



**Hitachi Freedom Storage™  
Lightning 9900™ V Series  
ShadowImage – S/390® User's Guide**



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- Added Host I/O Performance option information (Section 2.4.2, Figure 4.15).
- Changed the term "Storage Navigator PC" to "Storage Navigator computer".

# Preface

The *Hitachi Lightning 9900™ V Series ShadowImage - S/390® User's Guide* describes and provides instructions for performing ShadowImage - S/390® operations on the 9900V subsystem using the ShadowImage - S/390® Storage Navigator software. This user's guide assumes that:

- the user has a background in data processing and understands direct-access storage device (DASD) subsystems and their basic functions,
- the user is familiar with the Hitachi Lightning 9900™ V array subsystem and the 9900V Storage Navigator,
- the user has read and understands both the *Hitachi Lightning 9900™ V User and Reference Guide* and the *Hitachi Lightning 9900™ V Series Remote Console - Storage Navigator User's Guide*, and
- the user is familiar with the operating system (e.g., Windows®, Solaris®) and web browser software (e.g., Internet Explorer, Netscape Navigator) on the system hosting the 9900V Storage Navigator and ShadowImage Storage Navigator software.

**Note:** The term "9900V" refers to the entire Hitachi Freedom Storage™ Lightning 9900™ V Series subsystem family, unless otherwise noted. Please refer to the *Hitachi Lightning 9900™ V Series User and Reference Guide* (MK-92RD100) for further information on the 9900V RAID subsystems. For further information on the Storage Navigator computer, please refer to the *Hitachi Lightning 9900™ V Series Remote Console - Storage Navigator User's Guide* (MK-92RD101), or contact your Hitachi Data Systems account team.

**Note:** For information on performing ShadowImage operations from the UNIX®-based or PC-server host (instead of the 9900V Storage Navigator computer), please refer to the *Hitachi 9900V Command Control Interface User and Reference Guide*.

**Note:** The use of ShadowImage - S/390®, the ShadowImage - S/390® Storage Navigator Java applet program, and all other Hitachi Data Systems products is governed by the terms of your license agreement(s) with Hitachi Data Systems.

**Note:** The ShadowImage screens shown in this document were captured on a Windows® system with the Internet Explorer web browser. The ShadowImage screens may display differently on other operating systems and browsers. Please refer to the *9900V Remote Console - Storage Navigator User's Guide* for further information on UNIX® operating systems and browsers.

## Microcode Level

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### COMMENTS

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Make sure to include the document title, number, and revision.

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**Thank you!**

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# Chapter 1 Overview of Hitachi Copy Solutions

## 1.1 ShadowImage – S/390® and ShadowImage

The Hitachi ShadowImage - S/390® and ShadowImage features enable you to maintain subsystem-internal copies of all user data on the Hitachi Lightning 9900™ V Series (9900V) RAID storage subsystem for purposes such as data backup or duplication. The RAID-protected duplicate volumes are created within the same 9900V subsystem as the source volume at hardware speeds. ShadowImage - S/390® is used for S/390® data, and ShadowImage is used for UNIX®-based and PC server data. ShadowImage - S/390® can provide up to three duplicates of one source volume. Hitachi ShadowImage - S/390® and ShadowImage are key components of Hitachi Data Systems' solutions and service offerings.

ShadowImage - S/390® (SI390) operations are nondisruptive and allow the source (main) volume of each volume pair to remain online to all hosts for both read and write I/O operations. Once established, SI390 operations continue unattended to provide asynchronous internal data backup. Usability is further enhanced through a resynchronization capability that reduces data duplication requirements and backup time, thereby increasing user productivity. ShadowImage - S/390® also supports reverse resynchronization for maximum flexibility.

The licensed 9900V Hitachi Storage Navigator software allows you to configure the ShadowImage option on the 9900V subsystem. The 9900V Storage Navigator software communicates directly with the 9900V subsystem via a LAN. For further information on the 9900V Storage Navigator software, please refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator User's Guide* (MK-92RD101).

This user's guide describes and provides instructions for performing ShadowImage - S/390® operations using the licensed ShadowImage - S/390® software for the 9900V Storage Navigator computer and PPRC TSO or PPRCOPY ICKDSF commands:

- For operating systems which do not support PPRC/PPRCOPY commands, ShadowImage - S/390® operations are performed using the 9900V Storage Navigator computer. The ShadowImage - S/390® Storage Navigator software displays detailed SI390 information and allows you to perform SI390 operations. The Storage Navigator computer is attached to and communicates with the 9900V subsystems via the 9900V-internal LAN. For further information on the Storage Navigator computer, refer to the *Hitachi Lightning 9900™ V Series Remote Console - Storage Navigator User's Guide*.
- ShadowImage - S/390® is functionally compatible with the industry-standard IBM Peer-to-Peer Remote Copy (PPRC) host software functions. PPRC TSO commands and/or PPRCOPY ICKDSF commands may be used to perform ShadowImage - S/390® operations on the 9900V subsystem. See Chapter 5 for further information on using TSO/ICKDSF commands with the 9900V subsystem.
- ShadowImage - FlashCopy® is functionally compatible with the IBM FlashCopy® host software function. PPRC TSO commands and/or DFSMSdss commands may be used to perform ShadowImage - FlashCopy® operations on the 9900V subsystem. See *Hitachi Freedom Storage™ 9900 V Series FlashCopy® User Guide*, MK-92RD138-0 for further information on using PPRC TSO commands and DFSMSdss commands.

- ShadowImage - S/390® operations can be performed in conjunction with Hitachi TrueCopy - S/390® operations to provide additional remote copies of S/390 volumes. ShadowImage - S/390® also supports the Virtual LVI/LUN and FlashAccess features, ensuring that all S/390® user data on the 9900V subsystem can be duplicated by ShadowImage - S/390® operations. See section 3.4 for further information on combining ShadowImage - S/390® with these and other data management features.

This document does not cover ShadowImage operations for open-system and PC-server data. For information and instructions on performing ShadowImage operations, please refer to the *Hitachi Lightning 9900™ V Series ShadowImage User's Guide* (MK-92RD110).

**Note:** The use of ShadowImage - S/390® and all other Hitachi Data Systems products is governed by the terms of your license agreement(s) with Hitachi Data Systems.

## 1.2 Hitachi TrueCopy – S/390®

The Hitachi TrueCopy - S/390® (TC390) feature of the Hitachi Lightning 9900™ V subsystem enables you to create and maintain remote copies of the data stored on the 9900V subsystem for data backup and disaster recovery purposes. TrueCopy - S/390® provides synchronous and asynchronous copy modes to accommodate a wide variety of user requirements and data copy/movement scenarios. TC390 operations can be performed across distances of up to 30 km (18.6 miles) using single-mode longwave optical fibre cables in a switch configuration. Long-distance solutions are provided, based on user requirements and workload characteristics, using approved channel extenders and communication lines.

TrueCopy - S/390® can be used in conjunction with ShadowImage - S/390® to provide multiple copies of volumes at both your main (primary) and remote (secondary) sites. See section 3.4.1 for further information on combining ShadowImage - S/390® and TrueCopy - S/390®. This user's guide does not cover TrueCopy - S/390® operations. Please refer to the *Hitachi Lightning 9900™ V TrueCopy - S/390® User and Reference Guide* for further information on TrueCopy - S/390® operations.

## 1.3 Hitachi NanoCopy

Hitachi NanoCopy™ is the storage industry's first hardware-based solution which enables customers to make Point-in-Time (PiT) copies without quiescing the application or causing any disruption to end-user operations. NanoCopy is based on TC390 Asynchronous (TC390A), which is used to move large amounts of data over any distance with complete data integrity and minimal impact on performance. TC390 Asynchronous can be integrated with third-party channel extender products to address the "access anywhere" goal of data availability. TC390 Asynchronous enables production data to be duplicated via ESCON® or communication lines from a main (primary) site to a remote (secondary) site that can be thousands of miles away.

For further information on Hitachi NanoCopy™, please contact your Hitachi Data Systems account team.

## 1.4 HXRC and Concurrent Copy (CC)

The HXRC feature of the Hitachi Lightning 9900™ V subsystem is functionally compatible with the industry-standard IBM Extended Remote Copy (XRC) S/390® host software function. HXRC is also compatible with the DFSMS data mover which is common to the XRC environment. HXRC operations are performed in the same manner as XRC operations, by issuing XRC TSO commands from the host system to the 9900V subsystem. HXRC can also be used in conjunction with ShadowImage - S/390® to provide multiple copies of volumes at both your main (primary) and remote (secondary) sites. The HXRC feature must be enabled using the 9900V Storage Navigator computer.

The Hitachi Lightning 9900™ V subsystem is also functionally compatible with the IBM 3990 Concurrent Copy (CC) function.

Please contact your Hitachi Data Systems account team for further information on the 9900V HXRC and CC features.

**Note:** HXRC and CC operations, as well as TrueCopy Asynchronous, require additional cache to store the asynchronous recordsets. If you are performing HXRC and/or CC operations in addition to TrueCopy Asynchronous on the same 9900V subsystem, you must make sure that the subsystem has adequate cache installed and available to support the asynchronous copy workloads. Please contact your Hitachi Data Systems account team to determine how much cache will be needed for your operational configuration.



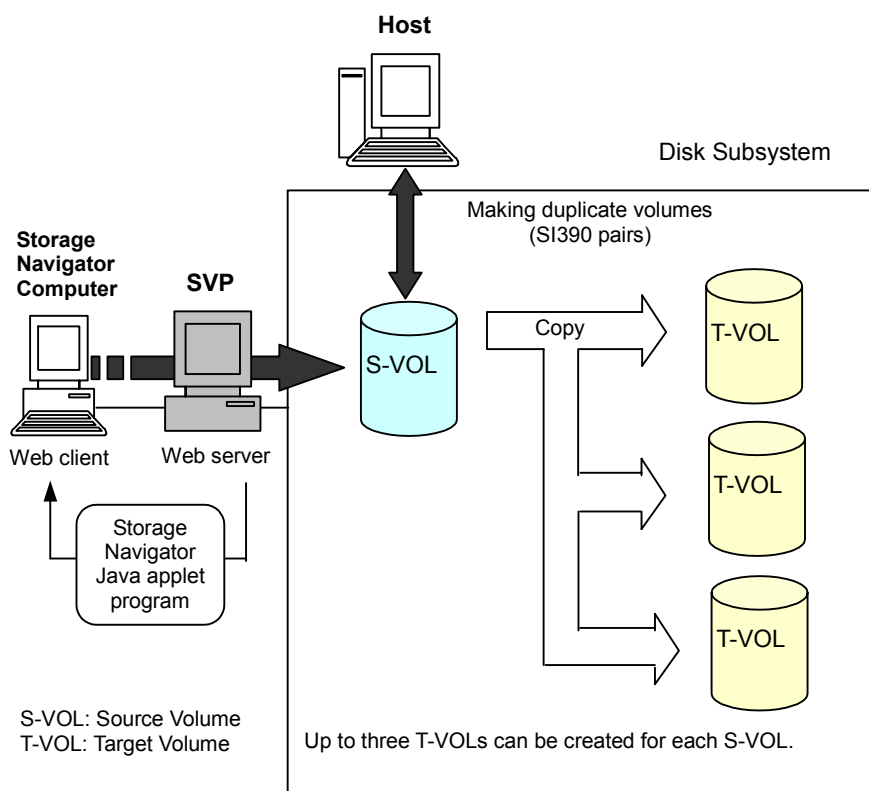
## Chapter 2 Overview of ShadowImage – S/390® Operations

Hitachi ShadowImage - S/390® is a storage-based hardware solution for duplicating logical volumes which reduces backup time and provides point-in-time backup. The SI390 source volumes (S-VOLs) contain the original data, and the SI390 target volume(s) (T-VOLs) contain the duplicate data. The user can choose to make up to three copies of each S-VOL. And since each T-VOL is paired with its S-VOL independently, each T-VOL can be maintained as an independent copy set that can be split, resynchronized, and deleted separately from the other T-VOLs assigned to the same S-VOL.

### 2.1 ShadowImage – S/390® Components

ShadowImage - S/390® operations involve the source and target volumes in the Hitachi Lightning 9900™ V subsystem, the Storage Navigator Java applet program downloaded from the connected SVP, and (optionally) the IBM PPRC host software functions. Figure 2.1 shows a typical ShadowImage - S/390® configuration. The SI390 system components are:

- ShadowImage - S/390® volume pairs (S-VOLs and T-VOLs) (see section 2.1.1),
- Storage Navigator Java applet program downloaded from the 9900V SVP (Web server) to the Storage Navigator computer (Web client) (see section 2.1.2), and
- (Optional) IBM PPRC host software functions (see section 2.1.3).
- (Optional) IBM DFSMSdss host software functions (see section 2.1.3).



**Figure 2.1 ShadowImage – S/390® Components**



## 2.1.1 Volume Pairs (S-VOLs and T-VOLs)

The Hitachi Lightning 9900™ V subsystem contains and manages both the original and copied ShadowImage - S/390® data. ShadowImage - S/390® supports a maximum of 8,192 pairs (4,096 pairs: 4,096 S-VOLs and 4,096 T-VOLs).

ShadowImage - S/390® performs internal copy operations for logical volume pairs established by the user. Each SI390 pair consists of one source volume (S-VOL) and up to three target volumes (T-VOLs) which are located in the same 9900V subsystem. The SI390 S-VOLs are the source volumes which contain the original data. The SI390 T-VOLs are the target or secondary (mirrored) volumes which contain the backup data. Each T-VOL must be paired with only one S-VOL. During normal SI390 operations, the S-VOLs remain available to all hosts at all times for read and write I/O operations. The T-VOLs become available for host access only after a split operation has been performed.

When an SI390 volume pair is added, the data on the S-VOL is copied to the T-VOL. During this initial copy operation and after the pair status becomes *duplex*, all write operations to the T-VOL are prohibited. If you need to access a T-VOL, you can “split” the pair to make the T-VOL accessible (the S-VOL is always accessible). While an SI390 pair is split, the 9900V subsystem keeps track of all changes to the S-VOL and T-VOL as a differential bitmap. When you “resync” the pair, the differential data in the S-VOL (due to S-VOL and T-VOL updates) is copied to the T-VOL so that the T-VOL is again identical to the S-VOL.

**Note:** ShadowImage - S/390® T-VOLs are updated asynchronously. For a volume pair with *duplex* status, the S-VOL and T-VOL may not be identical. For further information on ShadowImage - S/390® update copy operations, please see section 2.3.2.

**Note:** ShadowImage - S/390® S-VOLs or T-VOLs should not be concentrated in the same RAID group. To disperse workloads of the RAID groups, each RAID group should have both S-VOLs and T-VOLs evenly distributed. SI390 pairs for which an SI390 operation is performed simultaneously should be in different RAID groups. If ShadowImage - S/390® pairs are concentrated in only a few RAID groups, the host I/O performance may be degraded. To minimize effect on the host I/O performance, take the following actions:

- Specify **Slower** for the copy pace when you create, split, or resync SI390 pairs.
- If SI390 pairs that you want to perform copy operation are in the same ECC group, reduce the number of pairs at one copy operation. For example, if you want to split multiple SI390 pairs in the same ECC group, wait until one pair is completely split before splitting another pair.

If the 9900V subsystem is overloaded, you must increase cache, disk adapters, and/or RAID groups. It is recommended that ShadowImage - S/390® T-VOLs are assigned in the newly installed RAID groups. If you continue ShadowImage - S/390® operations with an overloaded 9900V subsystem, host I/O performance may be degraded.

## 2.1.2 ShadowImage – S/390® on the 9900V Storage Navigator Computer

The ShadowImage - S/390® for the 9900V Storage Navigator computer displays SI390 information and enables you to perform SI390 operations. The ShadowImage - S/390® runs on the web browser on the Storage Navigator computer and communicates with the SVP of the connected subsystem via the 9900V-internal LAN. The Storage Navigator computer can be attached to multiple 9900V subsystems. The Storage Navigator computer acquires status from and issues commands to both the ShadowImage - S/390® S-VOLs and the ShadowImage - S/390® T-VOLs.

**Note:** If the 9900V Storage Navigator computer is not installed, please contact your Hitachi Data Systems account team for information on ShadowImage - S/390® configuration services.

## 2.1.3 IBM PPRC Host Software Functions

ShadowImage - S/390® supports the IBM PPRC host software functions, including TSO PPRC commands and ICKDSF PPRCOPY commands. ShadowImage - S/390® pairs can be added, split, resynced, and deleted using TSO PPRC or ICKDSF PPRCOPY commands. Chapter 5 describes and provides instructions for using PPRC commands to create and maintain SI390 volume pairs on the Hitachi Lightning 9900™ V subsystem. ShadowImage - FlashCopy® also supports the IBM TSO PPRC commands and DFSMSdss commands. ShadowImage - FlashCopy® pairs can be established by defining “relationship” using TSO PPRC or DFSMSdss commands. For instructions on using TSOPPRC and DFSMSdss commands to define ShadowImage - FlashCopy® relationship, please refer to *Hitachi Lightning 9900™ V Series ShadowImage - FlashCopy® Extension User's Guide*.

## 2.2 ShadowImage – S/390® Requirements

ShadowImage – S/390® operations provide subsystem-internal copies of S/390® logical volume images (LVIs) on the Hitachi Lightning 9900™ V subsystem. Table 2.1 lists and describes the operational requirements for ShadowImage – S/390®.

**Table 2.1 ShadowImage – S/390® Requirements**

Parameter	Specification
Pair objects	Logical devices (LDEVs): 3390-x and 3380-x, including custom-size devices (e.g., 3390-3-CVS) and HRX devices (e.g., 3390-3A, -3B, -3C). Devices must be installed and formatted. The S-VOL and T-VOL must be same type and same size (e.g., 3390-3R to 3390-3R allowed, 3380-K to 3390-9 not allowed). A combination of M/F and HRX devices for creating a ShadowImage pair is supported, but this operation can only be performed by the host. A custom-size S-VOL must be paired with a T-VOL of the same type and same size.
Number of copies	Maximum three copies (T-VOLs) per source volume (S-VOL).
Maximum number of pairs	2048 pairs per 9900V subsystem (2048 S-VOLs and 2048 T-VOLs). When pairs include more than one T-VOL, the maximum number of S-VOLs decreases (e.g., if there are three T-VOLs per S-VOL: $4096 \div 4 = 1024$ S-VOLs max).
Maximum number of reserved volumes	2048 reserved volumes per 9900V subsystem.
Combinations of RAID levels	All combinations supported: RAID1-RAID1, RAID5-RAID5, RAID1-RAID5, RAID5-RAID1.
Dynamic sparing and auto correction copy	If a failure occurs that requires use of dynamic sparing or automatic correction copy, the status of the paired volumes associated with the failed physical device will not be affected.
Physical device (PDEV) maintenance	If a PDEV requires maintenance, the status of the logical volumes associated with that PDEV will not be affected. However, if PDEV maintenance requires access to a ShadowImage – S/390® pair volume, the pair must be deleted, and the <b>Reserve</b> attribute must be reset (unreserved).
Logical device maintenance	LDEV maintenance cannot be performed on LDEVs which are assigned to ShadowImage – S/390® pairs. If LDEV maintenance requires access to a ShadowImage – S/390® LDEV, the pair must be deleted, and the <b>Reserve</b> attribute must be reset (unreserved).
Cache maintenance	If 9900V cache maintenance is performed during a period of high I/O usage, one or more ShadowImage – S/390® pairs may be suspended. Reduce the I/O load before cache maintenance.
Point-in-time backup	For duplex pairs, host I/Os are copied to the T-VOL asynchronously. If you want to synchronize a pair and then access the T-VOL as soon as possible, vary the S-VOL offline and then split the pair before using the T-VOL.
Failures	When a failure of any kind prevents a ShadowImage – S/390® copy operation from completing, the pair is suspended. If an LDEV failure occurs, the pair is suspended. If a PDEV failure occurs, ShadowImage – S/390® pair status is not affected because of the RAID architecture.
Maintenance/Update	When the subsystem maintenance is performed, or the microprogram is updated, you may have to add ShadowImage – S/390® pairs again.

## 2.3 ShadowImage – S/390® Operations

ShadowImage - S/390® operations can be performed using the ShadowImage - S/390® using the Java applet program for ShadowImage - S/390®, or from the S/390® host using TSO and/or ICKDSF commands. For further information on using TSO/ICKDSF commands to set up and maintain ShadowImage - S/390® volume pairs, please see Chapter 5. Your Hitachi Data Systems representative can also perform ShadowImage - S/390® operations for you using the 9900V service processor (SVP). For information on ShadowImage - S/390® configuration services, please contact your Hitachi Data Systems account team.

### 2.3.1 Setting/Resetting Reserve Attribute Operation

The ShadowImage - S/390® set reserve attribute operation reserves a volume so that it can be used as an SI390 T-VOL. Reserved volumes can only be used as SI390 T-VOLs. The 9900V subsystem rejects all write operations to reserved volumes (unless in split status). You can reserve up to 4,096 volumes in one 9900V subsystem. The Set Reserve Attribute panel (see section 4.3) allows you to reserve volumes for use as T-VOLs.

The ShadowImage - S/390® reset reserve attribute operation unreserves a volume so that it can be varied online and accessed by hosts. After you reset the reserve attribute, the 9900V will accept all subsequent read and write I/O operations to the volume. The Reset Reserve Attribute panel (see section 4.4) allows you to unreserve volumes.

**Note:** When TSO or ICKDSF commands are used to establish ShadowImage - S/390® pairs, the T-VOLs do not need to be reserved. The CESTPAIR and PPRCOPY ESTPAIR commands require that potential T-VOLs be offline to the host.

## 2.3.2 Add Pair Operation

The ShadowImage - S/390® add pair operation establishes the new specified SI390 pair(s). The volume which will be the S-VOL must be in the simplex state, and the volume which will be the T-VOL must be reserved (if assigned automatically) and simplex before being added to an SI390 pair. The Add Pair Dialog panel (see section 4.5) allows you to add (start) new SI390 volume pairs.

