20. HRC & HODM SECTION

Contents

20.1 Overview

20.1.1 HRC/HODM Components

(1) HRC Components

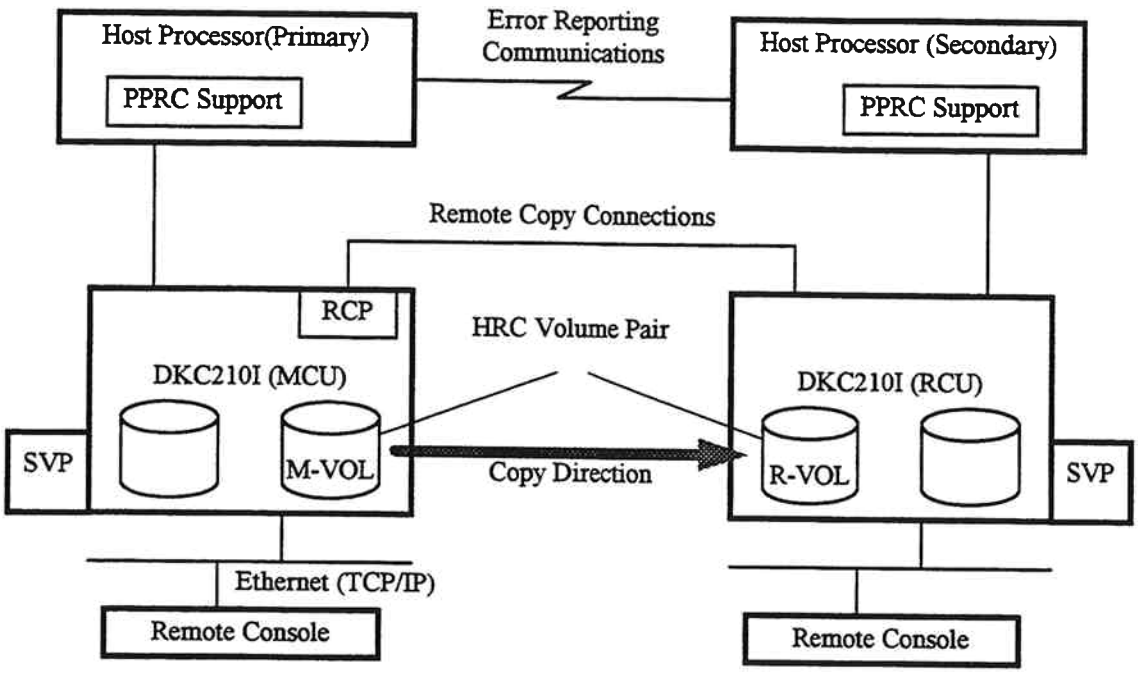


Fig. 20.1.1-1 HRC Components

(a) HRC Volume Pair

An **HRC volume pair** consists of two logical volumes, an M-VOL and an R-VOL, in different DKC210I subsystems.

An **M-VOL** (main volume) is a primary volume. It can be read or written by I/O operations from host processors.

An **R-VOL** (remote volume) is a secondary or a mirrored volume. Under control of the DKC210I subsystems, contents of an M-VOL and updates from host processors are copied to an R-VOL. Read or write I/O operations from host processors to R-VOLs are rejected.

The M-VOLs of the HRC volume pairs and the R-VOLs of other HRC volume pairs can be intermixed in one DKC210I subsystem.

(b) MCU and RCU

An **MCU** (main disk control unit) and an **RCU** (remote disk control unit) are disk control units in the DKC210I subsystems to which the M-VOLs and the R-VOLs are connected respectively.

An MCU controls I/O operations from host processors to the M-VOLs and copy activities between the M-VOLs and the R-VOLs. An MCU also provides functions to manage HRC status and configuration.

An RCU executes write operations directed by the MCU. The manner to execute write operations is almost same as that of I/O operations from host processors. An RCU also provides a part of functions to manage HRC status and configuration.

Note that an MCU/RCU is defined on each HRC volume pair basis. One disk control unit can operate as an MCU to control the M-VOLs and an RCU to control the R-VOLs.

(c) Remote Copy Connections

An MCU and an RCU must be connected with serial interface (ESCON) cables. Only multi mode ESCON cables whose length is up to 3km can be connected to the DKC210I subsystems. In order to locate the DKC210I subsystems more than 3km apart, IBM 9032/9033 ESCON directors or 9036 ESCON repeaters are required.

At least two independent remote copy connections should be established between an MCU and an RCU.

(d) RCP

An **RCP** (remote control port) is a serial interface port to which an RCU is connected. Any serial interface port of the DKC210I subsystems can be configured as an RCP.

When an MCU communicates with an RCU through ESCON interface protocol, the RCP plays the role of a host processor channel. The RCP supports ESCON dynamic connection. A serial interface port of the RCU to which the MCU is connected can be connected to host processor channels by using dynamic switching capability provided by ESCON directors.

However an RCP can not communicate with host processor channel. Channel interface paths must be connected to other serial interface ports.

(e) SVP and Remote Console

An **SVP** provides functions to set up , modify and display HRC/HODM configuration and status.

A **remote console** is a personal computer compatible with the PC/AT. It should be connected to DKC210I subsystems with an Ethernet network(TCP/IP) . A remote console provides same managing HRC/HODM functions as an SVP. Several DKC210I subsystems can be connected with one Ethernet network.

For remote console, Hitachi provides only two software components, an HRC/HODM application program and dynamic link library. Both of them require Microsoft Windows operating system. A personal computer, Ethernet materials and other software products are not provided by Hitachi.

(f) Error Reporting Communications

Error reporting communication is a communication means between host processors. An MCU generates the sense information when it fails in keeping synchronization of HRC volume pair. The sense information causes the corresponding message to be displayed on the host processor console. For the reference during disaster recovery at the secondary (recovery) site, this console message should be transferred to the secondary site through the error reporting communication.

The error reporting communications may be configured by using channel-to-channel communications, Netview technology or other interconnect technologies, depending on installation. Hitachi does not provide any product for error reporting communications.

(g) PPRC Support

HRC provides a host processor interface compatible with IBM PPRC. TSO commands, DSF commands and disaster recovery PTFs provided for PPRC can be used for HRC.

(2) HODM Components

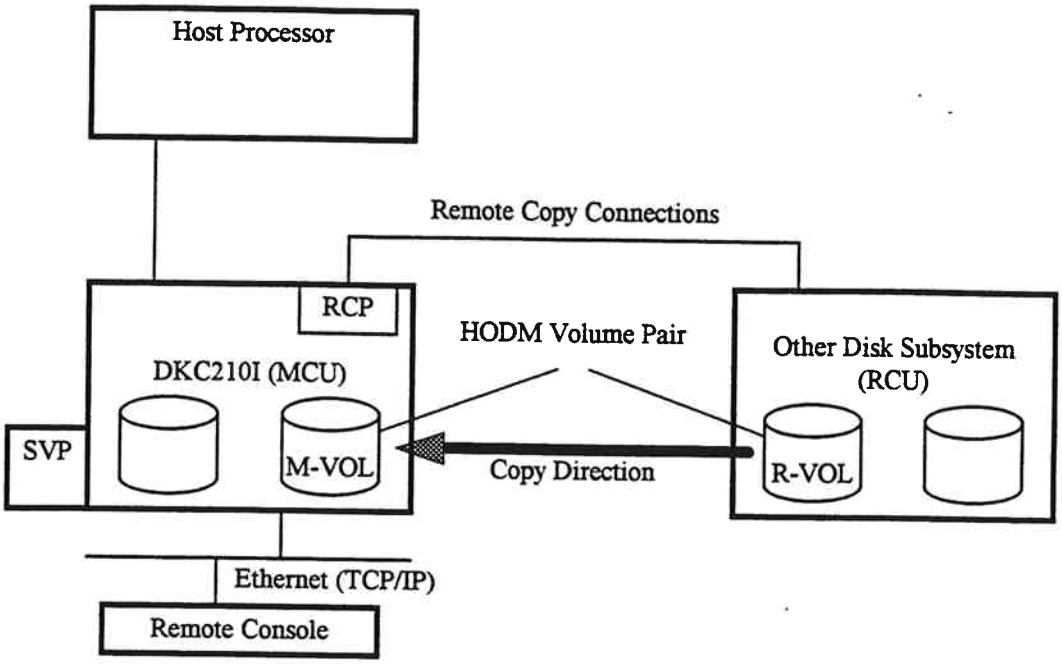


Fig. 20.1.1-2 HODM Components

(a) HODM Volume Pair

An **HODM volume pair** consists of one logical volume in a DKC210I subsystem and another disk volume in another disk subsystem, called an **M-VOL** (main volume) and an **R-VOL** (remote volume) respectively. But you can not establish HODM volume pair on condition that R-VOL is Dual Copy volume.

HODM copies the data written in the R-VOL into the M-VOL. Responding to read I/O operations from host processors to the M-VOL, HODM transfers the data read from the R-VOL if the requested data has not yet copied.

R-VOL should be protected from being updated during HODM. An operating environment must ensure this requirement because HODM does not protect it.

(b) MCU and RCU

An **MCU** (main disk control unit) is the disk control unit of a DKC210I subsystem. An **RCU** is the disk control unit of another disk subsystem in the HODM configuration.

(c) Remote Copy Connections

An MCU and an RCU must be connected with serial interface (ESCON) cables. Only multi mode ESCON cables whose length is up to 1km can be connected to the DKC210I subsystems. Although IBM 9032/9033 ESCON directors and 9036 ESCON repeaters are supported, the longer distance is not recommended because of performance reasons.

At least two independent remote copy connections should be established between an MCU and an RCU.

(d) RCP

An **RCP** (remote control port) is a serial interface port to which an RCU is connected. Any port of DKC210I subsystems can be configured as an RCP.

When an MCU communicates with an RCU through an ESCON interface protocol, an RCP plays the role of a host processor channel. An RCP supports ESCON dynamic connection. A serial interface port of an RCU to which an MCU is connected can be connected to host processor channels by using dynamic switching capability provided by ESCON directors.

However an RCP can not communicate with a host processor channel. Channel interface paths must be connected to other serial interface ports.

(e) SVP and Remote Console

An **SVP** provides functions to set up , modify and display HRC/HODM configuration and status.

A **remote console** is a personal computer compatible with a PC/AT. It should be connected to the DKC210I subsystems with an Ethernet network (TCP/IP). A remote console provides same managing HRC/HODM functions as an SVP. Several DKC210I subsystems can be connected with one Ethernet network.

For a remote console, Hitachi provides only two software components, an HRC/HODM application program and dynamic link library. Both of them require Microsoft Windows operating system. A personal computer, Ethernet materials and other software products are not provided by Hitachi.

20.1.2 HRC/HODM Theory of Operations

(1) HRC Copy Activities

HRC executes two kind of copy activities, **initial copy** and **update copy**.

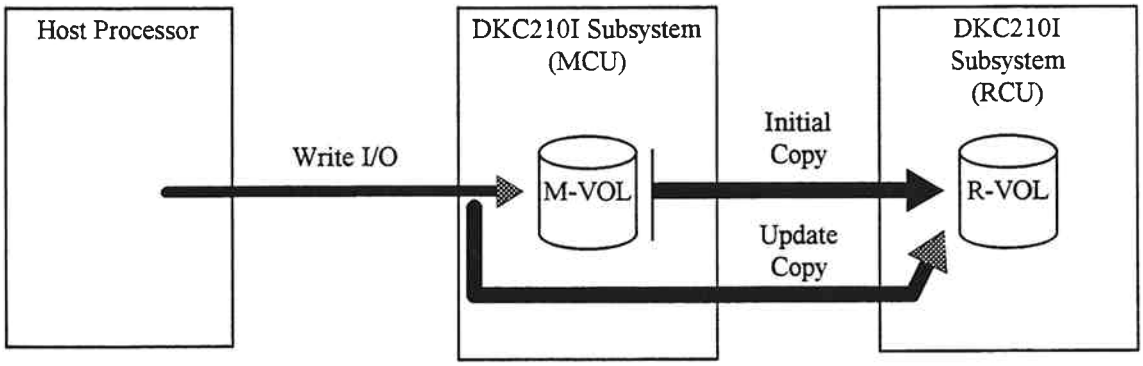


Fig.20.1.2-1 HRC Copy Activities

(a) Initial Copy

Responding to an Establish HRC Volume Pair operation from an SVP/remote console or an ESTPAIR PPRC command, HRC begins initial copy. Data field of record zero and following records on all tracks, except for alternate and CE tracks, are copied from M-VOL to R-VOL. The initial copy operation is performed in ascending order of cylinder numbers.

"No copy" can be specified as a parameter to the initial copy. When "no copy" is specified, HRC will complete an Establish HRC Volume Pair operation without copying any data. An operator or a system administrator should be responsible for ensuring that data on the M-VOL and the R-VOL is already identical.

"Only out-of-sync cylinders" can also be specified as a parameter to the initial copy. This parameter is used to recover (re-establish) HRC volume pair from suspended condition. After suspending HRC volume pair, the MCU maintains a cylinder basis bit map which indicates the cylinders updated by I/O operations from the host processors. When this parameter is specified, HRC will copy only cylinders indicated by the bit map.

(b) Controlling Initial Copy

Number of tracks copied by one initial copy activity can be specified by an SVP/remote console or an ESTPAIR PPRC command.

Number of volume pairs for which the initial copy are concurrently executed and priority of each volume pair can be specified from an SVP/remote console.

(c) Update Copy

Responding to the write I/O operations from the host processors, HRC copies the records updated by the write I/O operation to the R-VOL.

The update copy is a **synchronous remote copy**. An MCU starts the update copy after responding only channel-end status to the host processor channel, and sends device-end status after completing the update copy. The MCU will start the update copy when it receives:

- the last write command in the current domain specified by preceding locate record command;
- a write command for which track switch to the next track is required;
- each write command without being preceded by locate record command.

If many consecutive records are updated by single CCW chain which does not use locate record command, the third condition above may cause the significant impact on performance.

(d) Update Copy for Cache Fast Write Data

Cache fast write (CFW) data does not always have to be copied because CFW is used for temporary files, such as sort work data sets. These temporary files are not always necessary for disaster recovery.

In order to reduce update copy activities, HRC supports a parameter which specifies whether CFW data should be copied or not.

(e) Special Write Command for Initial Copy and Update Copy

In order to reduce overhead by the copy activities, HRC uses a special write command which is allowed only for copy activities between the DKC210I subsystems. The single write command transfers control parameters and an FBA formatted data which includes consecutive updated records in a track. It reduces interlocks on ESCON interface protocol and overhead required for converting FBA-to-CKD format and CKD-to-FBA format.

(2) HRC Read I/O Operations

Responding to read I/O operations, an MCU transfers the requested records form an M-VOL to a host processor. Even if reading records from the M-VOL is failed, the R-VOL is not automatically read for recovery. The redundancy of the M-VOL itself provided by RAID5 or RAID1 technique would recover the failure.

(3) HODM Copy Activities

HODM performs three kind of copy operations, **migration copy**, **restore copy** and **update copy**.

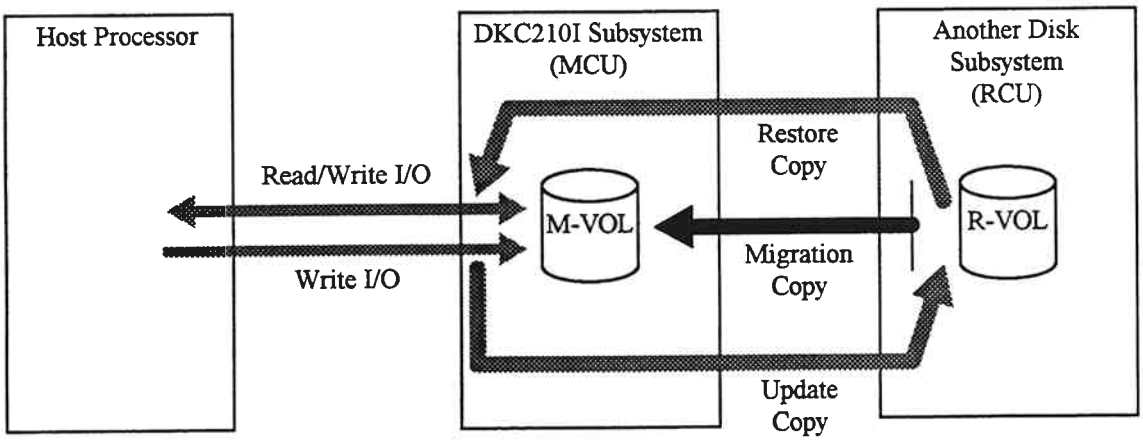


Fig. 20.1.2-2 HODM Copy Activities

(a) Migration Copy Operation

Responding to establishing HODM volume pair operation from SVP/Remote Console, HODM begins the migration copy. Data field of record zero and following records on all tracks, excluding alternate and CE tracks, are copied from R-VOL to M-VOL. The migration copy is performed in ascending order of cylinder numbers.

(b) Controlling Migration Copy

Number of volume pairs for which the migration copy operations are concurrently performed and priority of each volume pair can be specified from SVP/Remote Console.

(c) Restore Copy

When MCU receives read/write I/O operations from host processors and the requested data is not yet copied by the migration copy, HODM executes the restore copy. The restore copy copies the cylinder in which the requested records are stored. After completing the restore copy, MCU reads the requested records from the M-VOL for read I/O operation or executes the update copy for the write I/O operation.

While executing the restore copy, host processor channel is disconnected from the MCU with a command retry procedure.

(d) Update Copy

Responding to the write I/O operations while the migration copy is in progress, HODM copies the records updated by the write I/O operations to the R-VOL. The purpose of the update duplication is to keep consistency of data on the R-VOL during data migration.

(4) HRC Volume Pair Status

All volumes in a DKC210I subsystem are in one of the states shown in Table 20.1.2-1.

Status of the M-VOLs or the R-VOLs are kept by the MCU and the RCU respectively. The MCU is responsible to keep status of the R-VOLs identical to status of the M-VOLs. However, in the case of communication failure between the MCU and the RCU, they could be different.

From an SVP/remote console or by using an appropriate command for IBM PPRC, status of M-VOLs or status of R-VOLs can be obtained from the MCU or the RCU respectively.

Table 20.1.2-1 HRC Volume Status

Status	Description
Simplex	This volume does not belong to HRC volume pair. When the initial copy is started by an Add Pair operation, the volume is changed to "pending duplex" state.
Pending Duplex	The initial copy is in progress. Data on HRC volume pair is not fully identical. When completing the initial copy, the volume will be changed to "duplex" state.
Duplex	Volumes in HRC volume pair are synchronized. All updates from the host processors to the M-VOL are duplicated to the R-VOL.
Suspended	Volumes in HRC volume pair are not synchronized. When the MCU can not keep synchronization between HRC volume pair due to, for example, failure on the update copy, the MCU will put the M-VOL and the R-VOL in this state. When the MCU or the RCU accepts an Suspend operation from an SVP/remote console, the M-VOL and the R-VOL will be put in this state. When the RCU accepts the Delete Pair operation from the SVP/remote console, the MCU will detect the operation and put the M-VOL in this state.

For "suspended" volumes, cause of suspension is defined as shown in Table 20.1.2-2. The cause of suspension is displayed in the form of "Suspended (cause of suspension)" on an SVP/remote console.

Table 20.1.2-2 HRC Volume Status - Sub-status of Suspended Volume

Cause of Suspension	Description
M-VOL by Operator	The Suspend operation with "M-VOL failure" option was issued to the M-VOL. This cause of suspension is defined only for the M-VOLs.
R-VOL by Operator	The Suspend operation with "R-VOL" option was issued to the M-VOL or the R-VOL. This cause of suspension is defined for both the M-VOLs and the R-VOLs.
by MCU	The RCU received a request to suspend the R-VOL from an MCU. This cause of suspension is defined for only the R-VOLs.
by RCU	The MCU detected an error condition of the RCU which caused HRC volume pair to be suspended. This cause of suspension is defined only for the M-VOLs.
Delete Pair to RCU	The MCU detected that the R-VOL had been changed to "simplex" state by the Delete Pair operation. This cause of suspension is defined only for the M-VOLs.
R-VOL Failure	The MCU detected an error condition on the communication between the RCU or I/O error on the update copy. This cause of suspension is defined only for the M-VOLs. The cause of suspension of the R-VOLs are usually set to "by MCU" in this situation.
MCU IMPL	The MCU could not find valid control information in its non-volatile memory during its IMPL procedure. This situation may occur after the power supply failure.
Initial Copy Failed	The volume pair was suspended before completing the initial copy. Even if no write I/O has been issued after being suspended, the data in the R-VOL is not completely identical to the M-VOL.

(5) HODM Volume Pair Status

The M-VOLs of HODM volume pair are in one of the states shown in Table 20.1.2-3. From an SVP/remote console connected to the MCU, status of the M-VOLs can be obtained.

Table 20.1.2-3 HODM Volume Status

Status	Sub-status	Description
Simplex	(with no substatus)	This volume does not belong to HODM volume pair. When the initial copy is started by an Add Pair operation, the volume is set to "pending duplex" state.
	Migration Complete	All data on the R-VOL has been successfully copied to the M-VOL. When the Delete Pair operation is directed, the volume will return to pure "simplex " state. When the R-VOL Erase operation is directed, the volume will be put into "erasing in progress" state.
	Erasing in Progress	All data on the R-VOL has been successfully copied to M-VOL, and data on the R-VOL are being erased. When all tracks are successfully erased, the volume will return to pure "simplex" state. When an MCU is powered off, the volume will be put into "migration complete" state after the MCU is re-IMPLed. To complete erasing, the R-VOL Erase operation must be operated again.
	Erasing Error	Erasing process failed.
Pending Duplex	Migration in Progress	Data on the R-VOL is being copied to the M-VOL. During in this state, updates to the M-VOL from the host processors are duplicated to the R-VOL.
Suspended	Migration Error, M-VOL	The migration copy failed due to an error condition at the MCU or the M-VOL. Although the migration copy has been terminated, the MCU tries to execute the update copy and the restore copy to respond to the I/O operations from the host processors. In order to restart the migration copy, the Delete Pair operation followed by another Add Pair operation is required after removing the error condition from the MCU/M-VOL.
	Migration Error, R-VOL	The migration copy failed due to an error condition at the RCU or the R-VOL. Although the migration copy has been terminated, the MCU tries to execute the update copy and the restore copy to respond to the I/O operations from the host processors. In order to restart the migration copy, the Delete Pair operation followed by another Add Pair operation is required after removing the error condition from the RCU/R-VOL.
	R-VOL by Operator	The Suspend operation with "R-VOL" option was issued to the M-VOL.
	MCU IMPL	The MCU could not find valid control information in its non-volatile memory during its IMPL procedure. This situation may occur after the power supply failure.

20.1.3 HRC/HODM Control Operations

This section describes HRC/HODM control operations from an SVP or a remote console.

(1) Add RCU Operation

An Add RCU operation makes an MCU register the specified disk control unit as an RCU and establish the logical paths to the RCU. This operation also provides a function to modify the HRC/HODM options which will be applied to all HRC/HODM volume pairs in this subsystem. Refer to "20.4.3 Add RCU... Screen" for GUI image of this operation.

To register the RCU, the following parameters are required:

RCU S#	Serial number of the RCU.
SSID	SSID (subsystem identifier) of the RCU. Although the DKC210I subsystem can have up to four consecutive SSIDs, only the lowest SSID needs to be specified.
Num. of Path	Number of logical paths which should be established to the RCU on the remote copy connections.

Path parameters to specify one logical path are shown below. Up to four sets of the path parameters, as many as the "Num. of Paths" parameter specifies, must be specified. The description of path parameters is similar to the channel path definitions in IOCDS (I/O configuration dataset). In the IOCDS, a logical path is described with a sub-channel number, a link destination address and a logical address of the control unit image. A "Port" parameter, instead of the sub-channel number, is used to specify the serial interface port in the DKC210I subsystem.

Port	The serial interface port of the DKC210I subsystem where the logical path begins from. Before this operation, the serial interface port must be set to the RCP mode.
Link Adr	The link destination address. Similar to the logical path definitions in the IOCDS, this is the destination port address on the ESCD which is set to provide the dynamic connection capability. If the remote copy connection does not include the dynamic connection, x'00' must be specified.
Logical Adr	The logical control unit address of the control unit image. If the RCU is configured as an SPSD (single path storage director), either x'00' or x'01" must be specified. Otherwise, x'00' must be specified.

Fig. 20.1.3-1 shows an example for the RCU and the path parameters.

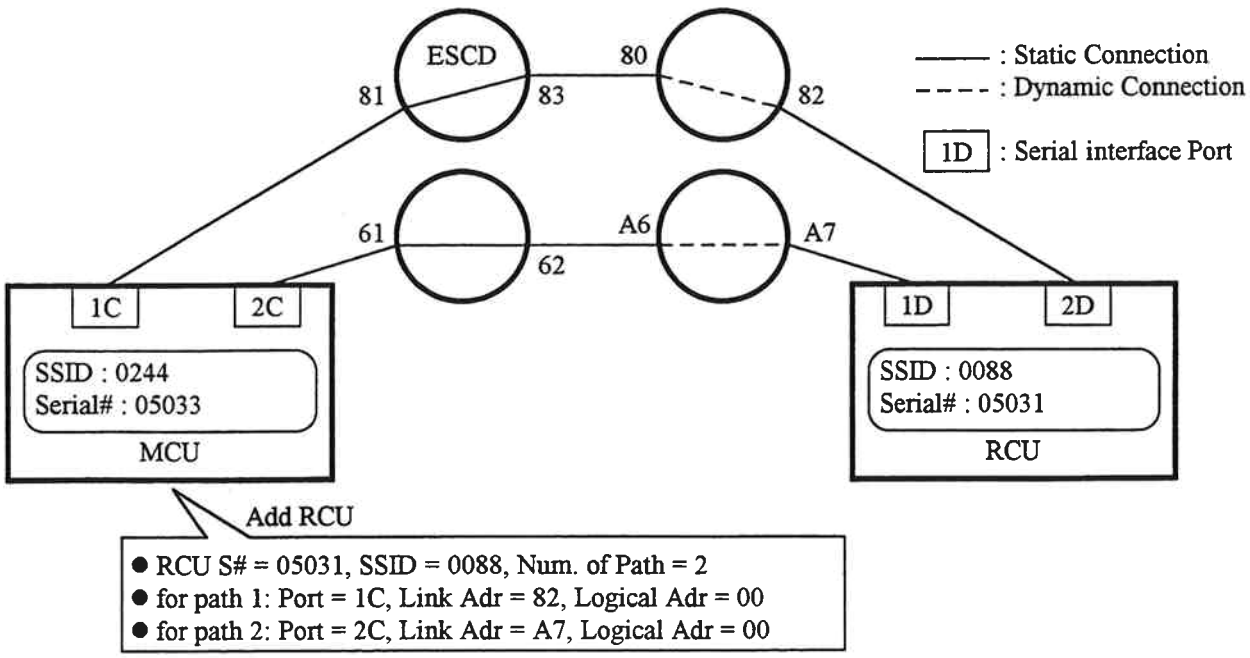


Fig. 20.1.3-1 Add RCU Operation Parameters Example

The following parameters modify the HRC/HODM options which will be applied to all HRC/HODM volume pairs in this subsystem. Refer to "20.4.5 RCU Option... Screen" for GUI image to set these parameters.

Minimum Paths	When the MCU blocks the logical path due to communication failure, if the number of remaining paths becomes less than the number specified by this parameter, the MCU will suspend all of the HRC/HODM volume pairs. The default value is set to "1". If the installation requirements prefers the subsystem I/O performance to the continuation of HRC/HODM, value between "2" and the number of the established logical paths can be specified.
Maximum Initial Copy Activities	It specifies how many HRC initial copy and HODM migration copy can be simultaneously executed by the MCU. If more HRC/HODM volume pairs are specified by an Add Pair operation, the MCU will execute the initial copy or the migration copy for as many volumes as specified by this parameter. The initial copy or the migration copy for other volumes is delayed until one of the initial copy or the migration copy is completed. This parameter can control the performance impact caused by the initial copy activity or the migration copy activity. Note: Default value of this parameter is "4" and currently it can not be changed.
Incident of RCU	This parameter specifies whether the link incident record generated by the RCU is to be sent or not to the host processor connected to the MCU.
PPRC supported by HOST	If "Yes" is specified, the MCU will generate the sense information which is compatible with IBM PPRC when the HRC volume pair is suspended, but DEV_SIM of HRC/HODM will not be reported to the HOST except "DF40" and "DF48" DEV_SIM. If "No" is specified, the MCU will generate only service information messages. Even if the SSB (F/M=FB) is specified by the Suspend Pair Operation, the x'FB' sense information will not be reported to the HOST.
Service SIM of HRC&HODM	If "Report" is specified, the HRC/HODM Service SIM will be reported to the HOST. If "Yes" is specified in PPRC supported by HOST option, DEV_SIM of HRC will not be reported to the HOST except "DF40" and "DF48" DEV_SIM. If "Not Report" is specified, the HRC/HODM Service SIM reporting will be suppressed. Refer to "SIM Reference Codes Detected by the Processor for HRC/HODM" in SIM-RC SECTION.

Note that these parameters will be applied to ALL RCUs registered to the MCU. If different parameters are specified, the last parameter will be applied.

(2) Edit Path Operation

An Edit Path operation makes the MCU add/delete the logical path to/from the registered RCU.

To add a logical path, the same path parameters as an Add RCU operation are required. The added logical path will be automatically used to execute the copy activities.

When deleting a logical path, pay attention to the number of remaining logical paths. If it becomes less than the number specified by "Minimum Paths", HRC/HODM volume pair could be suspended.

(3) RCU Option Operation

An RCU Option operation modifies the HRC/HODM options described in "20.1.3(1) Add RCU operation".

(4) Delete RCU Operation

A Delete RCU operation makes the MCU delete the specified RCU from RCU registration. All logical paths to the specified RCU will be removed.

If some volumes connected to the specified RCU are active R-VOLs, this operation will be rejected. All R-VOLs must be deleted by a Delete Pair operation before a Delete RCU operation.

(5) RCU Status Operation

An RCU Status operation makes the MCU display the status of RCU registration. It also provides the current status, time of registration and time of changing status for each logical path.

The current status of each logical path is defined as follows:

Normal	This logical path has been successfully established and can be used for the HRC/HODM copy activities.
Initialization Failed	The link initialization procedure between the RCU is failed. It occurred due to Missing physical path connection between MCU and RCU, or connecting MCU with HOST as RCU.
Resource Shortage(RCU)	Establish Logical Path link control function has been rejected by the RCU. All logical path resources in the RCU might be used for other connections.
Serial Number Mismatch	The serial number of the control unit which is connected to this logical path does not match to the serial number specified by "RCU S#" parameter.
Invalid Port	The serial interface port specified by "Port" parameter is not in the RCP mode.

(6) Add Pair Operation

An Add Pair operation makes the MCU establish a new HRC/HODM volume pair. It also provides function to modify the HRC/HODM options which will be applied to the selected HRC/HODM volume pair. Up to 256 HRC/HODM volume pairs can be established in one DKC210I subsystem.

To establish HRC/HODM volume pair, following parameters are required:

RCU	The disk control unit which controls the R-VOL of this HRC/HODM volume pair. It must be selected from RCUs which have already been registered by Add RCU operations.
R-VOL	Device number of the R-VOL.
Priority	Priority (scheduling order) of the initial copy or the migration copy for this volume pair. When the initial copy or the migration copy for one volume pair has been terminated, the MCU selects and start the initial copy or the migration copy for another volume pair which has the lowest value of this parameter. For the Add Pair operations, the value "1" through "256" can be specified. For establishing HRC volume pair by TSO command or DSF command for PPRC, "0" is implicitly applied to. "0" is the highest priority, "256" is the lowest, and default value for the Add Pair operation is "32". For the volume pairs to which the priority have been specified, the MCU Prioritizes the volume pairs in the arrival order of the Add Pair operations or TSO/DSF commands. If the MCU are performing the initial copy or the migration copy for the number of volume pairs, as much as the value of "maximum initial copy activities", and accepts further Add Pair operation, the MCU does not start other initial copy or the migration copy until one of the copy being performed will be completed.

Operation Mode	It specifies what kind of remote copy capability should be applied to this volume pair. "Remote Dual Copy" and "Migration Copy" means HRC and HODM respectively. "Erase after Migration" will make the MCU start erasing the R-VOL of this HODM volume pair. Note: "Erase after Migration" is not supported at the first version of HRC/HODM.
Initial Copy	It specifies what kind of initial copy activity should be executed for this HRC volume pair. The kind of the initial copy can be selected out of: - "Entire Volume" specifies that all cylinders excluding the alternate cylinder and the CE cylinders should be copied. - "Only Out-of-Sync Cylinders" specifies that only cylinders which have been updated during this HRC volume pair is in "suspended" state - "None" specifies that the initial copy does not need to be executed. The synchronization between volume pair must have been ensured by the operator.

