1 : 1	1 : 1	1 : 1	1 : 1	1 : 1

Table 3-2 LU specification (3/4)

No	Item		Specification				
1	Volume name		OPEN-3×n (n=2 to 36)	OPEN-8×n (n=2 to 36)	OPEN-9×n (n=2 to 36)	OPEN-E×n (n=2 to 36)	OPEN-L×n (n=2 to 36)
2	Volume attribute		- LU size expansion	- LU size expansion	- LU size expansion	- LU size expansion	- LU size expansion
3	Access right	FIBRE host	Read/Write	Read/Write	Read/Write	Read/Write	Read/Write
		M/F host	Read/Write (need HMBR option)	Read/Write (need HMBR option)	Read/Write (need HMBR option)	—	—
4	Logical Unit (LU) size	GB (10^9)	OPEN-3×n	OPEN-8×n	OPEN-9×n	OPEN-E×n	OPEN-L×n
		GB ($1,024^3$)					
5	Block size		512 Bytes	512 Bytes	512 Bytes	512 Bytes	512 Bytes
6	# of blocks		4,806,720×n	14,351,040×n	14,423,040×n	28,452,960×n	71,192,160×n
7	LDEV emulation name		—	—	—	—	—
8	LDEV size : LU size		1 : n	1 : n	1 : n	1 : n	1 : n

Table 3-2 LU specification (4/4)

No	Item		Specification				
1	Volume name		OPEN-M×n (n=2 to 36)	3390-3C	3380-KC	OPEN-K	OPEN-K × n (n = 2 to 36)
2	Volume attribute		- LU size expansion	- M/F volume - HMDE volume	- M/F volume - HMDE volume	- SCSI volume - HMBR volume	- LU size expansion
3	Access right	FIBRE host	Read/Write	Read/Write (need HMDE otm/mto option)	Read/Write (need HMDE otm option)	Read/Write	Read/Write
		M/F host	—	Read only	Read only	Read/Write (need HMBR option)	Read/Write (need HMBR option)
4	Logical Unit (LU) size	GB (10^9)	OPEN-M×n	—	—	1.87 GB	OPEN-K × n
		GB($1,024^3$)		—	—	1.74GB	
5	Block size		512 Bytes	512 Bytes	512 Bytes	512 Bytes	512 Bytes
6	# of blocks		92,158,560×n	5,825,520	3,836,160	3,661,920	3,661,920 × n
7	LDEV emulation name		—	3390-3C	3380-KC	OPEN-K	—
8	LDEV size : LU size		1 : n	1 : 1	1 : 1	1 : 1	1 : n

3.4.2 Logical Unit Mapping of FIBRE

Each volume name, such as OPEN-3, OPEN-8, OPEN-9, OPEN-E, OPEN-L, OPEN-M, OPEN-K, 3390-3A, 3390-3B, 3390-3C, 3380-KA, 3380-KB or 3380-KC 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 on the ECC group from the specified LDEV#. After creating LDEVs, each LUN of FIBRE port can be mapped on any location of LDEV within DKC. This setting is performed by SVP operation or Remote Console operation (option).

This flexible LU and LDEV mapping scheme enables multiple paths setting to the same logical volume, 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.

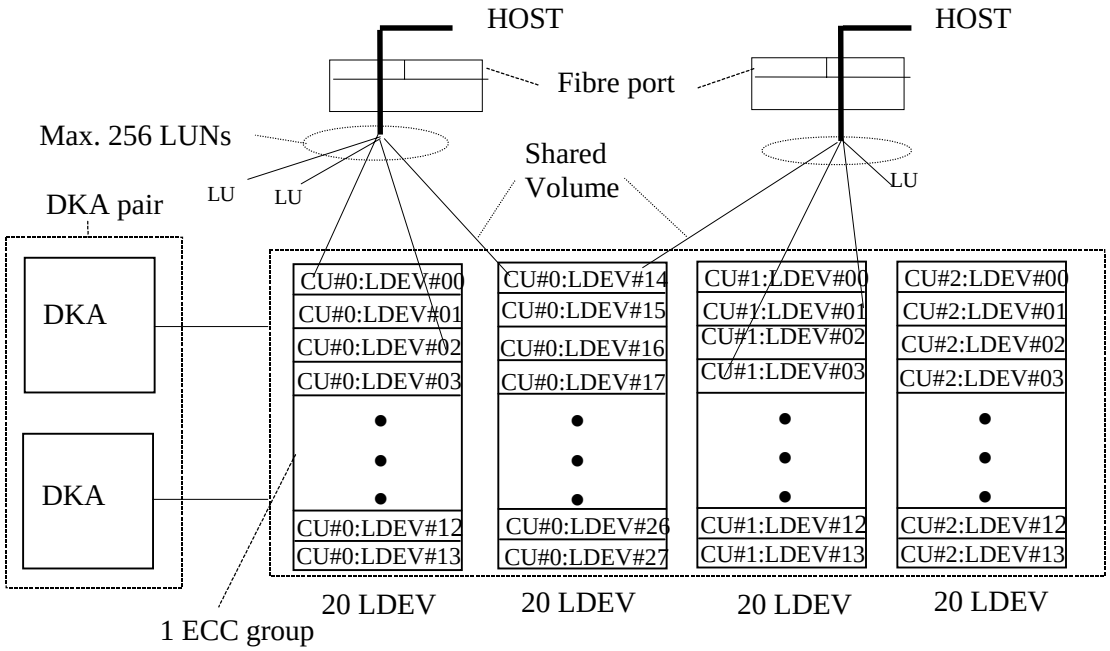


Figure 3-6 LDEV and LU mapping for FIBRE volume

3.4.3 LU size expansion

(1) Outline

This is a function to show the host the continuous LDEV of a volume exclusive for open system as a virtually large LU.

In the former configuration, one LU is one LDEV, but this expanding function can enlarge the LU size up to 1698 GB (OPEN-M×36) by showing the host two or more continuous LDEVs as a single LU.

It was necessary to create many LUs to cover the entire capacity of a disk subsystem before, this function enables a small number of LUs to cover it from the viewpoint of host interface.

MCU port (Initiator port) of Fibre Remote Copy function can not support LU size expansion.

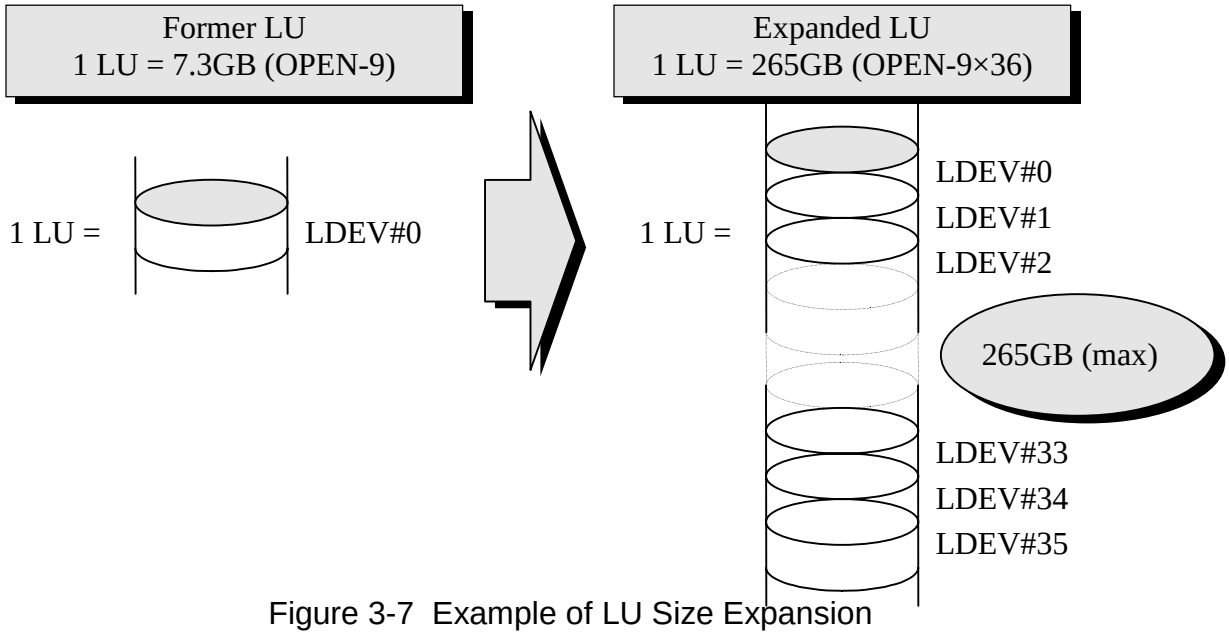


Figure 3-7 Example of LU Size Expansion

(2) Specifications

Table 3-3 shows specifications for the LU Size expansion.

Table 3-3 LU Size Expansion Specification(1/2)

Base volume	OPEN-3	OPEN-8	OPEN-9	OPEN-E	OPEN-L	OPEN-M	OPEN-K
LDEV Capacity	2.4GB	7.3GB	7.3GB	14.5GB	36.4GB	47.1GB	1.8GB
Number of connectable LDEVs/LU	2 to 36						
LU Capacity	4.9GB ~ 88.5GB	14.7GB ~ 264.4GB	14.7GB ~ 265.8GB	29.1GB ~ 524.4GB	72.9GB ~ 1312.2GB	94.3GB ~ 1698.6GB	3.7GB ~ 67.7GB
Product name for responding to INQUIRY	OPEN-3×n	OPEN-8×n	OPEN-9×n	OPEN-E×n	OPEN-L×n	OPEN-M ×n	OPEN-K×n
Restrictions of connecting LDEV	• Connection of LDEVs with different CU numbers are impossible. • Connection of CV with different capacity are impossible.						

n: Number of connected LDEVs

Table 3-3 LU Size Expansion Specification(2/2)

Base volume	OPEN-3-CVS	OPEN-8-CVS	OPEN-9-CVS	OPEN-E-CVS	OPEN-K-CVS
LDEV Capacity	35MB~2.3GB	35MB~6.9GB	35MB~7.0GB	35MB~13.5GB	35MB~1.7GB
Number of connectable LDEVs/LU	2 to 36				
LU Capacity	70MB~84.2GB	70MB~250.2GB	70MB~252.6GB	70MB~487.9GB	70MB~64.1GB
Product name for responding to INQUIRY	OPEN-3×n-CVS	OPEN-8×n-CVS	OPEN-9×n-CVS	OPEN-E×n-CVS	OPEN-K×n-CVS
Restrictions of connecting LDEV	• Connection of LDEVs with different CU numbers are impossible. • Connection of CV with different capacity are impossible.				

n: Number of connected LDEVs

(3) Effect and restrictions of LU expanding function

1) Effect

- Restrictions of usable capacity owing to the number of the usable hosts is released.
  -Restriction of the host capacity (for example, up to 8 LUs for HP-UX)
  -Restriction of capacity owing to restriction of the number of LUs of the HA software
- The disk connection function on the host side such as VxVM becomes unnecessary.
- Effect of LU size extending with CV.
  -LU of optional size can be composed.
  -The load of PDEV can be dispersed by making CV which dispersed around ECC LUSE.
  -Performance can be improved by the multiplex frequency of LDEV increasing.

2) Restrictions

- Some OSs are slow in disk accesses handling large data and may not be usable depending on environment. (Example: AIX is slow in accesses handling data larger than 2GB.)
- The capacity need to be determined when necessary in a system designed to achieve a high-speed operation by making the LUs perform multiple operation.

(4) Notes on use

When the LU is expanded, the following restrictions are added to a case where no expansion is made, such as a change in capacity seen from the open host owing to the specification of the expansion.

1) The LU size cannot be changed while the LU is being used by the host. When you want to change the LU size, the host must be rebooted once. If the LU size once set is to be changed, after shutting down the host, change the LU size, then start up the host again.
2) If an LU to being used or expanded LU is reconfigured in a new configuration or as a expanded LU, data used so far is lost.
   Perform physical replacement work of the disk including data backup, separation of the former LU, LU connection after the configuration change, and restoration of backup data.
3) When an LDEV in the LU is blocked, an LU blocking error does not occur unless an access is made to the blocked LDEV. When the access to the blocked LDEV is made, a blocking error occurs in the expanded LU.
4) The HMRS can use the LU whose LU size has been expanded. A volume with an expanded LU can be used by the HMBR, however, all the volumes need to be backed up and restored.
5) The maintenance procedure when an error such as an LDEV blocking occurs is the same as before. Check the LDEV status from the SVP and perform the maintenance considering the relation between the LDEV and the LU.

3.4.4 LU number expansion

(1) Outline

In this function, LUNs per one port of CHF can be identified from 0 to 255.
MCU port (Initiator port) of Fibre Remote Copy function can not support LU number expansion.

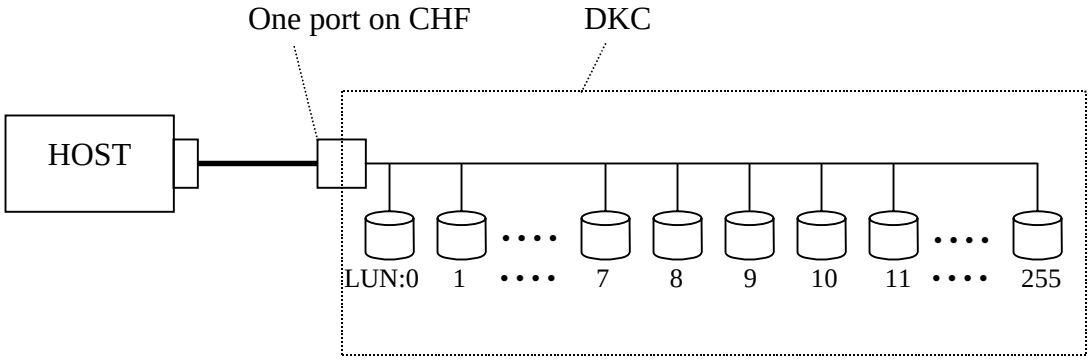


Figure 3-8 LU number expansion

(2) Notes on use

- This functionality is not available on the HOST that does not support numbers of LUN more than eight.

3.4.5 LUN Security

(1) Outline

This function can protect to access by the host server which are prohibited to access a LUN/LUNs which is assigned to SCSI path in Fibre port. Each port of host servers are distinguished by World Wide Name that is belong to each port. In the following example, the LU group A are accessible from the host server A and the LU group B are accessible from the host server B
MCU port (Initiator port) of Fibre Remote Copy function can not support LUN security.