**Note:** The CESTPAIR and PPRCOPY ESTPAIR commands allow you to add (start) ShadowImage - S/390® pairs. See Chapter 5 for further information on PPRC commands.

### Initial Copy Operation

The ShadowImage - S/390® initial copy operation takes place when you add a new SI390 pair (see Figure 2.2). The initial copy operation copies all data on the S-VOL to the associated T-VOL(s). The S-VOL remains available to all hosts for read and write I/Os throughout the initial copy operation. Write operations performed on the S-VOL during the initial copy operation will be duplicated at the T-VOL(s) by update copy operations after the initial copy is complete. The status of each pair is *pending* while the initial copy operation is in progress. The pair status changes to *duplex* when the initial copy operation is complete.

When adding pairs, you can select the pace for the initial copy operations: slower, medium, or faster. The slower pace minimizes the impact of SI390 operations on subsystem I/O performance, while the faster pace completes the initial copy operations as quickly as possible.

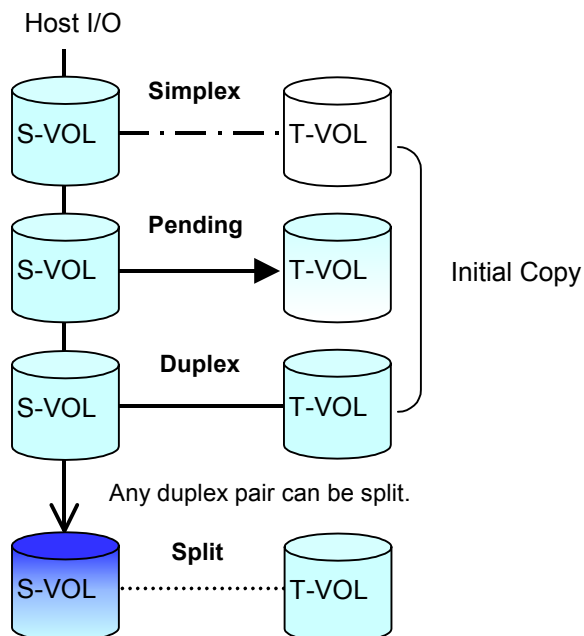


Figure 2.2 Adding a Pair

## Update Copy Operation

The ShadowImage - S/390® update copy operation updates the T-VOL of an SI390 pair after the initial copy operation is complete. Update copy operations take place only for duplex pairs. As write I/Os are performed on a duplex S-VOL, the 9900V stores a map of the S-VOL differential data, and then performs update copy operations periodically based on the amount of differential data present on the S-VOL as well as the elapsed time between update copy operations. Figure 2.3 illustrates an update copy operation in a ShadowImage - S/390® pair with only one T-VOL. Update copy operations are not performed for SI390 pairs with the following status: *pending*, *SP-pend*, *V-Split*, *split*, *resync*, *resync-R*, and *suspend*.

**Note:** Update copy operations do not occur every time a host issues a write I/O operation to the S-VOL of a ShadowImage - S/390® pair. SI390 update copy operations are performed asynchronously according to the differential bitmap, which is stored in shared memory. If shared memory is lost (e.g., offline micro exchange, volatile PS on), the differential bitmap is also lost. In this case the 9900V treats the entire S-VOL (T-VOL for *resync-R* pairs) as difference data and recopies all data to the T-VOL (S-VOL for *resync-R* pairs) to ensure proper pair resynchronization. For pairs with *SP-pend* or *V-Split* status, the 9900V changes the status to *suspend* due to the loss of the differential bitmap, ensuring proper resynchronization of these pairs. If shared memory has been lost, please allow extra time for SI390 operations.

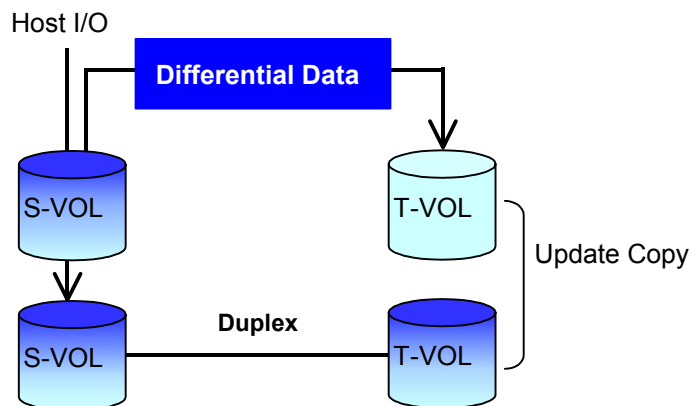


Figure 2.3 Update Copy Operation

### 2.3.3 Split Pair Operation

The ShadowImage - S/390® split capability provides point-in-time backup of your data, and also facilitates real data testing by making the SI390 copies (T-VOLs) available for host access. The SI390 split operation performs all pending T-VOL updates (those issued prior to the split command and recorded in the S-VOL track map) to make the T-VOL identical to the state of the S-VOL when the split command was issued. When the split operation is complete, the 9900V stops performing further update copy operations to the T-VOL, but continues accepting write I/O operations to the S-VOL. If subsequent write I/O operations are accepted, the 9900V keeps track of the S-VOL tracks which are updated while the pair is split. While the pair is split, the 9900V also provides full read/write access to the split T-VOL and keeps track of the T-VOL tracks which are updated while the pair is split. When a split pair is resynced, the 9900V merges the T-VOL track map into the S-VOL track map and copies all flagged tracks from the S-VOL to the T-VOL. This method ensures that the S-VOL and T-VOL are correctly resynchronized and also reduces the time needed to resynchronize the pair.

The Split Volume Pair panel (see section 4.6) allows you to split existing SI390 pairs, and also allows you to add and split new SI390 pairs in one step.

- When splitting pairs, you can select the pace for the pending update copy operation(s): **slower**, **medium**, and **faster**. The slower pace minimizes the impact of SI390 operations on subsystem I/O performance, while the faster pace splits the pairs as quickly as possible.
- When splitting pairs, you can also select the split type: **Quick Split** or **Steady Split**.
  - When the quick split operation starts, the pair status changes to *V-split*, the T-VOL is available immediately for read and write I/Os, and the 9900V performs all pending update copy operations to the T-VOL in the background. When the quick split operation is complete, the pair status changes to *split*, and you have full read/write access to the split T-VOL (even though it is still reserved). The S-VOL also remains fully accessible.
  - When the steady split operation starts, the pair status changes to *SP-pending*, and the 9900V performs all pending update copy operations to the T-VOL. When the steady split operation is complete, the pair status changes to *split*, and you have full read/write access to the split T-VOL (even though it is still reserved). The S-VOL also remains fully accessible.

When the pair status changes to *split*, the 9900V establishes a track map for the split S-VOL and T-VOL and records all updates to **both** volumes. Split operations cannot be performed on suspended pairs.

**Note:** The CSUSPEND and PPRCOPY SUSPEND commands allow you to split SI390 volume pairs. See Chapter 5 for further information on using PPRC commands to perform ShadowImage - S/390® operations on the 9900V subsystem.

## 2.3.4 Resynchronize Pair Operations (Normal, Quick, Reverse, Quick Restore)

ShadowImage - S/390® allows you to perform four types of resync operations:

- **Normal.** The normal resync operation (see Figure 2.4) resynchronizes the T-VOL with the S-VOL. The copy direction for a normal resync operation is S-VOL to T-VOL. The pair status during a normal resync operation is *resync*, and the S-VOL remains accessible to all hosts for both read and write operations during a normal resync operation. The T-VOL becomes inaccessible to all hosts during a normal resync operation.
- **Quick.** The quick resync operation speeds up the normal resync operation by copying the S-VOL differential data map only without copying the S-VOL data to the T-VOL. The S-VOL and the T-VOL are resynchronized when update copy operations are performed for duplex pairs. The pair status during a quick resync operation is *resync* until the differential map is copied, and the S-VOL remains accessible to all hosts for both read and write operations. The T-VOL becomes inaccessible to all hosts during a quick resync operation.
- **Reverse.** The reverse resync operation (see Figure 2.5) synchronizes the S-VOL with the T-VOL. The copy direction for a reverse resync operation is T-VOL to S-VOL. Table 2.2 lists the operational requirements for the reverse resync operation. The pair status during a reverse resync operation is *resync-r*, and the S-VOL and T-VOL become inaccessible to all hosts for write operations during a reverse resync operation. As soon as the reverse resync operation is complete, the S-VOL becomes accessible. The reverse resync operation can only be performed on split pairs, not on suspended pairs.
- **Quick Restore.** The quick restore operation (see Figure 2.5) speeds up the reverse resync operation by changing the volume map in the 9900V subsystem to swap the contents of the S-VOL and T-VOL without copying the T-VOL data to the S-VOL. The S-VOL and T-VOL are resynchronized when update copy operations are performed for pairs in the *duplex* status. The pair status during a quick restore operation is *resync-r* until the volume map change is complete. The S-VOL and T-VOL become inaccessible to all hosts for write operations during a quick restore operation. Table 2.2 lists the operational requirements for the quick restore operation.

**Caution:** During the quick restore operation, the **RAID levels**, **FlashAccess settings**, and **HDD types** of the S-VOL and T-VOL are exchanged. For example, if the S-VOL has a RAID-1 level and the T-VOL has a RAID-5 level, the quick restore operation changes the RAID level of the S-VOL to RAID-5 and of the T-VOL to RAID-1. To avoid any performance impact due to the quick restore operation:

1. Make sure that the S-VOL and T-VOL have the same RAID level and HDD type before performing the quick restore operation. If you want to restore the original RAID levels after quick restore, stop host I/Os to the pair, split the pair, perform the quick restore operation for that pair again, and then restart the host I/Os to the pair.



2. Because the FlashAccess settings are exchanged during a quick restore operation, you must perform one of the two following operations. If you do not, the change of location of the cache residence areas may cause I/O performance to the FlashAccess data to be down.
  - a) Set the same FlashAccess settings (locations) for the source volume and target volume before performing the quick restore operation.
  - b) Release the FlashAccess settings of the source and target volumes before the quick restore operation, and then reset the FlashAccess settings of the source and target volumes after the pair changes to *duplex* status as a result of the quick restore operation.

If you do not want the S-VOL and T-VOL to be resynchronized after the quick restore operation, you must set the Swap&Freeze option before performing the quick restore operation (see sections 2.4.1 and 0).

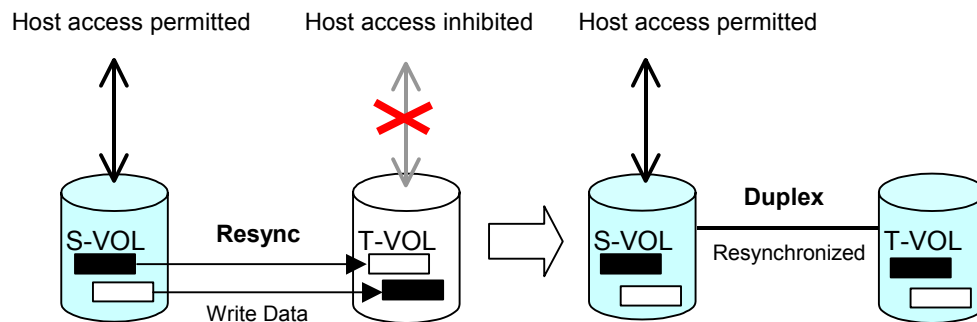


Figure 2.4 Normal and Quick Resync Operations

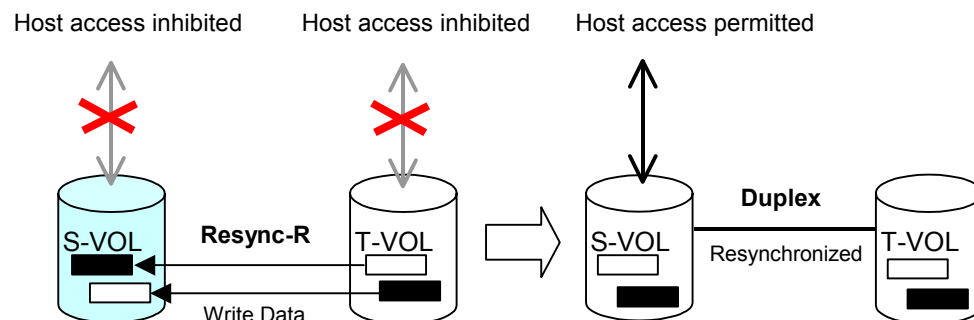


Figure 2.5 Reverse Resync and Quick Restore Operations

**Table 2.2 Reverse Resync and Quick Restore Requirements**

Parameter	Requirement(s)
Reverse resync or quick restore command.	<p>The specified pair must be in the <i>split</i> state. If not, the reverse resync or quick restore command will be rejected.</p> <p>All other pairs which share the same S-VOL as the specified pair must also be in the <i>split</i> or <i>suspended</i> state. If not, the reverse resync or quick restore command will be rejected.</p> <p>The specified pair must NOT be an HRX volume pair. If the specified pair is an HRX volume pair, the reverse resync or quick restore command will be rejected.</p>
Reverse resync or quick restore command issued to a shared SI390/TC390 volume.	<p>If the ShadowImage – S/390® and TrueCopy – S/390® pairs share the same volume (S-VOL = M-VOL, T-VOL = M-VOL, or S-VOL = R-VOL), and the TC390 pair is not in the <i>suspend</i> status, the reverse resync and quick restore operations cannot be performed. (The command will be rejected.)</p> <p>During the reverse resync or quick restore operation, a TrueCopy – S/390® pair cannot be created. The TC390 add pair command will be rejected when the SI390 pair status is <i>resync-r</i>.</p>
Effect on other pairs which share the S-VOL.	<p>If the reverse resync or quick restore operation is performed on one ShadowImage – S/390® pair in a 1-to-n configuration (n&gt;1), the S-VOL and the other T-VOLs are no longer synchronized. While this reverse resync or quick restore is in progress, you cannot perform add, split, or resync pair for any other pair which shares the same S-VOL (delete pair and suspend pair are allowed).</p>
Reverse resync or quick restore ends abnormally; OR Suspend pair is requested during reverse resync or quick restore.	<ol style="list-style-type: none"> <li>1. The pair status changes to <i>suspended</i>.</li> <li>2. The S-VOL of the <i>suspended</i> pair is read/write-enabled for all hosts; however, the data on the S-VOL is not guaranteed. The T-VOL of the suspended pair remains read/write-disabled.</li> <li>3. The status of other ShadowImage – S/390® pairs which share the same S-VOL does not change.</li> </ol>

ShadowImage - S/390® allows you to perform normal/quick resync operations on split and suspended pairs, but reverse resync operations can only be performed on split pairs:

- **Resync for split pair.** When a normal/quick resync operation is performed on a split pair, the 9900V merges the T-VOL track map into the S-VOL track map and then copies all differential data from the S-VOL to the T-VOL. When a reverse resync or quick restore operation is performed on a split pair, the 9900V merges the S-VOL track map into the T-VOL track map and then copies all differential data from the T-VOL to the S-VOL. This ensures that the S-VOL and T-VOL are properly resynchronized in the desired direction, and also greatly reduces the time needed to resynchronize the pair.
- **Resync for suspended pair.** When a normal/quick resync operation is performed on a suspended pair, the 9900V copies all data on the S-VOL to the T-VOL, since all S-VOL tracks were flagged as difference data when the pair was suspended. Reverse pairresync and quick restore operations cannot be performed on suspended pairs. The normal resync operation for suspended pairs is equivalent to and takes as long as the SI390 initial copy operation.

The Resynchronize Volume Pair panel (see section Figure 4.11) allows you to resynchronize split and suspended ShadowImage - S/390® pairs. When the resync operation starts, the pair status changes to *resync* or *resync-r*. When the resync is complete, the pair status changes to *duplex*. The 9900V resumes SI390 update copy operations after the pair status changes to *duplex*. The S-VOL remains fully accessible during a normal/quick resync operation, but becomes inaccessible to all hosts during a reverse resync or quick restore operation. This ensures that the data on the S-VOL is identical to the data on the T-VOL when the reverse resync or quick restore operation completes.

When resynchronizing pairs, you can select the pace for the resync operation(s): slower, medium, and faster. The slower pace minimizes the impact of ShadowImage - S/390® operations on subsystem I/O performance, while the faster pace resynchronizes the pair(s) as quickly as possible. The quick resync option provides the fastest normal resync operation.

**Note:** The CESTPAIR and PPRCOPY ESTPAIR commands allow you to resynchronize split ShadowImage - S/390® volume pairs. See Chapter 5 for further information on using PPRC commands to perform ShadowImage - S/390® operations on the 9900V subsystem.

**Note:** After an SI390 reverse resync or quick restore operation is performed, make sure that the pair status changes to *duplex* before performing a TC390 resume pair operation. If you perform the TC390 resume pair operation before the pair status changes to *duplex*, the command (resume pair operation) will be rejected.

### 2.3.5 Suspend Pair Operation

The ShadowImage - S/390® suspend pair operation suspends the update copy operations to the T-VOL of the pair. A ShadowImage - S/390® pair can be suspended by the user at any time. When a ShadowImage - S/390® pair is suspended, the 9900V stops performing update copy operations to the T-VOL, continues accepting write I/O operations to the S-VOL, and marks the entire S-VOL track map as difference data. When a resync operation is performed on a suspended pair, the entire S-VOL is copied to the T-VOL. Reverse resync and quick restore cannot be performed on suspended pairs. While the resync operation for a split pair can be very fast, the resync operation for a suspended pair will take as long as the initial copy operation.

The 9900V subsystem will automatically suspend a ShadowImage - S/390® pair when it cannot keep the pair mirrored for any reason. When the 9900V suspends a pair, sense information is generated to notify the host. The 9900V will automatically suspend a ShadowImage - S/390® pair under the following conditions:

- When the volume pair has been suspended or deleted from the host using TSO or ICKDSF commands,
- When the 9900V detects an error condition related to an update copy operation.
- When the S-VOL and/or T-VOL track map in shared memory is lost (e.g., due to offline microprogram exchange). This applies to *SP-pend* and *V-split* pairs only. For *duplex*, *split*, *resync*, or *resync-r* pairs, the pair is not suspended but the entire S-VOL (T-VOL for reverse resync) is marked as difference data.

The Suspend Volume Pair panel (see section 4.8) allows you to suspend SI390 pairs. When a pair is suspended, the pair status changes to *suspended*. When the resync operation starts, the pair status changes to *resync*. The S-VOL remains fully accessible while suspended and during the resync operation. The Resynchronize Volume Pair panel (see section Figure 4.11) allows you to resynchronize suspended SI390 pairs.

**Note:** The PPRC commands do not support the ShadowImage - S/390® suspend operation. You must use the ShadowImage - S/390® Storage Navigator software to suspend SI390 pairs. The CSUSPEND and PPRCOPY SUSPEND commands execute a ShadowImage - S/390® split operation instead of a suspend operation. See Chapter 5 for further information on using PPRC commands to perform ShadowImage - S/390® operations on the 9900V subsystem.

### 2.3.6 Delete Pair Operation

The ShadowImage - S/390® delete pair operation stops the ShadowImage - S/390® update copy operations to the T-VOL of the pair and changes the pair status of both volumes to *simplex*. A ShadowImage - S/390® pair can be deleted by the user at any time except during the quick split operation (i.e., any status except *simplex* and *V-split*). After you delete an SI390 pair, the T-VOL is still not available for write operations until the reserve attribute is reset.

The Delete Volume Pair panel (see section Figure 4.13) allows you to delete ShadowImage - S/390® pairs. When a ShadowImage - S/390® pair is deleted, pending update copy operations for the pair are discarded, and the status of the S-VOL and T-VOL is changed to *simplex*.

**Caution:** The T-VOL of a duplex pair may not be identical to its S-VOL, due to the asynchronous ShadowImage - S/390® update copy operations. To synchronize the volumes before deleting the pair, you must split the pair first (see section 4.6 for instructions).

## 2.4 ShadowImage – S/390® Options

ShadowImage - S/390® allows you to set thirty-two types of options for the SI390 operations. By using the SI390 options, you may enhance SI390 operations such as the add pair and resync pair operations.

**Table 2.3** Types of ShadowImage – S/390® Options

No.	Option Type	Requirement
1	Swap&Freeze (Refer to 2.4.1)	The ShadowImage – S/390® quick restore operation can be performed on the 9900V subsystem. If the 9900V setting disables the quick restore operation, you must change the setting to use the Swap&Freeze option.
2	Host I/O Performance (Refer to section 2.4.2)	—
3 – 32	Reserved (Currently unavailable)	—

**Note:** The number of available option types depends on the user's 9900V subsystem settings.

## 2.4.1 Swap&Freeze Option

The Swap&Freeze option allows the S-VOLs of a ShadowImage - S/390® pair to remain unchanged after the quick restore operation. If the quick restore operation is performed on an SI390 pair with the Swap&Freeze option, update copy operations are suppressed, and thus are not performed for pairs in the duplex status after the quick restore operation. If the quick restore operation is performed without the Swap&Freeze option, the S-VOL and T-VOL are resynchronized when update copy operations are performed for pairs in the duplex status. **Note:** Make sure that the Swap&Freeze option remains in effect until the pair status becomes *duplex* after the quick restore operation.

Figure 2.6 shows the state of the T-VOL after the quick restore operation with or without the Swap&Freeze option.

