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**D A T A   S Y S T E M S**

# Hitachi Freedom Storage™ Lightning 9900™ V Series

# Hitachi TrueCopy – S/390® User and Reference Guide

## (Synchronous and Asynchronous for S/390® Data)

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**Document Revision Level**

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**Source Documents for this Revision**

- *Hitachi Lightning 9900™ Hitachi TrueCopy – S/390® User and Reference Guide*, MK-91RD050-4a.

- TC345D0.DOC, TC345D0a.DOC (RSD input for 9900V TrueCopy – S/390® document)

**Referenced Documents**

- *Hitachi Lightning 9900™ V Series User and Reference Guide*, MK-92RD100

- *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide*, MK-92RD101

- *Hitachi Lightning 9900™ V Series and 9900 Command Control Interface (CCI) User and Reference Guide*, MK-90RD011

- *Hitachi Lightning 9900™ V Series Hitachi TrueCopy–S/390® User and Reference Guide*, MK-92RD107

- *Hitachi Lightning 9900™ V Series LUN Manager User's Guide*, MK-92RD105

- *Hitachi Lightning 9900™ V Series Remote Console Error Codes*, MK-92RD132

# Preface

The *Hitachi Lightning 9900™ V Series Hitachi TrueCopy – S/390® User and Reference Guide* describes and provides instructions for performing Hitachi TrueCopy – S/390® operations on the Hitachi Lightning 9900™ V Series subsystem. This document 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 Series disk array subsystem,

- the user has read and understands both the *Hitachi Lightning 9900™ V Series User and Reference Guide* (MK-92RD100) and the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide* (MK-92RD101), and

- the user is familiar with the Windows® operating system (e.g., opening and closing windows; using the keyboard and mouse to navigate on screen and select objects).

*Note:* The term "9900V" refers to the entire Lightning 9900™ V Series subsystem family, unless otherwise noted. For further information on the Lightning 9900™ V Series subsystem, please contact your Hitachi Data Systems account team.

*Note:* This document does not cover Hitachi TrueCopy operations for UNIX®-based and PC-server data on the 9900V subsystem. For information on TrueCopy, please refer to the *Hitachi Lightning 9900™ V Series Hitachi TrueCopy User and Reference Guide* (MK-92RD108).

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

## Microcode Level

This document revision applies to 9900V microcode version 21-01-*xx* and higher.

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**Please refer to specific page(s) and paragraph(s) whenever possible.**

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## Thank you!

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# Chapter 1     Overview of Hitachi Copy Solutions

## 1.1    Hitachi TrueCopy – S/390®

The Hitachi TrueCopy feature enables you to create and maintain duplicate copies of all user data stored on the Hitachi Lightning 9900™ V Series (9900V) subsystem for data duplication, backup, and disaster recovery purposes. Hitachi TrueCopy provides synchronous and asynchronous copy modes to accommodate a wide variety of user requirements and data copy/movement scenarios. Hitachi TrueCopy Asynchronous is unique to the Hitachi RAID storage subsystems and provides a superior hardware-based solution for data duplication, data migration, remote copy, and disaster recovery tasks. Hitachi TrueCopy is a key component of Hitachi Data Systems' solutions and service offerings (see section 1.2).

This document describes and provides instructions for TrueCopy – S/390® (TC390) operations using the licensed 9900V Hitachi Remote Console – Storage Navigator software. The Remote Console software communicates directly with the 9900V subsystems via a local-area network (LAN). The Remote Console software displays detailed TrueCopy information and allows you to configure and perform TrueCopy operations for the data stored on the 9900V subsystem.

Hitachi TrueCopy operations are nondisruptive, allowing the main volume of each TrueCopy pair to remain online to all hosts for both read and write I/O operations. Once established, TrueCopy operations continue unattended to provide continuous data backup. For fibre-channel connection, TrueCopy can be performed across distances of up to 30 km (18.6 miles) using single-mode longwave optical fibre cables in a switch configuration. For serial interface, TrueCopy can be performed across distances of up to 43 km (26.7 miles) using standard ESCON® support. Long-distance solutions are provided, based on user requirements and workload characteristics, using approved channel extenders and communication lines.

*Note:* Please contact your Hitachi Data Systems account team for the latest information on the availability of serial-channel TrueCopy – S/390® connections.

Once hardware connectivity between 9900V subsystems is established (or between 9900V and 9900/7700E subsystems), Hitachi TrueCopy – S/390® operations can be performed from the Remote Console PC and/or from the S/390® system software for maximum usability:

- The licensed TrueCopy – S/390® software for the 9900V Remote Console PC displays detailed TC390 information and allows you to perform all TC390 operations. In the event of a system failure or disaster at the main site, the TC390 software also simplifies and expedites disaster recovery procedures. For operating systems which do not support Peer-to-Peer Remote Copy (PPRC) or ICKDSF PPRCOPY commands, TC390 operations are performed using the 9900V Remote Console PC.

- Hitachi TrueCopy – S/390® is functionally compatible with industry-standard IBM® Peer-to-Peer Remote Copy (PPRC) host software functions. PPRC TSO commands (or ICKDSF PPRCOPY commands) combined with disaster recovery PTFs may be used to perform TC390 and disaster recovery operations on 9900V subsystems. Hitachi TrueCopy – S/390® supports the PPRC/Dynamic Address Switching (P/DAS) host software function, enabling you to use TC390 to relocate volumes nondisruptively. Hitachi TrueCopy – S/390® also supports the PPRC CGROUP TSO command which is used with IBM's Geographically Dispersed Parallel Sysplex® (GDPS) service offering.

Hitachi TrueCopy – S/390® can be performed in conjunction with ShadowImage – S/390® (see section 1.3.1) to provide multiple internal copies of TC390 volumes. TC390 also supports the Virtual LVI/LUN and FlashAccess features of the 9900V subsystem, ensuring that all S/390® user data can be protected by TC390 remote copy operations. See section 3.6 for further information on combining TC390 with other data management features.

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

## 1.2    Storage Management and Data Movement Solutions with TrueCopy – S/390®

Hitachi Data Systems offers several storage management and data movement solutions for the Lightning 9900™ V Series subsystem. TrueCopy – S/390® is a key component of the Hitachi NanoCopy™ solution.

For further information on storage management solutions, please contact your Hitachi Data Systems account team.

*Note:* TrueCopy – S/390® and Hitachi NanoCopy™ are available under a Hitachi Data Systems service agreement. The TrueCopy – S/390® Remote Console software is available under license from Hitachi Data Systems.

### 1.2.1 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. TC390A can be integrated with third-party channel extender products to address the "access anywhere" goal of data availability. TC390A 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.

NanoCopy copies data between any number of primary subsystems and any number of secondary subsystems, located any distance from the primary subsystem, without using valuable server processor cycles. The copies may be of any type or amount of data and may be recorded on subsystems anywhere in the world.

NanoCopy enables customers to quickly generate copies of production data for such uses as application testing, business intelligence, and disaster recovery for business continuance. For disaster recovery operations, NanoCopy will maintain a duplicate of critical data, allowing customers to initiate production at a backup location immediately following an outage. This is the first time an asynchronous hardware-based remote copy solution, with full data integrity, has been offered by any storage vendor.

Hitachi TrueCopy – S/390® Asynchronous with Hitachi NanoCopy support is offered as an extension to Hitachi Data Systems' data movement options and software solutions for the Lightning 9900™ V Series subsystem. Hitachi ShadowImage – S/390® can also operate in conjunction with TC390 Synchronous and Asynchronous to provide volume-level backup and additional image copies of data. This delivers an additional level of data integrity to assure consistency across sites and provides flexibility in maintaining volume copies at each site.

## 1.3 Other Data Duplication Features of the 9900V

In addition to TC390, the Hitachi Lightning 9900™ V Series subsystem provides several other data duplication features which are described below. Please contact your Hitachi Data Systems account team for further information on these 9900V features.

### 1.3.1 Hitachi ShadowImage

The Hitachi ShadowImage data duplication feature of the Lightning 9900™ V Series subsystem enables you to set up and maintain multiple copies of logical volumes within the same 9900V subsystem. ShadowImage operations for S/390® data are performed using the ShadowImage – S/390® (SI390) Remote Console software, and can also be managed via TSO and/or ICKDSF commands. ShadowImage operations for UNIX®/PC server-based data are performed using the ShadowImage Remote Console software, or the Hitachi Command Control Interface (CCI) software on the UNIX®/PC server host.

The RAID-protected ShadowImage duplicates are created within the same 9900V subsystem at hardware speeds. ShadowImage can be used in conjunction with Hitachi TrueCopy to maintain multiple copies of critical data at your primary and/or secondary (remote) sites. The Hitachi NanoCopy™ solution includes both Hitachi TrueCopy and ShadowImage for maximum flexibility in data backup and duplication activities. See section 3.6.1 for further information on combining TC390 and ShadowImage operations.

This document does not cover Hitachi ShadowImage operations. For information and instructions on performing ShadowImage operations, please refer to the *Hitachi Lightning 9900™ V Series ShadowImage – S/390® User's Guide* or the *Hitachi Lightning 9900™ V Series ShadowImage User's Guide*, or contact your Hitachi Data Systems account team.

### 1.3.2 Concurrent Copy (CC)

The Hitachi Lightning 9900™ V Series subsystem is also functionally compatible with the IBM® 3990 and 2105 Concurrent Copy (CC) function.

*Changing from 3990 to 2105:* Please see section 2.1.3 for important information and instructions on changing from 3990 to 2105 emulation for subsystems with existing CC volumes.

*Note:* CC operations also utilize sidefiles in cache. Subsystems performing CC in addition to TC390A and/or HXRC must have sufficient cache installed to handle the increased sidefile usage. Insufficient cache can degrade subsystem I/O performance and cause command retry requests and state-change-pending (SCP) messages. See section 2.3.6 for further information on cache usage and sidefile thresholds.

### 1.3.3   Hitachi Extended Remote Copy (HXRC)

The HXRC feature of the 9900V subsystem is functionally compatible with the industry-standard IBM® Extended Remote Copy (XRC) host software function, and is provided as a program product. Please refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide* (MK-92RD101) for information on HXRC installation. 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.

This document provides 9900V-specific HXRC information (e.g., SVP modes) but does not cover XRC operations. Please refer to the IBM® documentation on XRC for further information and instructions:  *Planning for IBM Remote Copy* (SG24-2595), *Advanced Copy Services* (SC35-0355), and *DFSMS MVS V1 Remote Copy Guide and Reference* (SC35-0169).

*SVP modes:* Please see Table 2.1 for important information on 9900V SVP modes for HXRC.

*16 session support:* The 9900V must be configured with 3990-6E emulation and 256 LDEVs/SSID for 16 session (per subsystem) support. APAR OW36948 must be applied. A subsystem power cycle is required when the SSID boundary is changed (64⇔256).

*Device blocking, load balancing:* Please see Appendix E for important information on HXRC device blocking support and load balancing control.

*Changing from 3990 to 2105:* Please see section 2.1.3 for important information and instructions on changing from 3990 to 2105 emulation for subsystems with existing HXRC volumes.

*Note:* HXRC operations, as well as TC390A operations, utilize additional cache to store the sidefile queue of asynchronous recordsets. If you are maintaining HXRC pairs and TC390A pairs, make sure that your 9900V subsystems have adequate cache installed and available to support your asynchronous remote copy workloads. Please contact your Hitachi Data Systems team to determine how much cache will be needed for your subsystem configuration.

*Note:* If the **ANTX5123W** console message is displayed during the RESUME operation for HXRC pairs, the operation might be unsuccessful.  In this case, you must perform the XDELPAIR operation to delete the pairs, and then perform the XADDPAIR operation to create the pairs again.

*Note:* If the ANTA5107E (RC=9014, REAS=604 or REAS=608) console message is displayed during the XADDPAIR operation, the HXRC option may not be installed. Make sure the HXRC option has been installed using the Hitachi Remote Console – Storage Navigator software.

*Note:* The HXRC option is only required for 2105 DKC emulation type. You can use HXRC for the 3990 controller emulation type without enabling the HXRC option.

### 1.3.4 Hitachi TrueCopy (TC)

As an enterprise advantage, the 9900V subsystem can be concurrently connected to S/390®
and a variety of UNIX®-based and PC-server hosts. Please contact your Hitachi Data Systems
account team for the latest information on platform and version support. The Hitachi
TrueCopy (TC) feature of the 9900V subsystem allows you to maintain remote copies of the
UNIX®/PC server data stored on the 9900V subsystem. TC390 volumes and TC volumes can
exist concurrently in the same 9900V subsystem.

This document does not cover TrueCopy operations for UNIX®-based and PC-server data. For
information and instructions on performing TC operations from the 9900V Remote Console
PC, please refer to the *Hitachi Lightning 9900™ V Series Hitachi TrueCopy User and
Reference Guide* (MK-92RD108).

The Hitachi Command Control Interface (CCI) software allows you to perform Hitachi
TrueCopy – S/390® operations from the UNIX®/PC server host. For information and
instructions on using CCI, please refer to the *Hitachi Lightning 9900™ V Series and 9900
Command Control Interface (CCI) User and Reference Guide* (MK-90RD011).

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

Hitachi TrueCopy – S/390® (TC390) provides a storage-based hardware solution for concurrent data duplication, migration, and disaster recovery operations. Once TC390 operations are established, remote copies of data are automatically maintained for backup and disaster recovery purposes. TC390 supports both SMS- and non-SMS-managed data, is completely application-independent, and is designed to run unattended. During normal TC390 operations, the main volumes remain online to all hosts and continue to process both read and write I/O operations.

Hitachi TrueCopy – S/390® Synchronous provides:

– Volume-based real-time data backup and is ideal for high-priority data backup, duplication, and migration tasks. In the event of a disaster or system failure at the main site, the remote (secondary) TC390 Synchronous data can be rapidly invoked to allow recovery at the volume level with an extremely high level of data integrity.

Hitachi TrueCopy – S/390® Asynchronous (TC390A) represents a unique and outstanding disaster recovery solution for large amounts of data which span multiple volumes and even multiple 9900V subsystems. TC390A's group-based update sequence consistency solution enables fast and accurate database recovery, even after a "rolling" disaster, without the need for time-consuming data recovery procedures. The TC390A volume groups at the remote site can be recovered with full update sequence consistency, but the updates will be behind the main site due to the asynchronous remote copy operations.

Hitachi TrueCopy – S/390® Asynchronous provides:

– Update sequence consistency for user-defined groups of volumes (e.g., large databases).

– Protection for write-dependent applications in the event of a disaster.

This overview of Hitachi TrueCopy – S/390® operations describes:

■ Hitachi TrueCopy – S/390® components (see section 2.1),

■ Hitachi TrueCopy – S/390® operations (see section 2.2),

■ Hitachi TrueCopy – S/390® Asynchronous recordset operations (see section 2.3),

■ Hitachi TrueCopy – S/390® Asynchronous consistency group operations (see section 2.4),

■ Hitachi TrueCopy – S/390® volume pair status and suspend types (see section 2.5), and

■ PPRC support, including P/DAS and GDPS (CGROUP) operations (see section 2.6).

## 2.1    Components

Hitachi TrueCopy – S/390® operations involve the 9900V subsystems (and/or 9900/7700E subsystems) at the main and remote sites, the physical communications paths between the main and remote subsystems, and the 9900V TrueCopy Remote Console software. The main and remote subsystems must have the same controller emulation. TC390 copies the original online data at the main site to the offline backup volumes at the remote site via the dedicated fibre-channel and/or ESCON® remote copy connections. The TrueCopy – S/390® software is included in the Hitachi Remote Console – Storage Navigator Java applet program, and all TrueCopy – S/390® functions and operations can be performed from within a web browser. The I/O time-stamping host software function (provided by MVS DFSMSdfp) is required for TC390A consistency groups which span multiple subsystems. Error reporting communications (ERC) is required for effective disaster recovery with TC390.

Figure 2.1 and Figure 2.2 show the TC390 components and their functions.

- Hitachi Lightning 9900™ V Series subsystems
  *Note:* The additional Shared Memory option is required for Hitachi TrueCopy operations.

- Main and remote control units (MCUs and RCUs)

- Volume pairs (local M-VOLs and remote R-VOLs)

- TrueCopy – S/390® Asynchronous consistency groups

- Host I/O time-stamping function

- Remote copy connections

- Ordinary target ports, initiator ports, and RCU target ports for fibre-channel interface

- Remote control ports (RCPs) and local control ports (LCPs) for serial interface*

- TrueCopy – S/390® Remote Console software

- Error reporting communications
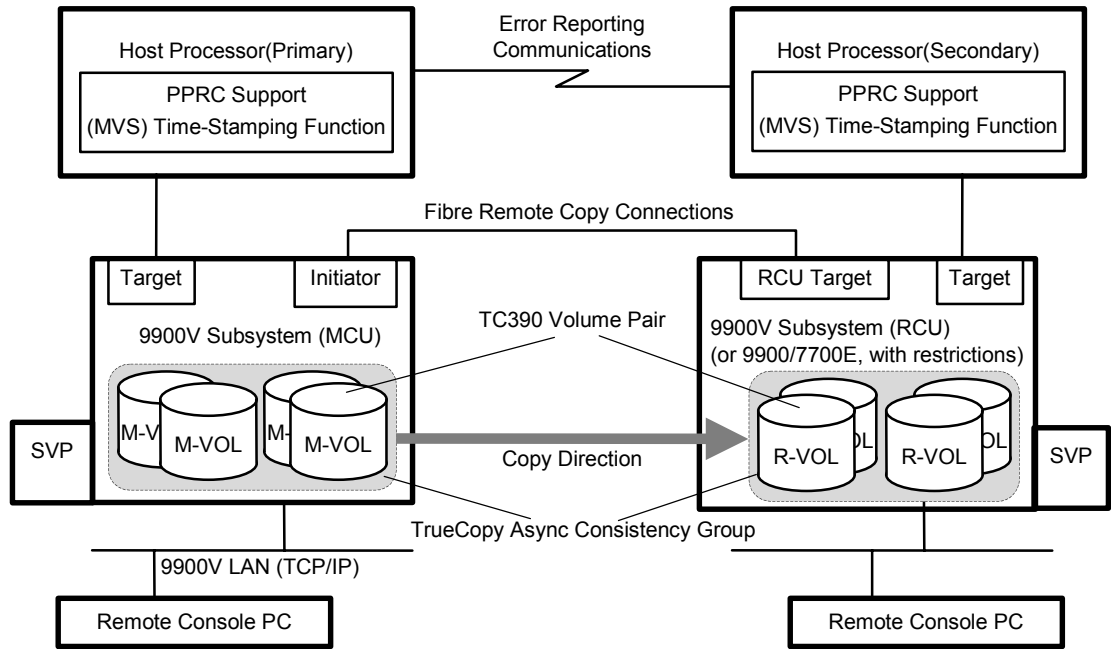
**Figure 2.1    TrueCopy – S/390® Components for Fibre-Channel Connection**
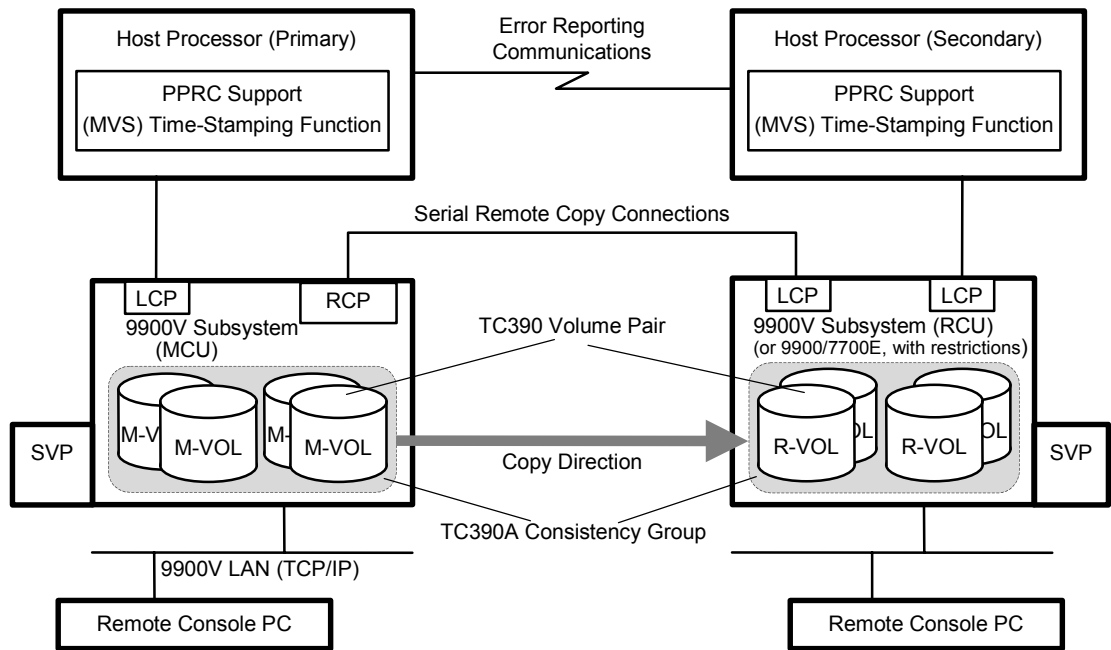


**Figure 2.2    TrueCopy – S/390® Components for Serial (ESCON®) Connection**

*Note:* Please contact your Hitachi Data Systems account team for the latest information on the availability of serial-channel TrueCopy – S/390® connections.

### 2.1.1 Lightning 9900™ V Series Storage Subsystems

Hitachi TrueCopy – S/390® operations involve the main (primary) disk subsystems and the remote (secondary) disk subsystems. This document covers TC390 operations in which the main subsystem is a 9900V and the remote subsystem is a 9900V (or 9900/7700E) subsystem. The main subsystems contain the TC390 main volumes (M-VOLs), which contain the original data and are online to the host(s). The remote subsystems contain the TC390 secondary volumes (R-VOLs), which are the synchronous or asynchronous copies of the M-VOLs. TC390 supports all CU images, logical volumes, and physical hard drive options for the 9900V subsystem. TC390 supports RAID 1 and RAID 5 configurations. All 9900V subsystems with TC390 installed are compatible with the IBM® PPRC host software function (see Appendix A for further information on PPRC).

*Note:* The additional Shared Memory option is required for Hitachi TrueCopy operations.

To provide greater flexibility and to enable the 9900V to be tailored to unique customer operating requirements, additional operational parameters, or optional modes, are available for the 9900V subsystem. At installation, the 9900V modes are set to their default values, so make sure to discuss these settings with your Hitachi Data Systems team. The 9900V modes can only be changed by your Hitachi Data Systems representative. Table 2.1 shows the 9900V modes related to TC390 and PPRC (and HXRC) operations. *Note:* This mode information was current at the time of publication of this document, but it may change. Please contact your Hitachi Data Systems representative for the latest 9900V SVP mode information.

*Note:* 9900V subsystems performing TC390A operations (main and remote) utilize sidefiles in cache for storing the TC390A recordsets. HXRC and Concurrent Copy (CC) also utilize cache sidefiles. Subsystems performing TC390A, HXRC, and/or CC must have sufficient cache installed to handle the increased sidefile usage. Insufficient cache can degrade subsystem I/O performance and cause command retry requests and state-change-pending (SCP) messages. See section 2.3.6 for further information on cache usage and sidefile thresholds.

**Table 2.1     9900V Modes for TrueCopy – S/390® (and HXRC) (continues on the next page)**

| Mode | Description |
|------|-------------|
| 20 | Enables TC390 – R-VOL read-only function (RCU only). |
| 21 | Required ON for MCUs and RCUs which connect to CNT channel extenders. |
| 36 | TC390 Synchronous – Selects function of CRIT=Y(ALL) or CRIT=Y(PATHS).<br>Mode 36 ON: CRIT=Y(ALL) => equivalent to Fence Level = Data.<br>Mode 36 OFF: CRIT=Y(PATHS) => equivalent to Fence Level = Status. |
| 38 | TC390 – Changes SSB reported against the WRITE I/O to the M-VOL in critical state.<br>Mode 38 ON: Intervention required.<br>Mode 38 OFF: Command rejected (PPRC specification). |
| 45 | HXRC – Sleep Wait suppressing option (see modes 61, 85, 86, 97; see Appendix E). When Mode 45 is ON and Mode 61 is ON, WRITE I/Os for LDEVs are blocked by the threshold specified by SDM.<br>Mode 45 OFF: Sidefile threshold activates Sleep Wait timer at the sleep wait threshold.<br>Mode 45 ON:  Sidefile threshold does not activate Sleep Wait timer at the sleep wait threshold. |

**Table 2.1    9900V Modes for TrueCopy – S/390® (and HXRC) (continued)**

| Mode | Description |
|------|-------------|
| 61 | HXRC – Enables the DONOTBLOCK option of the XADDPAIR command (see mode 45; see Appendix E). <u>Must be OFF if the operating system does not support the DONOTBLOCK option</u>. <br>Mode 61 OFF: DONOTBLOCK option ignored. <br>Mode 61 ON: DONOTBLOCK option activated. |
| 64 | TC390 CGROUP – Defines scope of CGROUP command within the 9900V. <u>Must be OFF for GDPS</u>. <br>Mode 64 OFF: TC390 volumes behind the specified LCU pair (main and remote LCUs). <br>Mode 64 ON:  All TC390 volumes in this 9900V subsystem. |
| 85, 86 | HXRC – Variable sidfile threshold (see modes 45, 97, 98; see Appendix E). <br>Mode 85 ON and Mode 86 OFF:  Thresholds for Sleep wait/SCP/Puncture = 30/40/50% <br>Modes 85 and 86 OFF:  Thresholds for Sleep wait/SCP/Puncture = 40/50/60% <br>Mode 85 OFF and Mode 86 ON:  Thresholds for Sleep wait/SCP/Puncture = 50/60/70% <br>Modes 85 and 86 ON:  Thresholds for Sleep wait/SCP/Puncture = 60/70/80% |
| 93 | Graduated delay process for sidefile control (see section 2.3.7): <br>Mode 93 OFF (default) = strong delay type <br>Mode 93 ON = soft delay type <br><br>Amount of sidefile / Strong delay type / Soft delay type <br>threshold – [15-20%] (HWM)  100 ms × 1 time   20 ms × 1 time <br>threshold – [10-15%]  200 ms × 1 time   40 ms × 1 time <br>threshold – [5-10%]  300 ms × 1 time   60 ms × 1 time <br>threshold – [0-5%]  400 ms × 1 time   80 ms × 1 time <br>threshold or higher  500 ms × permanent   100 ms × permanent |
| 97 | HXRC – Variable Sleep Wait timer duration (see modes 45, 85, 86; see Appendix E). <br>Mode 97 OFF:  Sleep Wait timer duration = 100 ms. <br>Mode 97 ON:  Sleep Wait timer duration = 10 ms. |
| 98 | HXRC – Selects SCP or session cancel (see modes 45, 85, 86; see Appendix E). <br>Mode 98 OFF:  SCP. <br>Mode 98 ON:  Forced session cancel. |
| 104 | TC390 CGROUP – Selects subsystem default for CGROUP FREEZE option. Applies to 3990 emulation only. ***Note:*** Mode 104 is invalid if the controller emulation is 2105. For 2105, use the CGROUP option of CESTPATH. <br>Mode 104 ON:  FREEZE enabled. <br>Mode 104 OFF (default):  FREEZE disabled. |
| 114 | TC390 – Allows dynamic port mode setting (RCP/LCP for serial, Initiator/RCU target for fibre-channel) through PPRC CESTPATH and CDELPATH commands. <br><br>Mode 114 ON: Set defined port to RCP/LCP mode (serial) or Initiator/RCU target mode (fibre-channel) as needed. <br>Mode 114 OFF (default): Port must be reconfigured using Remote Console PC (or SVP). <br><br>***Note:*** For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager. The fibre-channel interface ports need to be configured as initiator ports or RCU target ports *before* the CESTPATH and CDELPATH commands are issued. <br><br>***Caution:*** Before issuing the CESTPATH command, you must make sure that the relevant paths are offline from the host(s) (e.g., configure the Chipid offline, or deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed. |
| 118 | HXRC, CC, TC390A – SIM notification when: <br>    HXRC+CC sidefile reaches sleep wait threshold (see modes 45, 85, 86, 97). <br>    TC390A sidefile reaches high-water mark (HWM = sidefile threshold - 20%) (see mode 93). <br>Mode 118 ON:  Generate SIM. <br>Mode 118 OFF (default):  No SIM generated. |

## 2.1.2    Control Units (MCUs and RCUs)

The main control unit (MCU) and remote control unit (RCU) control TC390 operations:

■    The MCU is the control unit (CU) in the main subsystem which controls the M-VOLs of the TC390 volume pairs. The Remote Console PC must be LAN-attached to the MCU of each TC390 pair. The MCU communicates with the RCU via the dedicated remote copy connections. The MCU controls the host I/O operations to the TC390 M-VOLs as well as the TC390 initial copy and remote copy operations between the M-VOLs and R-VOLs. The MCU also manages the TC390 pair status and configuration information.

■    The RCU is the CU in the remote subsystem which controls the R-VOLs of the TC390 volume pairs. The RCU assists in managing the TC390 pair status and configuration (e.g., rejects write I/Os to TC390 R-VOLs). The RCU executes the remote copy operations issued by the MCU. The secondary Remote Console PC should be attached to the RCUs at the remote site on a separate LAN. The RCUs should also be attached to a host system to allow sense information to be reported in case of a problem with a secondary volume or remote subsystem and to provide disaster recovery capabilities.

The MCU and RCU can be defined separately for each TC390 pair. The 9900V CU can function simultaneously as an MCU for one or more M-VOLs and as an RCU for one or more R-VOLs, provided the remote copy connections and ports are properly configured. The 9900V CU provides up to 32 logical CU images with each CU image controlling up to 256 logical devices (LDEVs). TC390 operations can be performed on all logical devices (LDEVs) in all logical CU images. The TC390 software allows you to select the desired CU image in the connected MCU and specify the desired CU image in the RCU.

*Note:* This document provides instructions for performing TC390 operations with 9900V subsystems as the MCUs. If you are using 9900 subsystems as MCUs, please use the *Hitachi Lightning 9900™ Hitachi TrueCopy – S/390® User and Reference Guide* (MK-91RD050). The 9900/7700E subsystem can be used as an RCU connected to a 9900V MCU for TC390 Synchronous and/or Asynchronous operations.

*Caution:* If you are connecting the 9900V and 9900 subsystems in a mixed configuration, make sure that each subsystem has a unique serial number. It is possible that a serial number overlap could occur (although this would be extremely rare). If you have two subsystems with the same serial number and you need to configure remote copy pairs between the two subsystems, please contact your Hitachi Data Systems account team for assistance.

### 2.1.3   CU Emulation Types

Hitachi TrueCopy – S/390® supports 3990-6, 3990-6E, and 2105 controller emulation types for the MCU and RCU. The emulation type of the MCU and RCU can be different. The 3990-6, 3990-6E, or 2105 emulation is required for SMS I/O time-stamping of TC390 Asynchronous recordsets. The 2105 emulation type is required for Hitachi Parallel Access Volume (HPAV) operations.

*Changing from 3990 to 2105:* If you need to change the emulation from 3990 to 2105 for a 9900V which has existing HXRC and/or Concurrent Copy (CC) pairs, you must:

1.  Stop all Concurrent Copy jobs, and delete all HXRC pairs.

2.  Change the DKC emulation type of all CHA packages in the 9900V to 2105. For HXRC and CC operations, 3990 and 2105 emulations cannot be intermixed in the same subsystem.

3.  Restart Concurrent Copy jobs, and re-establish HXRC pairs.

*Note:* The PPRC commands are different for 3990 and 2105 emulation types. Please see Appendix A for further information on using PPRC TSO commands with 2105 emulation.

*Note:* See section 2.6.2 for important information on GDPS support and 2105 emulation.

### 2.1.4   Volume Pairs (M-VOLs and R-VOLs)

Hitachi TrueCopy – S/390® performs remote copy operations for logical volume pairs established by the user. Each TC390 pair consists of one main volume (M-VOL) and one remote volume (R-VOL) which are located in different subsystems. The TC390 M-VOLs are the primary volumes which contain the original data, and the TC390 R-VOLs are the secondary or mirrored volumes which contain the backup or duplicate data. The main and remote volumes must have the same format and capacity.

During normal TC390 operations, the M-VOL remains available to all hosts at all times for read and write I/O operations. The RCU rejects all I/Os to an R-VOL. The R-VOL read option (see section 2.2.4) allows read-only access to a TC390 R-VOL while the pair is suspended.

TrueCopy – S/390® supports a maximum of 8192 pairs (entire 9900V RCU). TC390 supports the basic logical volume images (LVIs) available on the 9900V subsystem (e.g., 3390-3, 3390-3R, 3390-9). See section 3.2.4 for LVI requirements and support.

*Caution:* Do not use M-VOLs or R-VOLs from hosts that have different CU emulation types (2105 and 3990) at the same time. If you use the M-VOLs or R-VOLs from the 2105 and 3990 hosts simultaneously, an MIH message might be reported to the 3990 host.

## 2.1.5    Remote Copy Connections

The remote copy connections are the physical paths used by the TC390 MCUs to communicate with the TC390 RCUs. The maximum number of physical paths per logical CU image is: eight for fibre-channel, eight for serial with 2105 emulation, four for serial with 3990 emulation. The MCUs and RCUs are connected via fibre-channel interface cables or serial (ESCON®) interface.

*Note:* Please contact your Hitachi Data Systems account team for the latest information on the availability of serial-channel TrueCopy – S/390® connections.

■    When fibre-channel interface (single-mode longwave) connections are used, two switches are required for distances greater than 10 km (6.2 miles), and distances up to 30 km (18.6 miles) are supported. Long-distance solutions are provided, based on user requirements and workload characteristics, using approved channel extenders and communication lines (e.g., T1/T3/ATM).

■    When serial interface connections are used, ESCON® directors (ESCDs) and/or ESCON® repeaters are required for distances greater than 3 km (1.9 miles). TC390 operations can be performed at distances of up to 43 km (26.7 miles) using standard ESCON® support. When fibre-channel interface (multimode shortwave) connections are used, two switches are required for distances greater than 0.5 km (1,640 feet), and distances up to 1.5 km (4,920 feet, 0.93 miles) are supported.

The MCU-to-RCU remote copy configuration (see section 3.3) for TC390 Asynchronous has different requirements than the TC390 Synchronous configuration, as follows:

■    TrueCopy – S/390® Synchronous supports 1-to-n and n-to-1 remote copy connections (n≤4). One MCU can be connected to as many as four RCUs, and one RCU can be connected to as many as four MCUs (one MCU/RCU = one physical CU, including all CU images). TC390 supports the dynamic switching capability of the ESCDs which is used to share the physical interface cables between the components. The ESCDs can accommodate channel-to-MCU and channel-to-RCU connections in addition to the remote copy connections.

■    TrueCopy – S/390® Asynchronous supports 1-to-1 remote copy connections within the same consistency group. The M-VOLs and R-VOLs of the pairs in a consistency group must be located within one physical MCU and one physical RCU. This configuration ensures backup integrity for data which is spread across multiple volumes within one 9900V subsystem (e.g., large databases).

   *Note:* TrueCopy 1-to-n and n-to-1 configurations are valid for TC390 Asynchronous, as long as each consistency group does not span local or remote subsystems.

■    Fibre remote copy supports 1-to-1 remote copy connections. One 9900V subsystem as an MCU can be connected to only one 9900V subsystem as an RCU via optical fibre cables. For the CU images within one 9900V subsystem, 1-to-4 and 4-to-1 remote copy connections are supported.

*Note:* Hitachi Data Systems strongly recommends that you establish at least two independent remote copy connections (one per cluster) between each MCU and RCU to provide hardware redundancy for this critical communications path.

### 2.1.6    Initiator Ports and RCU Target Ports

The initiator ports are the dedicated fibre-channel interface ports on the main subsystem (MCU) to which the RCUs (RCU target ports) are connected. The initiator ports connect to the RCUs to send write I/O operations directly to the RCUs. Any fibre-channel interface port of the 9900V subsystem can be configured as an initiator port. The TrueCopy – S/390® software allows you to change the configuration of the 9900V fibre-channel ports (ordinary target port, initiator port, or RCU target port) as needed (see section 4.2.1).

The RCU target ports are the dedicated fibre-channel interface ports on the remote subsystem (RCU) to which the MCU (initiator ports) are connected. Any fibre-channel interface port of the 9900V subsystem can be configured as an RCU target port. The RCU target ports can be connected to the host channel paths via the fibre-channel switch.

To fully support an automated environment, the 9900V subsystem automatically configures a fibre-channel port as an initiator or RCU target if required in response to the TSO CESTPATH and CDELPATH commands. See SVP mode 114 in Table 2.1.

*Note:* For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager.

*Note:* Two or more initiator ports must be configured before you can add the RCUs and create the TC390 volume pairs. The initiator ports cannot communicate with the host processor channels. To enable the host processor channels to send write I/O operations to the MCU, the host channel paths must be connected to the other fibre-channel interface ports in the MCU. Ordinary fibre-channel interface ports cannot be connected to the MCU. These ports (usually called target ports) can be connected to the host processor channels only.

## 2.1.7    Remote Control Ports (RCPs) and Local Control Ports (LCPs)

The remote control ports (RCPs) are the dedicated serial interface ports on the main disk subsystem (MCU) to which the RCUs are connected. The RCPs emulate host processor channels to enable the MCUs to send write I/O operations directly to the RCUs. The RCPs support the dynamic switching capability provided by the ESCDs. Any serial port of the 9900V subsystem can be configured as an RCP. The TrueCopy – S/390® software allows you to change the configuration of the 9900V serial ports (LCP or RCP) as needed (see section 4.2.1).

The local control ports (LCPs) are used for host processor channel interface. All serial interface ports on the 9900V subsystem have a default setting of LCP. An RCU port connected to an MCU must be in LCP mode to receive remote copy I/O operations from the MCU.

To fully support an automated environment, the 9900V subsystem automatically configures a serial port as an RCP or LCP if required in response to the TSO CESTPATH and CDELPATH commands. See SVP mode 114 in Table 2.1.

*Caution:* Before issuing the CESTPATH command, you must make sure that the relevant paths are offline from the host(s) (e.g., configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed.

*Note:* Two or more RCPs must be configured before you can add the RCUs and establish the TC390 volume pairs. The RCPs cannot communicate with the host processor channels and are dedicated to TC390 operations. The host channel interface paths must be connected to the other serial interface ports on the subsystem.

### 2.1.8    9900V TrueCopy Remote Console Software

The 9900V Hitachi Remote Console – Storage Navigator Java™ applet program product includes TrueCopy - S/390® and TrueCopy for the Lightning 9900™ V Series subsystem. The 9900V Remote Console software communicates with the SVP of the 9900V subsystem via defined TCP/IP connections. For further information on 9900V Remote Console operations, please refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide* (MK-92RD101), or contact your Hitachi Data Systems account team.

If you plan to use PPRC to perform TC390A operations, you must use the TrueCopy – S/390® software to add the consistency groups and select the desired group options and async options before you can add any TC390A pairs. These functions can only be performed using the 9900V Remote Console software (or SVP*). Once the groups and async options have been configured, PPRC commands can be used to establish and manage TC390A pairs.

If you will be using the 9900V Remote Console software to perform TrueCopy – S/390® operations (instead of PPRC), the MCU of each TrueCopy – S/390® pair must be LAN-attached to the 9900V Remote Console PC. You should also attach all RCUs to a 9900V Remote Console PC on a separate LAN at the remote site. Having a separate LAN at the remote site enables you to access the RCUs and TrueCopy – S/390® R-VOLs and perform TrueCopy – S/390® operations at the remote site in the event that the main site is not available (e.g., due to disaster). If you need to perform TrueCopy – S/390® operations in the reverse direction from the remote site to the primary site (e.g., disaster recovery), the TrueCopy – S/390® Remote Console software at the remote site simplifies and expedites this process.

*___Note:___ For information on TrueCopy – S/390® Asynchronous configuration services, please contact your Hitachi Data Systems account team.

### 2.1.9  Asynchronous Consistency Groups

A TrueCopy – S/390® Asynchronous consistency group is a user-defined set of volume pairs across which update sequence consistency is maintained and ensured at the remote site. Each TC390A volume pair must be assigned to a consistency group. TC390A allows you to configure up to 128 consistency groups (0-7F) for each MCU and provides group-based operations for consistency groups (e.g., suspend and resume group). Consistency groups enable you to maintain update sequence consistency for databases which span multiple volumes, allowing immediate database recovery at the remote site when needed. See section 2.4 for further information on TC390A consistency group operations.

### 2.1.10  Host I/O Time-Stamping Function

If you plan to establish TC390A consistency groups, the I/O time-stamping function must be installed on the host processor at the main (primary) site. The I/O time-stamp, which is provided by MVS DFSMSdfp, is the same time-stamp that is used by IBM® XRC pairs. The RCU requires the I/O time-stamp information to process TC390A recordsets. The I/O time-stamping function should also be installed on the host processor at the remote (secondary) site, so that time-stamps can be used when copying data in the reverse direction.

*Note:* If the main and/or remote system consists of several CPU complexes, a SYSPLEX timer is required to provide a common time reference for the I/O time-stamping function.

### 2.1.11  Error Reporting Communications

Error reporting communications (ERC), which transfers information between host processors at the main and remote sites, is a critical component of any disaster recovery effort. You can configure ERC using channel-to-channel communications, NetView technology, or other interconnect technologies, depending on your installation requirements and standards. Neither Hitachi TrueCopy – S/390® nor the TrueCopy – S/390® Remote Console software provides ERC between the main and remote sites.

When TC390 is used as a data migration tool, ERC is recommended but is not required. When TC390 is used as a disaster recovery tool, ERC is required to ensure effective disaster recovery operations. When a TC390 pair is suspended due to an error condition, the MCU generates sense information which results in an IEA491E system console message. This information should be transferred to the remote site via the ERC for effective disaster detection and recovery.

## 2.2 Remote Copy Operations

Figure 2.3 illustrates the two types of TC390 remote copy operations: initial copy and update copy. To reduce the overhead associated with these remote copy activities and maximize data transfer, the 9900V subsystem utilizes a special write command which is allowed only for TC390 initial and update copy operations. This command transfers the control parameters and the FBA-format data for consecutive updated records in a track using a single write operation. The special TC390 write command reduces interlocks on the ESCON® interface protocol as well as the overhead required for performing FBA-to-CKD and CKD-to-FBA conversions.
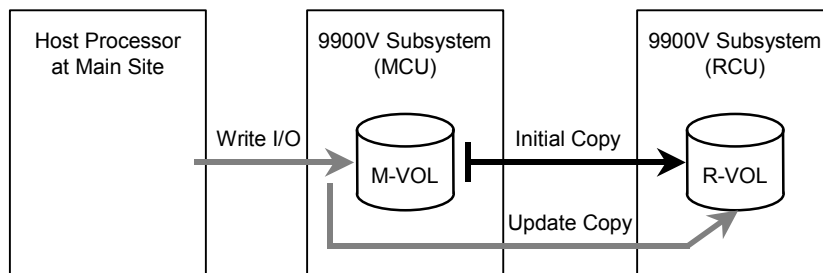


**Figure 2.3    TrueCopy – S/390® Remote Copy Operations**

This section describes the following aspects of TrueCopy – S/390® remote copy operations:

- Initial copy operations (see section 2.2.1),

- Update copy operations (see section 2.2.2),

- Read and Write I/O Operations for TrueCopy Volumes (see section 2.2.3),

- S-VOL Write Option (see section 2.2.4), and

- Difference management (see section 2.2.5).

### 2.2.1 Initial Copy Operation

The initial copy operation synchronizes the M-VOL and R-VOL independently of host I/O processes. The initial copy operation is the same for TC390 Synchronous and Asynchronous pairs. A TC390 initial copy operation takes place when you add a new pair or resume a suspended pair. When a new pair is established, the entire contents of the M-VOL are copied to the R-VOL cylinder by cylinder, including the VTOC (volume table of contents) but not including the diagnostic and unassigned alternate tracks. For new pairs, you can also select **None** for the initial copy mode, which copies only the VOLSER (volume serial number) to the R-VOL. If **None** is selected, the user is responsible for ensuring that the M-VOL and R-VOL are already identical. The MCU cannot verify the contents of the volumes. When a suspended pair is resumed, only the VOLSER and out-of-sync cylinders/tracks (updated by write I/Os while the pair was suspended) are copied to the R-VOL.

For additional flexibility, TC390 provides the following options for the initial copy operation:

- The **number of tracks** option allows you to specify how many tracks are copied simultaneously by the TC390 initial copy operation when adding/resuming a TC390 pair. This option can be specified using the TC390 Remote Console software and the CESTPAIR TSO command (PACE parameter).

- The **Initial Copy Priority** option allows you to specify the order in which the initial copy operations are performed when adding/resuming multiple TC390 pairs. This option can only be specified using the TC390 Remote Console software (not PPRC).

- The **Maximum Initial Copy Activities** option allows you to specify the maximum number of concurrent initial copy operations that each MCU can perform (not pair-specific). This option can only be specified using the TC390 Remote Console software (not PPRC).

### 2.2.2   Update Copy Operation

A Hitachi TrueCopy – S/390® update copy operation occurs when the host issues a write I/O operation to the M-VOL of a TC390 pair. The update copy operation duplicates the M-VOL write I/O at the R-VOL to keep the M-VOL and R-VOL synchronized. TC390 provides two modes for update copy operations:  synchronous and asynchronous. The update copy mode is specified when you add a TC390 pair and cannot be changed. TC390 also allows you to specify whether the cache-fast-write (CFW) data is included in the update copy operations.

For synchronous update copy mode, the MCU ensures that the M-VOL and R-VOL are synchronized at all times. The MCU does not return device-end status for the M-VOL write I/O until both the M-VOL write and its associated update copy operation at the RCU are complete. For synchronous mode, the MCU starts the update copy operation when it receives:

- the last write command in the current domain, specified by the preceding locate record command, or

- a write command which requires switching to the next track, or

- a write command which was not preceded by a locate record command.

*Note:* If many consecutive records are updated by a single CCW chain which does not use the locate record command (e.g., long sequential chained write operations), subsystem performance may be significantly impacted.

For asynchronous update copy mode, the MCU stores the M-VOL updates along with additional control information in cache, and sends the updates and control information to the RCU completely independent of the host I/O processes. These updates with their associated control information are called TC390A recordsets. The RCU stores the TC390A recordsets in cache and performs the updates to the R-VOLs in the same order as they were performed at the MCU(s) according to the TC390A time-stamp and sequence information. For further information on TC390A recordset operations, see section 2.3.

**Priority of initial and update copy:** In both TrueCopy – S/390® Synchronous and Asynchronous, update copy has higher priority than initial copy. However, initial copy is executed based on the copy pace (3 or 15 tracks), therefore, update copy must wait this interval if initial copy is being executed. For example, if the copy pace is 15 tracks, the update copy may wait up to 15 tracks (1 cylinder). In the case of TC390 Asynchronous, update copy is executed asynchronously, but the same scheduling conflict can occur between the asynchronous update copy (write recordset) and initial copy.

### 2.2.3 Read and Write I/O Operations for TrueCopy – S/390® Volumes

When an MCU receives a read command for a TC390 M-VOL, the MCU completes the read from either cache or the M-VOL. If the read fails, the redundancy provided by RAID technology recovers the failure. The MCU does not read the TC390 R-VOL for recovery.

When an MCU receives a write command for a TC390 Synchronous M-VOL with *pending duplex* status (and the track has already been copied to the R-VOL), the MCU performs a synchronous update copy operation to complete the write at the R-VOL. When an MCU receives a write command for a *pending duplex* TC390A M-VOL (and the track has already been copied to the R-VOL), the MCU performs an asynchronous update copy operation.

When an MCU receives a write command for an M-VOL with *duplex* status, the user-selected update copy mode of the pair (synchronous or asynchronous) determines the sequence of events:

■ **Synchronous Mode:** The MCU performs the write operation on the M-VOL, reports channel-end status to the host, starts the update copy operation for the R-VOL, and then reports device-end status to the host only after the update copy operation is complete. If the M-VOL write or R-VOL update copy operation fails, the MCU reports a unit check, and the host system and application program will regard that write operation to the M-VOL as failed. If a failure occurs at the M-VOL or the R-VOL, the corresponding volume of the TC390 pair will decommit the update to maintain exact synchronization of the volumes.

■ **Asynchronous Mode:** The MCU completes M-VOL write operations independently of the associated update copy operations at the R-VOL. The RCU manages the R-VOL updates according to the TC390A recordset information and maintains time-based data consistency for the R-VOLs. If the M-VOL write operation fails, the MCU reports a unit check and does not create the TC390A recordset for this operation. If the update copy operation fails, the RCU suspends either the affected pair or all TC390A pairs in the consistency group, depending on the type of failure. When the suspended TC390A pair or group is resumed, the MCU and RCU negotiate the resynchronization of the pair(s). See section 2.5.2 for further information on suspended TC390A pairs.

The RCU does not allow a TC390 R-VOL to be online and rejects all host-requested read and write I/O operations for a TC390 R-VOL. The TC390 R-VOLs must be offline during normal TC390 operations. *Note:* TrueCopy – S/390® provides a special R-VOL read option (see section 2.2.4) which allows read-only access to the R-VOL while the pair is suspended. If you need write access to a TC390 R-VOL, you must delete the pair.

### 2.2.4  R-VOL Read Option

For additional flexibility, TrueCopy – S/390® offers a special R-VOL read option. The Hitachi Data Systems representative enables the R-VOL read option on the RCU (mode 20). The R-VOL read option allows you to read a TC390 R-VOL only while the pair is suspended, that is, without having to delete the pair. The RCU will allow you to change only the VOLSER of the suspended R-VOL, so that the R-VOL can be online to the same host as the M-VOL while the pair is suspended. **All other write I/Os will be rejected by the RCU.** The MCU copies the M-VOL VOLSER back onto the R-VOL when the pair is resumed. When the R-VOL read option is not enabled and/or the pair is not suspended, the RCU rejects all read and write I/Os to a TC390 R-VOL. *Note:* If you need write access to an R-VOL, you must delete the pair.

*Note:* For 2105 controller emulation, the CSUSPEND command to the R–VOL of a suspended TC390 pair will be rejected when the TC390 R–VOL read option is used.

## 2.2.5 Difference Management

The differential data (updated by write I/Os during suspension) between M-VOL and R-VOL is stored in each cylinder bitmap. When a deleted/suspended pair is resumed, the MCU merges the M-VOL and R-VOL bitmaps, and the differential data is copied to the R-VOL. The unit of data stored in the bitmap is track or cylinder. When you add a pair, you can select Track or Cylinder, and you can also confirm the unit. Table 2.2 shows the availability of the difference management option for TrueCopy – S/390® and the PPRC TSO commands.

*Note:* For mixed subsystem configurations (e.g., 9900V MCU and 9900 RCU), the difference management option is not available during the add pair operation (preset to Cylinder).

**Table 2.2    Availability of the Difference Management Option**

| Program Product | Unit of Data Stored in Bitmap | | | Confirmation |
| --- | --- | --- | --- | --- |
| | Default * | Track | Cylinder | |
| TrueCopy Remote Console software | Not available | Available | Available | Available |
| PPRC TSO Commands | Not available | Not available | Not available | Not available |

* **Default:** Track or Cylinder is automatically set according to the basic LVI type. For 3390-L LVIs, the default is Cylinder. For other basic LVI types, the default is Track.

**Restriction on number of pairs.** When you add pairs with the setting of Track, the maximum number of pairs you can create is restricted. If you add more pairs than the maximum allowed, one or more pairs are automatically changed to Cylinder. You can restrict this automatic change of the setting. *Caution:* Before using this function, please contact your Hitachi Data Systems account team.

- The restriction on the number of pairs depends on the capacity of the volumes used for the pairs. Both the MCU and RCU are restricted. Table 2.3 shows the maximum number of pairs with Track difference management for each LVI type.

  The number of bitmap areas in the subsystem is 10,476. You can calculate the number of bitmap area. If the calculated bitmap area exceeds the number of bitmap area in the subsystem, adding pairs operation is restricted. To calculate the number of bitmap:

  $$( ( \uparrow (\text{Number of cylinders} \times 15) / 75,136) \uparrow ) - 1$$

  The $\uparrow...\uparrow$ symbols around a value indicate that the value should be rounded up to the next integer.

**Table 2.3    Maximum Number of Pairs Using Track Difference Management**

| Basic LVI Type | Number of Cylinders | Maximum Number of Pairs |
| --- | --- | --- |
| 3390-3 | 3,339 | 8,192 |
| 3390-9 | 10,017 | 8,192 |
| 3390-L | 32,760 | 1,746 |

## 2.3    TrueCopy – S/390® Asynchronous Recordset Operations

The TC390A recordsets contain the TC390A M-VOL updates and the associated control information, including the time-stamp of the M-VOL update, which enables the RCU to maintain update consistency of the TC390A R-VOLs. TC390A recordset operations include:

- Creating and storing recordsets at the MCU,

- Sending recordsets to the RCU,

- Storing recordsets at the RCU,

- Selecting and settling recordsets at the RCU,

- Types of recordsets,

- Inflow control for sidefiles, and

- Dummy pair mode.

### 2.3.1    Creating and Storing Recordsets at the MCU

When an MCU performs an update (host-requested write I/O) on a TC390A M-VOL, the MCU creates a TC390A recordset which contains: the updated record, time-stamp information, sequence number, record location (device, cylinder, track, record number), and record length. The TC390A recordsets are queued in the cache storage of the MCU and sent to the RCU independent of host I/O processes. The RCU utilizes the time-stamp and sequence number information in the recordsets to update the R-VOL(s) in the same order as the M-VOL(s).

The time-stamp information is acquired from the (MVS) host's I/O time-stamp function. This time stamp provides a protective measure for write-dependent applications and minimizes recovery time in the event of a disaster. The sequence number indicates the number of recordsets that the MCU has created for each consistency group. The recordset information, except for the updated records, is stored and queued in an area of cache known as sidefile cache (see section 2.3.6 for further information on sidefile cache).

### 2.3.2    Sending Recordsets to the RCU

The MCU sends the TC390A recordsets to the RCU in a similar manner to the TC390 Synchronous updates. The MCU's RCPs and/or initiator ports act as host processor channels and issue special I/O operations, called remote I/Os (RIOs), to the RCU. The RIO transfers the recordsets in FBA format (not CKD) using a single channel command, eliminating the overhead associated with FBA-CKD conversion and thus providing more efficient transfer of user data. The MCU can send several recordsets using a single RIO, even if their sequence numbers are not contiguous. Therefore, TC390A recordsets are usually sent to the RCU in a different order than the arrivals at the MCU. The RCU ensures that records are applied to the R-VOLs in the correct sequence. This method of remote I/O provides the most efficient use of MCU-to-RCU link resources.

*Note:* The parameter length and detailed specification of this TC390A channel command are different than for TC390 Synchronous RIOs. You must make sure that your channel extenders are capable of supporting this command. For further details, please contact your Hitachi Data Systems account team.

### 2.3.3    Storing Recordsets at the RCU

The RCU maintains queues to control the storing of recordsets in the sidefile and commitment of updating records in the R-VOLs. The RCU queuing mechanism uses time-stamping to control the sequence in which R-VOL updates are applied, and uses sequence numbers provided by the MCU to check for any missing updates.

*Note:* The MCU does not remove the sidefile entry for a recordset from its cache until it receives an I/O completion signal (device end) from the RCU. This is true even if the MCU and RCU are connected via a channel extender product. If a recordset is lost in transmission from the MCU to the RCU, the MCU's cylinder/track bitmap ensures that the missing recordset is identified and resent to the RCU.

### 2.3.4 Selecting and Settling Recordsets at the RCU

The RCU selects the recordset to be promoted to formal data (or "settled") as follows:

1. The RCU checks for a valid entry at the top of each queue in the consistency group. If the top of any queue is empty (i.e., recordset not yet received), the RCU waits for that entry.

2. When the top of each queue contains a valid entry (recordset), the RCU selects the entry which has the earliest time-stamp value, and then settles this recordset.

3. The RCU repeats steps (1) and (2) to select and settle TC390A recordsets.

Figure 2.4 (next page) illustrates recordset selection and settling at the RCU. In this example, the top of the queue contains a valid entry:  S1/T1. The RCU selects recordset S1/T1 to be settled, because T1 is the earliest time-stamp. When S1/T1 is removed from the MCU queue, recordset S2 becomes the top entry, but it is empty. When recordset S2 arrives (and its time-stamp is later than T1 and earlier than T3), the RCU selects S2/T2 as the next recordset to be settled. The recordset selected by the RCU is marked as "host-dirty" and treated as formal data. The time-stamp value of that recordset is promoted to the consistency time (C/T) of the group. The RCU settles the updated records in the recordset as follows:

■ If the corresponding track is in cache (track-hit), the updated records in the recordset are copied to the existing cached track, and the cache space for the sidefile is released.

■ If the corresponding track is not in cache (track-miss), the RCU changes the cache designation of the sidefile to formal data. The data is not physically moved.

## 2.3.5 Types of Recordsets

In addition to host update recordsets, the MCU passes control information to the RCU in special non-update recordsets. These special recordsets indicate when volume pair status changes and when an MCU power-off sequence is initiated, and also maintain sequence numbers in periods of low host activities.
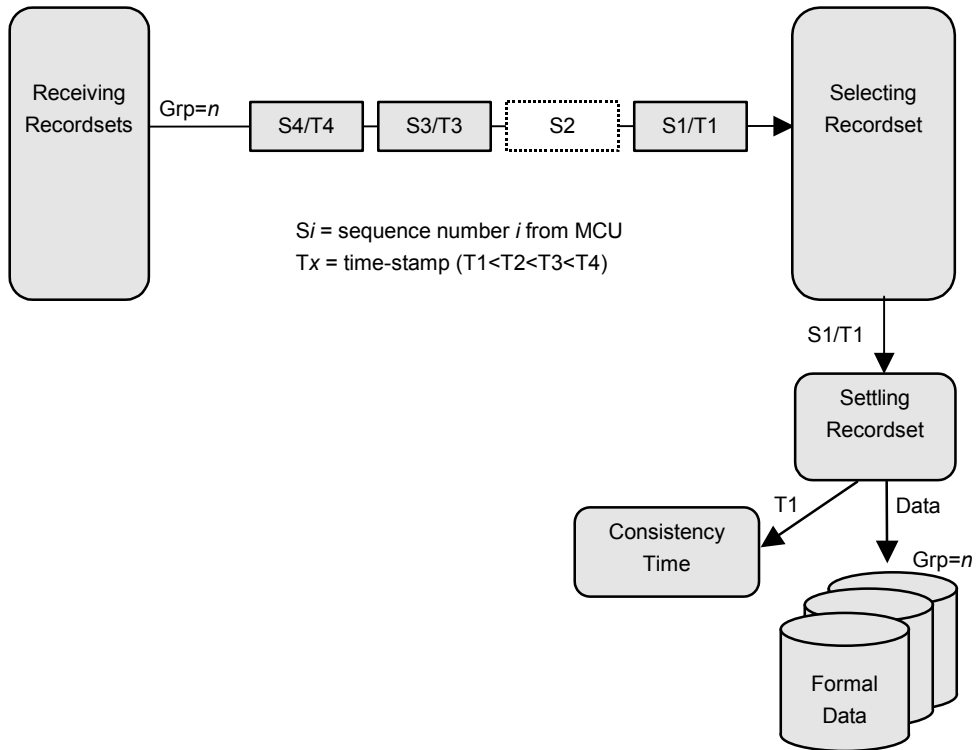


**Figure 2.4    Selecting and Settling TrueCopy – S/390® Async Recordsets at the RCU**

## 2.3.6    Inflow Control of Recordsets

As described in the previous sections (2.3.1-2.3.5), both the MCU and RCU create sidefiles for storing TC390A recordsets. Since the sidefiles occupy exclusive space in cache, both the MCU and RCU perform inflow control to prevent an overload of the subsystem's cache resources. The 9900V subsystem uses the following parameters (specified on the TC390 Async Option panel, see section 4.3.1) for TC390A cache inflow control:

- **Sidefile Threshold** = maximum cache % available for use by TC390A sidefiles. Table 2.4 shows the TC390A sidefile threshold values and describes the actions that occur when each threshold is reached.

  - The "high-water mark" (HWM), which is the sidefile threshold minus 20%, indicates when graduated delay begins for TC390A volume pairs (see next section). If SVP mode 118 is ON, a warning SIM is also generated.

  - The puncture threshold, which is the sidefile threshold plus 10%, indicates when the TC390A pairs will be suspended due to sidefile overflow (see section A.2.1).

  - **Inflow control by MCU:** When the amount of MCU sidefile cache reaches the HWM, the MCU responds to update I/Os from the host with state-change-pending (SCP) or channel-command-retry requests and begins graduated delay.

  - **Inflow control by RCU:** When the amount of RCU sidefile cache reaches the HWM, the RCU responds with channel-command-retry requests to the RIO commands which transfer the recordsets from the MCU. The only recordset accepted by the RCU is the recordset with the sequence number required to continue settling pending recordsets.

- **Offloading Timer** = maximum time between TC390A recordset transfers.

  - **Inflow control by MCU:** If the MCU is not able to send a recordset to the RCU within the user-specified offloading timer value, the MCU suspends all TC390A pairs and resets the SCP condition to avoid hanging up the system.

  - **Inflow control by RCU:** If the RCU is not able to settle a recordset within the user-specified offloading timer value, the RCU suspends all TC390A volume pairs and resets the channel-command-retry condition to avoid hanging up the MCU.

**HXRC and Concurrent Copy (CC).** HXRC and CC operations utilize a different cache sidefile than TC390A. Table 2.4 also shows the sidefile threshold values for HXRC and CC operations and describes the actions that occur when each threshold is reached. Subsystems performing TC390A in combination with HXRC and/or CC must have sufficient cache installed to handle the increased sidefile activity. If a "sidefile puncture" condition occurs (HXRC+CC sidefiles reach 10% over threshold), the CC session having the highest sidefile usage is terminated (or XRC session if there is no CC session).

*Important:* SIM reporting for sidefile conditions is disabled when mode 118 is OFF (Table 2.1).

*Note:* FlashAccess operations may decrease the total amount of cache available for TC390A, HXRC, and CC operations but do not directly affect sidefile cache usage. Available cache is defined as the amount of physical cache memory installed on the subsystem minus any cache reserved for the FlashAccess feature.

**Table 2.4    Sidefile Thresholds**

| Operation | Threshold(s) | Action(s) |
|---|---|---|
| TC390A | High-water mark (HWM) = sidefile threshold – 20% | MCU (RCU) reaches HWM: command retry to host (MCU), begin graduated delay. Delay times can be adjusted using mode 93 (see Table 2.1). |
|  | Sidefile threshold = 30-70% of cache, default = 50%. TC390A threshold can be adjusted from 30-70% (in 10% increments) using the TC390 Remote Console software. | MCU (RCU) reaches threshold: command retry to host (MCU), max delay time (500 or 100 ms). Delay time can be adjusted using mode 93 (see Table 2.1). |
|  | Puncture threshold = sidefile threshold + 10% | MCU (RCU) reaches puncture: suspend affected TC390A pairs due to sidefile overflow condition. |
| HXRC* | [XRC+CC sidefile] / [avail cache] = 40%, 50%, 60% XRC+CC thresholds can be adjusted by using modes 85 and 86 (see Table 2.1). Threshold 1/2/3 = 30/40/50%, 40/50/60%, or 60/70/80% | Threshold 1 = command retry. Threshold 2 = SCP message. Threshold 3 = puncture condition. |
| CC | [XRC+CC sidefile] / [avail cache] = 40%, 50%, 60% XRC+CC thresholds can be adjusted by using modes 85 and 86 (see Table 2.1). Threshold 1/2/3 = 30/40/50%, 40/50/60%, or 60/70/80% | Threshold 1 = no action. Threshold 2 = SCP message. Threshold 3 = puncture condition. |
| Write Pending | [write pending] / [avail cache - sidefile] = 70% | Command retry. |

*Note:* Please see Appendix E for further information on sidefile thresholds for HXRC operations.

### 2.3.7    Graduated Delay Sidefile Management

Figure 2.5 shows the graduated delay process for TC390A sidefile management. When the TC390A sidefile value reaches the high-water mark (threshold minus 20%), the 9900V subsystem begins command retry delay for host updates to TC390A M-VOLs and reports a warning SIM to the host. As the amount of sidefile increases, the delay increases incrementally as shown in Figure 2.5. Mode 93 on the 9900V SVP (refer to Table 2.1) allows you to select the delay type (long or short). This graduated delay methodology minimizes the potential for sidefile overcommitment, while at the same time providing another level of automation control.

*Important:* SIM reporting for TC390A sidefile conditions is enabled only when SVP mode 118 is ON (refer to Table 2.1).

You can disable the command retry delay for a limited number of critical volumes using the special "No delay" parameter for the CESTPAIR TSO command (see section A.2.2). When this parameter is set, the 9900V will not delay host write I/Os to the M-VOL until the TC390A sidefile amount reaches the puncture threshold (threshold + 10%). This prevents performance degradation for critical volumes and should be used only for a small number of volumes.

Sidefile Threshold (ST) = 30% to 70% user-specified
Example: Threshold = 50% (default)

Host Write I/O delayed
500 ms for every write if Mode 93=OFF
100 ms for every write if Mode 93=ON
until below threshold.

Suspend TC390A pairs at puncture due to sidefile overflow condition.

| | Long Delay Type<br>Mode 93 = OFF | Short Delay Type<br>Mode 93 = ON |
|---|---|---|
| Puncture Threshold = ST+10% | | |
| Sidefile Threshold (ST) | +400ms X1 delay | +80ms X 1 delay |
| | +300ms X1 delay | +60ms X 1 delay |
| | +200ms X1 delay | +40ms X 1 delay |
| High-Water Mark = ST-20% | +100ms X1 delay | +20ms X 1 delay |

100%
70%
60%
50%
45%
40%
35%
30%

SIM generated at HWM when mode 118 is ON.
SIM ref code = 490x, x = CU
Reported every 30 sec as long as condition exists.

**Figure 2.5    Graduated Delay Process for Sidefile Management**

## 2.3.8   Dummy Pair Mode

TC390 Asynchronous performance can be limited due to RIO response through CNT/ATM. This is because only one RIO at a time can transfer updates to remote side. RIO is issued with the device address of secondary volume. ESCON® protocol allows only one I/O at a time to the same device address. Dummy pair mode addresses this limitation by providing additional device addresses for specific high-usage volumes (see Figure 2.6).
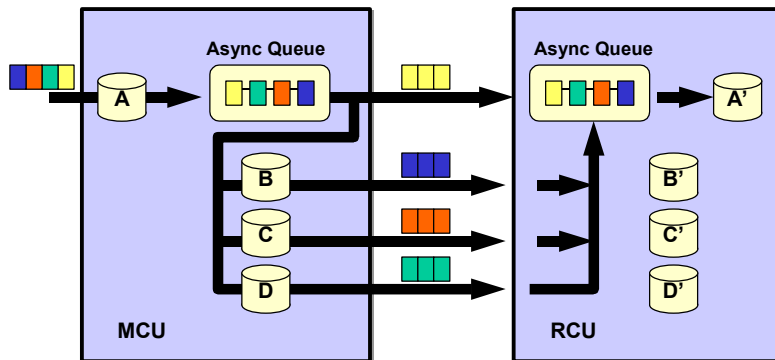


Updates to the primary volume (A) are transferred to the device addresses of its secondary volume (A')
as well as the secondary volumes of dummy volume pairs (B'-D') in parallel.

**Figure 2.6    Dummy Pair Mode**

The basic specifications for dummy pair mode are:

■   Up to three dummy pairs can be related to one real volume pair.

■   Volumes must be assigned in both the MCU and RCU for dummy pair.

■   Custom-size volumes of minimum size (one cylinder) can be used for dummy pair.

■   Dummy pair volumes cannot accept host I/Os, must be offline from all host systems.

■   Volumes for a dummy pair must be in the same logical CU image as the real pair.

Table 2.5 shows the main differences between dummy pair mode and HPAV operations.

**Table 2.5    Differences between TC390A Dummy Pair Mode and HPAV**

|  | **TC390A Dummy Pair** | **HPAV** |
|---|---|---|
| Paralleling | TC390 Async RIO | Host I/O |
| Effective for | Single or independent I/O requester | Independent I/O requester* (e.g. Different job and extend). Due to this reason, possibly HPAV is not effective for IMS WADS. |
| Requires | At least minimum CVS volumes | Only LDEV address |

General recommendation: When a specific TC390A volume could be a bottleneck due to high write I/O activity:

- If write I/Os are from independent I/O requester, consider dividing I/O activity to different volume (by dataset relocation, etc.).

- Otherwise consider using TC390A dummy pair(s).

You can use the PPRC CESTPAIR command as follows to establish TC390A dummy pairs and relationships to real volume pairs. For detailed information on configuring master and dummy pairs using the CESTPAIR TSO command, please see section A.2.2.

1. CESTPAIR    Establish real volume pair (A-A')

2. CESTPAIR    Establish 1st dummy pair (B-B') for A-A'

3. CESTPAIR    Establish 2nd dummy pair (C-C') for A-A'

4. CESTPAIR    Establish 3rd dummy pair (D-D') for A-A'

## 2.4  TrueCopy – S/390® Asynchronous Consistency Group Operations

Hitachi TrueCopy – S/390® Asynchronous consistency groups enable update sequence consistency to be maintained across a group of volumes. The R-VOLs of the pairs in a consistency group must be located within one RCU (n-to-1 requirement). The TC390A consistency group operations include:

- Group options,

- Group consistency time, and

- Group operations.

## 2.4.1 Group Options

Hitachi TrueCopy – S/390® Asynchronous provides the following options for each consistency group: **Timer Type**, **Time Out [Copy Pending]**, and **Time Out [RCU Ready]**. These options are selected when you add a group. If you want to change the **Time Out** options of a group, you must suspend all pairs in the group first. If you want to change the **Timer Type** option, you must delete all pairs. The **Timer Type** and **Time Out [Copy Pending]** options must be the same for all MCUs which contain M-VOLs in the group. The **Time Out [RCU Ready]** option can be different at each MCU if desired.

**Timer Type**. This group option determines how the MCU will acquire the time-stamp for the TC390A recordsets:

- **System**. When the **System** timer option is selected, the MCU acquires the time-stamp information for each recordset as follows. When a TC390A pair is established, the MCU reports state-change-interrupt (SCI) to all hosts. The host then issues a series of sense group commands to determine the device status change, and the MCU returns the same response as if the device had been added to an XRC session to activate I/O time-stamping for the device. Once I/O time-stamping is activated, the MVS IOS routine attaches the time-stamp information (contents of time-of-day (TOD) clock) to each write I/O operation for the device. The time-stamp indicates the time that the update was generated during start subchannel (SSCH) at the main host system, and the time-stamp is transferred to the MCU at the beginning of each I/O operation.

- **Local**. The **Local** timer option enables the MCU to generate the time-stamp for each update I/O using its own internal clock, rather than using the SMS I/O time-stamp.

- **None**. The **None** timer option should only be selected when establishing TC390A pairs in the reverse direction (from secondary to primary). When the **None** option is selected, the MCU still acquires the time-stamp information from the host I/O time-stamping function.

**Time Out [Copy Pending]**. This group option specifies the maximum delay allowed for TC390A copy operations. *WARNING:* See section 4.3.2 for instructions on selecting the correct **Time Out [Copy Pending]** setting for your operational environment.

The RCU will suspend all R-VOLs in the group when:

- The RCU has not had any communication from the MCU within the specified time. This situation could indicate a disaster or failure at the primary site.

- The RCU has been receiving recordsets from the MCU(s) but has not been able to settle a recordset within the specified time. This situation may indicate that the RCU does not have enough resources to handle the remote copy and I/O workloads.

**Time Out [RCU Ready]**. This option specifies the maximum delay for re-establishing MCU-RCU communications following MCU power-off. During MCU power-on, the MCU re-establishes communication with all registered RCUs. If it is not able to re-establish communication with an RCU within the specified time, the MCU suspends all affected TC390A volume pairs.

### 2.4.2 Group Consistency Time

During normal TC390A operations, the consistency time (C/T) of a group corresponds to the time-stamp value of the most recently settled recordset at the RCU. The consistency time for the group is indicated as part of the TC390A R-VOL pair status (also displayed by the CQUERY TSO command to the R-VOL). As the main system continues to update the TC390A M-VOLs, the difference between the current system time and the group consistency time indicates the amount of time that the R-VOLs are behind the M-VOLs. The M-VOL updates which take place during this time may be lost when a disaster occurs.

When a TC390A volume pair is suspended, the C/T of the suspended R-VOL is frozen. If the RCU can ensure the update sequence consistency between the suspended R-VOL and the other R-VOLs in the consistency group, the R-VOL C/T is frozen at the latest consistency time of the group. Otherwise, the R-VOL C/T is frozen at the time-stamp value of the most recent update that was successfully copied to the R-VOL. The C/T of a suspended R-VOL may be older than the C/T of other R-VOLs in the group, and if the entire group was not also suspended, the consistency time of the group is still ticking. For suspended TC390A R-VOLs, the TC390 Pair Status panel displays whether the C/T was frozen to the group or R-VOL time.

Once you have established TC390A operations, you should monitor the consistency time of each group at the RCU(s). If the average delay is longer than your disaster recovery design can accept, you should consider adding remote copy resources (e.g., paths, cache) and/or reducing the I/O workload to improve subsystem performance. If the delay between the M-VOL update and the corresponding R-VOL update reaches the time specified by the **Time Out [Copy Pending]** group option, the MCU will suspend all affected volume pair(s) due to the heavy I/O workload (at MCU or RCU). To prevent timeout errors, you can increase the **Time Out [Copy Pending]** value, reduce I/O workload, and/or add remote copy resources.

## 2.4.3 Group Operations

Hitachi TrueCopy – S/390® Asynchronous provides the following group-based operations to simplify and expedite disaster/failure recovery procedures:

- Group operations at the MCU:

  - Suspend all pairs in a consistency group. See section 5.6 for a description of the TC390A **Group** suspend option (supported by CSUSPEND TSO command).