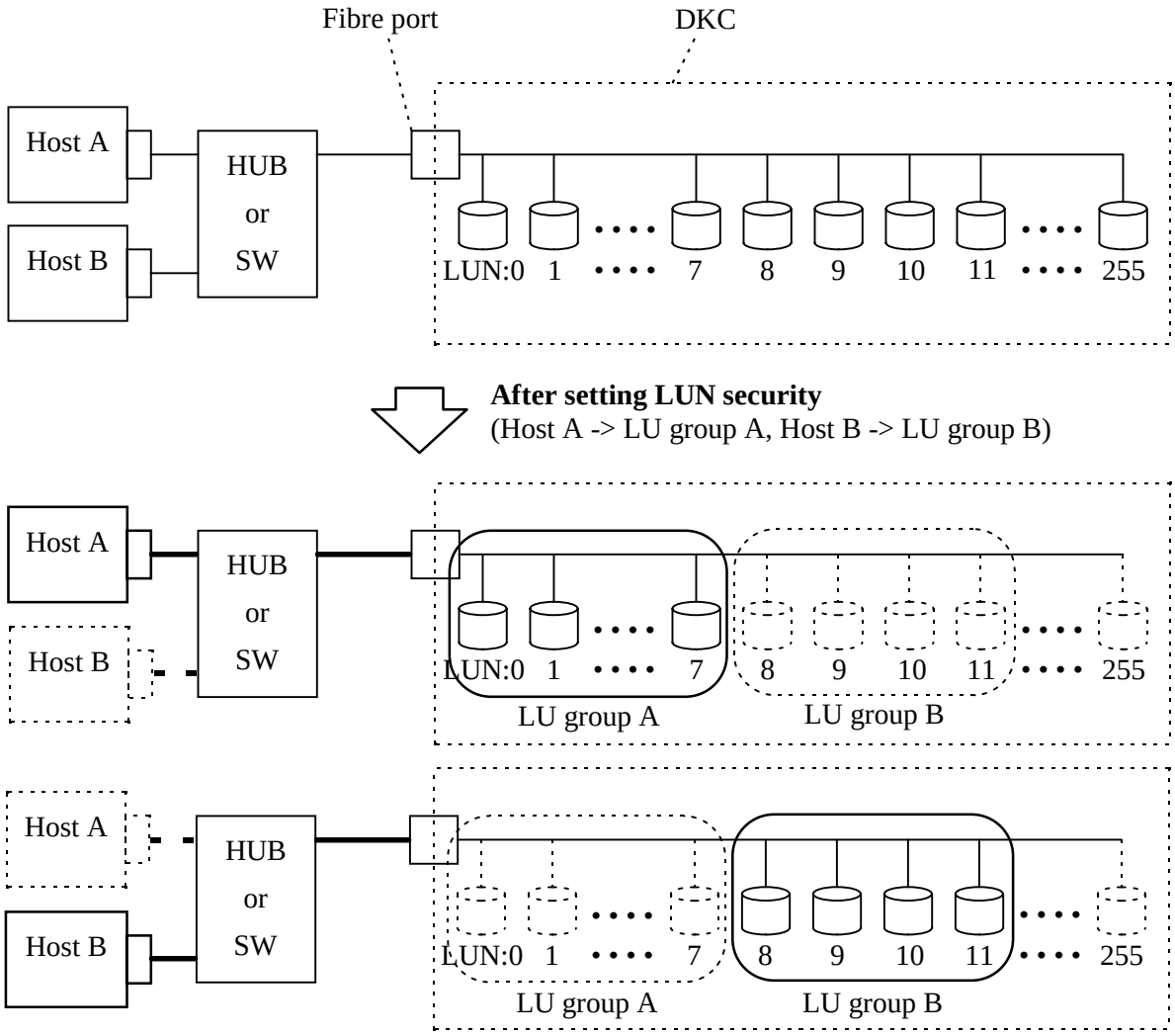


Figure 3-9 LUN Security

(2) Notes on use

You cannot connect some different kind of platforms into same DKC410 port via switch or HUB. Because of the DKC410 cannot distinguish a kind of the server.

3.4.6 Heterogeneous Platform support

(1) Outline

This function support SAN environment of Fibre connection via fabric switch.
MCU port (Initiator port) of Fibre Remote Copy function can not support a connection with a host computer.

(2) Supported Port

Platform	Solaris	Windows NT	
HBA	Jaycor	Emulex	Q-Logic
F-Port	OK	OK	NG
FL-Port	NG	NG	OK

(3) Supported HBA(Host Bus Adapter)

Supported HBA			
Platform	Solaris	Windows NT	
FC card	JAYCOR FC1063	Emulex	Q-Logic
Protocol chip	Tachyon	SuperFly	ISP2100
Specification	LUN 0-255 Fabric supported	LUN 0-31 Fabric supported	LUN 0-7 Fabric supported
Note	*1	—	—

*1) DKC410 do not support current SUN standard Fibre HBA.

3.5 Volume Specification

3.5.1 Volume Specification

The SCSI volume specification is summarized in Table 3-4.

(1) Separate Model emulation list

Table 3-4-1 List of RAID400 Separate Model Emulation Types for RAID5 (3D+1P) (1/2)

Item		Emulation contents						
Emulation	DKC	3990-3						
Type	DKU	OPEN-9	OPEN-8	OPEN-3	OPEN-K	OPEN-E	OPEN-L	OPEN-M
Storage capacity (GB/volume)		7.38	7.34	2.46	1.87	14.58	36.45	47.19
number of volumes / parity group	DKU-F405I-18J4	7	7	22	29	3	—	—
	DKU-F405I-18K4	7	7	21	28	3	—	—
	DKU-F405I-36K4	14	14	43	56	7	—	—
	DKU-F405I-47J4	19	19	57	75	9	—	3
	DKU-F405I-72J4	29	29	88	116	15	6	—
	DKU-F405I-72K4	28	29	86	113	14	5	—
	DKU-F405I-146J4	58	58	174	—	29	11	—
	DKU-F405I-180H4	69	70	209	—	35	14	10
Maximum number of parity groups	DKU-F405I-18J4	126	126	126	126	126	—	—
	DKU-F405I-18K4	126	126	126	126	126	—	—
	DKU-F405I-36K4	126	126	95	73	126	—	—
	DKU-F405I-47J4	126	126	71	54	126	—	126
	DKU-F405I-72J4	126	126	46	35	126	126	—
	DKU-F405I-72K4	126	126	47	36	126	126	—
	DKU-F405I-146J4	70	70	23	—	126	126	—
	DKU-F405I-180H4	59	58	19	—	117	126	126
Maximum number of volumes	DKU-F405I-18J4	882	882	2772	3654	378	—	—
	DKU-F405I-18K4	882	882	2646	3528	378	—	—
	DKU-F405I-36K4	1764	1764	4085	4088	882	—	—
	DKU-F405I-47J4	2394	2394	4047	4050	1134	—	378
	DKU-F405I-72J4	3654	3654	4048	4060	1890	756	—
	DKU-F405I-72K4	3528	3654	4042	4068	1764	630	—
	DKU-F405I-146J4	4060	4060	4002	—	3654	1386	—
	DKU-F405I-180H4	4071	4060	3971	—	4095	1764	1260
Subsystem capacity (user area)	DKU-F405I-18J4	51 GB to 6509 GB	51 GB to 6473 GB	54 GB to 6819 GB	54 GB to 6832 GB	43 GB to 5511 GB	—	—
	DKU-F405I-18K4	51 GB to 6509 GB	51 GB to 6473 GB	51 GB to 6509 GB	52 GB to 6597 GB	43 GB to 5511 GB	—	—
	DKU-F405I-36K4	103 GB to 13018 GB	102 GB to 12947 GB	105 GB to 10049 GB	104 GB to 7644 GB	102 GB to 12859 GB	—	—
	DKU-F405I-47J4	140 GB to 17667 GB	139 GB to 17571 GB	140 GB to 9955 GB	140 GB to 7573 GB	131 GB to 16533 GB	—	141 GB to 17837 GB
	DKU-F405I-72J4	214 GB to 26966 GB	212 GB to 26820 GB	216 GB to 9958 GB	216 GB to 7592 GB	218 GB to 27556 GB	218 GB to 27556 GB	—
	DKU-F405I-72K4	207 GB to 26037 GB	212 GB to 26820 GB	212 GB to 9943 GB	211 GB to 7607 GB	204 GB to 25719 GB	182 GB to 22964 GB	—
	DKU-F405I-146J4	428 GB to 29962 GB	425 GB to 29800 GB	428 GB to 9844 GB	—	422 GB to 53275 GB	400 GB to 50519 GB	—
	DKU-F405I-180H4	509 GB to 30043 GB	513 GB to 29800 GB	514 GB to 9768 GB	—	510 GB to 59705 GB	510 GB to 64297 GB	471 GB to 59459 GB

Table 3-4-1 List of RAID400 Separate Model Emulation Types for RAID5 (3D+1P) (2/2)

Item		Emulation contents	
Emulation	DKC	3990-3	
Type	DKU	3390-3A/3B/3C	3380-KA/KB/KC
Storage capacity (GB/volume)		2.98	1.96
number of volumes / parity group	DKU-F405I-18J4	18	28
	DKU-F405I-18K4	17	27
	DKU-F405I-36K4	35	54
	DKU-F405I-47J4	47	72
	DKU-F405I-72J4	73	111
	DKU-F405I-72K4	71	109
	DKU-F405I-146J4	144	—
	DKU-F405I-180H4	173	—
Maximum number of parity groups	DKU-F405I-18J4	126	126
	DKU-F405I-18K4	126	126
	DKU-F405I-36K4	117	75
	DKU-F405I-47J4	87	56
	DKU-F405I-72J4	56	36
	DKU-F405I-72K4	57	37
	DKU-F405I-146J4	28	—
	DKU-F405I-180H4	23	—
Maximum number of volumes	DKU-F405I-18J4	2268	3528
	DKU-F405I-18K4	2142	3402
	DKU-F405I-36K4	4095	4050
	DKU-F405I-47J4	4089	4032
	DKU-F405I-72J4	4088	3996
	DKU-F405I-72K4	4047	4033
	DKU-F405I-146J4	4032	—
	DKU-F405I-180H4	3979	—
Subsystem capacity (user area)	DKU-F405I-18J4	53 GB to 6758 GB	54 GB to 6914 GB
	DKU-F405I-18K4	50 GB to 6383 GB	52 GB to 6667 GB
	DKU-F405I-36K4	104 GB to 12203 GB	105 GB to 7938 GB
	DKU-F405I-47J4	140 GB to 12185 GB	141 GB to 7902GB
	DKU-F405I-72J4	217 GB to 12182 GB	217 GB to 7832 GB
	DKU-F405I-72K4	211 GB to 12060 GB	213 GB to 7904 GB
	DKU-F405I-146J4	429 GB to 12015 GB	—
	DKU-F405I-180H4	515 GB to 11857 GB	—

Table 3-4-2 List of RAID400 Separate Model Emulation Types for RAID1 (2D+2D) (1/2)

Item		Emulation contents						
Emulation	DKC	3990-3						
Type	DKU	OPEN-9	OPEN-8	OPEN-3	OPEN-K	OPEN-E	OPEN-L	OPEN-M
Storage capacity (GB/volume)		7.38	7.34	2.46	1.87	14.58	36.45	47.19
number of volumes / parity group	DKU-F405I-18J4	4	5	14	19	2	—	—
	DKU-F405I-18K4	4	4	14	18	2	—	—
	DKU-F405I-36K4	9	9	28	37	4	—	—
	DKU-F405I-47J4	12	12	38	50	6	—	2
	DKU-F405I-72J4	19	19	59	77	10	4	—
	DKU-F405I-72K4	19	19	57	75	9	3	—
	DKU-F405I-146J4	38	39	116	—	19	7	—
	DKU-F405I-180H4	46	46	139	—	23	9	7
Maximum number of parity groups	DKU-F405I-18J4	126	126	126	126	126	—	—
	DKU-F405I-18K4	126	126	126	126	126	—	—
	DKU-F405I-36K4	126	126	126	110	126	—	—
	DKU-F405I-47J4	126	126	107	81	126	—	126
	DKU-F405I-72J4	126	126	69	53	126	126	—
	DKU-F405I-72K4	126	126	71	54	126	126	—
	DKU-F405I-146J4	107	105	35	—	126	126	—
	DKU-F405I-180H4	89	89	29	—	126	126	126
Maximum number of volumes	DKU-F405I-18J4	504	630	1764	2394	252	—	—
	DKU-F405I-18K4	504	504	1764	2268	252	—	—
	DKU-F405I-36K4	1134	1134	3528	4070	504	—	—
	DKU-F405I-47J4	1512	1512	4066	4050	756	—	252
	DKU-F405I-72J4	2394	2394	4071	4081	1260	504	—
	DKU-F405I-72K4	2394	2394	4047	4050	1134	378	—
	DKU-F405I-146J4	4066	4095	4060	—	2394	882	—
	DKU-F405I-180H4	4094	4094	4031	—	2898	1134	882
Subsystem capacity (user area)	DKU-F405I-18J4	29 GB to 3719 GB	36 GB to 4624 GB	34 GB to 4339 GB	35 GB to 4476 GB	29 GB to 3674 GB	—	—
	DKU-F405I-18K4	29 GB to 3719 GB	29 GB to 3699 GB	34 GB to 4339 GB	33 GB to 4241 GB	29 GB to 3674 GB	—	—
	DKU-F405I-36K4	66 GB to 8368 GB	66 GB to 8323 GB	68 GB to 8678 GB	69 GB to 7610 GB	58 GB to 7348 GB	—	—
	DKU-F405I-47J4	88 GB to 11158 GB	88 GB to 11098 GB	93 GB to 10002 GB	93 GB to 7573 GB	87 GB to 11022 GB	—	94 GB to 11891 GB
	DKU-F405I-72J4	140 GB to 17667 GB	139 GB to 17571 GB	145 GB to 10014 GB	143 GB to 7631 GB	145 GB to 18370 GB	145 GB to 18370 GB	—
	DKU-F405I-72K4	140 GB to 17667 GB	139 GB to 17571 GB	140 GB to 9956 GB	140 GB to 7574 GB	131 GB to 16534 GB	109 GB to 13778 GB	—
	DKU-F405I-146J4	280 GB to 30007 GB	286 GB to 30057 GB	285 GB to 9987 GB	—	277 GB to 34904 GB	255 GB to 32148 GB	—
	DKU-F405I-180H4	339 GB to 30213 GB	337 GB to 30049 GB	341 GB to 9916 GB	—	335 GB to 42252 GB	328 GB to 41334 GB	330 GB to 41621 GB

Table 3-4-2 List of RAID400 Separate Model Emulation Types for RAID1 (2D+2D) (2/2)

Item		Emulation contents	
Emulation	DKC	3990-6/6E	
Type	DKU	3390-3A/3B/3C	3380-KA/KB/KC
Storage capacity (GB/volume)		2.98	1.96
number of volumes / parity group	DKU-F405I-18J4	12	18
	DKU-F405I-18K4	11	18
	DKU-F405I-36K4	23	36
	DKU-F405I-47J4	31	48
	DKU-F405I-72J4	48	74
	DKU-F405I-72K4	47	72
	DKU-F405I-146J4	96	—
	DKU-F405I-180H4	115	—
Maximum number of parity groups	DKU-F405I-18J4	126	126
	DKU-F405I-18K4	126	126
	DKU-F405I-36K4	126	113
	DKU-F405I-72J4	85	55
	DKU-F405I-72K4	87	56
	DKU-F405I-47J4	126	85
	DKU-F405I-146J4	42	—
	DKU-F405I-180H4	35	—
Maximum number of volumes	DKU-F405I-18J4	1512	2268
	DKU-F405I-18K4	1386	2268
	DKU-F405I-36K4	2898	4068
	DKU-F405I-47J4	3906	4080
	DKU-F405I-72J4	4080	4070
	DKU-F405I-72K4	4089	4032
	DKU-F405I-146J4	4032	—
	DKU-F405I-180H4	4025	—
Subsystem capacity (user area)	DKU-F405I-18J4	35 GB to 4505 GB	35 GB to 4445 GB
	DKU-F405I-18K4	32 GB to 4130 GB	35 GB to 4445 GB
	DKU-F405I-36K4	68 GB to 8636 GB	70 GB to 7973 GB
	DKU-F405I-47J4	92 GB to 11639 GB	94 GB to 7996 GB
	DKU-F405I-72J4	143 GB to 12158 GB	145 GB to 7977 GB
	DKU-F405I-72K4	140 GB to 12185 GB	141 GB to 7902 GB
	DKU-F405I-146J4	286 GB to 12015 GB	—
	DKU-F405I-180H4	342 GB to 11994 GB	—

(2) Single Cabinet Model emulation list

Table 3-4-3 List of RAID400 Single Cabinet Model Emulation Types for RAID5 (3D+1P) (1/2)