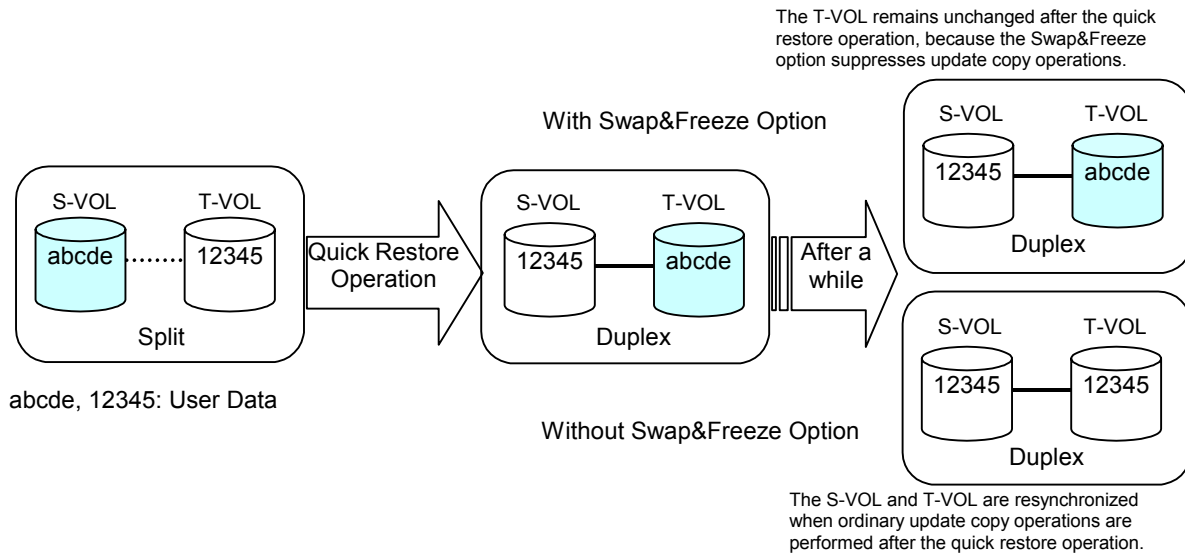


Figure 2.6 Quick Restore Operation With or Without Swap&Freeze Option

## 2.4.2 Host I/O Performance Option

The Host I/O Performance option improves host I/O responses over SI390 copying processing time. When the Host I/O Performance option is used, the subsystem suppresses execution of SI390 copying processing, and consequently the host I/O responses improve.

**Note:** When SI390 copying processing is suppressed by the Host I/O Performance option, the time taken for copying increases. Also, if ShadowImage pairs exist, host I/O responses might not be faster. In this case, set the Host I/O Performance option for ShadowImage as well.

## 2.5 ShadowImage – S/390® Pair Status

The ShadowImage - S/390® Storage Navigator software displays the SI390 pair status of all S/390® volumes under the specified CU image of the connected 9900V subsystem. Figure 2.7 illustrates the pair status transitions and the relationship between the pair status and the SI390 operations. Table 2.5 shows the allowable operations for each pair status.

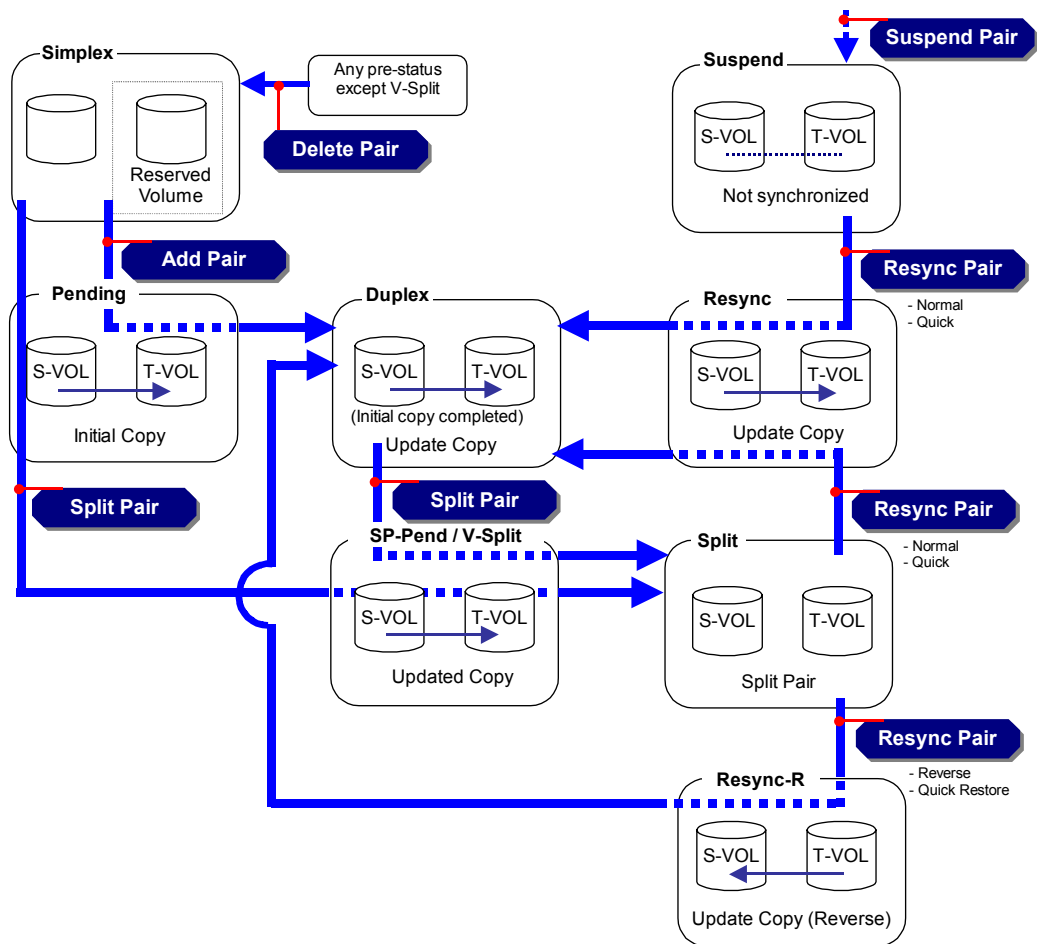


Figure 2.7 ShadowImage – S/390® Pair Status Transitions

If a volume is not assigned to a pair, its status is *simplex*. When you add an S/390 pair, the status of the S-VOL and T-VOL changes to *pending*. When the initial copy operation is complete, the pair status becomes *duplex*. If the 9900V cannot maintain *duplex* status for any reason, or if you suspend the pair, the pair status changes to *suspend*. When you split a pair, the pair status changes to *SP-pending* for steady split or *V-Split* for quick split. When the split is complete, the pair status changes to *split*, and you can access the split T-VOL. When you start a resync operation, the pair status changes to *resync*, and the T-VOL becomes inaccessible. When you specify reverse resync or quick restore, the pair status changes to *resync-r*, and the T-VOL and S-VOL are inaccessible during reverse resync/quick restore. When the resync is complete, the pair status changes to *duplex*. When you delete a pair, the pair status changes to *simplex*.

Table 2.4 shows the allowable operations for each pair status.

**Table 2.4 Pair Status versus Allowable Operations**

Operation	Pair Status								
	Simplex	Pending	Duplex	SP-Pend	V-Split	Split	Resync	Resync-R	Suspend
Split Pair	OK	OK	OK	x	x	x	x	x	x
Suspend Pair	x	OK	OK	OK	OK	OK	OK	x	x
Resync Pair	x	x	x	x	OK	OK	x	x	OK
Reverse Resync Quick Restore	x	x	x	x	x	OK	x	x	x
Delete Pair	x	OK	OK	OK	x	OK	OK	OK	OK



Table 2.5 lists and describes the ShadowImage - S/390® pair status conditions.

**Table 2.5 ShadowImage – S/390® Pair Status (continues on the next page)**

Status	Description	Host Status	S-VOL Access	T-VOL Access	
				Non-HRX	HRX Volume
Simplex	The volume is not assigned to an S/390 pair. The 9900V accepts read and write I/Os for all <i>simplex</i> volumes which are not reserved.	S-VOL = SIMPLEX T-VOL = SIMPLEX	N/A (there is no S-VOL yet).	N/A (there is no T-VOL yet).	N/A (there is no T-VOL yet).
Pending	The initial copy operation is in progress. The 9900V continues to accept read and write operations for the S-VOL but stops accepting writes for the T-VOL. No update copy operations are performed.	S-VOL = PPRI-PNDG T-VOL = PSEC-PNDG	Read/write.	Read/write disabled.	Read/write, but user must avoid read/write operations.
Duplex	The initial copy operation is complete, and the 9900V starts performing asynchronous update copy operations from the S-VOL to the T-VOL as needed. The S-VOL and T-VOL of a duplex pair may not be identical. The 9900V rejects all write I/Os for T-VOLs with the status <i>duplex</i> .	S-VOL = PPRIMARY T-VOL = PSECONDRY	Read/write.	Read/write disabled.	Read/write, but user must avoid read/write operations.
SP-Pend	The status becomes <i>SP-Pend</i> when the Steady Split mode is selected for the split operation. All S-VOL updates prior to the split command are being copied to the T-VOL. When these updates are complete, the split T-VOL is identical to the state of the S-VOL when the split started. The 9900V rejects writes for <i>SP-Pend</i> T-VOLs.	S-VOL = PPRI-PNDG T-VOL = PSEC-PNDG	Read/write.	Read/write disabled.	Read/write, but user must avoid read/write operations.
V-Split	The status becomes <i>V-Split</i> when the Quick Split mode is selected for the split operation. Only the S-VOL differential data is being copied to the T-VOL in background. The 9900V accepts writes for <i>V-Split</i> T-VOLs. The <i>V-Split</i> pairs cannot be deleted.	S-VOL = PPRI-SUSP T-VOL = SIMPLEX	Read/write.	Read/write, can be varied online.	Read/write, can be varied online.
Split	The 9900V stops performing update copy operations for split pairs, and starts accepting write I/Os for split T-VOLs. The 9900V keeps track of all updates to the split S-VOL and T-VOL, so the pair can be resynced accurately and quickly.	S-VOL = PPRI-SUSP T-VOL = SIMPLEX	Read/write.	Read/write, can be varied online.	Read/write, can be varied online.
Resync	The 9900V does not accept write I/Os for <i>resync</i> T-VOLs. When a split pair is resynchronized in normal mode, only the S-VOL differential data is copied to the T-VOL. When a suspended pair is resynchronized, the entire S-VOL is copied to the T-VOL. No update copy operations are performed during resync operation.	S-VOL = PPRI-PNDG T-VOL = PSEC-PNDG	Read/write.	Read/write disabled.	Read/write, but user must avoid read/write operations.

**Table 2.5 ShadowImage – S/390® Pair Status (continued)**

Status	Description	Host Status	S-VOL Access	T-VOL Access	
				Non-HRX	HRX Volume
Resync-R	The 9900V does not accept write I/Os for <i>resync-r</i> T-VOLs or S-VOLs. When a split pair is reverse resynchronized, the 9900V copies only the T-VOL differential data to the S-VOL. The reverse resync cannot be performed on suspended pairs. No update copy operations are performed during reverse resync or quick restore.	S-VOL = PPRI-PNDG T-VOL = PSEC-PNDG	Read/write disabled.	Read/write disabled.	Read/write, but user must avoid read/write operations.
Suspend	The 9900V continues accepting read and write I/Os for a suspended S-VOL, but does not perform update copy operations to a suspended T-VOL. The 9900V marks the entire S-VOL track map as differential data, so the entire S-VOL is copied to the T-VOL when the pair is resumed. Use resync command to resume a suspended pair. Reverse resync and quick restore cannot be used to resume suspended pairs.	S-VOL = PPRI-SUSP T-VOL = PSEC-SUSP	Read/write.	Read/write disabled..	Read/write, but user must avoid read/write operations.

## Chapter 3 Preparing for ShadowImage – S/390® Operations

### 3.1 System Requirements

Hitachi ShadowImage - S/390® operations involve the 9900V subsystem containing the source and target volumes, the ShadowImage - S/390® feature enabled on the 9900V Storage Navigator computer, and (optional) the S/390® host PPRC software functions. The ShadowImage - S/390® system requirements are:

- Hitachi 9900V subsystem. All 9900V hardware, microcode, and software required for ShadowImage - S/390® operations must be installed and enabled.
- 9900V Storage Navigator computer (user-supplied Windows®-based PC). Please refer to the *Hitachi 9900V Remote Console - Storage Navigator User's Guide* for instructions on installing and using the Storage Navigator computer and the Storage Navigator Java applet program.

**Note:** You must operate the Storage Navigator computer in modify mode to perform ShadowImage - S/390® operations. Users in view mode can only view ShadowImage - S/390® information.

- ShadowImage - S/390® feature enabled on the 9900V subsystem(s), and Storage Navigator Java applet program downloaded from the 9900V SVP to the Storage Navigator computer (see section 3.2).

### 3.2 Enabling the ShadowImage – S/390® Feature

The user enables the license key required for ShadowImage - S/390® operations on the 9900V Storage Navigator computer. To install the ShadowImage - S/390® license key:

1. Start the Storage Navigator Java applet program for the desired 9900V subsystem. For instructions, refer to the *Hitachi 9900V Remote Console - Storage Navigator User's Guide*.
2. Enable the ShadowImage - S/390® options on the 9900V Storage Navigator computer and on each ShadowImage - S/390® subsystem. If you plan to use ShadowImage - FlashCopy®, install the ShadowImage - FlashCopy® option, also. Please refer to the *Hitachi 9900V Remote Console - Storage Navigator User's Guide* for instructions.

### 3.3 Preparing for ShadowImage – S/390® Operations

To ensure that you and your 9900V subsystem(s) are ready for ShadowImage - S/390® operations, you should perform the following tasks to prepare for SI390 operations:

- ShadowImage - S/390® operations affect the I/O performance of the 9900V subsystem because of the additional write operations to the T-VOLs. If you have not already done so, you should consider the relative importance of the subsystem's I/O performance and the backup ShadowImage - S/390® copies. For example, assigning three T-VOLs to each S-VOL takes more resources than assigning only one or two. You can also use the SI390 copy pace option to reduce the impact of the SI390 initial copy operations. Using a slower copy pace minimizes the impact of SI390 operations on I/O performance, while a faster copy pace produces point-in-time copies more quickly but may affect I/O performance. The ShadowImage - S/390® initial copy operation is performed only once to each T-VOL (unless the pair is suspended).
- Identify the volumes (LDEVs) that will be the ShadowImage - S/390® volumes. For each volume, write down the CU image and LDEV ID, whether the volume will be an S-VOL or T-VOL, and the other volume(s) in its pair (see Table 3.1 for a sample table). The S-VOLs will remain fully accessible to all hosts throughout normal SI390 operations (except during reverse resync and quick restore). The T-VOLs will need to be varied offline before being reserved for ShadowImage - S/390® operations. Once assigned to a pair, a T-VOL rejects all write I/Os, except when the pair is split.
- ShadowImage - S/390® and TrueCopy - S/390® can function together in the same 9900V subsystem to provide both internal and remote backup for your important data. If you are planning to combine SI390 and TC390, please read the important configuration information in the next section.

**Table 3.1** Sample Table for ShadowImage – S/390® Configuration Information

CU #	LDEV	S-VOL?	Associated T-VOL(s)	T-VOL?	Associated S-VOL
0	00	Yes	0:10, 0:11	No	—
0	01	Yes	0:12, 0:13	No	—
etc.	...	...	...	...	...
0	0F	Yes	0:2E, 0:2F	No	—
0	10	No	—	Yes	0:00
0	11	No	—	Yes	0:00
0	12	No	—	Yes	0:01
etc.	...	...	...	...	...

### 3.4 Combining ShadowImage – S/390® with Other Data Management Operations

ShadowImage – S/390® supports concurrent operations with the following data management functions:

- **Virtual LVI/LUN.** Virtual LVI/LUN volumes can be assigned to ShadowImage – S/390® pairs, provided that the T-VOL has the same capacity as the S-VOL. If you need to perform Virtual LVI/LUN operations on an existing ShadowImage – S/390® S-VOL or T-VOL, you must delete the pair first to return the volume to *simplex* status.
- **FlashAccess.** FlashAccess volumes can be assigned to ShadowImage – S/390® pairs, and FlashAccess operations can be performed on existing SI390 S-VOLs and T-VOLs.  
**Caution:** See section 2.3.4 for important information on performing quick restore operations on FlashAccess volumes.
- **Hitachi TrueCopy – S/390® (TC390).** TC390 volumes can be assigned to SI390 pairs, and SI390 volumes can be assigned to TC390 pairs. Please read the next section (3.4.1) for important information on SI390 and TC390 shared volume configurations.  
**Note:** ShadowImage – S/390® is recommended for intra-subsystem copy operations. If ShadowImage – S/390® is not installed, TC390 (synchronous only) can be used to copy within the same 9900V subsystem. This TC390 configuration requires at least one fibre channel interface cable loop (minimum of two is recommended).
- **HXRC.** If SI390 S-VOLs and HXRC source volume (original data) share the same volumes, you cannot perform the reverse resync or quick restore operation for those volumes. Do not use HXRC target volumes (copied data) for SI390 volumes.
- **Concurrent Copy.** If SI390 S-VOLs and Concurrent Copy source volume (original data) share the same volumes, you cannot perform the reverse resync or quick restore operation for those volumes. Do not use Concurrent Copy target volumes (copied data) for SI390 volumes.
- **SANTinel – S/390.** SANTinel – S/390® operations do not directly affect ShadowImage – S/390® operations. Secure LDEVs can be assigned to SI390 pairs, and SI390 volumes can be secured. A secure LDEV will accept SI390 initial and update copy operations. When an S-VOL is secured by SANTinel – S/390, this setting does not apply to the corresponding T-VOLs. **Note:** ShadowImage – S/390® T-VOLs cannot be accessed by any host except when the pair is split.
- **Hitachi CruiseControl.** ShadowImage – S/390® volumes can be assigned to migration volumes of Hitachi CruiseControl. However, if the SI390 S-VOL is already paired with three T-VOLs, you must delete the SI390 pairs before migrating the volumes by CruiseControl. Also, if you want to assign SI390 volumes to destination volumes of migration by CruiseControl, or reserve SI390 volumes for CruiseControl, you must delete the SI390 volumes or unreserve SI390 volumes before using the volumes by CruiseControl. If you assign an SI390 S-VOL that is already paired with three T-VOLs to migration volumes of CruiseControl, or assign SI390 volumes to other CruiseControl volumes than migration volumes, the command will be rejected.

Also, if you split the SI390 pair that is assigned to CruiseControl migration volumes, migration of those volumes will be canceled.

**Note:** You cannot use migration volumes, destination volumes, and reserved volumes of CruiseControl for SI390 pair operations (the command will be rejected). If you want to use CruiseControl volumes for SI390 pair operations, you must release the volumes by CruiseControl.

### 3.4.1 Combining ShadowImage – S/390® and TrueCopy – S/390® Operations

ShadowImage - S/390® and TrueCopy - S/390® can function together in the same 9900V subsystem to provide both internal and remote backup for your important data. Table 3.2 describes the host pair status reporting for SI390 volumes, TC390 volumes, and SI390/TC390 shared volumes. Table 3.3 lists the currency of the data on shared SI390/TC390 volumes based on the SI390 and TC390 pair status.

- To obtain the SI390 pair status when SI390 and TC390 pairs share the same volume, query from the host:
  - the T-VOL status of the SI390 pair if the SI390 S-VOL and TC390 M-VOL share the same volume,
  - the T-VOL status of the SI390 pair if the SI390 S-VOL and TC390 R-VOL share the same volume, and
  - the S-VOL status of the SI390 pair if the SI390 T-VOL and TC390 M-VOL share the same volume.
- ShadowImage - S/390® supports multiple T-VOLs for each S-VOL. If you issue a pair status query to an SI390 S-VOL, the status for only one SI390 pair is reported (the pair with the T-VOL with the lowest LDEV ID). To obtain the pair status for the SI390 pair(s) with the other T-VOL(s), you must direct the host query to the specific T-VOL using the T-VOL's LDEV ID in the host command. The SI390 Storage Navigator software displays the LDEV ID and SI390 pair status of all T-VOLs associated with an S-VOL.
- Reverse resync and quick restore operations can be performed on shared SI390/TC390 pairs only when the TC390 pair is suspended.

**Table 3.2 Host Pair Status Reporting for SI390/TC390 Shared Volumes**

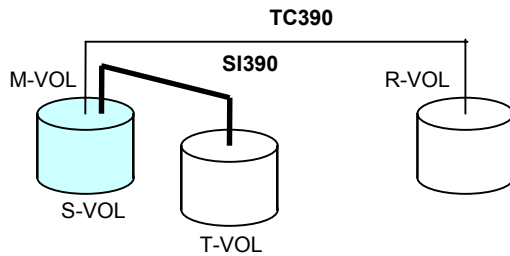
Number of SI390 S-VOLs	Number of TC390 Pairs	Pair Status Reported by 9900V
0	0	Simplex
1	0	SI390 pair status
2 or more	0	SI390 pair status for the pair whose T-VOL has the lowest LDEV ID
0	1	TC390 pair status
1	1	TC390 pair status
2 or more	1	TC390 pair status

**Table 3.3 Currency of a Shared SI390 and TC390 Volume**

SI390 Pair Status	TC390 Pair Status		
	Pending	Duplex	Suspended
Pending	Not current	Not current	Not current
Duplex	Not current	Not current	CURRENT
SP-Pending	Not current	Not current	CURRENT
V-Split	Not current	Not current	CURRENT
Split	CURRENT	CURRENT	CURRENT
Resync	Not current	Not current	CURRENT
Resync-r	—	—	CURRENT
Suspended	Not current	Not current	Not current

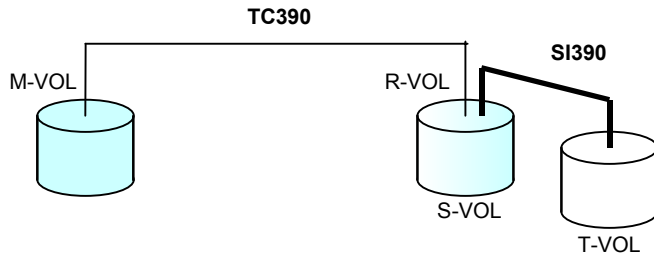
The configuration shown in Figure 3.1 is an example of a volume which is functioning as both an SI390 S-VOL and a TC390 M-VOL. This configuration allows you to:

- Use ShadowImage - S/390® to provide on-site backup copies of TC390 M-VOLs, and/or
- Use TC390 to provide remote backup copies of ShadowImage - S/390® S-VOLs.



