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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 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 Manager and the related manuals.

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 Ver2.1
   - NEC Storage BaseProduct Ver2.1
   - NEC Storage ReplicationControl Ver2.1

3. The term “iSM” in this text refers to all the NEC Storage Manager program products.

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5. 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.

<table>
<thead>
<tr>
<th>Type of Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>![Warning]</td>
</tr>
</tbody>
</table>

The First Edition in March 2003
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Chapter 1 Data Replication Overview

To manage an enormous amount of information accumulated in business in a unified way and promote effective and efficient utilization of the information, a high-throughput, large-capacity, and high-reliability storage system is required. Data Replication provides functions to build and manage such a storage system.

This chapter describes overview of Data Replication, hardware configuration, and software configuration.

1.1 Data Replication

Data Replication is a function that creates Replication Volumes (RV) of a Master Volume (MV). It is installed in the disk array. Replication volumes can be connected to or separated from the business volume at any time. Operations such as connection and separation can be instructed from the business server and the iSM Client (e.g. Windows system).

The following two methods are provided to create replication volumes.

1. Creating replication volumes within the same disk array (DDR: NEC Storage DynamicDataReplication)
2. Creating replication volumes in different disk arrays (RDR: NEC Storage RemoteDataReplication)

Master server
1.2 Examples of Applying Data Replication

When you introduce Data Replication and use replication volumes which can be separated, you can get the following benefits.

(1) The system down time during data backup is largely reduced. Lowered access performance to the business database during data backup in system operation can be prevented.

(2) A test environment using the actual business data can be built more easily.

(3) Processing becomes more efficient due to parallel processing of data update tasks and data reference tasks.

In this way, Data Replication makes system construction and system management easier and more effective. The following sections illustrate some applications of Data Replication.

1.2.1 Backup

This section describes an application for backup using replication volumes.

(1) Backing up from the replication volume to magnetic tape media

In this method, a replication volume of the master volume is backed up to the magnetic tape. In this case, operations are suspended only for the time it takes to separate replication volumes from the master volume. Therefore, the suspension time can be substantially reduced. Because backup is done from the replication volume, it does not affect the master volume.
(a) During operation, the master volume (MV) and replication volume (RV) are connected.
(b) Suspend the production task and separate the replication volume (RV). Resume the task after separation is complete.
(c) Use the separated replication volume (RV) to perform backup and the task in parallel. After backup is complete, reconnect the replication volume (RV) (Reconnection takes only a short time because only updated parts in the master volume are reflected to the replication volume (RV)).

(2) Using the replication volume as disk backup
In this method, the replication volume is used as backup of the master volume. In this case, you do not have to manage the existing magnetic tapes because they are not used as storage media. When the restoration instruction is complete, you can use the backup data even if the actual data replication has not been completed. If data to be accessed is not restored to the master volume, the data in the replication volume is accessed. The user does not have to be aware of using which of the master volume or replication volume.
This reduces the data restoration time substantially.

(a) Connect the replication volume 1 (RV1) to the master volume.
(b) Suspend the production task and separate the replication volume 1 (RV1). Resume the task after connecting the replication volume 2 (RV2).
(c) After that, use the replication volume 1 (RV1) and replication volume 2 (RV2) alternately to perform backup.
1.2.2 Test Environment Setting

You can set the same environment as the production task environment easily by creating replication volumes using the Data Replication function. You can evaluate an application program by using data used in the production task, which makes evaluation of application programs more efficient. Furthermore, in building an evaluation environment, operations are suspended only for the time which takes to separate replication volumes from the master volume. Therefore, the suspension time can be substantially reduced.

(a) Connect the master volume (MV) and replication volume (RV).
(b) Suspend the production task, separate the replication volume (RV), and then resume the task.
(c) Perform evaluation of the application program by using the separated replication volume (RV).
1.2.3 Parallel Processing of Search Operation

By creating replication volumes of the master database, you can separate the database and carry out update tasks and search tasks using different volumes. This allows you to carry out database update tasks without affecting database search tasks.

(a) In the nighttime, suspend search tasks and connect the master volume (MV) and replication volume (RV).

(b) In the daytime, separate the master volume (MV) and replication volume (RV). Perform update tasks and search tasks in parallel (RV contains data for the prior day).
1.3 System Configuration

To install and use the Data Replication function, the following hardware devices are required.

1. Disk array
   NEC Storage 3000/4000 Series disk array (additional Replication Director is required) or NEC Storage 2000 Series disk array with the Data Replication function (NEC Storage DynamicDataReplication or NEC Storage RemoteDataReplication).

2. Management server
   Controls the Data Replication function.

3. Business server
   Performs Data Replication operations.

Software to run Data Replication consists of the following components.

1. NEC Storage Manager
   Provides the disk array configuration and state display functions.
   Installing NEC Storage DynamicDataReplication and/or NEC Storage RemoteDataReplication allows
the replication management function (hereinafter, referred to as the Replication Management) incorporated in NEC Storage Manager. The Replication Management provides setting and operating functions such as state display, pair setting, and replication operation for NEC Storage DynamicDataReplication or NEC Storage RemoteDataReplication.

(2) NEC Storage ReplicationControl
   Provides commands for checking replication operations and replication states from the business server and also provides library functions.

(3) NEC Storage DynamicDataReplication
   The function to realize data replication within the same disk array.

(4) NEC Storage RemoteDataReplication
   The function to realize data replication in the different disk arrays.
Chapter 2  Data Replication

This chapter describes the types and state transitions of volumes you should know to perform operation using the Data Replication function.

2.1 Volume Classification

To create replication volumes using the Data Replication function, you must set the relation between the original volume and the target volume (replication volume) first. In replication control, the original volume is called MV (Master Volume), and replication volume is called RV (Replication Volume). Furthermore, MV and RV are set as a pair.

In a disk array to which the Data Replication function is installed, the volume classification in the disk array is categorized into the three types as shown in Table 2-1.

<table>
<thead>
<tr>
<th>Volume Classification</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated Volume</td>
<td>IV</td>
<td>Volume with no pair setting.</td>
</tr>
<tr>
<td>Master Volume</td>
<td>MV</td>
<td>Volume with the pair setting. The original volume in the pair.</td>
</tr>
<tr>
<td>Replication Volume</td>
<td>RV</td>
<td>Volume with the pair setting. The target volume in the pair.</td>
</tr>
</tbody>
</table>

(1) Isolated Volume (IV)
Volume with no pair setting.
By specifying the pair setting to IV, you can set it to MV or RV.

(2) Master Volume (MV)
Volume with the pair setting. The original volume in the pair. Normally, volumes used in operation are set as MVs.
To distinguish the uppermost MV from other MVs when multiple pairs are set in series hierarchically, it is called the Primary Volume (PV).

(3) Replication Volume (RV)
Volume with the pair setting. The target volume in the pair. Normally, volumes used as backup or in test operation are set as RVs.
The pair setting can be between the volumes within the same disk array, or between the volumes in different disk arrays. To distinguish them, the former is called a Dynamic Replication Volume (dRV) and the latter is called a Remote Replication Volume (rRV).
Figure 2-1 shows an example of volume classification.

<table>
<thead>
<tr>
<th>Volume</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1/A2/B1</td>
<td>IV</td>
</tr>
<tr>
<td>A3</td>
<td>MV (PV) of the pair A3/A4</td>
</tr>
<tr>
<td>A4</td>
<td>RV (dRV) of the pair A3/A4, and MV of the pair A4/B2</td>
</tr>
<tr>
<td>B2</td>
<td>RV (rRV) of the pair A4/B2</td>
</tr>
</tbody>
</table>

Figure 2-1 Example of Volume Classification
Chapter 2  Data Replication

2.2  Replication Operations

2.2.1  Replicate

This operation copies data from MV to RV. It is performed to replicate the latest data to the replication volume used in a test environment or search tasks.

2.2.2  Separate

This operation separates MV and RV. It is performed to suspend data replication between MV and RV to use RV in a test environment or search tasks.

When Separate is executed, all the difference between the MV and RV contents at the point of starting Separate is reflected into the RV, and then data replication is suspended and the RV is separated. At this time, you can determine when to make the RV available by choosing either of the following:

- Separate for using RV after completion of separation: separate (completion)
  - Reflects all the difference between the MV and RV contents into the RV, and makes the RV available after completion of separation.

- Separate for immediately using RV: separate (immediate)
  - While reflecting the difference between the MV and RV contents into the RV, the Separate function makes the RV available even during separation. You can instantly create RV and make it available by executing Separate immediately after starting Replicate.
  - This function is available only for performing data replication in the same disk array. The product “NEC Storage DynamicDataReplication Ver2” is necessary for using the function.
2.2.3 Restore

This operation copies data from RV to MV. It is performed to restore data from the backup volume (RV) when a failure occurs in MV. When Restore is executed, the RV contents at the point of starting Restore are reflected copied into the MV. At this time, you can determine whether to reflect the updated data of the MV into the RV by choosing either of the following:

- Restore with RV being updated: restore (update)
  Restores the MV while automatically reflecting the updated data of the MV into the RV.

- Restore without RV being updated: restore (protect)
  Restores the MV without reflecting the updated data of the MV into the RV. The Restore function enables you to protect the RV and save the RV data in the state before the restoration.

The product “NEC Storage DynamicDataReplication Ver2” or “NEC Storage RemoteDataReplication Ver2” is necessary for using the function.
2.3 Replication Operations and State Transitions

This section describes the replication operations and state transitions.

(1) Replicate and State Transitions

When Replicate is performed, data copy from MV to RV starts to reflect the content of MV at the beginning of Replicate to RV. Any update to MV after Replicate is also reflected to RV. After Replicate is performed, the difference between MV and RV gradually decreases, and eventually the content of MV at the beginning of Replicate is completely reflected to RV (The difference is zero). The state from the beginning of Replicate to the content of MV at the beginning of Replicate is completely reflected to RV is called the “Replicate execution”. The state where the difference between MV and RV is zero is called the state synchronized by Replicate, or simply the “sync state”. Replicate execution and the state synchronized by Replicate are collectively called the Replicate state.

Figure 2-2  Replicate and State Transitions
(2) **Restore and State Transitions**

When Restore is performed, data copy from RV to MV starts to reflect the content of RV at the beginning of Restore to MV. When Restore with RV update specified is executed, the updated data of the restored MV is reflected into the RV.

After Restore is performed, the difference between MV and RV gradually decreases, and eventually the content of RV at the beginning of Restore is completely reflected to MV (The difference is zero). The state from the beginning of Restore to the content of RV at the beginning of Restore is completely reflected to MV is called the “Restore execution”. The state where the difference between MV and RV is zero is called the state synchronized by Restore, or simply the “sync state”. Restore execution and the state synchronized by Restore are collectively called the Restore state.

When Restore with RV protection specified is executed, the updated data of the MV is not reflected into the RV. In this case, the updated information of the MV is managed as the difference between the MV and RV contents so that the difference can be reflected into the RV when Replicate/Restore is executed subsequently. When the Sync State (sync) is placed after Restore with RV protection specified is executed, it is automatically changed to the Separated State (separated).

When data of MV is referred to during Restore execution, the user can refer to the content of RV immediately after the instruction to start Restore even if the content of RV has not been completely reflected to MV. This is done by obtaining data from RV when the area where difference copy from RV to MV has not been completed is accessed in response to a reference request to MV.

![Diagram](image-url)
(3) Separate and State Transitions

When Separate is performed, the difference between MV and RV at the time of executing the Separate start instruction is reflected to RV and RV is separated. No update to MV after Separate is reflected to RV.

After Separate is performed, data copy to RV is performed if the contents of MV and RV at the beginning of Separate do not match, and all updates to MV before the Separate start instruction are reflected to RV. The state from the beginning of Separate to the content of MV at the beginning of Separate is completely reflected to RV is called the “Separate execution state”. The state where all updates to MV are reflected to RV is called the state separated by Separate, or the “separated state”. Separate execution and the separated state are collectively called the Separate state.

When Separate is executed under specification of immediate use of RV, the RV contents can be referred to or updated immediately after the Separate start instruction is issued, regardless of whether or not all the MV contents have been reflected into the RV. This feature is implemented as follows:

When an update/reference request for the RV is made and access to an area where difference copy from the MV into RV is not completed is to be made, control is performed for copying the difference from the MV into RV before permitting access to the area.

The updated states of MV and RV are managed in Separate State so that the difference between the MV and RV contents is reflected when Replicate/Restore is executed.

The replication operations and state transitions are summarized in Figure 2-5.

For information on accesses to MV and RV in the different activity states, refer to 2.6 “RV Access ...
The pair setting is specified but MV and RV are separated.

Difference between MV and RV is being reflected.

The pair setting is specified and synchronization has been established.

- MV and RV can be updated.
- RV cannot be updated.

- Updates to MV are reflected to RV.
- As a rule, access to RV is not allowed.

- When Restore with RV update specified is executed, the updated data of MV is reflected into the RV.
- When Restore with RV protection specified is executed, the updated data of the MV is not reflected into the RV.
- As a rule, access to RV is not allowed.

- When Restore with RV protection specified is executed, Sync State (rst/sync) is placed and then automatically changed to Separated State (separated).

Figure 2-5 Replication Operations and State Transitions
In replication control, Replicate, Restore, Restore(protect) and Separate states are called “activity states”, or simply “activities”.

The execution states indicating state transitions and the state in which the state transition is complete are called “sync states”.

Table 2-2 summarizes the activity states and sync states which transit as a result of replication operations.

<table>
<thead>
<tr>
<th>Activity State</th>
<th>Sync State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate State</td>
<td>Separate Execution (sep/exec)</td>
<td>• Temporal state until the difference between MV and RV becomes zero after Separate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• As a rule, read and write to RV are not allowed.</td>
</tr>
<tr>
<td></td>
<td>Separated(separated)</td>
<td>• Data copy between MV and RV is not performed. This state occurs immediately after the pair setting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Normally, read and write to RV are allowed.</td>
</tr>
<tr>
<td></td>
<td>Forced Separate(cancel)</td>
<td>• MV and RV are forcibly separated by Forced Separate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Read and write to RV are allowed.</td>
</tr>
<tr>
<td></td>
<td>Failure Separation (fault)</td>
<td>• MV and RV are forcibly separated in the disk array due to a copy fault.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Read and write to RV are allowed.</td>
</tr>
<tr>
<td>Replicate State</td>
<td>Replicate Execution (rpl/exec)</td>
<td>• Reflection of the difference between MV and RV at Replicate has not been completed (The difference is being reflected from MV to RV).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Updates to MV is reflected to RV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• As a rule, read and write to RV are not allowed.</td>
</tr>
<tr>
<td></td>
<td>Sync State(rpl/sync)</td>
<td>• Reflection of the difference between MV and RV at Replicate has been completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Updates to MV is reflected to RV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• As a rule, read and write to RV are not allowed.</td>
</tr>
<tr>
<td>Restore State and</td>
<td>Restore Execution(rst/exec)</td>
<td>• Reflection of the difference between MV and RV at Restore has not been completed (The difference is being reflected from RV to MV).</td>
</tr>
<tr>
<td>Restore (Protect) State</td>
<td></td>
<td>• When Restore with RV update specified is executed, the updated data of the MV is reflected into the RV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• When Restore with RV protection specified is executed, the updated data of the MV is not reflected into the RV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• As a rule, read and write to RV are not allowed.</td>
</tr>
<tr>
<td></td>
<td>Sync State(rst/sync)</td>
<td>• Reflection of the difference between MV and RV at Restore has been completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• When Restore with RV update specified is executed, the updated data of the MV is reflected into the RV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• When Restore with RV protection specified is executed, the updated data of the MV is not reflected into the RV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• As a rule, read and write to RV are not allowed.</td>
</tr>
</tbody>
</table>
2.4 Copy Control State

If the activity between volumes with the pair setting is the Replicate or Restore state, you can change the copy method of data between MV and RV according to the load status of the disk array. The state to which a transition is made by the instruction to change the copy method is called the “copy control state”.

There are the following two types of copy between MV and RV in the Replicate or Restore state.

- Copy for reflecting difference
  Copy to reflect the content of MV (RV for Restore) at Replicate or Restore to RV (MV for Restore). However, if Restore with RV protection specified is executed, the updated data of the MV is not reflected into the RV.

- Copy to reflect updates in MV to RV
  Copy to reflect updates in MV to RV after Replicate or Restore. However, if Restore with RV protection specified is executed, the updated data of the MV is not reflected into the RV.

You can switch between the two copy methods by changing the copy control state.

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

<table>
<thead>
<tr>
<th>Copy Control State</th>
<th>Copy State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreground Copy</td>
<td>Sync Mode</td>
</tr>
<tr>
<td></td>
<td>• Copy for reflecting difference is performed.</td>
</tr>
<tr>
<td></td>
<td>• Updates to MV are reflected RV sequentially.</td>
</tr>
<tr>
<td>Semi Sync Mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Copy for reflecting difference is performed.</td>
</tr>
<tr>
<td></td>
<td>• I/O of updates to MV is completed when data is written to MV, and the data is copied to RV immediately after that.</td>
</tr>
<tr>
<td></td>
<td>• Cannot be set to a pair (DDR) in the same disk array.</td>
</tr>
<tr>
<td>Background Copy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Copy for reflecting difference is performed.</td>
</tr>
<tr>
<td></td>
<td>• I/O of updates to MV is completed when data is written to MV, and the data is accumulated as difference information. For the accumulated difference, data is copied to RV asynchronously. The copy interval to RV (background copy level) can be changed in units of disk arrays.</td>
</tr>
<tr>
<td></td>
<td>• When performing Separate, the state must be changed to Foreground Copy in advance.</td>
</tr>
<tr>
<td>Suspend</td>
<td>Suspend</td>
</tr>
<tr>
<td></td>
<td>• Copy for reflecting difference is not performed.</td>
</tr>
<tr>
<td></td>
<td>• I/O of updates to MV is completed when data is written to MV, and the data is accumulated as difference information. Reflection to RV is not performed.</td>
</tr>
<tr>
<td>Suspend due to a failure</td>
<td>Forcefully suspended in the disk array due to a copy fault.</td>
</tr>
<tr>
<td></td>
<td>• Copy for reflecting difference is not performed.</td>
</tr>
<tr>
<td></td>
<td>• I/O of updates to MV is completed when data is written to MV, and the data is accumulated as difference information. Reflection to RV is not performed.</td>
</tr>
</tbody>
</table>

Table 2-3 Copy Control State
Copy control states can be specified when Replicate or Restore is performed. You can also change the copy control state you specified at Replicate or Restore as required.

When Restore with RV protection specified is executed, the updated data of the MV is not reflected into the RV. Therefore, specifying or changing a copy control state (synchronous copy mode, semi synchronous copy mode, or background copy) has no meaning.

There are the following five instructions to change the copy control state.

- Sync Copy instruction
- Semi-Sync Copy instruction
- Resume instruction
- Background Copy instruction
- Suspend instruction

Figure 2-6 shows the state transition diagram of the copy control states.

Figure 2-6 State Transition Diagram of Copy Control State
2.5 Relationship between Copy Performance and Copy Control State

If the copy control state is set to the Synchronized Copy state, the difference between MV and RV is not accumulated because updates in MV are immediately reflected to RV (except when Restore with RV protection specified is executed). However, the write time to MV is longer because it waits for reflection of the updates to RV. If the copy control state is set to the Suspend state, the difference between MV and RV is accumulated because updates in MV are not reflected to RV, but the write time to MV is the same as normal I/O.

In this way, there are correlations between the amount of accumulated differences in MV and RV and write performance in different copy control states (Table 2-4).

<table>
<thead>
<tr>
<th>Copy Control State</th>
<th>Difference Between MV and RV</th>
<th>Write Overhead to MV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreground (Sync)</td>
<td>Small</td>
<td>Exists</td>
</tr>
<tr>
<td>Foreground (Semi-Sync)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Background</td>
<td>Large</td>
<td>Does not exist</td>
</tr>
</tbody>
</table>

If the difference between MV and RV is large in the Replicate or Restore state, we recommend to select a copy control state which gives the difference between MV and RV smaller in a system without sufficient suspension time for Separate execution because the processing time of Separate increases. Also, we recommend you to select a copy control state without write overhead to MV in a system where write performance to MV must be maintained and improved.
2.6 RV Access Restriction

In the Replicate execution state, the contents of MV and RV are completely matched, and MV and RV cannot be used at the same time in the same system. In replication control, there are no access restrictions to MV, and MV can be referred to or updated at any time. You can specify RV access restrictions to RV in each sync state to prevent a malfunction.

Table 2-5 shows the states which can be specified as RV access restrictions.

<table>
<thead>
<tr>
<th>Access Restriction</th>
<th>Description</th>
<th>Sync State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Allowed/Update Allowed (RW)</td>
<td>• Read and write to RV are allowed.</td>
<td>rpl</td>
</tr>
<tr>
<td>Reference Allowed/Update Not Allowed (RO)</td>
<td>• Only read from RV is allowed.</td>
<td>&gt; Note 1</td>
</tr>
<tr>
<td>Reference Not Allowed/Update Not Allowed (NR)</td>
<td>• Access to RV is prohibited.</td>
<td>&gt; Note 2</td>
</tr>
</tbody>
</table>

Note: ! Can be specified  > : Can be specified, but with some restrictions on operation  - : Cannot be specified

rpl : Replicate state  RW : Read/Write
rst : Restore state   RO : Read Only
sep/exec : Separate execution   NR : Not Ready
sep : Separated state

There are no access restrictions for MV, and MV can be referred to or updated at any time.