Item		Emulation contents						
Emulation	DKC	3990-3						
Type	DKU	OPEN-9	OPEN-8	OPEN-3	OPEN-K	OPEN-E	OPEN-L	OPEN-M
Storage capacity (GB/volume)		7.38	7.34	2.46	1.87	14.58	36.45	47.19
number of volumes / parity group	DKU-F405I-18J4	7	7	22	29	3	—	—
	DKU-F405I-18K4	7	7	21	28	3	—	—
	DKU-F405I-36K4	14	14	43	56	7	—	—
	DKU-F405I-47J4	19	19	57	75	9	—	3
	DKU-F405I-72J4	29	29	88	116	15	6	—
	DKU-F405I-72K4	28	29	86	113	14	5	—
	DKU-F405I-146J4	58	58	174	—	29	11	—
	DKU-F405I-180H4	69	70	209	—	35	14	10
Maximum number of parity groups	DKU-F405I-18J4	11	11	11	11	11	—	—
	DKU-F405I-18K4	11	11	11	11	11	—	—
	DKU-F405I-36K4	11	11	11	11	11	—	—
	DKU-F405I-47J4	11	11	11	11	11	—	11
	DKU-F405I-72J4	11	11	11	11	11	11	—
	DKU-F405I-72K4	11	11	11	11	11	11	—
	DKU-F405I-146J4	11	11	11	—	11	11	—
	DKU-F405I-180H4	11	11	11	—	11	11	11
Maximum number of volumes	DKU-F405I-18J4	77	77	242	319	33	—	—
	DKU-F405I-18K4	77	77	231	308	33	—	—
	DKU-F405I-36K4	154	154	473	616	77	—	—
	DKU-F405I-47J4	209	209	627	825	99	—	33
	DKU-F405I-72J4	319	319	968	1276	165	66	—
	DKU-F405I-72K4	308	319	946	1243	154	55	—
	DKU-F405I-146J4	638	638	1914	—	319	121	—
	DKU-F405I-180H4	759	770	2299	—	385	154	110
Subsystem capacity (user area)	DKU-F405I-18J4	51 GB to 568 GB	51 GB to 565 GB	54 GB to 595 GB	54 GB to 596 GB	43 GB to 481 GB	—	—
	DKU-F405I-18K4	51 GB to 568 GB	51 GB to 565 GB	51 GB to 568 GB	52 GB to 575 GB	43 GB to 481 GB	—	—
	DKU-F405I-36K4	103 GB to 1136 GB	102 GB to 1130 GB	105 GB to 1163 GB	104 GB to 1151 GB	102 GB to 1122 GB	—	—
	DKU-F405I-47J4	140 GB to 1542 GB	139 GB to 1534 GB	140 GB to 1542 GB	140 GB to 1542 GB	131 GB to 1443 GB	—	141 GB to 1557 GB
	DKU-F405I-72J4	214 GB to 2354 GB	212 GB to 2341 GB	216 GB to 2381 GB	216 GB to 2386 GB	218 GB to 2405 GB	218 GB to 2405 GB	—
	DKU-F405I-72K4	207 GB to 2273 GB	212 GB to 2341 GB	212 GB to 2327 GB	211 GB to 2324 GB	204 GB to 2245 GB	182 GB to 2005 GB	—
	DKU-F405I-146J4	428 GB to 4708 GB	425 GB to 4682 GB	428 GB to 4708 GB	—	422 GB to 4651 GB	400 GB to 4410 GB	—
	DKU-F405I-180H4	509 GB to 5601 GB	513 GB to 5651 GB	514 GB to 5655 GB	—	510 GB to 5613 GB	510 GB to 5613 GB	471 GB to 5190 GB

Table 3-4-3 List of RAID400 Single Cabinet Model Emulation Types for RAID5 (3D+1P) (2/2)

Item		Emulation contents	
Emulation	DKC	3990-3	
Type	DKU	3390-3A/3B/3C	3380-KA/KB/KC
Storage capacity (GB/volume)		2.98	1.96
number of volumes / parity group	DKU-F405I-18J4	18	28
	DKU-F405I-18K4	17	27
	DKU-F405I-36K4	35	54
	DKU-F405I-47J4	47	72
	DKU-F405I-72J4	73	111
	DKU-F405I-72K4	71	109
	DKU-F405I-146J4	144	—
	DKU-F405I-180H4	173	—
Maximum number of parity groups	DKU-F405I-18J4	11	11
	DKU-F405I-18K4	11	11
	DKU-F405I-36K4	11	11
	DKU-F405I-47J4	11	11
	DKU-F405I-72J4	11	11
	DKU-F405I-72K4	11	11
	DKU-F405I-146J4	11	—
	DKU-F405I-180H4	11	—
Maximum number of volumes	DKU-F405I-18J4	198	308
	DKU-F405I-18K4	187	297
	DKU-F405I-36K4	385	594
	DKU-F405I-47J4	517	792
	DKU-F405I-72J4	803	1221
	DKU-F405I-72K4	781	1199
	DKU-F405I-146J4	1584	—
	DKU-F405I-180H4	1903	—
Subsystem capacity (user area)	DKU-F405I-18J4	53 GB to 590 GB	54 GB to 603 GB
	DKU-F405I-18K4	50 GB to 557 GB	52 GB to 582 GB
	DKU-F405I-36K4	104 GB to 1147 GB	105 GB to 1164 GB
	DKU-F405I-47J4	140 GB to 1540 GB	141 GB to 1552 GB
	DKU-F405I-72J4	217 GB to 2392 GB	217 GB to 2393 GB
	DKU-F405I-72K4	211 GB to 2327 GB	213 GB to 2350 GB
	DKU-F405I-146J4	429 GB to 4720 GB	—
	DKU-F405I-180H4	515 GB to 5670 GB	—

Table 3-4-4 List of RAID400 Single Cabinet Model Emulation Types for RAID1 (2D+2D) (1/2)

Item		Emulation contents						
Emulation	DKC	3990-3						
Type	DKU	OPEN-9	OPEN-8	OPEN-3	OPEN-K	OPEN-E	OPEN-L	OPEN-M
Storage capacity (GB/volume)		7.38	7.34	2.46	1.87	14.58	36.45	47.19
number of volumes / parity group	DKU-F405I-18J4	4	5	14	19	2	—	—
	DKU-F405I-18K4	4	4	14	18	2	—	—
	DKU-F405I-36K4	9	9	28	37	4	—	—
	DKU-F405I-47J4	12	12	38	50	6	—	2
	DKU-F405I-72J4	19	19	59	77	10	4	—
	DKU-F405I-72K4	19	19	57	75	9	3	—
	DKU-F405I-146J4	38	39	116	—	19	7	—
	DKU-F405I-180H4	46	46	139	—	23	9	7
Maximum number of parity groups	DKU-F405I-18J4	11	11	11	11	11	—	—
	DKU-F405I-18K4	11	11	11	11	11	—	—
	DKU-F405I-36K4	11	11	11	11	11	—	—
	DKU-F405I-47J4	11	11	11	11	11	—	11
	DKU-F405I-72J4	11	11	11	11	11	11	—
	DKU-F405I-72K4	11	11	11	11	11	11	—
	DKU-F405I-146J4	11	11	11	—	11	11	—
	DKU-F405I-180H4	11	11	11	—	11	11	11
Maximum number of volumes	DKU-F405I-18J4	44	55	154	209	22	—	—
	DKU-F405I-18K4	44	44	154	198	22	—	—
	DKU-F405I-36K4	99	99	308	407	44	—	—
	DKU-F405I-47J4	132	132	418	550	66	—	22
	DKU-F405I-72J4	209	209	649	847	110	44	—
	DKU-F405I-72K4	209	209	627	825	99	33	—
	DKU-F405I-146J4	418	429	1276	—	209	77	—
	DKU-F405I-180H4	506	506	1529	—	253	99	77
Subsystem capacity (user area)	DKU-F405I-18J4	29 GB to 324 GB	36 GB to 403 GB	34 GB to 378 GB	35 GB to 390 GB	29 GB to 320 GB	—	—
	DKU-F405I-18K4	29 GB to 324 GB	29 GB to 322 GB	34 GB to 378 GB	33 GB to 370 GB	29 GB to 320 GB	—	—
	DKU-F405I-36K4	66 GB to 730 GB	66 GB to 726 GB	68 GB to 757 GB	69 GB to 761 GB	58 GB to 641 GB	—	—
	DKU-F405I-47J4	88 GB to 974 GB	88 GB to 968 GB	93 GB to 1028 GB	93 GB to 1028 GB	87 GB to 962 GB	—	94 GB to 1038 GB
	DKU-F405I-72J4	140 GB to 1542 GB	139 GB to 1534 GB	145 GB to 1596 GB	143 GB to 1583 GB	145 GB to 1603 GB	145 GB to 1603 GB	—
	DKU-F405I-72K4	140 GB to 1542 GB	139 GB to 1534 GB	140 GB to 1542 GB	140 GB to 1543 GB	131 GB to 1443 GB	109 GB to 1203 GB	—
	DKU-F405I-146J4	280 GB to 3084 GB	286 GB to 3148 GB	285 GB to 3138 GB	—	277 GB to 3047 GB	255 GB to 2806 GB	—
	DKU-F405I-180H4	339 GB to 3734 GB	337 GB to 3714 GB	341 GB to 3761 GB	—	335 GB to 3688 GB	328 GB to 3608 GB	330 GB to 3633 GB

Table 3-4-4 List of RAID400 Single Cabinet Model Emulation Types for RAID1 (2D+2D) (2/2)

Item		Emulation contents	
Emulation	DKC	3990-3	
Type	DKU	3390-3A/3B/3C	3380-KA/KB/KC
Storage capacity (GB/volume)		2.98	1.96
number of volumes / parity group	DKU-F405I-18J4	12	18
	DKU-F405I-18K4	11	18
	DKU-F405I-36K4	23	36
	DKU-F405I-47J4	31	48
	DKU-F405I-72J4	48	74
	DKU-F405I-72K4	47	72
	DKU-F405I-146J4	96	—
	DKU-F405I-180H4	115	—
Maximum number of parity groups	DKU-F405I-18J4	11	11
	DKU-F405I-18K4	11	11
	DKU-F405I-36K4	11	11
	DKU-F405I-47J4	11	11
	DKU-F405I-72J4	11	11
	DKU-F405I-72K4	11	11
	DKU-F405I-146J4	11	—
	DKU-F405I-180H4	11	—
Maximum number of volumes	DKU-F405I-18J4	132	198
	DKU-F405I-18K4	121	198
	DKU-F405I-36K4	253	396
	DKU-F405I-47J4	341	528
	DKU-F405I-72J4	528	814
	DKU-F405I-72K4	517	792
	DKU-F405I-146J4	1056	—
	DKU-F405I-180H4	1265	—
Subsystem capacity (user area)	DKU-F405I-18J4	35 GB to 393 GB	35 GB to 388 GB
	DKU-F405I-18K4	32 GB to 360 GB	35 GB to 388 GB
	DKU-F405I-36K4	68 GB to 753 GB	70 GB to 776 GB
	DKU-F405I-47J4	92 GB to 1016 GB	94 GB to 1034 GB
	DKU-F405I-72J4	143 GB to 1573 GB	145 GB to 1595 GB
	DKU-F405I-72K4	140 GB to 1540 GB	141 GB to 1552 GB
	DKU-F405I-146J4	286 GB to 3146 GB	—
	DKU-F405I-180H4	342 GB to 3769 GB	—

3.5.2 Intermix Specification

Table 3-5 Intermix specification

No	Item	Intermix unit	Remark
1	LDEV intermix	ECC group	-
2	MF/OPEN LDEV intermix	ECC group	-
3	RAID1/RAID5 intermix	DKA pair	-
4	Same parity group PDEV intermix	ECC group	-
5	Different parity group PDEV intermix	DKA pair	-

(1) M/F and OPEN volume intermix
ECC group
It is allowed to allocate the mainframe volumes and OPEN volumes together under a same DKA pair.

(2) LDEV emulation type intermix
ECC group

(3) Drive intermix

(4) RAID5/RAID1 intermix
DKA pair

3.5.3 HMDE volume intermix within ECC group

3.5.3.1 HMDE volume intermix within ECC group

(1) The four types, 3390-3A/-3B/-3C/-3 (or 3390-3A/-3B/-3C/-3R), of emulated disk drives can coexist within one ECC group.
(2) The four types, 3380-KA/-KB/-KC/-K, of emulated disk drives can coexist within one ECC group.
(3) The type can be changed for each one volume within an ECC group.
(4) The type can be changed by the emulation type change function of the SVP.
(5) The emulation type change function allows any change of types among 3A, 3B, 3C, 3, and 3R (or among KA, KB, KC, and K).
(6) At "define configuration and install" or installation of disk drives, device definition and LDEV-FMT are performed in units of ECC group with any type of 3A, 3B, 3C, 3, and 3R (or any type of KA, KB, KC, and K). Afterwards the type is changed for each one volume if necessary.
When the type change is completed, all volumes are initialized (a VTOC is created for volumes) from the mainframe system.
(7) After the type change, data before the change is not assured.
After the type change, all volumes must be initialized (a VTOC must be created) from the mainframe system.
However, data is assured as before for type change between 3390-3 and 3390-3R, and if you want to assure the data, all volumes must not be initialized (a VTOC must not be created).
For type changes other than that between 3390-3 and 3390-3R, data is not assured.

3.5.3.2 Intermix with 3390-3R

(1) The 3390-3/-3A/-3B/-3C types can coexist within a subsystem.
Intermixing is allowed both within and beyond a 32-LDEV address boundary.
(2) The 3390-3R/-3A/-3B/-3C can coexist within a subsystem.
- An intermixture of the 3390-3R and any of 3390-3A/-3B/-3C is allowed in units of 32-LDEV address boundary (with the same type within each boundary). It is not allowed within a 32-LDEV address boundary because of the restriction on the mainframe system.
- An intermixture of the 3390-3A/-3B/-3C is allowed both within and in units of 32-LDEV address boundary.

(3) The 3390-3 and 3390-3R cannot coexist within a subsystem.
- When changing the type from 3390-3 to 3390-R and vice versa by the emulation type change function, since the 3390-3 and 3390-3R cannot coexist within a subsystem, the type must be changed not partially but totally.
The SVP reject partial change.
- The intermixture can be changed from that of the 3390-3/-3A/-3B/-3C to that of the 3390-3R/-3A/-3B/-3C (with an intermixture part of the 3390-3A/-3B/-3C remaining unchanged) and vice versa by the emulation type change function between 3390-3 and 3390-3R.

3.6 Volume Configuration

3.6.1 Volume Configuration

(1) Minimum Volume Configuration

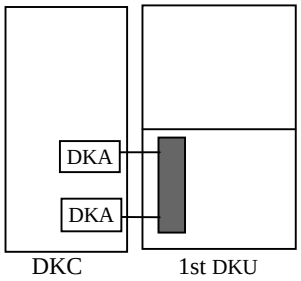


Figure 3-10 Minimum volume configuration

(2) Maximum Volume Configuration

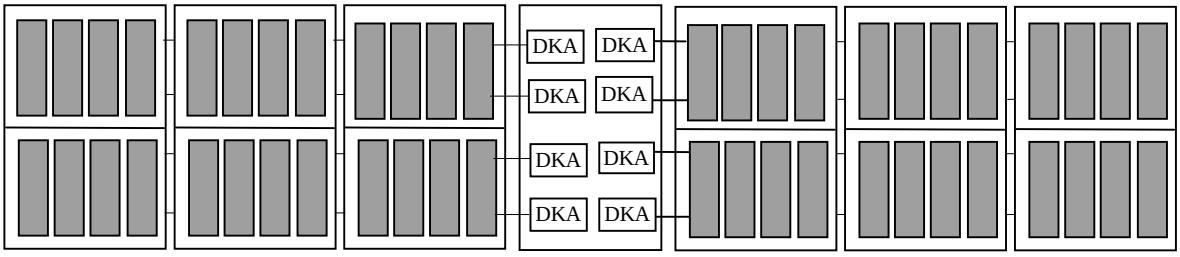


Figure 3-11 Maximum volume configuration

3.6.2 Intermix Volume Configuration

PDEV intermix of same parity group : ECC group
PDEV intermix of different parity group : DKA pair
RAID intermix : DKA pair
LDEV intermix : ECC group
MF/OPEN volume intermix : ECC group