**Figure 3.1 SI390 and TC390: Shared S-VOL/M-VOL**

The configuration shown in Figure 3.2 is an example of a volume which is functioning as both an SI390 S-VOL and a TC390 R-VOL. This configuration allows you to use SI390 to provide additional remote copies of TC390 M-VOLs.

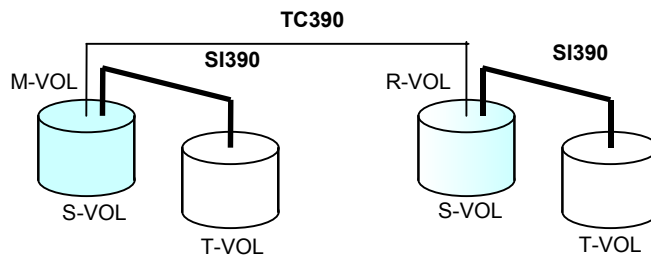


**Figure 3.2 SI390 and TC390: Shared S-VOL/R-VOL**



The configuration shown in Figure 3.3 is an example of a volume which is functioning as both a TC390 M-VOL and an SI390 S-VOL, while the R-VOL of the same TC390 pair is also functioning as the S-VOL of another SI390 pair. This configuration allows you to:

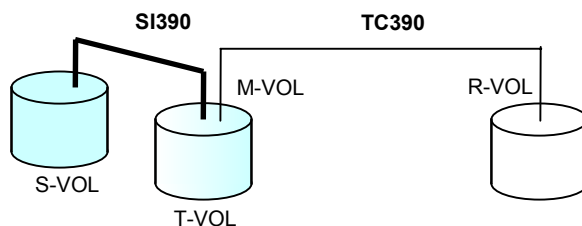
- Use ShadowImage - S/390® to provide on-site backup copies of TC390 M-VOLs and R-VOLs, and/or
- Use TC390 to provide remote backup of ShadowImage - S/390® S-VOLs.



**Figure 3.3 SI390 and TC390: Shared S-VOL/M-VOL and S-VOL/R-VOL**

The configuration shown in Figure 3.4 is an example of a volume functioning as both an SI390 T-VOL and a TC390 M-VOL. **Note:** This configuration does not allow SI390 and TC390 to copy at the same time. Add the SI390 pair first, and then split the pair before creating the TC390 pair. You must suspend the TC390 pair in order to resync the SI390 pair. The TC390 pair status cannot be changed when the SI390 pair is in the *V-Split* status.

**Note:** You cannot distinguish the *Split* status from the *V-Split* status with the PPRC command. When you use the SI390 and TC390 shared configuration shown in Figure 3.4, you must either use the PPRC command to perform the Steady Split operation, or use the Storage Navigator to confirm the pair statuses. You can perform the Steady Split operation by specifying the CSUSPEND parameters (Byte 7 = 'M', Byte 8 = 'P', Byte 9 = 'S'). For details about the PPRC commands, please see Chapter 5.



**Figure 3.4 SI390 and TC390: Shared T-VOL/M-VOL**

### 3.5 Starting up the ShadowImage – S/390® Feature

After you have enabled the feature the 9900V Storage Navigator computer and prepared for ShadowImage - S/390® operations, you are ready to start up the ShadowImage - S/390® feature:

1. Start up and log on to the Storage Navigator computer.
2. Start a Web browser on the Storage Navigator computer, and display the storage device list.
3. Log on to the SVP of the 9900V subsystem on which you will perform ShadowImage - S/390® operations. The Storage Navigator main panel opens (see section 4.1).
4. Click the **ShadowImage - S/390®** button on the Storage Navigator main panel to open the ShadowImage - S/390® main panel (see Figure 4.2). The ShadowImage - S/390® main panel displays the name of the connected 9900V subsystem, the currently selected CU image, and all of the volumes (LDEVs) installed under the current CU image.
5. You are now ready to perform ShadowImage - S/390® operations. You will first reserve the volumes that you plan to use as ShadowImage - S/390® T-VOLs (see section 4.3 for instructions), and then you will start adding the ShadowImage - S/390® pairs (see section 4.5 for instructions).

**Note:** When you use Storage Navigator on UNIX® workstations or in other non-Windows environments, certain additional operating conventions must be followed. For details, refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console - Storage Navigator™ User's Guide* (MK-92RD101).

## Chapter 4 Performing ShadowImage – S/390® Operations

### 4.1 Storage Navigator Main Panel

The Storage Navigator main panel (see Figure 4.1) opens automatically after a user logs in to the SVP. This main panel displays the user ID of the currently logged-on user, subsystem name, Storage Navigator version, and provides access to all general Storage Navigator functions.

Refer to the *Hitachi Lightning 9900™ V Series Remote Console-Storage Navigator User's Guide* for descriptions on this main panel.

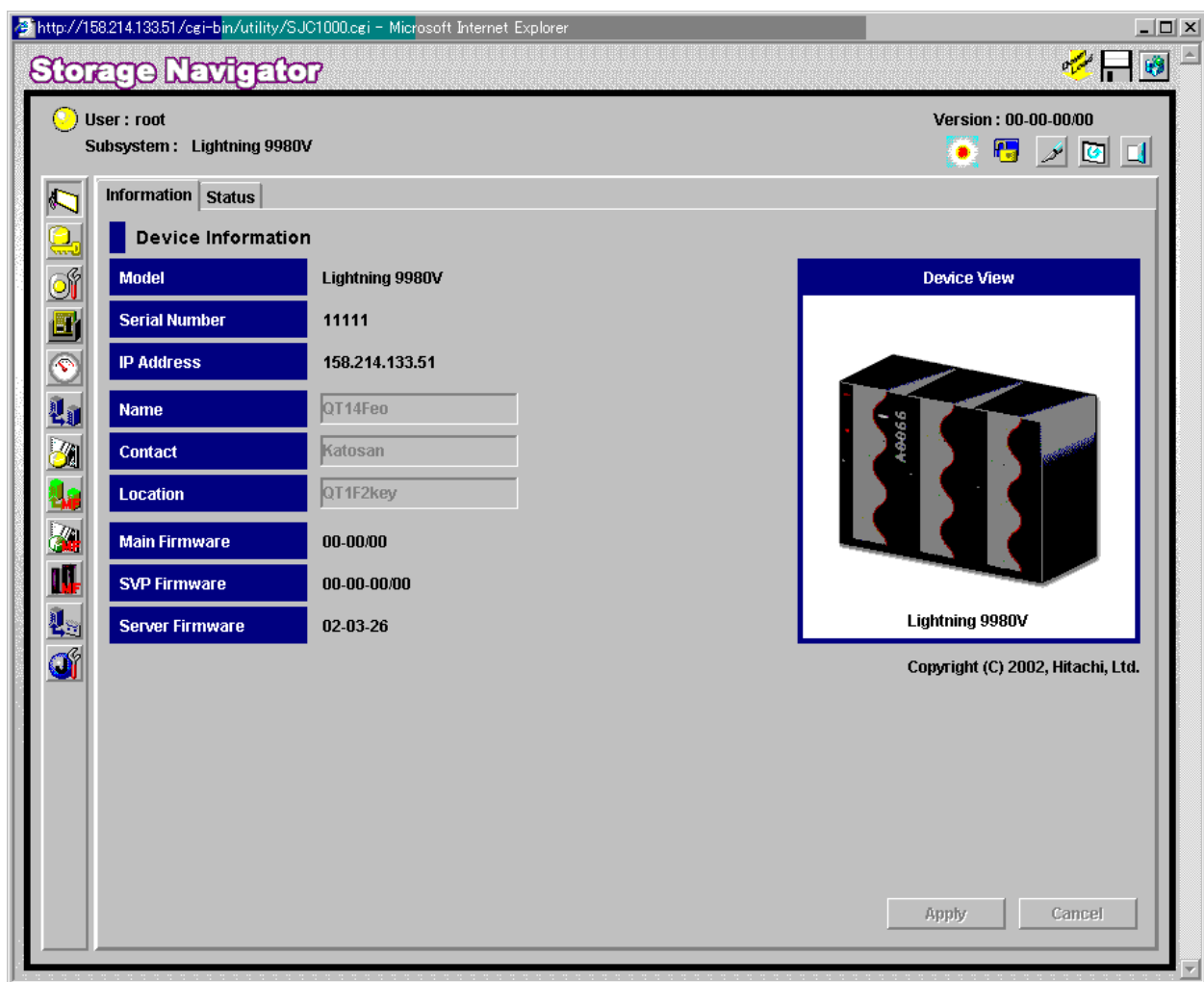



Figure 4.1 Storage Navigator Panel

## 4.2 The ShadowImage – S/390® Main Panel

The ShadowImage - S/390® main panel (see Figure 4.2) displays the ShadowImage - S/390® volume and pair information for the selected CU image of the connected 9900V subsystem and allows you to perform all ShadowImage - S/390® operations. To open the ShadowImage - S/390® main panel, connect to the desired 9900™ V Series subsystem from the Storage Navigator, and then select the ShadowImage - S/390® button (  ) on the Storage Navigator main panel. There are three tabs on the ShadowImage - S/390® main panel: **Main**, **History**, and **Options** tabs.

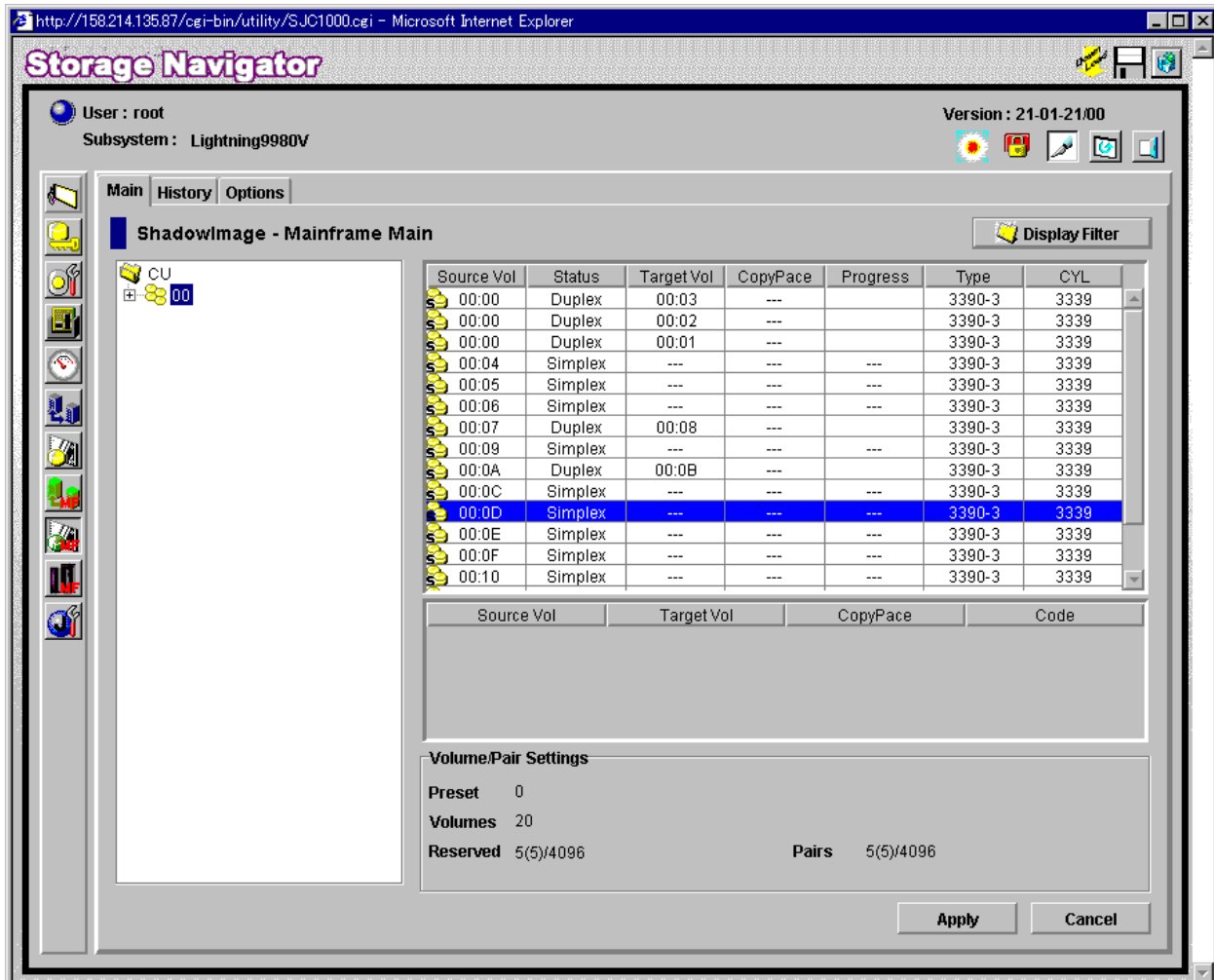






Figure 4.2 The ShadowImage – S/390® Main Panel

The **Main** tab of the ShadowImage - S/390® main panel has the following features:

- The **Tree View** box, which is on the left of the **Main** tab, allows you to select the desired CU image, or defined S-VOL (LDEV ID). **Note:** You can filter the volumes or volume pairs displayed in the **Volume List** box on the upper right of the **Main** tab, by selecting a CU image or a volume (LDEV ID) at a time. To display all volumes and pairs, select **CU** on the top of the **Tree View** box.

- The **Volume List** box, which is on the upper right of the **Display** tab, displays all available volumes on the CU image that you select in the **Tree View** box. You can sort the volumes by source volume (CU:LDEV), status, target volume (CU:LDEV), copy pace, progress of copying, device emulation type, and cylinder (capacity). You can also filter the volumes by reserve attribute, by pair condition, and pair status, on the Display Filter panel (see Figure 4.5). To open the Display Filter panel, click the **Display Filter** button.
- The following icons indicate the status of a volume or pair on the ShadowImage - S/390® panels:
  - : S-VOL
  - : T-VOL
  - : Reserved volume
  - : An error occurred during operations. This error icon is displayed in the **Preset Volume List** box on the ShadowImage - S/390® main panel.
- The **Display Filter** button allows you to filter the volumes displayed in the **Volume List** box.
- The **Preset Volume List** box, which is under the **Volume List** box, displays the specified operations (volume/pair information). These operations have not been performed in the 9900V subsystem. **Note:** The **Preset Volume List** box allows you to hold multiple settings of the same operation (e.g., Add Pair) only. You cannot display different types of operations (e.g., Split Pair and Resync Pair) in the **Preset Volume List** box at the same time. You can also cancel the operations in the **Preset Volume List** box. Refer to section 4.2.4 for information on the **Preset Volume List** box.
- The **Volume/Pair Settings** box displays:
  - **Preset:** The number of operations (volume/pair information), which have not been performed in the 9900V subsystem. The preset operations are displayed in the **Preset Volume List** box (see Figure 4.6), which is located below the **Volume List** box. You must click the **Apply** button to perform the specified operations displayed in the **Preset Volume List** box.
  - **Volume:** The total number of volumes defined in the 9900V subsystem.
  - **Reserve:** X(Y)/Z, where
    - X = total number of SI390 reserved volumes
    - Y = total number of SI390 and SI reserved vols
    - Z = maximum allowable number of reserved volumes
  - **Pair:** X(Y)/Z, where
    - X = total number of ShadowImage - S/390® pairs
    - Y = total number of SI390 and SI pairs
    - Z = maximum number of pairs (SI390/SI/Hitachi CruiseControl)

**Note:** The value (Y) does not include Hitachi CruiseControl pairs. If Hitachi CruiseControl pairs exist, it is possible for the SI390 add pair operation to fail even if (Y) is less than 4,096.

- The **Apply** button performs the ShadowImage - S/390® operations displayed in the **Preset Volume List** box in the 9900V subsystem. If the specified operations complete successfully, the **Preset Volume List** box will be cleared. If an error occurs during an operation, an icon (🚫) is displayed, and the failed operation will remain in the **Preset Volume List** box. You can display the error code and message for the failed operation by selecting the **Detail** command.
- The **Cancel** button cancels all operations specified in the **Preset Volume List** box.
- The **Refresh** button (🔄) updates the information displayed on the ShadowImage - S/390® main panel.
- The **Exit** button (🚪) exits the ShadowImage - S/390® program and closes the Storage Navigator main panel.

To perform ShadowImage - S/390® operations for the desired volume(s), select one or more volumes in the **Volume List** box, right-click using the mouse to display the popup menu commands (**Detail**, **Add Pair**, **Split Pair**, **Resync Pair**, **Suspend Pair**, **Delete Pair**, **Change Reserve**, and **Display Filter**), and then click the desired command (see section 4.2.1).

For the **History** and **Options** tabs of the ShadowImage - S/390® main panel, refer to sections 4.10 and 4.11.

## 4.2.1 The Volume List Box

The **Volume List** box (see Figure 4.3) displays volume/pair information based on the filter options you select in the **Tree View** box (along the left side of the panel). You can also filter the volumes by reserve attribute, by pair condition, and by pair status using the **Display Filter** button.

Source Vol	Status	Target Vol	CopyPace	Progress	Type	CYL
S 00:00	Split	00:03	---		3390-3	3339
S 00:00	Split	00:02	---		3390-3	3339
S 00:00	Split				3390-3	3339
S 00:04	Simplex			---	3390-3	3339
S 00:05	Simplex			---	3390-3	3339
S 00:06	Simplex			---	3390-3	3339
S 00:07	Split				3390-3	3339
S 00:09	Simplex			---	3390-3	3339
S 00:0A	Split				3390-3	3339
S 00:0C	Simplex			---	3390-3	3339
S 00:0D	Simplex			---	3390-3	3339
S 00:0E	Simplex			---	3390-3	3339
S 00:0F	Simplex			---	3390-3	3339
S 00:10	Simplex	---	---	---	3390-3	3339

Figure 4.3 The Volume List Box

The **Volume List** box lists all installed volumes (LDEVs) on the selected CU image and displays the following information for each volume:

- **Source Vol:** The CU:LDEV (control unit image:logical device ID) of the source volume (S-VOL).
- **Status:** The ShadowImage - S/390® pair status of the volume pair: **Simplex**, **Pending**, **Duplex**, **Split**, **Resync**, **Suspend**, **SP-Pend**, **Resync-R**, **V-Split**.
- **Target Vol:** The CU:LDEV (control unit image:logical device ID) of the T-VOL. If there is no T-VOL, --- is displayed.
- **Copy Pace:** The specified copy pace (**Slower**, **Medium**, or **Faster**) is displayed.
- **Progress:** The information (as shown in Table 4.1) according to the pair status is displayed.

**Table 4.1     Displayed Information in Progress**

Pair Status	Displayed Information
Simplex	- - - is displayed.
Pending	The progress (%) of copying.
Duplex	Identical data (%) of S-VOL and T-VOL.
SP-Pend	Copy completed data (%).
V-Split	Copy completed data (%).
Split	Identical data (%) of S-VOL and T-VOL.
Resync	Identical data (%) of S-VOL and T-VOL.
Resync-R	Identical data (%) of S-VOL and T-VOL.
Suspend	- - - is displayed.
F-Copy	Copy completed data (%).

- **Type:** The device emulation type (e.g., 3390-9, 3390-3R, 3390-3A/B/C).
- **CYL:** The number of cylinders assigned to the volume.

You can perform SI390 operations for the desired volume(s) in the **Volume List** box, by using the following popup menu commands that you can display by right-clicking using the mouse:

**Table 4.2     List of ShadowImage – S/390® Popup Menu Commands**

Command	Feature
<b>Detail</b>	Opens the Detail panel that displays information for the selected volume or pair (see Figure 4.4).
<b>Add Pair</b>	Opens the Add Pair Dialog panel, which allows you to create (add) new SI390 pairs (see Figure 4.9).
<b>Split Pair</b>	Opens the Split Volume Pair panel, which allows you to split SI390 pairs (see Figure 4.10).
<b>Resync Pair</b>	Opens the Resync Volume Pair panel, which allows you to resynchronize SI390 pairs (see Figure 4.11).
<b>Suspend Pair</b>	Opens the Suspend Volume Pair panel, which allows you to suspend SI390 pairs (see Figure 4.12).
<b>Delete Pair</b>	Opens the Delete Volume Pair panel, which allows you to delete SI390 pairs (see Figure 4.13).
<b>Change Reserve</b>	Opens the Set/Reset Reserve Attribute panel allows you to set/reset the SI390 reserve attribute (see Figure 4.7 and Figure 4.8).
<b>Display Filter</b>	Opens the Display Filter panel, which allows you to filter the volumes displayed in the <b>Volume List</b> box



## 4.2.2 The Detail Panel

The Detail panel displays information for the selected volume or pair. To open the Detail panel, select a pair or volume in the **Volume List** box on the ShadowImage - S/390® main panel, right-click using the mouse, and then select the **Detail** command. If the S-VOL of the selected pair has two or three T-VOLs that share the same S-VOL, all T-VOLs are displayed on the Detail panel.

**Note:** ShadowImage - S/390® supports the CQUERY/PPRCOPY QUERY commands for viewing S/390 pair status. See Chapter 5 for further information on using PPRC commands.

