

# Hitachi Virtual Storage Platform 5000 Series

SVOS RF 9.6

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## Hitachi Universal Replicator for Mainframe User Guide

Hitachi Universal Replicator software for Mainframe enables you to perform asynchronous remote replication operations.

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## Preface

Hitachi Universal Replicator software for Mainframe (URz) enables you to perform asynchronous remote replication operations on VSP 5000 series.

Please read this document carefully to understand how to use this product, and maintain a copy for your reference.

### Intended audience

This document is intended for system administrators, Hitachi Vantara representatives, and authorized service providers.

Readers of this document should be familiar with the following:

- Data processing and RAID storage systems and their basic functions.
- The VSP 5000 series storage systems and the *Hardware Guide* for your storage system model.
- The Hitachi Device Manager - Storage Navigator software and *System Administrator Guide*.

### Product version

This document revision applies to the following product versions:

- VSP 5000 series: 90-06-01 or later
- SVOS RF 9.6 or later

### Release notes

Read the release notes before installing and using this product. They may contain requirements or restrictions that are not fully described in this document or updates or corrections to this document. Release notes are available on Hitachi Vantara Support Connect: <https://knowledge.hitachivantara.com/Documents>.

## Changes in this revision

- VSP 5000 series models display in the **Add Remote Connection** and **History** windows.

## Conventions for storage capacity values

Physical storage capacity values (for example, disk drive capacity) are calculated based on the following values:

Physical capacity unit	Value
1 kilobyte (KB)	1,000 ( $10^3$ ) bytes
1 megabyte (MB)	1,000 KB or $1,000^2$ bytes
1 gigabyte (GB)	1,000 MB or $1,000^3$ bytes
1 terabyte (TB)	1,000 GB or $1,000^4$ bytes
1 petabyte (PB)	1,000 TB or $1,000^5$ bytes
1 exabyte (EB)	1,000 PB or $1,000^6$ bytes

Logical capacity values (for example, logical device capacity, cache memory capacity) are calculated based on the following values:

Logical capacity unit	Value
1 block	512 bytes
1 cylinder	Mainframe: 870 KB Open-systems: <ul style="list-style-type: none"> <li>▪ OPEN-V: 960 KB</li> <li>▪ Others: 720 KB</li> </ul>
1 KB	$1,024 (2^{10})$ bytes
1 MB	1,024 KB or $1,024^2$ bytes
1 GB	1,024 MB or $1,024^3$ bytes
1 TB	1,024 GB or $1,024^4$ bytes
1 PB	1,024 TB or $1,024^5$ bytes
1 EB	1,024 PB or $1,024^6$ bytes

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## Comments

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**Thank you!**

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# Chapter 1: Universal Replicator for Mainframe overview

With Hitachi Universal Replicator for Mainframe (URz) you can perform asynchronous replication of data to one or more remote sites.

## About Universal Replicator for Mainframe

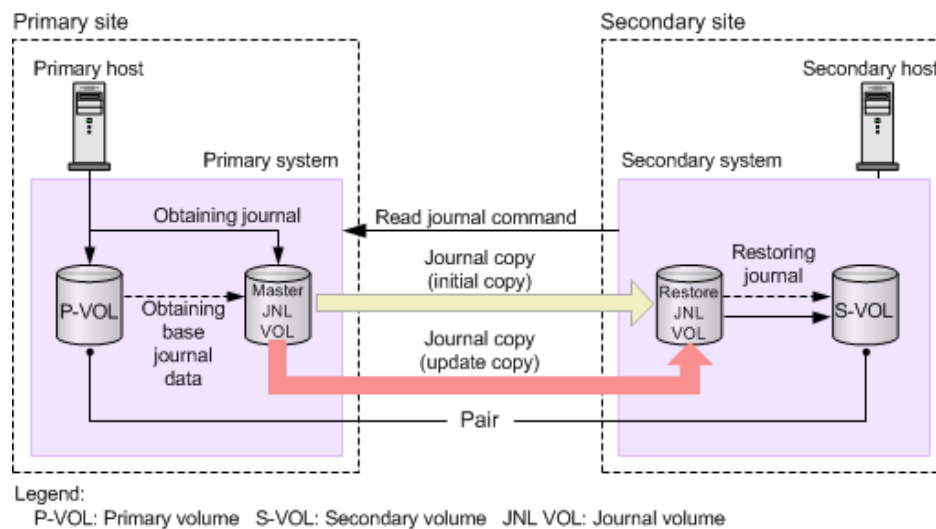
Hitachi Universal Replicator for Mainframe presents a solution to avoid cases when a data center is affected by a disaster that stops operations for a long period of time. In the Universal Replicator for Mainframe system, a secondary storage system is located at a remote site from the primary storage system at the main data center, and the data on the primary volumes (P-VOLs) at the primary site is copied to the secondary volumes (S-VOLs) at the remote site asynchronously from the host write operations to the P-VOLs. Journal data is created synchronously with the updates to the P-VOL to provide a copy of the data written to the P-VOL. The journal data is managed at the primary and secondary sites to ensure the consistency of the primary and secondary volumes.

The redundancy provided by the RAID configuration (for example, RAID1 or RAID5) enables recovery from a P-VOL read failure. The primary storage system never reads the Universal Replicator for Mainframe S-VOL for data recovery.

## Replication operations

Remote replication for a URz pair is accomplished using the master journal volume on the primary storage system and the restore journal volume on the secondary storage system. As shown in the following figure, the P-VOL data and subsequent updates are transferred to the S-VOL by obtain journal, read journal, and restore journal operations involving the master and restore journal volumes.





### Note:

- Universal Replicator does not have a feature to copy the data from one P-VOL to multiple S-VOLs or to copy the data from multiple P-VOLs to one S-VOL.
- If the primary system fails reading a P-VOL, the redundancy of RAID-1, RAID-5, or RAID-6 enables the recovery from the failure. The primary system never reads the S-VOL for data recovery.

## Obtain journal

Obtain journal operations are performed when the primary storage system writes journal data to the master journal volume. The journal data consists of the P-VOL data to be copied to the S-VOL as well as update sequence information and other metadata. When a pair is created and the P-VOL data is copied for the first time, the journal data copied to the master journal volume is called the base journal data. When the host writes updated data to the P-VOL, normal journal data is copied to the master journal volume. If a P-VOL write operation fails, the primary storage system does not create the journal data.

- The primary storage system assigns write-sequence numbers to the P-VOL data copied to the master journal volume.
- The write-sequence numbers and other metadata attached to the journal data ensure the consistency of the data in the P-VOL and S-VOL.

## Journal copy

Journal copy operations are performed when journal data is copied from the master journal volume to the restore journal volume on the secondary storage system.

- When the secondary storage system issues the read-journal command to the primary storage system, the primary storage system transfers the journal data stored in the master journal volume to the restore journal volume in the secondary storage system.
- Journal copy operations occur on a continual basis unless there is no journal data in the master journal volume. The request for data from the secondary storage system is repeated as soon as the previous read operation is completed.

The URz journal copy operations "pull" data from the primary storage system to the secondary storage system. Journal data is copied to the secondary site only when the secondary storage system issues a read-journal command, with the primary storage system operating as a resource controlled by the secondary storage system's transaction processor.

## Restore journal

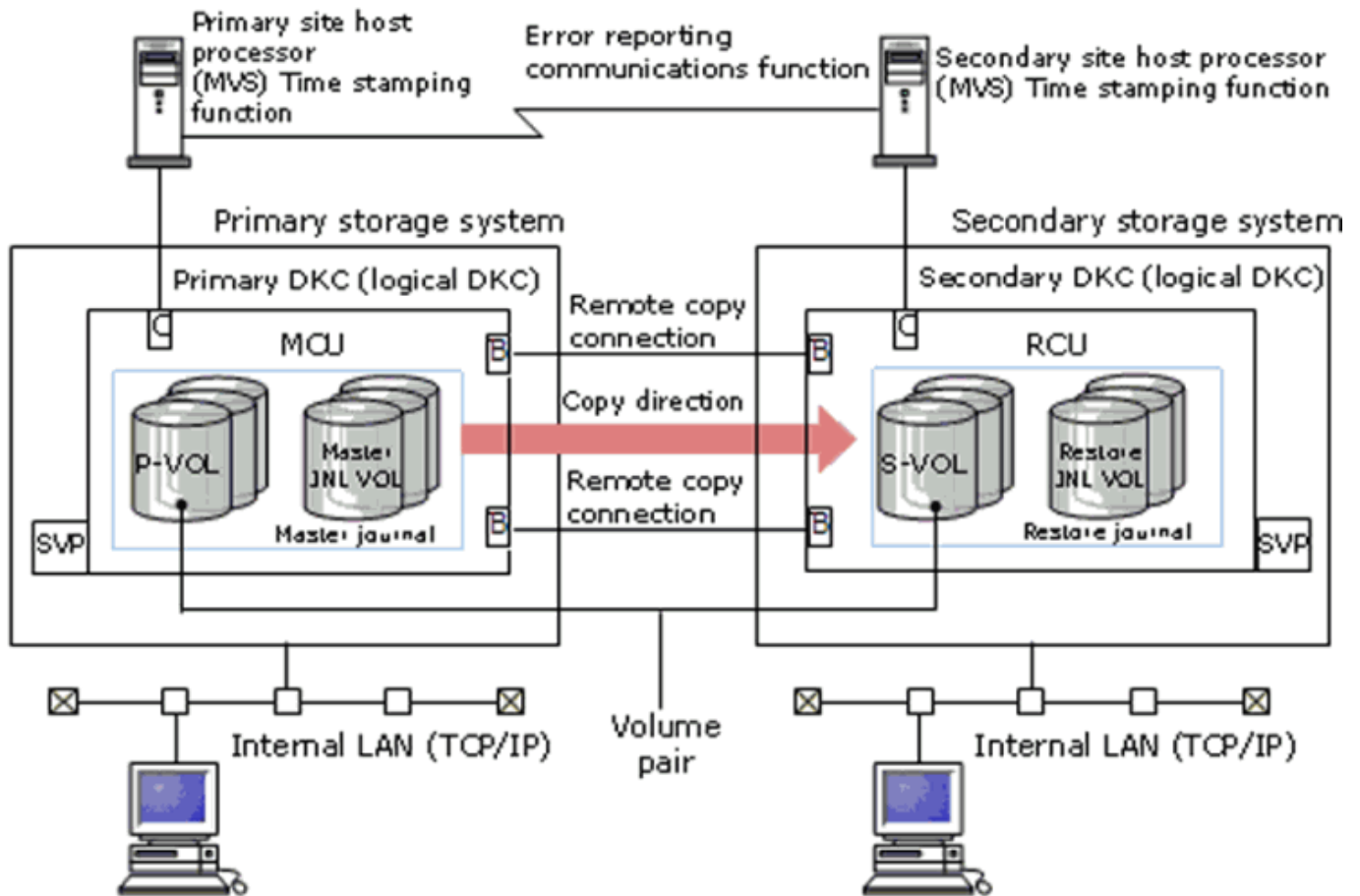
Restore journal operations are performed when the secondary storage system writes journal data in the restore journal volume to the S-VOL.

- Journal data in the restore journal volume is copied to the S-VOL according to the write-sequence numbers to ensure data consistency.
- When a restore journal operation to the S-VOL is completed, the journal data in the restore journal volume is discarded, and the journal data in the master journal volume is also discarded.



The primary storage system discards journal data in the master journal volume when it receives the sequence number from the restore journal, which is attached to the read journal command from the secondary storage system.

## System components

The following figure shows the Universal Replicator for Mainframe system components.



## Legend:

-  : CHF or CHG
-  : Bidirectional port
- P-VOL: Primary volume
- S-VOL: Secondary volume
- JNL VOL: Journal volume

The local storage system is a storage system connected to the management client. The remote storage system is a storage system connected to the local storage system. Unless otherwise stated, this document gives explanation on the premise that the local storage system is on the primary site, and the remote storage system is on the secondary site.

**URz system components**

- The storage systems at the primary and secondary sites. The primary storage system contains the P-VOLs and master journal volumes, and the secondary storage system contains the S-VOLs and restore journal volumes.
  - The master journal consists of the primary volumes and master journal volumes.
  - The restore journal consists of the secondary volumes and restore journal volumes.
- The data path connections between the systems. The primary and secondary storage systems are connected using dedicated Fibre Channel or iSCSI data paths. Data paths are routed from the ports on the primary storage system to the ports on the secondary storage system, and from the secondary storage system to the primary storage system.
- The URz software on both the primary storage system and the secondary storage system.
- The hosts connected to the primary and secondary storage systems. The hosts are connected to the storage systems using FICON® channel ports.
- The interface tools for configuring and performing URz operations:
  - Device Manager - Storage Navigator graphical user interface (GUI)
  - Business Continuity Manager (BCM)
  - Command Control Interface command-line interface (CCI)

When Universal Replicator for Mainframe journals consist of journal volumes located in multiple storage systems, a host I/O time stamping function is required. This is provided by MVS DFSMSdfp.

An error reporting communications (ERC) feature is also required when Universal Replicator for Mainframe is used for disaster recovery.

**Storage systems**

Universal Replicator for Mainframe operations involve two storage systems. One of the systems is located at the primary site and one is located at the secondary site.

The primary storage system consists of the main control unit and service processor (SVP). The secondary storage system consists of the remote control unit and its SVP.

- Each storage system can function simultaneously as a primary and secondary storage system.
- The primary storage system communicates with the secondary storage system over dedicated Fibre Channel or iSCSI remote copy connections.

- The primary storage system controls the P-VOL and the following operations:
  - Host I/Os to the P-VOL.
  - P-VOL data copy to the master journal.
- The secondary storage system controls the S-VOL and the following operations:
  - Initial copy and update copy between the P-VOL and the restore journal.
  - Journal commands to the primary storage system.
  - Journal data copy from the master journal to the restore journal.
  - Restore journal data copy to the S-VOL.
  - Pair status management and configuration (for example, rejecting write I/Os to the S-VOLs by way of command rejection or intervention request).

## Pair volumes

The P-VOL contains the original data, and the S-VOL is the copy of the P-VOL. The two volumes can be paired, split, resynchronized, and released. When synchronized, the volumes are paired. When the pair volumes are split, updates to the P-VOL are not copied to the S-VOL. When the pair volumes are resynchronized, changed P-VOL data is copied to the S-VOL. If a disaster occurs, production operations can be transferred to the S-VOL. When the primary site is functional again, operations can be transferred and data can be copied back to the P-VOL.

The P-VOL remains available to the host for read and write I/O operations. The secondary storage system rejects write I/Os for the S-VOL by way of command rejection or intervention request, unless the S-VOL write option (Secondary Volume Write) is enabled. If the S-VOL write option is enabled, write I/O is allowed to the S-VOL while the pair is split, and the secondary storage system keeps track of differential data on the S-VOL for use when the pair is resynchronized.

See [Duplicating VOLSERS \(on page 68\)](#) for further information on volume requirements and support.

## Journal volumes

For Universal Replicator for Mainframe operations, journal volumes are required on the primary and secondary storage systems.

- Updates to the P-VOL are copied to the master journal volume in the primary storage system. See the illustration in [Journals \(on page 22\)](#).
- Master journal data is copied to the restore journal volume on the secondary storage system.

- Journal volumes can have different volume sizes and different RAID configurations.
- You can register two journal volumes in a journal in the primary storage system and in the secondary storage system, but the second journal volume becomes a reserve journal volume, which is not used for normal operations. Use one journal volume in each system.

The reserve journal volume is used for restoring a disk in a pool or pool volume to which the journal volume belongs. For details, see [Restoring a pair by adding a reserve journal volume \(on page 161\)](#).

For information on planning journal volumes, see [Sizing journal volumes \(on page 64\)](#).

## Journals

Journals enable you to manage data consistency between multiple P-VOLs and S-VOLs. A journal is a group of one or more data volumes and the related journal volume. Like consistency groups, you can use journals to create multiple pairs and to split, resynchronize, and release multiple pairs. Journals are required on the primary and secondary storage systems.

Each data volume and its associated journal volume reside in the same journal.

- The master journal contains master journal volumes and is associated with the P-VOL.
- The restore journal contains restore journal volumes and is associated with the S-VOL

Each pair relationship between journals is called a mirror. A mirror ID identifies a pair relationship between journals. When the pair is created, it is assigned a mirror ID.

## Mirror

The relationship of a master journal and a restore journal is called a mirror.

A mirror is in Active status when it contains only pairs in Pending status (those not synchronized, with initial copy operation in progress) and pairs in Duplex status (those synchronized, with initial copy operation completed). Usually pairs are in Duplex status and thus mirrors are in Active status.

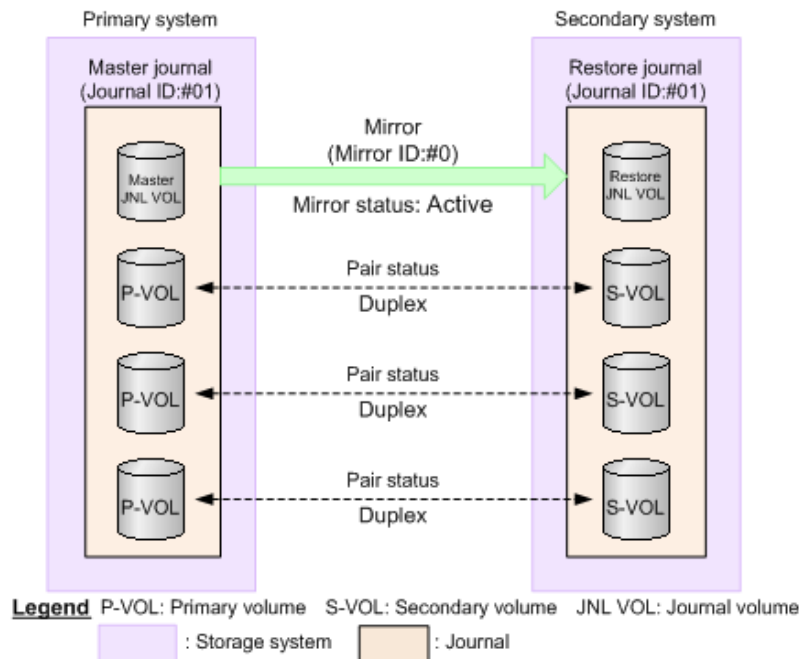
The mirror status changes when an operation is executed to a mirror. Be sure to check the mirror status to confirm that the operation is completed. The following are a few examples of the mirror statuses. For a complete list of mirror statuses, see [Mirror status definitions \(on page 156\)](#).

- **Initial:** Data volumes are not registered in the mirror, or deleting the mirror is completed.
- **Active:** The mirror has only pairs that are in Pending or Duplex status.
- **Stopped:** An operation for splitting or deleting the mirror is finished.

The mirror status can be checked only by HDvM - SN or CCI.



**Tip:** Universal Replicator for Mainframe assumes that pair operations are performed in units of mirrors. Be sure to perform pair split and resync operations for each mirror. Requests to perform a split or resync operation for each pair might be rejected.

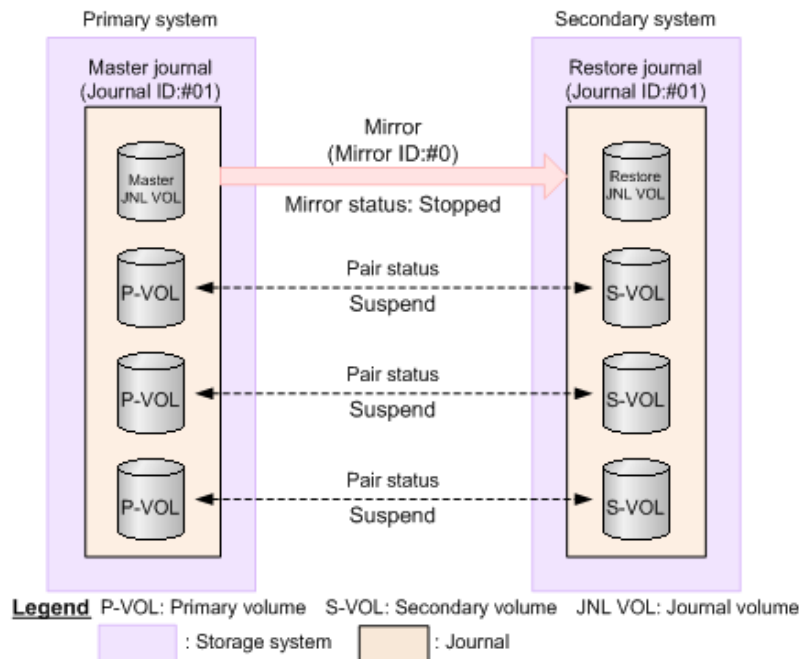


## Split mirror operations

When you split a mirror, all the pairs in the mirror are split and copy operations of data from the master journal to the restore journal stops. To split a mirror, you must place the mirror in Active status. When mirror splitting is completed, the mirror status becomes Stopped.

Updated data is not reflected to the S-VOL while the pair is split, but only later when the pair is resynchronized. To resynchronize all the pairs in the mirror, resynchronize the mirror itself.

You can select whether or not to enable the S-VOL write option when you split a mirror. If the Secondary Volume Write option is enabled, the host can write the data to the S-VOL while the pair is split. You split a mirror by the `YKSUSPND` command of BCM, by selecting Secondary Volume Write in HDvM - SN, or by the `pairsplit -rw` command of CCI.



You can also split a mirror after synchronizing the P-VOL and S-VOL. In that case, select Flush in Split Mode. This allows you to reflect the updated data to the S-VOL when the pair is split. When the secondary storage system accepts the pair split, all the journal data that has been held for the pair is written to the S-VOL. If no journal data (update data) comes to the pair for a fixed period of time, the pair status changes to Suspend. When all pairs in the journal are placed in the Suspend status, volume copying is complete, and the mirror status becomes Stopped.



**Tip:** To create a complete copy of the data volumes in the mirror, you need to stop I/O operations from the host. Creating an instantaneous copy on demand and a copy created in such a way are called point-in-time copy.

## Resync mirror operations

When you resynchronize a mirror, data copying from the P-VOL to S-VOL in all pairs in the mirror restarts. To resynchronize a mirror, make sure that the mirror status is Stopped.



**Note:** You should resynchronize mirrors while I/O load is low. This is especially important when different types of pairs are intermixed in the same consistency group. Performing a mirror resync operation on a consistency group with different pair types during high I/O load might result in a pair resync failure and pair suspension (Suspend status).

## Delete mirror operations

When you delete a mirror, all the pairs in the mirror are deleted, and data copying from the master journal to the restore journal stops.



Specify one of the following modes when deleting a mirror.

- Normal: The mirror is deleted only when the primary storage system can change the mirror status to Initial.
- Force: The mirror is forcibly deleted even when the primary storage system cannot communicate with the secondary storage system.

If the mirror status does not change to Initial after 5 or more minutes from when you start an operation to delete a mirror in Force mode, restart the delete operation in Force mode to ensure all pairs in the mirror are deleted.

After each delete operation in Force mode, wait at least five minutes before you create pairs in the same journal. Otherwise the paircreate operation might fail.

## Data path

The physical transmission link between the primary and secondary storage systems is called the data path.

Universal Replicator for Mainframe commands and data are transmitted through the Fibre Channel or iSCSI data path and switches. The data path is the cabling that connects the primary and secondary storage systems. Universal Replicator for Mainframe requires paths in both directions. More specifically, it requires paths with Initiator ports in the primary storage system connected to RCU Target ports in the secondary storage system, and paths with Initiator Ports in the secondary storage system connected to RCU Target ports in the primary storage system.

One data path connection in each direction is required. It is recommended that you use two or more independent connections to provide hardware redundancy. A maximum of eight paths in each direction can be used.

For details, see [Planning the data path \(on page 91\)](#).

## Consistency groups and journals

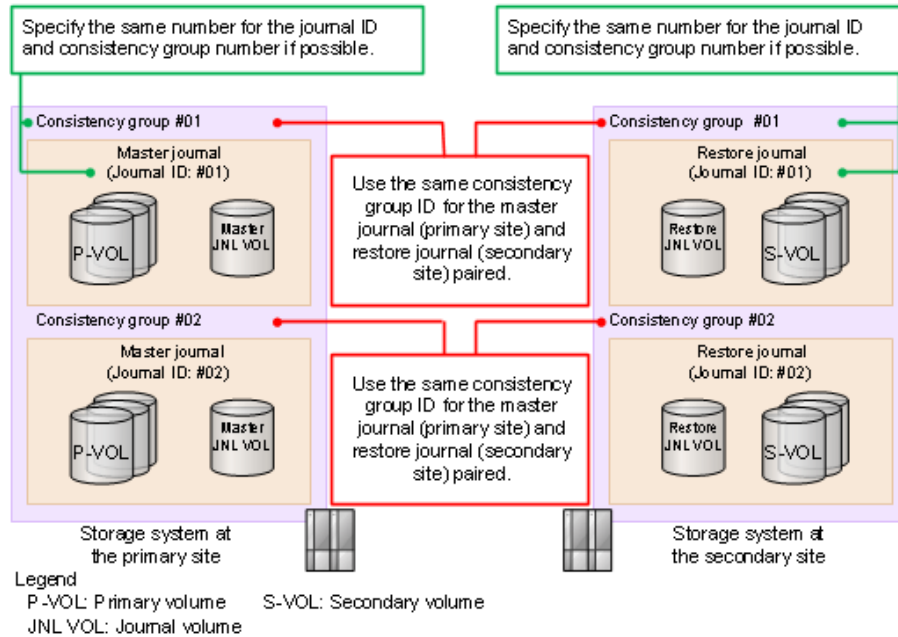
A consistency group is a group of pairs set in primary storage systems and secondary storage systems. By specifying a CTG ID with a BCM or CCI command, you can perform the same operation on all pairs belonging to the CTG in a batch while keeping data consistency.

A master journal is a group of volumes associated with primary storage system. A restore journal is a group of volumes associated with the secondary storage system. If you set each journal as a consistency group and specify a CTG ID, you can use BCM or CCI commands to operate master journal volumes in a master journal, or restore journal volumes in a restore journal in a batch. That is, you can operate volumes for each consistency group while retaining the data update order between the P-VOL and the S-VOL.

Journals are used in Universal Replicator for Mainframe to guarantee data consistency across multiple pairs. Consistency groups are used in other replication software for the same purpose. The same CTG IDs can be used for Universal Replicator for Mainframe and BCM or CCI. Therefore, when you use BCM or CCI, you can perform URz pair tasks using CTG IDs. For Universal Replicator for Mainframe, consistency group IDs specified by BCM or CCI are assigned to journal IDs. If you use Universal Replicator for Mainframe, it is recommended that you specify the same number for a CTG ID and a journal ID. The journal group number can be different in the primary and secondary storage systems.

The number of consistency groups that can be created depends on the storage system model. Following is the maximum number of consistency groups that can be created for P-VOL's consistency group and S-VOL's consistency group combined. The numbers in parenthesis indicate the range of CTG IDs.

- VSP 5000 series: 256 (0 to 255)



#### Caution:

- Use the same CTG ID for the P-VOL and S-VOL to be paired.
- Do not register a journal to multiple CCI CTGs. If you do, time stamps are issued from multiple CCIs, and data consistency in a consistency group cannot be guaranteed.

## Extended consistency groups

An extended consistency group (EXCTG) is a collection of journals in multiple primary storage systems and/or multiple secondary storage systems. EXCTGs allow you to guarantee data consistency during copy operations.

With EXCTGs, you perform operations on associated journals and their pairs at the same time. Journals can be registered and removed from EXCTGs. The journals of a maximum of four different storage systems can be registered with the same EXTG. However, one journal cannot be registered with multiple EXTGs.



#### Note:

- In the 3DC configuration, you cannot use EXCTGs.
- You cannot register a journal that has two mirror IDs to an EXCTG.
- When a journal is registered to an EXCTG, you cannot add a second mirror ID to that journal.

## Device Manager - Storage Navigator

Device Manager - Storage Navigator provides a GUI and command line interface for accessing and managing the storage system, including Universal Replicator for Mainframe.

Device Manager - Storage Navigator communicates with the SVP of each system over defined TCP/IP connections.

The Device Manager - Storage Navigator GUI displays "Local Storage System" for the storage system that you have accessed on the HDvM - SN server or for the storage system and "Remote Storage System" for storage systems that are connected to the storage system you accessed. Therefore, when you access a secondary storage system (contains S-VOLs) at a secondary site, the information for this secondary storage system is displayed under "Local Storage System", and the information for the primary storage system connected to this secondary storage system is displayed under "Remote Storage System".

You must have the Security Administrator (remote backup management) roll to perform the Universal Replicator operations. If you do not have the Security Administrator roll, you can refer to the Universal Replicator information only.

## Business Continuity Manager

With Business Continuity Manager (BCM) you can perform the same Universal Replicator for Mainframe operations as with the Device Manager - Storage Navigator GUI. In addition, you can automate pair operations and collection of operational state information using scripts. Business Continuity Manager also provides system performance metrics thresholds, which can help you avoid problems and optimize system performance.

## Copy operations

The copy operations for Universal Replicator for Mainframe include initial copy, update copy, and the underlying operations that are executed, such as journal processing and differential data management.

## Initial copy operation

When the initial copy operation is executed, all data in the P-VOL is copied in sequence directly to the S-VOL without use of the primary journal volumes. The copied data in the initial copy operation is referred to as base journal data, even though the primary journal volumes are not used.

- When you create or resynchronize two or more pairs within the same journal, the base journal data is copied to the respective S-VOLs, one at a time. This extends the time required for all the operations to be completed.
- As an option, you can create a pair and specify that no data is copied during the initial copy operation by specifying None for Initial Copy Type. This option should be specified only when the data in the P-VOL and S-VOL is already identical, or when the P-VOL and S-VOL do not yet contain any data. Use of this option establishes the pair quickly without the delay of the initial copy operation. Once the pair is established (pair status is Duplex), update copy operations are performed to copy all P-VOL updates to the S-VOL.
- A Universal Replicator for Mainframe pair can also be created using a TrueCopy initial copy operation. This reduces the time to complete the initial copy operation. For details, see [Planning pair volumes \(on page 66\)](#).

## Update copy operation

When a host performs a write I/O operation to a P-VOL of a volume pair, an update copy operation is performed. The updated data is copied to the master journal on the primary storage system along with metadata that includes sequence and other consistency information. The updated data and its metadata are called the journal data. When the secondary storage system issues the read-journal command, which occurs independently of host I/O activity, all journal data in the master journal is sent to the restore journal on the secondary storage system. When the P-VOL updates are successfully duplicated on the S-VOL, the journal data on the primary and secondary storage systems is discarded.

Journal data is transferred using special I/O operations called RIO (remote I/O) that are initiated by the secondary storage system. RIO provides the most efficient type of data transfer. The channel extenders must be capable of supporting RIO.

If an update copy operation fails, the secondary storage system suspends the affected pair or all pairs in the journal, depending on the type of failure. The suspended pair or journal returns to Paired status when the primary and secondary storage systems are resynchronized.



**Note:** If the primary storage system receives a request for writing to the P-VOL (update I/O) from a host during initial copy, the primary storage system suppresses initial copy to prioritize the update I/O. However, when a copy pace for mirror option is Faster in HDvM - SN, or when 4 or a larger value is specified by the `-copy_size` option of the `raidcom modify journal` command in CCI, the primary storage system does not suppress initial copy. When specifying Faster for a copy pace, be sure not to cause an update I/O during initial copy. If an update I/O occurs, data volume pairs might be split (suspended).

## Read and write I/O during remote copy

The primary storage system reads from the P-VOL when it receives a read I/O command. If the read fails, the redundancy provided by RAID 1, RAID 5, or RAID 6 technology recovers the failure. The primary storage system does not read the S-VOL for recovery.

When a primary storage system receives a write I/O command for a P-VOL in Duplex status, the system performs the write operation and performs the update copy operation. The write operation completes independently of the update copy operations on the S-VOL.

The secondary storage system updates the S-VOL according to the write sequence number in the journal data. This maintains data consistency between P-VOL and S-VOL.

If the P-VOL write operation fails, the primary storage system reports a unit check and does not create the journal data for this operation. As mentioned, if the update copy operation fails, the secondary storage system suspends either the affected pair or all Universal Replicator for Mainframe pairs in the journal, depending on the type of failure. When the suspended pair or journal is resynchronized, the primary and secondary storage systems negotiate the resynchronization of the pairs.

In PAIR status, S-VOLs are enabled for read I/O, but disabled for write I/O. The S-VOL write option can be enabled only when you split the pair from the primary storage system.

When you issue the DEVSERV command to the Universal Replicator for Mainframe S-VOL, INDETERMINATE FAILING UNIT is returned if the status of Universal Replicator for Mainframe S-VOL is online. INTERVENTION REQUIRED is returned, if the status of Universal Replicator for Mainframe S-VOL is offline.



**Note:** If the I/O data length for the URz P-VOL exceeds 21 MB, the URz pair might be split (suspended). If this happens, adjust the I/O block size for each host platform. For example, if the host platform is Linux, you set 512 as the value for the `max_sectors_kb` parameter.

## Differential data management

Differential data is the data that is changed in the P-VOL and S-VOL (if permitted) while a pair is suspended. This changed data is stored in a track bitmap and has not been written to the S-VOL. When the pair is resumed, the primary storage system merges the P-VOL and S-VOL bitmaps and copies the differential data to the S-VOL.

The required number of bitmap areas is based on the number of volumes being replicated and the size of the volumes. This affects the maximum number of pairs that can be created in the system.

When you use a DP-VOL in a pair under one of the following conditions, the differential data is managed by the pool to which the URz pair volume is related:

- You create a URz pair by using a DP-VOL that is larger than 262,668 cylinders. In this case, 1 page of pool capacity for differential management data is required every 4,096 cylinders.

Advanced System Setting No. 6: Manage differential bitmaps in DP pool at pair create operations for 4 TB or less TC/TCMF/UR/URMF/GAD pairs.

When enabled, the differential data is maintained in a pool with which a DP-VOL that has the user capacity (up to 4,194,304 MB) is linked when a new TC/TCMF, UR/URMF, or GAD pair is created using the DP-VOL. Note that differential data is maintained, regardless of this setting, in a pool linked with the DP-VOL that has the user capacity (greater than 4,194,304 MB) when a new TC/TCMF, UR/URMF, or GAD pair using the DP-VOL is created.

Advanced System Setting No. 5: Manage differential bitmaps in DP pool at pair create and resync operations for 4 TB or less TC/TCMF/UR/URMF/GAD pairs.

When enabled, the differential data is maintained in a pool with which a DP-VOL that has the user capacity (up to 4,194,304 MB) is linked when a new TC/TCMF, UR/URMF, or GAD pair is created using the DP-VOL, or resynchronized. Note that differential data is maintained, regardless of this setting, in a pool linked with the DP-VOL that has the user capacity (greater than 4,194,304 MB) when a new TC/TCMF, UR/URMF, or GAD pair using the DP-VOL is created.

When these Advanced System Settings (6 and 5) are enabled, the differential data is managed by the pool to which the pair volume is related even if the volume is smaller than 262,668 cylinders. This enables the total capacity of the pair volumes to be increased over 1.8 PB. If you want the differential data to be managed by the shared memory again after you create pairs whose total capacity is larger than 1.8 PB, you must reduce the total capacity of the pairs that are smaller than 262,668 cylinders to 1.8 PB by deleting some pairs. When the differential data is managed by the shared memory, the maximum total capacity of all remote copy pairs (including TC/TCz, UR/URz, and GAD) is 1.8 PB. For example, if the total capacity of the URz pairs is already 1.8 PB, you cannot create any TCz pairs.

When pages are not assigned to the URz pair volume, pages for recording control cylinder information might be created during the creation of URz pairs. However, if the pages have been assigned for all of the area in the volume, it is not required to add pool capacity for managing differential data since the page format for control cylinder information and for user data is the same. The control cylinder information for URz, TCz, Slz, and Compatible FlashCopy® are recorded in the same pages.



**Note:** After you create a pair whose differential data is managed in a pool, data management might fail due to insufficient pool capacity. In this case, all of the P-VOL data is copied to the S-VOL in units of tracks when the pair is resynchronized.

## S-VOL write option

When splitting a pair, you can set the S-VOL write option (Secondary Volume Write) to allow write I/O to the S-VOL. The S-VOL write option can be specified only when you are connected to the primary storage system, and it applies only to the specified pairs. When you resynchronize a split pair whose S-VOL is write-enabled, the secondary storage system sends the S-VOL track bitmap to the primary storage system, which merges the P-VOL and S-VOL bitmaps to determine the tracks that need to be updated. This ensures proper resynchronization of the pair based on the P-VOL data.

## S-VOL read option

You can change the VOLSER of suspended S-VOLs when system option mode 20 is set to ON. This read options allows the S-VOL to be online to the P-VOL's host. The read option is enabled while the pair is suspended.

Write updates are rejected by the secondary storage system during this time by the command being rejected or by required intervention.

The primary storage system copies the P-VOL VOLSER and VTOC to the S-VOL when the pair is resumed.

When the S-VOL read option is not enabled and/or the pair is not suspended, the secondary storage system rejects read and write I/O to the S-VOL by the command being rejected or by required intervention.

## Pair status



The pair status of a volume indicates the synchronization status of the pair to which it belongs. When a pair operation is performed, the pair status of the volumes changes. The pair status of a volume determines the operations that can be performed on the pair. For example, you can only split a pair when the pair status of the volumes is Pending or Duplex.


During normal operations you need to monitor the pair status to ensure that you can perform the desired operations and to verify that operations completed successfully.

## Pair status definitions


Device Manager - Storage Navigator displays both the Device Manager - Storage Navigator pair status name and the Business Continuity Manager pair status name, except when the names are the same. When they are the same, the Business Continuity Manager status is not displayed.





The following table lists and describes the pair status names.

HDvM - SN status	BCM status	Description	P-VOL access	S-VOL access
(Unpaired-no HDvM - SN status)	SIMPLEX	The volume is not assigned to a pair and is not in a journal.	Read/Write	Read/Write
 Pending	PENDING (01)	The initial copy operation is in progress.	Read/Write	No
 Duplex	DUPLEX (02)	The pair is synchronized. Updates to the P-VOL are duplicated on the S-VOL.	Read/Write	No

HDvM - SN status	BCM status	Description	P-VOL access	S-VOL access
 Suspend	SUSPOP (04), SWAPPING (04), SUSPER (07)	<p>The pair has been split by the user and the P-VOL and S-VOL are no longer synchronized.</p> <ul style="list-style-type: none"> <li>▪ The primary and secondary storage systems keep track of journal data discarded during the split operation.</li> <li>▪ In HDvM - SN, when the operation is performed on the primary storage system, the status of both the P-VOL and S-VOL changes to Suspend.</li> <li>▪ In HDvM - SN, when the operation is performed on the secondary storage system, the status of the S-VOL changes to Suspend, and the primary storage system detects this and changes the P-VOL status to Suspend.</li> </ul> <p>BCM suspend statuses initiated by the user:</p> <ul style="list-style-type: none"> <li>▪ SUSPOP (04): The user performed a split operation.</li> <li>▪ SWAPPING (04): The pair was split in the REVERSE direction (S-VOL to P-VOL).</li> <li>▪ SUSPER (07): The P-VOL was split by the system because the user deleted the pair from the S-VOL side.</li> </ul> <p>See also <a href="#">Suspend types (on page 38)</a>.</p>	Read/Write	SWAPPING (04): Read/Write. All others: Read Only if Mode=20 is ON, otherwise No.



HDvM - SN status	BCM status	Description	P-VOL access	S-VOL access
 Suspend	SUSPOP (05), SUSPCU (06), SUSPCU (08), SUSPER (09), SUSPER (50)	<p>The pair is suspended by the system due to an error; it is not synchronized.</p> <ul style="list-style-type: none"> <li>▪ The primary and secondary storage systems keep track of journal data discarded during the suspension operation.</li> <li>▪ The primary storage system keeps track of P-VOL tracks that are updated while the pair is suspended.</li> <li>▪ In HDvM - SN, when a URz suspension condition is detected, the primary storage system changes the P-VOL and S-VOL status to Suspend. If the secondary storage system detects the condition, it changes the S-VOL status to Suspend, and the primary storage system detects this and changes the P-VOL status to Suspend.</li> </ul> <p>BCM suspend statuses initiated by the primary or secondary storage system:</p> <ul style="list-style-type: none"> <li>▪ SUSPOP (05): The secondary storage system received a split request from the primary storage system and split the pair.</li> <li>▪ SUSPCU (06): The primary storage system split the pair because it detected an error in the secondary storage system.</li> <li>▪ SUSPCU (08): The pair was split because the primary storage system detected an error during communication with the secondary storage system or detected an I/O error during update copy.</li> </ul>	Read/Write	Read Only if Mode=20 is ON, otherwise No.

HDvM - SN status	BCM status	Description	P-VOL access	S-VOL access
		<ul style="list-style-type: none"> <li>▪ SUSPER (09): The pair was split because the primary storage system detected volatilization of pair control information on memory when power was ON (IMPL). This error occurs when power-off status of the primary storage system continues beyond the backup time for the nonvolatile memory.</li> <li>▪ SUSPER (50): The pair was split because data mismatch between P-VOL and S-VOL during initial copy operation. The cause of the error is invalid track format.</li> </ul> <p>See also <a href="#">Suspend types (on page 38)</a>.</p>		
 Suspend g	TRANS (60)	The pair is in transition to PSUS by user or PSUE by system status.	Read/Write	No
 Deleting	TRANS (61)	The pair relationship is being deleted. When the operation is complete, the status changes to unpaired.	Read/Write	No
 Hold <sup>1</sup>	HOLD (70)	<ul style="list-style-type: none"> <li>▪ When used with TCz, this status indicates that the creation of a delta resync pair is completed. Delta resync might not be executed depending on the internal process status even if the creation of the delta resync pair is completed. If the P-VOL status is Hold, the updated data of the TC or GAD S-VOL is stored in the master journal volume.</li> <li>▪ Operations allowed: <ul style="list-style-type: none"> <li>- Delta resync</li> <li>- Pair-delete</li> <li>- Change pair options</li> </ul> </li> </ul>	Read/Write	Read Only if Mode=20 is ON, otherwise No.
 Holding <sub>2</sub>	HOLDTRNS (72)	When used with TCz, this status indicates that the pair status is changing to Hold so that the delta resync pair can be created.	Read/Write	-

HDvM - SN status	BCM status	Description	P-VOL access	S-VOL access
		<p>Operations allowed on pairs in Holding status:</p> <ul style="list-style-type: none"> <li>▪ Delta resync operation</li> <li>▪ Pair release</li> <li>▪ Change pair options</li> </ul> <p>If the delta resync operation is run on a pair in Holding status, the operation could fail. If you specify Entire Copy for the Delta Resync Failure option (Change Journal Option dialog box), differential data is copied to an S-VOL.</p>		
(No equivalent HDvM - SN status)	HOLDER (71)	Differential data cannot be retained as a journal because of a hardware error.	-	-
(No equivalent HDvM - SN status)	HOLDER (73)	Although the user performed a resync, the delta resync cannot be run, and thus differential data cannot be retained as a journal.	-	-
(No equivalent HDvM - SN status)	NODELTA (74)	Although the user performed the data resync, difference data between the master journal and restore journal cannot be copied to the S-VOL in the current status. Running the delta resync in that status might fail. If the delta resync fails when Entire Copy is specified for Delta Resync Failure field in the HDvM - SN Change Journal Option dialog box, and all differential data is copied to S-VOL.	-	-
<p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. A URz pair S-VOL in Hold status is using 2 mirrors. In the 3DC configuration combined with TrueCopy for Mainframe, the access to the S-VOL depends on the status of the mirror that is not in HOLD status. In the 3DC configuration where three URz sites are combined, the host cannot write data to the S-VOL regardless of the mirror status.</li> <li>2. Holding indicates either that differential data used for a delta resync operation does not exist or that the system cannot judge whether the delta resync can be performed without the differential data.</li> </ol>				

HDvM - SN status	BCM status	Description	P-VOL access	S-VOL access
		<p>When differential data does not exist in the secondary TCz site, even after the S-VOL is updated, the differential data might be discarded due to the one of the following reasons:</p> <ul style="list-style-type: none"> <li>▪ The cache or shared memory was added to or removed from the system during maintenance work.</li> <li>▪ The system was powered off during maintenance work.</li> <li>▪ The URz or TCz pair was suspended and then resynchronized.</li> </ul> <p>After the system is back to normal, differential data is stored again in the TCz S-VOL if you update the data in the primary site.</p> <p>The delta resync operation can be executed without differential data if the primary site has not received a data update or if data in the TCz S-VOL and the URz S-VOL is the same.</p> <p>Even if the delta resync operation without differential data is executable, the pair status changes to Hold even when the differential data exists if the conditions for discarding the differential data are satisfied. To change the status of the pair to Hold, update the data in the primary storage system after the recovery from the condition of the differential data discarding.</p> <p>If you cannot connect to the secondary site of TCz due to failures or disasters, the transition from Holding to Hold is not performed correctly.</p>		

## **Additional information on pair status**

You should know what happens when you split or suspend a pair.

- When a pair is split by the user or suspended by the system, the primary storage system notifies the hosts by issuing a service information message (SIM). If SNMP is installed and operational, this SIM results in an SNMP trap indicating the reason for suspension.
- When you suspend a pair, the status changes to Suspending first, and then to Suspend. When you delete a pair, the status changes to Deleting first, and then the pair becomes unpaired. Suspending and Deleting pair status are displayed by BCM and Hitachi Device Manager - Storage Navigator. However, Suspending and Deleting are not displayed as the pair status in CCI.

- If you split a pair in Flush mode, it takes some time for the pair status to change to Suspend. To shorten the time, select Purge for Split Mode in HDvM - SN, or execute the `pairsplit -P` command in CCI before splitting a pair. If a pair is split in Flush mode, the status changes to Suspending first, and then it changes to Suspend when all journals in the master journal are restored to the restore journal. The time for a pair to change to Suspend can be calculated as follows (the actual time might vary depending on the internal processing status of storage systems):

$$\text{time-for-Suspending (sec.)} = C \times U / V$$

where:

- C is the total capacity (GB) of the master journal volume.
- U is the usage rate of data (%) in the master journal volume.
- V is the line speed (GB/sec) between the primary and the secondary storage systems.

The total capacity (GB) can be checked in the Journals tab of the **Journals** window or using the `raidcom get ldev` command.

The data usage rate can be checked in the **Performance Monitor** window in Performance Monitor or using the `raidcom get journal` command. For details about Performance Monitor, see the *Performance Guide*.

When using CCI to monitor the time until the status changes to Suspend in Flush mode, specify a value equal to or greater than the calculated time (in seconds) for the `-t` option of the `pairsplit` command.

When a URz pair in a journal of which Timer Type is System receives an invalid time stamp update from the primary site storage system, the SEQCHK status for URz is displayed. The SEQCHK status is caused by any of the following:

- An application might issue update I/Os, bypassing the MVS standard I/O procedure.
- The I/O time stamping function might not be active at the primary site.
- The time stamp value of the host is invalid.

The SEQCHK status can be checked in the Pairs table or in the Sub Status row of the Pair Details table. The SEQCHK status does not affect copy activities of URz, and it is deleted when the next time stamp update is copied to the S-VOL. Note, however, that if a disaster or a system failure occurs before the next time stamp update, the consistency in the update sequence between the S-VOL and other S-VOLs in the journal is not maintained. For secure disaster recovery, you need to detect and delete the source in the SEQCHK status.

## Suspend types

You can suspend a pair after the initial copy operation is complete. When you execute media maintenance on a P-VOL or if you want to access the S-VOL (Read only mode), you need to suspend the URz pair. When the URz pair is split by the user, the primary storage system and secondary storage system will do one of the following based on the user-specified Split Mode option (Flush or Purge):

- Flush: Execute suspended update copy, synchronize the pair, and then split the pair.
- Purge: Delete suspended update copy and then split the pair.

A pair can also be suspended by the primary or secondary storage system. Suspensions occur for the following conditions:

- When the primary storage system detects that the user has released the volume pair from the secondary storage system
- When the primary storage system detects an error condition related to the secondary storage system, S-VOL, or a journal data operation
- When the primary storage system is unable to communicate with the secondary storage system

When a pair is suspended, the primary storage system stops updating the S-VOL. The primary and secondary storage systems keep track of journal data discarded during suspension. Also, the primary storage system continues accepting write I/Os for the P-VOL and keeps track of the P-VOL tracks which are updated while the pair is suspended.

In addition to the suspended status, an S-VOL also has a consistency status that indicates its update sequence consistency with respect to the other S-VOLs in the same consistency group. The consistency status is available only on the secondary storage system. See [Table 2 Suspended S-VOL consistency status \(on page 40\)](#) for descriptions of suspended S-VOL consistency statuses.

When a pair is suspended, the primary storage system generates sense information to notify the hosts.

The following table lists and describes the suspend types.

**Table 1 Suspend types**

Suspend type	Applies to	Description
S-VOL by Operator	P-VOL, S-VOL	The user suspended the pair from the primary or secondary storage system using the S-VOL option.
By MCU	S-VOL	The secondary storage system received a request from the primary storage system to suspend the pair. The P-VOL suspend type is P-VOL by Operator or S-VOL by Operator.
By RCU	P-VOL	The primary storage system detected an error condition on the secondary storage system which caused the primary storage system to suspend the pair. The S-VOL suspend type is By MCU.
Delete Pair to RCU	P-VOL	The primary storage system detected that S-VOL status changed to unpaired because the user released the pair from the secondary storage system. The pair cannot be resynchronized because the S-VOL status is not Suspend.

Suspend type	Applies to	Description
S-VOL Failure	P-VOL	The primary storage system detected an error during communication with the secondary storage system or an I/O error during update copy. In this case, the S-VOL suspend type is usually By MCU.
MCU IMPL	P-VOL, S-VOL	The primary storage system could not find valid control information in its nonvolatile memory during the IMPL procedure. This condition occurs only if the primary storage system is completely without power for more than 48 hours (e.g., power failure and fully discharged backup batteries).
Initial Copy Failed	P-VOL, S-VOL	The pair was suspended before the initial copy operation was complete. The data on the S-VOL is not identical to the data on the P-VOL.
JNL Cache Overflow	P-VOL, S-VOL	The pair was suspended because it was highly likely that journal data will overflow.
MCU P/S-OFF	S-VOL	The primary storage system was powered off.

The following table describes the consistency statuses for suspended S-VOLs. These statuses indicate the S-VOL's update sequence consistency with respect to the other S-VOLs in the same consistency group.

**Table 2 Suspended S-VOL consistency status**

Consistency status	Description
Volume	<p>This URz volume pair was suspended alone. Update sequence consistency between this S-VOL and other S-VOLs in this mirror is not ensured.</p> <p>This S-VOL cannot be used for disaster recovery on the secondary storage system.</p> <p>This status is indicated when:</p> <p>This volume pair was split by the user using the Split Pairs window (URz Suspend option set to Volume).</p> <p>This volume pair was suspended due to a failure that did not affect the entire mirror, and the Error Level pair option for this pair is set to Volume.</p>
Mirror	<p>This URz volume pair was suspended along with the other pairs in its mirror. Update sequence consistency between this S-VOL and other S-VOLs in this mirror is ensured.</p>



Consistency status	Description
	<p>This S-VOL can be used for disaster recovery on the secondary storage system (after releasing the URz volume pair from the secondary storage system).</p> <p>This status is indicated when:</p> <ul style="list-style-type: none"> <li>▪ This mirror was split by the user using the Split Mirrors window (URz Suspend option set to Mirror).</li> <li>▪ All volume pairs in this mirror were suspended due to a failure that affected the entire mirror (not just one pair) (e.g., primary/secondary storage system communication failure).</li> <li>▪ The volume pair was suspended due to a failure that did not affect the entire mirror.</li> </ul>

### Suspension conditions on secondary storage systems

The following table provides conditions reported by the secondary storage system for suspending Universal Replicator for Mainframe pairs.

**Table 3 Suspension condition**

Suspension condition	Detected by	Pairs to be suspended
The secondary storage system could not copy the journal data successfully due to a hardware failure or logic error.	Secondary storage system	All S-VOLs in the journals, or the affected S-VOL.
The secondary storage system detected a logical error while selecting the journal data to be restored.	Secondary storage system	All S-VOLs in the journal, or the affected S-VOL, depending on the type of failure.
The secondary storage system could not restore the journal data due to a hardware failure, track condition, or logical error.	Secondary storage system	

For details, see [Troubleshooting by suspend type \(on page 213\)](#).

The primary storage system stores the differential bitmap for each P-VOL in the system's shared memory, and the secondary storage system stores the differential bitmap for each S-VOL in its shared memory. However, when a URz pair contains a DP-VOL whose capacity is larger than 262,688 cylinders, shared memory is not used.

The tracks containing the following journal data are marked in the differential bitmap as modified and will be copied when the pair is resynchronized:

- Journal data created by the primary storage system but not yet sent to the secondary storage system. After marking these P-VOL tracks as modified, the primary storage system discards these journal data.
- Journal data sent to the secondary storage system but not acknowledged by the secondary storage system. After marking these P-VOL tracks as modified, the primary storage system discards these journal data. This ensures that journal data lost during transmission are identified and marked.
- The journal data that reached the secondary storage system but have not yet been settled. After marking these S-VOL tracks as modified, the secondary storage system discards these journal data.
- The P-VOL records updated by host-requested write I/Os after the pair was suspended. When a suspended pair is resynchronized to the primary storage system and merged into its bitmap. The primary storage system then performs the resync operation according to the merged bitmap. This ensures that all the tracks, including discarded journal data, are resynchronized at this time.

## 3DC configurations with three URz sites

You create a 3DC multi-target or 3DC cascade configuration by combining three Universal Replicator for Mainframe sites. A 3DC multi-target configuration involves one primary site and two secondary sites. A 3DC cascade configuration involves a primary site, an intermediate site, and a secondary site.



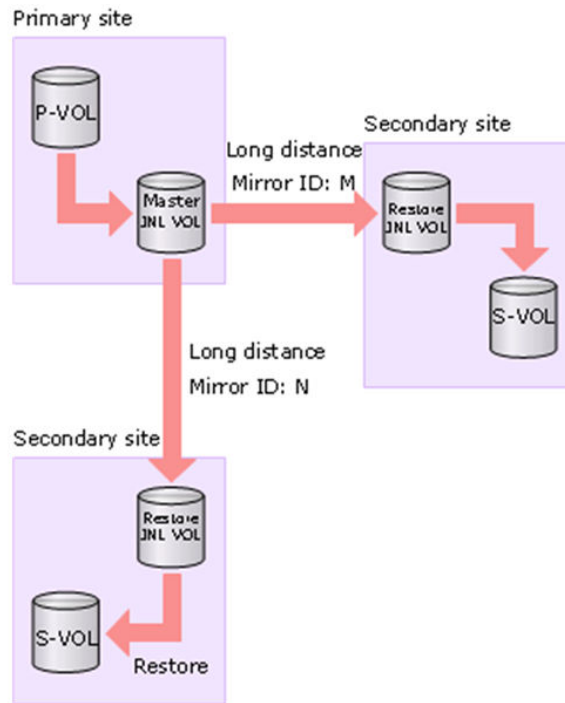
**Note:** A 3DC configuration with three Universal Replicator sites can be used only for configurations with VSP 5000 series as the primary system and VSP G1x00, VSP F1500 as the secondary system.

### 3DC multi-target configuration with three URz sites

With Universal Replicator for Mainframe, you can set up two secondary sites for one primary site.

The following illustration shows the 3DC multi-target configuration with three URz sites:

- URz primary site
- URz secondary site (copies data with a mirror whose ID is an arbitrary number (M in the illustration) from the primary site).
- URz secondary site (copies data with a mirror whose ID is an arbitrary number (N in the illustration) from the primary site).

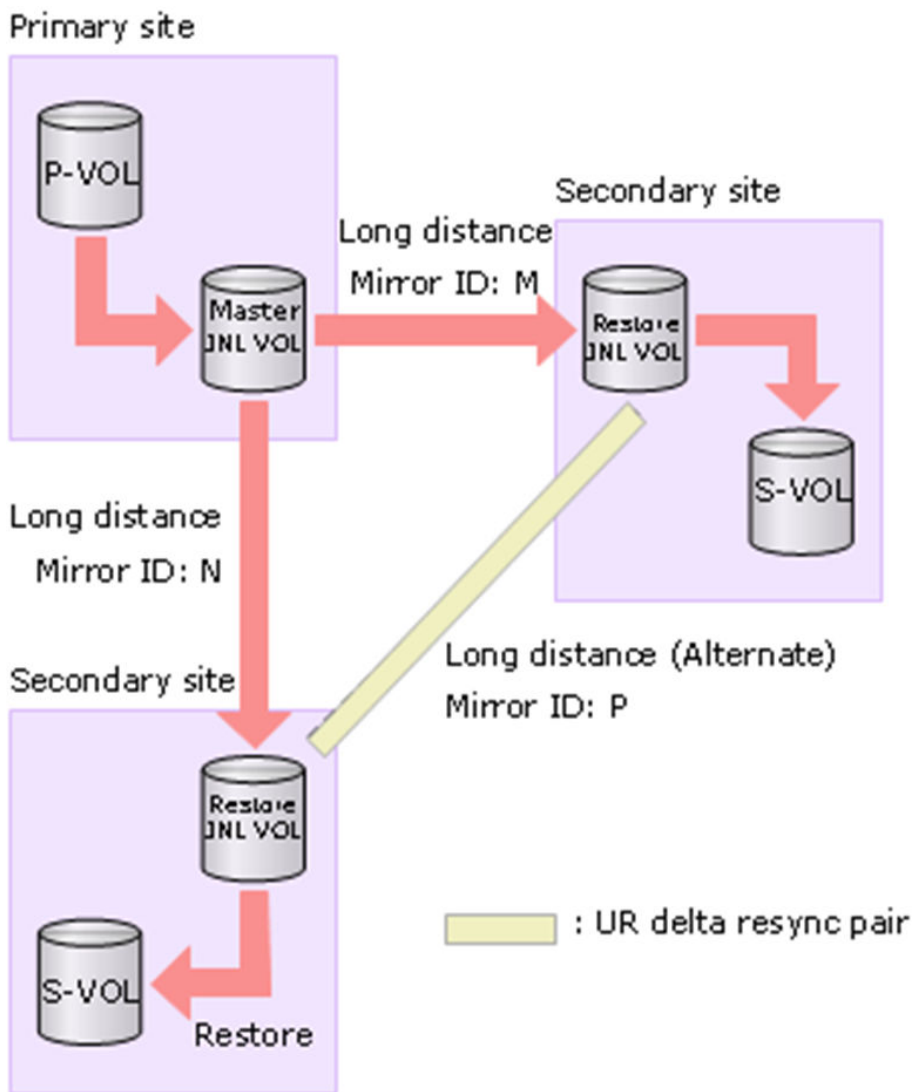


**Note:** In a 3DC multi-target configuration using delta resync with three URz sites, both the P-VOL and S-VOL of a delta-resync pair are displayed as secondary volumes in the Remote Replication window (Pair Position column).

### 3DC multi-target configuration with three URz sites using delta resync

You should create a URz pair that connects the two secondary sites so that the remote copy system created with the host operation site and backup site can be created immediately in the event of a failure or disaster at the primary site. A URz pair that is created to make a triangle-shaped remote copy connection among the three sites is called a URz delta resync pair. By creating a URz delta resync pair in advance, you can transfer the copying operations from between the secondary sites back to from the primary to the secondary site in a short time when the failure is corrected and the primary site is brought back online.

The following illustration shows the 3DC multi-target configuration with three URz sites using delta resync:

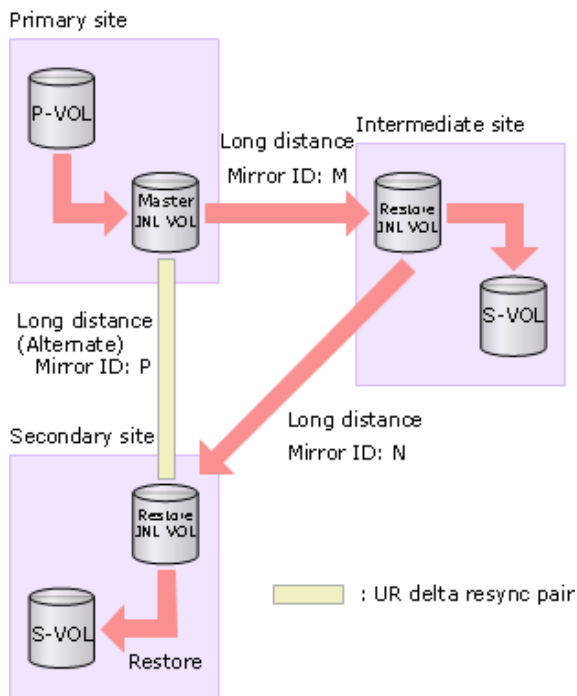


### 3DC cascade configuration with three URz sites

With Universal Replicator for Mainframe, you can set up one intermediate site and one secondary site for one primary site. It is advisable that you create a URz pair that connects the primary and secondary sites so that the remote copying system that is created with the host operation site and backup site is configured immediately in the event of a failure or disaster at the intermediate site. A URz pair that is created to make a triangle-shaped remote copy connection among the three sites is called URz delta resync pair. By creating a URz delta resync pair in advance, you can transfer the copying operations from between the primary and secondary sites back to between the intermediate and secondary sites in a short time when the intermediate site failure is corrected and the intermediate site is brought back online.

The following illustration shows the 3DC cascade configuration with three URz sites:

- URz primary site (copies data with a mirror whose ID is an arbitrary number (M in the illustration) to the intermediate site). Data can be copied with a mirror whose ID is an arbitrary number (P in the illustration) to the secondary site.
- URz intermediate site (copies data with a mirror whose ID is an arbitrary number (M in the illustration) from the primary site and copies data with a mirror whose ID is an arbitrary number (N in the illustration) to the secondary site). Data can be copied with a mirror whose ID is an arbitrary number (P in the illustration) from the primary site.
- URz secondary site (copies data with a mirror whose ID is an arbitrary number (N in the illustration) from the intermediate site). Data can be copied with a mirror whose ID is an arbitrary number (P in the illustration) from the primary site.



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## Chapter 2: Requirements and specifications

You need to understand the system and interoperability requirements to successfully use Hitachi Universal Replicator for Mainframe.

### System requirements

The following table lists the system requirements for URz operations.

Item	Requirement
Supported storage systems	<p>VSP 5000 series can be paired with the following:</p> <ul style="list-style-type: none"><li>▪ VSP 5000 series (90-01-4x-00/00 or later)</li><li>▪ VSP G1000 (80-06-70-00/00 or later)</li><li>▪ VSP G1500, and VSP F1500 (80-06-70-00/00 or later)</li><li>▪ VSP (70-06-63-00/00 or later)</li><li>▪ When creating a 3DC configuration in which the VSP G1000, VSP G1500, and VSP F1500 and VSP storage systems are combined, contact customer support about the support version. You cannot perform the delta resync operation in a 3DC configuration combined with the VSP storage system.</li></ul>
Number of storage systems	<p>A maximum of 64 units can be connected to one unit storage system. For example, you can make a configuration of one unit storage system for the primary site and 64 units storage system for the secondary site.</p>
Controller emulation	<p>CU emulation type I-2107 and H-6591-C3 must be used for the primary and secondary storage systems.</p>
Universal Replicator for Mainframe	<ul style="list-style-type: none"><li>▪ Must be installed on the primary and secondary storage systems.</li><li>▪ License keys required.</li><li>▪ UR and URz can coexist in the same storage system.</li><li>▪ For information on expired licenses or exceeding licensed capacity, see the <i>System Administrator Guide</i>.</li></ul>

Item	Requirement
Other licenses required	<ul style="list-style-type: none"> <li>▪ TrueCopy for Mainframe is required, whether or not TCz volumes are shared with URz.</li> <li>▪ Remote Replication Extended is required for 3DC configurations.</li> <li>▪ Dynamic Provisioning. DP-VOLs are required for journal volumes.</li> </ul>
Interfaces	<ul style="list-style-type: none"> <li>▪ Device Manager - Storage Navigator: <ul style="list-style-type: none"> <li>• Must be LAN-attached to the primary storage system.</li> <li>• Not required on the secondary storage system, but recommended in order to change URz parameters and access the S-VOL for disaster recovery and maintenance.</li> <li>• The following roles are required: <ul style="list-style-type: none"> <li>Storage Administrator (Remote Copy), to perform pair operations</li> <li>Storage Administrator (System Resource Management), to configure settings</li> </ul> </li> </ul> </li> <li>▪ Business Continuity Manager <ul style="list-style-type: none"> <li>• Preferred</li> <li>• Command device required</li> <li>• Business Continuity Manager does not support copy pair operations for copy pairs created by a different product (Hitachi Device Manager - Storage Navigator, for example). Business Continuity Manager also does not support copy pair operations on copy pairs managed by a different product even if the copy pairs were created in Business Continuity Manager. For these reasons, always use Business Continuity Manager to create and perform operations on copy pairs that you will manage using Business Continuity Manager.</li> </ul> </li> </ul>
Disk track format	<p>The track format for the P-VOL and S-VOL must meet the following requirements:</p> <ul style="list-style-type: none"> <li>▪ The URz P-VOL and S-VOL must have the same track format.</li> <li>▪ Record zero (R0) must be standard format, with key length of zero and data length of eight. The primary storage system aborts the initial copy operation if R0 is not standard format.</li> </ul>

Item	Requirement
	<ul style="list-style-type: none"> <li>▪ The CCHH (logical cylinder address and logical head address) of R0 must be identical to the physical cylinder address and physical head address of the track.</li> <li>▪ The CCHH of each user record in a track must be unique.</li> </ul>
Supported mainframe host platforms	<ul style="list-style-type: none"> <li>▪ MVS</li> <li>▪ OS/390</li> <li>▪ VOS3</li> <li>▪ z/Linux Redhat</li> <li>▪ z/Linux SuSE</li> <li>▪ z/OS</li> <li>▪ z/VM</li> <li>▪ z/VSE</li> </ul> <p>For the supported version, refer to the Hitachi Vantara interoperability matrix at <a href="http://support.hitachivantara.com/en_us/interoperability">http://support.hitachivantara.com/en_us/interoperability</a>.</p> <p>Also, note the following:</p> <ul style="list-style-type: none"> <li>▪ Optional error report communications (ERC) function requires MVS/DFP 3.2.0 or later.</li> <li>▪ In VOS3, the configuration relating WDCP (Double Disk Volume Control Program) to the secondary volume of Universal Replicator for Mainframe is not supported.</li> <li>▪ If the primary and/or secondary storage systems consist of several CPU complexes, a SYSPLEX timer is required to provide a common time reference for the host I/O time stamping function. However, the z/Linux operating system does not support a SYSPLEX timer. As a result, I/O from the z/Linux host is not consistent. Also, journal consistency is not maintained.</li> </ul>
Data path	<p>Fibre channel with either direct or switch connections.</p> <p>For details, see <a href="#">Supported data path configurations (on page 98)</a>.</p> <p>Up to eight paths can be registered in one path group.</p> <p>You can use multiple path groups by registering path groups with multiple path group IDs in the same storage system. But note that only one path group can be specified for a mirror.</p>



Item	Requirement
Path group	<p>Groups of remote paths, which allows you to configure or change the configuration of multiple paths at the same time.</p> <ul style="list-style-type: none"> <li>▪ A maximum of eight remote paths can be registered in a path group.</li> <li>▪ A maximum of 64 path groups can be set in a storage system.</li> <li>▪ The range of values for the path group ID is 0-255.</li> <li>▪ For a mirror, the path group ID that is used to connect the primary storage system to the secondary storage system must also be used to connect the systems in the reverse direction.</li> <li>▪ The path group is specified during the create pair operation. It cannot be changed by resynchronization or the swap operation.</li> <li>▪ Path groups can be created and specified using BCM or CCI.</li> </ul> <p>See configuration setting commands in <i>Command Control Interface User and Reference Guide</i> and sample configuration definition files in <i>Command Control Interface Installation and Configuration Guide</i>.</p> <ul style="list-style-type: none"> <li>▪ Specify different paths and path groups for TCz and URz secondary storage systems when using CU Free.</li> </ul>
Pair volumes	<ul style="list-style-type: none"> <li>▪ The P-VOL and S-VOL must be equal in size.</li> <li>▪ The maximum size of the P-VOL and S-VOL is: <ul style="list-style-type: none"> <li>• Other than DP-VOL: 262,668 cyl.</li> <li>• DP-VOL: Same as the maximum size of the DP-VOL (1,182,006 cyl. for 3390-A). For details, see <i>Provisioning Guide for Mainframe Systems</i>.</li> </ul> </li> <li>▪ A volume (LDEV) from a parity group with accelerated compression enabled cannot be used directly as a pair volume. Such volumes must be used as pool volumes for an HDP or HDT pool.</li> </ul>
Journals and journal volumes	<ul style="list-style-type: none"> <li>▪ Maximum number of journals supported per storage system: 256 (0 to 255)</li> <li>▪ Preferred number of journals: up to 4 for each MP unit</li> <li>▪ Maximum number of data volumes: 16,384 for each journal, and 8,192 for each mirror. When you create a 3DC multi-target or 3DC cascade configuration with three URz sites, use the same data volume in two mirrors.</li> </ul>

Item	Requirement
	<ul style="list-style-type: none"> <li>▪ Maximum journal volume size: 256 TB</li> <li>▪ Minimum journal volume size: 10 GB</li> <li>▪ Maximum number of data volumes per journal: 8,192</li> <li>▪ Emulation types for journal volumes: OPEN-V. Journal volumes must be DP-VOLs.</li> </ul> <p>The following volumes cannot be registered to a journal:</p> <ul style="list-style-type: none"> <li>• A DP-VOL with the Data Direct Mapping attribute.</li> <li>• A DP-VOL with the capacity saving enabled.</li> <li>• A deduplication system data volume.</li> </ul> <ul style="list-style-type: none"> <li>▪ The relationship between a master journal and a restore journal is called a mirror. Mirror IDs are 0 to 3.</li> <li>▪ Journal IDs cannot be duplicated among the virtual storage machines.</li> </ul> <p>For details, see <a href="#">Planning journal volumes (on page 65)</a>.</p>
LU number	<p>LU number: 0 to 4095.</p> <ul style="list-style-type: none"> <li>▪ The number of LU paths that can be created can be up to 4096 for VSP 5000 series whose DKCMAIN program version is 90-02-0x-xx/xx or later.</li> <li>▪ The number of LU paths that can be created when connecting a VSP 5000 series with an earlier DKCMAIN program version is limited to 2048.</li> </ul> <p>For details, see <a href="#">Restrictions when creating an LU whose LU number is 2048 or greater (on page 73)</a>.</p>
Supported volume types	<p>Virtual LVI:</p> <ul style="list-style-type: none"> <li>▪ Can be used for data and journal volumes.</li> <li>▪ S-VOL capacity must equal P-VOL capacity.</li> </ul>
Maximum number of pairs	<ul style="list-style-type: none"> <li>▪ VSP 5000 series: 65,280 pairs (maximum)</li> </ul>
Supported RAID groups	<ul style="list-style-type: none"> <li>▪ RAID1, RAID5, and RAID6 are supported for both data and journal volumes.</li> <li>▪ RAID1, RAID5, and RAID6 can co-exist in the same journal.</li> </ul>

Item	Requirement
Cache and nonvolatile storage (NVS)	<p>Must be operable for primary and secondary storage systems to ensure pair creation success. The secondary storage system cache must be configured to adequately support URz remote-copy workloads, as well as local workload activity. To determine the appropriate cache capacity to be increased, perform the following calculations A and B and use the smaller result:</p> <p>A. 1 GB × number of journals</p> <p>B. 25% of the necessary cache to support the storage capacity</p> <p><b>Note:</b> When pair status is Pending, neither cache nor shared memory can be added to or removed from the system. When either of these tasks is to be performed, first split any pairs in Pending status, and then resynchronize when the cache or shared memory operation is completed.</p>
Host failover software	Required for disaster recovery.
Extended consistency groups (EXCTGs)	<ul style="list-style-type: none"> <li>▪ A storage system can have a maximum of four EXCTGs.</li> <li>▪ An EXCTG can contain a maximum of 16 journals, if registered from Storage Navigator, and 64 journals, if registered from Business Continuity Manager.</li> <li>▪ A maximum of four unit systems can be used in one EXCTG.</li> <li>▪ A maximum of four units journal of different storage systems can be registered with the same EXCTG.</li> <li>▪ A journal can be registered in one EXCTG only.</li> </ul> <p>For example, you can configure the EXCTG of four units each for the primary site and secondary site. Likewise, you can configure the EXCTG of two units storage system for the primary site and one unit storage system for the secondary site.</p>
CCI consistency groups with multiple primary and secondary storage systems	<ul style="list-style-type: none"> <li>▪ In the CCI CTG with multiple storage systems, a maximum of four units storage system can be connected.</li> </ul> <p>For example, you can configure the CCI CTG storage system of four units each for the primary site and secondary site. Likewise, you can configure the CCI CTG multiple systems of two units storage system for the primary site and one unit storage system for the secondary site.</p> <ul style="list-style-type: none"> <li>▪ Up to 8,192 pairs.</li> </ul> <p>You can register the total number of pairs in the journals within one CCI consistency group. It is recommended that you register only up to 4,096 pairs.</p>

## Interoperability requirements

This topic provides the interoperability requirements for Universal Replicator for Mainframe.

Universal Replicator for Mainframe can be used extensively with TrueCopy for Mainframe and ShadowImage for Mainframe to provide additional data redundancy and enhanced disaster recovery solutions. For information about these configurations, see the following appendixes:

- [Configurations with TrueCopy for Mainframe \(on page 245\)](#)
- [Configurations with ShadowImage for Mainframe \(on page 265\)](#)

### Volume types that can be shared with Universal Replicator for Mainframe

You can use volumes used by other software products as URz P-VOLs, S-VOLs, and journal volumes. The following table shows whether a particular software product volume can be used as a URz P-VOL, S-VOL, or journal volume.

Volumes types and functions	Used as URz P-VOL?	Used as URz S-VOL?	Used as URz journal volume?
Compatible FlashCopy® V2 <sup>9</sup>			
Source volume	Yes <sup>1</sup>	No	No
T-VOL	Yes <sup>1</sup>	No	No
Hitachi Compatible Software for IBM® FlashCopy® SE <sup>9</sup>			
Source volume	Yes <sup>5</sup>	No <sup>5</sup>	No
T-VOL	No <sup>5</sup>	No <sup>5</sup>	No
Compatible PAV			
Compatible PAV	Yes	Yes	No
Compatible XRC			
Compatible XRC volume	No	No	No
Concurrent Copy			
Concurrent Copy volume	Yes	No	No
Cross-OS File Exchange			
Volume usable by both mainframe and open systems	No	No	No

Volumes types and functions	Used as URz P-VOL?	Used as URz S-VOL?	Used as URz journal volume?
Dynamic Provisioning for Mainframe <sup>6</sup>			
Virtual volume	Yes	Yes	No
Pool-VOL	No	No	No
Dynamic Tiering for Mainframe / Active flash for mainframe			
Virtual volume	Yes	Yes	No
Pool-VOL	No	No	No
Resource Partition Manager			
Resource Partition Manager volume	Yes <sup>13</sup>	Yes <sup>13</sup>	Yes <sup>14</sup>
ShadowImage for Mainframe <sup>7</sup>			
P-VOL in Split/SUSPOP status	Yes	Yes <sup>10, 11</sup>	No
P-VOL in Suspend/SUSPER status	Yes	Yes <sup>10, 11</sup>	No
P-VOL in Resync-R/REVERSY status	No	No	No
P-VOL that is also used as a TCz P-VOL or S-VOL	Yes	Yes <sup>10, 11</sup>	No
P-VOL (None of the above)	Yes	Yes <sup>6, 10, 11</sup>	No
S-VOL in Split/SUSPOP status	Yes	No	No
S-VOL in Suspend/SUSPER status	Yes	No	No
S-VOL (None of the above)	No	No	No
<b>Soft Fence</b>			
Volume for which Soft Fence is set	No <sup>12</sup>	No <sup>12</sup>	No (not supported)
TrueCopy for Mainframe <sup>8, 9</sup>			
P-VOL in Pending status	No	No	No
P-VOL in DUPLEX status	Yes <sup>3</sup>	No	No
P-VOL in Suspend status	Yes <sup>3</sup>	No <sup>2</sup>	No
S-VOL in Pending status	No	No	No
S-VOL in DUPLEX status	Yes <sup>3</sup>	No	No

Volumes types and functions	Used as URz P-VOL?	Used as URz S-VOL?	Used as URz journal volume?
S-VOL in Suspend status whose BCM status is other than SWAPPING	Yes <sup>3</sup>	No	No
S-VOL in Suspend status whose BCM status is SWAPPING	Yes <sup>3</sup>	No <sup>2</sup>	No
S-VOL is suspended due to a failure	Yes <sup>3</sup>	No	No
Universal Volume Manager			
Universal Volume Manager volume	Yes	Yes	No
Virtual LVI			
Virtual LVI volume	Yes	Yes	No
Volume Migration <sup>9</sup>			
Source volume (when volume migration is in progress)	Yes <sup>4</sup>	Yes <sup>4</sup>	No
Source volume (after volume migration is finished)	Yes	Yes	No
Volume Retention Manager			
Volume with Read/Write attribute	Yes	Yes	No
Volume with Read Only attribute	Yes	Yes	No
Volume with Protect attribute	No	No	No
<p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. The volume cannot be used as a URz pair volume for the delta resync operation.</li> <li>2. The volume can be used as an S-VOL only when restoring a URz pair or performing the YKRESYNC REVERSE operation. However, even in these cases, the volume cannot be used as the S-VOL for a URz delta resync pair.</li> <li>3. This is "No" if more than one primary storage system and more than one secondary storage system are used for remote copy (see <a href="#">Planning URz in multiple storage systems using an EXCTG (on page 76)</a>).</li> <li>4. URz pair status must be other than Pending or Duplex to use the P-VOL or the S-VOL as a source volume and perform volume migration. The migration operation stops if URz status changes to Pending or Duplex.</li> <li>5. For details, see the topic on interoperability with other products and functions in the <i>Hitachi Compatible FlashCopy/FlashCopy SE User Guide</i>.</li> </ol>			

Volumes types and functions	Used as URz P-VOL?	Used as URz S-VOL?	Used as URz journal volume?
<p>6. When a DP-VOL is used as a pair volume shared by ShadowImage for Mainframe and URz, the URz create pair operation can fail. For information about how to ensure against failure, see the bullet on DP-VOL s and ShadowImage in <a href="#">Dynamic Provisioning for Mainframe (on page 58)</a>.</p> <p>7. For complete information, see <a href="#">Configurations with ShadowImage for Mainframe (on page 265)</a>.</p> <p>8. For complete information, see <a href="#">Configurations with TrueCopy for Mainframe (on page 245)</a>.</p> <p>9. In a 3DC multi-target or 3DC cascade configuration in which three URz sites are combined, the volume shared with the two URz pairs cannot be used by this software. Also, the volume used in this software cannot be used as the volume shared with the two URz pairs.</p> <p>10. For 3DC configurations with three URz sites, do not assign the P-VOL of an Slz pair that uses DP-VOLs of Dynamic Provisioning for Mainframe as the S-VOL of a URz pair for delta resync.</p> <p>11. If you want to use DP-VOLs that are also used by a ShadowImage for Mainframe pair or used by a Volume Migration migration plan, perform the following operations:</p> <ol style="list-style-type: none"> <li>a. Delete the ShadowImage pair and disable the Volume Migration setting first.</li> <li>b. Create a UR pair.</li> <li>c. Re-create a ShadowImage pair and a Volume Migration migration plan.</li> </ol> <p>12. Pair resynchronization terminates abnormally if Soft Fence is set for the URz P-VOL or S-VOL. Pair split and pair deletion terminate normally.</p> <p>13. Only volumes assigned to user group to which the user belongs can be used.</p> <p>14. Only OPEN-V virtual volumes assigned to user group to which the user belongs can be used.</p>			

## Using DP-VOLs that are also used by ShadowImage for Mainframe pairs or Volume Migration

You can use DP-VOLs that are also used by a ShadowImage for Mainframe pair or that is used in a Volume Migration migration plan, but the URz pair must be created first.

If the ShadowImage for Mainframe pair or the Volume Migration setting is enabled before you create the URz pair, you must delete or disable them before creating the URz pair.

### Procedure

1. Delete the ShadowImage for Mainframe pair or disable the Volume Migration setting.
2. Create the URz pair.
3. Re-create the ShadowImage for Mainframe pair or the Volume Migration migration plan.

## Compatible FlashCopy® V2

URz P-VOLs can be shared with Compatible FlashCopy® V2 (FCv2) S-VOLs and T-VOLs.

To create the relationship with FCv2, specify the following options:

- DFSMSdss:FCTOPPRCPRIMARY
- TSO:TGTTPPRIM(YES)
- ICKDSF:TGTOKASPPRCPRIM(YES)
- ANTRQST Macro:TGTTPPRIM(YES)

### Cautions

- URz copy rate may lower when FCv2 copy processing takes place. The impact of FCv2 operations on the URz pair can be increased or decreased depending on URz copy range and copy pace, and the order of FCv2 copy processing.
- Data that FCv2 copies to URz P-VOLs are transferred to URz S-VOLs asynchronously. URz displays the progress of this asynchronous data transfer. Depending on the timing of the FCv2 and URz copy operations, a time delay may occur between the FCv2 copy operation and the URz copy operation, and the URz asynchronous data transfer may progress slowly
- The time stamp function cannot be used while an FCv2 copy operation is being performed.
- The FCv2 relationship can be created in the status under which the URz initial copy operation can be performed. If the P-VOL of the URz pair with Duplex or Pending status is assigned to the T-VOL of the FCv2 relationship, the URz initial copy operation is performed. However, if the FCv2 relationship is created in the status under which the URz initial copy operation cannot be performed, the URz pair may be suspended. The initial copy operation cannot be performed in the following statuses:
  - Both primary storage system cache and secondary storage system cache are blocked.
  - Shared memory is blocked.
  - The remote path is blocked.
  - LDEVs are blocked.
  - The secondary storage system does not support FCv2.
- If the P-VOL of a URz pair in Duplex or Pending status is assigned to the T-VOL of an FCv2 relationship, the data on FCv2 is copied to the URz P-VOL. When the data copy operation to the URz P-VOL is completed, the initial copy operation to the URz S-VOL is started. Then, the information about the URz pair for which the initial copy operation just started is displayed in the History window. The status of the URz pair is Pending until the initial copy operation is completed.

However, if the T-VOL of an FCv2 relationship is assigned to a URz P-VOL in the Pending status, another initial copy operation is started, and the information about this second initial copy operation is displayed in the History window. When the FCv2 data has been copied to the URz S-VOL by this second copy operation, the History window displays the information about the completion of the initial copy operation.



### 3DC multi target configuration

When sharing an Compatible FlashCopy<sup>®</sup> V2 T-VOL with a 3DC multi target configuration P-VOL, before performing the Compatible FlashCopy<sup>®</sup> V2 copy operation, you must suspend one of the 3DC pairs. In this case, use the following workflow:

1. Suspend the URz or TCz pair.
2. Perform the Compatible FlashCopy<sup>®</sup> V2 copy operation from the S-VOL to the T-VOL.
3. Wait until the non-suspended 3DC pair completes the resulting update and is in DUPLEX status.
4. Resynchronize the suspended 3DC pair.

### Cautions

- If TCz is used with Compatible FlashCopy<sup>®</sup> V2, specify Track as the unit of storage for the differential data of the TCz pair.
- If TCz incorporates with Compatible FlashCopy<sup>®</sup> V2, create the TCz pair without using the TCz consistency group function.
- The data copied to the TCz P-VOL or URz P-VOL by Compatible FlashCopy<sup>®</sup> V2 is asynchronously copied with the initial copy operation to the TCz S-VOL or URz S-VOL. Based on the speed of the data copy to TCz S-VOL or URz S-VOL, the concordance rate of the TCz pair and URz pair is calculated. Based on the copy processing performing order of the FCv2 relationship, initial copy processing of the TCz pair, and initial copy processing of the URz pair, performing of the TCz or URz initial copy operation may be forced to wait. In this case, the concordance speed of the TCz or URz pair may slow.
- If the delta resync operation incorporates with Compatible FlashCopy<sup>®</sup> V2, use the delta resync operation function, which is supported for the remote command device function.
- The relationship with Compatible FlashCopy<sup>®</sup> V2 can be created only when TCz pairs are in Duplex or Pending.

## Compatibility of Universal Replicator for Mainframe with Soft Fence

During a pair operation for a URz function, pairs cannot be created or resynchronized if Soft Fence is set for the volume. Soft Fence is a volume protection function for disaster recovery that is provided by IBM.

If you set Soft Fence for a URz pair during host I/Os or initial copy, the pair is suspended by failure. A pair is suspended by failure during restoration to the volume for which Soft Fence is set. Therefore, if journals remain, it might take some time for a pair to be suspended by failure after Soft Fence is set.

For information about how to check if Soft Fence is set, see the *Provisioning Guide for Mainframe Systems*. For other details about Soft Fence, see the *Provisioning Guide for Mainframe Systems* and IBM<sup>®</sup> documentation.

## Dynamic Provisioning for Mainframe

You can create a Universal Replicator for Mainframe pair by specifying a DP-VOL (Dynamic Provisioning virtual volume).

- DP-VOLs can be used for either the URz P-VOL or S-VOL, or both P-VOL and S-VOL.
- URz pairs can be created by specifying DP-VOLs.
- Only OPEN-V DP-VOLs can be used as journal volumes; only 3390-A volumes can be used as DP-VOLs. See the following table for details.

P-VOL type (Emulation type)	S-VOL type (Emulation type)		
	DP-VOL (3390-A)	Other than DP-VOL (3390-A)	Other than DP-VOL (3390-X <sup>1, 2</sup> )
DP-VOL (3390-A)	Yes	Yes	No
Other than DP-VOL (3390-A)	Yes	Yes	No
Other than DP-VOL (3390-X <sup>1, 2</sup> )	No	No	Yes <sup>3</sup>
<b>Legend:</b>			
Yes: Universal Replicator for Mainframe pairs can be created.			
No: Universal Replicator for Mainframe pairs cannot be created.			
<b>Notes:</b>			
<ol style="list-style-type: none"> <li>1. Emulation type 3390 except 3390-A. For details about emulation types supported by Universal Replicator for Mainframe, see <a href="#">Data and journal volume specifications (on page 67)</a>.</li> <li>2. You cannot create a Universal Replicator for Mainframe pair by combining an emulation type other than 3390 and a DP-VOL.</li> <li>3. You can create a Universal Replicator for Mainframe pair only when the emulation type is the same.</li> </ol>			

- When a DP-VOL is used for a URz P-VOL or S-VOL, the URz of the allocated pages for the DP-VOL is included in the URz licensed capacity. If the actual licensed capacity exceeds the available licensed capacity, you may use URz for 30 days. After 30 days, URz pairs may only be split or released.
- When you specify a DP-VOL that has allocated pages to a URz S-VOL, the used pool capacity will become temporarily larger than the actual capacity, because pages must be reallocated in the DP-VOL. Therefore, before creating the pair:
  - Make sure that DP-VOL pool capacity is sufficient.
  - Make sure that the pool-VOLs, which are added to a pool, are not blocked. If the pool-VOLs are blocked, restore the volume status and then create the pair.

- If you want to use DP-VOLs that are also used by a ShadowImage for Mainframe pair or that are in a Volume Migration migration plan, proceed as follows:
  1. Delete the ShadowImage for Mainframe pair or disable the Volume Migration setting.
  2. Create the URz pair.
  3. Re-create the ShadowImage for Mainframe pair or the Volume Migration migration plan.
- When a DP-VOL is used as the URz S-VOL, you might not be able to update the URz S-VOL because the capacity of the pool-VOL is full. In this instance, the pair status changes to Suspend.
- You can reclaim zero pages of the DP-VOL to release the appropriate pages. Free pool capacity increases after zero pages are reclaimed, but pages to which the control cylinders are assigned cannot be released. Therefore, when a pair is created using DP-VOLs only, page capacity or P-VOL and S-VOL license capacity might be different in the following cases:
  - If a track in the page is allocated to the P-VOL, URz overwrites the data by copying it to the S-VOL, even if the track has no records. The new page to which the control cylinders are assigned might be allocated because control cylinder information controlling the track is updated when the S-VOL data is overwritten.  
In this case, pages to which the control cylinders are assigned cannot be released. Therefore, there might be more pages allocated to the S-VOL than to the P-VOL.
  - When P-VOL zero data pages are copied to the S-VOL, new pages might not be allocated to the S-VOL.
  - When S-VOL data is updated while the pair is suspended, new pages to which the control cylinders are assigned might be allocated. In this case, pages to which the control cylinders are assigned cannot be released even after the pair is resumed. Therefore, there might be more pages allocated to the S-VOL than to the P-VOL.
- If you split and then resync a pair while the pair is being created (Pending status), or if you share a URz P-VOL with a Compatible FlashCopy<sup>®</sup> V2 target volume, pages that do not exist in the P-VOL might be allocated to the S-VOL. In these cases, make sure to reclaim zero pages in the DP-VOL.
- When you create a pair between DP-VOLs, even if there are no allocated pages in the P-VOL, one allocated page occurs for every 4,060 Cyl in the S-VOL volume for the control cylinder. As a result, the S-VOL might have more pages than the P-VOL.

## Resource Partition Manager

You can specify Resource Partition Manager volumes as URz P-VOL and S-VOL as long as they belong to the same resource group. For journal volumes, use a Resource Partition Manager OPEN-V virtual volume.

For details, see the *Provisioning Guide for Mainframe Systems*.

## Universal Volume Manager

You can create URz pairs using Universal Volume Manager-configured volumes.

For details, see the *Hitachi Universal Volume Manager User Guide*.

## Virtual LVI

Universal Replicator for Mainframe supports the Virtual LVI feature, which allows you to configure custom-size LDEVs that are smaller than standard-size LDEVs. When custom-size LDEVs are assigned to a Universal Replicator for Mainframe pair, the S-VOL must have the same capacity as the P-VOL.

To perform Virtual LVI operations on a pair's P-VOL and S-VOL, the pair must be deleted and the volumes' status returned to Simplex.

## Volume Migration

You can specify the Universal Replicator for Mainframe P-VOL or S-VOL as Volume Migration source volumes. However, when URz pair status is Pending or Duplex, do not perform the volume migration operation; otherwise, the operation is stopped.

URz pair volumes and journal volumes cannot be used as Volume Migration target volumes.

## Business Continuity Manager specifications

You can perform the following Universal Replicator for Mainframe operations by issuing Business Continuity Manager (BCM) commands from the host system to the storage system:

- Creating the remote copy association between the primary and secondary storage systems (add RCU).
- Adding, splitting, resynchronizing, and deleting pairs.
- Monitoring pair status.



### Note:

- If you do not use a command device for Business Continuity Manager, BCM commands are issued from the host to the scanned device. Because internal processing such as host I/O (Read / Write) processing and copy processing are operating in the scanned device, a conflict occurs between internal processing and BCM command processing. As a result, phenomena such as host I/O response delay or throughput decrease might occur, and moreover it might become MIH (Missing Interrupt Handler). Therefore, make sure to use the command device for BCM so as not to affect the host site.
- Make sure to set the missing interrupt handler (MIH) value for the BCM command device to a minimum of 45 (seconds). The MIH value is used as the I/O monitoring time for a volume used as a command device.

For complete information about Business Continuity Manager, see the Business Continuity Manager documentation.

## SAID values for CESTPATH/YKBLDPTH

For the values of VSP 5000 series system adapter ID (SAID), see Hitachi TrueCopy® for Mainframe User Guide.

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## Chapter 3: Planning for Universal Replicator for Mainframe

Planning the Universal Replicator for Mainframe system is tied to your business requirements and production system workload. You must define your business requirements for disaster downtime and measure the amount of changed data your storage system produces over time. Using this information, you can calculate the size of journal volumes and the amount of bandwidth required to handle the transfer of data over the data path network.

### Planning and design

Use the information you develop during your planning and design activities to work with your Hitachi Vantara account team to determine your URz implementation plan.

#### Plan and design activities

- Assess your organization's business requirements to determine the recovery requirements.
- Measure the write workload (MB/sec and IOPS) of your host applications to begin matching actual data loads with the planned URz system.
- Use the collected data along with your organization's recovery point objective (RPO) to size URz journal volumes. Journal volumes must have enough capacity to hold accumulating data over extended periods.

The sizing of journal volumes is influenced by the amount of bandwidth. These factors are interrelated. You can adjust journal volume size in conjunction with bandwidth to fit your organization's needs.

- Use IOPS to determine data transfer speed into and out of the journal volumes. Data transfer speed is determined by the number of Fibre Channel or iSCSI ports you assign to URz, and by RAID group configuration. You need to know port transfer capacity and the number of ports that your workload data will require.
- Use collected workload data to size bandwidth for the Fibre Channel data path. As mentioned, bandwidth and journal volume sizing, along with data transfer speed, are interrelated. Bandwidth can be adjusted with the journal volume capacity and data transfer speed you plan to implement.
- Design the data path network configuration, based on supported configurations, Fibre Channel switches, and the number of ports required for data transfer.
- Plan data volumes (primary and secondary volumes) based on the sizing of P-VOLs and S-VOLs, RAID group configurations, and other considerations.

- Review host OS requirements for data and journal volumes.
- Adjust cache memory capacity for URz.

## Assessing business requirements for data recovery

In a URz system, the journals remain fairly empty when the data path is able to transfer the updated data to the secondary site. However, if a path failure occurs, or if the amount of write-data exceeds bandwidth for an extended period of time, data flow can stop. Updated data that cannot be transferred to the secondary storage system accumulates in the master journal.

Use the following information to size the journals so they can hold the amount of data that can accumulate:

- The amount of changed data that your application generates. Measure the write-workload to gather this information.
- The maximum amount of time that journals can accumulate updated data. This information depends on your operation's recovery point objective (RPO).

## Determining your RPO

Your operation's RPO is the maximum time that can pass after a failure or disaster occurs before data loss is greater than the operation can tolerate.

For example, if a disaster occurs at 10:00 AM and the operation can tolerate a loss of up to one hour of data, then the system must be corrected by 11:00 AM.

For proper journal sizing, the journal must have the capacity to hold the maximum amount of data that can accumulate in one hour. If the RPO is 4 hours, then the journal must be sized to hold 4 hours of update data.

To assess RPO, you must know the host application's write-workload.

By measuring write workload and IOPS, you can analyze the number of transactions the write workload represents, determine the number of transactions the operation could lose and still remain viable, determine the amount of time required to recover lost data from log files or re-enter lost data, and so on. The result is your RPO.

## Write-workload

Write-workload is the amount of data that changes in your production system in MB per second. As you will see, write-workload varies according to the time of day, week, month, quarter. That is why workload is measured over an extended period.

With the measurement data, you can calculate workload averages, locate peak workload, and calculate peak rolling averages, which show an elevated average. Use this data to calculate the amount of data that accumulates over your RPO time, for example, 2 hours. This is a base capacity for your journal volumes or represents a base amount of bandwidth that your system requires.

Whether you select average, rolling average, or peak, workload is based on the amount of bandwidth you provide the data path (which is also determined by write-workload). Bandwidth and journal volume capacity work together and depend on your strategy for protecting data.

## Measuring write-workload

Workload data is collected using Hitachi Performance Monitor or your operating system's performance-monitoring feature (for example, IBM® Resource Measurement Facility). You will use IOPS to set up a proper data transfer speed, which you ensure through RAID group configuration and by establishing the number of Fibre Channel or iSCSI ports your URz system requires. Each RAID group has a maximum transaction throughput; the ports and their microprocessors have an IOPS threshold.

Workload and IOPS collection is best performed during the busiest time of month, quarter, and year. This helps you to collect data that shows your system's actual workloads during high peaks and spikes, when more data is changing, and when the demands on the system are greatest. Collecting data over these periods ensures that the URz design you develop will support your system in all workload levels.

## Data transfer speed considerations

The ability of your URz system to transfer data in a timely manner depends on the following two factors:

- RAID group configuration
- Fibre Channel or iSCSI port configuration

You must plan both of these elements to handle the amount of data and number of transactions your system will generate under extreme conditions.

