

## **NEC Storage Manager**

# Data Replication User's Manual (Installation and Operation Guide for Windows)



IS016-5E

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# Preface

This manual describes how to use the data replication function provided by NEC Storage DynamicDataReplication Ver2, NEC Storage RemoteDataReplication Ver2, and NEC Storage ReplicationControl.

The data replication function consists of the replication volume creation function provided in a disk array subsystem and software to manage and operate it. It utilizes replication volume to make business operation more effective.

Refer to the “NEC Storage Manager Manual Guide” (IS901) for the overview of NEC Storage and the related manuals. Also, refer to the “NEC Storage Manager Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)” (IS027) for details of how to use the remote data replication function provided by NEC Storage RemoteDataReplication/DisasterRecovery and NEC Storage ReplicationControl/DisasterRecovery.

Remarks 1. This manual explains functions implemented by the following program products:

- NEC Storage Manager and NEC Storage BaseProduct
- NEC Storage ReplicationControl
- NEC Storage DynamicDataReplication
- NEC Storage RemoteDataReplication

2. This manual is applicable to the program products of the following versions:

- NEC Storage Manager Ver3.3
- NEC Storage BaseProduct Ver3.3
- NEC Storage ReplicationControl Ver3.3

3. The NEC Storage Manager is referred to as iSM or Storage Manager in the text of this manual. Also, the NEC Storage series disk array subsystem is referred to as a disk array.

4. The following descriptions in the text of this manual refer to the corresponding products.

Description	Corresponding Product
Storage Manager	NEC Storage Manager
AccessControl	NEC Storage AccessControl
DynamicDataReplication	NEC Storage DynamicDataReplication
PerformanceMonitor	NEC Storage PerformanceMonitor
RemoteDataReplication	NEC Storage RemoteDataReplication
ReplicationControl	NEC Storage ReplicationControl
ReplicationControl SQL Option	NEC Storage ReplicationControl SQL Option
SnapControl	NEC Storage SnapControl

5. The following descriptions in the text of this manual refer to the corresponding manuals.

Description	Corresponding Manual
User's Manual (UNIX)	NEC Storage Manager User's Manual (UNIX) (IS001)
User's Manual	NEC Storage Manager User's Manual (IS004)
ReplicationControl SQL Option User's Manual	NEC Storage ReplicationControl SQL Option User's Manual (IS006)
Configuration Setting Tool User's Manual (GUI)	NEC Storage Manager Configuration Setting Tool User's Manual (GUI) (IS007)

Description	Corresponding Manual
Messages Handbook	NEC Storage Manager Messages Handbook (IS010)
Data Replication User's Manual (Function Guide)	NEC Storage Manager Data Replication User's Manual (Function Guide) (IS015)
Data Replication Command Reference	NEC Storage Manager Data Replication Command Reference (IS021)
PerformanceMonitor User's Manual	NEC Storage PerformanceMonitor User's Manual (IS025)

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7. In this document, matters to which careful attention needs to be paid will be described as follows:

Be sure to observe the contents.

If the indications are ignored and the system is improperly operated, settings which have been already made might be affected.

Type of Indication	
Type	Description
	Describes contents which require special attention during operation.

The First Edition in March 2003  
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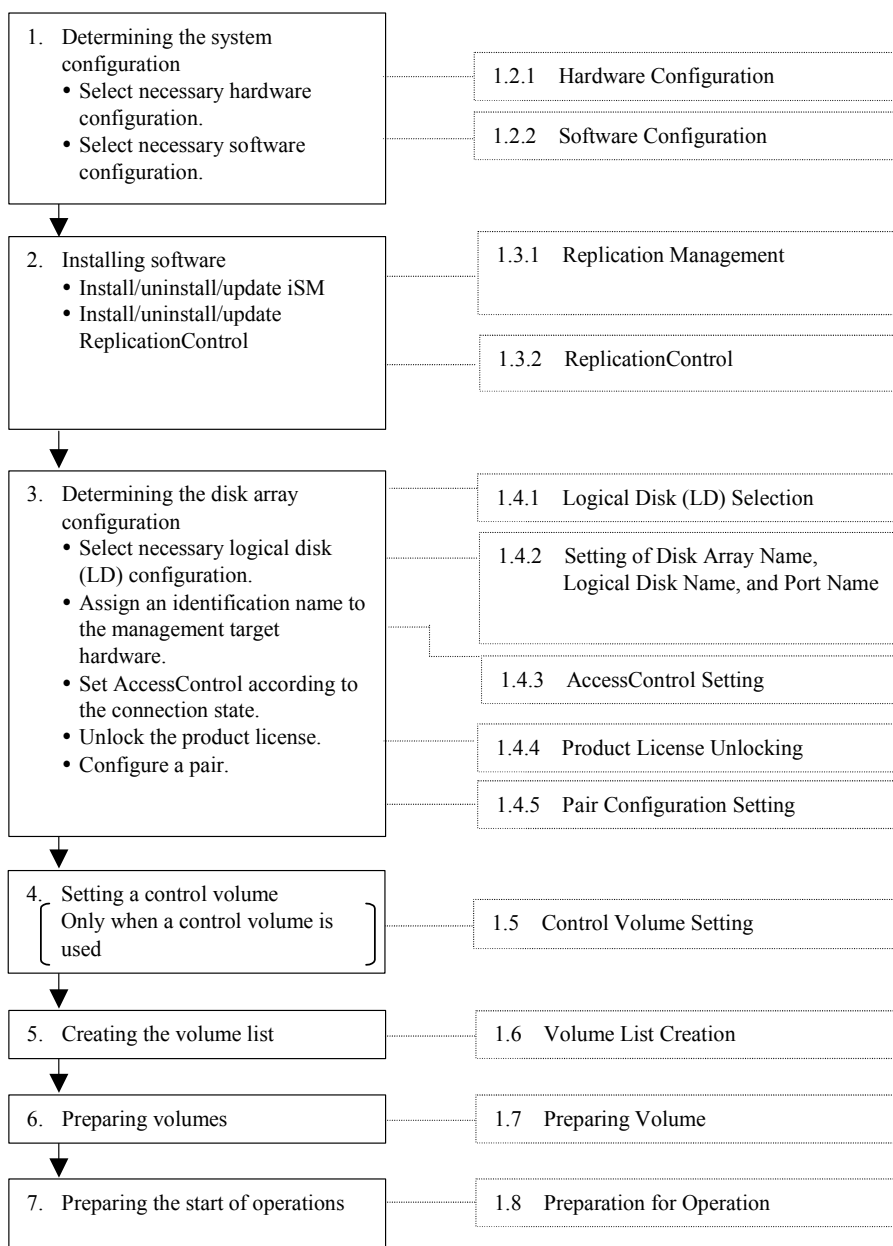
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# Chapter 1 Installation Procedure

This chapter describes the system installation procedures showing an example of a tape backup system that uses the 2000 series disk array subsystem.

## 1.1 Installation Procedure

Installation works are outlined below. For details of the procedures, refer to the associated sections.



## 1.2 System Configuration

### 1.2.1 Hardware Configuration

Select hardware components according to the business conditions, requirements, disk capacity, and so forth. Figure 1-1 shows an example of hardware configuration.

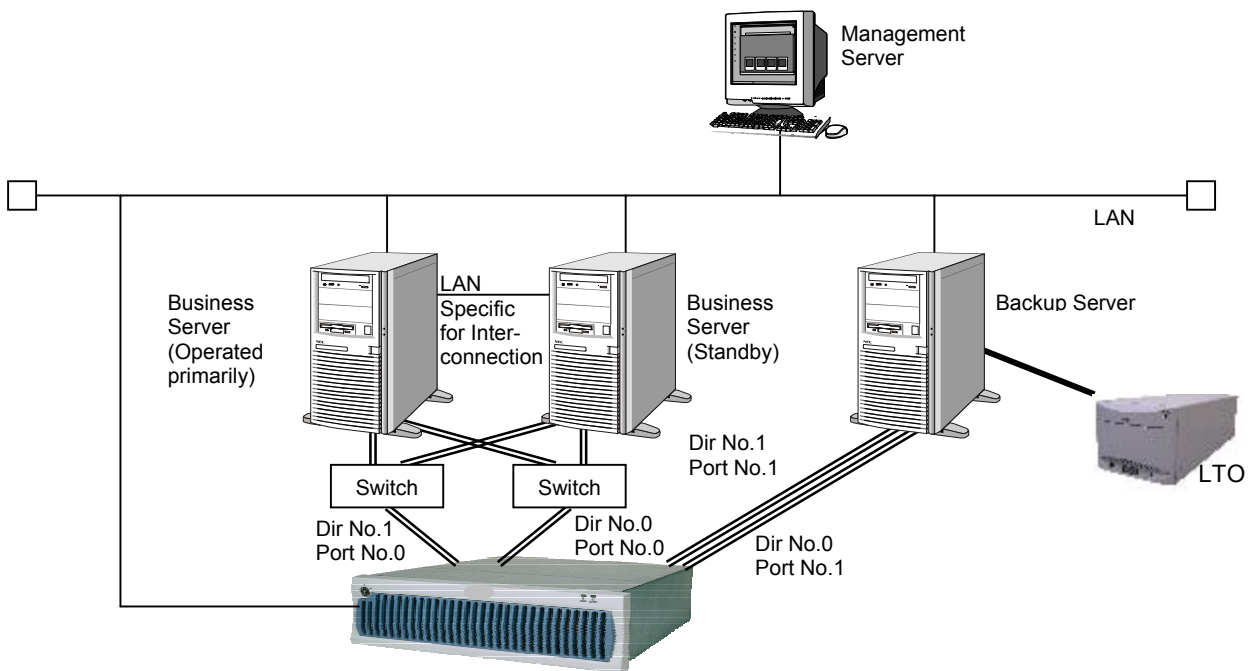


Figure 1-1 Hardware Configuration Example

- To utilize the data replication function most efficiently, it is better to separate business servers, which process tasks, from backup servers. Thus, tape backup operation gives no additional load to business servers.
- When doing disk backup instead of tape backup, no backup servers are required.
- Though the business or backup server may also be used as a management server, using a specific management server is recommended. To avoid conflicts with host accesses, use of LAN connection is strongly recommended for connection with disk array.
- The disk array accepts any tape drives. Select one of drives authorized by the backup software to be used.
- Connect the path of individual servers, to be connected to the disk array, to the port of different directors of the disk array, limiting the servers to be accessed by AccessControl.
- In the configuration example, the business servers are installed in a cluster and mutually connected through the LAN specific to interconnection.
- Using data replication in the 4000 series or 3000 series requires a separate replication director.



## 1.2.2 Software Configuration

Select software to be used according to the hardware components, operating conditions, etc. Figure 1-2 shows a software configuration example.

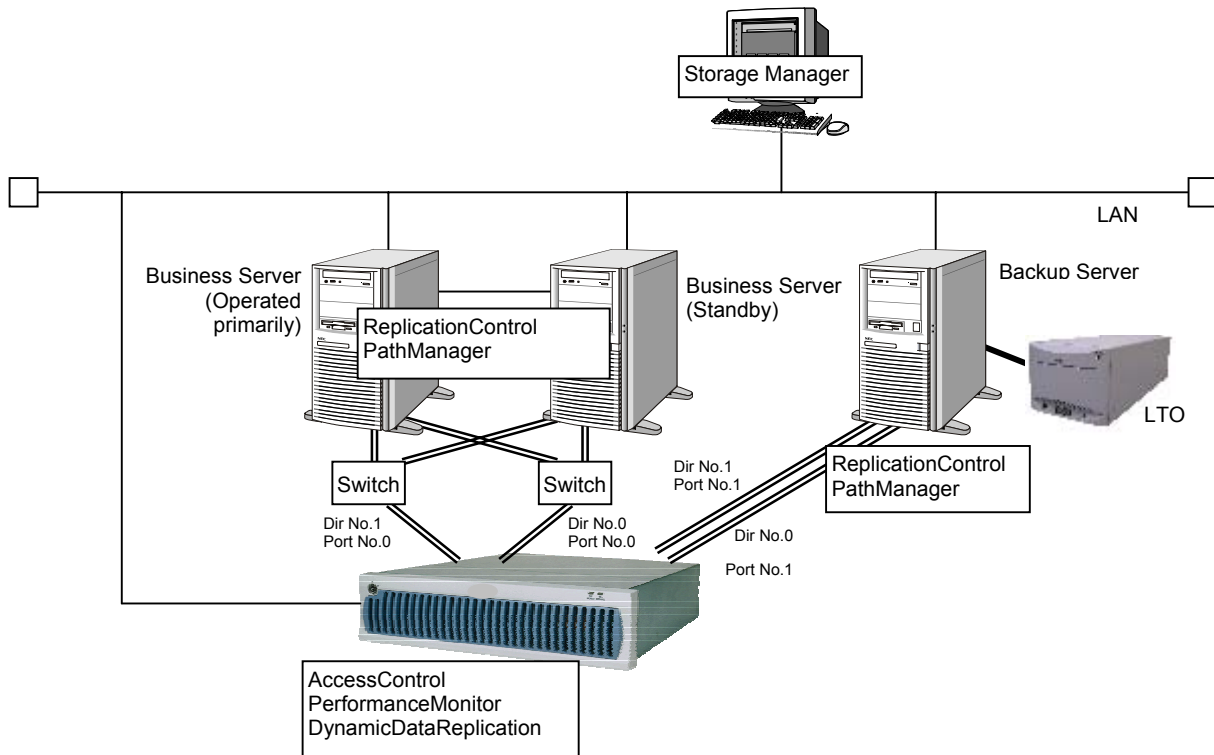


Figure 1-2 Software Configuration Example

- Because business servers are in cluster configuration, let both the administration and standby business servers belong to the same domain. In both the primary and standby business servers, install the same business application software.
- Install the backup software in the backup server.
- Install the management software in the management server. Install the iSM in the management server.
- Install the ReplicationControl in the master and backup servers.
- Install the DynamicDataReplication and the RemoteDataReplication in the disk array. From the server where the iSM is installed, the iSM replication management functions can be executed for disk arrays where the DynamicDataReplication or the RemoteDataReplication has been installed.

## 1.3 Software Installation

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### 1.3.1 Replication Management

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#### (1) Operating Environment

##### Replication Management (Server)

The replication management function is included in the iSM server.

For the operating environment, refer to the “User’s Manual” or “User’s Manual (UNIX)” in accordance with your OS.

##### Replication Management (GUI)

The replication management is an expanded function of the iSM client.

For the operating environment, refer to the “User’s Manual” or “User’s Manual (UNIX)” in accordance with your OS.

#### (2) Installation

##### iSM Server Installation

When you install the iSM server, the replication management function of the server is installed.

Refer to the “User’s Manual” or “User’s Manual (UNIX)” in accordance with your OS to install it.

##### iSM Server Setting

Create an environment definition file and the environment by referring to the “User’s Manual” or “User’s Manual (UNIX)” in accordance with your OS.

##### Replication Management (GUI) Installation

To use the Replication Management of the iSM client, you must install the basic+extended function.

Refer to the “User’s Manual” or “User’s Manual (UNIX)” in accordance with your OS to install it.

#### (3) Software Uninstallation

##### iSM Server Uninstallation

Refer to the “User’s Manual” or “User’s Manual (UNIX)” in accordance with your OS to uninstall iSM server.

### **Replication Management (GUI) Uninstallation**

Refer to the “User’s Manual” or “User’s Manual (UNIX)” in accordance with your OS to uninstall the Replication Management (GUI).

#### **(4) Software Update**

##### **iSM Server Update**

To update the iSM server, uninstall the existing software, and then install the new software.

##### **Replication Management (GUI) Update**

To update the iSM client, uninstall the existing software, and then install the new software.

## **1.3.2 ReplicationControl**

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#### **(1) Operating Environment**

##### **Operating system**

This software operates in the following operating systems.

Microsoft Windows 2000 Advanced Server (SP2 or later)

Microsoft Windows 2000 Server (SP2 or later)

Microsoft Windows Server 2003, Enterprise Edition

Microsoft Windows Server 2003, Standard Edition

##### **Required disk free space**

To install the ReplicationControl, at least 35 Mega-bytes of disk free space are required.

##### **Required memory**

To use the ReplicationControl, required memory capacity is shown below.

Microsoft Windows 2000 Advanced Server	approx. 2MB or more
Microsoft Windows 2000 Server	approx. 2MB or more
Microsoft Windows Server 2003, Enterprise Edition (64-bit)	approx. 6MB or more
Microsoft Windows Server 2003, Enterprise Edition (32-bit)	approx. 3MB or more
Microsoft Windows Server 2003, Standard Edition	approx. 3MB or more

### (2) ReplicationControl Software Installation

To install ReplicationControl, follow the procedure below.

- (1) Log on as the Administrator.
- (2) Set the ReplicationControl installation media on CD-ROM drive and execute the following install program in the CD-ROM drive:

```
\\SMRC\SETUP.EXE
```

- (3) Follow the directions of the installer.

The following software components are installed:

- ReplicationControl
- Storage Manager Volume List



To use the ReplicationControl, build the logical volumes to be operated on the disk array, set a pair of volumes under replication control, and then create a Volume List. Use the iSMvollist command to create the Volume List.



To use the ReplicationControl through the previously installed job scheduling software or Windows task scheduler, the services and systems need to restart for recognizing the path names of the installed execution files.



To install and use both ReplicationControl and SnapControl on the same server, they must be of the same version.

### (3) ReplicationControl Software Uninstallation

To uninstall ReplicationControl, follow the procedure below.

- (1) Log on as the Administrator.
- (2) Check whether the Storage Manager Volume List or ReplicationControl command is running and whether the Volume List Display screen is open.  
Terminate any running command and close any screen.
- (3) Close [Event Viewer] if it is open.

(4) Select the deletion of the following software component by using [Add/Remove Programs] ([Add or Remove Programs] for Windows Server 2003) in [Control Panel] to start uninstallation:

- ReplicationControl

(5) Follow the directions of the uninstaller.

The following software components are uninstalled:

- ReplicationControl
- Storage Manager Volume List

If the Storage Manager Volume List or ReplicationControl command is running or the Volume List Display screen is open, and uninstallation is performed, a message may appear which prompts you to reboot the operating system. In this case, be sure to reboot the operating system.

#### **(4) ReplicationControl Software Update**

To update the ReplicationControl software, uninstall the existing software, and then install the new software.

#### **(5) Replication operation option setting**

You can set various types of operations when executing a command by using the replication operation option setting file (iSMrpl.ini).

For details of the replication operation option setting file, refer to the “Data Replication Command Reference”.



ReplicationControl outputs the operation trace (trace log) in the folder iSMrpl\etc\trace under the folder where ReplicationControl has been installed (\Program Files\NEC\iSMrpl\etc\trace\ by default) to deal with faults if occur.

In operation trace files, messages output to the standard output, standard error output, event log, and command trace and the detailed internal information are recorded. These files are used as important data for analyzing a fault if occurs. For details of information to be collected in the event of a fault, refer to 2.2.7 “Information Gathering in the Event of a Fault”.

The amount of the output operation trace (file size) and retention amount and period vary depending on the command execution frequency and other factors. You can set these items optionally by writing the following option parameters:

[TRACELOG] section

RPLLOGFILENUM

Specifies the maximum number of log files to be saved.

When this option parameter is omitted, up to 10 log files are used sequentially.

RPLLOGFILEMAXSIZE

Specifies the maximum size per a log file to be saved in kilobytes.

When this option parameter is omitted, the size of one log file is about 400 kilobytes.