  - Resume all suspended pairs in a consistency group. See section 5.7 for a description of the TC390A **Resume-Group** resume option (supported by the CESTPAIR TSO command with the parameter MODE=RESYNC).

  - Delete all pairs in a consistency group. See section 5.8 for a description of the TC390A **Group** delete option (supported by CDELPAIR TSO command).

- Group operations at the RCU:

  - Suspend all pairs in a consistency group. See section 5.6 for a description of the TC390A **Group** suspend option (supported by CSUSPEND TSO command).

  - Delete all suspended pairs in a consistency group except for any inconsistent pairs. See section 5.8 for a description of the TC390A **C/T** delete option (not supported by CDELPAIR, CDELPAIR cannot be issued to the RCU).

  - Delete all pairs in a consistency group regardless of their consistency status. See section 5.8 for a description of the TC390A **Group** delete option (not supported by CDELPAIR, CDELPAIR cannot be issued to the RCU).

TC390A also provides the **Error level** pair option (see section 5.3.2) which is used to trigger automatic suspension of an entire consistency group. When a TC390A pair is suspended due to failure (not user-requested), this TC390A pair option determines whether all pairs in the same consistency group will also be suspended. If you select the **Group** error level for a TC390A pair, all pairs in the same group will be suspended. If you select the **Volume** error level, only the affected TC390A pair will be suspended.

*Note:* The **Error level** pair option is very important for managing TC390A groups and planning for disaster recovery. The **Group** error level should be selected for all TC390A volumes which are essential to disaster recovery. Suspended TC390A R-VOLs which have the **Volume** error level should not be used for disaster recovery.

## 2.5 TrueCopy – S/390® Volume Pair Status

Hitachi TrueCopy – S/390® Asynchronous displays the pair status for each volume in the selected logical CU image (CUI) of the connected 9900V subsystem. The MCU maintains the status of the M-VOL and is responsible for keeping the M-VOL and its R-VOL synchronized. The RCU maintains the status of the R-VOL. The MCU can change the pair status of the M-VOL and R-VOL. The RCU can change the pair status of the R-VOL but not the M-VOL. The MCU will detect when the RCU changes the R-VOL status (if the path status is normal) and will change the M-VOL status accordingly. The TC390 pair status can be acquired from the MCU and RCU using the TC390 software (Pair Status) and the CQUERY TSO command.

Table 2.6 lists and describes the TC390 volume pair status descriptions. A volume which is not assigned to a TC390 volume pair has the status *simplex*. When a TC390 pair is started, the MCU changes the status of both volumes (M-VOL and R-VOL) to *pending duplex*. When the initial copy operation is complete, the MCU changes the status of both volumes to *duplex*. When a pair is suspended from the MCU, the MCU changes the status of the M-VOL and R-VOL (if the path status is normal) to *suspended*. When a pair is suspended from the RCU, the RCU changes the status of the R-VOL to *suspended*, and the MCU detects the pair suspension (if the path status is normal) and changes the M-VOL status to *suspended*. When you delete a pair from the MCU, the MCU changes the status of the M-VOL and R-VOL (if the path status is normal) to *simplex*. When you delete a pair from the RCU, the RCU changes the R-VOL status to *simplex*, and the MCU detects the pair deletion (if the path status is normal) and changes the M-VOL status to *suspended*.

**TC390A-Specific Pair Status**

The TC390A *suspending* and *deleting* transitional states occur when a request to change TC390A pair status has been accepted, but the change to the requested status (*suspended* or *simplex*) is not yet complete. These states are not reported to the host. In the case of *suspending*, both the user and the MCU can request the status change. In the case of *deleting*, only the user can request the status change. If the user requested the status change, the final status is reported at the end of the transition. If an error caused the status to change to *suspended*, the suspended status is reported at the beginning of the transition.

The TC390A *SEQCHK* status is indicated when a TC390A pair assigned to a consistency group with the **System** timer type accepts a non-time-stamped update from the primary system. The *SEQCHK* status does not affect TC390A copy activities and will be removed when the next time-stamped update is successfully copied to the R-VOL. However, if a disaster or system failure occurs before the next time-stamped update, the update sequence consistency between the R-VOL and other R-VOLs in the consistency group is not ensured. To ensure effective disaster recovery, you should detect and remove the source of the *SEQCHK* status. The *SEQCHK* status can be caused by any of the following:

■ An application may issue update I/Os bypassing the MVS standard I/O procedure.

■ The I/O time-stamping function may not be active at the primary system.

**Table 2.6    TrueCopy – S/390® Volume Pair Status**

| Pair Status | Description |
|---|---|
| Simplex | This volume is not currently assigned to a TC390 volume pair. When this volume is added to a TC390 volume pair, its status will change to *pending duplex*. |
| Pending Duplex | The TC390 initial copy operation for this volume pair is in progress. This volume pair is not yet synchronized. When the initial copy is complete, the status changes to *duplex*. |
| Duplex | This volume pair is synchronized. Updates to the M-VOL are duplicated on the R-VOL. |
| Suspended (see Table 2.7 for suspend types) | This volume pair is not synchronized:<br>– For TC390 Synchronous only, if the MCU cannot keep the pair synchronized for any reason, the MCU changes the status of the M-VOL and R-VOL (if possible) to *suspended*.<br>– For TC390A only, if the MCU detects a TC390A suspension condition (see section 2.5.2), the MCU changes the M-VOL status and R-VOL status (if possible) to *suspended*.<br>– For TC390A only, when the RCU detects a TC390A suspension condition (see section 2.5.2), the RCU changes the R-VOL status to *suspended*.<br>– For TC390 Synchronous only, the MCU changes the status of all TC390 Synchronous pairs to *suspended* when it performs the CGROUP/RUN command (see section A.3).<br>– When you suspend a pair from the MCU, the MCU changes the status of the M-VOL and R-VOL (if possible) to *suspended*. When you suspend a pair from the RCU, the RCU changes the status of the R-VOL to *suspended*.<br>– When the MCU detects that the pair was suspended or deleted from the RCU, the MCU changes the status of the M-VOL to *suspended*. |
| **Pair Status for TC390A only:** | |
| Suspending | This pair is not synchronized. This pair is in transition from *duplex* or *pending duplex* to *suspended*. When the suspension is requested (by user, MCU, or RCU), the status of all affected pairs changes to *suspending*. When the suspension is complete, the status changes to *suspended*. |
| Deleting | This pair is not synchronized. This pair is in transition from *duplex*, *pending duplex*, or *suspended* to *simplex*. When the delete pair operation is requested (by user), the status of all affected pairs changes to *deleting*. When the delete pair operation is complete, the status changes to *simplex.* |
| SEQCHK | The RCU encountered a non-time-stamped recordset for a TC390A pair using the **System** timer type option. This status can be displayed at the MCU and RCU, but the MCU may not have the most current information. Always use the pair status information displayed at the RCU for disaster recovery. |

### 2.5.1   Suspended Pairs

Table 2.7 lists and describes the TC390 suspend types, which indicate the reason for suspension. A TC390 pair can be suspended by the user at any time after the initial copy operation is complete. The user must suspend a TC390 pair in order to perform ICKDSF maintenance on the M-VOL or to access the R-VOL (read only mode). TC390 pairs are also suspended when the CGROUP/ RUN command is processed (see section A.3). When a TC390 Synchronous pair is suspended by the user, the MCU ensures synchronization by completing any pending update copy operation before changing the status to *suspended*. When a TC390A pair is suspended by the user, the MCU and RCU ensure synchronization by either completing or discarding any pending update copy operations according to the user-specified drain/purge suspend option.

A Hitachi TrueCopy – S/390® pair is suspended by the MCU when the following suspension conditions are detected. A TC390A pair can also be suspended by the RCU (see section 2.5.2).

■   When the MCU detects that the user has deleted the volume pair from the RCU (e.g., to access an R-VOL at the remote site),

■   When the MCU detects an error condition related to the RCU, R-VOL, a TC390 Synchronous update copy operation or a TC390A recordset operation (see section 2.5.2),

■   When the RCU cannot execute DFW (DASD fast write) to the R-VOL (only if **DFW required** is selected), or

■   When the MCU is unable to communicate with the RCU.

If a TC390 Synchronous update copy operation fails, the MCU maintains exact synchronization by reporting a unit check and decommitting the M-VOL update, so that the host system and application program regard that write operation to the M-VOL as failed. For information on failed TC390A recordset operations, see section 2.5.2.

When a TC390 pair is suspended, the MCU stops performing update copy operations to the R-VOL. For a suspended TC390 Synchronous pair, the MCU may or may not continue accepting write I/Os for the M-VOL depending on the M-VOL fence level and suspend option (if user-requested). If the MCU accepts write I/Os for a suspended M-VOL, the MCU keeps track of the M-VOL cylinders/tracks which are updated while the pair is suspended. For a suspended TC390A pair, the MCU and RCU keep track of any recordsets that were discarded during suspension, and the MCU continues accepting write I/Os for the M-VOL and keeps track of the M-VOL cylinders/tracks which are updated while the pair is suspended.

A suspended TC390A R-VOL has an additional status called the consistency status which is displayed only at the RCU. The consistency status of a suspended TC390A R-VOL indicates its update sequence consistency with respect to the other R-VOLs in the same group. Table 2.8 lists and describes the consistency status descriptions for suspended TC390A R-VOLs.

When a TC390 pair is suspended, whether user-requested or due to failure, the MCU generates sense information to notify the host(s). If the host system supports IBM® PPRC (and the PPRC support RCU option is enabled), this notification results in an IEA494I and/or IEA491E system console message which indicates the reason for suspension. See section A.4 for further information on the IEA494I and IEA491E system console messages.

*Note:* If you need write access to an R-VOL, you must delete the pair.

**Table 2.7     Suspend Types**

| Suspend Type | Applies to | Description |
|---|---|---|
| M-VOL by operator | M-VOL (TC390 Sync only) | The user suspended the pair from the MCU using the **M-VOL Failure** option. The R-VOL suspend type is *by MCU*. |
| R-VOL by operator | M-VOL, R-VOL | The user suspended the pair from the MCU or RCU using the **R-VOL** option. |
| by MCU | R-VOL | The RCU received a request from the MCU to suspend the volume pair. The M-VOL suspend type is *M-VOL by Operator* or *R-VOL by Operator*. |
| by RCU | M-VOL | The MCU detected an error condition at the RCU which caused the MCU to suspend the TC390 volume pair. The R-VOL suspend type is *by MCU*. |
| Delete Pair to RCU | M-VOL | The MCU detected that the R-VOL status changed to *simplex* because the user deleted the pair from the RCU. The pair cannot be resumed because the R-VOL does not have the *suspended* status. |
| R-VOL Failure | M-VOL | The MCU detected an error during communication with the RCU or an I/O error during update copy. In this case, the R-VOL suspend type is usually *by MCU*. |
| MCU IMPL | M-VOL, R-VOL | The MCU could not find valid control information in its nonvolatile memory during the IMPL procedure. This condition occurs only if the MCU is completely without power for more than 48 hours (e.g., power failure and fully discharged backup batteries). |
| Initial Copy failed | M-VOL, R-VOL | The volume pair was suspended before the initial copy operation was complete. The data on the R-VOL is not identical to the data on the M-VOL. |
| by FREEZE | M-VOL, R-VOL (TC390 Sync only) | The volume pair was suspended by the CGROUP/RUN TSO command (see section A.3). |
| MCU P/S-OFF | R-VOL (TC390A only) | The RCU received a request from the MCU to suspend the R-VOL due to MCU power-off. The RCU stops expecting recordsets from that MCU. |
| by sidefile overflow | M-VOL, R-VOL (TC390A only) | The amount of sidefile exceeds the specified "current pending update data rate", and the RCU data is not transferred within the specified "offloading timer". |

**Table 2.8     Consistency Status for Suspended TrueCopy – S/390® Async R-VOLs**

| Consistency Status | Description |
|---|---|
| Volume | This TC390A volume pair was probably suspended alone. Update sequence consistency between this R-VOL and other R-VOLs in this consistency group is not ensured. This R-VOL cannot be used for disaster recovery at the secondary system. This status is indicated when:<br>– This volume pair was suspended due to a failure that did not affect the entire consistency group, and the **Error Level** pair option for this pair is set to **Volume**.<br>– This volume pair was suspended by a user-initiated suspend pair operation with the TC390A **Suspend (Async)** suspend option set to **Volume**. |
| Group | This TC390A volume pair was suspended along with the other pair in its consistency group. Update sequence consistency between this R-VOL and other R-VOLs in this consistency group is ensured. This R-VOL can be used for disaster recovery at the secondary system (after deleting the TC390 volume pair from the RCU). This status is indicated when:<br>– All volume pairs in this consistency group were suspended due to a failure that affected the entire consistency group (not just one pair) (e.g., MCU-RCU communication failure).<br>– The volume pair was suspended due to a failure that did not affect the entire group, and the **Error Level** TC390A pair option for this pair is set to **Group**.<br>– This volume pair was suspended by a user-initiated suspend pair operation with the TC390A **Suspend (Async)** suspend option set to **Group**. |

### 2.5.2    Suspended TrueCopy – S/390® Asynchronous Pairs

Hitachi TrueCopy – S/390® Asynchronous operations involve additional suspension conditions related to the asynchronous recordset operations. Both the MCU and RCU can detect TC390A suspension conditions and suspend TC390A pairs. Table 2.9 describes the TC390A suspension conditions and indicates which CU detects the condition and which volume pairs are suspended. The TC390A offloading timer async option (see section 4.3.1) and timeout group options (see section 4.3.2) are used to control the TC390A suspension conditions. See Table 7.4 in section 7.1 for troubleshooting information for TC390A suspension conditions.

**Table 2.9      TrueCopy – S/390® Asynchronous Suspension Conditions**

| Suspension Condition | Detected by: | TC390A Pairs to be Suspended |
|---|---|---|
| The MCU could not send a pending recordset to the RCU before the **offloading timer** async option expired (see section 2.3.6). | MCU | All TC390A pairs with M-VOLs in the MCU. |
| During MCU power-on, the MCU could not establish communication with the RCU before the **RCU ready timeout** group option expired (see section 2.4.1). | MCU | All TC390A pairs with M-VOLs in the MCU. |
| The RCU could not settle a pending recordset before the **copy pending timeout** group option expired. | RCU | All TC390A R-VOLs in the consistency group. |
| The RCU could not communicate with the MCU before the **copy pending timeout** group option expired. | RCU | All TC390A R-VOLs in the consistency group. |
| The RCU could not receive the recordset successfully due to a hardware failure. | RCU | Only the affected R-VOL. |
| The RCU detected a logical error while selecting the recordset to be settled. | RCU | All TC390A R-VOLs in the group, or only the affected R-VOL, depending on the failure type and **error level** TC390A pair option. |
| The RCU could not settle the recordset due to a hardware failure, a track condition, or a logical error. | RCU | |

The MCU stores a cylinder/track bitmap in cache for each TC390A M-VOL, and the RCU stores a cylinder/track bitmap in cache for each TC390A R-VOL. When a TC390A pair is suspended, the cylinders/tracks which contain the following records are marked in the bitmap as modified (to be copied during the resume pair operation):

- The recordsets that were created by the MCU but not yet sent to the RCU. After marking these cylinders/tracks as modified, the MCU discards these recordsets.

- The recordsets that were sent to the RCU but not acknowledged by the RCU. The MCU marks these M-VOL cylinders/tracks as modified and discards these recordsets. This ensures that recordsets which are lost during transmission to the RCU are identified and marked.

- The recordsets that reached the RCU but have not yet been settled. After marking these cylinders/tracks as modified, the RCU discards these recordsets.

- The M-VOL records updated by host-requested write I/Os after the volume pair was suspended (same function as for TC390 Synchronous pairs).

When a suspended TC390A pair is resumed (resynchronized), the contents of the RCU's cylinder/track bitmap are sent to the MCU and merged into the MCU's bitmap. The MCU then performs the resync operation according to the merged bitmap. This ensures that all cylinders/tracks containing recordsets that were discarded are resynchronized at this time.

## 2.6    PPRC Support

All Lightning 9900™ V Series subsystems with TC390 installed support IBM® PPRC host software functions. You can perform most TC390 operations by issuing PPRC TSO (or ICKDSF PPRCOPY) commands from the host system console to the 9900V subsystem. Using PPRC commands, you can establish and delete remote copy communication paths; establish, suspend, resume, and delete TC390 Synchronous and TC390A pairs/groups; and view TC390 path and pair status. See Appendix A for further information on using PPRC TSO and ICKDSF commands with the Hitachi Lightning 9900™ V Series subsystem.

For operating systems that do not support PPRC, the TC390 Remote Console software* is used to control and monitor TC390 operations. In this case, TC390 provides only state-change-pending (SCP) notifications with service information messages (SIMs).

**Restrictions**. If you plan to use PPRC commands instead of the TC390 software to perform TC390 operations, the following restrictions apply:

- **SVP mode 114** (see Table 2.1) must be enabled to allow automatic port configuration in response to PPRC commands. To fully support an automated environment, the 9900V subsystem is capable of automatically configuring a serial port as an RCP or LCP, or a fibre-channel port as an initiator or RCU target port if required in response to the TSO CESTPATH and CDELPATH commands. The 9900V subsystem will make sure that the specified MCU port is offline to the host, and will automatically configure it as an RCP or initiator port if required. Similarly, the corresponding RCU port will also be configured as an LCP or RCU target port if required. When the CDELPATH command is issued, the TC390 logical paths are removed, and if there are no more TC390 or TC logical paths on the port, the port is automatically changed from RCP mode to LCP mode, or from initiator port mode to RCU target port mode.

  *Note:* For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager. The fibre-channel interface ports need to be configured as initiator ports or RCU target ports *before* the CESTPATH and CDELPATH commands are issued.

  *Caution:* Before issuing the CESTPATH command, you must make sure that the relevant paths are offline from the host(s) (e.g., configure the Chipid offline, or deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed.

- The PPRC commands do not allow you to:

  **Change the RCU options.** The current default values are:  minimum paths = 1, max. initial copy activities = 4, SCP delay time = 120 sec., RIO MIH time = 15 sec, incident of RCU = to any host, PPRC support = yes, remote copy service SIM = not report, Freeze option = disable. The TC390 software* must be used to change these options.

  **Change the TC390 async options.** The current default values are: sidefile threshold = 50%, offloading timer = 5 minutes. The TC390 software* must be used to change these options.

**Configure TC390A consistency groups.** Since each TC390A pair must belong to one group, the TC390 software* must be used to add and configure the groups (timer type, copy pending timeout, RCU ready timeout) before you can add any TC390A pairs. Once the async options, groups, and group options are configured, the PPRC commands can be used to control/monitor TC390A pairs.

**Change the initial copy priority,** CFW data option, or DFW to R-VOL option. If CESTPAIR is used to establish a TC390 pair, the following options will be used:  initial copy priority = 0, CFW data = copy to R-VOL, and DFW to R-VOL = not required. The TC390 software* must be used to change these options.

*Note:* The DFW to R-VOL setting does not affect the I/O performance of the M-VOLs. If one side of cache is closed due to an RCU failure, the TC390 copy operation still uses DFW. The only difference between **not required** and **required** is that new pairs cannot be established with the **DFW-to-R-VOL required** option when one side of RCU cache is closed (the add pair operation fails).

***Note:*** If the 9900V Remote Console software is not installed, please contact your Hitachi Data Systems account team for further information on TC390 configuration services.

## 2.6.1    P/DAS Support

Hitachi TrueCopy – S/390® Synchronous supports the IBM® P/DAS host software function. P/DAS allows you to relocate or migrate data by redirecting all application I/Os from the M-VOL of a TC390 pair to the R-VOL without interrupting access to the data. Please refer to the following IBM® publications for important information on the requirements and procedures for P/DAS operations: *Planning for IBM Remote Copy* (SG24-2595), *Advanced Copy Services* (SC35-0355), *DFSMS MVS V1 Remote Copy Guide and Reference* (SC35-0169). *Note:* TC390A does not support P/DAS SWAP.

*Restrictions:*

■    P/DAS does not support CFW operations. You must stop CFW applications before performing P/DAS operations on TC390 volumes.

■    P/DAS through channel extenders is not supported.

■    P/DAS swap option #2 (switch pair & swap) is supported for P/DAS between the 9900V and 9900 subsystems (not supported between 9900V and 7700E).

Please contact your Hitachi Data Systems account team for the latest information on P/DAS support.

## 2.6.2    GDPS Support

Hitachi TrueCopy – S/390® provides remote copy support for IBM's Geographically Dispersed Parallel Sysplex® (GDPS) facility. GDPS is an IBM® service offering for mirroring data and balancing workload on subsystems spread across two or more sites up to 40 km (~20 miles) apart. With this support, users who are running IBM® Parallel Sysplex systems can take advantage of the 9900V subsystem's suite of remote copy options for data availability.

GDPS operations feature automatic control of groups of PPRC-managed volumes using host-based scripts and PPRC commands (e.g., CESTPATH CGROUP option for 2105, CGROUP (FREEZE/RUN) for 3990). GDPS support may have additional installation requirements for the 9900V TC390 MCUs and RCUs, depending on 9900V microcode levels and Remote Console software versions. Please check the following items with your Hitachi Data Systems representative:

■    SVP modes (e.g., 64, 104). For operations in a GDPS environment:
     Mode 64 must be OFF.
     Mode 104 must be ON for 3990 controller emulation (not valid for 2105 emulation).

     For further information on 9900V SVP modes related to TC390 operations, please refer to Table 2.1 in section 2.1.1.

Mode 104 must be set before any TC390 pairs are established in a GDPS environment. If TC390 pairs have already been established, you must delete all pairs and logical paths (CDELPAIR, CDELPATH), change the SSIDs and mode settings on the MCUs and RCUs, and then re-establish the paths and pairs (CESTPATH, CESTPAIR). Installation of mode 64 is nondisruptive and can be performed at any time.

*Note on LINK definitions in GDPS:* The 9900V does not support controlling the 'Freeze Option' through the CESTPATH LINK parameter. The 'Freeze Option' must be controlled using the CGROUP option of CESTPATH. Please make changes as needed to the CESTPATH LINK definitions in your GDPS configuration files or configuration database.

For further information on GDPS, please refer to the following IBM® publications: *Geographically Dispersed Parallel Sysplex: the S/390® Multi-site Application Availability Solution, Executive Summary* (GF22-5114); and *Geographically Dispersed Parallel Sysplex: the S/390® Multi-site Application Availability Solution* (GF22-5063).

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

## 3.1    System Requirements

Hitachi TrueCopy – S/390® operations involve the 9900V MCUs and RCUs containing the main and remote volumes, the remote copy connections between the MCUs and RCUs, the S/390® host(s) at the main and remote sites, and the TrueCopy – S/390® Remote Console software. The Hitachi TrueCopy – S/390® system requirements are:

- **MCU:** Lightning 9900™ V Series subsystem with TrueCopy – S/390® installed. *Note:* For information on remote copy operations using the 9900 subsystem as an MCU, please refer to the *Hitachi Lightning 9900™ Hitachi TrueCopy – S/390® User and Reference Guide* (MK-91RD050).

- **RCU:** Lightning 9900™ V Series subsystem with TrueCopy – S/390® installed. *Note:* The 9900 and 7700E subsystems with TrueCopy — S/390® (HRC) installed can be used as RCUs connected to a 9900V MCU. For assistance with mixed subsystem configurations, please contact your Hitachi Data Systems representative.

  *Note:* TrueCopy – S/390® can coexist with TrueCopy (all copy modes) in the same 9900V subsystem. Full fibre-channel support will allow concurrent fibre-mode TrueCopy and TC390 operations.

  *Note:* The 9900V subsystems may have additional installation requirements (e.g., SVP modes, DKC-F460I-8HSE, additional cache, etc.). For information on SVP modes for TrueCopy – S/390®, refer to Table 2.1.

- **S/390® host:**  MVS/DFP 3.2.0 + PTF, or VM/ESA® 2.1.0 + PTF.
  - Optional error recover procedure (ERP) functions require MVS/DFP 3.2.0 or later.
  - ICKDSF R16 + PTF functions require VM/ESA 2.1.0 or later.
  - If the primary and/or secondary system consists of several CPU complexes, a **SYSPLEX timer** is required to provide a common time reference for the host I/O time-stamping function.
  - APAR OW36948 is required for 16-session support for HXRC.

- **Remote copy connections – fibre channel** (see section 3.3.1 for further information):
  - Multimode or single-mode optical fibre cables are required at both the MCU and RCU.
  - For distances from 0.5 km to 1.5 km (1,640 to 4,920 feet), multimode shortwave fibre channel interface cables with up to two switches are required.
  - For distances from 10 km to 30 km (6.2 to 18.6 miles), single-mode longwave fibre channel interface cables with up to two switches are required.
  - For distances greater than 30 km, approved third-party channel extender products and telecommunications lines are required.

- **Serial remote copy connections** (see section 3.3.2 for further information):
  *Note:* Please contact your Hitachi Data Systems account team for the latest information on the availability of serial-channel TrueCopy – S/390® connections.

  – Multimode serial interface (ESCON®) cables are required at both the MCU and RCU.

  – For distances from 3 km to 43 km (1.9 to 26.7 miles), single-mode serial interface cables with IBM® 9032 or 9033 ESCON® directors (ESCDs) and/or 9036 ESCON® repeaters are required.

  – For distances greater than 9 km (5.6 miles), the extended distance facility (XDF) provided by the ESCDs and/or ESCON® repeaters is required.

  – For distances greater than 43 km (26.7 miles), approved third-party channel extender products and telecommunications lines are required. Long-distance TC390 solutions are provided based on user requirements and workload characteristics. *Note:* Use of channel extenders may require additional 9900V configuration (e.g., mode 21).

  – *Note:* All serial remote copy activities between two 9900V subsystems (i.e., TC390, TC390A, TrueCopy Sync, and TrueCopy Async) can share the same remote copy connections.

- **Remote Console Software and TrueCopy – S/390® license code(s):**

  – The **9900V Hitachi Remote Console – Storage Navigator** software is required for 9900V TrueCopy – S/390® operations. The TrueCopy – S/390® Remote Console software is a component of the 9900V Hitachi Remote Console – Storage Navigator.

  – The **TrueCopy – S/390® license key code(s)** are required to enable the TrueCopy – S/390® option(s) on the 9900V subsystem (see section 3.4). Separate license codes are required for each 9900V subsystem.

  *Note:* Administrator or TrueCopy – S/390® write access to the 9900V Remote Console software is required to perform TrueCopy – S/390® operations. Users without Administrator or TrueCopy – S/390® write access can only view TrueCopy – S/390® information.

  *Note:* You must operate the 9900V Remote Console software in Modify mode to perform TrueCopy – S/390® operations. Users in view mode can only view TrueCopy – S/390® information.

## 3.2 Requirements and Restrictions

Hitachi TrueCopy – S/390® has the following requirements and restrictions:

- Track format
- One-to-one volume copy operations
- Logical volume image (LVI) (also called device emulation or device type)
- Duplicate VOLSER
- Accessing TC390 M-VOLs and R-VOLs
- Cache, NVS, and DASD fast write
- Consistency groups
- Powering off TC390 components
- Combining TC390 with other data management operations

### 3.2.1 Track Format

Hitachi TrueCopy – S/390® has the following disk track format requirements which must be ensured by the user. TC390 cannot detect exceptions to these requirements. The MCU will abort the TC390 initial copy operation if the track format for both the M-VOL and R-VOL does not meet the following requirements.

- The TC390 M-VOL and R-VOL must have the same track format.
- Record zero (R0) must be standard format, with key length of zero and data length of eight. The MCU will abort the initial copy operation if R0 is not standard format.
- The CCHH (logical cylinder address and logical head address) of R0 must be identical to the physical cylinder address and physical head address of the track.
- The CCHH of each user record in a track must be unique.

### 3.2.2 One-to-One Volume Copy Operations

Hitachi TrueCopy – S/390® requires a one-to-one relationship between the logical volumes of the volume pairs. A volume can only be assigned to one TC390 pair at a time. TC390 does not support operations in which one M-VOL is copied to more than one R-VOL, or more than one M-VOL is copied to one R-VOL. Since TC390 pairs are created on logical volumes rather than datasets, multivolume datasets require special attention. For complete duplication and recovery of multivolume datasets, make sure that all volumes of a multivolume dataset are copied to TC390 R-VOLs, and use TC390A to ensure update sequence consistency across the R-VOLs at the remote site.

### 3.2.3 Duplicate VOLSER

The TC390 initial copy operation always copies the VOLSER of the M-VOL to the R-VOL, even if the **No Copy** initial copy option is selected. For this reason, the M-VOL and R-VOL of a TC390 pair must have the same VOLSER. Since the host operating system does not allow duplicate VOLSERs, the host system administrator must take precautions to prevent system problems related to duplicate VOLSERs. For example, the TC390 R-VOLs must be defined in the system generation so they do not come online automatically (see **WARNING** below).

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*WARNING:* If the volumes which will become TC390 R-VOLs are physically attached to the same system images as the production volumes which will become the TC390 M-VOLs, the following problems can occur:

- When a TC390 pair is established using the TSO CESTPAIR command, the secondary volume might be online (PPRC allows this; TC390 does not). This could produce a duplex secondary online to a host image, the results of which are not predictable.

- When a TC390 pair is deleted, the old secondary volume is usually offline. If a host image is IPL'd, the operator will be offered both volumes and asked which volume should be left offline – the old duplicate volser message. This can be confusing and is prone to error.

To avoid these problems, Hitachi Data Systems strongly recommends that the user specify OFFLINE=YES if the secondary volumes are to be generated in the production host's IOCP and system generation.

---

### 3.2.4 Logical Volume Image (LVI)

Hitachi TrueCopy – S/390® supports all basic mainframe LVIs which can be configured on the 9900V subsystem (e.g., 3390-3, -3R, -9, -L). TC390 does not support multiplatform volumes (3390-3A/B/C). TC390 can copy data between volumes with the same emulation and capacity (e.g., 3390-3R to 3390-3R), and can also copy from smaller volumes to larger volumes* (e.g., 3390-3 to 3390-9) of the same emulation (VTOC expansion must be used). TC390 also supports the Virtual LVI/LUN feature of the 9900V subsystem, enabling you to establish TC390 pairs with custom-size LVIs as well as standard-size LVIs. When custom-size LVIs are assigned to TC390 pairs, the R-VOL must have the same or larger capacity than the M-VOL. The TC390 Remote Console software displays the LVI of the M-VOLs and R-VOLs.

*Note:* If the M-VOL or R-VOL is a 3390-L LVI in a 9900 subsystem, and the number of cylinders is more than 10,017, the capacity of the M-VOL and R-VOL must be the same.

*\*WARNING:* If you utilize TC390 to copy from a smaller volume to a larger volume, you will not be able to perform TC390 operations in the reverse direction (from the secondary site to the primary site) after a disaster has occurred and the secondary site was used for production. This restriction exists because TC390 does not support copying from a larger volume to a smaller volume. Hitachi Data Systems strongly recommends that this capability (copying from a smaller volume to a larger volume) only be used for data migration purposes.

### 3.2.5   Accessing TrueCopy – S/390® M-VOLs and R-VOLs

Write operations to a TC390 M-VOL which specify normal authorization are duplicated on the R-VOL of the TC390 pair. Write operations with diagnostic or device support authorization (e.g., ICKDSF) are completed at the M-VOL but are not duplicated at the R-VOL. Therefore, you must suspend a TC390 volume pair before performing ICKDSF media maintenance on the M-VOL. See section 5.9 for instructions on running ICKDSF on TC390 volumes.

To ensure maximum data integrity during normal TC390 operations, the RCU rejects all read and write operations issued by a host to a TC390 R-VOL. If you need read-only access to a TC390 R-VOL, you must have the R-VOL read option (see section 2.2.4) enabled on the RCU, and you must suspend the pair to read the R-VOL. The R-VOL read option can only be enabled by the Hitachi Data Systems representative. If you need write access to a TC390 R-VOL (e.g., to perform ICKDSF), you must delete the pair from the RCU to change the R-VOL pair status to *simplex*. See section 5.9 for instructions on running ICKDSF on TC390 volumes.

### 3.2.6   Cache, NVS, and DASD Fast Write

Cache and nonvolatile storage (NVS) must be operable for both the MCU and RCU of a TC390 volume pair. If not, the Add Pair operation will fail. The remote subsystem cache should be configured to adequately support the TC390 remote copy workloads as well as any local workload activity.

DASD fast write (DFW) is required at the MCU and RCU only when the **DFW-to-R-VOL required** TC390 pair option (see section 5.3.2) is specified. If DFW to an R-VOL is blocked and the TC390 pair was established with the **DFW-to-R-VOL required** pair option, the MCU detects DFW OFF at the R-VOL and suspends the pair. TC390 pairs which were established using PPRC commands use the default value of **not required** and therefore are not suspended when DFW to the R-VOL is blocked.

*Note:* The DFW to R-VOL setting does not affect the I/O performance of the M-VOLs. If one side of cache is closed due to an RCU failure, the TC390 copy operation still uses DFW. The only difference between **not required** and **required** is that new pairs cannot be established with the **DFW-to-R-VOL required** option when one side of RCU cache is closed (the add pair operation fails).

### 3.2.7    Consistency Groups

The TC390A consistency groups have the following requirements:

- All TC390A pairs must be assigned to one and only one consistency group.

- The maximum number of volume pairs in one consistency group is 4096.

- The maximum number of consistency groups established for one MCU-RCU pair is 128. The RCU supports a maximum of 128 groups. This limit of 128 groups includes both TC390A groups and TC Asynchronous groups (e.g., 64 TC390A + 64 TCA).

- Each update I/O to the M-VOLs in one consistency group must be time-stamped using a common timer facility. The primary host system cannot access volume pairs of the same consistency group if the pairs do not have a common timer reference.

- A consistency group must consist of TC390A pairs or TCA pairs, but not both.


### 3.3    Installing the TrueCopy – S/390® Hardware

Initial installation of the TC390 hardware is planned and performed by the user and the Hitachi Data Systems representative. To install the hardware required for TC390 operations:

1. **User:**  Identify the TC390 M-VOLs and R-VOLs (main and remote volumes), so that the TC390 hardware can be installed and configured properly.

2. **User:**  On the host operating system, make sure that the missing interrupt handler (MIH) value (also called host I/O patrol time) is set high enough to accommodate the number of volume pairs, the cable length between the MCUs and RCUs, and the initial copy pace. The recommended MIH value for TC390 operations is 60 seconds. For MVS, the MIH value is specified in the SYS1.PARMLIB file. *Note:* The recommended MIH value for HXRC is different than for TC390. If you are performing TC390 and HXRC on the same 9900V (or 9900/7700E) subsystem at the same time, please contact your Hitachi Data Systems representative for assistance.

3. **Hitachi Data Systems Representative:**  Make sure that the MCU(s) and RCU(s) are configured for 9900V Remote Console operations (e.g., SVP connected to LAN). Refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide* for information and instructions on setting up 9900V Remote Console operations.

4. **Hitachi Data Systems Representative:**  Make sure that the MCUs and RCUs are properly configured for TC390 operations (e.g., cache, NVS, DFW) (see section 3.2.6). If the user plans to perform TC390A, HXRC, and/or Concurrent Copy operations in the same subsystem, make sure to install adequate cache to handle the increased sidefile usage. When determining the required amount of cache, you must also consider the amount of FlashAccess data to be stored in cache.

5. **Hitachi Data Systems Representative:**  Make sure that the desired SVP modes are enabled (see Table 2.1).

6.  **Hitachi Data Systems Representative:** Make sure the MCUs are configured to report sense information to the host(s). The RCUs should also be attached to a host processor to enable reporting of sense information in case of a problem with an R-VOL or RCU. If the remote site is unattended, the RCUs should be attached to a host processor at the main site, so that the system administrator can monitor the operational condition of the RCUs.

7.  **Hitachi Data Systems Representative:** For fibre-channel interface connections, install the fibre channel adapter features (e.g., DKC-F460I-8HSE). For serial interface connections, install the serial port adapter features [e.g., the DKC-F460I-8S serial 8-port adapter: pair of 4-port CHE cards, 1 card per cluster, provides eight ESCON® links). If the MCU and RCU are multiplatform subsystems, there may be available serial interfaces, and additional serial port adapter features may not be required. Please refer to the Installation section of the 9900V Maintenance Manual for detailed information and instructions.

8.  **Hitachi Data Systems Representative:** If the user plans to use the **Local** TC390A timer type option, set the SVP clock to local time so that the TC390A time-stamps will be correct.

9.  **Hitachi Data Systems Representative:** Install the TC390 remote copy connections between the MCU(s) and RCU(s). This hardware (optical fibre cables, switches, ESCON® cables, ESCON® directors, etc.) is supplied by the user. See section 3.3.2 for remote copy configurations. Distribute the paths between different storage clusters and ESCDs or switches to provide maximum flexibility and availability. The logical paths between the MCU and RCU must be separate from the logical paths between the host and RCU. For fibre-channel and serial interface connections, all remote copy activities between two 9900V subsystems (i.e., TC390, TC390A, TrueCopy Sync, and TrueCopy Async) can share the same remote copy connections. See section 3.3.3 for information on using channel extenders.

### 3.3.1 Fibre Remote Copy Connections

Figure 3.1 shows the remote copy connection configurations for fibre-channel interface TC390 operations. The MCU and RCU of each TC390 pair must be connected via multimode shortwave or single-mode longwave optical fibre cables. If you use multimode shortwave optical fibre cables, fibre cables up to 1.5 km in length and up to two switches are required for distances greater than 0.5 km. If you use single-mode longwave optical fibre cables, fibre cables up to 30 km in length and up to two switches are required for distances greater than 10 km. TC390 operations can be performed at distances of up to 30 km (18.6 miles) using standard single-mode longwave support. Long-distance solutions are provided using approved channel extenders and communication lines.
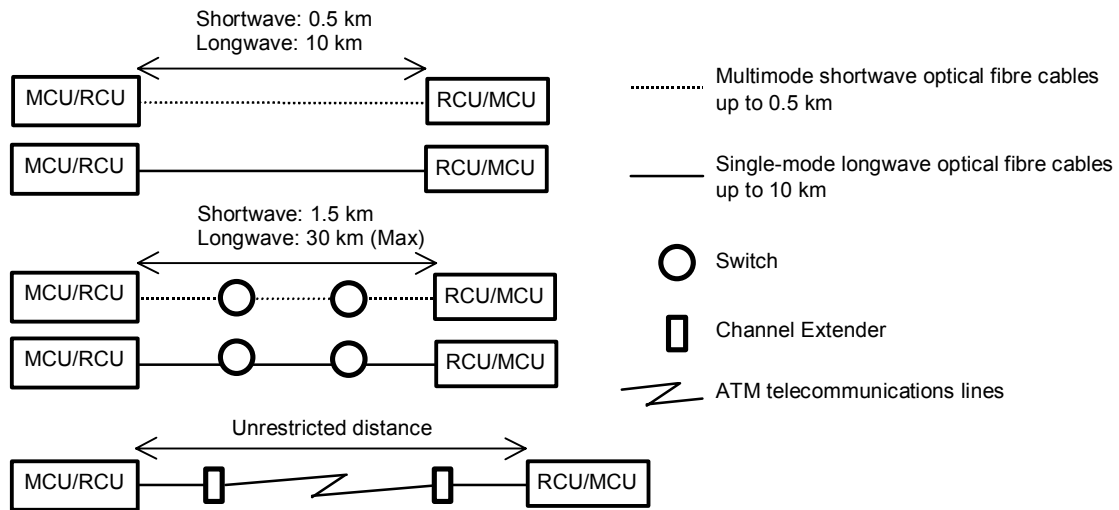


**Figure 3.1    Fibre-Channel Remote Copy Connection Configurations**

*Note:* For fibre-channel interface connections, you can use the switches as for ordinary switch connections, and no special settings are required for the 9900V subsystems.

Fibre-channel interface connection provides three different configurations (see also the *Hitachi Lightning 9900™ V Series LUN Manager User's Guide*):

- **Direct connection** (see Figure 3.2): Two devices are connected directly together.

- **Switch connection** (see Figure 3.3): Up to three optical fibre cables are connected together via the switches to connect the devices. Up to two switches can be used.

- **Extender connection** (see Figure 3.4): Channel extenders and switches are used to connect the devices across large distances.

Host (Primary)

Host (Secondary)

NL Port *

Initiator port

RCU target port

Ordinary fibre-channel interface port (target port)

MCU

RCU
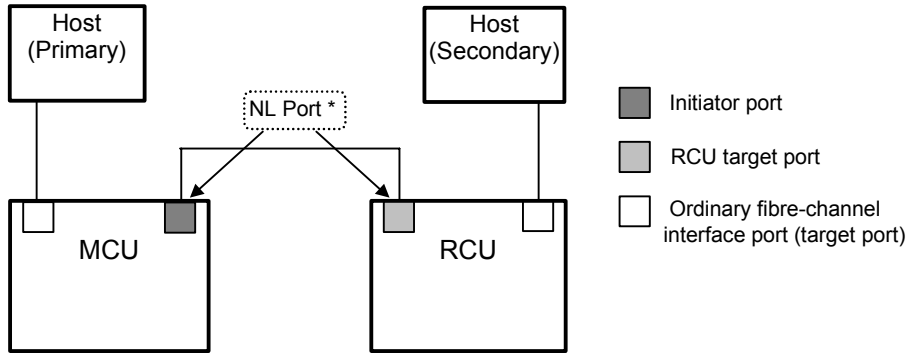
* To set ports, use LUN Manager and set port topology to:  Fab off, FC-AL.

**Figure 3.2      Fibre Channel Interface Direct Connection (NL_Port)**



Host (Primary)

FL_Port or F Port **[1]**

FL_Port or F Port **[1]**

Host (Secondary)

E Port

Initiator port

RCU target port

NL_Port or N Port  **[2]**

Ordinary fibre-channel interface port (target port)

MCU

RCU
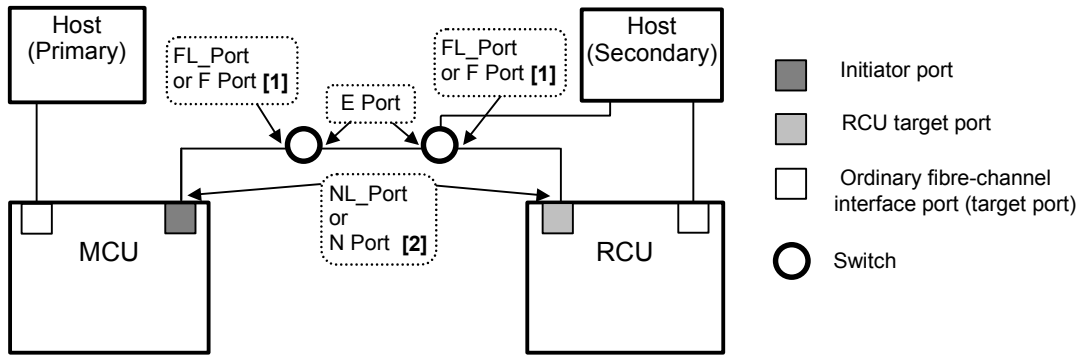
Switch

1. Some switch vendors require F port (e.g., McData ED5000).
2. To set ports, use LUN Manager and set port topology to:
    NL port:    Fab on, FC-AL
    N port:     Fab on, Point-to-Point

**Figure 3.3      Fibre Channel Interface Switch Connection (NL_Port or N_Port)**
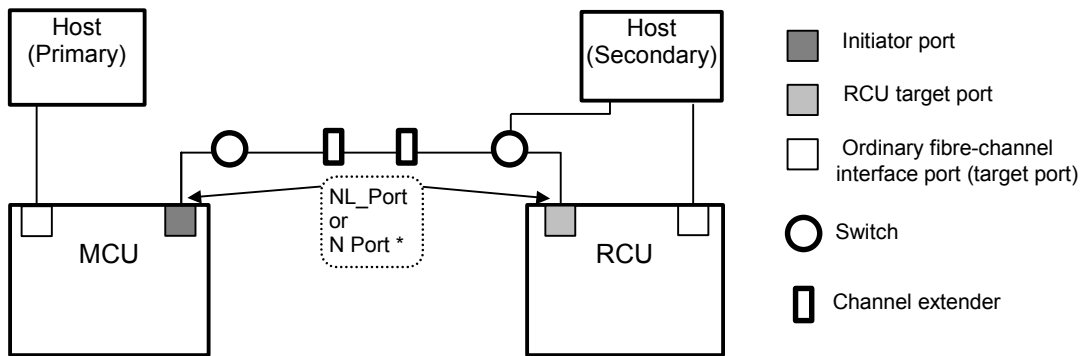


Host (Primary)

Host (Secondary)

Initiator port

RCU target port

Ordinary fibre-channel interface port (target port)

NL_Port or N Port *

MCU

RCU

Switch

Channel extender

* To set ports, use LUN Manager and set port topology to:
    NL port:    Fab on, FC-AL
    N port:     Fab on, Point-to-Point

**Figure 3.4      Fibre Channel Interface Extender Connection**

### 3.3.2 Serial Remote Copy Connections

Figure 3.5 shows the TC390 serial remote copy connection configurations. The MCU and RCU of each TC390 pair must be connected via multimode ESCON® cables. For distances greater than 3 km, single-mode cables up to 20 km in length and IBM® 9032/9033 ESCDs and/or 9036 ESCON® repeaters are required. Dedicated ESCON® channels may be installed, or existing ESCON® channels connected by ESCDs may be used. The IBM® 9032/9033 ESCD supports the extended distance facility (XDF), which uses single-mode ESCON® cables up to 20 km. The IBM® 9036 ESCON® repeater supports single-mode-to-single-mode connection or single-mode-to-multimode connection. When TC390 subsystems are more than 9 km apart, the XDF connections provided by the ESCDs or ESCON® repeaters are required. TC390 operations can be performed at distances of up to 43 km (26.7 miles) using standard ESCON® support, and long-distance solutions are provided, based on user requirements and workload characteristics, using approved channel extenders and communication lines.

*Note:* Please contact your Hitachi Data Systems account team for the latest information on the availability of serial-channel TrueCopy – S/390® connections.
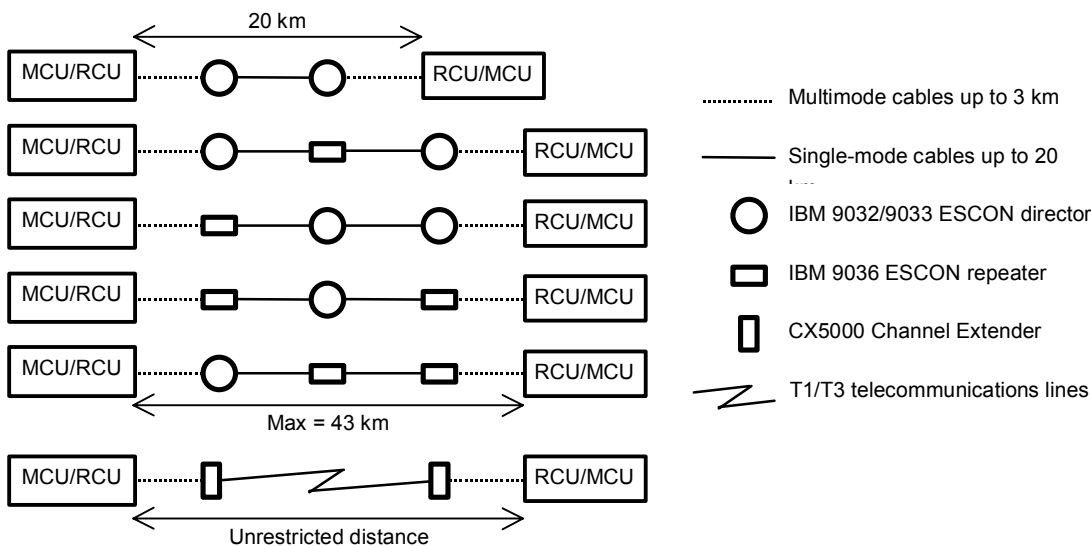


**Figure 3.5    Serial Remote Copy Connection Configurations**

The ESCDs can accommodate multiple MCU-RCU remote copy connections (see Figure 3.6). N-to-1 or 1-to-n remote copy connections (n≤4) can also be configured by using the dynamic switching capability of the ESCDs to share the physical interface cables between the components (see Figure 3.7). In addition, the ESCDs can accommodate channel-to-MCU and channel-to-RCU connections in addition to the remote copy connections (see Figure 3.8).
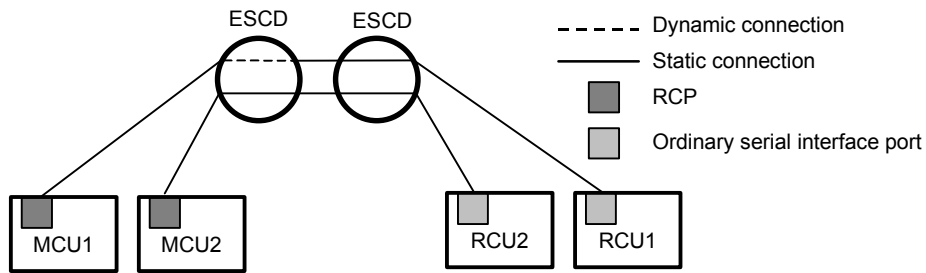
**Figure 3.6     N Pairs of Remote Copy Connections**
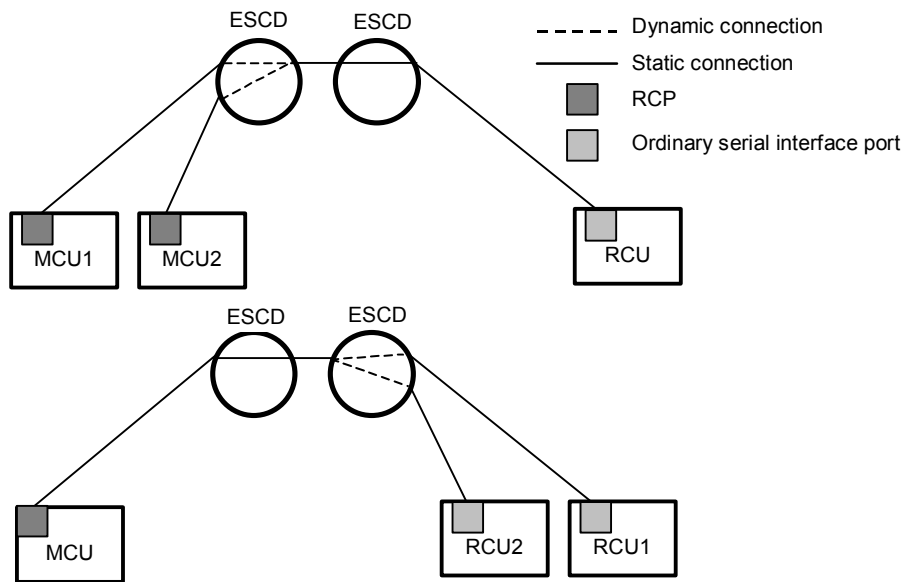


**Figure 3.7     n-to-1 and 1-to-n Remote Copy Connections (n≤4)**

*Note:* 1-to-n configurations (one main subsystem and multiple remote subsystems) are valid for TC390 Asynchronous, as long as a consistency group does not span remote subsystems.
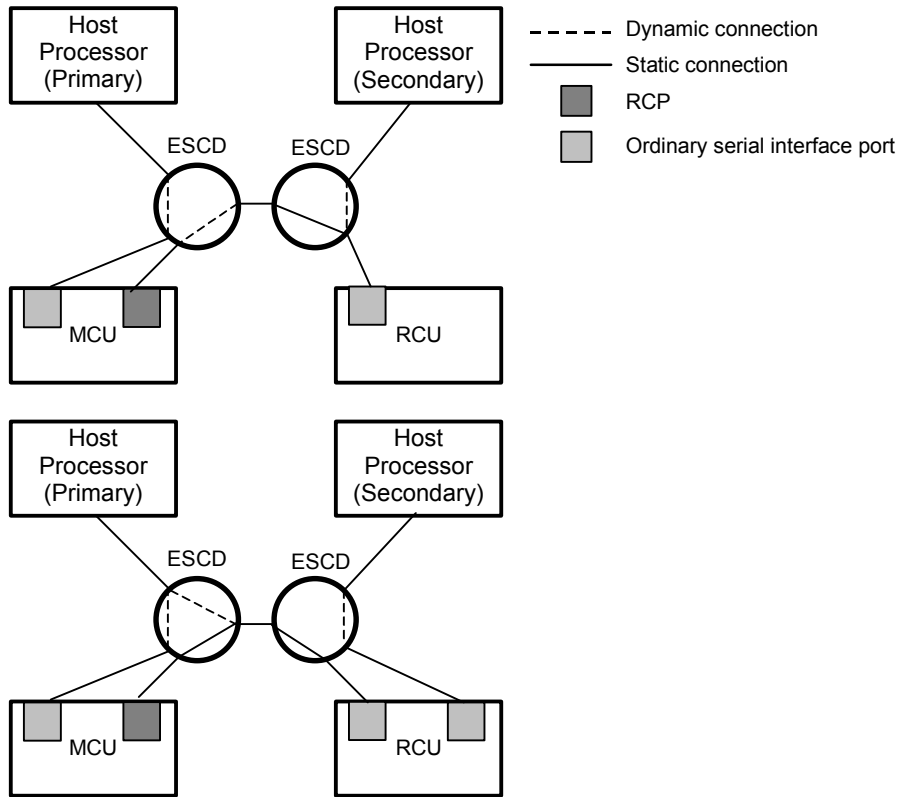
**Figure 3.8     Remote Copy Connections Shared With Channel-to-RCU Connections**

### 3.3.3 Channel Extenders for Serial Remote Copy Connections

Hitachi TrueCopy – S/390® Asynchronous (TC390A) can be integrated with third-party channel extender products to provide remote data backup for distances greater than 43 km. The following information was current at the time of publication of this document, but may change. Please contact your Hitachi Data Systems account team for the latest information on channel extender support for TC390.

*Note:* For fibre-channel interface connections, you can use the switches as for ordinary switch connections, and no special settings are required for the 9900V subsystems.

- Hitachi TrueCopy – S/390® has been tested with the CNT UltraNet Storage Director:
  - UltraNet supports T3 and ATM (asynchronous transfer mode) communication lines.
  - UltraNet supports ATM OC-3 (optical carrier) levels. The transfer speed of OC-3 is a maximum of 155 Mb/s.
  - The transfer speed of T3 is a maximum of 44 Mb/s.

- The 9900V subsystems' serial numbers must be set on the channel extenders as follows. If the serial numbers are not set correctly, the TC390 add pair operation will terminate with an error. For CNT UltraNet, this operation must be coordinated with the Hitachi Data Systems representative and performed by the CNT representative.
  - Set the RCU serial number to the MCU-side extender.
  - Set the MCU serial number to the RCU-side extender.
  - Set the serial number on each CNT UltraNet port.

- Make sure that your channel extenders are capable of supporting the TC390A channel command. The parameter length and detailed specification of the TC390A channel command are different than for TC390 Synchronous RIOs.

- The LDEV IDs of the R-VOLs must be assigned on each port of the MCU-side extender. The maximum number of LDEVs which can be assigned on each port is 254. Figure 3.9 shows the required LDEV assignment on each extender port. If the LDEV IDs are not assigned properly, the TC390 add pair operation will terminate with an error. For CNT UltraNet, this operation must also be performed by the CNT representative.

| CU# | LDEV ID Range | | Port | |
|---|---|---|---|---|
| #0 | 00-FD | → | #A | |
| #1 | 00-FD | → | #B | **CNT** |
| #2 | 00-FD | → | #C | **UltraNet** |
| #3 | 00-FD | → | #D | |
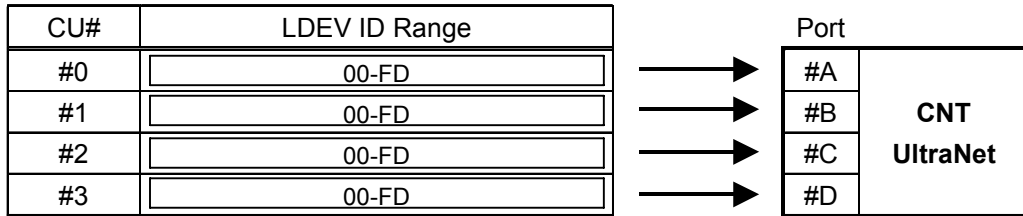
Example 1: Assigning the same LDEV IDs of a specific CU number to each port.

| CU# | #0 | #1 | #2 | #3 | | Port | |
|---|---|---|---|---|---|---|---|
| | 00-3F | 00-3F | 00-3F | 00-3D | → | #A | |
| LDEV ID | 40-7F | 40-7F | 40-7F | 40-7D | → | #B | **CNT** |
| Range | 80-BF | 80-BF | 80-BF | 80-BD | → | #C | **UltraNet** |
| | C0-FF | C0-FF | C0-FF | C0-FD | → | #D | |
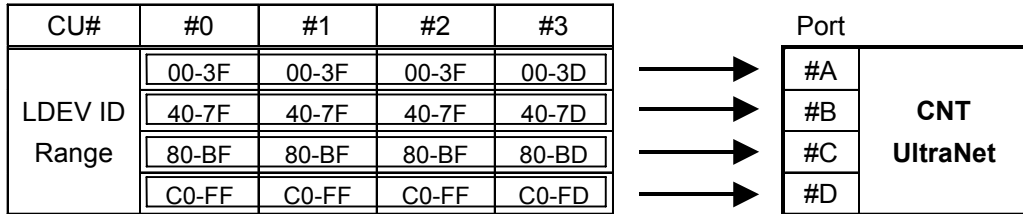
Example 2: Assigning specific LDEV IDs on each CU number to each port.

**Figure 3.9    Assigning R-VOL LDEV IDs to the Channel Extender Ports**

## 3.4    Enabling the TrueCopy – S/390® Option(s)

You must enable the TrueCopy – S/390® option(s) (Asynchronous and/or Synchronous) on the 9900V subsystems using the 9900V Remote Console software. Each TrueCopy – S/390® option requires a separate license key code, and each 9900V subsystem requires its own separate set of license key codes.

For instructions on using the 9900V Remote Console software and enabling the TrueCopy – S/390® option(s), please refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide* (MK-92RD101).

**Disabling TrueCopy**
For information on disabling the TrueCopy – S/390® options, please refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide*.

*Caution:* Before disabling a TrueCopy – S/390® option, you must delete all affected pairs and MCU-RCU paths. Please see section 4.8 for instructions on discontinuing TrueCopy – S/390® operations.

## 3.5 Configuring the MCUs and RCUs for TrueCopy – S/390® Operations

After you have installed the TC390 hardware and software, you can configure the MCUs and RCUs for TC390 operations. The configuration depends on the interface type of the remote copy connections: serial or fibre channel. *Note:* At this time serial and fibre-channel interface configurations cannot coexist for the same MCU (future support is planned).

### 3.5.1 Fibre-Channel Interface Configuration

To configure the MCUs and RCUs for TC390 fibre-channel operations:

1. Identify the volumes that will become the TrueCopy – S/390® M-VOLs and R-VOLs. You need to know the subsystem S/N, SSID, and CU image of each volume, so that you can configure the MCUs and RCUs correctly for your desired pairs and async groups. When you create the pairs, you will need to know the LDEV ID of each volume.

2. At the RCUs (i.e., remote site), use the TrueCopy – S/390® Remote Console software to configure the fibre-channel ports which are connected to the MCUs as RCU target ports (see Figure 3.10) (see section 4.2.1 for instructions).

3. At the main site, connect to and log in to the 9900V subsystem that you want to configure as a TC390 MCU. You must log in with Administrator or TrueCopy – S/390® write access, and you must be in Modify mode.

4. Select the **TrueCopy – S/390®** button (🏙) to display the TrueCopy – S/390® main panel.

5. Configure the fibre-channel ports which are connected to the RCUs as initiator ports (see Figure 3.10) (see section 4.2.1 for instructions).

6. Add the desired RCU(s) to each MCU CU image, and set the desired RCU options using the Add RCU panel (see Figure 3.11) and RCU Option panel (see Figure 3.12) (see section 4.2.2 for instructions). Enter the following information on the Add RCU panel:
   **RCU S/N** = serial number of the RCU
   **Controller ID** = For fibre-channel connection, the controller ID must be 02.
   **Logical Adr. (RCU CU #)** = RCU CU image number (00-1F)
   **SSID** = maximum of four SSIDs per CU image with 64 LDEVs per SSID. *Note:* If only one SSID is specified, there are 256 LDEVs per SSID.
   **MCU-RCU path** = physical port numbers (1A-2R) for each path (initiator port-to-RCU target port).

7. If you plan to create TC390 Asynchronous pairs with M-VOLs in this MCU, configure the Async options (see Figure 3.13) (see section 4.3.1 for instructions), and add the desired consistency group(s) to the MCU (see Figure 3.14) (see section 4.3.2 for instructions).

8. When you are finished configuring this MCU, exit the TrueCopy – S/390® Remote Console software, and disconnect from the subsystem.

9. Repeat steps (3)–(8) for each subsystem which will function as a TrueCopy MCU. After you have configured the MCUs, added the RCUs, and configured the TrueCopy Async options and consistency groups, you are ready to begin TrueCopy pair operations.
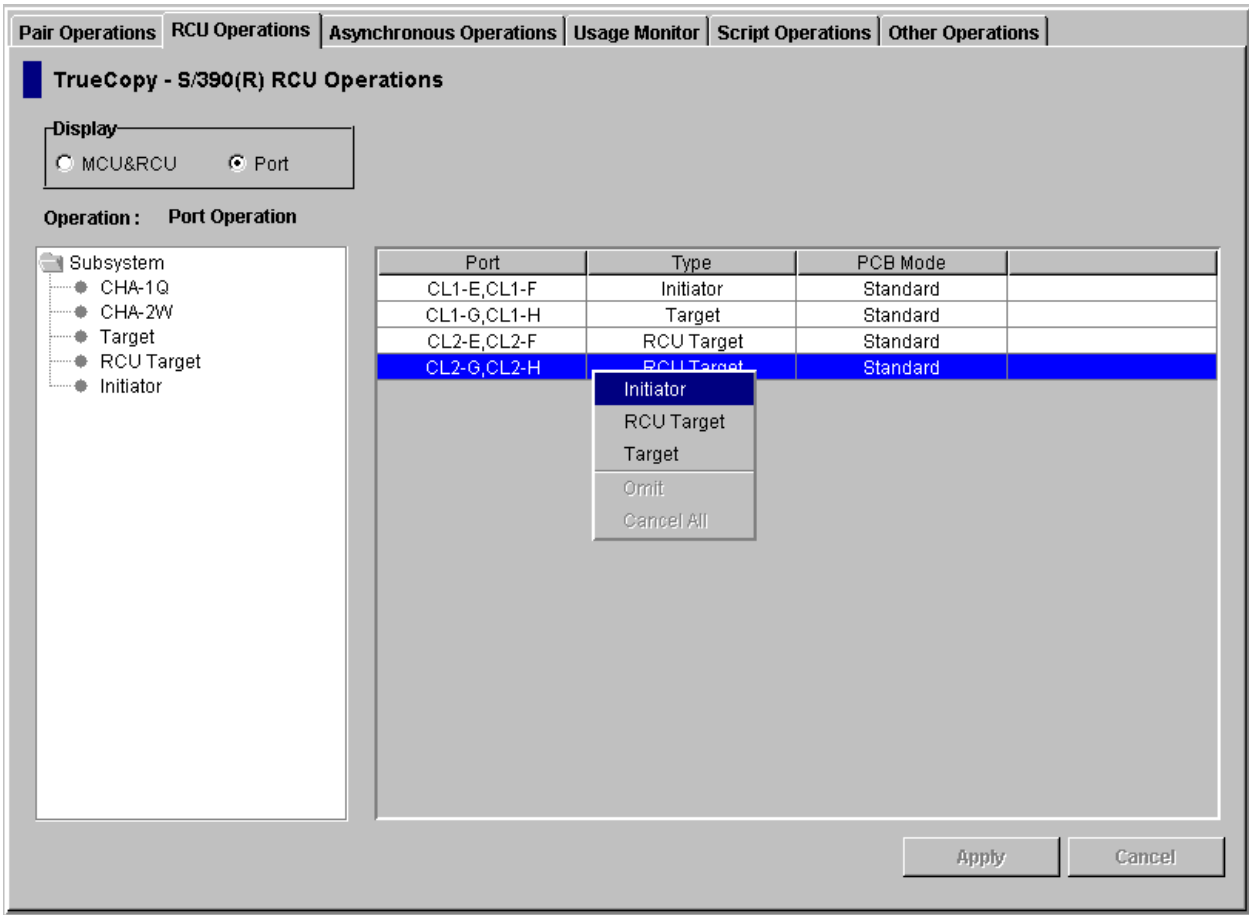
**Figure 3.10    Configuring the RCU Target and Initiator Ports**

**Figure 3.11    Adding the RCUs**
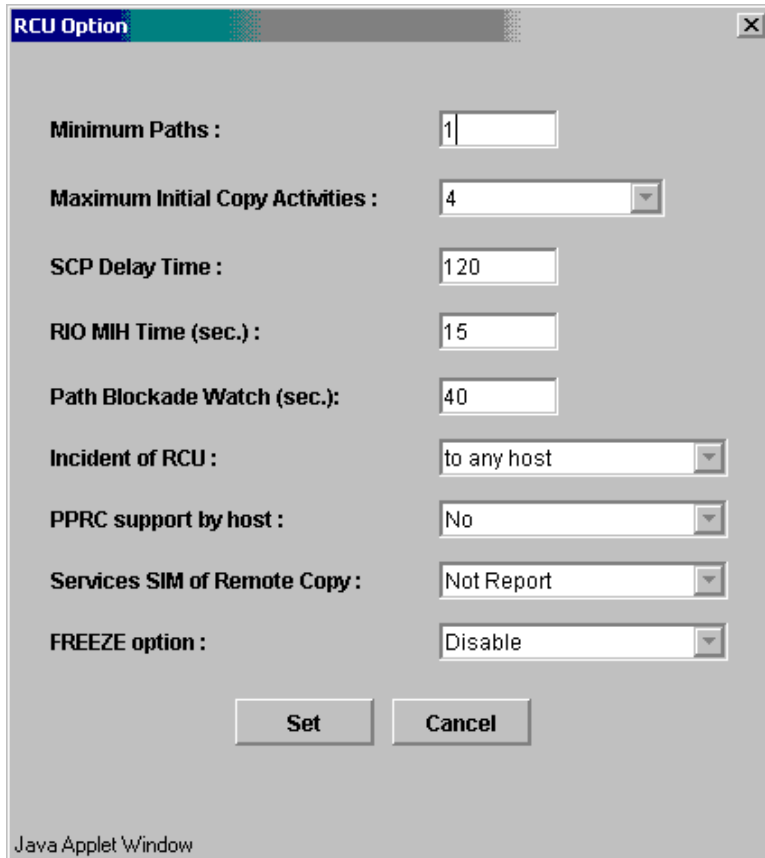
**Figure 3.12    Configuring the RCU Options**
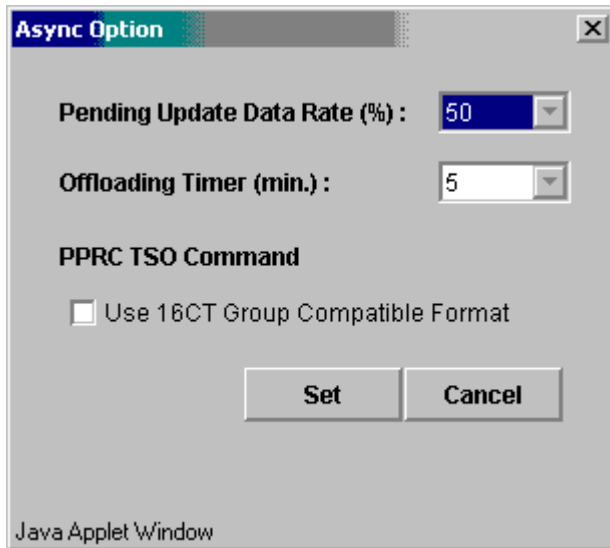


**Figure 3.13    Setting the Async Options**
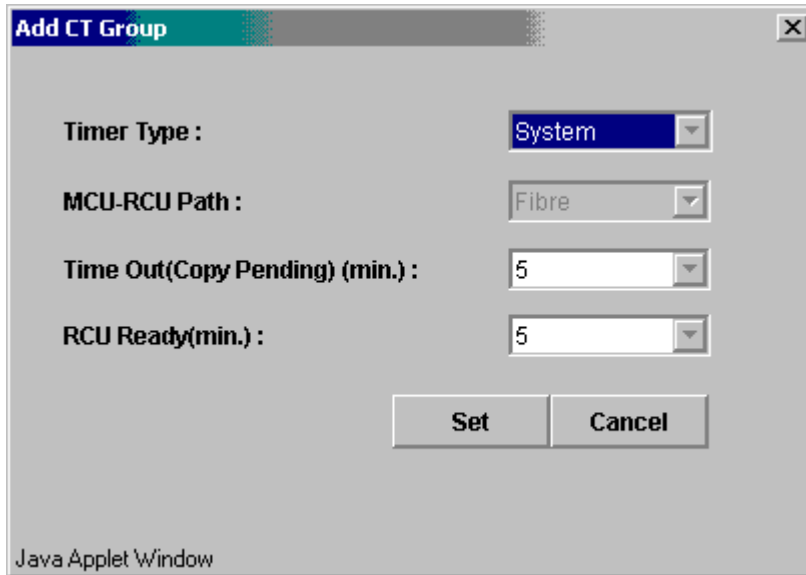
**Figure 3.14    Adding the Consistency Groups**

### 3.5.2 Serial-Channel Interface Configuration

*Note:* Please contact your Hitachi Data Systems account team for the latest information on the availability of serial-channel TrueCopy – S/390® connections.

To configure the MCUs and RCUs for TrueCopy – S/390® serial-channel operations:

1.  Identify the volumes that will become the TrueCopy M-VOLs and R-VOLs. You need to know the subsystem S/N, SSID, and CU image of each TC390 volume, so that you can configure the MCUs and RCUs correctly for your desired pairs and async groups. When you create the pairs, you will need to know the LDEV ID of each volume.

2.  At the main site, connect to and log in to the 9900V subsystem that you want to configure as an MCU. You must log in with Administrator or TrueCopy – S/390® write access, and you must be in modify mode.

3.  Select the **TrueCopy – S/390®** button ( ) to display the TrueCopy – S/390® main panel.

4.  Configure the serial-channel ports which are connected to the RCUs as RCPs (see section 4.2.1 for instructions).

5.  Add the desired RCU(s) to each MCU CU image, and set the desired RCU options using the Add RCU panel and RCU Option panel (see section 4.2.2 for instructions). Enter the following information on the Add RCU panel:
    **RCU S/N** = serial number of the RCU
    **Link Address** = destination port address on the ESCD (00 for static link to RCU)
    **Logical Adr. (RCU CU #)** = RCU CU image number (00-1F)
    **SSID** = maximum of four SSIDs per CU image with 64 LDEVs per SSID. *Note:* If only one SSID is specified, there are 256 LDEVs per SSID.
    **MCU-RCU path** = physical port numbers (1A-2R) for each path (RCP-to-LCP).

6.  If you plan to create TrueCopy – S/390® Asynchronous pairs with P-VOLs in this MCU, configure the Async options (see section 4.3.1 for instructions), and add the desired consistency group(s) to the MCU (see section 4.3.2 for instructions).

7.  When you are finished configuring this MCU, exit the TrueCopy – S/390® Remote Console software, and disconnect from the subsystem.

8.  Repeat steps (3)–(7) for each subsystem which will function as a TC390 MCU. After you have configured the MCUs, added the RCUs, and configured the Async options and consistency groups, you are ready to begin TrueCopy – S/390® pair operations.

## 3.6 Combining TrueCopy – S/390® with Other Data Management Operations

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

- **Virtual LVI/LUN.** Virtual LVI/LUN volumes can be assigned to TC390 pairs, as long as the R-VOL has the same or larger capacity than the M-VOL. If you need to perform Virtual LVI/LUN operations on an existing TC390 M-VOL or R-VOL, you must delete the pair first to return the volume to *simplex* status.

- **FlashAccess.** FlashAccess volumes can be assigned to TC390 pairs, and FlashAccess operations can be performed on TC390 M-VOLs and R-VOLs.

- **HXRC.** The Hitachi Lightning 9900™ V Series subsystem is functionally compatible with the IBM® Extended Remote Copy (XRC) function. See Table 3.1 below.

- **Concurrent Copy (CC).** The Hitachi Lightning 9900™ V Series subsystem is functionally compatible with the IBM® 3990 and 2105 Concurrent Copy function. See Table 3.1 below.

- **ShadowImage – S/390®.** ShadowImage volumes can be assigned to TC390 pairs, and TC390 volumes can be assigned to ShadowImage pairs. See section 3.6 for information on TC390 and ShadowImage shared volume configurations. This configuration requires at least one external ESCON® or fibre cable loop.

  *Note:* When TC390 and ShadowImage are both active on the same 9900V subsystem, TC390 cannot be used to copy *within* that subsystem. ShadowImage is recommended for subsystem-internal copy. If ShadowImage is not active, TC390 Synchronous supports intra-subsystem copy and requires at least one external ESCON® cable loop.

- **Priority Access.** The initiator ports in the MCU do not support the Priority Access option, since they are dedicated for TrueCopy operations.

- **Graph-Track.** The Hitachi Graph-Track (GT) software product provides detailed information on the I/O activity and hardware performance of the 9900V (and 9900, 7700E, 7700) subsystems. Graph-Track data collection does not affect 9900V subsystem operations in any way. For further information on Hitachi Graph-Track, please refer to the *Hitachi Graph-Track User's Guide* (MK-90RD032).

*Note:* When TrueCopy – S/390® and TrueCopy coexist in the same 9900V subsystem, each consistency group must contain either TC390A pairs or TCA pairs (not both), and TC390A and TCA share the same cache sidefile area.