## RAID group configuration

A RAID group can consist of physical volumes with a different number of revolutions, physical volumes of different capacities, and physical volumes of different RAID configurations (for example, RAID-1 and RAID-5). The data transfer speed of RAID groups is affected by physical volumes and RAID configurations.

## Fibre Channel or iSCSI port configuration

Your Fibre Channel or iSCSI ports have an IOPS threshold of which you should be aware so that you can configure an appropriate number of Fibre Channel or iSCSI ports.

You can use the performance monitoring information for the number of IOPS your production system generates to calculate the number of Fibre Channel or iSCSI ports the URz system requires.

## Sizing journal volumes

Journals volumes should be sized to meet all possible data scenarios, based on your business requirements. If the amount of data exceeds capacity, performance problems and suspensions result.

Journal volumes cannot be registered if capacity is lower than 10 GB.

Only DP-VOLs can be registered in journals. Therefore, a Dynamic Provisioning pool must have 10 GB for each journal as the capacity for journal volumes.

### Procedure

1. Follow the instructions for [Measuring write-workload \(on page 63\)](#).
2. Use your system's peak write-workload and your organization's RPO to calculate journal size. For example:

RPO = 2 hours

Write-workload = 30 MB/second

Calculate write-workload for the RPO. In the example, write-workload over a two-hour period is calculated as follows:

$30 \text{ MB/second} \times 60 \text{ seconds} = 1,800 \text{ MB/minute}$

$1,800 \text{ MB/minute} \times 60 \text{ minutes} = 108,000 \text{ MB/hour}$

$108,000 \text{ MB/hour} \times 2 \text{ hours} = 216,000 \text{ MB}$

Basic journal volume size = 216,000 MB (216 GB)

### Result

Journal volume capacity and bandwidth size work together. Also, your strategy for protecting your data might allow you to adjust bandwidth or the size of your journal volumes. For details about sizing strategies, see [Five sizing strategies \(on page 92\)](#).

### Next steps



**Note:** Journal data stored in the master journal volume is not deleted until the data is restored to the secondary volume. Therefore, if the restore journal volume is larger than the master journal volume, the master journal volume first becomes full. If you are planning for disaster recovery, the secondary storage system must be large enough to handle the production workload, and therefore, must be the same size as master journals.

## Planning journals

URz manages pair operations for data consistency through the use of journals. URz journals enable update sequence consistency to be maintained across a group of volumes.

Understanding the consistency requirements for an application (or group of applications) and their volumes will indicate how to structure journals.



For example, databases are typically implemented in two sections. The bulk of the data is resident in a central data store, while incoming transactions are written to logs that are subsequently applied to the data store.

If the log volume "gets ahead" of the data store, it is possible that transactions could be lost at recovery time. Therefore, to ensure a valid recovery image on a replication volume, it is important that both the data store and logs are I/O consistent by placing them in the same journal.

Use the following information about journal volumes and journals to plan your journals:

- A journal consists of one or more journal volumes and associated data volumes.
- A journal can have only P-VOLs/master journals, or S-VOLs/restore journals.
- A journal cannot belong to more than one storage system (primary or secondary).
- All the P-VOLs, or S-VOLs, in a journal must belong to the same storage system.
- Master and restore journal IDs that are paired can be different.

If using a consistency group ID, the consistency group ID of the P-VOL and S-VOL must be the same.

- Each pair relationship in a journal is called a mirror. Each pair is assigned a mirror ID. The maximum number of mirror IDs is 4 (0 to 3) per system.
- When UR and URz are used in the same system, individual journals must be dedicated either to one or the other, not both.
- Master and restore journals are managed according to the journal ID.
- Review journal specifications in [System requirements \(on page 46\)](#).
- A journal can contain a maximum of 2 journal volumes.

## Planning journal volumes

In addition to sizing journal volumes, you must also consider the following requirements and restrictions:

- Only DP-VOLs whose emulation type is OPEN-V can be used for journal volumes.
- A journal ID can be used in one virtual storage machine only.
- Volumes to which a path is set from a host cannot be registered as journal volumes.
- Journal volumes must be registered in a journal before the initial copy operation is performed.
- Journal volumes must be registered on both the primary and secondary storage systems.
- You can register two journal volumes in a journal in the primary storage system and in the secondary storage system, but we recommend using one journal volume in each system. The second journal volume becomes the reserve journal volume and is not used for normal operations.
- Primary and secondary EXCTGs must be set up and journals registered to them before registering journal volumes in journals.

- Journal volumes should be sized according to RPO and write-workload. For details, see [Sizing journal volumes \(on page 64\)](#).
- Journal volume capacity:
  - Journal volumes in a journal can have different capacities.
  - A master journal volume and the corresponding restore journal volume can have different capacities.
  - The displayed journal volume capacity is the master journal capacity and restore journal capacity. The reserve journal volume is not included in the displayed journal volume capacity.
  - Journal volume capacity is not included in accounting capacity.
  - In the GUI documents the journal volume capacity is called the journal capacity.
  - In the CCI documents the journal volume capacity is called the "capacity for the journal data on the journal volume" and "capacity of the data block size of the journal volume".
- The number of journal volumes in the master journal does not have to be equal to the number of volumes in the restore journal.
- A data volume and its associated journal volume can belong to only one journal.
- Journal volumes consist of two areas: One area stores journal data, and the other area stores metadata for remote copy.
- If you extend the journal volume when the journal volume size exceeds 36 GB, you need to restore the journal that is used for the extension to the S-VOL to use the extended capacity. However, it might take some time until the extended capacity becomes ready for use.

## Host I/O time stamp

The I/O time stamping function must be installed on the host processor at the primary site in order to provide data consistency in URz journals. The I/O time stamp, which is provided by MVS DFSMSdfp, is the same time stamp that is used by Compatible XRC pairs. The I/O time stamping function should also be installed on the host processor at the secondary site, so that time stamps can be used when copying data in the reverse direction.

If the system at the primary and/or secondary site consists of several CPU complexes, a SYSPLEX timer is required to provide a common time reference for the I/O time stamping function.

## Planning pair volumes

The following information can help you prepare volumes for configuration. For more information, see system requirements and specifications in [Requirements and specifications \(on page 46\)](#).

- Each P-VOL requires one S-VOL only, and each S-VOL requires one P-VOL only.
- The emulation and capacity for the S-VOL must be the same as for the P-VOL

- When the S-VOL is connected to the same host as the P-VOL, the S-VOL must be defined to remain offline.
- CU emulation type I-2107 must be used for primary and secondary storage systems.
- CU emulation type I-2107 is required for SMS I/O time stamping of URz journals.
- When creating multiple pairs in the same operation using Device Manager - Storage Navigator, make sure that you set up S-VOL LDEVs in a way that allows the system to correctly match them to selected P-VOLs.

Even though you select multiple volumes as P-VOLs in the Device Manager - Storage Navigator Create URz Pairs procedure, you are able to specify only one S-VOL. The system automatically assigns LDEVs on the secondary storage system as S-VOLs for the other selected P-VOLs according to LDEV.

You will have two options for specifying how the system matches S-VOLs to P-VOLs.

- Interval: The interval you specify will be skipped between LDEV numbers in the secondary storage system.

For example, suppose you specify LDEV 01 as the initial (base) S-VOL, and specify 3 for Interval. This results in secondary storage system LDEV 04 being assigned to the next P-VOL, 07 assigned to the subsequent P-VOL, and so on. To use Interval, you set up secondary storage system LDEV IDs according to the interval between them.

- Relative Primary Volume. The difference is calculated between the LDEV numbers of two successive P-VOLs. S-VOLs are assigned according to the closest LDEV number.

For example, if the LDEV IDs of three P-VOLs are 01, 05, and 06; and you set LDEV numbers for the initial S-VOL (Base Secondary Volume) at 02, the LDEV numbers of the three S-VOLs will be set at 02, 06, and 07, respectively.

- You can create a URz pair using a TrueCopy for Mainframe initial copy, which takes less time. To do this, system option 474 must be set on the primary and secondary storage systems. Also, a script is required to perform this operation. For more on system option 474 and how to do this operation, contact customer support.
- URz supports the Virtual LVI feature, which allows you to configure custom LDEVs that are smaller than standard LDEVs. When custom LDEVs are assigned to a URz pair, the S-VOL must have the same capacity as the P-VOL. For details about Virtual LVI feature, see the *Provisioning Guide for Mainframe Systems*.
- Identify the volumes that will become the P-VOLs and S-VOLs.
- You can create multiple pairs at the same time. Review the prerequisites and steps in [Creating a URz pair \(on page 131\)](#).
- When you create a URz pair, you will have the option to create only the relationship, without copying data from P-VOL to S-VOL. You can use this option only when data in the two volumes is identical.

## Data and journal volume specifications

The following table shows maximum capacities and volume types that can be used for data volumes and journal volumes.

Table 4 Data and journal volume specifications

Type		Support specifications	
		Data volume	Journal volume
Virtual LVI volume		Available	Unavailable
Cache Residency Manager for Mainframe volume		Available	Unavailable
Maximum volume capacity	3390-1	0.964GB	Unavailable
	3390-2	1.892GB	Unavailable
	3390-3	2.838GB	Unavailable
	3390-9	8.510GB	Unavailable
	3390-A	223.25GB	Unavailable
	3390-L	27.80GB	Unavailable
	3390-M	55.60GB	Unavailable
	OPEN-V	Cannot be used as data volume.	Capacity of OPEN-V volumes can be determined freely, and has dependencies on Virtual LVI volume specifications.
Minimum volume capacity	1 cylinder	10 GB for an OPEN-V volume.	

## Duplicating VOLSERS

When the P-VOL is copied to the S-VOL during the initial copy operation, the P-VOL VOLSER (volume serial number) is also copied to the S-VOL. Therefore, the P-VOL and S-VOL have the same VOLSER. Because the host operating system does not allow duplicate VOLSERS, the host system administrator must take precautions to prevent system problems related to duplicate VOLSERS (such as defining S-VOLs not to come online automatically).

If the volumes that become S-VOLs are physically attached to the same system images as the volumes that become the P-VOLs, the potential for error increases. For example, when a pair is released, the old S-VOL is usually offline. When a host system is IPL'd (initial program loaded), the operator is offered both volumes and asked which volume should be left offline. To avoid duplication of the VOLSER:

1. Identify the volumes that are not accessed by the host system.
2. Perform CHP OFF or some other operation to ensure that the volumes are inaccessible.
3. When performing IPL, make sure to perform LOAD CLEAR.

## Maximum number of pairs allowed

The maximum number of pairs might be smaller than the number listed in [System requirements \(on page 46\)](#) because the amount of used bitmap area differs depending on the user environment (volume size). The maximum number for your storage system is limited by:

- The number of cylinders in the volumes, which must be calculated.
- The number of bitmap areas required for Universal Replicator data and journal volumes. This is calculated using the number of cylinders.



**Note:** When Advanced System Setting No. 5 is enabled, the bitmaps for all pairs created with DP-VOLs smaller than 262,668 cylinders (4 TB), are managed in hierarchical memory and not in shared memory when a pair is created or resynchronized. In this case, the bitmap area in shared memory is not used, so you do not need to calculate the maximum number of pairs when Advanced System Setting No. 5 is enabled.

If the volume size is larger than 262,668 cylinders, the bitmap area is not used. Therefore, it is not necessary to calculate the maximum number of pairs when creating URz pairs with a DP-VOL whose size is larger than 262,668 cylinders.



**Note:** When Advanced System Setting No. 6 is enabled, the bitmaps for all pairs created with DP-VOLs smaller than 262,668 cylinders, are managed in hierarchical memory and not in shared memory when a pair is created. In this case, the bitmap area in shared memory is not used, so you do not need to calculate the maximum number of pairs when Advanced System Setting No. 6 is enabled.



**Caution:** The bitmap areas that are used for URz are also used for UR, TCz, TC, and GAD. If you use URz with any of these products, use the total number of each pair's bitmap areas to calculate the maximum number of pairs. In addition, if URz and TCz share the same volume, use the total number of both pairs regardless of whether the shared volume is primary or secondary.

## Calculating maximum number of pairs

The calculations in this topic use the following conventions:

- `ceil (<value>)` indicates that the value enclosed in parentheses must be rounded up to the next integer, for example: `ceil (2.2) = 3`

### Calculating the number of cylinders

Use one of the following formulas:

- For pairs created with a Virtual LVI volume or DP-VOL and emulation type 3390:

`The number of cylinders = (ceil ( (ceil (Number of logical blocks / 116) ) / 15))`

- For pairs created without a Virtual LVI volume or DP-VOL , use the number of cylinders for the emulation type as shown in the following table.

Emulation type	Number of cylinders
3390-1	1,113
3390-2	2,226
3390-3	3,339
3390-9	10,017
3390-A	262,668
3390-L	32,760
3390-M	65,520

### Calculating the number of required bitmap areas

Use the following formula:

`ceil((number of cylinders × 15) / 122,752) )`

where:

- `number of cylinders × 15` indicates the number of slots
- `122,752` is the number of slots that a bitmap area can manage

Doing this calculation for multiple volumes can result in inaccuracies. Perform the calculation for each volume separately, and then total the bitmap areas. The following examples show correct and incorrect calculations. Two volumes are used: one of 10,017 cylinders and another of 32,760 cylinders.

#### Correct calculation

```
ceil ((10,017 × 15) / 122,752) = 2
```

```
ceil ((32,760 × 15) / 122,752) = 5
```

Total: 7

#### Incorrect calculation

```
10,017 + 32,760 = 42,777 cylinders
```

```
ceil ((42,777 × 15) / 122,752) = 6
```

Total: 6

### Calculating the maximum number of pairs

The maximum number of pairs is determined by the following:

- The number of bitmap areas required for Universal Replicator for Mainframe (previously calculated).
- The total number of bitmap areas in VSP 5000 series: 65,536.

Calculate the maximum number of pairs using the following formula if you use Virtual LVI volumes.

```
Maximum number of pairs = floor( Number of bitmap areas / required number
of bitmap areas )
```

If the calculated maximum number of pairs exceeds the total number of LDEVs, and the total LDEVs are less than 65,280, then the total number of LDEVs is the maximum number of pairs that can be created.

The following table lists the maximum number of pairs that can be created according to emulation type when Virtual LVI volumes are not used.

**Table 5 Maximum number of pairs per emulation type - when Virtual LVI volumes are not used**

Emulation type	Maximum number of pairs	
	Additional shared memory	Additional shared memory when 64K LDEV Extension
3390-1	16,384	65,280
3390-2	16,384	65,280
3390-3	16,384	65,280
3390-9	16,384	32,768
3390-A	1,985	1,985
3390-L	13,107	13,107
3390-M	7,281	7,281

## Maximum initial copy operations and priorities

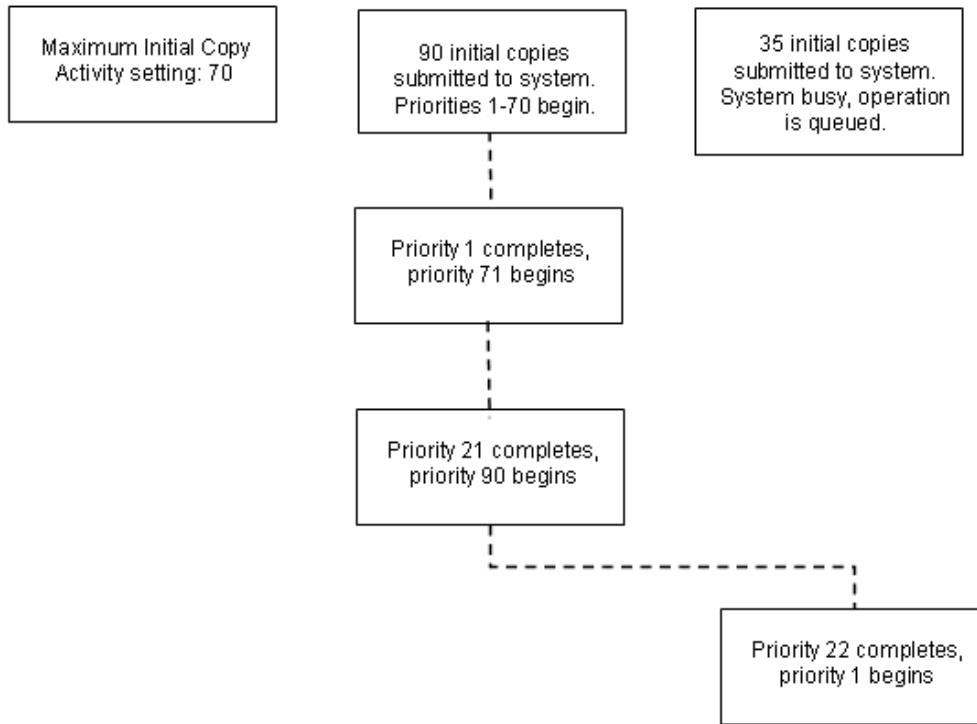
During configuration, you specify the maximum number of initial copies that can be run at one time. The system allows up to 128 initial copies to run concurrently for URz. You do this for performance reasons (the more initial copies running concurrently, the slower the performance).

You will also specify the priority for each initial copy during the create pair operation. Priority is used when you are creating multiple initial copies during an operation. Creating multiple initial copies in one operation is possible because you can specify multiple P-VOLs and S-VOLs in the Paircreate dialog box. The pair with priority 1 runs first, and so on.

When you create more pairs than the maximum initial copy setting, the pairs with priorities within the maximum number specified run concurrently, while the pairs with priorities higher than the maximum number wait. When one pair completes, a waiting pair begins, and so on.

If you perform a pair operation for multiple pairs (for a specific kind of data, for example), and then perform another operation for multiple pairs (for another kind of data, for example), the pairs in the first operation are completed in the order of their assigned priorities. The system begins processing pairs in the second set when the number of pairs left in the first set drops below the maximum number of initial copy setting. The following figure illustrates how the maximum number of initial copy setting works to control the impact of concurrent operations.





See the step for Priority in the procedure in [Creating a URz pair \(on page 131\)](#).

## Restrictions when creating an LU whose LU number is 2048 or greater

A pair can be created using LUs whose LU numbers are 2048 to 4095 if you connect VSP 5000 series, whose DKCMAIN program version is 90-02-0x-xx/xx or later, as the source storage system.

Do not try to create a pair using LUs whose LU numbers are 2048 to 4095 unless the storage system to which you are connecting is also VSP 5000 series, whose DKCMAIN program version is 90-02-0x-xx/xx or later. Failures, such as Pair Suspend, might occur if you try to create a pair using LUs whose LU numbers are 2048 or greater and the storage system to which you are connecting is one of the following:

- A storage system other than a VSP 5000 series
- A VSP 5000 series whose DKCMAIN program version is earlier than 90-02-0x-xx/xx.

For VSP 5000 series whose DKCMAIN program version is 90-02-0x-xx/xx or later, up to 4096 LU paths are possible for a Fibre Channel port or iSCSI port.

- If you set a host group for a Fibre Channel port, up to 4096 LU paths can be set for a host group. In addition, up to 4096 LU paths can be set for a port through the host group.
- If you configure an iSCSI target for an iSCSI port, you can configure up to 4096 LU paths for an iSCSI target. In addition, up to 4096 LU paths can be set for a port through the iSCSI target.

The following table lists LU numbers that can be used when different source storage systems and DKCMAIN program versions are connected to VSP 5000 series, whose DKCMAIN program version is 90-02-0x-xx/xx or later.

Connecting target storage system	Connecting source storage system		Restrictions	
	Storage system	Program version of DKCMAIN	LU number that can create a pair	Number of LU paths that can be set for a port
VSP 5000 series (90-02-0x-xx/xx or later)	VSP G1x00, VSP F1500	Earlier than 80-06-7x-xx/xx	Disabled	Disabled
		80-06-7x-xx/xx or later	0 to 2047	0 to 2048
	VSP 5000 series	Earlier than 90-02-0x-xx/xx	0 to 2047	0 to 2048
		90-02-0x-xx/xx or later	0 to 4095	0 to 4096

## Disaster recovery considerations

You begin a disaster recovery solution when planning the URz system. The following are the main tasks for preparing for disaster recovery:

- Identify the data volumes that you want to back up for disaster recovery.
- Pair the identified volumes using URz.
- Establish file and database recovery procedures.
- Install and configure host failover software error reporting communications (ERC) between the primary and secondary sites.

## Error reporting communications (ERC)

Error reporting communications (ERC) transfers information between host processors at the primary and secondary sites. It is a critical component of any disaster recovery effort. You can configure ERC using channel-to-channel communications, NetView technology, or other interconnect technologies, depending on your installation requirements and standards. Neither URz nor Device Manager - Storage Navigator provides ERC between the primary and secondary sites.

When URz is used as a data migration tool, ERC is recommended but not required. When it is used as a disaster recovery tool, ERC is required to ensure effective disaster recovery operations. When a pair is suspended due to an error condition, the primary storage system generates sense information which results in an IEA491E system console message. This information should be transferred to the primary site through the ERC for effective disaster detection and recovery.

## Cache and additional shared memory

Cache must be operable for the pair's primary and secondary system, otherwise pairs cannot be created. The secondary system cache must be configured to adequately support Universal Replicator for Mainframe remote copy workloads and any local workload activity.

The following workflows describe how to add and remove the cache memory or shared memory when it is used with URz pairs.

### Adding and removing cache memory

Use the following workflow to add or remove cache memory in a storage system in which URz pairs already exist:

#### Procedure

1. Identify the status of the URz volumes in the storage system.
2. If a URz volume is in the Pending status, wait until the status changes to Duplex, or split the URz pair.  
Do not add or remove cache memory when any volumes are in the Pending status.
3. When the status of all volumes has been confirmed, cache memory can be added to or removed from the storage system by your service representative. Contact customer support for adding or removing cache memory.
4. After the addition or removal of cache memory is complete, resynchronize the pairs that you split in step 2.

### Adding shared memory

Use the following workflow to add shared memory to a storage system in which URz pairs already exist:

#### Procedure

1. Identify the status of the URz volumes in the storage system.
2. If a URz volume is in the Pending status, wait until the status changes to Duplex, or split the URz pair.  
Do not add shared memory when any volumes are in the Pending status.
3. When the status of all volumes has been confirmed, shared memory can be added to the storage system by your service representative. Contact customer support for adding shared memory.
4. After the addition of shared memory is complete, resynchronize the pairs that you split in step 2.

## Sharing volumes with other product volumes

Universal Replicator for Mainframe volumes can be shared with other product volumes. Sharing pair volumes enhances replication solutions, for example, when Universal Replicator for Mainframe and TrueCopy for Mainframe or ShadowImage for Mainframe volumes are shared.

## Planning URz in multiple storage systems using an EXCTG

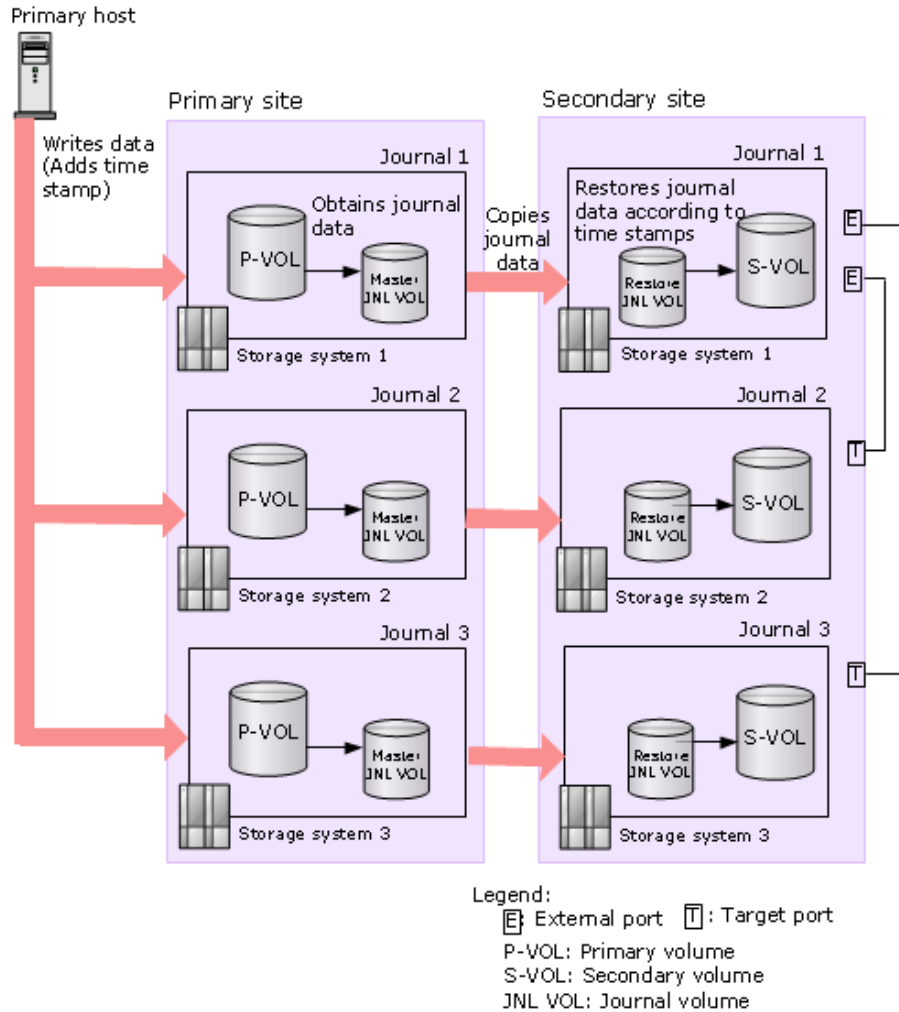
You can perform copy operations simultaneously on multiple URz pairs residing in multiple primary and multiple secondary storage systems by placing journals in the primary storage systems in an extended consistency group (EXCTG). Data update order in copy processing is guaranteed to the secondary storage systems.

With multiple systems, you can also place the journals from both open and mainframe systems in the same CCI consistency group.

In addition, Universal Replicator for Mainframe volumes in multiple systems can be shared with TrueCopy for Mainframe pairs. For details, see [Configurations with TrueCopy for Mainframe \(on page 245\)](#).

The URz system can configure a maximum of four units primary storage system and a maximum of four units secondary storage system. Any combination of primary and secondary storage system can be used in the range of one to four. For example, you can include journals from four primary storage systems and four secondary storage systems, two primary storage systems and one secondary storage system, and so on.

The following figure shows a sample configuration.



When data is sent to the secondary storage systems, the systems check the time stamps, which are added when data is written by the hosts to the P-VOLs. The secondary storage systems then restore the data to the S-VOLs in chronological order to ensure that the update sequence is maintained. For details about the time stamping function, see [Host I/O time stamp \(on page 66\)](#).

**The following does not apply to CCI consistency groups with both UR and URz journals:**

- The term "arbitration processing" refers to the maintenance of the data update sequence through the execution of the journal restore function based on time stamps. When there is more than one secondary storage system, one of them is used to perform tasks, including arbitration processing, on the other secondary storage systems. The secondary storage system that performs arbitration processing is called the supervisor DKC. Systems that are controlled by the supervisor DKC and are targets of arbitration processing are called subordinate DKCs.
- The supervisor DKC compares time stamps of data received by all the secondary storage systems (including the primary storage system) and then performs arbitration processing. The supervisor DKC must be connected with the subordinate DKCs.

## Requirements and recommendations for multiple system CTGs

Note the following when planning for multiple-system consistency groups:

- When using HDvM - SN, management clients are required at the primary and secondary sites.
- BCM is recommended on the host at the primary and secondary sites.

If including UR and URz journals together, CCI is required. CCI must be run on an Open system host; it cannot be run on the mainframe host.

- A remote command device for BCM must be created in the supervisor DKC. For details about secondary storage systems connections and remote command devices, see [Establishing connections between multiple secondary storage systems \(on page 79\)](#).
- Journal data is updated in the secondary storage system based on the time stamp and the sequence number issued by the host with write requests to the primary storage system. Time and sequence information remain with the data as it moves to the master and restore journals and then to the secondary volume. If a combined consistency group using open system and mainframe volumes is configured, it uses a marker in the work queue to perform the consistency arbitration and timestamps are not used.
- With CCI consistency groups, when a pair is split from the S-VOL side (P-VOL status = Duplex), each storage system copies the latest data from the P-VOLs to the S-VOLs. P-VOL time stamps might differ by storage system, depending on when they were updated.
- Disaster recovery can be performed with multiple storage systems, including those with UR and URz journals, using CCI. See [Switching host operations to the secondary site \(on page 181\)](#) for information.
- The time stamps issued by the mainframe host are not used when the URz journal is included in a CCI consistency group.
- Restoring data to the secondary storage system is performed when the time stamp of the copied journal is updated. The recommended interval between time stamps is one second.

Consider the following before setting the interval:

- Storage system activity can slow when EXCTG arbitration is being performed among multiple storage systems. If you shorten the interval, more markers are issued, resulting in increased arbitration activity.
- If the interval is lengthened, the amount of time that journal data can accumulate increases, which results in an increased amount of data to be copied.
- None of the above is true during the initial copy or resynchronization. During these operations, lengthening the interval between time stamps does not result in more accumulated journal data, because data restoring takes place regardless of time stamp.
- The recommended method for executing CCI commands is the in-band (host-based) method. This prevents I/O response from deteriorating, which can occur with the out-of-band (LAN-based) method.
- When UR and URz journals are in the same CCI consistency group, an error in one journal can cause suspension of all journals. For details, see [General troubleshooting \(on page 206\)](#).

- In a configuration in which multiple storage systems in primary and secondary sites are combined, configure the remote copy environment of each storage system as equally as possible. If the following conditions exist, the restoration performance of each journal is degraded, and journal data is accumulated:
  - The copy performance between the primary and secondary sites of some pairs is lower than other storage systems.
  - A problem occurs in a line between pairs.
- It is not possible to register a journal to multiple CCI consistency groups.

## Establishing connections between multiple secondary storage systems

When using more than one secondary storage system, connections among the secondary storage systems must be established by configuring paths for arbitration. These paths are configured using Fibre Channel ports.

A maximum of 16 journals can be handled by one remote command device. When using 17 or more journals in one storage system, you need multiple remote command devices.

### Procedure

1. Create an open-system command device in each of the secondary storage systems, except for the system that will be used as the supervisor DKC.
2. Configure external ports on the secondary storage system to be used as the supervisor DKC. If a switch is used, a single port can be configured. If the storage systems will be connected directly, the number of secondary storage subsystems minus 1 will be required in the supervisor DKC.
3. Configure paths between the external ports on the supervisor DKC and target ports on the subordinate DKCs. In the example below, secondary storage system 1 has two external ports, each of which is connected with a target port on the secondary storage systems 2 and 3.

For details about supervisor and subordinate DKCs, see the information about arbitration processing in [Planning URz in multiple storage systems using an EXCTG \(on page 76\)](#). For details about external ports, see the *Hitachi Universal Volume Manager User Guide*.

4. Create mapping between command devices in the supervisor DKC and the subordinate DKCs (see the example below). The supervisor DKC must be able to use command devices in subordinate DKCs through the remote command devices.

The following figure shows an example in which command devices A and B are created in the subordinate DKCs on secondary storage systems 2 and 3. Remote command devices are created on the supervisor DKC in secondary storage system 1 and are mapped to the subordinate DKCs. The emulation type of command devices and remote command devices must be OPEN-V. For details about remote command devices, see the *Hitachi Universal Volume Manager User Guide*.

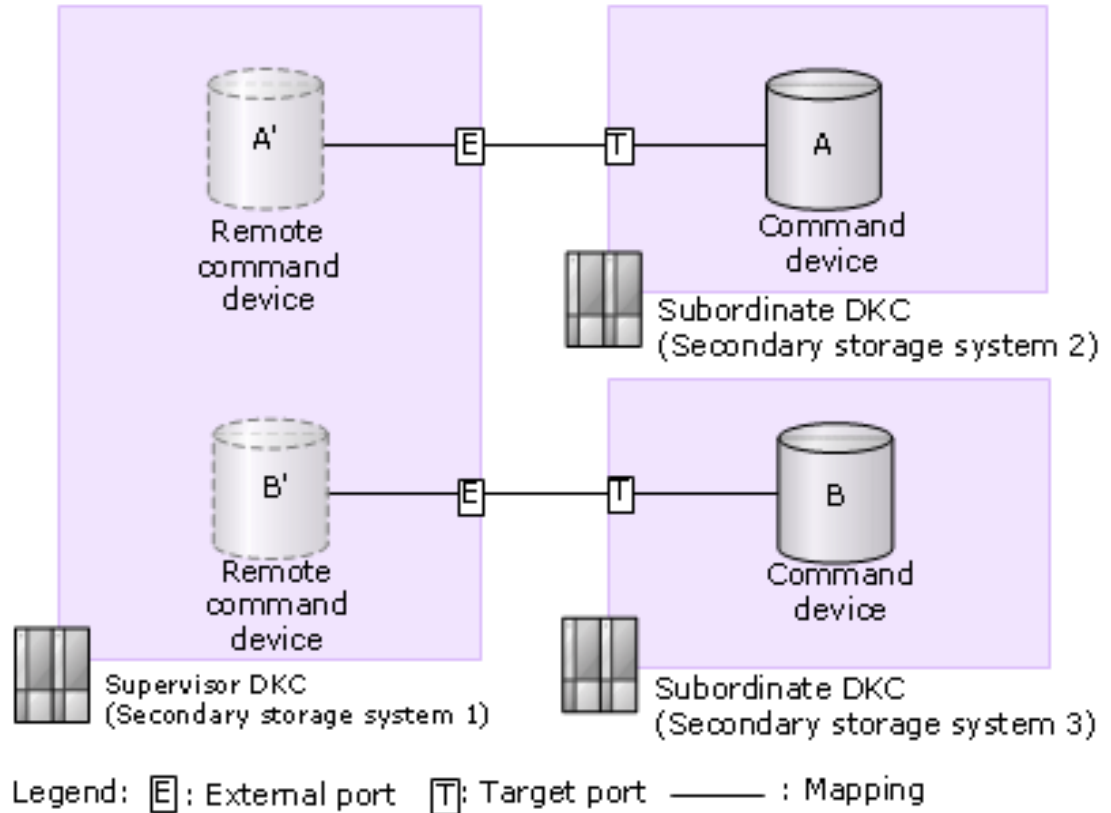


Figure 1 Connections between Supervisor, Subordinate DKCs

**Next steps**

By using Fibre Channel switches, you can also connect target ports to target ports on the secondary storage systems. For more information, see [Planning ports for data transfer \(on page 97\)](#).

**Registering multiple journals to a CCI consistency group**

Basically, only one journal should be registered to a CCI consistency group (CTG). However, in the configurations shown in the following figures, a maximum of four storage systems are registered to a CCI CTG. When the program products used in the primary site and secondary site storage system are the same, you can register either journal of the URz system.

For example, you can configure the CCI CTG storage system of four units each for the primary site and secondary site. Or you can configure the CCI CTG multiple systems of two units storage system for the primary site and one unit storage system for the secondary site, too.

In the following figures, multiple journals are registered to a consistency group.



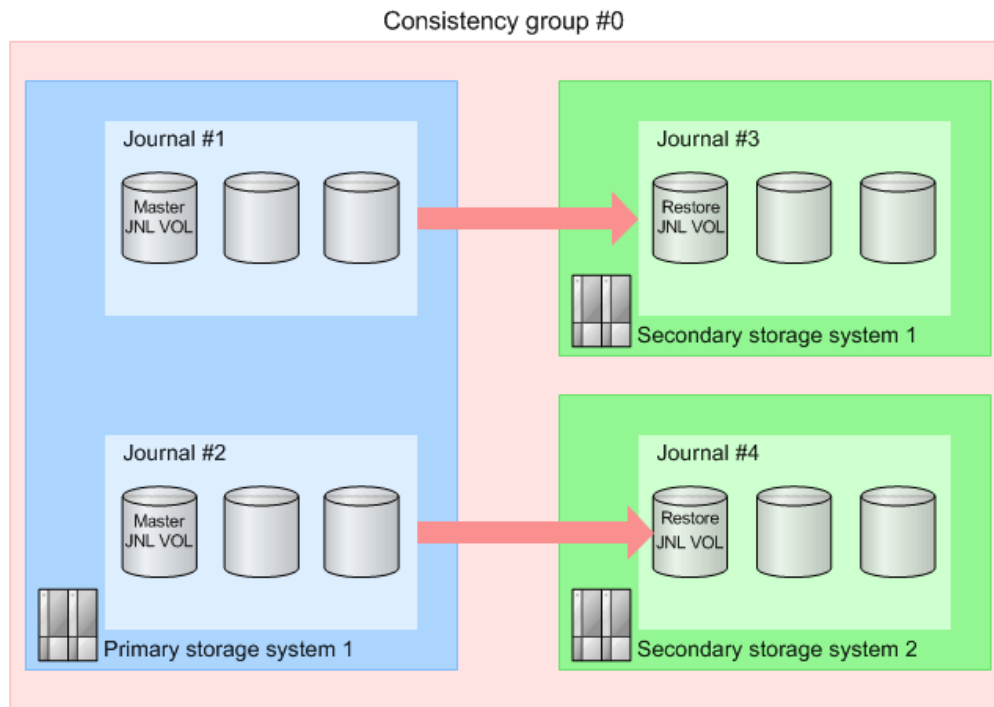


Figure 2 Configuration of a consistency group with multiple journals (1)

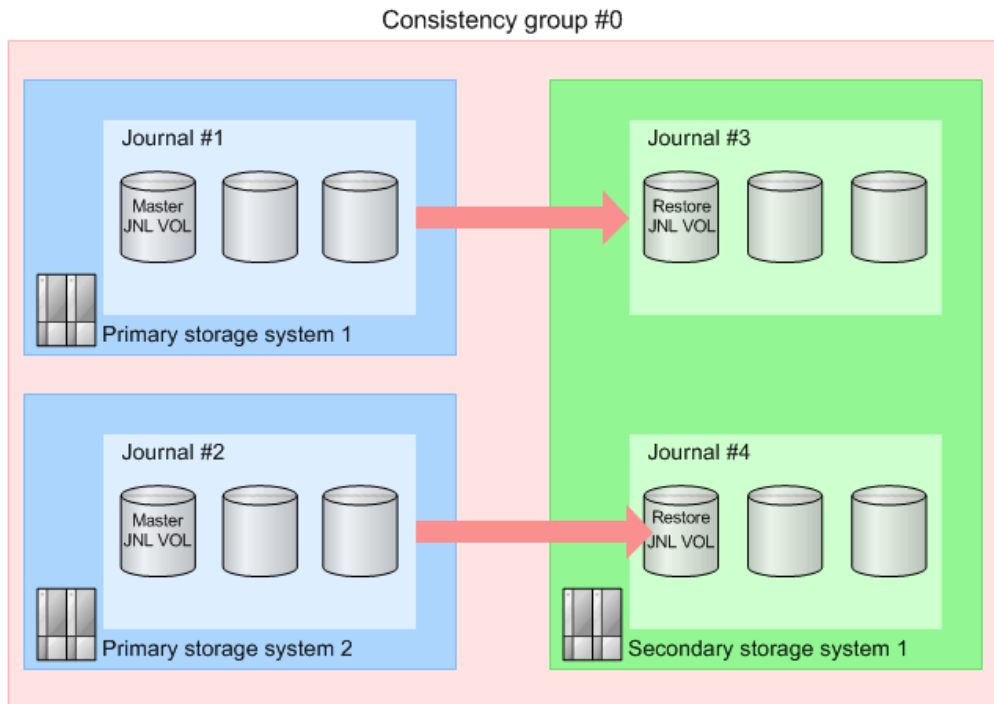


Figure 3 Configuration of a consistency group with multiple journals (2)

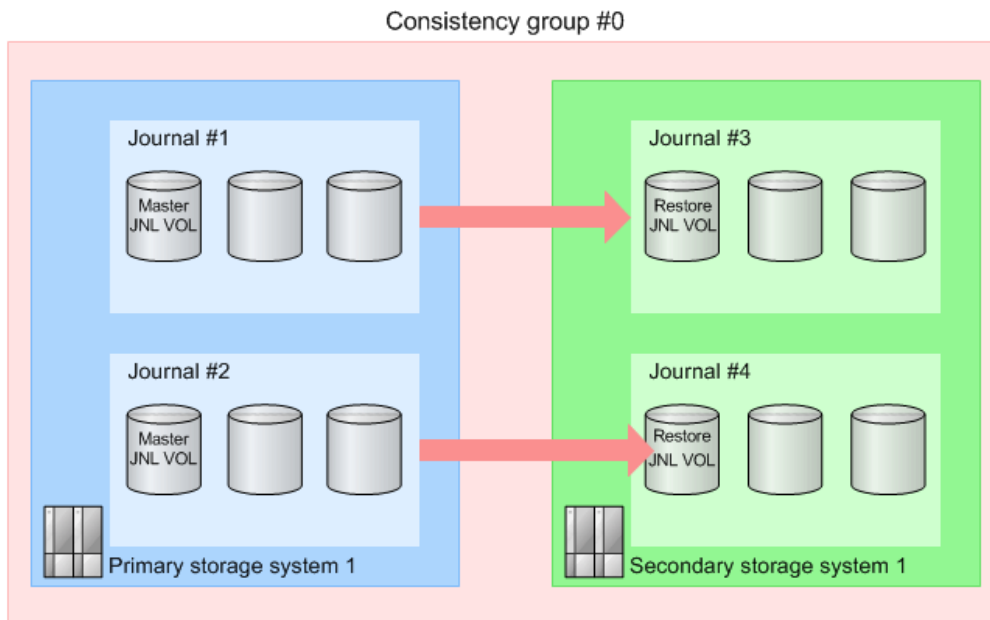


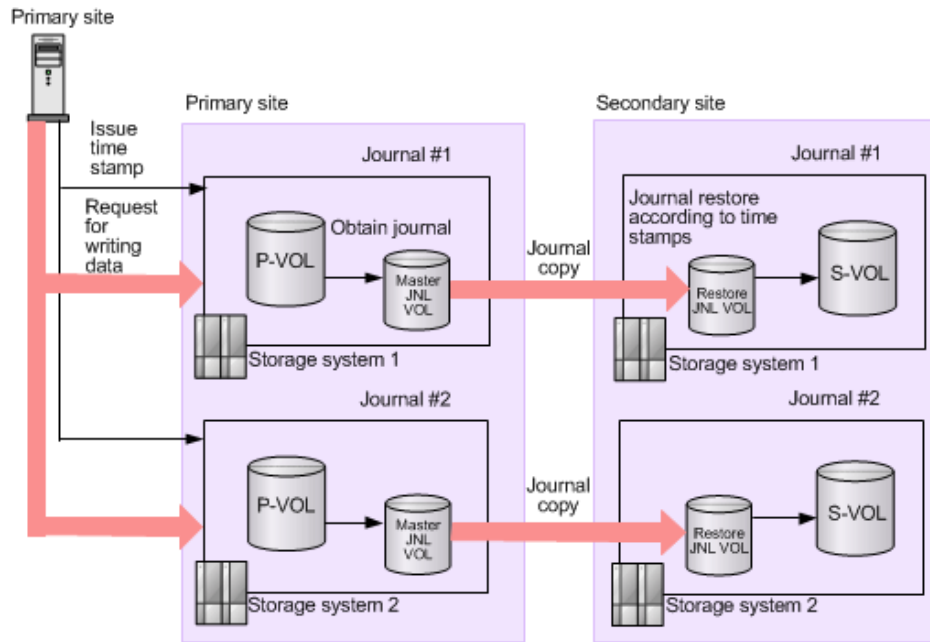
Figure 4 Configuration of a consistency group with multiple journals (3)

## Planning URz in multiple storage systems using CCI

For a Universal Replicator for Mainframe system, you can use CCI to combine a maximum of four storage systems in a primary site and a maximum of four storage systems in a secondary site. Any combination of primary and secondary storage systems can be used. For example, you can include four storage systems from a primary site and four storage systems from a secondary site, or two storage systems from a primary site and one storage system from a secondary site, and so on.

In addition, using CCI, you can combine a Universal Replicator system and a Universal Replicator for Mainframe system. Furthermore, you can share a URz pair volume that is embedded in a URz system that uses multiple VSP 5000 series systems with TrueCopy for Mainframe pairs. For details about using both Universal Replicator for Mainframe and TrueCopy for Mainframe, see [Configurations with TrueCopy for Mainframe \(on page 245\)](#).

The following figure shows a sample configuration.



In a configuration with multiple primary site storage systems and secondary site storage systems, CCI issues time stamps at specified intervals. These time stamps are added to data to be written to the P-VOL of URz. The secondary storage systems then restore the data to the data volume in chronological order to ensure that the update sequence is maintained. By using time stamps, data is updated at the same timing across storage systems. Therefore, data can be copied while consistency is maintained.



**Note:** Note the following when using multiple storage systems from the primary and secondary sites:

- Device Manager - Storage Navigator is required at the primary and secondary sites.
- CCI is required on the host at the primary and secondary sites.
- Journal data is updated in a secondary storage system based on the time stamps issued by CCI and the sequence number issued by the host with write requests to the primary storage system. The time stamp and sequence number remain with the data as it moves from the master journal volume to the restore journal volume to a storage system in the secondary site.
- Disaster recovery can be performed. See [Switching host operations to the secondary site \(on page 181\)](#) for information.
- With CCI consistency groups, when a pair is split from the S-VOL side (P-VOL status = PAIR), each storage system copies the latest data from the P-VOLs to the S-VOLs. The P-VOL time stamps might differ by storage system, depending on when they were updated.
- An error in one journal can cause suspension of all journals. For details, see [General troubleshooting \(on page 206\)](#).
- Time stamps issued by CCI and time stamps issued by the mainframe host are different. Because of this, time stamps issued by the mainframe host cannot be used when a Universal Replicator for Mainframe system is included in a configuration with multiple primary site storage systems and secondary site systems.
- Set the time-stamp interval to one second for the following reasons:
  - I/O response time slows down when time stamps are updating among multiple storage systems. If you shorten the interval to less than one second, more time stamps are issued, resulting in an I/O response time that is even slower.
  - If the interval is lengthened, the amount of time that journal data can accumulate increases, which results in an increased amount of data to be copied.
- The recommended method for executing CCI commands is the in-band method. In the out-of-band method, it takes longer to update time stamps across storage systems, and I/O response is deteriorated.
- If you specify a secondary volume to split a P-VOL pair in the DUPLEX status, each storage system copies the latest data when the pair was split from the P-VOL to S-VOL. As a result, according to the timing when a time stamp of a primary site storage system is updated, time stamps differ from one storage system to another.
- In a configuration in which storage systems in multiple primary and secondary sites are combined, configure the remote copy environment of each storage system as equally as possible. If the following conditions exist, the restoration performance of each journal is degraded, and journal data is accumulated.

- The copy performance between the primary and secondary sites of some pairs is lower than other storage systems.
- A problem occurs in a line between pairs.

## Planning for other storage systems

You should be aware of differences between your storage system and other storage systems if you want to pair volumes between them.

- You can perform remote copy operations when connecting VSP 5000 series to other storage systems.

Data can be copied from VSP 5000 series to and from the following storage systems:

- VSP 5000 series
- VSP G1x00, VSP F1500
- VSP

For information about VSP 5000 series URxUR support, contact customer support.

- A remote path must be connected between the current storage system and the other storage systems. For configuration instructions, see [Configuring primary and secondary storage systems for URz \(on page 120\)](#).
- When connecting to another storage system, the number of usable volumes varies depending on the current storage system model.

Current storage system model	Number of usable volumes	Range of CU:LDEV numbers
VSP 5000 series	65,280	00:00 to FE:FF

- When connecting to another storage system, contact your Hitachi Vantara representative for information regarding supported microcode versions.
- When using the previous model storage system at the secondary site, make sure the primary and secondary storage systems have unique serial numbers.



**Note:** When you specify the VSP 5000 series serial number in CCI commands, add a “5” at the beginning of the serial number. For example, for serial number 12345, enter 512345.

- VSP 5000 series, VSP G1x00, VSP F1500, VSP can be used in 3-data-center (3DC) cascade or multi-target configurations. These configurations are used when combining TrueCopy for Mainframe and Universal Replicator for Mainframe systems. See [Configurations with TrueCopy for Mainframe \(on page 245\)](#) to review these configurations.

There are no restrictions for combining primary and secondary sites between VSP 5000 series, VSP G1x00, VSP F1500, or VSP.

## Preparing the storage systems for URz

Use the following guidelines to ensure that your storage systems are ready for URz:

- Identify the locations where your URz primary and secondary data volumes will be located, and then install and configure the storage systems.
- Make sure that primary and secondary storage systems are properly configured for URz operations, for example, cache memory considerations. See the entry for Cache and Nonvolatile Storage in the requirements table, [System requirements \(on page 46\)](#). Also consider the amount of data to be stored in cache when determining the required amount of cache.
- Make sure that the required system option modes for your URz configuration have been set on the primary and secondary storage systems. For details, contact customer support.
- Make sure that primary storage systems are configured to report sense information to the host. Secondary storage systems should also be attached to a host server to enable reporting of sense information in the event of a problem with an S-VOL or secondary storage system. If the secondary storage system is not attached to a host, it should be attached to a primary site host server so that monitoring can be performed.
- If power sequence control cables are used, set the power select switch for the cluster to LOCAL to prevent the primary storage system from being powered off by the host. Make sure the secondary storage system is not powered off during URz operations.
- Install the URz remote copy connections (Fibre Channel or iSCSI cables, switches, and so on) between the primary and secondary storage systems.
- When setting up data paths, distribute them between different storage clusters and switches to provide maximum flexibility and availability. The remote paths between the primary and secondary storage systems must be separate from the remote paths between the host and secondary storage system.

### Advanced system settings

Advanced system settings allow the storage systems to be configured to specific customer operating requirements. The advanced system settings can be used with Universal Replicator in the following configurations:


- Delta Resync configuration with Universal Replicator and TrueCopy, or global-active device.
- Configuring split options for mirrors.

The following table lists the advanced system settings. You can change the advanced system settings in the **Edit Advanced System Settings** window. For more information about changing the advanced system settings, see the *System Administrator Guide*.



**Note:** Ensure that MCU and RCU have the same advanced system settings.

Number	Default	Description								
5	OFF	<p>Advanced System Setting No. 5: Manage differential bitmaps in DP pool at pair create and resync operations for 4 TB or less TC/TCMF/UR/URMF/GAD pairs.</p> <p>When enabled, the differential data is maintained in a pool with which a DP-VOL that has the user capacity (up to 4,194,304 MB) is linked when a new TC/TCMF, UR/URMF, or GAD pair is created using the DP-VOL, or resynchronized. Note that differential data is maintained, regardless of this setting, in a pool linked with the DP-VOL that has the user capacity (greater than 4,194,304 MB) when a new TC/TCMF, UR/URMF, or GAD pair using the DP-VOL is created.</p>								
6	OFF	<p>Advanced System Setting No. 6: Manage differential bitmaps in DP pool at pair create operations for 4TB or less TC/TCMF/UR/URMF/GAD pairs.</p> <p>When enabled, the differential data is maintained in a pool with which a DP-VOL that has the user capacity (up to 4,194,304 MB) is linked when a new TC/TCMF, UR/URMF, or GAD pair is created using the DP-VOL. Note that differential data is maintained, regardless of this setting, in a pool linked with the DP-VOL that has the user capacity (greater than 4,194,304 MB) when a new TC/TCMF, UR/URMF, or GAD pair using the DP-VOL is created.</p> <p>How this setting works with setting No. 5 is described in the following table.</p> <table border="1"> <thead> <tr> <th colspan="2">Setting No.</th> <th rowspan="2">Description</th> </tr> <tr> <th>5</th> <th>6</th> </tr> </thead> <tbody> <tr> <td>Disabled</td> <td>Disabled</td> <td> <p><b>Create operation:</b> Change the management method from hierarchical differences to SM differences.</p> <p><b>Resync operation:</b> Change the management method from hierarchical</p> </td> </tr> </tbody> </table>	Setting No.		Description	5	6	Disabled	Disabled	<p><b>Create operation:</b> Change the management method from hierarchical differences to SM differences.</p> <p><b>Resync operation:</b> Change the management method from hierarchical</p>
Setting No.		Description								
5	6									
Disabled	Disabled	<p><b>Create operation:</b> Change the management method from hierarchical differences to SM differences.</p> <p><b>Resync operation:</b> Change the management method from hierarchical</p>								

Number	Default	Description		
		<b>Setting No.</b>		<b>Description</b>
		5	6	
				differences to SM differences.
			Enabled	<p><b>Create operation:</b> Change the management method from SM differences to hierarchical differences.</p> <p><b>Resync operation:</b> The differential data management method is not changed.</p>
Enabled	Disabled	<p><b>Create operation:</b> Change the management method from SM differences to hierarchical differences.</p> <p><b>Resync operation:</b> Change the management method from SM differences to hierarchical differences.</p>		
	Enabled	<p><b>Create operation:</b> Change the management method from SM differences to hierarchical differences.</p> <p><b>Resync operation:</b> The differential data management method is not changed.</p>		
 <p><b>Note:</b> If the LDEV capacity exceeds 262,668 Cyl, it becomes the hierarchical memory management regardless of whether No. 5 and No. 6 are enabled.</p>				



Number	Default	Description
13	OFF	<p>The consistency time of a Universal Replicator for Mainframe pair shows the time stamp of the data that has just been copied to a restored journal volume.</p> <ul style="list-style-type: none"> <li>▪ Enabled: The time included in the time stamp of the data that has just been copied to a restored journal volume shows the consistency time.</li> <li>▪ Disabled: The time included in the time stamp of the data that has just been copied to a secondary volume shows the consistency time.</li> </ul> <p>This advanced system setting corresponds to system option mode 530 for previous storage systems.</p>
14 (VSP 5000 series)	OFF	<p>After delta resync, the pair status remains COPY during journal data copy.</p> <ul style="list-style-type: none"> <li>▪ Enabled: When a delta resync is performed in a 3DC multi-target configuration with TC and UR, the pair status remains COPY during journal data copy.</li> <li>▪ Disabled: When a delta resync is performed in a 3DC multi-target configuration with TC and UR, the pair status changes directly to PAIR.</li> </ul> <p>This setting corresponds to the system option mode 1015 for VSP G1x00, VSP F1500, or previous models.</p>
15 (VSP 5000 series)	OFF	<p>One minute after remote path failure detection, the mirror is split.</p> <ul style="list-style-type: none"> <li>▪ Enabled: When a remote path failure is detected, the mirror is split if the remote path is not restored within one minute after the detection.</li> <li>▪ Disabled: When a remote path failure is detected, the mirror is split if the remote path is not restored within the path monitoring time set by the mirror option.</li> </ul> <p>This setting is enabled only when No. 16 is enabled. When No. 16 is disabled, the mirror is not split even if a remote path failure is detected. This item corresponds to the system option mode 448 for VSP G1x00 and VSP F1500 or previous models.</p>
16 (VSP 5000 series)	OFF	<p>After remote path failure detection, the mirror is split.</p> <ul style="list-style-type: none"> <li>▪ Enabled: After a remote path failure is detected, the mirror is split.</li> <li>▪ Disabled: Even if a remote path failure is detected, the mirror is not split.</li> </ul>

Number	Default	Description																	
		<p>This item corresponds to the system option mode 449 for VSP G1x00 and VSP F1500 or previous models. However, Enabled and Disabled have the opposite meanings to the system option mode 449.</p> <p>How this setting works with setting No. 15 is described in the following table.</p> <table border="1"> <thead> <tr> <th colspan="2">Setting No.</th> <th rowspan="2">Description</th> </tr> <tr> <th>15</th> <th>16</th> </tr> </thead> <tbody> <tr> <td>Disabled</td> <td>Disabled</td> <td>Even if a remote path failure is detected, the mirror is not split.</td> </tr> <tr> <td>Enabled</td> <td>Disabled</td> <td>Even if a remote path failure is detected, the mirror is not split.</td> </tr> <tr> <td>Disabled</td> <td>Enabled</td> <td>After remote path failure detection, the mirror is split if the remote path is not restored within the path monitoring time.</td> </tr> <tr> <td>Enabled</td> <td>Enabled</td> <td>After remote path failure detection, the mirror is split if the remote path is not restored within one minute after the detection.</td> </tr> </tbody> </table>	Setting No.		Description	15	16	Disabled	Disabled	Even if a remote path failure is detected, the mirror is not split.	Enabled	Disabled	Even if a remote path failure is detected, the mirror is not split.	Disabled	Enabled	After remote path failure detection, the mirror is split if the remote path is not restored within the path monitoring time.	Enabled	Enabled	After remote path failure detection, the mirror is split if the remote path is not restored within one minute after the detection.
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15	16																		
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Enabled	Enabled	After remote path failure detection, the mirror is split if the remote path is not restored within one minute after the detection.																	
17 (VSP 5000 series)	OFF	<p>The copy pace for mirror option (Medium) becomes one level faster.</p> <p>When enabled, the pace for copying data during initial copy becomes one level faster when the copy pace for journal option is Medium. This item can be used to make the initial copy operation in Medium speed mode perform faster.</p> <p>This setting corresponds to the system option mode 600 for VSP G1x00, VSP F1500, or previous models.</p>																	
18 (VSP 5000 series)	OFF	<p>The copy pace for mirror option (Medium) becomes two level faster.</p> <p>When enabled, the pace for copying data during initial copy becomes two levels faster when the copy pace for journal option is Medium. This item can be used to make the initial copy operation in Medium speed mode perform faster.</p> <p>This setting corresponds to the system option mode 601 for VSP G1x00, VSP F1500, or previous models.</p>																	

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## Chapter 4: Planning the data path

You can plan the data path by calculating bandwidth and design the data path network.

### Data path design

The data path network must be designed to manage your organization's throughput to the secondary site. You must determine the bandwidth, number of ports, and Fibre Channel or iSCSI data path configuration that will ensure the update data arrives at the secondary site in a time consistent with your organization's RPO.

To set up a data path, you must establish the following:

- The amount of bandwidth required to move the data generated by your host applications under all I/O conditions. See [Sizing bandwidth \(on page 91\)](#).
- The number of ports that can send and receive data. See [Planning ports for data transfer \(on page 97\)](#).
- The types of cables and number of switches required for your network. See [Fibre Channel data path requirements \(on page 100\)](#).
- The data path configuration that works best for your sites. See [Supported data path configurations \(on page 98\)](#).



#### Note:

- Before replacing a data path (Fibre Channel or iSCSI), first delete the pairs and delete the remote paths that use the data path to be replaced, and then replace the data path. Do not replace a data path that is being used for remote copy operations.
- Use the same protocol for data paths between a host and a storage system and between primary and secondary storage systems. When different protocols are used in the data paths (for example, Fibre Channel data paths between the host and storage system and iSCSI data paths between the storage systems), make sure the timeout period for commands between the host and the storage system is equal to or greater than the timeout period for commands between the storage systems.

### Sizing bandwidth

Bandwidth is determined based on the amount of data to be transferred from the primary storage system to the secondary storage system within a certain amount of time. The amount of data to be transferred between the primary storage system and the secondary storage

system depends on the amount of host I/O activity and the amount of copied data during the initial copy operation (the initial copy operation or the resync copy operation).

If the amount of data to be transferred between the primary storage system and the secondary storage system is larger than the amount of bandwidth, the data updated in the P-VOLs is stored in the journal volume until the additional bandwidth capacity is added or becomes available. If the journal volume becomes full, the pairs are suspended with a failure. You need to perform the resync copy operation to restore the pair status.

While it can be costly to increase bandwidth, increasing the capacity of a journal volume is relatively inexpensive. However, as the amount of journal data accumulated in the journal volume increases, the data in the secondary volume will not be the latest. For this reason, the differences between the primary and secondary volumes increase as more update data accumulates in the journal, and the RPO (Recovery Point Objective) increases if a failure occurs on the primary storage system. Therefore, sizing bandwidth often involves a trade-off between expense and keeping the data currency of the secondary volumes within your RPO goals.

## Five sizing strategies

Refer to the following typical sizing strategies as you determine an approach to sizing bandwidth. This is not a complete list of sizing strategies, and your approach might combine several strategies.

- **Size bandwidth to peak workload:** This approach results in the smallest difference between the data in the P-VOL and S-VOL. Identify peak workload on the production volumes, and then add extra capacity to accommodate packet loss and protocol overhead. RPO is at or near zero when bandwidth is sized to peak workload.
- **Size bandwidth to peak workload rolling average:** The rolling average is less than peak but more than average. This guarantees that at some point data will accumulate in the journal, but most of the time it will not. Your system can afford to journal for the planned amount of time and still maintain RPO.
- **Size bandwidth to typical workload:** When bandwidth is sized to typical write-workload and an extended peak workload is experienced, excess write-data is written to journal. This excess data is delayed for subsequent transmission to the secondary site until network capacity becomes available. The amount of differential data is proportional to the amplitude and duration of the workload surge.

- **Size bandwidth to average or mean workload:** If you cannot determine a typical workload, sizing should be to the average or mean workload with a small compensation for network overhead. In this scenario, excess data in the journals will be completely emptied to the S-VOL only occasionally. If bandwidth is sized below average write-workload, the journals never fully drain and eventually overflow.
- **Alternate pair status between suspend and resync:** You can size bandwidth and journal size for cases such as data migration in which data consistency is not required. In this strategy, you can alternate the pair status between suspend and resync in order to process point-in-time copies in batches. When pairs are suspended, journals are not used to queue write operations. Instead, a bitmap is used to track the changed cylinders on the disks. For access patterns that favor multiple writes to a relatively small region of disk, this technique can provide especially efficient transfer of data: multiple writes to one region are not sent each and every time, and only the last update before resync is sent. The disadvantage of this strategy is that it does not guarantee I/O consistency on the secondary storage system until the resync is complete.

## Calculating bandwidth

To determine bandwidth for Universal Replicator for Mainframe, write-workload must be measured. Production system workload data is collected using performance monitoring software. See [Measuring write-workload \(on page 63\)](#).

When you have collected write-workload data, size your bandwidth according to your sizing strategy. In the following procedures, bandwidth is sized for peak and peak rolling average write-workload.

### Sizing bandwidth for peak write-workload

#### Procedure

1. Make sure that write-workload data is imported into a spreadsheet tool. Column C in the following figure shows an example of collected raw data over 10-minute segments.

	A	B	C	D	E	F	G	H
	Sample #	Time - 10 min. segments	Raw Data - MB/sec collected per 10 min. segment	30 Min Rolling Ave	60 Min Rolling Ave	24 Hour Rolling Avg		Raw Data Project Growth
1								
2								15.00%
3	1	0:00	0.863					0.992
4	2	0:10	2.81					3.232
5	3	0:20	0.858		1.24	2.17		0.987
6	4	0:30	0.45		1.56	2.17		0.518
7	5	0:40	0.813		1.36	2.17		0.935
8	6	0:50	1.63		1.56	2.17		1.875
9	7	1:00	2.81		2.24	2.17		3.232
10	8	1:10	1.58		2.30	2.18		1.817
11	9	1:20	2.05		2.36	2.18		2.368
12	10	1:30	4.57		2.48	2.17		5.256
13	11	1:40	1.13		2.66	2.17		1.300
14	12	1:50	2		2.72	2.16		2.300
15	13	2:00	3.56		2.30	2.16		4.094
16	14	2:10	2.64		2.26	2.19		3.036
17	15	2:20	2.39		2.34	2.19		2.749
18	16	2:30	2.06		2.17	2.18		2.369

2. Locate the highest peak. Based on your write-workload measurements, this is the greatest amount of data transferred during the collection period. It indicates the base amount of data that your bandwidth must be able to handle for near 0 RPO.

Though the highest peak is used for determining bandwidth, you should take notice of extremely high peaks. In some cases a batch job, defragmentation, or other process could be driving workload to abnormally high levels. It is sometimes worthwhile to review the processes that are running. After careful analysis, it might be possible to lower or even eliminate some spikes by optimizing or streamlining high-workload processes. Changing the timing of a process can lower workload.

3. With a base bandwidth value established, make adjustments for growth and a safety factor.
  - Projected growth rate accounts for the increase expected in write-workload over a 1, 2, or 3 year period.
  - A safety factor adds extra bandwidth for unusually high spikes that did not occur during write-workload measurement but could.

## Sizing bandwidth for peak rolling average write-workload

### Procedure

1. Using write-workload data imported into a spreadsheet and your RPO, calculate write rolling-averages.

For example, if RPO time is 1 hour, then 60-minute rolling averages are calculated. Do this by arranging the values in six 10-minute intervals, as follows:

- a. In cell E4 type, =average (b2:b7) , and press Enter. (Most spreadsheet tools have an average function.)

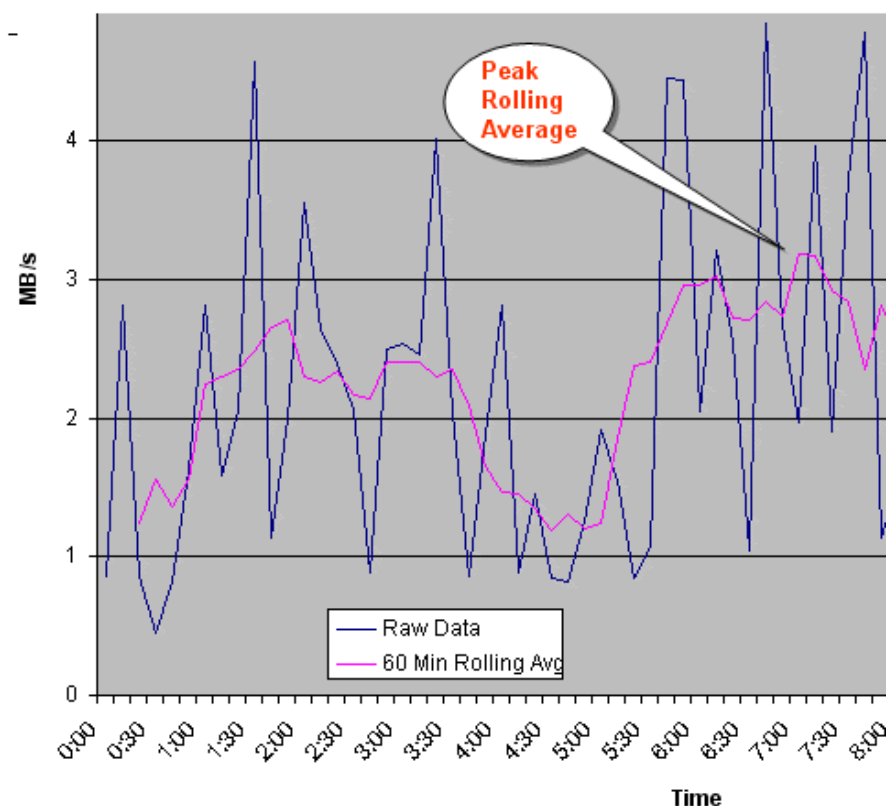
This instructs the tool to calculate the average value in cells B2 through B7 (six 10-minute intervals) and populate cell E4 with that data. (The calculations used here are for example purposes only. Base your calculations on your RPO.)

- b. Copy the value that displays in E4.
- c. Highlight cells E5 to the last E cell of workload data in the spreadsheet.
- d. Right-click the highlighted cells and select the Paste option.

Excel maintains the logic and increments the formula values initially entered in E4. It then calculates all of the 60-minute averages for every 10-minute increment, and populates the E cells, as shown in the following example. For comparison, 24-hour rolling averages are also shown.

	A	B	C	D	E	F	G	H
	Sample #	Time - 10 min. segments	Raw Data - MB/sec collected per 10 min. segment	30 Min Rolling Ave	60 Min Rolling Ave	24 Hour Rolling Avg		Raw Data Project Growth
1								
2								15.00%
3	1	0:00	0.863					0.992
4	2	0:10	2.81					3.232
5	3	0:20	0.858		1.24	2.17		0.987
6	4	0:30	0.45		1.56	2.17		0.518
7	5	0:40	0.813		1.36	2.17		0.935
8	6	0:50	1.63		1.56	2.17		1.875
9	7	1:00	2.81		2.24	2.17		3.232
10	8	1:10	1.58		2.30	2.18		1.817
11	9	1:20	2.05		2.36	2.18		2.358
12	10	1:30	4.57		2.48	2.17		5.256
13	11	1:40	1.13		2.66	2.17		1.300
14	12	1:50	2		2.72	2.16		2.300
15	13	2:00	3.56		2.30	2.16		4.094
16	14	2:10	2.64		2.26	2.19		3.036
17	15	2:20	2.39		2.34	2.19		2.749
18	16	2:30	2.06		2.17	2.18		2.369

For another perspective, you can use 60-minute rolling averages graphed over raw data, as shown in the following figure.



2. From the spreadsheet or graph, locate the largest or highest rolling average value. This is the peak rolling average, which indicates the base amount of data that your bandwidth must be able to handle.
3. With a base bandwidth value established, make adjustments for growth and a safety factor.
  - Projected growth rate accounts for the increase expected in write-workload over a 1, 2, or 3 year period.
  - A safety factor adds extra bandwidth for unusually high spikes that did not occur during write-workload measurement but could.

Other factors that must be taken into consideration because of their effect on bandwidth are latency and packet loss, as described in the following topics.

## Latency

Network latency affects replication. It is the amount of data that can be present in the data path. In the event of network failure, a certain number of transmitted records will not yet be resident in the secondary storage system's journal, because they are still in-route within the data path. During periods of low workload, there might be no records in the path, but during periods of heavy workload, the network might be fully used. This amount represents the minimum difference between data in the primary and secondary storage systems.



## Packet loss

Packet losses have the effect of reducing overall bandwidth because lost packets must be re-transmitted, which consumes network capacity that would otherwise be occupied by new data traffic. Also, a network can elongate consistency time, since journals are not applied until a contiguous sequence of records has arrived at the secondary site.

## Planning ports for data transfer

When new data exists in the P-VOL, the data is transferred through initiator ports and RCU target ports at the primary and secondary systems.

The operation commands (that is, for pair creation, and resynchronization) are sent from primary site initiator ports to secondary site RCU target ports.

For initial or update copy, the secondary site initiator port sends the `read-journal` command to the primary site RCU target port. The data is then sent through these ports, that is, from primary site RCU target ports to secondary site RCU initiator ports.

Note the following:

- An initiator port in one system must be connected to an RCU target port in the other system.
- Two or more initiator ports must be configured before you can create the URz relationship with the secondary storage system and create pairs.
- The amount of data that each port can transmit is limited. Therefore, it is critical to know the amount of data that will be transferred during peak periods. This knowledge will ensure that you can set up a sufficient number of ports as initiator and RCU target ports in order to handle all workloads.
- If your URz system supports a disaster recovery failover/failback environment, the same number of initiator and RCU target ports should be configured on primary and secondary storage systems to enable replication from the secondary site to primary site in a failover scenario.
- Up to eight paths can be established in both directions. It is recommended that you establish at least two independent data paths to provide hardware redundancy.

### Example configuration

- Two initiator ports on the primary storage system, with two matching RCU target ports on the secondary storage system.
- Four initiator ports on the secondary storage system, with four matching RCU target ports on the primary storage system.

## Port types

The primary and secondary storage systems require both initiator and RCU target ports. Both systems send and receive traffic during active replication.

- The initiator port on the primary side is connected to the RCU target port on the secondary side.
- The initiator port on the secondary side is connected to the RCU target port on the primary side.

Ports are designated as target ports by default. When you determine the number of initiator ports and RCU target ports your URz system requires, you change port attributes from target to initiator and RCU target.

The Fibre Channel and iSCSI ports can have the following attributes:

- Initiator port: Sends URz commands (that is, **operation** command or **read-journal** command) to the paired storage systems. For the secondary site, the port receives journal data from the primary site. Initiator ports must be configured on both primary and secondary storage systems for pair operations.
- RCU Target port: RCU Target ports on the primary site receive the **read-journal** command from the secondary site and send URz journal data to the secondary site. RCU target ports must be configured on both primary and secondary storage systems for pair operations.
- Target port: Connects the storage system and an open-systems host. When the host issues a write request, the request is sent through a target port to a volume on the system. Target ports are not used with mainframe volumes or URz operations. This port can be changed to an initiator, or RCU target port.
- External port: Required for Universal Volume Manager copy operations. This port type is used by URz for EXCTG arbitration in the supervisor DKC. This port can be changed to a target, initiator, or RCU target port.

## Supported data path configurations

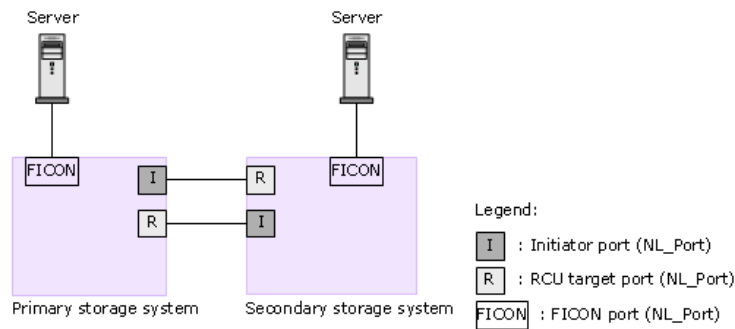
The data path can be configured using one of the following connection types. For port and topology setting, use Device Manager - Storage Navigator or CCI commands. For a switch connection, you must set the port to Fabric on, Point-to-Point (F-port).

Create at least two independent data paths (one per cluster) between the primary storage system and the secondary storage system for hardware redundancy for this critical element. Configure the paths bidirectionally by using the same connection type for each path:

- A path from the primary storage system to the secondary storage system
- A path from the secondary storage system to the primary storage system

### Direct connection

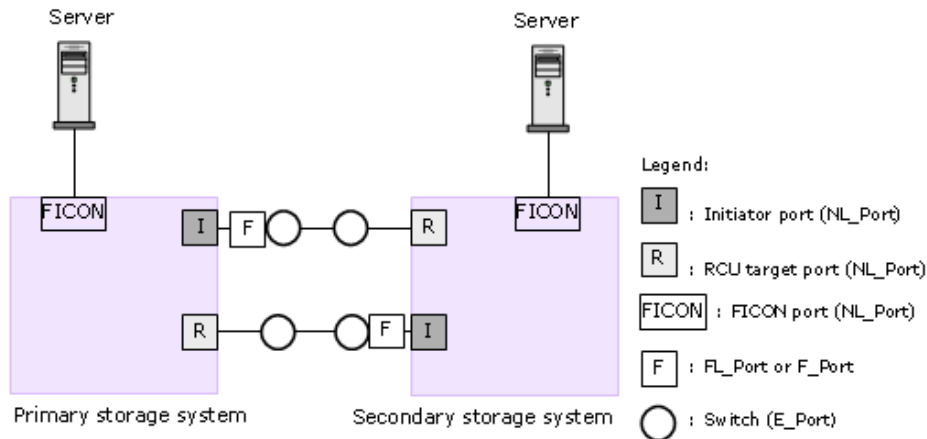
A direct connection (loop only) is a direct link between the primary and secondary arrays. NL-port (Node Loop) connections are supported for the data path and host-to-system path.



- Set the Fabric to OFF for the initiator port and the RCU target port.
- Set the topology to FC-AL.

### Switch connection

Switch connections push data from the local switch through a Fibre Channel link across a WAN to the remote switch and Fibre Channel of the secondary storage system. F-port (point-to-point) and FL-port (loop) switch connections are supported.

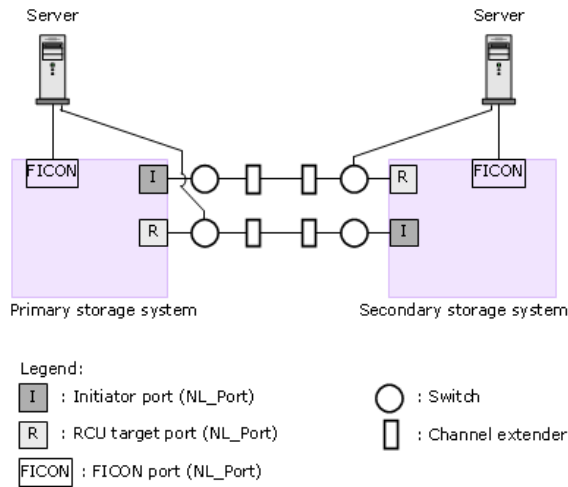


- Set the Fabric to ON for the initiator port and the RCU target port.
- Set the topology to Point-to-Point.

Switches from some vendors, McData ED5000 for example, require an F-port.

### Extender connection

Make sure that the extender supports remote I/O. Contact customer support for details.



- Set the Fabric to ON for the initiator port and the RCU target port.
- Set the topology to Point-to-Point.

**Note:** When the primary and secondary storage systems are connected using switches with a channel extender, and multiple data paths are configured, the capacity of data to be transmitted might concentrate on particular switches, depending on the configuration and the settings of switch routing. For more information contact customer support.

## Fibre Channel data path requirements

Multimode or single-mode optical fiber cables are required on primary and secondary storage systems. The type of cable and number of switches depends on the distance between primary and secondary sites, as specified in the following table.

Distance	Cable type	Data path relay
0 km to 1.5 km (4,920 feet)	Multimode shortwave Fibre Channel interface cables.	Switch is required between 0.5 km to 1.5 km.
1.5 km to 10 km (6.2 miles)	Single-mode longwave optical fibre cables.	Not required.
10 km to 30 km (18.6 miles)	Single-mode longwave optical fibre cables.	Switch is required.
Greater than 30 km (18.6 miles)	Communications lines are required.	Approved third-party channel extender products.

With Fibre Channel connections using switches, no special settings are required for the physical storage system. Direct connections up to 10 km with single-mode longwave Fibre Channel interface cables are supported.

Link speed	Distance maximum performance maintained
4 Gbps	3 km
8 Gbps	2 km
16 Gbps	1 km
32 Gbps	0.6 km

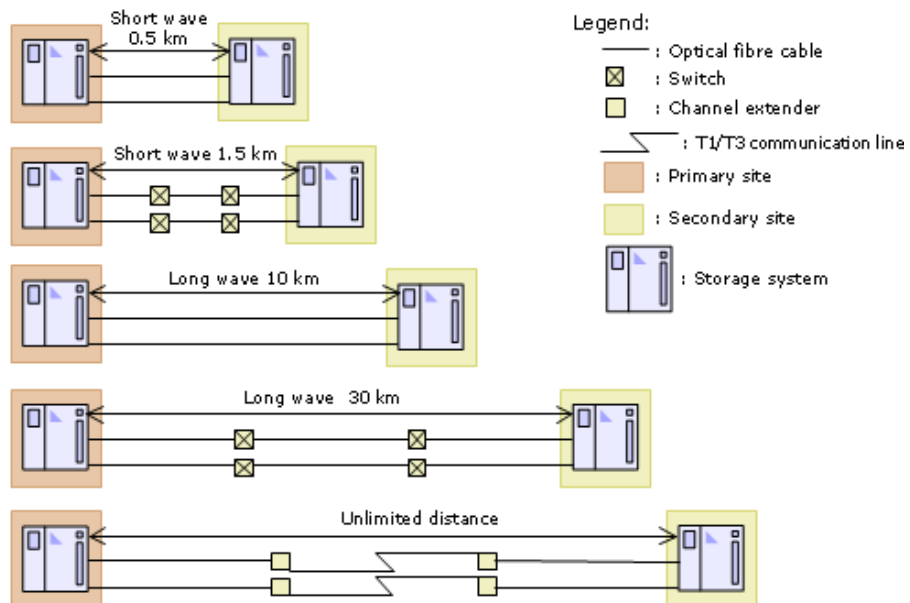
This information is illustrated in the graphic in *Additional switches (on page 101)*. Note that the type of cable determines the type of SFP used for the port. Longwave cables must be connected to longwave SFPs in the storage system and switch. Shortwave cables must be connected to shortwave SFPs in the storage system and switch. The default Fibre Channel SFP type is shortwave.

### Additional switches

When the initiator port on the primary storage system sends data to the secondary storage system, the Fibre Channel protocol accommodates a certain number of un-acknowledged frames before the sender must stop sending. These are known as buffer credits. As Fibre Channel frames are sent out, available buffer credits are exhausted. As acknowledgments come back, the supply of buffer credits is replenished. Because it takes longer for acknowledgments to return as distance increases, exhausting the supply of buffer credits becomes increasingly likely as distance increases.

Adding Fibre Channel switches on either end of the replication network provides the additional credits necessary to overcome buffer shortages due to the network latency.

The following figure shows data path types, switches, and distances.



## Fibre Channel used as remote paths

Before configuring a system using Fibre Channel, there are restrictions that you need to consider.

For details about Fibre Channel, see the *Provisioning Guide* for your system.

- When you use Fibre Channel as a remote path, if you specify Auto for Port Speed, specify 10 seconds or more for Blocked Path Monitoring. If you want to specify 9 seconds or less, do not set Auto for Port Speed.
- If the time specified for Blocked Path Monitoring is not long enough, the network speed might be slowed down or the period for speed negotiation might be exceeded. As a result, paths might be blocked.

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## Chapter 5: Using extended consistency groups

EXCTGs are necessary when you perform copy operations between multiple primary and multiple secondary storage systems. You must be able to set up and maintain journals in EXCTGs to make use of this capability.

### Overview

An EXCTG is a collection of journals in which data consistency is guaranteed. You must register journals in an EXCTG when performing copy operations between multiple primary storage systems and multiple secondary storage systems. Master journals are registered in primary EXCTGs, and restore journals are registered in secondary storage system EXCTGs.

Because the P-VOLs could be used as S-VOLs if a failure occurs, primary EXCTGs should be configured. Configuring both primary and secondary EXCTGs provides guaranteed consistency of the data update sequence and consistency time.

### Guaranteed Consistency of Data Update Sequence

Universal Replicator for Mainframe restores journal data to S-VOLs sequentially by taking the following steps:

1. Checks the EXCTG for the time stamps of all journal data not restored to S-VOLs, and then identifies the latest time stamp for each journal.

In the following example figure, the latest time stamp for each journal is as follows:

- In Journal 1, the latest time stamp is 15:00.
- In Journal 2, the latest time stamp is 15:02.
- In Journal 3, the latest time stamp is 15:03.
- In Journal 4, the latest time stamp is 15:04.



**Figure 5 EXCTG time stamps**

2. Searches for the oldest time stamp from the previous step, and then restores data up to that time to the S-VOLs.

In the example figure, the oldest time stamp is 15:00. URz restores all data with a time stamp of 15:00 or earlier to the S-VOLs.

- For Journal 1, URz restores all data up to 15:00.
- For Journal 2, URz restores all data up to 14:02.
- For Journal 3, URz restores all data up to 14:03.
- For Journal 4, URz restores all data up to 14:04.

In this way URz prevents newer journal data from being restored before older journal data to maintain consistency in the data update sequence.



## Consistency time

Device Manager - Storage Navigator displays the consistency times of EXCTGs and pairs in the URz windows. Make sure you check both consistency times.

- An EXCTG's consistency time is the latest time stamp of the restored data in the group in which consistency is guaranteed.

For example, if the consistency time is 14:00, the secondary volumes within the extended consistency group are synchronized with the primary volume as of 14:00. The display format is "year/month/day hours:minutes:seconds". Decimal digits are also displayed in "seconds".

- A pair's consistency time is the latest time stamp of the data that has been restored when the pair becomes suspended.

The consistency time is effective only for the update of pairs in Duplex status. Consistency time is not guaranteed if data is updated when a pair is in a status other than Duplex. This applies to a pair sharing a volume with Slz or TCz when one of those pairs is updated resulting in a change of the URz pair's status to other than Duplex.

Also, when no time stamp is assigned by the host at the time of update, the consistency time is invalid.

In the example in [Figure 5 EXCTG time stamps \(on page 104\)](#), if a pair in the journal 1, 2, 3 or 4 is suspended immediately after data are restored, the consistency time of the pair is as follows.

- If a pair in Journal 1 is suspended, the consistency time is 15:00.
- If a pair in Journal 2 is suspended, the consistency time is 14:02.
- If a pair in Journal 3 is suspended, the consistency time is 14:03.
- If a pair in Journal 4 is suspended, the consistency time is 14:04.



### Note:

- Extended consistency groups use time stamps to maintain consistency of the data update sequence. Note that the consistency across journals cannot be maintained if data with invalid time stamps or with time stamps of value 0 is included. If this happens, restoration is delayed through arbitration processing, and journal data is accumulated.
- Configure storage systems so that the copy performance between the primary and secondary sites of each journal belonging to an extended consistency group is the same. If the copy performance of a journal is lower than other journals, restoration is delayed, and journal data is accumulated.
- If a URz pair in a journal receives invalid time stamp updates from a primary site storage system, the SEQCHK status is displayed in the Sub Status row of the pair displayed in the View Pair Properties window. For details about the SEQCHK status, see [Pair status definitions \(on page 31\)](#).

## Restoring data to previous time stamps after failure

If a failure occurs in a primary storage system, restore journal data with time stamps later than the consistency time of the EXCTG, to the S-VOLs. In [Figure 5 EXCTG time stamps \(on page 104\)](#), the consistency time of the EXCTG is 15:00; therefore, you must restore the following data to S-VOLs:

- Data with the time stamp 15:02 in journal 2.
- Data with the time stamp 15:03 in journal 3.
- Data with the time stamp 15:04 in journal 4.

If a failure occurs in a secondary storage system, compare the consistency times of all journals in the EXCTG, identify the oldest consistency time, and then restore all data with time stamps later than the oldest consistency time, to the S-VOL. In [Figure 5 EXCTG time stamps \(on page 104\)](#), the consistency time of journal 2 is the oldest among journals 1 to 4. Since the consistency time of journal 2 is 14:02, you must restore the following data to S-VOLs.

- Data with the time stamp 15:00 in journal 1.
- Data with the time stamp 15:02 in journal 2.
- Data with the time stamp 14:03, and data with the time stamp 15:03 in journal 3.
- Data with the time stamp 14:04, and data with the time stamp 15:04 in journal 4.

## Registering journals in an EXCTG

When performing URz copy operations between multiple primary and secondary storage systems, you must register restore journals in an EXCTG.

It is recommended that master journals are also registered. Register the master journal and the restore journal in separate EXCTGs.

### Before you begin

- Primary and secondary EXCTGs can be set up using Business Continuity Manager prior to registering journals, or by using Device Manager - Storage Navigator in the following procedure.
- Journals must be in Active or Stopped status.
- Register master and restore journals in the separate EXCTGs.
- Journals can be deleted from the EXCTG only if the attribute is Master, Restore, or Updating.
- When URz pairs are cascaded with ShadowImage for Mainframe, and the Slz S-VOL and a URz P-VOL share the volume, data consistency cannot be maintained between primary and secondary storage systems, even when journals are registered in an EXCTG.

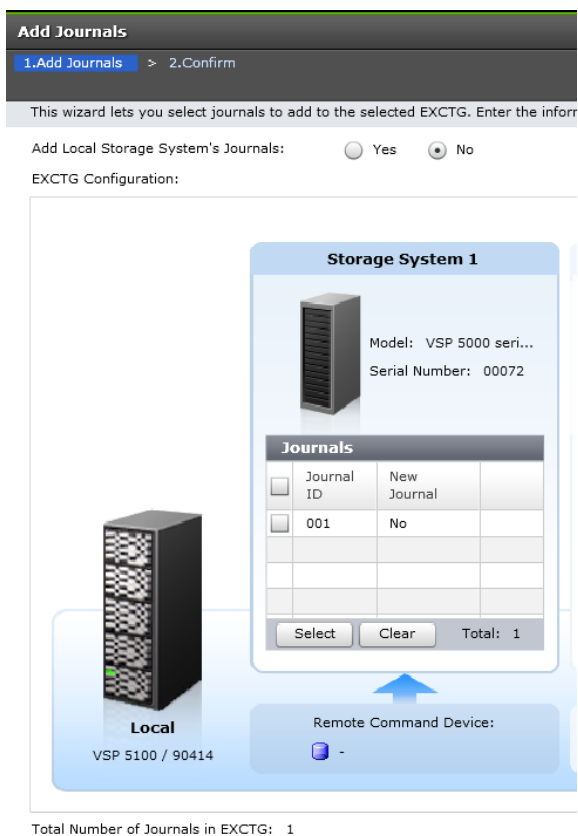
- When URz pairs are cascaded with TrueCopy for Mainframe, and the TCz S-VOL and URz P-VOL share the volume, make sure you enable the Host I/O Time Stamp Transfer option of all the TCz pairs in the journal for data consistency.
- Journals that can be used in a 3DC configuration with three URz sites cannot be registered in an EXCTG.

Journals are registered to EXCTGs in the Device Manager - Storage Navigator Add Journals window. Note the following.

- You can register journals in the primary or secondary EXCTG, from any of the four primary or four secondary storage systems. You will specify the EXCTG that you want to register journals in prior to landing on the Add Journals window. If you have not set up an EXCTG, a new EXCTG is automatically created during the procedure.
- The storage system you access in Device Manager - Storage Navigator is identified in the Add Journals window as Local. This is true whether the system is a primary or a secondary storage system.

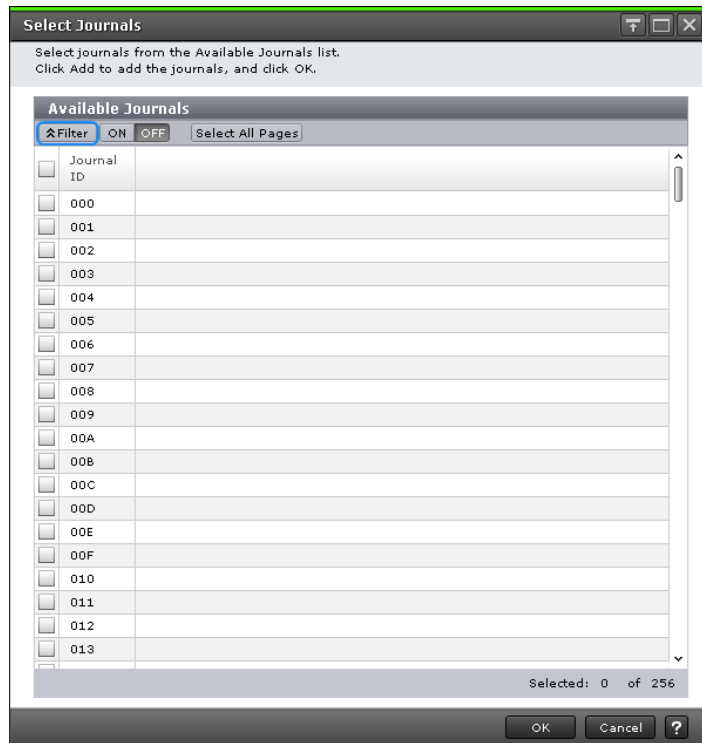
### Procedure

1. Open the **Journals** window in Device Manager - Storage Navigator.
  - a. In the **Explorer** pane, expand the **Storage Systems** tree.
  - b. Expand the target storage system tree, expand **Replication**, and click **Journals**.
2. Select the **EXCTGs** tab.
3. Select the EXCTG in which you want to register journals.  
If no EXCTG is created, an EXCTG is automatically created.
4. Click **Add Journals**.
5. If you are adding journals to an EXCTG for the first time, the **Add Journals** window displays as shown in the following figure.



Additional journals tables display if the EXCTG contains registered journals.

6. **Add Local Storage System Journals** is initially set to **No**, which indicates that you do not intend to add journals from the system you are accessing in Device Manager - Storage Navigator.  
Select **Yes** to register journals from the accessed system.
7. In **Storage System 1**, identify the **Model** and **Serial Number** for the system where the journals reside.  
If you selected **Yes** for **Add Local Storage System Journals**, these fields are set and the box is identified as **Local Storage System**.
8. Click **Select** below the Journals table.
9. In the **Select Journals** window, select the journals that you want to register in the EXCTG, and then click **OK**.



The selected journals display in the **Journals** table on the **Add Journals** window. **Yes** indicates the journals can be registered (not previously registered). **No** indicates that journals were previously registered and cannot be registered again.

10. For **Remote Command Device**, select the remote command device **CU** number and the **LDEV** number. No selection can be made if a remote command device has already been specified.
11. To register journals located in another storage system, select **Add** above the disabled **Storage System** table to the right.
12. The new Journals table is enabled. Repeat Steps 7 through 10. You can add journals from a total of four storage systems to the EXCTG.
13. To remove a journal from a table, select the journal and click **Clear**.
14. Click **Finish**.
15. In the **Confirm** window, check your settings and enter a task name in **Task Name**.
16. Click **Apply**.

## Viewing EXCTG properties

URz performs arbitration processing only for journals in the Active status to keep the update sequence of data. Journals in the Stopped status are not subject to the arbitration processing. If an invalid time stamp is detected, the following might be displayed:

- Underflow: The time stamp is below the time stamp's range.
- Overflow: The time stamp is above the time stamp's range.

The consistency time is enabled only for updates of URz pairs in the Duplex status. If data is updated when a URz pair is not in the Duplex status, the consistency time is not guaranteed. Because of this, the consistency time is invalid when a journal of a URz pair that shares a volume with a TCz or Slz pair is registered in an EXCTG, if the URz pair status when it is updated is not Duplex, or a TCz or Slz pair is updated. In addition, if no time stamp is added by a host when data is updated, the consistency time becomes invalid.

## Splitting, restoring, and releasing pairs in an EXCTG

With Business Continuity Manager, you can split, restore, and release all pairs in an EXCTG collectively.

### Pair-split operation

When you perform a pair-split operation in an EXCTG, you have the choice of specifying Flush or Purge for Split option.

- With Flush, the pairs in the EXCTG are split with the consistency of the data update sequence maintained.
- With Purge, consistency of the data update sequence is not maintained within the EXCTG, but within each journal. With Purge, the pair-split operation is completed faster than with Flush.
- When the path, port, or remote command device is used for the connection between the secondary storage systems, and a failure occurs in the path, port, or remote command device, the data volume pairs in the EXCTG cannot be split collectively. After recovering the failure segment, perform the pair-split operation.



**Note:** When you split all pairs in a specific journal in an EXCTG, you cannot use the REVERSE option of the BCM YKSUSPND command.

### Operations for a specific journal

When you split, restore, or release all pairs in a specific journal in an EXCTG, the supervisor DKC executes arbitration processing on the other journals.

For example, in [Figure 6 Multiple systems in EXCTGs \(on page 111\)](#), if you collectively split all pairs that belong to journal 1, the supervisor DKC executes arbitration processing on journals 2 and 3, and therefore consistency of data update sequence is maintained only within the primary storage systems 2 and 3 and the secondary storage systems 2 and 3. If you restore pairs in journal 1, the supervisor DKC executes arbitration processing on journals 1 and 3.

