NEC Storage Software

Data Replication
User’s Manual
(Function Guide)
Preface

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

The data replication function consists of the replication volume creation function provided in NEC Storage series disk array subsystem and software to manage and operate it. The function utilizes replication volumes for more efficiency of business operation.

Refer to the “NEC Storage Software Manual Guide” (IS901) for the overview of NEC Storage and the related manuals. Refer to the “NEC Storage Software Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)” (IS027) for the usage of the disaster recovery function of data replication provided by NEC Storage RemoteDataReplication/DisasterRecovery.

Remarks
1. This manual explains functions implemented by the following program products:
   - NEC Storage Manager and NEC Storage BaseProduct
   - NEC Storage ControlCommand
   - NEC Storage DynamicDataReplication
   - NEC Storage RemoteDataReplication
   - NEC Storage RemoteDataReplication Asynchronous
2. This manual is applicable to the program products of the following versions:
   - NEC Storage Manager Ver6.2
   - NEC Storage BaseProduct Ver6.2
   - NEC Storage ControlCommand Ver6.2
3. The NEC Storage Manager is referred to as iSM or Storage Manager in this manual unless clearly specified.

Also, the following terms refer to the corresponding NEC Storage software products:

<table>
<thead>
<tr>
<th>Term</th>
<th>NEC Storage Software Product</th>
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<tbody>
<tr>
<td>AccessControl</td>
<td>NEC Storage AccessControl</td>
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<td>ControlCommand</td>
<td>NEC Storage ControlCommand (*)</td>
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<td>DynamicDataReplication or DDR</td>
<td>NEC Storage DynamicDataReplication</td>
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<td>DynamicDataReplication Lite</td>
<td>NEC Storage DynamicDataReplication Lite</td>
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<tr>
<td>RemoteDataReplication or RDR</td>
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<td>RemoteDataReplication/DisasterRecovery</td>
<td>NEC Storage RemoteDataReplication/DisasterRecovery</td>
</tr>
<tr>
<td>VirtualStoragePartitioning</td>
<td>NEC Storage VirtualStoragePartitioning</td>
</tr>
</tbody>
</table>

Note: NEC Storage ControlCommand is a program product in which the following five functions are integrated:
   - ReplicationControl
4. The NEC Storage series disk array subsystem is referred to as a disk array in this manual unless clearly specified. Also, the following terms refer to the corresponding NEC Storage hardware products:

<table>
<thead>
<tr>
<th>Term</th>
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<tr>
<td>D series</td>
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<td>NEC Storage $xxx or NEC Storage $xxxx</td>
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</table>

xxx and xxxx represent the model number.

5. The following terms in this manual refer to the NEC Storage software manuals:

<table>
<thead>
<tr>
<th>Term</th>
<th>NEC Storage Software Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration Setting Tool User’s Manual (GUI)</td>
<td>NEC Storage Software Configuration Setting Tool User’s Manual (GUI) (IS007)</td>
</tr>
<tr>
<td></td>
<td>NEC Storage Software Data Replication User’s Manual (Installation and Operation Guide for Linux) (IS020)</td>
</tr>
<tr>
<td>Data Retention User’s Manual</td>
<td>NEC Storage Software Data Retention User’s Manual (IS040)</td>
</tr>
<tr>
<td>ControlCommand Command Reference</td>
<td>NEC Storage Software ControlCommand Command Reference (IS041)</td>
</tr>
<tr>
<td>Power Saving User’s Manual</td>
<td>NEC Storage Software Power Saving User’s Manual (IS042)</td>
</tr>
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</table>

6. The description of “RemoteDataReplication” also applies to the “RemoteDataReplication Asynchronous” unless clearly specified.

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8. This product includes the OSSs below. For details on the licenses, refer to Appendix B in this manual.
   - Apache log4j (http://logging.apache.org/)
   - flex (http://flex.sourceforge.net/)
   - OpenSSL (http://www.openssl.org/)

9. In this document, capacities are calculated based on units of 1024 (for example 1 KB = 1024 bytes) unless otherwise specified.

10. In this document, “system volume” means “storage system volume” unless otherwise specified.


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

   Be sure to observe the instructions.

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

<table>
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<th>Description</th>
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<tr>
<td><img src="image" alt="Warning" /></td>
<td>Describes contents which require users to pay special attention for operation.</td>
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</table>

1st Edition in March 2003
23rd Edition in January 2010
# Contents

Chapter 1  Data Replication Function

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Data Replication Overview</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Examples of Applying Data Replication</td>
<td>2</td>
</tr>
<tr>
<td>1.2.1 Backup</td>
<td>2</td>
</tr>
<tr>
<td>1.2.2 Creating Test Environment</td>
<td>4</td>
</tr>
<tr>
<td>1.2.3 Performing Search in Parallel</td>
<td>5</td>
</tr>
<tr>
<td>1.3 System Configuration</td>
<td>6</td>
</tr>
</tbody>
</table>

Chapter 2  Data Replication Function

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Volume Type</td>
<td>8</td>
</tr>
<tr>
<td>2.2 Replication Operations</td>
<td>10</td>
</tr>
<tr>
<td>2.2.1 Replicate</td>
<td>10</td>
</tr>
<tr>
<td>2.2.2 Separate</td>
<td>10</td>
</tr>
<tr>
<td>2.2.3 Restore</td>
<td>11</td>
</tr>
<tr>
<td>2.3 Replication Operations and State Transitions</td>
<td>12</td>
</tr>
<tr>
<td>2.3.1 Replicate and State Transitions</td>
<td>13</td>
</tr>
<tr>
<td>2.3.2 Separate and State Transitions</td>
<td>14</td>
</tr>
<tr>
<td>2.3.3 Restore and State Transitions</td>
<td>15</td>
</tr>
<tr>
<td>2.3.4 Activity and Synchronous State</td>
<td>16</td>
</tr>
<tr>
<td>2.4 Copy Control</td>
<td>18</td>
</tr>
<tr>
<td>2.5 Relationship between Copy Performance and Copy Control</td>
<td>25</td>
</tr>
<tr>
<td>2.6 Access Restriction for RV</td>
<td>26</td>
</tr>
<tr>
<td>2.7 Copy Failures and Sate Transitions</td>
<td>27</td>
</tr>
<tr>
<td>2.8 Freeze of Disk Arrays</td>
<td>28</td>
</tr>
<tr>
<td>2.9 Pair Configuration</td>
<td>29</td>
</tr>
<tr>
<td>2.10 Swap Function for RDR Pair</td>
<td>30</td>
</tr>
<tr>
<td>2.10.1 Swap Operation for RDR Pair</td>
<td>30</td>
</tr>
<tr>
<td>2.10.2 Cancellation of Update Prevention</td>
<td>30</td>
</tr>
<tr>
<td>2.10.3 Swap in RDR Pair and State Transition</td>
<td>31</td>
</tr>
<tr>
<td>2.11 Large-capacity Volume Larger Than 2 TB</td>
<td>32</td>
</tr>
<tr>
<td>2.12 Low-speed Line</td>
<td>33</td>
</tr>
<tr>
<td>2.12.1 Using Low-speed Line</td>
<td>33</td>
</tr>
<tr>
<td>2.12.2 Notes on Using Best-effort Line</td>
<td>34</td>
</tr>
<tr>
<td>2.13 RemoteDataReplication Asynchronous</td>
<td>36</td>
</tr>
<tr>
<td>2.14 Restrictions on Operation</td>
<td>37</td>
</tr>
<tr>
<td>2.14.1 Restrictions by Configuration Setting Operation Guard</td>
<td>37</td>
</tr>
<tr>
<td>2.14.2 Restrictions by Data Retention Function</td>
<td>37</td>
</tr>
<tr>
<td>2.14.3 Restrictions by Power Saving Function</td>
<td>39</td>
</tr>
<tr>
<td>2.14.4 Operation of Partitioning Function</td>
<td>40</td>
</tr>
<tr>
<td>2.14.5 Use of iSCSI</td>
<td>41</td>
</tr>
<tr>
<td>2.14.6 Restrictions by Thin Provisioning Function</td>
<td>42</td>
</tr>
<tr>
<td>2.14.7 Restrictions on Secure Mode</td>
<td>43</td>
</tr>
</tbody>
</table>

Chapter 3  Replication Manager

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Replication Manager Overview</td>
<td>44</td>
</tr>
<tr>
<td>3.1.1 Operations and Authority Levels</td>
<td>44</td>
</tr>
<tr>
<td>3.1.2 Event Detection and Operation Message Output</td>
<td>46</td>
</tr>
<tr>
<td>3.1.3 Notes on Operation</td>
<td>48</td>
</tr>
<tr>
<td>3.2 Replication Manager Screen</td>
<td>49</td>
</tr>
<tr>
<td>3.2.1 Replication Manager Screen</td>
<td>49</td>
</tr>
<tr>
<td>3.2.2 Configuration Display Area</td>
<td>50</td>
</tr>
<tr>
<td>3.2.3 Replication Information Screen</td>
<td>52</td>
</tr>
<tr>
<td>3.2.4 Disk Array LINK Information Screen</td>
<td>60</td>
</tr>
<tr>
<td>3.2.5 Menu Item List</td>
<td>63</td>
</tr>
<tr>
<td>3.2.6 Information Displayed on Execution Dialog</td>
<td>66</td>
</tr>
<tr>
<td>3.3 Operations of Replication Manager</td>
<td>69</td>
</tr>
<tr>
<td>3.3.1 Pair Setting/Unpair</td>
<td>69</td>
</tr>
</tbody>
</table>
Chapter 4 Functions of Replication Control

4.1 Command List
4.2 Operation Types
4.2.1 Direct Operation to Disk Array
4.2.2 Using Replication Control with ISM
4.3 Serially Configured Pair and Remote Operation
4.4 Volume Types
4.5 Replication Operation File
4.6 Displaying/Creating Volume List
4.6.1 Command Operations (Windows)
4.6.2 Command Operations (UNIX)
4.6.3 GUI Operations (Windows)
4.7 Replication Operations
4.7.1 Replicate Command
4.7.2 Separate Command
4.7.3 Restore Command
4.7.4 Copy Control Change Command
4.7.5 Wait Command
4.7.6 Replication State Display Command
4.7.7 Specific Volume Information Display Command
4.7.8 RV Access Restriction Change Command
4.7.9 Command for Canceling Update Prevention
4.8 Pair Operations
4.8.1 Logical Disk Information Display Command
4.8.2 Pair/Unpair Command
4.8.3 Pair Swap Command
4.9 Disk Array Operations
4.9.1 Command for Displaying Information on Replication Function
4.9.2 Disk Management/Operations
4.10 File System Flush Command
4.10.1 File System Flush Command
4.10.2 Volume Mount Command
4.10.3 Volume Unmount Command
4.10.4 Disk Signature Operation Command
4.10.5 Devices Scan Command

Appendix A Pair Information File Output Command

A.1 Pair Information File Output Command
A.1.1 Start/Termination
A.1.2 Options
A.1.3 Execution of Command
A.1.4 Output Files
Chapter 1  Data Replication Overview

To allow the unified management of an enormous amount of accumulated business information for using it more efficiently, a storage system with high performance, large capacity and high reliability is required. Data Replication provides functions to build and manage such a storage system.

This chapter provides an overview of Data Replication and hardware and software configurations.

1.1  Data Replication

Data Replication installed in the disk array creates Replication Volumes (RV) of Master Volume (MV). Replication volumes can be connected to or separated from the master volume at any time. Such connection and separation can be performed from the application server or iSM Client.

There are the following two methods to create replication volumes:
(1) Creating replication volumes within the same disk array (DDR: DynamicDataReplication)
(2) Creating replication volumes in different disk arrays (RDR: RemoteDataReplication)

![Data Replication Diagram]

Figure 1-1  Data Replication
1.2 Examples of Applying Data Replication

Introducing Data Replication to use separatable replication volumes enables the following:

- Substantially reducing system down time due to data backup and preventing the performance of access to the application database from being degraded during data backup performed while the system is running
- Simplifying the creation of test environment where actual application data is used
- Processing data update and data reference in parallel for more efficiency

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

1.2.1 Backup

This section describes how to apply Data Replication for backup using replication volumes.

Backup from Replication Volume to Magnetic Tape Media

With this method, you can perform backup from a replication volume to a magnetic tape media. With this type of backup, operation stops only while a replication volume is separated from the master volume, resulting in substantial reduction of operation downtime. Because backup is performed from a replication volume, the master volume is not affected.

Figure 1-2  Backup from Replication Volume
The procedure for backup from a replication volume is as follows:

(1) While the system is running, keep the MV (master volume) and RV (replication volume) connected.

(2) Suspend production tasks to separate the RV (replication volume). After the separation is completed, resume the tasks.

(3) Use the separated RV (replication volume) to perform backup in parallel with the tasks. After backup is completed, reconnect the RV (replication volume). (Reconnection is completed in a short time because only what has been updated in the master volume is reflected in the RV (replication volume)).

**Using Replication Volume for Disk Backup**

With this method, you can use a replication volume for backup of the master volume. Because magnetic tapes are not used as storage media, complicated magnetic-tape management is not required.

When restoration instruction is completed, backup data will become available even if the actual data replication has not been completed. If data to be accessed is not restored in the master volume, the data in the replication volume will be accessed. The volume being used remains transparent to the user.

This reduces the data restoration time substantially.

![Figure 1-3 Using Replication Volume for Backup](image)

The procedure for using a replication volume for backup is as follows:

(1) Connect the replication volume 1 (RV1) to the master volume.

(2) Suspend the production task to separate the RV1 (replication volume 1) and then connect the RV2 (replication volume 2). After the connection is completed, resume the task.

(3) Then use the replication volume 1 (RV1) and replication volume 2 (RV2) alternately to perform backup.
1.2.2 Creating Test Environment

You can easily create the same environment as the production task environment by using the Data Replication function to create replication volumes. The data to be used in the production task is available for evaluating an application program, allowing far more efficient application-program evaluation. Operation stops only when a replication volume is separated from the master volume during the test environment creation. This allows operation downtime to be reduced substantially.

Figure 1-4  Test Environment Setting

The procedure for using a replication volume as a test environment is as follows:

(1) Connect the master volume (MV) and replication volume (RV).

(2) Suspend the production task to separate the RV (replication volume), and then resume the task.

(3) Use the separated RV (replication volume) to perform evaluation of the application program.
1.2.3 Performing Search in Parallel

By creating replication volumes of the master database, you can separate the database to allocate volumes respectively for update and search operations. This allows you to update the database without affecting database search operations.

The procedure for performing search operation in parallel is as follows:

1. In the nighttime, suspend search operation to connect the MV (master volume) and RV (replication volume).

2. In the daytime, separate the master volume (MV) and replication volume (RV). Then perform update and search operations in parallel (RV contains data of the previous day).
To install the Data Replication function, the following hardware devices are required:

- **Disk array**
  Disk arrays with the data replication functions provided by either DynamicDataReplication or RemoteDataReplication are required.

- **Management server**
  This server monitors disk arrays of the iStorage series using the installed iStorage Manager and also controls disk arrays and data replication functions.

- **Application server/backup server**
  These servers perform Data Replication or backup operation in tandem with tasks.
Software to run Data Replication consists of the following components.

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

- **ReplicationControl**
  Provides commands for checking replication operations and replication states in the application server.

- **AccessControl**
  Provides functions to set logical disks that can be accessed for each application server.

- **DynamicDataReplication**
  Provides functions to allow data replication to be performed within the same disk array.

- **RemoteDataReplication**
  Provides functions to allow data replication to be performed in different disk arrays.
Chapter 2  Data Replication Function

This chapter describes types and state transitions of volumes that are required to use Data Replication functions for operation.

2.1 Volume Type

To use the Data Replication function for creating replication volumes, you must set the relation between the source volume and destination volume (replication volume) first. In replication control, the source volume is called Master Volume (MV) and the replication volume is called Replication Volume (RV). Furthermore, MV and RV are set as a pair.

For a disk array with the Data Replication function installed, the volume types used in the disk array are categorized into the three types described below. Figure 2-1 describes an example of combining volume types.

- Isolated Volume (IV)
  Volume with no pair setting.
  By setting a pair to IV, you can set it as MV or RV.

- Master Volume (MV)
  Volume with pair setting and from which copy is performed to the other volume of the pair (source volume). In general, set a volume used in tasks as MV.
  When multiple pairs are set in series hierarchically, the uppermost MV is called Primary Volume (PV) in order to distinguish it from other MVs.

- Replication Volume (RV)
  Volume with pair setting and to which copy will be made in the pair (destination volume). In general, set a volume used for backup or test operation as RV.
  Pair can be set between volumes within the same disk array or between volumes in different disk arrays. To distinguish those settings, the former is called Dynamic Replication Volume (dRV) and the latter is called Remote Replication Volume (rRV).
There are other related volumes (BV, SV, and LV) used for snapshot.

A Base Volume (BV) can be set as MV or RV for pair setting and used together with data replication and snapshot.

For details on volumes used for the snapshot, refer to the “Snapshot User’s Manual (Function Guide)”. 

Figure 2-1  Example of Combining Volume Types
2.2 Replication Operations

Replication operations include “Replicate” that copies data from MV to RV, “Separate” that separates MV and RV, and “Restore” that copies data from RV to MV.

2.2.1 Replicate

With this operation, you can copy data from MV to RV.

Use this operation to copy the latest data to a replication volume that will be used in a test environment or for search task. When Replicate is performed, data in MV is copied to RV. In addition, any update made in MV after Replicate is performed is reflected in RV.

2.2.2 Separate

With this operation, you can separate MV and RV.

Use this operation to suspend data copy between MV and RV to use the RV in a test environment or for search.

When Separate is started, all the differences between MV and RV by then is reflected in the RV, data copy is suspended and then the RV is separated. Updates made in the MV after the start of Separate are not reflected in the RV. Instead the update data is stored in a disk array as differences made by the update.

Before performing Separate, you can choose when to start using RV, from the following:

- Separate for making RV available after separation is completed: Separate (completion)
  Reflects all the differences between MV and RV in the RV to make the RV available after separation is completed.
  Even if Separate is performed immediately after Replicate starts, RV cannot be used while the difference between MV and RV is reflected into the RV. RV becomes available upon completion of separation.

- Separate for immediately making RV available: Separate (immediate)
  Makes an RV available even while the difference between MV and RV are reflected into the RV or MV and RV are separated. By performing Separate (immediate), you can create an available RV immediately. This function is available only when data replication is performed in the same disk array. To use this function, "DynamicDataReplication Ver.2" or later is required.
2.2.3 Restore

With this operation, you can copy data from RV to MV.
Use this operation to restore data from a backup volume (RV) when a failure occurs in MV.
When Restore is performed, data stored in RV by the time Restore is started is copied to MV. When performing Restore, you can choose whether to reflect data update made in the MV into the RV.

- Restore with RV update: Restore (update)
  Restores MV while automatically reflecting the data update made in the MV into RV. Even after the difference between MV and RV disappear and Restore is completed, data update made in the MV will be reflected into the RV.

- Restore without RV update: Restore (protect)
  Restores MV without reflecting the data update made in the MV into RV. After the difference between MV and RV disappear and Restore is completed, Separate is automatically performed. By using the Restore (protect) function, you can protect data in RV to save the data as it was before Restore is performed.
  To use this function, “DynamicDataReplication Ver2” or later, “RemoteDataReplication Ver2” or later, or “RemoteDataReplication Asynchronous” is required.
2.3 Replication Operations and State Transitions

This section describes replication operations and state transitions.

- **Pair setting is specified but MV and RV are separated.**
- **Difference between MV and RV is being reflected.**
- **Pair setting is specified and synchronization has been established.**

**Figure 2-2  Replication Operations and State Transitions**

- **Pair setting is specified but MV and RV are separated.**
- **Difference between MV and RV is being reflected.**
- **Pair setting is specified and synchronization has been established.**

- **Separation**
  - As a rule, RV cannot be updated.

- **Replicate**
  - RV cannot be updated.

- **Restore**
  - When Restore (update) is performed, updates made in MV are reflected into RV. When Restore (protect) is performed, updates made in MV are not reflected into RV. As a rule, access to RV is not allowed.

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

- **When Restore (protect) is executed, Sync State (rst/sync) is placed and then automatically changed to Separated State (separated).**

---

**preparing**: Replicate, Separate, or Restore preparing  
**exec**: Replicate, Separate, or Restore execution  
**sync**: Replicate or Restore sync state  
**rpl**: replicate (Replicate)  
  - rpl/preparing .... Sync preparing  
  - rpl/exec .......... Sync execution  
  - rpl/sync .......... Sync state  
**sep**: separate (Separate)  
  - sep/preparing..... Separate preparing  
  - sep/exec .......... Separate execution  
  - separated ........ Separated  
**rst**: restore (Restore)  
  - rst/preparing..... Restore preparing  
  - rst/exec .......... Restore execution  
  - rst/sync .......... Sync state
2.3.1 Replicate and State Transitions

When Replicate starts, data copy from MV to RV starts to reflect the content of the MV into the RV. Updates made in the MV after Replicate is performed are also reflected into the RV.

After Replicate starts, the difference between MV and RV is gradually reduced and eventually all the data stored in the MV at the start of the Replicate is reflected into the RV (no differences). The state from the beginning of Replicate to the moment data in MV is completely reflected into RV is called "Replicate execution". The state where there is no difference between MV and RV is called “Synchronized by Replicate” or simply “Synchronized (sync)”. When a large-capacity volume or low-speed line is used, the state of “Replicate preparing” temporarily appears before “Replicate execution” appears. The states of “Replicate preparing”, “Replicate execution” and “Synchronized by Replicate” are collectively called “Replicate”.

Figure 2-3  Replicate and State Transitions
2.3.2 Separate and State Transitions

When Separate is performed, the difference between MV and RV at the start of Separate is reflected into the RV to separate it. No updates made in MV after Separate is performed are reflected in RV.

If there is any differences between MV at the start of Separate and RV after the Separate, data will be copied to the RV to reflect all the updates made in the MV before the start of the Separate into the RV. The state from the beginning of Separate until all the data stored in MV at the beginning of the Separate is completely reflected into RV is called “Separate execution”. The state where all the updates made in MV are reflected into RV is called the state of “Separated by Separate” or “Separated (separated)”. When a large-capacity volume or low-speed line is used, the Separate preparing state temporarily appears before the Separate execution state. The states of “Separate preparing”, “Separate execution” and “Separated” are collectively called “Separate”.

When Separate is performed with immediate use of RV specified (Separate (immediate)), the data in RV can be referred to or updated immediately after the Separate start, even if all the data in MV is not reflected into the RV. This feature is implemented by the following copy control function:

If an update/reference request is given for an RV area where the difference between MV and RV is not completely copied yet, the copying will be completed before the access to the area is permitted.

In RV, data updated in MV before the start of Separate is reflected. Though updates made in MV after the start of Separate will not be reflected in RV, the data will be managed as differences made in the update.

While under the state of “Separate”, the update states of MV and RV are managed so that differences made during Replicate/Restore will be reflected.

Figure 2-4 Separate and State Transitions
2.3.3 Restore and State Transitions

When Restore starts, data copy from RV to MV starts to reflect the data stored in the RV at the start of Restore into the MV. When Restore (update) is performed, updates made in MV after Restore are reflected in RV.

After Restore starts, the difference between MV and RV is gradually reduced and eventually all the data stored in the RV at the start of the Restore is reflected into the MV (no differences). The state from the beginning of Restore until the data in RV is completely reflected into MV is called “Restore execution”. The state where the difference between MV and RV is zero is called the state synchronized by Restore, or simply the “sync” (sync). When a large-capacity volume or low-speed line is used, the Restore preparing state temporarily appears before the Restore execution state. The states of “Restore preparing”, “Restore execution” and “Synchronized by Restore” are collectively called “Restore”.

When Restore (protect) is performed, updates made in MV are not reflected into RV. In this case, the information about updates made in MV is managed as the difference between MV and RV so that the difference will be reflected at subsequent Replicate/Restore. After Restore (protect) is performed, the state of “Synchronized (sync)” automatically changes to “Separated (separated)”. When referring to the data in MV with Restore performed, the user can refer to RV data immediately after the start of Restore even if all the RV data is not reflected into the MV. This feature is implemented by obtaining data from RV when an area where the difference between RV and MV is not completely copied needs to be accessed upon request for reference to the MV.

![Figure 2-5  Restore and State Transitions](image)
Chapter 2  Data Replication Function

2.3.4 Activity and Synchronous State

In data replication, states such as Replicate, Restore, and Separate are called “Activity State” or simply "activity".

Also, states such as “execution” indicating state transition and "state transition completed" are called “synchronous state (Sync State)".

Table 2-1 lists the activity and synchronous states which transit when each replication operation is performed.

For information about how to handle access to MV and RV under each activity state, see 2.6 “Access Restriction for RV”.

Table 2-1  Activity and Sync states

<table>
<thead>
<tr>
<th>Activity</th>
<th>Sync</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate</td>
<td>Preparing</td>
<td>State in which Separate is prepared</td>
</tr>
<tr>
<td></td>
<td>(sep/preparing)</td>
<td>This state temporarily appears on MV when a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>large-capacity volume or low-speed line is used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In principle, read and write in RV are not allowed.</td>
</tr>
<tr>
<td></td>
<td>Execution</td>
<td>Temporary state until the difference between MV and RV become zero</td>
</tr>
<tr>
<td></td>
<td>(sep/exec)</td>
<td>after Separate is performed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>As a rule, read and write to RV are not allowed.</td>
</tr>
<tr>
<td>Separated</td>
<td></td>
<td>Data copy between MV and RV is not performed. This</td>
</tr>
<tr>
<td></td>
<td></td>
<td>state occurs immediately after a pair is set.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In general, read and write in RV are allowed.</td>
</tr>
<tr>
<td>Forced Separate</td>
<td></td>
<td>MV and RV are forcibly separated by Forced Separate.</td>
</tr>
<tr>
<td></td>
<td>(cancel)</td>
<td>Read and write in RV are allowed.</td>
</tr>
<tr>
<td>Failure Separation</td>
<td></td>
<td>MV and RV are forcibly separated in a disk array due to</td>
</tr>
<tr>
<td></td>
<td>(fault)</td>
<td>a copy failure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Read and write to RV are allowed.</td>
</tr>
<tr>
<td>Replicate</td>
<td>Preparing</td>
<td>State in which preparations for Replicate are being made</td>
</tr>
<tr>
<td></td>
<td>(rpl/preparing)</td>
<td>This state temporarily appears on MV when a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>large-capacity volume or low-speed line is used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>As a rule, read and write to RV are not allowed.</td>
</tr>
<tr>
<td>Replicate</td>
<td>Execution</td>
<td>Difference between MV/RV at the start of Replicate is not completely</td>
</tr>
<tr>
<td></td>
<td>(rpl/exec)</td>
<td>reflected (the difference is reflected from MV to RV).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Updates in MV are reflected into RV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>As a rule, read and write to RV are not allowed.</td>
</tr>
<tr>
<td>Sync</td>
<td></td>
<td>Difference between MV/RV at the start of Replicate is completely</td>
</tr>
<tr>
<td></td>
<td>(rpl/sync)</td>
<td>reflected.</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>Activity</td>
<td>Sync</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Restore State</td>
<td>Restore Preparing (rst/ preparing)</td>
<td>• State in which preparations for Restore are being made&lt;br&gt;• This state temporarily appears on MV when a large-capacity volume or low-speed line is used.&lt;br&gt;• As a rule, read and write to RV are not allowed.</td>
</tr>
<tr>
<td></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).&lt;br&gt;• When Restore (update) is performed, the updates made in MV are reflected into RV.&lt;br&gt;• When Restore (update) is performed, the updates made in MV are not reflected into RV.&lt;br&gt;• As a rule, read and write to RV are not allowed.</td>
</tr>
<tr>
<td></td>
<td>sync (rst/sync)</td>
<td>• Reflection of the difference between MV and RV at Restore has been completed.&lt;br&gt;• When Restore(update) is executed, the updated data of the MV is reflected into the RV.&lt;br&gt;• When Restore (protect) is performed, the state automatically changes to “Separated&quot; without reflecting updates in MV into RV.&lt;br&gt;• As a rule, read and write to RV are not allowed.</td>
</tr>
</tbody>
</table>
2.4 Copy Control

If an activity between volumes set as a pair is Replicate or Restore, you can change the method for copying data between MV and RV according to the status of the load on the disk array. A state that changes on the instruction to change a copy method is called “Copy Control State”.

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

- **Copy for reflecting difference**
  Copy to reflect data in MV at the start of Replicate (or RV at the start of Restore) into RV (MV for Restore).

- **Copy for reflecting updates made in MV into RV**
  Copy to reflect updates made in MV into RV after Replicate or Restore is performed. However, if Restore (protect) is performed, updates made in MV are not reflected into RV.

You can change a copy method and state by changing the copy control state. The following Table 2-2 lists the copy states included in copy control states:

<table>
<thead>
<tr>
<th>Copy Control State</th>
<th>Copy State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreground Copy</td>
<td>• Copy for reflecting difference is performed.</td>
</tr>
<tr>
<td></td>
<td>• Updates made in MV are reflected into RV sequentially.</td>
</tr>
<tr>
<td></td>
<td>Figure 2-6 shows an overview of foreground copy (synchronous copy mode).</td>
</tr>
<tr>
<td>Synchronous Copy Mode</td>
<td>• Copy for reflecting difference is performed.</td>
</tr>
<tr>
<td></td>
<td>• The I/O of updates made in MV is completed when the data is written into the MV. Immediately after that, the data is copied to RV.</td>
</tr>
<tr>
<td></td>
<td>• Can be set for a RemoteDataReplication pair.</td>
</tr>
<tr>
<td></td>
<td>Figure 2-7 shows an overview of foreground copy (semi-synchronous copy mode).</td>
</tr>
<tr>
<td>Semi-synchronous Copy Mode</td>
<td>• Copy for reflecting difference is performed.</td>
</tr>
<tr>
<td></td>
<td>• The I/O of updates made in MV is completed when the data is written into the MV. The data is copied to RV asynchronously with updating into the MV. The interval of the copy to RV (background copy level) can be set on a disk array basis. Figure 2-8 shows an overview of background copy mode.</td>
</tr>
<tr>
<td>Background Copy</td>
<td>• Copy for reflecting difference is performed.</td>
</tr>
<tr>
<td>-</td>
<td>• The I/O of updates made in MV is completed when the data are written into the MV. The data is accumulated as the difference information. Reflection in RV is not performed.</td>
</tr>
<tr>
<td>Suspend</td>
<td>• Copy for reflecting difference is not performed.</td>
</tr>
<tr>
<td>Suspend</td>
<td>• The I/O of updates made in MV is completed when the data are written into the MV. The data is accumulated as the difference information. Reflection in RV is not performed.</td>
</tr>
</tbody>
</table>
Suspend due to Failure

- Forcibly suspended in a disk array due to a copy failure.
- Copy for reflecting difference is not performed.
- The I/O of updates made in MV is completed when the data are written into the MV. The data is accumulated as the difference information. Reflection in RV is not performed.

<table>
<thead>
<tr>
<th>Copy Control State</th>
<th>Copy State</th>
</tr>
</thead>
</table>
| Suspend due to Failure | - Forcibly suspended in a disk array due to a copy failure.  
- Copy for reflecting difference is not performed.  
- The I/O of updates made in MV is completed when the data are written into the MV. The data is accumulated as the difference information. Reflection in RV is not performed. |
Figure 2-6 shows an overview of foreground copy (synchronous copy mode).

When MV and RV Are in the Same Disk Array

- (i) Writes the updated data for MV into the cache reserved for the MV.
- (ii) Writes the difference data to be copied from the cache reserved for the MV to RV into the cache reserved for the RV.
- (iii) Notifies that I/O is completed.
- (iv) Sends the updated data written into the cache to the MV and the RV.

When MV and RV Are in Different Disk Arrays

- (i) Writes the updated data for MV into the cache A.
- (ii) Writes the difference data to be copied from the cache A to RV into the cache B.
- (iii) Notifies that I/O is completed.
- (iv) Sends the updated data written into the cache to the MV and the RV.

Figure 2-6 Overview of Foreground Copy (Synchronous Copy Mode)
Figure 2-7 shows an overview of foreground copy (semi synchronous copy mode).

(i)  Writes the updated data for MV into the cache A.
(ii)  Notifies that I/O is completed.
(iii) Writes the difference data to be copied from the cache A to RV into the cache B.
(iv)  Reflects the updated data written in the caches of MV and RV into the MV and the RV.

Figure 2-7  Overview of Foreground Copy (Semi-synchronous Copy Mode)

The difference information is copied from the cache A to B.
The data updated in MV is copied to RV.

Figure 2-8 shows an overview of background copy mode.
The I/O of updates made in MV is completed at the same time as the data is written into the MV and the difference information is accumulated. The accumulated difference information is copied to the RV in the background asynchronously with the updating of the MV, according to the interval of the copy to the RV (background copy level).
When MV and RV Are in the Same Disk Array

(i) Writes the updated data for MV into the cache reserved for the MV.
(ii) Notifies that I/O is completed.
(iii) Writes into MV. The data is accumulated as the difference information.
(iv) Reads the accumulated information from the MV and writes the information into the cache reserved for the MV.
(v) Copies the difference information from the cache reserved for the MV to the cache reserved for the RV.
(vi) Copies the data updated in the MV into the RV.

When MV and RV Are in Different Disk Arrays

(i) Writes the updated data to MV on cache A. The data is accumulated as the difference information.
(ii) Notifies that I/O is completed.
(iii) Writes into MV.
(iv) Reads the accumulated difference information from the MV and writes the information into the cache A.
(v) Copies the difference information from the cache A to the cache B.
(vi) Copies the data updated onto the RV.

Figure 2-8  Overview of Background Copy Mode
An interval of copy to RV (background copy level) is indicated by a numerical value between 1 and 5. A larger value has a higher priority for copy processing. The recommended value for disk arrays is level 3.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Even when the load on a disk array is low or no I/O occurs, copy will have the lowest priority level. Note that when you set this level, it may take time to complete copy under this level.</td>
</tr>
<tr>
<td>2 to 4</td>
<td>The priority for copy is automatically adjusted depending on the load on disk arrays or the influence on I/O. If the load on a disk array is high or the amount of I/O data per unit time is large, the priority for copy will be lowered to the level 1 or equivalent. Conversely, if the load on a disk array is low or the amount of I/O data per unit time is small, the priority for copy will be raised to the level 5 or equivalent.</td>
</tr>
<tr>
<td>5</td>
<td>Copy has the highest priority regardless of the load on a disk array or the influence on I/O. Note that when you set this level, it may degrade the I/O performance.</td>
</tr>
</tbody>
</table>

Copy control can be specified when Replicate or Restore is performed. The copy control specified at Replicate or Restore can be changed as required.

When Restore with RV protection specified is performed, only copy for reflecting difference is performed, while updates in MV is not reflected in RV. Therefore, specifying or changing a copy control (Synchronous Copy Mode, Semi-synchronous Copy Mode, or Background Copy) has no effect.

There are the following five instructions to change a copy control:

- Synchronous Copy instruction
- Semi-synchronous Copy instruction
- Resume instruction
- Background Copy instruction
- Suspend instruction

Giving the Resume instruction changes Background Copy or Suspend to a specified copy control (Synchronous Copy Mode, Semi-synchronous Copy Mode, or Background Copy).

Figure 2-9 shows the state transition diagram of copy controls.
Figure 2-9 State Transition Diagram of Copy Controls

* Semi-synchronous Copy Mode can only be used for a RemoteDataReplication pair
2.5 Relationship between Copy Performance and Copy Control

If the state of copy control is set to Synchronized Copy, the difference between MV and RV will not be accumulated because updates made in the MV are immediately sent to RV. However, it takes extra time to write into the MV because it waits for reflection of the updates to RV.

If the state of copy control is set to Suspend, the difference between MV and RV will be accumulated because the updates made in the MV will not be reflected in the RV. The time to write into the MV is the same as normal I/O.

As described above, states of copy control are related to the amount of the accumulated differences between MV and RV and writing performance. Table 2-4 shows how copy controls are related to the difference between MV and RV and writing performance.

<table>
<thead>
<tr>
<th>Copy Control</th>
<th>Difference between MV and RV</th>
<th>Writing Overhead for MV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreground (Synchronous)</td>
<td>Small</td>
<td>High</td>
</tr>
<tr>
<td>Foreground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Semi-synchronous)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Background</td>
<td>Large</td>
<td>Low</td>
</tr>
<tr>
<td>Suspend</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If the difference between MV and RV is large under the state of Replicate, the processing time required for Separate will be increased. Therefore, it is recommended to select a copy control which makes the difference between MV and RV smaller for a system where business operations cannot be interrupted for a long period of time. Also, for a system where the performance of writing into MV needs to be maintained or improved, it is recommended to select a copy control that requires no writing overhead for MV.
2.6 Access Restriction for RV

Under the state of Replicate or Restore, MV is synchronized with RV to allow the data in the MV to be consistent with the data in the RV. However, RV may become inconsistent with others because the reflection of the difference between MV and RV is performed in a disk array independently of the operating system or file system. Therefore, the data replication function has no restrictions on access to MV so that MV can always be referred or updated. On the contrary, access restrictions can be set for each activity state for RV to prevent malfunctions.

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

<table>
<thead>
<tr>
<th>Access Restriction</th>
<th>Description</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read/Write (RW)</td>
<td>Read from/write into RV is enabled.</td>
<td>rpl: -</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rst: -</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sep/exec: Note 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>separated: ✓</td>
</tr>
<tr>
<td>Read Only (RO)</td>
<td>Read from RV is only enabled.</td>
<td>rpl: ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rst: ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sep/exec: ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>separated: ✓</td>
</tr>
<tr>
<td>Not Ready (NR)</td>
<td>Read from/write into RV is disabled.</td>
<td>rpl: ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rst: ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sep/exec: ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>separated: -</td>
</tr>
<tr>
<td>Not Available (NA)</td>
<td>Operating system cannot recognize RV, or LU (Logical Unit) is invalid.</td>
<td>rpl: ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rst: ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sep/exec: ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>separated: ✓</td>
</tr>
</tbody>
</table>

 ✓: Available ✓*: Available with administrative restrictions -: Unavailable

rpl: Replicate state rw: Read/Write
rst: Restore state  ro: Read Only
sep/exec: Separate execution
separated: Separated state
na: Not Available

Note 1: When Separate(immediate) is performed, “Read/Write (RW)” is set even if Separate is performed. In this case, note the following:
1. Because data is copied from MV to RV while Separate is performed, the I/O performance may be degraded if I/O load on the RV is high.

Note 2: You can set “Read Only (RO)” for RV under the state of Replicate, Restore, or Separate execution. In this case, note the following.
1. Before referring to RV under the state of Replicate or Restore, make sure that no updates are made in MV.
2. While an update is made in MV, I/O processing is performed in a disk through the operating system control such as file system. Even if the application has completed the update in the disk, the update in MV may have not been completed. Reflection of updates into RV is performed in a disk array independently of the operating system.

Therefore, RV which is inconsistent with others cannot be referred to in general. Set “Read Only (RO)” only when consistency is assured by the operation.
Note 3: To set “Read Only (RO)” for RV for which Separate is completed, note the following:

<For Windows>
1. If NTFS is used as a file system, you cannot refer to RV.
2. If FAT16 or FAT32 is used as a file system, use a mount command of disk control operation commands or start [Disk Management] (Windows) to associate the file system with the drive.
3. If FAT16 or FAT32 is used as a file system, writing into RV will cause an error. Therefore, do not use any application that automatically writes into a drive. [Disk Management] (Windows) cannot be used for performing operations that require writing into RV (change of partition configuration, etc.).

<For UNIX>
To mount a file system, specify “read only”.

Note 4: The Volume Shadow copy Service (VSS) automatically controls the transition to the state of “Not Available (NA)” because Not Available is valid when the VSS is used. A user need not perform this operation in general.

Note 5: When using a volume, check the protection access right for the volume.

2.7 Copy Failures and State Transitions

If copy between MV and RV is not successfully performed due to a connection failure between them, the state may change to one of the following depending on the timing or the type of the failure:

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

• Suspend due to failure (abnormal suspend)
  Forcibly suspended in a disk array due to a copy failure in the state of Replicate or Restore. Copy between MV and RV is suspended.
  To cancel the Suspend due to a failure, remove the cause of the copy failure to give an instruction to change the state of copy control as same as when cancelling the normal state of Suspend (refer to 2.4 “Copy Control”).
If the power of a disk array is turned off for maintenance, etc., access to the disk array will be disabled and copy of a volume paired with another volume in the disk array will not be continued. In this case, the data replication function of the disk array stops replication operations of the whole disk array.

Freezing of replication operations for the disk array due to power down of the disk array is called freezing of disk array and the state is called frozen disk array.

When a disk array is frozen, replication between paired volumes in the disk array are suspended, with the result that the copy control of the pair becomes frozen.

When a pair is frozen, a new replication operation cannot be performed. For a frozen pair, note the following:

- **Frozen in Separate**
  If the following operation is performed for a pair that became frozen during Separate execution, the state of the pair will change to Separate due to failure (failure separation):
  <When an update is made in an MV area where copy to RV is not completed>
  To use the RV after the pair is defrozen, perform Replicate again to copy the data then perform Separate.

- **Frozen in Replicate**
  If a pair is frozen in the Replicate state, copy between MV and RV will be suspended. Copy is automatically resumed when the pair is defrozen.