Note 1: If an option for using RV immediately after Separate execution is specified, “Read/Write (RW)” is set even during Separate execution. However, keep the following operational influence in mind:

• Data is being copied from the MV into RV during Separate execution. Therefore, if the I/O load on the RV is high, I/O performance on the MV side may lower.

Note 2: You can set “Read Only (RO)” to RV in the Replicate state, Restore state, or Separate execution. In this case, note the following.

• RV must be referred to while no update to MV is being done.
• For updates to MV, I/O processing is done to the disk by the operating system control of the file system. Even if the application has completed the update process to the disk, it has not necessarily completed the update process to MV. Reflection of the update to RV is processed in the storage independent of the operating system.
Therefore, RV cannot be referred to normally because it is not consistent as a volume.

You can use it if consistency is assured in the specific operation.
Note 3: If “Read Only (RO)” is set for RV, keep the following operational influence in mind:

On the Windows system
- 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 2000).
- 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 performing write operation for the drive. Do not perform any operation (e.g., changing of a partition configuration) in which write to RV is performed through [Disk Management] (Windows 2000).

On the UNIX system
- When mounting a file system, it is necessary to mount it by a read-only specification.
2.7 Copy Faults and State Transitions

If copy operation between MV and RV is not performed 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.

(1) Separate state due to a failure (failure separation)
    Forcefully separated in the disk array due to a copy fault. The contents of MV and RV are completely different.
    To cancel the Separate state due to a failure, remove the cause of the copy fault and perform restoration by using Replicate and Restore.

(2) Suspend state due to a failure (abnormal suspend)
    Forcefully suspended in the disk array due to a copy fault in the Replicate or Restore state. Copy between MV and RV is suspended.
    To cancel the Suspend state due to a failure, change the copy control state as you do to cancel the normal Suspend state after removing the cause of the copy fault (Refer to 2.4 “Copy Control State”).
2.8 Freeze of Disk Arrays

If the power to the disk array is turned off for maintenance, access to the disk array is disabled, disallowing to continue copy operation for the paired volumes in the disk array. In replication control, replication operations for the disk array are frozen to remove the effects of accesses to MV (or RV) due to power down of the disk array where it is stored.

The state in which replication operations for the disk array are frozen due to power down of the disk array is called the freeze state of the disk array.

When a disk array is in the freeze state, replication operations between volumes to which the pair setting with the volume in the disk array is specified are also suspended, and the copy control state of the pair becomes the freeze state.

When the pair is in the freeze state, no new replication operation can be performed.

For pairs in the freeze state, note the following.

(1) Freeze in the Separate state
    If the pair goes into the freeze state in Separate execution, it transits to the Separate state due to a failure (failure separation) when the following operation is performed.
    • Updates to MV are done to the area where copy from MV to RV has not been completed.
    In this case, to use RV after the freeze state is cancelled, you must perform Replicate again to copy data, and perform Separate.

(2) Freeze in the Replicate state
    If the pair goes into the freeze state in the Replicate state, copy operation between MV and RV is suspended.
    Copy operation is automatically resumed when the freeze state is cancelled.

(3) Freeze in the Restore state
    If the pair goes into the freeze state in the Restore state, I/O terminates abnormally when reference or update is performed to the area where copy from RV to MV has not been completed.
    If the pair goes into the freeze state in the restored state, copy operation between MV and RV is suspended.
    Copy operation is automatically resumed when the freeze state is cancelled.
3.1 Overview of Data Replication Operations

This chapter describes an overview of various operations and the management method regarding data replication that uses the NEC Storage Manager replication management function.

3.1.1 Operations and Authorization Levels

Use the following functions to perform operations related to Data Replication through the iSM Client:

(1) State Monitoring
(2) Replication manager
(3) Configuration setting

Because operations performed from Replication manager contain important operations regarding volumes, they are restricted according to the authorization level.

For information on how to set and log in, refer to the “NEC Storage Manager User’s Manual (Windows)” and “NEC Storage Manager User’s Manual(UNIX)”.

When the server is disconnected by State Monitoring after displaying the Replication screen, only the currently displayed state can be referenced regardless of the operation authorization.

- L1 : Allows only reference.
- L2 : Allows replication-related operations (copy operations) in the administration level.
- L3 : Allows all operations.
Table 3-1 lists the operations and state displays.

Table 3-1 List of Displays/Operations of Data Replication

<table>
<thead>
<tr>
<th>Operation Item</th>
<th>State Monitoring</th>
<th>Configuration Setting</th>
<th>Replication Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L1</td>
<td>L2</td>
<td>L3</td>
</tr>
<tr>
<td>Set Disk Array Name</td>
<td>√</td>
<td>√</td>
<td>-</td>
</tr>
<tr>
<td>Set Logical Disk Name</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Link State</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Pair Setting/Unpair</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Replicate</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Separate</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Restore</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Suspend/Resume Copy</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Change to Background Copy</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>RV Mode Change</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Forced Separate</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Forced Unpair</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Freeze/Defreeze</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Background Copy Level Change</td>
<td>-</td>
<td>-</td>
<td>√</td>
</tr>
<tr>
<td>Pair Batch Setting</td>
<td>-</td>
<td>√</td>
<td>-</td>
</tr>
</tbody>
</table>

✓: Available  -: Not available
L1: Allows only reference.
L2: Allows replication-related operations (copy operations) in the administration level.
L3: Allows all operations.

3.1.2 Event Detection and Operation Message Output

Events that occur in response to various operations performed on disk arrays and volumes can be detected by the state monitoring and displayed in the iSM Client’s message display area as operation messages.

By executing an environment setting beforehand, it is possible to detect events that occur as the result of executing replication operation commands or other operations as well as performing replication management operations, and it is also possible to display the events as operation messages to confirm them.

The following are replication-related events that can be confirmed as operation messages:
Table 3-2 The List of Replication-Related Events

<table>
<thead>
<tr>
<th>Operation target</th>
<th>Operation</th>
<th>Replication management operation</th>
<th>Other operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk array</td>
<td>Freeze</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Defreeze</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Change Background Copy level</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td>Volume</td>
<td>Pair setting / Unpair</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Replicate</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Sync State (rpl/sync)</td>
<td>∆</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Separate</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Separated</td>
<td>∆</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Restore</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Sync State (rst/sync)</td>
<td>∆</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Suspend/Resume Copy</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Change to Background Copy</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td></td>
<td>Change RV mode</td>
<td>○</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Change Copy mode</td>
<td>○</td>
<td>∆</td>
</tr>
</tbody>
</table>

○: Regular report  ∆: Additional report performed according to an environment setting  –: Not reported

Note: Replication management operations include operations performed together with the NEC Storage ReplicationControl commands.

Regarding S2100 and A2100, the detection of events other than pair setting and unpairing events may not be possible during the state monitoring.

Furthermore, the state monitoring monitors all the disk arrays’ volumes for a specified time interval (default: 15 seconds) to detect events. Therefore, there is a time difference between when an event actually occurred and when a message is output. Also, messages for each detected event are displayed at the same time.

For information about an environment setting regarding the state monitoring’s event detection time interval and operation message output control, refer to the “NEC Storage Manager User’s Manual(Windows)” and “NEC Storage Manager User’s Manual (UNIX)”.
3.2 Data Replication Operations

To perform an operation, select the volumes you want to perform the operation to in the Volume List Displayed on the Replication Information tab in the Replication Screen, and then click the [menu] on the menu bar. You can also right-click the volume to display the menu.

3.2.1 Replication Screen

The Replication Screen consists of the Tree screen (i) on the left part of the screen displaying the configuration and state of the disk array and the Configuration screen (ii) on the right part of the screen displaying the Volume List and disk array link configuration. When the Replication Screen appears for the first time, it contains only the Tree screen (i) and the Configuration screen (ii) is displayed by clicking the disk array icon. The Configuration screen (ii) shows the selected disk array and the Volume List of the disk array connected with the selected disk array by RemoteDataReplication.

(i) For details, refer to 3.2.2 “Tree Screen”.
(ii) For details, refer to 3.2.3 “Volume List Screen” and 3.2.4 “Disk Array LINK Information Screen”.

Figure 3-1 Example of Replication Screen
3.2.2 Tree Screen

The Tree screen is under the monitoring by the NEC Storage Manager and displays the list and the status of link among the Disk Arrays that can use the Replication function.

![Example of Tree Screen](image)

Figure 3-2 Example of Tree Screen
Disk Array icon

... Indicates that the disk array is normally operating.

... Indicates that the disk capacity of the NEC Storage DynamicDataReplication or NEC Storage RemoteDataReplication is insufficient.

- If disk space is insufficient, you cannot execute pair setting/unpair.

... Indicates that a fault occurs in any link path between the Disk Arrays.

... Indicates that the copy fault or the fault in all link paths between Disk Arrays occurs.

... Indicates that the Data Replication function invalidates.

... Indicates that the Data Replication function is not supported. And when the Replication at the link between Disk Arrays does not recognize address of link Disk Array, this icon is also displayed.

... Indicates that the State Monitoring is stopped.

A disk array on which neither the NEC Storage DynamicDataReplication nor the NEC Storage RemoteDataReplication is installed does not appear on the screen.

If the Replication does not recognize the link destination of the Disk Array when the link is established between Disk Arrays, the destination of the Disk Array name may be displayed as “SAA (Subsystem Absolute Address)”.

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3.2.3 Volume List Screen

When click the [Replication Information] tab in the configuration screen, the volume information of all the volumes in the selected disk array is displayed (Figure 3-3 Example of Volume List Screen).

The states of paired volumes are displayed in one line. Two lines are displayed for one pair because one line is displayed for MV and RV so that you can check the state of MV from RV, and vice versa. IV is displayed in one line. To perform sort, click the item name by which you want to sort. You can drag an item to change the order of the items.

When pair setting and unpairing are performed, volume information is updated according to the order of the last sort (It is sorted by Number by default).

![Figure 3-3 Example of Volume List Screen](image)

The Volume List Screen displays information regarding the following items.

### Classification

The volume types (volume attribute) is displayed.

- **(Green)** … Indicates Master Volume and is the volume of replication origin.
- **(Light Blue)** … Indicates Replication Volume and is the volume of replication object.
- **(White)** … Indicates Isolated Volume and is the volume except the replication object.

IV becomes MV or RV by operating pair setting.

- **(Red)** … Indicates the volume that the copy fault occurs.

### Number

The logical disk number is displayed in hex digit.

It is the same as the logical disk number shown in the main screen.
OS Type
Indicates the volume format.
A2 Indicates a logical disk operating on the ACOS-2 system.
A4 Indicates a logical disk operating on the ACOS-4 system.
AX Indicates a logical disk operating on the AIX system.
CX Indicates a logical disk operating on the Solaris system.
LX Indicates a logical disk operating on the Linux system.
NX Indicates a logical disk operating on the HP-UX system.
WN Indicates a logical disk operating on the Windows system.
* When performing Replication operations, the OS type must be correctly specified.

Logical Disk Name
The identification name or identifier (see Note) given for the logical disk is displayed.
It is the same as the logical disk name that is displayed in the main screen and the change is possible through the main screen.

When the events given below have occurred when displaying the Replication screen, the “Logical Disk Name” or “Paired Disk Name” field may show the unique volume number (Volume Absolute Address) managed inside the disk array.

- The path failure has occurred in all links,
and
- The Disk Array on the remote side is not managed by iSM or is in monitoring-stop state.
These events occur in a pair connected by RemoteDataReplication when the host to which a local volume is connected cannot recognize the volume on the remote side. Also in such a case, operations such as Forced Separate and Forced Unpair for local volumes are enabled.

Pair Number
The logical disk number of paired volume is displayed in hex digit.

Pair Disk Name
The logical disk name of paired volume is displayed.
Activity State
The replication operation status is displayed.
- Replicate: Indicates the status that copy is executing from MV to RV.
- Separate: Indicates the disconnection status of MV to RV.
- Restore: Indicates the status that copy is executing from RV to MV.
- Restore (protect): Indicates the state in which data is being copied from the RV into MV but the updated data of the MV is not reflected into the RV.

Disk Array
The identification name given to the Disk Array including the volume indicated by “Number” is displayed.
It is the same as the Disk Array Name displayed in the main screen, and can be changed from the main screen.

If the Replication Management does not recognize the link destination of Disk Array when the link is established between Disk Arrays, the Disk Array name may be displayed as “SAA”.

Sync State
The transition status in activity state is displayed.
For more information, refer to 2.3 “Replication Operations and State Transitions”.
- Separating: Indicates that Separate is being executed.
- Separated: Data copy between MV and RV is not performed. This state occurs immediately after the pair setting.
- Forced Separation: MV and RV are forcibly separated by Forced Separate.
- Fault: MV and RV are forcibly separated in the disk array due to a copy fault.
- Restoring: Indicates that Restore is being executed.
- Sync Execution: Copy operation is being performed and the difference still exists.
- Synchronized: Reflection of the difference between MV and RV at the copy start instruction has been completed, and updates to MV are reflected RV sequentially.

* When Restore is completed, the state becomes Restored(Synchronized).
Copy Control State
The control status in copying is displayed.
For more information, refer to 2.4 “Copy Control State”.
Foreground Copy Indicates the copy state in the sync or semi-sync mode.
Background Copy Indicates the asynchronous copy state by difference management.
Freeze Indicates that the Data Replication function is frozen.
Suspend Indicates that copy operation is suspended.
Abnormal Suspend Indicates that copy is forcibly suspended in the disk array due to a copy fault.

Differential Volume
Indicates the amount of difference (the remaining amount) during sync execution. Any difference occurred in the sync state is not displayed.
Amount of Difference may not change if I/O load is too heavy.
If a link failure occurs, Amount of Difference may not change. In this case, refer to Section 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)”.

LINK Number
Indicates the number of links of the related pair. This value is equal to “the number of volumes which make up the pair link minus 1”.
An example of pair relations and Number of Links is shown below.

<table>
<thead>
<tr>
<th>Number of Links</th>
<th>Pair Relation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image1.png" alt="Diagram 1" /></td>
</tr>
<tr>
<td>2</td>
<td><img src="image2.png" alt="Diagram 2" /></td>
</tr>
<tr>
<td>2</td>
<td><img src="image3.png" alt="Diagram 3" /></td>
</tr>
</tbody>
</table>

Some replication operations cannot be carried out while in the Replicate state, Restore state, or Separate execution if the pair relation has multiple layers or if multiple RVs are connected to one MV (Refer to the execution conditions of the operations). If the Number of Links is 2 or greater, check the hierarchy in the Connection screen.

Capacity [GB]
Indicates the capacity of the logical disk.
3.2.4 Disk Array LINK Information Screen

When you click the [Disk Array LINK Information] tab in the Configuration screen, all the link information currently set between the disk arrays is displayed (Figure 3-4 Example of Disk Array LINK Information Screen).

To perform sort, click the item name by which you want to sort. You can drag&drop an item to permute the order of the items.

<table>
<thead>
<tr>
<th>LINK Number</th>
<th>Disk Array Name</th>
<th>Path Number</th>
<th>Path State</th>
<th>Director Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h</td>
<td>NECStorageS4300</td>
<td>00h</td>
<td>Normal</td>
<td>05h</td>
</tr>
<tr>
<td>00h</td>
<td>NECStorageS4300</td>
<td>01h</td>
<td>Normal</td>
<td>04h</td>
</tr>
</tbody>
</table>

Figure 3-4 Example of Disk Array LINK Information Screen
The Disk Array LINK Information screen displays information regarding the following items.

**LINK Number**
Indicates the number of the linked disk array.
The number is 0 for the first unit and 1 for the second unit (Figure 3-5). The icons indicate the following path states.

- **(Green)** … Indicates the status of normal or link checking.
- **(Gray)** … Indicates the offline state.
- **(Light Blue)** … Indicates that the Data Replication function is disabled.
- **(Red)** … Indicates that the fault occurs.

**LINK Disk Array Name**
Indicates the identification name assigned to the linked disk array.

**Path Number**
Indicates the connection path number in the link.

If the link is connected via four paths, the path numbers are 0, 1, 2, and 3, respectively (Figure 3-5).

**Path State**
- **Normal** Indicates the normal state.
- **Offline** Indicates that the link setting is unconfirmed during startup of the disk array.
- **Freeze** Indicates that the Data Replication function in the target disk array is frozen.
- **Link Checking** Indicates that the link status is being checked due to a failure of communication in the link. It transits to Normal or Failure after a certain time interval.
- **Fault** Indicates that the link is invalid due to a failure of communication in the link.

**Director Number**
Indicates the number of the replication director to which the link path is connected.

Figure 3-5 shows an example of two disk arrays connected to Disk Array 1 for using RDR. The resource numbers are given in the Disk Array LINK Information Screen in Figure 3-4.
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Figure 3-5  Replication Link Information

Figure 3-5  Replication Link Information
The list of menu bar items of Replication Management is shown below. The chapters and sections you should refer to are provided in addition to simple descriptions.

3.4.1 “CSV Output of Replication Screen Information”
3.4.2 “Save Pair Setting Information”
Closes the Replication screen.

Shows or hides the status bar.
Shows or hides IVs.
3.4.8 “Copy Fault List”
3.4.5 “Record Screen Information”
3.4.3 “Environment Setting”
3.3.12 “Volume Connection Screen” (when “Connection Screen” is displayed)
3.4.6 “Disk Array Properties” (when Disk Array is selected from Tree screen and “Properties” is displayed)
3.4.7 “Link Properties” (when Director Port is selected from Disk Array LINK Information Screen and “Properties” is displayed)
3.4.4 “Refresh”
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3.3.8 “Forced Separate”
3.3.9 “Forced Unpair”
3.3.10 “Freeze/Defreeze”
3.3.11 “Background Copy Level Change”

Displays Help on the Replication screen.
Displays Help on the dialog list regarding Replication screen.
3.2.6 Information Displayed on Execution Dialog

The Execution dialog displayed for replication operations can be switched to Summary or Detail display mode for the volume-related information displayed.

In the description given below, the Unpair dialog is used as an example. You can read “operation” in the description as “Replicate execution”, “Restore execution”, etc. to be carried out.

Figure 3-6 shows an example of an Execution dialog information screen.

Figure 3-6  Example of Execution Dialog Information Screen.
Summary Display
When Summary Display is selected, the following items are displayed:

- **Execution Result**: Displays the execution result of the Operation. Operation cannot be performed for a pair with “Un-Executable”.
- **Un-Executable Reason**: Displays the reason why Operation cannot be performed.
- **Activity State**: Displays the execution state of the pair.
- **Logical Disk Name**: Displays the logical disk name of MV.
- **Number**: Displays the logical disk number of MV.
- **MV Disk Array Name**: Displays the disk array name which MV belongs to.
- **Pair Disk Name**: Displays the logical disk name of RV.
- **Pair Number**: Displays the logical disk number of RV.
- **RV Disk Array Name**: Displays the disk array name which RV belongs to.

Details Display
When Detail Display is selected, the following items are displayed in addition to Summary Display.

- **Copy Control State**: Displays the control state during copy.
- **Sync State**: Displays the transition status in the activity state.
- **Copy Mode**: Displays the sync/semi-sync mode during copy operation.
3.3 Various Operations of Data Replication

3.3.1 Pair Setting/Unpair

To perform replication operations, you must set pairs beforehand.
To set a pair, set the original volume as MV and the target volume as RV. You can also use the volume you have set as RV in another pair by setting it as MV.
You can set pairs freely within the following bounds.
You can set 3 volumes of RVs for one PV at the same time.
You can set RVs in up to 2 disk arrays for one PV.
You can set DynamicDataReplication only for one layer in the disk array.
You can set a pair only when the two volumes have the same capacity.

Figure 3-7 shows an example of the pair setting.

![Figure 3-7 Example of Pair Setting]

You may want to specify multiple pairs simultaneously, for example, when you initially build or rebuild a replication environment. To specify pair environments at a time, use “Replication Setting” of “New Setting” which is one of the configuration setting functions. For details, refer to the “NEC Storage Manager Configuration Setting Tool User’s Manual (GUI)” and Section 3.4.2 “Save Pair Setting Information”.

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(1) **Pair Setting**

To set a pair, select a volume, and then do the following on the menu bar of Replication Screen.

- Click [Operation], and then click [Pair Setting]

  or

- You can also right-click in the Volume List Screen, and then click [Pair Setting].

Figure 3-8 shows an example of the Pair Setting Screen.

![Figure 3-8  Example of Pair Setting Screen](image)

After the Pair Setting, the copy operation such as Replicate, Restore etc. is available.

(i) **Abstraction**

Select this option when you want to select a disk array and then select a Logical Disk Name.

* With ON selected, the Disk Array and Logical Disk (MV) are selected.

(ii) **Data Replication Mode**

Select the method of creating pairs.

NEC Storage DynamicDataReplication (within a Disk Array): MV and RV use the volumes in the same Disk Array.

NEC Storage RemoteDataReplication (between Disk Arrays): MV and RV use the volumes in different Disk Arrays.

(iii) **Disk Array Name**

Select the Disk Array to which you want to specify the setting.

(iv) **Logical Disk**

Select the Logical Disk to which you want to specify the setting.
When you click the [Execute] button, the following message is displayed.

![Confirmation Screen](image)

**Figure 3-9  Confirmation Screen**

(2) **Unpair**

To execute Unpair, select a volume, and then do the following on the menu bar of Replication Screen.

- Click [Operation], and then click [Unpair].
- Or
- You can also right-click in the Volume List Screen, and then click [Unpair].

Figure 3-10 shows an example of the Unpair screen.

![Unpair Screen](image)

**Figure 3-10  Example of Unpair Screen**

From the list, select a pair you want to unpair, and then click the [Execute] button.
You can select multiple executable pairs and execute them in a batch.
Non-executable pairs cannot be selected.
(i) List of Selected Volumes

Displays the list of the volumes selected in the Volume List Screen.

Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.

For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.

- Have Unpaired: Execute it for a volume with the pair setting.
- Replicated: Change it to the Separated state and execute it again.
- Restored: Change it to the Separated state and execute it again.
- Separating: Execute it again in the Separated state.
- Freeze: Defreeze the Data Replication function and execute it again.
- MV Force Unpaired: Perform Forced Unpair for RV.
- MV Monitoring Suspended: Change the disk array of MV to the Monitored state and execute it again.
- RV Monitoring Suspended: Change the disk array of RV to the Monitored state and execute it again.
- RV Force Unpaired: Perform Forced Unpair for MV.
- MV Outside iSM Management: Execute it for a pair under the iSM management.
- All Link Path Abnormal: Refer to Section 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

When you click the [Execute] button, the following message is displayed.

![Confirmation Screen](image)
[Execution Conditions]

To Pair setting or Unpair, the following conditions must be satisfied.

**Conditions for Pair setting**

Volumes in which the pair setting is performed must satisfy the following conditions.

(i) The volume capacities of MV and RV match.
(ii) The specified RV is not set as RV for another pair.
(iii) If the specified MV is set as RV for another pair, the maximum number of simultaneous pairs is not exceeded.
(iv) The volume formats match.
(v) The pair hierarchy does not form any loop.
(vi) When a pair is set to RV if MV and RV exist in the same disk array, it is in another disk array.
(vii) The disk array where the specified MV and RV are stored is monitored.
(viii) The disk array where the specified MV and RV are stored is not in the Freeze state.

---

Do not execute Pair Setting for a volume including the pooled spare disk of the business server or for a volume specified as a performance optimization work disk.

The replication screen does not display the Volume List.

---

**Conditions for Unpair**

Volumes in which unpaired must satisfy the following conditions.

(i) The specified MV and RV are paired.
(ii) The specified MV and RV are in the Separated state.
(iii) The disk array where the specified MV and RV are stored is monitored.
(iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
3.3.2 Replicate

When you perform Replicate for volumes with the pair setting, copy from MV to RV starts.

To set Replicate, select a volume, and then do the following on the menu bar of Replication Screen.
- Click [Operation], point to [Volume Operation], and then click [Replicate].
- You can also right-click in the Volume List Screen, point to [Volume Operation], and then click [Replicate].

Figure 3-12 shows an example of the Replicate Execution screen.

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.
You can select multiple executable pairs and execute them in a batch.
Non-executable pairs cannot be selected.
(i) List of Selected Volumes
Displays the list of the volumes selected in the Volume List Screen.
Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.
For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.
Have Unpaired Execute it for a volume with the pair setting.
Replicated Execute it for a volume in the Separate state.
Restored Execute it for a volume in the Separate state.
Replicating by other pair Replicate is being executed in another layer. Execute it again after Separate is complete.
Restoring by other pair Restore is being executed in another layer. Execute it again after Separate is complete.
Freeze Defreeze the Data Replication function and execute it again.
Separating by other pair Separate is being executed in another layer. Execute it again after Separate is complete.
MV Monitoring Suspended Change the disk array of MV to the Monitored state and execute it again.
RV Monitoring Suspended Change the disk array of RV to the Monitored state and execute it again.
MV Force Unpaired Perform Forced Unpair for RV.
RV Force Unpaired Perform Forced Unpair for MV.
MV Outside iSM Management Execute it for a pair under the iSM management.
All Link Path Abnormal Refer to Section 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.

(ii) Summary Display/Details Display
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) Range
Normally, Only Difference is selected, which copies only the difference area of MV and RV.
You can also select All, which copies the entire area explicitly.
• Only Difference Copies only the difference of the volumes.
• All Copies the entire volume.

(iv) Mode
You can specify the copy control state in Replicate Execution and the Sync state at the same time as Replicate. The following copy modes can be specified.
• Synchronous Changes the copy control state to the Sync Copy mode.
• Semi-synchronous Changes the copy control state to the Semi-Sync Copy mode. This can be specified for pairs in different disk arrays.
• Background Copy  Changes the copy control state to the Background Copy state.

(v)  RV Status
Specify the access restrictions from the host until Replicate is complete.
• Not Ready  Switches to the Not Ready state. Operations cannot be performed from the host.
• Read Only  For the volume, only read can be performed from the host.
* Care should be taken to specify Read Only. Refer to 2.6 “RV Access Restriction”.

When you click the [Execute] button, the following message is displayed.

![Confirmation Screen]

**Figure 3-13  Confirmation Screen**

### [Execution Conditions]
To perform Replicate, the following conditions must be satisfied.

(i) The target MV is recognized by Replication Management as the Replication target disk.
(ii) The target MV and RV are paired.
(iii) The activity state of the target pair is Separate.
(iv) The Semi-Sync copy mode cannot be specified for pairs set in the same disk array.
      The Semi-Sync copy mode can be specified only for pairs set in different disk arrays.
(v) The pair of the specified MV and the paired RV pair is not in the Restore state.
(vi) The activity state of the pair of the specified MV and the paired upper MV is Separate.
(vii) The activity state of the pair of the specified RV and the paired lower RV is Separate.
(viii) The disk array where the specified MV and RV are stored is not Freeze state.
(ix) The disk array where the specified MV and RV are stored is monitored.
(x) The RV has been unmounted from the host.
Figure 3-14 illustrates the execution conditions of Replicate (Each of (i) to (x) in the figure corresponds to the respective number above).

(i) Replication Target Disk
(ii) Pair Setting
(iii) Separated
(iv) Semi-Sync not allowed for the same disk array
(v) Not in the Restore state
(vi) Separated
(vii) Separated
(viii) Not in the Freeze state
(ix) Disk array monitored
(x) Unmounted from the host

Figure 3-14  Execution Conditions of Replicate
3.3.3 Separate

Separate separates MV and RV and makes RV available.

To set Separate, select a volume, and then do the following on the menu bar of Replication Screen.
- Click [Operation], point to [Volume Operation], and then click [Separate].

or
- You can also right-click in the Volume List Screen, point to [Volume Operation], and then click [Separate].

Figure 3-15 shows an example of the Separate Execution screen.

Figure 3-15  Example of Separate Execution Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Non-executable pairs cannot be selected.
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(i) List of Selected Volumes
Displays the list of the volumes selected in the Volume List Screen.
Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.
For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.

- **Have Unpaired**: Execute it for a volume with a volume of the Sync state.
- **Separated**: Execute it for a volume in the Sync state.
- **Restoring**: Execute it again when Restored is complete.
- **Suspend State**: Execute it again in the Sync state after copy is resumed.
- **Background Copy State**: Change it to Foreground Copy and execute it again.
- **Abnormal Suspend**: Refer to 2.2.2 “HW Fault Unique to Replication” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
- **Freeze**: Defreeze the Data Replication function and execute it again.
- **MV Monitoring Suspended**: Change the disk array of MV to the Monitored state and execute it again.
- **RV Monitoring Suspended**: Change the disk array of RV to the Monitored state and execute it again.
- **MV Force Unpaired**: Perform Forced Unpair for RV.
- **RV Force Unpaired**: Perform Forced Unpair for MV.
- **RV Forced Separate**: Execute it for a volume in the Sync state.
- **MV outside iSM Management**: Execute it for a pair under the iSM management.
- **All Link Path Abnormal**: Refer to 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.

(ii) Summary Display/Details Display
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) RV Use Start Time
Determine when to make the RV available.
- **Separate End**: After Separate execution, the RV becomes available when the difference between the MV and RV contents has been reflected into the RV.
- **Separate Start**: After Separate execution, the RV is immediately available while the difference between the MV and RV contents is being reflected into the RV.
  * NEC Storage DynamicDataReplication Ver2 needs to be installed for using this function. The function is available only for paired volumes in the same disk array.

(iv) Separated RV Status
Specifies the operation in response to a write request from the host after Separate is complete.
- **R/W Permit**: Read and write can be performed for a separated RV is complete from the
host.

- Read Only Only read can be performed for a separated RV is complete from the host.

When you click the [Execute] button, the following message is displayed.

![Confirmation Screen](image)

**Figure 3-16  Confirmation Screen**

**[Execution Conditions]**

To perform Separate, the following conditions must be satisfied.

(i) The target MV is recognized by Replication Management as the Replication target disk.

(ii) The target MV and RV are paired.

(iii) The activity state of the target pair is not Restore Execution.

(iv) The copy control state of the target pair is the Foreground Copy state.

* To separate pairs in the Background Copy state, you must perform Resume Copy and change them to the Foreground Copy state.

(v) The disk array where the specified MV and RV are stored is not in the Freeze state.

(vi) The disk array where the specified MV and RV are stored is monitored.

(vii) The MV is unmounted from the host.

If updates to MV are not complete, RV after Separate cannot be reused.

Figure 3-17 illustrates the execution conditions of Separate (Each of (i) to (vii) in the figure corresponds to the respective number above).

![Execution Conditions of Separate](image)
### 3.3.4 Restore

When you perform Restore for volumes with the pair setting, copy from RV to MV starts.

To set Restore, select a volume, and then do the following on the menu bar of Replication Screen.

- Click [Operation], point to [Volume Operation], and then click [Restore].

or

- You can also right-click in the Volume List Screen, point to [Volume Operation], and then click [Restore].

Figure 3-18 shows an example of the Restore Execution screen.

![Figure 3-18  Example of Restore Execution Screen](image)

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button. It is possible that multiple pairs are chosen and executed.

Non-executable pairs cannot be selected.
(i) List of Selected Volumes

Displays the list of the volumes selected in the Volume List Screen. Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.

For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.

Have Unpaired 
Execute it for a volume with the pair setting.

Replicated 
Execute it for a volume in the Separate state.

Restored 
Execute it for a volume in the Separate state.

Replicating by other pair 
Replicate is being executed in another layer. Execute it again after Separate is complete.

Restoring by other pair 
Restore is being executed in another layer. Execute it again after Separate is complete.

Separating 
Execute it again in the Separated state.

Freeze 
Defreeze the Data Replication function and execute it again.

Separating by other pair 
Separate is being executed in another layer. Execute it again after Separate is complete.

MV Monitoring Suspended 
Change the disk array of MV to the Monitored state and execute it again.

RV Monitoring Suspended 
Change the disk array of RV to the Monitored state and execute it again.

MV Force Unpaired 
Perform Forced Unpair for RV.

RV Force Unpaired 
Perform Forced Unpair for MV.

MV Outside iSM Management 
Execute it for a pair under the iSM management.

All Link Path Abnormal 
Refer to Section 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) Active Mode

Specify a Restore operation mode.

• RV Protection
Performs restoration without reflecting the updated data of the MV into the RV.

When the restoration is completed, Separate is automatically executed.

* To use this function for paired volumes located in the same disk array, the NEC Storage DynamicDataReplication Ver2 is necessary, and to use this function for paired volumes located in different disk arrays, the NEC Storage RemoteDataReplication Ver2 is necessary.

• RV Update
Performs restoration while reflecting the updated data of the MV into the RV.

When the restoration is completed, the state changes to Sync State (rst/sync).
The default operation mode in (iii) is “RV Protection”.
Confirm the Restore operation mode before executing Restore.
“RV Update” needs to be selected for executing Restore in the same operation mode as for
Version1.4 or earlier.
If “RV Protection” is selected, selection of (v) Copy mode is not permitted.

(iv) Range

Normally, Only Difference is selected, which copies only the difference area of MV and RV.
You can also select All, which copies the entire area explicitly.
• Only Difference Copies only the difference of the volumes.
• All Copies the entire volume.

(v) Copy Mode

You can specify the copy control state in Restore Execution and the Sync state at the same time as
Restore. The following copy modes can be specified.
• Synchronous Changes the copy control state to the Sync Copy mode.
• Semi-synchronous Changes the copy control state to the Semi-Sync Copy mode. This can
  be specified for pairs in different disk arrays.
• Background Copy Changes the copy control state to the Background Copy state.

(vi) RV Status

Specifies the access restrictions from the host until Restore is complete.
• Not Ready Switches to the Not Ready state. Operations cannot be performed from
  the host.
• Read Only For the volume, only read can be performed from the host.
  * Care should be taken to specify Read Only. Refer to 2.6 “RV Access
   Restriction”.

When you click the [Execute] button, the following message is displayed.

![Confirmation Screen](image)

Figure 3-19  Confirmation Screen

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[Execution Conditions]

To perform Restore, the following conditions must be satisfied.

(i) The target MV is recognized by Replication Management as the Replication target disk.
(ii) The target MV and RV are paired.
(iii) The activity state of the target pair is Separate, but not Separate Execution.
(iv) The Semi-Sync copy mode cannot be specified for pairs set in the same disk array.
    The Semi-Sync copy mode can be specified only for pairs set in different disk arrays.
(v) The activity state of the pair of the specified MV and the paired RV is Separate.
(vi) The activity state of the pair of the specified MV and the paired upper MV is Separate.
(vii) The activity state of the pair of the specified RV and the paired lower RV is Separate.
(viii) The disk array where the specified MV and RV are stored is not in the Freeze state.
(ix) The disk array where the specified MV and RV are stored is monitored.
(x) The MV and RV are unmounted from the host.

Figure 3-20 illustrates the execution conditions of Restore (Each of (i) to (x) in the figure corresponds to the respective number above).
### 3.3.5 Suspend/Resume Copy

You can suspend and resume copy operation in the Replicate or Restore state.

**(1) Suspend Copy**

The copy control state is changed from the Foreground Copy or Background Copy state to the Suspend Copy state.

To suspend copy, select a volume, and then do the following on the menu bar of Replication Screen.

- Click [Operation], point to [Volume Operation], and then click [Suspend Copy].
- You can also right-click in the Volume List Screen, point to [Volume Operation], and then click [Suspend Copy].

Figure 3-21 shows an example of the Suspend Copy screen.

![Example of Suspend Copy Screen](image)

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Non-executable pairs cannot be selected.
(i) List of Selected Volumes

Displays the list of the volumes selected in the Volume List Screen.

Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.

For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.

- **Have Unpaired**: Execute it for a volume with the pair setting.
- **Already Suspended**: Execute it for a volume in the Replicate state, Restore state.
- **Separate State**: Execute it for a volume in the Replicate state or Restore state.
- **Freeze**: Defreeze the Data Replication function and execute it again.
- **MV Monitoring Suspended**: Change the disk array of MV to the Monitored state and execute it again.
- **MV Force Unpaired**: Perform Forced Unpair for RV.
- **RV Force Unpaired**: Perform Forced Unpair for MV.
- **RV Forced Separate**: Execute it for a volume in the Sync state.
- **MV Outside iSM Management**: Execute it for a pair under the iSM management.
- **All Link Path Abnormal**: Refer to Section 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.


(2) Resume Copy

The copy control state is changed from the Suspend Copy or Background Copy state to the Foreground Copy state.

To resume copy, select a volume, and then do the following on the menu bar of Replication Screen.

• Click [Operation], point to [Volume Operation], and then click [Resume Copy].

or

• You can also right-click in the Volume List Screen, point to [Volume Operation], and then click [Resume Copy].

Figure 3-22 shows an example of the Resume Copy screen.
(i) List of Selected Volumes
Displays the list of the volumes selected in the Volume List Screen.
Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.
For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.
- Have Unpaired: Execute it for a volume with the pair setting.
- Foreground Copy State: Execute it for a volume in the Suspend state.
- Separate State: Execute it for a volume in the Suspend state.
- Freeze: Defreeze the Data Replication function and execute it again.
- MV Monitoring Suspended: Change the disk array of MV to the Monitored state and execute it again.
- RV Monitoring Suspended: Change the disk array of RV to the Monitored state and execute it again.
- MV Force Unpaired: Perform Forced Unpair for RV.
- RV Force Unpaired: Perform Forced Unpair for MV.
- RV Forced Separate: Execute it for a volume in the Sync state.
- MV Outside iSM Management: Execute it for a pair under the iSM management.
- All Link Path Abnormal: Refer to Section 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.

(ii) Summary Display/Details Display
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) Mode
You can specify the copy control state when copy is resumed.
The following copy modes can be specified.
- Synchronous: Changes the copy control state to the Sync Copy mode.
- Semi-synchronous: Changes the copy control state to the Semi-Sync Copy mode.
This can be specified for pairs in different disk arrays.

When you click the [Execute] button, the following message is displayed.

Figure 3-23 Confirmation Screen
[Execution Conditions]

To perform operations of the copy control state, the following conditions must be satisfied.

(i) The target MV is recognized by Replication Management as the Replication target disk.
(ii) The target MV and RV are paired.
(iii) The activity state of the target pair is Replicate or Restore.
(iv) The Semi-Sync copy mode cannot be specified for pairs set in the same disk array.
    The Semi-Sync copy mode can be specified only for pairs set in different disk arrays. (Can be set only when copy is resumed.)
(v) The disk array where the specified MV and RV are stored is not in the Freeze state.
(vi) The disk array where the specified MV and RV are stored is monitored.
    (In case of copy suspend, MV must be monitored)

Figure 3-24 illustrates the execution conditions of operations of the copy control state (Each of (i) to (vi) in the figure corresponds to the respective number above).
### 3.3.6 Change to Background Copy

The copy control state is changed from the Replicate or Restore state to the Background Copy state.

To change it to the Background Copy state, select a volume, and then do the following on the menu bar of Replication Screen.
- Click [Operation], point to [Volume Operation], and then click [Change to Background Copy].
- You can also right-click in the Volume List Screen, point to [Volume Operation], and then click [Change to Background Copy].

Figure 3-25 shows an example of the Change to Background Copy screen.

![Example of Change to Background Copy Screen](image)

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.
You can select multiple executable pairs and execute them in a batch.
Non-executable pairs cannot be selected.
(i) List of Selected Volumes
Displays the list of the volumes selected in the Volume List Screen.
Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.
For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.
Have Unpaired Execute it for a volume with the pair setting.
Separate State Execute it for a volume in the Replicate state or Restore state.
Already Background Copy State Execute it for a volume in Foreground Copy.
Freeze Defreeze the Data Replication function and execute it again.
MV Monitoring Suspended Change the disk array of MV to the Monitored state and execute it again.
RV Monitoring Suspended Change the disk array of RV to the Monitored state and execute it again.
MV Force Unpaired Perform Forced Unpair for RV.
RV Force Unpaired Perform Forced Unpair for MV.
RV Forced Separate Execute it for a volume in the Sync state.
MV Outside iSM Management Execute it for a pair under the iSM management.
All Link Path Abnormal Refer to Section 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.

(ii) Summary Display/Details Display
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

When you click the [Execute] button, the following message is displayed.

![Confirmation Screen](image)

Figure 3-26 Confirmation Screen
[Execution Conditions]

To perform changes to background copy, the following conditions must be satisfied.

(i) The target MV and RV are recognized by Replication Management as the Replication target disk.
(ii) The target MV and RV are paired.
(iii) The activity state of the target pair is Replicate or Restore.
(iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
(v) The disk array where the specified MV and RV are stored is monitored.

Figure 3-27 illustrates the execution conditions of changes to background copy (Each of (i) to (v) in the figure corresponds to the respective number above).
3.3.7 RV Mode Change

You can change the RV access restriction.

To change the RV mode, select a volume, and then do the following on the menu bar of Replication Screen.

- Click [Operation], point to [Volume Operation], and then click [RV Mode Change].
- You can also right-click in the Volume List Screen, point to [Volume Operation], and then click [RV Mode Change].

Figure 3-28 shows an example of the RV Mode Change screen.

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Non-executable pairs cannot be selected.

(i) List of Selected Volumes
Displays the list of the volumes selected in the Volume List Screen.
Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.
For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.

- **Have Unpaired**: Execute it for a volume with the pair setting.
- **Freeze**: Defreeze the Data Replication function in RV and execute it again.
- **RV Outside iSM Management**: Execute it for a pair under the iSM management.
- **RV Monitoring Suspended**: Change the disk array of RV to the Monitored state and execute it again.
- **MV Force Unpaired**: Perform Forced Unpair for RV.
- **RV Force Unpaired**: Perform Forced Unpair for MV.
- **All Link Path Abnormal**: Refer to Section 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.

(ii) **Summary Display/Details Display**
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) **RV Status**
Specifies the operations for a write request from the host.
- **R/W Permit**: Read and write can be performed for a volume from the host.
  * This cannot be executed in Replicate, Restore, or Separate execution. (Figure 3-27)
- **Not Ready**: Switches to the Not Ready state. Operations cannot be performed from the host.
- **Read Only**: For a volume, only read from the host can be performed.
  * Care should be taken to specify Read Only. Refer to 2.6 “RV Access Restriction”.

When you click the [Execute] button, the following message is displayed.

![Confirmation Screen]

Figure 3-29 Confirmation Screen

When it is performed for a volume in Replicate, Restore, or Separate execution, the following
warning message is displayed and the change of the RV mode of the volume is cancelled.

Figure 3-30  Warning Screen

[Execution Conditions]
To change the RV mode, the following conditions must be satisfied.
(i) The target RV is recognized by Replication Management as the Replication target disk.
(ii) The target MV and RV are paired.
(iii) In the Separated state (when R/W Permit is specified).
(iv) The disk array where the specified RV is stored is not in the Freeze state.
(v) The disk array where the specified RV is stored is monitored.

Figure 3-31 illustrates the execution conditions of change of the RV mode (Each of (i) to (v) in the figure corresponds to the respective number above).

Figure 3-31  Execution Conditions of Change of RV Mode
3.3.8 Forced Separate

When a failure occurs in the connection between disk arrays and the normal Separate cannot be performed on MV and RV, you can use Forced Separate to instruct Separate to MV and RV individually.

Forced Separate forcibly separates MV and RV and makes RV available.