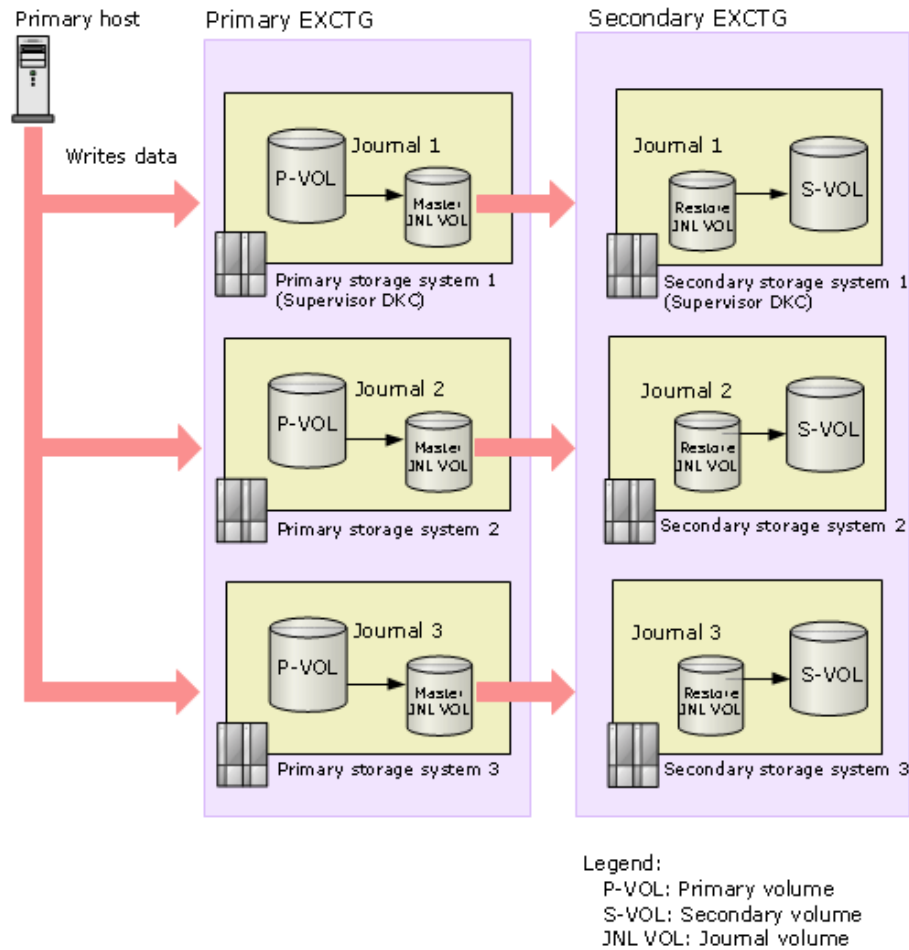


Figure 6 Multiple systems in EXCTGs

## Removing journals from an EXCTG

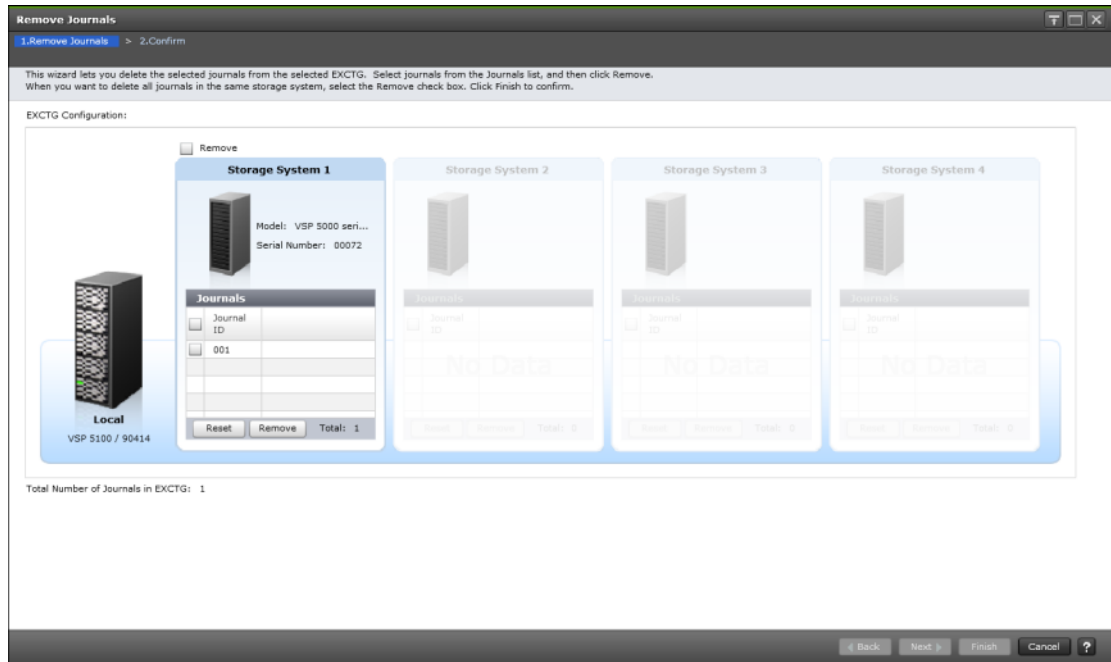
You can release single, multiple, or all journals from an EXCTG or from all EXCTGs. You can also release all journals in the system or LDKC. Additionally, you can forcibly remove a journal that could not be removed normally.

### Before you begin

- Journal attributes must be Master, Restore, or Updating.
- You must be logged in to the supervisor DKC to remove a journal.
- You can remove journals from an EXCTG at any time, regardless of the status of the journals.
- If you delete all data volumes from a journal in an EXCTG, the journal is automatically removed from the EXCTG.
- Removal of one or more journals from an EXCTG does not stop remote copy operations. Update sequencing by the EXCTG is affected for the journals, though not for others in the EXCTG.

**Procedure**

1. Open the **Journals** window in Device Manager - Storage Navigator.
  - a. In the **Explorer** pane, expand the **Storage Systems** tree.
  - b. Expand the target storage system tree, expand **Replication**, and click **Journals**.
2. Select the **EXCTGs** tab.
3. Select the EXCTG in which you delete the journal.
4. Click **Remove Journals**.
5. In the **Remove Journals** window, from the **Journals** table, select a journal then click **Remove**. To remove all journals within a specific storage system, click the **Remove** check box above the storage system.



6. Click **Finish**.
7. In the **Confirm** window, check your settings and enter a task name in **Task Name**.
8. Click **Apply**.

## Removing all journals from an EXCTG

You can delete all journals in an EXCTG at one time.

**Before you begin**

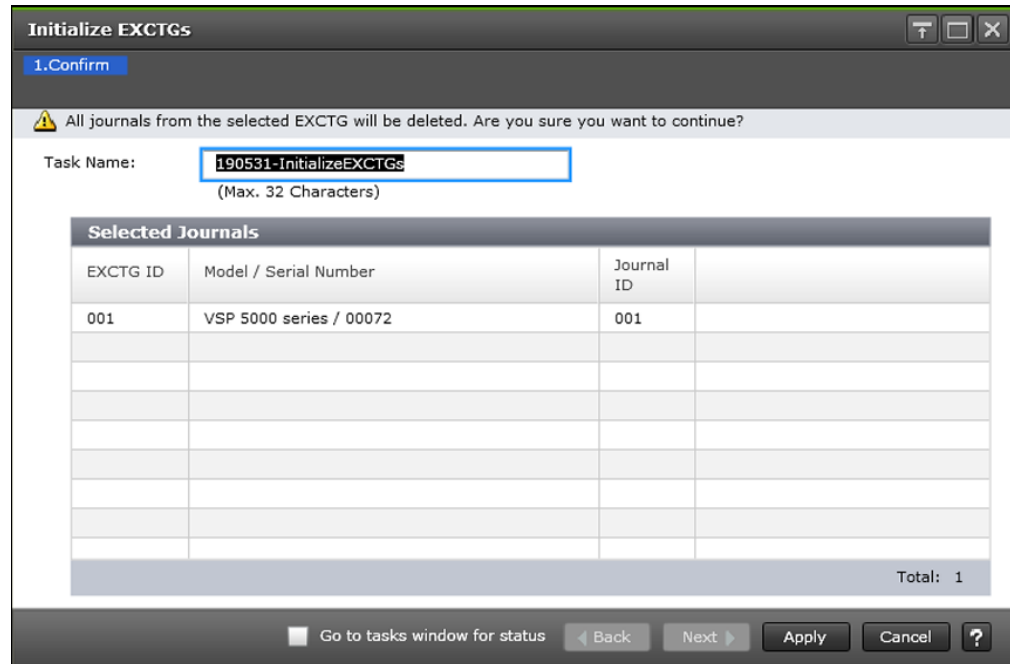
- Journal attributes must be Master, Restore, or Updating.
- You must be logged in to the supervisor DKC to remove a journal.

**Procedure**

1. Open the **Journals** window in Device Manager - Storage Navigator.
  - a. In the **Explorer** pane, expand the **Storage Systems** tree.
  - b. Expand the target storage system tree, expand **Replication**, and click **Journals**.



2. Select the **EXCTGs** tab.
3. Click **Initialize EXCTG**.
4. In the **Initialize EXCTG** window, enter a **Task Name** and review the journals in the EXCTG to be deleted.



5. To remove all journals, click **Apply**.

## Forcibly removing journals

Remove journals using the instructions in [Removing journals from an EXCTG \(on page 111\)](#). Use the following procedure only when that procedure fails to remove the journals.

### Procedure

1. Open the **Journals** window in Device Manager - Storage Navigator.
  - a. In the **Explorer** pane, expand the **Storage Systems** tree.
  - b. Expand the target storage system tree, expand **Replication**, and click **Journals**.
2. Select the **Journals** tab.
3. From the **Actions** menu, click **Journals > Force Remove Journals from EXCTG**.
4. From the **Selected Journals** table, check the journal or journals to be removed. Click **Cancel** to cancel and return to the Journals table.
5. Click **Finish**.

## Using EXCTGs with different model storage systems

URz can perform remote copy operations from more than one primary storage system to more than one secondary storage system using EXCTGs. Both the primary and secondary storage systems can be a mix of VSP 5000 series, VSP G1000, VSP G1500, VSP F1500, and VSP. If you register 17 or more journals in an EXCTG, use VSP 5000 series, VSP G1000, VSP G1500, and VSP F1500 for the supervisor DKC and the subordinate DKC.

URz can perform remote copy operations from more than one primary storage system to more than one secondary storage system using EXCTGs. Both the primary and secondary storage systems have to be VSP 5000 series. If you register 17 or more journals in an EXCTG, use VSP 5000 series for the supervisor DKC and the subordinate DKC.

- There is no restriction on which system can be the primary or secondary when pairing VSP 5000 series, VSP G1000, VSP G1500, VSP F1500, and VSP.
- There is a limit of 64 journals that can be registered in the EXCTG when the supervisor DKC is VSP 5000 series, VSP G1000, VSP G1500, or VSP F1500 and the multiple subordinate DKCs are VSP. All journals in VSP 5000 series, VSP G1000, VSP G1500, VSP F1500, and VSP can be specified as EXCTGs, as shown in the following figure.
- When the supervisor DKC is VSP, and subordinate DKCs are VSP 5000 series, VSP G1000, VSP G1500, or VSP F1500, journals of LDKCs other than LDKC00 cannot be registered in the EXCTGs. This is true even if the number of LDKCs is expanded in a future version.

Requirements for VSP 5000 series, VSP G1000, VSP G1500, and VSP F1500:

- A VSP 5000 series, VSP G1000, VSP G1500, or VSP F1500 (subordinate DKC) journal of LDKC00 can be registered in the EXCTG.
- A VSP 5000 series, VSP G1000, VSP G1500, or VSP F1500 (subordinate DKC) journal of LDKC01 cannot be registered in the EXCTG.

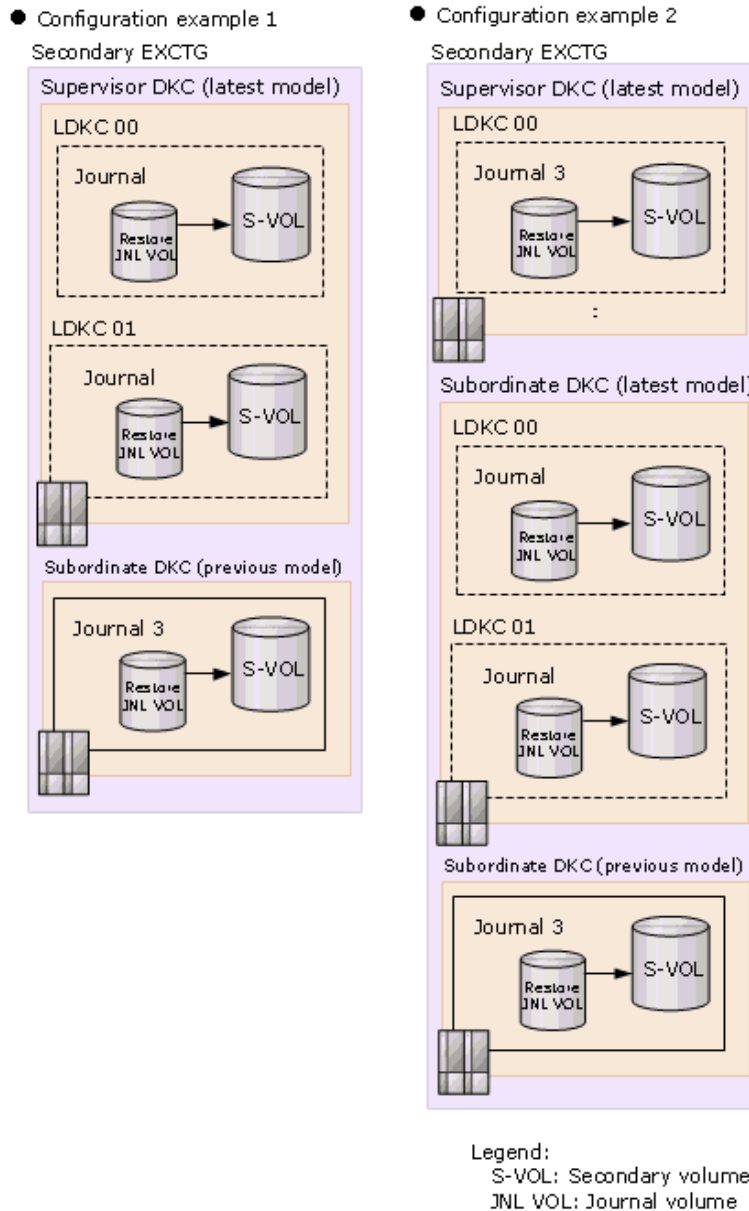


Figure 7 Journals that can be registered when VSP G1x00, VSP F1500, or VSP is the subordinate DKC

## Restoring journals manually

Normally, URz restores journals within EXCTGs. However, when an error occurs, manual restoration is necessary. The method for restoration differs according to whether the error occurs in the primary or secondary storage system.

**When the error is in the primary storage system**

If an error occurs in a primary storage system, restore journal data to the S-VOL with timestamps later than the EXCTG's consistency time. In the [Figure 5 EXCTG time stamps \(on page 104\)](#) example, EXCTG consistency time is 15:00. In this example, you must restore the following data to the S-VOLs:

- Data with time stamp 15:02 in journal 2
- Data with time stamp 15:03 in journal 3
- Data with time stamp 15:04 in journal 4

To manually restore data to the S-VOLs, specify a journal ID with the BCM command, YKRESYNC, and resynchronize all pairs in the specified journal collectively (see [Splitting, restoring, and releasing pairs in an EXCTG \(on page 110\)](#)).

**When the error is in the secondary storage system**

If an error occurs in a secondary storage system, compare consistency times of all journals in the EXCTG, and then restore journal data to the S-VOL with timestamps later than the EXCTG's consistency time. In the [Figure 5 EXCTG time stamps \(on page 104\)](#) example, journal 2 has the oldest timestamp, 14:02. Therefore, you must restore the following data to the S-VOLs:

- Data with time stamp 15:00 in journal 1
- Data with time stamp 15:02 in journal 2
- Data with time stamps 14:03 and 15:03 in journal 3
- Data with time stamps 14:04 and 15:04 in journal 4

To manually restore data to the S-VOLs, specify a journal ID with the BCM command, YKRESYNC, and resynchronize all pairs in the specified journal collectively (see [Splitting, restoring, and releasing pairs in an EXCTG \(on page 110\)](#)).

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## Chapter 6: URz configuration operations

Configuring Universal Replicator for Mainframe requires you to understand and follow a configuration workflow.

### Configuration workflow

The configuration workflow lists the tasks necessary to prepare your storage systems for Universal Replicator for Mainframe.

You must have Storage Administrator (Remote Copy) role to perform Universal Replicator for Mainframe operations. Be sure to check the prerequisites for each procedure (in "Before you begin"). Some tasks are performed from both primary and secondary storage systems. Other tasks are performed from one or the other.

Perform the following tasks to configure your systems for Universal Replicator for Mainframe operations:

1. Define the Fibre Channel or iSCSI port attributes. See [Defining Fibre Channel or iSCSI port attributes \(on page 119\)](#).
2. Set up remote paths between the primary and secondary storage systems. See [Configuring primary and secondary storage systems for URz \(on page 120\)](#).
3. If desired, enable reporting of service SIMs to the host. See [Enabling reporting of service SIMs \(on page 123\)](#).
4. Register journal volumes in a journal. See [Creating journals and adding journal volumes \(on page 124\)](#).
5. Assign an MP unit to a journal. See [Assigning an MP unit to a journal \(on page 126\)](#).

When you create a 3DC multi-target configuration in which three URz sites are combined, perform this step, and then perform the procedure described in [Workflow for 3DC multi-target configuration with three URz sites \(on page 117\)](#).

When you create a 3DC cascade configuration in which three URz sites are combined, perform this step, and then perform the procedure described in [Workflow for 3DC cascade configuration with three URz sites \(on page 118\)](#).

A 3DC multi-target configuration with three URz sites and a 3DC cascade configuration with three URz sites are supported in version 90-01-42 or later (VSP 5000 series). When you use journals created using earlier versions in a 3DC multi-target configuration with three URz sites or in a 3DC cascade configuration with three URz sites, split or resynchronize the journals for each mirror, or add pairs to the journals.

### Workflow for 3DC multi-target configuration with three URz sites

You must create two URz pairs for the two mirrors, create a delta resync pair, and allocate remote command devices to finish creating a 3DC multi-target configuration with three URz sites.

When you create a 3DC multi-target configuration with three URz sites, you must perform the following procedure after step 4 in [Configuration workflow \(on page 117\)](#).

1. Create a URz pair for the first mirror in the primary site. Specify from 0 to 3 for the mirror ID when you create a URz pair.
2. Wait until the URz pair status has changed to PAIR.
3. Create a URz pair for the second mirror in the primary site. Specify the same master journal volume and P-VOL used for the first mirror. Specify from 0 to 3 for the mirror ID. Assign a mirror ID not used in step 1.
4. Wait until the URz pair status has changed to PAIR. To create a 3DC multi-target configuration using the delta resync, perform the following procedure from steps 5 to 7.
5. Create a URz delta resync pair with the S-VOLs in the two secondary sites by doing the following:
  - Specify the S-VOL of the first mirror in the secondary site as the P-VOL.
  - Specify the S-VOL of the second mirror in the secondary site as the S-VOL.
  - Specify from 0 to 3 for the mirror ID. Assign a mirror ID not used in steps 1 and 3.



**Note:** Specify the P-VOL and S-VOL for the delta resync pair for convenience. When you actually perform a delta resync operation, the failover destination site is used as the P-VOL.

6. Allocate remote command devices for each two mirror IDs in the primary site.
7. Allocate remote command devices for a mirror ID of the URz delta resync pair in each secondary site.



**Note:**

- When you delete a URz pair of the first mirror created in step 1 or delete a URz pair of the second mirror created in the step 3, the delta resync mirror's URz pair created in step 5 will also be deleted.
- Perform the pair operations by using CCI for the 3DC multi-target configuration with three URz sites.

## Workflow for 3DC cascade configuration with three URz sites

You must create two URz pairs for the two mirrors, create a delta resync pair, and allocate remote command devices to finish creating a 3DC cascade configuration with three URz sites.

When you create a 3DC cascade configuration with three URz sites, you must perform the following procedure after step 4 in [Configuration workflow \(on page 117\)](#).

1. Create a URz pair for the first mirror in the primary site. Specify from 0 to 3 for the mirror ID when you create a URz pair.
2. Wait until the URz pair status has changed to PAIR.

3. Create a URz pair for the second mirror in the intermediate site. Specify the restore journal volume and S-VOL for the master journal volume and P-VOL used in the first mirror. Specify from 0 to 3 for the mirror ID. Assign a mirror ID not used in step 1.
4. Wait until the URz pair status is changed to PAIR. When you set up the delta resync configuration, use the steps from 5 to 7.
5. Create a URz delta resync pair with the primary and secondary site volumes by doing the following:
  - Specify P-VOL for P-VOL in the primary site of the first mirror.
  - Specify S-VOL for S-VOL in the secondary site of the second mirror.
  - Specify from 0 to 3 for a mirror ID. Assign a mirror ID not used in the step 1 and 3.
6. Allocate remote command devices for each two mirror IDs in the primary site.  
Allocate remote command devices also for the URz delta resync pair's mirror ID.
7. Allocate remote command devices for the mirror ID in the intermediate site.
8. Allocate remote command devices for the mirror ID in the secondary site.



**Note:** When you delete a URz pair of the first mirror created in step 1 or delete a URz pair of the second mirror created in step 3, the delta resync mirror's URz pair created in step 5 will also be deleted.

## Defining Fibre Channel or iSCSI port attributes

Bidirectional ports must be set up on the primary and secondary storage systems for Universal Replicator for Mainframe command and data transfer.

### Before you begin

- Before a Fibre Channel or iSCSI target port can be changed to a bidirectional port, the following must be performed:
  - Disconnect the port from the host.
  - Release all affected pairs.
  - Delete all remote paths from the bidirectional port to the secondary storage system.
  - Remove all cables to the port.
- Before a Fibre Channel or iSCSI bidirectional port can be changed to target or RCU target, the following must be performed:
  - Release all affected pairs.
  - Delete all remote paths from the bidirectional port to the secondary storage system.
  - After remote paths are deleted, remove the cables connecting the primary storage system to the secondary storage system.
- To prevent disconnection, limit the number of hosts connected to the target port to 128 or less.

**Procedure**

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, and click **Ports/Host Groups/iSCSI Targets**
3. In the **Ports** tab, click the port whose attribute you want to change then click **Edit Ports**
4. In the **Edit Ports** window, select the **Port Attribute: Bidirectional**. If you need to specify other settings, see the *Provisioning Guide*.
5. Click **Finish**.
6. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Configuring primary and secondary storage systems for URz

You associate the primary and secondary storage systems in the Universal Replicator for Mainframe relationship and define the remote paths between them in one procedure. This procedure must be performed on both primary and secondary storage systems.

You can perform this task using BCM. For details, see the BCM documentation.

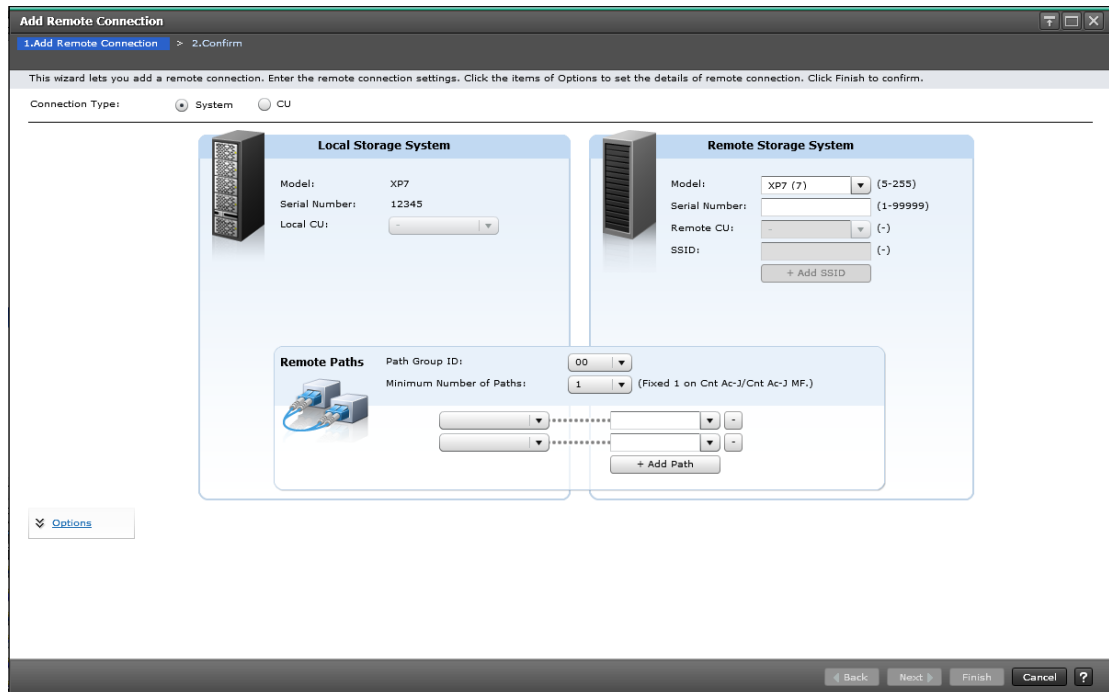
**Before you begin**

- The primary and secondary storage systems must already be configured for Universal Replicator for Mainframe operations. For details, see [System requirements \(on page 46\)](#).
- The data path must be set up. For details, see [Planning the data path \(on page 91\)](#).
- The port attributes on the primary and secondary storage systems must be configured for URz. For details, see [Defining Fibre Channel or iSCSI port attributes \(on page 119\)](#).
- The system's serial number and model will be required during this procedure.
- A path group ID will be required. This is a group of a maximum of remote paths. For details, see the Path Group item in [System requirements \(on page 46\)](#).

**Procedure**

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Connections**.
3. In the **Connections (To)** tab, click **Add Remote Connection**.
4. In the **Add Remote Connection** window, for **Connection Type**, select **System**.





5. In the **Remote Storage System** area, for **Model**, select the secondary storage system model and number.
  - For VSP 5000 series, select 8
    - If the local storage does not display VSP 5000 series (8) in the pull-down menu for **Model**, enter 8 to specify VSP 5000 series storage.
  - For VSP G1000, VSP G1500, and VSP F1500, select 7
  - For VSP, select 6
6. For **Serial Number**, enter the secondary storage system serial numbers (five or six digits).



**Note:**

- When the secondary storage system is VSP 5000 series, specify 5 + serial number (6 digits in total) in CCI, or specify the serial number only (5 digits in total) in Device Manager - Storage Navigator.
- When the secondary storage system is VSP G1x00 or VSP F1500, specify 3 + serial number (6 digits in total) in CCI, or specify the serial number only (5 digits in total) in Device Manager - Storage Navigator.

7. For **Path Group ID**, select the ID (00-FF) for the path group you want to use.
8. For **Minimum Number of Paths**, select the lowest number of paths between the secondary and primary storage system that you want your URz system to operate with (range = 1 to 8). If the number drops below this setting, the primary storage system will split the pair.
9. Select the primary and secondary Fibre Channel ports used by the data path.  
You can add more remote paths by clicking the **Add Path** button. For instructions, see [Configuring additional remote paths \(on page 122\)](#).

10. Click **Options** to enter **RIO MIH Time** (remote I/O missing interrupt handler), which is the waiting time from when copy starts until when it ends.

This value applies to the slots which received the request of copying data between storage systems. Exceeding the value causes the data transfer operation to be reported as failed by the system. Valid values range from 10 seconds to 100 seconds, and the default is 15 seconds.



**Note:** The recommended RIO MIH setting for a 3DC cascade configuration is 20 seconds.

11. Click **Finish**.
12. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Configuring additional remote paths

You can configure additional remote paths as needed. A maximum of eight remote paths can be configured between storage systems.

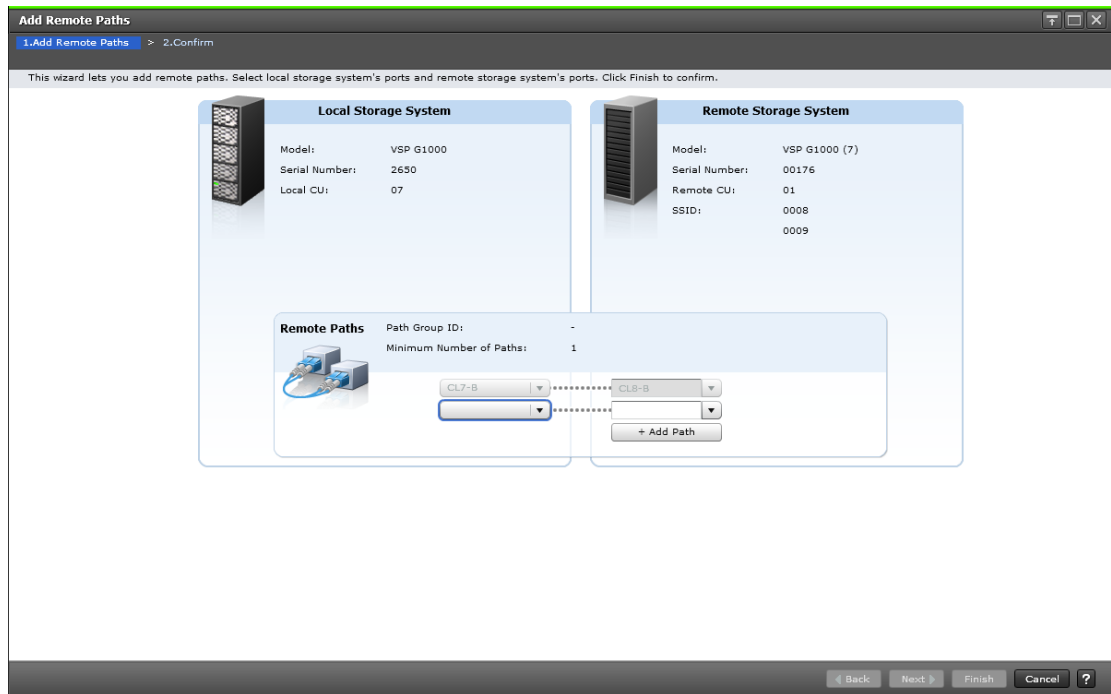
You can perform this task using BCM. For details, see the BCM documentation.

### Before you begin

- Review and understand the path-related prerequisites [Configuring primary and secondary storage systems for URz \(on page 120\)](#).

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Connections**.
3. In the **Connections (To)** tab, select the remote connection where you want to add remote paths.
4. Click **More Actions > Add Remote Paths**.
5. In the **Add Remote Paths** window, add a new remote path by selecting ports for the primary (left side) and secondary storage systems. You can make multiple selections. To add paths, click **Add Path**.



6. Click **Finish**.
7. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Enabling reporting of service SIMs

### Before you begin

- Required role: Storage Administrator (Remote Backup Management)
- Review the information about SIMs in [Service information messages \(SIMs\) \(on page 238\)](#).

### Procedure

1. Open the **Edit Remote Replica Options** window in Device Manager - Storage Navigator.
  - a. In the **Storage Systems** tree, click **Replication**.
  - b. From the **Actions** menu, click **Remote Replication > Edit Remote Replica Options**.
2. In the **Edit Remote Replica Options** window, for **Copy Type**, select **UR/URMF**.
3. Click the CU whose SIMs you want to enable or disable, and then click **Change CU Options**.
4. In the **Change CU Options** window, in **Services SIM of Remote Copy**, enable or disable reporting of SIMs to the host.
5. Click **Finish**.

6. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
7. Click **Apply** to save your settings to the system.

## Creating journals and adding journal volumes

You create journals and add and configure journal volumes in the same procedure.

For adding journal volumes to an existing journal, see [Adding an additional journal volume to an existing journal \(on page 167\)](#).

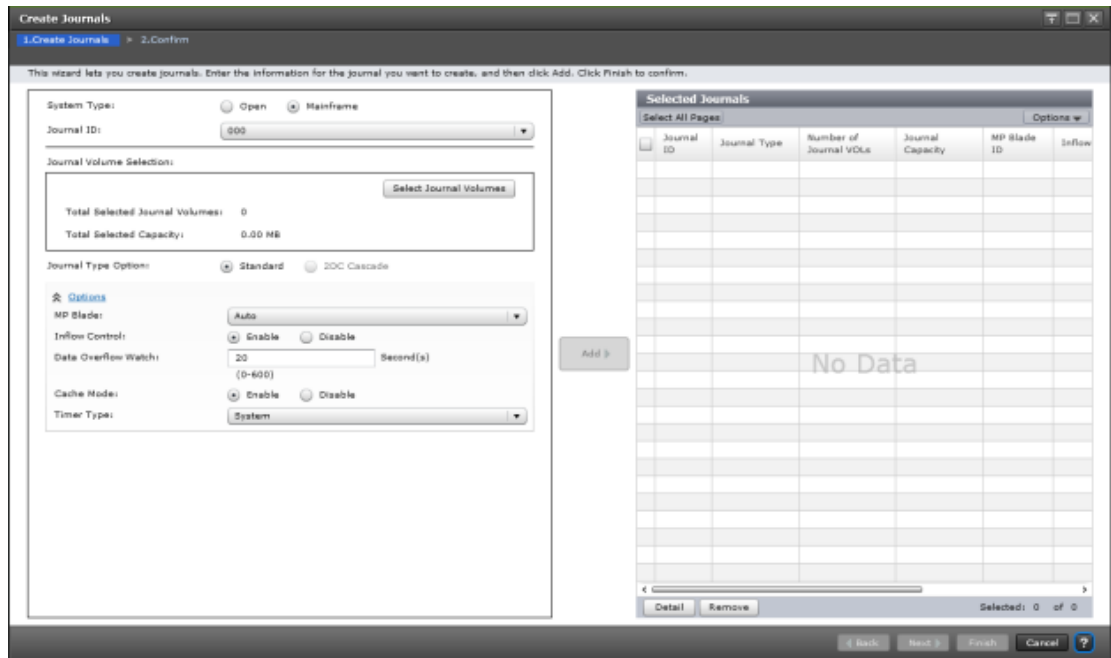
This task cannot be performed using BCM.

### Before you begin

- Review the following:
  - [System requirements \(on page 46\)](#)
  - [Planning journals \(on page 64\)](#)
  - [Planning journal volumes \(on page 65\)](#)
  - [Data and journal volume specifications \(on page 67\)](#)
- The journal's mirror status must be Initial, Active, Stopped, Hold, Holding, or Hold(Failure).
- The journal cannot be in use.
- Pair operations involving the journal cannot be in progress.
- If you will use EXCTGs, make sure to set them up before registering journals.
- Required role: Storage Administrator (Remote Copy).

### Procedure

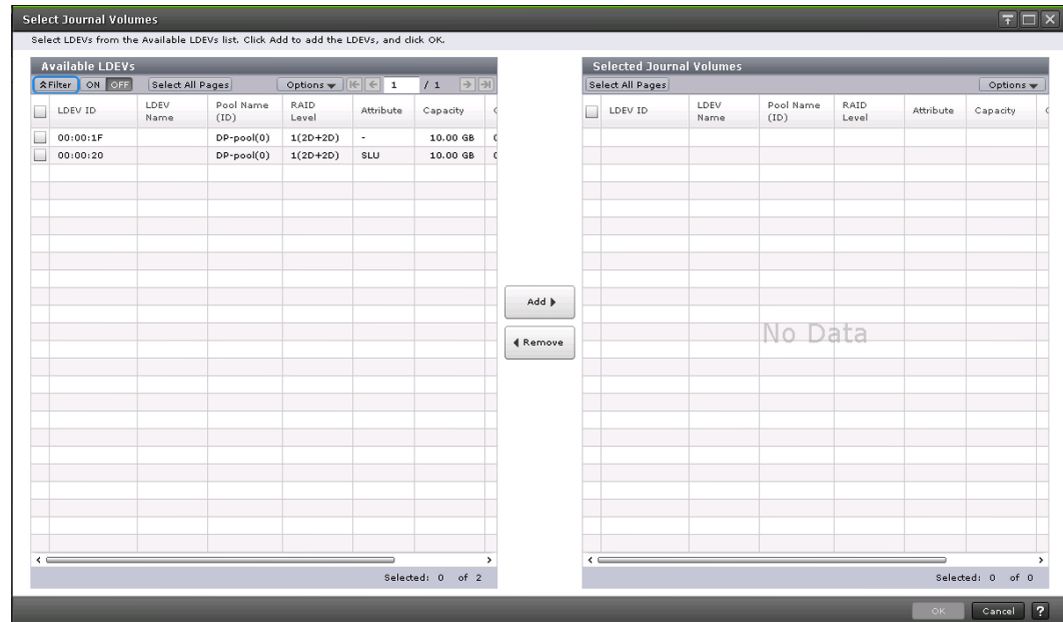
1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Journals**.
3. In the **Journals** tab, click **Create Journals**.
4. In the **Create Journals** window, for **System Type**, select **Mainframe**.




5. For **Journal ID**, select a journal ID from the list.
6. In the **Journal Volume Selection** box, click the **Select Journal Volumes** button.
7. In the **Select Journal Volumes** dialog box, from the **Available LDEVs** table, select the journal volumes (one or two) to be registered to the journal, and click the **Add** button. The volumes are now listed in the **Selected Journal Volumes** table.

To remove a volume from the **Selected Journal Volumes** table, select it and then click **Remove**.

Click **OK** when finished. If you register two journal volumes at the same time, the volume with the smaller LDEV number is registered as the journal volume, and the other volume is registered as the reserve journal volume.



8. In the **Create Journals** window, select a **Journal Type Option**.
    - Select **Standard** for journals in URz standalone pairs and pairs in a 3DC configuration.
  9. Optional: For **MP Unit**, you can specify an MP unit. **Auto** is available when one or more units can be assigned automatically. When **Auto** cannot be selected, the default is the unit with the lowest number.
  10. Optional: For **Inflow Control**, you can specify whether to restrict the flow of update I/O to the journal volume. Enabling this setting delays the response to hosts. Also, by restricting the inflow of data to one journal, you can allow other journals with higher-priority data unrestricted inflow.
    - **Enable** restricts inflow.
    - **Disable** leaves inflow unrestricted. With Disable selected, if metadata or journal data is full, update I/Os might stop.
  11. Optional: For **Data Overflow Watch**, you can specify the number of seconds for the system to monitor metadata and journal data when the journal volume is full (100%). Range is 0-600 seconds. The default is 20.
  12. Optional: For **Cache Mode**, you can specify whether to store journal data in the cache memory on the secondary side (restore journal).
    - **Enable**: Journal data will be stored in the cache. When there is insufficient space in the cache, journal data will also be stored into the journal volume. Enable is available only for journal volumes of RAID-5 or RAID-6.
    - **Disable**: Journal data will not be stored in cache but in the journal volume. Disable is the only setting possible for non-RAID-5 or RAID-6 journal volumes and external volumes.
-  **Note:** This setting does not affect master journals unless the Business Continuity Manager YKRESYNC REVERSE command is used to change a master journal into a restore journal.
13. Optional: For **Timer Type**, specify the type of clock used for consistency time. The specified value must be the same for the primary and secondary storage system.
    - **System**: Uses the mainframe host system clock. The host MVS IOS routine attaches time-stamp information from the time-of-day (TOD) clock to each write I/O operation. The time-stamp is transferred to the primary storage system at the beginning of each I/O operation.
    - **Local**: The mainframe system clock is not used.
    - **None**: Uses time stamp information from the host I/O time stamping function. None is available only when copy direction is reversed, that is, S-VOL-to-P-VOL.
  14. Click **Finish**.
  15. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Assigning an MP unit to a journal

You can assign an MP unit that controls journals.

**Note:** If you want to change MP unit IDs for multiple journals, wait for at least 10 minutes before changing another MP unit ID. In addition, after changing an MP unit ID, if you want to change the ID of the same journal, wait for at least 30 minutes. Waiting 30 minutes minimizes the possibility that changing the journal ownership might fail or that the UR pair might be suspended.

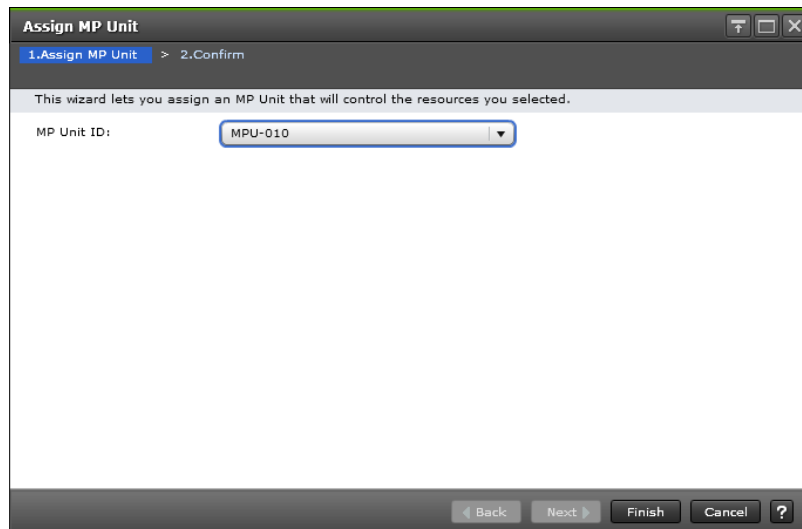
This task cannot be performed using BCM.

### Before you begin

- Required role: Storage Administrator (Remote Copy).

### Procedure

- In the **Explorer** pane, expand the **Storage Systems** tree.
- Expand the target storage system tree, expand **Replication**, and click **Journals**.
- In the **Journals** tab, select the journal you will add the unit to.
- Click **More Actions > Assign MP Unit**.
- In the **Assign MP Unit** window, for **MP Unit**, select a unit.



- Click **Finish**.
- In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Setting the remote replica options

You can set the following options using the Edit Remote Replica Options window:

- The number of volumes that can be copied concurrently in a single initial copy operation.
- The amount of time to monitor a path blockade.
- The amount of time to monitor the SIMs reported by a path blockade.

## Setting the maximum initial copy activities option

You can set the number of volumes that can be copied concurrently during pair creation and pair resynchronization using the Edit Remote Replica Options window (range = 1 to 128, default = 64). You can also change this setting later as needed.

This task cannot be performed using BCM.

### Before you begin

- Storage Administrator (Remote Copy) role is required.

### Procedure

- In the **Storage Systems** tree, select **Replication**.
- Click **Edit Options > Remote Replication**.
- In **Copy Type**, select **UR/URMF**.
- In **Maximum Initial Copy Activities**, enter a value from 1 to 128 as the number of volumes that can be copied concurrently during an initial copy operation. For example, if you specify 64 for **Maximum Initial Copy Activities** and then register 65 pairs concurrently, the local system starts the initial copy operations for the first 64 pairs. The initial copy operation for the 65th pair is started when one of the first 64 pairs becomes synchronized, so that no more than 64 initial copy operations are performed at the same time.



#### Note:

- The number of initial copy activities setting might affect the performance of the local storage system depending on the amount of I/O activity and the number of pairs that are registered concurrently.
- If you specify a large value, the number of pending activities in a remote storage system increases, and the response time of the remote I/Os for the update I/O operations might be affected.

- Click **Finish**.
- In the **Confirm** window, check the settings you made, and then enter the task name in **Task Name**.  
If you want to open the **Tasks** window automatically after closing this window, select **Go to tasks window for status**.
- Click **Apply**.  
The task is registered, and the **Tasks** window appears if **Go to tasks window for status** was selected.
- You can check the progress of the task on the **Tasks & Alerts** tab. Click the task name to view details of the task.

## Setting the blocked-path monitoring and blocked-path SIM monitoring options

You can set the period of time to monitor a blocked path and the time to monitor SIMs that are reported by a blocked path using the Edit Remote Replica Options window.



You can also change these settings later as needed.

- Blocked Path Monitoring: range = 2 to 45 seconds
- Blocked Path SIM Monitoring: range = 2 to 100 seconds

This task cannot be performed using BCM.

### Before you begin

- Storage Administrator (Remote Copy) role is required.

### Procedure

1. In the **Storage Systems** tree, select **Replication**.
2. Click **Edit Options > Remote Replication**.
3. In **Copy Type**, select **TC/TCMF**.  
These values are necessary for setting **Blocked Path Monitoring**, and are used for TC, TCz, UR, URz, and GAD operations.
4. In **Blocked Path Monitoring**, enter a value from 2 to 45 (sec.) as the time to monitor a path blockade.
5. In **Blocked Path SIM Monitoring**, enter a value from 2 to 100 (sec.) as the time to monitor SIMs that are reported by a path blockade.
6. Click **Finish**.
7. In the **Confirm** window, check the settings you made, and then enter the task name in **Task Name**.
8. Click **Apply**.  
The task is registered, and the **Tasks** window appears if the **Go to tasks window for status** check box is selected.
9. You can check the progress of the task on the **Tasks & Alerts** tab. Click the task name to view details of the task.

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## Chapter 7: URz pair operations

You perform different tasks on URz pairs in day to day operations as a Storage Administrator.

### Pair operations

You must have Storage Administrator (Remote Copy) role to perform Universal Replicator for Mainframe pair operations. The pair operations are:

- [Checking the pair status \(on page 135\)](#)
- [Creating a URz pair \(on page 131\)](#)
- [Splitting a URz pair \(on page 136\)](#)
- [Splitting a mirror \(on page 138\)](#)
- [Creating point-in-time copies \(on page 139\)](#)
- [Resynchronizing a URz pair \(on page 140\)](#)
- [Resynchronizing a mirror \(on page 142\)](#)
- [Deleting a URz pair \(on page 143\)](#)
- [Deleting a mirror \(on page 145\)](#)

You should be aware of the following behaviors when performing pair operations:

- When you perform pair operations between the primary and intermediate sites or between the intermediate and secondary sites in a 3DC cascade configuration in which three URz sites are combined, make sure that the pair operations are not performed in other sites.

If the pair operations are duplicated, either one of the pair operations might fail. When performing pair operations between other sites, make sure the pair status transition to the required status is completed before performing pair operations in another site.

- The pair operation and pair status cannot be verified using the GUI for data volumes for which the LU path settings have been canceled.

Configure the LU path settings in advance for the volume that is to be operated using Storage Navigator or whose pair status is to be verified.

- The pair operation cannot be performed during the firmware replacement.

Verify that the firmware replacement is complete, and then perform the pair operation.

- The pair operation cannot be performed if the firmware replacement is stopped when an error occurs or when Cancel is clicked.

Verify that the firmware replacement is complete correctly, and then perform the pair operation.

- If the maintenance operations are performed for the controller boards, or the shared memory is installed or removed on the primary storage system during the initial copy operation after a pair is created or resynchronized, the primary storage system suspends this pair.

## Creating a URz pair

When you create a pair, the pair relationship between the volumes is established, and the initial copy operation is performed. The P-VOL remains available to the host for I/O operations during the initial copy operation.

You can perform this task using the **YKMAKE** command. For details, see the BCM documentation.

### Before you begin

- You can create a pair only from the primary storage system.
- The S-VOL must be offline to all hosts.
- The primary and secondary storage systems must already be configured, and the remote paths must already be defined. For details, see [Configuring primary and secondary storage systems for URz \(on page 120\)](#).
- The P-VOL capacity and S-VOL capacity must be the same (same number of cylinders). To view the capacity in cylinders, click Options > Capacity Unit > Cyl in the Logical Devices window. If the capacity is displayed in GB or TB, a slight difference in P-VOL and S-VOL capacity might not be displayed.
- Journal volumes must be registered to the journals that are associated with pairs. For details, see [Creating journals and adding journal volumes \(on page 124\)](#).
- When you create a pair using Device Manager - Storage Navigator, you cannot specify a consistency group. When you create a pair using BCM or CCI, the journal group is the consistency group. The consistency group ID is displayed as "0" in CCI for pairs created by using Device Manager - Storage Navigator.
- When creating multiple pairs in a batch, you must set the number of volumes that can be copied concurrently during an initial copy operation in the storage system. For details, see [Setting the maximum initial copy activities option \(on page 128\)](#).
- If you are creating a URz delta resync pair, see [Delta resync configuration \(on page 250\)](#).
- Make sure that Performance Monitor is stopped.

The following additional information might be useful to you before beginning the procedure:

- You will select the volumes to be paired by CU and LDEV numbers. Make sure to have this information available.
- You will assign master and restore journals to the P-VOL and S-VOL during the operation.

- You will assign a mirror ID to the pair. This identifies the pair within the journal. A mirror refers to the pair within the journal.
- If the mirror ID you will assign to the new pair contains an existing pair or pairs, the new pair's volumes must belong to the same primary and secondary storage systems defined in the mirror.
- In a 3DC multi-target configuration in which three URz sites are combined, you cannot create a URz pair with the second mirror if the first URz P-VOL is in the COPY status.
- In a 3DC cascade configuration in which three URz sites are combined, you cannot create a URz pair between the intermediate and secondary sites if the URz S-VOL between the primary and intermediate sites is in the COPY status.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **UR Pairs** tab, click **Create UR Pairs**.
4. In the **Create UR Pairs** window, for **Copy Type**, select **Universal Replicator for Mainframe**.

### Create UR Pairs

1.Create UR Pairs > 2.Confirm

This wizard lets you create pairs. Enter the information for the pair you want to create, and then click Add. C

Copy Type: Universal Replicator for Mainframe

Remote Storage System: Model / Serial Number Path Group ID  
VSP G1000 / 00050 00

Primary Volume Selection:

Use Existing Volumes of URMF Pairs:  Yes  No

**Available Primary Volumes**

Filter ON OFF Select All Pages Options 1 / 18

<input type="checkbox"/>	LDEV ID	LDEV Name	Pair Position	Journal ID	Mirror ID	Pr Ty
<input type="checkbox"/>	00:00:20	MF_Pool				Ba
<input type="checkbox"/>	00:0E:00	DP_MF				Ba
<input type="checkbox"/>	00:0F:00	JNL_MF				Ba
<input type="checkbox"/>	00:0F:01	JNL_MF				Ba
<input type="checkbox"/>	00:0F:02	JNL_MF				Ba
<input type="checkbox"/>	00:0F:03	JNL_MF				Ba

Selected: 0 of 17281

Secondary Volume Selection:

Base Secondary Volume: LDKC CU LDEV  
00 00 00

Selection Type:  Interval 0  
 Relative Primary Volume

Mirror Selection: Master Journal Mirror ID Restore Journal  
010 0 000  
(000-OFF)

Current Number of Master Journal Mirrors: 0  
Total Number of Master Journal Mirrors: 0

[Options](#)

5. For **Remote Storage System**, select the secondary storage system's **Model/Serial Number** and **Path Group ID**.

If the mirror contains an existing pair, the same **Model/Serial Number** as the existing pair's must be selected.

6. In the **Primary Volume Selection** box, for **Use Existing Volumes of URMF Pairs**, select whether to use the volume used by the URz pair.
  - Select **Yes** if you are creating a pair in a 3DC multi-target configuration or a pair in a 3DC cascade configuration with three URz sites.
  - Select **No** if you are not creating a pair in a 3DC multi-target configuration or a pair in a 3DC cascade configuration with three URz sites.
7. In the **Primary Volume Selection** box, in **Available Primary Volumes**, select the volume to be the P-VOL
8. In the **Secondary Volume Selection** box, for **Base Secondary Volume**, select the S-VOL's **CU** number and **LDEV**.



**Caution:** For VSP, LDEV IDs are displayed in hexadecimal numbers. For VSP 5000 series, VSP G1000, VSP G1500, and VSP F1500, LDEV IDs display in decimal or hexadecimal numbers. If you have selected the decimal notation, when assigning an S-VOL in a VSP storage system, make sure to convert the hexadecimal LDEV ID number to decimal.

9. For **Selection Type**, select the method for assigning S-VOLs when multiple primary volumes are selected, **Interval** or **Relative Primary Volume**. See "Before you begin" for more information.
10. For **Mirror Selection**, specify the following:
  - a. For **Master Journal**, select a number from the list of registered journal IDs. The list excludes already-assigned master and restore journal IDs.
 

**Note:** If you selected **Yes** for **Use Existing Volumes of URMF Pairs** in the **Primary Volume Selection** box, **Depends on Selected P-Vols** is selected for **Master Journal**.
  - b. For **Mirror ID**, assign an identifier number for the mirror.
  - c. For **Restore Journal**, select a number from the list of registered journal IDs. All journal IDs display (000-OFF).
11. Click **Options** to define the following optional settings:
  - a. For **Initial Copy Type**, you can specify whether to copy data from P-VOL to S-VOL during the operation.
    - **Entire** creates the pair and copies data to the S-VOL. (Default)
    - **None** creates the pair but data is not copied to the S-VOL. This requires that data in the P-VOL and S-VOL are already identical.
    - **Delta** creates the delta resync pair but data is not copied to the S-VOL.

- b. For **Initial Copy Priority**, you can specify the scheduling order for this initial copy operation. Range is 1 to 256 (default = 32).

If a time out error occurs, the copy operation may not be executed in the order that you set with Initial Copy Priority. The time out error may be caused by the CU configuration or a remote copy path error. Review the error, release the pair with the error, and then retry the Paircreate operation.

- c. In the **Error Level** list, you can select one of the following system responses if a failure occurs during this operation:

- **Mirror**, to split all pairs in the failed pair's mirror. **Mirror** is the default.

However, if a volume failure occurs while the pair status is Pending, only the target pair in the mirror is split, even if **Mirror** is specified.

- **Volume**, to split only the pair that failed.

- d. In the **CFW** box, you can select one of the following to specify whether to copy cache-fast-write data to the S-VOL or not:

- **Primary Volume Only** (default): Does not copy cache-fast-write data to the S-VOL. Note that if the P-VOL fails and the host attempts to read the same data from the S-VOL when this option is used, I/O may end abnormally.

- **Secondary Volume Copy**: Copies cache-fast-write data to the S-VOL.

12. When ready, click **Add**. This moves the new pair to the **Selected Pairs** table. (To remove a pair from the table, select the pair and click **Remove**).
13. Click **Finish**.
14. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

### Result

Based on the initial copy option you selected, you can verify that the pair status is correct in the Remote Replication window. The following table specifies the pair status required to successfully complete the operation.

Initial Copy Option	Pair Status Requirement
Entire or None	Pending or Duplex
Delta	Hold, Holding

You can also monitor the progress of the operation by clicking File > Refresh in the menu bar. This updates the information in the list.

## Checking the pair status

Every URz operation requires that the pairs have a specific status. You should always check the pair status before performing any URz operation.

You can perform this task using the **YKQUERY** command. For details, see the BCM documentation.

**Before you begin**

- The pair status requirements are listed in the prerequisite information for each procedure (in "Before you begin").
- To review the definitions of the pair statuses, see [Pair status definitions \(on page 31\)](#).

**Procedure**

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. Select the **UR Pairs** tab, and then locate the desired pair in the list. The pair status is displayed in the **Status** column. Click **File > Refresh** as needed to display the most current pair status information in the **Remote Replication** window.
4. To view detailed pair properties, select the pair, and then click **More Actions > View Pair Properties**.

Pair Detail	
Status	Duplex / DUPLEX(02)
Processing Status	-
CTG ID	-
Sub Status	-
Reverse Resync	-
Error Level	Mirror
Secondary Volume Write	Disabled
Initial Copy Priority	32
Paired Time	2019/01/19 00:03:18
Last Update Time	2019/01/19 00:03:19
Pair Copy Time	000:00:01
Consistency Time	-
Timer Type	System
CFW	Primary Volume Only
Local Storage System	Virtual Storage Machine
	Virtual LDEV ID
	Virtual Device Name
	Virtual SSID
Remote Storage System	Virtual Storage Machine
	Virtual LDEV ID

## Splitting a URz pair

When you split a pair, write-data is no longer sent to the S-VOL and the pair is no longer synchronized. Splitting a pair or mirror gives you a point-in-time copy of the P-VOL.



The following information might be useful before beginning the procedure:

- Performing the pair split when I/O load is low reduces impact on performance. Operations on multiple pairs in the same consistency group with different statuses may result in suspension during periods of heavy write I/O.
- If you split pairs in Duplex status and other than Duplex status in the same mirror, an unexpected suspension could occur during the operation under heavy I/O load conditions. You can estimate whether the I/O load is heavy or not from frequency of host I/Os. This operation should be performed under light I/O load conditions.
- During normal operations, the secondary storage system rejects write operations to an S-VOL. If desired, you can enable write operations to the S-VOL while the pair is split by enabling the S-VOL write option. When this option is enabled, the secondary storage system sends the S-VOL track bitmap to the primary storage system during pair resync to ensure proper resynchronization of the pair. The S-VOL write option (Secondary Volume Write) is described in the pair-split procedure.

You can perform this task using the `YKXSUSPND` command. For details, see the BCM documentation.

### Before you begin

- This operation can be performed from the primary or secondary storage system.
- Pair status must be Pending or Duplex.
- To split multiple pairs at the same time, the pairs must belong to the same mirror. This ensures sequence consistency among S-VOLs in the mirror.
- Pairs in a CCI consistency group consisting of multiple primary and secondary storage systems can only be split in the mirror.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **UR Pairs** tab, select the pairs to be split and click **Split Pairs**.
4. In the **Split Pairs** window, review the pairs to be split in the **Selected Pairs** table. To remove a pair from the table, select the pair and click **Cancel**.

5. For **Secondary Volume Write**, specify whether data can be written to the S-VOL while it is split. Available only when performing the split operation from the pair's primary storage system.
  - **Enable**: The host can write data to the S-VOL.
  - **Disable**: The host cannot write data to the S-VOL.



**Note:** In a 3DC configuration in which three URz sites are combined, host I/O write requests to the split pair's S-VOL might be rejected when the delta resync pair shares the split S-VOL, even if you split a pair with the Secondary Volume Write option enabled.

6. Click **Finish**.
7. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Splitting a mirror

A mirror normally has multiple pairs with the same master and restore journals groups. When you split a mirror, you split all the pairs in the mirror. As with a normal pair split, data copying is suspended between primary and secondary journals.

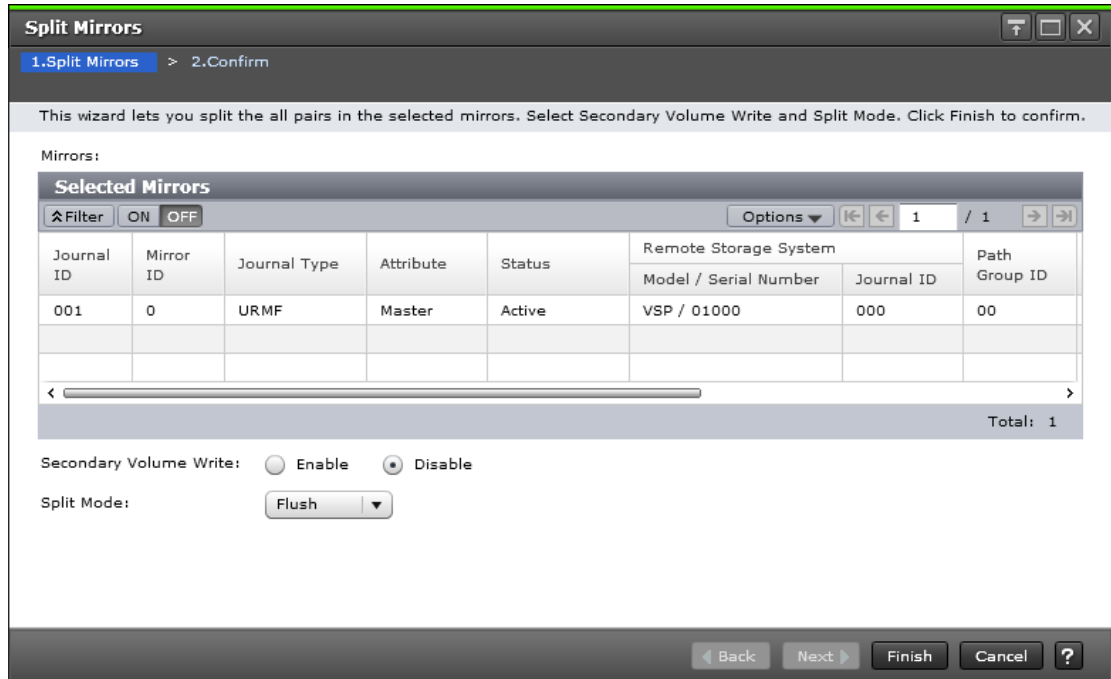
You can perform this task using the `YKSPND` command. For details, see the BCM documentation.

### Before you begin

- A mirror can be split from the primary or secondary storage system.
- Pair status must be Active.

## Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. On the **Mirrors** tab, select the mirrors to be split and click **Split Mirrors**.
4. In the **Split Mirrors** window, review the mirrors that you selected in the **Selected Mirrors** table. To remove a mirror, select it and click **Cancel**.



5. For **Secondary Volume Write**, specify whether data can be written to S-VOLs in the mirror while it is split.
  - **Enable**: The host can write data to S-VOLs in the mirror. Available only when the selected mirror's Attribute is Master. If Restore, Disable is used automatically.
  - **Disable**: The host cannot write data to S-VOLs in the mirror.
6. For **Split Mode**, specify whether data is written to S-VOLs in the mirror before the split operation runs.
  - **Flush**: Copies all update data from to S-VOLs in the mirror before the split.
  - **Purge**: Prevents update data from being copied to S-VOLs in the mirror before the split. Uncopied data is copied to the S-VOL when the pair is resynchronized.
7. Click **Finish**.
8. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Creating point-in-time copies

Universal Replicator for Mainframe allows you to make Point-in-Time (PIT) copies of volumes in the same journal. Point-in-Time describes a copy of data made at a specific time.

You can perform this task using the **YKSUSPND** command. For details, see the BCM documentation.

### Before you begin

- Review the prerequisite information (in "Before you begin") in [Splitting a mirror \(on page 138\)](#).

### Procedure

1. Stop all write I/Os from hosts to P-VOLs in the journal.
2. Split the mirror. Make sure to specify **Flush** for **Split Mode**.
3. When the status of all pairs in the journal changes to Suspend, the operation is completed. Resume write I/O to the P-VOLs.

## Resynchronizing a URz pair

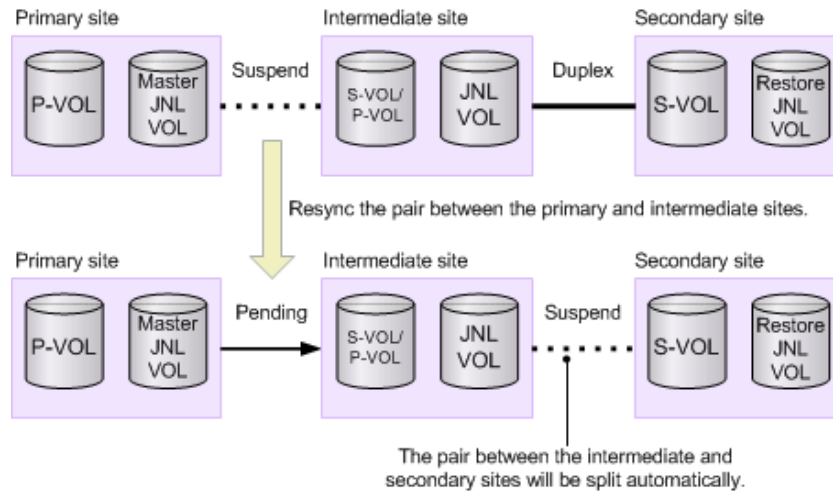
Resynchronizing a pair updates the S-VOL with differential data that accumulated since the pair was split. After the pair is resynchronized, the S-VOL is again updated from the journals.

You can perform this task using the **YKRESYNC** command. For details, see the BCM documentation.

### Before you begin

- This operation is performed from the primary storage system only.
- The pair status must be Suspend.  
If pair status is Hold, Holding, or Hlde, use the resynchronizing mirrors operation (see [Resynchronizing a mirror \(on page 142\)](#)).
- In a 3DC multi-target configuration with three URz sites, you cannot resynchronize the other mirror's URz pair when one mirror's URz P-VOL is in the Pending status.

- In a 3DC cascade configuration with three URz sites, you cannot resynchronize the URz pair between the primary and intermediate sites when the URz pair between the intermediate and secondary sites is in the Pending status, as illustrated in the following figure.



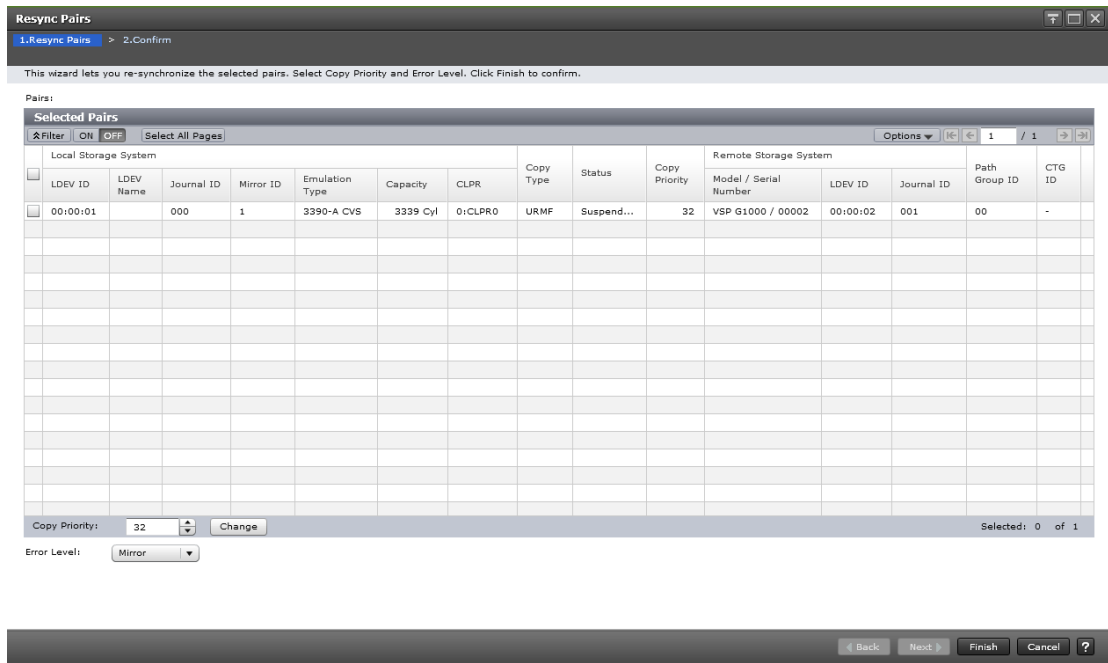
- In a 3DC cascade configuration with three URz sites, the pair between the intermediate and secondary sites will be split automatically when you resync the URz pair between the primary and intermediate sites, if the URz pair between the intermediate and secondary sites is in the Duplex status.
- Pairs suspended by the system (Suspend status) can be resynchronized only after the error causing the suspension has been corrected.

The following additional information might be useful before beginning the procedure:

- Performing the operation on a pair in Hide status changes the status to Hold.
- The primary storage system does not resynchronize a pair that is suspended due to an error until the cause of error is resolved.
- If P-VOL status is Failure and S-VOL status is unpaired, the pair cannot be recovered by resynchronizing. It must be deleted and created again.
- Resynchronizing pairs when I/O load is low reduces impact on performance. Operations on multiple pairs in the same mirror with different statuses may result in suspension during periods of heavy write I/O.
- If you resynchronize pairs in Duplex status and other than Duplex status in the same mirror, an unexpected suspension could occur during the operation under heavy I/O load conditions. You can estimate whether the I/O load is heavy or not from frequency of host I/Os. This operation should be performed under light I/O load conditions.

### Procedure

- In the **Explorer** pane, expand the **Storage Systems** tree.
- Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
- In the **UR Pairs** tab, select the pairs to be resynchronized and click **Resync Pairs**.
- In the **Resync Pairs** window, review the pairs in the **Selected Pairs** table. You can remove a pair from the table by selecting it and clicking **Cancel**.



5. For **Copy Priority** list, specify the scheduling order for resynchronizing selected pairs, between 0 and 256.
6. For **Error Level**, specify the system response if a failure occurs during this operation.
  - **Mirror**: Splits all pairs in the failed pair's mirror.  
However, if a volume failure occurs while the pair status is Pending, only the target pair in the mirror is split, even if **Mirror** is specified.
  - **Volume**: Splits only the specified pair or pairs that failed.
7. Click **Finish**.
8. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Resynchronizing a mirror

When you resynchronize a mirror, all the pairs with the mirror ID are resynchronized and update data copy to the S-VOL is resumed.

When you use URz with TCz and a mirror to which the delta resync pair belongs is resynchronized, the delta resync operation is performed.

You can perform this task using the **YKRESYNC** command. For details, see the BCM documentation.

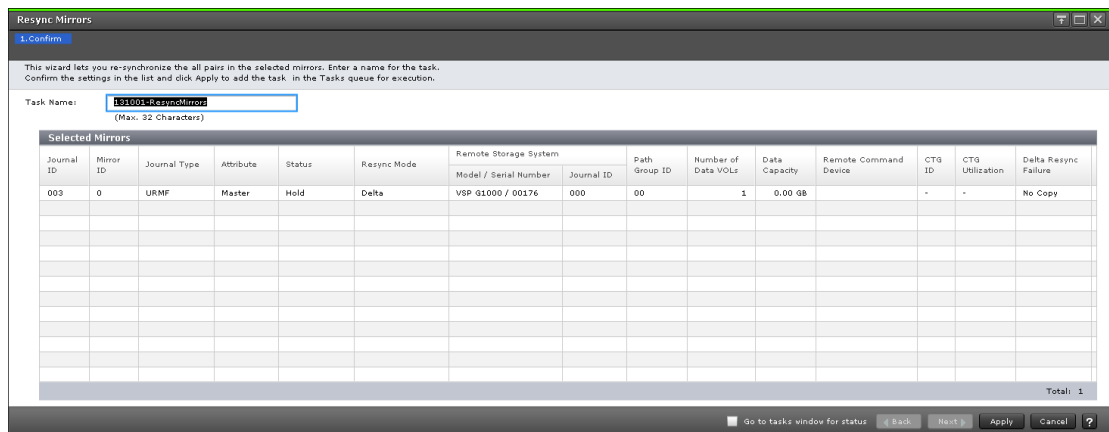
### Before you begin

- Perform this task only from the primary storage system.
- Mirror status must be Stopped, Hold, Holding, or Hold(Failure).
- Device Manager - Storage Navigator does not support multiple primary and secondary storage systems in a URz system. In this case, use BCM to restore a mirror.

- Resynchronizing a mirror when I/O load is low reduces impact on performance.
- If performing the delta resync operation, make sure to review [Performing the delta resync operation \(on page 261\)](#).

## Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. On the **Mirrors** tab, select the mirrors to be resynchronized, delta resynchronized, or changed from Hold(Failure) to Hold status, and then click **Resync Mirrors**.
4. In the **Resync Mirrors** window, review the mirrors in the **Selected Mirrors** table. You can remove a mirror from the table by selecting it and clicking **Cancel**.



5. Click **Finish**.
6. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Deleting a URz pair

When you delete a pair, the URz relationship between the P-VOL and S-VOL is released. Only the relationship is affected, the data volumes and their data remain.

You can perform this task using the **YKDELETE** command. For details, see the BCM documentation.



**Note:** In a delta resync configuration with TCz, if you want to delete some URz pairs in a consistency group, split the pairs for each consistency group before deleting them. After that, resynchronize the pairs for each consistency group. In a delta resync configuration with TCz, if you delete some URz pairs without splitting pairs for each consistency group, you need to split and resynchronize them for each consistency group after the deletion.

### Before you begin

- You must have the Storage Administrator (Remote Copy) role.
- This operation can be performed from the primary or secondary storage system.

- When S-VOLs are physically attached to the same host as P-VOLs, take the S-VOLs offline before releasing the pair. Doing this avoids confusion and possible error when the host is restarted.
- Pairs must be in Suspend status when their journal is in a CCI consistency group consisting of multiple primary and secondary storage systems. If all pairs in the journal are not in Suspend status, you can delete the desired pairs individually, or select Mirror in the Range field, which deletes all pairs in the pair's mirror.

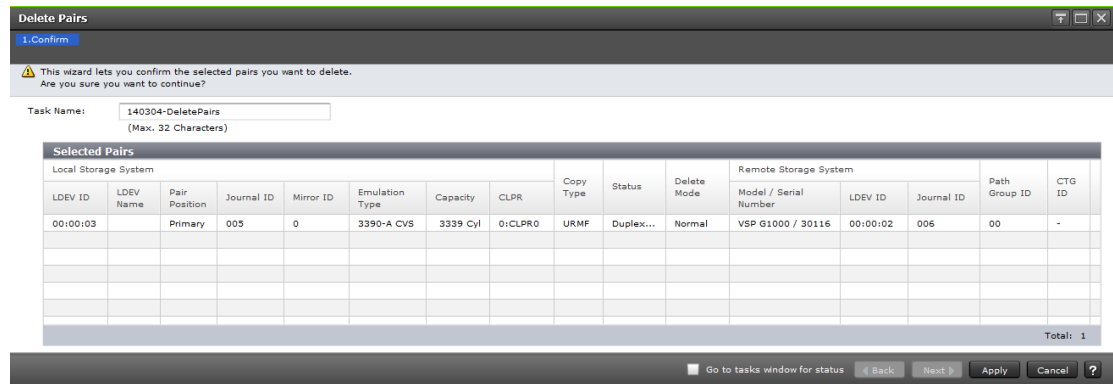
The following additional information might be useful to you before beginning the procedure:

- When a pair deletion is initiated, differential data is transferred from the S-VOL, the pair relationship is ended, and the volumes' status becomes unpaired.
- Pairs should be in Duplex status to ensure data consistency between volumes. However, a pair can be deleted in any status except Suspending or Deleting.
- If you delete a URz pair between the intermediate and secondary sites in a 3DC cascade configuration in which three URz sites are combined, change the status of the mirror between the primary and the intermediate sites to Stopped, or change the status of the pair you want to delete to Suspending.
- If the operation fails, the P-VOL nevertheless becomes unpaired, but transfer of differential data to the S-VOL is terminated.
- If you plan to delete all pairs in the journal and then create another pair, be sure to wait at least one minute after deleting the pairs before creating the new pair.
- Perform pair deletion when write I/O load is low to reduce impact on performance. Operations on pairs with different status in the same mirror may result in suspension during periods of heavy write I/O.
- If you delete pairs in Duplex status and other than Duplex status in the same mirror, an unexpected suspension could occur during the operation under heavy I/O load conditions. You can estimate whether the I/O load is heavy or not from frequency of host I/Os. This operation should be performed under light I/O load conditions.
- In a delta resync configuration with TCz, if you release the TCz pair, the URz delta resync pair is released as well. If you release the URz pair, the URz delta resync S-VOL is released.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **UR Pairs** tab, select the pairs to be deleted and click **More Actions > Delete Pairs**.
4. In the **Delete Pairs** dialog box, review the pairs in the **Selected Pairs** table. To remove a pair from the table, select the pair and click **Cancel**.





5. For **Delete Mode**, **Normal** is used for URz.



**Caution:** Note the following:

- Forced deletion in the primary storage system results in data that was not yet sent to the secondary storage system being deleted.
- Forced deletion in the secondary storage system results in data that was not yet restored being deleted.
- If pair status has not changed to Simplex five minutes after you forcibly delete the pair, delete it again.
- Make sure not to re-create the pair in the first five minutes after forcibly deleting it using the same journals (mirrors), even if pair status is Simplex and journal status is Initial: in this case pair creation could fail and the pair might suspend.
- A time-out error can occur at the time of a forced deletion if I/O is sent to another pair in the same journal and the pair's status is Duplex or Pending.

6. Click **Finish**.

7. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

## Deleting a mirror

When you delete a mirror, data copying between master and restore journals ends. After deleting the mirror, pairs in the mirror are also deleted.

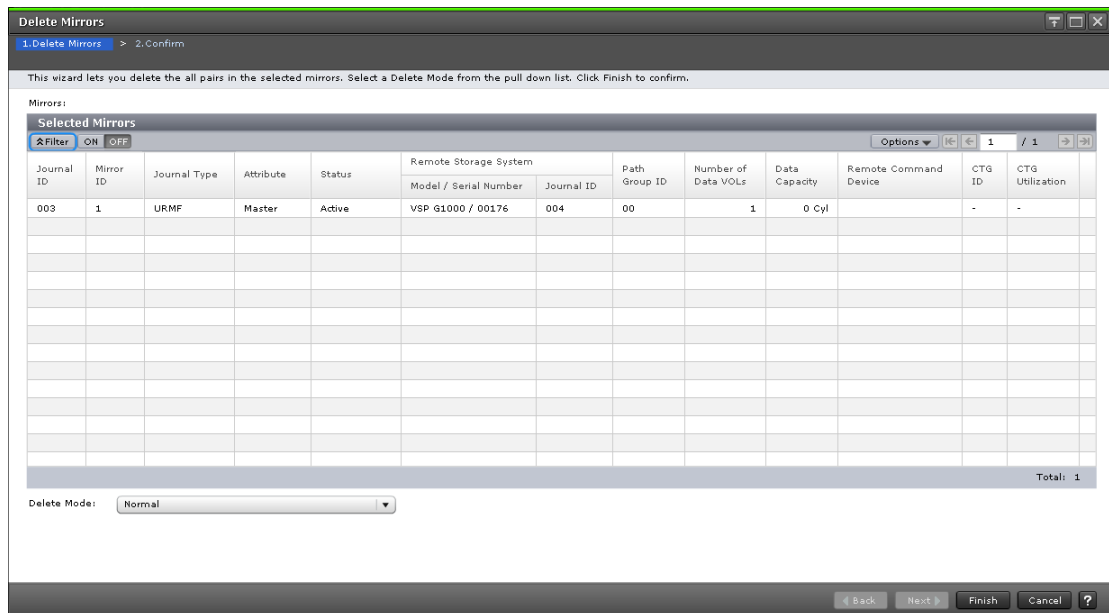
You can perform this task using the **YKDELETE** command. For details, see the BCM documentation.

## Before you begin

- This operation can be performed from the primary or secondary storage system.
- When you delete a mirror between the intermediate and secondary sites in a 3DC cascade configuration in which three URz sites are combined, change the status of the mirror between the primary and the intermediate sites to Stopped, or change the status of the mirror between the intermediate and secondary sites to Stopped.
- If a journal includes two mirrors:
  - If you specify a mirror in Hold, Holding, or Hold(Failure) status, only the URz pairs of the specified mirror are deleted.
  - If you specify a mirror that is not in Hold, Holding, or Hold(Failure) status, URz pairs of both mirrors (including the mirror that you did not specify) are deleted.

## Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. On the **Mirrors** tab, select the mirrors to be deleted, and then click **More Actions > Delete Mirrors**.
4. In the **Delete Mirrors** dialog box, review the mirrors in the **Selected Mirrors** table.



5. For **Delete Mode**, specify one of the following:
  - **Normal**: Mirrors are deleted only if the primary storage system can change the mirror status to Initial.
  - **Force**: Mirrors are forcibly deleted even when the primary storage system cannot communicate with the secondary storage system.
6. Click **Finish**.
7. In the **Confirm** window, review the settings, enter a task name, and then click **Apply**.

### Next steps



**Note:** If the journal (mirror) status is not Initial, even though you deleted pairs forcibly and five minutes have passed, perform the operation again to delete all pairs registered to the mirror.

Do not create pairs with the same journal for at least five minutes, even if the journal status was Initial; otherwise pair creation could fail and the pair would be suspended.

---

## Chapter 8: Monitoring the URz system

You can monitor how well Universal Replicator for Mainframe is performing, which allows you to detect and correct issues.

### Monitoring pair activity, status, license capacity

Monitoring pairs, journals, data paths, I/O, licensed capacity, and hardware performance is essential for ensuring that Universal Replicator for Mainframe pairs continue to function correctly.

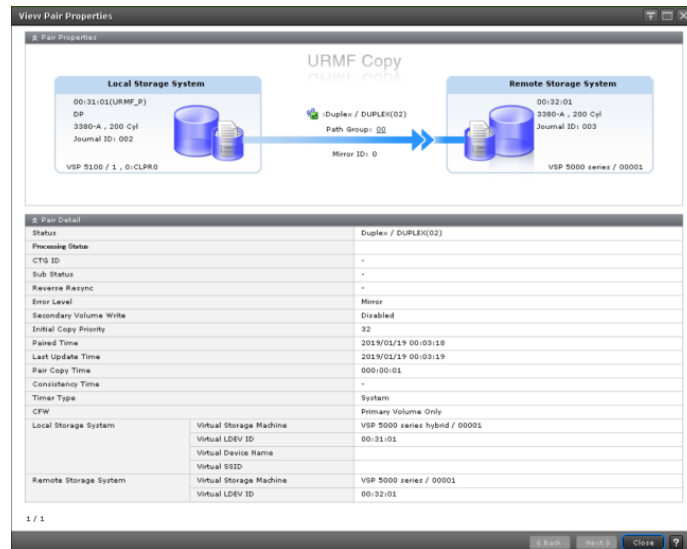
- Before performing a pair operation, check the pair status to verify that the desired operation can be performed. For details about the pair statuses, see [Pair status definitions \(on page 31\)](#).
- The pair status changes when an operation is performed. If the pair status is Duplex, data update is executed correctly from the P-VOL to the S-VOL. If the pair status is Suspend, the pair is split or suspended, and therefore differential data is managed.

Frequent monitoring of the system is recommended but optional. You can set up automatic e-mail notification from Device Manager - Storage Navigator for problems found during monitoring.

You can perform this task using the `YKQUERY` command. For details, see the BCM documentation.

#### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **UR Pairs** tab, select the pair that you want to monitor.
4. Click **More Actions > View Pair Properties**.
5. In the **View Pair Properties** window, you can display only the columns you want to see by clicking **Filter**. Click **File/Refresh** as needed to display the most current information.



- To review license capacity, see the **Summary** area in the **Replication** window.

## Monitoring URz pair synchronization rate

You can check the percentage of synchronized data between the P-VOL and S-VOL.

You can perform this task using the **YKQUERY** command. For details, see the BCM documentation.

The synchronization rate is displayed in HDvM - SN as follows.

- When the volume on the local storage system is a P-VOL, the initial copy progress is displayed. For initial copy of a URz pair, the control cylinder data is also copied. During the control cylinder copy, the synchronization rate is displayed as 99. When the control cylinder copy completes, the synchronization rate changes to 100.
- When the volume on the local storage system is an S-VOL, the synchronization rate depends on whether the pair is split:
  - If the pair is not split, a hyphen (-) is displayed.
  - If the pair is split, the S-VOL synchronization rate between before and after the split is displayed. For example, if the S-VOL content before and after the split is the same, 100 is displayed.



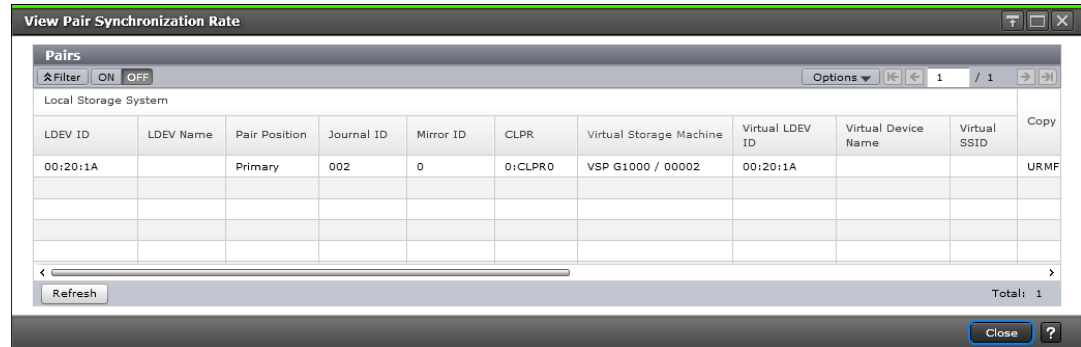
**Caution:** If the pair is split due to initial copy failure, a hyphen (-) is displayed. If initial copy fails, the status Initial copy failed is displayed in the View Pair Properties window.

- For the following cases, a hyphen (-) is displayed:
  - When the volume in the local storage system is neither a P-VOL nor an S-VOL.
  - When the volume in the local storage system has one of the following pair statuses: Hold, Holding, or Hlde.

**Procedure**

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **UR Pairs** tab, select the pair whose synchronization rate you want to monitor.
4. Click **More Actions > View Pair Synchronization Rate**.

Clicking **Refresh View** displays the latest synchronization rate.



## Monitoring URz operations history

In HDvM - SN, you can review the history of operations for each pair, including a description of each operation, the date and time the operation took place, primary and secondary storage system information, and other details.

This task cannot be performed using BCM.



**Note:** If you use 1,000 or more pairs concurrently, some operation history might not be recorded.

**Procedure**

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, and click **Replication**.
3. Click **View History > Remote Replication**.
4. In the **History** window, select **URMF** as the **Copy Type**.

## Pair operations history

The following table describes the operations displayed in the History window.

Operation	Description
Pair definition	A pair was defined.
Add Pair Start	Creation of the pair was started.

Operation	Description
Add Pair Complete	Creation of the pair was finished.
Resume Pair Start	Restoring of the pair was started.
Resume Pair Complete	Restoring of the pair was finished.
Suspend Pair Start	Splitting (Suspending) of the pair was started.
Suspend Pair Complete	Splitting (Suspending) of the pair was finished.
Suspend Pair(Failure)	The pair was split (suspended) because of a failure.
Delete Pair Start	Release of the pair was started.
Delete Pair Complete	Release of the pair was finished.
Status Change by MCU(Simplex to Pending)	The status of the pair was changed from unpaired (Simplex) to Pending because of an operation from the primary storage system.
Status Change by MCU(Simplex to Duplex)	The status of the pair was changed from unpaired (Simplex) to Duplex because of an operation from the primary storage system.
Status Change by MCU(Pending to Duplex)	The status of the pair was changed from Pending to Duplex because of an operation from the primary storage system.
Status Change by MCU(Pending to Suspend)	The status of the pair was changed from Pending to Suspend because of an operation from the primary storage system.
Status Change by MCU(Duplex to Suspend)	The status of the pair was changed from Duplex to Suspend because of an operation from the primary storage system.
Status Change by MCU(Duplex to Simplex)	The status of the pair was changed from Duplex to unpaired (Simplex) because of an operation from the primary storage system.
Status Change by MCU(Pending to Simplex)	The status of the pair was changed from Pending to unpaired (Simplex) because of an operation from the primary storage system.
Status Change by MCU(Suspend to Simplex)	The status of the pair was changed from Suspend to unpaired (Simplex) because of an operation from the primary storage system.
Status Change by MCU(Suspend to Pending)	The status of the pair was changed from Suspend to Pending because of an operation from the primary storage system.

Operation	Description
Status Change by RCU(Suspend Pair Start)	The status of the pair was changed because an operation for splitting a pair started at the secondary storage system.
Status Change by RCU(Suspend Pair Complete)	The status of the pair was changed because an operation for splitting a pair finished at the secondary storage system.
Status Change by RCU(Suspend to SMPL; Delete Pair Start)	An operation for releasing a pair has been started at the secondary storage system. The status of the pair changes from Suspend to unpaired (Simplex).
Status Change by RCU(Pending to SMPL; Delete Pair Start)	An operation for releasing a pair has been started at the secondary storage system. The status of the pair changes from Pending to unpaired (Simplex).
Status Change by RCU(Duplex to SMPL; Delete Pair Start)	An operation for releasing a pair has been started at the secondary storage system. The status of the pair changes from Duplex to unpaired (Simplex).
Status Change by RCU(Delete Pair Complete)	The status of the pair was changed because an operation for releasing a pair finished at the secondary storage system.
Ready for Delta resync	A pair became ready for delta resync.
Ready for Delta resync(Failure)	The failure occurred with the pair which was ready for delta resync.
Status Change for Delta resync	The status of the P-VOL was changed to Hold because of a delta resync operation.
Status Change by MCU(Simplex to Hold)	The status of the pair was changed from unpaired (Simplex) to Hold because of an operation from the primary storage system.
Status Change by MCU(Hold to Duplex)	The status of the pair was changed from Hold to Duplex because of an operation from the primary storage system.
Status Change by MCU(Hold to Pending)	The status of the pair was changed from Hold to Pending because of an operation from the primary storage system.
Status Change by MCU(Hold to Simplex)	The status of the pair was changed from Hold to unpaired (Simplex) because of an operation from the primary storage system.
Status Change by RCU(Hold to Simplex; Delete Pair Start)	An operation for releasing a pair has been started at the secondary storage system. The status of the pair changes from Hold to unpaired (Simplex).



Operation	Description
Status Change to Hold	The status of the S-VOL was changed to Hold because of a delta resync operation.
Status Change by MCU(Suspend to Pending)	The status of the pair was changed from Suspend to Pending because of an operation from the primary storage system.
Unknown	The system could not identify the type of the operation.

## Saving pair information to a text file

In HDvM - SN, you can save pair status and other information to a tab-delimited TSV file.

This task cannot be performed using BCM.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **UR Pairs** tab, select the pair that you want to monitor.
4. Click **More Actions** > **Export** and follow on-screen instructions.

## Monitoring copy operations and I/O statistics

You can monitor copy operations and I/O statistics to determine the replication performance.

For more information about monitoring performance, see the *Performance Guide*.

For the primary site in a 3DC multi-target configuration combining three URz sites, two or more mirrors are set in the primary system. The following table describes the data displayed in Logical Device (UR/URMF) and Journal (UR/URMF) for Performance Monitor in the primary storage system.

Object of monitoring <sup>1</sup>	Monitoring data	Description
Logical Device (UR/URMF)	Initial copy cache hit (%)	Average of all mirror's cache hit rates in primary system.
	Initial copy data transfer (MB/s)	Total of all mirror's data transfer amount in primary system during initial copy.

Object of monitoring <sup>1</sup>	Monitoring data	Description
Journal (UR/URMF)	Master journal throughput (IOPS)	Total throughput of all mirrors in the primary system.
	Master journal (count/sec)	Total of all mirror's journal responses in primary system.
	Master journal data transfer (MB/s)	Total of all mirror's data transfer amount in primary system.
	Master journal response time (ms)	Average of all mirror's response time in primary system.
Notes:		
1. The journal information per mirror is displayed in Journal (UR/URMF). Note that it is impossible to reference the initial copy information per mirror.		

If the journal group attribute is Master/Restore, only the restore journal information is displayed in Journal (UR/URMF), as shown in the following table.



**Note:** In a cascade configuration in which three URz sites are combined, a restore journal value might be greater than the corresponding master journal value.

Object of monitoring	Monitoring data	Description
Journal (UR/URMF)	Restore journal throughput (IOPS)	Restore journal throughput per second.
	Restore journal (count/sec)	Number of count for restore journal per second.
	Restore journal data transfer (MB/s)	Restore journal data transfer amount.
	Restore journal response time (ms)	Restore journal response time.
	Restore journal usage data (%)	Restore journal usage data.
	Restore journal metadata usage rate (%)	Restore journal metadata usage rate.

## Monitoring I/O and hardware performance with Performance Monitor

The Performance Monitor software provides detailed information on I/O activity and hardware performance.

Storage system usage and performance data that is collected and displayed by Performance Monitor enables you to:

- Identify the optimum timing for performing Universal Replicator copy operations.
- Determine the best locations for the Universal Replicator S-VOLs (for example, parity groups with less frequently accessed volumes to avoid bottlenecks of back-end activity).
- Monitor system performance during Universal Replicator operations and during testing activities.

Use the following procedure to lessen the impact on Universal Replicator operations while Performance Monitor is collecting data for one or more storage systems on the same internal LAN:

1. If Performance Monitor is collecting high amounts of LDEV data, disabling this activity, if possible, for one or more systems.
2. If Performance Monitor is collecting data for more than three storage systems on the internal LAN, disconnect Performance Monitor, if possible, from one or more systems before using Universal Replicator.
3. After you have disabled LDEV data collection and/or disconnected Performance Monitor wherever possible, then connect to the system using Device Manager - Storage Navigator and launch Universal Replicator.
4. When Universal Replicator operations are completed, exit Universal Replicator and Device Manager - Storage Navigator.
5. Re-enable Performance Monitor data collection.

For further information on Performance Monitor, see the *Performance Guide*.

## Monitoring journal (mirror) status












The status of a mirror associated with a journal relates to the pair operations that have been performed on the journal. Monitoring these statuses can help to resolve problems and maintain the Universal Replicator for Mainframe system.

This task cannot be performed using BCM.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Journals**.
3. In the **Journals** window, select the **Journal ID** for the journal you want to monitor. The **Mirror** tab is displayed.
4. In the **Mirror** tab, view the journal's status.

## Mirror status definitions

Status	Description
 Initial	Data volumes are not registered in the mirror.
 Active	The mirror has only pairs that are not synchronized with the initial copy operation in progress, or pairs that are synchronized with the initial copy complete.  If a mirror in Active status contains pairs that are split, Active (Warning) is displayed. The split pairs must be resynchronized to restore the mirror to the Active status.
 Active (Warning)	The mirror status is Active; some pairs in the mirror are split.
 HaltAccept	The status at the beginning of a mirror-split operation. The status changes immediately to Halting. HaltAccept indicates status of restore journals only.
 Halting	An operation for splitting or deleting the mirror is in progress. <ul style="list-style-type: none"> <li>▪ Splitting a mirror changes the status in the following order: Halting, Halt, Stopping, and finally Stopped.</li> <li>▪ Deleting a mirror changes the status in the following order: Halting, Halt, Stopping, Stopped, and finally Initial.</li> </ul>
 Halt	An operation for splitting or deleting the mirror is in progress.
 Stopping	An operation for splitting or deleting the mirror is in progress.
 Stopped	An operation for splitting or deleting the mirror is finished.
 Hold	When you use URz with TCz, a delta resync pair has been created. It is ready for the delta resync operation. Delta resync might not be executed depending on the internal process even when the creation of the delta resync pair is completed.
 Holding	When you use URz with TCz, a delta resync pair is being created.
 Hold(Failure)	An error occurred with the URz pair during the delta resync operation.

## Monitoring URz remote connections and path status

You can navigate to remote connection and remote path status to determine any issues with the remote paths. For remote path status definitions and troubleshooting, see [Remote path status problems](#) (on page 210).

You can perform this task using **YKQRYPTH** or **YKQRYDEV**. For details, see the BCM documentation.

**Procedure**

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Connections**.
3. Check the **Status** field.
4. To view more information, select a connection and click **View Remote Connection Properties**.

---

## Chapter 9: Maintaining the URz system

You perform some maintenance tasks in response to conditions discovered during system monitoring, such as pool-full conditions that cause pairs to become suspended. You can also change certain settings as needed to meet changing operational requirements.

### Maintenance activities

The following maintenance activities are covered:

- [Pair maintenance \(on page 158\)](#)
- [Journal and mirror maintenance \(on page 162\)](#)
- [Remote path maintenance \(on page 173\)](#)
- [Managing power-off for systems and network devices \(on page 176\)](#)

### Pair maintenance

You must have Storage Administrator (Remote Copy) role to perform Universal Replicator for Mainframe pair maintenance operations.

The topic describes and provides instructions for the following pair maintenance tasks.

- [Changing the maximum initial copy activities option \(on page 158\)](#)
- [Changing the pair options \(on page 159\)](#)
- [Forcibly deleting pairs \(on page 160\)](#)
- [Restoring a pair by adding a reserve journal volume \(on page 161\)](#)
- [Restoring a pair without adding a reserve journal volume \(on page 162\)](#)

### Changing the maximum initial copy activities option

You can change the maximum number of volumes that can be copied concurrently by adjusting the Maximum Initial Copy Activities setting (range = 1 to 128, default = 64). For example, you can increase this setting when you need to create or resynchronize a large number of pairs concurrently, and you can decrease this setting when you need to limit the impact of initial copy operations on system performance.

For details and instructions, see [Setting the maximum initial copy activities option \(on page 128\)](#).

**Note:**

- Performance of the primary storage system depends on this setting and the amount of I/O activity. You can limit the impact of initial copy operations on system performance by using the default setting.

## Changing the pair options

You can change the following pair options:

- Cache-fast-write (CFW)
- Error level

### Before you begin

- You can change the pair options only for pairs in Duplex, Suspend, Hold, Holding, or Hlde status.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **UR Pairs** tab, select the pair whose options are to be changed.
4. Click **More Actions > Edit Pair Options**.

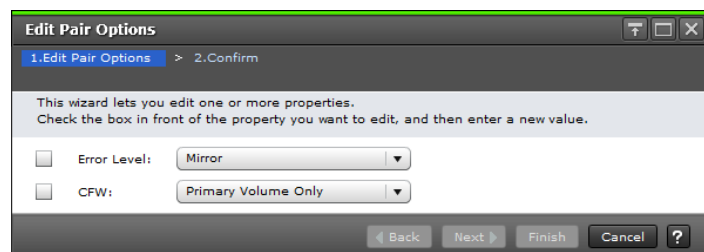


**Note:** When you select multiple pairs on the **UR Pairs** tab, **Edit Pair Options** values may be blank because the selected pairs have different values.

When you specify a value, it is set for all selected pairs.

5. In the **Edit Pair Options** window, for **Error Level**, specify the system response if a failure occurs in the pair.
  - **Mirror:** Splits all pairs in the failed pair's mirror. **Mirror** is the default.
 

However, if a volume failure occurs while the pair status is Pending, only the target pair in the mirror is split, even if **Mirror** is specified.
  - **Volume:** Splits only the pair that failed.



6. For **CFW** box, specify whether to copy cache-fast-write data to the S-VOL or not.
  - **Primary Volume Only** (default): Does not copy cache-fast-write data to the S-VOL.  
When "Primary Volume Only" is specified, if the P-VOL fails and the host attempts to read the same data from the S-VOL, the I/O might end abnormally.
  - **Secondary Volume Copy**: Copies cache-fast-write data to the S-VOL.



**Note:** In a 3DC multi-target configuration, specify the same CFW setting for both Universal Replicator for Mainframe and TrueCopy for Mainframe pairs. If you specify Secondary Volume Copy for either the URz or TCz pair, the cache-fast-write data is copied to the S-VOL of the other pair.