In ReplicationControl Ver2.1 or earlier, log data recorded during the number of days specified by option parameter RPLLOG was saved in one log file. This conventional method is not recommended due to the following reasons:

- The saved log file becomes larger in proportion to the command execution frequency.
- When the first command is executed after change-of-day, one day’s log out of the retention period is deleted. Therefore, if one day’s log data to be deleted is large, it takes time to delete it.

Accordingly, if option parameter RPLLOG has been used, it is advisable to change the setting to that using the above option parameters RPLLOGFILENUM and RPLLOGFILEMAXSIZE for operation.

## 1.4 Disk Array Configuration

For the disk array to be connected, determine the configuration for using the data replication.

### 1.4.1 Logical Disk (LD) Selection

According to the disk capacity necessary for business or operation conditions, determine the logical disk (LD) and hot spare configurations. For the 4000 series and the 3000 series, disk array configurations are executed by maintenance personnel and therefore should be determined before installation. To improve the access performance and keep tolerance against physical disk (PD) faults, assign MV and RV to different ranks. MV and RV to be paired should have the same LD capacity. If LD configuration is changed after starting the server, be sure to execute the create/display Volume List command (`iSMvollist -cr`) after changing the configuration.

Figure 1-3 shows an example of setting five pairs.

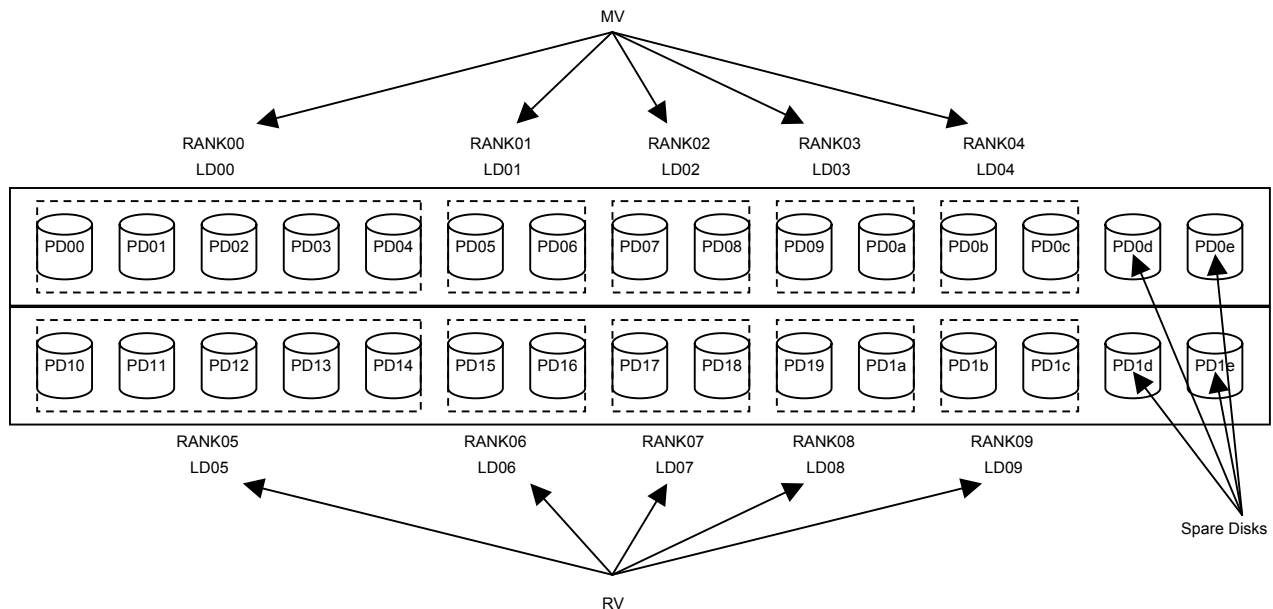


Figure 1-3 LD Configuration Example (2000 series)

- The PD group number for PD and RANK is 00.
  - One LD is associated with one RANK. (The whole area for one RANK is assigned to one LD.)
  - LD00 and LD05 are in RAID5 (4+P) configuration.
  - LD01 to LD04 and LD06 to LD09 are in RAID1 configuration.
  - Each DE has two spare disks.
  - LD00 to LD04 are used for MV and LD05 to LD09 are for RV.
- \* This configuration is just an example. Actual configuration should be determined based on your business conditions.

Figure 1-4 shows an example of setting five pairs and one IV on the backup server as a control volume. A control volume is used when a server issues control I/O to the relevant disk array. For details of a control volume, refer to 1.5 “Control Volume Setting”, 3.9 “Control Volume”, and the “Data Replication User’s Manual (Function Guide)”.

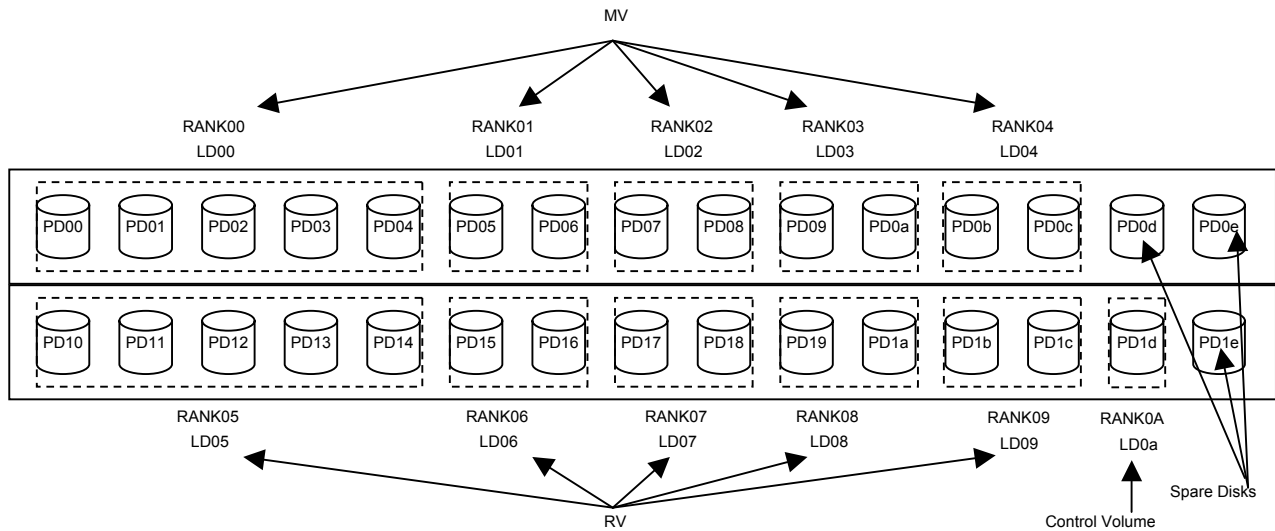


Figure 1-4 LD Configuration Example when a Control Volume Is Used (2000 Series)

- The PD group number for PD and RANK is 00.
  - For LD00 to LD09, one LD is associated with one RANK (the whole area for one RANK is assigned to one LD).
  - LD00 and LD05 are in RAID5 (4+P) configuration.
  - LD01 to LD04 and LD06 to LD09 are in RAID1 configuration.
  - LD00 to LD04 are used for the MV and LD05 to LD09 are for the RV.
  - For LD0a, only one small-capacity LD is built with a RANK in RAID0 configuration.
  - LD0a is used for an IV as the control volume.
- \* This configuration is an example. Actual configuration should be determined based on your business conditions.

For the disk arrays with pool, you can build a small-capacity logical disk for a control volume. For details of how to build a control volume, refer to descriptions about building logical disks in the “Configuration Setting Tool User’s Manual (GUI)”.



## 1.4.2 Settings of Disk Array Name, Logical Disk Name, and Port Name

You can assign identification names to hardware components managed by the iSM. Identification names can be given to the following items:

- Disk array subsystem name
- Logical disk name (plus OS type)
- Port name

A disk array subsystem name, logical disk name, and port name may be set without special restrictions, except character types and character length; however, it is better to set these names considering the operating conditions and server connection conditions. Determine the OS type according to the servers connected. They are set from the iSM client. If the LD configuration is changed after starting the servers, separate all pairs on all servers connected to the LD whose configuration is changed, and, after changing the configuration, be sure to execute the Volume List create/display command (iSMvollist -cr).

Table 1-1 Example of Disk Array Name Setting

Disk array subsystem	Disk array subsystem name
StorageS2130	Tokyo_Customer_DataBase

Remark 1: This is an example of setting a disk array name for administrating database of customers in Tokyo.

Table 1-2 Example of Setting Logical Disk Names and OS Types

LD No.	OS type	Logical disk name	Remarks
00	WN	DB_DATA_MV	MV for DB data file
01		DB_REDO1_MV	MV for DB REDO file 1
02		DB_REDO2_MV	MV for DB REDO file 2
03		DB_CTL_MV	MV for DB control file
04		DB_ARCHIVE_MV	MV for DB archive file
05		DB_DATA_RV	RV for DB data file
06		DB_REDO1_RV	RV for DB REDO file 1
07		DB_REDO2_RV	RV for DB REDO file 2
08		DB_CTL_RV	RV for DB control file
09		DB_ARCHIVE_RV	RV for DB archive file

Remark 1: Because logical disks are used by Windows servers, set the OS type as WN (the Windows operating system default value).

Remark 2: This example shows logical disk names reflecting the database configuration.

Table 1-3 gives an example of setting logical disk names and OS types for an LD configuration example when a control volume is used (Figure 1-4).

Table 1-3 Example of Setting Logical Disk Names and OS Types (When a Control Volume Is Used)

LD No.	OS type	Logical disk name	Remarks
00	WN	DB_DATA_MV	MV for DB data file
01		DB_REDO1_MV	MV for DB REDO file 1
02		DB_REDO2_MV	MV for DB REDO file 2
03		DB_CTL_MV	MV for DB control file
04		DB_ARCHIVE_MV	MV for DB archive file
05		DB_DATA_RV	RV for DB data file
06		DB_REDO1_RV	RV for DB REDO file 1
07		DB_REDO2_RV	RV for DB REDO file 2
08		DB_CTL_RV	RV for DB control file
09		DB_ARCHIVE_RV	RV for DB archive file
0a		BACKUP_CV	Control volume

Remark 1: Because logical disks are used by Windows servers, set the OS type as WN (the Windows operating system default value).

Remark 2: This example shows logical disk names reflecting the database and connection configurations.

Table 1-4 Example of Setting Port Names

Director No.	Port No.	Port name	Server connected
00	00	DB_SECONDARY	Business server
01	00	DB_PRIMARY	
00	01	BACKUP_PRIMARY	Backup server
01	01	BACKUP_SECONDARY	

Remark 1: This is an example of setting port names in accordance with the server connection configuration.

## 1.4.3 Access Control Setting

Normally, in a system without clusters, one volume cannot be connected to more than one server to prevent data inconsistency due to file update from servers.

To prevent erroneous updates to this volume or erroneous changes to disk configuration on the business servers, the RV must be separated using Access Control, etc. from the business server that uses the MV. Furthermore, the MV must be separated from the business server that uses the RV, in the same way.

To prevent errors in control volume operation, the control volume must be connected only to a specific server by using Access Control etc., so that it is not operated or updated from another server.

Before introducing servers, you must determine the server connection modes and design Access Control settings. Access Control can be set for individual Ports or WWNs. Setting for Access Control requires purchasing the AccessControl.

Figure 1-5 shows an example of Access Control setting for individual Ports.

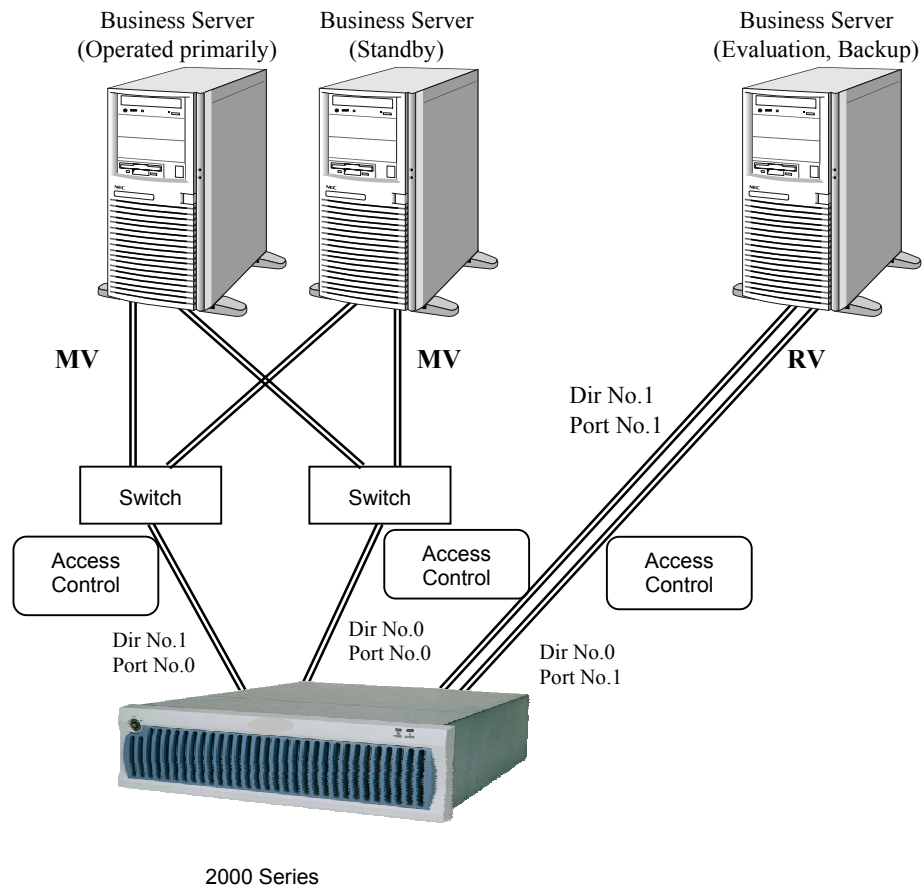


Figure 1-5 Connection Example in Cluster Configuration

Table 1-5 Access Control Setting Example

Director No.	Port No.	Access Control settings	Server connected
00	00	LD00 to LD04	Business server
01	00		
00	01	LD05 to LD09	Backup server
01	01		

Table 1-6 gives an Access Control setting example for an LD configuration example when a control volume is used (Figure 1-4).

Table 1-6 Access Control Setting Example (When a Control Volume is Used)

Director No.	Port No.	Access Control settings	Server connected
00	00	LD00 to LD04	Business server
01	00		
00	01	LD05 to LD09 and LD0a	Backup server
01	01		

When setting the configuration, take care not to overlap the ports (MV side) connected to the business servers and those (RV side) connected to the evaluation and backup servers.

## 1.4.4 Product License Unlocking

To use the DynamicDataReplication or the RemoteDataReplication, you must unlock the product license set in the disk array. To unlock the license, you must purchase the corresponding products for the capacity category equal to or greater than the total physical capacity of the disk array.

When the replication management is executed by starting up the ReplicationControl, these products check the licenses of the products purchased whether they are purchased properly.

If the total capacity of the physical disk exceeds the product's specified capacity because physical disks are added to the disk array system, no additional pairs can be set or canceled (however, replication operations for the preset pairs are enabled).

## 1.4.5 Pair Configuration Setting

In the basic pair configuration, one RV is connected to one MV. For certain operation conditions, more than one RV may be connected, but select the basic or parallel configuration for backup operations. The MV and RV to be paired must have the same LD capacity and OS type.

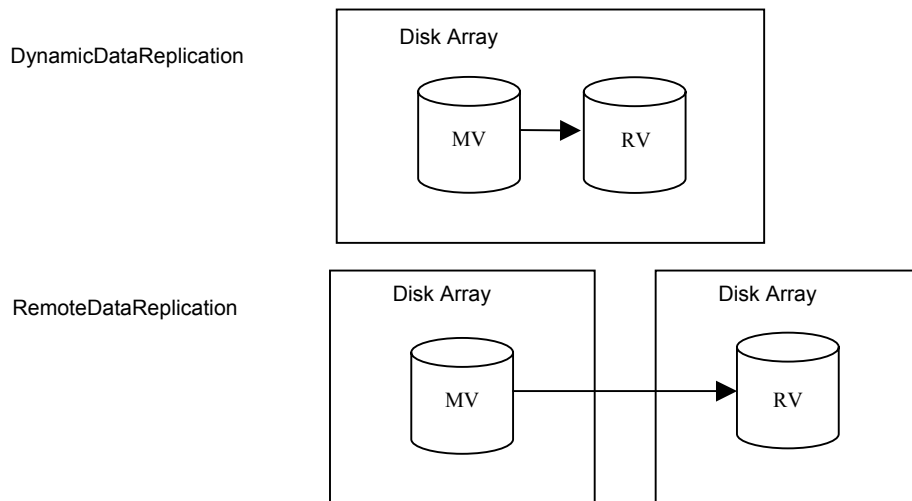


Figure 1-6 Basic Configuration

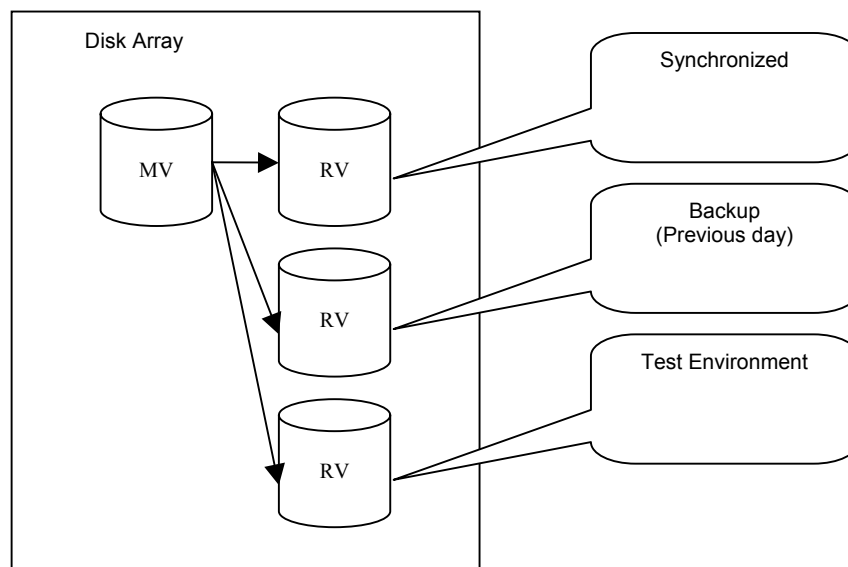


Figure 1-7 Example of Parallel Configuration

- An RV of a maximum of four volumes can be set for one PV.  
For DynamicDataReplication, an RV of a maximum of three volumes can be set at a time, however.
- An RV can be allocated to a maximum of two disk arrays for one PV.
- The DynamicDataReplication can be set in only one layer in the disk array.
- You cannot set dRV directly for dRV.
- Volumes with different volume capacities cannot be set as a pair.
- Unless the OS type is the same, the pair setting cannot be executed.

Table 1-7 Example of Setting Data Replication

Pair setting	
MV	RV
DB_DATA_MV	DB_DATA_RV
DB_REDO1_MV	DB_REDO1_RV
DB_REDO2_MV	DB_REDO2_RV
DB_CTL_MV	DB_CTL_RV
DB_ARCHIVE_MV	DB_ARCHIVE_RV

## 1.5 Control Volume Setting

A control volume is used when a server issues control I/O to the relevant disk array. Select one of the logical disks connected to each server for each disk array as the volume for issuing I/O to that disk array and register the volume in the Volume List.