**Combining TC390, HXRC, and CC**. Table 3.1 shows the requirements and restrictions for combining TC390, HXRC, and CC operations on the same 9900V device. For further information on XRC and/or CC, please refer to the applicable IBM® documentation.

**Table 3.1    Requirements and Restrictions for Combining TrueCopy – S/390®, HXRC, and CC**

| Combination allowed? | TC390 M-VOL | TC390 R-VOL | HXRC Primary | HXRC Secondary | CC Source |
|---|---|---|---|---|---|
| TC390 M-VOL | -- | No | Yes for TC390 Sync No for TC390 Async | Yes | Yes |
| TC390 R-VOL | No | -- | No | No | No |
| HXRC Primary | Yes for TC390 Sync No for TC390 Async | No | -- | Yes* | Yes |
| HXRC Secondary | Yes | No | Yes* | -- | Yes |
| CC Source | Yes | No | Yes | Yes | -- |

*__Note:__ A 9900V volume which is an HXRC secondary device cannot also be an HXRC primary in the same XRC session, but it can be an HXRC primary device in another XRC session.

## 3.6.1    Combining TrueCopy – S/390® and ShadowImage – S/390®

Hitachi TrueCopy – S/390® and ShadowImage – S/390® (SI390) can be used together in the same subsystem and on the same volumes to provide multiple copies of data at the main and/or remote sites. Table 3.2 describes the host pair status reporting for TC390 volumes, ShadowImage volumes, and TC390/ShadowImage shared volumes. Table 3.3 shows the currency of the data on a shared TC390/ShadowImage volume based on TC390 and ShadowImage pair status.

- For shared TC390/ShadowImage volumes, the TC390 pair status is reported to the host if you query the R-VOL. To obtain the ShadowImage pair status, query the target volume (T-VOL) of the pair.

- ShadowImage supports multiple target volumes (T-VOLs) for each source volume (S-VOL). If you issue a pair status query to a ShadowImage S-VOL (e.g., CQUERY), the status for only one ShadowImage pair is reported (the pair with the T-VOL with the lowest LDEV ID). To obtain the pair status for the ShadowImage 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 (e.g., CQUERY DEVN parameter). The ShadowImage Remote Console software displays the LDEV ID and ShadowImage pair status of all T-VOLs associated with an S-VOL.

**Table 3.2    Host Pair Status Reporting for TrueCopy/ShadowImage Shared Volumes**

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

**Table 3.3    Data Currency of a Shared TrueCopy/ShadowImage Volume**

| TC390 Pair Status | ShadowImage Pair Status | | | | | |
|---|---|---|---|---|---|---|
| | Pending Duplex | Duplex | Split-Pending | Split | Resync | Suspended |
| Pending Duplex | Not current | Not current | Not current | CURRENT | Not current | Not current |
| Duplex | Not current | Not current | Not current | CURRENT | Not current | Not current |
| Suspended | Not current | CURRENT | CURRENT | CURRENT | CURRENT | Not current |

Figure 3.15 through Figure 3.18 show the various TC390/ShadowImage configurations which share volumes. TC390 supports synchronous and asynchronous operations for shared volumes. Figure 3.15 shows an example of a volume which is functioning as both a TC390 M-VOL and a ShadowImage S-VOL. This configuration allows you to:

- Use TC390 to provide remote backup copies of SI390 S-VOLs, and/or

- Use SI390 to provide on-site backup copies of TC390 M-VOLs.
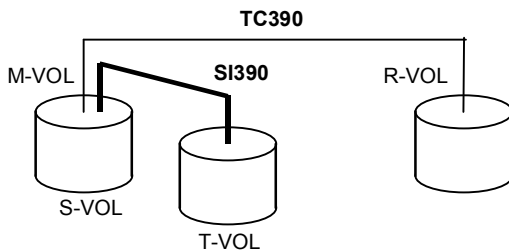


**Figure 3.15    TrueCopy – S/390® and ShadowImage – S/390®:  Shared M-VOL/S-VOL**

Figure 3.16 shows an example of a volume which is functioning as both a TC390 R-VOL and a ShadowImage S-VOL. This configuration allows you to use ShadowImage to provide additional remote copies of TC390 M-VOLs.
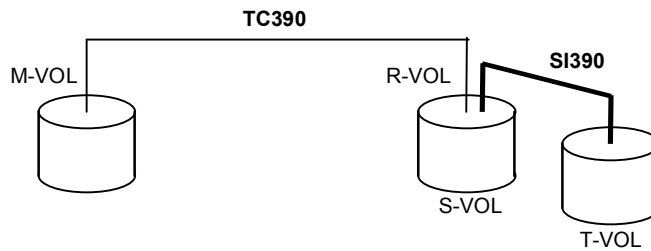


**Figure 3.16    TrueCopy – S/390® and ShadowImage – S/390®:  Shared R-VOL/S-VOL**

Figure 3.17 shows an example of a volume which is functioning as both a TC390 M-VOL and a ShadowImage S-VOL, while the R-VOL of the same TC390 pair is also functioning as the S-VOL of another ShadowImage pair. This configuration allows you to:

- Use TC390 to provide remote backup of ShadowImage S-VOLs, and/or

- Use SI390 to provide on-site backup copies of TC390 M-VOLs and R-VOLs.
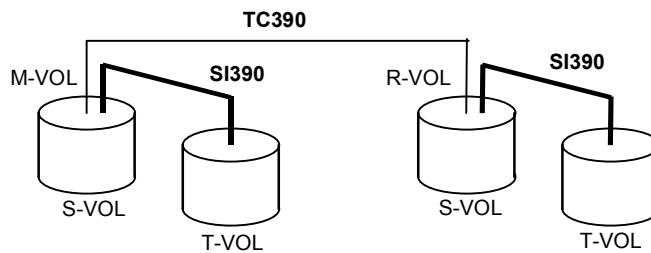


**Figure 3.17    TrueCopy – S/390® and ShadowImage – S/390®:  Shared M-VOL/S-VOL and R-VOL/S-VOL**

Figure 3.18 shows an example of a volume functioning as both a TC390 M-VOL and a ShadowImage T-VOL. *Note*: This configuration does not allow ShadowImage and TC390 to copy at the same time. Create the ShadowImage pair first, and then split the pair before creating the TC390 pair. You must suspend the TC390 pair in order to resync the SI pair.
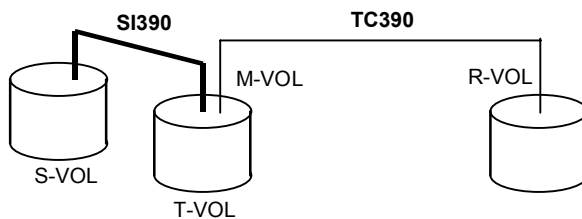


**Figure 3.18    TrueCopy – S/390® and ShadowImage – S/390®:  Shared M-VOL/T-VOL**

# Chapter 4    Performing TrueCopy – S/390® Configuration Operations

The TrueCopy – S/390® main panel and its six tabs (see section 4.1) provide access to all TrueCopy – S/390® operations:  pair operations, RCU operations, Asynchronous operations, usage monitor, script operations, and other operations. The TrueCopy configuration operations include RCU operations, Asynchronous operations, and usage monitor. The TrueCopy pair operations are described in Chapter 5.

**RCU operations.** The RCU operations (see section 4.2) configure the RCUs for TrueCopy – S/390® operations:

- Configuring the 9900V host interface ports for MCU-RCU connection,
- Adding the RCUs,
- Setting the RCU options,
- Adding/deleting logical paths to an RCU,
- Adding/deleting subsystem IDs (SSIDs) for an RCU,
- Viewing RCU status, and
- Deleting RCUs.

**Asynchronous operations.** The Asynchronous operations (see section 4.3) configure the TrueCopy – S/390® Asynchronous consistency groups and options:

- Setting the async options,
- Adding consistency groups,
- Viewing consistency group status,
- Changing the consistency group options,
- Changing the async options, and
- Deleting consistency groups.

**Usage Monitor operations.** The usage monitor operations (see section 4.4) enable you to collect the I/O statistics for the LDEVs on the 9900V subsystem.

**Script operations.** The scripting function (see section 4.5) allows you to specify and execute a series of TrueCopy – S/390® operations without having to issue each command separately. Appendix D provides the syntax and format requirements for the TC390 script files.

**Other operations.** The other operations (see section 4.6) include clearing SIMs.

**Optimizing TrueCopy – S/390® operations.** Section 4.7 provides information on optimizing TrueCopy – S/390® operations and 9900V subsystem performance by selecting the appropriate TrueCopy settings and options for your operational environment and also by addressing conditions which can affect subsystem performance.

**Discontinuing TrueCopy – S/390® operations.** Section 4.8 provides information on discontinuing TrueCopy – S/390® operations. When you want to discontinue TC390 operations, you must perform the required TC390 operations (e.g., pair deletion, RCU deletion, port reconfiguration, etc.) in a specific order to ensure smooth operations and avoid command rejects and error conditions.

## 4.1 TrueCopy – S/390® Main Panel

The TrueCopy – S/390® Main panel (see Figure 4.1) displays the TrueCopy – S/390® information for the connected subsystem and provides access to all TrueCopy – S/390® functions. To open the TrueCopy – S/390® main panel:

1. From the 9900V Remote Console PC, connect to and log on to the desired 9900V subsystem with Administrator access or TrueCopy – S/390® write access.

2. On the Remote Console main panel, select Modify mode) to perform TrueCopy – S/390® operations. Users in view mode can only view TrueCopy – S/390® information.

3. Select the TrueCopy – S/390® button (🏭) to open the TrueCopy – S/390® main panel.

*Note:* For information and instructions on using the 9900V Hitachi Remote Console – Storage Navigator Java™ applet program, please refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide* (MK-92RD101).
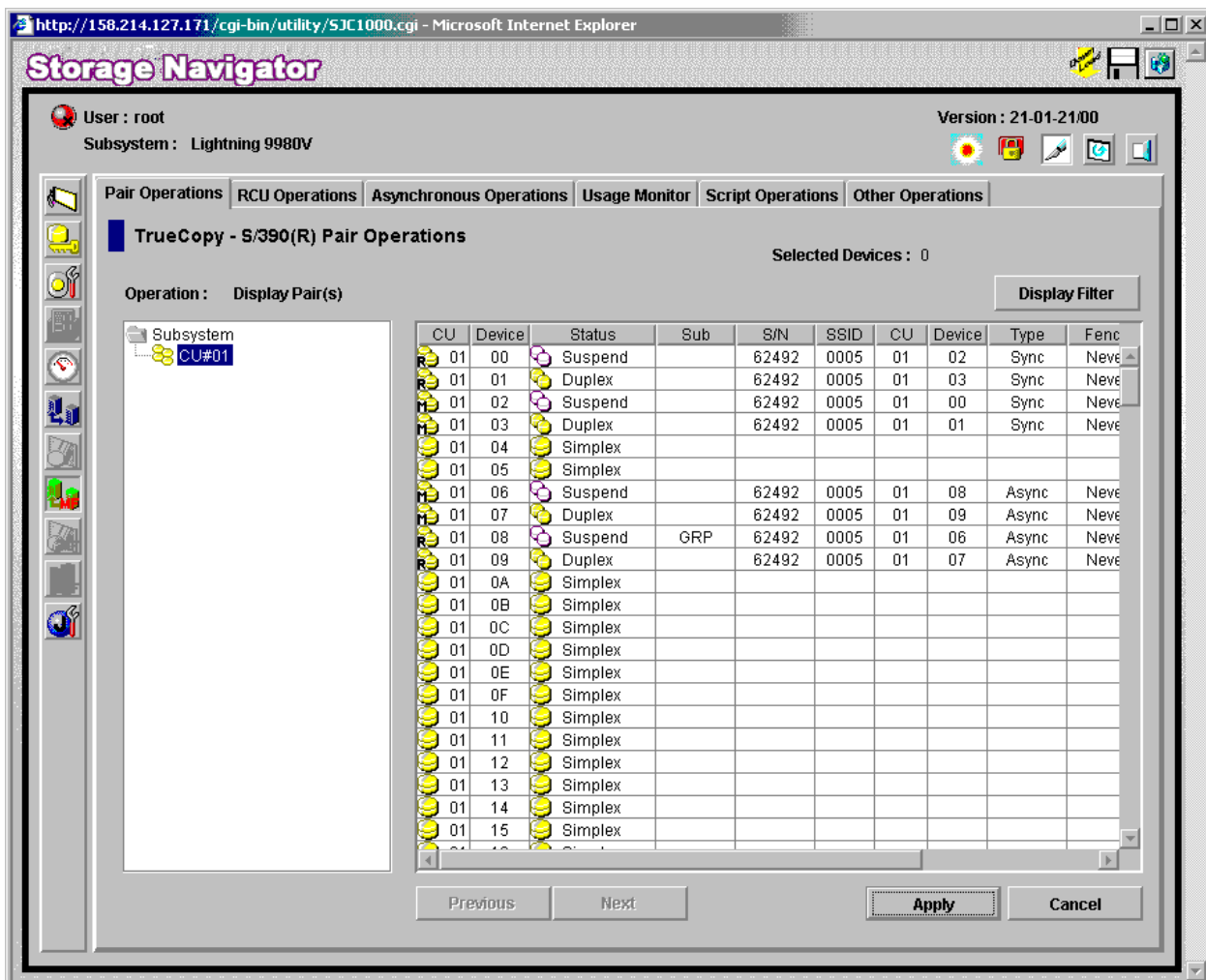


**Figure 4.1    Hitachi TrueCopy – S/390® Main Panel**

The TrueCopy – S/390® main panel presents six main tabs: **Pair Operations**, **RCU Operations**, **Asynchronous Operations**, **Usage Monitor**, **Script Operations**, and **Other Operations**. Table 4.1 shows the operations available for each tab. To start the operations that you set on each TrueCopy – S/390® function tab, use the **Apply** button at the lower right of the TrueCopy – S/390® panel.

**Table 4.1    TrueCopy Functions**

| Tab | Menu Command | Description |
|---|---|---|
| Pair Operations (see Chapter 5) | Pair Status | Displays CU information, path information, pair status, and options for TrueCopy – S/390® pairs. |
| | Add Pair → Synchronous | Allows you to create new TrueCopy – S/390® Synchronous pairs. |
| | Add Pair → Asynchronous | Allows you to create new TrueCopy – S/390® Asynchronous pairs. |
| | Delete Pair | Allows you to delete TrueCopy – S/390® pairs. |
| | Suspend Pair | Allows you to suspend TrueCopy – S/390® pairs. |
| | Resume Pair | Allows you to resume TrueCopy – S/390® pairs which are suspended. |
| | Change Pair Option | Allows you to change the TrueCopy – S/390® pair options. |
| RCU Operations (see section 4.2) | RCU Status | Displays the RCU status and path status for an RCU. |
| | RCU Operation → Add RCU | Allows you to add an RCU to the connected subsystem. |
| | RCU Operation → Delete RCU | Allows you to delete an RCU. |
| | RCU Operation → Change RCU Option | Allows you to change the RCU options. |
| | Edit Path → Add Path | Allows you to add paths to existing RCUs. |
| | Edit Path → Delete Path | Allows you to delete paths for existing RCUs. |
| | Edit SSID → Add SSID | Allows you to add SSIDs to existing RCUs. |
| | Edit SSID → Delete SSID | Allows you to delete SSIDs from existing RCUs. |
| | Port | Allows you to change the port types for the connected subsystem. |
| Asynchronous Operations (see section 4.3) | CT Group Operation → CT Group Status | Displays information of the consistency groups which are already registered. |
| | CT Group Operation → Add CT Group | Allows you to assign the consistency groups to the CUs. |
| | CT Group Operation → CT Group Option | Allows you to change the consistency group options. |
| | CT Group Operation → Delete CT Group | Allows you to delete consistency groups. |
| | Async Option | Allows you to change the Async options. |
| Usage Monitor (see section 4.4) | – | Allows you to collect I/O statistics using the Remote Copy Monitoring function. |
| Script Operations (see section 4.5) | -- | Allows you to configure and perform scripting operations. |
| Other Operations (see section 4.6) | Clear SIM | Allows you to clear the remote copy SIMs. |

*Note:* The snapshot and operation history functions are not supported for this version.
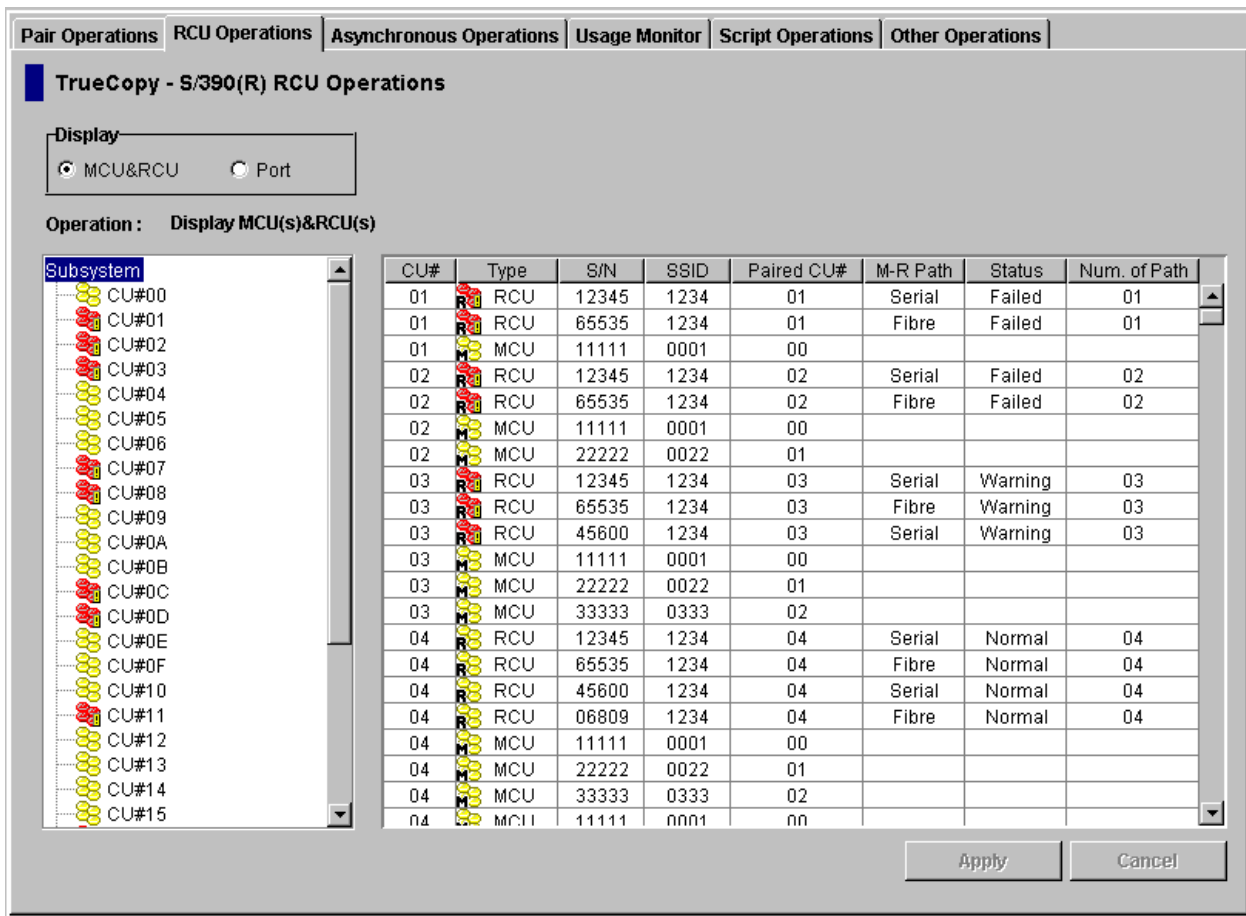
## 4.1.1 Pair Operations Tab

Please see section 5.2 for detailed information on the **Pair Operations** tab.

## 4.1.2 RCU Operations Tab

The **RCU Operations** tab (see Figure 4.2) displays the MCU/RCU and port information and allows you to perform the TrueCopy – S/390® RCU and port configuration operations (see section 4.2).

To update the information on the **RCU Operations** tab, select another tab and then reselect the **RCU Operations** tab, or select the **Refresh** button ( ![Refresh icon] ) (top right Remote Console panel). The MCU/RCU or port information is also updated when you select the **Apply** button.



| CU# | Type | S/N | SSID | Paired CU# | M-R Path | Status | Num. of Path |
|-----|------|------|------|-----------|----------|---------|--------------|
| 01 | RCU | 12345 | 1234 | 01 | Serial | Failed | 01 |
| 01 | RCU | 65535 | 1234 | 01 | Fibre | Failed | 01 |
| 01 | MCU | 11111 | 0001 | 00 | | | |
| 02 | RCU | 12345 | 1234 | 02 | Serial | Failed | 02 |
| 02 | RCU | 65535 | 1234 | 02 | Fibre | Failed | 02 |
| 02 | MCU | 11111 | 0001 | 00 | | | |
| 02 | MCU | 22222 | 0022 | 01 | | | |
| 03 | RCU | 12345 | 1234 | 03 | Serial | Warning | 03 |
| 03 | RCU | 65535 | 1234 | 03 | Fibre | Warning | 03 |
| 03 | RCU | 45600 | 1234 | 03 | Serial | Warning | 03 |
| 03 | MCU | 11111 | 0001 | 00 | | | |
| 03 | MCU | 22222 | 0022 | 01 | | | |
| 03 | MCU | 33333 | 0333 | 02 | | | |
| 04 | RCU | 12345 | 1234 | 04 | Serial | Normal | 04 |
| 04 | RCU | 65535 | 1234 | 04 | Fibre | Normal | 04 |
| 04 | RCU | 45600 | 1234 | 04 | Serial | Normal | 04 |
| 04 | RCU | 06809 | 1234 | 04 | Fibre | Normal | 04 |
| 04 | MCU | 11111 | 0001 | 00 | | | |
| 04 | MCU | 22222 | 0022 | 01 | | | |
| 04 | MCU | 33333 | 0333 | 02 | | | |
| 04 | MCU | 11111 | 0001 | 00 | | | |

**Figure 4.2    RCU Operations Tab**

The **RCU Operations** tab presents:

- **Display buttons**: allows you to select either **MCU&RCU** display (default) or **Port** display for the **RCU Operations** tab.

- **Operation**: indicates the current operation performed on the **RCU Operations** tab.

- **MCU&RCU display:**
  - **Outline view**: displays the CU images of the connected subsystem. Select the subsystem to display all MCU/RCU information. Select the desired CU image to display the MCU/RCU information for that CU image. You can only select one CU image at a time.

  - **List view**: displays the detailed MCU/RCU information (see section 4.1.2.1) for the subsystem (if selected) or for the selected CU image. The MCU/RCU information can be sorted by column and in ascending or descending order. For CU images with more than one MCU-RCU path, each path is displayed in a separate row.

- **Port display:**
  - **Outline view**: displays the channel adapters (CHAs) and port types of the connected subsystem. Select the subsystem to display all CHA/port information. Select the desired channel adapter or port type to display the port information for that adapter/port type. You can only select one CHA or port type at a time.

  - **List view**: displays the detailed port information (see section 4.1.2.2) for the subsystem (if selected ) or for the selected channel adapter or port type. The port information can be sorted by column and in ascending or descending order.

### 4.1.2.1  MCU&RCU Display on the RCU Operations Tab

When the **MCU&RCU** button is selected in the **Display** box, the **RCU Operations** tab displays the CU images in the outline view and the MCU/RCU information in the list view. Only CU images which include active MCUs or RCUs are displayed. When an MCU-RCU path fails, the TrueCopy – S/390® software displays an error icon ( ) for the affected CU image.

Select the subsystem to display all MCU/RCU information (refer to Figure 4.2). Select the desired CU image to display the MCU/RCU information for that CU image (see Figure 4.3). You can select only one CU image at a time. The MCU/RCU information includes:

- **CU#**:  CU number which is selected on the tree view.

- **Type**:  MCU or RCU.

- **S/N** and **SSID**:  Serial number and SSID of the other CU of the pair.

- **Paired CU#**:  CU number of the other CU of the pair.

- **M-R Path**:  Path channel type (fibre or serial) between the other CU of the pair.

- **Status**:  Normal indicates no path failure to the RCU. Failed indicates a failed path to the RCU. This column is blank when the connected CU is an RCU.

- **Num. of Path**:  Number of paths (blank when the connected CU is an RCU).
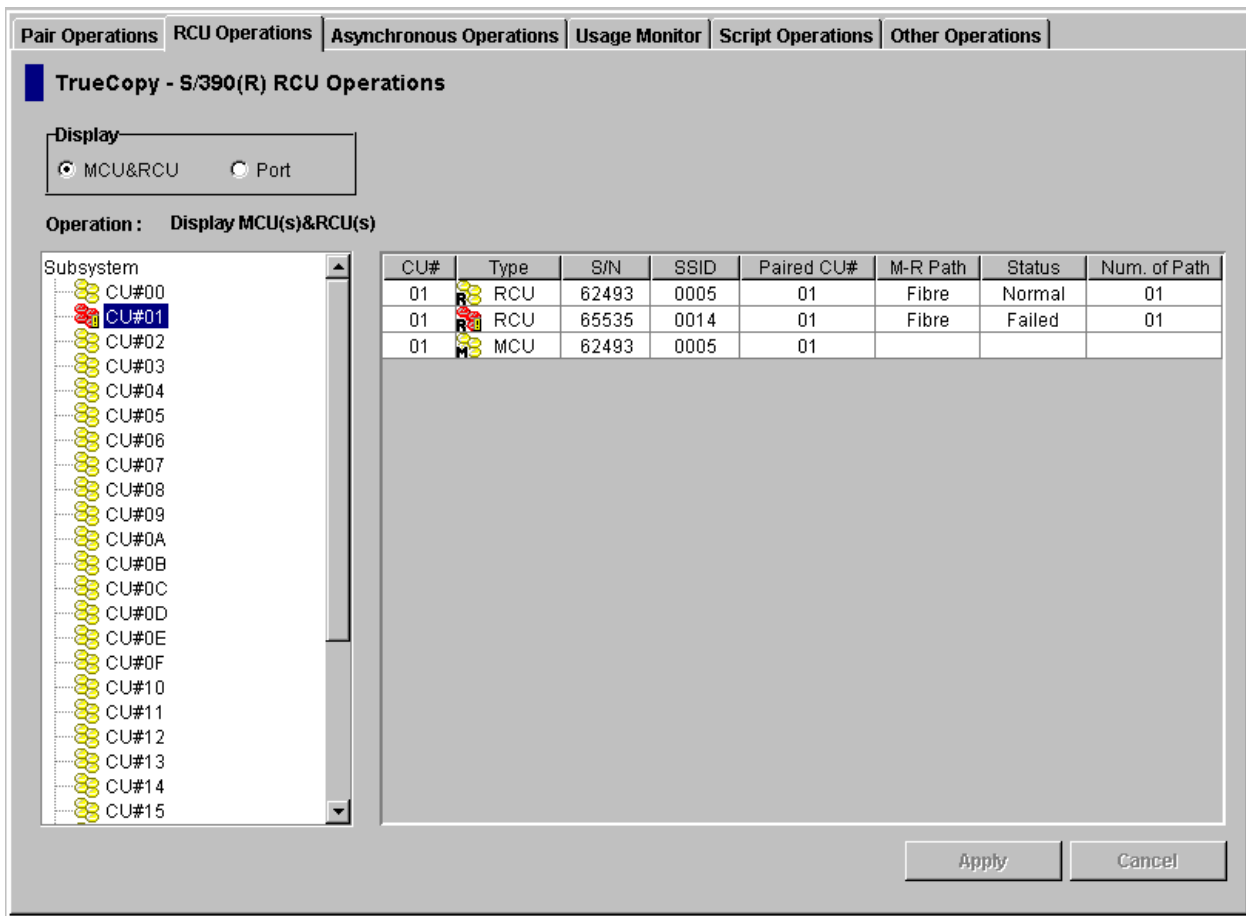


**Figure 4.3     MCU&RCU Display on the RCU Operations Tab**

### 4.1.2.2 Port Display on the RCU Operations Tab

When the **Port** button is selected in the **Display** box, the **RCU Operations** tab displays the channel adapters and port types in the outline view and the port information in the list view. Only ports which can be selected for remote copy operations are displayed.

Select the subsystem to display all port information. Select the desired channel adapter to display the port information for that adapter (see Figure 4.4). Select the desired port type to display the port information for that port type. You can select only one channel adapter or port type at a time. The port information includes:

- **Port**:  Cluster and port number (e.g., CL1-A).
- **Type**:  Port type:  initiator, target, RCU target, RCP, or LCP.
- **PCB Mode**:  Speed mode of the (fibre-channel) port: standard or high speed.

The port information in each row depends on the type of 9900V channel adapter:

- 1 port per row (standard speed) (DKC-F460I-8HSE, -8HLE) (see Figure 4.4).
- 4 ports per row (high speed) (DKC-F460I-8HSE, -8HLE) (see Figure 4.5).
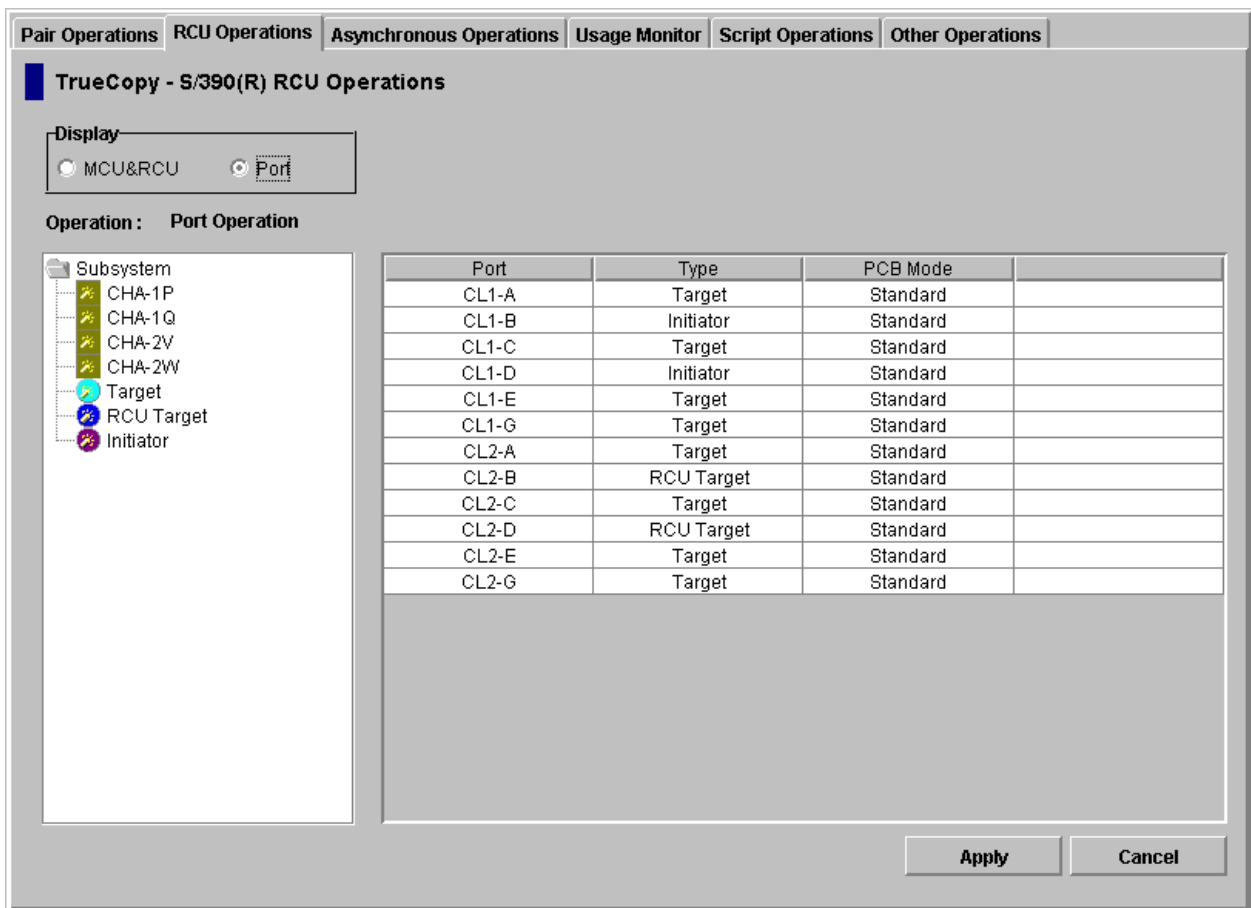


**Figure 4.4    Port Display on the RCU Operations Tab (standard-speed, one port per row)**

| Port | Type | PCB Mode | |
|------|------|----------|---|
| CL1-E(CL1-F - CL1-H) | Target | High | |

**Figure 4.5    Port Display on RCU Operations Tab (high-speed, four ports per row)**

### 4.1.3 Asynchronous Operations Tab

The **Asynchronous Operations** tab (see Figure 4.6) displays the consistency (CT) group information for the connected subsystem and allows you to perform the TrueCopy – S/390® Asynchronous configuration operations (see section 4.3).

To update the information on the **Asynchronous Operations** tab, select another tab and then reselect the **Asynchronous Operations** tab, or select the **Refresh** button ( ) (top right of Remote Console panel). The CT group information is also updated when you select the **Apply** button.

| Pair Operations | RCU Operations | Asynchronous Operations | Usage Monitor | Script Operations | Other Operations |

**TrueCopy - S/390(R) Asynchronous Operations**

Operation :    Display all CT groups          Pending Update Data Rate :    050 (%)    Offloading Timer :  005 (min.)

Display All
— Used
— Not Used

| CTG | This CU | M-R Path | Paired S/N | Paired SSID | Other S/N |
|-----|---------|----------|------------|-------------|-----------|
| 00 | | | | | |
| 01 | | | | | |
| 02 | | | | | |
| 03 | | | | | |
| 04 | | | | | |
| 05 | | | | | |
| 06 | | | | | |
| 07 | | | | | |
| 08 | M&R | Fibre | 62492 | 0005 | |
| 09 | | | | | |
| 0A | | | | | |
| 0B | | | | | |
| 0C | | | | | |
| 0D | | | | | |
| 0E | MCU | Fibre | | | |
| 10 | | | | | |
| 11 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |
| 16 | | | | | |
| 17 | | | | | |
| 18 | | | | | |

[ Apply ]   [ Cancel ]

**Figure 4.6    Asynchronous Operations Tab**

The **Asynchronous Operations** tab presents:

- **Operation**: indicates the current operation performed on the **Asynchronous Operations** tab.

- **Pending Update Data Rate**: indicates the maximum cache % available for use by TrueCopy – S/390® Asynchronous sidefiles.

- **Offloading Timer**: indicates the maximum time between TrueCopy – S/390® Asynchronous recordset transfers.

- **Outline view**: allows you to display all consistency groups (default), or only the consistency groups which are already in use (**Used**), or the consistency groups which are available for use (**Not Used**).

- **List view**: displays the following consistency group information:

  - **CTG**:  Consistency group number.

  - **This CU**:  the CU to which the group is registered. **MCU**: The group was added from the connected CU. **RCU**: The group was added from the paired CU (connected CU is RCU). **M&R**: MCU and RCU are in the same disk subsystem.

  - **M-R Path**:  Channel type: fibre or serial. If the consistency group is not in use, this column is blank.

  - **Paired S/N**:  Serial number of the paired subsystem (if there is more than one RCU, the subsystem with the lowest S/N is displayed). If the consistency group is not in use, this column is blank.

  - **Paired SSID**:  SSID of the paired subsystem (if there is more than one RCU, the subsystem with the lowest SSID is displayed). If the consistency group is not in use, this column is blank.

  - **Other S/N**:  Exist: indicates that there is more than one RCU for the group. If there is only one RCU, this column is blank.

### 4.1.4 Usage Monitor Tab

The **Usage Monitor** tab (see Figure 4.7) displays the status of remote copy usage monitoring and allows you to perform the TrueCopy – S/390® usage monitor operations. Please see section 4.4 for information and instructions on performing usage monitor operations.

- **Status**: displays **Stop** when monitoring is off; displays **Running** when monitoring is on.

- **Rate**: displays the data collection rate for usage monitoring.

- **Operation**: allows you to select the desired usage monitor operation (see section 4.4).

| Pair Operations | RCU Operations | Asynchronous Operations | Usage Monitor | Script Operations | Other Operations |

**TrueCopy - S/390(R) Usage Operations**

**Status:** Stop     **Rate:** 5   min.    **Operation:** 

Apply    Cancel
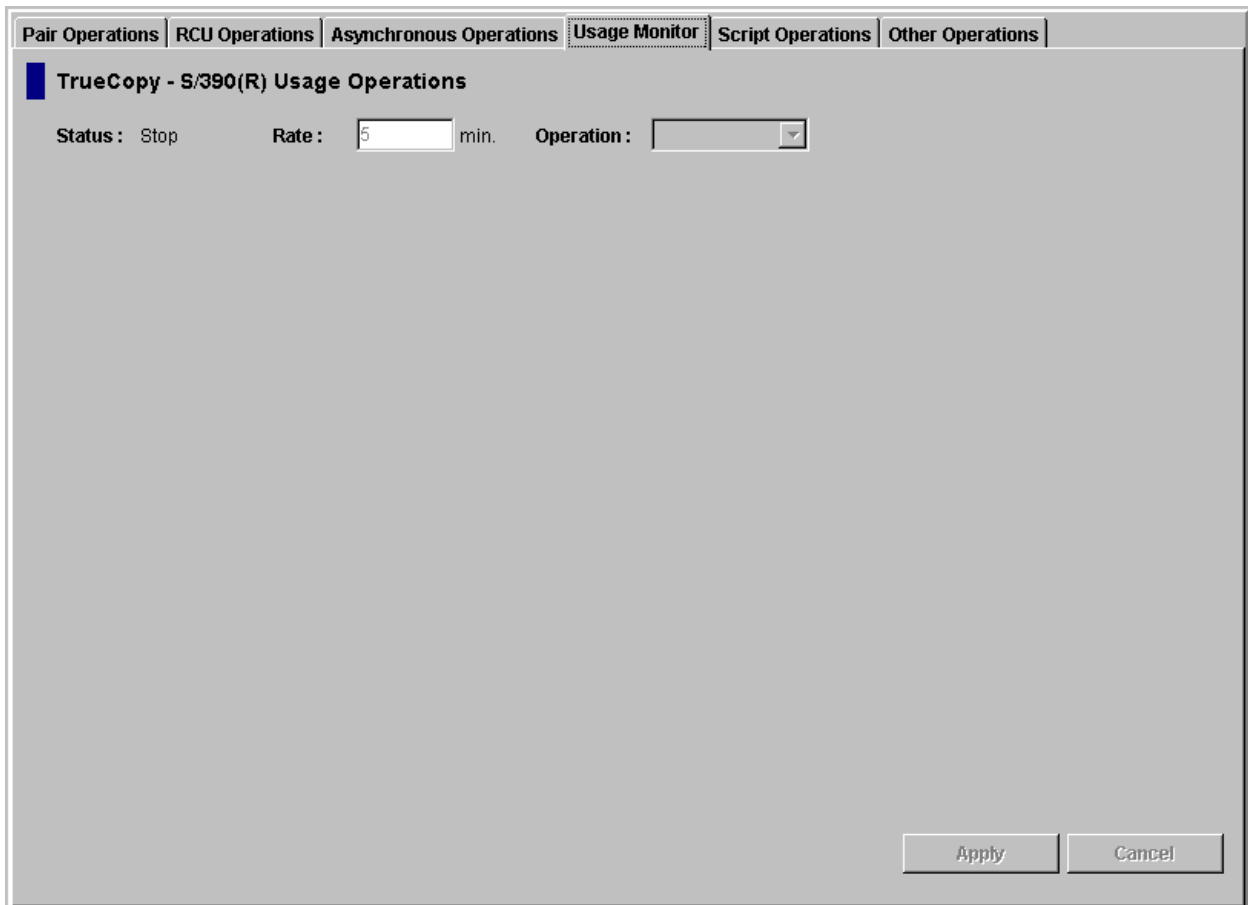
**Figure 4.7  Usage Monitor Tab**

## 4.1.5    Script Operations Tab

The **Script Operations** tab (see Figure 4.8) allows you to perform script operations and displays information on the script being executed. Please see section 4.5 for information and instructions on performing script operations.



| Pair Operations | RCU Operations | Asynchronous Operations | Usage Monitor | Script Operations | Other Operations |

**TrueCopy - S/390(R) Script Operations**

Status :  Stop        Script File Name :  [                    ]        Operation :  [       ▼]

Result :

Information

```
Message :
Date :
Line :
Loop :
Macro :
```

[Apply]    [Cancel]
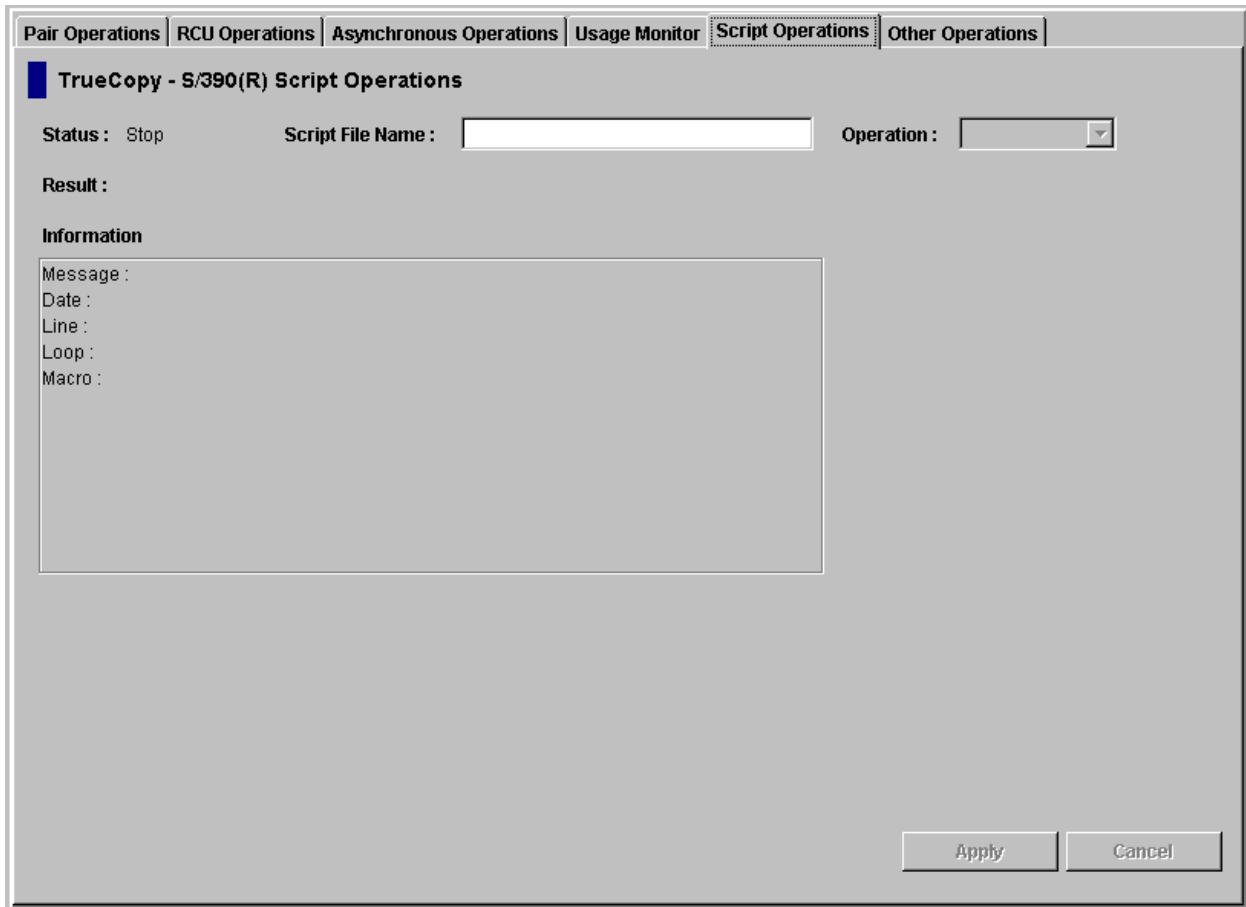
**Figure 4.8      Script Operations Tab**

**Status**: displays the status of script execution:  **Stop**, **Analyzing**, or **Running**.

**Script File Name**: allows you to enter the name of the TC390 script file to be executed.

**Operation**: allows you to **Run** or **Stop** the specified script file.

**Result**: displays the error code (four-digit hexadecimal number).

**Information**: displays the script information.

- **Message**:  **Normal End**, **Abort by operator**, or a message indicating abnormal end.
- **Date**:  The date when the script status changed.
- **Line**:  The script file line number being executed.
- **Loop**:  The current/total repetition count for a looped command (e.g., 150/300).
- **Macro**:  The macro (device process) being executed.

## 4.1.6 Other Operations Tab

The **Other Operations** tab (see Figure 4.9) allows you to clear the TrueCopy – S/390® (and TrueCopy) remote copy SIMs. Please see section 4.6 for information and instructions on clearing SIMs.
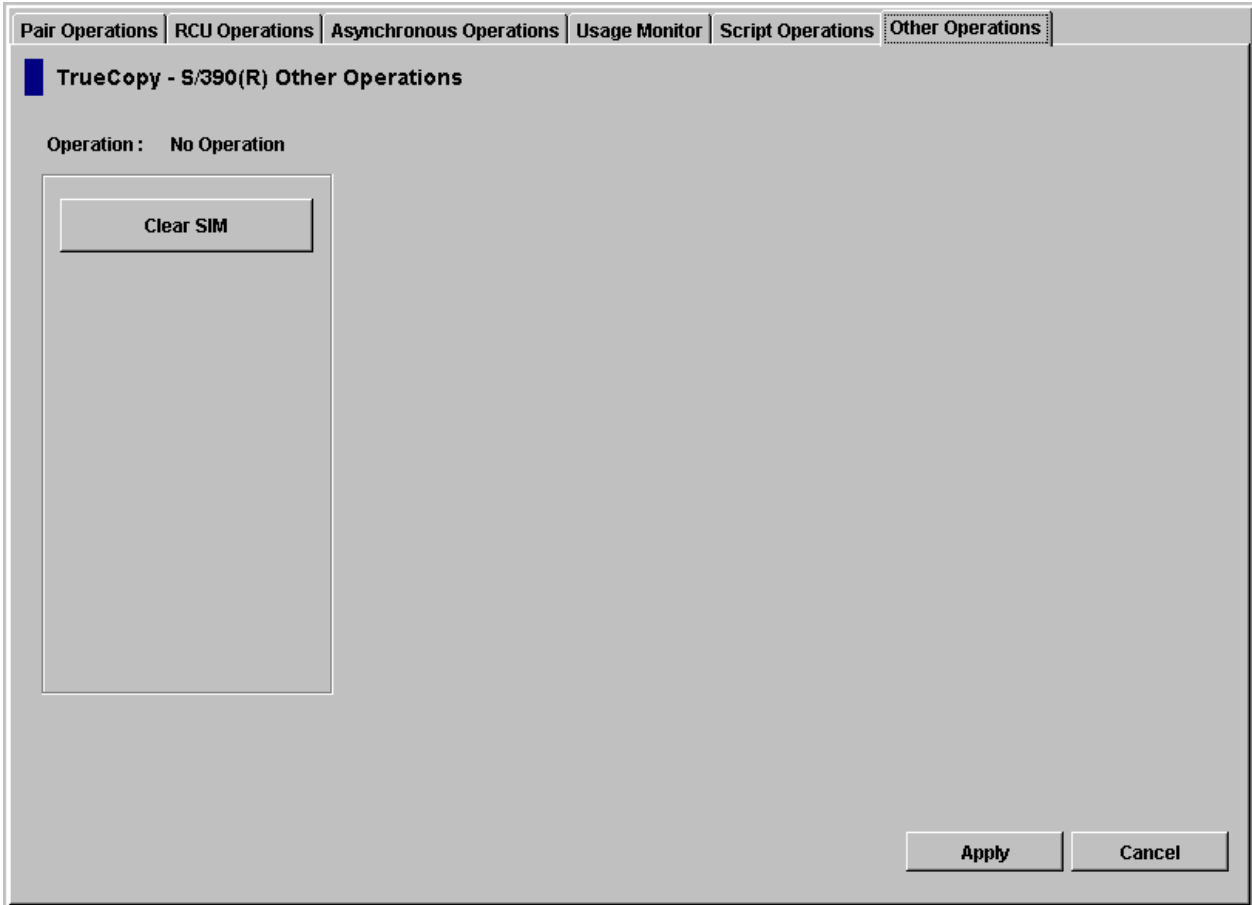


**Figure 4.9    Other Operations Tab**

## 4.2 RCU Operations

The RCUs are the control units which control the R-VOLs of the TrueCopy – S/390® volume pairs. The RCUs are connected to the MCUs via the remote copy connections and receive and process commands from the MCUs. For TC390 operations, the 9900V Remote Console should be installed on a separate LAN at the remote site to allow TrueCopy – S/390® commands to be issued directly to the RCU (e.g., in case of disaster or failure at the primary site).

The MCUs are the control units which control the M-VOLs of the volume pairs. The MCUs receive and process user-requested TrueCopy – S/390® commands from the Remote Console, and send the remote copy operations to the RCUs. The MCUs can also function as RCUs, provided the remote copy connections are properly configured.

The RCU operations are performed separately for each CU image of each MCU and RCU to provide maximum flexibility in TrueCopy – S/390® configurations. The RCU operations are:

- Configuring the host interface ports for MCU-RCU connection (see section 4.2.1),
- Adding an RCU (see section 4.2.2),
- Changing the RCU options (see section 4.2.3),
- Adding and deleting logical paths to an RCU (see section 4.2.4),
- Adding and deleting SSIDs for an RCU (see section 4.2.5),
- Viewing RCU status (see section 4.2.6), and
- Deleting an RCU (see section 4.2.7).

The **RCU Operations** tab (see section 4.1.1) allows you to perform the RCU operations. All operations performed on the **RCU Operations** tab have a common procedure. To perform any operation on the **RCU Operations** tab:

1. Select the desired display mode:  **MCU&RCU**, or **Port**.

2. Select the desired CU image, channel adapter, or port type in the outline view.

3. Select the desired RCU(s) or port(s) in the list view. When adding an RCU, do not select anything in the list view.

4. Right-click on the selected item(s) to display the pop-up menu (see Figure 4.10 and Figure 4.11).

   For the **MCU&RCU** display, the pop-up menu commands are:
   – **RCU Status**: allows you to display the RCU status (see section 4.2.6).
   – **RCU Operation**: allows you to perform the following RCU operations: add RCU (section 4.2.2), change RCU option (section 4.2.3), and delete RCU (section 4.2.7).
   – **Edit Path**:  allows you to add and delete paths (see section 4.2.4).
   – **Edit SSID**:  allows you to add and delete SSIDs (see section 4.2.5).

   For the **Port** display, the pop-up menu commands are (see section 4.2.1):
   – **Initiator**: allows you to change the selected port(s) to initiator ports.
   – **RCU Target**: allows you to change the selected port(s) to RCU target ports.
   – **Target**: allows you to change the selected port(s) to target ports.

5. For the **MCU&RCU** display, select the menu command for the desired operation. When two or more RCUs are selected, only the RCU Operation command is available. For the add and change operations, use the panel to perform the operation, and close the panel. There is no panel for the delete operations. The **RCU Operations** list view now displays the requested operation(s).

For the **Port** display, select the desired port type. The **RCU Operations** list view now displays the requested port change operation(s).

6. Verify the specified RCU or port operation(s). Make changes as follows:

   a) To change an operation, select the desired operation (RCU, path, SSID, port), right-click on it, select the desired port type, or select **Modify**, make the desired changes, and close the panel. The list view displays the updated information.

   b) To omit one or more operations, select the operation(s) to be omitted (RCU, path, SSID, port), right-click, and select **Omit**. The operation(s) is/are removed from the list view. If all operations are removed, the list view returns to its original display.

   c) To cancel all operations, right-click on the operations, and select **Cancel All**. All operations are removed, and the list view returns to its original display.

7. To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.
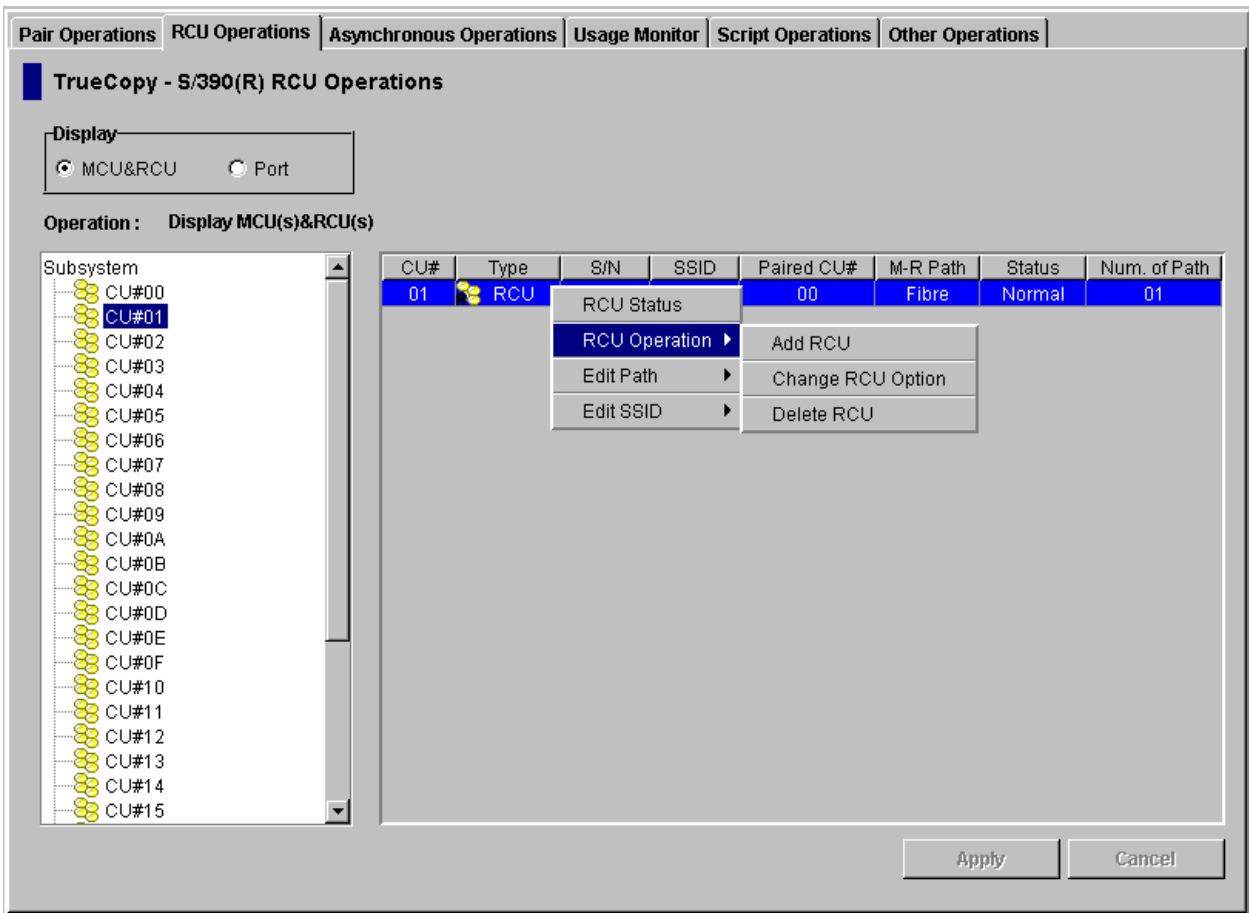


**Figure 4.10    Pop-up Menu for MCU & RCU Operations**
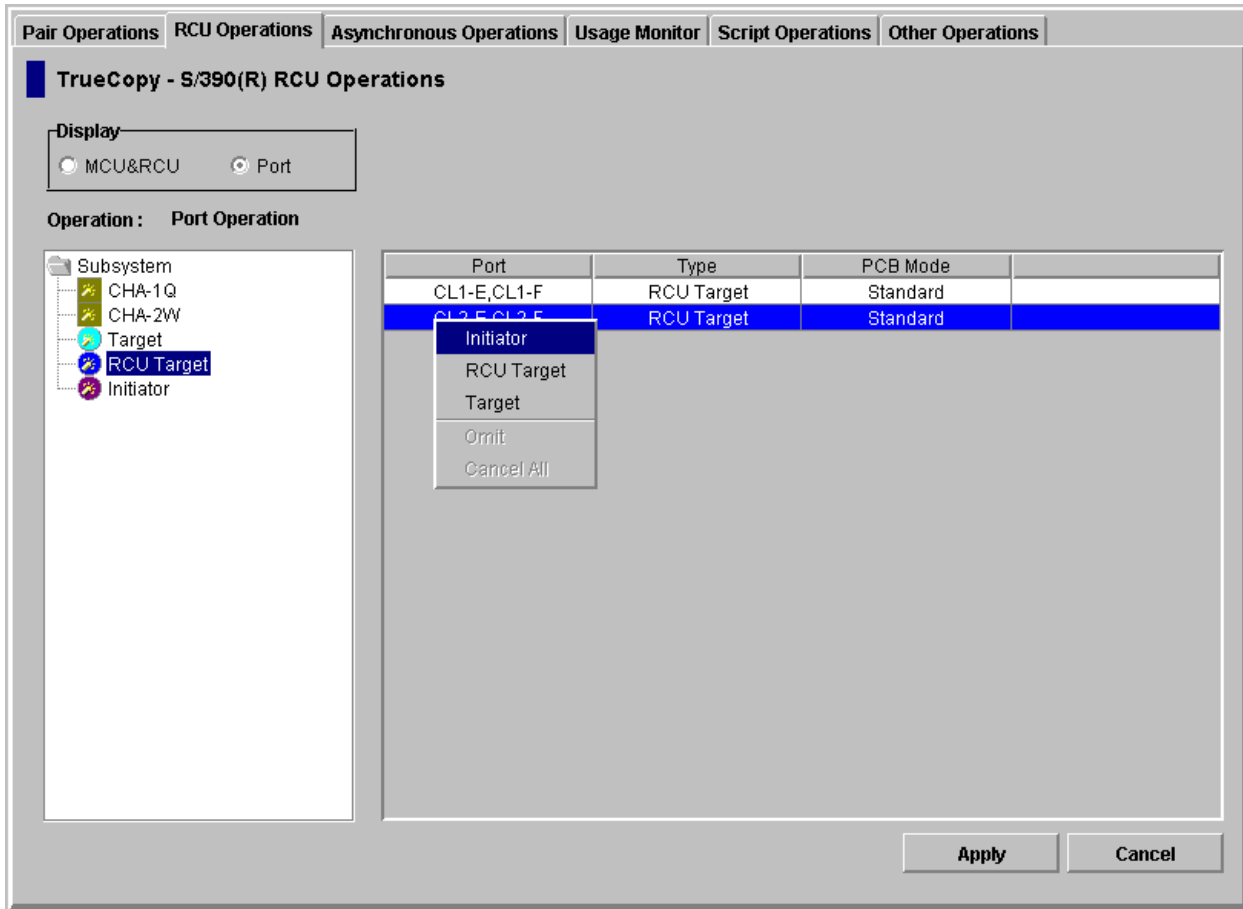
**Figure 4.11 Pop-Up Menu for Port Operations**

### 4.2.1 Configuring the Host Interface Ports

The TrueCopy – S/390® software allows you to change the configuration of the 9900V host interface ports as needed to accommodate the desired host and TrueCopy – S/390® communications paths.

The 9900V fibre-channel interface ports can be configured as target ports (default), initiator ports, or RCU target ports (see section 2.1.6).

- **Target**: The fibre-channel ports which will be connected to the host must be configured as target ports (default). Target mode is used for host processor channel interface.

- **Initiator**: The fibre-channel ports which will be used for TC390 communications to the RCUs must be configured as initiator ports. Initiator mode emulates a host channel to enable the MCU to send write I/O operations directly to the RCU target port.

  *Note:* Two or more initiator ports must be configured before you can add the RCUs and create the TrueCopy – S/390® pairs.

- **RCU target**: The fibre-channel ports in the RCU that will be used to communicate with the MCUs must be configured as RCU target ports.

The 9900V serial interface ports can be configured as LCPs or RCPs (see section 2.1.7). *Note:* TrueCopy – S/390® over serial interface is not supported for this version.

- **LCP**: The serial ports which will be connected to the host must be configured as LCPs (default). LCP mode is used for host processor channel interface. The serial ports in the RCU that will be used to communicate with the MCUs must also be configured as LCPs.

- **RCP**: The serial ports which will be used for TrueCopy – S/390® communications to the RCUs must be configured as RCPs. RCP mode emulates a host channel to enable the MCU to send write I/O operations directly to the RCU. The RCPs must be configured before you can add the RCUs and create the TrueCopy – S/390® pairs.

---

*WARNING:* Before changing a fibre-channel port to an initiator port, disconnect the port from the host, delete all affected TrueCopy – S/390® pairs, delete all paths from the port to the MCU (if RCU target), and then remove all channel paths to the port.

---

*WARNING:* Before changing a fibre-channel port from initiator to target or RCU target, delete all affected TrueCopy – S/390® pairs, delete all paths from the initiator port to the RCU, and then delete the RCU from the MCU.

*Caution:* Limit the number of hosts connected to an RCU target port to 128 or fewer to avoid mistaken disconnection. If more than 128 hosts are connected to an ordinary target, some hosts may be disconnected after changing the type from target to RCU target.

*Note:* The second port and/or the fourth port of the DKC-F460I-8GSE channel adapter package cannot be used for MCU-RCU communications.

To configure the 9900V fibre-channel ports:

1. Select the **RCU Operations** tab, and select the **Port** display button to display the channel adapters and port types for the connected subsystem in the outline view.

2. Select the desired channel adapter to display only the ports for that channel adapter. Select the desired port type to display all ports of the selected type.

3. Select the port(s) that you want to configure.

4. Right-click on the selected port(s), and then select the desired port type: initiator, RCU target, or target for fibre channel.

5. Verify the requested port change operation(s) displayed in the list view.

   To change one or more port operations, select the operation(s), right-click, and select the desired port type. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click on the list, and select **Cancel All**.

   *WARNING:* Read and follow the important warnings and caution above before starting the port change operations.

6. To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.

### 4.2.2 Adding an RCU

You can add up to four RCUs to each MCU and establish up to eight paths to each RCU. You must add each CU image as a separate RCU to each CU image of the MCU. The logical paths are established for the CU images of the MCU and RCU separately. The maximum number of logical paths for each MCU is 32 (8 paths per RCU $\times$ 4 RCUs per MCU).

The remote copy connections and MCU ports must be properly installed and configured before you can add an RCU. When you add an RCU, the selected CU image of the connected MCU adds the specified CU image as a TrueCopy – S/390® RCU and establishes the specified number of logical paths to the RCU. After you have added an RCU (and path status is normal), you can create TrueCopy – S/390® pairs which have R-VOLs in the newly added RCU.

The Add RCU panel (see Figure 4.12) allows you to add an RCU to the selected CU image of the connected MCU. To open the Add RCU panel, select the **MCU&RCU** display on the **RCU Operations** tab, select the desired CU image in the outline view, right-click on the list view, select the **RCU Operations** command, and then select the **Add RCU** sub-command.

**Figure 4.12    Add RCU Panel**

**RCU S/N**:  allows you to enter the five-digit serial number of the RCU being added.

**Controller ID**: allows you to enter the controller ID (subsystem family ID) of the RCU being added. The controller ID for 9900V is **3**, and the controller ID for the 9900 is **2**.

**Logical Adr. (RCU CU#)**: allows you to enter the CU number (0-1F) of the RCU being added.

**SSID**: allow you to enter the SSID(s) of the RCU being added. The 9900V uses one SSID for each set of 256 volumes and four SSIDs per CU image. SSID is 4-FFFE (hexadecimal).

**MCU-RCU Path**:

- **MCU Port**: allows you to select the MCU port number. Only the initiator ports are listed.
- **RCU Port**: allows you to select the RCU port number. You must select RCU target ports.

The **Option** button opens the RCU Option panel (see section 4.2.3). The **Cancel** button cancels the settings you made on the Add RCU panel and closes the panel.

To add an RCU to the connected MCU:

1. Make sure the remote copy connections and ports are properly configured. Get the S/N and SSID(s) for the desired CU image of the RCU. The add RCU operation will fail without this information. The 9900V subsystem should have a label or tag indicating its S/N and SSIDs, or ask your Hitachi Data Systems representative for the RCU S/N and SSIDs.

2. Select the **RCU Operations** tab, select the **MCU&RCU** display button, and select the desired CU image in the outline view. You must add RCUs to each CU image separately.

3. Right-click on the list (an RCU does not have to be selected), select **RCU Operation**, and then select **Add RCU** to open the Add RCU panel (refer to Figure 4.12).

4. On the Add RCU panel, enter the S/N, controller ID (**3** for 9900V, **2** for 9900), CU number, and SSID(s) for the desired RCU CU image. The MCU verifies the S/N when the paths are established, and verifies the SSIDs when the volume pairs are created. If desired, you can add and delete SSIDs later using the Add SSID panel (see section 4.2.5).

5. Select the MCU port and RCU port. The MCU will not allow you to establish less than the minimum number of paths as specified on the RCU Option panel. If desired, you can add and delete paths later using the Add Path panel (see section 4.2.4).

6. Select the **Option** button to open the RCU Option panel, and enter the desired settings for the TrueCopy – S/390® RCU options (see section 4.2.3).

   *Note:* For multiplatform 9900V configurations with both TrueCopy – S/390® and TrueCopy paths, set the Maximum Initial Copy Activities to 4 volumes.

7. Select **Set** to close the RCU Option panel, even if you made no changes. (Select **Cancel** to cancel the add RCU operations.) The list view now displays the requested add RCU operation(s) (see Figure 4.13).

8. Verify the requested operation(s) displayed in the list view. To check the path status for an RCU, select the RCU, right-click on it, and select **RCU Status** (see Table 7.2).

   To change one or more operations, select the operation(s), right-click, and select **Modify**. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click on the list, and select **Cancel All**.

9. To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.

| S/N | SSID1 | SSID2 | SSID3 | SSID4 | M-R Path | Num. of Path | MCU Port1 | RCU Port1 |
|---|---|---|---|---|---|---|---|---|
| 66325 | 0082 | | | | Fibre | 01 | CL1-E | CL1-B |

| MCU Port2 | RCU Port2 | MCU Port3 | RCU Port3 | MCU Port4 | RCU Port4 | MCU Port5 | RCU Port5 | MCU Port6 |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

| RCU Port6 | MCU Port7 | RCU Port7 | MCU Port8 | RCU Port8 | Min.Path | Activity | MIH Time | Path Watch |
|---|---|---|---|---|---|---|---|---|
| | | | | | 01 | 04 | 015 | 40 |

**Figure 4.13   Verifying the Add RCU Operation(s)**

## 4.2.2.1 RCU Path Parameters

For fibre-channel interface, two types of fibre-channel ports are provided: 4-port and 2-port adapters. The port mode depends on the port type. Also, each port may have a different PCB mode setting (Standard or High). Therefore, when you configure paths among the initiator ports, target ports, and RCU target ports, please study the port modes and specify the correct mode for each port. For details on the relationship between ports and PCB modes and instructions for setting the PCB mode, please refer to the *Hitachi Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105). Figure 4.14 shows a sample TrueCopy – S/390® fibre-channel interface configuration with connections going through switches and the TrueCopy – S/390® Add RCU panel used to define this configuration.

For serial-channel interface, the RCU path parameters are similar to the channel path definitions in the I/O configuration dataset (IOCDS). In the IOCDS, a logical path is specified with a subchannel number, link destination address, and logical address for the CU. TrueCopy – S/390® uses the "port" parameter instead of the subchannel number to specify the MCU's port. For the 9900V subsystem, the logical address must correspond to the CU number. Figure 4.15 shows a sample TrueCopy – S/390® serial-channel configuration with two paths.
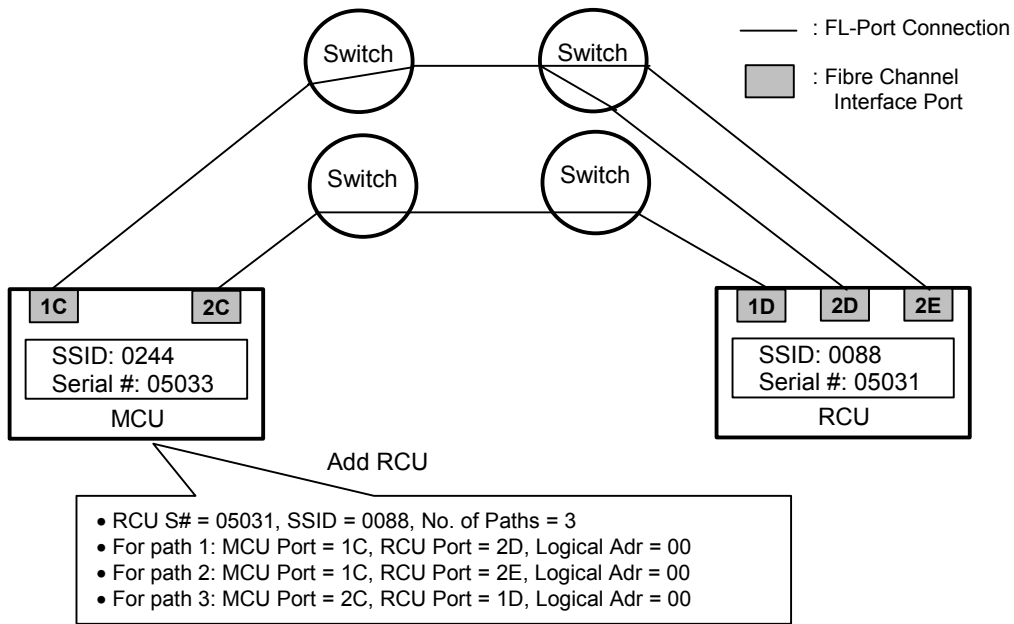
**Figure 4.14    Add RCU Operation – Example 1, Fibre-Channel Interface**
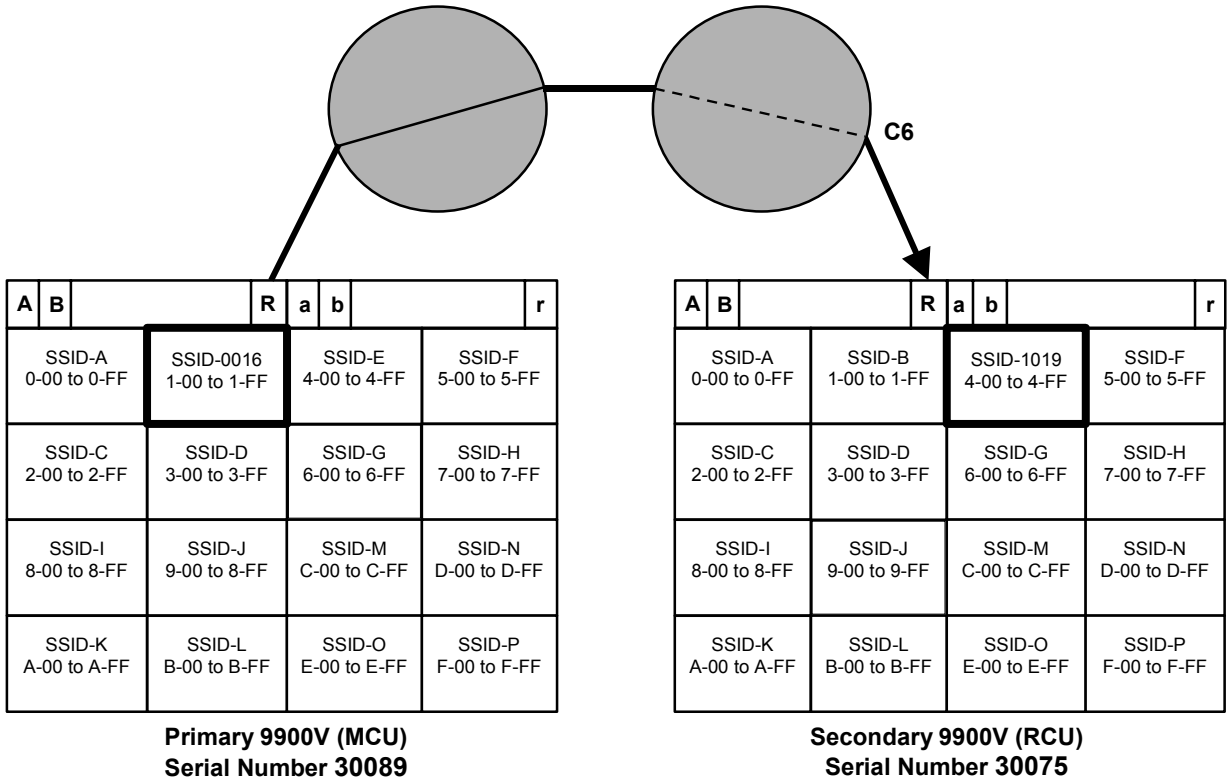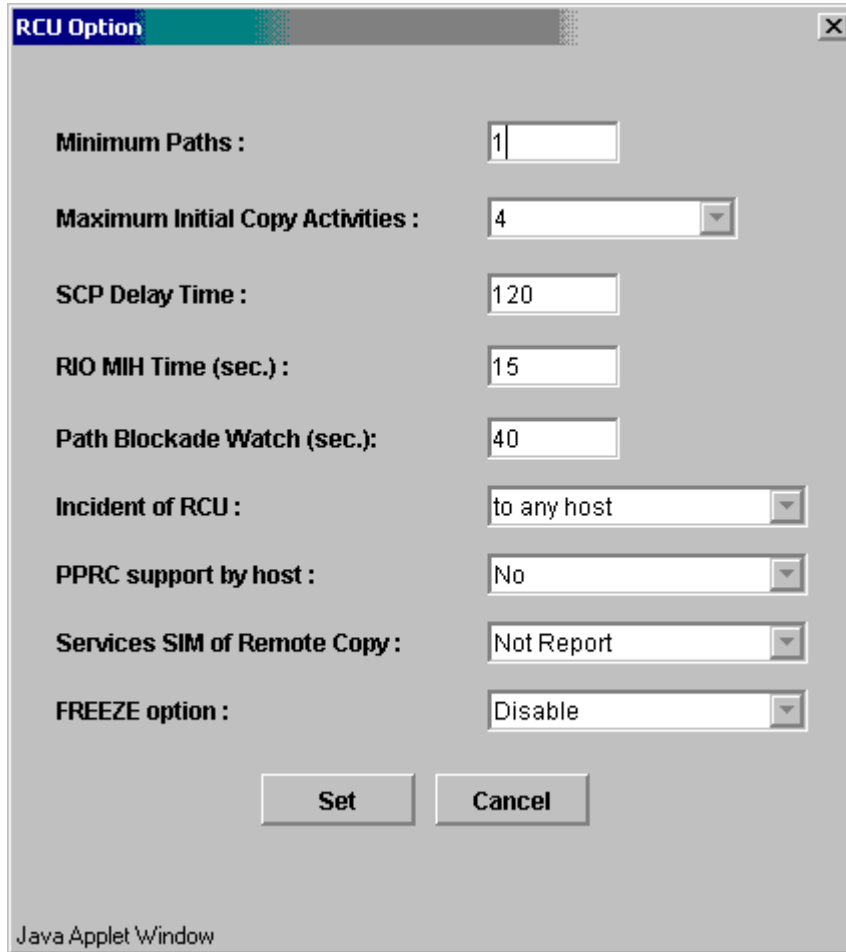
**Figure 4.15    Add RCU Operation – Example 2, Serial-Channel Interface**

### 4.2.3 Changing the RCU Options

The RCU Option panel (see Figure 4.16) allows you to set the RCU options for the connected MCU. The RCU options apply to all MCU CU images and to all RCUs connected to the MCU. The RCU Option panel is presented during the add RCU process, and can also be opened by right-clicking on the RCUs and selecting the **RCU Operation→Change RCU Option** command.



