Introduction

This “Introduction” volume describes the cautionary/prohibited notes in the maintenance work, the outline of the subsystem, and the configuration, etc.

Contents

This page is for editorial purpose only.

Chapter 1. Outline of Subsystem

This chapter explained about the outline of the subsystem which composes a disk array system. In this chapter, it mechanical and power supplying system structures of each model are explained separately.

1.1 What is RAID

To put RAID to practical use, some techniques such as striping, mirroring, and parity disk are used.

- Striping
  It means to store data spreading it on several Disk Drives. Since a datum is written on several Disk Drives, time required to access each Disk Drive is shortened and thus, time required for reading or writing is shortened.
- Mirroring
  It means to copy all the contents of one Disk Drive to one or more Disk Drives at the same time in order to enhance reliability.
- Parity disk
  It is a data writing method used when configure RAID with three or more Disk Drives.
  Parity of data in the corresponding positions of two or more Disk Drives is generated and stored on another Disk Drive.

1.1.1 Application of RAID Technology

When one I/O processing spans multiple Disk Drives (when the stripe size is too small) during transaction processing in RAID 5, the performance cannot be exhibited sufficiently.

Therefore, the stripe size of 256 k bytes is set as a default value in this subsystem. When the Cache Partition Manager function of the priced option is used, the stripe size can be changed to 256 k bytes or 512 k bytes for each LU.
Lump writing of data on the Disk Drive and pre-reading of old data are performed by use of the cache memory so as prevent occurrence of write penalty as far as possible.

- Write penalty
  In the RAID 5 configuration, 3 to 16 Disk Drives compose one parity group (2D+1P to 15D+1P); in the RAID 6 configuration, 4 to 30 Disk Drives compose one parity group (2D+2P to 28D+2P). Since parity data is generated from 2 to 15 data disks in the group, when partial writing of one stripe in the group occurs in the transaction processing, it is necessary to generate the corresponding parity data in the group once again. For RAID 5, since parity data is calculated by the following calculation formula, “data before update”, “parity before update” and “data after update” are necessary to create the parity.

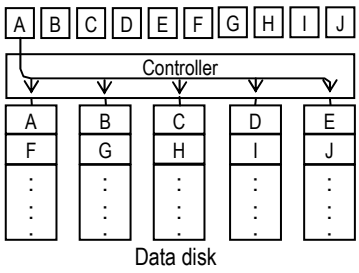
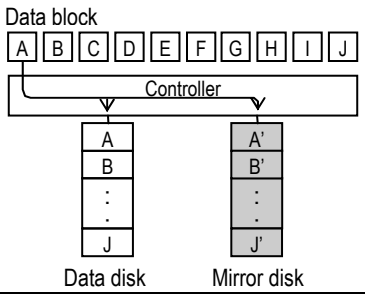
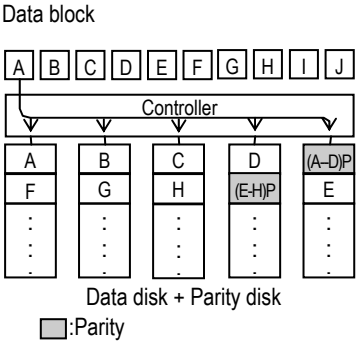
  RAID 5:
  [New parity] = ([Data before update] EOR [Data after update]) EOR [Parity before update]

  RAID 6:
  [New P parity] = ([Data before update] EOR [Data after update]) EOR [P parity before update]
  [New Q parity] = [Coefficient parity] AND ([Data before update] EOR [Data after update]) EOR [Q parity before update]

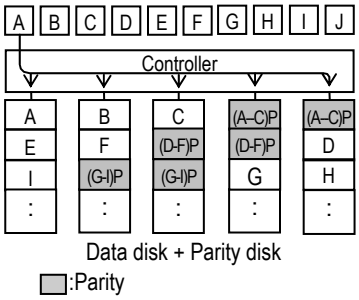
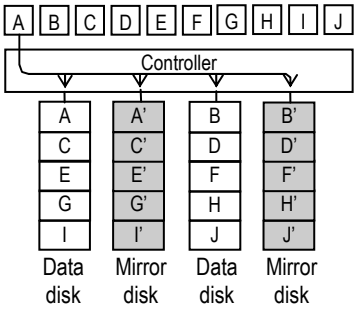
1.1.2 RAID Levels

It is necessary to understand the characteristics of each RAID level to make the environment most suitable for the system you want to construct.
The Hitachi AMS series support RAID 1, RAID 5 (2D+1P to 15D+1P), RAID 6 (2D+2P to 28D+2P) and RAID 1+0 (2D+2D to 8D+8D), and also support RAID 0 (2D to 16D) if the RKM/RKS/RKAK/RKAKX is connected.

Table 1.1.1 Outline of RAID Levels

Level	Configuration	Characteristics	
RAID 0		Outline	RAID 0 stripes data across Disk Drives (five Disk Drives in the DF800) to attain higher throughput.
		Advantages	Because Disk Drives having redundant data is not needed, Disk Drives can be used efficiently.
		Disadvantage	Data is lost in any failure of the Disk Drive.
RAID 1		Outline	RAID 1 provides data redundancy by copying all the contents of two Disk Drive to another (mirroring). Read/write performance is a little better than the individual Disk Drive.
		Advantages	Data is not lost even if a failure occurs in any Disk Drive. Performance is not lowered even when a Disk Drive fails.
		Disadvantage	RAID 1 is expensive because it requires twice the Disk capacity.
RAID 5		Outline	RAID 5 consists of three or more Disk Drives. It uses one of them as a parity disk and writes divided data on the other Disk Drives. Recovery from a failure of a data is possible by utilizing the parity data. Since the parity data is stored on all the Disk Drives, a bottleneck of the parity disk does not occur.
		Advantages	When reading data, RAID 5 stripes data across Disk Drives in the same way as that in RAID 0 to attain higher throughput.
		Disadvantage	When writing data, since parity data is required to be updated, performance of writing small random data is lowered although there is no problem regarding writing of continuous data. The performance is also lowered when a Disk Drive fails.

*1 : Only the RAID levels supported by DF800 are explained.

Level	Configuration	Characteristics	
RAID 6	Data block  Data disk + Parity disk :Parity	Outline	RAID 6 consists of four or more disk drives. Two independent disk drives of them are used as parity disk drives and data is scattered and written to the rest of them. The parity data enables data to be restored even when the two disk drives fail at the same time.
		Advantages	RAID 6 has ability to withstand failures that is superior to RAID 5 because one data block has two parities.
		Disadvantage	The performance is lowered because the number of disk drives is increased by one in comparison with that of RAID 5. The performance is lowered when one or two disk drives is/are failed.
RAID 1+0	Data block  	Outline	RAID 1+0 provides data redundancy like RAID 1 by copying all the contents of two Disk Drive to another. Different from RAID 1, data striping is performed over two to eight (RKS is seven) sets of two Disk Drives.
		Advantages	Data is not lost even if any Disk Drive fails. Besides, since RAID 1+0 stripes data, it can make the performance of dealing with small size random accesses higher comparing with RAID 1. Performance is not lowered even when a Disk Drive fails.
		Disadvantage	RAID 1+0 is expensive because it requires twice the disk capacity.

*1 : Only the RAID levels supported by DF800 are explained.

1.2 Overview of the DF800

1.2.1 Overview of Functions

- This subsystem has rackmount model.
  A rackmount model is a subsystem which uses Basic Chassis (RKH/RKEH/RKM/RKEM/RKS/RKES/RKEXS/RKHED/RKEHD) with Additional Chassis (RKAK/RKAKX/RKAKD) combined(‡1). The RKH/RKEH, RKM/RKEM, RKS/RKES, RKEXS, RKAK and RKAKX are the models which are supplied from AC power supply for external power supplying. The RKHED/RKEHD and RKAKD are the models which are supplied from DC power supply for external power supplying
  [Basic Chassis]
  - DF800-RKH (hereinafter called RKH.)
  - DF800-RKEH (hereinafter called RKEH.)
  - DF800-RKM (hereinafter called RKM.)
  - DF800-RKEM (hereinafter called RKEM.)
  - DF800-RKS (hereinafter called RKS.)
  - DF800-RKES (hereinafter called RKES.)
  - DF800-RKEXS (hereinafter called RKEXS.)
  - DF800-RKHED (hereinafter called RKHED.)
  - DF800-RKEHD (hereinafter called RKEHD.)

  [Additional Chassis]
  - DF-F800-RKAK (hereinafter called RKAK)
  - DF-F800-RKAKX (hereinafter called RKAKX)
  - DF-F800-RKAKD (hereinafter called RKAKD)

- The RKH is a CTU (Control Unit) in which Disk Drive are not installed. The RKH is a subsystem which configures a subsystem by connecting the RKAK/RKAKX and performs RAID control for the Disk Drives to be installed by the Control Unit. A subsystem can contain 480 disk drives, and connect up to 32 RKAKs or 10 RKAKXs.
- One RKAK installs up to 15 Disk Drives and can be used being connected to the RKH, RKM or RKS.
- One RKAKX installs up to 48 SATA Disk Drives (38 SAS Disk Drives) and can be used being connected to the RKH, RKM or RKS.
  When using RKAKX, the firmware of the Basic Chassis needs to be 0860/A or more.
- The Fibre Channel is adopted in the interface of the host computer.
- The RKH, RKM, RKS, RKAK and RKAKX are models to be installed in a 19-type rack frame.
- One RKH can be connected to the maximum of 32 RKAKs or 10 RKAKXs by using the exclusive cables, and construct a system(‡1) making 480 Disk Drives one set by the Control Unit of the RKH.
- One RKM can be connected to the maximum of 15 RKAKs or 4 RKAKXs by using the exclusive cables, and construct a system(‡1) making 240 Disk Drives one set by the Control Unit.
- One RKS can be connected to the maximum of 7 RKAKs or 3 RKAKXs by using the exclusive cables, and construct as system(‡1) making 120 Disk Drives (up to 159 Disk Drives when using RKAKXs) one set by the Control Unit of the RKS.

‡1 : Two or more RKHs/RKMs/RKSs/RKEXSs cannot be connected to one disk subsystem.

- There is a special rack frame (DF-F800-RK40) that can install a various combination of the RKH/RKM/RKS/RKAKX (4U) and the RKAK (3U) to the maximum of 40U (EIA standard)
- The Fibre Channel interface is adopted, and it can be transferred between the hosts with the maximum of 800 M bytes/s.
- The Fibre Channel interface of the RKM installs the 4 port/1 Control Unit.
- The Fibre Channel interface of the RKEM installs the 4 ports on board/1 Control Unit. Also, one optional FC interface board with 4 ports can be installed.
- The Fibre Channel interface of the RKS installs the 2 port/1 Control Unit.
- The Fibre Channel interface of the RKES installs the 2 ports on board/1 Control Unit. Also, one optional FC interface board with 2 ports can be installed.
- The Fibre Channel interface of the RKEXS installs the 2 ports on board/1 Control Unit.
- The Fibre Channel interface of the RKH installs the 8 port/1 Control Unit (at the time of the FC Interface Board addition).

The characteristic function of this equipment is summarized next.

(a) Scalability

- Various systems that meet the wide range of needs can be constructed from the single RKM with up to 15 Disk Drives to a system in which the maximum of 240 Disk Drives can be increased by connecting up to 15 RKAKs or 4 RKAKXs to the RKM.(‡1)
- Various systems that meet the wide range of needs can be constructed from the single RKS with up to 15 Disk Drives to a system in which the maximum of 120 Disk Drives (up to 159 Disk Drives when using RKAKXs) can be increased by connecting up to 7 RKAKs or 3 RKAKXs to the RKS.(‡1)
- Various systems that meet the wide range of needs can be constructed in which the maximum of 480 Disk Drives can be increased by connecting up to 32 RKAKs or 10 RKAKXs to the RKH.
- By using the exclusive rack frame (RK40), you can construct systems that meet needs.
- The Spare Disk Drives, which can be set up to 30 in one system (up to 15 in case of the RKS), do not choose the positions to be installed.
  You can use the system effectively by installing each Spare Disk in a Disk Drive slot left unused as a result of the system configuration.
- From the host computer, the subsystem can be used not only as a single large scale Disk Drive but also as 4,096 (in case of the RKH)/4,096 (in case of the RKM)/2,048 (in case of the RKS) logical disks (LUs) at the maximum.
- The flexible system, which the Fibre Channel connectors of SW become connectable for the number of the connectors, can be constructed for the Fibre Channel device subsystem including the host computer and the DF800 by connecting to the Fabric switch (hereinafter called SW).

(b) Multi-RAID configuration

- Five RAID levels of RAID 0, RAID 1, RAID 5, RAID 6 and RAID 1+0 can be set up.
- Since RAID 1, RAID 5 and RAID 1+0 have parity disks (mirror disks) with redundancy, even if a failure occurs in one of Disk Drives, they do not lose data and can read/write the data as well as the time when there was no failure.

‡1 : Two or more RKHs/RKMs/RKSs/RKEXSs cannot be connected to one disk subsystem.

- Since RAID 6 has two parity disks and redundancy, it does not lose data even if up to two Disk Drives fail at the same time and can read/write the data as well as the time when there was no failure.
- For the configuration with RAID 1+0, you can construct a flexible system meeting your needs from the configuration with four data disks (2D+2D) to the configuration with16 data disks (8D+8D).
- For the configuration with RAID 5, you can construct a flexible system meeting your needs from the configuration with 3 data disks (2D+1P) to the configuration with16 data disks (15D+P).
- For the configuration with RAID 6, you can construct a flexible system meeting your needs from the configuration with 4 data disks (2D+2P) to the configuration with 30 data disks (28D+2P).

(c) High-speed data transfer

- The subsystem can read/write data at high speed by starting two or more Disk Drives in parallel.
- With the Fibre Channel Connection, the subsystem can transfer data between the host computer and the subsystem at the maximum speed of 800 M bytes/s. Enough throughput can be acquired even when connecting two or more devices and making multiple access.
- Non-volatile large-capacity Cache memory (RKH is 2,048 M bytes/CTL to 16,384 M bytes/CTL, RKM is 1,024 M bytes/CTL to 8,192 M bytes/CTL, RKS is 1,024 M bytes/CTL to 4,096 M bytes/CTL) is adopted, and speed-up of command execution at the time of read/write hit is intended.

(d) Large capacity

- The maximum of 480 Disk Drives can be connected, and the Disk Drive capacity of the maximum of 351.5 T bytes (in case of RAID 0) can be achieved.

(e) High data availability

- In the redundant RAID configuration (RAID 1/1+0/5), the subsystem can continuously read/write data without shutting down the system by using the parity disks or mirror disks for the failure occurred in one Disk Drive.
- In the redundant RAID 6 configuration, the subsystem can continuously read/write data without shutting down the system by using parity disks for the failure occurred in up to two Disk Drives at the same time.

(f) High data reliability

- The Control Unit of the subsystem adds the original data assurance codes (8 bytes) by automatic generation, and writes them in the Disk Drive with the data. The data reliability is improved by checking the data at the time of reading.
- On the data bus in the Control Unit, the automatic generation of the data assurance codes and the check are executed, and the data reliability is improved by the data distribution and concentration control which is peculiar to the disk array.

(g) Diagnostic maintenance functions

- Diagnosis and maintenance of the subsystem can be performed by using the WEB function of a PC connected to the DF800 via a LAN.
- The status of the subsystem can be checked and a failed part can be identified by Hitachi Storage Navigator Modular 2.
- Diagnosis of the subsystem can be performed from a distant place by using the remote maintenance function (SNMP).

(h) Maintainability

- The addition and maintenance of the disk subsystem can be performed without powering off the system.
- All the parts of the maintenance target can be replaced without powering off the subsystem.
- When the correction copy attributing to the blockade of the dynamic sparing or the data Disk Drive is completed, if the capacity and the rotational speed are the same for the data Disk Drive and the Spare Disk Drive of the recovery destination and both of them are not the Disk Drives of the RKAK/RKAKX, the copy back does not operate even though the blocked Disk Drive is replaced because the attributes of the data Disk Drive and the Spare Disk Drive are switched.

  Therefore, the influence to the customer's operation is suppressed because there is no deterioration of the host I/O performance by the copy back start after the Disk Drive replacement, and the maintenance time is satisfied with the level of the replacement time of the Disk Drive, and the maintenance cost can be reduced.

  In the following cases, the copy backless does not operate, and the copy back surely operates after the Disk Drive replacement.

  - When the capacity or the rotational speed of the failed Disk Drive and the Spare Disk Drive which recovered the data differs

1.2.2 Differences between the DF800 and DF700

Differences between the DF800 and DF700 are shown below.

- Adoption of high-speed RISC processor
  The microprocessor for the RKM was changed from POWER PC 7447A (1.0 G Hz) of the DF800 to Intel-made LV Sossaman 1.67 G Hz that is faster and has higher performance. It is Value Sossaman 1.67 G Hz as for the RKEM/RKS/RKEXS. It is Sossaman 2 G Hz as for the RKH.
- Adoption of the maximum of 800 M bytes/s transfer with the Fibre Channel interface in the host interface
  The Fibre Channel interface is installed in the Control Unit as a standard function(‡1), and the maximum of 800 M bytes/s transfer is made in the host interface.
- Adoption of RAID 6
  The DF700 newly supported RAID 6. The DF800 supports RAID 6 as well.
- Duplicated power supply
  In the DF800 like the DF700, the power supply which integrates functions of the IN BOX and the Power Unit is duplicated as a standard configuration.
- Adoption of SAS Disk Drive
  The SAS Disk Drives are adopted for the DF800 although they were not adopted in the Disk Drives of the DF700. The maximum number of Disk Drives which can be connected to the RKM of the DF800 is 240 compared to 225 of the DF700, and various RAID configurationscan be constructed.
  The maximum number of Disk Drives which can be connected to the RKS of the DF800 is 120 compared to 105 of the DF700, and various RAID configurations can be constructed.
  The maximum number of Disk Drives which can be connected to the RKH of the DF800 is 480 compared to 450 of the DF700, and various RAID configurations can be constructed.
- Adoption of SATA Disk Drive
  The Disk Drives with the SATA interface are adopted for the RKM/RKS of the DF800 in the same way as the RKM of the DF700.
  The number of Disk Drives for the RKM of the DF800 is 240 compared to 225 of the DF700, and various RAID configurations can be constructed.
  The maximum number of Disk Drives which can be connected to the RKS of the DF800 is 120 compared to 105 of the DF700, and various RAID configurations can be constructed.
  The maximum number of Disk Drives which can be connected to the RKH of the DF800 is 480 compared to 450 of the DF700, and various RAID configurations can be constructed.
- Adoption of the model only for the SATA Disk Drive
  The model only for the SATA Disk Drive in the DF700 was the RKXS, but SATA Disk Drive is adopted in the Basic Chassis (RKM/RKS) of the DF800, and various RAID configurations can be constructed.

‡1 : For the RKEM/RKES/RKEXS, on-board Fibre Channel Interface is installed in the Control Unit.

1.3 Subsystem Structure

For a single unit of Rackmount model, there are RKM/RKS/RKEXS/RKH/RKAK/RKAKX/RKHED/RKAKD.
Rackmount model is configured by combining single units.
RKM/RKS/RKEXS/RKH/RKAK/RKAKX has a Power Unit power-supplied from AC power supply.
RKHED/RKAKD has a Power Unit power-supplied from DC power supply.

(1) The rackmount model that the RKM is the Basic Chassis can make the system configuration which connects the RKM (one unit) and the maximum of eleven units of the RKAK or four units of the RKAKX (Disk Drive: Maximum of 207 units) to one rack when the RK40 rack frame is used.
The system configuration, which connects the maximum of 15 units of the (Disk Drive: maximum of 240 units) to the maximum of two racks, can be made.
However, when mounting subsystems mixing RKAKs and RKAKXs, a maximum of 240 Disk Drives may not be mounted.
To the RKEM, the system can be configured by connecting up to five RKAKXs (Disk Drive: maximum of 255 units).
The rackmount model that the RKS is the Basic Chassis can make the system configuration which connects the RKS (one unit) and the maximum of seven units of the RKAK (Disk Drive: Maximum of 120 units) to one rack, can be made. The system can be also configured by connecting up to 3 RKAKXs to one RKS (up to 159 Disk Drives). When mounting subsystems mixing RKAKs and RKAKXs, the number of mountable Disk Drives depends on the combination.
The rackmount model that the RKEXS is the Basic Chassis can make the system configuration which connects the RKEXS (one unit) and the maximum of seven units of the RKAK (Disk Drive: maximum of 120 units) to one rack, can be made. The system can be also configured by connecting up to 3 RKAKXs to one RKEXS (up to 159 Disk Drives). When mounting subsystems mixing RKAKs and RKAKXs, the number of mountable Disk Drives depends on the combination.

The rackmount model that the RKH is the Basic Chassis can make the system configuration which connects the RKH (one unit), the maximum of eleven units of the RKAK or five units of the RKAKX (Disk Drive: Maximum of 240 units) to one rack when the RK40 rack frame is used.
The system configuration, which connects the maximum of 32 units of the RKAK or ten units of the RKAKX (Disk Drive: Maximum of 480 units) to the maximum of three racks, can be made.
However, when mounting subsystems mixing RKAKs and RKAKXs, a maximum of 480 Disk Drives may not be mounted.
When subsystems are mounted mixing the RKAKs and RKAKXs, the mounted number of each additional chassis and the maximum number of Disk Drives are shown in Table 1.3.1 and Table 1.3.2 (When the Basic Chassis is RKS and when its firmware is 0860/A or more and less than 0880/A, refer to Table 1.3.2).

Table 1.3.1 Mounted Number of Additional Chassis and the Maximum Mountable Number of Disk Drives

Basic Chassis (one unit)	Number of mounted additional chassis(*1)		Maximum mountable number of Disk Drives(*3)
	RKAK	RKAKX	
RKM	1	4	222 (182)
	5	3	234 (204)
	7	2	216 (196)
	11	1	228 (218)
	15	0	240 (240)
RKEM	0	5	255 (205)
	1	4	222 (182)
	5	3	234 (204)
	7	2	216 (196)
	11	1	228 (218)
	15	0	240 (240)
RKS(*2)/RKEXS	0	3	159 (129)
	3	2	156 (136)
	5	1	138 (128)
	7	0	120 (120)
RKH	0	10	480 (380)
	2	9	462 (372)
	6	8	474 (394)
	8	7	456 (386)
	12	6	468 (408)
	14	5	450 (400)
	16	4	432 (392)
	20	3	444 (414)
	24	2	456 (436)
	28	1	468 (458)
	32	0	480 (480)

*1 : For the RKH/RKM, up to 120 Disk Drives (60 Disk Drives for the RKS) are used per PATH. In the configuration including the RKAKX, if Disk Drives exceeding these limits are installed, the WARNING LED(orange) blinks. For the PATH #0, #1, #2, and #3 of the RKH, and the PATH #0 and #1 of the RKM/RKS, make the configuration where an equal number of Disk Drives are connected in both the A side and the B side of the RKAKX.

*2 : Table 1.3.1 indicates when the firmware of RKS is 0880/A or more. When the Basic Chassis is RKS, and when its firmware is 0860/A or more and less than 0880/A, refer to Table 1.3.2.

*3 : The figures in the brackets indicate the maximum mountable number when the SAS drives are installed in the RKAKX.

Table 1.3.2 Mounted Number of Additional Chassis and the Maximum Mountable Number of Disk Drives (When the firmware of RKS is 0860/A or more and less than 0880/A)

Basic Chassis (one unit)	Number of mounted additional chassis		Maximum mountable number of Disk Drives
	RKAK	RKAKX	
RKS	3	1	108
	7	0	120

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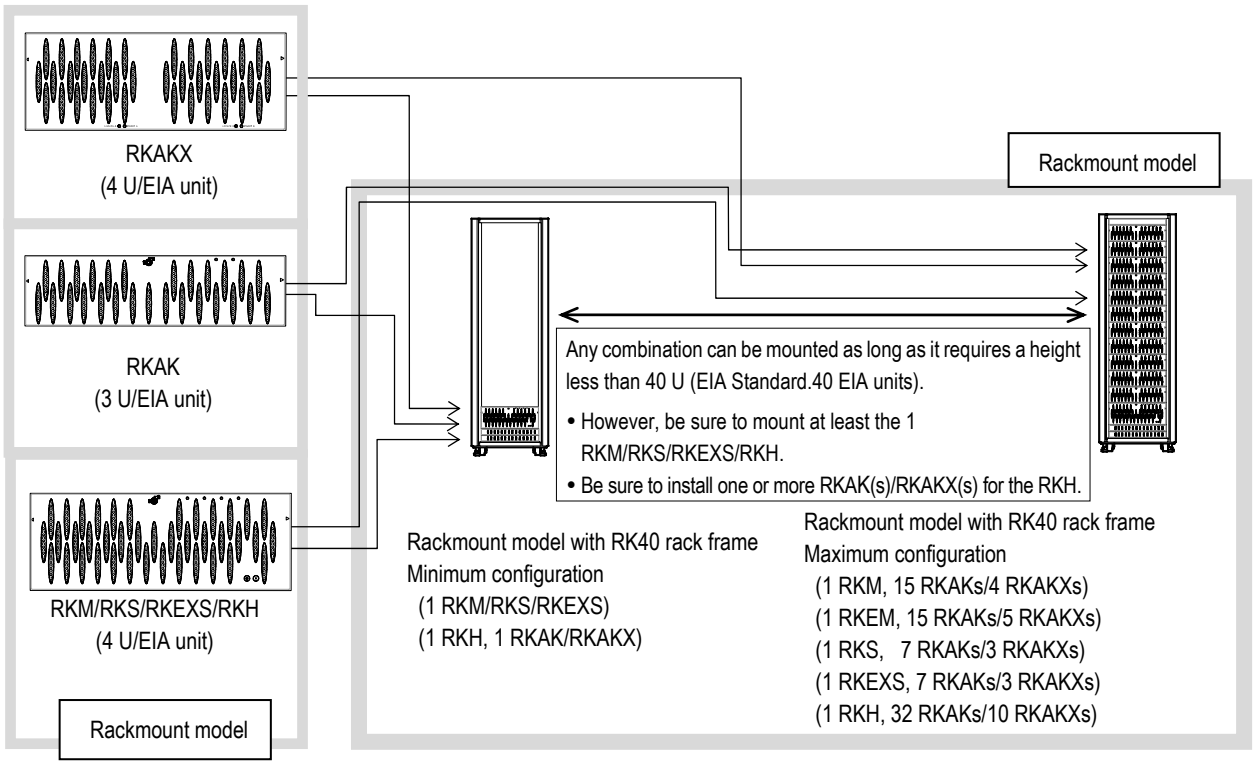

Figure 1.3.1 Subsystem Configuration

1.3.1 External Appearances

(1) Rackmount model (RKM, RKS, RKH/RKHED, RKAK/RKAKD, RKAKX)

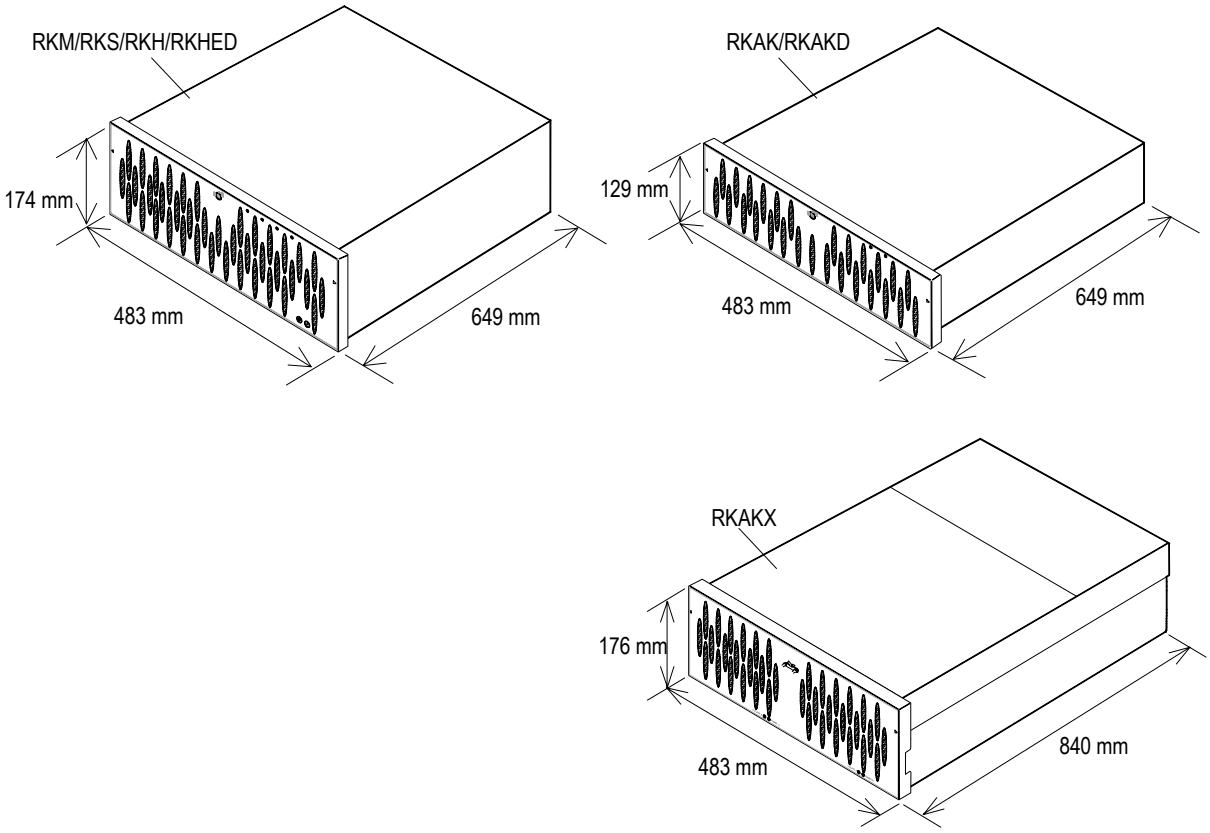

Figure 1.3.2 Appearances of the RKM, RKS, RKH/RKHED, RKAK/RKAKD, RKAKX

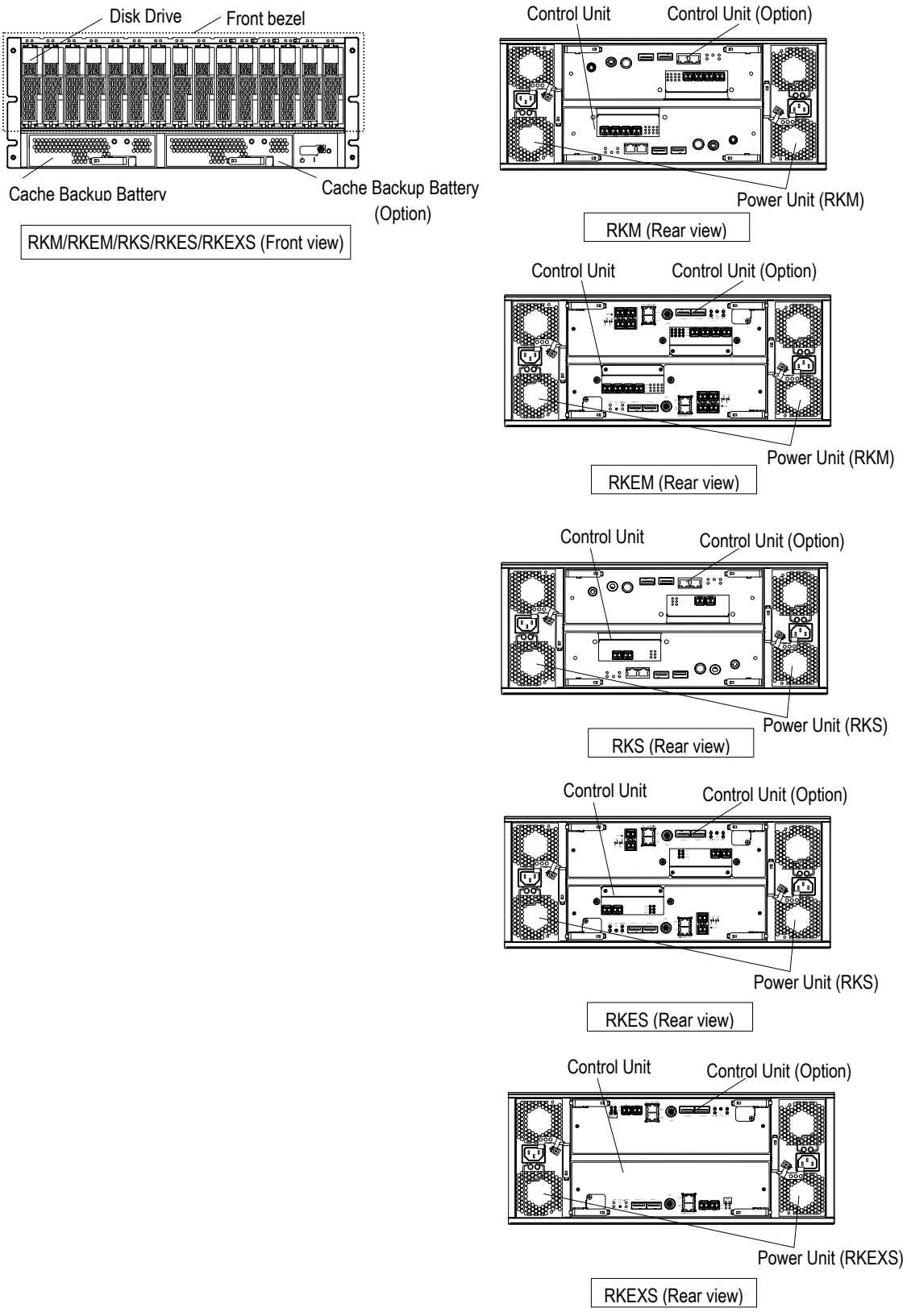

Figure 1.3.3 Major Components of the RKM/RKEM and RKS/RKES/RKEXS

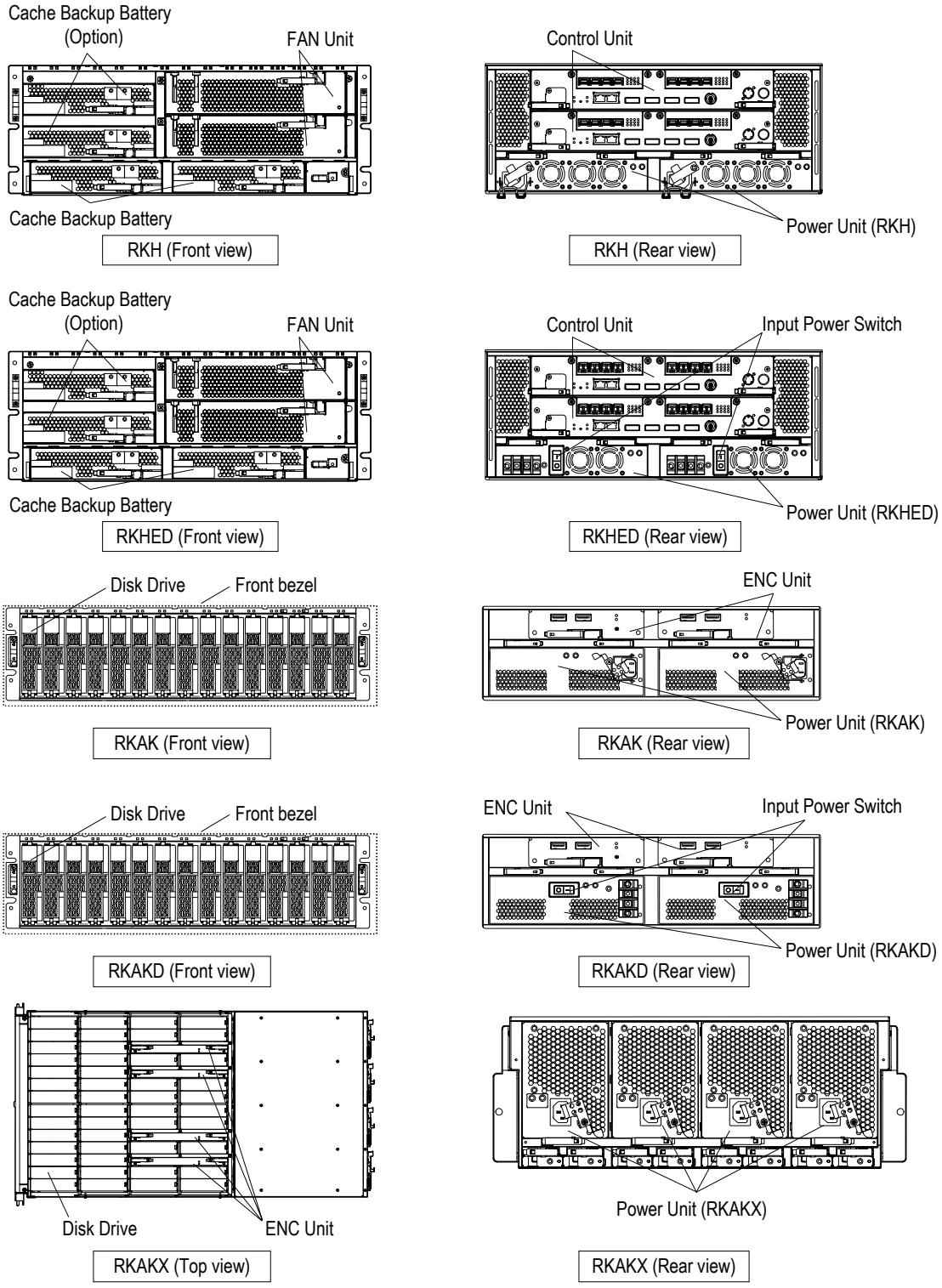

Figure 1.3.3.1.1 Major Components of the RKH/RKHED, RKAK/RKAKD and RKAKX

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(2) Additional Battery Box

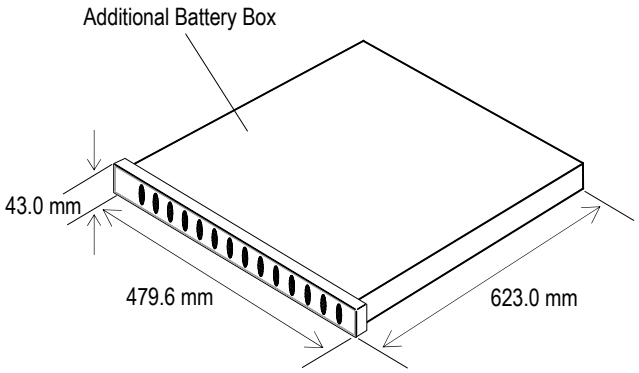
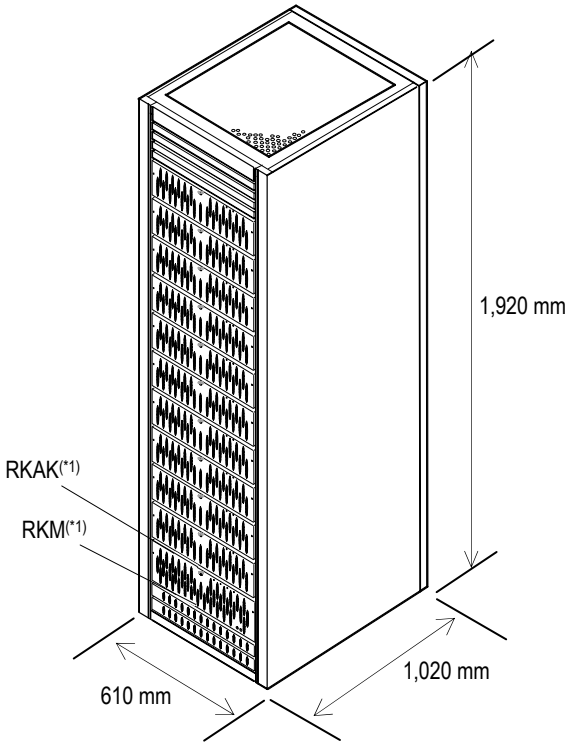


Figure 1.3.3.1 Appearances of the Additional Battery Box

(3) Rackmount model with RK40 rack frame

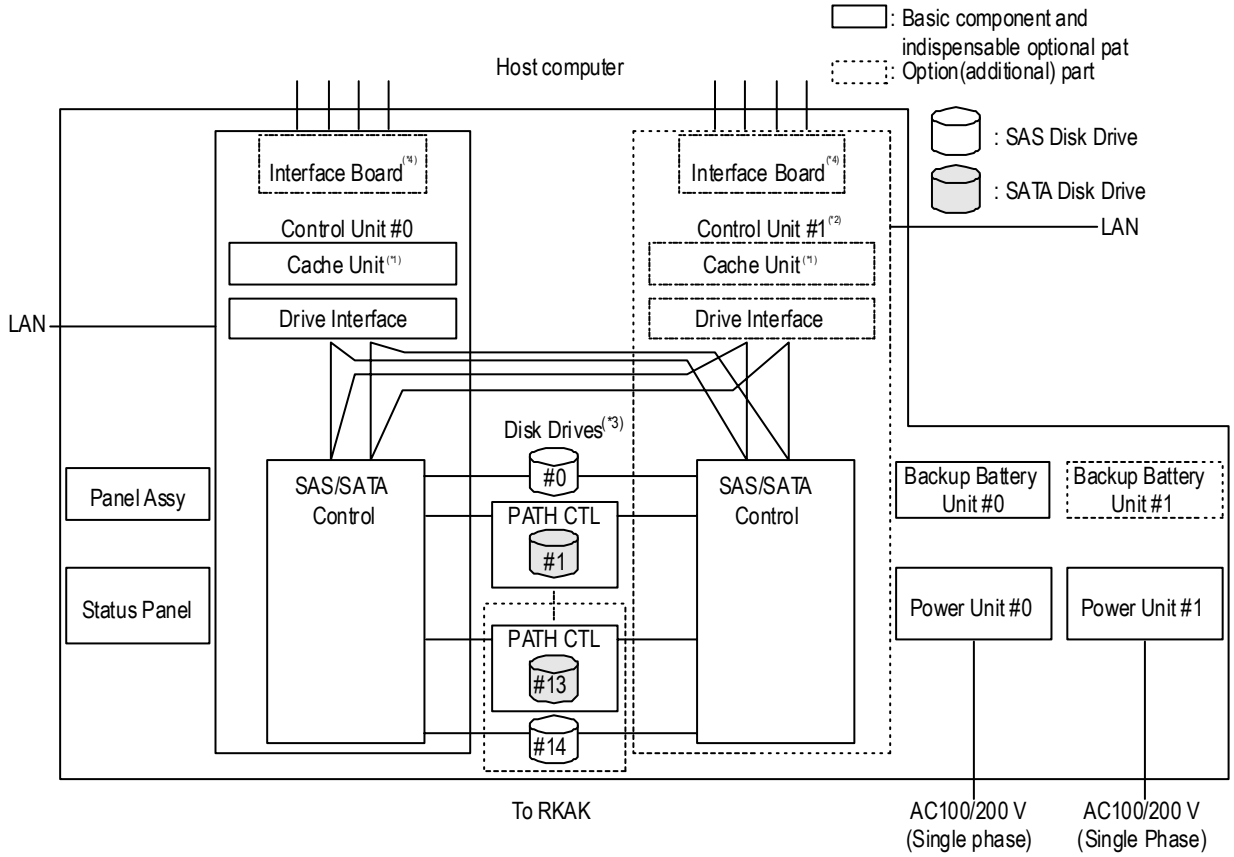


*1 : This figure shows an example of a subsystem with the one RKM and eleven RKAKs.

Figure 1.3.4 Appearances of the Rackmount Model with RK40 Rack Frame

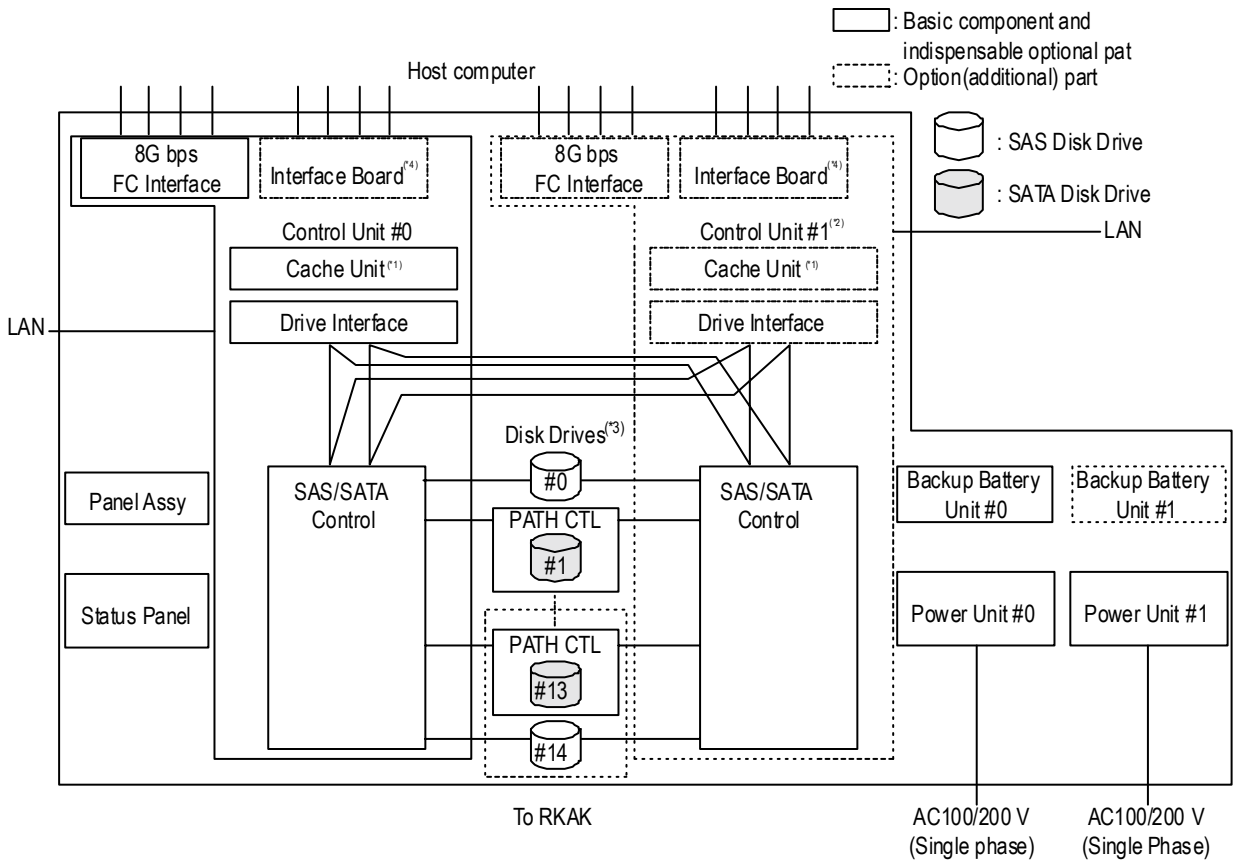
1.3.2 System Configuration of the Rackmount Model

(1) System configuration of the rackmount model
Figure 1.3.5 to Figure 1.3.8.3 shows the block configurations.