- **Frozen in Restore**
  If a pair is frozen during Restore and an area where copy from RV to MV is not completed is referenced or updated, I/O will terminate abnormally.
  If a pair is frozen after Restore is completed, copy between MV and RV will be stopped.
  Copy is automatically resumed when the pair is defrozen.
To perform a replication operation, you must set a pair beforehand.

To set a pair, set a source volume as MV and a destination volume as RV. By installing RemoteDataReplication, you can set another pair including MV that has been set as RV, allowing a serial configuration.

Pairs can be set as follows:

- MV and RV that will be paired must have the same volume capacity and OS type.
- Up to three dRVs or up to four RVs including rRV can be set simultaneously for one MV.
- DynamicDataReplication can set only one level for pair setting in a disk array. Two or more levels (serial configuration) cannot be set for pair setting in the same disk array.
- By installing RemoteDataReplication, you can set two or more levels (serial configuration) for pair setting in different disk arrays. Also, DynamicDataReplication and RemoteDataReplication pairs can be mixed in a configuration.

Figure 2-10 shows an example of pair configurations.

For more details of pair setting such as conditions for pair setting, refer to 3.3.1 “Pair Setting/Unpair” and 4.8.2 “Pair/Unpair Command”. For details of pair setting when RemoteDataReplication Asynchronous is installed, refer to 2.13 “RemoteDataReplication Asynchronous”.

---

**Figure 2-10  Example of Pair Configurations**

For more details of pair setting such as conditions for pair setting, refer to 3.3.1 “Pair Setting/Unpair” and 4.8.2 “Pair/Unpair Command”. For details of pair setting when RemoteDataReplication Asynchronous is installed, refer to 2.13 “RemoteDataReplication Asynchronous”.
2.10 Swap Function for RDR Pair

This function swaps the roles of MV and RV in an RDR pair.

Conventionally, to exchange roles in a pair, the pair is canceled to set another pair with the roles (MV and RV) switched. However, this requires a full copy at the first replication, which increases the time required as well as traffic on the line depending on the RDR line. In addition, MV data redundancy by RV is not ensured until this replication is completed.

With the swap function for RDR pairs, you can immediately swap the roles of MV and RV to prevent a full copy from being performed at the subsequent replication, ensuring the MV data redundancy by RV.

The following disk arrays support the swap function:
- D3 series, D4 series, and D8 series

The following product is required to use the swap function.
- RemoteDataReplication Ver3 or later

The swap operations for RDR pairs contain the RDR pair swap operation for exchanging roles of MV and RV and the forced cancellation of update prevention that is used for recovery from a failure.

2.10.1 Swap Operation for RDR Pair

This operation swaps the roles of MV and RV in an RDR pair.

This operation is used for exchanging the roles of MV and RV when the roles of master server and backup server are exchanged at failure. While a swap is performed in an RDR pair, the state of MV and RV temporarily becomes update prevention state (Prevent) and operations that require data updates in the MV and RV cannot be performed. Therefore, unmount MV and RV from the server before performing this operation.

Commands are used for performing this operation. For details about the conditions for using the commands, etc., refer to 4.8.3 “Pair Swap Command”.

2.10.2 Cancellation of Update Prevention

If a swap operation in an RDR pair is interrupted due to a failure, recovery from the failure will be required.

This operation is used for forcibly canceling the update prevention state set for MV and RV before performing recovery operation. By performing this operation, you can cancel the update prevention state to enable read from/write into the MV and RV. Perform this operation only for making recovery from a failure.

Commands are used on a screen for performing this operation. For details about the conditions for using the commands, etc., refer to 3.3.10 “Forced Cancellation of Update Prevention” and 4.7.9 “Command for Canceling Update Prevention”.
2.10.3 Swap in RDR Pair and State Transition

Start swapping in an RDR pair when the MV and RV are under the state of Replicate synchronous. When a swap starts in a pair, the state of MV and RV becomes update prevention state to prevent data updates in the MV and RV. Then, the pair is separated and the roles of MV and RV are swapped. Finally, the update prevention state set for the MV and RV is canceled. Commands are used on a screen for displaying the update prevention state. For more details, refer to 3.2.3 “Replication Information Screen” and 4.7.7 “Specific Volume Information Display Command”.

![Figure 2-11 Swap in RDR Pair and State Transition](image)
2.11 Large-capacity Volume Larger Than 2 TB

The capacity of volumes to be paired for data replication has an upper limit. This capacity is called Maximum Capacity of Volume to be Paired, which differs depending on the disk array.

- Volumes with a capacity of less than 2 TB can be paired in all disk arrays that support the data replication function.
- For a large-capacity volume of which capacity is 2 TB or more, in a disk array with Maximum Capacity of Volume to be Paired of 2 TB or more, volumes not exceeding the maximum volume capacity can be paired for DDR or RDR.
- For RDR, each disk array has an upper limit of Maximum Capacity of Volume to be Paired. The smaller capacity is set as the maximum capacity of volumes that can be paired.
- The Maximum Capacity of Volume to be Paired is displayed in the field of disk array properties on the Replication Information window of Replication Manager. It can also be displayed by using the iSMrc_arrayinfo command of ReplicationControl.

Before using a large-capacity volume larger than 2 TB, check whether the OS, volume manager, and file system support the volume.

For example, on Windows, you can use a large-capacity volume larger than 2 TB by following the procedure below.

Initialize the volume as a basic disk with GPT partition format on Windows. Because of this, specify “WG” which indicates the GPT format for Windows for “Type” when binding logical disks. Set the ReplicationControl operation configuration file on the application server to allow usage of the GPT disk. Because signature control using the iSMrc_signature command is unavailable for a partition disk with GPT format, MV and RV should be mounted on different servers.

For more details, refer to the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” and “ControlCommand Command Reference”.

For Linux, you can use a large-capacity volume larger than 2 TB by using a disk with GPT partition format. However, MV and RV must be mounted on different servers.
2.12 Low-speed Line

2.12.1 Using Low-speed Line

The mode in which a low-speed line or line with no bandwidth guaranteed (best-effort line) is used to link disk arrays for RDR is called low-speed line operation.

Whether a line is treated as a low-speed line is determined depending on the line speed specified at link setting on the basis of the standard listed in the table below.

The speed (that is, link mode) is displayed in [Link Mode] in the properties on the Disk Array LINK Information window of Replication Manager or by using the iSMrc_arrayinfo command of ReplicationControl.

<table>
<thead>
<tr>
<th>Link line speed</th>
<th>Treated as</th>
<th>[Link Mode] display</th>
</tr>
</thead>
<tbody>
<tr>
<td>The line speed is 30 Mbps or more, and the bandwidth is guaranteed.</td>
<td>-</td>
<td>Normal</td>
</tr>
<tr>
<td>The line speed is 10 Mbps or more and less than 30 Mbps, and the bandwidth is guaranteed.</td>
<td>Low-speed line</td>
<td>Low</td>
</tr>
<tr>
<td>The line speed is 10 Mbps or more and no bandwidth is guaranteed. (Best-effort line)</td>
<td>Low-speed line</td>
<td>Low</td>
</tr>
<tr>
<td>The line speed is less than 10 Mbps. (Not supported because of insufficient speed)</td>
<td>(Not supported because of insufficient speed)</td>
<td>Low</td>
</tr>
</tbody>
</table>

For a low-speed line, the system configuration and operation must be configured so that the data traffic will be small per unit of time.

- For original and target volumes for RDR, use disk arrays which support low-speed lines.
- Specify Background Copy.
- If a volume accessed in operation is directly replicated using a low-speed line, Background Copy may stop due to a link failure (when application data is written to MV during separation and a link failure occurs concurrently). Also the operation suspension time becomes longer because the transition time from the start of replication to the completion of separation is long. It is recommended to use a pair environment with a low-speed line that is achieved by using RV of DDR for the source disk array.

![Figure 2-12 Using DDR Together](image)

For more information, refer to the user's guide.
• It takes time from the start of replication to the completion of separation. In the meantime, data in the
RDR RV is left undetermined. So, back up RV by using DDR or in a tape as needed.
• Do not access MV while restoration is ongoing because access delay is long.
• To reduce the load, select the [Don’t update periodically] check box on the Replication Information
window. When this radio button is checked, to obtain the latest pair information during operation, select
[Refresh] from the menu on the Replication Management window or press the [F5] key. In the case of the
Connection window, click the [Refresh] button or press the [F5] key. After the latest information is
obtained, the transfer rate and remaining copy time are reported on the Connection window.
• If the ControlCommand function is used for operating a disk array at a remote site with remote operation,
the amount of data passing through a line will be increased. Perform operations from the server at the
same site as for the disk array whenever possible.

2.12.2 Notes on Using Best-effort Line

To use a best-effort line to link disk arrays for RDR, note the following features of this type of line to plan
operation based on them.

• The line bandwidth in the contract indicates the maximum speed. Test it in your environment to check the
transfer speed actually achieved. Use a line of which performance is 10 Mbps or more.
• The performance may vary depending on seasons or time of day.
  - Influence of neighboring heavy users (bandwidth reduction, and occurrences of delay and variation in
    performance)
  - Line delay (significant delay in response time)
For this reason, copy operation may not be completed within the expected time depending on the season or
time of day.
Take these variations into account when planning the system operation.

There is no guarantee against line failures such as accidental line disconnection, instantaneous interruption,
and poor line quality (increase in packet loss). When a line failure occurs, disk array link operation acts as
follows:
• If a line error or line bandwidth reduction is detected, the link state transits to the failure state (checking or
  Fault state). While background copy is performed, the copy operation is temporarily stopped and restarted
after recovery. The completion of the copy operation is delayed because the operation is temporarily
stopped.
• A newly started RDR operation results in an error while the link is in the failure state. Depending on a line
  error occurrence timing, an error may occur during iSM RDR pair monitoring or setting and disk
  monitoring may temporarily be stopped. In this case, maintenance notification (such as an ALIVE
  notification) is made following the monitoring stop.
If there is a problem with the line quality, consider selecting a different line or use of a WAN accelerator.

The operation of the ReplicationControl commands (iSMrc_replicate, iSMrc_resotre, iSMrc_separate, iSMrc_query, iSM rc_wait with IOPATH=DIRECT specified) can be continued by performing a retry operation inside the command, assuming that the line is automatically recovered when a failure occurs on a low-speed line. For more details, refer to the description of “Retry control for RDR on low-speed line” in Chapter 8 “Operation Settings” of “ControlCommand Command Reference”.
RemoteDataReplication Asynchronous is provided for users who transfer data between disk arrays or operate small remote data replication.

Functions of RemoteDataReplication Asynchronous are the same as RemoteDataReplication except for the following restrictions:

<table>
<thead>
<tr>
<th>Function</th>
<th>RemoteDataReplication</th>
<th>RemoteDataReplication Asynchronous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of RDR pairs that can be set for one logical disk (parallel RDR pair configuration)</td>
<td>Up to 4</td>
<td>1 (A DDR pair can be set for the same logical disk.)</td>
</tr>
<tr>
<td>Multilevel configuration consisting of upper and lower RDR pairs for one logical disk (serial RDR pair configuration)</td>
<td>Possible</td>
<td>Impossible (DDR and RDR pairs can be configured serially.)</td>
</tr>
<tr>
<td>Large-capacity volume</td>
<td>Available</td>
<td>Unavailable</td>
</tr>
<tr>
<td>Replicate copy mode</td>
<td>Foreground Copy</td>
<td>Background Copy only</td>
</tr>
<tr>
<td>RemoteDataReplication/Disaster Recovery</td>
<td>Available</td>
<td>Unavailable</td>
</tr>
</tbody>
</table>

A RDR pair set with RemoteDataReplication Asynchronous is the same as RemoteDataReplication. For this reason, a pair set with RemoteDataReplication Asynchronous can be used without modifications if the product is changed to RemoteDataReplication.

An RDR pair can be set between a disk array on which RemoteDataReplication is installed and another disk array on which RemoteDataReplication Asynchronous is installed. For this pair, however, the restrictions on RemoteDataReplication Asynchronous are applied.

For RemoteDataReplication Asynchronous, Replication Management windows can be operated only from the iSM Client (Web GUI).
2.14 Restrictions on Operation

Restrictions on operations of data replication are described below.

2.14.1 Restrictions by Configuration Setting Operation Guard

The configuration setting operation guard function prevents incorrect configuration changes made by a user's wrong operation. You can set this function using the LD Administrator function of the iSM.

If a logical disk is locked by the configuration setting operation guard, the operation restrictions listed below will be applied.

For more details about configuration setting operation guard, refer to the “LD Administrator User's Manual”.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair setting</td>
<td>If either of logical disks (MV and RV) to be paired (candidate) is locked, operation cannot be performed.</td>
</tr>
<tr>
<td>Unpairing</td>
<td>If either of logical disks (MV and RV) to be unpaired is locked, operation cannot be performed.</td>
</tr>
<tr>
<td>Forced unpair</td>
<td>When the user wants to unpair the MV side forcibly and the logical disk of the target MV is in the locked state, operation cannot be executed.</td>
</tr>
<tr>
<td></td>
<td>MV cannot be forcibly unpaired if the logical disk of the MV is locked.</td>
</tr>
</tbody>
</table>

2.14.2 Restrictions by Data Retention Function

The data retention function is used for preventing unauthorized data modification or data corruption by incorrect operations. With this function, you can set access restrictions (ReadOnly/NotAccessible) on a logical disk basis.

The restrictions listed below are imposed when a logical disk is protected by the data retention function.

For more details about the data retention function, refer to the “Data Retention User's Manual”.

Table 2-9  Operation Restrictions by Data Retention Function

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replicate</td>
<td>Replicate cannot be performed for a pair in which the logical disk of the MV is NotAccessible or the logical disk of the RV is protected (ReadOnly or NotAccessible). Operation restrictions for Replicate are shown in Table 2-10.</td>
</tr>
<tr>
<td>Restore(update)</td>
<td>Restore cannot be performed for a pair in which the logical disk of the MV or RV is protected (ReadOnly or NotAccessible). Operation restrictions for Restore are shown in Table 2-10.</td>
</tr>
<tr>
<td>Restore(protect)</td>
<td>Restore cannot be performed for a pair in which the logical disk of the MV is protected (ReadOnly or NotAccessible) or the logical disk of the RV is NotAccessible. Operation restrictions for Restore are shown in Table 2-10.</td>
</tr>
<tr>
<td>ATgroup building</td>
<td>A pair in which the logical disk of the MV or RV is protected (ReadOnly or NotAccessible) cannot be registered with an AT group.</td>
</tr>
</tbody>
</table>

Table 2-10  Operation Restrictions for Replicate and Restore

<table>
<thead>
<tr>
<th>Protection Mode</th>
<th>MV</th>
<th>RV</th>
<th>Replicate</th>
<th>Restore(update)</th>
<th>Restore(protect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal state</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>RO</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RO</td>
<td>✓</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RO</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Normal state</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RO</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

✓ : Available
- : Not available

RO: ReadOnly
NA: NotAccessible
### 2.14.3 Restrictions by Power Saving Function

The power saving function reduces power consumption by operating a pool including a volume only when necessary, depending on the use of the volume.

The restrictions listed below are imposed when a logical disk or a pool including a logical disk is stopped by the power saving function. For more details about the power saving function, refer to the “Power Saving User’s Manual”.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair setting</td>
<td>If the pool including either of logical disks (MV and RV) to be paired (candidate) is stopped, operation cannot be performed.</td>
</tr>
<tr>
<td>Unpairing</td>
<td>If the pool including either of logical disks (MV and RV) to be unpaired is stopped, operation cannot be performed.</td>
</tr>
<tr>
<td>Forced unpair</td>
<td>An MV cannot be forcibly unpaired if the pool including the logical disk of MV is stopped. When the user wants to forcibly unpair the RV side, if the pool to which the logical disk of the target RV belongs is in the rotation stop state, operation cannot be executed.</td>
</tr>
<tr>
<td>Replicate</td>
<td>Replicate cannot be performed for a pair in which the logical disk of MV or RV is not used or the pool including the logical disk is stopped.</td>
</tr>
<tr>
<td>Replicate</td>
<td>Restore cannot be executed for a pair containing MV or RV whose logical disk is in the not in use state or the pool to which the logical disk belongs is in the rotation stop state.</td>
</tr>
<tr>
<td>Separate</td>
<td>Separate cannot be executed for a pair containing MV or RV whose logical disk is in the not in use state or the pool to which the logical disk belongs is in the rotation stop state.</td>
</tr>
<tr>
<td>Forced separate</td>
<td>MV cannot be forcibly separated if the logical disk of the MV is not used or the pool with the logical disk of the MV is stopped. Forced separate cannot be executed on the RV side if the logical disk of the target RV is in the not in use state or the pool to which the logical disk belongs is in the rotation stop state.</td>
</tr>
<tr>
<td>Change of copy control of pair</td>
<td>The copy control of a pair in which the logical disk of the MV or RV is not used or the pool including the logical disk is stopped cannot be changed.</td>
</tr>
</tbody>
</table>
2.14.4 Operation of Partitioning Function

The partitioning function is used to divide disk-array resources (disks, cache memories, and ports) into logical units such as tasks to create and manage virtual storages (VSPAR: Virtual Storage Partition) that have independent resources.

In the partitioning function, the virtual storage is called partition.

A user who operates and manages specific partitions is called partition administrative user. The partition administrative user is authorized by a storage administrative user (user who operates and manages the entire disk array) to operate specific partitions. Partition administrative users have the same user levels as storage administrative users. Depending on the level, a partition administrative user can perform one of the following types of operation:

- L1: Only reference
- L2: Administrative operations related to replication (copy)
- L3: All operations

The operation restrictions listed below are imposed depending on the authority given to a partition administrative user. For more details about the partitioning function, refer to the “Partitioning User’s Manual”.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair setting</td>
<td>User must be authorized to manage the partition where MV and RV to be paired belong to perform pair settings.</td>
</tr>
<tr>
<td>Unpairing</td>
<td>User must be authorized to manage the partition where MV and RV to be unpaired belong to perform pair settings.</td>
</tr>
<tr>
<td>Forced unpair</td>
<td>User must be authorized to manage the partition where MV and RV belong to perform Forced Unpair.</td>
</tr>
<tr>
<td>Replicate</td>
<td>Replicate cannot be executed if the authority for the partition to which the MV or RV belongs is not given.</td>
</tr>
<tr>
<td>Restore</td>
<td>Restore cannot be executed if the authority for the partition to which the MV or RV belongs is not given.</td>
</tr>
<tr>
<td>Separate</td>
<td>Separate cannot be executed if the authority for the partition to which the MV or RV belongs is not given.</td>
</tr>
<tr>
<td>Forced separate</td>
<td>Forced separate cannot be executed if the authority for the partition to which the MV or RV belongs is not given.</td>
</tr>
<tr>
<td>Forced Cancellation of Update Prevention</td>
<td>User must be authorized to manage the partition where MV and RV belong to forcibly cancel update prevention.</td>
</tr>
<tr>
<td>Change of copy control of pair</td>
<td>The copy control cannot be changed if the authority for the partition to which the MV or RV belongs is not given.</td>
</tr>
<tr>
<td>RV mode change</td>
<td>The RV mode cannot be changed if the authority for the partition to which the MV or RV belongs is not given.</td>
</tr>
<tr>
<td>Freeze/defreeze</td>
<td>Freeze/defreeze cannot be performed.</td>
</tr>
<tr>
<td>Change of background copy level</td>
<td>The background copy level cannot be changed.</td>
</tr>
</tbody>
</table>
Note the following when using the partitioning function depending on the environment:

- When using the partitioning function for a pair connected by RemoteDataReplication that has a remote disk array managed by a different iSM, you must set user definition and authority for each iSM server. In this case, if the remote volume is MV, restrictions will be imposed on the operations from RV because the MV is not managed by the iSM server. The restrictions will also be applied if the partitioning function is used.

### 2.14.5 Use of iSCSI

If the connection protocol between the server and disk array is FC or iSCSI, the same replication function is available.
2.14.6 Restrictions by Thin Provisioning Function

The thin provisioning function is used to allocate a capacity of a disk array to a volume depending on the amount of data written into the volume.

For a disk array for which the thin provisioning function is available, any of the following combinations of logical disks to be paired can be set: virtual capacity logical disks, normal logical disks, and virtual capacity logical disk and normal logical disk. In RDR, a disk array not supporting the thin provisioning function can be paired with a virtual capacity logical disk in a disk array supporting the thin provisioning function.

For copy between virtual capacity logical disks, the allocated capacity is used. However, the capacity allocated for the destination volume may be increased rapidly by copy operations performed by Replicate or Restore.

- The allocated capacity increases as data is physically written into the disk. Therefore the capacity allocated for a volume that is seen as having a small amount of data, such as a volume in which data was deleted, may be larger.
  - If the capacity allocated to the source volume is large, the capacity allocated to the destination volume will rapidly increase.
- With data replication, the difference between physical blocks is copied.
  - If the physical arrangements of virtual capacity blocks used in the source and destination volumes substantially differs, the allocated capacity may be rapidly increased because the logical OR of blocks used in the both volumes are allocated for the destination volume.

For this reason, be careful about the free space in the pool with the destination virtual capacity logical disk. Especially, if the capacity of the free space in the pool with the destination virtual capacity logical disk is insufficient due to replication operation, a copy failure will occur.

If the allocated capacity is about to exceed the capacity quota allocated for the destination virtual capacity logical disk, replication operation will also result in a copy failure.

For more details about the thin provisioning operation, refer to the “Thin Provisioning User's Manual”.

42
2.14.7 Restrictions on Secure Mode

Secure mode is operating mode for restricting operations at the business operation level. This mode (function) restricts the ControlCommand operation scope and disk array configuration change stricter than the conventional standard mode. Secure mode can be set by the iSM Access Control function.

Set secure mode per LD set. If the arbitrary LD set assigned to the local server in the disk array is set to secure mode, the operating mode of the disk array changes to secure mode from the local server.

Whether the operating mode of the remote disk array (disk array where no logical disk is registered in the volume list) not connected from the local server is secure mode is determined from the linked local disk array (disk array where one or more logical disks are registered in the volume list). If the local disk array is secure mode, the remote disk array also changes to secure mode.

If the operating mode of the target disk array is set to secure mode, the following restrictions are applied:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replicate</td>
<td>If the operation target is the AT group, the MVs or RVs of all the pairs in the AT group must be registered in the volume list in advance.</td>
</tr>
<tr>
<td>Separate</td>
<td>Same as above</td>
</tr>
<tr>
<td>Restore</td>
<td>Same as above</td>
</tr>
<tr>
<td>Copy control state change</td>
<td>Same as above</td>
</tr>
<tr>
<td>Waiting command</td>
<td>Same as above</td>
</tr>
<tr>
<td>Replication state display</td>
<td>Same as above</td>
</tr>
<tr>
<td>Specific volume information display</td>
<td>Same as above</td>
</tr>
<tr>
<td>AT group binding</td>
<td>When any of the following functions is used:</td>
</tr>
<tr>
<td></td>
<td>- Forced deletion of AT group</td>
</tr>
<tr>
<td></td>
<td>- Pair deletion from AT group</td>
</tr>
<tr>
<td></td>
<td>- Pair registration in AT group</td>
</tr>
<tr>
<td></td>
<td>- Update of MV delay allowance time that is an AT group attribute</td>
</tr>
<tr>
<td></td>
<td>The MVs or RVs of all the pairs in the AT group must be registered in the volume list in advance.</td>
</tr>
<tr>
<td>Replication function information display</td>
<td>Unexecutable</td>
</tr>
<tr>
<td>Logical disk information display</td>
<td>The logical disk to be displayed must meet any of the following conditions:</td>
</tr>
<tr>
<td></td>
<td>- The logical disk must be registered in the volume list.</td>
</tr>
<tr>
<td></td>
<td>- The volume that makes a pair with the target logical disk must be registered in the volume list.</td>
</tr>
<tr>
<td></td>
<td>- The volumes in the upper or lower pair for the target logical disk must be registered in the volume list.</td>
</tr>
<tr>
<td></td>
<td>- If the target logical disk is the BV (base volume), SV (snapshot volume), or LV (link volume) of the snapshot function, the BV or the LV associated with the BV or SV must be registered in the volume list.</td>
</tr>
<tr>
<td></td>
<td>- The target logical disk is not locked by operation guard setting.</td>
</tr>
</tbody>
</table>
This chapter describes various operations of iSM Replication Manager with Graphical User Interface (GUI).

### 3.1 Replication Manager Overview

This section describes an overview of data replication operations you can perform by using iSM Replication Manager.

### 3.1.1 Operations and Authority Levels

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

- State Monitoring
- Replication Manager
- Configuration setting

Since operations performed from Replication Manager include important operations on volumes, the operation authority is set according to the following authority levels.

However, when the server is disconnected by State Monitoring after the Replication Manager window is displayed, the currently-displayed information (obtained while the server was connected) can only be referred to regardless of the operation authority.

- L1: Only reference
- L2: Administrative operations related to replication (copy)
- L3: All operations

For information about how to connect, refer to the “User's Manual” or “User's Manual (UNIX)".
Table 3-1 lists the operations and state displays.

<table>
<thead>
<tr>
<th>Operation</th>
<th>State Monitoring</th>
<th>Configuration Setting</th>
<th>Replication Manager</th>
<th>Operation Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Display</td>
<td>L1</td>
</tr>
<tr>
<td>Set Disk Array Name</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Set Logical Disk Name</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Link State</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Pair Setting/Unpair</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Replicate</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Separate</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Restore</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Suspend/Resume Copy</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Change to Background Copy</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>RV Mode Change</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Forced Separate</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Forced Unpair</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Forced Cancellation of Update</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Prevention</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Freeze/Defreeze</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Background Copy Level Change</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Pair Batch Setting</td>
<td>-</td>
<td>✓*</td>
<td>✓</td>
<td>-</td>
</tr>
</tbody>
</table>

✓: Available for storage administrative users and partition administrative users (partition administrative users must have the authority for target partitions.)
✓*: Available only for storage administrative users
- : Not available
L1: Only reference
L2: Administrative operations related to replication (copy)
L3: All operations
3.1.2 Event Detection and Operation Message Output

Events that occur following operations performed on disk arrays or volumes can be detected by the state monitoring and displayed in the message display area in the iSM client as operation messages.

By setting the environment beforehand, you can detect events that occur following other operations such as replication operation commands as well as operations performed from Replication Manager, and can also check the events displayed as operation messages.

Table 3-2 lists the events related to replication that can be displayed as operation messages.

<table>
<thead>
<tr>
<th>Operation Target</th>
<th>Operation</th>
<th>From Replication Manager</th>
<th>From Others</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>Synchronous 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>Synchronous 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>
<tr>
<td></td>
<td>Forced cancellation of update prevention</td>
<td>✓</td>
<td>✓*</td>
</tr>
</tbody>
</table>

✓: Regular report  ✓*: Report suppression enabled depending on an environment setting

Note:
1. Operations performed from Replication Manager include ReplicationControl command operations performed together with Replication Manager.
2. In S2100 or A2100 system, events other than pair setting/unpair may not be detected.
3. Because the state monitoring monitors volumes of all disk arrays at a specified time interval (default: 15 seconds) to detect events, there is a time difference between when an event actually occurs and when a message is output. Also, more than one messages for a detected event are displayed at the same time.

For information about environment setting such as time interval for event detection by state monitoring and control of operation message output, refer to the installation guide.
3.1.3 Notes on Operation

Note the following when operating Replication Manager:

1. **System Parameter Setting (for UNIX)**
   For more information, refer to the installation guide.

2. **Messages at Start**
   Immediately after iSM is started, replication-related device information is created internally. Then the replication-related device information is recreated as instructed by ReplicationControl. Therefore if attempting to display the Replication Manager window when information is recreated, you cannot display it because of no device information obtained. If this happens, retry to display the screen after a while.

3. **Trouble Shooting**
   Refer to a dialog (message) or help to take an appropriate action.

4. **Others**
   When an RDR is configured between disk arrays in different models, there may be difference in functions supported by each disk array. Functions supported by both the disk arrays are only available for RDR pair operations and remote operations. Operations not supported by the disk arrays cannot be performed.
3.2 Replication Manager Screen

To perform an operation, select a volume to operate from the volume list that appears in the replication information tab on the Replication Manager window and then select an item from the menu on the menu bar or the menu displayed by right-clicking.

3.2.1 Replication Manager Screen

The Replication Manager window consists of the following areas: configuration display area on the left of the screen that shows disk-array configurations and states (1) and information list display area on the right of the screen that shows a volume list and disk-array link configurations (2). The Replication Manager window that initially appears shows only the configuration display area (1). To display the information list display area (2), click the disk array icon. The information list display area (2) shows the list of volumes of the selected disk array and the disk array connected with the selected disk array by RemoteDataReplication.

![Figure 3-1 Example of Replication Screen](image)

(1) For more details, refer to 3.2.2 “Configuration Display Area”.
(2) For more details, refer to 3.2.3 “Replication Information Screen” and 3.2.4 “Disk Array LINK Information Screen”.

* For details on the ATgroup information window, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

49
3.2.2 Configuration Display Area

The configuration display area is monitored by iSM and shows the list and states of disk arrays available for the data replication function as well as links among the disk arrays.

![Example of Configuration Display Area](image-url)
### Disk array icons

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Disk array icon" /> (colored)</td>
<td>Indicates that the disk array is normally operating.</td>
</tr>
</tbody>
</table>
| ![License icon](image) | Indicates that the license capacity of the DynamicDataReplication, RemoteDataReplication, or RemoteDataReplication/DisasterRecovery is insufficient.  
* If the license capacity of DynamicDataReplication or RemoteDataReplication is insufficient, you cannot perform pair setting/unpair for DDR or RDR.  
If the license capacity of RemoteDataReplication/DisasterRecovery is insufficient, you cannot perform ATgroup creation/deletion, ATgroup volume addition/deletion, or ATgroup rename.  
* For the license state (licensed/not licensed/insufficient) of each product, see the corresponding product state on the disk array property window accessed from the iSM main window.  
To check the license state (licensed/not licensed/insufficient) of each product, see the state of the product on the disk array property window that can be accessed from the iSM main window. |
| ![Warning icon](image) | Indicates that a failure occurred in a link path between disk arrays.                                                                                                                                          |
| ![Copy failure icon](image) | Indicates that a copy failure occurred or failures occurred in all link paths between disk arrays.                                                                                                              |
| ![Replication frozen icon](image) (dark gray) | Indicates that the data replication function is frozen.                                                                                                                                                       |
| ![State monitoring stopped icon](image) (light gray) | Indicates that when disk arrays are linked, the destination disk array is not directly monitored by Replication Manager. However, when a failure occurred in a link path between disk arrays or the data replication function is frozen, one of the icons shown above that corresponds to the state appears. |
| ![Stopped icon](image) | Indicates that the state monitoring is stopped.                                                                                                                                                             |

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

For a partition administrative user, only the disk arrays of the partitions managed by the administrative user appear. In this case, if a disk array of the link destination is not directly monitored by the Replication Manager, the link-destination disk array will not appear.

If Replication Manager does not recognize the link-destination disk array while disk arrays are linked, a unique identification address (Subsystem Absolute Address) not assigned to other disk arrays may be used for the disk-array name.

Each information window to be explained in the following page or later may not be displayed depending on the display items selected in the configuration display area and the state of disk array as follows.
Tabs in the information list display area cannot be selected when “iSM server” specified in the configuration display area.

[Disk Array LINK Information] tab cannot be selected when the following disk arrays specified in the configuration display area.

- Disk arrays not supporting RemoteDataReplication
- Disk arrays without RemoteDataReplication license
- Unmanaged disk arrays

[ATgroup Information] tab cannot be selected when the following disk arrays specified in the configuration display area.

- Disk arrays not supporting RemoteDataReplication and RemoteDataReplication/Disaster Recovery
- Disk arrays without RemoteDataReplication and RemoteDataReplication/Disaster Recovery license
- Unmanaged disk arrays

### 3.2.3 Replication Information Screen

When [Replication Information] tab in the information list display area is clicked, the information about the volume included in the selected disk array appears (refer to Figure 3-3 “Example of Replication Information Screen”).

MV and RV are displayed in one line respectively (a total of two lines) for a pair and IV is displayed in one line. To perform sort, click the item name by which you want to sort. To change the order of the items, drag and drop an item.

When pair setting and unpairing are performed, volume information is updated according to the order of the last sort.

![Figure 3-3 Example of Replication Information Screen](image)
The Replication Information window displays information regarding the following items.

(i) **Type**

The volume types (volume attributes) are displayed.

<table>
<thead>
<tr>
<th>Displayed Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>MV, MV having the CV type (MV/CV), or MV having the BV type (MV/BV). Indicates a volume to be copied (source volume).</td>
</tr>
<tr>
<td>Light Blue</td>
<td>RV or RV having the BV type (RV/BV). Indicates a copy-destination volume (destination volume).</td>
</tr>
<tr>
<td>White</td>
<td>IV, CV or IV having the BV type (BV). Indicates a volume not subject to copy operation. Performing pair setting changes IV to MV or RV. Setting CV as MV for a pair changes the CV to MV/CV.</td>
</tr>
<tr>
<td>D series</td>
<td>Indicates a volume on which a copy failure occurred.</td>
</tr>
</tbody>
</table>

**Control volume (CV)**

- A control volume is a small-capacity logical disk which can be used for operations such as replication and snapshot. When replication or snapshot is performed from each server, a control volume is used for issuing a control I/O to a disk array.
- During operation, a control volume must always be accessible so that an I/O can surely be issued to a disk array from a server (OS). Therefore, do not perform pair setting for a logical disk built as a control volume, as RV.
- With a disk array of the series described below, the purpose (type) of a logical disk built as a control volume can be identified. The logical disk information shown on an iSM client, etc. includes the identification information indicating that the purpose (type) of the logical disk is a control volume.

D series

If the snapshot function is used, a base volume (BV) to be used for the function will also be displayed. For more information about the snapshot function, refer to the “Snapshot User's Manual (Function Guide)".
(ii) Number
A hexadecimal logical disk number.
It is the same as the logical disk number shown on the main window (State Monitoring window).

(iii) Volume Format
Indicates a volume format.
Specify an appropriate format for operating replication.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>Indicates a logical disk operated in an ACOS-2 system.</td>
</tr>
<tr>
<td>A4</td>
<td>Indicates a logical disk operated in an ACOS-4 system.</td>
</tr>
<tr>
<td>AX</td>
<td>Indicates a logical disk operated in an AIX system.</td>
</tr>
<tr>
<td>CX</td>
<td>Indicates a logical disk operated in a Solaris system.</td>
</tr>
<tr>
<td>LX</td>
<td>Indicates a logical disk operated in a Linux system.</td>
</tr>
<tr>
<td>NX</td>
<td>Indicates a logical disk operated in a HP-UX system.</td>
</tr>
<tr>
<td>SX</td>
<td>Indicates a logical disk operated in a SUPER-UX system.</td>
</tr>
<tr>
<td>WN</td>
<td>Indicates a logical disk operated in a Windows system (except for GPT disk).</td>
</tr>
<tr>
<td>WG</td>
<td>Indicates a logical GPT disk operated in a Windows system.</td>
</tr>
</tbody>
</table>

(iv) Logical Disk Name
Indicates the identification name or identifier (see Note ![Alert](https://example.com/alert)) assigned to the logical disk.
It is the same as the logical disk name displayed on the main window (State Monitoring window) and can be changed from the main window (State Monitoring window).

If the events indicated below occurs simultaneously when the Replication Information window is displayed, the “Logical Disk Name” or “Pair Disk Name” field may show a unique value (Volume Absolute Address) that identifies a volume internally managed by the disk array.

- Path failures have already occurred in all links.
- The disk array on the remote side is not managed by iSM or not monitored.

These events occur in a pair connected by RemoteDataReplication where the host connected with a local volume cannot recognize the volume on the remote side. Even in this case, operations such as Forced Separate and Forced Unpair are enabled.
(v) **PD Type**
Indicates a PD type.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC</td>
<td>Indicates that the physical disk type is FC.</td>
</tr>
<tr>
<td>ATA</td>
<td>Indicates that the physical disk type is ATA.</td>
</tr>
<tr>
<td>SAS</td>
<td>Indicates that the physical disk type is SAS.</td>
</tr>
<tr>
<td>SSD</td>
<td>Indicates that the physical disk type is SSD.</td>
</tr>
</tbody>
</table>

(vi) **Partition Name**
Indicates the name of partition including the volume.

(vii) **Pair Number**
Indicates the hexadecimal logical disk number of the paired volume.

(viii) **Pair Disk Name**
Indicates the logical disk name of the paired volume.

(ix) **Pair PD Type**
Indicates the PD type of the paired volume.
* For details about the types to be displayed, refer to (v) “PD Type”.

(x) **Pair Partition Name**
Indicates the name of the partition including the paired volume.

When a disk array that does not support the VirtualStoragePartitioning function or that does not have a VirtualStoragePartitioning license is selected, Partition Name and Pair Partition Name are not output.

(xi) **Pair Type**
Indicates a pair type.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDR</td>
<td>Indicates that the pair was created within the same disk array.</td>
</tr>
<tr>
<td>RDR</td>
<td>Indicates that the pair was created in different disk arrays.</td>
</tr>
<tr>
<td>RDR/DR</td>
<td>Indicates that the pair is registered in the ATgroup.</td>
</tr>
</tbody>
</table>

(xii) **Activity**
Indicates a replication operation status.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replicate</td>
<td>Indicates that copy from MV to RV is being performed.</td>
</tr>
<tr>
<td>Separate</td>
<td>Indicates that MV and RV are separated.</td>
</tr>
<tr>
<td>Restore</td>
<td>Indicates that copy from RV to MV is being performed.</td>
</tr>
<tr>
<td>Restore(protect)</td>
<td>Indicates that copy from RV to MV is performed without updates made in the MV reflected into the RV.</td>
</tr>
</tbody>
</table>
(xiii) Disk Array

Indicates the identification name assigned to the disk array including a volume indicated by "Pair Number".

It is the same as the disk array name displayed on the main window (State Monitoring window) and can be changed from the main window (State Monitoring window).

If the Replication does not recognize the link destination of the disk array when the link is established between disk arrays, the disk array name may be displayed as the address value (Subsystem Absolute Address), which can uniquely identify the disk array not duplicated with other disk arrays.

(xiv) Sync

Indicates the transition status in an Activity state.

For more information, refer to 2.3 “Replication Operations and State Transitions”.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate Preparing</td>
<td>Temporarily indicates the Separate Preparing state before Separating when a large-capacity volume or low-speed line is used.</td>
</tr>
<tr>
<td>Separating</td>
<td>Indicates the temporary status until the difference between MV and RV is reduced to zero after Separate is performed.</td>
</tr>
</tbody>
</table>
| Separated           | Indicates that data copy is not performed between MV and RV.  
This status is set right after pair setting is performed. |
| Forced Separation   | Indicates that MV and RV are separated forcibly by an instruction for Forced Separate.                                                  |
| Fault               | Indicates that MV or RV is forcibly separated in a disk array due to a copy failure.                                                      |
| Sync Preparation    | Indicates Replicate Preparing.  
Temporarily indicates the Sync Preparation state before Sync Execution when a large-capacity volume or low-speed line is used.     |
| Sync Execution      | Indicates Replicate Execution.  
Indicates that difference exists while copy is performed.                                                                               |
| Synchronized        | Indicates that the difference between MV and RV that existed at the start of copy has been reflected. In a pair in this state, updated made in the MV is sequentially sent to the RV. |
| Restore Preparing   | Temporarily indicates the Restore Preparing state before Restoring when a large-capacity volume or low-speed line is used.            |
| Restoring           | Indicates that the difference between MV and RV that existed at the start of Restore has not been reflected.                           |
| Restored (Synchronized) | Indicates that the difference between MV and RV that existed at the start of Restore has not been reflected. Updates made in the MV are reflected into the RV. |
(xv) Copy Control
Indicates the control status while copying.
For more information, refer to 2.4 “Copy Control”.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreground Copy</td>
<td>Indicates the copy state in the synchronous or semi-synchronous mode.</td>
</tr>
<tr>
<td>Background Copy</td>
<td>Indicates the background copy state by using difference management.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Indicates that the data replication function is frozen.</td>
</tr>
<tr>
<td>Suspend</td>
<td>Indicates that copy operation is suspended.</td>
</tr>
<tr>
<td>Abnormal Suspend</td>
<td>Indicates that copy is forcibly suspended in a disk array due to a copy failure.</td>
</tr>
</tbody>
</table>

(xvi) Copy Mode
Indicates the copy control in the synchronous state during Replicate/Restore.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous</td>
<td>With this mode set, copy to RV is completed within the processing time of the command for writing into MV.</td>
</tr>
<tr>
<td>Semi-synchronous</td>
<td>With this mode set, the command for writing into MV is stopped and then immediately copy to RV is started.</td>
</tr>
</tbody>
</table>

(xvii) RV Mode
Indicates an RV access restriction mode. For more information, refer to 2.6 “Access Restriction for RV”.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R/W Permit</td>
<td>Indicates that the volume can be read and written from the host.</td>
</tr>
<tr>
<td>Read Only</td>
<td>Indicates that the volume can be only read from the host.</td>
</tr>
<tr>
<td>Not Ready</td>
<td>Indicates that the volume cannot be operated from the host.</td>
</tr>
<tr>
<td>Not Available</td>
<td>Indicates that the volume cannot be operated from any host.</td>
</tr>
</tbody>
</table>

(xviii) Amount of Difference
Indicates the amount of difference after Separate (including right after pair setting) and the amount of difference (remaining amount) during Sync Execution.
For a device supporting a low-speed line, the difference management information of RV is not read after Separate (including right after pair setting) and the amount of the difference in MV is only displayed.
The amount of difference may not change if I/O load is high.
If a link failure occurs, the amount of difference may not change. For more information, refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)”.