The use of a control volume has the following effects, in particular, in the backup server environment:

- Operation can also be continued even when an RV connected to the server or a link-volume (LV) for the snapshot function cannot be accessed from the server (operating system) due to a data replication or snapshot operation.
- From a server that is not connected to an MV to be operated, Replicate and Separate can be executed. The logical disk which can be operated using the control volume from a server is a logical disk which is allowed to access that server by the Access Control setting for the disk array or a logical disk paired with a logical disk which is allowed to access that server.

For details of a control volume, refer to 3.9 “Control Volume” also.

For details of the Volume List Display function, refer to the help of the Volume List Display screen or the “Data Replication User’s Manual (Function Guide)”.

### 1.5.1 Starting the Volume List Display Function

Click the Windows [Start] button and select [Storage Manager Volume List] and [Volume List Display] from [Programs] ([All Programs] for Windows Server 2003) to start the Volume List Display function.

The screenshot shows the 'Volume List Display' window with a menu bar (File, View, Operation, Help) and a toolbar. Below the toolbar is a dropdown menu for 'Disk Array Subsystem' set to 'ALL'. The main area contains a table with the following data:

Drive Letter/Path Name	Volume Name	Disk No.	Volume Definition	LUN	LDN	LD Name	Disk Array	Classification
-	-	disk1	Control	000h	00a8h	DAS_Find_0...	S2800/0021	IV
-	-	disk2	-	001h	00a9h	DAS_Find_0...	S2800/0021	IV
-	-	disk3	-	000h	0000h	NE_NCNEE_...	S2300/0244	RV
-	-	disk4	-	001h	0121h	200000004C...	S2300/0244	IV
-	-	disk6	-	003h	0123h	200000004C...	S2300/0244	IV
-	-	disk7	-	004h	0124h	200000004C...	S2300/0244	IV
-	-	disk9	-	001h	0016h	1258/SHREK...	S2100/1258	IV
-	-	disk10	-	002h	0017h	1258/SHREK...	S2100/1258	IV
-	-	disk11	-	000h	0006h	mv_01	S2100/1259	MV
-	-	disk12	-	001h	0007h	mv_02	S2100/1259	IV
-	-	disk13	-	002h	011fh	RPL_200_011F	S2100/1259	IV
G:	\\?\Volume{...	disk5	-	002h	0122h	200000004C...	S2300/0244	IV
H:	\\?\Volume{...	disk8	-	005h	0125h	200000004C...	S2300/0244	IV

Below the main table is a section titled 'Paired/Linked Logical Disk Information List' with the following data:

Classification	LDN	LD Name	Disk Array
RV	0008h	rv_01	S2100/1259

The status bar at the bottom right indicates 'VOLUME : 13'.

Figure 1-8 Volume List Display Screen

Then, select [Define Control Volume] in [Operation] in the Volume List Display screen to open the Define Control Volume screen.

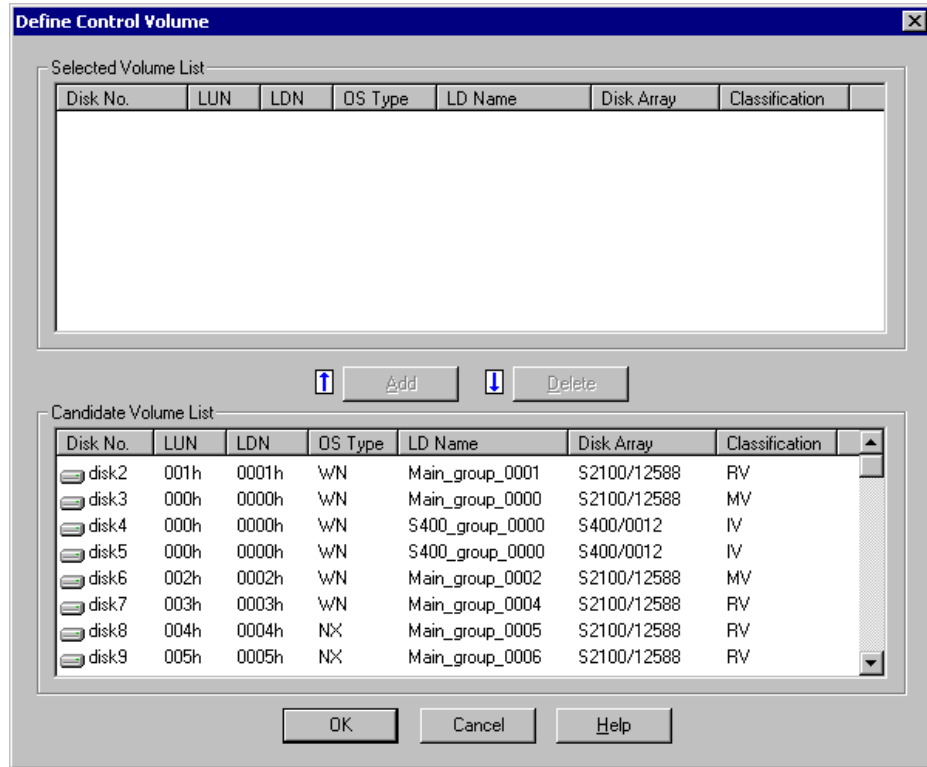


Figure 1-9 Define Control Volume Screen

“Selected Volume List”

Lists already registered control volumes.

“Candidate Volume List”

Lists candidate logical disks that can be registered as a control volume.

## 1.5.2 Registering a Control Volume

A control volume is used when a server issues control I/O to the relevant disk array. You can select one logical disk for each disk array as a control volume. Prepare a volume such as IV with which the server can properly issue I/O to the disk array.



Do not select an RV or a link-volume (LV) for the snapshot function as a control volume because it may enter the Not Ready state during operation.



- (1) Select a logical disk you want to use as a control volume from “Candidate Volume List”.
- (2) Click the [Add] button.
- (3) The selected logical disk is registered in “Selected Volume List”.

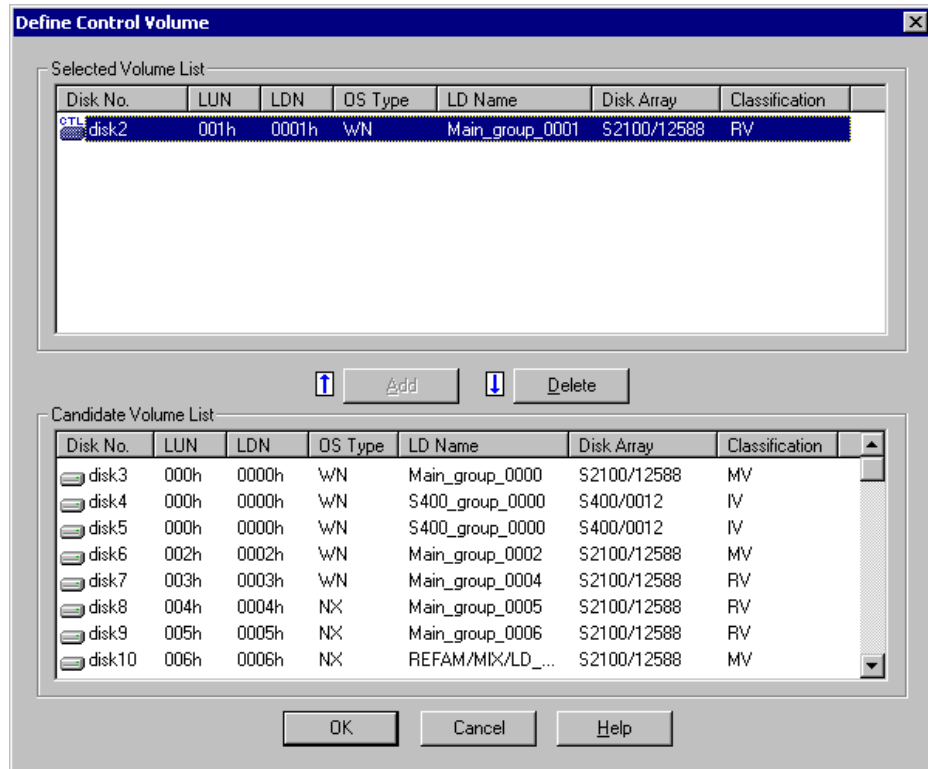


Figure 1-10 Registering a Control Volume

### 1.5.3 Saving Registered Data

Click the [OK] button on the Define Control Volume screen. A confirmation message appears asking if you want to save definition information.

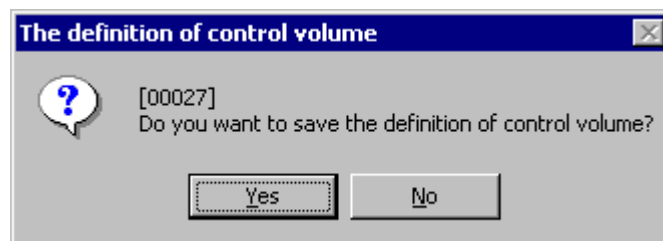


Figure 1-11 The definition of control volume: Saving Confirmation Screen

Clicking the [Yes] button for the message saves definition information and displays a termination message. Clicking the [No] button displays the Define Control Volume screen again.

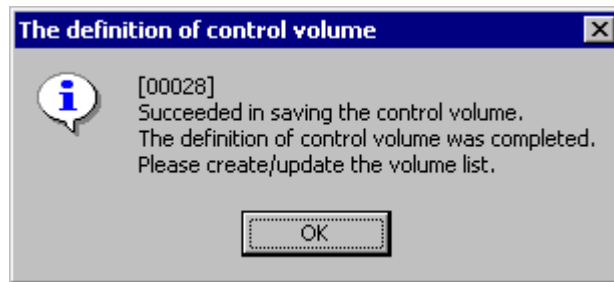


Figure 1-12 The definition of control volume: Termination Message Screen

Clicking the [OK] button closes the Define Control Volume screen and displays the Volume List Display screen again.

Clicking the [Cancel] button in the Define Control Volume screen displays a confirmation message asking if you want to cancel the definition.

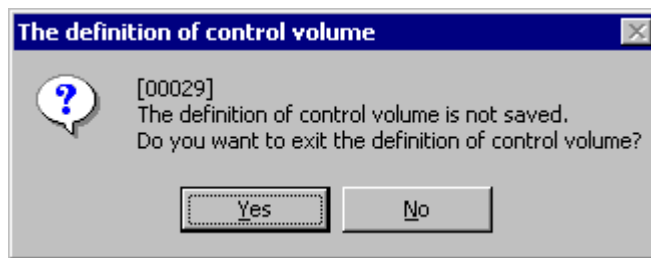


Figure 1-13 The definition of control volume: Cancel Confirmation Screen

Clicking the [Yes] button for the message cancels saving of the definition information. The Define Control Volume screen is closed and the Volume List Display screen appears again.

Clicking the [No] button displays the Define Control Volume screen again.

## 1.5.4 Reflecting Data to the Volume List

---

Select [Create/Update Volume List] from [File] in the Volume List Display screen to create or update the Volume List file, reflect the saved registration data of the control volume to the Volume List, and register it.

When the Volume List file has been created or updated, the Volume List Display screen is automatically refreshed. Confirm that "Control" is displayed for "Volume Definition" of the logical disk selected as a control volume.

## 1.6 Volume List Creation

Creation of Volume List is required before using replication operation command. A Volume List is created by the iSMvollist command with an argument -cr. Execute iSMvollist command by a user that belongs to Administrators group.

When you have already performed [Create/Update Volume List] using the Volume List Display function (screen operation) according to the instructions described in 1.5, "Control Volume Setting", you do not have to perform the following operation.

```
iSMvollist -cr
```

Upon successful creation of Volume List, the following message appears:

```
ISM11701: Volume list is created successfully.
```

If creation of a Volume List fails, execution of replication operation command is disabled.

Troubleshoot in accordance with an error message or with operation error tracing, create a Volume List again.

Even under operation with replication, a Volume List must be created again in the following cases. Failing in updating of Volume List may result in data inconsistency upon execution of replication operation command.

- Change of disk array settings (disk array name, logical disk name, format)
- Setting/Change of Access Control
- Adding/change/deleting of disk
- Adding/change/deleting of partition
- Adding/change/deleting of drive name on partition, and of drive path mounted on NTFS folder

To use a control volume, before creating or updating a Volume List, check the following:

- A control volume has been selected and registered in advance using the Define Control Volume function from the Volume List Display screen.

## 1.7 Preparing Volume

---

When using a volume for the first time for replication operation or changing the MV partition size, execute the steps given below for the target volume.



In data replication operation using ReplicationControl Ver3.2 or later, if NOTREADY is specified for the UMOUNT\_RVACC parameter in the replication operation option setting file, the mount point (drive letter or NTFS folder name) is automatically deleted and the automatic mount becomes unavailable at RV unmounting. On Windows 2000, the RV access restriction is changed to Not Ready to suppress automatic volume mounting by Windows. However, this parameter is set to the default that the automatic mounting is not suppressed. It is recommended that NOTREADY be specified for this parameter to suppress automatic RV mounting for operation.

For details of this parameter, refer to Chapter 3 “Operation Settings” in the “Data Replication Command Reference”.



On Windows Server 2003, use the MOUNTVOL command provided by the operating system to suppress automatic volume mounting before operation.

To suppress automatic volume mounting, execute the MOUNTVOL command with specifying the N option as follows:

```
MOUNTVOL /N
```

### Step 1. Creating MV partition

Using [Disk Management] (Windows), create partitions on a volume to be used for MV.

In a recommended partition configuration, one physical disk contains one partition.

### Step 2. Creating file system

Create a file system on a disk of MV where a partition has been created and assign a drive letter to the file system created.

### Step 3. Checking RV volume

In Windows 2000, using [Disk Management] (Windows), check that the disk to be used as RV is in an unassigned area. If signature is not found, execute “Signature Disk” here. If RV has partitions, delete them and place the area in unassigned state.

On Windows Server 2003, use [Disk Management] (Windows) to create partitions on the disk to be used as the RV in advance so that the disk has the same partition configuration as the MV. At this time, do not assign any drive letter.

### Step 4. Creating Volume List

On each host on MV and RV sides, create a Volume List using the iSMvollist command of the ReplicationControl.

Create the Volume List as follows:

```
iSMvollist -cr
```

When creating the Volume List has succeeded, the following message will appear:

```
iSMvollist: Info:          iSM11701: Volume list is created successfully.
```

Output the Volume List information to the vollist\_data.txt.

```
iSMvollist -a > vollist_data.txt
```

- \* After changing the logical disk name using the iSM, you must update the Volume List.
- \* To use a control volume, before creating a Volume List, select and register the control volume using the Define Control Volume function from the Volume List Display screen.

### Step 5. Saving disk signature

Execute the following command for each host on MV and RV sides and save the signature for the replication target disk.

```
iSMrc_signature -read -all
```

### Step 6. Backing up disk signature

Back up the disk signature saved in step 5 above, by executing the following command on each host on MV and RV sides:

```
iSMrc_signature -export file-name -all
```

- \* For the file-name, specify an arbitrary file name.
- \* This backup is performed to enable the disk signature to be restored to its saved status when an incorrect disk signature has been written due to an operation error.

### Step 7. Setting pair

Use the Replication Management (GUI) for setting a pair. In addition, the pair setting can also be executed by using the `iSMrc_pair` command. By checking the `vollist_data.txt` that stores the Volume List information created in step 4 and the volume displayed by the Replication Management, determine the target disk for replication and set a pair.

For pair setting, note the following:

- The MV and RV disk capacities must be the same.
- The MV and RV disks must be the basic disks.
- A volume format must be “WN” or “A2”.
- In the recommended configuration, MV contains one partition for one volume.

When executing Replicate for RV for the first time, RV must be in the following state:

- In Windows 2000, RV must be in unassigned area.
- On Windows Server 2003, the disk to be used as the RV has the same partition configuration as the MV. The drive letter is unassigned.

### Step 8. Copying disk

Execute Replicate for the pair set in step 7 above. In this example, execute Replicate for logical disk name `dev001`.

```
iSMrc_replicate -mv dev001 -mvflg ld -rv dev002 -rvflg ld
```

Then, the following start message appears and copying from MV to RV begins.

```
Replicate Start          2001/02/21 11:06:13
MV:10                   dev001                WN
  \\?\Volume{ce49f299-614e-11d5-b1df-009027520bce}\
G:
RV:-                     dev002                WN
-
-
```

### Step 9. Flushing MV file system

Flush the MV file system and write the file system buffer data, not yet written, to the disk. Assume that the MV volume has been assigned to G:.

```
iSMrc_flush -drv G:
```

Then, the following message appears and flushing occurs.

```
Flush Start              2001/02/21 11:08:14
disk10                   dev001                WN
  \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:
```

```

Flush Normal End          2001/02/21 11:08:14
disk10                    dev001                WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:

```

#### Step 10. Unmounting MV

Before separating MV/RV, you must create a complete static point of the MV data.

The purpose of this is to write out all data that is not reflected, including the file system control data and the metadata to disk and to keep the MV and RV data consistency by restricting accesses to the logical volume.

To keep MV and RV data consistency, unmount MV and clear the volume and file system associations after stopping the operation.

Before unmounting, you must close all applications that may access the drive. Also read the description about unmounting in Chapter 3 “Notes”.

```
iSMrc_umount -drv G:
```

Then, the following message appears and MV is unmounted.

```

Umount Start              2001/02/21 11:08:20
disk10                    dev001                WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:

Umount Normal End        2001/02/21 11:08:20
disk10                    dev001                WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:

```

#### Step 11. Executing Separate

Separate MV and RV from each other by executing Separate to make RV available.

In this example, Separate is executed according to the following settings:

- Access restrictions for RV separated: rw (Read/Write) (default value)
- Waiting for Separate completion

```
iSMrc_separate -mv dev001 -mvflg ld -wait
```

Then, the following message appears and Separate begins.

```

Separate Start            2001/02/21 11:08:21
MV:10                    dev001                WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:
RV:-                      dev002                WN

```

```
-  
-  
Separating...  
Separate Normal End      2001/02/21 11:08:21  
MV:10                    dev001                    WN  
    \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\  
    G:  
RV:-                      dev002                    WN  
-  
-
```

Note that, if the RV access restriction has been set to Read Only (ro) when executing Separate, attempting a write operation to that drive with the volume mounted causes a write error. In such a case, change the RV access restriction to Read/Write (rw) from the Replication Management (GUI).

### Step 12. Using MV

Mount MV to associate MV and file system.

```
iSMrc_mount -drv G:
```

Then, the following message appears and the mounted MV is available as a file system.

```
Mount Start              2001/02/21 11:08:22  
    disk10                dev001                    WN  
    \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\  
    G:  
  
Mount Normal End        2001/02/21 11:08:22  
    disk10                dev001                    WN  
    \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\  
    G:
```

### Step 13. Recognizing disk on RV side

Start [Disk Management] (Windows) from the host on the RV side and assign a drive name to the disk. In this example, assume that the RV drive letter has been assigned to H:.

### Step 14. Creating Volume List

Since a new drive name has been assigned to RV, creation of Volume List is required using iSMvollist command of the ReplicationControl.

Enter the following command to create a Volume List.

```
iSMvollist -cr
```



Upon successful creation of Volume List, the following message appears:

```
iSMvollist: Info:          iSM11701: Volume list is created successfully.
```

Output the Volume List data into the vollist\_data.txt.

```
iSMvollist -a > vollist_data.txt
```

- \* If a logical disk name has been changed using the iSM, the Volume List must be updated.
- \* To use a control volume, before creating a Volume List, select and register the control volume using the Define Control Volume function from the Volume List Display screen.