(1) Typical LDEV intermix configuration

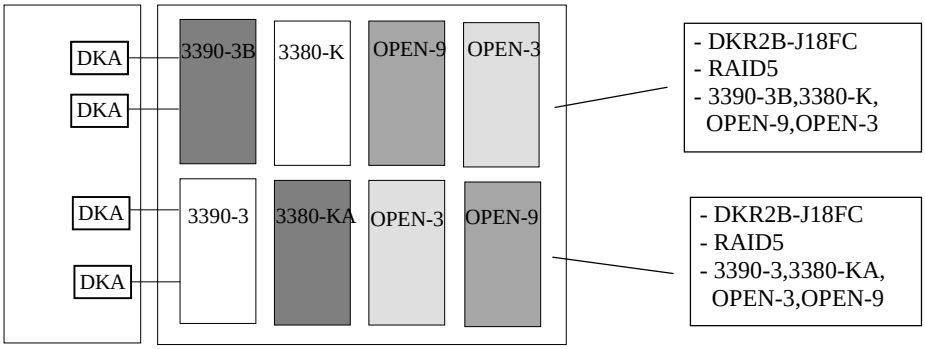


Figure 3-12 Typical LDEV intermix configuration example

(2) Typical RAID intermix configuration

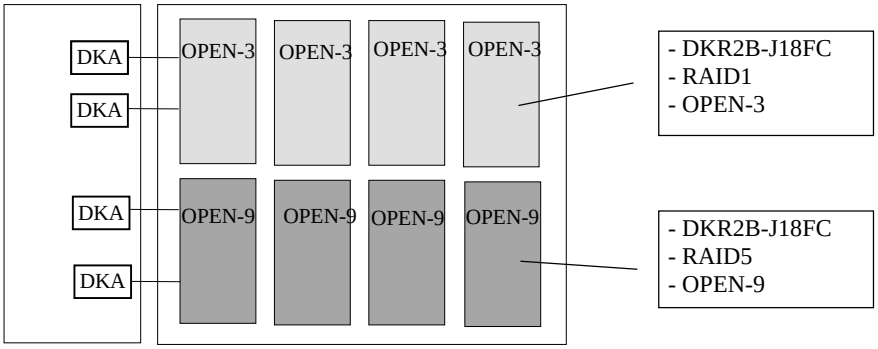


Figure 3-13 Typical RAID intermix configuration example

(3) Typical PDEV intermix configuration

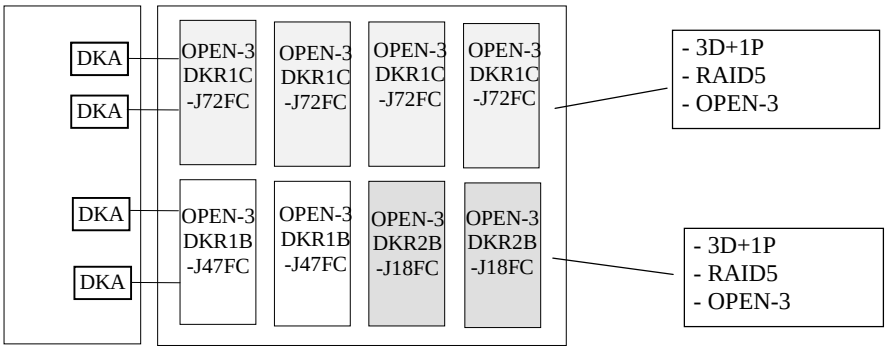


Figure 3-14 Typical PDEV intermix configuration example

3.6.3 HMDE Volume Configuration

(1) Typical volume configuration for HMDE

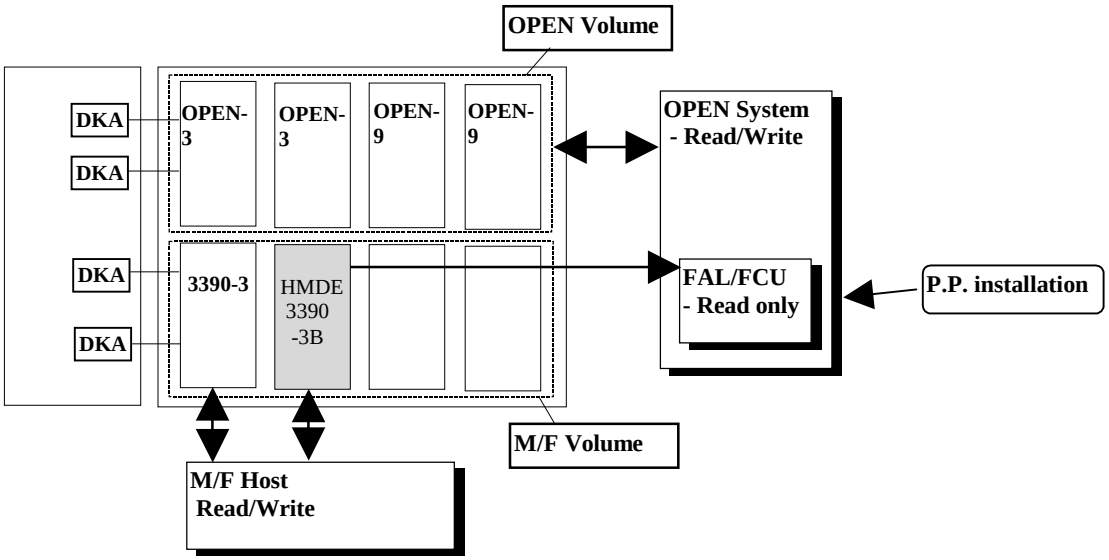


Figure 3-15 Typical volume configuration for HMDE

(2) Valid volume configuration

The configuration shown in Fig. 3-20 is valid.

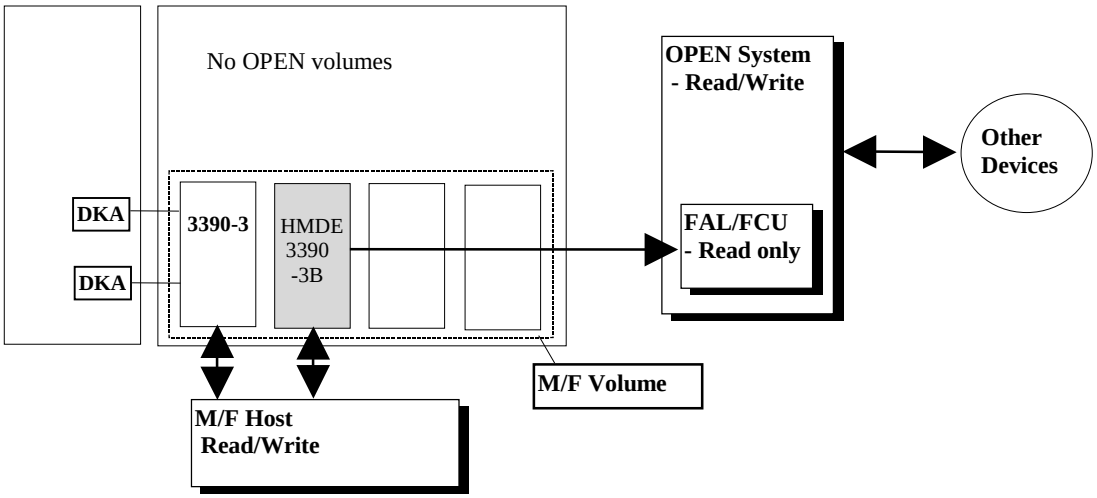


Figure 3-16 Valid volume configuration for HMDE

3.6.4 HMBR Volume Configuration

(1) Typical volume configuration example for HMBR

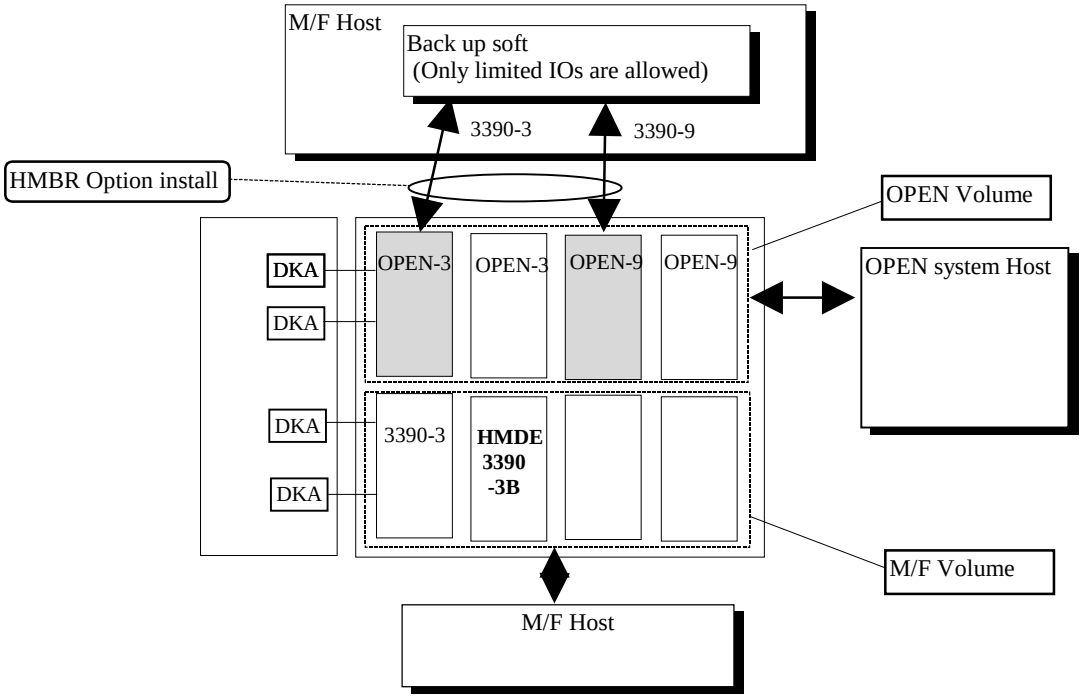


Figure 3-17 Typical volume configuration for HMBR

(2) Valid volume configuration example for HMBR

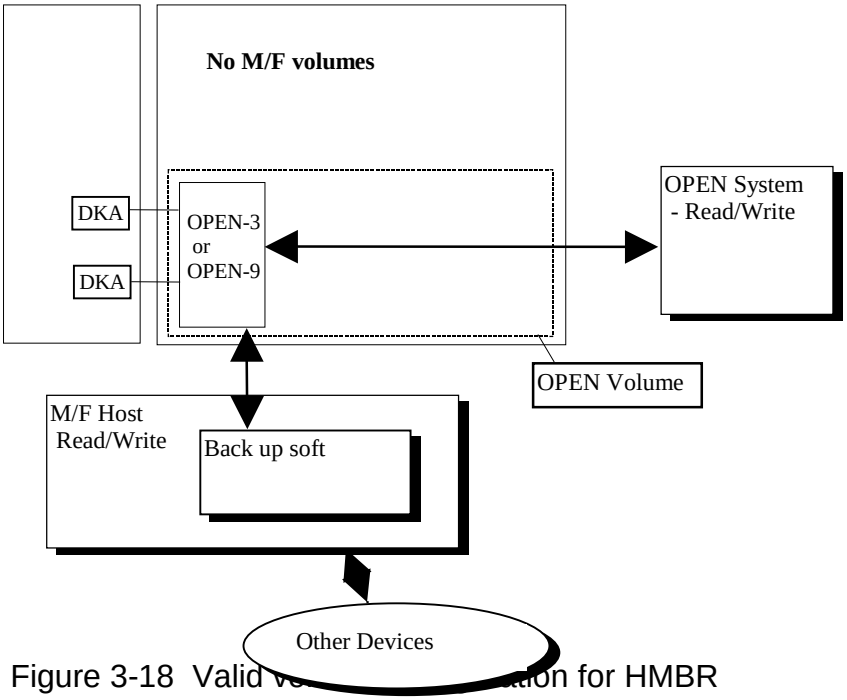


Figure 3-18 Valid volume configuration for HMBR

3.7 FIBRE Volume Setting

3.7.1 Setting of FIBRE volume space

The procedure of FIBRE volume setting is performed either by using the SVP or Remote Console function (optional feature).

3.7.2 LUN setting

- LUN setting:

- Select the CHF, FIBRE port and the LUN, and select the CU# and LDEV# to be assigned to the LUN
- Repeat the above procedure as needed.

MCU port (Initiator port) of Fibre Remote Copy function can not support this setting.

Note 1: It is possible to refer to the setting contents of already being set on the SVP display.
Note 2: The above setting can be done during on-line.
Note 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 the INSTALLATION SECTION for more detailed procedures.

4 CONTROL FUNCTION

4.1 Cache Usage

The DKC has two independent areas of non-volatile cache memory for the mainframe volumes. This mechanism also commonly applies to the OPEN volumes without any distinction. Thus, the high reliability and high performance realized by the following features can be commonly applied to the OPEN volumes.

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 anticipated and a data-writing time reduced for improved system throughput.

② Adoption of DFW (DASD Fast Write)

At the same time that it writes data into the cache, the normal write command reports the end of the write operations to a host. Disk writing of the data is asynchronous with host access. The host, therefore, can execute the next process without waiting for the end of disk writing.

③ Write data duplexing

The same write data is stored into the two areas of cache provided in the DKC. Thus, loss of DFW data due to even one failure in the cache can be avoided.

④ Nonvolatile cache

The cache in the DKC is non-volatile by battery backup. Once data has been written into the cache, its non-volatility will maintain the data, even if a power interruption occurs. Under a standard system configuration having a fully charged battery pack, data is guaranteed for at least 48 hours.

4.2 SCSI Command Multi-processing

4.2.1 Command Tag Queuing

The Command Tag Queuing function defined in SCSI specification is supported. This function allows each FIBRE port on CHF to accept a multiple SCSI commands even for the same LUN. The DKC can process those queued commands in parallel because a LUN is composed of a multiple physical disk drives.
MCU port (Initiator port) of Fibre Remote Copy function can not support this function because it does not support a connection with a host computer.

4.2.2 Concurrent data transfer

The four FIBRE ports on a CHF can perform the host I/Os and data transfer with maximum 100 MB/sec transfer concurrently.
This is also applied among the different CHFs.
MCU port (Initiator port) of Fibre Remote Copy function can not support this function because it does not support a connection with a host computer.

5 SCSI Commands

The DASD commands defined under the SCSI-2 standards and those supported by the DKC are listed in Table 5-1.

Table 5-1 SCSI-2 DASD commands and DKC-supported commands

Group	Op Code	Name of Command	Type	×:Supported	Remarks
0 (00_H -$1F_H$)	00_H	Test Unit Ready	CTL/SNS	×	
	01_H	Rezero Unit	CTL/SNS	Nop	
	03_H	Request Sense	CTL/SNS	×	
	04_H	Format Unit	DIAG	Nop	
	07_H	Reassign Blocks	DIAG	×	For RAID5, Nop
	08_H	Read	RD/WR	×	
	$0A_H$	Write	RD/WR	×	
	$0B_H$	Seek	CTL/SNS	Nop	
	12_H	Inquiry	CTL/SNS	×	
	15_H	Mode Select	CTL/SNS	×	
	16_H	Reserve	CTL/SNS	×	
	17_H	Release	CTL/SNS	×	
	18_H	Copy	–	–	
	$1A_H$	Mode Sense	CTL/SNS	×	
	$1B_H$	Start/Stop Unit	CTL/SNS	Nop	
	$1C_H$	Receive Diagnostic Results	DIAG	–	
	$1D_H$	Send Diagnostic	DIAG	Nop	Only self-test supported.
	$1E_H$	Prevent Allow Medium Removal	–	–	
	$1F_H$	Reserved code	–	–	
	Other	Vendor–unique	–	–	
1 (20_H -$3F_H$)	25_H	Read Capacity	CTL/SNS	×	
	28_H	Read (Extend)	RD/WR	×	
	$2A_H$	Write (Extend)	RD/WR	×	
	$2B_H$	Seek (Extend)	CTL/SNS	Nop	
	$2E_H$	Write And Verify	RD/WR	×	DKC410I supports only Write.
	$2F_H$	Verify	RD/WR	×	
	30_H	Search Data High	–	–	
	31_H	Search Data Equal	–	–	
	32_H	Search Data Low	–	–	
	33_H	Set Limits	–	–	
	34_H	Pre-Fetch	–	–	
	35_H	Synchronize Cache	CTL/SNS	×	
	36_H	Lock-Unlock Cache	–	–	
	37_H	Read Defect Data	DIAG	×	No defect always reported.
	38_H	Reserved code	–	–	
	39_H	Compare	–	–	
	$3A_H$	Copy And Verify	–	–	
	$3B_H$	Write Buffer	DIAG	×	
	$3C_H$	Read Buffer	DIAG	×	
	$3D_H$	Reserved code	–	–	
	$3E_H$	Read Long	–	–	

Table 5-1 SCSI-2 DASD commands and DKC-supported commands (Continued)

Group	Op Code	Name of Command	Type	×: Supported	Remarks
1 (20_H -$3F_H$)	$3F_H$	Write Long	–	–	
	Other	Vendor-unique	–	–	
2	40_H	Change Definition	–	–	
	41_H	Write Same	–	–	
	$4C_H$	Log Select	–	–	
	$4D_H$	Log Sense	–	–	
	55_H	Mode Select (10)	CTL/SNS	×	
	$5A_H$	Mode Sense (10)	CTL/SNS	×	
	Other	Reserved code	–	–	
3, 4, 5	60_H~BF_H	Reserved code	–	–	
6	$C0_H$~$D0_H$	Vendor-unique	–	–	
7 ($E0_H$ -FF_H)	$E8_H$	Read With Skip Mask ((IBM-unique)	CTL/SNS	–	
	EA_H	Write With Skip Mask (IBM-unique)	CTL/SNS	–	
	Other	Vendor-unique	–	–	

6 HMDE (Hitachi Multiplatform Data Exchange)

6.1 Overview

The Hitachi Multiplatform Data Exchange (HMDE) optional feature provides a function to enable the SAM files of the mainframe to be accessed by the open system host by executing the File Access Library (FAL) program or File Conversion Utility (FCU) program installed in the open system host. Main frame files which can be accessed are limited to the SAM files only.
The FCU program has code conversion function between EBCDIC and ASCII.
The FAL has disclosed API and users can incorporate the FAL program directly into a user program.
This optional feature is supplied as a program product (P.P.) that consists of the following programs:

1) File Access Library program
- C language functions and a Header file for incorporation into a user program

2) File Conversion Utility program
- An execution-format utility program that contains the access library

The program product is supplied separately for each platform of the open system. Table 6-1 lists platforms supported for using the HMDE.