57
(xiv) Number of Pairs
Indicates the number of related pairs. 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 Pairs is shown below.

<table>
<thead>
<tr>
<th>Number of Pairs</th>
<th>Pair Relation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="" alt="Diagram 1" /></td>
</tr>
<tr>
<td>2</td>
<td><img src="" alt="Diagram 2" /></td>
</tr>
<tr>
<td>2</td>
<td><img src="" alt="Diagram 3" /></td>
</tr>
</tbody>
</table>

Note that some replication operations cannot be performed while in the Replicate, Restore, or Separate Execution state if the pair relation has multiple layers or if multiple RVs are connected to one MV (refer to the conditions for performing each of the operation). If the Number of Pairs is 2 or larger, check the hierarchy on the Connection window.

(xx) Capacity [GB]
Indicates the capacity of the logical disk.
Any logical disk larger than the maximum capacity of a volume to be paired is not displayed on the Replication Information window.

(xxii) LD Set Name
Indicates the name of the LD Set to which the volume belongs.

(xxii) ATgroup Name
Indicates the name of the ATgroup to which the volume belongs.
* For more details about the ATgroup, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

(xxiii) Update Prevention State
Indicates the update prevention state of the volumes.
* For more details about the update prevention state, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Update Prevention</td>
<td>Indicates that updates of volume data are prevented.</td>
</tr>
</tbody>
</table>
(xxiv) Pair Update Prevention

Indicates the update prevention state of paired volumes.

* For the items to be displayed, refer to (xxiii) “Update Prevention State”.

(xxv) Identity

Indicates the identity of a pair.

* For more details about identity, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Certified</td>
<td>MV and RV have not been compared and their identity has not been certified. The state is Not Certified. Not Certified is also displayed when MV is in the Update Prevention state and RV is not in the Update Prevention state, and vice versa.</td>
</tr>
<tr>
<td>Comparing(xxx%)</td>
<td>MV and RV are being compared.</td>
</tr>
<tr>
<td>Identical</td>
<td>As a result of volume comparing, it was found that the data of MV and RV were identical.</td>
</tr>
<tr>
<td>Certifying(xxx%)</td>
<td>The identity between MV and RV is being certified.</td>
</tr>
<tr>
<td>Certified</td>
<td>Since identity between MV and RV has been certified, there are no differences.</td>
</tr>
<tr>
<td>Different</td>
<td>As a result of volume comparing, it was found that the data of MV and RV were not identical.</td>
</tr>
<tr>
<td>Fault(Comparing)</td>
<td>A failure occurred while MV and RV were compared.</td>
</tr>
<tr>
<td>Fault(Certifying)</td>
<td>A failure occurred while the identity between MV and RV was certified.</td>
</tr>
</tbody>
</table>

If a disk array not directly monitored by Replication Manager is selected, the following information will be left blank:

- PD Type
- LD Set Name
- ATgroup Name
- Pair Partition Name

For a partition administrative user, only volumes whose administrative authority belongs to the user are displayed.
3.2.4 Disk Array LINK Information Screen

When you click the [Disk Array LINK Information] tab in the information list display area, the link information currently set between the disk arrays is displayed (refer to Figure 3-4 “Disk Array LINK Information Screen”).

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

<table>
<thead>
<tr>
<th>Link Number</th>
<th>Link Disk Array Name</th>
<th>Link Mode</th>
<th>Path Number</th>
<th>Path State</th>
<th>Director Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h</td>
<td>2_R</td>
<td>Normal</td>
<td>00h</td>
<td>Normal</td>
<td>01b</td>
</tr>
<tr>
<td>00h</td>
<td>0_R</td>
<td>Normal</td>
<td>01h</td>
<td>Normal</td>
<td>01b</td>
</tr>
</tbody>
</table>

Figure 3-4  Disk Array LINK Information Screen

The Disk Array LINK Information window displays information regarding the following items.

(i) Link Number

Indicates the numbers of the linked disk arrays. The link number “0” is allocated to the first disk array, and “1” to the second disk array (refer to Figure 3-5 “Replication Link Information”). The icons show the following path statuses:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Green)</td>
<td>Indicates the normal status or a link is checked.</td>
</tr>
<tr>
<td>(Gray)</td>
<td>Indicates the offline status.</td>
</tr>
<tr>
<td>(Blue)</td>
<td>Indicates that the data replication function is frozen.</td>
</tr>
<tr>
<td>(Red)</td>
<td>Indicates that a failure occurred.</td>
</tr>
</tbody>
</table>
(ii) Link Disk Array Name
Indicates the identification name assigned to the linked disk array.

* If Replication Manager does not recognize the linked disk array, a unique identification address
(Subsystem Absolute Address) not assigned to other disk arrays may be used for the disk-array name.

(iii) Link Mode

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Indicates a normal line. The line speed is 30 Mbps or more and the bandwidth is guaranteed.</td>
</tr>
<tr>
<td>Low</td>
<td>Indicates a low-speed line. The line speed is less than 30 Mbps or this is a best-effort line.</td>
</tr>
</tbody>
</table>

(iv) Path Number
Indicates the connection path number in a link.
If a link is connected via four paths, the path numbers 0, 1, 2, and 3 are respectively assigned to the paths (refer to Figure 3-5 “Replication Link Information”).

(v) Path State

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Indicates the normal status.</td>
</tr>
<tr>
<td>Offline</td>
<td>Indicates that the link setting is unchecked during startup of the disk array.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Indicates that the Data Replication function in the linked disk array is frozen.</td>
</tr>
<tr>
<td>Link Checking</td>
<td>Indicates that the link status is being checked following a failure of communication in the link. It will transit to Normal or Fault in a specified period of time.</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>

(vi) Director Number
Indicates the number of the replication director (host director for the S2500, S2400, 2800 series, S1850AT, and S1800AT) to which link paths are connected.
Figure 3-5 shows an example of two disk arrays connected to Disk Array 1 for using RDR in the 3000/4000 series.

Figure 3-5  Replication Link Information
### 3.2.5 Menu Item List

The lists of menu bar items of Replication Manager are shown below. For more details, refer to the description of each menu item.

- **File**
  - CSV Output of Information List
  - Save the Pair Setting Information
  - Close (Alt+F4)

- **View**
  - Status Bar
  - IV Display
  - Copy Fault List
  - Record Screen Information
  - Environment Setting
  - Properties (F5)

- **Operation**

- **Help**

3.3.14 “CSV Output of Information List”

3.3.15 “Saving Pair Setting Information”

Closes the Replication Manager window.

Shows or hides the status bar.

Shows or hides IVs.

3.3.21 “Displaying Copy Fault List”

3.3.18 “Record Screen Information”

3.3.16 “Environment Setting”

3.3.13 “Displaying Connection Screen” (when “Connection Screen” is displayed)

3.3.19 “Displaying Disk Array Properties” (when a disk array is selected in the configuration display area and “Properties” is displayed)

3.3.20 “Displaying Link Properties” (when a director port is selected on the Disk Array LINK Information Screen and “Properties” is displayed)

3.3.17 “Refresh”
Chapter 3  Replication Manager

For details about operations related to ATgroup, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

Forced Separate
Forced Unpair
Forced Cancellation of Update Prevention

Freeze/Defreeze
Background Copy Level Change
Displays Help on the dialog list regarding Replication Manager.

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

On the Execution dialog information window displayed for replication operations, you can select [Summary] or [Details] as the display mode for the volume-related information. Figure 3-6 and the description given below explain the Execution dialog information window using the Unpair execution dialog window as an example. Replace “operation” in the description below with “Replicate”, “Restore”, etc. as necessary.

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

The Execution dialog information window shows the information about the items described below.

- Item (iv) is displayed only on the RV Mode Change window.
- Items (vi), (vii), and (viii) are displayed only when [Details] is selected.

On the Resume Copy window, however, the item (viii) is displayed even when “Summary” is selected.

(i) Execution Result

Displays the execution result of the operation. Operation cannot be performed for a pair with “Unexecutable” indicated.

After the operation is performed, the execution results for the operation are displayed. To check the progress after the operation, close the execution dialog to check the progress on the Connection Screen.
(ii) Unexecutable Info
Displays the reason why operation cannot be performed.

(iii) Activity
Displays the execution state of the pair.

(iv) RV Mode
Displays access restrictions for RV.

(v) Logical Disk Name
Displays the logical disk name of MV.

(vi) Copy Control
Displays the control state during copy.

(vii) Sync
Displays the transition status in the activity.

(viii) Copy Mode
Displays the Synchronous/Semi-synchronous mode during copy operation.

(ix) Number
Displays the logical disk number of MV.

(x) MV Disk Array Name
Displays the disk array name to which MV belongs.

(xi) Pair Disk Name
Displays the logical disk name of RV.

(xii) Pair Number
Displays the logical disk number of RV.

(xiii) RV Disk Array Name
Displays the disk array name to which RV belongs.
(xiv) ATgroup Name

Displays the name of the ATgroup to which the volume belongs.

- If the events indicated below occurs simultaneously when the Replication Information window is displayed, the “Logical Disk Name” or “Pair Disk Name” field may show a unique value (Volume Absolute Address) that identifies a volume internally managed by the disk array.
- Path failures have already occurred in all links.
- The disk array on the remote side is not managed by iSM or not monitored.
- If Replication Manager does not recognize the linked disk array, a unique identification address (Subsystem Absolute Address) not assigned to other disk arrays may be used for “MV Disk Array Name” or “RV Disk Array Name”.
3.3 Operations of Replication Manager

3.3.1 Pair Setting/Unpair

To perform replication operations, set pairs beforehand.

If you want to set multiple pairs and the environments when initially building or rebuilding a replication environment, etc., use “Replication Setting” of “New Setting” which is one of the configuration setting functions. For more details, refer to the “Configuration Setting Tool User’s Manual (GUI)” and 3.3.15 “Save Pair Setting Information”.

Operation Procedure

Pair Setting

Do one of the following to display the Pair Setting window:

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Pair Setting].
- Right-click on the Replication Information window to select [Pair Setting].

In pair setting, whether the selected volume can be set as MV is determined automatically. If the selected volume cannot be set as MV for a pair, the following prompt message will appear:

Figure 3-7 Confirmation Screen
The possible causes are as follows:

<table>
<thead>
<tr>
<th>Unexecutable Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDR/RDR</td>
<td>Due to the reason, the volume cannot be set as MV of DDR and RDR.</td>
</tr>
<tr>
<td>DDR</td>
<td>Due to the reason, the volume cannot be set as MV of DDR.</td>
</tr>
<tr>
<td>RDR</td>
<td>Due to the reason, the volume cannot be set as MV of RDR.</td>
</tr>
</tbody>
</table>

After checking the message, click the [Yes] button to display the Pair Setting window. To select a volume again on the Replication Information window, click the [No] button.

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

(i) Data Replication Mode
Select a method for setting pairs.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Data Replication (Within Disk Array)</td>
<td>MV and RV use volumes in the same disk array.</td>
</tr>
<tr>
<td>Remote Data Replication (Between Disk Arrays)</td>
<td>MV and RV use volumes in different disk arrays.</td>
</tr>
</tbody>
</table>
(ii) Disk Array Name
On the MV part, the name of the disk array including the selected volume is displayed.
On the RV part, the name of the disk array for which pair setting of remote data replication can be performed is displayed.

(iii) Target
Only the selected volumes will be MV target if you select [From Selected LDs Only].
All volumes that are available as MV will be MV target if you do not check [From Selected LDs Only].

(iv) PD Type
You can narrow down target volumes for which pair setting can be performed by specifying a PD type.
If target volumes for which pair setting can be performed are of the same PD type, no volume can be selected because you cannot narrow down the volumes by a PD type.

- ALL: All volumes are target for pairing.
- FC: Volumes whose PD type is FC are target for pairing.
- ATA: Volumes whose PD type is ATA are target for pairing.
- SAS: Volumes whose PD type is SAS are target for pairing.
- SSD: Volumes whose PD type is SSD are target for pairing.

(v) LD Set Name
You can narrow down target volumes for which pair setting can be performed by specifying an LD Set Name.
If target volumes for which pair setting can be performed are not registered in an LD set, no volume can be selected because you cannot narrow down the volumes by an LD Set Name.

- ALL: All volumes become selectable objects.
- LD Set Name: Volumes registered in the selected LD set are target for pairing.
- Undefined: Volumes not registered in any LD set are target for pairing.

(vi) Node Number
You can narrow down target volumes for which pair setting can be performed by specifying a node number.

- ALL: All volumes become selectable objects.
- Node Number: Volumes that belong to the selected node are target for pairing.

(vii) Partition Name
You can narrow down target volumes for which pair setting can be performed by specifying a partition name.
If target volumes for which pair setting can be performed are not allocated to a partition, no volume can be selected because you cannot narrow down the volumes by a partition name.
ALL: All volumes become selectable objects.
Partition Name: Volumes allocated to the selected partition are target for pairing.
Undefined: Volumes not allocated to a partition are target for pairing.

(viii) Logical Disk

Select a logical disk to set.

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

![Figure 3-9 Confirmation Screen]

Unpair

Do one of the following to display the Unpair window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Unpair].
- Right-click on the Replication Information window to select [Unpair].

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

![Figure 3-10 Example of Unpair Screen]

Selected  Not selected
Not selectable
Select a pair to unpair from the list and then click [Unpair].
Multiple pairs can be selected and unpaired in a batch.
Unexecutable pairs cannot be selected.

(i) Selected Volume List
Lists the information about the pair (MV/RV) selected on the Replication Information window.
Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the conditions to perform pair setting/unpairing.
For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform unpairing for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform unpairing for a paired volume.</td>
</tr>
<tr>
<td>Replicated</td>
<td>Change the state of the volume to Separated to perform unpairing again.</td>
</tr>
<tr>
<td>Restored</td>
<td>Change the state of the volume to Separated to perform unpairing again.</td>
</tr>
<tr>
<td>Separate Preparing</td>
<td>Perform unpairing again in the Separated state.</td>
</tr>
<tr>
<td>Separating</td>
<td>Perform unpairing again in the Separated state.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Defreeze the Data Replication function to perform unpairing again.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>MV Monitoring Stopped</td>
<td>Change the disk array of MV to the Monitored state to perform unpairing again.</td>
</tr>
<tr>
<td>RV Monitoring Stopped</td>
<td>Change the disk array of RV to the Monitored state to perform unpairing again.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>MV Outside iSM Management</td>
<td>Perform unpairing for a pair managed by iSM.</td>
</tr>
<tr>
<td>All Link Path Abnormal</td>
<td>Refer to 3.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform unpairing for a pair not registered with the ATgroup. Or, delete a volume from the ATgroup before performing unpairing.</td>
</tr>
<tr>
<td>Comparing/certifying</td>
<td>Perform unpairing again after RDR quick sync is completed.</td>
</tr>
</tbody>
</table>

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

73
When you click the [Unpair] button, the following message is displayed.

![Confirmation Screen](image)

**Figure 3-11 Confirmation Screen**

### Conditions to Perform Pairing/Unpairing

To perform pair setting or unpairing, the following conditions must be satisfied:

#### Conditions for Pair setting

Volumes to be paired must satisfy the following conditions:

- The volume capacities of MV and RV are the same.
- The specified RV is not set as RV for another pair.
- If the specified MV is set as MV for another pair, the maximum number of simultaneous pairs is not exceeded.
- The volume formats are the same.
- The pair hierarchy does not form any loop.
- When MV and RV exist in the same disk array and a pair is to be set for the RV, a volume to be paired with the RV is in a different disk array.
- The disk array where the specified MV and RV are stored is monitored.
- The disk array where the specified MV and RV are stored is not frozen.
- When the asynchronous remote data replication function (RemoteDataReplication Asynchronous) is used, only one RDR pair can be set for the specified MV. For RDR pair setting, the capacity of a volume should not exceed 2 TB.
- If the specified MV is registered in the ATgroup, the MV and the specified RV are set as a DDR pair.
- A volume having snapshot attributes other than BV is not set as MV.
- A volume having snapshot attributes other than BV is not set as RV.
- When using BV as RV for setting a pair:
  - For pair setting of DDR
    DynamicDataReplication Ver3 or later and DynamicSnapVolume Ver3 or later are installed in the disk array to which MV (RV) belongs.
  - For pair setting of RDR
    RemoteDataReplication Ver3 or later, or
    RemoteDataReplication Asynchronous is installed in the disk array to which MV belongs.
    RemoteDataReplication Ver3 or later, or
RemoteDataReplication Asynchronous, and DynamicSnapVolume Ver3 or later are installed in the disk array to which RV belongs.

- The specified MV or RV is not locked.
- The pool including the specified MV or RV is not stopped by the power saving function.
- The specified RV is not a CV.
- The system administrator partition user is authorized to control partitions to which the specified MV and RV belong.

Pair setting cannot be performed for a volume reserved for the application server, a volume set as a work disk for performance optimization, or a system volume. Also those volumes are not displayed in the volume list on the Replication window.

To use replication for the Storage D series, create a system volume for saving the differential map.

**Conditions for Unpairing**

Volumes to be unpaired must satisfy the following conditions:

- The specified MV and RV are paired.
- The specified MV and RV are in the Separated state.
- The disk array where the specified MV and RV are stored is monitored.
- The disk array where the specified MV and RV are stored is not frozen.
- If the specified MV is registered with the ATgroup, the MV and the specified RV are set as a DDR pair.
- The specified MV or RV is not locked.
- The pool including the MV or RV is not in the rotation stop state by the power saving function.
- The identity of the specified MV or RV is not Comparing, Identical, or Certifying.
- For a partition user, the system administrator partition user is authorized to control partitions to which the specified MV and RV belong.

RV unmounted by the ReplicationControl function from an application server or backup server of Windows may be set in the Not Ready state. In this case, even if the synchronous state of the pair is “Separated”, the RV mode will remain in the Not Ready state.

Be sure to use "RV mode change" to change the state of the RV from Not Ready to R/W Permit prior to unpairing of the pair, except when the logical disk of the RV will continue to be used in the application server or backup server after the unpairing.
3.3.2 Replicate

By performing Replicate for paired volumes, you can start copy from MV to RV.

Operation Procedure

Do one of the following to display the Replicate window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Volume Operation] and [Replicate].
- Right-click on the Replication Information window to select [Volume Operation] and [Replicate].

Figure 3-12 shows an example of the Replicate window.

Select a pair for which you want to perform Replicate from the list and then click [Replicate]. Multiple pairs can be selected and Replicate can be performed for the pairs in a batch. Unexecutable pairs cannot be selected.

(i) Selected Volume List

Lists the information about the pair (MV/RV) selected on the Replication Information window. Volumes whose Execution Result is "Unexecutable" cannot be selected because they do not satisfy the conditions to perform Replicate.

For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.
Chapter 3  Replication Manager

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform Replicate for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform Replicate for a paired volume.</td>
</tr>
<tr>
<td>Replicated</td>
<td>Perform Replicate for a volume in the Separate state other than Separate Preparing.</td>
</tr>
<tr>
<td>Restored</td>
<td>Perform Replicate for a volume in the Separate state other than Separate Preparing.</td>
</tr>
<tr>
<td>Separate Preparing</td>
<td>Perform Replicate for a volume in the Separate state other than Separate Preparing.</td>
</tr>
<tr>
<td>Being replicated by other pair</td>
<td>Replicate is performed in another layer. Perform Replicate again after Separate is completed.</td>
</tr>
<tr>
<td>Being restored by other pair</td>
<td>Restore is performed in another layer. Perform Replicate again after Separate is completed.</td>
</tr>
<tr>
<td>Being Separate Preparing by other pair</td>
<td>Separate is performed in another layer. Perform Replicate again after Separate is completed.</td>
</tr>
<tr>
<td>Separating by other pair</td>
<td>Separate is performed in another layer. Perform Replicate again after Separate is completed.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Defreeze the Data Replication function to perform Replicate again.</td>
</tr>
<tr>
<td>MV Monitoring Stopped</td>
<td>Try again after monitoring of the disk array of MV is started.</td>
</tr>
<tr>
<td>RV Monitoring Stopped</td>
<td>Try again after monitoring of the disk array of RV is started.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>MV Outside iSM Management</td>
<td>Perform Replicate operation for a pair managed by iSM.</td>
</tr>
<tr>
<td>All Link Path Abnormal</td>
<td>Refer to 3.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform Replicate for a pair not registered with the ATgroup.</td>
</tr>
<tr>
<td>Snapshotting</td>
<td>Perform Replicate for a pair for which snapshot is not performed.</td>
</tr>
<tr>
<td>Protected</td>
<td>MV or RV is protected. Perform Replicate again after cancelling the protection.</td>
</tr>
<tr>
<td>RV Update Prevention</td>
<td>Cancel the RV update prevention to perform Replicate again.</td>
</tr>
</tbody>
</table>

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

77
(iii) Range
In general, Differential Only is selected, which copies only the difference between MV and RV. You can also select All, which copies the entire area explicitly.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Only</td>
<td>Copies only the difference between volumes.</td>
</tr>
<tr>
<td>All</td>
<td>Copies the entire volume.</td>
</tr>
</tbody>
</table>

(iv) Copy Mode
You can specify the copy control mode to be set in the Sync Performed and Synchronized states as well as Replicate setting. The following copy modes can be specified.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous</td>
<td>Changes the copy control to the foreground copy (Synchronous) mode.</td>
</tr>
<tr>
<td>Semi-synchronous</td>
<td>Changes the copy control to the foreground copy (Semi-synchronous) mode. This can be specified for a pair set across different disk arrays.</td>
</tr>
<tr>
<td>Background Copy</td>
<td>Changes the copy control to the Background Copy. When a low-speed line is used, the Background Copy is strongly recommended.</td>
</tr>
</tbody>
</table>

(v) RV Status
Specifies the access restrictions on the host that will be applied until Replicate is completed.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Ready</td>
<td>The host cannot access the volume.</td>
</tr>
<tr>
<td>Read Only</td>
<td>The host can only read from the volume.</td>
</tr>
</tbody>
</table>

* Care should be taken to specify Read Only. Refer to 2.6 “Access Restriction for RV”.

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

![Confirmation Screen](image.png)
When RV is a virtual capacity logical disk, the following message is displayed.

![Confirmation Screen for Virtual Capacity RV](image)

**Conditions to Perform Replicate**

To perform Replicate, the following conditions must be satisfied.

- The target MV is recognized by Replication Manager as the Replication target disk.
- The target MV and RV are paired.
- The activity of the target pair is Separate and the synchronous state is not Separate Preparing.
- The Semi-synchronous Copy mode cannot be specified for a pair set in the same disk array.
  The Semi-synchronous Copy mode can be specified only for a pair set across different disk arrays.
- When the asynchronous remote data replication function (RemoteDataReplication Asynchronous) is used for a pair set across different disk arrays, Background Copy is specified as the copy mode.
- The activity of the pair of the specified MV and another paired RV is not Restore.
- The activity of the pair of the specified MV and the paired upper MV is not the Restore state.
- The activity of the pair of the specified RV and the paired lower RV is not the Restore state.
- Only Background Copy can be specified as copy mode if the activity of the pair of the specified MV and the paired upper MV is the Replicate state.
- When the activity of the pair of the specified RV and the lower RV paired to it is Replicate, the copy control of the pair is the Background Copy mode.
- The disk array where the specified MV and RV are stored is not Freeze state.
- The disk array where the specified MV and RV are stored is monitored.
- The RV is unmounted from the host.
- The specified MV is not registered in the ATgroup.
- The upper or lower pair is not in the Separating state.
- The lower pair is not in the Sync Preparation or Separate Preparing state.
- When the specified MV or RV is also used as a base volume (BV) of the snapshot function, Restore is not performed from the snapshot volume (SV).
- When the specified RV is also used as a base volume (BV) of the snapshot function, the copy control of the pair where the RV belongs is the Background Copy mode.
• When the specified RV is also used as a base volume (BV) of the snapshot function, link setting between the specified RV and a link volume (LV) is not ongoing.
• The protection state of the specified MV is not NotAccessible.
• The specified RV is not a protected volume.
• The pool including the MV or RV is not in the rotation stop state by the power saving function.
• The specified MV or RV is not stopped by the power saving function.
• The update prevention state of the specified RV is not Prevent.
• The system administrator partition user is authorized to control partitions to which the specified MV and RV belong.
Figure 3-15 shows the conditions to perform Replicate.

- Set as pair
- Pair Setting
- Separated
- Not in Separate Preparing
- Not in Semi-synchronous if the pair is set in the same disk array
- Not frozen
- Disk array monitored
- RV is unmounted from the host.
- The specified MV is not registered in the ATgroup.
- The pool including the specified MV or RV is not stopped.
- The specified MV or RV is not stopped.
- The update prevention state of the specified RV is not Prevent.
- For a partition user, the management authorization of the partition to which the target MV or RV belongs is given.
- When the asynchronous remote data replication function (RemoteDataReplication Asynchronous) is used for a pair set across different disk arrays, Background Copy is specified as the copy mode.

For a serial pair configuration using RDR
- When the upper pair is in the Replicate state, Background Copy is specified.
- The upper pair is not in the Sync Preparation, Separating or Separate Preparing state
- When the upper pair is in the Replicate state, Background Copy is specified.
- In the same disk array, serial DDR pair configuration is not allowed.
- DDR and RDR must be combined for serial pair configuration.

- Not in the Restoring state.
- Link is not set.

For a serial pair configuration using RDR
- The lower pair is not in the Restore state.
- The lower pair is not in the Sync Preparation, Separating or Separate Preparing state
- The lower pair is not in the Sync Preparation, Separating or Separate Preparing state

- The pair of the MV and another RV is not in the Restore state.

**Figure 3-15  Conditions to Perform Replicate**
3.3.3 Separate

If Separate is performed for paired volumes, MV will be separated from RV and RV will be made available. RV cannot be reused until Separate is completed, except when it is Separate (immediate).

Operation Procedure

Do one of the following to display the Separate window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Volume Operation] and [Separate].
- Right-click on the Replication Information window to select [Volume Operation] and [Separate].

Figure 3-16 shows an example of the Separate window.
Figure 3-17 shows an example of the Separate window (including ACOS-4 special function).

![Separate Window Example]

You can separate PV from NV by configuring the time PV becomes available and the status of PV after separation.

(i) **PV Use Start Time**
- Separate End
- Separate Start

(ii) **Separated PV Status**
- R/W Permit
- Read Only

(iii) **ACOS-4 Special Function**
- Rename Media
  - Yes
  - No
- Clear Soft Mirror into (vi)

(iv) **New Media Name**
- Enter new media name

Choose pairs you want to perform separation from the list, and click [Separate].
You can select one or more pairs to perform separation for them at once.

Select a pair for which you want to perform Separate from the list and then click the [Separate] button.
Multiple pairs can be selected and Separate can be performed for the pairs in a batch.
Unexecutable pairs cannot be selected.
(i) Selected Volume List
Lists the information about the pair (MV/RV) selected on the Replication Information window.
Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the conditions to perform Separate.
For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform Separate for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform Separate for a paired volume.</td>
</tr>
<tr>
<td>Separated</td>
<td>Perform Separate for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>Sync Preparation</td>
<td>Perform Separate again in the Replicate state other than Sync Preparation.</td>
</tr>
<tr>
<td>Restore Preparing</td>
<td>Perform Separate again when Restore is completed.</td>
</tr>
<tr>
<td>Restoring</td>
<td>Execute Separate again when Restored is completed.</td>
</tr>
<tr>
<td>Being Separate Preparing by other pair</td>
<td>Separate is prepared in another layer. Perform Separate again after the Separate is completed.</td>
</tr>
<tr>
<td>Separating by other pair</td>
<td>Separate is being executed in another layer. Perform Separate again after the Separate is completed.</td>
</tr>
<tr>
<td>Suspend</td>
<td>Perform Separate again in the Synchronous state after copy is resumed.</td>
</tr>
<tr>
<td>Abnormal Suspend</td>
<td>Refer to 3.2.2 “HW Fault Unique to Replication” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Defreeze the Data Replication function to perform Separate again.</td>
</tr>
<tr>
<td>MV Monitoring Stopped</td>
<td>Change the disk array of MV to the Monitored state to perform Separate again.</td>
</tr>
<tr>
<td>RV Monitoring Stopped</td>
<td>Change the disk array of RV to the Monitored state to perform Separate again.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>RV Forced Separate</td>
<td>Perform Separate for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>MV Outside iSM Management</td>
<td>Perform Separate for a pair managed by iSM.</td>
</tr>
<tr>
<td>All Link Path Abnormal</td>
<td>Refer to 3.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform Separate for a pair not registered with the ATgroup.</td>
</tr>
</tbody>
</table>

(ii) Summary/Details
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.
(iii) RV Use Start Time
Determines when to make RV available.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate End</td>
<td>RV becomes available after Separate is started and the difference between MV and RV is reflected into the RV (Separate (completion)).</td>
</tr>
<tr>
<td>Separate Start</td>
<td>After Separate is started, RV immediately becomes available while the difference between MV and RV is sent to the RV (Separate (immediate)).</td>
</tr>
</tbody>
</table>
* DynamicDataReplication Ver2 or later must be installed to use this function. The function is available only for paired volumes in the same disk array.

(iv) Separated RV Status
Specifies an operation to be performed in response to a writing request made by the host after Separate is completed or immediately after Separate is started.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R/W Permit</td>
<td>The host can read from/write into a separated RV.</td>
</tr>
<tr>
<td>Read Only</td>
<td>The host can only read from a separated RV.</td>
</tr>
</tbody>
</table>

(v) Rename Media
Specifies an operation to be performed in response to a request for renaming the media of RV that is made after Separate is completed.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Does not write a media name into a separated RV. The [Clear Soft Mirror Info] checkbox becomes selectable.</td>
</tr>
</tbody>
</table>
* When [No] is specified, the media name of RV becomes the same as that of MV after Separate is performed so that the ACOS-4 system may not recognize the volumes. |
| Yes          | Writes a media name into a separated RV. Enter a media name in the [New Media Name] edit box. The [Clear Soft Mirror Info] remains checked and unselectable so that the information is always cleared. |

(vi) Clear Soft Mirror Info
Specifies an operation to be performed in response to a request for clearing the software mirror information of RV that is made after Separate is completed.

<table>
<thead>
<tr>
<th>Checkbox</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checked</td>
<td>Clears the software mirror information for a separated RV.</td>
</tr>
<tr>
<td>Unchecked</td>
<td>Does not clear the software mirror information for a separated RV.</td>
</tr>
</tbody>
</table>

(vii) New Media Name
Enter a new media name in the [New Media Name] edit box.
You can use up to six uppercase alphabetical characters, numeric characters, and underscore "_" to specify a new media name.
Definition example: VOL_01

[ACOS-4 Special Function] indicates the operation the ACOS-4 system uses for volumes in a disk array. It is displayed only when the pair selected on the Replication Information window includes a volume of A4 type.
When multiple pairs of A4-type volumes or of A4- and other-type volumes are selected from the list of selected volumes, [New Media Name] becomes disabled and [Clear Soft Mirror Info] becomes enabled.
When a pair of other type than A4 is selected from the list of selected volumes, [ACOS-4 Special Function] becomes disabled.

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

Figure 3-18  Confirmation Screen
Conditions to Perform Separate

To perform Separate, the conditions described below must be satisfied. RV cannot be reused until Separate is completed. However, it can be used for Separate(completion).

- The target MV is recognized by Replication Manager as the Replication target disk.
- The target MV and RV are paired.
- The target pair is not in the Separate, Sync Preparation, Restore Preparing, or Restoring state.
- The disk array where the specified MV and RV are stored is not frozen.
- The disk array where the specified MV and RV are stored is monitored.
- The MV is unmounted from the host.
- The specified MV is not registered in the ATgroup.
- The upper or lower pair is not in the Separating state.
- The lower pair is not in the Separate Preparing state.
- The system administrator partition user is authorized to control partitions to which the specified MV and RV belong.

Figure 3-19 shows the conditions to perform Separate.

* In the same disk array, serial DDR pair configuration is not allowed.

DDR and RDR must be combined when serially configuring pairs.

Figure 3-19  Conditions to Perform Separate
3.3.4 Restore

By performing Restore for paired volumes, you can start copy from RV to MV.

Operation Procedure

Perform one of the following to display the Restore window:

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Volume Operation] and [Restore].
- Right-click on the Replication Information window to select [Volume Operation] and [Restore].

Figure 3-20 shows an example of the Restore window.
Figure 3-21 shows an example of Restore window (including ACOS-4 special function).

Select a pair for which you want to perform Restore from the list and then click the [Restore] button. Multiple pairs can be selected and Restore can be performed for the pairs in a batch. Unexecutable pairs cannot be selected.
(i) Selected Volume List

Lists the information about the pair (MV/RV) selected on the Replication Information window.

Volumes whose Execution Result is "Unexecutable" cannot be selected because they do not satisfy the conditions to perform Restore.

For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform Restore for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform Restore for a paired volume.</td>
</tr>
<tr>
<td>Replicated</td>
<td>Perform Restore for a volume in the Separate state.</td>
</tr>
<tr>
<td>Restored</td>
<td>Perform Restore for a volume in the Separate state.</td>
</tr>
<tr>
<td>Separate Preparing</td>
<td>Perform Restore again in the Separated state.</td>
</tr>
<tr>
<td>Separating</td>
<td>Perform Restore again in the Separated state.</td>
</tr>
<tr>
<td>Being replicated by other pair</td>
<td>Replicate is performed in another layer. Perform Restore again after Separate is completed.</td>
</tr>
<tr>
<td>Being restored by other pair</td>
<td>Restore is performed in another layer. Perform Restore again after Separate is completed.</td>
</tr>
<tr>
<td>Being Separate Preparing by other pair</td>
<td>Separate is prepared in another layer. Perform Restore again after Separate is completed.</td>
</tr>
<tr>
<td>Separating by other pair</td>
<td>Separate is performed in another layer. Perform Restore again after Separate is completed.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Defreeze the Data Replication function to perform Restore again.</td>
</tr>
<tr>
<td>Being separated by other pair</td>
<td>Separate is performed in another layer. Perform Restore again after Separate is completed.</td>
</tr>
<tr>
<td>MV Monitoring Stopped</td>
<td>Change the disk array of MV to the Monitored state to perform Restore again.</td>
</tr>
<tr>
<td>RV Monitoring Stopped</td>
<td>Change the disk array of RV to the Monitored state to perform Restore again.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>MV Outside iSM Management</td>
<td>Perform Restore operation for a pair managed by iSM.</td>
</tr>
<tr>
<td>All Link Path Abnormal</td>
<td>Refer to 3.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform Restore for a pair not registered with the ATgroup.</td>
</tr>
<tr>
<td>Snapshottting</td>
<td>Perform Restore for a pair for which snapshot is not performed.</td>
</tr>
<tr>
<td>protected</td>
<td>MV or RV is a protected volume. Perform Restore again after the protection is cancelled.</td>
</tr>
<tr>
<td>MV Prevent</td>
<td>Cancel the MV update prevention to perform Restore again.</td>
</tr>
<tr>
<td>RV Prevent</td>
<td>Cancel the RV update prevention to perform Restore again.</td>
</tr>
</tbody>
</table>
(ii) Summary/Details
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) Action Mode
Specifies a Restore operation mode.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV Protection</td>
<td>Performs Restore without reflecting updates made in MV into RV. When the Restore is completed, Separate is automatically performed. *To use this function for paired volumes in the same disk array, DynamicDataReplication Ver2 or later must be installed. For volumes paired across different disk arrays, RemoteDataReplication Ver2 or later or RemoteDataReplication Asynchronous must be installed.</td>
</tr>
<tr>
<td>RV Update</td>
<td>Performs Restore while sending the data of updates made in MV to RV. When the Restore is completed, the state changes to Restored (rst/sync).</td>
</tr>
</tbody>
</table>

The default operation mode in (iii) is “RV Protection”. Check the Restore operation mode to use before performing Restore. To perform Restore using the same operation mode as for Version 1.4 or earlier, select "RV Update". If "RV Protection" is selected, (v) Copy mode cannot be selected.

(iv) Range
In general, Differential Only is selected, which copies only the difference between MV and RV. You can also select All, which copies the entire area explicitly.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Only</td>
<td>Copies only the difference between volumes.</td>
</tr>
<tr>
<td>All</td>
<td>Copies the entire volume.</td>
</tr>
</tbody>
</table>

(v) Copy Mode
You can specify the copy control mode to be set in the Restore Execution and the Synchronous states as well as Restore setting. The following copy modes can be specified.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous</td>
<td>Changes the copy control to the foreground copy (Synchronous) mode.</td>
</tr>
<tr>
<td>Semi-synchronous</td>
<td>Changes the copy control to the foreground copy (Semi-synchronous) mode. This can be specified for a pair set across different disk arrays.</td>
</tr>
<tr>
<td>Background Copy</td>
<td>Changes the copy control to the Background Copy.</td>
</tr>
</tbody>
</table>
(vi) RV Status
Specifications the access restrictions on the host that will be applied until Restore is completed.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Ready</td>
<td>The host cannot access the volume.</td>
</tr>
<tr>
<td>Read Only</td>
<td>The host can only read from the volume.</td>
</tr>
<tr>
<td></td>
<td>* Care should be taken to specify Read Only. Refer to 2.6 “Access Restriction for RV”.</td>
</tr>
</tbody>
</table>

(vii) Rename Media
Specifies an operation to be performed in response to a request for renaming the media of MV that is made after Restore is completed.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Does not write a media name into a restored MV. The [Clear Soft Mirror Info] checkbox becomes selectable.</td>
</tr>
<tr>
<td></td>
<td>* When [No] is specified, the media name of MV becomes the same as that of RV after Restore is performed so that the ACOS-4 system may not recognize the volumes.</td>
</tr>
<tr>
<td>Yes</td>
<td>Writes a media name into a restored RV. Enter a media name in the [New Media Name] edit box. The [Clear Soft Mirror Info] remains checked and unselectable so that the information is always cleared.</td>
</tr>
</tbody>
</table>

(viii) Clear Soft Mirror Info
Specifies an operation to be performed in response to a request for clearing the software mirror information of MV that is made after Restore is completed.

<table>
<thead>
<tr>
<th>Checkbox</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checked</td>
<td>Clears the software mirror information for a restored MV.</td>
</tr>
<tr>
<td>Unchecked</td>
<td>Does not clear the software mirror information for a restored MV.</td>
</tr>
</tbody>
</table>
(ix) New Media Name

Enter a media name in the [New Media Name] edit box.

You can use up to six uppercase alphabetical characters, numeric characters, and underscore "_" to specify a new media name.

Definition example: VOL_01

[ACOS-4 Special Function] indicates the operation the ACOS-4 system uses for volumes in a disk array. It is displayed only when the pair selected on the Replication Information window includes a volume of A4 type.

When multiple pairs of A4-type volumes or of A4- and other-type volumes are selected from the list of selected volumes, [New Media Name] becomes disabled and [Clear Soft Mirror Info] becomes enabled.

When a pair of other type than A4 is selected from the list of selected volumes, [ACOS-4 Special Function] becomes disabled.

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

![Figure 3-22  Confirmation Screen](image)

When MV is a virtual capacity logical disk, the following message is displayed.

![Figure 3-23  Confirmation Screen for Virtual Capacity MV](image)
Conditions to Perform Restore
To perform Restore, the following conditions must be satisfied.

- The target MV is recognized by Replication Manager as the Replication target disk.
- The target MV and RV are paired.
- The activity of the target pair is Separate and the synchronous state is not Separate Preparing or Separating.
- The Semi-synchronous Copy mode cannot be specified for a pair set in the same disk array.
  The Semi-synchronous Copy mode can be specified only for a pair set across different disk arrays.
- The sync state of another RV paired with the specified MV is Separated.
- The sync state of the upper MV paired with the specified RV is Separated.
- The sync state of the lower RV paired with the specified RV is Separated.
- The disk array where the specified MV and RV are stored is not frozen.
- The disk array where the specified MV and RV are stored is monitored.
- The MV and RV are unmounted from the host.
- The specified MV is not registered in the ATgroup.
- When the specified MV is also used as a base volume (BV) of the snapshot function, snapshot has not been established for all snapshot volumes (SVs) paired with the base volume (BV).
- When the specified MV is also used as a base-volume (BV) of the snapshot function, link is not set for the specified MV and a link volume (LV).
- When the specified RV is also used as a base volume (BV) of the snapshot function, Restore is not performed from the snapshot-volume (SV).
- When the specified RV is also used as a base volume (BV) of the snapshot function, Restore (update) cannot be performed.
- When the specified RV is also used as a base volume (BV) of the snapshot function, link setting between the specified RV and a link volume (LV) is not ongoing.
- When the specified MV is also used as a base volume (BV) of the snapshot function, Restore is not performed from the snapshot volume (SV).
- The specified MV is not a protected volume.
- The protection state of the specified RV is not NotAccessible.
- When the protection state of the specified RV isReadOnly, Restore (update) cannot be performed.
- The pool including the specified MV or RV is not stopped by the power saving function.
- The specified MV or RV is not stopped by the power saving function.
- The update prevention state of the specified MV or RV is not Prevent.
- The system administrator partition user is authorized to control partitions to which the specified MV and RV belong.
Figure 3-24 shows the conditions to perform Restore.