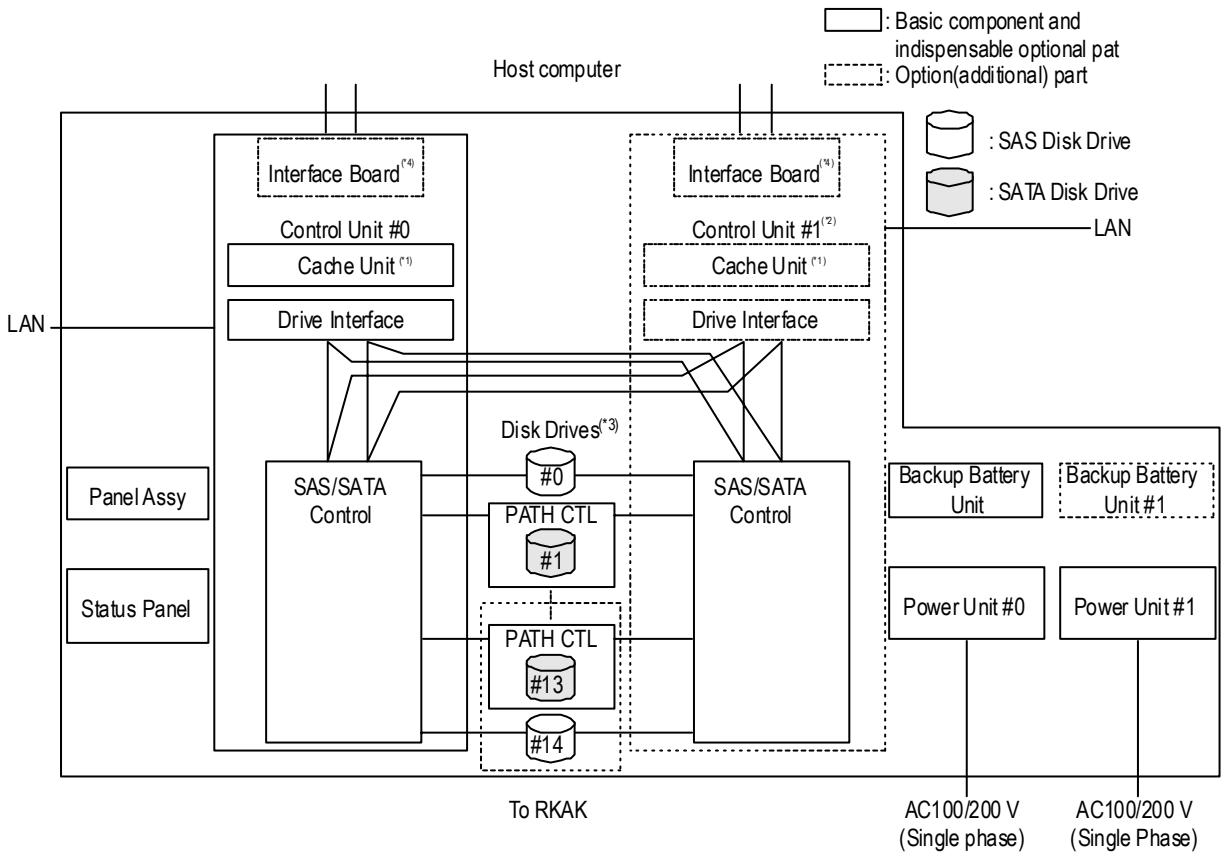
*1 : Cache Unit :
DF-F800-C1GK, DF-F800-C2GK, DF-F800-C4GK
*2 : Control Unit
RKM : DF-F800-F1KM
*3 : Disk Drive :
DF-F800-AKH146, DF-F800-AKH300, DF-F800-AKH450, DF-F800-AKF400, DF-F800-AKH600
DF-F800-AVE500, DF-F800-AVE750, DF-F800-AVE1K, DF-F800-AVE2K
DF-F800-AKS200
*4 : Interface Board :
DF-F800-DKF84
DF-F800-DKF44
DF-F800-DKS12

Figure 1.3.5 System Configuration Block Diagrams of the RKM



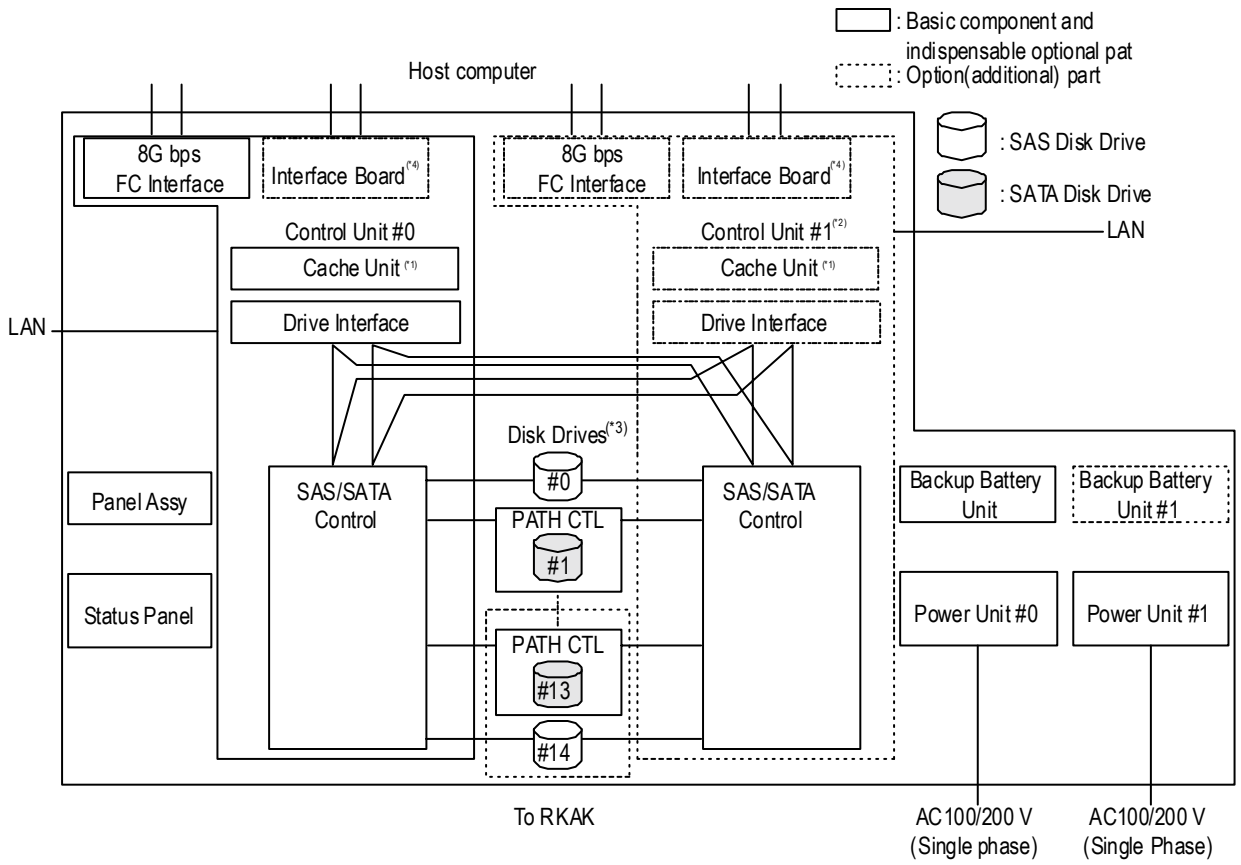
*1 : Cache Unit :
DF-F800-C1GK, DF-F800-C2GK, DF-F800-C4GK
*2 : Control Unit
RKEM : DF-F800-F1KEM
*3 : Disk Drive :
DF-F800-AKH146, DF-F800-AKH300, DF-F800-AKH450, DF-F800-AKF400, DF-F800-AKH600
DF-F800-AVE500, DF-F800-AVE750, DF-F800-AVE1K, DF-F800-AVE2K
DF-F800-AKS200
*4 : Interface Board :
DF-F800-DKF84
DF-F800-DKF44
DF-F800-DKS12

Figure 1.3.5.1 System Configuration Block Diagrams of the RKEM



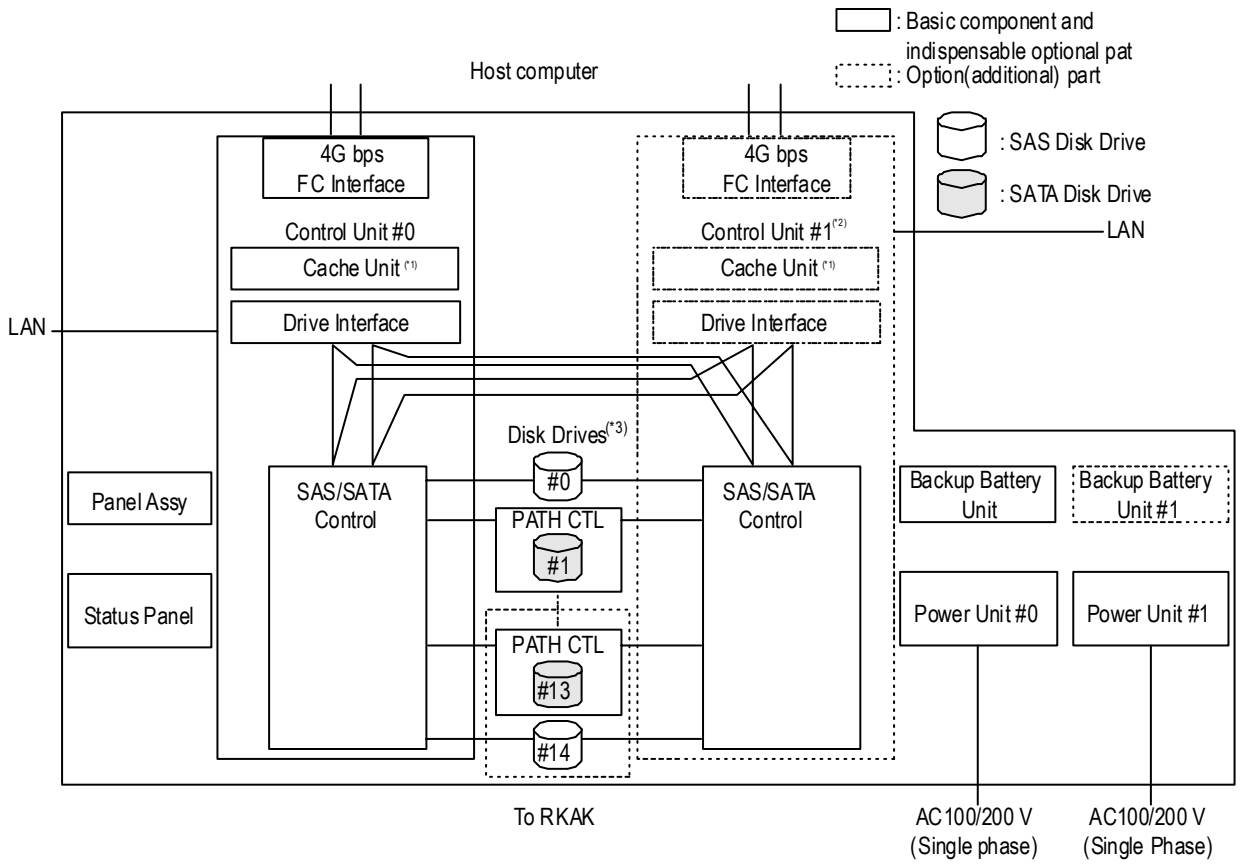
*1 : Cache Unit :
DF-F800-C1GK, DF-F800-C2GK, DF-F800-C4GK
*2 : Control Unit
RKS : DF-F800-F1KS
*3 : Disk Drive :
DF-F800-AKH146, DF-F800-AKH300, DF-F800-AKH450, DF-F800-AKF400, DF-F800-AKH600
DF-F800-AVE500, DF-F800-AVE750, DF-F800-AVE1K, DF-F800-AVE2K
DF-F800-AKS200
*4 : Interface Board :
DF-F800-DKF42
DF-F800-DKS12

Figure 1.3.6 System Configuration Block Diagrams of the RKS



*1 : Cache Unit :
DF-F800-C1GK, DF-F800-C2GK, DF-F800-C4GK
*2 : Control Unit
RKES : DF-F800-F1KES
*3 : Disk Drive :
DF-F800-AKH146, DF-F800-AKH300, DF-F800-AKH450, DF-F800-AKF400, DF-F800-AKH600
DF-F800-AVE500, DF-F800-AVE750, DF-F800-AVE1K, DF-F800-AVE2K
DF-F800-AKS200
*4 : Interface Board :
DF-F800-DKF82
DF-F800-DKF42
DF-F800-DKS12

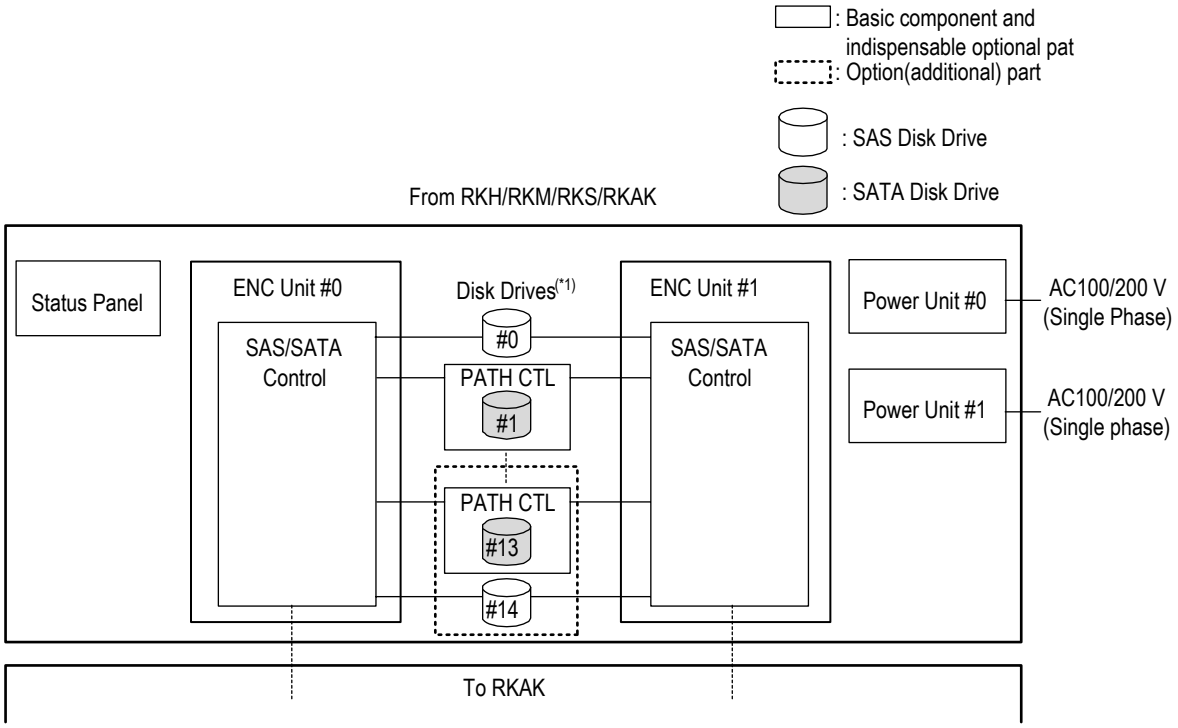
Figure 1.3.6.1 System Configuration Block Diagrams of the RKES



*1 : Cache Unit :
DF-F800-C1GK, DF-F800-C2GK, DF-F800-C4GK
*2 : Control Unit
RKEXS : DF-F800-F1KEXS
*3 : Disk Drive :
DF-F800-AKH146, DF-F800-AKH300, DF-F800-AKH450, DF-F800-AKF400, DF-F800-AKH600
DF-F800-AVE500, DF-F800-AVE750, DF-F800-AVE1K, DF-F800-AVE2K
DF-F800-AKS200

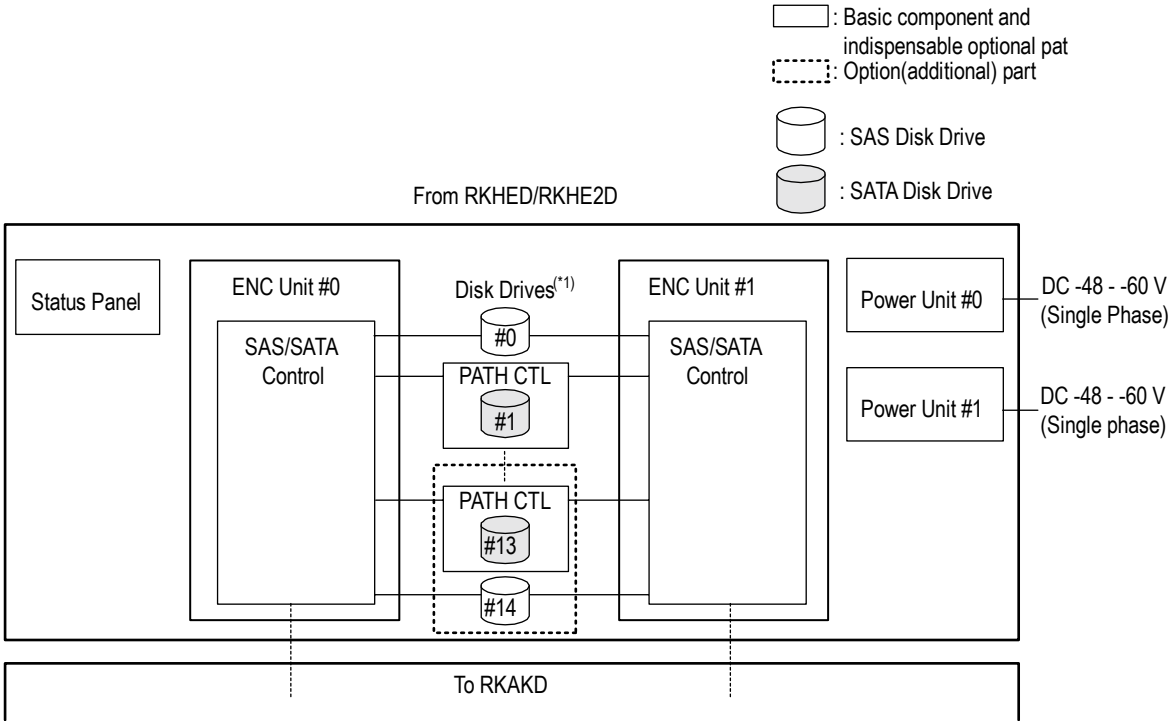
Figure 1.3.6.2 System Configuration Block Diagrams of the RKEXS

This page is for editorial purpose only.



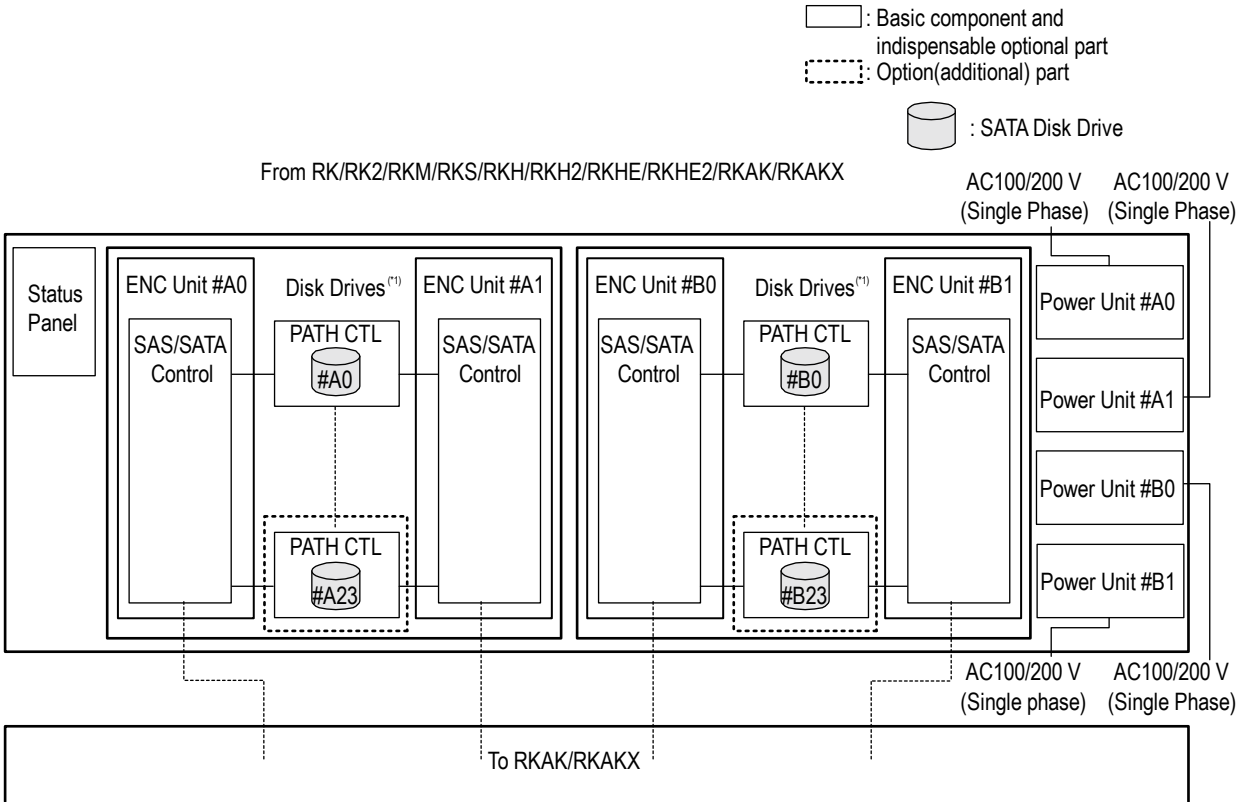
*1 : Disk Drive :
DF-F800-AKH146, DF-F800-AKH300, DF-F800-AKH450, DF-F800-AKF400, DF-F800-AKH600
DF-F800-AVE500, DF-F800-AVE750, DF-F800-AVE1K, DF-F800-AVE2K
DF-F800-AKS200

Figure 1.3.7 System Configuration Block Diagrams of the RKAK



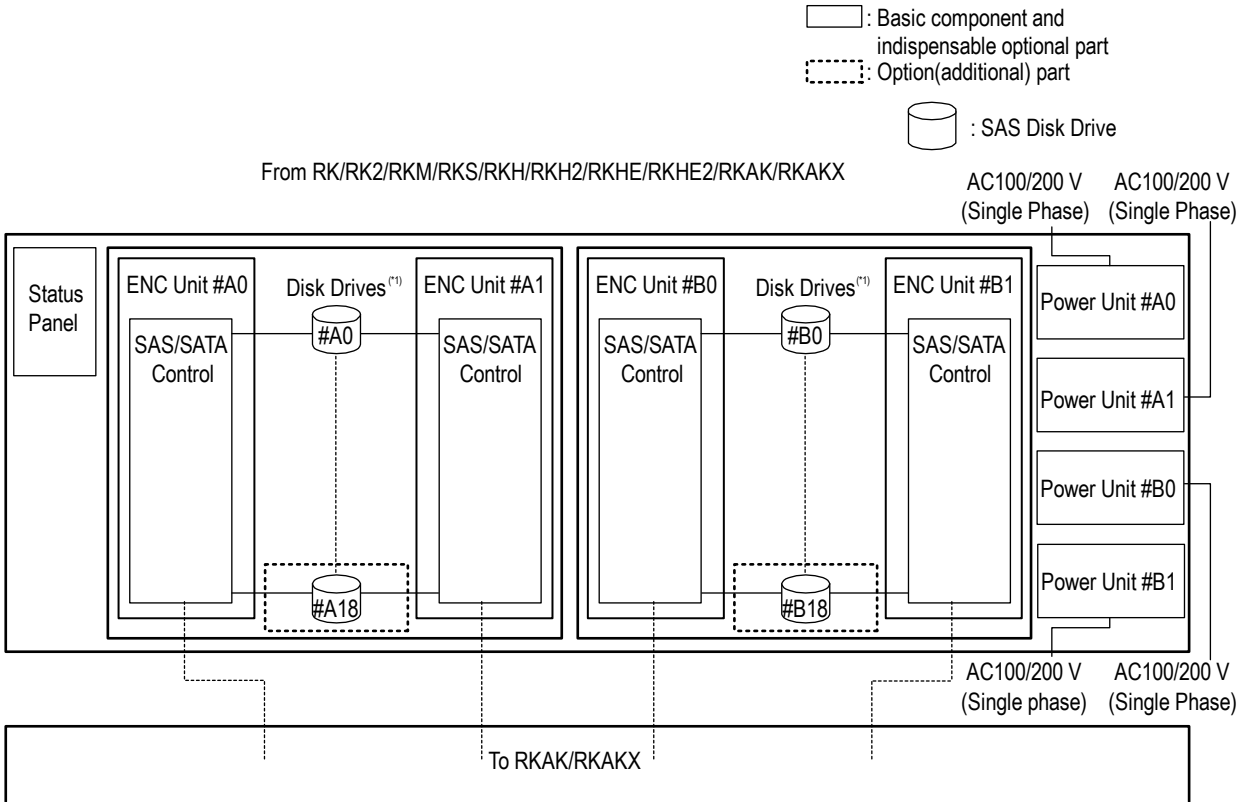
*1 : Disk Drive :
DF-F800-AKH146, DF-F800-AKH300, DF-F800-AKH450, DF-F800-AKF400, DF-F800-AKH600
DF-F800-AVE500, DF-F800-AVE750, DF-F800-AVE1K, DF-F800-AVE2K
DF-F800-AKS200

Figure 1.3.7.1 System Configuration Block Diagrams of the RKAKD



*1 : Disk Drive :
DF-F800-AVE1KX, DF-F800-AVE2KX
In a RKAKX, intermix of SAS Disk Drives and SATA Disk Drives is not supported for installation.

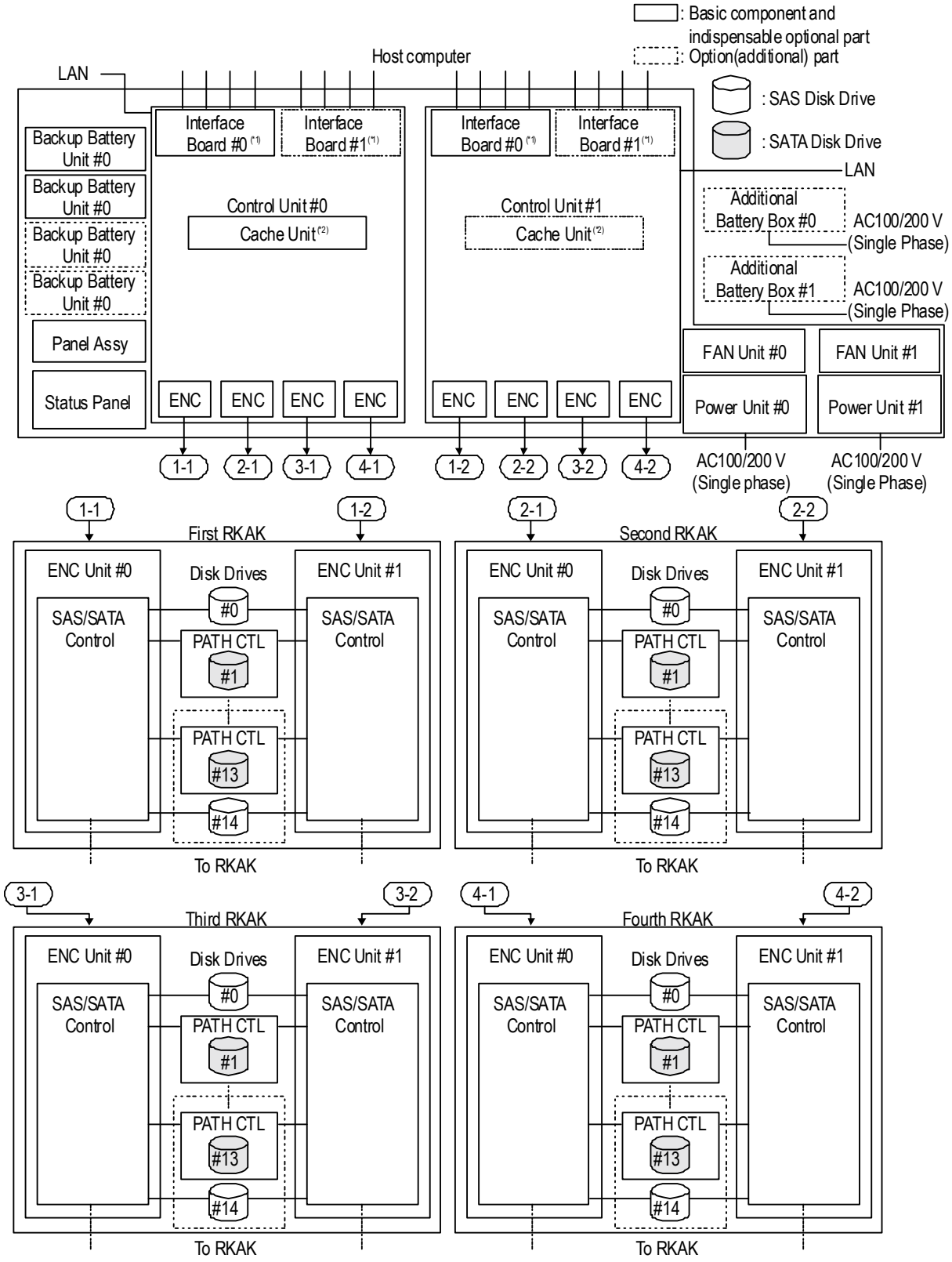
Figure 1.3.7.2 System Configuration Block Diagrams of the RKAKX (Installed SATA Disk Drive)



*1 : Disk Drive :
DF-F800-AKH450X, DF-F800-AKH600X
In a RKAKX, intermix of SAS Disk Drives and SATA Disk Drives is not supported for installation.

Figure 1.3.7.3 System Configuration Block Diagrams of the RKAKX (Installed SAS Disk Drive)

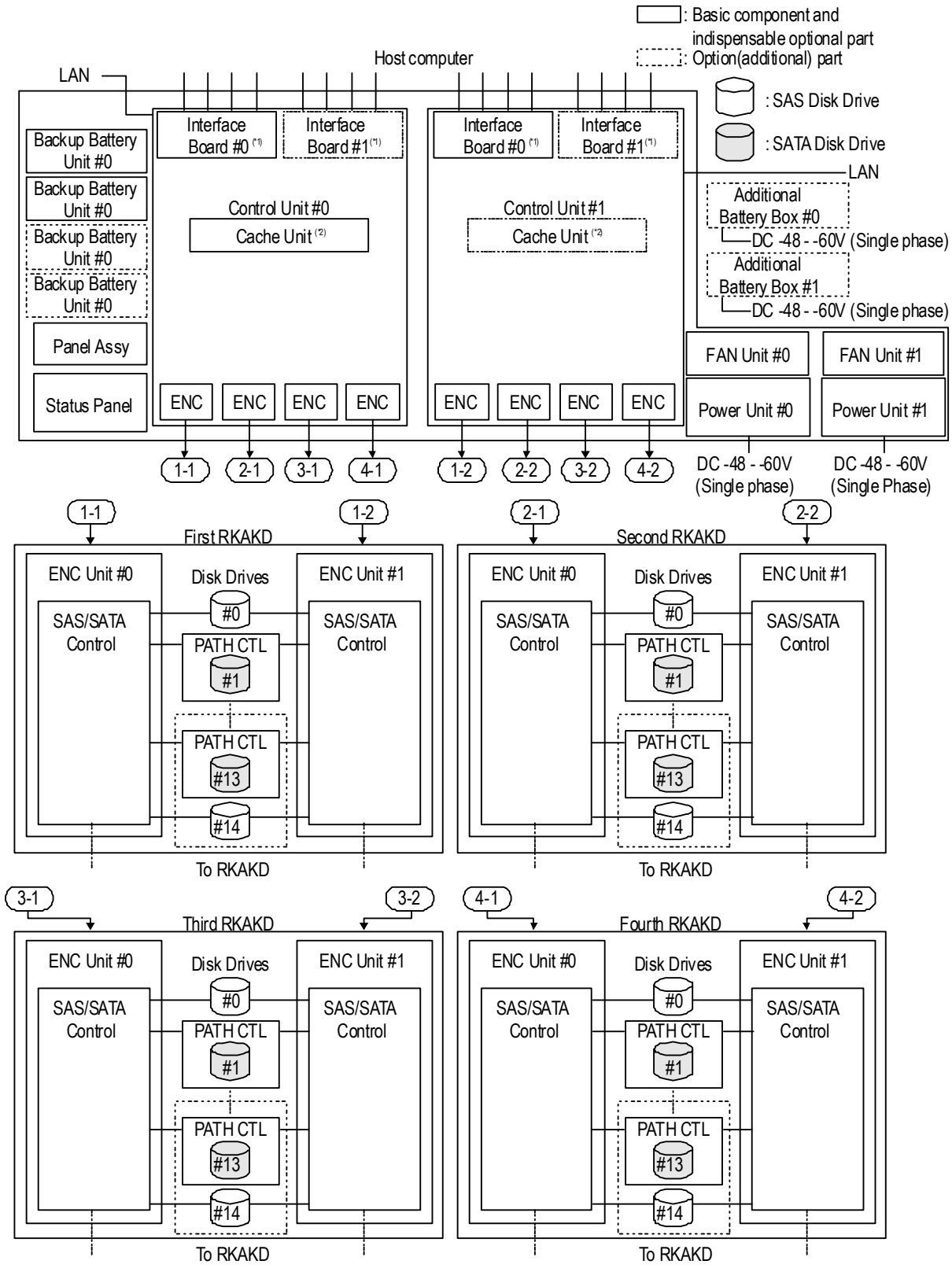
This page is for editorial purpose only.



*1: Interface Board : DF-F800-DKF44, DF-F800-DKS12

*2 : Cache Unit : DF-F800-C1GK, DF-F800-C2GK, DF-F800-C4GK

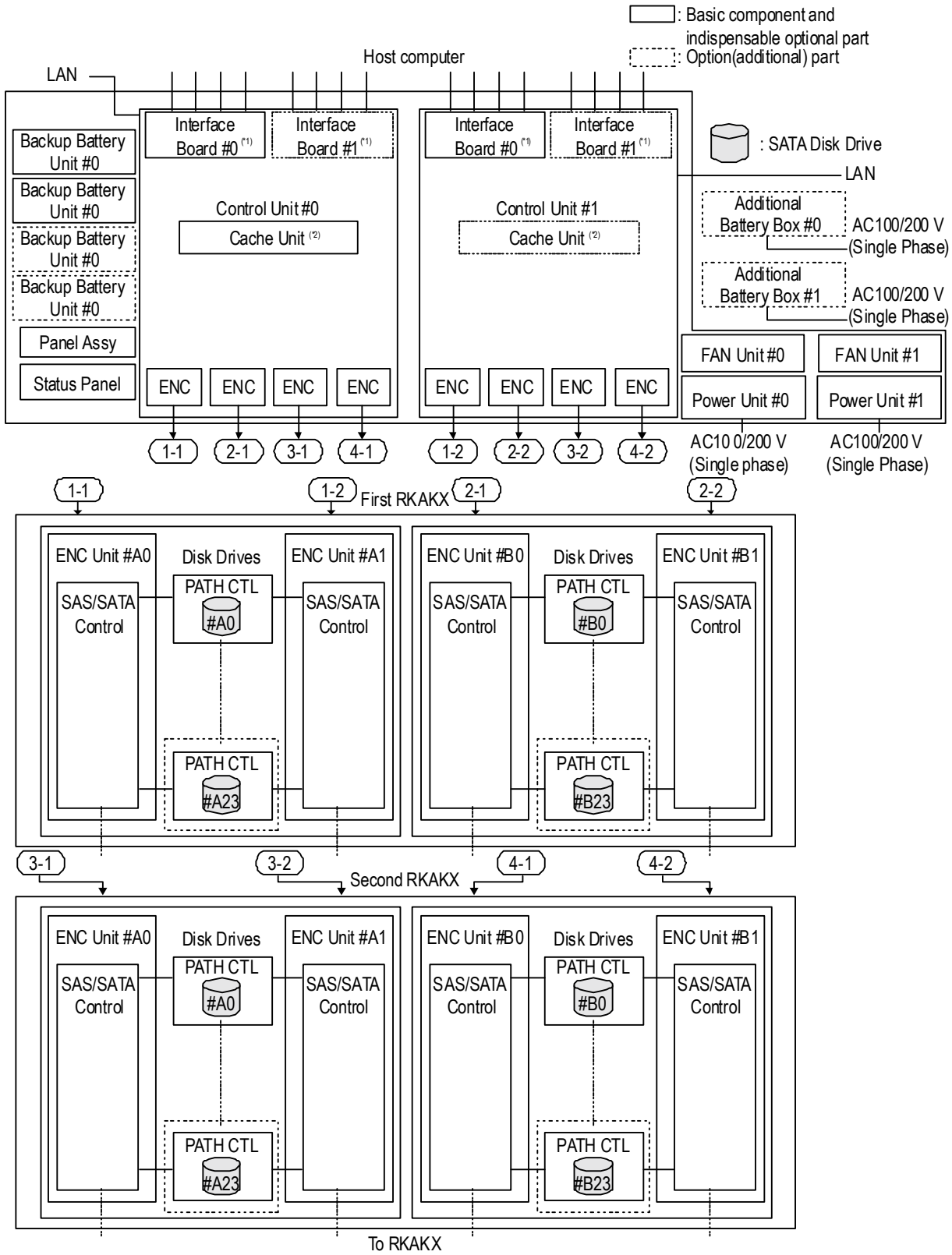
Figure 1.3.8 System Configuration Block Diagrams of the RKH (RKH+RKAK)



*1: Interface Board : DF-F800-DKF44, DF-F800-DKS12

*2 : Cache Unit : DF-F800-C1GK, DF-F800-C2GK, DF-F800-C4GK

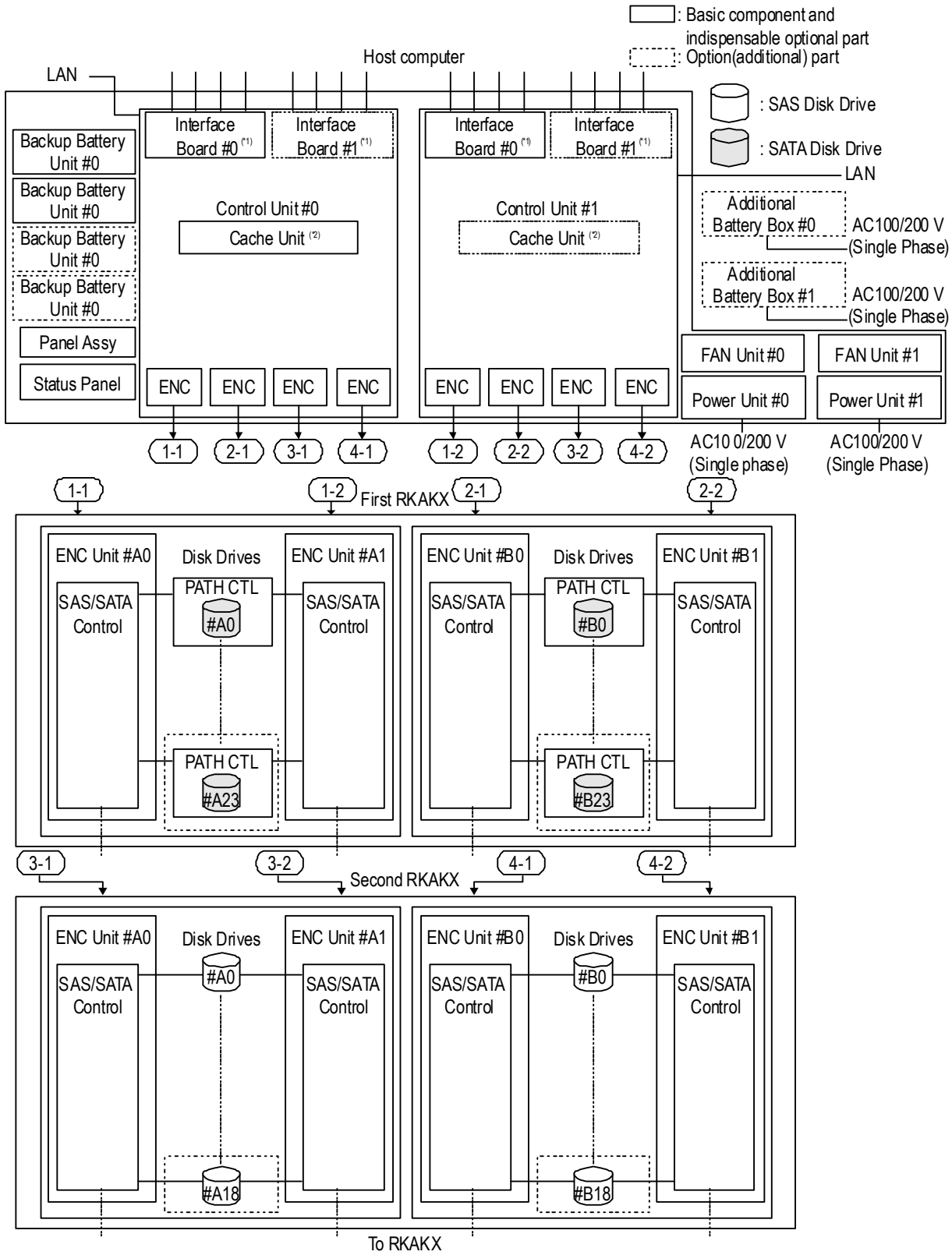
Figure 1.3.8.1 System Configuration Block Diagrams of the RKHED (RKHED+RKAKD)



*1: Interface Board : DF-F800-DKF44, DF-F800-DKS12

*2 : Cache Unit : DF-F800-C1GK, DF-F800-C2GK, DF-F800-C4GK

Figure 1.3.8.2 System Configuration Block Diagrams of the RKH (RKH+RKAKX) (Installed SATA Disk Drive)



*1: Interface Board : DF-F800-DKF44, DF-F800-DKS12

*2 : Cache Unit : DF-F800-C1GK, DF-F800-C2GK, DF-F800-C4GK

Figure 1.3.8.3 System Configuration Block Diagrams of the RKH (RKH+RKAKX) (Installed SAS Disk Drive)

This page is for editorial purpose only.

1.3.3 Configuration of Rackmount Model with RK40 Rack Frame

(1) Configuration of rackmount model with RK40 rack frame

A-6516-RK40 is mounting up to a height of 40 U (EIA Standard). (One RKM and eleven RKAKs) It consists of a rack frame main body and PDBs to be used to supply AC power to power supply units. The PDBs should be installed with a set of two PDBs to allow the power system to be duplicated.

Up to the eleven RKAKs can be mounted through an addition of the six PDU6s (option).

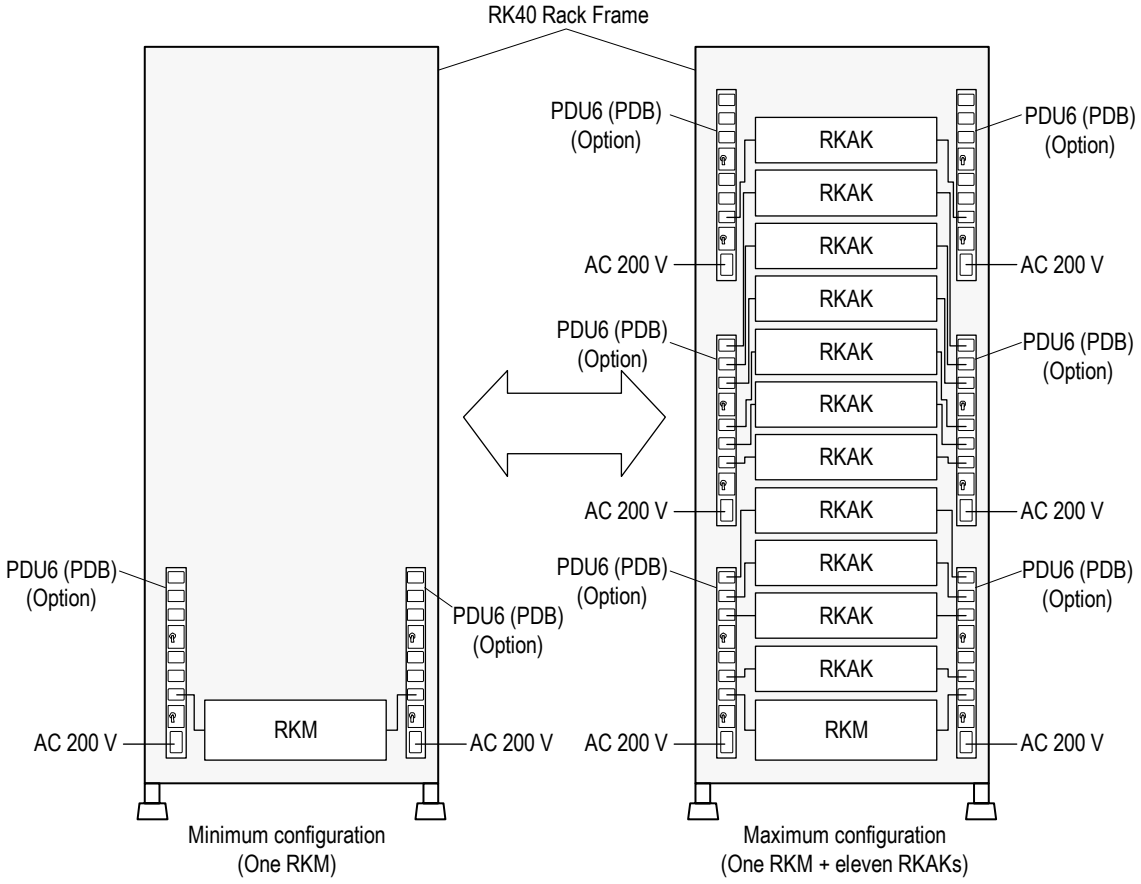


Figure 1.3.9 System Configuration of Rackmount Model with RK40 Rack Frame

1.4 Configuration of Internal Power Supply System

For a single unit of rackmount models, there are RKH/RKM/RKS/RKAK/RKAKX/RKHED/RKAKD. Rackmount models are configured by combining the single units.
The RKM/RKS/RKH/RKAK/RKAKX has the Power Unit to receive AC as the external power supply.
The RKHED/RKAKD has the Power Unit to receive DC as the external power supply.

(1) Internal power supply system configuration (RKM/RKS/RKH/RKAK/RKAKX)
Figure 1.4.1, Figure 1.4.2, Figure 1.4.3 and Figure 1.4.4 shows the connection diagrams of the internal power supply system of the RKM, RKS, RKH, RKAK and RKAKX respectively.
Input power to the RKM, RKS, RKH, RKAK and RKAKX is supplied from the Power Unit.
Even if the main switch is off, each voltage (BS) is supplied. For turning off the supply of each power voltage (BS), it is required to remove the power cables from the Power Units(‡1).
Two Power Units are installed as the standard to duplicate the power supply system.
Accordingly, the subsystem can continue its operation even when a failure occurs in one of the Power Unit or power cables. Further, part replacement can be done while the subsystem is operating.

‡1 : In the situation where the main switch is turned off, do not leave the components removed from the subsystem for a long time. The power supply alarm can be given because of an abnormal alarm.

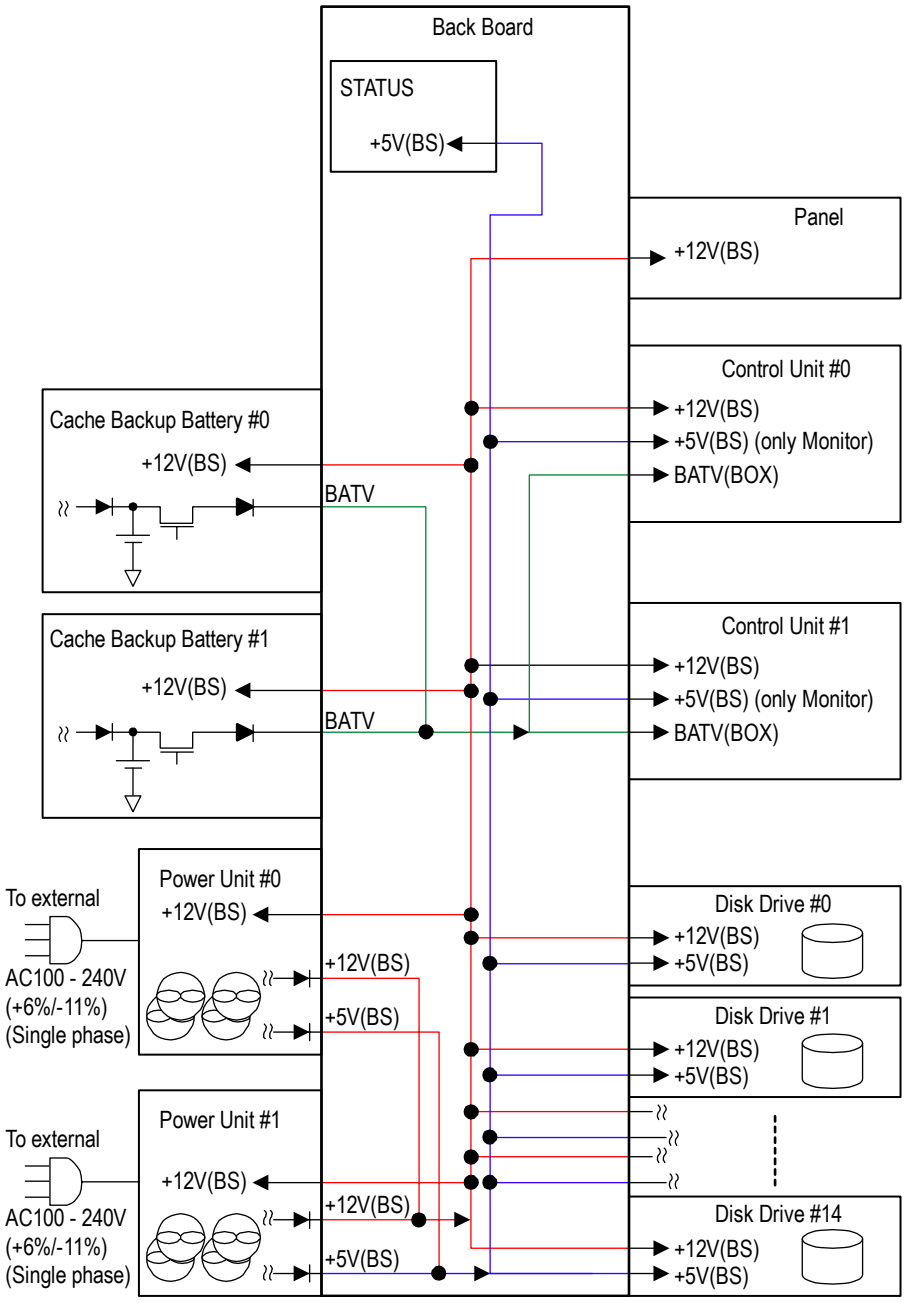


Figure 1.4.1 Connection Diagram of Power Supply System (RKM/RKS)

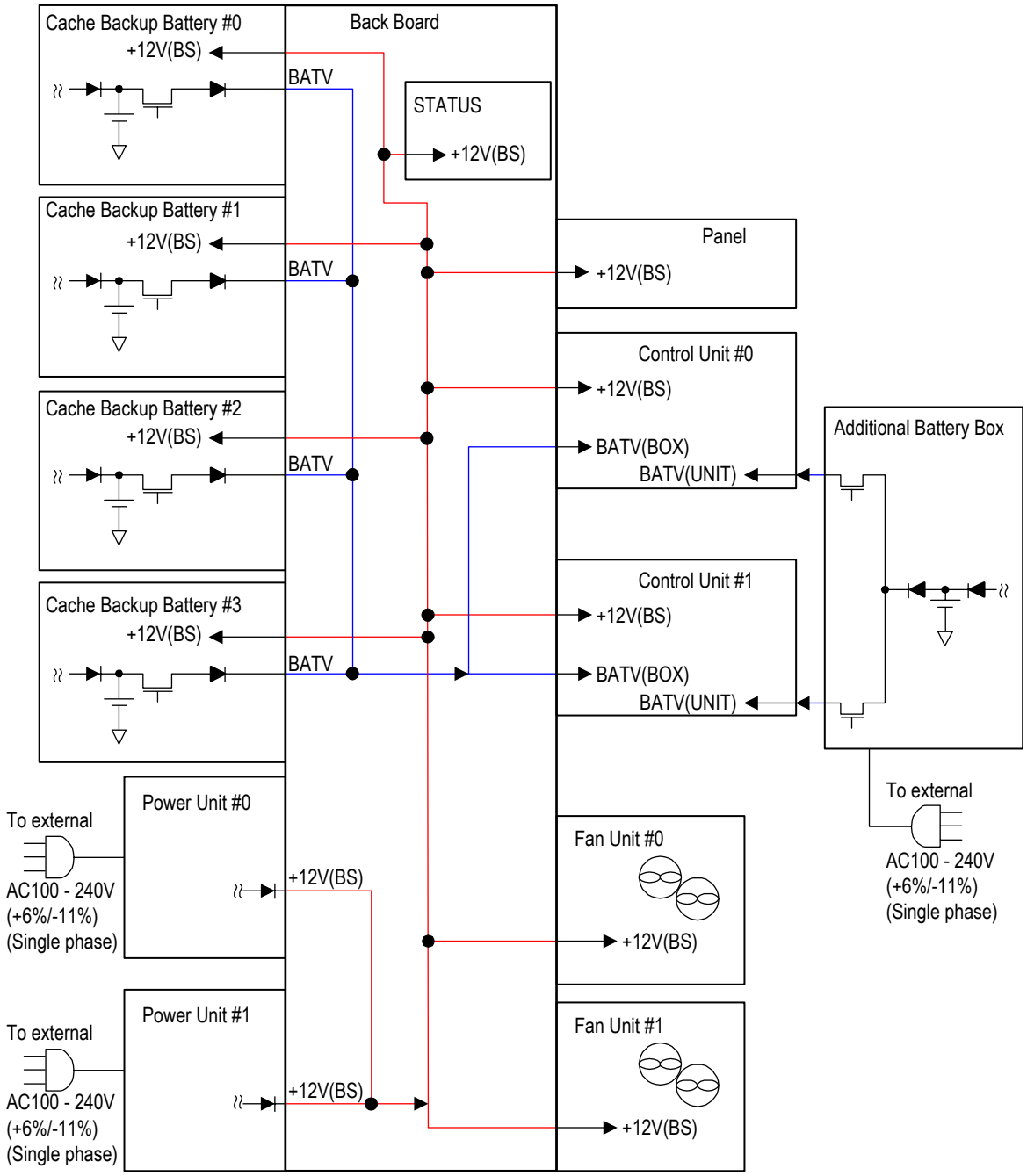


Figure 1.4.2 Connection Diagram of Power Supply System (RKH)

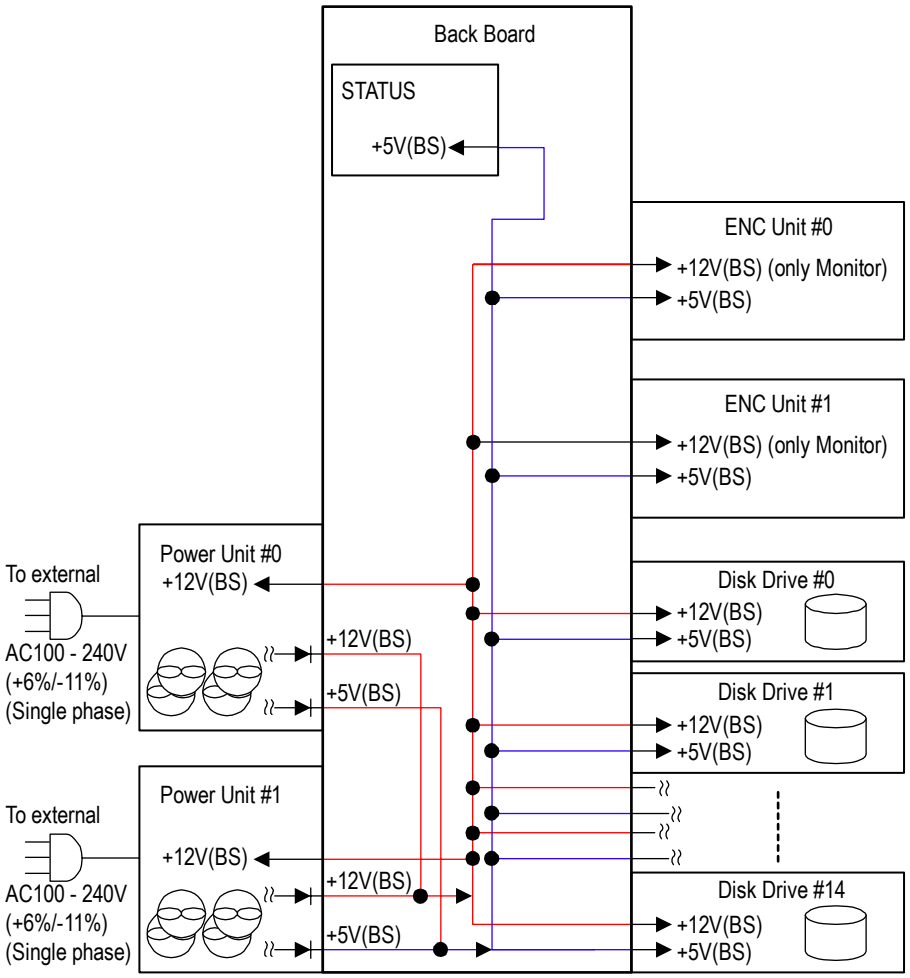


Figure 1.4.3 Connection Diagram of Power Supply System (RKAK)

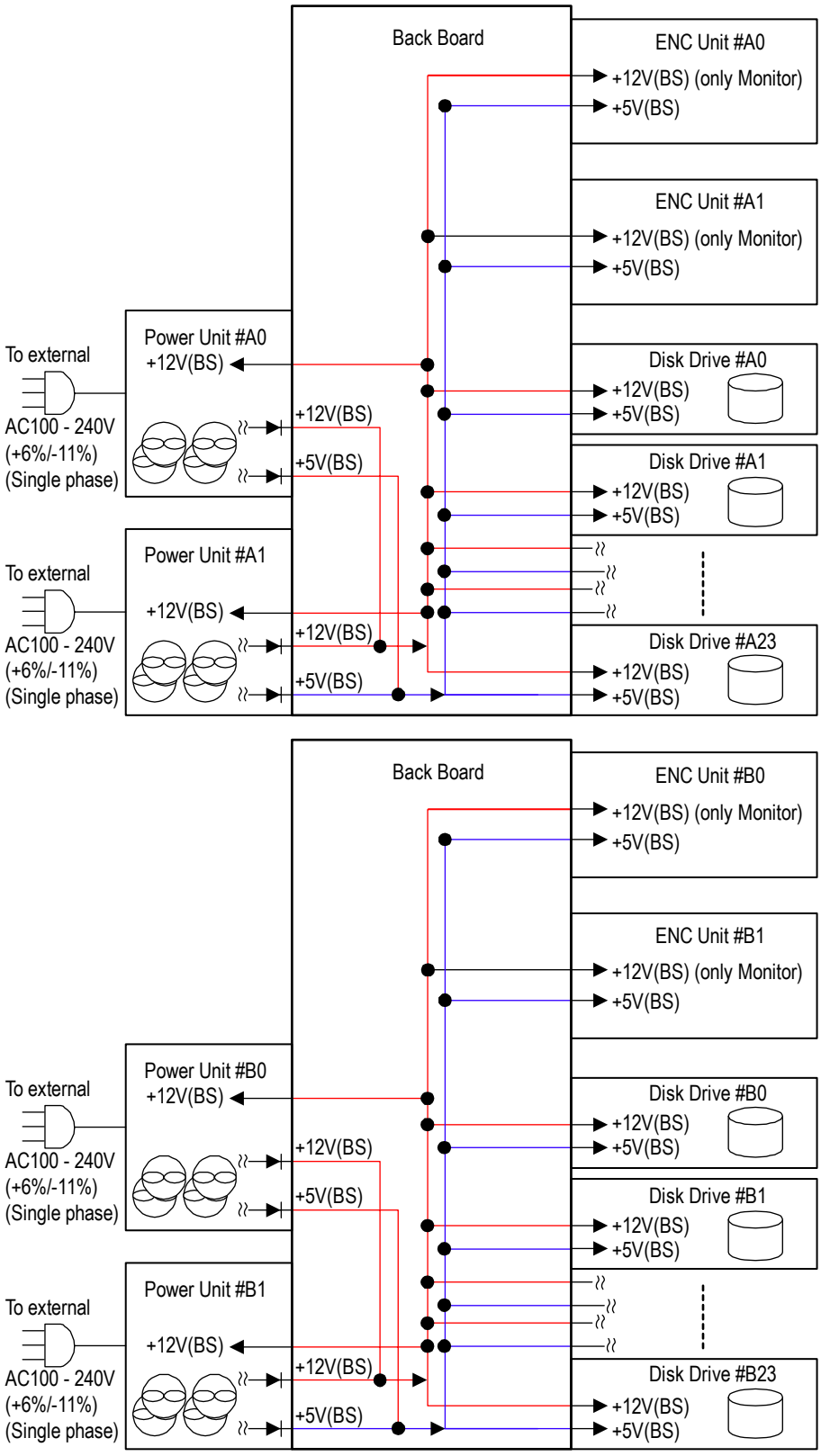


Figure 1.4.4 Connection Diagram of Power Supply System (RKAKX)

(2) Internal power supply system configuration (RKHED/RKAKD)

Figure 1.4.5 and Figure 1.4.6 shows the connection diagrams of the internal power supply system of the RKHED and RKAKD respectively.