7. Click **Finish**.
8. In the **Confirm** window, review the settings, enter a task name, and click **Apply**.

## Forcibly deleting pairs

You need to forcibly delete a pair for the following reasons:

- A currently unpaired volume that was previously in a pair is unusable because previous pair information is still in the volume.
- The pair cannot be connected to the secondary storage system due to a communication error. In this case, you need to delete the pair forcibly in both the primary storage system and the secondary storage system.



**Caution:** The following data is discarded:

- Data which is not sent to the secondary storage system when a pair in the primary storage system is deleted forcibly
- Data which is not restored when a pair is deleted forcibly in the secondary storage system

In addition, if a pair is deleted forcibly when a journal contains a pair in the PAIR/COPY status, host I/Os to the pair might time out.

This task cannot be performed using BCM.

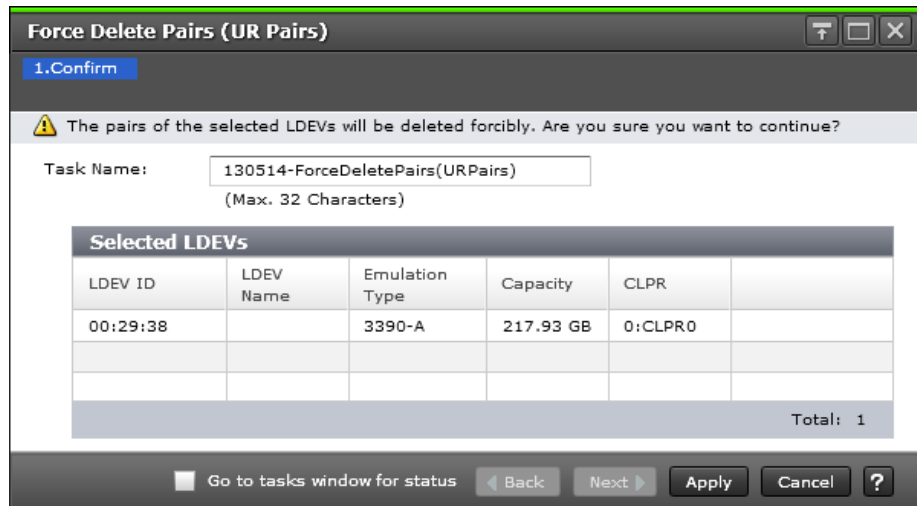
### Before you begin

- The volume must be unpaired.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, and click **Logical Devices**.
3. In the **LDEVs** tab, select the LDEV belonging to the pair that you want to delete forcibly, and then click **More Actions > Force Delete Pairs (UR Pairs)**.
4. In the **Force Delete Pairs (UR Pairs)** window, ensure that the volume you want to forcibly delete is in the **Selected LDEV** table.





5. Enter a name in the **Task Name** box.
6. Click **Apply** to save your settings to the system.

## Restoring a pair by adding a reserve journal volume

Use the following procedure to restore a UR pair that was split due to disk failure of the pool and pool volume to which the journal volume belongs or to replace the journal volume if PIN data occurs in the journal volume. When you use a reserve journal volume, you do not need to delete the UR pair.

You cannot reserve a journal volume using BCM.

### Procedure

1. Verify that the status for all mirrors in the journal is Stopped.  
If the mirror status is not Stopped, you must split all UR pairs belonging to the journal and then verify that the status for all mirrors in the journal is changed to Stopped.
2. Add a reserve journal volume. For details, see [Adding a reserve journal volume \(on page 170\)](#).



**Note:** If an unallocated journal volume is not available to become the reserve journal volume, you must delete the journal, restore the blocked journal volume, register the journal volume to the journal again, and then create the UR pair. Allocate a DP-VOL to the journal volume. For details about the restoration procedure when the DP-VOL is blocked, see the *Provisioning Guide for Mainframe Systems*.

3. Verify that the volume you added is a reserve journal volume.
  - Device Manager - Storage Navigator:  
Use the **Journal Volumes** window (**Type: Reserve Journal**).
  - CCI:  
Use the `raidcom get journal` command.  
An LDEV that is not displayed is a reserve journal volume.

4. Delete the first journal volume.
5. Resynchronize the pair, and then restore the UR pair.

## Restoring a pair without adding a reserve journal volume

Use the following procedure to restore a UR pair that was split by disk failure of the pool and pool volume to which the journal volume belongs. If you do not recover the volume and do not use a reserve journal volume, the UR pair must be deleted.

### Procedure

1. Resolve the problem with the volume, and then resynchronize the pair and restore the UR pair.

If the problem with the volume is not resolved, perform the following steps:

- a. Delete the UR pair.
- b. Delete the journal volume.
- c. Re-create the journal using a volume that does not have any problems.
- d. Re-create the UR pair.

## Journal and mirror maintenance

This topic describes and provides instructions for the following journal and mirror maintenance tasks:

- [Changing options used by journals \(on page 162\)](#)
- [Changing options used by mirrors \(on page 164\)](#)
- [Adding an additional journal volume to an existing journal \(on page 167\)](#)
- [Replacing a journal volume with a reserve journal volume \(on page 168\)](#)
- [Adding a reserve journal volume \(on page 170\)](#)
- [Deleting journal volumes from a journal \(on page 170\)](#)
- [Deleting journals \(on page 171\)](#)
- [Forcibly deleting journals from an EXCTG \(on page 172\)](#)

## Changing options used by journals

Most Universal Replicator for Mainframe pair operations are performed on multiple pairs, which share a journal group. You can change options that affect the pairs in journals.

You can control the following aspects of pair operations:

- **Inflow Control:** Allows you to restrict the inflow of data to allow other journals with higher priority data unrestricted inflow when the data transfer path accessing two journals is set.
- **Data Overflow Watch:** Establishes a timeout period.

In a 3DC multi-target configuration in which three URz sites are combined, if the status of the two mirrors in the primary site is both Active and the free space in the journal data area or metadata area is less than a certain amount, one of the mirrors in the journal will be suspended by error, regardless of the value in Data Overflow Watch.

- **Cache Mode:** Allows you to use journal data in the cache on the secondary storage system.
- **Timer Type:** Establishes the type of clock used for consistency time.

This task cannot be performed using BCM.

### Before you begin

- Journal options must be changed on both storage systems, primary and secondary.
- To change journal options, one of the following conditions must be satisfied:
  - The attribute of the journal is Initial.
  - The status of the journal in the mirror is one of the following:

- Initial
- Stopped
- Hold
- Holding
- Hold(Failure)

When one journal uses multiple mirrors, whether you can select Change Journal Option depends on the status of the journal whose mirror is not in Hold, Holding or Hold(Failure) status. For example, if mirrors in the journal are in the Hold and Active status, you cannot change the journal option. If mirrors in the journal are in the Hold and Stopped status, you can change the journal option.

- When changing options for multiple journals, you can leave some options unchanged by entering or selecting no value. If you specify a value, it is applied to the selected journals.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Journals**.
3. In the **Journals** tab, select the journal whose options you want to change.
4. Click **Edit Journal Options**.
5. In the **Edit Journal Options** dialog box, change the following options as needed.
  - Inflow Control
  - Data Overflow Watch

- Cache Mode
- Timer Type

For descriptions, see the procedure in [Creating journals and adding journal volumes \(on page 124\)](#).

6. Click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings to the system.

## Changing options used by mirrors

Most pair operations are performed on multiple pairs. This is done using a journal or mirrors. You can change the following options that affect the pairs in a mirror:

- Path Watch Time: the interval from the time when a physical path failure, such as disconnection of a path, occurs to the time when the mirror is suspended. This option becomes valid when both advanced system settings No. 16 and No. 15 are set to OFF.
- Path Watch Time Transfer: forwards the master journal's Path Watch Time value to the restore journal.
- Copy Pace: the pace at which data is copied.
- Transfer Speed: the speed for data transfer.
- Delta Resync Failure: the processing that takes place in the event of a failure.

This task cannot be performed using BCM.

**Before you begin**

- Mirror options can be changed on both primary and secondary storage systems.
- To change mirror options, the status of the mirror must be one of the following:
  - Initial
  - Active
  - Stopped
  - Hold
  - Holding
  - Hold(Failure)
- The Transfer Speed option can be changed if the mirror's status is Active, Hold, or Holding. When the status is Holding, the option can only be changed from the primary storage system.
- When changing options for multiple mirrors, a changed value is applied to all the mirrors. On the other hand, leave the options unchanged that you do not want to change.

**Procedure**


1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **Mirrors** tab, select the mirror whose options you want to change.
4. Click **More Actions > Edit Mirror Options**.
5. In the **Edit Mirror Options** window, for **Path Watch Time**, specify the interval from the time when a physical path failure occurs, such as a path disconnection, to the time when the mirror is suspended. Ranges are from 1 to 59 minutes, 1 to 23 hours, or 1 to 30 days. A numeric value is required.

The interval must be the same for master and restore journals in the same mirror, otherwise the journals suspend at different times. See next step to use this setting for both journals.



**Important:** If you want a mirror to split immediately after a physical path failure occurs, such as a path disconnection, ask customer support to set advanced system settings No. 15 to ON and set advanced system settings No. 16 to OFF.

6. For **Path Watch Time Transfer**, specify whether to use the same Path Watch Time value you specified for the master journal for the restore journal. Specify this option in the primary site only.
  - **Yes**: The Path Watch Time value is also used for the restore journal.  
For a pair in a delta resync configuration, select **Yes** in the primary site.
  - **No** (default): The Path Watch Time value is not used for the restore journal.
7. For **Copy Pace**, specify the pace for initial copy activity per volume. Specify this option in the primary site only.
  - **Slower** is the default.
  - If specifying **Medium**, ensure that write I/O is 10 MB/s or less per parity group. If it exceeds 10 MB/s, pairs may be suspended.
  - If specifying **Faster**, ensure that I/O will not occur. If update I/O occurs, pairs may be suspended.
8. For **Transfer Speed**, specify data transfer line speed in Mbps (megabits per second). You can specify 256, 100, 10, or 3.
  - Use **3** when the transfer speed is 3 to 9 Mbps.
  - Use **10** when the transfer speed is 10 to 99 Mbps.
  - Use **100** when the transfer speed is 100 to 255 Mbps.
  - Use **256** when the transfer speed is 256 Mbps or higher.

 **Note:** This setting does not affect master journals unless the Business Continuity Manager YKRESYNC REVERSE command is used to change a master journal into a restore journal.
9. For **Delta Resync Failure**, specify the processing that takes place when the delta resync operation cannot be performed. Specify this option in the primary site only.
  - **Entire Copy** (default): the entire P-VOL is copied to the S-VOL. Use Entire if your journals are part of a multiple-journal configuration in a CCI consistency group.
  - **No Copy**: No processing occurs: the S-VOL is not updated.
10. Click **Finish**.
11. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
12. Click **Apply** to save your settings to the system.

## Adding an additional journal volume to an existing journal

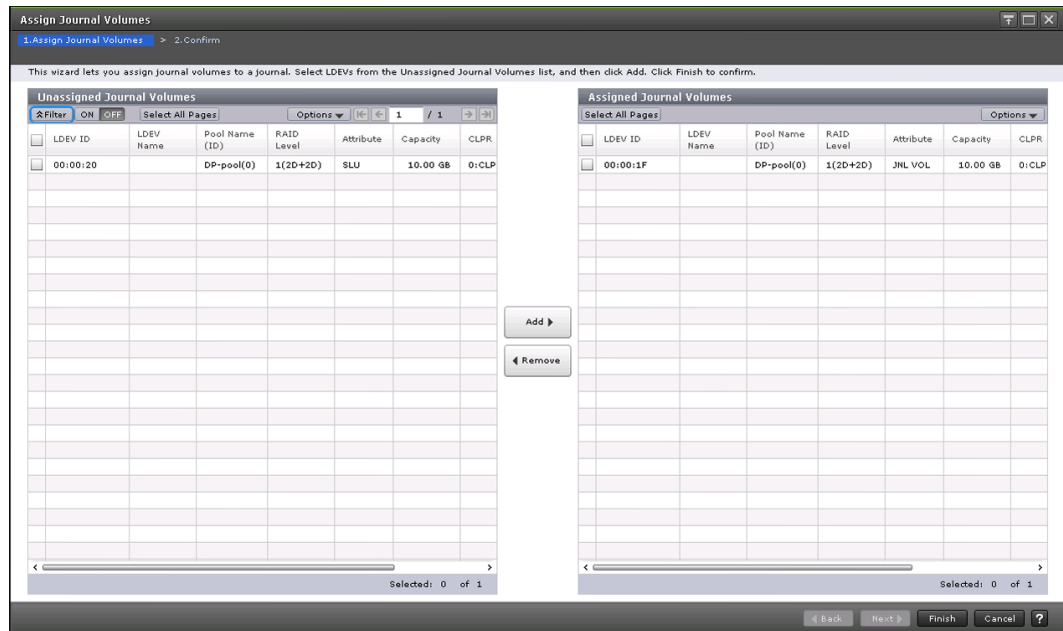
You can add one additional journal volume to a journal. The additional volume is not used unless needed for maintenance or to replace the first journal volume. In the event of pair failure, the additional reserve journal volume allows you to reduce the time to recover a blocked journal volume.

### Before you begin

- Review the following:
  - [System requirements \(on page 46\)](#)
  - [Planning journals \(on page 64\)](#)
  - [Planning journal volumes \(on page 65\)](#)
  - [Data and journal volume specifications \(on page 67\)](#)
- The journal's mirror status must be Initial, Active, Stopped, Hold, Holding, or Hold(Failure).
- The journal cannot be in use.
- Pair operations involving the journal cannot be in progress.
- Adding a reserve journal volume to a journal while remote copy is in progress causes only the journal data area to be used, but not the metadata area, because it is unavailable. To make the metadata area available in this case, split and resynchronize all pairs in the journal group.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **Mirrors** tab, select the **Journal ID** link for the journal you want to add journal volumes to.
4. In the **Journal Volumes** tab, click **Assign Journal Volumes**.
5. In the **Assign Journal Volumes** window, from the **Unassigned Journal Volumes** table, select the journal volume to be added to the journal, and then click **Add**. The selected journal volume moves to the **Assigned Journal Volumes** table.  
To remove a volume from the table, select the volume and click **Remove**.



6. Click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings to the system.

## Replacing a journal volume with a reserve journal volume

You can use the reserve journal volume to restore a disk in a pool or pool volume to which the journal volume belongs.

When you register two journal volumes in a journal, the second journal volume becomes the reserve journal volume, which is not used for normal operations. For details about reserve journal volumes, see [Journal volumes \(on page 21\)](#). For instructions on using CCI to replace a journal volume with a reserve journal volume, see [Replacing a journal volume with a reserve journal volume using CCI \(on page 169\)](#).

You cannot add a reserve journal volume using BCM.

### Before you begin

- Required role: Storage Administrator (Remote Copy)
- An unallocated journal volume that will be the reserve journal volume must be available.



**Note:** If an unallocated journal volume is not available to become the reserve journal volume and the journal volume is blocked, you must delete the journal, restore the blocked journal volume, register the journal volume to the journal again, and then re-create the suspended UR pairs. Allocate a DP-VOL to the journal volume. For details about the restoration procedure when the DP-VOL is blocked, see the *Provisioning Guide for Mainframe Systems*.



### Procedure

1. Add a reserve journal volume to the journal.  
For details, see [Adding a reserve journal volume \(on page 170\)](#).
2. Delete the journal volume that is in use.  
For details, see [Deleting journal volumes from a journal \(on page 170\)](#).
3. Resynchronize the journal.

## Replacing a journal volume with a reserve journal volume using CCI

### Before you begin

- Required role: Storage Administrator (Remote Copy)
- An unallocated journal volume that will be the reserve journal volume must be available.
- Specify the CCI instance number by using the `-I` parameter as needed.

### Procedure

1. Add a reserve journal volume to the journal.

```
raidcom add journal -journal_id <journal ID#> -ldev_id <ldev#>
```

- `<journal ID#>`: Specify the journal ID to which the replacement target journal volume is registered.
- `<ldev#>`: Specify the LDEV number of the unallocated journal volume that will be the reserve journal volume.

2. Check the LDEV number of the journal volume that is currently being used.

```
raidcom get journal
```

- The LDEV number displayed in the **LDEV#** column of the command output is the LDEV number that is currently being used.

3. Delete the journal volume to be replaced.

```
raidcom delete journal -journal_id <journal ID#> -ldev_id <ldev#>
```

- `<journal ID#>`: Specify the journal ID to which the replacement target journal volume is registered.
- `<ldev#>`: Specify the journal volume LDEV number checked in step 2.

## 4. Resynchronize the journal.

```
pairresync -g <group>
```

- **<group>**: Specify the data volume group name that is using the journal. The group name to be specified here is the group name defined in the CCI configuration definition file.
- Specify the `-IH` parameter as needed.

## Adding a reserve journal volume

This task cannot be performed using BCM.

### Before you begin

An unallocated journal volume that will be the reserve journal volume must be available.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **Mirrors** tab, select the **Journal ID** link for the journal to which you want to add journal volumes.
4. In the **Journal Volumes** tab, click **Assign Journal Volumes**.
5. In the **Assign Journal Volumes** window, from the **Unassigned Journal Volumes** table, select the journal volume to be added to the journal, and then click **Add**. The selected journal volume moves to the **Assigned Journal Volumes** table.  
To remove a volume from the table, select the volume and click **Remove**.
6. Click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings to the system.

## Deleting journal volumes from a journal

This task cannot be performed using BCM.

**Before you begin**

- A journal volume can only be deleted when one or more of the following conditions exists:
  - If the journal volume to be deleted is a reserve journal volume.
  - If the pair belonging to the mirror in the journal is suspended and a reserve journal volume exists.
  - If the pair belonging to the mirror in the journal is deleted.
  - If the state of every mirror in the journal is Initial, Stopped, or Hold(Failure), and a reserve journal volume exists. If one journal uses more than one mirror, you can delete a journal volume only under the conditions specified in the following table.

**Table 6 Conditions for deleting a journal volume (when one journal uses two types of mirror IDs)**

Status of journal		Other conditions
Mirror ID 1	Mirror ID 2	
Stopped	Stopped	-
Stopped	Hold(Failure)	When a 3DC configuration of URz and TCz is used. When a 3DC configuration in which three URz sites are combined.

- If all journal volumes in a journal are deleted (the journal is empty), all journal option data is initialized. To reset the journal's options, see [Changing options used by journals \(on page 162\)](#).

**Procedure**

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. In the **Mirrors** tab, select the **Journal ID** link for the journal you want to delete journal volumes from.
4. In the **Journal Volumes** tab, click **Assign Journal Volumes**.
5. From the **Assigned Journal Volumes** table, select the volumes to be deleted and click **Remove**.
6. Click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings to the system.

**Deleting journals**

Journals can be deleted from either system.

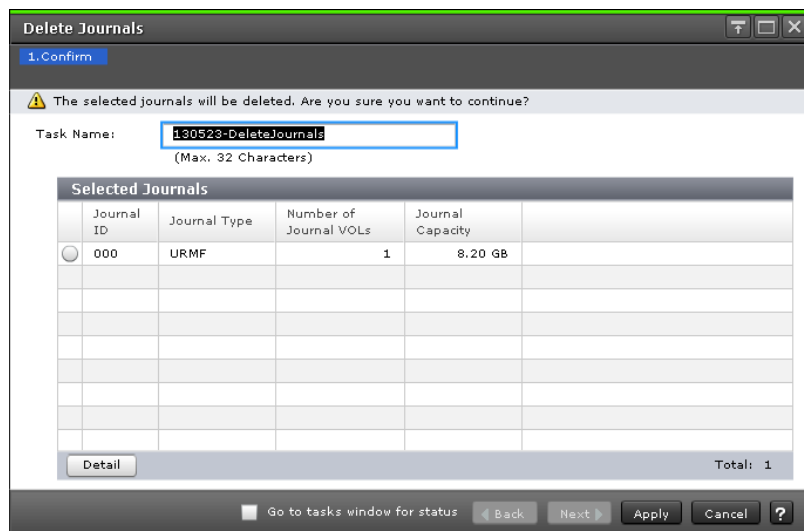
This task cannot be performed using BCM.

### Before you begin

- Journals can be deleted from the primary or secondary storage system.
- All mirrors in the journal must be Initial status.
- Master and restore journals cannot be deleted.
- Removing a journal volume from a journal that is registered results in the journal volume's LDEVs becoming blockaded. You can release the blockade by formatting the LDEVs.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Journals**.
3. In the **Journals** tab, select the **Journal ID** for the journal to be deleted.
4. Click **Delete Journals**.
5. In the **Delete Journals** window, make sure the journals you want to delete are listed in the **Selected Journals** table. To view more information about a journal, select the journal and click **Detail**. If you need to change the selections, click **Cancel**.



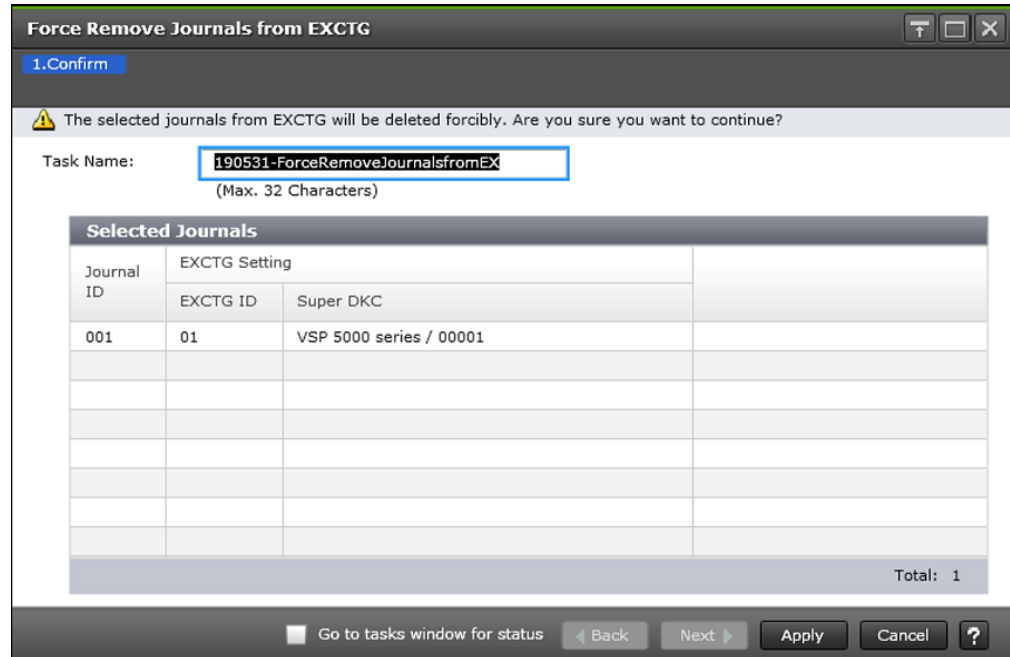
6. When satisfied, click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings to the system.

## Forcibly deleting journals from an EXCTG

You can forcibly delete journal that could not be deleted normally from an EXCTG. Normal deletion from an EXCTG is done with Business Continuity Manager. For more information about deleting normally, see the *Business Continuity Manager User Guide*.

## Procedure

1. Open the **Journals** window in Device Manager - Storage Navigator.
  - a. In the **Explorer** pane, expand the **Storage Systems** tree.
  - b. Expand the target storage system tree, expand **Replication**, and click **Journals**.
2. In the **Journals** tab, select the **Journal ID** for the journal you want to delete from an EXCTG.
3. Click **More Actions > Force remove Journals from EXCTG**.
4. In the **Force remove Journals from EXCTG** window's **Selected Journals** table, check the journal to be removed. To cancel the operation, click **Cancel**.



## Remote path maintenance

This topic describes and provides instructions for the following remote path maintenance tasks:

- [Modifying the data-transfer time threshold \(on page 173\)](#)
- [Deleting remote paths \(on page 174\)](#)
- [Deleting the URz relationship \(on page 175\)](#)

### Modifying the data-transfer time threshold

You can modify the threshold for data transfer to complete. If the threshold value is reached, the transfer is flagged as failing by the system.

This task cannot be performed using BCM.

**Before you begin**

- This operation can be performed from the primary or secondary storage system.
- The setting is made in the RIO MIH field on the DKC Options dialog box (RIO MIH--remote I/O missing interrupt handler). RIO MIH Time is the waiting time from when copy starts until when it ends. This value applies to the slots which received the request of copying data between storage systems.

**Procedure**

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Connections**.
3. In the **Connections (To)** tab, select the **Remote Storage System** with the data-transfer waiting-time to be changed.
4. Click **Edit Remote Connection Options**.
5. In the **Edit Remote Connection Options** window, note that **Minimum Paths** cannot be changed.
6. For **RIO MIH Time**, specify the amount of time the system waits after data copy between storage systems through the slot where the copy was requested begins before the copy ends. The range is 10 to 100 seconds, and the default is 15 seconds.
7. Click **Finish**.
8. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
9. Click **Apply** to save your settings to the system.

## Deleting remote paths

You can delete remote paths from the primary or secondary storage systems.

You can perform this task using `YKQDELPTH`. For details, see the BCM documentation.

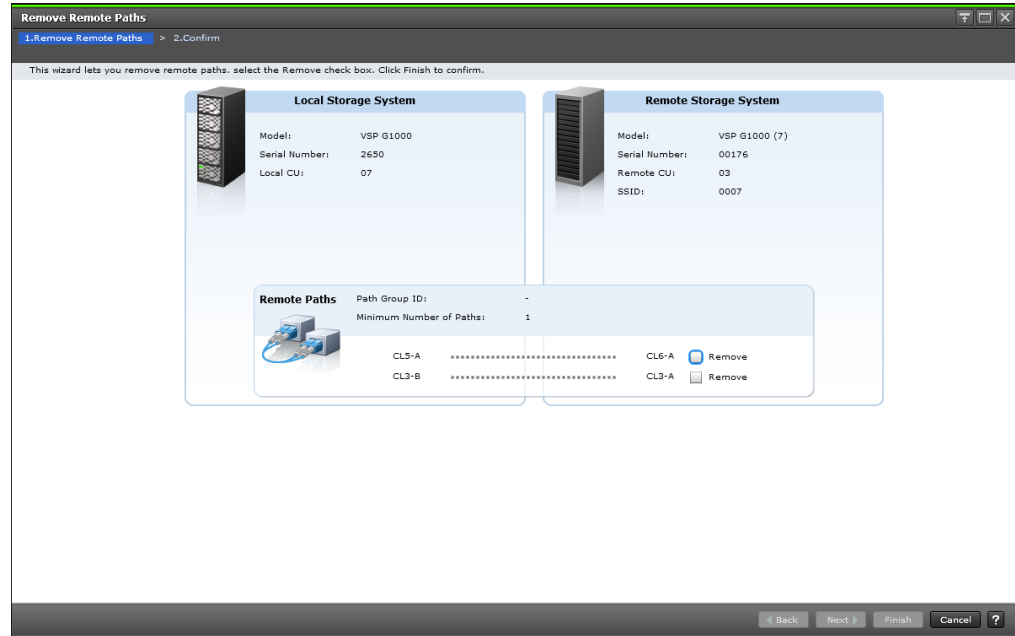
**Before you begin**

- Before deleting remote paths, make sure that the remaining number of remote paths will be greater than the minimum number of paths setting. You can do this in the View Remote Connection Properties window. The delete path operation will fail if the number of remaining paths is equal to or less than the minimum number of paths.
- The primary storage system administrator can delete remote paths between the bidirectional port of the primary storage system and the bidirectional port of the secondary storage system. The secondary System administrator can delete remote paths between the bidirectional port of the secondary storage system and the bidirectional port of the primary storage system.

**Procedure**

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Connections**.

3. In the **Connections (To)** tab, select the **Remote Storage System** with the remote path you want to delete.
4. Click **More Actions > Remove Remote Paths**.
5. In the **Remove Remote Paths** window, in the **Remote Paths** box, check the **Remove** box or boxes for the remote paths to be deleted.



6. Click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings to the system.

## Deleting the URz relationship

You can remove the Universal Replicator for Mainframe pair relationship between primary and secondary storage systems. You do this by removing the remote connection.

You can perform this task using the YKDELPTH command. For details, see the BCM documentation.

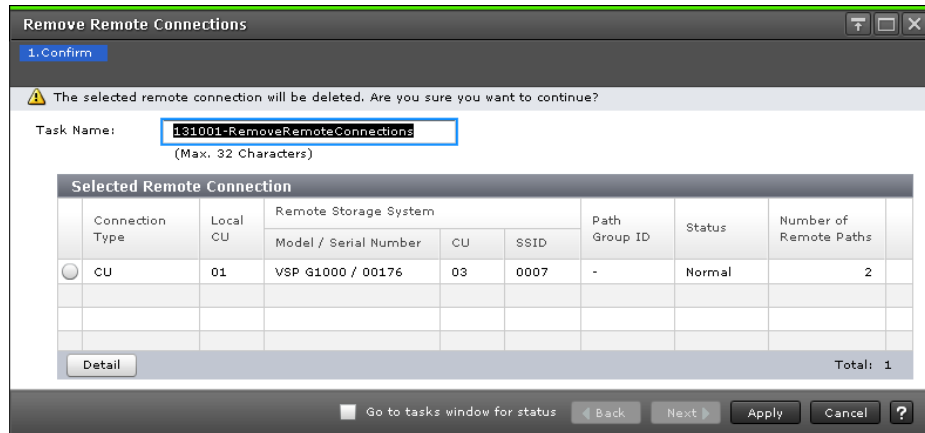
### Before you begin

- Required role: Storage Administrator (Remote Copy).
- Removing the relationship between the primary and the secondary storage systems also removes the remote paths between them.
- This operation must be performed on both the primary and secondary storage systems.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Connections**.

3. In the **Connections (To)** tab, select the **Remote Storage System** whose remote connection you want to delete.
4. Click **More Actions > Remove Remote Connections**.
5. In the **Remove Remote Connections** window, in the **Selected Remote Connections** box, check the **Remove** box for the remote connection to be deleted. To view more information about a remote path, select the path and click **Detail**. If you need to change the selections, click **Cancel**.



6. Click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
8. Click **Apply** to save your settings to the system.


## Managing power-off for systems and network devices

This topic describes power management for systems and network relay devices during copy operations:

- How to proceed when power is removed from systems or network relay devices for some unexpected reason.
- How to perform a planned outage of systems or network relay devices. Network relay devices include hardware that connects the primary and secondary storage systems, such as channel extenders and switches.

### When power stops unexpectedly

This topic describes what happens when power is removed from the storage systems or network relay devices for some unexpected reason.

 **Caution:** When a system is powered on, you must wait five (5) minutes before performing Universal Replicator for Mainframe operations. If not, the pairs might be suspended with a failure.



## When power is removed from primary or secondary storage system

- If power is removed from the primary storage system during remote copy operations, the primary storage system assumes that a failure has occurred and splits all pairs. When the primary storage system splits pairs, the secondary storage system also assumes that a failure occurs and splits all pairs.
- If power is removed from the secondary storage system during remote copy operations, the secondary storage system assumes that a failure has occurred and splits all pairs. When the secondary storage system splits pairs, the primary storage system also assumes that a failure occurs and splits all pairs.

## When power is removed from network relay devices

If power is removed from a network relay device during remote copy operations, the primary and secondary storage systems assume that a failure has occurred and split all pairs.

## Planned outage of storage systems and network devices

This topic provides instructions for performing a planned outage of storage systems and network relay devices.



**Note:** When you are planning to intentionally power off the primary or secondary storage system, contact your Hitachi Vantara account team and ask them to power off the system.

To power off primary and secondary storage systems at the same time, see [Powering-off primary and secondary storage systems at the same time \(on page 178\)](#).

## Powering-off the primary or secondary storage system

Use the following procedure to power off the primary or secondary storage system.

### Procedure

1. Ensure that all pairs or mirrors are split and that the status of all the pairs is Suspend. Otherwise the pairs could be suspended due to failure.  
If multiple primary and secondary storage systems are used with EXCTGs, ensure that all pairs in EXCTGs are split. When powering off the primary storage systems, power off the supervisor DKC first, and then the subordinate DKCs.
2. Turn power off.
3. When ready, power on the system.



**Caution:** Wait five (5) minutes after powering on a system before performing Universal Replicator for Mainframe operations; otherwise the pairs could be suspended with a failure.

4. When the system is ready to resume copy operations, on the primary site, resynchronize the pairs that have been split.
5. Confirm that the status of the pairs is Pending or Duplex.

### Correcting errors made when powering-off

If a secondary storage system remains in Suspending status because you powered-off while the primary storage system was copying data, delete the pair forcibly in both primary and secondary storage system, and then re-create the pair.

## Powering-off primary and secondary storage systems at the same time

The primary storage system must be powered off before the secondary storage system is powered off. When you are ready to power the systems on, the secondary storage system must be powered on before the primary storage system.

If multiple primary and secondary storage systems are used with EXCTGs, power off all primary storage systems first. When powering on again, power on all secondary storage systems first, and then the primary storage systems.

Use the following procedure to power off the primary and secondary storage systems at the same time.

### Procedure

1. Split all pairs that will be affected. For example, if two primary storage systems and one secondary storage system are connected to each other and you want to power off one of the primary storage system and the secondary storage system, you must split the pairs on all three systems since they are all affected.
2. After the pairs are split, confirm that their status is Suspend at the primary storage system.
3. Power off the primary storage system.
4. Power off the secondary storage system.
5. Power on the secondary storage system.
6. When the secondary storage system is ready to resume copy operations, power on the primary storage system.



**Caution:** Wait five (5) minutes after powering on a system before performing Universal Replicator for Mainframe operations; otherwise the pairs could be suspended with a failure.

7. When the primary storage system is ready to resume copy operations, resynchronize the pairs that have been split at the primary storage system. Confirm that the status of the pairs is changed to Pending or Duplex.

### Result

After turning power on or off for both the primary and secondary storage system at the same time, if pair status at primary storage system is Suspend and a status of a pair of secondary storage system is Duplex, use Device Manager - Storage Navigator to suspend the pair of the secondary storage system. After confirming that the statuses of the pair on both systems is Suspend, resynchronize the pair at the primary storage system.

## Powering-off network relay devices

Use the following procedure to power off network relay devices.

**Procedure**

1. Ensure that all pairs or mirrors are split and that the status of all the pairs is Suspend.
2. Power off the device.
3. When ready power on the network relay device.
4. When the network relay device is ready for copy operations, from the primary site, resynchronize the pairs that have been split.
5. Confirm that pair status is Pending or Duplex.

---

## Chapter 10: URz disaster recovery operations

You can perform disaster recovery operations using Business Continuity Manager and Command Control Interface, including general recovery planning and procedures, recovery for 3DC configurations, and recovery for URz/ShadowImage for Mainframe shared configurations.

### Overview of disaster recovery operations

The primary reason for using Universal Replicator for Mainframe and other remote replication software is disaster recovery. With copies of data at a secondary location, you can transfer operations to the secondary site, restore the lost or damaged information at the primary site, and then restore operations to the original configuration when recovery is complete.

Maintaining copies in multiple secondary locations increases the level of data security, but some recovery procedures can be complex.

### Workflow for disaster recovery

Workflow for disaster recovery operations

1. Prepare your data centers for disaster recovery, including identifying the data to be backed up, establishing the copy pairs, and installing and configuring the host failover software.

See [Preparing for disaster recovery \(on page 181\)](#).

2. Establish file and database recovery procedures before disaster or failure occurs, as part of the URz planning process.

See [Preparing for file and database recovery \(on page 181\)](#).

3. When a disaster or failure occurs at the primary site, switch host operations to the secondary site.

See [Switching host operations to the secondary site \(on page 181\)](#).

4. While host operations continue at the secondary site, recover the primary site, and then reverse the copy direction of the volume pairs to copy the current host data from the secondary site back to the primary site.

See [Reversing copy direction from secondary to primary site \(on page 182\)](#).

5. When the copy pairs are again synchronized, resume host operations at the primary site, and re-establish the original copy direction of the volume pairs.

See [Resuming host operations at the primary site \(on page 183\)](#).

## Preparing for disaster recovery

Perform the following tasks to prepare for disaster recovery:

- Identify the data volumes that you want to back up for disaster recovery.
- Pair the important volumes using Universal Replicator for Mainframe.
- Install and configure the required software for host failover between the primary and secondary sites.

## Preparing for file and database recovery

File recovery procedures are necessary when the primary or secondary storage system suspends a pair due to a disaster or failure. When this occurs, the S-VOL might contain in-process data resulting from an open data set or transactions that could not complete. File recovery procedures in these circumstances are the same as when a data volume becomes inaccessible due to control unit failure.

You detect and re-create lost updates by checking database log files and other current information at the primary site. Journal log file entries for most DBMS have the same clock information as the TOD clock, which is used for I/O time-stamps (when Timer Type = system). URz group consistency time can be extremely useful when performing this detection and retrieval. You can also use the sense information with system time stamp that is transferred through ERC.

Design your recovery plan so that detection and retrieval of lost updates is performed after the application is started at the secondary site. The detection and retrieval process can take some time.

Prepare for file and database recovery using files for file recovery (for example, database log files that have been verified as current).

Remote copy and disaster recovery procedures are inherently complex. Consult your Hitachi Vantara account team about recovery procedures.

## Switching host operations to the secondary site

Use these instructions for pairs in one or more primary or secondary storage systems.

The first recovery task is to switch host operations to the secondary site using Business Continuity Manager.

The basic procedures for switching operations to the secondary site are as follows.



**Note:** When a failure occurs in a primary or secondary storage system when multiple VSP G1000, VSP G1500, or VSP F1500 systems are used, all journals in an extended consistency group (EXCTG) are suspended and secondary copy operations are suspended. The consistency of data update sequence is maintained if a failure occurs in a primary storage system, but the consistency is not maintained if a failure occurs in a secondary storage system.



**Caution:** When performing the pair resync operation, you must stop host I/O until the delta resync pair is resynchronized. However, host I/O might continue even before the delta resync operation is run if the pair is configured with the IBM® HyperSwap® function. You must set system option mode 976 to ON in configurations with the IBM® HyperSwap® function.

1. If you need to perform an IPL of the secondary host system, delete SIMs and then perform the IPL. When the IPL finishes, the S-VOLs are usually varied online. If the secondary volume is not varied online, vary the volumes online.

In cases where all system volumes are being replicated, the volumes must be suspended before an IPL is performed to enable read/write data access.

If you do not need to perform an IPL of the secondary host system, ensure that the S-VOLs are varied online before continuing.

2. Check whether the restore journal includes an S-VOL with a pair status of Pending or Suspend with SUSPOP status in BCM.
  - a. If such a pair exists, consistency in the S-VOL is suspect. Recovery with guaranteed consistency is impossible. In this case, to use the S-VOL, you must release the pair.
  - b. If such a pair does not exist, run the YKSUSPND REVERSE option on the restore journal to split the pairs. Doing this ensures consistency in the S-VOLs and thus makes them usable.

If an error occurs, consistency in the S-VOL is dubious, and recovery with guaranteed consistency is impossible. In this case, to use the S-VOL, you must release the pair.

If no error occurs, wait until the split operation finishes.

3. Run the YKRESYNC REVERSE option on the restore journal (YKRESYNC resynchronizes the pair). This option attempts to resynchronize the pair and reverse the primary/secondary volume relationship.
4. Check for a pair whose restore journal status is Suspend with SWAPPING status in BCM.

If such a pair does not exist, the pair is successfully resynchronized and the copy direction is reversed. Copying of data from the secondary site to the primary site starts.

See the *Hitachi Business Continuity Manager User Guide* for more information.

## Reversing copy direction from secondary to primary site

When host operations have been switched to the secondary site, restore the primary site and re-establish the URz system from the secondary to the primary site.

### Procedure

1. Restore the primary storage system and data paths.
2. Bring up the host servers at the primary site.
3. Make sure that all URz components are operational.
4. Do all of the following, as applicable:

- a. At the primary site, locate P-VOLs whose status is Pending or Duplex. Locate corresponding S-VOLs at the secondary site whose status is Suspend, which indicates that data is being written to the S-VOLs. At the primary site, split these pairs.
  - b. At the primary site, locate P-VOLs whose status is other than unpaired. Locate corresponding S-VOLs at the secondary site whose status is unpaired. At the primary site, release the pairs.
  - c. At the primary site, locate pairs whose status is unpaired. At the secondary site, release the pairs.
5. On pairs that were split and in which S-VOL status is now Suspend, run the YKRESYNC REVERSE command. This reverses P-VOLs and S-VOLs and resynchronizes the pairs. The replication is from secondary site to original primary site.
  6. For S-VOLs whose status is unpaired, re-create the URz pairs specifying the S-VOLs as P-VOLs. This creates pairs in which P-VOLs and S-VOLs are reversed.
  7. Verify that pair status of all new S-VOLs (which were originally P-VOLs) changes from Pending to Duplex. When the pair status is changed to Duplex, initial copy operations are finished and consistency is maintained.

### **Result**

Data in the secondary site is now reflected on the primary site.

## **Resuming host operations at the primary site**

When URz pairs are established in the reverse direction between the secondary and primary sites, you can return host operations to the original configuration. This means resuming host operations at the primary site and reestablishing the original flow of data from primary to secondary storage systems. The following procedure explains how to resume normal operations at the primary site.

### **Procedure**

1. At both sites, make sure that URz components are operational.
2. Make sure that pair status of all P-VOLs and S-VOLs in all URz pairs is Duplex.
3. Stop host applications at the secondary site.
4. Issue a request for splitting pairs to master journals (these were originally the restore journals on the secondary site): YKSUSPND FLUSH SVOL PERMIT command. If an error occurs when splitting pairs, fix the error, resume host operations at the secondary site, and then go back to step 1.
5. If no errors occur, wait until suspension finishes. After suspension finishes, check for an S-VOL on the primary site whose status is not Suspend. If such a pair exists, fix the error and go back to step 1 after resuming your business task at the secondary site.
6. When all S-VOLs at the primary site are in Suspend status, data in P-VOLs and S-VOLs are the same. S-VOLs at the primary site are ready for host read/write activity. Resume applications at the primary site.
7. Run the YKSUSPND FORWARD command on the restore journal (which were originally master journal); YKSUSPND is a Business Continuity Manager command and FORWARD is an option. Wait until suspension completes.

8. After suspension completes, run the Business Continuity Manager YKRESYNC FORWARD command on the restore journal (originally the master journal). This reverses P-VOLs and S-VOLs to resynchronize pairs and restores copy direction to its original direction.

## Recovery for configurations with multiple primary systems and secondary systems

This topic provides recovery procedures for configurations with multiple primary systems and secondary systems.

### Switching from the primary to secondary site (multiple storage systems)

If a disaster or a failure occurs in the primary site in a configuration with multiple primary and secondary systems, the operation continues at the secondary site, and data consistency within CCI CTG is maintained.

If a disaster or a failure occurs at the primary site, switch the operation from the primary site to the secondary site first.

#### Procedure

1. Switch the operation from the primary site to the secondary site.
2. From the secondary site, specify the swap option to split the pair (`pairsplit -RS`).
3. Check if the UR S-VOLs of all storage systems at the secondary site are in the SSWS status.
4. Resume the operation at the secondary site using the data volume in the SSWS status of storage systems at the secondary site.

### Transferring operations back to the primary site (multiple storage systems)

After operations at the secondary site have resumed, if the other failures are corrected, operations at the primary site can be resumed.

#### Procedure

1. Make sure that the status of the UR secondary volumes of all secondary systems are SSWS.
2. In the secondary site, specify the swap option to resynchronize the pairs (`pairresync -swaps`).
3. Switch operation from the secondary site to the primary site.
4. In the primary site, execute the `horctakeover` command.



## Recovery for 3DC configurations with three URz sites

This topic provides recovery procedures for 3DC configurations with three URz sites.

### Recovery for 3 URz DC multi-target configuration (when the delta operation resync is performed)

In the event of a failure in the primary site, you can transfer production operations from the primary site to either one of the secondary sites. After the failure is corrected, you can transfer production operations back to the primary site.

Before performing the following procedures, refer to [Workflow for 3DC multi-target configuration with three URz sites \(on page 117\)](#) to confirm that the configuration is correct. If the correct configuration is not established, delete the delta resync UR pair, and perform the recovery operations according to [Switching from the primary to secondary site \(multiple storage systems\) \(on page 184\)](#).

### Moving business operations to the secondary site

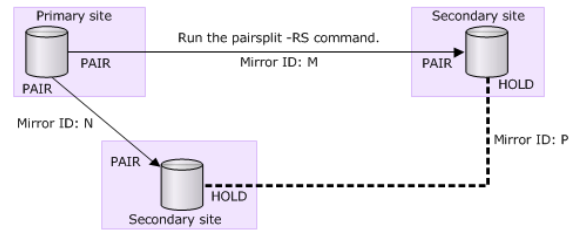
You keep business operations running in the event of a failure at the primary site by moving those operations to a secondary site.

#### Procedure

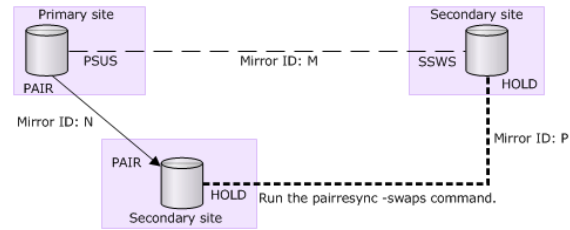
1. Run the `pairsplit -RS` command on the pair at the alternative secondary site.
2. Check the execution result of the `pairsplit -RS` command.
3. Perform the delta resync operation by running the `pairresync -swaps` command on the delta resync pair.
4. Check that the P-VOL of the pair for delta resync at the secondary site changes to the P-VOL of the pair at the primary site and that the status of the P-VOL for delta resync at the secondary site changes to PAIR.

You can use the P-VOL at the alternative secondary site to resume business operations after confirming these changes.

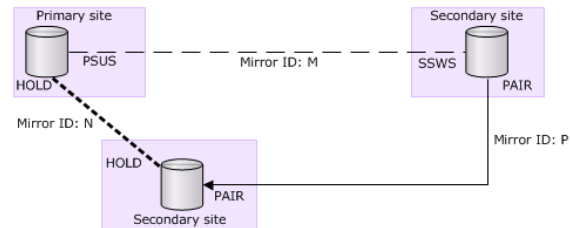
Business operations are performed at the alternative secondary site, and remote copy is performed at the secondary site which is not the alternative site using the delta resync pair (with mirror ID P).



Run the pairsplit -RS command for the pair at the secondary site, and check the result.



Run the pairresync -swaps command for the delta resync pair, and check the result.



Check if the delta resync pair is a normal pair, and the pair status of each volume is PAIR.

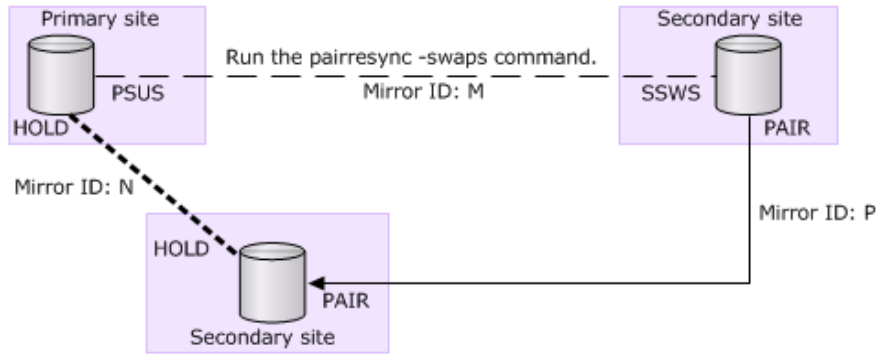
Legend  
 → : normal pair    - - - : split pair    - - - - - : delta resync pair  
 PAIR, PSUS, PSUE, HOLD, SSWS: pair status in each site (Status on CCI)

## Moving business operations back to the primary site

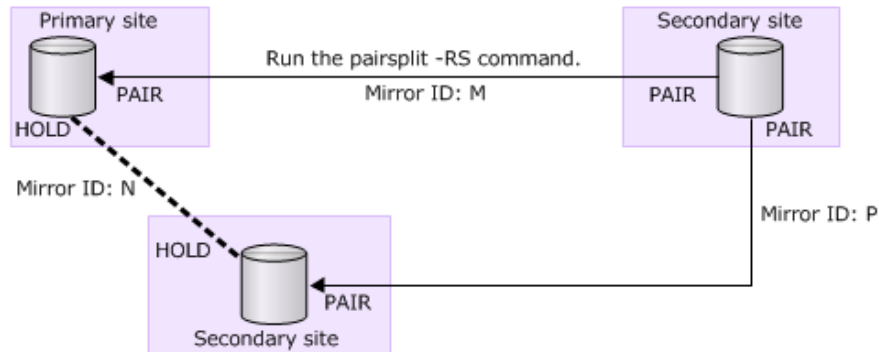
You can return business operations from the secondary site back to the primary site after removing failures at the primary site and other sites.

### Procedure

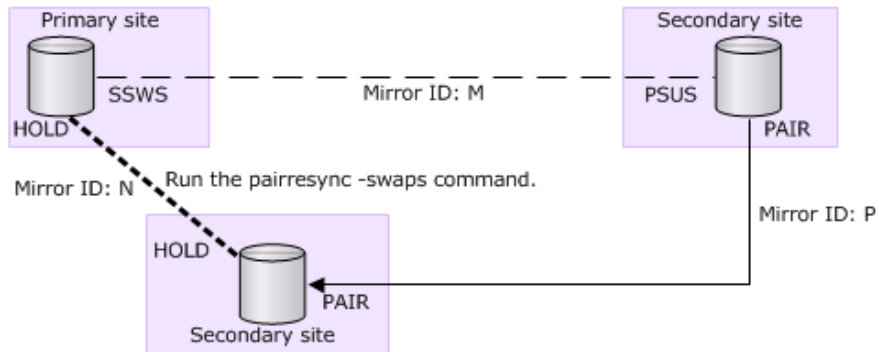
1. Stop business operations at the secondary site.
2. If the secondary site to be reversed and the primary site pair are suspended, resynchronize the pair (**pairresync -swaps**), and then reverse the pair's primary and secondary volumes.
3. Run the **pairsplit -RS** command for the pair between the secondary site to be reversed and the primary site.
4. Run the **pairresync -swaps** in the primary site, which reverses the primary and the secondary volumes to restore and resynchronize the pair.
5. Check the execution result of **pairresync -swaps** command.
6. Resume business operations at the primary site.



Run the pairresync -swaps command to replace the primary and secondary of the pair after stopping the operation at the alternative secondary site.

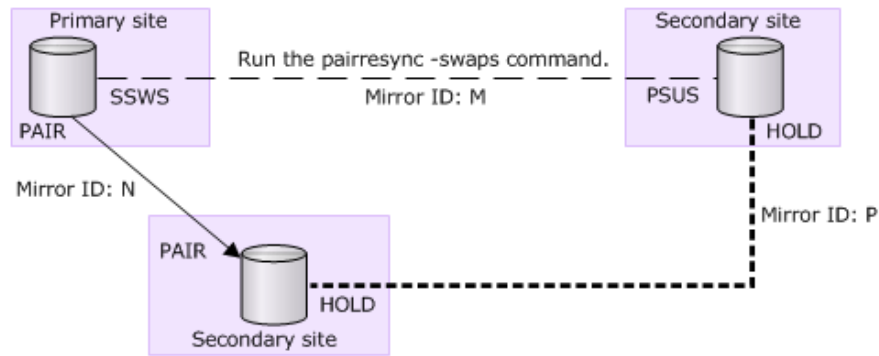


Run the pairsplit -RS command for the pair between the primary and alternative secondary sites.

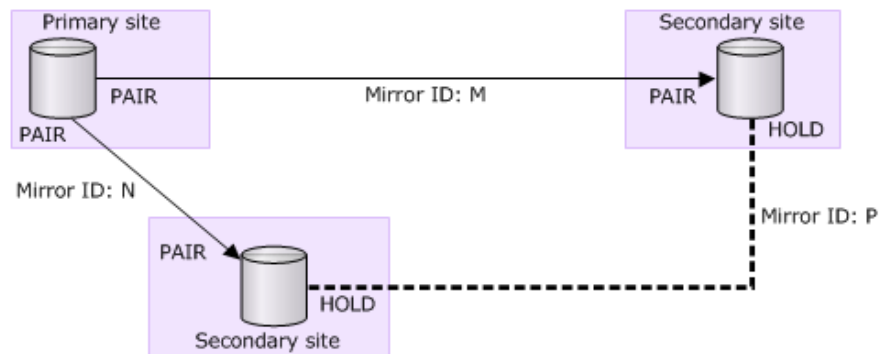


Run the pairresync -swaps command for the delta resync pair, and check the result.

Legend  
 → : normal pair    - - - : split pair    - - - - : delta resync pair  
 PAIR, PSUS, PSUE, HOLD, SSWS: pair status in each site (Status on CCI)



Run the pairresync -swaps command for the pair between the primary and secondary sites.



The system returns to the original multi-target configuration.

Legend

→ : normal pair    - - - : split pair    - - - - : delta resync pair  
 PAIR, PSUS, PSUE, HOLD, SSWS: pair status in each site (Status on CCI)

## Requirements for performing delta resync in 3DC multi-target configuration with three URz sites

**Note:** In a 3DC multi-target configuration with three URz sites, you can perform the delta resync operation only by using CCI. The delta resync operation cannot be performed by using Device Manager - Storage Navigator.

To perform the delta resync operation successfully, the following requirements must be met. If a regular URz pair that does not meet the requirements exists in the journal, even if the URz delta resync pair meets all the requirements, the delta resync pair will be suspended by error.

- There is a URz pair with a mirror ID that is different from the URz delta resync pair in the same journal in the secondary site specified for the delta resync operation (the pairs with mirror ID P and M in the figure in [3DC multi-target configuration with three URz sites using delta resync \(on page 43\)](#)).
- There is a URz pair with mirror ID that is different from the URz delta resync pair in the same journal in the URz delta resync pair's secondary site (the pairs with mirror ID P and N in the figure in [3DC multi-target configuration with three URz sites using delta resync \(on page 43\)](#)).

- One of the two pairs is a URz delta resync pair (with the mirror ID P) in HOLD status, and the URz pair between the intermediate and secondary sites (with mirror ID N) is either PAIR, PSUS, or PSUE.
- All of the differential data of the P-VOL and S-VOL is stored in the master journal volume.
- The path for the URz delta resync pair between the primary and secondary sites is valid.
- In all three sites, remote command device is allocated to the two mirror IDs. You can confirm this status by using the `raidcom get journal -key opt` command.
- The capacity of both the volumes used in a URz delta resync pair (with the mirror ID P) of the two pairs is the same.

If even one of the above requirements is not met, an error or suspend by error occurs, and the delta resync operation will fail.

If the delta resync fails, check the following status. Especially in the following case, delta resync will not be performed because the journal data necessary for the delta resync does not exist.

- After the URz pair between the primary site and the reversed intermediate site is split, the restore journal volume data of the URz delta resync pair in the unreversed secondary site exceeds 70% of the volume capacity as a result of updating the volume in the reversed secondary site.

If the specified URz delta resync pair status is not changed after performing the delta resync operation, the conditions for the delta resync operation described in this section might not be met. In this case, check the status of the URz pair and URz delta resync pair again, and verify whether all of the conditions for the delta resync operation are met. Then execute the delta resync again.



**Note:**

- When the URz delta resync pair is changed to HLDE, you cannot change it back to HOLD by pair resync. Delete the URz delta resync pair, and then create the URz pair again. After creating the URz pair, assign a remote command device to the mirror ID.
- If a suspend by error occurred in the pair specified the delta resync right after performing the delta resync operation, check the pair status and perform the following operation:
  - For URz P-VOL, resync the URz pair that is in suspend by error.
  - For URz S-VOL, delete the URz pair that is in suspend by error, and then create the URz pair again. After creating the URz pair, assign a remote command device to the mirror ID.

## Recovering from failures in a 3 URz DC cascade configuration

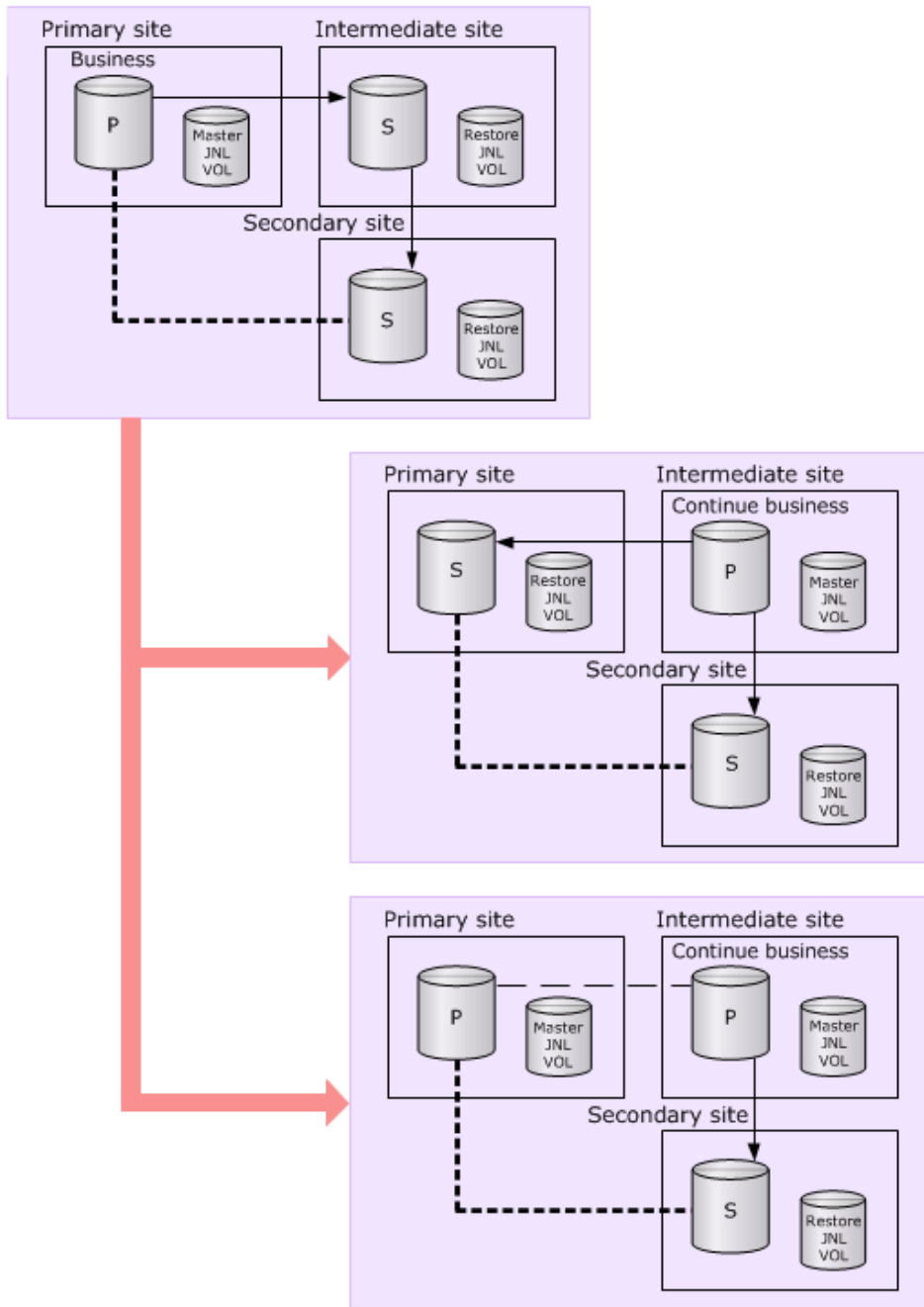
Disasters can occur at any point in a 3 URz DC cascade configuration that can affect business operations or production data backup. How you maintain business operations or data backup and recover from the failure, depends on where the disaster occurs.

## Recovering when a failure occurs in the primary site

If a disaster occurs in the primary site, you can continue business operations by switching operations from the primary site to the secondary or intermediate site. Then, you can recover from the failure and return operations back to the primary site.

### Procedure

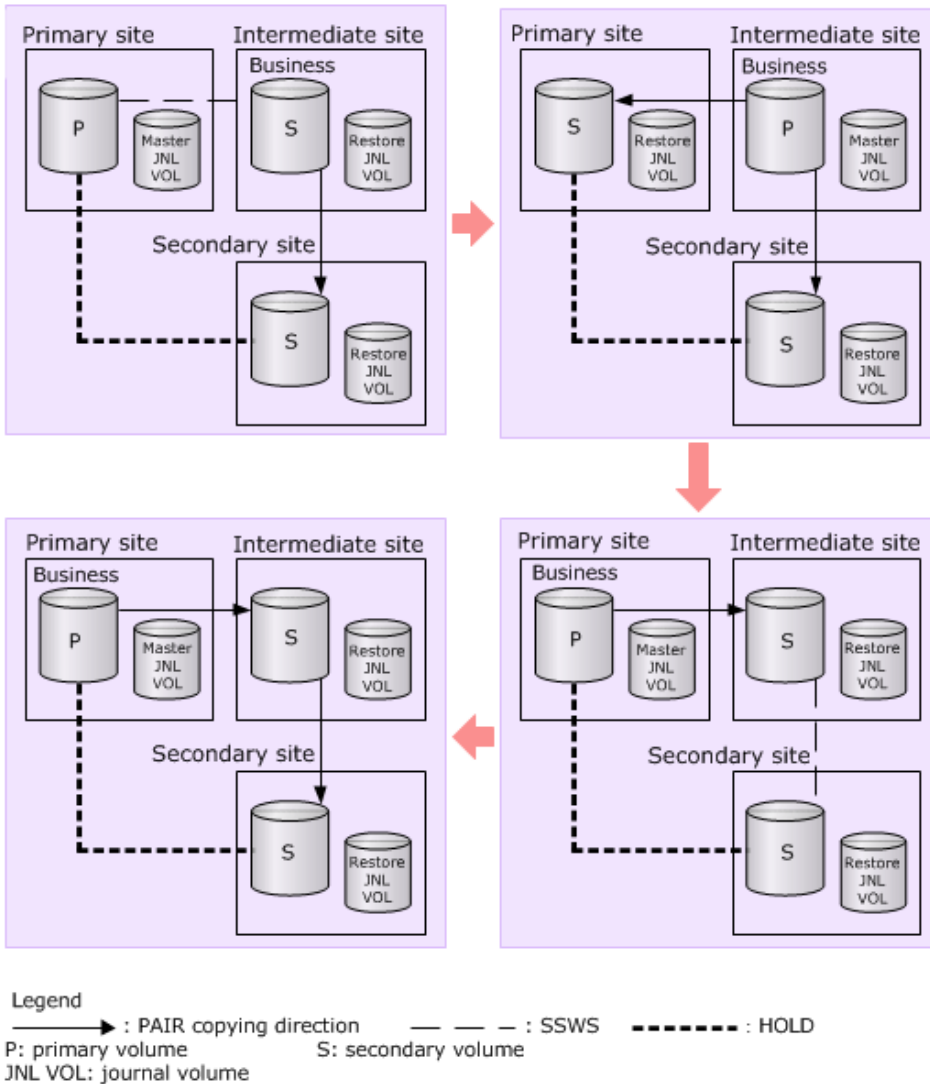
1. Transfer host operations to the intermediate site.
  - a. Run the `horctakeover` command on the primary-intermediate site pair.
  - b. Check the execution result.
  - c. Start host operations to the volume when the S-VOL status changes to an SSWS status or changes to a P-VOL status.



Legend  
 → : PAIR copying direction      - - - : SSWS      - - - - : HOLD  
 P: primary volume    S: secondary volume  
 JNL VOL: journal volume

2. Remove the failure or failures from the primary site.
3. Transfer business operations back to the primary site (when the delta resync operation is performed).
  - a. Stop business tasks at the intermediate site.

- b. If the primary-intermediate site pair is suspended, run the `horctakeover` command on the primary-intermediate site pair.  
The intermediate-secondary site pair is automatically suspended.
- c. Resume business operations using the primary volume in the primary site.
- d. Resynchronize the intermediate-secondary site pair.



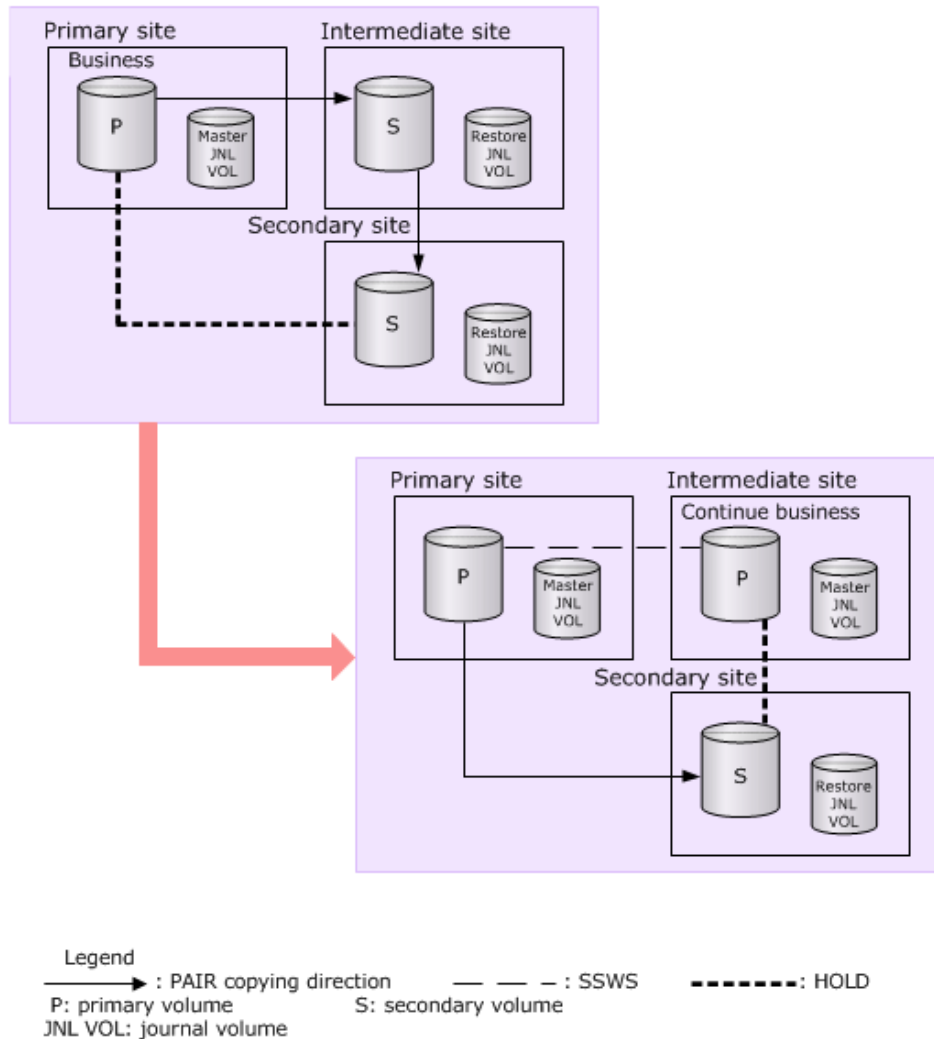
### Recovering when a failure occurs in the intermediate site

If a disaster occurs in the intermediate site, you can redirect production data backup to the secondary site. Then, you can recover from the failure and re-create the cascade configuration.

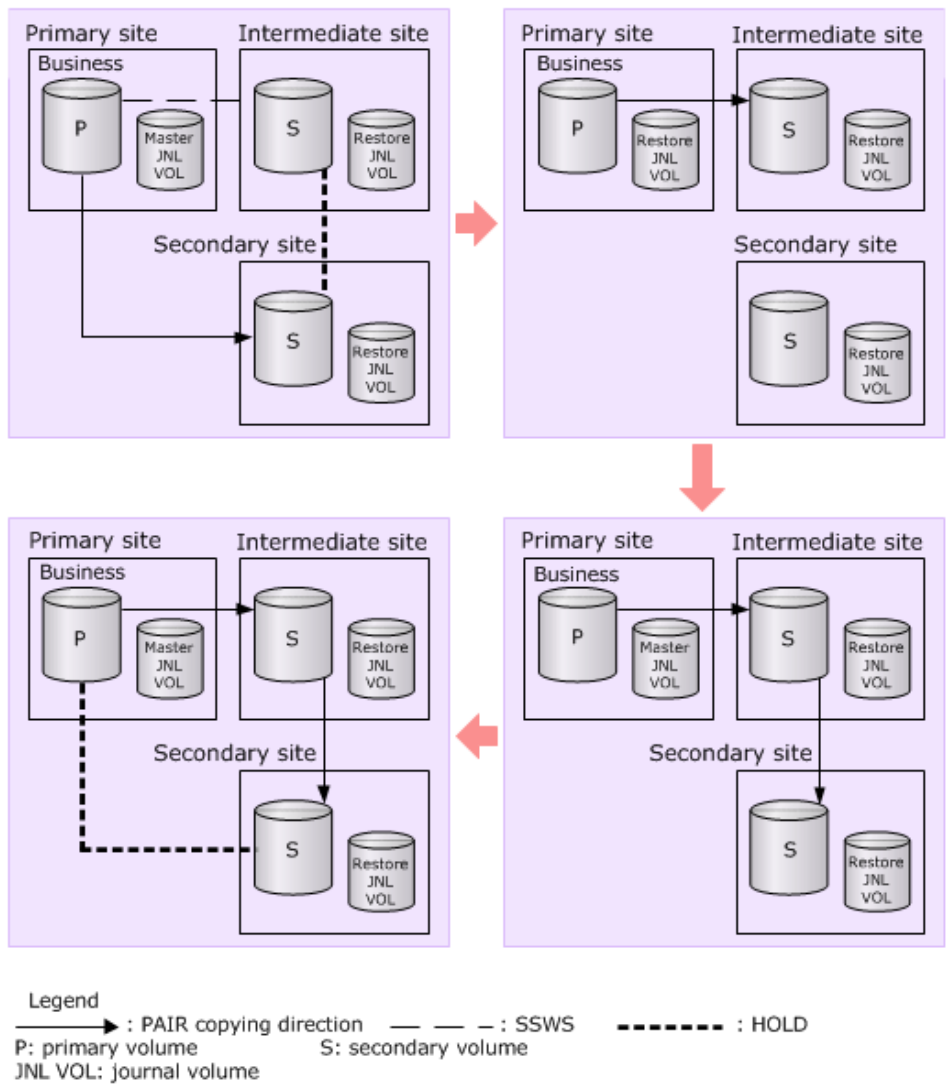
#### Procedure

1. Perform the delta resync operation between the primary site P-VOL and the secondary site S-VOL to redirect the production data backup.





2. Remove the failure or failures from the intermediate site.
3. Restore the intermediate site and cascade configuration (when the delta resync operation is performed).
  - a. If the primary-intermediate site pair is suspended, run the `horctakeover` command to resynchronize the pair.  
After the resynchronization, the primary volume and secondary volume of the pair are reversed. The intermediate-secondary site pair is suspended automatically.
  - b. Delete the primary-secondary site delta resync pair.  
As a result, the intermediate-secondary site pair is also deleted.
  - c. Create a pair between the intermediate and secondary sites, specifying `Entire` for `Initial Copy`.
  - d. Create a delta resync pair between the primary and secondary sites.



### Recovering when a failure occurs in the primary-intermediate path

If the data path between the primary and intermediate sites fails, the status of journals in these sites might change to Stopping (with pair status changed to Suspending). You can recover by either resynchronizing the primary and intermediate sites or by performing a delta resync between primary-secondary sites.

### Resynchronizing journals between the primary and secondary sites

You can recover from a primary-intermediate path failure by resynchronizing journals between the primary and secondary sites.

#### Procedure

1. Run the delta resync operation on the delta resync pair set up between the primary and secondary sites.  
 This changes the journal status between the primary and intermediate sites.

## Resynchronizing journals in the primary and intermediate sites

You can recover from a primary-intermediate path failure by resynchronizing journals in the primary and intermediate sites.

### Procedure

1. Delete the delta resync pair between the primary and secondary sites.
2. Confirm that the status of the journal between the primary and intermediate sites is changed to Stop.
3. Correct the reason for the data path failure.
4. Resync the pair between the primary and intermediate sites.

## Recovering when a failure occurs in the secondary site

If the secondary site fails, business operations are not affected because the primary and intermediate sites are still operating; therefore, recovering from a secondary site failure simply re-creates the cascade pairs.

### Procedure

1. Remove the failure or failures from the secondary site.
2. Set up the cascade pairs again.

## Recovery for 3DC cascade configuration with three URz sites

### Recovering from a primary site failure

When a failure or disaster occurs in the primary site, business tasks are transferred from the primary site to the intermediate site. After you correct the failure in the primary site, you can transfer the business tasks back to the primary site.

### Procedure

1. Stop host operations at the intermediate site.
2. If the URz pair between the primary and intermediate sites are in suspend status, resync the pair by running the CCI `horctakeover` command.  
After the resync, URz the P-VOL and S-VOL are switched. The URz pair between the intermediate and secondary sites are suspended automatically.
3. Resume host operations by using the P-VOL in the primary site.
4. Resync the URz pair between the intermediate and secondary sites.

### Recovering from an intermediate site failure for a 3DC cascade configuration with three URz sites

When a failure or disaster occurs in the intermediate site, data is duplicated by connecting the primary and secondary sites. After you correct the failure in the intermediate site, you can change back to the original cascade configuration.

### Procedure

1. If the URz pair between the primary and intermediate sites is suspended, resync the pair.
2. Delete the pair between the primary and secondary sites.  
The URz delta resync pair between the intermediate and secondary sites will be deleted automatically.
3. Create a URz pair between the intermediate and secondary sites.  
Specify **Entire** when performing the initial copy operation.
4. To create the delta resync configuration, create a URz delta resync pair between the primary and the secondary sites.

### Requirements for performing delta resync in 3DC cascade configuration with three URz sites

To perform delta resync operation successfully, the following requirements must be met. Note that the suspended by error will occur if a regular URz pair which does not meet the conditions exists in the journal, even if the URz delta resync pair meets all the requirements.

- There is a URz pair which has a different mirror ID than the URz delta resync pair in the same journal in the primary site (pairs with the mirror ID P and M shown in [3DC cascade configuration with three URz sites \(on page 44\)](#)).
- There is a URz pair which has a mirror ID different than the URz delta resync pair in the same journal in the URz delta resync pair's secondary site (pairs with the mirror ID P and N shown in [3DC cascade configuration with three URz sites \(on page 44\)](#)).
- Out of two pairs, one is URz delta resync pair (with the mirror ID P) and in HOLD status, and the other is the URz pair connecting the primary and intermediate sites and in PAIR or PSUE status.
- Out of two pairs, one is URz delta resync pair (with the mirror ID P) and in HOLD status, and the other is the URz pair connecting the intermediate and secondary sites (with the mirror ID P) and in PAIR, PSUS, or PSUE status.
- If you resynchronize the URz pair (with the mirror ID M) connecting the primary and intermediate sites, you must resynchronize the URz pair (with the mirror ID N) connecting the intermediate and secondary sites as well.
- P-VOL and S-VOL's entire differential data is stored in the master journal volume.
- The path between the primary and secondary sites of the URz delta resync pair is valid.
- Remote command devices are allocated to the two mirror IDs in all the three sites.

If even one of the above requirements is not met, an error occurs and the delta resync operation will fail. Especially in the following cases, delta resync will not be performed because the journal data necessary for the delta resync does not exist.

- After the URz pair between the intermediate site and secondary site is split, the journal volume data of the URz pair between the primary and intermediate sites in the secondary site exceeds 70% of the volume capacity.
- After updating the URz delta resync P-VOL, the journal volume data of the URz delta resync pair in the primary site exceeds 70% of the volume capacity.

Setting options can prevent the error from occurring in the delta resync operations with the cascade configuration with three URz sites, by copying the entire P-VOL data to the S-VOL when entire differential data of the P-VOL and S-VOL is not stored in the master journal. For setting the URz delta resync operation options for the URz delta resync pairs, see [Changing options used by journals \(on page 162\)](#).

If the specified URz delta resync pair status is not changed after performing the delta resync operation, the conditions for the delta resync operation described in this section might not be met. In this case, check the status of the URz pair and URz delta resync pair again and verify whether all of the conditions for the delta resync operation are met. Then execute the delta resync again.



**Note:** When the S-VOL of the URz delta resync pair is changed to HLDE, you cannot change it back to HOLD by pair resync. Delete the URz delta resync pair, and then create the URz pair again.

## Recovery for 3DC URz/TCz

Recovery procedures when URz P-VOLs and S-VOLs are shared with TrueCopy for Mainframe can be more complex than general procedures

If your storage system is VSP 5000 series, VSP G1x00, or VSP, you can combine URz and TrueCopy for Mainframe for disaster recovery. The following topics provide recovery procedures for resuming host operations at a backup site and then restoring the original system and configurations.

- [Recovery for 3DC URz/TCz cascade configuration \(on page 197\)](#)
- [Recovery for 3DC URz/TCz multi-target configuration \(on page 198\)](#)
- [Recovery in a delta resync configuration \(on page 201\)](#)

For mainframe systems, it is recommended that all operations are performed using BCM. It is possible to perform these operations using CCI, however host system status of the storage system and its volumes must be performed from the host.

### Recovery for 3DC URz/TCz cascade configuration

Host operations are transferred to the TCz secondary volume (S-VOL) at the intermediate site when a disaster or failure occurs in the primary site of a 3DC cascade configuration. The primary site failure is corrected and brought back online, and then either the cascade configuration is restored or the multi-target configuration is created.

See [3DC cascade configuration \(on page 246\)](#) for information and illustrations on the configuration covered in this procedure.

Use the following procedure to recover a 3DC cascade configuration failure.

#### Procedure

1. Check consistency of the secondary volume at the intermediate site.
2. Run the YKSUSPND REVERSE command on the secondary volume.

3. Start host operations to the secondary volume at the intermediate site.
4. Run the YKRESYNC REVERSE command on the copy groups of the primary-intermediate pair. This operation reverses the copy direction.

## Recovery for 3DC URz/TCz multi-target configuration

The recovery procedure you perform in a 3DC multi-target configuration depends on the location of the failure:

- For failure in the primary site only, see [Recovering from primary site failure \(on page 198\)](#).
- For failure in the primary and TrueCopy for Mainframe secondary sites, see [Recovering from primary and secondary site failure \(3DC multi-target\) \(on page 200\)](#)

See [3DC multi-target configuration \(on page 248\)](#) for information and illustrations on the configuration covered in this procedure.

### Recovering from primary site failure

Host operations are transferred to the secondary volume in the TCz secondary site when disaster or failure occurs in the primary site in a 3DC multi-target configuration. The replication direction changes so that data flows from the TCz secondary site to the primary site. Alternatively, a temporary URz system can be set up. Meanwhile, you correct the failure at the primary site and then transfer host operations back to it and return to a 3DC configuration.

Use the following procedure to recover a primary site failure.

#### Procedure

1. Release the URz pair to the S-VOL by executing the YKRECOVER command.
2. Suspend the TCz pair by executing the YKSUSPND REVERSE command. This stops copy operations.
3. Start host operations to the TCz secondary site S-VOL.
4. Reverse the TCz pair's copy flow using the YKRESYNC REVERSE command.

#### Result

Running the YKRESYNC REVERSE results in one of the following conditions:

- The original copy flow of the TCz pair reverses and flows from S-VOL to P-VOL.
- The original copy flow does not reverse because of failure in the primary site or data path.

Depending on the result, proceed as follows:

#### If the original TCz data flow reverses

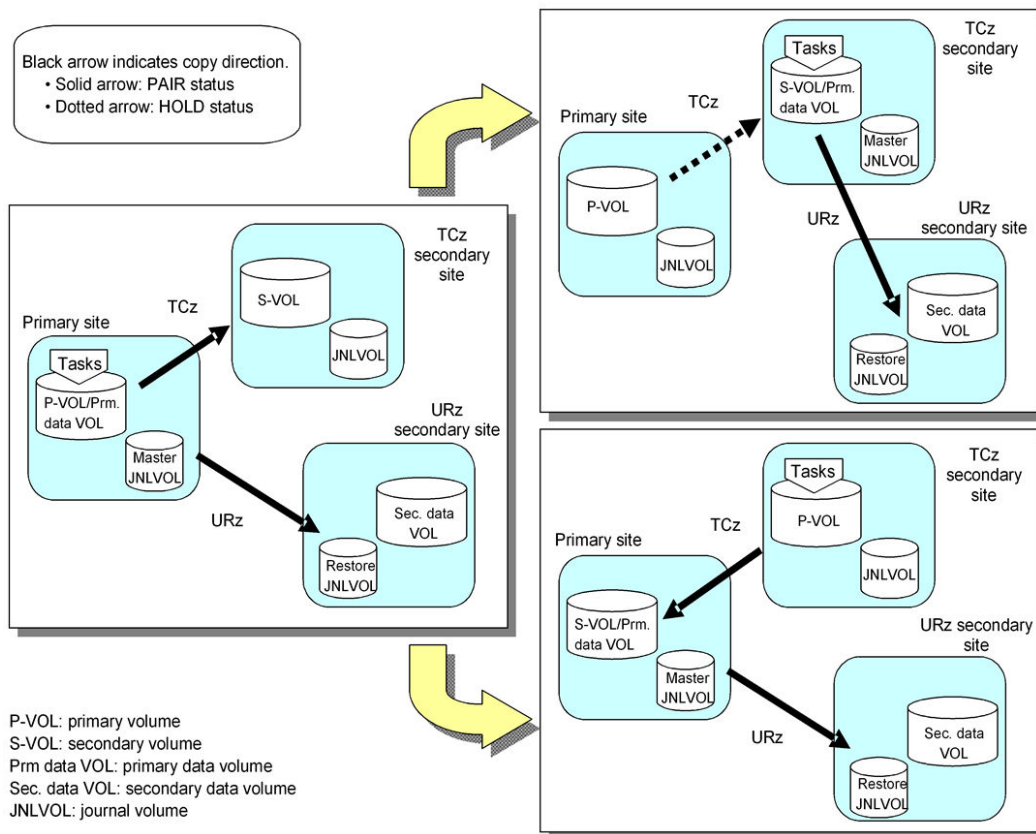
1. Re-create the URz pair using the YKMAKE command from the TCz primary site to the URz secondary site. This results in a 3DC cascade configuration, with the original TCz S-VOL as the primary volume. See the lower right configuration in the following figure.
2. Begin recovery of the original configuration by restoring the primary site or data path, or both. This must be done before proceeding.
3. Stop host operations to the TCz secondary site.

4. Suspend the TCz pair using the YKSUSPND FORWARD command.
5. Resume host operations to the TCz P-VOL in the primary site.
6. Run the YKRESYNC FORWARD command to resume the TCz pair with replication again from the original TCz P-VOL in the primary site to the TCz S-VOL in the secondary site.

The system changes back to the original 3DC multi-target configuration.

**If the original TCz data flow did not reverse**

1. To back up the data, create a new URz pair using YKMAKE from the TCz secondary site S-VOL to the URz secondary site S-VOL. See the upper-right configuration in the following figure.
2. Begin recovery of the original configuration by restoring the primary site or data path, or both. This must be done before proceeding.
3. Release the URz pair using the YKDELETE command.
4. Resynchronize the TCz pair using the YKRESYNC command to start the replication to the primary site.
5. Release the current UR pair, which extends between the TC secondary site and the URz secondary site.
6. Stop host operations at the TCz secondary site.
7. Suspend the TCz pair using the YKSUSPND FORWARD command.
8. Resume host operations at the primary site TCz volume.
9. Resynchronize the TCz pair from the primary site using the YKRESYNC FORWARD command. Replication is again from the original TCz P-VOL to the original S-VOL.
10. Re-create the URz pair from the primary site to the secondary site using the YKMAKE command. The system is now changed back to the original 3DC multi-target configuration.



### Recovering from primary and secondary site failure (3DC multi-target)

Host operations are transferred to the Universal Replicator for Mainframe secondary site S-VOL when a disaster or failure occurs in both the primary and TCz secondary sites in a 3DC multi-target configuration. Failures are corrected at the two sites, and then host operations are transferred back to the primary site.

Use the following procedure to recover a primary and TCz secondary site failure.

#### Procedure

1. Run the YKSUSPND REVERSE command on the URz pair.
2. Resume host operations at the URz secondary site.
3. Release the TCz pair using the YKDELETE command.
4. Make sure the URz pair is resynchronized so that the copy flow is from S-VOL to P-VOL. Use the YKRESYNC REVERSE command to resync the pair.
5. Stop host operations at the URz secondary site.
6. Run the YKSUSPND FORWARD command on the URz pair.
7. Resume host operations at the primary site.
8. Reverse the copy flow on the URz pair using the YKRESYNC FORWARD command. Copy flow is returned to its original direction, P-VOL to S-VOL.
9. Re-create the TCz pair using the YKMAKE command.



**Result**

The system is now changed back to the original 3DC multi-target configuration.

**Recovery in a delta resync configuration**

Host operations are transferred to the TrueCopy for Mainframe secondary site S-VOL when a disaster or failure occurs in the primary site in a delta resync configuration. Then you run the delta resync operation. When the failure at the primary site is corrected, host operations are transferred back to the primary site and the delta resync configuration is reestablished.

**Before you begin**

- For information and illustrations on the configuration covered in this procedure, see [Delta resync configuration \(on page 250\)](#).
- You can specify options for recovery in the event that the delta resync operation fails. See the Delta Resync Failure step in [Changing options used by mirrors \(on page 164\)](#). This also provides important information if you share the delta resync S-VOL with ShadowImage, Thin Image, or a DP-VOL.

**Procedure**

1. Make sure that the URz pair is in Duplex status and then run the YKSUSPND Flush FORWARD command.
2. Run the YKSUSPND REVERSE command on the TCz pair. This suspends the pair and stops copy operation temporarily.
3. Start host operations to the TCz secondary site S-VOL.
4. Reverse the copy flow of the TCz pair, if possible, using the YKRESYNC REVERSE command.
5. Perform the delta resync operation using the YKRESYNC DELTAJNL command on the TCz secondary site S-VOL.

See [Performing the delta resync operation \(on page 261\)](#). Note that pair status must be Hold before the operation. When the operation completes, pair status is Duplex or Pending.



**Note:** Pair status also changes for the original URz pair in the primary and URz secondary sites, from Duplex or Pending to Hold.

However, the status of the original pair may not change to the required state after the delta resync operation. If this occurs, host operations cannot be resumed in the primary site. See [Problems with pair status during delta resync recovery \(on page 202\)](#) and make the necessary corrections.

6. Resolve the problem at the primary site. This must be done before proceeding.
7. Make sure the URz pair is in Duplex status, and then run the YKSUSPND Flush FORWARD command on the pair.
8. If the TCz pair is suspended, resynchronize the pair and reverse the copy flow using the YKRESYNC REVERSE command.
9. Stop host operations to the TCz secondary site.
10. Suspend the TCz pair using the YKSUSPND FORWARD command.

11. Resume host operations to the TCz P-VOL in the primary site.
12. Run the YKRESYNC FORWARD command on the TCz pair to resynchronize and return the copy flow to its original direction.
13. Perform the delta resync operation on the volume in the TCz primary site. Pair status must be Hold. When the operation completes, pair status is Duplex or Pending.  
Also, pair status changes for the delta resync URz pair from the TCz secondary to the URz secondary site, from Duplex or Suspend to Hold.

If a failure occurs after the one volume capacity of a UR pair can be expanded, the creation, resync, swap resync, and horctakeover operations of the UR pair cannot be performed because the capacity of both the volumes is not the same. Make sure to expand the other volume capacity so that the capacity of both the volumes is the same, and then retry the operation.

### Result

The system becomes a delta resync configuration again.

## Problems with pair status during delta resync recovery

After performing the delta resync, it is necessary for the original URz pair from primary to URz secondary site to be in Hold status, in order to resume operations at the primary site. However, the pair may not be in this status.

If pair status is not Hold, match the pair's actual statuses in the following table, and then perform the corrective action.

Current status	Corrective action
Primary site: Duplex or Pending URz secondary site: Hold	<ol style="list-style-type: none"> <li>1. Make sure that the status of the pair in the primary site is Suspend.</li> <li>2. Release the URz pair from the primary site.</li> <li>3. Make sure that all the pairs belonging to the journal in the primary site are released.</li> <li>4. Create a URz delta resync pair that extends from the primary site to the URz secondary site.</li> </ol>
Primary site: Suspend URz secondary site: Hold	<ol style="list-style-type: none"> <li>1. Release the URz pair from the primary site.</li> <li>2. Make sure that all the pairs belonging to the journal in the primary site are released.</li> <li>3. Create a URz delta resync pair that extends from the primary site to the URz secondary site.</li> </ol>
Primary site: Hlde URz secondary site: Hold	Change the status of the Hlde pair back to Hold.
Primary site: unpaired URz secondary site: Hold	<ol style="list-style-type: none"> <li>1. Release the pair in Hold status from the URz secondary site.</li> </ol>

Current status	Corrective action
	2. Create a URz delta resync pair that extends from the primary site to the URz secondary site.

## Recovery for URz/Slz configurations

See [Configurations with Slz secondary volumes \(on page 269\)](#) for information and illustrations on the configuration covered in this procedure.

You resume host operations to the Universal Replicator for Mainframe secondary volume if a disaster or failure occurs at the primary site where the URz P-VOL is shared with a ShadowImage for Mainframe (Slz) secondary volume. Then you recover the primary site and then resume host operations.

Use the following procedure to recover a URz P-VOL/Slz S-VOL configuration.

### Procedure

1. Release the Slz pair using the YKDELETE command.
2. Suspend the URz pair using the YKSUSPND REVERSE command.
3. Reverse the copy direction and re-establish the URz pair using the YKRESYNC REVERSE command.
4. Delete the URz pair using the YKDELETE command.
5. Reverse the copy direction of the URz pair again to the original direction and re-establish the pair using the YKRESYNC FORWARD command.
6. Suspend the URz pair using the YKSUSPND command.
7. Reverse the copy direction of the Slz pair using the YKMAKE command.
8. Release the Slz pair using the YKDELETE command.
9. Reverse the copy direction of the Slz pair again to the original direction and re-establish the pair using the YKMAKE command.
10. Suspend the Slz pair using the YKSUSPND command.
11. Re-create the URz pair using the YKMAKE command.

### Result

The system becomes the original configuration again.

## Recovery from a failure at the primary site and TC secondary site

When a disaster or failure occurs both at the primary site and TC secondary site in the 3DC multi-target configuration, you can resume business by using the S-VOLs at the UR secondary site.

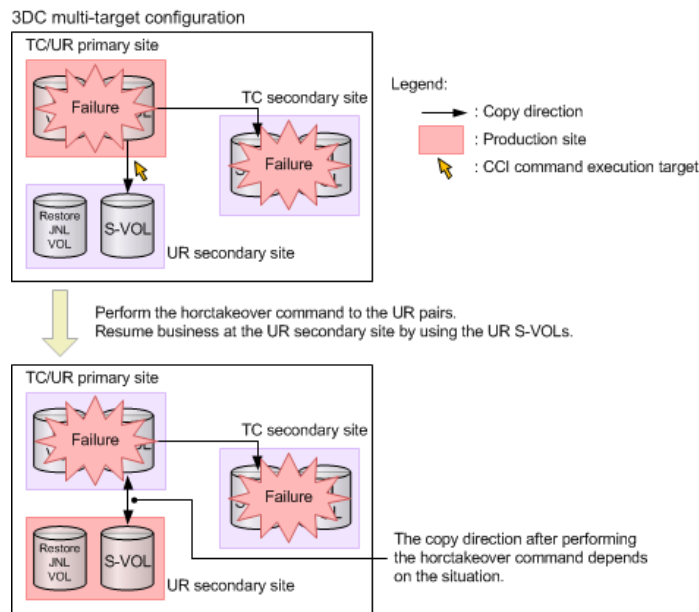
After transferring business tasks back to the UR secondary site, correct the failure at the primary site and TC secondary site so that business tasks can be transferred back to the primary site.

## Switching from the primary to secondary site (TC secondary site)

If a disaster or failure occurs both at the primary site and TC secondary site in the 3DC multi-target configuration, resume business by using the S-VOLs at the UR secondary site.

### Procedure

1. Run the CCI `horctakeover` command to the UR pairs.
2. Resume business operations by using the volumes at the UR secondary site.



## Transferring operations back to the primary site (TC secondary site)

After operations at the secondary site have resumed, if the other failures are corrected, operations at the primary site can be resumed.

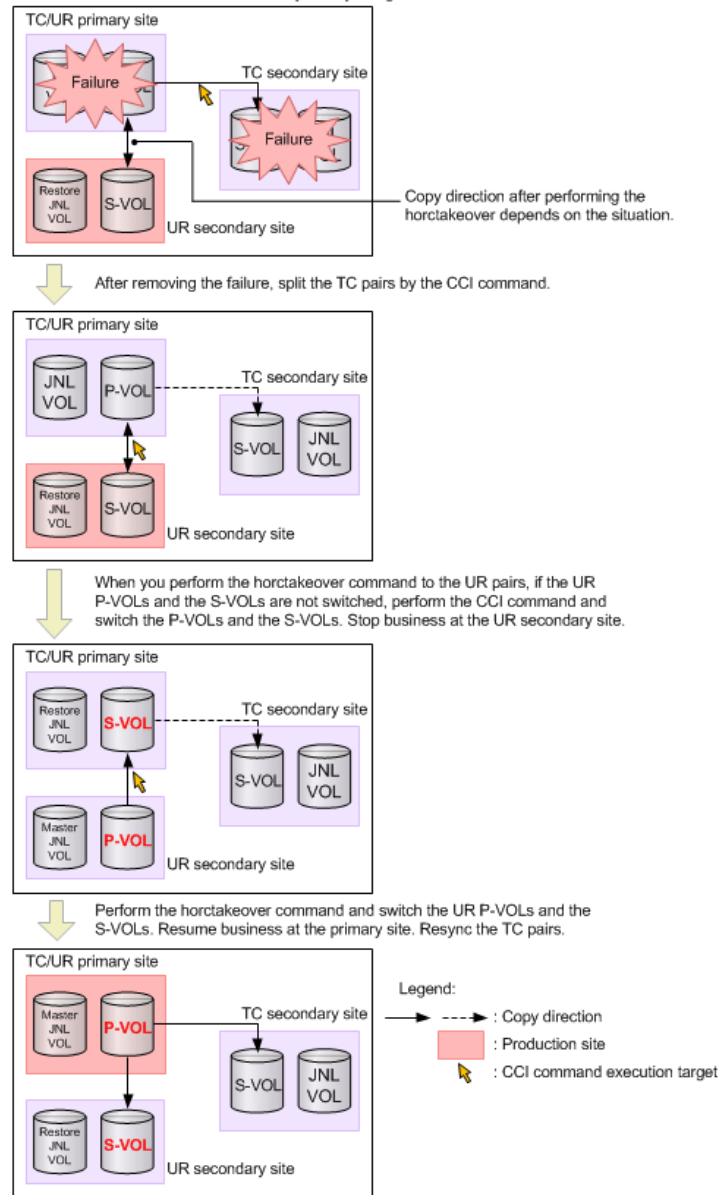
### Procedure

1. Split the TC pairs by using the CCI `pairsplit` command.
2. If the pair resync to switch the UR P-VOLs and the S-VOLs is not performed (UR pairs are split by failure), resync the pairs by using the CCI `pairresync` command and switch the P-VOLs and the S-VOLs.  
The original S-VOLs at the UR secondary site become the P-VOLs, and the original P-VOLs at the primary site become the S-VOLs.
3. Stop the business process at the UR secondary site.
4. Run the CCI `horctakeover` command to the UR pairs.  
The UR P-VOLs and the S-VOLs will be switched.
5. Resume business operations at the primary site by using the P-VOLs at the primary site.

6. Resync the TC pairs by using the CCI `pairresync` command.

The system configuration returns back to the 3DC multi-target.

Business is resumed at the UR secondary site by using the UR S-VOLs.



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## Chapter 11: Troubleshooting

When issues occur with Universal Replicator for Mainframe, there are a number of different troubleshooting options.