### **Step 15. Researching mount point volume name**

A mount point volume name used for operation must be researched.

Enter “MOUNTVOL /L” on DOS prompt.

```
MOUNTVOL /L
```

Then, the list of volumes available on system is displayed as follows:

```
\\?\Volume{e2464851-8089-11d2-8803-806d6172696f}\  
  F:\  
\\?\Volume{e2464852-8089-11d2-8803-806d6172696f}\  
  G:\  
\\?\Volume{e2464850-8089-11d2-8803-806d6172696f}\  
  H:\
```

A mount point volume name is required for replication operation for operations such as backup, etc.

Take a memo of the mount point volume names, which are displayed in the mount point volume name list, to use in the operation.

Now, the volume is ready.

## 1.8 Preparation for Operation

To operate the system in the Replicate state, take the following steps and re-synchronize (Replicate).

The following procedures are not required when the systems are operated separately.

### Step 1. Executing RV file system flush

Flush RV file system and write the unwritten data in file system buffer onto disk.

```
iSMrc_flush -drv H:
```

Then, the following message appears and the data is flushed.

```
Flush Start          2001/02/21 11:21:13
  disk11             dev002                WN
  \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
  H:

Flush Normal End    2001/02/21 11:21:13
  disk11             dev002                WN
  \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
  H:
```

### Step 2. Executing RV unmounting

Unmount RV and cancel association between volume and file system.

When the RV is unmounted, the mount point (drive letter or NTFS folder name) set for the volume is automatically deleted. On Windows 2000, the RV access restriction is changed to Not Ready.

\* Set NOTREADY for the UMount\_RVACC parameter in the replication operation option setting file to suppress automatic RV mounting before operation.

When executing unmounting, all application software, that may access the drive, must be terminated in advance.

Refer to descriptions about unmounting Chapter 3 “Notes” also.

```
iSMrc_umount -drv H:
```

Then, the following message appears and the RV is unmounted:

```
iSMrc_umount: Info:      iSM13221: Resetting drive letter (H:)
  (\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\) has succeeded.
  Umount Start          2001/02/21 11:21:14
  disk11                 dev002                WN
  \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
  H:
```

iSMrc\_umount: Info: iSM13221: Resetting drive letter (H:)  
(\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\) has succeeded.

```
Umount Normal End      2001/02/21 11:21:14
disk11                  dev002                  WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
H:
```

**Step 3. Executing Replicate**

Execute Replicate and re-synchronize (Replicate).

```
iSMrc_replicate -mv dev001 -mvflg ld -rv dev002 -rvflg ld
```

Then , the following message appears and data copying from MV to RV is started:

```
Replicate Start      2001/02/21 11:21:15
MV:10                dev001                  WN
\\?\Volume{ce49f299-614e-11d5-b1df-009027520bce}\
G:
RV:-                  dev002                  WN
-
-
```

## Chapter 2 Operation and Maintenance

This chapter describes an example of operation using the Data Replication function, the operation procedure for replication, and the trouble-shooting for faults that may occur during operations.

### 2.1 Operations

#### 2.1.1 Example of Backup Operation

This section describes an example of backup operation by using the Data Replication function. Although the text describes the commands in input order, the command execution is automated by job scheduling software on the system built actually.

##### (1) Overview

Data of the master volume (MV) used in operation is replicated to the replication volume (RV). Then, it is saved to the tape by using backup software.

Assume that the backup environment has the configuration shown in Figure 2-1. Now, the volumes have been set as a pair, and operation has started in the Separated state.

In this example, the MV drive letter is G: and the RV drive letter is H:.

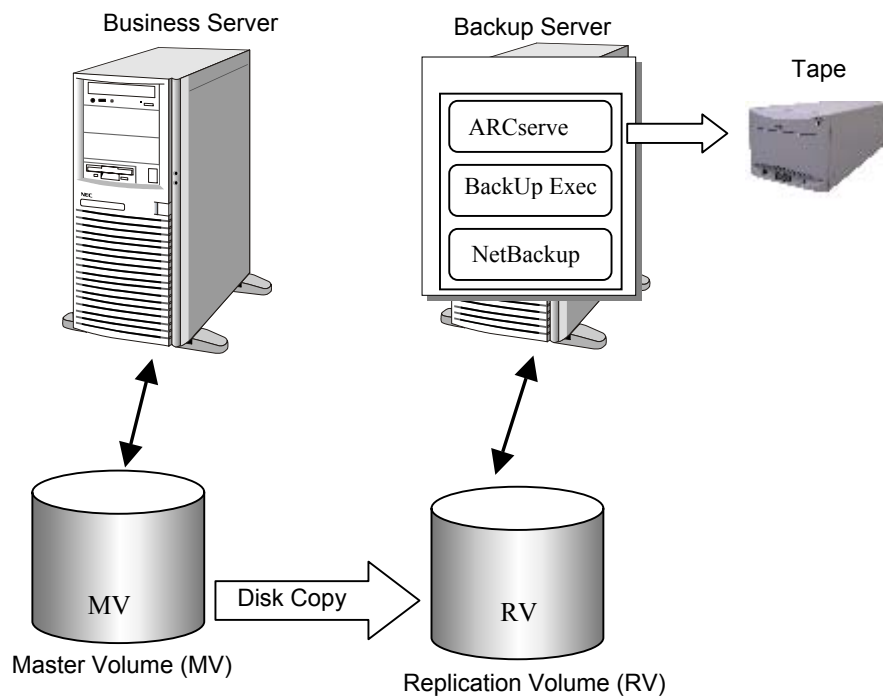
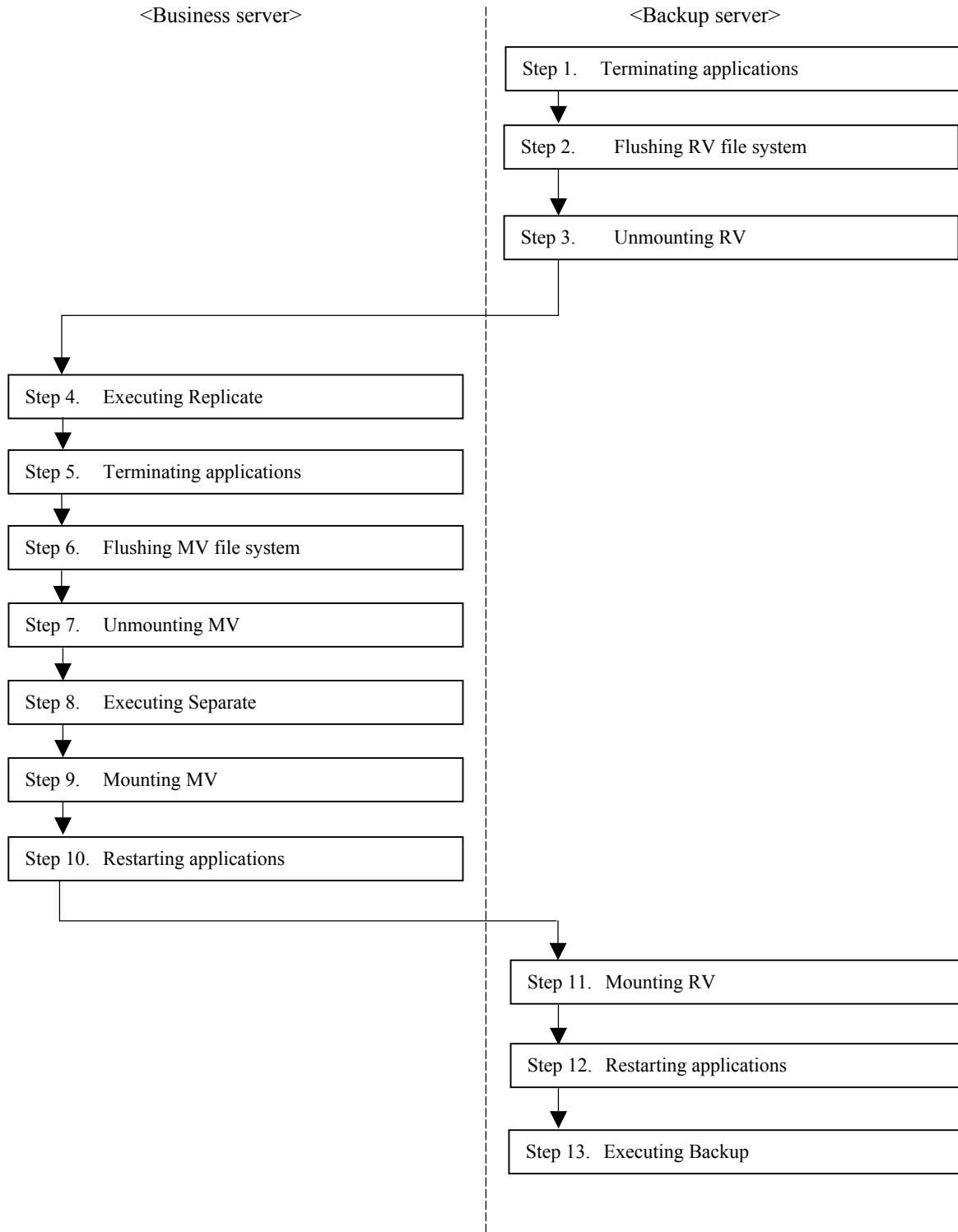


Figure 2-1 Online Backup

## Work flow of the backup example



### (2) Operation procedure

#### Step 1. Terminating applications (backup server)

To maintain data consistency, terminate or halt applications and specified services that are accessing the volume concerned.

If shared folders are used on the volume concerned, cancel sharing temporarily.

If application or service has not been halted or terminated, or accesses to shared folder exist, unmounting in step 3 fails.

(Example) Halting service

```
NET STOP (service name)
```

When halting a service "ESMCommonService", specify as follows:

```
NET STOP ESMCommonService
```

#### Step 2. Flushing RV file system (backup server)

Flush the RV file system and write the file system buffer data, not yet written, to the disk.

```
iSMrc_flush -drv H:
```

Thus, the following message appears and flushing occurs.

```
Flush Start          2001/02/21 12:27:01
                    disk11          dev002          WN
                    \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
                    H:

Flush Normal End     2001/02/21 12:27:01
                    disk11          dev002          WN
                    \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
                    H:
```

#### Step 3. Unmounting RV (backup server)

Unmount RV and cancel the volume and file system associations.

When the RV is unmounted, the mount point (drive letter or NTFS folder name) set for the volume is automatically deleted. On Windows 2000, the RV access restriction is changed to Not Ready.

\* Set NOTREADY for the UMount\_RVACC parameter in the replication operation option setting file to suppress automatic RV mounting before operation.

Before unmounting, you must close all applications that may access the drive. Also read the description about unmounting in Chapter 3 "Notes".

```
iSMrc_umount -drv H:
```

Then, the following message appears and RV is unmounted.

```
Umount Start                2001/02/21 12:27:02
      disk11                  dev002                      WN
      \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
      H:
```

```
iSMrc_umount: Info:        iSM13221: Resetting drive letter (H:)
(\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\) has succeeded.
```

```
Umount Normal End          2001/02/21 12:27:02
      disk11                  dev002                      WN
      \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
      H:
```

**Step 4. Executing Replicate (business server)**

Execute Replicate to copy data from MV to RV.

This example uses the replication operation file and executes replication according to the following settings.

- Copy range: Difference (default value)
- Update reflection to RV: Sync mode (default value)
- RV access restriction: nr (Not Ready) (default value)
- Waiting for copy completion not specified (default value)

Assume that the replication operation file contains the following:

disks.txt

# Type: MV	Type: RV
Id: dev001	Id: dev002

```
iSMrc_replicate -file disks.txt
```

Then, the following message appears and copying from MV to RV begins.

```
Replicate Start            2001/02/21 12:27:10
      MV:10 dev001                      WN
      \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
      G:
      RV:- dev002                      WN
      -
      -
```

### Step 5. Terminating applications (business server)

To maintain data consistency, terminate or halt applications and specified services that are accessing the target volume.

If a shared folder is used on the target volume, cancel the sharing temporarily.

If applications and services have not been halted or terminated, or a shared folder is accessed, the unmounting operation in step 7 will fail.

(Example) Halting service

```
NET STOP (service name)
```

When halting a service "ESMCommonService", specify as follows:

```
NET STOP ESMCommonService
```

(Example) Cancel the sharing of the shared folder.

```
NET SHARE share_name /delete
```

When canceling sharing of shared folder mv\_folder1, specify as follows:

```
NET SHARE mv_folder1 /delete
```

### Step 6. Flushing MV file system (business server)

Flush the file system of MV and write data in buffer of the file system which has not been written to the disk.

```
iSMrc_flush -drv G:
```

Then, the following message is displayed and flush is executed.

```
Flush Start                2001/02/21 12:23:14
disk10                    dev001                WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:

Flush Normal End          2001/02/21 12:23:14
disk10                    dev001                WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:
```



**Step 7. Unmounting MV (business server)**

You must create a perfect static point of MV data.

This is for writing the metadata of the file system completely to the disk. This is also for suppressing I/O to the logical volume to keep data consistency of MV and RV.

To keep data consistency of MV and RV, unmount MV after stopping operation, and cancel association between the volume and file system.

To execute unmount, you must quit all application software which access the drive. Also refer to the description about unmount in Chapter 3 "Notes".

If MV unmounting failed and no means of avoidance exists, wait for 60 seconds and proceed to step 8.

In addition, although separating is allowed without unmounting in this step, unmounting upon replication and restoration is mandatory.

```
iSMrc_umount -drv G:
```

Then, the following message is displayed and MV is unmounted.

```
Umout Start                2001/02/21 12:23:15
    disk10                  dev001                    WN
    \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
    G:
```

```
Umout Normal End          2001/02/21 12:23:15
    disk10                  dev001                    WN
    \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
    G:
```

**Step 8. Executing Separate (business server)**

Execute Separate to separate MV and RV to make RV available, and resume applications.

This example uses the replication file and separates MV and RV according to the following settings.

- Copy range: Difference (default value)
- Update reflection to RV: Sync mode (default value)
- Access restrictions for RV after Separate: rw (Read/Write) (default value)
- Specify the wait for Separate completion

```
iSMrc_separate -file disks.txt -wait
```

Then, the following message is displayed and MV is separated.

```
Separate Start          2001/02/21 12:23:16
MV:10 dev001           WN
  \\?\Volume{ce49f299-614e-11d5-b1df-009027520bce}\
G:
RV:- dev002           WN
-
-

Separating.....
Separate Normal End    2001/02/21 12:23:16
MV:10 dev001           WN
  \\?\Volume{ce49f299-614e-11d5-b1df-009027520bce}\
G:
RV:- dev002           WN
-
-
```

If access restrictions for RV is set to Read Only (ro) when Separate is executed, a write error occurs if you execute a write operation to the drive on which the volume is mounted.

In this case, change the access restrictions for RV to Read/Write Permit (rw) from the Replication Management (GUI).

### Step 9. Mounting MV (business server)

Use MV again on applications.

To associate MV and the file system, mount MV.

```
iSMrc_mount -drv G:
```

Then, the following message is displayed. MV is mounted and can be used as a file system.

```
Mount Start          2001/02/21 12:23:17
disk10              dev001           WN
  \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:

Mount Normal End    2001/02/21 12:23:17
disk10              dev001           WN
  \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:
```

**Step 10. Restarting applications (business server)**

Restart the applications closed in Step 5.

If services were halted in step 5, restart the services by the following procedures. If services were not halted in step 5, executing of the following is not required.

(Example) Starting service

```
NET START (service name)
```

To start the service "ESMCommonService", specify as shown below.

```
NET START ESMCommonService
```

If sharing of a folder was cancelled in step 5, specify sharing again. If sharing was not cancelled in step 5, executing of the following is not required.

(Example) Sharing of a folder

```
NET SHARE share_name=drive_letter: path
```

To enable the sharing of the folder mv\_folder1, specify as shown below.

```
NET SHARE mv_folder1=G:\mv_folder1
```

**Step 11. Mounting RV (backup server)**

To associate RV and the file system, mount RV.

When the RV is mounted with the mount point (drive letter or NTFS folder name) and target mount point volume name specified, the mount point (drive letter or NTFS folder name) is automatically set again. On Windows 2000, the RV is released from the Not Ready state.

```
iSMrc_mount -drv H: -mvol \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
```

Then, the following message is displayed. RV is mounted and can be used as a file system.

```
Mount Start                2001/02/21 12:26:14
disk11                     dev002                WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
H:
```

```
iSMrc_mount: Info:        iSM13220: Setting drive letter (H:)
(\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\) has succeeded.
```

```
Mount Normal End          2001/02/21 12:26:14
disk11                     dev002                WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
H:
```

Use RV for backup on applications.

**Step 12. Restarting applications (backup server)**

Start the applications and services terminated in step 1. For the procedures to start services and share the folder, refer to step 10.

**Step 13. Executing backup (backup server)**

Use backup software to back up the data copied to RV to the tape.

## 2.1.2 Example of Restoring Master Volume Data

---

This section describes procedures of restoring master volume (MV) data.

**(1) Data restoration without use of replication function**

When restoring data via network or restoring data on master volume (MV) directly from backup data on the tape, execute data restoration in the procedure specific to the backup software.

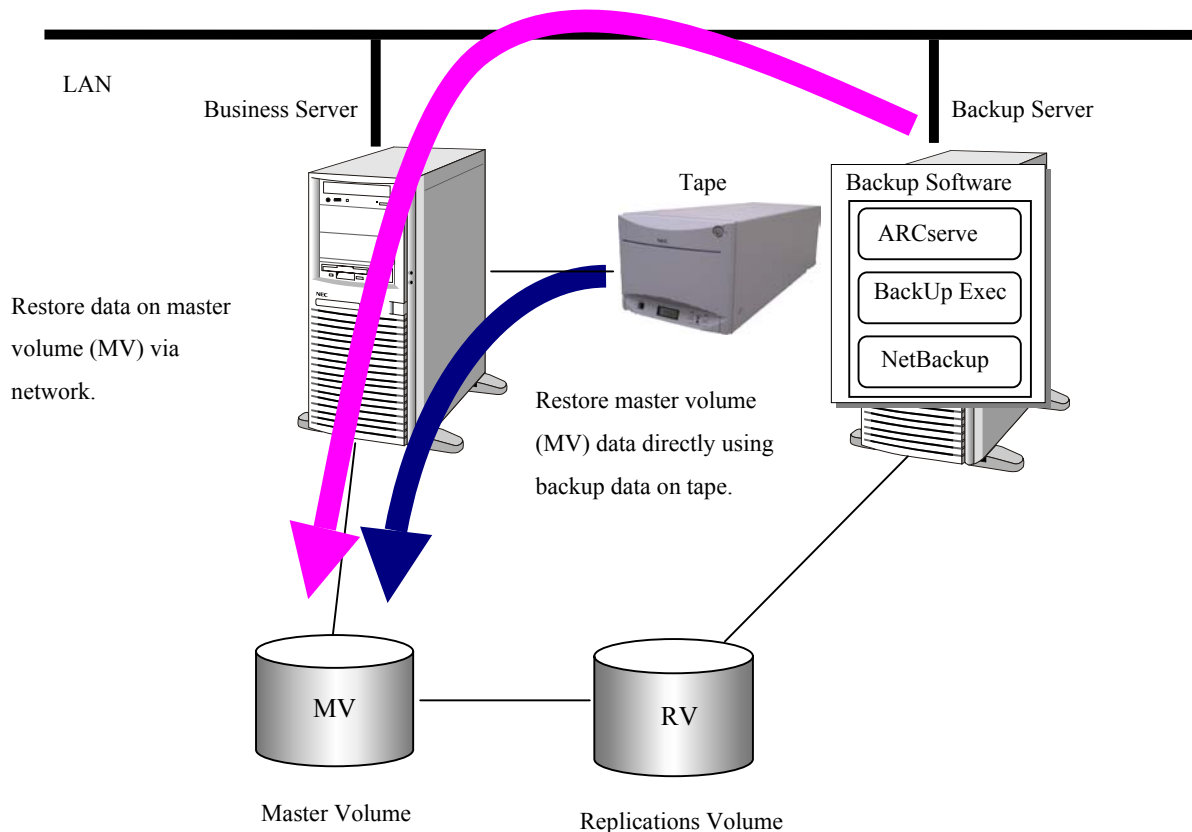


Figure 2-2 An Example of Data Restoration without Use of Replication Function

**(2) Data restoration with use of replication function**

The following describes the procedures of completely restoring data using backup tape, upon failure of data file. The procedures assume that MV data file has physical or logical failure, and the tape contains backup data previously retrieved.