HRC/HODM option parameters which will be applied to this HRC/HODM volume pair are as follows:

Initial Copy Pace	It specifies how many tracks should be copied at once by the initial copy. "15 Tracks" or "3 Tracks" can be specified. When "15 Tracks" is selected, elapsed time to complete the initial copy becomes shorter, however, the subsystem I/O performance during the initial copy could become worse. This parameter is valid only for HRC volume pair. Note: The default value of this parameter is "15".
DFW to R-VOL	It specifies whether the DFW capability of the R-VOL is required or not. If "DFW required" is specified, the HRC volume pair will be suspended when the RCU can not execute the DFW due to, for example, cache failure. If the installation requirements prefers the continuation of HRC to the subsystem I/O performance, "DFW not required" is recommended. This parameter is valid only for HRC volume pair.
CFW Data	It specifies whether the records updated by CFW should be copied to the R-VOL or not. "Only M-VOL", which means that CFW updates are not copied, is recommended because CFW data is not always necessary for disaster recovery.
When M-VOL Fails	It specifies whether the migration copy should be continued or stopped when the MCU detected unusual conditions, such as the correction copy or the dynamic sparing, of the M-VOL. This parameter is valid only for HODM volume pair. Note: This option is not effective. The migration copy will be continued regardless of correction access, correction copy and dynamic sparing.
M-VOL Fence Level	It specifies by what conditions the M-VOL will be fenced (the MCU will reject the write I/O operations to the M-VOL). - "R-VOL Data": The M-VOL will be fenced when the MCU can not successfully execute the update copy. - "R-VOL Status": The M-VOL will be fenced when the MCU can not put the R-VOL into "suspended" state. If status of the R-VOL is successfully changed to "suspended", the subsequent write I/O operations to the M-VOL will be permitted. - "Never": The M-VOL will never be fenced. The subsequent write I/O operations after the HRC volume pair has been suspended will be permitted. This parameter is valid only for HRC volume pairs.

Note : The Add Pair operation to establish the HODM volume pair will be rejected if the specified M-VOL is in "simplex" state and belongs to any path group. Before the Add Pair operation, the M-VOL must be varied offline from all attached host processors.
Add Pair operation will be failed if the specified volume is in "correction access" or "correction copy" state. The error message is described in section 20.5.

The HRC volume pair and the HODM volume pair can not concurrently exist under the same controller (MCU-RCU). Without DEL RCU operation, the HODM (HRC) volume pair can not establish in the controller that had the HRC (HODM) volume pair before.

(7) Delete Pair Operation

A Delete Pair operation makes the specified HRC/HODM volume pair being terminated. It can be operated on either the MCU or the RCU.

- When operated on the MCU, both the M-VOL and the R-VOL will be put into the "simplex" state.
- When operated on the RCU, only the R-VOL will be put into the "simplex" state. The M-VOL will be suspended when the MCU detects this operation. To complete deleting this volume pair, the MCU requires another Delete Pair operation.

When the MCU accepts this operation and it can not communicate with the RCU, this operation will be rejected. "Delete Pair unconditionally" option can make the MCU complete this operation, even if it can not communicate with the RCU.

The Delete Pair operation to the HODM volume pair without "unconditional" option is rejected if the M-VOL is not in "simplex (migration complete)" status and the M-VOL belongs to any path group. The Delete Pair operation to the HODM volume pair with "unconditional" option will be accepted regardless of status and path group of the M-VOL.

(8) Suspend Pair Operation

A Suspend Pair operation makes the MCU or the RCU suspend the specified HRC/HODM volume pair.
This operation also cancel erasing operation of an HODM volume pair. The specified volume will be put into "migration complete" state. To complete erasing, the R-VOL Erase operation must be operated again.

The option parameter of this operation are as follows:

SSB (F/M=FB)	The MCU and the RCU will generate sense information to notify the suspension of this volume pair to the attached host processors. This option is valid only for HRC volume pairs.
M-VOL Failure	The subsequent write I/O operations to the M-VOL will be rejected regardless of the fence level parameter. This option can be selected only when operating on the MCU. This option is valid for only HRC volume pairs.
R-VOL	For HRC volume pairs, the subsequent write I/O operations to the M-VOL will be permitted or rejected, depending on the fence level parameter. This option can be accepted by the MCU and the RCU. For HODM volume pairs, only the migration copy is suspended. It does not affect on I/O operations from host processors.

(9) Pair Option Operation

A Pair Option operation modifies the HRC/HODM option parameters which has been applied to the selected HRC/HODM volume pair. Refer to "20.1.3(6) Add Pair Operation" for the option parameters.

(10) Pair Status Operation

A Pair Status operation makes the MCU or the RCU display the result of the Add Pair operation or the Pair Status operation to the specified HRC/HODM volume pair, along with the following information:

Initial Copy Complete	When this HRC/HODM volume pair is in "pending duplex" state, it indicates how many cylinders have been successfully copied by the initial copy or the migration copy. When this HRC/HODM volume pair is in "suspended" state, it indicates how many cylinders are currently identical between this HRC/HODM volume pair. This information is provided only by the MCU.
Erase Complete	It indicates how many cylinders of the R-VOL have been successfully erased. This information is provided only by the MCU.

Pair Status	It indicates the status of the M-VOL or the R-VOL. Definition of the volume states is described in "20.1.2(3) HRC Volume Pair Status" and "20.1.2(4) HODM Volume Pair Status".
Last Update	It indicate the time stamp when the volume pair status has been updated. Note that the time stamp value is obtained from an internal clock in the DKC210I subsystem.
Pair Established	It indicates the time stamp when the volume pair has been established by an Add Pair operation. Note that the time stamp value is obtained from an internal clock in the DKC210I subsystem.

(11) Resume Pair Operation

A Resume Pair operation restart the suspended HRC/HODM volume pair. It also provides function to modify the HRC/HODM options which will be applied to the selected HRC/HODM volume pair.

As the initial copy parameters to the HRC volume pairs, only the "Only Out-of-Sync Cylinders" parameter can be specified.

"Out-of-Sync Cylinders" are recorded in the form of cylinder-bit-map allocated in SM (shared memory) of the DKC210I. If the MCU is powered off and the cylinder-bit-map is not retained due to the battery being discharged, the MCU resumes the initial copy as follows:

(a) For the HRC volume pair in "pending duplex" state, the initial copy is automatically resumed. The all cylinders of this volume will be copied.
(b) For the HRC volume pair in "suspended" state, the all cylinders of this volume will be copied responding to the Resume Pair operation.

(12) R-VOL Erase Operation

An R-VOL Erase operation makes the MCU start erasing the R-VOL. The migration copy from the R-VOL must have been successfully completed for this operation.

This operation can also restart an erasing operation of the R-VOL which is in "erasing error" or "migration complete" state. When restarting the R-VOL erasing, the MCU will erase the R-VOL from the cylinder 0.

(13) Port Operation

All serial interface ports in the DKC210I subsystem are initially set to the LCP mode, to which the host processor channels can be connected. At least two serial interface ports, one port from each storage cluster, must be set to the RCP mode for remote copy connections.

A Port operation makes the DKC210I subsystem change the operating mode of the specified serial interface port(s).

Before changing the operating mode from the LCP mode to the RCP mode, all channel paths to the specified port must be removed using host processor console or ESCD commands.

Before changing the operating mode from the RCP mode to the LCP mode, all RCUs which are connected through the specified port must be deleted by an Delete RCU operation.

Note: The Define Configuration & Installation operation also provide the function to set the operating mode of each serial interface mode.

20.1.4 Managing HRC Environment

(1) Setting Up HRC Volume Pairs

(a) Sequence of Operations

Sequence of operations to establish the HRC volume pairs are shown below.

Table 20.1.4-1 Operations to Set Up HRC Volume Pairs

Step		Operation	
		SVP*	Others
1	Set appropriate serial interface ports to the RCP mode.	Port	
2	Establish logical paths between the DKC210I HRC subsystems	Add RCU	Before this step, remote copy connections must be established. between DKC210I subsystems.
3	Ensure that the R-VOLs are offline from host processors		VARY OFFLINE system command, if necessary.
4	Establish HRC volume pairs.	Add Pair	

* : Operations form the SVP/remote console attached to the MCU.

Several volume pairs can be specified within one Add Pair Operation. After completing an Add Pair operation, another Add Pair operation can be executed to establish another HRC volume pairs.

Be sure to vary the R-VOLs offline from the attached host processors before executing the Add Pair operation. The RCU will reject the write I/O operations to the R-VOLs once the Add RCU operation has been accepted.

(b) Considering HRC Parameters

Setting of the "fence level" parameter to the Add Pair operation and the "PPRC supported by host" and "Service SIM of HRC/HODM" option to the Add RCU operation depends on your disaster recovery planning. Refer to "20.1.5(1) Preparing for Disaster Recovery" for these parameters.

Setting of the "CFW data" and "DFW to R-VOL" parameters to the Add Pair operation and the "minimum paths" parameter to the Add RCU operation depends on your performance requirement to the DKC210I subsystem at the primary site. Refer to "20.1.3(6) Add Pair operation" and "20.1.3(1) Add RCU operation" for these parameters.

Setting of the "maximum initial copy activities" parameter to the Add RCU operation and the "priority" and the "initial copy pace" parameters can control performance effect from the initial copy activities. Refer to "20.1.4(1)(c) Controlling Initial Copy Activities" for more detailed description.

Refer to "20.1.3(1) Add RCU operation and "20.1.3(6) Add Pair operation" for other parameters.

(c) Controlling Initial Copy Activities

To control performance effect from the initial copy activities, the "maximum initial copy activities" parameter and the "priority" and the "copy pace" parameters can be specified:

- The "maximum initial copy activities" parameter controls the number of volumes for which the initial copy are concurrently executed;
- The "priority" parameter specifies the executing order of the migration copy on volume pair basis;
- The "copy pace" parameter specifies how many tracks should be copied by each initial copy activity.

Refer to the following example for the "maximum initial copy activities" and the "priority" parameters.

Example
Conditions:
- The Add Pair operation specifies that devices 00~05 should be M-VOLs.
- "Maximum initial copy activities" is set to "4" (this is the default value, and can not be changed).
- "Priority" parameters for devices 00~05 are set to "3", "5", "5", "1", "4", and "2" respectively.

Under the above conditions, the MCU will performs the initial copy:
- for devices 00, 03, 04 and 05 immediately.
- for device 01 when one of the initial copy has been terminated.
- for device 02 when the initial copy for the second device has been terminated.

(2) Suspending and Resuming the HRC Volume Pairs

This section describes the operations to suspend or resume the HRC volume pair, which are necessary for the following sections in this chapter.

The Suspend Pair operation with the "R-VOL" option parameters can suspend the specified HRC volume pairs while the M-VOLs are still accessed from the attached host processors. The "SSB" option should not be selected to prevent the sense information from being generated.

To resume the suspended HRC volumes pairs, the Resume Pair operation must be executed.

Refer to "20.1.3(8) Suspend Pair Operation" and "20.1.3(6) Add Pair Operation" for more detailed description.

(3) Managing Power On/Off of HRC Components

(a) Cutting Power to HRC component

Cutting power to the RCU or the ESCDs on the remote copy connections, or other equivalent events which make the MCU unable to communicate with the RCU should be controlled in order not to affect the remote copy activities. If the MCU detects these events when it intends to communicate with the RCU, it would suspend all HRC volume pairs.

To avoid this problem, the applications on the primary host processors must be terminated or all HRC volume pairs must be suspended or terminated, before performing these events.

Refer to "20.1.4(2) Suspending and Resuming the HRC Volume Pairs" for the operations to suspend and resume the HRC volume pairs.

(b) Power Control Interface at the Secondary Site

In the secondary site, It is not recommended to use the power control interface which remotely cuts the power to the RCU or the ESCD on the remote copy connections in order to avoid the situation described in "20.1.4(3)(a) Cutting Power to HRC components".

(c) Power-on-sequence

The RCU and the ESCDs on the remote copy connections must become operable before the MCU accepts to first write I/O operation to the M-VOLs.

After the power-on-reset sequence of the MCU, It communicates with the RCU in order to confirm the status of the R-VOLs. If it is not possible, the MCU retries the confirmation until it is successfully completed or the MCU accepts the first write I/O operations to the M-VOLs.

If the MCU accepts the first write I/O operation before completing the confirmation, the MCU will suspend the HRC volume pair. This situation is critical because the status of the R-VOL can not be changed, that is, remains "duplex" state.

(4)Executing ICKDSF to HRC Volume Pairs

The updates by the channel programs which specify "diagnostic authorization" or "device support authorization" are not reflected to the R-VOL. ICKDSF commands which issue the write I/O operations to the M-VOL must be controlled. The HRC volume pairs must be suspended or terminated before performing ICKDSF commands.

Refer to "20.1.4(2) Suspending and Resuming the HRC Volume Pairs" for the operations to suspend and resume the HRC volume pairs.

20.1.5 HRC Error Recovery

(1) Preparing for Disaster Recovery

(a) Considering Fence Level Parameter

Table 20.1.5(1) shows how the fence level parameter of the Add Pair operation has an effect on the write I/O operations to the M-VOL after the HRC volume pair has been suspended. You should select one of the fence level considering the "degree of the currency" of the R-VOL required by your disaster recovery planning. The SVP or remote console, which is connected to either the MCU or the RCU, can display the fence level parameter which has been set to the HRC volume pairs.

Table 20.1.5-1 Effect of the Fence Level Parameter

Failure		Subsequent write I/O operations to the M-VOL will be ...		
		"Data"	"Status"	"Never"
1)	The update copy has failed,	rejected*	-	-
2)	(1) & however the status of the R-VOL could have been successfully changed to "suspended" state.	rejected*	accepted	accepted
3)	(1) & furthermore the status of the R-VOL could not have been changed to "suspended" state.	rejected*	rejected*	accepted

*) Sense bytes includes "command reject" and x'0F' of format/message.

Note: "Data" and "Status" has an effect when an HRC volume pair of "duplex" state is suspended. For HRC volume pairs which are in "pending duplex" state, subsequent write I/O operations will not be rejected regardless of Fence Level parameter.

1) Fence Level = "Data"

The data of the R-VOL is always identical to the M-VOL if once the HRC volume pair has been successfully synchronized. You can reduce the time to analyze whether the R-VOL is current or not in your disaster recovery procedures.

However, this parameter will make the M-VOL not accessible from your applications whenever the HRC copy activity has failed. Therefore you should specify this parameter to the most critical volumes for your disaster recovery planning.

Most of the database system supports duplexing the critical files, for example log files of DB2, for its file recovering capability. It is recommended to locate the duplexed files on the volumes in the physically separated DKC210I subsystems, and establish HRC volume pairs for each volumes by using physically separated remote copy connections.

Note 1: If the failure has occurred before completing the initial copy, the R-VOL can not be used for disaster recovery because the data of the R-VOL is not fully consistent yet. You can became aware of this situation with referring status of the R-VOL in your disaster recovery procedures. Refer to "20.1.5-2-2 Analyzing the Currency of R-VOLs" for more detailed description.

Note 2: Only the difference between the HRC volume pair must be the last update from the host processor. HRC is a synchronous remote copy. The MCU reports a "unit check" if it detects the failure on the write I/O operation including the update copy to the R-VOL. Therefore, the operating system and the application program does not regard the last (failed) I/O operation as successfully completed.

This parameter is functionally equivalent to "CRIT=YES" parameter for IBM PPRC

2) Fence Level = Never

The subsequent write I/O operations to the M-VOL will be accepted even if the HRC volume pair has been suspended. Therefore the contents of the R-VOL can become "older" (behind the currency of corresponding M-VOL) if the application program continue updating the M-VOL. Furthermore, the status of the R-VOL which will be obtained from the RCU can not be in a "suspended" state.

To use this parameter, your disaster recovery planning must satisfy the following requirements:

- The currency of the R-VOL should be decided by referring the error message which might have been transferred through the error reporting communications or analyzing the R-VOL itself with other files which are confirmed to be current.
- The data of the R-VOL should be recovered by using other files which are ensured to be current.

This parameter is functionally equivalent to "CRIT=NO" parameter for IBM PPRC

3) Fence Level = Status

The level of this parameter is between "Data" and "Never". Only when the status of the R-VOL can be ensured, the subsequent write I/O operations to the M-VOL will be permitted. Therefore the disaster recovery procedure of deciding the currency of the R-VOL can be reduced.

(b) Transferring the Sense Information through Error Reporting Communications

When the HRC volume pair is suspended, the MCU generates the sense information which notifies the host processor of the failure. This will help in deciding the currency of the R-VOLs in the disaster recovery procedures by transferring the sense information, or the system console message caused by the sense information, with the system time stamp information.

The sense information can be selected out of:

- x'FB' of format/message. The sense information is compatible with IBM PPRC and result on a corresponding system console message, for example IEA491E of MVS, if the operating system supports it.
- service information message whose reference code means that the HRC volume pair has been suspended.

Note: The first version of HRC is not completely certified under the operating system which does not support IBM PPRC. Therefore the x'FB' sense information must be selected.

The error reporting communications are essential if you use the fence level of "Status" or "Never".

(c) File Recovery Procedures Depending on Installations

HRC is a synchronous remote copy. All updates to the M-VOLs are copied to their R-VOLs before completing each channel program of the write I/O operations. When the HRC volume pairs have been suspended or the MCU has become inoperable due to a disaster, therefore, many data "in progress" could remain in the R-VOLs. That is, some data set might be still opened, or some transactions might not be committed yet. All breakdown cases should be previously considered.

Therefore, even if you have selected the fence level of "Data" for all HRC volume pairs, you should establish the file or volume recovery procedures. The situation which should be assumed is similar to that where the volumes have became not accessible due to the disk controller failure in non-remote copied environment.

If you use the fence level of "Status" or "Never", the suspended R-VOLs could become "ancient" compared to other volumes. This situation might cause a data inconsistency problem among several volumes.
You should prepare, in your disaster recovery, for recovering some files or some volumes which have become "ancient" by using:

- files for file recovery, for example DB2 log files, which have been confirmed to be current. To ensure the currency of these files, it is recommended to use the fence level of "Data" for these critical volumes.
- the sense information with the system time stamp which have been transferred through the error reporting communications.
- full consistent file or volume backups, if the sense information and the system time stamp can not be used.

(d) CSUSPEND/QUIESCE for IBM PPRC

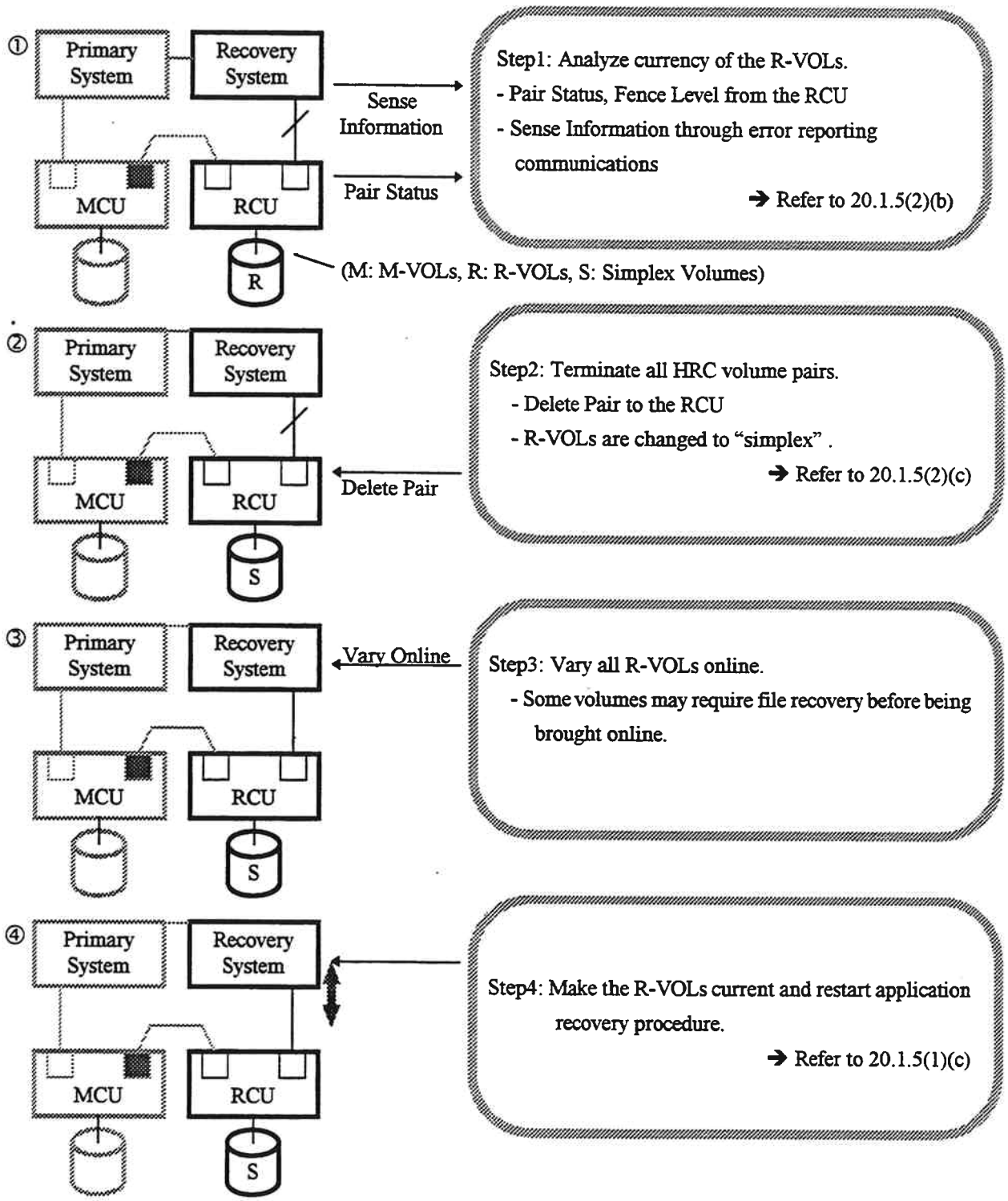
PPRC recommends to customers to establish their disaster recovery planning where the CSUSPEND/QUIESCE TSO command is programmed to be issued responding to the IEA491E system console messages. This procedure intentionally suspend the remaining volume pairs when some volume pairs have been suspended due to a disaster.

The CSUSPEND/QUIESCE TSO command will be supported as the enhancement to HRC.

(2) Disaster Recovery Procedures - Switching to the Recovery System

(a) Summary

⓪ Primary system and MCU becomes inoperable due to disaster.



(b) Analyzing the Currency of R-VOLs (Step 1)

1) Analyzing Status of the R-VOLs and Fence Level Parameter

Table 20.1.5-2 Currency of the R-VOLs

	Fence Level for this HRC volume pair		
Status of R-VOL	Data	Status	Never
Simplex	To be confirmed	To be confirmed	To be confirmed
Pending Duplex	Inconsistent	Inconsistent	Inconsistent
Duplex	Current	Current	To be analyzed
Suspended (Initial Copy Failed)	Inconsistent	Inconsistent	Inconsistent
Suspended (by other reason)	Current	Suspected	Suspected

Table 20.1.5(2) shows how to analyze the currency of the R-VOLs referring the status of the R-VOLs and the fence level parameter which have been specified when establishing the HRC volume pairs.
The status of the R-VOLs must be obtained from the RCU in your disaster recovery procedures.
The fence level parameter must be previously field since it cannot be obtained From RCU.

Meaning of the results or further actions shown in each column of table 20.1.5(2) are as follows:

To be confirmed This volume does not belong to any HRC volume pair. If you have certainly established the HRC volume pair for this volume and you have never deleted it, you should regard this volume as inconsistent.

Inconsistent The data on this volume is inconsistent because not all cylinders have successfully been copied to this volume yet. You can not use this volume for the applications unless this volume is initialized (or successfully copied from the M-VOL at later time).

Current The data on this volume is completely synchronized with the corresponding M-VOL.

To be analyzed The currency on this volume can not determined. To determine the currency, further analysis described in (2) of this section should be performed.

Suspected The data on this volume must be "older", behind the currency of corresponding M-VOL. You should restore the consistency of this volume at least, and the currency of this volume if required. The system time information which might have been transferred through the error reporting communications or time of suspension obtained from the Pair Status operation will help you decide the last time when this volume was current.

2) Further Analysis by Referring to Other Information

The M-VOLs, to which the fence level parameter has been set to "Never", will accepts the subsequent write I/O operations regardless of the result of communication to change the R-VOL into the "suspended" state. Therefore, the status of the R-VOL should be analyzed by referring to the following information:

- The sense information through the error reporting communications. If the sense information which denote the suspension of this volume is found, you can return to table 20.1.5-2 with assumption of the "suspended" state.
- The status of the M-VOL obtained from the MCU, if possible. You should return to table 20.1.5-2 with assumption of the same status as the M-VOL and fence level of "Status".
- The other related files, for example DB2 log files, which have been confirmed to be current.

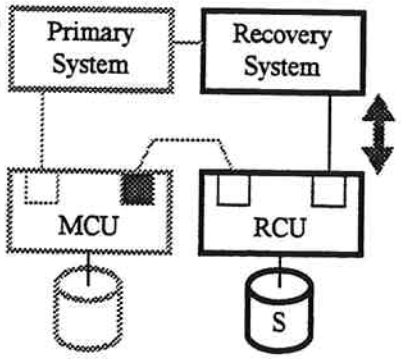
(c) Terminating HRC Volume Pairs (Step 2)

The "Delete Pair" operation to the RCU terminates the specified HRC volume pairs. These R-VOLs will be changed to "simplex" state. Refer to "20.1.3(7) Delete Pair Operation".

(3) Disaster Recovery Procedures - Returning to the Primary Site

(a) Summary

⓪



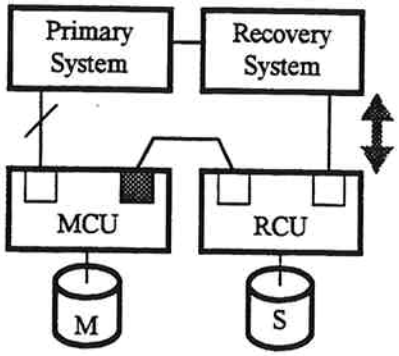
Applications are working at the recovery system.

①

Step1: Make the components in the primary system operable.

Repair Actions

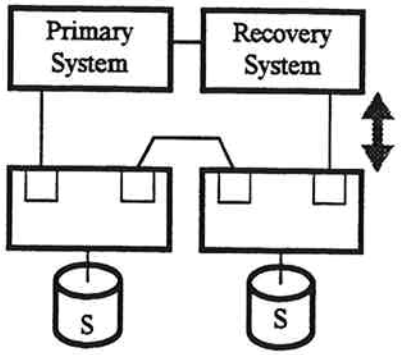
Repair Actions



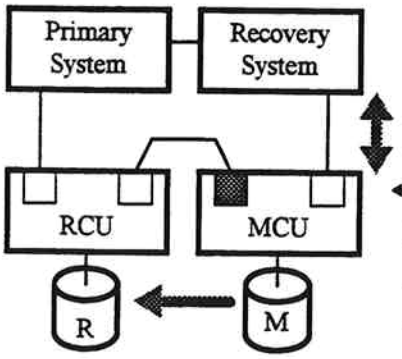
②

Step2: Terminate the HRC settings remaining in the MCU.
(1) Delete Pair: Delete all HRC volume pairs.
(2) Delete RCU
(3) Port: Change from RCP to LCP mode.
➔ Refer to 20.1.5(3)(b)

Delete Pair
Delete RCU
Port



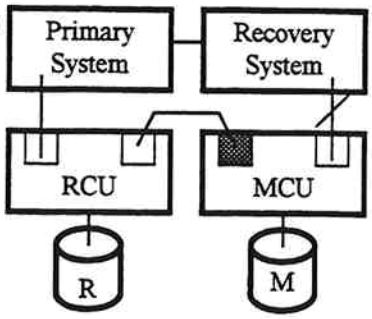
③



Port
Add RCU
Add Pair

Step3: Establish HRC with the reverse direction
(1) Port: Change from LCP to RCP mode.
(2) Add RCU
(3) Add Pair
➔ Refer to 20.1.5(3)(c)

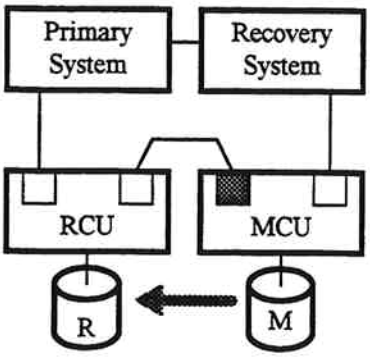
④



Vary Offline

Step4: Halt related applications and vary all M-VOLs offline from the recovery system.

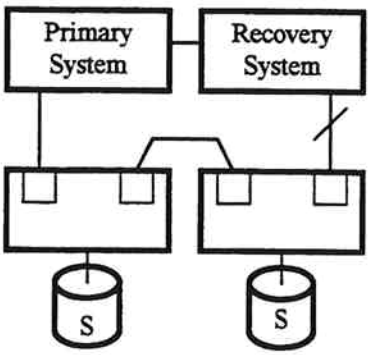
⑤



Pair Status

Step5: Confirm all HRC volume pairs become "duplex" state.

⑥



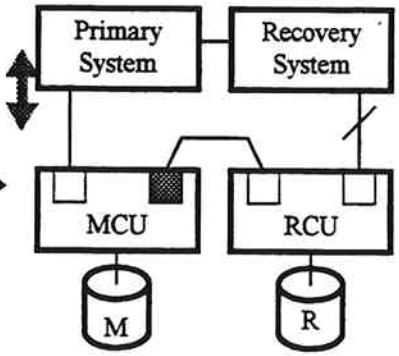
Delete Pair
Delete RCU
Port

Step6: Terminate all HRC settings.
(1) Delete Pair: Delete all HRC volume pairs.
(2) Delete RCU
(3) Port: Change from RCP to LCP mode.
➔ Refer to 20.1.5(3)(d)

⑦

Step7: Establish HRC pair with the original direction and start applications.
(1) Port: Change from LCP to RCP mode.
(2) Add RCU
(3) Add Pair
➔ Refer to 20.1.5(3)(e)

Port
Add RCU
Add Pair



(b) Terminating the HRC Settings Remaining in the MCU (Step2)

After the DKC210I subsystem becomes operable, the remaining registration of the HRC volume pairs and the RCU should be deleted by performing the Delete Pair operation and Delete RCU operation respectively.

To complete the Delete Pair operation, the "delete pair unconditionally" option is required because the original R-VOLs do not belong presently to any HRC volume pairs. The MCU will change the specified M-VOLs into "simplex" state without checking the current status of the corresponding R-VOLs.

Note that the status of M-VOLs may be "Suspended (Delete Pair to RCU)" because of Delete Pair operation issued to the RCU in step 2 of "20.1.5(2) Disaster Recovery Procedures - Switching to the Recovery System". It is normal condition in this situation.

Before performing the Delete RCU operation, all HRC volume pairs must be deleted.

If you want to use same remote copy connections for step 3, the serial interface ports which have been set to the RCP mode should be changed to the LCP mode by the Port operation.

(c) Establish HRC with the Reverse Direction (Step3)

The HRC volume pair should be established with the reverse direction to synchronize the original M-VOLs with the original R-VOLs. The procedures for this step are same as those described in "20.1.4-1 Setting Up HRC Volume Pairs". Note that the DKC210I subsystems in the original primary site and the recovery site are treated as the RCUs/R-VOLs and the MCUs/M-VOLs respectively.

Do not select "only out-of-sync cylinders" or "none" parameter to the Add Pair operations. The volumes in the original primary site are now behind the volumes in the recovery site. Furthermore the updates to the volumes in the recovery site have not been accumulated in cylinder bit map.

(d) Terminate Applications and HRC Settings at the Recovery Site (Step 4~6)

HRC settings with the reverse direction must be deleted after halting the applications in the recovery site (step 4) and confirming that all HRC volume pairs are in "duplex" state (step 5).

If you want to use same remote copy connections for step 7, the serial interface ports which have been set to the RCP mode should be changed to the LCP mode by the Port operation.

(e) Establish HRC Pair with the Original Direction and Start Applications (Step 7)

The HRC volume pair should be established with the original direction to synchronize the original M-VOLs with the original R-VOLs. The procedures for this step are same as those described in "20.1.4(1) Setting Up HRC Volume Pairs".

Do not select "only out-of-sync cylinders" or "none" parameter to the Add Pair operations. The volumes in the original primary site are now behind the volumes in the recovery site. Furthermore the updates to the volumes in the recovery site have not been accumulated in cylinder bit map.

20.1.6 Data Migration Procedure by HODM

(1) Data Migration Scenario

There are two possible data migration scenarios, **volumes by volumes** data migration and **subsystem to subsystem** data migration.

(a) Volumes by Volumes Data Migration

As shown in Fig. 20.1.6-1, only selected volumes are migrated by HODM at once. Other volumes in the existing disk subsystem should be accessed through the existing channel paths. After completing the migration copy for the selected volumes, another selected volumes can start being migrated.

The typical migration procedures are as follows:

① Define the volumes in DKC210I subsystem for the different volumes from the existing volumes in the I/O generations.
② Establish the remote copy connections between the existing disk subsystem and DKC210I subsystem
③ Connect the DKC210I subsystem to the host processor with different channel paths. Leave all volumes in the DKC210I subsystem offline from the host processors.
④ Vary offline the selected volume in the existing subsystem, for example A80~A83.
⑤ Start HODM for the selected volumes, for example device 00~03.
⑥ Vary online the corresponding volumes in DKC210I subsystem, for example C00~C03.
⑦ After completing HODM for device 00~03, continue procedures ④ to ⑤ for another volume group, for example A84~A87 and C04~C07.