Input power to the RKHED and RKAKD is supplied from the Power Unit.

Even if the main switch is off, each voltage (BS) is supplied. To turn off each voltage (BS), the DC power unit switch of the Power Unit needs to be turned off. (‡1)

Two Power Units are installed as the standard to duplicate the power supply system.

Accordingly, the subsystem can continue its operation even when a failure occurs in one of the Power Unit (DC) or power cables. Further, part replacement can be done while the subsystem is operating.

‡1 : In the situation where the main switch is turned off, do not leave the components removed from the subsystem for a long time. The power supply alarm can be given because of an abnormal alarm.

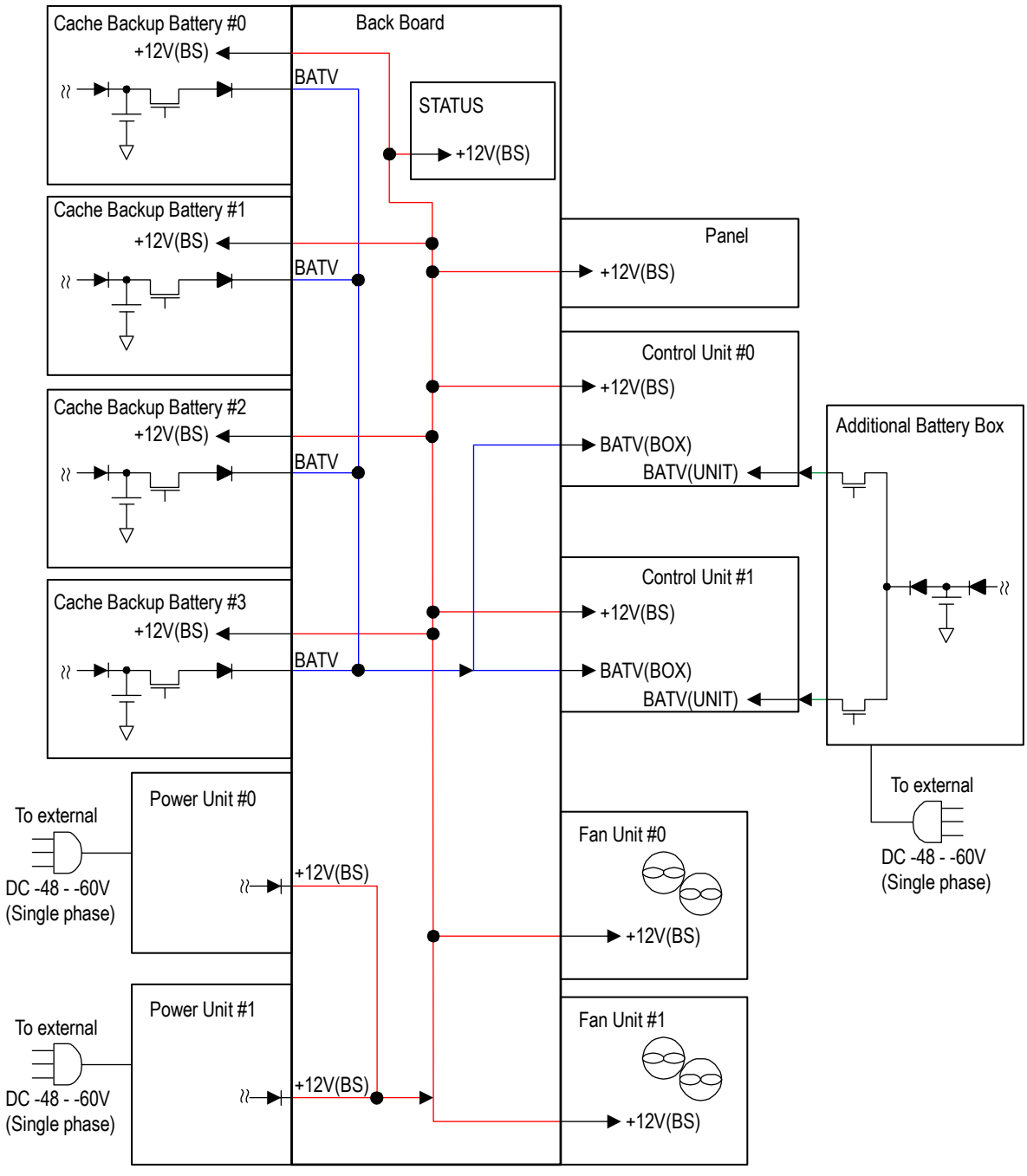


Figure 1.4.5 Connection Diagram of Power Supply System (RKHED)

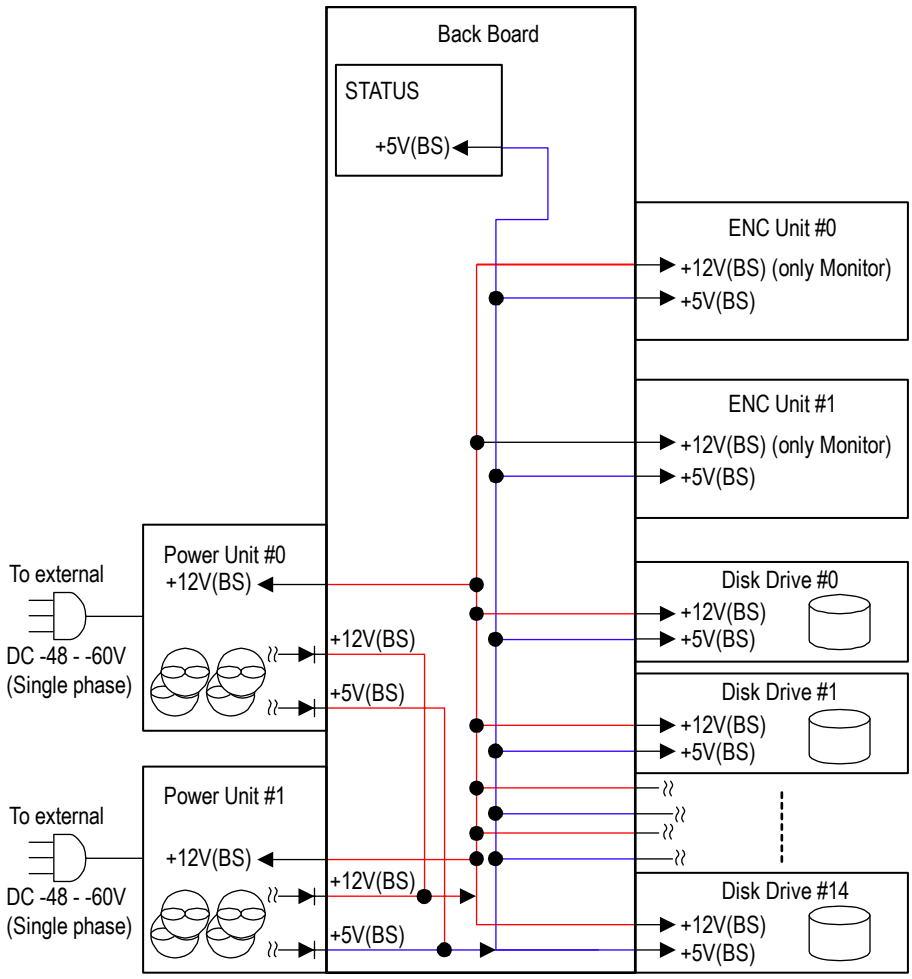


Figure 1.4.6 Connection Diagram of Power Supply System (RKAKD)

1.5 Configuration of Internal Data System

Figure 1.5.1 to Figure 1.5.4.2 shows the connection block diagram of the internal data system of the RKM, RKS, RKH, RKAK and RKAKX respectively.
Figure 1.5.5 shows the connection block diagram of the internal data system of the RKM+RKAK respectively.
Figure 1.5.6 shows the connection block diagram of the internal data system of the RKS+RKAK respectively.
Figure 1.5.7 shows the connection block diagram of the internal data system of the RKM+RKAK+RKAK respectively.
Figure 1.5.7.1 shows the connection block diagram of the internal data system of the RKM+RKAKX respectively.
Figure 1.5.7.2 shows the connection block diagram of the internal data system of the RKM+RKAKX×2 (Installed SATA Disk Drive) respectively.
Figure 1.5.7.3 shows the connection block diagram of the internal data system of the RKM+RKAKX×2 (Installed SAS Disk Drive) respectively.
Figure 1.5.8 shows the connection block diagram of the internal data system of the RKH+RKAK respectively.
Figure 1.5.8.1 shows the connection block diagram of the internal data system of the RKH+RKAKX×2 (Installed SATA Disk Drive) respectively.
Figure 1.5.8.2 shows the connection block diagram of the internal data system of the RKH+RKAKX×2 (Installed SAS Disk Drive) respectively.

(1) Host interface

In the DF800, the PCI-Express bus is adopted for the connection of the host interface and the Control Unit, and the Fibre Channel interface or the iSCSI interface is supported in standard. In the Fibre Channel configuration, one Control Unit can have up to two, four, or eight ports. With the dual Controller configuration, the subsystem can have up to 16 Fibre Channel ports. iSCSI configuration, one Control Unit can have up to two ports. With the dual Controller configuration, the subsystem can have up to eight iSCSI ports.

(2) Cache memory backup

The Cache Unit is backed up by the battery. Therefore, data in the Cache Unit is maintained even when a sudden power failure or a power supply unit failure occurs.

(3) Spare Disks

When a spare Disk Drive is set in a group of Disk Drives, even if a failure occurs in the Disk Drive, the same operation as before can be performed through reconstruction of data to the Spare Disk Drive. Up to 30 (for the RKS, up to 15) Spare Disk Drives can be set.

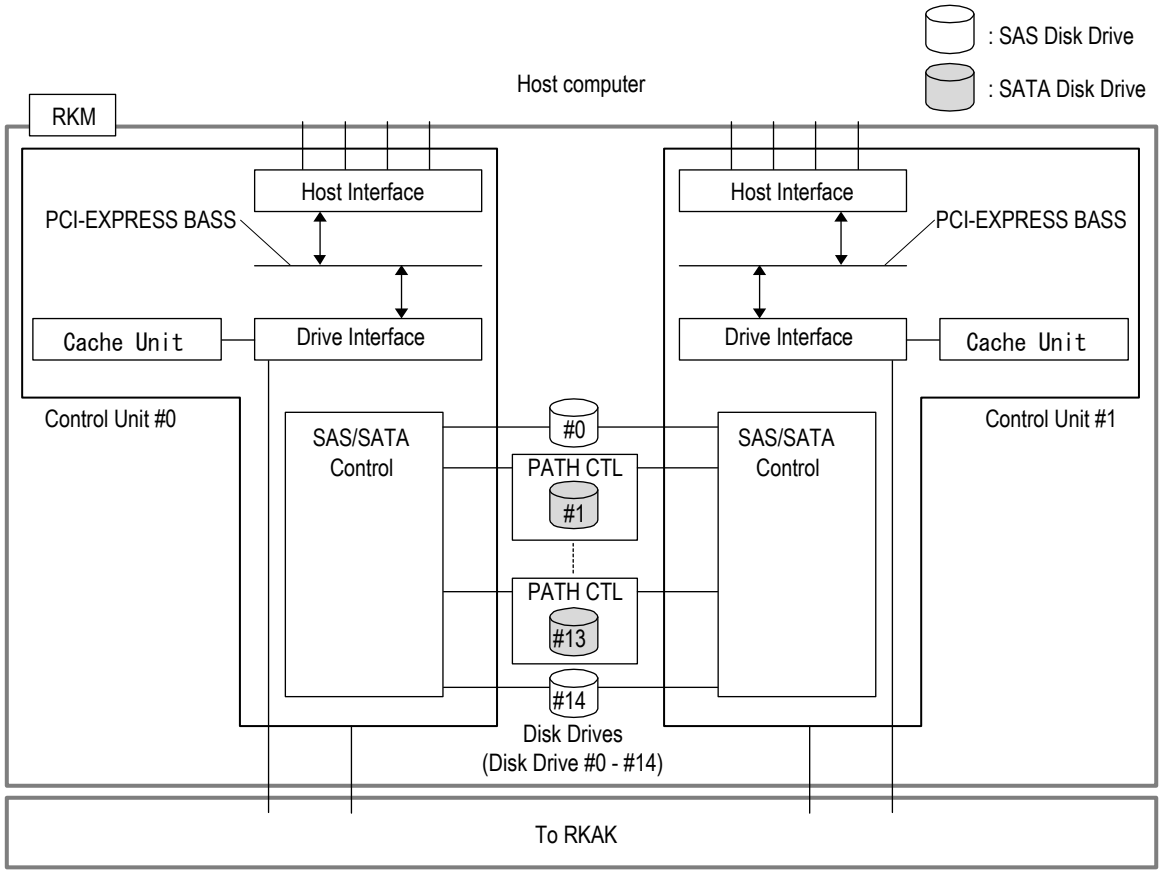


Figure 1.5.1 Internal Data Connection of the RKM

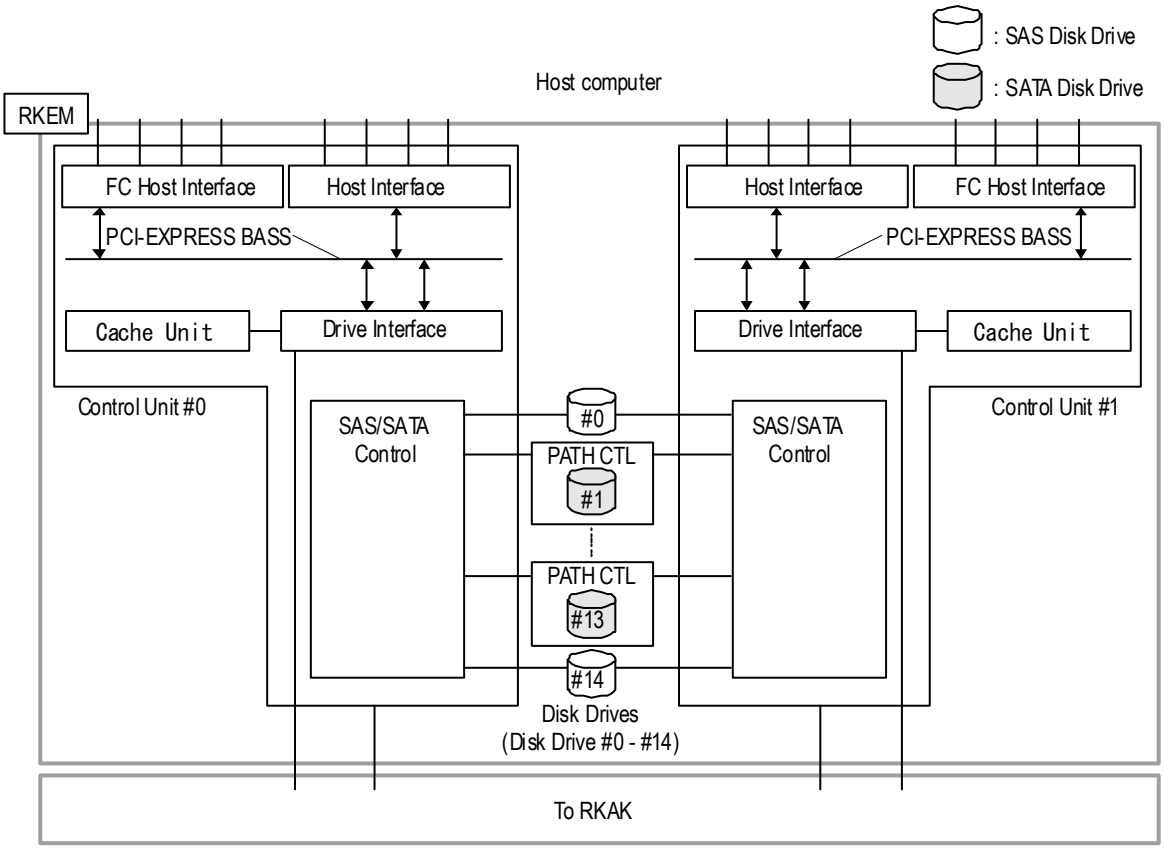


Figure 1.5.1.1 Internal Data Connection of the RKEM

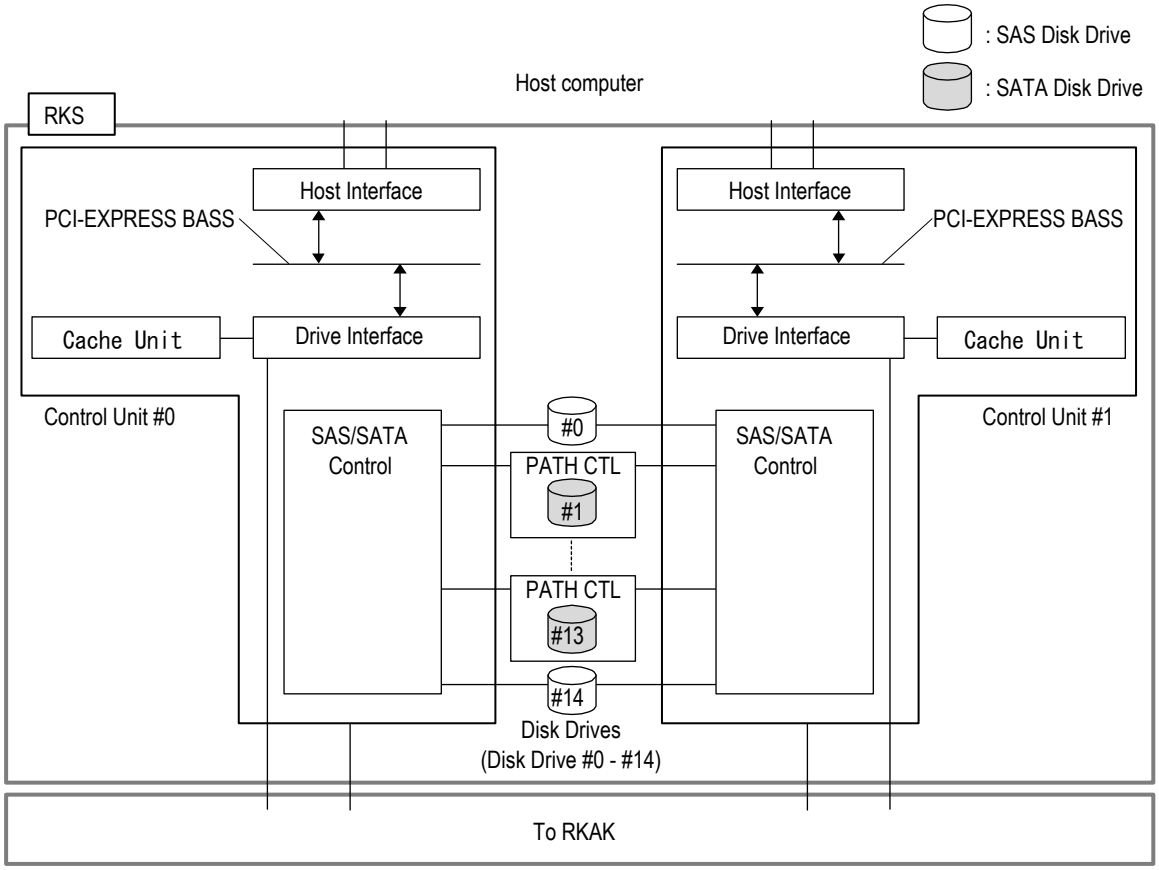


Figure 1.5.2 Internal Data Connection of the RKS

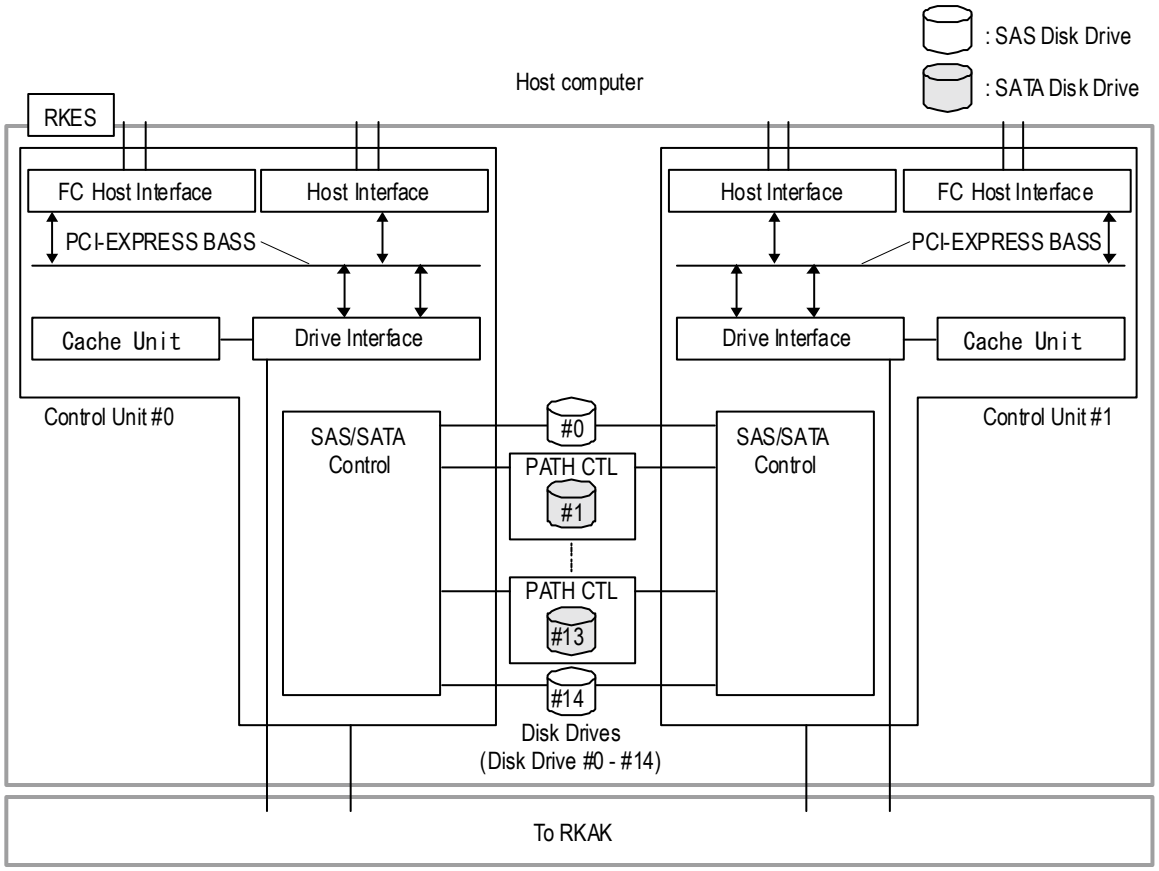


Figure 1.5.2.1 Internal Data Connection of the RKES

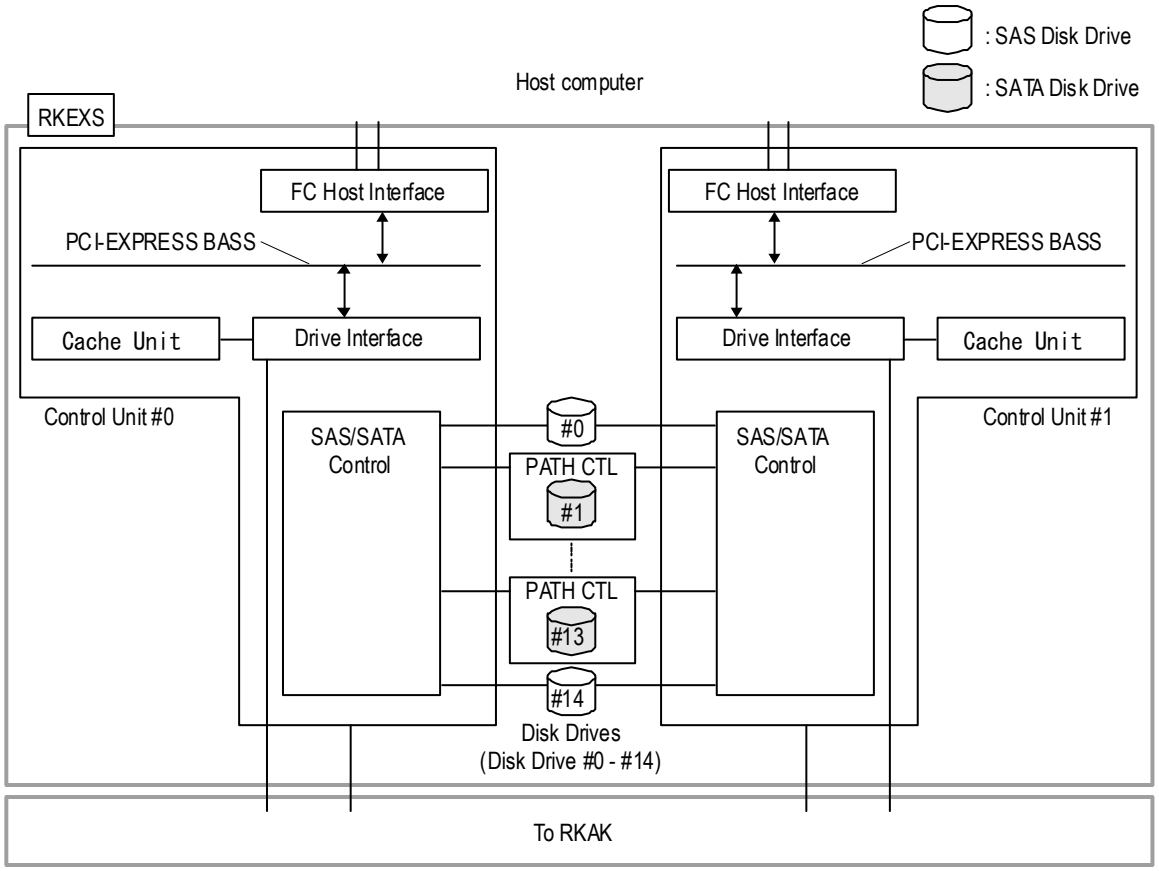


Figure 1.5.2.2 Internal Data Connection of the RKEXS

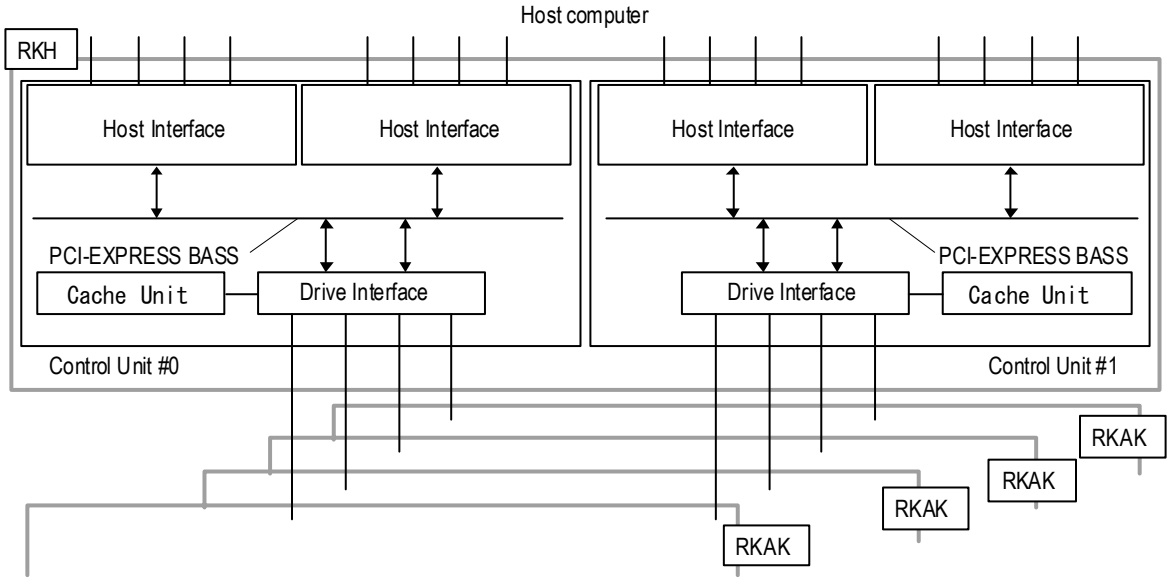


Figure 1.5.3 Internal Data Connection of the (RKH)

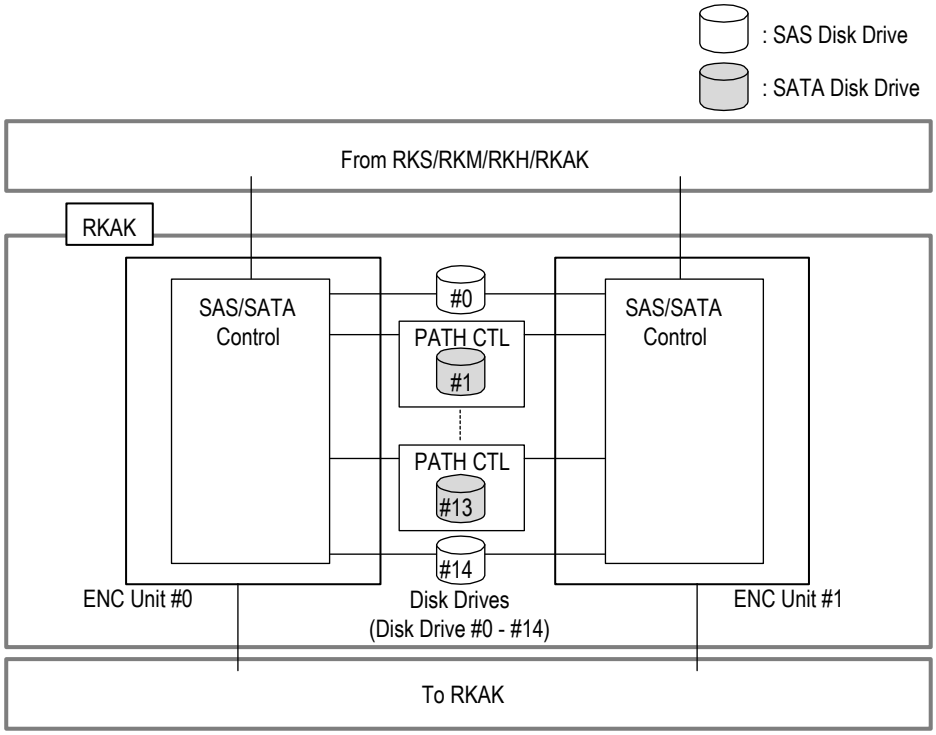


Figure 1.5.4 Internal Data Connection of the (RKAK)

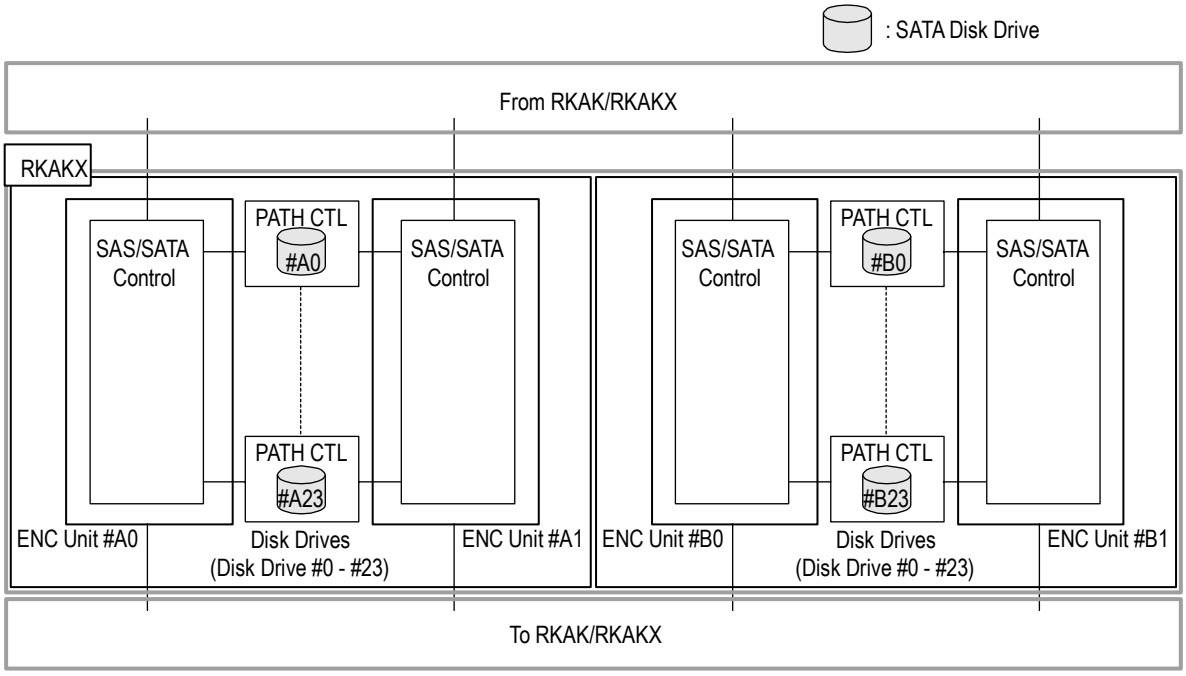


Figure 1.5.4.1 Internal Data Connection of the (RKAKX) (Installed SATA Disk Drive)

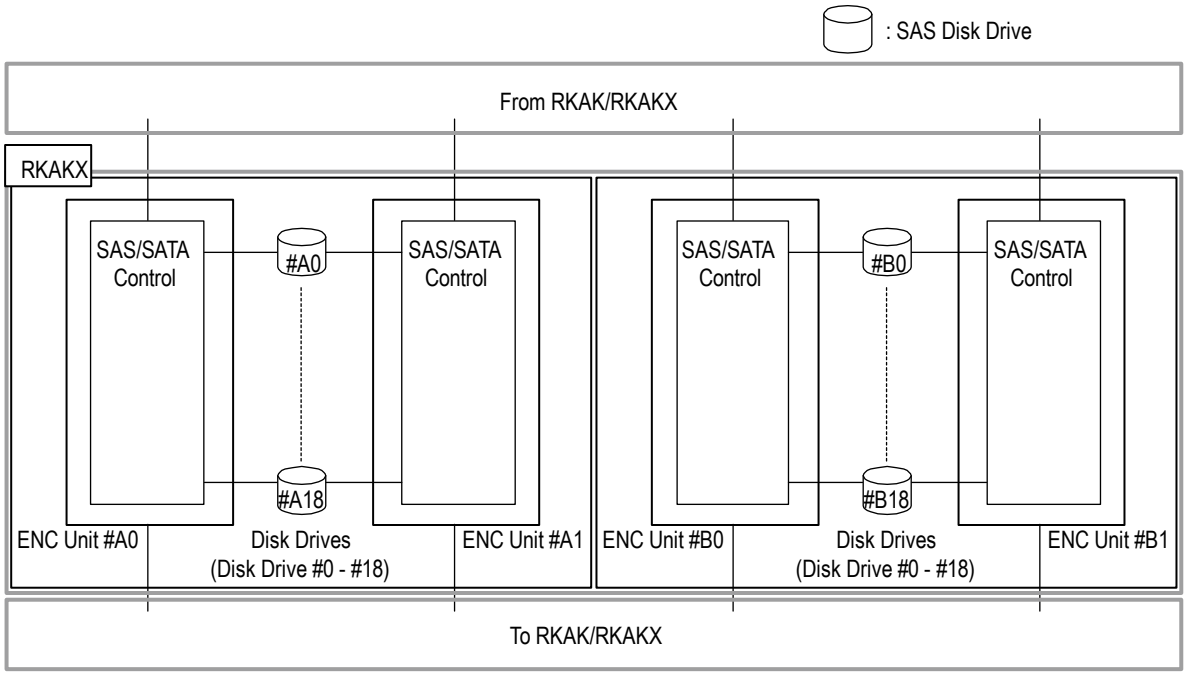


Figure 1.5.4.2 Internal Data Connection of the (RKAKX) (Installed SAS Disk Drive)

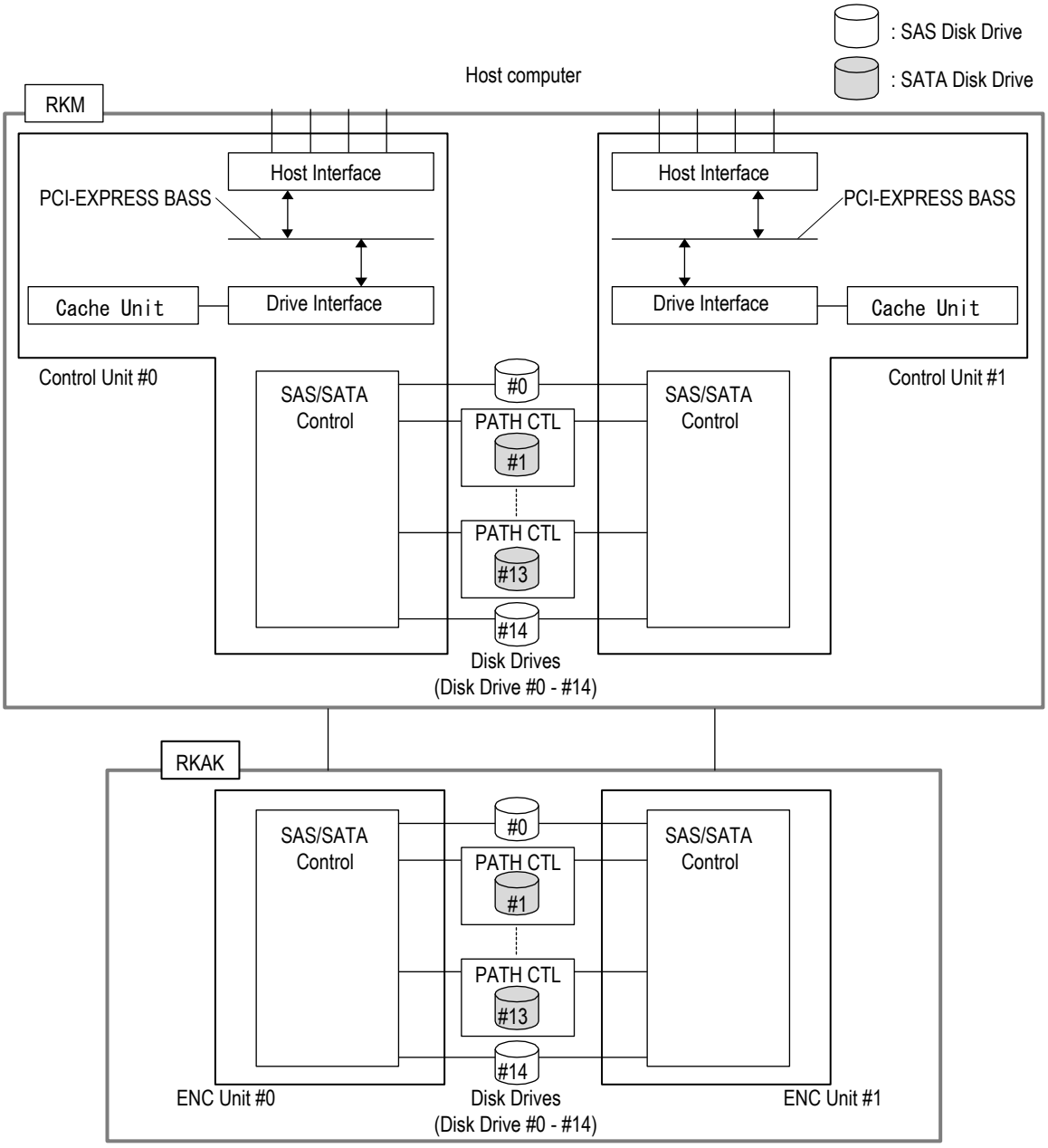


Figure 1.5.5 Internal Data Connection of the RKM+RKAK

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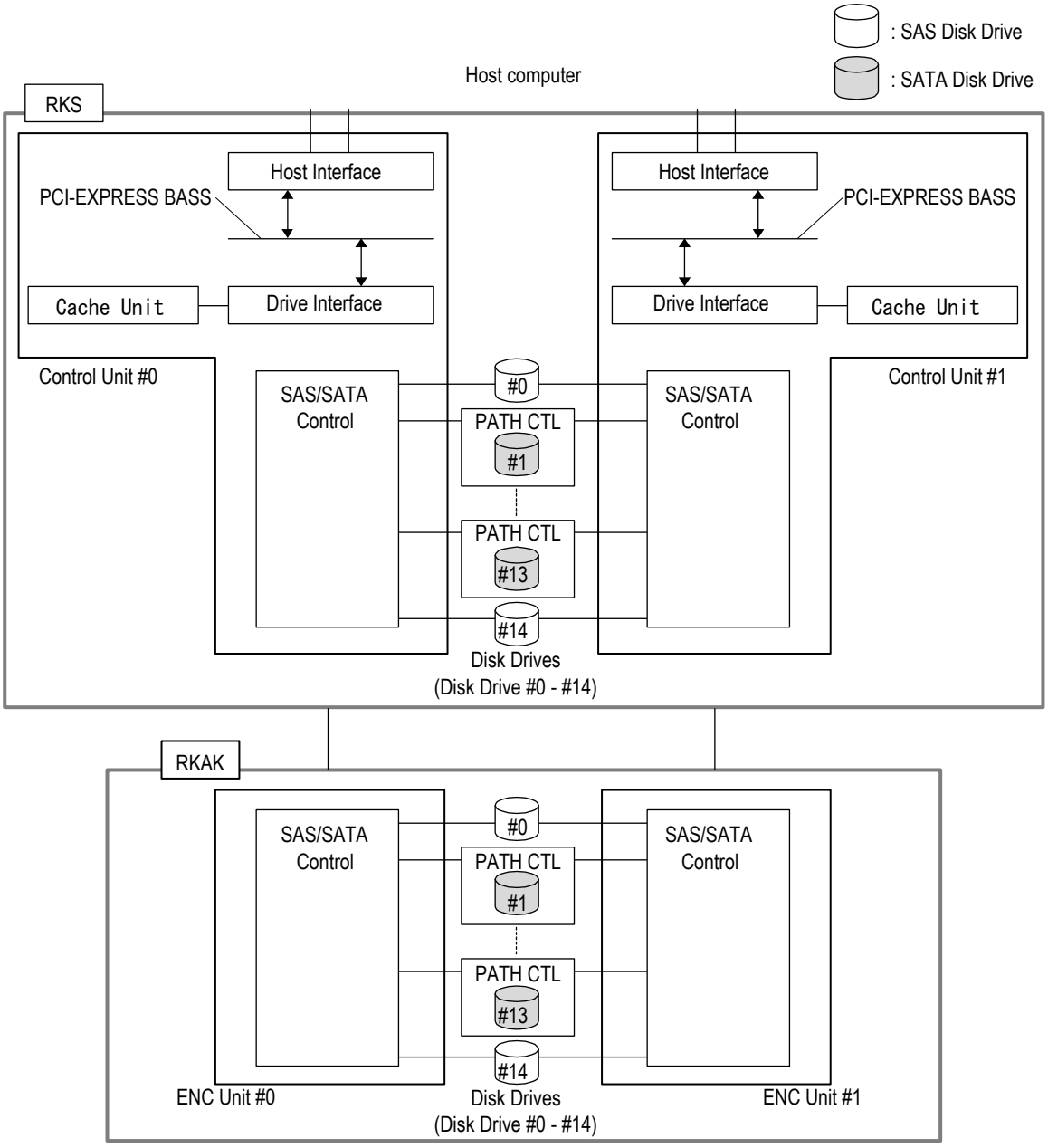