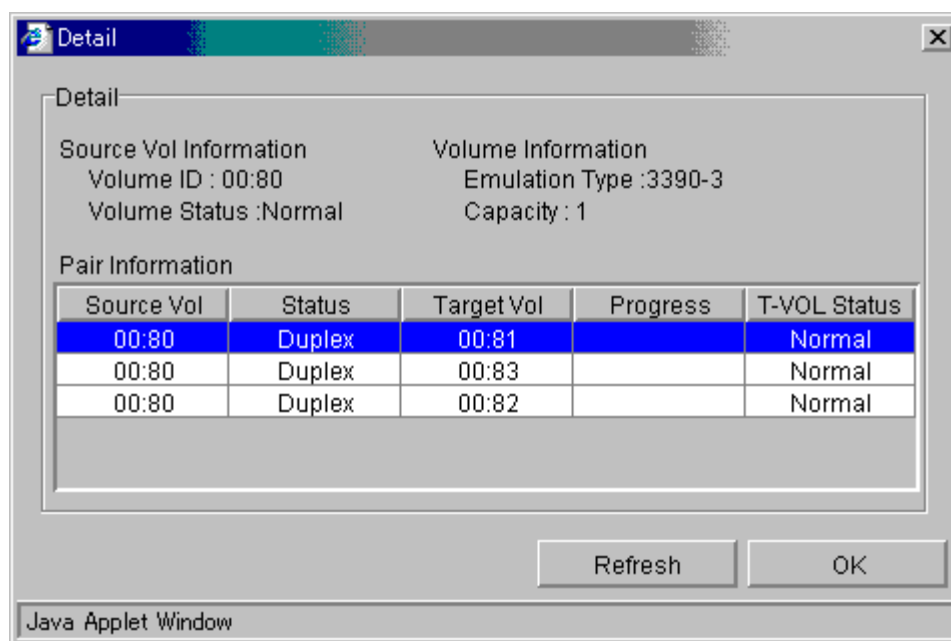


Figure 4.4 The Detail Panel

The Detail panel has the following features:

- The **Detail** box displays the following information:
  - **Source Vol Information:** the S-VOL's CU:LDEV and LDEV status.
  - **Volume Information:** the LDEV emulation type and capacity.
  - The **Pair Information** box displays the CU:LDEV of both the S-VOL and T-VOL of the pair, pair status, progress of copying, first path to the T-VOL.
- The **Refresh** button displays the latest information on the Detail panel.
- The **OK** button closes the Detail panel.

### 4.2.3 The Display Filter Panel

The Display Filter panel allows you to “filter” the volumes displayed in the **Volume List** box by reserve attribute, by pair condition, and by pair status. To open the Display Filter panel, click the **Display Filter** button on the ShadowImage - S/390® main panel. You can also open the Display Filter panel by using the **Display Filter** command.

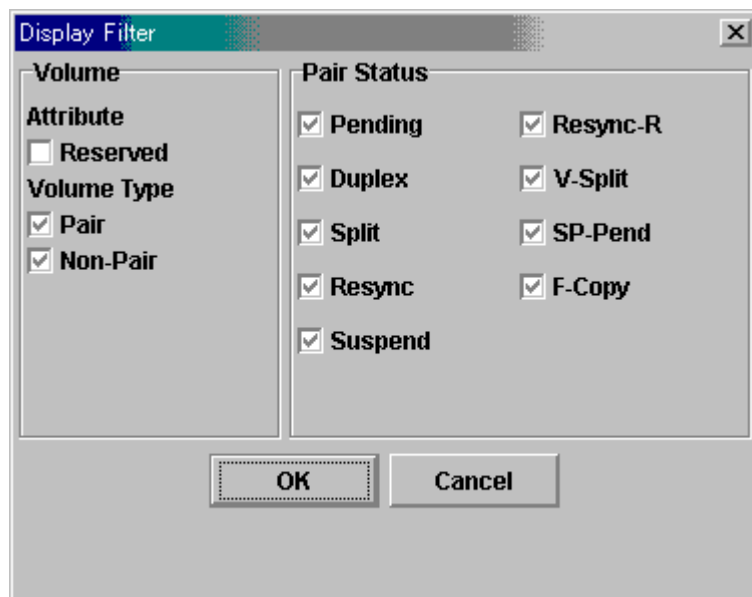


Figure 4.5 The Display Filter Panel

The Display Filter panel has the following features:

- The **Volume** box:
  - The **Reserve** check box allows you to display reserved or unreserved volumes. If you select the **Reserve** check box, only reserved volumes are displayed in the **Volume List** box. If you clear the **Reserve** check box, only unreserved volumes are displayed.
  - The **Pair** check box allows you to display paired volumes.
  - The **Non-Pair** check box allows you to display non-paired (simplex) volumes.
- The **Pair Status** box allows you to filter the pairs displayed in the **Volume List** box by pair status: **Pending**, **Duplex**, **Split**, **Resync**, **Suspend**, **Resync-R**, **V-Split**, **SP-Pend**, and **F-Copy**.

**Note:** All check boxes are selected by default.

- The **OK** button applies the settings, and closes the Display Filter panel.
- The **Cancel** button resets the settings, and closes the Display Filter panel.

**Note:** The filter settings are only effective within the current SI390 operations. If you switch to another option program (e.g., TrueCopy - S/390®), or click a button on the toolbar on the Storage Navigator main panel, the settings will be reset.

## 4.2.4 The Preset Volume List Box

The **Preset Volume List** box (see Figure 4.6) is located below the **Volume List** box, and lists the specified operations (volume/pair information), which have not been performed in the 9900V subsystem. **Note:** The **Preset Volume List** box allows you to hold multiple settings of the same operation (e.g., Add Pair) only. You cannot display different types of operations (e.g., Split Pair and Resync Pair) in the **Preset Volume List** box at the same time. You can also cancel the operations in the **Preset Volume List** box.






Source Vol	Target Vol	CopyPace	Code
 00:84	00:89	Medium	---
 00:85	00:8A	<b>Delete</b>	---
 00:86	00:8E	Delete All	---
 00:87	00:8F	Detail	---

Figure 4.6 The Preset Volume List Box Displaying Settings (Operations)

The **Preset Volume List** box displays the following information of specified operations:

- **Source Vol:** The CU:LDEV (control unit image:logical device ID) of the S-VOL.
- **Target Vol:** The CU:LDEV (control unit image:logical device ID) of the T-VOL.
- **Copy Pace:** The copying pace for all pairs being created: **Slower**, **Medium**, and **Faster**.
- **Code:** The reason code is displayed if the preset operations (settings) cannot be applied successfully with the **Apply** button.

To perform the specified operations, you must click the **Apply** button on the ShadowImage - S/390® main panel. When all the operations are performed successfully, the **Preset Volume List** box will be cleared. However, if some operations cannot be performed successfully, the failed operations will remain in the **Preset Volume List** box, and the error icon () is displayed. You can also cancel one or all operations by using the following popup menu commands:

- The **Delete** command cancels the selected operation only. **Note:** To display the **Delete** command, select a volume or pair, and then right-click using the mouse.
- The **Delete All** command cancels all operations displayed in the **Preset Volume List** box. **Note:** To display the **All Delete** command, deselect any volume or pair, and then right-click using the mouse.
- The **Detail** command displays the Error panel, which displays the error code and message for the failed operation (see section 6.2). For the ShadowImage - S/390® error codes see the manual *Hitachi Lightning 9900™ V Series Remote Console - Storage Navigator Error Codes*.

### 4.3 Setting the Reserve Attribute

The Set Reserve Attribute panel (see Figure 4.7) enables you to set the reserve attribute for (i.e., reserve) the volume(s) selected on the ShadowImage - S/390® main panel. To open the Set Reserve Attribute panel, select one or more unreserved *simplex* volumes in the **Volume List** box on the ShadowImage - S/390® main panel, right-click using the mouse, and then select the **Change Reserve** command.

**Note:** The reserve attribute is only required for SI390 Storage Navigator operations. The PPRC commands require that the potential T-VOLs are offline to the host, but do not require that the T-VOLs have the reserve attribute setting.

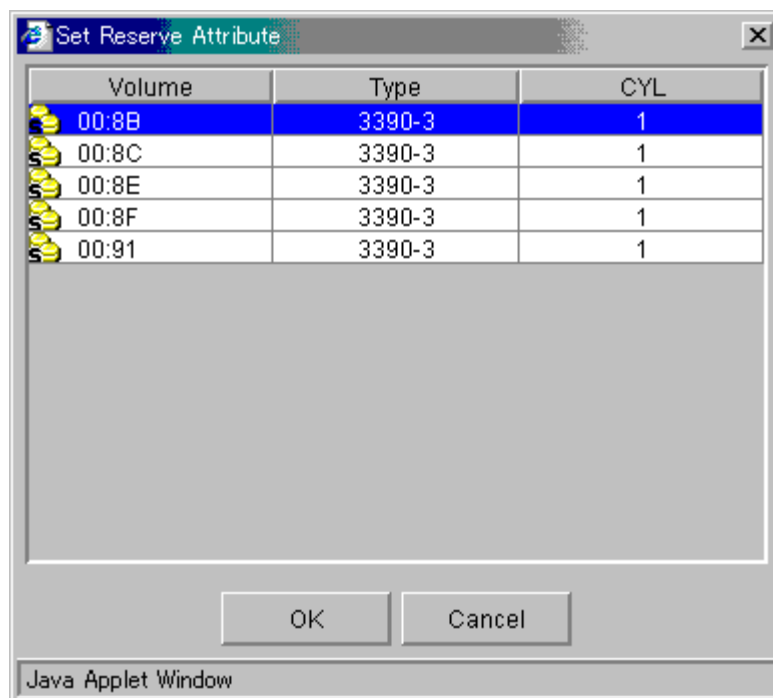


Figure 4.7 The Set Reserve Attribute Panel (Reserve)

The Set Reserve Attribute panel displays the unreserved volume(s) that you selected on the ShadowImage - S/390® main panel. The **OK** button allows you to set the reserve attribute for unreserved volume(s). **Note:** The setting(s) will be displayed in the **Preset Volume List** box on the ShadowImage - S/390® main panel. The **Cancel** button closes the Set Reserve Attribute panel without reflecting the settings. To apply the settings to the 9900V subsystem, click the **Apply** button on the ShadowImage - S/390® main panel.

To reserve one or more volumes for use as S/390 S-VOLs (set the reserve attribute):

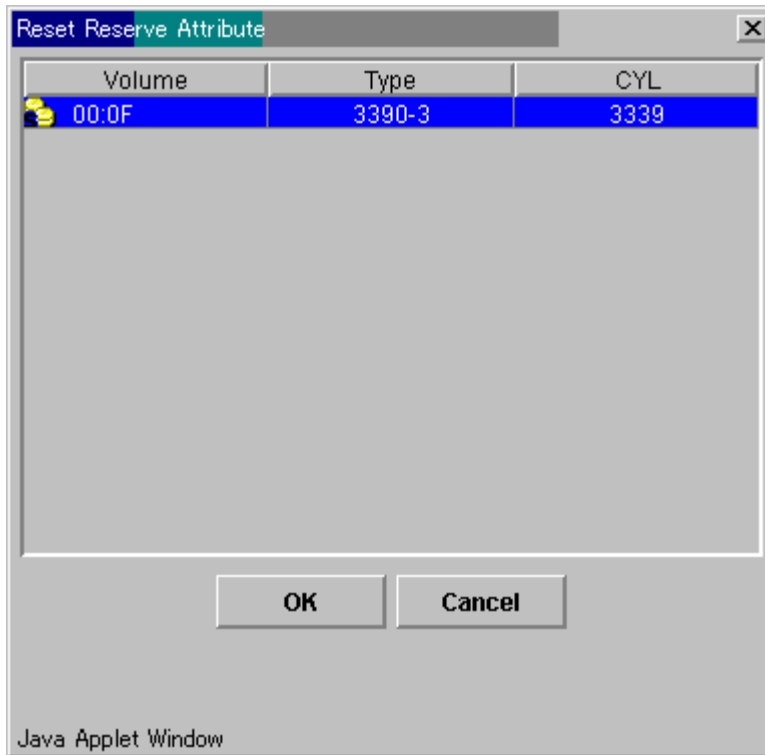
1. Vary the volume(s) that you will be reserving offline. The 9900V will reject all read/write I/Os to reserved volumes (except when in the *split* state).
2. On the ShadowImage - S/390® main panel, select the desired CU image or LDEV in the **Tree View** box.
3. Display unreserved *simplex* volumes in the **Volume List** box (e.g., to display unreserved *simplex* volumes, clear the **Reserve** and **Pair** check boxes, and select the **Non-Pair** check box on the Display Filter panel).
4. Select the desired volume(s), right-click using the mouse, and then select the **Change Reserve** command. The Set Reserve Attribute panel opens. If the **Change Reserve** command is not enabled, you selected paired volumes. Select only unreserved and unpaired volumes.
5. On the Set Reserve Attribute panel, select the volume(s) you want to reserve, and then select the **OK** button.

The setting will be reflected in the **Preset Volume List** box on the ShadowImage - S/390® main panel.

6. On the ShadowImage - S/390® main panel, select the **Apply** button.
7. Verify that the settings are reflected in the 9900V subsystem (You can check the attribute using the **Display Filter** button).

## 4.4 Resetting the Reserve Attribute

The Reset Reserve Attribute panel (see Figure 4.8) enables you to reset the reserve attribute for (i.e., unreserve) the volume(s) selected on the ShadowImage - S/390® main panel. To open the Reset Reserve Attribute panel, select one or more reserved *simplex* volumes in the **Volume List** box on the ShadowImage - S/390® main panel, right-click using the mouse, and then select the **Change Reserve** command.



**Figure 4.8** The Reset Reserve Attribute Panel (Unreserve)

The Reset Reserve Attribute panel displays the reserved volume(s) that you selected on the ShadowImage - S/390® main panel. The **OK** button allows you to reset the reserve attribute for reserved volume(s). **Note:** The setting(s) will be displayed in the **Preset Volume List** box on the ShadowImage - S/390® main panel. The **Cancel** button closes the Reset Reserve Attribute panel without reflecting the settings. To apply the settings to the 9900V subsystem, click the **Apply** button on the ShadowImage - S/390® main panel.

To unreserve one or more volumes (reset the reserve attribute):

1. Make sure that the volumes you want to unreserve are no longer assigned to SI390 pairs as T-VOLs. See section 4.9 for instructions on deleting SI390 pairs.
2. On the ShadowImage - S/390® main panel, select the CU image or LDEV in the **Tree View** box.
3. Display reserved *simplex* volumes in the **Volume List** box (e.g., to display reserved *simplex* volumes, select the **Reserve** check box on the Display Filter panel).
4. Select the desired volume(s), right-click using the mouse, and then select the **Change Reserve** command. The Reset Reserve Attribute panel opens. If the **Change Reserve** command is not enabled, you selected paired volumes. Select only reserved and unpaired volumes.
5. On the Reset Reserve Attribute panel, select the volume(s) you want to unreserve, and then select the **OK** button.

The setting will be reflected in the **Preset Volume List** box on the ShadowImage - S/390® main panel.

6. On the ShadowImage - S/390® main panel, select the **Apply** button.
7. Verify that the settings are reflected in the 9900V subsystem (You can check the attribute using the **Display Filter** button).

## 4.5 Adding ShadowImage – S/390® Pairs

**WARNING:** The ShadowImage – S/390® add pair operation overwrites all data on the T-VOLs. The user is responsible for backing up the data on the T-VOLs before adding SI390 pairs.

The Add Pair Dialog panel (see Figure 4.9) displays the S-VOL and T-VOL information for the pair(s) being added and allows you to select the T-VOL(s) for each S-VOL, set the copy pace for all pairs being added, and start the Add Pair operation(s). To open the Add Pair Dialog panel, select one or more pair or volumes in the **Volume List** box on the ShadowImage – S/390® main panel, right-click using the mouse, and then select the **Add Pair** command.

**Note:** ShadowImage – S/390® supports the CESTPAIR/PPRCOPY ESTPAIR commands for adding (starting) SI390 pairs. See Chapter 5 for further information on using PPRC commands.

The Add Pair Dialog panel is a Java Applet Window. It contains a table with the following data:

Source Vol	Status	Target Vol	Type	CYL
01:C0	Simplex	---	3390-3	1
01:C0		00:80	3390-3	1
01:C1	Simplex	---	3390-3	1
01:C1		00:82	3390-3	1
01:C2	Simplex	---	3390-3	1
01:C3	Simplex	---	3390-3	1
01:C4	Simplex	---	3390-3	1

Below the table, there is a 'Copy Pace' section with a dropdown menu set to 'Medium'. There is also a 'Select T-Vol' section with a 'CU' dropdown set to '00'. A 'Reserve' section has two checkboxes: 'Reserve' (checked) and 'non Reserve' (checked). To the right of these sections is a list of available target volumes:

Volume	Type	CYL
00:81	3390-3	1
00:83	3390-3	1
00:84	3390-3	1
00:85	3390-3	1
00:86	3390-3	1
00:87	3390-3	1
00:88	3390-3	1

At the bottom of the dialog are four buttons: 'Set', 'Change', 'OK', and 'Cancel'.

Figure 4.9 The Add Pair Dialog Panel



The Add Pair Dialog panel displays the S-VOL and T-VOL information for each pair being added: CU image, LDEV ID, volume status, emulation type, capacity (cylinders). The **Copy Pace** box allows you to select the copy pace for all pairs being added: **Slower**, **Medium**, and **Faster**. **Note:** When the **Preset Volume List** box already holds some Add Pair settings, and you specify a different copy pace for new pairs in the Add Pair Dialog panel, the copy pace for the existing Add Pair settings displayed in the **Preset Volume List** box will be also changed. The latest copy pace specified in the Add Pair Dialog panel is always reflected to the subsystem.

The **Select T-Vol** box allows you to filter the T-VOLs displayed in the T-VOL list. The **Reserve** box allows you to display the available T-VOLs by reserve attribute.


The **Set** button adds the selected T-VOL to the selected S-VOL. The **Change** button replaces the T-VOL of the selected pair in the list with the selected T-VOL. To remove any volumes from the S-VOL or T-VOL list, select the volumes, right-click using the mouse, and then select the **Delete** command. The **OK** reflects the new pairs in the list to the **Preset Volume List** box on the ShadowImage - S/390® main panel. **Note:** To add all pairs in the list, you must click the **Apply** button on the ShadowImage - S/390® main panel. The **Cancel** button undoes the operations and closes the Add Pair Dialog panel.

**Note:** If you want to add new S/390 pairs and then split them immediately so that you can access the T-VOLs as soon as possible, use the Split Pair operation instead of the Add Pair operation to establish and split new pairs at the same time (see section 4.5).

To add one or more new ShadowImage - S/390® pairs:

1. Make sure that the desired T-VOL(s) is/are offline.
2. On the ShadowImage - S/390® main panel, select the desired CU image or LDEV in the **Tree View** box to filter the volumes displayed in the **Volume List** box.
3. Select the desired S-VOL(s) for the new pair(s), right-click using the mouse, and then select the **Add Pair** command to open the Add Pair Dialog panel. **Note:** Do not select any reserved volumes.
4. Set the initial copy pace for all pairs being added: **Slower**, **Medium**, or **Faster**.
5. Verify that the Add Pair Dialog panel displays the desired S-VOL(s). If you want to remove any volumes from the list, select the volume(s), right-click using the mouse, and then select the **Delete** command.
6. Select the T-VOL(s) for each S-VOL as follows:
  - a) Select the desired S-VOL on the Add Pair Dialog panel.
  - b) Select the desired CU image, select the **Reserve** check box to display reserved volumes, and then select the desired T-VOL.
  - c) Select the **Set** button to create (add) the T-VOL to the selected S-VOL. The T-VOL is now displayed next to the selected S-VOL.

**Note:** You can select an unreserved volume as the T-VOL. When you create the pair, the 9900V subsystem changes the reserve attribute to "reserved" automatically.
  - d) If you want to add a second and/or third T-VOL to the same S-VOL, repeat steps (b) through (c) to add each T-VOL to the selected S-VOL. Each pair to be created is displayed separately in the list of pairs on the Add Pair Dialog panel.

7. Repeat step (6) until all desired pairs are displayed. Use the **Change** button to replace a T-VOL, use the **Set** button to add a T-VOL, and use the **Delete** command to remove pairs.
8. When the Add Pair Dialog panel displays the desired new pair(s), select the **OK** button to reflect all pairs (settings) in the list to the **Preset Volume List** box on the ShadowImage - S/390® main panel.
9. On the ShadowImage - S/390® main panel, click the **Apply** button to create the pair(s).  
When the initial copy operation(s) start, the ShadowImage - S/390® main panel shows the new pairs with *pending* status and the progress (%) of the initial copy operation(s).
10. Select the **Refresh** button () on the Storage Navigator main panel to monitor the progress of the initial copy operation(s).

## 4.6 Splitting ShadowImage – S/390® Pairs

The Split Volume Pair panel (see Figure 4.10) displays volume and pair information for the volume(s) and/or pair(s) selected on the ShadowImage - S/390® main panel and allows you to split existing ShadowImage - S/390® pairs. The Split Volume Pair panel can also be used to simultaneously add and split new SI390 pairs (see section 4.5). To open the Split Volume Pair panel, select volume(s) or pair(s) in the **Volume List** box on the ShadowImage - S/390® main panel, right-click using the mouse, and then select the **Split Pair** command.

**Note:** ShadowImage - S/390® supports the CSUSPEND/PPRCOPY SUSPEND commands for splitting SI390 pairs. See 5.1 for further information on using PPRC commands.

The screenshot shows the 'Split Volume Pair' dialog box. It contains a table with the following data:

Source Vol	Status	Target Vol	Type	CYL
00:88	Simplex	---	3390-3	1
00:88		00:8C	3390-3	1
00:89	Simplex	---	3390-3	1
00:89		00:8D	3390-3	1
00:8A	Simplex	---	3390-3	1
00:8A		00:90	3390-3	1
00:8B	Simplex	---	3390-3	1

Below the table are several controls:

- Copy Pace:** A dropdown menu set to 'Medium'.
- Select Split Type:** A dropdown menu set to 'Quick Split'.
- Select T-Vol:** A section with a 'CU' dropdown set to '00' and a 'Reserve' section with two checked options: 'Reserve' and 'non Reserve'.
- T-VOL List:** A table listing volumes 00:8E through 00:95, all of type 3390-3 with 1 cylinder.
- Buttons:** 'Set', 'Change', 'OK', and 'Cancel'.
- Footer:** 'Java Applet Window'.


Figure 4.10 The Split Volume Pair Panel

The Split Volume Pair panel lists the volume(s)/pair(s) selected on the ShadowImage - S/390® main panel and shows the pair status and copy pace for each pair. The **Copy Pace** box allows you to select the copy pace for all pairs that you are splitting: **Slower**, **Medium**, or **Faster**. The **Select Split Type** box allows you to select the split type for all pairs that you are splitting: **Quick Split** or **Steady Split**.