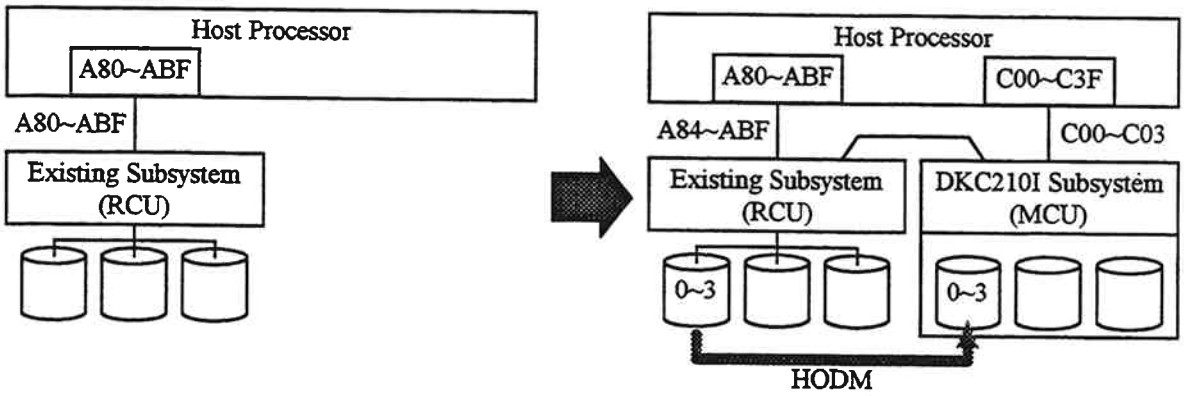


Fig.20.1.6-1 Volumes by Volumes Data Migration

In this scenario, the I/O generations for the volumes in the DKC210I subsystem and the repeated operations for each volume group must be permitted. The performance degradation, instead, may be lower than the subsystem to subsystem migration scenario. Additionally, if the data migration failed, the existing volumes, A80~A83 for example, could return to be accessible in the short recovery time.

To perform this scenario, the restrictions described in (note) should be especially considered.

(note)

HODM can migrate data between volumes of which device address are different. However HODM does not translate their device addresses for the I/O operations from the host processors.

Fig. 20.1.6-2 shows an example where device 05 are being migrated to device 00 by HODM and device 05 in the DKC210I subsystem does not belong to any HODM volume pair. Responding to read I/O operations directed to device 00, the DKC210I subsystem provides the data which have been stored in device 05 in another disk subsystem. It also provides the data from device 05 in the DKC210I subsystem for I/O operations directed to device 05.

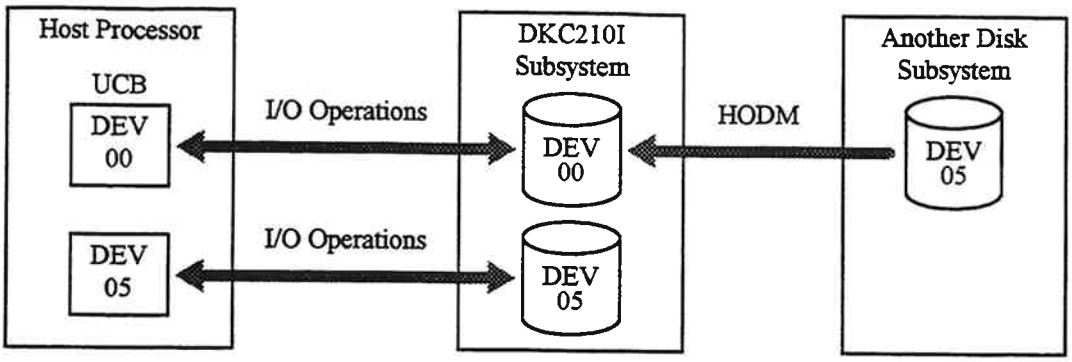


Fig. 20.1.6-2 HODM between Deferent Device Addresses

Customers' JCLs, catalogues and application programs should be modified if they depend on device address and HODM between different device addresses must be configured.

(b) Subsystem to Subsystem Data Migration

As shown in Fig. 20.1.6-3, all volumes in the existing disk subsystem are migrated at once.

The typical migration procedures are as follows:

① Vary offline all volume in the existing disk subsystem, A80~ABF for example.
② Disconnect the existing disk subsystem from the host processor.
③ Establish the remote copy connections between the existing disk subsystem and DKC210I subsystem.
④ Connect the DKC210I subsystem to the host processor with the same channel paths.
⑤ Start HODM for the all volumes, for example device 00~3F.
⑥ Vary online all volumes in DKC210I subsystem, for example A80~ABF.

In this scenario, the additional I/O generation may not be needed, except for restrictions described in (note). And the operating procedures are simple. However the performance during HODM could become worse than volume by volume data migration. And the error recovery procedures would be relatively complex.

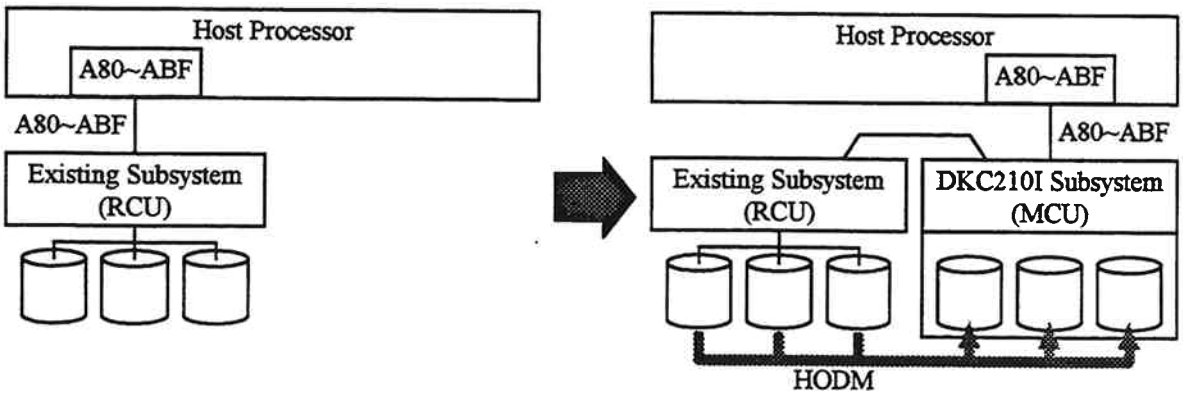


Fig.20.1.6-3 Subsystem to Subsystem Data Migration

(note)

HODM does not emulate the device/control unit characteristics of the R-VOL/RCU. Responding to I/O operations from host processors, the DKC210I subsystems always provides device model, device serial number, control unit model, control unit serial number, subsystem ID and other device/control unit characteristics of the M-VOL/MCU itself.

(2) Ordinary HODM Procedures

(a) Sequence of Operations

Ordinary sequence of operations is shown below.

Table 20.1.6-1 HODM Sequence of Operations

Procedure		Operation	
		SVP*	Others
1	Set appropriate serial interface port to the RCP mode.	Port	
2	Establish logical paths to the existing disk subsystem.	Add RCU	Before this procedure, DKC210I subsystem and the existing disk subsystem must be physically connected.
3	Ensure that the R-VOLs are offline from host processors		VARY OFFLINE system command, if necessary.
4	Establish HODM volume pairs.	Add Pair	
5	Bring the M-VOLs online.		VARY ONLINE system command, If necessary.
6	Start the customer's application.		
7	Confirm that the migration copy has been successfully completed.	Pair Status	
8	Start erasing the R-VOLs, if required.	R-VOL Erase	
9	Confirm that the erasing the R-VOLs has been successfully completed. Status of the HODM volume pair will be changed to "simplex" state when the R-VOL erasing is completed.	Pair Status	
10	Remove logical paths to the existing disk subsystem.	Delete RCU	The existing disk subsystem can be physically removed after this procedure.

* : Operated from the SVP/remote console

For the volumes by volumes data migration scenario, procedure #3 to #10 should be performed for only the selected volumes. For other volumes, procedure #3 to #10 can be repeated.

For the subsystem to subsystem data migration scenario, procedure #3 to #10t should be performed for all volumes in the existing disk subsystem.

(b) Device Online/Offline from Host Processors

Be sure to keep the following sequence of procedures to ensure data consistency of the HODM volume pair:

- The R-VOLs must be varied offline *before* the Add Pair operation. If the R-VOLs are still online and write I/Os are issued to R-VOLs, the updated data may not copied to the M-VOLs.
- The corresponding M-VOLs must be brought online *after* the Add Pair operation has successfully completed. For the I/O operations to the M-VOLs before starting the migration copy, the old data on the M-VOLs may be read or the updated data may be overlaid by the migration copy.

To check the second requirement described above, the Add Pair operation is be rejected if the specified M-VOL belongs to any path group.

(c) Confirming HODM Volume Status

By the Pair Status operation, the MCU can display the status of the specified volume pair.

- If the migration copy has been successfully started, the status of the M-VOL will turn to "Pending Duplex" state.
- If the migration copy has been successfully completed, the status of the M-VOL will turn to "simplex (migration complete)" state.

- If the erasing the R-VOL has been successfully started, the status of the M-VOL will turn to "simplex (erasing in progress)" state.
- If the erasing the R-VOL has been successfully terminated, the status of the M-VOL will turn to "simplex" state (without sub-status).

Refer to "20.1.2-4 HODM Volume Status" for more detailed description.

(d) Controlling Migration Copy Activities

Concerning to the I/O performance during HODM, following factors must be considered:
- Copy activities use the subsystem performance resources
- The restore copy and the update copy make I/O response time of the M-VOL longer

Note: Refer to "20.1.2(2) HODM Copy Operations" for the "restore copy" and the "update copy".

To control these factors, the "maximum initial copy activities" parameter and "priority" parameter can be specified. The first parameter controls the number of volumes for which the migration copy are concurrently executed. The second parameter specifies the executing order of the migration copy on volume pair basis.

Refer to the following example and "20.1.3(1) Add RCU Operation" and "20.1.3(6) Add Pair Operation" for detailed description about these parameters.

Example
Conditions:
- The Add Pair operation specifies HODM to M-VOLs 00~05.
- "Maximum initial copy activities" is set to "4" (this is the default value, and can not be changed).
- "Priority" parameters for devices 00~05 are set to "3", "5", "5", "1", "4", and "2" respectively.

Under the above conditions, the MCU will performs the migration copy:
- for devices 00, 03, 04 and 05 immediately.
- for device 01 when one of the migration copy has been terminated.
- for device 02 when the migration copy for the second device has been terminated.

To the R-VOL erasing operations, "maximum initial copy activities" and "priority" parameters are not applied.

(3) Canceling and Restarting HODM

1) Canceling HODM

The Suspend Pair operation and the Delete Pair operation can terminate the migration copy the R-VOL erasing for the specified volume. The deference between "suspend" and "delete" is:

- When the HODM volume pair is suspended, before the migration copy being complete the MCU still executes the restore copy and/or the update copy responding to I/O operations to the M-VOL.
- When the HODM volume pair is deleted, the MCU reads/write the data only on the M-VOL (even through it is not fully identical to the R-VOL)

Therefore, if you want to "delete" the HODM volume pair *before* completing the migration copy;
- The I/O operations to the M-VOL *must be previously quiesced*, for example, by VARY OFFLINE command.
- The M-VOL will *never be reused* by the applications until another migration copy to the M- VOL will successfully complete or the M-VOL will be completely initialized.

To check the first requirement described above, the Delete Pair operation without "unconditional" option is rejected if the M-VOL is not in "simplex (migration complete)" status and the M-VOL belongs to any path group.

Note: The Delete Pair operation with "unconditional" option will be accepted regardless of status and path group of the M-VOL.

HODM keeps the data consistency on R-VOL until the migration copy will complete. So the R-VOL can be used to resume the quiesced applications.

2) Restarting HODM

All of the updates to the M-VOL are copied to the R-VOL while the HODM volume pair is in "pending" or "suspended" status. Therefor, the Resume Pair operation can resume the migration copy for the "suspended" HODM volume pair. Only cylinders which have not copied yet will be copied by the resumed migration copy. In this case, the M-VOL need not to be varied offline from host processors before restarting HODM.

Note that the updates to the M-VOL are not copied to R-VOL once the migration copy is completed or canceled by the Delete Pair operation. Therefore *never* restart HODM for the volumes if;

- the migration copy have been successfully completed or canceled by the Delete Pair operation and;
- some updates have been issued to the M-VOL after completion of the migration copy or deleting the HODM volume pair.

You should confirm the volume status at the time of deleting the HODM volume pair to prevent this problem from occurring.

The R-VOL Erase operation can restart the R-VOL erasing which has been terminated due to the Suspend Pair operation, MCU being powered off or erasing failure.

(4) HODM Error Recovery Procedures

(a) Actions of MCU for Unrecoverable Failures

When the MCU detects an error conditions on copy activity, it retries the failed copy activity. If the failure can not be recovered in the specific time of retries, the MCU executes the following actions:

- Turns the status of the M-VOL to "suspended" state.
- Stops the migration copy for this volume pair.
- Generates the service information message (SIM) which indicates that the HODM volume pair has been suspended. This SIM will be reported to the host processor when the next I/O operation will issue to the M-VOL.
- Generates the internal sense information. The SVP of the MCU will store the sense information into SSB LOG file. The sense information may include the 32 bytes of sense data which have been reported from the RCU.
- Reports unit-check to the host processor channel if the failure have been occurred on the restore copy or the update copy activity. The sense data to the host processor indicates an "equipment check".

The MCU will still try to execute the restore copy and the update copy when the subsequent I/O operations require to do them. If the restore copy and the update copy can be successfully completed, the I/O operations will continue. If the restore copy or the update copy encounters the failure, an equipment check will be reported again.

(b) Error Recovery Procedures

Error recovery procedures are shown bellow:

① Quiesce customer's applications to access the failed volumes.
② Delete the failed HODM volume pair by the Delete Pair operation
③ Decide the failed portion by referring the sense information generated by the MCU.
④ Recover the failed portion according to the related sense information
⑤ Restart HODM volume pair
⑥ Resume the quiesced applications

Basically, the procedure ④ is similar to that which is currently performed for non-HODM disk subsystem except that the failed portion may be included in the existing disk subsystem. If the 32 bytes of sense data from the existing disk subsystem has been logged in the MCU, analyzing the sense data should be analyzed at procedure ③.

Be sure that procedure ⑤ will be performed only for the volumes for which the migration copy have been is progress. Refer to "(3) Canceling and Restarting HODM" for restarting procedure and its cautions.

20.1.7 Guard Concept for Maintenance Operation in HRC/HODM

(1) In this maintenance manual.....

SVP requires Password input for each setting operation. In each paragraph of this maintenance manual, we does not describe the password operation. If SVP requires to input password, please call TSC what the password is.

(2) Basic concept for password.

HRC / HODM applications which are installed in the SVP have guard process especially if the operator selects a button to execute HRC/HODM setting (Edit path, Add Pair, Delete Pair..). SVP requires the password input. These operations must be concerned with the direct access to customer data. So it is very dangerous operation for the system so that SVP needs guard operation.

(3) summary table

We arranged these concept as the following table.

#	Button (Function)	Operation which needs a password input
1	Add RCU	Y
2	Edit Path	Y
3	Delete RCU	Y
4	RCU Option	Y
5	RCU Status	N
6	Add Pair	Y
7	Delete Pair	Y
8	Pair Option	Y
9	Pair Status	N
10	Suspend Pair	Y
11	R-Vol Erase	Y
12	User	— (*1)
13	Usage	N
14	Connect	— (*1)
15	Port	* (*2)
16	Renew	N
17	Exit	N
	Explanatory notes	Y : It's necessary to input password. The all password are fixed N : Not necessary to input password * : It's necessary to input password when the operator uses some setting function. — : It is not supported(Displayed as gray color).

(*1) "User" and "Connect" functions are supported in the remote console application only. In the SVP, these button is displayed as gray to guard.

(*2) SVP does not require the password input at the first button selection. If the user selects port changing function (LCP-RCP), SVP requires the password input.

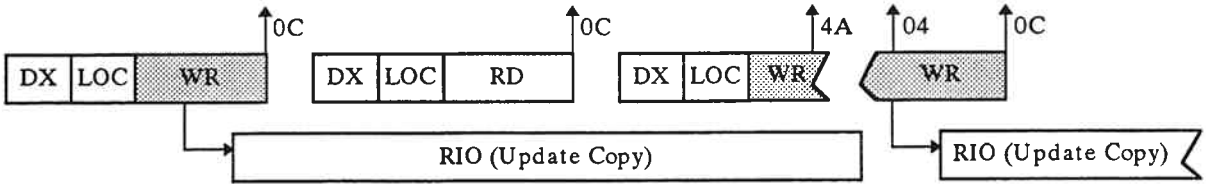
20.1.8 Outline & Specification of SemiSynchronous HRC

On the HRC Update copy operation accompanied HOST I/O, former operation which the Remote I/O is executed during CHL END & DEV END split to the HOST is called Synchronous Copy Mode. (Sync Copy). HRC supports new operation called SemiSynchronous Copy Mode. (SemiSync Copy)

(1) Write operation of SemiSynchronous HRC

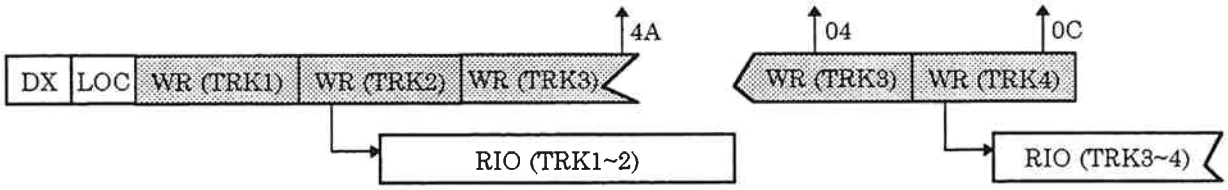
(a) Basic Operation of SemiSync Copy

- At final Write command in the Locate Domain, MCU reports DSB=0C (CHL END & DEV END) instead of DSB=08 (CHL END), then MCU issues Remote I/O.
- MCU accepts and performs subsequent I/O except WRT command, even if the preceding Remote I/O is still proceeding and has not completed yet. (In case of Read I/O to the same Track, MCU waits until the Slot is free. ; Slot Busy.)
- When MCU accepts the WRT I/O to the Device, if the preceding Remote I/O has not completed yet, the Write I/O waits by CMD Retry until the Remote I/O will be complete.



(b) Exception

Even if the HRC pair is specified SemiSync Copy mode, microprogram behave the I/O as Sync Copy mode in case that MCU issues Remote I/O during DSB=4A Retry.



(c) The order of Update Copy Schedule

Remote I/O of SemiSync Update Copy is arbitrary performed according to MCU internal algorithm. That is, Update Copy to R-VOL is issued by independent timing of the order of Write I/O to each devices.

(d) The opportunity of reporting SSB detected by Remote I/O operation

If Remote I/O of SemiSync Update Copy detects and creates some error SSB, MCU reports the SSB as asynchronous SSB at the first connection to the HOST. (At the timing of Req-Con and CHL initiate I/O.)

1) In case that MCU reports the Unit CHK at the Req-Con, the SSB which is created in Remote I/O attributed to preceding Write I/O may be reports during new CCW CHN.
2) CCHH in the SSB shows the CYL/HD# on which Update Copy is executing, it is not relating to the CYL/HD# executing HOST command.

Note; All of SSB created by Remote I/O are EQC, therefore above 1), 2) do not affect the OS Recovery procedure.

(2) Sync/SemiSync mode setting and display

(a) Definition

- The mode permit above Update Copy operation is defined as SemiSync mode. The mode restricts only Sync Update Copy is defined as Sync mode. (prior HRC)
- The both mode is defined as attribute of HRC pair, it is possible to set to each HRC pair independently.
- It allows to intermixing the Sync and SemiSync mode pair in one of MCU/RCU relation.

(b) Setting of the mode (Sync/SemiSync) ; Refer to SVP screen.

1) Add Pair operation

Add Pair parameter ;

M-VOL(LDEV#), R-VOL(LDEV#), priority, RCU(Serial#, SSID), Initial Copy ={Entire Volume/None}, Update Copy={Synchronous Mode/Semi-Synchronous Mode}

Note; The default is Sync. mode.

2) Mode Change

It is only allowed in case of Resume Pair. If operator would like to change the mode, it is necessary to suspend the pair.

3) PPRC command

In case of ESTPAIR from host, Sync. mode is set on as default.

(c) Display of the Pair Status

1) SVP Display

Refer to SVP screen. On HRC & HODM Main Control Screen, the mode is displayed at column "Type", "RDC0[x]" means Sync mode, and "RDC1[x]" means SemiSync mode.

2) PPRC command

Display of CQUERY is same as current specification. Sync/SemiSync is not displayed.

(d) Others

1) In case of SemiSync, other parameter and pair option (Initial Copy, Initial Copy Pace, M-VOL Fence Level, CFW Data, DFW to R-VOL) are possible to set independently, and they function as same as Sync Mode.
2) DELPAIR and SUSPEND from both of SVP and PPRC command are treated as same as current specification.

(e) Usage

The count of command retry due to waiting SemiSync Update Copy completion is newly added to Usage screen.

(3) HRC SIM

MCU distinguishes to report the Reference Code of HRC Pair SIM from Sync and SemiSync.

REF CODE= DFxx ; Sync Mode

REF CODE= DExx ; SemiSync Mode

(4) Application

(a) Pair Status

SemiSync Copy operation is available only Duplex Avail status. That is, even if SemiSync mode is specified at Add Pair operation, Update Copy is performed as synchronous during Pending Duplex.

(b) Program Version

SemiSync Copy Mode is available under the condition that MAIN version is equal to 03-15-xx or later, and SVP version is equal to 01-09-xx or above. If DKCMAIN is non-support version, SemiSync mode is not able to be set on the SVP screen (Add Pair / Resume Pair), and SVP does not display SemiSync mode on the screen.

SVP / MCU	Before 01-09-xx	01-09-xx or the later
Before 03-15-xx	Sync mode only	Sync mode only
03-15-xx or the later	Sync mode only	Sync or SemiSync mode is selectable

If MCU is SemiSync supported version (both of MAIN and SVP), it is possible to set SemiSync mode. If RCU is before version, HRC Status display or SIM on RCU is same as Sync mode Only.

RCU / MCU	Not supported	Supported
Not supported	Sync mode only	Sync mode only
Supported	SemiSync operation is available, but display on RCU is former figure.	SemiSync operation is available, and display on both of MCU and RCU is new figure.

(c) Version down to non-supported version

If SemiSync mode Pair is exist on MCU, version down to not supported version is rejected. It is necessary to suspend all of SemiSync mode Pair.

Even if R-VOL of SemiSync mode on RCU, version down to not supported version is allowed.

20.2 Introduction

20.2.1 HRC/HODM Components

(1) HRC Components

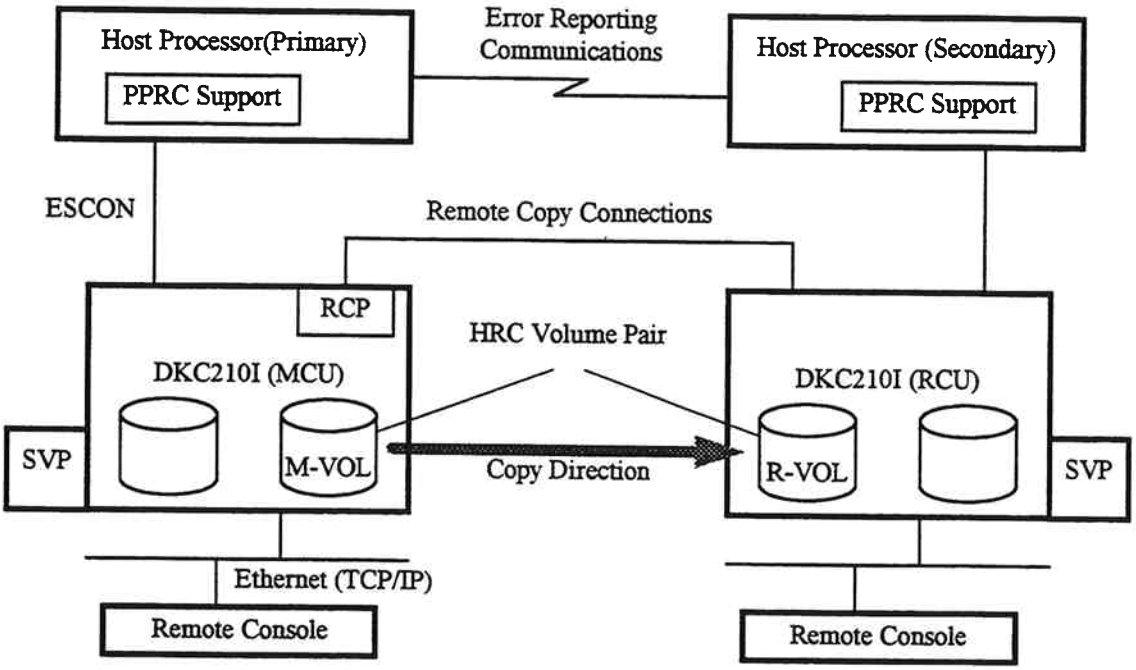


Fig. 20.2-1 HRC Components

(a) HRC Volume Pair

An **HRC volume pair** consists of two logical volumes, an M-VOL and an R-VOL, in different DKC210I subsystems.

An **M-VOL** (main volume) is a primary volume. It can be read or written by I/O operations from host processors.

An **R-VOL** (remote volume) is a secondary or a mirrored volume. Under control of the DKC210I subsystems, contents of an M-VOL and updates from host processors are copied to an R-VOL. Read or write I/O operations from host processors to R-VOLs are rejected.

The M-VOLs of the HRC volume pairs and the R-VOLs of other HRC volume pairs can be intermixed in one DKC210I subsystem.

(b) MCU and RCU

An **MCU** (main disk control unit) and an **RCU** (remote disk control unit) are disk control units in the DKC210I subsystems to which the M-VOLs and the R-VOLs are connected respectively.

An MCU controls I/O operations from host processors to the M-VOLs and copy activities between the M-VOLs and the R-VOLs. An MCU also provides functions to manage HRC status and configuration.

An RCU executes write operations directed by the MCU. The manner to execute write operations is almost same as that of I/O operations from host processors. An RCU also provides a part of functions to manage HRC status and configuration.

Note that an MCU/RCU is defined on each HRC volume pair basis. One disk control unit can operate as an MCU to control the M-VOLs and an RCU to control the R-VOLs.

(c) Remote Copy Connections

An MCU and an RCU must be connected with serial interface (ESCON) cables. Only multi mode ESCON cables whose length is up to 3km can be connected to the DKC210I subsystems. In order to locate the DKC210I subsystems more than 3km apart, IBM 9032/9033 ESCON directors or 9036 ESCON repeaters are required.

At least two independent remote copy connections should be established between an MCU and an RCU.

(d) RCP

An **RCP** (remote control port) is a serial interface port to which an RCU is connected. Any serial interface port of the DKC210I subsystems can be configured as an RCP.

When an MCU communicates with an RCU through ESCON interface protocol, the RCP plays the role of a host processor channel. The RCP supports ESCON dynamic connection. A serial interface port of the RCU to which the MCU is connected can be connected to host processor channels by using dynamic switching capability provided by ESCON directors.

However an RCP can not communicate with host processor channel. Channel interface paths must be connected to other serial interface ports.

(e) SVP and Remote Console

An **SVP** provides functions to set up , modify and display HRC/HODM configuration and status.

A **remote console** is a personal computer compatible with the PC/AT. It should be connected to DKC210I subsystems with an Ethernet network(TCP/IP) . A remote console provides same managing HRC/HODM functions as an SVP. Several DKC210I subsystems can be connected with one Ethernet network.

For remote console, Hitachi provides only two software components, an HRC/HODM application program and dynamic link library. Both of them require Microsoft Windows operating system. A personal computer, Ethernet materials and other software products are not provided by Hitachi.

(f) Error Reporting Communications

Error reporting communication is a communication means between host processors. An MCU generates the sense information when it fails in keeping synchronization of HRC volume pair. The sense information causes the corresponding message to be displayed on the host processor console. For the reference during disaster recovery at the secondary (recovery) site, this console message should be transferred to the secondary site through the error reporting communication.

The error reporting communications may be configured by using channel-to-channel communications, Netview technology or other interconnect technologies, depending on installation. Hitachi does not provide any product for error reporting communications.

(g) PPRC Support

HRC provides a host processor interface compatible with IBM PPRC. TSO commands, DSF commands and disaster recovery PTFs provided for PPRC can be used for HRC.

HRC/HODM operations from an SVP or a remote console and the corresponding TSO commands are shown in Table 20.1.1-1. Before using TSO commands or DSF commands for PPRC, the serial interface ports to which the RCU(s) will be connected must be set to the RCP mode. Refer to page HRC&HODM02-90 for this operation. Table 20.1.1-2 shows the value of the SAID (system adapter ID) parameters required for CESTPATH command. For full description on TSO commands or DSF commands for PPRC, refer to the appropriate manuals published by IBM corporation.

Table 20.1.1-1 HRC operations and corresponding TSO commands for PPRC

Function	HRC/HODM operations	TSO commands
Registering an RCU and establishing remote copy connections	Add RCU	CESTPATH
Adding or removing remote copy connection(s)	Edit Path	CESTPATH
Deleting an RCU registration	Delete RCU	CDELPATH
Establishing an HRC volume pair	Add Pair	CESTPAIR MODE (COPY)
Suspending an HRC volume pair	Suspend Pair	CSUSPEND
Disestablishing an HRC volume pair	Delete Pair	CDELPAIR
Recovering an HRC volume pair from suspended condition	Resume Pair	CESTPAIR MODE (RESYNC)

Table 20.1.1-2 SAID (system adapter ID) required for CESTPATH command

Port in RCP mode		SAID value	Port in RCP mode		SAID value
cluster	port		cluster	port	
1	CH 'A'	X'0000'	2	CH 'A'	X'0010'
	CH 'B'	X'0001'		CH 'B'	X'0011'
	CH 'C'	X'0002'		CH 'C'	X'0012'
	CH 'D'	X'0003'		CH 'D'	X'0013'
	CH 'E'	X'0004'		CH 'E'	X'0014'
	CH 'F'	X'0005'		CH 'F'	X'0015'
	CH 'G'	X'0006'		CH 'G'	X'0016'
	CH 'H'	X'0007'		CH 'H'	X'0017'

(2) HODM Components

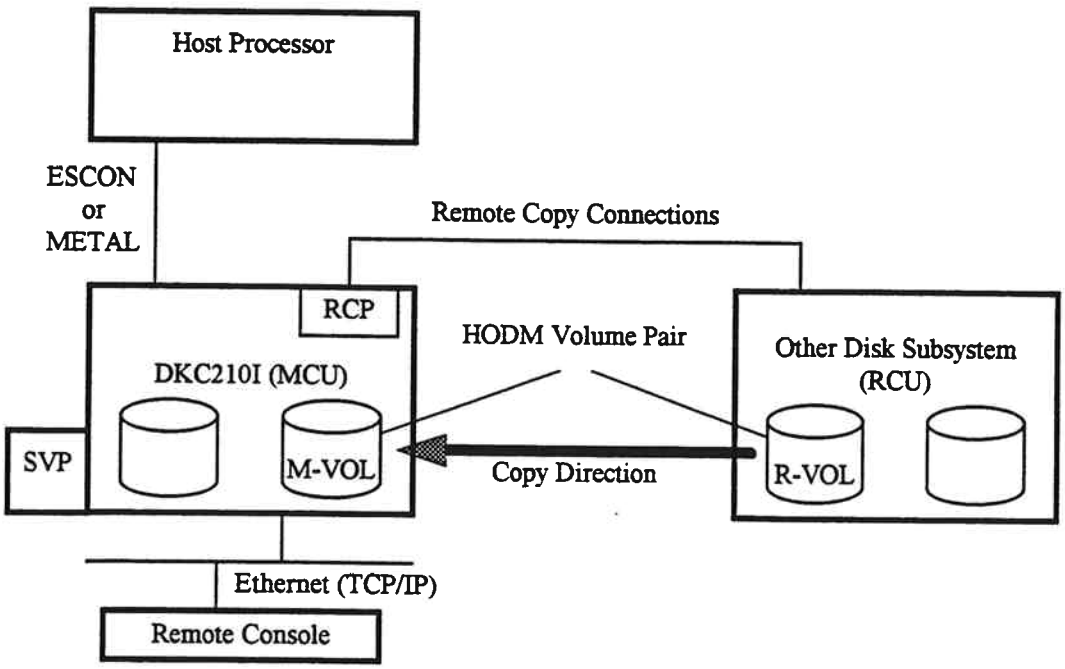


Fig. 20.2-2 HODM Components

(a) HODM Volume Pair

An **HODM volume pair** consists of one logical volume in a DKC210I subsystem and another disk volume in another disk subsystem, called an **M-VOL** and an **R-VOL** respectively. But you can not establish HODM volume pair on condition that R-VOL is Dual Copy volume.