- Set as pair
- Pair Setting
- Separated
- Not in semi-synchronous if the pair is set in the same disk array
- Not frozen
- Disk array monitored
- MV and RV are unmounted from the host.
- The specified MV is not registered in the AT group.
- The pool including the specified MV or RV is not stopped.
- The specified MV or RV is not stopped.
- The update prevention state of the specified MV or RV is not Prevent.
- For a partition user, the management authorization of the partition to which the target MV or RV belongs is given.

For a serial pair configuration using RDR
- The lower pair is Separated.

- Link is not set.
- Snapshot has not been established for all SVs paired with the MV (BV).
- Not in the Restoring state.
- Not Restore(update)
- Link is not set.

* In the same disk array, serial DDR pair configuration is not allowed. DDR and RDR must be combined for serial pair configuration.
3.3.5 Suspend/Resume Copy

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

Operation Procedure

Suspend Copy
Changes the state of Foreground Copy or Background Copy to Suspend Copy.

Do one of the following to display the Suspend Copy window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Volume Operation] and [Suspend Copy].
- Right-click on the Replication Information window to select [Volume Operation] and [Suspend Copy].

Figure 3-25 shows an example of the Suspend Copy window.

![Figure 3-25 Example of Suspend Copy Screen](image)

Select a pair for which you want to perform Suspend from the list and then click the [Suspend] button. Multiple pairs can be selected and Separate can be performed for the pairs in a batch. Unexecutable pairs cannot be selected.
(i) Selected Volume List
Lists the information about the pair (MV/RV) selected on the Replication Information window.
Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the conditions to stop copy.
For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform Suspend Copy for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform Suspend Copy for a paired volume.</td>
</tr>
<tr>
<td>Already Suspended</td>
<td>Perform Suspend Copy for a volume in the Replicate or Restore state.</td>
</tr>
<tr>
<td>Sync Preparation</td>
<td>Perform Suspend Copy again in the Replicate state other than Sync Preparation.</td>
</tr>
<tr>
<td>Restore Preparing</td>
<td>Perform Suspend Copy again in the Restore state other than Restore Preparing.</td>
</tr>
<tr>
<td>Separate</td>
<td>Perform Suspend Copy for a volume in the Replicate or Restore state.</td>
</tr>
<tr>
<td>Being Separate Preparing by other pair</td>
<td>Separate is prepared in another layer. Perform Suspend Copy again after Separate is completed.</td>
</tr>
<tr>
<td>Separating by other pair</td>
<td>Separate is performed in another layer. Perform Suspend Copy again after Separate is completed.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Defreeze the Data Replication function to perform Suspend Copy again.</td>
</tr>
<tr>
<td>MV Monitoring Stopped</td>
<td>Change the disk array of MV to the Monitored state to perform Suspend Copy again.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>RV Forced Separate</td>
<td>Perform Suspend Copy for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>MV Outside iSM Management</td>
<td>Perform Suspend Copy for a pair managed by iSM.</td>
</tr>
<tr>
<td>All Link Path Abnormal</td>
<td>Refer to 3.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform Suspend Copy for a pair not registered with the ATgroup.</td>
</tr>
</tbody>
</table>

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

97
### Resume Copy
Changes the state of Suspend Copy or Background Copy to the specified copy state.

Do one of the following to display the Resume Copy window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Volume Operation] and [Resume Copy].
- Right-click on the Replication Information window to select [Volume Operation] and [Resume Copy].

Figure 3-26 shows an example of the Resume Copy window.

Select a pair for which you want to perform Resume Copy from the list and then click the [Resume] button.

Multiple pairs can be selected and Resume Copy can be performed for the pairs in a batch. Unexecutable pairs cannot be selected.

(i) **Selected Volume List**
Lists the information about the pair (MV/RV) selected on the Replication Information window.
Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the conditions to resume copy.

For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.
<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform Resume Copy for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform Resume Copy for a paired volume.</td>
</tr>
<tr>
<td>Foreground Copy</td>
<td>Perform Resume Copy for a volume in the Suspend state.</td>
</tr>
<tr>
<td>Sync Preparation</td>
<td>Perform Resume Copy again in the Replicate state other than Sync Preparation.</td>
</tr>
<tr>
<td>Restore Preparing</td>
<td>Perform Resume Copy again in the Restore state other than Restore Preparing.</td>
</tr>
<tr>
<td>Separate</td>
<td>Perform Resume Copy for a volume in the Suspend state.</td>
</tr>
<tr>
<td>Being Separate Preparing by other pair</td>
<td>Separate is prepared in another layer. Perform Resume Copy again after Separate is completed.</td>
</tr>
<tr>
<td>Separating by other pair</td>
<td>Separate is performed in another layer. Perform Resume Copy again after Separate is completed.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Defreeze the Data Replication function to perform Resume Copy again.</td>
</tr>
<tr>
<td>MV Monitoring Stopped</td>
<td>Change the disk array of MV to the Monitored state to perform Resume Copy again.</td>
</tr>
<tr>
<td>RV Monitoring Stopped</td>
<td>Change the disk array of RV to the Monitored state to perform Resume Copy again.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>RV Forced Separate</td>
<td>Perform Resume Copy for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>MV Outside iSM Management</td>
<td>Perform Resume Copy for a pair managed by iSM.</td>
</tr>
<tr>
<td>All Link Path Abnormal</td>
<td>Refer to 3.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform Resume Copy for a pair not registered with the ATgroup.</td>
</tr>
</tbody>
</table>

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

(iii) **Copy Mode**
One of the following can be set as copy mode applied when copy is resumed:

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous</td>
<td>Changes the copy control to the foreground copy (Synchronous) mode.</td>
</tr>
<tr>
<td>Semi-synchronous</td>
<td>Changes the copy control to the foreground copy (Semi-synchronous) mode. This can be specified for a pair set across different disk arrays.</td>
</tr>
<tr>
<td>Background Copy</td>
<td>Changes the copy control to the Background Copy. When a low-speed line is used, the Background Copy is strongly recommended.</td>
</tr>
</tbody>
</table>
When you click the [Resume] button, the following message is displayed.

![Confirmation Screen](image)

**Conditions to Stop/Resume Copy**

To perform Suspend/Resume Copy, the following conditions must be satisfied:

- The target MV is recognized by Replication Manager as the Replication target disk.
- The target MV and RV are paired.
- The activity of the target pair is Replicate or Restore and the synchronous state is not Sync Preparation or Restore Preparing.
- The Semi-synchronous Copy mode cannot be specified for a pair set in the same disk array.
  The Semi-synchronous Copy mode can be specified only for a pair set across different disk arrays. (Can be set only when copy is resumed.)
- When the asynchronous remote data replication function (RemoteDataReplication Asynchronous) is used for a pair set across different disk arrays of which the activity is Replicate, Background Copy is specified as the copy mode for the target pair.
- The disk array where the specified MV and RV are stored is not frozen.
- The disk array where the specified MV and RV are stored is monitored.
  (For Suspend Copy, MV must be monitored.)
- The specified MV is not registered in the ATgroup.
- Only Background Copy can be specified as copy mode if the activity of the pair of the specified MV and the paired upper MV is Replicate.
- The activity of the pair of the specified RV and the paired lower RV is not Replicate or the copy control is not the foreground copy.
- The sync of the pair of the specified MV and the paired upper MV is not Separating.
- The sync of the pair of the specified RV and the paired lower RV is not Sync Preparation, Separate Preparing, or Separating.
- If the specified RV is also used as a base-volume (BV) of the snapshot function, the copy control of the appropriate pair must be in the Background Copy mode.
- The system administrator partition user is authorized to control partitions to which the specified MV and RV belong.
Figure 3-28 shows the conditions to stop or resume copy.

- Set as pair
- Pair Setting
- Replicate or Restore
- Not in Sync Preparation or Restore Preparing
- Not in Semi-synchronous if the pair is set in the same disk array
- Not frozen
- Disk array monitored
- The specified MV is not registered in the ATgroup.
- Background Copy is specified when the activity of the upper pair is Replicate.
- For a partition user, the authority of the partition to which the target MV or RV belongs is given.
- When the asynchronous remote data replication function (RemoteDataReplication Asynchronous) is used for a pair set across different disk arrays that is in the Replicate state, Background Copy is specified as the copy mode.

* In the same disk array, serial DDR pair configuration is not allowed. DDR and RDR must be combined for serial pair configuration.


3.3.6 Change to Background Copy

You can change the copy control set in the Replicate or Restore state to Background Copy.

Operation Procedure

Do one of the following to display the Change to Background Copy window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Volume Operation] and [Change to Background Copy].
- Right-click on the Replication Information window to select [Volume Operation] and [Change to Background Copy].

Figure 3-29 shows an example of the Change to Background Copy window.

Select a pair for which you want to perform Change to Background Copy from the list and then click the [Change] button.

Multiple pairs can be selected and Change to Background Copy can be performed for the pairs in a batch. Unexecutable pairs cannot be selected.

(i) Selected Volume List
Lists the information about the pair (MV/RV) selected on the Replication Information window.
Volumes whose Execution Result is "Unexecutable" cannot be selected because they do not satisfy the conditions to change to Background Copy.

For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.
# Chapter 3  Replication Manager

## Unexecutable Info

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform Change to Background Copy for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform Change to Background Copy for a paired volume.</td>
</tr>
<tr>
<td>Sync Preparation</td>
<td>Perform Change to Background Copy again in the Replicate state other</td>
</tr>
<tr>
<td></td>
<td>than Sync Preparation.</td>
</tr>
<tr>
<td>Restore Preparing</td>
<td>Perform Change to Background Copy again in the Restore state other</td>
</tr>
<tr>
<td></td>
<td>than Restore Preparing.</td>
</tr>
<tr>
<td>Separate</td>
<td>Perform Change to Background Copy for a volume in the Replicate state</td>
</tr>
<tr>
<td></td>
<td>other than Sync Preparation or the Restore state other than Restore</td>
</tr>
<tr>
<td></td>
<td>Preparing.</td>
</tr>
<tr>
<td>Being Separate Preparing by other</td>
<td>Separate is prepared in another layer. Perform Change to Background</td>
</tr>
<tr>
<td>pair</td>
<td>Copy again after Separate is completed.</td>
</tr>
<tr>
<td>Separating by other pair</td>
<td>Separate is performed in another layer. Perform Change to Background</td>
</tr>
<tr>
<td></td>
<td>Copy again after Separate is completed.</td>
</tr>
<tr>
<td>Already Background Copy</td>
<td>Perform Change to Background Copy for a volume in Foreground Copy.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Defreeze the Data Replication function to perform Change to Background</td>
</tr>
<tr>
<td></td>
<td>Copy again.</td>
</tr>
<tr>
<td>MV Monitoring Stopped</td>
<td>Change the disk array of MV to the Monitored state to perform Change</td>
</tr>
<tr>
<td></td>
<td>to Background Copy again.</td>
</tr>
<tr>
<td>RV Monitoring Stopped</td>
<td>Change the disk array of RV to the Monitored state to perform Change</td>
</tr>
<tr>
<td></td>
<td>to Background Copy again.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>RV Forced Separate</td>
<td>Perform Change to Background Copy for a volume in the Synchronous</td>
</tr>
<tr>
<td></td>
<td>state.</td>
</tr>
<tr>
<td>MV Outside iSM Management</td>
<td>Perform Change to Background Copy for a pair managed by iSM.</td>
</tr>
<tr>
<td>All Link Path Abnormal</td>
<td>Refer to 3.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform Change to Background Copy for a pair not registered with the ATgroup.</td>
</tr>
</tbody>
</table>
(ii) Summary/Details

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

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

![Confirmation Screen](image)

Figure 3-30 Confirmation Screen

**Conditions to Change to Background Copy**

To perform Change to Background Copy, the following conditions must be satisfied.

- The target MV and RV are recognized by Replication Management as the Replication target disk.
- The target MV and RV are paired.
- The activity of the target pair is Replicate or Restore and the synchronous state is not Separate Sync Preparation or Restore Preparing.
- The disk array where the specified MV and RV are stored is not frozen.
- The disk array where the specified MV and RV are stored is monitored.
- The specified MV is not registered in the ATgroup.
- The sync of the pair of the specified MV and the paired upper MV is not Separating.
- The sync of the pair of the specified RV and the paired lower RV is not Sync Preparation, Separate Preparing, or Separating.
- The system administrator partition user is authorized to control partitions to which the specified MV and RV belong.
Figure 3-31 shows the conditions to change to Background Copy.

* In the same disk array, serial DDR pair configuration is not allowed. DDR and RDR must be combined when serially configuring pairs.

Figure 3-31  Conditions to Change to Background Copy
3.3.7 RV Mode Change

You can change the access restrictions for RV.

**Operation Procedure**

Do one of the following to display the RV Mode Change window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Volume Operation] and [RV Mode Change].
- Right-click on the Replication Information window to select [Volume Operation] and [RV Mode Change].

Figure 3-32 shows an example of the RV Mode Change window.

![Figure 3-32 Example of RV Mode Change Screen](image-url)
Figure 3-33 shows an example of the RV Mode Change window (including ACOS-4 special function).

Select a pair for which you want to perform RV Mode Change from the list and then click the [Change] button. Multiple pairs can be selected and RV Mode Change can be performed for the pairs in a batch. Unexecutable pairs cannot be selected.
(i) Selected Volume List
Lists the information about the pair (MV/RV) selected on the Replication Information window. Volumes whose Execution Result is "Unexecutable" cannot be selected because they do not satisfy the conditions to perform RV Mode Change.
For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform RV Mode Change for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform RV Mode Change for a paired volume.</td>
</tr>
<tr>
<td>Sync Preparation</td>
<td>Perform RV Mode Change again in the Replicate state other than Sync Preparation.</td>
</tr>
<tr>
<td>Restore Preparing</td>
<td>Perform RV Mode Change again in the Restore state other than Restore Preparing.</td>
</tr>
<tr>
<td>Separate Preparing</td>
<td>Perform RV Mode Change again in the Separate other than Separate Preparing.</td>
</tr>
<tr>
<td>Being Sync Preparation by other pair</td>
<td>Replicate is prepared in another layer. Perform RV Mode Change again in the Replicate state other than Sync Preparation.</td>
</tr>
<tr>
<td>Being Restore Preparing by other pair</td>
<td>Preparations for Restore are being made in another layer. Perform RV Mode Change again in the Restore state other than Restore Preparing.</td>
</tr>
<tr>
<td>Being Separate Preparing by other pair</td>
<td>Separate is prepared in another layer. Perform RV Mode Change again in the Separate other than Separate Preparing.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>All Link Path Abnormal</td>
<td>Refer to 3.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform RV Mode Change for a pair not registered in the ATgroup.</td>
</tr>
</tbody>
</table>

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

Specifies an operation for a writing request from the host.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R/W Permit</td>
<td>The host can access the volume.</td>
</tr>
<tr>
<td></td>
<td>*This cannot be performed in Replicate, Restore, or Separating.</td>
</tr>
<tr>
<td>Not Ready</td>
<td>The host cannot access the volume.</td>
</tr>
<tr>
<td>Read Only</td>
<td>All hosts cannot access the volume.</td>
</tr>
<tr>
<td></td>
<td>*Care should be taken to specify Read Only. Refer to 2.6 “Access Restriction for RV”.</td>
</tr>
<tr>
<td>Not Available</td>
<td>For a volume, access from any host is disabled.</td>
</tr>
</tbody>
</table>

(iv) Clear Soft Mirror Info

Specifies an operation performed in response to a request for clearing the software mirror information of RV.

<table>
<thead>
<tr>
<th>Checkbox</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checked</td>
<td>Clears the software mirror information for the RV.</td>
</tr>
<tr>
<td>Unchecked</td>
<td>Does not clear the software mirror information for the RV.</td>
</tr>
</tbody>
</table>

[ACOS-4 Special Function] indicates the operation the ACOS-4 system uses for volumes in a disk array. It is displayed only when the pair selected on the Replication Information window includes a volume of A4 type.

When a pair of other type than A4 is selected from the list of selected volumes, [ACOS-4 Special Function] becomes disabled.

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

![Figure 3-34 Confirmation Screen](image-url)
If RV Mode Change is performed for a volume in the state of Replicate, Restore, or Separating, the following warning message will be displayed to cancel the RV Mode Change for the volume:

![Warning Screen](image)

**Figure 3-35 Warning Screen**

### Conditions to Perform RV Mode Change

To perform RV Mode Change, the following conditions must be satisfied:

- The target RV is recognized by Replication Manager as the Replication target disk.
- The target MV and RV are paired.
- In the Separated state (when R/W Permit is specified).
- The sync of the target pair is not Sync Preparation, Separate Preparing, or Restore Preparing.
- The sync of the pair of the specified RV and the paired lower RV is not Sync Preparation, Separate Preparing, or Restore Preparing.
- The disk array where the specified MV and RV are stored is not frozen.
- The disk array where the specified RV is stored is monitored.
- The specified RV is not registered in the ATgroup.
- The pool including the specified MV or RV is not stopped by the power saving function.
- The specified MV or RV is not stopped by the power saving function.
- The system administrator partition user is authorized to control partitions to which the specified MV and RV belong.
- In the Separated state (when Clear Soft Mirror Info is specified for a volume of A4 type).
- The RV is unmounted from the host.
Figure 3-36 shows the conditions to perform RV Mode Change.

- Set as pair
- Pair Setting
- Separate state (when R/W Permit is specified)
- Not in Sync Preparation, Separate Preparing, or Restore Preparing
- Not frozen
- Disk array in RV monitored
- The specified RV is not registered in the AT group
- The pool including the specified MV or RV is not stopped.
- The specified MV or RV is not stopped.
- For a partition user, the management authorization of the partition to which the target MV or RV belongs is given.
- Separated state (when Clear Soft Mirror Info is specified for a volume of A4 type)
- The RV is unmounted from the host.

* In the same disk array, serial DDR pair configuration is not allowed. DDR and RDR must be combined when serially configuring pairs.

Figure 3-36  Conditions to Perform RV Mode Change
Chapter 3  Replication Manager

3.3.8 Forced Separate

When a failure occurs in connection between disk arrays and normal Separate cannot be performed on MV and RV, you can use Forced Separate to give a Separate instruction to the MV and RV individually. Performing Forced Separate forcibly separates MV and RV, and makes RV available.

Operation Procedure

Do one of the following to display the Forced Separate window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Forced Operation] and [Forced Separate].
- Right-click on the Replication Information window to select [Forced Operation] and [Forced Separate].

Figure 3-37 shows an example of the Forced Separate window.

You can separate a pair forcefully.

Because the command for forced separation runs individually, if either of them is not under the control of this ISM, only one volume is forcefully separated. In this case, the reason why the command was not executed is shown.

Loose restriction of forced separated RV is "R/W Permit". When forced separation is performed, access restriction of RV becomes "R/W Permit".

Choose pair(s) you want to separate forcefully from the list, and click [Separate]. You can select one or more pairs to separate forcefully for them at once.

Figure 3-37  Example of Forced Separate Screen

Figure 3-38 shows an example of the Forced Separate window (including ACOS-4 special function).
Select a pair for which you want to perform Forced Separate from the list and then click the [Separate] button.

Multiple pairs can be selected and Forced Separate can be performed for the pairs in a batch.

Unexecutable pairs cannot be selected.
(i) Selected Volume List

Lists the information about the pair (MV/RV) selected on the Replication Information window.

Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the conditions to perform Forced Separate.

For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform Forced Separate for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform Forced Separate for a paired volume.</td>
</tr>
<tr>
<td>Separated</td>
<td>Perform Forced Separate for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>MV Separated Complete</td>
<td>Perform Forced Separate for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>Forced Separation</td>
<td>Perform Forced Separate for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>MV Forced Separate</td>
<td>Perform Forced Separate for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>MV Fault</td>
<td>Refer to 3.2.2 “HW Fault Unique to Replication” in the “Data Replication User’s Manual (Installation and Operation Guide)” to recover from the failure.</td>
</tr>
<tr>
<td>MV Outside iSM Management</td>
<td>After performing Forced Separate for RV, perform Forced Separate for MV paired with the RV.</td>
</tr>
<tr>
<td>MV Monitoring Stopped</td>
<td>After performing Forced Separate for RV, perform Forced Separate for MV paired with the RV.</td>
</tr>
<tr>
<td>MV Freeze</td>
<td>After performing Forced Separate for RV, perform Forced Separate for MV paired with the RV.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>RV Separate Complete</td>
<td>Perform Forced Separate for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>RV Forced Separate</td>
<td>Perform Forced Separate for a volume in the Synchronous state.</td>
</tr>
<tr>
<td>RV Outside iSM Management</td>
<td>After performing Forced Separate for MV, perform Forced Separate for RV paired with the MV.</td>
</tr>
<tr>
<td>RV Monitoring Stopped</td>
<td>After execution of MV Forced Separate, perform Forced Separate for the volume in RV with the pair setting.</td>
</tr>
<tr>
<td>RV Freeze</td>
<td>After execution of MV Forced Separate, perform Forced Separate for the volume in RV with the pair setting.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform Forced Separate for a volume not registered in the ATgroup.</td>
</tr>
</tbody>
</table>
(ii) Summary/Details
For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) Rename Media
Specifies an operation to be performed in response to a request for renaming the media of RV that is made after Separate is completed.

<table>
<thead>
<tr>
<th>Radio Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Does not write a media name into a separated RV. The [Clear Soft Mirror Info] checkbox becomes selectable. * When [No] is specified, the media name of RV becomes the same as that of MV after Separate is performed so that the ACOS-4 system may not recognize the volumes.</td>
</tr>
<tr>
<td>Yes</td>
<td>Writes a media name into a separated RV. Enter a media name in the [New Media Name] edit box. The [Clear Soft Mirror Info] remains checked and unselectable so that the information is always cleared.</td>
</tr>
</tbody>
</table>

(iv) Clear Soft Mirror Info
Specifies an operation to be performed in response to a request for clearing the software mirror information of RV that is made after Separate is completed.

<table>
<thead>
<tr>
<th>Checkbox</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checked</td>
<td>Clears the software mirror information for a separated RV.</td>
</tr>
<tr>
<td>Unchecked</td>
<td>Does not clear the software mirror information for a separated RV.</td>
</tr>
</tbody>
</table>

(v) New Media Name
Enter a media name in the [New Media Name] edit box. You can use up to six uppercase alphabetical characters, numeric characters, and underscore "_" to specify a new media name.
Definition example: VOL_01

[ACOS-4 Special Function] indicates the operation the ACOS-4 system uses for volumes in a disk array. It is displayed only when the pair selected on the Replication Information window includes a volume of A4 type.

When multiple pairs of A4-type volumes or of A4- and other-type volumes are selected from the list of selected volumes, [New Media Name] becomes disabled and [Clear Soft Mirror Info] becomes enabled.
When RV is not managed by an iSM in operation, [ACOS-4 Special Function] cannot be specified because Forced Separate is performed only for MV.
Chapter 3  Replication Manager

The window shown by Figure 3-39 is displayed when MV is not managed by an iSM in operation. When RV is not managed by an iSM in operation, the window shown by Figure 3-40 is displayed.

After performing the prompted operation, perform Forced Separate for MV or RV not separated.

![Figure 3-39  Warning Screen for MV without under iSM](image)

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

![Figure 3-40  Warning Screen for RV without under iSM](image)

![Figure 3-41  Confirmation Screen](image)
Conditions to Perform Forced Separate

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

- The target volume is recognized by Replication Manager as the Replication target disk.
- The target MV and RV are paired, or one of them is forcibly separated.
- The disk array where the specified MV and RV are stored is not frozen.
- The disk array where the specified volume is stored is monitored.
- The specified MV or RV is not registered in the ATgroup.
- The pool including the target volume is not stopped by the power saving function.
- The target volume is not stopped by the power saving function.
- The system administrator partition user is authorized to control partitions to which the specified MV and RV belong.

Figure 3-42 shows the conditions to perform Forced Separate.
### 3.3.9 Forced Unpair

When a failure occurs in the disk array of MV or RV, monitoring is suspended and the normal Unpair may not be performed. In such a case, you can use Forced Unpair to unpair the MV and RV individually.

#### Operation Procedure

Before performing Forced Unpair, you must separate MV and RV by using Separate or Forced Separate. Do one of the following to display the Forced Unpair window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Forced Operation] and [Forced Unpair].
- Right-click on the Replication Information window to select [Forced Operation] and [Forced Unpair].

Figure 3-43 shows an example of the Forced Unpair window.

Select a pair for which you want to perform Forced Unpair from the list and then click the [Unpair] button. Multiple pairs can be selected and Forced Unpair can be performed for the pairs in a batch. Unexecutable pairs cannot be selected.

---

**Figure 3-43 Example of Forced Unpair Screen**

Select a pair for which you want to perform Forced Unpair from the list and then click the [Unpair] button. Multiple pairs can be selected and Forced Unpair can be performed for the pairs in a batch. Unexecutable pairs cannot be selected.
### (i) Selected Volume List

Lists the information about the pair (MV/RV) selected on the Replication Information window.

Volumes whose Execution Result is "Unexecutable" cannot be selected because they do not satisfy the conditions to perform Forced Unpair.

For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaired Volume</td>
<td>Perform Forced Unpair for a paired volume.</td>
</tr>
<tr>
<td>Have Unpaired</td>
<td>Perform Forced Unpair for a paired volume.</td>
</tr>
<tr>
<td>Separate Preparing</td>
<td>Perform Forced Unpair again in the Separated state.</td>
</tr>
<tr>
<td>Separating</td>
<td>Perform Forced Unpair again in the Separated state.</td>
</tr>
<tr>
<td>MV Separating</td>
<td>Perform Forced Unpair again in the Separated state.</td>
</tr>
<tr>
<td>Replicate</td>
<td>Perform Forced Unpair for a volume in the Separate state.</td>
</tr>
<tr>
<td>MV Replicate</td>
<td>Perform Forced Unpair for a volume in the Separate state.</td>
</tr>
<tr>
<td>Restore</td>
<td>Perform Forced Unpair for a volume in the Separate state.</td>
</tr>
<tr>
<td>MV Restore</td>
<td>Perform Forced Unpair for a volume in the Separate state.</td>
</tr>
<tr>
<td>MV Outside iSM Management</td>
<td>After performing Forced Unpair for RV, perform Forced Unpair for MV paired with the RV.</td>
</tr>
<tr>
<td>MV Monitoring Stopped</td>
<td>After performing Forced Unpair for RV, perform Forced Unpair for MV paired with the RV.</td>
</tr>
<tr>
<td>MV Freeze</td>
<td>After performing Forced Unpair for RV, perform Forced Unpair for MV paired with the RV.</td>
</tr>
<tr>
<td>MV Force Unpaired</td>
<td>Perform Forced Unpair for RV.</td>
</tr>
<tr>
<td>RV Separating</td>
<td>Execute it again in the Separated state.</td>
</tr>
<tr>
<td>RV Replicate</td>
<td>Perform Forced Unpair for a volume in the Separate state.</td>
</tr>
<tr>
<td>RV Restore</td>
<td>Perform Forced Unpair for a volume in the Separate state.</td>
</tr>
<tr>
<td>RV Outside iSM Management</td>
<td>After performing Forced Unpair for MV, perform Forced Unpair for RV paired with the MV.</td>
</tr>
<tr>
<td>RV Monitoring Stopped</td>
<td>After performing Forced Unpair for MV, perform Forced Unpair for RV paired with the MV.</td>
</tr>
<tr>
<td>RV Freeze</td>
<td>After performing Forced Unpair for MV, perform Forced Unpair for RV paired with the MV.</td>
</tr>
<tr>
<td>RV Force Unpaired</td>
<td>Perform Forced Unpair for MV.</td>
</tr>
<tr>
<td>Have been registered to ATgroup</td>
<td>Perform Forced Unpair for a volume not registered with the ATgroup.</td>
</tr>
<tr>
<td>Comparing/certifying</td>
<td>Perform Forced Unpair again after RDR quick sync is completed.</td>
</tr>
<tr>
<td>MV comparing/certifying</td>
<td>Perform Forced Unpair again after RDR quick sync for MV is completed or stopping RDR quick sync.</td>
</tr>
<tr>
<td>RV comparing/certifying</td>
<td>Perform Forced Unpair again after RDR quick sync for RV is completed or stopping RDR quick sync.</td>
</tr>
</tbody>
</table>
(ii) Summary/Details

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. In this case, perform Forced Unpair for MV or RV for which Unpair is not performed.

The window shown by Figure 3-44 is displayed when MV is not managed by an iSM in operation. When RV is not managed by an iSM in operation, the window shown by Figure 3-45 is displayed.

Figure 3-44  Warning Screen for MV not monitored by iSM

Figure 3-45  Warning Screen for RV not monitored by iSM
When you click the [Yes] button, the following message is displayed.

![Confirmation Screen](image)

**Figure 3-46 Confirmation Screen**

**Conditions to Perform Forced Unpair**

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

- The target volume is recognized by Replication Manager as the Replication target disk.
- The target MV and RV are paired, or one of them is forcibly unpaired.
- The target pair is in the Separated or Forced Separate state.
- The disk array where the specified MV and RV are stored is not frozen.
- The disk array where the specified volume is stored is monitored.
- The target volume is not registered in the ATgroup.
- The target volume is not locked.
- The pool including the target volume is not stopped by the power saving function.
- The identity of the target volume is not Comparing, Identical, or Certifying.
- The system administrator partition user is authorized to control partitions to which the specified MV and RV belong.

**Figure 3-47 shows the conditions to perform Forced Unpair.**

![Target Pair](image)

- Set as pair
- Set as a pair, or one of them is forcibly unpaired.
- Separated or Forced Separate state
- Not frozen
- Disk array monitored
- The target volume is not registered in the ATgroup.
- The target volume is not locked.
- The pool including the target volume is not stopped.
- The identity state of the target volume is not Comparing, Identical, or Certifying.
- For a partition user, the management authorization of the partition to which the target MV or RV belongs is given.

**Figure 3-47 Conditions to Perform Forced Unpair**
3.3.10 Forced Cancellation of Update Prevention

When a failure occurs during a swap of an RDR pair (for more details on the swap function for RDR pairs, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide”), volumes may become in the update prevention state. In this case, for recovery from the failure, perform Forced Cancellation of Update Prevention to cancel the update prevention state of the volumes. For more details about recovery from a swap failure, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

Operation Procedure

Do one of the following to display the Forced Cancellation of Update Prevention window.

- Select a volume on the Replication Information window, click [Operation] on the menu bar of Replication Manager and then select [Forced Operation] and [Forced Cancellation of Update Prevention].
- Right-click on the Replication Information window to select [Forced Operation] and [Forced Cancellation of Update Prevention].

Figure 3-48 shows an example of the Forced Cancellation of Update Prevention window.

Select a pair for which you want to perform Forced Cancellation of Update Prevention from the list and then click the [Unprevent] button.

Multiple pairs can be selected and Forced Cancellation of Update Prevention can be performed for the pairs in a batch.

Unexecutable pairs cannot be selected.

![Figure 3-48 Example of Forced Cancellation of Update Prevention Screen](image)
(i) Selected Volume List

Lists the information about the volumes selected on the Replication Information window.

Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the conditions to perform Forced Cancellation of Update Prevention.

For "Unexecutable" volumes, take one of the actions listed below according to the Unexecutable Info.

<table>
<thead>
<tr>
<th>Unexecutable Info</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sync Preparation</td>
<td>Forced Cancellation of Update Prevention in the Replicate state other than Sync Preparation.</td>
</tr>
<tr>
<td>Separate Preparing</td>
<td>Perform Forced Cancellation of Update Prevention again in the Separate other than Separate Preparing.</td>
</tr>
<tr>
<td>Freeze</td>
<td>Defreeze the Data Replication function to perform Forced Cancellation of Update Prevention again.</td>
</tr>
<tr>
<td>Monitoring Stopped</td>
<td>Change the disk array of the selected volume to the Monitored state to perform Forced Cancellation of Update Prevention again.</td>
</tr>
<tr>
<td>Non-update prevention state</td>
<td>Perform Forced Cancellation of Update Prevention for a volume in the update prevention state.</td>
</tr>
</tbody>
</table>

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

Figure 3-49  Confirmation Screen

**Conditions to Perform Forced Cancellation of Update Prevention**

To perform Forced Cancellation of Update Prevention for a volume, the following conditions must be satisfied:

- The target volume is recognized by Replication Manager as the Replication target disk.
- The disk array where the specified volume is stored is monitored.
- The disk array where the specified volume is stored is not frozen.
- The sync of the pair to which the target volume belongs is not Sync Preparation or Separate Preparing.
- The target volume is not locked.
- The specified volume is not in the non-update prevention state.
- The system administrator partition user is authorized to control partitions to which the target volume belongs.
You can freeze or defreeze the Data Replication function of a disk array.

**Operation Procedure**

Do one of the following to display the Freeze/Defreeze window.

- Select a disk array on the configuration display area, click [Operation] on the menu bar of Replication Manager and then select [System Operation] and [Freeze/Defreeze].
- Right-click a disk array in the configuration display area and then select [Freeze/Defreeze].

Figure 3-50 shows an example of the Freeze/Defreeze window.

![Freeze/Defreeze Window](image)

### Freeze/Defreeze Execute

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeze</td>
<td>Freezes (invalidates) the Data Replication function of the disk array.</td>
</tr>
<tr>
<td>Defreeze</td>
<td>Defreezes (validates) the Data Replication function of the disk array.</td>
</tr>
</tbody>
</table>

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

![Confirmation Message](image)
Conditions to Perform Freeze/Defreeze

To perform Freeze/Defreeze, the following conditions must be satisfied.

- The target disk array is recognized by Replication Manager.
- The specified disk array is monitored.
- The user is a storage administrative user.

After Freeze is performed, no replication operations can be performed in the frozen disk array. For more details about Freeze, refer to 2.8 “Freeze of Disk Arrays”.
3.3.12 Background Copy Level Change

You can change the priority of Background Copy in a disk array.

**Operation Procedure**

Do one of the following to display the Background Copy Level Change window.

- Select a disk array on the configuration display area, click [Operation] on the menu bar of Replication Manager and then select [System Operation] and [Background Copy Level Change].
- Right-click a disk array in the configuration display area and then select [Background Copy Level Change].

Figure 3-52 shows an example of the Background Copy Level Change window.

![Background Copy Level Change Window](image)

**Figure 3-52  Example of Background Copy Level Change Screen**
(i)  Background Copy Level

Specifies the priority of copy operation that is applied for Background Copy selected in Replicate and
Restore.
A higher priority results in faster copying for reflecting difference. (For more information, refer to 2.4
“Copy Control”.)

• Restore Default Value
  Restores the default value of the disk array.
• Change
  You can specify the priority of Background Copy for the disk array.

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

![Confirmation Screen](image)

**Figure 3-53  Confirmation Screen**

**Conditions to Change Background Copy Level**

To perform copy control operations, the following conditions must be satisfied:

- The target disk array is recognized by Replication Manager.
- The specified disk array is monitored.
- The specified disk array is defrozen.
- The user is a storage administrative user.
3.3.13 Displaying Connection Screen

You can display the state of connected volumes on the Connection window. Replication-related and snapshot-related volumes are displayed on the Connection window. For more details about displaying and operating snapshot-related volumes, refer to the "Snapshot User's Manual (Function Guide)". Snapshot volumes for which snapshot is active are displayed in order of creation time.

Operation Procedure

Do one of the following to display the Volume Connection window.

- Select a volume on the Replication Information window, click [View] on the menu bar of Replication Manager and then select [Connection Screen].
- Right-click a volume on the Replication Information window and then select [Connection Screen].
- Select a volume on the Replication Information window, and press the [Enter] key.
- Double-click a volume on the Replication Information window.

Figure 3-54 shows an example of the Connection window.
(i) Disk Array Name
Displays the name of the disk array (or SAA) that contains the volume.
The name of the disk array that contains the volume selected to display the Connection window is highlighted.

(ii) Logical Disk Number, OS Type, Logical Disk Name
Displays them in the form of “(logical disk number) OS type:logical disk name (or VAA)”.
The logical disk number, OS type, and logical disk name of the volume selected to display the Connection window are highlighted.

(iii) Copy Progress
Displays the progress rate of copy. This information disappears when copy is completed.
The progress rate may not change if I/O load is too high.
If a link failure occurs, the progress rate may not change. In this case, refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide)”.

(iv) Access Restrictions for RV and LV
Displays the access restrictions for RV and LV that include the following modes:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R/W Permit</td>
<td>Indicates that the volume can be read and written from the host.</td>
</tr>
<tr>
<td>Read Only</td>
<td>Indicates that the volume can be only read from the host.</td>
</tr>
<tr>
<td>Not Ready</td>
<td>Indicates that the volume cannot be operated from the host.</td>
</tr>
<tr>
<td>Not Available</td>
<td>Indicates that the volume cannot be operated from any host.</td>
</tr>
</tbody>
</table>

(v) Display of Pair State
For between replication related volumes
Activity: Displays the replication operation status.
Sync: Displays the transition status in the activity.
Copy Control: Displays the control status in copying.
Copy Mode: Displays the copy control in the synchronous state during Replicate/Restore.
Operation Time Display: Displays the start and end times of the operation performed for a volume.
Displays the transition time when Forced Separate is performed or a failure occurred.
Displays the estimated remaining time until copy completion while Sync, Separate, or Restore is being performed.
Displays the time of the RV side when the RV is in the Separate or Forced Separate state.
Displays the time of the RV side when the disk array including MV is not recognized by Replication Manager.
Displays the time of the MV side when the disk array including RV is not recognized by Replication Manager.
Identity: Displays the identity of MV and RV.
The estimated remaining time may not be correct because it changes depending on the monitoring timing, devices, the status of lines, etc.

For between snapshot related volumes

The following information is displayed between BV and SV.

**Status:** Displays the snapshot status.

**Creation Time:** Displays the time the last snapshot was created.

**Generation Number:** Displays the generation number and the generation attribute of a snapshot.

While snapshot restoring, the following information is also displayed.

**Restore start:** Displays the start time of Restore.

**Remaining copy time:** Displays the estimated remaining time to completion of copy.

![Figure 3-55 Example of Snapshot Restoration](image)

(vi) **Amount of Difference**

Displays “remaining amount/transfer rate” while Sync is being performed.

(vii) **Protection of Snapshot**

Displays the state of snapshot protection.
(viii) Connection of Link Volumes
Indicates the state of link-volume connection. Connected link volumes are connected by a line.

(ix) Disk Array Button
When volumes in multiple disk arrays are displayed on the Connection window, disk array buttons are displayed at the top of the Connection window.
No disk array button appears when volumes in one disk array are displayed.
When a disk array button is selected, the volumes that belong to the disk array are highlighted.
To cancel the highlight, select the same button again.
Double-clicking a volume works in the same way as selecting the button of the disk array to which the volume belongs.

(x) Update Prevention State
Displays the update prevention state of the volume.

(xi) Refresh button
When you click the [Refresh] button or press the [F5] key, the [Refresh Information] progress bar appears. When the [Refresh Information] progress bar reaches the end, Refresh of the Connection window is completed.

![Figure 3-56  Example of Progress Bar](image)

**Characters in Volume**
Characters displayed in a volume figure indicate a volume attribute.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV</td>
<td>Master volume</td>
</tr>
<tr>
<td>RV</td>
<td>Replication volume</td>
</tr>
<tr>
<td>BV</td>
<td>Base volume</td>
</tr>
<tr>
<td>RV/MV</td>
<td>RV that is also MV paired with another RV. It has both attributes of RV and MV</td>
</tr>
<tr>
<td>MV/BV</td>
<td>BV paired as MV that has both attributes of MV and BV</td>
</tr>
<tr>
<td>MV/CV</td>
<td>CV paired as MV that has both attributes of MV and CV</td>
</tr>
<tr>
<td>RV/BV</td>
<td>BV paired as RV that has both attributes of RV and BV</td>
</tr>
<tr>
<td>RV/MV/BV</td>
<td>BV paired as RV/MV that has attributes of MV, RV, and BV</td>
</tr>
<tr>
<td>Attribute</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>SV</td>
<td>Snapshot volume&lt;br&gt;If snapshot is canceled due to the shortage of SRA capacity, 🔄 appears at the lower right of the volume figure.</td>
</tr>
<tr>
<td>LV</td>
<td>Link volume</td>
</tr>
</tbody>
</table>

"Not managed" may appear as shown above if paired volumes are connected by RemoteDataReplication and the disk array of the remote volume is not managed by iSM or not monitored.

"Unpaired" may appear as shown above if: (1) paired volumes are connected by RemoteDataReplication and the host connected with the local volume cannot recognize the remote volume because of Forced Unpair performed for the remote volume, etc.; (2) The ReplicationControl command is used to perform Forced Unpair for one volume of a DynamicDataReplication pair. If Forced Unpair is performed for the volume in the first or second layer of a pair having multiple layers, the upper or layer volume may not appear.

If a system administrator partition user is not authorized to manage a connected pair, "No Authority" may appear as shown above.
**Color of Volume**

Volumes are color-coded (in layer colors) according to the connection status (alignment) and volume types. The color of a volume changes to a layer color immediately after pair setting or when Separate is completed. A pair having volumes in the same color is synchronized.