- [General troubleshooting \(on page 206\)](#)
- [Remote path status problems \(on page 210\)](#)
- [Troubleshooting by suspend type \(on page 213\)](#)
- [Troubleshooting hardware problems affecting pairs \(on page 215\)](#)
- [Troubleshooting with CCI \(on page 217\)](#)
- [Service information messages \(SIMs\) \(on page 238\)](#)

### General troubleshooting

When an error occurs in a Universal Replicator for Mainframe pair operation with Device Manager - Storage Navigator, an error message with a four-digit error code and description is displayed. An SVP error code might also be included. See *Hitachi Device Manager - Storage Navigator Messages* for details about error codes.

You can download Device Manager - Storage Navigator dump files using the Dump tool. If you are unable to resolve an error, use the tool to copy the dump files to a file, and then contact customer support for assistance.

The following table lists error conditions and provides recommended action to resolve the condition.

Error	Recommended action
Device Manager - Storage Navigator hangs, or URz operations do not function properly.	<p>Make sure that the problem is not being caused by the computer or Ethernet hardware or software, and restart the computer. Restarting the Device Manager - Storage Navigator computer does not affect URz operations in progress.</p> <p>Make sure that URz requirements are met.</p> <p>Make sure that the primary and secondary storage systems and remote copy connections are powered on, and that NVS and cache are fully operational.</p>

Error	Recommended action
	<p>Check all the entered values and parameters to make sure that you entered the correct information on the Device Manager - Storage Navigator computer (for example, secondary storage system serial number, path parameters, P-VOL and S-VOL IDs).</p> <p>If you are using Performance Monitor, refrain from using it.</p>
An initiator channel-enable LED indicator (on the control window) is off or flashing.	Call customer support for assistance.
Status of pairs and/or remote paths is not displayed correctly.	Check whether you selected correct items and options in URz Device Manager - Storage Navigator windows.
An R-SIM warning appears on your Device Manager - Storage Navigator computer.	Locate the SIM (see <i>System Administrator Guide</i> for instructions). For information about URz SIMs, see <a href="#">Service information messages (SIMs) (on page 238)</a> .
A UR error message appears on the Device Manager - Storage Navigator computer.	Remove the error cause, and then retry the UR operation.
The status of a remote path is not normal.	Check the path status in the View Remote Connection Properties window of HDvM - SN, and see <a href="#">Remote path status problems (on page 210)</a> .
The pair status is suspended.	Check the pair status in the View Pair Properties window, and see <a href="#">Troubleshooting by suspend type (on page 213)</a> for suspend types and corrective action.

Error	Recommended action
The pair create or pair resync operation resulted in a timeout error.	<ul style="list-style-type: none"> <li>▪ If the timeout error was caused by a hardware failure, a SIM is generated. See <a href="#">Service information messages (SIMs) (on page 238)</a>. If necessary, call customer support, and retry URz operations after the problem is solved.</li> <li>▪ If no SIM was generated, wait for a while (5 or 6 minutes), and then check the pair status of the pairs being created or resynchronized. If the pair status changed correctly, the failed operation completed after the timeout message was issued. If the pair status did not change as expected, heavy workload might have prevented the URz operation from being completed. In this case, retry the URz operation when the system has a lighter workload.</li> <li>▪ If a time-out error occurs during the Add Pair operation, the copy operation might not have been executed correctly in the order specified in the Priority field. A time-out error may be caused by the CU configuration or a remote copy path error. Review the error, release the pair with the error, and then retry the Add Pair operation.</li> </ul>
A pair cannot be created or resynchronized.	Verify that the controller board is blocked on the primary storage system. Restore the blocked controller board, and then retry the operation.
A communication error between Device Manager - Storage Navigator and the SVP occurred.	For instructions see the <i>System Administrator Guide</i> .
Journal volumes are not registered in the journal.	The error caused the delete journal operation to suspend. Re-register the journal volumes that belong to the journal, and then delete the journal again.
The Resume Pair operation suspends with a warning message.	<p>This is caused when the following two conditions exist:</p> <ul style="list-style-type: none"> <li>▪ The Preview list contains two or more pairs belonging to the same mirror.</li> <li>▪ Mirror is defined in the Range column for at least one of these pairs.</li> </ul> <p>To continue processing, do either of the following:</p> <ul style="list-style-type: none"> <li>▪ Ensure that the Range column displays Volume for all pairs in the same mirror.</li> <li>▪ In the Preview list, delete all but one pair in the same mirror.</li> </ul>



Error	Recommended action
An error occurs when Apply is clicked for a pair operation.	The error code appears in the right-most column of the Preview list. To view detailed information about the error, right click the error code and select Error Detail.
The pairs cannot be deleted after the pair operations because the pair status changed to Suspending or Deleting.	See <a href="#">Deleting a mirror (on page 145)</a> and specify Force for Delete Mode.
The status of a delta resync pair does not change after you perform the delta resync operation.	One or more of the requirements and prerequisites might not be met (for example, SOM 506 must be enabled). First check the status of all pairs including the delta resync pair for information about the problem, and then review the prerequisite material in <a href="#">Delta resync configuration (on page 250)</a> .
All of the journals in a consistency group are suspended.	<p>All of the journals in a consistency group can be suspended when an error occurs in one of the journals in the consistency group. This takes place under the following conditions:</p> <ul style="list-style-type: none"> <li>▪ The communications lines between CCI and all primary storage systems are normal.</li> <li>▪ The status of the failed journal is PJSE or PJSF.</li> <li>▪ At least one journal in the consistency group is in normal status.</li> </ul> <p>When these conditions are present, you should be aware of the following information:</p> <ul style="list-style-type: none"> <li>▪ When an error occurs, the status of the journal changes from normal to PJSE (suspended by error).</li> <li>▪ For an error caused by overflowing capacity, the status changes to PJSF.</li> <li>▪ When the status of one journal becomes PJSE or PJSF, all other normal journals in PJNN status also change to the PJSE status.</li> <li>▪ If you use CCI and if a journal is in the normal status, it will be shown as PJNN.</li> </ul> <p>If some pairs in the journal become suspended by error but the whole journal does not become suspended, the status of other journals does not change.</p>
A hard disk failure occurs in a pool or in a pool volume to which a journal volume belongs, or PIN data occurs in a journal volume.	Recover from the hard disk failure or replace the journal volume. See <a href="#">Restoring a pair by adding a reserve journal volume (on page 161)</a> .

Error	Recommended action
A journal cannot be deleted from an EXCTG.	If you cannot delete a journal from an EXCTG because a communication error occurred between storage systems, or a user cannot log in to the Super DKC, forcibly delete the journal. For instructions, see <a href="#">Forcibly deleting journals from an EXCTG (on page 172)</a> .

## Remote path status problems

There are corrective actions you can take given the status of remote paths between the storage systems.

The following table provides troubleshooting information for the remote paths between the storage systems. If the remote path status is not normal, a hardware failure might occur over the network. A hardware failure can include a port failure between the local storage system and a remote storage system or a network relay device failure. In such cases, resolve the hardware failure first, and then perform the corrective actions described in the table.

Path status	Description	Corrective action
Normal	This path has been successfully established and can be used for URz copy activities.	None required.
Initialization Failed	The link initialization procedure to the remote storage system failed because the physical path connection was missing between the local and remote storage systems.	<ul style="list-style-type: none"> <li>▪ Make sure that the local and remote storage systems are physically and correctly connected.</li> <li>▪ Make sure that you entered the correct remote storage system serial number, model, and local and remote storage system port numbers.</li> <li>▪ Make sure the local and remote storage system ports are configured correctly.</li> </ul>
Communication Time Out	Communication between the local and remote storage system timed out.	<ul style="list-style-type: none"> <li>▪ Make sure the remote storage system is powered on and fully functional.</li> <li>▪ Make sure that the network relay devices are properly configured and functional, including cables, connectors, switches, extender devices, communication lines, and all other devices connected to the extenders.</li> </ul>

Path status	Description	Corrective action
Port Rejected	The local storage system rejected the logical path link control function because all logical path resources in the local storage system are being used for other connections.	<ul style="list-style-type: none"> <li>▪ Delete all remote paths not in use (for example, (use the <b>Remove Remote Paths</b> window of HDvM - SN, or use the <code>raidcom delete rcu_path</code> command of CCI).</li> <li>▪ Delete all remote connections not in use (for example, use the <b>Remove Remote Connections</b> window of HDvM - SN, or use the <code>raidcom delete rcu</code> command of CCI).</li> <li>▪ Make sure that bidirectional ports are configured both for local and remote storage systems.</li> <li>▪ Reconfigure the ports, and then add the paths and configure the remote storage systems to the local storage systems again.</li> </ul>
Pair-Port Rejected	The remote storage system rejected the logical path link control function because all logical path resources in the remote storage system are being used for other connections.	Follow the same corrective actions in Port Rejected.
Serial Number Mismatch	The remote storage system's serial number does not match the specified serial number.	<ul style="list-style-type: none"> <li>▪ Make sure that you entered the correct remote storage system serial number and model, and local and remote storage system port numbers.</li> <li>▪ Make sure the local and remote storage system ports are configured correctly.</li> <li>▪ Make sure that data path relay equipment is properly configured and functional. This includes cables, connectors, switches, extender devices, communication lines, and all other devices connected to the extenders.</li> </ul>

Path status	Description	Corrective action
Invalid Port Mode	The specified port is not configured as a Bidirectional port, or this path already exists.	<ul style="list-style-type: none"> <li>▪ Make sure the correct port on the local storage system is configured as a Bidirectional port.</li> <li>▪ Make sure that no two paths between local and remote storage system ports have the same settings.</li> <li>▪ Make sure that you entered the correct remote storage system serial number and model, and local and remote storage system port numbers.</li> <li>▪ Make sure that the local and remote storage system ports are configured correctly.</li> <li>▪ Make sure that data path relay equipment is properly configured and functional. This includes cables, connectors, switches, extender devices, communication lines, and all other devices connected to the extenders.</li> </ul>
Pair-Port Number Mismatch	The specified port in the remote storage system is physically disconnected from the local storage system.	<ul style="list-style-type: none"> <li>▪ Make sure that you specified the correct remote storage system port number. Correct the port number if necessary.</li> <li>▪ Make sure that the cables between the local and remote storage system ports and between the local and remote storage system switches are connected correctly.</li> <li>▪ Make sure that the topology settings of the local and remote storage system ports are correct.</li> </ul>
Pair-Port Type Mismatch	The specified remote storage system port is not configured as a Bidirectional port.	Make sure that the remote storage system port is configured as a Bidirectional port.
Communication Failed	The local storage system connected to the remote storage system successfully, but logical communication timeout occurred.	<ul style="list-style-type: none"> <li>▪ Make sure that the remote storage system port and the relay equipment are configured correctly.</li> <li>▪ Make sure that data path relay equipment is properly configured and functional. This includes cables, connectors, switches, extender devices, communication lines, and all other devices connected to the extenders.</li> </ul>

Path status	Description	Corrective action
In Progress	Paths are being created or deleted, or the port attribute is being changed.	Wait until processing is completed.
Logical Blockade	Logical blockade was detected.	Remove the remote connections and remote paths you set, and then restore the remote paths.*
Program Error	A program error is detected.	Restore the path.*
<p>* If you use Device Manager - Storage Navigator, restore remote paths by either of the following methods:</p> <ul style="list-style-type: none"> <li>▪ In the <b>Remove Remote Connections</b> window, delete the remote connection, and then register a remote connection again in the <b>Add Remote Connection</b> window.</li> <li>▪ In the <b>Remove Remote Paths</b> window, remove the remote path, and then create a remote path again in the <b>Add Remote Paths</b> window.</li> </ul> <p>When using CCI, use the <code>raidcom delete rcu_path</code> command to delete the remote path, and then use the <code>raidcom add rcu_path</code> command to recreate a remote path. Using this method, you can restore a remote path.</p> <p>When using BCM, restore a remote path by using the <code>YKDELPTH</code> command to delete the remote path, and using the <code>YKBLDPTH</code> command to recreate a remote path.</p> <p>If you cannot restore the path after deleting the remote storage system or deleting the remote path or re-registering by configuring the primary and secondary storage systems, contact Hitachi Vantara for assistance.</p>		

## Troubleshooting by suspend type

The following table provides troubleshooting information for suspended pairs by suspend type.

Suspend Type	Applies to	Description	Corrective Action
S-VOL by Operator	P-VOL, S-VOL	The user suspended the pair from the primary or the secondary storage system by using the S-VOL option.	Resynchronize the pair from the primary storage system.

Suspend Type	Applies to	Description	Corrective Action
By RCU	P-VOL	The primary storage system suspended a pair because the system detected an error condition at the secondary storage system.	Clear the error condition at the secondary storage system or S-VOL. If you need to access the S-VOL, release the pair from the secondary storage system. If any data on the S-VOL has changed, release the pair from the primary storage system and then re-create the pair (Add Pair). If data on the S-VOL has not changed, resynchronize the pair from the primary storage system.
Delete Pair to RCU	P-VOL	The primary storage system detected that the S-VOL status changed to unpaired because the user released the pair from the secondary storage system.	Release the pair from the primary storage system, and then resynchronize the pair. Use the Entire initial copy option to resynchronize the pair. You can use the None initial copy option only if no data on the P-VOL or S-VOL changed.
S-VOL Failure	P-VOL	The primary storage system detected an error during communication with the secondary storage system or detected an I/O error during update copy. In this case, the suspend type for the S-VOL is usually by MCU.	<p>Check the path status using the View Remote Connection Properties window (see <a href="#">Remote path status problems (on page 210)</a>).</p> <p>Clear any error conditions at the secondary storage system and the S-VOL. If you need to access the S-VOL, release the pair from the secondary storage system. If data in the S-VOL has been changed, release the pair from the primary storage system and then re-create the pair. If data in the S-VOL has not been changed, resynchronize the pair from the primary storage system.</p>

Suspend Type	Applies to	Description	Corrective Action
MCU IMPL	P-VOL, S-VOL	The primary storage system could not find valid control information in its nonvolatile memory during the IMPL procedure. This error occurs only if the primary storage system is without power for more than 48 hours (power failure and fully discharged batteries).	Resynchronize the pair (pairresync) from the primary storage system. The primary storage system performs an initial copy operation in response to the pairresync request; the entire P-VOL is copied to the S-VOL.
Initial Copy Failed	P-VOL, S-VOL	The primary storage system suspended this pair during the initial copy operation. The data on the S-VOL is not identical to the data on the P-VOL. Invalid track format can cause this suspension.	Release the pair from the primary storage system. Clear all error conditions at the primary storage system, the P-VOL, the secondary storage system, and the S-VOL. Reformat failed track by using ICKDSF. Restart the initial copy operation (Create URz Pairs window).
MCU P/S-OFF	S-VOL	The primary storage system suspended all URz pairs because it was powered off.	None. The primary storage system automatically resynchronizes these URz pairs when it is powered on.

## Troubleshooting hardware problems affecting pairs

The following table provides troubleshooting information for hardware failures affecting Universal Replicator for Mainframe operations. In addition to the following conditions, hardware failures that affect cache memory or shared memory can cause URz pairs to be suspended.

Classification	Causes of suspension	SIM	Recovery procedure
Primary or secondary storage system hardware	Hardware redundancy has been lost due to some blockade condition. As a result, one of the following could not complete: primary-secondary storage system communication, journal creation, copy operation, resynchronize operation, staging process, or de-staging process.	dc0x dc1x dc2x	Depending on the SIM, remove the hardware blockade or failure.

Classification	Causes of suspension	SIM	Recovery procedure
	<p>Journals cannot be retained because some portion of the cache memory or shared memory has been blocked due to hardware failure.</p> <p>The primary storage system failed to create and transfer journals due to unrecoverable hardware failure.</p> <p>The secondary storage system failed to receive and restore journals due to unrecoverable hardware failure.</p> <p>The drive parity group was in correction-access status while the URzpair was in Pending status.</p>		<p>If a failure occurs when Business Continuity Manager is being used, S-VOLs in Suspend (equivalent to SWAPPING in Business Continuity Manager) might remain in the master journal. If these volumes remain, execute the YKRESYNC REVERSE option on the S-VOLs with a pair status of Suspend with SWAPPING status in Business Continuity Manager (YKRESYNC is the Business Continuity Manager command for resynchronizing a pair). This operation changes all volumes in the master journal to primary volumes. After this operation, resynchronize the pairs.</p>
<p>Communication between the primary and secondary storage systems</p>	<p>Communication between the systems failed because the secondary storage system or network relay devices were not running.</p> <p>Journal volumes remained full even after the timeout period had elapsed.</p>	<p>dc0x dc1x</p>	<p>Remove the failure from the primary and secondary storage systems or the network relay devices.</p> <p>If necessary, increase resources as needed (for example, the amount of cache, the number of paths between primary and secondary storage systems, the parity groups for journal volumes, etc.).</p> <p>Resynchronize the failed pairs.</p>
<p>RIO overload or RIO failure</p>	<p>An unrecoverable RIO (remote I/O) timeout occurred because the system or network relay devices were overloaded. Or, RIO could not be finished due to a failure in the system.</p>	<p>dc2x</p>	<p>Release failed pairs (Delete Pair).</p> <p>If necessary, increase resources as needed (for example, the amount of cache, the number of paths between primary and secondary storage system, the parity groups for journal volumes, etc.).</p> <p>Re-create failed pairs.</p>
<p>Planned power outage to the primary storage system</p>	<p>The URz pairs were temporarily suspended due to a planned power outage to the primary storage system.</p>	<p>dc8x</p>	<p>No recovery procedure is required. The primary storage system automatically removes the suspension condition when the system is powered on.</p>



## Error codes for Device Manager - Storage Navigator

If an error occurs during the operation of Universal Replicator for Mainframe, Universal Replicator for Mainframe outputs an error message in the management client. The error message explains the error and shows an error code. When you contact customer support, report the error code. For error codes to be displayed in the management client, see *Hitachi Device Manager - Storage Navigator Messages*

## Troubleshooting with CCI

When an error has occurred in Universal Replicator for Mainframe pair operation when using CCI, you can identify the cause of the error by referring to the CCI operation log file.

The file is stored in the following directory by default:

```
/HORCM/log*/curlog/horcmlog_HOST/horcm.log
```

Where:

\* is the instance number.

HOST is the host name.

To identify the error code in the log file, open the CCI log file, and find the error code.

Example: 11:06:03-37897-10413- SSB = 2E31, 3703

Error codes appear on the right of the equal symbol (=). The alphanumeric characters on the left of the comma(,) indicates SSB1 (for example, 2E31), and on the right of the comma (,) indicates SSB2 (for example, 3703).

The following tables describe the CCI error codes for Universal Replicator for Mainframe.

### CCI error codes for URz: SSB1 = 2E31, B901, B9E0, B9E1, B9E2, B9E4, D004

Error code (SSB2)	Description
3703	A request of URz Pairresync to change the pair status from Hlde to Hold was rejected because the PIN data was existed in the journal volume.
3704	A request of URz Paircreate was rejected because the emulation types of the specified master journal and of the restore journal were different.
3705	A request of URz Paircreate or URz Pairresync for delta resync was rejected because the version of the secondary storage system did not support the corresponding command.
3706	A request of URz Paircreate for delta resync was rejected because the specified P-VOL was used as the S-VOL of TrueCopy for Mainframe, and the pair status was not Duplex.

Error code (SSB2)	Description
3707	<p>A request of URz Pairresync for delta resync was rejected because of the one of following reasons.</p> <ul style="list-style-type: none"> <li>▪ The specified P-VOL was the P-VOL of TrueCopy for Mainframe, and the URz pair status was not Duplex.</li> <li>▪ The specified P-VOL was the S-VOL of TrueCopy for Mainframe, and the URz pair status was not SSWS.</li> </ul>
3708	<p>The URz pair cannot be created because the specified P-VOL was being shredded.</p>
3709	<p>A request of URz Paircreate or URz Pairresync for delta resync was rejected because the specifying of the restore journal was incorrect.</p>
370B	<p>The URz pair cannot be resynchronized (DELTAJNL parameter specifying), because the specified P-VOL is not in the either of Hold or HOLDTRNS status. Or, the URz pair cannot be resynchronized (ALLJNL parameter specifying), because the specified P-VOL is not in the either of Hold, HOLDTRANS, or NODELTA status.</p>
370C	<p>A request of Paircreate or Pairresync for URz pair or URz delta resync pair was rejected because the status of the specified master journal or restore journal could not be transited, or the status transition was in progress.</p>
3719	<p>The operation failed because the specified P-VOL contains data which is being migrated by nondisruptive migration, and the P-VOL is used as a GAD pair.</p>
3722	<p>The Paircreate command was rejected because the emulation type of the selected volume is unsupported.</p>
3726	<p>The pair cannot be created because the volume specified as the P-VOL was the system disk.</p>
3728	<p>The Paircreate command was rejected because it was connected with the old model and the specified volume was unsupported.</p>
3729	<p>A request for URz Paircreate was received. However, the pair could not share the volume with TrueCopy for Mainframe because the Remote Replication Extended program product was not installed in the primary storage system.</p>
372B	<p>A pair cannot be created because the secondary storage system does not support the combination of multiple primary and secondary storage systems.</p>
372C	<p>The volume is inaccessible because the P-VOL is blocked.</p>

Error code (SSB2)	Description
372D	The specified volume is used in the system that consists of multiple primary and secondary storage systems. Therefore the command was rejected because the delta resync operation cannot be executed.
372E	A request to create or resynchronize a pair in the system that consists of multiple primary and secondary storage systems was rejected because the Remote Replication Extended program product was not installed in the primary storage system.
3734	<p>The task failed because of one of the following reasons:</p> <ul style="list-style-type: none"> <li>▪ The specified P-VOL is shared with a Compatible FlashCopy® V2 Target volume.</li> <li>▪ The specified P-VOL is shared with a suspended TrueCopy for Mainframe P-VOL.</li> </ul>
3735	The task failed because the specified P-VOL is shared with a Compatible FlashCopy® V2 Target volume that might not be normal due to failure.
3737	The URz pair operation failed because the status of the pair of the other mirror is not settled in the configuration where three URz sites are combined.
3738	A request for pair creation was rejected because the Remote Replication Extended program product was not installed in the primary storage system.
3739	The command was rejected because the journal to which the specified S-VOL belongs does not allow the configuration where three URz sites are combined.
373D	<p>A URz pair or a URz pair for delta resync cannot be created. The P-VOL for the pair must meet the following conditions:</p> <ul style="list-style-type: none"> <li>▪ A consistency group is not shared among multiple local storage systems and remote storage systems.</li> <li>▪ The volume is not combined with TrueCopy for Mainframe.</li> <li>▪ The volume is not combined with Volume Migration.</li> </ul>
373E	The pair operation failed because the status of a mirror in the journal in which the specified S-VOL belongs is other than Initial or Stopped.

Error code (SSB2)	Description
3744	<p>A URz pair or a URz pair for delta resync cannot be created. The S-VOL for the pair must meet the following conditions:</p> <ul style="list-style-type: none"> <li>▪ A consistency group is not shared among multiple local storage systems and remote storage systems.</li> <li>▪ The volume is not combined with TrueCopy for Mainframe.</li> <li>▪ The volume is not combined with Volume Migration.</li> </ul>
3745	<p>A request to create a URz pair between the primary site and the intermediate site in a cascade configuration where three URz sites are combined was received. However, the command was rejected since the journal to which the P-VOL belongs does not allow the configuration.</p>
3747	<p>In the configuration where three UR sites are combined, a request of UR pair resync (journal resync mode) was received. However, since the volume status was being changed, the command was rejected.</p>
3748	<p>The delta resync pair was not created because the status of the pair with the delta resync P-VOL is not Duplex.</p>
3749	<p>The delta resync pair was not created because the status of the pair with the delta resync P-VOL does not meet the following requirements.</p> <ul style="list-style-type: none"> <li>▪ The volume is the URz P-VOL and the pair status is Duplex, Suspend, Suspend, or SSWS.</li> <li>▪ The volume is URz S-VOL and the pair status is SSWS.</li> </ul>
3754	<p>The pair cannot be created because one of the storage systems does not support the 3DC UR function.</p>
3755	<p>The command was rejected because the specified S-VOL is used as an S-VOL in another mirror, and the pair status is not in SSWS status.</p>
3756	<p>The pair cannot be created because the secondary storage system does not support the Path Group ID, which was specified as other than 0.</p>
376A	<p>The internal process to secure tier memory difference has timed out. Wait 5 minutes, and then retry the operation.</p> <p>If this error occurs again, use Performance Monitor to find and resolve the specific problem. If retrying does not work, contact customer support.</p>
376B	<p>The pair cannot be created or resynchronized because the differential bitmap area is not available due to one of the following reasons:</p> <ul style="list-style-type: none"> <li>▪ Free area for shared memory in the primary storage system is insufficient.</li> <li>▪ Free area for Dynamic Provisioning pool specified as the P-VOL is insufficient.</li> </ul>

Error code (SSB2)	Description
37B2	Pair creation failed because the volume specified as the P-VOL is an external volume of which Data Direct Mapping attribute is enabled.
37B3	Pair creation failed because the attribute of the volume specified as the P-VOL is invalid.
37B6	Pair creation failed because the Data Direct Mapping attribute of the volume specified as the P-VOL is enabled, and the function of the R-DKC microcode version for mapping external volumes larger than 4 TB is not supported.
37AE	In a cascade configuration where the three URz sites are combined, the request to create a URz pair between the primary and intermediate sites was received. However, the command was rejected because another mirror to which the intermediate site belongs in the journal is used as the P-VOL for the URz pair between the intermediate and secondary sites and also the volume between the primary and intermediate sites is DP-VOL.
37AF	Pair creation failed because the volume specified as the P-VOL is a pool volume.
37B2	Pair creation failed because the volume specified as the P-VOL is an external volume of which data direct mapping attribute is enabled.
37B3	Pair creation failed because the attribute of the volume specified as the P-VOL is invalid.
37B6	Pair creation failed because the data direct mapping attribute of the volume specified as the P-VOL is enabled, and the function of the R-DKC firmware version for mapping external volumes larger than 4 TB is not supported.
37B7	UR pair operation failed. T10 PI attribute settings of the P-VOL and of the S-VOL are different.
37BB	The pair cannot be created or resynchronized because Soft Fence is set for the specified P-VOL.
37BC	The pair cannot be created or resynchronized because Soft Fence is set for the specified S-VOL.
8C19	The pair cannot be created because the specified CTG ID is out of range of supporting.
8C1A	The pair cannot be created or resynchronized because the specified journal ID is incorrect.
8C1B	The pair cannot be created because the specified journal ID is out of range of supporting.

Error code (SSB2)	Description
8C1E	<p>The pair cannot be created because of the one of following reasons:</p> <ul style="list-style-type: none"> <li>▪ The microcode version of the specified primary storage system does not support connection with the specified secondary storage system.</li> <li>▪ The specified primary storage system does not support connection with the specified secondary storage system.</li> </ul>
8C20	<p>The request to update options was rejected because the specified journal ID or mirror ID is incorrect.</p>
8F00	<p>The pair cannot be created because the specified volume was an external volume.</p>
8F04	<p>The command was rejected because an internal logical error occurred.</p>
8F10	<p>The pair operation failed because the specified P-VOL is one of the following:</p> <ul style="list-style-type: none"> <li>▪ An Slz S-VOL that is not in Split/SUSPOP status</li> <li>▪ An Slz volume in Reverse Copy status</li> <li>▪ A Compatible FlashCopy® V2 volume</li> </ul>
8F11	<p>The pair cannot be created. The processing of volume migration could not be stopped because the P-VOL was being migrated by Volume Migration.</p>
8F17	<p>The pair cannot be created because the specified volume was in the state of online from the host.</p>
8F18	<p>The pair cannot be created because the specified volume was used in a pair on another program product.</p>
8F19	<p>The pair cannot be created because the emulation type of the specified volume was unusable.</p>
8F1B	<p>The pair cannot be created because the specified P-VOL is already paired.</p>
8F1C	<p>The pair cannot be created because the specified P-VOL is not in the Suspend status.</p>
8F1E	<p>The Universal Replicator pair cannot be created because cache or shared memory is undergoing restoration.</p>
8F1F	<p>The Universal Replicator pair cannot be created because cache or shared memory is blocking.</p>

Error code (SSB2)	Description
8F21	<p>The pair cannot be created or resynchronized due to one of the following reasons.</p> <ul style="list-style-type: none"> <li>▪ The specified volume was a TCz P-VOL.</li> <li>▪ The specified volume was a TCz S-VOL belonging to a consistency group consisting of multiple primary and secondary storage systems.</li> <li>▪ Unavailable configuration of the status transition.</li> </ul>
8F24	<p>The pair cannot be created because a path between the devices was not created.</p>
8F25	<p>The pair cannot be created or resynchronized because PIN was existed in the specified volume.</p>
8F28	<p>The pair cannot be created or resynchronized because it could not access to the specified P-VOL or S-VOL.</p>
8F29	<p>The pair cannot be created because the specified master journal was unusable.</p>
8F2A	<p>The URz pair cannot be created nor resynchronized because of the one of following reasons.</p> <ul style="list-style-type: none"> <li>▪ The specified P-VOL is used by Compatible FlashCopy<sup>®</sup> V2.</li> <li>▪ The specified P-VOL is TSE-VOL or being used by Hitachi Compatible Software for IBM<sup>®</sup> FlashCopy<sup>®</sup> SE.</li> <li>▪ The specified P-VOL is a volume for the PreserveMirror FlashCopy function of Compatible FlashCopy<sup>®</sup> V2.</li> </ul>
8F2B	<p>The pair cannot be created because the protect attribute of the Data Retention Utility was set for the specified P-VOL.</p>
8F33	<p>The pair cannot be created because the specified volume was used in a pair on the TrueCopy for Mainframe or the ShadowImage for Mainframe.</p>
8F35	<p>The pair cannot be created because the specified volume was blocked.</p>
8F38	<p>The following programs for Mainframe systems might not be installed, or the licenses of them might be expired. Confirm settings for:</p> <ul style="list-style-type: none"> <li>▪ TrueCopy for Mainframe</li> <li>▪ Universal Replicator for Mainframe</li> </ul>
8F39	<p>The pair cannot be created because the program product of URz was not installed.</p>
8F46	<p>The pair cannot be created because cache CL2 is in abnormal status.</p>
8F47	<p>The pair cannot be created because cache CL1 is in abnormal status.</p>

Error code (SSB2)	Description
8F4D	<p>The pair cannot be created or resynchronized due to the following contributing factors:</p> <ul style="list-style-type: none"> <li>▪ A journal is not registered in the secondary storage system.</li> <li>▪ A volume in the journal which is registered in the secondary storage system is blocked.</li> </ul>
8F50	<p>The pair cannot be created or resynchronized because the load of the processing was high. Wait about 5 minutes, and then retry the operation.</p>
8F53	<p>The pair cannot be created because the status of the configuration could not be transited.</p>
8F58	<p>The pair cannot be created or resynchronized because of the one of following reasons.</p> <ul style="list-style-type: none"> <li>▪ The pair status of the specified S-VOL differed from the one of P-VOL.</li> <li>▪ The state of restore journal differed from the state of master journal.</li> </ul>
8F67	<p>The pair cannot be created because the specified secondary storage system did not support the external volume.</p>
8F6D	<p>The pair cannot be created because the specified volume was a command device.</p>
8FEA	<p>The pair cannot be created because the P-VOL is used for Thin Image.</p>
8FEC	<p>The pair cannot be created because the P-VOL is used for Thin Image.</p>
9100	<p>The command cannot be executed because user authentication is not performed.</p>
B91C	<p>The required shared memory for operating URz is not installed</p>
B992	<p>The information of the consistency group cannot be retrieved, because Universal Replicator for Mainframe was not installed.</p>
B9C0	<p>The source of command device has run out. Set to OFF the command device and to ON again from Hitachi Device Manager - Storage Navigator.</p>
EB2A	<p>The Universal Replicator for Mainframe pair for delta resync cannot be resynchronized due to one of the following reasons:</p> <ol style="list-style-type: none"> <li>1. In a 3DC configuration with TrueCopy for Mainframe and Universal Replicator for Mainframe, the updated data for the TrueCopy for Mainframe pair and that for the Universal Replicator for Mainframe pair are not the same, or an I/O is issued from the host to the secondary volume of the Universal Replicator for Mainframe pair.</li> </ol>



Error code (SSB2)	Description
	<p>2. In a 3DC configuration with three Universal Replicator for Mainframe sites, an I/O is issued from the host to the secondary volume of the Universal Replicator for Mainframe pair.</p> <p>Delete the pair that is ready for delta resync, and then copy all data of the primary volume to the secondary volume.</p>

**CCI error codes for URz: SSB1 = B9E1**

Error code (SSB2)	Description
B901	The command was rejected because the specified device is a command device.

**CCI error codes for URz: SSB1 = B901, B9E0, B9E1, B9E2, B9E4, D004**

Error code (SSB2)	Description
B900	A status of URz pair was acquired at the time of unavailable to use the URz during the power-on. Retry the operation.
B902	The command was rejected because the mirror ID is invalid. In a 3DC configuration with three Universal Replicator for Mainframe sites, an I/O is issued from the host to the secondary volume of the Universal Replicator for Mainframe pair.
B907	The command was rejected because the volume was unpaired.
B909	The command was rejected because the mirror ID is invalid.
B90A	The S-VOL hide mode is not supported.
B90D	The command was rejected because the URz program product is not installed.
B90E	The command was rejected because the path is not set between the systems.
B90F	The command was rejected because URz is not installed.
B910	The settings of the journal option could not be updated.
B912	The command was rejected because no journal was registered.

Error code (SSB2)	Description
B913	The command was rejected because the system configuration does not allow these operations.
B920	The pair cannot be created because the system identifier is not correct (left-most number in the 6-digit serial number).
B94B	The command was rejected because the URz configuration was changed. Check the status of the URz pair.
B9F8	The command was rejected because no journal was registered.
DB02	A request for status change was rejected because the status could not be changed (for example, the pair volumes were not unpaired when the Paircreate was requested, or were in a status other than Suspend when the Pairresync was requested).
DB03	A request of URz Pair status transition was rejected because the pair was in the state of Suspending or Deleting.
DB07	URz pair status cannot be transited during the power-on processing.
DB08	URz pair status cannot be transited during the power-off processing.
DB0C	The command was rejected because the specification was volume instead of group.
E843	The command was rejected because the CLPR ID of the specified volume differed from the CLPR ID of the journal.
E847	An operation request for the journal, which was used in the system that consists of single primary and secondary storage system, was rejected because the specified volume is defined to be used in the system that consists of multiple primary and secondary storage systems.
E848	An operation request for the journal, which was used in the system that consists of multiple primary and secondary storage systems, was rejected because the specified volume is defined to be used in the system that consists of single primary and secondary storage system.
E866	The specified consistency group ID is already used.
E869	The operation cannot be performed because the specified restore journal was used in another mirror and the mirror status was Halting or Stopping. Retry the operation after the mirror status is changed to a status other than Halting or Stopping.
E86E	You cannot use as data volume because shared memory is not implemented for specified LDEV number.

Error code (SSB2)	Description
E871	The command was rejected because the path between the storage devices for the both-way was not defined. Check whether the bidirectional normal path was defined or not.
E878	The command was rejected because the data volumes of 3390-9A and other than 3390-9A coexist in the specified journal.
E87B	The command was rejected because the specified journal was unregistered.
E87C	Journal volume is not registered in the specified journal.
E87D	The command was rejected because the specified volume was not for the URz pair.
E87E	The command was rejected because the specified P-VOL or S-VOL was a journal volume.
E880	The command was rejected because the emulation type was different between the specified P-VOL or S-VOL and the journal volume.
E881	The command was rejected because of the power-on processing.
E882	The command was rejected because the emulation type of the specified master journal or the restore journal was invalid.
E883	The specified mirror ID number or the CTG ID differs from the registered mirror ID number or the CTG ID.
E888	The command was rejected because a volume in the specified journal was used for maintenance.
E889	The command was rejected because the specified journal was already used in another URz's mirror ID.
E890	<p>The command was rejected because of one of following:</p> <ul style="list-style-type: none"> <li>▪ The specified volume is registered in another journal.</li> <li>▪ The specified volume is registered in the same mirror of the same journal.</li> <li>▪ The volume specified as the S-VOL is registered in another mirror of the same journal.</li> <li>▪ When creating a pair using the journal which is not supported in the system of the configuration where three URz sites are combined, a pair creation command for another mirror was received in the same journal.</li> </ul>
E891	The command was rejected because the number of pairs that are registered in the specified master journal or restore journal was already reached the maximum number.

Error code (SSB2)	Description
E894	When creating a pair using journal in the configuration with three URz sites, a request of pair creation of the third mirror was received in the same journal; therefore, the command was rejected.
E897	<p>A pair creation request was received, but the command was rejected because of one of the following reasons:</p> <ul style="list-style-type: none"> <li>▪ The specified primary and secondary journals do not permit the configuration combining three URz sites.</li> <li>▪ The specified secondary journal is already used as a secondary journal of another mirror.</li> <li>▪ The paired journal of the specified mirror is already used by another mirror.</li> <li>▪ The specified primary or secondary journals are created using versions that do not support a 3DC multi-target configuration with three URz sites or a 3DC cascade configuration with three URz sites. See <a href="#">Configuration workflow (on page 117)</a>.</li> </ul>
E898	The command was rejected because the specified secondary journal is already a secondary journal in another mirror.
E89A	The command was rejected because the path between the storage devices for the both-way was not defined. Check whether the bidirectional normal path was defined or not.
E89B	The command was rejected because the specified master journal or the restore journal remembered the state of connection with another system in the past. Specify another journal, or delete the journal once, and then retry the registration again.
E8A2	The command was rejected because the Serial Number, model, or Path Group ID of the specified secondary storage system is wrong.
E8A6	The specified journal ID is unregistered.
E8A7	Journal volume is unregistered on the specified journal.
E8A8	The command was rejected because the specified volume was not for a URz pair or was a volume of another journal.
E8A9	URz copy pair cannot be suspended because of the power-on processing.
E8B6	The command was rejected because the mirror ID of the specified restore journal was already used.
E8B8	The command was rejected because the volume in the specified journal was used for maintenance.

Error code (SSB2)	Description
E8F7	The command was rejected because there are multiple journals in the specified consistency group.
EA00	The command was rejected because the specified P-VOL was already used as an S-VOL.
EA01	The command was rejected because the specified P-VOL was already used by another URz pair.
EA02	The command was rejected because the specified S-VOL was used as the P-VOL.
EA03	The command was rejected because the specified P-VOL was already used by another URz pair.
EA07	The command was rejected because the number of the URz pair registrations in the primary journal exceeds the upper limit.
EA08	The command was rejected because the number of URz pair registrations in the secondary journal exceeds the upper limit.
EA09	The command was rejected because the state of master journal was other than Initial, Active, or Stopped.
EA0A	The command was rejected because the state of restore journal was invalid.
EA12	The command was rejected because the specified S-VOL was not in SSWS status.
EA13	The command was rejected because the request was received for the S-VOL as the P-VOL.
EA15	The command was rejected because the request was received for the P-VOL as the S-VOL.
EA18	The command was rejected because the pair status was not Suspend.
EA19	The command was rejected because the state of journal was not Stopped.
EA1B	The command was rejected because the journal could not execute the suspend transition, that is, the journal was in Hlde or Suspend status.
EA1C	The command was rejected because the specified secondary journal was not in the Stopped status.
EA1E	The command was rejected because the request was received for the S-VOL as the P-VOL.
EA20	The command was rejected because the request was received for the P-VOL as the S-VOL.

Error code (SSB2)	Description
EA22	The command was rejected because the state of journal was not Stopped.
EA25	The command was rejected because the state of S-VOL was not SSWS.
EA29	The command was rejected because the state of master journal was other than Active or Stopped.
EA2C	The command was rejected because the state of restore journal was other than Active or Stopped.
EA33	The command was rejected because the state of mater journal was other than Active.
EA36	The command was rejected because the state of restore journal was other than Active.
EA37	The pair suspend request was received but was rejected because the restore journal status was other than Active or Stopped.
EA3A	The command was rejected because the specified S-VOL was in the state of status transition.
EA3B	The command was rejected because the specified S-VOL was in the state of Suspending.
EA40	The command was rejected because the desired capacity exceeded the charging capacity of the primary storage system's program product.
EA41	The command was rejected because the desired capacity exceeded the charging capacity of the secondary storage system's program product.
EA46	In the intermediate site of the cascade configuration with three URz sites, the URz pair deletion and suspend commands were received. However, the commands were rejected because the status of the specified journal which is connected to the mirror of the specified journal is Active.
EA89	The command was rejected because the paircreate or pairresync cannot run with the journal's attribute or mirror status.
EA8A	The command was rejected because the pair status could not be changed during the power-on or power-off processing.
EA8B	The command was rejected because the specified volume is used in the system that consists of multiple primary and secondary storage systems.
EA95	The command was rejected because the volume specified for the P-VOL was initializing the pool of Dynamic Provisioning for Mainframe.

Error code (SSB2)	Description
EA9F	In the configuration with three URz sites, a request of URz pair resync (journal resync mode) was received. However, the command was rejected because the specified journal did not exist, or no pair existed in the specified journal.
EAA2	The command was rejected because the desired capacity exceeded the charging capacity of the primary storage system's URz. Check the license capacity as well as the related program product.
EAA3	The command was rejected because the desired capacity exceeded the charging capacity of the secondary storage system's TrueCopy for Mainframe. Check the License capacity as well as the related Program product.
EAA5	The command was rejected because the desired capacity exceeded the charging capacity of the secondary storage system's URz. Check the license capacity as well as the related program product.
EAA6	The command was rejected because the desired capacity exceeded the charging capacity of the primary storage system's TrueCopy for Mainframe. Check the license capacity as well as the related program product.
EAA8	In the configuration with three URz sites, a request of URz pair resync (journal resync mode) was received. However, the command was rejected because the specified option is incorrect.
EAB6	<p>The pair cannot be created or resynchronized because the differential bitmap area is not available due to one of the following reasons:</p> <ul style="list-style-type: none"> <li>▪ Free area for shared memory in the primary system is insufficient.</li> <li>▪ Free area for Dynamic Provisioning pool specified as the P-VOL is insufficient.</li> </ul>
EAB7	The paircreate operation failed because no extended shared memory is installed in the primary storage system. Install extended shared memory in the primary storage system and then repeat the operation.
EAB8	<p>The pair cannot be created or resynchronized because the differential bitmap area is not available due to one of the following reasons:</p> <ul style="list-style-type: none"> <li>▪ Free area for shared memory in the secondary system is insufficient.</li> <li>▪ Free area for Dynamic Provisioning pool specified as the S-VOL is insufficient.</li> </ul>
EAB9	The paircreate operation failed because no extended shared memory is installed in the secondary storage system. Install extended shared memory in the secondary storage system and then repeat the operation.

Error code (SSB2)	Description
EABC	The pair operation failed because shared memory is not installed in the specified LDEV number.
EAE5	The command was rejected because the specified P-VOL or S-VOL is in the process of having the capacity changed by Dynamic Provisioning for Mainframe.
EAF6	The command was rejected because the pair was in the state that was unavailable to transit.
EB24	<p>The URz delta resync pair cannot be created because the specified URz S-VOL is in either one of the following statuses:</p> <ul style="list-style-type: none"> <li>▪ The volume cannot be used as the URz volume for the delta resync operation.</li> <li>▪ The status of the URz pair is other than Duplex.</li> </ul>
EB25	<p>The URz delta resync pair cannot be created because the specified URz S-VOL is in either one of the following statuses:</p> <ul style="list-style-type: none"> <li>▪ The volume cannot be used as the URz volume for the delta resync operation.</li> <li>▪ The status of the URz pair is the status other than Duplex or SUSPEND.</li> </ul>
EB28	The command was rejected because the Remote Replication Extended program product was not installed in the secondary storage system.
EB29	The command was rejected because the delta resync settings are configured to the primary and secondary storage systems.
EB2D	The command was rejected because shared memory for operating URz is not installed.
EB2F	The command was rejected because the specified URz pair was used in the system that consists of multiple primary and secondary storage systems.
EB30	The command was rejected because the specified mirror ID was invalid.
EB37	The command was rejected because the microcode is being exchanged or the micro program exchange operation is suspended.



Error code (SSB2)	Description
EB48	<p>The URz delta resync pair cannot be created due to one of the following reasons:</p> <ul style="list-style-type: none"> <li>▪ The P-VOL of the URz pair is different from the P-VOL of the TrueCopy for Mainframe pair.</li> <li>▪ The serial number of the primary storage system that is recognized by the P-VOL and S-VOL is different.</li> </ul>
EB4C	A pair cannot be created because the restore journal was not registered.
EB4D	A pair cannot be created because the master journal was not registered.
EB4F	The URz pair cannot be created because the timer type of master journal and restore journal is different.
EB50	<p>The command was rejected because the specified S-VOL is in one of the following conditions:</p> <ul style="list-style-type: none"> <li>▪ Requesting intervention</li> <li>▪ Protected</li> <li>▪ Cannot be used</li> <li>▪ A ShadowImage for Mainframe S-VOL</li> <li>▪ Used by Universal Replicator for Mainframe</li> </ul>
EB51	The command was rejected because PIN data existed in the specified S-VOL.
EB52	The command was rejected because the specified S-VOL cannot be accessed.
EB53	The command was rejected because the specified S-VOL is blocked.
EB57	The command was rejected because the specified S-VOL was online from the host.
EB58	The command was rejected because the specified journal volume or S-VOL was reserved or being used in the storage system. Check the status of the volume.
EB59	The command was rejected because the specified S-VOL was being migrated by Volume Migration. Check the status of the volume.
EB5B	The command was rejected because the access attribute was set to the specified P-VOL or S-VOL by the Data Retention Utility.
EB5C	The command was rejected because an internal logical error occurred.
EB5E	The command was rejected because the S-VOL was already paired.

Error code (SSB2)	Description
EB5F	The command was rejected because the program product of URz was not installed in the secondary storage system.
EB60	The command was rejected because the P-VOL capacity is not the same as the S-VOL's.
EB61	The command was rejected because the path between the primary and the secondary storage systems was not valid.
EB62	The command was rejected because the specified P-VOL was a command device.
EB63	The command was rejected because the restore journal was already linked with another journal.
EB64	The command was rejected because the desired capacity exceeded the charging capacity of the program product.
EB65	The command was rejected because of the abnormal end which is related to the charging capacity of the program product.
EB66	The command was rejected and the retry processing was ordered because P-VOL SUSPENDING was detected when the CCI ReverseResync command was executed.
EB6B	<p>The URz pair cannot be created nor resynchronized because of the one of following reasons.</p> <ul style="list-style-type: none"> <li>▪ The specified S-VOL is being used by Compatible FlashCopy® V2.</li> <li>▪ The specified S-VOL is TSE-VOL or being used by Hitachi Compatible Software for IBM® FlashCopy® SE.</li> <li>▪ The specified P-VOL is a volume for the PreserveMirror FlashCopy function of Compatible FlashCopy® V2.</li> </ul>
EB6C	<p>The URz pair create processing was doubly executed:</p> <ul style="list-style-type: none"> <li>▪ There are no problems if the initial copy operation is restarted when the primary storage system is powered off.</li> <li>▪ There are no problems if a URz pair is created when the primary storage system is reset.</li> </ul>
EB6E	The command was rejected because the URz program product was not installed in the primary storage system.
EB70	The command was rejected because the specified S-VOL is assigned to a copy pair of other program products.
EB73	The command was rejected because the specified S-VOL is the system disk.

Error code (SSB2)	Description
EB78	The command was rejected because the specified data volume is a command device.
EB79	The command was rejected because the specified data volume is online.
EB7A	The command was rejected because the journal cache of the restore journal was remained.
EB7D	The command was rejected because the specified S-VOL is an external volume.
EB7E	<p>The pair operation failed because the specified S-VOL is in one of the following statuses.</p> <ul style="list-style-type: none"> <li>▪ The specified S-VOL is being used for a ShadowImage for Mainframe pair.</li> <li>▪ The specified S-VOL is a ShadowImage for Mainframe P-VOL and registered to a Business Continuity Manager consistency group and a Command Control Interface consistency group.</li> <li>▪ URz P-VOL and S-VOL are DP-VOL, and the specified S-VOL is being used as ShadowImage for Mainframe P-VOL.</li> <li>▪ URz P-VOL and S-VOL are DP-VOL, and the specified S-VOL is the source volume of Volume Migration.</li> </ul>
EB7F	The command was rejected because the emulation type of the specified S-VOL was unsupported.
EB80	The command was rejected because the specified volume was the V-VOL or the pool-VOL. Check the status of the volume.
EB87	The command was rejected because the path from the secondary storage system to the primary storage system is not set, or the volume used as the S-VOL is not paired.
EB88	<p>The URz pair cannot be created because of one of the following:</p> <ul style="list-style-type: none"> <li>▪ The specified S-VOL was being used as a ShadowImage for Mainframe S-VOL.</li> <li>▪ The specified S-VOL was Not Ready, which means that the data drive (HDD, SSD, SCM, or FMD) cannot be used.</li> </ul>
EB89	The command was rejected because the emulation types of the specified P-VOL and S-VOL were not the same.

Error code (SSB2)	Description
EB8A	<p>The UR pair could not be created because of one of the following statuses:</p> <ul style="list-style-type: none"> <li>▪ The emulation type of the master journal and restore journal you specified is different.</li> <li>▪ If you are changing the configuration to use both UR and global-active device, the P-VOL of the UR pair for delta resync and the S-VOL of the global-active device pair do not match.</li> </ul>
EB94	<p>The command was rejected because the specified pair could not transit the status.</p>
EB9F	<p>The command was rejected because the specified S-VOL was not mounted on the secondary storage system.</p>
EBA0	<p>The command was rejected because the specified S-VOL was not mounted on the secondary storage system.</p>
EBA7	<p>The command was rejected because the volume specified for the secondary volume was in either one of the following status.</p> <ul style="list-style-type: none"> <li>▪ Increasing the capacity by Dynamic Provisioning for Mainframe.</li> <li>▪ Releasing the page of Dynamic Provisioning for Mainframe.</li> <li>▪ Initializing the pool of Dynamic Provisioning for Mainframe.</li> </ul>
EBAF	<p>The command was rejected because the license capacity of the Data Retention Utility in the secondary storage system exceeds the setting value. Check the license capacity setting for Data Retention Utility in the secondary storage system.</p>
EBC6	<p>The command was rejected because the specified URz S-VOL was used by either ShadowImage for Mainframe or Compatible FlashCopy® V2.</p>
EBCA	<p>The command was rejected because the journal restore operation is in progress in the URz pair through another mirror ID.</p> <ul style="list-style-type: none"> <li>▪ If the URz pair with another mirror ID is in Suspending status, re-issue the request when the pair status is changed to the Suspend status.</li> <li>▪ If the URz pair with another mirror ID is in the Duplex status, reissue the request after a while.</li> </ul>
EBCE	<p>The command was rejected because un-updated differential data exists in the specified S-VOL.</p>
EBCF	<p>The URz Pairresync (journal resync mode that forcibly copies all data) was received because of the URz Pairresync (delta resync) failed. The command was rejected because the URz pair was not in Hold status.</p>

Error code (SSB2)	Description
EBD9	The command was rejected because the desired capacity exceeded the charging capacity of the secondary storage system's TrueCopy for Mainframe. Check the license capacity as well as the related program product.
EBDB	The command was rejected because the desired capacity exceeded the charging capacity of the secondary storage system's URz. Check the license capacity as well as the related program product.
EBDC	The command was rejected because the processing load of the storage system is heavy. Execute the command again after a while.
EBE0	The command was rejected because the specified S-VOL is already used in a URz delta resync pair.
EBE1	The command was rejected because the all S-VOLs of the specified restore journal were not the another URz's S-VOLs.
EBE2	<p>The resynchronization of the URz delta resync pair was rejected due to either of the following reasons:</p> <ul style="list-style-type: none"> <li>▪ Update data of TrueCopy for Mainframe (master journal of the URz delta resync pair operation) is inconsistent with the update data of the restore journal of the URz pair.</li> <li>▪ Host I/O is updated for the URz S-VOL.</li> </ul> <p>In the <b>Edit Mirror Options</b> window, specify Entire Copy for Delta Resync Failure to resynchronize the URz pair.</p>
EBE5	The command was rejected because the journal volume of specified restore journal was blocked.
EBF2	The command was rejected because the ATTIME Suspend function is used combining URz with Siz and the split time is restored to the specified restore journal.
EBF3	The command was rejected because the split time of the ATTIME Suspend function is restored.
EBFD	The command was rejected because the specified restore journal was not registered.

**CCI error codes for Universal Replicator: SSB1 = B9E2**

Error code (SSB2)	Description
B9E0	The command was rejected because the function for deleting pairs forcibly is not supported.

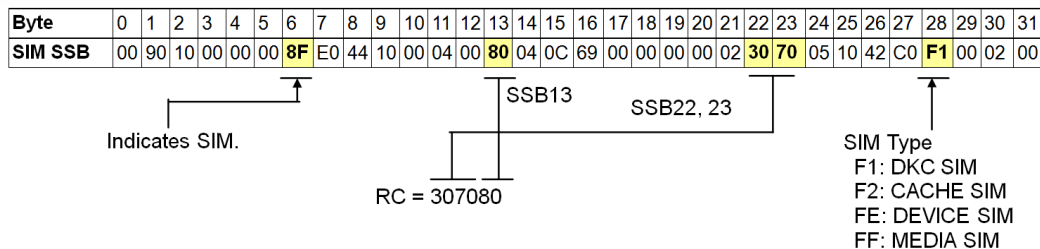
**CCI error codes for URz: SSB1 = B9FE**

Error code (SSB2)	Description
B902	Journal volumes are not registered in the specified journal.

## Service information messages (SIMs)

When service is required, storage systems generate service information message (SIMs). SIMs are generated by the channel and storage path microprocessors and by the SVP. All SIMs related to Universal Replicator for Mainframe processing are reported by the SVP. SIMs are classified according to the following severity levels: service, moderate, serious, or acute.

The following figure shows a typical 32-byte SIM. The six-digit reference code consists of bytes 22, 23, and 13. The reference code identifies the possible error and the severity level. The SIM type (byte 28) indicates the component that experienced the error. When the value of byte 22 is 21, the SIM is a control unit SIM. When the value of byte 22 is dx (where x is an arbitrary character), the SIM is a device SIM.



The SIMs are displayed in the Alert tab of the Storage System window of Device Manager - Storage Navigator or can be checked by maintenance utility. For details, see the *System Administrator Guide*. Each time a SIM is generated, the amber Message LED on the control window (under the Ready and Alarm LEDs) turns on as an additional alert for the user.

For details about SIM reporting, see the *Hardware Guide*.

When a URz pair is split by the user or suspended due to an error condition, a SIM is issued by the primary storage system, secondary storage system, or both.

- SIMs generated by the URz primary storage system include the device ID of the P-VOL (byte 13).
- SIMs generated by the URz secondary storage system include the device ID of the S-VOL (byte 13).

## SIM reference code tables

The following tables list the SIM reference codes related to Universal Replicator for Mainframe operations. To clear URz-related SIMs from the SVP, contact customer support.

For more information about SIM reference codes, see the or *System Administrator Guide*.

Most but not all SIMs are reported to the host, depending on system option modes 308 and 598 and the Services SIM of Remote Copy option. The SIMs reported to the host are logged in the SYS1.LOGREC dataset of the host operating system.

- SOM 308 controls the reporting of RIO path failure between the MCU and the RCU.
- SOM 598 controls the reporting of URz journal full.
- The Services SIM of Remote Copy option controls the reporting of SIMs related to expected state changes for URz pairs (for example, from Pending to Duplex).

For details about the SOMs for Universal Replicator for Mainframe, contact customer support. For details about the Services SIM of Remote Copy option, see [Enabling reporting of service SIMs \(on page 123\)](#).

The following table lists and describes the SIMs that require intervention.

**Table 7 SIMs requiring intervention**

Reference code		Severity	Description	Host report	System generating the SIM	SVP log file
Byte 22	Byte 23					
21	80	Moderate	A remote path is blocked due to failure.	Yes <sup>1</sup>	Primary, Secondary	SIM log
dc	0x	Serious	The P-VOL has been suspended. Path recovery is impossible.	Yes <sup>2</sup>	Primary	SIM log
dc	1x	Serious	The P-VOL has been suspended. A failure has been detected in the primary storage system.	Yes <sup>2</sup>	Primary	SIM log
dc	2x	Serious	The P-VOL has been suspended. A failure has been detected in the secondary storage system.	Yes <sup>2</sup>	Primary	SIM log

Reference code		Severity	Description	Host report	System generating the SIM	SVP log file
Byte 22	Byte 23					
dc	4x	Serious	The P-VOL has been suspended. The pair has been suspended at the secondary storage system.	Yes <sup>2</sup>	Primary	SIM log
dc	5x	Serious	The P-VOL has been suspended. A pair has been released at the secondary storage system.	Yes <sup>2</sup>	Primary	SIM log
dc	6x	Serious	The S-VOL has been suspended. Path recovery is impossible.	Yes	Primary	SIM log
dc	7x	Serious	The S-VOL has been suspended. A failure has been detected in the secondary storage system.	Yes <sup>2</sup>	Secondary	SIM log
dc	9x	Serious	A delta resync P-VOL has been suspended. A failure has been detected in the primary storage system.	Yes <sup>2</sup>	Primary	SIM log
dc	ax	Serious	A volume used in a P-VOL that is configured in a multiple primary and secondary storage system combination has been suspended. A failure has been detected in other primary and secondary storage systems.	Yes <sup>2</sup>	Primary	SIM log
dc	f1	Serious	The URz Read JNL was interrupted for five minutes. (A failure in the MCU was detected.)	No	Secondary	SIM log
dc	f3	Serious	The URz Read JNL was interrupted for five minutes. (A failure in the RCU was detected.)	No	Secondary	SIM log

**Notes:**

- When the DKC emulation type is I-2105 or I-2107, Yes or No in Host report depends on the SOM 308 setting.
  - When the SOM 308 is set to ON, SIM is reported to the host.
  - When the SOM 308 is set to OFF (default), SIM is not reported to the host.



Reference code		Severity	Description	Host report	System generating the SIM	SVP log file
Byte 22	Byte 23					
2. SIM is not reported to the host by default. To enable reporting of service SIMs, see <a href="#">Enabling reporting of service SIMs (on page 123)</a> .						

The following table lists and describes SIMs that do not need immediate intervention but might require intervention later.

**Table 8 SIMs for expected status change, no intervention**

Reference code		Severity	Description	Host report	System generating the SIM	SVP log file
Byte 22	Byte 23					
dc	e0	Moderate	URz M-JNL Meta overflow warning	No	Primary	SIM log
dc	e1	Moderate	URz M-JNL Data overflow warning	No	Primary	SIM log
dc	e2	Moderate	URz R-JNL Meta overflow warning	No	Secondary	SIM log
dc	e3	Moderate	URz R-JNL Data overflow warning	No	Secondary	SIM log
dc	f0	Moderate	The URz Read JNL was interrupted for one minute. (A failure in the MCU was detected.)	No	Secondary	SIM log
dc	f2	Moderate	The URz Read JNL was interrupted for one minute. (A failure in the RCU was detected.)	No	Secondary	SIM log
dc	f4	Moderate	URz M-JNL Meta overflow warning in URzxURz multi-target configuration	No	Primary	SIM log
dc	f5	Moderate	URz M-JNL Data overflow warning in URzxURz multi-target configuration	No	Primary	SIM log

The following table lists and describes service-level SIMs that report expected status changes and require no user intervention.

Table 9 Service SIMs for expected status changes, no intervention required

Reference code		Severity	Description	Host report	System generating the SIM	SVP log file
Byte 22	Byte 23					
21	81	Service	The remote path is restored.	No	Primary, Secondary	SSB log
d8	0x	Service	A volume to be used by URz was defined.	Yes*	Primary, Secondary	SIM log
d8	1x	Service	A volume to be used by URz began copying.	Yes*	Primary, Secondary	SIM log
d8	2x	Service	A volume to be used by URz completed copying.	Yes*	Primary, Secondary	SIM log
d8	3x	Service	A volume to be used by URz received a request for suspension.	Yes*	Primary, Secondary	SIM log
d8	4x	Service	A volume to be used by URz completed a suspension transaction.	Yes*	Primary, Secondary	SIM log
d8	5x	Service	A volume to be used by URz received a request for deletion.	Yes*	Primary, Secondary	SIM log
d8	6x	Service	A volume to be used by URz completed a deletion transaction.	Yes*	Primary, Secondary	SIM log
d8	7x	Service	A volume to be used by URz was defined (placed in Suspend immediately).	Yes*	Primary, Secondary	SIM log
d8	8x	Service	A delta resync volume to be used by URz was defined.	Yes*	Primary	SIM log
d8	9x	Service	A delta resync volume to be used by URz was redefined.	Yes*	Primary	SIM log
d9	zx	Service	A change to an S-VOL was received from the MCU.	Yes*	Secondary	SIM log
da	zx	Service	A change to an S-VOL was received from the RCU.	No	Secondary	SIM log
dc	8x	Service	A volume to be used by an S-VOL was suspended (PS OFF on the MCU was detected).	No	Secondary	SIM log

Reference code		Severity	Description	Host report	System generating the SIM	SVP log file
Byte 22	Byte 23					
* The SIM is not reported to the host by default. To enable reporting of service SIMs, see <a href="#">Enabling reporting of service SIMs (on page 123)</a> .						

## Completing SIMs

When the cause of the SIMs has been resolved, you need to complete the SIMs to change the SIM status to Completed.



**Note:** Performing this task completes all uncompleted SIMs for both UR and URz operations. If the cause of any of the SIMs has not been resolved, new SIMs will be issued.

### Before you begin

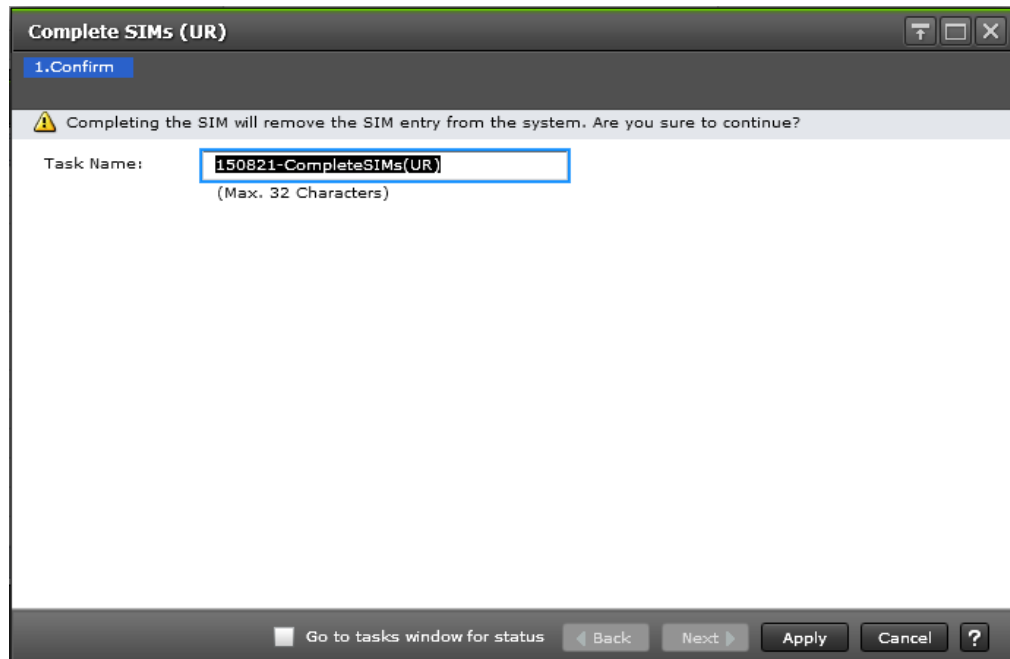
- Required role: Storage Administrator (System Resource Management)

### Procedure

- Resolve the cause of the SIM.
- Open the **Complete SIMs (UR)** window.

In Device Manager - Storage Navigator:

- From the Device Manager - Storage Navigator menu, click **Actions**.
- Click **Remote Replication > Complete SIMs (UR)**.



3. If desired, select **Go to tasks window for status**.
4. Click **Apply**.  
If you selected **Go to tasks window for status**, the **Tasks** window is displayed.

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## Appendix A: Configurations with TrueCopy for Mainframe

You can combine Universal Replicator for Mainframe and TrueCopy for Mainframe operations to a third location. For details about TrueCopy for Mainframe, see the *Hitachi TrueCopy® for Mainframe User Guide*.

### Overview of URz/TCz configurations

Universal Replicator for Mainframe (URz) and TrueCopy for Mainframe (TCz) can share the same data volumes. By combining URz and TCz you can extend disaster recovery options to a third data center.

The terms "P-VOL" (primary volume) and "S-VOL" (secondary volume) are used for TCz pair volumes as well as URz pair volumes.

### Sharing volumes with TrueCopy for Mainframe

Creating a URz backup and a TCz backup ensures that a copy in a third location is available in the event that both the primary and secondary sites fail.

Like URz, the TCz remote replication function provides copies of production volumes in a second location. However, unlike URz, the TCz S-VOLs are synchronous copies of the P-VOLs, and the secondary storage system is located in the same general region as the primary storage system.

You can combine URz and TCz operations in a variety of ways. The following configurations are described in this appendix:

- **3DC cascade:** In a 3-data-center cascade configuration (3DC cascade), three data centers are used: the TCz production site, the TCz/Universal Replicator for Mainframe intermediate site, and the distant URz secondary site. The figure in the [3DC cascade configuration \(on page 246\)](#) provides an illustration. With this configuration, you can locate the TCz synchronous site near the primary site to lower I/O response time, while the URz backup provides a disaster recovery solution at a secondary site.

For details, see [3DC cascade configuration \(on page 246\)](#).

- **3DC multi-target:** In a 3-data-center multi-target configuration (3DC multi-target), the production volume is shared by the TCz and URz. This volume is the primary volume (P-VOL) for both at the primary site. The targets of each system are located at different secondary sites. They provide the TCz solution and the URz asynchronous disaster recovery solution. The TCz secondary site is at an intermediate location, the URz secondary site is at a distant location.

For details, see [3DC multi-target configuration \(on page 248\)](#).

- **Delta resync:** Another application of the 3DC multi-target configuration is the URz delta resync configuration, which provides a quick way to regain a long-distance copy after disaster in the event that the TrueCopy for Mainframe/Universal Replicator for Mainframe P-VOL becomes unusable. In this case, the host continues I/O operations at the intermediate TCz S-VOL site. With a second URz pair previously configured between the TCz S-VOL and the URz S-VOL, only differential data needs to be copied to the URz S-VOL.

For details, see [Delta resync configuration \(on page 250\)](#).



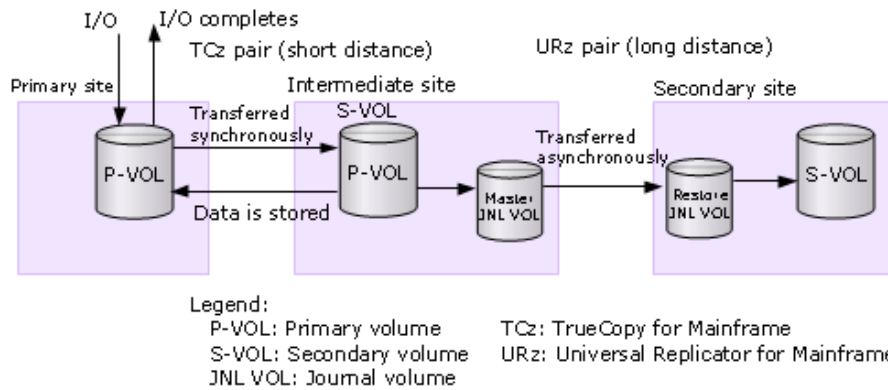
**Note:** The TCz zHyperWrite function cannot be used with 3DC configurations. I/Os reject commands when zHyperWrite is used in a 3DC URz/TCz configuration (F/M=0F, Reason Code=78). For more information about the zHyperWrite function, see the *Hitachi TrueCopy® for Mainframe User Guide*. Also, if you copy data in a 3DC configuration, do not specify a volume in which DB2® logs exist as the operation target.

## 3DC cascade configuration

In a multi-target configuration, data is copied from the primary site to two secondary sites. As shown in the following illustration, the TCz P-VOL is the primary production volume in a 3DC cascade configuration. The TCz secondary site is located at a short distance from the primary site.

The host issues an update to the TCz primary volume (P-VOL), which is copied synchronously to the S-VOL. The URz system copies the synchronous S-VOL data to the URz secondary site.

Data in the URz S-VOL is an asynchronous copy of the TCz P-VOL. Depending on RPO and bandwidth, URz S-VOL data can be very close to P-VOL data. As always with URz, data consistency is ensured.



Failure recovery occurs as follows:

- If a failure occurs at the TCz P-VOL, business continues because data in the URz S-VOL is restored to the primary storage system using the intermediate volume, if needed. Update sequence integrity is ensured.
- If a failure occurs at both TCz P-VOL and S-VOL, an implemented disaster recovery plan would re-direct host activities to the URz S-VOL.

For recovery information and procedures, see [Recovery for 3DC URz/TCz cascade configuration \(on page 197\)](#).

## Prerequisites for 3DC cascade

- When you set up 3DC cascade using VSP 5000 series, one VSP 5000 series, VSP G1x00, VSP F1500, VSP storage system is required for each of the primary, intermediate, and secondary sites. Any combination of the storage system models can be used.
- If a site has multiple storage system, 3DC cascade cannot be configured.
- When managing the storage system with Business Continuity Manager only, Business Continuity Manager is recommended at all the sites.
- When managing the storage system using HDvM - SN, Device Manager - Storage Navigator is required at all sites.
- The primary site requires the following:
  - Host application
  - TCz
  - TCz primary volume (P-VOL), the primary production volume
  - The TCz P-VOL fence level (Primary Volume Fence Level) must be Data .
- The intermediate site requires the following:
  - TCz
  - URz
  - TCz S-VOL = URz P-VOL
  - Remote Replication Extended
  - URz master journal volume

- The secondary site requires the following:
  - URz
  - URz S-VOL
  - URz restore journal volume
- Differential data is used to resynchronize a suspended TCz or URz pair.
- When the TCz pair is resynchronized, the URz pair in Duplex or Pending status is automatically split by the system.
- 3DC cascade is not supported for multiple primary and secondary storage systems. The URz or TCz pair in this configuration would be suspended when the status became Duplex or Pending.
- The response time for host I/Os will be the response time for TCz operation plus the creation time of journal data in the intermediate site.
- The utilization rate on the primary site with a 3DC cascade configuration is higher than if URz and a TCz systems are used independently.
- If you perform a Compatible FlashCopy® V2 copy operation on the TCz pair, the TCz pair status becomes Pending, and the URz pair is suspended.

## Setting up the 3DC cascade configuration

Use the following procedure to set up a 3DC cascade configuration.

### Procedure

1. Install and set up TCz and URz on the required systems.
2. Create the TCz pair on the primary storage system. See *Hitachi TrueCopy® for Mainframe User Guide* for instructions.
3. When TCz pair status is Duplex, create the URz pair on the secondary storage system using the TCz S-VOL as the URz P-VOL.  
Mirror ID must be set between 1 and 3.



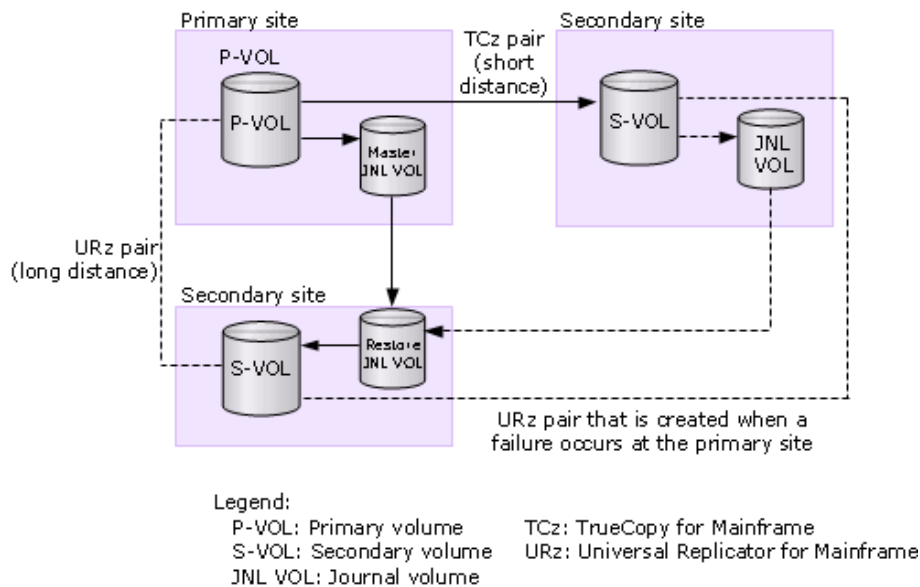
**Note:** The URz operation is rejected by the system if TCz pair status is not already Duplex.

## 3DC multi-target configuration

In a multi-target configuration, data is copied from the primary site to two secondary sites.

As shown in the following illustration, the P-VOL is paired with the TCz secondary volume and the URz S-VOL at separate secondary sites in a 3DC multi-target configuration. The TCz secondary site is at a short distance; the URz site is located at a greater distance.





The host issues an update to the production volume and, synchronously, to the TCz S-VOL. As with a standalone URz system, the update data is asynchronously written from the primary volume (P-VOL) to the URz S-VOL.

The benefit of this configuration is that it provides a third copy of the data, helping to ensure that business can continue in the event of a failure at the other two sites.

Failure recovery occurs as follows:

- If a failure occurs in the P-VOL, business is resumed using the TCz S-VOL. When the failure is corrected at the primary site, business tasks are transferred back to the primary site.

In addition, a quick disaster recovery solution can be put in place while the primary site is being restored, using a URz delta resync pair. In this configuration, the TCz S-VOL is paired with the URz S-VOL. See [Delta resync configuration \(on page 250\)](#) for more information.

- If a failure occurs in the TCz system (P-VOL and S-VOL), business is resumed using the URz S-VOL. When the failure is corrected, business tasks are transferred back to the primary site.
- If a failure occurs in the URz system (P-VOL and S-VOL), business is resumed using the TCz S-VOL.

For recovery information and procedures, see [Recovery for 3DC URz/TCz multi-target configuration \(on page 198\)](#).

## Prerequisites for 3DC multi-target

- At least one storage system (VSP 5000 series, VSP G1x00, VSP F1500, VSP) is required at the primary site, TCz secondary site, and URz secondary site.
- If you set up the 3DC multi-target configuration by using VSP 5000 series, any combination of VSP 5000 series, VSP G1x00 or VSP F1500, VSP can be used at the secondary sites.

- When managing the storage system with Business Continuity Manager only, Business Continuity Manager is recommended at all sites.
- When managing the storage system using HDvM - SN, Device Manager - Storage Navigator is required at all sites.
- The primary site requires the following:
  - TCz
  - URz
  - Remote Replication Extended
  - TCz P-VOL = URz P-VOL. This is the primary production volume.
  - URz master journal volume
- The TC secondary site requires the following:
  - TCz
  - URz
  - Remote Replication Extended
  - TCz S-VOL
  - UR master journal volume
- The URz secondary site requires the following:
  - URz
  - URz S-VOL
  - URz restore journal volume
- 3DC multi-target can be used in configurations with multiple primary and secondary storage systems. However, delta resync configurations are not supported in configurations with multiple primary and secondary storage systems.

## Setting up 3DC multi-target configuration

Use the following procedure to set up a 3DC multi-target configuration.

### Procedure

1. Install and set up TCz and URz on the required systems.
2. Create a TCz pair on the primary storage system. For instructions, see the *Hitachi TrueCopy® for Mainframe User Guide*.
3. When TCz pair status is Duplex, create the URz pair on the primary storage system. The mirror ID must be set between 1 and 3.

## Delta resync configuration

With the delta resync configuration, you bring the S-VOL to a consistent state more quickly after failure because only missing differential data must be copied.

You can set up two secondary sites for one primary site.

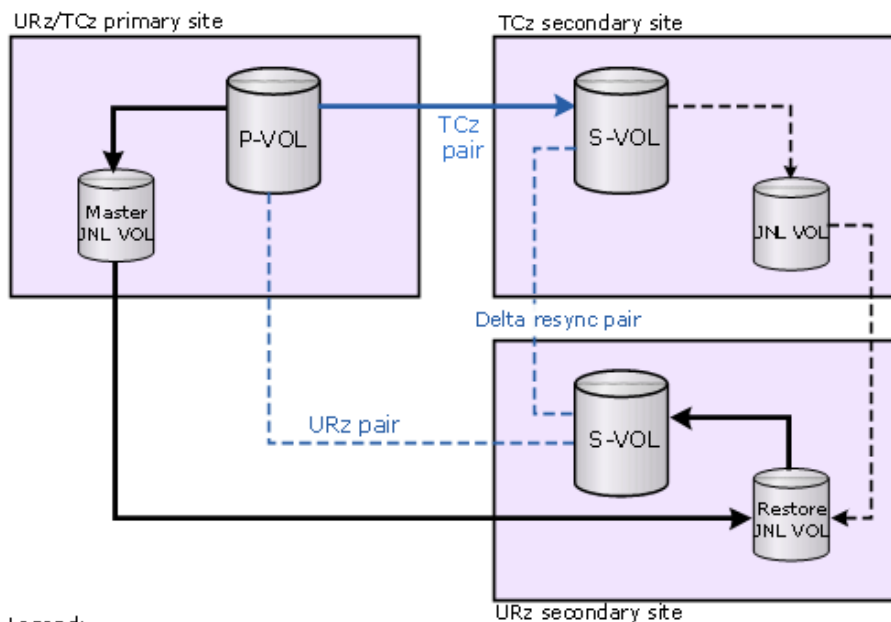
- If the primary site is a VSP 5000 series, install at least one VSP 5000 series, VSP F1500, VSP G1x00, at the intermediate site, and the secondary site respectively.



**Note:** To combine Universal Replicator and TrueCopy, use the previously described storage system configuration.

Copying data between two secondary sites in the event of a failure or disaster at the primary site is called delta resync. In a 3DC multi-target configuration using delta resync, only the differential data lost by a primary site failure is copied from the TCz secondary site to the URz secondary site. As a result, data at a secondary site in a remote location can be restored more quickly.

You create the delta resync configuration by adding a second URz pair to the 3DC multi-target configuration, using the TCz S-VOL and the URz S-VOL, as illustrated in the following figure. The delta resync operation is performed when the primary site fails.



Legend:

P-VOL: Primary volume

S-VOL: Secondary volume

JNL VOL: Journal volume

Delta resync pair: Delta resync Universal Replicator for Mainframe pair

URz: Universal Replicator for Mainframe

TCz: TrueCopy for Mainframe

## Procedure

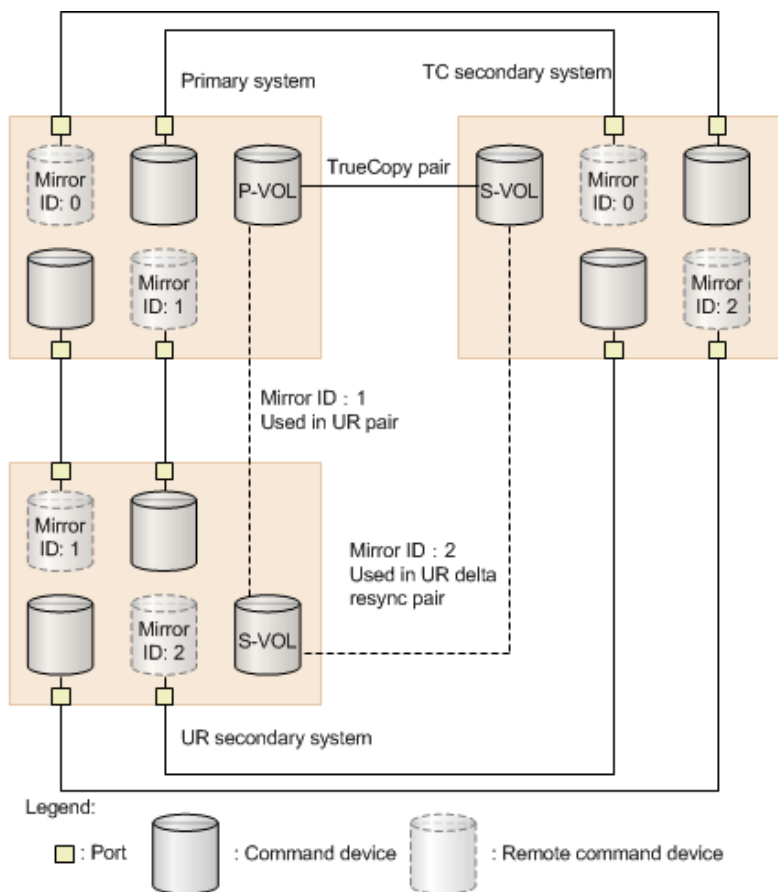
1. Create the URz delta resync pair. See [Creating the delta resync pair \(on page 253\)](#).
2. Set up and map remote command devices and external ports in each site. With remote command devices, sites automatically connect with each other. See [Setting up remote command devices for use with CCI \(on page 254\)](#).
3. Assign mirror IDs to remote command devices. See [Assigning mirrors to remote command devices for delta resync operations \(on page 257\)](#).
4. In a recovery situation, run the delta resync operation. See [Performing the delta resync operation \(on page 261\)](#).

## Additional task for the 3DC multi-target configuration using delta resync

To use delta resync, you need to perform an additional task after setting up 3DC multi-target configuration.

### Procedure

1. Create the URz delta resync pair.
2. Set up and map remote command devices and external ports in each site.  
The delta resync configuration will fail if the remote command devices for the delta resync are not set up. For setting up the remote command devices, see the *Hitachi Universal Volume Manager User Guide*.
3. Assign mirror IDs to remote command devices. Delta resync configuration will also fail when mirror IDs are not assigned to remote command devices. For assigning mirror IDs to remote command devices, see the related topics. With remote command devices, the TCz and URz secondary sites automatically connect with each other, and delta resync is ready. The following figure shows how remote command devices and mirror IDs respond.



## Creating the delta resync pair

The delta resync configuration is created after setting up the main TCz and URz pairs in the multi-target configuration.

- Data is not copied at the time you set up the delta resync pair. The P-VOL and S-VOL in this system contain data from their respective TCz and URz systems
- If a failure on the primary site occurs, the TCz S-VOL is made the primary production volume using Business Continuity Manager commands. Differential data stored in the journal volumes is used to synchronize the S-VOL using the YKRESYNC operation.

### Before you begin

- A URz delta resync pair can be created in a 3DC multi-target configuration only. To create the multi-target configuration, see [3DC multi-target configuration \(on page 248\)](#).
- A 3DC multi-target configuration with multiple primary and secondary storage systems cannot be used for delta resync.
- The TCz S-VOL is used as the delta resync P-VOL. It must be in Duplex status.
- The URz S-VOL is used as the delta resync S-VOL. It must be in Duplex status.
- The mirror ID must be between 1 and 3; however, make sure it is not the same as the mirror ID assigned to the URz pair in the 3DC multi-target configuration.
- Follow volume combinations shown in [Volume types that can be shared with Universal Replicator for Mainframe \(on page 52\)](#).
- System option mode 506 must be ON for delta resync.
- If you create more than one delta resync pair, the delta resync P-VOLs in the same master journal must use the same mirror ID.
- If you plan to create in-system pairs on the secondary site sharing the delta resync S-VOL, make sure to perform the delta resync create-pair operation first, and then create in-system pairs.
- You can set a back-up option in the event that the delta resync operation fails. This is done on the Change Mirror Options window (see the Delta Resync Failure step in [Changing options used by mirrors \(on page 164\)](#)).

### Procedure

1. Install and set up TCz and URz on the required systems.
2. Create a 3DC multi-target configuration.
  - a. Create a TCz pair from the primary storage system to the TCz secondary site.
  - b. When the TCz pair's status is Duplex, create the URz pair from the primary storage system to the URz secondary site.
3. Create a second URz pair from the TCz S-VOL to the URz S-VOL. Specify the Initial Copy option as Delta.

When creating URz delta resync pair, select different mirror ID (Mirror ID 1 to 3) than the mirror ID which was used in step 2.

## Setting up remote command devices for use with CCI

This procedure explains how to configure open-system command devices for use with CCI. If you are using BCM, CCI command devices are not needed. For information about how to set up command devices and a 3DC environment using BCM, see the *Business Continuity Manager User Guide*.

With remote command devices, communications between each pair of sites is performed automatically, allowing the delta resync operation to be run. A license for Universal Volume Manager is not required for remote command device mapping operations.

### Before you begin

To set up the remote command devices, the following conditions must be met:

- Two command devices and two remote command devices must be set up on each site: the primary site, the TCz secondary site, and the URz secondary site, as shown in the figure below. See *Provisioning Guide*.
- External paths must be set up on all sites for communications between command devices and remote command devices. See *Hitachi Universal Volume Manager User Guide* for setting up external paths and remote command devices.

To allocate mirror IDs to remote command devices, the following conditions must be met:

- Create a 3DC multi-target configuration and URz delta resync pairs.
- Remote command devices are set up between each site. For more information about setting up the remote command devices, see the *Hitachi Universal Volume Manager User Guide*.

### Procedure

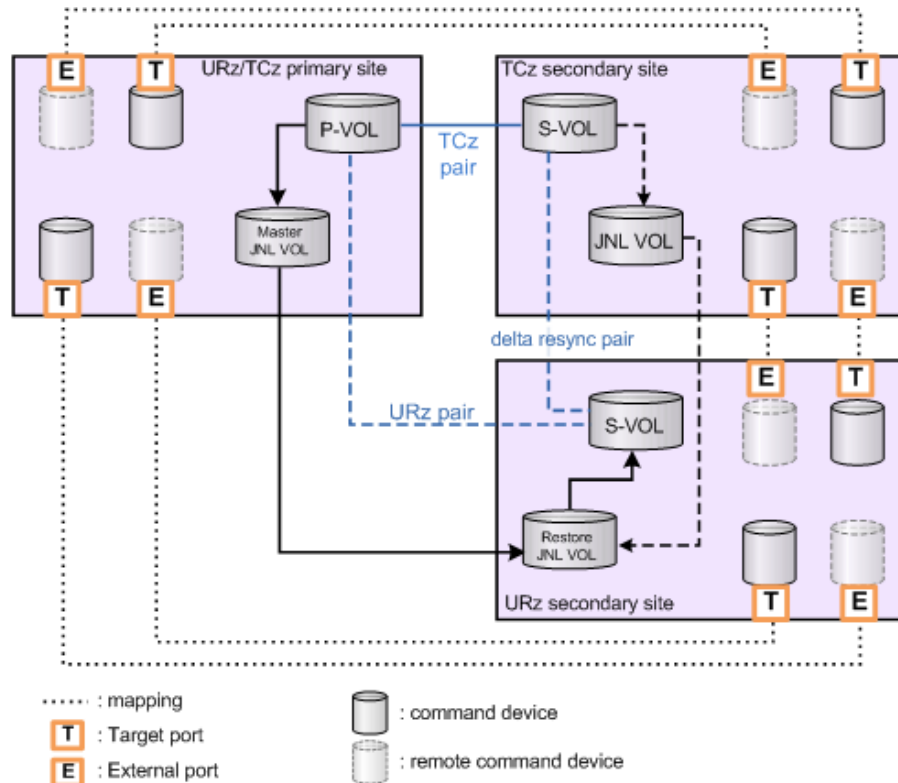
1. Set up four command devices each on the primary site and at the two secondary sites.
2. Set up and dedicate two external ports and two target ports on each site. Configure paths between external ports and target ports.  
For details about external ports, see the *Hitachi Universal Volume Manager User Guide*. For details about port and path settings, see the *Provisioning Guide*.
3. On each site, map a command device through a target port to a device on one of the other sites. You must map to the device on the other site as a remote command device, using an external port on that system. See *Hitachi Universal Volume Manager User Guide* for information about mapping the remote command devices.
4. Repeat the previous step so that two command devices on each site are mapped to a remote command device on each of the other two sites.
5. Assign mirror IDs to the remote command devices. This is required to enable communication for delta resync operations.

**Result**

Thus:

- Each site must have two command devices mapped through two target ports to the other two sites.
- Each site must also have two remote command devices mapped-to through external ports from the other two sites.

The following illustration shows this command/remote command device configuration with port configuration.



**Figure 8 Remote command devices in a delta resync configuration**

## Mapping remote command devices for delta resync operations

For information about command device and remote command device configurations, see [Setting up remote command devices for use with CCI \(on page 254\)](#).

**Procedure**

1. Set a path for the external port and target port of each site.  
For details about the external port, see the *Hitachi Universal Volume Manager User Guide*. For details about port and path settings, see the *Provisioning Guide for Mainframe Systems*.
2. Set command devices for all sites.  
For details about setting command devices, see the *Provisioning Guide for Mainframe Systems*.

3. In the site in which you are creating a pair, map command devices in all sites as remote command devices.

For details about mapping remote command devices, see the *Hitachi Universal Volume Manager User Guide*.

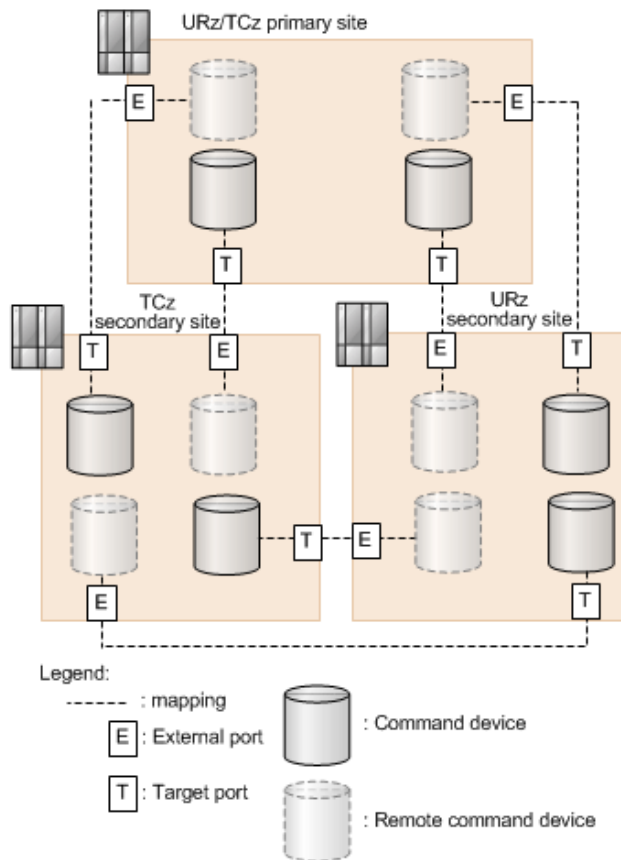
### Result

When the above procedure is performed, the status of each site changes as follows:

- Each site has two command devices mapped to the other two sites through two target ports.
- Each site has two remote command devices mapped from the other two sites through an external port.

In the Logical Devices window, logical devices that are command devices or remote command devices are displayed as Command Device or Remote Command Device (in the Attribute column in HDvM - SN). In CCI, command devices are displayed as CMD for VOL\_ATTR of the `raidcom get ldev` command, and remote command devices are displayed as RCMD for VOL\_ATTR of the `raidcom get ldev` command.

The following figure shows a configuration of command devices and remote command devices.



When mapping of remote command devices to each site is complete, you must assign mirror IDs to the remote command devices. This operation is required for delta resync operations.



## Assigning mirrors to remote command devices for delta resync operations

You assign the mirror IDs used by the configuration's journals to the remote command devices. This enables URz control information regarding the delta resync to be transferred and then read at the secondary sites. This is necessary for the delta resync operation.

### Before you begin

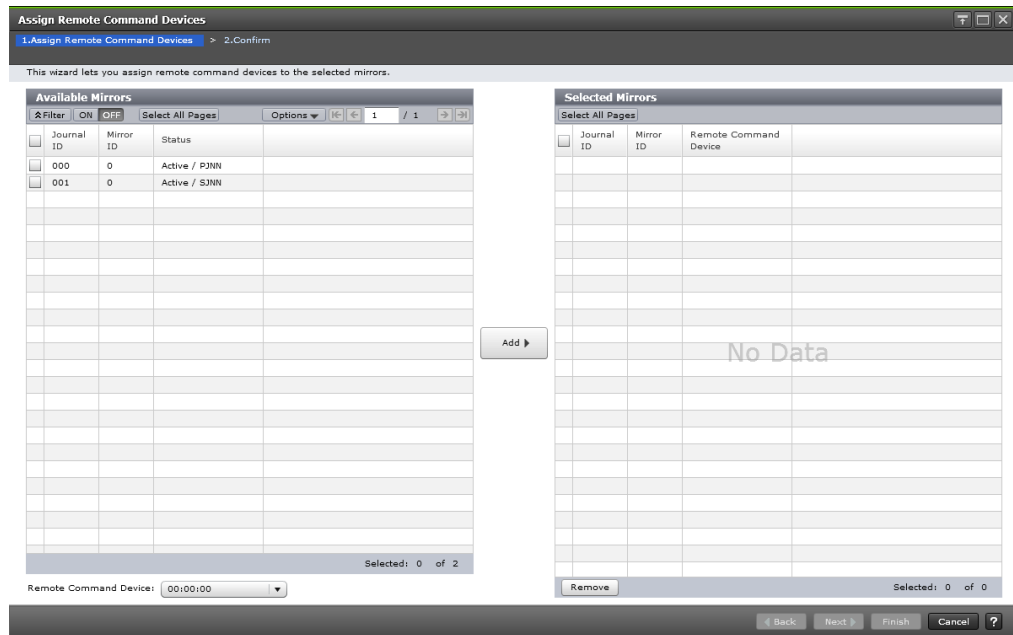
- Required role: Storage Administrator (Remote Copy)
- To assign a mirror to a remote command device, the mirror's status must be one of the following:  
Initial, Active, Halt, Stopped, Hold, Holding, or Holding(Failure)  
To use a mirror in Initial status, it must have mirror ID 0.
- Perform this operation for each journal.
- In a journal, you can assign multiple mirrors to two remote command devices in one operation.



**Note:** A remote command device allocated to a mirror is removed when all pairs in the 3DC delta resync configuration are deleted.

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. Select the **Mirrors** tab, and then select the mirror to which you will assign the remote command device.
4. From the **Actions** menu, click **Remote Replication > Assign Remote Command Devices**.
5. In the **Available Mirrors** table, select a mirror.



- On primary site:
  - Assign mirror ID 0 to the remote command device that is mapped to the TCz secondary site.
  - Assign the mirror ID used for the URz 3DC multi-target pair to the remote command device that is mapped to the secondary site.
- On the TCz secondary site:
  - Assign mirror ID 0 to the remote command device that is mapped to the primary site.
  - Assign the mirror ID used for the URz delta resync pair to the remote command device that is mapped to the URz secondary site.
- On the URz secondary site:
  - Assign the mirror ID used for the URz 3DC multi-target configuration to the remote command device that is mapped to the primary site.
  - Assign the mirror ID used for the URz delta resync pair to the remote command device that is mapped to the TCz secondary site.

When selecting mirror IDs and remote command devices, observe the following:

- Though two mirrors can be assigned to each remote command device, it is not required. **Mirror 2** is optional.
  - The same mirror ID cannot be specified from both Mirror ID lists.
6. Select the remote command device to be assigned from **Remote Command Device**.
  7. Click **Add**. The mirror to which the remote command device is assigned, is added to the **Selected Mirrors** table. If you want to remove the added mirror from the **Selected Mirrors** table, select the mirror and then click **Remove**.
  8. Click **Finish**.

9. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.
10. Click **Apply** to save your settings to the system.
11. To check newly assigned remote command devices, see **Remote Command Device** in the **Journal Volumes** window.
  - If a remote command device is assigned to the mirror, the LDEV number is displayed.
  - If a remote command device is not assigned to the mirror, the field is blank.
  - If a remote command device cannot be assigned to the mirror, a hyphen is displayed.

## Releasing a remote command device for delta resync operations assigned to a mirror

This operation is performed on the mirror when releasing the assigned remote command device.

### Before you begin

- Required role: Storage Administrator (Remote Copy).