HODM copies the data written in the R-VOL into the M-VOL. Responding to read I/O operations from host processors to the M-VOL, HODM transfers the data read from the R-VOL if the requested data has not yet copied.

Except for MCU,R-VOL should be protected from being updated during HODM. An operating environment must ensure this requirement because HODM does not protect it.

(b) MCU and RCU

An **MCU** is the disk control unit of a DKC210I subsystem. An **RCU** is the disk control unit of another disk subsystem in the HODM configuration.

(c) Remote Copy Connections

An MCU and an RCU must be connected with serial interface (ESCON) cables. Only multi mode ESCON cables whose length is up to 1km can be connected to the DKC210I subsystems. Although IBM 9032/9033 ESCON directors and 9036 ESCON repeaters are supported, the longer distance is not recommended because of performance reasons.

(d) RCP

An **RCP** is a serial interface port to which an RCU is connected. Any port of DKC210I subsystems can be configured as an RCP.

When an MCU communicates with an RCU through an ESCON interface protocol, an RCP plays the role of a host processor channel. An RCP supports ESCON dynamic connection. A serial interface port of an RCU to which an MCU is connected can be connected to host processor channels by using dynamic switching capability provided by ESCON directors.

However an RCP can not communicate with a host processor channel. Channel interface paths must be connected to other serial interface ports.

(e) SVP and Remote Console

An **SVP** provides functions to set up , modify and display HRC/HODM configuration and status.

A **remote console** is a personal computer compatible with a PC/AT. It should be connected to the DKC210I subsystems with an Ethernet network (TCP/IP). A remote console provides same managing HRC/HODM functions as an SVP. Several DKC210I subsystems can be connected with one Ethernet network.

For a remote console, Hitachi provides only two software components, an HRC/HODM application program and dynamic link library. Both of them require Microsoft Windows operating system. A personal computer, Ethernet materials and other software products are not provided by Hitachi.

20.2.2 HRC Software Requirements

Minimum level for HRC is MVS/DFP 3.2.0 + PTF or VM/ESA 2.1.0 + PTF.

- Optional error recovery procedure (ERP) functions - MVS/DFP 3.2.0 or above.
- ICKDSF R16 + PTF functions - VM/ESA 2.1.0 or above.

20.2.3 HRC/HODM Hardware Requirements

(1) HRC Supported Models

Table 20.2-1 HRC Supported Models

HA Models							HRC Support
MCU & RCU				M-VOL & R-VOL			
Emulation	Port Adapter	CHA Type	DKA Type	Drive	RAID Level	Emulation	
DKC210I (3990-6E) (3990-3)	WP027	DRAM	DRAM	DK30x-45	RAID5	3390-3	Y
						3390-3R	Y
						3390-2	Y
						3380-K	Y
		SRAM	SRAM	DK30x-45	RAID5	3390-3	Y
						3390-3R	Y
						3390-2	Y
						3380-K	Y
				DK308-90	RAID5	3390-9	—
						3390-3	Y
						3390-3R	Y
						3390-2	Y
						3390-1	—
						3380-K	Y
						3380-E	—
						3380-J	—
					RAID1	3390-3	Y
						3390-3R	Y
						3390-2	Y
						3390-1	—
						3380-K	Y
						3380-E	—
						3380-J	—

- Emulation type of an MCU and an RCU can be different.
- Emulation type of an M-VOL and an R-VOL must be same.
- No SC model is supported.

(2) HODM Supported Models

Table 20.2-2 HODM Supported Models (MCU & M-VOL)

HA Models							HODM Support
MCU				M-VOL			
Emulation	Port Adapter	CHA Type	DKA Type	Drive	RAID Level	Emulation	
DKC210I (3990-6E) (3990-6) (3990-3)	WP027	DRAM	DRAM	DK30x-45	RAID5	3390-3	Y
						3390-3R	Y
						3390-2	Y
						3380-K	Y
		SRAM	SRAM	DK30x-45	RAID5	3390-3	Y
						3390-3R	Y
						3390-2	Y
						3380-K	Y
				DK308-90	RAID5	3390-9	Y
						3390-3	Y
						3390-3R	Y
						3390-2	Y
						3390-1	Y
						3380-K	Y
						3380-E	Y
						3380-J	Y
					RAID1	3390-3	Y
						3390-3R	Y
						3390-2	Y
						3390-1	Y
						3380-K	Y
						3380-E	Y
						3380-J	Y

- No SC model is supported.
- Emulation type of an R-VOL must be same as an M-VOL.

Table 20.2-3 HODM Supported device types [3390 TYPE]

R-VOL \ M-VOL	3390-1	3390-2	3390-3	3390-9
3390-1	Y	Y	Y	—
3390-2	—	Y	Y	—
3390-3	—	—	Y	—
3390-9	—	—	—	Y

Table 20.2-4 HODM Supported device type [3380 TYPE]

R-VOL \ M-VOL	3380-J	3380-E	3380-K
3380-A	—	—	—
3380-D	—	—	—
3380-J	Y	—	—
3380-E	—	Y	—
3380-K	—	—	Y

Table 20.2-5 HODM Supported Models (RCU)

RCU	R VOL	Device Type	HODM Support
DKC80I-3	DKU98I	3380-A	—
	DKU85I-D	3380-D	—
	DKU85I-E	3380-E	Y
	DKU85I-J	3380-J	Y
	DKU85I-G	3380-E	Y
	DKU85I-K	3380-K	Y
	DKU87I-1	3390-1	Y
	DKU87I-2	3390-2	Y
	DKU87I-3	3390-3	Y
DKC90I-3	DKU87I-1	3390-1	Y
	DKU87I-2	3390-2	Y
	DKU87I-3	3390-3	Y
	DKU88I-3	3390-3	Y
	DKU88I-9	3390-9	Y
RAID200	3380-J	3380-J	Y
	3380-E	3380-E	Y
	3380-K	3380-K	Y
	3390-1	3390-1	Y
	3390-2	3390-2	Y
	3390-3	3390-3	Y
	3390-3R	3390-3	Y
	3390-9	3390-9	Y
IBM 3390-3	3380-J	3380-J	Y
	3380-D	3380-D	—
	3380-E	3380-E	Y
	3380-K	3380-K	Y
	3390-1	3390-1	Y
	3390-2	3390-2	Y
	3390-3	3390-3	Y
	3390-3R	3390-3	Y
	3390-9	3390-9	Y
IBM 3390-6	3390-1	3390-1	Y
	3390-2	3390-2	Y
	3390-3	3390-3	Y
	3390-3R	3390-3	Y
	3390-9	3390-9	Y
EMC	3380-D	3380-D	—
	3380-E	3380-E	Y
	3380-K	3390-K	Y
	3390-1	3390-1	Y
	3390-2	3390-2	Y
	3390-3	3390-3	Y
	3390-9	3390-9	Y

(3) Serial Port Adapter Requirements

There are two versions of a serial port adapter PCB, WP007 and WP027. The older PCB of WP007 is not supported. The PCBs of WP007 must be replaced with WP027 before HRC/HODM being configured.

DKC210I subsystem can have two or four serial port adapters. Each serial port adapter has two or four serial interface ports. All serial port adapters, including serial port adapters to which only host processors are connected, must be WP027. Intermixed configuration is not supported.

(4) Non-Disruptive Installation

Non-disruptive installation is available only for DKC210I subsystems into which performance "full boost" level micro program(DKCMAIN up to 02-07-xx-xx/xx) has been previously installed. For DKC210I subsystems of lower level , disruptive installation is required.

(5) Remote Console Requirements

An HRC/HODM application software and dynamic link library require Microsoft Windows 95.

(6) Distance between MCU and RCU

An MCU and an RCU must be connected with serial interface (ESCON) cables. Only multi mode ESCON cables whose length is up to 3km can be connected to the DKC210I subsystems. In order to locate disk subsystems more than 3km apart, IBM 9032/9033 ESCON directors (ESCDs) or 9036 ESCON repeaters are required.

IBM 9032/9033 ESCON director supports an extended distance facility (XDF). The XDF uses single mode ESCON cables of which length is up to 20km. IBM 9036 ESCON repeater supports single mode - to - single mode connection or single mode - to - multi mode connection. In order to locate disk control units more than 9km apart, the XDF connections provided by the ESCON directors or ESCON repeaters are required.

Maximum distance between disk subsystems is 43km.

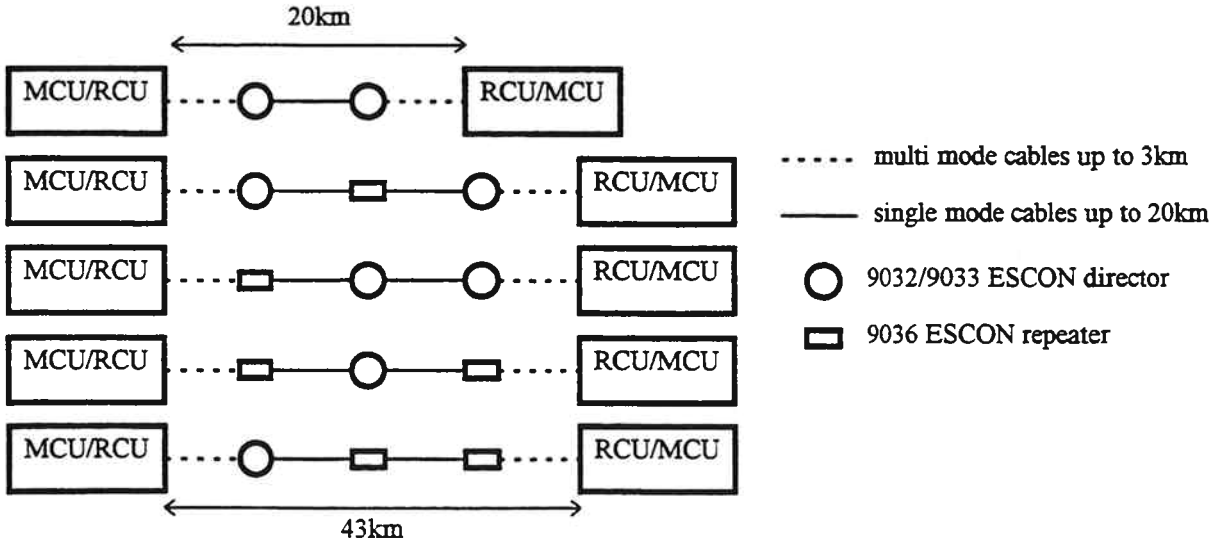


Fig. 20.2-3 Distance between Disk subsystems

(7) Recommendation of Host I/O patrol time and HRC/HODM configuration

Recommendation of Host I/O patrol time is 60 sec. for HRC, and 120 sec. for HODM. In addition that, Host I/O patrol time had better be set in consideration of the following factor.

- The number of pair volumes
- Cable length between MCU and RCU
- Volume status (Initial copy status)
- Under maintenance operation

When HRC/HODM configuration is instructed, take notice of as follows.

- The logical paths between MCU and RCU had better be established independent of the logical paths between Host and RCU.
- The logical paths between MCU and RCU had better be established maximum paths.
- RCP port had better be set in consideration of the host I/O rate and remote copy procedure.
- The Only important volumes had better be established HRC pair.
- Under the situation where the number of paths between MCU and RCU is decreased due to path failure, the traffic of the remaining paths is raised. It may cause some time-out I/O operation to RCU, and a lot of the time-out might cause suspension of HRC/HODM pair.

20.2.4 The revision of HRC/HODM Micro-programs

The revision of HRC/HODM micro-programs must be as followed.

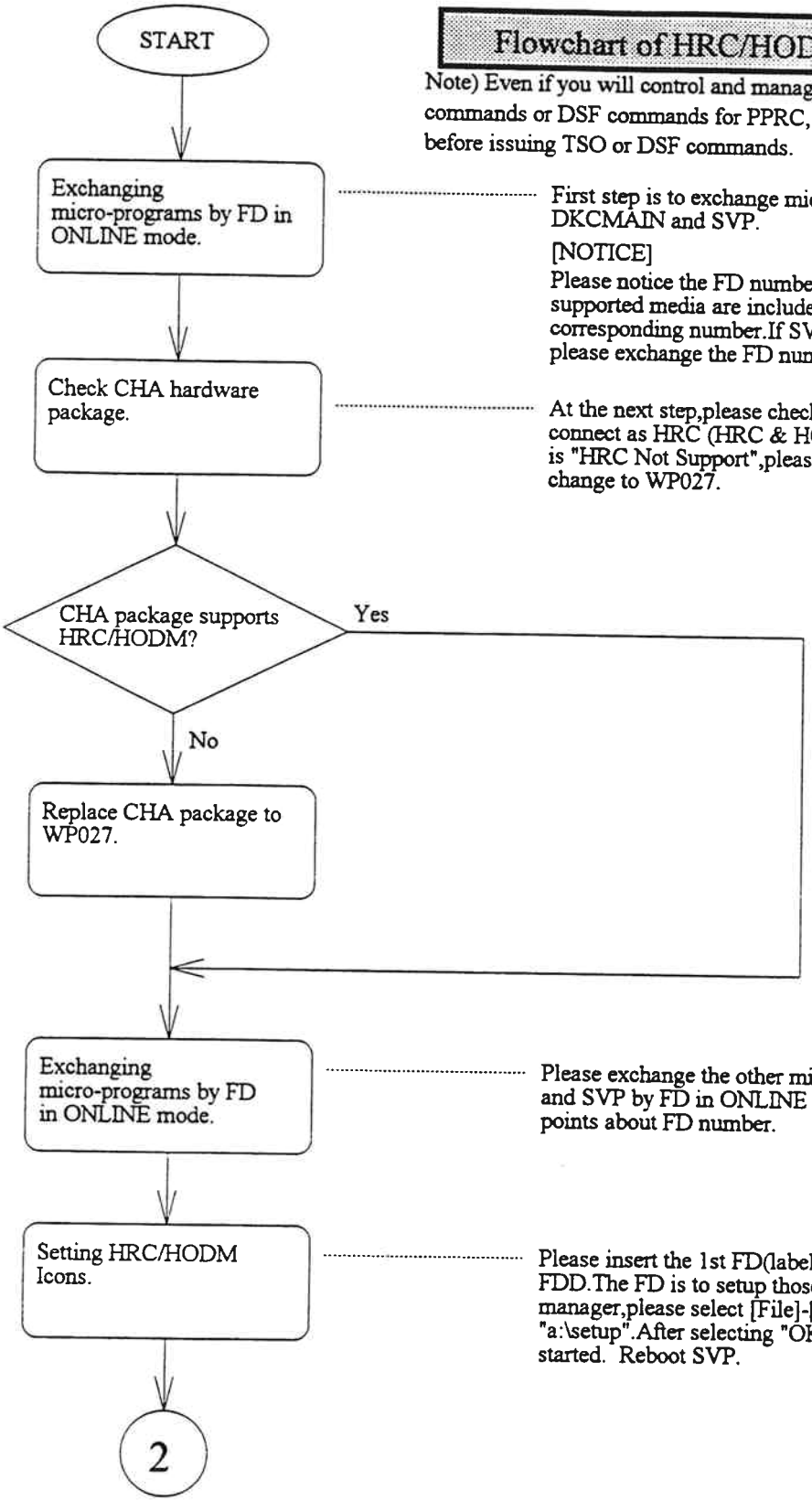
- DKCMAIN 02-10-xx-xx/xx, 02-12-xx-xx/xx or upper
- SVP 01-06-xx/xx or upper
- LCP 01-02-xx or upper
- LCDG 01-01-xx or upper
- CONFIG 01-07-xx/xx or upper

The number of micro-program media are increased from 14 to 19. See Table 20.2-3 for FD labels of HRC/HODM Micro-program.

Table 20.2-3 FD labels of HRC/HODM Micro-program

FD Kind	HRC/HODM not Support		HRC/HODM Support		VOL Kind
	FDs	FD Labels	FDs	FD Labels	
Setup installer	1	1	1	1	SETUP1
DKCMAIN	4	2~5	9	2~10	DKCMAIN1~9
SVP	3	6~8	3	11~13	SVP1~3
LCP/MCP/LCDG	1	9	1	14	LMCPDG1
CUDG4	1	10	1	15	CUDG1
DKU306/DKU308	1	11	1	16	DKU1
SSVP	1	12	1	17	SSVP1
RAM BOOT	1	13	1	18	PAM1
CONFIG	1	14	1	19	CONFIG1

20.2.5 The installation procedure for HRC/HODM



Flowchart of HRC/HODM installation

Note) Even if you will control and manage your HRC configuration by using TSO commands or DSF commands for PPRC, you must perform this installation procedure before issuing TSO or DSF commands.

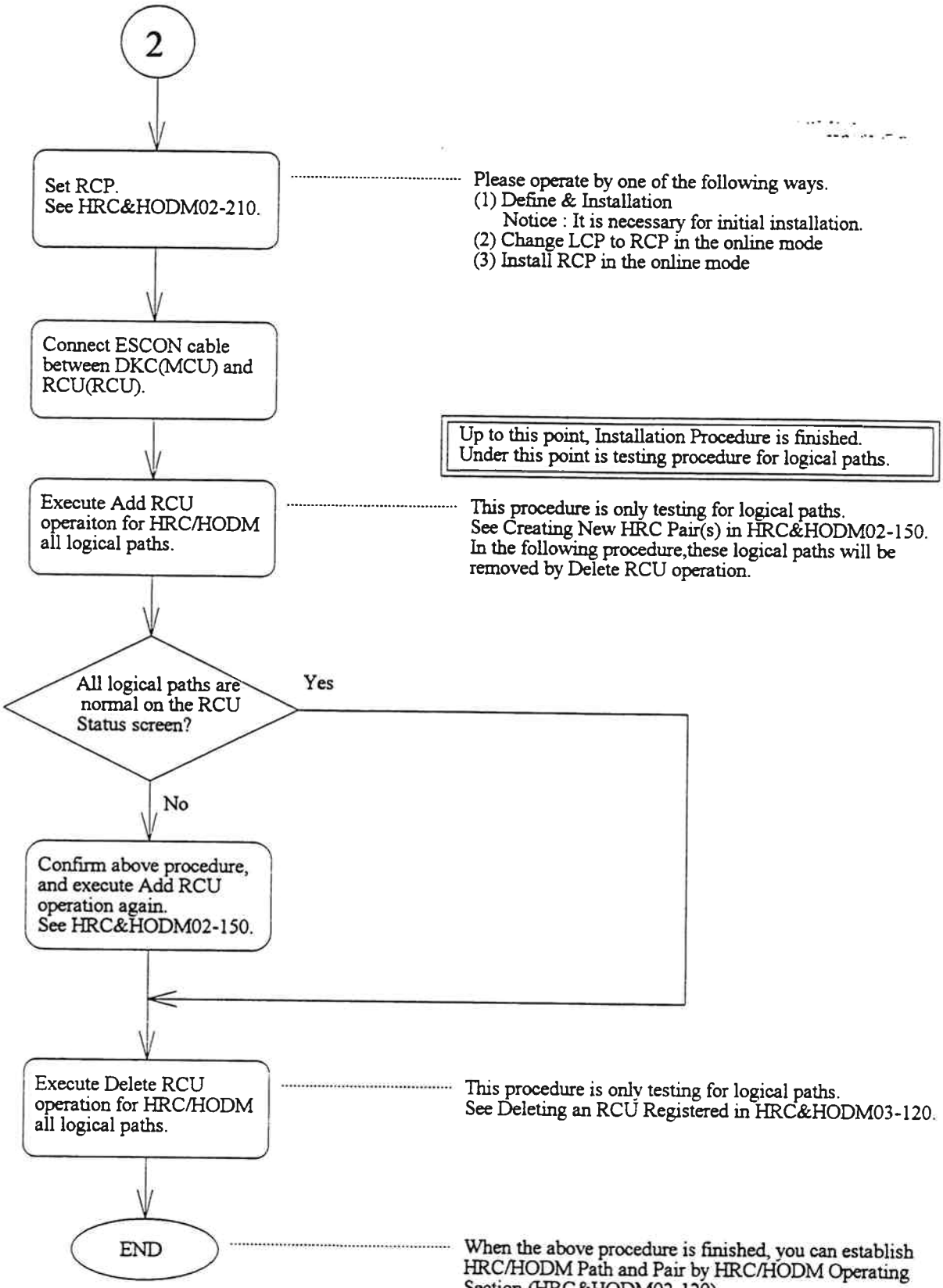
First step is to exchange micro-programs by FD. the targets are DKCMAIN and SVP.

[NOTICE]
Please notice the FD number on the label. the number of HRC/HODM supported media are included,but SVP does not display the corresponding number.If SVP displays the number of FD to install FDD, please exchange the FD number following the Table 20.2-3.

At the next step,please check target CHA P/K status which you want to connect as HRC (HRC & HODM02-120). If the status of the target CHA is "HRC Not Support",please replace the P/K on the ONLINE mode to change to WP027.

Please exchange the other microprograms except DKCMAIN and SVP by FD in ONLINE mode and notice the same points about FD number.

Please insert the 1st FD(labeled as FD 1/19) into the FDD.The FD is to setup those icons.Next, on the program manager,please select [File]-[Run...] menu and input "a:\setup".After selecting "OK",the setup installer will be started. Reboot SVP.



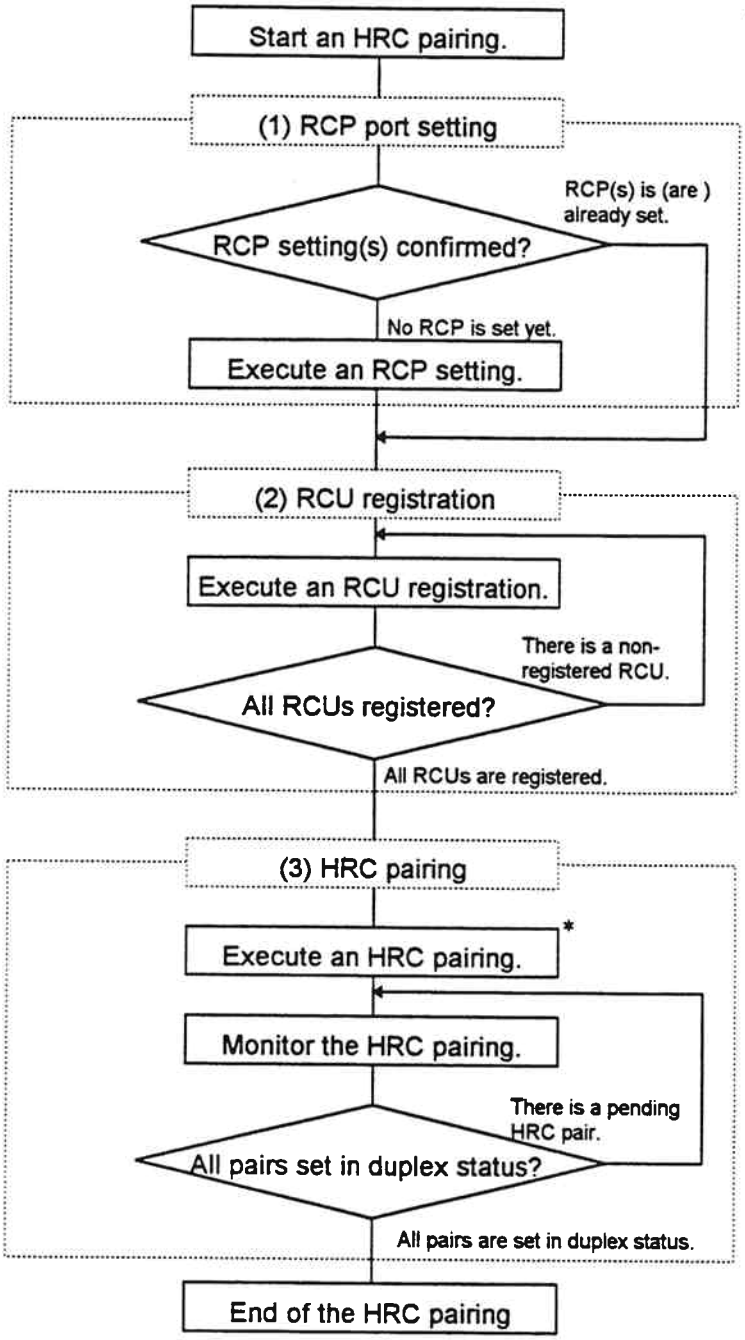
Appendix. HRC/HODM Installation check list

Table 20.2-4 HRC/HODM Installation Check List

No.	Item	Check
1	MCU/RCU emulation type must be correct. (See Table 20.2-1 and Table 20.2-2)	
2	M_VOL/R_VOL emulation type must be correct. (See Table 20.2-1 and Table 20.2-2)	
3	OS version must be as followed. • Optional error recovery procedure (ERP) functions - MVS/DFP 3.2.0 or above. • ICKDSF R16 + PTF functions - VM/ESA 2.1.0 or above.	
4	The revision of micro-programs must be as followed. • DKCMAIN 02-10-xx-xx/xx, 02-12-xx-xx/xx or upper • SVP 01-06-xx/xx or upper • LCP 01-02-xx or upper • LCDG 01-01-xx or upper • CONFIG 01-07-xx/xx or upper	
5	The revision of CHA hardware package must be "WP027". (See Table 20.2-1 and Table 20.2-2)	
6	HRC/HODM Icons must be set. (See HRC&HODM02-90 SECTION)	
7	RCP port must be set. (See HRC&HODM02-120 SECTION)	
8	ESCON cable between MCU and RCU must be connected.	
9	ESCON cable test between MCU and RCU must be executed.	

20.2.6 Creating New HRC Pair(s)

HRC Pairing Flow

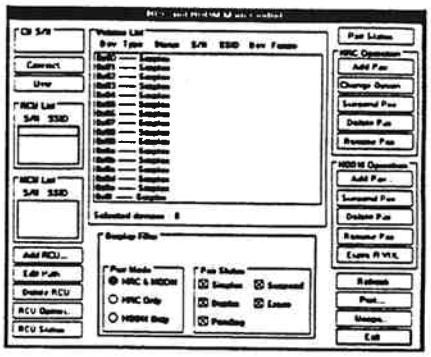


* Please take a memorandum of the selected M-VOL Fence Level for the Pair. (refer HRC&HODM02-180) And keep it in the recovery site. If the micro code version of DKCMAIN is 02-12-xx-xx/xx or upper, the fence level parameters can be referred through the SVP or the remote console which connects to the RCU. Therefore you do not always have to take a memorandum and keep them in the recovery site.
When the Pair suspend, the information is necessary for the recovery operation.

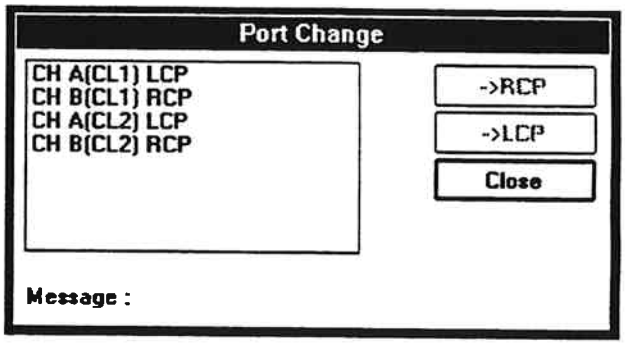
(1) RCP Port Setting

1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

2. Open the Port Setting window on the HRC & HODM screen.
   Press the [Port...] button (see the figure) on the HRC & HODM screen.



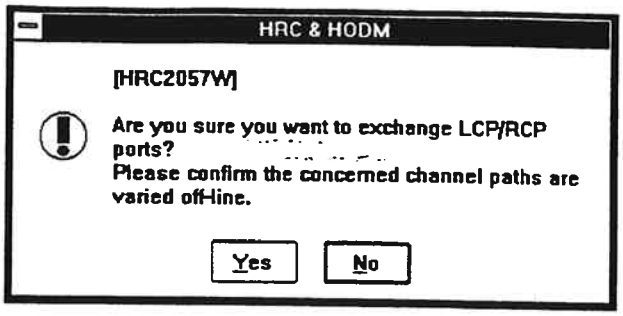
3. Confirming the port type(s)
   Compare the port setting(s) displayed on the screen with that(those) described on the work sheet. If the port setting(s) is(are) confirmed to be the same as that(those) on the work sheet, press the [Close] button (see the figure) and go to Item (2) "Registering the RCU(s)".



4. Changing the port type(s)
   Select all the ports desired to be changed to the RCP type, then press the [-> RCP] button (see the figure).
   - The port(s) to be changed to the RCP type must be disconnected from the host beforehand.
   - When a cable connection change instruction is displayed, connect the cable(s) to the object RCU(s). If the connection is(are) to be made via the ESCD(s), connect the cable to the ESCD(s).

5. Confirm the channel path

Confirm the changed path(s) is(are) varied off-line, and press [Yes] button.



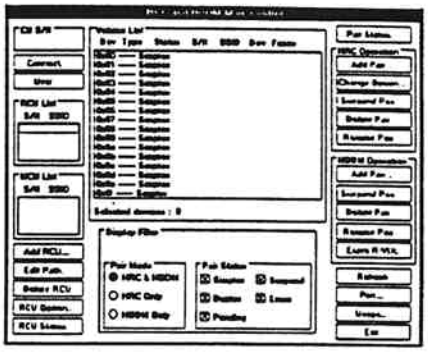
6. Terminating the RCP port setting

Compare again the port setting(s) displayed on the screen with that(those) described on the work sheet. Make sure that the port setting(s) has(have) been done as described on the work sheet, press the [Close] button (see the figure) and go to Item (2) "Registering the RCU(s)".

(2) RCU Registration

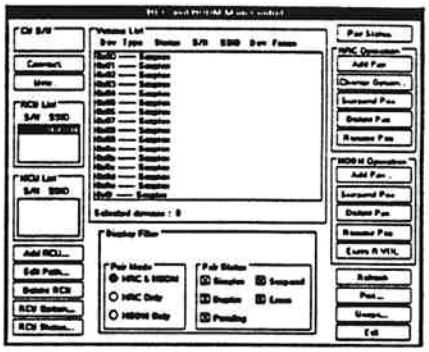
1. Confirming the registration of the existing RCU(s)

Compare the RCU(s) currently registered with the RCU(s) described on the work sheet referring to the RCU list (see the figure) on the HRC & HODM screen. When there is no need to register new RCU(s), go to Item (3) "HRC Pairing".



2. RCU registering screen

Press the [Add RCU...] button (see the figure) on the HRC & HODM screen.



3. Inputting RCU parameters

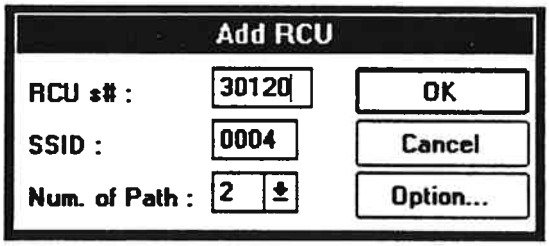
On the Add RCU screen (see the figure), perform the following.

Input a 5- digit decimal RCU serial number in RCU s#.

Input a 4- digit hexadecimal RCU SSID number in SSID.

Input SSID specified at the Define Configration and Install of RCU.

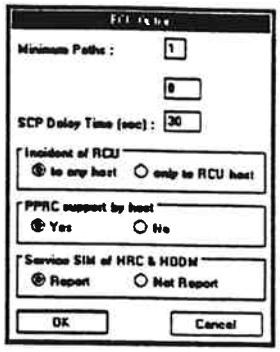
Select a number of the MCU-RCU logical paths from the combo-box at Num. of Path. The number can be either of 1 to 4.



When an RCU option other than the default one is to be selected, press the [Option...] button. Then go to step 4.

When all the above operations are finished, press the [OK] button (see the figure). Then go to step 5.

4. Setting the RCU option



On the RCU Option Setting screen (see the figure), perform the following.
Input the minimum number of paths to be used in succession in Minimum Paths.
Input the SCP delay time [sec.] in SCP Delay Time [sec.].
Set one of the following in Incident of RCU as the incident of the RCU.

- To any host
- Only to RCU host

Set one of the following in PPRC support by host.

- Yes
- No

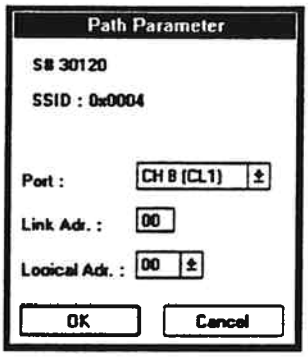
Set one of the following in Service SIM of HRC & HODM as handling the Service SIM of HRC & HODM.

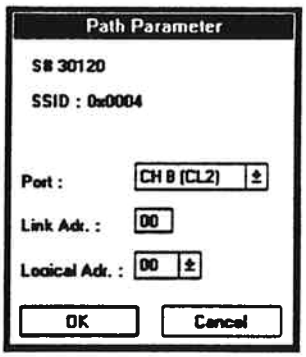
- Report
- Not Report

When all the above operations are finished, press the [OK] button (see the figure). Then go to step 3.