**Figure 4.16 RCU Option Panel**

The **Minimum Paths** option allows you to specify the minimum number of paths required for each RCU connected to the current MCU (default = 1). If you enter a larger number than the number of paths already set on the Add RCU panel, or if the number of paths falls below this number (e.g., failed path), an error occurs. When the error occurs, the MCU suspends all affected TrueCopy – S/390® (and TrueCopy) pairs to prevent remote copy operations from adversely affecting performance due to the inadequate number of paths. If the MCU contains TrueCopy – S/390® pairs which contain critical data for disaster recovery, set the minimum number of paths to one, so that TrueCopy – S/390® operations continue even if there is only one path to an RCU. If you need high performance at the MCU, set the minimum number of paths to two or more (up to eight per CU image), depending on the number of pairs managed by the MCU.

*Caution:* If TrueCopy – S/390® pairs are suspended because the number of paths has dropped below this setting, the M-VOL fence level pair option (see section 5.3.2) determines whether the TrueCopy – S/390® Synchronous M-VOLs are fenced (i.e., reject all write operations).

The **Maximum Initial Copy Activities** setting specifies the number of concurrent initial copy operations:  **4** volumes or **16** volumes. The default setting is 4 volumes. TrueCopy – S/390® initial copy activities can impact the performance of the main subsystem, depending on the amount of I/O activity and the number of pairs being registered at the same time. The maximum initial copy activities setting of **4** volumes allows you to limit the impact of initial copy activities on subsystem performance. For example, if you set the maximum initial copy activities to 4 volumes and then add five TrueCopy – S/390® pairs at the same time, the MCU starts the first four pairs and will not start the fifth pair until one of the first four pairs is synchronized (PAIR status). When you change the maximum initial copy activities setting, the new setting applies to pairs created after the setting was changed, not to existing pairs.

*Note:* The RCU options are common to both TrueCopy – S/390® and TrueCopy operations. For multiplatform 9900V configurations with both TrueCopy – S/390® and TrueCopy paths, the Maximum Initial Copy Activities must be set to 4 volumes, and the most recently entered Minimum Paths value (entered on TrueCopy – S/390® or TrueCopy RCU Option panel) will be applied to both TrueCopy – S/390® and TrueCopy operations.

The **SCP Delay Time** setting specifies the state-change-pending (SCP) delay time in seconds (0-600 seconds, default = 120). CGROUP/FREEZE utilizes the SCP state to suspend host I/Os to TC390 M-VOLs (see section A.3). TC390A utilizes the SCP state for inflow control to prevent cache storage overload (see section 2.3.6). Make sure to set the SCP delay time after you have added all MCU-RCU paths. *Caution:* You must select **OK** on the RCU Option panel to register the **SCP Delay Time** setting, even if you did not make any changes to the RCU options. Please make sure to select the appropriate SCP delay time for your TC390 system configuration.

The **RIO MIH Time** setting specifies the time value for the remote I/O (RIO) missing interrupt handler (MIH), which is the wait time until data transfer from the MCU to RCU is complete. The RIO MIH time value must be from 10 to 100 seconds. The default setting is 15 seconds. This setting is available for both serial and fibre-channel interfaces.

The **Path Blockade Watch** setting (fibre only) specifies the time for monitoring blockade in the fibre-channel paths on the MCU side. The path blockade watch value must be from 0 to 45 seconds. The default setting is 40 seconds.

The **Incident of RCU** option allows you to specify which host(s) the RCUs will report link incident records to. When **to any host** is selected, the RCUs will send link incident records to all RCU hosts and to all MCU hosts. When **only to RCU host** is selected, the RCUs send link incident records only to the RCU host(s). Make sure that RCU link incidents are reported to the proper host(s) so that corrective action, if needed, can be taken. The **to any host** setting is recommended when TC390 is being used for disaster recovery purposes.

The **PPRC support** option allows you to specify whether the MCU will generate sense information which is compatible with IBM® PPRC. This option is extremely important for TC390 disaster recovery planning. If the host does not support PPRC, select **No** to configure the MCU to report SIMs. If the host system supports PPRC, select **Yes** to configure the MCU to generate PPRC-compatible sense information when a TC390 pair is suspended instead of a service information message (SIM). If **Yes** is selected, the MCU will still report moderate- and serious-level SIMs, as well as DF40 and DF48 device SIMs. Refer to Appendix A for further information on PPRC support. *Note:* If you plan to utilize the CGROUP (FREEZE/RUN) command for TC390 pairs, you must select **Yes**.

The **Service SIM of Remote Copy** option allows you to specify whether the MCU will report the service-level remote-copy SIMs to the host(s). (The moderate-, serious-, and acute-level SIMs are always reported to the host.) Select **Report** to configure the MCU to report the service-level remote-copy SIMs to the host(s). The **Report** setting should be selected for TC390 disaster recovery planning. Select **Not Report** to suppress service-level SIM reporting. See Appendix C for a description of the TC390 and TC390A SIMs. *Note:* All service-level SIMs will be logged in the SSB.LOG file on the 9900V SVP, regardless of this setting.

The **FREEZE Option** setting allows you to enable or disable support for the CGROUP (FREEZE/ RUN) PPRC TSO command (see section A.3). The FREEZE option is available only when PPRC support = Yes. If you select **Enable**, the MCU will accept and perform the CGROUP command. If you select **Disable**, the MCU will reject the CGROUP command. *Note:* Enable the FREEZE option only after all MCU-RCU paths have been added.

*Note:* The PPRC commands do not allow you to change the RCU options. Refer to Appendix A for further information on PPRC TSO and ICKDSF commands.

To change the RCU options:

1. Select the **RCU Operations** tab, and select the **MCU&RCU** display button.

2. Right-click on the RCU list (you do not need to select anything), select **RCU Operation**, and select **Change RCU Option** to open the RCU Option panel (refer to Figure 4.16).

3. On the RCU Option panel, change the RCU options as desired, and select **Set** to close the RCU Option panel (or select **Cancel** to cancel the RCU option operation). The list view now displays the requested change RCU option operation.

4. Verify the requested operation(s) displayed in the list view (see Figure 4.17).

   To change the change RCU option operation, select the operation, right-click, and select **Modify**. To remove the operation, select it, right-click, and select **Cancel All**.

5. To apply the settings, select **Apply** (lower right of TrueCopy – S/390® panel). To cancel the operation and return the list view to its original display, select **Cancel**.

| S/N | SSID | M-R Path | Min.Path | Activity | MIH Time | Path Watch |
|-----|------|----------|----------|----------|----------|------------|
| 68325 | 0088 | Fibre | 01 | 04 | 015 | 40 |

**Figure 4.17   Verifying the Change RCU Option Operation**

### 4.2.4    Adding and Deleting Logical Paths to an RCU

Before adding a path to an RCU, make sure that the remote copy connection is properly installed, the appropriate MCU ports are configured as initiator ports (fibre) or RCPs (serial), and the appropriate MCU CU image is selected. You can add up to four RCUs to each MCU CU image and establish up to eight paths to each RCU. When you add a path to an RCU, TrueCopy – S/390® will automatically start using the new path to perform copy activities.

The Add Path panel (see Figure 4.18) allows you to add one or more paths to an existing RCU. To open the Add Path panel, select the **MCU&RCU** display on the **RCU Operations** tab, select the desired MCU CU image in the outline view, select the desired RCU, right-click on the RCU, select the **Edit Path** command, and then select the **Add Path** sub-command.
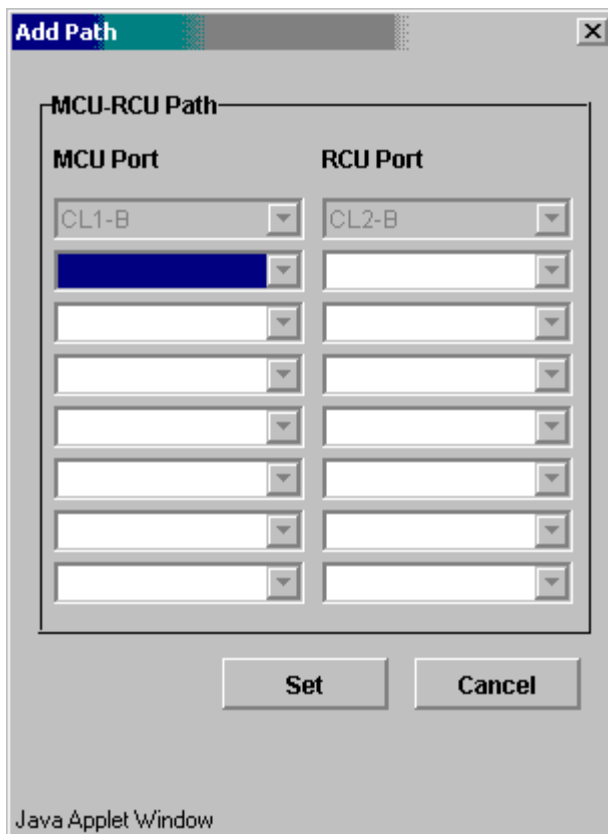


**Figure 4.18    Add Path Panel**

**MCU Port**: allows you to select the MCU port number. Initiator ports and RCPs are listed.

**RCU Port**: allows you to select the RCU port number. You must select an RCU target port.

*Note:* The number of enabled fields indicates the number of paths that can be added.

To add one or more new logical paths from the connected MCU to an existing RCU:

1. Select the **RCU Operations** tab, and select the **MCU&RCU** display button.

2. Select the desired MCU CU image in the outline view, and then select the RCU to which you want to add a path.

3. Right-click on the RCU, select **Edit Path**, and then select **Add Path** to open the Add Path panel (see Figure 4.19).

4. On the Add Path panel, enter the new path(s).

5. Select **Set** to close the Add Path panel. The list view now displays the requested add path operation(s).

6. Verify the requested operation(s) displayed in the list view (see Figure 4.20).

   To change the add path operation, select the operation, right-click, and select **Modify**. To remove the operation, select the operation, right-click, and select **Omit**.

7. To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). The MCU will automatically begin using the new logical path for TrueCopy – S/390® activities. To cancel the operation and return the list view to its original display, select **Cancel**.
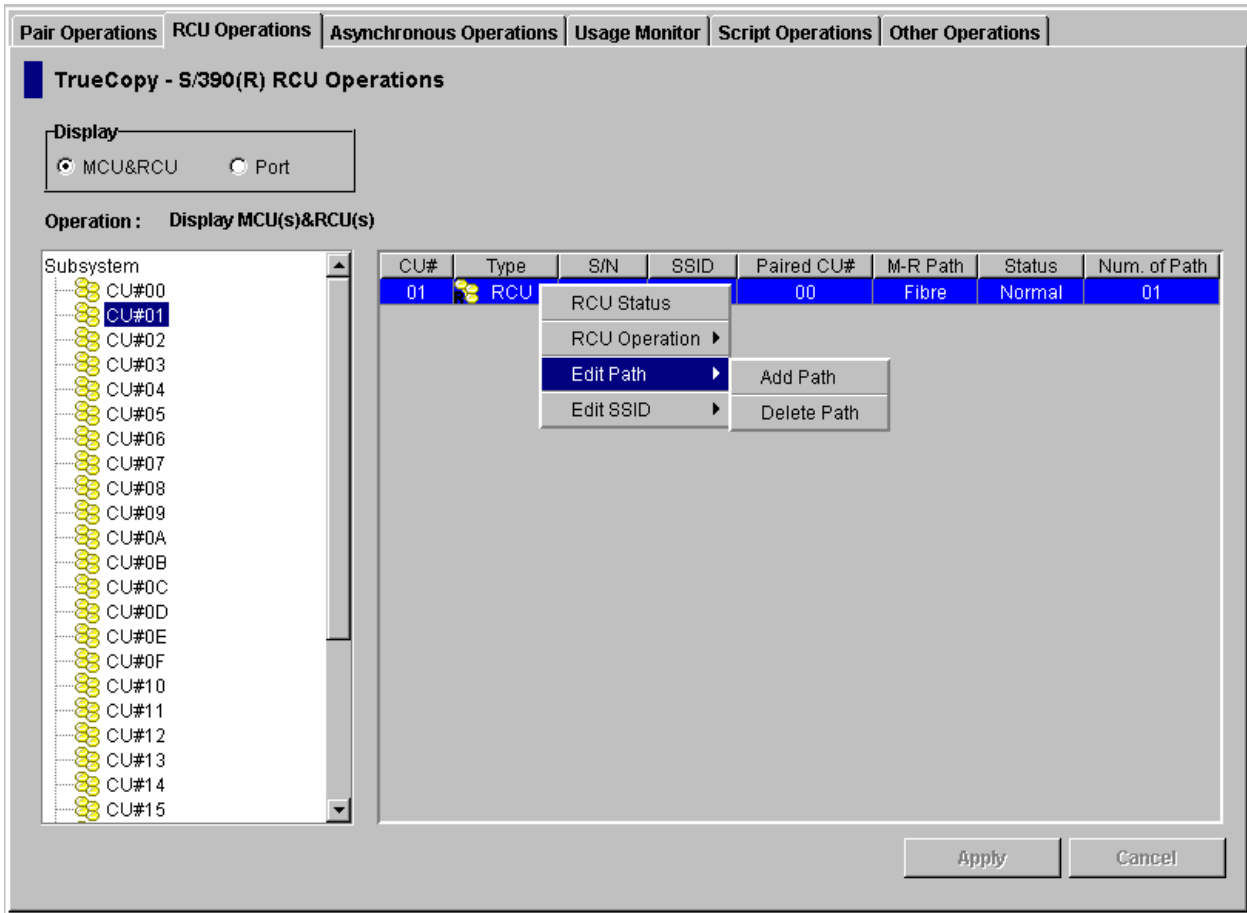


**Figure 4.19   Opening the Add Path Panel**

| S/N | SSID | M-R Path | MCU Port1 | RCU Port1 | MCU Port2 | RCU Port2 | MCU Port3 | RCU Port3 | MCU Port4 |
|-----|------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 62493 | 0005 | Fibre | - | - | CL1-F | CL2-E | | | |

| RCU Port4 | MCU Port5 | RCU Port5 | MCU Port6 | RCU Port6 | MCU Port7 | RCU Port7 | MCU Port8 | RCU Port8 |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | | | | | | | | |

**Figure 4.20    Verifying the Add Path Operation(s)**

Before deleting a path to an RCU, make sure that the remaining number of paths will be equal to or greater than the minimum number of paths setting (on the RCU Option panel). The delete path operation will fail if the number of remaining paths is less than the minimum number of paths.

The **Edit Path→Delete Path** command allows you to delete a path to an existing RCU. To delete a path from the connected MCU to an existing RCU:

1. Open the RCU Option panel, and check the **Minimum Paths** setting. If the remaining number of paths will be less than this value, the delete path operation will fail. If needed, change the **Minimum Paths** RCU option so that you can delete the desired path.

2. Select the **RCU Operations** tab, and select the **MCU&RCU** display button.

3. Select the desired MCU CU image in the outline view, and then select the RCU for which you want to delete a path.

4. Right-click on the RCU, select **Edit Path**, and then select **Delete Path**. The list view now displays the requested delete path operation.

5. Verify the requested operation displayed in the list view (see Figure 4.21).

   To change the delete path operation, select the operation, right-click, and select **Modify**. To remove the operation, select the operation, right-click, and select **Omit**.

6. To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel the operation and return the list view to its original display, select **Cancel**.

| S/N | SSID | M-R Path | MCU Port1 | RCU Port1 | MCU Port2 | RCU Port2 | MCU Port3 |
|-----|------|----------|-----------|-----------|-----------|-----------|-----------|
| 65535 | 1234 | Fibre | - | - | CL1-B | CL2-B | CL1-B |

| RCU Port3 | MCU Port4 | RCU Port4 | MCU Port5 | RCU Port5 | MCU Port6 | RCU Port6 | MCU Port7 |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| CL1-B | CL1-B | CL2-A | CL1-C | CL2-C | CL1-C | CL2-E | CL1-C |

| RCU Port7 | MCU Port8 | RCU Port8 |
|-----------|-----------|-----------|
| CL2-F | CL1-C | CL1-R |

**Figure 4.21    Verifying the Delete Path Operation**

### 4.2.5 Adding and Deleting SSIDs for an RCU

Before adding an SSID, make sure that the remote copy connection is properly installed. You can add three SSIDs to each RCU. Before deleting an SSID, make sure that the remaining SSIDs are still valid, or the connection between the MCU and RCU may be lost.

The Add SSID panel (see Figure 4.22) allows you to add up to three SSIDs to an existing RCU. To open the Add SSID panel, select the **MCU&RCU** display on the **RCU Operations** tab, select the desired MCU CU image in the outline view, select the desired RCU, right-click on the RCU, select the **Edit SSID** command, and then select the **Add SSID** sub-command.
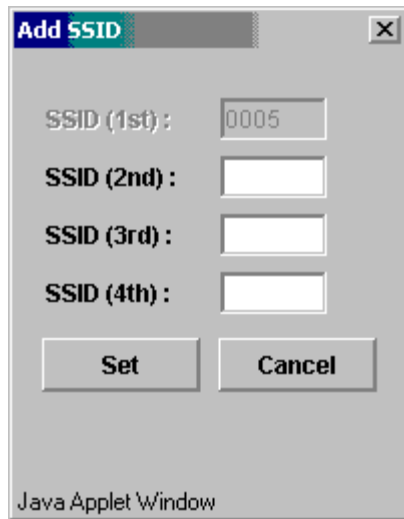


**Figure 4.22    Add SSID Panel**

To add one or more SSIDs to an existing RCU:

1.  Select the **RCU Operations** tab, and select the **MCU&RCU** display button.

2.  Select the desired MCU CU image in the outline view, and then select the RCU to which you want to add SSID(s).

3.  Right-click on the RCU, select **Edit Path**, and then select **Add Path** to open the Add Path panel (see Figure 4.23).

4.  On the Add SSID panel, enter the new SSID(s).

5.  Select **Set** to close the Add Path panel. The list view now displays the requested add path operation(s).

6.  Verify the requested operation(s) displayed in the list view (see Figure 4.24).

    To change the add SSID operation, select the operation, right-click, and select **Modify**. To remove the operation, select the operation, right-click, and select **Omit**.

7.  To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel the operation and return the list view to its original display, select **Cancel**.
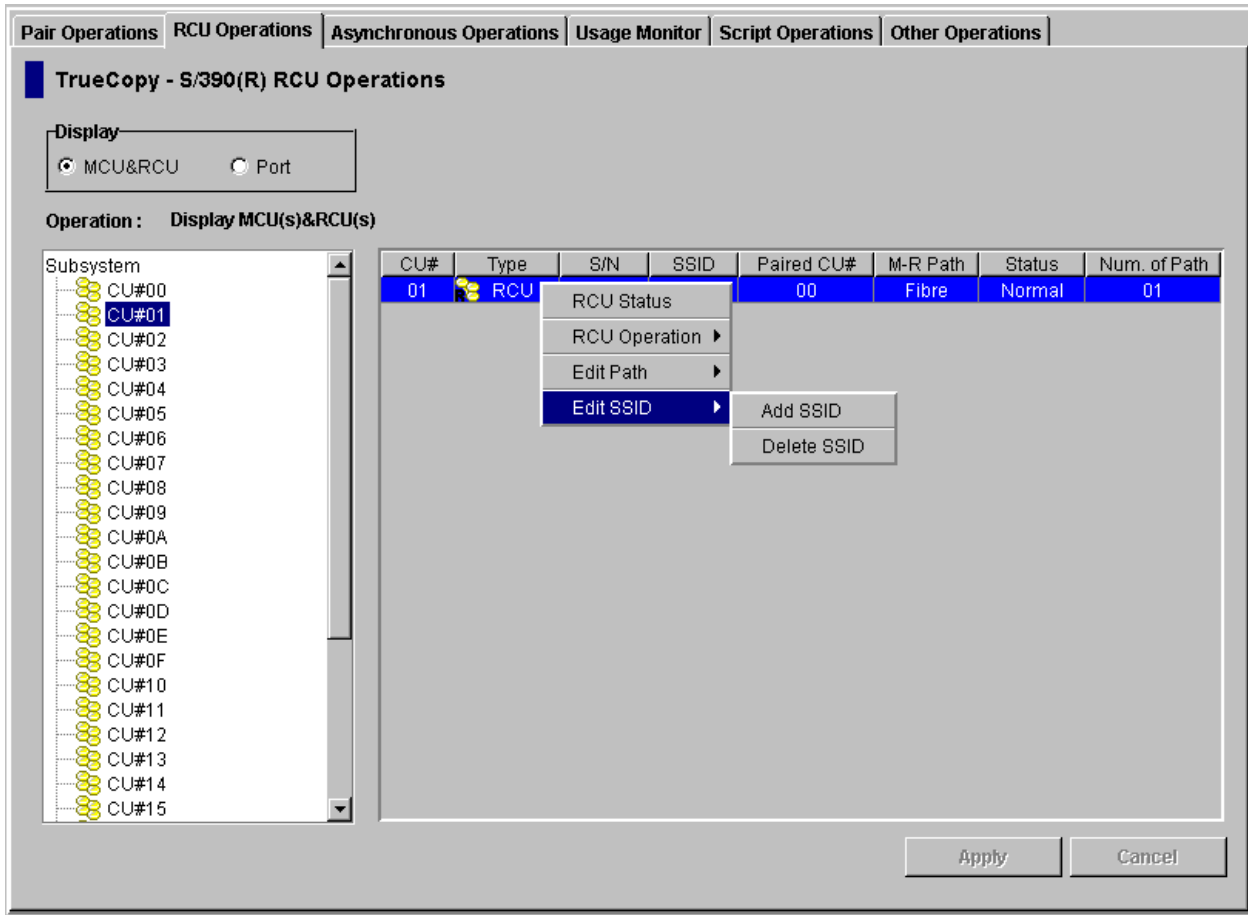
**Figure 4.23    Opening the Add SSID Panel**

| S/N | SSID1 | SSID2 | SSID3 | SSID4 |
|---|---|---|---|---|
| 62493 | - | 0006 | | |

**Figure 4.24    Verifying the Add SSID Operation**

Before deleting an SSID, make sure that all affected TrueCopy – S/390® pairs (pairs having R-VOLs in the RCU SSID to be deleted) have already been deleted. If all affected pairs have not been deleted, the MCU will reject the delete SSID operation to prevent accidental deletion of TrueCopy – S/390® pairs.

The **Edit SSID→Delete SSID** command allows you to delete an SSID from an existing RCU. To delete an SSID from an existing RCU:

1. Select the **RCU Operations** tab, and select the **MCU&RCU** display button.

2. Select the desired MCU CU image in the outline view, and then select the RCU for which you want to delete an SSID.

3. Right-click on the RCU, select **Edit SSID**, and then select **Delete SSID**. The list view now displays the requested delete SSID operation.

4. Verify the requested operation displayed in the list view (refer to Figure 4.24).

   To change the delete SSID operation, select the operation, right-click, and select **Modify**. To remove the operation, select the operation, right-click, and select **Omit**.

5. To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel the operation and return the list view to its original display, select **Cancel**.

## 4.2.6    Viewing RCU Status

The RCU Status panel (see Figure 4.25) displays the detailed status information for the selected RCU. Table 4.2 describes the path status descriptions. See section 7.1 for troubleshooting information for MCU-RCU paths.

To view the detailed RCU status information:

1. Select the **RCU Operations** tab, and select the **MCU&RCU** display button.

2. Select the desired MCU CU image in the outline view, and then select the RCU for which you want to display the status. You can only view status for one RCU at a time.

3. Right-click on the RCU, and select **RCU Status** to open the RCU Status panel.

| No. | Path Status | MCU Port | RCU Port |
|-----|-------------|----------|----------|
| 1 | Normal | CL1-A | CL1-A |
| 2 | Normal | CL1-B | CL1-E |
| 3 | Normal | CL1-C | CL1-J |
| 4 | Normal | CL1-D | CL1-N |

RCU S/N :                           06809

SSID :                              1234

RCU CU# :                           04

MCU-RCU Path :                      Fibre

Minimum Paths :                     5

Maximum Initial Copy Activity :     4 (Volumes)

Incident :                          to any host

PPRC support by host :             Yes

Services SIM of Remote Copy :      Not Report

RIO MIH Time :                     25 (sec.)

Path Blockade Watch :              30 (sec.)

RCU Registered :                   02/28/1999 16:59:58

Last Updated :                     07/24/2001 17:21:59

SCP Time :                         0

FREEZE option :                    Disable

[ Refresh ]   [ Close ]

**Figure 4.25    RCU Status Panel**

- **Path List**:
  - **No.**: Path number (path list item number).
  - **Path Status**: Path status. Table 4.2 describes the path status descriptions.
  - **MCU Port** number and **RCU Port** number.
- **RCU S/N**: Serial number of the RCU.
- **SSID**: SSID(s) of the RCU.
- **RCU CU#**: CU number of the RCU.
- **MCU-RCU Path**: Type of channel interface between the subsystems (fibre or serial).
- **Minimum Paths**: Minimum number of MCU-RCU paths for the selected RCU.
- **Maximum Initial Copy Activities**: Number of concurrent initial copy operations.
- **Incident**: The host(s) to which the RCUs will report link incident records.
- **PPRC Support by Host**: Status of PPRC support for the host.
- **Service SIM of Remote Copy**: MCU reporting status for service-level remote-copy SIMs to the host(s).
- **RIO MIH Time**: Time value for the remote I/O (RIO) missing interrupt handler (MIH), which is the wait time until data transfer from the MCU to RCU is complete.
- **Path Blockade Watch**: Time for monitoring blockade in the FC paths on the MCU side.
- **RCU Registered**: Date and time when the RCU was added.
- **Last Updated**: Date and time when the RCU was last updated.
- **SCP Time**: State-change-pending (SCP) time.
- **FREEZE Option**: Support for the CGROUP (FREEZE/ RUN) PPRC TSO command.

**Table 4.2    Logical Path Status**

| Status Description | Condition |
|---|---|
| Normal | This path has been successfully established and can be used for TC390 remote copy activities. |
| Initialization Failed | The link initialization procedure with the RCU has failed, because either the physical path connection between the MCU and the RCU or the connection between the MCU and the host was missing. |
| Communication Timeout | A timeout error has occurred between the MCU and RCU. |
| Resource Shortage | The establish logical path link function has been rejected by the RCU. All logical path resources in the RCU might be used for other connections. |
| Serial NumberMismatch | The serial number of the control unit which is connected to this logical path does not match the serial number specified by the Add RCU panel. |
| Invalid Port | The interface port specified is not in the initiator or RCP mode. |
| RCU Port Number Mismatch | There are three possible factors: The specified port in the RCU is physically disconnected from the MCU. The port is not configured as an RCU target port. The specified port number is not available. |
| RCU Port Type Mismatch | The microprogram at the RCU side does not support the fibre remote copy function. Or the specified port type is not RCU target. |
| Communication Failed | A timeout error has occurred on the fibre path between MCU and RCU. |

### 4.2.7    Deleting an RCU

You can delete an RCU from an MCU only after all TrueCopy – S/390® volume pairs between the MCU CU image and RCU CU image have been deleted. When you delete an RCU from an MCU, the MCU deletes all logical paths from the current MCU CU image to the selected RCU CU image. Deleting an RCU does not affect the TrueCopy – S/390® operations between the other MCU CU images and that RCU. After an RCU has been deleted, you can reconfigure the remote copy connections to add another RCU to the MCU, or you can remove the remote copy connections and reconfigure the MCU ports (initiator ports to ordinary target ports for fibre, RCPs to LCPs for serial) to provide additional host channels for the MCU.

*Note:* If all affected TrueCopy – S/390® pairs have not been deleted, the MCU will reject the delete RCU operation to prevent accidental deletion of TrueCopy – S/390® pairs.

The **RCU Operation→Delete RCU** command allows you to delete an RCU from an MCU CU image. The MCU will not allow you to delete an RCU which still has pairs with the MCU.

To delete one or more RCUs from an MCU CU image:

1.  Make sure that all affected TrueCopy – S/390® volume pairs have been deleted.

2.  Select the **RCU Operations** tab, and select the **MCU&RCU** display button.

3.  Select the desired MCU CU image in the outline view, and then select the RCU(s) that you want to delete.

4.  Right-click on the RCU(s), select **RCU Operation**, and then select **Delete RCU**. The list view now displays the requested delete RCU operation(s).

5.  Verify the requested operation(s) displayed in the list view. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click, and select **Cancel All**.

6.  To delete the RCU(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel the operation(s) and return the list view to its original display, select **Cancel**.

## 4.3    Asynchronous Operations

The TrueCopy – S/390® Asynchronous operations include:

■    Setting the asynchronous copy options (see section 4.3.1).

■    Adding consistency (CT) groups (see section 4.3.2),

■    Changing the consistency group options (see section 4.3.3),

■    Viewing consistency group status (see section 4.3.4), and

■    Deleting consistency groups (see section 4.3.5).

The **Asynchronous Operations** tab (see section 4.1.3) allows you to perform the asynchronous operations. All operations performed on the **Asynchronous Operations** tab have a common procedure. To perform any operation on the **Asynchronous Operations** tab:

1.    Select the desired display mode for the CT groups:  **Display All**, **Used**, or **Not Used**.

2.    Select the desired consistency group(s) in the outline view.

3.    Right-click on the selected item(s) to display the pop-up menu (see Figure 4.26):

     **Async Option**:  allows you to set the parameters for asynchronous copy operations (section 4.3.1).

     **CT Group Operation**:  allows you to perform the following operations: add CT group (section 4.3.2), change CT group option (section 4.3.3), view CT group status (section 4.3.4), and delete CT group (section 4.3.5).

4.    Select the command for the desired operation, use the panel to perform the operation, and close the panel. There is no panel for the delete CT group operation. The list view now displays the requested operation(s).

5.    Verify the specified asynchronous operation(s). Make changes as follows:

     −    To change an operation, select the desired operation, right-click, select **Modify**, make the desired changes, and close the panel. The list view displays the updated information.

     −    To omit one or more operations, select the operation(s) to be omitted, right-click, and select **Omit**. The operation(s) is/are removed from the list view. If all operations are removed, the list view returns to its original display.

     −    To cancel all operations, right-click on the operations, and select **Cancel All**. All operations are removed, and the list view returns to its original display.

6.    To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.

**Figure 4.26    Pop-up Menu for the Asynchronous Operations Tab**

## 4.3.1    Setting the Asynchronous Copy Options

The Async Option panel (see Figure 4.27) allows you to set and modify the TrueCopy – S/390®
Asynchronous copy option parameters for the connected subsystem. To open the Async
Option panel, right-click on the CT groups and select the **Async Option** command.

The async options apply to the entire physical control unit, including all TrueCopy – S/390®
M-VOLs and R-VOLs behind the control unit. The async options can only be modified when no
TrueCopy Asynchronous pairs or groups exist in the connected CU (M-VOLs or R-VOLs).
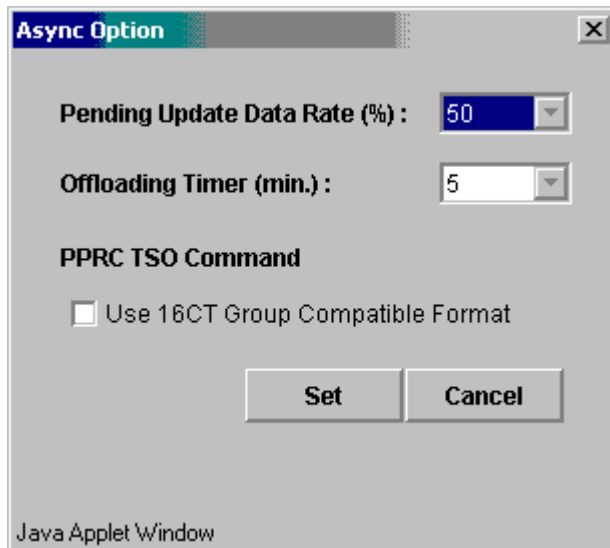


**Figure 4.27    Async Option Panel**

The **Pending Update Data Rate (%)** option allows you to specify the TrueCopy – S/390®
Asynchronous (and TrueCopy Asynchronous) sidefile threshold, which is the maximum
amount of cache that can be used for storing TrueCopy – S/390® (and TrueCopy) Async
recordsets (sidefiles). You can select any value between 30% and 70% (10% increments). For
further information on sidefile inflow control, please see section 2.3.6.

*Note:* The current pending update data rate is common to both TrueCopy – S/390® and
TrueCopy operations. The most recently entered value (on the TrueCopy – S/390® or
TrueCopy Async Option panel) will be applied to all TrueCopy – S/390® Async operations.

*Note:* If one or more consistency groups exist (TrueCopy – S/390® or TrueCopy), this setting
cannot be changed. This setting can only be changed when no CT groups are assigned.

The **Offloading Timer (sec.)** option allows you to specify the amount of time (0-255 seconds)
that the MCU will wait to send a TrueCopy – S/390® recordset to the RCU. The MCU will
suspend all affected TrueCopy – S/390® Async pairs, if it has not been able to offload a
recordset to the RCU within the specified time (e.g., the RCU is still responding channel-
command-retry).

*Note:* The offloading timer value should be set less than the HBA I/O timeout value.

*Note:* When channel-extenders are used for TrueCopy – S/390® Async, the offloading timer
should be set to 35 seconds or less to avoid affecting host I/O performance.

The **PPRC TSO Command** option allows you to select the 7700E-compatible format for PPRC TSO commands (see Appendix A). This option should be selected only if you are using 7700E subsystems as RCUs connected to this 9900V subsystem. The 7700E format limits PPRC operations to sixteen consistency groups (0-F). The 9900V-compatible format (default) enables you to perform PPRC operations for all 128 consistency groups (00-7F) of the 9900V subsystem.

To set the async options:

1. Select the **Asynchronous Operations** tab. You do not need to select anything in the outline view.

2. Right-click on the CT group list (you do not need to select anything), and select **Async Option** to open the Async Option panel (refer to Figure 4.27). The async options can only be modified when no TrueCopy – S/390® Asynchronous pairs or groups exist in the connected CU (M-VOLs or R-VOLs).

3. On the Async Option panel, select the desired parameters. For further information on the asynchronous copy options, see above and section 2.3.6.

4. Select **Set** to close the Async Option panel. (Select **Cancel** to cancel the async option operation.) The list view now displays the requested async option operation.

5. Verify the requested operation displayed in the list view (see Figure 4.28).

   To change the async option operation, select the operation, right-click, and select **Modify**. To remove the operation, select it, right-click, and select **Cancel All**.

6. To apply the settings, select **Apply** (lower right of TrueCopy – S/390® panel). To cancel the operation and return the list view to its original display, select **Cancel**.

| Pending Rate | Offloading | TSO Command |
|--------------|------------|-------------|
| 050 | 005 | Native |

**Figure 4.28    Verifying the Async Option Operation**

## 4.3.2   Adding Consistency Groups

The Add CT Group panel (see Figure 4.29) allows you to add consistency groups and select the options for the new groups. To open the Add CT Group panel, select the **Asynchronous Operations** tab, select **Display All** or **Not Used** in the outline view, select the group(s) to be added, right-click on the group(s), select **CT Group Operation**, and select **Add CT Group**.
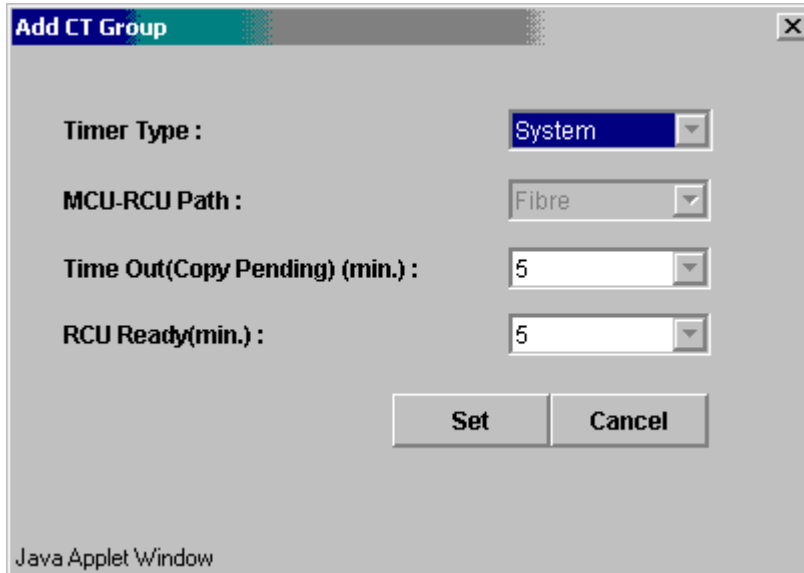


**Figure 4.29   Add CT Group Panel**

**Timer Type**: allows you to select the timer type option for the group:

- **System** = system timer (CPU TOD clock) provided by the I/O time-stamping function.

- **Local** = local timer (internal MCU TOD clock).

- **None** = system timer (CPU TOD clock) provided by the I/O time-stamping function. This timer type should only be selected when establishing TC390A pairs in the reverse direction (to copy from the secondary site back to the primary site). When **None** is selected, the MCU still acquires the time-stamp information from the host I/O time-stamping function.

**MCU-RCU Path**: allows you to select the port type for the remote copy connections.

**Time Out (Copy Pending) (min.)**:  allows you to select the maximum delay allowed for TrueCopy – S/390® Asynchronous copy (none or from 3 to 15 min., none = no timeout for copy pending). The default setting is five minutes. If the delay between the TC390 M-VOL update and the corresponding R-VOL update reaches the specified time, the RCU will suspend all R-VOLs in the group. A timeout occurs when the RCU was not able to settle a recordset within the specified time, or when the RCU has not had any communication from one of the MCUs in the group within the specified time.

*WARNING:* See step (9) below for instructions on selecting the correct **Time Out (Copy Pending)** setting for your operational environment.

**Time Out (RCU ready) (min.):** allows you to select the maximum delay allowed for re-establishing MCU-RCU communications following MCU power-off (none or from 1 to 10 min., none = no timeout for RCU ready). The default setting is five minutes. If the MCU is not able to re-establish communication with the RCU within the specified time, the MCU suspends all M-VOLs in the group.

To add one or more consistency groups to the connected MCU:

1. Make sure that the async options are configured as desired (see section 4.3.1).

2. Select the **Asynchronous Operations** tab, and select **Display All** or **Not Used** in the outline view to display the unused consistency groups in the list view.

3. Select the (unused) consistency group(s) that you want to add.

4. Right-click on the selected group(s), select **CT Group Operation**, and then select **Add CT Group** to open the Add CT Group panel (refer to Figure 4.29).

5. On the Add CT Group panel, select the desired port type and group options (copy pending timeout, RCU ready timeout). *Note:* You will not be able to modify the port type of the group, after you assign a pair to the group.

6. Select **Set** to close the Add CT Group panel. (Select **Cancel** to cancel the add group operations.) The list view now displays the requested add group operation(s).

7. Verify the requested operation(s) displayed in the list view (see Figure 4.30).

    To change one or more operations, select the operation(s), right-click, and select **Modify**. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click on the list, and select **Cancel All**.

8. To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.

9. If you are using TC390 Async in the n-to-1 configuration, reset the **Time Out (Copy Pending)** option as follows to avoid suspension of TC390 pairs due to timeout errors:

    a) Suspend all pairs in the group, so that you can change the group options.

    b) Select the group on the **Asynchronous Operations** tab, right-click and select **CT Group Operation → CT Group Option**, change the **Time Out (Copy Pending)** option to **None**, and select **Set**.

    c) Resume all pairs in the group, and then perform normal I/O operations to the M-VOLs in this group.

    d) Acquire the current TC390 async copy delay time by calculating the difference between the host I/O time-stamp information and the consistency time shown on the CT Group Status panel.

    e) Suspend all pairs in the group again, and set the **Time Out (Copy Pending)** group option to a value greater than the current copy delay time. If the value exceeds the maximum time (15 min.), reduce the host I/O rate, or set the option to **None**.

    f) Resume all pairs in the group.

| CTG | M-R Path | Time Out(Pending) | Time Out(Ready) |
|---|---|---|---|
| 08 | Fibre | 005 | 005 |

**Figure 4.30    Verifying the Add CT Group Operation**

### 4.3.3 Changing the Consistency Group Options

The CT Group Option panel (see Figure 4.31) allows you to change the group options for the existing consistency groups. To open the CT Group Option panel, select the **Asynchronous Operations** tab, select **Display All** or **Used** in the outline view, select the desired group(s), right-click on the group(s), select **CT Group Operation**, and then select **CT Group Option**.

*Note:* If you want to change the group options, you must suspend all pairs in the group first.
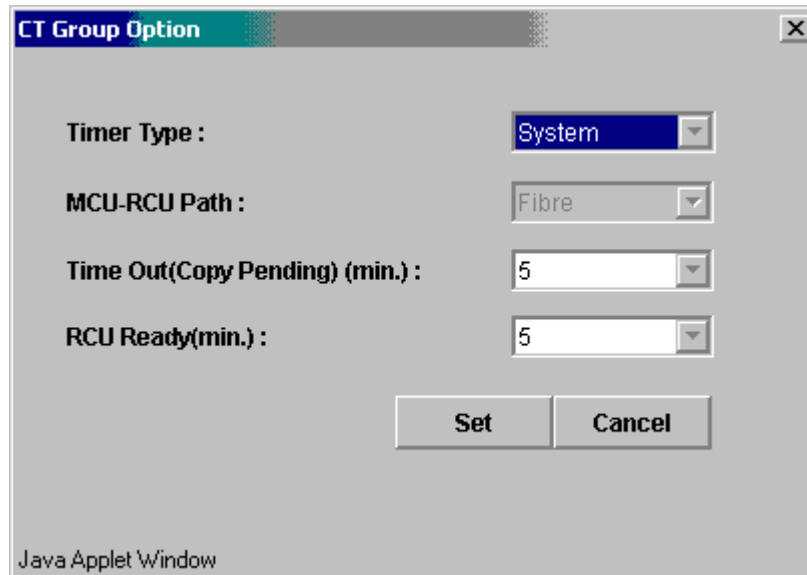


**Figure 4.31 CT Group Option Panel**

**Timer Type**: allows you to select the timer type option for the group:

- **System** = system timer (CPU TOD clock) provided by the I/O time-stamping function.
- **Local** = local timer (internal MCU TOD clock).
- **None** = system timer (CPU TOD clock) provided by the I/O time-stamping function. This timer type should only be selected when establishing TC390A pairs in the reverse direction (to copy from the secondary site back to the primary site). When **None** is selected, the MCU still acquires the time-stamp information from the host I/O time-stamping function.

**MCU-RCU Path**: allows you to select the port type for the remote copy connections. You can only change the port type when the group does not contain any pairs.

**Time Out (Copy Pending) (min.)**:  allows you to select the maximum delay allowed for TrueCopy – S/390® Asynchronous copy (none or from 1 to 15 min., none = no timeout for copy pending). The default setting is five minutes. If the delay between the TC390 M-VOL update and the corresponding R-VOL update reaches the specified time, the RCU will suspend all R-VOLs in the group. A timeout occurs when the RCU was not able to settle a recordset within the specified time, or when the RCU has not had any communication from one of the MCUs in the group within the specified time.

*WARNING:* See step (9) in section 4.3.2 (adding a group) for instructions on selecting the correct **Time Out (Copy Pending)** setting for your operational environment.

**Time Out (RCU ready) (min.)**: allows you to select the maximum delay allowed for re-establishing MCU-RCU communications following MCU power-off (none or from 1 to 10 min., none = no timeout for RCU ready). The default setting is five minutes. If the MCU is not able to re-establish communication with the RCU within the specified time, the MCU suspends all M-VOLs in the group.

To change the group options for one or more groups:

1. Make sure that all pairs in the group(s) have been suspended, so that you can change the group options. See section 5.6 for instructions on suspending pairs.

2. Select the **Asynchronous Operations** tab, and select **Display All** or **Used** in the outline view to display the existing consistency groups in the list view.

3. Select the consistency group(s) for which you want to change the options. You can only select groups for which the connected subsystem is the MCU (**This CU Type** = **MCU**).

4. Right-click on the selected group(s), select **CT Group Operation**, and then select **CT Group Option** to open the CT Group Option panel (refer to Figure 4.31). If the **CT Group Option** command is not enabled, you need to suspend the remaining pairs in this group.

5. On the CT Group Option panel, select the desired group options. For further information on the consistency group options, see above and section 2.4.1. You can only change the port type when the group does not contain any pairs.

   *WARNING:* See step (9) in section 4.3.2 (adding a group) for instructions on selecting the correct **Time Out (Copy Pending)** setting for your operational environment.

6. Select **Set** to close the CT Group Option panel. (Select **Cancel** to cancel the group option operation.) The list view now displays the requested change group option operation(s).

7. Verify the requested operation(s) displayed in the list view (see Figure 4.32).

   To change the group option operation(s), select the operation(s), right-click, and select **Modify**. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click on the list, and select **Cancel All**.

8. To apply the settings, select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.
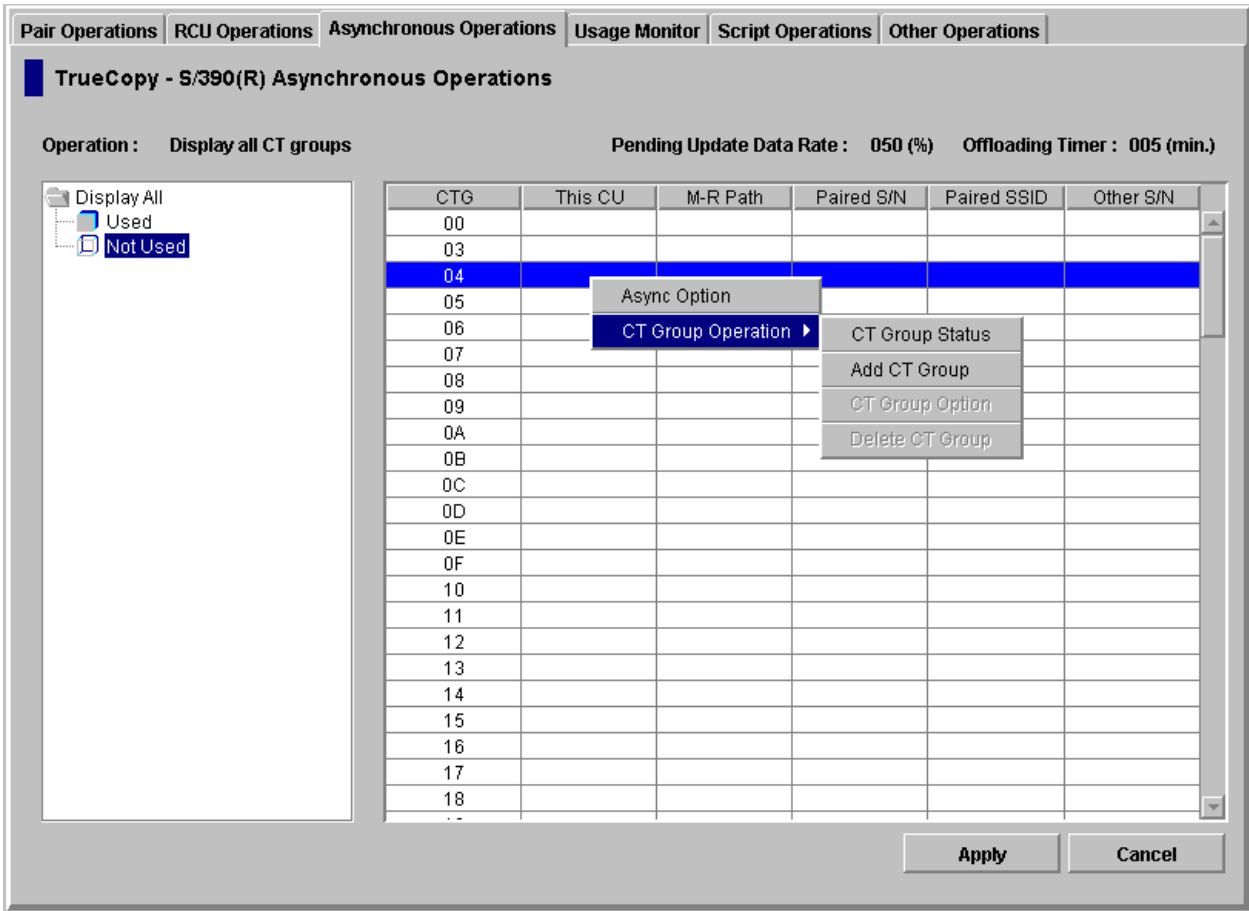
9. When you are finished changing the CT group options, you can resume all pairs in the group(s). See section 5.7 for instructions on resuming pairs.

| CTG | M-R Path | Time Out(Pending) | Time Out(Ready) | Timer |
|-----|----------|-------------------|-----------------|-------|
| 05  | Fibre    | 005               | 005             | System |

**Figure 4.32    Verifying the CT Group Option Operation**

### 4.3.4 Viewing Consistency Group Status

The CT Group Status panel (see Figure 4.33) displays the detailed status information for the selected TrueCopy – S/390® Asynchronous consistency group.

To view the detailed consistency group status information:

1. Select the **RCU Operations** tab, and select **Display All** or **Used** in the outline view.

2. Select the desired CT group in the list view. *Note:* Select only one consistency group.

3. Right-click on the group, select **CT Group Operation**, and then select **CT Group Status** to open the CT Group Status panel.
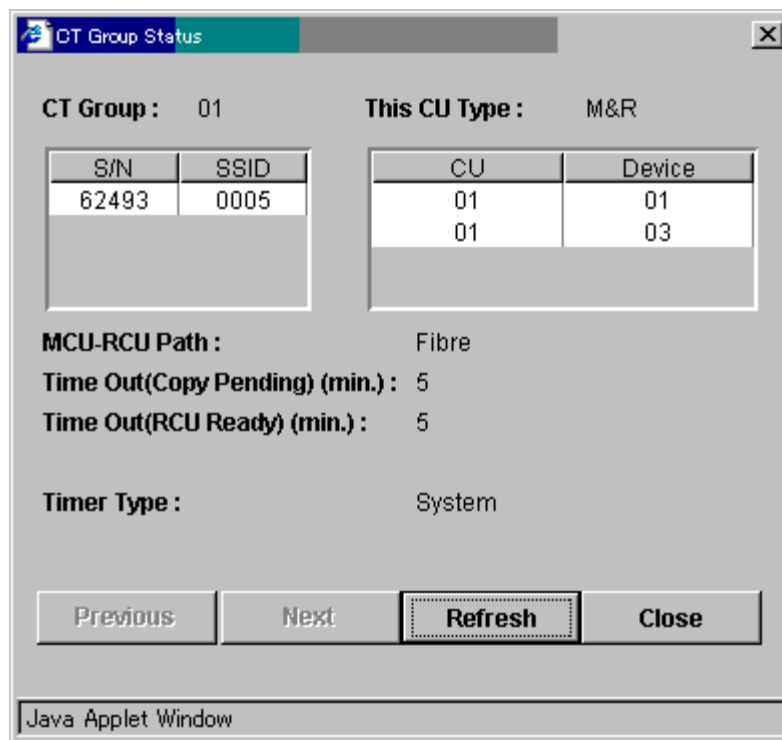


**Figure 4.33   CT Group Status Panel**

**CT Group**:  Group number of the selected consistency group.

**This CU Type**:  CU type (MCU or RCU) of the selected consistency group.

**S/N**, **SSID**:  Serial number and SSID of the CUs of the selected consistency group.

**CU**, **Device**:  Pairs in the connected CU that are in the selected consistency group.

**MCU-RCU Path**:  Type of channel interface between the subsystems (fibre or serial).

**Time Out (Copy Pending)**:  Maximum delay allowed for TrueCopy – S/390® Asynchronous copy (see section 4.3.3).

**Time Out (RCU Ready)**:  Maximum delay allowed for re-establishing MCU-RCU communications following MCU power-off (see section 4.3.3).

**Timer Type**:  Timer type of this group.

**SEQCHK: Yes**  indicates that at least one pair of this group has SEQCHK status.

> *Note:* The RCU manages the C/T and SEQCHK status, and the MCU acquires these from the RCU. If MCU-RCU communications are down, the MCU may not display the latest C/T and SEQCHK information. Always use the group status and R-VOL status displayed at the RCU for disaster recovery.

> *Note:* The SEQCHK status is also displayed as a pair status. To determine exactly which pair(s) in the group has the SEQCHK status, check the R-VOL pair status at the RCU.

The **Previous** button displays status information for the consistency group number before the current consistency group. The **Next** button displays status information for the CT group after the current group. The **Refresh** button refreshes the status information.

### 4.3.5  Deleting Consistency Groups

A consistency group can be deleted only from the MCU and only if the MCU does not contain any M-VOLs still assigned to the group. Deleting a consistency group from an MCU does not affect the consistency groups registered at other MCUs. The RCU will automatically delete a consistency group when the last volume pair in the group is deleted.

The **CT Group Operation→Delete CT Group** command allows you to delete a group from the current MCU. The MCU will not allow you to delete a group which still has M-VOLs in the current MCU.

To delete one or more consistency groups from an MCU:

1.  Make sure that all affected TrueCopy – S/390® Asynchronous pairs have been deleted.

2.  Select the **Asynchronous Operations** tab, and select **Display All** or **Used** in the outline view.

3.  Select the consistency group(s) that you want to delete. You can only delete consistency groups from the MCU (**This CU Type** = MCU).

4.  Right-click on the RCU, select **CT Group Operation**, and then select **Delete CT Group**. The list view now displays the requested delete group operation(s). If the **Delete CT Group** command is not enabled, one of the groups still contains M-VOLs in this MCU.

5.  Verify the requested operation(s) displayed in the list view. To remove one or more delete group operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click, and select **Cancel All**.

6.  To delete the group(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel the operation(s) and return the list view to its original display, select **Cancel**.

## 4.4    Usage Monitor Operations

The **Usage Monitor** tab allows you to perform the remote copy usage monitoring operations for the connected 9900V subsystem. The remote copy usage monitoring function enables you to collect I/O statistics for all LDEVs on the connected subsystem.

The usage monitor operations are:

- Starting monitoring (see section 4.4.1),

- Viewing the monitoring status (see section 4.4.2),

- Exporting the usage monitor data file (see section 4.4.3), and

- Stopping monitoring (see section 4.4.4).

*Note:* The graph display function will be supported in a future release.


## 4.4.1    Starting Monitoring

At each data sampling time interval, the usage monitoring function collects 480 pieces of data for each LDEV and up to 16,385 pieces of data for the entire subsystem.

To start remote copy usage monitoring for the connected 9900V subsystem:

1.  Select the **Usage Monitoring** tab.

2.  Enter the desired sampling time interval (in minutes) in the **Rate** box. You can enter from 1 to 546 minutes. A rate of five minutes or more is recommended.

3.  Select **Run** in the **Operation** box.

4.  To start monitoring, select **Apply** (lower right of TrueCopy – S/390® panel). To cancel your settings and return the panel to its original display, select **Cancel**.
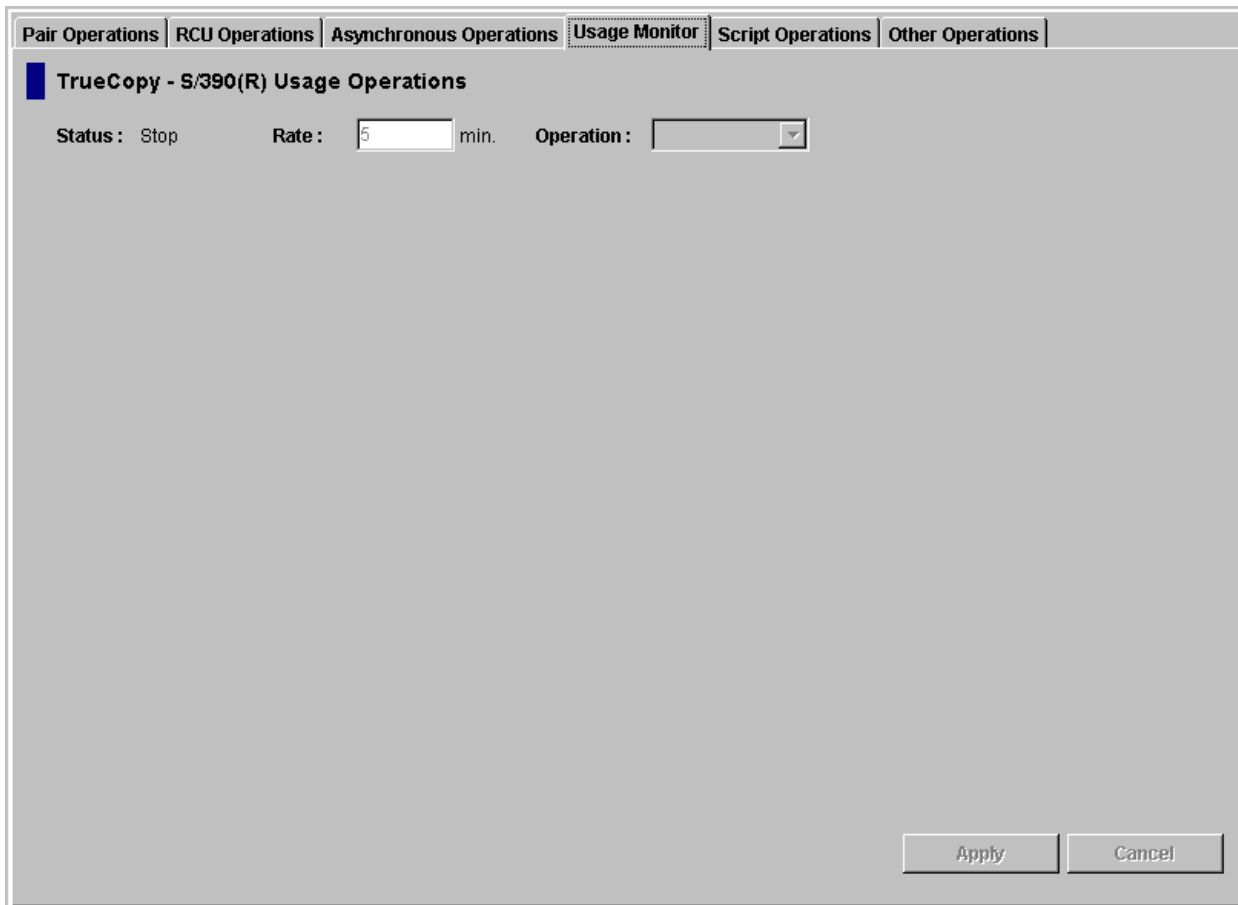
**Figure 4.34   Usage Operations Panel**

## 4.4.2   Viewing the Monitoring Status

The **Status** field on the **Usage Monitor** tab displays the current monitoring status:

- **Running**:  Monitoring is in process. The sampling interval is displayed in the **Rate** box.

- **Stop**:  Monitoring is stopped. The default value (5) is displayed in the **Rate** box.

## 4.4.3   Exporting the Usage Monitor Data File

The **Export File** button (⊞) on the Hitachi Remote Console – Storage Navigator main panel allows you to export the usage monitoring data file.

To export the usage monitoring data file:

1.   Select the **Usage Monitor** tab.

2.   Select the **Export File** button (⊞) on the Hitachi Remote Console – Storage Navigator main panel to open the Export Data Files panel (see Figure 4.35).

3. On the Export Data Files panel, select **Remote Copy Usage**. Only one button can be selected on the Export Data Files panel.

4. Click **Next>>** to open the Remote Copy Usage panel (see Figure 4.36, Figure 4.37).

5. Download the remote copy usage monitor file as follows:

   – When you are downloading the usage monitor file for the first time, select **Export Data** (see Figure 4.36), and then select **Download**.

   – After you have downloaded the usage monitor file at least once, select **Existing Export Data** (see Figure 4.37), and then select **Download**.

6. On the File Download confirmation panel, select **OK** to start the file compression process (or select **Cancel** to cancel your download request). The Compressing Files panel displays the progress of the file compression operation.

   *Note:* When other users are using the File Export or FD Dump function, an error occurs for this operation.

   *Note:* If file compression takes too long, the browser may time out. Close the Compressing Files panel (close (❌) button), and restart the export operation (step 2).

   *Note:* If you accidentally select **Cancel** during file compression, close the Compressing Files panel, wait a while, and download the file again (select **Existing Export Data**).

7. Select **OK** on the File Download panel to open the Save As panel (or select **Cancel** to cancel your request to export the file).

8. On the Save As panel, enter the desired name and location for the export file, and select **Save** (or select **Cancel** to cancel your request to export the file).

*Note:* The File Export function is a browser application, so each operation panel exists individually. Other panel operations are available during file export operations.

**Figure 4.35    Export Data Files Panel**
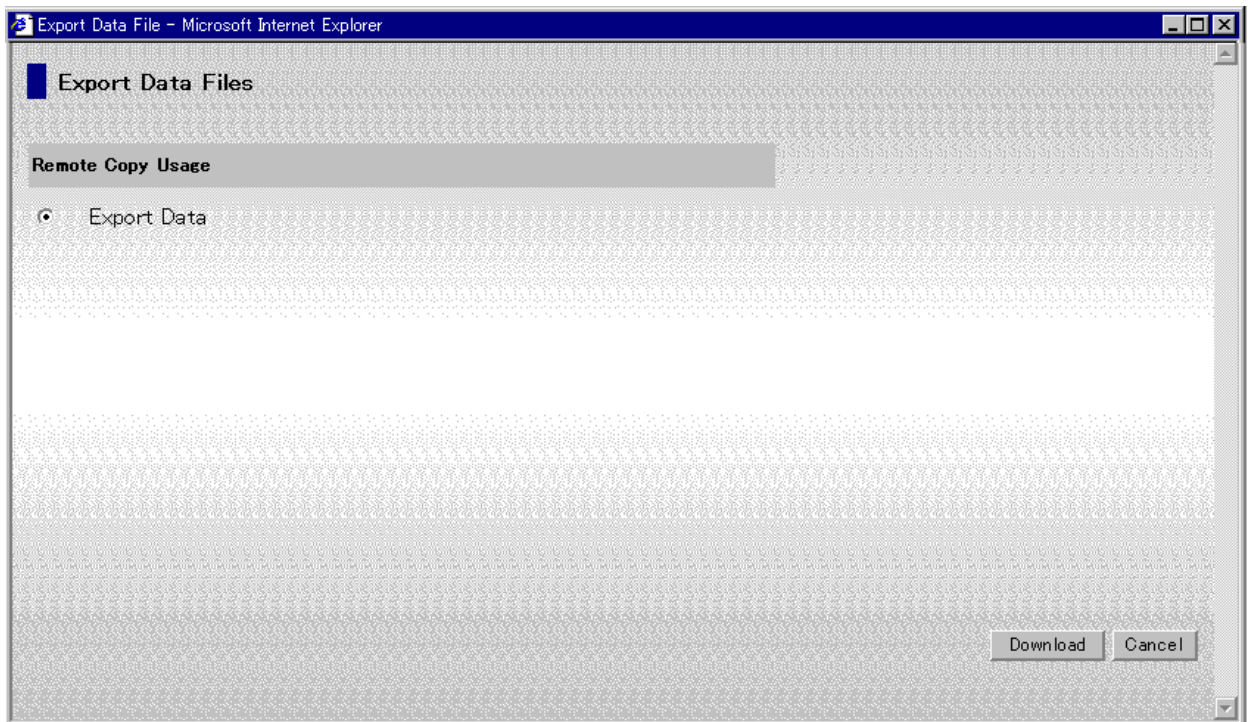


**Figure 4.36    Export Data Files – Remote Copy Usage (first export operation shown)**
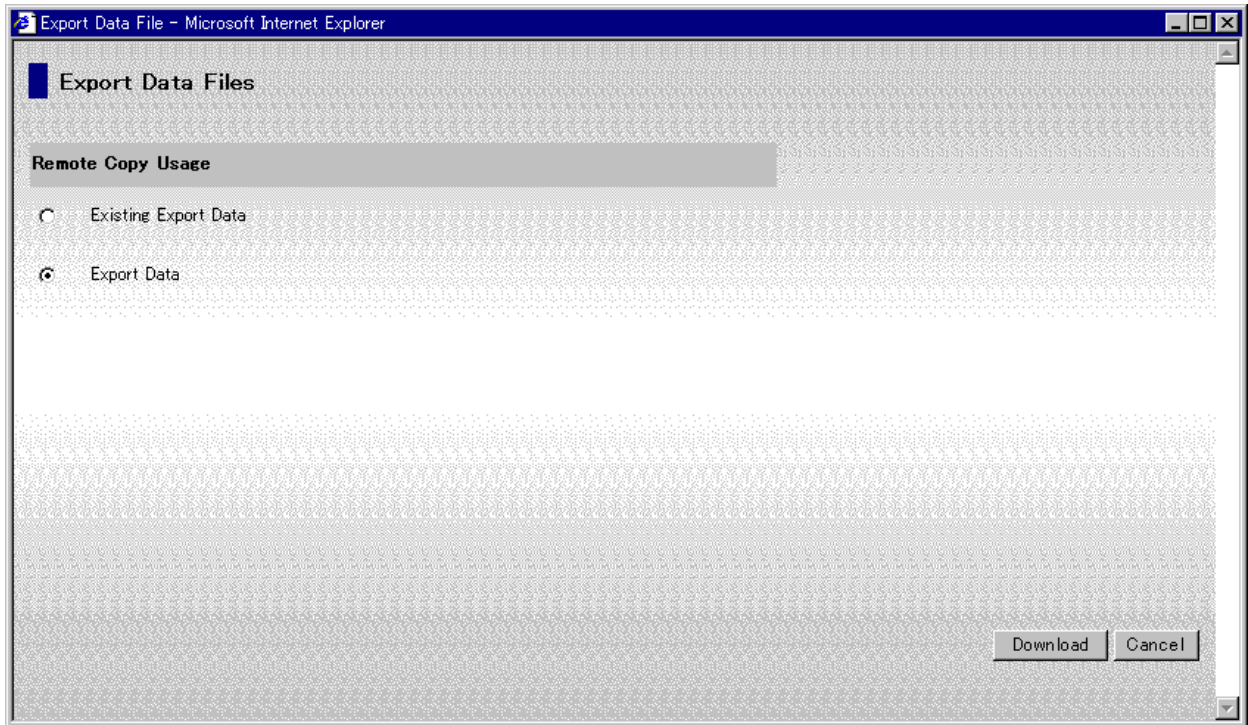
**Figure 4.37    Export Data Files – Remote Copy Usage**

## 4.4.4    Stopping Monitoring

To stop remote copy usage monitoring on the connected 9900V subsystem:

1.  Select the **Usage Monitor** tab.

2.  Select **Stop** in the **Operation** box.

3.  To stop monitoring, select **Apply** (lower right of TrueCopy – S/390® panel). To cancel your setting and return the panel to its original display, select **Cancel**.

## 4.5    Script Operations

The TC390 Remote Console software supports scripting for managing pre-defined TC390 operations. The TC390 scripting function enables you to define multiple TC390 operations in a text file that the TC390 Remote Console software reads and executes as a batch file. Scripting allows you to perform a series of TC390 operations without having to issue the commands separately. Using TC390 scripting, you can set up and execute a large number of TC390 commands within a short period of time. The TC390 scripting function enables you to:

■    save time by executing multiple TC390 operations with a single command,

■    run a series of predefined and tested TC390 operations after hours or overnight, and/or

■    allow a non-resident system administrator to set up and start an entire day's worth of TC390 operations in the limited time that the administrator is on-site.

*Caution:* Do not perform TC390 operations using the TrueCopy – S/390® main panel while the scripting function is being executed. To perform operations on the TrueCopy – S/390® main panel, wait until the script is complete, or make sure that the script in execution is aborted.

The **Script Operations** tab (see Figure 4.38) displays information for the script being executed. This section describes the selection and execution of an existing TC390 script file. Appendix D describes and specifies the requirements for TrueCopy – S/390® script files.
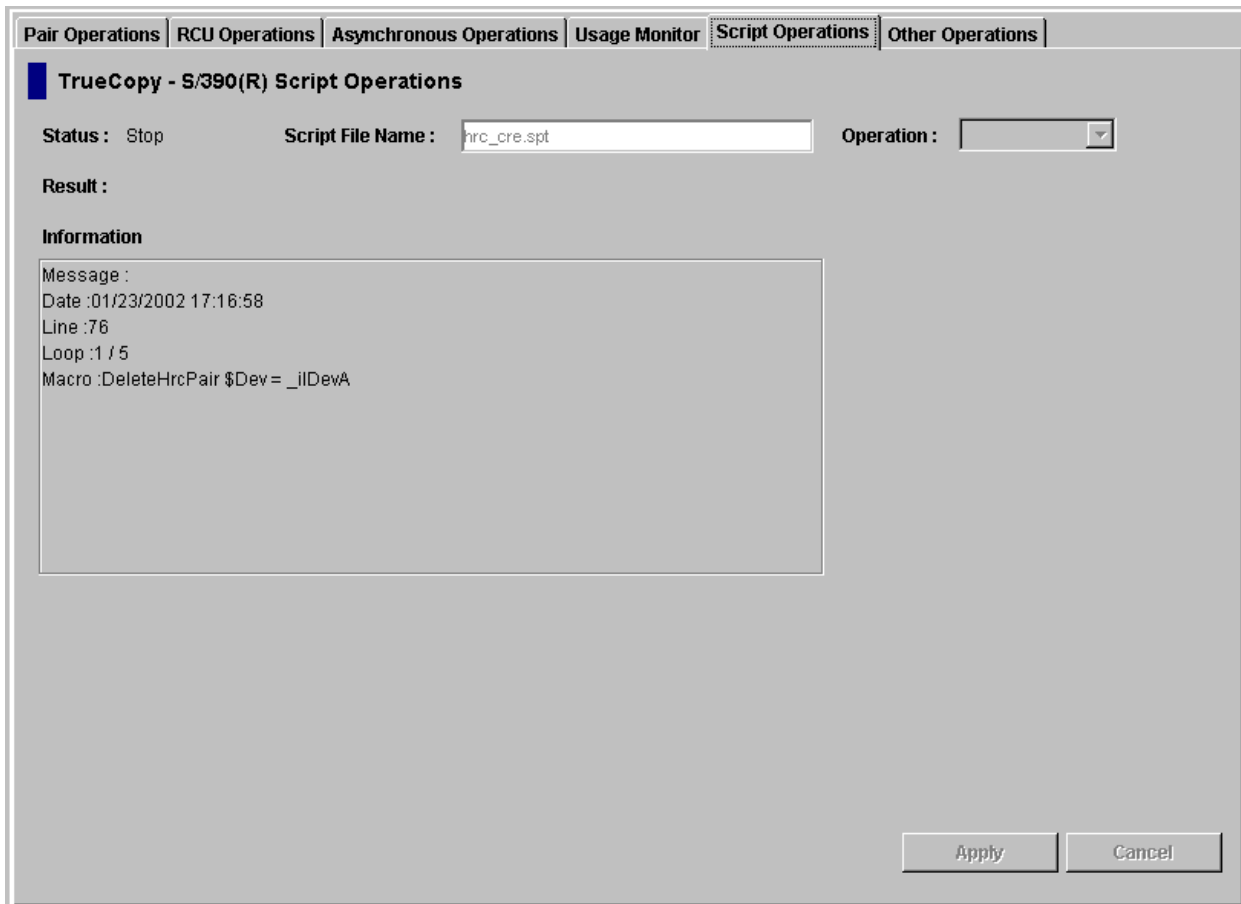


**Figure 4.38    Script Operations Tab (showing script in execution)**

**Status**: displays the status of script execution. To update the script status information, select the **Refresh** button (  ) (top right of Remote Console panel).

- **Stop**:  a script has not yet been executed, or script execution has been completed.
- **Analyzing**:  the script analysis operation is running.
- **Running**:  the script is running.

**Script File Name**: allows you to enter the name of the TC390 script file to be executed. The script file name can have up to eight characters, and the file extension must be **.spt**.

**Operation**: allows you to run/stop the specified script file. The TrueCopy – S/390® software must be in Modify mode.

- **Run**:  Run the TC390 script file specified in the **Script File Name** field. If a script file is currently running, **Run** cannot be selected.
- **Stop**:  Stop the TC390 script file being executed. The script operation is stopped on the script line basis. If script execution has been completed, **Stop** cannot be selected.