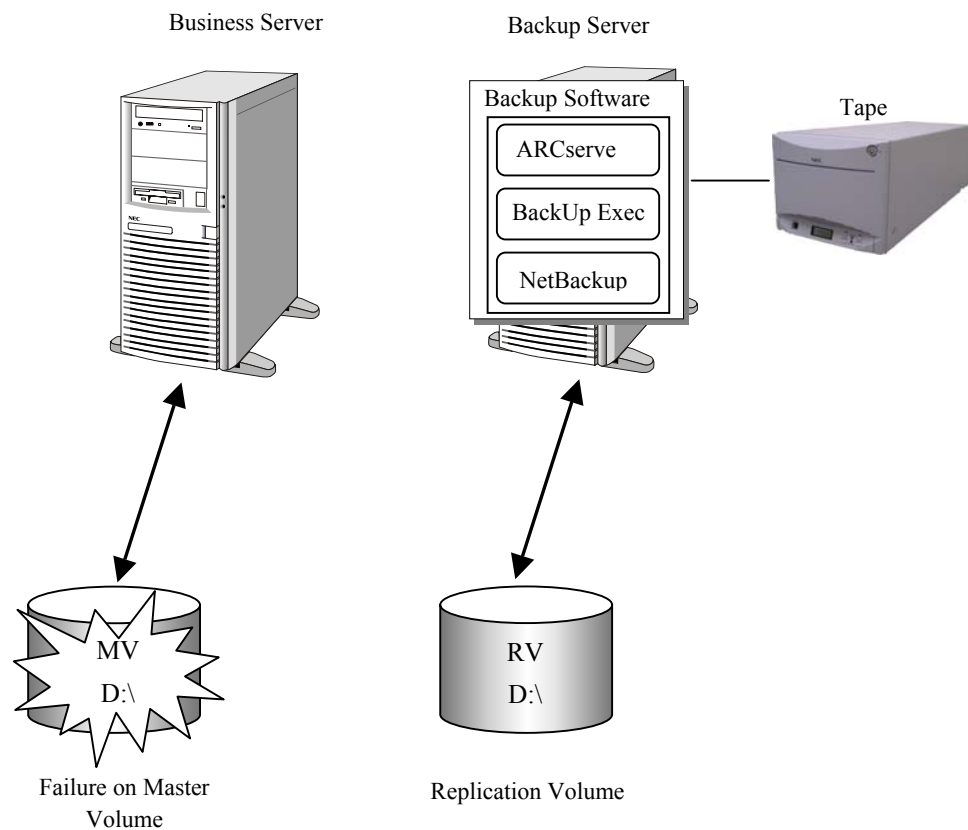
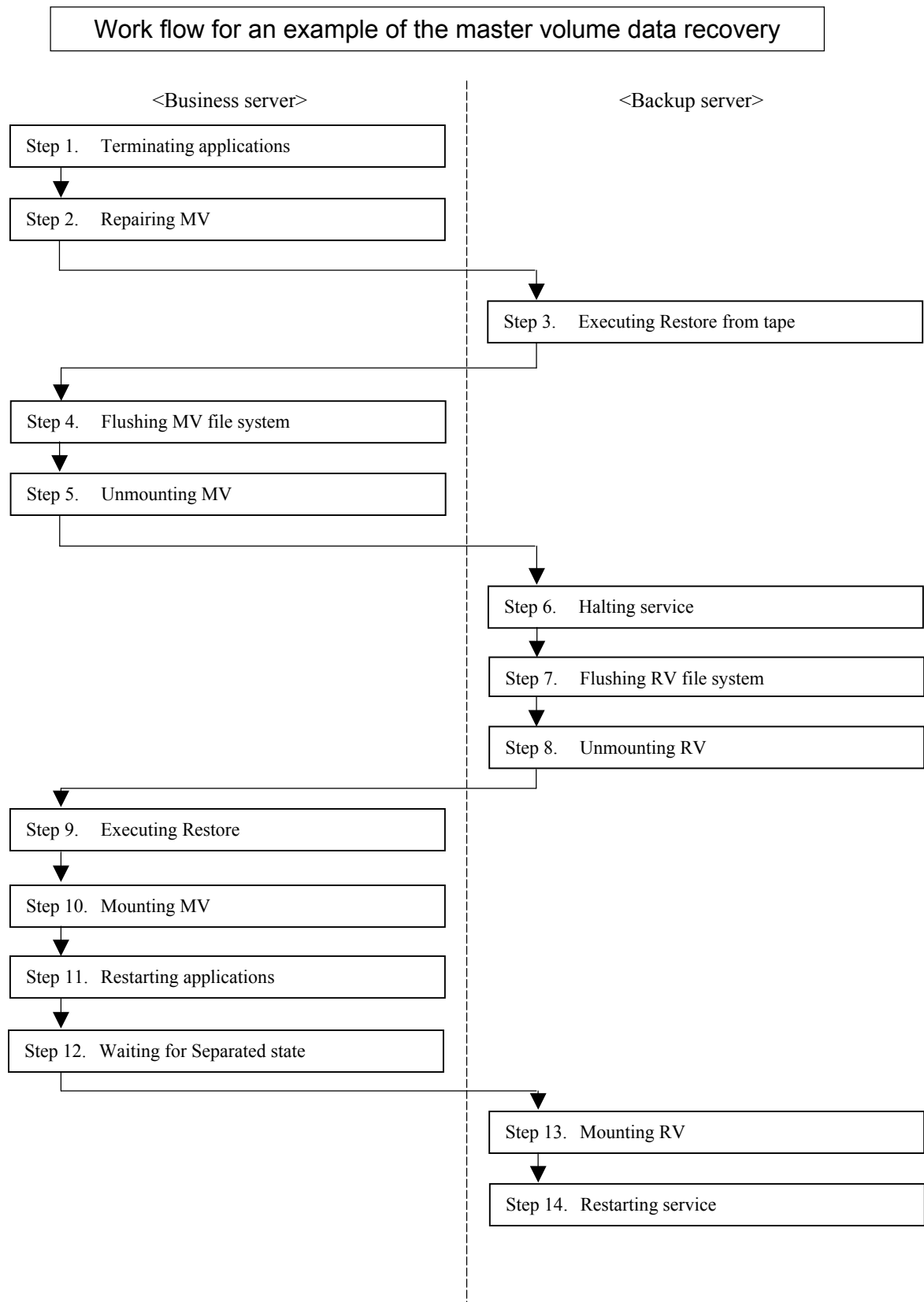


Figure 2-3 An Example of Data Restoration with Use of Replication Function

LD names of MV/RV are dev001 and dev002 respectively, and both are assigned to D drive in respective hosts.



**Step 1. Terminating applications (business server)**

Terminate or halt applications and specified services that are accessing the volume where a fault has occurred. If a shared folder is used on the target volume, cancel the sharing temporarily.

(Example) Halting service

```
NET STOP (service name)
```

When halting a service "ESMCommonService", specify as follows:

```
NET STOP ESMCommonService
```

(Example) Canceling sharing of folder

```
NET SHARE share_name /delete
```

When canceling the sharing of the folder mv\_folder1, specify as follows:

```
NET SHARE mv_folder1 /delete
```

Terminate application.

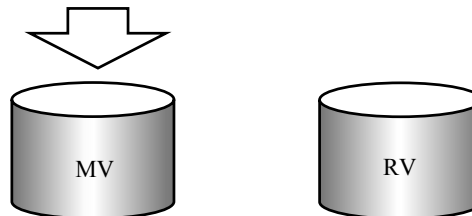


Figure 2-4 Terminating Application

**Step 2. Repairing MV (business server)**

When MV was rebuilt to recover from a hardware fault, or when a new logical volume was created, signature the disk by using [Disk Management] (Windows).

Then, set a partition, create a file system by carrying out format, and reset the drive letter. For the partition, file system and drive letter, use settings previously specified before the fault occurred.

Also, re-create a volume list and update it.

```
iSMvollist -cr
```

When the volume list has been successfully updated, the following message appears:

```
iSMvollist: info: iSM11701: Volume list is created successfully.
```

### Step 3. Executing Restore from tape (backup server)

Restore data from the tape to RV, using backup software.

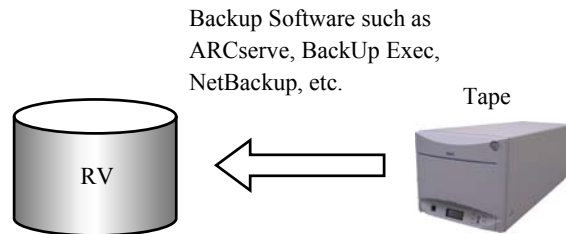


Figure 2-5 Restoring Backup Data to RV

### Step 4. Flushing MV file system (business server)

Flush the MV file system and discard data in the file system buffer.

```
iSMrc_flush -drv D:
```

Then, the following message appears and flushing is executed.

```
Flush Start                2001/02/21 12:23:03
disk10                    dev001                               WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
D:

Flush Normal End          2001/02/21 12:23:04
disk10                    dev001                               WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
D:
```

### Step 5. Unmounting MV (business server)

Unmount MV before executing Restore.

To execute unmounting, you must terminate all applications which access the drive. Also, refer to the description about unmounting in Chapter 3 “Notes”.

```
iSMrc_umount -drv D:
```

Then, the following message appears and unmounting is executed.

```
Umount Start              2001/02/21 12:23:15
disk10                    dev001                               WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
D:

Umount Normal End         2001/02/21 12:23:15
disk10                    dev001                               WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
```



D:

If normal unmounting fails, execute unmounting again by specifying the -force option.

```
iSMrc_umount -drv D: -force
```

**Step 6. Halting service (backup server)**

Terminate or halt applications and services that may prevent RV from being unmounted. If applications and services have not been halted or terminated, the unmounting operation in step 8 will fail.

(Example) Halting service

```
NET STOP (service name)
```

When halting a service “ESMCommonService”, specify as follows:

```
NET STOP ESMCommonService
```

**Step 7. Flushing RV file system (backup server)**

Flush the RV file system and write the unwritten data in file system buffer onto disk.

```
iSMrc_flush -drv D:
```

**Step 8. Unmounting RV (backup server)**

Unmount RV and cancel association between the volume and the file system.

When the RV is unmounted, the mount point (drive letter or NTFS folder name) set for the volume is automatically deleted. On Windows 2000, the RV access restriction is changed to Not Ready.

\* Set NOTREADY for the UMOUNT\_RVACC parameter in the replication operation option setting file to suppress automatic RV mounting before operation.

When executing unmounting, all application software, that is supposed to access the drive, must be terminated in advance.

Refer to descriptions about unmounting Chapter 3 “Notes” also.

```
iSMrc_umount -drv D:
```

**Step 9. Executing Restore (business server)**

Execute Restore on the MV volume.

In this example, it is assumed that the replication operation file is used and the data is restored according to the following settings:

- RV operation mode: RV protection
- RV access restriction: nr (Not Ready) (default value)
- Waiting for copy completion not specified (default value)

It is also assumed that the replication operation file contains the following:

```
disks.txt
```

# Type:MV	Type:RV
Id:dev001	Id:dev002

When Restore with RV protection specified is executed, Separate is automatically executed after Restore has been completed.

```
iSMrc_restore -file disks.txt -mode protect
```

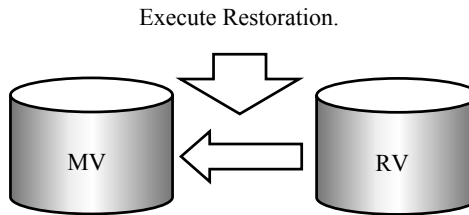


Figure 2-6 Executing Restoration

**Step 10. Mounting MV (business server)**

Use MV again on applications.

Mount MV to associate it with a file system.

```
iSMrc_mount -drv D:
```

Then, the following message appears, and MV is mounted allowing it to be used as a file system.

```
Mount Start          2001/02/21 12:23:17
disk10              dev001                WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
D:

Mount Normal End    2001/02/21 12:23:17
disk10              dev001                WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
D:
```

**Step 11. Restarting applications (business server)**

Restart the applications and services that have been terminated in Step 1.

If services have been halted in step 1, restart the services by the following procedures. If services were not halted in step 1, it is not necessary to execute the following.

(Example) Starting service

```
NET START (service name)
```

To start the service “ESMCommonService”, specify as shown below.

```
NET START ESMCommonService
```

If sharing of the folder was cancelled in step 1, specify the sharing again. If sharing was not cancelled in step 1, it is not necessary to execute the following.

(Example) Sharing of shared folder

```
NET SHARE share_name=drive_letter: path
```

To enable the sharing of the folder mv\_folder1, specify as shown below.

```
NET SHARE mv_folder1=G:\mv_folder1
```

**Step 12. Waiting for Separated state (business server)**

When Restore with RV protection specified has been executed, the system waits for the automatic Separate.

```
iSMrc_wait -file disks.txt -cond sep
```

Waiting for the Separated State.

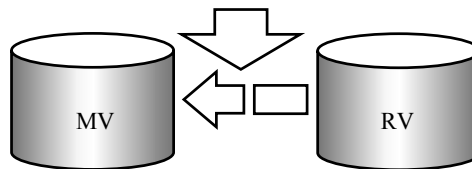


Figure 2-7 Waiting for the Separated State

**Step 13. Mounting RV (backup server)**

Mount RV to associate it with a file system.

When the RV is mounted with the mount point (drive letter or NTFS folder name) and target mount point volume name specified, the mount point (drive letter or NTFS folder name) is automatically set again. On Windows 2000, the RV is released from the Not Ready state.

```
iSMrc_mount -drv D: -mvol \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
```

Then, the following message appears, and RV is mounted allowing it to be used as a file system.

```
Mount Start          2001/02/21 12:26:14
disk11              dev002              WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
D:
```

```
iSMrc_mount: Info:    iSM13220: Setting drive letter (D:) (\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\) has succeeded.
```

```
Mount Normal End    2001/02/21 12:26:14
disk11              dev002              WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
D:
```

Use RV again as a backup volume.

### **Step 14. Restarting service (backup server)**

Resume the applications and services that have been terminated in step 6.

If the services have been halted in step 6, restart the services by the following procedure. If the services were not halted in step 6, it is not necessary to execute the following.

(Example) Restarting service

NET START (service name)

To restart the service "ESMCommonService", specify as shown below.

NET START ESMCommonService

## 2.1.3 Example of Using Replication Volumes

This section describes how to build the environment same as that used for actual operations, using a replication volume.

Figure 2-8 shows the replication volume structure.