To set Forced Separate, select a volume, and then do the following on the menu bar of Replication Screen.

- Click [Operation], point to [Forced Operation], and then click [Forced Separate].
- You can also right-click in the Volume List Screen, point to [Forced Operation], and then click [Forced Separate].

Figure 3-32 shows an example of the Forced Separate screen.

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Non-executable pairs cannot be selected.
List of Selected Volumes
Displays the list of the volumes selected in the Volume List Screen.
Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.
For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.
- Have Unpaired Execute it for a volume with the pair setting.
- Separated Execute it for a volume in the Sync state.
- MV Separated Complete Execute it for a volume in the Sync state.
- Cancel Execute it for a volume in the Sync state.
- MV Forced Separate Execute it for a volume in the Sync state.
- Fault Refer to Section 2.2.2 “HW Fault Unique to Replication” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
- MV Fault Refer to Section 2.2.2 “HW Fault Unique to Replication” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
- MV Outside iSM Management After execution of RV Forced Separate, perform Forced Separate for the volume in MV with the pair setting.
- MV Monitoring Suspended After execution of RV Forced Separate, perform Forced Separate for the volume in MV with the pair setting.
- MV Freeze After execution of RV Forced Separate, perform Forced Separate for the volume in MV with the pair setting.
- MV Force Unpaired Perform Forced Unpair for RV.
- RV Separate Complete Execute it for a volume in the Sync state.
- RV Forced Separate Execute it for a volume in the Sync state.
- RV Fault Refer to Section 2.2.2 “HW Fault Unique to Replication” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
- RV Outside iSM Management After execution of MV Forced Separate, perform Forced Separate for the volume in RV with the pair setting.
- RV Monitoring Suspended After execution of MV Forced Separate, perform Forced Separate for the volume in RV with the pair setting.
- RV Freeze After execution of MV Forced Separate, perform Forced Separate for the volume in RV with the pair setting.
- RV Force Unpaired Perform Forced Unpair for MV.

Summary Display/Details Display
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

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Figure 3-33 is displayed when MV is not under the iSM. Figure 3-34 is displayed when RV is not under the iSM.

After execution, perform Forced Separate for MV or RV not separated.

Figure 3-33  Warning Screen for MV without under the iSM

Figure 3-34  Warning Screen for RV without under the iSM

When you click the [Yes] button, the following message is displayed.

Figure 3-35  Confirmation Screen
[Execution Conditions]

To perform Forced Separate, the following conditions must be satisfied.

(i) The target volume is recognized by Replication Management as the Replication target disk.
(ii) The target MV and RV are paired, or one of them is forcibly separated.
(iii) The disk array where the specified MV and RV are stored is not in the Freeze state.
(iv) The disk array where the specified volume is stored is monitored.

Figure 3-36 illustrates the execution conditions of Forced Separate (Each of (i) to (iv) in the figure corresponds to the respective number above).

Figure 3-36  Execution Conditions of Forced Separate
3.3.9 Forced Unpair

When a failure occurs in the disk array of MV or RV and monitoring is suspended so that the normal Cancel Pair cannot be performed, you can use Forced Unpair to unpair the pairs for MV and RV separately.

Before performing Forced Unpair, you must separate MV and RV with Separate or Forced Separate.

To perform Forced Unpair, select a volume, and then do the following on the menu bar of Replication Screen.
• Click [Operation], point to [Forced Operation], and then click [Forced Unpair].
• You can also right-click in the Volume List Screen, point to [Forced Operation], and then click [Forced Unpair].

Figure 3-37 shows an example of the Forced Unpair screen.

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.
You can select multiple executable pairs and execute them in a batch.
Non-executable pairs cannot be selected.
(i) List of Selected Volumes
Displays the list of the volumes selected in the Volume List Screen.
Volumes whose Execution Result is “Un-Executable” cannot be selected because they do not satisfy the execution conditions.

For the “Un-Executable” volumes, do the following by referring to the Un-Executable Reason.

- **Have Unpaired**: Execute it for a volume with the pair setting.
- **Separating**: Execute it again in the Separated state.
- **MV Separating**: Execute it again in the Separated state.
- **Replicate**: Execute it for a volume in the Separate state.
- **MV Replicate**: Execute it for a volume in the Separate state.
- **Restore**: Execute it for a volume in the Separate state.
- **MV Restore**: Execute it for a volume in the Separate state.
- **MV Outside iSM Management**: After execution of RV Forced Unpair, perform Forced unpair for the volume in MV with the pair setting.
- **MV Monitoring Suspended**: After execution of RV Forced Unpair, perform Forced unpair for the volume in MV with the pair setting.
- **MV Freeze**: After execution of RV Forced Unpair, perform Forced unpair for the volume in MV with the pair setting.
- **MV Force Unpaired**: Perform Forced Unpair for RV.
- **RV Separating**: Execute it again in the Separated state.
- **RV Replicate**: Execute it for a volume in the Separate state.
- **RV Restore**: Execute it for a volume in the Separate state.
- **RV Outside iSM Management**: After execution of MV Forced Unpair, perform Forced unpair for the volume in RV with the pair setting.
- **RV Monitoring Suspended**: After execution of MV Forced Unpair, perform Forced unpair for the volume in RV with the pair setting.
- **RV Freeze**: After execution of MV Forced Unpair, perform Forced unpair for the volume in RV with the pair setting.
- **RV Force Unpaired**: Perform Forced Unpair for MV.

(ii) Summary Display/Details Display
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

If Forced Unpair is performed for either MV or RV, the replication operations will not function properly because inconsistency occurs in the recognized states of MV and RV. After execution, perform Forced Unpair for MV or RV for which Unpair is not performed.

Figure 3-38 is displayed when MV is not under the iSM. Figure 3-39 is displayed when RV is not under the iSM.
When you click the [Yes] button, the following message is displayed.

Figure 3-38  Warning Screen for MV without under the iSM

Figure 3-39  Warning Screen for RV without under the iSM

Figure 3-40  Confirmation Screen
[Execution Conditions]

To perform Forced Unpair, the following conditions must be satisfied.

(i) The target volume is recognized by Replication Management as the Replication target disk.
(ii) The target MV and RV are paired, or one of them is forcibly unpaired.
(iii) The target pair is in the Separated or Forced Separate state.
(iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
(v) The disk array where the specified volume is stored is monitored.

Figure 3-41 shows the execution conditions for Forced Unpair. ((i) to (v) in this figure correspond to those above.)

Figure 3-41  Execution Conditions of Forced Unpair
3.3.10 Freeze/Defreeze

You can freeze or defreeze the Data Replication function of the disk array.

To freeze or defreeze a disk array, select the disk array, and then do the following on the menu bar of Replication Screen.

- Click [Operation], point to [System Operation], and then click [Freeze/Defreeze].

or

- You can also select the disk array in the Tree Screen, right-click it, and then click [Freeze/Defreeze].

Figure 3-42 shows an example of the Freeze/Defreeze screen.

(i) Freeze/Defreeze Execute

- Freeze  Freezes the Data Replication function of the disk array.
- Defreeze Defreezes the Data Replication function of the disk array.

When you click the [Execute] button, the following message is displayed.
[Execution Conditions]
To perform Freeze/Defreeze, the following conditions must be satisfied.
(i) The target disk array is recognized by Replication Management.
(ii) The specified disk array is monitored.

When you perform Freeze, no replication operations can be performed in the disk array. Refer to 2.8 “Freeze of Disk Array”.
You can change the priority of background copy of the disk array.

To change the background copy level change, select a disk array, and then do the following on the menu bar of Replication screen.

- Click [Operation], point to [System Operation], and then click [Background Copy Level Change].
- or
- You can also select the disk array in the Tree Screen, right-click it, and then click [Background Copy Level Change].

Figure 3-44 shows an example of the Background Copy Level Change screen.

(i) Background Copy Level

Specifies the priority of copy operation when Background Copy is selected in Replicate and Restore.

A higher priority results in faster copying for reflecting difference (For more information, refer to 2.4 “Copy Control State”).

- Return Default Value
  Restores the default value of the disk array.
- Change
  You can specify the priority of the disk array.
When you click the [Execute] button, the following message is displayed.

![Confirmation Screen](image)

Figure 3-45  Confirmation Screen

**Execution Conditions**

To perform operations of the copy control state, the following conditions must be satisfied.

(1) The target disk array is recognized by Replication Management.
(2) The specified disk array is monitored.
3.3.12 Volume Connection Screen

The connection state of the volume is displayed.

To display the Volume Connection Screen, select a volume, and then do one of the following on the menu bar of Replication Screen.

- Select a volume in the Volume List screen, right-click it, and then click [Connection Screen].
- Select a volume in the Volume List screen, point to [View], and then click [Connection Screen].
- Double-click a volume in the Volume List screen.

Figure 3-46 shows an example of the Volume Connection screen.

![Example of Volume Connection Screen](image)

This screen displays the pair selected in the Volume List screen. If two or more volumes are selected, all of them are displayed.
(i) (Volume Number) Logical Disk Name
Displays the (volume number) logical disk name.

(ii) Copy Progress
Displays the progress of copy. This display disappears when copy is complete.
Progress may not change if I/O load is too heavy.
If a link failure occurs, Progress may not change. In this case, refer to Section 2.2.2 (2) “Link fault” in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)”.

(iii) Access Restrictions for RV
Displays the access restrictions for RV. There are the following modes.
- R/W Permit Read and write can be performed for a volume from the host.
- Read Only Only read can be performed for a volume from the host.
- Not Ready Operations for a volume cannot be performed from the host.

(iv) Operation Time Display
Displays the Start Time and End Time of the operation performed for the volume such as Replicate, Restore, or Separate. For Forced Separate or when a failure has occurred, displays the transition time.

1) Connection Display of Paired Volumes
Connections of volumes are displayed as pipes as shown below.
During copy operation, the color of the original disk moves through the pipe.

(i) For DynamicDataReplication

Replicate is executed : ← → Replicate is complete : ← →
Restore is executed : ← → Restore is complete : ← →
Separate is executed : ← → Separate is complete : ← →

(ii) For RemoteDataReplication

Replicate is executed : ← → Replicate is complete : ← →
Restore is executed : ← → Restore is complete : ← →
Separate is executed : ← → Separate is complete : ← →
(2) Amount of Difference/Transfer Rate
Displays the amount of difference and transfer rate during copy operation.
The unit of the amount of difference is variable (e.g. KB, MB, GB), and the unit of transfer rate is
fixed (MB/S).

Example of Display (Replicate)

<table>
<thead>
<tr>
<th>Amount of Difference</th>
<th>Transfer Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.51 GB (1.3 MB/S)</td>
<td></td>
</tr>
</tbody>
</table>

After Replicate is complete

When Replication is complete (Amount of Difference=0), Amount of Difference and Transfer
Rate (MB/S) disappears.

(3) Volume Color
The Volume Color is defined for each layer and it becomes the layer color immediately after
setting the pair or when Separate has completed.
When volume colors of the pair match, it indicates synchronization.
(i) PV : Yellowish green
(ii) 1st Layer : Light blue
(iii) 2nd Layer : Blue
(iv) 3rd Layer : Yellow

Example of Display

Yellowish green Light blue Blue Yellow

PV 1st Layer 2nd Layer 3rd Layer
In the pair connected by RemoteDataReplication, the remote disk array is not managed by iSM or, in a monitoring stop, may be displayed like the above.

In the pair connected by RemoteDataReplication, when Remote Volume cannot be recognized from the host computer which Local Volume has connected by having performed Forced Unpair to Remote Volume etc., it may display like the above.

Case of the 2nd layer or more layer pair composition, when Forced Unpair is performed to the volume of the 1st layer or the 2nd layer, the volume of upper layers may not be displayed.

(4) Copy Progress

Displays the progress of Replicate, Restore etc. as the change in volume.

(i) Example of Display 1  Replicate

Replicate Execution

Turns to the same color when synchronized.
(ii) Example of Display 2  Separate during Replicate

You can perform the replication operations by right-clicking the volume in the Volume Connection screen. For how to operate, refer to the items in 3.3.

- 3.3.2 Replicate
- 3.3.4 Restore
- 3.3.3 Separate
- 3.3.5 Suspend/Resume Copy
- 3.3.6 Background Copy
- 3.3.7 RV Mode Change
- 3.3.8 Forced Separate
3.4 Other Data Replication Operations

In addition to the operations described above, the following operations are available:
(i) CSV Output of Replication Screen Information
(ii) Save Pair Setting Information
(iii) Environment Setting
(iv) Refresh
(v) Record Screen Information
(vi) Disk Array Properties
(vii) Link Properties
(viii) Copy Fault List

3.4.1 CSV Output of Replication Screen Information

The data replication information currently displayed or what is displayed in the Disk Array LINK Information screen is saved to a file. On the menu bar, do the following:
• Click [File], and then click [CSV Output of Replication Screen Information].

Figure 3-47 shows an example of the Save As screen.

Figure 3-47  Example of Save As Screen
(1) **CSV file containing configuration screen information**

This section shows an example of the CSV file that is created by executing the CSV output of configuration screen information.

In this file, the information displayed on the screen is written in the format in which each item is separated by commas.

An example of the CSV file

<table>
<thead>
<tr>
<th>Classification</th>
<th>Number</th>
<th>OS Type</th>
<th>Logical Disk Name</th>
<th>Pair Number</th>
<th>Paired Disk Name</th>
<th>Activity State</th>
<th>Disk Array</th>
<th>Sync State</th>
<th>Copy Control State</th>
<th>Differential Volume</th>
<th>Number of Links</th>
<th>Capacity [GB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV</td>
<td>0000h</td>
<td>WN</td>
<td>driveWN0</td>
<td>0001h</td>
<td>driveWN1</td>
<td>Replicate</td>
<td>NECStorage4100</td>
<td>Synchronized</td>
<td>Foreground Copy</td>
<td>0 KB</td>
<td>1,4.2</td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>0001h</td>
<td>WN</td>
<td>driveWN1</td>
<td>0000h</td>
<td>driveWN0</td>
<td>Replicate</td>
<td>NECStorage4100</td>
<td>Synchronized</td>
<td>Foreground Copy</td>
<td>0 KB</td>
<td>1,4.2</td>
<td></td>
</tr>
<tr>
<td>MV</td>
<td>0002h</td>
<td>WN</td>
<td>driveWN2</td>
<td>0003h</td>
<td>driveWN3</td>
<td>Replicate</td>
<td>NECStorage4100</td>
<td>Sync Execution</td>
<td>Foreground Copy</td>
<td>3.7 GB</td>
<td>1,4.2</td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>0003h</td>
<td>WN</td>
<td>driveWN3</td>
<td>0002h</td>
<td>driveWN2</td>
<td>Replicate</td>
<td>NECStorage4100</td>
<td>Sync Execution</td>
<td>Foreground Copy</td>
<td>3.7 GB</td>
<td>1,4.2</td>
<td></td>
</tr>
<tr>
<td>MV</td>
<td>0004h</td>
<td>WN</td>
<td>driveWN4</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td></td>
<td>,</td>
<td>,</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>0005h</td>
<td>WN</td>
<td>driveWN5</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td></td>
<td>,</td>
<td>,</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>0006h</td>
<td>WN</td>
<td>driveWN6</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td></td>
<td>,</td>
<td>,</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>0007h</td>
<td>WN</td>
<td>driveWN7</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td></td>
<td>,</td>
<td>,</td>
<td></td>
</tr>
<tr>
<td>MV</td>
<td>0008h</td>
<td>WN</td>
<td>driveWN8</td>
<td>0009h</td>
<td>driveWN9</td>
<td>Restore</td>
<td>NECStorage4100</td>
<td>Restored(Synchronized)</td>
<td>Foreground</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>0009h</td>
<td>WN</td>
<td>driveWN9</td>
<td>0008h</td>
<td>driveWN8</td>
<td>Restore</td>
<td>NECStorage4100</td>
<td>Restored(Synchronized)</td>
<td>Foreground</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MV</td>
<td>000ah</td>
<td>WN</td>
<td>driveWNa</td>
<td>000bh</td>
<td>driveWNb</td>
<td>Separate</td>
<td>NECStorage4100</td>
<td>Forced Separation</td>
<td>,0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>000bh</td>
<td>WN</td>
<td>driveWNb</td>
<td>000ah</td>
<td>driveWNa</td>
<td>Separate</td>
<td>NECStorage4100</td>
<td>Forced Separation</td>
<td>,0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>000ch</td>
<td>WN</td>
<td>driveWNc</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td></td>
<td>,</td>
<td>,</td>
<td></td>
</tr>
<tr>
<td>MV</td>
<td>000dh</td>
<td>WN</td>
<td>driveWNd</td>
<td>000eh</td>
<td>driveWNe</td>
<td>Separate</td>
<td>NECStorage4100</td>
<td>Separated</td>
<td>,0 KB</td>
<td>1,4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>000eh</td>
<td>WN</td>
<td>driveWNe</td>
<td>000dh</td>
<td>driveWNd</td>
<td>Separate</td>
<td>NECStorage4100</td>
<td>Separated</td>
<td>,0 KB</td>
<td>1,4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>000fh</td>
<td>WN</td>
<td>driveWnf</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td></td>
<td>,</td>
<td>,</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>0010h</td>
<td>WN</td>
<td>driveWN10</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td></td>
<td>,</td>
<td>,</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>0011h</td>
<td>WN</td>
<td>driveWN11</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td></td>
<td>,</td>
<td>,</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>0012h</td>
<td>WN</td>
<td>driveWN12</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td>,</td>
<td></td>
<td>,</td>
<td>,</td>
<td></td>
</tr>
</tbody>
</table>
3.4.2 Save Pair Setting Information

This function saves the pair setting information for the selected disk array to a file.

On the menu bar, do the following:
• Click [File], and then click [Save the Pair Setting Information].

Figure 3-48 shows an example of the Save Pair Setting Information screen.

A file that stores pair setting information can be used for “Replication Setting” of “New Setting” which is one of configuration setting functions. For details, refer to the “NEC Storage Manager Configuration Setting Tool User’s Manual (GUI)".
Pair List

This section describes the pair list that is output to a file by the replication management function.

(1) Pair list format rules

(i) The file is a text file in the ASCII character format (the default file name is pairlist.txt).
(ii) Text from a semicolon (;) or sharp (#) to the end of the line is regarded as a comment.
(iii) There is a distinction between upper-case and lower-case characters.
(iv) Data is described in the following format.
   “MV Disk Array Name”,“MV Vol Type”,“MV Vol Name”,“RV Disk Array Name”,“RV Vol Type”,“RV Vol Name”

<table>
<thead>
<tr>
<th>Item Number</th>
<th>SYNTAX</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pair Name List</td>
<td>Identifier of this file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A space between characters is a half size.</td>
</tr>
<tr>
<td>2</td>
<td>MV Disk Array Name</td>
<td>Name of the disk array where the Master Volume (MV) belongs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The maximum number of characters is 32.</td>
</tr>
<tr>
<td>3</td>
<td>MV Vol Type</td>
<td>OS type of Master Volume.</td>
</tr>
<tr>
<td>4</td>
<td>MV Vol Name</td>
<td>Logical disk name of Master Volume</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The maximum number of characters is 24.</td>
</tr>
<tr>
<td>5</td>
<td>RV Disk Array Name</td>
<td>Name of the disk array where the Replication Volume (RV) belongs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The maximum number of characters is 32.</td>
</tr>
<tr>
<td>6</td>
<td>RV Vol Type</td>
<td>OS type of RV.</td>
</tr>
<tr>
<td>7</td>
<td>RV Vol Name</td>
<td>Logical disk name of RV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The maximum number of characters is 24.</td>
</tr>
</tbody>
</table>

(2) Example

Pair Name List

#NEC iSM Ver.2.1.3 Tue Dec 03 13:16:38 2002
[Pair]

#MV DiskArrayName, MV OSType, MV ExVolName, RV DiskArrayName, RV OSType, RV ExVolName
NECStorage4100/07,WN,ora45,NECStorage4100/10,WN,ora25
NECStorage4100/07,WN,ora45,NECStorage4100/07,WN,ora55
NECStorage4100/07,WN,ora46,NECStorage4100/10,WN,ora26
NECStorage4100/07,WN,ora46,NECStorage4100/07,WN,ora56
3.4.3 Environment Setting

The interval to obtain disk array information is specified. It is the interval to obtain copy progress information in the screen display.

On the menu bar, do the following:

• Click [View], and then click [Environment Setting].

Figure 3-49 shows an example of the Environment Setting screen.

The interval is the time interval after information is obtained until information is obtained next time.

To reflect the settings to the Replicate Screen next displayed, perform Record Screen Information.
### 3.4.4 Refresh

While the server in the root of the Tree screen is being selected, this function refreshes information of the disk array connected to the server.

While the Disk Array icon on the Tree screen is being selected, this function updates and redisplays the selected disk array and the list of volumes of the disk array linked to the selected disk array.

In any case, clicking [Cancel] before completing Update returns the screen to the state before update.

On the menu bar, do the following:

* Click [View], and then click [Refresh].

or

* You can also press the F5 key.

When you perform [Refresh], the following message is displayed.

![Warning Screen for Refresh](image)

Figure 3-50  Warning Screen for Refresh
3.4.5 Record Screen Information

The screen information of Replication Screen is recorded. The recorded items are reflected to the Replicate screen next displayed, after closing the current Replicate screen.

On the menu bar, do the following:

• Click [View], and then click [Record Screen Information].

Recorded Items

• Width of the item
• Location of the item
• Screen size
• Screen location
• IV display state
• Update interval of information
• Display state of the status bar
• Volume Connection screen location
3.4.6 Disk Array Properties

The setting states of the device are displayed.