The **Select T-Vol** box allows you to filter the T-VOLs displayed in the T-VOL list. The **CU** and **Reserve** boxes allow you to display the available S-VOLs by port and by reserve attribute.

The **Set** button adds the selected T-VOL to the selected S-VOL. The **Change** button replaces the T-VOL of the selected pair in the list with the selected T-VOL. To remove any volumes from the list, select the unneeded volumes, right-click using the mouse, and then select the **Delete** command. The **OK** button reflects all settings to the **Preset Volume List** box on the ShadowImage - S/390® main panel. **Note:** You must click the **Apply** button on the ShadowImage - S/390® main panel to split all pairs in the **Preset Volume List** box. The **Cancel** button undoes the operations and closes the Pairsplit panel.

To split one or more existing ShadowImage - S/390® pairs:

1. If you want the split T-VOLs to be identical to the S-VOLs, stop all write operations to the S-VOLs before splitting the pairs. This ensures that there are no updates to the S-VOLs while the split operations are synchronizing the T-VOLs to the S-VOLs.  
**Caution:** The S-VOL and T-VOL are synchronized only when the pair status changes from *SP-Pend* or *V-Split* to *Split*. Due to the ShadowImage - S/390® asynchronous update copy operations, this status transition can take several minutes.
2. On the ShadowImage - S/390® main panel, select the desired CU image or LDEV in the **Tree View** box to filter the volumes displayed in the **Volume List** box.
3. Select the pair(s) you want to split, right-click using the mouse, and then select the **Split Pair** command to open the Split Volume Pair panel. You cannot split a suspended pair.
4. On the Split Volume Pair panel, set the copy pace (**Slower**, **Medium**, or **Faster**) for all pairs being split. **Note:** If you change the setting, the last setting will become effective.
5. Set the split type (**Quick Split** or **Steady Split**) for all pairs being split. **Note:** The split type is set for all pairs being split. If you change the setting, the latest setting is applied to all pairs.
6. When the Split Volume Pair panel displays the desired pair(s), select the **OK** button to reflect all pairs to the **Preset Volume List** box on the ShadowImage - S/390® main panel. **Note:** Use the **Delete** command to remove any pairs from the list.
7. On the ShadowImage - S/390® main panel, click the **Apply** button to split the pair(s).  
When the pairsplit operation(s) start, the ShadowImage - S/390® main panel shows the new pairs with *SP-Pend* or *V-Split* status and the progress (%) of the update copy operation(s). The *Split* status is displayed right away if there were no pending update copy operations.
8. Select the **Refresh** button () on the Storage Navigator main panel to monitor the progress of the split operation(s).

#### 4.6.1 Adding and Splitting Pairs


The split operation can also be used to simultaneously add and split new SI390 pairs. In this case, the split operation changes the pair status from *simplex* to *SP-Pend* or *V-split*, copies all data on the S-VOL to the T-VOL, and then changes the pair status to *Split*.

**Note:** The combined add & split operation can be performed using PPRC commands. Please see Table 5.1 in section 5.1.

To add and split one or more new SI390 pairs with a single Storage Navigator operation:

1. If you want the split T-VOLs to be identical to the S-VOLs, stop all write operations to the S-VOLs before adding and splitting the pairs. This ensures that there are no updates to the S-VOLs while the split operations are synchronizing the T-VOLs to the S-VOLs.  
**Caution:** The S-VOL and T-VOL are synchronized only when the pair status changes from *SP-Pend* or *V-Split* to *Split*. Due to the ShadowImage - S/390® asynchronous update copy operations, this status transition can take several minutes.
2. On the ShadowImage - S/390® main panel, select the desired CU image or LDEV in the **Tree View** box to filter the volumes displayed in the **Volume List** box (e.g., to display unreserved simplex volumes).
3. Select the volume(s) which will be the S-VOL(s) of the new pairs to be added and split, right-click using the mouse, and then select the **Split Pair** command to open the Split Volume Pair panel.
4. Set the copy pace (**Slower**, **Medium**, or **Faster**) and split type (**Quick** or **Steady**) for all pairs being added and split.
5. Specify the T-VOL(s) as follows:
  - a) Select the desired S-VOL.
  - b) Select the desired CU image, display either reserved or unreserved volumes, and then select the desired T-VOL. **Note:** You can select unreserved T-VOL, because the subsystem will automatically reserve the T-VOL.
  - c) Select the **Set** button to add the T-VOL to the selected S-VOL. The T-VOL is now displayed below the selected S-VOL.
  - d) If you want to add another T-VOL to the same S-VOL, repeat steps (b) and (c) to add the next T-VOL to the selected S-VOL. Each pair to be added and split is displayed separately in the list of pairs.
6. Repeat step (5) until the desired pair(s) is/are displayed. Use the **Change** button to replace T-VOLs, the **Set** button to add T-VOLs, and the **Delete** command to remove pairs.

**Instructions continue on the next page.**

7. Select the **OK** button to reflect the settings to the **Preset Volume List** box on the ShadowImage - S/390® main panel.
8. On the ShadowImage - S/390® main panel, click the **Apply** button to create and split the pair(s).  
  
When the split operation(s) start, the ShadowImage - S/390® main panel shows the new pairs with *SP-Pend* or *V-Split* status and the progress (%) of the update copy operation(s). The *Split* status is displayed right away if there were no pending update copy operations.
9. Select the **Refresh** button () on the Storage Navigator main panel to monitor the progress of the pairsplit operation(s).

## 4.7 Resynchronizing ShadowImage – S/390® Pairs

The Resynchronize Volume Pair panel (see Figure 4.11) displays pair information for the pair(s) selected on the ShadowImage – S/390® main panel and allows you to resynchronize the pair(s). To open the Resynchronize Volume Pair panel, select one or more pairs in the Split, V-Split or Suspended status in the **Volume List** box on the ShadowImage – S/390® main panel, right-click using the mouse, and then select the **Resync Pair** command.

**Note:** ShadowImage – S/390® supports the CESTPAIR/PPRCOPY ESTPAIR commands for resynchronizing split or suspended SI390 pairs. See Chapter 5 for further information on using PPRC commands.

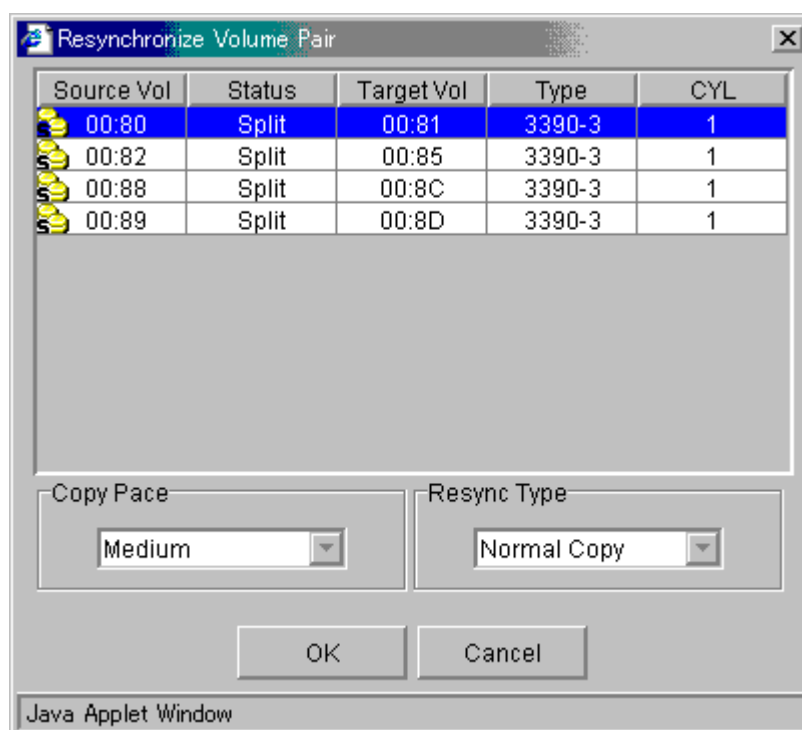


Figure 4.11 The Resynchronize Volume Pair Panel

The ShadowImage – S/390® panel lists the pair(s) selected on the ShadowImage – S/390® main panel and shows the pair status and copy pace for each pair. The **Copy Pace** box allows you to select the copy pace for the pairs being resynchronized: **Slower**, **Medium**, or **Faster**. The **Resync Type** box allows you to select the pairresync type for the pairs being resynchronized: **Normal Copy**, **Quick Resync**, **Reverse Copy**, or **Quick Restore**.

The **OK** button adds the specified pair(s) to the **Preset Volume List** box on the ShadowImage - S/390® main panel. **Note:** You must click the **Apply** button on the ShadowImage - S/390® main panel to start the resync operation for the specified pair(s). The **Cancel** button exits the Resynchronize Volume Pair panel and returns you to the ShadowImage - S/390® main panel. To remove any pair(s) from the list, select the unneeded pair(s), right-click using the mouse, and then select the **Delete** command.

To resynchronize one or more ShadowImage - S/390® pairs:

1. Vary the split T-VOLs offline before starting the resync operations. When the resync operation starts, the 9900V subsystem will stop accepting write I/Os to the T-VOL.
2. On the ShadowImage - S/390® main panel, select the desired CU image or LDEV in the **Tree View** box to filter the volumes displayed in the **Volume List** box (e.g., to display only split and suspended S/390 pairs).
3. On the ShadowImage - S/390® main panel, select the pair(s) you want to resync, right-click using the mouse, and then select the **Resync Pair** command to open the Resynchronize Volume Pair panel.
4. On the Resynchronize Volume Pair panel, select the pair(s), and select the desired copy pace (**Slower**, **Medium**, or **Faster**) and resync type (**Normal Copy**, **Quick Resync**, **Reverse Copy**, or **Quick Restore**) for each pair. Reverse and quick restore pairresync cannot be performed on pairs in the *V-Split* or *Suspended* status.


**WARNING:** Make sure to select the correct resync direction (normal/quick, or reverse/quick restore).

**Caution:** During the quick restore operation, the RAID levels, HDD types, and FlashAccess settings are swapped. To avoid performance impact due to quick restore operations:

- a) Make sure that the S-VOL and T-VOL have the same RAID level and HDD type before performing the quick restore operation. If you want to restore the original RAID levels after quick restore, stop host I/Os to the pair, split the pair, perform the quick restore operation for that pair again, and then restart the host I/Os to the pair.
- b) Because the FlashAccess settings are exchanged during a quick restore operation, you must perform one of the two following operations. If you do not, the change of location of the cache residence areas may cause I/O performance to the FlashAccess data to be down.
  - Set the same FlashAccess settings (locations) for the S-VOL and T-VOL before performing the quick restore operation.
  - Release the FlashAccess settings of the S-VOL and T-VOL before the quick restore operation, and then reset the FlashAccess settings of the S-VOL and T-VOL after the pair changes to *duplex* status as a result of the quick restore operation.

**Note:** If you do not want to resynchronize the S-VOL and T-VOL after the quick restore operation, you must set the Swap&Freeze option before performing the quick restore operation (see section 2.4.1 and 4.11).



5. Select the **OK** button to reflect the settings to the **Preset Volume List** box on the ShadowImage - S/390® main panel.
6. Repeat steps (4) through (5) until the **Preset Volume List** box on the ShadowImage - S/390® main panel displays the desired pairs (settings). **Note:** Make sure to vary the T-VOL(s) offline before starting resync operations.
7. On the ShadowImage - S/390® main panel, select the **Apply** button to resync the specified pair(s).  
The ShadowImage - S/390® main panel now displays the result(s) of the pairresync operation(s) (i.e., pair status changed to *resync*, *resync-R*, or *duplex*).
8. Select the **Refresh** button () on the Storage Navigator main panel to monitor the progress of the resync operation(s).

## 4.8 Suspending ShadowImage – S/390® Pairs

The Suspend Volume Pair panel (see Figure 4.12) displays pair information for the pair(s) selected on the ShadowImage - S/390® main panel and allows you to suspend the pair(s). To open the Suspend Volume Pair panel, select one or more pairs in the **Volume List** box on the ShadowImage - S/390® main panel, right-click using the mouse, and then select the **Suspend Pair** command.

**Note:** The CSUSPEND/PPRCOPY SUSPEND commands execute a ShadowImage - S/390® split operation. There is no TSO/ICKDSF command equivalent for manually suspending pairs. See Chapter 5 for further information on using PPRC commands.

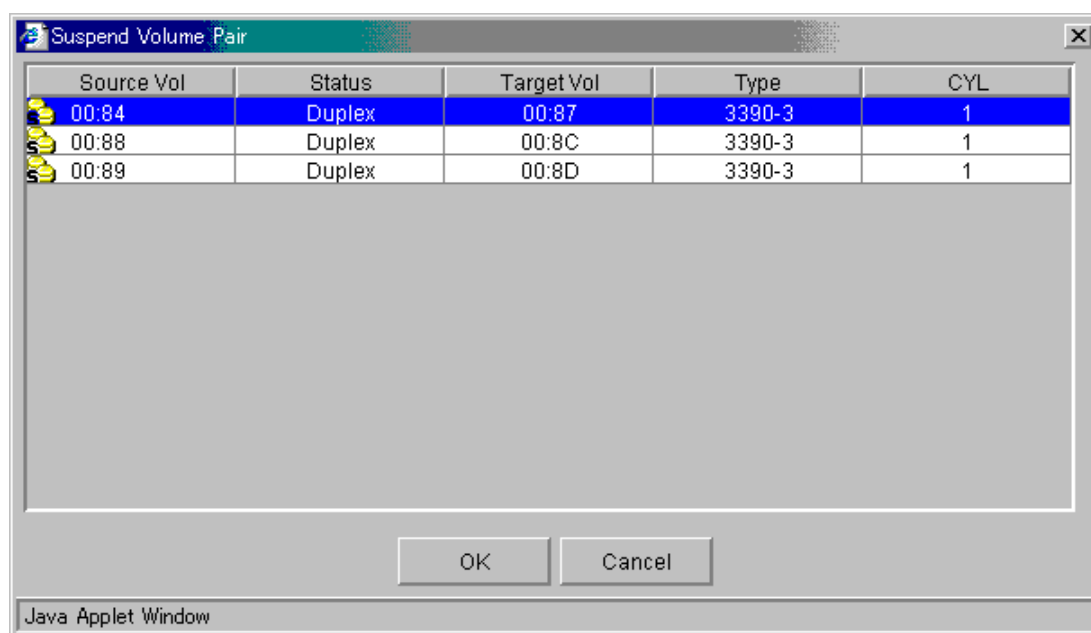


Figure 4.12 The Suspend Volume Pair Panel

The Suspend Volume Pair panel lists the pair(s) selected on the ShadowImage - S/390® main panel and shows the pair status and copy pace for each pair. The **OK** button suspends the selected pair(s). The **Cancel** button closes the Suspend Volume Pair panel and returns you to the ShadowImage - S/390® main panel.


To suspend one or more S/390 pairs:

1. On the ShadowImage - S/390® main panel, select the desired CU image or LDEV in the **Tree View** box to filter the volumes displayed in the **Volume List** box.
2. Select the pair(s) that you want to suspend (or the volume(s) whose pairs you want to suspend), right-click using the mouse, and then select the **Suspend Pair** command to open the Suspend Volume Pair panel.
3. On the Suspend Volume Pair panel, select the pair(s) you want to suspend, and select the **OK** button to reflect the settings to the **Preset Volume List** box on the ShadowImage - S/390® main panel.

**Note:** To remove pair(s) from the list, select the unneeded pair(s), right-click using the mouse, and then select the **Delete** command.

4. Repeat steps (2) and (3) to suspend additional pairs in the list.
5. On the ShadowImage - S/390® main panel, select the **Apply** button to suspend the specified pair(s).

The ShadowImage - S/390® main panel now displays the result(s) of the suspend operation(s) (i.e., pair status changed to *Suspend*).

6. Select the **Refresh** button () on the Storage Navigator main panel to display the latest information.

## 4.9 Deleting ShadowImage – S/390® Pairs

The Delete Volume Pair panel (see Figure 4.13) displays pair information for the pair(s) selected on the ShadowImage - S/390® main panel and allows you to delete the pair(s). To open the Delete Volume Pair panel, select one or more pairs (except *Simplex* and *V-Split* pairs) in the **Volume List** box on the ShadowImage - S/390® main panel, right-click using the mouse, and then select the **Delete Pair** command.

**Note:** ShadowImage - S/390® supports the CDELPAR/PPRCOPY DELPAIR commands for deleting SI390 pairs. See 5.1 for further information on using PPRC commands.

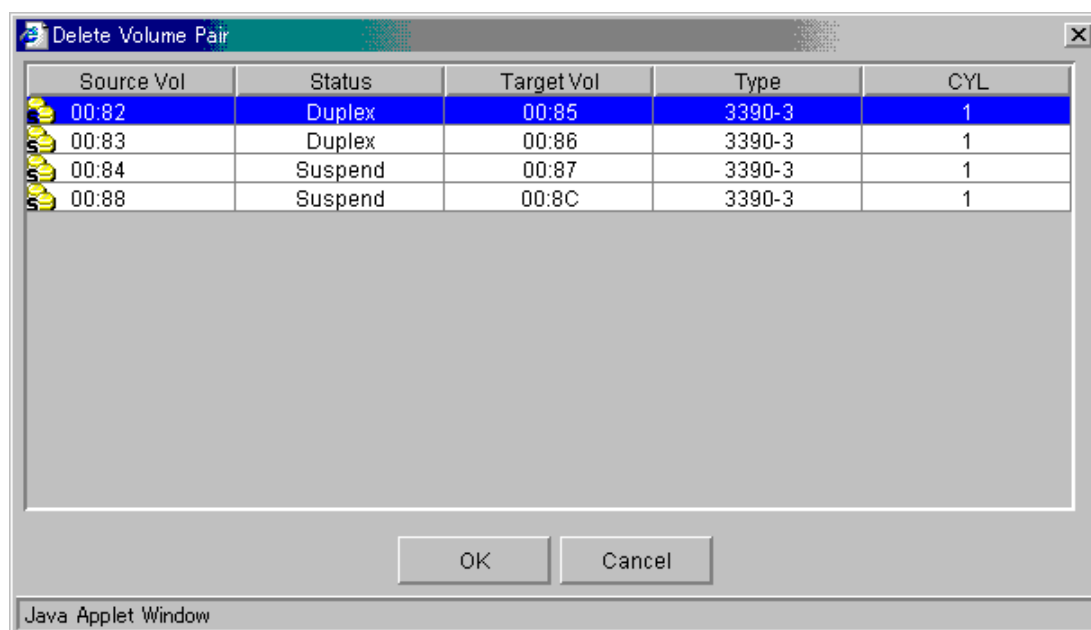



Figure 4.13 The Delete Volume Pair Panel

The Delete Volume Pair panel lists the pair(s) selected on the ShadowImage - S/390® main panel and shows the pair status and copy pace for each pair. The **OK** button deletes the selected pair(s). The **Cancel** button closes the Delete Volume Pair panel and returns you to the ShadowImage - S/390® main panel.

To delete one or more S/390 pairs:

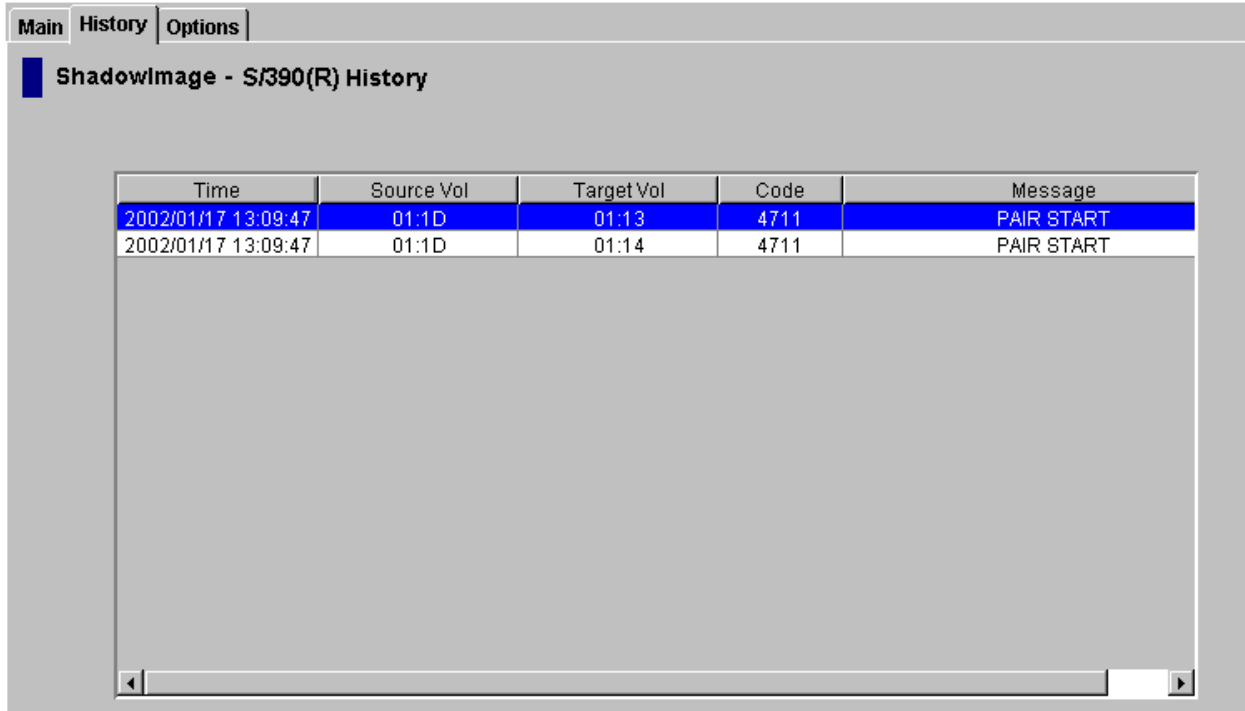
1. If you want to synchronize the S-VOL and T-VOL before deleting the pair:
  - a) Wait until all write I/Os to the S-VOL are complete, and then take the S-VOL offline to prevent the S-VOL from being updated during or after the delete operation.
  - b) After the S-VOL is offline, suspend the pair to copy all pending updates to the T-VOL.
  - c) When the pair status changes to *Split*, the S-VOL and T-VOL are synchronized.
2. On the ShadowImage - S/390® main panel, select the desired CU image or LDEV in the **Tree View** box to filter the volumes displayed in the **Volume List** box.
3. Select the pair(s) that you want to delete (or the volume(s) whose pairs you want to delete), right-click using the mouse, and then select the **Delete Pair** command to open the Delete Volume Pair panel.