Figure 1.5.6 Internal Data Connection of the RKS+RKAK

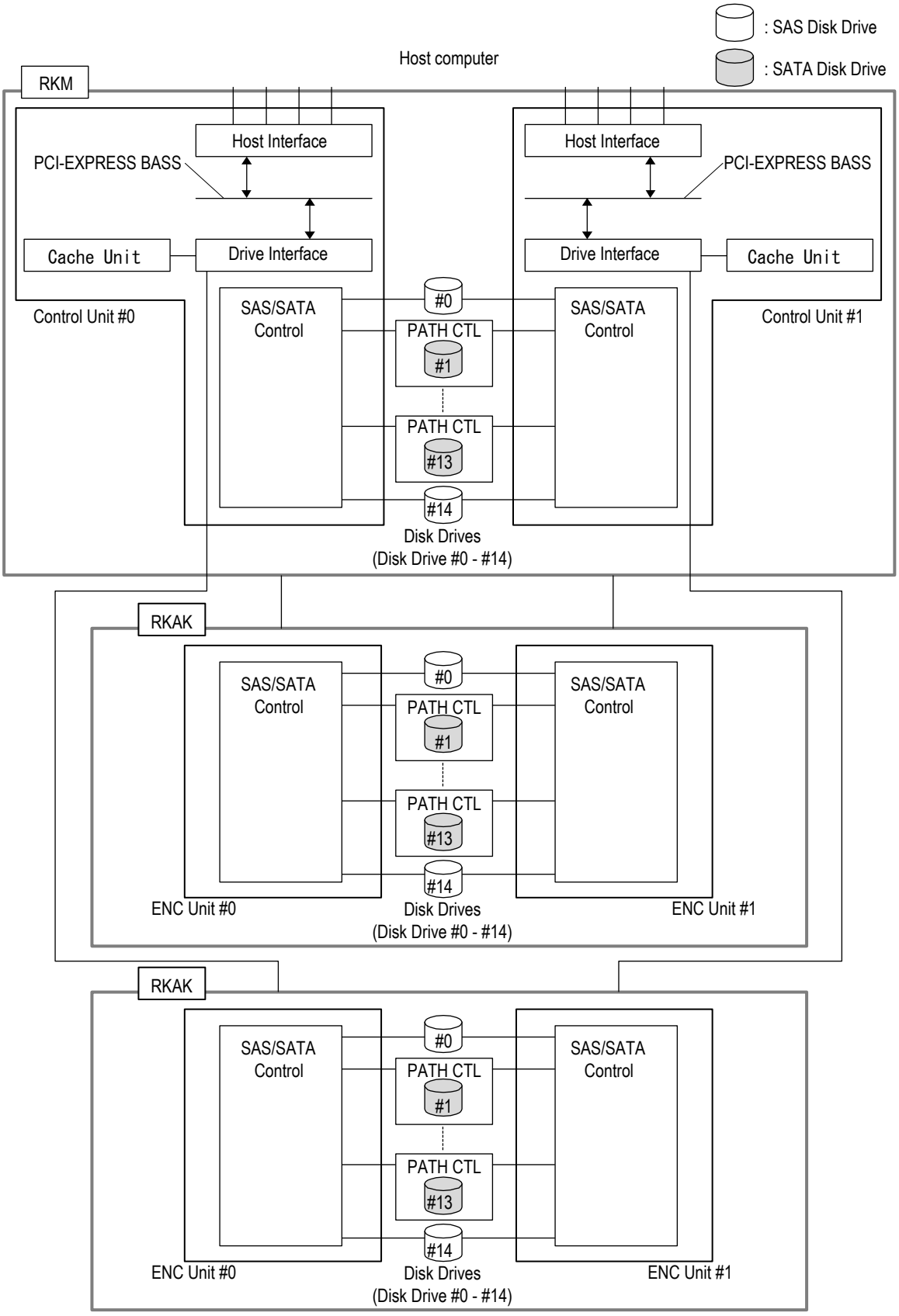


Figure 1.5.7 Internal Data Connection of the RKM +RKAK +RKAK

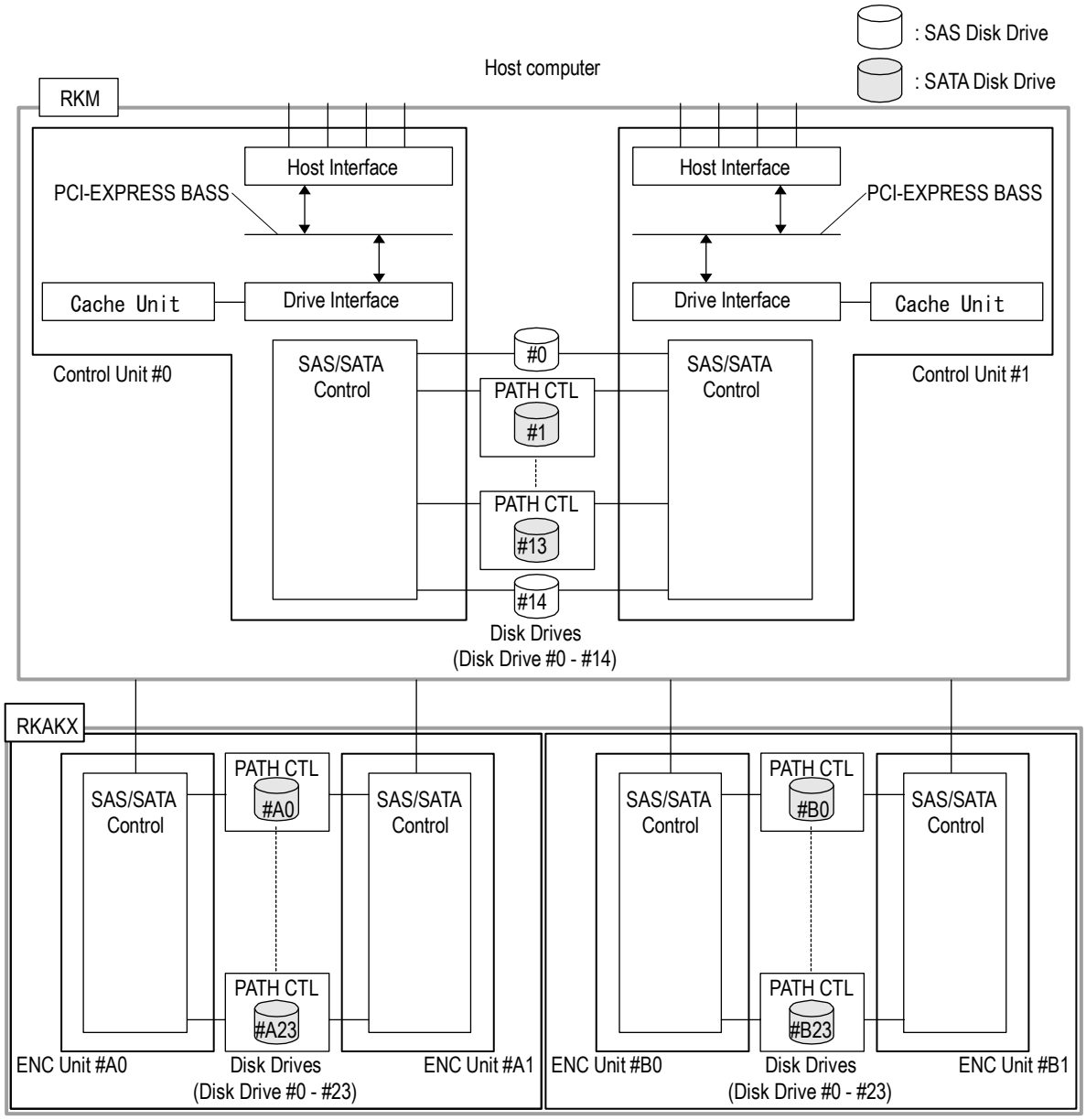


Figure 1.5.7.1 Internal Data Connection of the RKM+RKAKX

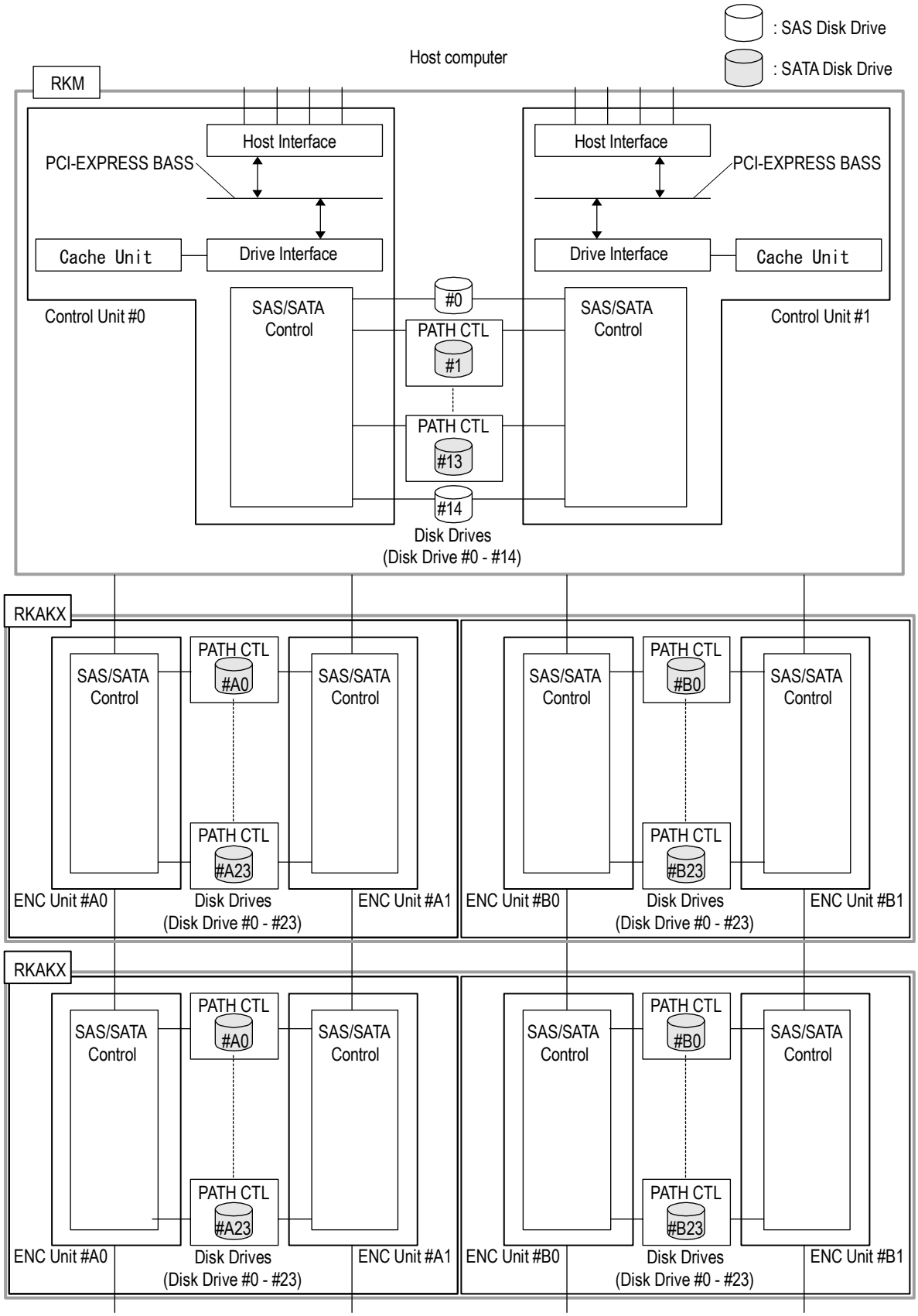


Figure 1.5.7.2 Internal Data Connection of the RKM+ RKAKX×2 (Installed SATA Disk Drive)

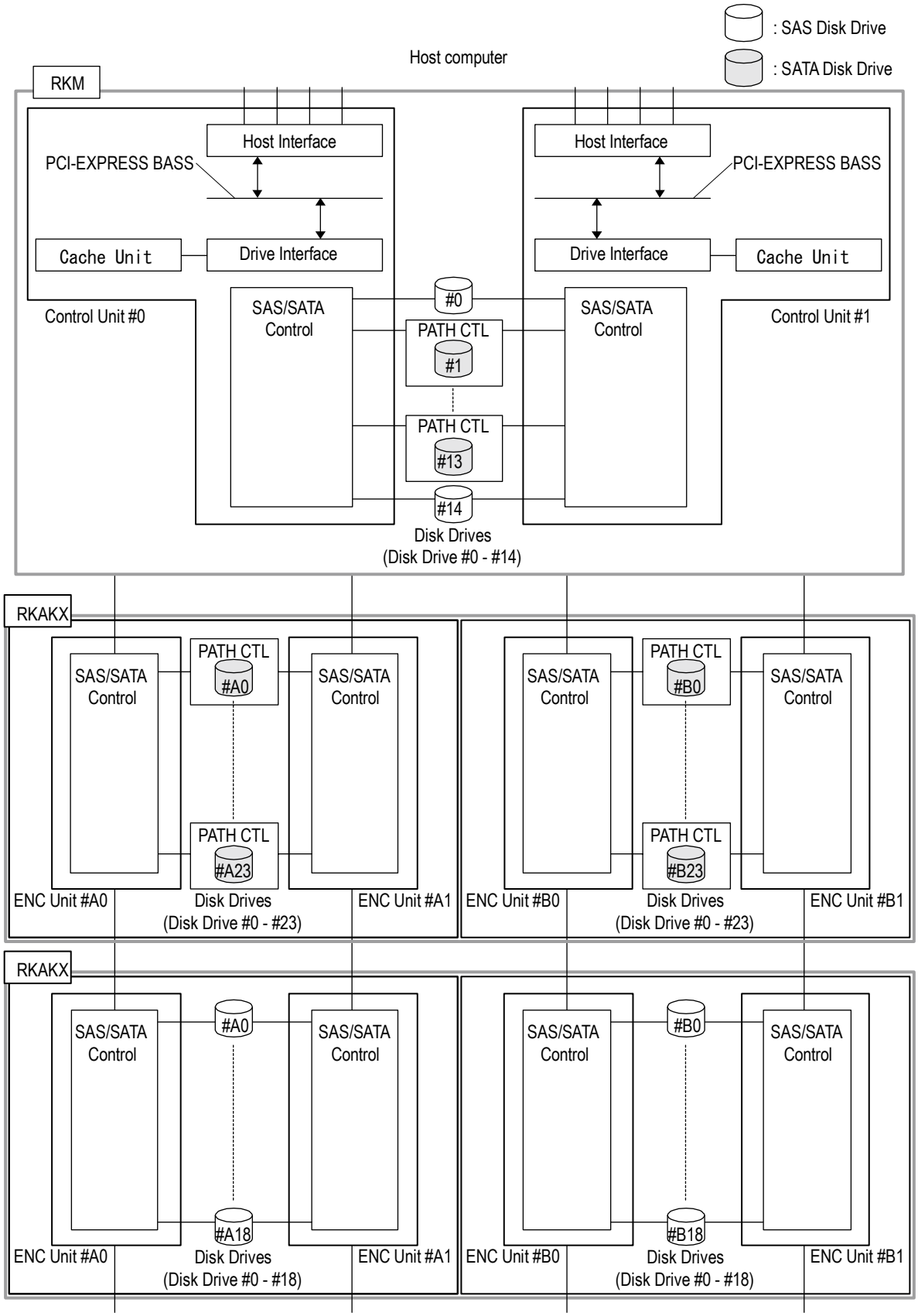


Figure 1.5.7.3 Internal Data Connection of the RKM+ RKAKX×2 (Installed SAS Disk Drive)

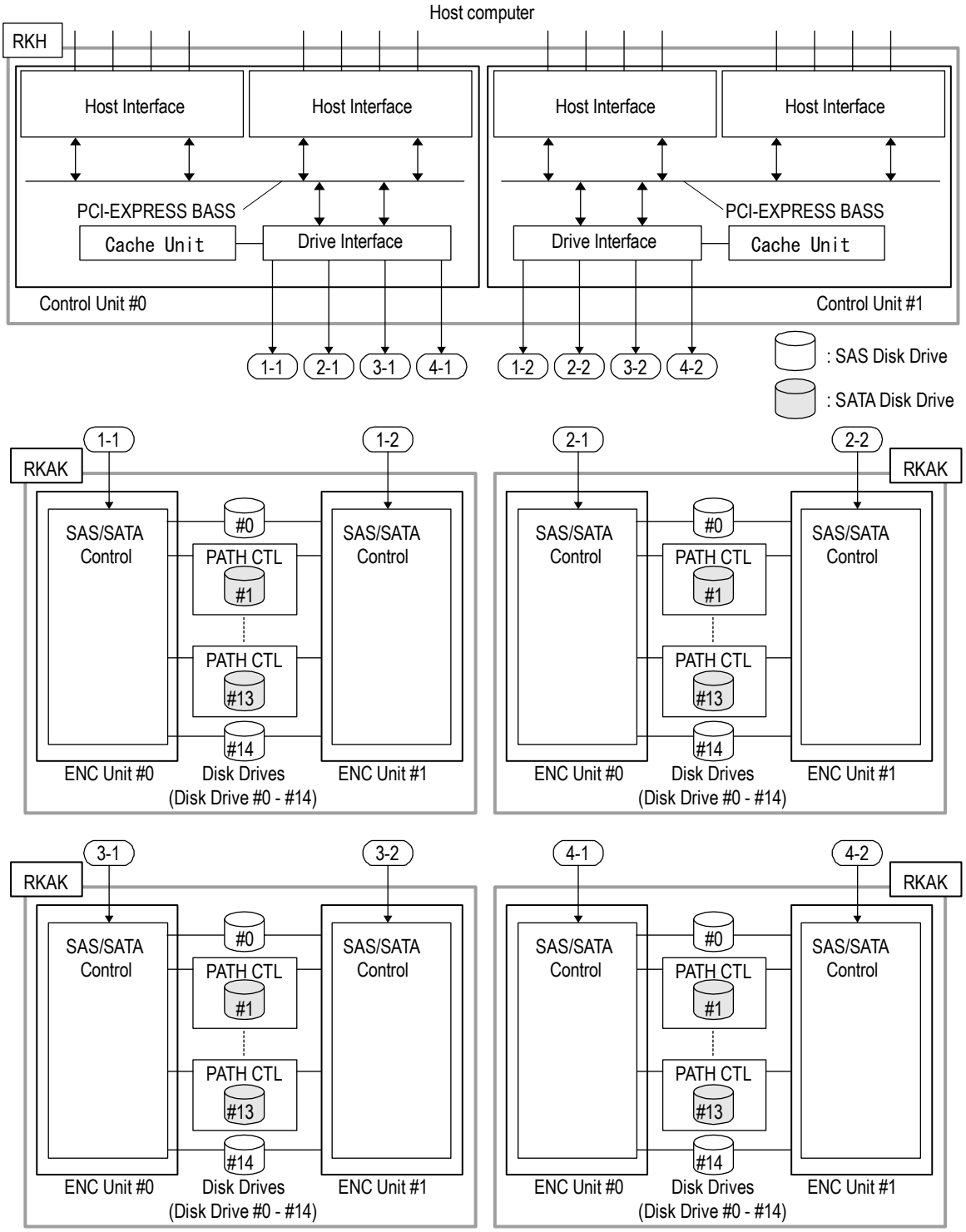


Figure 1.5.8 Internal Data Connection of the RKH+RKAK

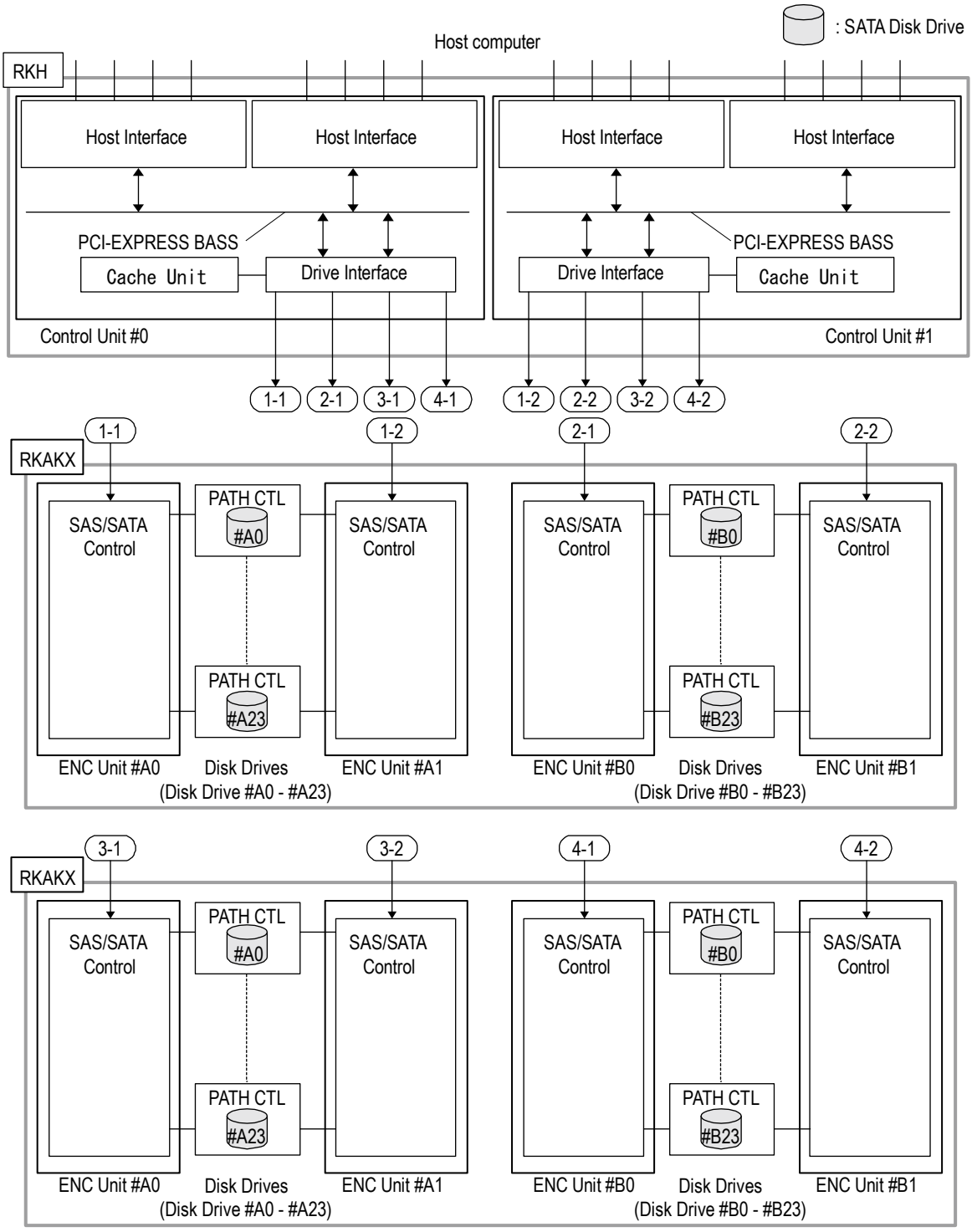


Figure 1.5.8.1 Internal Data Connection of the RKH+RKAKX×2 (Installed SATA Disk Drive)

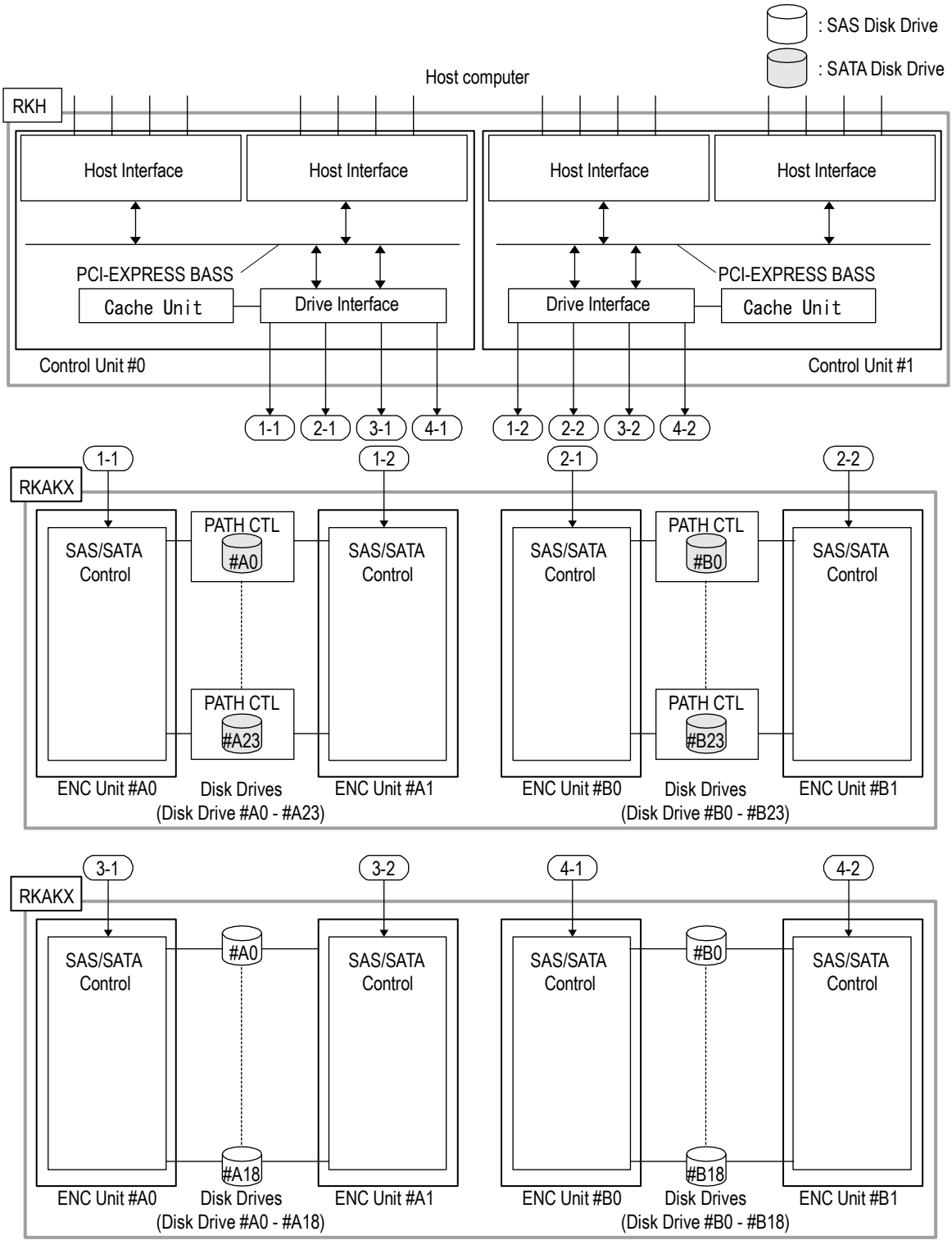
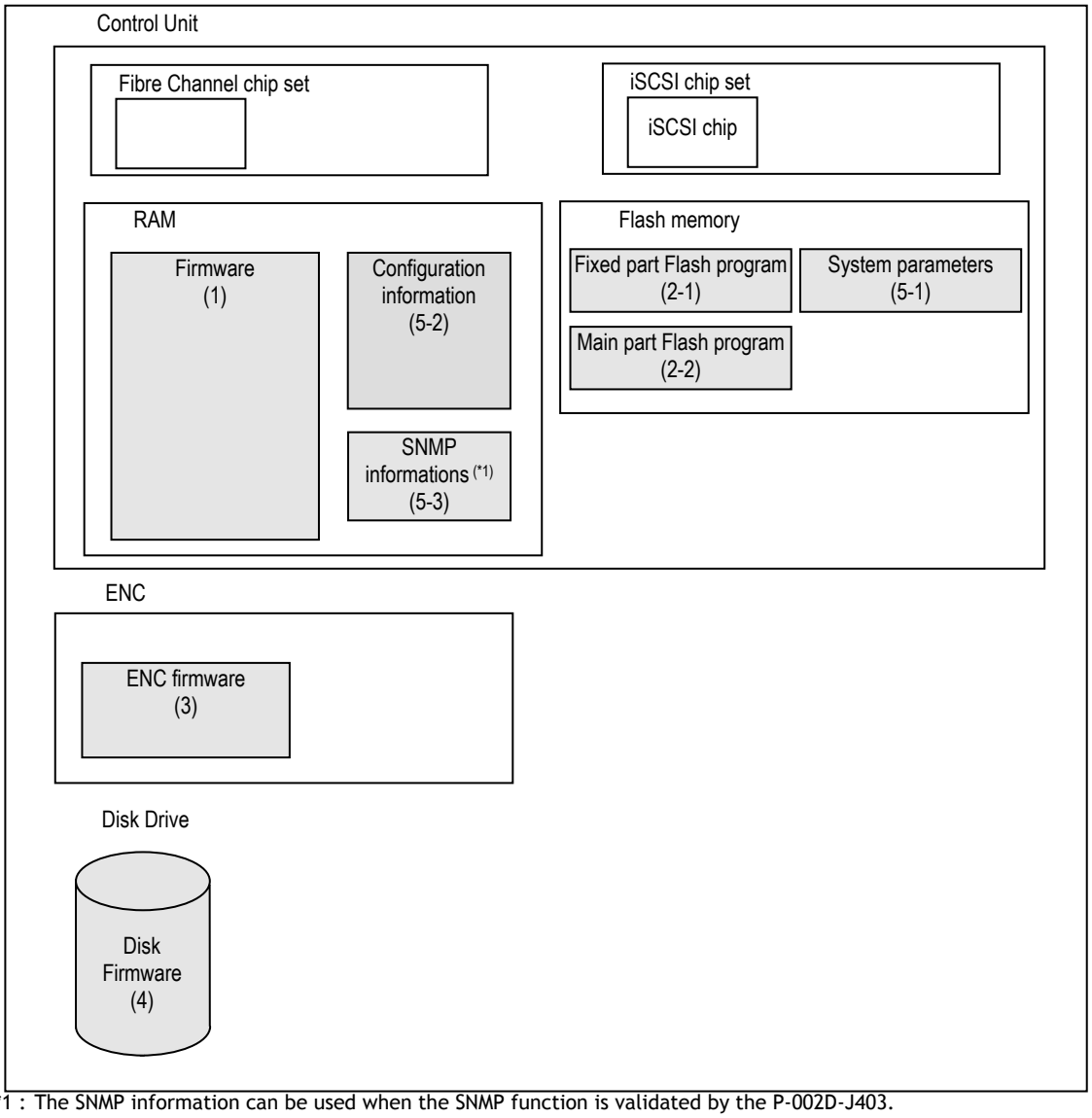


Figure 1.5.8.2 Internal Data Connection of the RKH+RKAKX×2 (Installed SAS Disk Drive)

1.6 Configuration of Built-in Software

1.6.1 Block Diagram of Built-in Software Configuration

The built-in software configuration is shown in Figure 1.6.1.
For the shaded portions in the figure, detailed explanations are given on the succeeding pages.



*1 : The SNMP information can be used when the SNMP function is validated by the P-002D-J403.

Figure 1.6.1 Software Structure

(1) Firmware

- These are programs that control.
- Their version numbers are controlled in the format of 08xxxxxx.
- There are types of Firmwares shown below corresponding to as many usages.

No.	Type of usage	Version	Supplying media
1	Fibre Channel, iSCSI	08xxxxxx (×:Optional)	One CD

- "/xx" in the version number may not be added or may be controlled by the other method.

(2) Flashprograms

- These are programs to start up the subsystem after powering on.

(2-1) Fixed part Flash program

No.	Name	Type
1	Fixed part Flash program	08xxxxxx (×:Optional)

(2-2) Main part Flash program

No.	Name	Type
1	Main part Flash program (Fibre Channel) (*1)	08xxxxxx (×:Optional)

*1 : This program and the Firmware are controlled unitarily.

(3) ENC firmware

- The version of the firmware can be see using Hitachi Storage Navigator Modular 2 or through the WEB. (It is also collectable with the simple trace)
- This firmware controls the RKS/RKM/RKH/RKAK/RKAKX.

(4) Drive firmware

- You can also refer to the version with Hitachi Storage Navigator Modular 2 or WEB for the firmware owned uniquely by the Disk Drive (it is also collectable with the simple trace).

(5) Parameter Information

The parameters are classified into the following three types for operating the subsystem.

(5-1) System parameters

- Parameters necessary for the subsystem start-up process from the turning on of the main switch to the coming on of the READY LED (green) are called system parameters.
  For the details of it, refer to the for System Parameter "Chapter 1. Setting (Hitachi Storage Navigator Modular 2)" (SYSPR 01-0000).
- The system parameters are stores in the flash memory.
  Back up of the system parameter is automatically performed to the drive in the changing opportunity.

(5-2) Configuration information

- This is a piece of information on the configuration, such as the RAID configuration and LU capacity, for the subsystem to record user data.
- The configuration information exists on the Disk Drives when the subsystem main switch is turned off, and is spread onto the RAM at the time when the main switch is turned on. When it is changed, that on the Disk Drives are also changed.

(5-3) SNMP information

The SNMP information is a parameter for making the SNMP agent support function work effectively.

- When the SNMP information makes the SNMP agent support function effective, it edits the template on the SNMP EVA FD and registers the template with the subsystem.
  To update the information, edit the SNMP information on the SNMP EVA FD and register it with the subsystem.
  For the details of it, refer to the “SNMP Agent Support Function User’s Guide”.

1.6.2 Storages for Parameters

The storages in which the parameters on the controller are stored are shown in Table 1.6.1.

Table 1.6.1 Storages for Parameter

No.	Parameter	Storage	Description
1	• Fixed part Flash program • Main part Flash program • System parameters	Flash memory	• The parameters are stored in the flash memory. No provision of storage against a power shut off is required for the parameters because the flash memory can retain information even if a power is shut off. • The parameters can be backed up to the following to provide against a trouble. Fixed part Flash program ..... Cannot be backed up. Main part Flash program ..... Automatically backed up to the system area. System parameters ..... Automatically backed up to the system area.
2	• Firmware • Configuration information • SNMP information	System area	• Generally, information in a RAM is erased when the main switch is turned off. Therefore, the subsystem also stores the parameters used on the RAM on the Disk Drive. (An area is reserved in the Disk Drive to store them. The area is called system area.)

This page is for editorial purpose only.

Chapter 2. Major Specifications of the Subsystem

Basic specifications of the subsystem and the optional devices which compose a disk array system are shown below.

(1) When the subsystem configuration of the Fibre Channel interface (Rackmount model)

(a) Rackmount model (RKM/RKAK/RKAKX)

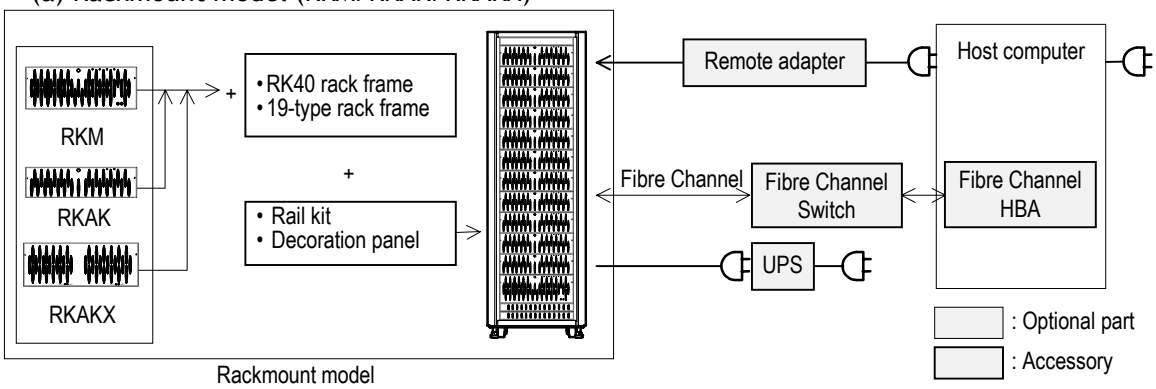


Figure 2.1 System Outline of Rackmount Model (RKM/RKAK/RKAKX)

(b) Rackmount model (RKS/RKAK/RKAKX)

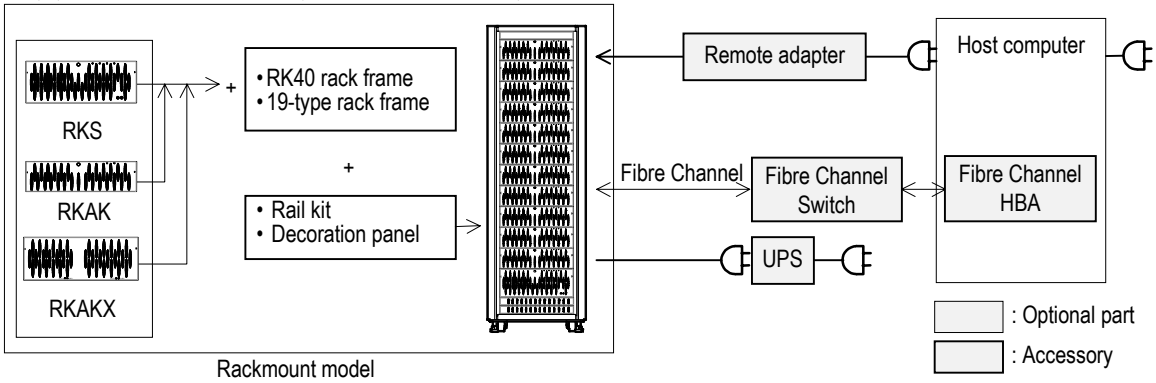


Figure 2.2 System Outline of Rackmount Model (RKS/RKAK/RKAKX)

(c) Rackmount model (RKH/RKAK/RKAKX)

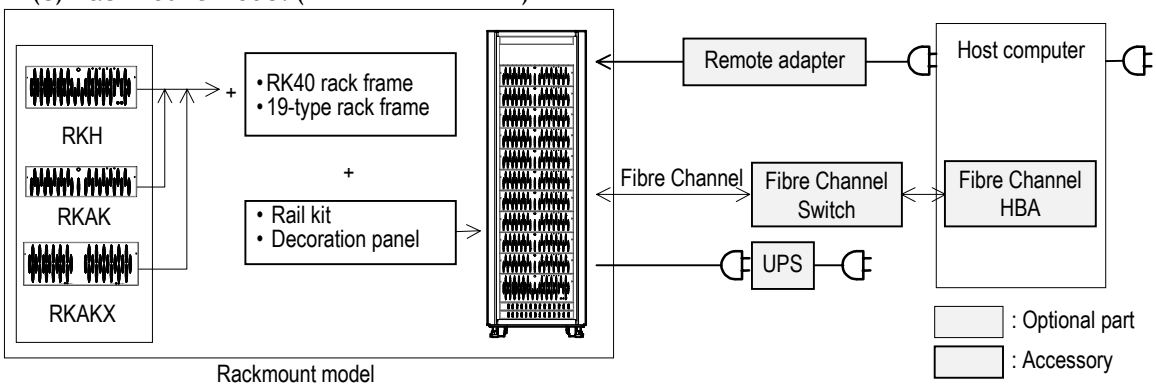


Figure 2.3 System Outline of Rackmount Model (RKH/RKAK/RKAKX)

(2) When the subsystem configuration of the iSCSI interface (Rackmount model)

(a) Rackmount model (RKM/RKAK/RKAKX)

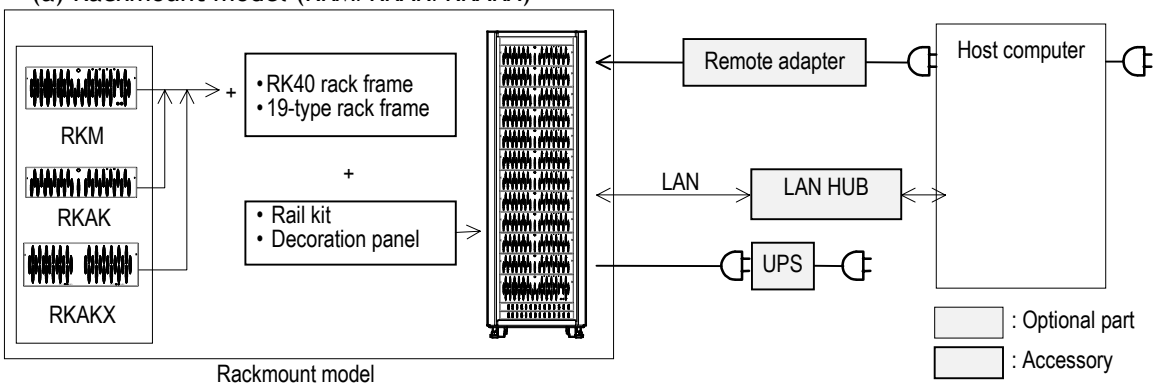


Figure 2.4 System Outline of Rackmount Model (RKM/RKAK/RKAKX)

(b) Rackmount model (RKS/RKAK/RKAKX)

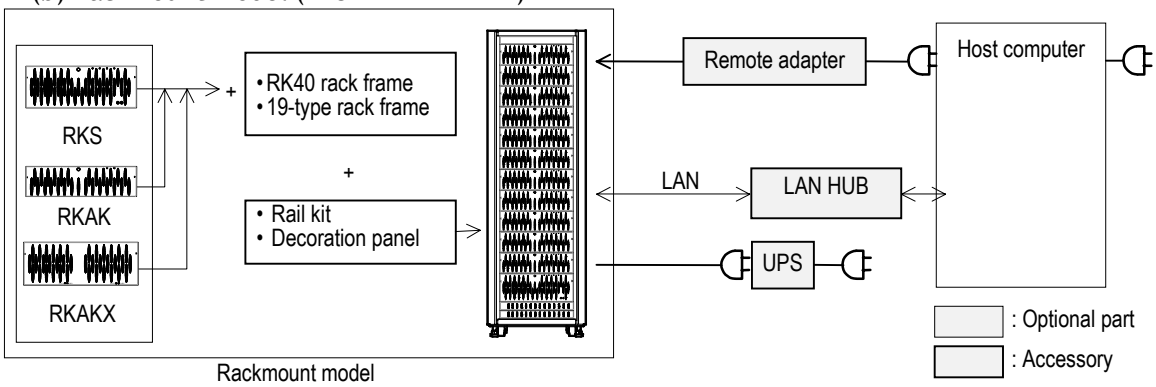


Figure 2.5 System Outline of Rackmount Model (RKS/ RKAK/RKAKX)

(c) Rackmount model (RKH/RKAK/RKAKX)

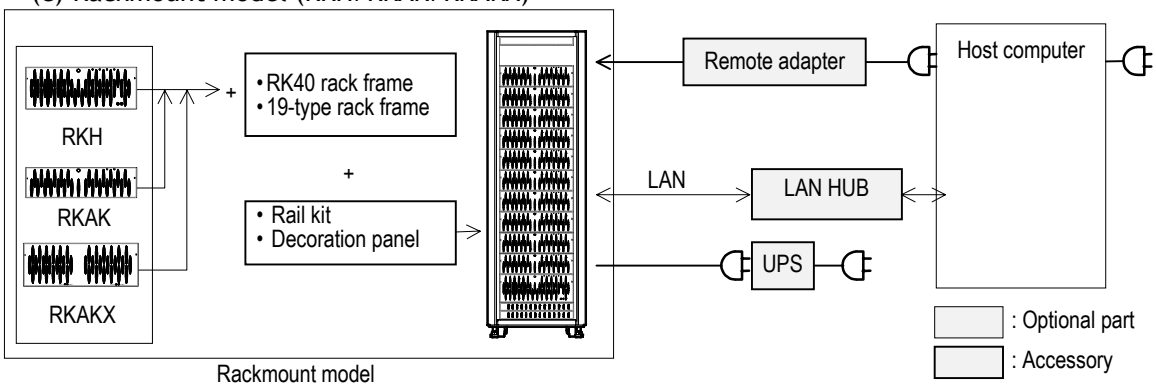
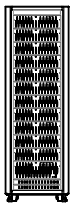


Figure 2.6 System Outline of Rackmount Model (RKH/ RKAK/RKAKX)

2.1 Basic Specifications of the Subsystem

(1) Rackmount (RKM+RKAK) Model

Table 2.1.3 Basic Specifications

Item		Model	Rackmount model			
			RKM	RKAK	RKM + RKAK + RK40 rack frame	
					One rack	Two racks
Configuration	Configuration		1 RKM	1 RKAK	1 RKM+ RKAK (11units)(*1) (Maximum configuration) + RK40 rack frame	1 RKM+ RKAK (15units)(*1) (Maximum configuration) + RK40 rack frame
	Subsystem appearance					
Disk Drive used	Disk Drive size (W×D×H) (mm)		101.6×147.0×26.1			
	Data capacity (*2) (G byte)		142.61 / 195.82 / 287.62 / 392.73 / 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52			
	Rotational speed (min^{-1})		142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive			
	Maximum mountable quantity (*3) (unit)		15		180	240
Host interface	Host interface		4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*4)	–	4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*4)	
	Data transfer speed (i.e. maximum speed for transfer to host)		800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*4)	–	800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*4)	
	Number of ports	Single controller	Fibre Channel : 4/ iSCSI: 2(*4)	–	Fibre Channel : 2/iSCSI: 4(*4)	
		Dual controller /Optional	Fibre Channel : 8/ iSCSI: 4(*4)	–	Fibre Channel : 4/iSCSI: 8(*4)	
	Transferred block size (bytes)		512			

*1 : When nine or more RKAKs are mounted on RK40 rack, optional PDU/PDB is necessary.

*2 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*3 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*4 : It indicates the value of when the iSCSI Interface Board is mounted to the Control Unit.

Item			Model	Rackmount model			
				RKM	RKAK	RKM + RKAK + RK40 rack frame	
						One rack	Two racks
RAID specifications (*2)	RAID level (*1)			0/1/5/6/1+0		SAS Disk Drive: 0/1/5/6/1+0	
	RAID configuration (unit of addition)	RAID 0		2D to 15D	2D to 16D	SATA Disk Drive: Not support	
		RAID 1		1D+1D			
		RAID 5		2D+1P to 14D+1P	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P	
		RAID 6		2D+2P to 13D+2P	2D+2P to 28D+2P		
		RAID 1+0		2D+2D to 7D+7D	2D+2D to 8D+8D		
Internal logic specifications	Control CPU			It is the same as 'With RK40 rack frame'	–	ULV Sossaman (1.67 GHz)	
	Control memory				–	• Flash memory : 16 M bytes • L2 Cache memory : 2 M bytes • SDRAM : 1 G bytes	
	Data assurance method				–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code	
Physical specifications	Start-up time (min)			Standard : 4(*4)			
	Chassis size (W×D×H) (mm)			(483×649×174)	(483×649×129)	(610×1,020×1,920)	((610×2)×1,020×1,920)
	Mass(*5) (kg)			51 approx.	40 approx.	755 approx.	1,150 approx.
	Acoustic noise(*6) (*7) (dB)			60 approx.	60 approx.	65 approx.	66 approx.
	EIA Standard for unit (U) (*8)			4	3	Max. 38	Max. 38
Input power specifications	Input voltage (Operable voltage range) (V)			AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)	
	Frequency (Hz)			50/60 ± 1			
	Number of phases, cabling			Single-phase with protective grounding			
	Steady-state current(*9) (*11) AC 100/200 (A)			3.8x2/1.9x2	2.4x2/1.2x2	-/16.0(One PDB)	-/16.0(One PDB)
	Breaking current (A)			16.0	16.0	8.0	
	Required power	Steady state (*11) (VA/W)		760/740 or less	480/460 or less	6,040/5,800 or less	7,960/7,640 or less
		Starting state (*10) (*11) (VA/W)		760/740 or less	480/460 or less	6,040/5,800 or less	7,960/7,640 or less
	Heat value (normal) (kJ/h)			2,670 or less	1,660 or less	20,880 or less	27,510 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*6 : A noise emitted at the time of start is not included.

*7 : Environmental temperature: 32°C or less
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*8 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*9 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*10 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*11 : This rating is based on the EN60950-1.

Item		Model: Rackmount model — RKM	RKAK	RKM + RKAK + RK40 rack frame: One rack	RKM + RKAK + RK40 rack frame: Two racks
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	1,024 to 8,192	
	Control method		–	Read LRU/Write after	
	Battery backup		–	Provided	
	Backup duration(*1) (h)		–	72 (When cache of 1 G bytes x 1/CTL) 72 (When cache of 2 G bytes x 1/CTL) 48 (When cache of 4 G bytes x 1/CTL) 36 (When cache of 1 G bytes x 2/CTL) 36 (When cache of 2 G bytes x 2/CTL) 24 (When cache of 4 G bytes x 2 /CTL)	
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)	•Control Unit •Disk Drive •Power Unit (RKM) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAK) •ENC Unit	•Control Unit •Disk Drive •Power Unit (RKM/ RKAK) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector •ENC Unit •PDB	
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)	
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling firmware patching • Disk Drive controlling firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)	
	Spare Disk	Up to 30 of mounted Disk Drive s can be set to Spare Disks			
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.	
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part			
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)	
	Insulation resistance	DC 500 V, 10 MΩ or more			

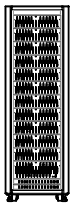
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
- In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
- Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
- Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
- If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
  In this case, charge the battery once per six months for longer than 24 hours.
- To minimize the deterioration of battery, use and keep a battery at the lowest temperature possible.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(2) Rackmount (RKEM+RKAK) Model

Table 2.1.4 Basic Specifications

Item		Model	Rackmount model			
			RKEM	RKAK	RKEM + RKAK + RK40 rack frame	
					One rack	Two racks
Configuration	Configuration		1 RKEM	1 RKAK	1 RKEM+ RKAK (11units)(*1) (Maximum configuration) + RK40 rack frame	1 RKEM+ RKAK (15units)(*1) (Maximum configuration) + RK40 rack frame
	Subsystem appearance					
Disk Drive used	Disk Drive size (W×D×H)	(mm)	101.6×147.0×26.1			
	Data capacity (*2)	(G byte)	142.61 / 195.82 / 287.62 / 392.73 / 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52			
	Rotational speed	(min^{-1})	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive			
	Maximum mountable quantity (*3)	(unit)	15		180	240
Host interface	Host interface		4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*4)	–	4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*4)	
	Data transfer speed (i.e. maximum speed for transfer to host)		800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*4)	–	800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*4)	
	Number of ports	Single controller	Fibre Channel : 8	–	Fibre Channel : 8	
			Fibre Channel : 4 + iSCSI: 2(*4)		Fibre Channel : 4 + iSCSI: 2(*4)	
		Dual controller /Optional	Fibre Channel : 8 × 2	–	Fibre Channel : 8 × 2	
			Fibre Channel : 4× 2 + iSCSI: 2(*4) × 2		Fibre Channel : 4× 2 + iSCSI: 2(*4) × 2	
	Transferred block size	(bytes)	512			

*1 : When nine or more RKAKs are mounted on RK40 rack, optional PDU/PDB is necessary.

*2 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*3 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*4 : It indicates the value of when the iSCSI Interface Board is mounted to the Control Unit.

Item			Model	Rackmount model			
				RKEM	RKAK	RKEM + RKAK + RK40 rack frame	
						One rack	Two racks
RAID specifications (*2)	RAID level (*1)			0/1/5/6/1+0		SAS Disk Drive: 0/1/5/6/1+0	
	RAID configuration (unit of addition)	RAID 0		2D to 15D	2D to 16D	SATA Disk Drive: Not support	
		RAID 1		1D+1D			
		RAID 5		2D+1P to 14D+1P	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P	
		RAID 6		2D+2P to 13D+2P	2D+2P to 28D+2P		
		RAID 1+0		2D+2D to 7D+7D	2D+2D to 8D+8D		
Internal logic specifications	Control CPU			It is the same as 'With RK40 rack frame'	–	Value Sossaman (1.67 GHz)	
	Control memory				–	• Flash memory : 16 M bytes • L2 Cache memory : 512 k bytes • SDRAM : 1 G bytes	
	Data assurance method				–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code	
Physical specifications	Start-up time (min)			Standard : 4(*4)			
	Chassis size (W×D×H) (mm)			(483×649×174)	(483×649×129)	(610×1,020×1,920)	((610×2)×1,020×1,920)
	Mass(*5) (kg)			51 approx.	40 approx.	755 approx.	1,150 approx.
	Acoustic noise(*6) (*7) (dB)			60 approx.	60 approx.	65 approx.	66 approx.
	EIA Standard for unit (U) (*8)			4	3	Max. 38	Max. 38
Input power specifications	Input voltage (Operable voltage range) (V)			AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)	
	Frequency (Hz)			50/60 ± 1			
	Number of phases, cabling			Single-phase with protective grounding			
	Steady-state current(*9) (*11) AC 100/200 (A)			3.8x2/1.9x2	2.4x2/1.2x2	-/16.0(One PDB)	-/16.0(One PDB)
	Breaking current (A)			16.0	16.0	8.0	
	Required power	Steady state (*11) (VA/W)		760/740 or less	480/460 or less	6,040/5,800 or less	7,960/7,640 or less
		Starting state (*10) (*11) (VA/W)		760/740 or less	480/460 or less	6,040/5,800 or less	7,960/7,640 or less
	Heat value (normal) (kJ/h)			2,670 or less	1,660 or less	20,880 or less	27,510 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*6 : A noise emitted at the time of start is not included.

*7 : Environmental temperature: 32°C or less
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*8 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*9 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*10 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*11 : This rating is based on the EN60950-1.