**Result**: displays the error code (four-digit hexadecimal number).

**Information**: displays the script information.

- **Message**:  displayed when script execution has been completed. **Normal End** indicates that the operation completed normally. When the script ended abnormally due to an error in the script file, a message indicating the abnormal end is displayed. When the script is stopped by the Stop command, **Abort by operator** is displayed.
- **Date**:  The date when the script status changed.
- **Line**:  The script file line number being executed.
- **Loop**:  The current/total repetition count for a looped command (e.g., 150/300).
- **Macro**:  The macro being executed. Macros which execute a process for a device are listed:  CreateHrcPair, ChangeHrcPair, SuspendHrcPair, ResumeHrcPair, and DeleteHrcPair.

## 4.5.1 Exporting the Script Trace Files

The **Export File** button (🖫) on the Hitachi Remote Console – Storage Navigator main panel allows you to export the TrueCopy – S/390® script trace files.

The downloaded compressed file (**Script.lzh**) includes two files: the macro trace file (MACRO.TRC), and the error trace file (ERROR.TRC) (ERROR.TRC is generated only when an error occurred). MACRO.TRC traces the macros used (see Figure 4.39). Table 4.3 describes the contents of the macro trace file. ERROR.TRC details the errors that occurred while running scripts (see Figure 4.40). Table 4.4 describes the contents of the error trace file.
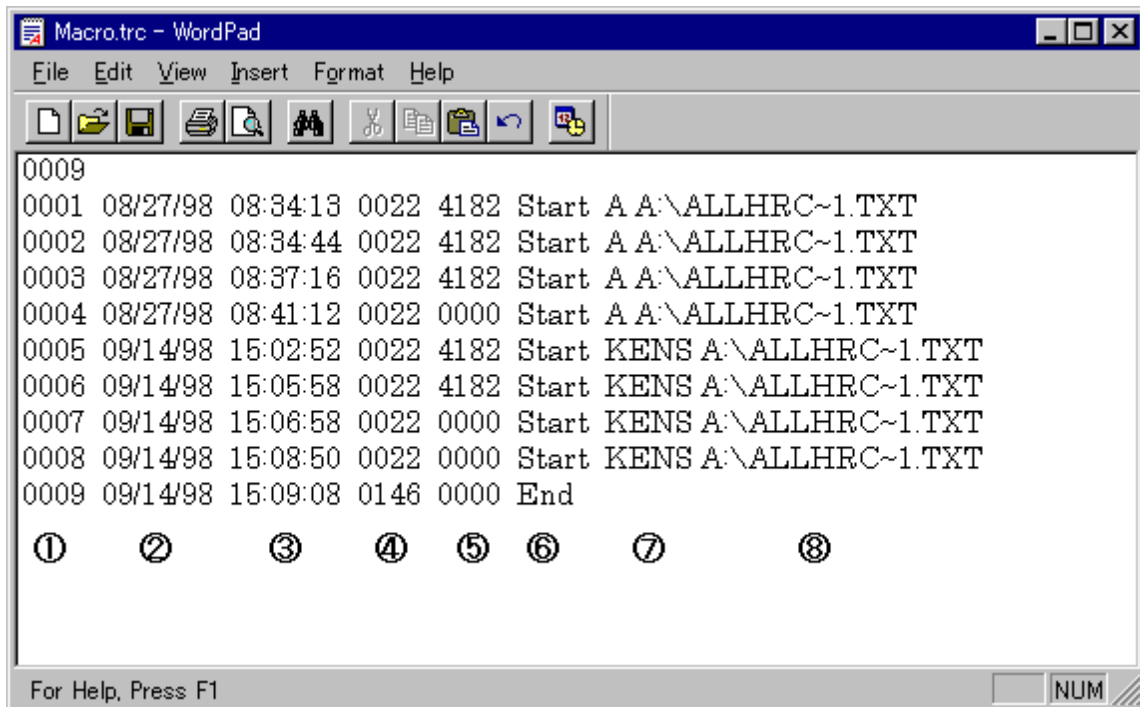


**Figure 4.39    Macro Trace File**

**Table 4.3    Macro Trace File Information**

| Number | Description |
|---|---|
| ① | All macros executed by TC390 are listed in chronological order and n②umbered. |
| ② | The date that the macro was executed. |
| ③ | The time that the macro was executed. |
| ④ | The location (script file line number) of the macro. |
| ⑤ | The TC390 scripting error code (0000 = no error). See Table D.18 (Appendix D) for scripting error codes. |
| ⑥ | The last registered status of the macro. If the macro was not completed, the last registered status is **Start**. If the macro was completed successfully, the last registered status is **End**. |
| ⑦ | The name of the 9900V subsystem (usually MCU of specified TC390 operation). |
| ⑧ | The name and location of the script file containing the specified macro. |
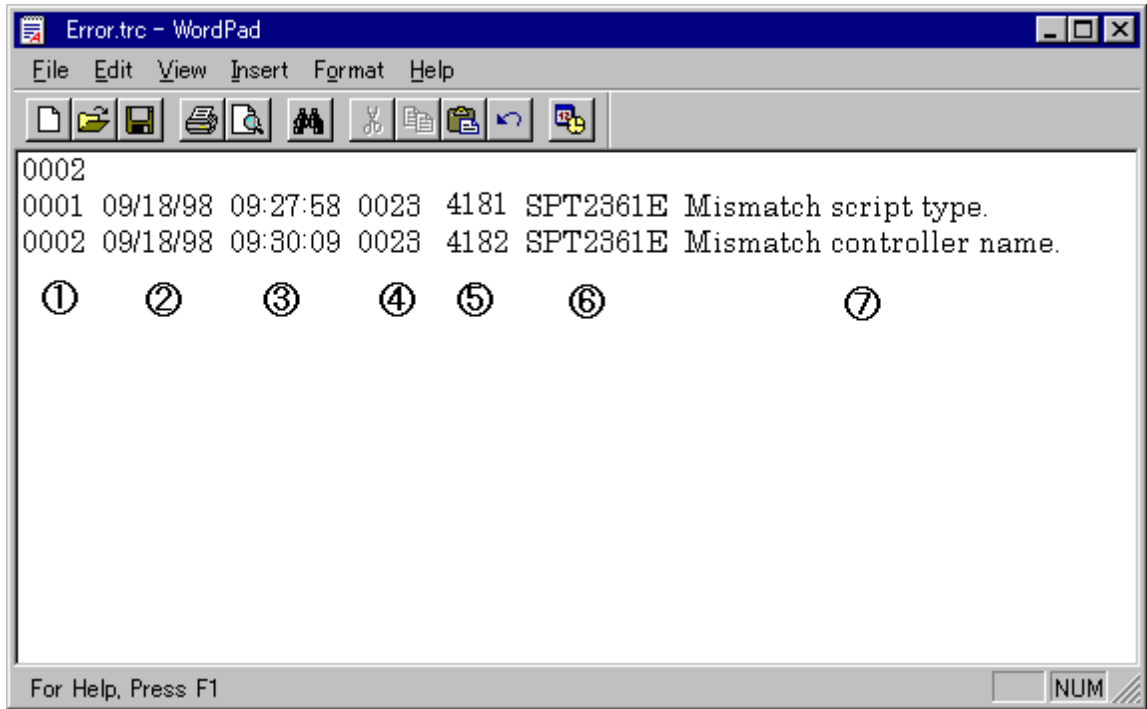
**Figure 4.40    Error Trace File**

**Table 4.4      Error Trace File Information**

| Number | Description |
|--------|-------------|
| ① | All macro errors encountered by TC390 are listed in chronological order and numbered. |
| ② | The date that the macro error occurred. |
| ③ | The time that the macro error occurred. |
| ④ | The location (script file line number) of the macro that caused the error. |
| ⑤ | The TC390 scripting error code (see Table D.18 in Appendix D). |
| ⑥ | The TC390 scripting error code message ID (see Table D.18 in Appendix D). |
| ⑦ | Brief description of the error. |

To export the script trace files:

1. Select the **Usage Monitor** tab.

2. Select the **Export File** button (🖫) on the Hitachi Remote Console – Storage Navigator main panel to open the Export Data Files panel (see Figure 4.35).

3. On the Export Data Files panel, select **Remote Copy Script**. Only one button can be selected on the Export Data Files panel.

4. Click **Next>>** to open the Remote Copy Script panel (see Figure 4.36, Figure 4.37).

5. To download the script trace files, select **Existing Export Data** (see Figure 4.37) (or select **Export Data** if you are downloading script trace files for the first time), and then select **Download**.

6. On the File Download confirmation panel, select **OK** to start the file compression process (or select **Cancel** to cancel your download request). The Compressing Files panel displays the progress of the file compression operation.

   *Note:* When other users are using the File Export or FD Dump function, an error occurs for this operation.

   *Note:* If file compression takes too long, the browser may time out. Close the Compressing Files panel (close (❌) button), and restart the export operation (step 2).

   *Note:* If you accidentally select **Cancel** during file compression, close the Compressing Files panel, wait a while, and download the file again (select **Existing Export Data**).

7. Select **OK** on the File Download panel to open the Save As panel (or select **Cancel** to cancel your request to export the file).

8. On the Save As panel, enter the desired name and location for the export file, and select **Save** (or select **Cancel** to cancel your request to export the file).

*Note:* The File Export function is a browser application, so each operation panel exists individually. Other panel operations are available during file export operations.

**Figure 4.41    Export Data Files Panel**
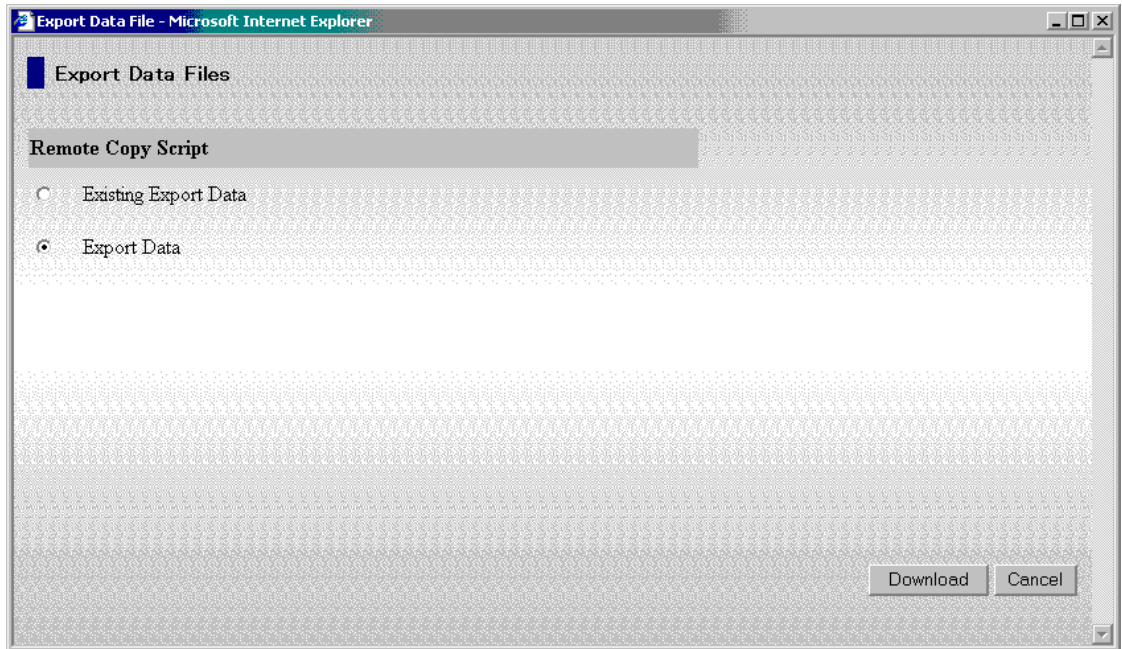


**Figure 4.42    Export Data Files – Remote Copy Script**

## 4.6    Other Operations

The **Other Operations** tab allows you to clear the remote copy SIMs for the connected Lightning 9900™ V Series subsystem.

### 4.6.1    Clearing SIMs

The **Clear SIM** button on the **Other Operations** tab allows you to clear all remote copy SIMs (service information messages) from the connected subsystem. Remote copy SIMs include all SIMs issued for TrueCopy – S/390® and TrueCopy operations.

The clear SIM function is intended for use during disaster recovery operations, while switching operations to the remote (secondary) backup site. Please see section 6.2 for specific instructions on clearing remote copy SIMs during disaster recovery operations.

To clear all remote copy SIMs from the connected 9900V subsystem:

1.  Select the **Other Operations** tab, and then select the **Clear SIM** button.

2.  On the Clear SIM confirmation panel, select **Yes** to clear all remote copy SIMs from the connected subsystem, or select **No** to cancel your request to clear SIMs.

3.  If you selected **Yes**, the subsystem verifies that the existing SIMs are being cleared.

    *Note:* When all SIMs have been cleared, the subsystem MESSAGE lamp on the 9900V control panel turns off. This may take up to 30 minutes. If there are any existing SIMs which are not related to remote copy operations, the MESSAGE lamp will not turn off.

■ **TrueCopy - S/390(R) Other Operations**

Operation :    No Operation

Clear SIM

Apply          Cancel
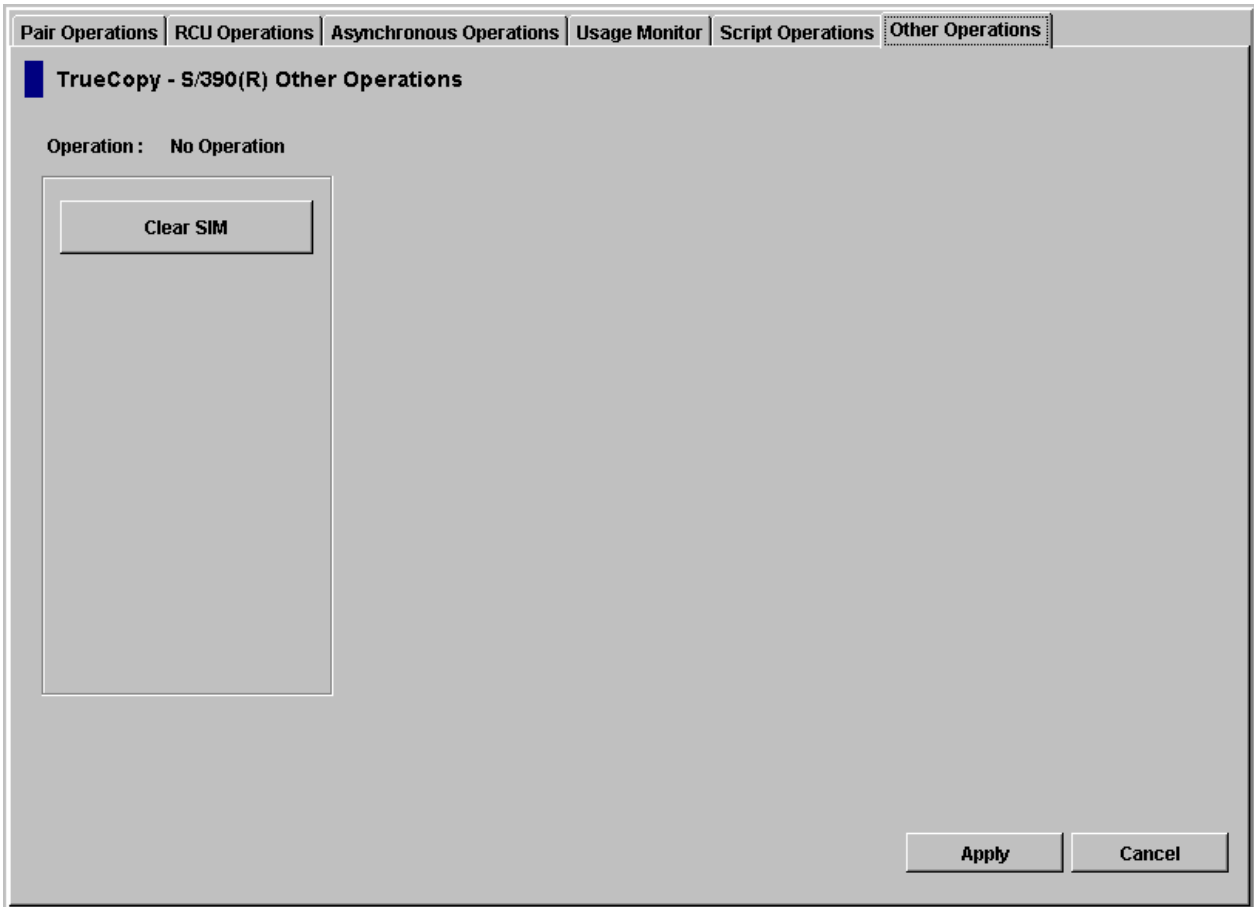
**Figure 4.43    Clearing Remote Copy SIMs**

## 4.7    Optimizing TrueCopy – S/390® Operations and Subsystem Performance

All TC390 operations result in increased utilization of the 9900V subsystem's channel resources because of the additional write (remote copy) operations to the secondary volumes. The TC390 update copy mode (synchronous or asynchronous) determines exactly how the remote copy operations will impact subsystem performance as follows:

- **Synchronous** copy mode (TC390 Synchronous) has an additional effect on subsystem performance:  increased service and disconnect time for write I/Os to TC390 M-VOLs due to the delay between channel-end and device-end. The length of this delay increases as the distance between the M-VOL and R-VOL increases, so that the longest delay occurs when the main and remote volumes are the maximum distance apart.

- **Asynchronous** copy mode (TC390A) eliminates all delays associated with TC390 Synchronous operations while providing increased protections for write-dependent applications in the event of a disaster. Write I/Os for TC390A M-VOLs are processed in the same way as writes for simplex volumes, without any increase in service or disconnect time. The asynchronous R-VOL updates are performed completely independent of all host I/O processes at the M-VOLs, and there are no restrictions on subsequent read/write operations to TC390A M-VOLs. The only performance concerns for TC390A are ensuring that adequate cache resources are available for sidefiles which are used to store the recordsets at both the MCUs and RCUs, and ensuring that sufficient ESCON® paths are defined for copy operations.

In addition to the TC390 update copy mode, several other factors can also affect 9900V subsystem performance. You can optimize both the TC390 operations and the I/O performance of the subsystems by analyzing workloads and addressing system-level conditions (e.g., number of ESCON® paths) which can affect subsystem performance. You can also control the impact of TC390 operations on subsystem performance by selecting the appropriate RCU options for each MCU (see section 4.2.3) and the appropriate update copy mode (synchronous or asynchronous) and pair options (see section 5.3.2) for each TC390 pair. In addition, you can upgrade the TC390 hardware components and/or adjust the configuration of the components to improve subsystem performance under a wide range of operating conditions. Table 4.5 lists some of the conditions which affect subsystem performance and provides recommendations for addressing these conditions.

**Table 4.5    Optimizing TrueCopy – S/390® Operations and 9900V Performance**

| Condition | Description | Recommendation(s) |
|---|---|---|
| Write-intensive workloads | Write-intensive workloads, such as SPOOL volumes and database logging volumes, can have a significant impact on subsystem I/O response times. | Spread write-intensive data across several volumes to minimize queuing. |
| Large block size | Workloads with large write block sizes, such as DB2® deferred writes, can impact performance. | Spread workloads with large write block sizes across several volumes. |
| High host channel demand | The demand on the MCU's host channels can affect performance. | Spread the workload across several disk subsystems to utilize additional channels. |
| Sequential write operations | TC390 operations can have a negative impact on workloads with a high percentage of sequential write operations, such as batch processing operations (e.g., dump/restore, sort operations). | Avoid performing restore operations to volumes which belong to TC390 pairs. Instead, restore data to a scratch volume and then establish the TC390 volume pair. |
| Cache size | Large cache size improves read hit performance, which allows more subsystem resources to be devoted to write operations. The resulting performance improvement can offset some or all of the performance loss due to the TC390 remote copy operations. TC390A, HXRC, and Concurrent Copy (CC) require additional cache for sidefile data. Insufficient cache resources can result in command retries, SCP notifications, and puncture conditions. | Consider increasing the cache size of the TC390 subsystems to handle TC390A, HXRC, and CC sidefile operations and to improve overall subsystem performance. For best results, the cache and NVS capacity of the main and remote subsystems should be the same (for TC390A the RCU sidefile requirements are 2x that of the MCU) to enable the remote site to function adequately during disaster recovery. |
| RCU capacity | The performance of the RCUs directly affects the performance of the MCUs. If an RCU becomes overloaded with heavy update activity, MCU and system performance can also be degraded. | Distribute TC390 remote copy operations among several remote subsystems to avoid overloading any one RCU. |
| ESCON® paths | An inadequate number of ESCON® paths may decrease subsystem performance. Performing TC390 Synchronous operations over long distances can also degrade subsystem performance. TC390A is recommended for long distances. | Make sure to install an adequate number of ESCON® paths between the main and remote subsystems. This is especially important for subsystems which contain both M-VOLs and R-VOLs. |

## 4.8    Discontinuing TrueCopy – S/390® Operations

If you plan to use TC390 for nondisruptive data migration or duplication (see section 5.10), you will configure and establish TC390 operations, allow TC390 to synchronize the volumes, redirect application I/Os (if migrating), and then discontinue TC390 operations. When you are ready to discontinue TC390 operations, you will need to perform TC390 operations in the correct order to avoid generating error messages. For example, TC390 will not allow you to delete an RCU path until you have deleted all TC390 pairs still using that path, and you cannot delete a group until you have deleted all TC390A pairs in that group from the MCU.

To discontinue all TC390 operations, perform the following actions in the following order:

1.  First delete all TC390 pairs from the MCU(s) (see section 5.8). For TC390A pairs, you can use the **Delete Range-Group** option to delete all pairs in a group using one operation. Verify that the pair status has changed to *simplex* for all TC390 volumes before continuing.

2.  Delete the TC390A group(s) from the MCU(s) (see section 4.3.5). The RCU will automatically delete a group when all pairs in the group have been deleted.

3.  Delete the RCUs (see section 4.2.7). Check each CU image of each MCU to make sure that all RCUs have been deleted before continuing. *Note:* If SVP mode 114 is enabled, you can use the CDELPATH TSO command to delete the RCUs and automatically reset the ports.

4.  Remove the remote copy connections (physical paths). If you are not familiar with the operation of the remote copy hardware components (e.g., switches, ESCON® directors, repeaters), please call the Hitachi Data Systems Support Center for assistance.

5.  At the MCU(s), reset the 9900V initiator port(s) to ordinary target(s) and the RCP(s) to LCP(s) (see section 4.2.1). At the RCU(s), reset the 9900V RCU target port(s) to ordinary target(s). *Note:* If you used the CDELPATH TSO command to delete the RCUs, the 9900V automatically reset each port after the last path to an RCU was deleted.

*Note:* For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager.

# Chapter 5 Performing TrueCopy – S/390® Pair Operations

## 5.1 Preparing for TrueCopy – S/390® Volume Pair Operations

Before starting TC390 operations, you must consider the relative importance of subsystem I/O performance and disaster recovery preparation. TC390 operations can affect the I/O performance of the MCUs and RCUs (see section 4.7). TC390 provides many options (RCU options, initial copy options, pair options, group options, and async options) which allow you to control the impact of TC390 operations on subsystem I/O performance. These options can be set separately for each TC390 pair, for each TC390A group, and for each MCU to provide maximum flexibility. You can select options which minimize the impact of TC390 operations on subsystem performance, or options which maximize the effectiveness of TC390 operations to ensure the best level of backup data integrity. System-level factors (e.g., number of ESCON® paths) can also affect TC390 operations and subsystem performance (Table 4.5).

For TC390 disaster recovery operations, you should make sure that the RCUs are attached to a host processor to enable reporting of sense information and transfer of ERC information. If the remote site is unattended, you should attach the RCUs to a host processor at the main site, so that the system administrator can monitor the operational condition of the RCUs.

To prepare for TC390 volume pair operations, you need to identify the volumes (by LDEV ID) for which you want to establish TC390 remote copy operations. You should identify not only the volumes which contain the important data to be backed up (e.g., DB2® log files), but also the volumes which contain the catalog and control datasets (i.e., master catalog, key user catalogs, system control datasets). Copying these datasets to the remote site will enable faster disaster recovery than maintaining a current version of these files at the remote site. For large databases which span multiple volumes and even multiple 9900V subsystems, you should plan to establish a TC390A consistency group for each database, so that the update sequence consistency of the database can be ensured at the remote site.

You can start establishing the TC390 volume pairs as soon as you have:

- Identified the volumes which will become the TC390 M-VOLs and R-VOLs,
- Ensured that all system and TC390 requirements have been met (sections 3.1 and 3.2),
- Completed hardware and software installation (sections 3.3 and 3.4),
- Configured the MCUs and RCUs for TC390 operations (section 3.5).
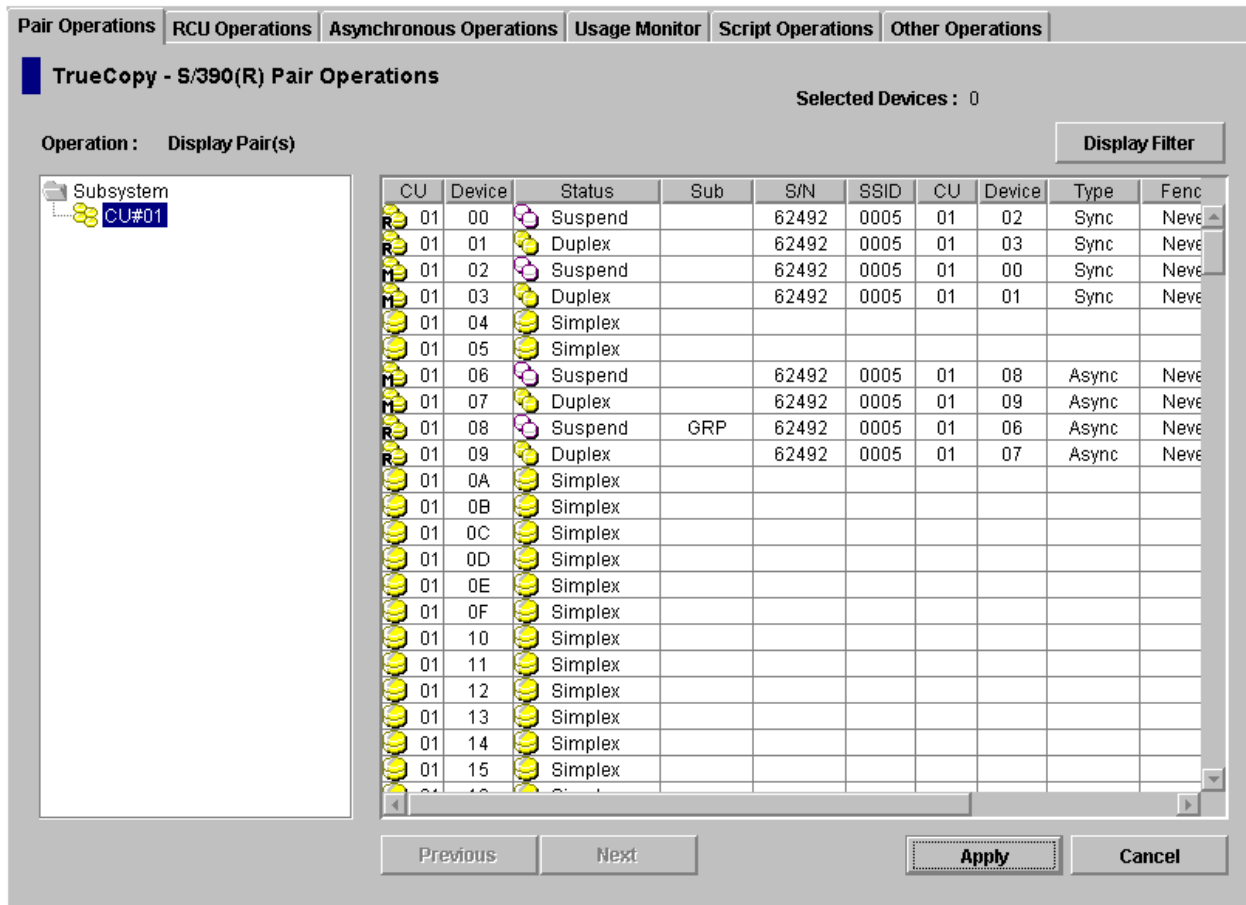
*Note:* TrueCopy – S/390® and ShadowImage can function together in the same 9900V subsystem to provide both internal and remote backup for your important data. If you are planning to combine TC390 and ShadowImage, please read the important configuration information in section 3.6.

If you will be using the TrueCopy – S/390® Remote Console software to perform TC390 operations, the MCU of each TC390 volume pair must be LAN-attached to the 9900V Remote Console PC. You should also attach all RCUs to a 9900V Remote Console PC via a separate LAN at the remote site. If you will be using PPRC commands instead of the 9900V Remote Console, please contact your Hitachi Data Systems account team for information on TC390 configuration services. The following TC390 operations cannot be performed using PPRC commands: async options, group addition/deletion, and group options. See Appendix A for further information on using PPRC commands with the 9900V subsystem.

## 5.2 Pair Operations Tab

The **Pair Operations** tab (see Figure 5.1) displays the TrueCopy – S/390® pair information for the connected subsystem and allows you to perform all TrueCopy – S/390® pair operations.

To update the information on the **Pair Operations** tab, select another tab and then reselect the **Pair Operations** tab, or select the **Refresh** button ( ) (top right of Remote Console panel). The pair information is also updated when you select the **Apply** button.



**Figure 5.1    Pair Operations Tab**

The **Pair Operations** tab presents:

- **Outline view**: displays the connected subsystem and the CU images which contain LVIs (CU images without LVIs are not displayed). Select the subsystem to display all LVIs, or select the desired CU image to display the LVIs for that CU image. You can only select one CU image at a time.

- **List view**: displays the detailed LVI information (see section 5.2.1.1) for the selected item (subsystem or CU image). The LVI information can be sorted by column and in ascending or descending order.

- **Display Filter button**: opens the Display Filter panel (see section 5.2.1.2), which allows you to control which volumes are displayed in the list view by CU image, pair type (sync and/or async), volume type (M-VOL and/or R-VOL), CT group, path type, and pair status.

- **Previous and Next buttons**: The list view can contain up to 256 rows. Use these buttons to display the previous or next 256 rows of LVI information.

The **Pair Operations** tab allows you to perform the TrueCopy – S/390® pair operations. All operations performed on the **Pair Operations** tab have a common procedure. To perform any operation on the **Pair Operations** tab:

1.  Select the subsystem or the desired CU image in the outline view.

2.  Select the desired LVI(s) or pair(s) in the list view.

3.  Right-click on the selected LVI(s)/pair(s) to display the pop-up menu (see Figure 5.2):

    **Pair Status**:  displays the LVI/pair status (see section 5.5).

    **Add Pair**:  allows you to create new pairs (sync or async) (see section 5.3).

    **Delete Pair**:  allows you to delete pairs (see section 5.8).

    **Suspend Pair**:  allows you to suspend pairs (see section 5.6).

    **Resume Pair**:  allows you to resume pairs (see section 5.7).

    **Change Pair Option**:  allows you to change the pair options (see section 5.4).

    *Note:* The availability of the commands (enabled/disabled) depends on the status of the LVI(s) or pair(s) selected in the list view.

4.  Select the command for the desired operation, use the panel to perform the operation, and close the panel. The list view now displays the requested operation(s).

5.  Verify the specified pair operation(s). Make changes as follows:

    –  To change an operation, select the desired operation, right-click, select **Modify**, make the desired changes, and close the panel. The list view displays the updated information.

    –  To omit one or more operations, select the operation(s) to be omitted, right-click, and select **Omit**. The operation(s) is/are removed from the list view. If all operations are removed, the list view returns to its original display.

    –  To cancel all operations, right-click on the operations, and select **Cancel All**. All operations are removed, and the list view returns to its original display.

6.  To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.

**Figure 5.2     Pop-up Menu for the Pair Operations Tab**

## 5.2.1.1    Volume List

The volume list on the **Pair Operations** tab displays detailed information for each volume (LVI) in the selected CU image (or entire subsystem when the subsystem is selected). You can sort the LVIs in the volume list by selecting the column heading to sort on. The **CU** column is selected by default. The screen in Figure 5.3 shows the volume list sorted by CU image number in ascending order. To change the sort order (ascending or descending), select the column heading.

*Note:* The number of columns displayed without horizontal scrolling can be changed by adjusting the font size.

| CU | Device | | Status | Sub | S/N | SSID | CU | Device | | Type | Fence | Diff | CTG | ErrLvl |
|----|--------|--|--------|-----|-----|------|----|--------|--|------|-------|------|-----|--------|
| R 01 | 00 | | Suspend | | 62493 | 0005 | 01 | 05 | | Sync | Never | Track | | |
| M 01 | 01 | | Duplex | | 62493 | 0005 | 01 | 03 | | Async | Never | Track | 01 | Group |
| 01 | 02 | | Simplex | | | | | | | | | | | |
| R 01 | 03 | | Duplex | | 62493 | 0005 | 01 | 01 | | Async | Never | Track | 01 | Group |
| 01 | 04 | | Simplex | | | | | | | | | | | |
| M 01 | 05 | | Suspend | | 62493 | 0005 | 01 | 00 | | Sync | Never | Track | | |
| M 01 | 06 | | Duplex | | 62493 | 0005 | 01 | 08 | | Sync | Never | Track | | |
| 01 | 07 | | Simplex | | | | | | | | | | | |
| R 01 | 08 | | Duplex | | 62493 | 0005 | 01 | 06 | | Sync | Never | Track | | |
| 01 | 09 | | Simplex | | | | | | | | | | | |
| 01 | 0A | | Simplex | | | | | | | | | | | |
| 01 | 0B | | Simplex | | | | | | | | | | | |
| 01 | 0C | | Simplex | | | | | | | | | | | |
| 01 | 0D | | Simplex | | | | | | | | | | | |
| 01 | 0E | | Simplex | | | | | | | | | | | |
| 01 | 0F | | Simplex | | | | | | | | | | | |
| 01 | 10 | | Simplex | | | | | | | | | | | |

**Figure 5.3      List View on the Pair Operations Tab**

The detailed volume (LVI) information includes:

- Volume icon:  Indicates the status of volumes.
    - 🟡: Simplex.
    - 🅼: M-VOL.
    - 🆁: R-VOL.
- **CU** and **Device**:  CU image number and and LDEV ID.

- **Status**:  (see section 2.5 for further information on TrueCopy – S/390® pair status)
    - : **Simplex**. The volume is not currently assigned to a TC390 pair. When the initial copy is started by an add pair operation, the volume status changes to Pending.
    - : **Pending**. The TC390 initial copy operation is in progress. Data on the pair is not fully identical. When the initial copy is complete, the status will change to Duplex.
    - : **Duplex**. The volume is currently assigned to a TC390 pair, and the pair is synchronized. All updates from the host to the M-VOL are duplicated at the R-VOL.
    - : **Suspend**. The pair has been suspended by the MCU or RCU due to an error condition. The volumes in this pair are not synchronized.
    - : **Suspending**. TrueCopy – S/390® Asynchronous only. This pair is not synchronized. This pair is in transition from Duplex or Pending state to the Suspend state.
    - : **Deleting**. TrueCopy – S/390® Asynchronous only. This pair is not synchronized. This pair is in transition from the Duplex, Pending, or Suspend state to the Simplex state.
- **Sub:**  Suspend Sub Status
    - **GRP:**  Consistency time of volume is same as that of the consistency group.
    - **VOL:**  Consistency time of volume is not same as that of the consistency group.
    - **OFF:**  Suspended by the PS OFF by the MCU.
- **S/N** and **SSID** of the other subsystem (MCU or RCU) of the volume pair.
- **CU** and **Device**:  CU image number and LDEV ID of the other volume of the volume pair.
- **Type:**  Pair mode: Synchronous or Asynchronous.
- **Fence:**  The M-VOL fence level of the TC390 volume pair:  data, status, or never. See sections 5.3.2 and 6.1.1 for a complete description of the M-VOL fence level option.
- **Diff:**  The differential data setting (bitmap table managed by cylinder or track).
- **CTG:**  Consistency group number (0-7F) of the pair (only for Asynchronous pairs).
- **ErrLvl:**  Error level (GRP or VOL) of the pair (only for Asynchronous pairs).

*Note:* The S/N, SSID, and Fence columns can be blank while a TrueCopy pair is in transition to the Simplex status. To display the latest information in these columns, refresh the screen.

### 5.2.1.2   Display Filter

The Display Filter panel (see Figure 5.4) allows you to control which volumes are displayed in the list view. To open the Display Filter panel, select the **Display Filter** button on the **Pair Operations** tab. *Note:* You must close the Display Filter panel to use other panels.

The selected item in the outline view (subsystem or CU image) determines which display filter settings are available. When the subsystem is selected, all settings on the Display Filter panel are available. When a CU image is selected, the CU# setting is not available.
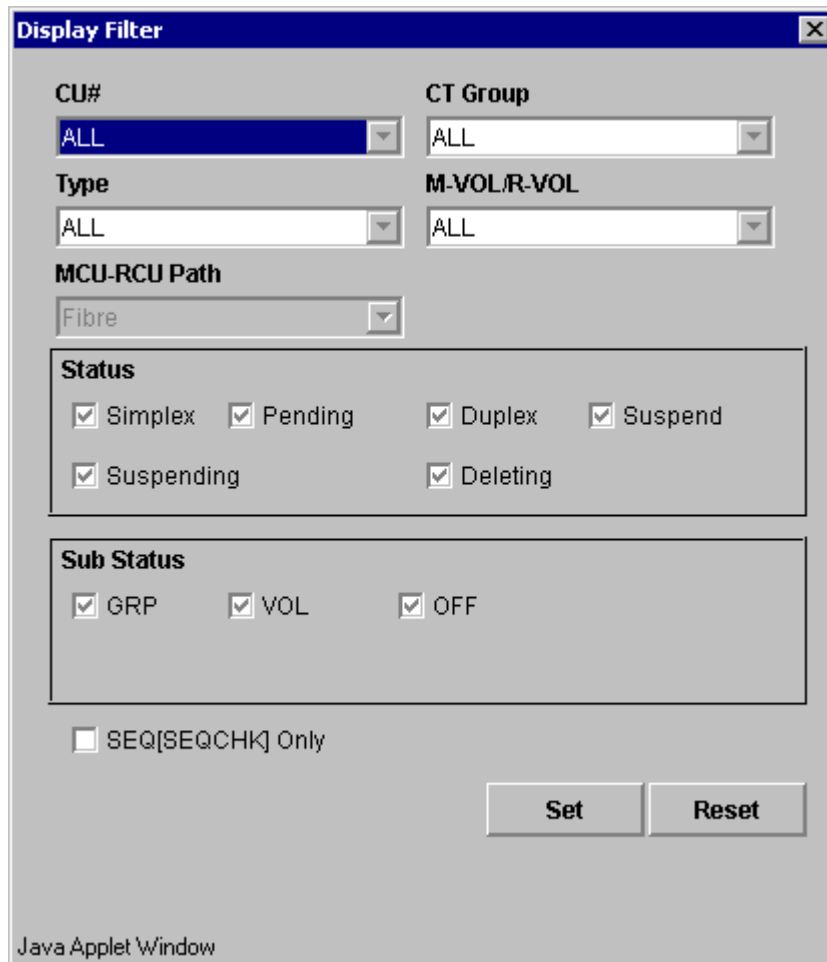
**Figure 5.4    Display Filter Panel**

**CU#**: allows you to select the CU image (or all CU images) to be displayed.

**Type**: allows you to select the pair type, sync or async (or all types), to be displayed.

**CT Group**: allows you to select the consistency group (or all groups) to be displayed. This applies only to Asynchronous pairs.

**M-VOL/R-VOL**: allows you to select the volume type, M-VOL or R-VOL (or all types), to be displayed.

**MCU-RCU Path**: allows you to select the path type (or all types) to be displayed.

**Status**: allows you to display only volumes which have the selected pair status:  Simplex, Pending, Duplex, Suspend, Suspending (async only), and/or Deleting (async only).

**Sub Status**:  allows you to select the consistency status of the Asynchronous pairs.

**SEQ(SEQCHK) only**: allows you to display only volumes with the SEQCHK status. When this option is selected, TC390 Synchronous and simplex volumes are not displayed.

The **Reset** button clears your selections and displays the default settings (ALL). The **Set** button applies your selections to the volume list and closes the Display Filter panel.

## 5.3 Adding Pairs

The Add Pair panel (see Figure 5.5 and Figure 5.6) allows you to add new TC390 pairs and set the initial copy options (see section 5.3.1) and pair options (see section 5.3.2) for the new pairs. To open the Add Pair panel, select the **Pair Operations** tab, select the desired CU image, select the LVI(s) which will be the M-VOL(s) of the new pair(s), right-click, select **Add Pair**, and then select the desired copy mode (sync or async) for the new pair(s).



**Figure 5.5     Add Pair Panel for Synchronous Pairs**
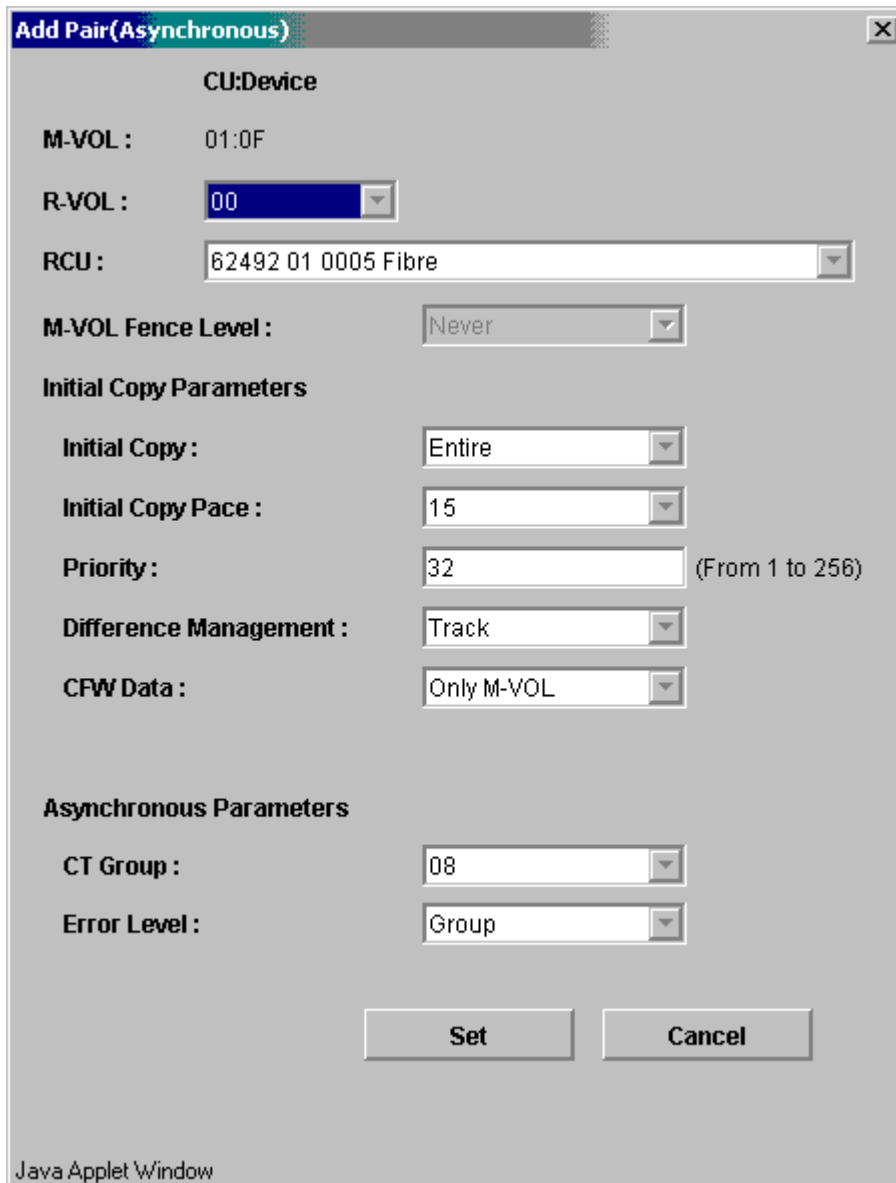
**Figure 5.6     Add Pair Panel for Asynchronous Pairs**

**M-VOL**: Displays the CU image number and LDEV ID of the selected LVI(s). If you selected more than one M-VOL, the M-VOL with the lowest LDEV ID is displayed.

**R-VOL**: Allows you to select the R-VOL(s) for the new pair(s). If you selected more than one M-VOL, select the R-VOL for the M-VOL being displayed. The R-VOLs for the rest of the M-VOLs are automatically assigned according to the LDEV ID. For example, if you select three M-VOLs and select LDEV 01 as the R-VOL for the first M-VOL, the R-VOLs for the two other M-VOLs will be LDEV 02 and LDEV 03.

**RCU**:  Select the RCU (serial number, CU number, SSID, and path type) for the TC390 pair(s) being created. The RCUs which have been added to the current MCU are displayed. The RCU must be the same for all pairs being created during one operation.

**M-VOL Fence Level** (Synchronous only): Select the fence level for the new pair(s) (default = Never). See section 5.3.2 for further information on this pair option.

- **Data**: the M-VOL will be fenced (reject write operations) when the MCU cannot successfully execute an update copy operation for any reason. This setting is functionally equivalent to the CRIT(YES-ALL) parameter for the CESTPAIR command.

- **Status**: the M-VOL will be fenced only if the MCU is not able to change the R-VOL status to suspended when an update copy operation fails. This setting is functionally equivalent to the CRIT(YES-PATHS) parameter for the CESTPAIR command.

- **Never**: the M-VOL will never be fenced. This setting is functionally equivalent to the CRIT(NO) parameter for the CESTPAIR command.

  *Note:* For further information on the CESTPAIR CRIT parameter and its two modes of operation, CRIT(YES-PATHS) and CRIT(YES-ALL), please refer to the IBM® document *Advanced Copy Services* (SC35-0355) or *DFSMS MVS V1 Remote Copy Guide and Reference* (SC35-0169).

**Initial Copy Parameters**: Select the initial copy options for the new pair(s). See section 5.3.1 for further information on the initial copy options.

- **Initial Copy** (default = Entire):
  - **Entire** = copy all M-VOL data to R-VOL. This setting is functionally equivalent to the MODE=COPY parameter for the CESTPAIR command.
  - **No Copy** = do not copy any M-VOL data to R-VOL. This setting is functionally equivalent to the MODE=NOCOPY parameter for the CESTPAIR command.

  *WARNING:* The user must ensure that the M-VOL and R-VOL are already identical when using the **No Copy** setting.

- **Initial Copy Pace**: desired number of tracks to be copied at one time during the initial copy operation (default = 15):
  - **15 Tracks**. This setting is functionally equivalent to the PACE=2-255 parameter for the CESTPAIR TSO command.
  - **3 Tracks**. This setting is functionally equivalent to the PACE=1 parameter for the CESTPAIR TSO command.

- **Priority**: priority (scheduling order) of the initial copy operations (1-256). The default setting is 32. *Note:* The CESTPAIR TSO command does not support the initial copy priority option. When CESTPAIR is used to establish TC390 pairs, the initial copy operations are performed in the order that the CESTPAIR commands are issued.

- **Difference Management**: Select **Cylinder** or **Track** as the basis for managing the differential data. The default is Cylinder for 3390-L LVIs and Track for the other LVIs.

- **CFW Data**: Specifies whether the CFW data will be copied to the R-VOL:
  - **Copy to R-VOL**: the MCU will copy the CFW data to the R-VOL.
  - **Only M-VOL**: the MCU will not copy the CFW data to the R-VOL. This setting is recommended for two reasons: (1) copying the CFW data impacts subsystem performance, (2) CFW data is typically used for temporary files (e.g., sort work datasets) which are not usually required for disaster recovery.

*Note:* If a TrueCopy – S/390® pair is established using PPRC commands, the CFW data option is set to the Copy to R-VOL setting.

■  **DFW to R-VOL** (Synchronous only): Specifies whether the MCU will suspend a TC390 volume pair when the RCU cannot execute DFW to the R-VOL:

–  **DFW not required**: the pair is not suspended when DFW to the R-VOL is blocked.

–  **DFW required**: the pair is suspended when DFW to the R-VOL is blocked.

*Caution:* The interaction of the **DFW required** setting and the M-VOL fence level setting can cause a host application to fail with a permanent I/O error when attempting to update an M-VOL. Keep track of which volume pairs have the DFW required setting, and make sure that DFW to the R-VOL is not blocked.

*Note:* If a TrueCopy – S/390® pair is established using PPRC commands, the DFW to R-VOL option is set to the DFW not required setting.

**Asynchronous Parameters** (Asynchronous only):

■  **CT Group**:  consistency group for the new pair(s). Consistency groups which have already been added to the current MCU are displayed. *Note:* This option cannot be changed after a pair has been added.

■  **Error Level**:  Select the desired error level for the new pair(s): **Group**, or **Volume** (default = Group).

*Note:* The CESTPAIR TSO command also allows you to specify the error level for TrueCopy – S/390® Asynchronous pairs (see Appendix A).

The **Cancel** button cancels the settings you have made and closes the Add Pair panel.  The **Set** button sets the parameters and closes the Add Pair panel.

To add (establish) one or more TC390 volume pairs:

1. At the remote site:

   a) Make sure that the LVI(s) which will be the R-VOL(s) are offline from all hosts.

   b) Connect to the subsystem which will be the RCU for the new pair(s), and log in with Administrator or TrueCopy write access.

   c) Make sure that the RCU remote copy port(s) is/are configured (RCU target port, RCP). See section 4.2.1 for instructions on configuring the ports.

2. At the main site:

   a) Connect to the subsystem which will be the MCU for the new pair(s), and log in with Administrator or TrueCopy write access.

   b) Make sure that the MCU remote copy port(s) is/are configured (initiator port, LCP). See section 4.2.1 for instructions on configuring the ports.

   c) Make sure that the correct RCU CU image (contains the LVIs that will be R-VOLs) has been added to the correct MCU CU image (contains the LVIs that will be M-VOLs). See section 4.2.2 for instructions on adding an RCU.

3. Select the **Pair Operations** tab, and select the CU image which contains the LVI(s) which will be the M-VOL(s) of the new pairs. Use the Display Filter as needed to display the desired LVIs (e.g., select Simplex status only) (see section 5.2.1.2).

4. Select the LVI(s) which will be the M-VOL(s) of the new TrueCopy – S/390® pair(s). You can create multiple pairs at the same time only when: (1) the R-VOLs are in the same RCU, and (2) the pairs have the same copy mode (sync or async). You cannot create TrueCopy – S/390® Sync pairs and TrueCopy – S/390® Async pairs at the same time.

5. Right-click, select **Add Pair**, and then select the desired pair mode (Synchronous or Asynchronous) to open the Add Pair panel (refer to Figure 5.5 and Figure 5.6).

   *Note:* The update copy mode, sync or async, has the greatest impact on performance and must be considered carefully (see section 2.2.2). Factors in mode selection include (but are not limited to) the use of TrueCopy – S/390® (for disaster recovery or migration), the number of pairs, and the write I/O activity to the M-VOLs.

6. On the Add Pair panel, enter the desired R-VOL for the pair, and select the RCU. If you are creating multiple pairs, select the R-VOL for the M-VOL being displayed. The R-VOLs for the rest of the M-VOLs will be assigned automatically according to the LDEV ID. For example, if you select three M-VOLs and select device 01 as the R-VOL for the first M-VOL, the R-VOLs for the two other M-VOLs will be device 02 and device 03.

7. Select the desired initial copy options (see section 5.3.1) and pair options (see section 5.3.2) for the pair(s) being created. The initial copy options and pair options you select are applied to all pairs being created, and you can modify the options for each pair as needed before starting the add pair operations (see step 9).

8. Select **Set** to close the Add Pair panel. The requested add pair operation(s) is/are now displayed in the list view.

9. Verify the requested operation(s) displayed in the list view (see Figure 5.7). Make sure that all options for each new pair are correct. After a pair has been created, you can only change the M-VOL fence level, CFW data, and error level options.

To change one or more operation(s), select the operation(s), right-click, and select **Modify**. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click on the list, and select **Cancel All**.

10. If you want to execute the requested operation(s) as quickly as possible, select the **Use Time-Saving Mode** box (above the list view).

11. To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.

    The MCU will start the initial copy operations according to the initial copy priority and the maximum initial copy activities setting of the RCU.

12. On the **Pair Operations** tab, verify that the add pair operation(s) is/are displayed correctly (Pending status) in the list view. To monitor the progress of the add pair operation(s), select **Refresh** to update the information in the list view, or use the Pair Status panel (see section 5.5) to monitor the detailed status of each pair.

*WARNING:* If a timeout error occurs when using the **Use Time-Saving Mode** option, confirm on the TrueCopy – S/390® main panel for which LVIs the add pair operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed LVIs, and retry the add pair operation.

*Note:* The add pair operation will be rejected if the M-VOL is in the correction access or correction copy state. If this occurs, wait for the volume state to change, and then repeat this procedure. If the status is not displaying correctly, make sure that the correct CU image is selected. See section 7.1 for information on troubleshooting suspended pairs.

*Note:* The CESTPAIR TSO command can be used to add TrueCopy – S/390® Synchronous and Asynchronous pairs (see Appendix A). CESTPAIR does not allow you to specify the initial copy priority, CFW data option, or DFW to R-VOL option.

| CU | Device | S/N | SSID | CU | Device | Type | Mode |
|----|--------|-------|------|----|--------|-------|--------|
| 01 | 01 | 62493 | 0005 | 00 | 00 | Async | Entire |

| Fence | Pace | Priority | Diff | CFW | DFW | CTG | ErrLvl |
|-------|------|----------|-------|------------|-----|-----|--------|
| Never | 15 | 032 | Track | Only M-VOL | | 01 | Group |

**Figure 5.7    Verifying the Add Pair Operations**

## 5.3.1    Initial Copy Options

When you add new TrueCopy pairs, you select the initial copy options on the Add Pair panel. After a pair has been added (i.e., the add pair operation has started), you cannot change the initial copy options, unless you delete and then restart the pair.

**Initial Copy**. Specifies the initial copy mode for the new pair(s).

- If **Entire Volume** is selected, the initial copy operation will copy all cylinders on the M-VOL (except diagnostic and unassigned alternate tracks) to the R-VOL. This setting is functionally equivalent to the MODE=COPY parameter for the CESTPAIR command.

- If **No Copy** is selected, the initial copy operation will not be performed. The MCU will begin performing update copy operations as needed. This setting is functionally equivalent to the MODE=NOCOPY parameter for the CESTPAIR command. *CAUTION:* The user must ensure that the M-VOL and R-VOL are already identical when using this setting.

**Initial Copy Pace**. Specifies the maximum number of tracks that can be copied at one time by the TC390 initial copy operation before the MCU accepts another host request:

- **15 Tracks**: speeds up the initial copy operation but may affect the subsystem's I/O performance if the M-VOL is experiencing high write I/O activity. This setting is functionally equivalent to the PACE=2-255 parameter for the CESTPAIR TSO command.

- **3 Tracks**: slows down the initial copy operation to minimize the impact of the initial copy operation on the subsystem's I/O performance. This setting is functionally equivalent to the PACE=1 parameter for the CESTPAIR command.

**Priority**. Specifies the order in which the initial copy operations will be performed, if the number of requested initial copy operations is greater than the maximum initial copy activities setting on the RCU Option panel (see section 4.2.3). The highest priority is 1, and the lowest priority is 256 (current default = 32). The TC390 initial copy priority option can be used to spread initial copy operations across array groups and/or array domains (ACP pairs) to reduce initial copy time as well as host I/O contention.

*Example*:  Let's say the maximum initial copy activities setting is 4, and you add 6 TC390 pairs at the same time (for LDEVs 00 through 05) with the initial copy priority set as follows:

| M-VOL of TC390 pair | Priority | |
|---|---|---|
| LDEV 03 | 1 | The MCU will start the initial copy operations for LDEVs 03, 05, 00, and 04 immediately, then start LDEV 01 when one of the first four initial copy operations is complete, and then start LDEV 02 when the next initial copy operation is complete. If additional TC390 pairs are added, the MCU also prioritizes the initial copy operations by time requested, so that all TC390 pairs in the first group are started before any pair in the next group is started. |
| LDEV 05 | 2 | |
| LDEV 00 | 3 | |
| LDEV 04 | 4 | |
| LDEVs 01, 02 | 5 | |

*Note:* The CESTPAIR TSO command does not support the initial copy priority option. When CESTPAIR is used to establish TC390 pairs, the initial copy operations are performed in the order that the CESTPAIR commands are issued.

**Difference management**. Specifies the measurement method that TrueCopy – S/390® will use to manage the differential data for the pair: cylinder, or track. For most LVI types, the default setting is Cylinder.

**DFW to R-VOL** (TrueCopy – S/390® Synchronous only). Specifies whether the MCU will suspend a TC390 volume pair when the RCU cannot execute DFW to the R-VOL:

- **DFW not required**: the MCU will not suspend the TC390 volume pair when DFW on the RCU is blocked. This option is recommended if you need to maintain synchronization of the TC390 volume pair. *Note:* If a TC390 pair is established using PPRC commands, the **DFW to R-VOL** option is set to **not required**.

- **DFW required**: the MCU will suspend the pair when DFW on the RCU is blocked. This option is recommended if you need to maintain high MCU I/O performance.

  *CAUTION:* The interaction of the **DFW required** setting and the M-VOL fence level setting can cause a host application to fail with a permanent I/O error when attempting to update an M-VOL. Keep track of which volume pairs have the **DFW required** setting, and make sure that DFW to the R-VOL is not blocked.

  *Note:* The DFW to R-VOL setting does not affect the I/O performance of the M-VOLs. If one side of cache is closed due to an RCU failure, the TC390 copy operation still uses DFW. The only difference between **not required** and **required** is that new pairs cannot be established with the **DFW-to-R-VOL required** option when one side of RCU cache is closed (the add pair operation fails).

**C/T Group** (TrueCopy – S/390® Synchronous only). Specifies the consistency group for the pair(s) being added. All TC390A pairs must be assigned to a consistency group. *Note:* The CESTPAIR command can be used to start TC390A pairs and assign them to groups, but the groups must already be configured (using the Add C/T Group panel, see section 4.3.2).

## 5.3.2    Pair Options

When you add new TrueCopy – S/390® pairs, you select the pair options on the Add Pair panel (see section 5.3). You can change the fence level, CFW data, and error level pair options after a pair has been added (see section 5.4). You cannot change the difference management, DFW to R-VOL, or CT group of an existing pair. You need to delete and then restart the pair to change any of these options.

**M-VOL Fence Level**  (TC390 Synchronous only). Specifies the conditions under which the MCU will reject write operations to the M-VOL, which is known as "fencing." This option is very important for disaster recovery planning (see section 6.1.1). TC390A M-VOLs are never fenced.

- **Data**: the M-VOL will be fenced when the MCU cannot successfully execute an update copy operation for any reason. This setting is functionally equivalent to the CRIT(YES-ALL) parameter for the CESTPAIR command.

- **Status**: the M-VOL will be fenced only if the MCU is not able to change the R-VOL pair status to suspended when an update copy operation fails. If the MCU changes the R-VOL pair status to suspended, subsequent write operations to the M-VOL will be permitted, and the MCU will keep track of all updates to the M-VOL while the pair is suspended. This setting is functionally equivalent to the CRIT(YES-PATHS) parameter for the CESTPAIR command.

- **Never**: the M-VOL will never be fenced. If the TC390 volume pair is suspended, write operations to the M-VOL will be accepted. This setting is functionally equivalent to the CRIT(NO) parameter for the CESTPAIR command.

*Note:* For further information on the CESTPAIR CRIT parameter and its two modes of operation, CRIT(YES-PATHS) and CRIT(YES-ALL), please refer to the IBM® document *Advanced Copy Services* (SC35-0355) or *DFSMS MVS V1 Remote Copy Guide and Reference* (SC35-0169).

The **CFW Data** option specifies whether the CFW data will be copied to the R-VOL:

- **Copy to R-VOL**: the MCU will copy the CFW data to the R-VOL.

- **Only M-VOL**: the MCU will not copy the CFW data to the R-VOL. This setting is recommended for two reasons:  (1) copying the CFW data impacts subsystem performance, (2) CFW data is typically used for temporary files (e.g., sort work datasets) which are not usually required for disaster recovery.

  *Note:* If a TC390 pair is established using PPRC commands, the CFW data option is set to the **Copy to R-VOL** setting.

**Error Level** option (Async only). Specifies the error level for the TC390A pair(s):

- **Group**:  When the specified pair is suspended, all TC390A pairs in the same group will be suspended, even if the failure affects only that pair and not the entire group.

  *Important:* Select the **Group** error level for all TC390A volumes which are essential to disaster recovery. Suspended TC390A R-VOLs which have the **Volume** error level should not be used for disaster recovery.

■ **Volume**: If the failure affects only the specified pair, then only that pair will be suspended. A failure that affects an entire group will always result in the suspension of all pairs in the group, as well as all other affected TC390 pairs.

*Note:* The CESTPAIR TSO command also allows you to specify the error level for TC390A pairs (see Appendix A).

## 5.4 Changing the Pair Options

The Change Pair Option panel (see Figure 5.8) allows you to change the pair options of existing TrueCopy – S/390® pairs. To open the Change Pair Option panel, select the **Pair Operations** tab, select the subsystem or the desired CU image, select the M-VOL(s) of the desired pair(s), right-click, and then select **Change Pair Option**.

For a detailed description of the TrueCopy – S/390® pair options, please see section 5.3.2.
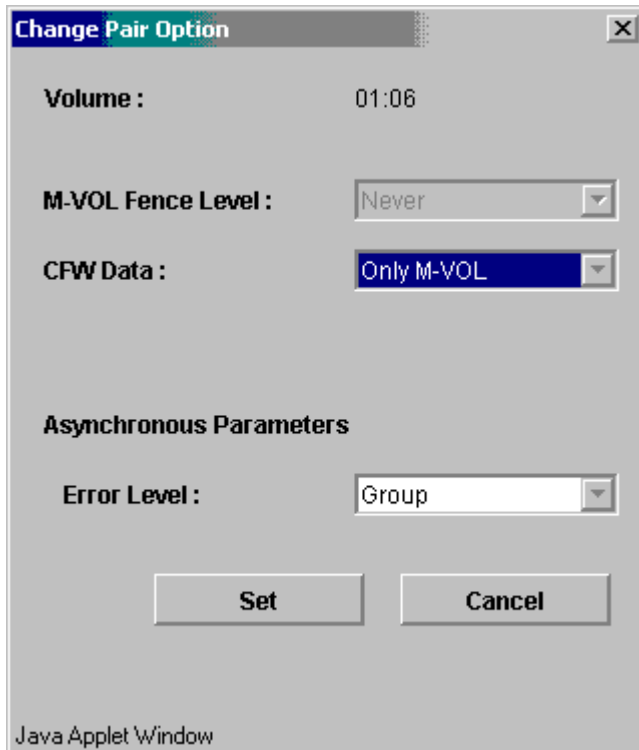


**Figure 5.8     Change Pair Option Panel (Asynchronous)**

To change the fence level, CFW data, or error level pair option for one or more pairs:

1.  Connect to the MCU of the pair(s) for which you want to change the option(s), and open the TrueCopy – S/390® main panel.

2.  In the outline view, select the subsystem or the CU image which contains the M-VOL(s) of the pair(s).

3.  In the list view, select the M-VOL(s) of the pair(s) for which you want to change the option. Select either TrueCopy – S/390® Synchronous pairs or Asynchronous pairs (not both). Use the Display Filter as needed to display the desired pairs (e.g., select Async only) (see section 5.2.1.2).

4.  Right-click, and select **Change Pair Option** to open the Change Pair Option panel (refer to Figure 5.8).

5. On the Change Pair Option panel, select the desired option(s) for the selected pair(s), and select **Set** to close the Change Pair Option panel. The list view now displays the requested change pair option operation(s).

6. Verify the requested operation(s) in the list view (see Figure 5.9).

   To change one or more operations, select the operation(s), right-click, and select **Modify**. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click on the list, and select **Cancel All**.

7. To perform the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.

8. On the **Pair Operations** tab, verify that the change pair option operation(s) completed successfully.

| CU | Device | S/N | SSID | Fence | CFW | ErrLvl |
|----|--------|-------|------|-------|-----------|--------|
| 01 | 01 | 62493 | 0005 | Never | Only M-VOL | Group |

**Figure 5.9** Verifying the Change Pair Option Operation(s)

## 5.5　Monitoring the Status of TrueCopy – S/390® Volume Pairs

The Pair Status panel (see Figure 5.10) displays the detailed status of the selected volume pair. To open the Pair Status panel, select the **Pair Operations** tab, select the subsystem or the desired CU image, select the desired pair, right-click, and then select **Pair Status**.

*Note:* The CQUERY TSO command can also be used to display pair status for TrueCopy – S/390® Synchronous and Asynchronous pairs at the MCU and RCU (see Appendix A).



**Figure 5.10　Pair Status Panel**

**M-VOL and R-VOL:**  CU image:device ID, LVI type, and number of cylinders of the M-VOL and R-VOL of the selected pair (shows custom-size LVIs).

**Pair Status**:  Current TC390 pair status (see section 2.5) of the selected volume:  *simplex, pending, duplex,* or *suspended.* If the pair status is *suspended,* the suspend type and consistency status (TC390A only) are also displayed.

**Pair Synchronized:**  For *pending duplex* pairs, this value indicates the percent completion of the initial copy operation. For *duplex* TC390 Synchronous pairs, this value is always 100% after the initial copy operation is complete. For TC390A pairs:

- For a *duplex* TC390A pair, this value indicates the number of cylinders/tracks (% of total) that are marked as modified in the bitmap for resynchronization. The total number of cylinders/tracks = the number of M-VOL cylinders/tracks (since the R-VOL can be larger than the M-VOL).

- For a *suspended* TC390A R-VOL, this value indicates the number of cylinders/tracks (% of total) containing recordsets lost at the RCU (reached the RCU but not settled before suspension).

- For a *suspended* TC390A M-VOL, this value indicates the number of cylinders/tracks (% of total) which contain:

  - Tracks that have not yet been copied by the initial copy or resync copy operation (this applies only when suspended during initial copy or during resync copy), and

  - Records updated by the primary system after suspension, and

  - Recordsets lost at the MCU (created but not sent to the RCU before suspension), and

  - Recordsets lost at the RCU (if the MCU can get this information from the RCU).

**RCU S/N and SSID:**  S/N and SSID of the RCU (or MCU if connected to the RCU).

**MCU-RCU Path:  Fibre** or **Serial**.

**Update Type:**  Synchronous or asynchronous.

**Initial Copy Pace:**  3 tracks or 15 tracks (displayed during initial copy and resync copy).

**Initial Copy Priority:**  1 - 256 (displayed during initial copy and resync copy).

**M-VOL Fence Level:**  Data, Status, or Never.

**R-VOL Write:**  Status of the R-VOL write suspend option (enabled or disabled).

**Pair Established**:  Date and time that the volume pair was established.

**Last Updated**:  Date and time that the volume pair status was last updated.

**Difference Management:**  Cylinder or Track.

**CFW Data:**  Copy to R-VOL or Only M-VOL.

**DFW to R-VOL:**  Required or Not required.

**Asynchronous Parameters**

- **CT Group**:  Consistency group to which the TC390A volume pair is assigned.
- **Error Level**:  Error level of the TC390A pair (Group or Volume).
- **CT**:  Consistency time (see section 2.4.2) of the group (displayed only for the R-VOL).
- **CT Type**:  Timer type (system, local, or none) for the TC390A group.

■ **SEQCHK:** Displayed when the TC390A pair has the *SEQCHK* status. This status is managed by the RCU, and the MCU may not have the most current information. Always use the R-VOL pair status information displayed at the RCU for disaster recovery.

The **Previous** button displays the pair status information for the previous pair in the list view (the pair in the row above). The **Next** button displays the pair status information for the next pair in the list view (the pair in the row below). The **Refresh** button updates the pair status information. The **Close** button closes the Pair Status panel.

*Note:* The Display Filter settings (see section 5.2.1.2) can affect how **Previous** or **Next** is recognized.

*Note:* The list view displays a maximum of 256 rows at once. The **Previous** and **Next** buttons on the Pair Status panel can only be used for the currently displayed 256 rows.

## 5.6 Suspending TrueCopy – S/390® Volume Pairs

The Suspend Pair panel (see Figure 5.11) allows you to suspend TC390 pairs and select the suspend options for the pair. To open the Suspend Pair panel, select the **Pair Operations** tab, select the subsystem or the desired CU image, select the pair(s) to be suspended, right-click, and select **Suspend Pair**. For further information on suspended pairs, see section 2.5.
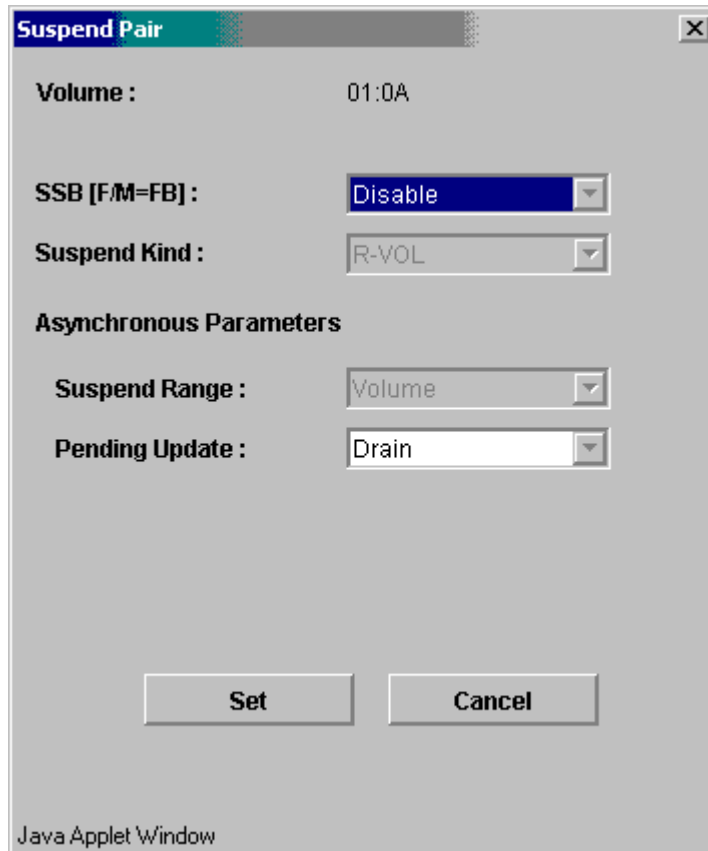


**Figure 5.11    Suspend Pair Panel (Asynchronous)**

The suspend options are:

- **Volume**:  Device ID of the selected M-VOL (R-VOL if connected to the RCU).

- **SSB [F/M=FB]**: When this option is enabled (and PPRC Support = Yes), the MCU will notify all attached hosts (IEA494I message) that the pair was suspended. This option should always be enabled. *Note:* If PPRC support = No, the x'FB' sense information will not be reported to the host, even if the **SSB (F/M = FB)** suspend option is enabled.

- **Suspend Kind** (default = R-VOL):

- **R-VOL**: the M-VOL will accept all subsequent write I/O operations, and the MCU will keep track of updates while the pair is suspended. Subsequent write I/O operations to the M-VOL will be accepted or rejected depending on the fence level of the pair. This setting is available from the MCU and RCU, and should be used if you need to keep the M-VOL online. All TrueCopy – S/390® Asynchronous pairs have this setting. This setting is functionally equivalent to CSUSPEND with the optional PRIMARY parameter (without QUIESCE).

- **M-VOL Failure** (available only for TrueCopy – S/390® Synchronous and only when connected to the MCU): the MCU will reject all write I/O operations to the M-VOL while the pair is suspended, regardless of the M-VOL fence level setting. This setting should be used if you need to maintain synchronization of the TC390 volume pair. This setting is functionally equivalent to CSUSPEND without the optional PRIMARY parameter.

- **Asynchronous Parameters**:

  - **Suspend Range**: Group or Volume (default = Group when one pair is selected, default = Volume when two or more pairs are selected). The CSUSPEND TSO command supports the TC390A suspend range option (see Appendix A).

    **Group**: The MCU/RCU will suspend all other pairs in the same consistency group as the selected pair. This option is available only when one pair is selected.

    **Volume**: The MCU/RCU will suspend only the specified pair(s) (even if the error level of the pair is group).

  - **Pending Update**: Drain or Purge (default = Drain). The CSUSPEND TSO command supports the TC390A pending update suspend option (Appendix A).

    **Drain**: The MCU will change the pair status from Suspending to Suspend only after the RCU accepts the suspend pair operation and completes the following steps:

    (a) Finish settling all pending recordsets for the pair, and

    (b) Complete the negotiation with all MCUs (report ready-for-suspension to all MCUs and receive their acknowledgements) without further recordsets generated.

    *Note:* If the RCU is not able to complete these actions within the copy pending timeout setting, the RCU will discontinue the original suspend request and forcibly suspend all affected TrueCopy – S/390® Asynchronous pairs. Thus, you can use the copy pending timeout parameter to limit the amount of time it takes to complete the suspend-drain operation.

    **Purge**: The MCU will change the pair status from Suspending to Suspend as soon as the RCU accepts the suspend pair operation. The MCU and RCU discard any pending recordsets and mark the cylinders/tracks that contain discarded recordsets as modified in the M-VOL and R-VOL bitmaps, respectively. When the pair is resumed, the M-VOL and R-VOL bitmaps will be merged at the MCU, and all cylinders/tracks marked as modified will be copied to the R-VOL.

    *Note:* If the MCU does not receive acknowledgement of the suspend operation from the RCU within the copy pending timeout setting, the MCU will forcibly suspend all affected TC390 Asynchronous pairs and report an IEA491E host console message.

*WARNING:* The QUIESCE option of the CSUSPEND command 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 of the CSUSPEND command. Please check with your Hitachi Data Systems account team before using the CSUSPEND command with the QUIESCE option to suspend TC390 volume pairs on 9900V (or 9900/7700E) subsystems. If the CSUSPEND command with 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. TC390A does not support the CSUSPEND/QUIESCE option.