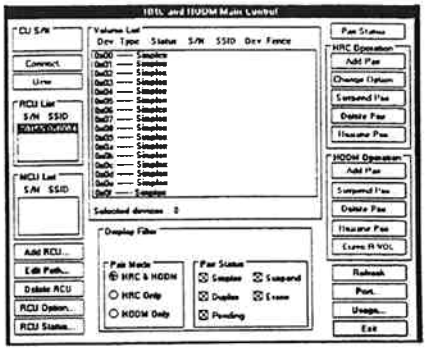
5. Inputting logical path parameters

This screen appears for each logical path inputted in step 3.
On each Logic Path Parameter Input screen, perform the following.
Select the RCP port to be connected to the object RCU from the combo-box in Port.
Input a 2-digit hexadecimal number of the link destination address in Link Adr. for the object RCU. When no ESCD is to be used, input '00' in Link Adr.
Select the logical address of the object RCU from the combo-box at Logical Adr.
Please select a logical address which are defined as CU images (00 through 03) in the RCU.
(Notes) DKC210I : It has only #00 as CU image.
DKC80I-3 : When the RCU is MPSD, select "00". When the RCU is SPSD, select "00" or "01" according to the device position.
Other DKC : There are some DKCs that have four CU images (00 through 03). In this case, please select corresponding logical address according to the device position.
After all the above operations are finished, press the [OK] button (see the figure).



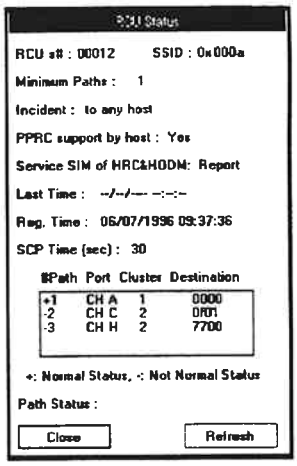


7. Select the RCU(s) currently registered from the RCU list displayed on the HRC & HODM screen, then select the [RCU Status...] screen.



8. Verifying the logical path(s)

Select one of the logical paths from the path list (see the figure) on the RCU Status screen. Make sure "Normal" is displayed in the "Status" field (see the figure).
After verifying the status of all the paths, press the [Close] button (see the figure).



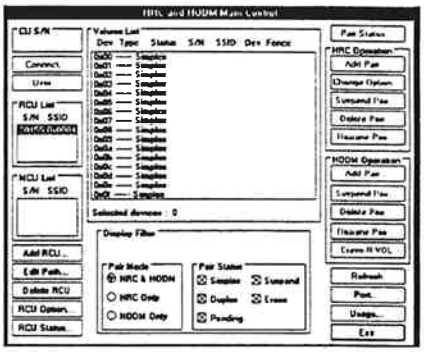
9. Registering the next RCU(s)

After registering the RCU(s), go to Item (3) "HRC Pairing". If there is(are) other RCU(s) to register, go back to step 2 to register it(them).

(3) HRC Pairing

1. Confirming the volume status

Make sure all the volumes to be paired are in the simplex status referring to the volume list (see the figure) on the HRC & HODM screen.



2. Selecting the volume(s) (M-VOL(s))

Select all the volumes to be paired from the volume list (see the figure) on the HRC & HODM screen and press the [Add pair...] button (see the figure) in "HRC Operacion".

Note : Don't select HODM R-Vol(s) as the HRC M_Vol(s).

3. Inputting the HRC pairing parameters

On the HRC Pairing Parameter Input screen, perform the following.

Input the volume number of the R-VOL in R-VOL corresponding to the M-VOL.

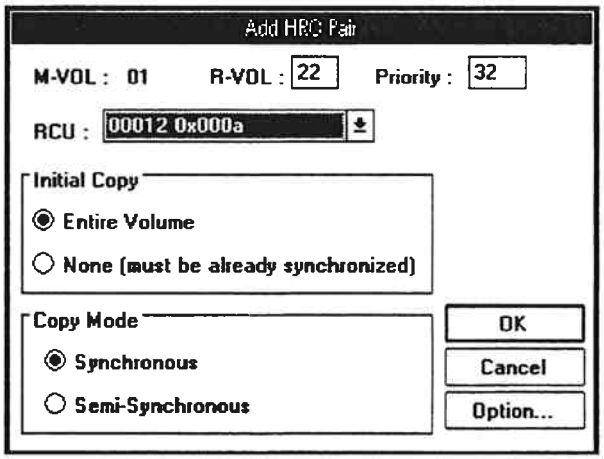
Input the Initial Copy Priority to the Priority.

Select the RCU from the combo-box at RCU.

Select one of the copy types indicated at Initial Copy.

Select one of the copy mode indicated at Copy Mode.

Press the [Option...] button (see the figure).



4. Setting HRC pair option

On the Pair Option screen, perform the following.

Set one of the following in Initial Copy Pace.

- 15 Tracks
- 3 Tracks

Set one of the following in DFW to R-VOL.

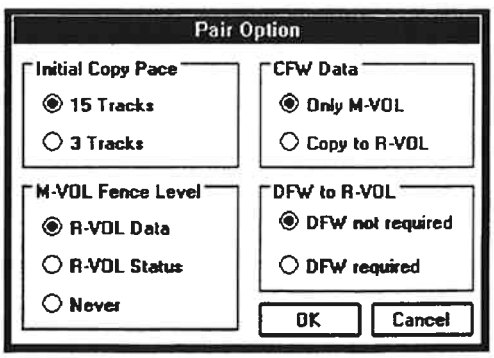
- DFW not required
- DFW required

Set one of the following in CFW data

- Copy to R-VOL
- Only M-VOL

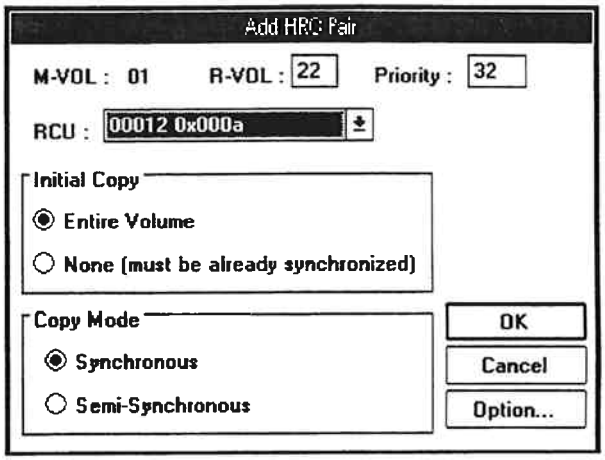
Set one of the following in M-VOL Fence Level.

- R-VOL Data
- R-VOL Status
- Never



When all above operations are finished, press [OK] button.

5. Press the [OK] button (see the figure).

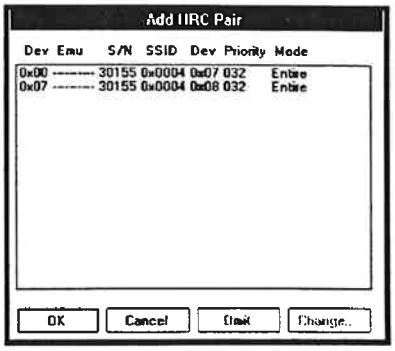


6. Confirm the parameter of an HRC paired

Confirm the volumes to be paired from the volume list (see the figure) on the Add HRC Pair screen and select [OK] button.

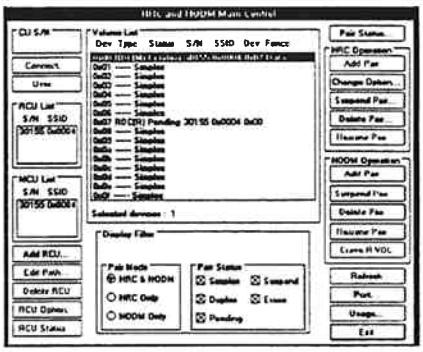
• If you want to change an HRC paired parameters of volumes, select the volumes from Add HRC Pair screen and select [Change...] button.

• If you want to omit an HRC pair create, select the volumes from Add HRC Pair screen and select [Omit] button.



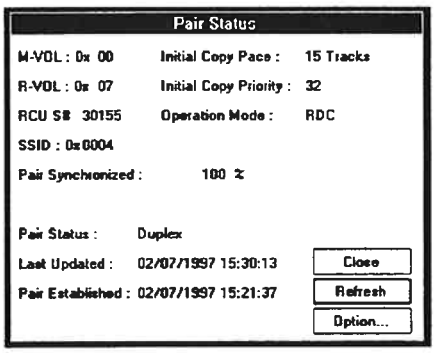
7. Verifying the status of an HRC paired

Select one of the volumes to be paired from the volume list (see the figure) on the HRC & HODM screen and press the [Pair Status...] button (see the figure).



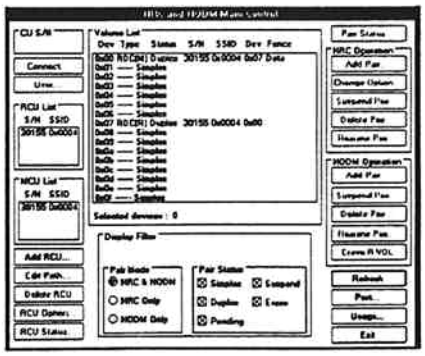
8. Checking the pairing matching rate check

Make sure "100%" is displayed for "Pair Synchronized" on the Pair Status screen. If not, wait for a while and press the [Refresh] button (see the figure) to update the display. After this, check the matching rate again. To refer to another VOL, press the [Close] button (see the figure) to go back to step 7. Repeat steps 7 and 8 until the matching rate of every volume to be paired reaches "100%".



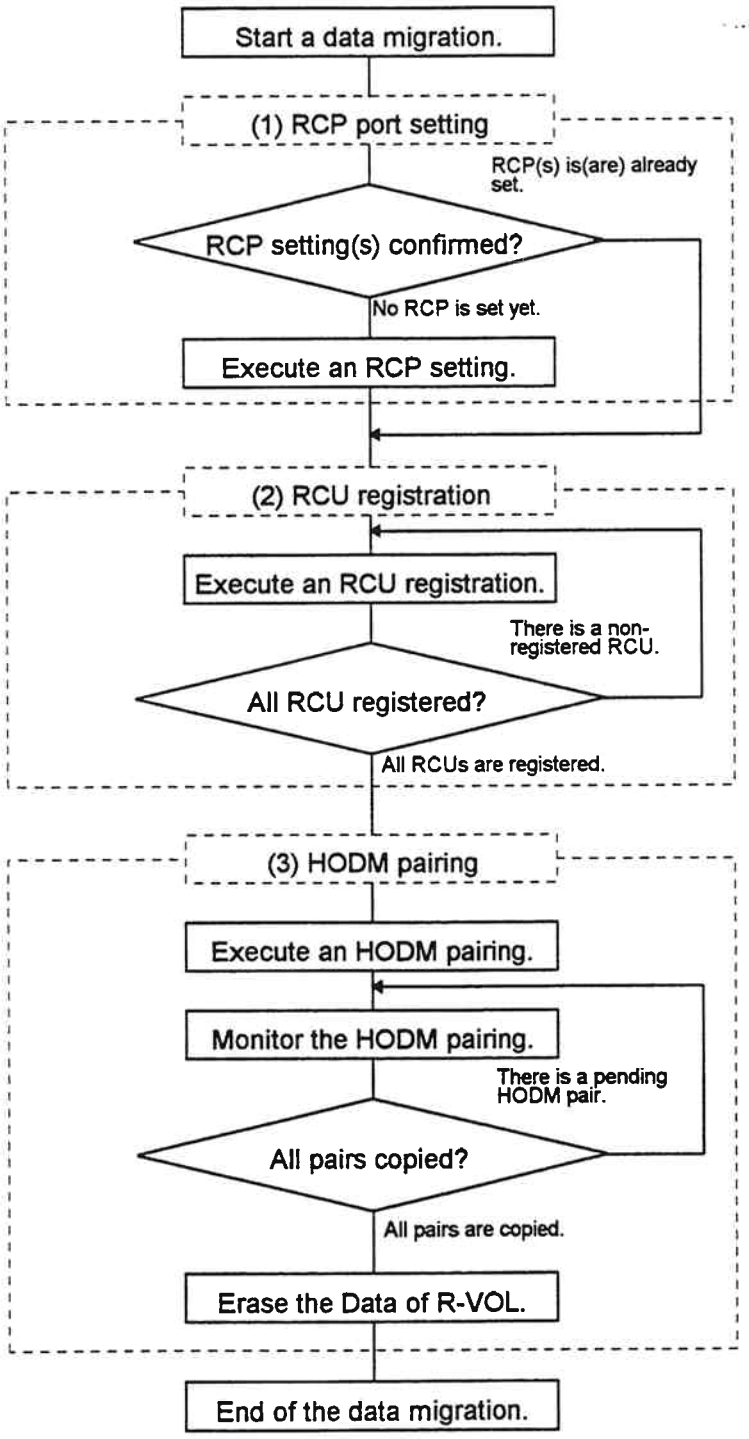
9. Final verification

Press the [Refresh] button (see the figure) on the HRC & HODM screen to update the screen display and make sure all the volumes to be paired and displayed in the volume list (see the figure) are in the duplex status.



20.2.7 Migrating Data (New HODM Pairing(s))

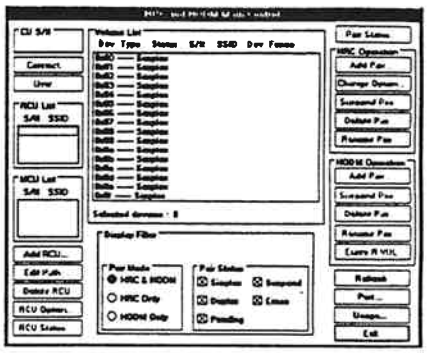
(1) Data Migrating Flow



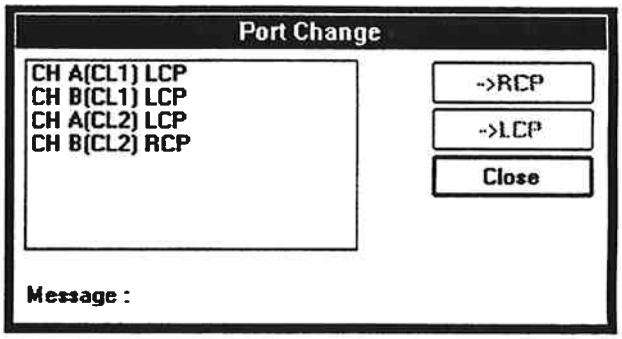
(1) RCP Port Setting

1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

2. Open the Port Setting window on the HRC & HODM screen.
   Press the [Port...] button (see the figure) on the HRC & HODM screen.



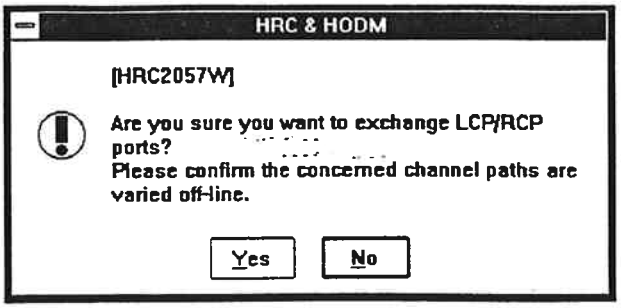
3. Confirming the port type(s)
   Compare the port setting(s) displayed on the screen with that(those) described on the work sheet. If the port setting(s) is(are) confirmed to be the same as that(those) on the work sheet, press the [Close] button (see the figure) and go to Item (2) "Registering the RCU(s)".



4. Changing the port type(s)
   Select all the ports desired to be changed to the RCP type, then press the [-> RCP] button (see the figure).
   - The port(s) to be changed to the RCP type must be disconnected from the host beforehand.
   - When a cable connection change instruction is displayed, connect the cable(s) to the object RCU(s). If the connection is(are) to be made via the ESCD(s), connect the cable to the ESCD(s).

5. Confirm the channel path

Confirm the changed path(s) is(are) varied off-line, and press [Yes] button.

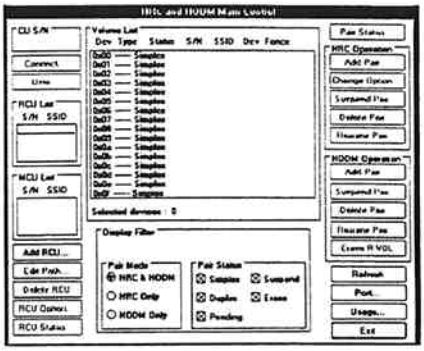


6. Terminating the of RCP port setting

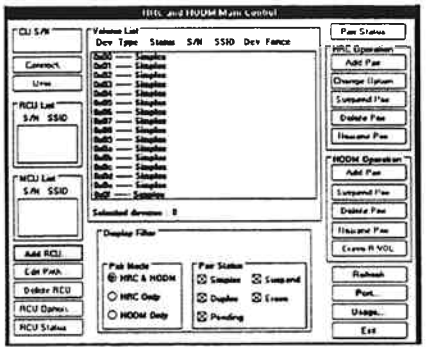
Compare again the port setting(s) displayed on the screen with that(those) described on the work sheet. Make sure that the port setting(s) has(have) been done as described on the work sheet, press the [Close] button (see the figure) and go to Item (2) "Registering the RCU(s)".

(2) Registering the RCU(s)

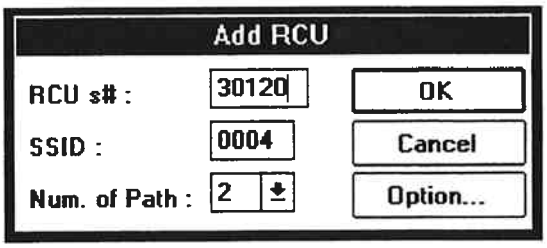
1. Confirming the RCU registration of the existing RCU(s)
Compare the RCU(s) currently registered with the RCU(s) described on the work sheet referring to the RCU list (see the Figure) on the HRC & HODM screen. When there is no need to register new RCU(s), go to Item (3) "HODM Pairing".



2. RCU registering screen
Press the [Add RCU...] button (see the figure) on the HRC & HODM screen.



3. Inputting RCU parameters
On the RCU Registering screen (see the figure), perform the following.
Input a 5- digit decimal RCU serial number in RCU s#.
Input a 4- digit hexadecimal RCU SSID number in SSID.
Input SSID specified at the Define Configration and Install of RCU.
Select a number of the MCU-RCU logical paths from the combo-box at Num. of Path. The number can be either of 1 to 4.
Press the [Option...] button (see the figure).

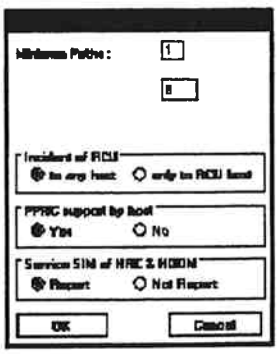


4. Setting the RCU option
On the RCU Option Setting screen (see the figure), perform the following.
Input the minimum number of paths to be used in succession in Minimum Paths.
Set one of the following in Incident of RCU.
- To any host
- Only to RCU host

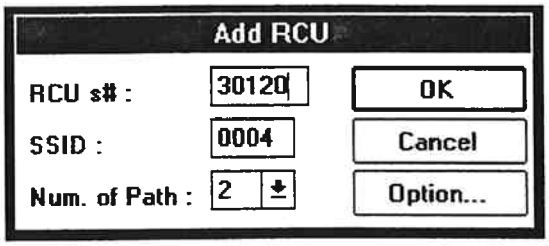
Set one of the following in PPRC support by host.
- Yes
- No

Set one of the following in Service SIM of HRC & HODM as handling the Service SIM of HRC & HODM.
- Report
- Not Report

When all the above operations are finished, press the [OK] button (see the figure).



5. Press the [OK] button (see the figure).



6. Inputting logical path parameters

This screen appears for each logical path inputted in step 3.

On each Logic Path Parameter Input screen, perform the following.

Select the RCP port to be connected to the object RCU from the combo-box in Port.

Input a 2-digit hexadecimal number of the link destination address in Link Adr. for the object RCU. When no ESCD is to be used, input '00' in Link Adr.

Select the logical address of the object RCU from the combo-box at Logical Adr.

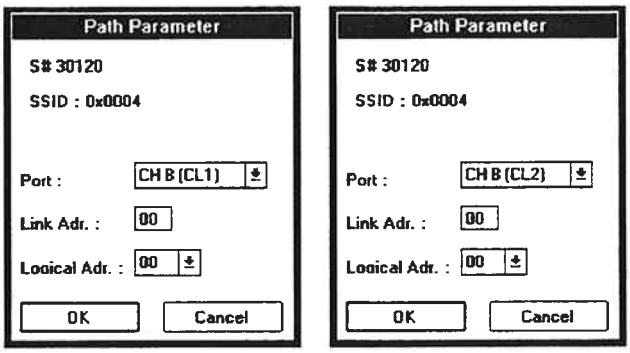
Please select a logical address which are defined as CU images (00 through 03) in the RCU.

(Notes) DKC210I : It has only #00 as CU image.

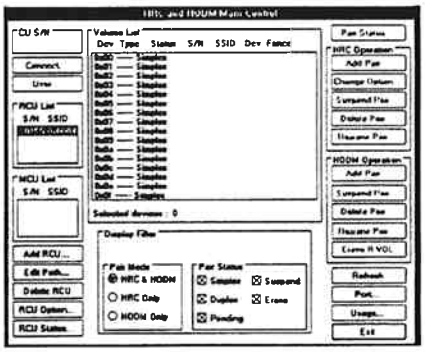
DKC80I-3 : When the RCU is MPSD, select "00". When the RCU is SPSD, select "00" or "01" according to the device position.

Other DKC : There are some DKCs that have four CU images (00 through 03).). In this case, please select corresponding logical address according to the device position.

After all the above operations are finished, press the [OK] button (see the figure).

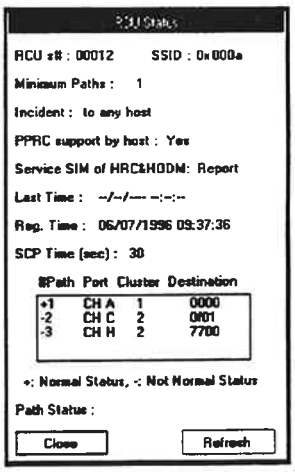


7. Select the RCU(s) currently registered from the RCU list displayed on the HRC & HODM screen, then press the [RCU Status...] button.



8. Verifying the logical path(s)

Select one of the logical paths from the path list (see the figure) on the RCU Status screen. Make sure "Normal" is displayed in the "Path Status" field (see the figure). After verifying the status of all the paths, press the [Close] button (see the figure).



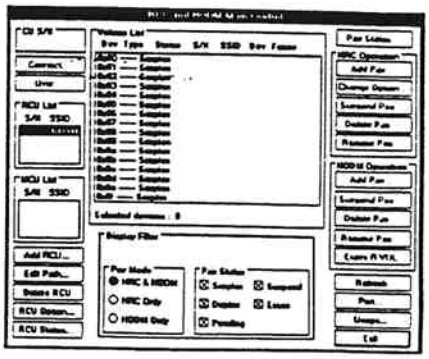
9. Registering the next RCU(s)

After registering the RCU(s), go to Item (3) "HODM Pairing". If there is(are) other RCU(s) to register, go back to step 2 to register it(them).

(3) HODM Pairing (Starting Data Migration)

1. Confirming the volume status

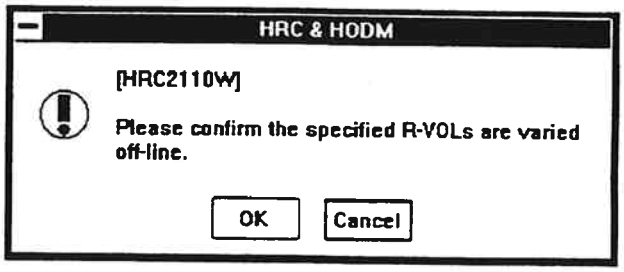
Make sure all volumes to be paired are in the simplex status referring to the volume list (see the figure) on the HRC & HODM screen.



2. Selecting the volume(s) (M-VOL(s))

Select all volumes to be paired from the volume list (see the figure) on the HRC & HODM screen and press the [Add pair...] button (see the figure) in "HODM Operation".

Then, confirm the R-Vols are varied off-line, press [OK] button.



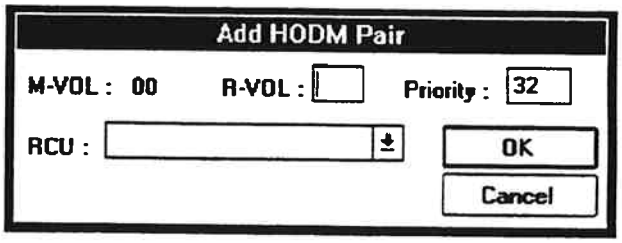
3. Inputting the HODM pairing parameters

On the HODM Pairing Parameter Input screen, perform the following.

Input the volume number of the R-VOL in R-VOL corresponding to the M-VOL.

Input the initial copy priority to the Priority.

Select the RCU from the combo-box at RCU.



When all operations above are finished, press the [OK] button (see the figure).

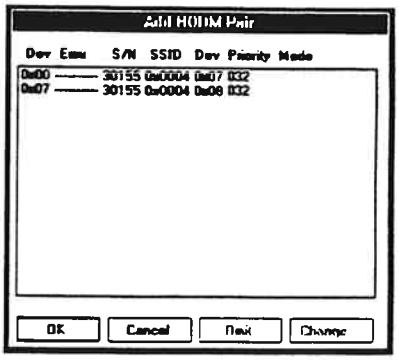
Note : Don't use the R-VOL of HODM as the M-VOL of HRC.

4. Confirm the parameter of an HODM paired

Confirm the volumes to be paired from the volume list (see the figure) on the Add HODM Pair screen and select [OK] button.

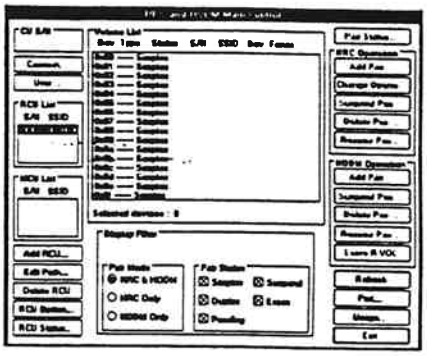
• If you want to change an HODM paired parameters of volumes, select the volumes from Add HODM Pair screen and select [Change...] button.

• If you want to omit an HODM pair create, select the volumes from Add HODM Pair screen and select [Omit] button.



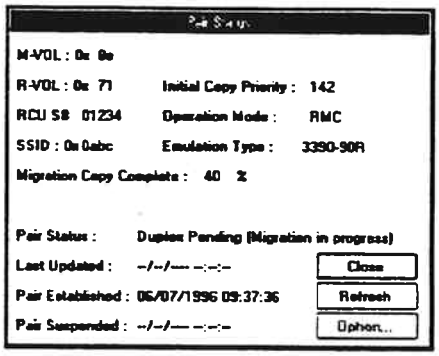
5. Verifying the status of an HODM paired

Select one of the volumes to be paired from the volume list (see the figure) on the HRC & HODM screen and press the [Pair Status...] button (see the figure).



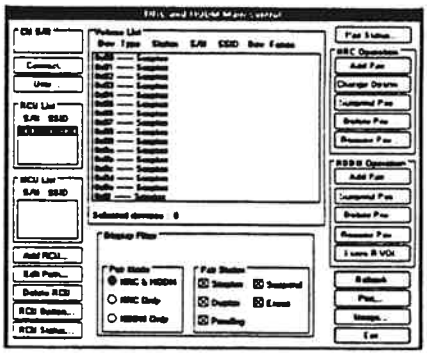
6. Checking the data migration progress rate

Make sure "100%" is displayed for "Migration Copy Complete" on the Pair Status screen. If not, wait for a while and press the [Refresh] button (see the figure) to update the display. After this, check the matching rate again. To refer to another VOL, press the [Close] button (see the figure) to go back to step 5. Repeat steps 5 and 6 until the matching rate of every volume to be paired reaches "100%".



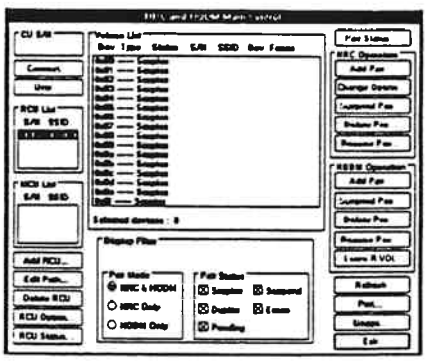
7. Verifying completion of the data migration

Press the [Refresh] button (see the figure) on the HRC & HODM screen to update the screen display and make sure all the volumes to be paired and displayed in the volume list (see the figure) are in the simplex(waiting for erasure) status (displayed as "Erase").



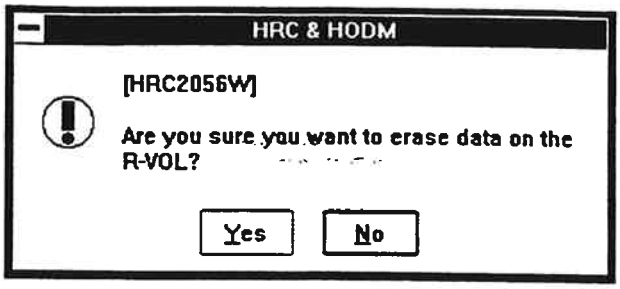
8. Erasing the source data of volume pair(s) completed migration

Select all the volume(s) to be erased from the volume list on the HRC&HODM screen and press the [Erase R-VOL] button (see the figure).



9. Instruction a erasing

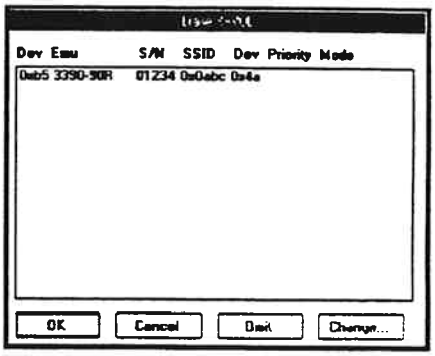
Press the [Erase R-VOL] button on the HRC & HODM screen. The confirmation message will appear. To delete the pair(s) really, press the [Yes] button.



10. Confirm the erasure volumes

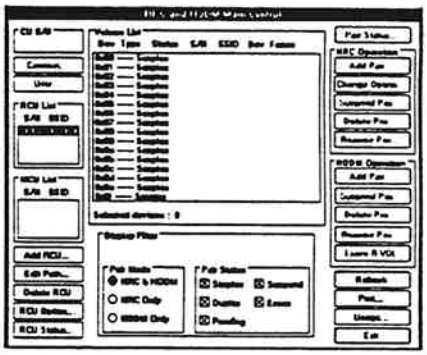
Confirm the erasure volumes that are displayed to the Erase R-VOL screen and select [OK] button.

If you want to omit the volume erasure, select the volumes from the list and select [Omit] button.



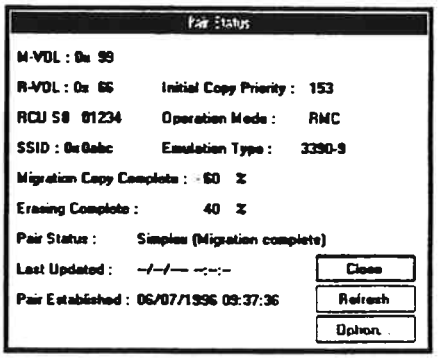
11. Verifying the status of an HODM paired

Select one of the volumes to be erased from the volume list (see the figure) on the HRC & HODM screen and press the [Pair Status...] button (see the figure).



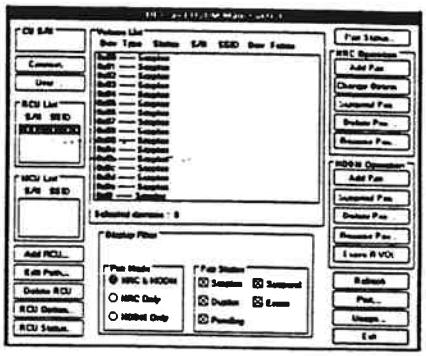
12. Checking the data erasing progress rate

Make sure "100%" is displayed for "Erasing Complete" on the Pair Status screen. If not, wait for a while and press the [Refresh] button (see the figure) to update the display. After this, check the matching rate again. To refer to another VOL, press the [Close] button (see the figure) to go back to step 10. Repeat steps 10 and 11 until the matching rate of every volume to be paired reaches "100%".



13. Verifying the data erase.

Verify if the volume(s) selected from the volume list (see the figure) is(are) in the simplex status by pressing the [Refresh] button on the HRC & HODM screen.



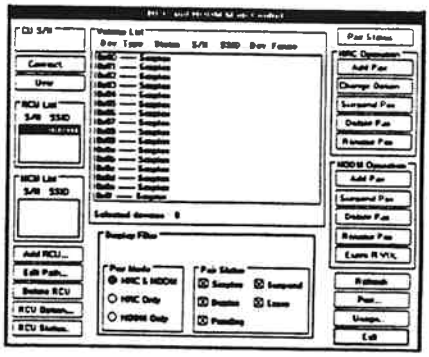
20.3 Maintenance Operation

20.3.1 Referring to the Path Status ..... HRC & HODM03-10

Refer to the MCU-RCU connection status. This operation is possible only from the MCU.