**Replication related volumes**

1. PV: Green
2. 1st layer: Light blue
3. 2nd layer: Blue
4. 3rd layer: Yellow

* The MV in the upmost layer is called Primary Volume (PV) to distinguish it from other MVs.

* The same coloring rule applies to MV/BV, RV/BV, and RV/MV/BV.

**Snapshot related volumes**

1. BV: Navy blue
2. SV: Light purple
3. LV: White
Line Connecting Volumes

A line between volumes that indicates the state of volume connection is like a pipe in shape as shown below. During copy, an arrow (represented in the color of the disk) on a line moves from the source volume to the target volume, indicating that copy is ongoing. An arrow automatically moves when periodical update is performed. To update information (move an arrow) at any other time than periodical update, press the [F5] key.

- For DynamicDataReplication

  Replicate is performed:  
  ![Replicate is performed](image)

  Replicate is completed:  
  ![Replicate is completed](image)

  Restore is performed:  
  ![Restore is performed](image)

  Restore is completed:  
  ![Restore is completed](image)

  Separate is performed:  
  ![Separate is performed](image)

  Separate is completed:  
  ![Separate is completed](image)

- For RemoteDataReplication

  Replicate is performed:  
  ![Replicate is performed](image)

  Replicate is completed:  
  ![Replicate is completed](image)

  Restore is performed:  
  ![Restore is performed](image)

  Restore is completed:  
  ![Restore is completed](image)

  Separate is performed:  
  ![Separate is performed](image)

  Separate is completed:  
  ![Separate is completed](image)

- For DynamicSnapVolume

  Active:  
  ![Active](image)

  Inactive:  
  ![Inactive](image)

  Restore is being performed:  
  ![Restore is being performed](image)

  Deletion is being performed:  
  ![Deletion is being performed](image)

  Active and Inactive are displayed alternately.
**Display of Link State**

The states of links between link volumes are displayed as shown below.

- For a link volume and a snapshot volume

  Connected:

  ![](image1)

  Not connected:

  ![](image2)

- For a link volume and a base-volume

  Connected:

  ![](image3)

  Not connected:

  ![](image4)

**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>271.00 MB</td>
<td>132.5 MB/S</td>
</tr>
</tbody>
</table>

After Replicate is completed

When Replication is completed (amount of difference=0), Amount of Difference and Transfer Rate (MB/S) disappears.
Progress of Copy
Displays the progress of Replicate, Restore, etc. by showing the change of the capacity.

Example of Display 1: Replicate

Sync Execution

StorageS2800/1
(0014h)WN:LDW_28_1_0
1.76 GB(71.7MB/S)
DynamicDataReplication

Replicate is completed

StorageS2800/1
(0014h)WN:LDW_28_1_0

Turns into the same color when synchronized.
Example of Display 2: Separate during Sync Execution

Sync Execution

Separate Execution

Separated

Turns into the layer color because Separate is completed.
### Operation on Connection Screen

By right-clicking a volume on the Connection Screen, you can display the operation menu shown below to perform an operation you want.

For more details about operation procedures, refer to the items in this section and “Snapshot User’s Manual (Function Guide)”.

- **When MV, RV, or RV/MV is selected:**

  - Replicate...
  - Separate...
  - Restore...
  - Suspend Copy...
  - Resume Copy...
  - Change to Background Copy...
  - RV Mode Change...
  - Forced Separate...
  - Forced Cancellation of Update Prevention...

  3.3.2 “Replicate”
  3.3.3 “Separate”
  3.3.4 “Restore”
  3.3.5 “Suspend/Resume Copy”
  3.3.6 “Change to Background Copy”
  3.3.7 “RV Mode Change”
  3.3.8 “Forced Separate”
  3.3.10 “Forced Cancellation of Update Prevention”

- **When MV/BV, RV/BV, or RV/MV/BV is selected:**

  - Replicate...
  - Separate...
  - Restore...
  - Suspend Copy...
  - Resume Copy...
  - Change to Background Copy...
  - RV Mode Change...
  - Forced Separate...
  - Forced Cancellation of Update Prevention...
  - Snapshot Cyclic Creation...

  3.3.2 “Replicate”
  3.3.3 “Separate”
  3.3.4 “Restore”
  3.3.5 “Suspend/Resume Copy”
  3.3.6 “Change to Background Copy”
  3.3.7 “RV Mode Change”
  3.3.8 “Forced Separate”
  3.3.10 “Forced Cancellation of Update Prevention”

  Refer to the “Snapshot User’s Manual (Function Guide)”.

- **When BV is selected:**

  - Snapshot Cyclic Creation...

  Refer to the “Snapshot User’s Manual (Function Guide)”.

- **When SV is selected:**

  - Snapshot Creation...
  - Snapshot Deletion...
  - Snapshot Restoration...
  - Snapshot Guard...
  - Snapshot Guard Cancel...

  Refer to the “Snapshot User’s Manual (Function Guide)”.

- **When LV is selected:**

  - Link Setting...
  - Unlink...
  - Access Mode Change...
  - Properties...

  Refer to the “Snapshot User’s Manual (Function Guide)”.
Notes on Using Connection Screen

- You can select up to 25 volumes from the list to display the Connection window.
- When a volume you want to operate is not managed, not monitored, frozen, or disconnected from the iSM server, you cannot select any item from the operation menu on a Replication or Snapshot execution window. If you right-click a volume for which "Not managed" or "Unpaired" is displayed, the operation menu is not displayed.
- A system administrator partition user cannot select from the data-replication operation menu for a volume with "No Authority" indicated because the administrator has no authority to operate the volume. However, the user may select items from some operation menus related to snapshot.
- When a low-speed line is used, the display of [Amount of Difference/Transfer Rate], [Progress of Copy], and [Estimated Remaining Time] may be delayed because the interval between updates is long. To display the latest values, press the [Refresh] button.
3.3.14 CSV Output of Information List

The replication information, the disk array LINK information, and the ATgroup information for the selected disk array can be reported to a file in CSV format.

This CSV file can be used in spreadsheet software.

To produce a CSV file, do the following:

- Select [File] and then [CSV Output of Information List].

Figure 3-57 shows an example of the CSV Output of Information List window.

![Example of CSV Output of Information List Screen](image-url)
With CSV output, the latest information obtained is produced in a CSV-format file. However if a selected disk array is not monitored or not managed, the information saved when [Save] button is pressed will be output. Note that this information reported to a CSV file may not be the latest.

**CSV File of Information Display List**

This section shows an example of the CSV file that is created by performing CSV Output of Information List.

This file reports the information included in the displayed window by delimiting it by comma on an item basis.

An example of the CSV file

```
"Type","Number","OS Type","Logical Disk Name","PD Type","Partition Name","Pair Number","Pair Disk Name","Pair PD type","Pair Type","Pair Partition Name","Activity","Disk Array","Sync","Copy Control","Copy Mode","RV Mode","Differential Quantity of Volume","Number of Pairs","Capacity [GB]","LD Set Name","ATgroup Name","Update Prevention","Pair Update Prevent","Identity"

"MV","0000h","NX","M_VOLUME001","FC","Par_A","0201h","R_VOLUME001","ATA","RDR","Par_B","Replicate","StorageS2800","Synchronized","Foreground Copy","Sync","","0KB","1","33.2","NX:shigoto1","","",""

"RV","0001h","NX","R_VOLUME001","FC","Par_A","0100h","M_VOLUME001","FC","RDR","Par_C","Replicate","StorageS2800","Synchronized","Foreground Copy","Sync","Not Ready","0 KB","1","33.2","NX:shigoto1","","",""

"MV","0002h","NX","M_VOLUME002","FC","Par_A","0205h","R_VOLUME005","ATA","RDR","Par_B","Replicate","StorageS2800","Synchronized","Foreground Copy","Sync","","0 KB","1","33.2","NX:shigoto1","ATG4300","","",""

"MV","0003h","NX","M_VOLUME003","FC","Par_A","0206h","R_VOLUME006","ATA","RDR","Par_B","Replicate","StorageS2800","Synchronized","Foreground Copy","Sync","","0 KB","1","33.2","NX:shigoto1","ATG4300","","",""

"RV","0004h","NX","R_VOLUME002","FC","Par_A","0104h","M_VOLUME004","FC","RDR","Par_C","Replicate","StorageS2800","Synchronized","Foreground Copy","Sync","Not Ready","0 KB","1","33.2","NX:shigoto1","","",""

"IV","0005h","NX","R_VOLUME003","FC","Par_A","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","","",
When a disk array that does not support the VirtualStoragePartitioning function or that does not have a VirtualStoragePartitioning license is selected, Partition Name and Pair Partition Name are not output.
### 3.3.15 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:

- Select [File] and then [Save the Pair Setting Information].

Figure 3-58 shows an example of the Save the pair setting information window.

![Save the pair setting information window](image)

**Figure 3-58  Example of Save the 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 more details, refer to the “Configuration Setting Tool User’s Manual (GUI)”.

For a system administrator partition user, the information about a volume whose management authority is not given to the administrator is not reported.
Chapter 3  Replication Manager

Pair List

This section describes the pair list that is output to a file by the replication management function.
* The ATgroup information can also be output to a CSV file. For more details, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)".

Rules of pair list format
(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) Case-sensitive.
(iv) Data is described in the following format.

“MV DiskArrayName”, “MV OSType”, “MV ExVolName”, “RV DiskArrayName”, “RV OSType”, “RV ExVolName”, “ATgroupName”, “LinkDiskArrayName”, “OSType”, “ExVolName”

Table 3-3  Rules of Pair List Format

<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>2</td>
<td>MV DiskArrayName</td>
<td>Name of the disk array where the Master Volume (MV) belongs. The maximum number of characters is 32.</td>
</tr>
<tr>
<td>3</td>
<td>MV OSType</td>
<td>OS type of MV.</td>
</tr>
<tr>
<td>4</td>
<td>MV ExVolName</td>
<td>Logical disk name of MV. The maximum number of characters is 24.</td>
</tr>
<tr>
<td>5</td>
<td>RV DiskArrayName</td>
<td>Name of the disk array where the Replication Volume (RV) belongs. The maximum number of characters is 32.</td>
</tr>
<tr>
<td>6</td>
<td>RV OSType</td>
<td>OS type of RV.</td>
</tr>
<tr>
<td>7</td>
<td>RV ExVolName</td>
<td>Logical disk name of RV. The maximum number of characters is 24.</td>
</tr>
<tr>
<td>8</td>
<td>ATgroupName</td>
<td>ATgroup name. The maximum number of characters is 32.</td>
</tr>
<tr>
<td>9</td>
<td>DiskArrayName</td>
<td>Name of the disk array to which the ATgroup belongs. The maximum number of characters is 32.</td>
</tr>
<tr>
<td>10</td>
<td>LinkDiskArrayName</td>
<td>Name of the linked disk array. The maximum number of characters is 32.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This is required when the function to specify the linked disk array name for the disk array specified with the disk array name is ON. In other cases, this is ignored. (Can be omitted.)</td>
</tr>
<tr>
<td>11</td>
<td>OSType</td>
<td>Usage type of the logical disk registered in the ATgroup</td>
</tr>
<tr>
<td>12</td>
<td>ExVolName</td>
<td>Name of the logical disk registered in the ATgroup. The maximum number of characters is 24.</td>
</tr>
</tbody>
</table>
**Example**

Pair Name List

#iSM  Ver.x.x.x  yyyyyyyyyyyyyyyyyyyyyyy

[Pair]

#MV DiskArrayName,MV OSType,MV ExVolName,RV DiskArrayName,RV OSType,RV ExVolName

LOCAL_ARRAY,WN,ora45,REMOTE_ARRAY,WN,ora25
LOCAL_ARRAY,WN,ora46,REMOTE_ARRAY,WN,ora26
LOCAL_ARRAY,WN,ora47,REMOTE_ARRAY,WN,ora55
LOCAL_ARRAY,WN,ora48,REMOTE_ARRAY,WN,ora56

#<0000h>

[atcreate]

#ATgroupName,DiskArrayName,LinkDiskArrayName

DB_Group,LOCAL_ARRAY,REMOTE_ARRAY

[atadd]

#ATgroupName,OSType,ExVolName

DB_Group,WN,ora45
DB_Group,WN,ora46

- x.x.x represents an actual program version. yyy…y represents the actual time and date of execution.
### 3.3.16 Environment Setting

The interval to obtain disk array information is specified. It is the interval to obtain the information on copy progress that is displayed on a window. By using the environment setting of iSM server, you can disable the information acquisition interval setting applied to the client. After disabling the setting, update the information manually because the information is not obtained periodically. For more details of iSM server environment settings, refer to the installation guide.

On the menu bar, do the following:
- Select [View] and then [Environment Setting].

Figure 3-59 shows an example of the window for setting the information acquisition interval when the interval setting for clients is enabled.

![Environment Setting](image)

**Figure 3-59** Example of the Screen for Setting the Information Acquisition Interval

(When the Setting Is Enabled)

The interval is the time between an information acquisition and the next.

When the [Don’t update periodically] check box is selected, the information acquisition interval is disabled and automatic information acquisition is stopped.

For a low-speed line, it is recommended to specify at least 20 seconds in [Information Acquisition Interval] or selecting the [Don’t update periodically] check box to suppress the amount of data on the line. To obtain the latest information, press the [F5] key.

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

Figure 3-59 shows an example of the window for setting the information acquisition interval when the interval setting for clients is disabled.
When the information acquisition interval setting for clients is disabled by iSM server environment settings, all clients do not obtain the information periodically.

For a low-speed line, it is strongly recommended to disable the information acquisition interval setting for clients by using iSM server environment settings to suppress the amount of data on the line. To obtain the latest information, press the [F5] key.

For more details of iSM server environment settings, refer to the installation guide.
3.3.17 Refresh

When Refresh is performed with the iSM server in the upper-left part of the configuration display area selected, the information on the disk array connected to the server is updated. The information displayed on the screen is cleared.

When Refresh is performed with a disk array icon in the configuration display area selected, the volume lists of the selected disk array and the linked disk array are refreshed and redisplayed.

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

Do one of the following:

- Select [View] on the menu bar to select [Refresh].
- Press the [F5] key.

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

![Confirmation Screen for Refresh](image)

3.3.18 Record Screen Information

The information on the Replication Manager window is recorded.

The recorded information is reflected the next time the Replication Manager window is activated.

On the menu bar, do the following:

- Select [View] and then [Record Screen Information].

**Recorded Items**

- Width of the item
- Location of the item
- Screen size
- Screen location
- IV display state
- Interval of information update
- Display state of the status bar
- Connection window location
- Connection window size
3.3.19 Displaying Disk Array Properties

Properties of a disk array shows how the disk array is set.

Do one of the following:
- Select a disk array in the configuration display area, select [View] on the menu bar and then [Properties].
- Select a disk array in the configuration display area, right-click it, and then select [Properties].

Figure 3-62 shows an example of the Disk Array Properties window.
The items shown on the screen are the following:

(i) Disk array name
Indicates a name to identify a disk array.

(ii) Differential Map
Displays whether or not the difference control function to retain the difference generated by updates in MV or RV is implemented. This function must be installed to copy differences. (The copy range is always All.)

(iii) Replication Status
Indicates whether the Data Replication function of the disk array is available.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>Indicates that it is operable.</td>
</tr>
<tr>
<td>FREEZE</td>
<td>Indicates that the Data Replication function is frozen due to power down of the disk array, etc.</td>
</tr>
</tbody>
</table>

(iv) Background Copy Level
Displays the priority of Background Copy.

(v) Maximum Number of RVs per MV
Indicates the maximum number of RVs which can be set for one MV (the number cannot be changed).

(vi) SAA (Subsystem Absolute Address)
Displays a unique address that is not used for other disk arrays.

(vii) Maximum Number of Concentrators, Maximum Number of concentrators Simultaneously Running on Semi-Synchronous Copy Mode, Maximum Number of Volume in All ATgroups, Maximum Number of Volumes in One ATgroup, Function to specify Destination Disk Array Name in Creating ATgroup
For details, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”. 

(viii) Maximum Capacity of a Volume to be Paired
Indicates the maximum capacity of a volume that can be paired. Any volume larger than this capacity is not displayed on the Replication Information window.
Chapter 3  Replication Manager

3.3.20 Displaying Link Properties

The link states are displayed.

Do one of the following:

- Select a disk array link information item, select [View] on the menu bar and then [Properties].
- Select and right-click a disk array link information item and then select [Properties].

Figure 3-63 shows an example of the Link Properties window.

![Figure 3-63  Example of Link Properties Screen](image)

The items shown on the screen are the following (refer to Figure 3-5 “Replication Link Information”):

(i)  **Disk array name**
    Indicates the identification name assigned to the disk array.

(ii)  **Path Number**
    Indicates the link path number of the selected link information.
(iii) Director Number
Indicates the number of the replication director (host director for the S2500, S2400, 2800 series, S1850AT, and S1800AT) of the selected link information.

(iv) Port Number
Indicates the port number of the replication director (host director for the S2500, S2400, 2800 series, S1850AT, and S1800AT).

(v) Replication Port N Port Identifier Lock
Indicates whether the port ID of the destination is variable or fixed.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h</td>
<td>Variable depending on the system configuration</td>
</tr>
<tr>
<td>01h</td>
<td>Fixed</td>
</tr>
</tbody>
</table>

(vi) Replication Port N Port Identifier
Indicates the port ID of the destination.

(vii) Path State

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Indicates the normal status.</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 destination disk array is frozen.</td>
</tr>
<tr>
<td>Link Checking</td>
<td>Indicates that the link status is being checked due to a communication failure in the link.</td>
</tr>
<tr>
<td>Fault</td>
<td>Indicates that the link is invalid due to a communication failure in the link.</td>
</tr>
<tr>
<td>Not Clear</td>
<td>Indicates the state other than the above.</td>
</tr>
</tbody>
</table>

(viii) Link Disk Array Name
Indicates a name to identify the linked disk array.

(ix) Link Mode

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Indicates a normal line. The line speed is 30 Mbps or more and the bandwidth is guaranteed.</td>
</tr>
<tr>
<td>Low</td>
<td>Indicates a low-speed line. The line speed is less than 30 Mbps or this is a best-effort line.</td>
</tr>
</tbody>
</table>
3.3.21 Displaying Copy Fault List

The copy fault list shows the pairs where a copy failure occurred.

When a copy failure occurs, do the following for recovery:

* The copy fault list window cannot be used for recovery from a failure that occurred in a pair registered with the ATgroup.
* When you have not obtained the volume information of the disk array where a copy failure occurred, obtain the information to display the pair with the failure on the copy fault list window. For the procedure for obtaining the volume information, refer to 3.2.3 “Replication Information Screen.”
* When a copy failure occurs in a volume that does not belong to a partition managed by a system administrator partition user, the pair is not displayed on the copy fault list window.

On the menu bar, do the following:

- Select [View] and then [Copy Fault List].

Figure 3-64 shows an example of the Copy Fault List window.

![Copy Fault List Window](image)

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

Fault | Because copy fault occurred, Forced Separate was executed inside the Disk Array. Replicate or Restore can be executed.
Abnormal | Because copy error occurred, Forced Suspend was executed inside the Disk Array. Force Copy or Forced Separate can be executed.

Fault/Abnormal Suspend Process

- Replicate
- Restore
- Pause Copy
- Forced Separate
- Close
- Help

When you select paired volumes with a failure from the list and click one of the buttons, the corresponding dialog box appears.
(i) Status

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault</td>
<td>Forcibly separated in the disk array due to a copy failure.</td>
</tr>
<tr>
<td>Abnormal Suspend</td>
<td>Forcibly suspended in the disk array due to a copy failure.</td>
</tr>
</tbody>
</table>

(ii) Replicate

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

(iii) Restore

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

(iv) Resume Copy

Performs Resume Copy for the selected pair.
This operation can be performed for a volume in the Abnormal Suspend state.

(v) 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 ReplicationControl that runs on the application server. ReplicationControl functions include the creation and display of volume lists, replication operations, pair operations, and disk control and operations that are necessary for operating MVs and RVs in the system.

The description of “UNIX” in this chapter includes all the UNIX systems supported by the ReplicationControl, such as Linux.
Chapter 4  Functions of ReplicationControl

4.1 Command List

Table 4-1 shows the commands provided by ReplicationControl.
For more details on the commands, refer to the “ControlCommand Command Reference”.

<table>
<thead>
<tr>
<th>Command Name</th>
<th>Operation</th>
<th>Description</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 information dependent on the system (server side), and displays the associated information.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_replicate</td>
<td>Replicate</td>
<td>Starts copy (Replicate) from MV to RV.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_separate</td>
<td>Separate</td>
<td>Separate MV and RV in the sync (Replicate or Restore).</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_restore</td>
<td>Restore</td>
<td>Starts copy (Restore) from RV to MV.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_change</td>
<td>Copy Control Change</td>
<td>Changes copy control applied to copy from MV to RV.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_wait</td>
<td>Wait for state</td>
<td>Waits for sync (rpl/sync), sync (rst/sync), or Separated state.</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>
</tr>
<tr>
<td>iSMrc_sense</td>
<td>Volume List Display</td>
<td>Displays volume information.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_rvmode</td>
<td>RV Access Restriction Change</td>
<td>Changes access restrictions for RV.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_updprevent</td>
<td>Cancellation of update prevention for a volume</td>
<td>Cancels update prevention for a volume.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_lldlist</td>
<td>Logical disk information display</td>
<td>Obtains and displays logical disk list information.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_pair</td>
<td>Pair Setting and Unpair</td>
<td>Pairs and unpairs volumes.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_swap</td>
<td>Swap for RDR pair</td>
<td>Swaps an RDR pair or resumes a swap.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_arrayinfo</td>
<td>Disk array information display</td>
<td>Displays information on the replication function of a disk array.</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>iSMrc_flush</td>
<td>File system buffer flush</td>
<td>Flushes the cache buffer of the file system.</td>
<td>✓  -</td>
</tr>
<tr>
<td>iSMrc_mount</td>
<td>Volume Mount</td>
<td>Mounts a volume (file system).</td>
<td>✓  -</td>
</tr>
<tr>
<td>iSMrc_umount</td>
<td>Volume Unmount</td>
<td>Unmounts a volume (file system).</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>
</tr>
<tr>
<td>iSMrc_scan</td>
<td>Disk scanning</td>
<td>Scans for detecting available disks.</td>
<td>✓  -</td>
</tr>
</tbody>
</table>

✓: Targeted  -: Not targeted
Notes:

1. On the Windows system, only a user who belongs to the Administrators group can run these commands.

   However, if User Account Control (UAC) is enabled in the Windows Server 2008 system and you want to log on the system using other authority than the local system administrator that has been installed in the system, you must be authorized as a system administrator in advance.

2. Right after ReplicationControl is installed on a UNIX system, only a super user can perform operations. While only super users can create volume lists, other users than super user can perform other operations by changing authority to execute commands and to access directories.
4.2 Operation Types

To use ReplicationControl, you can select one of the following operations:

- **Direct operation to a disk array**
  This operation allows a user to perform direct operations to a volume (MV or RV) connected to the server and recognized by the OS. It is the most basic operation to be used when you perform replications from the application server.
  A user can create a volume (IV) that can issue an I/O without fail to the disk array for operation via the created volume (control volume). Operations performed through the control volume is useful in the backup server environment where performing replications, etc. disables the OS to access the target volume (RV) connected to the server.
  Before performing direct operations for a disk array, you must register the logical disk of the target MV or RV with the volume list on the server that executes replication commands.
  For more details, refer to 4.2.1 “Direct Operation to Disk Array”.

- **Operations linked with the iSM**
  Installing ReplicationControl in the management server to link it with the replication management functions of the iSM for operation allows you to manage and maintain the data replication functions and construct an environment by using commands.
  A logical disk to be operated does not need to be connected to the server, which does not require you to create the volume list.
  Disk management and operation commands to create and display volume lists, to flush, mount, and unmount file systems, etc. are used for directly operating system volumes. Those commands are not used for operations linked with iSM.
  For more details, refer to 4.2.2 “Using ReplicationControl with iSM.”
<table>
<thead>
<tr>
<th>Command Name</th>
<th>Operation</th>
<th>Direct Operation to Disk Array</th>
<th>Operation Linked with iSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>iSMvollist</td>
<td>Volume List Creation/Display</td>
<td>✓✓²</td>
<td>-</td>
</tr>
<tr>
<td>iSMrc_replicate</td>
<td>Replicate</td>
<td>✓✓¹</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_separate</td>
<td>Separate</td>
<td>✓✓¹</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_restore</td>
<td>Restore</td>
<td>✓✓¹</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_change</td>
<td>Change Copy Control</td>
<td>✓✓¹</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_wait</td>
<td>Wait for state</td>
<td>✓</td>
<td>✓</td>
</tr>
<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_rvmode</td>
<td>RV Access Restriction Change</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_updpredict</td>
<td>Cancellation of update prevention for a volume</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_lldlist</td>
<td>Logical disk information display</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_pair</td>
<td>Pair Setting and Unpair</td>
<td>✓✓¹</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_swap</td>
<td>Swap for RDR pair</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_arrayinfo</td>
<td>Disk array information display</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>iSMrc_flush</td>
<td>File system buffer flush</td>
<td>✓✓²</td>
<td>-</td>
</tr>
<tr>
<td>iSMrc_mount</td>
<td>Volume Mount</td>
<td>✓✓²</td>
<td>-</td>
</tr>
<tr>
<td>iSMrc_umount</td>
<td>Volume Unmount</td>
<td>✓✓²</td>
<td>-</td>
</tr>
<tr>
<td>iSMrc_signature</td>
<td>Signature Operation</td>
<td>✓✓²</td>
<td>-</td>
</tr>
<tr>
<td>iSMrc_scan</td>
<td>Disk scanning</td>
<td>✓✓²</td>
<td>-</td>
</tr>
</tbody>
</table>

*: Not targeted  ✓: Available

*1  Available when a control volume is not used and the server (OS) recognizes MV to allow it to be accessed.

*2  Only volumes of the system recognized by the server are available.
4.2.1 Direct Operation to Disk Array

For direct operation for a disk array, you can select one of the following configurations for each server.

- Direct operation to MV or RV volumes
  The most basic operation to be used for replications from the application server.
  MV used for business operations is connected to the application server, and RV used for operations such as backup is connected to the backup server, etc. To perform direct operations to the volumes, you need to register the accessible logical disk recognized by a server (OS) with the volume list on the server.

- Operation using a control volume
  Since operations are performed through a control volume, you can operate MV or RV even if the application or backup server cannot access the MV or RV directly. However, according to the access control definition set to the disk array, you can only access logical disks that can access the server or logical disks that are paired with the accessible logical disks.
  Register a control volume with the volume list in advance to use it for I/O issue to the disk array.
  Registering a control volume with the volume list in advance allows the volume to be transparent to users during system operation. If a control volume is registered, the control volume will be automatically used for I/O issue to the disk array.
  For more details on control volume registration, refer to the “Data Replication User’s Manual (Installation and Operation Guide)” of the system you will use.
  The application server connected to MV can operate the MV directly without a control volume. The backup server connected to RV can perform replication or separation by using a control volume.
When setting the environment of ReplicationControl, select DIRECT (issuing I/O directly to disk array) for the path to issue I/O to the disk array.

For more details on environment settings, refer to Chapter 8 "Operation Settings" in the “ControlCommand Command Reference”.

**Notes on Operation**

Note the following when implementing direct operation to a disk array:

- Before connecting the logical disk of paired MV or RV to be operated or the logical disk to be used as a control volume to the server, use AccessControl functions to set the access control correctly. Also, create a volume list and register the target logical disk with the volume list before performing replications on a server.

- Make sure each server has one control volume. It is not recommended that different servers use the same logical disk as a control volume.

There are no restrictions on the RAID format and the capacity of a logical disk used as a control volume. For disk arrays supporting pools, small-capacity logical disks can be created as a control volume. You can identify the purpose (attribute) of the logical disk created as a control volume in the disk array indicated below. The identification information displayed on an iSM client, etc. shows that such logical disk is a control volume.

D series

For information on creating a control volume, refer to the “Configuration Setting Tool User’s Manual (GUI)”.  

- After changing a control volume, update the volume list. After adding or deleting a disk array, recreating a logical disk, changing the setting of a logical disk, or adding or deleting a logical disk that can be accessed by the server, be sure to update the volume list to the latest state.

- A control volume must always be accessible so that the server (OS) can issue an I/O to the disk array without fail while the system is running. Do not set a logical disk created as a control volume as RV to be paired.

- Create a control volume in a constantly-running pool, instead of a pool which a volume subject to power saving operation belongs to.
4.2.2 Using ReplicationControl with iSM

Using ReplicationControl together with the iSM enables you to run commands for using and maintaining data replication functions and for operations such as pairing and unpairing to set up an environment, which have been conventionally performed by an iSM client through GUI.

Logical disks you work on do not need to be connected to the server. They do not need to be registered with the volume list, which means that you do not need to create a volume list for operations linked with iSM.

To use ReplicationControl with iSM, install ReplicationControl on the server on which iSM is installed and running. Also, use the environment setting of ReplicationControl to select MANAGER (issuing I/O to disk arrays through iSM) for the setting of the path that issues I/O to disk arrays. For more details on the environment setting, refer to Chapter 8 “Operation Settings” in the “ControlCommand Command Reference”.

Benefits of using ReplicationControl with iSM are:

- You can use commands to manage and maintain data replication functions and construct the environment.
- Logical disks you work on do not need to be connected to the server. You can operate all the logical disks in the disk array to be monitored by the iSM.
- Performing operations through the iSM allows you to connect to a disk array and issue I/O to the disk array through LAN.

Figure 4-3  Operation Linked with iSM
Notes on Operation

Note the following when using ReplicationControl with the iSM:

- While ReplicationControl is used with the iSM, replication is performed asynchronously with business tasks. For replication associated with business tasks, data consistency must be retained by using an application or backup server for file system operations. Because of this, make sure to install ReplicationControl on each server to use ReplicationControl with iStorageManager in association with operations of the servers.

- To perform replications or paring, the disk-array state monitoring information held by the iSM needs to be the latest. Set a short update time interval of the state monitoring information held by the iSM or use the -cr option of the iSMrc_Idlist command to update the disk-array and logical-disk information before performing replication or pairing. For how to specify the environment settings, such as update time interval of state monitoring information held by the iSM, refer to the installation guide.
4.3 Serially Configured Pair and Remote Operation

It also enables you to perform replications for serially-configured pairs on a remote disk array.

The remote operations shown below can be performed for pairs and volumes on a remote disk array. These functions support the simultaneous replication of serially-configured pairs.

<table>
<thead>
<tr>
<th>Command Name</th>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>iSMrc_replicate</td>
<td>Replicate</td>
<td>Replicates a remote pair.</td>
</tr>
<tr>
<td>iSMrc_separate</td>
<td>Separate</td>
<td>Separates a remote pair.</td>
</tr>
<tr>
<td>iSMrc_restore</td>
<td>Restore</td>
<td>Restores a remote pair.</td>
</tr>
<tr>
<td>iSMrc_change</td>
<td>Copy Control Change</td>
<td>Changes the copy control of a remote pair.</td>
</tr>
<tr>
<td>iSMrc_wait</td>
<td>Wait for State</td>
<td>Waits for the copy state of a remote pair to change.</td>
</tr>
<tr>
<td>iSMrc_query</td>
<td>Paired State Display</td>
<td>Displays the copy state of a remote pair.</td>
</tr>
<tr>
<td>iSMrc_sense</td>
<td>Volume List Display</td>
<td>Displays information about a remote volume.</td>
</tr>
<tr>
<td>iSMrc_updprevent</td>
<td>Cancellation of update</td>
<td>Cancels update prevention for a volume.</td>
</tr>
<tr>
<td></td>
<td>prevention for a volume</td>
<td></td>
</tr>
<tr>
<td>iSMrc_swap</td>
<td>swap for RDR pair</td>
<td>Swaps a remote RDR pair or resumes a swap.</td>
</tr>
</tbody>
</table>

Notes on Operation

Note the following when performing local or remote operations for serially-configured pairs:

- When serially-configured pairs are replicated simultaneously, only the Background Copy mode can be used for replicating a pair on the second or subsequent layer.
- Copying to mutually and simultaneously in opposite directions cannot be performed between upper and lower pairs of serially-configured pairs (for example, it is impossible to restore the upper pair when the lower pair is replicated).
- If separation is being performed for the upper or lower pair of serially-configured pairs, the other of the pairs cannot be replicated or restored.
You can remotely operate only a pair or a volume that is registered with the volume list on the application server and that can be directly accessed by the server. Also you can operate disk arrays on up to the next layer. You cannot remotely operate pairs in disk arrays on the second or subsequent layer.

You cannot perform remote operations if a failure occurred on a link between disk arrays or the data replication function of either disk array is frozen.

The volume type you can use when specifying a pair or a volume on a remote disk array is only logical disk name.

When a best-effort line is used for a link between disk arrays, do not remotely operate a disk array on a remote site. Use the server on the same site as the disk array.

Figure 4-5  Relationships between Pairs that Can Be Operated Remotely
A pair configured with the disk array on the second or subsequent layer cannot be operated.

Figure 4-6  Relationships between Pairs that Cannot Be Operated Remotely
4.4 Volume Types

Table 4-4 shows the volume types you can specify as the operation target by using data replication commands.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Identifier</th>
<th>Target System</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Windows</td>
<td>UNIX</td>
</tr>
<tr>
<td>Logical disk name</td>
<td>Specifies a logical disk name set on the disk array side.</td>
<td>ld</td>
<td>✓</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>
<td>-</td>
</tr>
<tr>
<td>NTFS folder name</td>
<td>Specifies an NTFS folder name (path name) set to the volume.</td>
<td>mdir</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Drive letter</td>
<td>Specifies a drive letter set to the volume.</td>
<td>drv</td>
<td>✓</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>
<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>
<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>
<td>✓</td>
</tr>
</tbody>
</table>

✓: Targeted  -: Not Targeted

Notes:

1. An identifier is a character string that indicates a volume type and is used in the following cases:
   - When specifying a volume type by using a replication operation command option (-mvflg, -rvflg, or -volflg)
   - When specifying a volume type by specifying a pair (MV type or RV type) for a replication operation file
2. To use a volume group, the LVM environment is necessary.
3. To use a disk group, the VxVM environment is necessary.
4. When specifying a special file name (/dev/sdX#: X is an alphabetic lower-case character) on the Linux system, remove the partition number (#) of the special file name.
5. The pair setting and unpairing operation (iSMrec_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. When specifying paired volumes for remote operation, you can only use logical disk name as the volume type.
7. When the iSM is used together (i.e. control I/O issued to disk arrays by iSM), you can only use logical disk name as the volume type.
To set multiple pairs in a batch by using replication or pair operation commands, or to operate a specific pair by using multiple commands, use a replication operation file. Using the replication operation file allows you to describe target pairs in the file for managing and sharing the pairs, thereby improving system operations and maintenance performance of the data replication.

The following shows an example of description in the replication operation file:

- For Windows system

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

# Parallel configuration
ld: dev002  ld: dev003
ld: dev002  ld: dev004

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

- For UNIX system

```plaintext
#Type: MV  Type: RV
sfn: /dev/rdsk/c16t1d0  sfn: /dev/rdsk/c16t1d1
sfn: /dev/rdsk/c16t1d2  sfn: /dev/rdsk/c16t1d3
vg: vgvol  ld: /dev/rdsk/c16t1d4, /dev/rdsk/c16t1d5
dg: dg_name  ld: /dev/rdsk/c16t1d4