To suspend one or more TrueCopy – S/390® pairs:

1. If you plan to suspend one or more TC390A pairs using the **drain** suspend option, you must STOP all application I/Os to the TC390A M-VOL(s) before suspending the pair(s). This ensures that all pending data in cache is written to the R-VOL(s) during pair suspension. You do not need to vary the M-VOL(s) offline.

2. Connect to the MCU or RCU of the pair(s) to be suspended, open the TrueCopy – S/390® main panel, and select the **Pair Operations** tab. For TC390 Synchronous, you must connect to the MCU. For TC390A, you can connect to the MCU or RCU.

3. In the outline view, select the subsystem, or select the CU image which contains the pair(s) to be suspended.

4. In the list view, select the pair(s) that you want to suspend. Select either TrueCopy – S/390® Synchronous or Asynchronous pairs (not both). If you plan to use the **Group** suspend option, select only one pair in the desired group. The pair status must be Duplex. Use the Display Filter as needed to display the desired pairs (e.g., select Duplex status and Async only) (see section 5.2.1.2).

5. Right-click, and select **Suspend Pair** to open the Suspend Pair panel (refer to Figure 5.11).

6. On the Suspend Pair panel, select the desired suspend options for the pair(s), and select **Set** to close the panel. The list view now displays the requested suspend operation(s).

   *WARNING:* Do not use the M-VOL failure suspend kind option if the M-VOL is required for system operation (e.g., spool, page, or SYSRES volume). Make sure to use the R-VOL suspend kind option, so that the M-VOL continues accepting I/Os.

7. Verify the requested operation(s) in the list view (see Figure 5.12). Make sure that the suspend options for each pair are correct. The suspend kind option (R-VOL or M-VOL failure) and fence level of the pair (never, data, or status) determine whether the M-VOL will accept write I/O operations after the pair is suspended.

   To change one or more operations, select the operation(s), right-click, and select **Modify**. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click on the list, and select **Cancel All**.

8. If you want to execute the requested operation(s) as quickly as possible, select the **Use Time-Saving Mode** box (above the list view).

9. To start the operation(s), select the **Apply** button (lower right of TrueCopy panel). To cancel all operations and return the list view to its original display, select **Cancel**.

For TC390 Synchronous pairs, the MCU will complete all M-VOL write operations in progress and the associated update copy operations at the R-VOL before suspending the pair, so that the pair is synchronized at the time of suspension. For TC390 Asynchronous pairs, the pending update option (drain or purge) determines whether the pair is synchronized at the time of suspension.

10. On the **Pair Operations** tab, verify that the suspend pair operation(s) is/are completed successfully (Suspend status in the list view). To monitor the progress of the suspend pair operation(s), select **Refresh** to update the information in the list view, or use the Pair Status panel (see section 5.5) to monitor the detailed status of each pair. You can also monitor the host console messages (IEA494I vs. IEA491E) to verify the operation(s).

*WARNING:* If a timeout error occurs when the **Use Time-Saving Mode** option is selected, confirm on the TrueCopy – S/390® main panel for which pairs the suspend operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed pairs, and retry the suspend pair operation.

| CU | Device | S/N | SSID | SSB | Kind | Range | Mode |
|----|--------|-------|------|---------|-------|-------|-------|
| 01 | 01 | 62493 | 0005 | Disable | R-VOL | Group | Drain |

**Figure 5.12    Verifying the Suspend Pair Operation(s)**

## 5.7    Resuming TrueCopy – S/390® Volume Pairs

While a TC390 pair is suspended, the MCU does not perform any update copy operations.

- For a suspended TC390 Synchronous pair, the MCU may or may not continue accepting write I/Os for the M-VOL depending on the M-VOL fence level and suspend kind option (if user-requested). If the MCU accepts write I/Os for a suspended M-VOL, the MCU keeps track of the M-VOL cylinders/tracks which are updated while the pair is suspended, and copies the VOLSER and out-of-sync cylinders to the R-VOL when the pair is resumed.

- For a suspended TC390 Asynchronous pair, the MCU and RCU keep track of any recordsets that were discarded during suspension, and the MCU continues accepting write I/Os for the M-VOL. When a TC390A pair is resumed, the MCU merges the M-VOL and R-VOL cylinder/track bitmaps and then copies the VOLSER and out-of-sync cylinders or tracks to the R-VOL to resynchronize the pair.

The Resume Pair panel (see Figure 5.13) allows you to resume suspended TC390 volume pairs and select the resume options for each pair. To open the Resume Pair panel, select the **Pair Operations** tab, select the subsystem or the desired CU image, select the M-VOL(s) of the pair(s) to be resumed, right-click, and then select **Resume Pair**.



**Figure 5.13    Resume Pair Panel**

The resume options are:

- **M-VOL**: the device ID of the selected M-VOL. If you selected more than one M-VOL, the M-VOL with the lowest device ID is displayed.

- **M-VOL Fence Level** (sync only): if desired, you can change the fence level of the pair(s). See section 5.3.2 for further information on the fence level pair option.

- **Initial Copy Parameters** (see section 5.3.1 for further information on these options):

  – **Initial Copy Pace** (3 or 15): select the number of the tracks for the resume operation(s) (default = 15).

  – **Priority** (from 0 to 256): set the desired priority (0-256) (scheduling order) for the resume operations (default = 32).

- **Asynchronous Parameters**:

  – **Resume Range** (default = Group):

    **Group**: all suspended TrueCopy – S/390® Async pairs in the same group as the selected pair will be resumed.

    **Volume**: only the selected TrueCopy – S/390® Async pair(s) will be resumed.

  – **Error Level**: if desired, you can change the error level of the pair(s). This option is available only when the Volume resume range option is selected. See section 5.3.2 for further information on the error level option.

*Note:* If an MCU or RCU is powered off and its backup batteries are fully discharged while TrueCopy – S/390® pairs are suspended, the M-VOL/R-VOL bitmaps will not be retained. In this unlikely case, the MCU/RCU will mark all cylinders/tracks of all suspended TrueCopy volumes as modified, so that the MCU will perform the equivalent of an entire initial copy operation when the pairs are resumed. (The R-VOL cylinder/track map is used only for TC390 Asynchronous operations.)

*Note:* The CESTPAIR (MODE=RESYNC) command can be used to resume suspended TC390 Synchronous and TC390A pairs (see Appendix A).

To resume one or more suspended TrueCopy – S/390® volume pairs:

1. Determine if any data on the R-VOL has changed while the pair has been suspended. If so, do not resume the pair. You must delete the pair from the MCU and then restart the pair using the **Entire** initial copy mode option to resynchronize the M-VOL and R-VOL.

2. If any pair was suspended due to an error condition (use the Pair Status panel to view the suspend type), make sure that the error condition has been removed (see section 7.1 for troubleshooting information). The MCU will not resume the pair(s) until the error condition has been removed.

3. Connect to the MCU of the pair(s) to be resumed, open the TrueCopy – S/390® main panel, and select the **Pair Operations** tab.

4. In the outline view, select the subsystem, or select the CU image which contains the pair(s) to be resumed. Use the Display Filter as needed to display the desired pairs (e.g., select Async and Suspend status only) (see section 5.2.1.2).

5. In the list view, select the M-VOL(s) of the pair(s) to be resumed. Select either Sync or Async pairs (not both). If you want to use the Group Resume Range option (async only), select only one pair in the group.

6. Right-click, and select **Resume Pair** to open the Resume Pair panel (refer to Figure 5.13).

7. On the Resume Pair panel, select the desired resume options, and select **Set** to close the panel. The list view now displays the requested resume pair operation(s).

   *Note:* If you want to resume all suspended pairs in a consistency group, select the **Group** Resume Range option.

8. Verify the requested operation(s) in the list view (see Figure 5.14). Make sure that the resume options for each pair are correct.

   To change one or more operations, select the operation(s), right-click, and select **Modify**. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click on the list, and select **Cancel All**.

9. If you want to execute the requested resume pair operation(s) as quickly as possible, select the **Use Time-Saving Mode** box (above the list view).

10. To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.

11. On the **Pair Operations** tab, verify that the resume pair operation(s) is/are completed successfully (*Pending* and then *Duplex* status in the list view). To monitor the progress of the resume pair operation(s), select **Refresh** to update the information in the list view, or use the Pair Status panel (see section 5.5) to monitor the detailed status of each pair. You can also monitor the host console messages (IEA494I vs. IEA491E) to verify the operation(s).

*WARNING:* If a timeout error occurs when the **Use Time-Saving Mode** option is selected, confirm on the TrueCopy main panel for which pairs the pairresync operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed pairs, and retry the pairresync operation.

| CU | Device | S/N | SSID | Priority | Pace | Fence | ErrLvl | Range |
|----|--------|-------|------|----------|------|-------|--------|-------|
| 01 | 01 | 62493 | 0005 | 032 | 15 | Never | Group | Group |

**Figure 5.14    Verifying the Resume Pair Operation(s)**

## 5.8    Deleting Volume Pairs

A Hitachi TrueCopy – S/390® pair should be deleted from the MCU only when it is no longer necessary to maintain a remote copy of the M-VOL. When a TC390 volume pair is deleted from the MCU, the MCU stops all TC390 copy operations for that pair and changes the pair status of the M-VOL and R-VOL to *simplex*. After a pair is deleted, the MCU continues to accept all subsequent write I/O operations to the M-VOL and will not keep track of the M-VOL updates.

A Hitachi TrueCopy – S/390® pair should be deleted from the RCU only if you need to access the R-VOL, for example, to perform ICKDSF on the R-VOL (see section 5.9.2) or for disaster recovery (see Chapter 6). When a TC390 volume pair is deleted from the RCU, the RCU changes the R-VOL pair status to *simplex* but does not change the pair status of the corresponding M-VOL. When the MCU performs the next TC390 operation, the MCU detects that the R-VOL status changed and changes the status of the M-VOL to *suspended-delete pair to RCU*. When you delete a pair from the RCU in order to access the R-VOL, remember that the R-VOL and M-VOL have the same VOLSER, and take appropriate precautions to prevent a system problem due to duplicate VOLSERs. To restart a pair which was deleted from the RCU, you must first delete the pair from the MCU, and then add the pair from the MCU using the appropriate initial copy option (**Entire** or **No Copy**) to restart the pair.

You can delete all TC390 Synchronous pairs between an MCU and RCU (same CU image). You can also delete all TC390A pairs in a consistency group by connecting to the MCU. The TC390A pair status will change to *deleting* when the delete operation is accepted by the MCU and RCU, and then to *simplex* after the internal delete pair process is complete. In addition, you can delete TC390A pairs according to their consistency status (e.g., for disaster recovery) by connecting to the RCU (the RCU maintains the consistency status).

*Note:* The CDELPAIR TSO command can be used to delete TC390 pairs and TC390A groups of pairs from the MCU (see Appendix A).

*WARNING:* Please see the warning in section 3.2.3 about duplicate VOLSERs.

*WARNING:* As a general rule, when you want to delete a TrueCopy – S/390® Asynchronous pair from the MCU, it is strongly recommended that you perform the delete pair operation after the update copy operation is completed. If you request the delete pair operation while the update copy process is still in progress, it may take a long time to complete the operation. However, when you urgently need to delete a TC390 Asynchronous pair, you can perform the delete pair operation from the RCU. In this case, you will find the suspended status at the MCU after performing the delete pair operation from the RCU.

The Delete Pair panel (see Figure 5.15) allows you to delete one or more TC390 volume pairs and select the delete options for the pair(s). To open the Delete Pair panel, select the **Pair Operations** tab, select the subsystem or the desired CU image, select the pair(s) to be deleted, right-click, and then select **Delete Pair**.
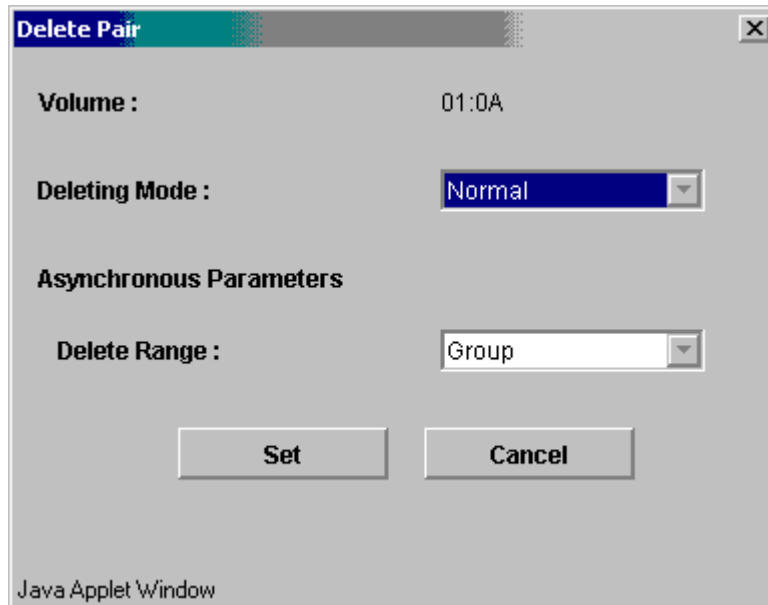


**Figure 5.15    Delete Pair Panel (Asynchronous)**

**Volume**:  the device ID of the selected volume. If you selected more than one volume, the volume with the lowest device ID is displayed.

**Deleting Mode**:

– **Normal**:  performs a normal delete pair operation for the selected pair(s). The pair(s) will only be deleted if the MCU is able to change the pair status of the M-VOL and R-VOL to *Simplex*.

– **All**:  allows you to delete all TC390 Synchronous pairs with the same MCU and RCU (same CU image) as the selected pair. This option can be selected from the MCU or RCU, and the Force option must also be selected. This option deletes the pairs more quickly than if you select all pairs on the TC390 main panel and delete them.

– **Force**:  allows you to override the restrictions on deleting a TC390 volume pair. If this option is selected, the pair(s) will be deleted even if the MCU is unable to communicate with the RCU. This option may be used to free a host waiting for device-end from an MCU which cannot communicate with its RCU, thus allowing host operations to continue. If this option is not selected, the pair(s) will only be deleted if the MCU is able to change the pair status of the M-VOL and R-VOL to *Simplex*.

When the status of the pair(s) to be deleted is *Simplex* or *Deleting*, the default setting is Force (cannot be changed). Otherwise, the default setting is Normal.

**Asynchronous Parameters**:

■ **Delete Range**:  The delete range option simplifies disaster recovery operations for TC390 Asynchronous consistency groups at the RCU (secondary (remote) subsystem).

– **Group** (MCU or RCU): the MCU/RCU will delete all TC390 Async pairs in the same consistency group as the selected pair, regardless of pair status and consistency status. This option is available only when one pair is selected. *Caution:* Do not use this option when deleting pairs at the RCU during disaster recovery.

– **C/T** (RCU only): the RCU will delete all TC390 Async pairs which have the same consistency time.

– **Volume** (MCU or RCU): the MCU/RCU will delete only the specified pair(s). This option can be used to remove individual volumes from consistency groups.

The default delete range settings are:

– When two or more pairs are selected:  Volume.

– When one pair is selected from the MCU (M-VOL is selected):  Group.

– When one pair is selected from the RCU (R-VOL is selected):  C/T.

*Note:* When a TrueCopy Asynchronous pair is forcibly deleted, the TrueCopy delete range option must be Group. Therefore, more than one pair cannot be forcibly deleted.

To delete one or more TC390 volume pairs:

1.  If you need to delete the volume pair(s) from the RCU in order to access the R-VOL(s) (e.g., to perform ICKDSF), connect to the MCU(s) and suspend the volume pair(s) first (see section 5.6 for instructions).

2.  Connect to the MCU or RCU* of the pair(s) to be deleted, open the TrueCopy – S/390® main panel, and select the **Pair Operations** tab.

    *\*Note:* If you plan to use the C/T Delete Range option, you must connect to the RCU.

3.  In the outline view, select the subsystem or the CU image which contains the pair(s) to be deleted. Use the Display Filter as needed to display the desired pairs (e.g., select Async only) (see section 5.2.1.2).

4.  In the list view, select the pair(s) that you want to delete. Select either TrueCopy – S/390® Synchronous or Asynchronous pairs (not both). If you plan to use the TC390 Synchronous All Deleting Mode option, select only one TC390 Sync pair. If you plan to use the C/T or Group delete range option, select only one TC390 Async pair in the group.

5.  Right-click, and select **Delete Pair** to open the Delete Pair panel (refer to Figure 5.15).

6.  On the Delete Pair panel, select the desired delete options, and select **Set** to close the panel. The list view now displays the requested delete pair operation(s).

7.  Verify the requested operation(s) in the list view (see Figure 5.16). Make sure that the delete options for each pair are correct.

    To change one or more operations, select the operation(s), right-click, and select **Modify**. To remove one or more operations, select the operation(s), right-click, and select **Omit**. To remove all operations, right-click on the list, and select **Cancel All**.

8.  If you want to execute the requested delete pair operation(s) as quickly as possible, select the **Use Time-Saving Mode** box (above the list view).

9.  To start the operation(s), select **Apply** (lower right of TrueCopy – S/390® panel). To cancel all operations and return the list view to its original display, select **Cancel**.

10. On the **Pair Operations** tab, verify that the delete pair operation(s) is/are completed successfully (*Simplex* or *Deleting* then *Simplex* status, not *Suspend*). To monitor the progress of the operation(s), select **Refresh** to update the information in the list view, or use the Pair Status panel (see section 5.5) to monitor the detailed status of each pair. You can also monitor the host console messages (IEA494I vs. IEA491E) to verify the operation(s).

*Note:* To restart a pair which was deleted from the RCU, first delete the pair from the MCU, and then restart the pair using the appropriate initial copy option (Entire or No Copy).

*WARNING:* If a timeout error occurs when the **Use Time-Saving Mode** option is selected, confirm on the TrueCopy – S/390® main panel for which pair(s) the delete operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed pair(s), and retry the delete pair operation.

| Port | Group | LUN | S/N | SSID | Mode | Range |
|------|-------|-----|-------|------|------|-------|
| CL1-A | 00 | 0C | 11111 | 0011 | No | Group |

**Figure 5.16    Verifying the Delete Pair Operation(s)**

## 5.9    ICKDSF Considerations for TrueCopy – S/390® Volumes

The Hitachi Lightning 9900™ V Series subsystem supports the use of the ICKDSF utility program. ICKDSF performs functions for the installation, use, and maintenance of DASD as well as service functions, error detection, and media maintenance. Please refer to the IBM® document *ICKDSF R16 Refresh User's Guide* (GC35-0033) for further information on ICKDSF. Please refer to the *Hitachi Lightning 9900™ V Series User and Reference Guide* (MK-92RD100) for further information on using ICKDSF with the 9900V subsystem.

### 5.9.1    ICKDSF on a TrueCopy – S/390® M-VOL

ICKDSF activities involve write I/O operations with device support authorization instead of normal authorization. Since the MCU does not duplicate write I/O operations with device support authorization at the R-VOL of a TC390 volume pair, you must suspend a TC390 pair before running ICKDSF on a TC390 M-VOL. To perform ICKDSF on a TC390 M-VOL:

1.  Connect to the MCU of the volume pair, and open the TrueCopy – S/390® main panel.

2.  Suspend the volume pair, if not already suspended, using the **R-VOL** suspend option and the TC390A **Volume** and **Purge** suspend options (see section 5.6). You can also use the CSUSPEND TSO command to suspend the pair.

3.  After the M-VOL status changes to *suspended/R-VOL by operator*, run ICKDSF to repair the M-VOL.

4.  When volume repairs are complete, resume the TC390 pair. When resuming a suspended TC390A pair, make sure to use the appropriate **Resume Range** option (see section 5.7). You can also use the CESTPAIR (MODE=RESYNC) command to resume the pair.

### 5.9.2 ICKDSF on a TrueCopy – S/390® R-VOL

If you need to run ICKDSF on a TC390 R-VOL, you must change the status of the R-VOL to *simplex* to allow write access to the R-VOL. The TC390 pair must then be restarted using the appropriate initial copy options. To perform ICKDSF on a TC390 R-VOL:

1. For TC390 Synchronous pairs, you can stop write I/Os to the M-VOL while the R-VOL is being repaired. To do this, suspend the pair from the MCU using the **M-VOL Failure** suspend option (see section 5.6) (or use CSUSPEND to suspend the pair).

2. Connect to the subsystem containing the R-VOL, and open the TrueCopy – S/390® main panel.

3. Locate and select the R-VOL to be repaired, and then delete the pair. For a TC390A R-VOL, make sure to use the **Volume** delete option (see section 5.8). You can also use CRECOVER to delete the pair at the RCU.

4. If necessary, change the R-VOL VOLSER to avoid problems due to duplicate VOLSERs.

5. Vary the R-VOL online, and run ICKDSF to repair the R-VOL. When the volume repairs are complete, vary the R-VOL offline.

6. Connect to the MCU, locate and select the M-VOL, note the group number, and delete the pair. For a TC390A M-VOL, make sure to use the **Volume** delete option.

7. Restart the pair using the Add Pair panel (or CESTPAIR). Use the **Entire** initial copy option to resynchronize the M-VOL and R-VOL. *Note:* If you are absolutely sure that the M-VOL and R-VOL are still identical, you can restart the pair using the **No Copy** option.

## 5.10   Using TrueCopy – S/390® for Data Migration and Duplication

### 5.10.1   Data Migration Using TrueCopy – S/390® Synchronous

Hitachi TrueCopy – S/390® Synchronous can be used for device or workload migration with minimal impact to host applications. You may need to migrate data from one volume to another for any of the following reasons:

- To load data onto new or scratch volumes (e.g., new or upgraded subsystem),

- To temporarily move data off a volume to accommodate other activities (e.g., repair), or

- To relocate volumes to balance workloads and distribute I/O activity evenly within and across subsystems for the purpose of improving subsystem and system performance.

*Note:* TC390 operations within one 9900V subsystem can only be performed if the ShadowImage option is not active on the subsystem.

The TC390 initial copy operation copies the entire contents of the M-VOL to the R-VOL. The data migration is complete when the initial copy operation completes and the pair status changes from *pending duplex* to *duplex*. The P/DAS host software function is used with TC390 Synchronous to complete the data migration nondisruptively. *Note:* If you are migrating data between subsystems using P/DAS, both subsystems must be the same type (9900V or 9900).

*Note:* If you need to migrate data from other vendors' storage subsystems onto the Lightning 9900™ V Series subsystem, please contact your Hitachi Data Systems account team.

To use TC390 Synchronous to migrate data from one volume to another:

1. Vary the R-VOL(s) offline from all attached hosts. The R-VOLs are the target volumes onto which you are migrating the data. The M-VOLs (source volumes) can remain online.

2. Connect to the subsystem containing the volume(s) to be migrated, and open the TrueCopy – S/390® main panel. If not already done, install the remote copy connections and configure the ports (initiator ports for fibre, RCPs for serial) (if migrating between subsystems), and then add the RCUs.

3. Select the correct CU image, select the desired volume(s), and then start the TC390 Synchronous pair(s) using the Add Pair panel (see section 5.3).

4. Monitor the progress of the initial copy operation(s) and the status of the pair(s) on the Pair Status panel (see section 5.5). Refresh the panel as needed. When the status has changed from *pending duplex* to *duplex*, the M-VOL and R-VOL are identical and synchronized.

5. Use the IBM® P/DAS host software function (see section 2.6.1) to redirect all application I/Os to the R-VOL(s) nondisruptively. If the host system does not support P/DAS, use the following procedure to stop using the M-VOL(s) and switch to the R-VOL(s):

   a) Quiesce all applications using the M-VOL(s).

   b) When all update activity to the M-VOL(s) has stopped, connect to the MCU, select the correct CU image, and delete the TC390 volume pair(s) (see section 5.8).

   c) If the M-VOL(s) and R-VOL(s) are attached to the same host, vary the M-VOL(s) offline first, and then vary the R-VOL(s) online. The M-VOL(s) and R-VOL(s) have the same VOLSERs and cannot be online to the same host(s) at the same time.

   d) If an R-VOL contains more cylinders than its M-VOL, update the R-VOL volume table of contents (VTOC) using ICKDSF/REFORMAT.

   e) If you want to keep the volumes synchronized, establish the same TC390 pair(s) in the reverse direction using the **No Copy** initial copy option (see section 5.3.1). If the original M-VOL(s) will be temporarily unavailable for update copy operations, you can suspend the new pair(s) so that the new MCU keeps track of changes.

   f) Start the applications with the R-VOL(s). When the original M-VOL(s) become available, you can resume the pair(s) using the Resume Pair panel (see section 5.7).

## 5.10.2  Point-in-Time (PiT) Data Duplication Using TrueCopy – S/390® Asynchronous

Hitachi TrueCopy – S/390® enables you to make Point-in-Time (PiT) duplicates of groups of volumes. The TC390A **Group** and **Drain** suspend options can be used together to create a PiT copy, relative to an application, of an entire TC390A consistency group of volumes. To produce a PiT duplicate of an existing TC390A consistency group:

1. Quiesce the applications accessing the TC390A M-VOLs to stop all update activity to all M-VOLs in the group.

2. After all M-VOL updates have completed, suspend the TC390A group using the **Group** and **Drain** suspend options. If you are suspending the group at the main site, you need to issue the suspend/group command to one M-VOL in the MCU. If you are suspending the group at the remote site, issue the suspend/group command to one R-VOL in the RCU.

   *Note:* The copy pending timeout setting for the group determines the maximum amount of time that the suspend/drain operation can take (see description of **Drain**, section 5.6).

3. When the status for all TC390A pairs in the group has changed to *suspended*, the duplicate set of volumes is complete. If desired, you can restart the application at the main site.

### 5.11 Powering Off/On TrueCopy – S/390® Components

The user is responsible for controlling power-off activities for subsystems involved in TC390 operations. If you need to power off the 9900V subsystem, please call your Hitachi Data Systems representative or the Hitachi Data Systems Support Center for assistance. Sections 5.11.1 through 5.11.3 provide instructions for performing planned outages of TC390 components.

If power is removed from an MCU while TC390 operations are in progress, the TC390 pairs are not affected, but the update sequence consistency of the TC390A groups at the RCU may be affected (see section 5.11.1 for further information). When power is restored to an MCU, the MCU communicates with its RCU(s) to confirm the pair status of the R-VOLs. Make sure that TC390 communications are fully restored (all RCU paths have normal status) before beginning I/O operations to the M-VOLs. If the MCU accepts a write I/O operation for an M-VOL before this confirmation is complete, the MCU will suspend the pair and change the status of the M-VOL to *suspended-by RCU* (the MCU will not be able to change the pair status of the R-VOL).

If power is removed from an RCU or remote copy connection while TC390 operations are in progress, the MCU(s) will detect the communication failure, suspend all affected pairs, and generate SIMs and console messages reporting the failures. The MCU will change the status of the M-VOLs to *suspended-by RCU* but will not be able to change the status of the R-VOLs.

*Note:* If an MCU/RCU is powered off and its backup batteries are fully discharged while TC390 pairs are suspended, the M-VOL/R-VOL cylinder maps will not be retained. In this unlikely case, the MCU/RCU will mark all cylinders of all suspended TC390 volumes as modified, so that the MCU will perform the equivalent of an entire initial copy operation when the pairs are resumed. (The R-VOL cylinder map is used only for TC390A operations.)

### 5.11.1 Planned Outage of the MCU

A planned MCU outage does not affect TC390 Synchronous pairs. For TC390A operations, the MCU must communicate with the RCU even when there are no M-VOL update I/Os from the primary system. During the power-off sequence, the MCU will automatically suspend all TC390A pairs in the *duplex* and *duplex pending* state (suspend type = MCU P/S-OFF). During power-on-reset sequence, the MCU will automatically resume these suspended pairs (pairs with other suspend types are not automatically resumed).

If a TC390A group contains M-VOLs in the MCU being powered off and in other MCU(s) which is/are not being powered off, the pairs behind the other MCU(s) will not be suspended and will continue to be updated. If you need to maintain a fully consistent group at the RCU during the planned MCU outage, take the following steps:

1. Quiesce the applications using all M-VOLs in the consistency group.

2. Suspend the group at the RCU using the **Group** suspend option. You can use the **Purge** or **Drain** suspend option since the M-VOL updates have stopped.

3. Perform the planned outage of the TC390 MCU.

4. When the MCU is fully powered on and ready to resume operations, resume the TC390A pairs at all MCUs that were powered off (use the resume group option).

### 5.11.2  Planned Outage of the RCU or Remote Copy Connection

You must suspend all affected TC390 pairs prior to a planned outage of an RCU or of a remote copy connection component (e.g., ESCON® director, channel extender, switch, extender). If you do not suspend the pairs first, the MCU(s) will detect the communication failure, suspend all affected pairs, and generate SIMs and console messages reporting the failures. To perform a planned outage of a TC390 RCU or remote copy connection component:

1.  Identify all TC390 M-VOLs which will be affected by the equipment outage. You need to know the MCU, CU image, and LDEV ID for each of these M-VOLs.

    –  For RCU power-off, identify all M-VOLs which are paired with R-VOLs in the RCU to be powered off.

    –  For remote copy connection outage, identify all M-VOLs in all MCUs which use the path/component to be powered off.

2.  Connect to each MCU which contains affected M-VOLs, and suspend all affected TC390 pairs. Make sure to confirm the pair status changes (TC390 Pair Status panel or CQUERY TSO command).

3.  Perform the planned outage of the RCU or remote copy connection.

4.  When the RCU is fully powered on and ready to resume operations, resume all TC390 pairs at each MCU. Make sure to confirm the pair status changes.


### 5.11.3  Planned Outage of the MCU and RCU

When you plan an outage of TC390 MCUs and RCUs at the same time, the MCUs must be powered off before the RCUs and powered on after the RCUs. To perform a planned outage of a TC390 MCU and RCU:

1.  If RCU power-on will be difficult to control (e.g., Power-Control-Interface setting), you should consider increasing or disabling the **RCU ready timeout** group option (see section 2.4.1) for each TC390A group with R-VOLs in the RCU(s) to be powered off.

2.  Perform the planned outage of the MCU(s) as described in section 5.11.1. Do not power-on the MCU(s) yet.

3.  If an RCU to be powered off is connected to an MCU which is not powered off, make sure to suspend those TC390 pairs before powering off the RCU as described in section 5.11.2.

4.  Perform the planned outage of the RCU(s).

5.  Power on the RCU(s). Make sure that they are fully operational and ready to resume operations before powering on the MCUs.

6.  Power on the MCU(s), and make sure that they are ready to resume operations. If you suspended any pairs in step (3), you can also resume those pairs now.

# Chapter 6    TrueCopy – S/390® Disaster Recovery Operations

## 6.1    Preparing for Disaster Recovery

The type of disaster and the status of the TC390 volume pairs will determine the best approach for disaster recovery. For example, if all TC390 volume pairs are in the *duplex* state when a total system failure occurs at a single point in time, the R-VOLs are current and recovery is straightforward. Unfortunately, some disasters are not so "orderly" and involve intermittent or gradual failures occurring over a longer period of time. The user should anticipate and plan for all types of failures and disasters. For additional information on planning for disaster recovery, please refer to *Planning for IBM Remote Copy*, IBM® document SG24-2595.

The major steps in preparing for disaster recovery are:

1. Identify the volumes and volume groups which contain important files and data for disaster recovery, for example, DB2® log files, master catalog, key user catalogs, and system control data sets. In addition to supporting TC390 remote copy operations as well as PPRC commands, the 9900V subsystem provides battery-backed nonvolatile duplexed cache, full hardware redundancy, dynamic sparing, and an advanced RAID-5 implementation to ensure full data integrity in the event of a sudden power outage or other failure.

2. Install the TrueCopy – S/390® hardware and software, and establish TC390 operations for the volumes and groups identified in step (1). Make sure to select the proper CU images to access the desired volumes. Refer to Chapter 3 for TC390 installation instructions. Refer to Chapters 4 and 5 for instructions on performing TC390 operations.

3. Use the appropriate combination of TC390 options for disaster recovery:

   – RCU options: **Incident of RCU**, **PPRC Support by host**, **Service SIM of Remote Copy**, and **FREEZE Option** (see section 4.2.3).

   – TC390A **offloading timer** async option (see section 4.3.1), and TC390A **copy pending timeout** group option (see section 4.3.3). The **copy pending timeout** group option can be used to limit the time duration during which updates may be lost.

   – TC390A **Error Level** pair option, and **M-VOL Fence Level** pair option for TC390 Synchronous pairs (see section 5.3.2).

4. Establish file and database recovery procedures. These procedures should already be established for recovering volumes which become inaccessible due to control unit failure.

5. Install and configure error reporting communications (ERC) between the main and remote sites. ERC is essential if you use the M-VOL fence level setting of **Status** or **Never** for any TC390 volume pairs.

6. Configure the primary host system to use the IEA494I message as a trigger for automation rather than the IEA491E message. The IEA491E message is reported to only one host, whereas the IEA494I message is reported to all attached MVS hosts each time the M-VOL pair status changes. See section A.4 for further information on the IEA494I and IEA491E system console messages.

## 6.1.1   Considering the M-VOL Fence Level Setting

The M-VOL fence level setting (see section 5.3.2) for each TC390 Synchronous volume pair determines whether the M-VOL will be fenced when TC390 remote copy operations fail. Table 6.1 summarizes the effect of the fence level setting on a TC390 Synchronous M-VOL.

*Note:* The M-VOL fence level setting does not apply to TC390A pairs. The TC390A M-VOL is never fenced due to suspension of the pair.

**Table 6.1     Effect of the Fence Level Setting on a TrueCopy – S/390® M-VOL**

| Type of Failure | | Fence Level Setting | | |
|---|---|---|---|---|
| | | Data (CRIT=YES-ALL) | Status (CRIT=YES-PATHS) | Never (CRIT=NO) |
| The update copy operation failed, and the MCU was able to change the status of the R-VOL to *suspended*. | Write I/O operations to the M-VOL will be: | REJECTED | Accepted | Accepted |
| The update copy operation failed, and the MCU was NOT able to change the status of the R-VOL to *suspended*. | Write I/O operations to the M-VOL will be: | REJECTED | REJECTED | Accepted |

**Data (CRIT=YES-ALL).** When this fence level setting is selected, the M-VOL will be fenced if an update copy operation fails. This M-VOL fence level setting ensures that the R-VOL remains identical to the M-VOL once the TC390 volume pair is synchronized, but makes the M-VOL inaccessible to applications for updates whenever TC390 remote copy operations fail. This setting should be considered for the most critical volumes for disaster recovery. This setting will reduce the amount of time required to analyze the currency of the R-VOL during disaster recovery efforts. This setting is also designed for applications which can continue to operate with another device pair (e.g., IMS logger dual write log files).

**Status (CRIT=YES-PATHS).** When this fence level is selected, the M-VOL is fenced only if the MCU is not able to change the R-VOL pair status to suspended. If the MCU successfully changes the R-VOL pair status to suspended, subsequent write I/O operations to the M-VOL will be accepted, and the MCU will keep track of updates to the M-VOL. This allows the volume pair to be resumed quickly using the resync (out-of-sync-cylinders) copy operation (MODE=RESYNC). This setting will also reduce the amount of time required to analyze the R-VOL currency during disaster recovery.

**Never (CRIT=NO).** When this fence level is selected, the M-VOL is never fenced when the pair is suspended. This fence level setting ensures that the M-VOL remains available to applications for updates, even if all TC390 copy operations have failed. The R-VOL may no longer be in sync with the M-VOL, but the MCU will keep track of M-VOL updates while the pair is suspended. ERC is essential if this fence level setting is used. For disaster recovery, the currency of the R-VOL is determined by using the sense information transferred via ERC or by comparing the R-VOL contents with other files confirmed to be current.

*Note:* To exchange CRIT=Y(ALL) and CRIT=Y(PATHS), the 9900V SVP mode 36 can be used. For further information on the 9900V modes, see Table 2.1.

*Note:* For further information on the CESTPAIR CRIT parameter and its two modes of operation, CRIT(YES-PATHS) and CRIT(YES-ALL), please refer to the IBM® document *Advanced Copy Services* (SC35-0355) or *DFSMS MVS V1 Remote Copy Guide and Reference* (SC35-0169).

### 6.1.2 Transferring Sense Information Between Sites

When the MCU (or RCU for TC390A) suspends a TC390 pair due to an error condition, the MCU/RCU sends sense information with unit check status to the appropriate host(s). This sense information is used during disaster recovery to determine the currency of the R-VOL. If the host system does not support IBM® PPRC, you must transfer the sense information to the remote site via the error reporting communications (ERC). If the host system supports IBM® PPRC and receives PPRC-compatible sense information related to a TC390 pair, the host operating system will:

1. Temporarily suspend all application I/O operations to the M-VOL.

2. Enter an IEA491E message in the system log (SYSLOG) which indicates the time that the M-VOL was suspended. Make sure that the system log is common to both the main and remote operating systems.

3. Place specific information about the failure (SIM) in the SYS1.LOGREC dataset for use by service personnel. See Appendix C for further information on the TC390 SIMs.

4. Wait for the IEA491E message to reach the remote system.

5. Resume all host application I/O operations to the M-VOL. If the M-VOL fence level setting does not allow subsequent updates, the MCU will return a unit check for all subsequent write I/O operations, and the application will terminate.

*Note:* Make sure that the MCUs and RCUs are configured to report the service-level SIMs to the host. Select the **Service SIM of Remote Copy** = **Report** setting on the RCU Option panel.

### 6.1.3 File and Database Recovery Procedures

When a TC390 Synchronous pair is suspended, or when the MCU fails due to a disaster, the R-VOL may contain in-process data. A data set could be open, or transactions may not have completed. Even if you use the **Data** fence level for all TC390 Synchronous pairs, you need to establish file recovery procedures. These procedures should be the same as those used for recovering any volume which becomes inaccessible due to control unit failure. These procedures are more important if the **Status** or **Never** fence level settings are used.

Hitachi TrueCopy – S/390® Asynchronous does not provide any procedure for detecting and retrieving lost updates. To detect and recreate lost updates, you must check other current information (e.g., database journal log file that was active at the primary system when the disaster occurred). Note that the journal log file entries of most DBMS have the same system TOD clock information that is used for the I/O time-stamps (when timer type = system). The TC390A group consistency time can be extremely useful when performing this detection and retrieval. Since this detection/retrieval process can take a while, your disaster recovery scenario should be designed so that detection and retrieval of lost updates is performed after the application has been started at the secondary system.

You should prepare for file and database recovery by using:

- Files for file recovery (e.g., DB2 log files which have been verified as current). To ensure the currency of these files, use the **Data** fence level setting for the TC390 pairs which contain these important files.

- The sense information with system time stamp which will be transferred via ERC.

*Important:* Remote copy and disaster recovery procedures are inherently complex. Consult your Hitachi Data Systems account team on sense-level settings and recovery procedures.

*Note:* See Appendix B for information on recovering a pinned track on a TC390 volume.

### 6.1.4 CSUSPEND/QUIESCE TSO Command

Please refer to IBM® documents SG24-2595, SC35-0355, and SC35-0169 for important information on the optional QUIESCE parameter for the CSUSPEND TSO command.

*WARNING:* The QUIESCE option of the CSUSPEND command 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 of the CSUSPEND command. Please check with your Hitachi Data Systems account team before using the CSUSPEND command with the QUIESCE option to suspend TC390 volume pairs on 9900V (or 9900/7700E) subsystems. If the CSUSPEND command with 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. TC390A does not support the CSUSPEND/QUIESCE option.

### 6.1.5 IEA494I System Console Message

The IEA494I message is recommended as a trigger for automation over the IEA491E message, because the IEA494I message is reported to all attached MVS hosts each time the M-VOL pair status changes, whereas the IEA491E message is reported to only one host system. See section A.4 for further information on the IEA494I and IEA491E messages.

## 6.2 Switching Operations to the Remote Site

If a disaster or failure occurs at the main site, the first disaster recovery activity is to switch your operations to the remote backup site. The TC390 Synchronous R-VOLs are recovered individually based on the pair status and M-VOL fence level information for each pair. The TC390A R-VOLs are recovered based on pair status, consistency status, and consistency time.

The basic procedures for switching operations to the remote backup site are:

1. Analyze the currency of the TC390 Synchronous R-VOLs (see section 6.2.1) and the consistency of the TC390A R-VOLs (see section 6.2.2).

2. Record the consistency time (C/T) of each group. The suspended TC390A R-VOLs with consistency status of *group* will indicate the same C/T.

3. Perform file recovery as needed (see section 6.1.3). The C/T of each TC390A group can be used to retrieve lost updates.

4. At the remote site, suspend all pairs by issuing the CSUSPEND TSO command to the R-VOLs. This command changes the R-VOLs to the *simplex* state. Use the TC390A group and drain suspend options to destage pending updates in cache to the R-VOLs.

   *Note:* If PPRC is not installed, connect to each RCU, and delete all TC390 pairs. For TC390A pairs, use the **C/T** delete option to delete all consistent pairs in the group at the same time. This option prevents you from accidentally using inconsistent pairs for disaster recovery. Delete all TC390 sync pairs using the **Deleting Mode-Force** and **Deleting Mode-All** options.

   *Caution:* Once an R-VOL changes to the *simplex* state, you cannot distinguish it from a non-TC390 *simplex* volume. The TC390A C/T is also discarded when the pair is deleted.

5. If necessary, use ICKDSF REFORMAT to change the labels (VOLSERs) of the R-VOLs.

6. Make sure that all required file recovery procedures have been completed before varying the R-VOLs online. If an IPL of the remote host system is not required, bring the R-VOLs online. If an IPL is required:

   a) Clear the remote copy SIMs from the RCUs before OS IPL. Connect to each RCU, open the TrueCopy – S/390® panel, select the **Other Operations** tab, and select the **Clear SIM** button (see section 4.6.1).

   b) Perform IPL of the remote host system.

   c) Wait until the IPL is complete, and then vary the R-VOLs online (if they did not come online automatically).

7. At this point you may start critical applications at the remote site with the previous R-VOLs taking the place of their M-VOLs.

### 6.2.1 Analyzing the Currency of TrueCopy – S/390® Synchronous R-VOLs

Table 6.2 shows how to determine the currency of a TC390 Synchronous R-VOL based on its pair status and M-VOL fence level setting. For TC390 Synchronous pairs with an M-VOL fence level setting of **Never**, further analysis will be required to determine the currency of these R-VOLs. The currency of these R-VOLs can be determined by using the sense information transferred via the ERC or by comparing the contents of the R-VOL with other files which are confirmed to be current (e.g., DB2 log files). These R-VOLs should be recovered using the files which are confirmed to be current.

**Table 6.2    Analyzing the Currency of TrueCopy – S/390® Synchronous R-VOLs**

| Status of R-VOL | Fence Level | Currency of R-VOL |
|---|---|---|
| Simplex | Data<br>Status<br>Never | **Inconsistent**. This R-VOL does not belong to a TC390 volume pair. (***Note:*** Even if you established a TC390 pair for this volume, you must regard this volume as inconsistent.) |
| Pending Duplex | Data<br>Status<br>Never | **Inconsistent**. This R-VOL is not synchronized because not all cylinders have been copied from the M-VOL yet. This R-VOL must be initialized (or copied from the M-VOL at a later time). |
| Duplex | Data<br>Status | **Current**. This R-VOL is synchronized with its M-VOL. |
| | Never | **Needs to be analyzed**. This R-VOL requires further analysis to determine its level of currency. |
| Suspended - initial copy failed | Data<br>Status<br>Never | **Inconsistent**. This R-VOL is not synchronized because not all cylinders have been copied from the M-VOL yet. This R-VOL must be initialized (or copied from the M-VOL at a later time). |
| Suspended - R-VOL by operator | Data<br>Status<br>Never | **Suspect**. This R-VOL is not synchronized with its M-VOL if any write I/Os were issued to the M-VOL after the pair was suspended. This pair should be restarted using the **Entire** initial copy option, but the **No Copy** option can be used if you are sure no data on the M-VOL changed. |
| Suspended - all other types | Data | **Current**. This R-VOL is synchronized with its M-VOL. |
| | Status<br>Never | **Suspect**. This R-VOL is not synchronized with its M-VOL if any write I/Os were issued to the M-VOL after the pair was suspended. Restore the consistency of this R-VOL and update it, if required. The system time stamp information transferred through ERC or the time of suspension indicated on the Pair Status panel will help to determine the last time this R-VOL was updated. |

## 6.2.2    Analyzing the Consistency of TrueCopy – S/390® Asynchronous R-VOLs

Table 6.3 shows how to determine the consistency of a TC390A R-VOL based on its pair status and consistency status. For TC390A R-VOLs with a consistency status of **Volume**, the volume is not consistent with other volumes in the same group, and further analysis will be required to determine the currency of each of these R-VOLs. The currency of these R-VOLs can be determined by using the sense information transferred via the ERC or by comparing the contents of the R-VOL with other files which are confirmed to be current (e.g., DB2 log files). These R-VOLs should be recovered using the files which are confirmed to be current.

**Table 6.3    Analyzing the Consistency of TrueCopy – S/390® Asynchronous R-VOLs**

| Status of R-VOL | Usable for Recovery? | Description |
|---|---|---|
| Duplex<br><br>Pending Duplex<br><br>Simplex | No<br><br>No<br><br>No | These states do not usually occur during TC390A disaster recovery, because the RCU suspends all TC390A pairs when communication with the MCU is lost. TC390A R-VOLs in these states should not be used for disaster recovery.<br><br>*Note:* Simplex volumes cannot be distinguished from R-VOLs which have already been deleted by the Delete Pair operation. |
| Suspended-Group | Yes | The update sequence consistency across these R-VOLs is ensured at the point in time indicated by the group consistency time. These R-VOLs can be used for disaster recovery at the secondary system.<br><br>*Note:* Updates which were performed at the primary system after the indicated consistency time were probably lost. |
| Suspended-Volume | No | The contents of this R-VOL may be behind the other R-VOLs in the consistency group. If this volume must be consistent with the other volumes in the same group, this R-VOL should not be used for disaster recovery.<br><br>The cause for this status is:<br><br>  – The TC390A **Error Level** pair option for this pair is **Volume** (not **Group)**, AND<br><br>  – This pair was suspended before the disaster/failure, at the beginning of the rolling disaster, or during the initial copy operation. |

## 6.3    Transferring Operations Back to the Main Site

Once the applications are running at the remote site, the next activity is to restore the main site and transfer operations back to the main site. To transfer operations to the main site:

1.  Bring up the host system at the main (primary) site, and ensure that all TC390 components are fully operational.

2.  At the main site, delete all TC390 pairs at the MCUs. The **Deleting Mode-Force** option must be used because the previous R-VOLs are now in the *simplex* state at the remote site. Use the **Deleting Mode-All** option to delete all TC390 sync pairs in each CU image. Use the **Delete Range-Group** option to delete all TC390A pairs in each group. Make sure to connect with all MCUs and all CU images to delete all TC390 pairs.

3.  At the main site, delete all TC390A consistency groups at the MCUs.

4.  At the main site, delete the RCUs. Remember to connect with each MCU and each CU image to make sure that all RCUs have been deleted.

5.  At the main site, configure the MCU ports as needed. If you plan to use the same remote copy connections to copy back, change the existing initiator ports to RCU target ports, and change the existing RCPs to LCPs. If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the CESTPATH command to add the pairs at the secondary site. *Note:* For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager. The fibre-channel interface ports need to be configured as initiator ports or RCU target ports *before* the CESTPATH and CDELPATH commands are issued.

6.  If you plan to use the same channel extenders, change the operating mode to the opposite direction. The boxes/nodes connected to the MCUs must be set to channel-mode, and the boxes/nodes connected to the RCUs must be set to device-mode.

7.  At the remote site, configure the RCU ports to enable TC390 operations in the reverse direction (change RCU target ports to initiator ports for fibre, change LCPs to RCPs for serial). This enables the original RCUs to send TC390 remote copy operations to the original MCUs to bring the original M-VOLs up to date. If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the TSO CESTPATH command to add the pairs at the remote site. *Note:* For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager. The fibre-channel interface ports need to be configured as initiator ports or RCU target ports *before* the CESTPATH and CDELPATH commands are issued.

    *Caution:* Before issuing the CESTPATH command, you must make sure that the relevant paths are offline from the host(s) (e.g., configure the Chipid offline, or deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (e.g., LCP/RCP) cannot be changed.

8.  At the remote site, establish the same TC390A groups and TC390 pairs in the reverse direction to synchronize the original M-VOLs with the R-VOLs. Make sure to use the **Entire** TC390 initial copy option. Table 6.4 shows the correct timer types for performing TC390A operations in the reverse direction.

**Table 6.4      Selecting the Correct Timer Type for TrueCopy – S/390® Async Disaster Recovery**

| Original Configuration | | Timer Type for Copy Back | |
|---|---|---|---|
| | | I/O Time-Stamp Function at Secondary System? | |
| **MCU-RCU Configuration** | **Timer Type** | **Yes** | **No** |
| n-to-1 (n>1) | System | None | None |
| 1-to-1 | System | System | None |
| | Local | Local | Local |

## 6.4    Resuming Normal Operations at the Main Site

Once the TC390 pairs have been established in the reverse direction, you are ready to resume normal operations at the main site. Remember that the TC390 terminology is now reversed:  the original RCUs and R-VOLs (remote site) are now the MCUs and M-VOLs, and the original MCUs and M-VOLs (main site) are now the RCUs and R-VOLs.

To resume normal operations at the main site:

1. At the remote site, make sure that all TC390 pairs are in the *duplex* state. This indicates that the TC390 initial copy operations are complete.

2. Halt the applications at the remote site, and vary the M-VOLs (original R-VOLs) offline at the remote site. This maintains synchronization of the TC390 Synchronous pairs.

3. At the remote site, suspend all TC390 pairs at the MCUs (original RCUs) to destage any pending data from cache. Confirm that the pairs are suspended before proceeding. If an error occurs, resolve it before proceeding.

4. At the remote site, delete all TC390 pairs at the MCUs (original RCUs) using the **Deleting Mode-All** option for TC390 sync pairs and the **Delete Range-Group** option for TC390A pairs. For TC390A pairs, the MCU and RCU complete all pending updates before changing the pair status to *simplex*.

5. At the remote site, change the TC390 settings at the MCUs (original RCUs) to prepare for normal TC390 operations. Delete the TC390A groups and the RCUs (original MCUs). If you plan to use the same remote copy connections, reconfigure the ports (change initiator ports back to ordinary target ports for fibre, change RCPs back to LCPs for serial). If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the TSO CESTPATH command to add the pairs at the main site. *Note:* For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager. The fibre-channel interface ports need to be configured as initiator ports or RCU target ports *before* the CESTPATH and CDELPATH commands are issued.

6. If you plan to use the same channel extenders, change the operating mode back to the original direction. The boxes/nodes connected to the MCUs must be set to channel-mode, and the boxes/nodes connected to the RCUs must be set to device-mode.

7. At the main site, configure the initiator ports and/or RCPs, add the RCUs, and add the TC390A groups. If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the TSO CESTPATH command to add the pairs at the main site.

   *Caution:* Before issuing the CESTPATH command, you must make sure that the relevant paths are offline from the host(s) (e.g., configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (e.g., LCP/RCP) cannot be changed.

8. At the main site, establish all TC390A groups and TC390 pairs in the original direction. You may use the **No Copy** initial copy option because all M-VOLs and R-VOLs are synchronized. If there is any possibility that the volumes are not 100% synchronized, use the **Entire** initial copy option to be safe.

9. Vary the MCU and M-VOLs online, and start the applications at the main site.

# Chapter 7    Troubleshooting

## 7.1    Troubleshooting TrueCopy – S/390® Operations

In the unlikely event of a problem with the 9900V Remote Console software, first make sure that the problem is not being caused by the PC or Ethernet hardware or software, and try restarting the PC. Exiting the Remote Console software does not affect TC390 operations already in progress. See section 7.2 for a description of the TC390 error messages displayed on the Remote Console PC. If you need to call the Hitachi Data Systems Support Center, refer to section 7.3 for instructions. *Note:* Use the **FD Dump Tool** (refer to the *Lightning 9900 V Series Remote Console – Storage Navigator User's Guide*) to copy the 9900V Remote Console configuration information onto diskette, and give the diskette(s) to Hitachi Data Systems service personnel.

Table 7.1 provides general troubleshooting information for TC390. Table 7.2 provides troubleshooting information for RCU paths. Tables 7.3 and 7.4 provide troubleshooting information for suspended TC390 pairs. For troubleshooting information on TC390 scripting, see Appendix D. For troubleshooting information on PPRC and P/DAS operations, please refer to the IBM® PPRC and P/DAS user documentation:  *Planning for IBM Remote Copy* (SG24-2595), *Advanced Copy Services* (SC35-0355), and *DFSMS MVS V1 Remote Copy Guide and Reference* (SC35-0169).

**Table 7.1      General TrueCopy – S/390® Troubleshooting**

| Error | Corrective Action |
|---|---|
| The 9900V Remote Console software hangs, or TC390 operations do not function properly. | Make sure that all TC390 requirements and restrictions are met (e.g., track format, LVI, VOLSER, DFW). See sections 3.1 and 3.2. |
| | Make sure the MCU and RCU are powered on and fully operational (NVS, cache, DFW). Refer to the *Hitachi Lightning 9900™ V Series User and Reference Guide* for operational and troubleshooting information. |
| | Check all input values and parameters to make sure you entered the correct information on the TrueCopy – S/390® panels (e.g., RCU S/N and SSID, path parameters, M-VOL and R-VOL IDs). |
| If any channel enable LED indicators (9900V control panel) are off or flashing. | Please call the Hitachi Data Systems Support Center for assistance. |
| The volume pairs and/or RCUs are not displaying correctly. | Make sure that the correct CU image is selected. |
| An R-SIM warning is displayed on the 9900V Remote Console. | Locate the SIM (see the *9900V Remote Console – Storage Navigator User's Guide* for instructions). Please contact the Hitachi Data Systems Support Center for further information on SIMs. |
| A TC390 error message is displayed on the Remote Console. | Resolve the specified error condition, and then try the TC390 operation again. |
| There is a problem with the Remote Console or TC390 Remote Console software. | Make sure that the problem is not the PC or LAN hardware or software. Try restarting the PC and reconnecting to the subsystem. |
| The RCU path status is not normal. | Check the path status (RCU Status panel) and see Table 7.2. |
| The pair status is *suspended*. | Check the detailed pair status (Pair Status panel) and see Tables 7.3 and 7.4 for suspend types and corrective action for suspended TC390 pairs. |

**Table 7.2    Troubleshooting RCU Path Status Problems (continues on the next page)**

| Path Status | Description | Corrective Action |
|---|---|---|
| Initialization Failed | The link initialization procedure to the RCU failed. | Make sure that you entered the correct RCU S/N and SSID and path parameters (CU #, controller ID, port, link address, logical address). |
| | | For fibre channel interface, make sure that the fibre-channel topology settings of the MCU and RCU ports are correct. |
| | | For serial, make sure that the correct MCU port is configured as an RCP. Make sure the correct RCU port is configured as an LCP. |
| Communication Time Out | Communication between the MCU and RCU timed out. | Make sure that the RCU is powered on and fully functional (NVS and cache ON). |
| | | Make sure that the remote copy connection hardware is properly configured and functional, including cables, connectors, ESCDs, repeaters, extender devices, communication lines, and all other devices connected to the extenders. |
| | | Delete the failed path. You may need to change the minimum paths setting or delete the RCU in order to delete the path. Then add the path/RCU using Edit Path or Add RCU. |
| Resource Shortage (MCU/RCU) | The MCU/RCU rejected the establish logical path link control function because all logical path resources in the MCU/RCU are being used for other connections. | Delete the failed path, and also delete all paths and RCUs not currently in use. The MCU can be connected to up to four RCUs with up to eight paths (four for serial 3990) to each RCU. |
| | | Make sure all MCU and RCU ports are properly configured: Fibre – ordinary target ports or RCU target ports for hosts, RCU target ports for MCUs, initiator ports for RCUs. Serial – LCPs for hosts and MCUs, RCPs for RCUs. |
| | | If necessary, connect to the RCU to delete paths/RCUs and reconfigure ports, then reconnect to the MCU. |
| | | Add the path/RCU again using Edit Path or Add RCU. |
| Serial Number Mismatch | The RCU's S/N does not match the specified S/N. | Make sure that you entered the correct RCU S/N and SSID and path parameters (CU #, controller ID, port, link address, logical address). |
| | | Delete the failed path. You may need to change the minimum paths setting or delete the RCU in order to delete the path. Then add the path/RCU using Edit Path or Add RCU. |
| | | For fibre-channel interface, make sure that you entered the correct controller ID, and also make sure that the fibre-channel topology settings of the MCU and RCU ports are correct. |
| Invalid Port | The specified port is not configured as an RCP or initiator port, or this path already exists. | For fibre, make sure that the fibre-channel topology settings of the MCU and RCU ports are correct. |
| | | For serial, make sure that the correct MCU port is configured as an RCP. Make sure the correct RCU port is configured as an LCP. |
| | | Make sure that you entered the correct RCU S/N and SSID and path parameters (CU #, controller ID, port, link address, logical address). |
| | | Delete the failed path. You may need to change the minimum paths setting or delete the RCU in order to delete the path. Then add the path/RCU using Edit Path or Add RCU. |
| RCU Port Number Mismatch | The specified port in the RCU is physically disconnected from the MCU, or the port is not configured as an RCU target port. | Make sure that you entered the correct RCU port number. Correct the port number if necessary. |
| | | Make sure that the port in the RCU is configured as an RCU target port. Configure the port as an RCU target port if necessary. |
| | | Make sure that the MCU and RCU are physically connected. |

**Table 7.2      Troubleshooting RCU Path Status Problems (continued)**

| Path Status | Description | Corrective Action |
|---|---|---|
| RCU Port Number Mismatch | The specified port in the RCU is physically disconnected from the MCU. | Make sure that you entered the correct RCU port number. Correct the port number if necessary.<br><br>Make sure that the MCU and RCU are physically connected.<br><br>For fibre-channel interface, make sure that the fibre-channel topology settings of the MCU and RCU ports are correct. |
| RCU Port Type Mismatch | The specified port in the RCU is not configured as an RCU Target port. | Make sure that the port in the RCU configured as an RCU target port. Configure the port as an RCU target port if necessary. |
| Communication failed. | The MCU connects to the RCU successfully, but logical communication time out occured. | Make sure that the RCU port and remote copy connection hardware (cables and switches) are properly configured and functioning. |
| Port Number Mismatch | The specified port number is not correct, or the cable is not connected to the specified port. | Delete the error path.<br>Make sure that you entered the correct port number.<br>Make sure that the cable is connected. |
| Communication Error | Communication between the MCU and RCU through the fibre path timed out. | Delete the failed path. |
| \<blank\> | This path was not established. | Delete the failed path. You may need to change the minimum paths setting or delete the RCU in order to delete the path. Then add the path/RCU using Edit Path or Add RCU. |

**Table 7.3     Troubleshooting Suspended TrueCopy – S/390® Pairs**

| Suspend Type | Applies to | Description | Corrective Action |
|---|---|---|---|
| M-VOL by Operator | M-VOL | The user suspended the pair from the MCU using the **M-VOL Failure** option. The R-VOL suspend type is *by MCU*. | Resume the pair from the MCU. |
| R-VOL by Operator | M-VOL, R-VOL | The user suspended the pair from the MCU or RCU using the **R-VOL** option. | Resume the pair from the MCU. |
| by MCU | R-VOL | The RCU received a request from the MCU to suspend the pair. The M-VOL suspend type is *M-VOL by Operator* or *R-VOL by Operator*. | Resume the pair from the MCU. |
| by RCU | M-VOL | The MCU detected an error condition at the RCU which caused the MCU to suspend the volume pair. The R-VOL suspend type is *by MCU*. | Clear the error condition at the RCU or R-VOL. If you need to access the R-VOL, delete the pair from the RCU.<br><br>If any data on the R-VOL has changed, delete the pair from the MCU and then restart the pair (Add Pair). If not, resume the pair from the MCU. |
| Delete Pair to RCU | M-VOL | The MCU detected that the R-VOL status changed to *simplex* because the user deleted the pair from the RCU. The pair cannot be resumed because the R-VOL does not have the *suspended* status. | Delete the pair from the MCU, and then restart the pair. You should use the **Entire** initial copy option to resynchronize the pair. You can use the **No Copy** initial copy option only if no data on the M-VOL or R-VOL changed. |
| R-VOL Failure | M-VOL | The MCU detected an error during communication with the RCU or an I/O error during update copy. In this case, the suspend type for the R-VOL is usually *by MCU*. | Check the path status on the RCU Status panel (see Table 7.2).<br><br>Clear any error conditions at the RCU/R-VOL. If you need to access the R-VOL, delete the pair from the RCU.<br><br>If any data on the R-VOL has changed, delete the pair from the MCU and then restart the pair (Add Pair). If not, resume the pair from the MCU. |
| MCU IMPL | M-VOL, R-VOL | The MCU could not find valid control information in its nonvolatile memory during the IMPL procedure. This error occurs only if the MCU is without power for more than 48 hours (power failure and fully discharged batteries). | Resume the pair from the MCU. The MCU will perform an entire initial copy operation in response to the resume pair request. |
| Initial Copy Failed | M-VOL, R-VOL | The MCU suspended this pair during the initial copy operation. The data on the R-VOL is not identical to the data on the M-VOL. Invalid track format can cause this suspension. | Delete the pair from the MCU. Clear all error conditions at the MCU, M-VOL, RCU, and R-VOL. Reformat failed track using ICKDSF. Restart the initial copy operation using the Add Pair panel. |
| by FREEZE | M-VOL, R-VOL | All TC390 Synchronous pairs in the MCU were suspended by the CGROUP/RUN command. | Resume the pair(s) from the MCU using Resume Pair or the CESTPAIR (MODE=RESYNC) TSO command. |
| MCU P/S-OFF | R-VOL (TC390A) | The MCU suspended all TC390A pairs due to MCU power-off. | None. The MCU will automatically resume these TC390A pairs during power-on. |
| by Sidefile Overflow | M-VOL, R-VOL | The amount of sidefile exceeds the specified current pending update data rate, and the RCU data is not transferred within the specified offloading timer. | Add cache memory, increase the number of paths between MCU and RCU, or decrease the number of Async pairs or host I/Os. |

Table 7.4 provides troubleshooting instructions for the TC390A suspension conditions caused by the offloading timer async option, the group timeout options (copy pending and RCU ready), and recordset errors. Hardware failures which affect the cache storage/shared memory of the MCU or RCU may also cause the TC390A volume pairs to be suspended.

**Table 7.4    Resolving TrueCopy – S/390® Asynchronous Suspension Conditions**

| Classification | Causes of Suspension | SIM | Recovery procedure |
|---|---|---|---|
| MCU/RCU hardware | Hardware redundancy has been lost due to some blockade condition. As a result, MCU-RCU communication, creating or receiving recordset, or the staging or de-staging process could not complete.<br><br>The pending recordset cannot be retained because one side of cache storage or shared memory has been blocked due to hardware failure.<br><br>MCU-Creating/sending recordset failed due to unrecoverable hardware failure.<br><br>RCU-Reading/Settling recordset failed due to unrecoverable hardware failure.<br><br>The drive parity group has been in the correction-access status while the TC390 volume pair was in pending state. | DB0x<br>DB1x<br>DB2x | According to SIM, remove the hardware blockade or failure.<br><br>Re-establish failed volume pairs (Resume Pair). |
| MCU-RCU communication | During the power-on-reset sequence, the MCU could not communicate with the RCU within the specified RCU ready timeout.<br><br>The RCU could not settle the pending recordset or could not communicate with the MCU before the copy pending timeout due to MCU not-ready or inoperative facilities on the remote copy connections. | DB0x<br><br>DB1x | Remove the failed condition at the RCU/MCU or on the remote copy connection.<br><br>Re-establish failed pairs (Resume Pair). |
| RIO overload | The unrecoverable RIO (remote I/O) timeout occurred due to overload of the RCU or the communication facilities on the remote copy connections.<br><br>No recordset could be sent within the specified copy pending timeout.<br><br>The RCU could not settle the pending recordset before the copy pending timeout due to overload of the RIO or the RCU itself. | DB1x | Delete failed pairs (Delete Pair).<br><br>Reconsider the performance resources necessary, and increase resources as needed (cache amount, number of MCU-RCU paths, etc.).<br><br>Re-establish failed pairs (Add Pair). |
| RIO failure | The RIO (remote I/O) could not complete due to the failure at the RCU. | DB2x | According to SIM generated at the RCU, remove the failure.<br><br>Re-establish failed pairs (Resume Pair). |
| MCU planned outage | The TC390A pairs were temporarily suspended due to a planned outage of the MCU. | DB8x | No recovery procedure is required. The MCU will automatically remove the suspension condition during the next power-on-reset sequence. |

## 7.2 TrueCopy – S/390® Software Error Codes

The TrueCopy – S/390® software displays error messages when error conditions occur during TC390 operations (see Figure 7.1). The error message describes the error and provides a part code and an error code (**Part Code = 6005**, **Error Code = 8736** in Figure 7.1). The error message may also include a 9900V SVP error code. If you need to call the Hitachi Data Systems Support Center for assistance, please report the TC390 and SVP error codes.

Please refer to the *Hitachi Lightning 9900™ V Series Remote Console Error Codes* (MK-92RD132) for a list of error codes displayed on the 9900V Remote Console PC.
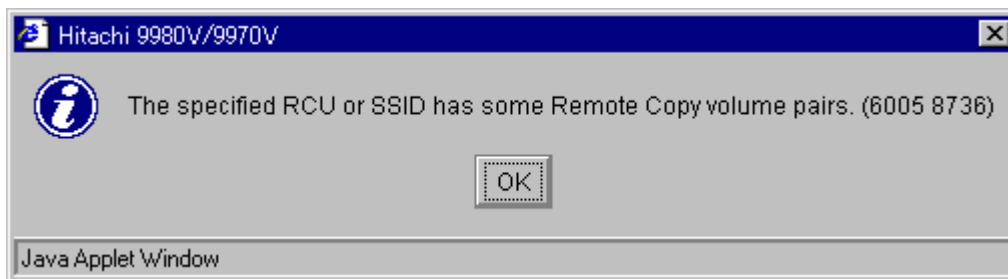


Delete RCU failed because the RCU still contains one or more pairs with the current MCU.

**Figure 7.1     Error Message for Failed Delete RCU Operation**

## 7.3  Calling the Hitachi Data Systems 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 Remote Console configuration information saved on diskette using the **FD Dump Tool** (see the *Hitachi Lightning 9900™ V Series Remote Console User's Guide*),

- The circumstances surrounding the error or failure,

- The exact content of any error messages displayed on the host system(s),

- The TC390 (or other) error code(s) displayed on the 9900V Remote Console, and

- The remote service information messages (R-SIMs) and the reference codes and severity levels of the recent R-SIMs.

The worldwide Hitachi Data Systems Support Centers are:

- 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

# Appendix A    Using PPRC Commands for TrueCopy – S/390®

## A.1    Overview of PPRC Commands

The Hitachi Lightning 9900™ V Series subsystem supports IBM® Peer-to-Peer Remote Copy (PPRC) TSO and ICKDSF commands to enable you to perform TC390 operations from the S/390® host system. PPRC TSO commands are issued from the system console to the M-VOL or R-VOL of a TC390 pair. PPRCOPY ICKDSF commands are issued from JCL job cards. The TC390 feature must be installed on the 9900V, and IBM® PPRC must be installed on the host operating system. For TC390A operations, special switches and parameters are used to control and monitor TC390A pairs and groups using PPRC commands.

The following TC390 operations cannot be performed using PPRC commands: async options, and TC390A group addition/deletion. The async options and groups must be configured using the Remote Console PC before you can add any TC390A pairs (CESTPAIR). You also cannot change the RCU options, initial copy priority, or the CFW data or DFW to R-VOL pair options using PPRC commands. See section 2.6 for further information on the restrictions associated with using PPRC commands instead of the TrueCopy – S/390® Remote Console software.

Port configuration (RCU target↔initiator, LCP↔RCP) is supported via the CESTPATH and CDELPATH TSO commands only when SVP mode 114 ON (refer to Table 2.1). If SVP mode 114 is OFF, you must configure the ports using the licensed TC390 software on the Remote Console PC before adding paths and after deleting paths.

Table A.1 lists the TC390 operations and describes the corresponding PPRC TSO and ICKDSF commands. Section A.2 provides instructions for using the PPRC TSO commands with TC390A pairs.

*Note:* For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager. The fibre-channel interface ports need to be configured as initiator ports or RCU target ports *before* the CESTPATH and CDELPATH commands are issued.

*Note:* PPRC TSO command parameter support depends on the CU emulation (3990 or 2105). PPRC command extensions are supported when running with 2105 emulation.

*Note:* The PPRC TSO and ICKDSF commands have required and optional parameters which are not described in detail in this document. For further information on using PPRC TSO and PPRCOPY ICKDSF commands, refer to IBM® publications *Advanced Copy Services* (SC35-0355), *DFSMS MVS V1 Remote Copy Guide and Reference* (SC35-0169), and *ICKDSF R16 Refresh User's Guide* (GC35-0033).

*Note:* The PPRC TSO and ICKDSF commands use slightly different command/keyword names to provide equivalent PPRC functions. For example, the **CESTPAIR** TSO command is equivalent to the **PPRCOPY ESTPAIR** ICKDSF command. This document describes the PPRC TSO commands. Please refer to the IBM® PPRC and ICKDSF documentation for complete information on using PPRCOPY ICKDSF instead of PPRC TSO commands.

*Note:* The CESTPATH RESETHP option rejects the host I/O operations. Before you use the RESETHP option of the CESTPATH command, stop the I/O operations from the host.

**Table A.1    TrueCopy – S/390® Operations versus PPRC TSO and ICKDSF Commands**

| TC390 Operation | TSO Command | ICKDSF Command | Command Issued to: | Description |
|---|---|---|---|---|
| Configure Port (LCP to RCP, or RCU target to initiator) | ----- | | ----- | If SVP mode 114 is OFF, the ports must be configured using the Remote Console PC (or SVP). If SVP mode 114 is ON, the ports are configured automatically (LCP/RCP to RCP/LCP, RCU target/initiator to initiator/RCU target) in response to the CESTPATH and CDELPATH TSO commands. *Note:* For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager. The fibre-channel interface ports need to be configured as initiator ports or RCU target ports *before* the CESTPATH and CDELPATH commands are issued. |
| Add RCU | CESTPATH | PPRCOPY ESTPATH | MCU | Establishes logical paths from an MCU to an RCU. The default RCU options are used (see section 2.6). See section A.2.1 for details on using CESTPATH for TC390A. |
| Delete RCU | CDELPATH | PPRCOPY DELPATH | M-VOL | Deletes all active paths between an MCU and an RCU. |
| RCU Status | CQUERY/PATHS | PPRCOPY QUERY/ PATHS | MCU | Displays the status of all paths for the CU specified by the DEVN parameter. TC390 supports the optional FORMAT/UNFORMAT and VOLUME/PATHS parameters. |
| Async Options | ----- | ----- | MCU/RCU | The default TC390 async options are used (see section 2.6). |
| Add Group | ----- | ----- | MCU | Must be performed using the TC390 software (see section 4.3.2). The group options are selected during add group. |
| Group Status | ----- | ----- | MCU/RCU | Must be performed using the TC390 software (see section 4.3.4). |
| Delete Group | ----- | ----- | MCU | Must be performed using the TC390 software (see section 4.3.5). |
| Add Pair | CESTPAIR (MODE=COPY) | PPRCOPY ESTPAIR | M-VOL | Establishes a TC390 pair and sets the initial copy and pair options (copy mode = synchronous or asynchronous only, priority = 0, CFW data = copy to R-VOL, DFW to R-VOL = not required). TC390 supports the optional MODE, PACE, and CRIT parameters. The MSGREQ parameter defaults to NO (not applicable to TC390A). See section A.2.2 for details on using CESTPAIR for TC390A. |
| Suspend Pair | CSUSPEND | PPRCOPY SUSPEND | M-VOL or R-VOL | Suspends a TC390 pair (or TC390A group). TC390 supports the optional PRIMARY parameter. See WARNING below on the QUIESCE parameter. See section A.2.3 for details on CSUSPEND for TC390A. |
| Delete Pair (to MCU) | CDELPAIR | PPRCOPY DELPAIR | M-VOL | Deletes a TC390 pair (or TC390A group) from the MCU. See section A.2.4 for details on using CDELPAIR for TC390A. |
| Delete Pair (to RCU) | CRECOVER | PPRCOPY RECOVER | R-VOL | Deletes a TC390 pair (or TC390A group) from the RCU. See section A.2.5 for details on using CRECOVER for TC390A. |
| Pair Status | CQUERY/ VOLUME | PPRCOPY QUERY/ VOLUME | M-VOL or R-VOL | Displays the TC390 & TC390A pair status of the volume. TC390 supports the optional FORMAT/UNFORMAT and VOLUME/PATHS parameters. See section A.2.6 for details on using CQUERY for TC390A. |
| Resume Pair | CESTPAIR (MODE= RESYNC) | PPRCOPY ESTPAIR | M-VOL | Resumes a TC390 pair (or TC390A group), and sets the TC390 initial copy options and pair options. TC390 supports the optional MODE, PACE, and CRIT parameters. See section A.2.2 for details on using CESTPAIR/RESYNC for TC390A. |

**Table A.1      TrueCopy – S/390® Operations versus PPRC TSO and ICKDSF Commands (continued)**

| TC390 Operation | TSO Command | ICKDSF Command | Command Issued to: | Description |
|---|---|---|---|---|
| ----- | P/DAS SWAP | ----- | M-VOL and R-VOL | Supported by TC390 Synchronous. Command is rejected by TC390A pairs. Redirects application I/Os from the M-VOL to the R-VOL. See section 2.6.1 for details on using P/DAS SWAP with TC390. |
| ----- | CGROUP (FREEZE/RUN) | ----- | MCU (M-VOL or simplex) | Supported by TC390 Synchronous. Command is rejected by TC390A pairs. See section A.3 for details on using CGROUP (FREEZE/RUN) with TC390 Synchronous pairs. |

*WARNING:* The QUIESCE option of the CSUSPEND command 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 of the CSUSPEND command. Please check with your Hitachi Data Systems account team before using the CSUSPEND command with the QUIESCE option to suspend TC390 volume pairs on 9900V (or 9900/7700E) subsystems. If the CSUSPEND command with 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. TC390A does not support the CSUSPEND/QUIESCE option.