On the menu bar, do the following:
• Select a disk array in the Tree screen, click [View], and then click [Properties].

or
• Select a disk array in the Tree screen, right-click it, and then click [Properties].

Figure 3-51 shows an example of the Disk Array Properties screen.

The items indicates the following information.

**Disk Array Name**
Indicates the identification name assigned to the disk array.

**Differential Map**
Indicates whether the difference control function to keep track of the update difference status of MV and RV exists. If it is not installed, difference copy cannot be performed (The copy range is always All).

**Replication Status**
Indicates whether the Data Replication function of the disk array is available.

READY: Indicates that it is operable.
FREEZE: Indicates that the Data Replication function is frozen due to a power down process of the disk array or acceptance of a Freeze instruction.
<table>
<thead>
<tr>
<th>Background Copy Level</th>
<th>Indicates the priority of Background Copy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Number of RV Setting</td>
<td>Indicates the maximum number of RVs which can be set for one MV (This cannot be changed).</td>
</tr>
<tr>
<td>SAA</td>
<td>Subsystem Absolute Address: Indicates an address value of the disk array which doesn’t overlap with other disk arrays.</td>
</tr>
</tbody>
</table>
3.4.7 Link Properties

The link states are displayed.

On the menu bar, do one the following:

- Select an item in the Disk Array LINK Information screen, click [View], and then click [Properties].
- Select an item in the Disk Array LINK Information screen, right-click it, and then click [Properties].

Figure 3-52 shows an example of the Link Properties screen.

![NICStorageS4100 Link Properties](image)

Figure 3-52 Example of Link Properties Screen

The items indicates the following information (Refer to Figure 3-5 “Replication Link Information”).

- **Link Disk Array Name**: Indicates the identification name assigned to the linked disk array.
- **Path Number**: Indicates the link path number of the selected link information.
- **Link Director Number**: Indicates the replication director number of the selected link information.
- **Link Port Number**: Indicates the port number of the replication director.
- **Replication Port N Port Identifier Lock**: Indicates whether the port ID of the target is variable or fixed.
  - 00h: Variable value depending on the system configuration
  - 01h: Fixed value
- **Replication Port N Port Identifier**: Indicates the port ID of the target.

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<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Indicates the normal state.</td>
</tr>
<tr>
<td>Offline</td>
<td>Indicates that the link setting is unconfirmed during startup of the disk array.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Indicates that the Data Replication function in the target disk array is frozen.</td>
</tr>
<tr>
<td>Link Checking</td>
<td>Indicates that the link status is being checked due to a failure of communication in the link.</td>
</tr>
<tr>
<td>Fault</td>
<td>Indicates that the link is invalid due to a failure of communication in the link.</td>
</tr>
</tbody>
</table>
3.4.8 Copy Fault List

The copy fault list displays only the pairs where a copy fault occurred. When a copy fault occurs, do the following to recover from the fault. Unless you have acquired the volume information of the disk array that has a copy fault, no faults are displayed on the copy fault list screen. You must acquire the volume information of the disk array that has a copy fault. For the procedure for acquiring the volume information, refer to 3.2.3 “Volume List Screen”.

On the menu bar, do the following:
• Click [View], and then click [Copy Fault List].

Figure 3-53 shows an example of the Copy Fault List screen.

![Copy Fault List Screen]

Choose volume pair in fault status from list, then click button, each dialog will be showed individually.

Fault -- Because copy error occurred, Volume was Forced Separate inside the Disk Array. Replicate or Restore can be executed.

Abnormal -- Because copy error occurred, Forced Suspend was executed inside the Disk Array. Resume Copy or Forced Separate can be executed.

When you select a volume of the failure pair from the list and click one of the buttons, the corresponding dialog box appears.
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Fault  Forcefully separated in the disk array due to a copy fault.
Abnormal Suspend  Forcefully suspended in the disk array due to a copy fault.

(i) Replicate
   Performs Replicate for the selected pair.
   This operation can be performed for a volume in the Fault state.

(ii) Restore
   Performs Restore for the selected pair.
   This operation can be performed for a volume in the Fault state.

(iii) Resume Copy
   Performs Resume Copy for the selected pair.
   This operation can be performed for a volume in the Abnormal suspend state.

(iv) Forced Separate
   Performs Forced Separate for the selected pair.
   This operation can be performed for a volume in the Abnormal suspend state.
This chapter describes how to operate functions of the NEC Storage ReplicationControl that runs on the business server. The NEC Storage ReplicationControl functions include the creation and display of the volume list, replication operations, pair operations, and disk operations that are necessary for operating MV’s and RV’s in the system.

The description of “UNIX” in this chapter includes all of the UNIX systems supported by the NEC Storage ReplicationControl, such as HP-UX, Solaris, and so on.

Table 4-1 shows the functions of the NEC Storage ReplicationControl.

For details of each command, refer to the “NEC Storage Manager Data Replication Command Reference”.

<table>
<thead>
<tr>
<th>Command name</th>
<th>Operation</th>
<th>Description</th>
<th>Target system</th>
<th>Target system</th>
</tr>
</thead>
<tbody>
<tr>
<td>iSMvollist</td>
<td>Volume List Creation/Display</td>
<td>Associates logical disk (disk array side) information with system dependent information (server side) and displays the associated information.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_replicate</td>
<td>Replicate</td>
<td>Starts Copy (Replicate) from MV to RV.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_separate</td>
<td>Separate</td>
<td>Separate RV from MV in the Copy state (Replicate or Restore).</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_restore</td>
<td>Restore</td>
<td>Starts Copy (Restore) from RV to MV.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_change</td>
<td>Change Copy Control State</td>
<td>Performs Copy Control State change when copying data from MV to RV.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_wait</td>
<td>Wait for state</td>
<td>Waits for Sync State(rpl/sync), Sync State(rst/sync), or Separated state.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_query</td>
<td>Paired Volume State Display</td>
<td>Displays the Copy state of a pair.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_sense</td>
<td>Volume List Display</td>
<td>Displays volume information.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_ldlist</td>
<td>Logical disk information display</td>
<td>Obtains and displays logical disk list information.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_pair</td>
<td>Pair Setting and Unpair</td>
<td>Sets and unpairs paired volumes.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_flush</td>
<td>File system buffer flush</td>
<td>Flushes the file system cache buffer.</td>
<td>○</td>
<td>–</td>
</tr>
<tr>
<td>iSMrc_mount</td>
<td>Volume Mount</td>
<td>Mounts a volume (file system).</td>
<td>○</td>
<td>–</td>
</tr>
<tr>
<td>iSMrc_umount</td>
<td>Volume Unmount</td>
<td>Unmounts a volume (file system).</td>
<td>○</td>
<td>–</td>
</tr>
<tr>
<td>iSMrc_signature</td>
<td>Signature Operation</td>
<td>Performs operation regarding the signature of each disk.</td>
<td>○</td>
<td>–</td>
</tr>
<tr>
<td>iSMrc_scan</td>
<td>Disk scanning</td>
<td>Scans for detecting available disks.</td>
<td>○</td>
<td>–</td>
</tr>
</tbody>
</table>

O: Targeted
–: Not targeted
Note:

(1) On the Windows system, operations are allowable only for a user who belongs to the Administrators group.

(2) On the UNIX system, operation authority is given to a super user immediately after the installation. The volume list can be created only by the super user; other operations, however, can be performed by anybody by changing the authority to access commands and directory operations.
4.1 **Volume Types**

Types of volumes that are specified as operation targets for data replication commands are as follows:

Table 4-2 shows the list of volume types.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Identifier</th>
<th>Target system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logical disk name</td>
<td>Specifies a logical disk name set on the disk array side.</td>
<td>ld</td>
<td>○  ○</td>
</tr>
<tr>
<td>Mount point volume name</td>
<td>Specifies a mount point volume name assigned to the volume by the system.</td>
<td>mvol</td>
<td>○  –</td>
</tr>
<tr>
<td>NTFS folder name</td>
<td>Specifies an NTFS folder name (path name) for the volume.</td>
<td>mdir</td>
<td>○  –</td>
</tr>
<tr>
<td>Drive letter</td>
<td>Specifies a drive letter for the volume.</td>
<td>drv</td>
<td>○  –</td>
</tr>
<tr>
<td>Special file name</td>
<td>Specifies a special file name assigned to the disk (logical disk) by the system.</td>
<td>sfn</td>
<td>–  ○</td>
</tr>
<tr>
<td>Volume group name</td>
<td>Specifies a name of the LVM’s volume group that includes the disk (logical disk).</td>
<td>vg</td>
<td>–  ○</td>
</tr>
<tr>
<td>Disk group name</td>
<td>Specifies a name of the VxVM’s disk group that includes the disk (logical disk).</td>
<td>dg</td>
<td>–  ○</td>
</tr>
</tbody>
</table>

○: Targeted  --: Not Targeted

**Note:**

1. The identifier is a character string that indicates the volume type and is used in the following cases:
   - When specifying a volume type by a replication operation command option (-mvflg, -rvflg, or -volflg)
   - When specifying a volume type by a pair specification (MV type or RV type) in the replication operation file

2. To use the volume group, the LVM environment is necessary.

3. To use the disk group, the VxVM environment is necessary.

4. On the UNIX system Solaris version, to specify a special file name (/dev/rdsk/c#t#d#s#), remove the special file name’s slice (partition) number (s#).

5. The pair setting and unpairing operation (iSMrc_pair command) is performed on a single logical disk; therefore, it is not possible to specify an LVM volume group or a VxVM disk group.

6. To conduct joint operation with the replication management (controlling the I/O issuance to disk arrays via the NEC Storage Manager), an applicable volume type is a logical disk name only.
4.2 Replication Operation File

To perform the batch setting of multiple pairs by executing replication and pair operation commands, or to execute multiple commands for a specific pair, use the replication operation file. Using the replication operation file allows operation target pairs to be described in the file, managed and shared, thereby improving system operations and maintenance performance of the data replication.

The following example shows a description in the replication operation file:

Example for the Windows system

```
#Type: MV  Type: RV
ld: dev000  ld: dev001
ld: dev006  drv: G
drv: H       ld: dev007

# MV: RV=1:1
ld: dev005
```

Example for the UNIX system

```
#Type: MV  Type: RV
sfn:/dev/rdsk/c16t1d0  sfn:/dev/rdsk/c16t1d1
vg:/dev/vgvol          ld:/dev/rdsk/c16t1d4, /dev/rdsk/c16t1d5
ld: dev003              sfn:/dev/rdsk/c23t2d0

# XXXX
sfn:/dev/rdsk/c16t2d0  sfn:/dev/rdsk/c16t2d1
sfn:/dev/rdsk/c16t2d0  sfn:/dev/rdsk/c16t2d2
```

To specify the replication operation file, use the -file option together with the replication operation commands and pair operation commands.

For information about how to describe and specify the replication operation file, refer to the “NEC Storage Manager Data Replication Command Reference”.

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4.3 Volume List Creation/Display

The function to create and display the volume list associates logical disk (disk array side) information with system dependent information (server side) and displays the associated information. Since it handles system dependent information, the function on the Windows system is different from the function on the UNIX system. On the Windows system, operations are possible by using the GUI (Graphical User Interface).

4.3.1 Command Operations (Windows)

On the Windows system, by using the volume list creation and display function by means of the iSMvollist command, it is possible to obtain and display drive letter, HBT (host adapter number/bus number/target ID) and LUN (logical unit number), physical disk and logical disk names, and associated OS type (hereafter, volume list) of logical disks in the disk arrays that are recognized by the business server.

The following is the description of the HBT:

<Host adapter number: HBA>
This is the number for an interface card that connects a SCSI bus to the host (system). There are multiple buses in the host adapter.

<Bus number: Bus>
This is the number for the path (bus) from the host adapter to a target (SCSI device). One path can handle multiple targets.

<Target ID: Target ID>
This ID is used for identifying a device that is connected to the SCSI bus. One ID is assigned to one disk array.

![Figure 4-1 Relations between System Configuration and HBT](image)

Business server

HBA

Bus

HBA

Bus

(sw)itch

Target ID

NEC Storage series

Figure 4-1 Relations between System Configuration and HBT
Before you use replication and disk management operation functions, you must execute the iSMvollist command to create the volume list. When joint operation with the replication management is performed (the I/O issuance to disk arrays is directly controlled via the NEC Storage Manager), it is not necessary to create the volume list. The iSMvollist command associates system side information with logical disks in the disk arrays that are recognized by the business server and stores necessary volume information in the volume list under %SystemRoot%\ismvol.

Volumes that can be specified to use the replication and disk management operations must be registered in the volume list beforehand.

When you have added or deleted disk arrays to or from the system or built or cancelled logical disks, you must update the volume list to reflect the information. If the volume list is not updated, data inconsistency may occur during replication and disk operations.

(1) Volume List Creation/Update

To create or update the volume list, execute the iSMvollist command with the -cr option.

- **-cr option**: Scans devices connected to the system and creates or updates the volume list.

```
C:\>iSMvollist -cr
```

When the volume list has been successfully created or updated, the following message appears.

```
iSM11700: Please wait a minute.
iSM11701: Volume list is created successfully.
```

If creation or update of the volume list failed, the following error message appears.

```
iSM11702: Failed to make volume list data.
```

(2) Volume List Display

To display the volume list, specify and execute one of the following options.

- **-a option**: Displays information associated with all logical disks.
- **-al option**: Displays information only associated with specified logical disks.
- **-ae option**: Displays information only associated with specified logical disk names.
- **-ad option**: Displays information only associated with a specified drive name or a path name of the NTFS folder.
- **-ap option**: Displays information only associated with specified logical disk numbers.
- **-ah option**: Displays information only associated with specified HBT. If LUN is also specified, the system displays information only associated with specified HBT and LUN.
- **-av option**: Displays information only associated with specified mount point volume names.
- **-d option**: Lists disk array information.
Chapter 4  Functions of NEC Storage ReplicationControl

- **dl option**: Displays information only associated with specified disk arrays sorted by using logical disk number as the key. If a specific logical disk name is specified, the system displays information only associated with the specified logical disk.

- **de option**: Displays information only associated with specified disk arrays sorted by using logical disk name as the key. If a specific logical disk name is specified, the system displays information only associated with the specified logical disk name.

- **dd option**: Displays information only associated with specified disk arrays sorted by using drive name as the key. If a specific drive letter or a path name of the NTFS folder is specified, the system displays information only associated with the specified drive letter or path name of the NTFS folder.

- **dp option**: Displays information only associated with specified disk arrays sorted by using physical disk number as the key. If a specific physical disk number is specified, the system displays information only associated with the specified physical disk.

- **dh option**: Displays information only associated with specified disk arrays sorted by using HBT and LUN as the key. If HBT is specified, the system displays information only associated with the specified HBT. If LUN is specified, the system displays information only associated with the specified HBT and LUN.

(i) The following example shows the display of all information contained in the volume list.

```
C:\> isMvollist -a
LDN   LD Name  VAA OS Type
       HBT           LUN   Disk No. Disk Array
Volume Name
Path
0000h dev000 30000000000000020000 WN
h4b0t35       000h disk1 NEC Storage 4100/07
\\?\Volume{4b94d348-58a7-11d5-abc1-806d6172696f}\G:
0001h dev001 30000000000000020001 WN
h4b0t35       001h disk2 NEC Storage 4100/07
\\?\Volume{4b94d349-58a7-11d5-abc1-806d6172696f}\H:
0002h dev002 30000000000000020002 WN
h4b0t35       002h disk3 NEC Storage 4100/07
- - -
0003h dev003 30000000000000020003 WN
h4b0t35       003h disk4 NEC Storage 4100/07
\\?\Volume{9ba5c1c4-147f-11d5-958d-00004c7929e8}\Y:
C:\>
```
![Chapter 4 Functions of NEC Storage ReplicationControl](image)

**Description**
- **LDN** Logical disk number
- **LD Name** Logical disk name
- **VAA** Volume Absolute Address
- **OS Type** OS type
- **HBT** Host adapter number, bus number, target ID
- **LUN** LUN
- **Disk No.** Physical disk number
- **Disk Array** Disk array name
- **Volume Name** Mount point volume name
- **Path** Drive letter or path name mounted in the NTFS volume folder accessed by a user

(ii) The following example shows the display of information of the volume that has a specific logical disk name.

```
C:\> iSMvollist -ae dev004  
LDN   LD Name  VAA OS Type  
HBT   LUN   Disk No.  Disk Array 
Volume Name  
Path  
0004h dev004  30000000000000020004 WN  
h4b0t35 004h disk5 NEC Storage 4100/07  
\??\Volume{9ba5c1c4-147f-11d5-958d-00004c7929e8}\Y:
C:\>
```

(iii) The following example shows the display that lists disk array information.

```
C:\> iSMvollist -d  
--- Disk Array List ---  
Disk Array Name Number of Drives  
NEC Storage 2000/13 12  
NEC Storage 4100/07 64  
NEC Storage 4100/10 128  
C:\>
```

**Description**
- **Disk Array Name** Individual name of the disk array (Nickname)
- **Number of Drives** Total number of logical disks that exist in each disk array

[Execution conditions]

To create and display the volume list, the following conditions must be met:

(i) While the volume list is being created or updated, it is not possible to display the volume list or execute replication operation commands.
4.3.2 Command Operations (UNIX)

On the UNIX system, by using the volume list creation and display function by means of the iSMvollist command, it is possible to obtain and display special file name, logical disk name, and associated OS type (hereafter, volume list) of the logical disks in the disk arrays that are recognized by the business server.

To use the replication operation function, it is necessary to create the volume list beforehand by executing the iSMvollist command. When joint operation with the replication management is performed (the I/O issuance to disk arrays is directly controlled via the NEC Storage Manager), it is not necessary to create the volume list. The iSMvollist command associates system side information with logical disks in the disk arrays that are recognized by the business server and stores the volume information in the volume list under /etc/iSMrpl.

Volumes that can be specified to use the replication operation must be registered in the volume list beforehand.

When you have added or deleted disk arrays to or from the system or built or cancelled logical disks, you must update the volume list to reflect the information. If the volume list is not updated, data inconsistency may occur during replication and disk operations.

The volume list can be created only by an appropriate privileged user (super user); however, anybody can refer to the information in the volume list by changing the setting. To do so, change the right to access to the /etc/iSMrpl directory where the volume list is stored, the execution file (iSMvollist) and the storage directory to an appropriate mode.

The UNIX HP-UX version iSMvollist command creates a special file (device file) in the SCSI path through device driver format, which is used for the replication operation, under /dev/nec_iSM/mkdl. For description of the SCSI path through device driver, refer to scsi_ctl(7) in the UNIX HP-UX manual.

(1) Volume List Creation/Update

(i) Automatically creating the volume list

The volume list can be automatically created at the start of the business server. However, if settings remain unchanged since installation, the volume list cannot be automatically created, and therefore, will need to be manually created.

To automatically create it, it is necessary to change the name of the rc file that has been created at the installation of the NEC Storage ReplicationControl.

For details, refer to the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)” for the system you use.

(ii) Creating the volume list by an operator

To create or update the volume list, specify and execute the iSMvollist command with the -r option.
Chapter 4 Functions of NEC Storage ReplicationControl

- \texttt{-r} option : Scans devices connected to the system and creates or updates the volume list.

```
# iSMvollist -r
```

When the volume list has been successfully created or updated, the following message appears.
Make sure that the necessary volumes have been registered by displaying the volume list (iSMvollist -l).

```
iSM11100:Command has completed successfully.
```

If the creation or update of the volume list failed, the following error message appears.

```
iSM11549:Cannot make or refresh volume list data.
```

The UNIX HP-UX version NEC Storage ReplicationControl executes ioscan(1M) to obtain device information when the volume list is created (iSMvollist -r). To do so, it uses the \texttt{-k} option so as to obtain device information from the kernel rather than from the actual hardware. Therefore, even though the hardware is made available, the actual hardware may not be made available. In this case, creation or update of the volume list fails and the following message appears. If this error message appears, execute the ioscan \texttt{-fn} to confirm the state of the actual hardware.

```
iSM11758: System call error (error code=214)
```

(2) Volume List Display

To display the volume list, specify and execute one of the following options.

- \texttt{-l} option : Displays information associated with all logical disks.
- \texttt{-d} option : Lists disk array information.
- \texttt{-vs} option : Displays information only associated with specified disk arrays sorted by using special file name as the key. If a specific special file name is specified, the system displays information only associated with the specified special file.
- \texttt{-vl} option : Displays information only associated with specified disk arrays sorted by using logical disk number as the key. If a specific logical disk number is specified, the system displays information only associated with the specified logical disk number.
- \texttt{-ve} option : Displays information only associated with specified disk arrays sorted by using
logical disk name as the key. If a specific logical disk name is specified, the system displays information only associated with the specified logical disk name.

(i) The following example shows the display of all information in the volume list.

```
# iSMvollist -l
LDN   LD NAME   VAA          TYPE
   Special File  Disk Array   Path
0001h disk001  30000000000000002000  NX
  /dev/rdsk/c5t0d0  NEC Storage 4100/07
0002h disk002  30000000000000002001  NX
  /dev/rdsk/c5t0d1  NEC Storage 4100/07
0003h disk003  30000000000000002002  NX
  /dev/rdsk/c5t0d2  NEC Storage 4100/07
0004h disk004  30000000000000002003  NX
  /dev/rdsk/c5t0d3  NEC Storage 4100/07
```

Description

- **LDN**: Logical disk number
- **LD Name**: Logical disk name
- **VAA**: Volume Absolute Address
- **TYPE**: OS type
- **Special File**: Special file name
- **Disk Array**: Disk array name
- **Path**: Availability of special file
  - **Available**: Non-display
  - **Unavailable**: ‘B’ is displayed

(ii) The following example shows the display of information of the volume that has a specific special file name.

```
# iSMvollist -l /dev/rdsk/c1t2d0
LDN   LD NAME   VAA          TYPE
   Special File  Disk Array   Path
0001h disk001  30000000000000002040  NX
  /dev/rdsk/c1t2d0  NEC Storage 4100/07
  #
```
(iii) The following example shows the display that lists disk array information.

```
# iSMvollist -d
--- Disk Array List ---
Disk Array Name Number of Drives
NEC Storage 2000/13 12
NEC Storage 4100/07 64
NEC Storage 4100/10 128
```

Description
- Disk Array Name: Individual name of the disk array (Nickname)
- Number of Drives: Total number of logical disks that exist in each disk array.