# Parallel configuration
sfn: /dev/rdsk/c16t2d0  sfn: /dev/rdsk/c16t2d1
sfn: /dev/rdsk/c16t2d0  sfn: /dev/rdsk/c16t2d2

# MV: RV=1:1
sfn: /dev/rdsk/c22t3d0
```

To specify a replication operation file, use the `-file` option together with a replication operation command and a pair operation command.

For information about how to describe and specify a replication operation file, refer to the “ControlCommand Command Reference”.

168
4.6 Displaying/Creating Volume List

The function to create and display the volume list associates logical disk information (disk array side) with system dependent information (server side) and displays the associated information. Because it handles system-dependent information, functions are different between Windows system and UNIX system. On the Windows system, Graphical User Interface (GUI) can be used.

4.6.1 Command Operations (Windows)

On the Windows system, by using the volume list creation and display function by means of the iSMvollist command, you can obtain and display the drive letter, the HBT (host adapter number/bus number/target ID) and LUN (logical unit number), the physical disk number and logical disk name, and associated OS type (hereafter, volume list) of a logical disk in a disk arrays.

The following describes 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 4-7  Relations between System Configuration and HBT](image)
By using the iSMvollist command, you can associate the corresponding system information with the logical
disk of a disk array that can be recognized by the application server to store the required volume information
in the volume list.
You can specify only the volumes registered with the volume list when performing data replication or
snapshot. Therefore, you need to execute the iSMvollist command to create the volume list beforehand.
After adding or deleting a disk array to/from the system, or creating or cancelling a logical disk, be sure to
update the volume list to reflect the information into the list. If the volume list is not updated, inconsistency
may occur during data replication, snapshot, or a disk operation such as flushing or unmounting of a
Windows volume.

Main Options
You can specify the following options with the iSMvollist command:
(i)  Creates/updates the volume list (-cr)
          Scans devices connected to the system to create or update the volume list.
(ii) Displays the volume list
        You can select one of the following options:
          -d option: Lists disk array information.
          -dl option: Sorts information by using logical disk number and displays how the specified disk array
                      is associated with volumes. If a logical disk number is specified, only the information
                      about association with the specified logical disk number will be displayed.
          -de option: Sorts information by using logical disk name and displays how the specified disk array is
                      associated with volumes. If a logical disk name is specified, only the information about
                      association with the specified logical disk name will be displayed.
          -dd option: Sorts information by using path information and displays how the specified disk array is
                      associated with volumes. If a drive letter or a path name of an NTFS folder is specified,
                      only the information about association with the specified drive letter or the path name of
                      the NTFS folder will be displayed.
          -dp option: Sorts information by using physical disk number and displays how the specified disk
                      array is associated with volumes. If a physical disk number is specified, only the
                      information about association with the specified physical disk number will be displayed.
          -dh option: Sorts information by using HBT and LUN and displays how the specified disk array is
                      associated with volumes. If HBT is specified, only the information about association with
                      the specified HBT will be displayed. If LUN is specified, only the information about
                      association with the specified HBT and LUN will be displayed.
          -a option: Displays the information about association with all logical disks.
          -al option: Displays only the information about association with the specified logical disk number.
          -ae option: Displays information only associated with specified logical disk names.
-ad option: Displays information only associated with a specified drive letter or a path name of the NTFS folder.
-ap option: Displays information only associated with specified physical disk numbers.
-av option: Displays information only associated with specified mount point volume names.
-ah option: Displays information only associated with specified HBT. If LUN is also specified, only the information about association with the specified HBT and LUN will be displayed.
-ai option: Displays the information about association with and configuration of the logical disk. Displays only information associated with specified PD Type if the PD Type (attribute of the physical disk configuring the logical disk) is specified.
-ctl option: Lists the physical disk numbers and logical disk numbers of control volumes and the corresponding disk array names.
-p option: Displays the property information about the volume list that includes the version and the date when the volume list is created.
-ax option: Lists the disk array information, the information about association with and configuration of all logical disks, and the property information of the volume list.

**Displayed Information**

(i) When the -cr option is specified:

   When a volume list is created or updated successfully, the following message appears:

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

(ii) When the -d option is specified:

   Disk array information is listed as shown below.

   --- Disk Array List ---
   Disk Array Name   Number of Drives
   disk_array_name   number

   Description
   disk_array_name: Disk array name
   number: Number of logical disk information (volume information) items for each disk array registered in the volume list
(iii) When the -a option is specified:
The information about association with a logical disk is listed as shown below.

<table>
<thead>
<tr>
<th>LDN</th>
<th>LD Name</th>
<th>VAA</th>
<th>OS Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBT</td>
<td>LUN</td>
<td>Disk No.</td>
<td>Disk Array</td>
</tr>
<tr>
<td></td>
<td>Volume Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Path</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ldn ld_name vaa type
hbt lun disk_num disk_array_name
volume_name path

Description
ldn: Logical disk number
ld_name: Logical disk name
vaa: VAA (Volume Absolute Address)
type: OS type
hbt: Host adapter number, bus number, target ID
lun: LUN
disk_num: Physical disk number
disk_array_name: 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

(iv) When the -ai option is specified:
The information about association with and configuration of a logical disk is listed as shown below.

Volume List iSMvollist Version X.X.XXX

<table>
<thead>
<tr>
<th>LDN</th>
<th>LD Name</th>
<th>VAA</th>
<th>PD Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBT</td>
<td>LUN</td>
<td>Disk No.</td>
<td>Disk Array</td>
</tr>
<tr>
<td></td>
<td>Volume Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Idn ld_name</td>
<td>vaa</td>
<td>type</td>
</tr>
<tr>
<td></td>
<td>hbt lun disk_num disk_array_name</td>
<td>pd_type</td>
<td></td>
</tr>
<tr>
<td></td>
<td>volume_name path</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Description
X.X.XXX: Version of the executed iSMvollist command
ldn: Logical disk number
ld_name: Logical disk name
vaa: VAA (Volume Absolute Address)
type: OS type
hbt: Host adapter number, bus number, target ID
lun: LUN
disk_num: Physical disk number
disk_array_name: Disk array name
pd_type: PD type
volume_name: Mount point volume name
path: Drive letter or path name mounted in the NTFS volume folder accessed by a user

(v) When the -ctl option is specified:
Information about control volumes is listed as shown below.

--- Control Volume List ---
Disk No.  LDN  Disk Array Name
disk_num  ldn  disk_array_name

Description
disk_num: Physical disk number
ldn: Logical disk number
disk_array_name: Disk array name

(vi) When the -p option is specified:
The property information about a volume list is listed as shown below.

--- Property of Volume List File ---
Version     version
Created     YYYY/MM/DD hh:mm:ss
Owner Host Name  host_name
Disk Array  disk_array_number
Volume Information  volume_number

Description
version: Version of the iSMvollist command used when the volume list is created
YYYY/MM/DD hh:mm:ss: Date when the volume list is created or updated
host_name: Host name of the server having the volume list
disk_array_number: Total number of disk arrays in the volume list
volume_number: Total number of volume information items in the volume list
(vii) When the `-ax` option is specified:

The disk array information, the information about association with and configuration of a logical disk, and the property information about the volume list are listed as shown below.

<table>
<thead>
<tr>
<th>Volume List</th>
<th>iSMvollist</th>
<th>Version X.X.XXX</th>
<th>Date: YYYY/MM/DD HH:MM:SS</th>
</tr>
</thead>
</table>

--- Disk Array List ---
Disk Array Name | Number of Drives
--- Volume List ---
LDN | LD Name | VAA | OS Type
HBT | LUN | Disk No. | Disk Array | PD Type
Volume Name | Path
LDN | LD_name | VAA | OS Type
HBT | LUN | Disk_num | disk_array_name | PD_type
Volume_name | Path
--- Property of Volume List File ---
Version | version
Created | yyyy/mm/dd hh:mm:ss
Owner Host Name | host_name
Disk Array | disk_array_number
Volume Information | volume_number

Description
X.X.XXX: Version information on the executed iSMvollist command
YYYY/MM/DD HH:MM:SS: Date when the iSMvollist command is executed
disk_array_name: Disk array name
number: Number of logical disk information (volume information) items for each disk array registered in the volume list
LDN: Logical disk number
LD_name: Logical disk name
VAA: VAA (Volume Absolute Address)
OS Type
hbt: Host adapter number, bus number, and target ID
LUN
Disk_num: Physical disk number
PD_type
volume_name: Mount point volume name
Chapter 4  Functions of ReplicationControl

Conditions to Create and Display Volume List
To create and display a volume list, the following conditions must be satisfied:

- While a volume list is created or updated, you cannot display a volume list, or cannot execute replication and snapshot operation commands.
- Create or update a volume list with the logical disk or the volume recognized by the OS on the server.
  A pair including a replication volume (RV) of the data replication function must be separated.
  For a link volume (LV) of the snapshot function, a link to a snapshot volume (SV) must be established.
- Create or update a volume list with a mount point (drive letter or NTFS folder) to be used set to volumes.

4.6.2 Command Operations (UNIX)
On the UNIX system, by using the volume list creation and display functions of the iSMvollist command, you can obtain and display the special file name, the logical disk name, and the associated OS type (hereafter, volume list) of the logical disk in a disk array.

You can specify only the volumes registered with the volume list when performing data replication or snapshot. Because of this, a volume list created by running the iSMvollist command must be in place.

Only a privileged user (super user) can create or update a volume list.

After adding or deleting a disk array to/from the system, or creating or cancelling a logical disk, be sure to update the volume list to reflect the information into the list. If the volume list is not updated, data inconsistency may occur during data replication and snapshot operations.
Main Options
You can specify the following options with the iSMvollist command:

(i) Creates/updates the volume list (-r, -nr, -or)
Scans devices connected to the system to create or update the volume list.
You can set a volume list to be automatically created at the start of the application server. However,
with the default setting, you need to create a volume list manually. To create a volume list
automatically, change the name of the rc file created at the installation of ControlCommand.

To check the version of the iSMvollist command, use the -ver option.

(ii) Displays the volume list
You can select one of the following options:

- d option: Lists disk array information.
- l option: Displays the information about association with all logical disks.
- vs option: Sorts information by using special file name and displays how the specified disk
array is associated with volumes. If a special file name is specified, only the
information about association with the specified special file will be displayed.
- vl option: Sorts information by using logical disk number and displays how the specified disk
array is associated with volumes. If a logical disk number is specified, only
the information about association with the specified logical disk number will be displayed.
- ve option: Sorts information by using logical disk name and displays how the specified disk
array is associated with volumes. If a logical disk name is specified, only the
information about association with the specified logical disk name will be displayed.
- ai option: Displays the information about association with and configuration of the logical
disk.
Displays only information associated with specified PD Type if the PD Type
(attribute of the physical disk configuring the logical disk) is specified.
- ctl option: Lists the special file name and logical disk number of a control volume and the
corresponding disk array name.
- p option: Displays the property information about the volume list that includes the version
and the date when the volume list is created.
- ax option: Lists the disk array information, the information about association with and
configuration of all logical disks, and the property information of the volume list.
Displayed Information

(i) When the -r option is specified:
When a volume list is created or updated successfully, the following message appears:

iSM11700: Please wait a minute.
iSM11100: Command has completed successfully.

(ii) When the -d option is specified:
Disk array information is listed as shown below.

--- Disk Array List ---
Disk Array Name Number of LDN
disk_array_name number

Description
disk_array_name: Disk array name
number: Number of logical disk information items (special file) for each disk array registered in the volume list

(iii) When the -l option is specified:
The information about association with a logical disk is listed as shown below.

<table>
<thead>
<tr>
<th>LDN</th>
<th>LD NAME</th>
<th>VAA</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Special File</td>
<td>Disk Array</td>
<td>Path</td>
</tr>
<tr>
<td>ldn</td>
<td>ld_name</td>
<td>vaa</td>
<td>type</td>
</tr>
<tr>
<td></td>
<td>special_file_name</td>
<td>disk_array_name</td>
<td>path</td>
</tr>
</tbody>
</table>

Description
ldn: Logical disk number
ld_name: Logical disk name
vaa: VAA (Volume Absolute Address)
type: OS type
special_file_name: Special file name
disk_array_name: Disk array name
path: Whether to use a special file
In general, this field is blank and nothing appears in this field. However, "B" will appear if an error is detected in access to the special file during data replication or snapshot.
State of Path (whether to use a special file)

Establishing multiple connections to the same logical disk enables a path (special file) to have a redundant configuration. In this case, if an error is detected in access to the path (special file) used for issuing an I/O, a command of data replication or snapshot automatically switches the access to another path (special file) registered with the volume list to try to continue I/O to the disk array.

When an error is detected in access to a path (special file), “B” is displayed in the Path information of the special file used at the time, which indicates an error occurs in the special file.

When a blocked path accesses a volume successfully after recovery from a path error, the Path information of the special file is cleared and the blocked state of the path is canceled.

(iv) When the -ai option is specified

The information about association with and configuration of a logical disk is listed as shown below.

<table>
<thead>
<tr>
<th>Volume List</th>
<th>iSMvollist</th>
<th>Version X.X.XXX</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDN</td>
<td>LD NAME</td>
<td>VAA</td>
</tr>
<tr>
<td>Special File</td>
<td>Disk Array</td>
<td>Path</td>
</tr>
<tr>
<td>ldn</td>
<td>ld_name</td>
<td>vaa</td>
</tr>
<tr>
<td>special_file_name</td>
<td>disk_array_name</td>
<td>path</td>
</tr>
<tr>
<td>pd_type</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Description

X.X.XXX: Version of the executed iSMvollist command
ldn: Logical disk number
ld_name: Logical disk name
vaa: VAA (Volume Absolute Address)
type: OS type
special_file_name: Special file name

Displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
disk_array_name: Disk array name
path: Whether to use a special file

In general, this field is blank and nothing appears in this field. However, “B” will appear if an error is detected in access to the special file during data replication or snapshot.

pd_type: PD type
(v) When the -ctl option is specified:

Information on a control volume as shown below is listed.

--- Control Volume List ---
Special File  LDN  Disk Array Name  Path
special_file_name  ldn  disk_array_name  path

Description
special_file_name: Special file name
Displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
ldn: Logical disk number
disk_array_name: Disk array name
path: Whether to use a special file
In general, this field is blank and nothing appears in this field. However, "B"
will appear if an error is detected in access to the special file during data
replication or snapshot.

(vi) When the -p option is specified:

Property information of the volume list as shown below is displayed.

--- Property of Volume List File ---
Version  version
Created  YYYY/MM/DD hh:mm:ss
Owner Host Name  host_name
Disk Array  disk_array_number
Volume Information  volume_number

Description
version: Version of the iSMvollist command used for creating the volume list
YYYY/MM/DD hh:mm:ss: Date when the volume list is created or updated
host_name: Host name of the server owning the volume list
disk_array_number: Total number of disk arrays in the volume list
volume_number: Total number of volume information items in the volume list
When the -ax option is specified:

Disk array information, information on correspondence and configuration of logical disks, and property information of the volume list are listed as shown below.

Volume List  iSMvollist  Version X.X.XXX  Date: YYYY/MM/DD HH:MM:SS

--- Disk Array List ---
Disk Array Name  Number of LDN
disk_array_name  number

--- Volume List ---
LDN  LD NAME  VAA  TYPE
Special File  Disk Array  Path
PD Type
ldn  ld_name  vaa  type
special_file_name  disk_array_name  path

--- Property of Volume List File ---
Version  version
Created  yyyy/mm/dd hh:mm:ss
Owner Host Name  host_name
Disk Array  disk_array_number
Volume Information  volume_number
Description
X.X.XXX:  Version information of the executed iSMvollist command
YYYY/MM/DD HH:MM:SS:  Date when the iSMvollist command is executed
disk_array_name:  Disk array name
number:  Number of logical disk information items (special file) for each disk array registered in the volume list
ldn:  Logical disk number
ld_name:  Logical disk name
vaa:  VAA (Volume Absolute Address)
type:  OS type
special_file_name:  Special file name

displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
disk_array_name:  Disk array name
path:  Whether to use a special file
In general, this field is blank and nothing appears in this field.
However, "B" will appear if an error is detected in access to the special file during data replication or snapshot.
pd_type: PD type
version: Version of the iSMvollist command used when the volume list is created
yyyy/mm/dd hh:mm:ss: Date when the column list was created or updated
host_name: Host name of the server owning the volume list
disk_array_number: Total number of disk arrays in the volume list
volume_number: Total number of volume information items in the volume list

**Conditions to Create and Display Volume List**

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

- While a volume list is created or updated, you cannot display a volume list, or cannot execute replication and snapshot operation commands.
- Create or update a volume list with the logical disk or the volume recognized by the OS on the server. A pair including a replication volume (RV) of the data replication function must be separated.
  
For a link volume (LV) of the snapshot function, a link to a snapshot volume (SV) must be established.
4.6.3 GUI Operations (Windows)

On the Windows system, you can create and display volume lists by using the GUI. By using GUI, you can create and/or update a volume list, display the volume list, narrow down the information to be displayed on a disk array basis, and so on.

A function with which you can define control volumes when performing data replication or snapshot through the application server is also provided.

Screen Configuration

To create or display a volume list via the GUI, use the Volume List Display window that consists of the items shown below.

(i) Title bar
   Displays "Volume List Display".

(ii) Menu bar
   For details about items displayed on the menu bar, refer to the “Menu Item List”.

Figure 4-8  Volume List Display Window
(iii) Toolbar buttons

<table>
<thead>
<tr>
<th>Toolbar Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Create/Update Volume List]</td>
<td>Works the same as selecting [Create/Update Volume List] from the menu.</td>
</tr>
<tr>
<td>![Define Control Volume]</td>
<td>Clicking this button has the same effect as selecting [Define Control Volume] from the menu.</td>
</tr>
<tr>
<td>![CSV Output of Information List]</td>
<td>Clicking this button has the same effect as selecting [CSV Output of Information List] from the menu.</td>
</tr>
</tbody>
</table>

(iv) Pair disk/Destination-volume List
For a volume selected on the Volume List Display window, obtains the information about volumes paired by the data replication function or about a volume linked by the snapshot function from the disk array to display the information.

(v) Status bar
The following information appears on the status bar.

- **VOLUME**: Displays the number of volume information items to be displayed on the Volume List Display window. If all disk arrays are targeted for volume-information display, the number of all volume information items in the volume list will be displayed. When disk arrays whose volume information is displayed are narrowed down, the number of volume information items of the target disk array will be displayed.

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

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

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Logical Disk]</td>
<td>Indicates a logical disk that can be used by the server.</td>
</tr>
<tr>
<td>![Control Volume]</td>
<td>Indicates a logical disk defined as a control volume.</td>
</tr>
</tbody>
</table>
| ![Inappropriate State] | Indicates that a logical disk defined as a control volume is in an inappropriate state for one of the following reasons:  
- The control volume is paired as RV.  
- A snapshot generation is added to specify the control volume as a base volume (BV).  
- A link volume (LV) is created with the same logical disk number as the control volume to make the LV accessible from the server.  
- The access control or the control volume is canceled to make the control volume inaccessible from the server.  
- The disk array to which the defined control volume belongs is not recognized.  
For measures that need to be taken for the cases above, refer to 4.6.3.9 “Defining Control Volume”. |
(viii) Volume Name
Displays volume names in the Volume List file.

(ix) Disk No.
Displays physical disk numbers in the Volume List file.

(x) Volume Definition
Displays the identification information of control volume definition.

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

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

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

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

(xv) Type
Displays the volume types (volume attributes) regarding data replication and snapshot that are obtained from a disk array.

(xvi) PD Type
Displays PD type information in the Volume List file.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC</td>
<td>Indicates that the physical disk has the FC attribute.</td>
</tr>
<tr>
<td>ATA</td>
<td>Indicates that the physical disk type has the ATA attribute.</td>
</tr>
<tr>
<td>SAS</td>
<td>Indicates that the physical disk type has the SAS attribute.</td>
</tr>
</tbody>
</table>

Among the information items shown above, items (vi) to (xiv) are obtained from a volume list, and (iv) to (xv) are obtained from a disk array.
Menu Item List
This section describes the items on the menu bar of the Volume List Display window.

- File menu

  ![Menu Items]

  - Create/Update Volume List
    4.6.3.3 “Create/Update the Volume List”
  - CSV Output of Information List
    4.6.3.4 “CSV Output of Information List”
  - Properties
    4.6.3.5 “Displaying Property Information of Volume List”
  - Exit
    4.6.3.1 “Starting/Terminating Volume List Display”

- View menu

  ![Menu Items]

  - Toolbar
    4.6.3.6 “View/Hide Toolbar”
  - Status Bar
    4.6.3.7 “View/Hide Status Bar”
  - Update Display Information
    4.6.3.8 “Update Display Information”

- Operation menu

  ![Menu Items]

  - Define Control Volume
    4.6.3.9 “Define Control Volume”

- Help menu

  ![Menu Items]

  - List Display Screen Help
    Displays information about the Volume List Display window.
  - About
    Displays information about the version.
4.6.3.1 Starting/Terminating Volume List Display

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

Operation Procedure
Starting Volume List Display window
(1) Select [Start] of Windows, [All Programs] ([Programs] for Windows 2000 Server), [Storage Manager Volume List] and then [Volume List Display].

(2) The Volume List Display window appears.

Terminating Volume List Display window
Do one of the following:
- Click the Close button of the system menu.

When the Volume List Display window is terminated, information such as the window size, column width of the list view, and the window position is saved automatically. The saved window information takes effect when the Volume List Display window is opened next time.
4.6.3.2 Narrowing Down by Disk Array

You can select a disk array in the combo box on the Volume List Display window to show only the information about the selected disk array.

**Operation Procedure**

1. Select a disk array from the disk array Selection Combo box on the Volume List Display window.

2. The volume information on the selected disk array is listed.

![Figure 4-10 Narrowing Down by Disk Array](image-url)
4.6.3.3 Create/Update the Volume List

To create or update a volume list, select [File] and then [Create/Update Volume List] on the Volume List Display window.

**Operation Procedure**

1. Select [File] and then select [Create/Update Volume List] on the Volume List Display window. The following inquiry message is displayed:

   ![Figure 4-11 Conformation Message for Creation/Update of Volume List](image)

2. Click the [OK] button to create or update the volume list.
   Click the [Cancel] button to return to the Volume List Display window instead of creating or updating the volume list.

3. The following message appears when the volume list is created/updated successfully.

   ![Figure 4-12 Message Notifying Creation/Update of Volume List Display](image)

4. Click the [OK] button to return to the Volume List Display window.

5. The Volume List Display window is automatically updated after creation/update of the volume list is terminated.
4.6.3.4 CSV Output of Information List

Information displayed on the Volume List Display window can be reported and saved in a CSV file.

Operation Procedure
Select [File] and then [CSV Output of Information List] on the Volume List Display window to display the CSV Output of Information List window.

Figure 4-13 CSV Output of Information List Screen

(1) Specify the destination where the file is saved.
The default destination folder is "etc" under the installation directory.

(2) Specify a file name.
The default name is “vollist.csv”.

(3) Click the [Save] button to save the file.
Click the [Cancel] button to return to the Volume List Display window without saving the file.

(4) When a file is saved successfully, the following message appears:

Figure 4-14 Message Notifying Data is Saved in CSV File

(5) Clicking the [OK] button returns to the Volume List Display window.
Chapter 4 Functions of ReplicationControl

File Example
The following is an example of CSV output of the information on the Volume List display window:

Drive Letter/Path Name,Volume Name,Disk No.,Volume Definition,LUN,LDN,LD Name,Disk
Array,Type,PD Type,Pair disk/Destination-volume
-,-,disk1,Control,000h,000ah,BACKUP_CV,Tokyo_Customer_DataBase,IV,FC,
-,\\?\Volume{cce89867-4d87-11d8-92a3-806d6172696f}\,disk2,-,001h,0005h,LOCAL_DATA1,T
okyo_Customer_DataBase,IV
,FC,
-,\\?\Volume{cce89868-4d87-11d8-92a3-806d6172696f}\,disk3,-,002h,0006h,LOCAL_DATA2,T
okyo_Customer_DataBase,IV
,FC,
E:,\\?\Volume{cce89869-4d87-11d8-92a3-806d6172696f}\,disk4,-,003h,0007h,DB_DATA_RV,T
okyo_Customer_DataBase,RV
,FC,"MV(0000h,DB_DATA_MV,Tokyo_Customer_DataBase,FC)"
F:,\\?\Volume{cce8986a-4d87-11d8-92a3-806d6172696f}\,disk5,-,004h,0008h,DB_REDO1_RV
,Tokyo_Customer_DataBase,RV
,FC,"MV(0001h,DB_REDO1_MV,Tokyo_Customer_DataBase,FC)"
G:,\\?\Volume{cce8986b-4d87-11d8-92a3-806d6172696f}\,disk6,-,005h,0009h,DB_REDO2_RV
,Tokyo_Customer_DataBase,RV
,FC,"MV(0002h,DB_REDO2_MV,Tokyo_Customer_DataBase,FC)"
H:,\\?\Volume{cce8986c-4d87-11d8-92a3-806d6172696f}\,disk7,-,006h,000bh,DB_CTL_RV,To
kyo_Customer_DataBase,RV
,FC,"MV(0003h,DB_CTL_MV,Tokyo_Customer_DataBase,FC)"
I:,\\?\Volume{cce8986d-4d87-11d8-92a3-806d6172696f}\,disk8,-,007h,000ch,DB_ARCHIVE_R
V,Tokyo_Customer_DataBase
,RV,FC,"MV(0004h,DB_ARCHIVE_MV,Tokyo_Customer_DataBase,FC)"
-,\\?\Volume{cce8986e-4d87-11d8-92a3-806d6172696f}\,disk9,-,000h,00a1h,BK_TEMP,Storag
eS4300/001,IV,FC,
-,\\?\Volume{cce8986f-4d87-11d8-92a3-806d6172696f}\,disk10,-,000h,0267h,BK_WORK,Stora
geS4300/002,IV,FC,

Figure 4-15 Output Example of CSV File
The file is an output of information displayed on the Volume List Display window. The information is
separated by commas.
The information about one volume is described on one line in the output file.
Logical disk information displayed in the pair disk/link-destination volume list is indicated in the format
shown below. Information on multiple logical disks is indicated as successive items, which are separated by
slashes by each logical disk information.

190


Chapter 4  Functions of ReplicationControl

“Type (LDN, LDName, DiskArray, PDType) […]”

**Type:** Type

**LDN:** Logical disk number

**LDName:** Logical disk name

**DiskArray:** Disk array name

**PDType:** PD type

### 4.6.3.5 Displaying Property Information of Volume List

To check the property information about a volume list, select [File] and then [Properties] on the Volume List Display window.

**Operation Procedure**

1. Select [File] and then [Properties] on the Volume List Display window to display property information as shown below.

2. Click the [Close] button to return to the Volume List Display window.

![Volume List Properties](image)

**Version**

Displays the version of the Volume List Display used to create the volume list.

**Created**

Displays the date when the volume list was created.
Chapter 4  Functions of ReplicationControl

- Owner Host Name
  Displays the host name of the server having the volume list.
- Disk Array
  Displays the total number of disk arrays in the volume list.
- Volume Information
  Displays the total number of volume information items in the volume list.

### 4.6.3.6 View/Hide Toolbar

To view or hide the toolbar, select [View] and then [Toolbar] on the Volume List Display window.

**View**

![Viewing Toolbar](Figure 4-17 Viewing Toolbar)

**Hide**

![Hiding Toolbar](Figure 4-18 Hiding Toolbar)

### 4.6.3.7 View/Hide Status Bar

To view or hide the status bar, select [View] and then [Status Bar] on the Volume List Display window.

**View**

![Viewing Status Bar](Figure 4-19 Viewing Status Bar)

**Hide**

![Hiding Status Bar](Figure 4-20 Hiding Status Bar)
4.6.3.8 Update Display Information

To update the Volume List file information, select [View] and then [Update Display Information] on the Volume List Display window.

By performing this operation, you can obtain the Volume List file contents to automatically update the Volume List Display window.

With a type and pair disk/destination volume list obtained from the disk array, the Volume List Display window is updated to display the obtained list.

4.6.3.9 Defining Control Volume

To start a window for defining a control volume, select [Operation] and then [Define Control Volume] on the Volume List Display window.

A control volume is used for issuing a control I/O to a disk array from a server. To define a control volume, you need a volume (IV) beforehand that can issue an I/O to a disk array from a server securely and that is not used by data replication or snapshot. You cannot select RV or a base volume (BV) or link volume (LV) of the snapshot function as a control volume, because they cannot be accessed from a server (OS) during data replication or snapshot.

For more information about control volume, refer to 4.2.1 “Direct Operation to Disk Array”.

The purpose (attribute) of logical disks created as control volumes can be identified in the D series disk arrays.

D series

When logical disk information is displayed for a D-series disk array by using an iSM client or other commands, identification information indicating the logical disk is a control volume is shown as the purpose (attribute) of the logical disk.

The procedure for setting a control volume differs depending on the disk array function as described below.

(1) Disk arrays that can identify control volume attributes

There is no need to use this function to define control volumes.

Use the ISM configuration setting functions to create a control volume and then create or update the volume list with the control volume recognized by the server. When a volume list is created or updated, the disk array identifies the control volume attribute among the logical disks connected to the server to register the attribute with the volume list.
with the volume list.

(2) Other disk arrays

Use this function to define control volumes. Refer to the following operating procedures.

In a disk array that can identify control volume attributes, a logical disk created as a control volume is not displayed on the control volume definition window so that the disk cannot be added, changed, or deleted.

Operation Procedure

(1) Select [Operation] and then [Define Control Volume] on the Volume List Display window to display the Define Control Volume window.

Figure 4-21  Define Control Volume Screen

The following describes the items displayed on the Define Control Volume window:
(i) Selected Volume List
Lists already-registered control volumes.

 Displays a logical disk selected as a control volume.

(ii) Candidate Volume List
Lists candidates of logical disks that can be registered as a control volume. The type of logical
disk displayed on the window is IV or MV.

 Displays a logical disk that can be registered as a control volume.

If an error is detected in the saved definition information, one of the following icons will appear to
indicate the error when the Define Control Volume window is opened:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Explanation and Action</th>
</tr>
</thead>
</table>
| ![Error Icon](image1.png) | Indicates that a logical disk defined as a control volume is in an
inappropriate state for one of the following reasons:
- The control volume is paired as RV.
- A snapshot generation is added to specify the control volume as
a base volume (BV).
- A link volume (LV) is created with the same logical disk number
as the control volume to make the LV accessible from the server.
- The access control or the control volume is canceled to make the
control volume inaccessible from the server.
- The disk array to which the defined control volume belongs is
not recognized. |
| ![Action Icon](image2.png) | Redefine a volume (IV) not used by data replication or snapshot as
a control volume. Alternatively, take any of the following actions depending on the
control volume state.
- If the control volume is paired, unpair it.
- If a snapshot generation has been added or LV has been created,
cancel the snapshot.
- If the control volume is not recognized, check the connection
state of the control volume to make it recognized again.
- If the disk array has been unrecognizable, check the connection
state of the disk array and make it recognizable again.
- If the definition of the control volume is inconsistent with others,
delete the definition of the control volume. |
| ![Explanation Icon](image3.png) | Indicates that the defined control volume is disabled for the
following reason:
- In a disk array that can identify control volume attributes, the
control volume has been created with the iSM configuration
setting functions and made accessible from the server. |
| ![Action Icon](image2.png) | Delete the existing control volume definition since the control
volume definition becomes unnecessary for the disk array. |
(2) Register, change, or delete a control volume.

A control volume is used to issue a control I/O to a disk array from a server. A logical disk can be selected for each disk array.

You cannot register RV or a base volume (BV) or link volume (LV) of the snapshot function as a control volume because they are in the Not Ready state during operation. Also, do not pair a logical disk created as a control volume as RV.

- Registering or changing a control volume

To register or change a control volume, select a logical disk to use as a control volume from [Candidate Volume List] and then click the [Add] or [Update] button.
When you try to change a control volume already registered with [Candidate Volume List], the confirmation window shown below appears.

Click the [Yes] button to change the control volume in [Selected Volume List] to the selected logical disk.

Click the [No] button to return to the Define Control Volume window without updating the control volume.

- Deleting a control volume

To delete a control volume already registered with [Selected Volume List], select a logical disk to delete from the [Selected Volume List] and then click the [Delete] button.
(3) When you click the [OK] button on the Define Control Volume window, the message for confirming whether to save the definition information appears.

Click the [Yes] button to save the definition information. A message telling the control volume completed successfully appears.

Click the [No] button to return to the Define Control Volume window.
Click the [OK] button to close the Define Control Volume window and to return to the Volume List Display window.
To enable the saved definition information, create or update the volume list to reflect the definition information of the control volume to the volume list.

When you click the [Cancel] button on the Define Control Volume window, the message for confirming whether to cancel the definition appears.
When you click the [Yes] button on the confirmation message, the definition information is not saved. Instead the Define Control Volume window is closed and then the Volume List Display window reappears.

To return to the Define Control Volume window, click the [No] button.

(4) Update the volume list to reflect the updated definition information to the volume list.
Select [File] and then [Create/Update Volume List] on the Volume List Display window to create or update the volume list and to reflect the saved control volume definition information into the volume list for registration.

When the volume list is successfully created or updated, the display on the Volume List Display window is updated automatically. See the displayed information about [Volume Definition] to check that the definition information is updated correctly.
4.7 Replication Operations

Replication operation commands provide functions to operate volumes by using the data replication function of a disk array and also to obtain and display various information.

4.7.1 Replicate Command

Use the iSMrc_replicate command for replication.

By executing the iSMrc_replicate command, you can start copy to RV paired with MV.

Main Options

For replication using the iSMrc_replicate command, you can specify the following options:

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

   For information on volume types, refer to 4.4 “Volume Types”.

   On the Windows system, you cannot perform operations for a volume that consists of multiple partitions by default because all the partitions in the volume will be targeted for operations if a certain partition (drive letter) is specified for the volume. To perform operations for a volume that consists of multiple partitions, change the settings of the replication operation option setting file. For information about the replication option setting file, refer to the “ControlCommand Command Reference”.

(2) Specifying copy range (-cprange)
   By default, only the difference (diff) between MV and RV is copied. You can use this option to specify that the entire area (full) will be copied.
(3) Specifying copy control (-cpmode)
You can specify a copy control state that will be applied when in replication is ongoing or MV and RV are synchronized. One of the following can be specified:

- Synchronous Copy (-cpmode sync)
  Set the copy control state to Synchronous Copy mode.
- Semi-synchronous Copy (-cpmode semi)
  Set the copy control state to Semi-synchronous Copy mode. This can be specified for a pair set across different disk arrays.
- Background Copy (-cpmode bg)
  Set the copy control state to Background Copy mode.

(4) Specifying access restrictions for RV (-rvacc)
You can specify access restrictions for RV that will be applied when in replication is ongoing or completed.

- Not Ready (-rvacc nr)
  Set the Not Ready state in which the system cannot access the volume.
- Read Only (-rvacc ro)
  The system can only read the volume.
  Be careful to specify Read Only (-rvacc ro) for the access restrictions for RV. For more details, refer to 2.6 “Access Restriction for RV”.

(5) Specifying a wait for copy completion (-wait/nowait)
The system can wait for command completion until the Synchronous state starts after replication.

- Wait Specified (-wait [second])
  If a value is specified in "second", the value will be set as the monitoring time interval of the disk array. The available range is from 1 through 30 seconds (integer). If a value is not specified, RPL_WATCHDEV setting in the replication option setting file will be used for Windows while the setting of environment variable RPL_WATCHDEV will be used for UNIX. For more details on those settings, refer to the “ControlCommand Command Reference”.
- No Wait (-nowait)
  Only instructs start of replication to terminate the command. To check the end of the replication, use the iSMrc_query or iSMrc_wait command.
Displayed Information

The iSMrc_replicate command displays one of the following messages when replication starts, is ongoing, and finishes:

**On the Windows system**

[Start message]

<table>
<thead>
<tr>
<th>Replicate 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>type</td>
</tr>
<tr>
<td>path</td>
<td></td>
</tr>
<tr>
<td>RV:disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume_name</td>
<td>type</td>
</tr>
<tr>
<td>path</td>
<td></td>
</tr>
</tbody>
</table>

[Execution message]

Replicating.....

[End message]

<table>
<thead>
<tr>
<th>Replicate 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>type</td>
</tr>
<tr>
<td>path</td>
<td></td>
</tr>
<tr>
<td>RV:disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume_name</td>
<td>type</td>
</tr>
<tr>
<td>path</td>
<td></td>
</tr>
</tbody>
</table>

**Description**

The execution and end messages appear only when -wait is specified to wait for copy completion. If you do not want the execution message to appear, change the RPL_WAITMSG setting in the replication option setting file. For information about the replication option setting file, refer to the “ControlCommand 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

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

If you do not want the execution message to appear, change the setting of the RPL_WAITMSG environment variable. For information about environment variables, refer to the “ControlCommand Command Reference”.

YYYY/MM/DD hh:mm:ss: Start/End time (Year Month Day Hour Minute Second)
special_file_name: Special file name
Displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
ld_name: Logical disk name
type: OS type
Replicating....: The “.” character is dynamically updated until Replicate is completed.

Conditions to Perform Replicate
To perform Replicate, the following conditions must be satisfied.

- The target MV and RV are paired.
- The activity of the target pair is Separate. The sync is not Separate Preparing, however.
- The Semi-synchronous Copy mode cannot be specified for a pair set in the same disk array. The Semi-synchronous Copy mode can be specified only for a pair set across different disk arrays.
- When the asynchronous remote data replication function (RemoteDataReplication Asynchronous) is used for a pair set across different disk arrays, Background Copy is specified as the copy mode.
- The disk array that stores the specified MV and RV is not in the Freeze state.
- The activity of the pair of the specified MV and another paired RV is not Restore.
• When the specified MV is also used as a base volume (BV) of the snapshot function, Restore is not performed from the snapshot volume (SV), or no restoration error has occurred.
• When the specified RV is also used as a base volume (BV) of the snapshot function, Restore is not performed from the snapshot volume (SV), or no restoration error has occurred.
• When the specified RV is used as a base volume (BV) of the snapshot function, linking is not ongoing for BV.
• When the specified RV is used as a base-volume (BV) of the snapshot function, the copy control of the appropriate pair must be in the Background Copy mode.
• The sync of the pair of the specified MV and the paired upper MV is Separated, Replicating, or Synchronized.
• When the activity of the pair of the specified MV and the paired upper MV is Replicate, the Background Copy mode is specified for the target pair.
• The sync of the pair of the specified RV and the paired lower RV is Separated, Replicating, or Synchronized.
• When the activity of the pair of the specified RV and the paired lower RV is Replicate, the Background Copy mode is specified for the replicated lower pair.
• MV is not NotAccessible, or RV is not protected (ReadOnly or NotAccessible) by the data retention function.
• A dynamic disk is not used.
• RV is unmounted.
• The update prevention state of RV is not prevented by the volume update prevention function.
• The logical disk of MV or RV is not stopped by or the pool to which the logical disk belongs is not stopped by the power saving function.

The following does not apply when ReplicationControl is used together with iSM:
• The target MV or RV is registered with the volume list.
Also, a remote pair to be operated (target pair) must satisfy the following conditions:
- The volumes in the upper or lower pair for the target pair are registered with the volume list.
- When MV or RV of the target pair is also used as a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.
• A volume list is not being created.
• When a combination of a volume group or a disk group with a special file name (logical disk name) is specified, the same number of logical volumes that make up the volume group or disk group is specified as MV (RV) on the special file name (logical disk name) side. In this case, replication is performed in the specified order.
• When a volume group is specified, the group (target volume group) must be active.
• When a disk group is specified, the group (target disk group) must be active.
• An iSM special file is not being created (for Linux version only).
Figure 4-29 shows the conditions to perform Replicate.

- Pair setting
- MV or RV is registered with the volume list.
- A volume list is not being created or updated
- RV is unmounted.
- The disk array is not frozen.
- Separated
- Not in Separate Preparing
- Not in Semi-synchronous copy if the pair is set in the same disk array
- RV is not NotAccessible, or RV is not protected (not ReadOnly or NotAccessible).
- Not a dynamic disk
- MV or RV is not stopped.
- The pool to which MV or RV belongs is not stopped.
- RV is not in the update prevention state.
- When the asynchronous remote data replication function (RemoteDataReplication Asynchronous) is used, only Background Copy is specified as copy mode for a pair set across different disk arrays.

For a serial pair configuration using RDR
- When the upper pair is in the Replicate state, background Copy is specified.

For a serial pair configuration using RDR
- The upper pair is not in the Restoring state
- When the lower pair is in the Replicate state, Background Copy is used.

* In the same disk array, serial DDR pair configuration is not allowed. DDR and RDR must be combined for serial pair configuration.

- Not in the Restoring state.
4.7.2 Separate Command

Use the iSMrc_separate command for Separate.
By using the iSMrc_separate command, you can separate MV and RV to make the RV available from the system.

Main Options
For separation using the iSMrc_separate command, you can specify the following options:

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

For information about volume types, refer to 4.4 “Volume Types”.

On the Windows system, you cannot perform operations for a volume that consists of multiple partitions by default because all the partitions in the volume will be targeted for operations if a certain partition (drive letter) is specified for the volume. To perform operations for a volume that consists of multiple partitions, change the settings of the replication operation option setting file. For information about the replication option setting file, refer to the “ControlCommand Command Reference”.

2) Specifying access restrictions for RV after Separate (-rvacc)
   - You can specify the access restrictions for RV after Separate.
     - Read/Write (-rvacc rw)
       RV can be referred or updated.
     - Read Only (-rvacc ro)
       RV can only be referred.
     - Be careful to specify Read Only (-rvacc ro) for the access restrictions for RV. For more details, refer to 2.6 “Access Restriction for RV”.

3) Specifying a wait for Separate completion (-wait /-nowait)
   - The system can wait for command completion until Separate is completed after the start of Separate.
     - Wait Specified (-wait [second])
       If a value is specified in "second", the value will be set as the monitoring time interval of the disk array. The available range is from 1 through 30 seconds (integer). If a value is not specified, RPL_WATCHDEV setting in the replication option setting file will be used for Windows while the setting of environment variable RPL_WATCHDEV will be used for UNIX. For more details on those settings, refer to the “ControlCommand Command Reference”.

206
- No Wait (-nowait)
  Only instructs start of Separate to terminate the command. To check the end of the separation, use the iSMrc_query or iSMrc_wait command.

(4) Forced Separate (-force)
If a failure occurs in connection between disk arrays and normal Separate cannot be performed for MV and RV, you can specify the -force option to perform Separate for MV and RV individually.
You can select one of the following options when performing Forced Separate:
• Performing Forced Separate for both MV and RV. (-force all)
• Performing Forced Separate for MV. (-force mv)
• Performing Forced Separate for RV. (-force rv)
When performing Forced Separate, note the following:
• Specify "all" in general. Perform forced separation using either the -force mv or rv option when either MV or RV can only be operated due to a disk failure or a failure in link configuration between disk arrays for an RDR pair.
• After performing Forced Separate with MV (or RV) specified, be sure to perform Forced Separate for the paired RV (or MV) in other system. If Forced Separate is performed for either MV or RV, states of MV and RV will be inconsistent and replications will not function correctly.

(5) Start time of RV use (-rvuse)
You can specify the time period during which RV is available.
• Immediately after start of Separate (-rvuse immediate)
  After Separate is started, RV becomes available even if separation is ongoing, while the difference between MV and RV is being reflected to RV (Separate (immediate)). This function can be used only for a DDR pair.
• After completion of Separate (-rvuse complete)
  After Separate is started, RV does not become available until the difference between MV and RV is fully reflected to RV and Separate is completed (Separate(completion)). RV cannot be used while the difference between MV and RV is being reflected to RV.
• Follows the default setting (-rvuse default)
  On the Windows system, the system follows the setting of RVUSE in the replication option setting file. On the UNIX system, the system follows the setting of the RPL_SEP_RVUSE environment variable. For more details on the settings, refer to the “ControlCommand Command Reference”.

207
Displayed Information

The iSMrc_separate command displays one of the following messages when separation starts, is ongoing, and finishes:

On the Windows system

[Start message]
Separate 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]
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

The execution and end messages appear only when -wait is specified to wait for separation completion. If you do not want the execution message to appear, change the RPL_WAITMSG setting in the replication option setting file. For information about the replication option setting file, refer to the “ControlCommand 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
The execution and end messages appear only when -wait is specified to wait for separation completion. If you do not want the execution message to appear, specify the RPL_WAITMSG environment variable. For information about environment variables, refer to the “ControlCommand Command Reference”.

YYYY/MM/DD hh:mm:ss: Start/End time (Year Month Day Hour Minute Second)
special_file_name: Special file name
  Displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
ld_name: Logical disk name
type: OS type
Separating...: The “.” character is dynamically updated until Separate is completed.

Conditions to Perform Separate
To perform Separate, the following conditions must be satisfied.

- The target MV and RV are paired.
- The sync of the target pair is not Replicate Preparing, Separate Preparing, Restore Preparing, or Restoring.
- The sync of the upper pair that is paired with MV of the target pair is not Separating.
- The sync of the lower pair that is paired with RV of the target pair is not Separate Preparing or Separating.
- The disk array where the specified MV and RV are stored is not frozen. For an RDR pair, forced separation can be performed for the MV or the RV on the local disk array even if the replication function of the remote disk array is frozen.
• The function to start the use of RV immediately after the start of separation (Separate (immediate)) cannot be used for an RDR pair.
• A dynamic disk is not used.
• Before starting separation, flush and unmount the file system of MV to secure the pause point.
• The logical disk of MV or RV is not stopped by or the pool to which the logical disk belongs is not stopped by the power saving function.
• When MV is separated, the logical disk of the MV is not stopped by or the pool to which the logical disk of the MV belongs is not stopped by the power saving function.
• When RV is separated, the logical disk of the RV is not stopped by or the pool to which the logical disk of the RV belongs is not stopped by the power saving function.

The following does not apply when ReplicationControl is used together with iSM:
• The target MV or RV is registered with the volume list.
  Also, a remote pair to be operated (target pair) must satisfy the following conditions:
  - The volumes in the upper or lower pair for the target pair are registered with the volume list.
  - When MV or RV of the target pair is also used as a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.
• A volume list is not being created.
• When a combination of a volume group or a disk group with a special file name (logical disk name) is specified, the same number of logical volumes that make up the volume group or disk group is specified as MV (RV) on the special file name (logical disk name) side. In this case, Copy is performed in specified sequential order.
• When a volume group is specified, the group (target volume group) must be active.
• When a disk group is specified, the group (target disk group) must be active.
• An iSM special file is not being created (for Linux version only).
Figure 4-30 shows the conditions to perform Separate.

- Pair setting
  - MV or RV is registered with the volume list.
  - A volume list is not being created or updated
  - MV is flushed or unmounted.
  - The disk array is not frozen.
  - Not in Separate Preparing, Replicate Preparing, Restore Preparing, or Restoring
  - Not a dynamic disk
  - MV or RV is not stopped.
  - The pool to which MV or RV belongs is not stopped.

For a serial pair configuration using RDR
- The upper pair is not in the Separating state.

For a serial pair configuration using RDR
- The lower pair is not in the Separate Preparing state.

* In the same disk array, serial DDR pair configuration is not allowed.
  DDR and RDR must be combined for serial pair configuration.

Figure 4-30  Conditions to Perform Separate
Chapter 4  Functions of ReplicationControl

4.7.3 Restore Command

Use the iSMrc_restore command for Restore.
By using the iSMrc_restore command, you can start copy from RV to the paired MV.

On the Windows system, unmount MV and then flush the buffer of the file system before starting restoration.
After starting restoration, mount the MV again. On the UNIX system, unmount the file system of MV before
performing restoration because the system will end abnormally without starting restoration if the file system
of MV is mounted.

Main Options

For restoration using the iSMrc_restore command, you can specify the following options:

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

For information about volume types, refer to 4.4 “Volume Types”.

On the Windows system, you cannot perform operations for a volume that consists of multiple
partitions by default because all the partitions in the volume will be targeted for operations if a certain
partition (drive letter) is specified for the volume. To perform operations for a volume that consists of
multiple partitions, change the settings of the replication operation option setting file. For information
about the replication option setting file, refer to the “ControlCommand Command Reference”.

(2) Specifying copy range (-cprange)
By default, only the difference (diff) between MV and RV is copied. You can use this option to specify
that the entire area (full) will be copied.

(3) Specifying copy control (-cpmode)
You can specify a copy control state that will be applied when restoration is ongoing or MV and RV are
synchronized.
• Synchronous Copy (-cpmode sync)
  Set the copy control state to Synchronous Copy mode.
• Semi-synchronous Copy (-cpmode semi)
  Set the copy control state to Semi-synchronous Copy mode. This can be specified for paired volumes
  in different disk arrays.
• Background Copy (-cpmode bg)
Set the copy control state to Background Copy mode.

(4) Specifying access restrictions for RV (-rvacc)
You can specify access restrictions for RV that will be applied when restoration is ongoing or completed.
- Not Ready (-rvacc nr)
  Switches to the Not Ready state. Operations cannot be performed for the volume from the system.
- Read Only (-rvacc ro)
  The system can only read the volume.
  Pay careful attention when you specify Ready Only (-rvacc ro) for the RV access restrictions. For more details, refer to 2.6 “Access Restriction for RV”.

(5) Specifying a wait for copy completion (-wait/nowait)
The system can wait for command completion until the Synchronous state starts after restoration.
- Wait Specified (-wait [second])
  If a value is specified in "second", the value will be set as the monitoring time interval of the disk array. The available range is from 1 through 30 seconds (integer). If a value is not specified, RPL_WATCHDEV setting in the replication option setting file will be used for Windows while the setting of environment variable RPL_WATCHDEV will be used for UNIX. For more details on those settings, refer to the “ControlCommand Command Reference”.
- No Wait (-nowait)
  Only instructs start of restoration to terminate the command. To check the end of the restoration, use the iSMrc_query or iSMrc_wait command.

(6) Specifying an operation mode for RV (-mode)
You can select whether to reflect the data updated in MV into RV while restoration is ongoing.
- RV update specified (-mode update)
  Performs restoration while reflecting the data updated in MV into RV. When restoration is completed and the system goes into the Synchronous state, the state changes to Restored.
- RV protection specified (-mode protect)
  Performs restoration without reflecting the data updated in MV into RV. When restoration is completed and the system goes into the Synchronous state, the RV is automatically separated from the MV and then the state changes to Separated.
- Follows the default setting (-mode default)
  The Windows system follows the MODE setting in the [RESTORE] section in the replication operation option setting file, and the UNIX system follows the setting of the RPL_SEP_MODE environment variable. For more details on the settings, refer to the “ControlCommand Command Reference”.

213
Displayed Information

The iSMrc_restore command displays one of the following messages when restoration starts, is ongoing, and finishes:

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

The execution and end messages appear only when -wait is specified to wait for restoration completion.
If you do not want the execution message to appear, change the RPL_WAITMSG setting in the replication option setting file. For information about the replication option setting file, refer to the “ControlCommand 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

Restoring...: The “.” character is dynamically updated until Restore is completed.

**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**

The execution and end messages appear only when -wait is specified to wait for replication completion. If you do not want the execution message to appear, change the setting of the RPL_WAITMSG environment variable. For information about environment variables, refer to the “ControlCommand Command Reference”.