## A.2    Using PPRC TSO Commands with TC390A

For TC390A operations, special switches and parameters are utilized to control and monitor TC390A pairs and groups using PPRC commands. This section describes this special use of PPRC TSO commands for TC390A volumes on 9900V subsystems. Table A.2 describes the typographic conventions used for the PPRC TSO commands described in this section.

*Note:* PPRC TSO command parameter support depends on the emulation (e.g., 2105 or 3990). PPRC command extensions are supported when running with 2105 emulation.

The **PPRC TSO Command** option on the Async Option panel allows you to select the 7700E-compatible format for PPRC TSO commands (groups 0-F instead of 00-7F). If this option is selected, please refer to the *Hitachi Freedom Storage™ 7700E HRC User and Reference Guide* for information on using the 7700E-compatible format for PPRC TSO commands.

*Note:* The DEVSERV PATHS command displays the pair status of a TC390A volume in the DC-STATE field. The contents of this field are the same as for TC390 Synchronous. Note that the TC390A transition states (*suspending* and *deleting*) are not displayed.

*Note:* This section does not specifically address the equivalent PPRCOPY ICKDSF commands. Please use caution when issuing ICKDSF commands to TC390A volumes, and refer to IBM® publications *Advanced Copy Services* (SC35-0355), *DFSMS MVS V1 Remote Copy Guide and Reference* (SC35-0169), and *ICKDSF R16 Refresh User's Guide* (GC35-0033).

**Table A.2    Typographic Conventions for PPRC TSO Commands**

| Typeface/Symbol | Example | Usage |
|---|---|---|
| Normal text | CRIT(YES) | Command/keyword names or console outputs. |
| Italics | *ssid* | Parameter to be replaced with an appropriate character or numeric string. |
| Bold | **cmd_param** | Command/keyword names, parameters, or console outputs that involve/denote special meaning for TC390 Asynchronous. |
| Square brackets | [PACE(15)] | Keywords/parameters that can be omitted. |
| Vertical pipe | (YES\|NO) | List of keywords to be selected. |
| Underline | (YES\|<u>NO</u>) | The default keywords/parameters. |
| Strikethrough | [~~QUIESCE~~] | Invalid keywords/parameters for TC390 Asynchronous. |

## A.2.1 CESTPATH

The CESTPATH command allows you to establish remote copy paths for the 9900V and can be used for either serial (ESCON®) or fibre-channel interface. For fibre, the RCU controller ID is specified. The syntax for the CESTPATH command is:

For 3990-6 and -6E controller emulations:
CESTPATH    DEVN(X'*dev#*') PRIM(X'*ssid*' *serial#*) SEC(X'*ssid*' *serial#*') LINK(X'*aabbccdd*')

For 2105 controller emulation ('lss' parameter for LCU no., CGROUP and RESETHP options):
CESTPATH    DEVN(X'*dev#*') PRIM(X'*ssid*' *serial#* X'*lss*') SEC(X'*ssid*' *serial#*' X'*lss*') LINK(X'*aabbccdd*')
            [CGROUP(YES|NO) RESETHP(YES|NO)]

*Note:* For fibre, do not use the RESETHP option. For serial, the RESETHP option rejects host I/O operations. Before you use this option, stop the I/O operations from the host.

*Note:* For 2105 emulation, use the CESTPATH CGROUP option to control freeze. Do not use the CGROUP FREEZE option. If you use the FREEZE option, the CESTPATH command will be rejected.

*Caution:* Before issuing the CESTPATH command, you must make sure that the relevant paths are offline from the host(s) (e.g., configure the Chipid offline, or deactivate the LPAR, or block the port in the ESCD). If any active paths still exist, the add path operation will fail because the port mode cannot be changed.

*Note:* For fibre-channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Manager. The fibre-channel interface ports need to be configured as initiator ports or RCU target ports *before* the CESTPATH and CDELPATH commands are issued.

Table A.3 describes the CESTPATH LINK parameter for serial and fibre-channel interface.

**Table A.3    CESTPATH LINK Parameter for Serial and Fibre Channel**

| LINK Parameter | Serial (ESCON®) Interface | Fibre-Channel Interface |
|---|---|---|
| **aa**<br>First two digits of SAID, see Table A.4. | FREEZE option<br>    0x00:keep the status<br>    0x01:Enabled<br>    0x02:Disabled<br>When there are several paths, the same values must be specified for all the paths. | Bit 0-3: RCU controller ID<br>    x2-xF: Number stands for RCU controller ID. (x'2' is specified.)<br>Bit 4-7: FREEZE option<br>    x0:keep the status<br>    x1:Enabled<br>    x2:Disabled<br>When there are several paths, the same values must be specified for all the paths. |
| **bb**<br>Second two digits of SAID, see Table A.4. | MCU port number (0x00-0x1f) | MCU port number (0x00-0x1f) |
| **cc** | Link Adr (0x00-0xff) | RCU port number (0x00-0x1f) |
| **dd** | CU number (0x00-0x0f) | CU number (0x00-0x0f) |

Table A.4 gives the 9900V system adapter ID (SAID) values for the CESTPATH LINK parameter.

- The last two digits of the link parameter must specify the logical CU number (00-1F for 9900V, 00-0F for 9900, 00-03 for 7700E).

- For 3990 controller emulation, the first two digits can be 00, 01, or 02. This option is unique to Hitachi RAID storage and controls freeze as follows:
      00 = use mode 104
      01 = freeze enabled
      02 = freeze disabled

- For 2105 emulation, the first two digits must be 00. The CGROUP option of the CESTPATH command is used to control freeze for 2105 emulation.

**Table A.4    SAID Values for the CESTPATH LINK Parameter**

| RCP or Initiator Port | | | RCP or Initiator Port | | |
|---|---|---|---|---|---|
| Cluster | Port | SAID Value | Cluster | Port | SAID Value |
| 1 | CH'A' | X'0000' | 2 | CH'A' | X'0010' |
| | CH'B' | X'0001' | | CH'B' | X'0011' |
| | CH'C' | X'0002' | | CH'C' | X'0012' |
| | CH'D' | X'0003' | | CH'D' | X'0013' |
| | CH'E' | X'0004' | | CH'E' | X'0014' |
| | CH'F' | X'0005' | | CH'F' | X'0015' |
| | CH'G' | X'0006' | | CH'G' | X'0016' |
| | CH'H' | X'0007' | | CH'H' | X'0017' |
| | CH'J' | X'0008 | | CH'J' | X'0018 |
| | CH'K' | X'0009 | | CH'K' | X'0019 |
| | CH'L' | X'000A | | CH'L' | X'001A |
| | CH'M' | X'000B | | CH'M' | X'001B |
| | CH'N' | X'000C | | CH'N' | X'001C |
| | CH'P' | X'000D | | CH'P' | X'001D |
| | CH'Q' | X'000E | | CH'Q' | X'001E |
| | CH'R' | X'000F | | CH'R' | X'001F |

### A.2.2  CESTPAIR

Table A.5 describes how to use the CESTPAIR command to establish TC390A pairs and resume TC390A pairs and groups. The syntax for the CESTPAIR command is:

For 3990-6 and -6E controller emulations:

CESTPAIR    DEVN(X*'dev#'*) PRIM(X*'ssid'* **cmd_param** X*'cca'*) SEC(X*'ssid' serial#* X*'cca'*)
            [MODE(COPY|NOCOPY|RESYNC)] [PACE(*pace*)] [**CRIT(YES|NO)**] [MSGREQ(YES|NO)]

For 2105 controller emulation (new 'lss' parameter for LCU number):

CESTPAIR    DEVN(X*'dev#'*) PRIM(X*'ssid'* **cmd_param** X*'cca'* X*'lss'*) SEC(X*'ssid' serial#* X*'cca'* X*'lss'*)
            [MODE(COPY|NOCOPY|RESYNC)] [PACE(*pace*)] [**CRIT(YES|NO)**] [MSGREQ(YES|NO)]

**Table A.5    Using CESTPAIR to Establish and Resume TrueCopy – S/390® Async Pairs**

| Parameter | Contents | Description |
|---|---|---|
| *cmd_param* | AG*nnd*<br>*nn* = consistency group number (00-7F) or master volume number (00-FF) for dummy pair mode.<br>*d* = 0, N, or D | Without MODE(RESYNC): Specifies the consistency group number nn to which the volume pair will belong.<br>With MODE(RESYNC): Specifies that all M-VOLs in the consistency group should be resynchronized (resumed).<br>*nn* must specify the consistency group number of the addressed device or the master volume number.<br>*d* specifies the delay option for command retry due to sidefile:<br>    0 = normal delay for command retry starting at HWM (see section 2.3.7)<br>    N = no delay time:  no command retry delay due to sidefile for this pair.<br>        *Note:* Use the **N** setting only for a limited number of critical volumes.<br>    D = dummy pair mode (*nn* must specify the master volume number). |
|  | AV*nnd*<br>*nn* = consistency group number (00-7F) or master volume number (00-FF) for dummy pair mode.<br>*d* = 0, N, or D | With MODE(RESYNC) : Specifies that only the addressed device should be re-synchronized.<br>*nn* must specify the consistency group number of the addressed device or the master volume number.<br>*d* specifies the delay option for command retry due to sidefile:<br>    0 = normal delay for command retry starting at HWM (see section 2.3.7)<br>    N = no delay time:  no command retry delay due to sidefile for this pair.<br>        *Note:* Use the **N** setting only for a limited number of critical volumes.<br>    D = dummy pair mode (*nn* must specify the master volume number). |
| PACE | (*pace*) | Specifies the pace of the initial copy operation: 1-255, default=15 tracks. |
| CRIT | (YES) | Specifies the Error Level (TC390A pair option) of Group. |
|  | (NO) | Specifies the Error Level (TC390A pair option) of Volume. |

*Notes:*

- If the first digit of the ***cmd_param*** is other than `A`, the subsystem interprets this command as pair establishment for TC390 Synchronous or ShadowImage.

- The consistency group *nn* must be registered prior to this command. Otherwise this command will be rejected.

- When `MODE(RESYNC)` is specified, the consistency group number *n* must be the consistency group number to which the addressed device belongs. If a different number is specified, this command will be rejected.

- When `MODE(RESYNC)` is specified, the copy mode (synchronous or asynchronous) cannot be changed. If a different copy mode is specified, this command will be rejected.

- If the consistency group requirements (see section 3.2.7) are not satisfied, this command may/may not be rejected.

- The delay option prevents command retry delay for this pair when sidefile is above the HWM (see section 2.3.7). If not specified correctly, command is rejected (F/M=04).

- When ***cmd_param*** `AGxxx` is specified, this command ends *before* the actual pair establishment/re-establishment successfully starts. Confirmation by CQUERY or IEA494I console message is recommended after this command.

- The dummy pair for each primary volume can only be established by the PPRC command. For the use of dummy pair, note:
    - Use the dummy pair only for a limited number of the critical volumes.
    - The dummy pair function is only for ESCON®-connected TC390A pairs.
    - Up to three dummy pairs can be specified for one master pair.
    - The dummy pair should be an actual volume which has the same CU number as the master pair.
    - The dummy pair should be offline from each host.
    - The dummy pair cannot be used as a user volume.
    - Establish the master pair before establishing the dummy pair.

## A.2.3  CSUSPEND

Table A.6 describes how to use the CSUSPEND command to suspend TC390A pairs and groups. The syntax for the CSUSPEND command is:

For 3990-6 and -6E controller emulations:

CSUSPEND    DEVN(X'*dev#*') PRIM(X'*ssid*' ***cmd_param*** X'*cca*') SEC(X'*ssid*' *serial#* X'*cca*')
            [~~PRIMARY~~] [~~QUIESCE~~]

For 2105 controller emulation, addressed device is M-VOL (new 'lss' parameter for LCU no.):

CSUSPEND    DEVN(X'*dev#*') PRIM(X'*ssid*' ***cmd_param*** X'*cca*' X'*lss*') SEC(X'*ssid*' *serial#* X'*cca*' X'*lss*')
            [~~PRIMARY~~] [~~QUIESCE~~]

For 2105 controller emulation, addressed device is R-VOL (new 'lss' parameter for LCU no.):

CSUSPEND    DEVN(X'*dev#*') PRIM(X'*ssid*' ***cmd_param*** X'*cca*' X'*lss*') SEC(X'*ssid*' *serial#* X'*cca*' X'*lss*')
            [~~PRIMARY~~] [~~QUIESCE~~]

*Note:* If you need write access to an R-VOL, you must delete the pair (CDELPAIR).

**Table A.6    Using CSUSPEND to Suspend TrueCopy – S/390® Async Pairs**

| Parameters | Contents | Description |
|---|---|---|
| ***cmd_param*** | AGD00 | Specifies that all the volume pairs in the consistency group should be suspended after all pending recordsets are settled (**Drain** suspend option). |
| | AGP00 | Specifies that all the volume pairs in the consistency group should be suspended. Pending recordsets are not always settled before suspension (**Purge** suspend option). |
| | AVD00 | Specifies that only addressed volume pair should be suspended after the pending recordset for addressed volume settled (**Drain** suspend option). |
| | AVP00 | Specifies that only the addressed volume pair should be suspended. Pending recordsets for addressed volume are not always settled (**Purge** suspend option). |
| PRIMARY | | Invalid keyword for TC390 Asynchronous volume pairs. |
| QUIESCE | | Invalid keyword for TC390 Asynchronous volume pairs. |

\*   If the addressed device is the M-VOL, only TC390A pairs in the same subsystem are suspended. Volume pairs whose M-VOLs are behind other MCUs are not affected.

Notes:

■  If the first digit of the ***cmd_param*** is other than A, the subsystem interprets this command as pair suspension for TC390 Synchronous or ShadowImage.

■  The D and P in ***cmd_param*** stand for the Drain and Purge options, respectively. See section 5.6 for a detailed description of these TC390A suspend options.

■  When P (Purge) is specified, it is not possible to determine exactly which recordset will be settled before the addressed volume pair is suspended.

■  Regardless of the number of volume pairs to be suspended, this command ends *before* the actual pair suspension is successfully completed. Confirmation by CQUERY or IEA494I console message is recommended after this command.

## A.2.4 CDELPAIR

Table A.7 describes how to use the CDELPAIR command to delete TC390A pairs and groups at the MCU. The syntax for the CDELPAIR command is:

For 3990-6 and -6E controller emulations:

CDELPAIR    DEVN(X'*dev#*') PRIM(X'*ssid*' *cmd_param* X'*cca*' X'*lss*') SEC(X'*ssid*' *serial#* X'*cca*' X'*lss*')

For 2105 controller emulation (new 'lss' parameter for LCU number):

CDELPAIR    DEVN(X'*dev#*') PRIM(X'*ssid*' *cmd_param* X'*cca*' X'*lss*') SEC(X'*ssid*' *serial#* X'*cca*' X'*lss*')

**Table A.7    Using CDELPAIR to Delete TrueCopy – S/390® Async Pairs/Groups at the MCU**

| Parameters | Contents | Description |
|---|---|---|
| *cmd_param* | AG000 | Specifies that all pairs in the consistency group* should be deleted. All pending recordsets will be settled before deleting the volume pairs. |
| | AV000 | Specifies that only the addressed pair should be deleted. All pending recordsets for the addressed volume will be settled before deleting the volume pair. |

\*    Only TC390A pairs in the same subsystem are deleted. Volume pairs whose M-VOLs are behind other MCUs are not affected.

Notes:

■ If the first digit of the *cmd_param* is other than A, the subsystem interprets this command as pair deletion for TC390 Synchronous or ShadowImage.

■ The specified pair(s) will be deleted regardless of their pair status. Once the pair(s) is/are deleted, the volume(s) will not indicate their pair status before pair deletion. To delete TC390A pairs with their update sequence consistency ensured:

– Issue the CSUSPEND command with *cmd_param* of AGP00 or AGD00.

– Issue CQUERY to confirm that the specified pairs have been successfully suspended with the consistency status of **Group**.

– Issue the CDELPAIR command.

■ Regardless of the number of volume pairs to be deleted, this command ends *before* the actual pair deletion is successfully completed. Confirmation by CQUERY or IEA494I console message is recommended after this command.

## A.2.5  CRECOVER

Table A.8 describes how to use the CRECOVER command to delete TC390A pairs and groups at the RCU. The syntax for the CRECOVER command is:

For 3990-6 and -6E controller emulations:

CRECOVER   DEVN(X'*dev#*') PRIM(X'*ssid*' **cmd_param** X'*cca*') SEC(X'*ssid*' *serial#* X'*cca*')
[ID(*old_volser*[*new_volser*])]

For 2105 controller emulation (new 'lss' parameter for LCU number):

CRECOVER   DEVN(X'*dev#*') PRIM(X'*ssid*' *serial#* X'*cca*' X'*lss*') SEC(X'*ssid*' **cmd_param** X'*cca*' X'*lss*')
[ID(*old_volser*[*new_volser*])]

**Table A.8    Using CRECOVER to Delete TrueCopy – S/390® Async Pairs/Groups at the RCU**

| Parameters | Contents | Description |
|---|---|---|
| **cmd_param** | AC000 | Specifies that all volume pairs (R-VOLs) in the consistency group whose consistency status is Suspended-Group should be deleted. |
| | AG000 | Specifies that all volume pairs (R-VOLs) in the consistency group should be deleted regardless of pair status and consistency status. All pending recordsets will be settled before deleting the pairs. |
| | AV000 | Specifies that the addressed volume pair (R-VOL) should be deleted regardless of pair status and consistency status. All pending recordsets for the addressed pair will be settled before deleting the pair. |
| [ID(*old_volser*[*new_volser*])] | | TC390A does not support this keyword. Depending on the timing, the write command to change the volume serial number may be rejected. |

Notes:

- The addressed device must be the R-VOL.

- If the first digit of the **cmd_param** is other than A, the subsystem interprets this command as pair deletion for TC390 Synchronous or ShadowImage.

- Regardless of the number of volume pairs to be deleted, this command ends *before* the actual pair deletion is successfully completed. Confirmation by CQUERY or IEA494I console message is recommended after this command.

### A.2.6 CQUERY for Serial Interface

The CQUERY command can be issued to a TC390A pair to determine its detailed pair status as well as its TC390A pair and group options. Figure A.1 shows the output of the CQUERY command with the VOLUME parameter issued to a TC390A M-VOL.

*Note:* When the controller emulation type is 3990, the CQUERY command only displays the path types and path status of the first four paths, even if more than four paths have been added.

```
*************** PPRC REMOTE COPY CQUERY - VOLUME ********************
*                                        (PRIMARY)   (SECONDARY)     *
*                                        SSID CCA    SSID CCA        *
*DEVICE   LEVEL       STATE     PATH STATUS SERIAL#     SERIAL#      *
*------ --------- ---------- ----------- ---------   ---------   *
* 0A32  PRIMARY.. PENDING... ACTIVE..      7700 32      7740 12  *
*       CRIT(NO)                         A00SNG030982 000000030954   *
* PATHS SAID/DEST STATUS:    DESCRIPTION                        *
* ----- --------- ------    ------------------                *
*   1    001D 0000  01      PATH ESTABLISHED...                *
*        ---- ----  00      NO PATH............                *
*        ---- ----  00      NO PATH............                *
*        ---- ----  00      NO PATH............                *
* IF STATE = PENDING/SUSPEND: FIRST CYL OUT OF SYNC = 00117     *
*                            LAST CYL OUT OF SYNC = 03338       *
*                            PERCENT OF COPY COMPLETE = 004%    *
********************************************************************
```

**Figure A.1    CQUERY Output Example: M-VOL/FORMAT/VOLUME**

The CRIT field is not used for TC390A (NO is always indicated).

The FIRST/LAST CYL OUT OF SYNC and PERCENT OF COPY COMPLETE fields indicate the first/last cylinder number and percentage of cylinders (including R-VOL cylinders) to be copied for pair resynchronization. See section 5.5 for a more detailed description.

The PATHS, SSID, DEST, STATUS, and DESCRIPTION fields show NO PATH for this volume pair instead of the actual path status. CQUERY with PATHS keyword provides the path status for this volume pair.

The MCU serial number field is used to display the following TC390A information:

For 3990-6 and -6E controller emulations:

```
┌───┬────┬───┬───┬───┬───┬────────┐
│ A │ 00 │ S │ 0 │ G │ 0 │ 030982 │
└───┴────┴───┴───┴───┴───┴────────┘
```

Indicates the serial number of the MCU.

Indicates the mode of the volume pair:
1–3 = master pair, (1-3) indicates number of dummy pairs.
D = dummy pair.
0 = the volume pair is not a master pair or dummy pair.

Indicates the Error Level of this volume pair:
G for Group, V for Volume.

N= no delay time. 0 = graduated delay.

Indicates the Timer Type of the consistency group (for R-VOL only):
S for System, L for Local, and N for None.

Indicates the consistency group number (00-7F).
Indicates the master volume number for dummy pair mode.

Indicates that this volume pair is TC390 Asynchronous, always A.

For 2105 controller emulation:

```
┌────┬───┬────┬───┬───┬───┬───┬──────┐
│ 00 │ A │ 00 │ S │ 0 │ G │ 0 │ 000  │
└────┴───┴────┴───┴───┴───┴───┴──────┘
```

Indicates the mode of the volume pair:
1–3 = master pair, (1-3) indicates the number of dummy pairs.
D = dummy pair.
0 = the volume pair is not a master pair or dummy pair.

Indicates the Error Level of this volume pair:
G for Group, V for Volume.

N = no delay time. 0 = graduated delay.

Indicates the Timer Type of the consistency group (for R-VOL only):
S for System, L for Local, and N for None.

Indicates the consistency group number (00-7F).
Indicates the master volume number for dummy pair mode.

Indicates that this volume pair is TC390 Asynchronous, always A.

Figure A.2 shows the output of the CQUERY command with the VOLUME parameter issued to a TC390A R-VOL.

```
************* PPRC REMOTE COPY CQUERY - VOLUME **********************
*                                         (PRIMARY)   (SECONDARY)       *
*                                         SSID CCA    SSID CCA          *
*DEVICE   LEVEL       STATE      PATH STATUS  SERIAL#      SERIAL#      *
*------ ---------  ----------  -----------  ---------   ---------       *
* 0B12  SECONDARY  SUSPEND(5)  ACTIVE..     7700 32   7740 12    *
*       .........                           ............  A00SGG030954  *
* PATHS SAID/DEST STATUS: DESCRIPTION                            *
* ----- --------- ------  ------------------                     *
*   0   ---- ----  00    NO PATH............                     *
*       ---- ----  00    NO PATH............                     *
*       ---- ----  00    NO PATH............                     *
*       ---- ----  00    NO PATH............                     *
* SECONDARY WAS SUSPENDED (YMD/GMT): 1998-10-17 14.18.12.242451   *
********************************************************************
```

**Figure A.2    CQUERY Output Example:  R-VOL/FORMAT/VOLUME**

The SECONDARY WAS SUSPENDED (YMD/GMT) field displays the consistency time of this pair if the pair status is Suspended or Duplex. See section 2.4.2 for further information on the TC390 Asynchronous consistency time.

If the timer type for the consistency group is System, the RCU indicates the content of the time-stamp given by the primary system with no modification.

The RCU serial number field is used to display the following TC390A information:

For 3990-6 and -6E controller emulations:

| A | 00 | S | G | G | 0 | 030954 |
|---|----|---|---|---|---|--------|

Indicates the serial number of the RCU.

Indicates the mode of the volume pair:
  1–3 = master pair, (1-3) indicates the number of dummy pairs.
  D = dummy pair.
  0 = the volume pair is not a master pair or dummy pair.

Indicates the Error Level of this volume pair:
  G for Group, V for Volume.

Indicates the consistency status of this volume pair:
  G for group, V for Volume, S for SEQCHK, M for MCU PS OFF.
  The priority of these indicators is: M, S, G or V

Indicates the Timer Type of the consistency group:
  S for System, L for Local, and N for None.

Indicates the consistency group number (00-7F).
Indicates the master volume number for dummy pair mode.

Indicates that this volume pair is TC390 Asynchronous, always A.

For 2105 controller emulation:

| 00 | A | 00 | S | G | G | 0 | 000 |
|----|---|----|---|---|---|---|-----|

Indicates the mode of the volume pair:
1-3 = master pair, (1-3) indicates the number of dummy pairs.
D = dummy pair.
0 = the volume pair is not a master pair or dummy pair.

Indicates the Error Level of this volume pair:
G for Group, V for Volume.

Indicates the consistency status of this volume pair:
G for group, V for Volume, S for SEQCHK, M for MCU PS OFF.
The priority of these indicators is: M, S, G or V

Indicates the Timer Type of the consistency group:
S for System, L for Local, and N for None.

Indicates the consistency group number (00-7F).
Indicates the master volume number for dummy pair mode.

Indicates that this volume pair is TC390 Asynchronous, always A.

### A.2.7 CQUERY for Fibre-Channel Interface

The path types and path status for fibre-channel remote copy connections can be displayed by the CQUERY command. The RCU controller ID can also be displayed.

Figure A.3 shows the output of the CQUERY command, and Table A.9 describes the parameters used in the example for both serial and fibre-channel interface.

*Note:* When the controller emulation type is 3990, the CQUERY command only displays the path types and path status of the first four paths, even if more than four paths have been added.

```
************** PPRC REMOTE COPY CQUERY - VOLUME *****************************
*                                              (PRIMARY)   (SECONDARY)    *
*                                              SSID CCA     SSID CCA       *
*DEVICE   LEVEL       STATE      PATH STATUS   SERIAL#        SERIAL#      *
*------ ---------   ----------   -----------   ---------      ---------    *
* 0A32  PRIMARY..  PENDING..     ACTIVE..       7700 32      7740 12       *
*       CRIT(NO)                             A00S0G030982   000000030954   *
* PATHS SAID/DEST  STATUS: DESCRIPTION                                     *
* ----- --------- ------  ------------------                              *
*   1   aabb ccdd  01     PATH ESTABLISHED...                             *
*       ---- ----  00     NO PATH............                             *
*       ---- ----  00     NO PATH............                             *
*       ---- ----  00     NO PATH............                             *
* IF STATE = PENDING/SUSPEND:  FIRST CYL OUT OF SYNC = 00117              *
*                             LAST CYL OUT OF SYNC = 03338                *
*                             PERCENT OF COPY COMPLETE = 004%             *
**************************************************************************
```

**Figure A.3    CQUERY Output Example**

**Table A.9    CQUERY Output for Serial and Fibre Channel**

| Parameters | Serial (ESCON®) Interface | Fibre-Channel Interface |
|---|---|---|
| *aa* | FREEZE option<br><br>0x00:keep the status<br>0x01:Enabled<br>0x02:Disabled | Bit 0-3:RCU controller ID<br><br>x2-xF:Number stands for the RCU controller ID.<br>Bit 4-7:FREEZE option<br><br>x0:keep the status<br>x1:Enabled<br>x2:Disabled |
| *bb* | MCU port number (0x00-0x1f) | MCU port number (0x00-0x1f) |
| *cc* | Link Adr (0x00-0xff) | RCU port number (0x00-0x1f) |
| *dd* | CU number (0x00-0x1f) | CU number (0x00-0x1f) |

## A.3 CGROUP (FREEZE/RUN) Support

The TC390 feature supports the CGROUP (FREEZE/RUN) TSO command for PPRC, which is also used in IBM's Geographically Dispersed Parallel Sysplex® (GDPS) environment. The CGROUP TSO command is used to control I/O operations for TC390 Synchronous pairs on a specific MCU-RCU pair. The CGROUP command is supported for 9900V (and 9900, 7700E) subsystems functioning as TC390 MCUs. The 9900V provides all required host reporting for CGROUP operations (e.g., IEA494I with extended long busy (ELB) state), which is a key component of GDPS operations. For disaster recovery implementations, you must use 9900V subsystems at both sites, since the RCUs will become MCUs in the event of a disaster.

The CGROUP command has two parameters, FREEZE and RUN. The CGROUP/FREEZE command stops all host I/O operations to the specified TC390 M-VOLs as well as all TC390 update copy operations to their associated R-VOLs. The CGROUP/RUN command changes the pair status to *suspended* and allows the M-VOLs to start accepting host I/Os.

*Note:* For 2105 controller emulation, do not use the FREEZE option. Use the CGROUP option of the CESTPATH command (see section A.2.1).

*Caution:* The 9900V subsystem executes the CGROUP command on TC390 Synchronous pairs. TC390A does not support the CGROUP TSO command. If CGROUP is issued to a TC390A volume, the 9900V will reject the command. CGROUP (FREEZE/RUN) operations on TC390 Synchronous pairs do not affect TC390A pairs in any way.

### A.3.1 Requirements

The CGROUP command can only be issued to a TC390 Synchronous M-VOL or a simplex volume in the MCU. If CGROUP is issued to a TC390 R-VOL, the RCU will reject the CGROUP command (F/M=0F, TC390 error code=58). The CGROUP command must be issued to each logical CU image of the MCU, unless the 9900's mode 64 (see description below) is enabled.

The requirements for CGROUP (FREEZE/RUN) support are:

- **MCU:** The MCUs to which the CGROUP command will be issued must be 9900V subsystems (all-mainframe and multiplatform subsystems are both supported). For disaster recovery implementations, you must use 9900V subsystems at both sites, since the RCUs will become MCUs in the event of a disaster.

- **PPRC:** The host systems at the main and remote sites must have IBM® PPRC support as well as the PPRC ERP PTF installed. ICKDSF does not support the CGROUP command.

- **SSIDs:** The MCUs to which the CGROUP command will be issued must have consecutive SSIDs. The Hitachi Data Systems representative configures the SSIDs on the 9900V SVP.

  *CAUTION:* MVS requires that the subsystem be offline during SSID changes. Reconfiguring SSIDs is therefore a disruptive event which must be carefully planned.

- **FREEZE Option (3990 only):** The FREEZE option must be enabled on the MCUs to which the CGROUP command will be issued. If not enabled, the MCU will reject the CGROUP TSO command. The FREEZE option is enabled using the Remote Console PC (RCU Option panel). Enable the FREEZE option only after adding all MCU-RCU paths.
  *Note:* Mode 104 (see below) changes the default FREEZE option from *disabled* to *enabled*. Mode 104 is invalid for 2105 emulation.

  *Note:* For 2105 controller emulation, do not use the FREEZE option. Use the CGROUP option of the CESTPATH command (see section A.2.1).

  The definition of the **LINK Parameter for the CESTPATH command** will be expanded to specify the FREEZE option on an **LCU pair basis**. The FREEZE option set by the CESTPATH command is effective until another CESTPATH command which specifies the same LCU pair but a different FREEZE Option is issued. The command syntax and parameter definitions are as follows (3990 only):

  **CESTPATH PRIM(x'ssid' serial#) SEC(x'ssid' serial#) LINK(x'ppppllcc', 'ppppllcc',…) DEVN(x'1234')**

  where:

  *pppp* = ESCON® or fibre-channel port ID of the primary CU (MCU) from which the TC390 paths should be established and the FREEZE option for the LCU pair. Note that the first two digits (FREEZE option) must be the same in a series of link parameters.

  For ESCON® cable:

  | Value | Port ID | Freeze Option |
  |---|---|---|
  | X'0000'-X'001F' | Interface 1A-2R | Default |
  | X'0100'-X'011F' | Interface 1A-2R | Enabled |
  | X'0200'-X'021F' | Interface 1A-2R | Disabled |

  For fibre-channel cable:

  | Value | Port ID | Freeze Option |
  |---|---|---|
  | X'2000'-X'201F' | Interface 1A-2R | Default |
  | X'2100'-X'211F' | Interface 1A-2R | Enabled |
  | X'2200'-X'221F' | Interface 1A-2R | Disabled |

  *ll* = For ESCON® cable: ESCON® destination link address. The destination port number of ESCD must be specified if the TC390 link is connected through an ESCD dynamic connection. Otherwise, "00" must be specified.

  For fibre-channel cable: Fibre-channel port ID of the secondary CU (RCU) from which the paths of the TC390 should be established

  *cc* = LCU number of the secondary CU (RCU).

  The parameters may be described in the GDPS DASD configuration list. The required link parameter values must be written into the list or must be given to RCMF input.

- **Mode 64 (optional):** Mode 64 extends the range of the CGROUP command to the entire MCU instead of just one logical CU image. When mode 64 is enabled, one CGROUP command to any M-VOL or simplex volume in the MCU is executed across all MCU-RCU paths and on all TC390 M-VOLs in the specified MCU, including all CU images (CU0-CU1F). When mode 64 is disabled, you must issue a separate CGROUP command to an M-VOL (or simplex volume) in each logical CU image of the MCU. Mode 64 can be enabled nondisruptively (i.e., existing TC390 pairs do not have to be deleted).

  *Note:* For operations in a GDPS environment, mode 64 must be OFF.

- **Mode 104 (3990 only):** Mode 104 changes the default FREEZE option to *enabled*. This mode should be enabled when CGROUP is being used in the GDPS environment. When mode 104 is enabled, the FREEZE option will remain enabled after the 9900V is powered off and then back on (e.g., due to some disaster). When mode 104 is not enabled, the FREEZE option will revert to the default value of *disabled* after the 9900V is powered off and back on.

  *Note:* For operations in a GDPS environment, mode 104 must be ON.

  *Note:* Mode 104 is invalid for 2105 emulation.

*Note:* For further information on 9900V SVP modes related to TC390 (and HXRC) operations, please refer to Table 2.1 in section 2.1.1.

### A.3.2 CGROUP (FREEZE/RUN) Command

The CGROUP TSO command specifies:

– the device (LDEV ID of TC390 M-VOL or simplex volume) (DEVN parameter),

– the MCU (S/N and lowest SSID in CU image) (PRIM parameter), and

– the RCU (S/N and lowest SSID in CU image) (SEC parameter).

The CGROUP TSO command has the following two options:

■ **FREEZE (3990 only):** When CGROUP is issued with the FREEZE option , the MCU:

– Blocks the logical path(s) between the specified MCU CU image and RCU CU image to stop all TC390 update copy operations to the R-VOLs in the specified RCU.

– Presents state change pending (SCP) with extended long busy status to host I/O requests, which causes the host to queue I/Os for the M-VOLs. SCP is indicated until the CGROUP/RUN command is issued or until the SCP delay time expires.

   *Note:* After all logical MCU-RCU paths are established, make sure to specify the desired SCP delay time (0-600 seconds) for the MCU using the RCU Option panel. To register the SCP delay time, select **OK** to close the RCU Option panel, even if you did not make any changes.

*Note:* If the specified MCU does not have any TC390 M-VOLs, the FREEZE command is executed without performing any operations (paths are not blocked, SCP is not indicated).

*Note:* For 2105 emulation, use the CESTPATH CGROUP option to control freeze.

■ **RUN:** When CGROUP is issued with the RUN option, the MCU:

– Suspends all TC390 pairs with M-VOLs on the specified MCU CU image.

– Presents a state-change-interrupt (SCI) to the host(s), so that the host(s) re-issue the I/Os which were waiting while the M-VOLs were in the SCP state.

– Changes the TC390 M-VOL fence level to **Never** (PPRC CRIT=NO), so that the suspended M-VOLs accept host write I/O operations.

Table A.10 shows the TC390 pair status for TC390 M-VOLs and R-VOLs during CGROUP (FREEZE/RUN) operations.

**Table A.10    TrueCopy – S/390® Pair Status During CGROUP (FREEZE/RUN) Operations**

|  | Before CGROUP (FREEZE/RUN) | | After CGROUP/FREEZE | | After CGROUP/RUN | |
|---|---|---|---|---|---|---|
|  | **M-VOL** | **R-VOL** | **M-VOL** | **R-VOL** | **M-VOL** | **R-VOL** |
| **TC390 Pair Status** | Simplex | --- | Simplex | --- | Simplex | --- |
|  | Pending | Pending | Pending | Pending | Suspended | Pending |
|  | Duplex | Duplex | Duplex | Duplex | Suspended | Duplex |
|  | Suspended | Suspended | Suspended | Suspended | Suspended | Suspended |

### A.3.3 Using the CGROUP Command

Figure A.4 shows a simplified operational example of the CGROUP (FREEZE/RUN) command implemented in a GDPS environment. The CGROUP (FREEZE/RUN) TSO command can be issued by the user or through automation (such as GDPS) to perform the following sequence of actions:

1. Suspend host updates to all TC390 M-VOLs on the specified MCU.

2. Block the specified MCU-RCU path to stop update copy operations to the R-VOLs.

3. Change all TC390 M-VOLs on the specified MCU to suspended.

4. Resume host updates to the suspended M-VOLs.

5. The add RCU operation (CESTPATH) must be performed to re-establish the blocked logical paths. After the MCU-RCU path is re-established, the resume pair operation (CESTPAIR/RESYNC) must be performed to resume the suspended pairs.
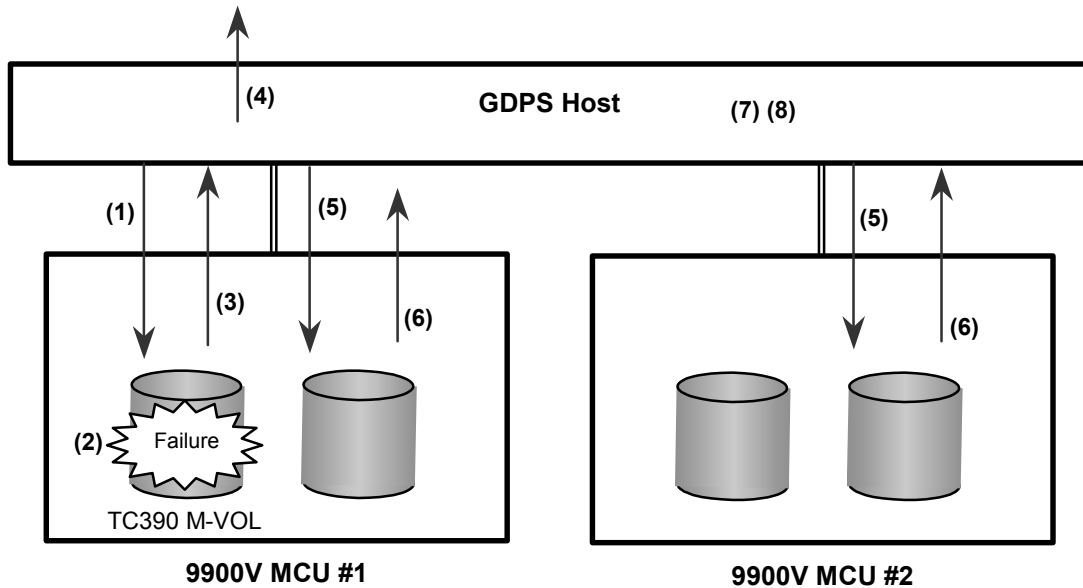


(1) Read/write I/Os are issued from the host.

(2) A failure occurs on a TC390 M-VOL, and the MCU suspends the pair.

(3) Suspend and extended long busy state are reported to the host.

(4) Host reports IEA494I with extended long busy state.

(5) CGROUP/FREEZE commands are issued to groups.

(6) SCP sense bytes are reported if an I/O is issued to a frozen volume.

(7) I/Os are queued at the host.

(8) Switch to remote (secondary) site.

**Figure A.4    Overview of GDPS Operations**

### A.3.4  Using PPRC TSO Commands with CGROUP Support

**CESTPATH**. You can use the CESTPATH command to recover a blocked MCU-RCU path. Make sure to use the same parameters as when the path was established.

**CESTPAIR**. After you re-establish the MCU-RCU path that was blocked, you can use the CESTPAIR/RESYNC command to resume the TC390 pairs suspended by the CGROUP/RUN command.

**CDELPAIR**. After you re-establish the MCU-RCU path that was blocked, you can use the CDELPAIR command to delete the TC390 pairs suspended by the CGROUP/RUN command. If CDELPAIR is issued to a TC390 pair whose MCU-RCU path is still blocked, the MCU rejects the command (F/M=0F, TC390 error code=5A).

**CRECOVER**. You can use the CRECOVER command to change a suspended R-VOL to simplex. This command is issued to the R-VOL and does not affect the suspended M-VOL.

**CQUERY/PATHS**. Figure A.5 shows the output of the CQUERY command issued to a TC390 MCU to which the CGROUP/FREEZE command has been issued. Figure A.6 shows the output of the CQUERY command issued to the TC390 RCU which has a blocked path due to the CGROUP/FREEZE command.

**CQUERY/VOLUME**. Figure A.7 shows the output of the CQUERY command issued to a TC390 M-VOL which has been suspended by the CGROUP/RUN command. As shown in Figure A.7, CQUERY issued to an M-VOL also indicates the status of the FREEZE option:  CGRPLB(YES) = enabled, CGRPLB(NO) = disabled. Figure A.8 shows the output of the CQUERY command issued to a TC390 R-VOL whose M-VOL has been suspended by the CGROUP/RUN command. The pair status and path status at the RCU are not changed.

```
*************** PPRC REMOTE COPY CQUERY – PATHS ********************
* PRIMARY UNIT: SERIAL#= 000000090217  SSID= 00F8                *
*               FIRST         SECOND         THIRD         FOURTH     *
*             SECONDARY      SECONDARY      SECONDARY     SECONDARY    *
*SERIAL NO: 000000090217  ............  ............  ............ *
*     SSID:    00F8           0000           0000          0000     *
*    PATHS:     1              0              0             0        *
*           SAID DEST S*  SAID DEST S*  SAID DEST S*  SAID DEST S* *
*           --------- --  --------- --  --------- --  --------- -- *
*        1: 0020 FF04 10  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*        2: ---- ---- 00  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*        3: ---- ---- 00  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*        4: ---- ---- 00  ---- ---- 00  ---- ---- 00  ---- ---- 00 *
*                                                                *
* S* = PATH STATUS:                                              *
* 00=NO PATH          01=ESTABLISHED        02=INIT FAILED       *
* 03=TIME OUT         04=NO RESOURCES AT PRI 05=NO RESOURCES AT SEC*
* 06=SERIAL# MISMATCH 07=(RESERVED)         08=(RESERVED)        *
* 09=(RESERVED)       10=CONFIGURATION ERROR                     *
******************************************************************
```

**Figure A.5    CQUERY Output Example:  M-VOL/Paths/Format**

```
*************** PPRC REMOTE COPY CQUERY - PATHS ********************
* PRIMARY UNIT: SERIAL#= ............  SSID= 0000               *
*              FIRST        SECOND       THIRD        FOURTH      *
*            SECONDARY    SECONDARY    SECONDARY     SECONDARY    *
*SERIAL NO: 000000090217  ............ ............ ............ *
*    SSID:    00F8          0000         0000         0000       *
*    PATHS:     1             0            0            0         *
*          SAID DEST S* SAID DEST S* SAID DEST S* SAID DEST S* *
*          --------- -- --------- -- --------- -- --------- -- *
*       1: 0020 FF04 10 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
*       2: ---- ---- 00 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
*       3: ---- ---- 00 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
*       4: ---- ---- 00 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
*                                                               *
* S* = PATH STATUS:                                             *
* 00=NO PATH         01=ESTABLISHED      02=INIT FAILED         *
* 03=TIME OUT        04=NO RESOURCES AT PRI 05=NO RESOURCES AT SEC*
* 06=SERIAL# MISMATCH 07=(RESERVED)       08=(RESERVED)         *
* 09=(RESERVED)      10=CONFIGURATION ERROR                     *
****************************************************************
```

**Figure A.6    CQUERY Output Example:  R-VOL/Paths/Format**

```
*************** PPRC REMOTE COPY CQUERY - VOLUME ****************  TC390 M-VOL is
*                                   (PRIMARY)   (SECONDARY) *   suspended by
*                                   SSID CCA    SSID CCA    *   CGROUP/RUN.
*DEVICE   LEVEL      STATE    PATH STATUS SERIAL#   SERIAL#  *
*------ --------- ---------- ----------- --------- --------- *  FREEZE option
* 0F80  PRIMARY.. SUSPEND(A)  INACTIVE   00F8 00    00F8 02  *  is enabled.
*       CRIT(NO)....... CGRPLB(YES) 000000090217 000000090217 *
* PATHS SAID/DEST STATUS: DESCRIPTION                        *
* ----- --------- ------ -------------------                 *  Logical path
* 1  0020 FF04   10    CONFIGURATION ERROR                   *  is blocked by
*    ---- ----   00    NO PATH............                   *  CGROUP/FREEZE.
*    ---- ----   00    NO PATH............                   *
*    ---- ----   00    NO PATH............                   *
*                      PERCENT OF COPY COMPLETE = 100%       *
****************************************************************
```

**Figure A.7    CQUERY Output Example:  M-VOL/Volume/Format**

```
*************** PPRC REMOTE COPY CQUERY - VOLUME ****************  No change to
*                                   (PRIMARY)   (SECONDARY) *  R-VOL pair
*                                   SSID CCA    SSID CCA    *  status.
*DEVICE   LEVEL      STATE    PATH STATUS SERIAL#   SERIAL#  *
*------ --------- ---------- ----------- --------- ------    *  No change to
* 0F82  SECONDARY DUPLEX...  ACTIVE.     00F8 00    00F8 02  *  path status.
*       ..............  ........... ........... 000000090217*
* PATHS SAID/DEST STATUS: DESCRIPTION                        *
* ----- --------- ------ -------------------                 *
* 1  0020 FF04   10    CONFIGURATION ERROR                   *
*    ---- ----   00    NO PATH............                   *
*    ---- ----   00    NO PATH............                   *
*    ---- ----   00    NO PATH............                   *
****************************************************************
```

**Figure A.8    CQUERY Output Example:  R-VOL/Volume/Format**

### A.4    IEA494I and IEA491E Console Messages

When a TC390 pair is suspended, whether user-requested or due to failure, the MCU generates sense information to notify the host(s). If the PPRC ERP PTF is installed and **PPRC Support = Yes** is selected on the RCU option panel, this notification results in an IEA494I system console message as well as an IEA491E message. The IEA491E message indicates the reason for suspension. The IEA494I and IEA491E messages are generated by the S/390® host based upon SSBs (sense bytes) from the subsystem and not SIMs from the subsystem. Therefore, SIMs reported by the subsystem to the host are not used by the GDPS scripting.

The IEA494I message is recommended as a trigger for automation over the IEA491E message. The IEA491E message is reported to only one host system, whereas the IEA494I message is reported to all attached MVS hosts each time the M-VOL pair status changes. GDPS uses the IEA494I message with extended long busy as a trigger for CGROUP (FREEZE/RUN).

*Note:* If **PPRC Support = No** is selected on the RCU Option panel, the host generates the system console message that includes the SIM instead of the IEA494I or IEA491E message.

### A.4.1  IEA494I Message

Whenever a TC390 pair status changes, with the exception of the TC390A transition states *suspending* and *deleting*, the MCU reports state-change-interrupt (SCI) to all hosts. In response to the SCI, the IEA494I system console message is generated (if supported by the host). The 9900V reports SCI for both online and offline devices, but the host system does not generate console messages for offline devices. Therefore, the IEA494I message is never generated with a TC390 R-VOL device address. Figure A.9 shows an example of an IEA494I message.

- The 9900V MCU reports SCI for all TC390A pairs whose status has changed, regardless of the Group/Volume option of the suspend or delete pair operation (if the status change was user-requested).

- The 9900V MCU reports SCI for all TC390 M-VOLs (synchronous only) which are in the SCP state due to the CGROUP/FREEZE command. As shown in Figure A.9, this IEA494I message indicates the extended long busy state.

- The 9900V MCU reports SCI for all TC390 M-VOLs (synchronous only) which are suspended due to the CGROUP/RUN command. This IEA494I message indicates the extended long busy state.

- When the FREEZE option is enabled, the 9900V MCU reports SCI for a TC390 pair which is suspended due to a failure. When the host supports GDPS, this IEA494I message with extended long busy triggers the CGROUP (FREEZE/RUN) command.

```
IEA494I 0FC3,RD0FC3,PPRC PAIR SUSPENDING,SSID=0FC0,CCA=03,EXTENDED LONG BUSY STATE
```

**Figure A.9    Example of IEA494I Message with Extended Long Busy State**

### A.4.2 IEA491E Message

When a TC390 pair is suspended due to a failure, the 9900V MCU reports SCI as well as unit check status and sense bytes with F/M = FB. In response to the F/M=FB sense bytes, the IEA491E system console message is generated (if supported by the host). Figure A.10 shows an example of an IEA491E message.

*Note:* If the host supports GDPS and the FREEZE option is enabled, the IEA494I system console message with extended long busy (which was generated in response to the SCI) triggers the CGROUP (FREEZE/RUN) command.

```
IEA491E DSLFC0,PPRC SUSPENDED, SECONDARY NOT READY, INTERVENTION_REQUIRED, (PRI)SER=0113-
90797,CCA=00 (SEC)SER=0113-90217,CCA=
```

**Figure A.10   Example of IEA491E Message**

### A.5    9900V Response Characteristics to Failure Conditions

The 9900V subsystem supports the CGROUP command in the GDPS environment by performing PPRC-compatible actions and returning PPRC-compatible messages to failure conditions. Figure A.11 shows the failure conditions, and Table A.11 describes the response characteristics of the 9900V subsystem to these failure conditions.

*Note:* The **PPRC Support=Yes** option must be selected on the RCU option panel (see section 4.2.3). If not, the host processor generates the system console message that includes the SIM instead of the IEA494I or IEA491E message.
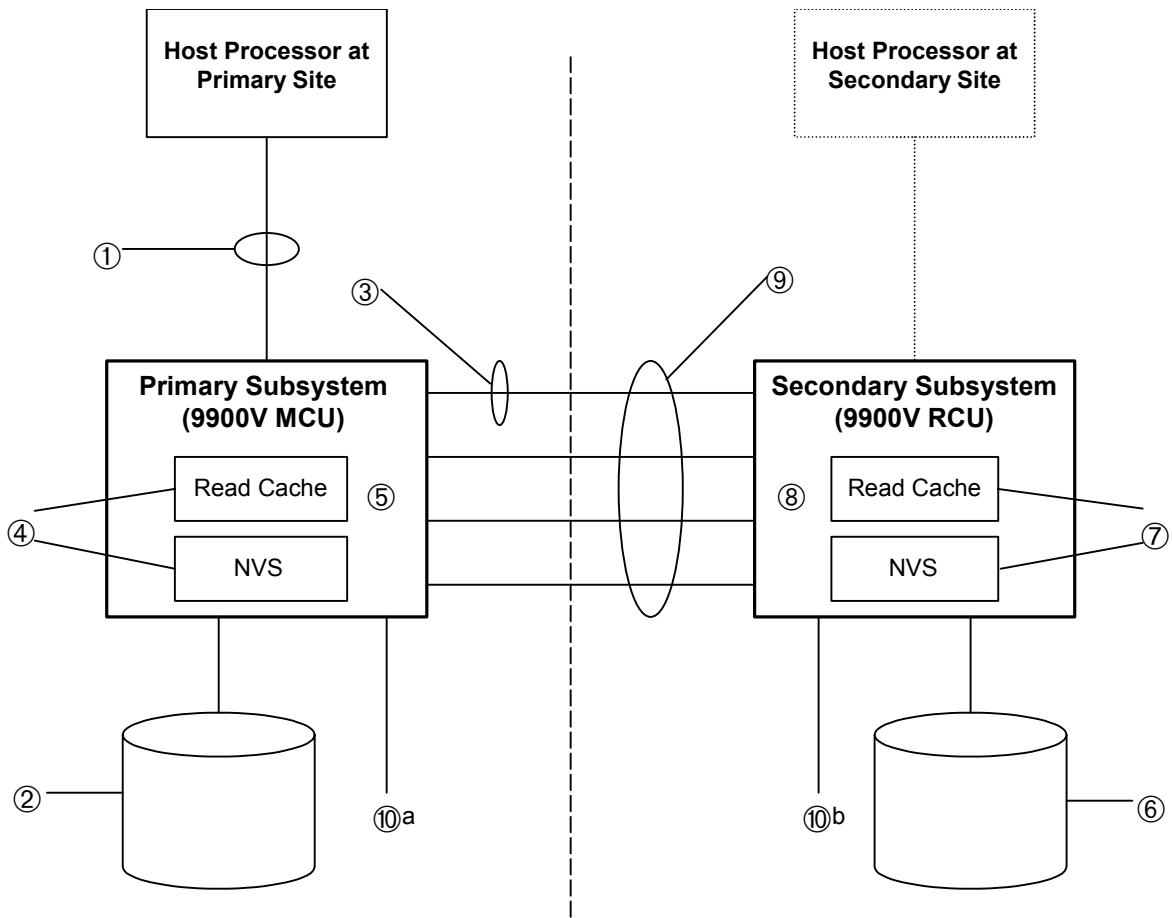


**Figure A.11    Failure Conditions (described in Table A.11)**

**Table A.11   9900V Response Characteristics to Failure Conditions (continues on the next page)**

| Failure Condition | TC390 Pairs Suspended? | Expected Messages | FREEZE Function |
|---|---|---|---|
| Failure of all channel interfaces on the MCU | No | No IEA480, IEA491, or IEA494 messages are displayed. | Not activated |
| Failure of a disk on the MCU | | | |
| (a) Failure of one physical device in a parity group | No | (1) IEA480 message (SIM for physical device blocked or port of physical device blocked) is displayed when the next I/O is issued to any logical volume in the parity group.<br>(2) No IEA491 or IEA494 messages are displayed. | Not activated |
| (b) Failure of two physical devices in a parity group | No | (1) IEA480 message (SIM for LDEV blocked) is displayed when the next I/O is issued to any logical volume in the parity group.<br>(2) No IEA491 or IEA494 messages are displayed. | Not activated |
| Failure of a link between the MCU and RCU | No | (1) IEA480 message (SIM for TC390 path blocked) is reported when the next I/O to any device in this MCU is issued.<br>(2) No IEA491 or IEA494 messages are displayed. | Not activated |
| Failure of NVS on the MCU; Failure of MCU read cache | | | |
| (a) One side of MCU cache blocked due to failure | No* | (1) IEA480 (SIM for cache blocked) is reported when the next I/O to any device in this MCU is issued.<br>(2) No IEA491 or IEA494 messages are displayed. | Not activated |
| (b) One side of MCU cache blocked due to maintenance | No* | No IEA480, IEA491, or IEA494 messages are displayed. | Not activated |
| (c) One side of MCU cache blocked by SET CACHE OFF | No* | No IEA480, IEA491, or IEA494 messages are displayed. | Not activated |
| Both sides of MCU cache blocked due to failure | No | No IEA480, IEA491, or IEA494 messages are displayed.<br>*Note:* The MCU returns CC=3 for all I/Os. | Not activated |
| Failure of a disk on the RCU | | | |
| (a) Failure of one physical device in a parity group | No | (1) The RCU reports IEA480 message (SIM for physical device blocked or port of physical device blocked) to either the MCU or the host processor (whichever issues the next I/O first) when the next I/O is issued to any logical volume in the parity group. If MCU receives the SIM, it passes the SIM to the attached host processor, and the IEA480 message is reported when the next I/O to this MCU is issued to any main (primary) volume paired with the logical volume in the parity group.<br>(2) No IEA491 or IEA494 messages are displayed. | Not activated |
| (b) Failure of two physical devices in a parity group | Yes | (1) The RCU reports IEA480 message (SIM for LDEV blocked) to either the MCU or the host processor (whichever issues the next I/O first) when the next I/O is issued to any logical volume in the parity group. If MCU receives the SIM, it passes the SIM to the attached host processor, and the IEA480 message is reported when the next I/O to this MCU is issued to any main volume paired with the logical volume in the parity group.<br>(2) One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed.<br>(3) One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed. | Activated if the FREEZE option is **enabled** for the affected LCU pairs. |

**Table A.11    9900V Response Characteristics to Failure Conditions (continued)**

| Failure Condition | TC390 Pairs Suspended? | Expected Messages | FREEZE Function |
|---|---|---|---|
| Failure of NVS on the RCU; Failure of RCU read cache | | | |
| (a) One side of RCU cache blocked due to failure | No | (1) The RCU reports IEA480 message (SIM for cache blocked) to either the MCU or the host processor (whichever issues the next I/O first). If MCU receives the SIM, it passes the SIM to the attached host processor. Therefore, IEA480 is reported when the next I/O to any device in this MCU issued. (2) No IEA491 or IEA494 messages are displayed. | Not activated |
| (b) One side of RCU cache blocked due to maintenance | No | No IEA480, IEA491, or IEA494 messages are displayed. | Not activated |
| (c) One side of RCU cache blocked by SET CACHE OFF | No | No IEA480, IEA491, or IEA494 messages are displayed. | Not activated |
| Both sides of RCU cache blocked due to failure | Yes | (1) No IEA480(SIM of cache blocked) is displayed. (2) One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. (3) One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed. (4) If CGROUP FREEZE and RUN are issued, IEA494 messages showing PAIR SUSPENDED are displayed when the MCU accepts CGROUP-RUN.  These messages are from the TC390 pairs for which FREEZE option is enabled, and from main volumes which did not already report IEA491/IEA494 at (3). | Activated if the FREEZE option is **enabled** for the affected LCU pairs. |
| Failure of all links between the MCU and RCU | Yes | (1) IEA480 (SIM for TC390 path blocked) message is reported when the next I/O to any device in this MCU is issued. (2) One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. (3) One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed. | Activated if the FREEZE option is **enabled** for the affected LCU pairs. |
| Power failure | | | |
| (a) On the MCU | No | No IEA480, IEA491, or IEA494 messages are displayed. | Not activated |
| (b) On the RCU | Yes | (1) IEA480 (SIM of TC390 path blocked) message is reported when the next I/O to any device in this MCU is issued. (2) One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. (3) One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed. | Activated if the FREEZE option is **enabled** for the affected LCU pairs. |

*__Note:__ When one side of the MCU cache is blocked, *duplex* TC390 pairs are not affected, but *pending duplex* TC390 pairs are suspended. Suspending TC390 pairs with *pending duplex* status provides additional protection in the unlikely event of a cache failure.

### A.5.1 GDPS-TC390-HXRC Matrix

Table A.12 compares IBM® 3990-6E GDPS support to Hitachi Lightning 9900™ V Series and 9900 GDPS support, and also provides a comparison of TC390 and HXRC to PPRC and XRC.

*Note:* The information shown in Table A.12 was current at the time of publication of this document but is expected to change over time. Please contact your Hitachi Data Systems account team for the latest GDPS-TC390-HXRC matrix information.

**Table A.12   GDPS-TC390-HXRC Matrix (continues on the following pages)**

| S/390® Feature | IBM® 3990-6E | Hitachi Lightning 9900™ V Series | Hitachi Lightning 9900™ |
|---|---|---|---|
| **GDPS** | | | |
| Planned outage | Supported | Supported | Supported |
| Unplanned outage via IEA494I | Supported | Supported | Supported |
| IEA494I Long Busy message | Default time of 120 sec for FREEZE after IEA494I message is issued. | Default time for FREEZE is 120 sec, optional user-defined from 0 to 600 sec after IEA494I message is issued. | Default time for FREEZE is 120 sec, optional user-defined from 0 to 600 sec after IEA494I message is issued. |
| **Peer-to-Peer Remote Copy** | **PPRC** | **TC390, TC390A** | **TC390, TC390A** |
| Hardware based | 3990-6 to 3990-6 | 9900V/9900 to 9900V/9900. *Note:* 9900V is restricted to CPU 0-F when attached to9900. | 9900/9900 to 9900/7700E. *Note:* 9900 is restricted to CPU 0-3 for 7700E RCU. |
| Subsystem-subsystem interface | ESCON® – max of 43 km Communication via channel extenders | ESCON® – maximum of 43 km<br><br>Communication via channel extenders<br>    CNT – Channelink or UltraNet<br>    InRange 9800MAX<br>    InRange 9801 – in certification | ESCON® – maximum of 43 km<br><br>Communication via channel extenders<br>    CNT – Channelink or UltraNet<br>    InRange 9800MAX<br>    InRange 9801 – in certification |
| Copy modes supported | Synchronous | Synchronous, asynchronous<br><br>*Note:* The default for IBM® software commands is synchronous. | Synchronous, asynchronous<br><br>*Note:* The default for IBM® software commands is synchronous. |
| Dual Copy combination support | Supported | Not Supported. Dual Copy is not supported by subsystem. | Not Supported. Dual Copy is not supported by subsystem. |
| TSO command Support | Supported | Supported. *Note:* Some additional options only available via Remote Console/SVP. | Supported. *Note:* Some additional options only available via Remote Console PC/SVP. |
| ICKDSF command support | Supported | Supported. *Note:* Some additional options only available via Remote Console/SVP. | Supported. *Note:* Some additional options only available via Remote Console PC/SVP. |
| P/DAS support | Supported | Supported | Supported |
| Maximum pairs | 64 | 8,192 | 4,096 |
| Maximum paths between subsystems | 4 | 8 per logical control unit | 8 per logical control unit |

**Table A.12   GDPS-TC390-HXRC Matrix (continued)**

| Peer-to-Peer Remote Copy (continued) | PPRC | TC390, TC390A | TC390, TC390A |
|---|---|---|---|
| Number of copy operations on initial copy | 4 | 1 to 4, default is 4 per LCU. *Note:* Requires Remote Console PC (or SVP) to change default. | 1 to 4, default is 4 per LCU. *Note:* Requires Remote Console PC (or SVP) to change default. |
| Dedicated interface between subsystems | No | Requires main subsystem port to be set to target/LCP by Remote Console (or SVP) or automatically in response to establish and delete path commands. | Requires main subsystem port to be set to target/LCP by Remote Console PC (or SVP) or automatically in response to establish and delete path commands. |
| PACE parameter initial copy option | 1-255, default is 15 (setting of 1 copies a maximum of 3 tracks at a time, 2-255 copies a maximum of 15 tracks at a time) | 3 or 15, default = 15 tracks | 3 or 15, default = 15 tracks |
| CRITICAL pair error options (Fence Level parameter) | Yes<br>No – Default | Data<br>Never – Default<br>Status | Data<br>Never – Default<br>Status |
| CGROUP | FREEZE/RUN by logical controller SSID pair | FREEZE/RUN by logical controller SSID pair, or optionally by entire subsystem using mode 64. | FREEZE/RUN by logical controller SSID pair, or optionally by entire subsystem using mode 64. |
| CQUERY | Supported | Supported. | Supported. When the connected control unit is Lightning 9900, Mode 49 must be ON to report on all the 256 LDEVs in each logical control unit. |
| **TC-Unique Features (specified via Remote Console PC or SVP)** | | | |
| **RCU Options** | | | |
| Minimum paths | Not supported | Default = 1. *Note:* If the minimum number of MCU-RCU active paths falls below this value, all pairs will be suspended based on the Fence Level option in effect. | Default = 1. *Note:* If the minimum number of MCU-RCU active paths falls below this value, all pairs will be suspended based on the Fence Level option in effect. |
| PPRC support by host | Host must support PPRC | Default = YES - PPRC supported, optional capability to allow host support for non PPRC capable operating systems. | Default = YES - PPRC supported, optional capability to allow host support for non PPRC capable operating systems. |
| RCU-to-MCU SIM reporting | Not supported per IBM® doc *Planning for IBM Remote Copy* (SG24-2594-009 p.184) | To any host or only to RCU host | To any host or only to RCU host |
| RCU to MCU service SIM reporting | Not supported per IBM® doc *Planning for IBM Remote Copy* (SG24-2594-009 p.184) | Default = Not report; Designed for non-MVS operating systems which do not support SIM reporting. | Default = Not report; Designed for non-MVS operating systems which do not support SIM reporting. |
| **Pair Options** | | | |
| Cache fast write data | Not supported | Optional to R-VOL, default = M-VOL | Optional to R-VOL, default = M-VOL |

**Table A.12   GDPS-TC390-HXRC Matrix (continued)**

| Extended Remote Copy | XRC | HXRC* | HXRC |
|---|---|---|---|
| SMS 1.3 - SDM ver. 1 | Not supported | Not supported | Not supported |
| SMS 1.3 + PTFs - SDM ver. 2 | Supported | Supported | Supported |
| SMS 1.4 – SDM ver. 2 | Supported | Supported | Supported |
| SMS 1.4+ PTFs – SDM ver. 2 | Supported | Supported | Supported |
| SMS 1.5 – SDM ver. 2 | Supported | Not supported, in QA test | Not supported, in QA test |
| Max. sessions | 4 per subsystem | 4 per CU image, 128 total | 4 per CU image, 64 total |
| Max. volumes | 256 per subsystem | 256 per CU image, 8192 total | 256 per CU image, 4096 total |
| Utility volumes with Multi Reader Support #OW30183 | Multiple supported | Multiple supported | Multiple supported |
| SIM/error messages | Per IBM® doc | Per IBM® doc | Per IBM® doc |
| Primary subsystem interface | Parallel or ESCON® | ESCON® only | ESCON® only |
| Secondary subsystem interface | Parallel or ESCON® | Parallel or ESCON® | Parallel or ESCON® |
| Channel extender support | Yes | CNT – Channelink or UltraNet | CNT – Channelink or UltraNet |
| Maximum sidefile size | 50% | 50% available cache | 50% available cache |
| Sidefile puncture % | 60% | 60%. *Note:* Retries issued at 40% utilization, host interface blocked at 50% utilization. | 60%. *Note:* Retries issued at 40% utilization, host interface blocked at 50% utilization. |

*Note:* Please see Appendix E for further information on HXRC device blocking and load balancing control.

# Appendix B   Pinned Track Recovery for TC390 Volumes

If a pinned track occurs on a TC390 M-VOL or R-VOL, the MCU will suspend the pair (SIM reference code = DB1x). Use the following procedure to ensure full data integrity of the volume pair while recovering the pinned track:

1. Connect to the MCU of the suspended pair, and select the correct CU image.

2. Delete the volume pair.

3. If the volume is offline (e.g., R-VOL has pinned track), vary the volume online.

4. Perform your usual procedure for recovering data from a pinned track. Refer to the pinned track recovery procedures for your operating system. Please contact your Hitachi Data Systems Support Center to inform them of the pinned track.

5. If the volume was previously offline (e.g., R-VOL), make sure to vary the volume offline again.

6. Restart the volume pair using the Add Pair panel, making sure to use the Entire Volume initial copy option.

# Appendix C   SIM Reporting

The Hitachi Lightning 9900™ V Series subsystem reports a service information message (SIM) to the host when it is necessary to notify the user of a possible service requirement for the subsystem. The SIMs are classified according to severity for reporting and logging purposes: service, moderate, serious, or acute. The SVP reports all SIMs related to TC390 operations, and all SIMs are stored on the SVP for use by Hitachi Data Systems personnel. The SIMs reported to the S/390® host are logged in the SYS1.LOGREC dataset of the host operating system. Each time a SIM is generated, the amber **Message** LED on the 9900V control panel (under the **Ready** and **Alarm** LEDs) turns on as an additional alert for the user. The 9900V Remote Console software displays the SIMs to provide an additional source of notification for the user. *Note:* For further information on SIM reporting, please contact your Hitachi Data Systems representative or the Hitachi Data Systems Support Center.

During TC390 operations, the MCU and RCU will generate a service SIM each time the pair status of the M-VOL or R-VOL changes for any reason, including normal status transitions (e.g., *pending duplex* to *duplex*). For TC390A transition states (*suspending* and *deleting*), a SIM is generated when the status changes to the transition state, and again when the transition is complete. SIMs generated by the MCU will include the M-VOL device ID (byte 13), and SIMs generated by the RCU will include the R-VOL device ID (byte 13). The RCU Option panel (see section 4.2.3) allows you to configure each MCU to report or not report service-level SIMs to the attached host(s).

Figure C.1 shows a typical 32-byte SIM from the 9900V subsystem. SIMs are displayed on the host console by reference code (RC) and severity. The six-digit RC (composed of bytes 22, 23, and 13) identifies the possible error and determines the severity. The SIM type (byte 28) indicates the component which experienced the error. When byte 22 = 21, the SIM is a control unit SIM. When byte 22 = Dx, the SIM is a device SIM. When byte 22 = (D5-D7, DB), the specified pair is TC390A. When byte 22 = (D8 - DC), the pair is TC390 Synchronous. The SIM reference codes DB6x, DB7x, and DB8x indicate a TC390A pair suspended by the RCU.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIM SSB | 00 | 90 | 10 | 00 | 00 | 00 | 8F | E0 | 44 | 10 | 00 | 04 | 00 | 80 | 04 | 0C | 69 | 00 | 00 | 00 | 00 | 02 | 30 | 70 | 05 | 10 | 42 | C0 | F1 | 00 | 02 | 00 |

Indicates SIM.

SSB13

SSB22, 23

RC = 307080

SIM type
F1: DKC SIM
F2: CACHE SIM
FE: DEVICE SIM
FF: MEDIA SIM
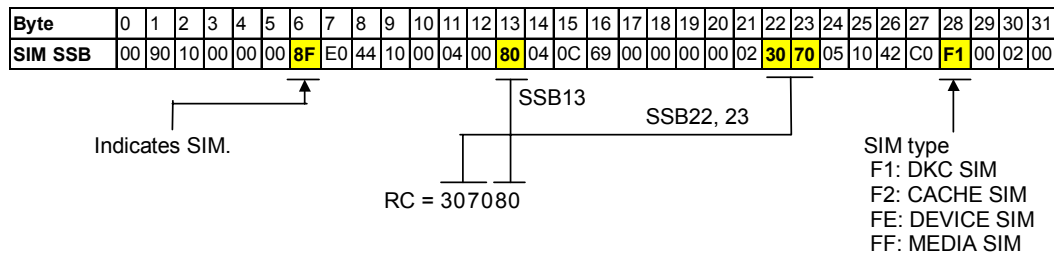
**Figure C.1   Typical 9900V SIM Showing Reference Code and SIM Type**

# Appendix D   TrueCopy – S/390® Scripting

## D.1   Overview of Scripting

An added benefit of the Hitachi TrueCopy feature is its support for scripting operations. This capability provides the user with additional flexibility in managing their TC390 environment. A TC390 script file contains a list of macros (commands) which describes a series of TC390 pair operations. The scripting macros are defined in a text file, and the TC390 Remote Console software reads the text file and executes the specified TC390 pair operations.

*Note:* This appendix assumes that the user is familiar with batch files and does not provide instructions for writing or editing batch files. The macro commands and parameters listed in this appendix are the only commands recognized by the TC390 scripting function.

*WARNING:* The user is responsible for testing the TC390 scripting function before running any TC390 scripts. If a TC390 script is run without prior testing and the script ends abnormally, data loss could occur. Before testing a TC390 script, back up the data and vary the volumes offline. If the volumes must remain online, back up the data and confirm that the target volume pair defined in the TC390 script is correct. The results of a TC390 script can be confirmed by checking the latest TC390 pair status update (**Last Updated** field on TC390 Pair Status panel).

Table D.1 lists the TC390 pair macro commands. Table D.2 lists the internal macro commands for TC390 scripting. The following TC390 operations cannot be performed using TC390 scripting and must be performed using the Remote Console PC:

- Configure serial/fibre ports (section 4.2.1)
- Monitor remote copy activity (section 4.4)
- Clear remote copy SIMs (section 4.6.1)
- Add/delete RCU (sections 4.2.2, 4.2.7)
- Change RCU options (section 4.2.3)
- Add/delete path/SSID (sections 4.2.4, 4.2.5)
- View RCU status (section 4.2.6)
- Change async options (section 4.3.1)
- Add/delete group (sections 4.3.2, 4.3.5)
- Change group options (section 4.3.3)
- View group status (section 4.3.4)

*Note:* The scripting command names did not change when the product name changed from HRC to TrueCopy. Your existing 7700E HRC scripting files can be used for TC390 operations.

**Table D.1   Functional Macro Commands for TrueCopy – S/390® Scripting**

| TC390 Scripting Macro | Description |
|---|---|
| CreateHrcPair | Registers a TC390 pair or pairs. (StartHrcPair is used to start the initial copy operation.) |
| SuspendHrcPair | Suspends a TC390 pair or pairs. |
| DeleteHrcPair | Deletes a TC390 pair or TC390 pairs. |
| ResumeHrcPair | Resumes a TC390 pair or TC390 pairs. |
| ChangeHrcOption | Changes the pair options for a TC390 pair or TC390 pairs. |
| StartHrcPair | Starts remote copy operations for the new pairs and/or resumed pairs specified in the preceding scripting commands. |
| GetHrcStatus | Displays the status of a TC390 pair or TC390 pairs. |
| SelectHrcDevice | Searches TC390 paired devices. |

**Table D.2    Internal Macro Commands for TrueCopy – S/390® Scripting**

| Type | Macro | Description |
|------|-------|-------------|
| For lists | SetList<br>AddList | Set (define) a list of items.<br>Add items to a list. |
| For non-lists | Start<br>End<br>Delay<br>If<br>EndIf<br>MakeString<br>Message | Declares the beginning of a script.<br>Declares the end of a script.<br>Suspends script execution for the specified length of time.<br>Executes a script conditionally.<br>Terminates a script conditionally.<br>Makes strings; converts numeric value to character string.<br>Displays a message window with buttons (OK, Yes/No). |

## D.2    Syntax for Scripting

### D.2.1  Syntax Overview

A Hitachi TrueCopy – S/390® script file can be written using any text editor (e.g., WordPad, NotePad). A script file consists of an unlimited number of statements which consist of macros (i.e., commands), work variables, and comments (see sections D.3 and D.4). The first executable statement in a TC390 script file must be the Start macro, and the last statement must be the End macro. Each line in a TC390 script file cannot exceed 240 bytes. A leading blank is ignored, and a leading tab character (0x09) is converted to a space (0x20). A tab character (0x09) within a string is not converted to a space.

Each script file should contain all five script statements (see Tables D.3 and D.4):

■   A comment statement, including a short preface for the script:  purpose, author, usage, description, operation, creation date, update date, and any reminder notes to the author. The comment statement is a non-execution statement. A comment statement begins with "//"and contains text (any character string) without any commands. Do not use the "//" symbol anywhere else in a script file, only at the beginning of a comment statement.