### Procedure

1. In the **Explorer** pane, expand the **Storage Systems** tree.
2. Expand the target storage system tree, expand **Replication**, and click **Remote Replication**.
3. Select the **Mirrors** tab, and then select the mirror with the remote command device to be deleted.
4. From the **Actions** menu, click **Remote Replication > Release Remote Command Devices**.
5. In the **Release Remote Command Devices** window, review your selection in the **Selected Mirrors** table. If you need to make a change, select **Cancel**.



6. When ready, click **Finish**.
7. In the **Confirm** window, review the settings and enter a task name in the **Task Name** box.

8. Click **Apply** to save your settings to the system.

## Relationship between deleted associated pairs and assigned remote command devices

You can change a 3DC configuration that uses the delta resync function to a configuration that does not use it by deleting pairs. At this time, along with the deleted pairs, associated pairs are also deleted automatically, and the assignment of remote command devices is released automatically.

If you delete pairs when you cannot communicate with remote command devices, the assignment of remote command devices is not released automatically. In this case, refer to information about releasing a remote command device assigned to a mirror.

If you delete pairs after a hardware failure has occurred or after a pair is suspended by error, the assignment of remote command devices you do not want to delete might be released. In this case, check if the necessary remote command devices are still assigned after the deletion. If the assignment is released, reassign the remote command devices.

### Automatically deleted pairs that are automatically released

There are configurations in which pairs that are automatically deleted and remote command devices that are automatically released along with the pairs you have deleted.

When all the TCz pairs linked to the URz pairs are deleted, the following pairs are also deleted automatically, and the assignment of the following remote command devices is released. The configuration changes to the URz only configuration.

- URz delta resync pair
- Remote command devices set for the URz mirror for delta resync
- Remote command devices set for the mirror between the primary site and the TCz secondary site

The assignment of remote command devices set for the URz mirror is not released.

When all the URz pairs between the primary site and the URz secondary site are deleted, the following pairs are also deleted automatically and the assignment of the following remote command devices is released. The configuration changes to the TCz only configuration.

- URz delta resync pair
- Remote command devices set for the URz mirror for delta resync
- Remote command devices set for the URz mirror
- Remote command devices set for the mirror between the primary site and the TCz secondary site

All the remote command device assignments are released.

When all the URz pairs for delta resync are deleted, the assignment of the following remote command devices is released automatically. The configuration changes to the 3DC multi-target configuration that does not use the delta resync function.

- Remote command devices set for the URz mirror for delta resync
- Remote command devices belonging to the TCz secondary site, and set for the mirror between the primary site and the TCz secondary site

The assignment of the following remote command devices is not released:

- Remote command devices set for the URz mirror
- Remote command devices belonging to the primary site, and set for the mirror between the primary site and the TCz secondary site

## Performing the delta resync operation

You perform the delta resync operation using the resynchronize mirrors operation. When the delta resync operation is performed, the differential data will be copied from the TCz S-VOL to the URz S-VOL. Review the following important prerequisite information, and then follow the procedure in [Resynchronizing a mirror \(on page 142\)](#).

- Note the following:
  - The delta resync pair must be created.
  - Remote command devices must be set up.
  - External ports must be set.
  - Mirror IDs must be assigned to remote command devices.

For details, see [Delta resync configuration \(on page 250\)](#).

- Required pair and volume statuses:
  - The TCz volume used as the 3DC multi-target S-VOL: Duplex or Swapping
  - The TCz S-VOL used as the delta resync P-VOL: Suspend.

Check this status after executing the BCM YKSUSPND REVERSE command and YKRESYNC REVERSE command.

  - The URz delta resync pair: Hold or Holding. If the pair status is Hlde, change to Hold by performing the pairresync operation.

This applies to all pairs in the journal in which the URz delta resync pair resides.

  - The URz volume used as the 3DC multi-target and the delta resync pair S-VOL and uses two mirror IDs, one for the 3DC multi-target pair and one for the delta resync pair:
    - 3DC multi-target S-VOL: Duplex or Suspend
    - Delta resync S-VOL: Hold.



**Note:** The URz S-VOL uses two mirror IDs because of its dual use in the 3DC multi-target and delta resync configurations. The statuses shown above are required for the two mirrors as well as for the journal in which the URz delta resync pair resides.

- If the delta resync S-VOL has been backed up on the secondary site using Slz, make sure to review the information for the Delta Resync Failure step in ([Changing options used by mirrors \(on page 164\)](#)).
- Differential data is stored in the master journal but may not be completely present after a failure at the primary site when the pair was being resynchronized (or after creating the delta resync pair configuration).
- When a URz pair has not been suspended and not resynchronized for a long time, the data in the restore journal might exceed 70% of capacity and old journal data is automatically deleted. In this case, the P-VOL and S-VOL are not synchronized completely by just copying the data, and delta resync will fail. In case of delta resync failure, based on Delta Resync Failure settings, the entire P-VOL data will be copied to the S-VOL or pair status becomes Hlde with no processing and delta resync ends abnormally.
- Journal data may also be destroyed in the following cases:
  - When you restore the TCz or URz pair in the multi-target configuration, and then also update the delta resync pair.
  - When retry-processing occurs because of a delay of the P-VOL update.
  - When the update of a TCz S-VOL is delayed.
- The URz pair status in a delta resync configuration could become Suspend if you split the pair, or if there is a failure when copying all data from the P-VOL to the S-VOL. If you then run the delta resync operation, all data might be copied from P-VOL to S-VOL regardless of journal option settings.
- After a power failure occurs in the primary storage system and you specify a URz pair as a master journal, resync the URz pair for a delta resync first, and then execute the host I/O. To ensure pair creation success, contact customer support.
- If the pair's mirror is in Halting or Stopping status, the `resume` command is rejected.
- When you perform delta resync with the IBM® HyperSwap® function, set system option mode 976 to ON at all sites.
- When using the IBM® HyperSwap® function, if you perform delta resync again shortly after you performed it, the second delta resync might fail. Perform the second delta resync after restoration of the journal of the first delta resync completes at the secondary site. Check the consistency time in Business Continuity Manager to understand the required interval between delta resync executions.

If you use advanced system setting No. 14, you can check the delta resync status from the pair status (Duplex) after delta resync, which is easier than checking the consistency time in Business Continuity Manager. However, when advanced system setting No. 14 is set to ON, the pair status during delta resync changes to Pending, and then differential data is searched and copied. Because of this, it takes some time until the pair status changes to Duplex.



**Note:** In a delta resync configuration, if you delete some URz pairs in a consistency group, split the pairs for each consistency group before deleting them. After that, resynchronize the pairs for each consistency group.

In a delta resync configuration, if you delete some URz pairs without splitting pairs for each consistency group, split and resynchronize them for each consistency group after the deletion.

If both URz and TCz pairs are suspended, resynchronize the URz pair first.

## Problems that can occur in the delta resync operation

Journal data will not exist, and therefore the delta resync operation will fail, in the following cases:

- After creating the URz pair, the primary delta resync P-VOL is updated but not the UR P-VOL.
- When the multi-target P-VOL is resynchronized after the TCz pair was split.
- When the URz S-VOL is resynchronized after it was split.
- When the URz pair is resynchronized after being split and then the journal volume at the TCz secondary site exceeds 70%.
- When the delta resync P-VOL is updated, and then the journal volume at the TCz secondary site exceeds 70%.
- When the delta resync pair is created and no volumes (including volumes after failover or failback) in the primary site are updated.
- When the status of the URz delta resync pair becomes Hlde, the journal data necessary for the delta resync operation might be discarded. In this case, all data in the delta resync P-VOL would be copied to the delta resync S-VOL.

However, you should check whether differential data can be copied by executing the Business Continuity Manager **YKRESYNC DELTAJNL ERRCHK** command.

- Do not assign the P-VOL of an Slz pair that uses a DP-VOL to the S-VOL of the URz delta resync pair.

## Delta resync failure error prevention

If you specify Entire Copy for the Delta Resync Failure option (**Edit Mirror Options** window) in advance, you can prevent errors from occurring by copying the entire P-VOL data to the secondary volume when the necessary journal data for delta resync is not available. However, the P-VOL data will not be copied to the S-VOL in case of error even if you specify Entire Copy for the Delta Resync Failure option in the following case:

- The UR delta resync S-VOL is assigned to the SI P-VOL or HTI P-VOL.

In the following case, entire data might be copied from the UR delta resync P-VOL to the S-VOL:

- Before performing delta resync, the pair status is changed to PSUS by pair split or PSUE by failure while copying the entire data from the P-VOL to the S-VOL as a UR pair.

In a delta resync configuration with TCz, if you want to delete some URz pairs in a consistency group, split the pairs for each consistency group before deleting them. After that, resynchronize the pairs for each consistency group. In a delta resync configuration with TCz, if you delete some URz pairs without splitting pairs for each consistency group, you need to split and resynchronize them for each consistency group after the deletion.



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## Appendix B: Configurations with ShadowImage for Mainframe

Universal Replicator for Mainframe (URz) and ShadowImage for Mainframe (Slz) can share the same data volumes to provide multiple copies of data at both the primary and secondary sites.

### Overview of URz/Slz configurations

The main function of Universal Replicator for Mainframe is to provide copies of production volumes in a remote location.

Using Slz to back up the URz volumes or using URz to back up the Slz volumes provides additional advantages.

- When the URz primary volume is shared with Slz:
  - On-site data backup is provided in case of a URz failure.
  - Multiple copies of production data are provided at the primary site for secondary purposes such as data analysis and testing.
- Sharing the Slz secondary volume with the URz primary volume at the primary site provides a remote copy.
- When Slz is cascaded at the secondary site, data in the Slz secondary volume can be used for testing the URz system and for recovery purposes.
  - The Slz secondary volume is available for continuous replication during a test.
  - If a URz problem is encountered during an actual recovery procedure, the Slz secondary volume provides a golden copy of the URz secondary volume, which can be used to restore the URz secondary volume.



**Note:**

- To split the Slz pairs in a consistency group whose volumes are also used in URz pairs, the URz pairs must be in Duplex or Suspend status.

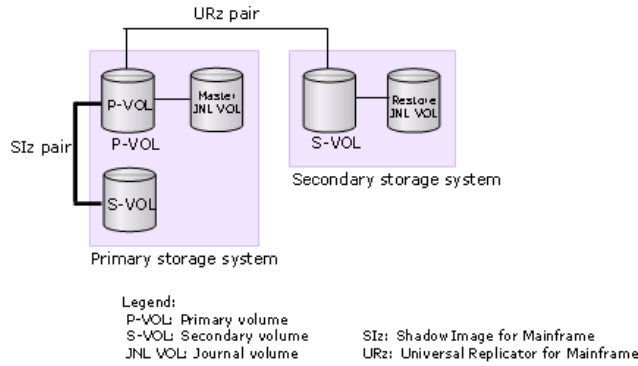
The following shared URz/Slz configurations are described in this appendix:

- [Configurations with Slz primary volumes \(on page 266\)](#)
- [Configurations with Slz secondary volumes \(on page 269\)](#)

## Configurations with Slz primary volumes

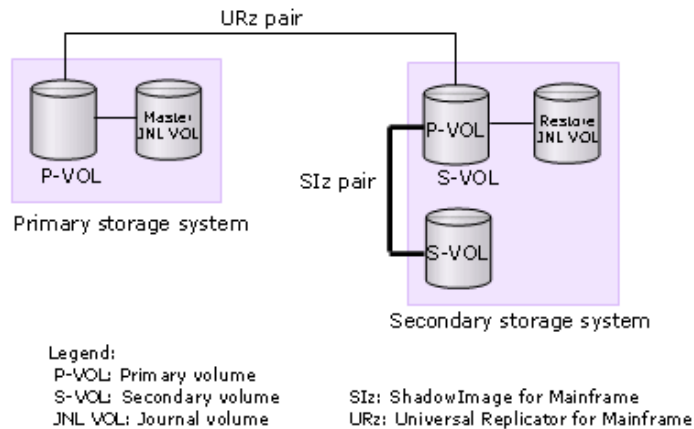
An Slz P-VOL can be shared with a URz P-VOL or S-VOL.

- An Slz P-VOL shared with the URz P-VOL is illustrated below. This configuration allows you to use Slz for on-site data backup in case of a URz failure, and to use URz to provide a secondary backup of the Slz P-VOL in case of an Slz failure.



Business Continuity Manager allows you to set the starting time of the backup copy to journals. In the above configuration, if you set the starting time of the backup copy, the write operations to the P-VOL up to that time are backed up to the S-VOL. If the above configuration is used in multiple journal volumes in multiple storage system, you can set the same starting time of the backup copy to all the journals. If you do this, the P-VOLS are backed up across the multiple disk systems at the same time.

- A URz S-VOL shared with an Slz P-VOL is illustrated below. With this configuration, multiple backup copies of the URz P-VOL can be made on the secondary storage system.



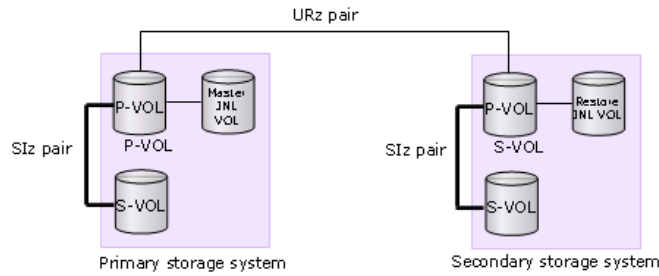
You can specify a suspend time for Slz pairs on the secondary storage system. For details, see [Using ATTIME SUSPEND for Slz pairs shared with URz \(on page 270\)](#).



**Caution:** When you share a URz S-VOL with an Slz P-VOL as shown in the following figure, the restore operation to the URz S-VOL takes time. This is especially the case when the Slz pair is in the V-Split/SUSPVS status because of the time needed to copy the Slz pair.

Because of the extra time that might be needed, make sure the URz journal volume is sized with enough capacity to handle the possible increase in I/O. If journal volume capacity is insufficient, the pair will be suspended because of failure.

- URz primary and secondary volumes shared with Slz primary volumes is illustrated below. This configuration provides multiple copies of the source volume at the primary and secondary sites.



Legend:  
 P-VOL: Primary volume  
 S-VOL: Secondary volume  
 JNL VOL: Journal volume  
 Slz: ShadowImage for Mainframe  
 URz: Universal Replicator for Mainframe

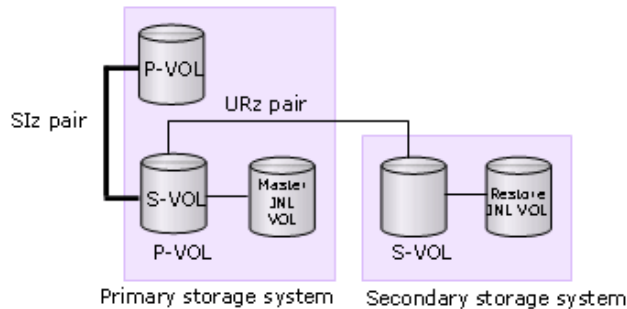
In the above configurations in which the Slz P-VOL is shared, you can only delete URz pairs when the Slz P-VOL status is Resync-R/REVRSY. The following table shows possibilities of URz pair operations according to the Slz P-VOL status.

Slz P-VOL status	URz pair operations				Switch operations between the primary and secondary sites (horctakeover)
	Create	Split	Resync	Delete	
PENDING SP-Pend/ TRANS Resync/ PENDING	Yes *	Yes	Yes	Yes	Yes
DUPLEX	Yes*	Yes	Yes	Yes	Yes
V-Split/ SUSPVS	Yes*	Yes	Yes	Yes	Yes
Split/ SUSPOP  Suspend/ SUSPER	Yes*	Yes	Yes	Yes	Yes
Resync-R/ REVRSY	No	No	No	Yes	No

\* If both the copy source and the copy destination of the volumes for a URz pair are DP-VOLs, and the copy destination volume is set as the P-VOL of Slz and Volume Migration (VM), you cannot create the URz pair. Release the Slz and VM pairs, and then create a URz pair. After that, re-create the Slz and VM pairs.

## Configurations with Siz secondary volumes

The following figure shows an Siz primary volume used as the production volume. A remote URz backup copy is made of the Siz secondary volume. The Siz pair must be in Split/SUSPOP status to perform the URz operation.



Legend:

P-VOL: Primary volume

S-VOL: Secondary volume

JNL VOL: Journal volume

Siz: ShadowImage for Mainframe

URz: Universal Replicator for Mainframe

In this configuration, before creating a URz pair, you must set the Siz pair in the DUPLEX status, split the Siz pair, and then set it in the Split/SUSPOP status. The following table shows possibilities of URz pair operations according to the Siz S-VOL status.

Siz S-VOL status	URz pair operations				
	Create	Split	Resync	Delete	Switch operations between the primary and secondary sites (horctakeover)
PENDING SP-Pend/ TRANS Resync/ PENDING	No	No	No	Yes	No
DUPLEX	No	No	No	Yes	No
V-Split/ SUSPVS	No	No	No	Yes	No
Split/ SUSPOP  Suspend/ SUSPER	Yes	Yes	Yes	Yes	No
Resync-R/ REVRSY	No	No	No	Yes	No

## Pair status and data currency

The following table shows whether the data in a shared volume is current, given the combined status.

URz pair status	Slz pair status					
	PENDING	DUPLEX	SP-Pend/ TRANS	Split/ SUSPO P	Resync/ Pending, Resync-R/ REVRSY	Suspend/ SUSPER
Pending	Not Current	Not Current	Not Current	Current	Not Current	Not Current
Duplex	Not Current	Not Current	Not Current	Current	Not Current	Not Current
Suspend	Not Current	Current	Current	Current	Current	Not Current

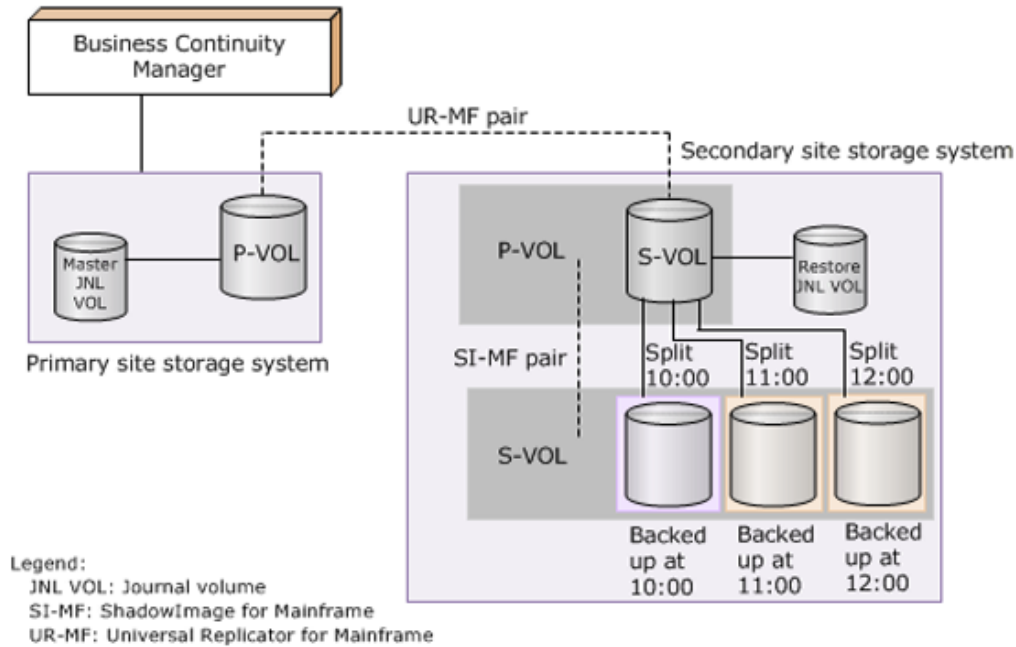
Check pair status for shared volumes as follows:

- For URz, check status of the primary volume or secondary volume.
- For Slz, check status of the primary volume.

Slz supports multiple secondary volumes for each primary volume. When you check pair status, the system returns status for only one pair: the pair whose secondary volume has the lowest LDEV ID. To see status for the pairs with a different secondary volume, direct a host query to the specific secondary volume using the secondary volume's LDEV ID in the `host` command.

## Using `ATTIME SUSPEND` for Slz pairs shared with URz

When Slz primary volumes are shared with URz secondary volumes, you can run the Business Continuity Manager `ATTIME SUSPEND` operation on Slz pairs to specify the split time. This is illustrated in the following figure (applies to multiple volumes).



The following takes place when you run the ATTIME SUSPEND on shared volumes:

1. URz restore journal data created before the suspend time is restored to URz secondary volumes (Slz primary volumes)
2. Restore journal operations are suspended if URz detects restore journal data with a time stamp later than the suspend time. After the URz suspension, the Slz suspend operations run.
3. When Slz suspend operations are completed, URz resumes the suspended restore journal operations.

## ATTIME SUSPEND requirements, restrictions, and recommendations

Observe the following when using the ATTIME SUSPEND with shared URz and Slz volumes.

- Register the suspend time using Business Continuity Manager. The ATTIME SUSPEND function is not supported by Device Manager - Storage Navigator.
- Slz primary volumes must be shared with the URz secondary volumes.
- Note the following:
  - Slz pairs must be registered in the same Slz consistency group.
  - URz S-VOLs (Slz P-VOLs) must be registered in the same journal.

Both configurations are necessary to insure consistent backup operations to Slz S-VOLs.

- Pair status must be the following:
  - URz pair status: DUPLEX.
  - Slz pair status: either DUPLEX or PENDING.

Note that if the URz or Slz pair is in the Suspend status due to a failure, journal data before the split time might not be restored to the S-VOL of the Slz pair after the split.

- One suspend operation may be applied to one Slz consistency group.
- A maximum of three suspend operations can be run on one journal group (equivalent to three Slz consistency groups).
- You can use Quick Split or Steady Split for the Slz ATTIME SUSPEND.
- The specified suspend time and the actual starting time of the operation might not be the same. The starting time delays according to the amount of journal data in the journal volume at the suspend time. For example, if the journal volume contains data that needs one hour to be restored, the starting time of the suspend operation delays for an hour.
- If a restore journal has a timeout period that ends after the suspend time, journal data may not be detected. In this case, the Slz suspend operation runs after the timeout period. Set the timeout value according to your requirements. The default value is 6 hours. See the *Business Continuity Manager User Guide* for more information.
- The specified suspend time remains enabled even after the suspend operation on Slz pairs is completed. Therefore you should delete the registered suspend time before specifying a new suspend time.
- If you use the ATTIME SUSPEND when URz volumes are shared with TCz in the following configurations, enable the time stamp transferring option of all the TCz pairs in the journal:
  - 3DC Cascade configuration
  - 3DC multi-target configuration that has been switched to a cascade configuration during disaster recovery

If you do not do this, data consistency is not guaranteed in the Slz consistency group.

- If a suspend time is specified, you cannot run the Reverse Resync operation on the URz pair. To run the Reverse Resync, delete the suspend times of the Slz pair whose secondary volume is related to the restore journal. See the *Business Continuity Manager User Guide* for more information of the Reverse Resync.
- You cannot create, resync, or suspend pairs from Business Continuity Manager when a suspend time is set for the Slz consistency group, unless you first delete the suspend time.

However, pairs can be deleted when a suspend time is set. The registered suspend time is canceled when you delete the following:

- All Slz pairs in the Slz consistency group.
  - All URz pairs in the URz restore journal.
- Registered split times are canceled if the storage system at the secondary site is subject to planned shutdown, or turned off.



## Appendix C: URz CLI reference

You can use lists of Universal Replicator for Mainframe operations and the corresponding CLI commands (CCI, BCM, PPRC) as a reference guide.

### Configuration operations

The following table lists the URz configuration operations and provides the corresponding CCI and BCM commands.

Operation	Options	In HDvM - SN?	CCI command and options	BCM <sup>1</sup> command
Edit Ports	Port Attribute	Yes	raidcom modify port -port_attribute <i>port attribute</i>	None
Add Remote Connection	Connection Type	Yes	None	None
	Remote Storage System	Yes	raidcom add rcu -rcu <i>serial# mcu# rcu# id</i>	YKBLDPTH
	Remote Paths	Yes	raidcom add rcu -cu_free <i>serial# id pid</i>	YKBLDPTH
	RIO MIH Time	Yes	raidcom modify rcu -rcu_option <i>mpt# rto rtt[fzd fze]</i>	None
Create Journals	System Type	Yes	raidcom add journal [-timer_type <i>timer_type</i> ] <sup>2</sup>	None
	Journal ID	Yes	raidcom add journal -journal_id <i>journal ID#</i>	None
	Journal Type Options <sup>3</sup> : Data Overflow Watch, Cache Mode, Timer Type	Yes	raidcom modify journal [-data_overflow_watchtime] [-cache_mode {y   n}][-timer_type <i>timer type</i> ]	None

Operation	Options	In HDvM - SN?	CCI command and options	BCM <sup>1</sup> command
	Journal Type Options <sup>3</sup> : Path Blockade Watch	Yes	raidcom modify journal -path_blocked_watchtime [-mirror_id <i>mu</i> #]	None
	Journal Type Options <sup>3</sup> : MP Unit	Yes	raidcom modify journal -mp_blade_id <i>mp</i> #	None
Assign Journal Volumes	None	Yes	raidcom add journal -journal_id <i>journalID</i> #	None
Add reserve journal volume	None	Yes	raidcom add journal -journal_id <i>journalID</i> # -ldev_id <i>ldev</i> #	None
Assign MP Unit	MP Unit	Yes	raidcom add journal [ -mp_blade_id <i>mp</i> # ]	None
Edit Remote Replica Options	Copy Type	Yes	None	None
	Maximum Initial Copy Activities	Yes	None	None
	Service SIM	Yes	None	None
<b>Notes:</b>				
<ol style="list-style-type: none"> <li>1. There are no BCM attribute definitions, nor options.</li> <li>2. The journal will be created as a mainframe journal if you specify the -timer_type option. If you do not specify -timer_type, the journal will be created for open systems.</li> <li>3. Data Overflow Watch, Cache Mode, Timer Type, Path Blockade Watch, and MP Unit can only be specified all at once during the create journal operation using Device Manager - Storage Navigator. You can only specify them one-by-one with CCI. For details, see the <i>Command Control Interface User and Reference Guide</i>.</li> </ol>				

## Pair operations

For you to be able to manage URz pairs, you should know commands and options that control those pairs.

The following table lists the URz pair operations and provides the corresponding CCI and BCM commands.



**Note:** For URz, pair operation commands and options are not available from PPRC.

Operation	Options	In HDvM - SN?	CCI command and options	BCM				
				Command name	z/OS BCM		VOS3 BCM	
					Definition attribute	Option	Definition attribute	Option
Create UR Pairs	Copy Type	Yes	paircreate None	YKMAKE	Copy Group Type	None	COPY MODE	None
	Mirror Selection	Yes	paircreate None <sup>1</sup>	YKMAKE	MIRROR ID	None	None	None
	Initial Copy Type	Yes	paircreate [-nocopy -nocsus]	YKMAKE	None	NOCOPY  HOLD	None	NOCOPY
	Error Level	Yes	paircreate None	YKMAKE	ERROR LVL	None	ERROR LEVEL	None
	Path Group ID	Yes	None	YKMAKE	Path ID	None	None	None
Split Pairs	Secondary Volume Write	Yes	pairsplit [-d] [-r or -rw]	YKSUSPND	PROT MODE	SVOL({ PROTECT  PERMIT})	ACCESS LEVEL	ACCESS LEVEL(READ WRITE)
	Range	No	None	YKSUSPND	None	DEVN	None	UNIT
	Suspend for reverse resync	No	None	YKSUSPND	None	REVERSE	None	REVERSE
Split Mirrors	Secondary Volume Write	Yes	pairsplit [-r or -rw]	YKSUSPND	PROT MODE	SVOL({ PROTECT  PERMIT})	ACCESS LEVEL	ACCESS LEVEL(READ WRITE)

Operation	Options	In HDvM - SN?	CCI command and options	BCM				
				Command name	z/OS BCM		VOS3 BCM	
					Definition attribute	Option	Definition attribute	Option
	Split Mode	Yes	pairsplit [-P]	YKSUSPND	None	FLUSH PURGE	None	FLUSH PURGE
Resync Pairs	Range	No	None	YKRESYNC	None	DEVN	None	UNIT
	Error Level	Yes	pairresync None	YKRESYNC	ERROR LVL	VOLUNIT	ERROR LEVEL	VOLUNIT
	Reverse Resync	Yes	pairresync -restore	YKRESYNC	None	REVERSE	None	REVERSE
Resync Mirrors	None	Yes	pairresync None	YKRESYNC	None	None	None	None
	Resync Mode	Yes	pairresync None	YKRESYNC	None	DELTAJNL ALLJNL PREPARE	None	None
Delete Pairs	Range	No	pairsplit [-S] [-d]	YKDELETE	None	DEVN	None	UNIT
	Delete Mode	No	pairsplit -S	YKDELETE	None	None	None	None
Delete Mirrors	Delete Mode	Yes	pairsplit [-S]	YKDELETE	None	None <sup>2</sup>	None	None <sup>2</sup>
Switch host control <sup>3</sup>	None	No	pairsplit -R[-S B]	None	None	None	None	None
<b>Notes:</b>								

Operation	Options	In HDvM - SN?	CCI command and options	BCM				
				Command name	z/OS BCM		VOS3 BCM	
					Definition attribute	Option	Definition attribute	Option
<ol style="list-style-type: none"> <li>1. The Mirror option cannot be specified with the paircreate command. Instead, specify the Mirror in the configuration definition file, in advance, and then run the pair create command.</li> <li>2. DEV must be specified for all volumes in the mirror.</li> <li>3. Switches the control from the primary site host to the secondary site host.</li> </ol>								

## Monitoring operations

The following table lists the URz monitoring operations and provides the corresponding CCI, BCM, and PPRC commands.

Operation	Options	In HDvM - SN?	CCI command and options	BCM <sup>1</sup> command name	PPRC <sup>2</sup> command and options
View Pair Properties	None	Yes	pairedisplay -m <i>mode</i>	YKQUERY	CQUERY None
View Pair Synchronization Rate	None	Yes	pairedisplay -fc	YKQUERY	CQUERY None
View Remote Connection Properties	None	Yes	pairedisplay -m <i>mode</i>	YKQRYDEV PATHS YKQRYPTH	CQUERY PATHS
<b>Notes:</b>					
<ol style="list-style-type: none"> <li>1. There are no BCM attribute definitions for monitoring commands.</li> <li>2. TSO command/ICKDSF command.</li> </ol>					

## Maintenance operations

The following table lists the URz maintenance operations and provides the corresponding CCI and BCM commands.

Operation	Options	In HDvM - SN?	CCI command	BCM command*
Edit Pair Options	Error Level	Yes	None	None
	CFW	Yes	None	None
Force Delete Pairs (URz Pairs)	None	Yes	None	None
Edit Journal Options	None	Yes	raidcom modify journal	None
Edit Mirror Options	None	Yes	None	None
Assign Journal Volumes	None	Yes	raidcom add journal -journal_id <i>journal ID#</i>	None
Delete Journals	None	Yes	raidcom delete journal -journal_id <i>journal ID#</i>	None
Edit Remote Connection Options	RIO MIH Time	Yes	None	None
Add Remote Paths	None	Yes	None	YKBLDPTH
Remove Remote Paths	None	Yes	None	YKDELPTH
Remove Remote Connections	None	Yes	None	YKDELPTH
Force Remove Journals from EXCTG	None	Yes	None	None
Assign Remote Command Devices	None	Yes	None	None
Release Remote Command Devices	None	Yes	None	None
* There are no BCM attribute definitions or options.				

## Parameter range for CCI options

The following table shows the range of parameters that can be set for CCI options. For details about CCI commands, see the *Command Control Interface Command Reference*.

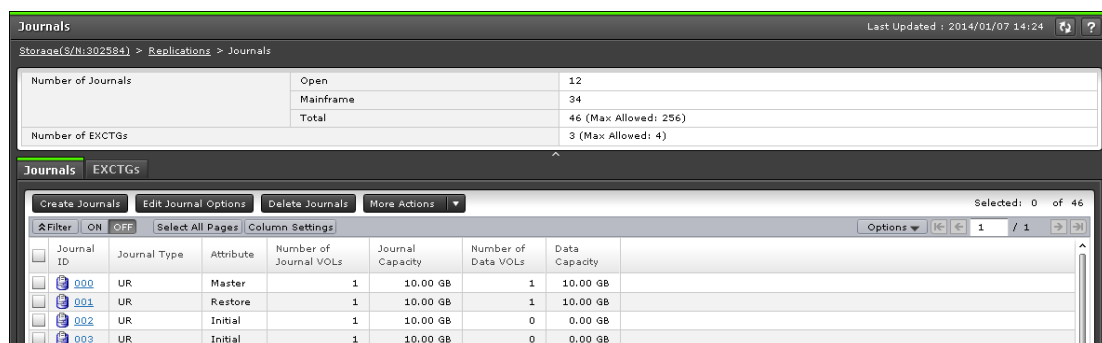
Parameter	Range
Mirror ID (MU#)	0 to 3
CTG ID	▪ 0 to 255
Journal ID	▪ 0 to 255
Path group ID	▪ 0 to 63

## Appendix D: URz GUI reference

As a reference, you can view Universal Replicator for Mainframe windows, dialog boxes, fields, and behaviors in the Device Manager - Storage Navigator GUI.

### Journals window

Use this window to view details about journals and their properties.



### Summary

Item	Description
Number of Journals	Total number of journals, with the maximum number in parentheses.
Number of EXCTGs (VSP 5000 series)	Number of the EXCTGs in use.

### Journals tab

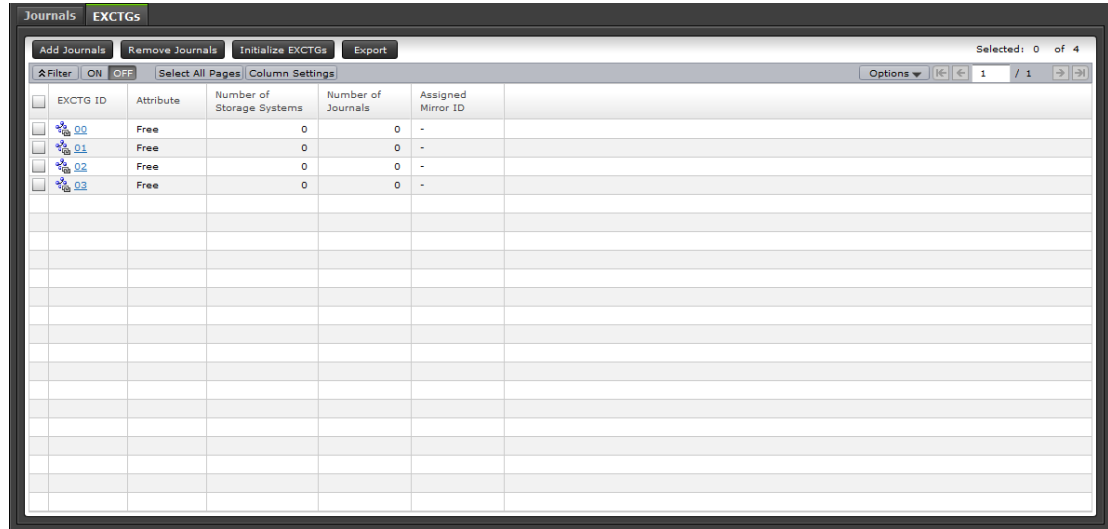
Item	Description
Journal ID	Journal identifier. Clicking the link displays more information about the journal and assigned mirrors and journal volumes.
Journal Type	Journal copy type.
Attribute	Whether the journal is Master, Restore, Master/Restore, or Initial.



Item	Description
Number of Journal VOLs	Number of journal volumes registered in the journal.
Journal Capacity	Capacity of the journal volume registered in the journal. If two journal volumes are registered, the capacity of the reserve journal volume is subtracted from the total capacity.
Number of Data VOLs	Number of volumes associated with the journal. (VSP 5000 series) If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.
Data Capacity	Total capacity of all the associated volumes. (VSP 5000 series) If the journal uses multiple mirror IDs, the capacity of volumes in mirrors with Hold, Holding, or Hold(Failure) status is not included.
MP Unit ID*	MP Unit ID identifier.
Encryption*	<p>Journal's encryption information:</p> <ul style="list-style-type: none"> <li>▪ Enabled: The journal contains only encrypted volumes.</li> <li>▪ Disabled: The journal contains only unencrypted volumes.</li> <li>▪ Mixed: The pool to which the journal volume belongs contains two or more of the following: <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <ul style="list-style-type: none"> <li>▪ Hyphen (-): The pool to which the journal volume belongs is an external volume, created in a migration volume (VSP 5000 series) or blocked.</li> </ul>
Inflow Control*	Whether the flow of update data to the journal volume is restricted by slowing the response to hosts.
Data Overflow Watch*	Number of seconds the system monitors metadata and journal data when the journal volume is full (100%). If Inflow Control is disabled, a hyphen (-) is displayed.

Item	Description
Cache Mode*	<p>Whether journal data is stored in cache memory in the restore journal.</p> <ul style="list-style-type: none"> <li>▪ Enable: Journal data is stored in cache memory. When the available cache memory becomes insufficient, the journal data is also stored in a journal volume.</li> <li>▪ Disable: Journal data is stored in a journal volume instead of cache memory. This setting is disabled in the master journal. However, this setting is enabled if you use the <code>horctakeover</code> command of CCI (for Universal Replicator) or the <code>YKRESYNC REVERSE</code> command of Business Continuity Manager (for Universal Replicator for Mainframe) to change the master journal to the restore journal.</li> </ul>
Timer Type*	<p>Type of clock used for consistency time. A hyphen (-) is displayed for URz pairs.</p> <ul style="list-style-type: none"> <li>▪ System: Mainframe system clock</li> <li>▪ Local: System clock is not used</li> <li>▪ None: Mainframe system clock</li> </ul>
EXCTG Setting*	<p>If journals are registered in the EXCTG, the following information is displayed.</p> <ul style="list-style-type: none"> <li>▪ EXCTG ID: Displays the EXCTG ID.</li> <li>▪ Super DKC: Displays the Super DKC device name followed by slash (/), and the serial number on the right side of the slash (/).</li> </ul> <p>A hyphen (-) is displayed if no journal is registered in the EXCTG.</p>
Create Journals	Opens the <b>Create Journals</b> window
Edit Journal Options	Opens the <b>Edit Journal Options</b> window
Delete Journals	Opens the <b>Delete Journals</b> window
More Actions	<p>When clicked, opens menu for accessing:</p> <ul style="list-style-type: none"> <li>▪ Assign MP Unit ID window</li> <li>▪ Force Remove Journals from EXCTG window</li> <li>▪ Export window</li> </ul>
*These items do not appear in the table by default. To display these items, you must change the column settings for the table (click Column Settings).	

**EXCTGs tab**



Item	Description
Add Journals	Clicking opens the <b>Add Journal</b> window, which is used to register journals in an EXCTG.
Remove Journals	Clicking opens the <b>Remove Journal</b> window, which is used to remove journals from an EXCTG.
Initialize EXCTGs	Clicking the link opens the Initialize <b>EXCTGs</b> window, which is used to remove all journals from an EXCTG.
Export	Clicking opens a window for exporting information about the EXCTG.
EXCTG ID	EXCTG identifier. Clicking the link opens the <b>EXCTG Properties</b> window.
Attribute	EXCTG attributes, which can be: <ul style="list-style-type: none"> <li>▪ Master: Primary storage system EXCTG</li> <li>▪ Restore: Secondary storage system EXCTG</li> <li>▪ Initializing: Journal deletion is in progress.</li> <li>▪ Free: No journal is registered in the EXCTG.</li> <li>▪ Updating: Registering journals is in process.</li> </ul>
Number of Storage Systems	Number of storage systems registered in the EXCTG.
Number of Journals	Number of journals registered in the EXCTG.

## Journal Volumes window

Use this window to view detailed information about individual journals, including the mirrors and journal volumes assigned to it.

002  
TESTSTORAGE(S/N:1) > Replication > Journals > 002  
Last Updated : 2018/12/10 09:20

Journal ID	002	MP Unit ID	MPU-010
Journal Type	URMF	Encryption	Disabled
Attribute	Master	Inflow Control	Disabled
Number of Journal Volumes	1 (Max Allowed: 2)	Data Overflow Watch	-
Journal Capacity	10.00 GB	Cache Mode	Enabled
Number of Data Volumes	1 (Max Allowed: 8192)	Timer Type	System
Data Capacity	200 Cyl (169.92 MB)		

**Mirrors** | Journal Volumes

Split Mirrors | Resync Mirrors | Create UR Pairs | More Actions

Selected: 0 of 4

Mirror ID	Attribute	Status	Remote Storage System Model / Serial Number	Journal ID	Path Group ID	Number of Data VOLs	Data Capacity	Remote Command Device
0	Master	Active	VSP 5000 series / 00001	003	00	1	200 Cyl	00:30:FE
1	Initial	Initial	-	-	-	0	0 Cyl	-
2	Initial	Initial	-	-	-	0	0 Cyl	-
3	Initial	Initial	-	-	-	0	0 Cyl	-

### Summary section

Item	Description
Journal ID	Journal identifier.
Journal Type	Journal copy type.
Attribute	Whether the journal is Master, Restore, Master/Restore, or Initial (registered but no pair volumes assigned).
Number of Journal VOLs	Number of journal volumes registered in the journal, with the maximum number allowed in parentheses.
Journal Capacity	Capacity of the journal volume registered in the journal. If two journal volumes are registered, the capacity of the reserve journal volume is subtracted from the total capacity.
Number of Data VOLs	Number of volumes associated with the journal. If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.

Item	Description
Data Capacity	<p>Total capacity of all the associated volumes.</p> <p>If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.</p>
MP Unit ID	MP unit identifier
Encryption	<p>Journal's encryption information:</p> <ul style="list-style-type: none"> <li>▪ Enabled: The journal contains only encrypted volumes.</li> <li>▪ Disabled: The journal contains only unencrypted volumes.</li> <li>▪ Mixed: The pool to which the journal volume belongs contains two or more of the following: <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <ul style="list-style-type: none"> <li>▪ Hyphen (-): The pool to which the journal volume belongs is an external volume, created in a migration volume or blocked.</li> </ul>
Inflow Control	Whether flow of update data to the journal volume is restricted by slowing the response to hosts.
Data Overflow Watch	Number of seconds the system monitors metadata and journal data when the journal volume is full (100%). A hyphen (-) displays if Inflow Control is disabled.
Cache Mode	<p>Whether journal data is stored in cache memory on the remote side (restore journal).</p> <ul style="list-style-type: none"> <li>▪ Enable: Journal data is stored in cache memory. When the available cache memory becomes insufficient, the journal data is also stored in a journal volume.</li> <li>▪ Disable: Journal data is stored in a journal volume instead of cache memory. This setting is disabled in the master journal. However, this setting is enabled if you use the <code>horctakeover</code> command of CCI (for Universal Replicator) or the <code>YKRESYNC REVERSE</code> command of Business Continuity Manager (for Universal Replicator for Mainframe) to change the master journal to the restore journal.</li> </ul>

Item	Description
Timer Type	Type of clock used for consistency time. A hyphen (-) is displayed for UR pairs. <ul style="list-style-type: none"> <li>System: Mainframe system clock</li> <li>Local: System clock is not used</li> <li>None: Mainframe system clock</li> </ul>

### Mirrors tab

This tab displays information about the selected journal's mirrors.

Mirror ID	Attribute	Status	Remote Storage System Model / Serial Number	Journal ID	Path Group ID	Number of Data VOLs	Data Capacity	Remote Command...
0	Master	Active	VSP G1000 / 12345	000	00	1	0 Cyl	
1	Master	Active	VSP G1000 / 12345	0FE	00	2	200 Cyl	
2	Initial	Initial	-	-	-	0	0 Cyl	-
3	Initial	Initial	-	-	-	0	0 Cyl	-

Item	Description
Mirror ID	Mirror identifier.
Attribute	Whether the journal is Master, Restore, or Initial (registered but no pair volumes assigned).
Status	Mirror's status. For definitions, see <a href="#">Monitoring journal (mirror) status (on page 155)</a> .
Remote Storage System	Displays the following information about the system connected to the system you accessed.: <ul style="list-style-type: none"> <li>Model/Serial Number: Storage system model and serial number. A hyphen displays if the mirror attribute is Initial.</li> <li>Journal ID: Journal identifier. A hyphen displays if the mirror attribute is Initial.</li> </ul>
Path Group ID	Path group identifier specified during pair creation.
Number of Data VOLs	Number of volumes associated with the journal. If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.
Data Capacity	Total capacity of all the associated volumes. If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.

Item	Description
Remote Command Device	<p>LDEV number of the remote command device if it is assigned to the mirror.</p> <ul style="list-style-type: none"> <li>▪ The column is blank if the remote command device is not assigned to the mirror.</li> <li>▪ A hyphen (-) indicates the remote command device cannot be assigned to the mirror.</li> </ul>
CTG ID*	Mirror's consistency group identifier. A hyphen indicates there is no consistency group.
CTG Utilization*	<p>Whether the consistency group is shared by multiple storage systems.</p> <ul style="list-style-type: none"> <li>▪ Single: The consistency group consists of a single pair of primary and secondary storage systems.</li> <li>▪ Multi: The consistency group consists of multiple storage systems.</li> </ul>
Path Watch Time*	<p>Interval from the time when a physical path failure occurs, such as a path disconnection, to the time when the mirror is suspended. A hyphen indicates if the status of the secondary mirror on the primary storage system is Hold, Holding or Hold(Failure).</p> <p>This option becomes valid when both advanced system settings No. 16 and No. 15 are set to OFF.</p>
Path Watch Time Transfer*	<p>Whether to assign the master journal's Path Watch Time value to the restore journal.</p> <p>When transferred, the Path Watch Time values of the mirror's primary side (MCU) and the secondary side (RCU) will be consistent.</p> <ul style="list-style-type: none"> <li>▪ Yes: Path Watch Time value will be transferred to the mirror's secondary side (RCU).</li> <li>▪ No: Path Watch Time value will not be transferred to the mirror's secondary side (RCU).</li> </ul>
Copy Pace*	Pace for copying data during initial copy: Slower (default), Medium, Faster. A hyphen indicates that the journal is a restore journal.
Transfer Speed*	Data transfer line speed in Mbps (megabits per second): 3, 10, 100, or 256.
Delta Resync Failure*	<p>Processing that takes place in the event of delta resync operation failure</p> <p>Entire Copy, No Copy.</p> <ul style="list-style-type: none"> <li>▪ Entire Copy: The entire P-VOL is copied to the S-VOL.</li> <li>▪ No Copy: No processing occurs. The S-VOL is not updated.</li> </ul>
Split Mirrors	Opens the <b>Split Mirrors</b> window.
Resync Mirrors	Opens the <b>Resync Mirrors</b> window.

Item	Description
Create UR Pairs	Opens the <b>Create UR Pairs</b> window
More Actions	When clicked, opens a menu for accessing: <ul style="list-style-type: none"> <li>▪ Edit Mirror Options window</li> <li>▪ View Remote Connection Properties window</li> <li>▪ Delete Mirrors window</li> <li>▪ Assign Remote Command Devices window</li> <li>▪ Release Remote Command Devices window</li> <li>▪ Export window</li> </ul>
*These items do not appear in the table by default. To display these items, you must change the column settings for the table (click Column Settings).	

### Journal Volumes tab

This tab displays information about the selected journal's journal volumes.

Item	Description
LDEV ID	Journal volume's identifier consisting of the LDKC number, CU number, and LDEV number. Clicking the link opens the <b>LDEV Properties</b> window.
LDEV Name	Name of the journal volume's LDEV.
Pool Name (ID)	Identifier consisting of the pool name and the pool ID. Clicking the link opens a window with pool information.
RAID Level	Type of RAID implementation for the journal volume.
Capacity	Journal volume's capacity.
CLPR	Journal volume's CLPR. The CLPR ID is displayed before the colon, and the CLPR name is displayed after the colon.



Item	Description
Encryption*	<p>Encryption information:</p> <ul style="list-style-type: none"> <li>▪ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>▪ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>▪ Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> </li> <li>▪ Hyphen (-): The LDEV is an external volume. For DP-VOL or DP-VOL for Mainframe, the pool to which the LDEV belongs is either an external volume or blocked.</li> </ul>
Resource Group Name (ID)	LDEV's resource group name and identifier. The ID is enclosed in parentheses.
Type	<p>Type of journal volume:</p> <ul style="list-style-type: none"> <li>▪ Journal: Journal volume</li> <li>▪ Reserve Journal: Reserve journal volume</li> </ul>
Assign Journal Volumes	Opens the <b>Assign Journal Volumes</b> window.
Export	Opens the window for exporting table information
*This item does not appear in the table by default. To display this item, you must change the column settings for the table (click Column Settings).	

## Journal Properties window

Use this window to view information about the selected journal.



Item	Description
	<ul style="list-style-type: none"> <li>▪ Mixed: The pool to which the journal volume belongs contains two or more of the following:               <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> </li> <li>▪ Hyphen (-): The pool to which the journal volume belongs is an external volume, created in a migration volume or blocked.</li> </ul>
Inflow Control	Indicates whether the flow of update data to the journal volume is restricted by slowing the response to hosts.
Data Overflow Watch	Number of seconds the system monitors metadata and journal data when the journal volume is full (100%). A hyphen (-) displays if Inflow Control is disabled.
Cache Mode	<p>Whether journal data is stored in cache memory on the remote side (restore journal).</p> <ul style="list-style-type: none"> <li>▪ Enable: Journal data is stored in cache memory. When the available cache memory becomes insufficient, the journal data is also stored in a journal volume.</li> <li>▪ Disable: Journal data is stored in a journal volume instead of cache memory. This setting is disabled in the master journal. However, this setting is enabled if you use the <code>horctakeover</code> command of CCI (for Universal Replicator) or the <code>YKRESYNC REVERSE</code> command of Business Continuity Manager (for Universal Replicator for Mainframe) to change the master journal to the restore journal.</li> </ul>
Timer Type	<p>URz only.</p> <p>Type of clock used for consistency time. A hyphen (-) is displayed when Copy Type is UR.</p> <ul style="list-style-type: none"> <li>▪ System: Mainframe system clock</li> <li>▪ Local: System clock is not used</li> <li>▪ None: Mainframe system clock</li> </ul>
Number of Journal VOLs	Number of journal volumes registered in the journal, with the maximum number allowed in parentheses.
Journal Capacity	Capacity of the journal volume registered in the journal. If two journal volumes are registered, the capacity of the reserve journal volume is subtracted from the total capacity.

## Journal Volumes table

Item	Description
LDEV ID	Journal volume's identifier consisting of the LDKC number, CU number, and LDEV number. Clicking the link opens the <b>LDEV Properties</b> window.
LDEV Name	Name of the journal volume's LDEV.
Pool Name (ID)	Identifier consisting of the pool name and the pool ID. Clicking the link opens a window with pool information.
RAID Level	Type of RAID implementation for the journal volume.
Capacity	Journal volume's capacity.
CLPR	Journal volume's CLPR. The CLPR ID is displayed before the colon, and the CLPR name is displayed after the colon.
Encryption	<p>Encryption information:</p> <ul style="list-style-type: none"> <li>▪ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>▪ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>▪ Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> </li> <li>▪ Hyphen (-): The LDEV is an external volume. For DP-VOL or DP-VOL for Mainframe, the pool to which the LDEV belongs is either an external volume or blocked.</li> </ul>
Resource Group Name (ID)	LDEV's resource group name and identifier. The ID is enclosed in parentheses.
Type	<p>Type of journal volume:</p> <ul style="list-style-type: none"> <li>▪ Journal: Journal volume</li> <li>▪ Reserve Journal: Reserve journal volume</li> </ul>



### Settings

System Type:  Open  Mainframe

Journal ID:

---

Journal Volume Selection:

[Select Journal Volumes](#)

Total Selected Journal Volumes: 1

Total Selected Capacity: 10.00 GB

⤴ [Options](#)

MP Unit ID:

Inflow Control:  Enable  Disable

Data Overflow Watch:  Second(s)

Cache Mode:  Enable  Disable

Timer Type:

Item	Description
System Type	Storage system type: Open or Mainframe.
Journal ID	Identifier for the journal, displayed in ascending order. Blank if no number is available.
Journal Volume Selection	<ul style="list-style-type: none"> <li>▪ Select Journal Volumes: When clicked, opens the Select Journal Volumes dialog box.</li> <li>▪ Total Selected Journal Volumes: Number of selected journal volumes.</li> <li>▪ Total Selected Capacity: Capacity of selected journal volumes.</li> </ul>
Total Selected Journal Volumes	Number of journal volumes selected in the Select Journal Volumes dialog box.

Item	Description
Total Selected Capacity	Total capacity of the journal volume selected in the Select Journal Volumes dialog box.
MP Unit ID	Journal MP unit. Options are: <ul style="list-style-type: none"> <li>▪ Availability depends on system configuration.</li> <li>▪ Auto: The default. Available when one or more MP units can be assigned automatically. If Auto cannot be selected, the default is the MP unit with the lowest number.</li> </ul>
Inflow Control	Controls the flow of update data to the journal volume by slowing the response to hosts. <ul style="list-style-type: none"> <li>▪ Enable: The flow of update data is restricted.</li> <li>▪ Disable: The flow of update data is not restricted.</li> </ul>
Data Overflow Watch	Number of seconds the system will monitor metadata and journal data when the journal volume is full (100%). When the metadata area or journal data area is full and no more data can be stored, the system regards this as an error and suspends the pairs in the journal. Range is 0-600 seconds. The UR default is 60; the URz default is 20. <p>In a 3DC multi-target configuration in which three UR sites are combined, if the status of the two mirrors in the primary site is Active and the free space in the journal data area or metadata area is less than a certain amount, one of the mirrors in the journal will be suspended by error, regardless of the value in Data Overflow Watch.</p>
Cache Mode	Whether to store journal data in cache memory on the restore journal. <ul style="list-style-type: none"> <li>▪ Enable: Journal data is stored in cache memory. When the available cache memory becomes insufficient, the journal data is also stored in a journal volume.</li> <li>▪ Disable: Journal data is stored in a journal volume instead of cache memory. This setting is disabled in the master journal. However, this setting is enabled if you use the <code>horctakeover</code> command of CCI (for Universal Replicator) or the <code>YKRESYNC REVERSE</code> command of Business Continuity Manager (for Universal Replicator for Mainframe) to change the master journal to the restore journal.</li> </ul>

Item	Description
Timer Type	<p>Type of clock used for consistency time. Values must be the same on primary and secondary storage systems. Displayed only when Mainframe is selected for System Type.</p> <ul style="list-style-type: none"> <li>▪ System: The local storage system acquires the time-stamp information for each journal data.</li> </ul> <p>When a URz pair is created, the local storage system reports state-change-interrupt (SCI) to all hosts. The host then issues a series of sense group commands to determine the device status change. The local storage system returns the same response as if the device was added to an XRC session to activate I/O time-stamping for the device. When I/O time-stamping is activated, the MVS IOS routine adds the time stamp information (contents of time-of-day (TOD) clock) to each write I/O instruction for the device. A time stamp indicates the time when an update was made on the main host during start sub-channel (SSCH). Time stamps are transferred to the local storage system at each start I/O instruction.</p> <ul style="list-style-type: none"> <li>▪ Local: The local storage system does not obtain time stamp information from host I/O time stamp.</li> <li>▪ None: The local storage system obtains time stamp information from host I/O time stamp. Available only when copy direction is reversed, S-VOL to P-VOL.</li> </ul>
Add	The journal setting in left hand side window is added to the <b>Selected Journals</b> table.



**Selected Journals table**

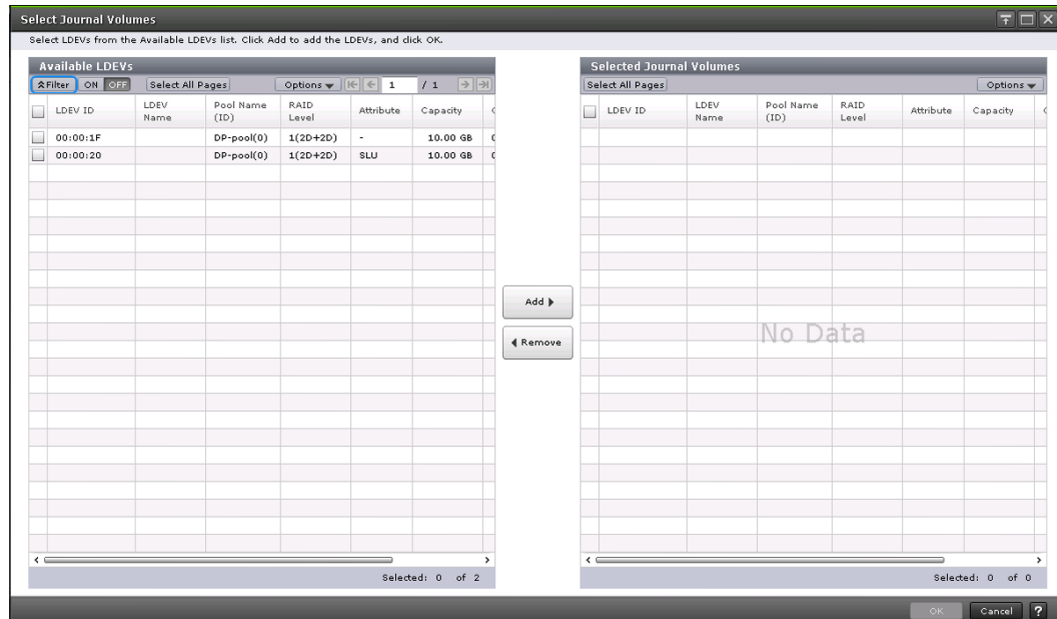
<input type="checkbox"/>	Journal ID	Journal Type	Number of Journal VOLs	Journal Capacity	MP Unit ID	Encryp
No Data						

Selected: 0 of 0

Item	Description
Journal ID	Identifier for the journal LDEV, displayed in ascending order. Blank if no number is available.
Journal Type	Journal copy type.
Number of Journal VOLs	Number of journal volumes registered in the journal.
Journal Capacity	Capacity of the journal volume registered in the journal. If two journal volumes are registered, the capacity of the reserve journal volume is subtracted from the total capacity.
MP Unit ID	MP unit identifier

Item	Description
Encryption	<p>Journal's encryption information:</p> <ul style="list-style-type: none"> <li>▪ Enabled: The journal contains only encrypted volumes.</li> <li>▪ Disabled: The journal contains only unencrypted volumes.</li> <li>▪ Mixed: The pool to which the journal volume belongs contains two or more of the following: <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <ul style="list-style-type: none"> <li>▪ Hyphen (-): The pool to which the journal volume belongs is an external volume, created by migration or blocked.</li> </ul>
Inflow Control	Whether flow of update data to the journal volume is restricted by slowing the response to hosts.
Data Overflow Watch (sec)	Number of seconds the system monitors metadata and journal data when the journal volume is full (100%). A hyphen (-) displays if Inflow Control is disabled.
Cache Mode	<p>Indicates whether journal data is stored in cache memory on the restore journal.</p> <ul style="list-style-type: none"> <li>▪ Enable: Journal data is stored in cache memory. When the available cache memory becomes insufficient, the journal data is also stored in a journal volume.</li> <li>▪ Disable: Journal data is stored in a journal volume instead of cache memory. This setting is disabled in the master journal. However, this setting is enabled if you use the <code>horctakeover</code> command of CCI (for Universal Replicator) or the <code>YKRESYNC REVERSE</code> command of Business Continuity Manager (for Universal Replicator for Mainframe) to change the master journal to the restore journal.</li> </ul>
Timer Type	<p>Type of clock used for consistency time. A hyphen (-) is displayed when URz is selected for Copy Type.</p> <ul style="list-style-type: none"> <li>▪ System: Mainframe system clock</li> <li>▪ Local: System clock is not used</li> <li>▪ None: Mainframe system clock</li> </ul>
Detail	Opens the <b>Journal Properties</b> window for the selected journal.
Remove	Removes the selected journal from the list.

## Select Journal Volumes dialog box



### Available LDEVs table

Item	Description
LDEV ID	Journal volume's identifier consisting of the LDKC number, CU number, and LDEV number.
LDEV Name	Name of the journal volume's LDEV.
Pool Name (ID)	Identifier consisting of the pool name and the pool ID. Clicking the link opens a window with pool information.
RAID Level	Type of RAID implementation for the journal volume.
Attribute	Journal volume's attribute. <ul style="list-style-type: none"> <li>▪ SLU: Volume with SLU attribute.</li> <li>▪ - (hyphen): The attribute is not set.</li> </ul>
Capacity	Journal volume's capacity.
CLPR	Journal volume's CLPR. The CLPR ID is displayed before the colon, and the CLPR name is displayed after the colon.

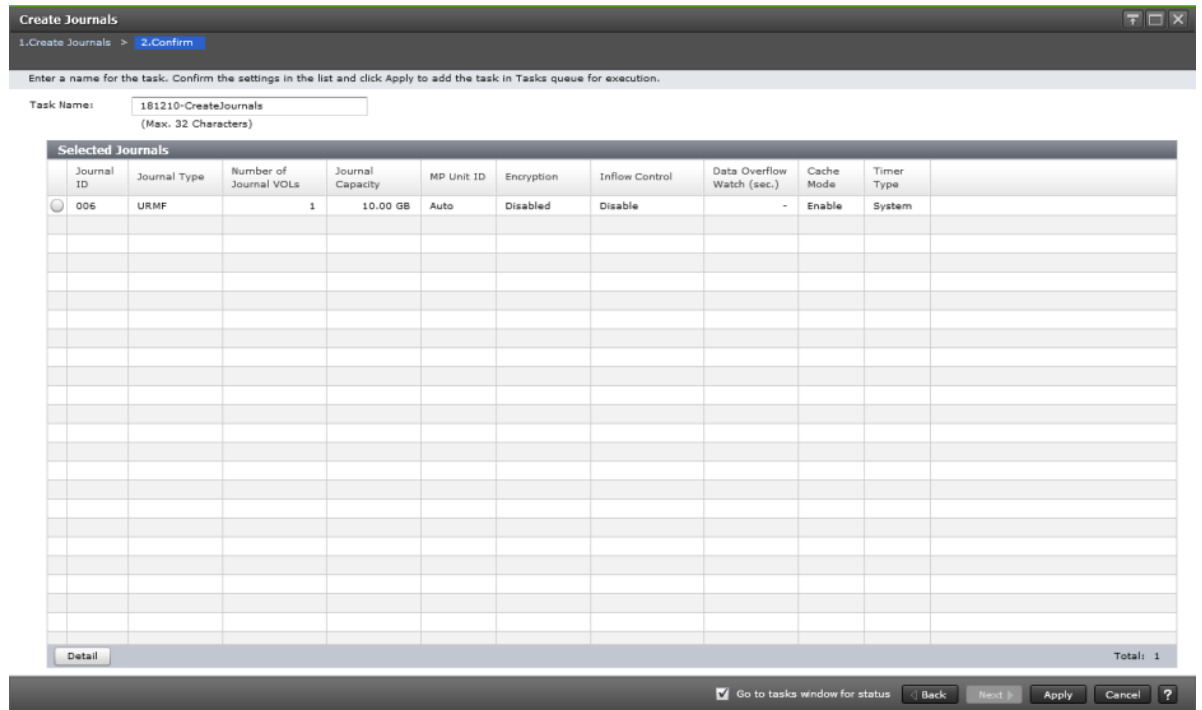
Item	Description
Encryption	<p>Encryption information:</p> <ul style="list-style-type: none"> <li>▪ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>▪ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>▪ Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV of which Encryption is Enabled or Disabled.</p> </li> <li>▪ Hyphen (-) : The LDEV is an external volume. For DP-VOL or DP-VOL for Mainframe, the pool to which the LDEV belongs is either an external volume or blocked.</li> </ul>
Resource Group Name (ID)	LDEV's resource group name and identifier. The ID is enclosed in parentheses.
Add	The LDEV selected from the <b>Available LDEVs</b> table is added to the <b>Selected Journal Volumes</b> table.
Remove	The selected journal volume is removed from the <b>Selected Journal Volumes</b> table.

#### Selected Journal Volumes table

Item	Description
LDEV ID	Journal volume's identifier consisting of the LDKC number, CU number, and LDEV number.
LDEV Name	Name of the journal volume's LDEV.
Pool Name (ID)	Identifier consisting of the pool name and the pool ID. Clicking the link opens a window with pool information.
RAID Level	Type of RAID implementation for the journal volume.

Item	Description
Attribute	Journal volume's attribute. <ul style="list-style-type: none"> <li>▪ SLU: Volume with SLU attribute.</li> <li>▪ - (hyphen): The attribute is not set.</li> </ul>
Capacity	Journal volume's capacity.
CLPR	Journal volume's CLPR. The CLPR ID is displayed before the colon, and the CLPR name is displayed after the colon.
Encryption	Encryption information: <ul style="list-style-type: none"> <li>▪ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>▪ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>▪ Mixed: The pool to which the LDEV belongs contains two or more of the following:               <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV of which Encryption is Enabled or Disabled.</p> </li> <li>▪ Hyphen (-) : The LDEV is an external volume. For DP-VOL or DP-VOL for Mainframe, the pool to which the LDEV belongs is either an external volume or blocked.</li> </ul>
Resource Group Name (ID)	LDEV's resource group name and identifier. The ID is enclosed in parentheses.

## Create Journals confirmation window



Item	Description
Journal ID	Identifier for the journal LDEV, displayed in ascending order. Blank if no number is available.
Number of Journal VOLS	Number of journal volumes registered in the journal.
Journal Capacity	Capacity of the journal volume registered in the journal. If two journal volumes are registered, the capacity of the reserve journal volume is subtracted from the total capacity.
MP Unit ID	MP unit identifier
Encryption	Journal's encryption information: <ul style="list-style-type: none"> <li>▪ Enabled: The journal contains only encrypted volumes.</li> <li>▪ Disabled: The journal contains only unencrypted volumes.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Mixed: The pool to which the journal volume belongs contains two or more of the following:               <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <ul style="list-style-type: none"> <li>▪ Hyphen (-): The pool to which the journal volume belongs is an external volume, created in a migration volume or blocked.</li> </ul>
Inflow Control	Whether flow of update data to the journal volume is restricted by slowing the response to hosts.
Data Overflow Watch (sec)	Number of seconds the system monitors metadata and journal data when the journal volume is full (100%). A hyphen (-) displays if Inflow Control is disabled.
Cache Mode	<p>Indicates whether journal data is stored in cache memory on the restore journal.</p> <ul style="list-style-type: none"> <li>▪ Enable: Journal data is stored in cache memory. When the available cache memory becomes insufficient, the journal data is also stored in a journal volume.</li> <li>▪ Disable: Journal data is stored in a journal volume instead of cache memory. This setting is disabled in the master journal. However, this setting is enabled if you use the <code>horctakeover</code> command of CCI (for Universal Replicator) or the <code>YKRESYNC REVERSE</code> command of Business Continuity Manager (for Universal Replicator for Mainframe) to change the master journal to the restore journal.</li> </ul>
Timer Type	<p>URz only.</p> <p>Type of clock used for consistency time. A hyphen (-) is displayed for URz pairs.</p> <ul style="list-style-type: none"> <li>▪ System: Mainframe system clock</li> <li>▪ Local: System clock is not used</li> <li>▪ None: Mainframe system clock</li> </ul>
Detail	Opens the <b>Journal Properties</b> window for the selected journal.

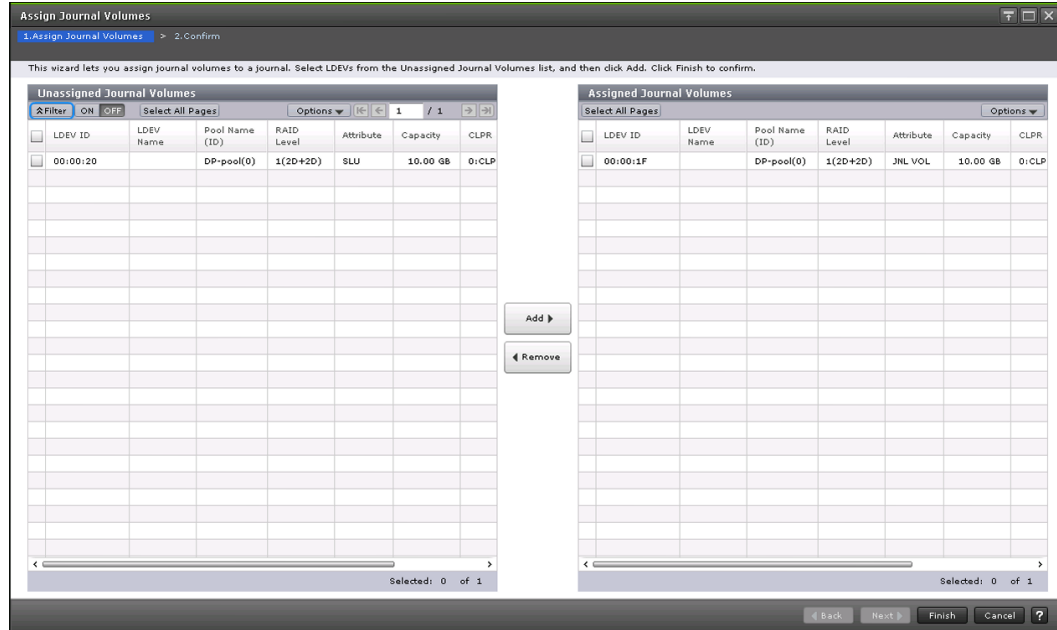
## Assign Journal Volumes wizard

Use this wizard to assign journal volumes to a journal.

## Assign Journal Volumes window

Use this window to assign journal volumes to a journal.

For instructions, see [Creating journals and adding journal volumes \(on page 124\)](#) and [Adding an additional journal volume to an existing journal \(on page 167\)](#).



### Unassigned Journal Volumes table

Item	Description
LDEV ID	Journal volume's LDEV identifier: LDKC number, CU number and LDEV number.
LDEV Name	Journal volume's LDEV name.
Pool Name (ID)	Journal volume's pool name and ID.
RAID Level	Journal volume's RAID level.
Attribute	Journal volume's attribute: <ul style="list-style-type: none"> <li>▪ JNL VOL: Journal volume</li> <li>▪ SLU: Volume with SLU attribute.</li> <li>▪ - (hyphen): The attribute is not set.</li> </ul>
Capacity	Journal volume capacity.
CLPR	Journal volume's CLPR ID and name.



Item	Description
Encryption	<p>Encryption information:</p> <ul style="list-style-type: none"> <li>▪ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>▪ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>▪ Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> </li> <li>▪ Hyphen (-) : The LDEV is an external volume. For DP-VOL or DP-VOL for Mainframe, the pool to which the LDEV belongs is either an external volume or blocked.</li> </ul>
Resource Group Name (ID)	LDEV's resource group name and ID (in parentheses).
Add	The journal volume selected from the <b>Unassigned Journal Volumes</b> table is added to the <b>Assigned Journal Volumes</b> table.
Remove	The selected journal volume is removed from the <b>Assigned Journal Volumes</b> table.

#### Assigned Journal Volumes table

Item	Description
LDEV ID	Journal volume's LDEV identifier: LDKC number, CU number and LDEV number.
LDEV Name	Journal volume's LDEV name.
Pool Name (ID)	Journal volume's pool name and ID.
RAID Level	Journal volume's RAID level.

Item	Description
Attribute	Journal volume's attribute: <ul style="list-style-type: none"> <li>▪ JNL VOL: The volume is a journal volume.</li> <li>▪ SLU: Volume with SLU attribute.</li> <li>▪ - (hyphen): The attribute is not set.</li> </ul>
Capacity	Journal volume capacity.
CLPR	Journal volume's CLPR ID and name.
Encryption	Encryption information: <ul style="list-style-type: none"> <li>▪ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>▪ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>▪ Mixed: The pool to which the LDEV belongs contains two or more of the following:               <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> </li> <li>▪ Hyphen (-) : The LDEV is an external volume. For DP-VOL or DP-VOL for Mainframe, the pool to which the LDEV belongs is either an external volume or blocked.</li> </ul>
Resource Group Name (ID)	LDEV's resource group name and ID (in parentheses).
Removable	Whether the journal volumes can be removed (Yes or No). If the mirror status to which the journals belong is Active, the journal volumes cannot be removed.



Item	Description
Capacity	Journal volume capacity.
CLPR	Journal volume's CLPR ID and name.
Encryption	<p>Encryption information:</p> <ul style="list-style-type: none"> <li>▪ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>▪ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>▪ Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <ul style="list-style-type: none"> <li>▪ Hyphen (-) : The LDEV is an external volume. For DP-VOL or DP-VOL for Mainframe, the pool to which the LDEV belongs is either an external volume or blocked.</li> </ul>
Resource Group Name (ID)	LDEV's resource group name and ID (in parentheses).

#### Unassigned Journal Volumes table

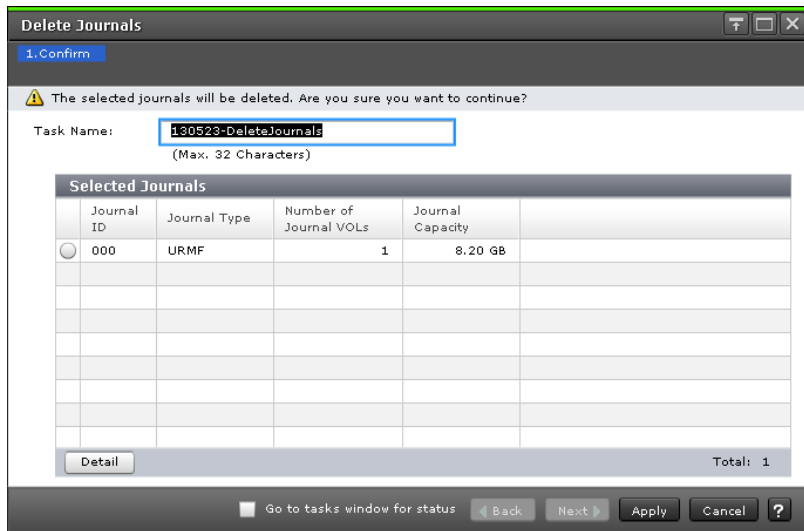
Item	Description
LDEV ID	Journal volume's LDEV identifier: LDKC number, CU number and LDEV number.
LDEV Name	Journal volume's LDEV name.
Type	<p>Type of journal volume:</p> <ul style="list-style-type: none"> <li>▪ Journal: Journal volume</li> <li>▪ Reserve Journal: Reserve journal volume</li> </ul>
Pool Name (ID)	Journal volume's pool name and ID.
RAID Level	Journal volume's RAID level.

Item	Description
Capacity	Journal volume capacity.
CLPR	Journal volume's CLPR ID and name.
Encryption	<p>Encryption information:</p> <ul style="list-style-type: none"> <li>▪ Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>▪ Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>▪ Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>• Volume for which encryption is enabled</li> <li>• Volume for which encryption is disabled</li> <li>• External volume</li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <ul style="list-style-type: none"> <li>▪ Hyphen (-) : The LDEV is an external volume. For DP-VOL or DP-VOL for Mainframe, the pool to which the LDEV belongs is either an external volume or blocked.</li> </ul>
Resource Group Name (ID)	LDEV's resource group name and ID (in parentheses).

## Delete Journals window

Use this window to delete journals.

For instructions, see the procedure in [Deleting journals \(on page 171\)](#).

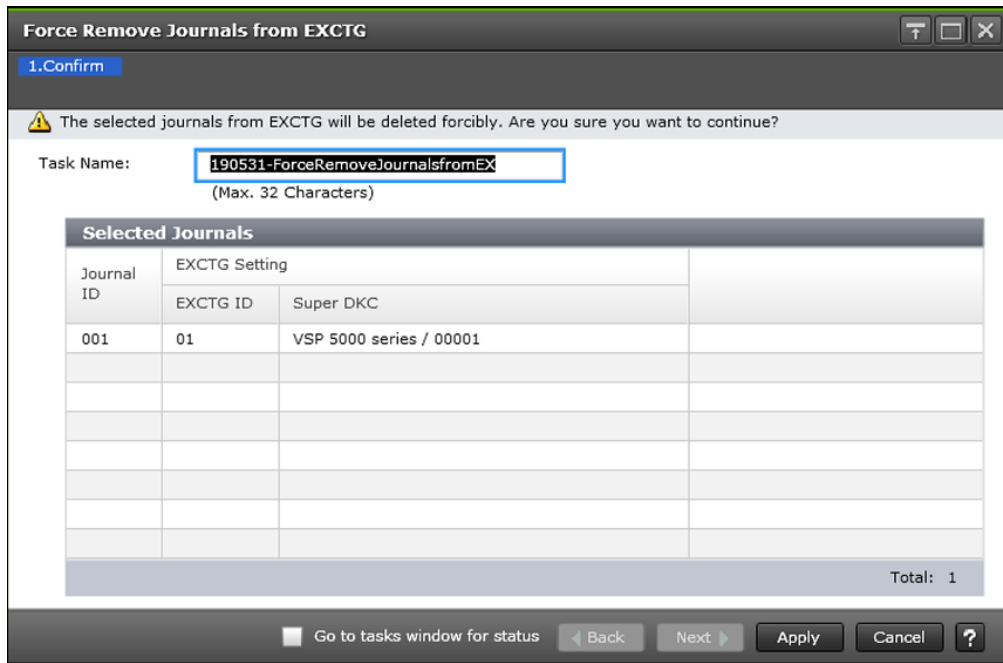


Item	Description
Journal ID	Journal identifier.
Number of Journal VOLs	Number of journal volumes registered in the journal.
Journal Capacity	Capacity of the journal volume registered in the journal. If two journal volumes are registered, the capacity of the reserve journal volume is subtracted from the total capacity.
Detail	Opens the <b>Journal Properties</b> window for the selected journal.

## Force Remove Journals from EXCTG window

Use this window to forcibly delete journals from an EXCTG.

For instructions, see [Forcibly deleting journals from an EXCTG \(on page 172\)](#).



Item	Description
Journal ID	Journal identifier.
EXCTG Setting	<ul style="list-style-type: none"> <li>▪ EXCTG ID: EXCTG identifier</li> <li>▪ Super DKC: Super DKC's serial number and model.</li> </ul>

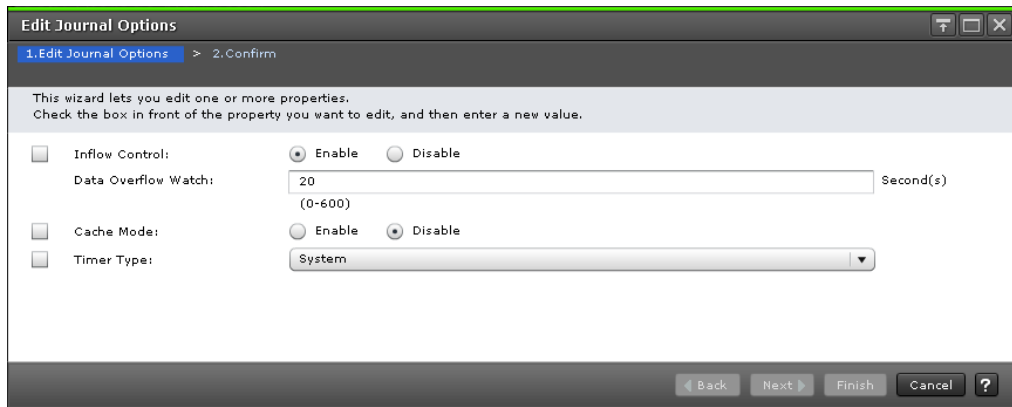
## Edit Journal Options wizard

Use this wizard to change journal options.

## Edit Journal Options window

Use this window to change journal options.

For instructions, see the procedure in [Changing options used by journals \(on page 162\)](#).

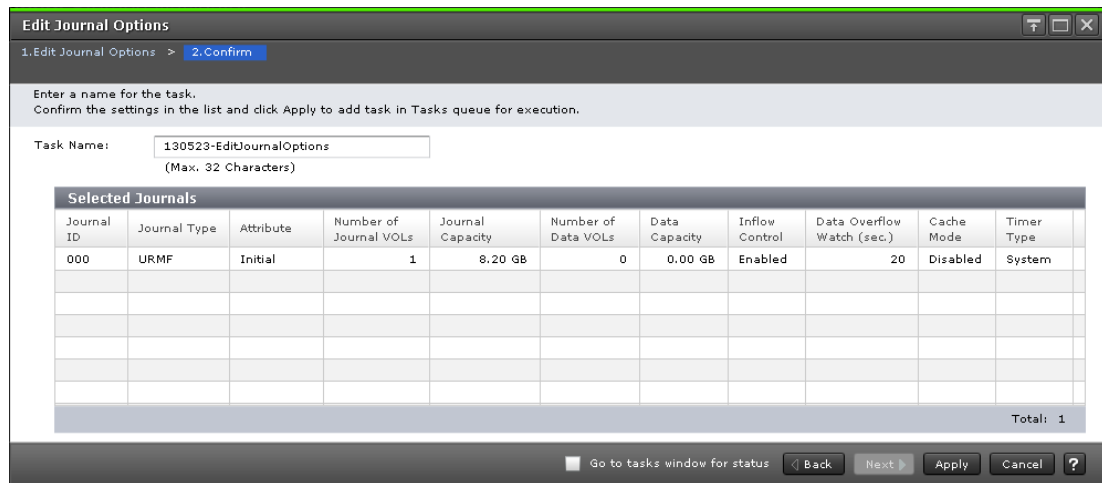


Item	Description
Inflow Control	Whether flow of update data to the journal volume is restricted by slowing the response to hosts.
Data Overflow Watch	<p>Number of seconds the system will monitor metadata and journal data to the journal volume when the journal volume is full (100%). The field is blank if Inflow Control is disabled.</p> <p>When the metadata area or journal data area are full and no more data can be stored, the system regards this as an error and suspends the pairs in the journal.</p> <p>The range is between 0 and 600, and the default is the value set when the journal was created.</p> <p>In a 3DC multi-target configuration in which three UR sites are combined, if the status of the two mirrors in the primary site is Active and the free space in the journal data area or metadata area is less than a certain amount, one of the mirrors in the journal will be suspended by error, regardless of the value in Data Overflow Watch.</p>
Cache Mode	<p>Indicates whether journal data is stored in cache memory on the restore journal.</p> <ul style="list-style-type: none"> <li>▪ Enable: Journal data is stored in cache memory. When the available cache memory becomes insufficient, the journal data is also stored in a journal volume.</li> <li>▪ Disable: Journal data is stored in a journal volume instead of cache memory. This setting is disabled in the master journal. However, this setting is enabled if you use the <code>horctakeover</code> command of CCI (for Universal Replicator) or the <code>YKRESYNC REVERSE</code> command of Business Continuity Manager (for Universal Replicator for Mainframe) to change the master journal to the restore journal.</li> </ul>



Item	Description
Timer Type	<p>Type of clock used for consistency time. Values must be the same on primary and secondary storage systems. Displayed only when Mainframe is selected for System Type. Not displayed for UR journals.</p> <ul style="list-style-type: none"> <li>▪ System: The local storage system acquires the time-stamp information for each journal data.</li> </ul> <p>When a URz pair is created, the local storage system reports state-change-interrupt (SCI) to all hosts. The host then issues a series of sense group commands to determine the device status change. The local storage system returns the same response as if the device was added to an XRC session to activate I/O time-stamping for the device. When I/O time-stamping is activated, the MVS IOS routine adds the time stamp information (contents of time-of-day (TOD) clock) to each write I/O instruction for the device. A time stamp indicates the time when an update was made on the main host during start sub-channel (SSCH). Time stamps are transferred to the local storage system at each start I/O instruction.</p> <ul style="list-style-type: none"> <li>▪ Local: The local storage system does not obtain time stamp information from host I/O time stamp.</li> <li>▪ None: The local storage system obtains time stamp information from host I/O time stamp. Available only when copy direction is reversed, S-VOL to P-VOL.</li> </ul>

## Edit Journal Options confirmation window



Item	Description
Journal ID	Journal identifier.

Item	Description
Attribute	Master, Restore, Master/Restore or Initial (registered but no pair volumes assigned).
Number of Journal VOLs	Number of journal volumes registered in the journal.
Journal Capacity	Capacity of the journal volume registered in the journal. If two journal volumes are registered, the capacity of the reserve journal volume is subtracted from the total capacity.
Number of Data VOLs	Number of volumes associated with the journal. If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.
Data Capacity	Total capacity of all the associated volumes. If the journal uses multiple mirror IDs, the capacity of volumes in mirrors with Hold, Holding, or Hold(Failure) status is not included.
Inflow Control	Whether flow of update data to the journal volume is restricted by slowing the response to hosts.
Data Overflow Watch	Number of seconds the system monitors metadata and journal data when the journal volume is full (100%). A hyphen (-) displays if Inflow Control is disabled.
Cache Mode	Indicates whether journal data is stored in cache memory on the restore journal. <ul style="list-style-type: none"> <li>▪ Enable: Journal data is stored in cache memory. When the available cache memory becomes insufficient, the journal data is also stored in a journal volume.</li> <li>▪ Disable: Journal data is stored in a journal volume instead of cache memory. This setting is disabled in the master journal. However, this setting is enabled if you use the <code>horctakeover</code> command of CCI (for Universal Replicator) or the <code>YKRESYNC REVERSE</code> command of Business Continuity Manager (for Universal Replicator for Mainframe) to change the master journal to the restore journal.</li> </ul>
Timer Type	URz only. Type of clock used for consistency time. Not displayed for UR journals. <ul style="list-style-type: none"> <li>▪ System: Mainframe system clock.</li> <li>▪ Local: System clock is not used.</li> <li>▪ None: Mainframe system clock.</li> </ul>

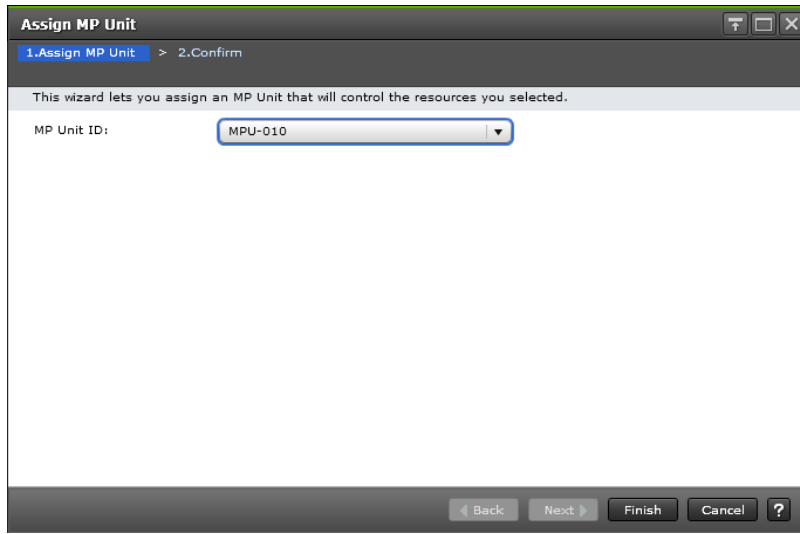
## Assign MP Unit ID wizard

Use this wizard to assign a MP unit to a journal.

## Assign MP Unit ID window

Use this window to assign a MP unit to a journal.

For instructions, see the procedure in [Assigning an MP unit to a journal \(on page 126\)](#).



Item	Description
MP Unit ID	Options for selecting an MP unit. Availability depends on system configuration. Default is the current MP unit number. Blank if the MP unit numbers in the selected row are mixed.

## Assign MP Unit ID confirmation window

Assign MP Unit

1. Assign MP Unit > 2. Confirm

Enter a name for the task.  
Confirm the settings in the list and click Apply to add the task in the Tasks queue for execution.

Task Name:  (Max. 32 Characters)

Selected Journals						
Journal ID	Journal Type	Attribute	Number of Journal VOLS	Journal Capacity	Number of Data VOLS	Data Capacity
002	URMF	Master	1	10.00 GB	1	0.16 GB
						Total: 1

Go to tasks window for status   Back   Next   Apply   Cancel   ?

Item	Description
Journal ID	Journal identifier.
Attribute	Whether the journal is Master, Restore, Master/Restore, or Initial (registered but no pair volumes assigned).
Number of Journal VOLS	Number of journal volumes registered in the journal.
Journal Capacity	Capacity of the journal volume registered in the journal. If two journal volumes are registered, the capacity of the reserve journal volume is subtracted from the total capacity.
Number of Data VOLS	Number of volumes associated with the journal. If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.
Data Capacity	Total capacity of all the associated volumes. If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.
MP Unit ID	MP unit identifier.

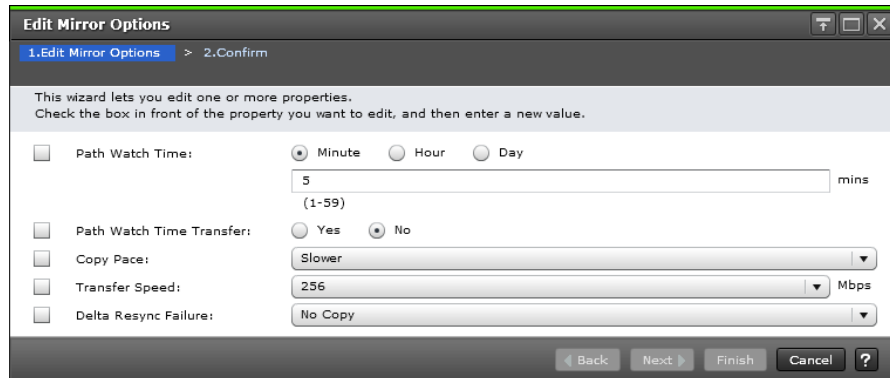
## Edit Mirror Options wizard

Use this wizard to change a mirror's options.

## Edit Mirror Options window

Use this window to change a mirror's options.

For instructions, see the procedure in [Changing options used by mirrors \(on page 164\)](#).



Item	Description
Path Watch Time	<p>Interval from the time when a physical path failure, such as disconnection of a path, occurs to the time when the mirror is suspended.</p> <p>The Path Watch Time value can be specified using Minutes, Hours, or Days. The range is 1 to 59 minutes, 1 to 23 hours, or 1 to 30 days.</p> <p>This setting becomes valid when both advanced system settings No. 16 and No. 15 are set to OFF.</p>
Path Watch Time Transfer	<p>Indicates whether to transfer the master journal's Path Watch Time value to the mirror's secondary side (RCU). When transferred, the Path Watch Time values of the mirror's primary side (MCU) and the secondary side (RCU) will be consistent.</p> <ul style="list-style-type: none"> <li>▪ Yes: Path Watch Time value will be transferred to the mirror's secondary side (RCU).</li> <li>▪ No: Path Watch Time value will not be transferred to the mirror's secondary side (RCU). Default value is No.</li> </ul>
Copy Pace	<p>Pace for copying data during initial copy: Slower is the default, Medium, Faster.</p>
Transfer Speed	<p>Data transfer line speed in Mbps (megabits per second): 3, 10, 100, or 256.</p>
Delta Resync Failure	<p>Processing that takes place in the event of delta resync operation failure.</p> <ul style="list-style-type: none"> <li>▪ Entire Copy: The entire P-VOL is copied to the S-VOL.</li> <li>▪ No Copy: No processing occurs. The S-VOL is not updated.</li> </ul> <p>Delta Resync Failure cannot be set at the secondary site. Use Entire Copy if your journals are part of a multiple-journal configuration in a CCI consistency group.</p>

Item	Description
	When you use UR with GAD, NO COPY applies regardless of the setting. If delta resync processing fails, no processing is performed and the S-VOL is not updated. In that case, resync the UR pair.

## Edit Mirror Options confirmation window

Item	Description
Journal ID	Journal identifier.
Mirror ID	Mirror identifier.
Attribute	Whether the journal is Master, Restore, or Initial (registered but no pair volumes assigned).
Status	Mirror's status.
Path Watch Time	Interval from the time when a physical path failure occurs, such as a path disconnection, to the time when the mirror is suspended.
Copy Pace	Pace for copying data during initial copy: Slower is the default, Medium, Faster. If the selected journal is a restore journal, a hyphen is displayed.
Transfer Speed	Data transfer line speed in Mbps (megabits per second): 3, 10, 100, or 256.
Delta Resync Failure	Processing that takes place in the event of delta resync operation failure. <ul style="list-style-type: none"> <li>▪ Entire Copy: The entire P-VOL is copied to the S-VOL.</li> <li>▪ No Copy: No processing occurs. The S-VOL is not updated.</li> </ul>

Item	Description
Remote Storage System	Displays the following information about the system connected to the system you accessed: <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system's model and serial number. A hyphen displays if the mirror attribute is Initial.</li> <li>▪ Journal ID: Journal identifier. A hyphen displays if the mirror attribute is Initial.</li> </ul>
Path Group ID	Path group identifier specified at DKC registration.
Number of Data VOLs	Number of volumes associated with the journal. If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.
Data Capacity	Total capacity of all the associated volumes. If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.
Remote Command Device	LDEV number of the remote command device if it is assigned to the mirror. <ul style="list-style-type: none"> <li>▪ The column is blank if the remote command device is not assigned to the mirror.</li> <li>▪ A hyphen (-) indicates the remote command device cannot be assigned to the mirror.</li> </ul>

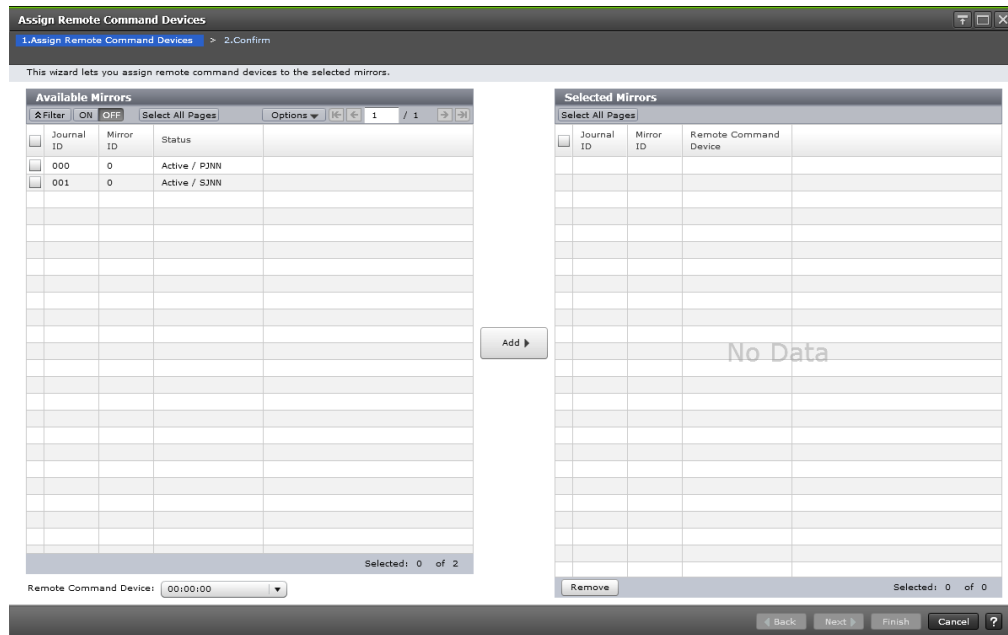
## Assign Remote Command Devices wizard

Use this wizard to assign remote command devices.

## Assign Remote Command Devices window

Use this window to assign mirrors to remote command devices.

For details, see [Assigning mirrors to remote command devices for delta resync operations \(on page 257\)](#).



### Available Mirrors table

Item	Description
Journal ID	Journal identifier.
Mirror ID	Mirror identifier.
Status	Mirror status.

### Information Settings area

Item	Description
Remote Command Device	Select the remote command device (LDKC, CU, and LDEV numbers) you want to assign to the mirror
Add	Adds the mirror selected in Available Mirrors table and the remote command device selected in Remote Command Device to the Selected Mirrors table.

### Selected Mirrors table

Item	Description
Journal ID	Journal identifier.



Item	Description
Mirror ID	Mirror identifier.
Remote Command Device	Displays the LDKC, CU, and LDEV numbers of the remote command device selected in the Remote Command Device.
Remove	Removes the mirror selected in the Selected Mirrors table.

## Assign Remote Command Devices confirmation window

Item	Description
Journal ID	Journal identifier.
Mirror ID	Mirror identifier.
Remote Command Device	LDKC, CU, and LDEV numbers of the remote command device.

## Release Remote Command Devices window

Use this window to release a remote command device from a mirror.