**Note:** Pairs with *V-Split* status cannot be deleted. To remove pair(s) from the list, select the unneeded pair(s), right-click using the mouse, and then select the **Delete** command.
4. On the Delete Volume Pair panel, select the pair(s) you want to delete, and select the **OK** button to reflect the settings to the **Preset Volume List** box on the ShadowImage - S/390® main panel.
5. On the ShadowImage - S/390® main panel, select the **Apply** button to delete the specified pair(s) or volume(s).

The ShadowImage - S/390® main panel now displays the result(s) of the delete operation(s).
6. Select the **Refresh** button () on the Storage Navigator main panel to display the latest information.

## 4.10 Viewing ShadowImage – S/390® Pair Status and History


The History panel (see Figure 4.14) displays current ShadowImage – S/390® pair status information as well as ShadowImage – S/390® pair history information for the selected CU image. To open the History panel, select the **History** tab on the ShadowImage – S/390® main panel.



Time	Source Vol	Target Vol	Code	Message
2002/01/17 13:09:47	01:1D	01:13	4711	PAIR START
2002/01/17 13:09:47	01:1D	01:14	4711	PAIR START

Figure 4.14 The History Panel

The **ShadowImage - S/390(R) History** box displays the following information:

- SI390 pair activity listed by: date and time, S-VOL and T-VOL ID (CU:LDEV), SI390 code and message (see Table 4.3). The **Time** button sorts the list by date and time. The **Source Vol** and **Target Vol** buttons sort the list by S-VOL or T-VOL. The **Code** button sorts by code number. The **Message** button sorts according to message type.
- The **Refresh** button () on the Storage Navigator main panel updates all information on the History panel.

**Table 4.3 ShadowImage Status & History Reference Codes and Messages**

Code	Message	Description
4710 - 471F	DUPLEX START	The SI390 initial copy operation started.
4720 - 472F	DUPLEX END	The SI390 initial copy operation ended, and the pair status changed to <i>Duplex</i> .
4730 - 473F	SPLIT START	The SI390 split operation started, and the pair status changed to <i>SP-Pend</i> or <i>V-Split</i> .
4740 - 474F	SPLIT END	The SI390 split operation ended, and the pair status changed to <i>Split</i> .
4750 - 475F	RESYNC START RESYNC-R START	The SI390 resync operation started, and the pair status changed to <i>Resync</i> or <i>Resync-R</i> .
4760 - 476F	RESYNC END RESYNC-R END	The SI390 resync operation ended, and the pair status changed to <i>Duplex</i> .
4774	F-COPY START	The ShadowImage - FlashCopy® operation started.
4775	F-COPY END	The ShadowImage - FlashCopy® operation ended normally.
4776	F-COPY DELETE	The ShadowImage - FlashCopy® delete operation was performed.
4780 - 478F	SIMPLEX	The SI390 delete operation was performed, and the pair status changed to <i>Simplex</i> .
4790 - 479F	SUSPENDED	The SI390 suspend operation was performed, and the pair status changed to <i>Suspend</i> .
47A0 - 47AF	PENDING WARNING END	A copy ended with a warning.
47B0 - 47BF	PENDING ABNORMAL END(SVOL BLOCKADE)	A copy ended abnormally due to S-VOL blockade.
47C0 - 47CF	PENDING ABNORMAL END(TVOL BLOCKADE)	A copy ended abnormally due to T-VOL blockade.
47D0 - 47DF	PENDING ABNORMAL END	A copy ended abnormally (reason other than above).
47E7	COMPULSION PAIR SUSPEND	A pair was suspended compulsorily.
4B00 - 4B0F	F-COPY ABNORMAL END	The ShadowImage - FlashCopy® operation ended abnormally.

## 4.11 Setting ShadowImage - S/390® Options

You can set options for ShadowImage - S/390® on the Options panel (see Figure 4.15). Select the **Options** tab on the ShadowImage - S/390® main panel to open the Options panel. On the Options panel, select and/or clear the check boxes to set options.

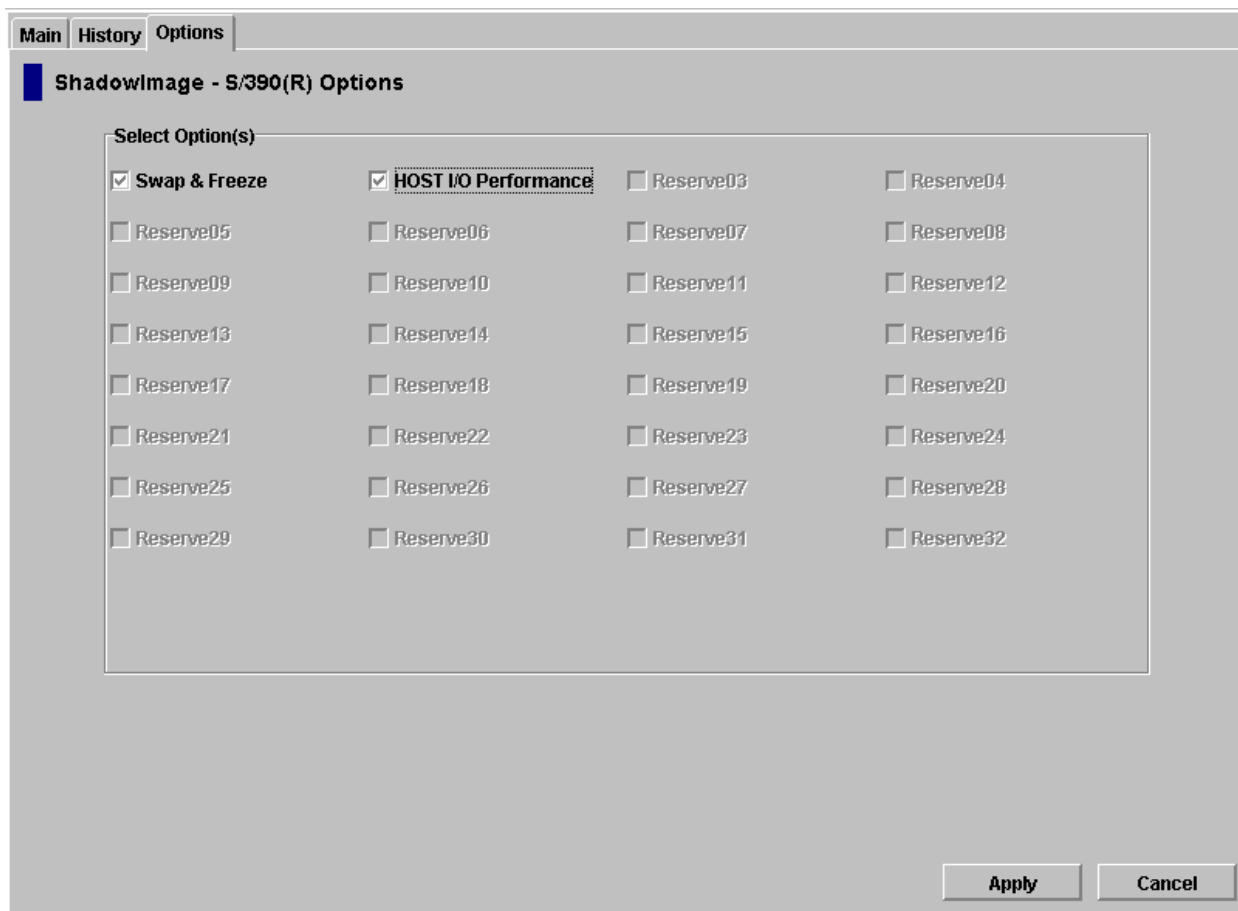


Figure 4.15 The Options Panel

The **Select Option(s)** box displays the check boxes of the ShadowImage - S/390® options.

**Note:** More options will be supported in the future. Refer to section 2.4 for further information.

To set a ShadowImage - S/390® option (Swap&Freeze option):

1. On the ShadowImage - S/390® main panel, select the **Options** tab to display the Options panel.  
When the Options panel is opened, it shows the current status of the option.
2. Select the check box you want to set. **Note:** If you do not want to set any option, clear all check boxes in the **Select Option(s)** box.
3. Select the **Apply** button.

You can right now perform a ShadowImage - S/390® operation with the specified option.



## Chapter 5 Using PPRC Commands for ShadowImage – S/390®

ShadowImage – S/390® supports both TSO PPRC commands and ICKDSF PPRCOPY commands to enable you to perform ShadowImage – S/390® operations from the S/390® host system. This user's guide does not provide complete instructions for using PPRC commands. For detailed information on using PPRC TSO and ICKDSF commands, please refer to the following IBM user documents: *DFSMS/MVS V1 Remote Copy Guide and Reference* (SC35-0169) and *ICKDSF R16 Refresh User's Guide* (GC35-0033).

### 5.1 PPRC Command Support

Table 5.1 lists and describes the PPRC commands supported by ShadowImage – S/390®. Table 5.2 lists and describes the TSO command parameters supported by SI390. Table 5.3 lists and describes the ICKDSF command parameters supported by SI390.

**Table 5.1 PPRC Commands**

SI390 Storage Navigator Operation	TSO Command	ICKDSF Command	Function	Restrictions
Set Reserve Attribute (reserve)	Not required	Not required	Sets the reserve attribute of the specified volume.	The specified volume must be <i>simplex</i> and offline to host.
Reset Reserve Attribute (unreserve)	Not required	Not required	Resets reserve attribute of the specified volume.	The specified volume must be <i>simplex</i> .
Add Pair (duplex request)	CESTPAIR	PPRCOPY ESTPAIR	Adds a pair, starts initial copy operation.	The specified volume must be <i>simplex</i> .
Add and Split Pair	CESTPAIR	PPRCOPY ESTPAIR	Adds and simultaneously splits a pair.	The specified volume must be <i>simplex</i> .
Quick Split Pair	CSUSPEND	PPRCOPY SUSPEND	Splits a pair, starts quick split operation.	The specified volume must be <i>duplex</i> or <i>pending</i> .
Steady Split Pair	CSUSPEND	PPRCOPY SUSPEND	Splits a pair, starts steady split operation.	The specified volume must be <i>duplex</i> or <i>pending</i> .
Normal Resync Pair	CESTPAIR	PPRCOPY ESTPAIR	Resynchronizes a pair, starts normal resync.	The specified volume must be <i>split</i> , <i>V-split</i> , or <i>suspended</i> .
Quick Resync Pair	CESTPAIR	PPRCOPY ESTPAIR	Resynchronizes a pair, starts quick resync.	The specified volume must be <i>split</i> , <i>V-split</i> , or <i>suspended</i> .
Reverse Resync Pair	CESTPAIR	PPRCOPY ESTPAIR	Resynchronizes a pair, starts reverse resync.	The specified volume must be <i>split</i> .
Quick Restore Pair	CESTPAIR	PPRCOPY ESTPAIR	Resynchronizes a pair, starts quick restore.	The specified volume must be <i>split</i> .
Delete Pair (simplex request)	CDELPAR	PPRCOPY DELPAIR	Deletes a pair, changes status to simplex.	The specified volume cannot be <i>simplex</i> .
Suspend Pair	Not available*	Not available*	Stops update copy operations.	The specified volume cannot be <i>simplex</i> .
Detail (the Detail panel), the History panel	CQUERY	PPRCOPY QUERY	Displays detailed pair status information.	None.

**\*Note:** The ShadowImage – S/390® suspend operations cannot be requested using TSO/ICKDSF commands. The CSUSPEND/PPRCOPY SUSPEND commands execute split operations on ShadowImage – S/390® pairs.

**Table 5.2 TSO Command Parameters (continues on next page)**

Command	Parameter	Description
CESTPAIR	DEVN	Device number.
	PRIM	<p>Primary volume (S-VOL): SSID, serial number, channel connection address, CU number (only for the DKC emulation type 2105).</p> <p>You can set an additional parameter corresponding to each request instead of a serial number.</p> <p>(1) For an Add and Split request (refer to sections 4.5 and 4.6), the parameter is <b>MSF00</b>. This request is valid for MODE(COPY) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)  Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390.  Byte 8: Subcode-1 'S' = Split ← Requests simultaneous add and split.  Byte 9: Subcode-2 'F' = Fast Mode ← Requests quick split.  Byte 10-11: Not used (xF0*2)</p> <p>(2) For a Quick Resync request, the parameter is <b>MRF00</b>. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)  Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390.  Byte 8: Subcode-1 'R' = Resync ← Distinguishes resync from add.  Byte 9: Subcode-2 'F' = Fast Mode ← Requests quick resync.  Byte 10-11: Not used (xF0*2)</p> <p>(3) For a Quick Restore request, the parameter is <b>MRQ00</b>. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)  Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390.  Byte 8: Subcode-1 'R' = Resync ← Distinguishes resync from add.  Byte 9: Subcode-2 'Q' = Quick Mode ← Requests quick restore.  Byte 10-11: Not used (xF0*2)</p> <p>(4) For a Reverse Resync request, the parameter is <b>MRR00</b>. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)  Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390.  Byte 8: Subcode-1 'R' = Resync ← Distinguishes resync from add.  Byte 9: Subcode-2 'R' = Reverse Resync ← Requests reverse resync.  Byte 10-11: Not used (xF0*2)</p> <p>If you set a parameter other than the above parameters, the command will be rejected.</p>
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address, CU number (only for the DKC emulation type 2105).
	MODE	<p>COPY = Initial full-volume copy.  NOCOPY = Same as COPY.  RESYNC = Re-establish a split or suspended volume pair.</p>
	PACE	<p>For DKC emulation type 2105: Always medium.  For others: 1 (slow), other than 1 (medium).</p>
	CRIT	Not applicable.
	MSGREQ	<p>YES = Applicable.  NO = Not applicable.</p>
	ONLINSEC	<p>YES = Does not check path group.  NO = Checks path group.  <b>Note:</b> This parameter is valid only for the DKC emulation type 2105.</p>

**Table 5.2 TSO Command Parameters (continued)**

Command	Parameter	Description
CSUSPEND	DEVN	Device number.
	PRIM	Primary volume (S-VOL): SSID, serial number, channel connection address, CU number (only for the disk controller emulation type 2105).  You can set an additional parameter corresponding to each request instead of a serial number. For a steady split request, the parameter is <b>MPS00</b> . This request is valid for steady split. The parameter locations and descriptions are as follows:  Byte 0-6: fixed value (xF0*7) Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390. Byte 8: Subcode-1 'P' = SPLIT Byte 9: Subcode-2 'S' = Steady Split ← Requests steady split. Byte 10-11: Not used (xF0*2)  If you set a parameter other than the above parameters, the command will be rejected.
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address, CU number (only for the disk controller emulation type 2105)..
	PRIMARY	Not applicable.
	QUIESCE	See section 5.5.1 for information on the QUIESCE parameter.
CDELPAIR	DEVN	Device number.
	PRIM	Primary volume (S-VOL): SSID, serial number, channel connection address, CU number (only for the disk controller emulation type 2105).
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address, CU number (only for the disk controller emulation type 2105).
CQUERY	DEVN	Device number.
	PATHS	Not applicable.
CRECOVER	CRECOVER is not used for SI390. Refer to the TC390 documentation for information on CRECOVER.	
CGROUP	CGROUP is not used for SI390. Refer to the TC390 documentation for information on CGROUP.	

**Table 5.3 ICKDSF Command Parameters (continues on the next page)**

Command	Parameter	Description
ESTPAIR	DDNAME   SYSNAME   UNITADDRESS	DDNAME = <i>dname</i> = JCL statement identifying the volume. SYSNAME = <i>sysxxx</i> = SYSNAME in the ASSGN system control statement. UNITADDRESS = <i>ccuu</i> = device number.
	PRI	<p>Primary volume (S-VOL): SSID, serial number, channel connection address.</p> <p>You can set an additional parameter corresponding to each request instead of a serial number.</p> <p>(1) For an Add and Split request (refer to sections 4.5 and 4.6), the parameter is <b>MSF00</b>. This request is valid for MODE(COPY) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)            Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390.            Byte 8: Subcode-1 'S' = Split ← Requests simultaneous add and split.            Byte 9: Subcode-2 'F' = Fast Mode ← Requests quick split.            Byte 10-11: Not used (xF0*2)</p> <p>(2) For a Quick Resync request, the parameter is <b>MRQ00</b>. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)            Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390.            Byte 8: Subcode-1 'R' = Resync ← Distinguishes resync from add.            Byte 9: Subcode-2 'F' = Fast Mode ← Requests quick resync.            Byte 10-11: Not used (xF0*2)</p> <p>(3) For a Quick Restore request, the parameter is <b>MRQ00</b>. This request is valid for MODE(RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)            Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390.            Byte 8: Subcode-1 'R' = Resync ← Distinguishes resync from add.            Byte 9: Subcode-2 'Q' = Quick Mode ← Requests quick restore.            Byte 10-11: Not used (xF0*2)</p> <p>(4) For a Reverse Resync request, the parameter is <b>MRR00</b>. This request is valid for MODE (RESYNC) only. The parameter locations and descriptions are as follows:</p> <p>Byte 0-6: fixed value (xF0*7)            Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390.            Byte 8: Subcode-1 'R' = Resync ← Distinguishes resync from add.            Byte 9: Subcode-2 'R' = Reverse Resync ← Requests reverse resync.            Byte 10-11: Not used (xF0*2)</p> <p>If you set a parameter other than the above parameters, the command will be rejected.</p>
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address.
	MODE	COPY = Initial full-volume copy. NOCOPY = Same as COPY. RESYNC = Re-established a split or suspended volume pair.
	PACE	For DKC emulation type 2105: Always medium. For others: 1 (slow), other than 1 (medium).
	CRIT	Not applicable.
	MSGREQ	YES = Applicable. NO = Not applicable.
	LSS	Primary volume CU number, secondary volume CU number (only for the disk controller emulation type 2105).

**Table 5.3 ICKDSF Command Parameters (continued)**

Command	Parameter	Description
SUSPEND	DDNAME   SYSNAME   UNITADDRESS	DDNAME = dname = JCL statement identifying the volume. SYSNAME = sysxxx = SYSNAME in the ASSGN system control statement. UNITADDRESS = ccuu = device number.
	PRI	Primary volume (S-VOL): SSID, serial number, channel connection address.  You can set an additional parameter corresponding to each request instead of a serial number. For a steady split request, the parameter is <b>MPS00</b> . This request is valid for steady split. The parameter locations and descriptions are as follows:  Byte 0-6: fixed value (xF0*7) Byte 7: Indication of MRCF 'M' = MRCF ← Distinguishes SI390 from TC390. Byte 8: Subcode-1 'P' = SPLIT Byte 9: Subcode-2 'S' = Steady Split ← Requests steady split. Byte 10-11: Not used (xF0*2)  If you set a parameter other than the above parameters, the command will be rejected.
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address.
	PRIMA	Not applicable.
	QUIESCE	See section 5.5.1 for information on the QUIESCE parameter.
	LSS	Primary volume CU number, secondary volume CU number (only for the disk controller emulation type 2105).
DELPAIR	DDNAME   SYSNAME   UNITADDRESS	DDNAME = dname = JCL statement identifying the volume. SYSNAME = sysxxx = SYSNAME in the ASSGN system control statement. UNITADDRESS = ccuu = device number.
	PRI	Primary volume (S-VOL): SSID, serial number, channel connection address.
	SEC	Secondary volume (T-VOL): SSID, serial number, channel connection address.
	LSS	Primary volume CU number, secondary volume CU number (only for the disk controller emulation type 2105).
QUERY	DDNAME   SYSNAME   UNITADDRESS	DDNAME = dname = JCL statement identifying the volume. SYSNAME = sysxxx = SYSNAME in the ASSGN system control statement. UNITADDRESS = ccuu = device number.
	PATHS	Not applicable.
	PRIMAINT	Directs PPRC to reject all write I/Os to the S-VOL except ICKDSF media maintenance channel programs. Causes the 9900V to unit check all application write I/Os to the S-VOL. Use only as part of a media maintenance procedure.
RECOVER	PPRCOPY RECOVER is not used for SI390.	

## 5.1.1 PPRC Restrictions

Table 5.4 lists and describes the restrictions for using TSO/ICKDSF commands with SI390 volumes. Table 5.5 lists the conditions for accepting TSO/ICKDSF commands.

**Table 5.4 Restrictions for PPRC Commands**

Command/Parameter	Restriction	Error Report
ESTPAIR Command SUSPEND Command	Do not issue ESTPAIR or SUSPEND command to a PENDING device.	PPRC PENDING STATUS CC = 12
RECOVER Command	Recovery commands are not valid, because SI390 pairs are constructed within the same 9900V subsystem. <b>Note:</b> If a recovery command is used by mistake, the result is the same as a delete pair command, except when VOLID is specified.	PPRC PENDING STATUS CC = 4
PRIMARY Parameter	SI390 does not support use of the primary parameter within the SUSPEND command.	SI390 ignores this parameter.
Set Path	Not needed for SI390.	SI390 ignores this parameter.