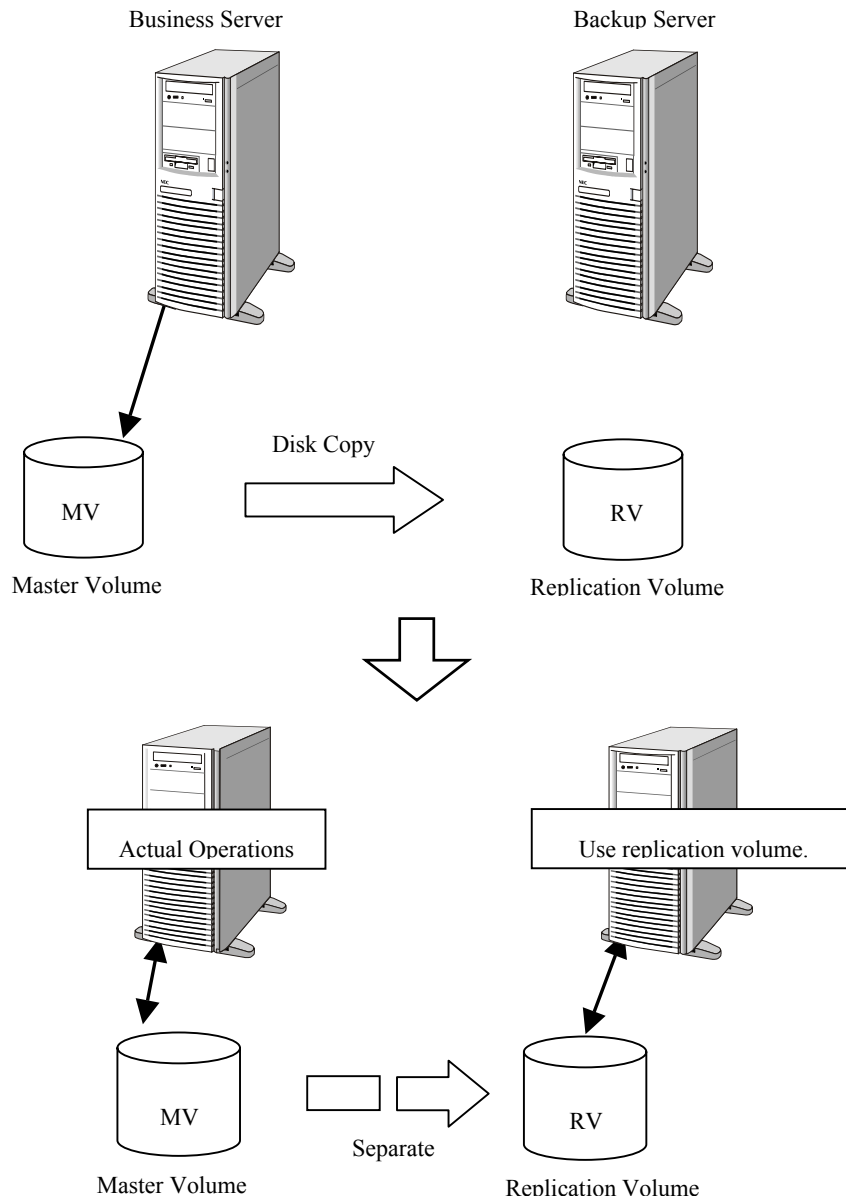


Figure 2-8 Building Replication Volume

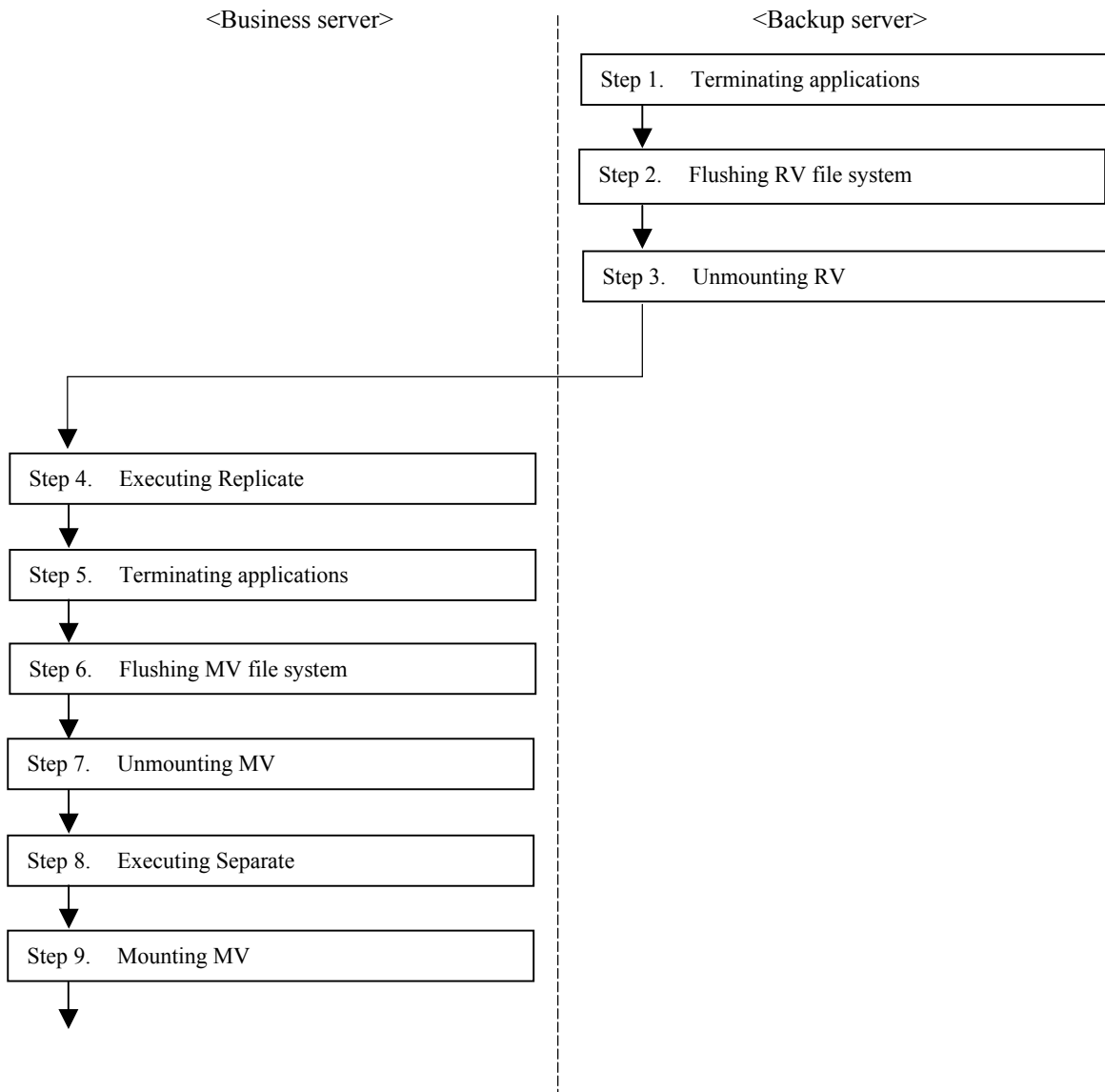
By using the Separate function which enables the use of RV also in the middle of separation while reflecting the difference of MV and RV, it is not necessary to wait for the copy operation to finish, thereby reducing the time duration when the master operations are halted. Also, it is possible to refer to the replication volume for the latest data, thereby reducing the time duration when the server-side operations are halted.

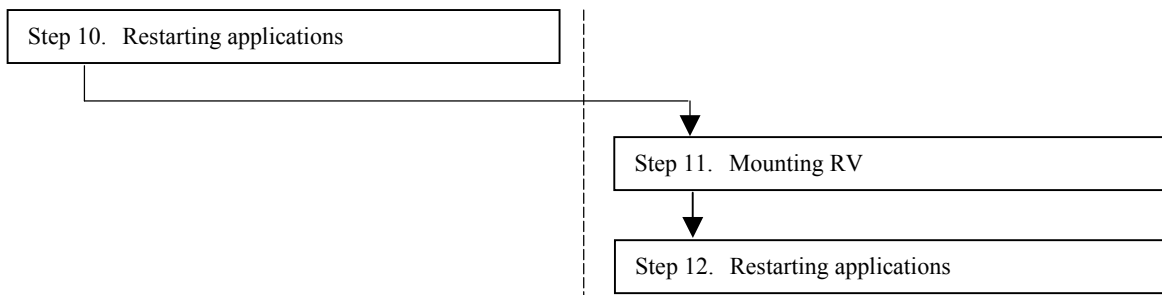
In this example, replication volume building is explained by assuming that the volumes have been set as a pair and operation has started using the business server, the pair is separated, and the MV drive letter is G and the RV drive letter is H.

Before starting replication operations, prepare the target volumes beforehand.

For more information on how to prepare volumes, refer to 1.7 “Preparing Volume”.

### Work flow for an example of the use of the replication





The following describes the procedure for executing replication control for the RV that is can be used as a file system through the prepared volumes:

### Step 1. Terminating applications (backup server)

To maintain data consistency, terminate or halt applications and specified services that area accessing the volume concerned.

(Example) Stopping service

```
NET STOP (service name)
```

To stop the service "ESMCommonService", specify as shown below.

```
NET STOP ESMCommonService
```

### Step 2. Flushing RV file system (backup server)

Flush the file system of RV and write data in buffer of the file system which has not been written to the disk.

```
iSMrc_flush -drv H:
```

Then, the following message is displayed and flush is executed.

```

Flush Start                2001/02/21 11:21:13
    disk11                  dev002                      WN
    \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
    H:

Flush Normal End          2001/02/21 11:21:13
    disk11                  dev002                      WN
    \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
    H:
  
```

### Step 3. Unmounting RV (backup server)

Unmount RV and cancel association between the volume and the file system.

When the RV is unmounted, the mount point (drive letter or NTFS folder name) set for the volume is automatically deleted. On Windows 2000, the RV access restriction is changed to Not Ready.

\* Set NOTREADY for the UMount\_RVACC parameter in the replication operation option setting file to suppress automatic RV mounting before operation.

When executing unmounting, all application software, that may access the drive, must be terminated in advance.

Refer to descriptions about unmounting Chapter 3 “Notes” also.

```
iSMrc_umount -drv H:
```

Then, the following message appears and RV is unmounted:

```
Umount Start          2001/02/21 11:21:14
disk11                dev002                WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
H:
iSMrc_umount: Info:   iSM13221: Resetting drive letter (H:)
(\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\) has succeeded.

Umount Normal End    2001/02/21 11:21:14
disk11                dev002                WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
H:
```

#### Step 4. Executing Replicate (business server)

Execute Replicate for the pair that needs replication.

In this example, it is assumed that the replication operation file is used and replication is executed according to the following setting:

- Copy range: Difference (default value)
- Update reflection to RV: Sync mode
- RV access restriction: nr (Not Ready) (default value)
- Waiting for copy completion: Not specified (default value)

It is also assumed that the replication operation file contains the following:

```
disks.txt
```

# Type:MV	Type:RV
Id:dev001	Id:dev002

```
iSMrc_replicate -file disks.txt
```

Then, the following message appears and the data copy from MV to RV is started:

```
Replicate Start      2001/02/21 12:21:15
MV:10                dev001                WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:
RV:-                  dev002                WN
-
-
```



**Step 5. Terminating applications (business server)**

To maintain data consistency, terminate or halt applications that are accessing the volume concerned.

If application has not been terminated, unmounting in step 7 fails.

If shared folders are used on the volume concerned, cancel sharing temporarily.

(Example) Stopping service

```
NET STOP (service name)
```

To stop the service "ESMCommonService", specify as shown below.

```
NET STOP ESMCommonService
```

(Example) Canceling shared folder

```
NET SHARE shared name/delete
```

To cancel the sharing of the folder mv\_folder1, specify as shown below.

```
NET SHARE mv_folder1 /delete
```

**Step 6. Flushing MV file system (business server)**

Flush the MV file system and write the file system buffer data, not yet written, to the disk.

```
iSMrc_flush -drv G:
```

Then, the following message appears and flushing is executed.

```
Flush Start                2001/02/21 12:23:14
      disk10                dev001                WN
      \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
      G:

Flush Normal End          2001/02/21 12:23:14
      disk10                dev001                WN
      \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
      G:
```

**Step 7. Unmounting MV (business server)**

You must create a perfect static point of MV data.

This is for writing the metadata of the file system completely to the disk. This is also for suppressing I/O to the logical volume to keep data consistency between MV and RV.

To keep data consistency between MV and RV, unmount MV after terminating applications, and cancel association between the volume and file system.

To execute unmount, you must terminate all application software which access the drive. Also refer to the description about unmount in Chapter 3 "Notes".

If MV unmounting failed and no means of avoidance exists, wait for 60 seconds and proceed to step 8.

In addition, although separating is allowed without unmounting in this step, unmounting upon replication and restoration is mandatory.

```
iSMrc_umount -drv G:
```

Then, the following message is displayed and MV is unmounted.

```
Umount Start                2001/02/21 12:23:15
disk10                      dev001                      WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:

Umount Normal End          2001/02/21 12:23:15
disk10                      dev001                      WN
\\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
G:
```

### Step 8. Executing Separate (business server)

Execute Separate to separate MV and RV to make RV available.

In this example, it is assumed that the replication operation file is used and Separate is executed according to the following settings:

- The time to make RV available: immediately after Separate execution
- RV access restrictions after Separate: rw (Read/Write)(default value)

By setting the time to make RV available to the time immediately after Separate execution, RV can be used immediately after Separate has been executed while reflecting the difference between MV and RV.

```
iSMrc_separate -file disks.txt -rvuse immediate
```

Then, the following message appears and Separate is executed.

```
Separate Start              2001/02/21 12:23:16
MV:10                      dev001                      WN
\\?\Volume{ce49f299-614e-11d5-b1df-009027520bce}\
G:
RV:-                        dev002                      WN
-
-
```

If access restrictions for RV is set to Read Only (ro) when Separate is executed, a write error occurs if you execute a write operation to the drive after the volume is mounted.

Therefore, change the RV access restriction setting to Read/Write Permit (rw).

**Step 9. Mounting MV (business server)**

To associate MV and the file system, mount MV.

```
iSMrc_mount -drv G:
```

Then, the following message is displayed. MV is mounted and can be used as a file system.

```
Mount Start                2001/02/21 12:23:17
    disk10                  dev001                    WN
    \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
    G:

Mount Normal End          2001/02/21 12:23:17
    disk10                  dev001                    WN
    \\?\Volume{822575dd-63d9-11d5-b1e0-009027520bce}\
    G:
```

**Step 10. Restarting applications (business server)**

Reuse the applications and shared folder, that is terminated and canceled in step 5.

If service has been halted in step 5, restart the service with the following procedure. If service has not been halted in step 5, the following step is not required.

(Example) Starting service

```
NET START (service name)
```

To start the service "ESMCommonService", specify as shown below.

```
NET START ESMCommonService
```

If sharing of a folder was cancelled in step 5, specify sharing again. If sharing was not cancelled in step 5, executing of the following is not required.

(Example) Sharing of shared folder

```
NET SHARE Share_name=drive_letter: path
```

To enable the sharing of the shared folder mv\_folder1, specify as shown below.

```
NET SHARE mv_folder1=G:\mv_folder1
```

**Step 11. Mounting RV (backup server)**

Mount RV to associate it with a file system.

When the RV is mounted with the mount point (drive letter or NTFS folder name) and target mount point volume name specified, the mount point (drive letter or NTFS folder name) is automatically set again. On Windows 2000, the RV is released from the Not Ready state.

```
iSMrc_mount -drv H: -mvol \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}
```

Then, the following message appears, and RV is mounted, allowing it to be used as a file system.

```
Mount Start          2001/02/21 12:26:14
disk11              dev002                WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
H:

iSMrc_mount: Info:   iSM13220: Setting drive letter (H:) (\\?\Volume{37d84cca-2507-
11d5-a0f7-00004c714491}\) has succeeded.

Mount Normal End    2001/02/21 12:26:14
disk11              dev002                WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
H:
```

Use RV again for backup on applications.

### **Step 12. Restarting applications (backup server)**

Restart the applications terminated in Step 1 above.

If service has been halted in step 1, restart the service with the following procedure. If service has not been halted in step 1, the following step is not required.

(Example) Restarting service

```
NET START (service name)
```

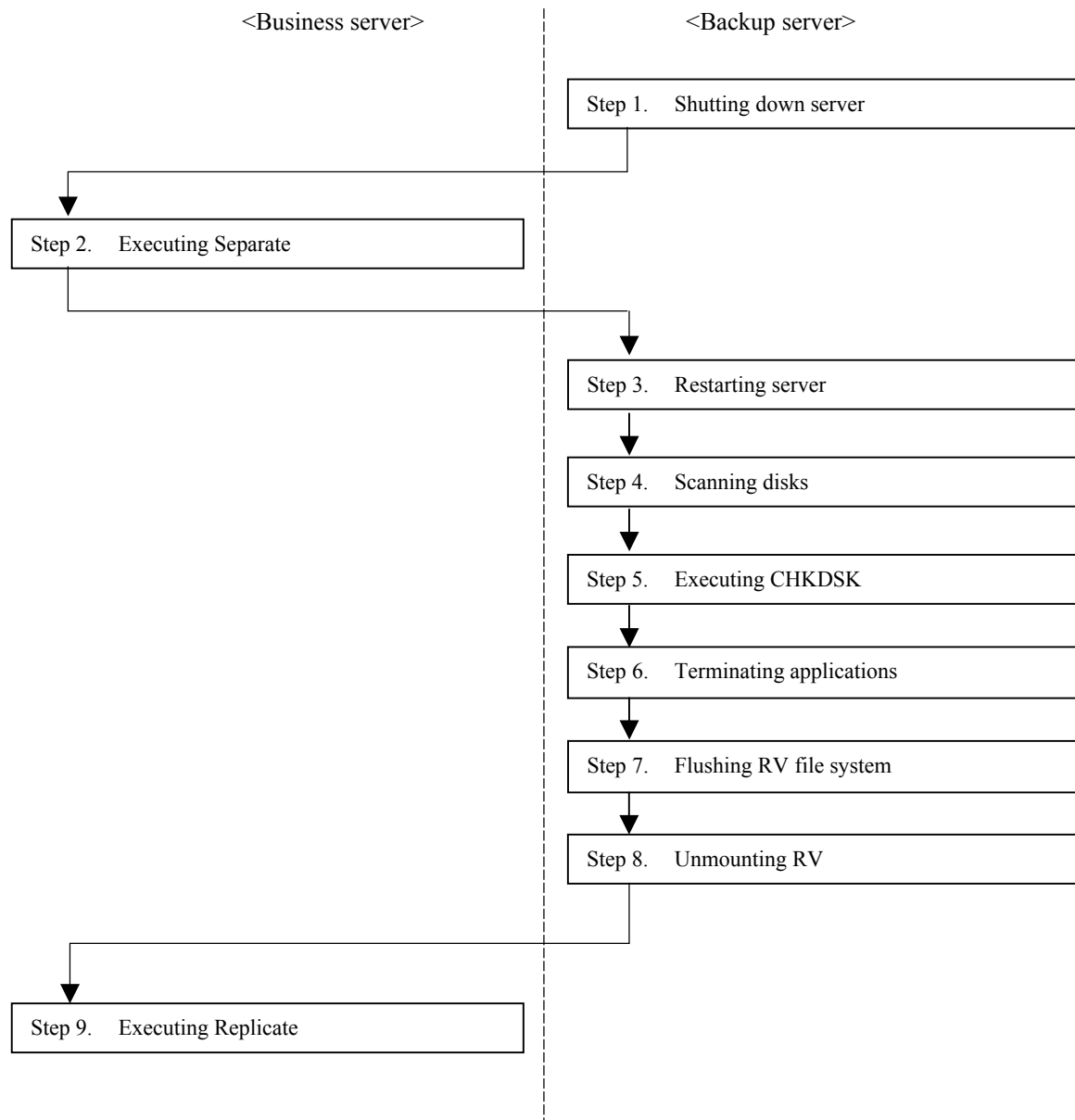
To restart the service "ESMCommonService", specify as shown below.

```
NET START ESMCommonService
```

## 2.1.4 Restarting Business/Backup Server

This section describes procedures for restarting a server that uses the data replication function.

The following describes the procedures for restarting backup server.



### Step 1. Shutting down server (backup server)

Shut down a server that is connected with RV.

### Step 2. Executing Separate (business server)

Execute Separate on RV that is not separated and connected with the backup server. If the RV is separated already, separation is not required.

This example uses the replication file for the execution according to the following settings.

- Access restriction on RV after separation: rw (Read/Write)
- Separation completion wait specified

Assume that the replication operation file is used and Separate is executed under the following conditions:

disks.txt

# Type:MV	Type:RV
Id:dev001	Id:dev002

```
iSMrc_separate -file disks.txt -wait
```

### Step 3. Restarting server (backup server)

After verifying completion of separation, restart the backup server.

### Step 4. Scanning disks (backup server)

Scan the disks to make the server recognize the disks in the Not Ready state and volumes which cannot be mounted.

On Windows 2000, disks may be left in the Not Ready state by unmounting using the iSMrc\_umount command. In this case, release the disks from the Not Ready state and make the server recognize the disks.

```
iSMrc_scan
```

The operation displays the following message and scans disks.

This operation may take several tens of seconds to complete.

```
Scan Start                2001/02/21 11:19:13
Scan Normal End           2001/02/21 11:20:26
```

Use the MOUNTVOL command to check that all target disks can be recognized from the operating system.

On Windows Server 2003, use the MOUNTVOL command to disable automatic volume mounting:

```
MOUNTVOL /N
```

**Step 5. Executing CHKDSK (backup server)**

In step 2, separation was executed without specifying a static point. Execute CHKDSK /F to remove inconsistency in file system.

```
CHKDSK H: /F
```

**Step 6. Terminating applications (backup server)**

To maintain data consistency, terminate or halt applications and specified services.

(Example) Terminating service

```
NET STOP (service name)
```

To stop the service "ESMCommonService", specify as shown below.

```
NET STOP ESMCommonService
```

**Step 7. Flushing RV file system (backup server)**

Flush RV file system and write the unwritten data in file system buffer onto disk.

```
iSMrc_flush -drv H:
```

The operation displays the following message and flushes the data.

```
Flush Start                2001/02/21 11:21:13
disk11                    dev002                        WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
H:

Flush Normal End          2001/02/21 11:21:13
disk11                    dev002                        WN
\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
H:
```

**Step 8. Unmounting RV (backup server)**

Unmount RV and cancel association between volume and file system.

When the RV is unmounted, the mount point (drive letter or NTFS folder name) set for the volume is automatically deleted. On Windows 2000, the RV access restriction is changed to Not Ready.

\* Set NOTREADY for the UMount\_RVACC parameter in the replication operation option setting file to suppress automatic RV mounting before operation.

When executing unmounting, all application software, that may access the drive, must be terminated in advance.