Table 6-1 Platforms supported

#	Platform supported	OS	Window System
1	SUN	Solaris 2.5, 2.6, 7(32bit/64bit)	Motif 1.2
2	HP	HP-UX 10.2, 11.x(32bit/64bit)	Motif 1.2
3	IBM	AIX 4.1.4 or 4.2 or 4.3(32bit/64bit)	Motif 1.2
4	(Not specified)	WindowsNT4.0/Windows2000	MFC
5	SEQUENT	DYNIX/ptx v 4.4.4	Motif 1.2
6	Digital	Digital UNIX 4.0	Motif 1.2

6.2 Installation

(1) Installation of P.P.
For the method of installing the P.P. (containing FAL and FCU) and its detailed specifications, refer to the manual attached to the P.P.

(2) HMDE volume setting
Volumes whose emulation type is 3390-3A, 3390-3B, 3390-3C, 3380-KA, 3380-KB and 3380-KC can be used for the HMDE operations. In addition to being accessible as 3390-3 type volumes from the mainframe host in the same manner as before, the 3390-3B type volumes permit read-only access from the open system host.
The 3390-3A type volumes can be accessible as 3390-3 from the mainframe host and permit read and write access from the open system host. The 3390-3C can be read only accessible as 3390-3 from mainframe host and permit read and write access from the open system host. The 3390-3C permit create and update of VTOC.
The 3380-KB can be accessible as 3380-K from the mainframe host and permit read-only access from the open system host. The 3380-KA can be accessible as 3380-K from the mainframe host and permit read and write access from the open system host. The 3380-KC can be read-only accessible as 3380-K from mainframe host and permit read and write access from the open system host. The 3380-KC permit create and update of VTOC.

Table 6-2 HMDE volume specifications

#	Volume attribute	Emulation Type	Access right		Remarks
			Mainframe	Open system	
1	Mainframe volume	3390-3A	R/W	R/W	HMDE volume
2		3390-3B	R/W	R	HMDE volume
3		3390-3C	R	R/W	HMDE volume
4		3380-KA	R/W	R/W	HMDE volume
5		3380-KB	R/W	R	HMDE volume
6		3380-KC	R	R/W	HMDE volume
7	Open volume	OPEN-3	(Backup/Restore)	R/W	HMDE volume
8		OPEN-8	(Backup/Restore)	R/W	HMDE volume
9		OPEN-9	(Backup/Restore)	R/W	HMDE volume
10		OPEN-K	(Backup/Restore)	R/W	HMDE volume

The 3390-3A, 3390-3B, 3390-3C, 3380-KA, 3380-KB and 3380-KC type HMDE volumes can be set during initial installation or LDEV addition. To use volumes used by the mainframe and/or SCSI as the HMDE volumes they must be set as the HMDE volumes by removing the corresponding ECC group once and then adding them again.
This procedure is the same as the ordinary one for setting emulation type of another drive.

The drive emulation type can be changed between 3390-3 and 3390-3A and 3390-3B and 3390-3C by change emulation operation. It is same for 3380-K and 3380-KA and 3380-KB and 3380-KC.

(3) Setting from the open system host

- To access the HMDE volumes from the open system host, it is necessary to define connection to the open system host and to set an SCSI path. The method of defining the SCSI path for the open system host is the same as that of the ordinary SCSI path definition with the SVP.
- Refer to the manual attached to the P.P. for the method of setting the open system host to enable it to access the HMDE volumes. This setting operation requires labeling of the HMDE volumes, for example.

6.3 Notes on Use

Alike the ordinary mainframe volumes, the 3390-3B, 3390-3A, 3380-KB and 3380-KA type HMDE volumes can be accessed from the mainframe. The 3390-3C and 3380-KC type HMDE volumes can be read only accessed without VTOC area from the mainframe.
If the SCSI path are not defined for 3390-3A/B or 3380-KA/B, the volume can not be accessed from the open system host.

7 HMBR (Hitachi Multiplatform Backup/Restore)

7.1 Overview

The Hitachi Multiplatform Backup/Restore (HMBR) optional feature provides a function to enable a mainframe host to backup a open system volume on the DKC disk subsystem by reading it by a volume unit. It also enables a mainframe host to restore the backup data onto the open system volume.

Any special additional software packages are not required to perform these functions on both mainframe host and open system host. Because, the DKC disk subsystem can convert the different data block format between open system (fixed block length data) and mainframe system (CKD format data).
The HMBR has the following features:

(1) Enabling mainframe host to backup open system data under the DKC Multiplatform disk subsystem by utilizing backup/restore programs, such as “DFHSM and DFDSS” or “DFSMShsm and DFSMSdss”, with a Logical Unit volume unit, and to restore it from the mainframe to the Logical Unit.

(2) Performing backup and restore with high data transfer rate of ESCON 17 MB/s between mainframe host and the DKC disk subsystem.

(3) Providing the open systems with powerful backup functions being used on mainframe systems, such as backup generation management, primary/secondary duplication management, and automatic backup control.

(4) Offering various backup media to the system, such as disk drives, magnetic tapes, or magnetic tape libraries.

7.2 System Configuration

A system configuration example and functional overview are shown in the Figure 7-1.

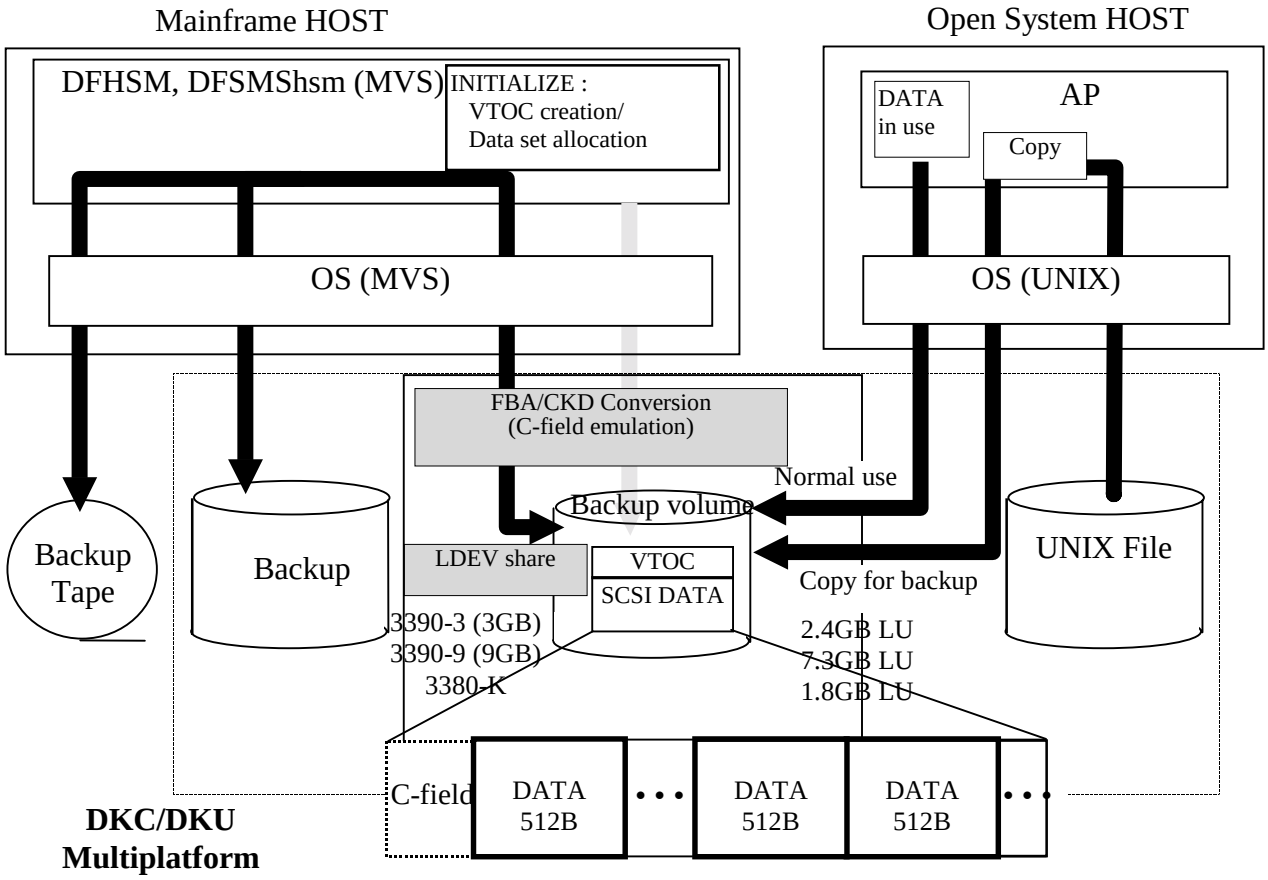


Figure 7-1 System configuration example

7.3 Basic Specification

The basic specification of HMBR is shown in the Table 7-1.

Table 7-1 Basic specification of HMBR

No	Item		Specification			Remarks
1	Attached system	Mainframe	MVS/ESA			
2		Open system	SUN (Solaris 2.6) or later HP (HP-UX 10.x) or later IBM (AIX 4.2) or later WindowsNT4.0/Windows2000			
3	Backup software	Mainframe	DFHSM, DFDSS DFSMShsm, DFSMSdss			
4	Device type	Mainframe	3390-3	3390-9	3380-K	
5		Open system	OPEN-3 (LUN=2.4GB)	OPEN-8/9 (LUN=7.3GB)	OPEN-K (LU=1.8GB)	
6	Maximum number of volumes for backup/restore		- As many Logical Units as specified for OPEN-3/9/K for Open system.			
7	Setup for backup volume		- By installing HMBR option (on SVP), all Logical Units defined as OPEN-3/8/9/K can be accessed from MVS			
8	Preparation before taking backup	VSN, VTOC creation	- DSF (INIT)			
9		Dataset allocation	- IEFBR14			
10	Backup method		- Volume full tracks dump by using DFDSS and DFSMSdss.			
11	VTOC format		- Standard VTOC. Note: Do not use SMS for backup volumes since Index VTOC is used in SMS.			
12	VTOC allocation		- Cylinder 0, Head 1 to 14 (fixed location)			
13	Data set allocated	# of data sets	- One/VOL	- Three/VOL	- One/VOL	
14		Extent	- Cylinder 1, Head 0 to User cylinder MAX.			
15	Restrictions for mainframe side utility programs		- Other utility programs than listed above are not allowed. - For Write type commands, other than those used by the above listed utility programs are rejected. (Only FORMAT WR with 16KB data length is allowed for write type command.) Read or Control type commands can be used. - Verify option is not allowed.			

7.4 Backup Volume Specification

1) Setup for Backup Volume
   Step-1 : Install the HMBR option to the DKC by using SVP. Refer to the option install procedure described in SVP section. (SVP05-10)
   Step-2 : By installing the option above, all the SCSI Logical Units (OPEN-3, OPEN-8, OPEN-9 and OPEN-K type), already installed or newly installed, will be ready to be used for backup/restore from the mainframe host.

   Note-1 Immediately after the HMBR option is de-installed, an access from the mainframe to OPEN-3, OPEN-8, OPEN-9 or OPEN-K will be rejected.
   Note-2 The Logical Unit and data stored on it, which has been used before installing HMBR option, can be used continuously for its original use and/or for backup/restore purpose.

2) Access to Backup Volume
   The specification applied to accessing the backup volume is shown in the Table 7-2.

Table 7-2 Specification of accessing the backup volume

No	Items	Specification
1	Volume type	- OPEN-3 (2.4GB), OPEN-8 (7.3GB), OPEN-9 (7.3GB), OPEN-K (1.9GB)
2	Access from Open system	- No restriction.
3	Access from mainframe host	- Possible to Read/Write as 3390-3 for OPEN-3 as 3390-9 for OPEN-8/9 and as 3380-K for OPEN-K. - For Write type commands, only the following command is allowed: - Format Write with data length of 16 KB. - Other write type commands are rejected.

7.5 Precautions

(1) Preparations

<System generation>

The volume for HMBR is recognized as the 3390-3, 9 or 3380-K from the MVS system. Specify UNIT = 3390 or 3380 using the IODEVICE macro when incorporating the volume into the MVS system.
This volume can be backed up or restored using only DFDSS from the MVS system. Access from other programs is rejected.

<Volume initialization>

Use the system utility to initialize the volume from the mainframe system.
You must create VTOC in Cylinder 0. This initialization causes VSN to be written in an area other than the area in the volume where the open system data is written, which does not damage the open system data.

<Dataset allocation>
After volume initialization, allocate a single dataset (for OPEN-3 and OPEN-K; three datasets for OPEN-9) to the volume from the mainframe system. The extent of the dataset from cylinder 1, head 0 to the user cylinder end.

When executing backup or restoration of the open system data by using HMBR, the backup/restoration utility in the mainframe specifies VSN/DSN of the above volume and dataset for execution. Thus you can facilitate backup or restoration by assigning to VSN and DSN names related to the device file names in the open system of the volume (LU).

(2) Unmounting the volume
When obtaining backup by using HMBR, terminate the open system processing in advance and unmount the volume in order to assure consistency of the backup data. Moreover, for backup of the volume connected to the AIX system, the varyoffvg command must be executed. If the backup utility in the mainframe is activated without doing this, the backup job may be halted awaiting operator intervention or the job may contain inconsistent, incomplete backup data.

(3) Volume exclusion
Though the volume as target for HMBR is an open volume and stores data in the open system, it also has VSN and can be accessed from the mainframe. Normally it is wise to keep the volume off-line from the mainframe to prevent a data write from the mainframe that will damage the open system data. During backup or restoration, establish locks to prevent access to the HMBR-target volume (LU) from the open system.

(4) Backup unit
Unit of backup by HMBR is LU. Note that restoring backup data for recovery from damaged files will recover the state when backup was obtained, including other files (files which have not been damaged) within the same LU.

(5) Specification of backup-from volume and restore-to volume
When the backup-from volume (Logical Unit) and the restore-to volume (LU) differs from each other the open system host cannot recognize the restore-to volume. Thus specify the same volume name (LU) to the backup-from volume and the restore-to volume.

(6) Backup of the volume managed by LVM
Unit of data which can be backed up/restored by HMBR is the physical volume (LU) only. However, because the logical volume may be mapped over more than one physical volume, the consistency of the logical volume data is not assured by LU-based backup. When using HMBR in a system managed by such LVM, you must back up all physical volumes (LUs) comprising volume groups in the same occasion. This requires operational expertise as the following describes:

① **Study of physical/logical mapping (OPEN system)**
Use the commands of the OPEN system to check correspondence between the logical volume group and physical volume group (LU) for the backup target volume.