1. Display the HRC & HODM screen.
   Double-clock the HRC & HODM icon in the SVP group.

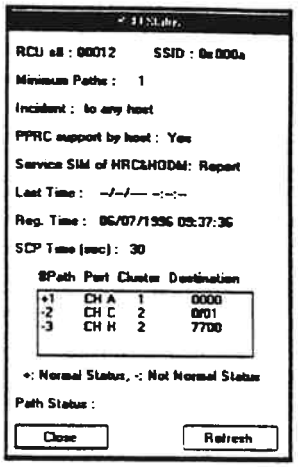
2. Selecting an RCU
   Select an RCU whose path status is desired to be referred to from the RCU list (see the figure) on the HRC & HODM screen. (Two or more RCUs cannot be selected here.)



3. Displaying the RCU status
   Select the [RCU Status...] button on the HRC & HODM screen to display the RCU Status screen.

4. Selecting a path to be displayed

The path list is displayed on the RCU Status screen. Select a path whose status is desired to be displayed from the list. (Two or more paths cannot be selected here.)



5. Updating the path status

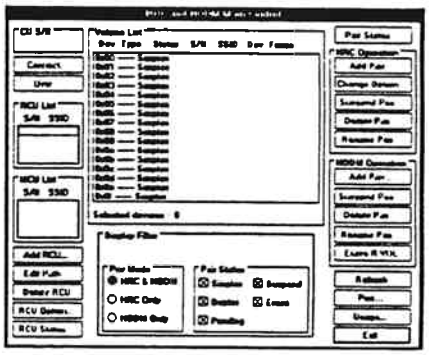
Select the [Refresh] button on the RCU Status screen to update the screen display. When updating the screen display, select the [Refresh] button. When closing the screen, select the [Close] button.

20.3.2 Referring to the Pair Status ..... HRC&HODM03-30

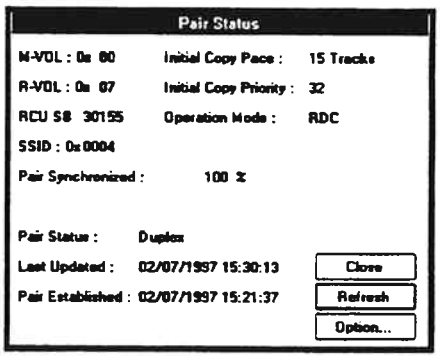
Refer to the object volume pair status. The screen data displayed will differ between when this operation is executed from only the MCU and when it is executed from the RCU.

1. Displaying the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

2. Selecting a volume
   Select a volume whose status is desired to be referred to from the volume list (see the figure) on the HRC & HODM screen. (Select only one volumes here although two or more volume can be selected from the list.)



3. Displaying the pair status
   Select the [Pair Status...] button on the HRC & HODM screen. The Pair Status screen will appear.



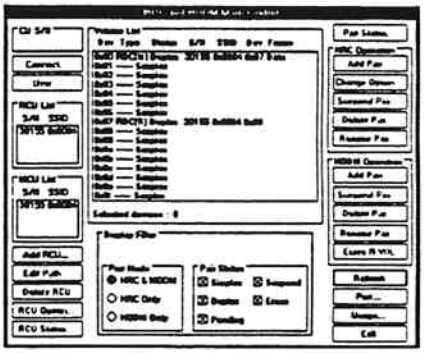
4. Updating the pair status
   Select the [Renew] button on the Pair Status screen. This operation updates the display of the pair status. Press the [Close] button to close the screen.

20.3.3 Suspending the Volume Pair (s) ..... HRC&HODM03-40

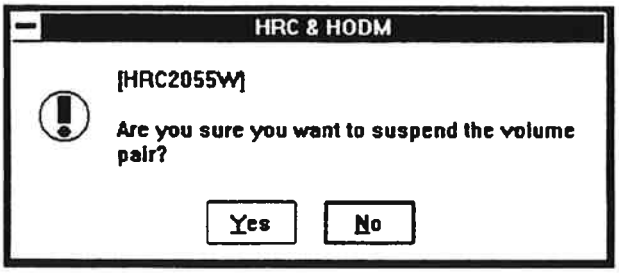
This operation suspends the object volume pair(s). The operation can be executed from both the MCU and the RCU.

1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

2. Selecting the volume(s)
   Select the volume(s) desired to be suspended from the volume list (see the figure) on the HRC & HODM screen.



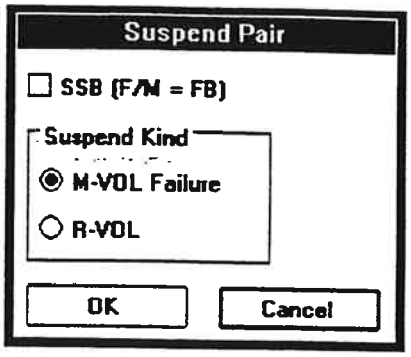
3. Instructing a suspension
   Select the [Pair Suspend...] button on the HRC & HODM screen. A confirmation message will appear. To suspend the pair really, press the [Yes] button. The Suspend Pair screen will appear.



4. Confirm the suspension volumes
   Confirm the suspension volumes that are displayed to the Suspend pair screen and select [OK] button and go to 6.
   If you want to change suspend parameters, select the volumes from the volume list and select [Change...] button and go to 5.
   If you want to omit the volume suspension, select the volumes from the volume list and select [Omit] button.

5. Inputting the suspending parameters

Press the [OK] button on the Suspend Pair screen to execute the suspending processing.

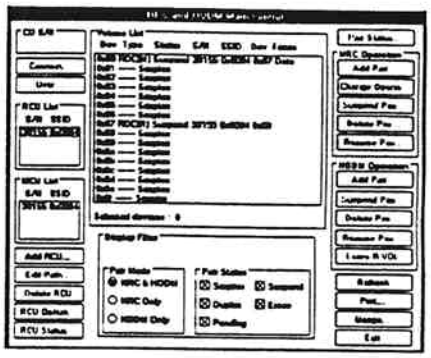


- SSB [F/M= FB]
  This parameter specifies whether to issue a suspension report with SSB[F/M= FB].
- Suspend type
  This parameter specifies which instruction is to be issued, an M-VOL suspension or an R-VOL suspension.

Notice : During the initial copy, M-VOL suspension is rejected. (Error Code = 0102)

6. Verifying the suspension

Verify if the volume selected from the volume list (see the figure) is in the suspended status or not by pressing the [Refresh] button on the HRC & HODM screen.

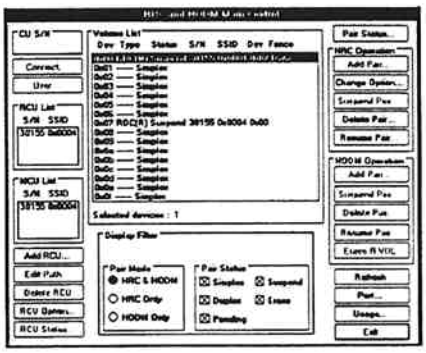


20.3.4 Resuming the Suspended Pair(s) ..... HRC&HODM03-60

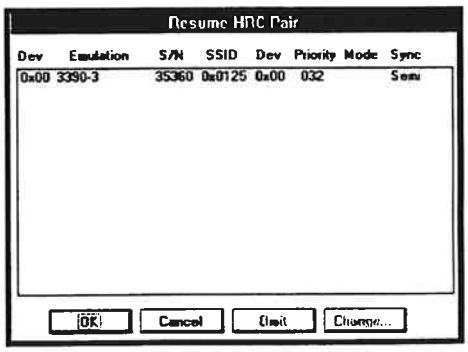
This operation resumes the volume pair(s) suspended. The operation can be performed only from the MCU.

1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

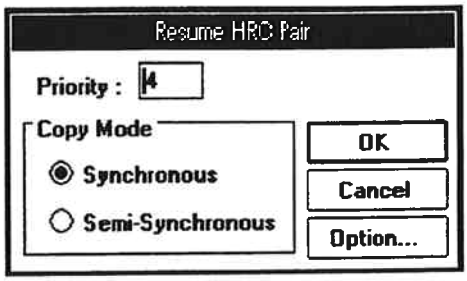
2. Selecting the volume(s)
   Select the volume(s) desired to be resumed from the volume list (see the figure) on the HRC & HODM screen to resume it.
   Select the [Resume Pair...] button on the HRC & HODM screen. The Resume Pair screen will appear.



3. Confirm a resume parameter
   Confirm a resume option on the Resume HRC Pair screen.
   Select the [OK] button on the Resume HRC Pair screen and go to 5.
   If you want to change resume parameter, select the volumes from the volume list and select [Change...] button and go to 4.
   If you want to omit resume pair, select the volumes from the volume list and select [Omit] button.



4. Inputting the resume parameter
   On the Resume HRC pair Parameter Input screen, perform the following.
   Input the initial copy priority to the Priority.
   Select one of the copy mode indicated at Copy Mode.
   If you want to set pair option, press [Option...] button and go to 5.
   When all operations above are finished, press the [OK] button (see the figure) and go to 3.



5. Setting HRC pair option

On the Pair Option screen, perform the following.

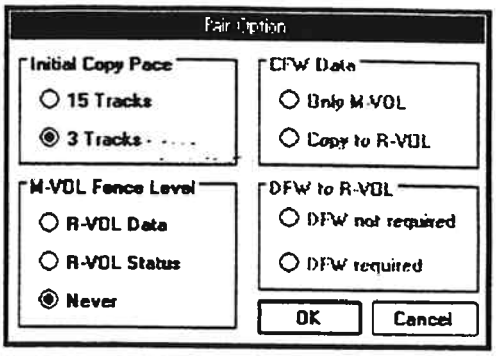
Set one of the following in Initial Copy Pace.

- 15 Tracks
- 3 Tracks

Set one of the following in M-VOL Fence Level.

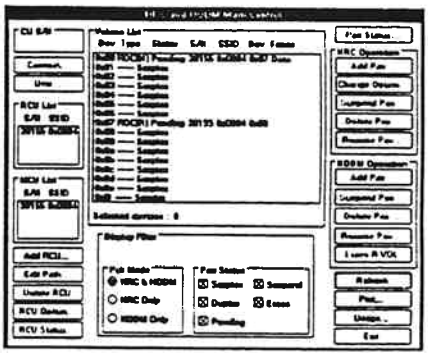
- R-VOL Data
- R-VOL Status
- Never

When all above operation are finished, press [OK] button. Then go to 4.



6. Verifying the resumption

Verify if the volume(s) selected from the volume list (see the figure) is in the pending (or duplex) status by pressing the [Refresh] button on the HRC & HODM screen.

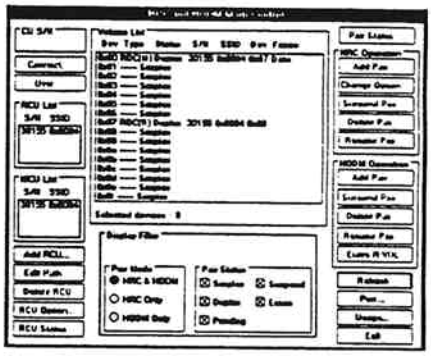


20.3.5 Deleting the Existing HRC Pair(s) ..... HRC&HODM03-80

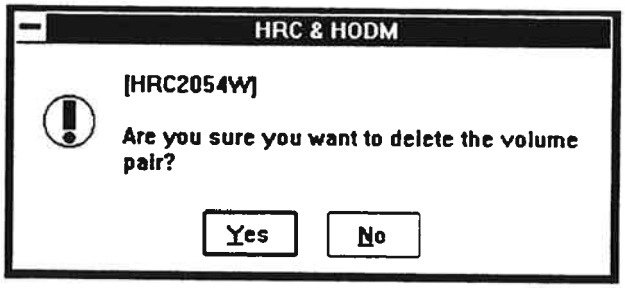
This operation deletes the HRC pair(s). The operation can be performed from both the MCU and the RCU.

1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

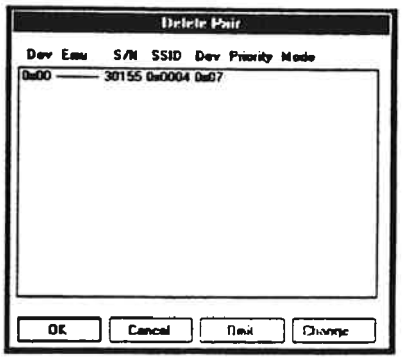
2. Selecting the volume(s)
   Select the volume pair(s) desired to be deleted from the volume list (see the figure) on the HRC & HODM screen.



3. Instructing the deletion
   Select the [Delete Pair...] button on the HRC & HODM screen. The confirmation message will appear. To delete the pair(s) really, press the [Yes] button. Then Delete Pair screen will appear.

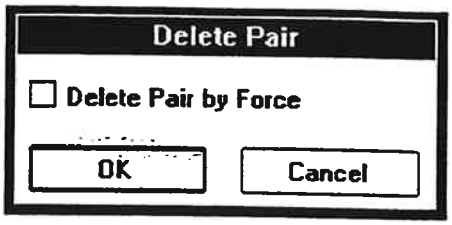


4. Confirm the deletion volumes
   Confirm the deletion volumes that are displayed to the Delete pair screen and select [OK] button and go to 6.
   If you want to change delete parameters, select the volumes from the volume list and select [Change...] button and go to 5.
   If you want to omit the volume deletion, select the volumes from the volume list and select [Omit] button.



5. Inputting a deleting parameter

Press the [OK] button on the Delete Pair screen to execute the deletion and go to 4.

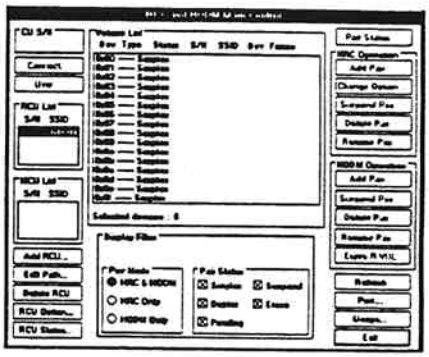


• Delete by Force

This parameter deletes the selected pair(s) forcibly regardless of the status of the communication between MCU and RCU.

6. Verifying the pair(s) deleted

Verify if the volume(s) selected from the volume list (see the figure) is(are) in the simplex status by pressing the [Refresh] button on the HRC & HODM screen.

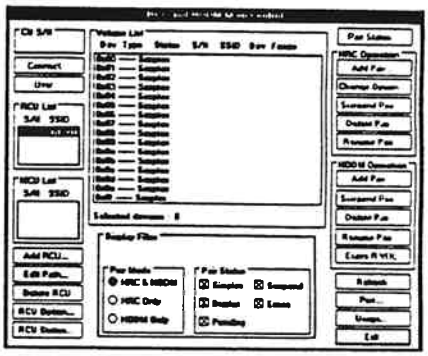


20.3:6 Deleting the Existing HODM Pair(s) ..... HRC&HODM03-100

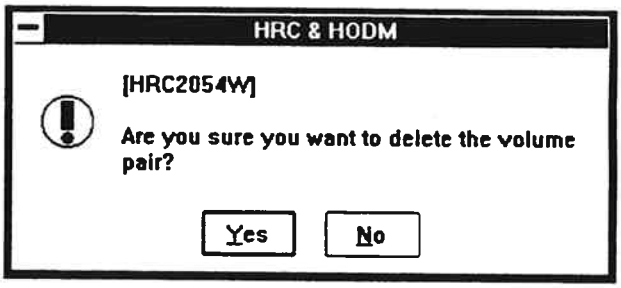
This operation deletes the HODM pair(s). The operation can be performed only from the MCU.

1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

2. Selecting the volume(s)
   Select the volume pair(s) desired to be deleted from the volume list (see the figure) on the HRC & HODM screen.



3. Instructing a deletion
   Press the [Delete Pair...] button on the HRC & HODM screen. The confirmation message will appear. To delete the pair(s) really, press the [Yes] button. The Delete Pair screen will appear.



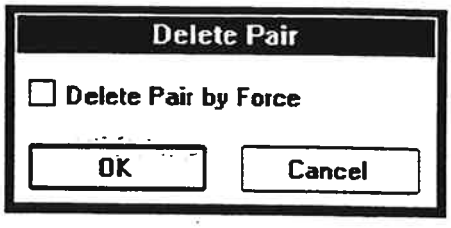
4. Confirm the deletion volumes
   Confirm the deletion volumes that are displayed to the Delete pair screen and select [OK] button and go to 6.
   If you want to change delete parameters, select the volumes from the volume list and select [Change...] button and go to 5.
   If you want to omit the volume deletion, select the volumes from the volume list and select [Omit] button.

5. Inputting a deleting parameter

Press the [OK] button on the Delete Pair screen to execute the deletion and go to 4.

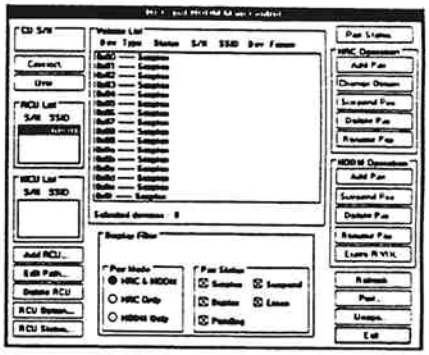
- Delete by Force

This parameter deletes the selected pair(s) forcibly regardless of the status of the communication between MCU and RCU.



6. Verifying the pair(s) deleted

Verify if the volume(s) selected from the volume list (see the figure) is(are) in the simplex status by pressing the [Refresh] button on the HRC & HODM screen.

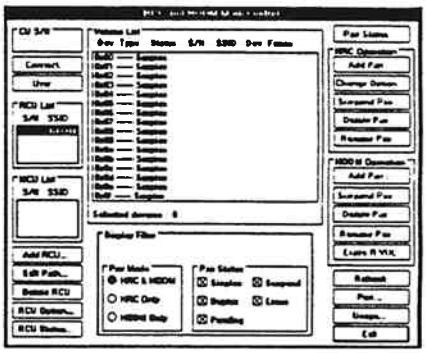


20.3.7 Deleting an RCU Registered ..... HRC&HODM03-120

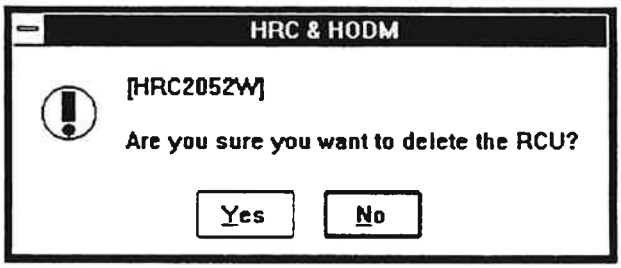
This function deletes an RCU. The function can be executed only from the MCU.

1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

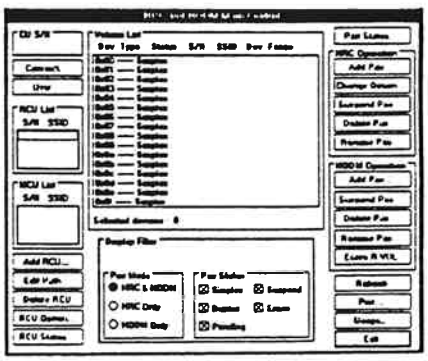
2. Selecting an RCU
   Select an RCU desired to be deleted from the RCU list (see the figure) on the HRC & HODM screen. (Only one RCU can be selected here.)



3. Instructing the deletion
   Select the [Delete RCU] button on the HRC & HODM screen. The confirmation message will appear. To delete the RCU really, press the [Yes] button.



4. Verifying the RCU deletion
   Press the [Refresh] button on the HRC & HODM screen to verify if the RCU selected from the RCU list (see the figure) is deleted.

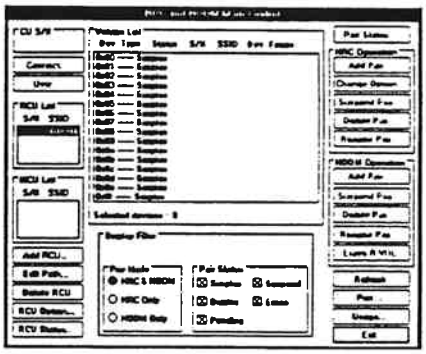


20.3.8 Adding the Path(s) to the RCU ..... HRC&HODM03-130

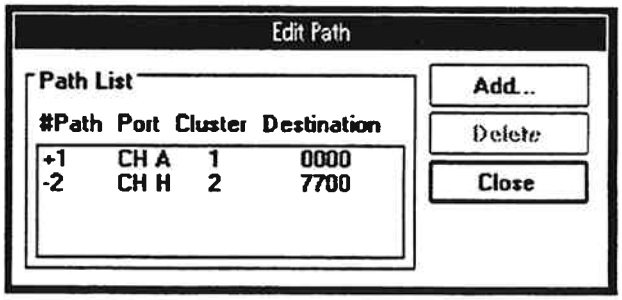
This operation adds the path(s) to the RCU already registered. The operation can be performed from both the MCU and the RCU.

1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

2. Selecting an RCU
   Select an RCU the number of paths to which is desired to be increased from the RCU list (see the figure) on the HRC & HODM screen. (Only one RCU can be selected here.)



3. Instructing the addition of the path(s)
   Select the [Edit Path ...] button on the HRC & HODM screen. The Edit Path screen will appear. Then press the [Add...] button on the screen.



4. Inputting the parameters

When the Path Parameter screen appears, input the necessary parameters and press the [OK] button.

- Port

  Specify the RCP port.

- Destination link address

  Specify the RCU side link address. When the ESCD is to be used, input the RCU-connected link address. When the ESCD is not used, input '00'.

- Logical address

Please select a logical address which are defined as CU images (00 through 03) in the RCU.

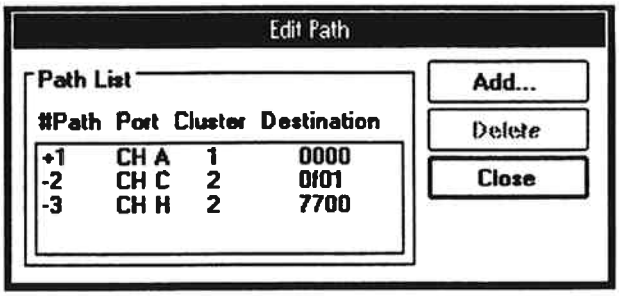
(Notes) DKC210I : It has only #00 as CU image.

DKC80I-3 : When the RCU is MPSD, select "00". When the RCU is SPSD, select "00" or "01" according to the device position.

Other DKC : There are some DKCs that have four CU images (00 through 03).). In this case, please select corresponding logical address according to the device position.

5. Verifying the path added

Make sure on the Edit Path screen that the specified path has been added correctly.

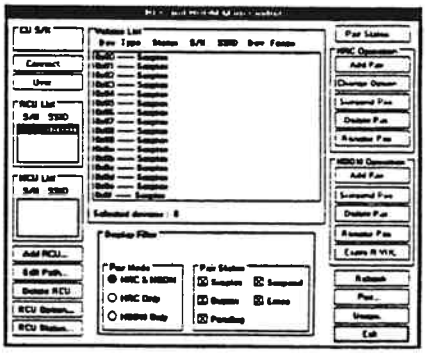


20.3.9 Reducing the Path(s) from the RCU ..... HRC&HODM03-150

This operation reduces the number of paths connected to an RCU registered already.

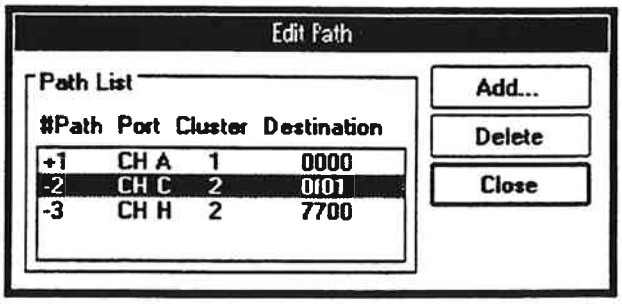
1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

2. Selecting an RCU selection
   Select an RCU the number of paths to which is desired to be reduced from the RCU list (see the figure) on the HRC & HODM screen. (Only one RCU can be selected here.)



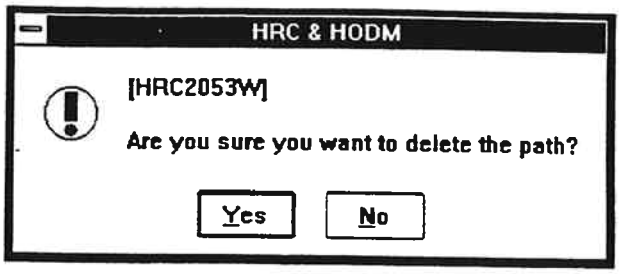
3. Instructing the reduction of the path(s)
   Select the [Edit Path...] button on the HRC & HODM screen. The Edit Path screen will appear.

4. Selecting a path to be deleted
   Select a path desired to be deleted from the path list displayed on the Edit Path screen and press the [Delete] button.



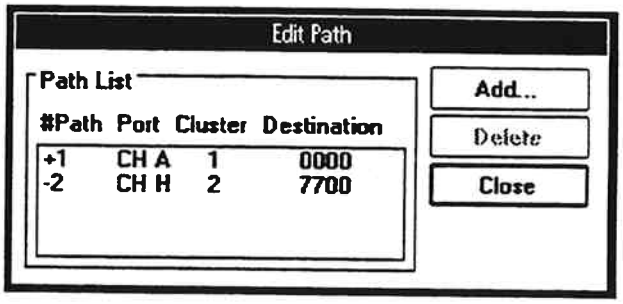
5. Confirmation message

When the confirmation message appears, confirm the path to be deleted and press the [Yes] button.



6. Verifying the path deleted

Make sure on the Edit Path screen that the path specified has been deleted correctly.

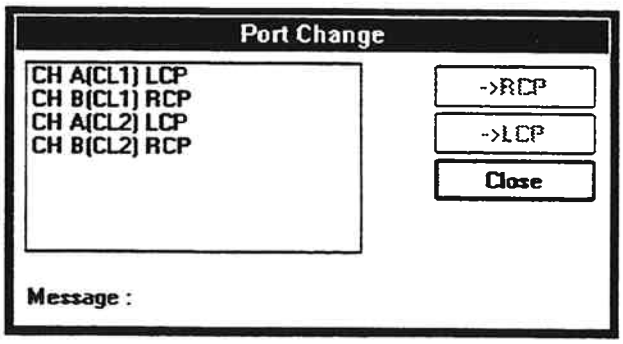


20.3.10 Changing the Port Type ..... HRC&HODM03-170

This operation specifies which port type is selected, LCP (to connect to the host) or RCP (to connect to the RCU).

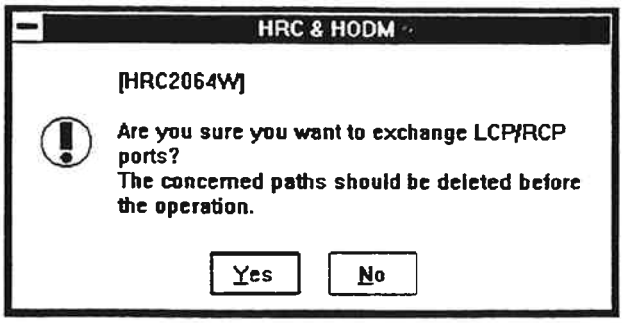
1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

2. Selecting the processing to change the port type
   Select the [Port...] button on the on the HRC & HODM screen to display the Path Change screen.



3. Instructing the port change
   When the port list and the port types are displayed in the list box on the Path Change screen, select one or more ports whose type(s) is(are) to be changed.
   To select LCP for the port type, press the [-> LCP] button. Then go to step 4.
   To select RCP for the port type, press the [-> RCP] button. Then go to step 5.

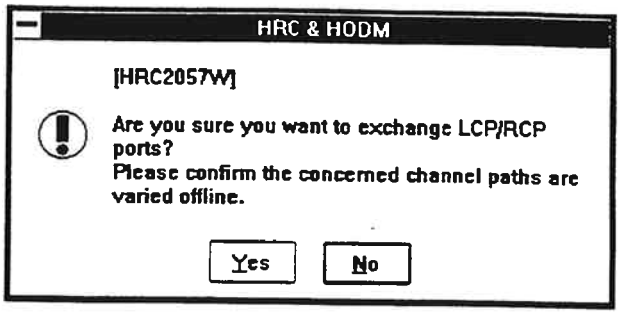
4. Confirmation message and indication of executing status
   When the confirmation message appears, confirm the port(s) whose type(s) is(are) to be changed again. If it is correct, press the [Yes] button.
   Status of execution is displayed in the "Message" field on the Port Change screen.
   Go to step 6.



5. Confirmation message and indication of executing status

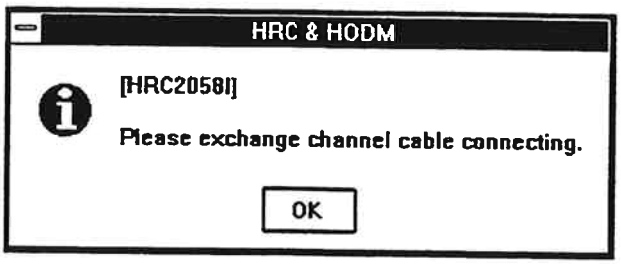
When the confirmation message appears, confirm the port(s) whose type(s) is(are) to be changed again. If it is correct, press the [Yes] button.

Status of execution is displayed in the "Message" field on the Port Change screen.



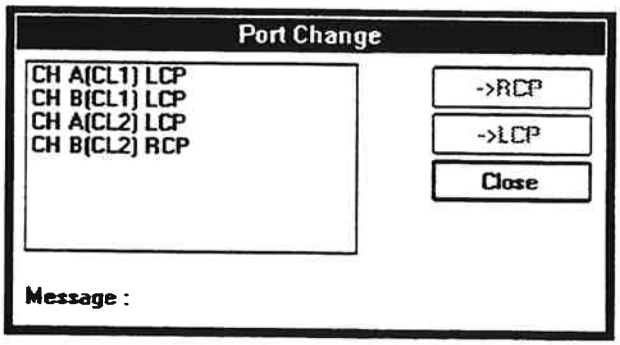
6. Indication message

After exchanging channel cable connecting, press the [OK] button.



7. Verifying port change

After the change is finished, make sure on the Port Change screen that the type(s) of the specified port(s) has(have) been changed correctly.

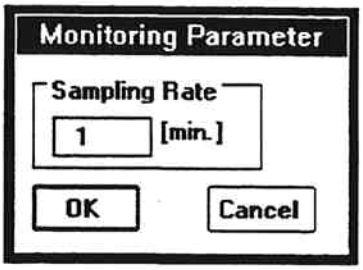


20.3.11 Displaying HRC/HODM Operation Status ..... HRC&HODM03-190

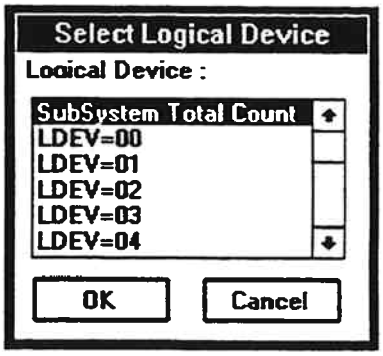
This operation displays a graphic indication of the HRC/HODM operation status.

1. Display the HRC & HODM screen.
   Double-click the HRC & HODM icon in the SVP group.

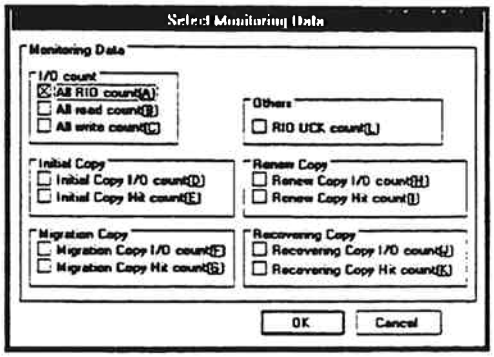
2. Setting a sampling rate
   Press the [Usage...] button on the on the HRC & HODM screen to display the Sampling Rate Setting screen. Then, input a sampling rate and press the [OK] button. (Sampling rate can be set within 1 to 546 minutes in steps of 1 minute.)



3. Selecting an object device
   When the valid logical device list is displayed in the list box on the Select Logical Device screen, select a logical device and press the [OK] button. To display the information of the whole subsystem, select "Sub System".

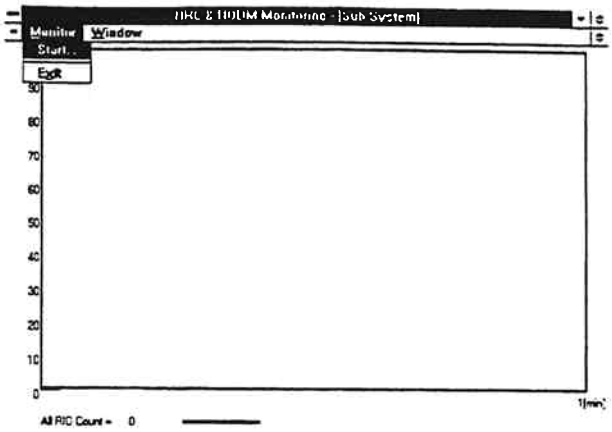


4. Selecting information desired to be acquired
   Select one or more data items on the Select Monitoring Data screen, then press the [OK] button.