For details, see the procedure in [Releasing a remote command device for delta resync operations assigned to a mirror \(on page 259\)](#)



### Selected Mirrors table

Item	Description
Journal ID	Journal identifier.
Mirror ID	Mirror identifier.
Remote Command Device	LDKC, CU, and LDEV numbers of the remote command device assigned to the mirror.
Attribute	Whether the journal is Master, Restore, or Initial (registered but no pair volumes assigned).
Status	Mirror's status.
Remote Storage System	Displays the following information about the Remote Storage System. <ul style="list-style-type: none"> <li>Model/Serial Number: Storage system model and serial number. A hyphen displays if the mirror attribute is Initial.</li> <li>Journal ID: Journal identifier. A hyphen displays if the mirror attribute is Initial.</li> </ul>
Path group ID	Path group's identifier.
Number of Data VOLs	Number of volumes associated with the journal. If the journal uses multiple mirror IDs, volumes in mirrors with Hold, Holding, or Hold(Failure) status are not included.
Data Capacity	Total capacity of all the associated volumes. If the journal uses multiple mirror IDs, the capacity of volumes in mirrors with Hold, Holding, or Hold(Failure) status is not included.

## EXCTG Properties window

Use this window to view information related to an extended consistency group (EXCTG).

The screenshot shows the EXCTG Properties window with the following data:

EXCTG Properties	
EXCTG ID	001
Attribute	Master
Consistency Time	-
Number of Storage Systems	1
Number of Journals	1

Storage Systems		
Filter: ON OFF		
Model / Serial Number	Number of Journals	
VSP 5000 series / 00072	1	
Total: 1		

Journals				
Filter: ON OFF				
Model / Serial Number	Journal ID	Mirror Status	Remote Command Device	
VSP 5000 series / 00072	001	Active	-	
Total: 1				

### EXCTG Properties table

Item	Description
EXCTG ID	EXCTG identifier.
Attribute	ECXCTG attributes. <ul style="list-style-type: none"> <li>▪ Master: Primary storage system's EXCTG</li> <li>▪ Restore: Secondary storage system's EXCTG</li> <li>▪ Initializing: Journal deletion is in progress.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Free: No journal is registered in the EXCTG.</li> <li>▪ Updating: Registering journals is in process.</li> </ul>
Consistency Time	Consistency time of the extended consistency group. Check the consistency times for each EXCTG and for each pair.
Number of Storage Systems	Number of storage systems registered in the EXCTG.
Number of Journals	Number of journals registered in the EXCTG.

### Storage System table

Item	Description
Model/Serial Number	Storage system's model and serial number.
Number of Journals	Number of journals registered in each storage system.

### Journals table

Item	Description
Model/Serial Number	Storage system's model and serial number.
Journal ID	Journal ID.
Mirror Status	Mirror status.
Remote Command Device	Remote command device LDKC number, CU number, and LDEV number. A hyphen (-) displays for a local storage system.

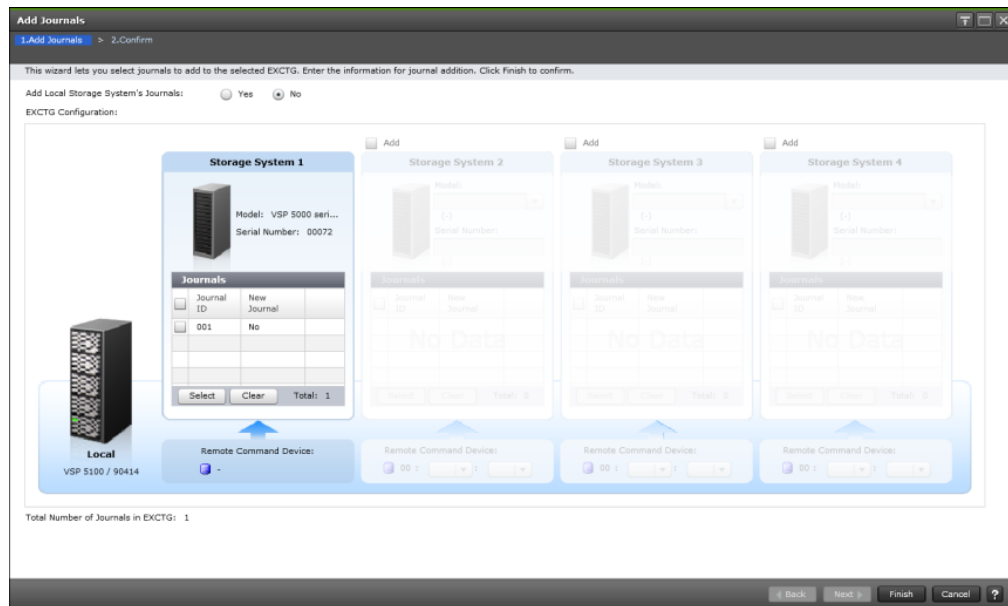
## Add Journals wizard

Use this wizard to register journals in an EXCTG.

## Add Journals window

Use this window to register journals in an EXCTG.

For instructions, see the procedure in [Registering journals in an EXCTG \(on page 106\)](#).



Item	Description
Add Local Storage System's Journals	Whether or not to register the local storage system's journals to EXCTGs.

### EXCTG configuration

Item	Description
Local	Model and serial number of the storage system you accessed.
Add	Clicking allows selection of remote (secondary) system journals for registration in the EXCTG.
Local Storage System	The accessed storage system model and serial number. Displays only when the local system journal is registered to the EXCTG.
Storage System	System model and serial number for the paired storage system. For registered storage systems, displayed information cannot be changed.

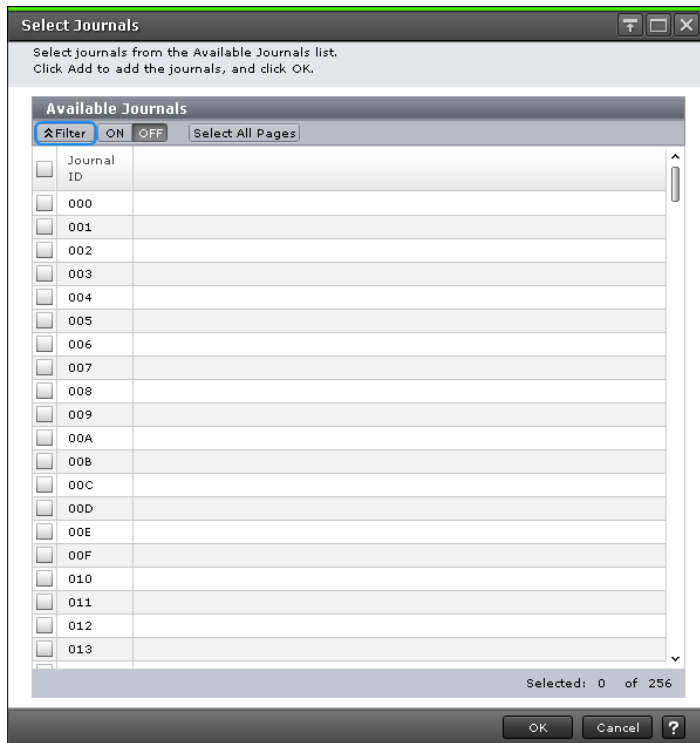
Item	Description
	<p>The following values can be specified for Model:</p> <ul style="list-style-type: none"> <li>▪ VSP 5000 series (8)</li> <li>▪ VSP (6)</li> <li>▪ VSP G1x00 and VSP F1500 (7)</li> </ul> <p>The following numbers can be specified for Serial Number:</p> <ul style="list-style-type: none"> <li>▪ VSP 5000 series, VSP G1x00, and VSP F1500, VSP: 1 to 99999</li> <li>▪ Storage systems to be supported in the future: 0 to 99999</li> </ul>
Journals table	
Journal ID	Journal's identifier.
New Journal	Whether the journal can be added to the EXCTG. No indicates that the journal has already been added and is therefore no longer available.
Select	Clicking opens the Select Journal window, which is used to add the journal.
Clear	Removes selected journals.
Total	Total number of journals.
<p>*For HUS VM, only the number (19) can be specified. If a number other than 5, 6, 7, and 19 is specified, it is regarded as a storage system that will be supported in the future. In this case, the number is displayed in parenthesis for Model, and enter a number from 0 through 99999 for Serial Number.</p>	

### Remote Command Device

Item	Description
Remote Command Device	<p>Remote command device LDKC number, CU number, and LDEV number.</p> <p>To register journals in the local storage system, the CU number and the LDEV number cannot be specified.</p>
Total Number of Journals in EXCTG	Sum of the number of registered journals and number of journals to be added. Sixteen journals can be added to one EXCTG.

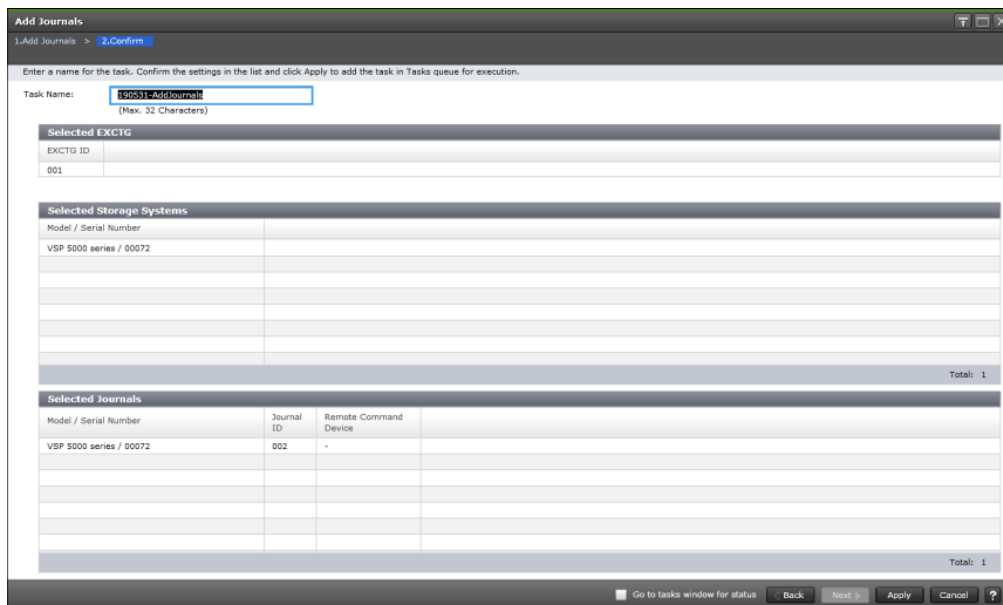
## Select Journals window

Use this window to select journals to be added to an EXCTG.



Item	Description
Journal ID	Journal's identifier.
Selected	Number of selected journals in relation to the total number of journals.

## Add Journals confirmation window



**Selected EXCTG table**

Item	Description
EXCTG ID	EXCTG identifier.

**Selected Storage Systems table**

Item	Description
Model / Serial Number	Storage system's model and serial number.

**Selected Journals table**

Item	Description
Model/Serial Number	Model and serial number of the storage system.
Journal ID	Journal's identifier.
Remote Command Device	Remote command device LDKC number, CU number, and LDEV number. A hyphen (-) displays for a local storage system.

## Remove Journals wizard

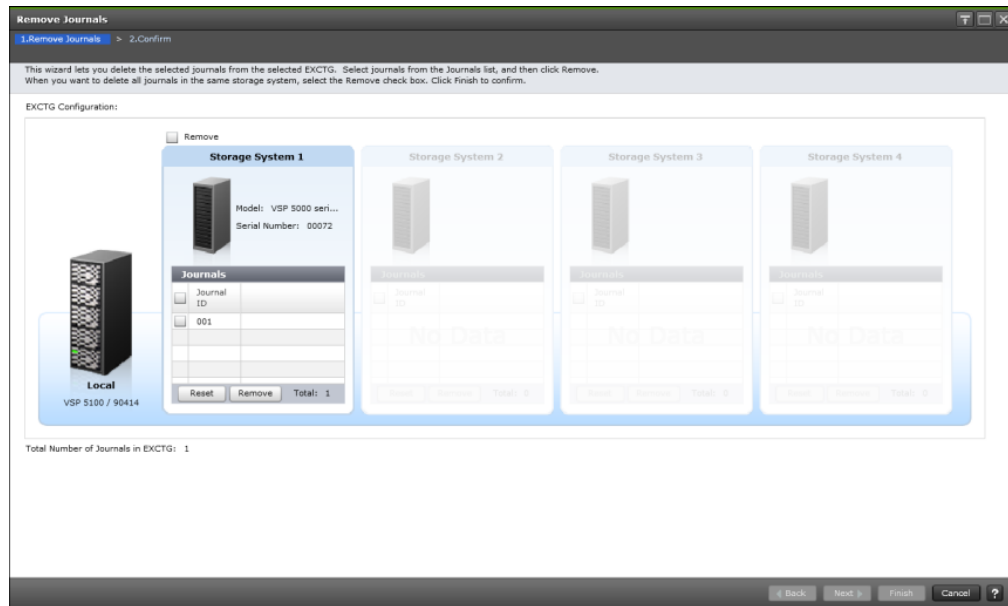
Use this wizard to remove journals from an EXCTG.

## Remove Journals window

Use this window to remove journals from an EXCTG.

For instructions, see the procedure in [Removing journals from an EXCTG \(on page 111\)](#).

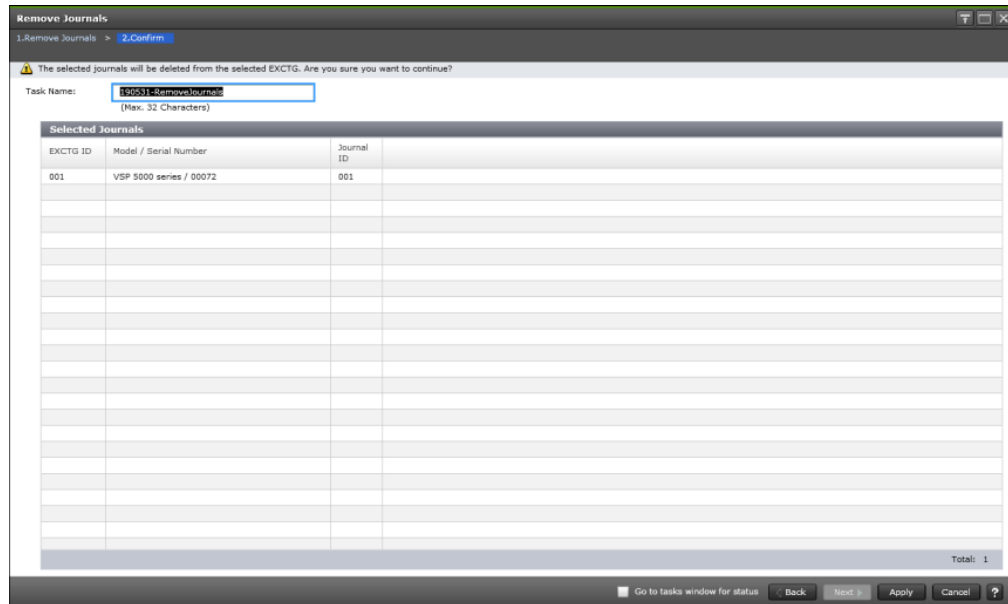




### EXCTG configuration

Item	Description
Local	Model and serial number of the storage system you accessed.
Remove	Clicking allows selection of journals for removal from the EXCTG.
Local Storage System	Accessed storage system model and serial number. Displays only when the local system journal is registered to the EXCTG.
Storage System	System model and serial number for the paired storage system.
Journals table	
Journal ID	Journal's identifier.
Total	Total number of journals.
Reset	Cancels the selection.
Remove	Removes selected journals.
Total Number of Journals in EXCTG	Total number of journals registered in EXCTG.

## Remove Journals confirmation window



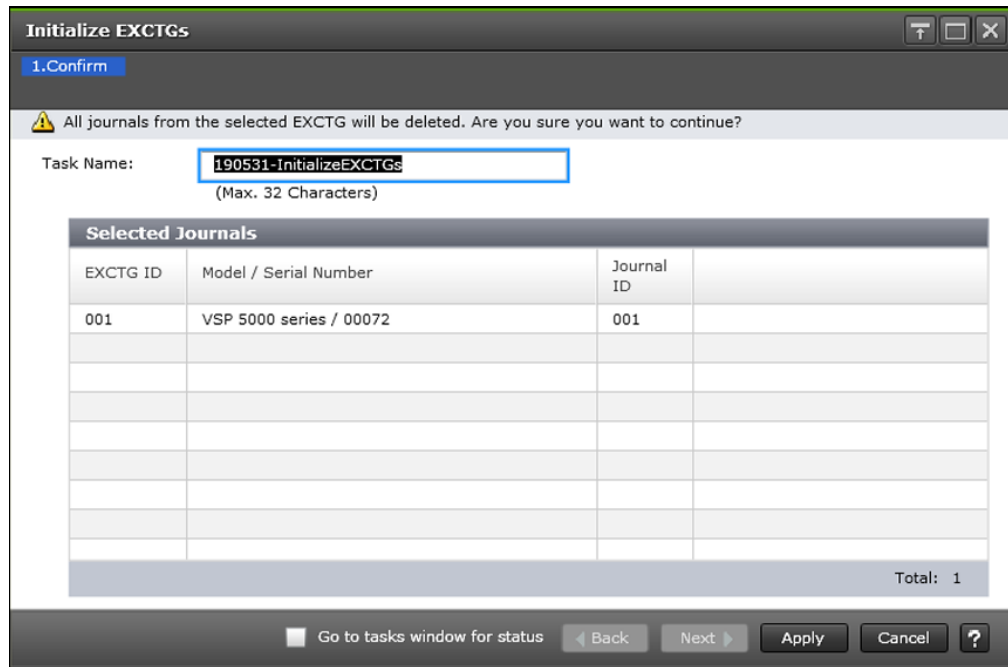
### Selected Journals table

Item	Description
EXCTG ID	EXCTG identifier.
Model / Serial Number	Storage system's model and serial number.
Journal ID	Journal's identifier.
Total	Total number of journals to be removed.

## Initialize EXCTGs window

Use this window to remove all journals from an EXCTG.

For instructions, see the procedure in [Removing all journals from an EXCTG \(on page 112\)](#).

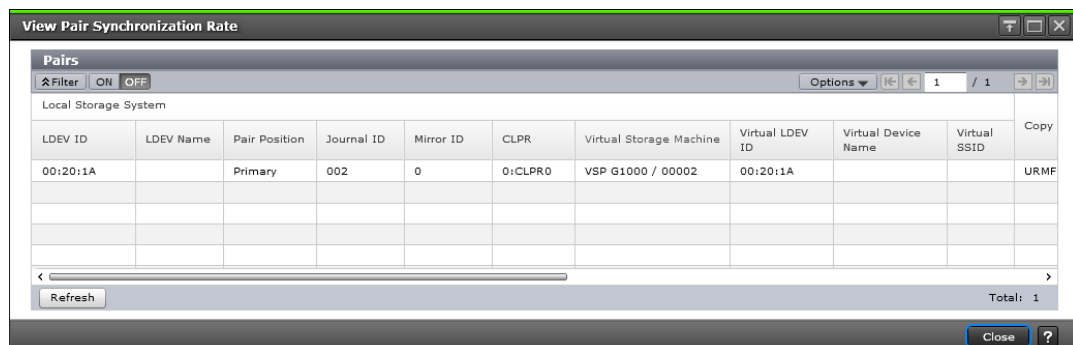


Item	Description
EXCTG ID	EXCTG identifier.
Model / Serial Number	Storage system's model and serial number.
Journal ID	Journal's identifier.
Total	Total number of journals to be removed from the EXCTG.

## View Pair Synchronization Rate window

Use this window to view the percentage of synchronized data between P-VOL and S-VOL.

For detailed information, see [Monitoring URz pair synchronization rate \(on page 149\)](#).



Item	Description
Local Storage System	<p>Displays the following information about pair volumes in the Local Storage System.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ LDEV Name: LDEV name.</li> <li>▪ Pair Position: Identifies the volume as primary or secondary.</li> <li>▪ Journal ID: Journal identifier.</li> <li>▪ Mirror ID: Pair's mirror ID</li> <li>▪ CLPR: CLPR ID</li> <li>▪ Virtual storage machine: Virtual storage machine's model type and serial number.</li> <li>▪ Virtual LDEV ID: Volume's virtual LDEV identifier.</li> <li>▪ Virtual Device Name: Volume's virtual device name, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute <ul style="list-style-type: none"> <li>- Only attributes that are specified display.</li> <li>- "CVS" displays at the end of the device name, if the virtual CVS attribute is specified.</li> <li>- A blank indicates no values are specified.</li> </ul> </li> <li>▪ Virtual SSID: Volume's virtual SSID. A blank indicates that no virtual SSID is specified.</li> </ul>
Copy Type	<p>Type of pair:</p> <ul style="list-style-type: none"> <li>▪ UR: Universal Replicator</li> <li>▪ URMF: Universal Replicator for Mainframe</li> </ul>
Status	<p>Pair's status. For more information, see <a href="#">Pair status definitions (on page 31)</a>.</p>
Sub Status	<p>S-VOL's consistency status. For URz, the SEQCHK status is displayed if there is no consistency in the update sequence between the S-VOL and other S-VOLs in the journal.</p>

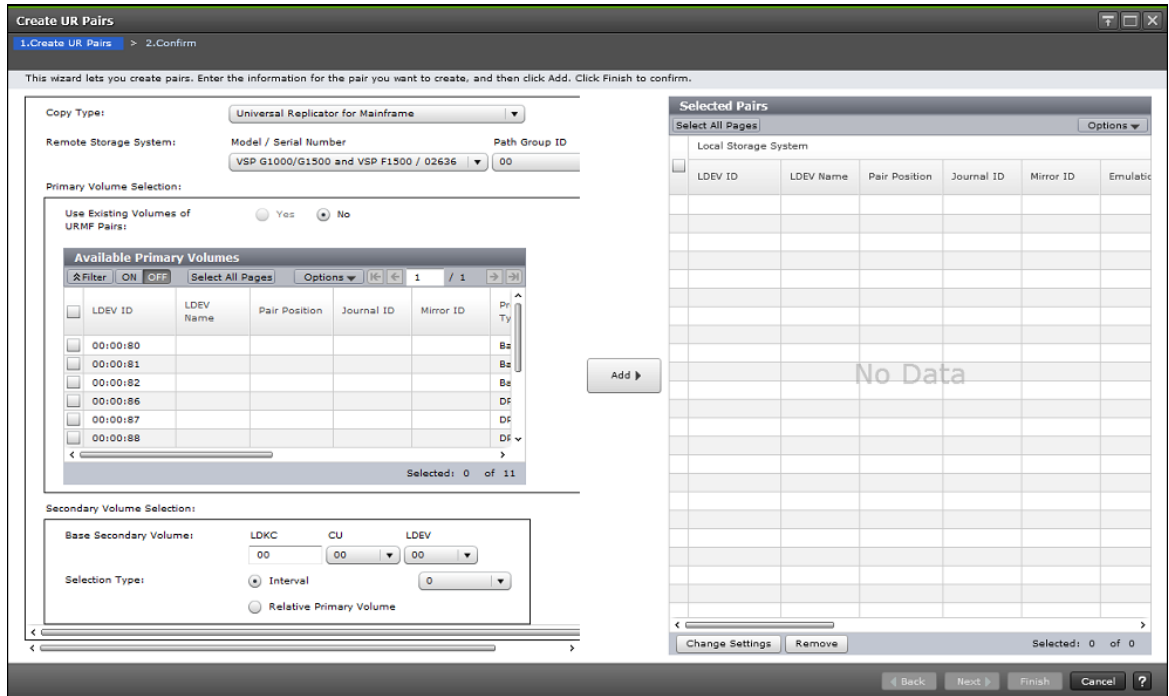
Item	Description
Synchronization Rate (%)	<p>Displayed as follows:</p> <ul style="list-style-type: none"> <li>▪ When the volume on the local storage system is a P-VOL: Initial copy progress is displayed. For the initial copy of a URz pair, the control cylinder data is also copied. During the control cylinder copy, the synchronization rate is displayed as 99. When the control cylinder copy completes, the synchronization rate changes to 100.</li> <li>▪ When the volume on the local storage system is an S-VOL: The synchronization rate depends on whether the pair is split: <ul style="list-style-type: none"> <li>• If the pair is not split, a hyphen (-) is displayed.</li> <li>• If the pair is split, the S-VOL synchronization rate between before and after the split is displayed. For example, if the S-VOL content before and after the split is the same, 100 is displayed.</li> </ul> <p><b>Caution:</b> If the pair is split due to initial copy failure, a hyphen (-) is displayed. If initial copy fails, the status Initial copy failed is displayed in the View Pair Properties window.</p> </li> <li>▪ If processing has not started, "(Queuing)" is displayed.</li> <li>▪ For the following cases, a hyphen (-) is displayed: <ul style="list-style-type: none"> <li>• When the volume in the local storage system is neither a P-VOL nor an S-VOL.</li> <li>• When the volume in the local storage system has one of the following pair statuses: HOLD, HOLDING, HLDE for Universal Replicator pairs, and Hold, Holding, Hlde for Universal Replicator for Mainframe pairs.</li> </ul> </li> </ul>
Remote Storage System	<p>Displays the following information about pair volumes in the Remote Storage System.</p> <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ Journal ID: Journal identifier.</li> <li>▪ Virtual storage machine: Virtual storage machine's model type and serial number.</li> <li>▪ Virtual LDEV ID: Volume's virtual LDEV identifier.</li> </ul>
Path Group ID	Path group identifier
Refresh	When clicked, updates information in the window.

## Create UR Pairs wizard

Use this wizard to create UR pairs.

## Create UR Pairs window

Use this window to create pairs.



### Settings

Item	Description
Copy Type	Type of pair: <ul style="list-style-type: none"> <li>Universal Replicator</li> <li>Universal Replicator for Mainframe</li> </ul>
Remote Storage System	Selections in the remote system. <ul style="list-style-type: none"> <li>Model / Serial Number: Select the model and serial number.</li> <li>Path Group ID: Select the ID of the path group.</li> </ul>

## Primary Volume Selection

Item	Description
Use Existing Volumes of UR Pairs	<p>UR only.</p> <ul style="list-style-type: none"> <li>▪ Yes: Create a pair using the existing volumes of UR pairs. Select this item when creating a pair with 3DC multi-target by 3 UR sites or with cascade configuration.</li> <li>▪ No: Create a pair without using the existing volumes of UR pairs. Select this item when not creating a pair with 3DC multi-target by 3 UR sites or with cascade configuration.</li> </ul>
Use Existing Volumes of URMF Pairs	<p>URz only.</p> <ul style="list-style-type: none"> <li>▪ Yes: Create a pair using the existing volumes of URz pairs. Select this item when creating a pair with 3DC multi-target by 3 URz sites or with cascade configuration.</li> <li>▪ No: Create a pair without using the existing volumes of URz pairs. Select this item when not creating a pair with 3DC multi-target by 3 URz sites or with cascade configuration.</li> </ul>
LU Selection	<p>Select an LU in the local storage system.</p> <ul style="list-style-type: none"> <li>▪ Port ID: Local system's port identifier.</li> <li>▪ Host Group Name: Host group name. Displays only when Fibre port is selected in Port Name.</li> <li>▪ iSCSI Target Alias: Selections for iSCSI target alias. All of the LUNs in the indicated port for Available LDEVs if Any is selected. Displays when iSCSI port is selected for Port Name.</li> </ul>
Available Primary Volumes	<p>Information about P-VOLs. Displayed when Fibre port is selected in Port ID for LU Selection.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ LDEV Name: LDEV name.</li> <li>▪ Pair Position: Identifies the volume as primary or secondary. A blank is displayed if the volume is not used by a pair.</li> <li>▪ Journal ID: Journal identifier. A blank is displayed if the volume is not used by a pair.</li> <li>▪ Mirror ID: Mirror ID. A blank is displayed if the volume is not used by a pair.</li> <li>▪ Provisioning Type: Whether the volume is Basic (internal) or External.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Attribute <ul style="list-style-type: none"> <li>• ALU: Volume with ALU attribute.</li> <li>• SLU: Volume with SLU attribute.</li> <li>• Data Direct Mapping: Volume with the data direct mapping attribute.</li> </ul> <p>If the attribute is not set, a hyphen (-) is displayed.</p> </li> <li>▪ Emulation Type: Emulation type</li> <li>▪ Capacity: LDEV's capacity.</li> <li>▪ CLPR: CLPR ID.</li> <li>▪ Encryption: Encryption information. <ul style="list-style-type: none"> <li>• Enabled: The parity group encryption to which LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>• Disabled: The parity group encryption to which LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>• Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>▪ Volume for which encryption is enabled</li> <li>▪ Volume for which encryption is disabled</li> <li>▪ External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV for which Encryption is Enabled or Disabled.</p> <p>A hyphen (-) is displayed for an external volume. For DP-VOLs, the pool to which the LDEV belongs is either an external volume or blocked.</p> </li> </ul> </li> <li>▪ Capacity Saving: Information on the capacity saving function. <ul style="list-style-type: none"> <li>• Compression: The compression function is used.</li> <li>• Deduplication and Compression: The deduplication function and the compression function are used.</li> <li>• Disabled: The capacity saving function is not used.</li> </ul> </li> </ul>



Item	Description
	<ul style="list-style-type: none"> <li>▪ T10 PI: T10 PI attribute of the volume. <ul style="list-style-type: none"> <li>• Enabled: T10 PI attribute of the volume is enabled.</li> <li>• Disabled: T10 PI attribute of the volume is disabled.</li> </ul> </li> </ul> <p>A hyphen (-) is displayed if the emulation type is other than OPEN-V.</p> <ul style="list-style-type: none"> <li>▪ Paired Volume: Paired volume information. A blank is displayed if the volume is not used by a pair. <ul style="list-style-type: none"> <li>• Model / Serial Number: Model and serial number.</li> <li>• LDEV ID: LDEV identifier.</li> <li>• Port ID: Port identifier of the volume.</li> <li>• Host Group ID / iSCSI Target ID: Host group ID or iSCSI target ID.</li> <li>• LUN ID: LUN identifier of the volume.</li> </ul> </li> </ul>

### Secondary Volume Selection

Item	Description
Base Secondary Volume	<p>Information about Base Secondary Volume.</p> <p>UR only.</p> <ul style="list-style-type: none"> <li>▪ Port ID: Port identifier.</li> <li>▪ Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target identifier.</li> <li>▪ LUN ID: LUN identifier.</li> </ul> <p>URz only.</p> <ul style="list-style-type: none"> <li>▪ LDKC: "00" is displayed, cannot be changed.</li> <li>▪ CU: the CU number of the remote system, ranging from 00 to FE.</li> <li>▪ LDEV: LDEV number, ranging from 00 to FF.</li> </ul>
Selection Type	<p>Default is Interval.</p> <ul style="list-style-type: none"> <li>▪ Interval: Interval for allocating S-VOLs.</li> <li>▪ Relative Primary Volume: S-VOLs paired with P-VOLs relative to LUN or LDEV numbers.</li> </ul>

**Mirror Selection**

Item	Description
Master Journal	Select the master journal to which you allocate the primary volume. Registered journal IDs (except for those of restore journals) are displayed.
Mirror ID	Mirror's identifier.
Restore Journal	Select the restore journal to which you allocate secondary volumes. All journal IDs (000 to 0FF) are displayed.
Current Number of Master Journal Mirrors	Number of mirrors in the master journal.
Total Number of Master Journal Mirrors	Displays the following: <ul style="list-style-type: none"> <li>▪ Number of mirrors in the master journal.</li> <li>▪ Number of mirrors added during the Create UR Pairs operation.</li> <li>▪ Number of mirrors for the selected volume in Selected Pairs table.</li> </ul>
CTG ID	Displays consistency groups registered in the storage system. An asterisk indicates it is assigned to a pair in the Select Pairs table. Displayed for UR pairs only.

**Options**

Item	Description
Initial Copy Type	Indicates whether data is copied to the S-VOL during this operation. <ul style="list-style-type: none"> <li>▪ Entire Volume: Data is copied. The default.</li> <li>▪ None: Data is not copied.</li> <li>▪ Delta: Data is not copied.</li> </ul>
Initial Copy Priority	Scheduling order for the initial copy operation. Range is 1 to 256; default is 32.

Item	Description
Error Level	<p>Whether to split all pairs in the mirror if a failure occurs during this operation:</p> <ul style="list-style-type: none"> <li>▪ Mirror: Pairs in the mirror are split. However, if a volume failure occurs while the pair status is Pending, only the target pair in the mirror is split, even if Mirror is specified.</li> <li>▪ LU: Only the failed pair is split.</li> <li>▪ Volume (URz): Only the failed pair is split.</li> </ul>
CFW	<p>URz only.</p> <p>Whether to copy cache fast write (CFW) data to the S-VOL.</p> <ul style="list-style-type: none"> <li>▪ Primary Volume Only: Does not copy. Default.</li> <li>▪ Secondary Volume Copy: Copies.</li> </ul>
Add	<p>The pair specified in left hand side window is added to the <b>Selected Pairs</b> table.</p>

#### Selected Pairs table

Item	Description
Local Storage System	<p>Information about volumes in the accessed system.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ LDEV Name: LDEV name.</li> <li>▪ Pair Position: Indicates whether the volume is the P-VOL or S-VOL of the pair.</li> <li>▪ Attribute: <ul style="list-style-type: none"> <li>• ALU: The volume has the ALU attribute.</li> <li>• SLU: The volume has the SLU attribute.</li> <li>• Data Direct Mapping: The volume has the data direct mapping attribute.</li> </ul> <p>If the attribute is not set, a hyphen (-) is displayed.</p> </li> <li>▪ Emulation Type: Emulation type of the volume.</li> <li>▪ Journal ID: Journal's identifier.</li> <li>▪ Mirror ID: Mirror identifier.</li> <li>▪ Capacity: Volume's capacity.</li> <li>▪ CLPR: Volume's CLPR.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Encryption: Encryption information: <ul style="list-style-type: none"> <li>• Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>• Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>• Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>▪ Volume for which encryption is enabled</li> <li>▪ Volume for which encryption is disabled</li> <li>▪ External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <p>For an external volume, a hyphen (-) is displayed.</p> <p>For V-VOLs of Dynamic Provisioning or Dynamic Provisioning for Mainframe, the pool to which the LDEV belongs is an external volume or blocked.</p> </li> </ul> </li> <li>▪ Journal Encryption: Journal's encryption status. UR or URz only. <ul style="list-style-type: none"> <li>• Enabled: The journal contains encrypted volumes.</li> <li>• Disabled: The journal contains unencrypted volumes.</li> <li>• Mixed: The pool to which the journal volume belongs contains two or more of the following: <ul style="list-style-type: none"> <li>▪ Volume for which encryption is enabled</li> <li>▪ Volume for which encryption is disabled</li> <li>▪ External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <p>A hyphen (-) is displayed if the pool to which the journal volume belongs is an external volume, created by migration, or blocked.</p> </li> </ul> </li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Capacity Saving: Information on the capacity saving function. <ul style="list-style-type: none"> <li>• Compression: The compression function is used.</li> <li>• Deduplication and Compression: The deduplication function and the compression function are used.</li> <li>• Disabled: The capacity saving function is not used.</li> </ul> </li> <li>▪ T10 PI: T10 PI attribute of the volume. UR only. <ul style="list-style-type: none"> <li>• Enabled: T10 PI attribute of the volume is enabled.</li> <li>• Disabled: T10 PI attribute of the volume is disabled.</li> </ul> </li> </ul>
Remote Storage System	<p>Information about the remote system.</p> <ul style="list-style-type: none"> <li>▪ Model / Serial Number: Model and serial number.</li> <li>▪ Port ID: Port identifier. UR only.</li> <li>▪ Host Group ID / iSCSI Target ID: Host group or iSCSI target identifier. UR only.</li> <li>▪ LUN ID: LUN identifier. UR only.</li> <li>▪ LDEV ID: LDEV identifier. URz pairs only.</li> <li>▪ Journal ID: Journal's identifier. URz pairs only.</li> </ul>
Path Group ID	Path group ID.
Initial Copy Type	Type of the pair create operation.
Initial Copy Priority	Scheduling order for pair create operation by using a decimal number from 0 to 255.
Error Level	Indicates whether all pairs in the mirror are split if a failure occurs during this operation.
CFW	Whether CFW data is copied to the S-VOL. URz pairs only.
Change Settings	Opens the <b>Change Settings</b> window.
Remove	Removes the specified pair from the table.

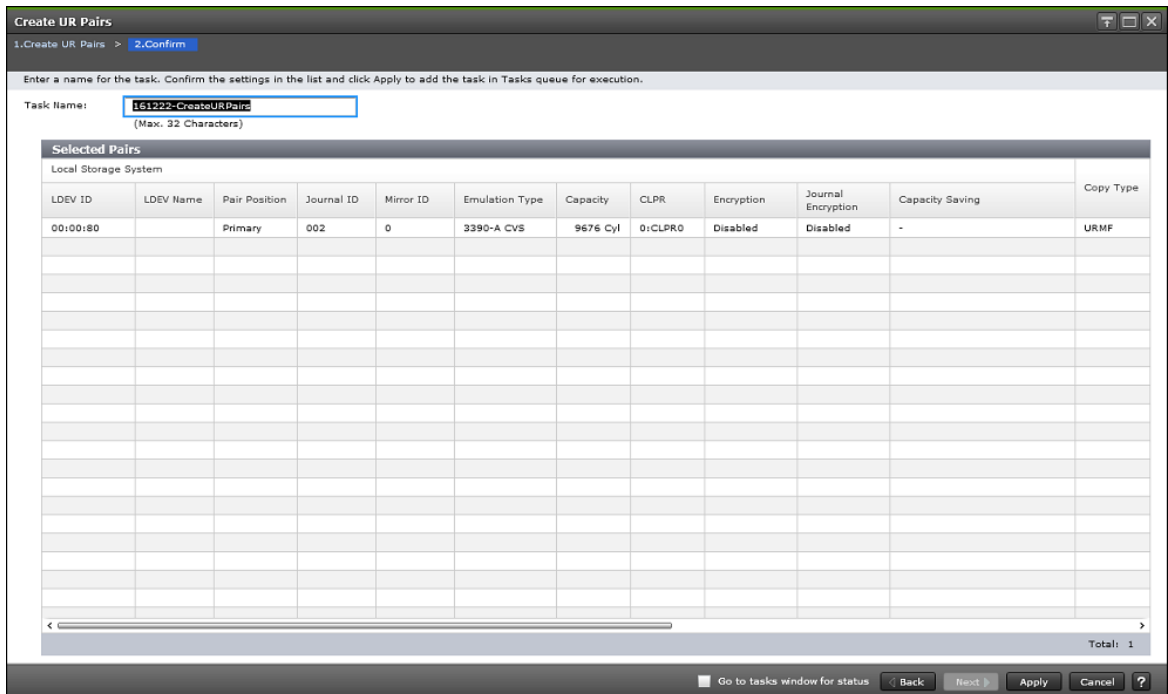
## Change Settings window

Use this window in the pair creation wizard to change options that affect how the pair is created.

Item	Description
Base Secondary Volume	<p>Select when changing Base Secondary Volume setting.</p> <ul style="list-style-type: none"> <li>▪ For UR pairs: <ul style="list-style-type: none"> <li>• Port ID: Port identifier.</li> <li>• Host Group ID/iSCSI Target ID: Host group or iSCSI target identifier.</li> <li>• LUN ID: LUN identifier.</li> </ul> </li> <li>▪ For URz pairs: <ul style="list-style-type: none"> <li>• LDKC: "00" is displayed, cannot be changed.</li> <li>• CU: For TCz: the CU number of the volume. For URz: the CU number of the remote system, ranging from 00 to FF.</li> <li>• LDEV: LDEV number, ranging from 00 to FF.</li> </ul> </li> <li>▪ Interval: The interval for allocating S-VOLs to P-VOLs. For UR and URz pairs.</li> </ul>
Initial Copy Type	<p>Indicates whether data is copied to the S-VOL when the pair is created.</p> <ul style="list-style-type: none"> <li>▪ Entire Volume: Data is copied. The default.</li> <li>▪ None: Data is not copied. If you choose this option, you should confirm the data be equal between the P-VOL and S-VOL.</li> <li>▪ Delta: Data is not copied.</li> </ul> <p>For Universal Replicator delta resync pairs, the status will be changed to HOLD or HOLDING.</p> <p>For Universal Replicator for Mainframe delta resync pairs, the status will be changed to Hold or Holding.</p>
Initial Copy Priority	<p>Scheduling order for the initial copy operation. Range is 1 to 256; default is 32.</p>
Error Level	<p>Indicates whether to split all pairs in the mirror if a failure occurs during this operation:</p> <ul style="list-style-type: none"> <li>▪ LU: Only the failed pair is split.</li> <li>▪ Mirror: Pairs in the mirror are split.</li> </ul> <p>However, if a volume failure occurs while the pair status is Pending, only the target pair in the mirror is split, even if Mirror is specified.</p> <ul style="list-style-type: none"> <li>▪ Volume: Only the failed pair is split. URz pairs only.</li> </ul>

Item	Description
CFW	<p>Whether to copy cache fast write (CFW) data to the S-VOL. URz pairs only.</p> <ul style="list-style-type: none"> <li>Primary Volume Only: Does not copy. Default.</li> <li>Secondary Volume Copy: Copies.</li> </ul>

## Create UR Pairs confirmation window



### Selected Pairs table

Item	Description
Local Storage System	<p>Information about volumes in the accessed system.</p> <ul style="list-style-type: none"> <li>LDEV ID: LDEV identifier.</li> <li>LDEV Name: LDEV name.</li> <li>Pair Position: Identifies the volume as primary or secondary. A blank is displayed if the volume is not used by a pair.</li> <li>Emulation Type: Emulation type of the volume. TCz/TC/URz only.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Journal ID: Journal's identifier.</li> <li>▪ Mirror ID: Mirror identifier.</li> <li>▪ Attribute: <ul style="list-style-type: none"> <li>• ALU: The volume has the ALU attribute.</li> <li>• SLU: The volume has the SLU attribute.</li> <li>• Data Direct Mapping: The volume has the data direct mapping attribute.</li> </ul> </li> </ul> <p>If the attribute is not set, a hyphen (-) is displayed.</p> <ul style="list-style-type: none"> <li>▪ Capacity: Volume's capacity.</li> <li>▪ CLPR: Volume's CLPR.</li> <li>▪ Encryption: Encryption information: <ul style="list-style-type: none"> <li>• Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>• Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>• Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>▪ Volume for which encryption is enabled</li> <li>▪ Volume for which encryption is disabled</li> <li>▪ External volume</li> </ul> </li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <p>For an external volume, a hyphen (-) is displayed.</p> <p>For V-VOLs of Dynamic Provisioning or Dynamic Provisioning for Mainframe, the pool to which the LDEV belongs is an external volume or blocked.</p>



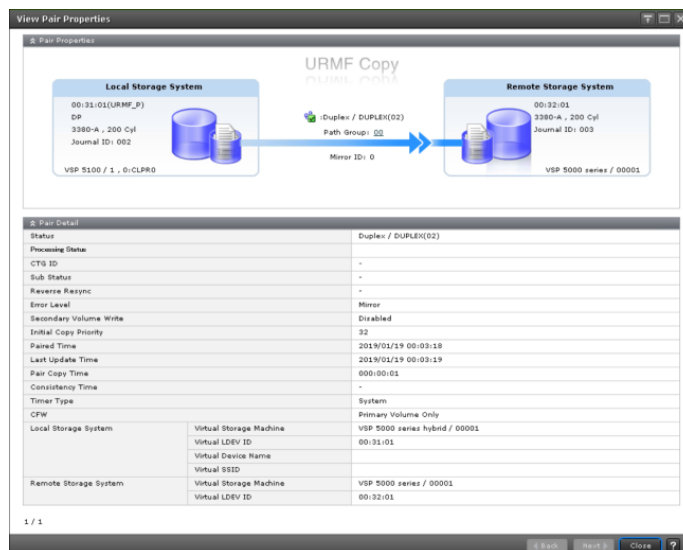
Item	Description
	<ul style="list-style-type: none"> <li>▪ Journal Encryption: Journal's encryption status. UR or URz only. <ul style="list-style-type: none"> <li>• Enabled: The journal contains encrypted volumes.</li> <li>• Disabled: The journal contains unencrypted volumes.</li> <li>• Mixed: The pool to which the journal volume belongs contains two or more of the following: <ul style="list-style-type: none"> <li>▪ Volume for which encryption is enabled</li> <li>▪ Volume for which encryption is disabled</li> <li>▪ External volume</li> </ul> </li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <p>A hyphen (-) is displayed if the pool to which the journal volume belongs is an external volume, created by migration, or blocked.</p> <ul style="list-style-type: none"> <li>▪ Capacity Saving: Information on the capacity saving function. <ul style="list-style-type: none"> <li>• Compression: The compression function is used.</li> <li>• Deduplication and Compression: The deduplication function and the compression function are used.</li> <li>• Disabled: The capacity saving function is not used.</li> </ul> </li> <li>▪ T10 PI: T10 PI attribute of the volume. UR only. <ul style="list-style-type: none"> <li>• Enabled: T10 PI attribute of the volume is enabled.</li> <li>• Disabled: T10 PI attribute of the volume is disabled.</li> </ul> </li> </ul>
Copy Type	Type of pair: <ul style="list-style-type: none"> <li>▪ UR: Universal Replicator</li> <li>▪ URMF: Universal Replicator for Mainframe</li> </ul>
Remote Storage System	Information about volumes in the system connected to the system you accessed. <ul style="list-style-type: none"> <li>▪ Model / Serial Number: Model and serial number.</li> <li>▪ Port ID: Port identifier. UR only.</li> <li>▪ Host Group Name / iSCSI Target Alias: Host group name or iSCSI target alias. UR only.</li> <li>▪ LUN ID: LUN identifier. UR only.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>LDEV ID: LDEV identifier. TCz/URz only.</li> <li>Journal ID: Journal's identifier.</li> </ul>
Path Group ID	Path group identifier.
CTG ID	Consistency group identifier. UR only.
Initial Copy Type	Type of initial copy operation.
Initial Copy Priority	Scheduling order for the initial copy operation. Range is 1 to 256; default is 32.
Error Level	Indicates whether to split all pairs in the mirror if a failure occurs during this operation: <ul style="list-style-type: none"> <li>Mirror: Pairs in the mirror are split.</li> <li>Volume: Only the failed pair is split.</li> </ul>
CFW	URz only. Whether to copy cache fast write (CFW) data to the S-VOL. <ul style="list-style-type: none"> <li>Primary Volume Only: Does not copy. Default.</li> <li>Secondary Volume Copy: Copies.</li> </ul>

## View Pair Properties window

Use this window to view the data related to pairs and their volumes.

For instructions, see [Monitoring pair activity\\_status\\_license capacity \(on page 148\)](#).



## Pair Properties

Item	Description
Local Storage System box	<p>Displays the following information about the volume on the local storage system.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID (LDEV name): LDEV identifier and name. "---" displays for long names. Hover the mouse over it to display the complete name.</li> <li>▪ Number of paths: Number of data paths between primary and secondary storage systems.  Clicking the number displays the path list (UR only ).</li> <li>▪ Provisioning Type, Encryption status: Provisioning type and encryption status of the local storage system's volume. Encryption status is displayed only when the volume's encryption is Enabled or Mixed. If ... is displayed, move the cursor over ... to display the hidden contents as a tooltip.</li> <li>▪ Emulation Type, Capacity: System's emulation type and capacity.</li> <li>▪ Journal ID (Encrypted): Journal identifier and encryption status. The encryption status is displayed only when the volume's encryption is Enabled or Mixed. If an elipsis (...) is displayed, move the cursor over the elipsis to display the hidden contents as a tooltip.</li> <li>▪ Model/Serial number, CLPR ID:CLPR name: Local storage system's model, serial number, CLPR ID, and CLPR name.</li> </ul>
Copy type	Pair's copy type.
Status	Pair's status.
Path Group	Pair's path group. Clicking the path group number displays the remote path list if the P-VOL is in the Local Storage System..
Mirror ID	Pair's mirror identifier
Remote Storage System box	<p>Displays the information about the Remote Storage System.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier and name, which displays when you hover the mouse over it.</li> <li>▪ Port name/Host group ID or iSCSI target ID/LUN ID: System's port name, host group ID or iSCSI target ID and LUN ID. This information is useful when specifying an LDEV ID at pair creation. It does not change, even if you change path settings.</li> <li>▪ Emulation type, Capacity: System's volume emulation type and capacity.</li> <li>▪ Journal ID: Journal identifier.</li> <li>▪ Model/Serial number: System's model, serial number.</li> </ul>

## Pair Detail

Item	Description
Status	The pair's status
Processing Status	<p>The processing status for a pair volume is displayed.</p> <ul style="list-style-type: none"> <li>▪ Expanding: The capacity of a UR pair volume is being expanded.</li> </ul> <p>If the volume capacity is not being expanded, or if V-VOLs other than DP-VOLs are used as pair volumes, this field remains blank.</p>
CTG ID	Consistency group identifier
Sub Status	S-VOL's consistency status. For URz, the SEQCHK status is displayed if there is no consistency in the update sequence between the S-VOL and other S-VOLs in the journal.
Reverse Resync	Indicates that a reverse resync has changed the copy direction.
Error Level	Whether pairs are split if an error occurs. Specified during the create pair procedure.
Secondary Volume Write	<p>Indicates whether data can be written (Enabled) or not written (Disabled) to the S-VOL. The pair must be split for Enabled to display.</p> <p>If the volume accessed is an S-VOL and can be written to, Enabled/Received or Enabled/Not Received is displayed. Indicates whether a write operation is received from the host or not.</p> <p>In a 3DC multi-target and 3DC cascade configuration in which three UR sites are combined, if one of the mirrors set for the S-VOL is for delta resync, data cannot be written to the S-VOL, even if Enabled is set.</p>
Initial Copy Priority	<p>Initial copy scheduling order. The range is from 1 to 256 for UR in decimal.</p> <p>The range is from 0 to 256 for URz in decimal.</p>
Paired Time	Date and time pair-creation completed.
Last Update Time	Date and time that the last update was run.
Pair Copy Time	Time used to copy the P-VOL.
Consistency Time	Time when data consistency is guaranteed.
Timer Type	URz only.

Item	Description
	<p>Type of clock used for consistency time, specified during journal creation. A hyphen (-) is displayed for UR pairs.</p> <ul style="list-style-type: none"> <li>▪ System: Mainframe system clock.</li> <li>▪ Local: System clock is not used.</li> <li>▪ None: Mainframe system clock.</li> </ul>
Local Storage System	<ul style="list-style-type: none"> <li>▪ Virtual storage machine: Virtual storage machine's model type and serial number.</li> <li>▪ Virtual LDEV ID: Volume's virtual LDEV identifier.</li> <li>▪ Device Name: Volume's virtual device name, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute <ul style="list-style-type: none"> <li>- Only attributes that are specified display.</li> <li>- "CVS" displays at the end of the device name, if the virtual CVS attribute is specified.</li> <li>- A blank indicates no values are specified.</li> </ul> </li> <li>▪ Virtual SSID: Volume's virtual SSID. A blank indicates that no virtual SSID is specified.</li> </ul>
Remote Storage System	<ul style="list-style-type: none"> <li>▪ Virtual storage machine: Virtual storage machine's model type and serial number.</li> <li>▪ Virtual LDEV ID: Volume's virtual LDEV identifier.</li> </ul>
CFW	<p>URz only.</p> <p>Whether CFW data is copied to the S-VOL; specified during pair creation.</p>
Page Number	Current/Selected

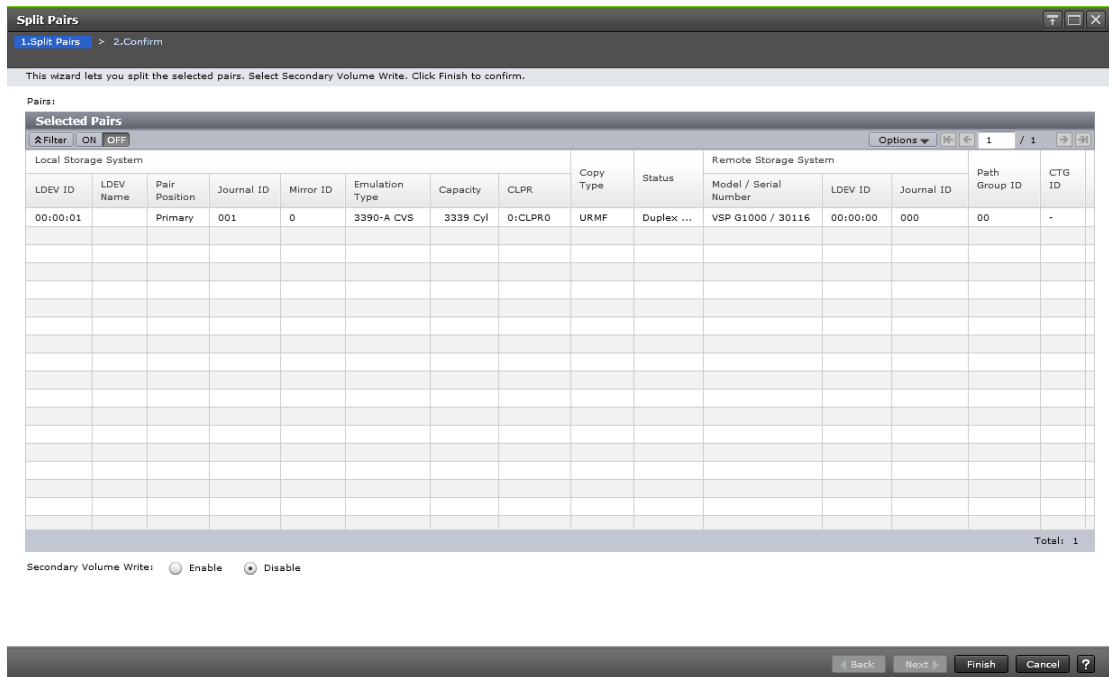
## Split Pairs wizard

Use this wizard to split pairs.

## Split Pairs window

Use this window to split pairs.

For instructions, see the procedure in [Splitting a URz pair \(on page 136\)](#).



### Selected Pairs table

Item	Description
Local Storage System	<p>Displays the following information about pair volumes in the Local Storage System.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: Pair volume LDEV identifier.</li> <li>▪ LDEV Name: Pair volume LDEV name.</li> <li>▪ Pair Position: Identifies the volume as primary or secondary.</li> <li>▪ Journal ID: Journal identifier.</li> <li>▪ Mirror ID: Mirror identifier</li> <li>▪ Emulation Type: Pair volume emulation type.</li> <li>▪ Capacity: Pair volume capacity</li> <li>▪ CLPR: CLPR ID</li> </ul>
Copy Type	<p>Type of pair:</p> <ul style="list-style-type: none"> <li>▪ UR: Universal Replicator</li> <li>▪ URMF: Universal Replicator for Mainframe</li> </ul>
Status	Pair status.

Item	Description
Remote Storage System	Displays the following information about pair volumes in the Remote Storage System. <ul style="list-style-type: none"> <li>Model/Serial Number: Storage system model name and serial number.</li> <li>LDEV ID: Pair volume LDEV identifier.</li> <li>Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.
CTG ID	Pair's consistency group identifier

### Settings

Item	Description
Secondary Volume Write	Indicates whether data can be written to the S-VOL while the pair is split. <ul style="list-style-type: none"> <li>Enable: Data can be written to the S-VOL. Available only when the selected mirror's Attribute is Master. If Restore, Disable is used automatically.</li> <li>Disable: The default. Data cannot be written to the S-VOL.</li> </ul>

## Split Pairs confirmation window

Split Pairs

1. Split Pairs > 2. Confirm

Enter a name for the task. Confirm the settings in the list and click Apply to add task in Tasks queue for execution

Task Name:  (Max. 32 Characters)

Local Storage System										Remote Storage System						
LDEV ID	LDEV Name	Pair Position	Journal ID	Mirror ID	Emulation Type	Capacity	CLPR	Copy Type	Status	Secondary Volume Write	Split Mode	Model / Serial Number	LDEV ID	Journal ID	Path Group ID	CTG ID
00:00:01		Primary	001	0	3390-A CVS	3339 Cyl	0:CLPR0	URMF	Duplex ...	Disabled	Flush	VSP G1000 / 30116	00:00:00	000	00	-
Total: 1																

Go to tasks window for status     ?

**Selected Pairs table**

Item	Description
Local Storage System	<p>Displays the following information about pair volumes in the Local Storage System.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: Pair volume LDEV identifier.</li> <li>▪ LDEV Name: Pair volume LDEV name.</li> <li>▪ Pair Position: Identifies the volume as primary or secondary.</li> <li>▪ Journal ID: Journal identifier.</li> <li>▪ Mirror ID: Mirror identifier</li> <li>▪ Emulation Type: Pair volume emulation type.</li> <li>▪ Capacity: Pair volume capacity</li> <li>▪ CLPR: CLPR ID</li> </ul>
Copy Type	<p>Type of pair:</p> <ul style="list-style-type: none"> <li>▪ UR: Universal Replicator</li> <li>▪ URMF: Universal Replicator for Mainframe</li> </ul>
Status	Pair status.
Secondary Volume Write	<p>Indicates whether data can be written to the S-VOL when the pair is split.</p> <p>A hyphen displays if performing the split operation from the secondary storage system, regardless of the option selected.</p>
Split Mode	<p>Indicates whether update data is written to S-VOLs in the mirror before the split operation.</p> <ul style="list-style-type: none"> <li>▪ Flush: Data is copied to S-VOLs.</li> <li>▪ Purge: Data is not copied to S-VOLs until resynchronization.</li> </ul>
Remote Storage System	<p>Displays the following information about pair volumes in the Remote Storage System.</p> <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ LDEV ID: Pair volume LDEV identifier</li> <li>▪ Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.
CTG ID	Pair's consistency group identifier



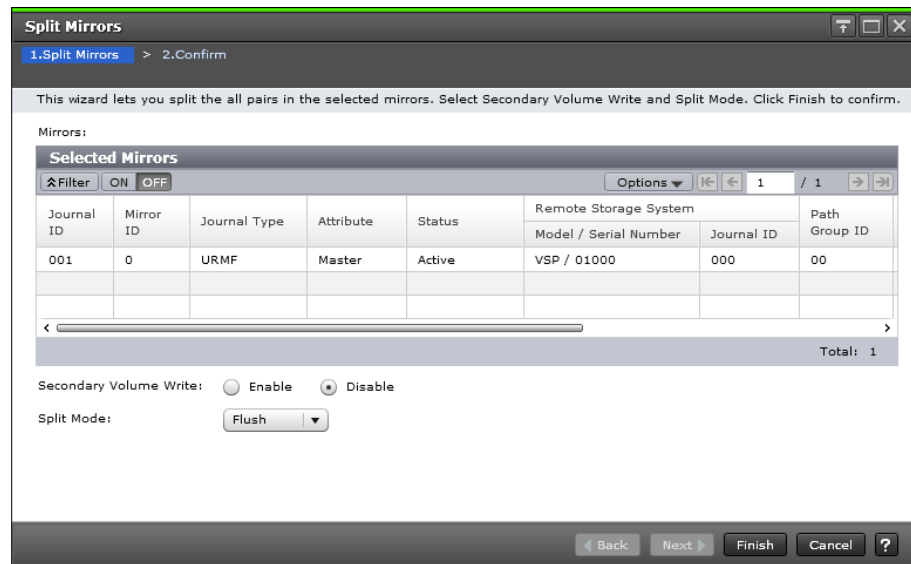
## Split Mirrors wizard

Use this wizard to split mirrors.

## Split Mirrors window

Use this window to split pairs.

For instructions, see the procedure in [Splitting a mirror \(on page 138\)](#).



### Selected Mirrors table

Item	Description
Journal ID	Journal identifier.
Mirror ID	Mirror's identifier
Journal Type	Journal copy type, plus the following journal type option: <ul style="list-style-type: none"> <li>Standard, a normal pair</li> </ul> <p>If Standard is the journal type option, then only the copy type is displayed.</p> <p>Journal type options are defined in the Create Journals window.</p>
Attribute	Mirror's attribute: Master, Restore, or Initial. <ul style="list-style-type: none"> <li>Master is displayed when the P-VOL is paired (initial copy performed).</li> <li>Restore is displayed when the S-VOL is paired (initial copy performed).</li> <li>Initial is displayed when neither data volume is paired yet (initial copy not performed).</li> </ul>

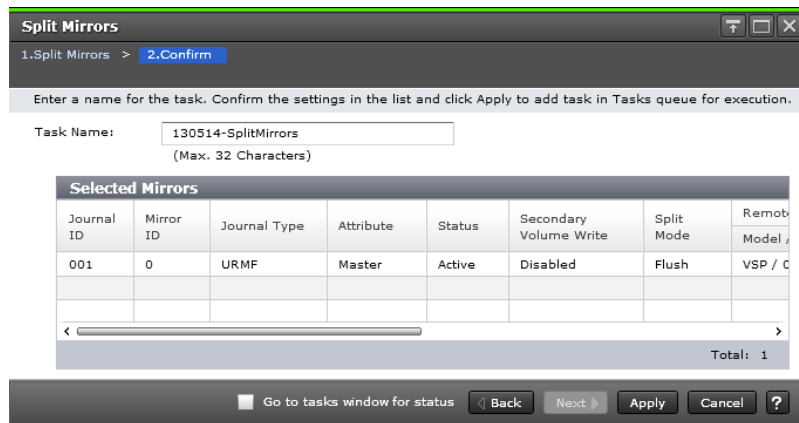
Item	Description
Status	Mirror's status.
Remote Storage System	Displays the following information about pair volumes in the Remote Storage System. <ul style="list-style-type: none"> <li>Model/Serial Number: Storage system model name and serial number.</li> <li>Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.
Number of Data VOLs	Number of volumes associated with the journal.
Data Capacity	Total capacity of all the data volumes. If the journal uses multiple mirror IDs, the capacity of volumes in mirrors with Hold, Holding, or Hold(Failure) status is not included.
Remote Command Device	LDEV number of the remote command device if it is assigned to the mirror. <ul style="list-style-type: none"> <li>The column is blank if the remote command device is not assigned to the mirror.</li> <li>A hyphen (-) indicates the remote command device cannot be assigned to the mirror.</li> </ul>
CTG ID	Consistency group identifier.
CTG Utilization	Whether the consistency group is shared by multiple storage systems. <ul style="list-style-type: none"> <li>Single: The consistency group consists of a single pair of primary and secondary storage systems.</li> <li>Multi: The consistency group consists of multiple storage systems.</li> </ul>

### Settings

Item	Description
Secondary Volume Write	Whether data can be written to the S-VOL while the pair is split. <ul style="list-style-type: none"> <li>Enable: Data can be written to the S-VOL. Available only when the selected mirror's Attribute is Master. If Restore, Disable is used automatically.</li> <li>Disable: Data cannot be written to the S-VOL (default).</li> </ul>

Item	Description
Split Mode	Whether update data is written to S-VOLs in the mirror before the split operation. <ul style="list-style-type: none"> <li>Flush: Data is copied to S-VOLs.</li> <li>Purge: Data is not copied to S-VOLs until resynchronization.</li> </ul>

## Split Mirrors confirmation window



### Selected Mirrors table

Item	Description
Journal ID	Journal identifier.
Mirror ID	Mirror's identifier
Attribute	Mirror's attribute: Master, Restore, or Initial. <ul style="list-style-type: none"> <li>Master is displayed when the P-VOL is paired (initial copy performed).</li> <li>Restore is displayed when the S-VOL is paired (initial copy performed).</li> <li>Initial is displayed when neither data volume is paired yet (initial copy not performed).</li> </ul>
Status	Mirror's status.
Secondary Volume Write	Indicates whether data can be written to the S-VOL while the pair is split. <ul style="list-style-type: none"> <li>Enable: Data can be written to the S-VOL.</li> <li>Disable: Data cannot be written to the S-VOL.</li> </ul> <p>A hyphen displays if performing the split operation from the secondary storage system, regardless of the option selected.</p>

Item	Description
Split Mode	Whether update data is written to S-VOLs in the mirror before the split operation. <ul style="list-style-type: none"> <li>▪ Flush: Data is copied to S-VOLs.</li> <li>▪ Purge: Data is not copied to S-VOLs until resynchronization.</li> </ul>
Remote Storage System	Displays the following information about pair volumes in the Remote Storage System. <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ LDEV ID: Pair volume LDEV identifier</li> <li>▪ Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group's identifier.
Number of Data VOLs	Number of volumes associated with the journal.
Data Capacity	Total capacity of all the data volumes. If the journal uses multiple mirror IDs, the capacity of volumes in mirrors with Hold, Holding, or Hold(Failure) status is not included.
Remote Command Device	LDEV number of the remote command device if it is assigned to the mirror. <ul style="list-style-type: none"> <li>▪ The column is blank if the remote command device is not assigned to the mirror.</li> <li>▪ A hyphen (-) indicates the remote command device cannot be assigned to the mirror.</li> </ul>
CTG ID	Consistency group identifier.
CTG Utilization	Whether the consistency group is shared by multiple storage systems. <ul style="list-style-type: none"> <li>▪ Single: The consistency group consists of a single pair of primary and secondary storage systems.</li> <li>▪ Multi: The consistency group consists of multiple storage systems.</li> </ul>

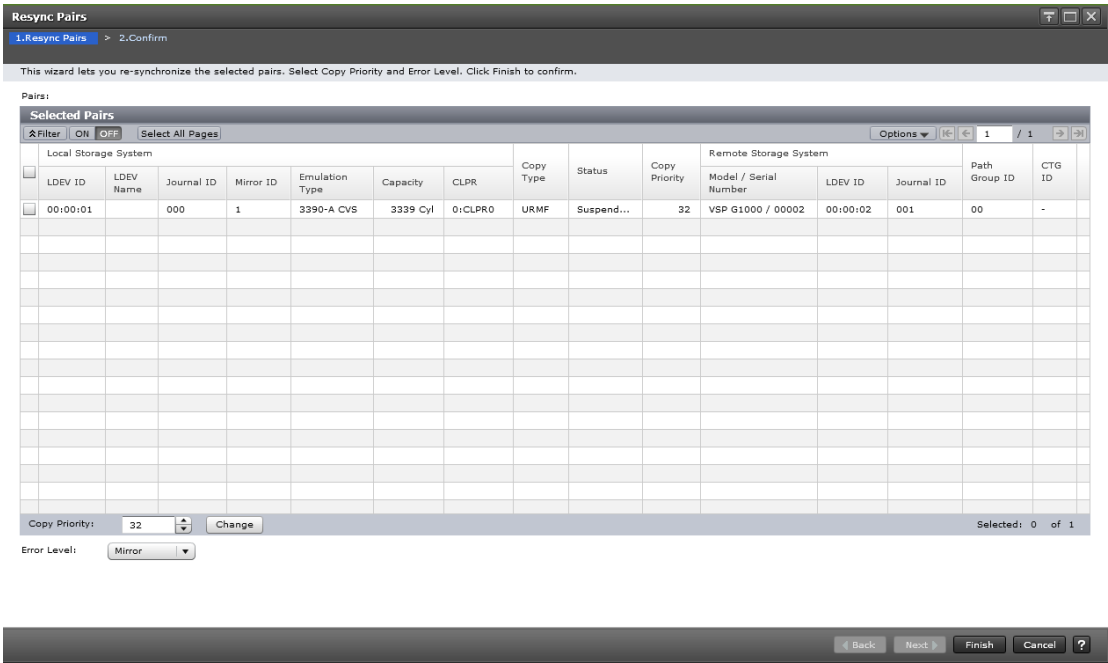
## Resync Pairs wizard

Use this wizard to resynchronize pairs.

## Resync Pairs window

Use this window to resynchronize pairs.

For instructions, see the procedure in [Resynchronizing a URz pair \(on page 140\)](#).



**Selected Pairs table**

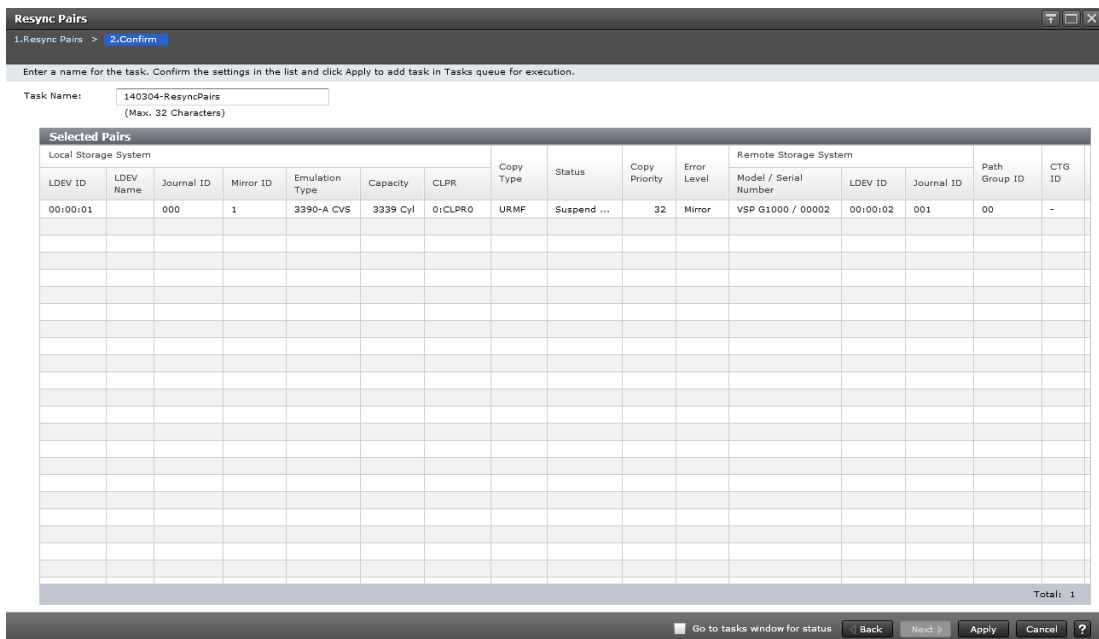
Item	Description
Local Storage System	Displays the following information about pair volumes in the accessed system. <ul style="list-style-type: none"> <li>▪ LDEV ID: Pair volume LDEV identifier.</li> <li>▪ LDEV Name: Pair volume LDEV name.</li> <li>▪ Journal ID: Journal identifier.</li> <li>▪ Mirror ID: Mirror identifier.</li> <li>▪ Emulation Type: Pair volume emulation type.</li> <li>▪ Capacity: Pair volume capacity.</li> <li>▪ CLPR: CLPR ID.</li> </ul>
Copy Type	Type of pair: <ul style="list-style-type: none"> <li>▪ UR: Universal Replicator</li> <li>▪ URMF: Universal Replicator for Mainframe</li> </ul>
Status	Pair status.
Copy Priority	Scheduling order for resync operations. The range is from 1 to 256 for UR. 0-256 for URz.

Item	Description
Remote Storage System	Displays the following information about pair volumes in the Remote Storage System. <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ LDEV ID: Pair volume LDEV identifier</li> <li>▪ Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.
CTG ID	Pair's consistency group identifier
Copy Priority button	Scheduling order for resync operations. The range is from 1 to 256 for UR. 0-256 for URz.

### Settings

Item	Description
Error Level	Used to select which pairs are split if an error occurs. <ul style="list-style-type: none"> <li>▪ Mirror: All pairs in the mirror are split.</li> <li>▪ LU: Only the failed pair is split. UR only.</li> <li>▪ Volume: Only the failed pair is split. URz only.</li> </ul>

# Resync Pairs confirmation window



Item	Description
Local Storage System	<p>Displays the following information about pair volumes in the accessed system.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: Pair volume LDEV identifier.</li> <li>▪ LDEV Name: Pair volume LDEV name.</li> <li>▪ Journal ID: Journal identifier.</li> <li>▪ Mirror ID: Mirror identifier.</li> <li>▪ Emulation Type: Pair volume emulation type.</li> <li>▪ Capacity: Pair volume capacity.</li> <li>▪ CLPR: CLPR ID.</li> </ul>
Copy Type	<p>Type of pair:</p> <ul style="list-style-type: none"> <li>▪ UR: Universal Replicator</li> <li>▪ URMF: Universal Replicator for Mainframe</li> </ul>
Status	Pair status.
Copy Priority	<p>Scheduling order for resync operations. The range is from 1 to 256 for UR.</p> <p>0-256 for URz.</p>

Item	Description
Error Level	Which pairs are split if an error occurs. <ul style="list-style-type: none"> <li>▪ Mirror: All pairs in the mirror are split.</li> <li>▪ (Open systems) LU: Only failed pair is split.</li> <li>▪ (Mainframe systems) Volume: Only failed pair is split.</li> </ul>
Remote Storage System	Displays the following information about pair volumes in the system connected to the system you accessed. <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ LDEV ID: Pair volume LDEV identifier</li> <li>▪ Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.
CTG ID	Pair's consistency group identifier

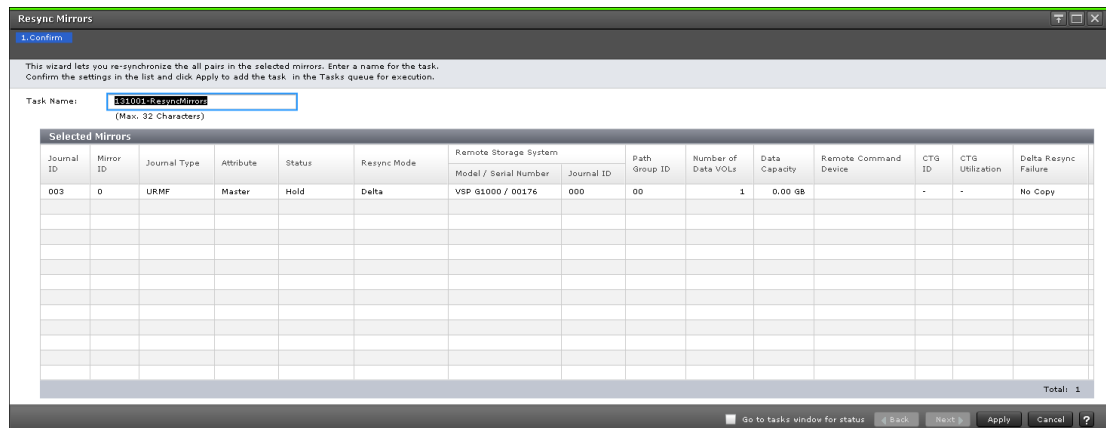
## Resync Mirrors wizard

Use this wizard to resynchronize mirrors.

## Resync Mirrors window

Use this window to resynchronize mirrors.

For instructions, see the procedure in [Resynchronizing a mirror \(on page 142\)](#).





**Selected Mirrors table**

Item	Description
Journal ID	Journal identifier.
Mirror ID	Mirror's identifier
Attribute	<p>Attribute of the mirror: Master, Restore, or Initial.</p> <ul style="list-style-type: none"> <li>▪ Master is displayed when the P-VOL is paired (initial copy performed).</li> <li>▪ Restore is displayed when the S-VOL is paired (initial copy performed).</li> <li>▪ Initial is displayed when neither data volume is paired yet (initial copy not performed).</li> </ul>
Status	Status of the mirror.
Resync Mode	<p>The type of mirror resynchronization to be performed.</p> <ul style="list-style-type: none"> <li>▪ Normal: Resynchronizes split pairs in the mirror that are in PSUS or PSUE status (open systems) or Suspend status (mainframe systems).</li> <li>▪ Delta: Runs the delta resync operation for all pairs in the mirror.</li> <li>▪ Return to standby: Recovers the status of pairs in the mirror from HLDE to HOLD for open systems (Hlde to Hold for mainframe).</li> </ul>
Remote Storage System	<p>Displays the following information about pair volumes in the Remote Storage System.</p> <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.
Number of Data VOLs	Number of volumes associated with the journal.
Data Capacity	<p>Total capacity of all the data volumes.</p> <p>If the journal uses multiple mirror IDs, the capacity of volumes in mirrors with Hold, Holding, or Hold(Failure) status is not included.</p>
Remote Command Device	<p>LDEV number of the remote command device if it is assigned to the mirror.</p> <ul style="list-style-type: none"> <li>▪ The column is blank if the remote command device is not assigned to the mirror.</li> <li>▪ A hyphen (-) indicates the remote command device cannot be assigned to the mirror.</li> </ul>
CTG ID	Consistency group identifier.

Item	Description
CTG Utilization	<p>Whether the consistency group is shared by multiple storage systems.</p> <ul style="list-style-type: none"> <li>Single: The consistency group consists of a single pair of primary and secondary storage systems.</li> <li>Multi: The consistency group consists of multiple storage systems.</li> </ul>
Delta Resync Failure	<p>Processing to take place if delta resync cannot be performed.</p> <ul style="list-style-type: none"> <li>Entire Copy: All data in the P-VOL is copied to the S-VOL.</li> <li>No Copy: No data is copied to the S-VOL.</li> </ul>

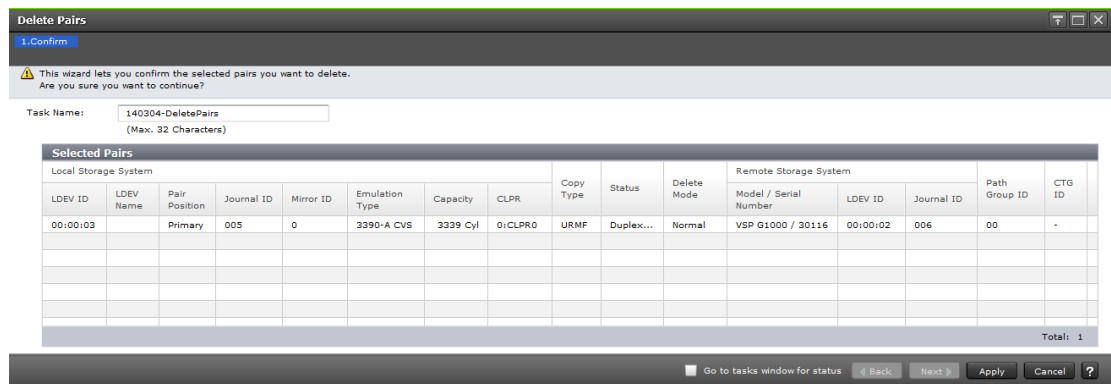
## Delete Pairs wizard

Use this wizard to delete pairs.

## Delete Pairs window

Use this window to delete pairs.

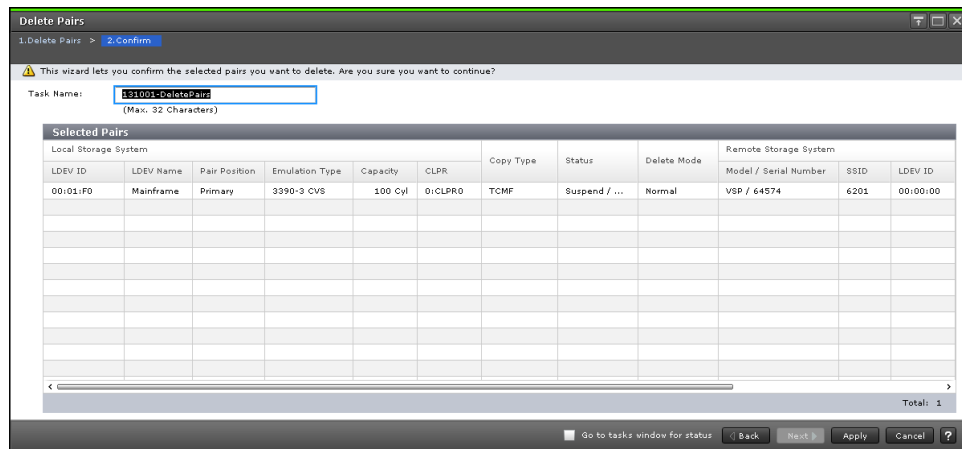
For instructions, see the procedure in [Deleting a URz pair \(on page 143\)](#).



Item	Description
Local Storage System	<p>Displays the following information about pair volumes in the Local Storage System.</p> <ul style="list-style-type: none"> <li>LDEV ID: Pair volume LDEV identifier.</li> <li>LDEV Name: Pair volume LDEV name.</li> <li>Pair Position: Whether the volume is a primary or secondary volume</li> <li>Journal ID: Journal identifier.</li> <li>Mirror ID: Mirror identifier.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Emulation Type: Pair volume emulation type.</li> <li>▪ Capacity: Pair volume capacity.</li> <li>▪ CLPR: CLPR ID.</li> </ul>
Copy Type	Type of pair: <ul style="list-style-type: none"> <li>▪ UR: Universal Replicator</li> <li>▪ URMF: Universal Replicator for Mainframe</li> </ul>
Status	Pair status.
Delete Mode	Options for deleting pairs. Only Normal is available.
Remote Storage System	Displays the following information about pair volumes in the Remote Storage System. <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ LDEV ID: Pair volume LDEV identifier</li> <li>▪ Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.
CTG ID	Pair's consistency group identifier

## Delete Pairs confirmation window



## Selected Pairs table

Item	Description
Local Storage System	Information about volumes in the accessed system. <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ LDEV Name: LDEV name.</li> <li>▪ Pair Position: Whether volume is a P-VOL or S-VOL.</li> <li>▪ Emulation Type: Emulation type of the volume.</li> <li>▪ Capacity: Capacity of the volume.</li> <li>▪ CLPR: CLPR ID of the volume.</li> </ul>
Copy Type	Type of pair: <ul style="list-style-type: none"> <li>▪ TC: TrueCopy</li> <li>▪ TCMF: TrueCopy for Mainframe</li> </ul>
Status	Pair status.
Delete Mode	How the pair is deleted.
Remote Storage System	Information about the remote system. <ul style="list-style-type: none"> <li>▪ Model / Serial Number: Model and serial number.</li> <li>▪ SSID: SSID number. TCz only.</li> <li>▪ LDEV ID: LDEV identifier.</li> </ul>
Path Group ID	TC only. Path group identifier.
CTG ID	Pair's consistency group identifier.
CTG Utilization	Whether the consistency group is shared by multiple storage systems. <ul style="list-style-type: none"> <li>▪ Single: The consistency group consists of a single pair of primary and secondary storage systems.</li> <li>▪ Multi: The consistency group consists of multiple storage systems.</li> </ul>
Preserve Mirror Status	TCz only. <ul style="list-style-type: none"> <li>▪ Blank: Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair.</li> <li>▪ Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy<sup>®</sup> V2.</li> </ul>
Fence Level	P-VOL fence level.

## Force Delete Pairs window

Use this window to forcibly delete pairs.

For instructions, see the procedure in [Forcibly deleting pairs \(on page 160\)](#).

Item	Description
LDEV ID	The Pair volume LDEV identifier
LDEV Name	Name of the pair volume LDEV.
Emulation Type	The volume's emulation type.
Capacity	The volume's Capacity.
CLPR	The volume's CLPR ID.

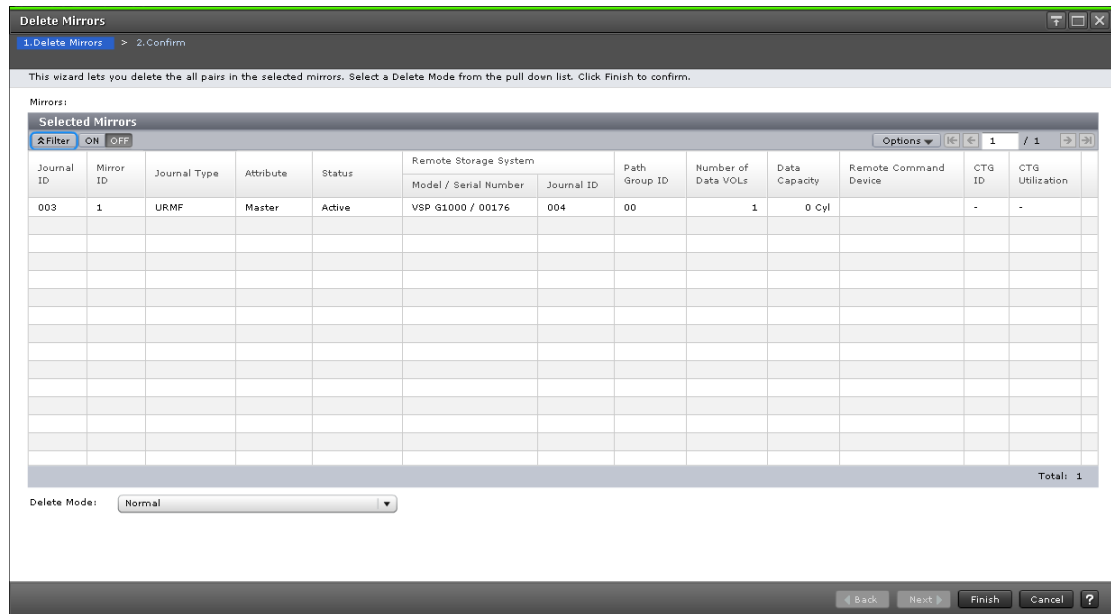
## Delete Mirrors wizard

Use this wizard to delete mirrors.

## Delete Mirrors window

Use this window to delete mirrors.

For instructions, see the procedure in [Deleting a mirror \(on page 145\)](#).



Item	Description
Journal ID	Journal identifier.
Mirror ID	Mirror's identifier
Attribute	<p>Mirror's attribute: Master, Restore, or Initial.</p> <ul style="list-style-type: none"> <li>▪ Master is displayed when the P-VOL is paired (initial copy performed).</li> <li>▪ Restore is displayed when the S-VOL is paired (initial copy performed).</li> <li>▪ Initial is displayed when neither data volume is paired yet (initial copy not performed).</li> </ul>
Status	Mirror's status.
Remote Storage System	<p>Displays the following information about pair volumes in the Remote Storage System.</p> <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.
Number of Data VOLS	Number of volumes associated with the journal.
Data Capacity	<p>Total capacity of all the data volumes.</p> <p>If the journal uses multiple mirror IDs, the capacity of volumes in mirrors with Hold, Holding, or Hold(Failure) status is not included.</p>

Item	Description
Remote Command Device	LDEV number of the remote command device if it is assigned to the mirror. <ul style="list-style-type: none"> <li>The column is blank if the remote command device is not assigned to the mirror.</li> <li>A hyphen (-) indicates the remote command device cannot be assigned to the mirror.</li> </ul>
CTG ID	Consistency group identifier.
CTG Utilization	Indicates whether the consistency group is shared by multiple storage systems. <ul style="list-style-type: none"> <li>Single: The consistency group consists of a single pair of primary and secondary storage systems.</li> <li>Multi: The consistency group consists of multiple storage systems.</li> </ul>
Delete Mode	Options for deleting pairs <ul style="list-style-type: none"> <li>Normal: Delete pairs only when the primary storage system can change both the P-VOL and S-VOL to unpaired volumes.</li> <li>Force: Forcibly deletes pairs regardless of primary storage system's ability to change both volumes to unpaired. Force allows host operations to continue.</li> </ul>

## Delete Mirrors confirmation window

Journal ID	Mirror ID	Journal Type	Attribute	Status	Delete Mode	Remote Storage System		Path Group ID	Number of Data VOLS	Data Capacity	Remote Command Device	CTG ID	CTG Utilization
						Model / Serial Number	Journal ID						
003	1	URMF	Master	Active	Normal	VSP G1000 / 00176	004	00	1	0 Cyl		-	-

Item	Description
Journal ID	Journal identifier.

Item	Description
Mirror ID	Mirror's identifier
Attribute	<p>Mirror's attribute: Master, Restore, or Initial.</p> <ul style="list-style-type: none"> <li>▪ Master is displayed when the P-VOL is paired (initial copy performed).</li> <li>▪ Restore is displayed when the S-VOL is paired (initial copy performed).</li> <li>▪ Initial is displayed when neither data volume is paired yet (initial copy not performed).</li> </ul>
Status	Mirror's status.
Delete Mode	Shows whether mirrors are deleted forcibly or not.
Remote Storage System	<p>Displays the following information about pair volumes in the Remote Storage System.</p> <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.
Number of Data VOLs	Number of volumes associated with the journal.
Data Capacity	<p>Total capacity of all the data volumes.</p> <p>If the journal uses multiple mirror IDs, the capacity of volumes in mirrors with Hold, Holding, or Hold(Failure) status is not included.</p>
Remote Command Device	<p>LDEV number of the remote command device if it is assigned to the mirror.</p> <ul style="list-style-type: none"> <li>▪ The column is blank if the remote command device is not assigned to the mirror.</li> <li>▪ A hyphen (-) indicates the remote command device cannot be assigned to the mirror.</li> </ul>
CTG ID	Consistency group identifier.
CTG Utilization	<p>Whether the consistency group is shared by multiple storage systems.</p> <ul style="list-style-type: none"> <li>▪ Single: The consistency group consists of a single pair of primary and secondary storage systems.</li> <li>▪ Multi: The consistency group consists of multiple storage systems.</li> </ul>



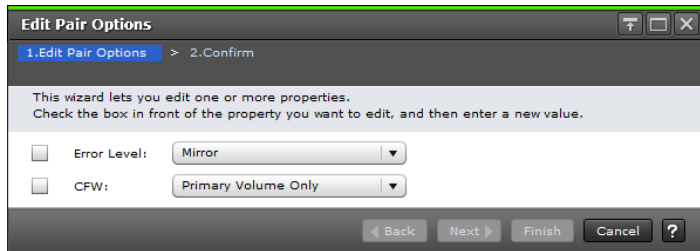
## Edit Pair Options wizard

Use this wizard to change pair options.

## Edit Pair Options window

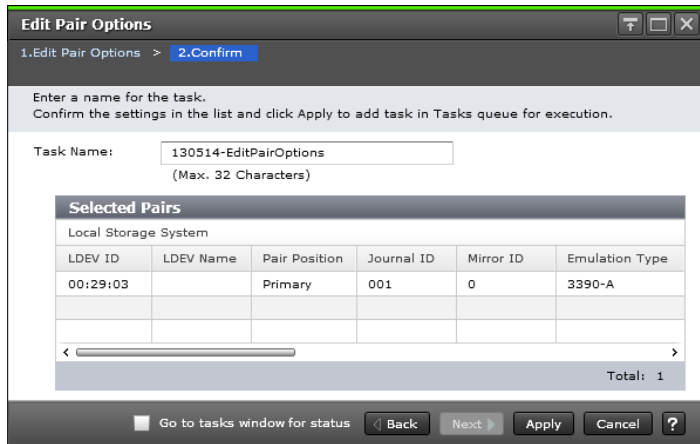
Use this window to change pair options.

For instructions, see the procedure in [Changing the pair options \(on page 159\)](#).



Item	Description
Error Level	<p>The pairs that are split if an error occurs.</p> <ul style="list-style-type: none"> <li>▪ Mirror: All pairs in the mirror are split. However, if a volume failure occurs while the pair status is Pending, only the target pair in the mirror is split, even if Mirror is specified.</li> <li>▪ LU (UR): Only the failed pair is split.</li> <li>▪ Volume (URz): Only the failed pair is split.</li> </ul>
CFW	<p>URz only. Whether CFW data is copied to the S-VOL or not.</p> <ul style="list-style-type: none"> <li>▪ Primary Volume Only: Data is not copied to the S-VOL.</li> <li>▪ Secondary Volume Copy: Data is copied to the S-VOL.</li> </ul>

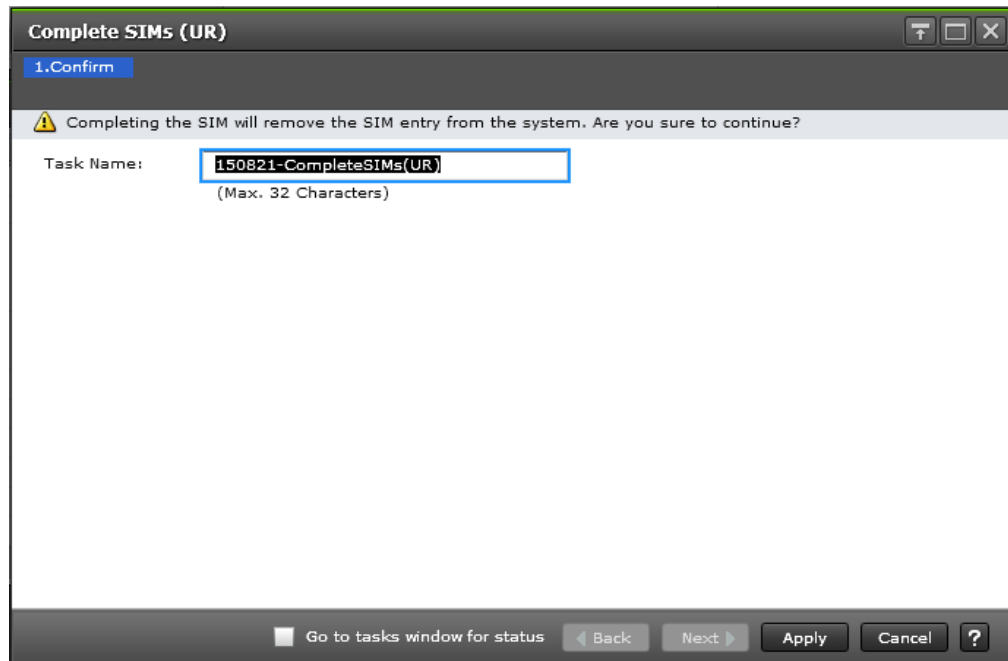
## Edit Pair Options confirmation window



Item	Description
Local Storage System	<p>Displays the following information about pair volumes in the accessed system.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: Pair volume LDEV identifier.</li> <li>▪ LDEV Name: Pair volume LDEV name.</li> <li>▪ Pair Position: Whether the volume is a primary or secondary volume</li> <li>▪ Journal ID: Journal identifier.</li> <li>▪ Mirror ID: Mirror identifier.</li> <li>▪ Emulation Type: Pair volume emulation type.</li> <li>▪ Capacity: Pair volume capacity.</li> <li>▪ CLPR: CLPR ID.</li> </ul>
Copy Type	<p>Type of pair:</p> <ul style="list-style-type: none"> <li>▪ UR: Universal Replicator</li> <li>▪ URMF: Universal Replicator for Mainframe</li> </ul>
Error Level	<p>The pairs that are split if an error occurs:</p> <ul style="list-style-type: none"> <li>▪ Mirror: All pairs in the mirror are split.</li> <li>▪ LU (UR): Only the failed pair is split.</li> <li>▪ Volume (URz): Only the failed pair is split.</li> </ul>
CFW	<p>URz only.</p> <p>Whether CFW data is copied to the S-VOL or not.</p> <ul style="list-style-type: none"> <li>▪ P-VOL Only: Data is not copied to the S-VOL.</li> <li>▪ Copy to S-VOL: Data is copied to the S-VOL.</li> </ul>

Item	Description
Remote Storage System	Displays the following information about pair volumes in the Remote Storage System. <ul style="list-style-type: none"> <li>▪ Model/Serial Number: Storage system model name and serial number.</li> <li>▪ LDEV ID: Pair volume LDEV identifier</li> <li>▪ Journal ID: Journal identifier.</li> </ul>
Path Group ID	Path group identifier.

## Complete SIMs (UR) window



Item	Description
Task Name	Displays the default name of the task (date in the format <i>yymmdd</i> and description) and allows you to enter a different task name (maximum 32 characters, case sensitive).
Go to tasks window for status	When selected, the Tasks window opens automatically after you click Apply.

## Replication window

Use this window to view information about pairs and pair volumes.