② **Creating the job control statement (JCL) (mainframe)**
From all physical volumes (LUs) comprising the backup-target volume group obtained in step ①, list the mainframe VSNs and DSNs corresponding to the device file names. When executing backup using the batch job format, create the JCL for executing the backup utility specifying VSNs and DSNs listed above.

③ **Unmounting the target logical volume**
Unmount all logical volumes in the backup-target volume group.

④ **Executing the mainframe backup utility**
Execute the mainframe backup utility to obtain backup of VSNs/DSNs corresponding to all physical volumes (LUs) comprising the backup-target volume group.

⑤ **Precautions**
In the above volume-group-based backup, all logical volumes in the volume group are backed up in the same occasion. Note that restoration is made on a per volume group basis and the entire volume group returns to the state when backup was obtained. When logical-volume-based backup or restoration is required, a volume group must contain only one logical volume.
When modification to the configuration of the logical volume or volume group is made (such as addition, deletion or splitting of logical volumes in a volume group, or addition of a new physical volume in a volume group), volume-group-based backup must be executed using the new configuration. If this is skipped and backup data obtained via HMBR is restored, only data entity is restored to the old LV/LG configuration. This may disrupt the consistency with the LVM management information stored separately from the data entity, causing damage to data.

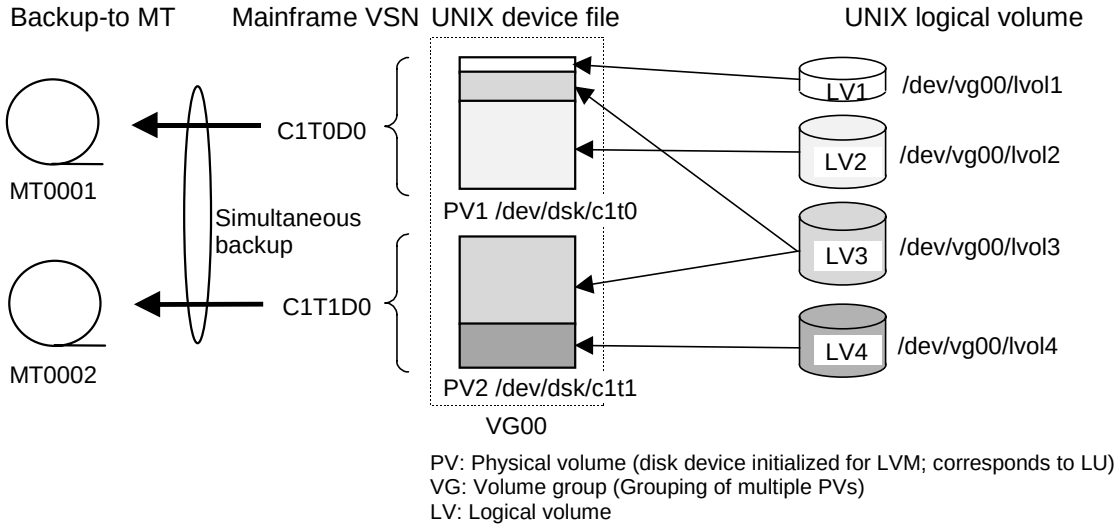


Figure 7-2 Backup of Volumes managed by LVM

(7) Backup of database
To backup a database, first terminate its operation to place it off-line before making a backup. You must backup of all LUs where data files are stored at the same occasion. Follow the required backup method for each database management system to determine whether or not backup is required and the backup method for other files comprising the database (such as control file and log file.) Follow the restoration procedure or approach for each database management system to determine when a log file must be used to restore the database to the state just before fault occurrence or synchronicity of the control file and data file must be restored.

(8) Backup of open volume
When obtaining backup by using HMBR, do not use verify option of mainframe utility.

(9) A method of backup and restore for WindowsNT system data is shown in the following.
<Backup>
(a) Delete drive letter to the Logical Units by Disk Administrator.
(b) Re-allocate drive letter to the Logical Units by Disk Administrator.
(c) Backup WindowsNT system data by mainframe host.
<Restore>
(a) Delete drive letter to the Logical Units by Disk Administrator.
(b) Restore it from mainframe host to the Logical Units.
(c) Re-allocate drive letter to the Logical Units by Disk Administrator.

8 SCSI HA Software Linkage Configuration in a Cluster Server Environment

When this subsystem 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.

8.1 Example of System Configurations

(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 cables of the active and standby hosts to different CHF FIBRE ports.

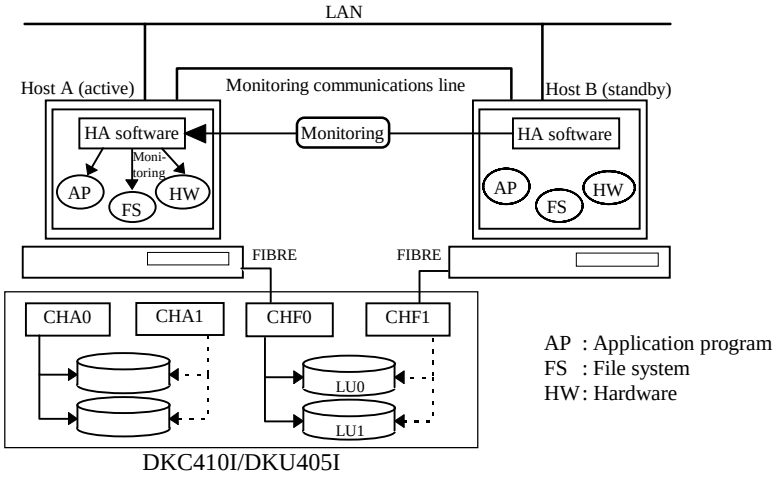


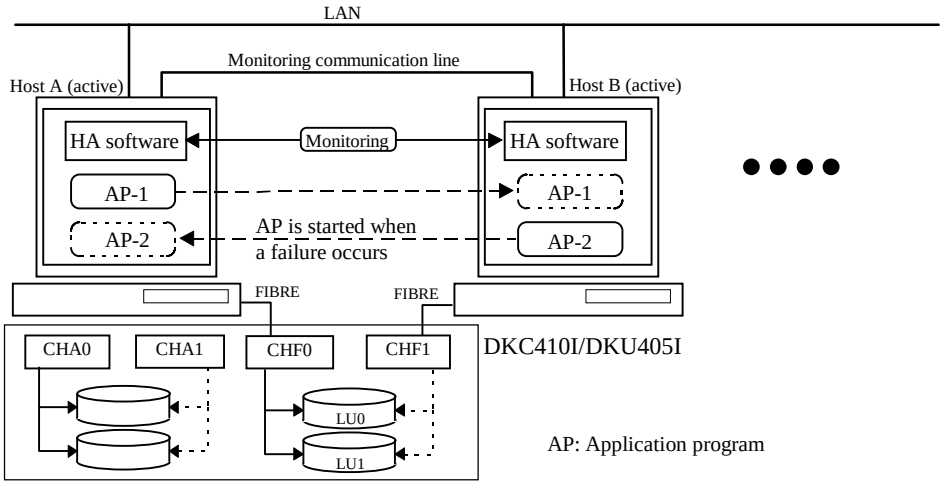
Figure 8-1 Hot-standby configuration

• The HA software under the hot-standby configuration operates in the following sequence:

a. 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.
b. 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").
c. 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 request 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 request may need to be executed once again.

(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 subsystem has eight FIBRE ports, it can, in particular, be applied to a large-scale cluster environment in which more than two hosts exist.



- 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 subsystem is scheduled to support VERITAS Software FirstWatch, Hewlett-Packard MC/ServiceGuard, and IBM HACMP and so on.

8.2 HA Software

This subsection describes about HA configuration with FIBRE I/F.
The following list shows alternate link and HA software for each hosts. It is necessary to set Host Mode by using SVP, when changing a host system.
The meaning of each mode are follows.

MODE 00 : standard mode
MODE 03 : HP host (Extension) mode
MODE 04 : Sequent host mode
MODE 05 : Open VMS mode
MODE 07 : Tru64 mode
MODE 08 : HP host mode
MODE 09 : Solaris host mode
MODE 0A : Netware host mode
MODE 0C : WindowsNT/2000 mode
MODE 0E : HI-UX host mode
MODE 0F : AIX host mode
others : Reserved

Please see “SCSI I/F Configuration” (INST05-720 to INST05-800). Also see the operational manual for more detailed information about the alternate link and HA software.

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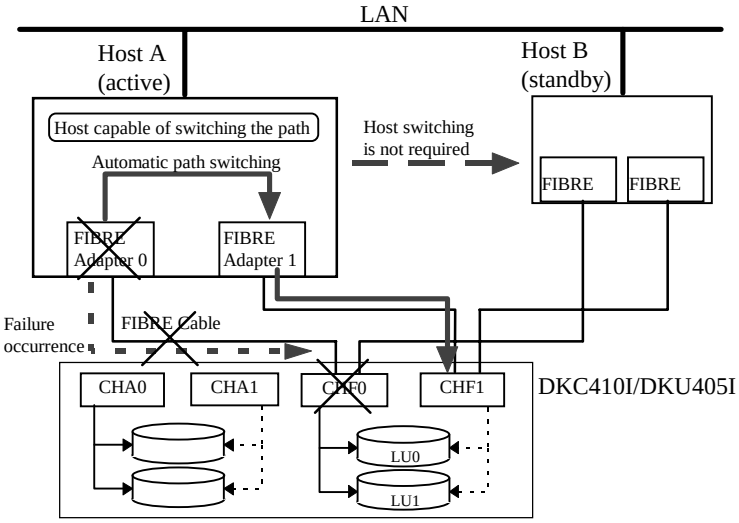
8.3 Configuration Using Host Path Switching Function

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



The path switching function enables processing to be continued without host switching in the event of a failure in the FIBRE adapter, FIBRE cable, array controller, or other components.

8.4 Procedures for online microprogram exchange and CHF replacement using alternate path

8.4.1 Outline

The alternate path function enables a microprogram exchange and a CHF replacement without stopping an I/O operation of the host connected to the CHF (that is, online exchange/replacement).

8.4.2 Prior confirmation of alternate path

An alternate path must be correctly established and the path switching must function at the time of exchange/replacement in order to exchange a microprogram or replace the CHF during online operation. Confirm the path state by asking an SE concerned or a customer.
See "Procedures for Confirming Alternate Path State and Recovering It" shown in Table 1.

8.4.3 Types of microprogram exchange

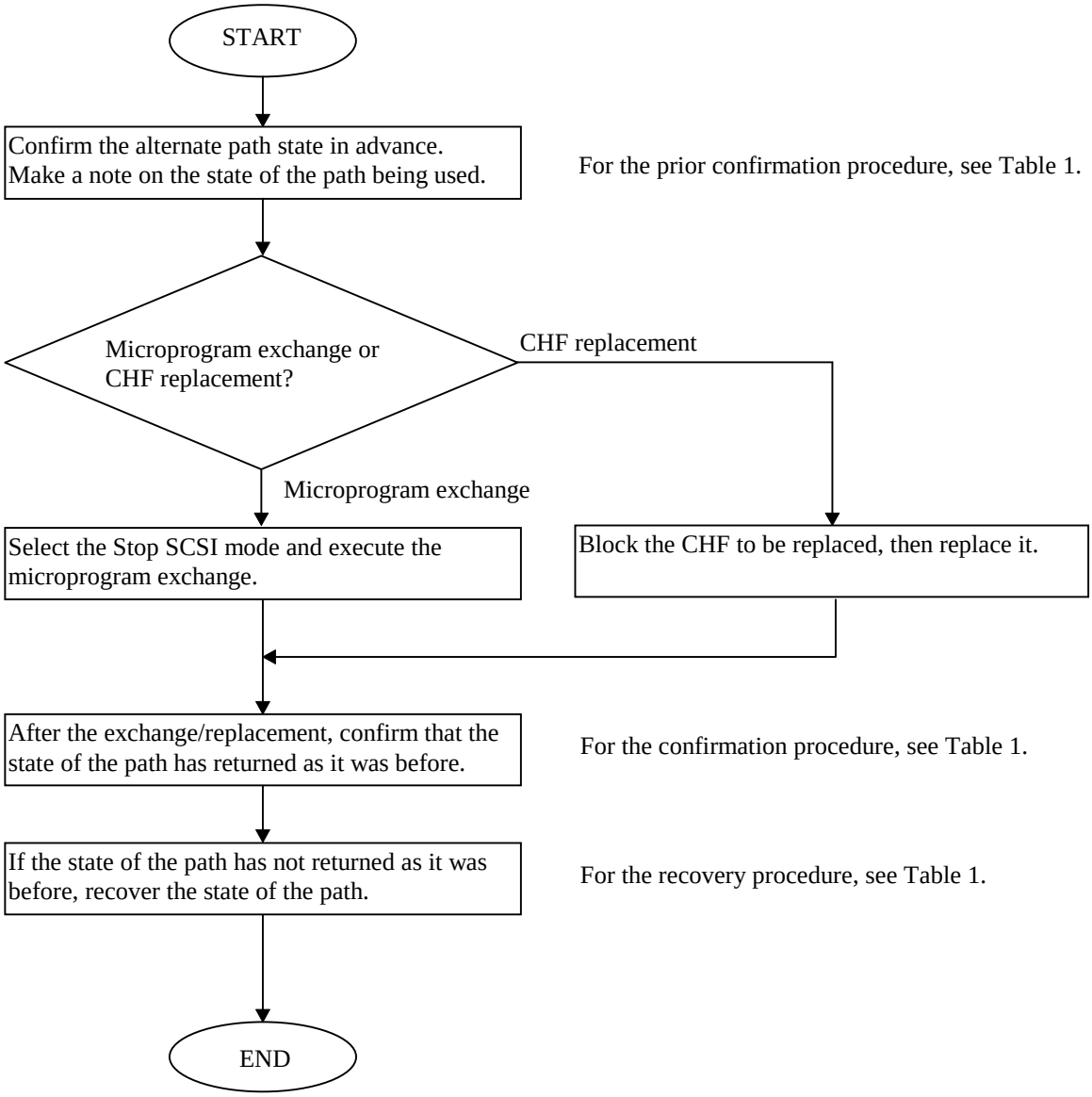
For HP-UX:	STOP SCSI mode
Solaris, AIX and Windows NT:	Alternate SCSI Path mode

8.4.4 Restrictions

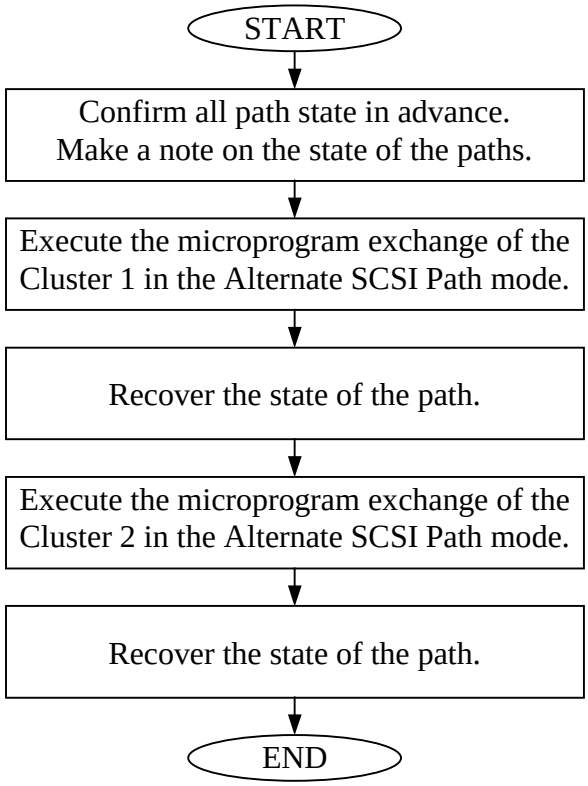
(1) Confirm that the alternate path is correctly set.
(2) Online exchange/replacement is possible when both primary and alternate paths are normal. If the path state is abnormal, recover it to be normal, then perform the online exchange/replacement.
(3) An alternate path function cannot be used with respect to HMDE volume.
Disable I/Os to the HMDE volume concerned when exchanging a microprogram or replacing the CHF.
(4) Disable I/Os to the LDEV for which the alternate path is not set.
(5) The microprogram exchange on HP is executed in the Stop SCSI mode. And on Solaris, AIX or Windows NT, in the Alternate SCSI Path mode. When these coexist on the same DKC, determine the mode to be either the Stop SCSI mode or the Alternate SCSI Path mode in which to exchange a microprogram, and disable I/Os of a platform in the other mode before exchanging a microprogram.
(6) In the case of the Dual Active configuration, a load may concentrate on one of the two paths during the microprogram exchange or CHF replacement. Take preventive measures against it such as to choose a period (time zone) when the host load is low to perform the online exchange/replacement.