Refer to descriptions about unmounting Chapter 3 "Notes" also.

```
iSMrc_umount -drv H:
```

Then, the following message appears and RV is unmounted.

```
Umount Start                2001/02/21 11:21:14
    disk11                    dev002                        WN
    \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
    H:
```

```
iSMrc_umount: Info:         iSM13221: Resetting drive letter (H:)
(\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\) has succeeded.
```

```
Umount Normal End          2001/02/21 11:21:14
    disk11                    dev002                        WN
    \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\
    H:
```

### Step 9. Executing Replicate (business server)

Execute replicate for the pair that needs replication.

In this example, it is assumed that the replication operation file is used and replication is executed according to the following settings:

- Copy area: Differences (default value)
- Reflecting update on MV: Synchronization mode (default value)
- Access restriction on RV: nr (Not Ready) (default value)
- Completion wait not specified (default value)

```
iSMrc_replicate -file disks.txt
```

Then, the following message appears and the data copy from MV to RV is started:

```
Replicate Start            2001/02/21 12:21:15
    MV:10                     dev001                        WN
    \\?\Volume{ce49f299-614e-11d5-b1df-009027520bce}\
    G:
    RV:-                      dev002                        WN
    -
    -
```

Execute usual backup procedures after the processes above.



## 2.2 Measures for Errors

### 2.2.1 Error Types

Data replication errors can be categorized as follows:

- (1) HW fault unique to replication
- (2) iSM Server or client fault
- (3) ReplicationControl abnormal end
- (4) Down of server machine connected to RV
- (5) Invalid product

### 2.2.2 HW Fault Unique to Replication

The data replication function realized by HW may cause errors given below, in addition to ordinary HW faults. These errors can be checked from the iSM Client screen. These errors may abnormally stop ReplicationControl commands.

#### (1) Copy Fault

##### Detecting a copy fault

If copy operation between MV and RV is not executed normally due to a connection failure between them, a transition to the following states may occur depending on the timing and type of the failure.

- Separate state due to a failure (failure separation)
- Suspend state due to a failure (abnormal suspend)

If a transition occurs to one of the states above, you can use Replication Screen to check the status of the copy fault (Figure 2-9).

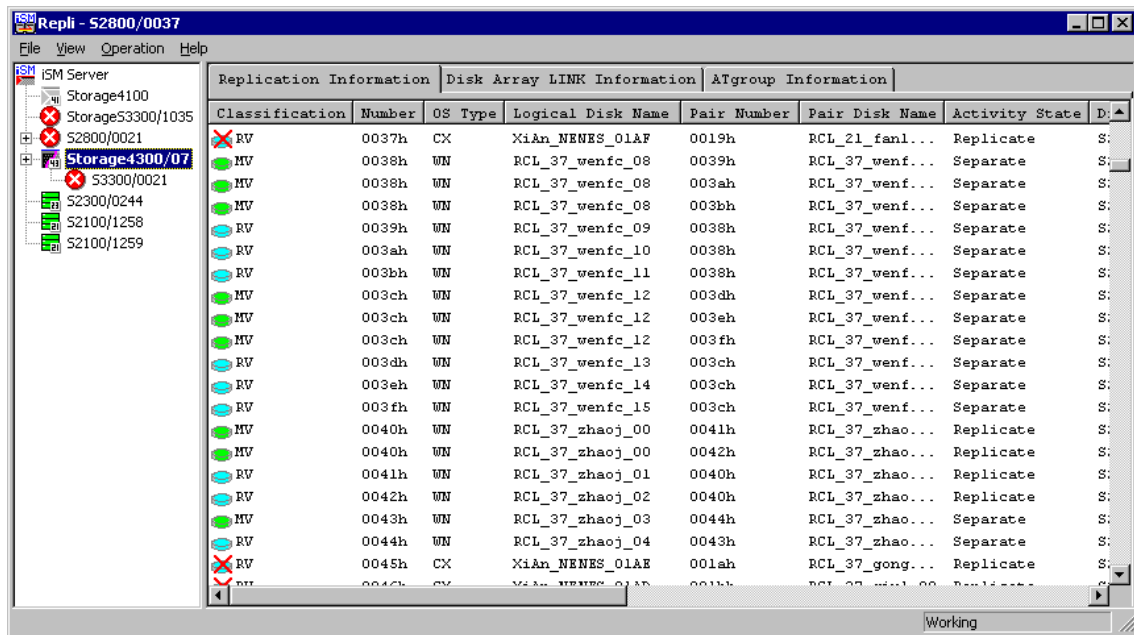


Figure 2-9 An Example of the Copy Fault Occurrence Screen

**Operations after recovering from a copy fault**

For information on operation to recover the state of the pair where the copy fault occurred to the normal state after removing the cause of the copy fault, refer to 3.3.20 “Display Copy Fault List” in the “Data Replication User’s Manual (Function Guide)”.

**(2) Link fault**

**Detecting a link fault**

A link fault occurs due to a cable fault between disk arrays or a fault of Replication Director. If it occurs during Replication, it may cause a copy fault.

If a link fault occurs, you can use the Replication Screen to check it.

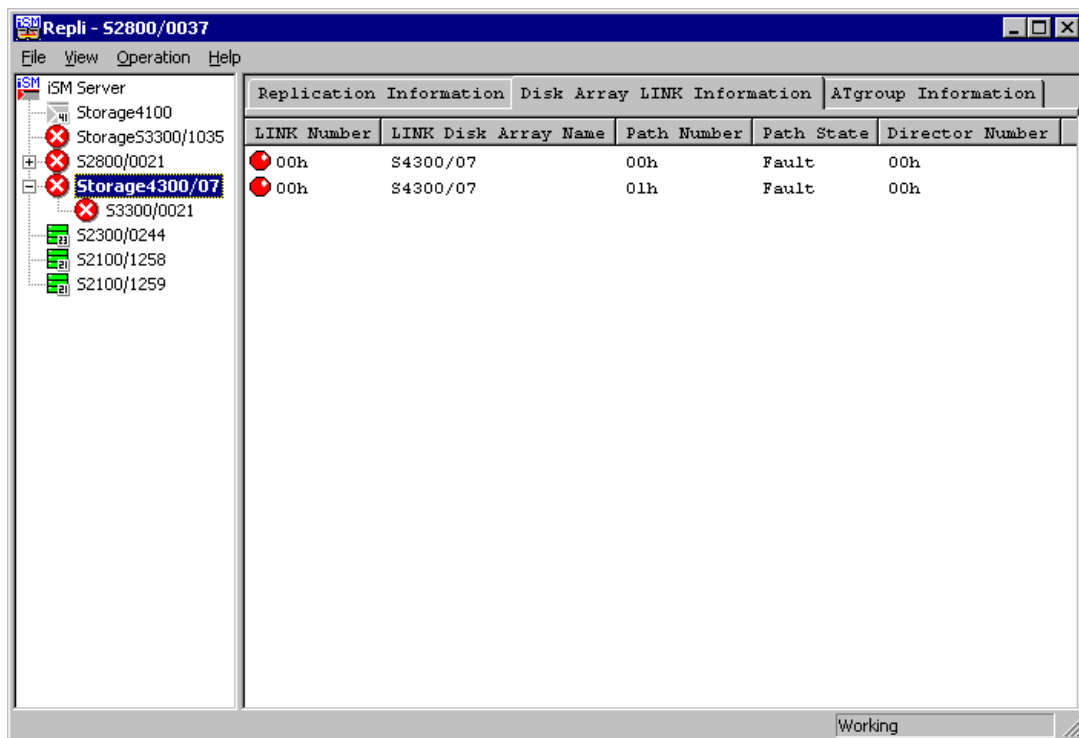


Figure 2-10 An Example of the Link Failure Occurrence Screen

#### Operations after recovering from a link fault

After you remove the cause of the link fault, check that the state of the path is normal in this screen.

If a copy fault occurs due to this fault, refer to 3.3.20 “Display Copy Fault List” in the “Data Replication User’s Manual (Function Guide)” to recover from the failure.

## 2.2.3 Server or Client Fault

### (1) Communication failures

If communication with the iSM Server fails, the following message is displayed and Replication Screen terminates.

Take necessary actions referring to the “User’s Manual”.

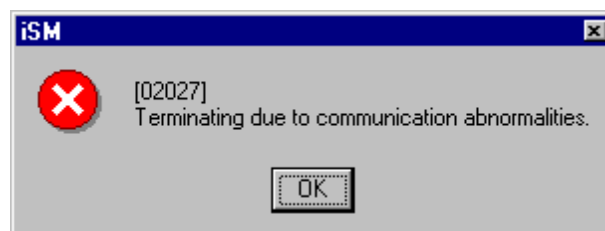


Figure 2-11 Communication Failure Message Screen

## 2.2.4 Abnormal End of ReplicationControl

---

ReplicationControl outputs error contents to the standard output, standard error output, event log, command trace, or operation trace when an error has occurred.

The standard output, standard error output, event log, or command trace records the messages described in the “Messages Handbook”. Take necessary actions depending on the message.

The command trace is output in the folder iSMrpl\etc under the folder where ReplicationControl has been installed (\Program Files\NEC\iSMrpl\etc\ by default) with a file name beginning with “iSM\_Log”. Check the contents using a text editor.

The operation trace records the messages output to the standard output, standard error output, event log, or command trace and the detailed internal information. If a fault occurs and you want to request the provider to investigate the fault, you must collect the operation trace. For details of how to collect information when a fault occurs, refer to 2.2.7, “Information Gathering in the Event of a Fault”.

### (1) Abnormal End of iSMrc\_umount Command

If a program running on server is referring to a volume concerned, the command outputs the following message and terminates abnormally.

iSM13609: Access of specified disk was refused.

For obtaining a static point in file system, the program in question must be researched and halt of the program must be specified in operation procedures.

\* For researching an application that accesses to the drive, Sysinternals’s free software is useful.

Refer to descriptions about unmounting Chapter 3 “Notes” also.

If iSMrc\_umount still terminates abnormally after halting all applications and services accessing to a disk in question, take the following actions:

**- When iSMrc\_umount command terminates abnormally on business server -**

#### **Step 1. Terminate application (business server)**

Halt applications and services with programs running on server, that are referring to a volume concerned. After verifying halt of applications and services, execute iSMrc\_umount again. If iSMrc\_umount terminates normally, execution of the following processes is not required.

If the command still terminates abnormally after this process, take the following step.

#### **Step 2. 60-second waiting (business server)**

If MV unmounting failed wait for 60 seconds.

If it is separated in the 60-second wait time, files smaller than 600 byte and files being updated may not be reflected on RV. If separation was executed without unmounting, execute CHKDSK /F upon mounting on RV.

This process allows separation without unmounting.

**- When iSMrc\_umount command terminates abnormally on business server -**

**Step 1. Terminate application (backup server)**

Halt applications and services with programs running on server, that are referring to a volume concerned. After verifying halt of applications and services, execute iSMrc\_umount again.

**Step 2. Executing CHKDSK (backup server)**

Execute the CHKDSK to maintain a static point of the file system.

Execution example on CHKDSK:

In CHKDSK, specify a mount point volume name omitting “\” at the end.

```
CHKDSK \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491} /F /X
```

\* Refer to CHKDSK help before using the CHKDSK command.

**Step 3. Executing iSMrc\_umount (backup server)**

After completion of CHKDSK, execute iSMrc\_umount again.

If the command still terminates abnormally after this process, take the following step.

**Step 4. Restarting backup server**

If CHKDSK/F/X fails, restart the backup server by taking the steps in 2.1.4 “Restarting Business/Backup Server”.

**(2) Abnormal end of the iSMrc\_restore command**

The state, in which setting the drive letter of MV or mounting the MV in the NTFS folder is canceled, remains in the following case:

During control under which the MV is unmounted at start of Restore, a server fails, or re-setting the drive letter of the MV or remounting the MV in the NTFS folder fails for some reason.

If re-setting the drive letter for MV or mounting the MV in the NTFS folder fails, the iSMrc\_restore command outputs either of the following messages:

```
iSM13634: Failed to set drive letter (drive letter:).
```

```
iSM13634: Failed to set mount point (NTFS folder path name).
```

In this case, recovery (e.g., re-setting of the drive letter or remounting of MV into the NTFS folder) is necessary for restarting operation. The following describes the recovery procedure:

**Step 1. Collecting volume information**

If a server has failed, restart it by executing the procedure in 2.1.4 “Restarting Business/Backup Server”, starting with Step 2.

Collect the volume information (drive letter and mount point volume name) of the MV that was to be restored. To collect the volume information of the MV, confirm the following message that is output to the event log or the batch file execution result:

iSM13224: MV is restored.

Volume Name: mount point volume name

Mount Point: drive letter or NTFS folder path name

### Step 2. Re-setting the drive letter and remounting MV into the NTFS folder

Start [Disk Management]. According to the collected MV volume information (drive letter and mount point volume name), operate the volume with [Change Drive Letter and Path] to set the drive letter and mount the MV with the NTFS folder path name specified.

You can also set the drive letter and mount the MV in the NTFS folder by entering the MOUNTVOL command through the command prompt.

Example of setting a drive letter

To set the drive letter H for the volume under the mount point volume name

“\\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\”, specify as shown below.

MOUNTVOL H: \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491}\

### Step 3. Repairing the file system

The file system may contain conflicting data. Execute CHKDSK /F to repair the file system.

Example of executing CHKDSK

Omit the “\” at the end of the mount point volume name in specifying it for CHKDSK.

CHKDSK \\?\Volume{37d84cca-2507-11d5-a0f7-00004c714491} /F

\* For notes on executing CHKDSK, refer to the help information of CHKDSK.

## (3) Illegal File System on RV Connection Server

Replication operation without unmounting RV may result in illegal file system.

If RV file system has become illegal, restore the system by the restoration procedures.

### Research method

- When an error occurs in using the ReplicationControl or an access program.

If the ReplicationControl command outputs the following error message or errors meaning “destroyed file or disk”, the RV file system is illegal. Restore the file system by the restoration procedures.

iSM13639: Specified path is not normal status.

- If backup server is allowed to access RV during replication or unmounting operation
  - \* Normally, access to RV during replication operation or unmounting operation with automatic mounting suppressed on Windows 2000 is not allowed because RV is in the Not Ready state.

Try access to RV volume during replication or unmounting operation from My Computer.

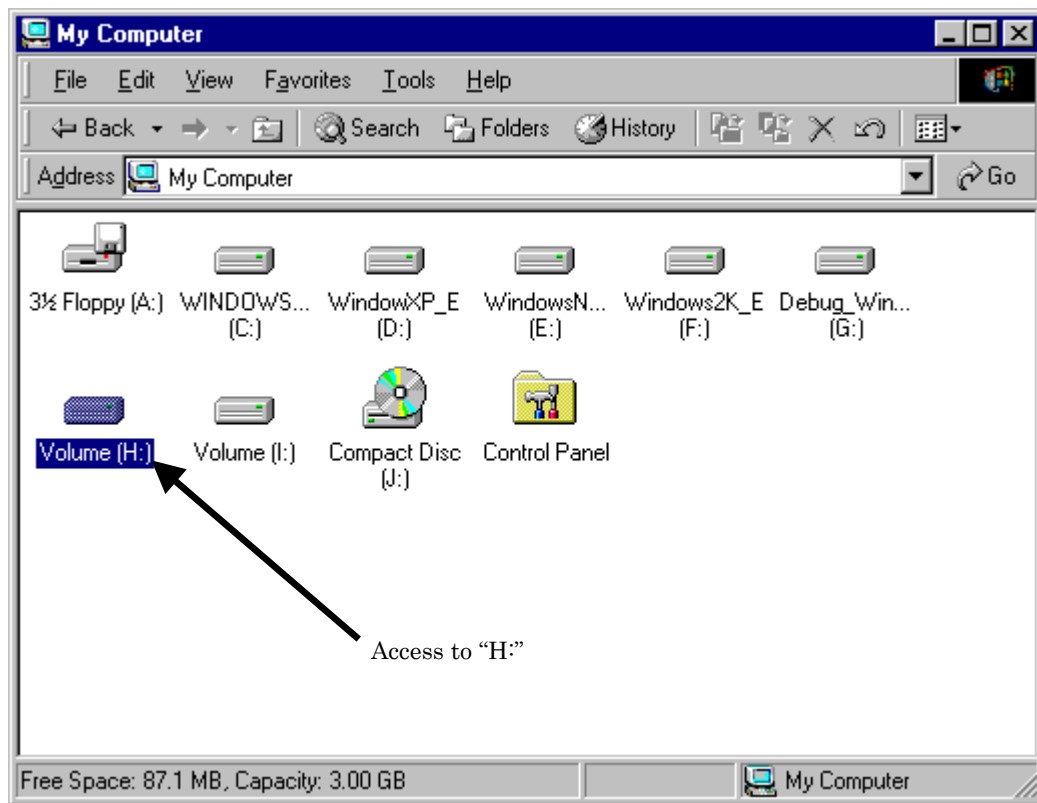


Figure 2-12 My Computer Screen

When RV is “Not Ready” and cannot be accessed, the following message appears.  
If this dialog appears, RV is successfully unmounted.



Figure 2-13 Media Error Message Screen

If a message above does not appear and access to the volume of the target RV is allowed, an illegal RV file system is suspected. Restore the system by the restoration procedures.

### Restoration

For restoration, take step 2 according to 2.1.4 “Restarting Business/Backup Server”.

## 2.2.5 Down of Server Machine Connected to RV

---

When the server connected to RV has gone down, RV may not be recognized from the Operating System after restarting the server. This may occur when the server is restarted while the RV is placed in the Not Ready (unavailable for read or write) state by executing Replicate or Restore or while it is unmounted by the iSMrc\_umount command and is in the Not Ready state on Windows 2000. In this case, you must make the Operating System recognize RV. This section describes how to do this.

### (1) If server is done down

#### Step 1. Executing Separate

For all RV pairs, in Replicate/Restore state, execute Separate.

If ordinary Separate fails, execute Forced Separate.

#### Step 2. Starting server

Start the server that has been down.

#### Step 3. Recognizing the RV again

Execute the following command to scan the disks and make the server recognize the disks in the Not Ready state and the volumes which cannot be mounted.

On Windows 2000, disks may be left in the Not Ready state by unmounting using the iSMrc\_umount command. In this case, release the disks from the Not Ready state and make the server recognize the disks.

This operation may take several tens of seconds to complete.

```
iSMrc_scan
```

Use the MOUNTVOL command to check that all target disks can be recognized from the operating system.

On Windows Server 2003, use the MOUNTVOL command to disable automatic volume mounting:

```
MOUNTVOL /N
```

#### Step 4. Recovering to normal operation

Execute Replicate referring to 2.1 “Operations”.

\* When the partition contains an error, execute Replicate referring to 1.7 “Preparing Volume”.



**(2) If server is restarting**

Execute the procedure below so that the OS to recognize the RV again.

**Step 1. Executing Separate**

For all RV pairs in Replicate/Restore state, execute Separate.

If ordinary Separate fails, execute Forced Separate.

**Step 2. Recognizing RV again**

Execute the following command to scan the disks and make the server recognize the disks in the Not Ready state and the volumes which cannot be mounted.

On Windows 2000, disks may be left in the Not Ready state by unmounting using the iSMrc\_umount command. In this case, release the disks from the Not Ready state and make the server recognize the disks.

This operation may take tens of seconds to complete.

```
iSMrc_scan
```

Use the MOUNTVOL command to check that all target disks can be recognized from the operating system.