Path (availability of the special file)
Depending on hardware, multiple connections (multiple controllers) to one logical disk are possible. If multiple connections are made available, even when a fault occurs in the primary path, it is possible to continue accessing a disk array by way of an alternate path.

If a replication operation command detects an I/O error in a specified volume (special file), it automatically switches the processing to another path that has been registered in the volume list and attempts to continue accessing the disk array. The “Path” field in the volume list indicates the state of the access path.

If the system detects an I/O error by accessing the volume, it displays ‘B’ in the “Path” field indicating that the access path cannot be used.

After the access path has been repaired, this field will be cleared when the path is accessed or the volume list is re-created.

[Execution conditions]
To create and display the volume list, the following conditions must be met:

(i) While the volume list is being created or updated, it is not possible to display the volume list or execute replication operation commands.

(ii) While the iSM Server is running on the same server, the volume list only can be displayed, but it cannot be created or updated. (UNIX system HP-UX version)

(iii) The iSM special file is not being created (UNIX system HP-UX version only).
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4.3.3 Screen Operations (Windows)

On the Windows system, the volume list creation and display function can be used via the GUI. The GUI functions include volume list display, selective display of disk arrays, creation and update of the volume list, volume list CSV output, re-obtaining volume list file information and Help function.

(1) Starting/Terminating Volume List Display

This section describes the procedures for starting and terminating the Volume List Display function.

Starting Volume List Display function

(i) Select [Start] of Windows → [Programs] → [NEC Storage Volume List] → [Volume List Display].

(ii) The Volume List Display screen appears.

Terminating the Volume List Display function

Select the following menu from the menu bar of the Volume List Display screen:
Select [Exit] in [File].
Alternatively, click the [close] button of the system menu.
Chapter 4 Functions of NEC Storage ReplicationControl

(2) Screen of Volume List Display

The following is the layout of the Volume List Display screen.

(i) Title bar
Displays the title of the Volume List Display function.

(ii) Menu bar
For details on each item of the menu bar, refer to (3) “Menu Item List”.

(iii) Toolbar Buttons

[Create/Update Volume List] Toolbar Button
Clicking this button has the same effect as selecting [Create/Update Volume List] from the menu.

[CSV Output of Information List] Toolbar Button
Clicking this button has the same effect as selecting [CSV Output of Information List] from the menu.

(iv) Disk Array Selection Combo box
Clicking the pull-down button displays the list of disk arrays currently registered in the Volume List file.

(v) Drive Letter/Path Name
Displays path information in the Volume List file.

(vi) Volume Name
Displays volume names in the Volume List file.
(vii) Disk No.
Displays physical disk numbers in the Volume List file.

(viii) LUN
Displays logical unit numbers in the Volume List file.

(ix) LDN
Displays logical disk numbers in the Volume List file.

(x) LD Name
Displays logical disk names in the Volume List file.

(xi) Disk Array
Displays disk array names in the Volume List file.

(3) Menu Item List
This section describes the items on the menu bar of the Volume List Display screen.

File

View

Help

List Display Screen Help
Displays information about the Volume List Display screen.

About
Displays information about the version.
(4) Volume List Display

Starting the Volume List Display function will list the information of all the volumes contained in the Volume List file.

Execution procedure

(i) Select [Start] of Windows → [Programs] → [NEC Storage Volume List] → [Volume List Display].

(ii) The Volume List Display screen appears.

(5) Selecting Disk Array Name

Click the pull-down button of disk array Selection Combo box on the screen of Volume List Display, and select the target disk array. The information of only the selected disk array is displayed.

Execution procedure

Select the target disk array from the disk array Selection Combo box on the screen of Volume List Display.
The information of the selected disk array is displayed.

(6) **Create/Update the Volume List**

To update the Volume List, select [File] and then select [Create/Update Volume List] on the Volume List Display screen.

**Execution procedure**

(i) Select [File] and then select [Create/Update Volume List] on the Volume List Display screen. The following inquiry message is displayed:

![Create/Update Volume List](image)

Figure 4-6  Execution Confirmation Screen for Create/Update Volume List


(iii) The following message appears when the Volume List has been created/updated successfully.

![Create/Update Volume List](image)

Figure 4-7  Confirmation Screen for Create/Update Volume List

(iv) Clicking the [OK] button returns to the Volume List Display screen.

(v) The Volume List Display screen is updated after the Volume List file has been created/updated.
(7) CSV Output of Information List

To output an information list as a CSV file, select [File] and then select [CSV Output of Information List] on the Volume List Display screen.

Execution procedure

Select [File] and then select [CSV Output of Information List] on the Volume List Display screen. The CSV Output of Information List screen appears.

Specify the save destination.

The default save destination is “InstallDir\etc”. It can be changed to another folder.

Specify the file name.

The default file name is “vollist”. It can be changed to another file name.

Click the [Save] button to save the input information.

Clicking the [Cancel] button cancels the operation.

When the file has been saved successfully, the following message appears:

Clicking the [OK] button returns to the Volume List Display screen.
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File example
The following example shows the CSV file that is output as the result of the CSV output of the information display list.
This file outputs information displayed on the screen by separating each piece of information by commas.

| Drive Letter/Path Name, Volume Name, Disk No., LUN, LDN, LD Name, Disk Array |
|---------------------------------|-----------------|-----------------|----------------|----------------|-----------------|
| D:, \??\Volume{e1fc27a8-e54e-11d5-b7d5-00004c0f5e8f}, disk5, 004h, 0304h, 200000004C010530304, Storage4100 |
| E:, \??\Volume{edf01536-26cd-11d6-ae08-00004c0f5e8f}, disk6, 005h, 0305h, 200000004C010530305, Storage4100 |
| F:, \??\Volume{eabf96fe-4642-11d6-8cad-806d6172696f}, disk7, 006h, 0306h, 200000004C010530306, Storage4100 |

(8) Updating Display Information
To update the information of the Volume List file, select [View] and then select [Update Display Information] on the Volume List Display screen.
The Volume List file contents are updated and the Volume List Display screen is redrawn.

(9) Recording Screen Information
The window size of the currently displayed Volume List Display screen, the column width of List View, and the screen position are automatically recorded when the Volume List Display function terminates.
The recorded information becomes valid when the function is started next time.
Replication operation commands provide a function to operate volumes by using disk array’s Data Replication function as well as a function to obtain and display a variety of information.

### 4.4 Replication Operations

Replication operation commands provide a function to operate volumes by using disk array’s Data Replication function as well as a function to obtain and display a variety of information.

#### 4.4.1 Replicate Command

For Replicate, the iSMrc_replicate command is used.

By executing the iSMrc_replicate command, copy from MV to the paired RV starts.

Before Replicate is performed, MV and RV to be specified must be paired beforehand. In addition, the MV must be registered in the volume list (created by iSMvollist).

If MV and RV are used as file systems, the mount of the file systems must be canceled.

For the iSMrc_replicate command, you can specify the following options regarding the Replicate operation.

1. **Specifying paired volumes**
   - Specify MV and RV volumes.
   - Specify MV (-mv volume -mvflg mv_flg) Specifies the volume and volume type of MV.
   - Specify RV (-rv volume -rvflg rv_flg) Specifies the volume and volume type of RV.
   
   For information on volume types, refer to 4.1 “Volume Types”.

   On the Windows system, when a specific partition (drive letter) is specified for a volume consisting of multiple partitions, all partitions in the volume become operation targets; therefore, the default setting does not allow the multiple partitions to be operated. To perform operations for a volume consisting of multiple partitions, you need to change the default setting. For information about the replication operation option setting file, refer to the “NEC Storage Manager Data Replication Command Reference”.

2. **Specifying the copy range (-cprange)**
   - By default, only the difference area (diff) of MV and RV is copied. You can also instruct to copy the entire area (full) explicitly.

3. **Specifying the Copy Control state (-cpmode)**
   - You can specify the Copy Control state during Replicate execution or in the Sync state. The following can be specified.

   - Sync Copy (-cpmode sync) Changes the Copy Control state to the Sync Copy mode.
   - Semi-Sync Copy (-cpmode semi) Changes the Copy Control state to the Semi-Sync Copy mode.

   This can be specified for pairs in different disk arrays.
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- Background Copy (-cpmode bg) Changes the Copy Control state to the Background Copy state.

(4) Specifying the access restrictions to RV (-rvacc)
You can specify the access restrictions to RV in Replicate Execution or when Replicate is complete.

- Not Ready (-rvacc nr) Switches to the Not Ready state. Operations cannot be performed from the system.
- Read Only (-rvacc ro) Only Read from the system can be performed. Pay careful attention when you specify Ready Only (-rvacc ro) for the RV access restrictions. For details, refer to 2.6 “RV Access Restriction”.

(5) Specifying the wait for Copy completion (-wait/nowait)
The system can wait for the completion of the command after Replicate has been performed until the Sync state starts.

- Wait Specified (-wait [second]) If a value is specified in second, the monitoring time interval of the disk array becomes the specified value. The available range is from 1 through 30 seconds (integer). If the value is omitted, it is set to 5 seconds.
- No Wait (-nowait) Performs only a Replicate start instruction and terminates the command. You can check the termination of the command by the iSMrc_query or iSMrc_wait command.

The iSMrc_replicate command displays messages when Replicate starts, during execution, and when Replicate ends.

On the Windows system

[Start message]
Replicate Start YYYY/MM/DD hh:mm:ss
MV:disk_number ld_name type
volume name path
RV:disk_number ld_name type
volume name path

[Execution message]
Replicating.....
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[End message]

Replicate Normal End  YYYY/MM/DD hh:mm:ss
MV: disk_number  ld_name  type
  volume name
  path
RV: disk_number  ld_name  type
  volume name
  path

Description of Message
The execution message and the end message appear only when -wait has been specified to wait for
the Replication completion state.
If you don’t want the execution message to appear, change the RPL_WAITMSG setting in the
replication operation option setting file. For information about the replication operation option
setting file, refer to the “NEC Storage Manager Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss  Start/End time (Year Month Day Hour Minute Second)
disk_number  Physical disk number
ld_name  Logical disk name
type  OS type
volume name  Mount point volume name
path  Drive letter or path name mounted in the NTFS volume folder
accessed by users
Replicating...  The “.” character is dynamically updated until Replicate is
completed.

On the UNIX system
[Start message]

Replicate Start  YYYY/MM/DD hh:mm:ss
MV: special_file_name  ld_name  type
RV: special_file_name  ld_name  type

[Execution message]

Replicating....

[End message]

Replicate Normal End  YYYY/MM/DD hh:mm:ss
MV: special_file_name  ld_name  type
RV: special_file_name  ld_name  type
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Description of Message
The execution message and the end message appear only when -wait has been specified to wait for the Copy completion state.

If you don’t want the execution message to appear, change the setting of the RPL_WAITMSG environment variable. For information about environment variables, refer to the “NEC Storage Manager Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss   Start/End time (Year Month Day Hour Minute Second)
special_file_name   Special file name
ld_name   Logical disk name
type   OS type
Replicating...   The “.” character is dynamically updated until Replicate is completed.

Figure 4-10 illustrates the execution conditions of Replicate.

Figure 4-10  Execution Conditions of Replicate

[Execution conditions]
To perform Replicate, the following conditions must be satisfied.

(1)  The target MV and RV have been paired.
(2)  MV is in a disk array under control of its own system.
(3)  The target MV has been registered in the volume list.
(4)  The volume list is not being created or updated.
(5)  RV has been unmounted.
(6)  The disk array that stores the specified MV and RV is not in the Freeze state.
(7)  Separated
(8)  Not in the Restore state
(9)  Separated
(10) Separated
(11) Semi Synchronous Copy cannot be performed on the same disk array.
(7) The Activity State of the target pair is Separate.
(8) The pair of the specified MV and the paired RV is not in the Restore state.
(9) The Activity State of the pair of the specified MV and the paired upper MV is Separate.
(10) The Activity State of the pair of the specified RV and the paired lower RV is Separate.
(11) The Semi-Sync Copy mode cannot be specified for paired volumes set in the same disk array.
    The Semi-Sync copy mode can be specified only for paired volumes set in different disk arrays.
(12) Specifying a volume of a dynamic disk is not allowed (Windows only).
(13) The iSM dedicated special file is not being created (HP-UX version UNIX only).
(14) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk
    group must be active (UNIX only).
(15) When specifying the combination of an LVM volume group or a VxVM disk group with a special
    file name (logical disk name), you must specify the same number of logical volumes that make up
    the volume group or disk group as MV (RV) on the special file name (logical disk name) side.
    In this case, Replication is performed in specified sequential order (UNIX only).

The above execution conditions (2), (3), (4), (12), (13), (14) and (15) are applicable only when joint
operation with the replication management is not performed (the I/O issuance to disk arrays is directly
controlled via the FC).
4.4.2 Separate Command

For Separate, the iSMrc_separate command is used.

The iSMrc_separate command separates RV from MV and makes RV available from the system.

For iSMrc_separate command, you can specify the following options regarding the Separate operation.

1. Specifying paired volumes
   - Specify MV and RV volumes.
     - Specify MV (-mv volume -mvflg mv_flg) Specifies the volume and volume type of MV.
     - Specify RV (-rv volume -rvflg rv_flg) Specifies the volume and volume type of RV.

   For information about volume types, refer to 4.1 “Volume Types”.

   On the Windows system, when a specific partition (drive letter) is specified for a volume consisting of multiple partitions, all partitions in the volume become operation targets; therefore, the default setting does not allow the multiple partitions to be operated. To perform operations for a volume consisting of multiple partitions, you need to change the default setting. For information about the replication operation option setting file, refer to the “NEC Storage Manager Data Replication Command Reference”.

2. Specifying the access restrictions to RV after Separate(-rvacc)
   - You can specify the access restrictions to RV after Separate.
     - Read/Write (-rvacc rw) Reference and update can be performed for RV.
     - Read Only (-rvacc ro) Only reference can be performed for RV. Pay careful attention when you specify Ready Only (-rvacc ro) for the RV access restrictions. For details, refer to 2.6 “RV Access Restriction”.

3. Specifying the wait for Separate completion(-wait /-nowait)
   - The system can wait for the completion of the command after Separate until Separate is complete.
     - If a value is specified in second, the monitoring time interval of the disk array becomes the specified value. The available range is from 1 through 30 seconds (integer). If the value is omitted, it is set to 5 seconds.
     - Performs only a Separate start instruction and terminates the command. You can check the termination of the command by the iSMrc_query or iSMrc_wait command.

4. Forced Separate (-force)
   - If a fault occurs in the connection between disk arrays and the normal Separate cannot be performed for MV and RV, you can specify the -force option to instruct Separate to MV and RV separately.
   - You can specify one of the following as a Forced Separate target.
- Performing Forced Separate for both MV and RV (-force all)
- Performing Forced Separate only for MV (-force mv)
- Performing Forced Separate only for RV (-force rv)

When performing Forced Separate, note the following:

- If MV and RV are in the same system, the “all” is normally specified.
- Forced Separate by specifying MV or RV is used when MV and RV are in the different systems.
- When Forced Separate is performed by specifying MV (or RV), after the problem has been solved, Forced Separate must be performed by specifying RV (or MV) in the other system.
- If Forced Unpair is performed for either MV or RV, subsequent replication operations will not function properly because inconsistency occurs in the recognized states of MV and RV.
- You cannot perform Forced Separate for RV which is not recognized by the business server.

(5) RV use start time (-rvuse)

You can select one of the following as the time for making the RV available:

- Immediately after Separate execution (-rvuse immediate): After Separate execution, the RV is immediately made available while the difference between the MV and RV contents is being reflected into the RV.
- After completion of Separate (-rvuse complete): After Separate execution, the RV is made available when the difference between the MV and RV contents has been reflected into the RV.
- According to the default setting (-rvuse default): On the Windows system, the system follows the RVUSE specification in the replication operation option setting file. On the UNIX system, the system follows the setting of the RPL_SEP_RVUSE environment variable. For details of each setting, refer to the “NEC Storage Manager Data Replication Command Reference”.

The iSMrc_separate command displays messages when Separate starts, during execution, and when Separate ends.

**On the Windows system**

<table>
<thead>
<tr>
<th>Separate Start</th>
<th>YYYY/MM/DD hh:mm:ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV: disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume name</td>
<td>path</td>
</tr>
<tr>
<td>RV: disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume name</td>
<td>path</td>
</tr>
</tbody>
</table>
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[Execution message]
Separating...

[End message]

Separating Normal End YYYY/MM/DD hh:mm:ss
MV:disk_number ld_name type
volume name path
RV:disk_number ld_name type
volume name path

Description of Message
The execution message and the end message appear only when -wait has been specified to wait for the Separated state.
If you don’t want the execution message to appear, change the RPL_WAITMSG setting in the replication operation option setting file. Information about the replication operation option setting file, refer to the “NEC Storage Manager Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss Start/End time (Year Month Day Hour Minute Second)
disk_number Physical disk number
ld_name Logical disk name
type OS type
volume name Mount point volume name
path Drive letter or path name mounted on the NTFS volume folder accessed by users
Separating... The “.” character is dynamically updated until Separate is completed.

On the UNIX system
[Start message]
Separate Start YYYY/MM/DD hh:mm:ss
MV:special_file_name ld_name type
RV:special_file_name ld_name type

[Execution message]
Separating...

[End message]
Separate Normal End  YYYY/MM/DD hh:mm:ss
  MV:special_file_name  ld_name  type
  RV:special_file_name  ld_name  type

Description of Message

The execution message and the end message appear only when -wait has been specified to wait for the Separated state.

If you don’t want the execution message to appear, specify the RPL_WAITMSG environment variable. For information about environment variables, refer to the “NEC Storage Manager Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss  Start/End time (Year Month Day  Hour Minute Second)
special_file_name  Special file name
ld_name  Logical disk name
type  OS type
Separating...  The “.” character is dynamically updated until Separate is completed.

Figure 4-11 illustrates the execution conditions of Separate.

(1) Pair setting
(2) MV is in a disk array under control of its own system.
(3) MV has been registered in the volume list.
(4) The volume list is not being created or updated.
(5) MV has been flushed or unmounted.
(6) Disk array is not in the Freeze state.
(7) Not in the Restore state
(8) In the Foreground Copy state.

Figure 4-11  Execution Conditions of Separate

[Execution conditions]
To perform Separate, the following conditions must be satisfied.

(1) The target MV and RV are paired.
(2) MV is in a disk array under control of its own system.
(3) The target MV has been registered in the volume list.
(4) The volume list is not being created or updated.
(5) When starting Separate, the file system cache used for MV until the instruction is executed must be flushed or placed in unmount state to complete updating to MV.
(6) The disk array where the specified MV and RV are stored is not in the Freeze state.
(7) The Activity State of the target pair is not Restore Execution.
(8) The Copy Control state of the target pair is the Foreground Copy state. To separate paired volumes in the Background Copy state, you must perform Resume Copy and then change it to the Foreground Copy state.

(9) Specifying a volume of a dynamic disk is not allowed (Windows only).

(10) The iSM dedicated special file is not being created (HP-UX version UNIX only).

(11) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).

(12) When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side. In this case, Copy is performed in specified sequential order (UNIX only).

The above execution conditions (2), (3), (4), (9), (10), (11) and (12) are applicable only when joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC).
4.4.3 Restore Command

For Restore, the iSMrc_restore command is used. By executing the iSMrc_restore command, copy from RV to the paired MV starts. Before Restore is performed, MV and RV to be specified must be paired beforehand. In addition, MV and RV to be specified must be registered in the volume list (created by iSMvollist) beforehand. If RV is used as a file system, the mount of the file system must be canceled before Restore is started.

When joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC), on the Windows system, unmount the MV and flush the buffer of the file system before starting Restore. Then, mount the MV again after starting Restore. On the UNIX system, if an MV’s file system is mounted, Restore does not start resulting in an abnormal end. Therefore, before executing Restore, you must unmount the MV’s file system.

For the iSMrc_restore command, you can specify the following options regarding the Restore operation.

1) Specifying paired volumes
   Specify MV and RV volumes.
   - Specify MV (-mv volume -mvflg mv_flg) Specifies the volume and volume type of MV.
   - Specify RV (-rv volume -rvflg rv_flg) Specifies the volume and volume type of RV.
   For information about volume types, refer to 4.1 “Volume Types”.

   On the Windows system, when a specific partition (drive letter) is specified for a volume consisting of multiple partitions, all partitions in the volume become operation targets; therefore, the default setting does not allow the multiple partitions to be operated. To perform operations for a volume consisting of multiple partitions, you need to change the default setting. For information about the replication operation option setting file, refer to the “NEC Storage Manager Data Replication Command Reference”.

2) Specifying the copy range (-cprange)
   Normally, only the difference area (diff) of MV and RV is copied. You can also instruct to copy the entire area (full) explicitly.