```
YYYY/MM/DD hh:mm:ss:  Start/End time (Year Month Day  Hour Minute Second)
special_file_name:  Special file name
   Displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
ld_name:  Logical disk name
type:  OS type
Restoring...:  The “.” character is dynamically updated until Restore is completed.
```
Conditions to Perform Restore

To perform Restore, the following conditions must be satisfied.

- The target MV and RV are paired.
- The activity of the target pair is Separate and the synchronous state is not Separate Preparing or Separating.
- The Semi-synchronous Copy mode cannot be specified for a pair set in the same disk array. The Semi-synchronous Copy mode can be specified only for a pair set across different disk arrays.
- The disk array where the specified MV and RV are stored is not frozen.
- The sync state of another RV paired with the specified MV is Separated.
- When the specified MV is also used as a base volume (BV) of the snapshot function, no restoration error has occurred.
- When the specified MV is also used as a base volume (BV) of the snapshot function, snapshot has not been established for all snapshot volumes (SVs) paired with BV.
- When the specified RV is also used as a base volume (BV) of the snapshot function, Restore is not performed from the snapshot volume (SV), or no restoration error has occurred.
- When the specified RV is also used as a base volume (BV) of the snapshot function, Restore (update) cannot be performed.
- When the specified MV or RV is also used as a base volume (BV) of the snapshot function, linking is not ongoing for BV.
- The sync state of the upper MV paired with the specified MV is Separated.
- The sync state of the lower RV paired with the specified RV is Separated.
- When MV or RV is protected (ReadOnly or NotAccessible) by the data retention function, Restore (update) cannot be performed.
- When MV is protected (ReadOnly or NotAccessible) or RV is NotAccessible by the data retention function, Restore (protect) cannot be performed.
- A dynamic disk is not used.
- Both MV and RV are unmounted.
- When the update prevention state of MV or RV is not prevented by the volume update prevention function, Restore (update) cannot be performed.
- When the update prevention state of MV is prevented by the volume update prevention function, Restore (protect) cannot be performed.
- The logical disk of MV or RV is not stopped by or the pool to which the logical disk belongs is not stopped by the power saving function.

The following does not apply when ReplicationControl is used together with iSM:

- The target MV or RV is registered with the volume list.
  Also, a remote pair to be operated (target pair) must satisfy the following conditions:
  - The volumes in the upper or lower pair for the target pair are registered with the volume list.
  - When MV or RV of the target pair is also used as a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.
A volume list is not being created.

When a combination of a volume group or a disk group with a special file name (logical disk name) is specified, the same number of logical volumes that make up the volume group or disk group is specified as MV (RV) on the special file name (logical disk name) side. In this case, restoration is performed in the specified order.

When a volume group is specified, the group (target volume group) must be active.

When a disk group is specified, the group (target disk group) must be active.

An iSM special file is not being created (for Linux version only).
Chapter 4  Functions of ReplicationControl

Figure 4-31 shows the conditions to perform Restore.

- Pair setting
- MV or RV is registered with the volume list.
- A volume list is not being created or updated
- Both MV and RV are unmounted.
- The disk array is not frozen.
- Separated
- Not in Separate Preparing
- Not in Semi-synchronous if the pair is set in the same disk array
- MV or RV is not protected (not ReadOnly or NotAccessible) for Restore (update).
- MV is not protected (not ReadOnly or NotAccessible) or RV is not NotAccessible for Restore (protect).
- Not a dynamic disk
- MV or RV is not stopped.
- The pool to which MV or RV belongs is not stopped.
- The update of MV or RV is not prevented for Restore (update).
- The update of MV is not prevented for Restore (protect).

- The pair of MV and another RV is in the Separate state.

For a serial pair configuration using RDR
- The upper pair is in the Separate state.

In the same disk array, serial DDR pair configuration is not allowed. DDR and RDR must be combined for serial pair configuration.

- Link is not set.
- Snapshot is not established for all SVs paired with MVs (BVs).
- Not in the Restoring state.
- Link is not set.
- Restore (update) is not performed.

Figure 4-31  Conditions to Perform Restore
**4.7.4 Copy Control Change Command**

To change a copy control, use the `iSMrc_change` command.

By using the `iSMrc_change` command, you can change the copy control applied in the Replicate or Restore state.

If RV Restore (protect) is performed, the data updated in MV will not be reflected into RV. Therefore changing a copy control (Synchronous Copy Mode, Semi-synchronous Copy Mode, or Background Copy) has no effect.

**Main Options**

For changing a copy control using the `iSMrc_change` command, you can specify the following options:

1. **Specifying paired volumes**
   - Specify MV and RV.
     - Specifying MV (`-mv volume -mvflg mv_flg`)
       - Specifies a volume and volume type for MV.
     - Specifying RV (`-rv volume -rvflg rv_flg`)
       - Specifies a volume and volume type for RV.
   For information about volume types, refer to 4.4 “Volume Types”.

2. **Copy Control**
   - You can specify one of the following copy controls:
     - Synchronous Copy (`-sync`)
       - Set the copy control state to Synchronous Copy mode.
     - Semi-synchronous Copy (`-semi`)
       - Set the copy control state to Semi-synchronous Copy mode. This can be specified for paired volumes in different disk arrays.
     - Background Copy (`-bg`)
       - Set the copy control state to Background Copy mode.
     - Suspend (`-suspend`)
       - Set the copy control state to Suspend.
     - Resume (`-resume`)
       - Set the copy control state to Foreground Copy.

The following table shows the relations between copy controls before change and change options:
Table 4-6  Relations between Copy Controls

<table>
<thead>
<tr>
<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 (synchronous)</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td>✓*</td>
</tr>
<tr>
<td>semi (semi-synchronous)</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td>✓*</td>
</tr>
<tr>
<td>bg (background)</td>
<td>✓</td>
<td>✓</td>
<td>✓*</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>suspend (suspend)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓*</td>
<td>✓</td>
</tr>
</tbody>
</table>

✓: The state can be changed.
✓*: The state can be changed, but the copy control cannot be changed.
-: The state cannot be changed.

Displayed Information

The iSMrc_change command displays one of the following messages when copy-control change starts and finishes:

On the Windows system

[Start message]

Change 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

[End message]

Change 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

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]

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

[End message]

Change Normal End YYYY/MM/DD hh:mm:ss
MV:special_file_name ld_name type
RV:special_file_name ld_name type

Description
YYYY/MM/DD hh:mm:ss: Start/End time (Year Month Day Hour Minute Second)
special_file_name: Special file name
Displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
ld_name: Logical disk name
type: OS type

Conditions to Change Copy Control
To change the copy control, the following conditions must be satisfied:

• The target MV and RV are paired.
• The activity of the target pair is Replicate or Restore and the synchronous state is not Replicate Preparing or Restore Preparing.
• The Semi-synchronous Copy mode cannot be specified for a pair set in the same disk array.
• The Semi-synchronous Copy mode can be specified only for a pair set across different disk arrays.
• When the asynchronous remote data replication function (RemoteDataReplication Asynchronous) is used for a pair between different disk arrays of which the activity is Replicate, Background Copy is specified as the copy mode for the target pair.
• The disk array where the specified MV and RV are stored is not frozen.
• You cannot change a copy control from Synchronous to Semi-synchronous or vice versa.
• When the activity of the target pair is Replicate and that of the pair of the specified MV and the paired upper MV is also Replicate, Background Copy is specified as the copy mode for the target pair.
• When the specified RV is used as a base volume (BV) of the snapshot function, Background Copy is specified as the copy mode for the target pair.
• The sync of the pair of the specified MV and the paired upper MV is not Separating.
• The sync of the pair of the specified RV and the paired lower RV is not Separate Preparing, Replicate Preparing, or Separating.
• A dynamic disk is not used.
• The logical disk of MV or RV is not stopped by or the pool to which the logical disk belongs is not stopped by the power saving function.
The following does not apply when ReplicationControl is used together with iSM:

- The target MV or RV is registered with the volume list.
  Also, a remote pair to be operated (target pair) must satisfy the following conditions:
  - The volumes in the upper or lower pair for the target pair are registered with the volume list.
  - When MV or RV of the target pair is also used as a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.
- A volume list is not being created.
- When a combination of a volume group or a disk group with a special file name (logical disk name) is specified, the same number of logical volumes that make up the volume group or disk group is specified as MV (RV) on the special file name (logical disk name) side.
- When a volume group is specified, the group (target volume group) must be active.
- When a disk group is specified, the group (target disk group) must be active.
- An iSM special file is not being created (for Linux version only).

Figure 4-32 shows the conditions to perform copy control operations.

![Diagram](image)

- Pair setting
- MV or RV is registered with the volume list.
- A volume list is not being created or updated
- The disk array is not frozen.
- In the Replicate or Restore state
- Not in Replicate Preparing or Restore Preparing
- Not in Semi-synchronous copy if the pair is set in the same disk array
- The change is not Synchronous Copy to Semi-synchronous Copy or vice versa.
- When the target activity of the target and upper pairs is Replicate, Background copy is specified.
- Not a dynamic disk
- MV or RV is not stopped.
- The pool to which MV or RV belongs is not stopped.
- When the asynchronous remote data replication function (RemoteDataReplication Asynchronous) is used, only Background Copy is specified as copy mode for a pair set across different disk arrays.

* In the same disk array, serial DDR pair configuration is not allowed.

DDR and RDR must be combined when serially configuring pairs.

Figure 4-32  Conditions to Change Copy Control
4.7.5 Wait Command

Use the iSMrc_wait command to wait for completion of replication, of restoration copy (synchronization), or of separation.

Main Options

For performing wait operations using the iSMrc_wait command, you can specify the following options:

(1) Specifying paired volumes

Specify MV and RV.

• Specifying MV (-mv volume -mvflg mv_flg)
  Specifies a volume and volume type for MV.

• Specifying RV (-rv volume -rvflg rv_flg)
  Specifies a volume and volume type for RV.

For information about volume types, refer to 4.4 “Volume Types”.

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

• MV and RV
  Waits for operations for a specified pair

• MV only
  When one MV is paired with one RV, RV can be omitted and the system waits for operations in the same way as when MV and RV are specified for the pair.

• RV only
  Waits for operations in the same way as when MV and RV are specified.

(2) Wait end condition (-cond)

You can specify a condition for ending wait operations. This option must be specified.

• Completion of replication or restoration (-cond sync)
  Waits for sync (rpl/sync) or sync(rst/sync).

• Completion of separation (-cond sep)
  Waits for completion of separation (including separation completion accompanied by completion of Restore (protect)).

(3) Pair 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, you can specify the default setting by using RPL_WATCHDEV in the replication option setting file. On the UNIX system, you can specify the default setting by using the RPL_WATCHDEV environment variable. For more details on the settings, refer to the “ControlCommand Command Reference”.

223
(4) Time limit of pair monitoring (-limit)

You can specify a time limit to stop monitoring the state of paired volumes. If a wait is not completed by the time (value) specified, the wait will be discontinued, resulting in an abnormal end.

- Specifying a time limit (-limit [second])
  Specify a value (in seconds) in [second] for a monitoring time limit. A value from 0 to 86,400 seconds (integer) can be specified.

- No limit (-limit nolim)
  Waits for completion of operation unlimitedly.

On the Windows system, you can specify the default setting by using RPL_LIMWATCHDEV in the replication option setting file. On the UNIX system, you can specify the default setting by using the RPL_LIMWATCHDEV environment variable. For more details on the settings, refer to the “ControlCommand Command Reference”.

Displayed Information

The iSMrc_wait command displays the following messages when the system is waiting and the waiting ends:

On the Windows system

[Execution message]
Waiting...

[End message]

<table>
<thead>
<tr>
<th>activity_state</th>
<th>Normal End</th>
<th>YYYY/MM/DD hh:mm:ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV/disk_number</td>
<td>ld_name</td>
<td>type</td>
</tr>
<tr>
<td>volume_name</td>
<td>path</td>
<td></td>
</tr>
<tr>
<td>RV/disk_number</td>
<td>ld_name</td>
<td>type</td>
</tr>
<tr>
<td>volume_name</td>
<td>path</td>
<td></td>
</tr>
</tbody>
</table>

Description

If you do not want the execution message to appear, change the RPL_WAITMSG setting in the replication option setting file. For information about the replication option setting file, refer to the “ControlCommand Command Reference”.

activity_state: Activity of the paired volumes for which the wait is completed

- Replicate sync (rpl/sync)
- Restore sync (rst/sync)
- Separate Separated (including the separated state that follows completion of RV Restore (protect))
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...: Periods are dynamically updated until a 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
If you do not want the execution message to appear, change the setting of the RPL_WAITMSG environment variable. For information about environment variables, refer to the “ControlCommand Command Reference”.
activity_state: Activity of the paired volumes for which the wait is completed
Replicate sync (rpl/sync)
Restore sync (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
Displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
ld_name: Logical disk name
type: OS type
Waiting...: Periods are dynamically updated until a wait is completed.
Conditions to Execute Wait Command

To execute wait commands, the following conditions must be satisfied:

- The target MV and RV are paired.
- A dynamic disk is not used.

The following does not apply when ReplicationControl is used together with iSM:
- The target MV or RV is registered with the volume list.
  
  Also, a remote pair to be operated (target pair) must satisfy the following conditions:
  - The volumes in the upper or lower pair for the target pair are registered with the volume list.
  - When MV or RV of the target pair is also used as a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.
- A volume list is not being created.
- When a combination of a volume group or a disk group with a special file name (logical disk name) is specified, the same number of logical volumes that make up the volume group or disk group is specified as MV (RV) on the special file name (logical disk name) side. In this case, Copy is performed in specified sequential order.
- When a volume group is specified, the group (target volume group) must be active.
- When a disk group is specified, the group (target disk group) must be active.
- An iSM special file is not being created (for Linux version only).

Figure 4-33 shows the conditions to execute wait commands.

![Figure 4-33 Execution Conditions for Wait Commands](image)
4.7.6 Replication State Display Command

To display a replication state, use the iSMrc_query command.

Main Options
You can specify the following options with the iSMrc_query command:

(1) Specifying paired volumes
   Specify MV and RV.
   - Specifying MV (-mv volume -mvflg mv_flg)
     Specifies a volume and volume type for MV.
   - Specifying RV (-rv volume -rvflg rv_flg)
     Specifies a volume and volume type for RV.
   For information about volume types, refer to 4.4 “Volume Types”.

The target volumes (MV and/or RV) can be specified in any of the combinations below.
- MV and RV
  Displays the state of the specified pair.
- MV only
  Displays the states of all the pairs set with MV.
- RV only
  Displays the states of pairs in the same way as when MV and RV are specified.

Displayed Information
The iSMrc_query command displays the following information.

On the Windows system

[Displayed information]

<table>
<thead>
<tr>
<th>MV: Disk No.</th>
<th>disk_number</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD Name</td>
<td>ld_name</td>
</tr>
<tr>
<td>Type</td>
<td>type</td>
</tr>
<tr>
<td>Volume Name</td>
<td>volume_name</td>
</tr>
<tr>
<td>Path</td>
<td>path</td>
</tr>
<tr>
<td>RV: Disk No.</td>
<td>disk_number</td>
</tr>
<tr>
<td>LD Name</td>
<td>ld_name</td>
</tr>
<tr>
<td>Type</td>
<td>type</td>
</tr>
<tr>
<td>Volume Name</td>
<td>volume_name</td>
</tr>
<tr>
<td>Path</td>
<td>path</td>
</tr>
<tr>
<td>Activity State</td>
<td>activity</td>
</tr>
<tr>
<td>Sync State</td>
<td>sync</td>
</tr>
<tr>
<td>Copy Control State</td>
<td>copy</td>
</tr>
</tbody>
</table>
### Functions of ReplicationControl

- **<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
- **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 folder
- **activity**: Activity
- **sync**: State of pair operation
- **copy**: Copy Control
- **<state> Start Time**: Operation start time (<state> is variable)
- **<state> End Time**: Operation end time (<state> is variable)
- **separate_diffsize**: Difference in data that was made in the Separate state

*Updates made in MV and RV are separately managed as the difference in data. Updates in MV will be displayed if MV is specified, and updates in RV will be displayed if only RV is specified.*

- **copy_diffsize**: Difference in data that was made in the Replicate or Restore state
- **rvacc**: Access restrictions for RV
- **prev_state**: Previous state of pair operation before the state changed

#### 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
Chapter 4  Functions of ReplicationControl

RV Access  rvacc
Previous Active  prev_state

Description
special_file_name: Special file name
Displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
ld_name: Logical disk name
type: OS type
activity: Activity
sync: State of pair operation
copy: Copy Control
<state> Start Time: Operation start time (<state> is variable)
<state> End Time: Operation end time (<state> is variable)
separate_diffsize: Difference in data that was made in the Separate state
  * Updates made in MV and RV are separately managed as the difference in data. Updates in MV will be displayed if MV is specified, and updates in RV will be displayed if only RV is specified.
copy_diffsize: Difference in data that was made in the Replicate or Restore state
rvacc: Access restrictions for RV
prev_state: Previous state of pair operation before the state changed

Conditions to Display State
To display states, the following conditions must be satisfied:

- The target MV and RV are paired.
- A dynamic disk is not used.

The following does not apply when ReplicationControl is used together with iSM:
- The target MV or RV is registered with the volume list.
  Also, a remote pair to be operated (target pair) must satisfy the following conditions:
  - The volumes in the upper or lower pair for the target pair are registered with the volume list.
  - When MV or RV of the target pair is also used as a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.
- A volume list is not being created.
- When a combination of a volume group or a disk group with a special file name (logical disk name) is specified, the same number of logical volumes that make up the volume group or disk group is specified as MV (RV) on the special file name (logical disk name) side.
- When a volume group is specified, the group (target volume group) must be active.
- When a disk group is specified, the group (target disk group) must be active.
- An iSM special file is not being created (for Linux version only).
Figure 4-34 shows the conditions to display replication states.

4.7.7 Specific Volume Information Display Command

To display specific volume information, use the iSMrc_sense command.

Main Options

You can specify the following options with the iSMrc_sense command:

(1) Specifying volumes
    Specify a target volume.
    • Specify volumes (-vol volume -volflg vol_flg)
      Specifies a volume and volume type.
      For information about volume types, refer to 4.4 “Volume Types”.

(2) Displaying attribute information (-attr)
    Displays logical disk attributes and the link state of the link volume (LV).

(3) Displaying data protection information (-protect)
    Displays information about logical disk protection by the data retention function.

(4) Displaying update prevention state (-updprevent)
    Displays the volume update prevention state.
Displayed Information

The iSMrc_sense command displays the following information:

On the Windows system

(1) When the -attr option is specified:
   - Disk No. disk_number
   - LD Name ld_name
   - VAA vaa
   - Type type
   - Volume Name volume_name
   - Path path
   - Attribute attribute
   - LV Link Status link_status

(2) When the -protect option is specified:
   - Disk No. disk_number
   - LD Name ld_name
   - VAA vaa
   - Type type
   - Volume Name volume_name
   - Path path
   - Protection Information:
     - Protection State protection_state
     - Begin Date begin_date
     - Retention Date retention_date
     - Retention Mode retention_mode
     - Reinitialize reinitialize_state

(3) When the -updprevent option is specified:
   - Disk No. disk_number
   - LD Name ld_name
   - VAA vaa
   - Type type
   - Volume Name volume_name
   - Path path
   - Update Prevention State prevention_state
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
attribute: Logical disk attribute
Displayed only when the -attr option is specified.
link_status: Link state of the link volume
Displayed only when the -attr option is specified. When the target volume is not a link volume, “-” (hyphen) appears.
link Link
unlink Unlink
protection_state: The state of the logical disk protection by the data retention function
If the logical disk is not protected or protection information cannot be obtained, a hyphen (-) will be displayed.
RO Read only (valid)
NA Not accessible (valid)
RO(expired) Read only (expired)
NA(expired) Not accessible (expired)
begin_date: Date when data retention function starts protecting the logical disk
If the logical disk is not protected or protection information cannot be obtained, a hyphen (-) will be displayed.
retention_date: Date until which the data retention function will protect the logical disk
If the logical disk is not protected or protection information cannot be obtained, a hyphen (-) will be displayed.
permanent Data is retained permanently by the data protection function.
retention_mode: Mode in which the data retention function protects the logical disk
If the logical disk is not protected or protection information cannot be obtained, a hyphen (-) will be displayed.
normal normal mode
You can cancel protection or reset the retention period at any time.
secure secure mode
You cannot cancel protection until the retention period has expired. You can extend the retention period or change the protection state.
strict  
strict mode
You cannot cancel protection until the retention period has expired. Neither can you reset the retention period and protection state.

reinitialize_state: Logical disk reinitialization state
If reinitialization is not performed, a hyphen (-) will be displayed.
formatting(nn\%)
Reinitialization in progress

nn indicates a value that shows the progress of initialization.

format-fail Reinitialization failed

Update Prevention State: Volume update prevented
When the swap function for RDR pair cannot be used or the information cannot be obtained, a hyphen (“-”) is displayed.
Prevent Prevent state
When an RDR pair is being swapped, swapping an RDR pair is suspended, or the RDR quick sync function is used, the paired MV and RV are in the Prevent state. For more details on the RDR quick sync function, refer to 2.4 “RDR Quick Sync” in the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

Not Prevent Not prevented
Normal state.

On the UNIX system
(1) When the -attr option is specified:

<table>
<thead>
<tr>
<th>Special file</th>
<th>LD Name</th>
<th>VAA</th>
<th>Type</th>
<th>Attribute</th>
<th>LV Link Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>special_file_name</td>
<td>ld_name</td>
<td>vaa</td>
<td>type</td>
<td>attribute</td>
<td>link_status</td>
</tr>
</tbody>
</table>

To change the output format as shown below, set ON to the environment variable RPL_VERTICAl_INDEX. For more details on environment variables, refer to the “ControlCommand Command Reference”.

Special file special_file_name
LD NANE ld_name
VAA vaa
Type type
Attribute attribute
LV Link Status link_status
(2) When the -protect option is specified:

Special file: special_file_name
LD NAME: ld_name
VAA: vaa
Type: type

Protection Information
- Protection State: protection_state
- Begin Date: begin_date
- Retention Date: retention_date
- Retention Mode: retention_mode
- Reinitialize: reinitialize_state

(3) When the -updprevent option is specified:

Special file: special_file_name
LD NAME: ld_name
VAA: vaa
Type: type

Update Prevention State: prevention_state

Description:
- special_file_name: Special file name
  Displayed as a 32-byte item on HP-UX and Linux as well as 64-byte item on Solaris.
- ld_name: Logical disk name
- vaa: VAA (Volume Absolute Address)
- type: OS type
- attribute: Logical disk attribute
  Displayed only when the -attr option is specified.
- link_status: Link state of the link volume
  Displayed only when the -attr option is specified. When the target volume is not a link volume, “-” (hyphen) appears.
  - link: Linked
  - unlink: Unlinked
- protection_state: The state of the logical disk protection by the data retention function
  If the logical disk is not protected or protection information cannot be obtained, a hyphen (-) will be displayed.
  - RO: Read only (valid)
  - NA: Not accessible (valid)
  - RO(expired): Read only (expired)
  - NA(expired): Not accessible (expired)
<table>
<thead>
<tr>
<th><strong>begin_date:</strong></th>
<th>Date when data retention function starts protecting the logical disk. If the logical disk is not protected or protection information cannot be obtained, a hyphen (-) will be displayed.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>retention_date:</strong></td>
<td>Date until which the data retention function will protect the logical disk. If the logical disk is not protected or protection information cannot be obtained, a hyphen (-) will be displayed.</td>
</tr>
<tr>
<td><strong>retention_mode:</strong></td>
<td>Mode in which the data retention function protects the logical disk. If the logical disk is not protected or protection information cannot be obtained, a hyphen (-) will be displayed.</td>
</tr>
<tr>
<td>normal</td>
<td>normal mode</td>
</tr>
<tr>
<td>secure</td>
<td>secure mode</td>
</tr>
<tr>
<td>strict</td>
<td>strict mode</td>
</tr>
<tr>
<td><strong>reinitialize_state:</strong></td>
<td>Logical disk reinitialization state. If reinitialization is not performed, a hyphen (-) will be displayed.</td>
</tr>
</tbody>
</table>
| formatting(nn%) | Reinitialization in progress. 

*nn* indicates a value that shows the progress of initialization. |
| format-fail | Reinitialization failed |

**Update Prevention State:** Volume update prevented. 

When the swap function for RDR pair cannot be used or the information cannot be obtained, a hyphen ("-"') is displayed. 

Prevent | Prevent state |
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Prevent | When an RDR pair is being swapped, swapping an RDR pair is suspended, or the RDR quick sync function is used, the paired MV and RV are in the Prevent state. For more details on the RDR quick sync function, refer to 2.4 “RDR Quick Sync” in the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”. |
| Not Prevent | Not prevented |
Normal state.

**Conditions to Display Specific Volume Information**

To display specific volume information, the following conditions must be satisfied.

The following conditions are not applicable when performing an operation together with iSM.

- The target volume or a volume to be paired with the target volume is registered with the volume list. Also, a remote volume to be operated (target volume) must satisfy the following conditions:
  - The target volume is paired with another and the volumes in the upper or lower pair for the target volume are registered with the volume list.
  - When the target volume is paired with another and MV or RV of the pair is also used as a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.
  - When the target volume is a base volume (BV), snapshot volume (SV), or link volume (LV), BV or LV linked to BV or SV is registered with the volume list.

- A volume list is not being created.

- When a volume group is specified, the group (target volume group) must be active.

- When a disk group is specified, the group (target disk group) must be active.

- An iSM special file is not being created (for Linux version only).

Figure 4-35 shows the conditions to display specific volume information.

![Figure 4-35 Displaying Specific Volume Information](image)

### Notes

- A control volume to be displayed as a logical disk attribute when the -attr option is specified must be created in a disk array that can identify control volume attributes. The attribute will not be displayed if a logical disk is defined as a control volume on the server.
4.7.8 RV Access Restriction Change Command

Use the iSMrc_rvmode command to change access restrictions for RV and the states of RV data.

Main Options

For changing access restrictions for RV or the states of RV data using the iSMrc_rvmode command, you can specify the following options:

1. Specifying paired volumes
   Specify RV.
   • Specifying RV (-rv volume -rvflg rv_flg)
     Specifies the volume and volume type of an RV.
     For information on volume types, refer to 4.4 “Volume Types”.

2. Specifying access restrictions for RV (-rvacc)
   The following access restrictions can be specified for RV:
   • Read Write (-rvacc rw)
     RV can be referred or updated.
   • Read Only (-rvacc ro)
     RV can only be referred.
     Be careful to use Read Only (-rvacc ro) for setting access restrictions for RV. For more information, refer to 2.6 “Access Restriction for RV”.
   • Not Ready (-rvacc nr)
     RV cannot be referred nor updated.
   • Not Available (-rvacc na)
     RV becomes disabled and unavailable.
     Specify the -force option as well when setting access restrictions for RV to Not Available (-rvacc na).

3. Forcibly specifying or canceling access restrictions for RV (-force/-cancel)
   With the -force option, you can specify more forceful access restrictions for RV than those specified when replication, separation, or restoration is performed. The access restrictions you can specify are only Not Ready (-rvacc nr) and Not Available (-rvacc na).
   The access restrictions for RV specified using the -force option are maintained without being affected by those specified when replication, separation, or restoration is performed.
   To cancel access restrictions for RV specified using the -force option, specify the -cancel option to execute the iSMrc_rvmode command again. Using this option resumes any access restrictions for RV specified when replication, separation, or restoration is performed.
(4) State of RV data (-rvdata)

The state of RV data can be changed with one of the options below.
You do not need to change the state of RV data in general because this setting is automatically
controlled by the hardware provider in a joint operation with VSS (Volume Shadow copy Service) on

- Enabling the state of RV data (-rvdata valid)
  Enables the state of RV data.
- Disabling the state of RV data (-rvdata invalid)
  Disables the state of RV data.

Displayed Information

When the iSMrc_rvmode command succeeds in changing access restrictions for RV or the state of RV data,
the following message appears:

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

Description

pppp: Process number
xxxx: Detailed information (code value for maintenance)

Conditions to Display Specific Volume Information

To change access restrictions for RV or the state of RV data, the following conditions must be satisfied:

- The target RV is paired.
- In order to set the status of RV to be Read/Write, the activity of the target pair must be Separate.
- The sync of the target pair is not Replicate Preparing, Separate Preparing, or Restore Preparing.
- The sync of the pair of the specified RV and the paired lower RV is not Replicate Preparing, Separate
  Preparing, or Restore Preparing.
- The disk array where the target RV and the paired MV are stored is not frozen.
- A dynamic disk is not used.

The following does not apply when ReplicationControl is used together with iSM:

- The target RV is registered with the volume list.
  Volumes in a remote disk array cannot be operated remotely.
- A volume list is not being created.
- When a volume group is specified, the group (target volume group) is active.
- When a disk group is specified, the group (target disk group) is active.
- An iSM special file is not being created (for Linux version only).
Figure 4-36 shows the conditions to change access restrictions for RV and the state of RV data.

Figure 4-36  Conditions to Change Access Restrictions for RV/State of RV Data
4.7.9 Command for Canceling Update Prevention

To cancel update prevention, use the iSMrc_updprevent command.

You can forcibly cancel the update prevention state of a volume by using the iSMrc_updprevent command.

Main Options

To forcibly cancel update prevention with the iSMrc_updprevent command, you can specify the following options:

1. Specifying volumes (-vol)
   Specify the target volume.
   • Specifying volumes (-vol volume -volflg vol_flg)
     Specifies a volume and volume type.
     For information about volume types, refer to 4.4 “Volume Types”.

2. Specifying the forced cancellation of update prevention (-mode cancel -force)
   Specify the forced cancellation of update prevention.

Displayed Information

When the iSMrc_updprevent command succeeds in forced cancellation of update prevention, the following message appears:

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

Description
pppp: Process number
xxxx: Detailed information (code value for maintenance)
Conditions to Display Specific Volume Information

To perform forced cancellation of update prevention, the following conditions must be satisfied.

- The disk array where the target volume is stored is not frozen.
- The forced cancellation of update prevention cannot be performed for a volume being swapped by the swap function for RDR pair. Forced cancellation of update prevention should be performed only for recovery from a failure.
- A dynamic disk is not used.
- When a volume to be operated is used as MV, the sync of the pair is not Replicate Preparing or Separate Preparing.

The following does not apply when ReplicationControl is used together with iSM:

- The target volume or a volume to be paired with the target volume is registered with the volume list.
  Also, a remote volume to be operated (target volume) must satisfy the following conditions:
  - The target volume is paired with another and the volumes in the upper or lower pair for the target volume are registered with the volume list.
  - When the target volume is paired with another and MV or RV of the pair is also used as a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.
  - When the target volume is a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.
- A volume list is not being created.
- When a volume group is specified, the group (target volume group) is active.
- When a disk group is specified, the group (target disk group) is active.
- An iSM special file is not being created (for Linux version only).

Figure 4-37 shows the conditions to perform forced cancellation of update prevention.

![Figure 4-37 Conditions to Perform Forced Cancellation of Update Prevention](image-url)
4.8 Pair Operations

Pair operation commands provide functions for display of logical disk list, pair setting, and unpairing.
Pair operations allow for data replication that changes or switches RVs dynamically.

4.8.1 Logical Disk Information Display Command

To display logical disk information, use the iSMrc_ldlist command.
With the iSMrc_ldlist command, you can obtain and display logical-disk and other related information about
disk arrays recognized by the system.

Main Options
You can specify the following options with the iSMrc_ldlist command:

- -a option
  Lists information about the logical disks stored in all disk arrays.
- -d option
  Lists information about disk arrays recognized by the system.
- -de option
  Lists information about the logical disks stored in the specified disk array. If a logical disk name is
  specified, only information about the specified logical disk name will be displayed.
- -cr option
  This option can be used only when iSM (controlling I/O issue to disk arrays via iSM) is used together.
  Specify this option to allow iSM to obtain the disk-array and logical-disk information again, which will
  not be displayed.
- -protect option
  Specify the -protect all or -protect only option to display additional information about whether logical
  disks are protected by the data retention function.
  When -protect only is specified, only protected volumes are displayed.
  Specify this option together with the -a option or -de option.
- -node option
  When the -node option is specified, the node number to which the logical disk belongs is additionally
  displayed.
  Specify this option together with the -a option or -de option.
Displayed Information

(1) When the -a option or the -de option is specified:
Logical disk information is listed as shown below.

Receiving...

__________________________________________________________________________________________
<table>
<thead>
<tr>
<th>Disk Array Name</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDN</td>
<td>OS Type</td>
</tr>
<tr>
<td>disk_array_name</td>
<td>management</td>
</tr>
</tbody>
</table>

Description

Receiving...: Message indicating that data is being received.
When ReplicationControl is used with iSM, this message is displayed until data is completely received. While data is being received, periods increase.

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
type: OS type
ldn: Logical disk number
ld_name: Logical disk name
attribute: Logical disk attribute
capacity: Logical disk capacity
pd_type: PD Type (attribute of the physical disks constituting the logical disk)
FC: Logical disk configured of physical disks with the FC attribute
ATA: Logical disk configured of physical disks with the ATA attribute
SAS: Logical disk configured of physical disks with the SAS attribute
SSD: Logical disk configured of physical disks with the SSD attribute

(2) When the -d option is specified:
Logical disk information is listed as shown below.

Receiving...

__________________________________________________________________________________________
<table>
<thead>
<tr>
<th>Disk Array Name</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk_array_name</td>
<td>management</td>
</tr>
</tbody>
</table>

243
Description
Receiving...: Message indicating that data is being received.
When ReplicationControl is used with iSM, this message is displayed until data is completely received. While data is being received, periods increase.

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

(3) When the -protect only option or the -protect all option is specified:
Logical disk information as shown below is displayed.

Receiving...

[Disk Array Name](Management)
LDN  OS Type  LD Name  Attribute  Capacity  PD Type  Data Protection

[Disk Array Name](management)
ldn  type  ld_name  attribute  capacity  pd_type  protection_state

Description
The items not described below are the same as those in (1). Refer to (1) for the description of these items.

protect_state: Whether the logical disk is protected by the data retention function

- Protection  Protected logical disk
- - Unprotected logical disk

(4) When the -node option is specified:
Logical disk information as shown below is displayed.

Receiving...

[Disk Array Name](Management)
LDN  OS Type  LD Name  Attribute  Capacity  PD Type  Node Number

[Disk Array Name](management)
ldn  type  ld_name  attribute  capacity  pd_type  node_number
Description
The items not described below are the same as those in (1). Refer to (1) for the description of these items.

node_number: Node number to which the logical disk belongs
When it is not a logical disk of a disk array supporting nodes, or node numbers cannot be obtained, “-” is displayed.

Conditions to Display Specific Volume Information
The following does not apply when ReplicationControl is used together with iSM:

- One or more logical disks of the target disk array is registered with the volume list.
- A volume list is not being created.
- An iSM special file is not being created (for Linux version only).
- The logical disk to be displayed must meet any of the following conditions for the disk array where the operating mode from the system is set to secure mode and the link destination disk array:
  - The logical disk must be registered in the volume list.
  - The volume that makes a pair with the target logical disk must be registered in the volume list.
  - The volumes in the upper or lower pair for the target logical disk must be registered in the volume list.
  - If the target logical disk is the BV (base volume), SV (snapshot volume), or LV (link volume) of the snapshot function, the BV or the LV associated with the BV or SV must be registered in the volume list.
  - The target logical disk is not locked by operation guard setting.

Notes
- The following logical disk attributes are not displayed.
  Reservation attribute (registered with a reservation group)
  Snapshot data volume (SDV) of the snapshot function
  System volume
- Attributes are displayed for control volumes created in a disk array that can identify control-volume attributes.
  When a control-volume attribute cannot be obtained from a disk array not recognized by the system (“management” is “indirect”), the attribute is not displayed.
  In addition, for a logical disk defined as a control volume on the server, the attribute is not displayed.
4.8.2 Pair/Unpair Command

To perform pair setting or unpairing, use the iSMrc_pair command. With the iSMrc_pair command, you can perform pair setting or unpairing for the specified MV or RV. Also, if you cannot perform normal unpairing due to a failure that occurred on the disk array on the MV or RV side, you can forcibly perform unpairing by using this command.

Main Options

For performing pair setting or unpairing with the iSMrc_pair command, you can specify the following options:

1. Specifying pair setting (-pair) or unpairing (-unpair)
   - Setting a pair (-pair)
     Performs pair setting for the specified paired volumes.
   - Unpairing (-unpair)
     Unpairs the specified paired volumes.

2. Specifying paired volumes
   - Specifying MV (-mv volume -mvflg mv_flg)
     Specifies a volume and volume type for MV.
   - Specifying RV (-rv volume -rvflg rv_flg)
     Specifies a volume and volume type for RV.

Because pair setting or unpairing is performed on a logical-volume basis, you cannot specify an LVM volume group or a VxVM disk group as a volume. For more details on volume types, refer to 4.4 “Volume Types”.

On the Windows system, you cannot perform operations for a volume that consists of multiple partitions by default because all the partitions in the volume will be targeted for operations if a certain partition (drive letter) is specified for the volume. To perform operations for a volume that consists of multiple partitions, change the settings of the replication operation option setting file. For information about the replication option setting file, refer to the “ControlCommand Command Reference”.

3. Forced Unpair (-force)
   - If you cannot perform normal unpairing due to a failure that occurred in connection between disk arrays, etc., you can specify the -force option to perform unpairing individually for MV and RV.
   - You can specify one of the following as a Forced Unpair target.
     - Perform Forced Unpair for both MV and RV. (-force all)
     - Perform Forced Unpair only for MV. (-force mv)
• Perform Forced Unpair only for RV. (-force rv)

Note the following when performing Forced Unpair.
• In general, when MV and RV are in the same system, specify -force all.
• Use Forced Unpair with MV and RV specified when MV and RV are in different systems.
• After performing Forced Unpair with MV (or RV) specified, remove the cause of the failure and then perform Forced Unpair for the other volume (RV or MV) in other normal system.
• If Forced Unpair is performed for either MV or RV, subsequent replication operations will not function properly because the states of MV and RV are inconsistent.

Displayed Information
When the iSMrc_pair command succeeds in pair setting or unpairing, the following message appears:

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

Description
pppp: Process number
xxxx: Detailed information (code value for maintenance)

Conditions to Display Specific Volume Information
To perform pair setting or unpairing, the following conditions must be satisfied:

• The disk array where the MV and RV are stored is not frozen.
• The capacities and OS types of MV and RV that will be paired are the same.
• The logical disk for which pair setting will be performed does not exceed the maximum capacity of a volume that can be paired.
• RV to be set as a pair is not set as RV of another pair.
• The pair to be unpaired is in the Separated state.
• The logical disk to be paired is not registered with the reservation group.
• The volume to be paired is not a link volume (LV).
• The volume to be paired is not a snapshot volume (SV) or a snapshot data volume (SDV) of the snapshot function.
• The volume to be paired is not a system volume.
• The logical disk to be paired as MV or RV is not locked by the operation guard setting.
• The MV or RV to be unpaired is not locked by the operation guard setting. Unlocked MV or RV can be forcibly unpaired individually.
• A dynamic disk is not used.
• To set the logical disk of RV as a base volume (BV) of snapshot to use data replication and snapshot in serial configuration, DynamicDataReplication Ver3 or later or RemoteDataReplication Ver3 or later, and DynamicSnapVolume Ver3 or later are required.
• The process of comparing or establishing identity by using the RDR quick sync function is not ongoing to the pair to be unpaired. However, MV or RV for which comparing or establishing identity is not ongoing can be forcibly unpaired individually. For more details on the RDR quick sync function, refer to 2.4 “RDR Quick Sync” in the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

• The pair to be unpaired is not being swapped by the RDR pair swap function. Forced Unpair can be performed for such pair.

• The pair in which RV to be paired is set as MV is not being swapped by the RDR pair swap function.

• The pool to which the logical disk of MV or RV to be paired (candidate) belongs is not stopped by the power saving function.

• The pool to which the logical disk of MV or RV to be unpaired belongs is not stopped by the power saving function.

• The pool where the logical disk of the MV or RV to be forcibly unpaired belongs is not stopped by the power saving function.

• A logical disk created as a control volume is not RV to be paired. In a disk array which can identify control volume attributes, a logical disk created as a control volume is not set as RV to be paired.

The following does not apply when ReplicationControl is used together with iSM:

• The target volume that serve as MV is registered with the volume list.
  
  Pair setting, unpairing, and Forced Unpair cannot be remotely performed for volumes in a remote disk array.

• A volume list is not being created.

• An iSM special file is not being created (for Linux version only).
4.8.3 Pair Swap Command

To swap a pair, use the `iSMrc_swap` command.

With the `iSMrc_swap` command, you can swap or resume swapping the specified RDR pair.

Main Options

For swapping or resuming swapping a pair with the `iSMrc_swap` command, you can specify the following options:

1. Specifying pair volumes
   - Specify MV and RV.
     - Specifying MV (`-mv volume -mvflg mv_flg`)
       Specifies a volume and volume type for MV.
     - Specifying RV (`-rv volume -rvflg rv_flg`)
       Specifies a volume and volume type for RV.

   For details on the volume type, refer to 4.4 “Volume Types”.

On the Windows system, you cannot perform operations for a volume that consists of multiple partitions by default because all the partitions in the volume will be targeted for operations if a certain partition (drive letter) is specified for the volume. To perform operations for a volume that consists of multiple partitions, change the settings of the replication operation option setting file. For information about the replication option setting file, refer to the “ControlCommand Command Reference”.

Displayed Information

When the `iSMrc_swap` command succeeds in swapping or resuming swapping a pair, the following message appears:

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

Description

- **pppp**: Process number
- **xxxx**: Detailed information (code value for maintenance)

Conditions to Display Specific Volume Information

To swap an RDR pair, the following conditions must be satisfied:

- The target MV and RV are paired.
- The target pair is an RDR pair.
- The target MV is included in a pair on the uppermost level.
- The number of pairs of the specified RV and the lower RVs has not reached the maximum number of pairs that can be set.
The disk array where the specified MV and RV are stored is not frozen.

The sync state of the target pair is sync of Replicate.

The sync state of the specified RV paired with the lower RV is not Replicate Preparing, Separate Preparing, or Separating.

When the specified MV is paired with RV that is also paired with another volume, the sync state of the pair is not Replicate Preparing, Separate Preparing, or Separating, or the pair is not being swapped.

A dynamic disk is not used.

MV and RV are unmounted.

The target pair or the specified MV paired with RV, which is also paired with another volume, is not being compared/identified by the RDR quick sync function. For more details on the RDR quick sync function, refer to 2.4 “RDR Quick Sync” in the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

The target pair is not being swapped.

The target pair is not registered with the AT group.

The logical disk of MV or RV is not stopped by the power saving function.

Resume swapping for recovering from an failure that occurs during swapping. For more details, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

The following does not apply when ReplicationControl is used together with iSM:

The target MV or RV is registered with the volume list.

Also, a remote pair to be operated (target pair) must satisfy the following conditions:

- The volumes in the upper or lower pair for the target pair are registered with the volume list.

- When MV or RV of the target pair is also used as a base volume (BV) of the snapshot function, the BV or LV linked to the BV is registered with the volume list.

A volume list is not being created.

When a combination of a volume group or a disk group with a special file name (logical disk name) is specified, the same number of logical volumes that make up the volume group or disk group is specified as MV (RV) on the special file name (logical disk name) side. In this case, swapping is performed in the specified order.

When a volume group is specified, the group (target volume group) is active.

When a disk group is specified, the group (target disk group) is active.

An iSM special file is not bein created (for Linux version only).
Figure 4-38 shows the conditions to swap RDR pairs.

- Pair setting
- MV or RV is registered with the volume list.
- A volume list is not being created or updated
- RDR pair
- MV is a PV.
- MV or RV is unmounted.
- The disk array is not frozen.
- The pair is in Replicate sync.
- Not a dynamic disk
- MV or RV is not stopped.
- The pool to which MV or RV belongs is not stopped.
- Swap is not being performed.
- The pair is not being compared/identified.

- The PV paired with another RV is not in the Separate Preparing, Replicate Preparing, or Separating state.

- The lower pair set for RV/MV is not in the Separate Preparing, Replicate Preparing, or Separating state.
- The number of lower pairs paired with RV/MV has not reached the maximum number of settable pairs.
4.9 Disk Array Operations

The disk array operation command provides the functions to display information on the replication function of a disk array.

4.9.1 Command for Displaying Information on Replication Function

To display information on the replication function of a disk array, use the iSMrc_arrayinfo command. With the iSMrc_arrayinfo command, you can obtain and display information related to the replication function of the disk arrays recognized by the system.

Main Options

For displaying information on the replication function with the iSMrc_arrayinfo command, you can specify the following options:

- Displaying setting information (-dinfo)
  Obtains and displays the disk array settings related to the replication function.
- Displaying link information (-linfo)
  Obtains and displays how disk arrays having the RemoteDataReplication function are connected each other and the status of link paths.

Displayed Information

(1) When the -dinfo option is specified

Information on the replication function of a disk array is displayed as shown below.

<table>
<thead>
<tr>
<th>Disk Array Name</th>
<th>disk_array_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAA</td>
<td>saa</td>
</tr>
<tr>
<td>Differential Map</td>
<td>diff_map</td>
</tr>
<tr>
<td>Replication Status</td>
<td>replication_status</td>
</tr>
<tr>
<td>Back Ground Copy Level</td>
<td>bgcopy_level</td>
</tr>
<tr>
<td>Max Number of RV Setting</td>
<td>rv_setting</td>
</tr>
<tr>
<td>Max Capacity of Pair Volume</td>
<td>volume_capacity</td>
</tr>
</tbody>
</table>

**Description**

- **disk_array_name**: Disk array name
- **saa**: SAA (Subsystem Absolute Address)
  Indicates a unique value that identifies a disk array.
Chapter 4  Functions of ReplicationControl

diff_map: Installation of Differential Map
Indicates whether the difference management function, which retains the update difference between MV and RV, exists.
Build  Differential Map is installed.
Not Build  Differential Map is not installed.

replication_status: Status of the replication function of the disk array
Ready  The function is available.
Freeze  The function is unavailable.
The replication function of the disk array is frozen or the disk array is powered off.

bgcopy_level: Background copy level
Indicates the priority of Background Copy.

rv_setting: Maximum number of RVs that can be set
Indicates the maximum number of RVs that can be set for one MV.

volume_capacity: Maximum capacity
Indicates the maximum capacity of a volume that can be paired in GB.

(2)  When the -linfo option is specified
How disk arrays are connected each other and the status of link paths are displayed. When multiple paths are connected or multiple disk arrays are linked, all information on the link paths is displayed.

<table>
<thead>
<tr>
<th>Link Disk Array Name</th>
<th>disk_array_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link No</td>
<td>link_number</td>
</tr>
<tr>
<td>Link Mode</td>
<td>link_mode</td>
</tr>
<tr>
<td>Path No</td>
<td>path_number</td>
</tr>
<tr>
<td>Path State</td>
<td>path_state</td>
</tr>
<tr>
<td>Director No</td>
<td>director_number</td>
</tr>
</tbody>
</table>

Description

disk_array_name: Name of the link-destination disk array
link_number: Link number
Number of the linked disk array (link number), beginning with 0
link_mode: Link mode
Indicates the mode of the link between disk arrays.
Low  A low-speed line is used.
Normal  A normal line is used.

path_number: Path number
Connection number assigned on a linked-disk-array basis, beginning with 0
path_state: Path status
Indicates the connection status for each path indicated by the path number.
- Ready: Link normal
- Fault: Link abnormal
- Freeze: The replication function of the link-destination disk array is frozen.
- Offline: Link status unknown (disk array starting)
- Link Check: The link status is being checked because a failure occurred.

director_number: Director number
Number of the replication director or host director to which the path indicated by a path number is connected

Conditions to Display Specific Volume Information
To display information on the replication function of a disk array, the following conditions must be satisfied.

The following does not apply when ReplicationControl is used together with iSM:

- One or more logical disks of the target disk array is registered with the volume list.
- A volume list is not being created.
- An iSM special file is not being created (for Linux version only).
- The command cannot be executed if the operating mode from the system is set to secure mode in the operation target disk array.
4.10 Disk Management/Operations

The disk management/operation function, which works only on the Windows system, enables you to control and operate disks so as to operate data replication, etc. on the Windows system.

Disk management/operation commands provide functions necessary for Windows disk operation in tandem with replication operation commands, etc. rather than a function that can be replaced with “Disk Management” of Windows. This enables you to easily perform operations equivalent to UNIX system on the Windows system.

4.10.1 File System Flush Command

To flush a file system, use the iSMrc_flush command.

With the iSMrc_flush command, you can flush a file system without unmounting the association of the drive letter and the volume, and write the data in the file system buffer, which has not been reflected into the disk.

By executing this command, you can reflect data into the disk without stopping active applications. This command performs flushing on a volume basis to flush only Windows file systems so that other volumes and 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.

Main Options

To execute the iSMrc_flush command, specify a target volume by using the drive letter, mount point volume name, or NTFS folder name.

Displayed Information

The iSMrc_flush command displays one of the following messages when flushing starts and finishes:

[Start message]

<table>
<thead>
<tr>
<th>Flush Start</th>
<th>YYYY/MM/DD hh:mm:ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume_name</td>
<td>type</td>
</tr>
<tr>
<td>path</td>
<td></td>
</tr>
</tbody>
</table>

[End message]

<table>
<thead>
<tr>
<th>Flush Normal End</th>
<th>YYYY/MM/DD hh:mm:ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk_number</td>
<td>ld_name</td>
</tr>
<tr>
<td>volume_name</td>
<td>type</td>
</tr>
<tr>
<td>path</td>
<td></td>
</tr>
</tbody>
</table>
Description
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

Conditions to Display Specific Volume Information
To perform flushing, the following conditions must be satisfied:

- The target volume is registered in the volume list.
- The target volume can be read and written in.
- A dynamic disk is not used.
- The specified file system is mounted.
- 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, flush the application data first and then use this command to flush the file system.
- The update of the target volume is not prevented by the volume update prevention function.
4.10.2 Volume Mount Command

To mount a volume, use the iSMrc_mount command.

With the iSMrc_mount command, you can associate volumes of each partition with file systems. Mounting enables you to use a volume as a file system (local disk such as C: and D:) on the Windows system.

For volumes to which no mount point (drive letter or NTFS folder name) is set, specify a volume to be mounted and the mount point to be set to the volume to associate the volume with the mount point before mounting the volume. This operation cancels the Not Ready state of a volume that was set in the state when unmounted by the iSMrc_umount command.

Main Options

For the iSMrc_mount command, use the mount point volume name, drive letter, or NTFS folder name to specify a target volume.

When you want to mount a volume without the mount point (drive letter or NTFS folder name) set, also specify the name of the mount point volume to be mounted and the mount point to be set to the volume. Then set the specified mount point for the target volume to mount it.

Displayed Information

The iSMrc_mount command displays one of the following messages when mounting starts and finishes:

[Start message]

iSMrc_mount: Info:  
Mount Start YYYY/MM/DD hh:mm:ss  
disk_number ld_name type  
volume_name path  
iSMrc_mount: Info:  
iSM13220: Setting drive letter (drive:) has succeeded.

[End message]

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

Description

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
iSM13220: Setting drive letter (drive:) has succeeded.
Message output when a drive letter or an NTFS folder name is set

Conditions to Display Specific Volume Information
To perform mounting, the following conditions must be satisfied:

- The target volume is registered in the volume list.
- The target volume can be read and written in, or was changed to the Not Ready state when unmounted by the iSMrc_umount command.
- A dynamic disk is not used.
- The update of the target volume is not prevented by the volume update prevention function.
- When the server is restarted while the access restriction for the disk has been set to the Not Ready state by the unmount operation, the volume is not recognized by the OS. In this case, after restarting the server, use the iSMrc_scan command to cancel the Not Ready state and scan the devices to allow the OS to recognize the volume before mounting the volume.
### 4.10.3 Volume Unmount Command

To unmount a volume, use the iSMrc_umount command.

With the iSMrc_umount command, you can cancel the association of volumes of each partition with file systems. Unmounting a volume completely flushes the file system buffer of the specified volume.

When access is made to the file system of the unmounted volume, the Windows system mounts the volume automatically. When the Windows system mounts a volume automatically, unmounting is disabled. Note that the file system may be damaged if unintended data is left in the file system buffer due to this operation.

To suppress an unexpected automatic mount, use the -offline option. When the -offline option is specified, the mount point (drive letter or NTFS folder name) set in the target volume is deleted automatically and the volume is unmounted with the automatic mount suppressed. At this time, Windows 2000 changes the access restriction for the disk (logical disk) to the Not Ready state.

When the -offline option is omitted and the volume to be unmounted is LV, the system always acts in the same way as the time when the -offline option is specified. When the volume to be unmounted is RV, the system works according to the UMOUNT_RVACC parameter of the replication option setting file.

If the -force option is specified, the target volume is forcibly unmounted even if it cannot be locked because it is in use. When the volume to be unmounted is a business volume such as MV or BV, it is not recommended to specify this option because the volume may be forcibly unmounted without data consistency secured.

When the volume to be unmounted is RV or LV, the system always acts in the same way as the time when the -force option is specified even if this option is omitted.

#### Main Options

To execute the iSMrc_umount command, specify a target volume by using the mount point volume name, drive letter, or NTFS folder name. The following option can be specified.

- **Forced Unmount (-force)**
  
  Even when the volume to be unmounted cannot be locked, unmounts it forcibly.

- **Deleting Mount Point (-offline)**
  
  Deletes the mount point not to unmount the volume automatically. In addition, even when the volume to be unmounted cannot be locked, unmounts the volume forcibly.

#### Displayed Information

The iSMrc_umount command displays one of the following messages when unmounting starts and finishes:

- [Start message]

  | Umount Start | YYYY/MM/DD hh:mm:ss |
  | disk_number | ld_name | type |
  | volume_name | path |

  iSMrc_umount: Info: iSM13221: Resetting drive letter (drive:) has succeeded.
Chapter 4  Functions of ReplicationControl

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

Description
  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

iSM13221: Resetting drive letter (drive:) has succeeded.
Message output when a drive letter or an NTFS folder name is
deleted automatically

Conditions to Display Specific Volume Information
To perform unmounting, the following conditions must be satisfied:

- The target volume is registered in the volume list.
- The target volume can be read and written in.
- A dynamic disk is not used.
- When the volume to be unmounted is being used by another application, executing the iSMrc_unmount
  command may result in an error. If this error occurs, execute the CHKDSK command with /F /X specified
  to forcibly cancel reference or update by other applications.
- When the offline option is specified or the volume to be unmounted is LV on Windows 2000, the access
  restrictions for the disk (logical disk) is changed to the Not Ready state. When unmounting a volume on
  the disk with multi-partition configuration, you should understand the procedure well and unmount the
  volume carefully because all volumes (partitions) on the target disk are in the state where reference and
  update are disabled.
- To specify the -offline option or when the volume to be unmounted is LV, only one mount point (drive
  letter or NTFS folder name) needs to be set to the target volume. A volume to which no mount point is set
  or multiple mount points are set cannot be unmounted.
- The update of the target volume is not prevented by the volume update prevention function.
4.10.4 Disk Signature Operation Command

To perform the disk signature operation, use the iSMrc_signature command.

Disk signature is system information used for identifying disks on Windows system. Each disk on an
Windows system must have a unique signature. For example, Data replication automatically avoids the same
disk signature when MV and RV are synchronized. If a failure occurs during replication, the disk signatures
of MV and RV may become inconsistent. In such a case, use the disk signature operation command to restore
the signatures. Disk signature operation can be performed either on a disk basis by specifying a disk number
or for all disks.

Main Options

For performing disk signature operations with the iSMrc_signature command, you can specify the following
options:

- Saving signature (-read)
  Saves the disk signature recognized by the Windows system. Signatures are saved 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 saved in the map file.

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

- Lists signature information (-list)
  Lists signatures saved in the map file, those on the physical disk, and those saved in the disk array, or
  displays signatures on 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.

Displayed Information

The signature information list of the iSMrc_signature command displays the following information:

[Displayed information]

<table>
<thead>
<tr>
<th>Disk Array Name</th>
<th>Disk</th>
<th>Map</th>
<th>Disk</th>
<th>Saved</th>
<th>Signature</th>
<th>Attribute</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>---------------</td>
<td>------</td>
<td>-----</td>
<td>------</td>
<td>-------</td>
<td>-----------</td>
<td>-----------</td>
<td>--------</td>
</tr>
<tr>
<td>disk_array_name</td>
<td>dskn</td>
<td>ldn</td>
<td>mapSig</td>
<td>diskSig</td>
<td>savedSig</td>
<td>attribute</td>
<td>linkStatus</td>
</tr>
</tbody>
</table>
**Description**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk_array_name</td>
<td>Disk array name</td>
</tr>
<tr>
<td>dskn</td>
<td>Physical disk number</td>
</tr>
<tr>
<td>ldn</td>
<td>Logical disk number (in hexadecimal)</td>
</tr>
<tr>
<td>map_sig</td>
<td>Displays signature information that was read by using the <code>-read</code> option and saved in the map file.</td>
</tr>
<tr>
<td>disk_sig</td>
<td>Displays signature information read from the physical disk directly.</td>
</tr>
<tr>
<td>saved_sig</td>
<td>Displays signature information retained by the disk array.</td>
</tr>
<tr>
<td>attribute</td>
<td>Displays the logical disk attribute</td>
</tr>
<tr>
<td>link_status</td>
<td>Displays the link state when the target physical disk is a link volume (LV) used for the snapshot function. Displays “-” (hyphen), unless the target is a link volume.</td>
</tr>
</tbody>
</table>

**Conditions to Display Specific Volume Information**

To perform the disk signature operation, the following conditions must be satisfied:

- A disk signature value displayed by the iSMrc_signature command and a disk signature value displayed by Windows or another disk management tool may seem different, because how to handle the order of bytes for disk signature data is different between them.
  
  You should note this when you use the disk signature shown or saved by using the iSMrc_signature command for other disk management tools.
- The target volume is registered with the volume list.
- The target volume is not in “Not Ready”.
- A dynamic disk or a GPT-format partition disk cannot be specified.
- When the update of the target volume is prevented by the volume update prevention function, operations to initialize a signature on the physical disk and to restore a disk signature saved in the map file to the disk cannot be performed.
4.10.5 Devices Scan Command

To scan devices, use the iSMrc_scan command.

By executing the iSMrc_scan command, you can scan devices to allow the system to recognize available devices.

When the system is started with the devices not connected to the system or set in the “Not Ready” state, the system cannot recognize those devices. For example, when a server using RV is restarted in the state where the RV is in the Not Ready state after replication, the RV is not recognized by OS.

In this case, separate the pair to set the RV to the state where the RV can be read or written in, and then execute this command to allow the OS to recognize the RV.

When the access restrictions for the devices are changed to the Not Ready state by performing unmounting with the iSMrc_umount command, cancel the Not Ready state before scanning the devices.

When this command is executed, the system acts in the same way as the time when “Rescan Disks” by the “Disk Management” function of Windows is performed. Using “Disk Management” function of Windows instead of this command enables the system to recognize the devices.

Main Options
The iSMrc_scan command requires no options.

Displayed Information
When the iSMrc_scan command is executed, the following message appears.

It may take tens of seconds to complete the operation after executing the iSMrc_scan command.

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

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

Description
YYYY/MM/DD hh:mm:ss: Start/End time (Year Month Day Hour Minute Second)
A.1 Pair Information File Output Command

The pair information file output command (iSMpairinfo) report and save the information about the states of pairs and AT groups of a disk array in a CSV file. Table A-1 shows the CSV files. When this command is executed, new files are created, and the information shown in Table A-1 below is reported and saved in the files. For more details on the files, refer to A.1.4 “Output Files”.

Table A-1  File List

<table>
<thead>
<tr>
<th>File Name</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>PairInfo_diskarrayname.csv</td>
<td>Information about pairs * This file is not created if the DynamicDataReplication and RemoteDataReplication licenses are not applied.</td>
</tr>
<tr>
<td>ATGInfo_diskarrayname.csv</td>
<td>Information about Atomic Groups * This file is not created if the RemoteDataReplication/DisasterRecovery license is not applied.</td>
</tr>
</tbody>
</table>

A.1.1 Start/Termination

(1) Start of command

To start the pair information file output command (iSMpairinfo) (hereinafter referred to as “this command”), enter iSMpairinfo in the command line.

If an option is omitted, the program version and the usage are displayed as shown below.

<table>
<thead>
<tr>
<th>iSMpairinfo Version n.n.nnn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usage: iSMpairinfo -arrayname &lt;Disk Array Name&gt; -out &lt;directory&gt;</td>
</tr>
<tr>
<td>Usage: iSMpairinfo -ver</td>
</tr>
<tr>
<td>Usage: iSMpairinfo -?</td>
</tr>
</tbody>
</table>

* The above is a display sample. The actual program version is displayed in “Version”.

(2) Termination of command

When the pair information file output command terminates normally, the pair information file is created in the specified directory.
A.1.2 Options

The functions and options of the pair information file output command are as follows:

- **-arrayname <Disk Array Name>** option:
  Specifies the target disk array name.
  Check the disk array name with the configuration display command (iSMview).
  For details, refer to the “Configuration Display Command (iSMview)” in the “User’s Manual” or “User’s Manual (UNIX)”).

- **-out <directory>** option:
  Specifies a directory to which the file is created and saved. The pair information file is created in the directory specified in “directory”. If a space is included in the directory name, add a [‘ (single quotation mark)] or [“ (double quotation mark)] before and after the directory name.
  * An error will occur if the specified directory does not exist.

A.1.3 Execution of Command

An example of executing the pair information file output command is shown below.