8.4.5 Procedures for online microprogram exchange and CHF replacement

(1) Procedures for microprogram exchange or CHF replacement executed on HP-UX



(2) Procedures for microprogram exchange executed on Solaris, AIX or Windows NT

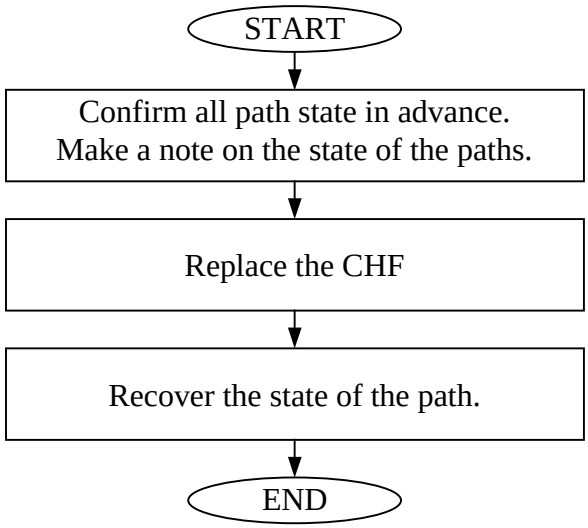


For the confirmation procedure, see Table 1.

For the recovery procedure, see Table 1.

For the recovery procedure, see Table 1.

(3) Procedures for CHF replacement executed on Solaris, AIX or Windows NT



For the confirmation procedure, see Table 1.

For the recovery procedure, see Table 1.

Table 1 Procedures for Confirming Alternate Path State and Recovering It (1 of 2)

No.	Platform	Alternate path state confirmation procedure	Recovery procedure
1	HP	Display and confirm the path states (Pstates) of all the devices (LUs) by the "vgdisplay-v" command. If "PV Name" is displayed as Alternate Link, the path has been switched to the alternate path.	Automatic recovery Display and confirm the path states (Pstates) of all the devices (LUs) by the "vgdisplay-v" command.
2	Sun	[VxVM DMP] Display and confirm the path states of all the devices (LUs) by the "vxdisk list *diskxx*" or "vxdisk list *cxtxdxsx*" command of VxVM. Perform one of the following operations depending on the path state. • Disabled: The path is faulty. (Or, after the microprogram exchange or CHF replacement, the path concerned has not been recovered yet.) After recovery, check it again according to this procedure. • Enabled: After recording this state, execute the microprogram exchange or CHF replacement. Note: If there is at least one failed path, do not execute the online microprogram exchange or CHF replacement. Be sure to execute the exchange or replacement after recovering the failure.	[VxVM DMP] Step ①: Recover the path by the "vxdctl enable" command of VxVM. Step ②: Confirm that all the paths are in the Enabled state (initial state) bythe "vxdisk list *diskxx*" or "vxdisk list *cxtxdxsx*" command. If the path in the Disabled state remains, execute the procedure again from Step ① after the path is recovered. Or recover the path failure, then execute the procedure again from Step ①.

Table 1 Procedures for Confirming Alternate Path State and Recovering It (2 of 2)

No.	Platform	Alternate path state confirmation procedure	Recovery procedure
3	Windows NT	[Path Manager] Confirm the states of all adapters by using "datapath query adapter" command Perform one of the following operations depending on the Adapter State. • All NORMAL: All paths are in use. It is possible to exchange microprogram or replace CHF. • DEGRAD or FAILED: The path is faulty. Recover the path failure, then set the path online according to the Recovery procedure.	[Path Manager] Step ①: Check the number of the DEGRAD or FAILED adapter which must be set to online, using "datapath query adapter" command. Step ②: Use the "datapath set adapter *n* online" command. (*n* is the adapter number checked by Step ①.) Step ③: Check the states of all adapters have returned to NORMAL, using "datapath query adapter" command again. • All NORMAL: All paths are in use. • DEGRAD or FAILED: The path is faulty. After the microprogram exchange or CHF replacement, execute the procedure again from Step ① after the path is recovered. Or recover the path failure, then execute the procedure again from Step ①.
4	AIX	[Path Manager] Confirm the states of all adapters by using "datapath query adapter" command Perform one of the following operations depending on the Adapter State. • All NORMAL: All paths are in use. It is possible to exchange microprogram or replace CHF. • DEGRAD or FAILED: The path is faulty. Recover the path failure, then set the path online according to the Recovery procedure.	[Path Manager] Step ①: Check the number of the DEGRAD or FAILED adapter which must be set to online, using "datapath query adapter" command. Step ②: Use the "datapath set adapter *n* online" command. (*n* is the adapter number checked by Step ①.) Step ③: Check the states of all adapters have returned to NORMAL, using "datapath query adapter" command again. • All NORMAL: All paths are in use. • DEGRAD or FAILED: The path is faulty. After the microprogram exchange or CHF replacement, execute the procedure again from Step ① after the path is recovered. Or recover the path failure, then execute the procedure again from Step ①.

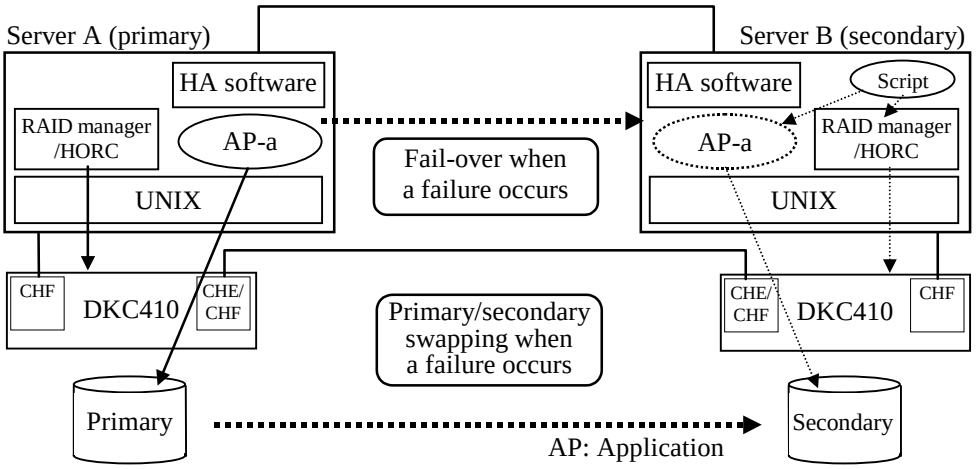
9 HORC (Hitachi Open Remote Copy)

9.1 Overview

The Hitachi Open Remote Copy function can remotely duplicate data (volumes) under the control of the subsystem by directly connecting the two DKC410s. A backup system against disasters can be constructed by installing one of the two DKC410s at the main site and the other at the recovery site and configuring the HA cluster on the server side by means of the HA (High Availability) software.
This function also enables the two volumes containing identical data to be used for different purposes by duplicating data (volumes) within the same DKC410 or between the two DKC410s and separating the volumes in a primary-and-secondary relation at any time.
An online database can be backed up or batch programs can be executed while the database is being accessed.
The HORC makes various settings and it controls operations by means of the RAID manager/HORC, which runs on the open system. The RAID manager/HORC provides various commands for user applications to control the HORC functions. Creation of a user shell script using these commands enables the HORC control being interlocked with server's fail-over executed by the HA software.

There are two kinds of Serial interface (ESCON/ACONARC) and Fibre channel interface of connection form between CUs.
As for the explanation of Fibre channel interface connection, it is done with “THEORY OF OPERATION section 3.13.7 Fibre Channel connection”.

Outline of HORC Function and Example of Application to HA Configuration
(Hot Standby Configuration)



9.2 Basic Specifications

Basic HORC specifications are shown below.

Basic Specifications of HORC

No.	Item	Description	Remarks
1	Host interface on open system side	Fibre Channel	supporting for HP-UX, Solaris, Win/NT and AIX4.2
2	Supporting platform	HP-UX, AIX, Solaris, Windows/NT 4.0, Windows2000, Digital UNIX, Dynax, NetWare	They are HP-UX, AIX, Solaris, Windows/NT, Windows2000, NetWare in the case of Fibre Remote Copy.
3	Connection between the CUs	ESCON, ACONARC/Fibre Channel	An ESCON/ACONARC connection can't be mixed with the Fibre Channel connection.
4	Means for setting the paired LU	Command instruction from the RAID Manager/HORC	RAID Manager does not support for Netware
		Remote console	
		SVP	
5	Number of LUs capable of the duplicated writing	Maximum 4095 pairs	
6	LU size capable of the duplicated writing (The paired VOL must be the same DEV type.)	OPEN-3 (2.4GB)	
		OPEN-8 (7.3GB)	
		OPEN-9 (7.3GB)	
		LUSE	
		OPEN-K (1.8GB)	
		CVS Volume	
		OPEN-E (14GB)	
		OPEN-L (36GB)	
		OPEN-M (47GB)	
7	Duplicated writing mode	Synchronized, Asynchronized	
8	Combination of the CUs	One-to-one correspondence N-to-one correspondence one-to-N correspondence	
9	Fence level	Data, Status, Never	Supports a function equivalent to the MF HRC.
10	Number of ESCON paths between the CUs	Maximum 4 paths per CU	
11	Multiple CUs support	Yes	For CU#0 through CU#15, HORC pairs can be created.
12	Control of the MF HRC and the open HRC in DKC mixture	Can be mixed	It can't be mixed with MF HRC in the case of Fibre Remote Copy.

(1) Means for setting the paired LU:
The following three means are provided.
- Command instruction from the RAID Manager/HORC
- Instruction from the remote console
- Instruction from the SVP

Not only the pairing but also a series of pair state changes are possible by using these three means. However, the user can use two means only: the command instruction from the RAID Manager/HORC and the instruction from the remote console.

(2) LU size capable of the duplicated writing:
OPEN-3, OPEN-8, OPEN-9, OPEN-K, OPEN-E, OPEN-L, OPEN-M and LUSE are supported as the LU sizes capable of the duplicated writing. Provided that the paired VOL must be the same DEV type.

(3) Fence level:
The HORC, alike the HRC, supports three types of fence level: Data, Status, and Never.

(4) Control of the HRC pairs and the HORC pairs mixture:
Control of the mixture of the HRC pairs and the HORC pairs is possible within the one DKC.

(5) R-VOL (secondary VOL) access:
① An RD access to the secondary VOL is permitted to accept the RD command issued to the label when the secondary server is started.
② In order to support the DataPlex function, write access to the secondary VOL is permitted on condition that the pair is being suspended.
Using the RAID Manager/HORC or SVP, you can indicate the permission of write operation to R-VOL. After this indication, if the server performs any write operation to R-VOL, in Pair Resync (Resume) operation all tracks on M-VOL will be copied to R-VOL.
If using SVP, the permission of write operation to R-VOL is executed by setting “R-VOL write Enable” on Suspend Pair display in the indication of R-VOL Suspend on MCU.
Also, you can confirm using RAID manager/HORC or SVP whether “R-VOL write Enable” on R-VOL is permitted or not.

(6) HMBR function for the HORC paired VOL
① Overview
Open Remote Copy function makes possible to make a backup of HORC pair volumes and restore it using a mainframe machine. (HMBR function for the HORC paired VOL)
After splitting HORC pairs by a HORC command of RAID Manager/TT, you can make a backup from a mainframe machine. In this case the backup data is got from S-Vols. Therefore to make a backup, you don’t have to stop processes from open systems to P-Vols.
Before restoring backup data, you must delete HORC pairs and make them simplex volumes by a HORC command of RAID Manager/TT. After restoring data, create HORC pairs using the same volumes as P-Vols or S-Vols before deleting pairs. Thus you can create the same duplicated status as before.

② Preparation for Backup
Before making a backup of HORC pair volumes using HMBR function, you need to set VSN, and to create VTOC from a mainframe machine as written in “4.7.3 HMBR”. These operations must be done before HORC pairs are created.

③ VSN, VTOC in HORC pairs
By the initial copy of a HORC pair, VSN and VTOC in the P-Vol are copied to S-Vol. As a result, both P-Vol and S-Vol have the same VSN and VTOC. If you need to set the different VNS to S-Vol, after splitting the pair, you can change VNS in S-Vol.

④ Write operation from a mainframe machine to HORC pair volumes.
Once a HORC pair is created, all write operations from a mainframe machine to the HORC pair volume are rejected, except rewriting of VNS to S-Vol. Therefore a mainframe machine cannot erase original data written by an open system.

⑤ Others
While an initial copy for HORC pairs is executed, the link between S-Vol and a mainframe machine should be off-line. If the link is on-line, the initial copy is aborted.
While there exists any I/O from a mainframe machine to an open volume, don’t start initial copy from the volume to another. When you start the copy operation, a mainframe I/O is aborted.
When you start initial copy, you need to stop a mainframe I/O to a open volume which is to be a P-Vol of a HORC pair.

◆Restrictions:

(1) Command device:

① The HORC provides users with a command to enable a state change and status display of the HORC pair from the server.

② Assign a special LUN called a command device so that the DKC410 can receive this pair state change and pair status display commands.

③ Users cannot use the command device. A command device with a capacity of 2.4GB within the subsystem cannot be used (when the OPEN3 is assigned as a command device). If you install the micro version supporting CVS function for Open volume, you can specify CVS volume as command device. In this case, the minimum capacity of command device is 36MB.

④ Use the SVP to specify the command device.

(2) Flashing updated data in the server
When the HORC is used as a DataPlex function, split the primary/secondary paired VOL. A Sync command or the like must be issued before splitting it and a file system buffer must be flashed when acquiring a backup from the secondary VOL. Thus, the latest backup can be acquired.

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10 Online LUN installation

10.1 Overview

Online LUN installation feature makes it enable to add LUNs to DKC410 FIBRE ports while I/Os are still running.
Some host operations are required before the added volumes are recognized and become usable from FIBRE host operating systems.
MCU port (Initiator port) of Fibre Remote Copy function can not support Online LUN installation.

10.2 Specifications

(1) General
1) Onine LUN installation feature is supported for FIBRE interface.
2) Online LUN installation is supported.
3) Online LUN installation can be used only for FIBRE ports on which SCSI paths are already existing.
   Use normal disruptive SCSI path configuration change feature when FIBRE ports do not have any existing SCSI paths.
4) HOSTMODE of FIBRE ports can not be changed by Online LUN installation feature.
   Use normal disruptive SCSI path configuration change feature to change or set HOSTMODE.
5) Online LUN installation can not be used for FIBRE ports which have 04(SEQUENT HOST MODE) or 14(SEQUENT HOST MODE + Ultra SCSI) for their HOSTMODE.
6) Online LUN installation can be executed by SVP or by Remote Console.
7) Some operating systems require reboot operation to recognize the newly added volumes.
8) It may take about 30 seconds to complete Online LUN installation.
9) When new LDEVs should be installed for Online LUN installation, install the LDEVs by SVP first. Then add SCSI paths by Online LUN installation from SVP or Remote Console.
10) MCU port (Initiator port) of Fibre Remote Copy function can not support Online LUN installation.

(2) Supported feature
Online LUN installation feature provides the next two features.
1) Add new LUNs under existing target ID. (for FIBRE ports)
2) Add new target IDs and new LUNs.

(3) Volume type support
Volume types supported Online LUN installation are the same as already supported ones.

(4) Platform support
Host Platforms supported for Online LUN installation are shown in Table 10-1.

Table 10-1 Platform support level.