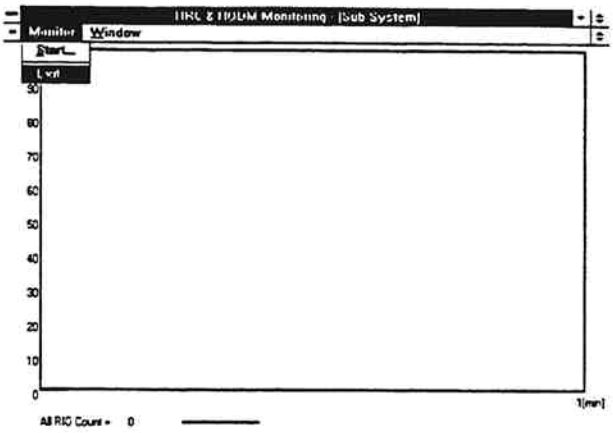
5. Displaying the operation information

The Operation Information Display window appears. To view operation information of other devices, select Monitor-Start from the menu and go to step 3. (Two or more screens can be displayed at a time.)



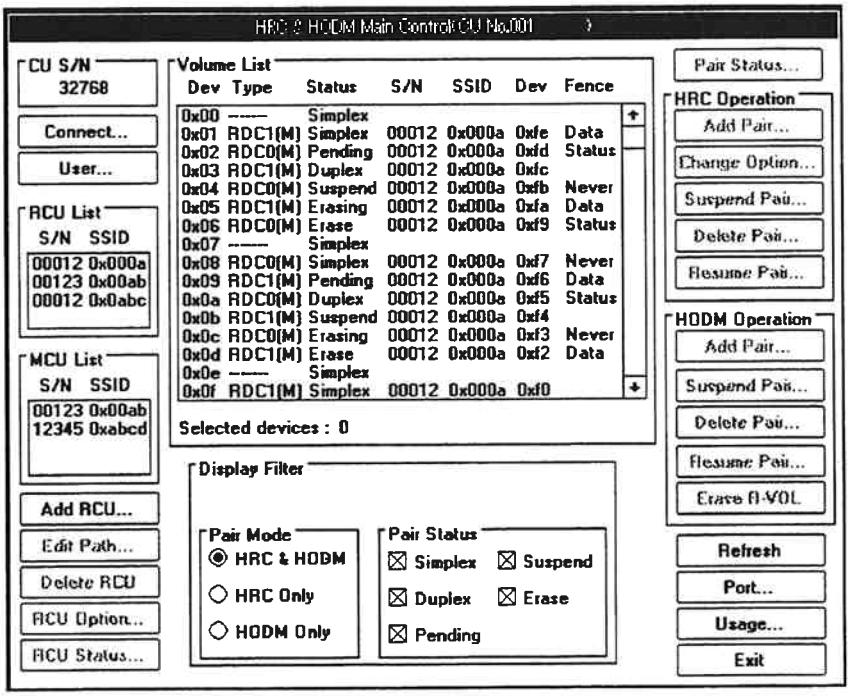
6. Terminating the operation information display

To terminate the operation information display, select Monitor-Exit to return to the HRC & HODM screen.



20.4 References for SVP Operation Screen

20.4.1 HRC & HODM Main screen



RCU List ..... This List Box displays Controllers as RCU(Remote disk Control Unit).
"XXXXX 0xXXXX"
Serial Number SSID

MCU List ..... This List Box displays Controllers as MCU(Main disk Control Unit).
(Only volume pairing is established.)
"XXXXX 0xXXXX"
Serial Number SSID

Volume List..... This List Box displays valid LDEV(Logical Device) and the pair status.
"0xXX XXXX(X) XXXXXXX XXXXX 0xXXXX 0xXX X"
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① #LDEV ..... LDEV address

② Copy Type..... "RDC" : Remote Dual Copy(HRC)
"RMC" : Remote Migration Copy(HODM)
"---" : SIMPLEX Volume

③ Copy Mode..... "0" : Synchronous
"1" : Semi-Synchronous
"-" : SIMPLEX Volume

④ Volume Type..... "M" : Main Volume,
"R" : Remote Volume
" - " : SIMPLEX Volume

⑤ Pair status ..... Volume pair status
"Simplex" : Simplex
"Duplex" : Duplex
"Pending" : Pending
"Suspend" : Suspend
"Erase" : Simplex (Waiting for Erasure)
"Erasing" : Simples (Erasing in progress)

⑥ Serial Number/SSID..... Serial Number and SSID of destination Controller.

⑦ #LDEV ..... LDEV address on the destination Controller.

⑧ Fence Level ..... LDEV Fence Level

Display Filter..... Display filter of the Volume List.
"All".....All valid LDEVs are displayed.
"Select" .....LDEVs that were selected by check box are displayed.

Port Operation

Port ..... Changes the port type between LCP and RCP.

When the MCU is connected to the RCU, the MCU side port type must be set to RCP.

Path Operation

Add RCU ..... Establishes the path between the MCU and the RCU. When establishing the path, the MCU must register the object RCU first. This function registers the object RCU and establishes the path at a time. When the MCU registers the object RCU successfully, the RCU is added to the RCU list. (Up to 4 RCU units can be registered for one MCU.)

Edit Path ..... Adds/reduces the number of paths to an RCU selected from the RCU list within a range of 1 to 4.

Delete RCU ..... Deletes an RCU selected from the RCU list and the path(s) to the RCU at a time. Before executing this function, all the units paired with the RCU must be set to simplex status.

RCU Option ..... Changes the option for connection to an RCU selected from the RCU list. The connection option can also be specified when the RCU is registered, but this function is used to change the option during operation.

RCU Status ..... Displays the status of an RCU selected from the RCU list. This function can also display the status of each path to the RCU.

Pair Operation

Pair Status..... Displays the status of a volume selected from the volume list. This function is disabled if two or more volumes are selected from the volume list.

HRC Pair Operation

Add Pair..... Creates the HRC pair(s) by making the simplex volume(s) selected from the volume list become the M-VOL(s). Before executing this function, the CU that includes the R-VOL(s) must be registered as the RCU(s). This function is disabled if the volume(s) selected include(s) the volume(s) in the status other than simplex.

Change Option..... Changes the pair option of the volume(s) (not in the simplex status) selected from the volume list. The pair option can also be specified when the pair is created, but this function is used to change the option during the operation. This function is disabled if any volume(s) selected include(s) the simplex volume(s).

Suspend Pair ..... Suspends the pair(s) of the volume(s) (not in the simplex status) selected from the volume list. This function is disabled if any volume(s) selected include(s) the simplex volume(s).

Delete Pair ..... Deletes the pair of the volume(s) (not in the simplex status) selected from the volume list. This function is disabled if the volume(s) selected include(s) a simplex volume(s).

Resume Pair..... Resume the pair of the volume(s) (in the suspend status) selected from the volume list. This function is disabled if the volume(s) selected include(s) a simplex volume(s).

HODM Pair Operation

Add Pair..... Instructs the simplex volume(s) selected from the volume list to migrate data to volume(s). Before executing this function, the CU that includes source volume(s) must be registered as the RCU. This function is disabled if the selected volume(s) include(s) the volume(s) in the status other than simplex.

Suspend Pair ..... Suspends the pair(s) of the volume(s) (not in the simplex status) selected from the volume list. This function is disabled if any volume(s) selected include(s) the simplex volume(s).

Delete Pair ..... Deletes the pair of the volume(s) (not in the simplex status) selected from the volume list. This function is disabled if the volume(s) selected include(s) a simplex volume(s).

Resume Pair..... Resume the pair of the volume(s) (in the suspend status) selected from the volume list. This function is disabled if the volume(s) selected include(s) a simplex volume(s).

Erase R-VOL ..... Instructs the volume(s) (waiting for data erasure) selected from the volume list to erase R-VOL data.

Remote Console Functions

User ..... Registers/deletes HRC/HODM users and changes their passwords. This function cannot be used from the SVP (can be used only from the remote console).

Connect..... Switches CU connected. This function cannot be used from the SVP (can be used only from the remote console).

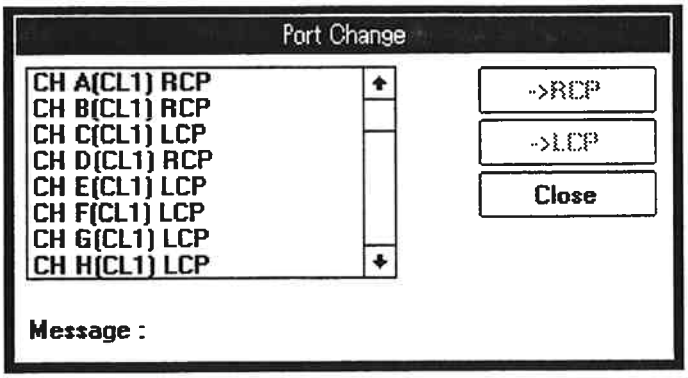
Other Functions

Usage..... Displays HRC/HODM operation control information.

Refresh..... Updates information displayed on the screen. Information displayed on the screen is kept as is until this function is executed.

Exit..... Exits the operation screen.

20.4.2 Port...screen



List..... Displays the list of usable serial channels.

CH X[CL Y] XXX
① ② ③

① Channel ID (A to H)

② Cluster ID (1 or 2)

③ Channel type (LCP or RCP)

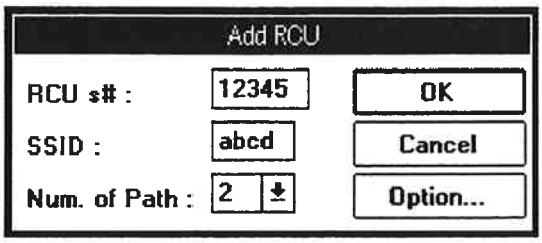
-> RCP ..... Changes the channel type selected from the list to the RCP.

-> LCP ..... Changes the channel type selected from the list to the LCP.

Message..... Displays the progress of each changing process when the Changing function is started.
Checking port# CH X[CL Y] ...
Blocking port# CH X[CL Y] ...
Setting port# CH X[CL Y] ...
Restoring port# CH X[CL Y] ...

20.4.3 Add RCU... screen

• Specify RCU parameter.



RCU s# — Input the Serial number of RCU.
"XXXXX".... 5 decimal digits number.
If the serial number is greater than 65535, input "0" followed by the last 4 digits of the serial number. For example, you must input "07890" for the serial number of "67890".

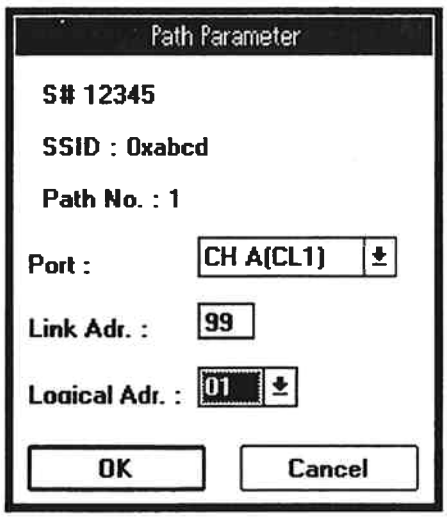
SSID.....Input the SSID of RCU.
"XXXX" ..... 4 hexadecimal digits number.

Num. Of Path .....Specifies the number of path between MCU & RCU.(1 ~ 4)

Option... .....Specified RCU option item. (Refer to RCU Option...)

• Specify PATH parameter.

Input the RCU parameter, then input the path parameter for each specified path.

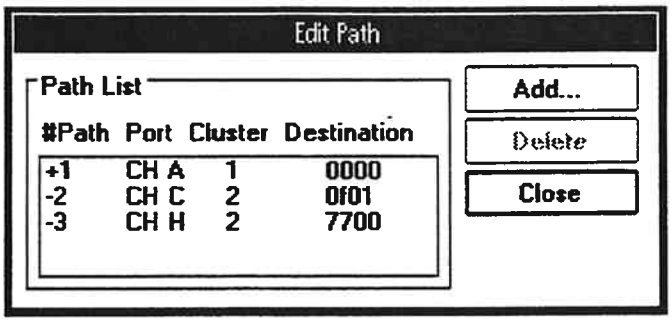


Port — Specified port using as RCP in the Combo Box.

Link Adr. — Input the destination link address.
"XX" ..... 2 characters of hexadecimal number. ("00" through "fd")
If RCU is connected to MCU directly without ESCD, specified "00" at the [Link Adr.].
If RCU is connected to MCU with ESCD, specified destination link address at the [Link Adr.].

Logical Adr. .....Specified logical address of the destination DKC.
Please select a logical address which are defined as CU images (00 through 03) in the RCU.
(Notes) DKC210I : It has only #00 as CU image.
DKC80I-3 : When the RCU is MPSD, select "00". When the RCU is SPSD, select "00" or "01" according to the device position.
Other DKC : There are some DKCs that have four CU images (00 through 03).). In this case, please select corresponding logical address according to the device position.

20.4.4 Edit Path... screen



Path List.....Display current path's information.

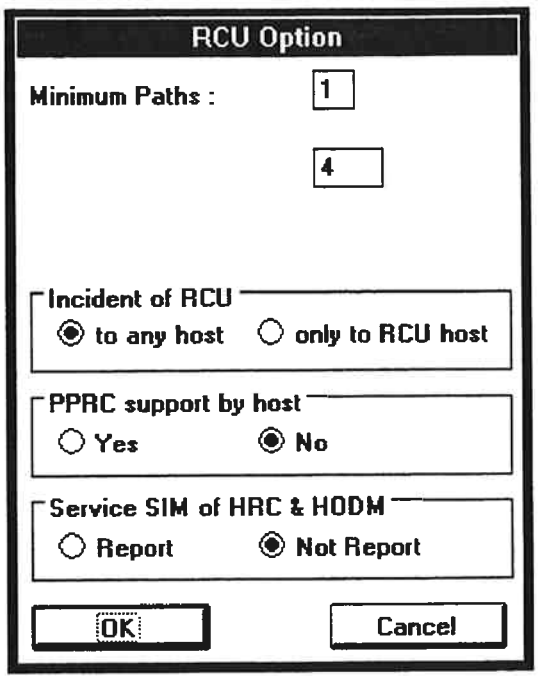
"X CH X X XXXX"
① ② ③ ④

① #Path ..... Status(+:Normal -:Abnormal) and Path No.(1 ~ 4)
② #Port..... Port of path creating.(CH A ~ CH H)
③ #Cluster..... Cluster. (1 ~ 2)
④ Destination ..... Link address (2 hexdecimal numbers) + Logical address (2 hexdecimal numbers)

Add... .....Adding new path.(Refer to Add.. RCU-Specified Path Parameter)

Delete.....Deleting the path selected in the Path List.

20.4.5 RCU Option... screen



Minimum Paths ..... Specifies lowest number of paths needed for continuation of HRC&HODM.
Defined between 1 to 4.

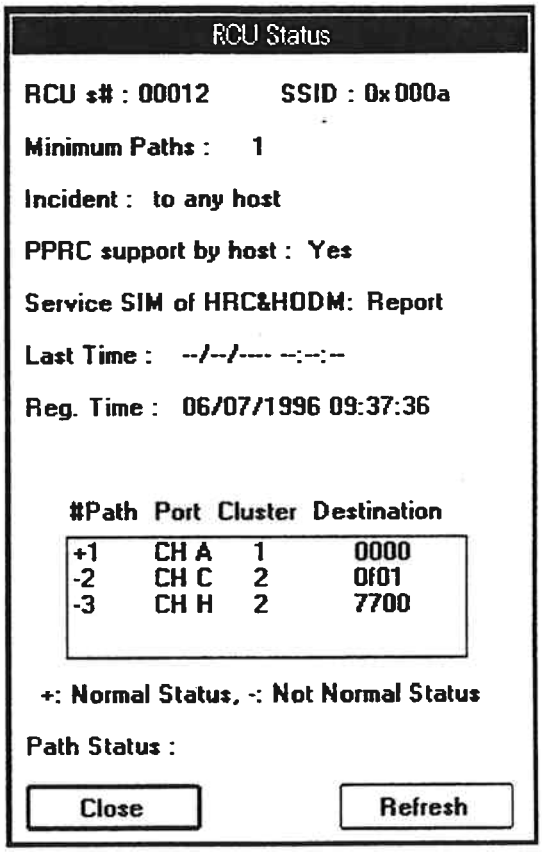
Maximum Initial ..... Specifies maximum number of Initial copy execution.
(First group of defined HRC volume pairs.)
Fixed at '4' at present

Incident of RCU..... Specifies method for handling Incident that occurs in RCU.
"to any host" ..... Incident is reported to MCU host too.
"only to RCU host" ..... Incident is reported to only RCU host .

PPRC support by host ..... Is PPRC(HRC) supported by RCU host .
"Yes" ..... Supported.
"No" ..... Not supported.

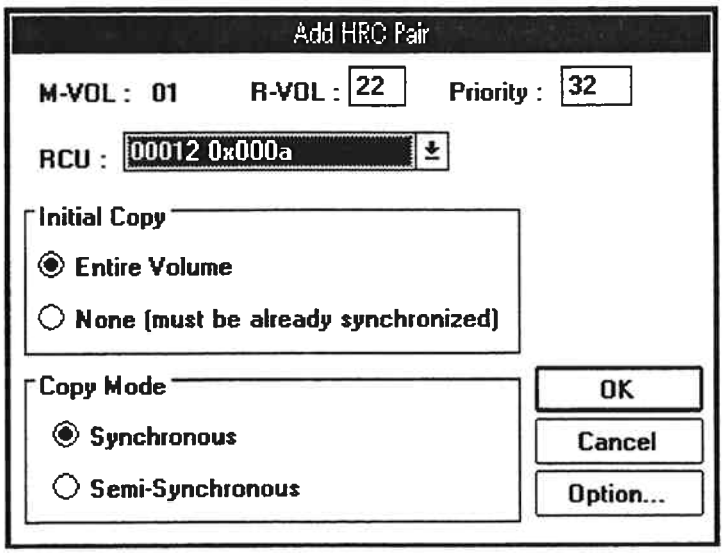
Service SIM of HRC & HODM..... Specifies method for handling SIM of HRC & HODM.
"Report" ..... SIM is reported.
"Not Report" ..... SIM is not reported.

20.4.6 RCU Status... screen



RCU s#.....Display Serial number of the RCU.
"XXXXX".....5 decimal digits.
SSID.....Display SSID of the RCU.
"XXXX".....4 hexadecimal digits.
Minimum Paths.....Display lowest number of paths necessity for continuation of HRC&HODM.
Incident.....Display method for handling Incident that occurs in RCU.
"to any host".....Incident is reported to MCU host too.
"only to RCU host".....Incident is reported to only RCU host.
PPRC support by host.....Display PPRC support information of HOST system.
"Yes".....PPRC is supported by HOST.
"No".....PPRC isn't supported by HOST.
Service SIM of HRC & HODM.....Specifies method for handling SIM of HRC & HODM.
"Report".....SIM is reported.
"Not Report".....SIM is not reported.
Last Time.....Display last update time & date of the RCU.
Reg. Time.....Display registration time & date of the RCU.
Path Status.....Display status of path that selected in list.
If it isn't "Normal", do the recovery action according to HRC&HODM06-10 "Recovery Action of Path Status Error".
"Nothing".....No established.
"Normal".....The status of path is normal.
"Initialization Failed".....Error has occurred in the path initialization.
"Communication Time Out".....Communication between MCU and RCU time out.
"Resource Shortage(MCU)".....Resource at the MCU is short.
"Resource Shortage(RCU)".....Resource at the RCU is short.
"Serial Number Mismatch".....Specified serial number is mismatch.
"Invalid Port".....Specified port is invalid.
Refresh.....Refresh displayed information.

20.4.7 Add Pair... screen



M-VOL ..... Display volume(LDEV) that is MCU side.

R-VOL ..... Specifies volume(LDEV) that is RCU side.
"XX" ..... 2 hexadecimal digits.

Priority ..... Specifies priority of initial copy execution. (Fixed item [1])

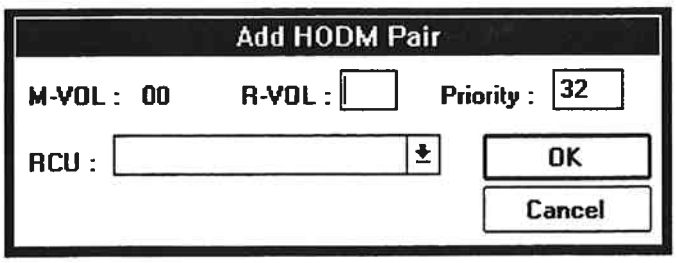
RCU ..... Select RCU from the Combo Box.
The list of RCUs currently registered will appear.

Initial Copy ..... Specifies initial copy type. (Valid only for the remote dual copy function.)
"Entire Volume" ..... Specifies all cylinders.
"None" ..... Nothing

Copy Mode ..... Specifies copy mode. (Valid only for the remote dual copy function.)
"Synchronous" ..... Specifies synchronous copy.
"Semi-Synchronous" ..... Specifies semi-synchronous copy.

Option... ..... Specifies pair option item. (Refer to Pair Option...)

20.4.8 Add Pair... screen(HODM)



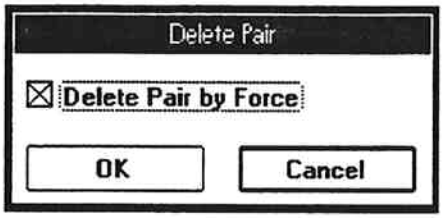
M-VOL ..... Display volume(LDEV) that is MCU side.

R-VOL ..... Specifies volume(LDEV) that is RCU side.
"XX" ..... 2 hexadecimal digits.

Priority ..... Specifies priority of initial copy execution. (Fixed item [1])

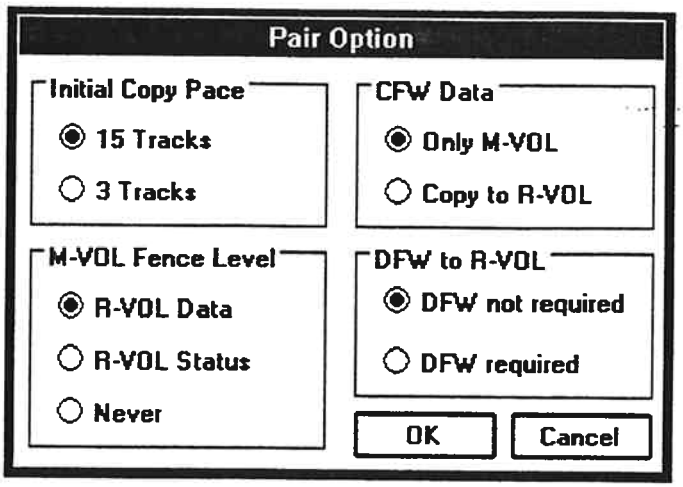
RCU ..... Select RCU from the Combo Box.
The list of RCUs currently registered will appear.

20.4.9 Delete Pair... screen



Delete Pair by Force..... Specified forcibly delete mode.
The pair status is deleted even when the communication with the CU is disabled.

20.4.10 Pair Option... screen



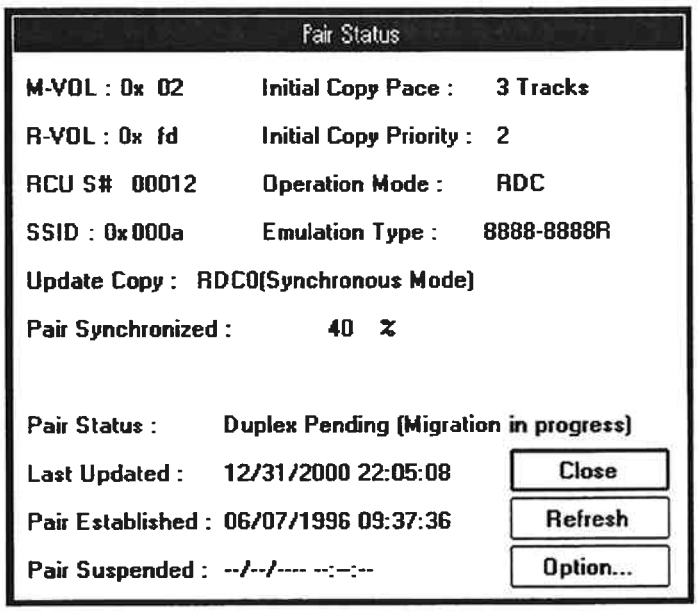
Initial Copy Pace .....Specifies Initial copy pace. (Remote Dual Copy)(HRC option)
"15 Tracks".....15tracks
"3 Tracks".....3tracks

DFW to R-VOL.....Is Remote Dual Copy continued when DFW blockade occurred. (HRC option)
"DFW not required".....When DFW block, Remote Dual Copy do not stop.
"DFW required".....When DFW block, Remote Dual Copy stop.

CFW Data .....Is the CFW data on the subject of Remote Dual Copy ? (HRC option)
"Copy to R-VOL".....Yes
"Only to M-VOL" .....No

M-VOL Fence Level.....M-VOL fence level(HRC option)
"R-VOL Data" .....M-VOL fence when data is unmatched
"R-VOL Status" .....M-VOL fence when status can not be changed.
"Never".....Never fence

20.4.11 Pair Status... screen



M-VOL ..... Displays volume(LDEV) (MCU side).

R-VOL ..... Displays volume(LDEV) (RCU side).

RCU s#..... Displays serial number of the RCU.

SSID..... Displays SSID of the RCU.

Initial Copy Pace ..... Displays Initial copy pace. (Remote Dual Copy)
"15 Tracks" 15tracks
"3 Tracks" 3tracks

Initial Copy Priority..... Displays priority of initial copy execution.

Operation Mode..... Displays pair creative mode.
"RDC"..... Remote Dual Copy(HRC)
"RMC" ..... Migration Copy(HODM)

Emulation Type..... Displays device emulation type.

Update Copy..... Displays pair synchronous mode.

Pair Synchronized..... Displays progress of initial copy(Remote Dual Copy).

Migration Copy Complete.. Displays progress of migration copy (Remote Migration Copy).

Erasing Complete ..... Displays progress of erasing R-VOL data.

Pair Status ..... Displays pair status information.
"Simplex"
"Duplex Pending"
"Duplex"
"Suspended(M-VOL by Operator)"
"Suspended(R-VOL by Operator)"
"Suspended(by MCU)"
"Suspended(by RCU)"
"Suspended(Delete pair to RCU)"
"Suspended(R-VOL failure)"
"Suspended(MCU IMPL)"
"Simplex(Migration in progress)"
"Simplex(Migration Complete)"
"Simplex(Erasing in progress)"
"Simplex(Erasing Error)"
"Simplex(Erasing Error)"

"Duplex Pending(Migration in progress)"
"Suspended(Migration Error, M-VOL)"
"Suspended(Migration Error, R-VOL)"
"Suspended(Initial Copy Failed)"

Last Updated ..... Displays last update time of pair status.

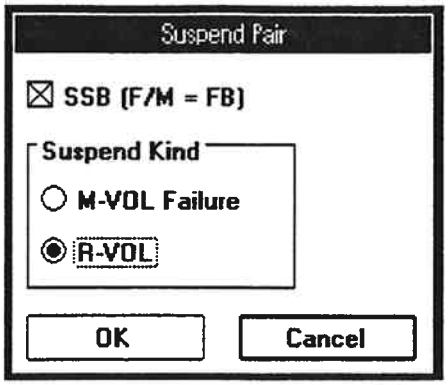
Pair Established..... Displays registration time the volume pair.

Pair Suspended..... Displays suspension time of the volume pair.

Option... ..... Displays pair option item. (Same to Pair Option...)

Refresh ..... Refresh displayed information.

20.4.12 Suspend Pair... screen

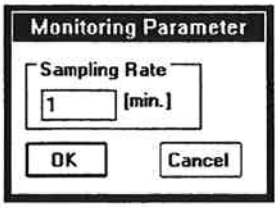


SSB (F/M=FB) ..... Specifies suspension reporting method.

Suspend Kind ..... Specifies suspended type.
"M-VOL Failure" ..... M-VOL suspension reported as M-VOL failure.,
"R-VOL" ..... R-VOL suspension

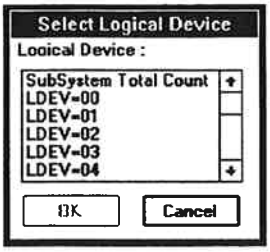
20.4.13 Usage... screen

Monitoring Parameter



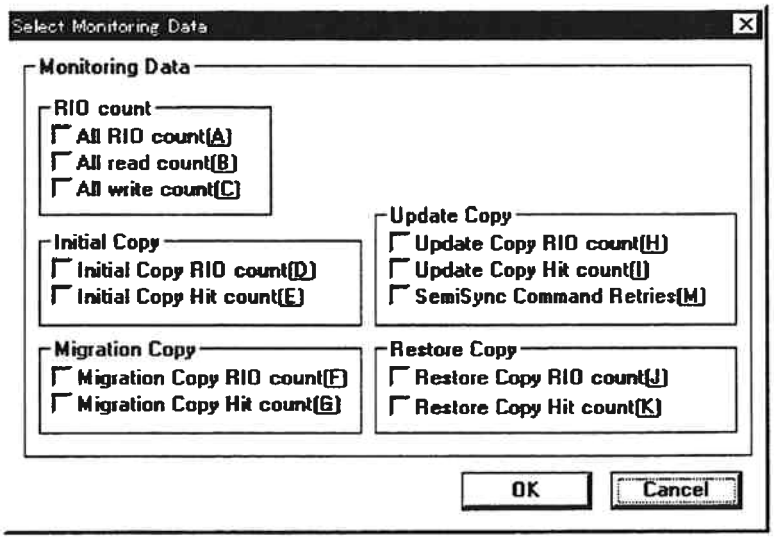
Sampling Rate .....Sets the sampling rate of operation control information within a range of 1 to 546 in steps of a minute.

Select Logical Device



Logical Device:.....Displays the list of logical devices valid in the subsystem. Select the device from the list to display its operation information. To display the operation information of the whole subsystem, select "Sub System".

Select Monitoring Data



I/O count .....Specifies the read/write count concerning the HRC/HODM.

Initial Copy .....I/O count for the initial copy

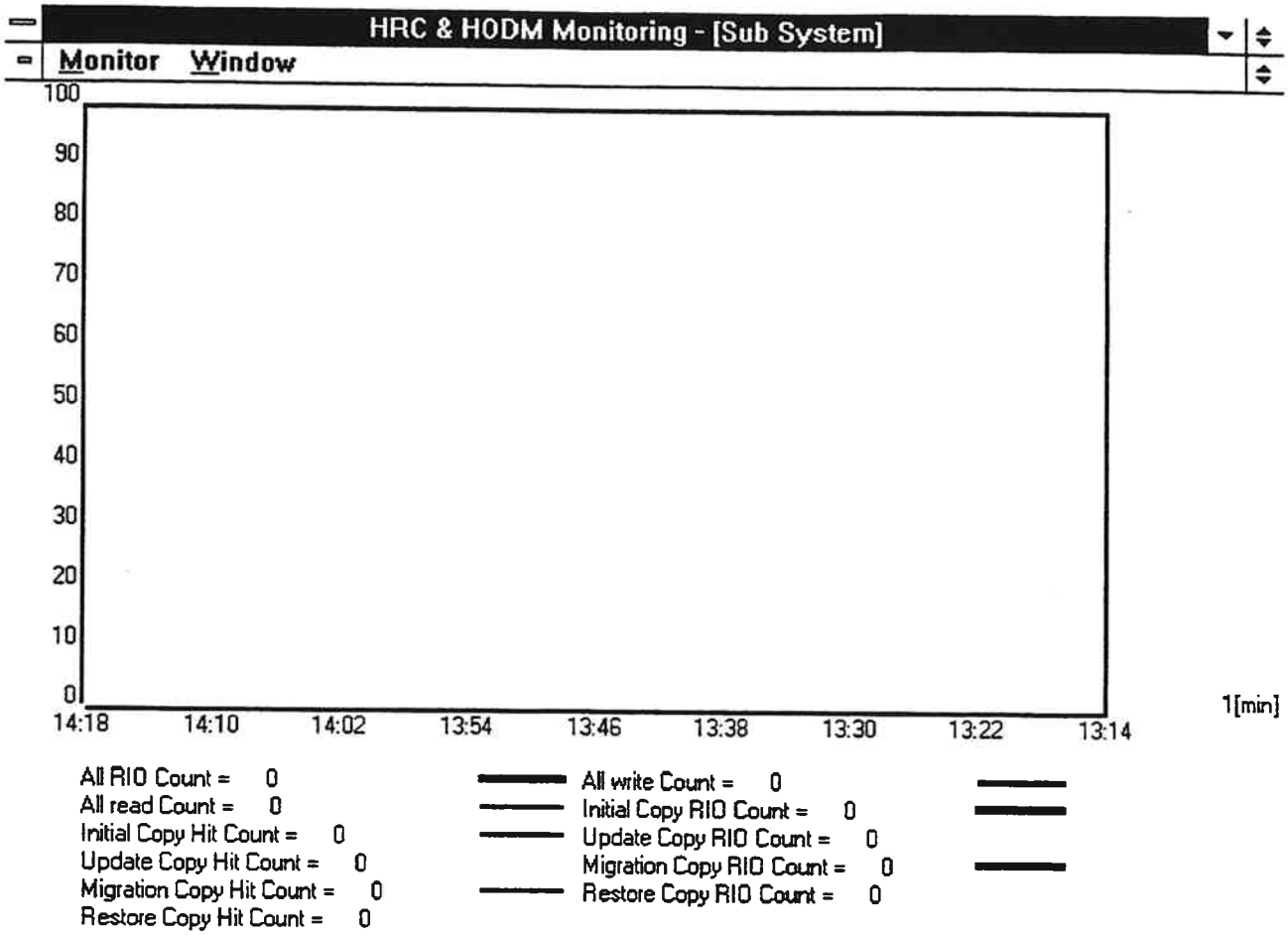
Migration Copy .....I/O count for migration copy

Renew Copy .....I/O count for renewal copy

Recovering Copy .....I/O count for recovering copy

Others.....RIO UCK count

HRC & HODM Monitoring Screen



Monitor Menu .....Start... ..... Displays another HRC & HODM Monitoring screen.
EXit... ..... Closes the HRC & HODM Monitoring screen.