```
> iSMview -d
--- Disk Array List ---
Product ID  Disk Array Name  Resource State  Monitoring
S2300 Disk Array  Storage001  ready  running
S4300 Disk Array  Storage002  ready  running

> iSMpairinfo -arrayname Storage001 -out directory
iSM10506:Command completed successfully.
```

The above is an example of when disk array name is Storage001.

- Use the configuration display command (iSMview -d option) to check the disk array name.
- Specify a disk array name and a directory name to execute this command.
- Multiple CSV files about the pair information of the disk array (Storage001) are created in the specified directory.
This section explains CSV files created by the pair information file output command.

(1) Information about pairs (PairInfo_diskarrayname.csv)

Reports information about pairs of the replication function.

<table>
<thead>
<tr>
<th>#</th>
<th>Type: MV</th>
<th>Type: RV</th>
<th>Activity</th>
<th>Pair Type</th>
<th>ATgroup Name</th>
<th>MV Disk Array Name</th>
<th>RV Disk Array Name</th>
<th>OS Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ld:NEC0001</td>
<td>ld:NEC0002</td>
<td>replicate</td>
<td>DDR</td>
<td>Storage001</td>
<td>Storage001</td>
<td>NX</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>ld:NEC0003</td>
<td>ld:NEC0004</td>
<td>replicate</td>
<td>DDR</td>
<td>Storage001</td>
<td>Storage001</td>
<td>NX</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>ld:NEC0005</td>
<td>ld:NEC0006</td>
<td>restore</td>
<td>RDR</td>
<td>Storage001</td>
<td>Storage002</td>
<td>NX</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>ld:NEC0007</td>
<td>ld:NEC0008</td>
<td>-</td>
<td>RDR/DR</td>
<td>ATG0001</td>
<td>Storage001</td>
<td>Storage002</td>
<td>NX</td>
</tr>
</tbody>
</table>

The displayed items are as follows:

- **Type: MV**: Logical disk name of MV
- **Type: RV**: Logical disk name of RV
- **Activity**: Activity
- **Pair Type**: Type of pair
- **ATgroup Name**: Atomic Group name
- **MV Disk Array Name**: Disk array name to which MV belongs
- **RV Disk Array Name**: Disk array name to which RV belongs
- **OSType**: OS type of MV and RV
(2) **Information about Atomic Groups (ATGInfo_diskarrayname.csv)**

Reports information about Atomic Groups.

<table>
<thead>
<tr>
<th>ATgroup Name</th>
<th>Number of Registered Volume</th>
<th>Activity</th>
<th>Disk Array Name</th>
<th>Link Disk Array Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATG0001</td>
<td>1</td>
<td>replicate</td>
<td>Storage001</td>
<td>Storage002</td>
</tr>
</tbody>
</table>

The displayed items are as follows:

- **ATgroup Name:** Atomic Group name
- **Number of Registered Volume:** Number of volumes registered with the Atomic Group
- **Activity:** Activity
- **Disk Array Name:** Individual name of the disk array
- **Link Disk Array Name:** Individual name of the link-destination disk array

1. This command can be executed by a user authorized as administrator or an iSM administrator.
2. It may take time to obtain the pair information by using this command depending on the configuration.
Appendix B  Command for Displaying Enabled/Disabled States of SCSI Pass Through I/O Issuances for Hyper-V Virtual Machine

B.1 Command for Displaying Enabled/Disabled States of SCSI Pass Through I/O Issuances for Hyper-V Virtual Machine

This command displays the enabled and disabled states of SCSI pass through I/O issuances so that you can use commands for volume list creation and display and replication, etc., on the Hyper-V virtual machine. To perform these operations from the Hyper-V virtual machine, you must execute this command once on the host machine before operating the Hyper-V virtual machine. You must also execute this command even if a new Hyper-V virtual machine is added.

B.1.1 Start/Termination

(1) Start of command

To start this command, type “iSMpassthrough_enabler” at the command line.

If no option is specified, all the SCSI pass through I/O issuances for Hyper-V virtual machine bound on the host machine where this command was started are enabled.

(2) Termination of command

When this command terminates normally, all the SCSI pass through I/O issuances for Hyper-V virtual machine bound on the host machine where this command was started are enabled. Starting the Hyper-V virtual machine subsequently enables you to use commands for volume list creation and display and replication, etc., on the Hyper-V virtual machine.
Appendix B  Command for Displaying Enabled/Disabled States of SCSI Pass Through
I/O Issuances for Hyper-V Virtual Machine

B.1.2  Options

The functions and options of this command are as follows:

• (No option specification)
  Enables the issuance of SCSI pass through I/O from all the Hyper-V virtual machines set up on the host where this command is executed.
• -l option: Displays whether SCSI pass through I/O can be issued from all the Hyper-V virtual machines set up on the host where this command is executed.
• -ver option: Displays the version information of this command.
• -? option: Displays the usage of this command.

B.1.3  Execution of Command

An example of executing this command is shown below.

```
C:\>iSMpassthrough_enabler
iSMpassthrough_enabler:002   SCSI pass-through setting was enabled  successfully. (Host
= HostMachine Virtual = VirtualMachine1)
iSMpassthrough_enabler:002   SCSI pass-through setting was enabled  successfully. (Host
= HostMachine Virtual = VirtualMachine2)
iSMpassthrough_enabler:001   Command has completed successfully.
```

The above is an example of executing this command on the host machine HostMachine.
This command in the above example enables the Hyper-V virtual machines VirtualMachine1 and VirtualMachine2, which are set up on the host HostMachine, to issue SCSI pass through I/O. Starting these Hyper-V virtual machines subsequently enables you to use commands for volume list creation and display and replication, etc., on the virtual machines.

```
C:\>iSMpassthrough_enabler -l
--- Host Machine ---
Name : HostMachine

--- Virtual Machines ---
Name : VirtualMachine1
SCSI Pass Through : enabled

Name : VirtualMachine2
SCSI Pass Through : enabled
```

269
Appendix B  Command for Displaying Enabled/Disabled States of SCSI Pass Through I/O Issuances for Hyper-V Virtual Machine

Executing this command with the -l option on the host machine HostMachine displays the enabled states of SCSI pass through I/O issuances for the Hyper-V virtual machine.

The displayed items are as follows:

--- Host Machine ---
Name : Host machine name

--- Virtual Machine ---
Name : Hyper-V virtual machine name
SCSI Pass Through : Whether SCSI pass through I/O can be issued from this virtual machine
  enabled: Enable to issue SCSI pass through I/O
  disable: Disable to issue SCSI pass through I/O

1. This command can be installed in an environment running Windows Server 2008 R2 or later.
2. This command can be executed in an environment running Windows Server 2008 R2 or later and Windows Server 2008 R2 Hyper-V or later.
3. This command can be executed in an environment where .NET Framework is installed
4. SCSI pass through I/O can be issued from a Hyper-V virtual machine by executing this command as a user with administrator privileges.
5. After enabling the issuance of SCSI pass through I/O by using this command, it is necessary to start a Hyper-V virtual machine.
Appendix C  License

C.1  Apache log4j License

Apache License
Version 2.0, January 2004
http://www.apache.org/licenses/

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273
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Index

A

abnormal suspend........................................27
Access Restriction for RV...............................26
activity...........................................................16, 55
application server ...........................................1, 6, 7, 32, 75, 155, 158, 160, 163, 165, 170, 176, 182

B

background copy .............................................18, 102
background copy level change..........................150, 253
background copy level change ..........................126
backup ....................................................................2
best-effort line ..................................................34
bus number ......................................................169
business volume ..............................................1

cancellation of update prevention for a volume
.................................................................156, 159, 164
capacity .............................................................58
change copy control...........................................159, 164
Change to Background Copy...........................102
cmd for canceling update prevention ..................240
cmd for displaying information on replication
function ............................................................252
configuration display area .................................120
connection state of the volume .........................128
count control volume ......................................53, 171, 173, 176, 179, 193
copy control .....................................................18, 57
copy control state change ..................................156
copy control state change command ..................219
copy failures ....................................................27
copy mode ........................................................77
copy performance ..........................................25
create/update the volume list .........................176, 188
creating test environment..................................4
CSV output of information list .........................140, 189
data replication ...............................................1
database ............................................................2
DDR .................................................................1
defining control volume ....................................193
defreeze ...........................................................124
devices scan ....................................................263
dg .................................................................167
differential map ...............................................150, 253
differential volume ............................................57
DIRECT .........................................................161
direct operation to disk array .........................160
director number ...............................................61, 152, 254
disk array .........................................................56
disk array icon ....................................................51
disk array information display .........................156, 159
disk array link information window ..................60
disk array name ...............................................151
disk array operation command .........................252
disk array operations ........................................252
disk group name ..............................................167
disk management/operations .........................255
disk operation command ..................................255
disk scanning ...................................................156, 159
disk signature operation command ...................261
disk signature operations .................................261
displaying connection window .........................128
displaying copy fault list ..................................153
displaying disk array properties .......................149
displaying information on the replication function ...252
displaying link properties ................................151
displaying property information of volume list ....191
displaying/creating volume list .......................169
drive letter ........................................................167, 169
drv .................................................................167
dRV .................................................................8
dynamic replication volume ...............................8
DynamicDataReplication ..................................1, 7, 70
DynamicDataReplication Ver2 .........................10, 11

event detection ................................................46

F

failure separation ...........................................16, 27
-file .........................................................168
file system buffer flush ....................................156, 159
file system flush ...............................................255
file system flush command ...............................255
flush ...............................................................255
forced separate ...............................................16, 112
forced unpair ...................................................118
foreground copy ............................................18
freeze ............................................................28, 124, 125, 150, 253

G

GUI operations (Windows).................................182
<table>
<thead>
<tr>
<th><strong>H</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>HBA .................................................. 169</td>
</tr>
<tr>
<td>HBT .................................................. 169</td>
</tr>
<tr>
<td>host adapter number ........................................ 169</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>I</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O issuing path ........................................ 161</td>
</tr>
<tr>
<td>interval to obtain disk array information ................. 146</td>
</tr>
<tr>
<td>iSMrc_arrayinfo ....................................... 156, 159, 252</td>
</tr>
<tr>
<td>iSMrc_change .......................................... 156, 159, 219</td>
</tr>
<tr>
<td>iSMrc_flush ........................................... 156, 159, 255</td>
</tr>
<tr>
<td>iSMrc ldlist ........................................... 156, 159, 163, 242</td>
</tr>
<tr>
<td>iSMrc mount ............................................ 156, 159, 257</td>
</tr>
<tr>
<td>iSMrc_pair ............................................. 156, 159</td>
</tr>
<tr>
<td>iSMrc_query ........................................... 156, 159, 164, 227</td>
</tr>
<tr>
<td>iSMrc_replicate ....................................... 156, 159, 200</td>
</tr>
<tr>
<td>iSMrc_restore ......................................... 156, 159, 212</td>
</tr>
<tr>
<td>iSMrc_rmode ........................................... 156, 159, 237</td>
</tr>
<tr>
<td>iSMrc_scans ........................................... 156, 159, 263</td>
</tr>
<tr>
<td>iSMrc_sense ........................................... 156, 159, 164, 230</td>
</tr>
<tr>
<td>iSMrc_separate ........................................ 156, 159, 206</td>
</tr>
<tr>
<td>iSMrc_signature ...................................... 156, 159, 261</td>
</tr>
<tr>
<td>iSMrc_swap ............................................ 156, 159, 249</td>
</tr>
<tr>
<td>iSMrc_umount ......................................... 156, 159, 259</td>
</tr>
<tr>
<td>iSMrc_updpinvalid ................................... 156, 159, 240</td>
</tr>
<tr>
<td>iSMrc_wait ............................................. 156, 159, 164, 223</td>
</tr>
<tr>
<td>iSMVollist ............................................. 156, 159, 169, 175</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>L</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>large-capacity volume ................................... 32</td>
</tr>
<tr>
<td>ld .......................................................... 167</td>
</tr>
<tr>
<td>LD set name ........................................... 58</td>
</tr>
<tr>
<td>link disk array name .................................. 61, 152</td>
</tr>
<tr>
<td>link mode ................................................ 61, 152, 253</td>
</tr>
<tr>
<td>link number ............................................ 60, 253</td>
</tr>
<tr>
<td>link path number ..................................... 151</td>
</tr>
<tr>
<td>logical disk information display ......................... 156, 159, 242</td>
</tr>
<tr>
<td>logical disk information display command ............... 242</td>
</tr>
<tr>
<td>logical disk name ...................................... 54, 167</td>
</tr>
<tr>
<td>logical disk number ................................... 55</td>
</tr>
<tr>
<td>logical unit number ................................... 169</td>
</tr>
<tr>
<td>low-speed line .......................................... 33</td>
</tr>
<tr>
<td>LUN ...................................................... 169</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>M</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>management server ..................................... 6</td>
</tr>
<tr>
<td>MANAGER ............................................... 162</td>
</tr>
<tr>
<td>master volume ......................................... 1</td>
</tr>
<tr>
<td>maximum capacity of a volume to be paired .......... 32, 150</td>
</tr>
<tr>
<td>maximum number of RV Setting ......................... 150</td>
</tr>
<tr>
<td>maximum number of RVs that can be set ................. 253</td>
</tr>
<tr>
<td>mkdir .................................................. 167</td>
</tr>
<tr>
<td>menu bar ............................................... 63</td>
</tr>
<tr>
<td>mount point volume name ................................ 167</td>
</tr>
<tr>
<td>MV ...................................................... 167</td>
</tr>
<tr>
<td>mvol .................................................... 167</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>N</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>NA. ...................................................... 26</td>
</tr>
<tr>
<td>narrowing down by disk array ......................... 187</td>
</tr>
<tr>
<td>Not Available ........................................ 26</td>
</tr>
<tr>
<td>Not prevented .......................................... 233, 235</td>
</tr>
<tr>
<td>not ready .............................................. 26</td>
</tr>
<tr>
<td>notes on operation .................................... 48</td>
</tr>
<tr>
<td>NR ....................................................... 26</td>
</tr>
<tr>
<td>NTFS folder name ...................................... 167</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>O</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>operation authority .................................... 45</td>
</tr>
<tr>
<td>operation message ....................................... 46</td>
</tr>
<tr>
<td>operation types ........................................ 158</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>P</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>pair .................................................... 246</td>
</tr>
<tr>
<td>pair configuration ..................................... 29</td>
</tr>
<tr>
<td>pair disk name ........................................ 55</td>
</tr>
<tr>
<td>pair list ................................................ 144</td>
</tr>
<tr>
<td>pair number ............................................ 55</td>
</tr>
<tr>
<td>pair operation commands ............................... 242</td>
</tr>
<tr>
<td>pair partition name ................................... 55</td>
</tr>
<tr>
<td>Pair PD Type ........................................... 55</td>
</tr>
<tr>
<td>pair setting ............................................ 69, 246</td>
</tr>
<tr>
<td>pair setting and unpair ............................... 156, 159</td>
</tr>
<tr>
<td>pair setting and unpairing ............................ 246</td>
</tr>
<tr>
<td>pair setting/unpair .................................... 69</td>
</tr>
<tr>
<td>pair type ............................................... 55</td>
</tr>
<tr>
<td>pair/unpair command .................................. 246</td>
</tr>
<tr>
<td>paired volume state display ......................... 156, 159, 164</td>
</tr>
<tr>
<td>partition ............................................... 40</td>
</tr>
<tr>
<td>partition name ........................................ 55</td>
</tr>
<tr>
<td>partitioning function .................................. 40</td>
</tr>
<tr>
<td>path number .......................................... 253</td>
</tr>
<tr>
<td>path state ............................................. 61</td>
</tr>
<tr>
<td>path status ............................................ 254</td>
</tr>
<tr>
<td>PD type ................................................ 184, 243</td>
</tr>
<tr>
<td>PD Type ............................................... 171, 176</td>
</tr>
<tr>
<td>performing search in parallel ......................... 5</td>
</tr>
<tr>
<td>physical disk .......................................... 169</td>
</tr>
<tr>
<td>pir operations ......................................... 242</td>
</tr>
<tr>
<td>port number .......................................... 152</td>
</tr>
<tr>
<td>Prevent state .......................................... 233, 235</td>
</tr>
<tr>
<td>primary volume ....................................... 8</td>
</tr>
<tr>
<td>property information of volume list ... 171, 173, 176, 180, 191</td>
</tr>
<tr>
<td>PV ...................................................... 8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>R</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>RDR .................................................... 1</td>
</tr>
<tr>
<td>read only .............................................. 26</td>
</tr>
<tr>
<td>read/write ............................................. 26</td>
</tr>
<tr>
<td>remote operation ...................................... 164</td>
</tr>
<tr>
<td>remote replication volume ............................ 8</td>
</tr>
<tr>
<td>RemoteDataReplication ............................... 1, 7, 70</td>
</tr>
</tbody>
</table>