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

10.3 Operations

(1) Operations
Step 1: If there is not existing SCSI path on the ports, use normal disruptive operation.
Step 2: Confirm whether or not the initiator platform of the FIBRE port supports Online LUN installation with Table 10-1.
Support (A),(B) -> Go to Step 3.
Not support (C) -> Use normal disruptive SCSI path configuration change.
Step 3: If HOSTMODE must be change, then use normal disruptive operation.
If not go to Step 4.
Step 4: If HOSTMODE of the FIBRE port is 04 or 14, use normal disruptive operation. If not, go to Step 5.
Step 5: Execute Online LUN installation from SVP or from Remote Console.
Step 6: Confirm whether or not the initiator platform of the FIBRE port supports Online LUN recognition with Table 10-2.
Support (A) -> Execute online LUN recognition procedures in Table 10-2.
Not support (B) -> Reboot host and execute normal install procedure.

(2) Host operations
Host operations for Online LUN recognition are shown in Table 10-2.

Table 10-2 Online LUN recognition procedures outline for each platform

Platform	Online LUN recognition procedures
HP-UX	(1) **`ioscan`** (check device added after IPL) (2) **`insf -e`** (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

11 Online LUN de-installation

11.1 Overview

Online LUN de-installation feature makes it enable to delete LUNs to DKC410 FIBRE ports while I/Os are still running.
MCU port (Initiator port) of Fibre Remote Copy function can not support Online LUN de-installation.

11.2 Specifications

(1) General
1) Online LUN de-installation feature is supported for FIBRE interface.
2) Online LUN de-installation can be used only for FIBRE ports on which SCSI paths are already existing.
3) HOST MODE of FIBRE ports can not be changed by online LUN de-installation feature.
4) Online LUN de-installation can not be used for FIBRE ports which have 04(SEQUENT HOST MODE), 14(SEQUENT HOST MODE+Ultra SCSI) for their HOST MODE.
5) Online LUN de-installation can be executed by SVP or by Remote Console.
6) It may takes about 30 seconds to complete Online LUN de-installation.
7) When LUNs should be de-installed for Online LUN de-installation,stop Host I/O of concerned LUNs.
8) If necessary , execute backup of concerned LUNs.
9) De-install concerned LUNs from HOST.
10) In case of AIX, release the reserve of concerned LUNs.
11) In case of HP-UX do not delete LUN=0 under existing target ID.
12) MCU port (Initiator port) of Fibre Remote Copy function can not support Online LUN de-intallation.

(Note)
If Online LUN de-installation should be done without stopping Host I/O, or releasing the reserve, it would have failed. Then stop HOST I/O or release the reserve of concerned LUNs and try again. If Online LUN de-installation would have failed after stopping Host I/O or releasing the reserve, there is possibility that health check command from HOST is issued. At that time, wait about three minutes and try again.

(2) Supported feature
Online LUN de-installation feature provides the next two features.
1) Delete LUNs under existing target ID. (for FIBRE ports)
2) Delete existing target ID.

(3) Volume type support
Volume types supported for Online LUN de-installation are the same as already supported ones.

(4) Platform support
Host platforms supported for Online LUN de-installation are shown in Table 11-1.

Table 11-1 Support platform

Platform	OS	Fibre
HP	HP-UX	○
SUN	Solaris	○
RS/6000	AIX	○
PC	WindowsNT	×

(example) ○: support, ×: not support

11.3 Operations

(1) Operations

Step 1: Confirm whether or not the initiator platform of the FIBRE port supports Online LUN de-installation with Table 11-1.
Support :Go to Step 2.
Not support :Use normal disruptive SCSI path configuration change.

Step 2: If HOST MODE must be changed, then use normal disruptive operation.
If not, go to Step 3.

Step 3: If HOST MODE of FIBRE port is 04 or 14 use normal disruptive operation. If not, go to Step 4.

Step 4: Stop Host I/O of concerned LUNs.

Step 5: If necessary, execute backup of concerned LUNs.

Step 6: De-install concerned LUNs form HOST.

Step 7: In case AIX, release the reserve of concerned LUNs.
If not, go to Step 8.

Step:8 Execute Online LUN de-installation from SVP or from Remote Console.

(2) Host operations
Host operations for LUN de-installation procedures are shown in Table 11-2.

Table 11-2 LUN de-installation procedures outline for each platform

Platform	LUN de-installation 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)

12 Prioritized Port Control (PPC)

12.1 Overview

The Prioritized Port Control (PPC) feature 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 can 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.
Note: The Prioritized Port Control option cannot be used simultaneously for both the ports and WWNs for the same DKC. Up to 32 ports or 256 WWNs (8 WWNs × 32 ports) can be controlled for each DKC. (DKCMAIN: 01-13-xx or later: 1024 WWNs (32 WWNs × 32 ports))

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. 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.

- 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.

- 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.

12.2 Overview of Monitoring

- 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 minute, and you can view the varying data in real time. The offline mode displays the stored performance data. The data can be stored for up to one week, and can be displayed in increments ranging from five minutes, one hour, one day, or one week. A graph is plotted per unit of one minute regardless of the displayed scale (unit of grid).

- 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 one week. 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.

  - 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.
  - 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. (See Figure 12-1.)

12.3 Procedure (Flow) of Prioritized Port Control

To perform the prioritized port control, determine the upper limit to the non-prioritized port by checking that the performance monitoring function does not affect production. Figure 12-1 shows the procedures for prioritized port control.

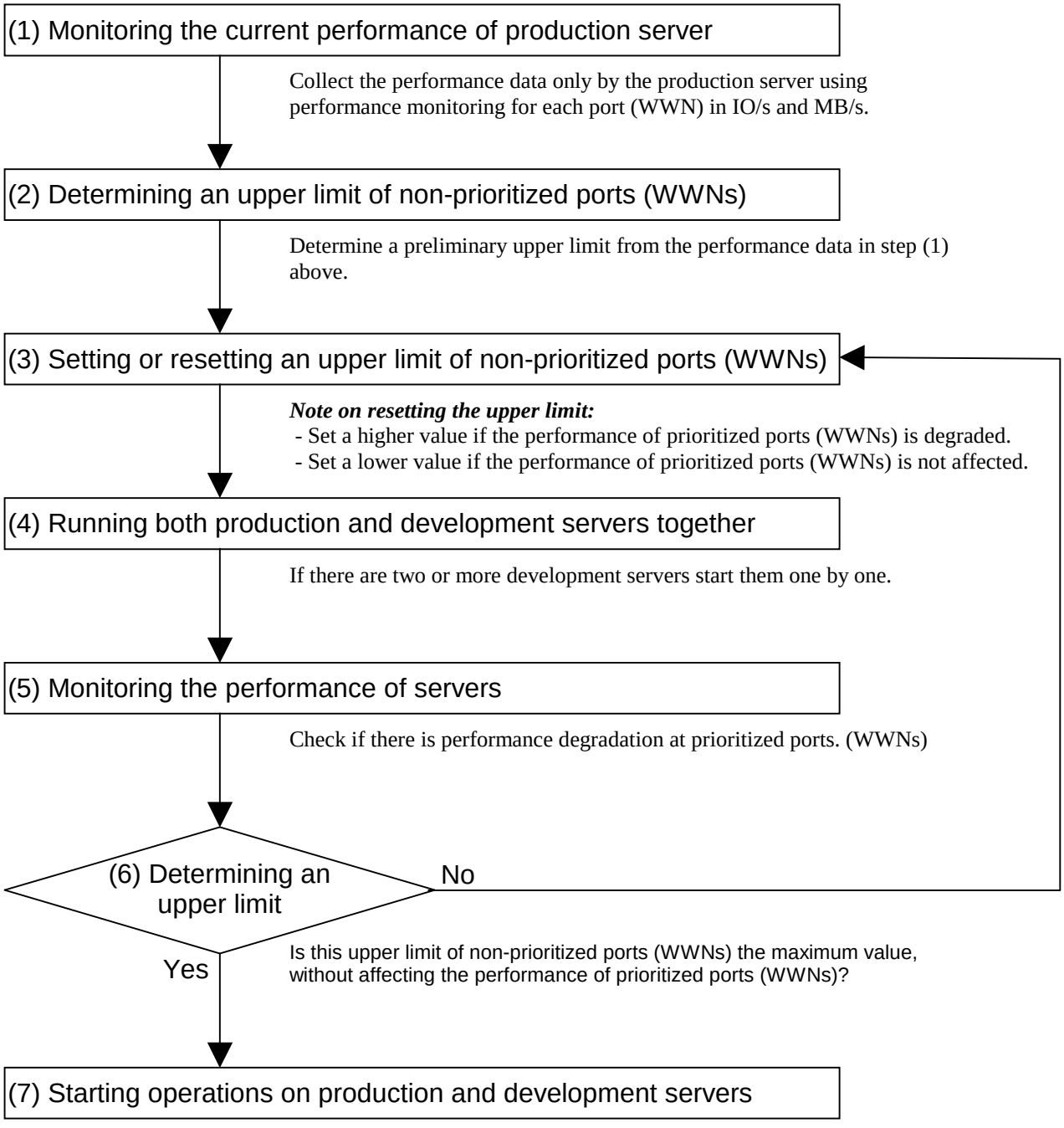

Figure 12-1 Flow of Prioritized Ports Control

13 High-Speed Microprogram Replacement

13.1 High-Speed Microprogram Replacement Function

The function enables microprogram replacement to be done during an I/O from/to a host by sharply shortening the offline time required for the microprogram replacement to about 30 seconds or so (when both microprogram versions before and after the replacement are 01-11-XX or later).
The host is, from its viewpoint, indeed disabled from access to an LU during the microprogram replacement because the connection path is made offline, but it can continue an I/O without an abend of the program as long as the microprogram replacement is completed and the access can be retried by the time when the access is abandoned owing to a timeout of retrying of access to the LU from the host. (Some hosts may record it as an error, however.)
By virtue of the function, microprogram replacement (hot replacement) can be done without suspension of an I/O from/to a host connected to a port of the CHF even in a system that has not adopted the alternate path function. (For server platforms supported by the function, see Section 13.2.)
In the high-speed microprogram replacement, no writing onto the FM (flash memory) is done in order to shorten the offline time sharply. Therefore, the version of the microprogram on the FM remains as it was before the microprogram replacement although the version of the microprogram on the SM (shared memory) is changed to that after the high-speed microprogram replacement. The microprogram on the FM
is not changed to the new one unless a powering off and on or PCB replacement is done after the microprogram replacement.

When System Option MODE 161 is setting ON, writing onto the FM (flash memory) is done so that not high-speed microcode replacement function but alternate path function is used to perform a microprogram exchange and a replacement without stopping an I/O operation. It is same even though specified mode is STOP SCSI mode or Alternate SCSI Path mode.
When MODE 161 is setting OFF, no writing onto the FM (flash memory) is done so that the High-Speed Microprogram Replacement Function is available to use.
The setting is prohibited to change without direction from support division.

13.2 Conditions of Support by High-Speed Microprogram Replacement

Platforms, that can replace the microprogram during an I/O from/to a host connected to a port of the CHF even if the alternate path function is not adopted, are those that satisfy the following conditions.
The host platforms supported by the high-speed microprogram replacement function are shown in Table 13-1 below.

Table 13-1 Supported Platforms

Platform	Fibre channel adapter	Setting value of fibre channel adapter (queue-depth)	Microprogram replacement mode
HP-UX	HP A3740A/A3404A/A3591B	64 or less per port and 8 (default) per LU	Stop SCSI host
Solaris	Jaycor FC64-1063/FCI-1063	256 or less per port and 256 (default) per LU	Stop SCSI host
AIX	IBM 6227/IBM 6228	256 or less per port and 32 (default) per LU	Stop SCSI host
Windows NT	Emulex LP7000E/LP8000	256 or less per port and 32 (default) per LU	Stop SCSI host
Windows 2000	Emulex LP8000	256 or less per port and 32 (default) per LU	Stop SCSI host

13.3 Notes on Operation

- When the high-speed microprogram replacement is done in a system in which the alternate path software is running, it is possible that the system detects it as a failure in a short time and switches a path from the primary to the secondary. Therefore, the high-speed microprogram replacement cannot be done in such a system.

- In a system in which the subsystem is used as a boot disk, the high-speed microprogram replacement cannot be done. That is because recovery from a failure that occurs during the microprogram replacement may be unable to be done since an I/O retrying for a boot disk is performed less frequently comparing with that for the other disks.

- In a configuration in which both the supported and unsupported platforms are connected, the microprogram replacement must be done after stopping an I/O from/to a host that uses the unsupported platform or adopting the alternate path software with the automatic recovery function.

- It is recommended to perform the microprogram replacement at the time (in a time zone) when a load on a host is not heavy.

- When a powering off causing data volatilization is done on some occasion in a state in which versions of microprograms on the FM and SM are different with each other, the CHF is restarted with a microprogram of the version same as that of the microprogram on the FM after the subsystem power is turned on again. The replacement of the microprogram with that on the SVP is required again. Perform the microprogram replacement after completing recovery from the failure that has caused the volatilization of data including the microprogram on the SM. When the microprogram replacement cannot be done because of a trouble such as a CHF blockade, contact the TSC immediately.

- The high-speed microprogram replacement can not be done on the AIX system via Switch.

14 2GB PCB (8HSE SUPPORT)

14.1 Summary

8HSE PCB has achieved the maximum transfer rate of 200 M bytes/sec, while a typical FIBRE CHANNEL I/F PCB offers that of 100 M bytes/sec.
The following table (14-1) shows the basic specification of 8HSE PCB.

Table14-1 Basic Specification

Item	Specification		Note
Model	8GSE	8HSE	–
Topology	L-Port F-Port	L-Port F-Port	
Service Class	3	3	–
Protocol	FCP	FCP	–
Max. Channel Number (per PCB)	4	4	–
Data Transfer Rate	100 M bytes/sec	200 M bytes/sec	–
PORT Number/PCB	4 Port (SP Mode*) 2 Port (HP Mode*)	4 Port (SP Mode*) 2 Port (HP Mode*)	–
FibreHORC Support	Available	Available	–
Connector	SC connector	LC connector	–

SP Mode : Standard Performance Mode
HP Mode : High Performance Mode

Table14-2 FC I/F Support Level

No.	Item	I/F type	Support Level
1	Optical type	LC-SC(Shortwave) for 100 M bytes/sec	Available
2		LC-LC(Shortwave) for 200 M bytes/sec	Available

14.2 Setting for Replacement and Installation

(1) Replacement
When the PCB type selected in SVP is SE-FibreT-4ch, you may replace 8HSE with 8GSE. Note that PCB should be changed in pair.

(2) Installation
Set the PCB type selected in SVP to “SE-FibreT 4ch” if you want to add 8HSE or 8GSE.

14.3 Notes for Replacement and Add-on

(1) Replacement between 8HSE and 8GSE
In case of a failure, the previous PCB type of the processor closing SIM would be reported. However, when the replacement has finished, the correct PCB type would be indicated for repair (except the case that all MPs are closed).

(2) Add-on-8HSE
In case of a failure, that PCB type of the processor closing SIM would be reported. However, when the replacement has finished, the correct PCB type would be indicated for repair (except the case that all MPs are closed).

14.4 AutoNegotiation

8HSE can transfer data either in 100 M bytes/sec or 200 M bytes/sec. Normally switching between 100 M bytes/sec and 200 M bytes/sec is automatically selected by AutoNegotiation. When HostBusAdapter supports 200 M bytes/sec, connection is performed in 200 M bytes/sec. In case that HostBusAdapter supports only 100 M bytes/sec, 8HSE is connected in 100 M bytes/sec by AutoNegotiation.
However, AutoNegotiation does not function well with some host adapters of 100 M bytes/sec. If the link status is not stable, fix the transfer mode in 100 M bytes/sec as described in Table 14.4.

Table 14.4 Host Mode List

Host Name	Host Mode	Host Mode Fixed to 100MB/sec
Standard	MODE 00	MODE 10
HP	MODE 03	MODE 13
Sequent	MODE 04	MODE 14
Open VMS	MODE 05	MODE 15
Tru64	MODE 07	MODE 17
HP	MODE 08	MODE 18
Solaris	MODE 09	MODE 19
Netware	MODE 0A	MODE 1A
WindowsNT/2000	MODE 0C	MODE 1C
IOTrace	MODE 0D	MODE 1D
HI-UX	MODE 0E	MODE 1E
AIX*	MODE 0F	MODE 1F

* If you want to connect with HOST Adapter FC6228, set the host mode to MODE 1F.