■   A macro statement (sections D.3 and D.4). The macro statement is an execution statement. Only one macro instruction can be set per line, and a macro can span more than one line.

■   A work variable statement (section D.5). The work variable statement is also an execution statement. Only one work variable statement can be set per line, and a work variable statement cannot span more than one line.

■   A blank statement (Table D.3). The blank statement is a non-execution statement.

■   An empty statement (Table D.3). The empty statement is a non-execution statement.

**Table D.3    Syntax Description**

| Statement Name | Description |
|---|---|
| Blank statement | Space or Tab with a return |
| Comment statement | One line beginning with // |
| Empty statement | Return only |
| Execution statement | Work variable statement (non-list type work variable = constant) |
| Macro statement | Macro name [parameter list] (Refer to sections D.3 and D.4 for macro information.) |

**Table D.4    Script Components**

| Component Name | Description |
|---|---|
| Macro name | Either an internal macro or a functional macro. |
| Parameter list | Parameter identification name (defined in each macro format) = non-list type expression. |
| Expression | List, constant, and work variable. |
| List | In a list description, a constant is enclosed in braces "{}". A comma "," is inserted between constants. For example {1, 2, 3, 4}, or {"ABC", "qtw" }. Lists and work variables cannot be described in a list. |
| Constant | String or a numeric value. |
| String | The string covers the following lists. (Enclose a list with a double-quotation mark  (""). Letters (uppercase and lowercase), numbers, symbols<br>■   Numeric list:  List that consists of (0, 1, 2, 3, 4, 5, 6, 7, 8, 9)<br>■   Hexadecimal number list:  List that begins with 0x/0X of (A, B, C, D, E, F, a, b, c, d, e, f) |
| Reserved variables | Reserved variables can only be referenced in a script. Setting a value is not possible. |

### D.2.2 Script File Requirements

Table D.5 lists the requirements for the components of a script file.

**Table D.5    Script File Requirements**

| Item | Requirement |
|---|---|
| Maximum length of one line of a script | 240 bytes |
| Maximum number of items of one list type identification name | 4096 |
| Maximum length of one item of a list type work variable string | 16 bytes |
| Maximum length of one item of a non-list type string | 150 bytes |
| Maximum number of items of macro trace storage | 1,000 |
| Maximum number of items of error trace | 1,000 |

### D.2.3  Script Symbols

Symbols can be used in a script to enhance or limit the power of each script command. Table D.6 lists and describes the symbols that can be used in a script.

**Table D.6    Script Symbols**

| Symbol | Use |
|---|---|
| Quotation mark | Used to define the character constant by enclosing with it quotation marks. |
| Space | Used to delimit the before and after phrases. |
| Comma | Used to delimit the before and after phrases.  This symbol must be placed by following each macro description rule. |
| Brace | Used to describe a list. |
| Parenthesis | Only used to describe a condition in the If statement. |
| Exclamation mark | Used as an operator in the If statement by placing the equal sign next to it.  This symbol is not useful when used alone. |
| Unequal sign | Used as an operator in the If statement when used alone.  When the equal sign follows, nothing changes. |
| Equal sign | Used as a substitute sign when used alone.  When the equal sign follows, it becomes an operator in the If statement. |

*Note:* The before and after phrases are split by the above symbols. Each symbol is recognized as a single word.

## D.3    Operation Macro Commands

The functional macros are the script equivalents of the following TC390 pair operations:

- Create pairs (see section D.3.1),

- Delete pairs (see section D.3.2),

- Suspend pairs (see section D.3.3),

- Resume pairs (see section D.3.4),

- Change pair options (see section D.3.5),

- Start pairs (see section D.3.6),

- Get pair status (see section D.3.7), and

- Select pair devices (see section D.3.8).

### D.3.1  Create Pairs

The CreateHrcPair command allows you to establish new TC390 volume pairs. *Note:* The CreateHrcPair command only creates the pair. You must run the StartHrcPair command after establishing the pair to start the remote copy process.

The CreateHrcPair parameters are:

- M-VOL device list (numeric): C x 0x100 + VV, where C=CU#, VV=vol# within CU.

- Serial number list (string):  RCU serial number (serial number is five digits decimal 0-9). Do not specify more than 12 RCUs.

- SSID number list (numeric):  RCU SSID (four digits hexadecimal).

- R-VOL device list (numeric):  C x 0x100 + VV, where C=CU#, VV=vol# within CU.

- Initial copy pace list (string):  "CP_MIDDLE" (0x01) = 3 tracks; "CP_FAST" (0x02) = 15 tracks; default = CP_FAST.

- Initial copy mode list (string):  "E" (0x00) = entire; "N" (0x01) = none; default = E.

- Sync level list (string):  "S0" or "Synchronous0" (0x00) = sync, "S2" or "Synchronous2" (0x02) = async; default = S0. S0 and S2 cannot be specified at the same time.

- CT group list (numeric):  consistency group number (0x00 - 0x7F). For async pairs you must specify this parameter. For sync pairs you must omit this parameter.

- Priority list (numeric):  priority of initial copy operation (1-256); default = 32.

- Fence level list (string):  "N" or "Never" = (0x00); "S" or "Status" = (0x02); "D" or "Data" = (0x01); default = "Never". For async pairs you must either specify N (never) or omit this parameter.

- CFW flag list (numeric):  0 = copy CFW data to R-VOL; 1 = only M-VOL; default = 1.

- DFW flag list (numeric):  0 = DFW not required; 1 = DFW required; default = 0. Must be omitted for async pairs.

- Error level list (string):  "G" (0x00) = group; "V" (0x01) = volume; default = G. For sync pairs you must omit this parameter.

- Time-Saving Mode flag:  "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.

Figure D.1 shows an example of the pair macro commands needed to create the specified pairs with the parameters listed in Table D.7.

*Caution:* When using the CreateHrcPair command to create more than one pair, make sure to keep each line within the maximum line length (240 bytes). Refer to section D.2.2 for script command restrictions and parameters.

**Table D.7    Example of CreateHrcPair Parameters**

| Parameter | Value | Parameter | Value |
|---|---|---|---|
| M-VOL | _ilDevA | CT group | [omit – N/A] |
| Serial number (RCU) | _slWorkA | Priority | _ilWorkA |
| SSID (RCU) | 11 | Fence level | Never |
| R-VOL | _ilDevB | CFW flag | 0 |
| Initial copy pace | _slWorkB | DFW flag | 1 |
| Initial copy mode | E | Error level | [omit – N/A] |
| Sync level | S0, S0, S0 | Time-Saving Mode | [omit – default] |

```
:
:
CreateHrcPair $Dev=_ilDevA,$RcuSn=_slWorkA,$RcuSsid=11,$Rdev=_ilDevB,$CopyPace=_slWorkB,
$CopyMode="E",$Sync={"S0","S0","S0"},$Priority=_ilWorkA,$Fence="N",$OptCfw=0,$OptSusDfwBlk=1
:
:
...
   ...
StartHrcPair
```

**Figure D.1    Example of CreateHrcPair Command**

### D.3.2 Delete Pairs

The DeleteHrcPair command allows you to delete TC390 pairs. The DeleteHrcPair parameters include:

- Device list (numeric): C x 0x100 + VV, where C=CU#, VV=vol# within the CU.

- Delete mode list (numeric): 0 (0x00) = normal, 1 (0x01) = delete by force; default = 0. You must specify 0 (normal) when deleting two or more async pairs.

- Delete range list (string): "G" or "Group" = group; "V" or "Volume" = volume; "C" or "C/T" = consistency time. For sync pairs you must omit this parameter.
  - When two or more volumes are specified, the default = V. If you want to delete two or more specific async pairs, you can specify V or omit this parameter.
  - When one volume is specified, the default = G under these conditions:
    Volume is an M-VOL and delete mode = 0 (normal) (any pair status); or
    Volume is an R-VOL, delete mode = 0, and pair status = suspending or deleting.
    If you want to delete an entire group by force (delete mode = 1), you must specify G.
  - When one volume is specified, the default = C/T under these conditions:
    Volume is an R-VOL, delete mode = 0, and pair status is not suspending or deleting.

- Time-Saving Mode flag: "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.

Figure D.2 provides an example of the pair macro commands needed to delete the specified pair with delete mode = normal.

```
MakeString $D=_sMsgE,$Fmt="RMS=(x%x %d %d). ",$Item=_Result,_MsgResult,_SelectResult

GetHrcStatus $Dev=_iNumA

MakeString $D=_sMsgA,$Fmt="%s  RCU=(S/N=%s, SSID=x%x)  Mode=%s  Mvol=%x
Rvol=%x",$Item=_sMsgF,_HrcStatus_Sn,_HrcStatus_Ssid,_HrcStatus_CopyType,_HrcStatus_DeviceM,_HrcStatus_DeviceR

MakeString $D=_sMsgA,$Fmt="%s    Status=(%s, %d%)  Fence=%s  %s  Continue with
CreateHrcPair?",$Item=_sMsgA,_HrcStatus_PairStatus,_HrcStatus_CopyRatio,_HrcStatus_Fence,_sMsgE

Message $Msg=_sMsgA,$OptMsg=0x0004
:

DeleteHrcPair $Dev=18,$DelMode=0
:
:
```

**Figure D.2    Example of DeleteHrcPair Command**

### D.3.3  Suspend Pairs

The SuspendHrcPair command allows you to suspend TC390 pairs. The SuspendHrcPair parameters include:

- Device list (numeric):  C x 0x100 + VV, where C=CU#, VV=vol# within the CU.

- Suspend mode list (string):  "M" or "M-Vol" (0x00) = M-VOL failure, "R" or "R-Vol" (0x01) = R-VOL; default = R-VOL. You must specify R or omit this parameter when suspending async pairs.

- Flag list (numeric):  suspend report flag: 0 = reports; 1 = no reports; default = 1.

- Suspend range list (string):  "G" or "Group" (0x04) = group; "V" or "Volume" (0x00) = volume. For sync pairs you must omit this parameter.

  – When one volume is specified, the default = G. If you want to suspend only one async pair, you must specify V.

  – When two or more volumes are specified, the default = V. When two or more volumes are specified, you must either specify V or omit this parameter.

- Pending data flag list (string):  "D" or "Drain" (0x00) = drain; "P" or "Purge" (0x08) = purge; default = D. For sync pairs you must omit this parameter.

- Time-Saving Mode flag:  "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.

Figure D.3 provides an example of the pair macro commands needed to suspend the specified pair with suspend mode = R-VOL and the default flag of no reports.

```
:
:
MakeString $D=_sMsgE,$Fmt="RMS=(x%x %d %d). ",$Item=_Result,_MsgResult,_SelectResult
GetHrcStatus $Dev=_iNumA
MakeString $D=_sMsgA,$Fmt="%s  RCU=(S/N=%s, SSID=x%x)  Mode=%s  Mvol=%x
Rvol=%x",$Item=_sMsgF,_HrcStatus_Sn,_HrcStatus_Ssid,_HrcStatus_CopyType,_HrcStatus_DeviceM,_HrcStatus_DeviceR
MakeString $D=_sMsgA,$Fmt="%s   Status=(%s, %d%)  Fence=%s  %s  Continue with
ResumeHrcPair?",$Item=_sMsgA,_HrcStatus_PairStatus,_HrcStatus_CopyRatio,_HrcStatus_Fence,_sMsgE
Message $Msg=_sMsgA,$OptMsg=0x0004
:
:
SuspendHrcPair $Dev=18,$SusMode="R"
```

**Figure D.3     Example of SuspendHrcPair Command**

### D.3.4  Resume Pairs

The ResumeHrcPair command allows you to resume TC390 pairs. The ResumeHrcPair parameters include:

- M-VOL device list (numeric): C x 0x100 + VV, where C=CU#, VV=vol# within CU.

- Priority list (numeric):  priority of initial copy operation (numeric 1-256); default = 32.

- Fence level list (string):  "N" or "Never" (0x00) = never; "S" or "Status" (0x02) = status; "D" or "Data" (0x01) = data; default = current value. For async pairs you must either specify N (never) or omit this parameter.

- Sync level list (string):  "S0" or "Synchronous0" (0x00) = sync, "S2" or "Synchronous2" (0x02) = async; default = current value.

- Error level list (string):  "G" or "Group" (0x00) = group; "V" or "Volume" (0x01) = volume; default = current value. For sync pairs you must omit this parameter.

- Resume range list (string):  "G" (0x00) = group; "V" (0x01) = volume. For sync pairs you must omit this parameter.

   - When one volume is specified, the default = G. If you want to resume only one async pair, you must specify V.

   - When two or more volumes are specified, the default = V. When two or more volumes are specified, you must either specify V or omit this parameter.

- Time-Saving Mode flag:  "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.

Figure D.4 provides an example of the pair macro commands needed to resume the specified pair in synchronous mode with fence level = never and priority = 1. *Note:* After resuming pairs, you must run the StartHrcPair command to begin remote copy activity.

```
:
MakeString $D=_sMsgE,$Fmt="RMS=(x%x %d %d). ",$Item=_Result,_MsgResult,_SelectResult
GetHrcStatus $Dev=_iNumA
MakeString $D=_sMsgA,$Fmt="%s  RCU=(S/N=%s, SSID=x%x)  Mode=%s  Mvol=%x
Rvol=%x",$Item=_sMsgF,_HrcStatus_Sn,_HrcStatus_Ssid,_HrcStatus_CopyType,_HrcStatus_DeviceM,_HrcStatus_DeviceR
MakeString $D=_sMsgA,$Fmt="%s    Status=(%s, %d%)  Fence=%s  %s  Continue with DeleteHrcPair
?",$Item=_sMsgA,_HrcStatus_PairStatus,_HrcStatus_CopyRatio,_HrcStatus_Fence,_sMsgE
Message $Msg=_sMsgA,$OptMsg=0x0004
:
ResumeHrcPair $Dev=25,$Priority=1,$Fence="N",$Sync="Synchronous0"
StartHrcPair
```

**Figure D.4    Example of ResumeHrcPair Command**

### D.3.5  Change Pair Options

The ChangeHrcOption command allows you to change the pair options for TC390 pairs. The ChangeHrcOption parameters include:

- M-VOL device list (numeric): C x 0x100 + VV, where C=CU#, VV=vol# within CU.

- Fence level list (string):  "N" or "Never" (0x00) = never, "S" or "Status" (0x02) = status; "D" or "Data" (0x01) = data; default = current value. For async pairs you must either specify N or omit this parameter.

- CFW flag list (numeric):  0 = copy CFW data to R-VOL; 1 = only M-VOL; default = current value.

- DFW flag list (numeric):  0 = DFW not required; 1 = DFW required; default = current value. For async pairs you must omit this parameter.

- Error level list (string):  "G" (0x00) = group; "V" (0x01) = volume; default = current value. For sync pairs you must omit this parameter.

- Time-Saving Mode flag:  "Yes" = The **Use Time-Saving Mode** option is enabled; "No" = The **Use Time-Saving Mode** option is disabled; default = "Yes". This parameter is a non-list type and only one value can be specified.

Figure D.5 provides an example of the pair macro commands needed to change the pair options for the pair with LDEV ID 0x4a as follows:  set fence level option to **Never**, set CFW option to M-VOL only, and set DFW to required.

```
MakeString $D=_sMsgE,$Fmt="RMS=(x%x %d %d). ",$Item=_Result,_MsgResult,_SelectResult
GetHrcStatus $Dev=_iNumA
MakeString $D=_sMsgA,$Fmt="%s  RCU=(S/N=%s, SSID=x%x)  Mode=%s  Mvol=%x
Rvol=%x",$Item=_sMsgF,_HrcStatus_Sn,_HrcStatus_Ssid,_HrcStatus_CopyType,_HrcStatus_DeviceM,_HrcStatus_DeviceR
MakeString $D=_sMsgA,$Fmt="%s    Status=(%s, %d%)  Fence=%s  %s  Continue with
SuspendHrcPair?",$Item=_sMsgA,_HrcStatus_PairStatus,_HrcStatus_CopyRatio,_HrcStatus_Fence,_sMsgE
Message $Msg=_sMsgA,$OptMsg=0x0004
:
:
ChangeHrcOption $LDEV=0x4a,$Fence="Never",$OptCfw=1,$OptSusDfwBlk=1
```

**Figure D.5    Example of ChangeHrcOption Command**

### D.3.6 Starting a Pair

The StartHrcPair command allows you to start the remote copy process for all new and resumed TC390 pairs (CreateHrcPair and ResumeHrcPair commands). The StartHrcPair command does not have any arguments or parameters. After you have created and/or resumed all desired TC390 pairs, add the StartHrcPair command to the script to begin remote copy activity for all preceding new and resumed pairs. Figure D.6 provides an example of the StartHrcPair command as it appears within a script file.

```
MakeString $D=_sMsgE,$Fmt="RMS=(x%x %d %d). ",$Item=_Result,_MsgResult,_SelectResult
GetHrcStatus $Dev=_iNumA
MakeString $D=_sMsgA,$Fmt="%s  RCU=(S/N=%s, SSID=x%x)   Mode=%s   Mvol=%x
Rvol=%x",$Item=_sMsgF,_HrcStatus_Sn,_HrcStatus_Ssid,_HrcStatus_CopyType,_HrcStatus_DeviceM,_HrcStatus_DeviceR
MakeString $D=_sMsgA,$Fmt="%s   Status=(%s, %d%)   Fence=%s  %s  Continue with
GetHrcStatus?",$Item=_sMsgA,_HrcStatus_PairStatus,_HrcStatus_CopyRatio,_HrcStatus_Fence,_sMsgE
Message $Msg=_sMsgA,$OptMsg=0x0004
:
:
StartHrcPair
```

**Figure D.6     Example of StartHrcPair Command**

### D.3.7 Getting Pair Status

The GetHrcStatus macro command allows you to obtain the status of a specific TC390 pair. The GetHrcStatus argument is:

- Device (numeric constant, non-list-type and numeric-type work variable): VOL = C x 0x100 + VV, where C=CU#, VV=vol# within the CU.

The GetHrcStatus command obtains the status of the pair from the 9900V subsystem and displays the status as a reserved variable "_HrcStatus" (see Table D.15). Figure D.7 provides an example of the GetHrcStatus command for the pair with LDEV ID 0x4a.

```
GetHrcStatus $Dev=0x4a
_sMsgB=_HrcStatus_Fence
_sMsgC=_HrcStatus_Sync
_sMsgD=_HrcStatus_Sn
_iNumB=_HrcStatus_Ssid
_iNumC=_HrcStatus_DeviceR
MakeString $D=_sMsgE,$Fmt="RMS=(x%x %d %d). ",$Item=_Result,_MsgResult,_SelectResult
MakeString $D=_sMsgA,$Fmt="%s  RCU=(S/N=%s, SSID=x%x)  Mode=%s  Mvol=%x
Rvol=%x",$Item=_sMsgF,_HrcStatus_Sn,_HrcStatus_Ssid,_HrcStatus_CopyType,_HrcStatus_DeviceM,_HrcStatus_DeviceR
MakeString $D=_sMsgA,$Fmt="%s   Status=(%s, %d%)  Fence=%s  %s  Continue with
ChangeHrcOption?",$Item=_sMsgA,_HrcStatus_PairStatus,_HrcStatus_CopyRatio,_HrcStatus_Fence,_sMsgE
Message $Msg=_sMsgA,$OptMsg=0x0004
```

**Figure D.7    Example of GetHrcStatus Command**

### D.3.8  Selecting Devices

The SelectHrcDevice command allows you to search for TC390 pairs whose status matches the specified parameters. The SelectHrcDevice argument is:

- Output list (list-type and numeric work variable)

The SelectHrcDevice parameters include:

- Device list (numeric):  list of devices to be searched: C x 0x100 + VV, where C=CU#, VV=vol# within CU. Default = all possible target devices that can be specified.

- Serial number list (string):  RCU serial number. Default = not specific.

- SSID number list (numeric):  RCU SSID. Default = not specific.

- Fence level list (string):  "N" or "Never" (0x00) = never; "S" or "Status" (0x02) = status; "D" or "Data" (0x01) = data. Default = not specific.

- Sync level list (string):  "S0" or "Synchronous0" (0x00) = sync, "S2" or "Synchronous2" (0x02) = async. Default = not specific.

- Pair status list (string):  "Simplex", "Pending", "Duplex", "Suspended0" (suspended during initial copy), "Suspended1" (suspended after initial copy), "Suspended" (all suspend types), "Suspending", "Deleting", "Undefined". Default = not specific.

- Device attribute list (string):  "M" or "M-Vol", "R" or "R-Vol". Default = not specific.

- Error level list (string):  "G" or "Group"; "V" or "Volume". Default = not specific.

- CT group list (numeric):  consistency group number (0x00 - 0x7F). Default = not specific.

- SEQCHK flag list (string): "Yes" = SEQCHK on; "No" = SEQCHK off. Default = not specific.

Figure D.8 provides an example of the SelectHrcDevice command to find the pairs with the parameters listed in Table D.8.

**Table D.8    Select Device Parameters**

| Parameter | Value |
|---|---|
| Output list | _ilDevA |
| Device list | _ilDevB |
| RCU serial number | _slWorkA |
| RCU SSID | _ilWorkA |
| Fence level | N |
| Copy mode | S0, S0, S0 |
| Pair status | Suspended0 |
| Device attribute | M |

```
GetHrcStatus $Dev=_iNumA

_sMsgB=_HrcStatus_Fence

_sMsgC=_HrcStatus_Sync

_sMsgD=_HrcStatus_Sn

_iNumB=_HrcStatus_Ssid

_iNumC=_HrcStatus_DeviceR

MakeString $D=_sMsgE,$Fmt="RMS=(x%x %d %d). ",$Item=_Result,_MsgResult,_SelectResult

SelectHrcDevice $DevList=_ilDevA,$Dev=_ilDevB,$RcuSn=_slWorkA,$RcuSsid=_ilWorkA,$Fence="N",
$Sync={"S0","S0","S0"},$PairStatus="Suspended0",$DevAttr="M"
```

**Figure D.8    Example of SelectHrcDevice Command**

## D.4    Internal Macro Commands

The internal macro commands are the connection agents that allow you to connect the functional macros together and produce a complete and functioning script. The internal macros are divided into two groups as shown in Table D.9:  list types and non-list types.

**Table D.9    Internal Macro Commands**

| Type | Macro | Description |
|------|-------|-------------|
| For lists | SetList<br>AddList | Set (define) a list of items.<br>Add items to a list. |
| For non-lists | Start<br>End<br>Delay<br>If<br>EndIf<br>MakeString<br>Message | Declares the beginning of a script.<br>Declares the end of a script.<br>Suspends script execution for the specified length of time.<br>Executes a script conditionally.<br>Terminates a script conditionally.<br>Makes strings; converts numeric value to character string.<br>Displays a message window with buttons (OK, Yes/No). |

The **Start** and **End** commands are used together to begin and end the functions of a script. Every script must have a **Start** and **End** command. The **If/EndIf** commands are also used concurrently to string two or more functional commands together. The **If/EndIf** commands must be used together. For every **If** command in a script there must be an **EndIf** command. The **Delay** command allows you to delay a script for up to an hour, while the **Message** command allows you to create graphic user interface (GUI) messages to the user. The **MakeString** command allows you to assign several values to a string statement, or the **MakeString** command can convert numeric values to sting values. The **SetList** command allows you to create a list (e.g., all the searchable ports in the 9900, all the searchable LDEVs in the 9900) and the **AddList** command allows you to expand the parameters of a list created with the **SetList** command.

### D.4.1    Internal Macro Command Definitions

#### AddList

The **AddList** command allows you to add a specified value to a specific list type. If you add a value to a list that exceeds the maximum number of items for that output list, the excess values will be ignored. The format for the **AddList** command is:  **AddList $D=** the output list to which you want to add a value **,$S=** the expressions or values to be added to the output list with a numeric range of 0x0000 to 0xffff. For example, to add these values (0, 1, 2, 3, 0x1e, and 0x1f) to the Dev (Device) B list, the **AddList** command would be:

**AddList $D=_ilDevB**
    **,$S={0,1,2,3,0x1e,0x1f}**

## Delay

The **Delay** command allows you to delay a script for a specified length of time. The script delay time is set in seconds (0 - 3600). The format for the **Delay** command is: **Delay $Time=** the length of time you want to delay the script. For example, to delay a script by 60 seconds, the **Delay** command would be:
**Delay $Time=60**

## End

The **End** command allows you to declare the end of a script. The **End** command also terminates the execution of a script. At least one **End** statement must be described in the trailing line of the script statement. The format for the **End** statement is: **End**

## If / EndIf

The **If/EndIf** statements are used together to allow you to verify the conditions of an expression. If the **If/EndIf** statement is successfully completed, succeeding statements will be processed. If the **If/EndIf** statement is not successfully completed, the script will abort and the succeeding statements will not be completed. When **If/EndIf** statements are used, several conditions must be met. You must end an **If** statement with an **EndIf** statement. The execution statement cannot be defined on the same line as the **If** statement. The **If** statement must contain one conditional decision statement within parentheses. The string values must be compared as ASCII character codes (see Table D.10). The format for an **If/EndIf** statement is:

**If** expression one compared with expression two (see Table D.11 for comparison expressions) macro statement, either internal or functional
**EndIf**

For example, to start a TC390 pair only if the pair was created successfully (result value of CreateHrcPair command is not 0), use the following **If/EndIf** command:

**If (_Result!=0)**
**StartHrcPair**
**EndIf**

**Table D.10   ASCII Character Codes**

| Character | Code |
|-----------|------|
| 0 | 0x30 |
| 1 | 0x31 |
| 9 | 0x39 |
| A | 0x41 |
| Z | 0x5a |
| a | 0x61 |
| z | 0x7a |

**Table D.11   If/EndIf Comparison Symbols**

| Symbol | Meaning |
|--------|---------|
| = = | Expression 1 is equal to Expression 2. |
| < | Expression 1 is less than Expression 2. |
| <= | Expression 1 is less than or equal to Exp 2. |
| > | Expression 1 is greater than Expression 2. |
| >= | Expression 1 is greater than or equal to Exp 2. |
| != | Expression 1 is not equal to Expression 2. |

## MakeString

The **MakeString** command allows you to edit a string and/or convert numeric values to string characters. When using the **MakeString** statement several conditions must be met. For each format control string statement there must be an $Item statement. The format control string of expression 1 must be enclosed in quotation marks (""). If you set a value exceeding the maximum length of a string, the extraneous portion of the value will be not set. Table D.12 defines the two expression statement in the **MakeString** command. The format for the **MakeString** command is:
**MakeString $D=** output buffer **,$Fmt=** expression 1**,$Item=** expression 2

**Table D.12    MakeString Expression Definitions**

| Expression 1 | Expression 2 |
|---|---|
| Expression 1 is one of three format control strings ($Fmt): <br> **%d**    Converts a 16-bit numeric expression to a decimal number (0 - 65535). <br> **%x**    Converts a 16-bit numeric expression to a hexadecimal number (0 - 0xffff). <br> **%s**    Sets a string as it is. | Expression 2 is any expression not containing a list reserved variable (must be constant or work variable). |

For example, to create a **MakeString** statement that will convert the 16-bit numeric expression to a hexadecimal number (0 - 0xffff) and set the string as it is, with an output buffer of _sMsg, the command would be:

**MakeString $D=_sMsgB**
       **,$Fmt="EndCode=(0x%x):%s"**
       **,$Item=_Result,_sMsgA**

For the **MakeString** command listed above: _sMsgB = "EndCode=(0x110f):Error Occurred".


## Message

The **Message** command allows you to display GUI messages along with user option buttons. The format for the **Message** command is:
**Message $Msg=** String or work variable message **,$OptMsg=** message option (0x0000 = OK button, 0x0004 = Yes/No buttons). For example, to display a message saying "Do you want to end?" with the Yes and No user option buttons the command would be:

**Message $Msg="Do you want to end?",$OptMsg=0x0004**

## SetList

The **SetList** command allows you to assign specific items to a list. The format of the **SetList** command is:  **SetList $D=** output list**,$S=**expression(attribute of the items to be assigned to the list with a numeric range of 0x0000 to 0xffff). For example, to set 0, 1, 2, 0x1e, and 0x1f to be displayed in the Dev (Device) B list the command would be:

**SetList $D=ilDevB,$S={0,1,2,0x1e,0x1f}**

## Start

The **Start** command allows you to declare the beginning of a script and check to verify that the controller name matched the connected controller. When using the **Start** command, several conditions must be met. The **Start** command must be described on the first line of the script. The **Start** statement cannot include a comment statement, an empty statement or a blank statement. The **Start** statement must appear at the beginning of every script. If the controller name does not match the connected controller, an error will occur and the script will be aborted. The format of the **Start** command is:  **Start $Script="HRC",$Svr=** controller name. For example, to start a script for a controller named Training 9900V the command would be:

**Start $Script="HRC",$Svr="Training 9900"**

## D.5    Work Variables

There are two types of work variables:  list type, and non-list type. All work variables are
initialized before a script is executed.

■  Numeric work variables may have a value between 0x0000 and 0xffff. Numeric work
   variables are initialized with 0.

■  A non-list string work variable may have a string with length up to 150 bytes. A list string
   work variable may have strings with length up to 16 bytes each. String work variables
   are initialized with a null string whose length is 0.

■  A list work variable may have up to 1024 items. A non-list work variable is a constant.
   List work variables are initialized as empty (no items).

The work variable is part of an execution statement in a script. Table D.13 provides a
description and the storage type of each work variable statement for list and non-list types.

**Table D.13   Work Variables**

|  | Variable | Type | Description and Storage Type |
|---|---|---|---|
| List Type | _ilDEV | Numeric | Stores the device number list.<br>Expression: _ilDevA, _ilDevB, _ilDevC |
|  | _ilPriority | Numeric | Stores the priority number list.<br>Expression: _ilPriorityA, _ilPriorityB, _ilPriorityC |
|  | _ilWork | Numeric | Stores any 16-bit numeric values.<br>Expression: _ilWorkA, _ilWorkB, _ilWorkC _ilWorkD, _ilWorkE, _ilWorkF |
|  | _slWork | String | Stores any strings.<br>Expression: _slWorkA, _slWorkB, _slWorkC, _slWorkD, _slWorkE, _slWorkF |
| Non-List Type | _iNum | Numeric | Stores any 16-bit numeric value.<br>Expression: _iNumA, _iNumB, _iNumC, _iNumD, _iNumE, _iNumF |
|  | _sMsg | String | Stores any string.<br>Expression: _sMsgA, _sMsgB, _sMsgC, _sMsgD, _sMsgE, _sMsgF |

## D.6 Reserved Variables

Reserved variables include result variables (i.e., result of macro execution) and status variables (i.e., pair status of specified volume). The reserved variables are for reference use only.

### D.6.1 Reserved Result Variables

When a functional macro is executed (e.g., CreateHrcPair), a result value (_Result) is issued. Figure D.9 illustrates the result statement format, and Table D.14 lists and defines the valid result values. When a new macro is initiated, the result value automatically resets to 0x0000. The functional macro executes on the specified number of devices. If the macro does not satisfy the execution condition, a conditional error occurs. If a conditional error is found, the result value is OR'ed with 0x1000, and the macro is logged in the error and macro trace files (see section 4.5.1). If the return value of the API (application program interface) is not 0, an API error occurs. If an API error occurs, the result value is OR'ed with 0x0100, and the macro is logged in the error and macro trace files.

**_Result:0xNNNN**

- Reserved
- Reserved
- Result of API (0: Normal, 1: Error)
- Result of functional macro (0:Normal, 1: Error)
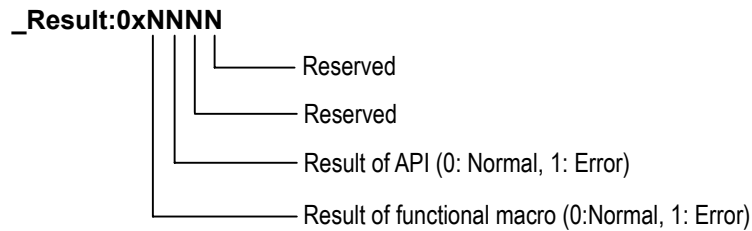
**Figure D.9    Result Statement Format**

**Table D.14    Reserved Result Variables**

| Variable | Type | Description |
|---|---|---|
| _Result | Numeric | Stores the execution results of a macro.<br>0 = normal end. Other values depend on the macro. |
| _MsgResult | Numeric | Stores the execution results of a Message (internal) macro.<br>1 = OK, 6 = Yes, 7 = No. |
| _SelectResult | Numeric | Stores the number of devices found by SelectHrcDevice macro.<br>0 = no devices found. |

### D.6.2 Reserved Status Variables

When a GetHrcStatus command is issued, the Remote Console PC obtains the status of the specified TC390 pair(s) from the 9900V subsystem. The results of this query are displayed in the reserved status variables. Table D.15 lists and describes the valid reserved status variables.

**Table D.15  Reserved Status Variables**

| Variable | Type | Description |
|---|---|---|
| _HrcStatus _CopyType | String | Stores the copy type:  "RDC" = remote copy mode ; "RMC' = migration mode; "---" = other than the above modes. |
| _HrcStatus _DeviceAttr | String | Stores the device attribute:  "M-Vol" = M-VOL  "R-Vol" = R-VOL  "---" = other than the above modes. |
| _HrcStatus _DeviceM | Numeric | Stores the M-VOL device number. |
| _HrcStatus _DeviceR | Numeric | Stores the R-VOL device number. |
| _HrcStatus _Sn | String | Stores the serial number of the controller for the remote copy pairs. |
| _HrcStatus _Ssid | Numeric | Stores the storage subsystem ID (SSID) of the controller for the remote copy pairs. |
| _HrcStatus _PairStatus | String | Stores the copy pair status:  "Simplex" = simplex; "Duplex" = duplex; "Pending" = initial copy in progress; "Suspended0" = copy abort in initial copy; "Suspended1" = copy abort other than initial copy; "Suspending" = TC390A suspend in progress; "Deleting" = TC390A delete in progress; "Undefined" = undefined. |
| _HrcStatus _Fence | String | Stores the M-VOL fence level:  "Never" = no fence; "Status" = fence due to an R-VOL status change failure; "Data" = fence due to a data error; "Undefined" = undefined. |
| _HrcStatus _Sync | String | Stores the synchronous level:  "Synchronous0" = sync; "Synchronous2" = async; "Undefined" = undefined. |
| _HrcStatus _TimeOfUpdate | String | Stores the pair status update time:  "MM/DD/YYYY hh:mm:ss" = MM: month, DD: day, YYYY: year, hh: hour, mm: minute, ss: second. |
| _HrcStatus _TimeOfEstablish | String | Stores the pair creation update time:  "MM/DD/YYYY hh:mm:ss" = MM: month, DD: day, YYYY: year, hh: hour, mm: minute, ss: second. |
| _HrcStatus _CopyRatio | Numeric | Stores the copy progress ratio (0 – 100). |
| _HrcStatus _InternalStatus | Numeric | Stores the internal status code. |
| _HrcStatusTypeOfCT | String | Stores the timer type of the consistency group:  "System" = system timer; "Local" = local (SVP) timer; "None" = no timer; "Undefined" = undefined. |
| _HrcStatus_CTG | Numeric | Stores the consistency group number:  0x00-0x7F. |
| _HrcStatus_SuspendBy | String | Stores the async suspension status:  "Group" = consistency time of suspended volume matches consistency time of group; "Volume" = consistency time of suspended volume does not match the group consistency time; "Undefined" = undefined. |
| _HrcStatus_ErrLv | String | Stores the error level (async) pair option:  "Group" = all volumes in the group will be suspended if this volume is suspended; "Volume" = this volume will be suspended individually; "Undefined" = undefined. |

## D.7    Optional Script Parameters

The parameters outlined in Table D.16 are optional parameters that can be added to a script at the script creator's discretion. If any of these parameters are included in a script, the 9900V subsystem will perform a syntactical check of the script to ensure that the syntax requirements for the parameter have been met. If no optional parameters are included, the 9900V will not check any part of the script. The 9900V will run the script commands based only on what has been specified in the text of the script. Table D.16 lists the optional script parameters in the order that the 9900V subsystem will execute them, and describes the syntax requirements that will be evaluated.

**Table D.16    Syntax Requirements for Optional Parameters (continues on the following pages)**

| Parameter | Syntax Requirements |
|---|---|
| Length | Check that each line does not exceed the maximum length for a script statement. |
| Phrases in a script statement | A phrase is enclosed by the quotation symbols.<br>Use of the parentheses is correct, and the number of parentheses is exact.<br>A statement does not terminate with an equal sign.<br>The parameter identification name (phrase beginning with "$") is always defined.<br>The work variable and reserved variable (phrase beginning with "_") are always defined. |
| Script statement | The first line begins with (Start) as an execution statement.<br>The lead of one line in the execution statement always begins with a macro name or an identification name for non-list type work variable. |
| Substitute statement | The number of phrases is correct.<br>The equal sign is described exactly between the right side and the left side.<br>The right side of the substitute statement is correct. |
| SetList, AddList | The number of phrases is not less than the minimum count.<br>Duplicate parameter identification names are not specified.<br>The required parameter identification name is defined.<br>The equal sign is described between the right side and $D.<br>Specifying the right side is correct.<br>The equal sign is described between the right side and $S.<br>Specifying the right side is correct.<br>The parameter identification name is described immediately after the macro.<br>The parameter identification names are delimited by a comma (,).<br>An illegal phrase is not included in any statement. |

**Table D.16   Syntax Requirements for Optional Parameters (continued)**

| Parameter | Syntax Requirements |
|---|---|
| Start | The number of phrases is not fewer than the minimum count.<br>Duplicate parameter identification names are not specified.<br>The required parameter identification name is defined.<br>The equal sign is described between the right side and $Script.<br>Specifying the right side is correct.<br>The equal sign is described between the right side and $Svr.<br>Specifying the right side is correct.<br>The parameter identification name is described immediately after the macro.<br>The parameter identification names are delimited by a comma (,).<br>An illegal phrase is not included in one statement. |
| End | Check that the number of phrases matches. |
| Delay | The number of phrases matches.<br>The required parameter identification name is defined.<br>The equal sign is described between the right side and $Time.<br>Specifying the right side is correct. |
| If | The number of phrases matches.<br>The parentheses are described in the correct location.<br>Expressions 1 and 2 are correctly described.<br>The attribute of expressions 1 and 2 matches.<br>Specifying the right side is correct.<br>The comparison operator is correctly described. |
| EndIf | The number of phrases matches.<br>The macro is describe with the related If statement. |
| MakeString | Duplicate parameter identification names are not specified.<br>The required parameter identification name is defined.<br>The equal sign is described between the right side and one of $D, $Fmt and $Item.<br>Specifying the right side is correct.<br>The items are split by a comma (,) if multiple items are specified in $Item.<br>The parameter identification name is described immediately after the macro.<br>The parameter identification names are delimited by a comma (,).<br>The matching between the specification of the control string and the description of the item is correct.<br>An illegal phrase is not included in any statement. |

| Parameter | Syntax Requirements |
|-----------|---------------------|
| Message | The number of phrases is not less than the minimum count. |
| | Duplicate parameter identification names are not specified. |
| | The required parameter for the identification name is defined. |
| | The equal sign is described between the right side and $Msg. |
| | Specifying the right side is correct. |
| | The equal sign is described between the right side and $OptMsg. |
| | Specifying the right side is correct. |
| | The parameter identification name is described immediately after the macro. |
| | The parameter identification names are delimited by a comma (,). |
| | An illegal phrase is not included in one statement. |
| Functional macro (except for StartHrcPair) | The number of phrases is not less than the minimum count. |
| | Duplicate parameter identification name is prohibited. |
| | The required parameter for the identification name is defined. |
| | The equal sign is described between the right side and the parameter identification name. |
| | Specifying the right side is correct. |
| | The parameter identification name is described immediately after the macro. |
| | The parameters for the identification names are delimited by a comma (,). |
| | An illegal phrase is not included in any statement. |
| StartHrcPair | Check that the number of phrases matches. |
| Entire check | Check that the (If) has a matching (EndIf). |
| | Check that the last line in the execution statement terminates at (END.) |

## D.8    Error Reporting

The TC390 scripting error codes are slightly different than the general TC390 error codes. Figure D.10 shows the format of the scripting error codes. Table D.17 describes the TC390 scripting error messages. Table D.18 lists the TC390 scripting error codes. In Table D.18 the message ID is the four-digit number displayed on the error message. The internal code is the four-digit number displayed in the fifth column of the error trace file (refer to section 4.5.1). Refer to Chapter 7 for additional TC390 troubleshooting information.

**X X X X** (4 bytes)

**2nd byte: error type**
   0: Warning
   1: Fatal

**1st byte: occurrence location**
   1: Screen processing
   2: Syntax analysis
   3: Macro expansion
   4: Syntax execution
   5: API generation
   6: Tracing
   9: Other processing
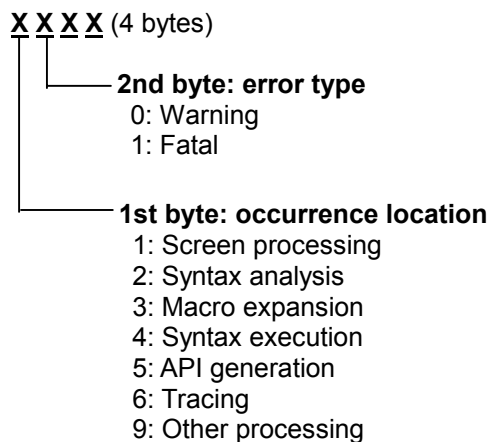
**Figure D.10    Scripting Error Code Format**

**Table D.17    Error Messages**

| Error Message | Conditions to Verify | Corrective Action |
|---|---|---|
| Syntax error | The syntax validity of the script is checked at the start of execution. An error message will be displayed if failed. | Use the scripting error code to determine which line contains the syntax error (see Table D.18), and fix the syntax error. |
| Parameter error | The parameter validity of the script is checked on executing each instruction. An error message will be displayed if failed. | Use the scripting error code to determine which line contains the parameter error (see Table D.18), and fix the parameter error. |
| Rejection | The result of the execution is checked on each target device. If failed, the last error status is displayed and error flag is set in the reserved variable _Result. Also script continues to be executed. | If you want to terminate the script or display a message of error occurrence and indication following steps, check that _Result is not 0 in script. |
| Skip if not executable | The condition of each target device is checked to be executable status. For example, the M-VOL status must be *simplex* to create a pair. If failed, error flag is set in the reserved variable _Result. Also script continues to be executed. | If you want to terminate the script or display a message of error occurrence and indication following steps, check that _Result is not 0 in script. |

**Table D.18   TrueCopy – S/390® Scripting Error Codes (continues on the following pages)**

| Message ID | Internal Code | Error Message | Error Description |
|---|---|---|---|
| 2338 | -- | Normal End. | The script execution has completed successfully. |
| 2339 | 1102 | Cannot open a file by 'Memo' command. | The 'Memo' command cannot start the Write application. The Write.exe file may be absent from the Windows directory. |
| 2340 | 1103, 1104 | Invalid command line parameter. | An error is found in the startup parameter of the script monitor. The installation process may not have been complete. |
| 2341 | 1f01, 1f02 | File I/O error (parameter). | The parameter file cannot be opened. The installation process may not have been complete. |
| 2341 | 2f01, 2f02 | File I/O error (script). | The specified file may be corrupt. |
| 2341 | 2f03~ 2f05, 4101, 4102 | File I/O error (temporary). | The work middle file is abnormal. The disk capacity maybe insufficient or the file may be corrupt. |
| 2341 | 6101~ 6105 | File I/O error (trace). | The macro trace file cannot be opened. The disk capacity may be insufficient or the file may be corrupt. |
| 2341 | 6111~ 6115 | File I/O error (trace). | The error trace file cannot be opened. The disk capacity may be insufficient or the file may be corrupt. |
| 2342 | 2101 | Too long line. Line = nnnn | A script line exceeds the maximum character length (240), where nnnn is the script line number. |
| 2343 | 2201, 2203 | Illegal 'If' and 'EndIf' pair. Line = nnnn | 'If' and 'EndIf' script commands do not match, in script line nnnn |
| 2344 | 2202 | 'End' is required. Line = nnnn | 'End' does not exist at the end of the script line nnnn. |
| 2345 | 2204 | 'Start' is required. Line = nnnn | The script line nnnn does not begin with 'Start.' |
| 2346 | 2205 | Illegal word is found. Line = nnnn | An illegal word was found in script line nnnn. |
| 2347 | 2206 | List type variable is unexpected. Line = nnnn | The list type variable is incorrect in script line nnnn. |
| 2348 | 2207 | Illegal quotation. Line = nnnn | A quotation mark is not found at the end of a string in script line nnnn. |
| 2349 | 2208 | Required value is not found. Line = nnnn | The end of line nnnn is "=". |
| 2350 | 2209, 220a | Illegal '('and')' pair. Line = nnnn | The parentheses are not matched in script line nnnn. |

**Table D.18    TrueCopy – S/390® Scripting Error Codes (continued)**

| Message ID | Internal Code | Error Message | Error Description |
|---|---|---|---|
| 2351 | 220b, 2303 | Syntax error. Line = nnnn | An illegal word is included in script line nnnn. |
| 2351 | 27xx | Syntax error. Line = nnnn | The parameter setting for script line nnnn is invalid. |
| 2351 | 29xx | Syntax error. Line = nnnn | The macro description for script line nnnn is invalid. |
| 2351 | 2axx | Syntax error. Line = nnnn | An invalid comma is used in script line nnnn. |
| 2352 | 220e | Illegal expression. Line = nnnn | An unavailable operator is defined in the if statement of script line nnnn. |
| 2353 | 220f | Illegal parameter. Line = nnnn | The list of the format control string and the value of the expression specified by $Item do not match in the Make String command. Or, the format control string and the expression do not match the attributes in script line nnnn. |
| 2353 | 24xx | Illegal parameter. Line = nnnn | The parameters of script line nnnn are invalid. |
| 2354 | 2301 | Unknown parameter. Line = nnnn | An undefined parameter is used in script line nnnn. |
| 2355 | 2355 | Unknown identifier. Line = nnnn | An undefined word is used to define the parameters in script line nnnn. |
| 2356 | 25xx | Same parameter appears again. Line = nnnn | A duplicate parameter was found in script line nnnn. |
| 2357 | 26xx | Required parameter is not found. Line = nnnn | A required parameter for script line nnnn was not found. |
| 2358 | 28xx | Value type mismatch. Line = nnnn | The values on the left and right side of script line nnnn are not compatible. |
| 2359 | 1001, 4111, 4112 | Internal error. | An internal program error has occurred. The program installation may not have been complete. |
| 2360 | 4181 | Mismatch script type. | The script types specified by the Start macro and by the execution environment file are different. |
| 2361 | 4182 | Mismatch controller name. | The device names specified by the Start macro and by the execution environment file are different. |
| 2362 | 5101 | Parameter value error ($Dev). | A functional macro parameter error was found. Check the setting value in the $Dev parameter. |
| 2362 | 5102 | Parameter value error ($Priority). | A functional macro parameter error was found in setting $Priority. |
| 2362 | 5103 | Parameter value error ($Fence). | A functional macro parameter error was found in setting $Fence. |

**Table D.18   TrueCopy – S/390® Scripting Error Codes (continued)**

| Message ID | Internal Code | Error Message | Error Description |
|---|---|---|---|
| 2362 | 5104 | Parameter value error ($Sync). | A functional macro parameter error was found in setting $Sync. |
| 2362 | 5105 | Parameter value error ($SusMode). | A functional macro parameter error was found in setting $SusMode. |
| 2362 | 5106 | Parameter value error ($SusReport). | A functional macro parameter error was found in setting $SusReport. |
| 2362 | 5107 | Parameter value error ($DelMode). | A functional macro parameter error is found in the setting $DelMode. |
| 2362 | 5108 | Parameter value error ($OptCfw). | A functional macro parameter error is found in setting $0ptCfw. |
| 2362 | 5109 | Parameter value error ($OptSusDfwBlk). | A functional macro parameter error is found in setting $0ptSusDfwblk. |
| 2362 | 5110 | Parameter value error ($RcuSn). | A functional macro parameter error was found in setting $RcuSn. |
| 2362 | 5111 | Parameter value error ($RcuSsid). | A functional macro parameter error was found in the setting $RcuSsid. |
| 2362 | 5112 | Parameter value error ($Rdev). | A functional macro parameter error was found in the setting $Rdev. |
| 2362 | 5113 | Parameter value error ($CopyPace). | A functional macro parameter error was found in the setting $CopyPace. |
| 2362 | 5114 | Parameter value error ($CopyMode). | A functional macro parameter error was found in the setting $CopyMode. |
| 2362 | 5115 | Parameter value error ($PairStatus). | A functional macro parameter error was found in the setting $PairStatus. |
| 2362 | 5116 | Parameter value error ($DevAttr). | A functional macro parameter error was found in the setting $DevAttr. |
| 2362 | 5117 | Parameter value error ($DevAttr). | A functional macro parameter error was found in the setting $DevAttr. |
| 2362 | 5118 | Parameter value error ($DevAttr). | A functional macro parameter error was found in the setting $DevAttr. |
| 2362 | 5121 | Parameter value error ($RcuSn!=$Dev). | A functional macro parameter error was found in the $RcuSn!=$Dev setting. |
| 2362 | 5122 | Parameter value error ($RcuSsid!=$Dev). | A functional macro parameter error was found in the $RcuSsid!=$Dev settings. |
| 2362 | 5123 | Parameter value error ($Rdev!=$Dev). | A functional macro parameter error was found in the $Rdev!=$Dev settings. |
| 2362 | 5124 | Parameter value error ($CopyMode!=$Sync). | A functional macro parameter error is found in the $CopyMode!=$Sync settings. |

| Message ID | Internal Code | Error Message | Error Description |
|---|---|---|---|
| 2362 | 5132 | Parameter value error ($CTG). Error Code = eeee | A functional macro parameter error is found. Set the correct CT group number in the $CTG parameter. |
| 2362 | 5133 | Parameter value error ($OptErrLv). Error Code = eeee | A functional macro parameter error is found. Set the correct error level in the $OptErrLv parameter. |
| 2362 | 5134 | Parameter value error ($SusRange). Error Code = eeee | A functional macro parameter error is found. Set the correct suspend range in the $SusRange parameter. |
| 2362 | 5135 | Parameter value error ($PendData). Error Code = eeee | A functional macro parameter error is found. Set the correct peding data flag in the $PendData parameter. |
| 2362 | 5136 | Parameter value error ($DelRange). Error Code = eeee | A functional macro parameter error is found. Set the correct delete range in the $DelRange parameter. |
| 2362 | 5137 | Parameter value error ($OptRsmRange). Error Code = eeee | A functional macro parameter error is found. Set the correct resume range in the $OptRsmRange parameter. |
| 2362 | 5138 | Parameter value error ($Seqchk). Error Code = eeee | A functional macro parameter error is found. Set the correct SEQCHK flag in the $Seqchk parameter. |
| 2362 | 5139 | Parameter value error ($TimeSave). Error Code = eeee | A functional macro parameter error is found. Set the correct time-saving mode flag in the $TimeSave parameter. |
| 2995 | 5201 | Illegal combination ($Sync and $OptSusDfwBlk). Error Code = eeee | A functional macro parameter combination error is found.  ($Sync and $OptSusDfwBlk.) |
| 2995 | 5203 | Illegal combination ($Sync and $CTG). Error Code = eeee | A functional macro parameter combination error is found.  ($Sync and $CTG.) |
| 2995 | 5204 | Illegal combination ($Sync and $OptErrLv). Error Code = eeee | A functional macro parameter combination error is found.  ($Sync and $OptErrLv.) |
| 2996 | 5301 | $CTG not found. Error Code = eeee | $CTG is not described when asynchronous copy pair creation. |

# Appendix E    HXRC Device Blocking and Load Balancing

The Lightning 9900™ V Series subsystem supports the IBM®-compatible specifications for XRC device blocking and load balancing control. In addition, the 9900V provides more flexible tuning methods for load balancing control under HXRC environments as shown below.

*Note:* If the ANTA5107E (RC=9014, REAS=604 or REAS=608) console message is displayed during the XADDPAIR operation, the HXRC option may not be installed. Make sure the HXRC option has been installed using the Hitachi Remote Console – Storage Navigator software.

*Note:* The HXRC option is only required for 2105 DKC emulation type. You can use HXRC for the 3990 controller emulation type without enabling the HXRC option.

## E.1    Device Blocking Function

The 9900V subsystem HXRC function supports the new TSO command specifications for the XRC device blocking function.

- **DONOTBLOCK option.** DONOTBLOCK is a new option parameter which is specified by the XADDPAIR command.

  – **Not specified (Default):** The amount of write data for application programs are blocked by the threshold specified by SDM. Default value is "500"HEX RECSETs.

  – **Specified:** When the DONOTBLOCK option is specified to a logical device, the amount of write data of application programs for the logical device is not blocked.

- **XQUERY.** The number of RECSET and the current threshold value corresponding to a logical device will be displayed by the XQUERY command.

*WARNING:* If you specify the DONOTBLOCK option for too many devices, a sidefile puncture condition will occur. Please use caution when determining the appropriate tuning (devices with DONOTBLOCK option, SVP modes) for your operational environment.

## E.2    Load Balancing Control

### E.2.1  Current Load Balancing Control

The 9900V has three fixed thresholds and three levels of load balancing for varying amounts of sidefile cache as follows: Threshold 1/2/3 = 40/50/60%.

- **Level 1:** Sidefile capacity is 40% -50% of the total cache capacity. Write I/Os are blocked by "Sleep"-"Wait" logic. The following modes are set on the 9900V SVP:

  - **Mode 45:** "Sleep" -"Wait" suppression option
    **OFF** (Default): Subsystem performs "Sleep" -"Wait" command retry per one write I/O in order to block write I/O until the amount of sidefile is less than 40% of total cache.
    **ON**: Subsystem does not perform "Sleep" -"Wait" command retry.

  - **Mode 97:** "Wait" timer control
    **OFF** (Default): When the amount of sidefile is over 40% of total cache capacity, the 9900V subsystem waits 100 ms as "Sleep" - "Wait" timer for write I/O.
    **ON**: When the amount of sidefile is over 40% of total cache capacity, the 9900V subsystem waits 10 ms as "Sleep" -"Wait" timer for write I/O.

- **Level 2:** Sidefile capacity is over 50% -60% of the total cache capacity. Write I/Os are blocked by "SCP"-"SCI" logic. The following modes are set on the 9900V SVP:

  - **Mode 98:** "SCP" reporting suppression option
    **OFF** (Default): When the amount of sidefile is over 50% of total cache capacity, the 9900V subsystem reports SCP status for write I/O. Operating system cannot issue the write I/O until SCI status is received. The 9900V subsystem reports SCI when the amount of sidefile is less than 50% of the total cache capacity.
    **ON**: The 9900V subsystem does not perform "SCP" reporting for write I/O.

- **Level 3:** Sidefile capacity exceeds 60% in the total cache capacity. Sidefile puncture occurs. The session which has the largest amount stored in sidefile cache is canceled.

*Note:* The 9900V SVP mode settings are preserved, even during microprogram exchange or subsystem power-off.
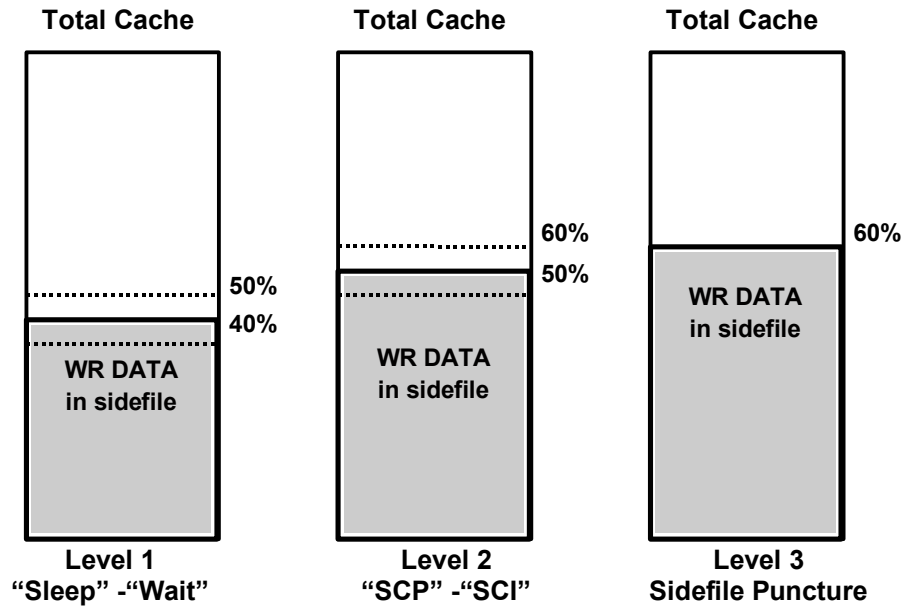
**Figure E.1    Current Load Balancing Control**

### E.2.2 New Load Balancing Control

The following conditions are required to activate the new DONOTBLOCK option for the XADDPAIR TSO command:

- The operating system must support the new DONOTBLOCK option.

- Mode 61 must be ON.
  If Mode 61 is OFF (default), the 9900V performs current load balancing control. If the operating system does not support the DONOTBLOCK option, set Mode 61 = OFF.

**DONOTBLOCK option:**
The 9900V subsystem does not block write I/Os for the specified logical device, to avoid performance impact for application programs. *WARNING:* If you specify the DONOTBLOCK option for too many devices, a sidefile puncture condition will occur. Please use caution when determining the appropriate tuning (devices with DONOTBLOCK option, SVP modes) for your operational environment.

**Load balancing control for sidefile:** When the DONOTBLOCK option is not specified, the 9900V subsystem has four levels of load balancing for amount of sidefile. Level 0 control is new for load balancing control.

- Level 0: Sidefile capacity is less than threshold 1 in the total cache capacity.
  MODE 45 = ON:  Write I/Os for logical devices are blocked ("Sleep"-"Wait" logic) by the threshold (500 HEX RECSETS) specified by SDM.
  MODE 45 = OFF:  Write I/Os are not blocked.

- Level 1: Sidefile capacity is over threshold 1 - threshold 2 of the total cache capacity.
  MODE 97: "Wait" timer control. Same as level 1 in current load balancing control.

- Level 2: Sidefile capacity is over threshold 2 - threshold 3 of the total cache capacity.
  MODE 98 : "SCP" reporting suppression option. Same as level 2 in current load balancing control.

- Level 3: Sidefile capacity exceeds threshold 3 of the total cache capacity. Sidefile puncture occurs. Same as level 3 in current load balancing control.

**Variable sidefile threshold.** Two new system options are assigned as variable sidefile threshold as follows. These options are effective whether Mode 61 = ON or OFF.

- MODE 85, 86 (see Figures E.2-E.5)

  - Combination 1 : MODE 85,86 = ON,OFF – Threshold 1/2/3=30/40/50%

  - Combination 2 : MODE 85,86 = OFF,OFF – Threshold 1/2/3=40/50/60%  **Default**

  - Combination 3 : MODE 85,86 = OFF,ON – Threshold 1/2/3=50/60/70%

  - Combination 4 : MODE 85,86 = ON,ON – Threshold 1/2/3=60/70/80%

## Figure E.2

**Total Cache**     **Total Cache**     **Total Cache**     **Total Cache**

30%

40%

30%

50%

40%

50%

WR DATA in sidefile

WR DATA in sidefile

WR DATA in sidefile

WR DATA in sidefile

**Level 0**

**Level 1**
"Sleep" -"Wait"

**Level 2**
"SCP" -"SCI"

**Level 3**
Sidefile Puncture

**MODE45=ON**
  "Sleep"-"Wait" for device
  threshold (500HEX) by SDM
**MODE45=OFF**
  No "Sleep" -wait
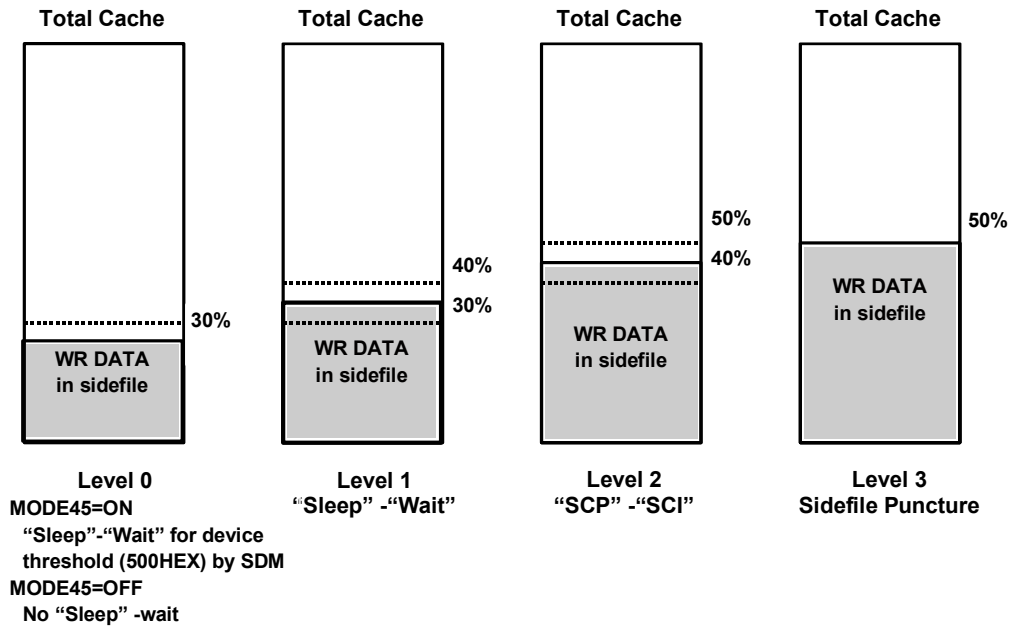
**Figure E.2**    **Combination 1: MODE 85,86 = ON,OFF; Threshold 1/2/3 = 30/40/50%**

## Figure E.3

**Total Cache**     **Total Cache**     **Total Cache**     **Total Cache**

40%

50%

40%

60%

50%

60%

WR DATA in sidefile

WR DATA in sidefile

WR DATA in sidefile

WR DATA in sidefile

**Level 0**

**Level 1**
"Sleep" -"Wait"

**Level 2**
"SCP" -"SCI"

**Level 3**
Sidefile Puncture

**MODE45=ON**
  "Sleep"-"Wait" for device
  threshold (500HEX) by SDM
**MODE45=OFF**
  No "Sleep" -wait
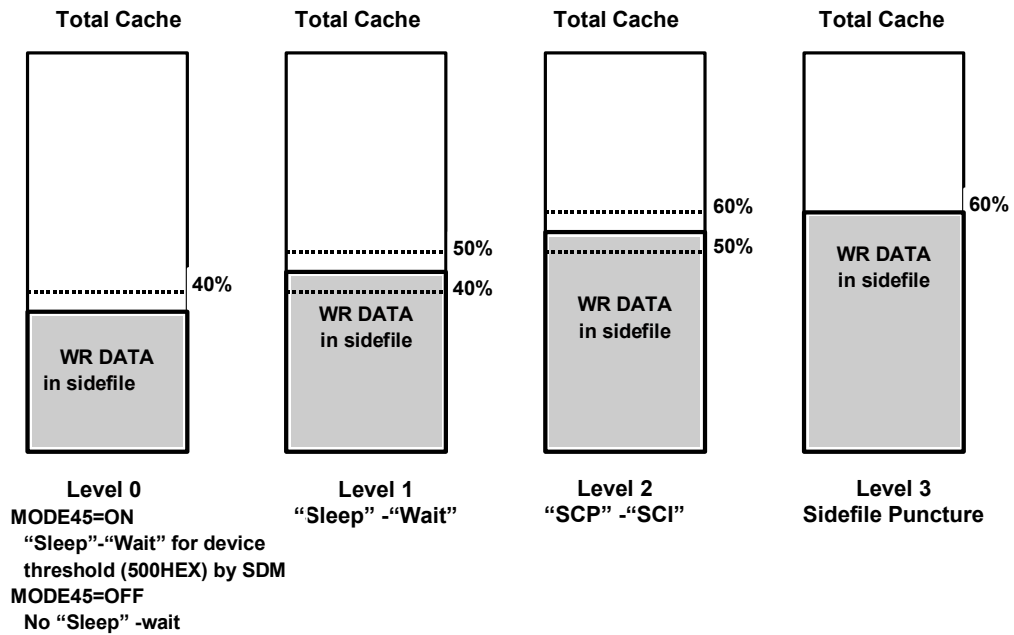
**Figure E.3**    **Combination 2 (Default): MODE 85,86 = OFF,OFF; Threshold 1/2/3 = 40/50/60%**

**Total Cache**     **Total Cache**     **Total Cache**     **Total Cache**

50%

WR DATA
in sidefile

60%

50%

WR DATA
in sidefile

70%

60%

WR DATA
in sidefile

70%

WR DATA
in sidefile

**Level 0**

MODE45=ON
  "Sleep"-"Wait" for device
  threshold (500HEX) by SDM
MODE45=OFF
  No "Sleep" -wait

**Level 1**
**"Sleep" -"Wait"**

**Level 2**
**"SCP" -"SCI"**

**Level 3**
**Sidefile Puncture**
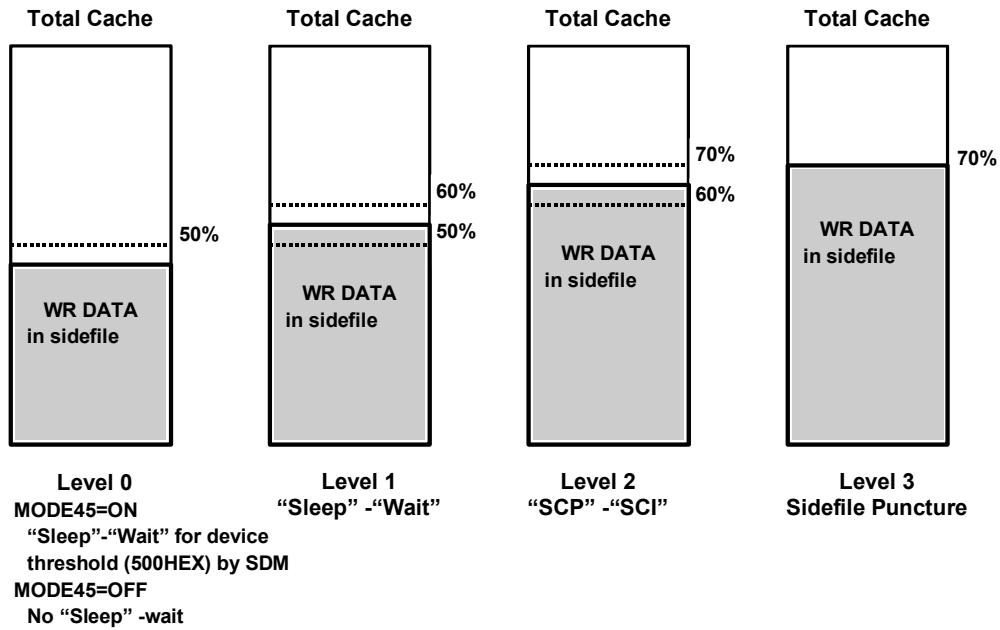
**Figure E.4     Combination 3:  MODE 85,86 = OFF,ON – Threshold 1/2/3 = 50/60/70%**



**Total Cache**     **Total Cache**     **Total Cache**     **Total Cache**

60%

WR DATA
in sidefile

70%

60%

WR DATA
in sidefile

80%

70%

WR DATA
in sidefile

80%

WR DATA
in sidefile

**Level 0**

MODE45=ON
  "Sleep"-"Wait" for device
  threshold (500HEX) by SDM
MODE45=OFF
  No "Sleep" -wait

**Level 1**
**"Sleep" -"Wait"**

**Level 2**
**"SCP" -"SCI"**

**Level 3**
**Sidefile Puncture**
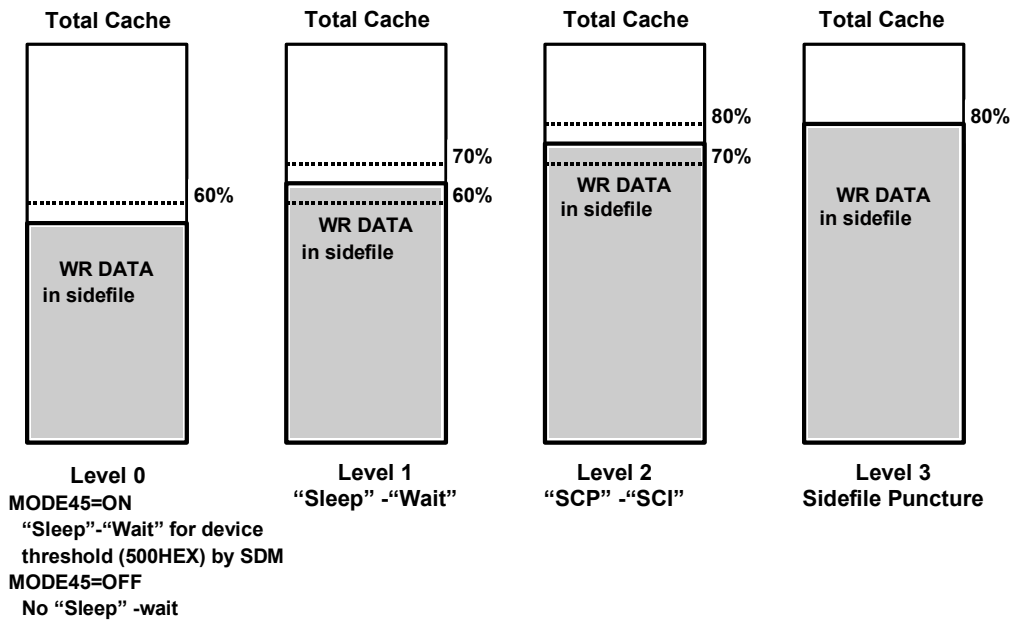
**Figure E.5     Combination 4:  MODE 85,86 = ON,ON – Threshold 1/2/3 = 60/70/80%**

# Acronyms and Abbreviations

| | |
|---|---|
| ACP | array control processor |
| Adr | address |
| async | asynchronous |
| ATM | asynchronous transfer mode |
| | |
| CCHH | cylinder, cylinder, head, head |
| CCI | Command Control Interface |
| CCW | channel command word |
| CFW | cache fast write |
| CH | channel |
| CL | cluster |
| CNT | Computer Network Technologies |
| C/T | consistency time |
| CU | control unit |
| CUI | CU image |
| CYL | cylinder |
| | |
| DASD | direct access storage device |
| DB2 | DATABASE 2 |
| DFSMS | Data Facility Storage Management Subsystem |
| DFP | Data Facility Product |
| DFW | DASD fast write |
| DSF | Device Support Facilities |
| DWL | duplex write line |
| | |
| ELB | extended long busy |
| ERC | error reporting communications |
| ERP | error recovery procedure |
| ESA | Enterprise Systems Architecture |
| ESCON® | Enterprise System Connection (IBM® trademark for optical channels) |
| ESCD | ESCON® director |
| | |
| FBA | fixed-block architecture |
| F/M | format/message |
| | |
| GDPS | Geographically Dispersed Parallel Sysplex |
| GUI | graphical user interface |
| | |
| HD | head |
| HDS | Hitachi Data Systems Corporation |
| HRC | Hitachi Remote Copy (used on 7700E subsystem) |
| HVR | Hitachi Volume Relocation |
| HWM | high-water mark |
| HXRC | Hitachi Extended Remote Copy |
| | |
| I/O | input/output |
| IBM® | International Business Machines Corporation |
| ICKDSF | A DSF program used to perform media maintenance |

| | |
|---|---|
| IDCAMS | access method services (a component of Data Facility Product) |
| IML | initial microcode load |
| IMPL | initial microprogram load |
| IMS | Information Management System |
| IOCDS | I/O configuration dataset |
| IPL | initial program load |
| | |
| JCL | job control language |
| | |
| kB | kilobytes |
| km | kilometers |
| | |
| LAN | local-area network |
| LCP | local control port |
| LCU | logical control unit |
| LDEV | logical device |
| LED | light-emitting diode |
| LU | logical unit |
| LVI | logical volume image (also called device emulation or device type) |
| | |
| Mb/s | megabits per second |
| MCU | main control unit |
| MIH | missing interrupt handler |
| MPSD | multiple path storage director |
| ms | milliseconds |
| M-VOL | main volume |
| MVS | Multiple Virtual Storage |
| | |
| NVS | nonvolatile storage |
| | |
| P/DAS | PPRC dynamic address switching |
| PC | personal computer system |
| PiT | Point-in-Time |
| PPRC | Peer-to-Peer Remote Copy |
| PS | power supply |
| PTF | program temporary fix |
| | |
| RAID | redundant array of independent disks |
| RAID-1/5 | specific RAID architectures |
| RC | reference code |
| RCP | remote control port |
| RCU | remote control unit |
| RDC | remote dual copy (same as remote copy) |
| RIO | remote I/O |
| RMCMAIN | Remote Console Main software |
| R-VOL | remote volume |
| | |
| SAID | system adapter ID |
| SCI | state-change-interrupt |
| SCP | state-change-pending |
| SDM | System Data Mover |
| SI | ShadowImage |

| | |
|---|---|
| SI390 | ShadowImage – S/390® |
| SIM | service information message |
| SMS | Storage Management Subsystem |
| S/N | serial number (also abbreviated as s#) |
| SSB | sense byte |
| SSCH | start subchannel |
| SSID | storage subsystem identification |
| SVP | service processor |
| sync | synchronous |
| S# | serial number (also abbreviated as S/N) |
| | |
| TC | Hitachi TrueCopy |
| TC390 | Hitachi TrueCopy – S/390® |
| TC390A | Hitachi TrueCopy – S/390® Asynchronous |
| TCA | Hitachi TrueCopy Asynchronous |
| TOD | time-of-day |
| TSO | Time Sharing Option |
| | |
| VM | Virtual Machine |
| VOL | volume |
| VOLSER | volume serial number |
| VSE | Virtual Storage Extended |
| VTOC | volume table of contents |
| | |
| XRC | Extended Remote Copy |