Item	Model	Rackmount model			
		RKEM	RKAK	RKEM + RKAK + RK40 rack frame	
				One rack	Two racks
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	1,024 to 8,192	
	Control method		–	Read LRU/Write after	
	Battery backup		–	Provided	
	Backup duration(*1) (h)		–	72 (When cache of 1 G bytes x 1/CTL) 72 (When cache of 2 G bytes x 1/CTL) 48 (When cache of 4 G bytes x 1/CTL) 36 (When cache of 1 G bytes x 2/CTL) 36 (When cache of 2 G bytes x 2/CTL) 24 (When cache of 4 G bytes x 2 /CTL)	
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)	•Control Unit •Disk Drive •Power Unit (RKM) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAK) •ENC Unit	•Control Unit •Disk Drive •Power Unit (RKM/ RKAK) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector •ENC Unit •PDB	
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)	
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling firmware patching • Disk Drive controlling firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)	
	Spare Disk	Up to 30 of mounted Disk Drive s can be set to Spare Disks			
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.	
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part			
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)	
	Insulation resistance	DC 500 V, 10 MΩ or more			

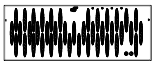
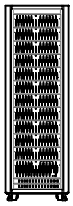
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
- In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
- Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
- Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
- If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
  In this case, charge the battery once per six months for longer than 24 hours.
- To minimize the deterioration of battery, use and keep a battery at the lowest temperature possible.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(3) Rackmount (RKM+RKAKX) Model

Table 2.1.5 Basic Specifications

Item \ Model			Rackmount model		
			RKM	RKAKX	RKM + RKAKX + RK40 rack frame One rack
Configuration	Configuration		1 RKM	1 RKAKX	1 RKM+ RKAKX (4units) + RKAK (1unit) (Maximum configuration) + RK40 rack frame
	Subsystem appearance				
Disk Drive used	Disk Drive size (W×D×H) (mm)		101.6×147.0×26.1		
	Data capacity (*1) (G byte)		142.61 / 195.82 / 287.62 / 392.73 / 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52	439.44 / 575.30 / 983.69 / 1,968.52	Installed in the RKM: 142.61 / 195.82 / 287.62 / 392.73 / 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52 Installed in the RKAKX: 439.44 / 575.30 / 983.69 / 1,968.52
	Rotational speed (min^{-1})		142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive	439.44 / 575.30 G byte : 15,000 983.69 / 1,968.52 G byte : 7,200	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive
	Maximum mountable quantity (*2) (unit)		15	SAS drive: 38 SATA drive: 48	222 (182(*4))
Host interface	Host interface		4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*3)	–	4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*3)
	Data transfer speed (i.e. maximum speed for transfer to host)		800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*4)	–	800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*3)
	Number of ports	Single controller	Fibre Channel : 4/ iSCSI: 2(*3)	–	Fibre Channel : 2/iSCSI: 4(*3)
		Dual controller /Optional	Fibre Channel : 8/ iSCSI: 4(*3)	–	Fibre Channel : 4/iSCSI: 8(*3)
	Transferred block size (bytes)		512		

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*3 : It indicates the value of when the iSCSI Interface Board is mounted to the Control Unit.

*4 : It indicate the maximum mountable number when the SAS drives are installed in the RKAKX.

Item			Model: Rackmount model			
			RKM	RKAKX	RKM + RKAKX + RK40 rack frame	
					One rack	
RAID specifications (*2)	RAID level (*1)		0/1/5/6/1+0	1/5/6/1+0	SAS Disk Drive: 0/1/5/6/1+0	
	RAID configuration (unit of addition)	RAID 0	2D to 15D	–	SATA Disk Drive: Not support	
		RAID 1	1D+1D			
		RAID 5	2D+1P to 14D+1P	2D+1P to 15D+1P (*3)	2D+1P to 15D+1P	
		RAID 6	2D+2P to 13D+2P	2D+2P to 28D+2P		
		RAID 1+0	2D+2D to 7D+7D	2D+2D to 8D+8D		
Internal logic specifications	Control CPU		It is the same as 'With RK40 rack frame'	–	ULV Sossaman (1.67 GHz)	
	Control memory			–	• Flash memory : 16 M bytes • L2 Cache memory : 2 M bytes • SDRAM : 1 G bytes	
	Data assurance method			–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code	
Physical specifications	Start-up time (min)		Standard : 4 (*4)	Standard : 5 (*5)	Standard : 4 (*4)	
	Chassis size (W×D×H) (mm)		(483×649×174)	(483×840×176)	(610×1,020×1,920)	
	Mass (*6) (kg)		51 approx.	81 approx.	674 approx.	
	Acoustic noise (*7) (*8) (dB)		60 approx.	62 approx.	67 approx.	
	EIA Standard for unit (U) (*9)		4	4	Max. 40	
Input power specifications	Input voltage (Operable voltage range) (V)		AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)	
	Frequency (Hz)		50/60 ± 1			
	Number of phases, cabling		Single-phase with protective grounding			
	Steady-state current (*10) (*12) AC 100/200 (A)		3.8x2/1.9x2	3.7x4/1.9x4	-/16.0(One PDB)	-/16.0(One PDB)
	Breaking current (A)		16.0	16.0	8.0	
	Required power	Steady state (*12) (VA/W)	760/740 or less	1,480/1,440 or less	7,160/6,960 or less	
		Starting state (*11) (*12) (VA/W)	760/740 or less	1,480/1,440 or less	7,160/6,960 or less	
	Heat value (normal) (kJ/h)		2,670 or less	5,190 or less	25,060 or less	

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : The start-up time may be longer than five minutes depending on the configuration.

*6 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*7 : A noise emitted at the time of start is not included.

*8 : Environmental temperature: 32°C or less (RKKAX: 30°C)
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*9 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*10 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*11 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*12 : This rating is based on the EN60950-1.

Item	Model	Rackmount model		
		RKM	RKAKX	RKM + RKAKX+ RK40 rack frame One rack
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	1,024 to 8,192
	Control method		–	Read LRU/Write after
	Battery backup		–	Provided
	Backup duration(*1) (h)		–	72 (When cache of 1 G bytes x 1/CTL) 72 (When cache of 2 G bytes x 1/CTL) 48 (When cache of 4 G bytes x 1/CTL) 36 (When cache of 1 G bytes x 2/CTL) 36 (When cache of 2 G bytes x 2/CTL) 24 (When cache of 4 G bytes x 2 /CTL)
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)	•Control Unit •Disk Drive •Power Unit (RKM) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAKX) •ENC Unit (RKAKX)	•Control Unit •Disk Drive •Power Unit (RKM/ RKAKX) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector •ENC Unit •PDB
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling firmware patching • Disk Drive controlling firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)
	Spare Disk	Up to 30 of mounted Disk Drive s can be set to Spare Disks		
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part		
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)
	Insulation resistance	DC 500 V, 10 MΩ or more		

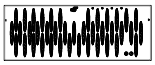
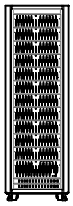
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
- In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
- Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
- Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
- If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
  In this case, charge the battery once per six months for longer than 24 hours.
- To minimize the deterioration of battery, use and keep a battery at the lowest temperature possible.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(4) Rackmount (RKEM+RKAKX) Model

Table 2.1.6 Basic Specifications

Item \ Model			Rackmount model		
			RKEM	RKAKX	RKEM + RKAKX + RK40 rack frame One rack
Configuration	Configuration		1 RKEM	1 RKAKX	1 RKEM+ RKAKX (5 units) + RKAK (1unit) (Maximum configuration) + RK40 rack frame
	Subsystem appearance				
Disk Drive used	Disk Drive size (W×D×H)	(mm)	101.6×147.0×26.1		
	Data capacity (*1)	(G byte)	142.61 / 195.82 / 287.62 / 392.73 / 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52	439.44 / 575.30 / 983.69 / 1,968.52	Installed in the RKM: 142.61 / 195.82 / 287.62 / 392.73 / 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52 Installed in the RKAKX: 439.44 / 575.30 / 983.69 / 1,968.52
	Rotational speed	(min^{-1})	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive	439.44 / 575.30 G byte : 15,000 983.69 / 1,968.52 G byte : 7,200	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive
	Maximum mountable quantity (*2)	(unit)	15	SAS drive: 38 SATA drive: 48	255 (205 (*4))
Host interface	Host interface		4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*3)	–	4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*3)
	Data transfer speed (i.e. maximum speed for transfer to host)		800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*4)	–	800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*3)
	Number of ports	Single controller	Fibre Channel : 8	–	Fibre Channel : 8
			Fibre Channel : 4 + iSCSI: 2(*3)		Fibre Channel : 4 + iSCSI: 2(*3)
		Dual controller /Optional	Fibre Channel : 8 × 2	–	Fibre Channel : 8 × 2
			Fibre Channel : 4× 2 + iSCSI: 2(*3) × 2		Fibre Channel : 4× 2 + iSCSI: 2(*3) × 2
	Transferred block size	(bytes)	512		

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*3 : It indicates the value of when the iSCSI Interface Board is mounted to the Control Unit.

*4 : It indicate the maximum mountable number when the SAS drives are installed in the RKAKX.

Item			Model	Rackmount model			
				RKEM	RKAKX	RKEM + RKAKX + RK40 rack frame	
						One rack	
RAID specifications (*2)	RAID level (*1)			0/1/5/6/1+0	1/5/6/1+0	SAS Disk Drive: 0/1/5/6/1+0	
	RAID configuration (unit of addition)	RAID 0		2D to 15D	–	SATA Disk Drive: Not support	
		RAID 1		1D+1D			
		RAID 5		2D+1P to 14D+1P	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P	
		RAID 6		2D+2P to 13D+2P	2D+2P to 28D+2P		
		RAID 1+0		2D+2D to 7D+7D	2D+2D to 8D+8D		
Internal logic specifications	Control CPU			It is the same as 'With RK40 rack frame'	–	Value Sossaman (1.67 GHz)	
	Control memory				–	• Flash memory : 16 M bytes • L2 Cache memory : 512 k bytes • SDRAM : 1 G bytes	
	Data assurance method				–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code	
Physical specifications	Start-up time (min)			Standard : 4(*4)	Standard : 5(*5)	Standard : 4(*4)	
	Chassis size (W×D×H) (mm)			(483×649×174)	(483×840×176)	(610×1,020×1,920)	
	Mass(*6) (kg)			51 approx.	81 approx.	674 approx.	
	Acoustic noise(*7)(*8) (dB)			60 approx.	62 approx.	67 approx.	
	EIA Standard for unit (U) (*9)			4	4	Max. 40	
Input power specifications	Input voltage (Operable voltage range) (V)			AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)	
	Frequency (Hz)			50/60 ± 1			
	Number of phases, cabling			Single-phase with protective grounding			
	Steady-state current(*10)(*12) AC 100/200 (A)			3.8x2/1.9x2	3.7x4/1.9x4	-/16.0(One PDB)	-/16.0(One PDB)
	Breaking current (A)			16.0	16.0	8.0	
	Required power	Steady state (*12) (VA/W)		760/740 or less	1,480/1,440 or less	7,160/6,960 or less	
		Starting state (*11)(*12) (VA/W)		760/740 or less	1,480/1,440 or less	7,160/6,960 or less	
	Heat value (normal) (kJ/h)			2,670 or less	5,190 or less	25,060 or less	

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : The start-up time may be longer than five minutes depending on the configuration.

*6 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*7 : A noise emitted at the time of start is not included.

*8 : Environmental temperature: 32°C or less (RKKAX: 30°C)
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*9 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*10 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*11 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*12 : This rating is based on the EN60950-1.

Item	Model	Rackmount model		
		RKEM	RKAKX	RKEM + RKAKX+ RK40 rack frame One rack
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	1,024 to 8,192
	Control method		–	Read LRU/Write after
	Battery backup		–	Provided
	Backup duration(*1) (h)		–	72 (When cache of 1 G bytes x 1/CTL) 72 (When cache of 2 G bytes x 1/CTL) 48 (When cache of 4 G bytes x 1/CTL) 36 (When cache of 1 G bytes x 2/CTL) 36 (When cache of 2 G bytes x 2/CTL) 24 (When cache of 4 G bytes x 2 /CTL)
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)	•Control Unit •Disk Drive •Power Unit (RKM) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAKX) •ENC Unit (RKAKX)	•Control Unit •Disk Drive •Power Unit (RKM/ RKAKX) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector •ENC Unit •PDB
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling firmware patching • Disk Drive controlling firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)
	Spare Disk	Up to 30 of mounted Disk Drive s can be set to Spare Disks		
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part		
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)
	Insulation resistance	DC 500 V, 10 MΩ or more		

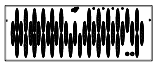
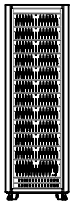
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
- In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
- Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
- Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
- If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
  In this case, charge the battery once per six months for longer than 24 hours.
- To minimize the deterioration of battery, use and keep a battery at the lowest temperature possible.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(5) Rackmount (RKS+RKAK) Model

Table 2.1.7 Basic Specifications

Item \ Model			Rackmount model		
			RKS	RKAK	RKS + RKAK + RK40 rack frame One rack
Configuration	Configuration		1 RKS	1 RKAK	1 RKS+ RKAK (7units) (Maximum configuration) + RK40 rack frame
	Subsystem appearance				
Disk Drive used	Disk Drive size (W×D×H) (mm)		101.6×147.0×26.1		
	Data capacity (*1) (G byte)		142.61 / 195.82 / 287.62 /392.73/ 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52		
	Rotational speed (min-1)		142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive		
	Maximum mountable quantity (*2) (unit)		15		120
Host interface	Host interface		4 G bps Fibre Channel Optical (*4)/ 1 G bps iSCSI [1000Base-T](*4)	–	4 G bps Fibre Channel Optical (*4)/ 1 G bps iSCSI [1000Base-T](*4)
	Data transfer speed (i.e. maximum speed for transfer to host)		400 M bytes/s (Fibre Channel)(*3)/ 100 M bytes/s (iSCSI)(*4)	–	400 M bytes/s (Fibre Channel)(*3)/ 100 M bytes/s (iSCSI)(*4)
	Number of p Host connector	Single controller	Fibre Channel : 2 (*5)/iSCSI: 2(*4)	–	Fibre Channel : 2/iSCSI: 2(*4)
		Dual controller /Optional	Fibre Channel : 4 (*5)/iSCSI: 4(*4)	–	Fibre Channel : 4/iSCSI: 4(*4)
	Transferred block size (bytes)		512		

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*3 : It indicates the value of when the FC Interface Board is added to the Control Unit.

*4: It indicates the value of when the iSCSI Interface Board is added to the Control Unit.

Item \ Model			Rackmount model		
			RKS	RKAK	RKS + RKAK + RK40 rack frame One rack
RAID specifications (*2)	RAID level (*1)		0/1/5/6/1+0		SAS Disk Drive : 0/1/5/6/1+0
	RAID configuration (unit of addition)	RAID 0	2D to 15D	2D to 16D	SATA Disk Drive : Not support
		RAID 1	1D+1D		
		RAID 5	2D+1P to 14D+1P	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P
		RAID 6	2D+2P to 13D+2P	2D+2P to 28D+2P	
		RAID 1+0	2D+2D to 7D+7D	2D+2D to 8D+8D	
Internal logic specifications	Control CPU		It is the same as 'With RK40 rack frame'	–	Value Sossaman (1.67 GHz)
	Control memory			–	• Flash memory : 16 M bytes • L2 Cache memory : 512 k bytes • SDRAM : 1 G bytes
	Data assurance method			–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code
Physical specifications	Start-up time (min)		Standard : 4(*4)		
	Chassis size (W×D×H) (mm)		(483×649×174)	(483×649×129)	(610×1,020×1,920)
	Mass(*5) (kg)		51 approx.	40 approx.	580 approx.
	Acoustic noise(*6) (*7) (dB)		60 approx.	60 approx.	63 approx.
	EIA Standard for unit (U) (*8)		4	3	Max. 38
Input power specifications	Input voltage (Operable voltage range) (V)		AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)
	Frequency (Hz)		50/60 ± 1		
	Number of phases, cabling		Single-phase with protective grounding		
	Steady-state current(*9) (*11) AC 100/200 (A)		3.8x2/1.9x2	2.4x2/1.2x2	-/16.0(One PDB)
	Breaking current (A)		16.0	16.0	8.0
	Required power	Steady state (*11) (VA/W)	760/740 or less	480/460 or less	4,120/3,960 or less
		Starting state (*10) (*11) (VA/W)	760/740 or less	480/460 or less	4,120/3,960 or less
	Heat value (normal) (Kj/h)		2,670 or less	1,660 or less	14,260 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*6 : A noise emitted at the time of start is not included.

*7 : Environmental temperature: 32°C or less
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*8 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*9 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*10 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*11 : This rating is based on the EN60950-1.

Item	Model	Rackmount model		
		RKS	RKAK	RKS + RKAK + RK40 rack frame One rack
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	1,024, 2,048, 4,096
	Control method		–	Read LRU/Write after
	Battery backup		–	Provided
	Backup duration(*1) (h)		–	72 (When cache of 1 G bytes/CTL) 72 (When cache of 2 G bytes/CTL) 48 (When cache of 4 G bytes/CTL)
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)	•Control Unit •Disk Drive •Power Unit (RKS) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAK) •ENC Unit	•Control Unit •Disk Drive •Power Unit (RKS/ RKAK) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/ iSCSI) and Host Connector •ENC Unit •PDB
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling Firmware patching • Disk Drive controlling Firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)
	Spare Disk	Up to 15 of mounted Disk Drive s can be set to Spare Disks		
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part		
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)
	Insulation resistance	DC 500 V, 10 MΩ or more		

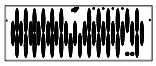
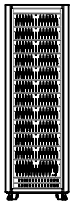
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
• In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
• Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
• Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
• If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
In this case, charge the battery once per six months for longer than 24 hours.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(6) Rackmount (RKES+RKAK) Model

Table 2.1.8 Basic Specifications

Item \ Model			Rackmount model		
			RKES	RKAK	RKES + RKAK + RK40 rack frame One rack
Configuration	Configuration		1 RKES	1 RKAK	1 RKES+ RKAK (7units) (Maximum configuration) + RK40 rack frame
	Subsystem appearance				
Disk Drive used	Disk Drive size (W×D×H) (mm)		101.6×147.0×26.1		
	Data capacity (*1) (G byte)		142.61 / 195.82 / 287.62 /392.73/ 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52		
	Rotational speed (min-1)		142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive		
	Maximum mountable quantity (*2) (unit)		15		120
Host interface	Host interface		4 G bps Fibre Channel Optical(*3)/ 1 G bps iSCSI [1000Base-T](*4)	–	4 G bps Fibre Channel Optical(*3)/ 1 G bps iSCSI [1000Base-T](*4)
	Data transfer speed (i.e. maximum speed for transfer to host)		400 M bytes/s (Fibre Channel)(*3)/ 100 M bytes/s (iSCSI)(*4)	–	400 M bytes/s (Fibre Channel)(*3)/ 100 M bytes/s (iSCSI)(*4)
	Number of p Host connector	Single controller	Fibre Channel : 4(*3)	–	Fibre Channel : 4(*3)
			Fibre Channel : 2(*3) + iSCSI: 2(*4)		Fibre Channel : 2(*3) + iSCSI: 2(*4)
		Dual controller /Optional	Fibre Channel : 4(*3) × 2	–	Fibre Channel : 4(*3) × 2
			Fibre Channel : 2(*3)× 2 + iSCSI: 2(*4) × 2		Fibre Channel : 2(*3)× 2 + iSCSI: 2(*4) × 2
	Transferred block size (bytes)		512		

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*3 : It indicates the value of when the FC Interface Board is added to the Control Unit.

*4: It indicates the value of when the iSCSI Interface Board is added to the Control Unit.

Item \ Model			Rackmount model		
			RKES	RKAK	RKES + RKAK + RK40 rack frame One rack
RAID specifications (*2)	RAID level (*1)		0/1/5/6/1+0		SAS Disk Drive : 0/1/5/6/1+0
	RAID configuration (unit of addition)	RAID 0	2D to 15D	2D to 16D	SATA Disk Drive : Not support
		RAID 1	1D+1D		
		RAID 5	2D+1P to 14D+1P	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P
		RAID 6	2D+2P to 13D+2P	2D+2P to 28D+2P	
		RAID 1+0	2D+2D to 7D+7D	2D+2D to 8D+8D	
Internal logic specifications	Control CPU		It is the same as 'With RK40 rack frame'	–	Value Sossaman (1.67 GHz)
	Control memory			–	• Flash memory : 16 M bytes • L2 Cache memory : 512 k bytes • SDRAM : 1 G bytes
	Data assurance method			–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code
Physical specifications	Start-up time (min)		Standard : 4(*4)		
	Chassis size (W×D×H) (mm)		(483×649×174)	(483×649×129)	(610×1,020×1,920)
	Mass(*5) (kg)		51 approx.	40 approx.	580 approx.
	Acoustic noise(*6) (*7) (dB)		60 approx.	60 approx.	63 approx.
	EIA Standard for unit (U) (*8)		4	3	Max. 38
Input power specifications	Input voltage (Operable voltage range) (V)		AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)
	Frequency (Hz)		50/60 ± 1		
	Number of phases, cabling		Single-phase with protective grounding		
	Steady-state current(*9) (*11) AC 100/200 (A)		3.8x2/1.9x2	2.4x2/1.2x2	-/16.0(One PDB)
	Breaking current (A)		16.0	16.0	8.0
	Required power	Steady state (*11) (VA/W)	760/740 or less	480/460 or less	4,120/3,960 or less
		Starting state (*10) (*11) (VA/W)	760/740 or less	480/460 or less	4,120/3,960 or less
	Heat value (normal) (Kj/h)		2,670 or less	1,660 or less	14,260 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*6 : A noise emitted at the time of start is not included.

*7 : Environmental temperature: 32°C or less
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*8 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*9 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*10 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*11 : This rating is based on the EN60950-1.

Item		Model	Rackmount model		
			RKES	RKAK	RKES + RKAK + RK40 rack frame One rack
Cache specifications	Capacity (M bytes/CTL)		It is the same as 'With RK40 rack frame'	–	1,024, 2,048, 4,096
	Control method			–	Read LRU/Write after
	Battery backup			–	Provided
	Backup duration(*1) (h)			–	72 (When cache of 1 G bytes/CTL) 72 (When cache of 2 G bytes/CTL) 48 (When cache of 4 G bytes/CTL)
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)		•Control Unit •Disk Drive •Power Unit (RKS) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAK) •ENC Unit	•Control Unit •Disk Drive •Power Unit (RKS/ RKAK) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/ iSCSI) and Host Connector •ENC Unit •PDB
	Firmware installation method		It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)
	SVP (built-in exclusive tool) function		It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling Firmware patching • Disk Drive controlling Firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)
	Spare Disk		Up to 15 of mounted Disk Drive s can be set to Spare Disks		
	Collection of trace and dump		It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.
	Display function		• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part		
Insulation performance	Insulation withstand voltage		AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)
	Insulation resistance		DC 500 V, 10 MΩ or more		

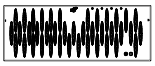
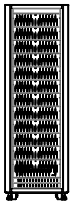
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
• In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
• Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
• Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
• If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
In this case, charge the battery once per six months for longer than 24 hours.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(7) Rackmount (RKS+RKAKX) Model

Table 2.1.9 Basic Specifications

Item \ Model			Rackmount model		
			RKS	RKAKX	RKS + RKAKX + RK40 rack frame One rack
Configuration	Configuration		1 RKS	1 RKAKX	1 RKS+ RKAKX (3 units) (Maximum configuration) + RK40 rack frame
	Subsystem appearance				
Disk Drive used	Disk Drive size (W×D×H) (mm)		101.6×147.0×26.1		
	Data capacity (*1) (G byte)		142.61 / 195.82 / 287.62 /392.73/ 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52	439.44 / 575.30 / 983.69 / 1,968.52	Installed in the RKS: 142.61 / 195.82 / 287.62 /392.73/ 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52 Installed in the RKAKX: 439.44 / 575.30 / 983.69 / 1,968.52
	Rotational speed (min^{-1})		142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive	439.44 / 575.30 G byte : 15,000 983.69 / 1,968.52 G byte : 7,200	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive
	Maximum mountable quantity (*2) (unit)		15	SAS drive: 38 SATA drive: 48	159 (129(*5))
Host interface	Host interface		4 G bps Fibre Channel Optical (*4)/ 1 G bps iSCSI [1000Base-T](*4)	–	4 G bps Fibre Channel Optical (*4)/ 1 G bps iSCSI [1000Base-T](*4)
	Data transfer speed (i.e. maximum speed for transfer to host)		400 M bytes/s (Fibre Channel)(*3)/ 100 M bytes/s (iSCSI)(*4)	–	400 M bytes/s (Fibre Channel)(*3)/ 100 M bytes/s (iSCSI)(*4)
	Number of p Host connector	Single controller	Fibre Channel : 2 (*5)/iSCSI: 2(*4)	–	Fibre Channel : 2/iSCSI: 2(*4)
		Dual controller /Optional	Fibre Channel : 4 (*5)/iSCSI: 4(*4)	–	Fibre Channel : 4/iSCSI: 4(*4)
	Transferred block size (bytes)		512		

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*3 : It indicates the value of when the FC Interface Board is added to the Control Unit.

*4: It indicates the value of when the iSCSI Interface Board is added to the Control Unit.

*5 : It indicate the maximum mountable number when the SAS drives are installed in the RKAKX.

Item \ Model			Rackmount model		
			RKS	RKAKX	RKS + RKAKX + RK40 rack frame One rack
RAID specifications (*2)	RAID level (*1)		0/1/5/6/1+0	1/5/6/1+0	SAS Disk Drive : 0/1/5/6/1+0
	RAID configuration (unit of addition)	RAID 0	2D to 15D	–	SATA Disk Drive : Not support
		RAID 1	1D+1D		
		RAID 5	2D+1P to 14D+1P	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P
		RAID 6	2D+2P to 13D+2P	2D+2P to 28D+2P	
		RAID 1+0	2D+2D to 7D+7D	2D+2D to 8D+8D	
Internal logic specifications	Control CPU		It is the same as 'With RK40 rack frame'	–	Value Sossaman (1.67 GHz)
	Control memory			–	• Flash memory : 16 M bytes • L2 Cache memory : 512 k bytes • SDRAM : 1 G bytes
	Data assurance method			–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code
Physical specifications	Start-up time (min)		Standard : 4(*4)	Standard : 5(*5)	Standard : 5(*5)
	Chassis size (W×D×H) (mm)		(483×649×174)	(483×840×176)	(610×1,020×1,920)
	Mass(*6) (kg)		51 approx.	81 approx.	565 approx.
	Acoustic noise(*7)(*8) (dB)		60 approx.	62 approx.	64 approx.
	EIA Standard for unit (U)(*9)		4	4	Max. 40
Input power specifications	Input voltage (Operable voltage range) (V)		AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)
	Frequency (Hz)		50/60 ± 1		
	Number of phases, cabling		Single-phase with protective grounding		
	Steady-state current(*10)(*12) AC 100/200 (A)		3.8x2/1.9x2	3.7x4/1.9x4	-/16.0(One PDB)
	Breaking current (A)		16.0	16.0	8.0
	Required power	Steady state (*12) (VA/W)	760/740 or less	1,480/1,440 or less	5,200/5,060 or less
		Starting state (*11)(*12) (VA/W)	760/740 or less	1,480/1,440 or less	5,200/5,060 or less
	Heat value (normal) (Kj/h)		2,670 or less	5,190 or less	18,240 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : The start-up time may be longer than five minutes depending on the configuration.

*6 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*7 : A noise emitted at the time of start is not included.

*8 : Environmental temperature: 32°C or less (RKAKX : 30°C)
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*9 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*10 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*11: Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*12: This rating is based on the EN60950-1.

Item	Model	Rackmount model		
		RKS	RKAKX	RKS + RKAKX + RK40 rack frame One rack
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	1,024, 2,048, 4,096
	Control method		–	Read LRU/Write after
	Battery backup		–	Provided
	Backup duration(*1) (h)		–	72 (When cache of 1 G bytes/CTL) 72 (When cache of 2 G bytes/CTL) 48 (When cache of 4 G bytes/CTL)
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)	•Control Unit •Disk Drive •Power Unit (RKS) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAKX) •ENC Unit (RKAKX)	•Control Unit •Disk Drive •Power Unit (RKS/ RKAKX) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/ iSCSI) and Host Connector •ENC Unit •PDB
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling Firmware patching • Disk Drive controlling Firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)
	Spare Disk	Up to 15 of mounted Disk Drive s can be set to Spare Disks		
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part		
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)
	Insulation resistance	DC 500 V, 10 MΩ or more		

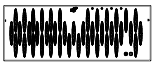
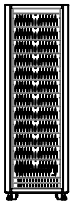
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
• In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
• Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
• Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
• If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
In this case, charge the battery once per six months for longer than 24 hours.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(8) Rackmount (RKES+RKAKX) Model

Table 2.1.10 Basic Specifications

Item		Model	Rackmount model		
			RKES	RKAKX	RKES + RKAKX + RK40 rack frame One rack
Configuration	Configuration		1 RKES	1 RKAKX	1 RKES+ RKAKX (3 units) (Maximum configuration) + RK40 rack frame
	Subsystem appearance				
Disk Drive used	Disk Drive size (W×D×H)	(mm)	101.6×147.0×26.1		
	Data capacity (*1)	(G byte)	142.61 / 195.82 / 287.62 /392.73/ 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52	439.44 / 575.30 / 983.69 / 1,968.52	Installed in the RKS: 142.61 / 195.82 / 287.62 /392.73/ 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52 Installed in the RKAKX: 439.44 / 575.30 / 983.69 / 1,968.52
	Rotational speed	(min^{-1})	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive	439.44 / 575.30 G byte : 15,000 983.69 / 1,968.52 G byte : 7,200	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive
	Maximum mountable quantity (*2)	(unit)	15	SAS drive: 38 SATA drive: 48	159 (129(*5))
Host interface	Host interface		4 G bps Fibre Channel Optical (*3)/ 1 G bps iSCSI [1000Base-T](*4)	–	4 G bps Fibre Channel Optical (*3)/ 1 G bps iSCSI [1000Base-T](*4)
	Data transfer speed (i.e. maximum speed for transfer to host)		400 M bytes/s (Fibre Channel)(*3)/ 100 M bytes/s (iSCSI)(*4)	–	400 M bytes/s (Fibre Channel)(*3)/ 100 M bytes/s (iSCSI)(*4)
	Number of p Host connector	Single controller	Fibre Channel : 4(*3)	–	Fibre Channel : 4(*3)
			Fibre Channel : 2(*3) + iSCSI: 2(*4)		Fibre Channel : 2(*3) + iSCSI: 2(*4)
		Dual controller /Optional	Fibre Channel : 4(*3) × 2	–	Fibre Channel : 4(*3) × 2
			Fibre Channel : 2(*3)× 2 + iSCSI: 2(*4) × 2		Fibre Channel : 2(*3)× 2 + iSCSI: 2(*4) × 2
	Transferred block size	(bytes)	512		

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*3 : It indicates the value of when the FC Interface Board is added to the Control Unit.

*4: It indicates the value of when the iSCSI Interface Board is added to the Control Unit.

*5 : It indicate the maximum mountable number when the SAS drives are installed in the RKAKX.

Item \ Model			Rackmount model		
			RKES	RKAKX	RKES + RKAKX + RK40 rack frame One rack
RAID specifications (*2)	RAID level (*1)		0/1/5/6/1+0	1/5/6/1+0	SAS Disk Drive : 0/1/5/6/1+0
	RAID configuration (unit of addition)	RAID 0	2D to 15D	–	SATA Disk Drive : Not support
		RAID 1	1D+1D		
		RAID 5	2D+1P to 14D+1P	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P
		RAID 6	2D+2P to 13D+2P	2D+2P to 28D+2P	
		RAID 1+0	2D+2D to 7D+7D	2D+2D to 8D+8D	
Internal logic specifications	Control CPU		It is the same as 'With RK40 rack frame'	–	Value Sossaman (1.67 GHz)
	Control memory			–	• Flash memory : 16 M bytes • L2 Cache memory : 512 k bytes • SDRAM : 1 G bytes
	Data assurance method			–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code
Physical specifications	Start-up time (min)		Standard : 4(*4)	Standard : 5(*5)	Standard : 5(*5)
	Chassis size (W×D×H) (mm)		(483×649×174)	(483×840×176)	(610×1,020×1,920)
	Mass(*6) (kg)		51 approx.	81 approx.	565 approx.
	Acoustic noise(*7)(*8) (dB)		60 approx.	62 approx.	64 approx.
	EIA Standard for unit (U)(*9)		4	4	Max. 40
Input power specifications	Input voltage (Operable voltage range) (V)		AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)
	Frequency (Hz)		50/60 ± 1		
	Number of phases, cabling		Single-phase with protective grounding		
	Steady-state current(*10)(*12) AC 100/200 (A)		3.8x2/1.9x2	3.7x4/1.9x4	-/16.0(One PDB)
	Breaking current (A)		16.0	16.0	8.0
	Required power	Steady state (*12) (VA/W)	760/740 or less	1,480/1,440 or less	5,200/5,060 or less
		Starting state (*11)(*12) (VA/W)	760/740 or less	1,480/1,440 or less	5,200/5,060 or less
	Heat value (normal) (Kj/h)		2,670 or less	5,190 or less	18,240 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : The start-up time may be longer than five minutes depending on the configuration.

*6 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*7 : A noise emitted at the time of start is not included.

*8 : Environmental temperature: 32°C or less (RKAKX : 30°C)
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*9 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*10 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*11: Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*12: This rating is based on the EN60950-1.

Item	Model	Rackmount model		
		RKES	RKAKX	RKES + RKAKX + RK40 rack frame One rack
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	1,024, 2,048, 4,096
	Control method		–	Read LRU/Write after
	Battery backup		–	Provided
	Backup duration(*1) (h)		–	72 (When cache of 1 G bytes/CTL) 72 (When cache of 2 G bytes/CTL) 48 (When cache of 4 G bytes/CTL)
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)	•Control Unit •Disk Drive •Power Unit (RKS) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAKX) •ENC Unit (RKAKX)	•Control Unit •Disk Drive •Power Unit (RKS/ RKAKX) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/ iSCSI) and Host Connector •ENC Unit •PDB
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling Firmware patching • Disk Drive controlling Firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)
	Spare Disk	Up to 15 of mounted Disk Drive s can be set to Spare Disks		
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part		
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)
	Insulation resistance	DC 500 V, 10 MΩ or more		

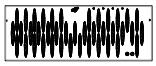
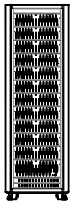
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
• In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
• Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
• Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
• If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
In this case, charge the battery once per six months for longer than 24 hours.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(9) Rackmount (RKEXS+RKAK) Model

Table 2.1.11 Basic Specifications

Item \ Model			Rackmount model		
			RKEXS	RKAK	RKEXS + RKAK + RK40 rack frame One rack
Configuration	Configuration		1 RKEXS	1 RKAK	1 RKEXS+ RKAK (7units) (Maximum configuration) + RK40 rack frame
	Subsystem appearance				
Disk Drive used	Disk Drive size (W×D×H) (mm)		101.6×147.0×26.1		
	Data capacity (*1) (G byte)		142.61 / 195.82 / 287.62 /392.73/ 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52		
	Rotational speed (min^{-1})		142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive		
	Maximum mountable quantity (*2) (unit)		15		120
Host interface	Host interface		4 G bps Fibre Channel Optical	–	4 G bps Fibre Channel Optical
	Data transfer speed (i.e. maximum speed for transfer to host)		400 M bytes/s (Fibre Channel)	–	400 M bytes/s (Fibre Channel)/100 M bytes
	Number of p Host connector	Single controller	Fibre Channel : 4	–	Fibre Channel : 4
		Dual controller /Optional	Fibre Channel : 4 × 2	–	Fibre Channel : 4 × 2
	Transferred block size (bytes)		512		

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

Item \ Model			Rackmount model		
			RKEXS	RKAK	RKEXS + RKAK + RK40 rack frame One rack
RAID specifications (*2)	RAID level (*1)		0/1/5/6/1+0		SAS Disk Drive : 0/1/5/6/1+0
	RAID configuration (unit of addition)	RAID 0	2D to 15D	2D to 16D	SATA Disk Drive : Not support
		RAID 1	1D+1D		
		RAID 5	2D+1P to 14D+1P	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P
		RAID 6	2D+2P to 13D+2P	2D+2P to 28D+2P	
		RAID 1+0	2D+2D to 7D+7D	2D+2D to 8D+8D	
Internal logic specifications	Control CPU		It is the same as 'With RK40 rack frame'	–	Value Sossaman (1.67 GHz)
	Control memory			–	• Flash memory : 16 M bytes • L2 Cache memory : 512 k bytes • SDRAM : 1 G bytes
	Data assurance method			–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code
Physical specifications	Start-up time (min)		Standard : 4(*4)		
	Chassis size (W×D×H) (mm)		(483×649×174)	(483×649×129)	(610×1,020×1,920)
	Mass(*5) (kg)		51 approx.	40 approx.	580 approx.
	Acoustic noise(*6) (*7) (dB)		60 approx.	60 approx.	63 approx.
	EIA Standard for unit (U) (*8)		4	3	Max. 38
Input power specifications	Input voltage (Operable voltage range) (V)		AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)
	Frequency (Hz)		50/60 ± 1		
	Number of phases, cabling		Single-phase with protective grounding		
	Steady-state current(*9) (*11) AC 100/200 (A)		3.8x2/1.9x2	2.4x2/1.2x2	-/16.0(One PDB)
	Breaking current (A)		16.0	16.0	8.0
	Required power	Steady state (*11) (VA/W)	760/740 or less	480/460 or less	4,120/3,960 or less
		Starting state (*10) (*11) (VA/W)	760/740 or less	480/460 or less	4,120/3,960 or less
	Heat value (normal) (Kj/h)		2,670 or less	1,660 or less	14,260 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*6 : A noise emitted at the time of start is not included.

*7 : Environmental temperature: 32°C or less
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*8 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*9 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*10 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*11 : This rating is based on the EN60950-1.

Item		Model	Rackmount model		
			RKEXS	RKAK	RKEXS + RKAK + RK40 rack frame One rack
Cache specifications	Capacity (M bytes/CTL)		It is the same as 'With RK40 rack frame'	–	1,024, 2,048, 4,096
	Control method			–	Read LRU/Write after
	Battery backup			–	Provided
	Backup duration(*1) (h)			–	72 (When cache of 1 G bytes/CTL) 72 (When cache of 2 G bytes/CTL) 48 (When cache of 4 G bytes/CTL)
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)		•Control Unit •Disk Drive •Power Unit (RKEXS) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAK) •ENC Unit	•Control Unit •Disk Drive •Power Unit (RKEXS/RKAK) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/ iSCSI) and Host Connector •ENC Unit •PDB
	Firmware installation method		It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)
	SVP (built-in exclusive tool) function		It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling Firmware patching • Disk Drive controlling Firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)
	Spare Disk		Up to 15 of mounted Disk Drive s can be set to Spare Disks		
	Collection of trace and dump		It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.
	Display function		• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part		
Insulation performance	Insulation withstand voltage		AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)
	Insulation resistance		DC 500 V, 10 MΩ or more		

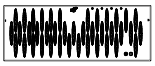
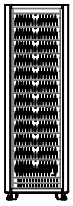
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
• In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
• Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
• Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
• If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
In this case, charge the battery once per six months for longer than 24 hours.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(10) Rackmount (RKEXS+RKAKX) Model

Table 2.1.12 Basic Specifications

Item		Model	Rackmount model		
			RKEXS	RKAKX	RKEXS + RKAKX + RK40 rack frame One rack
Configuration	Configuration		1 RKEXS	1 RKAKX	1 RKEXS+ RKAKX (3 units) (Maximum configuration) + RK40 rack frame
	Subsystem appearance				
Disk Drive used	Disk Drive size (W×D×H) (mm)		101.6×147.0×26.1		
	Data capacity (*1) (G byte)		142.61 / 195.82 / 287.62 /392.73/ 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52	439.44 / 575.30 / 983.69 / 1,968.52	Installed in the RKS: 142.61 / 195.82 / 287.62 /392.73/ 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52 Installed in the RKAKX: 439.44 / 575.30 / 983.69 / 1,968.52
	Rotational speed (min^{-1})		142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive	439.44 / 575.30 G byte : 15,000 983.69 / 1,968.52 G byte : 7,200	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte : 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive
	Maximum mountable quantity (*2) (unit)		15	SAS drive: 38 SATA drive: 48	159 (129(*3))
Host interface	Host interface		4 G bps Fibre Channel Optical	–	4 G bps Fibre Channel Optical
	Data transfer speed (i.e. maximum speed for transfer to host)		400 M bytes/s (Fibre Channel)	–	400 M bytes/s (Fibre Channel)
	Number of p Host connector	Single controller	Fibre Channel : 4	–	Fibre Channel : 4
		Dual controller /Optional	Fibre Channel : 4 × 2	–	Fibre Channel : 4 × 2
	Transferred block size (bytes)		512		

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*3 : It indicate the maximum mountable number when the SAS drives are installed in the RKAKX.

Item \ Model			Rackmount model		
			RKEXS	RKAKX	RKEXS + RKAKX + RK40 rack frame One rack
RAID specifications (*2)	RAID level (*1)		0/1/5/6/1+0	1/5/6/1+0	SAS Disk Drive : 0/1/5/6/1+0
	RAID configuration (unit of addition)	RAID 0	2D to 15D	–	SATA Disk Drive : Not support
		RAID 1	1D+1D		
		RAID 5	2D+1P to 14D+1P	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P
		RAID 6	2D+2P to 13D+2P	2D+2P to 28D+2P	
		RAID 1+0	2D+2D to 7D+7D	2D+2D to 8D+8D	
Internal logic specifications	Control CPU		It is the same as 'With RK40 rack frame'	–	Value Sossaman (1.67 GHz)
	Control memory			–	• Flash memory : 16 M bytes • L2 Cache memory : 512 k bytes • SDRAM : 1 G bytes
	Data assurance method			–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code
Physical specifications	Start-up time (min)		Standard : 4(*4)	Standard : 5(*5)	Standard : 5(*5)
	Chassis size (W×D×H) (mm)		(483×649×174)	(483×840×176)	(610×1,020×1,920)
	Mass(*6) (kg)		51 approx.	81 approx.	565 approx.
	Acoustic noise(*7)(*8) (dB)		60 approx.	62 approx.	64 approx.
	EIA Standard for unit (U)(*9)		4	4	Max. 40
Input power specifications	Input voltage (Operable voltage range) (V)		AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)
	Frequency (Hz)		50/60 ± 1		
	Number of phases, cabling		Single-phase with protective grounding		
	Steady-state current(*10)(*12) AC 100/200 (A)		3.8x2/1.9x2	3.7x4/1.9x4	-/16.0(One PDB)
	Breaking current (A)		16.0	16.0	8.0
	Required power	Steady state (*12) (VA/W)	760/740 or less	1,480/1,440 or less	5,200/5,060 or less
		Starting state (*11)(*12) (VA/W)	760/740 or less	1,480/1,440 or less	5,200/5,060 or less
	Heat value (normal) (Kj/h)		2,670 or less	5,190 or less	18,240 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than four minutes depending on the configuration.

*5 : The start-up time may be longer than five minutes depending on the configuration.

*6 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*7 : A noise emitted at the time of start is not included.

*8 : Environmental temperature: 32°C or less (RKAKX : 30°C)
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*9 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*10 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*11: Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*12: This rating is based on the EN60950-1.

Item	Model	Rackmount model		
		RKEXS	RKAKX	RKEXS + RKAKX + RK40 rack frame One rack
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	1,024, 2,048, 4,096
	Control method		–	Read LRU/Write after
	Battery backup		–	Provided
	Backup duration(*1) (h)		–	72 (When cache of 1 G bytes/CTL) 72 (When cache of 2 G bytes/CTL) 48 (When cache of 4 G bytes/CTL)
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*2)	•Control Unit •Disk Drive •Power Unit (RKS) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAKX) •ENC Unit (RKAKX)	•Control Unit •Disk Drive •Power Unit (RKS/ RKAKX) •Cache Unit •Cache Backup Battery (*3) •Interface Board (FC/ iSCSI) and Host Connector •ENC Unit •PDB
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling Firmware patching • Disk Drive controlling Firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)
	Spare Disk	Up to 15 of mounted Disk Drive s can be set to Spare Disks		
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part		
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)
	Insulation resistance	DC 500 V, 10 MΩ or more		

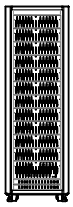
*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed two batteries of a full charge).
• In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
• Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
• Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
• If the subsystem is not energized for more than six months, the over discharging of the battery occurs and it may cause the battery an unrecoverable damage.
In this case, charge the battery once per six months for longer than 24 hours.

*2 : Only the trained service personnel can perform a hot replacement.

*3 : The battery in the Cache Backup Battery is a part to be recycled.

(11) Rackmount (RKH+RKAK) Model

Table 2.1.13 Basic Specifications

Item		Model	Rackmount model			
			RKH	RKAK	RKH + RKAK + RK40 rack frame	
					One rack	Three racks
Configuration	Configuration		1 RKH	1 RKAK	1 RKH+ RKAK (11units) (Maximum configuration (*1)) + RK40 rack frame	1 RKH+ RKAK (32units) (Maximum configuration (*1)) + RK40 rack frame (3units)
	Subsystem appearance					
Disk Drive used	Disk Drive size (W×D×H) (mm)		–	101.6×147.0×26.1		
	Data capacity (*2) (G byte)		–	142.61 / 195.82 / 287.62 /392.73 / 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52		
	Rotational speed (min^{-1})		–	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte: 10,000 491.25 / 737.49 / 983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive		
	Maximum mountable quantity (*3) (unit)		–	15	150	480
Host interface	Host interface		4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*4)	–	4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*4)	
	Data transfer speed (i.e. maximum speed for transfer to host)		800 M bytes/s (Fibre Channel)/ 100 M bytes/s (iSCSI)(*4)	–	800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*4)	
	Number of ports	Dual controller	Fibre Channel : Max.16/ iSCSI: 8(*4)	–	Fibre Channel : Max.16/ iSCSI: 8(*4)	
	Transferred block size (bytes)		512			

*1 : When nine or more RKAKs are mounted on RK40 rack, optional PDU/PDB is necessary.

*2 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*3 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*4 : It indicates the value of when the iSCSI Interface Board is mounted/added to the Control Unit.

Item			Model: Rackmount model			
			RKH	RKAK	RKH + RKAK + RK40 rack frame	
					One rack	Three racks
RAID specifications (*2)	RAID level (*1)		–	0/1/5/6/1+0	SAS Disk Drive : 0/1/5/6/1+0	
	RAID configuration (unit of addition)	RAID 0	–	2D to 16D	SATA Disk Drive : Not support	
		RAID 1	–	1D+1D		
		RAID 5	–	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P	
		RAID 6	–	2D+2P to 28D+2P		
		RAID 1+0	–	2D+2D to 8D+8D		
Internal logic specifications	Control CPU		It is the same as 'With RK40 rack frame'	–	LV Sossaman (2.0 GHz)	
	Control memory			–	• Flash memory : 16 M bytes • L2 Cache memory : 2 M bytes • SDRAM : 1 G bytes	
	Data assurance method			–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code	
Physical specifications	Start-up time (min)		Standard : 5(*4)			
	Chassis size (W×D×H) (mm)		(483×649×174)	(483×650×129)	(610×1,020×1,920)	((610×3)×1,020×1,920)
	Mass(*5) (kg)		46 approx.	40 approx.	760 approx.	2,130 approx.
	Acoustic noise(*6) (*7) (dB)		60 approx.	60 approx.	70 approx.	72 approx.
	EIA Standard for unit (U) (*8)		4	3	Max. 38	Max. 38
Input power specifications	Input voltage (Operable voltage range) (V)		AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)	
	Frequency (Hz)		50/60 ± 1			
	Number of phases, cabling		Single-phase with protective grounding			
	Steady-state current(*9) (*11) AC 100/200 (A)		2.2×2/1.1×2	2.4×2/1.2×2	-/16.0(One PDB)	-/16.0(One PDB)
	Breaking current (A)		16.0	16.0	8.0 (for each output of PDB)	
	Required power	Steady state (*11) (VA/W)	440/400 or less	480/460 or less	5,720/5,460 or less	15,800/15,120 or less
		Starting state (*10) (*11) (VA/W)	440/400 or less	480/460 or less	5,720/5,460 or less	15,800/15,120 or less
	Heat value (normal) (kJ/h)		1,440 or less	1,660 or less	19,660 or less	54,440 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than five minutes depending on the configuration.

*5 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*6 : A noise emitted at the time of start is not included.

*7 : Environmental temperature: 32°C or less
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*8 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*9 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*10 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*11 : This rating is based on the EN60950-1.

Item	Model	Rackmount model			
		RKH	RKAK	RKH + RKAK + RK40 rack frame	
				One rack	Three racks
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	8,192 / 16,384	
	Control method		–	Read LRU/Write after	
	Battery backup		–	Provided	
	Backup duration(*1) (h)		–	48 (When cache of 2 G bytes x 4/CTL) 24 (When cache of 4 G bytes x 4/CTL) 168 (When cache of 2 G bytes x 4/CTL) (*2) 96 (When cache of 4 G bytes x 4/CTL) (*2)	
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*3)	•Control Unit •Disk Drive •Power Unit (RKH) •Cache Unit •FAN Unit •Cache Backup Battery (*4) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAK) •ENC Unit	•Control Unit •Disk Drive •Power Unit (RKH/RKAK) •Cache Unit •FAN Unit •Cache Backup Battery (*4) •Interface Board (FC/iSCSI) and Host Connector •ENC Unit •PDB	
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)	
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling firmware patching • Disk Drive controlling firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)	
	Spare Disk	Up to 30 of mounted Disk Drive s can be set to Spare Disks			
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.	
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part			
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)	
	Insulation resistance	DC 500 V, 10 MΩ or more			

*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed four batteries of a full charge).
- In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
- Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
- Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
- When a device is kept with power-off for more than six months, the battery may be excessively discharged, and it may cause an unrecoverable damage. In such a storing condition, the battery must be charged once every six months for more than 24 hours.
- To minimize the deterioration of battery, use and keep a battery at the lowest temperature possible.

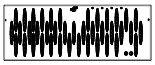
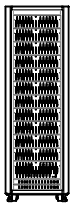
*2 : Installing the two Additional Battery Box is required.

*3 : Only the trained service personnel can perform a hot replacement.

*4 : The battery in the Cache Backup Battery is a part to be recycled.

(12) Rackmount (RKH+RKAKX) Model

Table 2.1.14 Basic Specifications

Item \ Model		Rackmount model			
		RKH	RKAKX	RKH + RKAKX + RK40 rack frame	
				One rack	Two racks
Configuration	Configuration	1 RKH	1 RKAKX	1 RKH+ RKAKX (5units) (Maximum configuration) + RK40 rack frame	1 RKH+ RKAKX (10units) (Maximum configuration) + RK40 rack frame (2units)
	Subsystem appearance				
Disk Drive used	Disk Drive size (W×D×H) (mm)	–	439.44 / 575.30 / 983.69 / 1,968.52		
	Data capacity (*1) (G byte)	–	439.44 / 575.30 G byte : 15,000 983.69 / 1,968.52 G byte : 7,200		
	Rotational speed (min^{-1})	–	7,200		
	Maximum mountable quantity (*2) (unit)	–	SAS drive: 38 SATA drive: 48	240 (190(*5))	480 (380(*4))
Host interface	Host interface	4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*3)	–	4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*3)	
	Data transfer speed (i.e. maximum speed for transfer to host)	800 M bytes/s (Fibre Channel)/ 100 M bytes/s (iSCSI)(*3)	–	800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*3)	
	Number of ports / Dual controller	Fibre Channel : Max.16/ iSCSI: 8(*3)	–	Fibre Channel : Max.16/ iSCSI: 8(*3)	
	Transferred block size (bytes)	512			

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*3 : It indicates the value of when the iSCSI Interface Board is mounted/added to the Control Unit.