3) Specifying the Copy Control state (-cpmode)
   You can specify the Copy Control state in Restore Execution and the Sync state.
   - Sync Copy (-cpmode sync) Changes the Copy Control state to the Sync Copy mode.
   - Semi-Sync Copy (-cpmode semi) Changes the Copy Control state to the Semi-Sync Copy mode. This can be specified for paired volumes in different disk arrays.
   - Background Copy (-cpmode bg) Changes the Copy Control state to the Background Copy state.
(4) Specifying the access restrictions for RV (-rvacc)
You can specify the access restrictions for RV in Restore Execution or when Restore is complete.

- Not Ready (-rvacc nr)  Switches to the Not Ready state. Operations cannot be performed for the volume from the system.
- Read Only (-rvacc ro)  For the volume, only Read from the system can be performed. Pay careful attention when you specify Ready Only (-rvacc ro) for the RV access restrictions. For details, refer to 2.6 “RV Access Restriction”.

(5) Specifying the wait for copy completion (-wait/nowait)
The system can wait for completion of the command after Restore until the Sync state.

- Wait Specified (-wait [second])  If a value is specified in second, the monitoring time interval of the disk array becomes the specified value. The available range is from 1 through 30 seconds (integer). If the value is omitted, it is set to 5 seconds.
- No Wait (-nowait)  Performs only a Restore start instruction and terminates the command. You can check the termination of Restore by the iSMrc_query or iSMrc_wait command.

(6) Specifying an operation mode for RV (-mode)
You can select whether to reflect the updated data of the MV into the RV while performing Restore.

- RV update specified (-mode update)  Performs Restore while reflecting the updated data of the MV into the RV. When Restore is completed and the Sync State is placed, the state changes to Sync State (rst/sync).
- RV protection specified (-mode protect)  Performs Restore without reflecting the updated data of the MV into the RV. When Restore is completed and the Sync State is placed, Separate is automatically executed and then the state changes to Separated State.
- According to the default setting (-mode default)  On the Windows system, the system follows the MODE specification in the replication operation option setting file. On the UNIX system, the system follows the setting of the RPL_SEP_MODE environment variable. For details of each setting, refer to the “NEC Storage Manager Data Replication Command Reference”.

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The iSMrc_restore command displays messages when Restore starts, during execution, and when Restore ends.

**On the Windows system**

[Start message]

```
iSM13224: MV is restored.
Volume name: volume name
Mount Point: path
Umount Start  YYYY/MM/DD hh:mm:ss
Umount Normal End  YYYY/MM/DD hh:mm:ss
Restore Start  YYYY/MM/DD hh:mm:ss
MV:disk_number ld_name  type
volume name
path
RV:disk_number ld_name  type
volume name
path
```

[Execution message]

```
Restoring...
```

[End message]

```
Restore Normal End  YYYY/MM/DD hh:mm:ss
MV:disk_number ld_name  type
volume name
path
RV:disk_number ld_name  type
volume name
path
```

**Description of Message**

The execution message and the end message appear only when -wait has been specified to wait for the Sync State(rst/sync).

If you don’t want the execution message to appear, change the RPL_WAITMSG setting in the replication operation option setting file. For information about the replication operation option setting file, refer to the “NEC Storage Manager Data Replication Command Reference”.

```
YYYY/MM/DD hh:mm:ss  Start/End time (Year Month Day  Hour Minute Second)
disk_number  Physical disk number
ld_name  Logical disk name
```
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<table>
<thead>
<tr>
<th>type</th>
<th>OS type</th>
</tr>
</thead>
<tbody>
<tr>
<td>volume name</td>
<td>Mount point volume name</td>
</tr>
<tr>
<td>path</td>
<td>Drive letter or path name mounted on the NTFS volume folder accessed by users</td>
</tr>
<tr>
<td>Restoring...</td>
<td>The “.” character is dynamically updated until Restore is completed</td>
</tr>
</tbody>
</table>

On the UNIX system

[Start message]

- **Restore Start**: YYYY/MM/DD hh:mm:ss
  - MV:special_file_name  ld_name  type
  - RV:special_file_name  ld_name  type

[Execution message]

- **Restoring...**

[End message]

- **Restore Normal End**: YYYY/MM/DD hh:mm:ss
  - MV:special_file_name  ld_name  type
  - RV:special_file_name  ld_name  type

Description of Message

The execution message and the end message appear only when -wait has been specified to wait for the Sync State(rpl/sync).

If you don’t want the execution message to appear, change the setting of the RPL_WAITMSG environment variable. For information about environment variables, refer to the “NEC Storage Manager Data Replication Command Reference”.

- **YYYY/MM/DD hh:mm:ss Start/End time**: (Year Month Day Hour Minute Second)
- **special_file_name**: Special file name
- **ld_name**: Logical disk name
- **type**: OS type
- **Restoring...**: The “.” character is dynamically updated until Restore is completed.

Figure 4-12 illustrates the execution conditions of Restore.
[Execution conditions]
To perform Restore, the following conditions must be satisfied.

(1) The target MV and RV are paired.
(2) MV is in a disk array under control of its own system.
(3) The target MV has been registered in the volume list.
(4) The volume list is not being created or updated.
(5) Both MV and RV have been unmounted.
(6) Disk array is not in the Freeze state.
(7) Separated
(8) The pair of the specified MV and the paired RV is not in the Separate state.
(9) The Activity State of the pair of the specified MV and the paired upper MV is Separate.
(10) The Activity State of the pair of the specified RV and the paired lower RV is Separate.
(11) The Semi-Sync Copy mode cannot be specified for paired volumes set in the same disk array.

The Semi-Sync Copy mode can be specified only for paired volumes set in different disk arrays.

(12) Specifying volume of a dynamic disk is not allowed (Windows only).
(13) The iSM dedicated special file is not being created (HP-UX version UNIX only).
(14) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
(15) When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side.

In this case, Restoration is performed in specified sequential order (UNIX only).
The above execution conditions (2), (3), (4), (12), (13), (14) and (15) are applicable only when joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC).
4.4.4 Copy Control State Change Command

For changing the Copy Control state, the iSMrc_change command is used. You can use option specification of the iSMrc_change command to perform the Copy Control state change in the Replicate or Restore state. Before the Copy Control state is changed, MV and RV to be specified must be paired beforehand. In addition, MV and RV to be specified must be registered in the volume list (created by iSMvollist).

When Restore with RV protection specified is executed, the updated data of the MV is not reflected into the RV. Therefore, changing a Copy Control state (synchronous copy mode, semi synchronous copy mode, or background copy) is meaningless.

For iSMrc_change command, you can specify the following options for changing the Copy Control state.

1) Specifying paired volumes
   Specify MV and RV volumes.
   - Specify MV (-mv volume -mvflg mv_flg) Specifies the volume and volume type of MV.
   - Specify RV (-rv volume -rvflg rv_flg) Specifies the volume and volume type of RV.

   For information about volume types, refer to 4.1 “Volume Types”.

2) Copy Control State
   The following Copy Control State can be specified.
   - Sync Copy (-sync) Changes the Copy Control state to the Sync Copy mode.
   - Semi-Sync Copy (-semi) Changes the Copy Control state to the Semi-Sync Copy mode.
     This can be specified for paired volumes in different disk arrays.
   - Background Copy (-bg) Changes the Copy Control state to the Background Copy state.
   - Suspend (-suspend) Changes the Copy Control state to the Suspend state.
   - Resume (-resume) Changes the Copy Control state to the Foreground Copy state.

   The following table shows the Copy Control state before and after the change is made.

   Table 4-3 Relations of Copy Control State

<table>
<thead>
<tr>
<th>State before change</th>
<th>Change option</th>
<th>sync (synchronization)</th>
<th>semi (semi-synchronization)</th>
<th>bg (background)</th>
<th>suspend (suspend)</th>
<th>resume (resume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>sync (synchronization)</td>
<td>×</td>
<td>×</td>
<td>○</td>
<td>○</td>
<td>Δ</td>
<td></td>
</tr>
<tr>
<td>semi (semi-synchronization)</td>
<td>×</td>
<td>×</td>
<td>○</td>
<td>○</td>
<td>Δ</td>
<td></td>
</tr>
<tr>
<td>bg (background)</td>
<td>○</td>
<td>○</td>
<td>Δ</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>suspend (suspend)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>Δ</td>
<td>○</td>
<td></td>
</tr>
</tbody>
</table>

   O: The state can be changed.
   Δ: The state can be changed, but the Copy Control state cannot be changed.
The state cannot be changed.

The `iSMrc_change` command displays the following message when the Change Copy Control State starts and ends.

### On the Windows system

**[Start message]**

<table>
<thead>
<tr>
<th>Change Start</th>
<th>YYYY/MM/DD hh:mm:ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV:disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume name</td>
<td>path</td>
</tr>
<tr>
<td>RV:disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume name</td>
<td>path</td>
</tr>
</tbody>
</table>

**[End message]**

<table>
<thead>
<tr>
<th>Change Normal End</th>
<th>YYYY/MM/DD hh:mm:ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV:disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume name</td>
<td>path</td>
</tr>
<tr>
<td>RV:disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume name</td>
<td>path</td>
</tr>
</tbody>
</table>

**Description of Message**

- **YYYY/MM/DD hh:mm:ss**: Start/End time (Year Month Day Hour Minute Second)
- **disk_number**: Physical disk number
- **ld_name**: Logical disk name
- **type**: OS type
- **volume name**: Mount point volume name
- **path**: Drive letter or path name mounted on the NTFS volume folder accessed by users

### On the UNIX system

**[Start message]**

<table>
<thead>
<tr>
<th>Change Start</th>
<th>YYYY/MM/DD hh:mm:ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV:special_file_name</td>
<td>ld_name</td>
</tr>
<tr>
<td>RV:special_file_name</td>
<td>ld_name</td>
</tr>
</tbody>
</table>

**[End message]**

<table>
<thead>
<tr>
<th>Change Normal End</th>
<th>YYYY/MM/DD hh:mm:ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV:special_file_name</td>
<td>ld_name</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>RV: special_file_name</th>
<th>ld_name</th>
<th>type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of Message</td>
<td>Start/End time (Year Month Day Hour Minute Second)</td>
<td>Special file name</td>
</tr>
<tr>
<td>YYYY/MM/DD hh:mm:ss</td>
<td>special_file_name</td>
<td>Logical disk name</td>
</tr>
<tr>
<td>ld_name</td>
<td>type</td>
<td>OS type</td>
</tr>
</tbody>
</table>

Figure 4-13 illustrates the execution conditions of operations regarding the Copy Control state.

[Execution conditions]
To perform operations regarding the Copy Control state, the following conditions must be satisfied.

1. Pair setting
2. MV is in a disk array under control of its own system.
3. MV has been registered in the volume list.
4. The volume list is not being created or updated.
5. Disk array is not in the Freeze state.
6. In the Replicate or Restore state
7. Semi-Synchronous Copy cannot be performed in the same disk array.
8. Synchronous Copy cannot be changed to Semi Synchronous Copy, or Semi Synchronous Copy cannot be changed to Synchronous Copy.

Figure 4-13  Execution Conditions of Copy Control State Operation

(1) Pair setting
(2) MV is in a disk array under control of its own system.
(3) MV has been registered in the volume list.
(4) The volume list is not being created or updated
(5) Disk array is not in the Freeze state.
(6) In the Replicate or Restore state
(7) Semi Synchronous Copy cannot be performed in the same disk array.
(8) Synchronous Copy cannot be changed to Semi Synchronous Copy, or Semi Synchronous Copy cannot be changed to Synchronous Copy.

[Execution conditions]
To perform operations regarding the Copy Control state, the following conditions must be satisfied.

1. The target MV and RV are paired.
2. The target MV is in a disk array under control of its own system.
3. The target MV has been registered in the volume list.
4. The volume list is not being created or updated.
5. The disk array where the specified MV and RV are stored is not in the Freeze state.
6. The Activity State of the target pair is Replicate or Restore.
7. The Semi-Sync copy mode cannot be specified for paired volumes set in the same disk array.
   The Semi-Sync copy mode can be specified only for paired volumes set in different disk arrays.
8. Changing from Sync Copy to Semi-Sync Copy mode or from Semi-Sync Copy to Sync Copy mode is disabled.
9. Specifying volume of a dynamic disk is not allowed (Windows only).
10. The isM dedicated special file is not being created (HP-UX version UNIX only).
11. When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
12. When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side.
   In this case, Copy is performed in specified sequential order (UNIX only).
The above execution conditions (2), (3), (4), (9), (10), (11) and (12) are applicable only when joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC).
4.4.5 Wait Command

Use the iSMrc_wait command to wait for state Sync State (rpl/sync), Sync State (rst/sync), or Separated State.

A pair of MV and RV must be specified as the target volumes beforehand. The MV and RV to be specified must be registered in the Volume List (created by the iSMvollist).

The iSMrc_wait command enables the specification of the following options for wait operation:

1) Specifying paired volumes
   Specify MV and RV volumes.
   - Specify MV (-mv volume -mvflg mv_flg) Specifies the volume and volume type of MV.
   - Specify RV (-rv volume -rvflg rv_flg) Specifies the volume and volume type of RV.
   For information about volume types, refer to 4.1 “Volume Types”.

   The target volumes (MV and/or RV) can be specified in any of the combinations below.
   - MV and RV: Waits for a specified pair of volumes to enter a target state.
   - MV only: Waits for all the pairs set with MV to enter a target state.
   - RV only: Same operation as when MV and RV are specified

2) Wait end condition (-cond)
   You can specify a condition for ending Wait. This option must be specified.
   - Completion of synchronous copy (-cond sync): Waits for Sync State (rpl/sync) or Sync State (rst/sync).
   - Completion of separation (-cond sep): Waits for Separated State.

3) Paired-volume state monitoring interval (-interval [second])
   You can specify a time interval (in seconds) at which the state of paired volumes is to be monitored.
   A value (in seconds) specified for [second] is the monitoring time interval. A value 1 to 30 seconds (integer) can be specified.
   On the Windows system, the default value can be specified by using RPL_WATCHDEV in the replication operation option setting file. On the UNIX system, the default value can be specified by using the RPL_WATCHDEV environment variable. For details of each setting, refer to the “NEC Storage Manager Data Replication Command Reference”.
(4) Paired-volume state monitoring time limit (-limit)

You can specify a time limit for stopping the monitoring of the paired-volume state. If the Wait is not completed before the elapse of the specified time, it is discontinued and the command ends abnormally.

- Time specification (-limit [second]): A value (in seconds) specified for [second] is the monitoring time limit. A value from 0 to 86,400 seconds (integer) can be specified.

- No limit (-limit nolim): Unlimited wait.

On the Windows system, the default value can be specified by using RPL_ENDWATCHDEV in the replication operation option setting file. On the UNIX system, the default value can be specified by using the RPL_ENDWATCHDEV environment variable. For details of each setting, refer to the “NEC Storage Manager Data Replication Command Reference”.

The isMrc_wait command displays the following message during Wait execution and when Wait ends.

On the Windows system

[Execution message]

Waiting...

[End message]

```
activity_state Normal End YYYY/MM/DD hh:mm:ss
MV:disk_number ld_name type
  volume name
  path
RV:disk_number ld_name type
  volume name
  path
```

Description of Message

If you don’t want the execution message to appear, change the RPL_WAITMSG setting in the replication operation option setting file. Information about the replication operation option setting file, refer to the “NEC Storage Manager Data Replication Command Reference”.

```
activity_state: Activity State of the paired volumes for which the wait command is completed
  Replicate : Sync State (rpl/sync)
  Restore   : Sync State (rst/sync) or rst/sync (protect)
  Separate  : Separated
YYYY/MM/DD hh:mm:ss Start/End time (Year Month Day Hour Minute Second)
```
disk_number Physical disk number
ld_name Logical disk name
type OS type
volume name Mount point volume name
path Drive letter or path name mounted on the NTFS volume folder accessed by users
Waiting... The “.” character is dynamically updated until Wait is completed.

On the UNIX system
[Execution message]
Waiting...

[End message]
activity_state Normal End YYYY/MM/DD hh:mm:ss
MV:disk_number ld_name type
RV:disk_number ld_name type

Description of Message
If you don’t want the execution message to appear, change the setting of the RPL_WAITMSG environment variable. For information about environment variables, refer to the “NEC Storage Manager Data Replication Command Reference”.
activity_state Activity State of the paired volumes for which the wait command is completed
Replicate : Sync State (rpl/sync)
Restore : Sync State (rst/sync) or rst/sync (protect)
Separate : Separated
YYYY/MM/DD hh:mm:ss Start/End time (Year Month Day Hour Minute Second)
special_file_name Special file name
ld_name Logical disk name
type OS type
Waiting... The “.” character is dynamically updated until Wait is completed.

Figure 4-14 shows the Wait execution conditions.
[Execution conditions]
The following conditions must be satisfied for executing the wait command:

1. The target MV and RV are paired.
2. The target MV or RV is in the disk array under control of its own system.
3. The target MV or RV has been registered in the volume list.
4. The volume list is not being created or updated.
5. The disk array where the specified MV and RV are stored is not in the Freeze state.
6. Specifying volume of a dynamic disk is not allowed (Windows only).
7. The iSM dedicated special file is not being created (HP-UX version UNIX only).
8. When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
9. When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side.

In this case, Copy is performed in specified sequential order (UNIX only).

The above execution conditions (2), (3), (4), (6), (7), (8) and (9) are applicable only when joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC).
4.4.6 Replication State Display Command

To display the replication state, the iSMrc_query command is used.

In the target volume, MV and RV to be specified must be paired beforehand. In addition, MV and RV to be specified must be registered in the volume list (created by iSMvollist).

The iSMrc_query command enables the specification of the following options:

1. Specifying paired volumes
   - Specify MV and RV volumes.
   - Specify MV (-mv volume -mvflg mv_flg) Specifies the volume and volume type of MV.
   - Specify RV (-rv volume -rvflg rv_flg) Specifies the volume and volume type of RV.

   For information about volume types, refer to 4.1 “Volume Types”.

The target volumes (MV and/or RV) can be specified in any of the combinations below.

- MV and RV: Waits for a specified pair of volumes to enter a target state.
- MV only: Waits for all the pairs set with MV to enter a target state.
- RV only: Same operation as when MV and RV are specified.

The iSMrc_query command displays the following information.

**On the Windows system**

<table>
<thead>
<tr>
<th>Displayed information</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV: Disk No.</td>
</tr>
<tr>
<td>LD Name</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Volume Name</td>
</tr>
<tr>
<td>Path</td>
</tr>
<tr>
<td>RV: Disk No.</td>
</tr>
<tr>
<td>LD Name</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Volume Name</td>
</tr>
<tr>
<td>Path</td>
</tr>
<tr>
<td>Activity State</td>
</tr>
<tr>
<td>Sync State</td>
</tr>
<tr>
<td>Copy Control State</td>
</tr>
<tr>
<td>&lt;state&gt; Start Time</td>
</tr>
<tr>
<td>&lt;state&gt; End Time</td>
</tr>
<tr>
<td>Separate Diff</td>
</tr>
<tr>
<td>Copy Diff</td>
</tr>
<tr>
<td>RV Access</td>
</tr>
<tr>
<td>Previous Active</td>
</tr>
</tbody>
</table>
### Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk_number</td>
<td>Physical disk number</td>
</tr>
<tr>
<td>ld_name</td>
<td>Logical disk name</td>
</tr>
<tr>
<td>type</td>
<td>OS type</td>
</tr>
<tr>
<td>volume name</td>
<td>Mount point volume name</td>
</tr>
<tr>
<td>path</td>
<td>Drive letter or path name mounted in the NTFS folder</td>
</tr>
<tr>
<td>activity</td>
<td>Activity State</td>
</tr>
<tr>
<td>sync</td>
<td>Paired operation state</td>
</tr>
<tr>
<td>copy</td>
<td>Copy Control State</td>
</tr>
<tr>
<td>&lt;state&gt; Start Time</td>
<td>Operation start time (&lt;state&gt; varies)</td>
</tr>
<tr>
<td>&lt;state&gt; End Time</td>
<td>Operation end time (&lt;state&gt; varies)</td>
</tr>
<tr>
<td>separate_diffsize</td>
<td>Difference of copy occurred in the Separate state</td>
</tr>
<tr>
<td>copy_diffsize</td>
<td>Difference of copy occurred in the Replicate or Restore state</td>
</tr>
<tr>
<td>rvacc</td>
<td>Access restrictions for RV</td>
</tr>
<tr>
<td>prev_state</td>
<td>Paired operation state before the state transition</td>
</tr>
</tbody>
</table>

### On the UNIX system

[Displayed information]

- MV: Special File: `special_file_name`
- LD Name: `ld_name`
- Type: `type`
- RV: Special File: `special_file_name`
- LD Name: `ld_name`
- Type: `type`
- Activity State: `activity`
- Sync State: `sync`
- Copy Control State: `copy`
- <state> Start Time: `YYYY/MM/DD hh:mm:ss`
- <state> End Time: `YYYY/MM/DD hh:mm:ss`
- Separate Diff: `separate_diffsize`
- Copy Diff: `copy_diffsize`
- RV Access: `rvacc`
- Previous Active: `prev_state`

### Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>special_file_name</td>
<td>Special file name</td>
</tr>
<tr>
<td>ld_name</td>
<td>Logical disk name</td>
</tr>
<tr>
<td>type</td>
<td>OS type</td>
</tr>
<tr>
<td>activity</td>
<td>Activity State</td>
</tr>
<tr>
<td>sync</td>
<td>Paired operation state</td>
</tr>
<tr>
<td>copy</td>
<td>Copy Control State</td>
</tr>
</tbody>
</table>
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- `<state>` Start Time  Operation start time (`<state>` varies)
- `<state>` End Time  Operation end time (`<state>` varies)
- separate_diffsize  Difference of copy occurred in the Separate state
- copy_diffsize  Difference of copy occurred in the Replicate or Restore state
- rvacc  Access restrictions for RV
- prev_state  Paired operation state before the state transition

Figure 4-15 shows execution conditions for displaying the replication state.