**Table 5.5 Accepting PPRC Commands**

TSO PPRC Command	ICKDSF PPRCOPY Command	Issued to S-VOL	Issued to T-VOL
CESTPAIR	ESTPAIR	OK	Not accepted
CESTPAIR with MODE(RESYNC)	ESTPAIR with MODE(RESYNC)	OK	Not accepted
CSUSPEND	SUSPEND	OK	Not accepted
CDELPAIR	DELPAIR	OK	Not accepted
CQUERY	QUERY	OK	OK

### 5.1.2 PPRC Commands with ShadowImage – S/390® and TrueCopy – S/390®

Both ShadowImage - S/390® and TrueCopy - S/390® support PPRC commands. The user must ensure that commands are being executed by the correct program against the correct volumes. A PPRC command issued to the 9900V subsystem will be executed by SI390 against SI390 pairs if all of the following conditions are met. If any of these conditions is not met, the PPRC command will be executed by TrueCopy - S/390® against TrueCopy - S/390® pairs.

1. The ShadowImage - S/390® feature and software must be installed and enabled on the 9900V subsystem.
2. The serial numbers of the S-VOL and the T-VOL must be the same.
  - a) If you enter different serial numbers for an existing S-VOL and T-VOL, the command will fail.
  - b) If you enter different serial numbers and the specified ShadowImage - S/390® pair does not exist, the command will be executed by TrueCopy - S/390®.
3. If the 9900V subsystem contains TrueCopy - S/390® pairs, at least one ShadowImage - S/390® pair must exist before the command is issued.
  - a) If the 9900V subsystem contains both SI390 and TC390 pairs, PPRC and PPRCOPY commands which specify the same serial number for the primary (source) and secondary (target) volumes will be executed by ShadowImage - S/390®.
  - b) If the 9900V subsystem does not contain any SI390 or TC390 pairs, PPRC and PPRCOPY commands which specify the same serial number for the primary (source) and secondary (target) volumes will be executed by ShadowImage - S/390®.
  - c) If the 9900V subsystem contains TC390 pairs but no SI390 pairs, PPRC and PPRCOPY commands which specify the same serial number for the primary (source) and secondary (target) volumes will be executed by TC390.
  - d) To start ShadowImage - S/390® operations on a 9900V subsystem which already contains TC390 pairs, you must use the SI390 Storage Navigator software to add at least one SI390 pair. After a ShadowImage - S/390® pair exists, the condition in 3(a) is met.

## 5.2 PSF and DEVSERV Commands

The perform subsystem function (PSF) commands key the 9900V subsystem to accept commands and requests from the user. Table 5.6 describes the operability of PSF commands on ShadowImage - S/390® volumes. Table 5.7 describes the PSF Read Subsystem Data and DEVSERV Sense Subsystem Status results for ShadowImage - S/390® volumes.

**Table 5.6 PSF Command Operability for ShadowImage – S/390® Volumes**

Item	Operability for ShadowImage – S/390®
Device pair status.	See Table 5.7.
Percent completion of the copy operation.	Not available for ShadowImage – S/390®, because the ShadowImage – S/390® differential bitmap format is different than the TrueCopy – S/390® differential bitmap format.
S-VOL with 2 or more T-VOLs.	Displays information for the pair having the T-VOL with the lowest LDEV ID.
Path status.	Active.
Path number.	If the volume does not also belong to a TC390 pair, 1 is displayed with TC390 info.

**Table 5.7 PSF and DEVSERV Results for ShadowImage – S/390® Volumes**

Pair Status	PSF Read Subsystem Data		DEVSERV Sense Subsystem Status	
	S-VOL	T-VOL	S-VOL	T-VOL
Pending	PPRI-PNDG	PSEC-PNDG	PPRI-PNDG	PSEC-PNDG
Duplex	PPRIMARY	PSECONDRY	PPRIMARY	PSECONDRY
SP-Pend	PPRI-PNDG	PSEC-PNDG	PPRI-PNDG	PSEC-PNDG
V-Split	PPRI-SUSP	PSEC-SUSP	PPRI-SUSP	SIMPLEX
Split	PPRI-SUSP	PSEC-SUSP	PPRI-SUSP	SIMPLEX
Suspend	PPRI-SUSP	PSEC-SUSP	PPRI-SUSP	PSEC-SUSP
Resync	PPRI-PNDG	PSEC-PNDG	PPRI-PNDG	PSEC-PNDG

**Note:** PPRIMARY and PSECONDRY indicate that the volume is in the DUPLEX state.



### 5.3 Adding Pairs: CESTPAIR and PPRCOPY ESTPAIR

The CESTPAIR and PPRCOPY ESTPAIR commands are equivalent to the SI390 add pair operation (changes pair status to *pending*). Figure 5.1 shows an example of the CESTPAIR command. Figure 5.2 shows an example of the PPRCOPY ESTPAIR command. The CESTPAIR and PPRCOPY ESTPAIR commands must be issued to the S-VOL of the pair being created, and the T-VOL must be offline to the host before these commands are issued.

```
CESTPAIR  DEVN (X 'DE80' )  PRIM (X '0080' ,30158,X '00' ) SEC (X '0080' ,30158,X '01' )  
          MODE (COPY)  PACE (15)
```

**Figure 5.1** Example of CESTPAIR Command

```
//EPAIR      JOB  
//           EXEC  PGM=ICKDSF  
//SYSPRINT   DD  SYSOUT=*  
//DD1        DD  UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80  
//SYSIN      DD  *  
PPRCOPY      ESTPAIR DDNAME(DD1) PRI(X'0080',30158,X'00') SEC(X'0080',30158,X'01')  
              MODE(COPY) PACE(15)  
/*  
//
```

**Figure 5.2** Example of PPRCOPY ESTPAIR Command

## 5.4 Displaying Pair Status: CQUERY, PPRCOPY QUERY, DEVSERV

The CQUERY TSO and PPRCOPY QUERY ICKDSF commands are equivalent to the SI390 pair status display and status & history functions. Figure 5.3 shows an example of the CQUERY command. Figure 5.4 shows an example of the PPRCOPY QUERY command.

The DEVSERV command can also be used to display ShadowImage - S/390® pair status. Figure 5.5 shows an example of the DEVSERV command. Refer to Table 5.7 for a description of the DEVSERV command results for ShadowImage - S/390® volumes.

ShadowImage - S/390® supports multiple T-VOLs for an S-VOL, and SI390 and TC390 can both be defined for the same volume. When multiple pairs exist on one volume, the CQUERY and PPRCOPY QUERY commands can only report the status of one pair. Table 5.8 lists the status displayed by the host for the SI390 and/or TC390 volume pair configurations.

- If the 9900V contains only ShadowImage - S/390® pairs, the CQUERY and PPRCOPY QUERY commands will report the ShadowImage - S/390® pair status.
- If the 9900V contains only TrueCopy - S/390® pairs, the CQUERY and PPRCOPY QUERY commands will report the TC390 pair status.
- If the 9900V contains both ShadowImage - S/390® and TrueCopy - S/390® pairs, the CQUERY and PPRCOPY QUERY commands will report the TC390 pair status. **Note:** To obtain the HRMCF pair status, issue the status command to the SI390 T-VOL or use the ShadowImage - S/390® Storage Navigator software to view the SI390 pair status.
- If an S-VOL has multiple T-VOLs, the status command will report pair status for the pair whose T-VOL has the lowest LDEV ID. To obtain the status of a ShadowImage - S/390® pair with one of the other T-VOLs, issue the status command to the desired T-VOL.

```

CQUERY  DEVN (X 'DE80' )
97244 13:04:38.57 TSU00684 ANTP0030I CQUERY VOLUME FORMATED 695
695 *****
695 *                                     (PRIMARY) (SECONDARY) *
695 *                                     SSID CCA   SSID CCA   *
695 *DEVICE   LEVEL       STATE       PATH STATUS  SERIAL#    SERIAL#    *
695 *-----  -
695 * DE80    PRIMARY..   DUPLEX....  ACTIVE..   0080 00    0080 01    *
695 *          CRIT(NO)          000000030158 000000030158 *
695 * PATHS SAID/DEST STATUS: DESCRIPTION *
695 * ----  -
695 * 1      FFFF FFFF  01    PATH ESTABLISHED... *
695 *          ----  00    NO PATH *
695 *          ----  00    NO PATH *
695 *          ----  00    NO PATH *
695 *****
97244 13:04:39.57 TSU00684 ANTP0001I CQUERY COMMAND COMPLETED. COMPLETION CODE: 00

```

Figure 5.3 Example of CQUERY Command

```
//EQUERY      JOB
//              EXEC  PGM=ICKDSF
//SYSPRINT DD  SYSOUT=*
//DD1         DD  UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80
//SYSIN       DD  *
PPRCOPY      QUERY DDNAME(DD1)
/*
//

                QUERY REMOTE COPY - VOLUME

                                (PRIMARY)  (SECONDARY)
                                SSID CCA   SSID CCA
DEVICE   LEVEL      STATE      PATH STATUS  SERIAL#      SERIAL#
-----
DE80     PRIMARY    DUPLEX     ACTIVE    0080 00      0080 01
                                30158      30158

PATHS SAID/DEST STATUS: DESCRIPTION
-----
  1     FFFF FFFF    01      PATH ESTABLISHED...
        ---- ----    00      NO PATH
        ---- ----    00      NO PATH
        ---- ----    00      NO PATH
```

**Note:** Status display is the same as the CQUERY TSO command.

**Figure 5.4**    Example of PPRCOPY QUERY Command

```
97244  13:04:37.39      DS P,DE80,1
97244  13:04:38.57      IEE459I  13.04.37 DEVSERV PATHS 692
                        692 UNIT DTYPE M CNT VOLSER CHPID=PATH STATUS
                        692          RTYPE SSID CFW TC DFW PIN DC-STATE CCA DCA
                        692 DE80,33903 ,0,000,DKDE80,54=+ 1C=+ D4=+ 9C=+
                        692          0080 Y YY. YY. N PPRIMARY 00 00
```

**Figure 5.5**    Example of DEVSERV Command

**Table 5.8**    Pair Status Reported by the Host for Volumes in Multiple Pairs

Number of SI390 Pairs	Number of TC390 Pairs	Status Displayed by Host
0	0	SIMPLEX
1	0	SI390 pair status
2 or more	0	SI390 pair whose T-VOL has the lowest LDEV ID
0	1	TC390 pair status
1	1	TC390 pair status
2 or more	1	TC390 pair status

## 5.5 Splitting Pairs: CSUSPEND and PPRCOPY SUSPEND

The CSUSPEND and PPRCOPY SUSPEND commands are equivalent to the ShadowImage - S/390® split pair operation (changes pair status to *SP-pend*). Figure 5.6 shows an example of the CSUSPEND command. Figure 5.7 shows an example of the PPRCOPY SUSPEND command. The CSUSPEND and PPRCOPY SUSPEND commands must be issued to the S-VOL, and the pair status must be *duplex*. See section 5.5.1 below for information on the optional QUIESCE parameter for the CSUSPEND TSO command.

```
CSUSPEND  DEVN (X 'DE80' )  PRIM (X '0080' ,30158,X '00' ) SEC (X '0080' ,30158,X '01' )
```

**Figure 5.6** Example of CSUSPEND Command

```
//EPAIR      JOB
//          EXEC  PGM=ICKDSF
//SYSPRINT DD  SYSOUT=*
//DD1       DD  UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80
//SYSIN      DD  *
PPRCOPY     SUSPEND DDNAME(DD1) PRI(X'0080',30158,X'00') SEC(X'0080',30158,X'01')
/*
//
```

**Figure 5.7** Example of PPRCOPY SUSPEND Command

## 5.5.1 CSUSPEND QUIESCE Parameter

Please refer to the following IBM documents for important information on the optional QUIESCE parameter for the CSUSPEND TSO command: *Planning for IBM Remote Copy* (SG24-2595), *DFSMS MVS V1 Remote Copy Guide and Reference* (SC35-0169).

**WARNING:** The CSUSPEND QUIESCE option has been disabled by APAR OW15247 or APAR OW15248. Refer to either of these APARs and the latest IBM PPRC documentation for detailed information on the QUIESCE option. Please check with your Hitachi Data Systems account team before using the QUIESCE option with the 9900V subsystem. If the QUIESCE option is issued to certain volumes (e.g., active SPOOL, PAGE, or CATALOG datasets, active SYSRES volume), the attached host(s) may enter a deadlock condition and may require a storage control IML to correct the condition.

The QUIESCE parameter is used to modify the functionality of the CSUSPEND TSO command. For example, if the QUIESCE parameter is specified, the pair will be quiesced and subsequent write requests to the S-VOL will be suspended by the host until the QUIESCE condition is released. If the QUIESCE parameter is not specified, subsequent write operations will be rejected and write-reserved write requests will be processed. Table 5.9 lists the requirements for using the QUIESCE parameter with ShadowImage - S/390® pairs.

**Table 5.9 QUIESCE Parameter Requirements for ShadowImage – S/390®**

Pair Status	QUIESCE Accepted?
Simplex	No
Pending	No
Duplex	Yes
SP-Pend	No
V-Split	No
Split	No
Resync	No
Suspend	No

If a ShadowImage - S/390® S-VOL has more than one T-VOL, the QUIESCE parameter is effective if at least one pair is specified. Write requests at the S-VOL will start when all QUIESCE conditions are released. The following conditions cause the 9900V subsystem to automatically release the QUIESCE condition:

- A CSUSPEND TSO command without the QUIESCE parameter is accepted.
- A CDELPAIR TSO command is accepted.
- A Delete, Suspend, or Split Pair command (from the Storage Navigator) is accepted.
- Subsystem power-on-reset is executed.

**Note:** If a ShadowImage - S/390® pair is suspended because of an internal subsystem error condition, the QUIESCE option is applied. In this case, release the QUIESCE condition by deleting the pair.

**Note:** SI390 and TC390 are processed independently. The CSUSPEND/QUIESCE command is effective for either the SI390 or TC390 pair specified in the command.

## 5.6 Resynchronizing Pairs: MODE(RESYNC) Parameter

The MODE(RESYNC) option of the CESTPAIR and PPRCOPY ESTPAIR commands is equivalent to the ShadowImage - S/390® normal resync operation (changes pair status to *resync*). Figure 5.8 shows an example of the CESTPAIR command with the MODE(RESYNC) parameter. Figure 5.9 shows an example of the PPRCOPY ESTPAIR command with the MODE(RESYNC) parameter. The CESTPAIR and PPRCOPY ESTPAIR commands must be issued to the S-VOL, and the pair status must be *split* or *suspend* when MODE(RESYNC) is specified.

```
CESTPAIR  DEVN (X 'DE80' )  PRIM (X '0080' ,30158,X '00' ) SEC (X '0080' ,30158,X '01' )  
          MODE (RESYNC)  PACE (15)
```

**Figure 5.8** Example of CESTPAIR with MODE(RESYNC) Parameter

```
//EPAIR      JOB  
//          EXEC  PGM=ICKDSF  
//SYSPRINT   DD  SYSOUT=*  
//DD1        DD  UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80  
//SYSIN      DD  *  
PPRCOPY     ESTPAIR DDNAME(DD1) PRI(X'0080',30158,X'00') SEC(X'0080',30158,X'01')  
            MODE(RESYNC) PACE(15)  
/*  
//
```

**Figure 5.9** Example of PPRCOPY ESTPAIR with MODE(RESYNC) Parameter

## 5.7 Deleting Pairs: CDELPAIR and PPRCOPY DELPAIR

The CDELPAIR and PPRCOPY DELPAIR commands are equivalent to the ShadowImage - S/390® delete pair operation (changes pair status to *simplex*). Figure 5.10 shows an example of the CDELPAIR command. Figure 5.11 shows an example of the PPRCOPY DELPAIR command. The CDELPAIR and PPRCOPY DELPAIR commands must be issued to the S-VOL.

A DELPAIR command performed when pair status is *split* enables the T-VOL to be accessed by the host. A DELPAIR command performed when pair status is other than *split* allows non-reserved T-VOLs to be accessed by the host. Reserved *simplex* volumes cannot be accessed.

**WARNING:** For *duplex* ShadowImage - S/390® pairs, the S-VOL and its associated T-VOL(s) are usually not identical; because SI390 update copy operations are asynchronous. Therefore, if a pair is deleted with status other than *split*, the data integrity of the T-VOL cannot be guaranteed.

```
CDELPAIR  DEVN (X 'DE80' )  PRIM (X '0080' ,30158,X '00' ) SEC (X '0080' ,30158,X '01' )
```

Figure 5.10 Example of TSO Delete Command

```
//EPAIR      JOB
//              EXEC  PGM=ICKDSF
//SYSPRINT   DD  SYSOUT=*
//DD1        DD  UNIT=SYSDA,DISP=SHR,VOL=SER=DKDE80
//SYSIN      DD  *
PPRCOPY      DELPAIR DDNAME(DD1) PRI(X'0080',30158,X'00') SEC(X'0080',30158,X'01')
/*
//
```

Figure 5.11 Example of ICKDSF Delete Command





# Chapter 6 Troubleshooting

## 6.1 General Troubleshooting

If you have a problem with the 9900 V Series (9900V) Storage Navigator computer or Storage Navigator software, please refer to the *Hitachi Lightning 9900™ V Series Remote Console - Storage Navigator User's Guide* (MK-92RD101) for troubleshooting information. If a ShadowImage error code or message is displayed on the 9900V Storage Navigator, please refer to section 6.2 for a description of the ShadowImage error codes and recommended corrective action. If you need to call the Hitachi Data Systems Support Center, please refer to section 6.3 for instructions.

Table 6.1 provides general troubleshooting instructions for ShadowImage - S/390® operations. For troubleshooting information on ICKDSF and TSO operations, please refer to the IBM user documentation: *Planning for IBM Remote Copy* (SG24-2595), and *Remote Copy Guide and Reference* (SC35-0169).

**Table 6.1 General ShadowImage – S/390® Troubleshooting**

Error	Corrective Action
The Storage Navigator computer hangs, or SI390 operations do not function properly.	Make sure that all ShadowImage – S/390® requirements and restrictions are met.  Make sure the 9900V subsystem is powered on and fully functional (NVS, cache, DFW). Please refer to the <i>Hitachi Lightning 9900™ V Series User and Reference Guide</i> for operational and troubleshooting information for the 9900V subsystem.  Check all input values and parameters to make sure you entered the correct information on the Storage Navigator computer (e.g., S-VOL and T-VOL IDs).
If any channel enable LED indicators (on the 9900V control panel) are off or flashing.	Please call the Hitachi Data Systems Support Center for assistance.
The volume pairs are not displaying correctly.	Make sure the correct CU image is selected.
An R-SIM warning is displayed on the 9900V Storage Navigator.	Locate the SIM using the RMCMAIN R-SIM panel (see the <i>9900 V Series Remote Console – Storage Navigator User's Guide</i> for instructions). Refer to the <i>Hitachi Lightning 9900™ V Series User and Reference Guide</i> for a listing of 9900V SIMs.
An SI390 error message is displayed on the Storage Navigator computer.	Refer to section 6.2 for a description of the SI390 error codes.
There is a problem with the Storage Navigator or SI390 Storage Navigator software.	Make sure the problem is not the computer or LAN hardware or software. Try restarting the computer and reconnecting to the subsystem.

## 6.2 ShadowImage – S/390® Error Panel

The ShadowImage - S/390® Java applet program displays error messages on the Storage Navigator when error conditions occur during SI390 operations. The ShadowImage - S/390® Error panel (see Figure 6.1) displays the SI390 error code and message. To display the Error panel, select the failed volume in the **Preset Volume List** box on the ShadowImage - S/390® main panel, right-click using the mouse, and then select the **Detail** button. Please refer to the manual *Remote Console-Storage Navigator Error Codes* for the list of error codes and corrective actions.

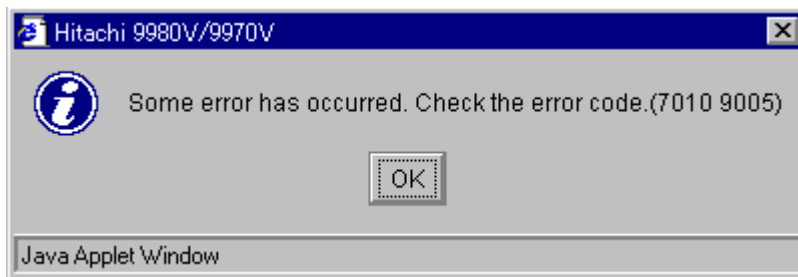


Figure 6.1 The Error Panel

## 6.3 Calling the Hitachi Data Systems Technical Support Center

If you need to call the Hitachi Data Systems Support Center, make sure to provide as much information about the problem as possible, including:

- The 9900V Storage Navigator configuration information saved on diskette using the FD Dump Tool (see the *Hitachi Lightning 9900™ V Series Hitachi Remote Console - Storage Navigator User's Guide* for instructions),
- The circumstances surrounding the error or failure,
- The exact content of any error messages displayed on the host system(s),
- The ShadowImage (or other) error code(s) displayed by the 9900V Storage Navigator software, and
- The reference codes and severity levels of the recent service information messages (SIMs).
- Hitachi Data Systems North America/Latin America  
San Diego, California, USA  
1-800-348-4357
- Hitachi Data Systems Europe  
Contact Hitachi Data Systems Local Support
- Hitachi Data Systems Asia Pacific  
North Ryde, Australia  
011-61-2-9325-3300

# Acronyms and Abbreviations

ACP	array control processor
CC	Concurrent Copy
CU	control unit (logical control unit)
CVS	custom volume size
DASD	direct-access storage device
DFW	DASD fast write
DKA	disk adapter
ESCON®	Enterprise System Connection (IBM trademark for optical channels)
HRX	Hitachi RapidXchange
HCC	Hitachi CruiseControl
HRX	Hitachi RapidXchange
LAN	local-area network
LDEV	logical device
LVI	logical volume image
MRCF	Multi-RAID Coupling Feature
NVS	nonvolatile storage
PC	personal computer
PDEV	physical device
RAID	redundant array of independent disks
R-SIM	remote service information message
SI390	Hitachi ShadowImage - S/390®
SI	Hitachi ShadowImage (for UNIX®- and PC-server-based data)
SI-FCOPY	ShadowImage - FlashCopy® (compatible with IBM FlashCopy®)
SIM	service information message
SM	shared memory
S-VOL	source volume
SVP	service processor
TC390	Hitachi TrueCopy - S/390®
T-VOL	target volume



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