*4 : It indicate the maximum mountable number when the SAS drives are installed in the RKAKX.

Item			Model: Rackmount model			
			RKH	RKAKX	RKH + RKAKX + RK40 rack frame	
					One rack	Two racks
RAID specifications (*2)	RAID level (*1)		–	1/5/6/1+0	SAS Disk Drive : 0/1/5/6/1+0	
	RAID configuration (unit of addition)	RAID 0	–	–	SATA Disk Drive : Not support	
		RAID 1	–	1D+1D		
		RAID 5	–	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P	
		RAID 6	–	2D+2P to 28D+2P		
		RAID 1+0	–	2D+2D to 8D+8D		
Internal logic specifications	Control CPU		It is the same as 'With RK40 rack frame'	–	LV Sossaman (2.0 GHz)	
	Control memory			–	• Flash memory : 16 M bytes • L2 Cache memory : 2 M bytes • SDRAM : 1 G bytes	
	Data assurance method			–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code	
Physical specifications	Start-up time (min)		Standard : 5(*4)			
	Chassis size (W×D×H) (mm)		(483×649×174)	(483×840×176)	(610×1,020×1,920)	((610×3)×1,020×1,920)
	Mass(*5) (kg)		46 approx.	81 approx.	722 approx.	1,391 approx.
	Acoustic noise(*6) (*7) (dB)		60 approx.	62 approx.	68 approx.	71 approx.
	EIA Standard for unit (U) (*8)		4	4	Max. 40	Max. 40
Input power specifications	Input voltage (Operable voltage range) (V)		AC 100/200 (89 to 127/178 to 254)		AC 200 (178 to 254)	
	Frequency (Hz)		50/60 ± 1			
	Number of phases, cabling		Single-phase with protective grounding			
	Steady-state current(*9) (*11) AC 100/200 (A)		2.2×2/1.1×2	3.7x4/1.9x4	-/16.0(One PDB)	-/16.0(One PDB)
	Breaking current (A)		16.0	16.0	8.0 (for each output of PDB)	
	Required power	Steady state (*11) (VA/W)	440/400 or less	1,480/1,440 or less	7,840/7,600 or less	15,240/14,800 or less
		Starting state (*10) (*11) (VA/W)	440/400 or less	1,480/1,440 or less	7,840/7,600 or less	15,240/14,800 or less
	Heat value (normal) (kJ/h)		1,440 or less	5,190 or less	27,360 or less	53,280 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than five minutes depending on the configuration.

*5 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*6 : A noise emitted at the time of start is not included.

*7 : Environmental temperature: 32°C or less (RKAKX : 30°C)
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*8 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*9 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*10 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*11 : This rating is based on the EN60950-1.

Item	Model	Rackmount model			
		RKH	RKAKX	RKH + RKAKX+ RK40 rack frame	
				One rack	Two racks
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	8,192 / 16,384	
	Control method		–	Read LRU/Write after	
	Battery backup		–	Provided	
	Backup duration(*1) (h)		–	48 (When cache of 2 G bytes x 4/CTL) 24 (When cache of 4 G bytes x 4/CTL) 168 (When cache of 2 G bytes x 4/CTL) (*2) 96 (When cache of 4 G bytes x 4/CTL) (*2)	
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*3)	•Control Unit •Disk Drive •Power Unit (RKH) •Cache Unit •FAN Unit •Cache Backup Battery (*4) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAKX) •ENC Unit (RKAKX)	•Control Unit •Disk Drive •Power Unit (RKH/RKAKX) •Cache Unit •FAN Unit •Cache Backup Battery (*4) •Interface Board (FC/iSCSI) and Host Connector •ENC Unit •PDB	
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)	
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling firmware patching • Disk Drive controlling firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)	
	Spare Disk	Up to 30 of mounted Disk Drive s can be set to Spare Disks			
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.	
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part			
Insulation performance	Insulation withstand voltage	AC 1,500 V (10 mA, 1 min)		AC 1,500 V (100 mA, 1 min)	
	Insulation resistance	DC 500 V, 10 MΩ or more			

*1 : • The backup time of the data on the Cache memory is indicated (in the case of installed four batteries of a full charge).
- In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
- Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
- Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
- When a device is kept with power-off for more than six months, the battery may be excessively discharged, and it may cause an unrecoverable damage. In such a storing condition, the battery must be charged once every six months for more than 24 hours.
- To minimize the deterioration of battery, use and keep a battery at the lowest temperature possible.

*2 : Installing the two Additional Battery Box is required.

*3 : Only the trained service personnel can perform a hot replacement.

*4 : The battery in the Cache Backup Battery is a part to be recycled.

(13) Rackmount (RKHED+RKAKD) Model

Table 2.1.15 Basic Specifications

Item		Model	Rackmount model			
			RKHED	RKAKD	RKHED + RKAKD+ RK40 rack frame	
					One rack	Three racks
Configuration	Configuration		1 RKHED	1 RKAKD	1 RKHED+ RKAKD (11units) (Maximum configuration) + RK40 rack frame	1 RKHED+ RKAKD(32units) (Maximum configuration) + RK40 rack frame (3units)
	Subsystem appearance					
Disk Drive used	Disk Drive size (W×D×H)	(mm)	–	101.6×147.0×26.1		
	Data capacity (*1)	(G byte)	–	142.61 / 195.82 / 287.62 /392.73 / 439.44 / 491.25 / 575.30 / 737.49 / 983.69 / 1,968.52		
	Rotational speed	(min^{-1})	–	142.61 / 287.62 / 439.44 / 575.30 G byte : 15,000 392.73 G byte: 10,000 491.25 /737.49 /983.69 / 1,968.52 G byte : 7,200 195.82 G byte : Flash Drive		
	Maximum mountable quantity (*2)	(unit)	–	15	150	450
Host interface	Host interface		4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*3)	–	4 G / 8 G bps Fibre Channel Optical/1 G bps iSCSI [1000Base-T](*3)	
	Data transfer speed (i.e. maximum speed for transfer to host)		800 M bytes/s (Fibre Channel)/ 100 M bytes/s (iSCSI)(*3)	–	800 M bytes/s (Fibre Channel)/100 M bytes/s (iSCSI)(*3)	
	Number of ports	Dual controller	Fibre Channel : Max.16/ iSCSI: 8(*3)	–	Fibre Channel : Max.16/ iSCSI: 8(*3)	
	Transferred block size	(bytes)	512			

*1 : The drive capacity values are calculated as 1 G byte =1,000,000,000 bytes. This definition is different from that calculated as 1 k byte =1,024 bytes, which are actually displayed on PCs that you are using.
The RAID group capacity values displayed in the Hitachi Storage Navigator Modular 2 are calculated as 1 k byte =1,024 bytes.

*2 : Can be mounted on the Hitachi special rack frame (RK40). For the mounting, special rails for the rack frame and decoration panel(s) are required separately depending on the number of the mounted subsystem(s).

*3 : It indicates the value of when the iSCSI Interface Board is mounted/added to the Control Unit.

Item			Model	Rackmount model			
				RKHED	RKAKD	RKHED+ RKAKD + RK40 rack frame	
						One rack	Three racks
RAID specifications (*2)	RAID level (*1)			–	1/5/6/1+0	SAS Disk Drive : 0/1/5/6/1+0	
	RAID configuration (unit of addition)	RAID 0		–	–	SATA Disk Drive : Not support	
		RAID 1		–	1D+1D		
		RAID 5		–	2D+1P to 15D+1P(*3)	2D+1P to 15D+1P	
		RAID 6		–	2D+2P to 28D+2P		
		RAID 1+0		–	2D+2D to 8D+8D		
Internal logic specifications	Control CPU			It is the same as 'With RK40 rack frame'	–	LV Sossaman (2.0 GHz)	
	Control memory				–	• Flash memory : 16 M bytes • L2 Cache memory : 2 M bytes • SDRAM : 1 G bytes	
	Data assurance method				–	• Data bus : Parity • Cache memory :ECC (1 bit for correction, 2 bits for detection) • Disk Drive : Data assurance code	
Physical specifications	Start-up time (min)			Standard : 5(*4)			
	Chassis size (W×D×H) (mm)			(483×649×174)	(483×649×129)	(610×1,020×1,920)	((610×3)×1,020×1,920)
	Mass(*5) (kg)			46 approx.	40 approx.	760 approx.	2,130 approx.
	Acoustic noise(*6) (*7) (dB)			60 approx.	60 approx.	70 approx.	72 approx.
	EIA Standard for unit (U) (*8)			4	3	Max. 38	Max. 38
Input power specifications	Input voltage (Operable voltage range) (V)			DC -48 to -60 (-40 to -72)		–	
	Steady-state current(*9) (*11) (A)			4.2×2	4.6×2	–	–
	Breaking current (A)			20.0	30.0	–	
	Required power	Steady state (*11) (VA/W)		400/400 or less	440/440 or less	5,240/5,240 or less	14,480/14,480 or less
		Starting state (*10) (*11) (VA/W)		400/400 or less	440/440 or less	5,240/5,240 or less	14,480/14,480 or less
	Heat value (normal) (kJ/h)			1,440 or less	1,590 or less	18,870 or less	52,130 or less

*1 : Although the subsystem with a configuration of RAID 6, RAID 5, RAID 1, or RAID 1+0 provides data reliability enhanced by means of redundancy, a possibility remains that user data is lost owing to an unexpected failure of a host computer or hardware/software of the subsystem itself.
Therefore, users are requested to back up all data for restoration in case where the original data is lost.

*2 : D : Data disk
P : Parity disk

*3 : It is recommended to use the RAID configuration within 6D+1P.

*4 : The start-up time may be longer than five minutes depending on the configuration.

*5 : Value of maximum configuration (in the case where all the mountable Disk Drives and Control Unit are mounted).

*6 : A noise emitted at the time of start is not included.

*7 : Environmental temperature: 32°C or less
It may exceed this standard value when the high load continues under high-temperature environment or when a failure occurs in one part of the subsystem because the internal temperature of the subsystem controls the rotating speed of the FAN.

*8 : Racks height are measured in meters, EIA units, and "U". 1EIA unit equals 1U, which equals 44.45 mm.

*9 : The current value in the operation by a single power supply unit is same as that in the operation by both power supply units.

*10 : Power requirement in the case of the maximum configuration is shown. When planning facilities such as the uninterrupted power supply (UPS), specify the power factor as 100% for calculation. Value at 100 V/200 V is shown. (Example : 300 W=300 VA)
The actual required power may exceed the value shown in the table when the tolerance is included.

*11 : This rating is based on the EN60950-1.

Item	Model	Rackmount model			
		RKHED	RKAKD	RKHED + RKAKD+ RK40 rack frame	
				One rack	Three racks
Cache specifications	Capacity (M bytes/CTL)	It is the same as 'With RK40 rack frame'	–	2,048 to 16,384	
	Control method		–	Read LRU/Write after	
	Battery backup		–	Provided	
	Backup duration(*1) (h)		–	72 (When cache of 1 G bytes x 2/CTL, when cache of 2 G bytes x 2/CTL) 48 (When cache of 1 G bytes x 4/CTL, when cache of 1 G bytes x 2/CTL + cache of 2 G bytes x 2/CTL, when cache of 2 G bytes x 4/CTL, when cache of 4 G bytes x 2/CTL) 24 (When cache of 1 G bytes x 2/CTL + cache of 4 G bytes x 2/CTL, when cache of 2 G bytes x 2/CTL + cache of 4 G bytes x 2/CTL, when cache of 4 G bytes x 4/CTL) 288 (When cache of 1 G bytes x 2/CTL, when cache of 2 G bytes x 2/CTL) (*2) 168 (When cache of 1 G bytes x 4/CTL, when cache of 1 G bytes x 2/CTL + cache of 2 G bytes x 2/CTL, when cache of 2 G bytes x 4/CTL, when cache of 4 G bytes x 2/CTL) (*2) 96 (When cache of 1 G bytes x 2/CTL + cache of 4 G bytes x 2/CTL, when cache of 2 G bytes x 2/CTL + cache of 4 G bytes x 2/CTL, when cache of 4 G bytes x 4/CTL) (*2)	

*1 :
- The backup time of the data on the Cache memory is indicated (in the case of installed four batteries of a full charge).
- In the battery that exceeds the periodic replacement cycle, the backup time may become remarkably short.
- Non-volatility of data in the cache memory is ensured against power trouble such as a sudden power failure. It transfers data in the Cache memory to Disk Drives by turning off the power normally, and prevents the battery charge from being wasted.
- Since battery is subject to effect of environmental temperature, avoid using a battery in unnecessarily continuous operation at high temperature.
- When a device is kept with power-off for more than six months, the battery may be excessively discharged, and it may cause an unrecoverable damage. In such a storing condition, the battery must be charged once every six months for more than 24 hours.
- To minimize the deterioration of battery, use and keep a battery at the lowest temperature possible.

*2 : Installing the two Additional Battery Box is required.

Item	Model	Rackmount model			
		RKHED	RKAKD	RKHED + RKAKD+ RK40 rack frame	
				One rack	Three racks
Maintenance specifications /anti-fault specifications	Parts to which hot replacement is applicable (*1)	•Control Unit •Disk Drive •Power Unit (RKHED) •Cache Unit •FAN Unit •Cache Backup Battery (*4) •Interface Board (FC/iSCSI) and Host Connector	•Disk Drive •Power Unit (RKAKD) •ENC Unit	•Control Unit •Disk Drive •Power Unit (RKHED/RKAKD) •Cache Unit •FAN Unit •Cache Backup Battery (*2) •Interface Board (FC/iSCSI) and Host Connector •ENC Unit •PDB	
	Firmware installation method	It is the same as 'With RK40 rack frame'	–	Flash memory/Disk Drive (resident)	
	SVP (built-in exclusive tool) function	It is the same as 'With RK40 rack frame'	–	• Failure information logging/Power control • Controlling firmware patching • Disk Drive controlling firmware down loading • Configuration information change • Disk Drive recovery initiating process (This process is automatically executed when Disk Drive is replaced.)	
	Spare Disk	Up to 30 of mounted Disk Drive s can be set to Spare Disks			
	Collection of trace and dump	It is the same as 'With RK40 rack frame'	–	Download the trace and dump through LAN on the maintenance PC.	
	Display function	• Status LEDs (POWER, READY, WARNING, and ALARM) • LED of maintenance part			
Insulation performance	Insulation withstand voltage	DC 1,000 V (10 mA, 1 min)		DC 1,000 V (100 mA, 1 min)	
	Insulation resistance	DC 500 V, 10 MΩ or more			

*1 : Only the trained service personnel can perform a hot replacement.

*2 : The battery in the Cache Backup Battery is a part to be recycled.

(14) Additional Battery Box

Table 2.1.16 Basic Specifications

Item \ Model		DF-F800-N1RK	DF-F800-N1RKD
Physical specifications	Subsystem appearance		
	Chassis size (W×D×H) (mm)	(479.6×623.0×43.0)	
	Mass (kg)	15 approx.	
Input power specifications	Input voltage (Operable voltage range) (V)	AC 100/200 (89 to 127/178 to 254)	DC -48 to -60 (-40 to -72)
	Steady-state current (*1) (A)	1.0/0.5 (100 V/200 V)	1.5
	Power consumption (*1) (VA/W)	100/100	72/72
	Heat value (normal) (kJ/h)	360	260

*1: This rating is based on the EN60950-1.

2.2 Basic Specifications of the Drive

Table 2.2.1 SAS Disk Drive (146 GB)

Item \ Mode		DF-F800-AKH146			
Disk Drive Model Name	Seagate	ST3146855SS (DKS2E-K146SS)	-	ST3146356SS (DKS2F-K146SS)	-
	HGST	HUS151414VLS300 (DKR2F-K146SS)	HUS153014VLS300 (DKR2G-K146SS)	-	HUS156030VLS600 (DKR2J-K300SS)
Capacity (G bytes)		142.61	142.61	142.61	142.61
Number of Heads	Seagate	4		3	-
	HGST	10	4	-	4
Number of Disks	Seagate	2	-	2	-
	HGST	5	2	-	2
Seek Time (ms) (Read/Write)	minimum	0.2/0.4	-	0.2/0.44	-
	average	3.7/4.1	3.4/3.8	3.4/3.9	3.3/3.8
	maximum	6.7/7.4	4.6/5.1	6.43/7.12	6.3/6.8
Average latency time (ms)		2.0	2.0	2.0	2.0
Rotational speed (min^{-1})		15,000	15,000	15,000	15,000
Interface data transfer rate (MB/S)		300	300	300	300
Internal data transfer rate (MB/S)		73 - 125	71.7 - 123	112 - 171	173 - 297
Interface		SAS	SAS	SAS	SAS

Table 2.2.2 SAS Disk Drive (300 GB)

Item \ Mode		DF-F800-AKH300					
Disk Drive Model Name	Seagate	ST3300655SS (DKS2E-K300SS)	-	ST3300656SS (DKS2F-K300SS)	-	ST3300657SS (DKS2G-K300SS)	-
	HGST	-	HUS153030VLS300 (DKR2G-K300SS)	-	HUS154530VLS300 (DKR2H-K300SS)	-	HUS156030VLS600 (DKR2J-K300SS)
Capacity (G bytes)		287.62	287.62	287.62	287.62	287.62	287.62
Number of Heads	Seagate	8	-	6	-	4	-
	HGST	-	8	-	8	-	4
Number of Disks	Seagate	4	-	3	-	2	-
	HGST	-	4	-	4	-	2
Seek Time (ms) (Read/Write)	minimum	0.2/0.4	-	0.2/0.44	-	0.20/0.44	-
	average	3.5/4.5	3.6/4.1	3.4/3.9	3.6/4.1	3.4/3.9	3.3/3.8
	maximum	6.7/7.4	4.7/5.1	6.43/7.12	6.6/7.1	6.6/7.4	6.3/6.8
Average latency time (ms)		2.0	2.0	2.0	2.0	2.0	2.0
Rotational speed (min^{-1})		15,000	15,000	15,000	15,000	15,000	15,000
Interface data transfer rate (MB/S)		300	300	300	300	300	300
Internal data transfer rate (MB/S)		-	71.7 - 123	112 - 171	98.2 – 135.0	186 - 296	173 - 297
Interface		SAS	SAS	SAS	SAS	SAS	SAS

Table 2.2.3 SAS Disk Drive (400 GB)

Item \ Mode		DF-F800-AKF400	
Disk Drive Model Name	Seagate	ST3400755SS (DKS2E-J400SS)	ST3450802SS (DKS2G-J450SS)
	HGST	-	-
Capacity (G bytes)		392.73	392.73
Number of Heads	Seagate	8	6
	HGST	-	-
Number of Disks	Seagate	4	3
	HGST	-	-
Seek Time (ms) (Read/Write)	minimum	0.35/0.52	0.22/0.22
	average	3.9/4.2	3.8/4.4
	maximum	6.8/7.5	8.1/8.7
Average latency time (ms)		2.98	2.98
Rotational speed (min^{-1})		10,000	10,000
Interface data transfer rate (MB/S)		300	300
Internal data transfer rate (MB/S)		54 - 97	126 - 230
Interface		SAS	SAS

Table 2.2.4 SAS Disk Drive (450 GB)

Item \ Mode		DF-F800-AKH450/DF-F800-AKH450X			
Disk Drive Model Name	Seagate	ST3450856SS (DKS2F-K450SS)	-	ST3450857SS (DKS2G-K450SS)	-
	HGST	-	HUS154545VLS300 (DKR2H-K450SS)	-	HUS156045VLS600 (DKR2J-K450SS)
Capacity (G bytes)		439.44	439.44	439.44	439.44
Number of Heads	Seagate	8	-	6	-
	HGST	-	8	-	6
Number of Disks	Seagate	4	-	3	-
	HGST	-	4	-	3
Seek Time (ms) (Read/Write)	minimum	0.2/0.44	-	0.20/0.44	-
	average	3.4/3.9	3.6/4.1	3.4/3.9	3.3/3.8
	maximum	6.43/7.12	6.6/7.1	6.6/7.4	6.3/6.8
Average latency time (ms)		2.0	2.0	2.0	2.0
Rotational speed (min^{-1})		15,000	15,000	15,000	15,000
Interface data transfer rate (MB/S)		300	300	300	300
Internal data transfer rate (MB/S)		112 - 171	99.0 - 160.0	186 - 296	173 - 297
Interface		SAS	SAS	SAS	SAS

Table 2.2.5 SAS Disk Drive (600 GB)

Item \ Mode		DF-F800-AKH600/DF-F800-AKH600X	
Disk Drive Model Name	Seagate	ST3600057SS (DKS2G-K600SS)	-
	HGST	-	HUS156060VLS600 (DKR2J-K600SS)
Capacity (G bytes)		575.30	575.30
Number of Heads	Seagate	8	-
	HGST	-	8
Number of Disks	Seagate	4	-
	HGST	-	4
Seek Time (ms) (Read/Write)	minimum	0.20/0.44	-
	average	3.4/3.9	3.3/3.8
	maximum	6.6/7.4	6.3/6.8
Average latency time (ms)		2.0	2.0
Rotational speed (min^{-1})		15,000	15,000
Interface data transfer rate (MB/S)		300	300
Internal data transfer rate (MB/S)		186 - 296	173 - 297
Interface		SAS	SAS

Table 2.2.6 SATA Disk Drive (500 GB)

Item \ Mode		DF-F800-AVE500		
Disk Drive Model Name	Seagate	ST3500630NS (ST3500630NS)	-	ST3500320NS (ST3500320NS)
	HGST	HDS725050KLA360 (HDS725050KLA360)	HUA721050KLA330 (HDS721050KLA33R)	-
Capacity (G bytes)		491.25	491.25	491.25
Number of Heads	Seagate	6	-	4
	HGST	10	6	-
Number of Disks	Seagate	3	-	2
	HGST	5	3	-
Seek Time (ms) (Read/Write)	minimum	0.8/1.3	0.8/1.3	0.8/1.0
	average	8.5/9.5	8.2/9.2	8.5/9.5
	maximum	14.7/15.7	14.7/15.7	-
Average latency time (ms)		4.17	4.17	4.16
Rotational speed (min^{-1})		7,200	7,200	7,200
Interface data transfer rate (MB/S)		300	300	300
Internal data transfer rate (MB/S)		31 - 72	-	105
Interface		SATA	SATA	SATA

Table 2.2.7 SATA Disk Drive (750 GB)

Item \ Mode		DF-F800-AVE750		
Disk Drive Model Name	Seagate	ST3750640NS (ST3750640NS)	-	ST3750330NS (ST3750330NS)
	HGST	-	HUA721075KLA330 (HDS721075KLA33R)	-
Capacity (G bytes)		737.49	737.49	737.49
Number of Heads	Seagate	8	-	6
	HGST	-	8	-
Number of Disks	Seagate	4	-	3
	HGST	-	4	-
Seek Time (ms) (Read/Write)	minimum	0.8/1.3	0.8/1.3	0.8/1.0
	average	8.5/9.5	8.2/9.2	8.5/9.5
	maximum	14.7/15.7	14.7/15.7	-
Average latency time (ms)		4.17	4.17	4.16
Rotational speed (min^{-1})		7,200	7,200	7,200
Interface data transfer rate (MB/S)		300	300	300
Internal data transfer rate (MB/S)		-	-	105
Interface		SATA	SATA	SATA

Table 2.2.8 SATA Disk Drive (1,000 GB)

Item \ Mode		DF-F800-AVE1K/DF-F800-AVE1KX	
Disk Drive Model Name	Seagate	-	ST31000340NS (ST31000340NS)
	HGST	HUA721010KLA330 (HDS721010KLA33R)	-
Capacity (G bytes)		983.69	983.69
Number of Heads	Seagate	-	8
	HGST	10	-
Number of Disks	Seagate	-	4
	HGST	5	-
Seek Time (ms) (Read/Write)	minimum	0.8/1.3	0.8/1.0
	average	8.2/9.2	8.2/9.2
	maximum	14.7/15.7	-
Average latency time (ms)		4.17	4.16
Rotational speed (min^{-1})		7,200	7,200
Interface data transfer rate (MB/S)		300	300
Internal data transfer rate (MB/S)		-	105
Interface		SATA	SATA

Table 2.2.9 SATA Disk Drive (2,000 GB)

Item \ Mode		DF-F800-AVE2K/ DF-F800-AVE2KX
Disk Drive Model Name	Seagate	-
	HGST	HUA722020ALA330 (HDS722020ALA330)
Capacity (G bytes)		1,968.52
Number of Heads	Seagate	-
	HGST	10
Number of Disks	Seagate	-
	HGST	5
Seek Time (ms) (Read/Write)	minimum	0.6/0.9
	average	8.2/9.2
	maximum	-
Average latency time (ms)		4.17
Rotational speed (min^{-1})		7,200
Interface data transfer rate (MB/S)		300
Internal data transfer rate (MB/S)		-
Interface		SATA

Table 2.2.10 Flash Drive

Item \ Mode	DF-F800-AKS200
Drive Model Name	SDT2A-S200SS
Capacity (G bytes)	195.82
The average time of access (μs)	20 - 120
Interface data transfer rate (MB/S)	Maximum of 300

Chapter 3. Introduction of Operation

This chapter explains the flow and format of data. It also explains the data processing.

3.1 Power On/Off Sequence

3.1.1 IMPL Sequence

The procedure for processing the IMPL (Initial Microprogram Load) executed when the subsystem is started is explained below. The IMPL sequence is broadly divided into four processes and they are executed sequentially.

(1) Boot loader
After the flash memory is booted, the BIOS executes the minimum necessary CUDG and the hardware initial setting. After that, BIOS develops the local memory loader from the flash memory to the local memory and transfers the control.

(2) Local memory loader
The local memory loader performs the CUDG and hardware initialization which are necessary for loading the OS load module. It loads the OS load module in the local memory after the spin-up of the Disk Drives of the first five Basic Chassis. After that, it transfers the control to the OS.

(3) OS
The OS initializes the table on the local memory for the communication between the tasks using the root task of the OS and generates the DF initialization task.

(4) DF initialization task
After making the initial setting of the hardware and the DF table, DF initialization task generates DF task. The load of the CUDG and the takeover information is executed in the DF task, and the diagnosis on the Disk Drive side and the load of the PIN data are performed. After that, all Disk Drives of the Basic Chassis and the Additional Chassis are spun up.

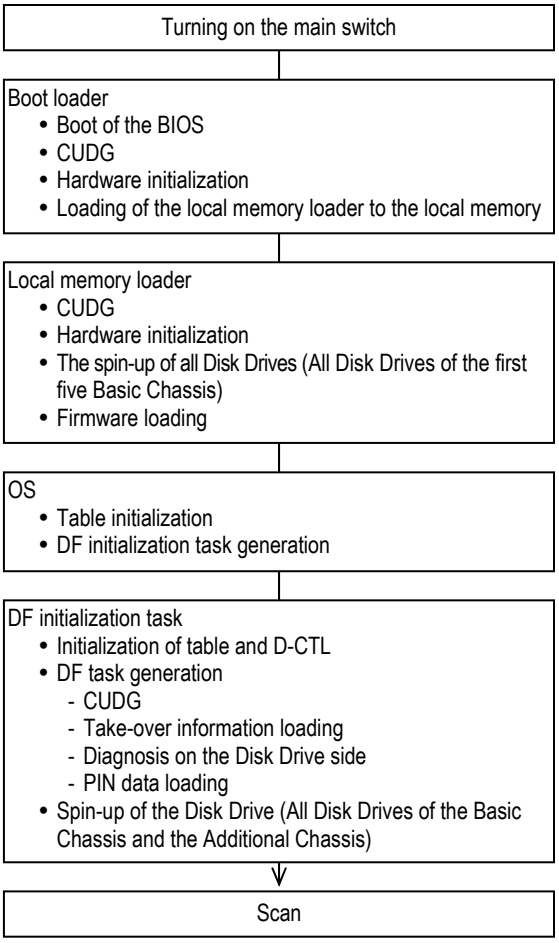


Figure 3.1.1 IMPL Sequence

3.1.2 Disk Drive Powering On Sequence

If all the Disk Drive motors are rotated at the same time an overcorrect may be caused. To avoid it, the drives are started in the following sequence.

(1) Disk Drive starting sequence (RKM/RKS/RKAK)

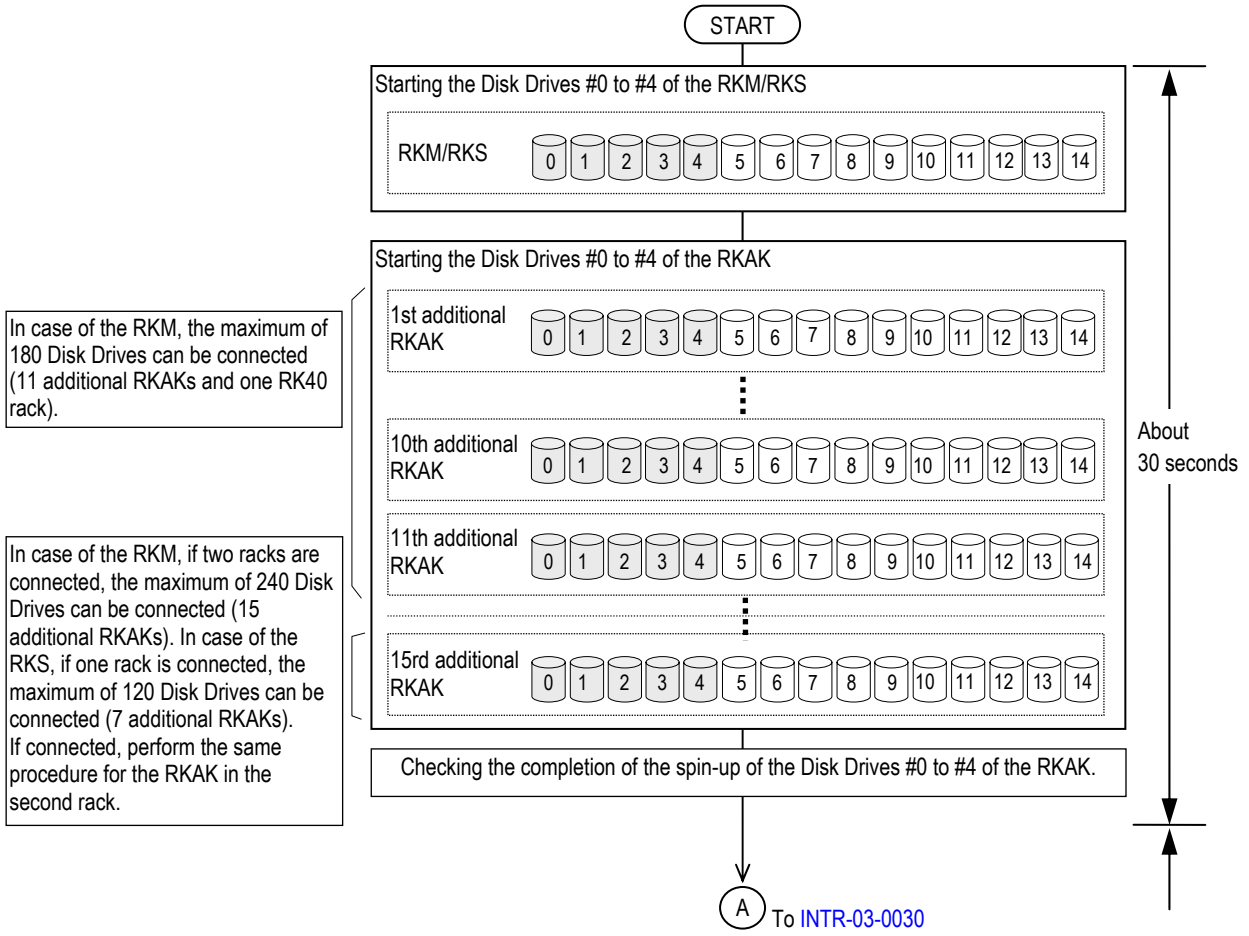


Figure 3.1.2(1/2) Disk Drive Starting Sequence (RKM/RKS/RKAK)

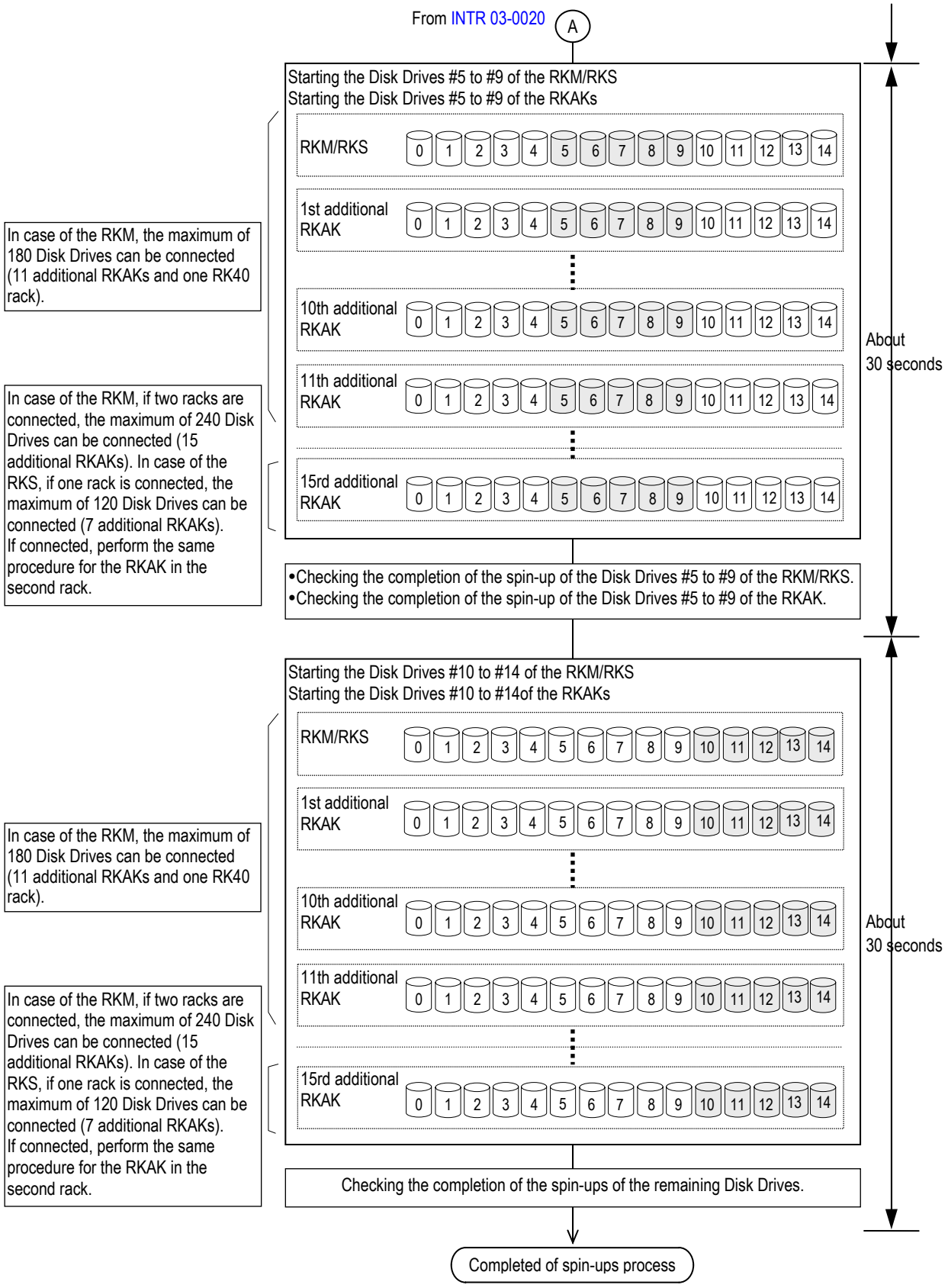


Figure 3.1.2(2/2) Disk Drive Starting Sequence (RKM/RKS/RKAK)

(2) Disk Drive starting sequence (RKH/RKAK)

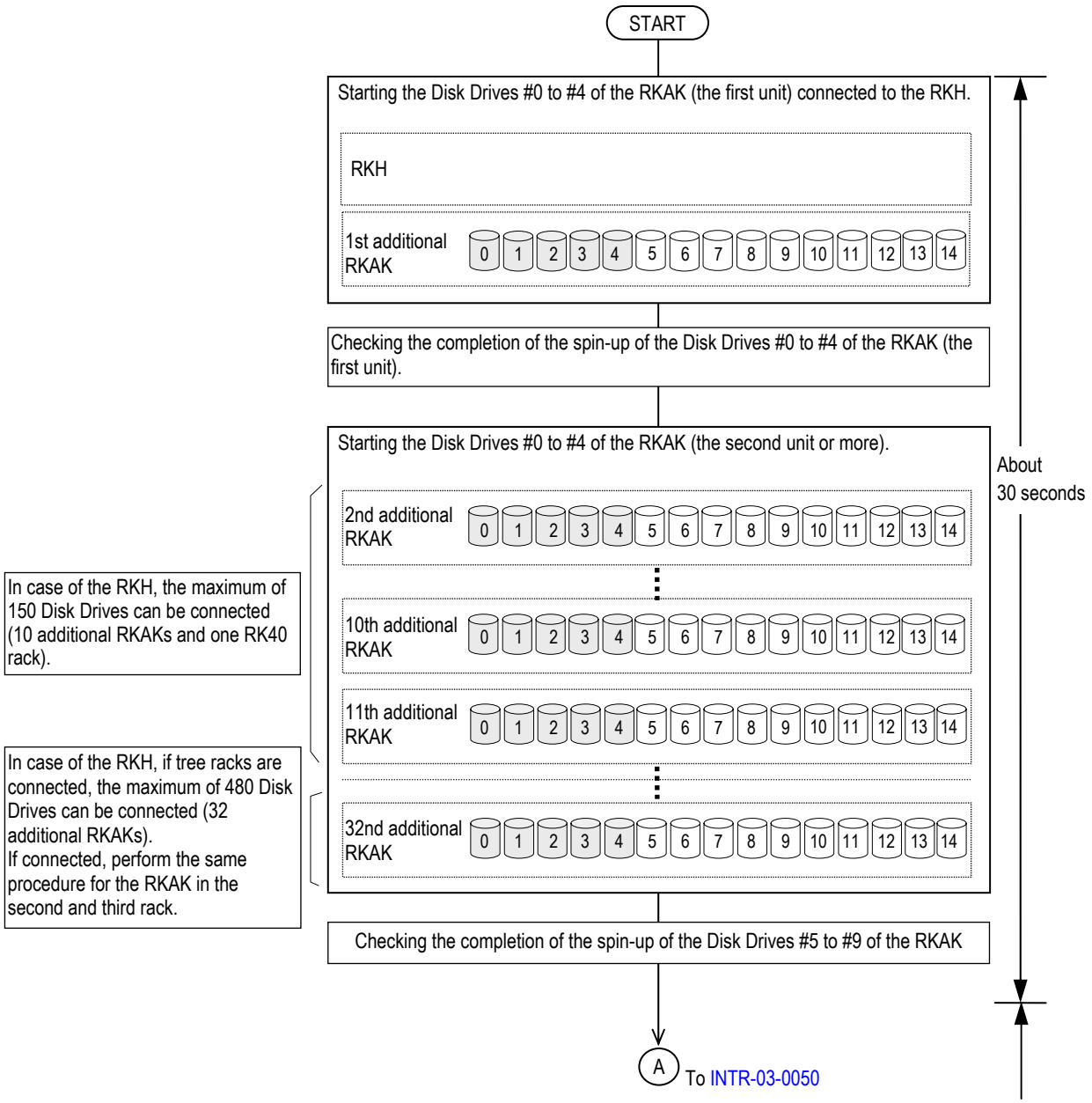


Figure 3.1.3 (1/2) Disk Drive Starting Sequence (RKH/RKAK)

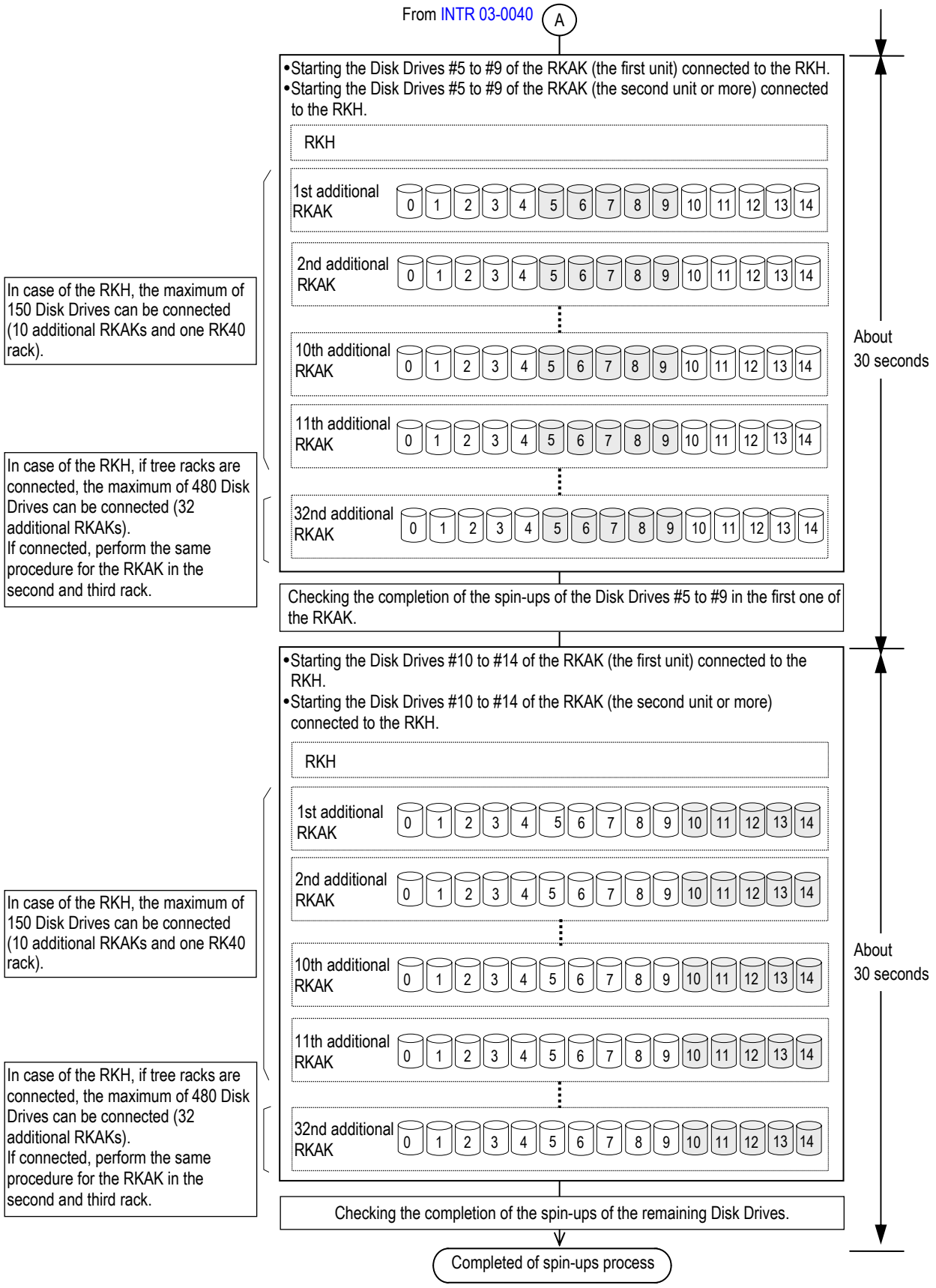


Figure 3.1.3 (2/2) Disk Drive Starting Sequence (RKH/RKAK)

3.1.3 Sequential Shutdown

If the subsystem receives instructions of a stop (remote control) by having turned off the power supply of the host computer and a stop (local control) by having turned off the main switch, the destaging operation is performed after confirming the completion of all of them. After that, the termination status of the processing, which is beginning or executing, is monitored for all the logical devices.
After ascertaining completion of all of them, it executes the destaging.
When doing the above, if a track failed to be destaged (pinned data) occurs, it stores the Pin information in the system area on the system disk.
Then, after the take-over information is stored in the system area of the system disk and the power supplying from the Cache Backup Battery is shut off, the subsystem is notified of the permission for powering off.
For the subsystem, the power cables can be removed from the Power Units after permitting the power supply turning off.

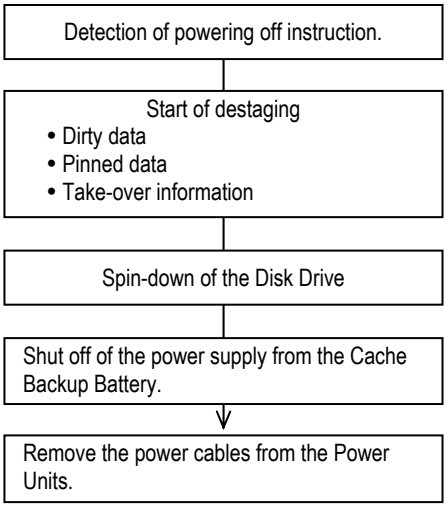


Figure 3.1.4 Flow Chart of Sequential Shutdown

3.2 Data Format

Figure 3.2.1 shows the data format.

To the sub-block, the check code the address assurance code (LA), write sequence (WR_SEQ), reserve (RSV) and data assurance code (LRC), is added.

The physical format on the physical disk is that recorded in the data field in units of 520 bytes.

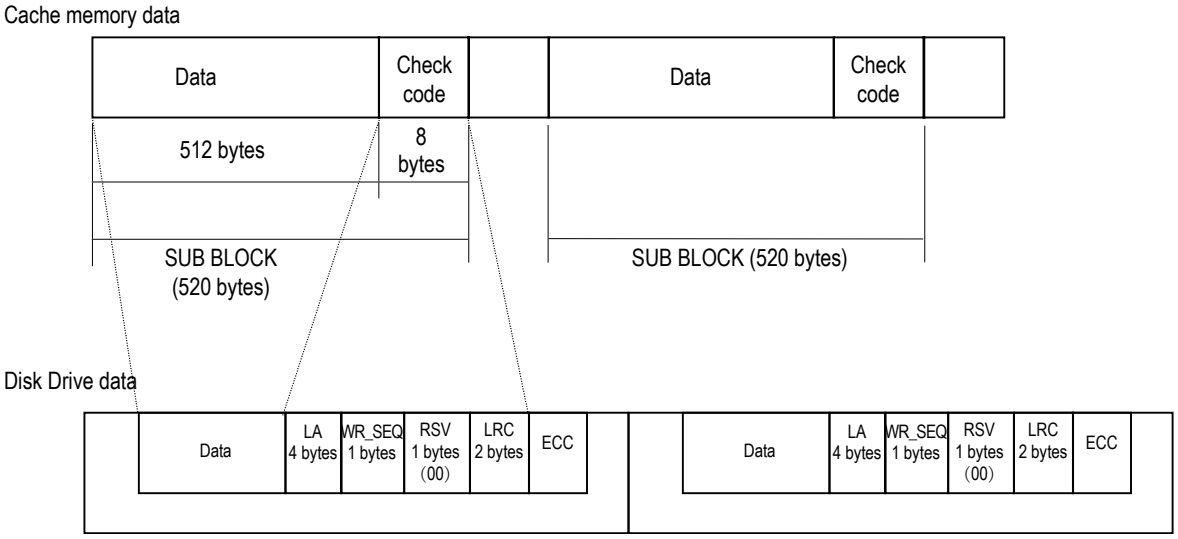


Figure 3.2.1 Data Format

3.3 Read/Write Operation

3.3.1 Command Execution

In the subsystem, all R/W commands are executed via the Cache memory.

- When the data is on the Cache memory at reading, the data on the Cache memory is transferred to the host computer (Read hit processing).
- Only when the data is not on the Cache memory at reading, the data is transferred to the host computer directly from the Disk Drive (Read miss processing). The data is left in the Cache memory then, the read hit operation can be performed at the time of the next reading.
- To improve the responding performance of the write processing, the write-after processing that returns the completion report to the host computer when the data writing to the Cache memory is completed is performed.
  After that, the Controller generates the parity and writes the data on the Disk Drive asynchronously.
- Data in the Cache memory is backed up by batteries. Thus, a data loss caused by a power failure, etc. can be prevented.
- Write-Through is an operation responding to a host computer after writing write data to disk drives when the subsystem receives the write data from the host computer. Therefore, the response time of the command to the host computer delays when the subsystem executes the Write-Through.
  The conditions that the subsystem executes the Write-Through are as follows.
  - When the Turbo LU Warning of the system parameter is disable (default) and the subsystem receives the write data in the PIN area
  - When the Write Unique Response Mode of the system parameter is enable (However, the write command for the LUs of RAID 1 and RAID 1+0 are excluded.)
  - When the forced write through mode of the system parameter is valid and a blockade of the Control Unit (it is not this condition in the single controller configuration) or a power unit failure occurred
  - When the Cache Backup Battery that can operate normally is lost
  - When a failure occurs in the battery backup circuit (except when the Control Unit is blocked)

Data flows are shown in Figure 3.3.1.

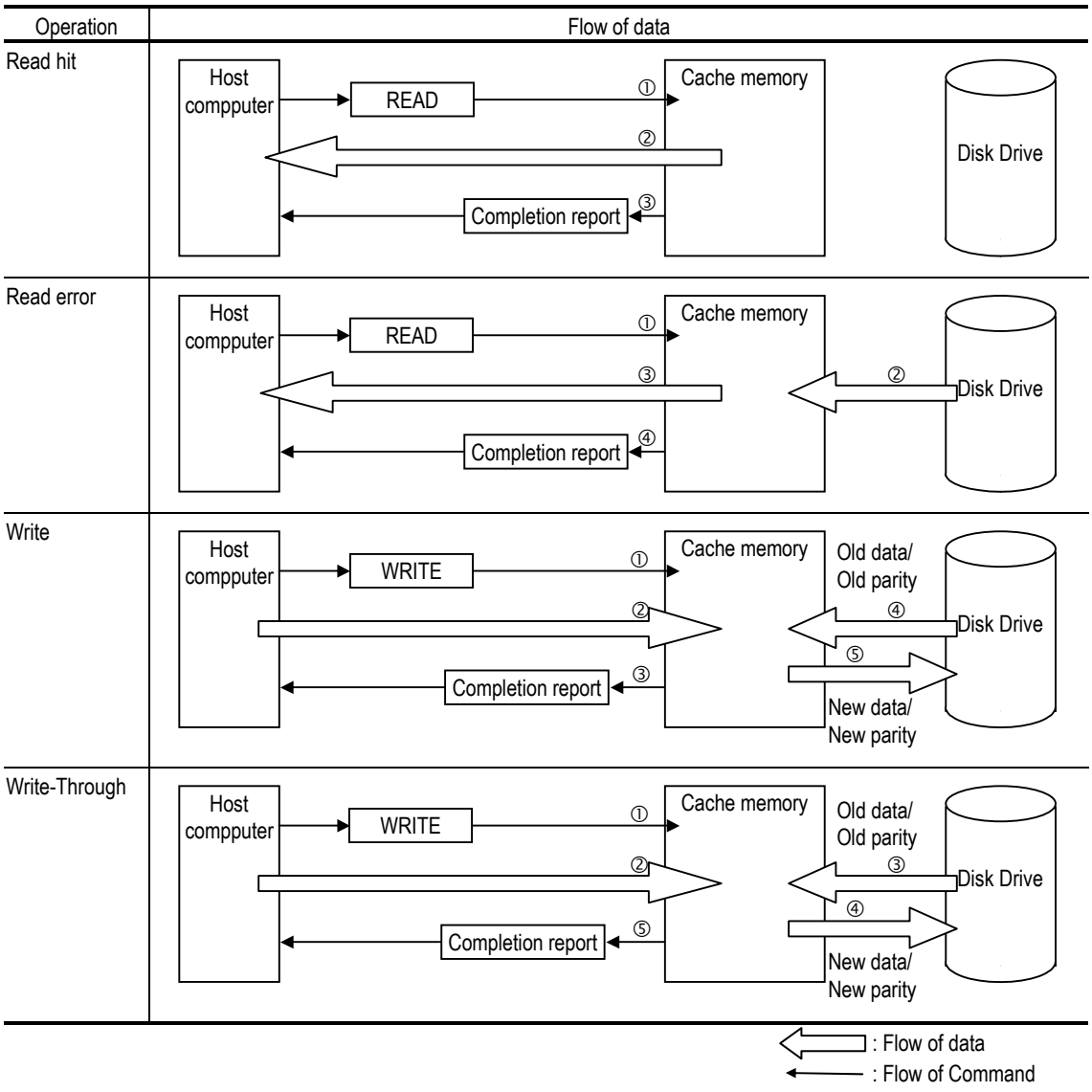


Figure 3.3.1 Flow of Data

3.3.2 Dual System Configuration

(1) Feature of dual system

(a) The flexible system can be configured by virtue of the two Control Units installed.
This allows the system configuration, which fits the host computer operation, to be provided.
For details, refer to Item (2), "Dual system configuration".