![Target pair](image)

### Target pair

1. Pair setting
2. MV or RV is in a disk array under control of its own system.
3. MV or RV has been registered in the volume list.
4. The volume list is not being created or updated.

Figure 4-15  Displaying Replication State

[Execution conditions]

To perform state display, the following conditions must be satisfied.

1. The target MV and RV are paired.
2. The target MV or RV has been registered in the volume list.
3. The target MV or RV has been registered in the volume list.
4. The volume list is not being created or updated.
5. Specifying volume of a dynamic disk is not allowed (Windows only).
6. The isM dedicated special file is not being created (HP-UX version UNIX only).
7. When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
8. When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side. In this case, Copy is performed in specified sequential order (UNIX only).

The above execution conditions except for (1) are applicable only when joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC).
4.4.7 Specific Volume Name Display Command

To carry out a specific volume name display, the iSMrc_sense command is used.
The volume to be specified must be registered in the volume list (created by iSMvollist).

The iSMrc_sense command enables the specification of the following options:
(1) Specifying volumes
   Specify the target volume.
   • Specify volumes (-vol volume -volflg mv_flg) Specifies the volume and volume type.
      For information about volume types, refer to 4.1 “Volume Types”.

The iSMrc_sense command displays the following information:

On the Windows system
[Displayed information]
| Disk No. | disk_number |
| LD Name  | ld_name     |
| VAA      | vaa         |
| Type     | type        |
| Volume Name | volume name |
| Path     | path        |

Description
| disk_number | Physical disk number |
| ld_name     | Logical disk name   |
| vaa         | VAA (Volume Absolute Address) |
| type        | OS type             |
| volume name | Mount point volume name |
| path        | Drive letter or path name mounted on the NTFS volume folder accessed by users |

On the UNIX system
[Displayed information]
| Special file  | LD Name | VAA     |
| Type           |         |         |
| special_file_name | ld_name | vaa     |
| type           |         |         |
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Description

<table>
<thead>
<tr>
<th>special_file_name</th>
<th>Special file name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ld_name</td>
<td>Logical disk name</td>
</tr>
<tr>
<td>vaa</td>
<td>VAA (Volume Absolute Address)</td>
</tr>
<tr>
<td>type</td>
<td>OS type</td>
</tr>
</tbody>
</table>

Figure 4-16 shows execution conditions for displaying a specific volume name.

![Diagram showing execution conditions](image)

Figure 4-16 Displaying Specific Volume Name

[Execution conditions]

1. The target volume is in the disk array under control of its own system.
2. The target volume has been registered in the volume list.
3. The volume list is not being created or updated.
4. Specifying volume of a dynamic disk is not allowed (Windows only).
5. The iSM dedicated special file is not being created (HP-UX version UNIX only).
6. When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).

The above execution conditions are applicable only when joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC).
4.5 Pair Setting and Unpair Operations

Pair operation commands make functions available for listing logical disks, pair setting and unpairing. In the data replication batch job operation, pair operation enables RVs to be dynamically changed or switched.

4.5.1 Logical Disk Information Display Command

To perform logical disk information display, the iSMrc_ldlist command is used. The iSMrc_ldlist command targets disk arrays that are recognized by the system and obtains and displays logical disks and associated information.

To display logical disks and associated information by using the iSMrc_ldlist command, specify the following options.

- **-a option**: Lists information of the logical disks stored in all disk arrays.
- **-d option**: Lists information of disk arrays that are recognized by the system.
- **-de option**: Lists information of the logical disks stored in the specified disk array.
  
  If a specific logical disk name is specified, only information of the specified logical disk name is displayed. When joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC), only disk arrays that are directly recognized by the system as targets can be specified.

- **-cr option**: Updates the latest information by re-obtaining information of disk arrays and logical disks that are connected to the system. This option can be used only when the replication management (controlling the I/O issuance to disk arrays via the NEC Storage Manager) is simultaneously conducted.

(1) The following example shows the display of information of logical disks in all disk arrays (UNIX).

```
```
```
# iSMrc_Idlist -a
Receiving...

--------------------------------------------------------------------------------------------------------------------------
| [Disk Array Name](Management) | LDN | OS Type | LD Name  | Attribute | Capacity |
--------------------------------------------------------------------------------------------------------------------------
| [NECStorage4100](direct)      | 0000h | 200000004C0010550000 | IV       | 1.0 MB    |
|                               | 0001h | LX       | lx_rpl01 | IV        | 2.0 GB   |
|                               | 0002h | LX       | lx_rpl04 | IV        | 2.0 GB   |
| [NECStorage4200](indirect)    | 0000h | NX       | LD0000   | MV        | 3.9 GB   |
|                               | 0001h | NX       | LD0001   | RV        | 3.9 GB   |
|                               | 0002h | WN       | EXP120RA1| RV/MV     | 3.9 GB   |
|                               | 0003h | WN       | EXP120RA2| MV        | 3.9 GB   |
```

**Description**

Receiving... Message indicating that data is being received.

During a joint operation with replication management, this message is displayed until data has been received. While data is being received, the "." character is updated.

**Disk Array Name** Disk array name

**Management** Identifies whether the system recognizes the disk array.

direct Disk array directly recognized by the system.

indirect Disk array which is not recognized by the system

**OS Type** OS type

**LDN** Logical disk number

**LD Name** Logical disk name

**Attribute** Logical disk attribute (identification of IV, and, MV, RV)

**Capacity** Logical disk capacity
(2) The following example shows the display of specific logical disk information (Windows).

```
C:\> iSMrc_ldlist -de NECStorage4100 lx_rp104
---------------------------------------------------------------------------------------------------------------
[Disk Array Name](Management)
LDN  OS Type  LD Name   Attribute  Capacity 
---------------------------------------------------------------------------------------------------------------
[NECStorage4100](direct)
0002h  LX  lx_rp104   IV   2.0 GB
C:\>
```

(3) The following example shows the list of disk array information (Windows).

```
C:\> iSMrc_ldlist -d
Receiving...
---------------------------------------------------------------------------------------------------------------
Disk Array Name  Management 
---------------------------------------------------------------------------------------------------------------
NECStorage4100  direct
NECStorage4200  indirect
C:\>
```

Description
Receiving... Message indicating that data is being received.
During a joint operation with replication management, this message is displayed until data has been received. While data is being received, the “.” character is updated.

Disk Array Name Disk array name
Management Identifies whether the system recognizes the disk array.
direct Disk array directly recognized by the system
indirect Disk array which is not recognized by the system

[Execution conditions]
(1) The volume list is not being created or updated.
(2) The iSM dedicated special file is not being created (HP-UX version UNIX only).

The above execution conditions are applicable only when joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC).
4.5.2 Pair/Unpair Command

To execute pair setting or unpair, the iSMrc_pair command is used.

The iSMrc_pair command sets and unpairs specified paired MV and RV. If a failure occurred on the MV side or RV side disk array and the regular unpairing becomes impossible, Forced Unpair can be performed.

The iSMrc_pair command enables the specification of the following option regarding pair setting and unpairing.

1. Specifying pair setting (-pair) or unpairing (-unpair)
   Specify whether to set a pair or a pair.
   - Specify a pair (-pair): Specifies pair setting for specified paired volumes.
   - Unpair (-unpair): Unpair the specified paired volumes.

2. Specifying paired volumes
   Specify MV and RV volumes.
   - Specify MV (-mv volume -mvflg mv_flg): Specifies the volume and volume type of MV.
   - Specify RV (-rv volume -rvflg rv_flg): Specifies the volume and volume type of RV.

The pair setting and canceling operation (iSMrc_pair command) is performed on a single logical disk; therefore, it is not possible to specify an LVM volume group or a VxVM disk group as a volume. For details of the volume types, refer to 4.1 “Volume Types”.

On the Windows system, when a specific partition (drive letter) is specified for a volume consisting of multiple partitions, all partitions in the volume become operation targets; therefore, the default setting does not allow the multiple partitions to be operated. To perform operations for a volume consisting of multiple partitions, you need to change the default setting. For information about the replication operation option setting file, refer to the “NEC Storage Manager Data Replication Command Reference”.

3. Forced Unpair (-force)
   If a failure occurred in the connections between disk arrays and the regular unpairing becomes impossible, it is possible to perform Forced unpair for MV and RV individually by specifying the -force option.
   You can specify one of the following as a Forced Unpair target.
   - Performing Forced Unpair for both MV and RV (-force all)
   - Performing Forced Unpair only for MV (-force mv)
   - Performing Forced Unpair only for RV (-force rv)
   Note the following when performing Forced Unpair.
   - When MV and RV are in the same system, execute the “all” specification.
   - When MV and RV are in different systems, use Forced Unpair by specifying MV or RV.
• When performing Forced Unpair by using MV specification (or RV specification), after removing the cause of the failure, you must perform Forced Unpair for the other volume.
• If Forced Unpair is performed for either MV or RV, subsequent replication operations will not function properly because inconsistency occurs in the recognized states of MV and RV.
• You cannot perform Forced Unpair for RV which is not recognized by the business server.

When the pair setting and unpairing has been successfully performed by the iSMrc_pair command, the following message appears.  Values of the pppp, xxxx, yyyy, and zzzz in the following message are changeable.

iSM13247: Command has completed successfully. (code=pppp-xxxx-yyyy-zzzz)

[Execution conditions]
To set or unpair, the following conditions must be satisfied:
(1) The target MV is in the disk array under control of its own system.
(2) The disk array where the specified MV and RV are stored is not in the Freeze state.
(3) When setting a pair, the MV’s and RV’s logical disk capacity and OS type must coincide.
(4) The RV to be set as a pair should not be paired with another volume.
(5) The pair to be cancelled must be in the Separated state.
(6) The volume list is not being created or updated.
(7) The iSM dedicated special file is not being created (HP-UX version UNIX only).

The above execution conditions (1), (6) and (7) are applicable only when joint operation with the replication management is not performed (the I/O issuance to disk arrays is directly controlled via the FC).
4.6 Disk Operations

The disk operation function, which functions only on the Windows system, enables disks to be controlled and operated so as to operate the Data Replication function that uses MV and RV on the Windows system.

Disk operation commands do not provide a function that replaces Windows 2000’s “Disk Management”, however, they do provide a function necessary for operating MV and RV in combination with replication operation commands. By using disk operation commands together with replication operation commands, on the Windows system, you can easily conduct the data replication batch job operation that is similar to the operation conducted on UNIX.

4.6.1 File System Flush Command

To carry out a file system flush, the iSMrc_flush command is used.

The iSMrc_flush command flushes the file system without unmounting the association of a drive letter and volume, and writes the data in the file system buffer, which has not been reflected to the disk.

When you execute this command, you can reflect data to the disk without quitting the application.

This command executes Flush in units of volumes and flushes only Windows file systems so that other volumes or applications handling their own cache control are not affected. To flush application data, you also need to use the flush process specific to the application.

The iSMrc_flush command displays the following messages when Flush starts and ends.

[Start message]
Flush Start YYYY/MM/DD hh:mm:ss
disk_number ld_name type
volume name
path

[End message]
Flush Normal End YYYY/MM/DD hh:mm:ss
disk_number ld_name type
volume name
path

Description of Message
YYYY/MM/DD hh:mm:ss Start/End time (Year Month Day Hour Minute Second)
disk_number Physical disk number
ld_name Logical disk name
type OS type
Chapter 4  Functions of NEC Storage ReplicationControl

volume name  Mount point volume name
path  Drive letter or path name mounted on the NTFS volume folder accessed by users

[Execution conditions]
To perform Flush, the following conditions must be satisfied.
(1) The target volume is registered in the volume list.
(2) Specifying volume of a dynamic disk is not allowed.
(3) The specified file system is mounted.
(4) This command flushes only the Windows file systems so that the data of applications handling their own cache cannot be flushed. To flush application data to the disk, you need to flush application data first, and then execute the Flush command to flush the file system.
To carry out a volume mount, the iSMrc_mount command is used.

The iSMrc_mount command associates volumes (partitions created in MV and RV) and file systems.

Mounting allows MV and RV to be used as file systems (local disks such as C: and D:) on the Windows system.

The iSMrc_mount command is different from Mount provided by “Disk Management” (Windows 2000).

The iSMrc_mount command displays messages when Mount starts and ends.

[Start message]

   Mount Start
         YYYY/MM/DD hh:mm:ss
         disk_number  ld_name  type
         volume name  path

[End message]

   Mount Normal End
         YYYY/MM/DD hh:mm:ss
         disk_number  ld_name  type
         volume name  path

Description of Message

   YYYY/MM/DD hh:mm:ss  Start/End time (Year Month Day  Hour Minute Second)
   disk_number           Physical disk number
   ld_name               Logical disk name
   type                  OS type
   volume name           Mount point volume name
   path                  Drive letter or path name mounted on the NTFS volume folder accessed by users

[Execution conditions]

To perform Mount, the following conditions must be satisfied.

(1) The target volume is registered in the volume list.
(2) Read/Write is allowed for the target volume.
(3) Specifying a volume of a dynamic disk is not allowed.
(4) If the drive to be mounted is being used by another application, the iSMrc_mount command results in an error. Therefore, the iSMrc_mount command provides a Mount retry function.

Operations regarding the retry function can be specified in the replication operation option setting file (iSMrpl.ini). For the file description format, refer to the “NEC Storage Manager Data Replication Command Reference”.

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4.6.3 Volume Unmount Command

To unmount a volume, the iSMrc_umount command is used. The iSMrc_umount command cancels the association of volumes (partitions created in MV and RV) with file systems. When you perform unmount, the file system is flushed and the file system buffer of the specified drive is flushed to the disk.

The iSMrc_umount command allows the specification of the following options.


The iSMrc_umount command displays the following messages when Unmount starts and ends.

[Start message]

Umount Start YYYY/MM/DD hh:mm:ss
disk_number ld_name type
volume name path

[End message]

Umount Normal End YYYY/MM/DD hh:mm:ss
disk_number ld_name type
volume name path

Description of Message

<table>
<thead>
<tr>
<th>YYYY/MM/DD hh:mm:ss</th>
<th>Start/End time (Year Month Day Hour Minute Second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk_number</td>
<td>Physical disk number</td>
</tr>
<tr>
<td>ld_name</td>
<td>Logical disk name</td>
</tr>
<tr>
<td>type</td>
<td>OS type</td>
</tr>
<tr>
<td>volume name</td>
<td>Mount point volume name</td>
</tr>
<tr>
<td>path</td>
<td>Drive letter or path name mounted on the NTFS volume folder accessed by users</td>
</tr>
</tbody>
</table>
[Execution conditions]

To perform Unmount, the following conditions must be satisfied.

(1) The target volume is registered in the volume list.
(2) Read/Write are allowed for the target volume.
(3) Specifying a volume of a dynamic disk is not allowed.
(4) If the drive to be unmounted is being used by another application, the iSMrc_umount command results in an error. Therefore, the iSMrc_umount command provides an Unmount retry function. Operations regarding the retry function can be specified in the replication operation option setting file (iSMrpl.ini). For the file description format, refer to the “NEC Storage Manager Data Replication Command Reference”. In addition, also refer to the description of the iSMrc_umount command in the “NEC Storage Manager Data Replication User’s Manual (Installation and Operation Guide for Windows)”.

4.6.4 Disk Signature Operation Command

For the disk signature operations, the iSMrc_signature command is used.
A disk signature is system information used for identifying the disk on the Windows system. On the Windows system, two disks with the same signature cannot be used in the same system. Replication operation commands automatically avoid the same disk signature when MV and RV are synchronized. If a failure occurs during replication operations and a conflict occurs in the disk signatures of MV and RV, you can use the Disk Signature operation command to restore them. To perform the disk signature operation, you can specify the disk number to operate in units of disks, or you can operate all disks as targets.

For the iSMrc_signature command, you can specify the following options regarding Disk Signature operation.

- **Saving signature (-read)**
  Saves the disk signature recognized by the Windows system. Signatures are recorded in the signature map file managed by the iSMrc_signature command.

- **Writing signature (-set)**
  Restores the signature saved in the map file to the disk.

- **Deleting signature (-del)**
  Deletes the signature from the map file.

- **Initializing signature (-init)**
  Initializes the signature of the physical disk.

- **Displaying the list of signature information (-list)**
  Displays a list of signatures saved in the map file and those saved in the disk array or displays the signatures of the specified physical disk.

- **Exporting signature to a file (-export)**
  Writes the signature information to the specified file.

- **Importing signature from a file (-import)**
  Reads and registers the signature information recorded in the specified file.

[Execution Conditions]
To perform Disk Signature operation, the following conditions must be satisfied.
(1) The target MV or RV is registered in the volume list.
(2) The target MV or RV is not “Not Ready”.

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4.6.5 Devices Scan Command

To scan devices, the iSMrc_scan command is used. Executing the iSMrc_scan command scans devices and lets the system recognize available devices. When the system is starting up with the devices not connected to the system or in “Not Ready” state, the system cannot recognize those devices. When a server that uses an RV is restarted while the RV is in Replicate state, the RV is in “Not Ready” state and therefore, cannot be recognized by the system. In such a case, separate all pairs and then execute this command so that the OS recognizes the RV. The iSMrc_scan command is executable only on Windows 2000. Executing the command has the same effect as selecting “Scan for Hardware Change” from the Device Manager menu. Instead of using this command, the RV can be recognized by the disk management function of the Windows system.

The iSMrc_scan command requires no options. When this command is executed, the following message appears. The iSMrc_scan command may take tens of seconds to complete the operation.

[Start message]
Scan Start YYYY/MM/DD hh:mm:ss

[End message]
Scan Normal End YYYY/MM/DD hh:mm:ss

Description of Message
YYYY/MM/DD hh:mm:ss Start/End time (Year Month Day Hour Minute Second)
By operating the NEC Storage ReplicationControl together with the NEC Storage Manager’s replication management function, it is possible to conduct operations and management, such as pairing, unpairing and various other replication operations, which have been conventionally conducted by the NEC Storage Manager’s client, by executing replication operation commands.

To conduct a joint operation with the replication management function, install the NEC Storage ReplicationControl on the server on which the NEC Storage Manager has been installed and is operating.

Also, in the environment setting of the NEC Storage ReplicationControl, it is necessary to specify beforehand that the I/O issuing path to the disk array is to be set via the NEC Storage Manager. For details of the environment setting, refer to Chapter 3 “Operation Settings” in the “NEC Storage Manager Data Replication Command Reference”.

In the joint operation with the replication management function, the following effects can be expected regarding the operability.

• The HBA (host bus adapter) and device drivers are not required for connecting disk arrays and issuing I/O to the disk arrays. As a result, it is possible to use a LAN that is almost independent of the system or the hardware environment.

• It is possible to operate all logical disks in the monitoring target disk arrays. The replication operation can also be conducted for a logical disk that is not recognized by the system as being a disk device.

• The command operation can be automatically conducted by making a script or using a job scheduling software program.

• It is possible to confirm the command operation conducted for a disk array by reading the message that appears in the iSM Client’s message display area.
In the joint operation with the replication management function, the replication operation can also be conducted for a logical disk that is not recognized by the system as being a disk device. Therefore, a logical disk name only can be used to specify volumes that are specified as MV and RV. It is not necessary to create the volume list beforehand.

Furthermore, the joint operation with the replication management function can be performed for the commands of the replication and pair operations that are conducted for disk arrays. However, commands for creating and displaying the volume list and performing disk management operations directly operate the system’s volumes; therefore, those commands are not joint operation targets.
Target commands available for the joint operation with the replication management function are as follows:

### Table 4-4 Joint Operation with Replication Management

<table>
<thead>
<tr>
<th>Command name</th>
<th>Operation</th>
<th>System</th>
<th>Joint operation</th>
</tr>
</thead>
<tbody>
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<td>Volume list creation/display</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_replicate</td>
<td>Replicate</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_separate</td>
<td>Separate</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_restore</td>
<td>Restore</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_change</td>
<td>Perform copy control state change</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_wait</td>
<td>Wait for state</td>
<td>○</td>
<td>○</td>
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<tr>
<td>iSMrc_query</td>
<td>Paired volume state display</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_sense</td>
<td>Volume list display</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_ldlist</td>
<td>Logical disk information display</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>iSMrc_pair</td>
<td>Pair setting/unpair</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
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<td>File system buffer flush</td>
<td>○</td>
<td>–</td>
</tr>
<tr>
<td>iSMrc_mount</td>
<td>Volume mount</td>
<td>○</td>
<td>–</td>
</tr>
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<td>iSMrcUnmount</td>
<td>Volume unmount</td>
<td>○</td>
<td>–</td>
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<td>iSMrc_signature</td>
<td>Disk signature operations</td>
<td>○</td>
<td>–</td>
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<tr>
<td>iSMrc_scan</td>
<td>Disk scanning</td>
<td>○</td>
<td>–</td>
</tr>
</tbody>
</table>

○: Targeted  –: Not Targeted

The disk array’s state monitoring information stored by the replication management function (NEC Storage Manager) is updated at a constant time interval (default: 15 seconds). Before conducting the replication operation or pair operation, to update the disk array’s state monitoring information to the latest state, reduce the update time interval for the state monitoring information stored in the NEC Storage Manager, or re-obtain disk array and logical disk information by using the -cr option for the logical disk information display command (iSMrc_ldlist command).

For information about the environment setting, such as an update time interval for state monitoring information stored in the NEC Storage Manager, refer to the “NEC Storage Manager User’s Manual”.

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