The screenshot displays the 'Replication' window with the following data:

Local Replication	Licensed Capacity (Used/Licensed)	Remote Replication	Licensed Capacity (Used/Licensed)
ST	200.00 GB / Unlimited	TC	100.00 GB / Unlimited
TI	400.00 GB / Unlimited	UR	100.00 GB / Unlimited
SIMF	200.00 GB / Unlimited	TCMF	100.00 GB / Unlimited
FCv2	200.00 GB / Unlimited	URMF	100.00 GB / Unlimited
FCSE	200.00 GB / Unlimited	GAD	100.00 GB / Unlimited

Summary statistics:

- Number of Replica LDEVs: 16
- Number of FCv2/FCSE Relationships: 2
- Number of Differential Tables: 824 (Max Allowed: 419200)

The 'Replica LDEVs' table below shows details for 16 LDEVs:

LDEV ID	LDEV Name	Emulation Type	Capacity	Copy Type												
				ST-L1	ST-L2	T1	SIMF	FCv2	FCSE	TC	UR	TCMF	URMF	GAD		
00:10:00	OPEN-V CVS	OPEN-V CVS	100.00 GB	Primary	-	-	-	-	-	-	-	-	-	-	-	-
00:10:01	OPEN-V CVS	OPEN-V CVS	100.00 GB	Secondary	Primary	-	-	-	-	-	-	-	-	-	-	-
00:10:02	OPEN-V CVS	OPEN-V CVS	100.00 GB	-	Secondary	-	-	-	-	-	-	-	-	-	-	-
00:10:03	OPEN-V CVS	OPEN-V CVS	100.00 GB	-	-	Primary	-	-	-	-	-	-	-	-	-	-
00:10:04	OPEN-V CVS	OPEN-V CVS	100.00 GB	-	-	Secondary	-	-	-	-	-	-	-	-	-	-
00:10:05	OPEN-V CVS	OPEN-V CVS	100.00 GB	-	-	-	-	-	-	Primary	-	-	-	-	-	-
00:10:06	OPEN-V CVS	OPEN-V CVS	100.00 GB	-	-	-	-	-	-	-	Primary	-	-	-	-	-
00:29:00	3390-A	3390-A	100.00 GB	-	-	-	Primary	-	-	-	-	-	-	-	-	-
00:29:01	3390-A	3390-A	100.00 GB	-	-	-	-	S-Normal	-	-	-	-	-	-	-	-
00:29:02	3390-A	3390-A	100.00 GB	-	-	-	-	-	S-Normal	-	-	-	-	-	-	-
00:29:03	3390-A	3390-A	100.00 GB	-	-	-	-	Secondary	-	-	-	-	-	-	-	-
00:29:04	3390-A	3390-A	100.00 GB	-	-	-	-	-	T-Normal	-	-	-	-	-	-	-
00:29:05	3390-A	3390-A	100.00 GB	-	-	-	-	-	-	T-Normal	-	-	-	-	-	-
00:29:06	3390-A	3390-A	100.00 GB	-	-	-	-	-	-	-	-	Primary	-	-	-	-
00:29:07	3390-A	3390-A	100.00 GB	-	-	-	-	-	-	-	-	-	Primary	-	-	-
00:30:00	OPEN-V CVS	OPEN-V CVS	100.00 GB	-	-	-	-	-	-	-	-	-	-	-	-	Primary

In this topic, you can view the following tables.

- Summary section
- Replica LDEVs tab

### Summary section

Item	Description
Licensed Capacity (Used/Licensed)	Used capacity and licensed capacity for each local and remote replication program product.
Number of Replica LDEVs	Number of LDEVs used in replication.
Number of FCv2/FCSE relationships	Number of Compatible FlashCopy <sup>®</sup> V2 and Compatible FlashCopy <sup>®</sup> SE relationships.
Number of differential tables	The number and the maximum number of differential tables that are already used in local replication.  The number of differential tables that are already used in remote replication is not included.

Item	Description
	Differential tables will not be used for the following operations. Therefore, number of differential tables will not change when you execute the following operations. <ul style="list-style-type: none"> <li>▪ SI pair operations for a DP-VOL that exceeds 4 TB.</li> <li>▪ TI pair operations.</li> <li>▪ Slz pair operations for a DP-VOL that exceeds 262,668 cylinders.</li> <li>▪ Compatible FlashCopy<sup>®</sup> V2 or Compatible FlashCopy<sup>®</sup> SE relationship operations.</li> </ul>
View History - Local Replication	Opens the <b>History</b> window for local replication.
View History - Remote Replication	Opens the <b>History</b> window for remote replication.
Edit Options - Local Replication	Opens the <b>Edit Local Replica Options</b> window.
Edit Options - Remote Replication	Opens the <b>Edit Remote Replica Options</b> window.
Edit Options - SCP Time	Opens the <b>Edit SCP Time</b> window.

### Replica LDEVs tab

Item	Description
LDEV ID	LDEV identifier. Clicking the link opens the <b>LDEV Properties</b> window.
LDEV Name	LDEV name.
Emulation Type	LDEV's emulation type.
Capacity	LDEV's capacity.
Copy Type	Copy and volume type of the pair. <ul style="list-style-type: none"> <li>▪ SI-L1: ShadowImage L1 pair</li> <li>▪ SI-L2: ShadowImage L2 pair</li> <li>▪ SIMF: ShadowImage for Mainframe pair</li> <li>▪ TI: Thin Image</li> <li>▪ FCv2: Compatible FlashCopy<sup>®</sup> V2 relationship</li> <li>▪ FCSE: Compatible FlashCopy<sup>®</sup> SE relationship</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ TC: TrueCopy pair</li> <li>▪ TCMF: TrueCopy for Mainframe pair</li> <li>▪ UR: Universal Replicator pair</li> <li>▪ URMF: Universal Replicator for Mainframe pair</li> <li>▪ GAD: global-active device pair</li> </ul> <p>Volume types (SI, TI, SIMF, TC, UR, TCMF, URMF, GAD)</p> <ul style="list-style-type: none"> <li>▪ Primary: Primary volume</li> <li>▪ Secondary: Secondary volume</li> </ul> <p>Volume types (FCv2, FCSE)</p> <p>S indicates the source volume and T indicates the target volume:</p> <ul style="list-style-type: none"> <li>▪ S-Normal: Normal source volume</li> <li>▪ T-Normal: Normal target volume</li> <li>▪ ST-Normal: Normal volumes set for both the source and target volumes</li> <li>▪ S-Failed, S-Full, S-Full &amp; Failed: Abnormal source volume</li> <li>▪ T-Failed, T-Full, T-Full &amp; Failed: Abnormal target volume</li> <li>▪ ST-Failed, ST-Full, ST-Full &amp; Failed: Abnormal volume set for both the source and target volumes.</li> </ul> <p>A hyphen (-) is displayed if no pair is set.</p>
Virtual Storage Machine*	<p>Information about the LDEV's virtual storage machine and about the LDEV.</p> <ul style="list-style-type: none"> <li>▪ Model type/Serial number: Model type and serial number.</li> <li>▪ LDEV ID: Virtual LDEV identifier of the volume.</li> <li>▪ Device Name: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute <ul style="list-style-type: none"> <li>• Only attributes that are specified are displayed.</li> <li>• If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name.</li> <li>• A blank indicates that no values are specified.</li> </ul> </li> <li>▪ SSID: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.</li> </ul>
Export	Opens the window for exporting the table information.

Item	Description
* This item does not appear in the window by default. To display this item, change the Column Settings option for the table.	

## Remote Replication window

Use this window to view information about remote replication pairs and mirrors UR / URz only.

Remote Replication window showing summary and detailed information.

Number of Pairs		Number of Mirrors	
TrueCopy	2	Open	8
TrueCopy for Mainframe	2	Mainframe	0
Universal Replicator	0	Total	8
Universal Replicator for Mainframe	0		
Global-Active Device	6		
Total	10		

Local Storage System	LDEV ID	LDEV Name	Port ID	Host Group Name / iSCSI Target Alias	iSCSI Target Name	LUN ID	Pair Position	Copy Type	Status	Remote Storage Sy Model / Serial Num
	00:00:37		-	-	-	-	Primary	TCMF	DUPLEX ...	VSP G1000 / 00050
	00:00:38		-	-	-	-	Secondary	TCMF	DUPLEX ...	VSP G1000 / 00050
	00:0A:00	DDMDP	CL3-B	3B-G00 (00)	-	0	Primary	TC	PSUE	VSP G1000 / 00050
	00:0A:01	DDMDP	CL3-B	3B-G00 (00)	-	1	Secondary	TC	PSUE	VSP G1000 / 00050

### Summary section

Item	Description
Number of Pairs	Number of pairs for each remote replication product and the total of all pairs.
Number of Mirrors	Open: Number of mirrors for open systems Mainframe: Number of mirrors for mainframe systems

Item	Description
	Total: Total number of mirrors

**TC Pairs tab**

Only the pairs to which the volumes of the local storage system are allocated for each user are displayed.

Item	Description
Local Storage System	<p>Information about volumes in the accessed storage system.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier. Click to open the <b>LDEV Properties</b> window.</li> <li>▪ LDEV Name: LDEV name.</li> <li>▪ Port ID: Port identifier. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs.</li> <li>▪ Host Group Name/iSCSI Target Alias: Host group name or iSCSI target alias. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs.</li> <li>▪ iSCSI Target Name: Volume's iSCSI target name. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs.</li> <li>▪ LUN ID: LUN identifier. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs.</li> <li>▪ Pair Position: Whether the volume is a primary or secondary volume.</li> <li>▪ Provisioning Type<sup>1</sup>: Provisioning type of the volume.</li> <li>▪ Emulation Type<sup>1</sup>: Emulation type of the volume.</li> <li>▪ Capacity<sup>1</sup>: Capacity of the volume.</li> <li>▪ CLPR<sup>1</sup>: CLPR ID of the volume.</li> </ul>



Item	Description
	<ul style="list-style-type: none"> <li>▪ Encryption<sup>1</sup>: Encryption information <ul style="list-style-type: none"> <li>• Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>• Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>• Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>▪ Volume for which encryption is enabled</li> <li>▪ Volume for which encryption is disabled</li> <li>▪ External volume</li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <p>For an external volume or migration volume, a hyphen (-) is displayed.</p> <p>For DP-VOL's, the pool to which the LDEV belongs is an external volume or blocked.</p> </li> </ul> </li> <li>▪ Capacity Saving<sup>1</sup>: Information on the capacity saving function. <ul style="list-style-type: none"> <li>• Compression: The compression function is used.</li> <li>• Deduplication and Compression: The deduplication function and the compression function are used.</li> <li>• Disabled: The capacity saving function is not used.</li> </ul> </li> <li>▪ T10 PI<sup>1</sup>: T10 PI attribute of the volume. <ul style="list-style-type: none"> <li>• Enabled: T10 PI attribute of the volume is enabled.</li> <li>• Disabled: T10 PI attribute of the volume is disabled.</li> </ul> <p>A hyphen (-) is displayed if the emulation type is other than OPEN-V.</p> </li> <li>▪ Virtual storage machine<sup>1</sup>: Virtual storage machine's model type and serial number.</li> <li>▪ Virtual LDEV ID<sup>1</sup>: Virtual LDEV identifier of the volume.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Virtual Device Name<sup>1</sup>: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute               <ul style="list-style-type: none"> <li>• Only attributes that are specified are displayed.</li> <li>• If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name.</li> <li>• A blank indicates no values are specified.</li> </ul> </li> <li>▪ Virtual SSID<sup>1</sup>: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.</li> </ul>
Copy Type	<ul style="list-style-type: none"> <li>▪ TC: TrueCopy</li> <li>▪ TCMF: TrueCopy for Mainframe</li> </ul>
Status	<p>Pair status. In Storage Navigator, the pair status is displayed as pair-status-in-Storage Navigator/pair-status-in-CCI-or-Business-Continuity-Manager. If the pair status in Device Manager - Storage Navigator and the pair status in CCI or Business Continuity Manager are the same, the pair status in CCI or Business Continuity Manager is not displayed.</p>
Processing Status	<p>The processing status for a pair volume is displayed.</p> <ul style="list-style-type: none"> <li>▪ Expanding: The capacity of a TC pair volume is being expanded.</li> </ul> <p>If the volume capacity is not being expanded, or if V-VOLs other than DP-VOLs are used as pair volumes, this field remains blank.</p>
Remote Storage System	<p>Information about volumes in the storage system connected to the accessed system.</p> <ul style="list-style-type: none"> <li>▪ Model / Serial Number: Remote system's model and serial number.</li> <li>▪ SSID: Remote system's SSID number. TCz only.</li> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ Port ID: Port identifier when specifying an LDEV ID at pair creation. Note that this field does not change if the remote system path settings are changed. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs.</li> <li>▪ Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target identifier when specifying an LDEV ID at pair creation. Note that this field does not change even if the remote system path settings are changed. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ LUN ID: LUN identifier. TC only. A hyphen (-) is displayed for TrueCopy for Mainframe pairs.</li> <li>▪ Virtual storage machine<sup>1</sup>: Virtual storage machine's model type and serial number.</li> <li>▪ Virtual LDEV ID<sup>1</sup>: Virtual LDEV identifier of the volume.</li> </ul>
Path Group ID	Path group identifier.
Update Type <sup>1</sup>	<p>One of the following:</p> <ul style="list-style-type: none"> <li>▪ Sync: It is a TC or TCMF pair which is not assigned to consistency group.</li> <li>▪ Sync (Specified CTG): It is a TC or TCMF pair created by specifying consistency group.</li> </ul>
CTG ID <sup>1</sup>	Pair's consistency group identifier.
CTG Utilization <sup>1</sup>	<p>Whether the consistency group is shared by multiple storage systems.</p> <ul style="list-style-type: none"> <li>▪ Single: The consistency group consists of a single pair of primary and secondary storage systems.</li> <li>▪ Multi: The consistency group consists of multiple storage systems.</li> </ul>
Preserve Mirror Status <sup>1</sup>	<ul style="list-style-type: none"> <li>▪ - (hyphen): Indicates that it is a Preserve Mirror status without any problem or it is not a Preserve Mirror pair.</li> <li>▪ Withdrawn: Indicates that pair volume data does not match due to suspending copy of Compatible FlashCopy<sup>®</sup> V2.</li> </ul>
Fence Level <sup>1</sup>	Specified P-VOL fence level.
Host I/O Time Stamp Transfer <sup>1</sup>	Whether the host time stamp is transferred to an S-VOL.
Create TC Pairs	Opens the Create TC Pairs window.
Split Pairs	Opens the <b>Split Pairs</b> window.
Resync Pairs	Opens the <b>Resync Pairs</b> window.
View Pair Synchronization Rate <sup>2</sup>	Opens the <b>View Pair Synchronization Rate</b> window when the pair's primary system is accessed.
View Pair Properties <sup>2</sup>	Opens the <b>View Pair Properties</b> window.
View Remote Connection Properties <sup>2</sup>	Opens the <b>View Remote Connection Properties</b> window.

Item	Description
Edit Pair Options <sup>2</sup>	Opens the <b>Edit Pair Options</b> window.
Delete Pairs <sup>2</sup>	Opens the <b>Delete Pairs</b> window.
Export <sup>2</sup>	Opens the window for exporting the table information.
<b>Notes:</b>	
<ol style="list-style-type: none"> <li>1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.</li> <li>2. This item is displayed when you select More Actions.</li> </ol>	

### UR Pairs tab

Only the pairs to which the volumes of the local storage system are allocated for each user are displayed.

The screenshot shows the 'Remote Replication' window with the 'UR Pairs' tab selected. At the top, there is a summary table:

Number of Pairs		Number of Mirrors	
TrueCopy	4	Open	0
TrueCopy for Mainframe	0	Mainframe	0
Universal Replicator	0	Total	0
Universal Replicator for Mainframe	0		
Global-Active Device	0		
Total	4		

Below this, the 'UR Pairs' tab is active, showing a table with the following columns: LDEV ID, LDEV Name, Port ID, Host Group Name / iSCSI Target Alias, iSCSI Target Name, LUN ID, Pair Position, Journal ID, Mirror ID, and Copy Type. The table is currently empty.

Item	Description
Local Storage System	<p>Information about volumes in the accessed storage system.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier. Clicking the link opens the <b>LDEV Properties</b> window.</li> <li>▪ LDEV Name: LDEV name.</li> <li>▪ Port ID: Port identifier. UR only. A hyphen (-) is displayed for URz pairs.</li> <li>▪ Host Group Name/iSCSI Target Alias: Host group name or iSCSI target alias. UR only. A hyphen (-) is displayed for URz pairs.</li> <li>▪ iSCSI Target Name: iSCSI target name. UR only. A hyphen (-) is displayed for URz pairs.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ LUN ID: LUN identifier. UR only. A hyphen (-) is displayed for URz pairs.</li> <li>▪ Pair Position: Whether the volume is a primary or secondary volume.</li> <li>▪ Journal ID: Journal identifier.</li> <li>▪ Mirror ID: Mirror identifier.</li> <li>▪ SLU ID: For an LDEV with the SLU attribute, the SLU ID is displayed. For an LDEV with other than the SLU attribute, a hyphen (-) is displayed. If the SLU ID is not set, a question mark (?) is displayed.</li> <li>▪ Provisioning Type<sup>1</sup>: Provisioning type of the volume.</li> <li>▪ Emulation Type<sup>1</sup>: Emulation type of the volume.</li> <li>▪ Capacity<sup>1</sup>: Capacity of the volume.</li> <li>▪ CLPR<sup>1</sup>: CLPR ID of the volume.</li> <li>▪ Encryption<sup>1</sup>: Encryption information <ul style="list-style-type: none"> <li>• Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>• Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>• Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>▪ Volume for which encryption is enabled</li> <li>▪ Volume for which encryption is disabled</li> <li>▪ External volume</li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <p>For an external volume or migration volume, a hyphen (-) is displayed.</p> <p>For Dynamic Provisioning or Dynamic Provisioning for Mainframe virtual volumes, the pool to which the LDEV belongs is an external volume or blocked.</p> </li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Journal Encryption<sup>1</sup>: Journal's encryption status. <ul style="list-style-type: none"> <li>• Enabled: The journal contains encrypted volumes.</li> <li>• Disabled: The journal contains unencrypted volumes.</li> <li>• Mixed: The pool to which the journal volume belongs contains two or more of the following: <ul style="list-style-type: none"> <li>▪ Volume for which encryption is enabled</li> <li>▪ Volume for which encryption is disabled</li> <li>▪ External volume</li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <p>A hyphen (-) is displayed if the pool to which the journal volume belongs is an external volume, created by migration, or blocked.</p> </li> <li>▪ Capacity Saving<sup>1</sup>: Information on the capacity saving function. <ul style="list-style-type: none"> <li>• Compression: The compression function is used.</li> <li>• Deduplication and Compression: The deduplication function and the compression function are used.</li> <li>• Disabled: The capacity saving function is not used.</li> </ul> </li> <li>▪ T10 PI<sup>1</sup>: T10 PI attribute of the volume. <ul style="list-style-type: none"> <li>• Enabled: T10 PI attribute of the volume is enabled.</li> <li>• Disabled: T10 PI attribute of the volume is disabled.</li> </ul> <p>A hyphen (-) is displayed if the emulation type is other than OPEN-V.</p> </li> <li>▪ Virtual storage machine<sup>1</sup>: Virtual storage machine's model type and serial number.</li> <li>▪ Virtual LDEV ID<sup>1</sup>: Virtual LDEV identifier of the volume. When the virtual LDEV ID is not assigned, this item is blank.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Virtual Device Name<sup>1</sup>: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute <ul style="list-style-type: none"> <li>• Only attributes that are specified are displayed.</li> <li>• If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name.</li> <li>• A blank indicates no values are specified.</li> </ul> </li> <li>▪ Virtual SSID<sup>1</sup>: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.</li> </ul>
Copy Type	<ul style="list-style-type: none"> <li>▪ UR: Universal Replicator</li> <li>▪ URMF: Universal Replicator for Mainframe</li> </ul>
Status	Pair status.
Processing Status	<p>The processing status for a pair volume is displayed.</p> <ul style="list-style-type: none"> <li>▪ Expanding: The capacity of a UR pair volume is being expanded.</li> </ul> <p>If the volume capacity is not being expanded, or if V-VOLs other than DP-VOLs are used as pair volumes, this field remains blank.</p>
Remote Storage System	<p>Information about volumes in the system connected to the system you accessed.</p> <ul style="list-style-type: none"> <li>▪ Model / Serial Number: Remote system's model and serial number.</li> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ Port ID: Port identifier. UR only. A hyphen (-) is displayed for URz pairs.</li> <li>▪ Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target identifier when specifying an LDEV ID at pair creation. Note that this field does not change even if the remote system path settings are changed. UR only. A hyphen (-) is displayed for URz pairs.</li> <li>▪ LUN ID: LUN identifier. UR only. A hyphen (-) is displayed for URz pairs.</li> <li>▪ Journal ID: Journal's identifier.</li> <li>▪ Virtual storage machine<sup>1</sup>: Virtual storage machine's model type and serial number.</li> <li>▪ Virtual LDEV ID<sup>1</sup>: Virtual LDEV identifier of the volume.</li> </ul>
Path Group ID	Path group identifier.

Item	Description
CTG ID <sup>1</sup>	Consistency group identifier.
Error Level <sup>1</sup>	The error level.
Create UR Pairs	Opens the Create UR Pairs window.
Split Pairs	Opens the <b>Split Pairs</b> window.
Resync Pairs	Opens the <b>Resync Pairs</b> window.
View Pair Synchronization Rate <sup>2</sup>	Opens the <b>View Pair Synchronization Rate</b> window when the pair's primary system is accessed.
View Pair Properties <sup>2</sup>	Opens the <b>View Pair Properties</b> window.
View Remote Connection Properties <sup>2</sup>	Opens the <b>View Remote Connection Properties</b> window. Displays only if Pair Position is Primary.
Edit Pair Options <sup>2</sup>	Opens the <b>Edit Pair Options</b> window.
Delete Pairs <sup>2</sup>	Opens the <b>Delete Pairs</b> window.
Split Mirrors <sup>2</sup>	Opens the <b>Split Mirrors</b> window.
Resync Mirrors <sup>2</sup>	Opens the <b>Resync Mirrors</b> window.
Delete Mirrors <sup>2</sup>	Opens the <b>Delete Mirrors</b> window.
Export <sup>2</sup>	Opens the window for exporting the table information.
<p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.</li> <li>2. This item is displayed when you select More Actions.</li> </ol>	

### Mirrors tab

UR / URz only. Only the mirrors to which all volumes are allocated for each user are displayed.



The screenshot shows the 'Remote Replication' window with a summary table at the top and a detailed table below. The summary table includes:

Number of Pairs	TrueCopy	0	Number of Mirrors	Open	8
	TrueCopy for Mainframe	0		Mainframe	0
	Universal Replicator	0		Total	8
	Universal Replicator for Mainframe	0			
	Global-Active Device	13			
	Total	13			

The detailed table below has columns: Journal ID, Mirror ID, Journal Type, Attribute, Status, Remote Storage System (Model / Serial Number, Journal ID), Path Group ID, Number of Data VOLS, Data Capacity, and Remote Device. It lists 12 rows of replication pairs with various statuses like 'Active / ...' and 'Initial / ...'.

Item	Description
Journal ID	Journal identifier. Clicking opens the <b>Journal Volumes</b> window.
Mirror ID	Mirror identifier.
Journal Type	The journal's copy type and journal type option are displayed. If the journal type is standard, only the copy type is displayed.
Attribute	Whether the journal is Master, Restore, or Initial-registered but with no pair volumes assigned to it.
Status	Mirror status.
Remote Storage System	<ul style="list-style-type: none"> <li>Model / Serial Number: Remote system model and serial number.</li> <li>Journal ID: Remote system journal identifier</li> </ul>
Path Group ID	Path group identifier.
Number of Data VOLS	Number of volumes associated with the mirror.
Data Capacity	Total capacity of all the associated volumes.
Remote Command Device	<p>LDEV ID of the remote command device if it is assigned to the mirror.</p> <ul style="list-style-type: none"> <li>The column is blank if the remote command device is not assigned to the mirror.</li> <li>A hyphen (-) indicates the remote command device cannot be assigned to the mirror.</li> </ul>
CTG ID <sup>1</sup>	Displays the consistency group ID.

Item	Description
CTG Utilization <sup>1</sup>	<p>Whether the consistency group is shared by multiple storage systems.</p> <ul style="list-style-type: none"> <li>▪ Single: The consistency group consists of a single pair of primary and secondary storage systems.</li> <li>▪ Multi: The consistency group consists of multiple storage systems.</li> </ul>
EXCTG Setting <sup>1</sup>	<p>Displays the EXCTG ID and Super DKC (device name and serial number) if the journal belongs to the EXCTG.</p> <p>A hyphen (-) is displayed when no journal is registered in the EXCTG.</p>
Path Watch Time <sup>1</sup>	Displays the path watch time.
Path Watch Time Transfer <sup>1</sup>	<p>Specifies whether to forward the Path Watch Time value of the master journal to the secondary mirror. If the Path Watch Time value is forwarded from the master journal to the secondary mirror, both the primary and secondary mirrors will have the same Path Watch Time value.</p> <ul style="list-style-type: none"> <li>▪ Yes: The Path Watch Time value will be forwarded to the secondary mirror.</li> <li>▪ No: The Path Watch Time value will not be forwarded to the secondary mirror.</li> </ul>
Copy Pace <sup>1</sup>	Indicates the speed of initial copy of a volume. Slower, Medium, or Faster is displayed. A hyphen is displayed if the journal is a restore journal.
Transfer Speed <sup>1</sup>	Specifies the transfer speed (in Mbps (megabits per second)). Specify one of the following: 256, 100, 10, or 3.
Delta Resync Failure <sup>1</sup>	<p>Indicates the processing that must be performed if delta resync cannot be performed.</p> <ul style="list-style-type: none"> <li>▪ Entire Copy: Copies all data in the primary volume to the secondary volume if delta resync cannot be performed.</li> <li>▪ No Copy: Does not perform any processing if delta resync cannot be performed. Does not update the secondary volume.</li> </ul>
Split Mirrors	Opens the <b>Split Mirrors</b> window.
Resync Mirrors	Opens the <b>Resync Mirrors</b> window.
Create UR Pairs	Opens the Create UR Pairs window.
Edit Mirror Options <sup>2</sup>	Opens the <b>Edit Mirror Options</b> window.

Item	Description
View Remote Connection Properties <sup>2</sup>	Opens the <b>View Remote Connection Properties</b> window when the value for Attribute is "Master".
Delete Mirrors <sup>2</sup>	Opens the <b>Delete Mirrors</b> window.
Assign Remote Command Devices <sup>2</sup>	Opens the <b>Assign Remote Command Devices</b> window.
Release Remote Command Devices <sup>2</sup>	Opens the <b>Release Remote Command Devices</b> window.
Export <sup>2</sup>	Opens the window for exporting the table information.
<b>Notes:</b>	
<ol style="list-style-type: none"> <li>1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.</li> <li>2. This item is displayed when you select More Actions.</li> </ol>	

### GAD Pairs tab

Only the pairs to which the volumes of the local storage system are allocated for each user are displayed.

LDEV ID	LDEV Name	Port ID	Host Group Name / iSCSI Target Alias	iSCSI Target Name	LUN ID	Pair Position	Provisioning Type	Capacity	CLPR	Encryption	I/
00:10:A0		CL1-B	1B-G00 (00)	-	32	Primary	DP	2.00 GB	0:CLPR0	Disabled	Mi
00:10:A1		CL1-B	1B-G00 (00)	-	33	Primary	DP	2.00 GB	0:CLPR0	Disabled	Mi
00:10:A3		CL1-B	1B-G00 (00)	-	35	Secondary	DP	2.00 GB	0:CLPR0	Disabled	Mi

Item	Description
Local Storage System	<p>Information about volumes in the Local Storage System.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier. Click to open the <b>LDEV Properties</b> window.</li> <li>▪ LDEV Name: LDEV name.</li> <li>▪ Port ID: Port identifier.</li> <li>▪ Host Group Name/iSCSI Target Alias: Host group name or iSCSI target alias.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ iSCSI Target Name: iSCSI target name of the volume.</li> <li>▪ LUN ID: LUN identifier.</li> <li>▪ Pair Position: Whether the volume is a primary or secondary volume.</li> <li>▪ Provisioning Type<sup>1</sup>: Provisioning type of the volume.</li> <li>▪ Capacity<sup>1</sup>: Capacity of the volume.</li> <li>▪ CLPR<sup>1</sup>: CLPR ID of the volume.</li> <li>▪ Encryption<sup>1</sup>: Encryption information. <ul style="list-style-type: none"> <li>• Enabled: Encryption of the parity group to which the LDEV belongs is enabled, or a V-VOL is associated with a pool in which a pool volume has encryption enabled.</li> <li>• Disabled: Encryption of the parity group to which the LDEV belongs is disabled, or a V-VOL is associated with a pool in which a pool volume has encryption disabled.</li> <li>• Mixed: The pool to which the LDEV belongs contains two or more of the following: <ul style="list-style-type: none"> <li>▪ Volume for which encryption is enabled</li> <li>▪ Volume for which encryption is disabled</li> <li>▪ External volume</li> </ul> </li> </ul> <p><b>Note:</b> Encryption of data is not ensured in an LDEV with the Mixed encryption status. To manage data encryption, use an LDEV in which Encryption is Enabled or Disabled.</p> <p>For an external volume or migration volume, a hyphen (-) is displayed. For DP-VOLs, the pool to which the LDEV belongs is an external volume or blocked.</p> </li> <li>▪ I/O Mode: I/O Mode of the volume.</li> <li>▪ ALUA Mode: Information about the ALUA mode.</li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ Capacity Saving<sup>1</sup>: Information on the capacity saving function.               <ul style="list-style-type: none"> <li>• Compression: The compression function is used.</li> <li>• Deduplication and Compression: The deduplication function and the compression function are used.</li> <li>• Disabled: The capacity saving function is not used.</li> </ul> </li> <li>▪ T10 PI<sup>1</sup>: T10 PI attribute of the volume.               <ul style="list-style-type: none"> <li>• Enabled: T10 PI attribute of the volume is enabled.</li> <li>• Disabled: T10 PI attribute of the volume is disabled.</li> </ul> </li> </ul>
Status	Pair status.
Processing Status	<p>The processing status for a pair volume is displayed.</p> <ul style="list-style-type: none"> <li>▪ Expanding: The capacity of a GAD pair volume is being expanded.</li> </ul> <p>If the volume capacity is not being expanded, or if V-VOLs other than DP-VOLs are used as pair volumes, this field remains blank.</p>
Failure Factor <sup>1</sup>	<p>Failure Factor.</p> <p>To check the failure factors, see the <a href="#">Failure Factors (on page 392)</a> for more details.</p>
Remote Storage System	<p>Information about volumes in the Remote Storage System.</p> <ul style="list-style-type: none"> <li>▪ Model / Serial Number: Remote system's model and serial number.</li> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ Port ID: Port ID when specifying an LDEV ID at pair creation. Note that this field does not change if the remote system path settings are changed.</li> <li>▪ Host Group ID/iSCSI Target ID: Host group identifier or iSCSI target ID when specifying an LDEV ID at pair creation. Note that this field does not change even if the remote system path settings are changed.</li> <li>▪ LUN ID: LUN identifier when specifying an LDEV ID at pair creation. Note that this field does not change even if the remote system path settings are changed.</li> </ul>
Path Group ID	Path group identifier.
Mirror ID	Mirror identifier.

Item	Description
Quorum Disk	Information about the quorum disk. <ul style="list-style-type: none"> <li>▪ ID: Quorum disk identifier</li> <li>▪ LDEV ID: LDEV identifier of the quorum disk. A hyphen (-) is displayed if no LDEV is set for the quorum disk.</li> </ul>
CTG ID	Consistency group identifier.
Pair Operating Mode When Quorum Disk Blocked	Displays the pair operating mode when the quorum disk is blocked. A hyphen (-) is displayed if no LDEV is set for the quorum disk or GAD pairs are split. <ul style="list-style-type: none"> <li>▪ Pair Retained (both Primary and Secondary Accessible): The server can access both the P-VOL and the S-VOL.</li> <li>▪ Pair Retained (Primary Accessible and Secondary Inaccessible): The server can access the P-VOL. The data written to the P-VOL is written to the S-VOL.</li> <li>▪ Pair Suspension: The server can access the P-VOL. The data written to the P-VOL is not written to the S-VOL.</li> </ul>
Virtual Storage Machine	Information about the LDEV's virtual storage machine. <ul style="list-style-type: none"> <li>▪ Model type/Serial number: Model type and serial number.</li> <li>▪ LDEV ID: Virtual LDEV identifier of the volume.</li> <li>▪ Device Name: Virtual device name of the volume, in the format: virtual emulation type/number of virtual LUSE volumes/virtual CVS attribute.               <ul style="list-style-type: none"> <li>• Only attributes that are specified are displayed.</li> <li>• If the virtual CVS attribute is specified, "CVS" is displayed at the end of the device name.</li> <li>• A blank indicates no values are specified.</li> </ul> </li> <li>▪ SSID: Virtual SSID of the volume. A blank indicates that no virtual SSID is specified.</li> </ul>
Create GAD Pairs	Opens the Create GAD Pairs window.
Suspend Pairs	Opens the <b>Suspend Pairs</b> window.
Resync Pairs	Opens the <b>Resync Pairs</b> window.
View Pair Synchronization Rate <sup>2</sup>	Opens the <b>View Pair Synchronization Rate</b> window when the pair's primary system is accessed.
View Pair Properties <sup>2</sup>	Opens the <b>View Pair Properties</b> window.
View Remote Connection Properties <sup>2</sup>	Opens the <b>View Remote Connection Properties</b> window.

Item	Description
Delete Pairs <sup>2</sup>	Opens the <b>Delete Pairs</b> window.
Export <sup>2</sup>	Opens the window for exporting the table information.
<b>Notes:</b>	
<ol style="list-style-type: none"> <li>1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.</li> <li>2. This item is displayed when you select More Actions.</li> </ol>	

### GAD Consistency Groups tab

Item	Description
CTG ID	Consistency group identifier.
Usage	Displays whether a consistency group is used. <ul style="list-style-type: none"> <li>▪ Used</li> <li>▪ Free</li> </ul>
Status	Consistency group status. See the <i>Global-Active Device User Guide</i> for status descriptions.
Quorum Disk	Information about the quorum disk. <ul style="list-style-type: none"> <li>▪ ID: Quorum disk identifier</li> <li>▪ LDEV ID: LDEV identifier of the quorum disk. A hyphen (-) is displayed if no LDEV is set for the quorum disk.</li> </ul>
Mirror ID	Mirror identifier.
Pair Position	Displays whether the GAD pair volume registered to the consistency group is a primary or secondary volume.

Item	Description
I/O Mode	Displays the I/O mode of the GAD pair that is registered to the consistency group.
Virtual Storage Machine	Displays the model type/serial number of the virtual storage machine.
Number of Pairs	Number of pairs registered to the consistency group.
Suspend Consistency Groups	Opens the <b>Suspend Consistency Groups</b> window.
Resync Consistency Groups	Opens the <b>Resync Consistency Groups</b> window.
Create GAD Pairs	Opens the Create GAD Pairs window.
Export	Opens the window for exporting the table information.

### Failure Factors

The following table shows failure factors displayed in the Failure Factor column and their meanings.

Failure Factor	Meanings
Local Volume Failure	A failure is detected on a volume in the local storage system.
Remote Path Failure	A failure is detected on the remote path.
Quorum Disk Failure	A failure is detected on the quorum disk.
Internal Error	An internal error is detected.
Not Failure	No failure is detected. The pair is suspended when the local storage system is turned on.
Remote Volume Failure	A failure is detected on a volume in the remote storage system.
Remote Side Unidentified Failure	A failure due to an unidentified factor is detected on a volume in the remote storage system.
blank cell	No failure is detected.



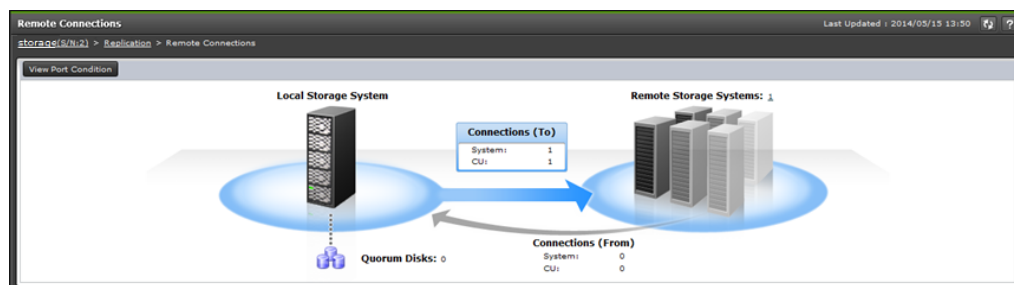
## Remote Connections window

Use this window to view information about remote connections and paths, and add additional remote connections and paths.

In this topic you can review the following tables:

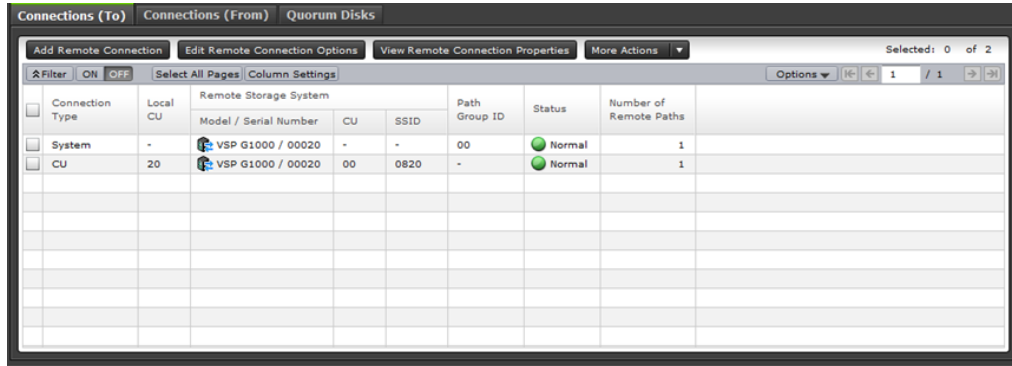
- [Remote connections window \(on page 393\)](#)
- [Connections \(To\) tab \(on page 394\)](#)
- [Connections \(From\) tab \(on page 395\)](#)
- [Quorum Disks tab \(on page 396\)](#)

### Remote connections window



Item	Description
View Port Condition	Opens the <b>View Port Condition</b> window.
Connections (To)	<ul style="list-style-type: none"> <li>▪ System: Number of system-to-system connections from local to remote system.</li> <li>▪ CU: Number of CU-to-CU connections from local to remote system.</li> </ul>
Remote Storage System	Number of remote systems connected to the local system.
Connections (From)	<ul style="list-style-type: none"> <li>▪ System: Number of system-to-system connections from remote to local system.</li> <li>▪ CU: Number of CU-to-CU connections from remote to local system.</li> </ul> <p>Only the number of remote connections used for TC/TCz pairs is displayed as the number of connections.</p>
Quorum Disks	The number of quorum disks.
View Port Location	Opens the <b>View Port Location</b> window.

## Connections (To) tab



Use this tab to view information about the remote system.

Item	Description
Connection Type	<ul style="list-style-type: none"> <li>System: system-to-system connection (local to remote).</li> <li>CU: CU-to-CU connections (local to remote).</li> </ul>
Local CU	Local system CU number.
Remote Storage System	<ul style="list-style-type: none"> <li>Model / Serial Number: Model and serial number.</li> <li>CU: Remote Storage System's CU number.</li> <li>SSID: Remote Storage System's SSID number.</li> </ul>
Path Group ID	Path group identifier.
Status	Remote connection status. <ul style="list-style-type: none"> <li>Normal: All remote paths are normal.</li> <li>Failed: All remote paths are abnormal.</li> <li>Warning: Some remote paths are abnormal.</li> </ul>
Number of Remote Paths	Number of remote paths.
Minimum Number of Paths <sup>1</sup>	The specified minimum number of paths.
RIO MIH Time (sec.) <sup>1</sup>	The specified RIO MIH time in seconds.
Roundtrip Time (msec.) <sup>1</sup>	The specified roundtrip time in milliseconds.
FREEZE Option <sup>1</sup>	The specified the FREEZE option.
Add Remote Connection	Opens the <b>Add Remote Connection</b> window.
Edit Remote Connection Options	Opens the <b>Edit Remote Connection Options</b> window.
View Remote Connection Properties	Opens the <b>View Remote Connection Properties</b> window.

Item	Description
Add Remote Paths <sup>2</sup>	Opens the <b>Add Remote Paths</b> window.
Remove Remote Paths <sup>2</sup>	Opens the <b>Remove Remote Paths</b> window.
Add SSIDs <sup>2</sup>	Opens the <b>Add SSIDs</b> window.
Delete SSIDs <sup>2</sup>	Opens the <b>Delete SSIDs</b> window.
Remove Remote Connections <sup>2</sup>	Opens the <b>Remove Remote Connections</b> window.
Export <sup>2</sup>	Opens the window for exporting the table information.
<b>Notes:</b>	
<ol style="list-style-type: none"> <li>1. This item does not appear in the window by default. To display this item, change the Column Settings option for the table.</li> <li>2. This item is displayed when More Actions is clicked.</li> </ol>	

### Connections (From) tab

Use this tab to view information about the remote storage system. This information is displayed only when remote connections are used for TC and TCz pairs.

Item	Description
Connection Type	<ul style="list-style-type: none"> <li>▪ System: system-to-system connection from remote to local.</li> <li>▪ CU: CU-to-CU connections from remote to local.</li> </ul>
Local CU	Local system CU number.
Remote Storage System	<ul style="list-style-type: none"> <li>▪ Model / Serial Number: Model and serial number.</li> <li>▪ CU: CU number.</li> <li>▪ SSID: SSID number.</li> </ul>
Path Group ID	Path group identifier.
Export	Opens the window for exporting the table information.

## Quorum Disks tab

Use this tab to view information about quorum disks allocated to users.

Quorum Disk ID	LDEV ID	LDEV Name	Status	CLPR	Capacity	Remote Storage System	Read Response Guaranteed Time When Quorum Disk Blocked (sec)
00	00:00:56	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
01	00:00:55	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
02	00:00:54	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
03	00:00:53	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
04	00:00:52	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
05	00:00:51	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
06	00:00:50	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
07	00:00:4F	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
08	00:00:4E	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
09	00:00:4C	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
0A	00:00:4D	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40
0B	00:00:4B	QuorumDisk	Normal	0:CLPR0	20.00 GB	VSP G1000 / 00001	40

Item	Description
Quorum Disk ID	Quorum disk identifier.
Quorum Disk	<p>Below is some information about quorum disks.</p> <ul style="list-style-type: none"> <li>▪ LDEV ID: Virtual LDEV identifier of the volume. Click to open the <b>LDEV Properties</b> window. A hyphen (-) is displayed if no LDEV is set for the quorum disk.</li> <li>▪ LDEV Name: LDEV Name of the volume. A hyphen (-) is displayed if no LDEV is set for the quorum disk.</li> <li>▪ Status: Displays the status of the volume: <ul style="list-style-type: none"> <li>•  Normal: Volume is in normal status.</li> <li>•  Blocked: Volume is blocked. Access cannot be made from the host.</li> <li>•  Warning: Volume has a problem.</li> <li>•  Formatting: Volume is being formatted.</li> <li>•  Preparing Quick Format: Preparation for quick formatting is in progress.</li> <li>•  Quick Formatting: Volume is under quick formatting.</li> <li>•  Correction Access: Access attribute is being corrected.</li> <li>•  Copying: Volume data is being copied.</li> <li>•  Read Only: Volume is in Read Only status. Data cannot be written.</li> <li>•  Shredding: Volume is being shredded.</li> <li>•  - : Volume is in a status other than the above.</li> </ul> </li> </ul>

Item	Description
	<ul style="list-style-type: none"> <li>▪ CLPR: CLPR ID of the volume. A hyphen (-) is displayed if no LDEV is set for the quorum disk.</li> <li>▪ Capacity: Capacity of the volume. A hyphen (-) is displayed if no LDEV is set for the quorum disk.</li> </ul>
Remote Storage System	Model/Serial number of Remote Storage System.
Read Response Guaranteed Time When Quorum Monitoring Stopped	Displays the time elapses until the S-VOL pair status changes to PSUE (Block) after a remote path disconnection is detected if a quorum disk is blocked, or if no LDEV is set for the quorum disk.
Add Quorum Disk	Opens the window to add quorum disks.
Remove Quorum Disk	Opens the window to remove quorum disks.
Edit Quorum Disks	Opens the window to edit quorum disks.
Export	Opens the window to export the table information.

## View Remote Connection Properties window

Use this window to view information about remote connections and paths.



Item	Description
Path Group ID	Path group identifier.
Channel Type	Displays the channel type or type of data path. <ul style="list-style-type: none"> <li>▪ Fibre: Local port type of all remote paths in the remote connection is Fibre.</li> <li>▪ iSCSI: Local port type of all remote paths in the remote connection is iSCSI.</li> <li>▪ Mixed: Local port type of at least two remote paths in the remote connection is not the same.</li> </ul>
Status	Remote connection status. <ul style="list-style-type: none"> <li>▪ Normal: All remote path within remote connection are fine.</li> <li>▪ Failed: All remote path within remote connection has problem.</li> <li>▪ Warning: Some remote path within remote connection has problem.</li> </ul>
Minimum Number of Paths	The specified minimum number of remote paths.
RIO MIH Time	The specified RIO MIH time in seconds.
Roundtrip Time	The specified roundtrip time in milliseconds.
FREEZE Option	Whether the FREEZE option is enabled or disabled.
Registered Time	Date and time the connection was established.
Last Update Date	Date and time of the last update.
Number of Remote Paths	Number of paths specified in the remote connection.

**Remote Paths table**

Item	Description
Local	Information about ports on local storage systems. <ul style="list-style-type: none"> <li>▪ Port ID: Port identifier</li> <li>▪ Port Type: Port type (Fibre, iSCSI)</li> <li>▪ Virtual Port ID: Virtual port ID. Displayed when the port type is iSCSI.</li> </ul>

Item	Description
Remote	Information about ports on remote storage systems. <ul style="list-style-type: none"> <li>Port ID: Port identifier</li> <li>IP Address: IP address of the port. Displayed when the port type is iSCSI.</li> <li>TCP Port Number: TCP port number of the port. Displayed when the port type is iSCSI.</li> </ul>
Status	Remote path status.

## History window

Use this window to review the operations that have been performed on a pair.

The screenshot shows the History window interface. At the top, there is a 'Copy Type' dropdown menu set to 'TCMF' and a 'Last Updated' timestamp of '2014/10/29 15:15:54'. Below this is a 'TCMF History (Page.1)' section with a 'Filter' button and 'ON/OFF' toggle. The main area contains a table with the following data:

Date and Time	Local Storage System		Remote Storage System		Description
	LDEV ID	Provisioning Type	LDEV ID	Provisioning Type	
2013/06/18 18:44:37	00:01:C6	Basic	00:03:25	Basic	Pair Delete
2013/06/18 18:44:37	00:01:E8	Basic	00:03:47	Basic	Pair Delete
2013/06/18 18:44:36	00:01:B3	Basic	00:03:12	Basic	Pair Delete
2013/06/18 18:44:36	00:01:EA	Basic	00:03:49	Basic	Pair Delete
2013/06/18 18:44:36	00:01:B9	Basic	00:03:18	Basic	Pair Delete
2013/06/18 18:44:36	00:01:B1	Basic	00:03:10	Basic	Pair Delete
2013/06/18 18:44:36	00:01:FA	Basic	00:03:59	Basic	Pair Delete
2013/06/18 18:44:36	00:01:FF	Basic	00:03:5E	Basic	Pair Delete
2013/06/18 18:44:36	00:01:F3	Basic	00:03:52	Basic	Pair Delete
2013/06/18 18:44:36	00:01:DC	Basic	00:03:3B	Basic	Pair Delete

At the bottom of the window, there is an 'Export' button, a 'Total: 10' indicator, and 'Close' and '?' buttons.

In this topic, you can view the following tables.

- [Settings \(on page 401\)](#)
- [History table \(when Copy Type is TC or TCMF\) \(on page 401\)](#)



**Settings**

Item	Description
Copy Type	Type of pair: <ul style="list-style-type: none"> <li>▪ TC: TrueCopy</li> <li>▪ UR: Universal Replicator</li> <li>▪ TCMF: TrueCopy for Mainframe</li> <li>▪ URMF: Universal Replicator for Mainframe</li> <li>▪ GAD: global-active device</li> </ul>
Last Updated	Date and time of the last update. Displayed after Copy Type is specified.
Page Number	Page number. Click the button, turn over the page. Displayed after Copy Type is specified.

**History table (when Copy Type is TC or TCMF)**

Item	Description
Date and Time	Date and time of the operation.
Local Storage System	Information about volumes in the accessed system. <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ Provisioning Type: Provisioning type of the volume.</li> <li>▪ Pair Position: Whether the volume is a primary or secondary volume. GAD only.</li> <li>▪ Journal ID: Journal's identifier. UR or URz only.</li> <li>▪ Mirror ID: Mirror's identifier. UR or URz only.</li> </ul>
Remote Storage System	Information about volumes in the system connected to the system you accessed. <ul style="list-style-type: none"> <li>▪ LDEV ID: LDEV identifier.</li> <li>▪ Model / Serial Number: Remote storage system's model and serial number. GAD only.</li> <li>▪ Provisioning Type: Provisioning type of the volume.</li> </ul>
EXCTG ID	EXCTG identifier. URz only.
Mirror ID	Mirror identifier. GAD only.
Quorum Disk ID	Quorum disk identifier. GAD only.

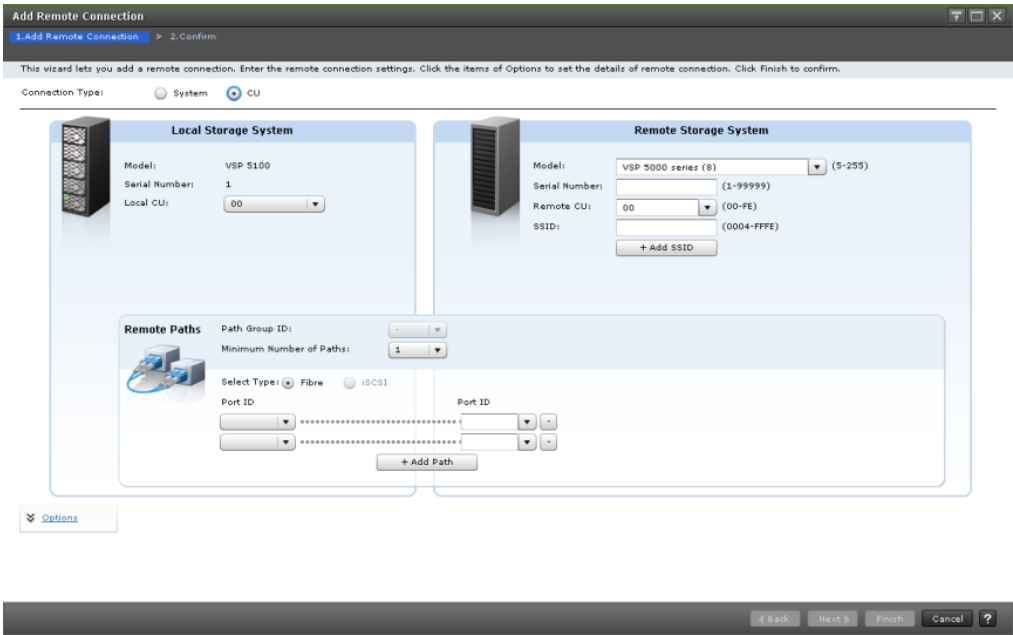
Item	Description
CTG ID	Consistency group identifier. GAD only.
Virtual Storage Machine	Information about volumes in the virtual storage machine. GAD only. <ul style="list-style-type: none"> <li>▪ Model / Serial Number: Virtual storage system's model and serial number.</li> <li>▪ LDEV ID: LDEV identifier of the volume.</li> </ul>
Description Code	Description code. GAD only.
Description	Describes the operation.
Copy Time	Elapsed time for create or resync pairs operation. When the Description is other than Pair Add Complete or Pair Resync Complete, a hyphen is displayed.
Started	Start time of create or resync pairs operation. When the Description is other than Pair Add Complete or Pair Resync Complete, a hyphen is displayed.
Export	Opens the window for exporting table information.

## Add Remote Connection window

Use this window to connect storage systems for remote replication.

For complete UR or URz information, see the section on configuring primary and secondary systems in the *Hitachi Universal Replicator User Guide* or *Hitachi Universal Replicator for Mainframe User Guide*.

When Select Type is Fibre:



Item	Description
Connection Type	<ul style="list-style-type: none"> <li>▪ System: system-to-system connection. TC/UR/URz/GAD.</li> <li>▪ CU: CU-to-CU connections. TCz only.</li> </ul> By default, System is selected.

**Local Storage System**

Item	Description
Model	Local model.
Serial Number	Local serial number.
Local CU	Local system CU number (00 to FE), displayed when Connection Type is CU. A hyphen (-) is displayed when Connection Type is System.

## Remote Storage System

Item	Description
Model	<p>Remote system's model.</p> <ul style="list-style-type: none"> <li>▪ VSP 5000 series (8)</li> </ul> <p>If the local storage does not display VSP 5000 series (8) in the pull-down menu for Model, enter 8 to specify VSP 5000 series storage.</p> <ul style="list-style-type: none"> <li>▪ VSP G1x00, and VSP F1500 (7)</li> <li>▪ VSP (6)</li> </ul> <p>If a value other than the above is specified, it is regarded as a storage system that will be supported in the future. In this case, in the <b>Remote Connections</b> window, the specified value will be enclosed by parentheses, such as (255), is displayed.</p>
Serial Number	<p>Last five or six digits of the remote system serial number, as follows:</p> <ul style="list-style-type: none"> <li>▪ VSP 5000 series and VSP G1x00, VSP F1500: 1 to 99999 (5 digits)</li> <li>▪ VSP: 1 to 99999 (5 digits)</li> <li>▪ Future storage systems: 0 to 99999</li> </ul> <p>When using virtual storage machine volumes, make sure to specify the serial number of the physical storage system. Do not specify the serial number of a virtual storage machine.</p>
Remote CU	Remote system CU number, displayed when Connection Type is CU.
SSID	Remote system SSID in hexadecimal (0004 to FEFF). Can be selected when Connection Type is CU. If there are two or more SSID numbers, clicking the minus (-) button deletes the SSID text box.
Add SSIDs	Clicking adds the SSID to the remote system. The maximum is four. This button is not displayed if four SSID numbers are already added.

**Remote Paths**

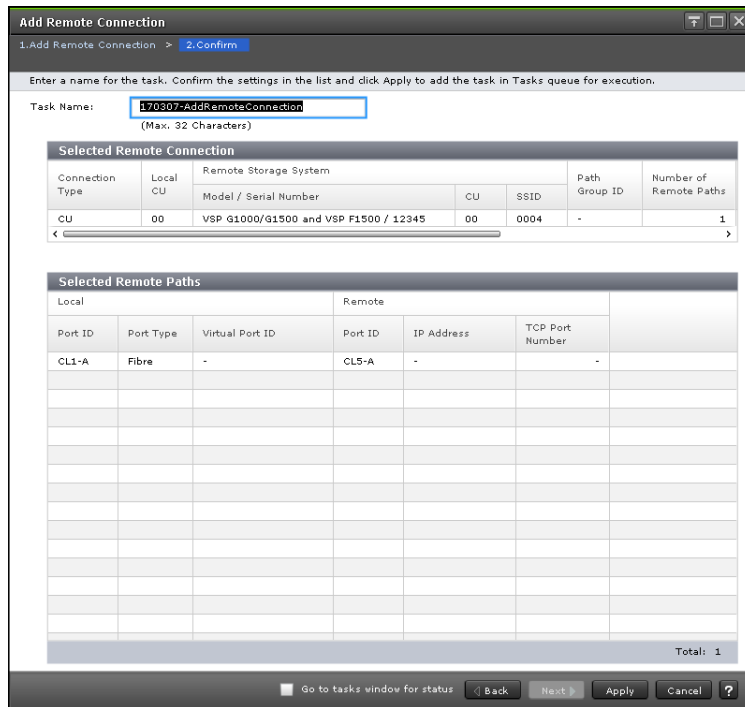
Item	Description
Path Group ID	Path group identifier (00 to FF). Up to 64 path group IDs can be registered per storage system. Path group IDs can be selected when Connection Type is System.
Minimum Number of Paths	Minimum number of remote paths. <ul style="list-style-type: none"> <li>▪ TC and TCz: The range is from 1 to 8, and the default is 1.</li> <li>▪ UR and URz: The minimum number is set to 1, regardless of the number entered.</li> </ul>
Select Type	Select the port type. <ul style="list-style-type: none"> <li>▪ Fibre: Fibre Channel port</li> <li>▪ iSCSI: iSCSI port</li> </ul>
Port ID (for local storage systems)	Select the port identifier of the local storage system.
Virtual Port ID (for local storage systems)	Virtual port ID of the local storage system. Displayed when iSCSI is selected as the port type.
Port ID (for remote storage systems)	Select the port identifier of a remote storage system. A hyphen (-) is displayed if the number of valid paths is greater than the minimum number of paths. Clicking the hyphen deletes the text box of the port for the local and remote storage systems.
IP address	Select the IP type (IPv4 or IPv6) for the port of the remote storage system to enter the IP address. Displayed only when iSCSI is selected as the port type.
TCP Port Number	Enter the TCP port number of the remote storage system. Displayed only when iSCSI is selected as the port type.
Add Paths	Opens a dialog box for creating additional paths (maximum of eight).

**Options**

Item	Description
RIO MIH Time	Time limit between 10 and 100 seconds for the data-transfer operation to complete (15 is the default).

Item	Description
Roundtrip Time (msec.)	TC, TCz and GAD only. Time limit between 1 and 500 milliseconds for data copy from P-VOL to S-VOL (1 is the default).
FREEZE Option (Mainframe systems)	Enables or disables support for the CGROUP (FREEZE/RUN) PPRC TSO command. Can be selected when Connection Type is CU.

## Add Remote Connection confirmation window



In this topic, you can view the following tables.

- [Selected Remote Connection table \(on page 406\)](#)
- [Selected Remote Paths table \(on page 407\)](#)

### Selected Remote Connection table

Item	Description
Connection Type	System or CU.
Local CU	TCz only.

Item	Description
	Specified local system CU number, displayed when Connection Type is CU.
Remote Storage System	<ul style="list-style-type: none"> <li>▪ Model / Serial Number: Model and serial number.</li> <li>▪ CU: CU number.</li> <li>▪ SSID: SSID.</li> </ul>
Path Group ID	Specified path group identifier.
Number of Remote Paths	Specified number of remote paths.
Minimum Number of Paths	Specified minimum number of remote paths.
RIO MIH Time (sec.)	Specified RIO MIH time.
Roundtrip Time (msec.)	Specified roundtrip time.
FREEZE Option	Specified FREEZE option.

**Selected Remote Paths table**

Item	Description
Local	Information about ports on the local storage system. <ul style="list-style-type: none"> <li>▪ Port ID: Port identifier</li> <li>▪ Port Type: Port type can be Fibre, iSCSI</li> <li>▪ Virtual Port ID: Virtual port ID. Displayed when the port type is iSCSI.</li> </ul>
Remote	Information about ports on the remote storage system. <ul style="list-style-type: none"> <li>▪ Port ID: Port identifier</li> <li>▪ IP Address (displayed only when the port type is iSCSI)</li> <li>▪ TCP Port Number (displayed only when the port type is iSCSI)</li> </ul>

**Edit Remote Replica Options window**

You use this window to change options that affect the replication system.

1.Edit Remote Replica Options > 2.Confirm

This wizard lets you edit one or more properties. Enter the new value and click Finish to confirm.

Copy Type: TC/TCMF

Storage System Options:

Maximum Initial Copy Activities: 64 (1-512)

Blocked Path Monitoring: 40 Second(s) (2-45)

Blocked Path SIM Monitoring: 70 Second(s) (2-100)

Services SIM of Remote Copy:  Report  No Report

CU Options:

Maximum Initial Copy Activities:  Enable  Disable

CU	Maximum Initial Copy Activities	PPRC Support	Services SIM
00	-	No	No Report
01	-	No	No Report
02	-	No	No Report
03	-	No	No Report
04	-	No	No Report
05	-	No	No Report
06	-	No	No Report
07	-	No	No Report
08	-	No	No Report
09	-	No	No Report

Change CU Options Selected: 0 of 255

Back Next Finish Cancel ?

In this topic, you can view the following tables.

- [Setting Fields \(on page 409\)](#)
- [Storage System Options \(on page 409\)](#)
- [CU Options \(on page 409\)](#)



**Setting Fields**

Item	Description
Copy Type	Type of pair: <ul style="list-style-type: none"> <li>▪ TC/TCMF: TrueCopy or TrueCopy for Mainframe</li> <li>▪ UR/URMF: Universal Replicator or Universal Replicator for Mainframe</li> <li>▪ GAD: global-active device</li> </ul>
Maximum Initial Copy Activities	Number of volumes that can be copied per initial copy operation: 1 to 512 (default = 64). Displayed only when GAD is selected for Copy Type.

**Storage System Options**

This area is not displayed when GAD is selected for Copy Type.

Item	Description
Maximum Initial Copy Activities	Number of volumes that can be copied per initial copy operation. When the selected Copy Type is TC/TCMF or GAD: 1 to 512 (default = 64) When the selected Copy Type is UR/URMF: 1 to 128 (default = 64)
Blocked Path Monitoring	Number of seconds for the system to monitor blocked paths: 2 to 45 (default = 40). Displayed for TC or TCz pairs. <b>Note:</b> When monitoring the path blockade in GAD or UR/URz, select TC/TCMF for Copy Type, then enter the value.
Blocked Path SIM Monitoring	Number of seconds for the system to monitor SIMs reported for blocked paths: 2 to 100 (default = 70). Displayed for TC or TCz pairs. <b>Note:</b> When monitoring a SIM reported by path blockade in GAD or UR/URz, select TC/TCMF for Copy Type, then enter the value.
Services SIM of Remote Copy	Whether services SIMs in the remote CU are reported to the host (default = No Report). Displayed for TC or TCz pairs.

**CU Options**

The CU options are not displayed when the selected Copy Type is GAD.

Item	Description
Maximum Initial Copy Activities*	<ul style="list-style-type: none"> <li>▪ Enable: Allows you to change the maximum initial copy activities setting for the selected CUs.</li> <li>▪ Disable (default): The maximum initial copy activities setting for each CU cannot be set or changed.</li> </ul>
CU	CU number.
Maximum Initial Copy Activities*	Maximum initial copy activities setting for the CU (default = 4). A hyphen is displayed if Disable is selected in Maximum Initial Copy Activities.
PPRC Support*	Whether PPRC is supported by the host (default = No).
Services SIM	Whether remote copy service SIMs are reported to the host (default = No Report).
Change CU Options	Opens the <b>Change CU Options</b> window to allow you to change the CU options for the selected CUs. This button cannot be used if the Disable radio button is selected for Maximum Initial Copy Activities.
* These items are displayed only when the selected Copy Type is TC/TCMF.	

## Edit Remote Replica Options confirmation window

1.Edit Remote Replica Options > 2.Confirm

Enter a name for the task. Confirm the settings in the list and click Apply to add task in Tasks queue for execution.

Task Name:  (Max. 32 Characters)

TC/TCMF Storage System Options				
Maximum Initial Copy Activities	Blocked Path Monitoring (sec)	Blocked Path SIM Monitoring (sec)	Services SIM	
64	40	70	No Report	

TC/TCMF CU Options				
CU	Maximum Initial Copy Activities	PPRC Support	Services SIM	
00	-	No	No Report	
01	-	No	No Report	
02	-	No	No Report	
03	-	No	No Report	
04	-	No	No Report	
05	-	No	No Report	
06	-	No	No Report	
07	-	No	No Report	
08	-	No	No Report	
09	-	No	No Report	
0A	-	No	No Report	
0B	-	No	No Report	
0C	-	No	No Report	
0D	-	No	No Report	
0E	-	No	No Report	
0F	-	No	No Report	
10	-	No	No Report	
11	-	No	No Report	

Total: 255

Go to tasks window for status    < Back    Next >    Apply    Cancel    ?

In this topic, you can view the following tables.

- [Storage System Options \(on page 411\)](#)
- [CU Options \(on page 412\)](#)

### Storage System Options

Item	Description
Maximum Initial Copy Activities	Number of volumes that can be copied per initial copy operation.

Item	Description
Blocked Path Monitoring (sec)	TC/TCz only. Number of seconds for the system to monitor blocked paths
Blocked Path SIM Monitoring (sec)	TC/TCz only. Number of seconds for the system to monitor SIMs reported for blocked paths
Services SIM	TC/TCz only. Whether services SIMs are reported to the host.

### CU Options

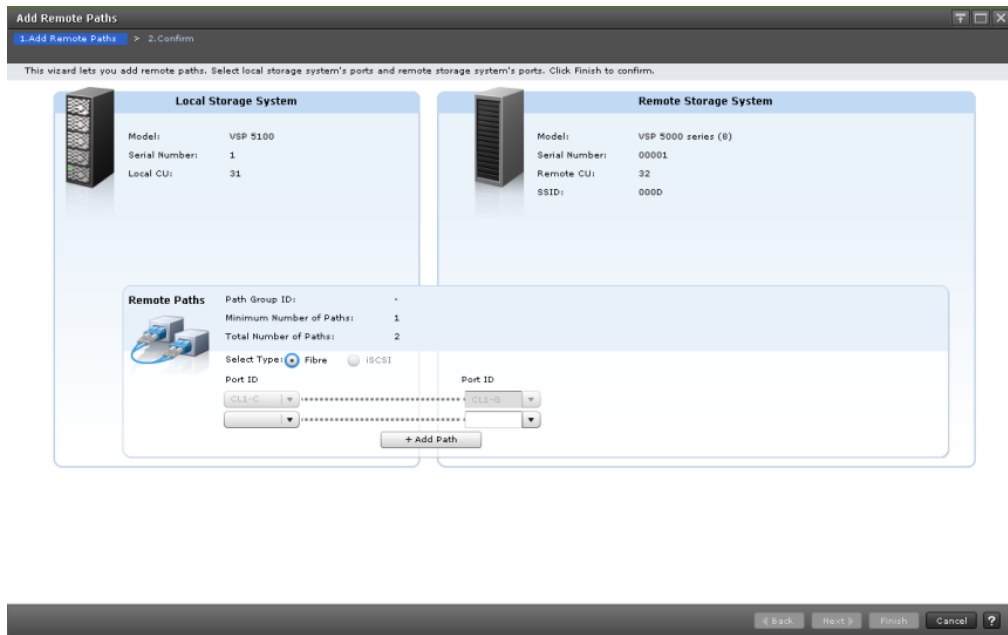
Following will not be displayed if selecting GAD for Copy Type.

Item	Description
CU	CU number.
Maximum Initial Copy Activities	TC/TCz only. Number of volumes that can be copied per initial copy operation.
PPRC support by host	TC/TCz only. Whether PPRC is supported by the host.
Services SIM	Whether services SIMs are reported.

## Add Remote Paths window

You use this window to add remote paths to a remote connection.

When Select Type is Fibre:



### Local Storage System

Item	Description
Model	Local system model.
Serial Number	Local system serial number.
Local CU	Local system CU number. A hyphen is displayed in case of system connection.

### Remote Storage System

Item	Description
Model	Remote system model.
Serial Number	Remote system serial number.
Remote CU	Remote system CU number. A hyphen is displayed in case of system connection.
SSID	Remote system SSID. A hyphen is displayed in case of system connection.

**Remote Paths**

Item	Description
Path Group ID	Path group identifier. A hyphen is displayed for CU connection.
Minimum Number of Paths	Specified minimum number of remote paths.
Total Number of Paths	Total number of paths. Total of the number of paths registered for remote connections and the number of paths to be added (including blank lines).
Select Type	Select the port type. <ul style="list-style-type: none"> <li>▪ Fibre: Fibre Channel port (default)</li> <li>▪ iSCSI: iSCSI port</li> </ul> For TCz and URz, Fibre is selected automatically because connections using iSCSI ports are not supported.
Port ID (for local storage systems)	Select the port identifier of the local storage system.
Virtual Port ID (for local storage systems)	Virtual port ID of the local storage system. Displayed when iSCSI is selected as the port type.
Port ID (for remote storage systems)	Select the port identifier of a remote storage system. A minus button is displayed if the number of valid paths is greater than the minimum number of paths. Clicking the minus button deletes the text box of the port for the local and remote storage systems.
IP address	Select the IP type (IPv4 or IPv6) for the port of the remote storage system to enter the IP address. Displayed only when iSCSI is selected as the port type.
TCP Port Number	Enter the TCP port number of the port on a remote storage system. Displayed only when iSCSI is selected as the port type.
Add Paths	Clicking adds more paths, up to eight.



Item	Description
Channel Type	Channel type for remote connections. <ul style="list-style-type: none"> <li>▪ Fibre: Port type of all remote paths in the remote connection is Fibre.</li> <li>▪ iSCSI: Port type of all remote paths in the remote connection is iSCSI.</li> <li>▪ Mixed: Port type of at least two remote paths in the remote connection is not the same.</li> </ul>
Number of Remote Paths	Number of remote paths including those being added.
Minimum Number of Paths	Specified minimum number of remote paths.

#### Selected Remote Paths table

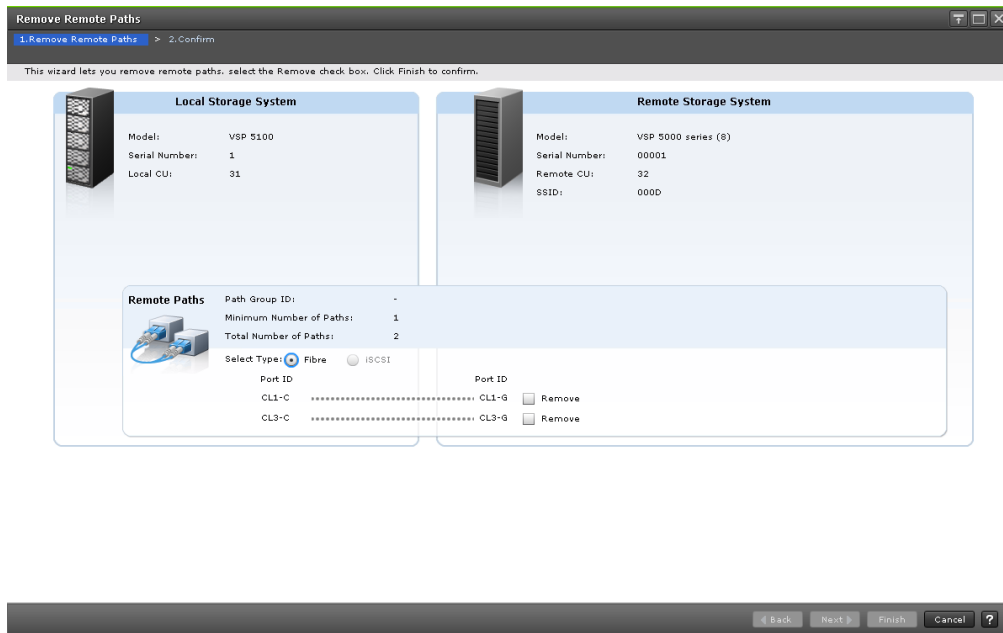
Item	Description
Local	Information about ports on the local storage system. <ul style="list-style-type: none"> <li>▪ Port ID: Port identifier</li> <li>▪ Port Type: Port type (Fibre, iSCSI)</li> <li>▪ Virtual Port ID: Virtual port ID. Displayed when iSCSI is selected for Port Type.</li> </ul>
Remote	Information about ports on the remote storage system. <ul style="list-style-type: none"> <li>▪ Port ID: Port identifier</li> <li>▪ IP Address: IP address of the port. Displayed when iSCSI is selected for Port Type.</li> <li>▪ TCP Port Number: TCP port number of the port. Displayed when iSCSI is selected for Port Type.</li> </ul>

## Remove Remote Paths window

Use this window to remove paths from a remote connection.

When Select Type is Fibre:





### Local Storage System

Item	Description
Model	Local system model.
Serial Number	Local system serial number.
Local CU	Local system CU number. A hyphen (-) is displayed in the case of system connection.

### Remote Storage System

Item	Description
Model	Remote system model.
Serial Number	Remote system serial number.
Remote CU	Remote system CU number. A hyphen (-) is displayed for system connection.
SSID	Remote system SSID. A hyphen (-) is displayed for system connection.

**Remote Paths**

Item	Description
Path Group ID	Path group identifier. A hyphen is displayed for CU connection.
Minimum Number of Paths	Specified minimum number of remote paths.
Total Number of Paths	Total number of paths. Displays the total number of path registered to remote connection and path to be added (includes blank line).
Select Type	Select the port type. <ul style="list-style-type: none"> <li>▪ Fibre: Fibre Channel port</li> <li>▪ iSCSI: iSCSI port</li> </ul> For TCz and URz, Fibre is selected automatically because connections using iSCSI ports are not supported.
Port ID (for local storage systems)	Port identifier of the local storage system. Information of the added paths.
Virtual Port ID (for local storage systems)	Virtual port ID of the local storage system. Displayed only when iSCSI is selected as the port type.
Port ID (for remote storage systems)	Port identifier of a remote storage system. Information of the added paths.
IP address	IP address of a port on a remote storage system. Displayed only when iSCSI is selected as the port type.
TCP Port Number	TCP port number of a port on a remote storage system. Displayed only when iSCSI is selected as the port type.
Remove	Check box for deleting the path from the remote connection.



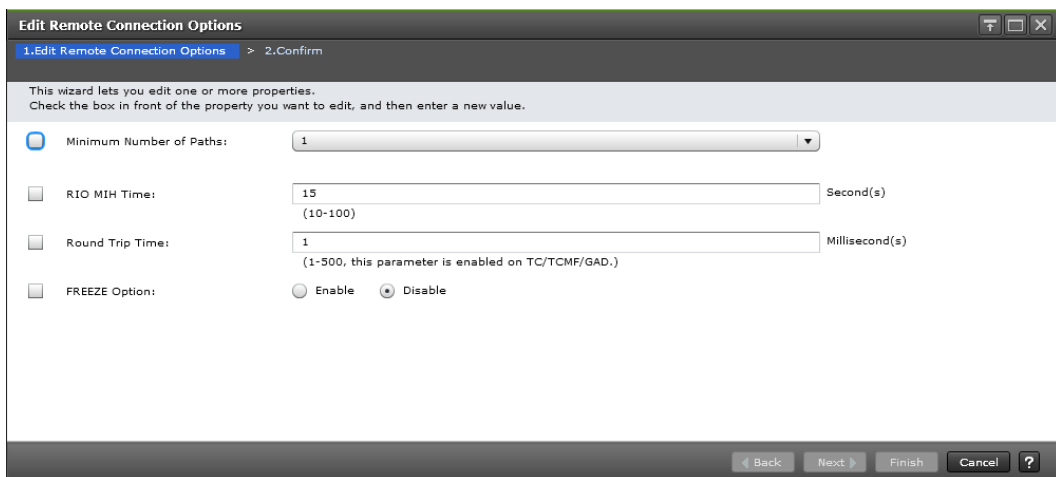
Item	Description
Minimum Number of Paths	Specified minimum number of remote paths.

**Selected Remote Paths table**

Item	Description
Local	<p>Information about ports on the local storage system.</p> <ul style="list-style-type: none"> <li>▪ Port ID: Port identifier</li> <li>▪ Port Type: Port type (Fibre, iSCSI)</li> <li>▪ Virtual Port ID: Virtual port ID. Displayed when iSCSI is selected for Port Type.</li> </ul>
Remote	<p>Information about ports on the remote storage system.</p> <ul style="list-style-type: none"> <li>▪ Port ID: Port identifier</li> <li>▪ IP Address: IP address of the port. Displayed when iSCSI is selected for Port Type.</li> <li>▪ TCP Port Number: TCP port number of the port. Displayed when iSCSI is selected for Port Type.</li> </ul>

## Edit Remote Connection Options window

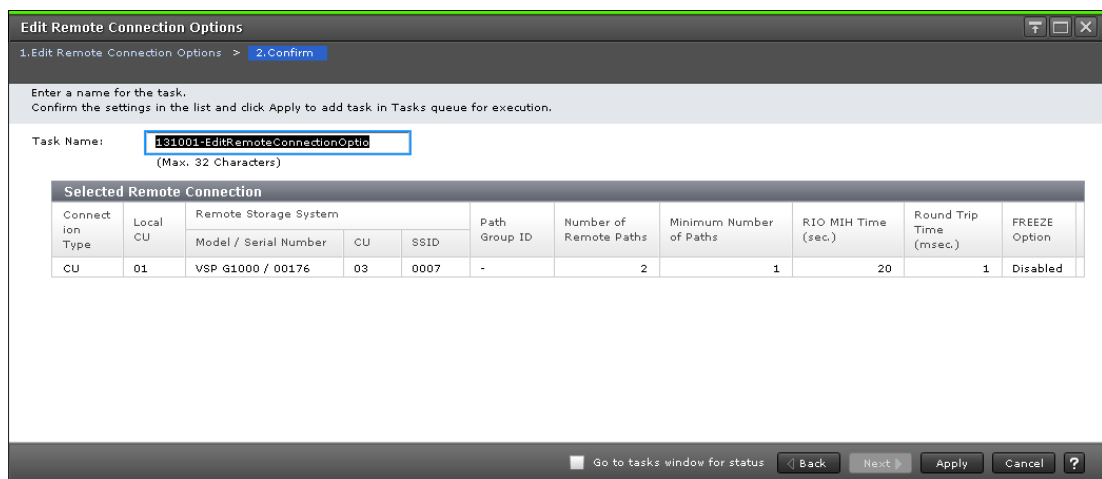
You use this window to edit remote connection options, such as minimum paths and round trip time.



**Selected Remote Connection table**

Item	Description
Minimum Number of Paths	<p>Minimum number of remote paths.</p> <ul style="list-style-type: none"> <li>TC and TCz: The range is from 1 to 8, and the default is 1.</li> <li>UR and URz: The minimum number is set to 1, regardless of the number entered.</li> </ul>
RIO MIH Time	Time limit between 10 and 100 seconds (default = 15) for the data-transfer operation to complete.
Round Trip Time	<p>TC, TCz, and GAD only.</p> <p>Time limit between 1 and 500 milliseconds for data copy from P-VOL to S-VOL (1 is the default).</p>
FREEZE Option	<p>TCz only.</p> <p>Enables or disables support for the <b>CGROUP (FREEZE/RUN) PPRC TSO</b> command.</p> <ul style="list-style-type: none"> <li>Enable: The local storage system accepts and runs the <b>CGROUP</b> command.</li> <li>Disable: The local storage system rejects the <b>CGROUP</b> command (default).</li> </ul> <p>Displayed only when Connection Type is CU.</p>

## Edit Remote Connection Options confirmation window

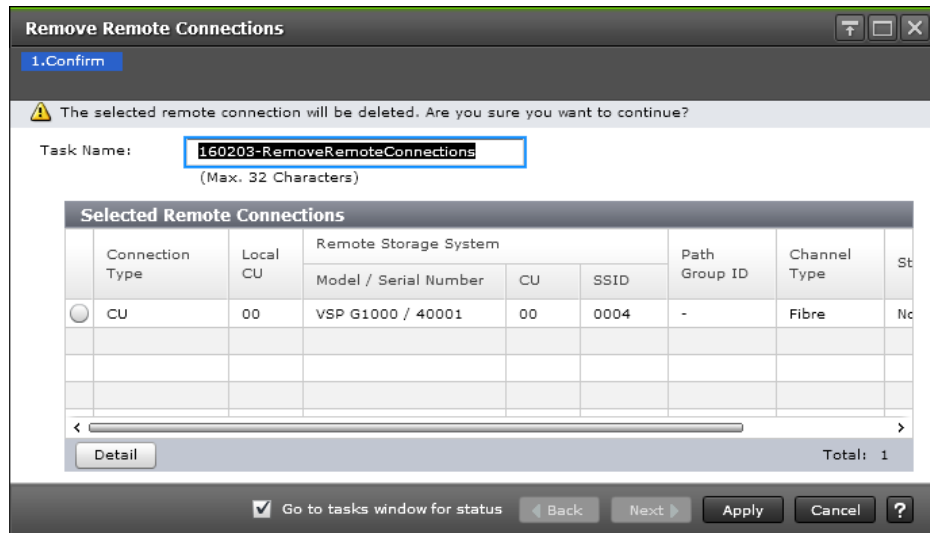


**Selected Remote Connection table**

Item	Description
Connection Type	<ul style="list-style-type: none"> <li>▪ System: system-to-system connection.</li> <li>▪ CU: CU-to-CU connections.</li> </ul>
Local CU	Local system CU number.
Remote Storage System	<ul style="list-style-type: none"> <li>▪ Model / Serial Number: Model and serial number.</li> <li>▪ CU: Remote Storage System's CU number.</li> <li>▪ SSID: Remote Storage System's SSID number. TCz only.</li> </ul>
Path Group ID	Path group identifier.
Number of Remote Paths	Number of remote paths including those being added.
Minimum Number of Paths	<p>Minimum number of remote paths.</p> <ul style="list-style-type: none"> <li>▪ TC and TCz: The range is from 1 to 8, and the default is 1.</li> <li>▪ UR and URz: The minimum number is set to 1, regardless of the number entered.</li> </ul>
RIO MIH Time	Time limit between 10 and 100 seconds (default = 15) for the data-transfer operation to complete.
Round Trip Time (msec.)	<p>TC, TCz, and GAD only.</p> <p>Time limit between 1 and 500 milliseconds for data copy from P-VOL to S-VOL (1 is the default).</p>
FREEZE Option	<p>TCz only.</p> <p>Enables or disables support for the CGROUP (FREEZE/RUN) PPRC TSO command.</p>

**Remove Remote Connections window**

Use this window to remove remote connections.

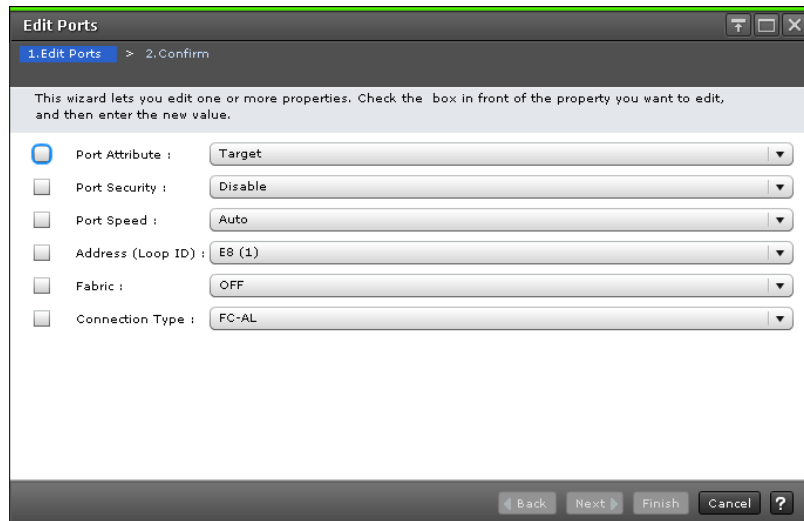


### Selected Remote Connections table

Item	Description
Connection Type	<ul style="list-style-type: none"> <li>▪ System: system-to-system connection.</li> <li>▪ CU: CU-to-CU connections.</li> </ul>
Local CU	Local system CU number.
Remote Storage System	<ul style="list-style-type: none"> <li>▪ Model / Serial Number: Model and serial number.</li> <li>▪ CU: CU number.</li> <li>▪ SSID: SSID number. TCz only.</li> </ul>
Path Group ID	TC only. Path group identifier.
Channel Type	Channel type for remote connections. <ul style="list-style-type: none"> <li>▪ Fibre: Port type of all remote paths in the remote connection is Fibre.</li> <li>▪ iSCSI: Port type of all remote paths in the remote connection is iSCSI.</li> <li>▪ Mixed: Port type of all remote paths in the remote connection is not the same (at least two are different).</li> </ul>
Status	Path status.
Number of Remote Paths	Number of remote paths including those being added.
Detail	Opens the <b>View Remote Connection Properties</b> window.

# Edit Ports window

## Fibre Channel



## For Fibre Channel ports

Item	Description
Port Attribute	Port I/O flow: <ul style="list-style-type: none"> <li>▪ Target: Receives I/O commands from a host</li> <li>▪ Bidirectional</li> </ul>
Port Security	LUN security (Enabled or Disabled)
Port Speed	Transfer speed, in Gbps, for the selected Fibre Channel port. If Auto is selected, the storage system automatically sets the data transfer speed to 4, 8, 16, or 32 Gbps. <b>Caution:</b> These cautions must be observed when setting speed on a Fibre Channel port: <ul style="list-style-type: none"> <li>▪ If a port supports 4, 8, 16 or 32 Gbps, use 4, 8, 16 or 32 Gbps for the port speed, respectively.</li> <li>▪ If the Auto Negotiation setting is required, some links might not be up when the server is restarted. Check the channel lamp. If it is flashing, disconnect the cable, and then reconnect it to recover from the link-down state.</li> <li>▪ If the port speed is set to Auto, some equipment might not be able to transfer data at the maximum speed.</li> </ul>



Item	Description
	<ul style="list-style-type: none"> <li>▪ When you start a storage system, HBA, or switch, check the host speed displayed in the Port list. If the transfer speed is different from the maximum speed, select the maximum speed from the list on the right, or disconnect, and then reconnect the cable.</li> <li>▪ The available port speed that is specified in Port Speed is limited due to the combination of the type of the Fibre Channel port and the topology that is specified in Connection Type.</li> <li>▪ If the transfer speed of the CHB (FC) port is set to Auto, the data might not be transferred at the maximum speed depending on the connected device. Confirm the transfer speed displayed in Speed in the Ports list when you start up the storage system, HBA, or switch. When the transfer speed is not the maximum speed, select the maximum speed from the list on the right or remove and reinsert the cable.</li> </ul>
Address (Loop ID)	Address of the selected port
Fabric	Whether a fabric switch is on or off
Connection Type	<p>Topology:</p> <ul style="list-style-type: none"> <li>▪ FC-AL: Fibre Channel arbitrated loop</li> <li>▪ P-to-P: Point-to-point</li> </ul> <p><b>Caution:</b> Some fabric switches require that you specify point-to-point topology. If you enable a fabric switch, check the documentation for the fabric switch to determine whether your switch requires point-to-point topology.</p>

## iSCSI

### For iSCSI ports

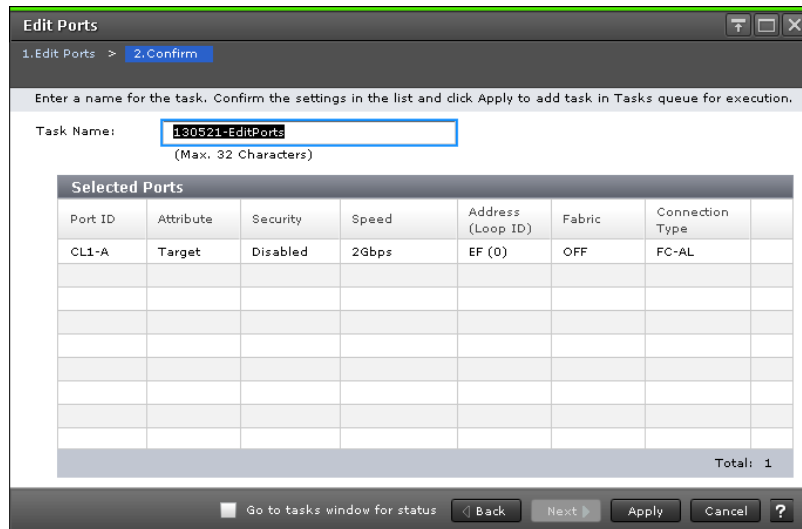
Item	Description
IPv4 Settings	<ul style="list-style-type: none"> <li>▪ IP Address: IP address of the port.</li> <li>▪ Subnet Mask: Subnet mask of the port.</li> <li>▪ Default Gateway: Default gateway of the port.</li> </ul> <p>If the iSCSI virtual port mode is enabled for the port, this item is not available.</p>
IPv6 Mode	<ul style="list-style-type: none"> <li>▪ Enable: IPv6 mode is enabled. If Enable is selected, the IPv6 Settings can be specified.</li> <li>▪ Disable: IPv6 mode is disabled.</li> </ul>

Item	Description
	If the iSCSI virtual port mode is enabled for the port, this item is not available.
IPv6 Settings	<ul style="list-style-type: none"> <li>▪ Link Local Address: Link local address for the port: <ul style="list-style-type: none"> <li>• Auto: Link local address is set automatically.</li> <li>• Manual: Link local address is set manually.</li> </ul> </li> <li>▪ Global Address: Global address for the port: <ul style="list-style-type: none"> <li>• Global Address: If Manual is selected, the global address must be entered.</li> <li>• Global Address 2: If Manual is selected, the global address 2 must be entered.</li> </ul> </li> <li>▪ Default Gateway: Default gateway address for the port.</li> </ul> <p>If the iSCSI virtual port mode is enabled for the port, this item is not available.</p>
Port Attribute	<p>Port I/O flow:</p> <ul style="list-style-type: none"> <li>▪ Target: Receives I/O command from a host</li> <li>▪ Bidirectional</li> </ul>
Port Security	<ul style="list-style-type: none"> <li>▪ Enable: LUN security is used on the port.</li> <li>▪ Disable: LUN security is not used on the port.</li> </ul>
Port Speed	The data transfer speed is fixed to 10 Gbps.
TCP Port Number	TCP port number. If the iSCSI virtual port mode is enabled for the port, this item is not available.
Selective ACK	<ul style="list-style-type: none"> <li>▪ Enable: Selective ACK is enabled.</li> <li>▪ Disable: Selective ACK is disabled.</li> </ul> <p>If the iSCSI virtual port mode is enabled for the port, this item is not available.</p>
Delayed ACK	<ul style="list-style-type: none"> <li>▪ Enable: Delayed ACK is enabled.</li> <li>▪ Disable: Delayed ACK is disabled.</li> </ul> <p>If the iSCSI virtual port mode is enabled for the port, this item is not available.</p>
Maximum Window Size	Maximum window size from 64 KB, 128 KB, 256 KB, 512 KB, or 1024 KB. If the iSCSI virtual port mode is enabled for the port, this item is not available.

Item	Description
Ethernet MTU Size	Ethernet MTU size from 1500 bytes, 4500 bytes, or 9000 bytes. If the iSCSI virtual port mode is enabled for the port, this item is not available.
Keep Alive Timer	Interval time to perform the keep alive timer option. If the iSCSI virtual port mode is enabled for the port, this item is not available.
VLAN Tagging Mode	<ul style="list-style-type: none"> <li>▪ Enable: VLAN tagging mode is enabled. VLAN ID must be entered.</li> <li>▪ Disable: VLAN tagging mode is disabled.</li> </ul> If the iSCSI virtual port mode is enabled for the port, this item is not available.
iSNS Server	<ul style="list-style-type: none"> <li>▪ Enable: iSNS server mode is enabled. The IP address and TCP port number must also be specified.</li> <li>▪ Disable: iSNS server mode is disabled.</li> </ul> If the iSCSI virtual port mode is enabled for the port, this item is not available.
IP Address	IP address for IPv4 or IPv6. If the iSCSI virtual port mode is enabled for the port, this item is not available.
TCP Port Number	TCP port number. If the iSCSI virtual port mode is enabled for the port, this item is not available.
CHAP User Name	CHAP user name
Secret	Secret to be used for host authentication
Re-enter Secret	Secret must be re-entered for confirmation

## Edit Ports confirmation window

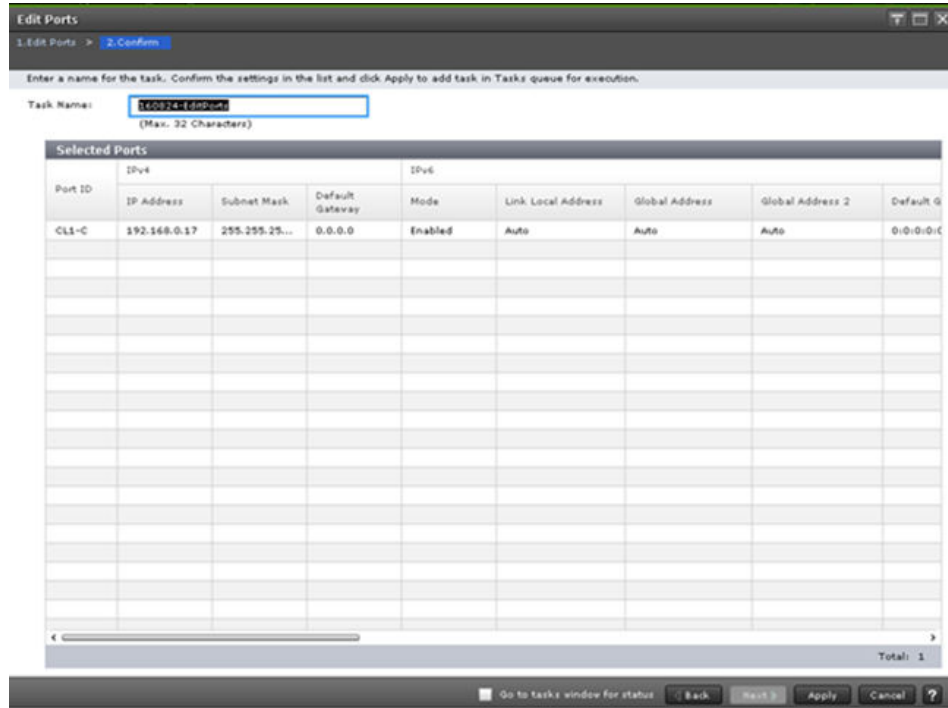
### Fibre Channel



### Selected Ports table for Fibre Channel ports

Item	Description
Port ID	Port ID
Attribute	Port I/O flow: <ul style="list-style-type: none"> <li>Target: Receives I/O commands from a host</li> <li>Bidirectional</li> </ul>
Security	LUN security (Enabled or Disabled) on the port
Speed	Data transfer speed for the selected Fibre Channel port in Gbps (Gigabits per second)
SFP Data Transfer Rate	SFP data transfer rate of 16 Gbps or 32 Gbps
Address (Loop ID)	Address of the selected port
Fabric	Status (ON or OFF) for a fabric switch
Connection Type	Topology of the selected port: <ul style="list-style-type: none"> <li>FC-AL: Fibre Channel arbitrated loop</li> <li>P-to-P: Point-to-point</li> </ul>

iSCSI



Selected Ports table for iSCSI ports

Item	Description
Port ID	Port ID
IPv4	<ul style="list-style-type: none"> <li>▪ IP Address: IP address of the port</li> <li>▪ Subnet Mask: Subnet mask of the port</li> <li>▪ Default Gateway: Default gateway of the port</li> </ul>
IPv6	<ul style="list-style-type: none"> <li>▪ Mode: IPv6 setting (Enabled or Disabled) for the port</li> <li>▪ Link Local Address: Link local address for the port</li> <li>▪ Global Address: Global address for the port</li> <li>▪ Global Address 2: Global address 2 for the port</li> <li>▪ Default Gateway: Default gateway address for the port</li> </ul>
Attribute	Port I/O flow: <ul style="list-style-type: none"> <li>▪ Target: Receives I/O commands from a host</li> <li>▪ Bidirectional</li> </ul>
Port Security	<ul style="list-style-type: none"> <li>▪ Enable: LUN security is enabled.</li> <li>▪ Disable: LUN security is disabled.</li> </ul>

Item	Description
Port Speed	Data transfer speed for the selected port: 1 Gbps, 10 Gbps, or Auto
TCP Port Number	Address of the selected port. TCP port number.
Selective ACK	<ul style="list-style-type: none"> <li>▪ Enable: Selective ACK is enabled.</li> <li>▪ Disable: Selective ACK is disabled.</li> </ul>
Delayed ACK	<ul style="list-style-type: none"> <li>▪ Enable: Delayed ACK is enabled.</li> <li>▪ Disable: Delayed ACK is disabled.</li> </ul>
Maximum Window Size	Maximum window size from 64 KB, 128 KB, 256 KB, 512 KB, or 1024 KB
Ethernet MTU Size	Ethernet MTU size from 1500 bytes, 4500 bytes, or 9000 bytes
Keep Alive Timer	Interval time to perform the keep alive timer option
VLAN	<ul style="list-style-type: none"> <li>▪ Tagging Mode: enabled or disabled for VLAN</li> <li>▪ ID: identifier of the VLAN</li> </ul>
iSNS Server	<ul style="list-style-type: none"> <li>▪ Mode: iSNS server setting (Enabled or Disabled)</li> <li>▪ IP Address: IP address of the iSNS server</li> <li>▪ TCP Port Number: TCP port number of the iSNS server</li> </ul>
CHAP Authentication	<ul style="list-style-type: none"> <li>▪ User Name: User name.</li> <li>▪ Secret: If the secret is specified, a character string of six asterisks (*) is displayed.</li> </ul>

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