(b) Data is duplicated and written on the Cache memories on the two Control Units respectively.
The duplication makes it possible to continue the operation and assure user data even when a Controller failure occurs.

(2) Dual system configuration

The Dual Active mode makes the two controllers operate in parallel.
In this system configuration, it internally allocates the LU in charge to each Control Unit.
However, since the performance is equivalent in the cases where the Control Unit accesses the LU not in charge or accesses the LU in charge, it is usually unnecessary to be conscious of the Control Unit in charge.
Also, the CPU that executes the processing of the access from the host computer becomes a Control Unit of which the LU takes charge. Therefore, the load of the CPU of both Control Units is monitored regularly and when the imbalance occurs, reallocation of the LU in charge is automatically executed and the imbalance of the CPU load is resolved.

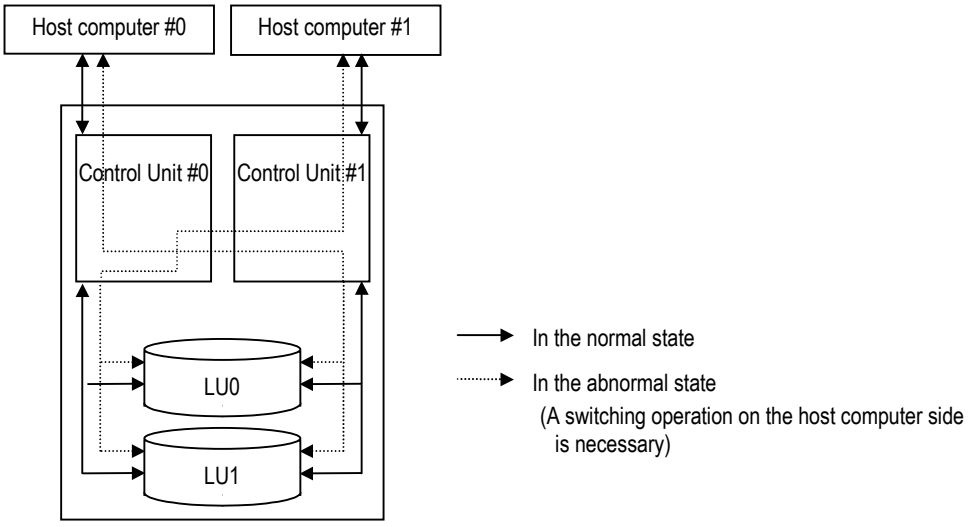


Figure 3.3.2 System Configuration

3.4 Cache Memory Control

3.4.1 Purpose of Cache Memory

(1) Mitigation of the write penalty (overheads for generating the parity which is unique to RAID) that accompanies the write-after operation
The write data received here is nonvolatile with the batteries to prevent the data loss due to the power failure before it is written in the Disk Drive. Also, the write data is double written in the Cache memories of both Control Units, and the data loss can be prevented at the time of a Control Unit failure by becoming the dual controller configuration (optional).

(2) Speed-up of sequential reading operation by means of pre-fetch
The reading performance is enhanced as follows. The subsystem studies the received commands and when it perceives that it is receiving read commands to read data from continuous addresses, it executes the pre-fetch operation to read the next read data from a Disk Drive before receiving the next read command. Thus the subsystem makes it possible to read from the cache memory when it receives the read command from a host.

(3) Faster sequential read operation
Performance of the sequential read operation is improved through impounding some amount of write data in the Cache memory at the sequential access and destaging it out to an HDD at once.

(4) Achieving the complete Cache read hit by the Cache Residency Manager function
One-hundred percent Cache hit can be realized by the Cache Residency Manager function.
(Refer to "3.5 (7) Cache Residency Manager" (INTR 03-0190).)

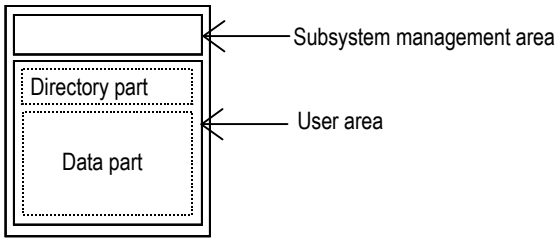
3.4.2 Cache Memory Configuration

The cache memory consists of the following components.

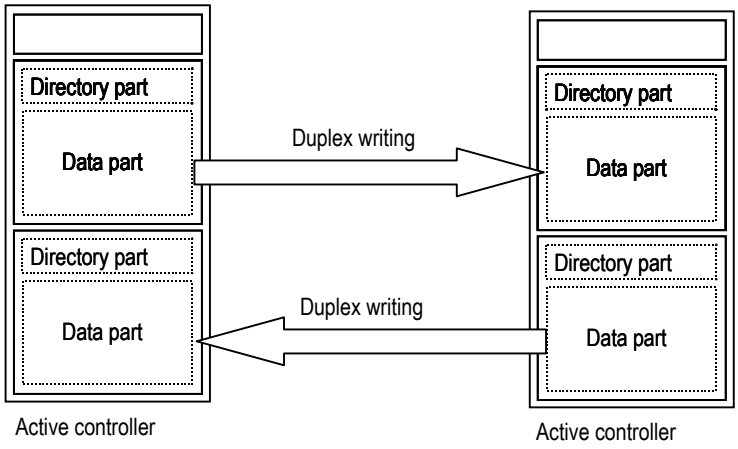
- Subsystem management area
- Directory part
- Data part

The cache memory configuration corresponding to each subsystem configuration is shown below.

a. For the single controller configuration



b. For the dual controller configuration (in the Dual Active mode)



3.4.3 Cache Memory Structure

(1) Cache memory structure

The Cache memory consists of a directory section for controlling data and a data section for storing user data.

(2) Data part

The data in the Cache memory is controlled by dividing it into the segments with the fixed length of 16 k bytes (a default value). However, when the Cache Partition Manager function is used, the segment length can be changed to 4 k bytes, 8 k bytes, 64 k bytes, 256 k bytes or 512 k bytes.

The minimum unit of data is sub-block (logical block of 512 bytes). When the segment length is 16 k bytes, one segment is 32 sub-blocks. Data storage is done in units of sub-block.

When a command to write data of one logical block (512 bytes) is received, for example, a segment is secured and the received write data is stored in one of the sub-blocks in the segment. The data area is also used as a work area while of the parity generation.

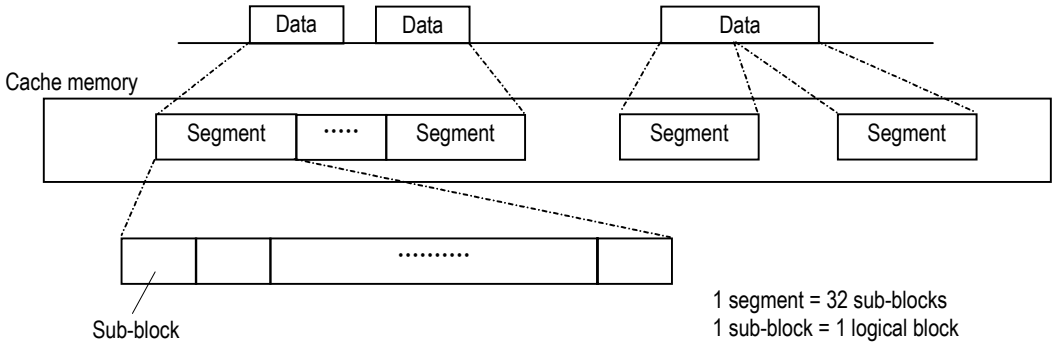


Figure 3.4.1 Data Structure in Cache Memory

(3) Directory part

The directory consists of a hash table for deciding hit or miss and SGCBs for controlling the segments. The SGCB has a one-to-one correspondence with the segment and has a pointer to the segment concerned and information regarding the status of the segment concerned.
The hash table stores the segment management information addresses.
When the segment management information is NULL, an error is occurs.

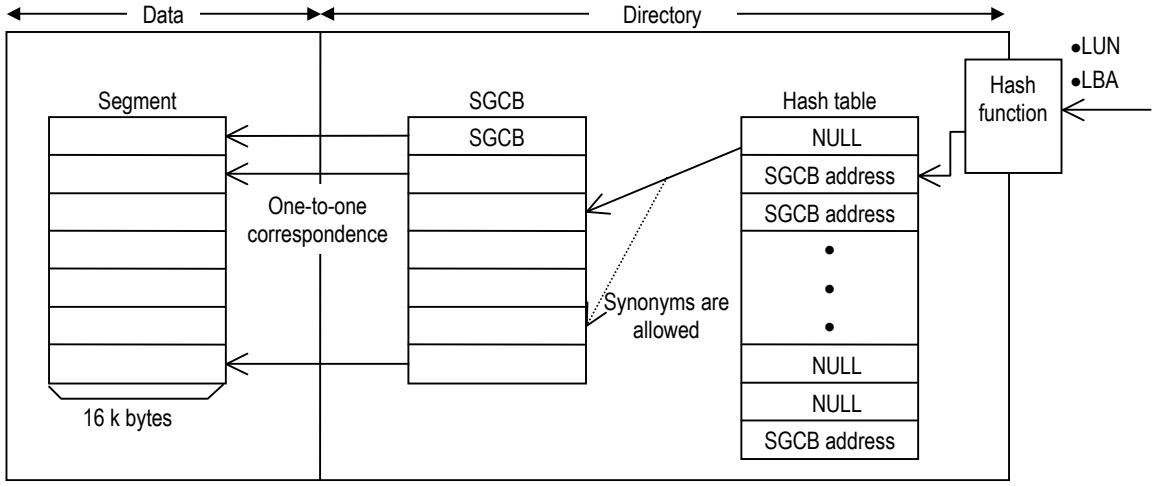
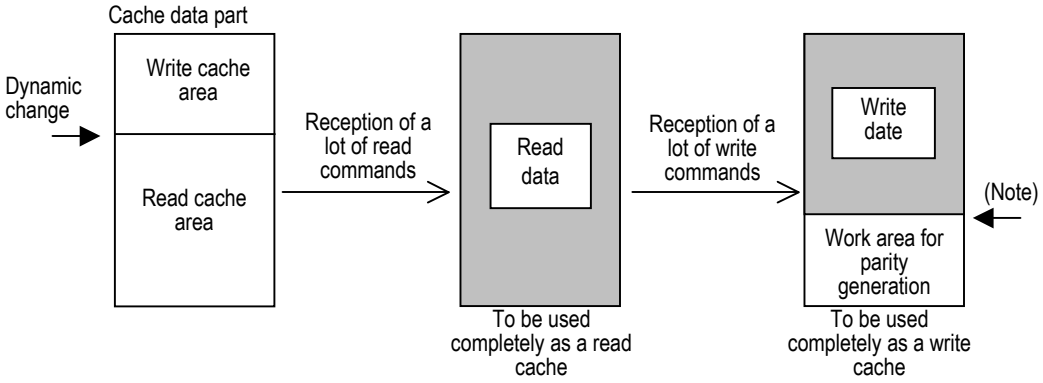


Figure 3.4.2 Control Structure in Cache Memory

3.4.4 Basic Operation of Cache Control

The following dynamic optimizing operation is performed in the cache control.

(1) Dynamic optimization of read/write cache area assignment
The read and write cache areas are not fixed but dynamically assigned according to an I/O instruction from a host.



NOTE : No wider write cache data area than the threshold value is assigned in order to secure the area for parity generation.

(2) Dynamic optimization of destaging algorithm
The optimum destaging algorithm is selected automatically according to a writing pattern given by a host computer. (Refer to Subsection "3.4.5 Destaging Operation" (INTR 03-0160).)

(3) Dynamic optimization of staging algorithm
The optimum staging algorithm is selected automatically through a study of a read command issued by a host computer. (Refer to Subsection "3.4.6 Staging Operation (Writing to the Cache Memory)" (INTR 03-0170).)

3.4.5 Destaging Operation

Write data transferred from a host computer is stored in the cache memory and written to a Disk Drive asynchronously. This operation to write data to a Disk Drive asynchronously is called destaging operation.

In the destaging operation, random and sequential accesses are discriminated and written to a Disk Drive in a way optimum for each of them.

(1) Destaging of random data

Data is destaged in units of LBA. Old data and its parity to be destaged are staged from a disk. A new parity is generated from new data, the old data, and the old parity and then the new data and new parity are destaged in units of LBA.

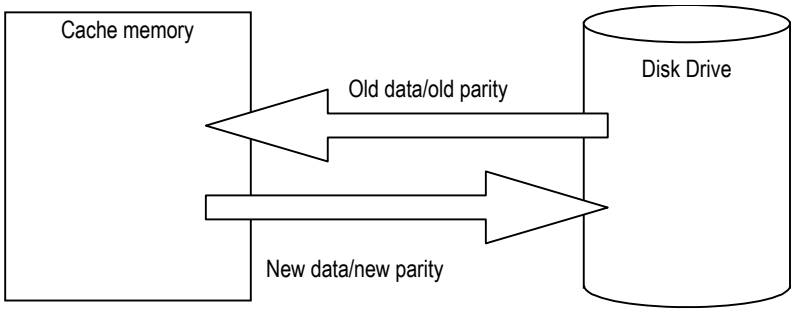


Figure 3.4.3 Destaging of Random Data

(2) Destaging of sequential data

Data is destaged in units of stripe. A new parity is generated from write data, and then new data and the new parity are destaged in units of stripe.

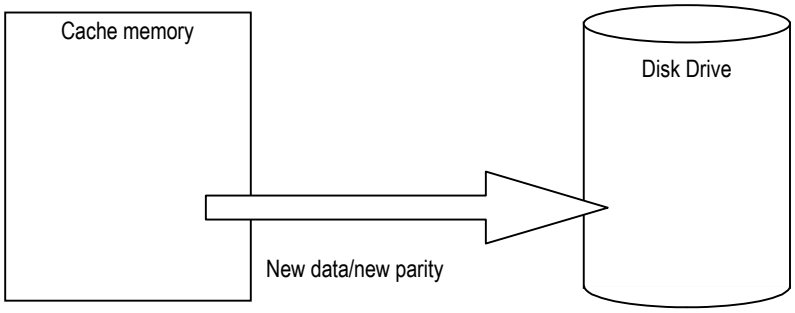


Figure 3.4.4 Destaging of Sequential Data

3.4.6 Staging Operation (Writing to the Cache Memory)

(1) Random reading

For allocating the Cache memory, FIFO (First In First Out) and LRU (Least Recently Used) are selectable, and the most appropriate allocation is performed according to the access pattern to improve the hit rate.

(2) Sequential reading

According to the learning of received commands, in case of a command to read back data from consecutive addresses is received, a pre-fetch read data from the next area of the HDD is performed prior to the following read command. When the following read command is received, the data is read back from the Cache memory, so that the read performance is improved.

3.5 Optional Functions

(1) ShadowImage in-system replication

This subsystem provides the ShadowImage in-system replication function as an optional function.

To use the ShadowImage in-system replication, the P-002D-J411 (the P-002D-J411W for RKS) is required separately.

The ShadowImage in-system replication controls LU copying done within one and the same subsystem. It can create a copy (secondary volume) of an LU within one and the same subsystem keeping the redundancy that the source LU (primary volume) has.

(For the details, refer to the manual supplied with the P-002D-J411 or the P-002D-J411W.)

(2) TrueCopy remote replication

The subsystem provides the TrueCopy remote replication as an optional function. To use the TrueCopy remote replication, the P-002D-J412 (the P-002D-J412W for RKS) is required separately.

The TrueCopy remote replication supports the mode, in which data of disk subsystems connected via the Fibre Channel interface are equalized, by always synchronizing their data. Besides, the function makes the copying speed higher by transferring differential data only.

(For the details, refer to the manual supplied with the P-002D-J412 or the P-002D-J412W.)

(3) TrueCopy Extended Distance

The subsystem provides the TrueCopy Extended Distance as an optional function. To use the TrueCopy Extended Distance, the P-002D-J415 (the P-002D-J415W for RKS) is required separately.

TrueCopy Extended Distance supports the mode, in which data of disk subsystems connected via the Fibre Channel interface are equalized, by always synchronizing their data periodically. Besides, the function makes the copying speed higher by transferring differential data only.

(For the details, refer to the manual supplied with the P-002D-J415 or the P-002D-J415W.)

(4) Copy-on-write SnapShot

This subsystem provides the Copy-on-write SnapShot as an optional function.

To use the Copy-on-write SnapShot, the P-002D-J410 (the P-002D-J410W for RKS) is required separately.

Copy-on-write SnapShot is a function to internally retain a logical duplication of the primary volume data at the time of the command instruction.

Copy-on-write SnapShot can create up to 15 duplication volumes per primary volume and manage data in two or more generations within the disk subsystem. (For the details, refer to the manual supplied with the P-002D-J410 or the P-002D-J410W.)

(5) Data Retention Utility

This subsystem provides the Data Retention Utility as an optional function.
To use the Data Retention Utility, the P-002D-J409 (the P-002D-J409W for RKS) is required separately.
Data Retention Utility is an option for protecting a logical unit (LU) against an illegal access from a host computer by setting an access attribute to LU. (For the details, refer to the manual supplied with the P-002D-J409 or the P-002D-J409W.)

(6) LUN Manager

The subsystem provides the LUN Manager as an optional function.
To use the LUN Manager, the P-002D-J408 (the P-002D-J408W for RKS) is required separately.
The LUN Manager enables the subsystem to make a suitable response to each connected host even within the same port by grouping the connected hosts within a port and setting the logical unit mapping and the Host Connection mode for each host group. (For the details, refer to the manual supplied with the P-002D-J408 or the P-002D-J408W.)

(7) Cache Residency Manager

This subsystem provides the Cache Residency Manager as an optional function.
To use the Cache Residency Manager, the P-002D-J405 is required separately.
The Cache Residency Manager to make the data of the specified LU resident in the Cache memory installed in the Control Unit, and to execute all the accesses from the server related to the LU concerned by cache hit without generating any access of the Disk Drive. (For the details, refer to the manual supplied with the P-002D-J405.)

(8) SNMP Agent Support Function

This subsystem provides the SNMP Agent Support Function as an optional function.
To use the SNMP Agent Support Function, the P-002D-J403 is required separately.
The SNMP Agent Support Function reports occurrences of failure to the workstation for monitoring the network via the SNMP (Simple Network Management Protocol) of the open platform. It reports conditions of command operation (such as a number of command receptions and number of cache hits) of the disk array subsystem.
It enables you to refer to the conditions of command operation depending on a type of access from a host and you can utilize it as information for tuning subsystem performance. (For the details, refer to the manual supplied with the P-002D-J403.)

(9) Password Protection

The subsystem provides the Password Protection as an optional function.
To use the Password Protection, the P-002D-J402 is required separately.
The Password Protection prevents any DF800 from being concurrently accessed by users by limiting users of Hitachi Storage Navigator Modular 2 to be permitted to access the DF800. It can suspend the information provided from the DF800 to the user who has no access authority, and avoid the case that two or more users update the configuration information at the same time. (For the details, refer to the manual supplied with the P-002D-J402.)

(10) Performance Monitor

This subsystem provides the Performance Monitor as an optional function.
To use the Performance Monitor, the P-002D-J406 is required separately. Performance Monitor acquires information on performance of the subsystem and utilization rates of resources. Further, the information acquired is displayed with line graphs in the Monitor.
(Refer to the attached manual of P-002D-J406 for more details).

(11) Cache Partition Manager

The subsystem provides the Cache Partition Manager as an optional function. To use the Cache Partition Manager, the P-002D-J407 is required separately.
Cache Partition Manager is a function to tune the cache memory and has the following functions. (For the details, refer to the manual supplied with the P-002D-J407.)

- A function to partition the cache memory and to make each LU's domain exclusive
- A function to be able to change the segment length for each partition from 16 k bytes of a default value to 4 k bytes, 8 k bytes, 64 k bytes, 256 k bytes and 512 k bytes for the partitions other than the master partition.

(12) Modular Volume Migration

This subsystem prepares Modular Volume Migration as an optional function.
P-002D-J416 (the P-002D-J416W for RKS) is separately required to use Modular Volume Migration.
Modular Volume Migration is a function to transfer the LU to other RAID groups in the disk array subsystem with the Read operation and the Write operation from the host continued. (Refer to the attached manual of P-002D-J416 or the P-002D-J416W for more details).

(13) Account Authentication

This subsystem prepares Account Authentication as an optional function.
P-002D-J417 is separately required to use Account Authentication.
Account Authentication controls the login authentication to the array subsystem and the access to the subsystem resource by using the account information that the user registered beforehand. The user ID, the password, and the information on the roll classification are included in the account information, and the login authentication is performed with the user ID and the password, and right or wrong of the update setting and the information reference to each resource of the subsystem is decided by the roll classification.
Therefore, the illegal access to the DF800 can be prevented. (Refer to the attached manual of P-002D-J417 for more details.)

(14) Audit Logging

This subsystem prepared Audit Logging as an optional function.
P-002D-J418 is separately required to use Audit Logging.
Audit Logging is a function to generate the log of the event when the user performs the setting operation, configuration change, etc. for the DF800.
The log is generated in the syslog form, and it is immediately output to the server for syslog that the user set (Refer to the attached manual of P-002D-J418 for more details).

(15) Power Saving

This subsystem prepares Power Saving as an optional function.
P-002D-J419 is separately required to use Power Saving.
Power Saving is the function to reduce the electric power consumption of the DF800 by spinning down (rotation stop of the Disk Drives) the Disk Drives which configure the RAID Group that the user specified. (Refer to the manual attached to P-002D-J419 for the details.)

(16) TrueCopy Modular Distributed

The subsystem provides the TrueCopy Modular Distributed as an optional function.
To use the TrueCopy Modular Distributed, the P-002D-J412M (RKS: J412MW) is required separately. (Customer who owns TrueCopy remote replication needs the P-002D-J422.)
TrueCopy Modular Distributed extends the function which equalizes the data of both disk subsystems so that it can be used between multiple disk subsystems and one disk subsystem.
(For the details, refer to the manual supplied with the P-002D-J422, J412M or J412MW.)

(17) Dynamic Provisioning

The subsystem provides the Dynamic Provisioning as an optional function.
To use the Dynamic Provisioning, the P-002D-J423 (RKS: J423W) is required separately.
Dynamic Provisioning is a function to improve the capacity efficiency of disk drives by assigning physical capacity On Demand at the time of the Write command receipt without assigning the physical capacity to LUs.
(For the details, refer to the manual supplied with the P-002D-J423 or P-002D-J423W.)

3.6 Operation Against Disk Failure Occurs

(1) I/O operation against Disk Drive failure

In the subsystem with the RAID1, RAID5, or RAID1+0 configuration, even when a failure occurs in one Disk Drive and data cannot be read from it, the target data can be recovered by means of using data on the other normal Disk Drives.

In the case of RAID1 and RAID1+0, data on the mirror Disk Drive is used, and in the case of RAID5, data on the other Disk Drive on the same stripe is used. By means of these measures, even when a Disk Drive failure occurs, reading/writing can be done as before.

Even when failures occur in two Disk Drives at the same time and reading from them becomes impossible, the RAID 6 configuration can restore the data concerned utilizing data stored in normal Disk Drives.

In the RAID 6 configuration, each Disk Drive utilizes data in the other Disk Drives in the same stripe. If failures occur in two Disk Drives, reading/writing can be done in the same way as before the failures by virtue of the above.

Figure 3.6.2 shows the outline of the data reading operation performed when a Disk Drive failure occurs.

Data B reading request

(a) Data B read request

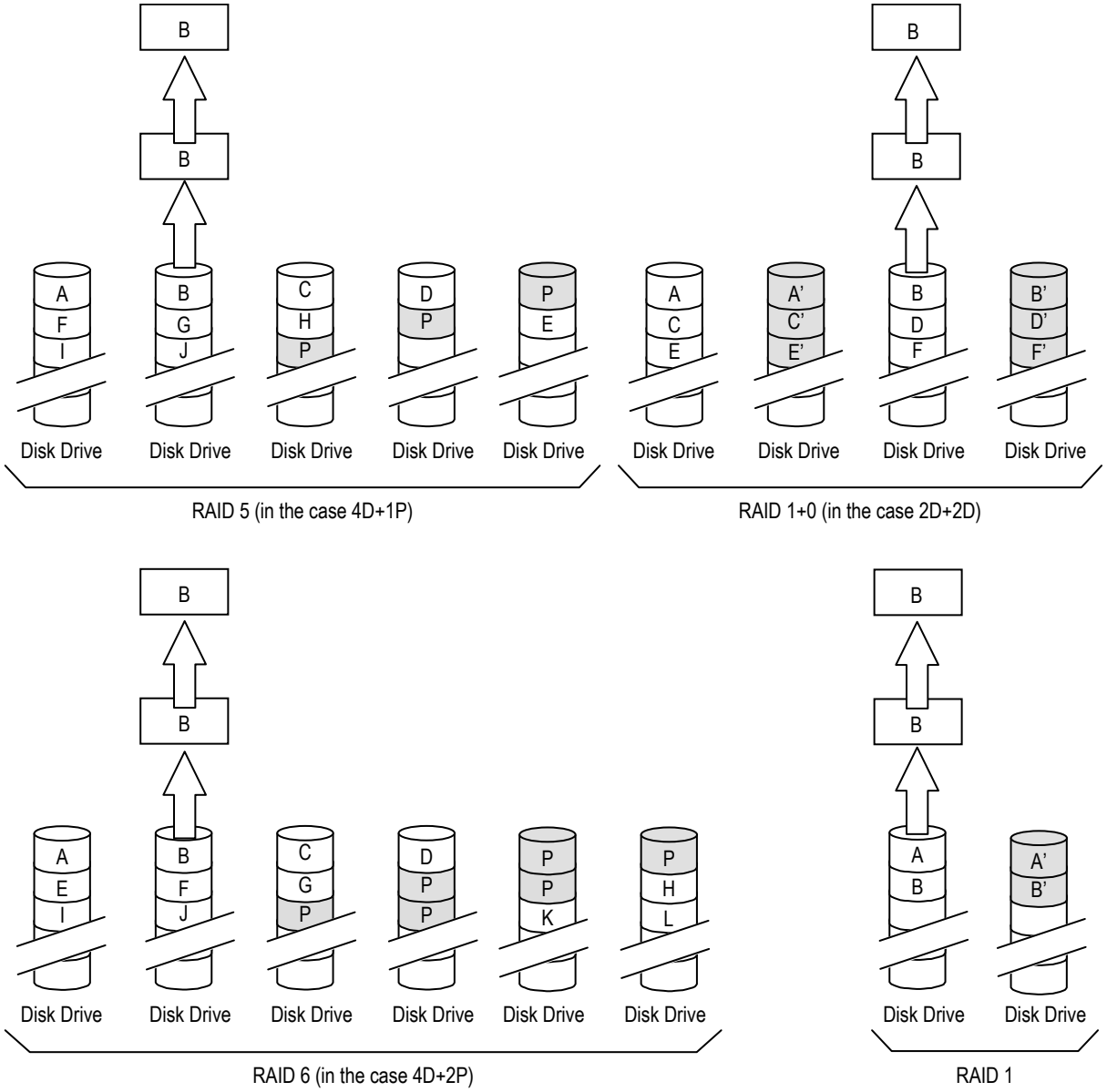
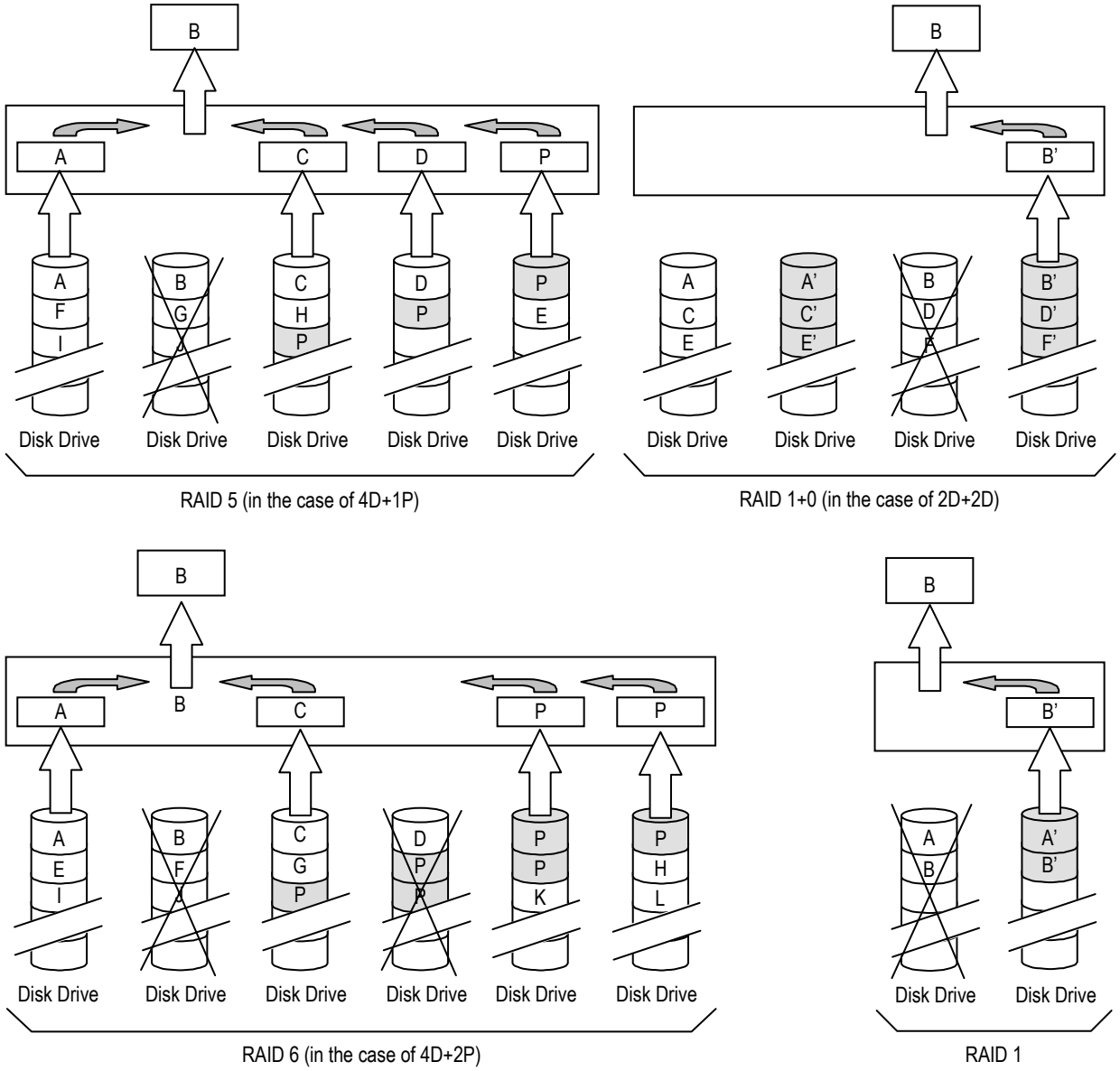


Figure 3.6.1 Data Reading Operation when Disk Drive is Normal

(b) When a Disk Drive failure occurs



A, B, C ⋯ ; data
P ; parity data
A', B', C'⋯ ; mirror data

Figure 3.6.2 Data Reading Operation when a Disk Drive Failure Occurs

(2) Data assurance when a disk failure occurs

The subsystem can have a Spare Disk (s) optionally. Data on a Disk Drive which is blocked owing to its failure or a Disk Drive in which a number of error occurrence has exceeded the specified value is automatically reconstructed on the Spare Disk.

The data to be copied on the Disk Drive to restructure data in the Spare Disk Drive is the data on the logical unit which an LU format is already completed.

This operation is performed in the background without making the host computer conscious of it, so that I/O request can be accepted continuously. When the failed Disk Drive is replaced, the data saved on the Spare Disk is copied to the new Disk Drive.

The data recovery processing to the Disk Drive of the Dynamic sparing function, Correction copy function and Copy back function operates to one set of the Disk Drives. After the data recovery to one set of the Disk Drives is completed, the data recovery is started to one another set. Also, these three functions do not operate at the same but serve as operation of the order of ① Correction copy function, ② Copy back function, and ③ Dynamic sparing function. For example, when two sets of the Disk Drives are blocked in the RAID Group of the RAID level 6, the Correction copy function does not recover two sets of the blocked data at the same time, but recovers one set at a time.

(a) Dynamic sparing

Errors which occur during ordinary reading/writing operation are controlled for each Disk Drive. When a number of error occurrences of a Disk Drive exceeds the specified value, data on the Disk Drive is automatically copied onto the Spare Disk because it is determined that there exists a risk that a failure (an uncorrectable error) will occur in the Disk Drive. This function is called a dynamic sparing function.

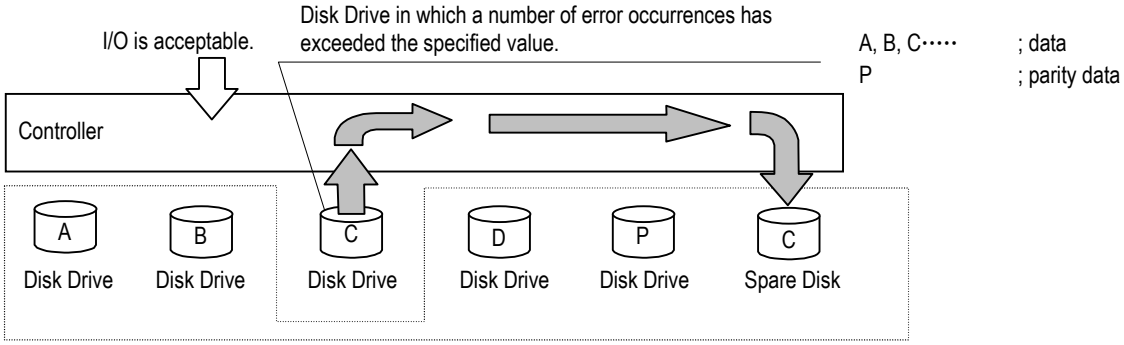


Figure 3.6.3 Dynamic Sparing

(b) Correction copy

In the subsystem with the RAID 5 and RAID 6 configuration, when a failure occurs in a Disk Drive and data reading/writing from on it cannot be done, the data on the failed Disk Drive is restored using those on the other data Disk Drives and the parity Disk Drive, and then copied onto the Spare Disk. In the subsystem with the RAID 1 or RAID 1+0 configuration, when the same situation as above occurs, data on the mirror Disk Drive is copied onto the Spare Disk. In the RAID 0 configuration, the correction copy cannot be done.

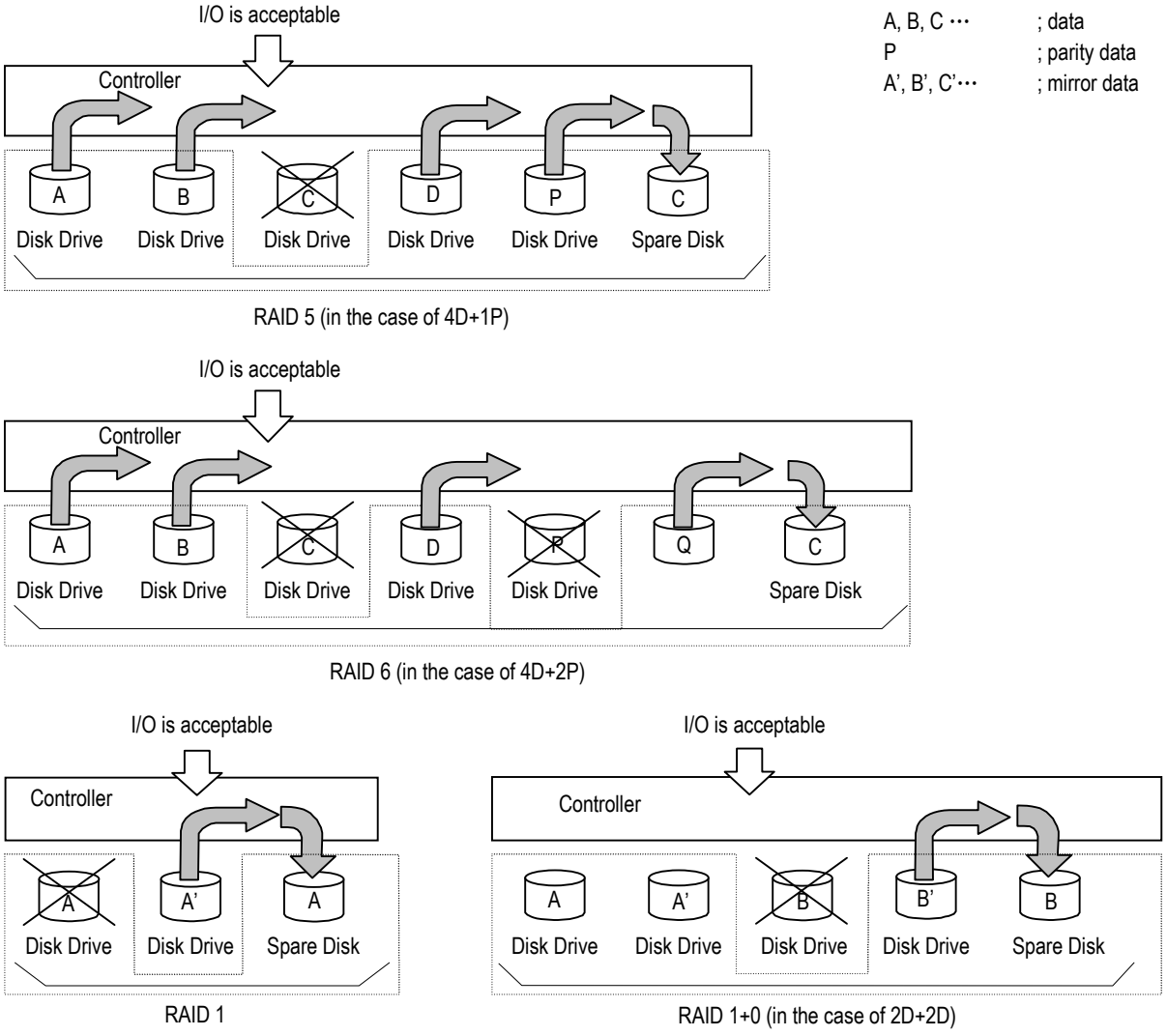


Figure 3.6.4 Correction Copy

(3) Operation after replacing the failed Disk Drive

Copy back is the processing returned to the original status by copying the data in the Spare Disk to the replaced Disk Drive after replacing the failed Disk Drive when the data is reconstructed in the Spare Disk Drive by the dynamic sparing or the correction copy.

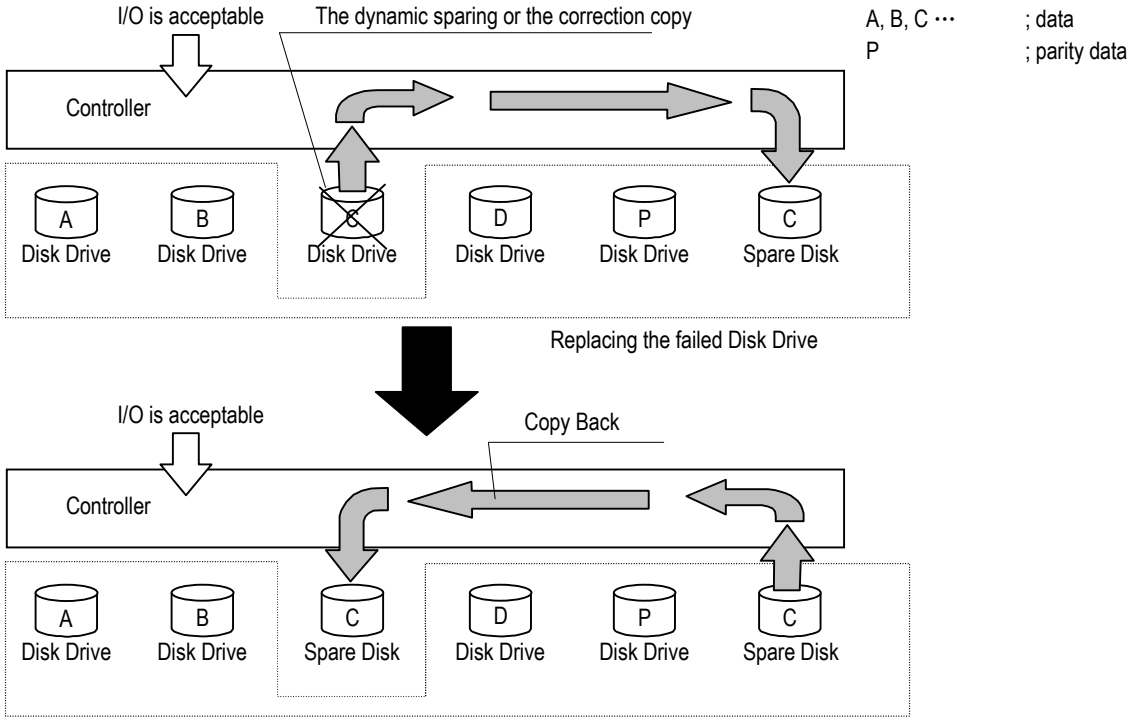


Figure 3.6.5 Copy Back

The Copy back may or may not operate depending on the relationship among the setting value of “Spare Drive”, the Spare Disk which recovered the data, and the failed Disk Drive.
The setting value of “Spare Drive” and the operation specification are shown in Table 3.6.1.

Table 3.6.1 Setting of "Spare Drive" and the Operation Specification (SAS Disk Drive)

The first parameter (Spare Drive)	The second parameter (Applying No Copy back Mode on All the Units)	Operation specification
Fixing (Fixed)	–	If the failed Disk Drive is replaced, the data saved in the Spare Disk Drive is copied back to the replaced Disk Drive. (Refer to Figure 3.6.6.) The location of the Disk Drive which configures the RAID Group never changes from the time of creating the RAID Group. Therefore, this parameter is set when fixing the location of the Disk Drive which configures the RAID Group.
Variable (Variable) (*1) (This is set in default.)	Disable (Default) Enable	Although the dynamic sparing or the correction copy is completed, the data saved in the Spare Disk Drive is not copied to the replaced Disk Drive if the capacity and the rotational speed of the failed Disk Drive and the Spare Disk Drive which recovered the data are the same. The copy backless operates because the replaced Disk Drive becomes a new Spare Disk. (Refer to Figure 3.6.7.) In the following case, the copy backless does not operate, and the copy back surely operates after replacing the failed Disk Drive. •- When the capacity or the rotational speed of the failed Disk Drive and the Spare Disk which recovered the data differs

*1 : When the Power Saving function is installed and valid, if the setting of the Spare Disk Drive is performed in the Disk Drive #0 to #4 of the RKM/RKS or the Disk Drive #0 to #4 of the RKAK connected to the head of the RKH, the copy backless does not operate at the time of the data restoration to the Disk Drive concerned, and the copy back surely operates after replacing the Disk Drive.

Table 3.6.2 Setting of "Spare Drive" and the Operation Specification (SATA Disk Drive)

The first parameter (Spare Drive)	The second parameter (Applying No Copy back Mode on All the Units)	Operation specification
Fixing (Fixed)	–	If the failed Disk Drive is replaced, the data saved in the Spare Disk Drive is copied back to the replaced Disk Drive. (Refer to Figure 3.6.6.) The location of the Disk Drive which configures the RAID Group never changes from the time of creating the RAID Group. Therefore, this parameter is set when fixing the location of the Disk Drive which configures the RAID Group.
Variable (Variable) (This is set in default.)	Disable (Default) Enable	Although the dynamic sparing or the correction copy is completed, the data saved in the Spare Disk Drive is not copied to the replaced Disk Drive if the capacity and the rotational speed of the failed Disk Drive and the Spare Disk Drive which recovered the data are the same. The copy backless operates because the replaced Disk Drive becomes a new Spare Disk. (Refer to Figure 3.6.7.)

*1 : When the Power Saving function is installed and valid, if the setting of the Spare Disk Drive is performed in the Disk Drive #0 to #4 of the RKM/RKS or the Disk Drive #0 to #4 of the RKAK connected to the head of the RKH, the copy backless does not operate at the time of the data restoration to the Disk Drive concerned, and the copy back surely operates after replacing the Disk Drive.

(3-1) When "Spare Drive" is fixed

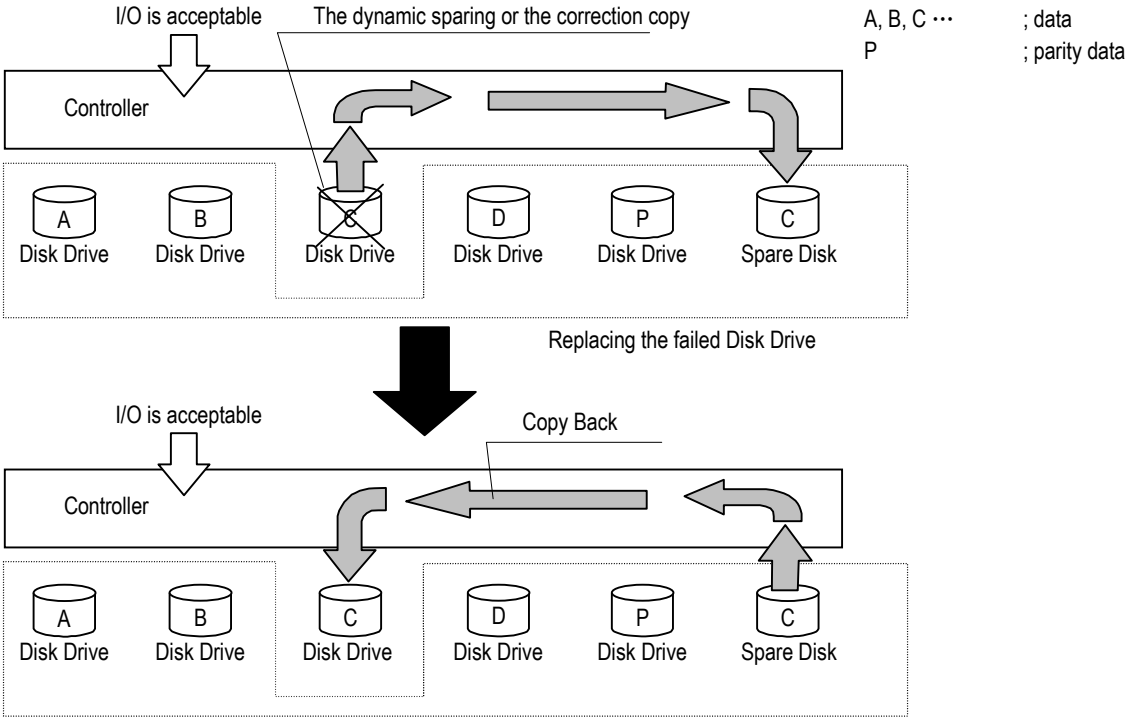


Figure 3.6.6 Copy Back

(3-2) When "Spare Drive" is variable and "Applying No Copy Back Mode on All the Units" is disabled

(a) When the rotational speed and the capacity of the failed Disk Drive and the Spare Disk Drive are the same, if the Disk Drive restoration (dynamic sparing or correction copy) is completed, the copy backless operates.

The copy back does not operate even if the failed Disk Drive is replaced.

NOTE : When the Power Saving function is installed and valid, if the setting of the Spare Disk is performed in the Disk Drive #0 to #4 of the RKM/RKS or the Disk Drive #0 to #4 of the RKAK connected to the head of the RKH, the copy backless does not operate at the time of the data restoration to the Disk Drive concerned, and the copy back surely operates after replacing the Disk Drive.

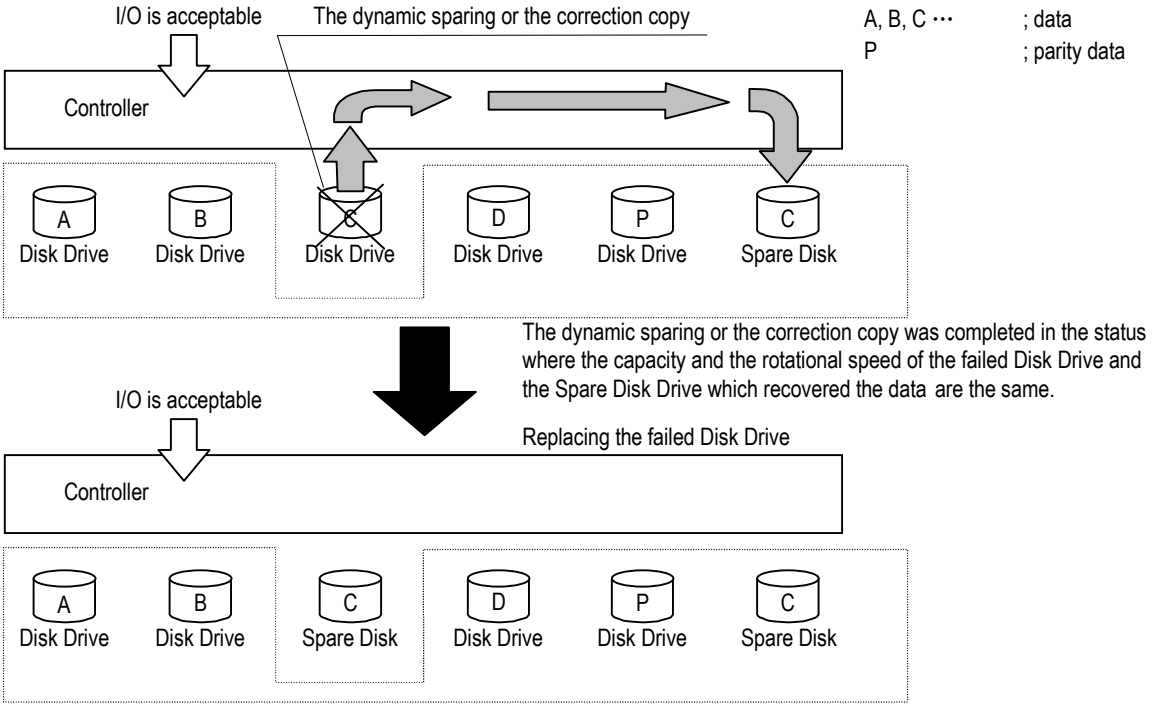


Figure 3.6.7 Copy Backless

(b) When the rotational speed and the capacity of the failed Disk Drive and the Spare Disk Drive differ, the copy backless does not operate at the time of completing the Disk Drive restoration (dynamic sparing or correction copy), and the copy back operates after replacing the failed Disk Drive.