On Windows Server 2003, use the MOUNTVOL command to disable automatic volume mounting:

```
MOUNTVOL /N
```

**Step 3. Recovering to normal operation**

Execute Replicate referring to 2.1 “Operations”

\* When the partition contains an error, execute Replicate referring to 1.7 “Preparing Volume”.

## 2.2.6 Invalid Product

---

If the product for replication (refer to 1.4.4 “Product License Unlocking”) has not been purchased or if it does not match the total physical capacity of the disk array, the Replication does not function properly.

If the products are not purchased properly, the icon on the Replication screen (Tree view) changes to indicate missing products or products not purchased.

For purchased products, check disk array Properties in the State Monitoring screen.

## 2.2.7 Information Gathering in the Event of a Fault

---

When an error whose reason is unknown has occurred and you want to request the provider to investigate the error, you must collect information required for error analysis.

### (1) For Replication Management error

Collect the necessary information referring to the “User’s Manual”.

### (2) For ReplicationControl error

Follow the steps below to execute the command and collect the operation trace and other fault information at a time.

A disk for storing fault information must have at least about 4 MB of unused space. The total size of fault information files differs depending on the system status, so it may exceed 4 MB. It is advisable to allocate an unused space of enough size.

- (1) Log on as a member in the Administrator group.
- (2) Click the Windows [Start] button and select [Storage Manager Volume List] and [Difficulty Information Gather] from [Programs] ([All Programs] for Windows Server 2003).

If you want to change the storage destination directory and execute the command, specify a directory on the relevant server. Do not specify any directory on another server connected via the network.

- (3) Confirm that the iSMvolgather directory is created under the installation directory when the storage destination directory is not changed or under the specified directory when it is changed, and obtain the files under that directory.

## Chapter 3 Notes

This chapter describes some notes regarding management and operations of Data Replication.

### 3.1 Windows System Volumes and Partitions

Data replication handles target volumes for individual disk array's logical disk. If replication operation is executed for a volume that contains more than one partition or logical volume in one logical disk, for a volume consisting of more than one partition or logical volume and for a volume such as a dynamic disk, data consistency is not guaranteed for certain operations. Table 3-1 gives functional scopes for disk types.

Table 3-1 Available Volume Types

Disk type	Volume type	Availability
Basic disk	Primary partition (MBR format)	√
	Primary partition (GPT format)	-
	Logical volume on expanded partition	√
Dynamic disk	Simple volume	-
	Span volume	-
	Stripe volume	-
	Mirror volume	-
	RAID-5 volume	-

√: Recommended configuration

-: Operation inhibited



On Windows Server 2003, use the MOUNTVOL command provided by the operating system to disable automatic volume mounting before operation.

To disable automatic volume mounting, specify the N option and execute the MOUNTVOL command as follows:

```
MOUNTVOL /N
```



Data replication operation using a logical disk containing multiple partitions or logical volumes is not recommended.

In ReplicationControl, when the volume to be operated is recognized from the server (operating system) and can be accessed, and if the volume contains multiple partitions or logical volumes obtained by the disk configuration information of the target volume, operation is not allowed (default).

You can perform operation for a logical disk containing multiple partitions or logical volumes by changing settings in the replication operation option setting file. In this case, be extremely careful about operation.

For details of the replication operation option setting file, refer to the “Data Replication Command Reference”.

**Disk containing multiple partitions or logical volumes**

When a drive letter is specified to execute replication operation for a logical disk containing multiple partitions or logical volumes, all partitions or logical volumes on the logical disk become the target for the replication operation. This is because replication operation is executed for an individual logical disk.

Figure 3-1 shows an example where each of MV and RV consist of multiple partitions, with drives E: and F: assigned to MV and drives J: and K: assigned to RV. Assume that you execute replication by specifying drive E: as MV, attempting to replicate only the data of drive E: of MV to drive J: of RV. As the result, data of drive F: is also replicated, overwriting RV drive K: with data of MV drive F:. That is, data of RV drive K: will be lost. At this time, unless the disk association with the file system of RV drive K: is cleared, the file system of drive K: will be placed in inconsistent state.

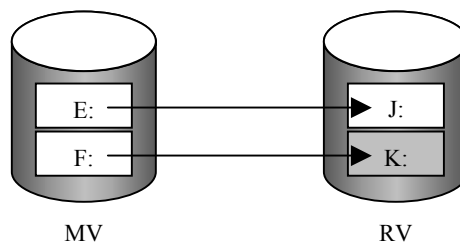


Figure 3-1 Replicating a Disk Containing Multiple Partitions

To avoid this type of trouble, data replication operations are not recommended for a logical disk containing multiple partitions or logical volumes. Take care when you execute operations to a logical disk containing multiple partitions or logical volumes.

## 3.2 File System Selection

You can configure a file system for the target MV and RV volumes for replication operations. In addition, these volumes may be used as RAW devices for ORACLE, etc. The target MV and RV paired for replication operations must have the same type of partitions and file systems. If these rules are not observed, data consistency is not guaranteed.

## 3.3 Windows System Selection

As business servers and backup servers using each of MV and RV volume, Windows 2000 servers and Windows Server 2003 servers cannot be used together. Use the MV and RV volumes from the same Windows operating system. If the MV and RV volumes are used from different Windows operating systems, data consistency cannot be guaranteed.

## 3.4 Disk Signatures

A disk signature is the disk identifier that is written in the header block of the disk when it is referenced for the first time by [Disk Management] (Windows). The Windows system does not allow using two or more disks with the same signature in the same system.

For a volume in the Windows system (OS type “WN” or “A2”), the data replication function restores the original identifier before copying so that the MV and RV do not have the same identifier when separating the pair.

## 3.5 Copy Control State Selection

There are three copy control states available when executing Replicate or Restore. When applying data replication to the backup system, it is necessary to take backup by Separate and immediately resolve the difference between MV and RV when re-synchronizing. For that purpose, select Sync mode.

When Restore with RV protection specified is executed, the updated data of the MV is not reflected into the RV. Therefore, copy control by using Foreground Copy (Sync Mode or Semi Sync Mode) and Background Copy has no effect.

There are the following copy control states as shown in Table 3-2.

Table 3-2 Copy Control States

Copy Control State	Sub-State	Copy State
Foreground Copy	Sync Mode	<ul style="list-style-type: none"> <li>• Updates MV and RV synchronously. After completing the MV and RV update, informs the host of I/O completion.</li> <li>• For DDR, copy is done only to the cache. Therefore, this copy mode little lowers the performance.</li> <li>• For RDR, performance lowered by this copy mode is in proportion to the distance between the disk arrays.</li> </ul>
	Semi Sync Mode	<ul style="list-style-type: none"> <li>• Updates to MV and RV are done asynchronously up to a certain data size. When the MV update completes and data not reflected to RV is within the predetermined data size, informs the host of I/O completion without waiting for the RV update and immediately reflects the update to the RV. If the data not reflected to RV has exceeded the predetermined size, the operation is the same as Foreground Copy (sync mode).</li> <li>• This can be set only for RDR.</li> </ul>
Background Copy	-	<ul style="list-style-type: none"> <li>• Updates to MV and RV are done asynchronously. After completing the MV update, informs the host of the I/O completion without waiting for the RV update. The RV update is accumulated as differential information and reflected to RV asynchronously with the MV update. The interval of copy to RV can be set for individual disk arrays (background copy level).</li> </ul>

## 3.6 RV Access Restriction Setting

Because RV is replicated within the disk array independently of the server, its replicated contents are completely match with the contents of MV. When the Windows system is used, MV and RV cannot be used at the same time within the same system, because the volume identification information used by the Windows system to identify the volume is also the same. Data replication gives no access restrictions for MV, allowing Read/Write (RW) at any time. For RV, set the RV access restriction in Replicate or Restore state to Not Ready (NR) to prevent malfunctioning unless there are specific reasons. When Read Only (RO) is set, the results vary depending on the OS and or file systems used. So, do not set RO unless you are familiar with the OS and file system operations.

Table 3-3 RV Access Restriction

Access restriction	Description	Commands		
		replicate	restore	separate
Read/Write (RW)	RV is enabled for read/write.	-	-	○
Read Only (RO)	RV is enabled only for reading.	Δ	Δ	Δ
Not Ready (NR)	RV is disabled for read/write.	○	○	-
Not Available (NA)	RV is not recognized by the operating system or the LU (Logical Unit) is invalid.	-	-	-

○: Available      Δ: Available with administrative restrictions      -: Unavailable

RW: Read/Write      RO: Read Only      NR: Not Ready      NA: Not Available

If “Read Only (RO)” is set for RV, keep the following operational influence in mind:

- If NTFS is used as a file system, reference to the RV is disabled.
- If FAT16/FAT32 is used as a file system, associate the file system with the drive by using the mount command of the disk control operation commands or by starting [Disk Management] (Windows).
- If FAT16/FAT32 is used as a file system, an attempt to write to RV ends up with an error.

Therefore, do not use any application for automatically executing write operation for the drive. Do not execute any operation (e.g., changing of a partition configuration) in which write to RV is executed through [Disk Management] (Windows).

## 3.7 Data Replication and Data Consistency

For making copies of operation data with the data replication function, and for putting the data in use, the data must be that of a user’s desired point in time and the data must be complete. Furthermore, using RV on Windows operating system requires consistency in the file system.

The following must be considered for making the replicated data usable:

### (1) Separate and data consistency

To use files on RV from the backup server, MV and RV must be separated by Separate. For guaranteeing data consistency, a static point is specified in before separation. Usually a static point is specified by temporarily halting operation. Oracle8 and Microsoft SQL Server 2000 however, have a system of maintaining static point. Separation is enabled on such systems even under operating status, without stopping operations.

### **Usual file**

As basic operations, first temporarily halt the operations on the MV and flush the MV cache data using the command provided by replication operation. Then, unmount the MV to release association between the file system and disks. At this time, when the MV is used from another operation or service, an unmounting error occurs.

If unmounting error occurred due to referencing or access from unexpected product, writing process is completed after waiting for completion of delayed updating process, in several tens of seconds. If Separate is executed without writing cache data completely, files on the RV may lack file consistency. In such a case, executing CHKDSK command upon mounting RV on backup server restores inconsistent files.

For planning backup operations, extract processes and services to be halted. Against unmounting errors, processes to wait for delayed updating must be considered.

### **Oracle**

Combination of the Oracle standard on-line backup function and the data replication function allows producing backup data even under business operation. The on-line backup reserves a logical static point in combination with log. The log is used upon recovery.

For executing cold backup or using data replication for files other than database requires considerations similar to those for usual files.

### **Microsoft SQL Server 2000**

Use of the ReplicationControl SQL Option allows producing backup data even under business operation. Refer to the "ReplicationControl SQL Option User's Manual" for details. In the cases above also, backup of transaction logs is made via network. Using data replication for transaction log requires considerations similar to those for usual files.

Halting database and making backup physically requires considerations similar to those for usual files. The backup data made in such process cannot be used for transaction log.

## **(2) Replicate and Data Consistency**

When using RV file on backup server and replicating data again, cache data on backup server must be discarded.

To discard cache data, flush the cache data and unmount the RV using the commands provided by replication operation. You can use the -force option to forcibly unmount the RV even when the file system is being used.

If the process above is omitted, inconsistency may occur between cache and volume upon separating again, which may result in destruction of file system.



### (3) Restoration and Data Consistency

When restoring data upon failure on MV of business server, backup data existing on tape is utilized in the following operations:

- (i) From backup server, restore data on MV that is connected to business server via network.
- (ii) If tape device is connected to business server, restore data from tape to MV directly.
- (iii) Restore data on RV upon backup server, and synchronize MV with RV using the restoration function of data replication.

When restoring master volume data with operation (i) or (ii), data is restored with the standard function of backup software, just as the backup operation without data replication.

When restoring master volume data with operation (iii), the static points on both business server and backup server must be specified. Maintain data consistency in the following procedures.

The processes are applicable also when using RV itself as a backup medium.

#### **On business server**

Deletion of partition or discarding of cache data is required on business server.

To discard cache data, flush the MV cache data and unmount the MV using the commands provided by replication operation. You can use the `-force` option to forcibly unmount the MV even when the file system is being used.

If the process above is omitted, inconsistency may occur between cache and volume upon separating again, which may result in destruction of file system.

#### **On backup server**

Primarily, temporarily halt the operations on the RV, and flush the cache data and unmount the RV using the commands provided by replication operation to release the association between the file system and disks.

### (4) Restoring file system

If MV is separated RV without releasing association between file system and disk on volume used on MV, access to volume on RV may result in displaying an error message and use of RV is disabled. In such a case, execution of `CHKDSK` command on the accessing volume removes file system inconsistency. Refer to `CHKDSK` help before using the `CHKDSK` command.

## 3.8 Access Right Settings on Volumes

---

Access right settings on folders and files in volumes used in MV or RV are reflected on RV (or MV) after replication (or restoration), and existing access right settings are overwritten.

If the overwritten access right settings are different from existing settings, the access to folders or files used before may be disabled. Therefore, access right settings on folders or files must be specified the same on MV and RV servers.

## 3.9 Control Volume

---

A control volume is used when a server issues control I/O to the relevant disk array. Select one of logical disks connected to each server for each disk array as the volume for issuing I/O to that disk array and register the volume in the Volume List. Prepare one control volume for each server. It is not advisable to use the same logical disk as the control volume from different servers.

To define a control volume, prepare a volume such as an IV with which the server can properly issue I/O to each disk array. Do not select an RV or a link-volume (LV) for the snapshot function as a control volume because it cannot be accessed from the server (operating system) during data replication or snapshot operation.

For a logical disk used as a control volume, the RAID format and capacity are not limited. For the disk arrays with pool, you can build a small-capacity logical disk for a control volume. For details of how to build a control volume, refer to descriptions about building logical disks in the “Configuration Setting Tool User’s Manual (GUI)”. For details of how to define a control volume, refer to 1.5 “Control Volume Setting”.

## 3.10 Management and Operations of Data Replication

---

- (1) You can execute replication operations such as Replicate, Separate, and Restore by using the replication control function. However, the operations are asynchronous with business operation, and trouble may occur. To execute these replication operations, therefore, use the ReplicationControl in principle that operates on the business server.
- (2) Only a logical drive on the primary partition or expanded partition can be selected as a target volume for replication operation. Also only a basic disk can be used.

- (3) Separate, Replicate, and Restore are executed in units of disks but not units of partitions. Be careful in setting and operating partitions. To prevent operation errors and trouble, the partition settings on the MV and RV sides must be the same for all the servers.
- (4) To ensure data consistency, keep the following in mind:
- Before executing Separate, unmount the MV.
  - Before executing Replicate, unmount the RV.
  - Before executing Restore, unmount the MV and RV.
  - When executing Replicate and Separate, generally do not specify Read Only as RV access restriction.
  - The MV and RV file systems must be in the same format.
  - Use the MV and RV on different servers.
- (5) When separating volumes operating on Windows system, the data applications and operating system are storing on buffer must be reflected on volumes, using combination of iSMrc\_flush command and iSMrc\_umount command.
- \* If file control information is not reflected on volumes, an error message may appear upon mounting RV, disabling use of RV.
- \* Oracle or Microsoft SQL Server 2000 has a system of maintaining data consistency (static point) even under operating status, without stopping operations. (Refer to 3.7 (1) “Separate and data consistency”.)
- (6) When Unmount is executed for a drive on a Windows system, the drive may be automatically mounted if a service or application which accesses a disk is operating.
- Therefore when unmounting drive using iSMrc\_umount command, all applications and services accessing to the drive must be terminated in advance.
- Target services and applications (example):
- Recycle bin
  - ESMPRO (ESMCommonService, ESMFS Server, ESM Storage Service)
  - IIS (IIS Admin Service, World Wide Web Publishing Service)
  - FTP (FTP Publishing Service)
  - Link Tracking Service
  - Monitor (virus/drive) software
  - Backup software
- \* Applications accessing to the drive is identified using the following utility (visit the web site for detailed use of the software.)
- Utility: Process Explorer (GUI type), Handle (command line type)
- Web site: <http://www.sysinternals.com/>
- \* If access to drive is not complete, unmounting (iSMrc\_umount) may terminate abnormally. It is useful to create a batch file that activates “Handle” upon abnormal termination of unmounting (iSMrc\_umount).
- For discarding cache data in RV file system, forcible unmounting is allowed with -force option. However, note that it causes errors in applications and services accessing to the drive.

- (7) Upon failure of unmounting, CHKDSK /F /X is executed with mount point volume name specified. “\” at the end of mount point volume name must be omitted in the name specified for CHKDSK.
- (8) If you execute replication or disk operation from the terminal service client, the operation is not guaranteed.
- (9) The difference backup system that operates archive bits is not available for making RV data backup copies in a tape unit.
- (10) In cluster environment, install ReplicationControl in both servers of the operating system and standby system. The servers cannot share the environment setting. Set up environment for each server.
- (11) In cluster environment, use the iSMrc\_signature command for all the disks that are to be replication target disks of the operating system in order to get and save (export) the disk signature information and import the information in the standby system. (Replication target disks are disks with the disk signature already written.) If disk signature information such as cluster failover is lost, it can be restored.
- (12) In cluster environment, the RV that moved into the Not Ready state at execution of Replicate or Restore needs to be recognized as a faulty disk. You cannot use RV as a shared disk of CLUSTERPRO in a system configuration including CLUSTERPRO.
- (13) Executing the iSMrc\_unmount command to unmount a shared disk of MSCS (Microsoft Cluster Server) may cause failover. Therefore, do not execute Unmount for the shared disk. To obtain the static point of data at execution of Separate, stop the application, and then execute the iSMrc\_flush command to flush the disk and wait for completion of delayed updating. Before executing Restore, unmount the disk while the MSCS service is in stopped state. If DynamicDataReplication is used in a system configuration including MSCS (Microsoft Cluster Server), you can use MV as a shared disk, but not RV. You cannot place a quorum disk of MSCS on MV, either.
- (14) A physical disk number may be changed by the SCSI device driver's Plug and Play function during system operation. Therefore, except for the iSMrc\_signature command, the volume specification that uses a physical disk number is not supported by the ReplicationControl Ver2.1 and later. If the physical disk number has changed causing inconsistency between the state of the system device and volume list information, re-create the volume list.
- (15) The iSMrc\_editdl command is not supported by the ReplicationControl Ver2.1 and later. To set and cancel the drive letter, use the Windows standard MOUNTVOL command.
- (16) On Windows Server 2003, use the MOUNTVOL command provided by the operating system to disable automatic volume mounting (MOUNTVOL /N) before operation.
- (17) When using ReplicationControl Ver3.2 or later, specify NOTREADY for the UMOUNT\_RVACC parameter in the replication operation option setting file to suppress automatic RV mounting. Before applying this setting, take note of the following points then check and review the operation procedures as required:

- On Windows 2000, when an RV is unmounted, the RV access restriction is changed to Not Ready. Accordingly, when a volume in a multi-partition configuration is unmounted, all volumes (partitions) on the relevant disk cannot be read or written. After that, another partition on the same disk cannot be accessed to read/write or be flushed by the iSMrc\_flush command until the RV is mounted by the iSMrc\_mount command.
- Unmounting using the iSMrc\_unmount command must be executed in the status in which only one mount point (drive letter or NTFS folder name) is set for the target volume. If no mount point or multiple mount points are set, unmounting cannot be executed. For this reason, this setting is unavailable for an operation procedure such as deleting all mount points using the D option of the MOUNTVOL command before unmounting. When multiple mount points are set for a volume, use the D option of the MOUNTVOL command to set only one mount point for the volume, and then unmount the volume.

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