Window Menu.....Cascade (C)..... Displays HRC & HODM Monitoring windows side by side.
Tile (T) ..... Displays lined-up HRC & HODM Monitoring windows.
Icon (I)..... Lines up HRC & HODM Monitoring window icons.
All close (A)..... Closes all the HRC & HODM Monitoring windows.

Vertical Axis .....Indicates the count number.

Horizontal axis .....Indicates the time elapsed. A scale division on the horizontal axis indicates a sampling rate. Newer data is shown further on the left and older data is shown further on the right. The left most data is the latest one.

20.5 Error Codes when Operating HRC & HODM

Message ID	HRC2001I
Content	SVP requires the retry operation for HRC &.HODM.
Action	Please retry the same operation for a few times.

Message ID	HRC2002I
Content	Logical Path does not exist between MCU and RCU
Action	Confirm the path status on RCU Status screen, and reestablish the paths with Edit Path

Message ID	HRC2003I
Content	The pair status is not permissible status for the operation.
Action	Renew and confirm the HRC & HODM screen. If M-VOL is permissible status please retry the operation.

Message ID	HRC2004I
Content	- Invalid serial number or SSID. - At HRC operation, RCU is not RAID200. - At HODM operation, RCU is not Controller80I-3 or Controller90I-3.
Action	Confirm serial number and SSID of RCU, and set correct value. Please refer to error code table more detail.

Message ID	HRC2005I
Content	Delete RCU is rejected because some pair volume under the RCU.
Action	Do it after Delete Pair for all pairs under the RCU.

Message ID	HRC2006W
Content	Internal error has occurred.
Action	See SSB LOG, and call technical support center to report them with the error code

Message ID	HRC2007W
Content	MCU NVS status specified by HOST is not active.
Action	Confirm the NVS status of the MCU from HOST, set it on and retry. If it cannot set on, please call TSC.

Message ID	HRC2008W
Content	RCU NVS status specified by HOST is not active.
Action	Confirm the NVS status of the RCU from HOST, set it on and retry. If it cannot set on, please call TSC.

Message ID	HRC2009I
Content	The logical paths between MCU and RCU are not established.
Action	Confirm the paths status between MCU and RCU.

Message ID	HRC2010W
Content	Pinned track exists on the M-VOL.
Action	Confirm pin track status of the M-VOL, and clear the volume of the pinned tracks.

Message ID	HRC2011W
Content	Pinned track exists on the R-VOL.
Action	Confirm pin track status of the R-VOL, and clear the volume of the pinned tracks.

Message ID	HRC2012W
Content	M-VOL is not useable. For example. 1.Specified M-VOL is copying data (correction copy or drive copy). 2.Specified M-VOL is correction access condition. 3. Specified M-VOL is blocked. 4. Specified M-VOL is under maintenance. 5. Specified M-VOL is RD ONLY condition.
Action	If the M-VOL is under maintenance, retry the operation after the maintenance will be complete.

Message ID	HRC2013I
Content	The R-VOL is already used by other system. For example, 1. The R-VOL is already used by Dual Copy 2. The R-VOL is already used by XRC. 3. The R-VOL is already used by PPRC or HRC. 4. The R-VOL is already used by Concurrent Copy. 5. The R-VOL is reserved. 6. Specified M-VOL and R-VOL are same volume in the DKC.
Action	Confirm the R-VOL status of the RCU from HOST.

Message ID	HRC2014I
Content	(The meaning is same as the message)
Action	Confirm the Device emulation type with Refer Configuration, and refer to HRC & HODM SECTION of the Maintenance Manual.

Message ID	HRC2015I
Content	Specified volume is not HRC/HODM pair.
Action	Please check the volume.

Message ID	HRC2016I
Content	HRC is not supported under the Controller emulation type of the MCU.
Action	Confirm the Controller emulation type, and refer to HRC & HODM SECTION of the Maintenance Manual.

Message ID	HRC2017I
Content	Suspend mode is not for R-VOL
Action	Please confirm the suspend and retry.

Message ID	HRC2018W
Content	Invalid R-VOL
Action	Please confirm the R-VOL status.

Message ID	HRC2019W
Content	Time out error has occurred.
Action	Please confirm the Controller status and retry.

Message ID	HRC2020I
Content	Invalid parameter.
Action	Please check the inputted value and retry.

Message ID	HRC2021I
Content	DKC-MAIN microprograms don't support this function.
Action	Please check the DKC-MAIN version.

Message ID	HRC2022W
Content	Communication Error has occurred between SVP and SSVP.
Action	Please check the SSVP status and retry.

Message ID	HRC2023I
Content	Communication busy. Please Retry later.
Action	Please wait for a moment and retry.

Message ID	HRC2024I
Content	There is no CU
Action	Please confirm the CPU lamp.

Message ID	HRC2025I
Content	There is a same path.
Action	Please check the inputted value.

Message ID	HRC2026I
Content	The number of path is over high limit.
Action	Please check the operation.

Message ID	HRC2027I
Content	The path dose not exist.
Action	Please check the inputted value.

Message ID	HRC2028I
Content	The number of path is under low limit.
Action	Please check the operation.

Message ID	HRC2029I
Content	The CHA does not support HRC & HODM.
Action	Please replace the CHA and retry.

Message ID	HRC2030W
Content	SVP detected other blocked parts which are influenced to the HRC operation.
Action	After recovering their blocked parts, please retry the same operation.

Message ID	ONL2031W/ SPC2031W
Content	SVP detected the warning operation.
Action	Please select [OK] to stop the operation and end the HRC/HODM volume pair.

Message ID	ONL2032W/ SPC2032W
Content	SVP detected the warning operation.
Action	Please select [OK] to stop the operation. You should delete RCU operation by decided with customers and retry again.

Message ID	ONL2033W/ SPC2033W
Content	SVP detected the warning operation.
Action	If [Yes], SVP will stop the process so that you should end or suspend the pair. If [No], SVP will continue the process, but you must be careful to operate.

Message ID	ONL2034W/ SPC2034W
Content	SVP detected the warning operation.
Action	Please select [OK] to stop the operation and delete the HRC volume pair.

Message ID	ONL2035W/ SPC2035W
Content	SVP detected the warning operation.
Action	If [Yes], SVP will stop the process so that you should suspend the pair from M-VOL. If [No], SVP will continue the process, but you must be careful to operate.

Message ID	ONL2036W/ SPC2036W
Content	SVP detected the warning operation.
Action	If [Yes], SVP will stop the process so that you should end or suspend the pair from M-VOL. If [No], SVP will continue the process, but you must be careful to operate.

Message ID	ONL2037W/ SPC2037W
Content	SVP detected the warning operation.
Action	If [Yes], SVP will stop the process so that you should end the pair from M-VOL. If [No], SVP will continue the process, but you must be careful to operate.

Message ID	ONL2038W/ SPC2038W
Content	SVP detected the warning operation.
Action	If [Yes], SVP will stop the process so that you should end the path from MCU. If [No], SVP will continue the process, but you must be careful to operate. Note1. Before you replace CHA, please vary off-line the path to the CHA which is connected from MCU. After replacement, please vary online the path. If you de-install CHA, please vary off-line the path to the CHA which is connected from MCU.

Message ID	HRC2039E
Content	The Specified number of paths do not cover 1 to 4.
Action	Confirm the number of paths you specified.

Message ID	HRC2040E
Content	(The meaning is same as the message)
Action	Confirm the configuration of LCP/RCP. And specify correct Port or change the port to RCP.

Message ID	HRC2041E
Content	The specified Logical Address is not 00 or 01.
Action	Confirm Logical Address and set correct Link Address.

Message ID	HRC2042E
Content	The specified Link address and port are already used.
Action	Confirm all existing logical path address, and specify other Link address or RCP port.

Message ID	HRC2043E
Content	(The meaning is same as the message)
Action	Confirm serial number, SSID and Link Address of RCU, and set correct value.

Message ID	HRC2044E
Content	4 RCUs are already entered.
Action	Please check the inputted value and retry.

Message ID	HRC2045E
Content	Path establishing was partly failed.
Action	Confirm the path connections between MCU and RCU. Then retry the operation.

Message ID	HRC2046E
Content	Path establishing was failed.
Action	Confirm the path connections between MCU and RCU. Then retry the operation.

Message ID	HRC2047E
Content	The operation causes no operable remote I/O path of some pair.
Action	Add another path, or delete all pairs on the RCU. Then retry the operation.

Message ID	HRC2048E
Content	SVP detected the pending data on the port.
Action	Please retry again.

Message ID	HRC2049E
Content	SVP detected Port exchange error.
Action	Please replace the target CHA.

Message ID	HRC2050E
Content	SVP detected logical paths on the port.
Action	Please delete the path and retry.

Message ID	HRC2051E
Content	SVP detected unknown error code.
Action	Please call TSC.

Message ID	HRC2052W
Content	This message is to check your operation again.
Action	If you continue, please select [OK], if you stop the operation, please select [Cancel].

Message ID	HRC2053W
Content	This message is to check your operation again.
Action	If you continue, please select [OK], if you stop the operation, please select [Cancel].

Message ID	HRC2054W
Content	This message is to check your operation again.
Action	If you continue, please select [OK], if you stop the operation, please select [Cancel].

Message ID	HRC2055W
Content	This message is to check your operation again.
Action	If you continue, please select [OK], if you stop the operation, please select [Cancel].

Message ID	HRC2056W
Content	This message is to check your operation again.
Action	If you continue, please select [OK], if you stop the operation, please select [Cancel].

Message ID	HRC2057W
Content	This message is to check your operation.
Action	Please vary off-line the concerned path. If you continue, please select [OK], if you stop the operation, please select [No].

Message ID	HRC2058I
Content	SVP promote you to exchange channel cable connecting.
Action	Please follow the message.

Message ID	ONL2059W/SPC2059W
Content	SVP detects the data copy by HRC/HODM.
Action	If [Yes] is selected, you should wait until copy is finished, or you should delete or suspend the pair after you negotiate with your customer. If [No] is selected, SVP will stop the process.

Message ID	ONL2060W/SPC2060W
Content	SVP detects the warning that HRC/HODM pair will be suspended or you could not operate more.
Action	If [Yes] is selected, SVP will stop the process, but if [No] is selected, SVP will continue the process.

Message ID	HRC2061I
Content	(The meaning is same as the message)
Action	Please exit other SVP applications (ONLINE or INSTALL if you executed) and retry.

Message ID	HRC2062I
Content	There is no waiting pair.
Action	Please check the pair status and retry.

Message ID	HRC2063W
Content	Communication error has occurred.
Action	Please check the SVP status and connectivity status between Console-SVP.

Message ID	HRC2064W
Content	This message is to check your operation.
Action	If the concerned paths does not delete, please select [No] and delete it. If you continue, please [Yes].

Message ID	HRC2065W
Content	(The meaning is same as the message)
Action	Please check the port status and retry.

Message ID	SPC2066I
Content	(The meaning is same as the message)
Action	Please wait for 30 seconds and reboot SVP.

Message ID	ONL2067I
Content	(The meaning is same as the message)
Action	Please wait for 30 seconds. And select [OK] and reboot SVP.

Message ID	HRC2068W
Content	SVP rejected the number was less than the minimum.
Action	Please check the number of Paths

Message ID	HRC2069W
Content	Microprograms do not support.
Action	Please check the microprograms version. If the version of microprograms supported HRC/HODM functions, please exchange LCP microprogram again. If the error code is 0x401b,please refer to "The installation procedure for HRC/HODM(HRC/HODM02-90)" to re-install.

Message ID	HRC2070W
Content	HODM cannot start because the volume is online from HOST.
Action	Please check if the volume is online. If online, please vary offline the path and retry. Refer to attached sheet. (HRC & HODM05-190)

Message ID	HRC2071W
Content	(The meaning is same as the message)
Action	Please confirm the R-VOL status

Message ID	HRC2072W
Content	HODM could not start because the specified volume may be online from HOST.
Action	Please check the status if migration copy is in progress or the volume is online.

Message ID	ONL2073W/SPC2073W
Content	Alternate path must be added or pair must be deleted or suspended.
Action	Please select [Yes] to stop operation and decide with your customer which you have to do, add HRC alternate path, or delete the pair if the fence level of the volume is Data/Status, suspend the pair if the fence level of the volume is never. And retry. If you select [No], SVP will continue the process.

Message ID	ONL2074W/SPC2074W
Content	Alternate path must be added or pair must be deleted.
Action	Please select [Yes] to stop the operation and add the alternate path or delete the pair by decided by customers. If you select [No], SVP will continue the process.
Message ID	ONL2075W/SPC75W
Content	Alternate path must be added.
Action	Please select [Yes] to stop the operation and add the alternate path by decided with customers. If you select [No], SVP will continue the process.
Message ID	ONL2076W/SPC2076W
Content	(The meaning is same as the message)
Action	Please select [Yes] to stop the operation. You should finish HODM copy or add alternate path by decided with customers and retry again. If you select [No], SVP will continue the process.
Message ID	ONL2077W/SPC2077W
Content	(The meaning is same as the message)
Action	Please select [Yes] to stop the operation. Please decide with your customer which you have to do, add the HODM alternate path or stop the I/O from HOST. If you select [No], SVP will continue the process.
Message ID	ONL2078W/SPC2078W
Content	(The meaning is same as the message)
Action	Please select [Yes] to stop the operation. You should delete the pair or add alternate path by decided with customers and retry again. If you select [No], SVP will continue the process.
Message ID	ONL2079W/SPC2079W
Content	(The meaning is same as the message)
Action	Please select [Yes] to stop the operation. You should wait until HRC/HODM is finished copy or you have to delete or suspend the HRC/HODM pair from MCU by decided with customers and retry again.
Message ID	HRC2080I
Content	(The meaning is same as the message)
Action	Please check if the input number of R-VOL is correct. If not, input the correct R-VOL number. If the number is correct, please vary offline the concerned path from the host. Refer to attached sheet. (HRC & HODM05-190)
Message ID	HRC2081E
Content	Remote Console could not connect to the DKC.
Action	Please check the connection and retry the same operation.
Message ID	ONL2082I
Content	Remote Console could not connect to the DKC.
Action	Please check the connection and retry the same operator.

Message ID	HRC2083I
Content	Remote Console could not connect to the DKC.
Action	Please check the connection and retry the same operator.

Message ID	HRC2084W
Contents	The number of Paths is less than the Minimum number of Paths on RCU option screen.
Action	Confirm the number of Minimum Paths with RCU Option screen and retry the operation after establishing the number of paths more than Minimum Paths.

Message ID	HRC2085W
Contents	The number of Paths is less than the Minimum number of Paths on RCU option screen as a result of communication error between MCU and RCU.
Action	Confirm the path status on RCU Status screen, and reestablish the paths with Edit Path.

Message ID	HRC2086W
Contents	The path couldn't be deleted due to the communication error between MCU and RCU or the blockade of the CHA.
Action	Confirm the CHA status with "STATUS" on the MCU. If the CHA is blockaded, replace it by a new one. Then retry the operation.

Message ID	HRC2087W
Contents	Parameter specified by HRC operation is invalid. For example, the R-VOL which is specified is already used as the R-VOL of another HRC pair.
Action	Please establish the correct parameter and retry the operation.

Message ID	HRC2088W
Contents	Parameter specified by HODM operation is invalid. For example, the R-VOL which is specified is already used as the R-VOL of another HODM pair.
Action	Please establish the correct parameter and retry the operation.

Message ID	HRC2089W
Contents	The pair status is not permissible status for the operation.
Action	Renew and confirm the HRC & HODM screen. If R-VOL is permissible status please retry the operation.

Message ID	HRC2090W
Contents	HODM is not supported under the Controller emulation type of the MCU.
Action	Confirm the Controller emulation type and refer to HRC & HODM SECTION of the Maintenance Manual.

Message ID	HRC2091W
Contents	HRC is not supported under the Controller emulation type of the RCU.
Action	Confirm the Controller emulation type, and refer to HRC & HODM SECTION of the Maintenance Manual.

Message ID	HRC2092W
Contents	HODM is not supported under the Controller emulation type of the RCU.
Action	Confirm the Controller emulation type and refer to HRC & HODM SECTION of the Maintenance Manual.

Message ID	HRC2093W
Contents	Invalid serial number or SSID of MCU.
Action	Confirm the serial number or SSID of MCU. Retry with correct parameter.

Message ID	HRC2094W
Contents	Invalid serial number or SSID of RCU.
Action	Confirm the serial number or SSID of RCU. Retry with correct parameter.

Message ID	HRC2095W
Contents	Inactive Subsystem Cache status on MCU.
Action	Confirm the Subsystem Cache status of MCU from HOST. If it is off, set it on and retry. If it cannot set on, call TSC.

Message ID	HRC2096W
Contents	Invalid Cache status on MCU.
Action	Check the Cache of MCU and recover it. Then retry the operation.

Message ID	HRC2097W
Contents	Unexpected error occurred on MCU.
Action	Call TSC.

Message ID	HRC2098W
Contents	Inactive Subsystem Cache status on RCU.
Action	Confirm the Subsystem Cache status of RCU from HOST. If it is off, set it on and retry. If it cannot set on, call TSC.

Message ID	HRC2099W
Contents	Track Format of M-VOL and R-VOL do not match.
Action	Confirm the Device type of the specified M-VOL and R-VOL.

Message ID	HRC2100W
Contents	Combinations of the device type of M-VOL with R-VOL is not supported.
Action	Confirm the Device type of the specified M-VOL and R-VOL.

Message ID	HRC2101W
Contents	Inactive the Device Cache status of R-VOL.
Action	Confirm the Device Cache status of R-VOL from HOST. If it is off, set it on and retry. If it cannot set on, call TSC.

Message ID	HRC2102W
Contents	Inactive the DFW status of R-VOL.
Action	Confirm the DFW status of R-VOL from HOST. If it is off, set it on and retry. If it cannot set on, call TSC.

Message ID	HRC2103W
Contents	Specified R-VOL is not usable. For example 1.Specified R-VOL is blocked. 2.Specified R-VOL is under maintenance. 3.Specified R-VOL is copying data (collection copy or drive copy). 4.Specified R-VOL is failed. 5.Specified R-VOL is CC=3 condition. 6.Specified R-VOL is intervention required. 7.Specified R-VOL is correction access condition. 8.Permanent I/O Error occurred on the R-VOL. 9.Specified R-VOL is READ ONLY condition.
Action	Confirm the status of the specified R-VOL from HOST or Status screen or check the SSB of R-VOL.

Message ID	HRC2104W
Contents	HODM is not supported under the Device emulation type of the M-VOL.
Action	Confirm the Device emulation type of the specified M-VOL and refer to HRC & HODM SECTION of the Maintenance Manual.

Message ID	HRC2105W
Contents	HRC is not supported under the Device emulation type of the R-VOL.
Action	Confirm the Device emulation type of the specified R-VOL with Refer Configuration, and refer to HRC & HODM SECTION of the Maintenance Manual.

Message ID	HRC2106W
Contents	HODM is not supported under the Device emulation type of the R-VOL.
Action	Confirm the Device emulation type of the specified R-VOL and refer to HRC & HODM SECTION of the Maintenance Manual.

Message ID	HRC2107W
Contents	The RCU containing the R-VOL specified "ADD HODM PAIR " is using as RCU of HODM..
Action	Verify the operation whether the RCU is using as HODM. Then retry the operation after "Del RCU" once.

Message ID	HRC2108W
Contents	The RCU containing the R-VOL specified "ADD HRC PAIR " is using as RCU of HRC.
Action	Verify the operation whether the RCU is using as HRC. Then retry the operation after "Del RCU" once.

Message ID	HRC2109W
Contents	Remote Console could not connect to Controller.
Action	Please check.

Message ID	HRC2110W
Contents	When entering HODM pair, SVP guides an operator to confirm the specified R-VOLs are varied off-line.
Action	If you finish confirming the specified R-VOLs are varied off-line, please select "OK". If not, please select "Cancel".

Message ID	ONL2111W
Contents	SVP detected the CHA-PCB type was not available.
Action	If [OK], SVP will finish this process. Please prepare the same PCB before replacement or the same PCB as you define. And retry again.

Message ID	ONL2112W
Contents	SVP could not recover because of the different type of CHA-PCB.
Action	There are two cases that the port is set as RCP or the PCB does not support HRC. Please check the PCB. If [OK], SVP will finish this process. Please prepare the same PCB before replacement or the same PCB as you define. And retry again.

Message ID	ONL2113W
Contents	SVP could not recover.
Action	If [OK], SVP will finish this process. Please prepare the same PCB before replacement or the same PCB as you define. And retry again.

Message ID	ONL2114I
Contents	SVP detected the PCB does not support HRC/HODM.
Action	Please replace to the PCB which supports HRC/HODM.

Message ID	HRC2115W
Contents	The number of Paths is less than the Minimum number of Paths on RCU option screen as a result of communication error between MCU and RCU.
Action	Confirm the path status on RCU Status screen, and reestablish the paths with Edit Path.

Message ID	HRC2116I
Contents	Specified volume is not HRC/HODM pair.
Action	Please check the volume.

Message ID	HRC2117W
Contents	WARNING:Destination volume of specified volume pair may contain some inconsistency because volume copy is not completed yet. Full volume initialization is required before re-using it. Own Dev:0xXX S/N:XXXXX SSID:0xXXXX Pair Dev:0xXX if you want to delete pair, press OK.
Action	Please note the volume pair which are displayed and finish this operation. After, please negotiate your customer to initialize the volume which might have a illegal contents.

Message ID	INS2118W
Contents	This subsystem is used by HRC & HODM.
Action	If [Yes], SVP finishes this process. Please contact your customer to delete RCU and retry. If [No], SVP continues this process.

Message ID	INS2119W
Contents	This subsystem is used by HRC.
Action	If [Yes], SVP finishes this process. Please contact your customer to delete RCU from MCU side and retry. If [No], SVP continues this process.

Message ID	HRC2120W
Contents	The Cache on MCU is automatically recovering now.
Action	If [OK], SVP finishes this process so that please wait several minutes and retry again. If [No], SVP continue this process.

Message ID	HRC2121W
Contents	R-VOL option change operation failed because the RCU side does not support to display fence level. SVP changed only M-VOL option.
Action	Please select [OK].

Message ID	HRC2122W
Contents	SVP detected the communication error or R-VOL status invalid.
Action	Please check the status.

Message ID	HRC2123W
Contents	SVP detected M-VOL was suspend.
Action	

Message ID	HRC2124W
Contents	SVP detected some error when a set of pairs was entered/deleted/recovered/changed options.
Action	If [Yes], SVP continues this operation. If [No], SVP finishes.

Message ID	HRC2125W
Contents	SVP detected Multi platform feature has been installed in MCU.
Action	Please check the configuration of this MCU machine.

Message ID	HRC2126W
Contents	SVP detected Multi platform feature has been installed in RCU.
Action	Please check the configuration of the RCU machine.

Message ID	HRC2127W
Contents	SVP detected Multi platform feature has been installed.
Action	Please check the configuration of this machine.

Message ID	HRC2128W
Contents	SVP detected the pair which was forced delete was HRC and the mode was other than Simplex.
Action	Please select [OK] and change the R-VOL to Simplex.

Message ID	HRC2129W
Contents	SVP detected the pair which was forced delete was HODM and the status was other than waiting erase.
Action	Please contact your customer to change the mode to Simplex. After, please select [OK].

Message ID	INS2130E / ONL2130E
Contents	SVP detected illegal version of microprograms.
Action	Please execute microprograms exchange.

Message ID	INS2131E / ONL2131E
Contents	This microprogram does not support to set HRC/HODM and Multi platform feature together.
Action	Please set either HRC/HODM or Multi platform.

Message ID	ONL2132E
Contents	SVP detected that the target has connected SCSI channel port.
Action	Please erase SCSI path set and de-install the target.

Message ID	HRC2133E
Contents	There is no valid RCP Port.
Action	Please select [OK] to stop this process and check the port.

Message ID	HRC2134E
Contents	When you change the parameters against suspend pair, the specified volume contain some R-VOLs so that SVP could not change parameters against R-VOL.
Action	Please select [OK] to stop this process. SVP will change the parameters against M-VOLs only.

Message ID	HRC2135I
Contents	You should shutdown concerned connecting SCSI host(s) or switch to the alternate SCSI channel path(s).
Action	If you do not confirm yet, please select [No] to stop the process. If you already has confirmed, please select [Yes] to continue.

Message ID	HRC2136I
Contents	Multi platform feature has been already installed in MCU.
Action	HRC or HODM function is exclusive to Multi platform feature. Please de-install CHS PCB(s) in MCU before HRC or HODM function is performed.

Message ID	HRC2137I
Contents	Multi platform feature has been already installed in RCU.
Action	HRC or HODM function is exclusive to Multi platform feature. Please de-install CHS PCB(s) in RCU before HRC or HODM function is performed.

Message ID	HRC2159W
Contents	Setting the number of minimum paths of the RCU Option Setting operation is rejected because the number of minimum paths is more than the number of normal paths.
Action	Please do the operation according to the Error Code. (1) Error Code = 100c Set the number of minimum paths after adding normal paths so that the number of minimum paths won't be more than the number of normal paths. (2) Error Code = 100d Delete paths after adding normal paths or decreasing the number of minimum paths so that the number of minimum paths won't be more than the number of normal paths.

Message ID	HRC2160W
Contents	The Add RCU operation or the Edit Path operation is rejected because some Logical Addresses of added paths are invalid.
Action	1. Case of Add RCU operation Specify the same Logical Address. 2. Case of Edit Path operation Specify the same Logical Address as existing paths. (Refer to the Edit Path Screen.)

Message ID	HRC2161W
Contents	The edit Path operation is rejected because Logical Addresses of existing paths are not equal.
Action	Execute the Delete RCU Operation and the Add RCU operation again. You must specify the same Logical Address.

Message ID	HRC2166W
Content	The M-VOL is already used by XRC.
Action	Confirm the M-VOL XRC status from HOST.

Message ID	HRC2167W
Content	As the result of this operation, you will not be able to re-start Erase R-VOL operation.
Action	If it is no problem not to be able to restart Erase R-VOL operation, please select [OK]. If not, please select [Cancel].

Message ID	HRC2168W
Content	As the result of this operation, you will not be able to re-start Erase R-VOL operation. To delete the pair forcibly, please try again with 'Force' option.
Action	Delete the pair with 'Force' option.

Message ID	ONL2169E/INS2169E
Contents	The parameter's value was invalid.
Action	Call technical support center.

Message ID	ONL2170I/INS2170I
Contents	This operation de-install the function. If the function is running, it will be stopped by operation.
Action	If you want to de-install, press [OK]. If you don't, press [Cancel].

Message ID	ONL2171I/INS2171I
Contents	This function is not supported.
Action	If you want to install the function, call technical support center.

Message ID	ONL2172I
Contents	This option needs special FD.
Action	If you have a special FD, please insert it and press [OK]. If you don't, press [Cancel].

Message ID	ONL2173E
Contents	Inserted FD is not avairable
Action	Please check the inserted FD, if it is correct and does not have Write Protect.

Message ID	HRC2174E
Contents	Combination of the controller type of MCU with RCU is not supported.
Action	Confirm the controller type of the specified MCU and RCU.

Message ID	SMT2179W
Contents	This microprogram does not support some functions. After microprogram exchage, some function in action will end abnormally.
Action	At first, you should note Bitmap in this message and select [Cancel] to stop microprogram exchange. Next, please refer to the Function Bit Map Table in M-FC section. Bitmap in message corresponds the table so you should recognize function which is described about bit on item. Please do the corresponding action in this table. After all, please retry microprogram exchange again.

Message ID	ONL2180E
Contents	File I/O error has occurred.
Action	Please check if the floppy disk is not write protect. If it is so, release the write protect and retry again.

Procedure to trace the Online CHL route

1. Ahalyze the SSB.LOG

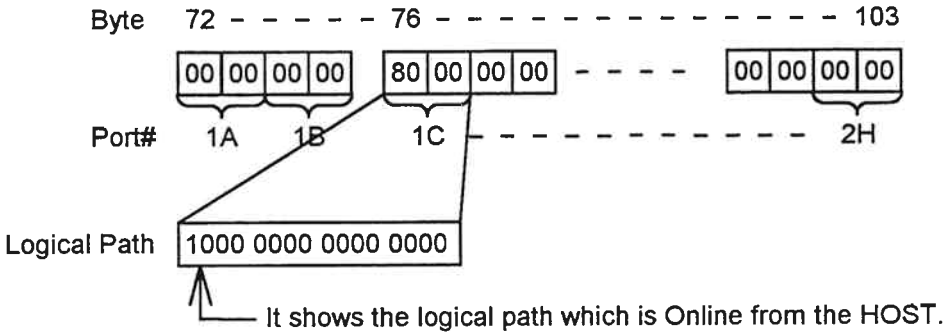
   HRC2080I; The Specified R-VOL of HRC is still Online from the HOST.

   Check the SSB.LOG on SVP of the specified RCU. SSB containing F/M=0F, EC=C0CA on the specified R-VOL number should be logged.

   HRC2070W; The M-VOL of HODM is Online from the HOST.

   Check the SSB.LOG on SVP of the MCU. SSB containing F/M=0F, EC=C0A6 on the specified M-VOL should be logged.

   Both SSB are same format, from SSB byte72(0x48) through byte103(0x67) show the Bit Map of Logical Path indicating Online from the HOST. Each 2bytes correspond to each port. They indicate the Logical Path number on which the valid Path Group is established for this device.



2. Run DSF/ANALYZE-ALLCHPID to trace the Path Group ID of the Online route.

   Run DSF/ANALYZE with ALLCHPID. The output shows the Path Group ID which is Online to the subsystem.

LOGICAL PATH		SYSTEM	FULL	SP FENCES	HOST PATH GROUP ID		
NUMBER	type	ADAPTER ID	ESCON LINK ADDRESS	0 1 2 3	CPU SERIAL#	CPU TYPE	CPU TIME STAMP
1	E	00	0101		XXXXXXX	YYYY	ZZZZZZZZ
2 - 32	N/E	00 - 01					
33	E	02	0200		XXXXXXX	YYYY	ZZZZZZZZ

   "SYSTEM ADAPTER ID" corresponds to the number of the CHL adapter port.

   (Ex; Port#1C is "02".)

   Trace the Path Group ID indicated the SYSTEM ADAPTER ID corresponding to the value on SSB LOG of EC=C0CA or C0A6.

20.6 Recovery Action of Path Status Error

Path Status	Recovery Action
"Nothing"	Delete the path with "Edit Path" or "Delete RCU", and add a new path with "Edit Path" or "Add RCU" again. (Refer to HRC&HODM04-20 "Path Operation".)
"Initialization Failed" "Communication Time Out"	Refer to TRBL06-30 "HRC/HODM Path Recovery Section".
"Resource Shortage (MCU)" "Resource Shortage (RCU)"	There are too many HRC&HODM paths on the MCU (RCU) side. Delete the path and the other useless paths with "Edit Path" or "Delete RCU", and add a new path with "Edit Path" or "Add RCU" again. (Refer to HRC&HODM04-20 "Path Operation".)
"Serial Number Mismatch"	Confirm the RCU serial number and the path connection, and delete the RCU with "Delete RCU". So add a new RCU with the correct serial number. (Refer to HRC&HODM03-120 "Deleting an RCU Resistered".)
"Invalid Port"	This Status is occured by the following two causes. (1) There are the same paths in the RCU. Then confirm the Port, the Link Address, and the Logical Address. And delete the path with "Edit Path". (Refer to HRC&HODM03-150 "Reducing the Path(s) from the RCU".) (2) The Port isn't an RCP. Then confirm the Port, and delete the path with "Edit Path". Set the port to RCP, and add a new path with "Edit Path" again. (Refer to HRC&HODM02-130 "RCP Port Setting" and HRC&HODM04-20 "Path Operation".)