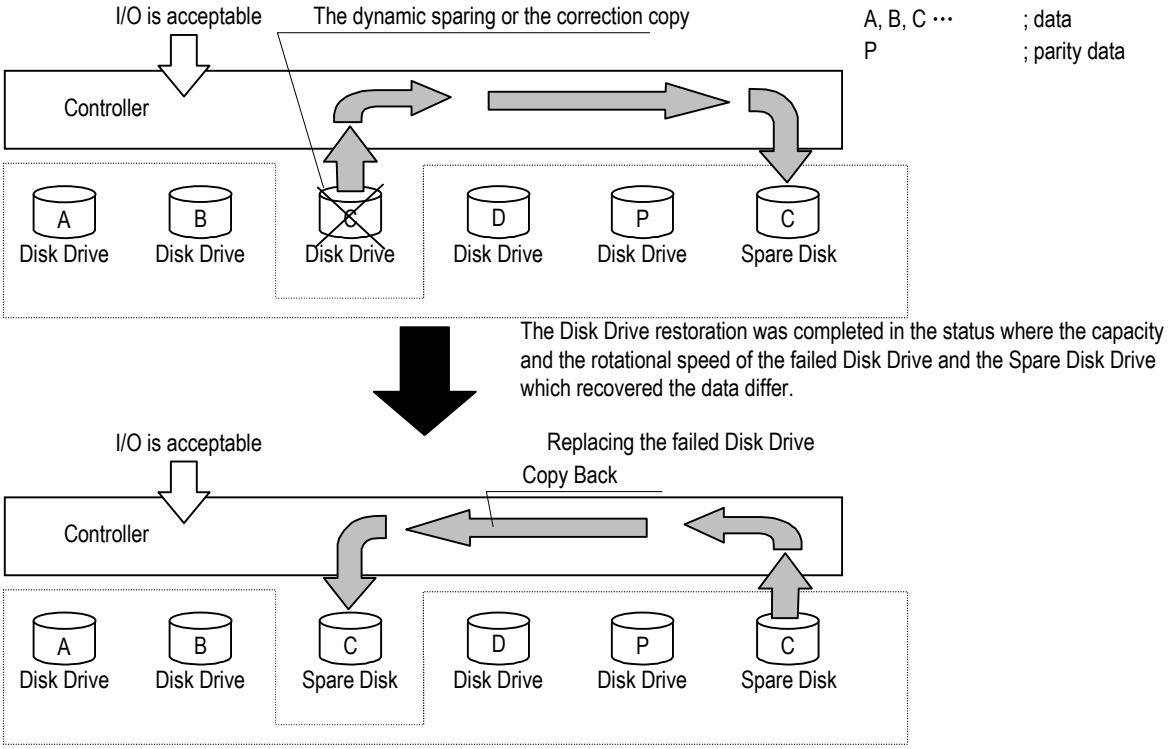


Figure 3.6.8 Copy Back

(c) The combination of the failed Disk Drive which becomes the copy backless and the Spare Disk Drive

The Copy backless operates depending on the types of the failed Disk Drive and the Spare Disk Drive and the relation between the rotational speed, the capacity and 720 hours/month operational condition (SATA Disk Drive) of the failed Disk Drive and the Spare Disk Drive.
The relation between the failed Disk Drive and the Spare Disk Drive is shown in Table 3.6.3, Table 3.6.4, and Table 3.6.5.

Table 3.6.3 Availability of the Copy Backless Operation between the SAS Disk Drives of the RKM/RKS/RKAK

Attribute				Spare Disk				
	Chassis			RKM/RKS/RKAK				
Failed Disk Drive (SAS)	RKM/RKS/RKAK	Capacity [G bytes]		146	300	400	450	600
			Rotational speed [min^{-1}]	15,000	15,000	10,000	15,000	15,000
		146	15,000	○	×	×	×	×
		300	15,000	–	○	×	×	×
		400	10,000	–	–	○	×	×
		450	15,000	–	–	–	○	×
		600	15,000	–	–	–	–	○

○ : Copy backless
× : Copy back
– : The Disk Drive restoration does not operate.

Table 3.6.4 Availability of the Copy Backless Operation between the SATA Disk Drives of the RKM/RKS/RKAK/RKAKX

Attribute				Spare Disk			
	Chassis			RKM/RKS/RKAK/RKAKX			
Failed Disk Drive (SATA)	RKM/RKS/ RKAK/RKAKX	Capacity [G bytes]		250	750	1,000	2,000
			Rotational speed [min^{-1}]	7,200	7,200	7,200	7,200
		500	7,200	○	×	×	×
		750	7,200	–	○	×	×
		1,000	7,200	–	–	○	×
		2,000	7,200	–	–	–	○

○ : Copy backless
× : Copy back
– : The Disk Drive restoration does not operate.

Table 3.6.5 Availability of the Copy Backless Operation between the Flash Drives of the RKM/RKS/RKAK

Attribute			Spare Disk (Flash Drive)
	Chassis		RKM/RKS/RKAK
Failed Disk Drive (Flash Drive)	RKM/RKS/RKAK	Capacity [G bytes]	200
		200	○

○ : Copy backless
× : Copy back
– : The Disk Drive restoration does not operate.

(4) Method for selecting a Spare Disk

When data is restored to a Spare Drive in the case where two or more Spare Drives are installed, the Spare Drive is selected according to priorities of the following items.

Priority item	Description	Degree of priority
Drive type	It is judged which drive type the drive that requires restoration is of SAS, S-ATA, or Flash Drive and only a drive of the same type is used.	High
Model name	A Spare Disk Drive with the same model name as the failed Disk Drive is used preferentially.	
Drive capacity	A spare disk with the same capacity as a RAID group to be restored is used preferentially. When a drive with the same capacity does not exist, a drive with the most approximate and larger capacity is selected preferentially.	
Rotational number	A Spare Disk Drive with the same capacity as the failed Disk Drive is used preferentially.	
The loop of the drive interface	A Spare Disk in the same loop as the failed Disk Drive is used preferentially.	Low

3.7 Setting RAID Group

You can set the RAID group and RAID level shown below by using the setting function.

(1) RAID level

The range of the RAID levels supported by the DF800 is shown in the table below.

Table 3.7.1 Range of Supported RAID Levels

No.	RAID level	Supported range			Remarks
		RKM + RKAK	RKS + RKK	RKH + RKAK	
1	RAID 0	2D to 16D (SATA is not supported)	2D to 16D (SATA is not supported)	2D to 16D (SATA is not supported)	The stripe size is 256 k bytes in default. It can be changed to 64 k bytes or 512 k bytes.
2	RAID 1	1D+1D	1D+1D	1D+1D	
3	RAID 5	2D+1P to 15D+1P	2D+1P to 15D+1P	2D+1P to 15D+1P	
4	RAID 6	2D+2P to 28D+2P	2D+2P to 28D+2P	2D+2P to 28D+2P	
5	RAID 1+0	2D+2D to 8D+8D	2D+2D to 8D+8D	2D+2D to 8D+8D	

(2) Selection of Disk Drives

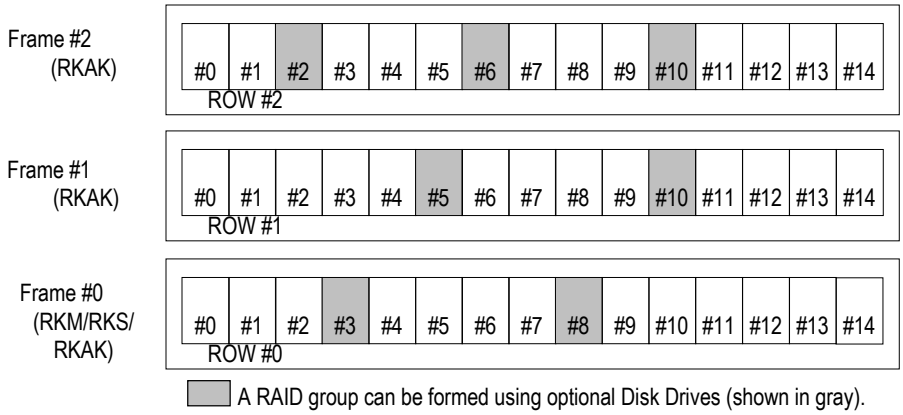
Disk drives for a RAID group

It is possible to create the RAID Group by selecting either one optional Disk Drive of SAS and SATA among the Disk Drives which are not set in the RAID Group or the Spare Disks and not blocked.

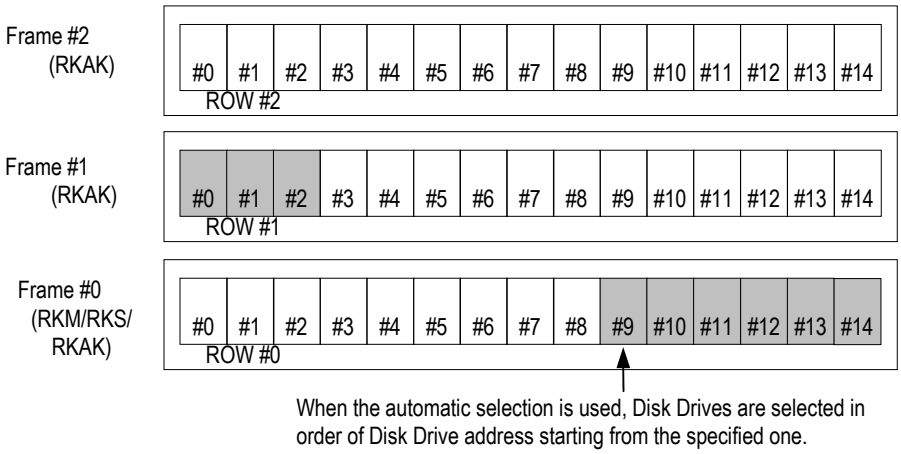
When selecting the Disk Drives to configure the RAID Group manually, it is recommended to continuously select the Disk Drives in the Basic Chassis and the Additional Chassis (either one Disk Drive of SAS and SATA which are not set in the RAID Group or the Spare Disks and not blocked) with Hitachi Storage Navigator Modular 2.

When using the automatic selection, the Disk Drives for the RAID width (number of Disk Drives in the parity group) × depth (number of parity groups) are allocated from the specified first Disk Drive by the numerical order (in ascending order) in device # order as the RAID Group configuration.

(2-1) Selection of optional Disk Drives



(2-2) Automatic selection



(3) User data area

All the Disk Drives allocated to a RAID group are managed as those having the same capacity because of the full mapping.

The size of the user data in one Disk Drive is the specified Disk Drive capacity from which the system area capacity is subtracted and rounded with 0x0800.

Expression:

User data size = ((LAST LBA + 1) - Data portion beginning LBA) & 0xFFFFF800

When the capacity of the Disk Drives installed within the range where the RAID group is allocated is smaller than the specified Disk Drive capacity, the RAID group cannot be defined.

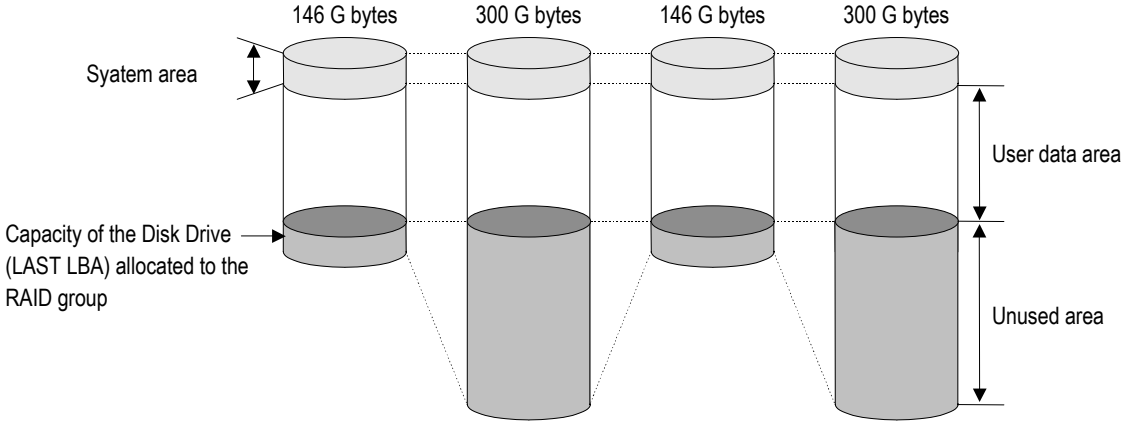
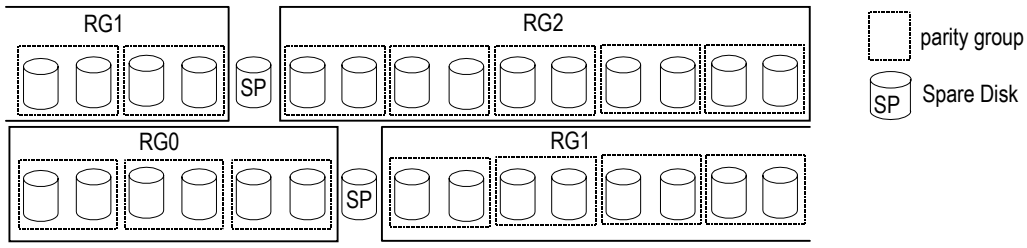


Figure 3.7.1 User Data Area

(4) Image of RAID group definition for each RAID level (RKAK + RKAK connected to RKM/RKS + RKAK, RKH)

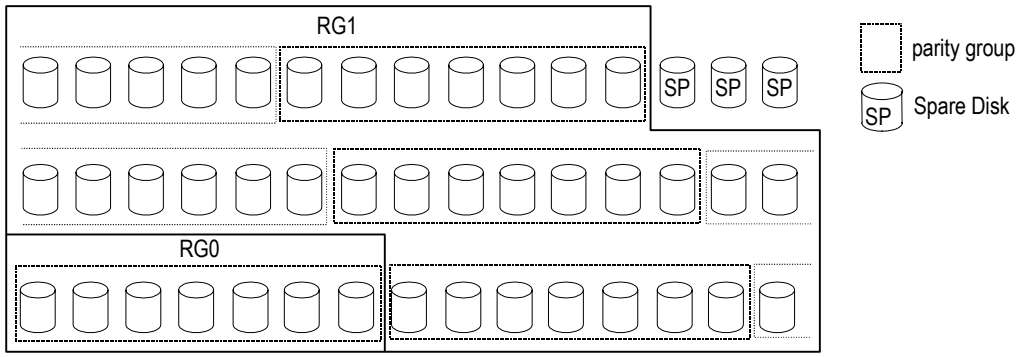
(a) RAID 0 (SATA is not supported)

- In the case of 2D



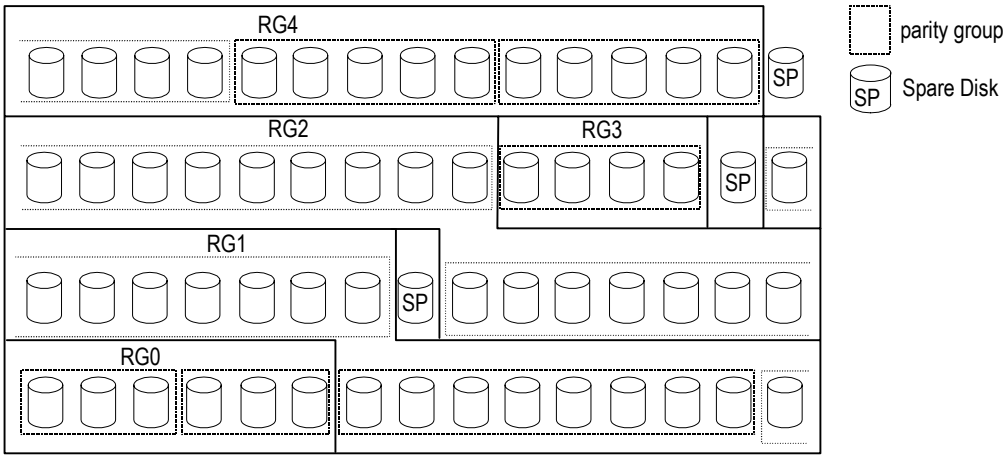
RG0 : Number of the Disk Drive in the parity group = 2
Number of parity groups = 3
RG1 : Number of the Disk Drive in the parity group = 2
Number of parity groups = 6
RG2 : Number of the Disk Drive in the parity group = 2
Number of parity groups = 5

- In the case of 7D



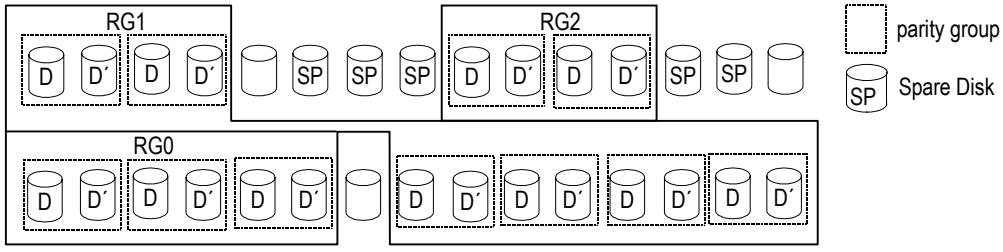
RG0 : Number of the Disk Drive in the parity group = 7
Number of parity groups = 1
RG1 : Number of the Disk Drive in the parity group = 7
Number of parity groups = 5

- In the case of 2D to16D



RG0 : 3D Number of the Disk Drive in the parity group = 3
Number of parity groups = 2
RG1 : 8D Number of the Disk Drive in the parity group = 8
Number of parity groups = 2
RG2 : 16D Number of the Disk Drive in the parity group = 16
Number of parity groups = 1
RG3 : 4D Number of the Disk Drive in the parity group = 4
Number of parity groups = 1
RG4 : 5D Number of the Disk Drive in the parity group = 5
Number of parity groups = 3

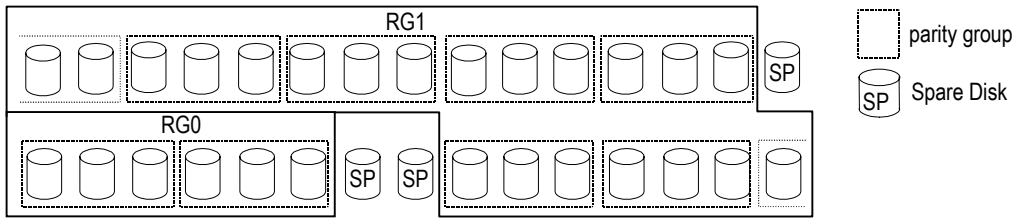
(b) RAID 1



RG0 : Number of the Disk Drive in the parity group = 2
Number of parity groups = 3
RG1 : Number of the Disk Drive in the parity group = 2
Number of parity groups = 6
RG2 : Number of the Disk Drive in the parity group = 2
Number of parity groups = 2

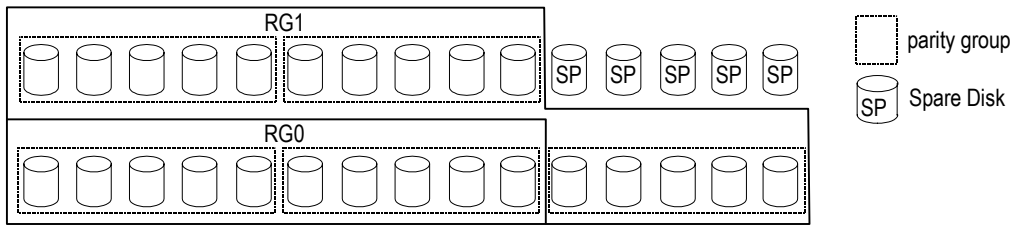
(c) RAID 5

- In the case of 2D + 1P



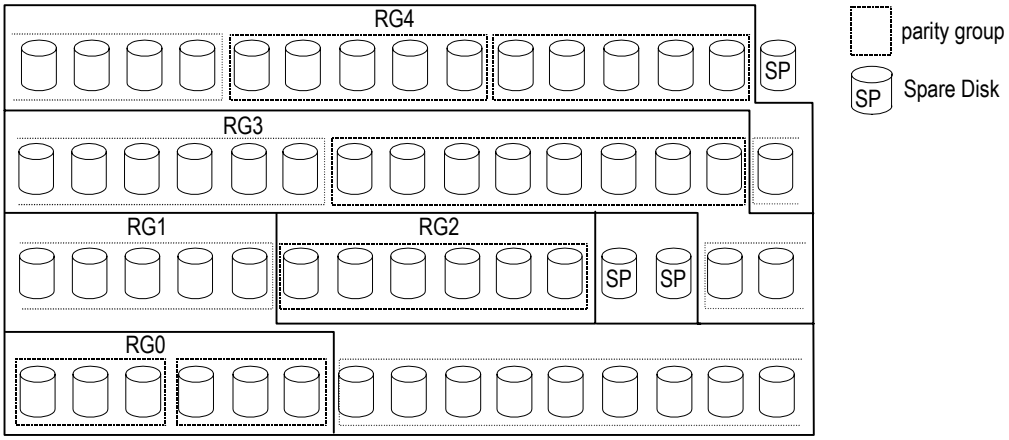
RG0 : Number of the Disk Drive in the parity group = 3
Number of parity groups = 2
RG1 : Number of the Disk Drive in the parity group = 3
Number of parity groups = 7

- In the case of 4D + 1P



RG0 : Number of the Disk Drive in the parity group = 5
Number of parity groups = 2
RG1 : Number of the Disk Drive in the parity group = 5
Number of parity groups = 3

• In the case of 2D + 1P to 15D + 1P



RG0 : 2D + 1P Number of the Disk Drive in the parity group = 3
Number of parity groups = 2

RG1:13D + 1P Number of the Disk Drive in the parity group = 14
Number of parity groups =1

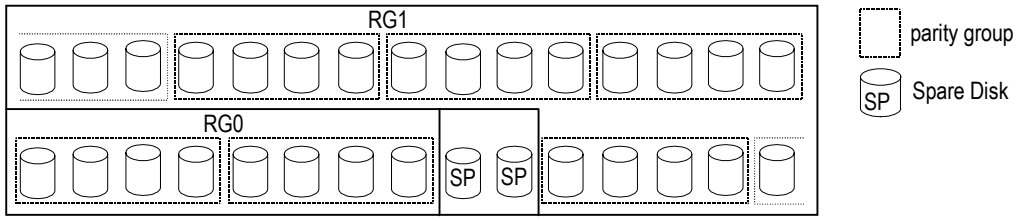
RG2: 5D + 1P Number of the Disk Drive in the parity group = 6
Number of parity groups = 1

RG3: 7D + 1P Number of the Disk Drive in the parity group = 8
Number of parity groups = 2

RG4: 4D + 1P Number of the Disk Drive in the parity group = 5
Number of parity groups = 3

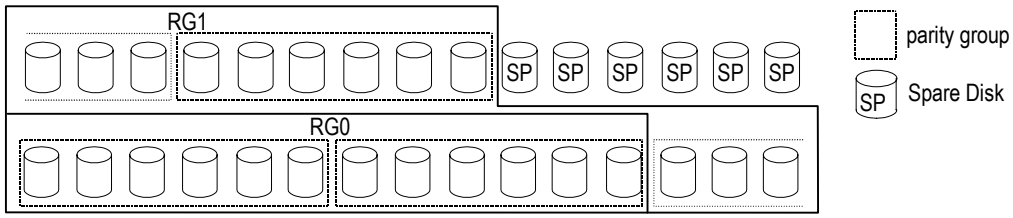
(d) RAID 6

- In the case of 2D + 2P



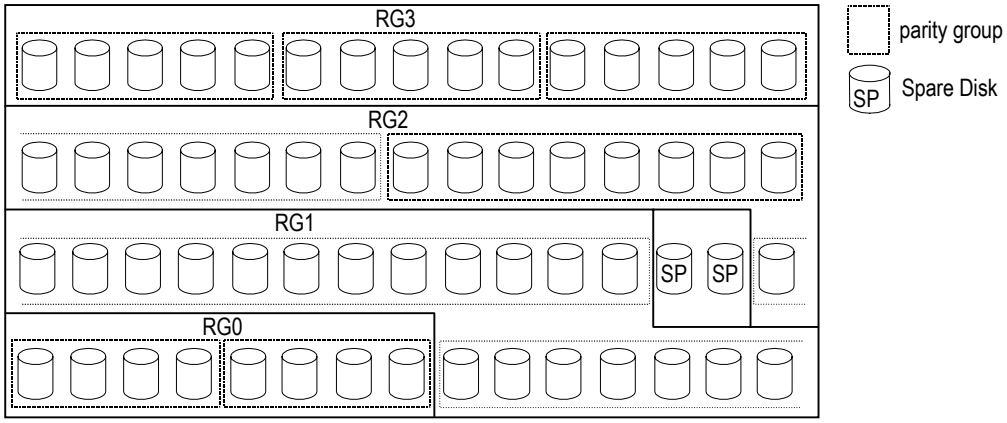
RG0 : Number of the Disk Drive in the parity group = 4
Number of parity groups = 2
RG1 : Number of the Disk Drive in the parity group = 4
Number of parity groups = 5

- In the case of 4D + 2P



RG0 : Number of the Disk Drive in the parity group = 6
Number of parity groups = 2
RG1 : Number of the Disk Drive in the parity group = 6
Number of parity groups = 2

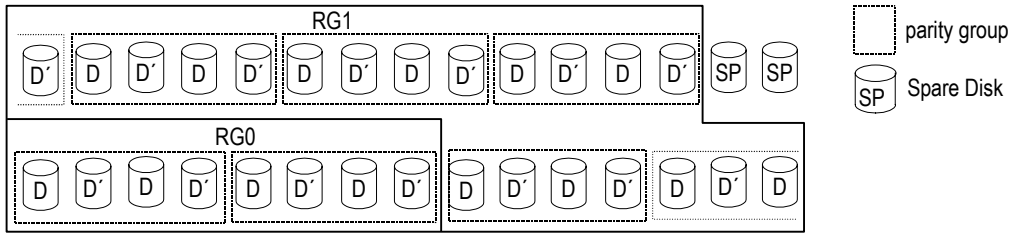
- In the case of 2D + 2P to 28D + 2P



RG0 : 2D + 2P Number of the Disk Drive in the parity group = 4
Number of parity groups = 2
RG1:17D + 2P Number of the Disk Drive in the parity group = 19
Number of parity groups =1
RG2: 6D + 2P Number of the Disk Drive in the parity group = 8
Number of parity groups = 2
RG3: 3D + 2P Number of the Disk Drive in the parity group = 5
Number of parity groups = 3

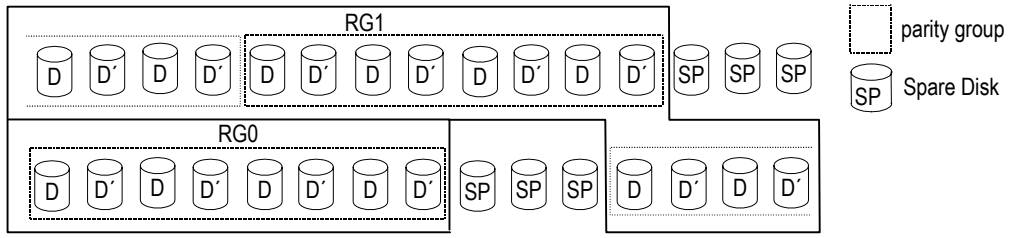
(e) RAID 1+0

- In the case of 2D + 2D



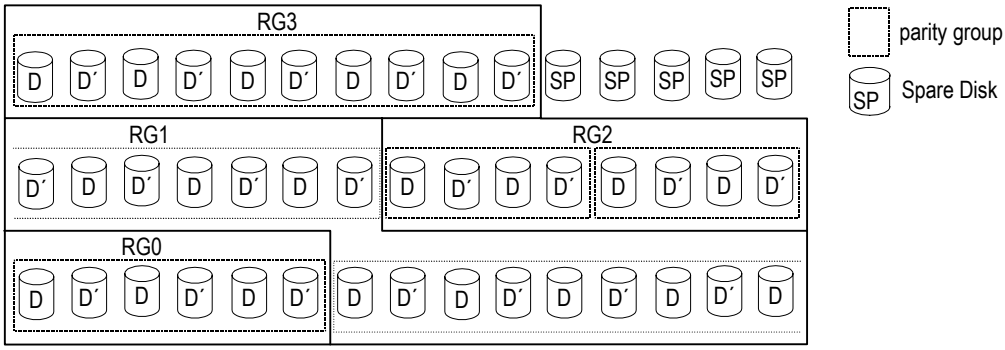
RG0 : Number of the Disk Drive in the parity group = 4
Number of parity groups = 2
RG1 : Number of the Disk Drive in the parity group = 4
Number of parity groups = 5

- In the case of 4D + 4D



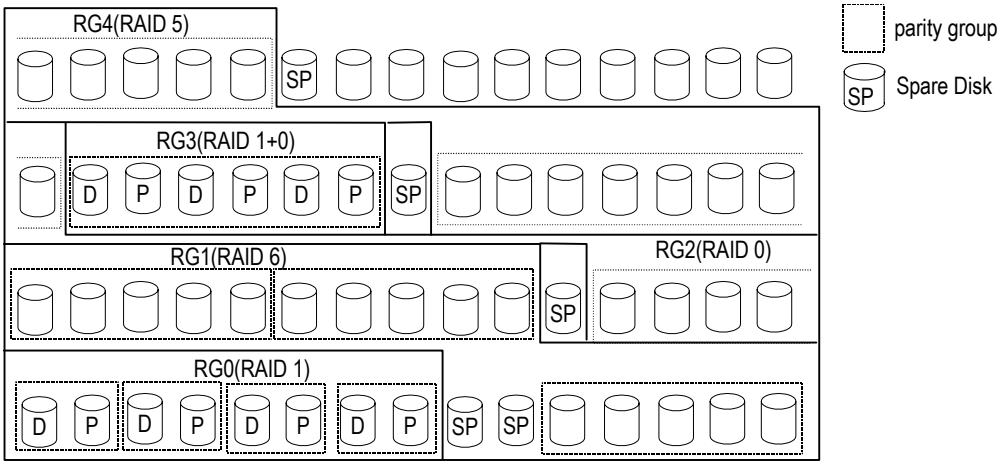
RG0 : Number of the Disk Drive in the parity group = 8
Number of parity groups = 1
RG1 : Number of the Disk Drive in the parity group = 8
Number of parity groups = 2

- In the case of 2D + 2D to 8D + 8D



RG0 : 3D + 3D Number of the Disk Drive in the parity group = 6
Number of parity groups = 1
RG1 : 8D + 8D Number of the Disk Drive in the parity group = 16
Number of parity groups = 1
RG2 : 2D + 2D Number of the Disk Drive in the parity group = 4
Number of parity groups = 2
RG3 : 5D + 5D Number of the Disk Drive in the parity group = 10
Number of parity groups = 1

(d) In the case where RAID levels coexist



RG0 (RAID 1) :1D+1D Number of the Disk Drive in the parity group = 2
Number of parity groups = 4

RG1 (RAID 6) : 3D + 2P
Number of the Disk Drive in the parity group = 5
Number of parity groups = 3

RG2 (RAID 0) : 5D
Number of the Disk Drive in the parity group = 5
Number of parity groups = 1

RG3 (RAID 1+0) : 3D + 3D
Number of the Disk Drive in the parity group = 6
Number of parity groups = 1

RG4 (RAID 5) : 11D + 1P
Number of the Disk Drive in the parity group = 12
Number of parity groups = 1

3.8 Online Verify

(1) Outline of Function

The online verify function executes verification of the disk medium surface, detects a disk medium fault, and recovers the data by reassignment to prevent an occurrence of data loss caused by a disk medium fault.

(2) Online Verify Specification

Check results of the online verify for each state of the check object and action against error are shown in Table 3.8.1.

Table 3.8.1 Check Results and Action Against the Error According to the State of the Check Object (1/2)

Check object	LU state		Check results	Retry	Action against error
RAID-0	LU undefined		Correctable error, uncorrectable error	Yes (*1)	The alternate sector is assigned.
			Hardware error, other errors	None	Ignore the error and continue the processing. (The test is continued from the next LBA. At this time, the Disk Drive is not blocked.)
	LU defined	Unformatted	Correctable error, uncorrectable error	Yes (*1)	The alternate sector is assigned.
			Hardware error, other errors	None	Ignore the error and continue the processing. (The test is continued from the next LBA. At this time, the Disk Drive is not blocked.)
		Normal/ blocked	Correctable error	Yes (*2)	The alternate sector is assigned, and the writing is performed. (*3)
			Uncorrectable error, hardware error, other errors	None	Ignore the error and continue the processing. (The test is continued from the next LBA. At this time, the Disk Drive is not blocked.)

*1 : Retry one time by the VERIFY command.

*2 : When there is staging data or no data on the cache, retry two times by the READ command. When there is dirty data, pin data, or write incomplete data on the cache, retry two times by the VERIFY command. When errors occur in both retries, recover the data. If there is no error in both retries, it is treated as normal.

*3 : (a) If the data recovery fails, ignore the faulty sector and go to the next LBA.
(b) Even if the alternate sector assignment fails, execute the recovery data write & verify function. When returned due to sector exhaustion, block the corresponding drive and go to the next drive.
(c) If the write & verify of the recovered data fails, leave the recovered data as dirty data and go to the next LBA.

*4 : Error count is managed. (When this error occurs at a Disk Drive twice within 24 hours, the Disk Drive is blockaded in case of redundant composition.)

Table 3.8.1 Check Results and Action Against the Error According to the State of the Check Object (2/2)

Check object	LU state		Check results	Retry	Action against error
RAID 1/1+0/ 5/6	LU undefined		Correctable error, uncorrectable error	Yes (*1)	The alternate sector is assigned.
			Hardware error, other errors	None	Ignore the error and continue the processing. (The test is continued from the next LBA. At this time, the Disk Drive is not blocked.) (*4)
	LU defined	Unformatted	Correctable error, uncorrectable error	Yes (*1)	The alternate sector is assigned.
			Hardware error, other errors	None	Ignore the error and continue the processing. (The test is continued from the next LBA. At this time, the Disk Drive is not blocked.)(*4)
		Normal/ blocked	Correctable error, uncorrectable error	Yes (*2)	The data is restored, the alternate sector is assigned, and the writing is performed. (*3)
			Hardware error, other errors	None	Ignore the error and continue the processing. (The test is continued from the next LBA. At this time, the Disk Drive is not blocked.) (*4)
RAID undefined	LU undefined		Correctable error, uncorrectable error	Yes (*1)	The alternate sector is assigned.
			Hardware error, other errors	None	Ignore the error and continue the processing. (The test is continued from the next LBA. At this time, the Disk Drive is not blocked.) (*4)
System area	–		Correctable error, uncorrectable error, hardware error, other errors	None	Blocked system area. Immediately after the blockade, it is recovered by the automatic operation of the system copy. (The retrials are to be made up to ten times.)

*1 : Retry one time by the VERIFY command.

*2 : When there is staging data or no data on the cache, retry two times by the READ command. When there is dirty data, pin data, or write incomplete data on the cache, retry two times by the VERIFY command. When errors occur in both retries, recover the data. If there is no error in both retries, it is treated as normal.

*3 : (a) If the data recovery fails, ignore the faulty sector and go to the next LBA.
(b) Even if the alternate sector assignment fails, execute the recovery data write & verify function. When returned due to sector exhaustion, block the corresponding drive and go to the next drive.
(c) If the write & verify of the recovered data fails, leave the recovered data as dirty data and go to the next LBA.

*4 : Error count is managed. (When this error occurs at a Disk Drive twice within 24 hours, the Disk Drive is blockaded in case of redundant composition.)

(3) Online Verify Starting Timing

The online verify function is active from becoming ready to scheduled stop. The start of the online verification after being READY is resumed from the position when the planned shutdown was normally performed last time. When the online verify is completed to the last LBA of the Disk Drive, the online verify is resumed from the Disk Drive head LBA. The operation of the online verification can be set to disable or enable by the Hitachi Storage Navigator Modular 2. However, the online verify function is not executed during the drive recovery operation or the copy operation of ShadowImage in-system replication/TrueCopy remote replication/Copy-on-Write Snapshot/TrueCopy Extended Distance.

(4) Online Verify by Dual Controller

In the dual controller configuration, the controller 0 takes charge of the even number Chassis (Basic Chassis, Additional Chassis #2, 4, ..., 14), and the controller 1 takes charge of the odd number Chassis (Additional Chassis #1, 3, ..., 13). When online verify function is completed, it will be executed again from the beginning.

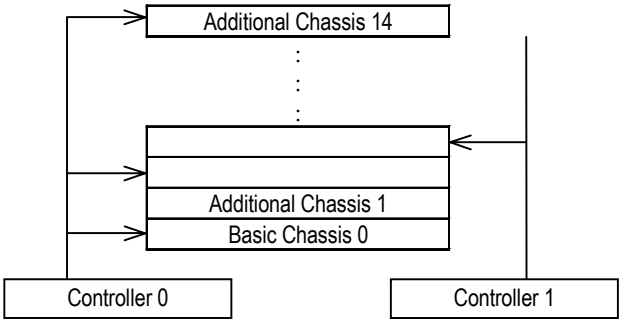


Figure 3.8.1 Online Verify by Dual Controller

3.9 Setting of LAN Interface

LAN interface and the setting on DF800 are shown below.

(1) Type of LAN interface

The subsystem installs following LAN interfaces;

Parts	Name of LAN port	Use
Controller	Maintenance port	For maintenance operation
	User management port	For customer
iSCSI Interface Board	iSCSI port	For customer

(2) Setting item of LAN interface

When you use LAN interface of subsystem, following setting should be correct between subsystem and device connected to the subsystem.

○ : Setting item of subsystem
✧ : Setting item of device connected to the subsystem
× : Not required

Setting item		IP address, subnet mask, default gateway	Negotiation	LAN port number	MTU
Maintenance port of controller	Using WEB	○	✧ (Auto negotiation)	×	✧ (1500)
	Using SNM(*1)	×	✧ (Auto negotiation)	○	✧ (1500)
User management port of controller	Using WEB	○	○	×	✧ (1500)
	Using SNM(*1)	○	○	○	✧ (1500)
iSCSI port		○	✧ (1000Mbps/ Full duplex)	○	✧ (1500)

*1 : Hitachi Storage Navigator Modular 2

(a) Setting of IP address, length of subnet mask/ subnet prefix and default gateway

Set IP address, length of subnet mask/ subnet prefix and default gateway to each LAN port.

(a-1) Setting of the subsystem shipped from the factory

Setting item			IP address	Length of subnet mask/ subnet prefix	Default gateway
Maintenance port of controller	IPv4	CTL0	10.0.0.16	255.255.255.0	0.0.0.0
		CTL1	10.0.0.17		
	IPv6	CTL0	fe80::16	64	::
		CTL1	fe80::17		
User management port of controller	IPv4	CTL0	192.168.0.16	255.255.255.0	0.0.0.0
		CTL1	192.168.0.17		
	IPv6	CTL0	Automatic	64	::
		CTL1	Automatic		
iSCSI port	Port 0A		192.168.0.200	255.255.255.0	0.0.0.0
	Port 0B		192.168.0.201		
	Port 1A		192.168.0.208		
	Port 1B		192.168.0.209		

(a-2) Notes on Setting

(a-2-1) When using it in the IPv4 environment

If you use DHCP mode for user management port, IP address, subnet mask and default gateway are assigned automatically from DHCP server. In this case, you cannot set above parameters.

If you set these parameters, be careful about the followings.

(i) For the head value of IP address, '0', '127' and '255' cannot be specified.
You cannot set 0.xxx.xxx.xxx, 127.xxx.xxx.xxx and 255.xxx.xxx.xxx.

(ii) Set correct subnet mask.
You cannot use discontinuous one-bit IP address for example 255.0.255.0.

(iii) Set a host address of IP address and default gateway address which is not 0 or 255.
For example, when subnet mask is 255.255.255.0, you cannot set like 192.168.0.0 and 192.168.0.255 for IP address and default gateway address.

(iv) Set the same network address for IP address and default gateway.
If no default gateway address for management port is specified, set "0.0.0.0".
For example, when subnet mask is 255.255.255.0 and IP address is 192.168.0.16, you cannot set 192.168.1.1 for default gateway.

(v) When you set following IP address, you cannot set same network address.
Set individual network address for each IP address.
• Maintenance port of controller / User management port of controller
For example, when subnet mask is 255.255.255.0 and IP address of maintenance port is 10.0.0.16, you cannot set 10.0.0.xxx for user port.

(vi) When the network address of the LAN device, which is connected via the Gateway in the extension of the user management port, is the same as that of the Maintenance port, the communication cannot be made normally because of the conflict between them.
Therefore, use a value other than the network address set to the maintenance port for the LAN device connected to the port for the user management via Gateway. Or change the IP address of the maintenance port to a value other than the network address of the LAN device connected via Gateway by Hitachi Storage Navigator Modular 2. (Refer to System Parameter "4.2 (4) Setting of Maintenance LAN" (SYSPR 04-0160).)

(a-2-2) When using it in the IPv6 environment

The user management port can set these setting automatically by RA (Router advertisement). In that case, the IP address, length of subnet prefix and default gateway cannot be set manually.

Be careful of the following when setting the IP address, length of subnet prefix and default gateway.

(i) Set the IP address other than the multicast address (fe00::/8), loopback address (::1) and unset (::). Do not set the link local address (fe80::/10) because it may duplicate the link local address that the subsystem automatically generates.

(ii) Set the correct length of subnet prefix. The standard length is 64.

(iii) Set the IP address and default gateway address as the same network address.
If not using the gateway address, do not enter anything.

(iv) When setting the IP address of the following port, you cannot set the same IP address. Set the IP address so that the network address does not duplicate.

- Maintenance port and user management port
  For the maintenance port, fe80::16, fe80::17, fe80::f6 or fe80::f7 is used.

(v) By extension of the user management port, when the network address of the LAN device connected through Gateway becomes the same as the network address of the maintenance port, they both compete and communication is not performed normally.
Therefore, use an address other than the network address set to the maintenance port for the LAN device connected to the user maintenance port through Gateway (refer to System Parameter "4.2 (3) Setting of LAN' (SYSPR 04-0120)"). Or, change the IP address of the maintenance port to a value other than the network address of the LAN device connected through Gateway by Hitachi Storage Navigator Modular 2 (System Parameter "4.2 (4) Setting of Maintenance LAN' <SYSPR 04-0160>").

(a-3) Method of setting

- User management port of controller
  Refer to System Parameter "4.2 (3) Setting of LAN" (SYSPR 04-0120).
- Maintenance port of controller
  Refer to System Parameter "4.2 (4) Setting of Maintenance LAN" (SYSPR 04-0160).
- iSCSI port
  Refer to Hitachi Storage Navigator Modular 2 Help "iSCSI Settings".

This page is for editorial purpose only.

(b) Setting of negotiation

Set negotiation to each LAN port.

(b-1) Setting of the subsystem shipped from the factory

Setting item	Negotiation
Maintenance port of controller	Auto negotiation (10M/100Mbps, Half/Full duplex)
User management port of controller	Auto negotiation (10M/100Mbps, Half/Full duplex)
iSCSI port	1000Mbps, Half duplex

(b-2) Firmware revision and Hitachi Storage Navigator Modular 2 for Setting

The setting availability of the negotiation is shown below.

○ : Settable, × : Unset table

Maintenance port of controller	× (Auto negotiation (10M/100Mbps, Half/Full duplex))
User management port of controller	○
iSCSI port	× (1000Mbps, Half duplex)

(b-3) Notes on Setting

Conform the negotiation of subsystem to the negotiation of the device connected to LAN port. If the negotiation of subsystem is different from the negotiation of the device connected to LAN port, the throughput or response performance of network communication may decrease and the control Unit may not communicate the destination device across a network.

(b-4) Method of setting

- User management port of controller

  Refer to System Parameter “4.2 (3) Setting of LAN” (SYSPR 04-0120).

(c) Setting of LAN port number

Set LAN port number to use when connecting.

(c-1) Setting of the subsystem shipped from the factory

Setting item	LAN port number
Maintenance port of controller	2000
User management port of controller	
iSCSI port	3260

(c-2) Firmware revision and Hitachi Storage Navigator Modular 2 for Setting

The setting availability of the LAN port number is shown below.

○ : Settable, × : Unset table

Maintenance port of controller	(Same as LAN port number of User management port of controller)
User management port of controller	○
iSCSI port	○

(c-3) Notes on Setting

(i) When you change LAN port number, confirm that the LAN port number is not used.
If you set LAN port number that one already uses, the control Unit may not communicate the destination device across a network.

(ii) If you change LAN port number, you have to change setting of LAN port number on your PC.
In case of User management port of controller, edit “Service” file on PC using Hitachi Storage Navigator Modular 2.
In case of iSCSI port, change the setting of LAN port number on iSCSI initiator.

(c-4) Method of setting

- User management port of controller
  Refer to System Parameter “4.2 (3) Setting of LAN” (SYSPR 04-0120).
- iSCSI port
  Refer to Hitachi Storage Navigator Modular 2 Help “iSCSI Settings”.

(d) Setting of MTU

Set packet size of sending (MTU : Max Transfer Unit) to each LAN port.

(d-1) Setting of the subsystem shipped from the factory

Setting item	Negotiation
Maintenance port of controller	1500
User management port of controller	
iSCSI port	1500

(d-2) Firmware revision and Hitachi Storage Navigator Modular 2 for Setting

○ : Settable, × : Unsettable

Maintenance port of controller	× (1500)
User management port of controller	× (1500)
iSCSI port	× (1500)

(d-3) Notes on Setting

Conform the MTU of subsystem to the MTU of the device connected to LAN port.
If the MTU of subsystem is different from the MTU of the device connected to LAN port, the control Unit may not communicate the destination device across a network.

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Chapter 4. Outline of P.P.

4.1 P.P.s Required for Maintenance

P.P.s included in DF800 required for maintenance are divided mainly into two categories (Fibre Channel/iSCSI) depending on the related part.

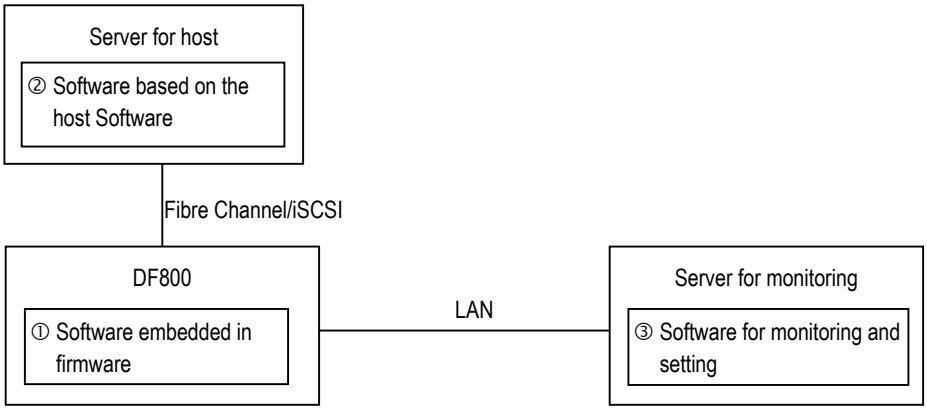

Figure 4.1.1 P.Ps Required for Maintenance and its Related Parts

① Software embedded in Firmware:
Is software embedded in Firmware in DF800. This software will be enabled by unlocking.

② Software based on the host:
Is software performed and installed on server for host connected to the DF800 with Fibre Channel/iSCSI interface.

③ Monitoring, setting software:
Is software performed and installed on the monitoring server / PC connected to the DF800 with a LAN.

The P.Ps required for maintenance are shown in Table 4.1.1.

Table.4.1.1 The P.Ps Required for Maintenance

No.	Program product	Type	Object for maintenance	Related part			The title of manual
				Basic Firmware	Host computer	Monitoring	
1	Hitachi Storage Navigator Modular 2	P-002D-J401	③	○	–	○	• Hitachi Storage Navigator Modular 2 (for GUI) User's Guide
2	ShadowImage in-system replication (include RAID Manager)	P-002D-J411/ P-002D-J411W	①,②	○	○	–	• ShadowImage in-system replication User's Guide • Command Control Interface (CCI) Installation Guide • Command Control Interface (CCI) User's Guide • Command Control Interface (CCI) Reference Guide
3	TrueCopy remote replication (include RAID Manager)	P-002D-J412/ P-002D-J412W	①,②	○	○	–	• TrueCopy remote replication User's Guide • Command Control Interface (CCI) Installation Guide • Command Control Interface (CCI) User's Guide • Command Control Interface (CCI) Reference Guide
4	TrueCopy Extended Distance (include RAID Manager)	P-002D-J415/ P-002D-J415W	①,②	○	○	–	• TrueCopy Extended Distance User's Guide • Command Control Interface (CCI) Installation Guide • Command Control Interface (CCI) User's Guide • Command Control Interface (CCI) Reference Guide
5	Copy-on-write SnapShot (include RAID Manager)	P-002D-J410/ P-002D-J410W	①,②	○	○	–	• Copy-on-write SnapShot User's Guide • Command Control Interface (CCI) Installation Guide • Command Control Interface (CCI) User's Guide • Command Control Interface (CCI) Reference Guide
6	Data Retention Utility (include RAID Manager)	P-002D-J409/ P-002D-J409W	①,②	○	○	–	• Data Retention Utility User's Guide • Command Control Interface (CCI) Installation Guide • Command Control Interface (CCI) User's Guide • Command Control Interface (CCI) Reference Guide
7	LUN Manager	P-002D-J408/ P-002D-J408W	①	○	–	–	• LUN Manager User's Guide
8	Cache Residency Manager	P-002D-J405	①	○	–	–	• Cache Residency Manager User's Guide

No.	Program product	Type	Object for maintenance	Related part			The title of manual
				Basic Firmware	Host computer	Monitoring	
9	SNMP Agent Support Function	P-002D-J403	①	○	–	–	• SNMP Agent Support Function User's Guide
10	Password Protection	P-002D-J402	①	○	–	–	• Password Protection User's Guide
11	Performance Monitor	P-002D-J406	①	○	–	–	• Performance Monitor User's Guide
12	Cache Partition Manager	P-002D-J407	①	○	–	–	• Cache Partition Manager User's Guide
13	In-System Replication Bundle	P-002D-J413/ P-002D-J413W	①	○	–	–	• ShadowImage in-system replication User's Guide • Copy-on-write SnapShot User's Guide • Command Control Interface (CCI) Installation Guide • Command Control Interface (CCI) User's Guide • Command Control Interface (CCI) Reference Guide
14	Modular Volume Migration	P-002D-J416/ P-002D-J416W	①,②	○	○	–	• Modular Volume Migration User's Guide • Command Control Interface (CCI) Installation Guide • Command Control Interface (CCI) User's Guide • Command Control Interface (CCI) Reference Guide
15	Account Authentication	P-002D-J417	①	○	–	–	• Account Authentication User's Guide
16	Audit Logging	P-002D-J418	①	○	–	–	• Audit Logging User's Guide
17	Power Saving	P-002D-J419	①	○	–	–	• Power Saving User's Guide
18	TrueCopy Modular Distributed	P-002D-J422	①	○	–	–	• TrueCopy Modular Distributed User's Guide
19	Dynamic Provisioning	P-002D-J423/ P-002D-J423W	①	○	–	–	• Dynamic Provisioning User's Guide